ANALECTA PRAEHISTORICA LEIDENSIA

43/44

2011
2012

ANALECTA PRAEHISTORICA LEIDENSIA 43/44

ANALECTA PRAEHISTORICA LEIDENSIA 43/44

PUBLICATION OF THE FACULTY OF ARCHAEOLOGY
LEIDEN UNIVERSITY

THE END OF OUR FIFTH DECADE

EDITED BY
CORRIE BAKELS AND HANS KAMERMANS

LEIDEN UNIVERSITY 2012

Series editors: Corrie Bakels / Hans Kamermans

Editor of illustrations: Joanne Porck

Copy and language editor: Kelly Fennema

ISSN 0169-7447
ISBN 978-90-818109-1-3

Subscriptions to the series *Analecta Praehistorica Leidensia*
and single volumes can be ordered at:

http://archaeology.leiden.edu/organisation/publications/analecta-praehistorica-leidensia/

or

P.J.R. Modderman Stichting
Faculty of Archaeology
P.O. Box 9515
NL-2300 RA Leiden
The Netherlands

Contents

Editorial

Archaeology and Leiden University have been associated since 1818 when the Dutch King Willem I took the initiative to have Caspar Reuvens installed as the first professor in archaeology. The discipline prospered and it became possible to study the archaeology of the Classic Mediterranean World, Egypt, Mesopotamia, and, later on, the Carribean, Central America and parts of the Far East. For years these studies were part of a study in History, Art or an appropriate language, extinct or not. Therefore, archaeology was taught in the Faculty of Humanities, except for the archaeology of the Near East which belonged to Theology.

Things became complicated when the Board of Leiden University decided to add the study of Prehistory. As there were no languages for affiliation and as the discipline of Prehistory extensively used methods borrowed from Science, Prehistory acquired a status of its own, namely the Interfaculty of Prehistory, founded in 1962. By and by the other archaeologies joined Prehistory and in 1997 a true Faculty of Archaeology came into being. Only the archaeologies of Egypt and Mesopotamia did not leave Humanities as their study was very much intertwined with the study of the associated languages and scripts.

In 2012 we celebrate the foundation of the initial independent core of the Faculty of Archaeology, now 50 years ago. Fifty years is not very old in archaeological terms, but normally a 50th anniversary has a special meaning. The Interfaculty of Prehistory had started its own journal, the Analecta Praehistorica Leidensia and on this occasion the Board of the Faculty of Archaeology has asked its editors to open its pages to all disciplines. It was a pleasure for us to invite the permanent staff of the Faculty to contribute. The

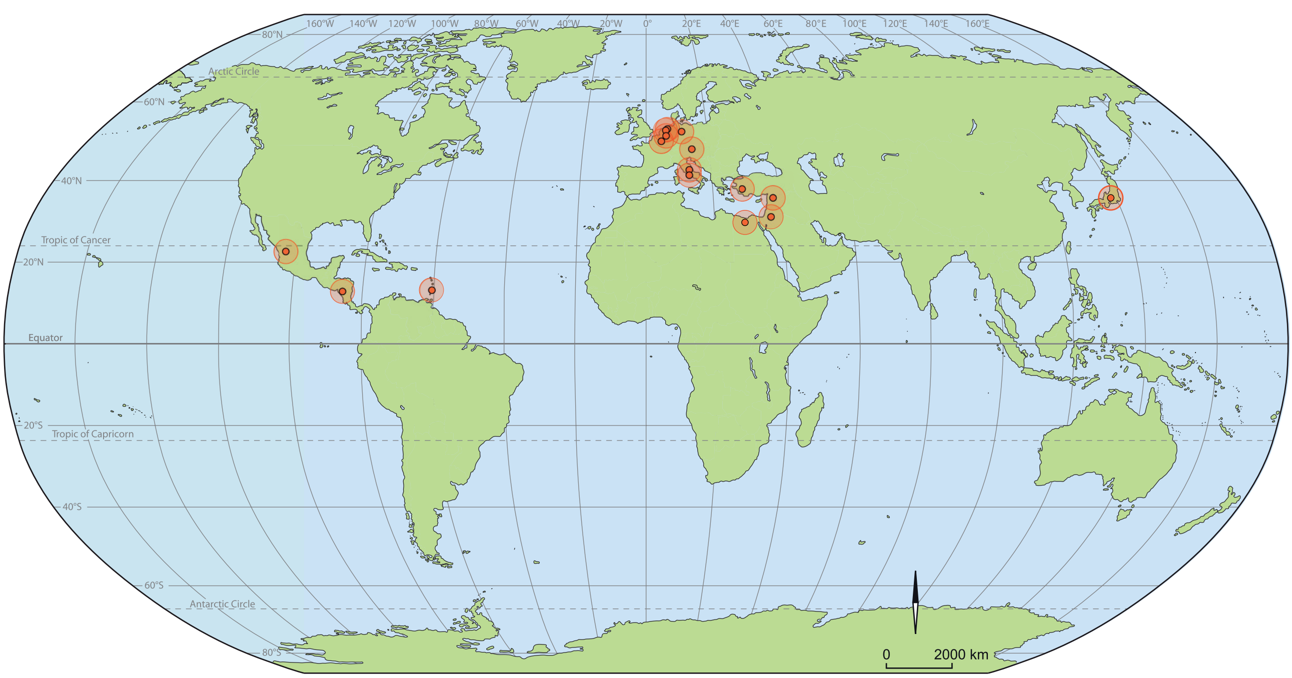


Figure 1 The location of the research areas mentioned in this volume.

invitation was accepted with enthusiasm and most members found time to write a paper. The volume presented here is the result. The subjects offered are very diverse and provide the reader with a written ‘Tableau de la troupe’, as it was intended to be.

Archaeology in the 21st century is a fast evolving discipline with many different faces. There is Archaeology as Anthropology, Archaeology as History or as Science, or the distinction in the different regions like Mediterranean Archaeology, the Archaeology of the Far East or of the Caribbean. Also the place of Archaeology in the modern world is heavily debated. Some see Archaeology as part of the broader field of Heritage Management, the part that studies the human past by way of its material culture. Others have a different view and see Heritage Management as part of Archaeology because we must not only study the past but also manage the relics. The result is that some archaeologists think that Archaeology is about the past and others think it is about the present or even the future. In our Faculty all these different flavours of Archaeology are present.

This is reflected in the book. The first contributions are about the present. They deal with the problem of preserving archaeology in situ, the evaluation of twenty years of the Malta convention and the current variety of approaches in archaeology. However the rest of the book is about the past. We organized this volume in such a way that you go back in time, and as good archaeologists we start from the top and dig our way into the past. We start in the 17th century AD in the Caribbean and end with research on a 300 000 years old site in Germany. Geographically speaking the book presents research from all over the world (fig. 1).

We like to continue this diversity in Analecta Praehistorica Leidensia in the future. Up to this volume the series only published monographs and edited volumes on Prehistory and Archaeological Science. From now on we would like to turn Analecta into a platform for all archaeologists in our Faculty and we hope to publish each year an inspiring volume on research from the Faculty of Archaeology, Leiden University.

Corrie Bakels
Hans Kamermans

Problems with preservation in situ

Willem J.H. Willems

Preservation in situ has developed into a central dogma of western archaeological heritage management. This paper examines assumptions underlying that dogma and the way in which it works out in practice, both in western and non-western contexts. Bureaucratization and commercialization are seen as important drives behind its rise as a dominating concept in heritage policy. While surely useful and important in some situations, preservation in situ is too problematic in several ways to be acceptable as an ethical principle with broad validity.

1 Introduction

This paper was originally a contribution to a conference session that looked at the issue what the preservation of remains from the past reveals about the present.[1] An important aspect of heritage preservation in archaeology is the concept of preservation in situ. Although quite problematic in many ways, preservation in situ has over the past 25 years or so become one of the central dogmas of western archaeological heritage management practice. I remember when in the early 1990s the Dutch journalist Theo Holleman – in a paper about archaeological heritage management – wrote that employing archaeologists to protect archaeological heritage amounted to the same thing as employing rabbits to guard a field of carrots. Although he was deadly serious about it and I was director of the Dutch State Service for Archaeology (ROB) at the time, I thought that was not just a funny but actually also a quite realistic viewpoint. Many of my colleagues at the state service saw it as an outrageous and unfounded attack on what had by then already become one of the holiest principles underlying our work.[2]

At this same time, the United Kingdom and parts of Germany were still the only areas in Europe where commercial archaeology existed, although that situation would change drastically in the following years as a result of the Valletta Convention signed in 1992. The situation is now completely different. Some 25 years ago we were at the end of an era when massive infrastructure developments, housing projects etc. had caused the destruction of archaeological remains at such an unprecedented scale that the rescue archaeology of the 70s and 80s had been unable to cope. In that situation, there were essentially two approaches that were not mutually exclusive. One was to try and organize rescue archaeology in such a way that maximum knowledge of the cultural history of an area was obtained by large scale and innovative research projects.[3] The other was to move from rescue archaeology to preventive archaeology and to try – by surveying, predictive modeling, regional inventories and other such means – to obtain advance knowledge of archaeological sites so that they could be avoided during development and be preserved in situ.

The thoughts behind this were clear enough. A substantial part of the soil archive was being destroyed with usually no option to prevent that from happening. The resulting attitude was that the need for consumption of archaeological sites for research purposes could be more than satisfied by sites that would disappear anyway, and it was best to preserve sites in situ as archives for future consumption by academic research – and very occasionally for public enjoyment when there were suitable visual aspects. Already in 1980 the then State Antiquarian of Denmark, Olaf Olsen had published a paper in *Antiquity* (Olsen 1980) in which he challenged the practices of archaeology to satisfy academic curiosity by excavating ever more basically unthreatened sites. Such statements were followed by many others, and since then the management of archaeological resources in Europe and elsewhere has successfully been integrated into processes of spatial development, the principles have become incorporated into international treaties. An example is the Valletta Convention (Council of Europe 1992) that demands of countries that signed the treaty in Art. 4.2 to implement measures for the physical protection of the archaeological heritage, making provision for the conservation and maintenance of the archaeological heritage, preferably *in situ*, and in Article 5.4, to make provision, when elements of the archaeological heritage have been found during development work, for their conservation *in situ* when feasible.

2 The means and the goal

Principles such as these have meanwhile become accepted in most western countries, and indeed elsewhere (for example Naffé *et al*. 2008). By itself, there is nothing wrong with that. It is still true today that much problem-oriented research can also be done in the context of ‘archaeological heritage management' (AHM) or 'cultural resource management' (CRM) on sites that will have to disappear anyway for development reasons.[4] And it is also true that the archaeological resources contained in the soil of most western countries have been eroding heavily for at least a century now – through various means from environmental deterioration to development, so there is a reason for concern as the supply is finite. Nevertheless, in western heritage management practice, preservation has become the new orthodoxy and to such an extent that preservation in situ has in practice developed into an unreflexive preservation mindset that governs decisions by governmental heritage managers and decision makers. It is the good thing to do, it has become a goal in itself (Lipe 1996; Holtorf and Ortman 2008).

Of course there still are also western academic archaeologists that are involved in research elsewhere in the world that often continue excavation practices as they have been since the 19th century. Many Egyptologists, for example, keep shovelling sand in the desert looking for new tombs and other treasure and thus keep increasing the existing and already enormous conservation problems. And also the risks to exposed archaeological substance, both natural and man-made, as recent events in the Middle East have shown all too clearly. Similar forms of exploitative archaeology occur in many other countries and other areas of the world. But in North America, Australia and most of Europe preservation in situ has become a central and almost undisputed dogma that governs the practice of CRM and is a formidable obstacle to problem-oriented archaeological research. There are two causes for this development through which the means have become the goal: one is called *bureaucratization*, the other *commercialization*.

The *bureaucratic* development is a result of the fact that archaeological sites, or remains, or resources or whatever else we choose to call them, are not just objects of study for archaeologists. They are normally also part of a nation's cultural heritage, or at least mostly and in so far as they are known. That means that they have values ascribed to them that can go (far) beyond research value and may have social, ideological and economic relevance. The implication is that archaeological resources – as with all cultural heritage – are subject to conflicting interests from a whole range of stakeholders, are considered of local, national or international significance, and are therefore government and administrative concerns. That means there is a need for regulation.

Until the 1970s archaeology was still largely an academic pursuit, and the specialized bureaucracies dealing with archaeological heritage management were mostly still in their infancies. In fact, they were mostly not yet dealing with managing heritage in the modern sense but rather with an activity known as 'monuments protection' and listing or scheduling sites in a kind of national stamp collections. When these bureaucracies began to grow, they were initially – and in some countries they still are – run by people with academic attitudes and training. By contrast archaeological heritage management today is usually part of a much larger bureaucracy within organizations such as quasi-governmental organizations (quango's) or state services and ministries of culture, or national parks or combinations of these. These have much broader and sometimes very different core purposes,[5] they have specialists in very different fields,[6] and they have senior staff with management rather than academic qualifications. These organizations almost universally believe that the pursuit of knowledge is something that has no place in their organization because that is what universities are for. They see their own role as policy advisors, regulators and/or facilitators. As a policy, preservation in situ suits them well: it is respectable, it is part of their mission of "*Preserving the past for the future*" (Spennemann 2011), and internationally everybody else does it or at least claims to do it. As a rule it does not cost much money and if it does there are so-called mitigation strategies whereby development is allowed under certain conditions and often on the basis of untested assumptions about the effect of these measures. And last but not least it is of course a source of considerable bureaucratic power. After all, being able to decide or influence decisions on spatial and economic development is a far more powerful position than legally protecting some chosen places as (national) monuments, issuing excavation permits or controlling repositories.

3 Commercial archaeology

The other reason why preservation in situ has become such a dogma, is *commercialization*. Table 1 presents the various types of archaeological work over the past eight years in the Netherlands. It was derived from the 2011 Annual Report of the Dutch Heritage Inspectorate (Erfgoedinspectie 2012, 14), but the area and dates are in fact not important in this context, because similar data can be found for many other countries and areas. What is relevant is that the first three lines all indicate evaluation work and only the fourth indicates excavations. It is clear that only about 5-6 percent of all archaeological work involves excavation. Table 2 shows that about one third of these excavations is actually just a very short affair of a few days, usually just one. This is typical, and apparently in all western countries that have commercial archaeology, it is primarily evaluation work that gets done. It is much more in demand by the bureaucracy and it is much less risky as a business. No company that is honest and works according to normal standards and ethical principles can exist on only excavation as a business, let alone make an acceptable profit. They can, however, do real well on evaluation work and consultancy.

	2004	2005	2006	2007	2008	2009	2010	2011
Borehole survey	-	-	2231	2333	2556	2261	2318	2100
Watching brief	177	242	214	246	249	279	296	353
Trial pits/trenches	232	323	410	420	500	503	540	481
Excavations	194	193	187	194	204	200	148	179

Table 1 The number and type of archaeological projects in the Netherlands from 2004-2011 (source: Erfgoedinspectie 2012, 15).

	2004	2005	2006	2007	2008	2009	2010	2011
1-5 days	54	58	63	60	58	59	38	59
6-10 days	23	23	29	38	43	37	30	29
11-30 days	41	69	55	57	71	63	47	52
more than 30 days	38	39	34	37	29	40	31	37
unknown	38	4	6	2	3	1	2	2
total excavations	194	193	187	194	204	200	148	179

Table 2 The duration of excavations in the Netherlands from 2004-2011 (source: Erfgoedinspectie 2012, 15).

That conclusion is not meant to put the blame with commercial archaeology or to disqualify commercial work, this is simply a result of the way the commercialized system works. There are evidently also quality issues related to commercial excavations and their contribution to research, but these are ambiguous and not the real issue here.[7] Surveys and other evaluation methods are widely used to assess the archaeological potential of an area and what is supposed to be a cyclical process whereby some sites are then excavated and generate new knowledge, does in fact stop with a few test pits or trial trenches and lots of evaluations that declare sites to be of not enough value (Bonnie 2010, 12-13). From those that remain, a considerable portion is then 'avoided' by the development and thus preserved in situ. In a recent report it was concluded on the basis of a selected sample that – of the selection of sites that were evaluated as 'worth preserving' – 38% is then actually preserved in situ (Schute *et al*. 2011). It is difficult to interpret that figure, because it is not known how many sites were not considered valuable enough ('worth preserving'), and it is also unclear if the percentage is representative for the Netherlands in general. However the same study indicates that in practice virtually none of these sites are subsequently protected legally or subjected to actual preservation measures, though a small part (almost 9%) receives protection from destruction through the spatial planning system. For the remainder (30%), development plans have been adapted or abandoned. The other 60% was excavated in some form or examined under a watching brief. These may not be representative figures but at least they give some indication of the situation in a densely populated country with a high development pressure.

What is achieved by this preservation in situ policy is no doubt that less excavation work is necessary, so the development becomes cheaper, and substantial numbers of sites remain in situ. By itself that is of course what the policy aims to do, though in most cases it is totally uncertain what will happen to the sites involved. In addition to this lack of legal or planning protection, there is still little research being done that could underpin the assumption that preservation in situ would actually be the best solution in the increasingly polluted environment of today. There are groups such as around the Paris meetings, where PARIS stands for "preserving archaeological remains in situ" (Corfield *et al*. 1996; Kars and Van Heeringen 2008). This type of science-based research is of course very useful (Huisman 2009; Bonnie 2010), but also quite expensive and for the moment its results remain limited because of the complexity of degradation processes. The ongoing process of climate change probably dwarfs anything that can be done through technical preservation measures, as does the intensification of agriculture.

Also, as mentioned above, it is increasingly common in the practice of heritage management to define all sorts of damaging impacts that are allowed to take place on preserved sites as part of mitigation strategies. There are sites that are allowed to be built over, or partially excavated sites of which the remaining portions are "preserved in situ" in awful conditions by administrative decision, just to reach a compromise and with virtually no chance of survival until a very hypothetical future research excavation. Even in the western countries discussed so far that is quite unlikely to ever happen. There still are a very few pure research institutions left, but their capacity is infinitely small compared to the size of the problem, and they also serve political goals as is evident from their connection to Ministries of Foreign Affairs.[8] University-based academics are in fierce competition over scarce grants and increasingly need to publish in peer-reviewed journals and in the English language, or perish. The contribution they can make is also very limited.

To be fair, it should also be acknowledged that the system does have at least one real benefit because at the regional level our knowledge of the landscape and its uses in the past, does on average increase and we get much better ideas on its habitation and other uses (Van den Dries 2011). Or at least we do in countries where results get published or, at a minimum, results can be made publicly available. That is most of the world, except in countries such as the USA or the UK, where (from a non-Anglo Saxon perspective) rather peculiar legal principles let the client decide on that. In continental European countries and legal traditions, this practice is out of the question: where the public interest is at stake the information belongs to the state and cannot be withheld.

4 Points to consider

The result of the development and policies discussed above is that fewer properly resourced excavations get done, that we therefore learn less about the past and that the social role of archaeology diminishes where its negative economic impact increases through the burden that they place. Archaeology costs more and simply has fewer new stories to tell. Of course the general public has no interest in field evaluations of whatever kind, let alone in preserving bits of land in complicated administrative processes at high cost and with mostly very unappealing gains.[9] There are several points to consider here.

First, there is the obvious truth that where the gains for society are more appealing, there will be more political and public support for preservation policies. As has long been recognized, subsurface archaeological sites can best be preserved through the careful management of change in landscapes (Fairclough and Rippon 2002; Lozny 2008; Bloemers *et al*. 2010). This creates added values that may be perceived as compensation for and legitimation of the cost of preserving land containing archaeological resources. But in the end, it remains of course the visible landscape that is perceived as valuable or enjoyable, and so even within that framework it is necessary to provide historical and other context about places to illustrate their relevance and justify why they should be preserved. Buried archaeological sites lack associative values of visible sites, but they should be regarded as an asset, not a burden.

This is a point that has recently been put forward most explicitly by Spennemann (2011), who rightly points out that the cost of historic preservation is incurred *today*, in the here and now, so its benefits should be clear today. He warns against the "preserving the past for the future" phraseology so widely used by heritage organizations as justification for preservation policies. Indeed, heritage is all about ascribed values, and archaeological resources become archaeological heritage through the values we attach to them. There is no way to predict what values will be held by future generations, so essentially, according to Spennemann (2011, 12), we are preserving the past for ourselves. That fits well with earlier statements such as by Tunbridge and Ashworth (1996, 6) who concluded that "the present selects an inheritance from an imagined past for current use and decides what should be passed on as useful to an imagined future".

So in order to be relevant for the world of today, archaeological heritage can contribute in various ways to the economic and social well-being of present-day nations or communities, it can be "a driver of development",[10] a source of income through tourism and it can be used to provide identity and a sense of rootedness. None of these is without problems and risks, and much attention is nowadays paid to develop best practices and standards to help overcome unwanted effects and consequences. But in the end, in order to actually *be* useful and relevant today, all this needs to be based on research. No matter whether we 'discover' the past or 'create' it, and no matter if we do this through scientific research or by more collaborative means involving stakeholder communities, we do need to investigate so that we can have the stories needed for interpretation.

That is one more reason why dogmatic policies of preservation in situ will not work. This paper is of course not intended as a suggestion to completely reverse archaeological practice and go back to Olsen's *rabies archaeologorum* from before. It is bad enough that remnants of that still survive in parts of western archaeology. But there is surely a middle road in this, one that was laid out over a decade ago by Bill Lipe (1996, 27) in his conclusion to a paper in which he poses the thesis that preservation is only a means, not an end:

In sum, what should drive archaeological preservation is the social benefit that archaeology can provide to society over the long run. That benefit is primarily the contribution of knowledge about the past derived from systematic study of the archaeological record. In situ preservation of archaeological resources is a tool for optimizing that benefit. (.......)

Long-term, frugal consumption of the archaeological record by well-justified research—both problem-oriented and *mitigation-driven—must be an accepted and integrated part of the preservation program. If the research doesn't get done, or if it gets done and we don't learn anything from it, or if only scholars learn from it and the public is shut out, then preservation will have been in vain, because its goals will have not been achieved.*

There are recent examples of projects in which heritage authorities appear to have perceived the need for new knowledge and allowed some of Lipe's *frugal consumption* even at high status protected sites. This has been done for example in the United Kingdom at Stonehenge, where English Heritage granted permission for a small trench to be dug in 2008 for the first time in forty years, surrounded by all sorts of publicity (Darvill and Wainwright 2009, 5). Something similar happened in the Netherlands, where the Barrow Landscapes Project was initiated and authorities gave Leiden University permission to excavate barrows, also after research of barrows had stalled for about forty years (fig. 1). Here too there was much publicity and the intent was to answer new research questions and provide a better background for information and public outreach (Fontijn 2010). Both examples may also be a good illustration of the way in which academic archaeology can in the future fruitfully contribute to archaeological heritage management (Lohof 2011, 53). Another way that has been explored in recent years is by digesting and interpreting the many reports of preventive archaeological investigations produced by development-driven archaeology, and use them to create new

Figure 1 Barrow excavation at the Royal Estate near Apeldoorn in 2007, in which also sizeable portions of the surrounding area were investigated. This new approach has yielded fundamental new insights and was only possible after lengthy discussion between the Faculty, the municipality of Apeldoorn and the National Heritage Agency RCE (Fontijn *et al.* 2011, 16-17).

syntheses. But the contribution that academic archaeology can make in the bulk of development-driven archaeological research is severely limited for quantitative reasons and the way in which academic research works.

5 Beyond Europe and North America

That point is even more true in third world countries, where academic archaeology is usually even smaller in absolute terms and may be limited to just a few people at the national level. In a recent paper, Scott MacEachern (2010) has outlined what can happen in such a situation when western companies start large-scale projects. International organizations, such as UNESCO, the World Bank, the European Development Bank, or major international businesses like Exxon and Rio Tinto, have developed standards on how to manage cultural heritage and they have ethical policies to deal with the impact of development on cultural resources. For international companies such as Rio Tinto,[11] good CRM policies have become sound business principles and part of their risk management strategies, so compliance is not an issue. Most companies are used to taking responsibility for cultural heritage, but it appears that the way in which this is done determines whether it is of any use.

MacEachern has been dealing with Exxon in Central Africa, and worked on a pipeline project in Chad and Cameroon. In his paper he comments on the archaeological heritage management strategy that was mirrored after western practices. This implied that, for example, senior local academics not used to tenders and contract work were excluded because they could not respond adequately. Apart from such mostly unintended consequences, the western (in this case North American) model of CRM programmes was used, which meant that site avoidance and mitigation of construction impacts on cultural heritage were the primary goals. Excavation for research purposes – to learn something about the cultural history of an area – or for training purposes were seen as both an illegitimate use of client funds and an unacceptable act of destruction of archaeological resources. However, the idea that site avoidance and preservation are the only valid strategies in CRM work is, in MacEachern's view, based upon assumptions about archaeological work that are not realistic in a third world and particularly a Central African context.

Unlike in western countries, it cannot be assumed that resources exist to support research archaeology in a context separate from that of development-led heritage management work. Even to assume this will be possible in the future, is unfounded. Another circumstance that is very different from the situation in western contexts is the fact that after the conclusion of a CRM programme, it may well be totally impossible to get access to particular areas or particular classes of sites. And in cases where it would be possible to undertake any follow-up research, that is still rather unlikely to ever happen because resources are normally lacking. Even worse is the presumption that the primarily commercial relationship between contractor and client should not take into account 'extraneous' issues like the development of national archaeological capabilities and the investigation of cultural history in different parts of the world. This makes sense in the western world where the developer does not want to pay for things that belong to the responsibility of the state. But elsewhere it is not just shortsighted, it is worse than that. Not taking these opportunities into account goes against principles codified in World Bank directives on cultural heritage protection in bank-assisted projects (MacEachern 2010, 357). Using such opportunities of infra-structure development, capacity building and investigation of cultural history are in fact seen by the bank as legitimate objectives. The same attitude is also evident from other examples, such as the cultural policy of Rio Tinto. In that policy (see Bradshaw 2011, 16) it is stated explicitly that "cultural heritage management for Rio Tinto businesses is broader than just managing the impacts of ground disturbance".

In general, it would seem to be a very bad idea therefore to export western notions of preservation in situ and site avoidance and mitigation procedures. Instead, it would be much more useful if in third world contexts capacity building and taking advantage of properly resourced research opportunities as a rule take precedence over maintaining sterile principles. In addition, while in many situations it may be unavoidable to employ western methods and staff, care should be taken not to transplant the complete *modus operandi*. If we do not use the opportunity when it presents itself, we will lose not just the information about the past and what it can be used for, but also the sites, the fabric, will be lost and possibly even the rare chance to properly train and educate local colleagues. Especially if the work is done in a collaborative setting, much can be learned from both sides as I experienced myself in a recent heritage project in Mongolia (Gunchinsuren *et al*. 2011).

To conclude, it is evident that of course in some particular situations and especially in densely populated western countries, preservation in situ sometimes is a useful strategy. In non-western countries this may occasionally also be the case. After all we are dealing with a non-renewable resource that is limited, and sometimes local populations do not wish resources that they value – as heritage or in other ways – to be touched. But often preservation in situ is either misused by uncritical application in situations where research and other objectives might have been better served by proper investigation, or it is consciously misused to prevent additional costs and investment. As an ethical principle that has universal application, it is therefore questionable and in need of serious reconsideration, as a bureaucratic policy it has serious negative aspects that need to be considered, and as a dogma of archaeological resource management, it is highly dubious and may even be counterproductive.

Notes

1 The paper was prepared in the context of the EU-funded ACE-project (Archaeology in Contemporary Europe) and was presented at a session entitled *An Archaeology of Heritage,* during the 2011 Society for American Archaeology meeting in Sacramento, California, organized by Elizabeth Chilton and Cornelius Holtorf. The session has meanwhile been published in a thematic issue of *Heritage & Society* (2012). I am grateful to Elizabeth Chilton and Cornelius Holtorf for inspiring me to write this paper and to Monique van den Dries for critical comments on an earlier draft.

2 See Holleman 1996 for an explicit position, especially chapters 4-6.

3 See Willems 1997, Zwart 2011, chapter 1.

4 Archaeological heritage management or AHM is the common term in Europe, while in North America it is more usual to speak of CRM or Cultural Resource Management.

5 For example, tourism.

6 Such as forestry, spatial planning, public outreach, data management, etc.

7 See for example the recent discussion between Kristiansen and Van den Dries in World Archaeology (Kristiansen 2009; Van den Dries 2011). Also Van den Dries, this volume.

8 Good examples are the *Deutsches Archäologisches Institut* and the *Écoles françaises* in various parts of the world.

9 The recent dissertation of A. Zwart (2011) provides some interesting case studies "Ex situ or in situ, the battle for the buried archaeological record. On archaeological heritage, planning and the quality of the living environment".

10 As was the theme of the 2011 General Assembly of ICOMOS in Paris, see Gottfried and Hidalgo Sánchez 2012.

11 An outstanding example is Rio Tinto's recent cultural heritage guide (Bradshaw 2011).

References

Bloemers, J.H.F., H. Kars, A. Van der Valk and M. Wijnen (eds) 2010. *The Cultural Landscape & Heritage Paradox*, Amsterdam.

Bonnie, R. 2010. Behoud ex situ of Behoud in situ? Waarom vergelijken we niet eens. *Archeobrief* 14(4), 10-17.

Bradshaw, E. (ed.) 2011. *Why cultural heritage matters. A resource guide for integrating cultural heritage management into Communities work at Rio Tinto*. Melbourne/London.

Corfield, M., P. Hinton, T. Nixon and M. Pollard (eds) 1996. *Preserving archaeological remains in situ. Proceedings of the conference 1st-3rd April 1996,* London.

Darvill, T. and G. Wainwright 2009. Stonehenge excavations 2008. *The Antiquaries Journal* 89, 1-19.

Erfgoedinspectie 2012. *Verslag van het toezicht in 2011*. Den Haag.

Fairclough, G. and S. Rippon (eds) 2002. *Europe's Cultural Landscape: archaeologists and the management of change*. London (EAC Occasional Paper 2).

Fontijn, D.R. 2010. *Living near the dead: The barrow excavations of Rhenen-Elst: Two millennia of burial and habitation on the Utrechtse Heuvelrug*. Leiden.

Fontijn, D.R., Q. Bourgeois and A. Louwen (eds) 2011. *Iron Age Echoes. Prehistoric land management and the creation of a funerary landscape - the "twin" barrows at the Echoput in Apeldoorn*. Leiden.

Gottfried, C. and S. Hidalgo Sánchez (eds) 2012. *Heritage, a driver of development. Proceedings of the 17th ICOMOS General Assembly Symposium*. Paris.

Gunchinsuren, B., Ch. Amartuvshin, S. Chuluun, J. Gerelbadrakh, K. Tsogtbaatar, J.H. Altschul, J.A. Homburg, J.W. Olsen, G. Wait and W.J.H. Willems 2011. *The Oyu Tolgoi Cultural Heritage Program*, Ulaanbaatar.

Holleman, T. 1996. *Een verleden op de schop. Beheer en studie van het Nederlandse bodemarchief*. Amsterdam.

Holtorf, C. and O. Ortman 2008. Endangerment and Conservation Ethos in Natural and Cultural Heritage: The Case of Zoos and Archaeological Sites. *International Journal of Heritage Studies* 14, 74-90.

Huisman, D.J. 2009. *Degradation of Archaeological Remains*, Den Haag.

Kars, H. and R.M. Van Heeringen (eds) 2008. *Preserving archaeological remains in situ. Proceedings of the 3rd conference 7-9 December 2006, Amsterdam,* Amsterdam (Geoarchaeological and Bioarchaeological Studies 10)

Kristiansen, K. 2009. Contract archaeology in Europe: an experiment in diversity. *World Archaeology* 41 (4), 641-648.

Lipe, W.D. 1996. In Defense of Digging: Archeological Preservation as a Means, Not an End. *CRM Cultural Resource Management* 19 (7), 23-27.

Lohof, E. 2011. Voor U gelezen. *Vitruvius* 4 (16), 52-53.

Lozny, L.R. (ed.) 2008. *Landscapes Under Pressure. Theory and Practice of Cultural Heritage Research and Preservation*. New York.

MacEachern, S. 2010. Seeing like an oil company's CHM programme. Exxon and archaeology on the Chad Export Project. *Journal of Social Archaeology* 10, 347-366.

Naffé, B.O.M., R. Lanfranchi and N. Schlanger (eds) 2008. *L'archéologie préventive en Afrique: enjeux et perspectives,* Paris.

Olsen, O. 1980. Rabies archaeologorum. *Antiquity* 64, 15-20.

Schute, I.A., M.E. Lobbes and M. Verbruggen 2011. *Wie wat bewaard die heeft wat*. Amsterdam (RAAP Rapport 2525).

Spennemann, D.H.R. 2011. Beyond "Preserving the Past for the Future": Contemporary Relevance and Historic Preservation. *CRM: The Journal of Heritage Stewardship* 8(1-2), 7-22.

Tunbridge, J.E. and G.J. Ashworth 1996. *Dissonant Heritage: The Management of the Past as a Resource in Conflict*. New York.

Van den Dries, M. 2011. The good, the bad and the ugly? Evaluating three models of implementing the Valletta Convention. *World Archaeology* 43(4), 594-604.

Willems, W.J.H. 1997. Archaeological Heritage Management in the Netherlands: Past, Present and Future. In: W.J.H. Willems, H. Kars and D.P. Hallewas (eds), *Archaeological Heritage Management in the Netherlands*, Amersfoort, 3-17.

Zwart, A., 2011. *Erop of eronder. De strijd om het bodemarchief in drie vinexlocaties. Over archeologische monumentenzorg, ruimtelijke ordening en de kwaliteit van de leefomgeving*. Amsterdam.

Willem J.H. Willems
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
w.j.h.willems@arch.leidenuniv.nl

Figure 2 HRM Queen Beatrix is briefed on the burial mounds project at the Crown Domain by dr. David Fontijn. It is a good illustration of the wider social relevance and interest generated by the stories from well targeted research in protected monuments: added value instead of dogmatic preservation in situ (photo RVD).

Twenty years after Malta: archaeological heritage as a source of collective memory and scientific study anno 2012

Monique van den Dries and Sjoerd van der Linde

A recent evaluation of the Dutch Monument Act shows that it serves its purpose fairly well. It was however not evaluated to what extent the new law and its associated heritage management system contribute to achieving the main goals of the underlying Malta Convention. In this paper a start is made with this. On the basis of various studies an analysis is made of to what extent Dutch archaeological heritage serves as a source of collective memory and scientific study twenty years after the Convention was signed.

1 Introduction

This Analecta is a jubilee issue, celebrating the 50th anniversary of the Faculty of Archaeology. During these fifty years, the archaeological world has changed tremendously. Many things that were dreamed of back then have become reality, but many other things that were cherished have been lost. One of the main forces behind most of these changes has been the signing of the Valletta Convention in 1992, with its aim to 'protect the archaeological heritage as a source of the European collective memory and as an instrument for historical and scientific study' (Article 1.1).[1] As it is this year the 20th anniversary of this convention, we will use the opportunity of this Analecta to evaluate to what degree we have so far reached its goal. At the time of the signing of the convention, many things were already organized or under construction, but several additional measures have been taken since in order to reach its goals.[2] Most of the organizational issues have been dealt with and have juridical power through the Monument Act, which was revised for this purpose in 2007. The only exception is the promotion of public awareness (Article 9); no formal or legal provisions have been made to achieve this goal.

A recent evaluation of this revised law, commissioned by the Ministry of Education, Culture and Science, shows that it serves its purpose reasonably well (Van der Reijden et al. 2011). What however has not been evaluated is to what extent the new law and its associated heritage management system contribute to achieving the main goal of the underlying convention, namely to better protect the archaeological heritage as a source of collective memory and an instrument for scientific study. As it is not guaranteed that this aim is met when the organizational matters have been dealt with and the facilities have been created, we believe that this should be evaluated too. There are various ways to evaluate this, but we decided to interpret it as: to what degree does the archaeological community produce new knowledge, what do we do with this knowledge in the sense of professional dissemination, valorization, and public outreach, and does it affect public support for archaeology? Our analysis is partly based on our own observations and on the results of some researches we recently undertook, either as part of our (research) projects or as supervisors of the theses and internship researches of our master and bachelor students.[3]

2 Knowledge production

The issue of knowledge production provokes recurring debates in the Dutch archaeological community. Shortly after the revised law had come into force in September 2007, Professor Raemaekers (Groningen University) expressed his concern in the national magazine Archeobrief (Raemaekers 2008) that a lot of money is spent on research that yields no or hardly any new knowledge about the past. In addition he complained about the quality of the publications (mainly site reports), in the sense that they would hardly provide valuable new insights either. Also abroad people have the impression that the situation of knowledge production in our country is rather poor (*e.g.* Kristiansen 2009).

It can be questioned, however, whether most research is indeed of limited relevance and of poor quality. First of all, we have to take the purpose of the investigations into account and to make a distinction between research which is intended to write historic narratives and research which is intended to locate and value sites. Due to Malta it is common practice now in the Netherlands that building locations are investigated and valuated prior to disturbing activities. On an annual basis between 2500 and 3000 of such field evaluations are carried out. It is estimated that 52 per cent of these valuations do not lead to further research (Theunissen and Deeben 2011, 38). This does not mean that these researches are useless. They simply make sure no valuable sites are being destroyed.

With respect to the quality of the work and reports, indeed the situation is not ideal (see also Van den Dries and Willems 2007). Quality assessment studies by both the

Inspectorate and the State Agency (*e.g.* Bazelmans *et al.* 2005; Van den Dries and Zoetbrood 2008) have demonstrated that regarding site reports there is ample room for improvement. However, if we put this in perspective, it is not as dramatic as it seems. It all depends on how you decide to look at these matters (see Van den Dries 2011). For instance, from the 2008 valuation of the 85 site reports, we could also highlight that 67 per cent of the reports was of sufficient or good quality (Van den Dries and Zoetbrood 2008). Moreover, the Inspectorate for Cultural Heritage recently concluded that although there are large differences between projects when it comes to quality – mainly because it relates much more to the capabilities of the individual fieldwork leaders than to the quality control systems of their organizations – they are generally positive about the quality of the work of the project managers that was conducted between 2008 and 2010 (Erfgoedinspectie 2011, 55). From another study by the National Agency for Cultural Heritage can be deduced that a sample of excavation and test pit reports shows that these researches add new knowledge of various subjects (Theunissen and Deeben 2011, 29-31). In the majority of the excavations (60%), the output is much larger even than the contractor expected (*idem*, 37).

In the context of evaluating to what extent the Malta Convention has added to the gain in knowledge, we should ideally compare the current situation with the situation prior to the signing of the Convention. Unfortunately not a lot of data is available from the pre-Malta period. However, the data that we do have does not seem to support the hypothesis that knowledge production has decreased. We know for instance that the pre-Malta practice has been stopped in which fieldwork results were often not analysed nor reported. Presumably half of the 8000 excavations that were executed between 1900 and 2000 have never been published (Hessing and Mietes 2003), while today everything has to be reported. We also know that the number of sites that are being studied has considerably increased, from an estimated number of 100 in 1990 to around 160 in 2000 and even 208 in 2008.

On the other hand, it has been noticed that the share of extensive excavations is very small – in 2009 it was found that only 14% of the excavations of 2006, 2007 and 2008 lasted longer than 40 days (Bazelmans 2011, 15). This could create the impression that the new way of working does indeed affect the knowledge production negatively. However, if we look at the percentage of long and short excavations in a longer perspective (table 1), we can infer that long-lasting excavations were already in a minority long before the Malta principles were implemented in our legislation in 2007 and that their share has been decreasing since the 1990s.

Also a slightly downward trend in the duration of projects has been observed (*e.g.* Van den Dries *et al.* 2010, 62). This could also be interpreted as a sign that there is a reduced rate in knowledge production. However, a diminished duration of projects does not necessarily mean that knowledge production is dwindling. If for instance it relates to an increased efficiency due to technological improvements and computerization or to having better educated and skilled employees, a shorter duration may have no negative effect on the output. This ought to become clear if we would compare the volume of fieldwork projects in square metres, but unfortunately, such data is not available.

Seen from these perspectives, it cannot (yet) be claimed that knowledge production has diminished. Perhaps some aspects have developed less than we had hoped, but this is compensated by other aspects that have hugely improved. Huge progress has for instance been made in the way we select our researches. Nowadays this is a far more conscious process, led by informed decision-making. During the former era, which was dominated by rescue archaeology, research was highly dependent on lucky finds and on the availability of last-minute financial sources. Today, research is predominantly directed by research agendas and when heritage is sacrificed to building or farming activities, we at least know much better what exactly is being destroyed.

This does not imply that we do not have to be concerned. On the contrary, a serious concern for the future regarding knowledge production relates to the fact that the authority on the management of archaeological heritage has been decentralized; it is nowadays the municipal council – so non-specialists – who is in charge of taking decisions on the volume, aims and even the contents of research. This means that the academics have lost a large part of their supervision or guardianship over the archaeological resource. Consequently, the choices and selections made by these new

	not indicated		10 days or less		11-30 days		31-60 days		more than 61 days	
	number	%	number	%	number	%	number	%	number	%
2010 (N=149)	0	0	68	45.6	48	32.2	16	10.7	17	11.4
2000 (N=40)	11	27.5	10	25	9	22.5	5	12.5	5	12.5
1990 (N=10)	1	10	4	40	3	30	0	0	2	20

Table 1 Duration in days of the excavations in the Netherlands (source: Archis).

powers may no longer match the academic interests and priorities. That this has already started to happen is shown by one of our master students through her thesis research (Van Vuuren 2010). She discovered that selection policies of municipalities tend to favour the more recent archaeology. Several municipalities even exclude almost the entire prehistoric period (Van Vuuren 2010, 68-71). As the more recent archaeology is considered to offer the best potential for presentation purposes, this suits local interests and purposes of city-marketing best. Moreover, agendas like these hardly help to fill gaps in our archaeological knowledge. Hitherto this approach has only been applied on a small scale (in 2010, nine municipalities had such qualitative selection policies), but if this becomes the dominant approach, it surely will become problematic (Van den Dries and Van Vuuren 2012).

Another reason for concern is the increasing marginalization of the role of universities in the actual fieldwork. As they cannot compete in acquisition with the commercial sector, their share in fieldwork has been reduced dramatically, to less than ten per cent (see Van den Dries and Kwast in press). Since universities usually provide good-quality reports, which have the best citation figures (see below), this is not a good development for the production of archaeological knowledge.

3 Knowledge dissemination and valorization

What definitely has improved due to the revised legislation (and compliance control) is the publishing of fieldwork results. Nowadays 75 per cent of all projects is reported within two years after the field work was finished (Erfgoedinspectie 2010). This, however, has introduced a new difficulty, *i.e.* the ever-increasing volume of grey literature (Rijksdienst voor het Cultureel Erfgoed 2009, 108). The hundreds of reports that are being produced per annum are clearly not optimally used for subsequent research. A Dutch student, doing a master degree course in Dublin, showed by a citation analysis of 3739 site reports that were produced in 2006, 2007 and 2008, that until 2009 more than 50 per cent of these reports had not yet been cited in any other report or publication (Helwig 2009). This not only was the case with reports on bore hole surveys, but also with excavation reports. Of these merely 38 per cent was cited. Notably, the reports of the universities were cited most (Helwig 2009, 19-20).

It may be impossible to keep track with so much information forthcoming, but it is also difficult to get hold of. The State Agency is obliged to provide access to these site reports, but an assessment by the State Inspectorate in 2010 (Erfgoedinspectie 2010) made clear that only 38 per cent of the reports from 2003-2006 was by then centrally registered and publicly available. Fortunately, many contractors publish a large part of their reports on their websites, but this of course is not the best way as one may not know all the knowledge-producing parties and nobody can afford to spend a lot of time and energy to collect all these dispersed bits of knowledge. As of April 2011, the additional measure was taken that site reports have to be uploaded digitally – instead of being sent in hard copy – to the national archaeological information system (Archis).

This measure may improve the availability of new data, but it may not help to have it consumed and upgraded to syntheses. This is another difficulty regarding valorization. Our knowledge dissemination is almost exclusively restricted to site reports. It was calculated for the 2009 heritage report of the National Agency for Cultural Heritage (Rijksdienst voor het Cultureel Erfgoed 2009, 111) that the annual number of synthetic studies (articles and monographs) and dissertations had declined from 25 in 2002 to 18 in 2006. A recent inventory of the National Agency has confirmed that this downward trend is continuing (Theunissen and Deeben 2011, 34). The number of dissertations went from ten in 2000 to three in 2010. This trend is striking, as it completely contrasts with the general Dutch trend of an increasing scientific output.[4]

This downward trend in archaeology could well be caused by the decreased staff size at universities and at the national heritage agency. Their research and financial capacity has been cut down seriously in the last couple of decades (Koninklijke Nederlandse Akademie van Wetenschappen 2007, 15). An additional cause may be that for many years all available research capacity was absorbed by developer-funded research (see for instance Van den Dries *et al*. 2010). Most archaeologists were very much preoccupied with writing site reports and with additional tasks and thus had less time for additional scientific publications.

For the future it is not expected that this will change for the better. The archaeological community could take more notice of the research results than it is doing now, but as long as there are no financial resources or other incentives available, it will remain difficult to conduct synthetic analyses on a scale that fits the demand for it. That additional funding can help to transform the bits of knowledge in the development-led excavation reports into comprehensive syntheses is shown by our British colleagues. The new synthesis of British and Irish prehistory is mainly based on grey literature (Bradley 2007), and the subsequent re-contextualization of the prehistory of Britain and Ireland, that is currently carried out by the universities of Reading and Leicester, is based on the unpublished excavation reports on sites in northern France, Belgium, Luxembourg, the Netherlands, north-western Germany and western Denmark.[5] These examples also show that development-led excavation reports do contain valuable knowledge.

4 Public outreach

The issues of knowledge production and dissemination are closely linked to the issue of public outreach. What does the public gain from archaeologists generating new knowledge about the past? Twenty years ago, just after she had signed the Malta Convention, the minister of Wellbeing, Health and Culture - Hedy D'Ancona - gave a speech at a student symposium in which she urged the archaeological community to further exploit its opportunities to generate publicity and to enlarge public engagement and participation (Archeologisch Informatie Centrum 1993).[6] The question is: did we do this?

Some archaeologists have an outspoken answer to that. For instance Professor Theuws (then University of Amsterdam, now University of Leiden) recently said in a television documentary that "In the Netherlands presumably around 100 million euro is spent on archaeology annually. What does society get in return? Nothing."[7] (translation by the authors).

Considering the available data, our answer is less negative. First of all, a lot of archaeological fieldwork is not meant to produce narratives of the past but rather to locate and value archaeological resources, as was discussed above. Moreover, in those cases in which excavations are conducted and in which indeed reconstructing the habitation history is the aim, the public interest is often taken into account. Ever since the 1960s and the emergence of "public archaeology" (McGimsey 1972), the archaeological community is very aware of the importance of public support and nowadays much effort is being put into educating the public and into public outreach activities. The issue is frequently the subject of seminars and other vocational meetings, and we even have a university chair on the public aspects of archaeology.[8] Consequently, the archaeological community is doing more than ever before. In the last twenty years at least 25 companies have specialized in public outreach activities and, together with the municipality archaeologists and provincial heritage centres, they have organized all kinds of activities, such as open days and exhibitions, and numerous public books, leaflets, websites, etc. are being produced.

The attention for public outreach can also be seen in several studies. In 2011, as partner of a European research project ('Archaeology in Contemporary Europe')[9] that was funded by the European Commission, the Faculty of Archaeology sent a questionnaire to all organizations active in Dutch archaeology (public and private), to map the profession and the work. From the responses – 62 organizations contributed – can be deduced that there is a lot of attention for public outreach activities (Van den Dries and Kwast in press). All governmental organizations except two (94%) consider it a very important task and also 64 per cent of the commercial companies disseminates findings to the

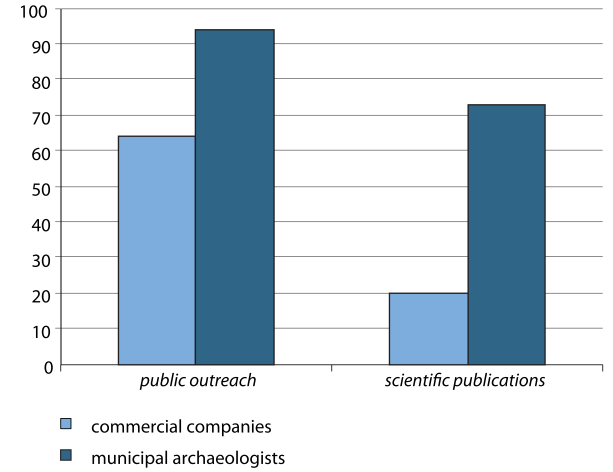


Figure 1 The percentages of Dutch companies and municipal archaeologists that indicated (in a questionnaire sent out in 2011 for the Archaeology in Contemporary Europe research project) to be active in public outreach activities and in the production of scientific output.

public. In fact, it seems that there is more output for the public than scientific output (fig. 1).

Apart from data on the attention of archaeologists for the public, there is also some data on the attention from the audience for archaeology. We know for instance that museums regularly draw huge crowds with unique and exotic exhibitions - in 2008 the terracotta army from Xi'an attracted over 353,000 visitors to the Drents Museum.[10] Also open days are popular - in 2003, four open days at the excavations of the Roman vessel at De Meern (near Utrecht) were attended by 30,000 people.[11] Moreover, archaeological finds and heritage related issues such as repatriation claims of objects and the demolition and looting during the recent Arab revolts are frequently covered by the media. Local newspaper journalists like to report on local research; nearly 85 per cent of the municipalities that filled in our ACE-questionnaire indicated that they use (local) papers to disseminate their findings. Finally, a serious interest of society in archaeology can also be seen in the engagement of local authorities. Although mainly inspired by financial considerations, they are increasingly interested in directing both the selection policies (Van Vuuren 2010) and the scientific goals of archaeological research on their territory.

It is however more difficult to explore whether the attention for and from the public adds to the use of archaeological heritage as a source of collective memory. Is this what the public wants and are they satisfied? We have some indications that this may not necessarily be the case. In 2010, one of our master students had questionnaires filled in by members of the public (109) and by archaeologists (21), to find out in which way the audience wants to be informed about – or involved with – archaeology, and in which way the archaeologists want to inform the public (Lampe 2010a). She noticed a considerable discrepancy in the preferences of both groups. Whereas archaeologists tend to think of organizing open days (93%), of building small exhibitions at excavations, of writing newsletters and of making films as the best ways to engage the public, the public, on the other hand, seemed to be mostly interested in visiting a theme park like Archeon (55%) or a museum (49%), in watching a film (42%) and in participating in an excavation (39%). The audience is also interested in talking with an archaeologist (33%), but far less interested in reading about archaeology on websites (17%) or in playing computer games (13%). Interestingly, the least interest (12%) is in reading a book on archaeology (Lampe 2010b, 64).

That publications and exhibitions are not very popular was confirmed by another survey carried out by another of our master students among inhabitants (100) of The Hague (Wasmus 2010). He found that only a small part of the respondents in The Hague were interested in getting information through exhibitions (10%) or publications (11%). There was a preference for getting information on (local) archaeology from (local) newspapers or (local) television (53%). Second best were open days and information panels in the field or in the street (both 26%): when provided, such public information on the street was enjoyed by as much as 75 per cent of the audience (Wasmus 2010, 53). The majority (61%) was not interested in a guided tour at the local repository, and half of the participants (51%) indicated *not* to be interested in seeing how archaeologists do their job. Young people were the least interested in archaeology and in what is offered: they indicated they would not go to exhibitions or open days at all.

That books might indeed not be what the general public wants, is also illustrated by the sales figures of Onder Onze Voeten (‘Under Our Feet’ by Van Ginkel and Verhart 2009), which was published in 2009.[12] This is one of the largest public outreach projects of the last couple of years[13] and was intended to succeed the very famous and in 1981 extremely successful public book Verleden land (‘Past Land’ by Bloemers et al. 1981), of which 120,000 copies (!) were sold. Of this new book, which is truly a splendid and beautiful comprehensive piece of work that only costs 25 euro, only 9000 copies – of a total print run of 15,000 – were sold in 2011 (pers. comm. E. van Ginkel 2011).

That this time a similar success fails to occur may have to do with the fact that in contrast with the 1980s there is an abundance of (free) information on excavations and archaeology available, either through websites, booklets, press articles, open days, museum presentations, etc. There is also more attention at schools, through for example ready-made lessons and packages for pupil presentations. The strong appetite for information that was there in the 1980s seems to have been satisfied or – in case there still is an appetite – it is now being satisfied through other means.

These experiences and findings should make us wonder whether we listen sufficiently to the needs and wishes of the public, or whether we sometimes are looking too much to our own interests instead of those of the public (Holtorf 2007). In the public survey in The Hague, 60 per cent of the respondents indicated to be satisfied with the information that archaeologists provide, but the remaining 40 per cent said that more results should be disseminated to the public (Wasmus 2010). In the study of Sophie Lampe, even 64 per cent of the participants said that Dutch archaeologists could present archaeology in a much more pleasant way (Lampe 2010a, 37). They indicated that there is quite an interest in doing excavations themselves. That community archaeology can be an effective means to increase participation is shown in the United Kingdom, where it involves at least 215,000 individuals (Thomas 2010, 15, 22), yet very few opportunities for community archaeology are offered in the Netherlands.

In other outreach domains, not all public groups are sufficiently served either. An analysis by a master student of the target groups that the seven main archaeological museums in the Netherlands engage with, shows that teenagers, young adults, middle-aged adults and migrant groups are currently underrepresented among the visitors (Van Kesteren 2010). As it is far more difficult to attract these groups, museums seem to put most effort in serving the easier target groups of school children, families and elderly people (Van Kesteren 2010, 42).

The group which Dutch archaeology seems to serve best are the organized volunteers. We have quite a substantial contingency of volunteers – estimated at around 4000 individuals in 2008 (Duineveld *et al.* 2008, 30), and with the implementation of the revised act – introducing the obligation to work according to the Dutch Quality Standard – there was a lot of concern that the role of volunteers would fade. Both the volunteers (*e.g.* De Grood 2003), and the Dutch archaeological interest organization (Stichting voor de Nederlandse Archeologie), and even external researchers (Duineveld *et al.* 2008) expressed their concerns. However, from a recent survey among all groups of the main organization of volunteers (Archeologische Werkgemeenschap Nederland, AWN) it can be deduced that 76 per cent of the regional groups has been participating in archaeological research between 2007 and 2010 (Van de Rijdt 2011, 116) and that more than half (57%) of them still conducts field work autonomously. It seems that they still have a valuable contribution to make to all kinds of research and other activities. Although there may still be some difficulties, such as for instance the Dutch archaeological system unintentionally excluding volunteers in decision-making (Duineveld *et al*. 2008), at least the archaeological contractors, the local authorities and the National Agency are all willing to involve the non-professionals even better. In fact, at the beginning of 2012, the two branch organizations (Vereniging van Ondernemers in Archeologie, VOiA and Nederlandse Vereniging van Archeologische Opgravingsbedrijven, NVAO) signed an agreement with the AWN to stimulate the companies making use of the capabilities and knowledge of the volunteers.

As the above studies show that it differs per age group or target group how they want to be informed and involved, we apparently have to offer a broader repertoire of outreach activities and products, and to apply a more tailor-made approach. We have plenty of opportunities to provide creative and innovative ways of engagement, but hitherto we have mainly walked the conservative pathways. Often the excuse can be heard that we do not know our public very well and that we do not know what their needs and wishes are. This however is only partly true, as various larger and small studies of audiences are available. The main difficulty probably is that we are not always sufficiently skilled in this job. Most of us are trained as archaeologists, not as communication and marketing experts. In this, the field of heritage management may be of help; it increasingly provides the required skills and research results.

Apart from the needs of the public, the effectiveness of the outreach activities should be studied as well. Sometimes quite an effort has been made (also financially) but it does not seem to achieve its goals. This can be illustrated by an internship research of one of our master students. She evaluated for a public outreach company (TGV Teksten & Presentatie) two public, outdoor exhibits – one in a train station (Rotterdam Blaak) and one in a tram station (Grote Markt, The Hague) – that were placed there in the 1990s. In particular, she explored to what degree they are being noticed by the public and how they are appreciated. Two hundred questionnaires were collected and it turned out that at both locations quite a large number of people (almost 50%) had never noticed the exhibit, despite the fact that they all had been there before (Libert 2010, 37). However, those that did know about it – or once they were made aware of it – were very positive about the exhibits. As the only problem seems to have been that both displays were not very visible due to their remote location, out of sight of people walking the main routes, this can either be easily solved or taken into account in future projects.

Such studies can also help to put things in perspective. Sometimes people simply are not very interested in archaeology. This is clearly shown by an internship research that two of our students carried out for the National Agency for Cultural Heritage. They interviewed 45 people visiting the Boshoverheide (Weert), where the largest prehistoric urnfield of our country is excavated. Already in 1987 the burial mounds were reconstructed, a path was created and an information panel was erected, and the national agency and the owner of the terrain, the Ministry of Defence, wanted to know how many people would come to visit these monuments and how many people actually realised that they are walking in a prehistoric landscape.[14] Surprisingly, it turned out that the majority of the visitors (73%) knew about the presence of the monuments and that 78% had noticed the information panel. However, not a single visitor indicated that the monuments were the reason for their visit (Elemans and Munawar 2012, 13-14). They simply came to walk their dog or to enjoy the ‘natural’ landscape of this heathland and drift dune area.

5 Public support

Attention for the public may be less dramatic than Theuws presumes, but the question is whether all efforts affect public support for archaeology. There are various indications that some public groups are not very satisfied with the new heritage management approach, especially not with the amount of money that it involves. This was even discussed in parliament; in November 2010 – when the budget of the Ministry of Economic Affairs, Agriculture and Innovation was discussed in the Second Chamber – public attention was drawn to the costs of archaeological research by two members of parliament (of different parties) who defended the interests of the agrarian sector. It was said “As the costs of archaeological research are completely running out of hand, we request the government to make a proposal before the first of July 2011 to reduce the expenses for archaeological research.” (translation by the authors).[15]

Also in magazines, such as Binnenlands Bestuur (the main newsletter on domestic policy, management and administration for directors and civil servants that is weekly produced for 55,000 readers)[16], negative opinions can be heard frequently. They often relate to the costs. All these expressions have in common that they typify archaeological research as spielerei which is considered a burden on society, in particular on local authorities, developers and farmers.

However, such complaints are not quite supported by the facts. First of all, the general picture is that archaeologists excavate all archaeology. The truth is, however, that a lot of selection is going on prior to any research. One of our master students showed with her thesis research that 43 per cent of the municipalities apply quantitative selection (Van Vuuren 2010). In accordance with article 41a of the Monument Act they often allow quite extensive exemptions to the obligation to conduct research (De Groot et al. 2011). This means that for a lot of disturbing activities there is still no research required. Furthermore, far from everything that is discovered with field evaluations is excavated. The archaeological sector itself is very selective in its recommendations for further research, and also municipalities apply qualitative selection policies (Van Vuuren 2010). Consequently, the number of excavations that result from field inventories is only 1 out of 16 (Theunissen and Deeben 2011).[17] And this means that on an annual basis, only 37 per cent of the municipalities commission an excavation.

Secondly, the general picture is that archaeology is a huge burden for disturbers. But if we put the costs that are involved with archaeology in perspective, these are not very high. It is for instance interesting to compare it with the turnover of the other (complaining) stakeholders.[18] In 2009, the turnover of the building and construction sector was 87 billion euro, that of the archaeology sector was estimated between 70-80 million euro in 2008 (Van den Dries et al. 2010, 57), the year with the largest number of fieldwork projects ever. If this would all have to be paid for by the building business, it would amount to less than one per cent of its turnover. From the heritage report it is however known that in 2007, 58 per cent of the archaeological research was commissioned and paid for by the private sector (developers, builders but also ordinary citizens), the remainder by the public sector (Rijksdienst voor het Cultureel Erfgoed 2009, 229), so it is far less than one per cent. Besides, the development sector probably does not necessarily carry these costs itself; presumably they are included in the prices the sector charges to its clients.

Likewise, the supposed burden on the agrarian sector can be toned down too. We know that 60 per cent of all valuable archaeological areas are located in rural areas (Rijksdienst voor het Cultureel Erfgoed 2009, 77)[19] and that ploughing is one of the most disturbing activities, but also that in the rural areas more generous exemption rules apply than in urban areas (De Groot et al. 2011). Moreover, excavations are mostly conducted in urban areas (Van den Dries and Kwast in press). As, again, probably only 58 per cent of this research is commissioned by private disturbers, including non-farmers like ordinary citizens and developers, only a relatively small portion of the costs is being paid for by the agrarian sector.

In relation to the turnover of the agrarian sector, 4.7 billion euro in 2010, the 14 million euro turnover that the archaeology sector earns with projects in the rural areas comes down to 0.3 per cent. That is when all rural research would be paid for by the agrarian sector. If they pay for only half the research, the costs are 0.1% of the total turnover. For the sector as a whole that is not much, although we do acknowledge that for individual farmers it may be a burden. They can hardly pass on these costs in the prices of milk and wheats.

Nonetheless, all stakeholder complaints surely reflect genuine feelings and such expressions probably affect public opinion as well. Does it mean however that there is little public support for archaeology? Also on this issue few recent data is available, but the studies by our students indicate that this may not be the case. For instance, developers seem to have a rather more positive attitude towards archaeological research than we might have expected. One of our students interviewed for her bachelor thesis five large developers (out of a group of 60) who are active in the area of Leiden. They all consider archaeology as an intrinsic part of development work, like the soil purification procedures, and they mentioned that it has the potential to generate added value for developers (Van Donkersgoed 2011, 57).[20]

From other stakeholders there seems to be quite some support too. The above mentioned survey in The Hague showed that a majority of the interviewees from the general public (68%) says that archaeology is important (Wasmus 2010), and in the research conducted by Sophie Lampe even 74 per cent of the participants said to be interested in archaeology (Lampe 2010b, 65). In comparison with the pre-Malta era, when 72 per cent of a representative sample of the Dutch population showed involvement with Dutch archaeology (Archeologisch Informatie Centrum 1996, 17), not much seems to have changed.

This does not mean that we could not do more to strengthen or even improve the relationship with other stakeholders. The developers for instance expressed clear dissatisfaction with what they get in return for the money they invest. They are not very interested in the scientific reports they receive – which the contractor is obliged to produce (Van Donkersgoed 2011, 50). They are mostly interested in new and important findings, which they can present to their employees and use for promotional purposes, *i.e.* things that can enhance their image (Van Donkersgoed 2011, 47). Their support and willingness to spend a large sum of money depends on the uniqueness and importance of the finds and what they can do with it. For them added value would for instance also be achieved if the research results would be used at (local) schools. It is in this respect noticeable that the developers found archaeologists to be hesitant about participating in public activities or sharing photographic material (let alone finds).

Moreover, the communication with stakeholders could be improved. Developers for instance mentioned that their main problem with archaeology is its unpredictability (in time and expenses) and that the need for the research is not always made clear to them (Van Donkersgoed 2011, 49). Thus, the sector itself could do much more to get more support for (the costs of) archaeological research. In any case, dramatic performances in the media highlighting the uselessness of our researches do not contribute to a positive image.

6 Conclusion

With this paper we aimed to discuss to what extent the current Dutch heritage management system has so far contributed to achieving the main goal of the Malta Convention, namely to better protect the archaeological heritage as a source of collective memory and an instrument for scientific study. In the past years various statements have been made in the media indicating that both the academic world and the public would be served badly by this new system. Our conclusion on the basis of this (yet limited) evaluation is that the available data provides no indications that this is true if we look at knowledge production and public outreach. Knowledge dissemination and valorization could surely be much improved. There is for example reason for concern about the role and influence of the universities in generating data, in directing research questions and in generating syntheses, which may be even further marginalized if no measures are taken to prevent this.

Although attention for public outreach has not been included in the legislation, much is happening. Still, there is much to gain if the needs of the various target groups would be served better. A lot of energy is for instance spent on the production of books and websites, but these seem to be outreach activities that a large part of the public likes least. Especially to reach out effectively to younger generations, we will have to explore new communication means, like the social media, and new ways of spending leisure time.

Regarding public support for archaeology, there were signals indicating that this may be dwindling. Studies show however that this may not be the case and that the support is not too bad. Nevertheless, we must remain cautious. There is no guarantee that the current relatively positive situation will last. Things may change rapidly due to the continuously developing circumstances around us, such as the global economy, political power relations and public opinion. We should therefore exploit all opportunities to root the public support more firmly in society. We are making it less expensive and easier to handle, but do we also make it more relevant and enjoyable? We should at least communicate better with all stakeholders and try to serve their various needs better. On the other hand, it is also important to put the complaints about archaeology in perspective. As these are not always supported by the facts, it is important that we postulate this message too.

For the near future we recommend that the archaeological community looks more critically at its own attitude and practices and that it asks itself whether enough is being done to gain public support by the way in which we use the archaeological resource as an instrument for scientific study and as a source of our collective memory of the past. It is also clear that a lot of work still needs to be done. We will have to further study the public and its wishes, to evaluate the effectiveness of outreach activities, to synthesize the results of such studies, to disseminate the findings, and to learn to apply them. Fortunately, we experience that younger generations of archaeologists are very eager to work on these issues and the results of their researches, some of which were presented in this paper, demonstrate that it is worthwhile and rewarding to include such heritage management issues in the academic and vocational training.

Acknowledgements

We would like to thank our students, not just those who did the researches we refer to in this article, but all of them for the inspiring discussions on heritage management issues and the interesting research projects they came up with.

Notes

1 Http://conventions.coe.int/Treaty/en/Treaties/html/143.htm.

2 We have a legal system for the protection of the archaeological heritage (Article 2), with provisions for inventories, for the designation of protected monuments and for the reporting of stray finds. We guarantee the scientific significance of archaeological research work (article 3), among others by ensuring that it is carried out by qualified and authorised individuals (Article 3.ii). We implemented measures for the physical protection (Article 4) and in situ conservation (Article 4.iii) of the archaeological heritage. We have integrated archaeology in planning policies (Article 5) and arranged the financial support for research (Article 6). Finally we have taken measures to facilitate the dissemination of scientific information (Articles 7 and 8), as we have the obligation to provide excavation reports within two years after the field work is finished and to have all reports and documentation delivered digitally to an e-depot.

3 At Leiden University students can follow the master specialisation track 'Archaeological Heritage Management in a world context'.

4 An overview in the Dutch newspaper NRC Handelsblad of March 12 2011 showed an increase of journals, articles and PhD's (2,000 to 3,700) between 1997 and 2009.

5 See for more information http://www2.le.ac.uk/departments/archaeology/research/projects/british-irish.

6 The symposium was organised by the Leiden student organisation Johan Picardt on the subject of improving the position of archaeologists in society.

7 "*Het is niet uitgesloten dat er tegen de 100 miljoen euro aan archeologie wordt omgezet per jaar in Nederland. Wat krijgt de Nederlandse samenleving daar voor terug? Niks*." From *Een Vandaag,* June 4th 2009 (http://player.omroep.nl/?aflID=9606047).

8 Since 2009, the University of Groningen has a special chair on 'archaeology and society'.

9 See www.ace-archaeology.eu.

10 Http://www.gochinaassengroningen.nl/recordaantal-bezoekers-voor-het-drents-museum/

11 Http://www.utrecht.nl/smartsite.dws?id=198287.

12 Written by one of the main Dutch experts on public outreach and a very experienced museum curator.

13 It was financed with public sources from the NWO funding programme '*Oogst van Malta*' (The Malta Harvest), see http://www.nwo.nl/nwohome.nsf/pages/NWOA_6ZJCZF. The costs were at least 200,000 euro.

14 As part of the NWO funding programme Odyssee. See: http://www.cultureelerfgoed.nl/node/2055 or http://www.erfgoednederland.nl/odyssee/projecten/5.-de-boshoverheide/item10674.

15 "*[...] constaterende dat kosten van archeologisch onderzoek totaal uit de hand lopen, verzoekt [indiener] de regering, voor 1 juli 2011 met voorstellen te komen die leiden tot een forse reductie van de kosten voor archeologisch onderzoek [...].*" Quote from request by Snijder-Hazelhoff/Koopmans on 24 November 2010 (http://www.europa-nu.nl/9353000/1/j4nvgs5kjg27kof_j9vvikqpop-jt8zm/viklovhp55zi/f=/kst32500xiii86.pdf)

16 Http://www.binnenlandsbestuur.nl/

17 In 2011 181 excavations were conducted in 418 municipalities (source: Archis).

18 It would be more interesting to look at profits, but such figures are hard to find. Only Quote Magazine indicated that the profit of the top-10 of Dutch construction companies was 159 million euro in 2009, which was a very bad year for this sector. This top-10 provided 27% of the total turnover. If they were also producing a quarter of the profit, the total profit may have been 636 million euro (4 × 159). If the archaeological sector costs 34 million euro (58% of a turnover of 60 million), that would be the equivalent of 5.3% of the total profit.

19 Due to the fact that 65% of the Dutch land is used for agriculture.

20 It must be stressed that these developers seem to have good experiences with the municipality archaeologist, the archaeological contractor of the Faculty of Archaeology (Archol BV) and with Leiden University, but this situation does not have to be the same everywhere and results may differ in other regions.

References

Archeologisch Informatie Centrum 1993. Archeologie, Maatschappij en Ethiek. *Archeologisch Informatie Cahier* 5, Leiden.

Archeologisch Informatie Centrum 1996. Samenvatting Bevolkingsonderzoek 'archeologie'. *Archeologisch Informatie Cahier* 10, Leiden.

Bazelmans, J. 2011. Serving two masters: Dutch archaeology since the Valletta Convention. In: L. Webley, M. vander Linden, C. Haselgrove and R. Bradley (eds), *Development-led archaeology in Northwest Europe, proceedings of a round table at the University of Leicester 19th-21st November 2009*, Oxford: Oxbow Books, 9-21.

Bazelmans, J.G.A., O. Brinkkemper, J.H.C. Deeben, J. van Doesburg, R.C.G.M. Lauwerier and P.A.M. Zoetbrood 2005. Mag het ietsje meer zijn? Een onderzoek naar de door bedrijven opgestelde Programma's van Eisen voor archeologisch onderzoek uit de periode 2003-2004, Amersfoort (Rapportage Archeologische Monumentenzorg 120).

Bloemers, J.H.F., L.P. Louwe Kooijmans and H. Sarfatij 1981. *Verleden land. Archeologische opgravingen in Nederland*, Amsterdam: Meulenhoff Informatief.

Bradley, R. 2007. *The Prehistory of Britain and Ireland*, Cambridge: Cambridge University Press.

Donkersgoed, J. van 2011. *Archeologie: bron van inspiratie of bodemloze put? Onderzoek naar het draagvlak voor archeologie bij projectontwikkelaars*, Leiden (unpublished Master thesis University of Leiden).

Dries, M.H. van den 2011. The good, the bad and the ugly? Evaluating three models of implementing the Valletta Convention. *World Archaeology* 43(4), 594-604.

Dries, M.H. van den and W.J.H. Willems 2007. Quality Management – The Dutch Perspective. In: W.J.H. Willems and M.H. van den Dries (eds), *Quality Management in Archaeology*, Oxford: Oxbow Books, 50-65.

Dries, M.H. van den and P.A.M. Zoetbrood 2008. *Werk in uitvoering 2 – Van veldwerk tot standaardrapport. Onderzoek naar de kwaliteit van rapporten van archeologische proefsleuvenprojecten en opgravingen*, Den Haag: Erfgoedinspectie. (Http://www.erfgoedinspectie.nl/uploads/publications/werkinuitvoering(2).pdf)

Dries, M.H. van den, K.E. Waugh and C. Bakker 2010. A crisis with many faces. The impact of the economic recession on Dutch archaeology. In: N. Schlanger and K. Aitchison (eds), *Archaeology and the global economic crisis – multiple impacts, possible solutions*, Tervuren: CultureLab, 55-68. (Http://ace-archaeology.eu/fichiers/25Archaeology-and-the-crisis.pdf)

Dries, M.H. van den and M. van Vuuren 2012. Het selectiebeleid van gemeenten – kiezen voor bekende thema's. *Archeobrief* 16(1), 32-37.

Dries, M.H. van den and S.M. Kwast, in press, Post-Malta developments in the Dutch archaeological profession.

In: INRAP, *The Archaeological Profession*, Paris (INRAP Cahier 5). (forthcoming ACE-publication)

Duineveld, M., K. van Assche and R. Beunen 2008. Uitgesloten amateurs in het nieuwe landschap van de Nederlandse archeologie. *Vrijetijdstudies* 26(4), 29-39.

Elemans, L. and N.-A. Munawar 2012. The experience of the visitors of the Boshoverheide: the biggest prehistoric urnfield in the Netherlands. In: J. van Donkersgoed, L. Elemans and A. Rhebergen (eds), *Out in the Field – Internships Master Students Archaeological Heritage Management 2011-2012*, Leiden: Sidestone Press (Graduate School of Archaeology Occasional Papers 10), 12-15.

Erfgoedinspectie 2010. *Zoek! Een speurtocht naar de rapporten van opgravingen 2003-2006*, Den Haag: Erfgoedinspectie. (http://www.erfgoedinspectie.nl/uploads/publications/zoek__een_speurtocht.pdf)

Erfgoedinspectie 2011. *Kwaliteit een zorg? Kwaliteitszorg en zelfregulering in de Nederlandse archeologie*. *Opgravingen en proefsleuven 2008-2010*, Den Haag: Erfgoedinspectie. (http://www.erfgoedinspectie.nl/uploads/publications/kwaliteit_een_zorg_erfgoedinspectie_rapport_september_2011_copy1.pdf)

Ginkel, E. van and L. Verhart 2009. *Onder onze voeten. De archeologie van Nederland*, Amsterdam: Uitgeverij Bert Bakker.

Grood, J., de 2003. De amateur in het veranderende archeologisch bestel. *Westerheem* 52, 164-166.

Groot, T. de, A. Koekelkoren, M. Lobbes and B.I. Smit 2011. Deel III - Effecten van vrijstellingen voor archeologisch erfgoed. In: R.C.G.M. Lauwerier, T. de Groot, B.J.H. van Os and L. Theunissen (eds), *Vragen over Malta*, Amersfoort: Rijksdienst voor het Cultureel Erfgoed (Rapportage Archeologische Monumentenzorg 196), 87-135.

Helwig, F. 2009. *The Contribution of Standard Reports to Archaeological Research in the Netherlands. An Evaluation Using the Bibliometric Method*, Dublin (unpublished Master thesis University College Dublin).

Hessing, W.A.M. and E.K. Mietes 2003. *Project Odyssee. Een zoektocht naar de achterstand in de uitwerking van archeologisch onderzoek in Nederland*, Bunschoten: Archeologisch Dienstencentrum.

Holtorf, C. 2007. Can You Hear Me At the Back? Archaeology, Communication and Society. *European Journal of Archaeology* 10, 149-165.

Kesteren, Ch.R. van 2010. *What for whom? The presentation of Dutch archaeological collections in Dutch provincial and national museums*, Leiden (Unpublished Master thesis University of Leiden).

Koninklijke Nederlandse Akademie van Wetenschappen 2007. *De toren van Pisa rechtgezet – over de toekomst van de Nederlandse archeologie*, Amsterdam (Verkenningen van de Koninklijke Nederlandse Akademie van Wetenschappen) (with English summary).

Kristiansen, K. 2009. Contract archaeology in Europe: an experiment in diversity. *World Archaeology* 41(4), 641-648.

Lampe, S. 2010a. *Digging up the public*, Leiden (Unpublished Master thesis University of Leiden).

Lampe, S. 2010b. Liever zelf fantaseren over vroeger. *In Brabant* 1(5), 60-65.

Libert, M. 2010. Public survey on archaeological public exhibits in the underground tunnels of Rotterdam and The Hague, Netherlands. In: A. Degenhardt and S. Lampe (eds), *Out in the field, Internships Master students Archaeological Heritage Management 2009-2010*, Leiden: Sidestone Press (Graduate School of Archaeology Occasional Papers 5), 35-38.

McGimsey, C.R. 1972. *Public Archaeology*, New York: McGraw Hill.

Raemaekers, D.C.M. 2008. Het einde van Malta. *Archeobrief* 12(1), 17-20.

Reijden, H. van der, G. Keers and H. van Rossum 2011. *Ruimte voor archeologie, Synthese van de themaveldrapportages*, Amsterdam (RIGO report P18090).

Rijdt, T. van de 2011. 'Malta' en de rol van vrijwilligers in de archeologie (3): meewerken aan archeologisch onderzoek. *Westerheem* 60(3), 114-121.

Rijksdienst voor het Cultureel Erfgoed 2009. *Erfgoedbalans 2009, Archeologie, monumenten en cultuurlandschap in Nederland*, Amersfoort: Rijksdienst voor het Cultureel Erfgoed. (Http://www.cultureelerfgoed.nl/organisatie/publicaties-rijksdienst/erfgoedbalans-2009)

Theunissen, L. and J. Deeben 2011. Deel I - Een onderzoek naar de effectiviteit van de archeologische onderzoeksketen voor beeldvorming over het verleden. In: R.C.G.M. Lauwerier, T. de Groot, B.J.H. van Os and L. Theunissen (eds), *Vragen over Malta*, Amersfoort: Rijksdienst voor het Cultureel Erfgoed (Rapportage Archeologische Monumentenzorg 196), 9-40.

Thomas, S. 2010. *Community Archaeology in the UK: Recent findings*. (Report Council for British Archaeology).

Electronic document, http://www.britarch.ac.uk/sites/www.britarch.ac.uk/files/node-files/ CBA%20Community%20 Report%202010.pdf, accessed May 10, 2012.

Vuuren, M. van 2010. *What to dig? Selection in Dutch municipal archaeological policies*, Leiden (Unpublished Master thesis University of Leiden).

Wasmus, F. 2010. The past is alive: an analysis of public opinion about archaeology in The Hague. In: A. Degenhardt and S. Lampe (eds), *Out in the field, Internships Master students Archaeological Heritage Management 2009-2010*, Leiden: Sidestone Press (Graduate School of Archaeology Occasional Papers 5), 49-55.

Monique van den Dries
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
m.h.van.den.dries@arch.leidenuniv.nl

Sjoerd van der Linde
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
s.j.van.der.linde@arch.leidenuniv.nl

The Internationalization of archaeological discourse?

John Bintliff

Present disputes within Europe over the competing claims of homogeneity and regionalism in the spheres of politics and economics have their resonances in archaeological theory and practice. This paper offers a 'third way' in which a fractal perspective is seen as advantageous: a variety of approaches to doing archaeology at all scales, from the individual scholar up to the European level and beyond, is healthier and democratic and will sustain a more flexible and innovative discipline.

1 Introduction

Having moved from England (where I had taught at four different universities since 1975), to the Netherlands and in a wider sense to the European Mainland in 1999, has encouraged me over the last thirteen years to reflect on the contemporary and past differences in the way Archaeology is practised and thought about across the sub-continent of Europe. Being in Holland also allows easy interaction with colleagues in France, Belgium, Germany and Denmark, and this has been a very stimulating experience, as well again as alerting me to the special history of Archaeology in each of these countries. The Faculty of Archaeology at Leiden, with its origins in the Institute of Prehistory fifty years ago, was always international both in its intellectual horizons and to a lesser extent in its personnel, although even here particular foci on traditions of innovative research in Landscape Archaeology and Prehistory have remained amongst the strongest pillars of its archaeological community, in their turn reflecting aspects especially associated internationally with Dutch archaeology since the days of van Giffen.

In parallel with the currently-contested political and economic process of Europeanization, archaeological research in Europe is faced with a similar dilemma. Should all European countries, especially those within the European Community, encourage their archaeological methods and theory to be submerged under a uniform agenda, represented by deliberately-targeted global textbooks promoted by multinational publishing houses (for example Cultural History taught from Scarre (2009), and Archaeological Theory taught from Johnson (2010))? The radical alternative might be the cultivation of diverse regional traditions with deep roots in nationalistic scholarly schools (figs 1 and 2). In fact Kristian Kristiansen (2003) has documented how archaeological communities, even in the large Western European countries, are increasingly becoming insular in their citation of relevant literature and use less and less 'foreign language' sources beyond their own country. However I wonder if I was the only person who gained no pleasure in watching the opening and closing ceremonies of the 2004 Athens Olympics, a prolonged exercise in chauvinism with archaeology and history being the main source.

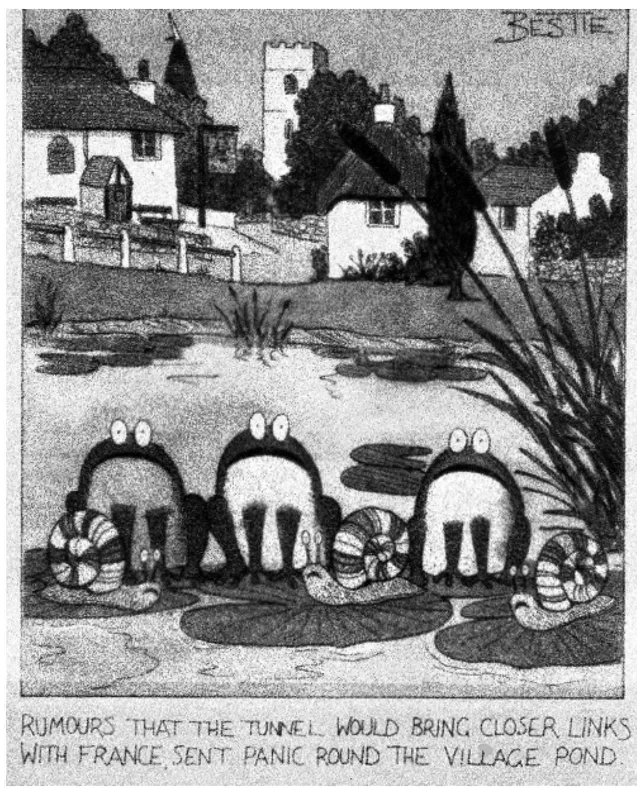
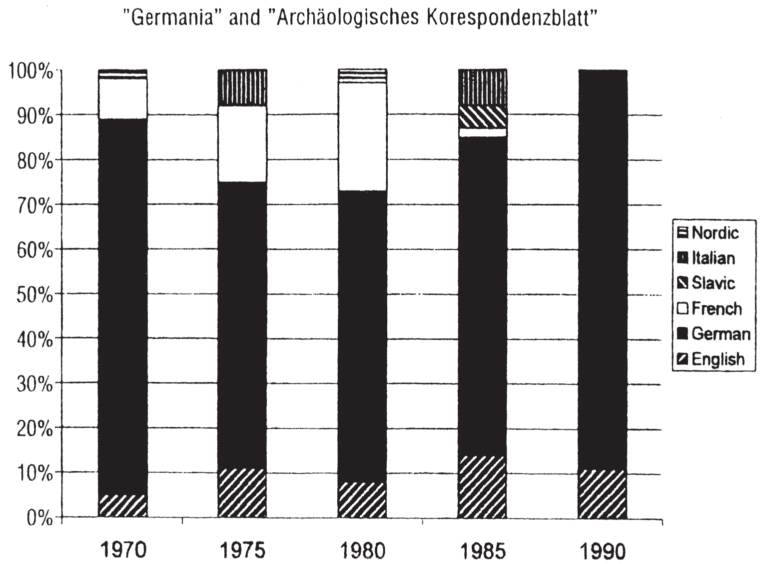
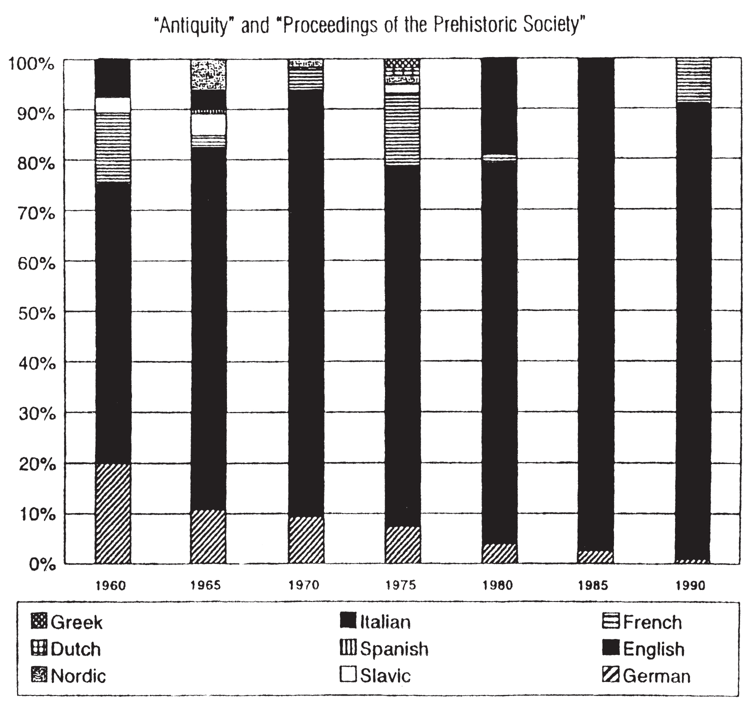


Figure 1 'Rumours that the Tunnel would bring closer links with France, sent panic round the village pond'. A humorous English postcard suggests that the construction of the tunnel under the English Channel making access from France much easier, may not be welcome to everyone. The caption reflects the imagined reactions of English snails and frogs to the perils awaiting them if French culinary culture reaches quiet traditional English villages.

Kristian Kristiansen



a
References divided by language in two German journals at five year intervals (after Margalit, Bertheau and Johansson).



b
References divided by language in two English journals at five year intervals (after Margalit, Bertheau and Johansson).

Figure 2 Research on the linguistic range of articles cited in major national archaeological publications in Europe over time, shows that each country is becoming more monolingual into their national tongue, despite supposed increasing Europeanization. These two examples show the results from bibliographic analysis for two key German journals and two from the United Kingdom. From Kristiansen (2003).

But there is a third clear alternative: diversity of methods and theories across Europe could be celebrated and promoted as a shared European resource, comparable to a rich library you were not aware of before, full of new and stimulating texts. Moreover, the more one learns about the national traditions of archaeology, the more one realizes that each European land has always been a mosaic of different schools of the discipline. In the terms of Chaos Theory (Coveney and Highfield 1990; cf. Lewin 1993; Bintliff 1997; 2004), we could envisage what is known as a 'Fractal Perspective', where the configuration at one level is the same as at other higher levels. Thus *within* each nation-state, with its own developmental pathway within Europe, we have also always witnessed a variety of archaeological schools linked to individual institutions, universities or even individual scholars, so that the reality of archaeological traditions is more complex than the model of 'national schools' of method and theory now under threat from a 'McDonaldization' process of European homogenization.

2 Internationalization

But just as the success and innovativeness of a particular scholar or institute often led to a wider following in the same country, giving rise to phases of a national emphasis or an approach characteristic for one European country, so we find in the history of archaeology that innovation constantly bursts the boundaries not only of the region and individual but also of the nation. Let us take the case of Gerhard Bersu (Evans 1989) (fig. 3). In the heyday of pre-War National Socialism in Germany, techniques of open-area excavation were developed and promoted as

Figure 3 Popular illustration from late 1930s Germany explaining how evidence for the activities of 'our forefathers' can be brought to light by modern activity (above), and how to report this, enlivened by a reconstruction bringing to life the surviving traces (shown below). From Crawford and Austin 1938, also reproduced in Evans (1989).

a means to expose the 'Volk' and bring the German prehistoric past to the participatory consciousness of Germans in the 1930s. Its foremost exponent, a brilliant excavator, Bersu, was invited by a group of young English archaeologists to introduce these revolutionary techniques to Britain, as a deliberate counterweight to the emphasis on stratigraphy and chronological discontinuity promoted by researchers such as Mortimer Wheeler (Hawkes 1982). A very different political context to subsequent generations, but the methodology has remained a major approach in British and wider European archaeology ever since.

In the fields of professional archaeology in Europe, involving standards for accreditation, excavation and publication, suitable terms of employment, the wider implementation of laws on heritage and the antiquities' trade, I see only positive advantages to the homogenization of practices across the Continent, and this process is actively being promoted by the European Association of Archaeologists through its linked council of professional heads of public archaeology. In the areas of method and theory regarding research goals, ways of study and interpreting new results, however, I would advocate an eclectic approach (cf. Bintliff 2000a), where the diverse ideas and practices of each country, each region, each innovative archaeologist form a rich resource for all of us to learn from, to try out. Being English and living in the Netherlands, I know this very well, because to find great cuisine in either country you should turn to a French or Belgian restaurant!

I would like to devote the remainder of this contribution to a further case-study, where I hope to demonstrate how fruitful the exploration of our new 'shared' regional traditions can be for research archaeology, and I shall take my own specialist field of Landscape Archaeology.

3 Case-study

As a research student, I was astonished at the breadth and novelty, for the English-speaking world, of the project by Kossack and others on the German island of Sylt, published in 1974 (Kossack 1974) (figs 4-6). The full integration into a coherent whole of environmental science, high technology field excavation and survey, history and anthropology, still strikes one as an ideal model for a regional project – it even anticipated post-processual theory in conveying an emotional message about the story of the islanders. Yet it was only one of the most impressive amongst a German-speaking tradition of settlement research developed by geographers and archaeologists – *Siedlungskunde*.

This tradition was also very significant in regions formerly within the German-speaking political world, such as the Czech Republic. Our Prague colleagues have in recent years been innovating in this field of settlement archaeology, building on and modifying Siedlungskunde and integrating it with forms of surface field survey methodology emanating ultimately from the United States (fig. 7). The Prague concept of *Community Area* (cf. Neustupny 1991; Kuna *et al*. 1993; Dreslerova 1995; Kuna 1998; 2000) offers an important rethinking in terms of field observation of empirical data, to the older concept developed within Siedlungskunde of the 'settlement chamber' or *Siedlungskammer* (figs 8 and 9). As a result of my own fruitful research-visit to Prague some years ago I picked up many new ideas from this development which I was subsequently able to apply to my landscape studies in Greece, summarized in papers in 1999 and 2000 (Bintliff *et al*. 1999; Bintliff 2000b).

The highlighting of statistical and computer applications in the Prague landscape school reflects onto older intellectual links, a special debt to French analytical archaeology as incorporated by Soudsky and others into Czech archaeological theory in the 1960s (cf. Soudsky 1962) (and which incidentally strongly influenced Dutch landscape archaeology through the common presence of Linear Bandkeramik settlements). This leads us easily into recent French landscape archaeology, where once again there is a fruitful cross-fertilization between Anglo-American intensive field survey methods, the Gallic tradition of statistical and computer archaeology (cf. Gardin 1970), and Dutch landscape archaeology.

The Archaeomedes Project and related research programmes focused around landscape archaeologists in Provence and Languedoc, and combined French geographical concepts of landscape character (cf. Vidal de la Blache 1926) with rigorous parameterization of surface survey and test excavation data, to produce powerful trends and groups which could then be given historic meaning (Raynaud 1996; 2000; Durand-Dastès *et al*. 1998; van de Leeuw (ed.) 1998; Trément 1999) (figs 10-12). The vital theoretical stimulus of Sander van de Leeuw (a Leiden alumnus!) however reminds of the influence of personalities bridging strong regional traditions.

Finally I find equally stimulating and worthy of emulation the recent trend in British archaeology towards the hyper-intensive study of a single parish or commune, using all the range of techniques available. This must originate in the special fascination in English history, literature and ecology in the particular life of the individual rural parish (Lee 1959; cf. White 1789). In archaeology this development is best exemplified by the Shapwick Project (a village in south-west England) (Aston and Gerrard 1999) (fig. 13), which deployed total intensive fieldwalking, test pits over large areas (including digging a trench into the garden of each contemporary villager), very extensive geophysics, careful study of all placenames to the level of the different parts of individual fields, and exhaustive research in local archives. The results show that such intensity yields new data and patterns of meaning (figs 14 and 15).

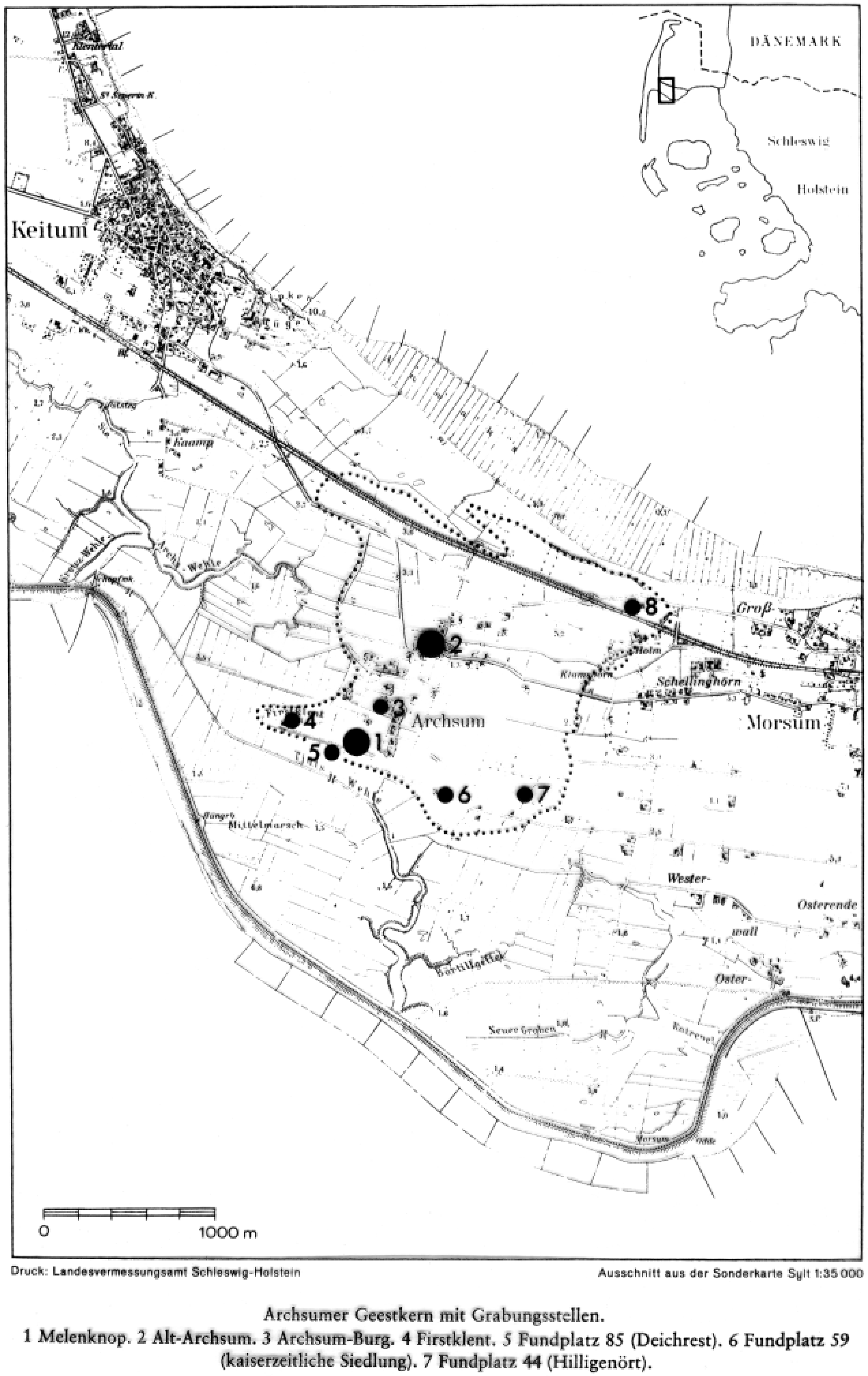


Figure 4 Map showing the central research zone of the German Sylt Project, the Archsum village settlement chamber, with major excavation sites and the core dryland occupation zone on this former island off the far north-west coast of Germany, by the Danish border. From Kossack (1974).

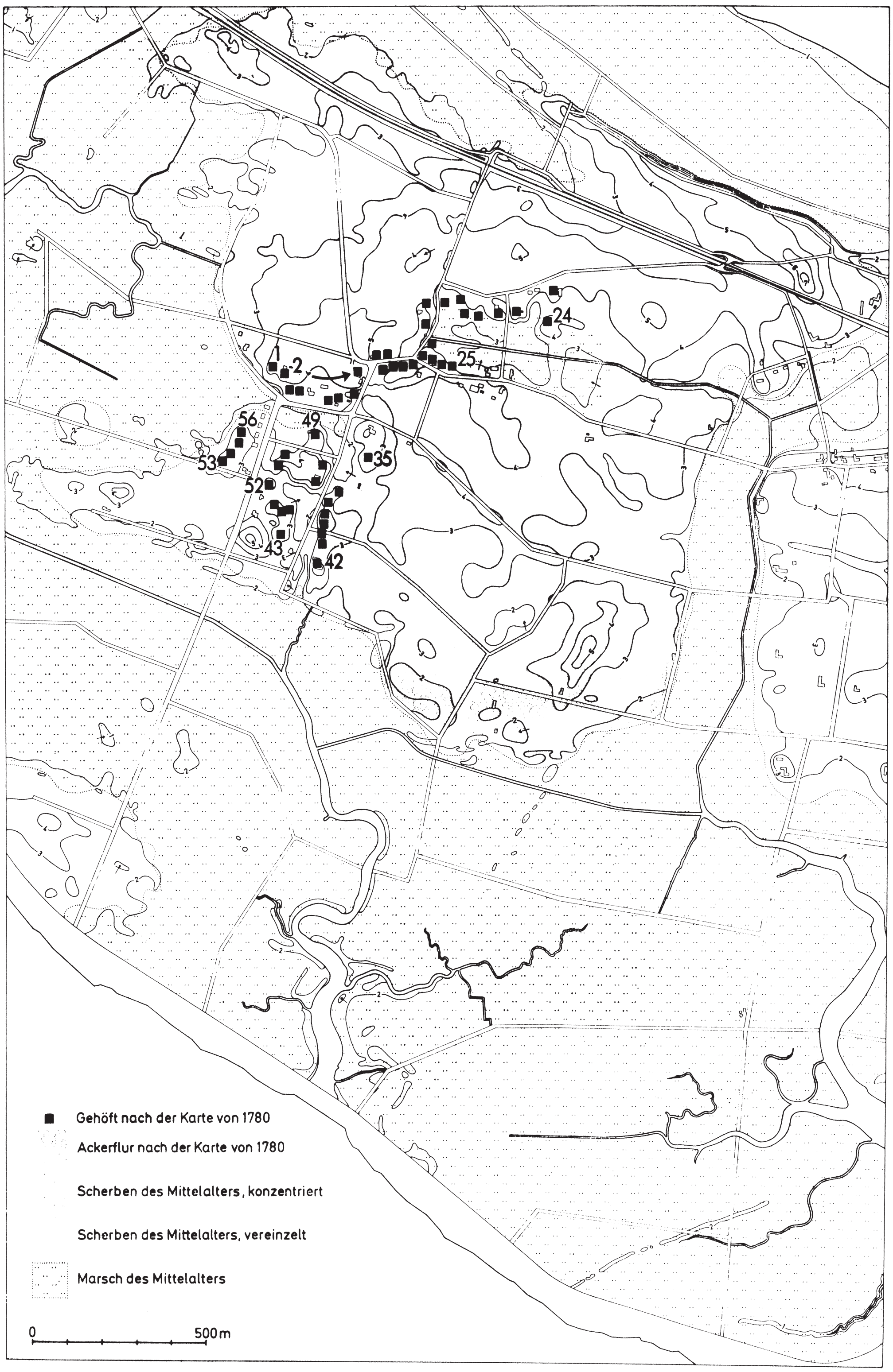
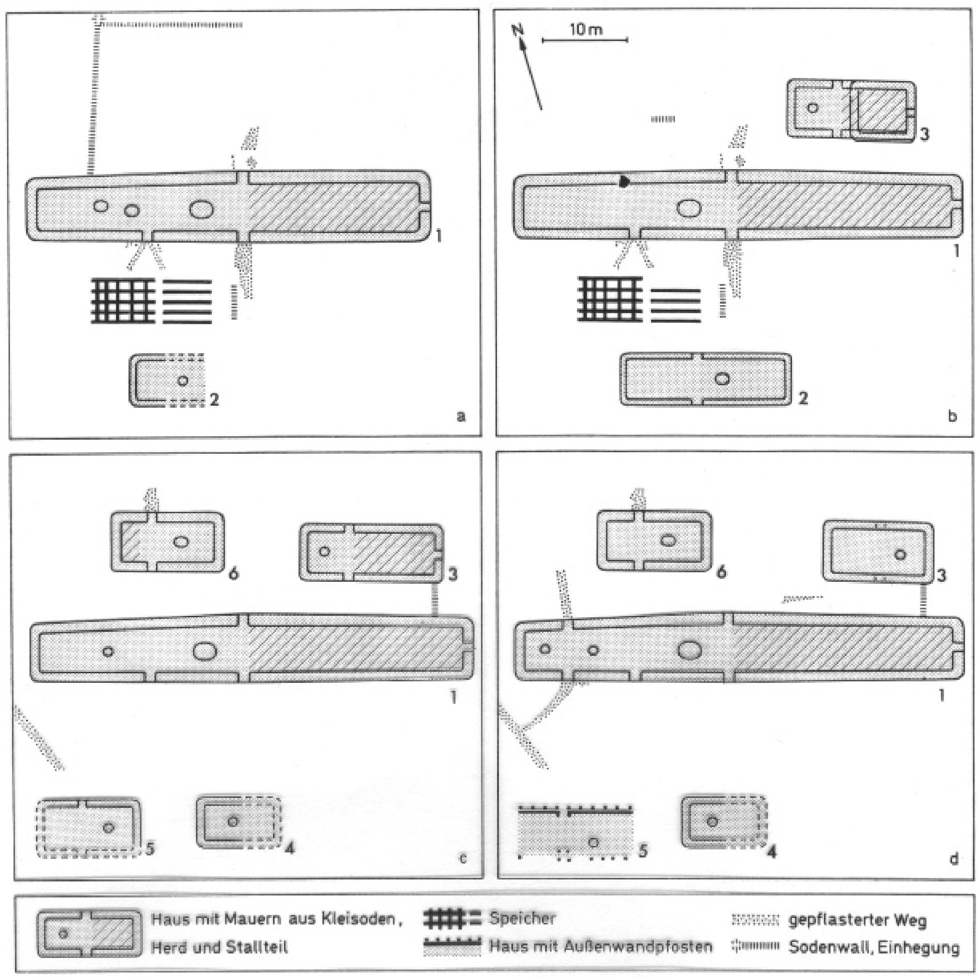


Figure 5 Medieval and Post-Medieval landscape on central Sylt, the village and settlement chamber of Archsum, with 18th century AD farms and fields, and the spread of surface Medieval sherds. From Kossack (1974).



Archsum-Melenknop. Baugeschichte des Großgehöftes der Bauperiode B 2 (ältere römische Kaiserzeit), a: Phase B 2 alt 1; b: Phase B 2 alt 2; c: Phase B 2 jung 1; d: Phase B 2 jung 2. M. 1:900.

Figure 6 Changing plans of an excavated great farmhouse complex of Roman Imperial age, the site of Archsum-Melenknop. From Kossack (1974).

4 Conclusion

A convergence is now possible, between such a microlandscape long-term study and the pioneering work of Dutch and German archaeologists such as Harry Fokkens, Jens Lüning and Andreas Zimmermann, whose meticulous excavation of large swathes of landscape allows them to follow the movement of individual households by generation in the Neolithic and Bronze Ages (cf. Fokkens 1996; Zimmermann *et al*. 2004).

So my message is: let us all feast at the international table of regional delicacies, try this dish or that, then offer our own recipes up, and impose nothing.

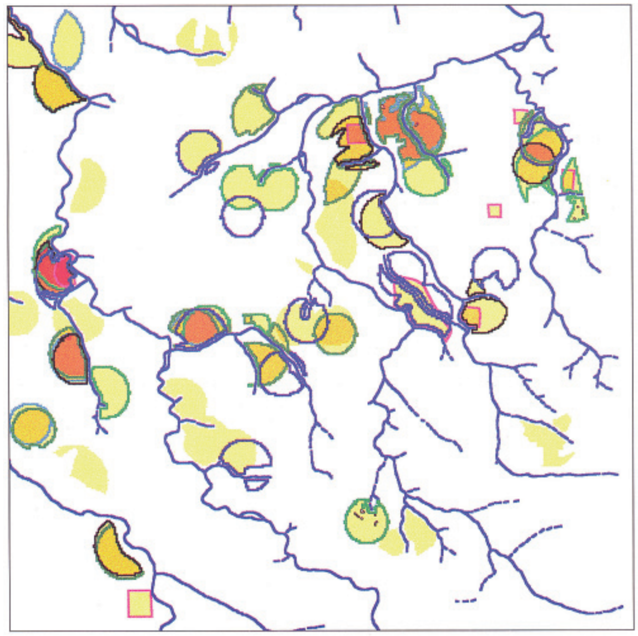


Figure 8 Hypothetical centres of settlement areas. Settlement traces from 1 (light yellow), 2 (dark yellow), 3 (orange), 4 (red), and 5 (dark red) periods. Frames indicate periods: purple – Neolithic; light green – Bronze Age; light blue – Hallstatt period; dark green – La Tène period; black – Roman period; dark blue – Early Medieval period. From Kuna (1998).

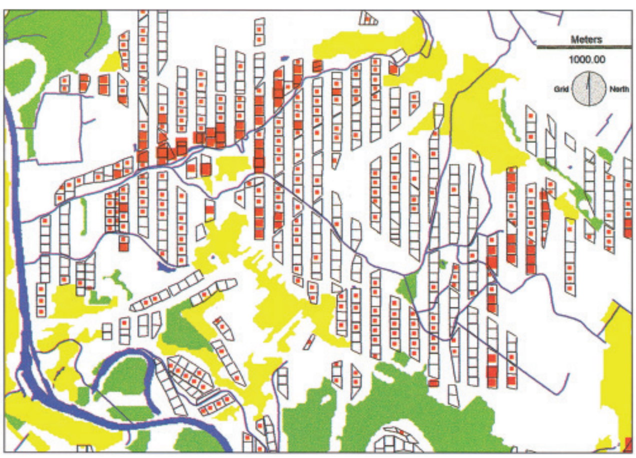


Figure 7 Field survey transect map from the Ancient Landscape Reconstruction Project in Bohemia. Distribution of sample units (survey squares) and find density. Green: woodland; yellow: villages and towns (built-up areas); blue: present streams. Red solid squares show three classes of prehistoric pottery density (1-10, 11-100, >100). From Kuna (1998).

Factor	Period	Date
Factor 3	Neolithic	5500 - 4300 BC
Factor 5	Eneolithic	4300 - 2200 BC
Factor 1	Bronze Age", including: Early-Middle Bronze Age Late Bronze Age Final Bronze Age	2200 - 750 BC
Factor 2	"Iron Age , including: Hallstatt Period La Tène Period Roman Period	750 BC - 400 AD
Factor 6	Early Medieval (EM 2?)	7-8th cent. AD
Factor 4	Early Medieval 3	9-10th cent. AD
Factor 7	Early Medieval 4	11-12th cent. AD

Figure 9 Chronological significance of the chief factors in surface finds in Bohemia identified by Principal Components Analysis. From Kuna (1998).

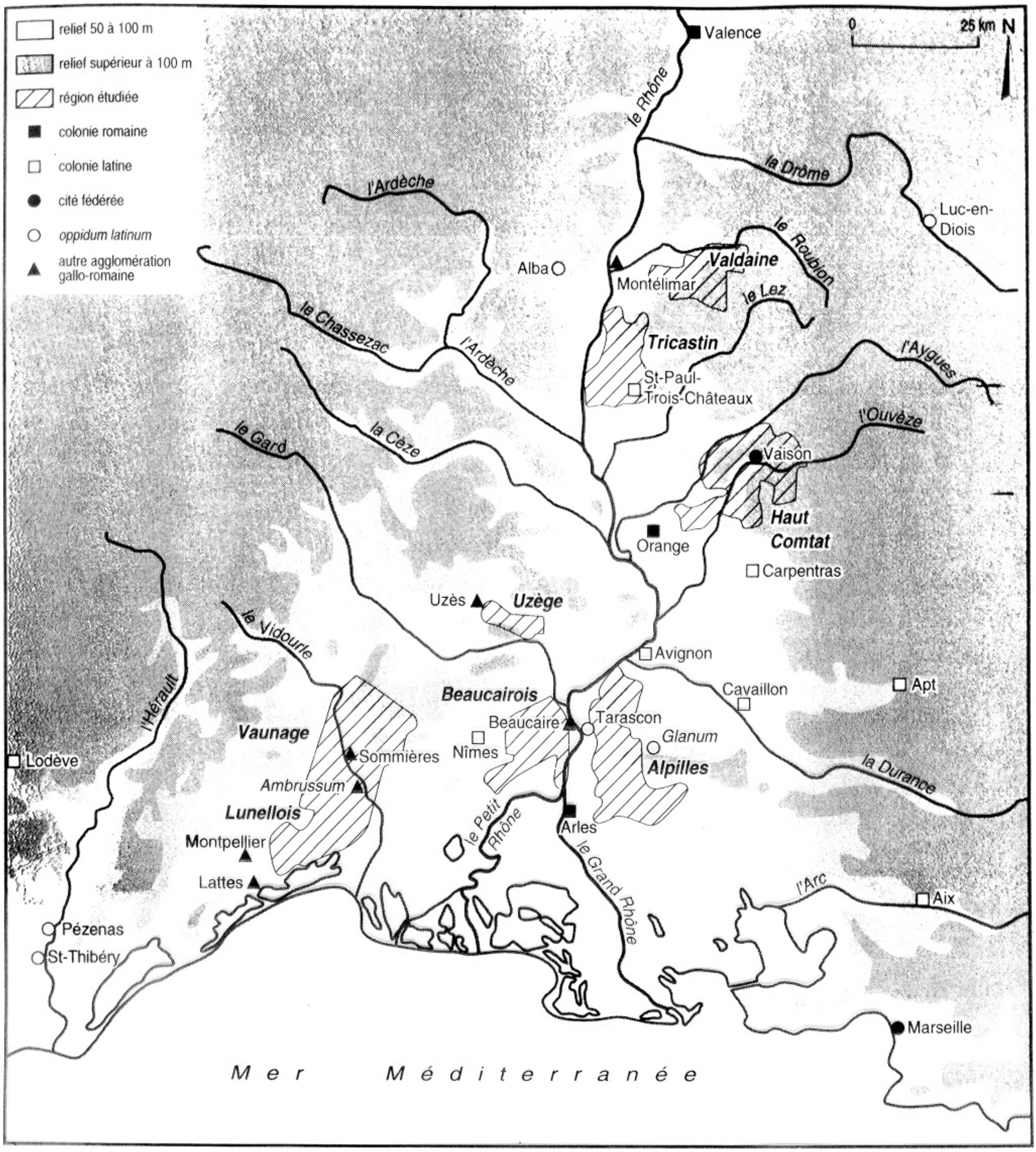


Figure 10 Map of areas studied by the Archeomedes Project in the Lower Rhône valley, France. From Durand-Dastès *et al.* (1998).

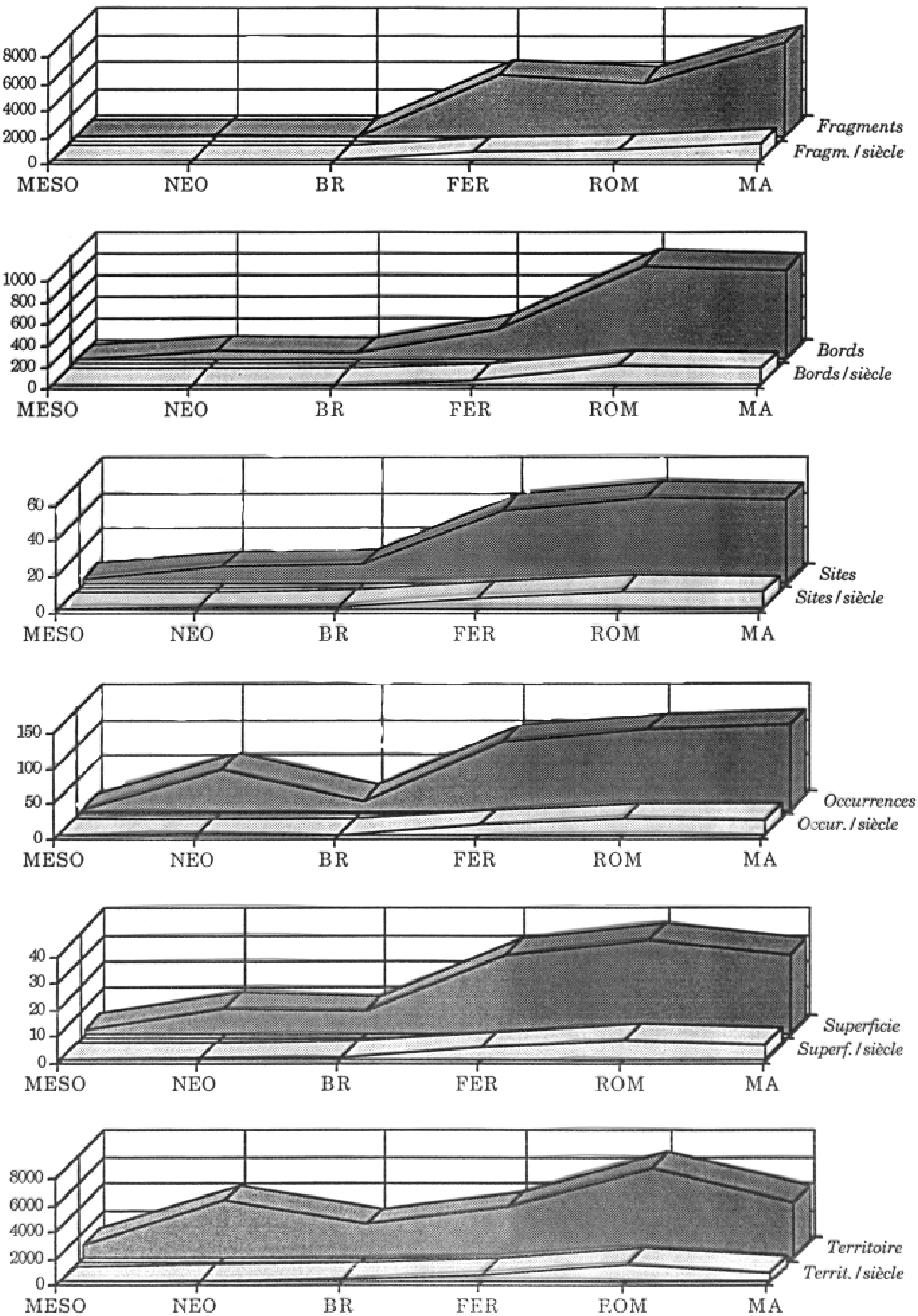


Figure 11 Analysis of surface ceramic finds from the Étang de Berre region of Provence by Frederick Trément (1999), from Neolithic to Medieval times.

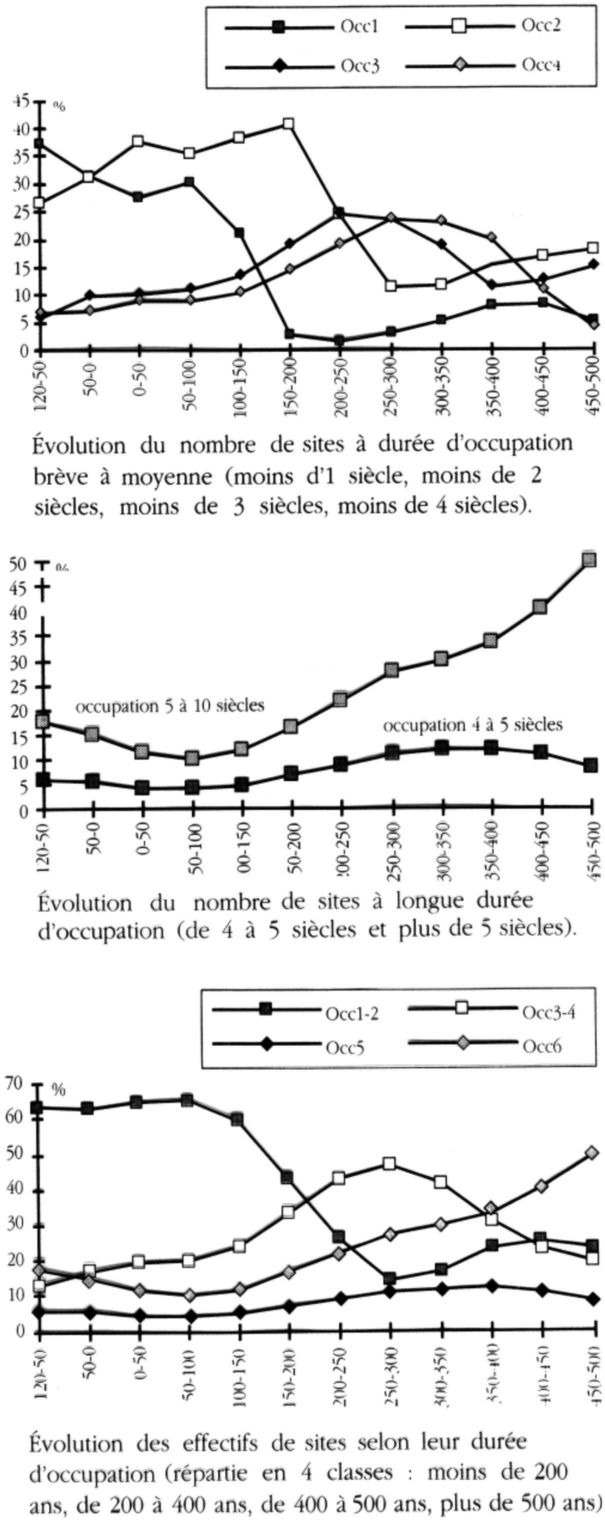


Figure 12 Analysis of comparative site numbers over time and by length of occupation, in the Lower Rhône valley, from early to post-Roman times. From Raynaud (1996).

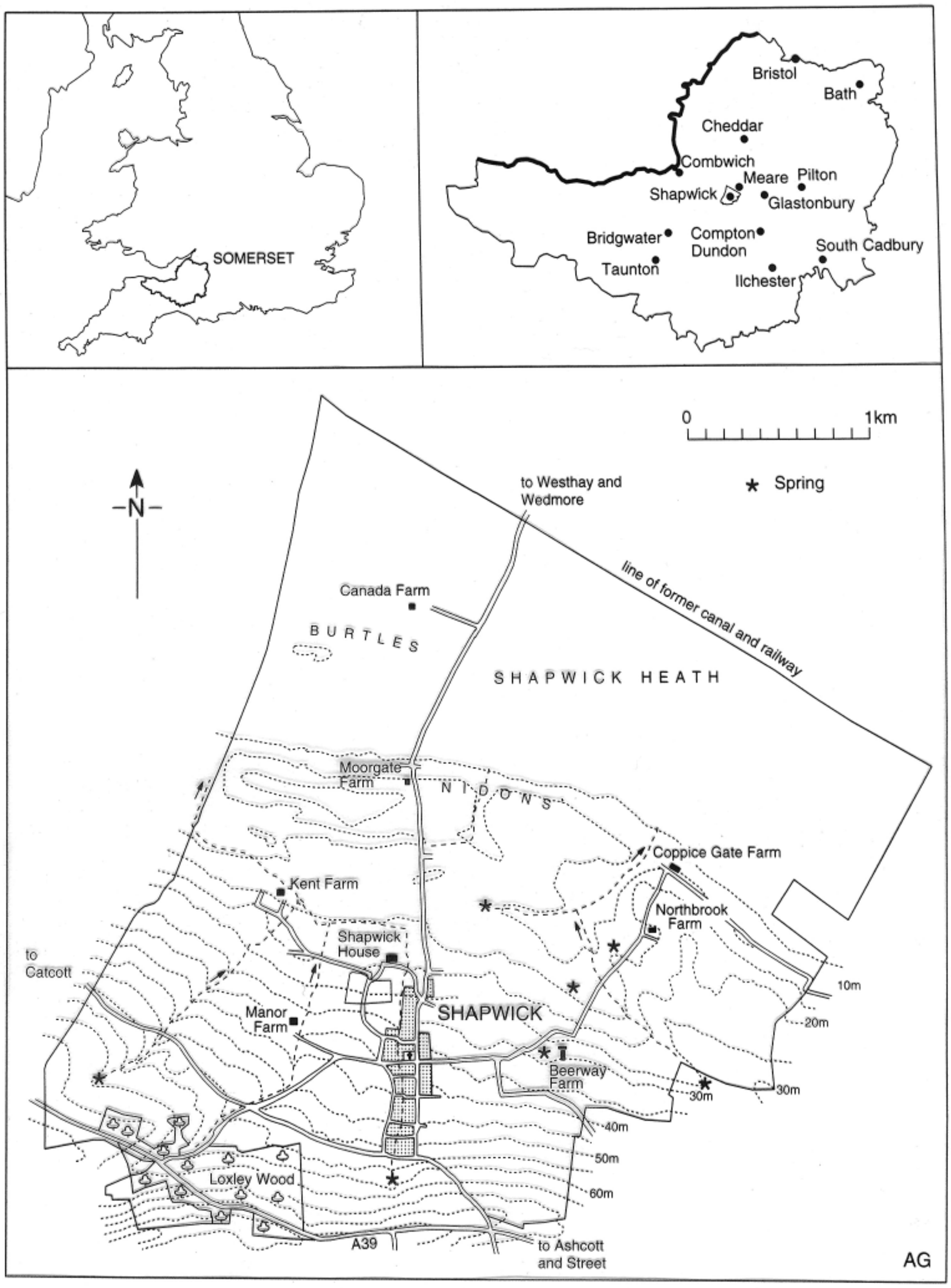


Figure 13 Location of the parish of Shapwick in the county of Somerset, Southwest England. From Aston and Gerrard (1999).

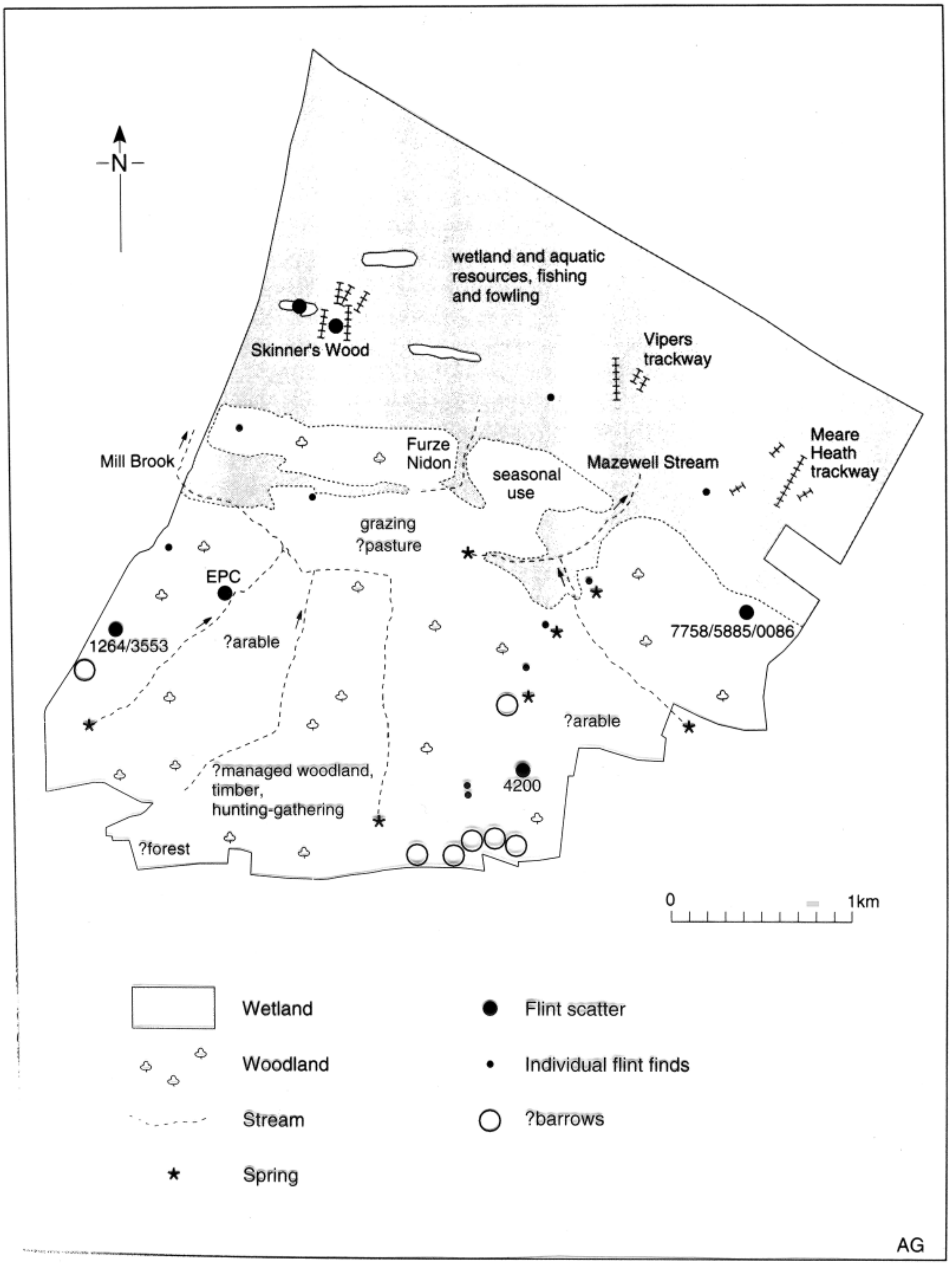


Figure 14 The parish of Shapwick. Reconstruction of settlement and land use in the Bronze Age, based on environmental analysis, surface survey and test excavation. From Aston and Gerrard (1999).

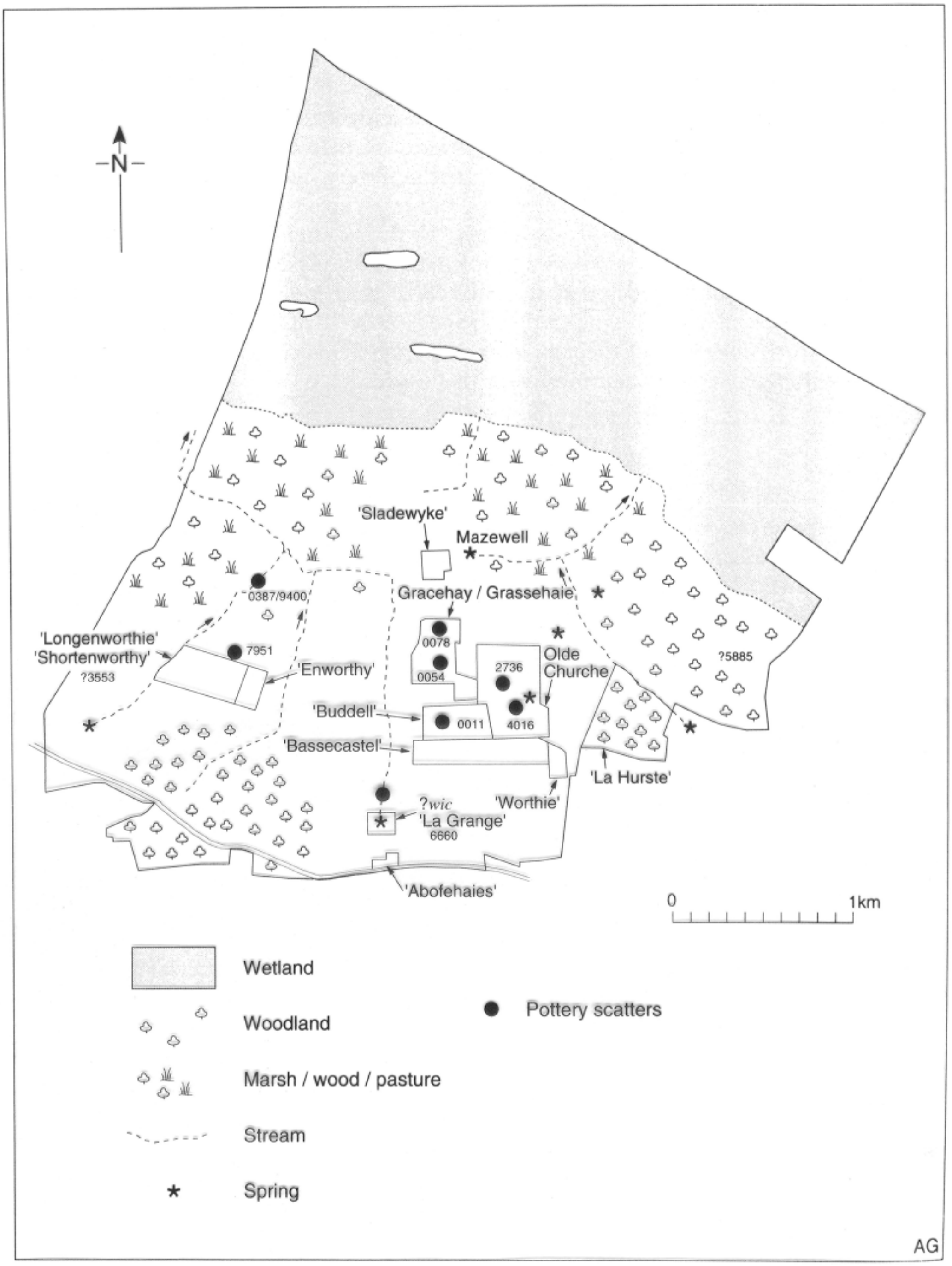


Figure 15 The Early Medieval landscape of Shapwick parish, based on surface survey, excavation, placename and official archival evidence. From Aston and Gerrard (1999).

References

Aston, M. and C. Gerrard 1999. 'Unique, traditional and charming'. The Shapwick Project, Somerset. *The Antiquaries Journal* 79, 1-58.

Bintliff, J.L. 1997. Catastrophe, chaos and complexity: the death, decay and rebirth of towns from Antiquity to today. *TheJournal of European Archaeology* 5, 67-90.

Bintliff, J. L. 2000a. Archaeology and the philosophy of Wittgenstein. In: C. Holtorf and H. Karlsson (eds), *Philosophy and Archaeological Practice. Perspectives for the 21st Century*, Goteborg, 153-172.

Bintliff, J. 2000b. Deconstructing 'The Sense of Place'? Settlement systems, field survey, and the historic record: A case-study from Central Greece. *Proceedings of the Prehistoric Society* 66, 123-149.

Bintliff, J. 2004. Time, structure and agency: The Annales, emergent complexity, and archaeology. In: J. Bintliff (ed.), *A Companion to Archaeology*, London & New York, 174-194.

Bintliff, J.L., P. Howard and A.M. Snodgrass 1999. The hidden landscape of prehistoric Greece. *Journal of Mediterranean Archaeology* 12.2, 139-168.

Coveney, P. and R. Highfield 1990. *The Arrow of Time*, London.

Crawford and Austin 1938. Editorial notes. *Antiquity* 12, 129-134.

Dreslerova, D. 1995. A settlement-economic model for a prehistoric microregion. In: M. Kuna and N. Venclova (eds), *Whither Archaeology? Papers in Honour of Evzen Neustupny*, Prague, 145-160.

Durand-Dastès, F, F. Favory, J.L. Fiches, H. Mathian, D. Pumain, C. Raynaud, L. Sanders and S Van der Leeuw (eds), 1998, *Des Oppida aux Métropoles*, Paris.

Evans, C. 1989. Archaeology and modern times: Bersu's Woodbury 1938 and 1939. *Antiquity* 63, 436-450.

Fokkens, H. 1996. The Maaskant Project: continuity and change of a regional research project. *Archaeological Dialogues* 3, 196-215.

Gardin, J.-C. (ed.) 1970. *Archéologie et Calculateurs : Problèmes Sémiologiques et Mathématiques*, Paris (Colloques int. du CNRS: Sci. humaines).

Hawkes, J. 1982. *Mortimer Wheeler: Adventurer in Archaeology*, London.

Johnson, M. 2010. *Archaeological Theory: An Introduction* (2nd Edition), Oxford-New York.

Kossack, G. 1974. Zehn Jahre Siedlungsforschung in Archsum auf Sylt. *Bericht der Römisch-Germanischen Kommission* 55, 261-427.

Kristiansen, K. 2003. Borders of ignorance: research communities and language. In: Z. Kobylinski (ed.), *Quo Vadis Archaeologia?*, Warsaw, 38-43.

Kuna, M. 1998. The memory of landscapes. In: E. Neustupny (ed.), *Space in Prehistoric Bohemia*, Praha, 106-115.

Kuna, M. 2000. Surface artefact studies in the Czech Republic. In: J. Bintliff, M. Kuna and N. Venclova (eds), *The Future of Archaeological Field Survey in Europe*, Sheffield, 29-44.

Kuna, M., M. Zvelebil, P.J. Foster and D. Dreslerova 1993. Field survey and landscape archaeology research design: Methodology of a regional field survey in Bohemia. *Pamatky Archeologicke* 84(2), 110-130.

Lee, L. 1959. *Cider with Rosie*, London.

Lewin, R. 1993. *Complexity. Life at the Edge of Chaos*, London.

Neustupny, E. 1991. Community areas of prehistoric farmers in Bohemia. *Antiquity* 65, 326-331.

Raynaud, C. 1996. Les campagnes Rhodaniennes: Quelle crise? In: Anon (ed.), *Le IIIe Siècle en Gaule Narbonnaise. Données régionales sur la crise de l'empire*, Sophia, Antipolis, 189-212.

Raynaud, C. 2000. Territoire et peuplement en France, de l'Age du Fer au Moyen Age. L'archéologie spatiale à la croisée des chemins. In: J. Bintliff, M. Kuna and N. Venclova (eds), *Archaeological Field Survey in Europe*, Sheffield, 57-71.

Scarre, C. (ed.) 2009. *The Human Past* (2nd Edition), London.

Soudsky, B. 1962. The Neolithic Site of Bylany. *Antiquity* 36, 190-200.

Trément, F. 1999. Projet archéologique et démographique en Provence. In: J. Bintliff and K. Sbonias (eds), *Reconstructing Past Population Trends in Mediterranean Europe*, Oxford, 93-113.

van de Leeuw, S.E. (ed.) 1998. *The Archaeomedes Project – Understanding the natural and anthropogenic causes of land degradation and desertification in the Mediterranean*, Luxemburg.

Vidal de la Blache, P. 1926. *Principles of Human Geography*, London.

White, G. 1789. *The Natural History and Antiquities of Selborne*, London.

Zimmermann, A., J. Richter, T. Frank and K.P. Wendt 2004. Landschaftsarchäologie II: Überlegungen zu Prinzipien einer Landschaftsarchäologie. *Bericht der Römisch-Germanischen Kommission* 85, 37-95.

John Bintliff
Faculty of Archaeology
P.O. Box 9515
2300 RA Leiden
The Netherlands
j.bintliff@arch.leidenuniv.nl

A short history of archaeological research in the Lesser Antillean archipelago

Arie Boomert

Three major stages can be distinguished in the history of archaeological investigation in the Lesser Antilles. The Early Period of research stretches from the mid-seventeenth century until well into the 1910s. It is characterized by an emphasis on the occasional collecting and rudimentary description of individual prehistoric artefacts. The next stage or Formative Period, from the 1910s into the 1960s, sees the development of stratigraphic excavation and classificatory-historical studies stressing the establishment of local chronologies in the West Indies. Finally, the Interpretative Period, from the 1960s until the present, is typified by a continuation of chronological studies next to the development of research focusing on the reconstruction of past lifeways, environmental relationships, socio-political development, and patterns of interaction.

1 Introduction

The Lesser Antilles form a gradually bending, bifurcating arc of oceanic islands stretching from the Leeward Antilles and the Margarita archipelago off the coastal zone of Venezuela and Trinidad and Tobago to Puerto Rico. This island chain, which shows a high diversity in landforms and other environmental features, can be divided into three major archipelagic groupings, from south to north: (1) the Windward Islands from Grenada up to and including Dominica, as well as Barbados, (2) the Leeward Islands from Guadeloupe up to Sombrero, and (3) the Virgin Islands, Culebra and Vieques, the latter two islands both politically belonging to Puerto Rico. These island groupings become increasingly smaller in size from south to north until Puerto Rico, the first island of the Greater Antilles, is reached. Biogeographically, islands constituting arcs such as that of the Lesser Antilles are known as stepping-stone islands as they form almost uninterrupted rows of mutually intervisible islands, strung out from a mainland. The configuration of such insular chains facilitates the movement of both humans and animals into the archipelagoes in question. Understandably, the multi-staged peopling of the Lesser Antilles during prehistoric times has been a major focus of archaeological research in these islands.

In coastal areas and archipelagoes such as the Caribbean, the sea is not just the main conduit of contact between the inhabited places, it is central to human lifeways. Because of their focus on the sea, littoral and insular peoples throughout the world are closely related in terms of lifestyles and beliefs. It is the 'maritime cultural landscape' shared by these communities that should form the research interest of archaeologists and anthropologists, encompassing the material and immaterial aspects of human life on the continental seaboards and on islands. Local knowledge and lived experience are central to how people socialize seascapes. The sea achieved significance and became socially constructed in the minds of people throughout the world through their active and enduring engagement with it (Boomert and Bright 2007; Rainbird 2007, 49). The sea is universally recognized as a balance of opposites. Teeming with marine life, it provides a subsistence base to littoral people and islanders. However, the sea can be treacherous and unpredictable: it gives and it takes, it can destroy and create land, it sustains life and it may kill. The sea is both valued and feared, to be utilized as well as respected. It is the specific kind of maritime cultural landscape which developed and blossomed among the Amerindians of the Lesser Antillean archipelago that forms the focal point of archaeological and anthropological research in the region.

The historic experience of the Lesser Antilles is one of political, cultural and linguistic fragmentation, resulting in Spanish-, English-, French- and Dutch-speaking entities of varying political status, at present either part of an independent polity or linked to some metropolitan power in one way or another. This heterogeneous character of the Lesser Antilles is borne out by the development of scientific research in the region, including the history of archaeological investigation. Three major stages of archaeological research can be distinguished. The Early Period of investigation stretches from the mid-seventeenth century until well into the 1910s. It is characterized by an emphasis on the occasional collecting and only rudimentary description of individual prehistoric artefacts. The next stage or Formative Period, from the 1910s into the 1960s, sees the development of stratigraphic excavation and classificatory-historical studies stressing the establishment of local chronologies in the West Indies. Finally, the Interpretative Period, from the 1960s until the present, is typified by a continuation of chronological studies next to the development of research focusing on the reconstruction of past lifeways, environmental relationships, socio-political development, and patterns of interaction.

2 The Early Period

It was typically in the most advanced island colonies of the Lesser Antilles, *i.e.* the French West Indies and Barbados, that the first references to the pre-Columbian antiquities of the Caribbean were made. As early as 1647 Father Raymond G. Breton, the famous Dominican missionary to the Island Caribs of Guadeloupe, Dominica and Martinique, described and illustrated three engraved rocks on Basse-Terre, Guadeloupe, which, however, he ascribed to the Spanish (fig. 1; see Breton 1978, I, 83-84; Dubelaar 1995, 329-333). In this same period French soldiers are recorded to have recovered a series of cotton idols from a cave in Martinique which the local Island Caribs ascribed to their presumed predecessors on this island, the '*Ygneris*' (du Tertre 1973, II, 349). Early in the eighteenth century the French scholar Antoine de Jussieu compared chance finds of prehistoric stone axes from the French West Indies with European specimens (Trigger 2006, 94; Delpuech 2007), while in 1750 the Rev. Griffith Hughes described and depicted examples of pre-Columbian pottery and shell tools, including "broken Images, Pipes, Hatchets, and Chissels" from Barbados (Hughes 1750, 7), also recording various site locations (fig. 2; see Drewett 1991).

In 1804 the human skeletons (*anthropolithes*) which were discovered by Mathieu Guesde, one of the first antiquarians of the Antilles, in the calcified beach rock deposits of La Moule (Morel), Grande-Terre, Guadeloupe, raised considerable interest. Sent to Paris and London, they were investigated by the great French palaeontologist Georges Cuvier who established their recent origin (Delpuech 2003). The accidental recovery of prehistoric artefacts accelerated in the second half of the nineteenth century, leading to occasional conjectures about their origins by the local antiquarians involved. Finds were generally attributed either to the ancestors of the Amerindians who inhabited the Windward Islands in historic times, the Island Caribs, or their supposed precursors. In Guadeloupe Mathieu Guesde and his son Louis accumulated a large collection of stone artefacts which was studied in detail by Otis T. Mason of the Smithsonian Institution, Washington, DC, in 1885 (H. Petitjean Roget 1993). Apart from Guadeloupe and Barbados, chance discoveries of pre-Columbian artefacts were now recorded from islands such as Dominica, Martinique, St. Vincent, and Battowia (Grenadines). They were often deposited in European museums.

The first true archaeological excavations of the region were undertaken by the Rev. William H. Brett, an Anglican missionary, in the shell mounds of the coastal zone of British Guiana (present Guyana) in 1865 (fig. 3). As on the coasts of North America, the Brazilian littoral and elsewhere in the

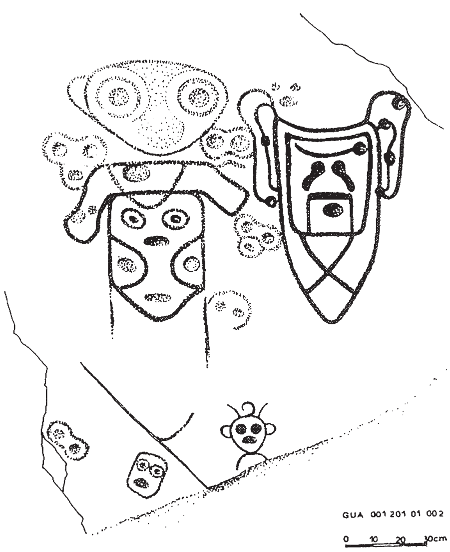


Figure 1 Petroglyphs at Capesterre-Belle-Eau, Pérou River, Basse-Terre, Guadeloupe, described by Father Raymond G. Breton in 1647. (After Delpuech 2001, Fig. 2).

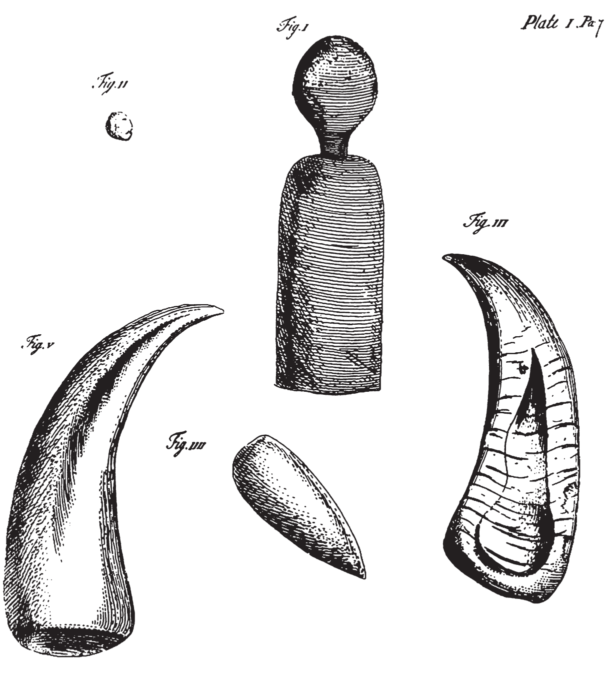


Figure 2 Pre-Columbian stone and shell artefacts from Barbados, illustrated by the Rev. Griffith Hughes in his *Natural History of Barbados* (1750).

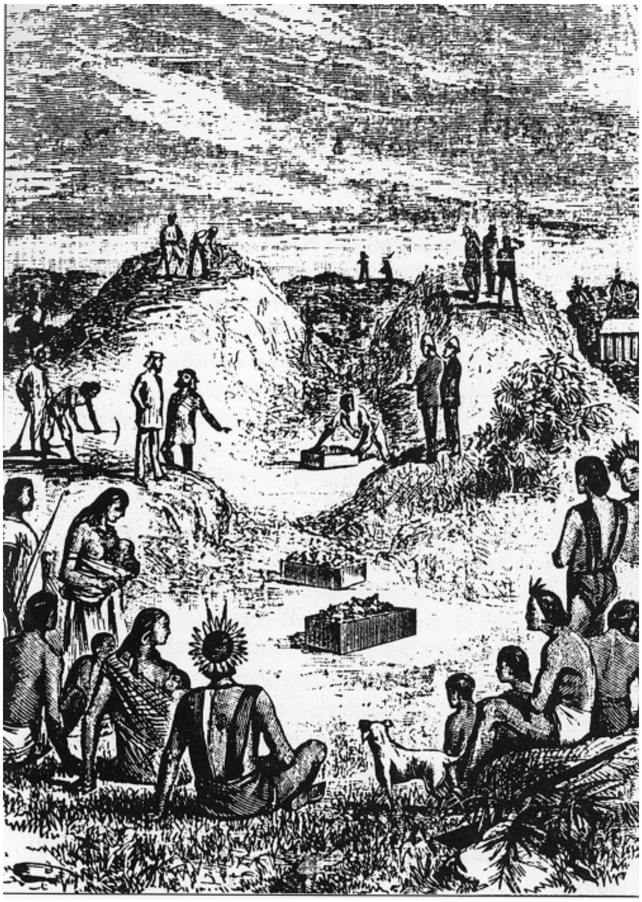


Figure 3 Excavation of the Waramuri shell midden, British Guiana (present Guyana), by Warao Indians under the direction of the Rev. William H. Brett in 1865. (After Brett 1868, 430).

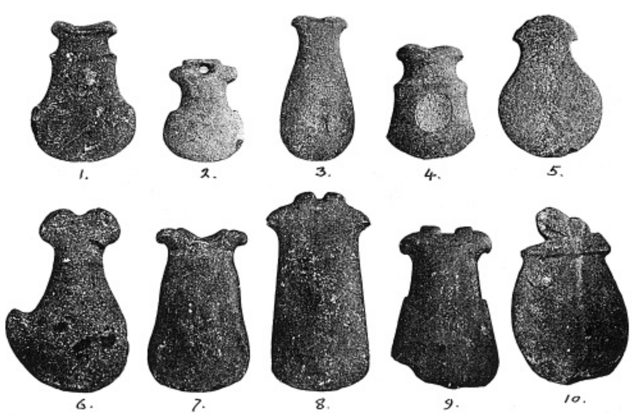


Figure 4 'Carib' stone axes of the Lesser Antilles. Legend: (1) Trinidad; (3-6) St. Vincent; (8) Grenada; (2, 7, 9-10) probably St. Vincent. (After Joyce 1916, Plate XXIV).

world, they were stimulated by the much publicized pioneering work of Danish scholars in the shell 'kitchen middens' (*kjøkkenmøddinger*) of Scandinavia which had started some twenty years previously (Brett, 1868, 420-43; Trigger 2006, 14, 163; Rostain 2007). Concurrently, comparable shell midden deposits in Trinidad, first interpreted as natural phenomena, were identified as Amerindian refuse heaps by the famous naturalist R.J. Lechmere Guppy. In 1888 the discovery of the Erin shell midden site on this island sparked much interest due to the attractively decorated pottery encountered there which ultimately found its way to the Royal Victoria Institute, Port-of-Spain, established in 1892 (Boomert 2000, 8). In these years petroglyph sites from St. Kitts, Guadeloupe, Marie-Galante, and Grenada were recorded for the first time (Dubelaar 1995, 9-10; Delpuech 2007).

At the turn of the century, numerous prehistoric artefacts were purchased from local collectors from the entire southern Lesser Antilles by the Rev. Thomas Huckerby of Trinidad on behalf of George G. Heye's private Museum of the American Indian, New York. In these years attempts at formulating classifications of artefacts, typically framed in terms of 'Indian environments or culture areas' were made by scholars such as Otis T. Mason and the traveller/ornithologist Frederick A. Ober (see Watters 1976, 8-9). Time depth is lacking in their work which remained largely descriptive. This applies also to the first region-wide archaeological and ethnohistorical outline of the Caribbean which was written by the British Museum curator Thomas A. Joyce (1916). Lacking a regional chronology, it is primarily concerned with interpretations of the region's art and iconography, attempting to understand the worldview of its prehistoric inhabitants (fig. 4).

3 The Formative Period

A new era of investigation was ushered in by Jesse Walter Fewkes who in the first decades of the twentieth century made various collecting expeditions to the West Indies, visiting *e.g.* Puerto Rico, Trinidad, Barbados, Baliceaux, St. Vincent, St. Kitts, and St. Croix, commissioned by the Bureau of American Ethnology and later by Heye's Museum of the American Indian and the Smithsonian Institution. Presenting a detailed synthesis of Caribbean archaeology and ethnohistory, Fewkes also developed the first rudimentary chronological outline of the region's prehistory and studied the environmental factors affecting the indigenous cultures of the West Indies. Influenced by the then current anthropological theory, Boasian historicism, he emphasized fieldwork and the spatial diffusion of cultural traits, distinguishing three culture areas in the Caribbean, *i.e.* the Greater Antilles, the Lesser Antilles and the Bahamas, which he subdivided into a series of geographically defined "cultural centers" (Fewkes 1907; 1922; Watters 1976, 28-9). Fewkes' work is emblematic of the shift in archaeological research orientation from purely descriptive to classificatory-historical, which took place in the United States in this period (Willey and Sabloff 1980, 83). It is noteworthy that it was in Guadeloupe in 1916 that the first governmental attempts were made to protect an archaeological site in the Lesser Antilles, the petroglyphs of Trois-Rivières, Basse-Terre. This was a reaction to the sending of part of one of the site's most elaborately decorated rocks to an exhibition in the United States in 1901. The petroglyph slab was subsequently placed in the Museum of the American Indian (Dubelaar 1995, 170).

Theodoor de Booy, John A. Bullbrook and Gudmund Hatt were the first to use modern stratigraphic excavation techniques in the West Indies. Hired by Heye in order to expand the collection of the Museum of the American Indian, de Booy, educated as a Dutch naval officer, dug in Margarita and Trinidad in 1915, and in the British Virgin Islands and Martinique the following year. Bullbrook, a British-born geologist interested in archaeology, was commissioned by the colonial administration to excavate the Palo Seco site of Trinidad in 1919 (fig. 5). Due to his efforts part of the site was officially protected by declaring it a Crown Reserve (Bullbrook 1953; see Boomert 2000, 9). Major stratigraphic work was undertaken by Gudmund Hatt of the University of Copenhagen, Denmark, during an expedition to the US Virgin Islands in 1922-3. It resulted in a three-phase local chrono-cultural sequence for these islands which has stood the test of time to the present day (Hatt 1924; cf. Wilson 2007, 18-19, 47).

Simultaneously and partly cooperating with Hatt, J.P.B. de Josselin de Jong of Leiden University, the Netherlands, surveyed the islands of St. Eustatius, Saba, and St. Martin. The site reports of especially de Booy, Bullbrook and Hatt, of which unfortunately the report by Bullbrook was not

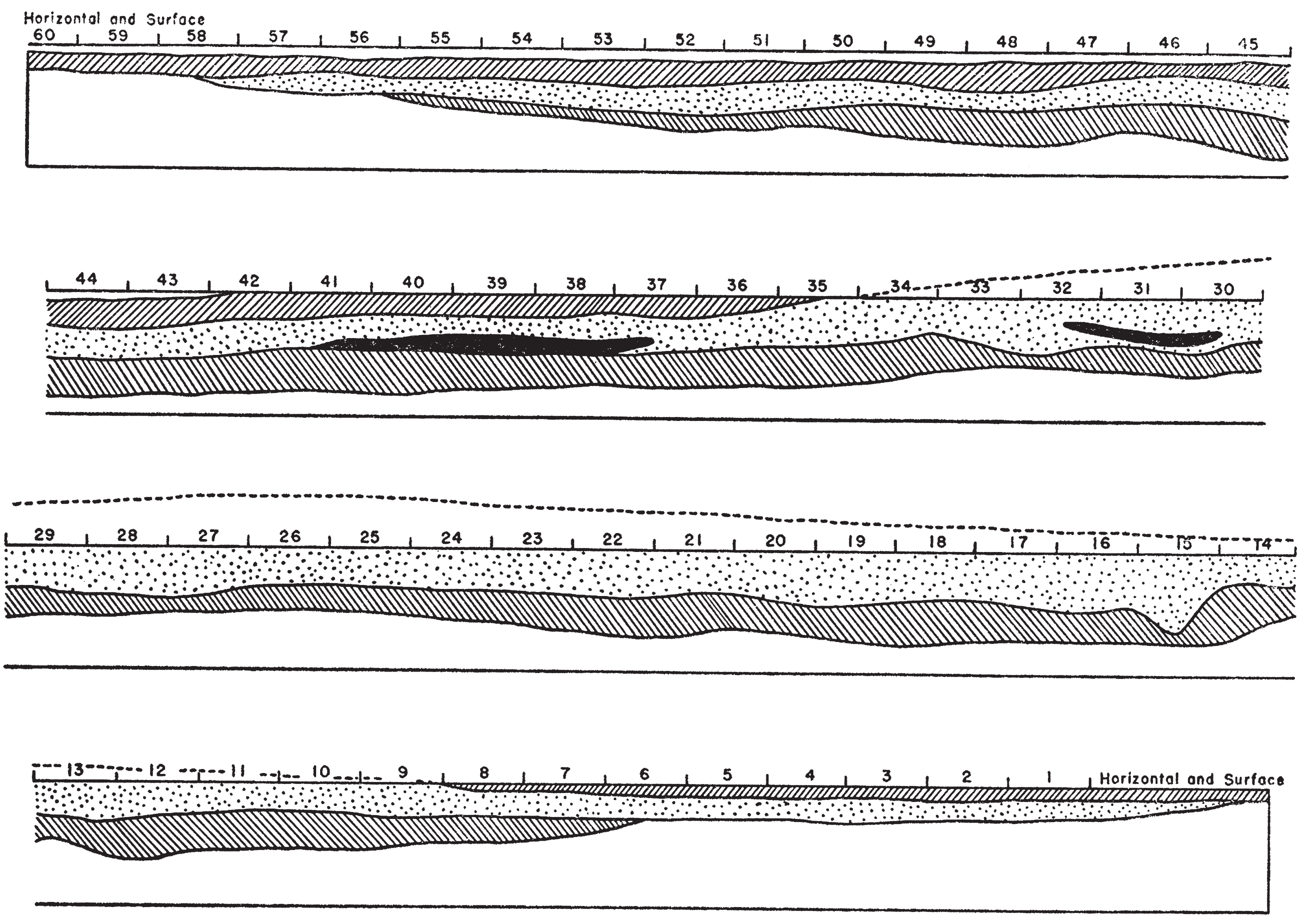


Figure 5 Section of the stratigraphy of the Palo Seco shell midden, Trinidad, recorded by John A. Bullbrook, 1919. (After Bullbrook 1953, Fig. 4).

published until the 1950s, are remarkable for their early emphasis on the reconstruction of prehistoric subsistence patterns. It was a Swede, Sven Lovén, who in the mid-thirties recapitulated the achievements of Fewkes, de Booy, Hatt and scholars from Puerto Rico, the Dominican Republic and Cuba of the first near-century of Caribbean archaeology on a region-wide scale, adding relative time depth to his synthesis, while deepening it with detailed ethnohistorical investigation. Organized in diffusionistic terms, it is primarily concerned with the origins of Caribbean ('Taíno') culture on the South American mainland. Lovén's pivotal work has remained a classic of interdisciplinary research (Lovén 1935).

In the 1930s the concern with establishing regional culture-historical syntheses, based on stratigraphic excavation techniques and processes of stylistic similarity seriation, now pervading archaeological research in North America (Willey and Sabloff 1980, 91-99), spilled over to the Caribbean. This was mainly due to the establishment in 1933 of the Caribbean Anthropological Program of Yale University, New Haven, CT, which originated as an offshoot of a US government-designed programme for improving relations with Latin America. Subsequent to the work of Cornelius Osgood and others in Venezuela, it led to surveys and excavations in Puerto Rico in cooperation with the US National Museum by Froelich G. Rainey in 1934-5, followed by a major archaeological research project by Benjamin Irving Rouse in 1936-8 as part of the Scientific Survey of Porto Rico and the Virgin Islands, sponsored by the New York Academy of Sciences. Rouse's work included a systematic archaeological reconnaissance of Vieques (Rainey 1940; Rouse 1952). It was the first of his numerous research projects in the West Indies and adjoining areas which would earn Rouse the honorary title 'father of modern Caribbean archeology'. While also initiating research in Cuba and Haiti, leading to Rouse's classic *Prehistory in Haiti: A Study in Method* (1939) in which he developed his 'analytical' modal approach to handle ceramic attributes, unfortunately Yale's Caribbean Program fully bypassed the Lesser Antilles where research was left to resident amateurs.

It was in Martinique that the first ongoing local programme of excavation was started when Father Jean-Baptiste Delawarde, a geographer, initiated digging and collecting at several pottery sites in 1932. Another geographer and local amateur, Eugène Revert, was commissioned in 1939 by the Musée de l'Homme, Paris, to continue excavating at these and other sites on the island, following the tricentennial exhibition in Paris of 1935 (J. Petitjean Roget 1970; Giraud 1997; Vidal 2007). On Barbados C.N.C. Roach was active in collecting archaeological finds throughout the 1930s. Here the Barbados Museum, which opened its doors in 1933, became the focus of research (Drewett 1991). Finally, in 1930 the British anthropologist Douglas M. Taylor visited the Island Carib communities of Dominica for the first time in order to study the language and oral traditions of the last Amerindians of the West Indies. Settled permanently on the island from 1938 until his death in 1981, he would contribute to our knowledge of Island Carib culture, society and linguistics in a way unmatched since the seventeenth-century travellers and missionaries (fig. 6).

Meanwhile Bullbrook continued excavating at the Erin site under the auspices of the Archaeological Section of the Historical Society of Trinidad and Tobago. Subsequent to an extensive archaeological survey of Venezuela by Osgood and George D. Howard in 1941, which was followed by excavations on the Middle Orinoco conducted by the latter, Osgood paid a short visit to Trinidad, noting close resemblances between Bullbrook's Erin material and the ceramics he had just excavated on the Lower Orinoco (Osgood 1942). Intrigued by these stylistic similarities, Osgood induced Rouse to extend Yale's Caribbean Program to Trinidad while he himself conducted a field survey of coastal British Guiana in 1944 (Osgood 1946). It resulted in

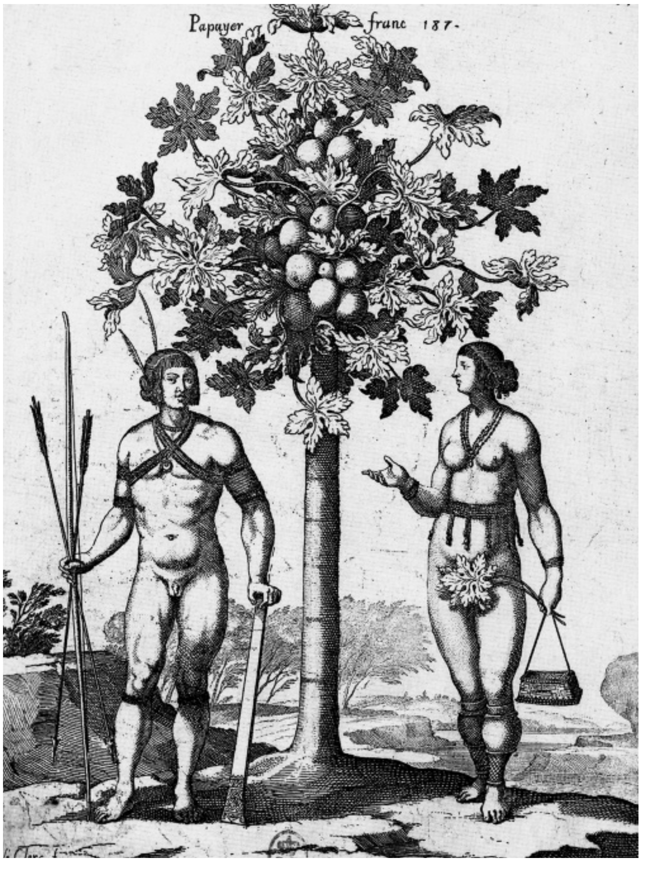


Figure 6 Papaw tree with Island Carib man and woman, 1667/1671. (After du Tertre 1973, II, opposite p. 336).

expeditions to Trinidad by Rouse in 1946 and 1953, leading to the island's first relative chronology and prehistoric cultural classification. Moreover, Rouse obtained the first radiocarbon dates for the region from samples collected in Trinidad (Rouse 1947; see Boomert 2000, 9-10).

Simultaneously Eugène Revert conducted the first archaeological reconnaissance of Guadeloupe while, continuing the latter's work in Martinique, Father Robert Pinchon, a naturalist and teacher, started systematic archaeological research in 1945. His work resulted in the first relative cultural chronology of the island, couched in ethnic terminology (J. Petitjean Roget 1970). Following his research in Trinidad, Rouse turned his attention to Venezuela where he excavated extensively in collaboration with José M. Cruxent throughout the 1950s (Rouse 1961). Their investigations culminated in Cruxent and Rouse's classic culture-historical synthesis of the country's prehistory (Cruxent and Rouse 1958/9). Besides, it induced Rouse to develop his phylogenetic system of cultural taxonomy of Caribbean assemblages. Rouse also stimulated research in the Lesser Antilles by his Yale students, including Gary S. Vescelius in St. Croix and Marshall McKusick in St. Lucia who established local chrono-cultural sequences for these islands (*e.g.* McKusick 1960). Finally, the first archaeological reconnaissance of Tobago was carried out by Geoffrey H.S. Bushnell of the University of Cambridge, England, in 1955 (see Boomert 1996, 19-20).

In these years Rouse's normative view of culture was seriously challenged by environmentalist perspectives such as the culture-ecological approach presented by Julian H. Steward (*e.g.* Steward 1949). It prompted important archaeological fieldwork by Betty J. Meggers and Clifford Evans in Brazilian Amazonia and British Guiana in the late 1940s and 1950s (*e.g.* Evans and Meggers 1960). Steward's 'Circum-Caribbean' hypothesis, suggesting an Andean derivation of the chiefdom societies of northwest South America and the Antilles and explaining Tropical Forest Culture as a degenerate version of the latter, elicited a firm rebuttal from Rouse (1953). The culture-ecological perspective stimulated interest in prehistoric lifeways and adaptive strategies. In the Caribbean the first detailed analysis of food remains other than shells recovered from archaeological sites was carried out by Elizabeth S. Wing of the University of Florida who studied the animal bone material excavated by Rouse in Trinidad (Wing 1962). It signalled the beginning of a shift in archaeological research orientation from exclusively culture-historical interpretation towards reconstruction of past subsistence patterns and modes of life in the region. Ironically, in North America a similar alteration in research objectives took place as early as about 1940, *i.e.* some twenty years earlier than in the West Indies (Willey and Sabloff 1980, 130-131). A true milestone was reached in the Lesser Antilles in 1961 when Father Pinchon organized the first international meeting of regional archaeologists in Fort-de-France, Martinique. Starting in 1967, this conference would convene biennially, each time hosted by another country or territory in the region (fig. 7), from 1985 onwards formally enlarging its audience to the entire Antilles as the trilingual congress of the International Association for Caribbean Archaeology (IACA).

Conducting fieldwork in the entire Lesser Antilles and beyond, a truly region-wide perspective was developed by Ripley P. Bullen of the University of Florida and his wife Adelaide K. Bullen during the late 1950s through 1970s. Closely cooperating with local amateurs, they dug at various sites in Trinidad, Barbados, Grenada, St. Vincent and the Grenadines, St. Lucia, Martinique, Guadeloupe, St. Martin, St. John, St. Thomas, and Puerto Rico. Contrary to Rouse,

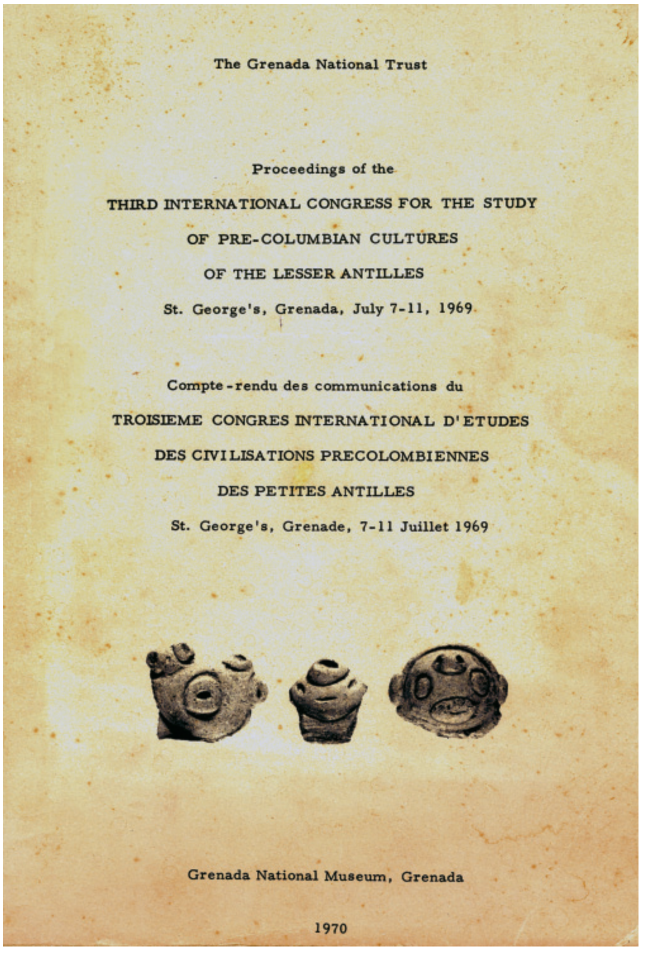


Figure 7 Cover of the *Proceedings of the Third International Congress for the Study of Pre-Columbian Cultures of the Lesser Antilles* (1970), held in Grenada, July 1969.

the Bullens used the 'taxonomic' type-variety model in order to classify their archaeological materials. The cultural chronology of the Windward Islands, framed in ethnic identifications, which they devised, would turn out to be highly influential (*e.g*. Bullen and Bullen 1976). Besides, it was Adelaide K. Bullen who initiated osteological archaeology in the region (Goodwin 1978).

In these years important research was carried out on St. Thomas by Frederick W. Sleight of the William L. Bryant Foundation, Orlando, FL, on St. Lucia and Martinique by William G. Haag of Louisiana State University, Baton Rouge, LA, and by local avocational archaeologists such as Ronald V. Taylor on Barbados, I.A. Earle Kirby on St. Vincent, the Rev. C. Jesse on St. Lucia, Jacques Petitjean Roget on Martinique, Father Maurice Barbotin on Marie-Galante, Edgar Clerc on Guadeloupe (Delpuech 2002), and Fred Olsen and Desmond V. Nicholson on Antigua. In 1973 the latter joined forces with Rouse, leading to a multi-year excavation project at various Ceramic Age sites on the island under the auspices of Yale University. In addition, one of Rouse's students, Dave D. Davis, investigated the Archaic occupation of Antigua. In these years the foundation of various museums and archaeological societies in the Lesser Antilles further stimulated research. For instance, in 1970 the Musée Départemental d'Archéologie opened its doors in Martinique. Mario Mattioni, an art historian, was appointed its first director. French laws regarding archaeological research were now formally implemented in the French West Indies (Mézin 1991; Giraud 1995; 1997; 2002; Delpuech 2007; Vidal 2007).

4 The Interpretative Period

The contextual-functional perspective which pervaded North American archaeology in the 1950s led to a major interest in environmentalist approaches and reconstructing prehistoric settlement patterns, especially following Willey's Virú Valley project (Willey and Sabloff 1980, 130-131, 146-149). It was adopted by researchers in the West Indies at a time when in North America it had already evolved into the New Archaeology or 'processual' approach which saw cultural development as resulting primarily from long-term adaptive processes and swept throughout global academia during the 1970s and 1980s (Trigger 2006, 392-405). In the Caribbean detailed analysis of zooarchaeological remains now became customary in order to reconstruct past lifeways and subsistence strategies. It was Mattioni who in the 1970s initiated area excavations aiming at deducing local community structure and house plans at the Vivé and Fond-Brûlé sites in Martinique (Giraud 1997).

Simultaneously, Peter O'B. Harris carried out important fieldwork at various sites in Trinidad under the auspices of the Historical Society of Trinidad and Tobago (South Section), which enabled him to develop the first detailed chrono-cultural sequence for the Archaic Age in the island. In addition, Harris continued Bushnell's work in Tobago and initiated research into the preceramic cultural ecology of Trinidad which he was able to correlate with the Holocene sea-level rise in the Gulf of Paria (Harris 1976). In spite of the increased emphasis on analysing settlement and subsistence patterns, most of the research carried out in the Lesser Antilles in these years continued to be primarily culture-historical in character. Partly this was due to the still fragmentary chrono-cultural sequences available for many of the West Indian islands. Instead, it was French structuralism that influenced archaeological methodology in especially the French West Indies in these decades. A clearly structuralist 'cognitive' perspective, which in North America would break through during post-processual times more than a decade afterwards, was presented by Henry Petitjean Roget (1975) who analysed Early Ceramic pottery decoration of the West Indies in order to reconstruct the worldview of its manufacturers.

New research questions were now raised and old ones approached from different angles. In Martinique Louis Allaire, one of Rouse's students, investigated the subject of archaeologically identifying Island Carib pottery, rejecting Bullen's conclusions on this matter and excavating extensively on the island in the 1970s and 1980s under the auspices of Yale University, the Université de Montréal and Manitoba University, Canada (Allaire 1977). Simultaneously, in 1978-9 David R. Watters of Pittsburgh University, PA, introduced probability sampling to the West Indies by archaeologically surveying the islands of Barbuda and Montserrat using random selection of aligned transects, specifically arranged to reconnoitre on foot the various ecosystems of these islands. In these same years Luis A. Chanlatte Baik (University of Puerto Rico, Rio Piedras) initiated a major excavation project on Vieques which he would continue throughout the 1980s and 1990s, cooperating with Yvonne Narganes Storde (Chanlatte Baik and Narganes Storde 1983; 2005). Meanwhile Rouse continued working on his chrono-cultural chart of the West Indies, refining it from time to time (fig. 8; see Rouse 1964; 1986; 1992). He cooperated with Watters in analysing the environmental diversity of the Caribbean, while the latter compared the patterns of horticulturalist colonization of Oceania and the Antilles (*e.g*. Watters and Rouse 1989).

A truly 'processual' approach was presented by R. Christopher Goodwin (Smithsonian Institution, Washington, DC) who attempted to show that demographic factors underlaid subsistence change during the Ceramic Age in St. Kitts and beyond. From 1981 to 1992 the systematic registration of rock art sites in the Lesser Antilles was undertaken on a region-wide scale by the Dutch scholar Cornelis N. Dubelaar (1995), who previously had inventoried

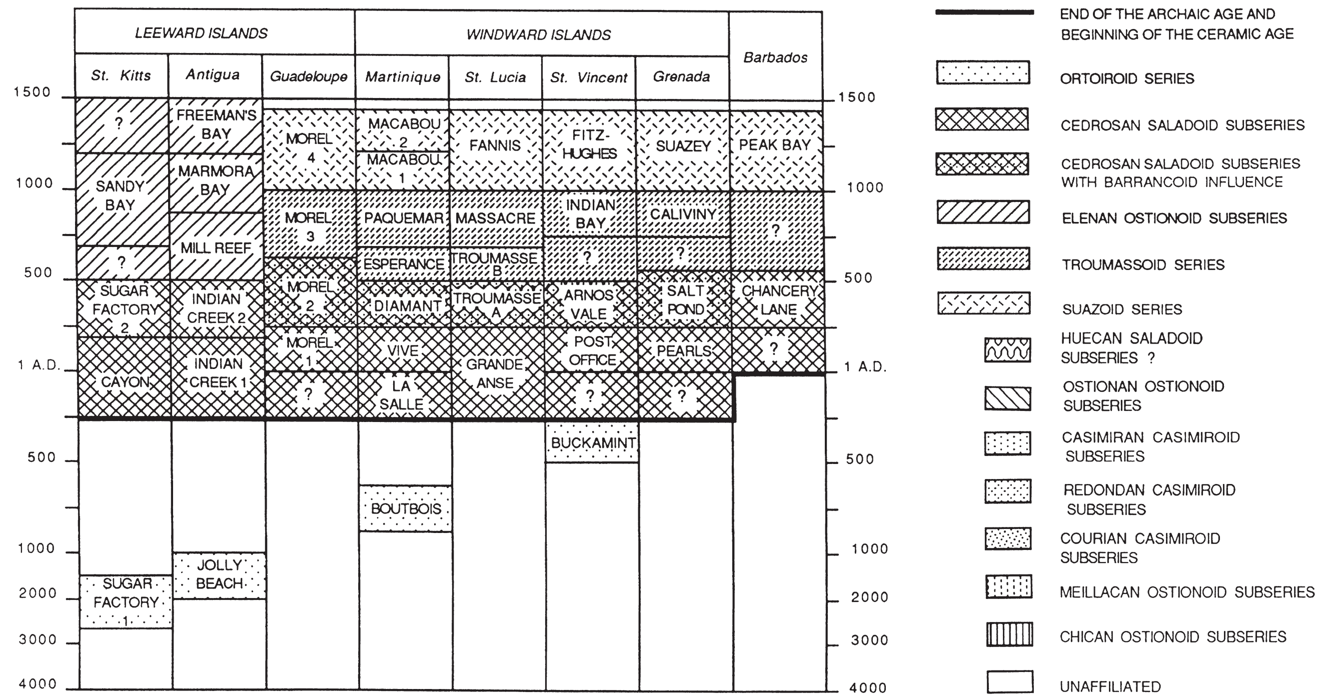


Figure 8 Chronological chart of the ‘peoples and cultures in the Lesser Antilles’, drafted by B. Irving Rouse. (After Rouse 1992, Fig. 15).

the petroglyphs and rock paintings of the Guianas. A series of major excavation programmes were now being initiated. Such fieldwork was carried out by a team of Vienna University, Austria, led by Herwig Friesinger at various sites on St. Lucia between 1983 and 1986. In 1984 the Barbados Museum and University College London established the Barbados Archaeological Survey which would entail systematic field surveys and excavations led by Peter L. Drewett throughout the 1980s and 1990s. In Trinidad the establishment of the Archaeological Centre at the St. Augustine campus of the University of the West Indies (UWI) would lead to a programme of site surveying and excavating in both Trinidad and Tobago, as well as to efforts at registration and official protection of known sites by the author in cooperation with Peter O’B. Harris of the Historical Society of Trinidad and Tobago (South Section) throughout the 1980s and afterwards. Besides, the author continued Allaire’s archaeological and ethnohistorical research into the identification of Island Carib pottery (Boomert 1986).

Research accelerated tremendously in the Lesser Antilles during the final quarter of the twentieth century, being carried out by local museums or archaeological societies and institutions, often associated with North American or West European universities. Epoch-making area excavations were conducted by Aad H. Versteeg of Leiden University, the Netherlands, at the Golden Rock site of St. Eustatius from 1984 to 1989. His excavation of part of a Ceramic Age village exposed numerous features including soil marks of postholes which enabled the reconstruction of a number of house plans (Versteeg and Schinkel (eds) 1992). Versteeg’s work marked the start of a series of major projects emphasizing settlement archaeology in the Lesser Antilles conducted by archaeologists of Leiden University, notably Corinne L. Hofman and Menno L.P. Hoogland, on Saba, St. Martin, Guadeloupe, Désirade, St. Lucia, and St. Vincent (fig. 9). In fact, the Leiden methods of analysing site formation processes and spatial interpretation would become the model for Caribbean archaeological research in the years to come.

The establishment of regional archaeological services in Martinique (1986) and Guadeloupe (1992) by the French government would give research in the French West Indies a major impetus (Delpuech 2001). Much fieldwork was now realized here either independently or in cooperation with Leiden University, the Université de Paris I and the Université de Provence, Aix-en-Provence, both in France, under the responsibility of the Direction Régionale des Affaires Culturelles (DRAC) of Guadeloupe and that of Martinique (Giraud 1997; Bérard 2004; Delpuech 2007; Vidal 2007). In the 1990s and following years other

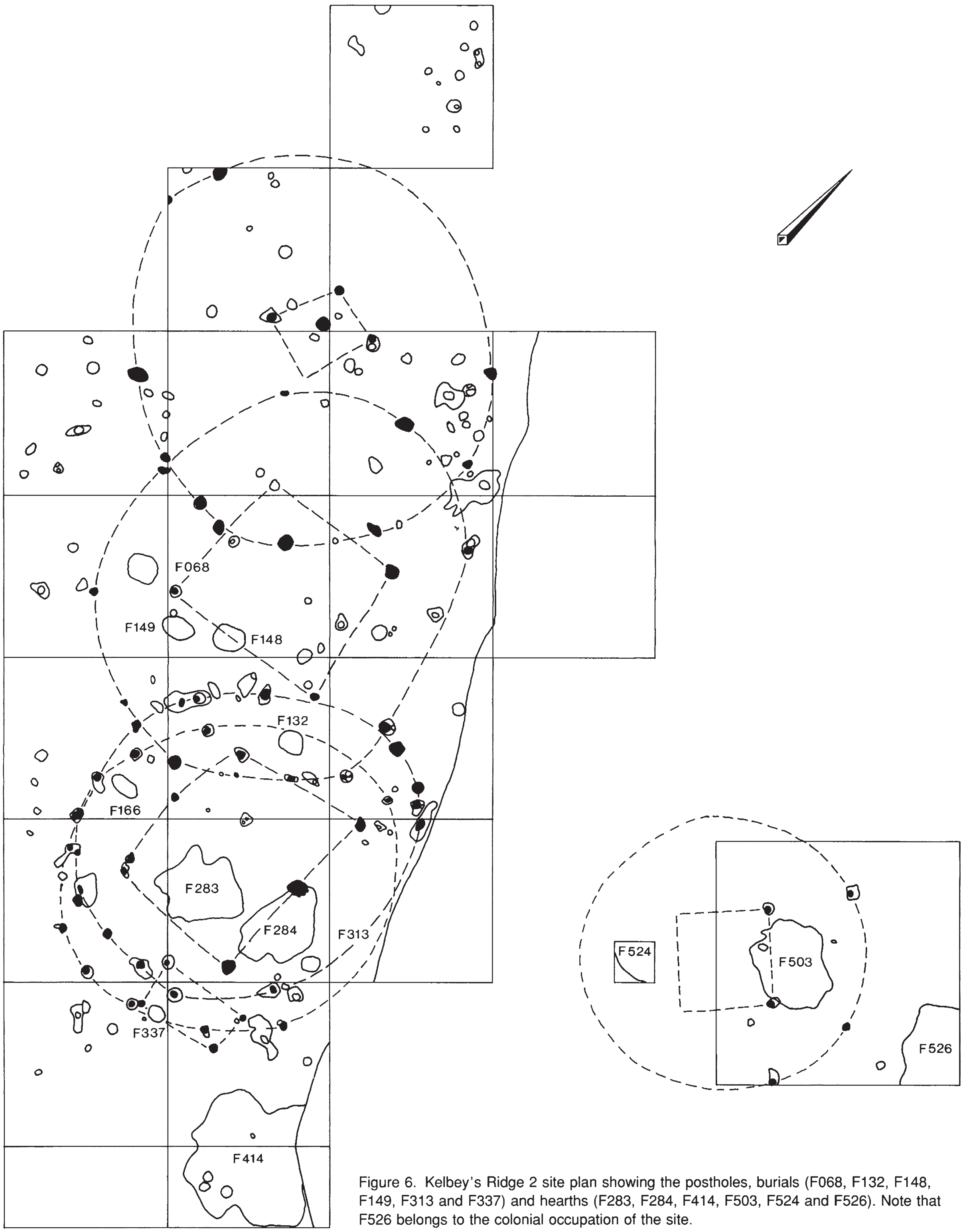


Figure 9 Site plan of Kelbey's Ridge 2 settlement, Saba, showing soil marks of postholes, burials and hearths. (After Hoogland and Hofman 1993, Fig. 6).

multi-year excavation projects were executed by Richard T. Callaghan and Iosif Moravetz (University of Calgary, Alta., Canada) on St. Vincent, by David R. Watters (Carnegie Museum, Pittsburgh, PA) and James B. Petersen (University of Maine at Farmington, ME) on Montserrat, by the latter and John G. Crock (University of Vermont at Burlington, VT) on Anguilla, by A. Reg Murphy (National Parks Antigua, St. John's) and Paul F. Healy (Trent University, Peterborough, Ont., Canada) on Antigua, by Elizabeth Righter (Division for Archaeology and Historic Preservation, US Virgin Islands) on St. Thomas, US Virgin Islands, by Michele H. Hayward and Michael A. Ciquino (Panamerican Consultants, Inc., Buffalo, NY) on St. Croix, US Virgin Islands, by Peter L. Drewett on Tortola, British Virgin Islands, and throughout the 1980s and 1990s by Samuel M. Wilson (University of Texas at Austin, TX) on Nevis. Especially Righter's work at the Tutu site stands out for its multidisciplinary approach (Righter (ed.) 2002).

The years around the turn of the century saw a noteworthy widening of research interests. Study of the two dominant themes in Caribbean archaeology, the multi-staged peopling of the archipelago as a whole and the rise of complex society in the Greater Antilles, intensified, while serious attempts were now made to understand the processes of cultural development and social interaction in the archipelago (Crock and Petersen 2004; Hofman and Hoogland 2004; Keegan 2004). This has led to heightened insight into the intercommunity exchange relationships throughout the prehistoric Lesser Antilles and beyond (*e.g.* Watters 1997; Hofman *et al.* 2007). Accordingly, investigation into innovative methods of identifying the source areas of objects of trade or exchange including ceramics and stone or shell artefacts deepened (*e.g.* Knippenberg 2006). The compositional and radiographical analysis of pottery, initiated by Jacques Petitjean Roget (1970) in Martinique and followed up by Donahue *et al.* (1990) in the Leeward Islands, is presently being pursued by Hofman and others at Leiden University where microscopic study of fabrics is combined with that of geochemical analysis and ethnoarchaeological research (Hofman and Bright 2004). This research dovetails with the compositional studies of Caribbean ceramics by Descantes and others at the University of Missouri, MO (Descantes *et al.* (eds) 2008). In addition, a programme of sourcing clays throughout the Lesser Antilles next to workability tests is currently being carried out at Leiden University to enable identification of the provenance areas of pottery. In a similar way trace element variability in cherts is being tested (Hofman *et al.* 2008). The study of use-wear traces on shell, stone, bone, antler and coral tools, artefact replication and experimental archaeology, pioneered by Jeffery B. Walker in Puerto Rico in the 1970s, is undertaken at Leiden University as well (Lammers-Keijsers 2007).

As to the analysis of past subsistence patterns, following the initial attempts at isotopic research of amino acids in fossil bone collagen in order to reconstruct prehistoric diet and the first systematic archaeobotanical research of Lesser Antillean sites in the 1990s (*e.g.* van Klinken 1991), important progress is now being made in starch and phytolith residue studies as well as that of human dental wear as evidence of dietary practices. All of this recently enabled synthesizing Caribbean palaeoethnobiology on a region-wide level (Newsom and Wing 2004; also Serrand 2007). In addition, stable isotope analyses of bone and tooth enamel are currently being used to reconstruct prehistoric life histories in the Lesser Antilles, notably the patterns of inter-island movement of individual Amerindians (Hoogland *et al.* 2010; Laffoon and de Vos 2011). Also, the investigation of the climatically induced environmental alterations in the Lesser Antilles and their impact on human life in the archipelago has recently been intensified (*e.g.* Bertran *et al.* 2004), while the accelerated development of information science during the past decade has led to an increased use of sophisticated geophysical surveys, GIS-generated mapping, aerial photography, photogrammetry and satellite imagery in West Indian archaeology, notably on Trinidad, Barbados, the Leeward and Virgin Islands (Reid 2008). Finally, no doubt the first complete excavation by teams of Leiden University of an Island Carib settlement site at Argyle, St. Vincent, in 2010, represents one of the most important archaeological investigations in the Lesser Antilles of the past few decades (see Hoogland *et al.* n.d.).

5 Conclusions

In retrospect, the political, cultural and linguistic fragmentation of the Lesser Antilles has modelled the development of scientific research in the area, including that of archaeological investigation. The lack of region-wide academic institutions and the late- to post-colonial political situation led to research being advanced initially mainly due to foreign initiative, either by North American or West-European scholars. It was in the French West Indies that in the 1930s the first continuous local programme of archaeological investigation was developed. Interestingly, while throughout most of its history archaeological research in the Caribbean followed the same line of development as that in North America (Willey and Sabloff 1980), typically 'processual' research strategies had relatively little impact in at least the Lesser Antilles during the time New Archaeology was reigning academia in the United States and Western Europe. In contrast, from these years onwards it was a clearly structuralist-derived 'cognitive' perspective that influenced archaeological investigation in especially the French West Indies, thus being initiated in the region more than a decade earlier than the breakthrough of post-processualism in

North America. At present local museums, universities, heritage foundations or historical societies are actively protecting and pursuing archaeological investigation in the Lesser Antilles, often in collaboration with European or North American universities. Clearly, research is most thriving in territories which form part of larger political units with established and firmly endorsed forms of protective heritage legislation and the financial means to enforce them.

Acknowledgements

This paper was written under the auspices of the project 'Communicating communities: Unraveling networks of human mobility and exchange of goods and ideas from a pre-colonial, pan-Caribbean perspective', led by Professor Corinne L. Hofman of Leiden University, the Netherlands, and funded by the Netherlands Organisation for Scientific Research, The Hague. The author is indebted to Alice V.M. Samson, Alistair J. Bright, Jimmy L.J.A. Mans, and Angus A.A. Mol, all of the Faculty of Archaeology, Leiden University, for valuable comments on the first draft of this paper.

References

Allaire, L. 1977. *Later Prehistory in Martinique and the Island Caribs: Problems in Ethnic Identification*. Ann Arbor, MI: unpublished Ph.D. thesis, Yale University, New Haven, CT.

Bérard, B. 2004. *Les premières occupations agricoles de l'arc antillais, migration et insularité: Le cas de l'occupation saladoïde ancienne de la Martinique*. Oxford: BAR International Series 1299.

Bertran, P., D. Bonnissent, D. Imbert, P. Lozouet, N. Serrand and C. Stouvenot 2004. Paléoclimat des Petites Antilles depuis 4000 ans BP: l'enregistrement de la lagune de Grand-Case à Saint-Martin. *Comptes Rendus Geoscience* 336, 1501-1510.

Boomert, A. 1986. The Cayo complex of St. Vincent: Ethnohistorical and archaeological aspects of the Island Carib problem. *Antropológica* 66, 3-68.

Boomert, A. 1996. *The Prehistoric Sites of Tobago: A Catalogue and Evaluation*. Alkmaar.

Boomert, A. 2000. *Trinidad, Tobago and the Lower Orinoco Interaction Sphere: An Archaeological/Ethnohistorical Study*. Alkmaar: Ph.D. thesis Leiden University.

Boomert, A. and A.J. Bright 2007. Island archaeology: In search of a new horizon. *Island Studies Journal* 2 (1), 3-26.

Breton, Père R.G. 1978. *Relations de l'île de la Guadeloupe*. Basse-Terre [Originally written 1647/1656].

Brett, Rev. W.H. 1868. *The Indian Tribes of Guiana; Their Conditions and Habits*, 2nd ed. London.

Bullbrook, J.A. 1953. *On the Excavation of a Shell Mound at Palo Seco, Trinidad, B.W.I.* New Haven, CT: Yale University Publications in Anthropology 50.

Bullen, R.P. and A.K. Bullen 1976. Culture areas and climaxes in Antillean prehistory. In: *Proceedings of the Sixth International Congress for the Study of the Pre-Columbian Cultures of the Lesser Antilles, Guadeloupe 1975*, 1-10.

Chanlatte Baik, L.A. and Y.M. Narganes Storde 1983. *Vieques-Puerto Rico: Asiento de una Nueva Cultura Aborigen Antillana*. Santo Domingo.

Chanlatte Baik, L.A. and Y.M. Narganes Storde 2005. *Cultura La Hueca: Finca Sorcé, Barrio La Hueca, Vieques*, Río Piedras. Puerto Rico.

Crock, J.G. and J.B. Petersen 2004. Inter-island exchange, settlement hierarchy and a Taíno-related chiefdom on the Anguilla Bank, Northern Lessser Antilles. In: A. Delpuech and C.L. Hofman (eds), *Late Ceramic Age Societies in the Eastern Caribbean*. Oxford: BAR International Series 1273, 139-156.

Cruxent, J.M. and B.I. Rouse 1958/1959. *An Archeological Chronology of Venezuela*, 2 vols., Washington, DC: Pan American Union, Social Science Monographs 6.

Delpuech, A. 2001. Archéologie historique en Guadeloupe. Une autre approche du passé antillais. *Bulletin de la Société d'Histoire de la Guadeloupe* 129, 109-159.

Delpuech, A. 2002. La recherche archéologique en Guadeloupe. In: A. Delpuech, J.-P. Giraud and A. Hesse (eds), *Archéologie précolombienne et coloniale des Caraïbes*, Paris, 27-36.

Delpuech, A. 2003. Les 'anthropolithes' de la Guadeloupe. Aux origines de l'archéologie Antillaise. In: *Proceedings of the Twentieth International Congress for Caribbean Archaeology, Santo Domingo 2003*, II, 443-448.

Delpuech, A. 2007. Archéologie amérindienne en Guadeloupe: Autour de la création d'un service régional dans un département d'outre-mer. *Les Nouvelles de l'archéologie* 108/109, 10-19.

Descantes, C., R.J. Speakman and M.D. Glascock (eds) 2008. An exploratory study into the chemical characterization of Caribbean ceramics. *Journal of Caribbean Archaeology, Special Publication* 2.

Donahue, J., D.R. Watters and S. Millspaugh 1990. Thin section petrography of Northern Lesser Antilles ceramics. *Geoarchaeology: An International Journal* 5 (3), 229-254.

Drewett, P.L. 1991. History of research. In: P.L. Drewett (ed), *Prehistoric Barbados*. London/Barbados, 1-5.

Dubelaar, C.N. 1995. *The Petroglyphs of the Lesser Antilles, the Virgin Islands and Trinidad*. Amsterdam: Publications Foundation for Scientific Research in the Caribbean Region 135.

Evans, C. and B.J. Meggers 1960. *Archeological Investigations in British Guiana*. Washington, DC: Smithsonian Institution, Bureau of American Ethnology Bulletin 177.

Fewkes, J.W. 1907. *The Aborigines of Porto Rico and Neighboring Islands*. Washington, DC: Twenty-fifth Annual Report of the Bureau of American Ethnology [1903-1904].

Fewkes, J.W. 1922. *A Prehistoric Island Culture Area of America*. Washington, DC: Thirty-fourth Annual Report of the Bureau of American Ethnology [1912-1913].

Giraud, J.-P. 1995. La recherche archéologique en Martinique, État de la question et perspectives. In: *Proceedings of the Sixteenth International Congress for Caribbean Archaeology, Guadeloupe 1995*, I, 45-51.

Giraud, J.-P. 1997. L'archéologie à la Martinique des années 1930 à 1980. In: C. Celma (ed.), *Exposition l'archéologie à la Martinique: 60 années de passion et de recherches,* Fort-de France, 9-29.

Giraud, J.-P. 2002. Histoire et problématiques de la recherche archéologique en Martinique. In: A. Delpuech, J.-P. Giraud and A. Hesse (eds), *Archéologie précolombienne et coloniale des Caraïbes*, Paris, 15-25.

Goodwin, R.C. 1978. The history and development of osteology in the Caribbean Area. *Revista/Review Interamericana* 8 (3), 463-494.

Harris, P. O'B. 1976. The Preceramic period in Trinidad. In: L. Sickler Robinson (ed.), *Proceedings of the First Puerto Rican Symposium on Archaeology*. San Juan de Puerto Rico: Fundación Arqueológica, Antropológica e Historica de Puerto Rico Report 1, 33-64.

Hatt, G. 1924. Archaeology of the Virgin Islands, *Proceedings of the Twenty-first International Congress of Americanists, First Part, The Hague 1924*, I, 29-42.

Hofman, C.L. and A.J. Bright 2004. From Suazoid to Folk pottery: Pottery manufacturing traditions in a changing social and cultural environment on St. Lucia. *New West Indian Guide/Nieuwe West-Indische Gids* 78 (1/2), 73-104.

Hofman, C.L. and M.L.P. Hoogland 2004. Social dynamics and change in the Northern Lesser Antilles. In: A. Delpuech and C.L. Hofman (eds), *Late Ceramic Age Societies in the Eastern Caribbean*, Oxford: BAR International Series 1273, 47-57.

Hofman, C.L., A.J. Bright, A. Boomert and S. Knippenberg 2007. Island rhythms: The web of social relationships and interaction networks in the Lesser Antillean archipelago between 400 B.C. and A.D. 1492. *Latin American Antiquity* 18 (3), 243-268.

Hofman, C.L., M.L.P. Hoogland and A.L. van Gijn 2008. Crossing disciplinary boundaries and national borders: New methods and techniques in the study of archaeological materials from the Caribbean. In: C.L. Hofman, M.L.P. Hoogland and A.L. van Gijn (eds), *Crossing the Borders: New Methods and Techniques in the Study of Archaeological Materials from the Caribbean*, Tuscaloosa, 1-17.

Hoogland, M.L.P. and C.L. Hofman 1993. Kelbey's Ridge 2, A 14th century Taino settlement on Saba, Netherlands Antilles. *Analecta Praehistorica Leidensia* 26, 163-181.

Hoogland, M.L.P., C.L. Hofman and A. Boomert (n.d.) *Argyle, St. Vincent: New insights into the Island Carib occupation of the Lesser Antilles*, Paper presented to the Twenty-fourth International Congress for Caribbean Archaeology, Martinique 2011.

Hoogland, M.L.P., C.L. Hofman and R.G.A.M. Panhuysen 2010. Interisland dynamics: Evidence for human mobility at the site of Anse à la Gourde, Guadeloupe. In: S.M. Fitzpatrick and A.H. Ross (eds), *Island Shores, Distant Pasts: Archaeological and Biological Approaches to the Pre-Columbian Settlement of the Caribbean*, Gainesville, FL, 148-162.

Hughes, Rev. G. 1750. *The Natural History of Barbados*. London.

Joyce, T.A. 1916. *Central American and West Indian Archaeology Being an Introduction to the Archaeology of the States of Nicaragua, Costa Rica, Panama and the West Indies*. London.

Keegan, W.F. 2004. Islands of chaos. In: A. Delpuech and C.L. Hofman (eds), *Late Ceramic Age Societies in the Eastern Caribbean*, Oxford: BAR International Series 1273, 33-44.

Klinken, G.J. van 1991. *Dating and Dietary Reconstruction by Isotopic Analysis of Amino Acids in Fossil Bone Collagen – With Special Reference to the Caribbean*. Amsterdam: Publications Foundation for Scientific Research in the Caribbean Region 128.

Knippenberg, S. 2006. *Stone Artefact Production and Exchange among the Northern Lesser Antilles*. Leiden: Ph.D. thesis, Leiden University.

Laffoon, J.E. and B.R. de Vos 2011. Diverse origins, similar diets: An integrated isotopic perspective from Anse à la Gourde, Guadeloupe. In: C.L. Hofman and A. van Duijvenbode (eds), *Communities in contact: Essays in archaeology, ethnohistory and ethnography of the Amerindian circum-Caribbean*, Leiden, 187-203.

Lammers-Keijsers, Y.M.J. 2007. *Tracing Traces from Present to Past: A Functional Analysis of Pre-Columbian Shell and Stone Artefacts from Anse à la Gourde and Morel, Guadeloupe, FWI*. Leiden: Ph.D. thesis, Leiden University.

Lovén, S. 1935. *Origins of the Tainan Culture, West Indies*. Göteborg.

McKusick, M.B. 1960. *Distribution of Ceramic Styles in the Lesser Antilles, West Indies*. Ann Arbor, MI: unpublished Ph.D. thesis, Yale University, New Haven, CT.

Mézin, L. 1991. *Archéologie Martinique: Guide des Collections*, Fort-de-France.

Newsom, L.A. and E.S. Wing 2004. *On Land and Sea: Native American Use of Biological Resources in the West Indies*, Tuscaloosa, AL.

Osgood, C. 1942. Prehistoric contact between South America and the West Indies. *Proceedings of the National Academy of Sciences* 28 (1), 1-4.

Osgood, C. 1946. *British Guiana Archeology to 1945*. New Haven, CT: Yale University Publications in Anthropology 36.

Petitjean Roget, H. 1975. *Contribution à l'Étude de la Préhistoire des Petites Antilles*, 2 vols., Fort-de-France.

Petitjean Roget, H. 1993. Histoire d'un nom: Calina, Cannibale, Carib et Caraïbe. In: A. Yacou and J. Adélaïde-Merlande (eds), *La découverte et la conquête de la Guadeloupe*, Guadeloupe/Paris, 64-67.

Petitjean Roget, J. 1970. L'Archéologie Martiniquaise. *Parallèles* 36/37, 4-67.

Rainbird, P. 2007. *The Archaeology of Islands*. Cambridge.

Rainey, F.G. 1940. *Porto Rican Archaeology*. New York, NY: Scientific Survey of Porto Rico and the Virgin Islands XVIII:1.

Reid, B.A. 2008. Introduction archaeology and geoinformatics: Case studies from the Caribbean. In: B.A. Reid (ed.), *Archaeology and Geoinformatics: Case Studies from the Caribbean*, Tuscaloosa, AL, 1-9.

Righter, E.C. (ed.) 2002. *The Tutu Archaeological Village Site: A Multidisciplinary Case Study in Human Adaptation*. London.

Rostain, S. 2007. Histoire de la recherche archéologique dans les Guyanes côtières. *Les Nouvelles de l'Archéologie* 108/109, 36-56.

Rouse, B.I. 1939. *Prehistory in Haiti: A Study in Method*. New Haven, CT: Yale University Publications in Anthropology 21.

Rouse, B.I. 1947. Prehistory of Trinidad in relation to adjacent areas. *Man* 47, 93-98.

Rouse, B.I. 1952. *Porto Rican Prehistory*. New York, NY: Scientific Survey of Porto Rico and the Virgin Islands XVIII: 3/4.

Rouse, B.I. 1953. The Circum-Caribbean theory, an archeological teSt. *American Anthropologist* 55, 188-200.

Rouse, B.I. 1961. Archaeology in lowland South America and the Caribbean, 1935-60. *American Antiquity* 27 (1), 56-62.

Rouse, B.I. 1964. Prehistory of the West Indies. *Science* 144, 499-514.

Rouse, B.I. 1986. *Migrations in Prehistory: Inferring Population Movement from Cultural Remains*. New Haven, CT.

Rouse, B.I. 1992. *The Tainos: Rise and Decline of the People Who Greeted Columbus*. New Haven, CT.

Serrand, N. 2007. Exploitation des invertébrés par les sociétés précolombiennes des Petites Antilles. *Journal de la Société des Américanistes* 93 (1), 7-47.

Steward, J.H. 1949. South American cultures: An interpretative summary. In: J.H. Steward (ed.), *Handbook of South American Indians*, V, Washington, DC: Smithsonian Institution, Bureau of American Ethnology Bulletin 143, 669-772.

Tertre, J.B. du 1973. *Histoire Générale des Antilles Habitées par les François*, 4 vols. Fort-de-France, Martinique [First published Paris 1667/1671].

Trigger, B.G. 2006. *A History of Archaeological Thought*. 2nd ed. Cambridge.

Versteeg, A.H. and K. Schinkel (eds) 1992. *The Archaeology of St. Eustatius: The Golden Rock Site*. Oranjestad: St. Eustatius Historical Foundation Publication 2.

Vidal, N. 2007. Soixante-dix ans d'archéologie en Martinique, 1930-2000. *Les Nouvelles de l'Archéologie* 108/109, 20-29.

Watters, D.R. 1976. *Caribbean Prehistory: A Century of Researchers, Models, and Trends*. Reno, NV: unpublished MA thesis, University of Nevada.

Watters, D.R. 1997. Maritime trade in the prehistoric Eastern Caribbean. In: S.M. Wilson (ed.), *The Indigenous People of the Caribbean*, Gainesville, FL, 88-99.

Watters, D.R. and B.I. Rouse 1989. Environmental diversity and maritime adaptations in the Caribbean Area. In: P.E. Siegel (ed.), *Early Ceramic Population Lifeways and Adaptive Strategies in the Caribbean*, Oxford: BAR International Series 506, 129-144.

Willey, G.R. and J.A. Sabloff 1980. *A History of American Archaeology*. 2nd ed. London.

Wilson, S.M. 2007. *The Archaeology of the Caribbean*. Cambridge.

Wing, E.S. 1962. *Succession of Mammalian Faunas on Trinidad, West Indies*. Ann Arbor, MI: unpublished Ph.D. thesis, University of Florida, Gainesville, FL.

Arie Boomert
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
aboomert@hotmail.com

Indigenous religious traditions in Central Nicaragua: ethnohistorical documentation for an unknown archaeological record

Laura N.K. Van Broekhoven and Alexander Geurds

The archaeological record in the central region of Nicaragua remains one of the most poorly understood in the Americas. Currently, there is merely a sketchy view on initial occupation, and some rudimentary data on late prehistoric habitational characteristics. An important aid in improving this regional field of archaeology is the use of Colonial Period documentary Spanish sources. In these texts, observations by Spanish missionaries and soldiers describe the ritual practices of the indigenous communities in the region, and reveal particular Mesoamerican or pan-American features. These improve current archaeological understandings of indigenous ceremonial activities and views of sacred landscapes.

1 Introduction

The colonization of the Americas has produced an invaluable documentary record for the study of the indigenous past of the continent. Although far from straightforward in their content, the chronicles written by those involved in the conquest have left us a look at the indigenous societies in many regions of Central and South America. Even for the pre-Hispanic past of Nicaragua, the small number of known early works has received considerable attention from both (ethno-)historians and archaeologists. However, not until the late sixteenth century are any detailed written data available for the central region of Nicaragua. Considered a mountainous backwater during the first half of the sixteenth century, this central region (including the areas of the modern political provinces or departments of Matagalpa, Boaco, Chontales, San Juan del Sur and RAAS) did not grasp the attention of the Spanish colonizer (fig. 1). Also due to its poorly accessible geography and hostile indigenous population, considered 'barbaric', any significant extent of colonization effort was discouraged. In large part due to the communications that occurred between the Spanish and the Nicarao indigenous peoples, living on the Pacific coast, a pejorative cultural representation of the indigenous communities in the central region was formed around the ethnic identifier of 'Chontal' (Ibarra Rojas 1994, 233). Considered enemies by the Nicarao, the Chontal in particular, and the central region in general, came to be seen as unattractive to Spanish entries.

These negative considerations on the part of the Spanish change dramatically once the earliest reports on the natural resources in the central region started to emerge. Mainly due to the reported presence of gold around the communities of La Libertad and Santo Domingo, the region now becomes rather attractive to have control over, both to the Spanish Crown and to the English and the Dutch from the Caribbean side of the country. Still, the mines of Chontales were not exploited until the eighteenth century, so that these activities predominantly had their effect on the Nueva Segovia region at the beginning of the conquest.

For the Spanish 'colonizer', the English and Dutch incursions and the potential threat these formed to the Spanish Pacific region were the convincing argument for establishing a permanent and visible Spanish presence in the central region. From the subsequent period, multiple historical documents are known with accounts and descriptions of the indigenous cultural practices witnessed by Spanish missionaries and soldiers active in the region. Such cultural practices provide contexts to the archaeological remains currently being studied in the central region. In this chapter we elaborate briefly on some of these valuable but little-studied documentary sources, from the *Archivo General de Indias* (hereafter AGI), the *Archivo General de Centro America* (hereafter AGCA), the Historical Archives of the Franciscan Province of Michoacán, the Temple of San Francisco at Celaya (hereafter AHC) and the Archives of the Curia of the City of Guatemala (hereafter ACG).[1] We focus on the presence of Spanish missionaries and their views on the indigenous ritual practices to improve current understandings of ceremonial activities and indigenous views of sacred landscapes.

2 The Spanish colonization of Central Nicaragua

As elsewhere in Central America, central Nicaragua was not conquered in one single attempt. This is confirmed by the early chronicles of the time and tribute lists, which indicate that at no time were major Spanish cities established there, in the sense of administrative centres. Consequently, cultural, economic and political change followed a trajectory different to that in the Pacific region. These differences formed a basis

Figure 1 Map of Central Nicaragua.

for introducing the concept of the so-called "Frontera Segoviana", following the central mountains of Nicaragua and effectively circumscribing the Spanish-controlled territory (Van Broekhoven 2002, 69-70).

Previous studies have observed that the demographic decline of the population was much greater on the Pacific coast than in the central region of the country and that villages closer to Spanish settlements were significantly more affected than remote indigenous communities. Likely the indigenous Mosquito population, located in the Caribbean coastal zone, had some sense of the dangers represented by the Spanish colonizer (Van Broekhoven 2002, 69-70). Knowing the difficulties experienced by the Spanish when conquering the area, one wonders how reliable the numbers are that we have from the first census for the central region of Nicaragua. Nonetheless, it is significant that the number of expedited land titles is significantly lower than in other regions of Nicaragua, and that land rights of the indigenous communities seem to have been better protected, or at least were not as severely affected by the arrival of the Spanish (Radell 1969; Newson 1987, 116; Incer 1990). This limited impact was likely due to the fact that most of the indigenous communities were located in the mountainous interior, which had effectively not been conquered by the Spanish.

3 Conquering the invincible

While the central region only experienced sporadic contact with the Spanish colonizers, the Pacific was placed entirely under Spanish control, and therefore, under the *encomienda* system in the early sixteenth century. This system regulated rights to land and (indigenous) labour in the Spanish colonies. From the mid-sixteenth century, however, the boundary of the area administrated by the Spanish was gradually expanded eastward. As such, ever more indigenous communities were subjected to the *encomienda* system. Meanwhile, in the frontier areas, which had proved difficult to conquer, catholic missions were established. For much of the Colonial period, however, a large portion of the indigenous population in the central region remained outside Spanish control, immediately east of the *Frontera Segoviana*.

In the territory of the modern province of Chontales, contacts with the Spanish were somewhat irregular. For example, direct contact between royal and local officials and representatives of indigenous people was established only through mayors and magistrates who, according to Newsom, "were probably the worst oppressors of the Indians" (Newson 1987, 128). Formally, these officials were responsible for collecting taxes, redistribution of work within the division or township and civil and criminal jurisdiction in cases of “indios contra españoles” or “indios contra indios”. As such, mayors and magistrates exercised almost exclusive control over the communication between the colonized and colonizers, being in the ideal position to equally exploit both. This type of contact mostly occurred in rural areas, not in towns: “the nearer villages were to the residences of officials, the greater the likelihood and degree of exploitation they suffered” (Newson 1987, 129).

The abuse of the magistrates who ruled the central region was many times the subject of discussion in colonial documents, found in the archives of Guatemala and Spain. A long range of abuses is mentioned, often tyrannical and cruel behaviour by the governors, magistrates and mayors that even frightened the Spanish visitors to the region, causing them to report these serious abuses. Already in 1608 Friar Francisco Rivera mentions that relocation of the montañeses or mountain people is difficult, above all, for fear of abuse: “lo que mas se temen [los indígenas], es del mal tratamiento de los españoles”.[2] Later on we will discuss some of the writings of Friar Rivera.

In general, magistrates and mayors ruling over provinces of Nicaragua and Costa Rica were notorious for abusing the indigenous people working on their farms and land: they forbade them to go to church on holidays and sold them goods at inflated prices. The magistrates of Sébaco are mentioned as some of the cruelest in such abuses. Around 1670, for example, the abuse at Sébaco reached such a degree that they caused “mas [de] trecientos Indios con sus familias [..] dejasen su reducción y se fuesen a los Montes”.[3] Similarly, in a report of Friar Andrés de las Navas Quevedo from 1680 concerning the mayor of Sébaco, Jacob of Alcayaga, the friar compares the attitude of the magistrates and mayors to the destruction that would have followed would three pests have been unleashed in sequence, and even that would not have caused an equal amount of harm.[4]

Based on this destructive behaviour, combined with the introduction of diseases and the slave trade, the population of the central region had been reduced to such an extent that cattle ranchers, originating from Granada and intent on settling in the region, easily came to outnumber the indigenous population (Radell 1969). The largely indigenous population of the central region predominantly lived in the mountains. Since land divisions were focused on the foothills and plains of the region and less in the mountains, much of the indigenous population in the central region was not much affected by these divisions, or by the *encomienda* system. This is the primary reason why there is only little information on the indigenous communities of this central region and the pertaining land divisions and land titles. Based on this lack of previously known historical data, some researchers have proposed that the central region was scarcely inhabited and that its indigenous population density was much lower than elsewhere. However, numerous reports, some presented here, authored by the missionaries of communities in the mountains and its hinterland, sketch a different image for the early colonial period in central Nicaragua.

4 Christianization: Missionary strategy and indigenous response

The spiritual conquest of the region was carried out mainly by the Franciscan missions of the Order of Divine Mercy. During the seventeenth and eighteenth centuries, this order focused on relocating numerous indigenous communities in order to subject them to Spanish rule and the Catholic faith.

Even though the Franciscans had a number of missions in Nicaragua and in part managed some of the taxpaying indigenous villages, they remained inactive in the conversion of indigenous subjects until the last quarter of the sixteenth century. Their missionary efforts were largely unsuccessful, to some extent due to the limited financial support given to them by the Crown, and also because of the conversion methods used by missionaries. Their written reports, however, describe a number of indigenous ritual practices.

At the outset of the process to relocate the indigenous population, the church thought that this would take place in an orderly fashion and relatively quickly. It was believed that “aquellas bárbaras gentes que depuesta la nativa ferocidad, [..] vienen como mansos corderos al rebano de la iglesia”.[5] That was the Franciscan outlook, when in 1610, Friar Francisco de Rivera revisits the relocated indigenous populations in the central region and reports that about two hundred people were living “en formada población” and were in the process of being instructed in the faith. Among them 84 adults and at least 54 minors had already been baptized, which, according to Rivera, is a straightforward affair: “porque al pareçer reçiuan estos infieles lo que se les enseña, y aun a nosotros con voluntad y amor”.[6] Friar Juan de Albuquerque mentions the same thing when it comes to the relocations carried out further inland, on the banks of the river Muy Muy: “visto que sin mucha contradicción y algo alegres revivían nuestra santa fe, procuro q en un lugar cómodo junto al mismo rio hiciesen las casas y yglesias y para ello”.[7]

Simultaneously, however, the friars realized the difficulties of their undertaking. Consequently, they tried to convert the indigenous people as far removed as possible from their communities since they would, even though supposedly converted or relocated, still return to their homes in the mountains: “no lo e logrado porque luego que me sentian desamparauan sus bibiendas y se me huiian a la Montaña que es ynpentransible”.[8] In the late seventeenth and early eighteenth centuries, the indigenous people were no longer so easily persuaded with gifts and trinkets as in earlier periods. Besides that, their previous interest had waned, many of the gifts were readily available via trade in the Mosquitia with the Sambo indigenous people and the English themselves (Ibarra Rojas 2011). The result of all this is that the so-called 'mountain people' largely ceased to come down from the mountains, not only for fear of the diseases that awaited them there, but also due to the high taxes that were demanded from them and the abuse they received.

When the mentioned techniques of persuasion failed, Spanish soldiers were sent to the indigenous mountain communities with orders to return them to their relocations. There was considerable controversy among the Spanish over the use of force in converting the indigenous people here. While some felt that it was impossible to do this by force, and persuasion was seen as the only way to make a lasting conversion, others believed in fierce and long-lasting punishment.[9] The former considered the participation of indigenous 'relocators' timely and essential. These were speakers of native languages and knowledgeable about the customs of the peoples concerned.

One of the problems that the Catholic powers faced was the diversity of languages spoken among the different communities. The Order accordingly advised missionaries to learn and know the languages spoken in the regions where they preached in order to facilitate the conversion of the indigenous people.[10] However, it was almost impossible to learn them all. To solve this problem, the missionaries operating in the central region adopted different strategies. One was to capture and convert a small number of indigenous people, who could then act as interpreters. This phenomenon can be observed, for example, during visits by judges who brought multilingual interpreters with them.[11] Another method was to use indigenous converts, who had proven to be very devout, sending them to the people that remained to be relocated.

In a letter from Duarte Navarro directed at Juan de Albuquerque concerning the relocations, the methods applied in relocating the locals are described in detail, carefully explaining this process for the central region. Here we can observe that the first conversions that took place far inland in the central region, in the year 1606, were undertaken in charge of a native of the region of Muy Muy, who knew the language and was the only one brave enough to enter more than 30 leagues inland. He dared enter very rough and high mountains, crossing fast-flowing rivers and walking across very muddy land:

"Fray Juan de Albuquerque de la horden de nra señora de la merced dice que en el año de 1606, siendo comendador del convento del pueblo de çibaco juridición de leon [..] supo como en las montañas de tauauaca junto al rrio de muy muy habia cantidad de yndios montañeses ynfieles y procuro ynbiarles un yndio cristiano llamado Don Diego Hernandez para que les persuadiese de su parte a que reuiuiese el Santo Bautismo [..] procuro luego [..] y les trajo se boluiesen xnos y a monesto lo muebo q les ynportaua el serlo y que desta manera ganarian el cielo y tendrian comunicacion con los otros yndios xnos y que Vuestra magestad los fauoreceria y ampararia en todo y que nadie les agrauiaria lo qual tomaron bien".[12]

Moreover, he was the only one who could communicate with the natives he encountered in the area:

"... dexo al yndio don Diego xno le seruia de ynterprete, por que la lengua que el sauia del pueblo de cebaco aunque en algunos bocablos frisaba e con la suya, no hera vastante para poderles deçir y dar a entender lo que el queria y hasi servia este yndio de ynterpete [sic] y por q este hauia sido el primero q de ellos dio noticia se detubo los dias q pudo".[13]

After finding new indigenous communities, missionaries typically decided to relocate them. In other words, people were removed from their homes, displaced, and had their livelihood completely changed. To relocate them from further afield in the mountains to for example the river plains, to keep them under control and in the vicinity of the estates of the conquerors to enable them to provide personal services, missionaries needed to obtain land and build homes for settling the newly relocated indigenous people. These themselves used to build a church and, separately, had to learn the Christian faith, attend Mass and dress like the other Christianized indigenous people. The Spanish offer in return, instead of trinkets, usually consisted of promising tax exemptions. The intention was that the other indigenous people in the region, who had refused to be relocated, seeing the good treatment, "dejaran sus ydolatrias y vendran a conocimiento de la Berdad".

At first, some of the missionaries were convinced that only through mild treatment could the indigenous people be relocated. However, over time, this attitude changed completely. Complaints about mistreatment of indigenous people by the Spanish conquerors were countless, as were complaints about the missionaries. We found numerous documents by various municipal authorities ("Regidor y todos los los prinsipales y tatoques") directed to the Royal Crown. These contain complaints of abuse, theft of money, rape and abuse of female mayors, which, according to these letters, motivated the regional depopulation: "por lo cual se despuebla mi pueblo temerosos de que no hallan remedio, ni consuelo ni administracion, ni sacerdote que los entierre [..]".[14]

5 Indigenous ritual concepts in the central region

The importance of missionary texts, although written in Spanish and by religious evangelists during the seventeenth and eighteenth centuries, cannot be underestimated. These texts provide us with an inexhaustible source of information of a highly variable character, both about the intentions of the friars, and about the thinking, customs and beliefs of the indigenous peoples of central Nicaragua. In fact, they provide us with the only texts that endured to the present time since so far no other reviews about worldview, ideology, beliefs and customs of this area were known. Unfortunately, the information generated in these documents is utterly corrupted by the intolerant views of the friars. These were trained monks who arrived prepared to condemn any opinion or tradition that did not coincide with theirs. As we will see below, in doing so, indigenous concepts were placed within their own preconceived frameworks, serving Christian religious concepts such as "demonios", "brujas (witches)" and other forms of "idolatría" in general.

5.1 Indigenous "Witchcraft"

When the Friars Rodrigo de Betancourt and Tomas Delgado arrived at the Pueblo Nuevo of San Pedro Metapa near Sébaco, they received the news that in some villages in the vicinity witchcraft was still being practised. In particular, in the communities of Matagalpa, Solingalpa, Molaguina, Xinotega and Muy Muy, all of them pertaining to Sébaco. Fray Rodrigo de Betancourt decided not to enter the towns because he was not very hopeful this would pay off. Considering that the mentioned communities were close to where they were at the time, the friars instead decided to bring over some of these "brujos ydolatras y malos". Based on the information given by inhabitants of Pueblo Nuevo, Rodrigo de Betancourt admonished the "brujos" to cease their "errors".

The friar compiled a report which in part refers to an enchanted cave, located in a hill called Cuyotepet, situated near the village of Sébaco. The "presidente Capitán Alguazil mayor, sus ministros y mujeres," came to this cave every week to make human sacrifices (eight persons including children, young and old), slit throats and give blood to "los demonios", committing acts of cannibalism: stewing the meat of the slaughtered persons and eating it. According to the report, those attending transformed into different types of animals by wearing their skins, and once in their converted state began to cohabitate "nefanda- y bestialmente". Also, through their powders, enchanted rocks and roots they had all kinds of powers and supernatural forces. They could kill, love, "torear y melear". In the eyes of the friars such acts should be denominated as diabolical and superstitious and therefore had to be eliminated. The report furthermore reveals that the cave had a snake in a "chaguite" which could only be seen by those who visited to the cave, while in fact the cave would only open when hearing some words from the mouths of particular people: the President and the Captain.[15]

What can be seen here is that nearly all the elements mentioned above correspond to stereotypical characteristics of witchcraft in Europe. Examples are the slit throats, acts of cannibalism, or processing of animals and humans living together in a kind of Black Sabbath. Phenomena which can be seen in the famous meetings of witches in Late Medieval Europe, who supposedly flew on broomsticks to live among themselves and execute their spells.

On the other hand, many of these same elements could also be interpreted as remnants of rites and ceremonies with a pre-Hispanic indigenous origin, such as the transforming into different animals, like a tiger, monkey or deer, all of which played an important role in the indigenous worldview. Also the use of dust, rocks and roots to manipulate situations and people is a pre-Hispanic indigenous practice.

Other elements that appear in the documents even more clearly indicate that part of the narrative produced by the friars surely must be interpreted as having an indigenous pre-Hispanic nature. This is seen in, for example, the phenomenon of the 'owners' of the hills, the rain and the storms, the demon that "les apareze las mas vezes en figura de sus biejos difuntos" and who, therefore, easily knows how to manipulate neighbours of the community, the use of red beans as an instrument of divination, the use of crosses as a repellent for "brujas", the gourd of worms that had to be conserved through "flores de espino".

The friars, having heard of the cave, would have wanted to try and find it and end the ceremonies that took place there. To this purpose they attempted to attract the elderly and women who controlled its entry. Thus, they entered the village of Sébaco, and took two old men and one woman, incarcerating two of them, the president Melchor Lopez and his wife, in El Castillo, this probably being the Spanish fortification on the San Juan river. The cave, however, was never found.

5.2 Resistance to conversion

According to reports by friars, the attitude of the villagers of Xinotega, Matagalpa and Sébaco towards them was hostile and deceitful. Consider, for example, the description offered by Friar Antonio Margíl de Jesús when he says:

> "... los yndios le an engañado traiendole dos o tres noches por el monte tonteando sin querer descubrir la orrorosa cueba por que el demonio les manda no lo agan por ser tan orrorosa".[16]

The consternation of the friar suggests that Margíl de Jesús was not used to being tricked like this. As we will discuss below, Luis Antonio Muñoz, Chief Justice and War Captain of Sébaco, was also often facing the same kind of deceptions and misunderstandings in a village near to Jinotega. The most extreme case can be seen in Sébaco where friar Rodrigo de Betancourt tells us, his desperation reached such a point that he no longer considered it possible to evangelize the community and decided to leave it as a lost case, filled with rebels:

"Fray Rodrigo, abiendo salido de el dicho Pueblo Nuevo para este de Matagalpa y passando mui zerca de el de Sébaco no quiso entrar en el a azer la Santa mission conoziendo el poco fruto que abía de sacar y les echo su maldizion por rebeldes y bino a este de Matagalpa[..]."[17]

In some cases, the friar thought it indeed quite impossible to eradicate the witchcraft practices. To illustrate this, the following quote by Margíl de Jesús:

"No excusso en la ocasion pressisa dezir azerca de tantos tan repetidos y diabolicos enbustes en que la fazil y mala naturaleza de estos Yndios estan metidos el poco o ningun remedio que a de tener esto porque aunque aora con las exortaxiones de estos varones apostholicos pareze hauerse consumido muchos ynstrumentos diabolicos quemado y conjurado cuebas extinguido pactos y abussos; como no se han hecho castigos exemplares que les sirba de escarmiento an de boluer con maior fuerza a sus maldades y aunque sean quitado estas tres o quatro cauezillas con destierro al castillo sin embargo dejan muchas raizes en la enseñanza de sus dizipulos porque todos ellos son Naturalm[en]te, [124r] ynclinados a lo malo y a cossas diabolicas sin poder los reducir a razon ; porque quitar a los Yndios si se les pierde la bestia o la vez que dejen de buscar al zaboril, o sabio (que ellos llaman) para que echela suerte o les dee el Polbo o la piedra es querer atajar los reios y poner puertas al campo porque es aquello mas de su errencia que la ley evangelica."[18]

In this quote one can recognize how far removed his preachings were from the laws and customs of the indigenous populations of central Nicaragua.

In this particular case, all inhabitants of Matagalpa were summoned to turn in their "maldades, cañutos, polvos para enamorar, boltear, sortear, torear, encantar, melear y otras cosas" as it was known, "por ciertos informes", that "brujerías, ydolatrías y malefizios" existed in the town.[19] As Luis Antonio Muñoz confirms in his letter, the inhabitants of Matagalpa had been threatened that "si bien no lo entregauan serían castigados por la justizia". It is unclear whether this 'justice' refers to an ecclesiastical or secular court. Apparently, all residents had turned in their powders and other instruments of "brujería": "Me asegura dicho M.[R.P.] que todos fueron entregando sus maldades cañutos, polvos para enamorar, boltear, sortear, torear, encantar, melear y otras cosas".[20]

However, there was still the cave from where all these instruments originated. In fact there were four caves, decorated with pictographs. The cave wall paintings represented various wild animals like snakes, jaguars, and monkeys and were made using red and chalk pigments:

"[..] descubrieron quatro cuevas (no me quisso dezir si abía en ellas sacrifizios) dijome supe y vi que en ellas auía pintados demonios sierpes tigres micos y otros animales ynmundos en los peñascos. Como asi vi el y dados de Almagra y tiza y tan feos y abominables que caussaban orror [..]".[21]

The level of detail offered in the friar's description of the ceremonies held in the cave, is impressive:

"... y que/ estos al son de un tanboritillo mui funesto y peque/ño rezeuian y tomaban cuerpo bailaban comian/ y coabitaban con los Cofrades de las Tales cuebas/ y al mismo son se ponia el tamborillillo como de oro/ y toda la cueba mui limpia enrramada y dora/da con pacto y aparienzia diabolica enseñome / un gusanillo biuo que era un demonio para sus em/bustes de hechura extraordinaria y unos ojillos/ alumbrantes que de noche alumbrauan como una can/dela y una corona de ule para el Rey y otros trastes/ que recojio tan supertiziosos que dava orror".

In this quote several elements are mentioned that play a role in the ritual practices conducted in the caves. For example, the little drum "mui funesto y pequeño", to the sound of which, those who visited the cave, lived and danced with the "cofrades de la cueva". We can interpret these "cofrades" as "duendes" that are mentioned further on in the text and will be discussed later on. Another feature of the drum was that it changed in appearance and turned golden when beaten. During such ceremonies the cave itself also underwent certain changes. It was decorated with flowers, and, similar to the drum, its interior colour changed into a golden colour. It is unclear why the "trastes" caused horror or were objects of superstition. Were these ceramic vessels or gourds? Did these have decorative elements that caused the horror among the friars? Concerning the worm symbol with which the cheating was done, this also has some magical properties: apart from being a living creature, it had eyes that lit up at night, which obviously may point to an identification as a firefly.

Of particular interest is the mention of a rubber crown "para el Rey". We do not know what kind of king is referred to here by the friars, but this information is highly significant because, until now, it had been generally accepted that the central region of Nicaragua had poorly defined social inequality.

To the extent possible for them, the friars were keen on destroying the caves by setting fires in them, a feat that had to be undertaken in risky circumstances:

"[..] que [lla]maronse las dhas quatro cuebas con assistensia de mi theniente en Ynterim que yo estaua en sebaco; y me aseguran de una dhas cuebas que esta cassi dentro de el Pueblo y mui zercana a la Yglesia de la parzialidad molaguina que con poca lleña se le dio fuego y luego comenzo a hazer un ruido como bramidos sordos de toro y a poco rato dio unos truenos tan orrorosos y arrojo por alto las peñas mui grandes mui largo trecho que todos se admiraron concordando los dictamenes en que fue sentimiento de algun Demonio que allí abitaba. [120r] Y en las demas cuebas susedio lo mismo aunque no con tal movimiento."[22]

5.3 *A possible reference to stone statuary in the central region*

In Jinotega the resistance to the conquest expressed itself in a similar manner. When the war captain Luis Antonio Muñoz, the missionaries, together with the priest from Matagalpa, Ignacio Galiano, arrive at the town of Jinotega, a resident of the village offers them to deliver the "bulto de Virgen". Its description (see below), including words like "Ydolo" and "ydolo demonio", makes it likely that this bundle of the Holy Virgin looked like a type of stone statue, anthropomorphic in character, female, two feet or more in height: "de media bara o tres quartas de alto de piedra blanquisca echura de muger las manos puestas y la cara rossada".[23]

The description is ambiguous, it might be a reference to a statue of the Catholic Virgin but it seems implausible that the friars and Luis Antonio Muñoz would describe this image as 'ydolo demonio'. The description of the bundle or statue is reminiscent of the widespread pre-Hispanic tradition of stone statuary documented in the central region (Geurds *et al.* 2010). The description that Luis Antonio Muñoz offers is arguably somewhat brief, but still allows for a comparison with the indigenous stone statues in the collection of the Museum Gregorio Aguilar Barea (Figure 2). Luis Antonio Muñoz's references to the statue as being an idol, who spoke to them "en todo quanto se les ofrezia y le pedian", combined with the references to ceremonies and offerings of candles and incense that were made to the idol by the indigenous religious specialist and two other persons who, "en aquel tiempo (eran) Adan y Eva" and went to the mountain to "buscar el remedio de sus nessesidades", undoubtedly provide more evidence. The statues may have been material memories of ancestors, possibly from a deep and sacred past. Indeed, the references by Luis Antonio Muñoz, Margíl de Jesús and friar Rodrigo de Betancourt indicate that some of the statues were seen and worshipped as pre-Hispanic deities, and that the Virgin as described by them is merely another example of this.

6 The "duende": an evil power

During their quest to eliminate the cult of the Virgin bundle, Luis Antonio Muñoz and friar Margíl de Jesús, learned of other beliefs in Jinotega as well, expressed by "pontifizes" and representations of Adam and Eve. The latter were represented as an old man and his wife, seen accompanying

Figure 2 Stone statues in the collection of the Museum Gregorio Aguilar Barea

others on their journey to the abovementioned cave, crossing a small lagune "que haze a la falda de un serro entre monte espeso sombrio y funebre". The old man told them that in this place, in the location of the lake, the image of the "demonio" first appeared. At that time in Spanish garb, but during the second time dressed as an "Yndio Viejo". This old man was the one who provided them with powders to fall in love or make other charms, and gave "frijoles y para tirar bien las flechas al benado y para fuerza y otras yeruas y raizes venenosas y malas".

Based on the information we currently have, most of "las brujerías" were made by women of an advanced age, and therefore with considerable knowledge. Take, for example, the reference by friar Margíl to a witch from Queretaro (Mexico) who admits all her spells to Margíl and friar Juan Alonso de Ortega. Margíl describes the scene in reference to a quote from "Treatise on the superstitions of the Indians Matagalpja [sic], Jinotega, Muimui, and others from Sébaco; and the various entanglements with which the devil deceives so-called sorcerers", authored by friar Rodrigo de Betancourt. The contents of this document are still unknown at the moment, and, accordingly, the extracts we documented in the Archivo de la Curia, are extremely interesting. When Margíl comes across a "bruja" in Queretaro and hears her confessions, the priest views the situation described by friar Rodrigo about "witches" in Matagalpa and Sébaco as greatly similar:

> "[812r] cuando [..] pasé a Queretaro, una gran bruja, mobida por Dios, nos comunicó, y declaró al Reverendo Padre Fray Juan Alonso de Ortega, Ex Guardian de dicho colegio [812v] y a mi, todas sus artes, nos entregó los instrumentos, declaró quienes son los papas, obispos de Queretaro, y sus alrededores, y el modo de sacrificios, maleficios, nahuales, armas etc. es lo mismo, que lo que escribe en su Quaderno el Reverendo Padre Fray Rodrigo, solo sirve disuena, lo que dicho Padre Fray Rodrigo dice en su dicho Quaderno, que todos todos, desde el vientre de su Madre nacen brujos etc. por que sus padres desde entonses los entregan al Demonio, no es assi, por que esta misma vieja, con ser desde el vientre de su madre gran bruja, porque sus padres lo eran, y la entregaron al Demonio, pero es casada con un yndio ladino, mui buen cristiano, inosente de toda la maldad de su muger, pues dice ella, que siempre se ha guardado de su marido, y de todos los demas cristianos, sean Indios, o no lo sean, que no son del Arte, y assi no todos son brujos, sino solos aquellos que desienden de brujos, o por su mal natural lo quieren ser, arrimandose a los brujos, como disipulos para aprender & y lo mismo creo de todo esse Reyno de Guatemala".[24]

Contrastingly, Muñoz also refers to a young person aged between sixteen and twenty years who he had arrested. This young man told him: "[..] que tenía una cueba donde con siertas palabras le salia un duende en figura de un hombre chiquillo y le ablaua y le daua poluos de enamorar, piedras de torear y debrazos raizes de matar poluos de tirar venado y otros ymmundizias".[25] The agreement with this "duende" was that after obtaining the powders which are necessary, the one who received them "se abía de labar la chrisma en una batea que sacaba allí el demonio".[26] Such an act was considered diabolical in the eyes of the friars.

The description is revealing also for the reason that for the "duende" to give what it was asked, the requesting person also had to maintain four worms that were kept in a gourd and that one had to "mantener estos quatro gusanos con unas flores de espino que llevaba cada semana a remudar". Here then is mentioned a list of objects that played a role in the indigenous ceremonies: a gourd (hence our suggestion that the "trastes" mentioned in the folio [119v] may have been gourds), the punt and chrism. It also mentions a "duende" which lives in the cave, and four white-coloured worms.

However, this case is not the only example. Elsewhere, the friars also were confronted with evil "duendes" and deceivers who seemed to have some common characteristics, such as the ability to make predictions, knowing how to avoid the friars, not showing themselves when the friars came to stop them, and talking loudly while hiding from sight.

7 Hunting for witches

In central Nicaragua, as in medieval Europe, the demonological aspects of witch hunt were accompanied by a period of political and social upheaval. Who were these witches Margíl de Jesús, Betancourt and his companions had in mind? What kind of witchcraft did Luis Muñoz expect to encounter when he made his entry into Sébaco and Jinotega? To answer this we have to clarify the cultural context in which the friars based their judgments and findings. Since it is the Catholic and European mentality during the seventeenth and eighteenth centuries that is the likely cause of the lack of understanding on the part of the friars, when confronted with, what were to them, unknown and mysterious indigenous ritual practices in Nicaragua.

If we uncritically accept the interpretations of the conquerors in order to understand the beliefs and ritual system of the indigenous communities in Central Nicaragua, we then would need to assume that a notion of evil existed among the indigenous concepts, that equaled the European concept of Satan or a comparable entity that embodied all the evil in the world and, simultaneously, another entity that symbolized everything good and divine in the world. As Irene Silverblatt rightly shows in the case of Andean indigenous societies:

> "[..] La cosmología andina no tenia una noción del mal, encarnado en un ser satánico. En contrario, la filosofía andina implica una visión 'dialéctica' del universo en el cual fuerzas opositoras eran vistas como recíprocas y complementarias, necesario para la reproducción de la sociedad en su conjunto" (Silverblatt 1987:172).[27]

Silverblatt's description has been shared by many contemporary authors, both for the Andean world and for the circum-Caribbean and Mesoamerican culture areas. But this obviously was not the image that the conquerors sought to demonstrate to the European public. The tremendous discrepancy between the image that the friars were projecting onto the indigenous reality and reality itself, is noteworthy. Similarly, in the case of central Nicaragua, the Franciscan friars, together with the conquistadores, through the lens of their demonological xenophobia, found themselves surrounded by witchcraft, encountering evil deeds everywhere. A devil might be hiding under any rock and a witch under any bed.[28]

This unwavering belief caused any magic or miracle that could not be attributed unequivocally to divine intervention, to be attributed to the devil. Gradually, this increased the opposition to witchcraft and the commonly encountered traditional healers. These also began to be accused of diabolical practices, and allegedly making pacts with Satan. Most of the accusations were aimed at women, even though in this particular case of central Nicaragua there is a notable absence of women as protagonists of "brujerías". Especially elderly women or single ones were viewed as more susceptible to the promises of the devil, in the eyes of witch-hunters, taking into account that Eve was the one who was seduced by the serpent in Eden.

The Spanish conquest was able to convey the concept of the devil to the Americas, and along with her the idea of the witch and wizard, as can be amply observed in Mexico, North America and the Andean area. This process introduced these concepts in cultures that do not have any link to ideas of that nature.

The campaign waged by the Church to destroy the indigenous ritual practices is an integral part of the process of colonization by the Spanish conquerors. It is commonly known that from the Spanish first contact with the New World, the devil was omnipresent in the minds of the savage, barbaric and primitive inhabitants of these lands: "How else to explain the dedication that these people had towards the hills, trees, stones, sun, moon, rivers and water sources?" (Silverblatt 1987, 170).

8 Evaluating the Christian faith of the indigenous peoples of central Nicaragua

In 1700 the Bishop of the Cathedral of Nicaragua sent notice of his doubts about whether indigenous peoples were truly converted to the Real Audiencia of Guatemala. He notes that: "[...] llegado a aquella Provincia [...] hallo tan grande ygnorancia en mucha gente de ella de los misterios de la fe, que muchos no sabian la doctrina christiana y esto no solo entre los Indios, negros, mulatos y Mezticos [..], sino en muchos Españoles, hijos de los que auian pasado de estos Reynos desde su conquista [..]".[29]

The situation made him take the necessary measures to repair "so much loss". He commanded the ministers and friars to carefully teach the Christian Doctrine[30], and force the faithful to hear mass on holidays. Hundreds of friars were sent throughout the whole of New Spain in order to verify up to what point 'the natives' had truly been converted. It soon became clear that a re-evangelization needed to be undertaken. The result of the missions could only be interpreted in one way: although the indigenous peoples involved pretended to have been converted to the Catholic faith and were worshipping the true and only God, in reality they were still worshiping their old 'idols', they continued to worship the powers of nature, at the same time as the Catholic Saints.

During his travels throughout Chontales, captain Muñoz met a great variety of peoples that had not been converted at all. According to him, the indigenous peoples:

> "acuden al pueblo y a la Yglesia a missa y cossas de christianos forzados de el temor de la Justizia y no de otra suerte, entran en la yglessia aziendo mill zeremonias para engañarnos como yo e visto en los Yndios que se an hallado aora ser brujos y demonios quien los biera antes en las yglessias no lo creeiera siendo los que parecen de mas razon y ladinos y estos los peores y como son por estos los demas estimaxion entre ellos con fazilidad persuaden a otros ygnorantes a estas maldades."[31]

He came to the conclusion that in large parts of the more marginal areas outside the urbanized Spanish settlements, and specifically in the central region, the spiritual conquest of the population had failed miserably. Muñoz, who, for example had expected to find the village of Jinotega clean of all wizardry, since it had been visited by friar Rodrigo de Betancourt, finds its inhabitants to be persistent in an innumerable number of superstitions and wickedness. All the while, Fray Rodrigo de Betancourt had declared the village to have been cleaned of all idols and other evildoers. According to him, all idolatrous objects had been turned over to the friars and destroyed. Nonetheless, Muñoz account tells of "una idolatría muy antigua" ([120r]) in which the whole village was involved, and those who were not disposed to participate in its mischievous acts, were killed by the neighbours of the village: "haber los Yndios marterizado muerto y quemado un yndio llamado Salbador Ruiz que era buen christiano y no quisso entrar en la ydolatria".[32]

8.1 Antropomorphic Crosses

On top of this, Muñoz found in Jinotega "otro genero de brujería y superstizion esquissita": at the time when the instruments of witchcraft were asked to be turned in, four neighbours turned in crosses made of wooden bark ("cáscara de madera") bound together with rope, as to resemble anthropomorphic figures. The crosses that represented female figures were smaller in size than the male ones:

"... cada Yndio tenia dos cruzes la una para Hombre y la otra para mujer la de Hombre era un poco maior y la de mujer menor echas de una cascara de palo a manera de estopa mui bien rebuelto y amarrado con unos mecatillos en ygualdad, formando manos en los remates de los brazos y en la cauera como una carilla pintada y rebueltos unos trapillos sutiles."[33]

With those crosses, they said, they could paralyse witches. They were, so to speak, counter-witch instruments to be located on crossroads that were known to be places where game wandered at night. It was known that game were actually transformed witches who liked to wander around. With the crosses the game/witch could be paralysed and killed by means of a bow and arrow.

"de manera que para matar los brujos que andauan de noche por los caminos o por el pueblo echos animales tigres micos et[cetera] ponian estas cruzes en el suelo encontradas dos cruzes de Hombre y mujer y en llegando alli los animales brujos se detenian de tal suerte que no podian dar passo atras ni adelante por la fuerza de el encanto y alli los flechauan y matauan que para ello estauan espiando los que abian puesto las cruzes y de esta suerte hauian muerto muchos segun le contaron al M.R.P. fr. Antonio y a mi."[34]

Nonetheless, according to the friars the crosses were as diabolical as the witches and their spells, reason for which they decided to also burn them: "quemaronse tambien con lo demas estas superstiziones de brujos contra brujos diablos contra diablos: a estos llaman zaories". In the well-known treatise of indigenous "superstitions" by Ruíz de Alarcón (1953), we find a quote dealing with the importance of crossroads. On them, the indigenous people had placed anthropomorphic "ídolos", which were given offerings in order to prevent bad things from happening to those who were travelling:

"Suele auer en estos montones de piedra, y en los portillos y encrucijadas de los caminos algunos ydolos y piedras que tienen semejança de rostros, y a estos va enderezado el intento del que ofrenda pretendiendo que les sea favorable la deidad que creen recide allí o para que no les susceda mal en el viaje que hazen, o para tener cosecha, o para cosas semejantes, en especial los enfermos por consejo de sus sortilegos medicos que se lo aconsejan, y aun se, lo mandan, como lo han declarado ante mi, que lleban al rio candelas de cera y a bezes por los enfermos ba el médico, y echa las candelas en el río, o las lleva a los montes" (Ruiz de Alarcon, cited in Ponce 1987, vol. 4: Chapter 2).

8.2 *Kidney beans*

In Jinotega, kidney beans were used to prognosticate. Through these, you guessed deaths, births, travel and all kinds of events: " [..] tenian otra superstizion de suertes con unos frijolillos colorados exquissitos / con que adeuinauan muertes partos viajes buenos y malos susesos y otras cossas con su diabolico engaño".[35] We know that in Mesoamerica, until now, it is customary "echar suerte" and make predictions based on the results of counting fists of corn or beans. The same is true in sixteenth century Yucatan, as Aguilar tells us:

"Son sortilegos, y echan suertes con un gran puño de maíz, contando de dos en dos, y si salen pares, buelue a contar una, y dos, y tres vezes, hasta que salga nones, y en su mente lleva el concepto sobre que va la suerte, verbi gratia. Huyose una vez una niña de una casa, y la madre como India llamo a un Sortilego destos, y echo suertes sobre los caminos, y cupo la suerte a tal camino, y embiando a buscar la niña, la hallaron en el pueblo de aquel camino. Castigue a este sortilego, que era de un pueblo una legua de Valladollid, y examinandole de espacio, halle, que las palabras que dezia mientras contaua el maiz, no eran mas de dezir nones, o pares: Huylan nones: caylan pares, y no supo dezir, si inuocaua al demonio con ellas porque el Sortilego era simplicissimo, y casi tonto" (Ruiz de Alarcon, cited in Ponce 1987, vol. 6: 84)

In Nicaragua, the kernels suffered the same fate as the crosses. These, after being in the hands of the friars, were collected and burned, based on the moral that: "asta aqui puede llegar la maldad y engaño de estos barbaros" [loc cit] and because "de otra suerte no sacara fruto sino acompa/ña a la misericordia el vigor y castigo".[36] Also, the friars were astonished at the customs of the people of Jinotega towards disease and death:

"[..] si estan enfermos la suerte para si an/ de vibir o morir si murio bañan el difunto y/ ponerle para el viaje si piden la suerte al /sabio, auinar no comer carne y sal y dejar dor/mir con sus mujeres los dias que les manda el sa/bio es Ynbiolable en ellos crreer y executar estos /abussos y otros agueros supertiziossos: de que el zerro la quebrada el chaguite lagunas rios tienen su dueño que ynbia llubias o caussa tem/pestades".[37]

9 Conclusions

We have seen that there were different stages of development in the process of relocation and conquest of the so-called 'mountain people' in the course of time.
We have discussed the entry of the Spaniards and their euphoria to find large populations of 'infidels' to be converted to the faith and relocated physically. The Spanish immediately come to the conclusion that the only way to relocate these populations is by treating them well and as such seduce them to come and live near Spanish settlements. Through the interference of the religious orders they try to relocate the populations that they came across. The seduction consisted of exoneration of tributes, gifts (hats, mirrors, etc.), promises of livestock and land, the construction of houses and churches. All set up to ensure that all populations that stayed in their villages in the mountains would automatically also want to come down to the villages, be converted to the Christian faith and become easier to dominate, and eventually lead to more individuals from whom to collect taxes.

At first we saw that on several occasions, the politics of the conquerors gave good results. In the middle of the seventeenth century, nevertheless, the new towns began to lose populations. The promises were not fulfilled and the good treatments were only kept up in the initial stages. The maltreatments and abuses by the friars and conquerors were sheer endless, for which reason a significant part of the recently moved indigenous inhabitants decided to return to the mountains. The result is that at the beginning of the eighteenth century, the Spanish colonial grip on central Nicaragua becomes more and more difficult and costly; the interest of the Crown diminishes and the religious orders also become more pressed for resources and personnel. At the same time, the problem arises that the majority of the newly converted did not truly accept the Christian faith and instead maintained their own beliefs and celebrated them through their own traditions.

The above-mentioned indigenous elements such as omens, forms of statuary, and anthropomorphic crosses, permit us a small glimpse into the scenery of religious customs practised in this area around this colonial time period. Some evidence points to pan-American indigenous cultural aspects, such as for example the animated nature of hills, rivers and lagoons and their capacity to cause certain climatic phenomena. Several of these elements we can encounter throughout Central America as well, for example among the Talamanca indigenous communities in Costa Rica. There, the cave also was the most important place to establish communication between spirits and shamans.

The paucity of data on the indigenous cultural world, in both the archaeological and historical record complicates reaching a better understanding of indigenous society in central Nicaragua. Nonetheless, the ethnohistorical data presented here is indicative of the richness and durability of its cultural traits.

Notes

1 See Van Broekhoven 2002 for a more extensive and encompassing data analysis.

2 “What is most feared [by the indigenous people], is to be treated badly by the Spanish”.

3 “More [than] three hundred Indians with their families [..] left their place of relocation (*reducciones*) and fled to the mountains”. In AGCA, A1.23.1519, f.213-214. When quoting a historical document we will present the original transcription. A translation to English is added in the pertaining footnote.

4 AGI, AG 162: 413r-415r (1680).

5 “those barbaric people who depose their native ferocity, [...] come as meek lambs to the flock of the church”. AGI, AG 183: fol 2r.

6 “because apparently these infidels received what they are taught, even to us with voluntariness and love”. AGI, AG 174, [1v] (1610).

7 “saw that without much contrariness and some cheerfulness revived our holy faith, I am trying to have them make their houses and churches in a comfortable place along the same river”. AGI, AG 174, exp s.n. [1v] (1615).

8 “[..] and I did not succeed not because when they sensed my they abandoned their houses and fled to mountains which are impenetrable.” AGCA, A1.12.77.633, [1r] (1726).

9 AGCA, A1.12.77.629.

10 AGI AG 183.

11 AGI, AG 162, 1531; CS 3:113-116.

12 “Fray Juan de Albuquerque of the Order of the Lady of Mercy says that in 1606, being commander of the convent of the community of Sébaco, jurisdiction of León [..] [he] found out that in the mountains near tauauaca close to the Muy Muy river, there were many infidel indigenous people, and he tried to send them a Christianized Indian named Don Diego Hernandez to persuade them to embrace the Holy Baptism [..] he then tried [..] and they brought it and told them that in this way would go the Heaven and would have communication with the other Indians and that Your Majesty would favor them and support them in all and that no one would abuse them, which they took well”. AGI, AG 174, exp s.n. [1v] (1615).

13 “[..] I left the Indian Don Diego because he served as interpreter, because, even though the language that he knew about [the one spoken in] the community of Sébaco was sometimes close in its vocabulary to his, it was not much to tell them and have them understand what it was he wanted and as such this Indian served as interpreter and because he had been the first of them to bring news he remained all the days that he could”. AGI, AG 174, exp s.n. [1v] (1615).

14 “Wherefore my community becomes depopulated for fear of not finding remedy or comfort or administration, nor priest to bury them [..]”. AGCA, A1.11.16.5802.48971, f.5r (1678).

15 AHC, Letra i, Leg.4, 11 [118r].

16 “[..] he was deceived by the Indians who took him through the woods for two or three nights, fooling him, and not wanting to discover the horrible cave that the devil sends them in not making it so horrible”. AHC, Letra i, Leg.4, 11 [118r].

17 “Fray Rodrigo, having left the mentioned town of Pueblo Nuevo and heading to Matagalpa and passing close to Sébaco, did not want to enter conduct the Holy mission, knowing the lack of success that could be achieved there, and came to Matagalpa [..]”. AHC, Letra i, Legajo 4, 11: [118r-118v].

18 AHC, Letra i, Legajo 4, 11: [123v-124r].

19 AHC, Letra i, Legajo 4, 11: [119v].

20 AHC, Letra i, Legajo 4, 11: [119v].

21 AHC, Letra i, Legajo 4, 11: [119v].

22 AHC, Letra i, Legajo 4, 11: [119v-120r].

23 AHC, Letra I, Legajo 4, 11: [120v].

24 ACG, Margíl de Jesús, ramo 4 estante R f.812r-812v.

25 AHC, Letra I, Legajo 4, 11:[121r].

26 AHC, Letra I, Legajo 4, 11:[121r].

27 "... The Andean cosmology had no notion of evil, embodied in a satanic being. In contrast, Andean philosophy implies a vision "dialectic" of the universe in which opposition forces were seen as reciprocal and complementary, necessary for the reproduction of society as a whole".

28 Demonology has its roots in Medieval Europe, and so do the social stereotypes of the witch and the warlock. These stereotypes were key to the construction of an ideology of political persecution. The image of the witch itself was developed within a local and narrow context, but soon took on a life of its own, becoming an integral part of European folk belief.

29 "[..] arriving at that Province [..] he found big ignorance in many people about the mysteries of the faith, he noticed that many do not know the Christian doctrine and this not only among the Indians, blacks, mulattos and Mezticos [.], but many Spaniards, children of those who have came to this Kingdom since its conquest [..]". AGC, A1.23.1520.71r (1672).

30 AGC, A1.23.1520.71r (1672).

31 AHC, Letra I, Legajo 4, 11:[124r].

32 "having seen how the Indians had martyred, killed and burnt an Indian called Salvador Ruiz, who was a good Christian and did not want to participate in this idolatrous practice." AHC, Letra I, Legajo 4, 11:[120r].

33 AHC, Letra I, Legajo 4, 11:[123r].

34 AHC, Letra I, Legajo 4, 11:[123r-123v].

35 AHC, Letra i, Legajo 4, 11: [123v].

36 AHC, Letra I, Legajo 4, 11: [123v].

37 AHC, Letra I, Legajo 4, 11: [124r].

References

Geurds, A., J. Zambrana and C. Villanueva 2010. Escultura de piedra en el Centro de Nicaragua: Logros y desafíos. *Mi Museo y Vos* 4 (13), 4-7.

Ibarra Rojas, E. 1994. *Las Sociedades cacicales de Costa Rica (siglo XVI)*, San Jose: Universidad de Costa Rica

Ibarra Rojas, E. 2011. *Del arco y la flecha a las armas de fuego. Los indios mosquitos y la historia centro americana 1633-1786*. Universidad de Costa Rica, San José.

Incer, J. 1990. *Nicaragua: Viajes, rutas y encuentros 1502-1838*. Libro Libre, San José.

Newson, L. 1987. *Indian survival in colonial Nicaragua*. University of Oklahoma Press, Norman.

Ponce, Pedro 1987. *Sanchez de Aguilar Pedro y otros*. El alma encantada, Fondo de Cultura Económica, México.

Radell, D.R. 1969. *An historical geography of western Nicaragua. Spheres of influence of Leon, Granada and Managua 1519-1965*. Unpublished PhD dissertation, Ann Arbor.

Ruiz de Alarcon, H. 1953[1629]. *Tratado de las supersticiones y costumbre gentílicas que hoy viven entre los indios naturales de esta nueva España*. Ediciones Fuente Cultural, Mexico.

Silverblatt, I. 1987. *Moon, Sun, and Witches: Gender Ideologies and Class in Inca and Colonial Peru*. Princeton University Press, Princeton.

Van Broekhoven, L.N.K. 2002. *Conquistando lo invencible. Fuentes históricas sobre las culturas indígenas de la región central de Nicaragua*. CNWS Publications, Leiden.

Historical sources
Leg.: Legajo
f.: Folio
r.: recto
v.: verso

ACG, Margíl de Jesús, ramo 4 estante R f.812r-812v.
AGCA, A1.11.16.5802.48971, f.5r (1678).
AGCA, A1.12.77.633, [1r] (1726).
AGCA, A1.12 77.629.
AGCA, A1.23.1519, f. 213-214
AGCA, A1.23.1520.71r (1672).
AGI, AG 162.
AGI, AG 174.
AGI, AG 183.
AHC, Letra i, Leg.4,11.

Laura N.K. van Broekhoven
National Museum of Ethnology
P.O. Box 212
2300 AE Leiden
The Netherlands
laurab@volkenkunde.nl

Alexander Geurds
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
a.geurds@arch.leidenuniv.nl

Caribbean encounters: rescue excavations at the early colonial Island Carib site of Argyle, St. Vincent

Corinne L. Hofman and Menno L.P. Hoogland

A collaborative rescue project by Leiden University, the St. Vincent and the Grenadines National Trust and the International Airport Development Company Limited (ADC) in 2010 has revealed around 350 features and the floor plans of at least eleven domestic structures at the early colonial Island Carib site of Argyle, St. Vincent. The structures belong to two large oval structures and nine round houses. The presence of three burials inside two of the small round houses attests to the practice of burying the dead under the house floors as mentioned by the early colonial chroniclers. Material remains recovered from around the site suggest an occupation in the late 16th –early 17th century and concurs with the Carib occupation of the Lesser Antilles. Typical Cayoid ceramics, with mainland (Koriabo) and Greater Antillean (Chicoid) affiliation were found associated with European materials. The co-occurrence and intermingling of Amerindian and European artefacts and traits at Argyle point to interactions and inter-cultural dynamics at play hitherto not documented. The settlement which is located on a strategic location on top of a ridge overlooking the Atlantic Ocean, next to the mouth of a river, seems to have offered unique living conditions and subsistence opportunities for the Amerindian inhabitants of this early colonial period settlement. This paper focuses on the early colonial cultural encounters between Amerindians and Europeans in the Caribbean Lesser Antilles and uniquely unravels the layout of an Island Carib village and its individual house structures using archaeological and ethnohistoric evidence.

1 Introduction

The cultural encounters between the New and Old Worlds are some of the most infamous in human history. The Caribbean was situated at centre stage for these encounters that had profound global impacts and the enduring repercussions of which are etched into the fabric of modern multi-ethnic Caribbean society. Despite the significant role of the indigenous Amerindian inhabitants in these encounters, there is a large gap in our understanding of the transformations of indigenous cultures and societies in response to European colonization. Within the Caribbean, the Lesser Antilles represent one of the major regions in which the lasting effects of encounters between cultures with dramatically different ideological, social, technological, and economic frameworks can be studied in the context of world history.

In 1492 the Lesser Antilles first became known to Europeans through Columbus' reports of his conversations with the indigenous people of the Greater Antilles (Rouse 1992; Curet 2005; Oliver 2009). These people recounted their fears of cannibalistic Carib Indians allegedly living to the south-east (Lesser Antilles) who continually raided their settlements. Accounts of cannibalism fuelled prejudice on the part of the Europeans who held misconceptions about these distant, unfamiliar peoples based on preconceived (Late Medieval) ideas about a "phantastic insular world" (Hulme 1986; Hofman *et al*. 2008). Spain had designs mainly on the Greater Antilles, considering the Lesser Antilles initially a nuisance and later as a source of slaves. The Spaniards' lack of interest in the *islas inútiles* and their subsequent failed ventures at settlement allowed other European nations to involve in the Lesser Antilles. Approximately 130 to 150 years passed before permanent European settlements were established in the Lesser Antilles despite fierce indigenous resistance from the Island Carib or *Kalinago*, a people who claimed origin from the South American mainland and asserted themselves aggressively – particularly between Tobago and St. Kitts[1] (Allaire 1977; Figueredo 1978; Boomert 1986, 1995; Sued-Badillo 1995; Whitehead 1995a:105) (fig. 1). A pattern of exchange developed in the late 16th century between European nations and the Island Carib which culminated in the cultivation by the latter of tobacco for sale to bypassing traders. Island Carib society was characterized by considerable local autonomy and several levels of political authority. Early documents refer to Island Carib villages as comprising a series of houses, typically a men's house and a number of family dwellings (*e.g*. Breton 1665/1666; 1978). Early colonial sources, written by Spanish, Dutch, French, and English explorers, sailors, and missionaries, provide vivid testimony of the slow but inexorable encroachment of European nations on the Lesser Antilles and the marginalization of Amerindian culture and society society (*e.g*. Nicholl 1605; Coppier 1645; Rochefort 1658; Breton 1665/1666, 1978; Du Tertre 1667-1671; Pinchon 1961; Chanca 1988;

Anonyme de Carpentras 2002; Labat 2005[1722]). The sources describe hamlets or single households dispersed across the landscape (Labat 2005[1722]).

Meanwhile, Carib communities on some islands absorbed increasing numbers of escaped African slaves, leading to the formation of a Black Carib ethnic identity, alongside those communities that remained purely Amerindian. After several wars with the English, the Black Carib were deported from St. Vincent to Central America in 1797, where they now live and are known as the *Garifuna* (Palacio 2005). By 1800 a major collapse in native populations dramatically reduced the Carib presence in much of the Lesser Antilles. Indigenous populations either became extinct or were completely marginalized. Descendants of the *Kalinago* are still present throughout the Lesser Antilles, most notably on Dominica, St. Vincent and Trinidad where they actively claim their Amerindian roots as an integral part of their identity in Caribbean society (Whitehead 1995a; Sued Badillo 2003; Reid 2009; Lenik 2012).

2 Rescue excavations at Argyle, St. Vincent

The site area at Argyle was extensively used in the pre-colonial and colonial period, as evidenced from the presence of two large Early Ceramic Age sites (Escape and Argyle 2) excavated by Richard Callaghan (University of Calgary) and Margaritha Guzman (Canada), the early colonial site of Argyle previously tested by Louis Allaire in the 1990s (Allaire 1994), and several colonial features (*i.e.* tobacco sheds, sugar plantation). Until recently, the ridge on which the site is situated was used as a palm plantation.

In 2009 and 2010, rescue excavations at the Argyle site, St. Vincent were urgently required due to the construction of a runway for a new international airport at its location (Hoogland *et al.* 2011) (fig. 2). At the instigation of Henri Petitjean Roget (Guadeloupe) and Kathy Martin (St. Vincent and Grenadines National Trust), a team from Leiden University in collaboration with the St. Vincent and Grenadines National Trust and financially supported by the International Airport Development Company Ltd. excavated a surface area of 2800 m^2 at Argyle and revealed the first complete early colonial Island Carib settlement in the Lesser Antilles. The settlement remains were associated with so-called Cayoid ceramics, previously documented by Earle Kirby and Henri Petitjean Roget in the 1970s, and extensively published by Arie Boomert since the 1980s (Boomert 1986; 2009; 2011).

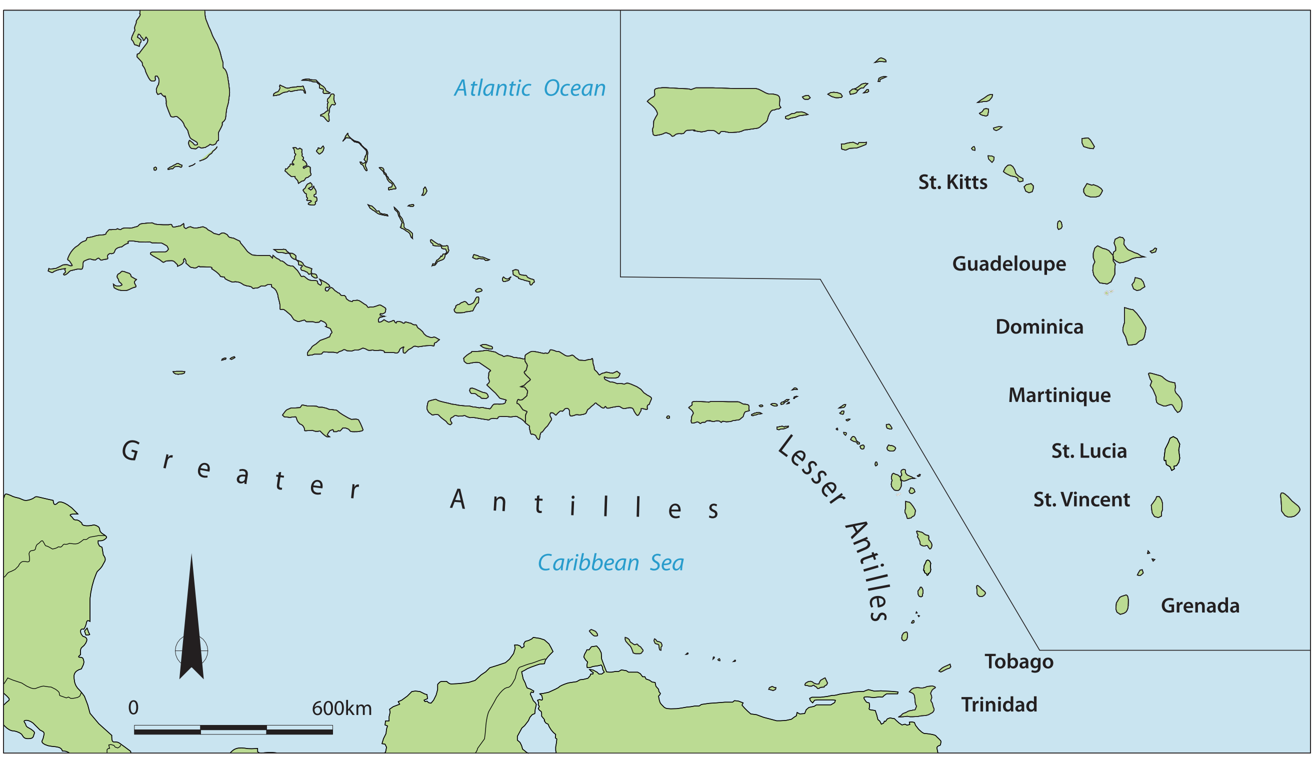


Figure 1 Map of the Caribbean area with major Island Carib strongholds.

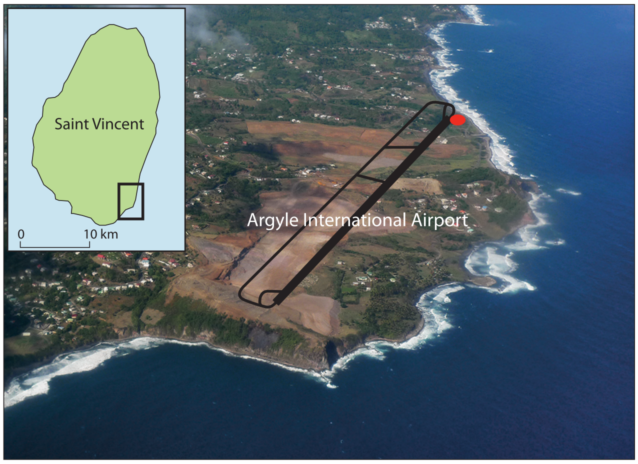


Figure 2 Location of the Argyle site, St. Vincent and construction plans for the new international airport.

3 Material culture affiliations

3.1 Amerindian artefacts

The great majority of the material remains were recovered from the eroding slope of the Argyle ridge. As no organic materials appear to have been preserved due to the acidity of the volcanic clays, it is difficult to determine if the ridge slope indeed formed the trash area of the settlement, leaving us with poor information on subsistence and without adequate samples for radiocarbon dating.

The Argyle pottery assemblage is composed of Cayoid ceramics and reflects a mosaic-like cultural aggregate with mainland Koriabo and Greater Antillean Chicoid affiliations illustrative of the wide-ranging contacts of the Island Carib in early colonial times (Boomert 1986; 2004; 2009; 2011; Hoogland *et al*. 2011) (fig. 3). Fabric and compositional analysis carried out by Niels Groot has showed that the majority of the pottery is made of local clays probably quarried at clay sources in the vicinity of the site (Hoogland *et al*. 2011). Until now archaeological components with Cayoid pottery have been found in three locations in Grenada (Sauteurs Bay, Galby Bay and more recently at La Poterie) (Cody Holdren 1998; Petitjean Roget pers. comm. 2012); one site on the Grenadines (Ile de Ronde) (Petitjean Roget pers. comm.); 11 sites on St. Vincent (Mount Pleasant/Rawacou, New Sandy Bay, Owia 2, Spring, Friendly, Fancy, Camden Park, Lot 14, Argyle 1, Sans Souci and Grand Sable) (Bullen and Bullen 1972; Kirby1974; Boomert 1986; Allaire 1994); five sites on Dominica (Woodford Hill Bay, Melville Hall 1 and 2 (B), Eden 1) (Boomert 2009; Honychurch 2000). Isolated Cayo sherds have been reported from the Black Bay site, St. Lucia and the site of Macabou, Martinique amidst an otherwise Suazoid assemblage (Bright 2011). The most northern occurrence of Cayo pottery is on Basse Terre, Guadeloupe at the site of Arrière Plage de Roseau in Capesterre Belle Eau (Richard 2002). Also at the site of Anse à la Gourde (Grande Terre, Guadeloupe), and Morne Cybèle and Morne Souffleur (La Désirade) Cayo affiliated pottery has been documented (Hofman 1995; Hofman et al. 2004; de Waal 2006) (fig. 4).

Analysis of the lithics carried out by Sebastiaan Knippenberg revealed that the unworked lithic materials include fragments of igneous rock, jasper and chalcedony. Knippenberg conducted an initial analysis of the material and performed a survey of the island to identify lithic sources. He stresses that all igneous rock found at Argyle exhibit strong similarities with the igneous rock occurrences at the adjacent beach and Yambou river bed. He therefore concludes that the occupants of the settlement must have collected these materials locally (Knippenberg 2010). The exogenous jasper and chalcedony, both related to a technology aimed at the manufacture of flake tools, may very well have originated from the northern part of St. Lucia, where these materials occur in large quantities. The most spectacular artefact recovered is an eared stone axe head, which was not found on the slope, but on the contrary in the settlement area on top of the ridge. Such stone axe heads are well known from, for example, Fancy in northern St. Vincent and reported by Fewkes in the 1920s (Fewkes 1922). It was found in situ next to one of the domestic structures (fig. 5). This is the first example of an eared axe head encountered in archaeological context in the Lesser Antilles.

3.2 European artefacts

Numerous European trade wares were recovered from the site. These include pieces of iron, lead, earthenware (an admixture of late 16th- to early 17th century Spanish olive jars, and Spanish as well as Portuguese majolica), glass bottles and a series of beads (seed and chevron beads, as well as some 18th century French and English ceramics (fig. 6). Of particular interest is a Cayoid rim fragment inlaid with European seed beads. A similar specimen has been reported from the site by Louis Allaire (1994). Noteworthy of the earlier colonial (16th or 17th century) European ceramics are a tin-glazed serving platter with an orange body decorated in a 'majolica' form most probably produced in Spain and Portugal. Dutch copies of majolica were however produced from the later 17th century onwards but in that case it would have a yellow body and blue painted decorations. Furthermore, there is a rim sherd from a tin-glazed earthenware produced in France known generally outside France as 'Faience'. The undulating rim, cross-hatched pattern, and pinkish/buff coloured body are all indicative of this ceramic type. It is most likely from a serving platter as about 99% of the vessel forms are platters. This could date anywhere from the 1500s to the late 1700s.

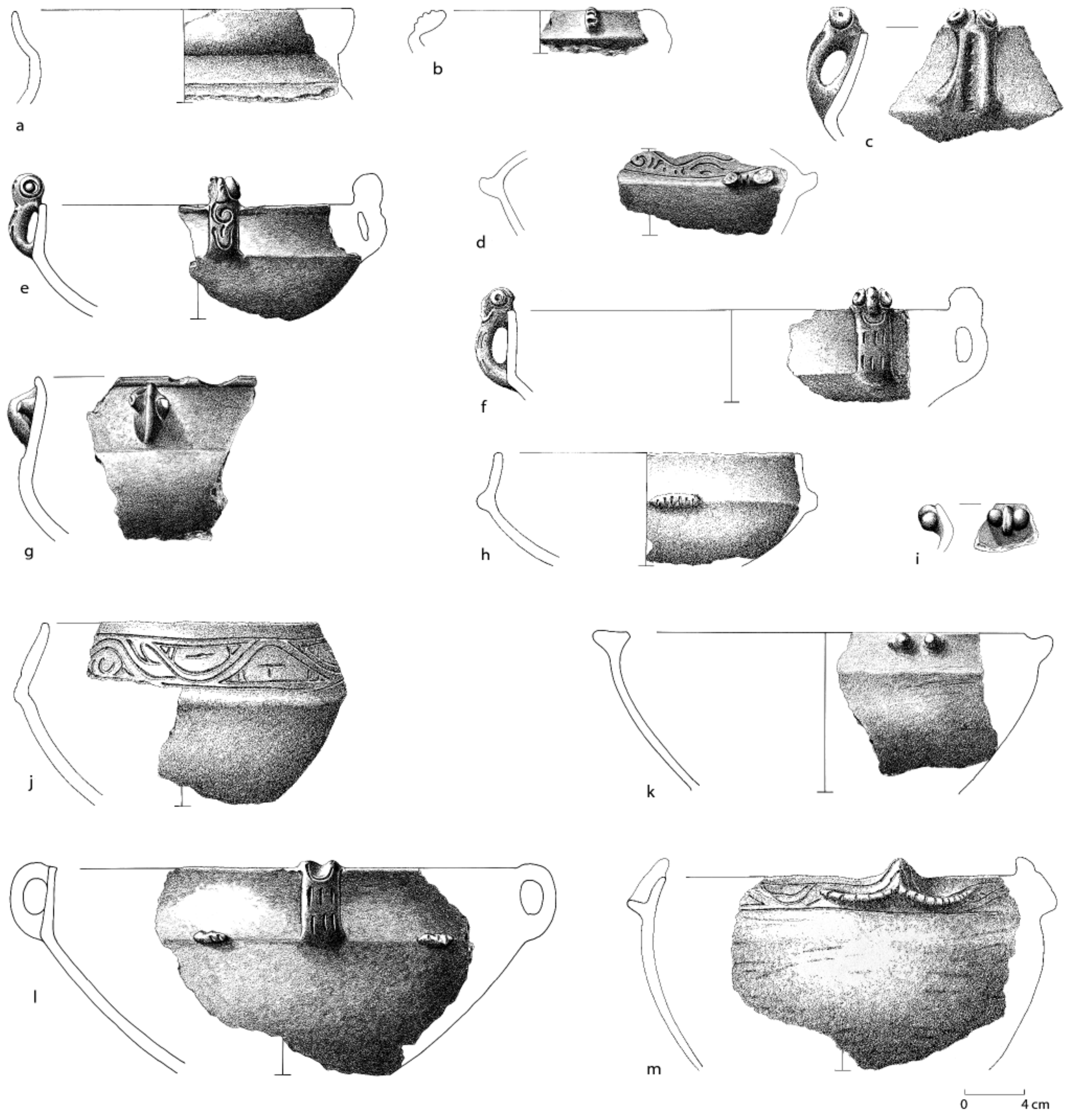


Figure 3 Examples of Cayoid pottery from Argyle.

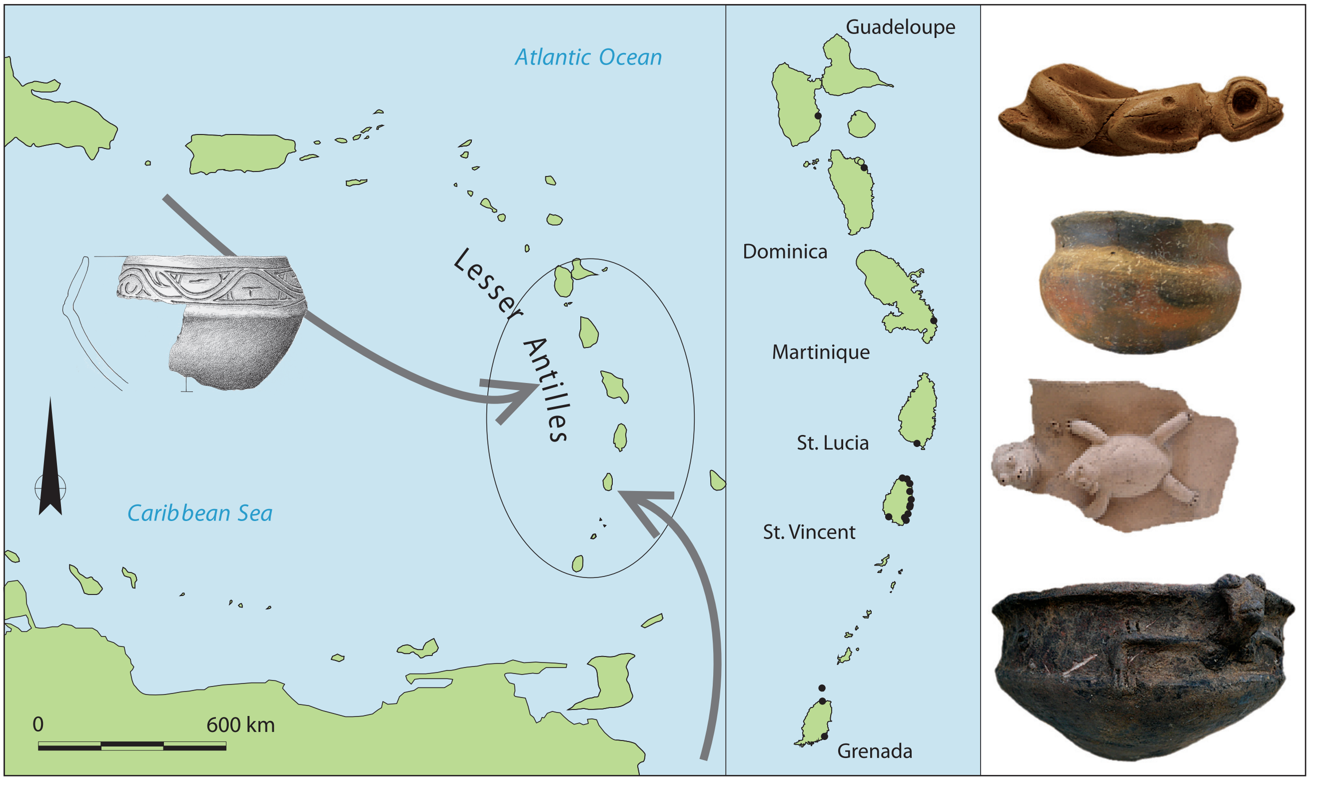


Figure 4 Distribution of Cayoid pottery in the Lesser Antilles.

According to the classification by Goggin (1960), the olive jar is a type B with rim shape 3 (cf. Marken 1994, 50-51). The mark on the rim is stamped in wet clay and represents rather the ownership of the jar than a makers' mark (Marken 1994, 76). The first documented olive jars with rim marks are from three securely dated Spanish wrecks from the first half of the 17th century and disappear in the artefact assemblages of later wrecks (Marken 1994, 116).

Among the later 18th century earthenware are an iron oxide- and salt-glazed stoneware jug fragment – most likely from England dating from the late 18th century on into the 19th century (*c.* 1840s). The 18th century artefacts possibly belong to the tobacco shed which has been documented among the Amerindian features at Argyle.

4 Structures, burials and village layout

From the 350 documented features at Argyle, approximately 50% could be assigned to domestic structures. There are eleven structures apparent including nine round houses and two which are oval in shape. In addition, two small rectangular structures could be identified. Larger features in the round houses were revealed to be grave pits. The relatively low number of features, the absence of palimpsests and the high assignment percentage of the features to potential structures attest to a rather short period of occupation of the settlement. The presence of two plazas, however, suggests the rebuilding of structures at least once during the period of occupation of the site.

The settlement data from Argyle strongly match the descriptions of the 17th century French missionary Father

Figure 5 Eared axe found next to one of the house structures at Argyle.

Figure 6 European artefacts recovered from the slope of the ridge at Argyle intermingled with Amerindian ceramics.

Raymond Breton on village organization and domestic structures as described in his two dictionaries "Caraibe-François" (1665) and "François-Caraibe" (1666). Connecting data from various time periods requires the use of the direct historical approach. The principles of this perspective dictate that where cultural continuity is expected from pre-colonial to colonial times, historical data can be extrapolated back into the (later) pre-Colonial period (Lyman and O'Brien 2001). The problem of colonial bias in the historic sources cannot be neglected, however, and therefore, while a degree of continuity can be anticipated in the Lesser Antilles, this study critically applies the direct historical approach, taking into account its potential and pitfalls (cf. Hulme 1986; Wilson 1994). An ethnographically-archaeologically informed reading forms the basis of this approach (cf. Hulme and Whitehead 1992; Whitehead 1995a, b), involving the extraction of ethnographic information on Island Carib society that is compatible with the archaeological data. The great detail of Breton's descriptions of the construction of the houses and the architectural elements considerably helped to interpret the floor plans identified in the field, in particular the reconstruction of the large men's houses or *táboui*. In the following section the archaeological data on structures, burials and village layout is therefore supported by ethnohistoric information.

4.1 Settlement location

The early colonial site of Argyle is located at a strategic location on top of a ridge overlooking the Atlantic Ocean, next to the mouth of the Yambou River in the southeastern part of St. Vincent (fig. 7). The Yambou River drains the Mesopotamia Valley, an area known to be dotted with petroglyph sites. The valley has extremely rich agricultural soils suited for the cultivations of root crops such as manioc, sweet potatoes, and yam and taller.

Breton mentions that while constructing a settlement or *icábanum* the Island Carib did not clear many trees, purposefully obscuring their settlements from the view of the Europeans. They also had a preference for the windward side of the islands because of the steep cliffs and rough seas that aided in defending settlements. The settlements are usually located close to the sea and close to the river where they washed and sourced fresh drinking water (Breton 1665, 279). The immediate relationship between village and sea becomes evident from the term *hueitinocou* which both means villager and crewmember of a canao. Their *ichâli* or gardens are situated away from the villages, up to one hour walking distance (Breton 1665, 281). Here cassava, sweet potatoes, yam, taller, maize, pumpkin and other cultigens were planted (Breton 1665, 59, 241, 342-344, 365, 407, 453).

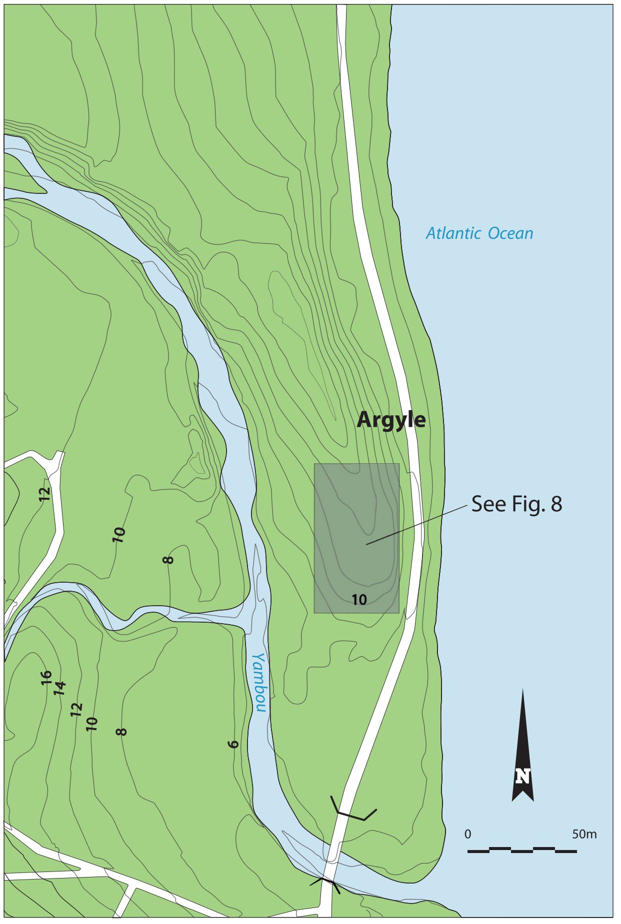


Figure 7 Overview of the location of the archaeological site between the Atlantic Ocean and the Yambou River.

4.2 Plazas

Two plazas are documented at the site. The plaza of the first phase measured approximately 10 × 15 m. During the second phase the plaza was reorganized and measured 15 × 25 m. The two plazas probably represent two construction phases of the village at Argyle (fig. 8).

According to Breton there is in the village is just room for the *táboui* or men's hut and a few smaller houses around a plaza. Breton describes the *acaonagle* or *bouellélebou* as the plaza which lies between the houses (Breton 1665, 10, 85). Every household keeps a part of this plaza in front of its house clean. The village was seemingly kept quite clean and the expression '*baraboucae píembou*' means take your food remains away. The trash was taken away, because it would attract *chiké* or sand fleas (Breton 1665, 303).

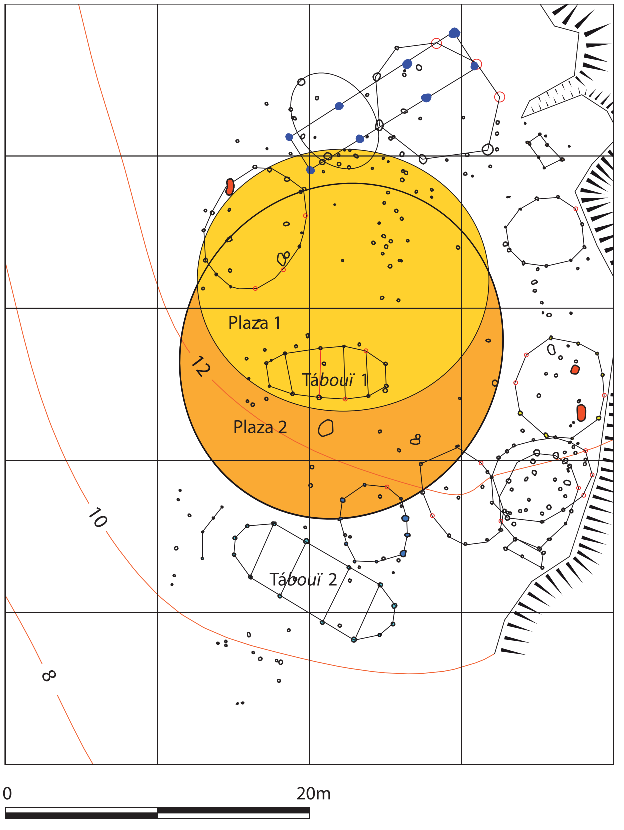


Figure 8 Reconstruction of the two *plazas* at Argyle representing two phases of occupation.

4.3 *Large oval structures*

There are two oval structures, the smaller one measures about 7.7 × 3.5 m and the floor plan consists of 12 postholes. This structure probably represents the first phase of the village (fig. 9). The oval house was rebuilt in a more southern location as a part of the second phase. At that point the plaza was reorganized and the oval house was the southernmost structure. The floor plan of this main structure measures 11.8 × 4 m and consists of 14 postholes, all between 35 and 50 cm deep (fig. 10).

Breton mentions that central in the village is the *táboui* or *innobone*, an oval structure in the shape of a cradle, where the men drink, rest, meet and receive guests (Breton 1665, 474). The main construction of a *táboüi* consists of posts standing 2 metres above the ground and forked at the top. Lengthwise the main posts were connected by two long wall plates or *boulénum* connected crosswise by tie beams which were set 2.30 to 3 m apart (Breton 1665, 90). The tie beams are important architectural elements as the Island Caribs attached their hammocks to these and the number of tie beams determines how many men could be housed in a *táboüi*. In the case of Argyle the large oval structure has only four tie beams and a width of 4 m, so it could eventually have accommodated some 24 to 30 men.

According to Breton the roof construction consisted of rafters resting in notches in the wall plates, coupled and connected at the roof-ridge. A ridge pool was laid on the rafters and tied with lianas. Roof battens lent the construction strength lengthwise and were the framing for the roof covering. On the ground the rafters were resting on small forked posts some 20-40 cm above the surface. The roof was thatched with the heads of reed or *manboúlou* and the stems were split and served to secure the thatching (Breton 1665, 90).

The *táboüi* described by Breton had four small doors 1.20 m high and diametrically situated in the middle of the wall and in the butts of the building; however, the smaller Argyle example likely had only two doors (fig. 11).

Figure 9 Plan view of the oval structure belonging to the first phase of occupation.

Figure 10 Plan view of the oval structure belonging to the second phase of occupation.

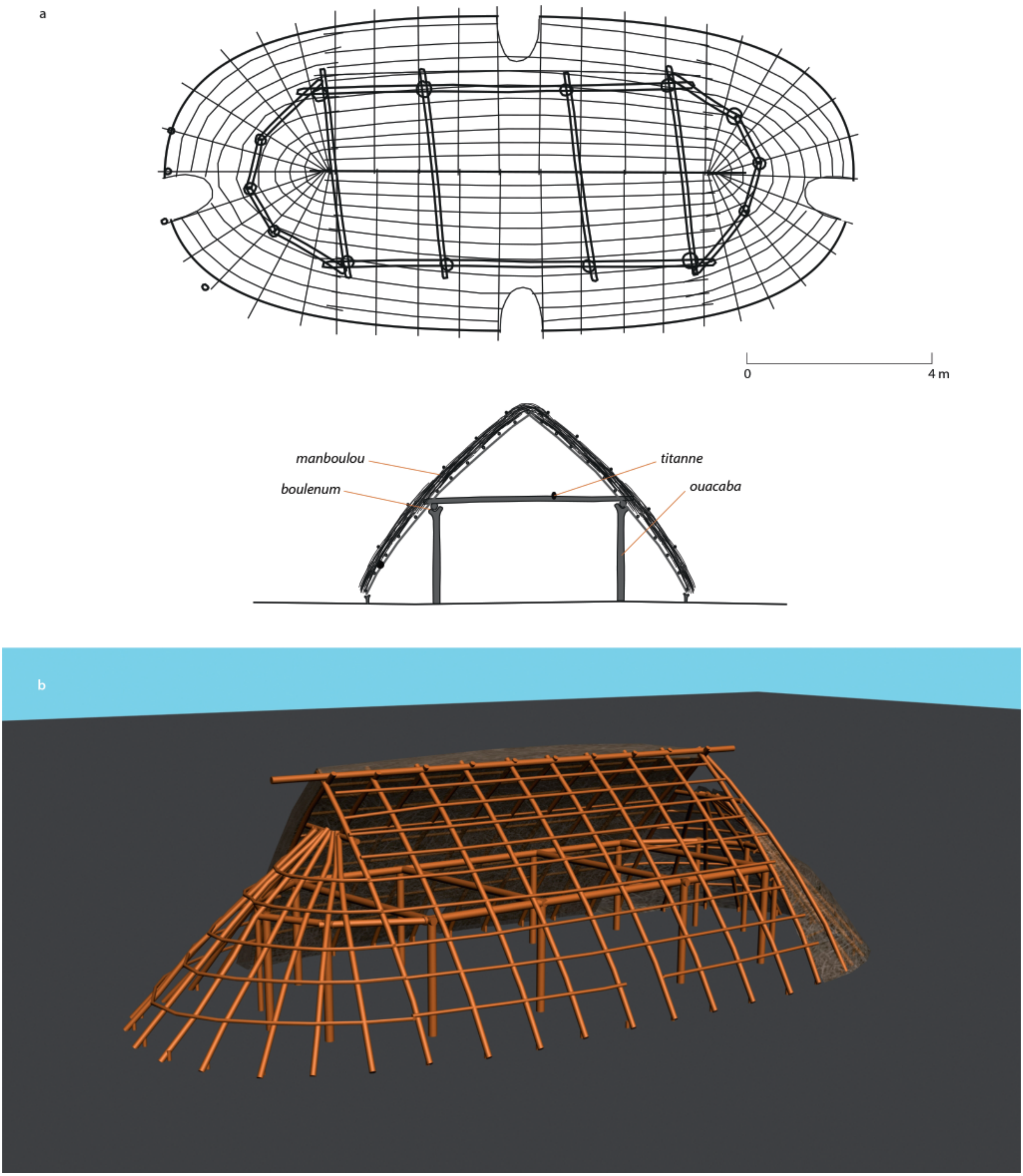


Figure 11 Reconstruction of the Argyle *tábouï* by Menno Hoogland and Walter van der Laan.

4.4 Small round to oval houses and auxiliary structures

In addition to the oval structures, in total nine small round to oval houses have been documented. They are scattered around the plaza. The dimensions of their floor plans vary between 4.5 × 5 m and 6 × 8 m (fig. 12). The constructions are simple with 10 to 14 posts. In one case two structures overlay each other, probably pointing to a rebuilding of the structure at nearly the same location. Next to the small family houses, there are a number of small rectangular structures such as racks and sheds, this also concurs with the descriptions in Breton.

The small round or oval houses correspond to the *mánna* or family houses described by Breton. These structures for individual households are spread around the central building. There is only one opening, a small one of approximately 120 cm high. According to Breton the house is not divided into different quarters (Breton 1665, 354-355). Other chroniclers, like Du Tertre (1654; 1667-1671), describe two or three quarters, and compares the *mánna* to the creole houses on the islands. The *barbakot* or *boucan* (*aribelet*), is a wooden rack which consists of four forked wooden sticks on which thin straight branches were placed (Breton 1665, 52). The cooking place consisted of three stones or *manbacha*, on which wood and wood pulp was burned (Breton 1665, 350).

4.5 Burials

A total of three burial pits have been documented in two of the round houses. Their presence inside the houses attests to the practice of burying the dead under the house floors such as described by the chroniclers. The skeletal material has not been preserved due to the high acidity of the soil. However, two of the three burial pits yielded some fragmented teeth, confirming the use of these pits as inhumation graves. These teeth have been examined by Hayley L. Mickleburgh. The first burial (F 42-15) represents an adult individual, with an age between 17 and 25 years based on the wear of the teeth. The preservation of the teeth is very bad with two examples of caries present. The incisors are very clearly shovel-shaped, a characteristic of Amerindian populations. The second burial (F 23-19) possibly represents an adult individual, but the age based on the dental eruption sequence and wear is between 14 and 25 years, which would mean that it could also be a sub-adult. The teeth are free of caries. The incisors are typically shovel-shaped as well. Strontium isotope analysis on the teeth by Jason Laffoon revealed that the first individual is nonlocal to the site, while the second individual falls within the local range.

Figure 12 Plan view of one of the small round houses.

It is very unfortunate that bone material is not preserved at Argyle, but similar burial pits under house floors are known from several Late Ceramic Age sites on the neighboring islands. Examples from Anse à la Gourde, Guadeloupe and Lavoutte, St. Lucia (Hoogland *et al*. 1999; Hofman *et al*. 2001; 2012) show a varied and complex mortuary behaviour which also matches the descriptions from ethnohistoric sources. Burials at these two sites revealed that at death, the body of the deceased was likely prepared before deposition, by wrapping the body in a hammock or placing it in a container such as a basket. The body was desiccated over a low fire in a few cases, as evidenced by the extremely flexed lower extremities and the fact that the ribcage is not collapsed. Subsequently, the body was deposited in a small and shallow pit. In some instances the entire body or the face of the deceased was then covered by a ceramic vessel. Ash spots in and around some of the graves suggests that a fire burned near or in the grave pit, possibly to incinerate the personal belongings. Decomposition of the body often took place in an open grave. In some cases bones (*i.e*. one of the long bones or the cranium) were removed, without disturbance of the anatomical articulations of the skeleton. The bone that was removed was then either reburied in the same grave or in another grave, or kept in the settlement. These examples could serve as a point of reference for the way in which the dead were buried at Argyle and eventually indicate a widespread and long-lasting custom in the region that would have had its roots in pre-Colonial times.

Breton mentions that the dead were buried in the houses, under the house floors or if ever they were buried elsewhere, a small shelter was always erected at the location. After placing the deceased in a prepared grave and wrapping them with a hammock, a large fire would be lit in a circle, around which all the elders, both men and women, would crouch down on their knees (Breton 1665, 237-238; 1978, 80). They would dig a round pit three feet deep in the house for it to be covered. The body was washed and then rubbed down with *roucou*[2]. The hair was carefully oiled and combed, preparing the deceased as they would be presented at important social events such as a great feast. Wrapped in a brand-new hammock, the deceased would be put in the grave in almost the same position as a child in a mother's womb, neither backwards nor flat faced on the dirt, but straight, feet first, head up, bent on their knees, and the grave covered with a plank. While moaning, the women threw dirt in the grave with their hands. And then they lit a fire over it. If the deceased happened to possess captives, they were to be killed at this time, yet oftentimes they would run away without being pursued. The place of death was considered important, especially in deciding where the deceased should be buried. The grave pit was sometimes covered by reed (mat) or boards/planks and sometimes ceramic vessels were buried over the head. When the burial was outside the house, a small hut or house was built over it, for they would never leave the dead without a cover.

Breton also mentions the unearthing of long bones and crania. After a captain (chief) had been buried for a period of one year, which was called *chiric assoura*, the widow or the children would organize a *cayounage* in which all the inhabitants of the island and some from surrounding islands were invited, and, gathered in the hall or *tabouité*. The three oldest captains (chiefs) of the island, with their faces smeared with black colour and their heads wrapped with linens would hold their bows bent with the arrows prepared as if ready to shoot, whilst outwardly lamenting and jumping incoherently. This would continue for five or six turns around the grave, pretending to shoot their arrows again and again. Afterwards they go back and forth, repeating their entry and exit up to five or six times. After which, they would go drinking with the others until night falls, at which point it is time for the three mentioned above along with the other captains (chiefs) to dig up the captain's (chief's) bones. These remains, as well as those of his relatives and his captives, located on top of his goods, are then burned and the ashes carefully collected. These are then distributed among the closest relatives who pack the ashes into calabashes as small as nuts, which they wear hanging from their necks, especially on days of *cayounages*. And when they go to war, they will drink a little of the ash mixture and rub it on their body to help them defeat their enemies. Sometimes hair or some bones of deceased kin would be put in a calabash and kept in one's house or *carbet*; this was used for sorcery. It was believed that the spirit of the dead would speak to the holder of these remains and warn them of their enemies' plans. The deceased personal belongings such as baskets, spun cotton and other items were burned over the grave by the women in the village. Also at this last point of contact with the deceased, bows and arrows, *boutou* or clubs, a crown of feathers, ear pendants, necklaces, rings, bracelets, baskets, vessels, and other belongings would either be buried with the remains or burned over the grave.

5 Concluding remarks

The recent rescue investigations at Argyle, St. Vincent, ironically made possible through the construction of the new international airport, have for the first time yielded 16-18th century Amerindian settlement remains and associated material culture repertoires. Large-scale horizontal excavation and methodological artefact collection have yielded a wealth of new information on Island Carib lifeways, settlement structure, exchange relationships, inter-cultural dynamics and human mobility during the early colonial era. The correlation of the archaeological data with ethnohistorical information has in this case uniquely aided the interpretation of the structures and village layout. This research offers the unique possibility of studying continuity and change of inter-community social relationships and transformations of Amerindian culture and society in the advent of European colonialism. Its relevance lies in recasting Island Carib history in a more nuanced, inclusive light, dispelling colonial documentary bias, and positioning archaeological research on the Island Carib within the wider context of Caribbean archaeology and the European encounter. Further relevance lies in bridging the gap between pre-colonial and colonial period archaeology in the Caribbean and from a more general perspective, this research contributes to the discussions of cultural contact and that of colonial encounters worldwide (*e.g.* Lightfoot 1995; Gosden 2004; Silliman 2005). Furthermore, the present-day indigenous peoples in the Lesser Antilles are the direct inheritors of Carib cultural traditions, with a considerable stake in archaeological cultural heritage (Honychurch 2000; Twinn 2006). These new discoveries therefore also represent a source of considerable historical interest for the *Kalinago* and *Garifuna* communities, both in St. Vincent and throughout the wider Caribbean area and Central America as their origin has long been contested due to a lack of firm archaeological evidence.

Acknowledgments

The project has been facilitated by the Faculty of Archaeology, Leiden University, the St. National Trust of St. Vincent and the Grenadines and the St. Vincent and the Grenadines International Airport Construction Company. We would like to acknowledge Henri Petitjean Roget (Guadeloupe) and Kathy Martin (National Trust of St. Vincent and the Grenadines) for making this project possible and their invaluable efforts to implement the reassessment of the site. We would also like to express gratitude to Rachel Moses from the National Trust for her help during our stay on the island. Arie Boomert is acknowledged for his collaboration in this project and for sharing his tremendous knowledge of the Island Carib and the Cayoid pottery with us. We would like to thank all the St. Vincent volunteers, in particular Roydon Lumpkin and the students from Leiden University for their motivation and hard work during the fieldwork. Special thanks in this respect go to Alistair Bright, Angus Mol and Hayley Mickleburgh for their assistance during the fieldschools. Benoit Roux, Sebastiaan Knippenberg, Jason Laffoon and Niels Groot are thanked for specialized expertise during the analyses, and Grant Gilmore III for the identification of the colonial materials. Anja Vroegop is thanked for helping in formatting of the text of this article.

Notes

1 Island Carib is a recent denominator derived from the term *Caraïbes* which was used by 17th century French chroniclers to distinguish them from the *Kali'na/Galibi* (Mainland Carib) of the coastal zone of the Guianas. They have been subject of an ongoing debate centred around theories on their appearance on the islands and archaeological visibility (Allaire 1977, 1987, 1997; Boomert 1995; Davis and Goodwin 1990; Whitehead 1995a). The first theory associates the Island Carib migration with a particular pre-Colonial ceramic assemblage (so-called Suazey or Suazan Troumassoid). The second sees the Island Carib presence as the result of a migration from the mainland or adaptation to cultural influences from the Mainland Carib in pre-Colonial times and relates it to Cayo pottery.

2 *Bixa orellana*

References

Allaire, L. 1977. *Later Prehistory in Martinique and the Island Caribs: Problems in Ethnic Identification*. New Haven (unpublished Ph.D. thesis, Yale University, CT. University Microfilms, Ann Arbor).

Allaire, L. 1987. Some Comments on the Ethnic Identity of the Taino-Carib Frontier. In: R. Auger, M.F. Glass, S. MacEachern and P.H. McCartney (eds), *Ethnicity and Culture*, Calgary, 127-133.

Allaire L. 1994. *Historic Carib site discovered!* University of Manitoba St. Vincent Archaeological Project Newsletter 1.

Allaire L. 1997. The Caribs of the Lesser Antilles. In: S.M. Wilson (ed.), *The Indigenous People of the Caribbean*, Gainesville, 177-185.

Anonyme de Carpentras 2002. *Un flibustier français dans la mer des Antilles* (1618-1620). *Relation d'un voyage infortuné fait aux Indes occidentales par le capitaine Fleury avec la description de quelques îles qu'on y rencontre, recueillie par l'un de ceux de la compagnie qui fit le voyage*. Text presented by J.P. Moreau, Paris.

Boomert, A. 1986. The Cayo Complex of St. Vincent: Ethnohistorical and Archaeological Aspects of the Island-Carib problem. *Antropológica* 66, 3-68.

Boomert, A. 1995. Island Carib Archaeology. In: N.L. Whitehead (ed.), *Wolves from the Sea: Readings in the anthropology of the native Caribbean*, Leiden, 23-35.

Boomert, A. 2004. Koriabo and the Polychrome Tradition: The late-prehistoric era between the Orinoco and Amazon mouths. In: A. Delpuech and C.L. Hofman (eds), *Late Ceramic Age Societies in the Eastern Caribbean*, Oxford, 251-266 (Paris Monographs in American Archaeology 14).

Boomert, A. 2009. Searching for Cayo in Dominica. Proccedings of the 23rd *International Congress for Caribbean Archaeology*, Antigua.

Boomert, A. 2011. From Cayo to Kalinago: Aspects of Island Carib archaeology. In: C.L. Hofman and A. van Duijvenbode (eds), *Communities in Contact. Essays in archaeology, ethnohistory and ethnography of the Amerindian circum-Caribbean*, Leiden, 291-306.

Breton, R. 1665. *Dictionnaire caraïbe-françois*. Gilles Bouquet, Auxerre

Breton, R. 1666. *Dictionnaire françois-caraïbe*. Gilles Bouquet, Auxerre.

Breton, R. 1978. *Relation de l'île de la Guadeloupe*. Société d'Histoire de la Guadeloupe, Basse-Terre.

Bright, A.J. 2011. *Blood is thicker than water,* Leiden. (PhD thesis, Leiden University).

Bullen, A.K. and R.P. Bullen 1972. Archaeological Investigations on St. Vincent and the Grenadines West Indies. *American Studies Report* 8, 129-159.

Chanca, D. Alvarez 1988 [1494]. The report of Dr. Chanca. In: C. Jane (ed.), *The Four voyages of Columbus*, vol. 1: 20-73, New York.

Cody Holdren, A. 1998. *Raiders and Traders: Caraïbe Social and Political Networks at the Time of European Contact and Colonization in the Eastern Caribbean,* Los Angeles (unpublished PhD thesis, University of California, University Microfilms, Ann Arbor).

Coppier, G. 1645. *Histoire et voyages aux Indes Occidentales, et de plusieurs autres régions maritimes et esloignée,* Lyon.

Curet, L.A. 2005. *Caribbean paleodemography: Population, culture history and sociopolitical processes in ancient Puerto Rico*, Tuscaloosa.

Davis, D.D. and R.C. Goodwin 1990. Island Carib origins: Evidence and nonevidence. *American Antiquity* 55(1), 37-48.

Du Tertre, J.B. 1654. *Histoire générale des îles de S. Christophe, de la Guadeloupe, de la Martinique, et autres dans l'Amérique*. Jacques et Emmanuel Langlois, Paris.

Du Tertre, J.B. 1667. *Histoire générale des Antilles habitées par les François,* Paris.

Fewkes, J. 1922. *A prehistoric island culture area of America,* Washington.

Figueredo, A.E. 1978. The early European colonization of St. Croix (1621-1642). *Virgin Islands Archaeological Society* 6, 59.

Goggin, J.M. 1960. *The Spanish olive jar. An introductory study*. Papers in Caribbean Anthropology, vol. 62, New Haven.

Gosden, C. 2004. *Archaeology and colonialism,* Cambridge.

Hofman, C.L. 1995. Three Late Prehistoric Sites in the Periphery of Guadeloupe: Grande Anse, Les Saintes and Morne Cybèle 1 and 2, La Désirade. In: G. Richard (ed.), *Proceedings of the 16th International Congress for Caribbean Archaeology,* Basse Terre, 156-167.

Hofman, C.L., A.J. Bright, M.L.P. Hoogland and W.F. Keegan 2008. Attractive ideas, desirable goods: examining the late Ceramic Age relationships between Greater and Lesser Antillean societies. *Journal of Island and coastal archaeology* 3, 1-34.

Hofman, C.L., M.L.P. Hoogland, H.L. Mickleburgh, J.F. Laffoon, M.H. Field and D.A. Weston 2012. Life and death at Lavoutte, Saint Lucia, Lesser Antilles, as revealed from rescue excavations. *Journal of Field Archaeology* 37 (3), 209-225.

Hofman, C.L., M.L.P. Hoogland and A. Delpuech 2001. *Le site de l'Anse à la Gourde, Saint-Francois, Guadeloupe. Fouille programmée pluriannuelle 1995-2000, Leiden/Paris. (unpublished report,* Leiden University / DRAC).

Hofman, C.L., A. Delpuech, M.L.P. Hoogland and M.S. de Waal 2004. Late Ceramic Age Survey of the northeastern islands of the Guadeloupean archipelago. In: A. Delpuech and C.L. Hofman (eds), *Late Ceramic Age societies in the eastern Caribbean, Oxford, 159-182* (Paris Monographs in American Archaeology 14).

Honychurch, L. 2000. *Carib to Creole: A History of Contact and Culture Exchange*, Roseau.

Hoogland, M.L.P., T. Romon and P. Brasselet 1999. Troumassoid burial practices at the site of Anse à la Gourde, Guadeloupe, *Proceedings of the 18th International Congress for Caribbean Archaeology,* Grenada, 173-178.

Hoogland, M.L.P., C.L. Hofman and A. Boomert 2011 Argyle, St. Vincent: new insights on the Island Carib occupation of the Lesser Antilles. Paper presented at the 24th International Congress for Caribbean Archaeology, Martinique.

Hulme, P. 1986. *Colonial encounters: Europe and the native Caribbean,* London.

Hulme, P. and N.L. Whitehead (eds) 1992. *Wild Majesty: Encounters with Caribs from Columbus to the present day - an anthology,* Oxford.

Kirby, I.A.E. 1974. The Cayo pottery of St. Vincent—a pre-Calivigny series. *Proceedings of the International Congress for the Study of the Pre-Columbian Cultures of the Lesser Antilles* 5, 61-64.

Labat, J.B. 2005 [1722]. *Voyages aux isles de l'Amérique* (Antilles), 1693-1705. Text presented by A. T'Serstevens, Paris.

Lenik, S. 2012. Carib as a Colonial Category, *Ethnohistory* 59 (1).

Lightfoot, K.G. 1995. Culture contact studies: Redefining the relationships between prehistoric and historical archaeology. *Latin American Antiquity* 60(2), 199-217.

Lyman, R.L. and M.J. O'Brien 2001. The direct historical approach, analogical reasoning, and theory in American archaeology, *Journal of Archaeological Method and Theory* 8(4), 303-342.

Marken, M.W. 1994. *Pottery from Spanish shipwrecks 1500-1800*, Gainesville.

Nicholl, J. 1605. *An hourglass of Indian news*, London.

Oliver, J. 2009 *Caciques and Cemi idols*: *The web spun by Taíno rulers between Hispaniola and Puerto Rico,* Tuscaloosa.

Palacio, J.O. 2005. *The Garifuna, a nation across borders,* Benque Viejo del Carmen.

Pinchon, R.P. 1961. Description de l'Isle de Saint-Vincent. Manuscrit anonyme du début du XVIIIème Siècle. *Annales des Antilles* 9, 35-81.

Reid, B. 2009. *Myth and reality of Caribbean history,* Tuscaloosa.

Richard, G. 2002. Travaux et recherches archéologiques de terrain. Capesterre Belle-Eau: Arrière plage de Roseau. *Bilan Scientifique de la Région Guadeloupe*, 52-4.

Rochefort, C. 1658. *Histoire naturelle et morale des îles Antilles de l'Amérique,* Rotterdam.

Rouse, I. 1992. *The Tainos: Rise and decline of the people who greeted Columbus*, New Haven.

Silliman, S.W. 2005. Culture contact or colonialism? Challenges in the archaeology of Native America. *American Antiquity* 70(1), 55-74.

Sued-Badillo, J. 1995. The Island Caribs: new approaches to the question of ethnicity in the early Colonial Caribbean. In: N.L. Whitehead (ed.), *Wolves from the Sea*, Leiden, 61-89.

Sued-Badillo, J. 2003. The indigenous societies at the time of contact. In: J. Sued-Badillo (ed.), *General History of the Caribbean*, vol. 1, *Autochthonous societies*, Cambridge, 259-291.

Twinn, P. 2006. Land ownership and the construction of Carib identity in St.Vincent. In: M.C. Forte (ed.), *Indigenous resurgence in the contemporary Caribbean: Amerindian survival and revival*, New York, 89-106.

Waal, M.S. de 2006. *Pre-Columbian social organisation and interaction interpreted through the study of settlement patterns. An archaeological case-study of the Pointe des Châteaux, La Désirade and Les Îles de la Petite Terre micro-region, Guadeloupe, F.W.I.,* Leiden (unpublished PhD thesis, Leiden University).

Whitehead, N.L. (ed.) 1995a. *Wolves from the Sea,* Leiden.

Whitehead, N.L. (ed.) 1995b. The historical anthropology of text: The interpretation of Raleigh's *Discoveries of Guiana*. *Current Anthropology* 36(1), 53-74.

Wilson, S.M. 1994. Structure and history: Combining archaeology and ethnohistory in the Contact period Caribbean. In: J. Marcus and J.F. Zeitlin (eds), *Caciques and their people: A volume in honour of Ronald Spores*, Ann Arbor, 19-30 (Anthropological Papers 89).

Corinne L. Hofman
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
c.l.hofman@arch.leideuniv.nl

Menno L.P. Hoogland
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
m.l.p.hoogland@arch.leidenuniv.nl

The Ancient Mexican Books of Time: interpretive developments and prospects

Maarten E.R.G.N. Jansen

Time was an important theme in the indigenous civilization of Mesoamerica (Mexico and Central America). A prime source for understanding the ancient symbolic associations and related practices is the small corpus of – still quite enigmatic – ancient screenfold manuscripts, nowadays dispersed over libraries and museums in different countries. The central structuring principle of these pictographic and hieroglyphic texts is the pre-colonial calendar, which was not only the dominant framework for historiography and astronomical observations, but was also used for divination, medical treatment, ritual performance, community organization and moral codes. Here we will examine the state of the art in the progress of interpretation and indicate prospects for future research.

1 Introduction

The perception and conceptualization of time is pre-understood in cultural and social codes, determining ideas about order, agency, memory, causality, progress, life and death (Nowotny 1994). Obviously, time is a major topic in physical theories and Western philosophy, playing a central role in works of such fundamental authors as St. Augustine and Heidegger, particularly with implications for identity (e.g. Ricoeur 1984-88; Campbell *et al*. 2010). Techniques of time-reckoning are a fundamental characteristic of cultures, and, as such, have all kinds of practical, symbolical, psychological and ideological implications (Aveni 2002). Chronological structures are present in narrative and ritual performances, which often include the manifestation of moral commitments with communitarian goals, and consequently have the potential to create and affirm individual and collective identities (Rappaport 1999; Orlove 2004). Both memory and ritual commemorations create "mnemonic communities" (Zerubavel 2003). Cultural historians and philosophers (such as Elias and Ricoeur), therefore, have stressed the social and narrative aspects of time. Archaeologists too have focused on the temporal dimension of the formation of the archaeological record, with forays into the Braudelian time-process or the relationship between landscape and time (e.g. Ingold 2000).

As a determinant of collective behaviour, time is an important topic in the study of intercultural communication, as different time concepts in a group may affect many aspects of its interaction, planning, memory, social rhythms, and the expression of emotions and identity (Gudykunst 2005; Samovar *et al*. 2009). The complex (frequently even violent and traumatic) cultural and ethnic interactions of the past centuries have led to characterize the relationships between coexisting populations in terms of time: dominated people being considered as "stuck" in an earlier stage of development (Fabian 1983). Anthropologists have reflected on how temporality contributes to the construction of social systems; interest in conceptualizations of time itself in different cultures, has, indeed, increased in the past decades (e.g. Gell 1992; Munn 1992; James and Mills 2005).

2 Mesoamerican writing and calendar

Stretching between the deserts of Northern Mexico and the tropical forests of Central America, the culture area Middle America ('Mesoamerica') is a complex mosaic of cultures and peoples (such as the Aztecs, Mixtecs and Mayas). By the time of the Spanish conquest (AD 1521), a multifaceted development of several thousand years had created an impressive cultural heritage (Evans 2008). Within the modern Spanish-speaking republics, scores of Native American peoples preserve their languages and many ancient traditions, blending them with elements from the 'Western' world. Despite their numerical paucity (some 15-20 million) these indigenous peoples have a strong emblematic value, providing cultural roots for the national societies (Bonfil Batalla 1996).

Before the Spanish conquest, Mesoamerican peoples had developed several original writing traditions, the most important of which are: (1) the syllabic hieroglyphic script, i.e. phonetic writing, of the Maya peoples in East Mexico and Guatemala (which often included pictorial illustrations of the texts in hieroglyphs), and (2) the pictography of the Mexica (Aztecs), Ñuu Dzaui (Mixtecs) and other peoples in Central and Southern Mexico (expressing complex messages in coherent sequences of polychrome figurative images, which might contain the use of phonetic signs as well in toponyms or personal names).[1]

Manuscripts generally consisted of large pieces of cotton cloth (lienzos in Spanish) or of books (now referred to as 'codices'). These books were made of strips of deerskin or native paper (amate), glued together, folded in a screenfold manner, and covered with a delicate layer of stucco on which polychrome images or hieroglyphic texts were painted. The Spanish conquest brought this tradition to a halt. Less than twenty of such screenfold books have survived the dramatic cultural transformations that followed the conquest. This small pre-colonial corpus is enriched by scores of early colonial works in the same style, often accompanied by comments in Spanish or in indigenous languages written with the alphabetic script. In addition, ethnohistorical sources (such as the works of Spanish missionaries) provide crucial information, but are often incomplete and biased, as their descriptions form part of a 'crusade' against indigenous beliefs. Few Mesoamerican manuscripts remain in the place where they were made; most became victim of colonial disruptions and alienations. Collected as curiosities, they are nowadays kept in libraries, museums and archives either in Mexico itself, or in European countries or in the United States of America, where they are now kept as unique testimonies of the intellectual and artistic achievements of that fascinating Amerindian civilization, which form part of a shared and mutual Mesoamerican-European heritage. Together with the relevant colonial reports, which are equally limited in number and dispersed over the world, they form a corpus which is our main historical source for studying the ancient Mesoamerican history and 'philosophy of time'.

According to their contents we may distinguish two main groups within the corpus of pre-colonial books. One deals with the world of kings and queens, concretely the history of the dynasties that ruled the city-states of the Mixteca Alta region (State of Oaxaca, Mexico) in the six centuries before the Spanish invasion. These manuscripts may also contain references to rituals and divine powers, but their overall structure is descriptive and narrative in character (for an overview, see: Jansen and Pérez Jiménez 2011). They provide a valuable access to pre-colonial memory.

The second group is the main topic of this article: it consists of a handful of pictographic books with religious contents. These unique manuscripts belong to the sacred texts of humanity. For most of them the place of origin is not known, but their contents can be related to the colonial documents that inform us about Aztec religion. The Aztec language (Nahuatl) therefore is our main language of reference.

This corpus, however small and fragmentary, has an enormous value, as it contains original works of art, of great aesthetic impact, which are also examples of original Mesoamerican religious texts. The latter is the more important, as most of the information about the Mesoamerican intellectual world comes from colonial chronicles, especially the accounts by Spanish monks, who were engaged in a spiritual crusade against indigenous religion.

In the colonial diaspora of these manuscripts, the information about their place of origin and about their contents was often lost. Many were called after the collections that hold them, after people who collected or interpreted them, and in some cases after socially or politically prominent figures that the name-giver wanted to honour. As such names have no relationship with (nor relevance for) the peoples who produced them, Mixtec investigator Gabina Aurora Pérez Jiménez and I have proposed to rename the main manuscripts in Mesoamerican terms and call them after their place of origin or after salient topics in their contents (Jansen and Pérez Jiménez 2004). For example, scholars have baptized the corpus of pre-colonial religious codices the "Borgia Group", after the main manuscript which was named after its European owner at the end of the 18th century: Cardinal Stefano Borgia (1731-1804). In the Aztec language, however, this genre was known as teo-amoxtli, literally "divine book(s)". This is the reason for proposing to introduce the new designation "Teoamoxtli Group" or "Books of Wisdom" (table 1). According to Mesoamerican tradition, the 'original' teoamoxtli was formed by Huemac, a ruler of the Toltec realm, which preceded the Aztecs and was considered by them the exemplary ancient civilization par excellence (Ixtlilxochitl 1975/77, I: 270 ff).[2]

Although the provenience of most members of the Teoamoxtli Group is not precisely known, it is clear that three of these codices (Yada, Yecu, Yauhtepec) are related to the Oaxaca region and that this group in general shares many stylistic and iconographical elements with the Mixtec historical codices. On the other hand, there are important links to Aztec manuscripts such as Codex Cihuacoatl (Borbonicus). Codex Yoalli Ehecatl has parallels with frescos from the Tlaxcala region (Tizatlan, Ocotelulco) in Central Mexico, but also with the frescos of Mitla in the Southern Mexican State of Oaxaca. Last but not least there are important parallels with the few surviving Maya books, especially the codex preserved in Dresden.[3] All this suggests that we are looking at products that stem from a long and widespread tradition, which included the practice of copying earlier works, and that share an artistic and religious horizon as well as a historical background in which this tradition could develop and diffuse. Historical and archaeological data point to the cultural interaction in the Early Postclassic as the closest by phenomenon that could have been responsible for this connection. This interaction coincides with the Toltec expansion and its aftermath. The strong links in contents and iconography of the Teoamoxtli Group to the different parts of Mesoamerica provide support for the idea that this genre has indeed a Toltec antecedent.

The key for interpreting the pre-colonial images is the corpus of early colonial manuscripts that were produced under supervision of Spanish monks in order to document

Traditional name (institution where preserved)	New name (meaning)	Edition / commentary
Codex Borgia (Biblioteca Apostolica Vaticana, Rome)	*Codex Yoalli Ehecatl* (‘Book of Night and Wind’)	Nowotny 1976; Anders & Jansen & Reyes García 1993; Batalla Rosado 2008
Codex Vaticanus 3773 / “B” (Biblioteca Apostolica Vaticana, Rome)	*Codex Tonalpouhqui* (‘Book of the Diviner’)	Anders & Jansen 1993
Codex Cospi (Biblioteca Universitaria, Bologna)	*Codex Tlamanalli* (‘Book of Offerings’)	Laurencich Minelli 1992; Anders & Jansen & Van der Loo 1994
Codex Fejérvàry-Mayer (City of Liverpool Museums)	*Codex Tezcatlipoca* (‘Book of the Smoking Mirror’)	Anders & Jansen & Pérez Jiménez 1994; León-Portilla 2005
Codex Laud (Bodleian Library, Oxford)	*Codex Mictlan* (‘Book of Death’)	Anders & Jansen 1994
Codex Porfirio Díaz [1](Biblioteca Nacional de Antropología e Historia, Mexico City)	*Codex Yada* (Book of Tututepetongo)	Anders & Jansen 1994: part IV; Van Doesburg 2001
Codex Fonds Mexicain 20/21 Bibliothèque Nationale, Paris)	*Codex Yecu* (Painting of the War Ritual)	Jansen 1998; Simonin 1998.
Codex Yauhtepec[2] (in community)	*Codex Yauhtepec*	unpublished

Table 1 The Teoamoxtli (Borgia) Group

the ‘pagan’ religious convictions that they wanted to eradicate.[4] The Mesoamerican calendar is the main subject matter and structuring principle of the ancient books. Inscriptions show that this specific time count was already in use more than 2000 years ago. The system used in Central and Southern Mexico (Caso 1967) differed slightly from that of the Maya area, but the fundamental characteristics were the same. The basic unit was a cycle of 260 days, formed by combining the numbers 1 to 13 with twenty day signs in a fixed sequence. With this unit many more periods were formed. Within the continuous sequence of 260-day cycles, solar years of 365 days were distinguished and marked as units for agricultural purposes (including rituals) and for dating historical events (fig. 1). The solar years were subdivided into 18 ‘months’ of 20 days, with 5 ‘superfluous days’. The feasts of these periods were the hallmarks of community life. The solar years were grouped into units of 52 (the “Calendar Round”). In Central and Southern Mexico each solar year was named after a specific day, the “year bearer”. Full dates consisted of a day and a year bearer. The Maya achieved a similar connection of the 260-day cycle with the 365-day cycle by registering each day’s position in a ‘month’. For mathematical reasons only four day-signs may occur in year-bearer positions. Classic Maya dates counted the number of years that had elapsed since a virtual ‘zero point’ in 3114 BC. The inscriptions often contain astronomical references, such as lunar positions, heliacal risings of Venus, solar eclipses, etc. (Freidel et al. 1993).

Much more than a chronometric device, the calendar was the paramount structuring principle of religious and social life. Each of the 260 days, but also each of the many periods defined within the calendar, was associated with specific patron deities, mythical personages and events, as well as with cosmologic realms (world-directions, earlier creations, layers of the universe). In spells and ritual speech, days appear as esoteric names for artefacts, places and natural elements. Each moment in time thus had a symbolic value, which was crucial for divination and ritual. A person’s day of birth became his/her ‘calendar name’, and this defined character, personhood, possible marriage partners and destiny. According to the day on which crucial events happened or problems (such as illness) manifested themselves, the priests predicted the outcome and prescribed ritual remedies and appropriate behaviour (Anders and Jansen 1993).

In the religious manuscripts we find different calendar units and periods associated with symbolic statements painted in figurative form and/or hieroglyphic signs, which, taken together, suggest the good and bad times for certain activities, respectively which rituals have to be performed in order to guarantee the desired outcome. The predictions and related ritual prescriptions make use of a wide-ranging and complex symbolic vocabulary that offers insights not only into their perception of time but also into the community’s ethos, psychology and attitudes toward nature.

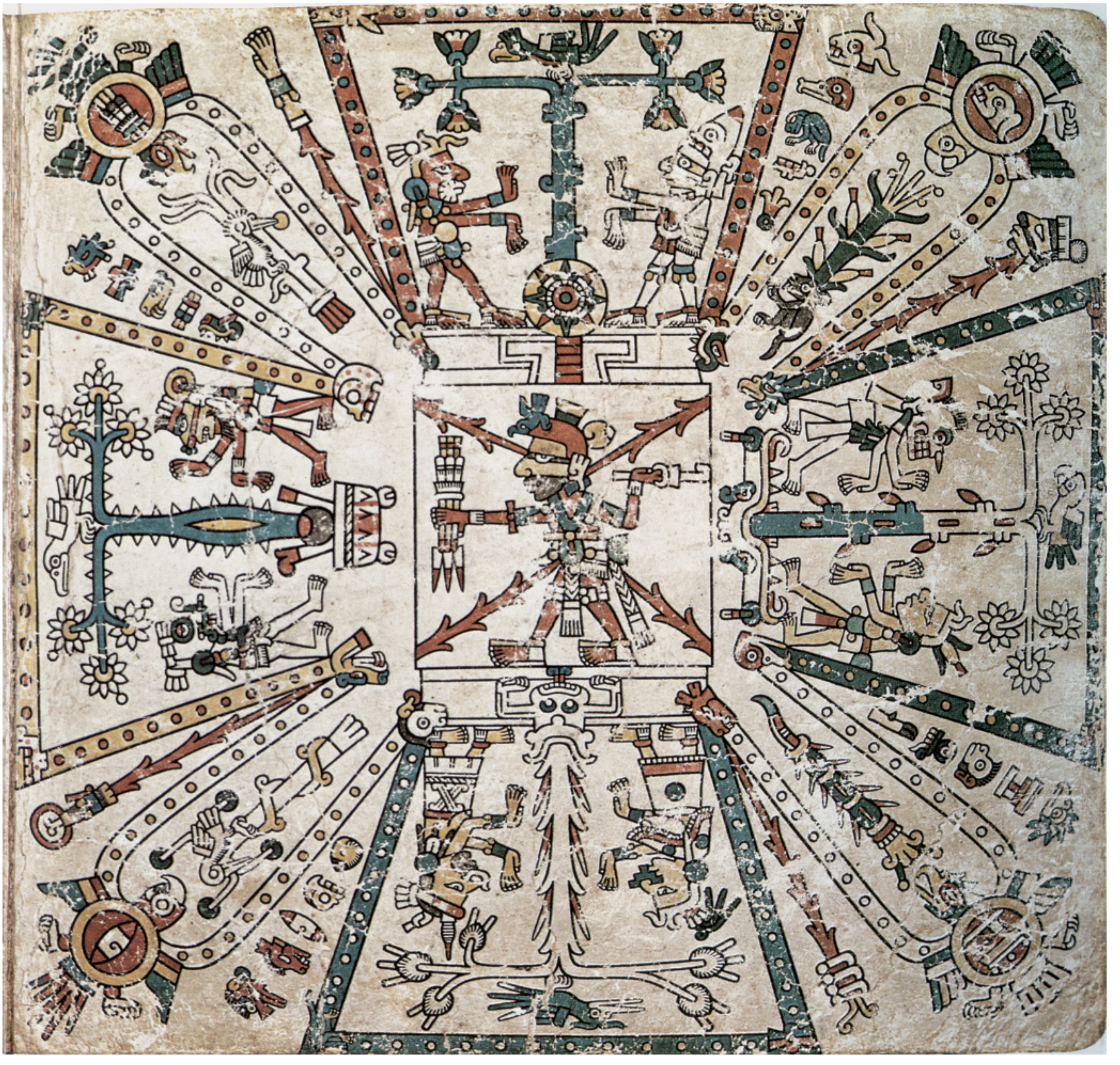


Figure 1 Codex Fejérváry-Mayer, p. 1 (Mexican pictographic book, Liverpool). The calendar count of 260 days encircles the four directions and the 9 Deities of the Nights, with symbolic references to the four directions (trees, birds) and harvest predictions. The East-West axis is represented by an altar with the rising sun and a white being carrying the moon (in the upper and lower segment respectively).

3 Colonial transformation

The 16th century colonization connects the history of Middle America with that of late- and post-medieval Europe. The Spanish conquistadors and missionaries (e.g. Motolinia, Sahagún, Durán, Ruiz de Alarcón and Landa) already refer to the social importance, the astronomical complexity, the symbolic associations and ritual dimension of the calendar used by the Aztecs, Mixtecs, Mayas and other Mesoamerican peoples, but, being children of their time, they considered the religious aspects of the native calendar "diabolical" and consequently provided incomplete and biased descriptions (Gruzinski 1988; Burkhart 1989). In their zeal to replace the native religion by Catholicism, they tried to erase this calendar, by prohibiting its use and by burning the pre-colonial manuscript books in which its religious meanings were registered. This religious persecution was part of the same process as the contemporaneous witch trials in Europe (e.g. Ginzburg 1989; Cohn 2001).

In the decades following the Spanish conquest of Mexico (AD 1521), religious and ideological processes were set in motion that would transform Middle America's world and symbolic universe drastically. The colonizers and the colonized coexisted during hundreds of years, combining complex interaction with a persistent mental segregation. In inscribing their own, new sacred landscape on the earlier Mesoamerican locales, the Spanish Dominican missionaries, together with native artists and workers, built monasteries and churches, which in their architecture and art (altarpieces, sculptures, frescos) expressed the Christian ideas, but also, in directing themselves to the native population, made use of the pre-existing Mesoamerican idiom of terms, techniques, spatial organization, and symbolic associations. In many cases the locations for these Catholic buildings followed an underlying pre-colonial indigenous conceptualization of geography in terms of cosmic order.

On a more abstract level the same phenomenon affected the perception of and dealing with time. Particularly interesting is the development of the fiesta cycle and the related world-view during the colonial period (e.g. Ingham 1986; Curcio-Nagy 2004). Here we find a "symbolic reconfiguration" and "double encoding" of religious ideas and practices in both native and Christian terms, a special form of what commonly is referred to as "hybridity" or "syncretism" (e.g. Burke 2009; Witter 2011), which allowed for a strengthening and revival of traditional values and ritual life in the face of violent, disintegrating forces from the outside. Ancient deities and myths were fused with saints and Christian concepts. Widespread examples of intercultural translations are the identification of Christ as Lord Maize or acts such as making the sign of the cross (both a Christian symbol and a reference of the four directions) and praying to 'Lord Sun' at daybreak as 'Eternal Father' to watch over the supplicant's road during daytime.

In the process of cultural interaction, indigenous authors produced some fascinating documents, which constitute a central concern within ethnohistorical studies (Wood 2003; Berdan 2009; Jansen and Pérez Jiménez 2009). The study of documents in indigenous languages is crucial for understanding the dialogues between Europeans and Mesoamerican peoples, rather than focusing on the European monologue. These documents – partly in Spanish, partly in Mesoamerican languages – contain valuable details on the structure and use of the calendar, the divinatory meaning of days, associated ritual practices and related sacred narratives. They show how on the one hand pre-colonial ideas were continued, and on the other new terms and elements from Europe were incorporated and adapted. Particularly interesting is the relationship between calendar-based prophecies and indigenous resistance movements (cf. Ouweneel 2005).

The Books of Chilam Balam, for example, constitute a corpus of texts in Yucatec Maya, written with the alphabet that was introduced by the Spaniards. These texts connect references to historical events with prophetic images associated with specific days and periods, resulting in a remarkable form of "mantic historiography" based on a cyclical view and interpretation of time (Farriss 1987). Another example is the translation of European astrological texts, almanacs, 'books of hours' and reportorios de los tiempos into Mesoamerican languages – one example is the Izcatqui manuscript in the Aztec language, preserved in the Tropenmuseum, Amsterdam.[5] These documents provide new insights into the translation, interpretation and discussion of the European world-view by indigenous daykeepers, in the wider dramatic context of colonial transculturation and changes in symbolic meaning and ritual structuring of time and their consequences for collective memory and identity. The particular consequences of this process manifest themselves today in the ways in which indigenous diviners make use of Spanish astrological and other 'occult' texts (e.g. the Oráculo de Napoleón and the Libro de San Cipriano, which are widely distributed and easily available). This particular intellectual interaction between Mesoamericans and Europeans in the colonial period is an interesting chapter in the global history of ideas but has not yet received the scholarly attention it deserves.

4 Decipherment of the Teoamoxtli Group

The exiled Jesuit Joselino Fábrega, working in Rome for Cardinal Borgia at the end of the 18th Century, was the first to write a commentary on Codex Borgia, comparing it to the colonial religious manuscripts, explained by Spanish friars (Fábrega 1899). Fábrega's work (nurtured by indications from the great Mexican scholar Antonio de León y Gama, his contemporary) was eclipsed by the interpretive studies of Eduard Seler (1845-1922), which produced generally very well-founded iconographical descriptions and identifications of the individual signs (cf. Anders 1967). According to the ideas of his time, which saw religion as a metaphoric representation of natural phenomena, particularly those of the sky, Seler tended to interpret the contents of these books in terms of symbols that ultimately had an astronomical meaning (*Astraldeutung*). Seler's influence has remained very strong. His commentary on Codex Borgia, originally published in German (Seler 1904-1909), was translated into Spanish and published in an accessible edition in Mexico (1963), which has been reprinted several times since. Obviously this publication could be connected easily with rising modern interest in archaeo-astronomy. We should remember, however, that although his contributions to iconographical analysis are fundamental and lasting, Seler's interpretive paradigm already had become obsolete in the mid-20th century (Dorson 1955).

The basis for the modern interpretation of the few religious books of the ancient Mesoamerican civilization that have survived colonial destruction, is the work of the Austrian scholar Karl Anton Nowotny (1904-1978). Having been introduced to the astronomical interpretation during his university study in Vienna before World War II, Nowotny started a series of innovative in-depth investigations of Mexican visual art after the war was over. He made a thorough analysis of the place signs in the Aztec Codex Mendoza, providing nothing less than a nutshell pictographic dictionary (Nowotny 1959; cf. Reyes García 1997).

In parallel to the work of the Mexican archaeologist Alfonso Caso, he discovered the historical character of the Mixtec codices – that other part of the corpus of pre-colonial pictorial manuscripts – and commented on their ritual scenes. His profound knowledge of religious texts and divinatory systems in Medieval Europe and other cultures (evidenced in his edition of Agrippa von Nettesheim's *De occulta philosophia*) enabled Nowotny to recognize the Teoamoxtli codices (Borgia Group) as priestly manuals dealing with the art of divination and with prescriptions for rituals, based on the Mesoamerican calendar and its multiple symbolic associations. A synthesis of this breakthrough is his major work: *Tlacuilolli, die mexikanischen Bilderhandschriften, Stil und Inhalt, mit einem Katalog der Codex Borgia Gruppe*, published in 1961. This magnum opus is more than a compendium or manual; it is a paradigmatic change with respect to Seler. It is not a polemic work but presupposes a good knowledge of Seler's contributions. Like Seler, Nowotny parts from a superb overview of the whole corpus of codices and related texts, and from a conviction that the scenes are not to be seen or used as mere illustrations, but are impressive, coherent works with their own voice. He qualified the genre of most religious codices as "mantic" and "ritual", and analysed the scenes not as occult codifications of astronomical cycles, but as sets of symbols that give meaning to calendrical structures. The Maya codices do contain astronomical calculations but in this same mantic context. Methodologically Nowotny identified a number of pitfalls and criticized particularly those who wanted to rush to premature, fanciful speculations. Nowotny did indicate the road to arrive at that stage of more advanced interpretation, however, by emphasizing the cultural continuity in Mesoamerica as a crucial clue for understanding the ancient images. As parallels in Europe he mentioned the research on toponyms and legends (*Flurnamenforschung, Sagenforschung*) in connection with a general documentation and study of lore and oral tradition (*Heimatkunde*). More field research was necessary – an activity which he himself was not able to undertake, due to his limited possibilities before and after the war.

As he organizes and discusses the scenes in terms of the distinct calendar counts, with few explanations of the symbolism used, Nowotny's text is condensed, technical and abstract. Still, his work inspired a next generation of students, such as Ferdinand Anders, Werner Stenzel and Hans Biedermann, and formed the point of departure for a long-term project of facsimile editions of Mexican codices at the Akademische Druck- und Verlagsanstalt (ADEVA) in Graz. In 1976 Nowotny himself contributed to this series an important commentary on Codex Yoalli Ehecatl (Borgia), which became the basis for a less technical and more accessible study of this genre by Biedermann (1989).

Teaching at the Institut für Völkerkunde of Vienna University, Ferdinand Anders followed Nowotny's focus on the connection between the ancient Mexican civilization and the cultural heritage of contemporary indigenous peoples, and started a project of fieldwork in the Ñahñu (Otomí) village of San Pablito in the Sierra de Puebla, a centre of traditional amate-paper production. In the curing and planting rituals, involving figures cut from *amate* paper, Anders and his students discovered important conceptual and even iconographical parallels to the codices (cf. Anders and Jansen 1986).

Continuing in this line of scholarship, which combines a historical-geographical dimension with references to rituals and sacred narratives, Gabina Aurora Pérez Jiménez, working at Leiden University, and I have tried together with several students and PhD candidates, to reconnect the images of the codices to on-going cultural traditions, in the wider context of the struggle of indigenous peoples for emancipation, dignity and cultural rights.[6] For the Teoamoxtli group an important moment was the prolonged workshop organized at Dumbarton Oaks, Washington D.C. (summer of 1982) with the participation of Ferdinand Anders, Elizabeth Boone, John Carlson, Henry B. Nicholson, Edward B. Sisson, Peter van der Loo, Gabina Aurora Pérez Jiménez and myself.

At the occasion of the 500th commemoration of Columbus' fateful voyage, a collaborative effort of the Fondo de Cultura Económica (FCE), Mexico, and the Akademische Druck- und Verlagsanstalt (ADEVA), Graz, made it possible to publish in the 1990s a series of facsimile editions with new commentaries in Spanish: the series *Códices Mexicanos*, actually one work in 13 volumes, under supervision and editorship of Anders, Jansen and Reyes García (1991-1997). Our main aim was to let the ancient books speak for themselves, as a testimony of the great civilization that had suffered the onslaught of colonialism. Inspired and guided by the cooperation of Gabina Aurora Pérez Jiménez and Luis Reyes García with their active knowledge of respectively Mixtec and Nahuatl oral literature, I designed the commentaries as 'readings' of the pictorial texts, based upon detailed iconological analysis and a review of the relevant historical and ethnographic data (finding their way in the introductions and notes).

For the historical ('descriptive') codices a reading in the form of a narrative was logical, but for the predominantly religious ('prescriptive') codices this method was more difficult, as we are dealing here with a different genre. Following Nowotny's analysis, we tried to interpret and *read* their contents as mantic texts or as prescriptions for rituals. Confronted with these colourful sacred books, one might feel tempted to look precisely for mystical theological-philosophical speculations or narrative structures of myths. Mantic texts, however, although using arcane expressions and religious associations, generally aim to do the contrary, namely to present relatively straightforward statements about the influence of specific deities on a variety of quotidian human activities during certain time periods. These mantic expressions are intimately tied to the daily life and cultural surroundings of the expected clients (fig. 2).

From a comparative perspective we know that mantic texts tend to be fundamentally ambivalent and 'open', a quality created through the use of the literary, arcane language, full of metaphors. This brought us to consider the forms of Mesoamerican ceremonial discourse, e.g. the 'speaking in pairs' (difrasismos), present in early colonial documents and still alive in oral tradition.[7] It is precisely from this perspective that we have tried to read the images in the codices by connecting them to the historically documented and/or still living traditions. We have found that the very effort to read the scenes in terms of indigenous languages, metaphors and conventions of oral literature is a fruitful

Figure 2 Codex Borgia, p. 21: In this period, indicated by the days [3] Water, Alligator, Reed, Serpent and Movement and six following sets of days, the merchant carrying precious goods (quetzal bird) travels under the auspices of the deity Red Tezcatlipoca ("Smoking Mirror"). He may encounter bad luck: the tree (success, continuity, lineage, rulership) breaks; serpents and dangerous animals bar the road. A mysterious enemy (Black Tezcatlipoca) throws a burning stick with spikes at him.

heuristic procedure. Of course, we do not pretend that our interpretation is final and definitive; on the contrary we stress that our commentaries should be used as tools to produce improvements and further understanding.

The commentaries of the *Códices Mexicanos* series, therefore, contain 'direct readings', transliterations of the images, as their central part, while the arguments that support the underlying interpretations are given in introductions and notes. This new way of writing commentaries, in combination with the fact that we followed the breakthroughs and methodological principles of Nowotny, which – being published only in German – had not yet become generally known, was bound to cause surprise and bewilderment among several colleagues. In spite of the abundant supporting data given in the multi-volume work, some reviewers asked for even more evidence for our interpretations, as they limited their attention to some specific sections and maybe were not always aware of the real state of the art in this complex field (cf. Jansen 1999).

5 New commentaries

Fortunately several new books have appeared in the past five years, which will permit a new appreciation of these beautiful pictorial manuscripts. First of all we should mention the English translation of Nowotny's *Tlacuilolli* (1961), published by the well-known University of Oklahoma Press (2005). The idea for this translation was born already in 1982 at the Dumbarton Oaks summer workshop and then realized through the collaboration of George Everett (associate professor of German) and Edward Sisson (an archaeologist specialized in the style and iconography of Postclassic Mexico). These two scholars have done much more than a translation: by adding notes and a bibliography they provided a very useful update of this now classic monograph. The foreword by Ferdinand Anders explains its importance and gives valuable background information.

Although all modern research on codices should build on Nowotny's work, this proves to be not so easy, as he wrote in an aphoristic style. Who looks through the pages for a straightforward interpretation of specific scenes will often suffer a disillusion. The value of this magnum opus is in its method and scope. Therefore, in order to understand Nowotny's contribution one really needs a good previous knowledge of the subject matter (e.g. reading his texts against Seler's), as well as concentration, discipline and patience, which in the end will be rewarded with critical insights.

Another outcome of the above-mentioned Dumbarton Oaks summer workshop (1982) is the new monograph on the Teoamoxtli (Borgia) Group by Elizabeth Boone, entitled *Cycles of Time and Meaning in the Mexican Books of Fate* (2007). Boone applies an art-historical focus on the composition of the pictorial scenes, presenting comprehensive and clear descriptions of such aspects as reading patterns, different types of almanacs (lists, tables, diagrams), and different series of deities. When it comes to meaning of the scenes and to the discussion of provenience, she follows existing literature, but provides a very well-ordered and illustrated presentation with good explanatory tables, notes and bibliographical references.[8] Although Boone's monograph is not based on fieldwork or other personal familiarity with living Mesoamerican culture, and is consequently limited in what it offers as original interpretations, it is a much needed overview and a very instructive and comprehensive introduction to the complex world of the Mexican religious codices. It is a worthy counterpart to her earlier synthetic presentation of the Aztec and Mixtec pictorial manuscripts with historical and geographical contents (Boone 2000).

Shortly after Boone's study, the Biblioteca Apostólica Vaticana itself brought out a magnificent new edition of Codex Yoalli Ehecatl (Borgia). Author of the monumental commentary (2008) is Juan José Batalla Rosado, a historian specialized in the study of Mexican codices, teaching at the Universidad Complutense, Madrid. His text goes much further than explaining the images of the codex: it contains a detailed introduction to Mesoamerican archaeology, religion, calendar and writing system (more than 200 pages), furthermore a detailed discussion of the whole Teoamoxtli (Borgia) Group, its provenience, the problems and methods of interpretation (some 60 pages), and finally a page-by-page discussion of the Codex Yoalli Ehecatl (Borgia) with multiple cross-references to other manuscripts. In his thorough treatment Batalla Rosado explicitly reproduces and discusses earlier interpretations.[9] His analytic descriptions are detailed and excellent. The erudition is impressive, the methodology of source criticism in the best historical tradition, the codicological research is original and meticulous.

With its broad introduction and its comprehensive and critical references to the different interpretations of each scene, Batalla Rosado's commentary complements very nicely the more generally structured book of Boone. Taken together, both works form an excellent point of departure for new modern studies of this subject matter.

Both Boone and Batalla Rosado offer new ideas about the famous enigmatic central chapter of Codex Yoalli Ehecatl (Borgia), pp. 29-47. Seler, inspired by Babylonian texts (*sic*), saw in this section the descent of Venus into the Underworld, while Nowotny interpreted these pages as a sequence of rituals in a specific ceremonial centre. In the FCE series, I followed Nowotny's indication and elaborated this considerably further, identifying the central figure in these rituals as the priest of Cihuacoatl, a complex skeletal

Goddess, associated with the nightly sky and with the ancestors, a power of death and birth (Klein 1988; 2000).

Boone takes from Seler the idea that these scenes tell a religiously charged narrative, but she proposes that the narrative deals with creation. The first scene or episode (page 29), where I see hallucinogenic smoke rising from a central bowl and producing a visionary experience, represents in Boone's opinion a burst of creative energy and power – one would say some form of Mesoamerican 'big bang' (fig. 3). In a similar way Boone interprets the following episodes not as rituals but as different stages of creation. Batalla Rosado also tends to combine Seler's narrative interpretation with Nowotny's focus on ritual. He suggests that the scenes might refer to the visionary voyage of a priest through the underworld.

These suggestions are interesting and should provoke new research. Do the different scenes in which objects are animated and in which certain beings emerge from concrete elements, indeed represent creation acts or rather the forces that are invoked and liberated through ritual?

Clearly, ritual is a central element in the temple scenes of Codex Yoalli Ehecatl (Borgia). Many acts are ritual in character: self-sacrifices, opening of the Sacred Bundle, bathing, etc., and take place in typical ritual spaces, such as temple buildings and chambers, plazas, and ball courts, connected by roads. Seler already noted that there are abbreviated parallels of all this in the Mixtec codex Tonindeye (Nuttall), p. 15, which shows similar buildings as part of a ritual event in a historical context. In the colours surrounding the temples in Codex Yoalli Ehecatl (Borgia), pp. 29-32, we observe the progression of night, dawn and day (Nowotny 1976), which seems to specify the moment of ritual activity.

The distinction between a ritual and a narrative interpretation is less essential than one might suppose. Rituals are obviously priestly activities which often have cosmological connotations and are connected to the world of visions and ancestors. They are often connected with (enactments of) sacred narratives, deal with similar themes and bring out similar roles, personages, environments, objects, metaphors and dramatic structures (cf. Turner 1990; Tilley 2000).

In connection with these two new commentaries one should certainly consult the really transcending new interpretive monograph *El Lenguaje Enmascarado: Un acercamiento a las representaciones gráficas de deidas nahuas* (2008), by Katarzyna Mikulska-Dąbrowska (University of Warsaw). This extraordinary and well-documented work takes a technical iconographical question concerning the representation of deities as point of departure for an in-depth study of religious metaphorical and ceremonial language and a profound search for the very character of those deities and for the nature of Mesoamerican religion itself. On the basis of a well-explained philological and semiotic-iconological method, in the best European tradition, Mikulska guides us through the world of the Mexican pictorial manuscripts in a very original, yet coherent, well argued and founded manner. She discusses the different divinities, the body parts and animic forces, the value of various materials, cosmology, ancestor cult, visionary experiences and the alter ego (nahual), bringing us back to the thought and conceptualization of the authors of the ancient books, and showing the process of their artistic creativity in speech and painting.[10] Among the interpretive problems she solves is that of the deity Ometeotl, whose name has been translated as "two (ome) - god (teotl)" and interpreted as a pre-colonial philosophical concept: a deification of the idea of duality (a notion particularly popular in the current of structuralism). After a detailed discussion, Mikulska concludes in favour of an alternative interpretation which reads this name as omi(tl) teotl, "God of Bone(s)", i.e. a reference to a deity of death and the world of the ancestors.

6 Cultural continuity

Both Boone (2007) and Batalla Rosado (2008) base themselves on the commentaries published in the Fondo de Cultura Económica series, but they themselves do not follow the method, indicated there, of enriching interpretive potential with the results of ethnographic fieldwork and collaboration with indigenous experts. Still, for a full understanding of the ancient Mexican books, a much better analysis of mantic symbolism with related ritual practices, narratives and ceremonial discourses is indispensable. And, as only a limited number of mantic texts from Mesoamerica have been adequately registered, the valuable (but biased and incomplete) information of the colonial sources should be complemented by contemporary oral traditions.

Nearly everywhere on the American continent did the colonization lead to the annihilation of ancient time-counts. In Mexico and Guatemala there are, however, a few communities where (part of) the pre-colonial calendar is still in use (originally identified by Schultze Jena 1933/38; cf. Miles 1952). The question of what can be derived from cultural continuity (also referred to as "analogy") was a subject of much contention back in the 1980s, but that debate has since largely been superseded by the introduction of long-term perspectives (inspired by the Braudelian "*longue durée*"). Needless to say, cultures are in permanent development, change and renewal. Yet, at the same time, they tend to keep on grappling with recurring, relatively stable matters. These are identified by López Austin's authoritative studies (1990; 1994) as a core ("*núcleo duro*"), *i.e.* a coherent set of traits and tendencies that show long continuity over time and that may be used as building blocks in the interpretation process. Specialists on this topic

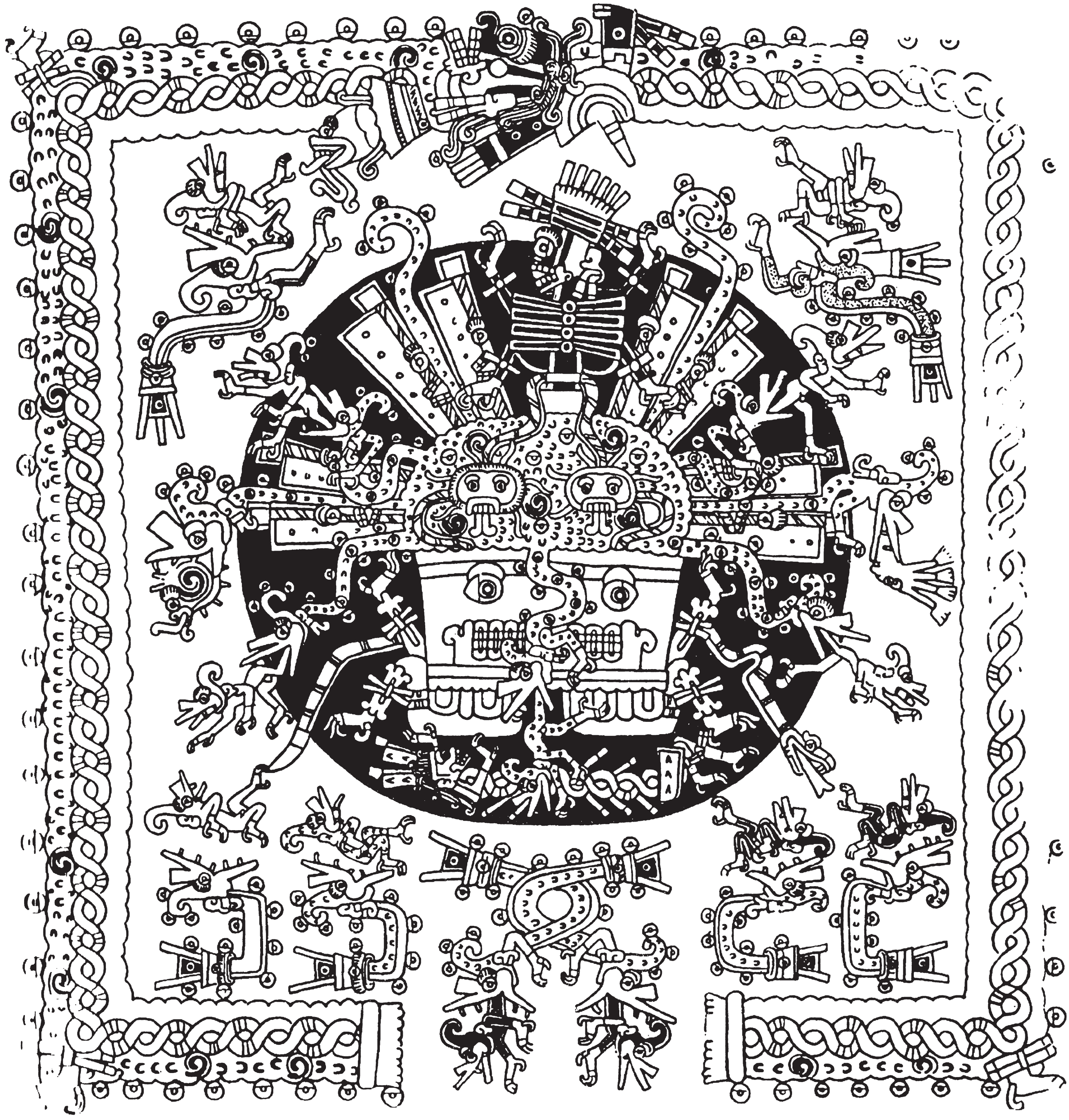


Figure 3 Codex Yoalli Ehecatl (Borgia), p. 29 (Nowotny 1961).

generally accept that the contemporary indigenous calendars with their specific characteristics are continuous from the pre-colonial calendar with the same characteristics. Tedlock in her classic monograph (1982) states on the first page: "*But it is among the Highland Maya rather than among their Lowland cousins that time continues to this day to be calculated and given meaning according to ancient methods*." Thus, our comparison between past and present stages is not aimed at demonstrating that there is a stable continuity between the two, but that – while taking account of principal differences and historical processes – there are recurring patterns, which allow us to follow and understand the indigenous tradition in changing cultural-historical contexts. Of course the comparison between cultural elements of the present (oral traditions) with those of the past (visual art, historical sources) is a critical procedure, which implies that we should examine and take into account the changes and innovations that have occurred. In other words, we have to situate this comparison always in the context of an in-depth study of cultural-historical differences and developments (cf. Lightfoot 1995; Joyce *et al*. 2002).

Today elements of the Mesoamerican calendar still survive among the Nahua, Mixe, Mazatec, Mixtec, Zapotec, K'iché, Ixil, Kanjobal, and several other peoples, precisely in mantic and ritual contexts, associated with traditional healing rituals in the widest sense.[11] Here the ancient calendar is used by "daykeepers", religious specialists who act as traditional healers and mediators in conflicts. They fulfil a crucial role as interpreters of the divine will, which they recognize and read in the names of days and associated deities. Time gives diverse kinds of information to the daykeeper, so he/she can recommend specific ritual treatments. The 260-day count, with its different divisions, is still the basis for their divinatory practices and complex counting-mechanisms, involving the casting of beans and/or crystals, and calendar ceremonies at specific locales in the sacred landscape in and around the villages. In accordance with the four day-signs that can occur as "year bearer", the solar years of 365-days are connected to the four world-directions with their symbols and auguries. The New Year is 'greeted' in a ceremony at one of the four sacred mountaintops that represent those cardinal points. Many of the feasts associated with the ancient calendar have been incorporated into the Christian ritual year.

The Mesoamerican liturgical year (set of rituals in relation to agriculture and astronomy) was overwritten with the Christian calendar of saints and feasts, but remained present in a syncretistic manner as an underlying structure. This process determined the choice of certain Patron Saints and certain feasts as being particularly important. The focal points of the indigenous liturgical cycle became the Days of the Dead (Oct. 31st / Nov. 2nd) and the Day of the Holy Cross (May 3), the first being a family ceremony which to some extent continues the ancient ancestor worship, the second involving a collective ritual for the Rain God. Carnival has taken the place of the five-day period at the end of the year, while the Holy Week coincides with the end of the dry season, when the Maize God – Christ – has died. In this way much of the calendar's cosmological character and ritual function is (often implicitly) maintained. Some aspects of related astronomical lore may still be found (Remington 1977).

The divinatory calendar dictates which date is 'good' and appropriate to do or start a particular petition or heal the body. The starting moment of an illness or a bad dream is very relevant. If somebody falls ill on a day considered not that good, with unfortunate auguries accompanying it, this means that the sickness will be hard to cure or that somebody else having transformed into an animal-companion (*nahual*) may have caused the injuries. The prayer texts associated with the calendar rituals are generally esoteric in character and language, using archaic terms, metaphors and literary forms (parallelism, hendiadys), e.g. 'stick and stone' for punishment or misfortune (fig. 4). The divinatory meaning of a day is often expressed through 'mnemonics', i.e. short expressions that are phonetically similar to or otherwise associated with the day name (Tedlock 1982).

Almost no consultation of the calendar is complete without complex and esoteric divination rituals, such as the casting of maize seeds (Rojas Martínez Gracida 2012). The symbolic categories, used in divination, often correlate with the meanings attributed to dream images. Dreams are connected with time and have complex symbolic implications: they are vehicles to communicate with the Other World, where the elders and owners of nature (hills, rivers, etc.) live, and consequently they may reveal important facts on the health of the dreamer or other specific persons and indicate negative or positive influences on them, as well as contain indications for future actions. The deceased do not disappear from the world of the living and do not stop being social agents: they constantly interact with the living and if they are not kept in mind and respected, they can cause problems (bad luck) or illnesses. If elders that have passed away appear in the dream, it means that they are asking for ritual attention, including prayers, candles and food offerings. Consequently, dreams are very important in Mesoamerican culture, and a main topic of daily family talks. The examination of dreams helps the daykeeper / healer to recommend a proper ritual treatment. Similarly, revelation dreams are a common aspect of the vocation and initiation of ritual specialists (Anders *et al*. 1994; Rojas Martínez Gracida 2012)

The symbols and divine powers are intimately connected to the calendar, that is, to structured and symbolically charged time, contributing to the sense of order and security. The continuous and 'logical' reference to complex external

Figure 4 Left: traditional Mixe altar with offerings today on the sacred mountain Zempoaltepetl (photo: courtesy of Araceli Rojas Martínez Gracida). Right: offerings of bundles of 11 fir needles or flowers, laid out in two rows of 10 and one row of 11 on an altar for a Deity of Light on the day 1 Death, together with burning fire wood, against harm and dangers symbolized by thorns and biting or stinging animals - Codex Tezcatlipoca (Fejérváry-Mayer), p. 5.

data (the calendar and its symbols) as well as to the authority of tradition and world-view, lends a sense of 'objective' value to the message and the vision of the future, removing it from purely subjective guesswork. This is reinforced by the ritual acts and ceremonial speech (cf. fig. 4), which may involve special mnemonics, including phonetic or other associations, as may be observed in several contemporary cases worldwide (cf. Tilley 2000; Zeitlyn 2001; Hatfield 2002; Keane 2004).

Several ritual acts, as well as symbols and metaphors associated with contemporary calendar use, also appear in the ancient manuscripts (cf. Dehouve 2007). These scenes do not reveal the future but the dispositions of unseen powers, and present sets of symbols from which the human mind selects what seems adequate for the situation. In this manner the specialist, making use of his/her profound experience, local knowledge and psychological insights, enables the person who consults him/her to recognize and interpret the different aspects of the situation, and so provides psychological guidance. Analysing the symbolic images together and trying to apply them to the concrete situation, the expert (priest) and the one who seeks council discuss which road to go and may arrive at a shared determination or concrete advice.

Divination usually concludes with a moral message: one should live carefully and attend the superhuman powers with respect, humility and piety, bringing offerings and performing self-sacrifice; all of the recommendations are in accordance with the traditional value system (the "canonical messages" discussed by Rappaport 1999).

Mantic operations should not be seen as 'tricks' in which the expert pretends to know the future, but as valuable shared psychological examinations under the guidance of an expert. Usually they have a profound and positive effect: the application of cultural symbols to interpret and explore the different aspects of a problem may transform a state of anxiety, doubts and affliction into one of reflection and serenity (a state that promotes proper decision-making). The result of this exercise generally is a *katharsis* and a new confidence that the situation is understood and will end well, an inner power and sense of hope, which enables the individual to confront problems and find consolation.

This psychological-social approach takes divination seriously as an important cultural phenomenon, related to the perception and symbolic evaluation of time. As such, it escapes from the discussion about the relationships between magic and science (cf. Curry 2010).

Unfortunately Mesoamerican cultural memory, in particular the remains of religious thought and practice, are rapidly eroding under the influences of discrimination and violence, as well as modernization and globalization. While Catholicism, imposed in the colonial period, has had a negative impact on Mesoamerican religion but also permitted its partial survival in syncretistic forms. However, the more recent introduction of Protestantism has also become a seriously detrimental factor as it strongly condemns traditional ideas and practices. Large-scale migration to the cities and to the U.S. is an element of both disruption and new consciousness (Fox and Rivera-Salgado 2005). Younger generations, very much influenced by modern urban life-styles and media, are often no longer aware of calendar knowledge and its symbolic-ritual dimensions, but, on the other hand, may start a new quest for their origins.

Similarly, the ancient calendar has been discovered by revitalization movements in Guatemala after the period of genocide as a marker of ethnic/cultural identity. The K'iche' calendar, for example is now being reproduced and modelled by cultural revitalization activists all over Guatemala (Paz 1992; Wilson 1999; Frühsorge 2010). In fact, such widespread revitalizations make it difficult to see or uncover original local traditions. Another, more disturbing factor is the hype of popular fascination with the 'Maya calendar' in the context of 'Western' spiritualist-esoteric-tourist movements and sensational fantasies concerning 'the end of the world in 2012'.

All in all, we are now seeing the very last remnants of traditional calendar uses and knowledge. A further more detailed documentation of these endangered traditions and concepts is therefore urgently needed.

7 Theoretical implications

The difference between the Middle American calendar and the European/Christian calendar has been characterized as 'cyclical' vs. 'linear' (reformulated as 'polychrome' vs. 'monochrome'). Although this dichotomy is much too facile (Farriss 1987; Hassig 2001), we adopt these terms here for the sake of brevity. These designations are not mutually exclusive: both calendar systems (and world-views) have cyclical and linear aspects. Middle American tradition focuses on natural forces and rhythms: human activities may be presented in a linear way (e.g. genealogies of rulers), but generally subordinated to the cycles of sacred, cosmic time, which give them quality and meaning. The Christian calendar, although keeping track of seasons and other cyclical aspects, is predominantly structured along an eschatological time-line (*Creation > Birth and Crucifixion of Christ > Last Judgment*). The 'Western' focus on causality in history, and the scientific concept of evolution have further strengthened this linear view. On the other hand, European astrology is quite 'cyclical', which facilitated its incorporation in colonial Mesoamerican culture.

An examination of Mesoamerican stories, story-telling and memory, reveals different structures: linear vs. non-linear, cyclical or multilinear. Linear structures are plot-driven, based on some form of causality, and as such are easily recognized and understood by a 'Western' audience, accustomed since Antiquity to such forms of story-telling, still the dominant practice in Hollywood movies (Bal 1997). Quite a few native accounts do not conform to such an arrangement, however, and may be qualified as 'non-linear'. A similar phenomenon may be observed in contemporary myths and folktales. The Teoamoxtli group contains many examples of cyclical compositions, but also the Codex Yuta Tnoho (Vindobonensis) is not 'plot-driven': instead it presents events in sacred time according to symbolic considerations and spatial cosmovision.

The transformation of the pre-colonial sacred landscape and symbolic universe (new religious norms as well as new economic structures) under Spanish rule called for new ways of identification with the world, informed by an ideational representational system based upon different conceptions of time, landscape, divinity and the self (Gruzinski 1988). Such a context confronts individuals with conflicting realities, and demands creative mental openings for the negotiation of identity (Bhabha 1994). In the contemporary markings of ethnic identity, such as community liturgy (fiestas such as Holy Week, the Patron Saint and the Days of the Dead), we see the social-cultural potential of concepts, actions and texts to provide a narrative cohesion, an identity to groups and individuals. Historical trauma and contemporary processes of modernization, globalization and migration shape and affect these identities, while also offering challenging opportunities (Alexander *et al*. 2004).

The analysis of the identitarian and intercultural dynamics in past and present brings us into the field of postcolonial studies, in particular the deconstructive analysis of Eurocentric representations (e.g. Mason 1991; Shohat and Stam 1996; Loomba 1998). Given the dramatic historical changes and conflicts in the region, "identity" is not to be explored in a reifying or essentializing ("nationalist") sense, but rather from a postmodern perspective (following philosophers such as Deleuze and historians such as Hobsbawm) as a dynamic process of "multiple becomings", a "nomadic" movement, in changing webs of affections and social relations (Braidotti 1994; 2006; Ríos Morales 2011).

Traditionally the pre-colonial world is investigated by archaeologists, the colonial period by (etno-)historians, and the present by anthropologists. This produces a fragmentation of knowledge. Furthermore, the indigenous cultures have often been studied, interpreted, collected and measured according to Western parameters of interest, a circumstance which may include the danger of Eurocentric bias and a lack of structural connections to indigenous agency in the field of education, cultural creativity, defence of rights etc. The situation is now changing. The indigenous peoples, generally living in disadvantaged conditions, victims of outside exploitation, discrimination and social conflicts (see the U.N. report *State of the World's Indigenous Peoples*, 2009) are internationally recognized in I.L.O. convention 169 and the U.N. Declaration of the Rights of Indigenous Peoples (after twenty years of preparatory work, adopted by the U.N. General Assembly in 2007 and also recognized as normative document by the European Union). These documents argue strongly for the respect for and protection of the cultural diversity embodied by the indigenous peoples.

This asks for rethinking methodology, theory and practice in order to create new forms of understanding, dialogue and partnership. Traditional divisions have to be replaced by a truly interdisciplinary approach with a focus on intercultural communication, and a further elaboration of "decolonizing methodology" (Tuhiwai Smith 1999; Denzin *et al*. 2008). This implies a connection of in-depth studies of indigenous languages, cultures, history and religion, with postcolonial theory (cf. Rios Morales 2011) and, first and foremost, the prominent active participation of indigenous experts.

Notes

1 The interpretation of these pictorial manuscripts has been a prominent part of the research I have carried out at the Faculty of Archaeology over the past three decades, together with Gabina Aurora Pérez Jiménez and several PhD candidates. With the support of the Netherlands Organisation for Scientific Research (NWO), we have focused in the past years on surviving Mesoamerican time symbolism and memory, with the participation of Araceli Rojas Martínez Gracida, Caroline Aretz and Søren Wichmann. An Advanced Grant of the European Research Council makes it possible to develop this line of research further in the coming years.

2 It is now generally accepted that the term 'Toltec' not only refers to the archaeological culture associated with Tula (Early Postclassic) but also comprises the earlier, Classic civilization of Teotihuacan. The concept of civilization associated with this Toltec tradition is synthesized in the Aztec term *toltecayotl*.

3 An important Aztec parallel is Codex Cihuacoatl (Borbonicus), which likely comes from Xochimilco and was sent by Aztec nobles to the Spanish king: it is mentioned among the possessions of Phillip II (Anders *et al*. 1991). The three Maya codices (Dresden, Madrid, Paris) have been published in an exemplary manner by Ferdinand Anders at the Akademische Druck- und Verlagsanstalt in Graz, Austria (e.g. Deckert and Anders 1975): his exemplary facsimile editions have been reproduced by others several times. For advances in their interpretation see: Love 1994; Davoust 1997; Schele and Grube 1997; Vail and Aveni 2004; Bricker and Bricker 2011.

4 Most important in this respect are the codices Telleriano-Remensis (Quiñones Keber 1995), Vaticanus A (Anders and Jansen 1996), Tudela (Batalla Rosado 2002), Magliabechi (Anders and Jansen *et al*. 1996) and Ixtlilxochitl (Van Doesburg and Carrera González 1996). For Aztec calendar and divination: see also the explicit information in the work of Sahagún and the analytical study by Hinz 1978.

5 At present this text is topic of PhD research by Ilona Heijnen at Leiden University.

6 As for the Mixtec codices, we have built on the ground breaking work of Alfonso Caso, and followed the orientation of expert teachers such as Wigberto Jiménez Moreno, Mary Elizabeth Smith, Nancy Troike and Emily Rabin. Our work has initiated what has been called the "Dutch school" or "escuela holandesa" in the interpretation of Mexican codices (Oudijk 2008; Batalla Rosado 2008). This term seems unfortunate to us, however, as this line of research started in Vienna, Austria (Ferdinand Anders), and was further developed at Leiden University in cooperation with colleagues from other institutions such as CIESAS in Mexico, the Faculty of Political Sciences of the University in Messina, Italy, and the Abteilung Altamerikanistik of Bonn University, Germany. Consequently this "school", or rather line of research, is not limited to the Dutch environment, nor are all of its practitioners Dutch. More principally, a specific scholarly perspective should not be identified with a nationality. A general designation as "ethno-iconological method" (De la Cruz 2008: 20-21; cf. Jansen 1988) or "postcolonial hermeneutics" (Jansen and Pérez Jiménez 2011) seems more fitting. Examples of applications to Native American religion are the dissertations of Loo (1987), López García (2007), Witter (2011), Ríos Morales (2011), Rojas Martínez Gracida (2012), which all concern Mesoamerica, and – focusing on the Yukon First Nations' art in Canada – Van Kampen (2012).

7 For the Mixtec use of *difrasismos* see López García 2007 and Jansen and Pérez Jiménez 2009.

8 "Although I do explain the iconography and mantic properties of a number of almanacs in some detail, readers should consult Seler as well as Anders *et al*. for the details of other almanacs, passages, and supernaturals." (Boone 2007, 10).

9 "In synthesis, our position in interpreting the Borgia Group is generally in accordance with the current of Nowotny, developed with more amplitude by Ferdinand Anders and Maarten Jansen, although we will not hesitate to include the opinions of other authors and our own when we believe this is convenient." (Batalla Rosado 2008, 268, my translation).

10 In a paper for the AHILA conference in Leiden, Mikulska (2009) elaborated upon the use of metaphors in pictorial writing. The topic was also discussed in several papers presented at a conference at Louvain-la-Neuve, edited by Sylvie Peperstraete (2009).

11 Nahua: Stresser-Péan 2005. Mixe: Weitlaner Johnson and Weitlaner 1963; Miller 1966; Lipp 1991; Duinmeijer1996; Rojas Martínez Gracida 2012. Mazatec: Weitlaner and Weitlaner 1946; Van Doesburg and Carrera González 1996. Chinantec: Weitlaner 1936. Mixtec: Van Liere and Schuth 2001. Zapotec: Van Meer 1990. K'iché: Tedlock 1982; Molesky-Poz 2006; Hart 2008. Kaqchikel: Maxwell and Hill 2006; Scott 2009. Q'eqch'i: Wilson 1999. Ixil: Colby and Colby 1981. Kanjobal: LaFarge and Byers 1931; Hinz 1990; Deuss 2007. Mam, Popti and Chuj: LaFarge 1947; Oakes 1951.

References

Alexander, J.C., R. Eyerman, B. Giesen, N.J. Smelser and P. Sztompka 2004. *Cultural Trauma and Collective Identity*, Berkeley.

Anders, F. 1967. *Wort- und Sachregister zu Eduard Seler, Gesammelte Abhandlungen zur Amerikanischen Sprach- und Altertumskunde*, Graz (ADEVA).

Anders, F. and M.E.R.G.N. Jansen 1986. *Altmexiko: Mexikanische Zauberfiguren, Alte Handschriften beginnen zu sprechen*, Linz (Katalog zur Ausstelling, Stadtmuseum Linz-Nordico).

Anders, F. and M.E.R.G.N. Jansen 1993. *El Manual del Adivino*. *Libro explicativo del llamado Códice Vaticano B,* Mexico (Fondo de Cultura Económica).

Anders, F. and M.E.R.G.N. Jansen 1994. *Pintura de la Muerte y de los Destinos*. *Libro explicativo del llamado Códice Laud,* Mexico (Fondo de Cultura Económica).

Anders, F. and M.E.R.G.N. Jansen 1996. *Religión, Costumbres e Historia de los Antiguos Mexicanos*. *Libro explicativo del llamado Códice Vaticano A (Códice Vaticano 3738)*, Mexico (Fondo de Cultura Económica).

Anders, F. and M.E.R.G.N. Jansen, with contributions by J. Davilar and A. van 't Hooft 1996. *Libro de la Vida*. *Texto explicativo del llamado Códice Magliabechiano*, Mexico (Fondo de Cultura Económica).

Anders, F., M.E.R.G.N. Jansen and G.A. Pérez Jiménez 1994. *El Libro de Tezcatlipoca, Señor del Tiempo*. *Libro explicativo del llamado Códice Fejérváry-Mayer,* Mexico (Fondo de Cultura Económica).

Anders, F., M.E.R.G.N. Jansen and L. Reyes García 1991. *El Libro del Ciuacoatl*. *Homenaje para el año del Fuego Nuevo*. *Libro explicativo del llamado Códice Borbónico,* Mexico (Fondo de Cultura Económica).

Anders, F., M.E.R.G.N. Jansen and L. Reyes García 1993. *Los Templos del Cielo y de la Oscuridad: Oráculos y Liturgia*. *Libro explicativo del llamado Códice Borgia,* Mexico (Fondo de Cultura Económica).

Anders, F., M.E.R.G.N. Jansen and P.L. Van der Loo 1994. *Calendario de Pronósticos y Ofrendas*. *Libro explicativo del llamado Códice Cospi*, Mexico (Fondo de Cultura Económica).

Aveni, A. 2002. *Empires of Time*. *Calendars, Clocks and Cultures*, University Press Colorado.

Bal, M. 1997. *Narratology: introduction to the theory of narrative*, University of Toronto Press.

Batalla Rosado, J.J. 2002. *Códice Tudela*, Madrid (Ministerio de Educación, Cultura y Deportes).

Batalla Rosado, J.J. 2008. *Codex Borgia*, Madrid (Testimonio Compañía Editorial).

Berdan, F. 2009. Mesoamerican Ethnohistory. *Ancient Mesoamerica* 20, 211-215.

Bhabha, H. 1994. *The Location of Culture*, London (Routledge).

Biedermann, H. 1989. *Jade, Gold und Quetzalfedern*. *Altmexikos bedeutendstes Vermächtnis – Der Codex Borgia*, Graz (ADEVA).

Bonfil Batalla, G. 1996. *México Profundo*. *Reclaiming a Civilization*, Austin (University of Texas Press).

Boone, E.H. 2000. *Stories in Red and Black*. *Pictorial histories of the Aztecs and Mixtecs*, *Stories in Red and Black*. *Pictorial histories of the Aztecs and Mixtecs*, Austin (University of Texas Press).

Boone, E.H. 2007. *Cycles of Time and Meaning in the Mexican Books of Fate*, Austin (University of Texas Press).

Braidotti, R. 1994. *Nomadic Subjects,* New York (Columbia University Press).

Braidotti, R. 2006. *Transpositions: on Nomadic Ethics*. Cambridge (Polity Press).

Bricker, H.M. and V.R. Bricker 2011. *Astronomy in the Maya Codices*. Memoirs of the American Philosophical Society, Vol. 65.

Burke, P. 2009. *Cultural Hybridity*. Cambridge (Polity Press).

Burkhart, L.M. 1989. *The Slippery Earth: Nahua-Christian Moral Dialogue in Sixteenth-Century Mexico,* Tucson (University of Arizona Press).

Campbell, J.K., M. O'Rourke and H.S. Silverstein (eds) 2010. *Time and Identity*, Cambridge Mass. (MIT Press).

Caso, A. 1967. *Los Calendarios Prehispánicos*. Mexico (UNAM).

Cohn, N. 2001. *Europe's Inner Demons*, University Chicago Press.

Colby, B.N. and L.M. Colby 1981. *The daykeeper,* Cambridge Mass. (Harvard University Press).

Curcio-Nagy, L.A. 2004. *The great festivals of colonial Mexico City: performing power and identity*, Albuquerque (University New Mexico Press).

Curry, P. (ed.) 2010. *Divination*. *Perspectives for a New Millennium*, Ashgate.

Davoust, M. 1997. *Un nouveau commentaire du Codex de Dresde*. Paris (CNRS).

De la Cruz, V. 2008. *Mapas genealógicos del Istmo oaxaqueño*. Oaxaca (Colección Diálogos).

Deckert, H. and F. Anders 1975. *Codex Dresdensis*, Graz (ADEVA).

Dehouve, D. 2007. *Offrandes et sacrifice en Mésoamérique*. Paris (Riveneuve).

Denzin, N.K., Y.S. Lincoln and L. Tuhiwai Smith (eds) 2008. *Handbook of Critical and Indigenous Methodologies*, Los Angeles / London / New Delhi / Singapore (Sage Publications).

Deuss, K. 2007. *Shamans, Witches and Maya Priests,* London (The Guatemalan Maya Centre).

Dorson, R.M. 1955. The Eclipse of Solar Mythology. *Journal of American Folklore* 68, 393-416.

Duinmeijer, R. 1996. *Ayuuk ja'ayët jëts xyëbë ye'eby: de Mixe kalender van Oaxaca, Mexico*. Leiden University (unpublished MA thesis).

Evans, S.T. 2008. *Ancient Mexico and Central America. Archaeology and Culture History*, London (Thames & Hudson).

Fábrega, J.L. 1899. Interpretación del Códice Borgiano. *Anales del Museo Nacional de México 5, 1-260.*

Fabian, J. 1983. *Time and the Other,* New York (Columbia University Press).

Farriss, N. 1987. Remembering the Future, Anticipating the Past: History, Time and Cosmology among the Maya of Yucatan. *Comparative Studies in Society and History* 29, 566-593.

Fox, J. and G. Rivera-Salgado 2005. *Indigenous Mexican Migration in the United States*, San Diego (University of California).

Freidel, D., L. Schele and J. Parker 1993. *Maya Cosmos*, New York (Morrow).

Frühsorge, L. 2010. *Archäologisches Kulturerbe, lokale Erinnerungskultur und jugendliches Geschichtsbewusstsein bei den Maya*, Hamburg (Schriften Zur Kulturwissenschaft, 87).

Gell, A. 1992. *The Anthropology of Time*, Oxford (Berg).

Ginzburg, C. 1989. *Storia notturna: Una decifrazione del Sabba*, Einaudi.

Gruzinski, S. 1988. *La colonisation de l'imaginaire. Sociétés indigènes et occidentalisation dans le Mexique espagnol XVe-XVIIIe siècle*, Paris (Éditions Gallimard).

Gudykunst, W.B. (ed.) 2005. *Theorizing about intercultural communication*, Sage Publications.

Hart, T. 2008. *The Ancient Spirituality of the Modern Maya*, Albuquerque (University New Mexico Press).

Hassig, R. 2001. *Time, History and Belief in Aztec and Colonial Mexico*, Austin (University Texas Press).

Hatfield, D.J. 2002. Fate in the narrativity and experience of selfhood, a case from Taiwanese chhiam divination. *American Ethnologist* 29 (4), 857-877.

Hinz, E. 1978. *Analyse aztekischer Gedankensysteme*, Wiesbaden (Franz Steiner Verlag).

Hinz, E. 1990. *Misstrauen führt zum Tod,* Wayasbah Verlag.

Ingham, J.M. 1986. *Mary, Michael & Lucifer*, Austin (University of Texas Press).

Ingold, T. 2000. *The Perception of the Environment*, London / New York (Routledge).

Ixtlilxochitl, F. 1975/77. *Obras Históricas* (2 vols.), Mexico (UNAM).

James, W. and D. Mills 2005. *The Qualities of Time. Anthropological approaches*, Oxford / New York (Berg).

Jansen, M.E.R.G.N. 1988. The Art of Writing in Ancient Mexico: an ethno-iconological perspective. *Visible Religion* VI, 86-113. Leiden (E.J. Brill).

Jansen, M.E.R.G.N. 1998. La Fuerza de los Cuatro Vientos. Los manuscritos 20 y 21 del Fonds Mexicain. *Journal de la Société des Américanistes* 84 (2), 125-161. Paris.

Jansen, M.E.R.G.N. 1999. Los fundamentos para una 'lectura lírica' de los códices. *Estudios de Cultura Náhuatl* 30, 165-181. Mexico (UNAM).

Jansen, M.E.R.G.N. and G.A. Pérez Jiménez 2004. Renaming the Mexican Codices, *Ancient Mesoamerica* 15, 267-271. Cambridge University Press.

Jansen, M.E.R.G.N. and G.A. Pérez Jiménez 2009. *La Lengua Señorial de Ñuu Dzaui. Cultura literaria de los antiguos reinos y transformación colonial,* Mexico (Colegio Superior para la Educación Integral Intercultural de Oaxaca & Gobierno del Estado de Oaxaca & Yuu Núú A.C.).

Jansen, M.E.R.G.N. and G.A. Pérez Jiménez 2011. *The Mixtec Pictorial Manuscripts. Time, Agency and Memory in Ancient Mexico*, Leiden / Boston (E.J. Brill).

Joyce, R.A. *et al.* 2002. *The Languages of Archaeology*, Oxford (Blackwell Publishers).

Keane, W. 2004. Language and Religion. In: A. Duranti (ed.), *A Companion to Linguistic Anthropology*, Oxford (Blackwell), 431-448.

Klein, C.F. 1988. Rethinking Cihuacoatl: azteca Political Imagery of the Conquered Woman. In: J.K. Josserand and K. Dakin (eds), *Smoke and Mist: Mesoamerican Studies in Memory of Thelma D. Sullivan* (Part I, 237-277. Oxford (BAR IS 40.).

Klein, C.F. 2000. The Devil and the Skirt: An Iconographic Inquiry into the Prehispanic Nature of the Tzitzimime. *Estudios de Cultura Nahuatl* 31, 17-74.

LaFarge, O. 1947. *Santa Eulalia,* University Chicago Press.

LaFarge, O. and D. Byers 1997 [1931] *El Pueblo del Cargador del Año*, Guatemala (CIRMA).

Laurencich Minelli, L. 1992. *Calendario y Rituali precolombiani: Codice Cospi*, Milan (. Jaca Book).

León-Portilla, M. 2005. *El Tonalámatl de los Pochtecas (Códice Fejérváry-Mayer)*, Mexico (Arqueología Mexicana, edición especial 18).

Lightfoot, K.G. 1995. Culture Contact Studies: redefining the relationship between prehistoric and historical archaeology. *American Antiquity* 60 (2), 199-217.

Lipp, F.J. 1991. *The Mixe of Oaxaca : religion, ritual, and healing*, Austin (University Texas Press).

Loo, P.L. 1987. *Códices, Costumbres y Continuidad*, Leiden University (Ph.D. dissertation).

Loomba, A. 1998. *Colonialism / Postcolonialism*, London / New York (Routledge).

López Austin, A. 1990. *Los mitos del tlacuache*, Mexico (Alianza Editorial).

López Austin, A. 1994. *Tamoanchan y Tlalocan*, Mexico (Fondo de Cultura Económica).

López García, U. 2007. *Sa'vi. Discursos ceremoniales de Yutsa To'on (Apoala)*. Leiden University (PhD thesis).

Love, B. 1994. *The Paris Codex. Handbook for a Maya Priest*, Austin (University Texas Press).

Mason, P. 1991. *Deconstructing America. Representations of the Other*, London / New York (Routledge).

Maxwell, J. and R.M. Hill 2006. *Kaqchikel Chronicles*, Austin (University of Texas Press).

Mikulska-Dąbrowska, K. 2008. *El Lenguaje Enmascarado*, Mexico (UNAM).

Miles, S.W. 1952. An analysis of modern Middle American calendars. *Actas del XXIX Congreso Internacional de Americanistas*: 273-284.

Miller, W.S. 1966. El tonalamatl mixe y los hongos sagrados. In: A. Pompa y Pompa (ed.), *Summa Anthropológica, en homenaje a Roberto J. Weitlaner*, Mexico (INAH), 317-328.

Molesky-Poz, J. 2006. *Contemporary Maya Spirituality*, Austin (University of Texas Press).

Munn, N.D. 1992. The Cultural Anthropology of Time. *Ann. Review of Anthropology* 21, 93-123.

Nowotny, H. 1994. *Time: The Modern and Postmodern Experience*. Cambridge (Polity Press).

Nowotny, K.A. 1959. Die Hieroglyphen des Codex Mendoza: der Bau einer mittelamerikanischen Wortschrift. *Mitteilungen Museum für Völkerkunde und Vorgeschichte Hamburg*, XXV, 97-113.

Nowotny, K.A. 1961. *Tlacuilolli, die mexikanischen Bilderhandschriften, Stil und Inhalt, mit einem Katalog der Codex Borgia Gruppe*, Berlin (Gebr. Mann). English translation: 2005. *Tlacuilolli: Style and Contents of the Mexican Pictorial Manuscripts with a Catalog of the Borgia Group*, Norman (University of Oklahoma Press).

Nowotny, K.A. 1976. *Codex Borgia*, Graz (ADEVA).

Oakes, M. 1951. *Two Crosses of Todos Santos. Survivals of Mayan Religious Ritual*, New York (Pantheon Books).

Orlove, B.S. 2004. Identity, Temporality and Moral Geographies. *Current Anthropology* 45.

Oudijk, M.R. 2008. De tradiciones y métodos: investigaciones pictográficas. *Desacatos* 27, 123-138.

Ouweneel, A. 2005. *The Flight of the Shepherd*, Amsterdam (Aksant).

Paz, M.A. de 1992. *Calendario Maya. El camino infinito del tiempo*, Guatemala.

Quiñones Keber, E. 1995. *Codex Telleriano-Remensis*, Austin (University Texas Press).

Rappaport, R.A. 1999. *Ritual and Religion in the Making of Humanity*, Cambridge University Press.

Remington, J.A. 1977. Current Astronomical Practices among the Maya. In: A.F. Aveni (ed.), *Native American Astronomy*, Austin / London (University of Texas Press), 75-88.

Reyes García, L. 1997. *Matrícula de Tributos o Códice de Moctezuma*, Mexico (Fondo de Cultura Económica).

Ricoeur, P. 1984 / 1985/ 1988. *Time and Narrative*, 3 vols, University of Chicago Press.

Rios Morales, M. 2011. *Béné Wha Lhall, Béné Lo Ya'a. Identidad y Etnicidad en la Sierra Norte Zapoteca de Oaxaca,* Leiden University (PhD thesis).

Rojas Martínez Gracida, A. 2012. *El Tiempo y la Sabiduría en Poxoyëm. Un calendario sagrado entre los ayook de Oaxaca*, Leiden University (PhD thesis).

Sahagún, B. de 1950/78. *Florentine Codex*, Santa Fe (The School of American Research).

Samovar, L.A., R.E. Porter and E.R. McDaniel 2009. *Communication between cultures*, Boston (Wadsworth).

Schele, L. and N. Grube 1997. *Notebook for the XXI Maya Hieroglyphic Workshop at Texas: The Dresden Codex*, Austin (University of Texas).

Schultze Jena, L. 1933/38. *Indiana* (3 vols), Jena (Gustav Fischer).

Scott, A.R. 2009. *Communicating with the sacred earthscape*, Austin (University of Texas Press).

Seler, E. 1904/09. *Codex Borgia. Eine altmexikanische Bilderschrift der Bibliothek der Congregatio de Propaganda Fide* (3 vols). Berlin. Spanish translation: 1963 as *Comentarios al Códice Borgia.*, Mexico (Fondo de Cultura Económica).

Shohat, E. and R. Stam 1996. *Unthinking Eurocentrism*, London / New York (Routledge).

Simonin, M. 1998. *Manuscrit Aubin No. 20*, Villeneuve d'Ascq (Presses Universitaires du Septentrion).

Stresser-Péan, G. 2005. *Le soleil-dieu et le Christ*, Paris (L'Harmattan).

Tedlock, B. 1982. *Time and the Highland Maya*, Albuquerque (University of New Mexico Press).

Tilley, C. 2000. *Metaphor and Material Culture*, Oxford (Blackwell).

Tuhiwai Smith, L. 1999. *Decolonizing Methodologies,* London / New York (Zed Books).

Turner, V. 1990 (1974). *Dramas, Fields and Metaphors*, Ithaka / London (Cornell University Press).

U.N. report 2009. *State of the World's Indigenous Peoples*, New York (United Nations publication).

Vail, G. and A. Aveni 2004. *The Madrid Codex,* University Press Colorado.

Van Doesburg, G.B. 2001. *Códices Cuicatecos. Porfirio Díaz y Fernández Leal*, Mexico (Miguel Angel Porrúa & Gobierno del Estado de Oaxaca).

Van Doesburg, G.B. and F. Carrera González 1996. *Códice Ixtlilxochitl: Apuntaciones y pinturas de un historiador*, Mexico (Fondo de Cultura Económica).

Van Kampen, U. 2012. *History of Yukon First Nations Art*. Leiden University (PhD thesis).

Van Liere, C. and M. Schuth 2001. *Savi Kutu, Savi Kuika,* Leiden University (unpublished MA thesis).

Van Meer, R. 1990. *Xub Xa Wiz*. Leiden University (unpublished MA thesis).

Weitlaner, I. 1936. A Chinantec Calendar. *American Anthropologist* 38, 197-201.

Weitlaner R.J. and I. Weitlaner 1946. The Mazatec Calendar. *American Antiquity* 11(3), 194-197.

Weitlaner Johnson, I. and R.J. Weitlaner 1963 Nuevas versiones sobre calendarios mijes. *Revista Mexicana de Estudios Antropológicos* XIX, 47-77. México.

Wilson, R. 1999. *Maya Resurgence in Guatemala*, Norman (University of Oklahoma Press).

Witter, H.-J. 2011. *Die gefiederte Schlange und Christus: eine religionshistorische Studie zum mixtekisch-christlichen Synkretismus*, Leiden University (PhD thesis).

Wood, S. 2003. *Transcending Conquest. Nahua views of Spanish Colonial Mexico*, Norman (University of Oklahoma Press).

Zerubavel, E. 2004. *Time Maps: Collective Memory and the Social Shape of the Past*. University of Chicago Press.

Zeitlyn, D. 2001. Finding Meaning in the Text: the process of interpretation in text-based divination. *The Journal of the Royal Anthropological Institute* 7 (2), 225-240.

Maarten E.R.G.N. Jansen
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
m.e.r.g.n.jansen@arch.leidenuniv.nl

Structuring the landscape in Iron Age and Roman Period (500 BC – AD 250): the multi-period site Oss-Horzak

Richard Jansen and Stijn van As

During the Iron Age and the Early and Middle Roman Period the cover-sand plateau of the micro-region Oss (North-Brabant, the Netherlands) became densely settled. Extensive excavations enable us to see how in this period farmers transformed the natural forested environment into a vastly structured so-called cultural landscape. Based on the results of the recently excavated multi-period site of Oss-Horzak we want to discuss how in the Late Iron Age and Roman Period (500 BC – AD 250) the (local) landscape in the Oss-region becomes increasingly structured.

The initial and 'gradual' transformations in the (Late) Iron Age and Early Roman Period are interrupted at the end of the 1th century cal AD when the structuring of the landscape seems to accelerate, encouraged by the Roman administration. Large parts of the landscape are (re-)structured in such a way that we can call it an orchestrated land consolidation or reparcelling. This development took place in large parts of the Meuse-Demer-Scheldt-area as well as in the Central River Area and the Western Netherlands.

1 Oss-Horzak: excavating the 'local' landscape

1.1 The research area Oss

The site of Oss-Horzak is situated at the northern edge of a large cover-sand plateau, close to the clay area of the Maaskant, which lies in the north-eastern corner of the province of North-Brabant (fig. 1). Nowadays the river Meuse runs a few kilometres north of Horzak, though in the Iron Age and Roman Period the river flowed further to the south, approximately 800 m north of Horzak. A remnant of this fossil river course is still present in the landscape (fig 1: Ossermeer).

The Oss-region is an area with an extensive history of archaeological research. Since the first rescue excavations were carried out in 1974 at Oss-IJsselstraat (Wesselingh 1993), this region was 'adopted' by archaeologists from Leiden University when the excavations became integrated into the Maaskant Project (Van der Sanden 1988; Fokkens 1996). From the start the project focused on the long-term developments of farming economy, social structures and hierarchies, ideology and burial ritual, settlement systems and, later on, the perception of the (cultural) landscape. All are studied diachronically from the Late Neolithic through the Roman Period, both within the study area and in relation to the wider region of the Southern Netherlands and Northern Belgium (Fokkens 1996; Wesselingh 2000, 3-7).

Due to continuous estate developments hitherto almost 70 hectares have been excavated, including settlements, burial sites, cult places, field systems and activity-areas, dating from the late Neolithic until the Middle Ages (fig. 1). More than three decades of research (1976-2008) by the Faculty of Archaeology of Leiden University makes this area one of the most intensively researched regions in the Netherlands, providing a sound basis for models about, in this case, the way in which farming communities structured the (local) landscape in Late Prehistory and Roman Period.

1.2 Habitation history of Oss-Horzak

The excavations in the research area Oss-Horzak lasted from 1998 until 2008, during which an area of *c*. 12 ha was excavated, bringing to light traces of settlements, cemeteries, activity areas and field systems dating between the Early Bronze Age and the Middle Ages (Jansen and Fokkens 2002; Jansen in prep.).

The oldest features date to the Early Bronze Age (2000-1800 BC): two small pits with Early Bronze Age pottery and a ring ditch that can be associated with one of the pits. From the Middle Bronze Age period (1800-1050 BC), a cluster of postholes and pits and some dispersed pits were found. For the Late Bronze Age (1050-800 BC), again a few pits and a house plan are known (fig. 2). It is likely that these features formed the first gradual but persistent reclamation of the sandy soils of the cover sand area north of Oss (Bakels 2002; Jansen and Arnoldussen 2007). From this point onwards, the habitation and exploitation of the region would intensify.

Dozens of house plans from the Iron Age have been revealed at Oss-Horzak (800-19 BC). Because the excavated area forms only a small part of a much larger (probably) continuously habituated territory, the plans represent contemporaneous or successive 'snapshots' of the discontinuous Bronze and Iron Age habitation history of the researched area. In addition to the house plans, dozens of other elements known from Bronze and Iron Age settlements were found: pits, small granaries, wells and ditches. A remarkable system

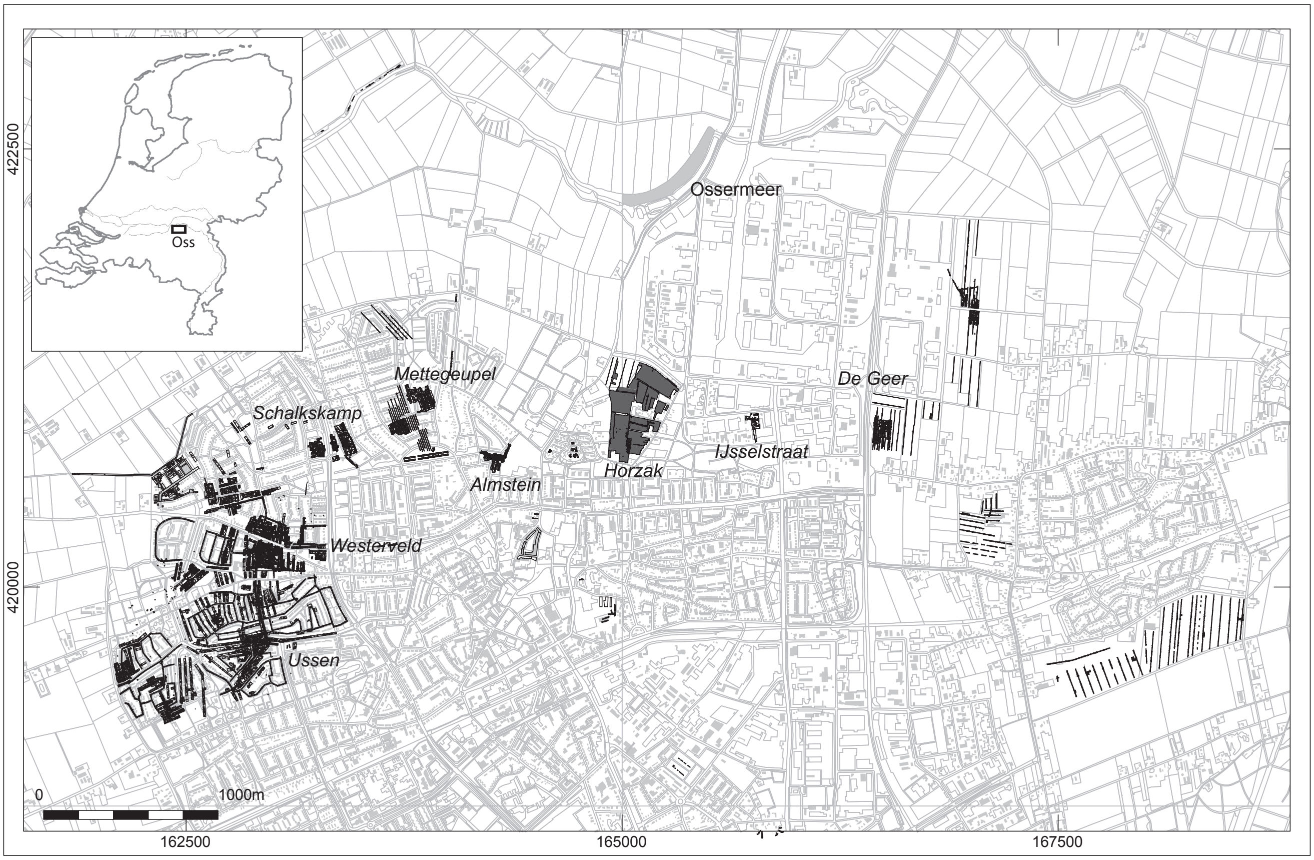


Figure 1 Location of the Oss-region in the Netherlands and an overview of all excavations carried out in Oss until 2008 (Faculty of Archaeology Leiden University, graphics S. van As).

of two parallel ditches with significant measurements dates to the Late Iron Age. The roughly linear ditches 'cut' through the landscape from east to west over a length of *c*. 380 m (Van As 2008). At the same time, besides solitary farmsteads, a small nucleation of Late Iron Age farmhouses occurs south of the ditches (Van As 2008; Jansen in prep.).

The Early and Middle Roman Period is noticeably the most prominent period, represented by a cemetery and dozens of houses including a rectangular enclosed settlement. In this period the settlement develops from loosely structured farmhouses, surrounded by a large irregular ditch system, to a smaller rectangular enclosed settlement. The rectangular ditch system appears to have been laid out in the second half of the first century AD without giving much attention to the previously existing structured landscape (Pruysen 2007; Jansen in prep.). To the west of the enclosed settlement lay similar orientated ditches belonging to a field system. At the end of the 2nd / beginning of the 3rd century AD the settlement was abandoned, like most known settlements in the Southern Netherlands (Wesselingh 2000; Heeren 2009).

Only centuries later does the Horzak-area becomes inhabited once again. At least two farmsteads dating to 13th-15th century AD were excavated, situated along one of the arterial roads of the nearby medieval city of Oss.

Besides a long-term analysis of farmstead and settlement, the excavation of Oss-Horzak provides ample opportunities for an analysis of what is here referred to as the *local landscape*, the environment within the 'direct' surroundings of farmstead(s) and/or settlement(s), assumingly the location of daily activities, including associated structures. In this article we will discuss, based on the results of Oss-Horzak, the structuring of farmyard, settlement and (local) landscape between *c*. 500 BC – AD 250, starting with the Middle Iron Age.

2 Structuring the landscape in the Iron Age

2.1 Middle Iron Age

The Iron Age is generally characterized by a dynamic settlement system in which one or more individual farmsteads were regularly relocated within a settlement territory. Farms

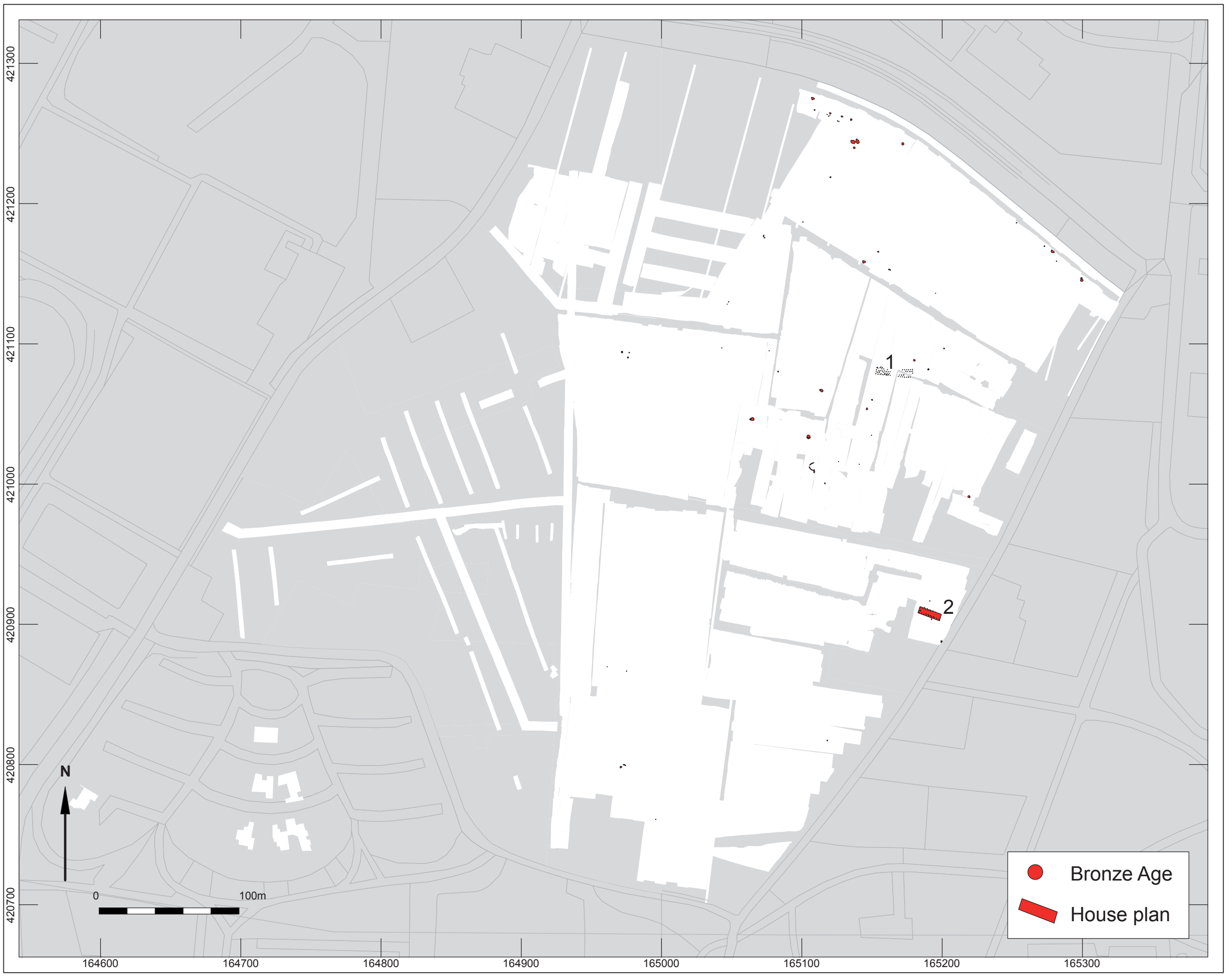


Figure 2 Oss-Horzak; features from the Early, Middle and Late Bronze Ages (2000-800 BC). 1 Possible structure Early Bronze Age, 2 House plan Late Bronze Age (Faculty of Archaeology Leiden University, graphics S. van As).

appear to have been built on the same yard only incidentally and therefore settlements comprise of a loose aggregation of a small group of such farms (Schinkel 1998, 25-27).[1]

The Horzak site shows a similar picture. During the first five centuries of the Iron Age habitation, the dispersed farmsteads and settlements do not seem to have clear (physical) boundaries (fig. 3). In general, due to its dynamics, both seem to have an open character, gradually 'flowing' into the environment.

The structuring of the local landscape in the Early and Middle Iron Age seems to be minimal as well. At Horzak, but also in other excavations in Oss, indicators like fences, pits and/or ditches are scarce. Drinking pools seem to be the most frequent element in the surroundings of the settlement, with the earliest examples dating to the Middle Bronze Age (Oss-Mettegeupel: Jansen *et al.* in prep.). Occasionally, and in some cases connected with drinking pools, lightly founded fences were found. They probably had multiple functions within the settlement and (local) landscape, like the alignments which are frequently found at Bronze Age settlements in the Dutch river area (Arnoldussen 2008, 251-252).

A Middle Iron Age non-settlement relict found at Oss-Horzak is an activity area with granaries, clusters of pits, the functions of which so far are unknown, and a corral where livestock could drink from a pool, enclosed by ditches (fig. 4). A more rectangular ditch system was constructed just outside the corral's boundary, arranging a larger area. To the north lay some contemporary granaries, emphasizing the

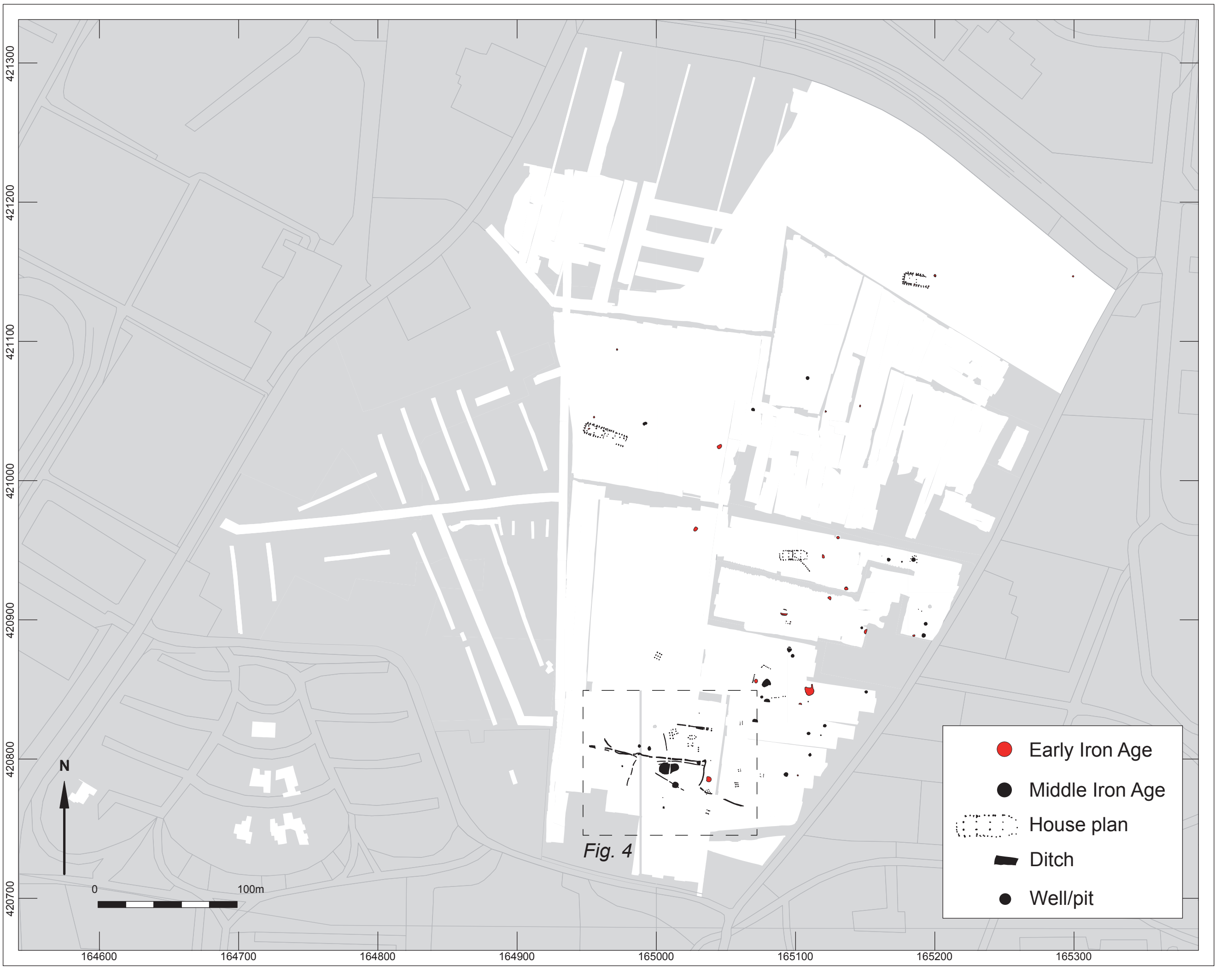


Figure 3 Oss-Horzak; structures from the Early and Middle Iron Ages (800-250 BC) (Faculty of Archaeology Leiden University, graphics S. van As).

functional structuring of the area (Van der Linde 2007, 62-68; Van As 2010, 89). Although no contemporary houses were recognized in the excavated area, it is assumed here that this structured local landscape lies in the direct vicinity of one or more farmsteads. Structures like these are scarce. A possible parallel was found in Loon op Zand-Kraanvensche Heide. Here an enclosed area with ditches, directly north of a few Early Iron Age house plans, is interpreted as a corral, although an interpretation as cult place is not excluded (Roymans and Hiddink 1991).

The structuring of the supra-local landscape in the Iron Age in the Oss-region shows a segregated location of settlements and cemeteries. At Oss-Ussen for centuries a large area was exclusively used as a burial and ritual ground (Van der Sanden 1998) (fig. 5). All Iron Age farmsteads lay outside this ancestral barrow landscape, implying that it was respected for a long time, even until the Early Roman Period. A comparable structuring of the landscape with a static cemetery and a dynamic settlement system has also been established elsewhere in the Southern Netherlands, for instance Someren-Waterdael and Breda, and can also be expected in the Oss-Horzak region (Someren: Kortlang 1999; Breda: Berkvens and Kooistra 2004).

2.2 *Late Iron Age*

In the first half of the Late Iron Age little has changed. Still hardly any differentiation can be perceived in the house plans that have been found at Oss-Horzak. From approximately

Figure 4 Oss-Horzak; structuring of the local landscape in the Middle Iron Age with a corral surrounded by ditches, granaries and clusters of pits. Red dot indicates location of features (Faculty of Archaeology Leiden University, graphics S. van As).

150 BC on differences become apparent with the rebuilding of houses on the same yard and the clustering of houses (Jansen in prep.; Van As 2010) (fig. 6).

Differences in size and layout are visible between the different Late Iron Age settlements of Oss. At Oss-Schalkskamp and -Almstein (parts of) ditches were found bounding the settlement (Almstein: Fokkens *et al.* in prep. a; Schalkskamp: Wesselingh 2000, 172-182). The nucleation of Late Iron Age settlements occurs in large parts of the southern Netherlands (Gerritsen 2003; Arnoldussen and Jansen 2011), with other examples at for instance Haps (Verwers 1972) and Beegden (Roymans 1988).

At the same time the structuring of the local landscape also increases in the Late Iron Age. A remarkable feature has been found at Oss-Horzak (Van As 2010; Jansen in prep.): two 380 m long rectilinear, parallel and profound ditches appear 'within' the Late Iron Age landscape.[2] The orientation is slightly east-north-east – west-south-west, with no obvious split ups, no major curves and no entrances found so far. At the western end the ditches end abruptly, closing in at each other with a large pit in the remaining opening (Pruysen and Van As 2012). Between both ditches, with an average distance of 4 to 5 m, a bank could have been erected. At different locations in the ditches, large complexes of sherds have been found dating to the Late Iron Age, phase I-K (c. 250 - 75 BC) (fig. 7).[3]

Although the function is so far unknown, it is obvious that the digging of the ditches required a lot of time and energy

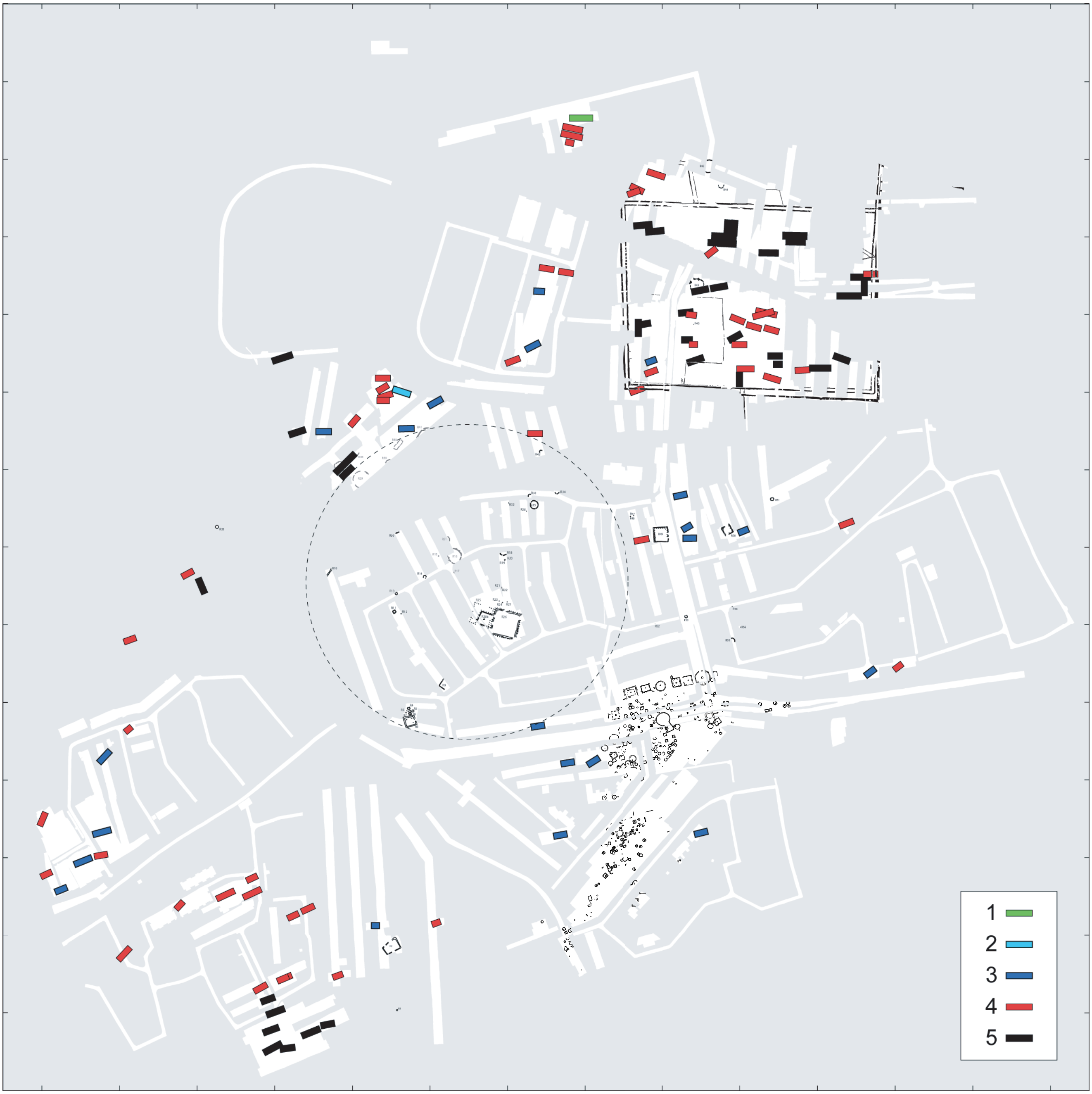


Figure 5 Oss-Ussen; an Early and Middle Iron Age cemetery and ritual area as a focal point in the Iron Age and even the Early Roman period landscape. 1 Bronze Age; 2 Early Iron Age; 3 Middle Iron Age; 4 Late Iron Age; 5 Roman Period (Faculty of Archaeology Leiden University, after Schinkel 1998).

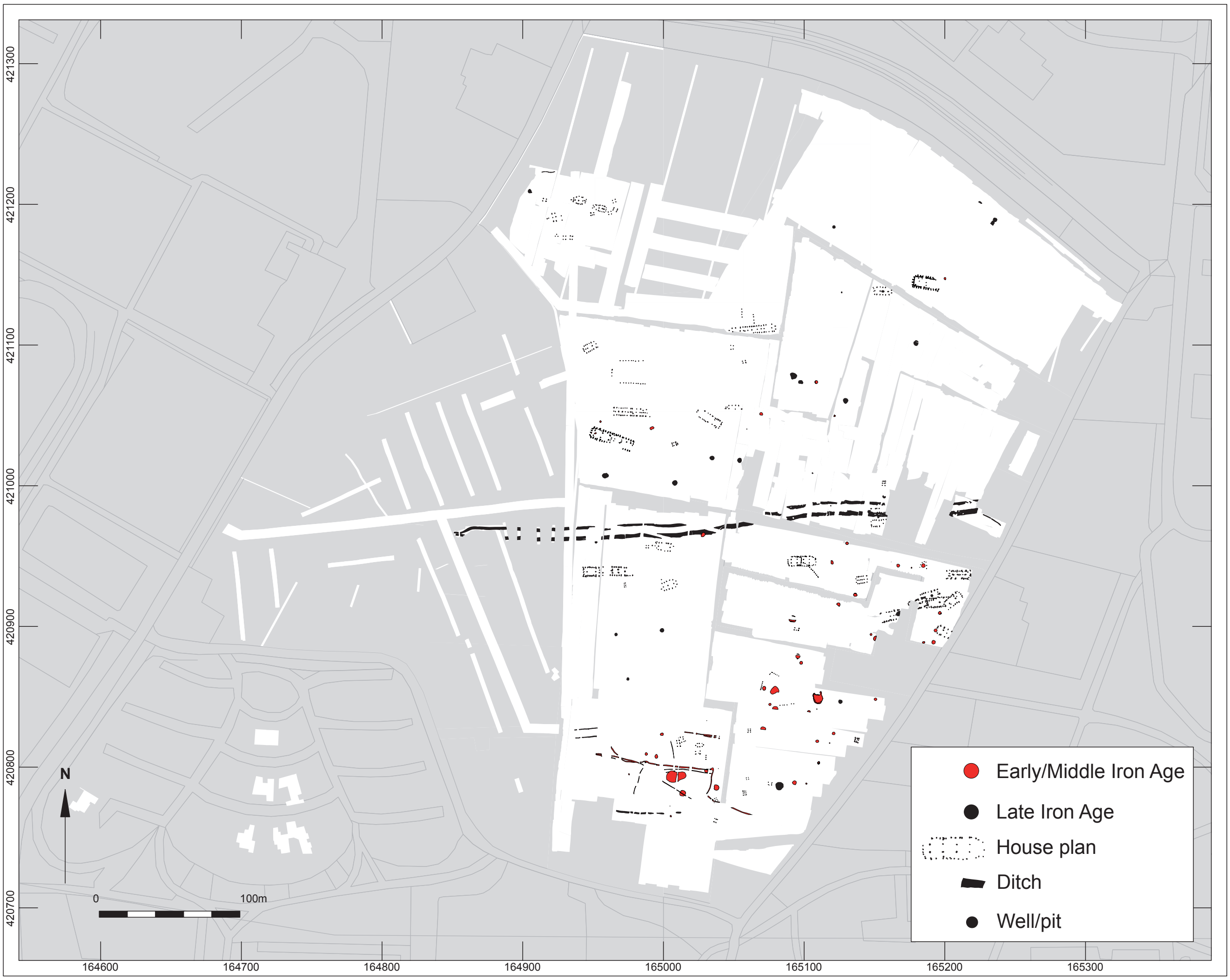


Figure 6 Oss-Horzak; structures from the Late Iron Age (250-19 BC) (Faculty of Archaeology Leiden University, graphics S. van As).

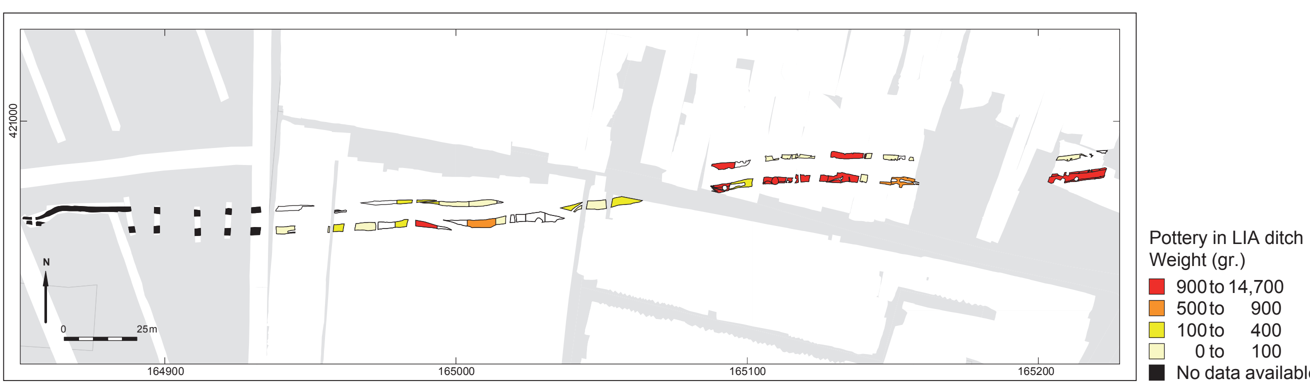


Figure 7 Oss-Horzak; the Late Iron Age ditch system with the distribution of pottery (Faculty of Archaeology Leiden University, graphics S. van As).

irrespective of which function(s) it had. Firstly, forming a physical barrier in the local landscape, it might have functioned as a line of defence and/or boundary. Sling bullets were found spread along the eastern area of the ditch, as well as an iron spearhead. Secondly, the ditches could also have had a symbolic or religious meaning, possibly associated with its function as a boundary. In the northeastern corner of the Late Iron Age ditch at Oss-Schalkskamp *c*. 200 sling bullets were found, together with dozens of loom weights, spindle whorls and sherds and a complete, burned La Tène bracelet (Fokkens *et al*. in prep. b). Also several depositions of pottery complexes were found in the ditch at Horzak.

Another possibility that has been considered is the presence of a road between the ditches where farmers drove their livestock. However, the effort put into the construction of the ditches seems greater than required for herding livestock in a certain direction. Therefore, and also considering the ditch's western ending, this option is not evident. Also the possibility of drainage is unlikely. The fill of the ditches showed no traces of water having run through the ditches. And the orientation would be incorrect, the land slopes towards the river Meuse in the north. The last hypothesis is that the ditches at Horzak constitute a zone between two local communities. North and south of the ditch system contemporary and even equally orientated farmhouses were recovered (fig. 6). A same compartmentalization or zonation of the landscape has been determined at Oss-Mettegeupel. Two, again east-west orientated, shallow ditches divide the (local) landscape here into three zones with in the southern zone an activity area with a pen for cattle and granaries, and farmhouses in the other two zones (Fokkens 1996).

Although the exact function of the ditches at Horzak remains unclear, it is obvious that it formed a prominent and extraordinary relict in the Late Iron Age landscape which indicates that people had started to organize the (local) landscape into a more permanent layout; an arrangement that must have affected several households or even a whole local community.

Also within the supra-local landscape things were changing. There is still a clear spatial distinction between settlements and cemeteries but the cemeteries became smaller and less static and, besides solitary farmsteads, we see the emergence of more static, nucleated settlements or even small 'villages' (see Gerritsen 2003). There are even indications of central places. A Late Iron Age regional central settlement and/or cult place is suspected at Kessel/Lith, not far from the Oss-excavations (Roymans 2004, 144-148).

3 A structured landscape in the Roman Period

3.1 Early Roman Period

The Early Roman pre-Flavian habitation of Oss-Horzak is strongly rooted in the Late Iron Age. Houses are frequently rebuilt on the same yard and clusters of houses are apparent (fig. 8). The settlement still consists of 'traditional' rectangular farmhouses, combining a stable and a living section under one roof. The length of the houses increases however, together with a stronger construction of the poles implying a longer lifespan of the houses (a.o. Van Hoof 2007).

Zooming out, also the differences in size and layout between settlements (slowly) increase. Besides small, 'open' settlements, two examples of enclosed Early Roman Period settlements are known from the Oss-region: Oss-Schalkskamp and the first phases of Oss-Westerveld, strongly differing in size, structure and period of habitation (Schalkskamp: Wesselingh 2000, 172-182; Fokkens *et al*. in prep. b; Westerveld: Wesselingh 2000).

As for the structuring of the local landscape, at some point a large area in the Horzak area is delimited by an extensive ditch system. The ditches have an irregular layout enclosing a large area of *c*. 7 ha. The ditches were dug out or re-dug for maintenance, so they probably functioned during several habitation phases. Within the enclosure houses are concentrated in two clusters, while other areas are undeveloped, possibly functioning as fields or gardens. (Early-)Roman Period features are also lacking outside the ditches, suggesting the enclosure formed a 'real' boundary.

The increasing structuring of the supra-local landscape is nicely illustrated by the Ussen-research and surrounding excavations. Several differing settlements, an open-air cult place, field systems and a large cemetery were excavated here close to each other (fig. 9). The older relict of an Iron Age cemetery seems also included within this structured cultural landscape (see fig. 5).

3.2 Middle Roman Period

With the beginning of the Middle-Roman Period, from 70 cal AD onwards the situation changes considerably. At Horzak there is a noticeable restructuring of the settled area into a renewed rectangular layout. Based on the modest dimensions, it is not likely that the ditches had a defensive function. Rather they display the formation of a strongly structured settlement following a Roman scheme (Wesselingh 2000, 214). With the enclosure the Middle-Roman period settlement of Horzak is visibly separated from the surrounding landscape. At the same time the structured character continued into the surrounding local landscape, which is structured by ditches belonging to a field system and a corral north of the settlement (fig. 10). A radical restructuring of the landscape can be seen at Oss-Brabantstraat, where a cult place was 'overbuilt' with ditches and at Oss-IJsselstraat, where a small settlement was built 'on top of' a Middle Iron Age cemetery (Brabantstraat: De Leeuwe 2011; IJsselstraat: Wesselingh 1993). It is as if the previous structures were purposely denied and replaced by a new

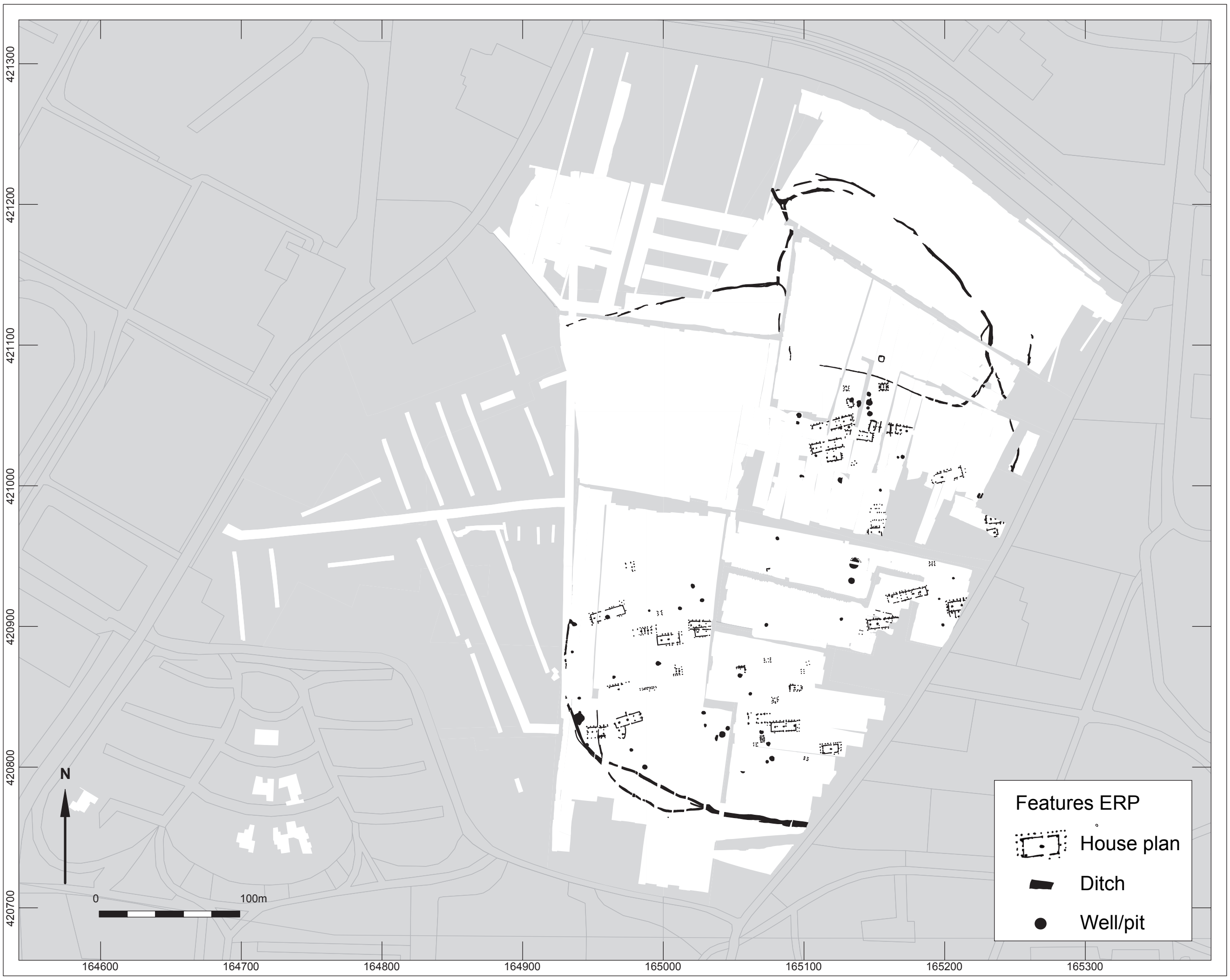


Figure 8 Oss-Horzak; structures from the Early Roman Period (19 BC-70 AD) (Faculty of Archaeology Leiden University, graphics S. van As).

layout of the entire landscape. At Oss-Ussen a large area, including the Iron Age cemetery, was reclaimed whereby dozens of ditches were constructed, overrunning the former burial monuments, while a new cemetery was founded at close distance.

In addition to continued habitation of most of the Early Roman Period settlements new settlements were founded. At Oss-De Geer reclamation farms (*Einzelhöfe*) were erected, reclaiming an area which was unoccupied until then (Jansen and Van Hoof 2003). Extensive studies of the ceramics found at the settlement Nistelrode-Zwarte Molen, located a few kilometres south of the town of Oss, indicate that this settlement was founded around 70 AD (Van Enckevort 2008). The settlement had a very structured character based on Roman measurements that continued into the surrounding local landscape (Jansen and Van Enckevort 2008).

With the excavation of the Middle Roman Period enclosed settlement at Oss-Horzak it is clear that in this period there are on the cover sand plateau of the micro-region Oss at least two territories (local communities) present with in each territory a central settlement: Oss-Westerveld and, 3 km further east, Oss-Horzak. Other, smaller settlements and solitary farms were situated close to these central places, and each cluster appears to have its own cemetery (Ussen: Hessing 2000, 183-188; Horzak: Jansen and Fokkens 2002; Bruineberg 2004).

The (local) landscape is vastly structured by ditches, corrals and other structures, like at Oss-Ussen. Here the

Figure 9 Oss; settlements, cemetery, cult place and field system in a structured Early Roman Period landscape (Faculty of Archaeology Leiden University-Archol bv, graphics S. van As).

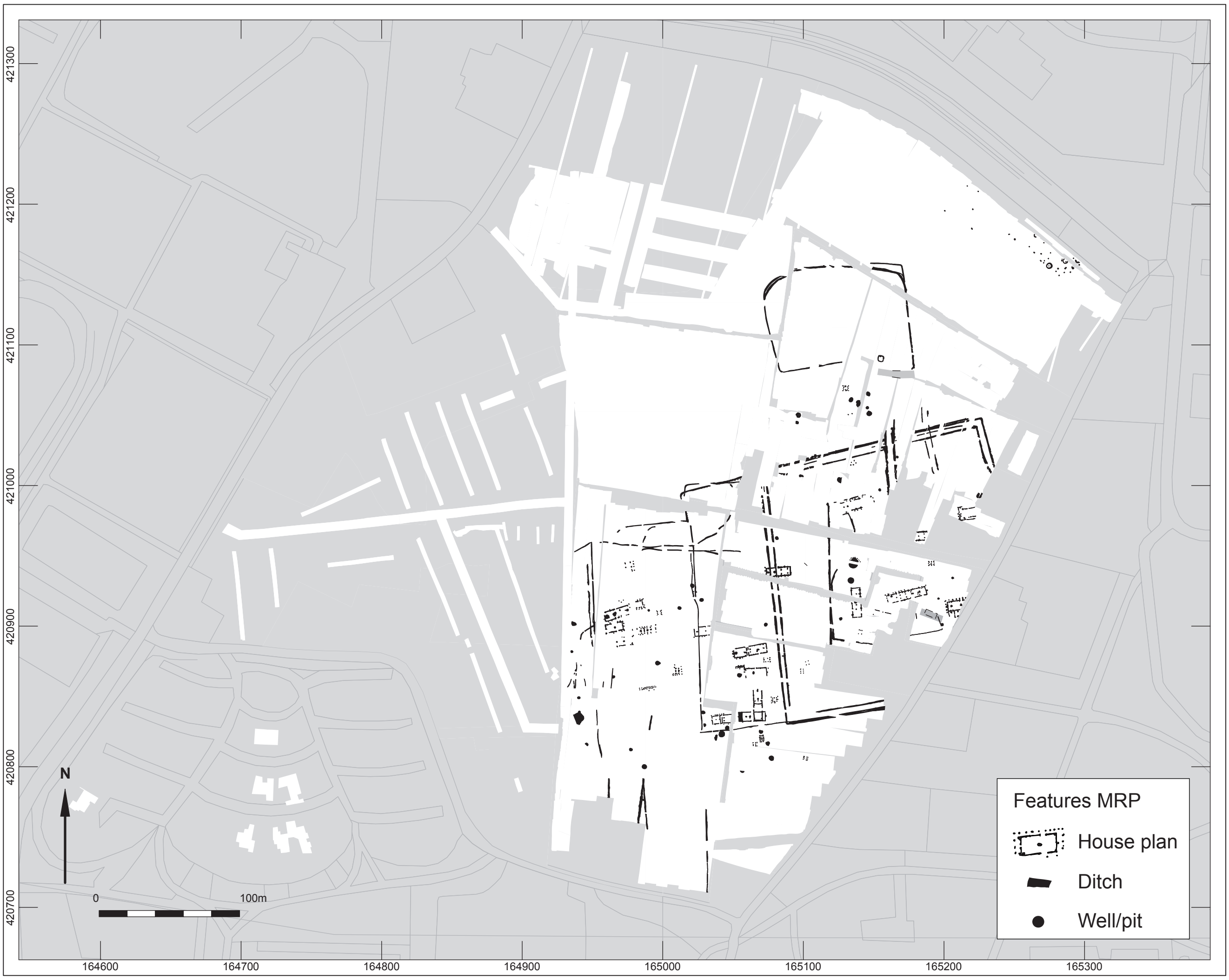


Figure 10 Oss-Horzak; structures from the Middle Roman Period (70-*c*. 250 AD) (Faculty of Archaeology Leiden University, graphics S. van As).

surroundings of the settlements were arranged on a large scale, predominantly with ditches belonging to roads (?), field systems and corrals (fig. 11). Circa 900 m northwest, in the area of Oss-Mettegeupel, a Roman Period ditch system is interpreted as (extended) arable and grazing grounds (Jansen *et al*. in prep.).[4] This is equivalent to the surroundings of Horzak, where an identically orientated ditch west of the settlement IJsselstraat, 400 m to the east of Horzak, illustrates the large-scale of the parcellation of the landscape.

Contemporaneous extended ditch systems are also uncovered elsewhere in the southern Netherlands Meuse-Demer-Scheldt-area, and also the Central River Area and Western Netherlands show comparable, structured landscapes (Central River Area: Vos 2009; Western Netherlands: Van Londen 2003).

4 (Re-)structuring an ‘empty’ landscape in the Middle Ages?

From the Early 3rd century AD onwards there is a strong decline in habitation in large parts of the southern Netherlands (a.o. Heeren 2005). In the Oss-region most settlements, including Horzak, are abandoned. Features and finds from the Late Roman Period and Early Middle Ages are found, but further south on the cover sand plateau, where the current city centre of Oss is situated, and north, in the river area of the Maaskant.

Only with the development of the (medieval) town of Oss were the sandy soils north of Oss once again reclaimed and turned into a rural area. In the north-western corner of Horzak at least two farmsteads have been uncovered, dating to the 13th-14th century AD (fig. 12). Farmhouses, haystacks and

Figure 11 Oss-Ussen; the local landscape between the Roman Period settlements of Oss-Westerveld, Oss-Zomerhof and Oss-Vijver arranged with ditches (Faculty of Archaeology Leiden University, after Schinkel 1998).

Figure 12 Oss-Horzak; structures from the Late Medieval Period (*c*. 13th-14th century AD) (Faculty of Archaeology Leiden University, graphics S. van As).

wells were found, and also a ditch system bounding fields. As many centuries have passed since, it is assumed that this was a reclaiming of an 'empty' landscape. This seems to be the case for Oss-Horzak, where the orientation of Iron Age and Roman Period ditches does not correspond to ditches on the early 19th century topographical map (fig. 13). But when the (Roman Period) ditch systems of Schalkskamp and Oss-Mettegeupel are pictured on the topographical maps of *c*. 1830 the similarities in orientation are striking. At Schalkskamp the sub-recent parcelling system, probably based on (Late) Medieval ditches even seems to connect to (the orientation of) Roman Period ditches, laid out more than a millennium earlier. Instead of a structuring of an 'empty' landscape in the Middle Ages, it was rather a re-structuring of a landscape still holding traces of the Roman Period landscape organization.

5 Conclusion

The multi-period site of Oss-Horzak, excavated between 1998 and 2008, complements the earlier research in the micro-region Oss. Contrary to previous excavations here a contiguous area was excavated providing insight into the structuring of the surroundings of farmsteads and settlements, over a long period. In order to distinguish and understand the developments of landscape organization that occur in the Roman Period, we started in the (Late) Iron Age since the developments in the Roman Period are part of the long-term habitation history of this region.

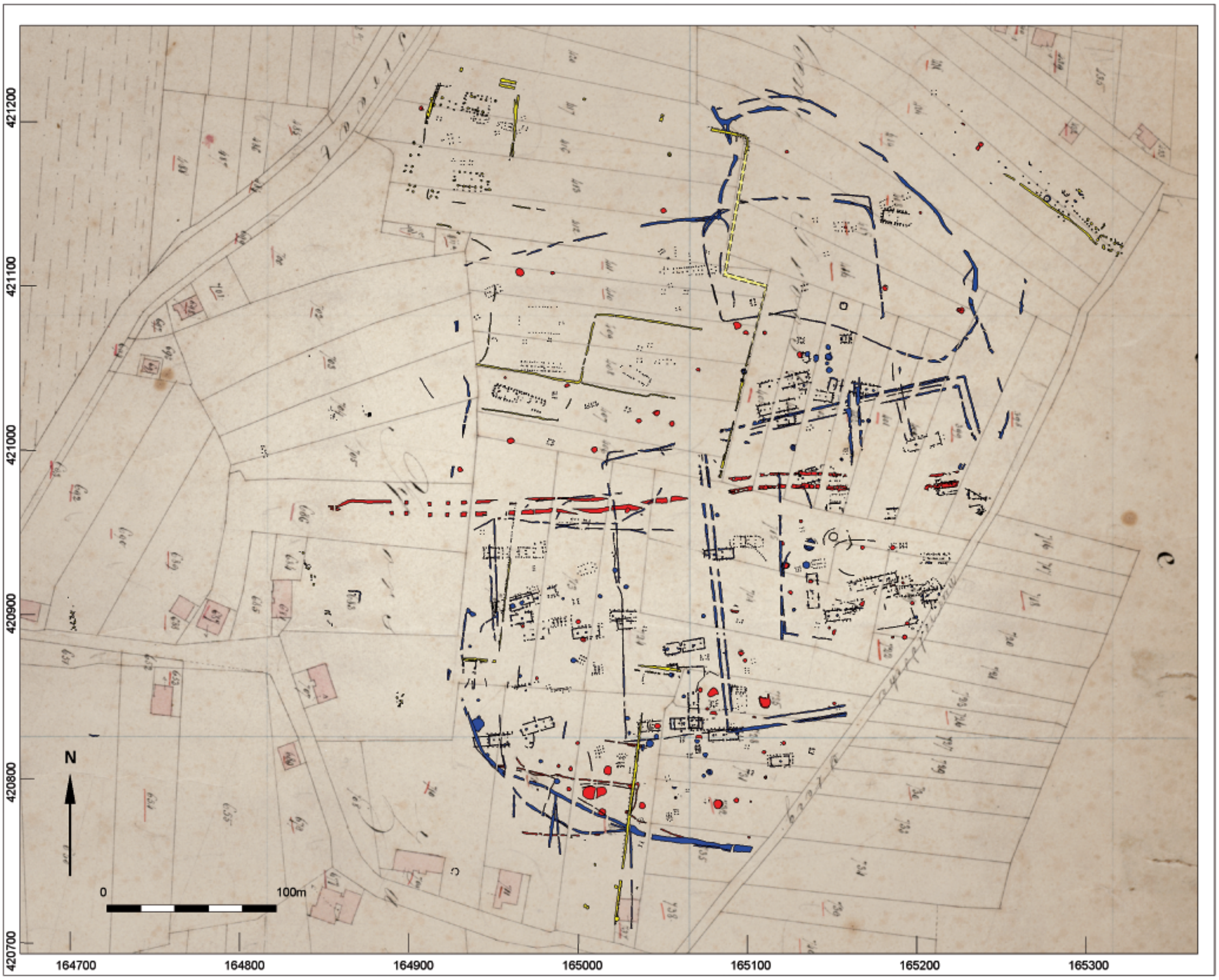


Figure 13 Oss-Horzak; structures and ditches from all periods plotted on the topographical map from *c*. 1830 (map: WatWasWaar.nl; graphics S. van As.).

With the structuring of Early and Middle Iron Age settlement and (local) landscape as starting point, it is clear that already prior to the end of the Late Iron Age the dynamic Iron Age settlement system is gradually replaced by a more static one with nucleated, sometimes enclosed farmsteads. Houses are rebuilt close to their predecessors on the same yard, enclosures of yards and settlements occur. Farmsteads became stable places in the landscape where consecutive generations built their houses (Gerritsen 2003, 105-108).

The local landscape becomes more structured, with a more permanent layout for different elements like farmstead/settlement, cemetery, cult place and activity area. This process thus started at least a hundred years before the region was officially integrated into the Roman Empire, indicating that these changes were not the direct result of Roman policy. These changes must be explained from a long-term perspective, as part of two thousand years of occupation history, continuing into the Early Roman Period. The causes for these continuous and gradual changes are difficult to identify and beyond the scope of this article. It is clear that the differences between settlement system and landscape organization in the Iron Age and the Roman Period cannot be ascribed to Roman influences only. The incorporation in the Roman Empire accelerated the developments, resulting in an enlargement of settlements, an increasing hierarchization between and the installation of new settlements, and an increasing reclamation and structuring of the landscape.

From 70 cal AD onwards the rural landscape of the Oss-region underwent an organised reorganization. During this period the settlement system and arrangement of the (local) landscape changed considerably. The differences in size and layout between settlements increase greatly. A few settlements formed the top of the rural settlement hierarchy, which also consisted of dispersed (reclamation-) farms and small (enclosed) clusters of farms (Jansen and Fokkens 2010).

Within this system, under the influence of Roman authorities, one settlement can be seen as the central place and residence of the local elite, possibly veterans of the army or other officials. The settlement of Oss-Horzak, like Oss-Westerveld and Nistelrode-Zwarte Molen, is interpreted as a central place within a highly structured local rural landscape. It is remarkable that older relicts and/or orientations within this landscape, either abandoned farmsteads, settlements, cemeteries or cult places, are sometimes denied or even (knowingly) erased. As if the past had no meaning anymore during this re-parcelling.

Instead of the earlier landscape organization by local farming communities, these developments are (greatly) instigated as a result of Roman politics, probably with the aim of pacifying and controlling this part of the Batavian region (e.g. Heeren 2009, ch. 8; Vos 2009). The latter includes the possibility of a function of the ditch systems in the registration of land use, possibly used for the levying of taxes (Heeren 2009, 241-250).

At the end of the first century AD this resulted in a extended and well-structured rural landscape, that changed the character and perception of the landscape considerably and that in some cases even formed the basis for (Late-) Medieval and Modern Period reclamations.

Notes

1 Schinkel introduced the widely supported term ‘wandering’ farmsteads (German: *Wandersiedlung*; Dutch: *Zwervende Erven*) which is now criticized increasingly (see Gerritsen 2003; Arnoldussen 2008).

2 The larger southern ditch has a maximum width of 2.6 m and a depth of more than 1 m. The northern ditch has a maximum width of 1.6 m and is 0.6 m deep. These measurements were originally even larger and deeper, site formation processes have since homogenized the upper layer(s) of the ditches.

3 Dating by P. van den Broeke, see Schamp 2001 and Van As 2010; see also Van den Broeke 1987.

4 Wesselingh mentioned many ditch fragments situated between the settlements of which none could be dated to any period (chapter 6, note 26). Based on the excavations in Oss-Horzak where many ditches could be dated to the Roman Period, we have re-analysed the ditch fragments in Oss-Ussen and concluded that they too date to the Roman Period (Jansen in prep.).

References

Arnoldussen, S. 2008. *Living Landscape: Bronze Age settlement sites in the Dutch river area (c. 2000-800 BC)*, Leiden.

Arnoldussen, S. and R. Jansen 2011. Iron Age habitation patterns on the southern and northern Dutch Pleistocene coversand soils: the process of settlement nucleation. In: M. Meyer (ed.), *Haus-Gehöft-Weiler-Dorf. Siedlungen der Vörromischen Eisenzeit im nördlichen Mitteleuropa* (Berliner Archäologische Forschungen 8), Rahden/Westf., 381-399.

As, S. van 2008. *Een Fysieke Barrière. Een uniek greppel-systeem uit de IJzertijd*, bachelor thesis University Leiden.

As, S. van 2010. *The settlement within the landscape. A critical view on Iron Age habitation in the southern Netherlands*, master thesis University Leiden.

Bakels, C.C. 2002. Het pollendiagram Oss 45E/346. In: H. Fokkens and R. Jansen (eds), *2000 Jaar bewonings-dynamiek. Brons- en ijzertijdbewoning in het Maas-Demer-Scheldegebied*, Leiden, 259-270.

Berkvens, R. and L.I. Kooistra 2004. De laat-prehistorische bewoning: interpretaties en conclusies. In: C.W. Koot and R. Berkvens (eds), *Bredase akkers eeuwenoud: 4000 jaar bewoningsgeschiedenis op de rand van zand en klei* (ROB Rapportage Archeologische Monumentenzorg 102), Breda, 191-210.

Broeke, P.W. van den 1987. Oss-Ussen: het handgemaakte aardewerk. In: W.A.B. van der Sanden and P.W. van den Broeke (eds), *Getekend Zand. Tien jaar archeologisch onderzoek in Oss-Ussen* (Bijdragen tot de studie van het Brabants Heem 31), Waalre, 101-119.

Bruineberg, M. 2004. *Dood en begraven. Het inheems-Romeinse grafveld Oss-Horzak in regionaal prespectief*, master thesis University Leiden.

Enckevort, H. van 2008. Scherven van Romeins vaatwerk uit Nistelrode. In: R. Jansen (ed.), *Bewoningsdynamiek op de Maashorst. De bewoningsgeschiedenis van Nistelrode van laat-neolithicum tot volle middeleeuwen*, Leiden (Archol Rapport 48), 245-378.

Fokkens, H. 1996. The Maaskant project: continuity and change of a regional research project. *Archaeological Dialogues* 3 (2), 197-216.

Fokkens, H. *et al.* in prep. a. The quarter of Oss-Almstein. In: H. Fokkens, R. Jansen and S. van As (eds), *The second decade. Excavations at Oss* (Analecta Leidensia Praehistorica 45), Leiden.

Fokkens, H. *et al*. in prep. b. The quarter of Oss-Schalkskamp. In: H. Fokkens, R. Jansen and S. van As (eds.), *The second decade*. *Excavations at Oss* (Analecta Leidensia Praehistorica 45), Leiden.

Gerritsen, F. 2003. *Local identities*. *Landscape and community in the late prehistoric Meuse-Demer-Scheldt region* (Amsterdam Archaeological Studies 9), Amsterdam.

Heeren, S. 2005. De verlating van het Maas-Demer-Schelde gebied in de 3de eeuw na Chr. In: E. van Rossenberg et al. (eds) *SOJA-bundel 2002-2003*, Leiden/Amsterdam, 53-67.

Heeren, S. 2009. *Romanisering van rurale gemeenschappen in de civitas Batavorum*. *De casus Tiel-Passewaaij*, (Nederlandse Archeologische Rapporten 36), Amersfoort.

Hessing, W.A.M. 2000. The Roman period cemetery. In: D.A. Wesselingh, *Native neighbours: local settlement system and social structure in the Roman period at Oss (the Netherlands)* (Analecta Praehistorica Leidensia 32), 183-187.

Hoof, L.G.L. van 2007. Variaties op een rechthoek. Huizenbouwtradities en huisoffers in Romeins Nederland. In: R. Jansen and L.P. Louwe Kooijmans (eds), *10 jaar Archol*. *Van contract tot wetenschap*, Leiden, 255-270.

Jansen, R. in prep. *The third decade*. *Excavations in Oss-Horzak from 1998-2008*, Leiden.

Jansen, R. and S. Arnoldussen 2007. Early and Middle Bronze Age settlement features of the multi-period site Oss-Horzak (province Noord-Brabant, Nl.). *Lunula Archaeologia protohistorica* 15, 23-34.

Jansen, R. and H. van Enckevort 2008. Bewoningssporen uit de Romeinse tijd. In: R. Jansen, *Bewoningsdynamiek op de Maashorst*. *De bewoningsgeschiedenis van Nistelrode van laat-neolithicum tot volle middeleeuwen* (Archol Rapport 48), Leiden.

Jansen, R. and H. Fokkens 2002. Een korte biografie van Oss-Horzak, een lokale gemeenschap tussen Maaskant en Heikant. In: H. Fokkens and R. Jansen (eds), *2000 Jaar bewoningsdynamiek*. *Brons- en ijzertijdbewoning in het Maas-Demer-Scheldegebied*, Leiden, 315-340.

Jansen, R. and H. Fokkens 2010. Central places in the 1st and 2nd century AD in the Maaskant-region (Southern Netherlands). Reinterpreting the Roman settlement of Oss-Westerveld. In: H. Jöns and E. Strahl (eds), *Siedlung und Küstenforschung im südlichen Nordseegebiet* 33, Wilhelmshaven, 133-146.

Jansen, R. and L.G.L. van Hoof 2003. *Archeologisch onderzoek Oss-De Geer*. *Bewoningssporen uit de bronstijd en de Romeinse tijd* (Archol Rapport 19), Leiden.

Jansen, R. *et al*. in prep. The quarter of Oss-Mettegeupel. In: H. Fokkens, R. Jansen and S. van As (eds), *The second decade*. *Excavations at Oss* (Analecta Leidensia Praehistorica 45), Leiden.

Kortlang, F. 1999. The Iron Age urnfield and settlement from Someren-'Waterdael'. In: F. Theuws and N. Roymans (eds), *Land and ancestors*. *Cultural dynamics in the Urnfield period and the Middle Ages in the southern Netherlands* (Amsterdam Archaeological Studies 4), Amsterdam, 133-197.

Leeuwe, R. de 2011. *Een cultusplaats in Oss; opgraving van een ijzertijd nederzetting en cultusplaats aan de Brabant-straat* (Archol Rapport 123), Leiden.

Linde, C.M. van der 2007. *Geketend aan Zand*. *Terug naar Oss-Horzak, terug naar toen*, master thesis University Leiden.

Londen, H. van, 2003. *Midden-Delfland*. *The Roman Native Landscape Past and Present*, Amsterdam.

Pruysen, M.P. 2007. *Lang geleden*. *Een bewoningsreconstructie van de inheems-Romeinse nederzetting te Oss-Horzak*, master thesis University Leiden.

Pruysen, M.P. and S. van As 2012. *Bewoningssporen in de Horzak*. *Een proefsleuvenonderzoek en opgraving te Oss-Horzak West* (Archol Rapport), Leiden.

Roymans, N. 1988. Beegden: nederzetting en grafveld uit de IJzertijd en Romeinse Tijd. In: H. Stoepker (ed.), *Archeologische kroniek van Limburg over 1987* (PSHAL 124), 345-425.

Roymans, N. 2004. *Ethnic Identity and Imperial Power* (Amsterdam Archaeological Studies 10), Amsterdam.

Roymans, N. and H. Hiddink 1991. Nederzettingssporen uit de bronstijd en de vroege ijzertijd op de Kraanvensche Heide te Loon op Zand. In: H. Fokkens and N. Roymans (eds), *Nederzettingen uit de bronstijd en de vroege ijzertijd in de Lage Landen* (Nederlandse Archeologische Rapporten 13), Amersfoort, 111-127.

Sanden, W.A.B. van der 1988. The Ussen project: large-scale settlement archaeology of the period 700 BC-AD 250, a preliminary report. *Analecta Praehistorica Leidensia* 20, 95-123.

Sanden, W.A.B. van der 1998. Funerary and related structures at Oss-Ussen. In: H. Fokkens (ed.), *The Ussen Project*. *The first decade of excavations at Oss* (Analecta Praehistorica Leidensia 30), 307-336.

Schamp, C. 2001. Opgraving Oss-Horzak 2000, bachelor thesis University Leiden.

Schinkel, K. 1998. Unsettled settlements, occupation remains from the Bronze Age and the Iron Age at Oss-Ussen. The 1976-1986 excavations. In: H. Fokkens (ed.), *The Ussen Project. The first decade of excavations at Oss* (Analecta Praehistorica Leidensia 30), 5-305.

Verwers, G.J. 1972. *Das Kamps Veld in Haps in Neolithikum, Bronzezeit und Eisenzeit*, Leiden (Analecta Praehistorica Leidensia 5).

Vos, W.K. 2009. *Bataafs platteland. Het Romeinse nederzettingslandschap in het Nederlandse Kromme-Rijn-gebied* (Nederlandse Archeologische Rapporten 35), Amersfoort.

Wesselingh, D.A. 1993. Oss-IJsselstraat. Iron Age graves and a native-Roman settlement. *Analecta Praehistorica Leidensia* 26, 111-138.

Wesselingh, D.A. 2000. *Native neighbours: local settlement system and social structure in the Roman period at Oss (the Netherlands)* (Analecta Praehistorica Leidensia 32), PhD thesis Leiden University.

Richard Jansen
Faculty of Archaeology
P.O. Box 9515
2300 RA Leiden
The Netherlands
r.jansen@arch.leidenuniv.nl

Stijn van As MA
Faculty of Archaeology
P.O. Box 9515
2300 RA Leiden
The Netherlands
s.f.m.van.as@arch.leidenuniv.nl

Investigating imperial space on the Palatine Hill in Rome: preliminary results of the Domus Flavia 2012 research campaign

Natascha Sojc, Léon J. Coret and Lisa C. Götz

Palace architecture from the Roman Imperial period has been investigated both from an archaeological as well as a spatial perspective. Following a combined approach, circa 25 rooms and spaces, which were until now considered 'unspectacular', and have therefore been neglected by researchers, have been evaluated for the first time in terms of their spatial and functional properties.

1 Introduction

On the Palatine Hill in the centre of Rome the remains of the Imperial palaces are exposed and on public display: A seemingly endless maze of brick architectural structures forming tracts around peristyle courtyards and framed by open spaces where the delimiting of interior and exterior is sometimes impossible to locate, since main entrances are largely missing (fig. 1). These palaces were erected,

Figure 1 Northern and western part of the Imperial palace, the area of the Domus Flavia in its current state of preservation, seen from the south. In front: central fountain and peristyle courtyard. On the far left: palace forecourt of the Area Palatina. Source D-DAI-ROM-2010.1065 (D. Gauss).

according to literary sources, by various Emperors "each one building his own house (domus) next to the ones already in existence"[1], but most of the structures were in use simultaneously from the second half of the 1st century AD until the end of the 3rd century AD as the residence of the ruling Emperor, his family and his court[2]. In addition, they were the seat of the Imperial bureaucracy, where various activities ranging from handling court cases to the archiving of documents took place. In short, this multifunctional complex served as one of the most important interaction spaces of the ruling elite.

As the Imperial domus have been alluded to by ancient authors in the most suggestive anecdotes, researches have been engaged over the centuries to find out where for example Emperor Domitian dined like the god Jupiter[3]. Of particular interest for archaeological examination is the so-called Domus Flavia with its enormous, luxuriant halls that is located more or less in a central position on the Palatine Hill. The term is of modern origin, attributed to the building because it was interpreted as the residence of the Flavian dynasty, which ruled in the second half of the 1st century AD[4]. Even so, the attribution is debated, but it has stayed in use as an archaeological technical term to denote a particular area of the Palatine remains (fig. 2).

Since all the excavations of the Domus Flavia have been only inadequately published with research and restoration starting as early as the first half of the 18th century[5], there still are to date largely unexplained fundamental questions about this central area of the Imperial palace, such as concerning the dating of the complex and its utilisation, its connection to component parts of circumjacent palace tracts and the exterior of the palace. Due to the fragmentary state of the information alone, a new archaeological examination was started in 2009 by the universities of Würzburg and Leiden, in collaboration with the universities of Aix-Marseille I (Provence) and Augsburg[6]. Simultaneously, the area was surveyed by architects of the German Archaeological Institute in close cooperation[7]. Whereas the campaigns of 2009-2011 focused on a combined effort by the participating institutions to collect information in the whole area to obtain a general overview of the chronology of the palace tract[8], the goal of Leiden University's Domus Flavia research campaign in 2012 was to combine the archaeological chronological analysis with a spatial investigation[9]. This goal was chosen because one major research problem in the Domus Flavia is that so far it has been nearly impossible to find out more about the utilization of the rooms and spaces. The three halls in the northern part of the Domus Flavia (530-532) have already been interpreted by F. Bianchini with regard to their functional use, and this view continues quite predominantly in research to this day. The excavator considered room 530 to be a place of imperatorial dispensation of justice[10], the so-called Aula Regia (531) as a reception hall, and room 532 as an entrance hall for the palace[11]. However, the rooms only open onto a terrace and not into the open, in front of the palace, meaning that their accessibility remains an open question[12]. However, a further fundamental research problem is thus raised: It is that by concentrating on the large halls, research of the remaining, circa 50, rooms of the Domus Flavia continues to be ignored. Some of the rooms in our examination are therefore focused on for the first time. How does one get from A to B? How clearly arranged were the routing layouts designed? Were smaller rooms also structured by a spatial hierarchization within their own area? It was to be expected, with an analysis within a micro-spatial context of the palace architecture, that new findings regarding the everyday use of Domus Flavia would be gained[13].

It was therefore decided to concentrate our spatial examination on the entrances and passages in two different areas (fig. 2). Firstly, an obvious movement divider – a room with five openings – and its adjoining spaces was investigated (533, 534, 575-582) and secondly, a set of rooms that stands out in the plan because of its symmetrical layout (517-527). The subjects of these case studies were chosen also on the grounds of them most probably belonging to the same period, which was tested and subsequently confirmed at the beginning of the campaign. A foundation has thus been assured for the combination of the results from the separately conducted spatial investigations. The research objective was to obtain an overview of perception and usage of space as well as a first insight into the movement system[14] within the Palatine residence in one of its periods.

First of all, it was important to determine the chronological development of the complex; which walls and passages belonged to the original phase and which came in later? This chronological research[15] was conducted by analysing the brick walls, foundations and brick stamps[16]: The bricks used, the components of the mortar, the type of nucleus of the wall, as well as various technical features, e.g. scaffolding holes – all these details differ over time and therefore tell us something about the phase in which a certain wall was constructed. In the foundations constructed with the help of a Roman version of concrete (opus caementitium), the composition of the material changed significantly over time and was analysed as well. A further indicator of the chronological positioning of the respective walls is brick stamps, which can – on the basis of their inscription – be linked to a certain period of production. Based on the study and documentation of this information, preserved structures were finally appointed to the various phases[17].

After the phase-identification, an investigation was carried out into how these contemporary architectural elements functioned together from a spatial point of view. As the research was meant to be exploratory we concentrated on the

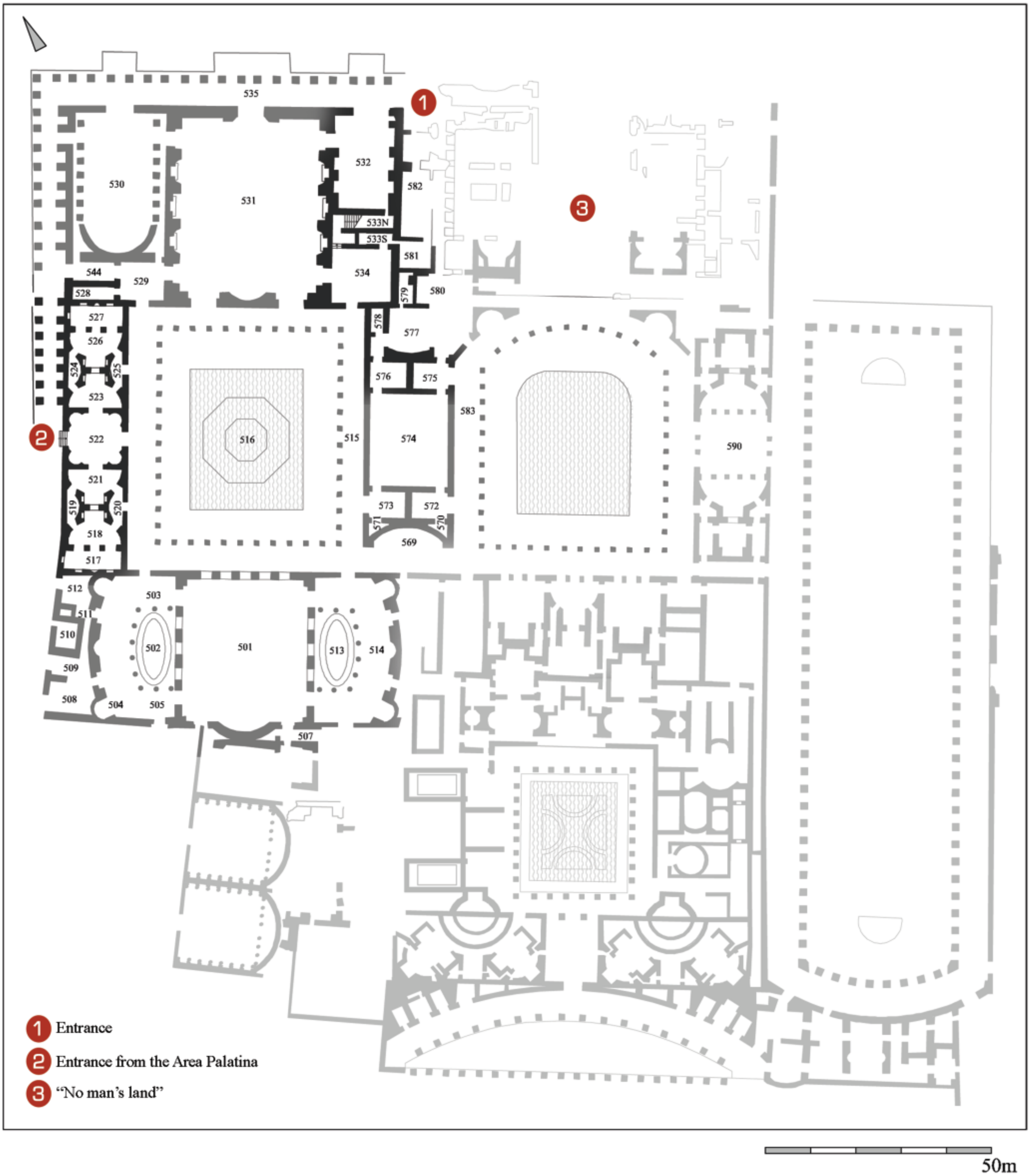


Figure 2 The central complex of the Imperial palace on the Palatine Hill in Rome. Reconstructed plan. In black the areas of Leiden University's research campaign in the Domus Flavia in 2012. The plan is only partially numbered as the investigation of the Domus Flavia is still ongoing and some conflicting criteria have not been conclusively resolved. The 500 numbers denote that the room or space is on the main circulation level of the palace. Drawing by M. Knechtel and A. Rheeder, after directions of N. Sojc.

visibility, permeability, integration, and depth of the various rooms and passages: With regard to visibility, the main axial line within a space was investigated. While examining permeability we wanted to test the possibility of moving through certain spaces instead of just being able to see them. Regarding integration, we referred to the relative interconnectivity of a certain space in relation to the other spaces. The more connections a certain space had, the more integrated it was in the building.This depends on the integration of its adjacent spaces. To analyse the integration of a certain space we took into account the centrality of its location as well as its depth into the building from the main entrances[18]. As mentioned above, it was decided to analyse the spatial properties of mainly one phase, the original building phase. However, the later phases were taken into account to better understand the influence that architectonic changes within the building had had on the usage of space.

2 Case study 1: a movement divider and its adjoining spaces (533, 534, 575-582)

The northeastern corner of the Domus Flavia has always been one of the most debated locations in the quest for entrances that led into the Imperial palace: Several researchers have reconstructed the main entrance into the complex in this area[19]. The main reason for this assumption is that one of the main access ways from the city to the palace, the so-called Clivus Palatinus, led up the Palatine Hill nearby. As the archaeological remains of the ancient street can only be followed to about midway up the hill, it is not clear how it was linked up to the palace and thus the argumentation can only be based on the still remaining internal palace structures. This is also problematic because of the bad condition of the building parts to the east: There, basically only the foundation and some unrelated smaller wall partitions are left standing, hence this part has been dubbed a "no-man's-land"[20]. Due to the same orientation of these structures as the ones still in existence in the Domus Flavia, some link between the structures can be assumed but not investigated in detail. Located in this northeastern context, room 534 was chosen as a starting point for the spatial analysis because its five entrances show that the room functioned as a movement divider. A further reason for the choice was that immediately to the east, possibly one of the main entrances was positioned[21] (fig. 2).

2.1 Archaeological analysis

The brickwork walls still standing to a considerable height in the northeastern part of the Domus Flavia (fig. 3) have a

Figure 3 North-eastern part of the Domus Flavia in its current state of preservation, seen from the south. Source D-DAI-ROM-2010.1068 (D. Gauss).

homogeneous appearance, which is also the case for the visible foundations[22]. The original building phase presents a uniform brick facing with reddish *sesquipedales*[23]. The mortar in the joints between the bricks contains red and black volcanic materials and was worked with a very typical trowel technique (*stilatura*). Furthermore, all these wall structures show continuous rows of yellowish *bipedales* as well as scaffolding holes at regular intervals on the same level. The original building phase is also characterized by the pre-planned water drainage channels still visible in the brick facings[24]. In the northeastern part, a series of wall structures differs significantly from the original building phase. They can be attributed to a subsequent phase based on the following characteristics: these structures are not linked with the original walls, and all are built on a different kind of foundation[25]. Taken as a whole, these structures have a more heterogeneous appearance compared with the original phase: the *sesquipedales* used here are less uniform in colour and size, and the actual construction work shows a more irregular facing. Furthermore, the rows of *bipedales* and the scaffolding holes are not situated at the same levels compared to the original phase; water drainage channels are missing completely[26]. In addition to the analyses of brick walls and foundations, the large amount of new brick stamps[27] enables a more detailed chronology. One important find was brick stamp No. 1 (cf. Appendix) on a *bipedalis* still in situ in the vault of the staircase room 533N[28], which gave access to the two upper levels of the palace. Based on the known production date of the brick, the construction of the staircase can be dated at the latest to the beginning of the 2nd century AD, i.e. the original building phase. As the other brick stamps (cf. Appendix: Nos. 2-4) were found in walls of the subsequent phase, which shows here a homogeneous appearance, these constructions can all be dated to the 1st quarter of the 2nd century AD, perhaps even more precisely to around AD 123[29].

The analysis in the movement divider 534 and the adjoining spaces enabled the identification of two ancient building phases[30]. Based on the identification of these building phases the system of room connections seems to have changed considerably over time.

For the original building phase the area can be reconstructed as follows (fig. 4): in between the Domus Flavia and the “no-man’s-land” in the east, corridor 582 ran north to south up to the semicircular apse in space 577. Here, corridor 582 matched up with the passage between the peristyle courtyards of the Domus Flavia and its neighbour, most likely mirroring the architectural solution present to the south (fig. 2: 569-574). Furthermore, from corridor 582, two entrances provided access to the western rooms of the palace[31]. The first, northern entrance is approximately 3.2 m wide and gave access to space 533, divided into two parts (fig. 5). In 533S, two separate internal passages gave access to room 534[32]. The

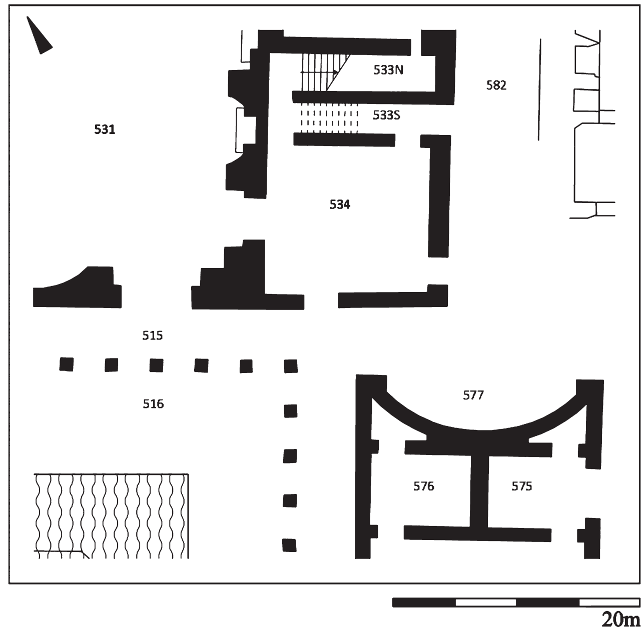


Figure 4 North-eastern part of the Domus Flavia. Plan of the original building phase. Drawing by A. Rheeder, after directions of N. Sojc and L.C. Götz.

second entrance of 582, which is approximately 2.4 m wide, led into movement divider 534 as well (fig. 6). This nearly square room, in addition to the three connections already mentioned, gave access to the southern and western quarters as well, the latter through an even wider opening of *c*. 3.76 m (fig. 2): an enfilade connected movement divider 534 with the hall-like representation room 531 (Aula Regia) and the western entrance 544; to the south it opened into the portico of the central peristyle courtyard 515.

The alterations of the original layout a few decades after its construction seem to have taken its starting point from corridor 582 (fig. 8) which was divided into several sections through the insertion of narrow wall structures. Thus around the above mentioned entrances to rooms 534 and 533 new spaces, were created: additionally the entrance to room 533 was reduced in size by the insertion of a small extension to its original northeast-wall; contemporaneously its western opening towards 534 was enlarged by a small set of stairs that now led to staircase 533N. Furthermore, the entrance leading from corridor 582 into movement divider 534 was closed off by some of these new structures, the rooms 577-580, which now blocked any movement from the east into the peristyle courtyard; room 534 was thereby also no longer directly connected with one of the main entrances to the palace and lost its original main function of distributing guests through the various spaces.

Figure 5 Entrance to room 533S, seen from the west: The existing entrance is a later reduction of a wider opening from the original building phase. The changes can be deduced e.g. from the remains of the relieving arches. Photo L.C. Götz.

Figure 6 Entrance to room 534, seen from the east. In front: additions from the 2nd century. Photo L.C. Götz.

2.2 Spatial analysis

Now that the general plan of the original building phase has been reconstructed, it is possible to more accurately investigate the northeastern part of the Domus Flavia from a spatial point of view for this period in time. In regard to visibility, movement divider 534 is remarkable in so far that, as one entered and continued to move through this room, then all connections, as well as the Aula Regia 531 and the peristyle courtyard 515, would become immediately visible. The straight sightline from the eastern entrance into room 534 is blocked by the western wall of the room, while the isovist analysis[33] shows that it was possible for the visitor to oversee the entire space. However, it seems probable that the main axial line from this entrance was orientated towards the Aula Regia 531 through the portal-like passage in the west or to the south into the peristyle courtyard 515. Altogether, 534 is a rather straightforward space from an architectural point of view concerning visibility, as it seems that all the spatial connections are nearly equal. Only with regard to the traversability is there a slight hierarchical presence through the graduation of its openings' width (from c. 2.40 m to 3.76 m). In contrast, the main axial line from the east into staircase room 533 runs along the elongated, tunnel-like space, but nonetheless after a few steps into the room it would have been possible to actually look through the southern openings into movement divider 534 and the following spaces. In contrast, the staircase itself in 533N is not visible from any location – only if one would actually turn the corner would the stairs become apparent.

In regard to the depth of rooms 533 and 534 and their integration, the following observations can be made: most important in this respect is their spatial interconnectivity to corridor 582 – one of the supposed main entrances for the Imperial palace, especially to the Domus Flavia (figs. 2 and 7). From room 534 with its five connections, as already stated, the Aula Regia 531 and the peristyle courtyard 515 could be reached, whence one could move on to all the other quarters and the 1st floor of the palace. Indeed, movement

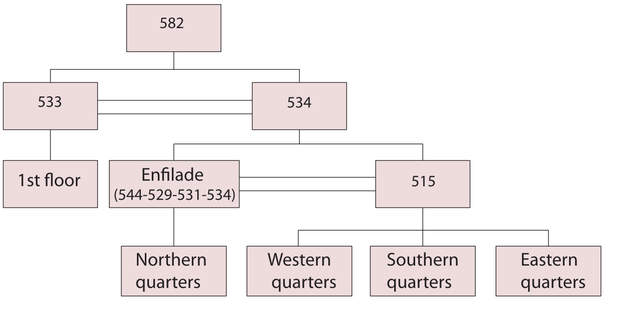


Figure 7 Depth diagram of the rooms in the north-eastern part of the Domus Flavia. Drawing by L.C. Götz.

divider 534 was fundamental for any further movement in the palace due to its good integration and high connectivity. It is likely that the incoming visitors – whether in groups or alone – were distributed in this space to enter the various parts of the palace to engage in their respective social interactions, such as attending audiences or banquets. Therefore, room 534, was the first room one would enter from corridor 582 and the assumed palace entrance facing west, is already responsible for a division of movement based on the purpose of the visitor: on the one hand, one could be led either to the larger halls (530, 531) through the enfilade, or to the smaller, more intimate rooms through the peristyle courtyard. Nonetheless, no matter to which opening one would move, it would always have been possible to look also into the rooms directly adjacent to the other openings. Even if one's actual purpose was to climb the staircase, the impressive state rooms would have been visible for a few moments. As a result, it seems that a visitor could leave the palace without entering all the different spaces, but could look into most of these on his or her way. In the end, it can be concluded that movement divider 534, in connection with staircase room 533, controlled the access into the northeastern part of the palace. However, as described above, the interventions of the later building phase brought about a drastic change to the original movement system[34]: the original grand scale design in this area – with its grand entrances, sight lines, and movement system – was modified presumably in the 1st quarter of the 2nd century AD, to a more complexly structured area with smaller sectors and passages, which meant a reduced visibility and an increased depth of the internal spaces. A possible explanation for these changes in spatial organization could be that this area of the palace became even more strongly controlled in this later phase (fig. 8).

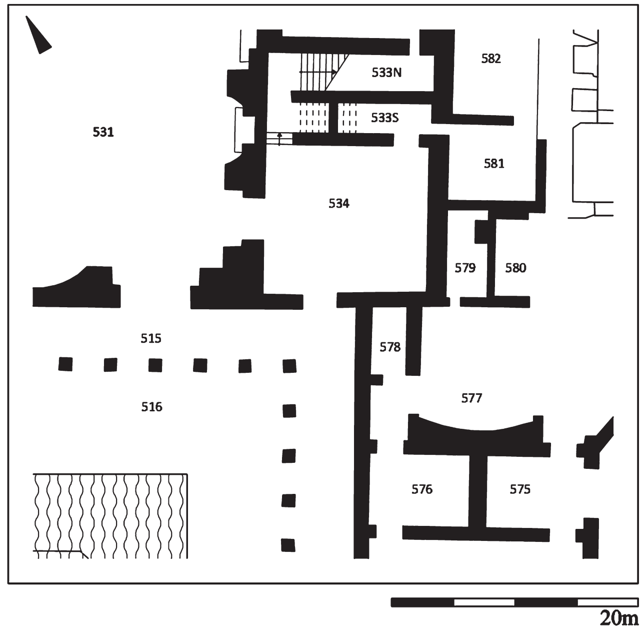


Figure 8 North-eastern part of the Domus Flavia. Plan of the second phase of the 1st quarter of the 2nd century AD. Drawing by A. Rheeder, after directions of N. Sojc and L.C. Götz.

3 Case study 2: a symmetrical suite of rooms west of the peristyle courtyard (517-527)

The suite of rooms stands out in the plan due to its symmetrical layout, and contains in its centre one of the original entrances (522) into the Domus Flavia (fig. 2). P. Rosa, the 19th century excavator of this area, located just outside of the palace on the Area Palatina[35], one of the central assembly and waiting areas of the palace known from ancient literary sources[36]. Even though these sources do not allude to any identifiable topography and the term's rightful application to this location is disputable as well, it has remained in use in archaeological literature to denote this open space, which separates the Domus Flavia from the western palace tracts (Domus Tiberiana) and the sanctuary around the Apollo temple to the south. Following up Rosa's argumentation with regard to room functions in the palace, H. Finsen proposed that the central octagonal room 522 was used as a *vestibulum*, a vestibule[37]. As this room function does not correspond with a specific layout in Roman architecture[38], the room was studied solely by us on the grounds of its still examinable archaeological and spatial characteristics. With its four openings, it is also a movement divider, but in contrast to the above-mentioned room 534, it was once also an entrance room adorned with semicircular recesses, which could have been used for the positioning of servants, guards or statues[39] and planned to be at the centre of a suite of rooms.

3.1 Archaeological analysis

Based on the internal symmetry in this suite of rooms (figs 9 and 10), between the northern (523-527) and southern (517-521) parts, it was decided to clean in the north only, as it seemed probable that the results from here could be extrapolated onto the southern rooms[40]. In order to establish a dating for the room suite, the brick walls, foundations and brick stamps were analysed. The characteristics of the brick walls, such as the type of bricks used, mortar and wall-core, correspond closely with the walls investigated in the north-eastern part (cf. Case study 1) and thus belong to the same phase identified here as the original building phase[41]. For example, the same type of foundation can be recognized by the fact that beneath the brick walls a row of *bipedales* was placed, under which either a layer of basalt can be found

Figure 9 Western part of the Domus Flavia with the peristyle courtyard in its current state of preservation, seen from the north. Photo L.J. Coret.

directly beneath it, or, in the case of a difference in height, another row of bricks was present[42]. The attribution of the room suite to the original building phase was finally affirmed by the four brick stamps that were recorded for the first time during the campaign: Of these, only one is unreadable; the rest – all different types – can be securely identified and dated to the last quarter of the 1st century AD (cf. Appendix: nos. 5-7, 9)[43]. Finally, the connections between the outermost spaces (526-527, 517-518) needed to be clarified, and to do so, it was necessary to investigate the demarcation between them, and in addition, architectural characteristics had to be compared. Several cleanings were made, during which it became apparent that the foundations of rooms 518 and 526 did not continue on the same level in the outer spaces 517 and 527[44]. This would suggest that the floor level there was lower than in the rooms. The presence of water drainage channels in these spaces suggests that they could actually have been open to the air, in contrast to the covered rooms in between. This would then explain the difference in floor level, because a lower ground level would assure that rain would not flow into the higher, covered rooms. A further indication that corroborates the difference in floor level comes from the height of the niches in the open-air spaces 517 and 527, where they are placed on a higher level than in all the other rooms, which means that if viewed from these they would appear to be on the same levels as the niches in the other rooms[45]. A further hypothesis involves the presence of four columns[46] to mark the division between the rooms and the open-air spaces 517 and 527, two in each case, since it would make sense to have more weight-carrying elements present. If the proposal of open-air spaces is correct, it would mean that the roofs of the surrounding rooms would also

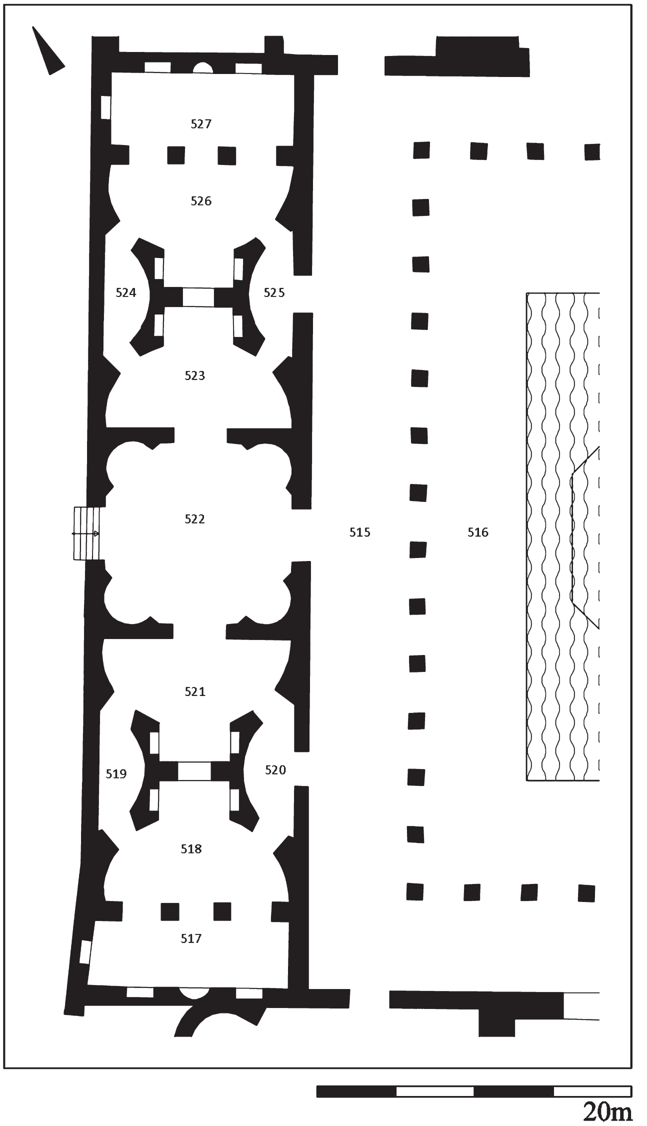


Figure 10 Plan of the western part of the Domus Flavia. Drawing by A. Rheeder, after directions of N. Sojc, L.J. Coret and J. Grinbold.

need to have been carried on the northern and southern sides, which would coincide with the discussed divisions between the outermost rooms and the inner ones, and that the proposed columns would have supported the roofs. Furthermore, in other parts of the palace, columns are known to have formed the division between the open-air spaces and the covered rooms. In the case of the group of rooms adjoining the central court (fig. 2: 590), the columns are placed exactly on the crossings of the division of spaces and the edges of the perpendicular sightline[47]. The same architectural organization is thus proposed for the room suite under investigation here.

3.2 *Spatial analysis*

In the suite of rooms in the west wing of the Domus Flavia are two main axial lines: the first one leads from the outside through room 522 into the peristyle courtyard (fig. 10). The second one is between open-air spaces 517 and 527, through rooms 518, 521-523 and 526, as there are windows between rooms 518 and 521 and between rooms 523 and 526. Entrance room 522 forms the cross-axis, because both axial lines pass through this space (fig. 11)[48].

Immediately recognizable as corridors are spaces 519-520 and 524-525, since they appear to be too small to have any other function. Furthermore, their narrowness points to a deliberate segregation of spheres. Corridors 519 and 524, which are only connected to two other rooms, do not seem to have played a role in the visibility of the suite of rooms under discussion here. The situation is different for corridors 520 and 525, each of which is not only connected to two other rooms, but also to the peristyle courtyard. Furthermore, these corridors have a continual sightline through their space, while 519 and 524 do not: An preliminary isovist analysis of the connection between room 523 and corridor 525 seems to indicate that it was almost impossible to look from this point into the grand assembly hall, the Aula Regia (fig. 2: 531). However, this is not simply due to the small openings (fig. 10: 515-525); rather, the possible sightline appears to be blocked by the presence of the columns in the peristyle portico (515, 516). Even more curious is the presence of niches in the western walls of open-air spaces 517 and 527, which are not parallel to the eastern sides. This could point to the importance of narrow sightlines from the peristyle courtyard into these rooms through the connections 518-520 and 525-526.

Figure 11 Western part of the Domus Flavia: The visible but not traversable axis seen from room 518 in the direction of the open-air space 527. In front: the window between rooms 518 and 521. Photo L.J. Coret.

The design of the suite of rooms under discussion shows a calculated interplay between visibility and permeability, i.e. the traversability of the spaces. The axial line from outside into the peristyle through the central room (522) is cut off by the fountain in the peristyle court (516). The other axial line, i.e. the sightline between open-air spaces 517 and 527, is also not traversable. Direct pedestrian access is blocked by the walls between rooms 518 and 521, and between 523 and 526, but the above-mentioned windows do however provide a view through them (fig. 11). Between the rooms connected by the sightline, one could only move along the corridors (519-520, 524-525).

With regard to the integration of spaces, the entrance room and movement divider 522 emerges as the central space of this suite of rooms. It is the only room which is connected to all four main parts (exterior of the palace, peristyle, and the northern and southern set of rooms); furthermore, in several locations it was only possible to move from one part into the other through the movement divider, otherwise it was necessary to make a detour, e.g. through the peristyle.

The corridors 520 and 525 are better integrated than 519 and 524, due to their connection to the peristyle. Considered together with the paragraph concerning the niches, the well-integrated corridors do show a sightline towards a niche, whereas the less-integrated corridors do not. Based on the observable differences of integration, it is possible to make a hierarchical distinction between the internal connections of the rooms, even though at first glance they seemed completely similar from an architectural point of view. Taking the northern part as an example: the connection 523-525 is the most integrated, because it forms the direct connection between the central room 522 and the peristyle courtyard. On the other hand, the connection 524-526 is the least integrated, because it is neither directly related to movement divider 522, nor to the peristyle.

Finally, if the depth of every space in the room suite is analysed assuming the central room 522 to function as an entrance from the outside, the Area Palatina, it becomes clear that the depth increases as one moves away from it, either to the north or to the south (fig. 12).

Based on the results of the spatial analyses, the following conclusions can be drawn with regard to the role that these spaces played in the movement system of the room suite. Starting once again with the realization that even though the main entrance is through central room 522 and the main axial line runs directly towards the peristyle, it can be concluded that, for anyone entering, attention would probably have gone immediately towards the peristyle, and was thus drawn towards the portico and the fountain. One could therefore ask to what extent the northern or southern set of rooms would have been noticed at all and doubt that guests would have been tempted to follow a minor sightline instead

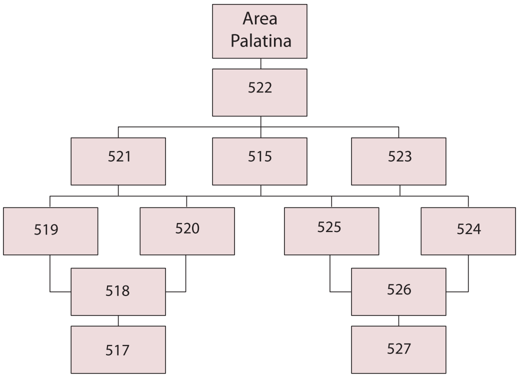


Figure 12 Depth diagram of the western part of the Domus Flavia. Drawing by L.J. Coret.

of the main one[49]. It seems that if someone was specifically told to go into either room, only then would these spaces have become the centre of attention. It can be deduced from the typical layout of rooms 518 and 526 that they functioned as banqueting rooms[50]. These rooms were equally visible from movement divider 522 and the other rooms of the suite along the axial line through the windows as well as from the peristyle courtyard, but they were only accessible from the sides, and not directly. Based on the presence of the niches on only the western side of the annexed open-air spaces 517 and 527, it seems that corridors 520 and 525 were used only as official entrances to the dining rooms. It is striking that these sightlines from the peristyle into the rooms seem to have been of minor importance because of the main sightlines from the peristyle being directed towards its fountain. What does this mean? As a hypothesis it can be suggested that, instead of a deliberate creation to control movement through these rooms, some other spatial arrangements had priorities for the architects, so, for instance the above-mentioned visibility without traversability could also be investigated from a social perspective[51].

4 Conclusion and perspectives for further research

The examination of two selected areas in Domus Flavia has revealed that the analysis of small rooms within their spatial context can yield a better understanding of the everyday utilisation of a palace tract. As already presented here in the exploratory investigation, which mainly concentrates on a particular phase in the running of the palace at the beginning of the 2nd century AD, two differing concepts of routing layouts could be determined regarding two movement dividers. The room to the north (534) proved to be a functional divider between entrance corridor, upper storeys, peristyle courtyard and representative halls, which without any additional architectural decoration and with the varying widths of its openings, indicates a hierarchization of the passageways. Spatial analysis confirmed that the movement divider to the west (522), primarily served as an entrance area and connecting room, from whence, with the help of visual stimuli, one would have been virtually 'swept along' into the central peristyle. Only as its secondary function did it distribute the visitors into the dining halls, some of whom were perhaps presented only with views through the windows, without being able to enter themselves.

Both movement dividers and adjacent rooms reveal a very conscious knowledge of the principles of visibility and permeability. It can thus be presumed that, through architecture, the 'visible' (windows, enfilades) was defined as not necessarily reachable. Since similar situations can also be observed in other areas of the Palatine palace (e.g. the lower level of Domus Augustana[52]), the desire for a social demarcation suggests it to be the reason for architectural differentiation. The authors of this article feel reminded by this phenomenon of demonstrations of ceremonial as they are first known from early modern times, for instance of the importance at court, pointed out by N. Elias – behind a barrier – of watching the Monarch eating or going to bed[53]. Such phenomena would still have to be examined for the Roman court, not only through recent reading of written sources but also through broadening the application of micro-spatial analysis on further areas and the subsequent consolidation of this knowledge. Furthermore, it would also be important to systematically further pursue and monitor the chronological development of such areas. Only then could results be evaluated – such as the realization, obtained for the north-east area in the Domus Flavia (fig. 2) examined here, that only a few interventions were sufficient in order to prevent a movement divider from operating – in terms of their consequence for the everyday functioning of the various palace tracts. In a unique sense, the question initially remains open as to whether this palace area was subject only to a stronger physical access control or whether at the same time the uses of the individual tracts (to the west of Domus Flavia, to the east of the "no-man's-land") should be more strongly isolated from one another.

The results that answer such questions could also be compared to the descriptive assertions from literary sources. Somewhat like the information in the matter under consideration here that, under Emperor Domitian, access to the ruler was controlled by densely staggered architectural barriers – long corridors, closed doors, endless room sequences – whereas entry to the rooms of his successor Trajan was possible directly[54], even though both resided in the 'same palace'[55]. Our exploratory study of archaeological remains points to a different situation at least in the north east area of the Domus Flavia: the original building phase there – which could tentatively be attributed to the Domitianic reign – was characterized by direct access and easily surveyable spaces, whereas in the following phase – most likely effected by one of this Emperor's successors – large spaces were subdivided into smaller ones, thus making the access to the palace more complicated and less clear to overlook. Clearly, further investigations will be necessary to find out how, in this instance, archaeological and literary sources' information on the usage of space in the Imperial palaces can be reconciled.

Notes

1 Ios. ant. Iud. 19, 117. For the interpretation of this passage cf. Cecamore (2002, 218-220).

2 For the Palatine Hill and the Imperial palace see cf. Giuliani (1982); Papi (1999, 28-30.); Royo (1999); Winterling (1999); Hofmann and Wulf (2004).

3 Stat. silv. 4, 2, 18-31; cf. Gibson et al. (1994, 67-85); Zanker (2002, 110-125).

4 For a general overview of the research of the Domus Flavia see cf. Giuliani (1977); Gibson et al. (1994); Zanker (2002); cf. Cecamore (2002, 230-232).

5 Cf. Bianchini (1738); cf. AA.VV. (1994); Miranda (2000).

6 A special debt of thanks is due to the Gerda Henkel Foundation, which financed and supported the study of the Domus Flavia.

7 For ongoing and fruitfull cooporation we wish to thank the Architekturreferat of the German Archaeological Institute, above all Ulrike Wulf-Rheidt as well as Adolf Hoffmann, Jens Pflug and Dörthe Blume. For stimulating discussions we want to thank Heinz Beste (German Archaeological Institute, Rome).

8 This infomation is in preparation for publication by (among others) Dörthe Blume who is preparing a PhD thesis with the title "Die Baugeschichte der Domus Flavia in Rom" at the University of Cottbus, as well as by Heinz Beste (German Archaeological Institute, Rome) and Evelyne Bukowiecki (University of Aix-Marseille I, Provence) who is preparing an extensive study on brick wall analysis and brick stamps.

9 The spatial analysis of the Imperial palaces on the Palatine by Leiden University is planned to continue for the next couple of years; the present publication is a first preliminary report, which is meant to point out the possibilities of this kind of research. With regard to the spatial analysis we especially wish to thank Hanna Stöger for her questions, comments and practical help.

10 For the discussion about the authenticity of the barrier of the tribunal see Tomei (1999, 291-315).

11 Cf. Bianchini (1738, 225); Bianchini's plan and research status published in Malmberg (2003, 28-43 fig. 6); cf Tomei (1999, 285-298).

12 Since no direct parallels exist for residential architecture nor for public buildings, and literary descriptions are lacking, the utilisation of the rooms cannot be more closely determined in detail.

13 The authors wish to express their thanks to the Soprintendenza Speciale per i Beni Archeologici di Roma, in particular to Roberto Egidi, for having authorized this research, and to Maria Antonietta Tomei for highlighting its importance. The scientific exchange made possible by them, and Daniela Spadoni has been of inestimable value. For their organizational assistance we wish to thank Maurizio Rulli, Gloria Nolfo and Bruno Angeli. Much appreciation and gratitude goes to the directors of the Netherlands Institute in Rome Bernard Stolte and Gert-Jan Burgers for their invaluable advice and constant help. We also wish to express our thanks to the department of Classical Archaeology of Augsburg University, especially Valentin Kockel and Andrea Schmölder-Veit for their cooperation, as well as to Judith Grinbold who participated in the campaign work. We would like to express our particular gratitude to the German Archaeological Institute in Rome for its technical support. For their productive discussions we further wish to thank Marike van Aerde, Annetta Alexandridis, Christine Ertel, Klaus S. Freyberger, Pia Kastenmeier, Eva Mol, Richard Neudecker, Clemens Voigts and Stephan Zink, as well as the participants of the KNIR guided tour for their comments and questions. We express our thanks to Jonathan Smale for his help with the English language version of this article.

The abbreviations of journals etc. follow the guidelines of the German Archaeological Institute; the abbreviations of the ancient authors and their works follow the guidelines of the DNP.

14 For an introduction in Space Syntax analysis in archaeology, cf. Stöger (2011). For an explanation of the spatial concepts and their associated methodologies, cf. Hillier (2007).

15 The authors wish to express their thanks to the students who have participated in the work: M. van der Boon, A. van der Meulen, B. van der Meulen, J. Splinter, D. Visser and V. van der Werf.

16 During earlier campaigns on the Palatine, these aspects have proven to be of significance for the identification of the chronological position of the constructions. On methodology and results for various areas of the palace see Bukowiecki (2008); idem (2010); Sojc (2012).

17 As the investigation methods can be used mainly for dating in longer periods and because of this being a preliminary presentation of the results, we refrained from an attribution of the palace building activities to reigns of certain Emperors.

18 As the number of spaces under investigation here is relatively small, it was possible to identify a relative hierarchy of integration of the spaces without using computer analyses, cf. Hillier and Hanson (1984).

19 On the discussion of the entrance in the north-eastern part of the Domus Flavia, cf. Finsen (1969, 8f.); Zanker (2004, 96); Mar (2009, 257-261); most recent comprehensive overview presented by F. Villedieu and N. André, cf. André et al. (2004, 119-121 fig. 168). See also Wulf-Rheidt and Sojc 2009.

20 The term was created by H. Finsen during his investigations of the Imperial palace, cf. Finsen (1969, 5). Since 2009 the area is

under investigation by the Università degli Studi "La Sapienza" Roma (P. Carafa and A. Carandini), but results have yet to be published.

21 Cf. Dutert (1873, 105 note 14 tab. 2, F).

22 The analysis of the brickwork is based on the results of E. Bukowiecki, cf. Bukowiecki (2012). The Flavian foundation on the eastern side is located at a very deep level. With the exception of the few locations on the site where this foundation remains uncovered, it was not found in the cleanings of about +/- 10cm depth. The analysis and chronology of the foundations in *opus caementitium* with basalt as the main component (the other one is tuff) is based on the foundation research in the Domus Augustana by M. Fink and P. Wech, cf. Fink and Wech (2012).

23 The Roman brick production consists of several standardized forms and sizes: the bricks used in the constructions here under investigation are sesquipedales and bipedales. The first type with a length of c. 45 cm (sesquipedales = 1.5 Roman feet) was split into smaller pieces and installed in the wall facing. The second type was used unbroken (c. 60 cm = 2 Roman feet) at problematic static positions like e.g. floor preparations and relieving arches.

24 The wall constructions in the southeast (569-574) are less well preserved: in several instances only a few lines of bricks of the original structure are still in situ and the post-antique restorations, as well as the modern paths laid out for the visitors, hinder any investigation of these.

25 Our cleaning has clarified the type of foundation, which here consists of brick-faced walls and a row of bipedales on a higher level in comparison with the deeply located foundations of the original phase.

26 All the wall structures under investigation still have preserved traces of revetment deriving from different phases which refer to the once luxurious interior. Because it was not studied systematically it was not taken into account in the spatial analysis.

27 Even though the general state of preservation is rather poor, it was possible to identify 40 out of 65 in the northeastern part (cf. Appendix: Nos. 1-4, 9). A catalogue of brick stamps retrieved in the campaigns 2010 and 2011 is in preparation by E. Bukowiecki.

28 Cf. Appendix: No. 1. The same type was found in a part of a wall-nucleus, which, as can be concluded from the same composition of the cement, probably once belonged to the vault of the staircase as well.

29 The stamps were nearly all found on *sesquipedalis* that were part of the brick facing, cf. Appendix: Nos. 2-4.

30 It was also possible to tell apart the traces of modern interventions in this tract, i.e. of the buildings that had re-used the ancient walls but were themselves demolished completely when the Palatine was excavated at the end of the 19th and beginning of the 20th century.

31 Another entrance for the north façade 535 is still under discussion, although the reconstruction of a direct passage way from the outside over stairways into the grand northern halls has been given up, cf. Zanker (2004, 114-116); Mar (2009, 257-259 fig. 4).

32 The staircase room 533 and movement divider 534 were already connected by two openings in the original building phase (fig. 4): the partition wall between the two is only original in the western part, the eastern side is completely restored (passages with width of c. 2.34 m and c. 3.24 m). However, the presence of a pilaster, which is connected to the east wall of 533 and 534 of the original phase, proves the presence of a passage in this location (the diagonal position of the uppermost brick points to the presence of a relieving arch in this phase).

33 It is important to make a distinction between the main axial line and the isovist within a certain space: The former is the main line of sight from a certain point; the latter is everything that is visible from a certain point in a certain space (360 degrees around the chosen location).

34 The newly created rooms 577, 579 and 580 blocked indeed the main eastern entrance into room 534, but seem to have provided some smaller passages among each other and partly also to room 534; however, these were closed off again after a short period as the date of the brick stamps suggests (cf. Appendix: Nos. 2-4).

35 Cf. Tomei (2000, 28-32); André et al. (2004, 120); Mar (2009, fig. 3). For the Area Palatina see Torelli (1993).

36 Gell. 20, 1, 2.

37 Cf. Finsen (1969, 9f.).

38 Cf. Speksnijder (in preparation), passim.

39 Cf. e.g. the so-called Palazzo delle Colonne in Tolemaide, cf. Pesce (1950) passim.

40 The small differences between the architectural layout of the two parts that can be observed, seem not to be significant for the spatial analysis.

41 Parts of the eastern wall of rooms 523 and 526, as well as a large part of the walls of room 525, are later restorations. However, there are no indications to assume that these restorations altered the original layout of the rooms, especially because the layout in the original brickwork is preserved in the southern wing (cf. rooms 518-520-521). Traces of later wall revetments have only been recorded in room 526.

42 Based on homogenous appearance of the foundations and their correspondence to one of the foundation types, which was in use at the beginning of the 2nd century AD as has been established by Martin Fink and Pierre Wech, cf. Fink and Wech (2012), a dating to the original building phase seems to be corroborated.

43 Cf. Appendix: Nos. 5-7, 9. Two of these were found on *bipedales* which were part of the original floor level in room 525 (partitioning 525-526); one brick stamp was found on a *bipedalis* in the south-western wall of room 526 (partitioning 524-526); another brick stamp was found in the northern wall of room 523 (partitioning 523-526).

44 Due to the limited scope of the 2012 research campaign, the foundations of the outermost rooms were not recorded in detail, although in the southern set of rooms a row of *bipedales* was found at a depth of 20 cm This row is visible through one of the water

channels cut into the outer wall, the ground level of which on the outside is on a considerably lower level.

45 These observations and deductions in regard to the niches we owe to J. Grinbold who is preparing a Master thesis on the topic with the title "Die Nischenarchitektur der *Domus Augustana inferiore* auf dem Palatin in Rom" at Augsburg University.

46 There are two columns present in the plans of F. Coarelli, cf. Coarelli (1974, 136-7) and of I. Gismondi, published Sojc and Winterling (2009, fig. 1). Further research on this issue will include archive research, e.g. on the excavations of Giacomo Boni, cf. AA.VV. (1994, 103 fig. 104).

47 There is exactly enough space for a single column placed on a base of c. 90 cm between the end of the window and the beginning of the inner north-south orientated wall .

48 This means that the room itself is never the centre of attention, but rather it provides the open space needed for both axial lines, cf. e.g. Newsome's (2009, 33; with reference to Varro *ling*. V 11-2) discussion on the two types of centrality in the urban landscape which is also applicable here: movement divider 522 is a room which visitors move *through* (i.e. to get from A to B), but which they do not move *to*, i.e. it is not a destination in itself as for instance the dining rooms are.

49 It has been observed in urban contexts that visitors who are not familiar with certain urban zones are tempted to follow the main sightlines and avoid the smaller connections between them, even if these would save them time, cf. Hillier and Hanson (1984, 17); Lynch (1960, 54). It seems logical to expect a similar response to the movement through internal space as well.

50 Cf. Sojc (2009); Sojc and Winterling (2009) and Sojc (2012) on the typical layout of dining rooms.

51 This point will be expanded on elsewhere.

52 Cf. Sojc (2005).

53 Cf. Elias (1969: 144-183).

54 Plin. paneg. 47, 5: *Quod enim forum, quae templa tam reserata? … Nullae obices nulli contumeliarum gradus superatisque iam mille liminibus ultra semper aliqua dura et obstantia.*

55 Plin. paneg. 48, 3: *in communi domo*. Plin. paneg. 49, 2: *eadem domus*.

References

AA. VV. 1994. F. Sicilia (ed.) *Archeologia in posa: cento anni di fotografie del Palatino*, Roma.

André, N., Y. Thébert and F. Villedieu 2004. Vom ‚schwebenden Garten' zum Tempelbezirk. Die Untersuchung der École Française de Rome in der Vigna Barberini. In: A. Hoffmann and U. Wulf (eds), *Die Kaiserpaläste auf dem Palatin in Rom*, Mainz, 112-143.

Bianchini, F. 1738. *Del Palazzo de' Cesari*, Verona.

Bukowiecki, E. 2008. *La brique dans l'architecture impériale à Rome. Quelques grands chantiers du Palatin*, Lille (unpublished PhD thesis University of Aix-Marseille I).

Bukowiecki, E. 2010. La taille des briques de parement dans l'*opus testaceum* à Rome. In: S. Camporeale (ed.), *Arqueología de la construcción 2. Los procesos constructivos en el mundo romano. Italia y provincias orientales (Certosa di Pontignano, Siena, 13-15 de Noviembre de 2008)*, Madrid, 143-151.

Bukowiecki, E. 2012. La Domus Augustana inferiore organizzazione del cantiere e principali fasi costruttive. In: N. Sojc (ed.), *Domus Augustana. Archäologische und bauforscherische Dokumentationsarbeiten in der Domus Augustana auf dem Palatin*, Leiden, 43-69.

Cecamore, C. 2002. *Palatium. Topografia storica del Palatino tra III sec. a. C. e I sec. d. C.*, Roma.

Coarelli, F. 1974. *Guida archeologica di Roma*, Milano.

Dutert, F. 1873. *Étude et restauration du palais public des Césars sur le mont Palatin*, Paris.

Elias, N. 1969. *Die höfische Gesellschaft. Untersuchungen zur Soziologie des Königtums und der höfischen Aristokratie*, Berlin.

Fink, M. and P. Wech 2012. Foundations in *opus caementicium* and their building process in the imperial architecture of the Palatine: Typology as a means of dating in a local system. In: N. Sojc (ed.), *Domus Augustana. Archäologische und bauforscherische Dokumentationsarbeiten in der Domus Augustana auf dem Palatin*, Leiden, 71-101.

Finsen, F. 1969. *La residence de Domitien sur le Palatin*, København (Analecta Romana Instituti Danici V Supplementum).

Gibson, S., J. De Laine and A. Claridge 1994. The Triclinium of the Domus Flavia: a New Reconstruction. *BSR* 62, 67-97.

Giuliani, C.F. 1977. Domus Flavia. Una nuova lettura. *RM* 84, 91-106.

Giuliani, C.F. 1982. Note sull'architettura delle residenze imperiali dal I al III secolo d. C. *ANRW* 2, 12, 1, 246-254.

Hillier, B. 2007. *Space is the machine: a configurational theory of architecture*, London.

Hillier, B. and J. Hanson 1984. *The social logic of space*, Cambridge.

Lynch, K. 1960. *The image of the city*, Cambridge, MA.

Malmberg, S. 2003. *Dazzling dining. Banquets as an expression of Imperial legitimacy*, Uppsala.

Mar, R. 2009. La Domus Flavia. Utilizzo e funzioni del palazzo di Domiziano. In: F. Coarelli (ed.), *Divus Vespasianus. Il bimillenario dei Flavi. Catalogo della mostra Roma, Colosseo, Curia e Criptopotico 'neroniano', 27 marzo 2009 - 10 gennaio 2010*, Roma, 250-263.

Miranda, S. 2000. *Francesco Bianchini e lo scavo farnesiano del Palatino (1720-1729),* Pavia.

Newsome, D.J. 2009. Centrality in its place: defining urban space in the city of Rome. In: M. Driessen et al. (eds), *TRAC 2008: proceedings of the eighteenth annual Theoretical Roman Archaeology Conference, which took place at the University of Amsterdam, 4-6 March 2008*, Oxford, 25-38.

LTUR IV (1999) 28-38 s. v. *Palatium (64 – V. sec. d. C.)* (E. Papi)

Pesce, G. 1950. *Il "Palazzo delle Colonne" in Tolemaide di Cirenaica*, Roma.

Royo, M. 1999. *Domus Imperatoriae. Topographie, formation et imaginaire des palais impériaux du Palatin (IIe siècle av. J.-C. - Ier siècle ap. J.-C.)*, Roma (Bibliothèque des Ecoles françaises d'Athènes et de Rome 303).

Sojc, N. 2005/2006. Festsaal und Nebenräume in der Domus Augustana auf dem Palatin. Ergebnisse der archäologischen Dokumentationsarbeiten 2004 und 2005. *RM* 112, 339-50.

Sojc, N. 2009. *Domus principum. Ursprung und Entwicklung der Kaiserpaläste auf dem Palatin in der Zeit von Augustus bis Hadrian* (upublished professoral dissertation, Universität Würzburg).

Sojc, N. and A. Winterling 2009. I banchetti nel palazzo imperiale in epoca flavia attraverso le testimonianze archeologiche e letterarie. In: F. Coarelli (ed.), *Divus Vespasianus. Il bimillenario dei Flavi. Catalogo della mostra Roma, Colosseo, Curia e Criptopotico 'neroniano', 27 marzo 2009 - 10 gennaio 2010*, Roma, 294-301.

Sojc, N. (ed.) 2012. *Domus Augustana. Archäologische und bauforscherische Dokumentationsarbeiten in der Domus Augustana auf dem Palatin*, Leiden.

Speksnijder, S. in preparation. The elusive vestibulum: a comparison of the archaeological and literary sources on Roman domestic waiting areas (in prep.).

Stöger, H. 2011. *Rethinking Ostia: a spatial enquiry into the urban society of Rome's Imperial port-town*, Leiden (Archaeological Studies Leiden University 24).

Tomei, M.A. 1999, *Scavi francesi sul Palatino. Le indagini di Pietro Rosa per Napoleone III (1861–1870)*, Roma (Roma antiqua 5).

Tomei, M.A. 2000, Le case di Augusto sul Palatino. *RM* 107, 7-36.

LTUR I (1993) 119 s.v. Area Palatina (M. Torelli).

Winterling, A. 1999. *Aula Caesaris – Studien zur Institutionalisierung des römischen Kaiserhofes in der Zeit von Augustus bis Commodus (31 v. Chr. - 192 n. Chr.)*, München.

Wulf-Rheidt, U. and N. Sojc 2009. Evoluzione strutturale del Palatino sud-orientale in epoca flavia. Domus Augustana, Domus Severiana, Stadio. In: F. Coarelli (ed.), *Divus Vespasianus. Il bimillenario dei Flavi. Catalogo della mostra Roma, Colosseo, Curia e Criptopotico 'neroniano', 27 marzo 2009 - 10 gennaio 2010*, Roma, 268-279.

Zanker, P. 2002. Domitian's palace on the Palatine and the Imperial image. In: A.K. Bowman, H. M. Cotton, M. Goodman and S. Price (eds), *Representations of empire. Rome and the mediterranean world*, *Proceedings of the British Academy 114*, Oxford, 105-130.

Zanker, P. 2004. Domitians Palast auf dem Palatin als Monument kaiserlicher Selbstdarstellung. In: A. Hoffmann and U. Wulf (eds), *Die Kaiserpaläste auf dem Palatin in Rom. Das Zentrum der römischen Welt und seine Bauten*, Mainz, 86-99.

Natascha Sojc
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
n.sojc@arch.leidenuniv.nl

Appendix

Catalogue of brick stamps recorded during the Domus Flavia 2012 research campaign

N° of brick stamp and photograph[1]		N° CIL	Text	Location[2]	Quantity	Date[3]	Information
1		**153**	L·VALERI O D SEVERI	**533N-n**	**1**	Beginning of 2nd century AD	Brick type: bipedalis Stamp shape: tabula ansata
2		**563**	PAETINO ET APRONIA M VINIC PANTAG SVLP (or variant)	**579-e**	**1**	AD 123	Brick type: sesquipedalis Stamp shape: rectangular
2a		**563a-k**	PAETINO ET APRONIA M VINIC PANTAG SVLP (or variant)	**577-ne** **577-nw** **579-se**	**1** **1** **1**	AD 123	Brick type: sesquipedalis Stamp shape: rectangular
2b		**563n-q**	SVL M VINI PANTAGA PAETI ET APRON COS (or variant)	**579-se**	**1**	AD 123	Brick type: sesquipedalis Stamp shape: rectangular
3		**565**	VIN PAN SVL xx (or variant)	**533S-e** **577-ne** **577-se** **580-n** **580-s** **580-w** **578-w** **582-s**	**7** **1** **1** **2** **1** **1** **9** **3**	c. AD 123	Brick type: sesquipedalis Stamp shape: rectangular without margins
3a		**565e**[4]	VIN PAN SVL IO	**533S-e** **533S** **(staircase)**	**1** **1**	c. AD 123	Brick type: sesquipedalis Stamp shape: rectangular without margins

3b		**565l**	VIN PAN SVL VA	**582-s**	**1**	c. AD 123	Brick type: sesquipedalis Stamp shape: rectangular without margins
3c		**565var.**	VIN PAN SVL PI	**580-s**[5]	**1**	c. AD 123	Brick type: sesquipedalis Stamp shape: rectangular without margins
3d[6]		565	VIN PAN SVL xx (or variant)	**533S-w 579-sw** **580-w**	**1** **1** **1**	c. AD 123	Brick type: sesquipedalis Stamp shape: rectangular without margins
4		**578a**	TI CLA BLA SVL	**578-w**	**1**	c. AD 117-138	Brick type: sesquipedalis Stamp shape: rectangular without margins
5		**1000a**	PRIM^{I}GEN DVO DOM^{I}TIOR·S_{E}R·F	**526-swn**	**1**	AD 60-93	Brick type: bipedalis Stamp shape: rectangular
6		**1094h**	CN DOMITIVS (palm twig) ARIGNOTVS·F	**525-w**	**1**	c. AD 75-100	Brick type: bipedalis Stamp shape: orbicular
7		**1449a**	(palm twig) L·SEXTILI·RVFI (palm twig)	**525-w**	**1**	c. end of 1st century AD	Brick type: bipedalis Stamp shape: orbicular
8		**Anepi- graphic**	None	**579-s**[7] **(restored)**	**1**	After c. AD 138	Brick type: sesquipedalis Stamp shape: circular

9		**Uniden-tified**	Unkown	**523-n** **533S-e** **533S-w** **577-ne** **577-w** **578-e** **578-w**	**1** **11** **1** **2** **1** **4** **6**	Unknown	Brick type: bipedalis (523-n); sesquipedalis (rest) Stamp shape: orbicular/circular (523-n); rectangular without margin (rest)

1 Displayed are the most representative finds as stand-ins for the different brick stamps. Photographs, rubbings and mouldings: 1, 2/2a, 3a, 3b, 8 (L. Götz); 2b, 5 (M. van Aerde); 3, 3c, 3d, 4, 6, 9 (L. Coret); 7 (M. van der Boon).

2 The location's specification is built up out of: room specification and respective wall based on wind direction, cf. fig. 2#.

3 In our campaign report the date is given according to CIL.

4 Known as JO in CIL; however, it looks more like a prolonged I. Furthermore, the letter J was not part of the Roman alphabet, therefore this identification cannot explain the original text.

5 CIL XV, 1 does not mention this stamp, but its categorization system allows the addition of new finds to the 365 group on the grounds of the basic text similarities.

6 Under 3d all those brick stamps are assembled of which only two letters are legible. As these are very characteristic in shape, it is most probable that they belong to the CIL N° 365 group.

7 The brick is part of a modern restoration of the ancient wall.

Decoration and ideology in Nero's Domus Aurea in Rome

Paul G.P. Meyboom and Eric M. Moormann

Some 140 rooms remain of the reception pavilion on the Oppian hill in Rome, which once belonged to Nero's Golden House. It was built and decorated between AD 64 and 68. The study of the paintings reveals that these were made by three workshops, each of which worked in its own typical style; all three are variations of the Pompeian Fourth Style. Moreover it appeared that marble wall revetments played an important role in the decorations of several rooms, which actually were the more important rooms, and that these marble revetments were valued higher than the wall paintings. The fashion of marble revetments originated in the Hellenistic kingdoms of the eastern Mediterranean. With the adoption of this fashion Nero wanted to emphasize his claim to the absolute monarchy over the Roman world.

1 History of the research

In the last quarter of the 15th century underground rooms were discovered beneath the remains of the Baths of Trajan on the Oppian hill. These rooms were part of the famous Domus Aurea, the Golden House, which Nero Caesar built between AD 64 and 68. Until this discovery, its marvels were only known from descriptions by Tacitus (*Ann*. 15.42-43) and Suetonius (*Nero* 31). These underground rooms, usually *c*. 10 m high, were named "le grotte" and they attracted especially the attention of artists like Raphael and his school, who admired the fantastic wall paintings which they named the "grottesche", a name which survives in our term grotesque. In the following centuries more rooms were discovered and at present some 140 rooms and corridors are known. Now and then some wall and vault decorations were copied and published, like the 56 fine plates in the large folio volume edited in Rome in 1776 by Mirri and Carletti after colour drawings made on the spot by V. Brenna, M. Carloni and F. Smugliewicz (see e.g. fig. 5).

The first serious attempt at a scholarly study was undertaken by De Romanis and appeared in Rome in 1822. Later some newly discovered rooms were published only occasionally, but a complete study of the structure and its decorations was not undertaken except for the important study by Weege (1913) who published several parts of the east wing. This lack of scholarly interest may have been caused partly by the enormous size of the building, the poor state of the paintings covered with layers of dirt and deposits of lime, and the difficult working conditions in the dark, cold and damp rooms.

Serious scholarly attention to the building decorations was given by the Dutch school of students of Roman wall painting founded by H.G. Beyen (Professor of Classical Archaeology at Leiden University 1954-1965), his pupils F.L. Bastet (Leiden University) and W.J.Th. Peters (Radboud University Nijmegen), and their pupils P.G.P. Meyboom (Leiden University) and E.M. Moormann (Radboud University).

Traditionally four styles are distinguished in chronological order in Roman wall decoration, called the four Pompeian Styles after the Campanian town of Pompeii which is the most important source of Roman wall painting. The First Style actually is not real wall painting but an imitation of marble revetment in painted stucco relief and does not contain figural elements. Real wall painting, containing illusionistic and figural elements, began with the Second Pompeian Style in the beginning of the 1st century BC.

After studies of the Second Style by Beyen (1938; 1960) and R.A. Tybout (1989) and a study of the Third Style by Bastet and M. de Vos (1979), the Fourth Style became the subject of study (Peters 1982; 1993). This style flourished in Pompeii roughly in the period between the earthquake of AD 62 and the destruction of the town by the eruption of the Vesuvius in AD 79. The largest number of wall paintings preserved in Pompeii belong to this style. Because of the large number and the relatively short period from which they date, it proved difficult to establish a stylistic development and a chronology. Therefore the attention was diverted to the wall paintings in Nero's Domus Aurea which usually are dated in the even more limited period of AD 64-68. However, it appeared that – like we just saw – these wall paintings never had been the subject of a more complete and serious study.

Around 1980 Peters and Meyboom started a survey of the decorations, and some 15 years later Moormann took over Peters' part. The original plan was to obtain some insight into the wall paintings in the Domus Aurea in order to acquire a better understanding of the Pompeian Fourth Style. However, they found such a variety in styles and forms that it became necessary to study the remaining paintings as a whole in order to achieve a real insight, and because of the monument's enormous size and the large amount of remains of decorations, the work almost developed into a life's work. In the near future a comprehensive monograph will appear (supplement BABesch) on the monument and its decorations by the present authors who offer here a summary of their research.

2 Historical introduction (fig.1)

2.1 The development of the imperial residences in Rome

The first imperial residence in Rome was the house that Augustus built on the south-west corner of the Palatine hill in the 30s and 20s of the first century BC. Some houses of patrician families related to the imperial family, like the house of the Claudii on the west side of the Palatine, were connected to it. Upon this house Nero, who had come to the throne in an irregular way in AD 54 at the age of 17, built a palace rising above the Forum, which later was called the Domus Tiberiana. Besides that, he built some luxurious pavilions, one of which is now erroneously called the Domus Transitoria. Nero built the real Domus Transitoria (Transitional House) on the Velia and the Oppius with the purpose of connecting his possessions on the Palatine to the Villa of Maecenas on the Esquiline, which Maecenas had already bequeathed to Augustus. In AD 64 the great Fire of Rome broke out and destroyed especially the poor people's quarters in the valleys between the Palatine, the Oppius and the Caelius. The last-mentioned hill had also become an imperial possession since Agrippina, wife of the emperor Claudius and Nero's mother, had started there the construction of the huge temple for the Divus Claudius.

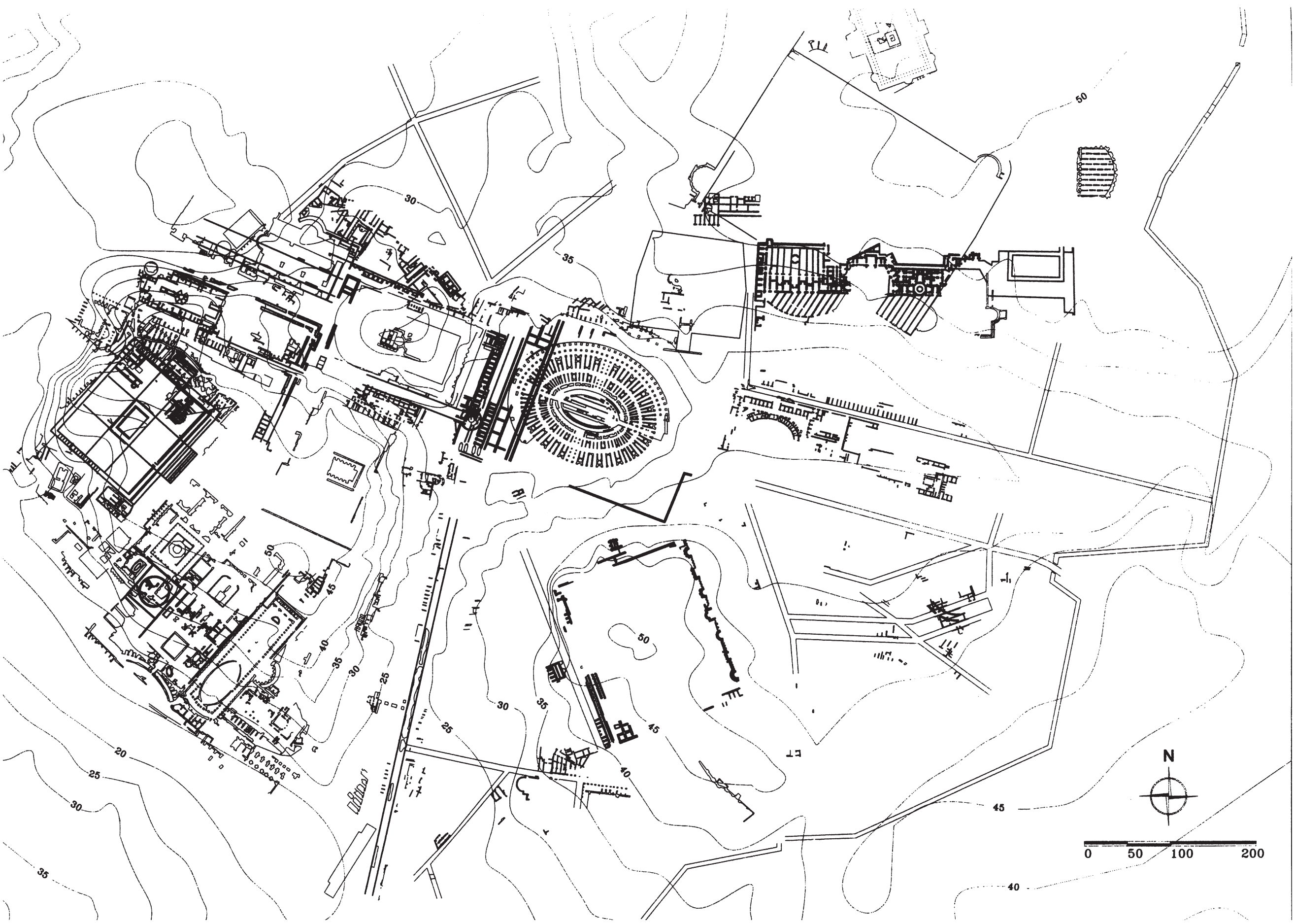


Figure 1 Plan of the Domus Aurea complex, left the Palatine, right the Caelius and above right the Oppius with the pavilion (after Fabbrini 1995, 377, fig. 18).

2.2 *The various parts of the new complex* (fig. 1)

The disastrous Fire, at least for the people of Rome, gave Nero the opportunity to combine the imperial possessions on the mentioned hills in the centre of Rome into one huge complex of *ca* 100 hectares. Nero named this new complex the Domus Aurea, which suggested the beginning of a new Aetas Aurea, a Golden Age, in imitation of his ancestor Divus Augustus. From the temple of Divus Julius (the deified Julius Caesar and the founder of the dynasty) on the Roman forum ran the old Sacra Via, flanked by large porticoes, towards a large rectangular platform which later was included in the platform of the temple of Venus and Roma and which still exists. This platform was also surrounded by porticoes and served as forecourt to the new complex. On it, in the centre of Rome, rose an enormous bronze statue *c*. 40 m high, which represented the emperor as Apollo-Sol, the bringer of the new Golden Age. This statue, which became known as the Colossus, must have been visible from all the hills of the city.

From this forecourt one could turn right to climb the Palatine with the imperial possessions, including the palace which may have served for public functions.

In the valley behind the forecourt, more or less the centre of the entire complex, an artificial lake was created and the slopes of the surrounding hills were covered with groves, rivulets and pastures for grazing cattle. In this landscape-villa setting various kinds of structures were built, like monumental nymphaea, baths (the so-called Baths of Titus may originally have been the baths of the Domus Aurea) and pavilions for banquets and other amusements, such as the famous circular dining room which turned around day and night, the exceptionally shaped base of which seems to have been discovered recently in the north-east part of the Palatine (see the descriptions by Tacitus and Suetonius).

What Nero actually was trying to do was to create in the centre of Rome a huge palace complex – comparable to the royal palace of Alexandria with its shrines, courtyards, porticoes, parks, the mouseion and the zoo – which combined all aspects of a public residence and a luxurious private villa. It was a kind of microcosmos symbolizing his absolute power over the Roman Empire. The Roman people had known extreme luxury in the villas outside Rome but never in their city, and they strongly resented that Nero had sacrificed the centre of their city for what they considered to be a megalomaniac's folly.

After his death in AD 68 his ultimate successors, the Flavian dynasty, stopped the building of the Domus Aurea, opened the area to the public and symbolically expressed the return of the city to its people by the construction of the famous Flavian amphitheatre in the centre of the Domus Aurea at the place of the artificial lake. This policy was aptly summarized by the contemporary poet Martialis (De spectaculis 2,11-12): "*Reddita Roma sibi est et sunt, te praeside Caesar* (i.e. Titus), *deliciae populi quae fuerant domini*" (Rome has been restored to herself and, under your guidance, Caesar, the delights which once were reserved for a tyrant now belong to the people). Ironically the amphitheatre later was called the Colosseum after Nero's Colossus, which in a somewhat modified form still stood beside it until late antiquity.

Among the various structures in this enormous complex was the pavilion on the Oppius which is now usually called the Domus Aurea and which is the subject of our study.

3 The pavilion (figs. 1 and 2)

This pavilion has survived because it was partly incorporated into the substructures for the Baths of Trajan which were dedicated in AD 104. Now it is roughly 200 m long but originally probably *c*. 350 m, the centre presumably being the stupendous octagonal hall (128). The east wing was demolished because it extended beyond the Baths. This pavilion consisted mainly of dining rooms, other kinds of reception rooms and corridors, and served for the *otium* of the emperor, such as receptions and, banquets, but not for living in. It thus resembled the Royal Pavilion at Brighton built by the Prince Regent of England in 1815 and following years. It had the character of a portico-villa, i.e. a long structure with the main rooms in the façade which, through a portico and a terrace before it, had a fine view on the landscape park lying in front of it.

Here is not the place to present a detailed chronology of the building and its decorations. In the last decades some efforts have been made to ascribe different parts of the building and decorations to the Early Neronian or to the Flavian period. Our conclusion is, however, that the building and the decoration took place in the short period between the Fire of Rome in AD 64 and the death of Nero in AD 68.

This is, in the first place, because there are no traces in the building of serious fire damage. This seems strange if it had existed already before the Fire, because the poor people's quarter, lying immediately below it in the valley of the modern Via Labicana, was totally destroyed by the Fire. Secondly, the pavilion is orientated towards the crescent-shaped Caelian hill just facing it on the other side of the Via Labicana valley, which must have offered a fine view on the landscape park (fig. 1). It is highly improbable that this fine scenic design for Nero's belvedere was planned before the Fire, when the poor people's quarter with its smells and noises directly below the pavilion, still existed. And thirdly, it could be concluded that the three painters workshops which decorated the pavilion (see below) worked more or less at the same time alongside each other in different parts of the building. Also it is apparent that throughout the whole building rooms remained undecorated, which implies that the pavilion cannot have been in full use. These observations can only be explained by linking them with the death of Nero and the ensuing closing of the pavilion by the Flavian emperors in AD 68.

4 The decorations

4.1 The painted wall decorations

In about 90 of the *c*. 140 rooms, traces of the decorations have been preserved consisting of remains of wall paintings and – in a smaller number of rooms – imprints of marble revetments. In many rooms only little remains of the original decorations. In several cases, however, old drawings and watercolours show much larger parts of the original decorations. In such cases it is uncertain to what extent these copies correctly depict the original decorations. There are, however, several rooms in which the original decoration has been entirely preserved beneath the layer of dirt and lime which now covers the walls, and the copies of these decorations appear to be faithful reproductions of the original decoration (fig. 5). These copies may therefore help with the reconstruction of the original decoration.

After having made an inventory and documentation of all the decorations which in one way or another have been preserved, we have been able to draw conclusions regarding the original decorations of the pavilion. In the first place a clear distinction could be made between three kinds of decorative styles which we ascribed to three workshops named A, B and C.

Workshop A used a white background, on which were painted more or less monumental architectural elements like columns in various combinations, including perspective views, in yellow, red and blue, which sometimes were combined with human figures (fig. 3). These decorations thus created a light, open and spatial impression. We named this style the Architectural Style.

Workshop B used much smaller architectural elements and favoured a large variety of unusual exotic colours. Pink, orange and purple, light and dark green and blue, are combined in one decoration. White is totally absent, as are human figures (fig. 4). So this style shows no spatial illusions and its main characteristic is the variety of brilliant contrasting colours. These colours are mentioned especially by Vitruvius (*Arch*. 7.5.8) who states that white, yellow, red and blue, were the usual household colours of a painter's workshop which the painters had to bring with them themselves, but that the mentioned exotic colours were expensive because of the rare pigments and had to be paid for separately by the clients. We named this style the Polychrome style.

The style of workshop C is characterized by large panels with a plain background, often black or red, with miniature architectural elements and ornaments in yellow and white,

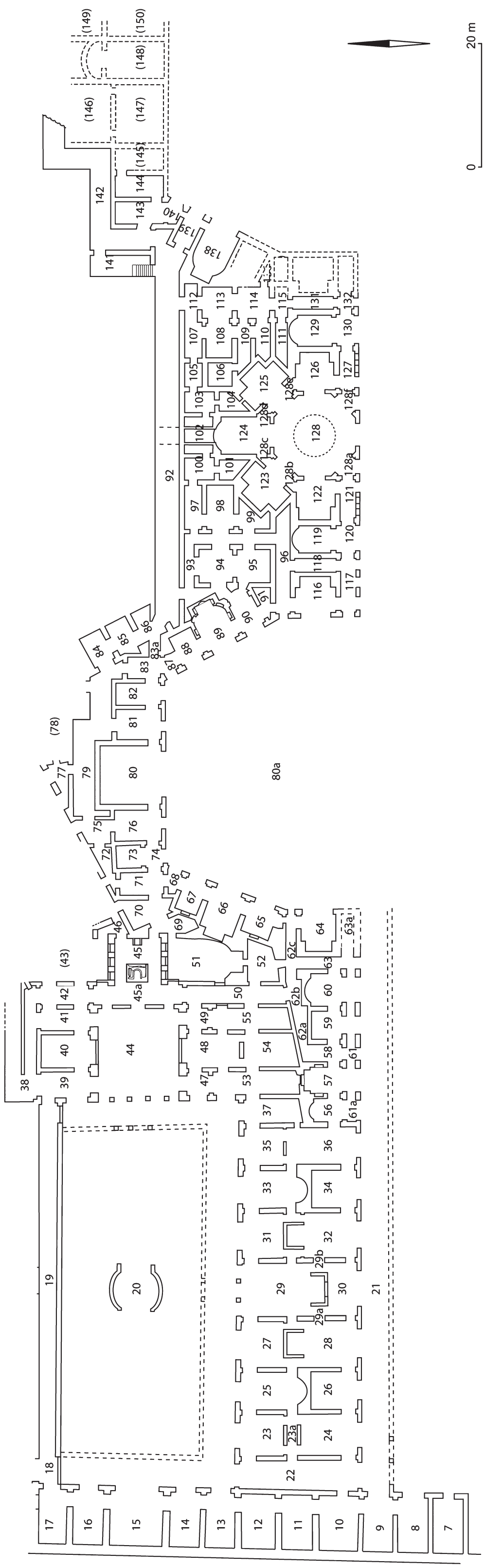


Figure 2 Plan of the Domus Aurea pavilion (after Fabbrini 1995, 400-401, fig. 21, with some adaptations).

Figure 3 Corridor 131, wall painting by workshop A (after Picard 1970, pl. 47).

Figure 4 Passage 87, wall painting by workshop B (photo Radboud University).

reminiscent of gold and silver (fig. 5). A suggestion of openness is entirely absent in this style. We named this the Miniaturistic style.

Moreover it appeared that the workshops A and C in general used two forms of their style, i.e. a monumental façade for more important rooms and a form with large panels for less important rooms (figs 3 and 5). The remains of the decorations by workshop B are too fragmentary to allow conclusions in this respect. Furthermore it appeared that figurative elements played a minor part. The relatively few figurative panels show sometimes mythological scenes and more often landscapes and still lifes, single figures usually show connections with the theatre and the cult of Dionysus.

If we now look at the distribution of these three styles in the pavilion it appears that, roughly, the three styles may be found in three more or less coherent parts of the pavilion (fig. 7). The Architectural style of workshop A can be found in particular in the eastern part of the pavilion and in the façade of the western part, the Polychrome style of workshop B in the central part, and the Miniaturistic style of workshop C around the peristyle in the west wing. The different styles may therefore be considered as the house-styles of three workshops that worked at the same time alongside each other. It appears that only in a late phase of the decoration process artists of a certain workshop, for example of workshop A, were employed in the area where another workshop was engaged in decorating rooms which had not yet been decorated.

Besides these three styles, we found a number of very simple decorations in red on a white or yellow background (fig. 7). These decorations were applied to rooms which had not yet been decorated by one of the three workshops or they served to redecorate new smaller rooms which were created by a subdivision of existing larger rooms. They belong to a post-Neronian phase when parts of the pavilion were perhaps used to house workmen who were employed in activities of the Flavian emperors, such as the removal of the marble revetments and building of the amphitheatre.

When we turn to Pompeii for parallels for these styles it appears that all three styles may be found there in more or less the same way. Furthermore, it may be observed that the greater part of the Fourth Style decorations in Pompeii show the Architectural style of workshop A and that it may even

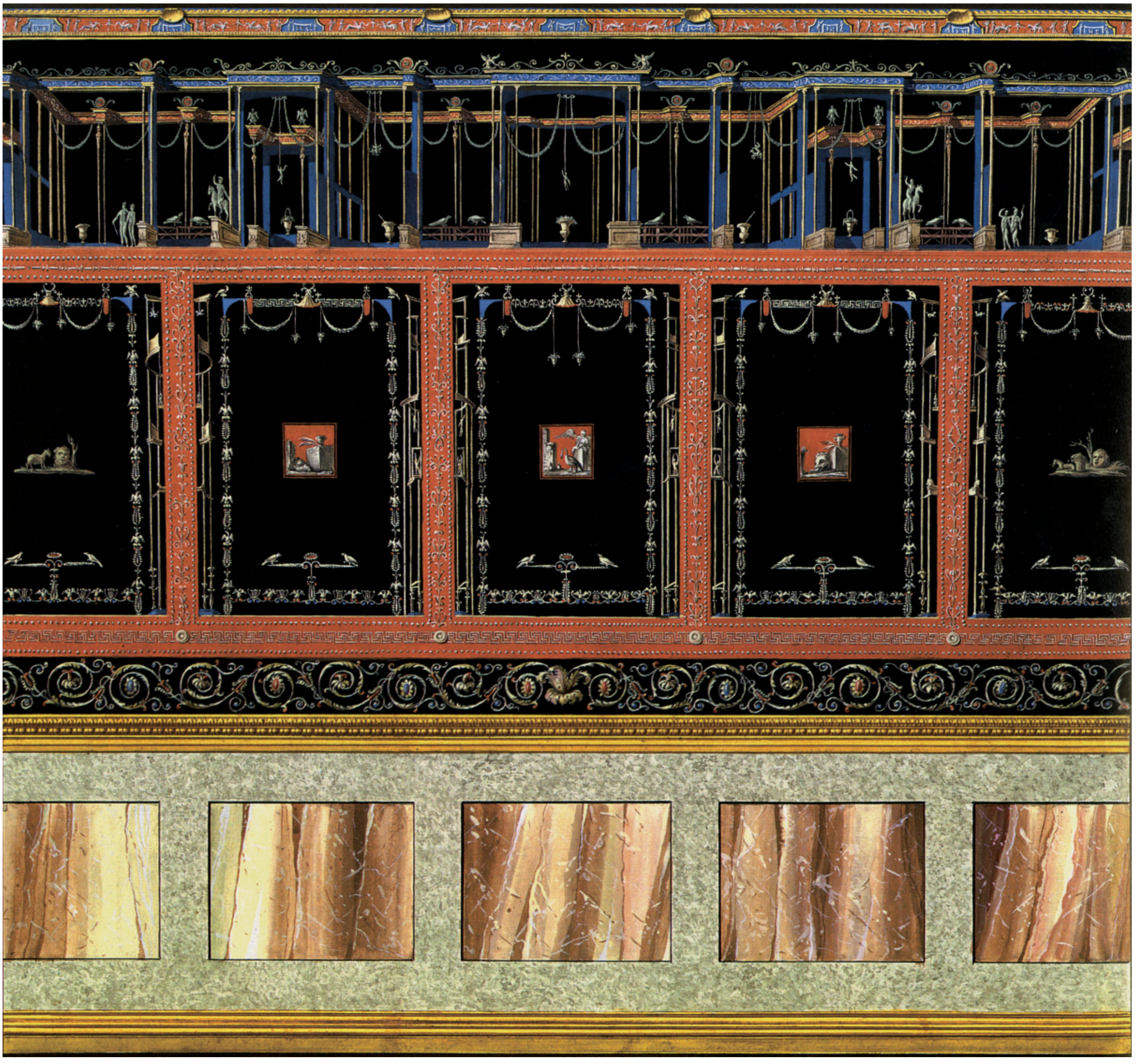


Figure 5 Room 32, wall painting by workshop C (after Mirri 1776, contemporary hand-coloured copy in the Louvre.

have appeared there before AD 62. The Polychrome style of workshop B is rare in Pompeii, probably because of the high costs mentioned by Vitruvius. The Miniaturistic style with plain backgrounds of workshop C also appears quite rarely in Pompeii while more examples may be found in Herculaneum, especially in the Flavian period. So it seems that a certain degree of development within the Fourth Style can be distinguished. The Architectural style of workshop A was the earlier and more common version of the Fourth Style, the Polychrome style of workshop B was a rare (and perhaps somewhat late) variation of it, the Miniaturistic style of workshop C with plain backgrounds seems to reflect a somewhat later return to the closed decorations of the Third Style. Nevertheless, this relative development does not allow an absolute chronology because all three styles may be found alongside each other in the Domus Aurea pavilion. The fact that different styles could appear alongside each other leads to the conclusion that the character of the wall paintings in the pavilion was of no great importance to its owner, the emperor. Actually, as we shall see below, in the more important rooms of the pavilion the walls were decorated with marble revetments instead of wall paintings.

4.2 The vault decorations

In the pavilion the decorations of more than 30 vaults have been preserved. This is more than in any other structure, or even site (except possibly Pompeii and Herculaneum) in the ancient world, and this makes the vault decorations of the pavilion the most important source of our knowledge of vault decorations in antiquity. Most of the vault decorations in the pavilion were executed in paint and stucco-relief in the important rooms and only in paint in the less important rooms. Workshop C did not use any stucco decoration. Only the vaults of the two splendid reception rooms 44 and 128 and the adjacent nymphaea 45 and 124 show traces of mosaic decorations. Because the vault decorations do not appear to be relevant for the study of the ideological aspects of the decorations of the Domus Aurea pavilion, we will give here only a brief introduction to the subject.

Already in the Greek world two main types existed for the decoration of ceilings and vaults, i.e. the coffer pattern and the canopy motive. In the Late Classical and Hellenistic periods these types could become richer in form and include figural elements but essentially they remained the same.

Only in the Augustan period do we find an increasing tendency to create freer and even fantastic decorative schemes, in which the existing motifs may be combined in very original ways. The pinnacle of this development is in the Fourth Style period and the vault decorations in the Domus Aurea pavilion is the best illustration of this. Splendid vault decorations, like the Volta Dorata (the Gilt Vault) (room 80, workshop B, fig. 6) and the Volta delle Civette ((the Vault with the Owls, room 29, workshop C), show fantastic compositions made up of concentric friezes and axial elements which may even suggest complicated vault constructions like cloister vaults and perhaps even cross vaults (which in fact seem to have been created in this period) instead of the simple barrel vaults which they decorate. To these complicated compositions may be added panels of various shapes and sizes with mythological or genre scenes, and all this executed in a wealth of colours and in some cases even gilt. These were the highlights of ancient vault decoration. These vault decorations in particular greatly impressed the artists of the Renaissance, and their influence may be noticed in the Vatican and other Renaissance palaces and villas. After the Fourth Style period, when Ostia is our main source for Roman ceiling and vault decorations, the genre seems in general to have lost its impetus and becomes more traditional again, like wall painting.

We have seen that the wall paintings in the Domus Aurea were quite traditional and did not differ essentially from those in Pompeii and Herculaneum. This was probably due to the fact that for the walls of the more important rooms marble revetment was preferred to wall painting as we shall see below. The vault decorations in the pavilion show the stylistic characteristics of each workshop and therefore must have been made by the same artists who made the wall decorations. Several examples of the vault decorations, however, do show a striking richness and originality. These vault decorations can be found in the rooms where marble revetments played an important part. The splendor of the marble wall decorations seems to culminate in the richness of the vault decoration (fig. 6). So it appears that, when the situation asked for it, the painters really were capable of creating highly original decorations. These were presumably designed by the masters of the different workshops, while the assistants executed the more simple wall paintings.

4.3 The marble decorations

While we were making an inventory of the remains of the painted decorations in the pavilion, it became clear that another aspect originally had played an important role in the decoration of the rooms, viz. the marble revetments. This aspect had been largely overlooked until then, because the costly marble revetments had been removed after Nero’s death to be reused elsewhere. Nevertheless, the imprints of the marble slabs left in the mortar which covered the walls allow for the reconstruction of the original decorations (figs. 5 and 6).

In more than 65 of the 140 rooms traces of marble revetment could be found. We could distinguish three types of marble decorations. In the first type the entire walls, more or less 6 metres high, were decorated with marble slabs (fig. 6). This type was found in 10 rooms (fig. 8). In the second type about two-thirds, 4-5 m, of the height of the walls was covered with marble slabs. This type was found in more than 30 rooms (fig. 8). In both types the composition of the marble decoration consisted of a socle-zone, 2-3 m high, in which the marble slabs were placed horizontally, and a main zone with larger slabs placed vertically (fig. 6). Above the latter could be placed a second row of small vertical slabs or, more frequently, one or more marble friezes. In the third type the marble decoration remained restricted to the socle-zone with horizontal slabs (fig. 5). This type was found in *c.* 15 rooms (fig. 8). In all rooms with such marble revetments the floors were decorated in marble *opus sectile*. Some imprints of intricate geometric or

Figure 6 Room 80, the Volta Dorata, vault decoration by workshop B and imprints of marble slabs on the wall (photo S. Mols, Radboud University).

floral patterns survive. Thus in more than 40 of the 140 rooms in the pavilion, marble wall decorations were the most important aspect of the room's decorations and in *c*. 25 other rooms there were marble socle decorations.

In the remaining *c*. 75 rooms were no traces of marble decorations. If these rooms were decorated at all, the walls were decorated entirely in paint. The floors of these rooms were decorated with simple black and white mosaics. Although in the last type marble wall decoration did not play a part, we included it as a fourth type of wall decoration forming together four decorative types. Now it is interesting to study the distribution of these four types of decorations throughout the pavilion and to compare this with the zones where the three painters' workshops were active (figs. 7 and 8).

Figure 7 Plan with indication of the decorations by the various workshops (design by the authors, execution J. Porck, Leiden University).

Figure 8 Plan with the indication of the four decorative classes (design by the authors, execution J. Porck, Leiden University).

The rooms decorated with the first type, *i.e.* walls decorated entirely with marble, were the largest rooms in the pavilion and were always positioned in the centre of a certain part or wing. Such rooms were flanked by smaller rooms decorated with the second type, walls decorated with marble until circa two-thirds of the height of the walls. These rooms were surrounded by rooms or corridors of the third type with marble socles. The fourth type with painted walls appears only in the back parts of the pavilion.

From the distribution of the marble decorations and a comparison with the working areas of the painters's workshops, it appears that there was no relationship at all between the marble and the painted decorations. Therefore the marble decorations cannot have been a kind of decoration favoured by one of the painter's workshops. Apparently the extent of marble decoration is linked to the position and the size of the rooms, and indicated the function and the status of the rooms. The rooms of the first type obviously were the most important reception and dining rooms, meant to be used by the emperor and his most important guests (rooms 29, 44, 80 (fig. 6) and 128 with the adjacent rooms). The rooms of the second type were less important reception rooms or ante-chambers for guests with a slightly lower status (e.g. rooms 67 and 81, 119 and 129). The rooms of the third type apparently served as rooms connecting the rooms of the first and second degree of importance with simple dark rooms of the fourth type, which served for the passing of the servants or only served to connect the splendid rooms in the façade with the hillside (e.g. resp. rooms 20a, 32 (fig. 5) 50, 55, 118, 131 and 19, 79, 84-86, 92, 114 (fig. 3), 142). For these reasons we have called the four decorative types the four decorative classes.

With regard to the decoration process, it has become clear that for practical reasons the vault decorations were applied first. Then followed the painted decoration of the walls from the upper to the lower part, except for the socle-zone. Next the floor decoration was applied and finally the socle was decorated, and in the case of classes I and II the higher marble revetments. So the height of the marble decoration of the walls must have been known before the application of the painted decoration by each workshop in its own style. This implies that the distribution of the four classes had been established and indicated beforehand. This conclusion stresses the importance which must have been attached to the marble decorations as indication of the functions and status of the rooms.

4.4 The meaning of the marble decorations

The conclusion that a marble decoration was valued higher than a painted decoration was quite disappointing for the amateurs of Roman wall painting. The question arises therefore why the marble decoration was preferred by the emperor and his entourage. It is possible that because of his boastful character Nero valued marble decoration higher since it was much more expensive than a painted decoration. A very rough estimate of the amount of marble used originally in the pavilion comes to a surface area of one hectare, and a considerable part of it must have been imported from all over the Mediterranean. Another reason may have been that a marble background was considered to be a better background than a painted wall for the exhibition of real pictures and sculptures in the important reception rooms. A third explanation, while none excludes the others, may be found in a passage in Pliny's *Naturalis Historia* where he discusses the history of the use of marble interior decoration (*NH* 36.48). Pliny tells us that the first person to introduce the "unworthy" habit of marble interior decoration in Rome was Mamurra. He was an agent of Julius Caesar and was notorious for the large fortune that he had gained through corruption. From this remark we learn that marble interior decoration was introduced in Rome already more than one century before the time of Nero, and that Pliny considered it an unworthy (*indignus*) habit. Furthermore, Pliny states that marble wall decoration was used for the first time in history in the palace of Mausolus at Halicarnassus around the middle of the fourth century BC (*NH* 36.47). Lucanus, first Nero's courtier and later his opponent, describes in his *Pharsalia* (10.114-116) how the royal palace in Alexandria, where Cleopatra – in Roman eyes the symbol of eastern decadence – received Julius Caesar, radiated with precious stones and marbles. From these stories it becomes clear why Pliny considered marble interior decoration unworthy: such presumptuous luxury was associated with the detested sovereigns of the Hellenistic world. By surrounding himself with marble wall decorations Nero presented himself to the Roman people as such a divine monarch, it was an act of imperial self presentation. Naturally this was considered unworthy, if not disgraceful, by men of senatorial rank who feigned to hold up old republican virtues like austerity.

When we look for marble interior decorations in the Campanian towns of Pompeii and Herculaneum, we find some examples of marble socles and several examples of painted imitations. There is only one example of a marble decoration of class II, viz. in a discretely positioned dining room in the Casa degli Dioscuri at Pompeii. So Nero's example apparently was not considered proper for the more common people.

5 Conclusion

We have seen that Nero's Domus Aurea complex was meant to be a fitting residence for the absolute ruler of the Roman Empire. In this complex, the pavilion served for the *otium* of the emperor. Nevertheless, also here Nero's pretentions were expressed by the marble wall decorations. It can be concluded that there was more ideology behind Nero's pretentions and project than mere megalomania. Anyway, it was as yet not acceptable for the Roman people. In AD 68 the legions revolted and, at the age of 31, Nero committed suicide. His successors stopped the Domus Aurea project and largely destroyed it. It must be observed, however, that only some fifteen years after Nero's death, Domitian definitely established the absolute monarchy. He introduced among other things the "*proskynesis*" (kneeling before the emperor) and the imperial titles "*dominus et deus*" (lord and god), and the walls of the main rooms of his imperial palace on the Palatine were entirely covered with marble. Domitian's introduction of the absolute monarchy in the eastern mediterranean style, did no longer meet with open resistance. It was this form of absolute monarchy which was to last until the end of the Western and the Eastern Roman Empires. It was taken over by the Papal court and the European monarchies and, essentially, it survived in several countries until in the 20th century.

So in his attempt to establish an openly absolute monarchy, after the disguised monarchy of the Augustan principate, Nero was in a certain way ahead of his time, but he lacked the mental stability and the political abilities necessary for the implementation of such a creation.

References

Bastet, F.L. and M.De Vos 1979. *Il terzo stile pompeiano*, 's-Gravenhage.

Beyen, H.G. 1938 and 1960. *Die pompejanische Wanddekoration vom II. bis zum IV. Stil, I-II*, Haag.

Mirri, L. and G. Carletti 1776. *Le antiche camere delle terme di Tito e le loro pitture*, Roma. (a facsimile edition of a hand-coloured copy in the Louvre was published by M.-N. Pinot de Villechenon-Lepointe, *Domus Aurea. La decorazione pittorica del palazzo neroniano nell'album delle "Terme di Tito" conservato al Louvre*, Roma, 1998).

Fabbrini, L. 1995. Domus Aurea: il palazzo sull'Esquilino. *LTUR II*, 56-63.

Peters, W.J.Th. 1982. La composizione delle pitture parietali di IV stile a Roma e in Campania. In *La regione sotterrata dal Vesuvio, Studi e prospettive*, Napoli, 635-659.

Peters, W.J.Th. 1993. *La Casa di Marcus Lucretius Fronto e le sue pitture*, Amsterdam.

Picard, G.-C. 1970. *Roman Painting*, London.

Tybout, R.A. 1989. *Aedificiorum figurae. Untersuchungen zu den Architekturdarstellungen des frühen zweiten Stils*, Amsterdam.

Weege, F. 1913. *Das Goldene Haus des Nero (Neue Funde und Forschungen)*. Jarhbuch des deutschen archäologischen Instituts 28, 127-244.

Selected Bibliography on the Domus Aurea

General:

Ball, L.F. 2003. *The Domus Aurea and the Roman Architectural Revolution*, Cambridge.

Bergmann, M. 1994. *Der Koloss Neros, die Domus Aurea und die Mentalitatswandel im Rom der fruhen Kaiserzeit* (=*TrWPr* 13), Mainz.

De Romanis, A. 1822. *Le antiche camere Esquiline dette comunemente delle Terme di Tito, disegnate e illustrate*, Roma.

Meyboom, P.G.P. and E.M. Moormann 1992 (= 1995). Appunti sul padiglione della Domus Aurea neroniana sul Colle Oppio. *Bolletino di Archeologia* 16-18, 139-145.

Moormann, E.M. 1998. "Vivere come un uomo". L'uso dello spazio nella Domus Aurea. In: M. Cima and E. La Rocca (eds), *Horti Romani: Atti del convegno internazionale*, Roma 4-6 maggio 1995, Roma, 345-361.

Moormann, E.M. 1998. Das goldene Haus Neros in Rom: eine orientalische Erfindung? In: R. Rolle, K. Schmidt and R.F. Docter (eds), *Archäologische Studien in Kontaktzonen der antiken Welt (Festschrift fur H.G.Niemeyer)*, Göttingen, 689-701.

Villedieu, F. 2011. Une construction neronienne mise au jour sur le site de la Vigna Barberini: la coenatio rotunda de la Domus Aurea? *Neronia Electronica* 1, 37-52.

Decorations:

Bastet, F.L. 1964. Wann fing der vierte Stil an? *BABesch* 39, 149-155.

Dacos, N. 1969. *La découverte de la Domus Aurea et la formation des grotesques à la renaissance*, Leiden/London.

Iacopi, I. 1999. *Domus Aurea*, Milano.

Meyboom, P.G.P. 1995. Famulus and the Painters' Workshops of the Domus Aurea. *MededRome* 54, 229-245.

Meyboom, P.G.P. 2004. Painters' Workshops, Styles and Compositions. Some Observations on the Vault Decorations of the Domus Aurea. In: L.Borhy (ed.), *Plafonds et voutes à l'époque antique*. Actes du VIIe Colloque international de l'Association International pour la Peinture Murale Antique, 15-19 mai 2001, Budapest-Vesprem, 201-205.

Meyboom, P.G.P. and E.M. Moormann 2002. L'interpretazione delle scene figurative nelle decorazioni dipinte della Domus Aurea. In: J.-M. Croisille and Y. Perrin (eds), *Neroniana VI. Rome à l'époque néronienne*, Bruxelles, 46-53.

Meyboom, P.G.P. and E.M. Moormann 2010. The interplay of wall painting and marble revetment in Nero's Domus Aurea. Some remarks on taste and ideology. In: I. Bragantini (ed.), *Atti del X Congresso Internazionale dell' AIPMA*, Annali di Archeologia e Storia Antica 18.1, Napoli, 77-81.

Peters, W.J.Th. 1982. Die Landschaftsbilder in den Wand- und Deckenmalereien der Domus Aurea. *BABesch* 57, 52-69.

Peters, W.J.Th. and P.G.P. Meyboom 1982. The Roots of Provincial Roman Painting – Results of Current Research in Nero's Domus Aurea. In: J. Liversidge (ed.), *Roman Provincial Wall Painting of the Western Empire*, Oxford (BAR Int. Series 140), 33-74.

Peters, W.J.Th. and P.G.P. Meyboom 1993. Decorazione ed ambiente nella Domus Aurea di Nerone. In: E.M. Moormann (ed.), *Functional and Spatial Analysis of Wall Painting* (Proceedings of the Fifth International Congres of Ancient Wall Painting, Amsterdam September 1992, (BABesch Suppl. 3), Leiden, 59-63.

Paul G.P. Meyboom
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
p.g.p.meyboom@arch.leidnuniv.nl

Eric M. Moormann
Faculty of Arts
Radboud University
P.O. Box 9103
6500 HD Nijmegen
e.moormann@let.ru.nl

Connectivity in the south-western part of the Netherlands during the Roman period (AD 0-350)

Jasper de Bruin

On January 1st 2012 a new department, that of Provincial Roman and Medieval Archaeology, was added to the Faculty of Archaeology at Leiden University. Even though Provincial Roman archaeology was not an official specialization before 2012, the Faculty conducted research on two Roman period settlements in the coastal area of south-western Holland. These two sites produced evidence of the existence of a supra-regional exchange network, of which traces can be found on other sites in the region. It can be concluded that Roman State or Military investments resulted in processes leading to increasing connectivity in coastal areas of the Roman Empire, but that the expansion and sustainability of the connections varied over time.

1 Introduction

On April 14th 1970, a local fisherman found pieces of two Roman altars in his fishing nets in the estuary of the Oosterschelde near the village of Colijnsplaat in the south-western part of the Netherlands (Stuart 2003, 38-41; fig. 1).[1] Throughout the years 1970-1972, staff of the National Museum of Antiquities in Leiden started 'fishing' in the same location, yielding around 330 altars, all dedicated to the goddess Nehalennia (Stuart 2003, 44; fig. 2). The name of the goddess was not unfamiliar; already in 1647 the remains of a Roman temple had been found at the beach in Domburg, yielding 27 altars dedicated to the same goddess (Hondius-Crone 1955).

Origin dedicant	Number
Cologne (German Rhineland)	4
Trier/Treves (Germany, Moselle region)	3
Nijmegen (Netherlands)	1
Dormagen (Germany)	1
Area around Besançon (Eastern France)	1
Area around Rouen (Normandy, France)	1
Area around Augst (Switzerland)	1

Table 1 Origin of people who dedicated altars at Colijnsplaat (after Stuart en Bogaers 2001, 32-33 and 47-48).

The inscriptions on the altars found at Colijnsplaat make clear they had been erected by merchants and boatmen, involved in shipping between Britain, France and the Rhineland.[2] The goods they shipped were *allec* (fish sauce), pottery, salt and wine (fig. 3). Some of the people who dedicated altars originated from the Rhine/Moselle region, but also more distant regions are mentioned (table 1, derived from Stuart and Bogaers 2001, 32-33 and 47-48). The altars date between AD 188 and 227 (Stuart and Bogaers 2001, 40-41) and represent evidence of the existence of an extensive exchange system in the south-western part of the Netherlands, that connected communities in various regions in north-western Europe with each other.

2 Connectivity

Recently, a study was published about North Sea and Channel connectivity during the Late Iron Age and the Roman Period (Morris 2010). The concept of connectivity, that was introduced by Horden and Purcell in 2000, can be defined as "...the various ways in which microregions cohere, both internally and also one with another – in aggregates that may range in size from small clusters to...." much wider areas, as, for example "... something approaching the whole Mediterranean." (Horden and Purcell 2000, 123). Based on an extensive research of archaeological and written sources, Morris concludes that the degree of connectivity varied over time and was "... vulnerable to wider political and economic changes." (Morris 2010, 155). Morris emphasizes the importance of "...short- and medium-term changes into the bigger *longue durée* picture..." of connectivity between Britain and other regions in northwestern Europe (Morris 2010, 156). Fact is that connectivity in the Roman period increased, but the question is whether this was felt in all places and at the same time. Another question is who the driving forces were behind this increasing connectivity.

Morris (2010) uses the spread of specific groups of material culture to detect four periods in which the scale of connectivity increased. The same approach, using archaeological data to gain insight in the expansion of connectivity in the Roman period, is used in this article. The focus lies on two sites that were subject of research, carried out by the Faculty of Archaeology in the coastal area of south-western

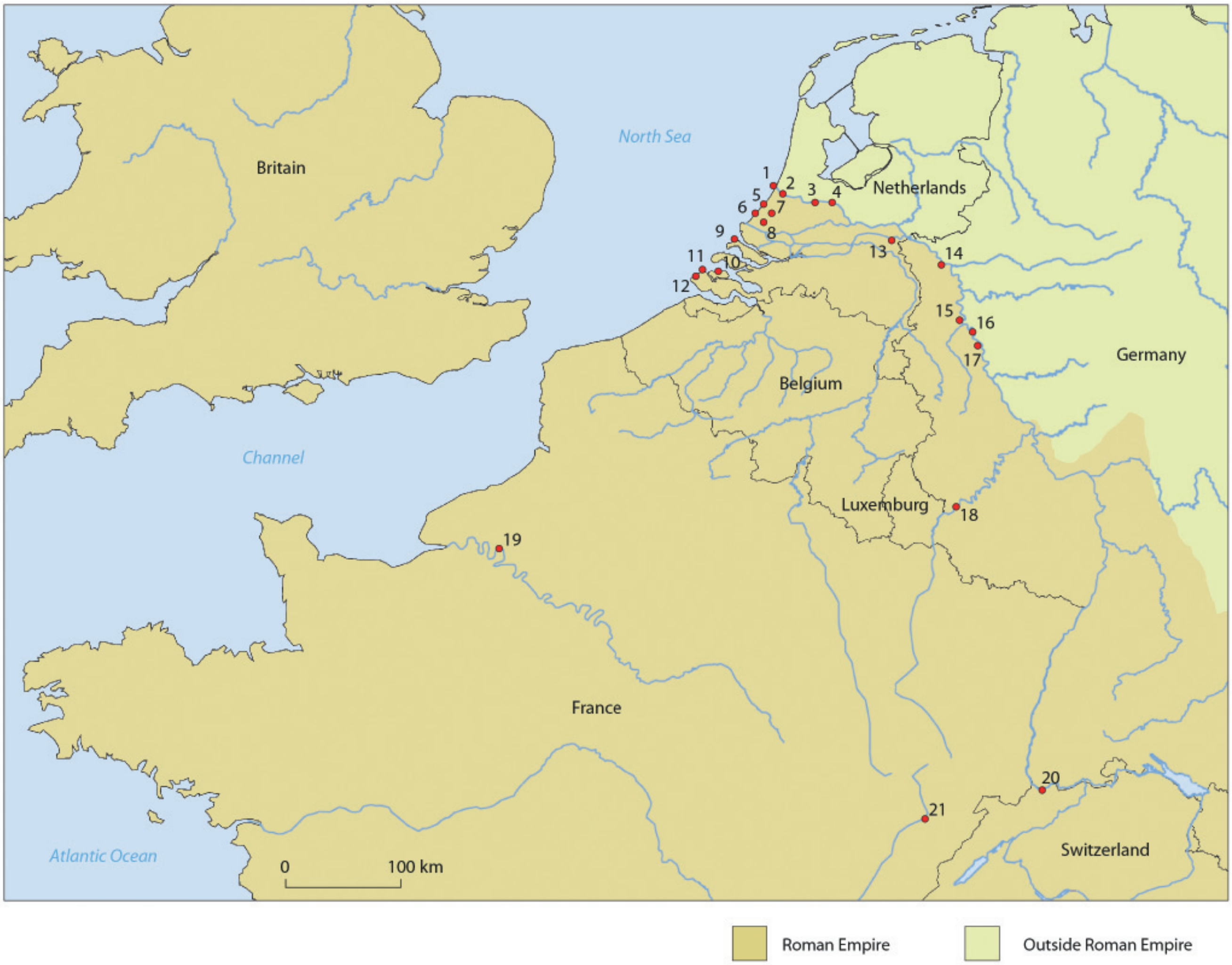


Figure 1 Relevant place names mentioned in the text. 1. Katwijk, 2. Leiden, 3. Woerden, 4. Utrecht, 5. The Hague-Scheveningseweg, 6. The Hague-Ockenburgh, 7. Voorburg, 8. Naaldwijk, 9. Goedereede, 10. Colijnsplaat, 11. Veere, 12. Domburg, 13. Nijmegen, 14. Xanten, 15. Neuss, 16. Dormagen, 17. Cologne, 18. Trier/Treves, 19. Rouen, 20. Augst, 21. Besançon.

Holland from 2007 onwards. In Roman times this area was characterized by sandy ridges along the coast, clay areas along the rivers and a large peat bog in the interior (fig. 4). The majority of the area can be characterized as wetland, in which transport over water was obviously important. In the Roman period the region was part of the province of *Germania Inferior*.

Before we take a closer look at the results of the investigation into the two sites, it is important determine which communities were the main players in exchange and connectivity in this area.

3 The Military

Earlier work on exchange in north-western Europe suggested that the Roman military played a key role in the development of networks of exchange (Carroll 2001, 95-97; Mattingly 2006, 511-513). The large numbers of Roman soldiers that were stationed along the Rhine Frontier required substantial amounts of supplies. Evidence of the active part of military officials in collecting basic needs for the garrisons can be found in the Rimini inscriptions (CIL XI, 390-391), that mention a *centurio* from the *Legio VI Victrix* (stationed at Neuss, Germany), who was probably responsible for the purchase of salt or even

Figure 2 Altar found at Colijnsplaat. The text reads *Deae / Nehaleniae / M(arcus) Exgingius / Agricola / cives Trever / negotiator / salaries / C(oloniae) A(rae) A(grippinensium) v(orum) s(olvit) l(ibens) m(erito)* (Stuart and Bogaers 2001, 51). This can be translated as: 'To the goddess Nehalenia, Marcus Exgingius Agricola, citizen of Trier (Treves), merchant of salt in Cologne, has redeemed his vow, willingly and with reason'. Height of the altar is 91 centimetres. Photo © National Museum of Antiquities (Rijksmuseum van Oudheden), Leiden.

Figure 3 Vessel with wine barrels, depicted on one of the altars found at Colijnsplaat. Width of the fragment is approximately 40 centimetres. Photo © National Museum of Antiquities (Rijksmuseum van Oudheden), Leiden.

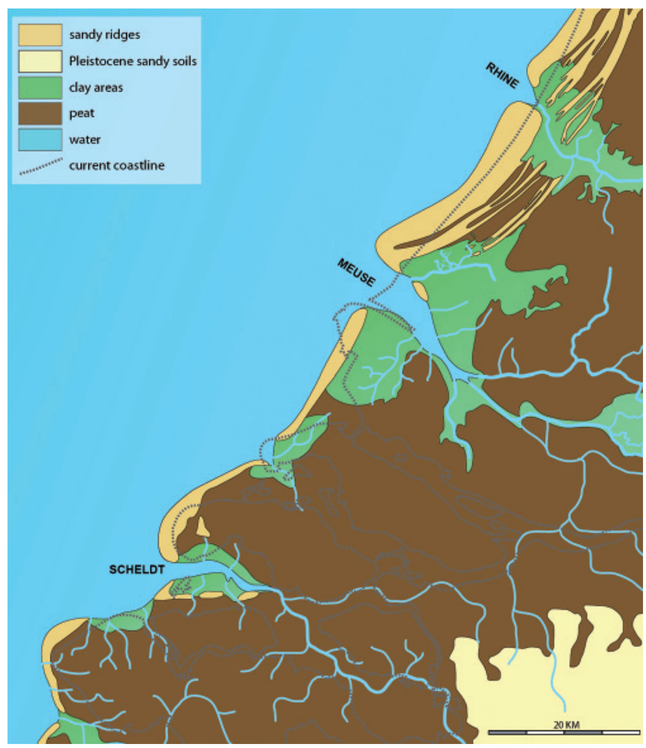


Figure 4 Palaeogeographic reconstruction of the coastal area of south-western Holland during the Roman period. Indicated are the three river mouths that discharged into the North Sea: the Rhine, the Meuse and the Scheldt.

supervised the production thereof in the *civitas Menapiorum* and *Morinorum*, areas located to the south of the river Scheldt in Belgium and Northern France (Trimpe Burger 1999, 17; Carroll 2001, 97; De Clercq 2009, 475). Another example is an officer (*sesquiplicarius*) named on an altar from Colijnsplaat who was part of the *Ala I Noricum*, stationed at Dormagen (Germany) and who was probably involved in collecting or shipping supplies for his comrades in the German Rhineland (Stuart and Bogaers 2001, 38 and 121-122).[3]

Infrastructure, that was needed for supply, was very important for the Roman Army. A good example is the creation of the so-called Corbulo channel or *Fossa Corbulonis* by the Roman military around AD 50 (De Kort and Raczynski-Henk 2008a, 26), that linked the rivers Rhine and Meuse with each other. This channel has been found at several excavations. Military sites, especially watchtowers, excavated at the Lower Rhine Frontier near Utrecht, were probably built for guarding the "... vulnerable infrastructure..." (Graafstal 2002, 19). It is clear that the Roman military was keen on protecting their supply lines and that soldiers were active not only along the Frontier, but also in the hinterland. A number of settlements with a clear military link or even actual military structures and finds along the North Sea coast in the Netherlands, Belgium and Northern France might indicate another important supply line that needed to be guarded.

4 Civilians

Besides army officials, civilians were also involved in the exchange of goods in the western part of the Netherlands. This is attested by epigraphical information on the altars from Colijnsplaat which record professions like *negotiator* (trader), *nauta* (shipowner) and *actor navis* (skipper) (Stuart and Bogaers 2001, 34-38). Also the *sevirii augustales* (freedmen who were responsible for the Imperial Cult), of whom two altars were found, can be linked to trading activities (Morris 2010, 55). Another inscription of a *sevir augustales* is known from the Roman town in Voorburg (Hees 2006, 343-344). Shipping goods for the military was lucrative because goods that were transported under military contracts were excluded from customs that had to be paid at provincial borders (Carroll 2001, 97). Merchants frequently added supplementary goods to their military cargoes in order to sell these products for themselves, even though this was illegal (Mattingly 2006, 513).

5 Two sites along the Dutch coast

Until recently, archaeological evidence of harbours or harbour settlements was relatively scarce. Excavated settlements in the south-western part of the Netherlands indicated that society was largely rural in character and was, at least until the second half of the second century AD, to a limited level connected with a supra-regional exchange of goods. From 2007 onwards, two research projects, directed by the department of Provincial Roman and Medieval Archaeology of the Faculty of Archaeology, gained important insight in the organization and functioning of this exchange system. The first project, Goedereede, focused upon the post-excavation analysis of old excavations. The second project, Naaldwijk, consisted of a two-year excavation, followed by an analysis of features and finds.

5.1 Goedereede

In the early seventeenth century AD, "the foundations of large houses and large streets" (Twisch 1620) appeared on the beach north of the town of Goedereede. Besides these structures, Roman coins and seal rings were found, accompanied by "stones and a lot of red and blue pottery" (Jongejan 1830). Unfortunately, no drawings of the remains were made, making it impossible to establish the character of the remains. The find spot was named 'The Old World' by local inhabitants. The remains of the site were later washed away by the sea.

Ditch digging in the 1950s exposed Roman finds and features on a location about 1.5 to 3 kilometres away from The Old World. This discovery led to the idea that by researching this settlement, more insight could be gained in the character of the long lost Old World. Excavations were carried out in 1958-1959 and 1983-1983. Yet, a published synthesis of the research was lacking, so for years it was not clear what the extent and character of the settlement was. In 2010-2011, a grant by NWO (the Netherlands Organisation for Scientific Research) was assigned to the Faculty of Archaeology, in order to unlock the data of the site. This was done by analysing the excavated features and a selection of the find material. The site was published in 2012 (De Bruin *et al.* 2012).

The settlement was located on a small levee of a relatively wide gully (16 metres), which, based on botanical evidence, carried brackish water. The natural environment can be characterized as brackish marshland, intersected by watercourses. Because the levee offered only space for small structures, the settlers raised the surface with clay sods, fixed with rows of wooden posts. On these elevations the first houses were built. In later phases of the settlement, these elevations were extended to the surrounding area, using refuse in addition to clay sods. Long, narrow and mostly shallow ditches, in which sometimes remains of wooden posts were observed, probably retained the soil, creating a raised platform on which the enlargement of the settlement could be realized.

An important question was why this settlement was built in this wet, brackish environment. The answer lies in the presence of the gully, which was, based on its dimensions, navigable. This assumption is confirmed by revetments and quay works, that were built alongside the bank of the gully (fig. 5). The revetments were made of closely juxtaposed wooden posts. A more elaborate quay work was also constructed, indicated by a bedding trench, dug out just behind the revetments, probably forming the base for a quay.

In the settlement, no less than six locations with remains of houses were found. In most cases, these houses were rebuilt several times on the same location, complicating the analysis of the different ground plans of the houses.

Figure 5 Revetments along the gully at Goedereede. To the right closely juxtaposed wooden posts, to the left a bedding trench, probably forming the base for a quay.

Figure 6 House plans from Goedereede, dating before AD 150.

Interestingly, the oldest houses, dating from around AD 85 to the middle of the second century AD, were relatively large, with dimensions of approximately 30 metres long and seven metres wide (fig. 6). One of these houses, located close by the gully, yielded a large amount of burnt barley (*Hordeum vulgare*) and also some spelt (*Triticum spelta*). This house probably had a (partial) storage function. Interestingly, spelt was mostly grown in the loess area where the Roman *villae* flourished, indicating that these stored crops could have been waiting for transport to a (military or civil) market (De Bruin *et al*. 2012, 116).

After AD 150 new buildings were erected at the site. These structures were built according to Roman principles of construction (fig. 7) and can be interpreted as warehouses, although they probably also had a residential function. Storage seems to be an important function of the site and also, in combination with the harbour remains, transhipment and distribution. The warehouse, shown in figure 7, upper house plan, burnt down probably around the end of the second century AD. In this warehouse, large amounts of burnt bread wheat (*Triticum aestivum* s.l.) were found. This kind of wheat is only found in Roman forts, towns and villae, indicating that the settlement played an important role in supplying these kinds of settlements. This is also attested by the presence of corncockle (*Agrostemma githago* L.), a non-local arable weed that grows among grain and which has a similar distribution (Bakels 2010, 13-20), indicating that wheat was imported to Goedereede.

Based on the provenance of the pottery, people in Goedereede were connected with trading networks between Britain, France and Germany. Overall, very few sherds of locally manufactured hand-shaped pottery were found. Instead, the find complex is characterized by large amounts

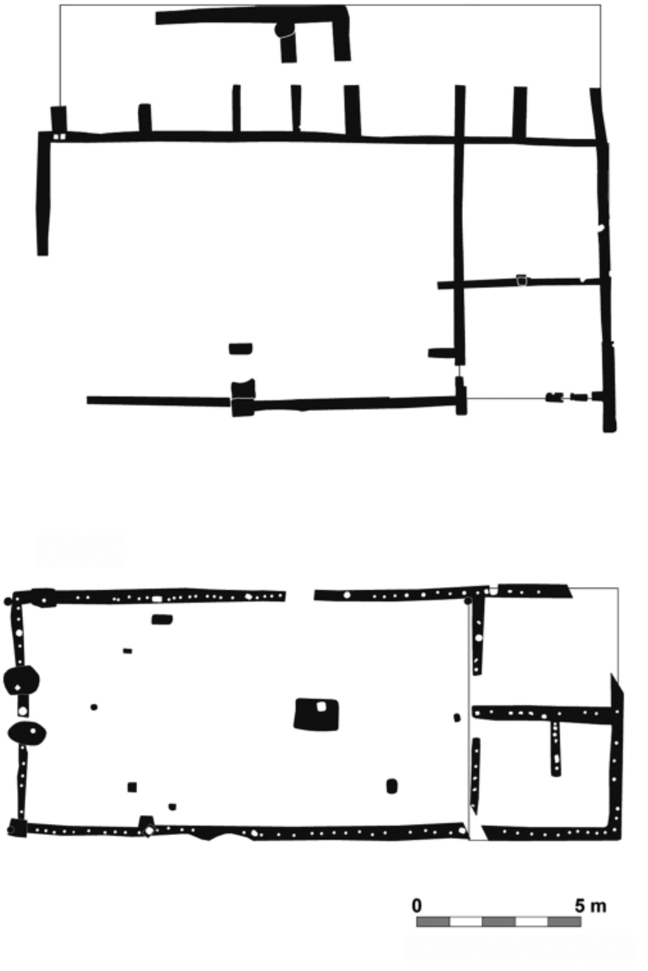


Figure 7 Structures from Goedereede, built according to Roman principles of construction.

of imported, wheel-thrown pottery. Especially the amounts of terra sigillata are not equalled on other sites in the wider region. The relatively large quantities of terra sigillata from La Graufesenque and Lezoux (both in France), dating between AD 85 and the first half of the second century AD, indicate relatively early connections with shipping routes along the western Atlantic coast of France. It seems that from the outset the settlement is part of a supra-local exchange network.

Combining the presence of a navigable gully with revetments and quay works, non-local crops that were probably stored to be distributed to Roman towns and forts, and the broad range and amounts of imported pottery, the settlement at Goedereede can be characterized as a harbour settlement. The settlement yielded no military equipment or other finds that could be related to the army. Only two stamped bricks were found, one of which could be attributed to the *Classis Germanica*, the Roman fleet. An important discussion concentrates on the question which routes were used to get all these commodities in (and along) the settlement at Goedereede. Large parts of the landscape around Goedereede were eroded after the Roman period. A paleogeographical reconstruction, based on archaeological data, points to a possible connection via the Goedereede gully to more northern streams that connected to the mouth of the river Meuse. Although a peat area probably separated both streams, it is possible that a connection was dug, as was done by the creation of the Corbulo channel (fig. 8).

The research did not provide any more information about the character of the settlement at 'The Old World', but the presence of a harbour and storage facilities at Goedereede might indicate that the latter provided goods for the site at 'The Old World'. This could mean that 'The Old World' was a Roman fort or even the long-lost civitas capital of the Frisiavones, who lived in this area (Bogaers 1971, 231).[4]

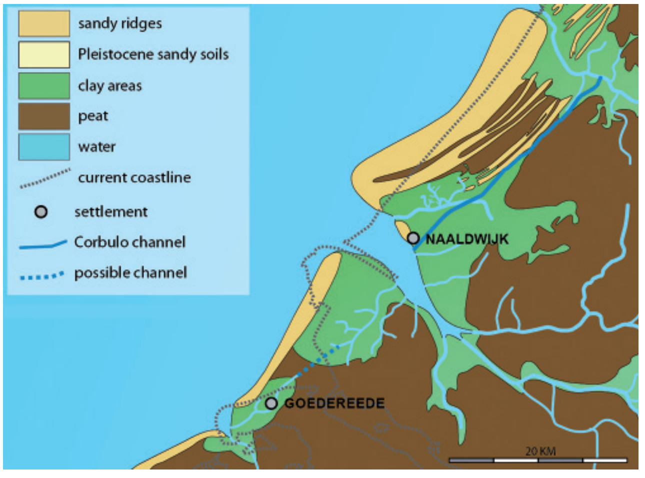


Figure 8 Location of the possible dug-out channel between the Goedereede gully and the northern streams that flowed into the Meuse. The Corbulo channel that connected the Meuse with the river Rhine lies further to the north.

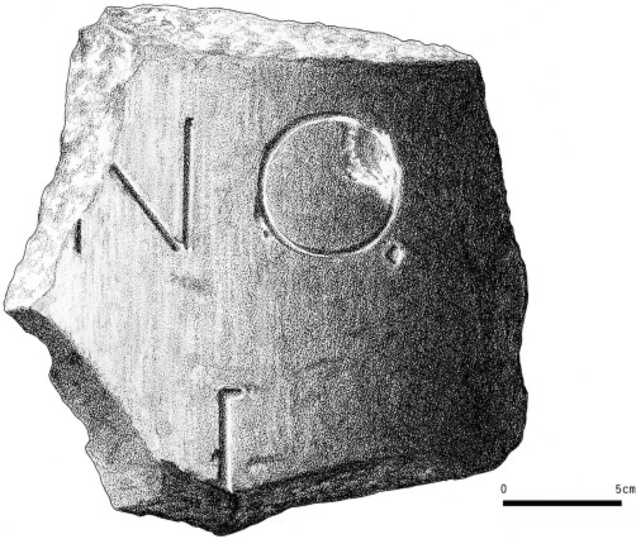


Figure 9 Fragment of a Roman milestone, discovered during excavations in Naaldwijk in 2007. There are three letters visible on the fragment, above are visible the letters NO, below is probably an L. Unfortunately it is impossible to identify the emperor in whose honour the milestone was erected. After Goossens (ed.) in prep. The drawing was made by R. Timmermans.

5.2 Naaldwijk

The find of a hand of a life-size Roman bronze statue in the 1930s led between 2004 and 2011 to several excavations on this site, partly conducted by Leiden University.[5] The site is situated on a sandy soil, as part of a raised beach, in an area that is dominated by marine clay and peat sediments. There are indications that in Roman times the site overlooked the mouth of the river Meuse. It is assumed that not only the Corbulo channel reached the Meuse estuary near the settlement, but that also one or more Roman roads were passing this strategic point. The latter is attested by the discovery of a part of a Roman milestone at the excavation (fig. 9).

The features that were excavated in Naaldwijk are hard to interpret. This is due to the fact that from the 6th century AD (the Early Middle Ages) onwards the site was reoccupied for about thousand years, resulting in a lot of disturbances of the Roman period features. After the medieval period, sand extraction and levelling for the purpose of greenhouse horticulture did further damage to the archaeological remains. Still, the excavations yielded important data about the development of the settlement. Traces of ploughing were found on the site, probably dating around the beginning of our era. After a period of dune formation, resulting in a layer of sand on the former farmland, houses were built on the terrain. The features and finds point to an 'average' rural settlement that can be dated from the middle of the first century to the early third century AD. From around AD 150 onwards, locally manufactured hand-shaped pottery was rapidly replaced by imported wheel-thrown pottery. This impression is consistent with a broader development that can be archaeologically attested in the wider region. Based on the coin finds, little activity took place on the site in the early years of the third century.

Around AD 240 the site was reoccupied again, though the features that can be ascribed to this period suffered a lot from the post-Roman activities on the site, and no clear house plans could be unravelled. Finds from a large well, that was probably filled up after AD 259-268, based on a coin find at the bottom of the well, show that the material culture of the settlement could fit into urban or military contexts. This also applies to a ditch in which a large amount of third-century AD pottery was found, together with two seal stones. The activities on the site probably ended around 275/300.

In the fourth century AD, the site was once again occupied. No house plans or other distinct features could be attributed to this period, with the exception of the remains of a blacksmith's hearth. Based on the collected hand-shaped pottery, the inhabitants' cultural background was largely influenced by that of the area north of the Lower Rhine Frontier. The inhabitants were mainly engaged in smelting large quantities of Roman metal objects. Scattered over the site pieces of large Roman bronze statues, bronze plaques with inscriptions, pieces of furniture, brooches and coins were found, that escaped the kiln. Although the metal objects could have been collected from the Roman town some 30 kilometres away, the quantities and the careless handling of the sometimes relatively large pieces imply a nearby source. This is attested by the well-known Naaldwijk plaque which bears an inscription dedicated by the Roman fleet, the *Classis (Augusta) Germanica Pia Fidelis*, that most likely can be dated in AD 130/131, under the reign of emperor Hadrian (Derks 2010, 287; fig. 10). The presence of no fewer than eighteen *Classis* stamps on brick from the settlement, probably show that a naval base was located in the vicinity of the site. It is tempting to assume that the metal objects that were collected during the fourth century AD came from this base, so that we get a glimpse of the role metal played in the monumentality of such fortifications.

Summarizing the data collected in Naaldwijk shows that probably from the period around 130/131 AD, based on the Naaldwijk plaque, the Roman navy was active in the vicinity of the site. After the (partial) abandonment of the rural site around 200 AD, new activities from 235-240 AD show a settlement that was probably more closely connected with the nearby located navy base. When this base was abandoned around 300 AD, metal pieces from the fort's interior were melted on the site.

Figure 10 The Naaldwijk plaque, showing a Hadrianic inscription by the Classis Au(gusta) Germanica. Photo by ADC Archeoprojecten, Amersfoort.

6 Results

The results from the analysis of the two excavated settlements can be combined with information concerning the surrounding area, showing the extent and diachronic development of connectivity in the coastal area of Germania Inferior. The starting date of Goedereede roughly coincides with the first building phase of the *via miliaris* along the Lower Rhine Frontier in Utrecht between AD 85 and 89 (Luksen-IJtsma 2010, 125). It can be assumed that the establishment of the Roman province of Germania Inferior around AD 85 was the occasion for the construction of (military) infrastructure along the Lower Rhine. Possibly, Goedereede may have been founded as logistic support centre for supplies for the army. This is indicated by the relatively large quantities of terra sigillata from especially La Graufesenque, that were collected on the site. Terra sigillata sherds from this production centre are scarce at rural settlements in the wider region, but abundant in military sites. Storage of spelt in the first period of the settlement at Goedereede also points to a linkage with the military. The construction of a quay also fits into the image of a transhipment point for goods.

From AD 130/131 (based on the dating of the Naaldwijk plaque) to the end of the second century AD, tile stamps from the *Classis* point to an increasing importance of the fleet in this coastal area (table 2 and fig. 11). The largest concentrations of stamps were found in Katwijk, Voorburg, Naaldwijk and Veere. These were probably the locations for naval bases. They are situated at strategic locations near the estuaries of the Rhine, Meuse and Scheldt, though it is not certain that all river mouths were navigable (De Bruin *et al.* 2012, 140-141). The discovery of an important harbour at Voorburg (Driessen and Besselsen (eds) in prep.) explains the frequency of fleet stamps here. Above all, it emphasizes the varying roles of the fleet. For example, epigraphical evidence points to their involvement in quarrying and supplying building stones for the forum in Xanten in AD 160 (Precht 2008, 352, CIL XIII 8036). Unfortunately, the *Classis* stamps in Voorburg were found all over the site (Buijtendorp 2010, 609), so it is not possible to link involvement of the fleet in specific building activities.

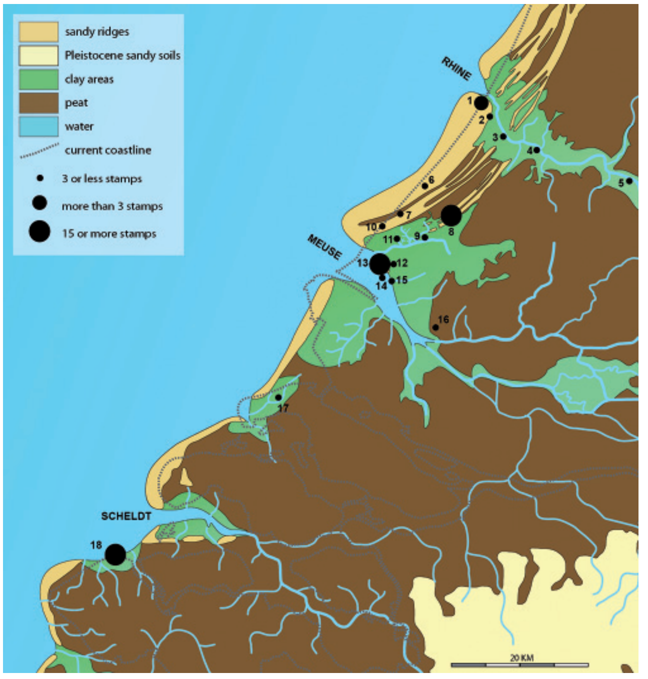


Figure 11 Distribution of C(lassis) G(ermanica) P(ia) F(idelis) stamps. The numbers refer to table 2.

Site number	Site name	Number	Reference
1	Katwijk-Brittenburg (incl. Uitwateringssluizen)	9	Bloemers and De Weerd 1984, 45
2	Katwijk-Klein Duin	1	Holwerda 1912, 52 OMROL 1912, 54-62
3	Valkenburg-De Woerd	1	Beunder 1987, 210
4	Leiden-Roomburg	1	Bogaers 1962, 194
5	Zwammerdam	1	Beunder 1987, 210
6	Den Haag-Scheveningseweg	1	Beunder 1987, 210; Waasdorp 1986, 311-312
7	Den Haag-Ockenburgh	1	Waasdorp and Zee 1988, 54
8	Voorburg-Forum Hadriani	26	Beunder 1987, 210; Driessen pers. comm.
9	Den Haag-Hoge Veld	2	Siemons and Lanzing 2009, 291
10	Monsterse Geestje	3	Beunder 1987, 210
11	Poeldijk-Westhof B	1	Van Pruissen and Kars 2007, 73
12	Naaldwijk-'t Zand Heultje	1	Stray find P. van Giesen
13	Naaldwijk-Hoogwerf	18	Van der Feijst 2007, 75; Brakman and Van Pruissen 2008, 168-169; Goossens 2012 in prep.
14	Maasdijk-Honderdland	1	De Kort and Raczynski Henk 2008b, 46
15	De Lier-Leehove	3	Bult and Groen 2009, 44; Bakx pers. comm. and pers. observ.
16	Vlaardingen Alkeet-Binnenpolder	1	Beunder 1987, 210
17	Goedereede	1	De Bruin 2012, 109
18	Walcheren-Noordstrand	15	Beunder 1987, 210; Van Heeringen 1988, 7

Table 2 C(lassis) G(ermanica) P(ia) F(idelis) stamps, found at sites along the coast in south-western Holland.

The question why the fleet from the 130s AD became increasingly active in the coastal area of the western Netherlands has recently been debated by Wouter Dhaeze (Dhaeze 2011). He states that the main reason for the construction of military installations along the coast was a response to increasing raids by Germanic pirates, apart from the function these forts had in supporting logistics for the military and civilian administration (Dhaeze 2011, 225). However, despite the historically attested acts of piracy, there is no archaeological evidence for raids or destructions of sites in the research area.[6] The increasing interest of the Roman military for this area can also be explained by the growing importance of the present waterways as supply lines to the Lower Rhine Frontier. A discovery that sheds light on the importance of the 'western supply route' is the find of the Woerden 1 barge.

In 1978, during excavations nearby the Roman fort of Laur(i)um on the Lower Rhine frontier at Woerden, a Roman cargo ship was found and which is today known as the Woerden 1 barge. This ship was sunk after AD 175 (Haalebos 1996, 482) with the ship inventory and cargo of grain still on board. This grain had apparently been stored for at least a year before it was shipped (Pals and Hakbijl 1992, 295). On the basis of the weeds found among the wheat it was assumed that this corn came from a loess area (Pals and Hakbijl 1992, 294). This soil type occurs from the German Rhineland into northern France and the South of Belgium. The ship's inventory, however, offers a possible clue to the origin of this grain. In the accommodation of the crew, beside the fireplace, a set of pottery was found. Of the five forms present there are four from the Flemish coastal plain. This is remarkable because this pottery category is relatively scarce in the frontier zone (Haalebos 1996, 485). Possibly the pots were purchased during the trip. This could mean that the Woerden 1 sailed via the Scheldt to the Rhine (Haalebos 1996, 490).[7] This means that a (substantial?) part of the army's supply was shipped through the south-western part of the Netherlands. As the evidence from Goedereede suggests, vegetable crops were even stored in warehouses along the supply line.

In the period between AD 150 and 200 archaeological evidence points to other major changes that took place in the research area. First, the area between Rhine and Meuse was parcelled, which meant that the rural sites were incorporated in a designed landscape, in which possession of land probably plays a significant role. This landscape is accessed by a Roman road, the first phase of which is dated AD 151 (Waasdorp 2003, 21). These developments may be caused by the fact that probably around the same time the Roman town in Voorburg was granted the *Municipium* status, transforming it into the civic centre for the region. The city's first harbour quay was constructed around AD 160 (Driessen and Besselsen (eds) in prep.), showing that there might be a connection between the granting of the municipal status to a relatively unimportant small town (with no more than approximately 2000 inhabitants) and the development of an important shipping route. The altars found at Colijnsplaat demonstrate the intensity of shipping at the end of the second and the first quarter of the third century.

From 150 until 180 AD a Roman fortlet was in use at the site of Ockenburgh in The Hague (Waasdorp 2012, 133). Another military settlement in The Hague, called the Scheveningseweg, can be dated between 190 and 240 AD (Waasdorp 1999, 171, Waasdorp 2012, 142). The construction of these military sites seems to be a response to the increasing importance of the region for supply routes of the Roman army. A side effect was economic prosperity in the rural settlements in the area, that were flooded with imported wheel-thrown pottery and other Roman bric-a-brac, including Romano-British brooches (fig. 12), although these might be interpreted as indicators of Britons in the area, notably as auxiliaries at the fort of Ockenburgh (Waasdorp 2012, 131-132).[8]

From around AD 240 till around AD 275/300, most settlements in the area are abandoned. The Roman forts along the Lower Rhine Frontier show a radical drop in the amount of coinage after the Severan period (AD 193-238, Kemmers 2008, 96 Fig. 2). The military settlement at the Scheveningseweg in The Hague fell into disuse. Most rural sites did not survive very long after AD 225. The harbour at Voorburg silted up from AD 230 onwards (Driessen and Besselsen (eds) in prep.). Interestingly, the Roman road that

Figure 12 Romano-British brooch from Naaldwijk. Photo by Restaura, Haelen.

ran through the area was maintained until at least AD 250. This is attested by three milestones, of which one can be ascribed to Gordianus III and the two other to Decius. The first was dated to AD 242-244 (Waasdorp 2003, 33) the latter can be dated to AD 250 (Waasdorp 2003, 37).

It is remarkable that the number of Roman coins at Naaldwijk increases after AD 240. The diagram (fig. 13) shows that the settlement is occupied again in this period until AD 275-300. Naaldwijk might have been in use as a military settlement in the vicinity of a Roman fleet base, based on the large numbers of *Classis* stamps on brick. Some of these stamps are poorly impressed, as if the stamp was old, leading to the impression that these stamps are of later date than those of the second century, which are relatively tidy (fig. 14). Another function of the site at Naaldwijk could have been as the transhipment point for the Roman town at Voorburg, following the obsolescence of the harbour basin there. The diversity of the pottery in features from this period in Naaldwijk is an indication of the growing importance of the settlement in supra-regional exchange.

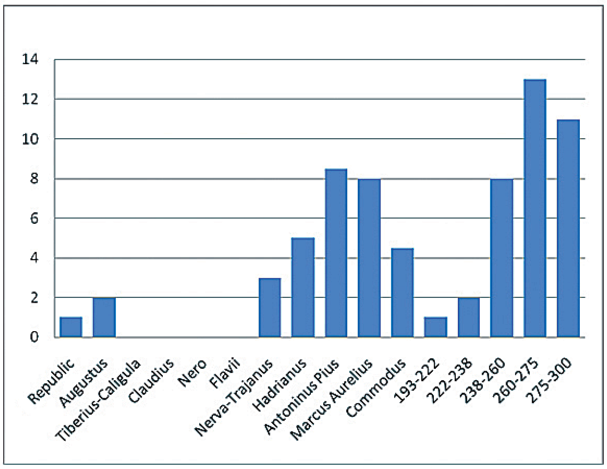


Figure 13 Number of coin finds per period at the settlement in Naaldwijk. The total number of coins is 65.

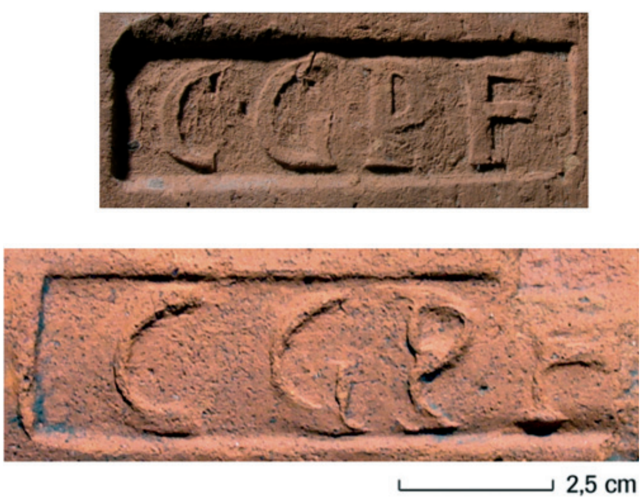


Figure 14 Two stamps of the C(lassis) G(ermanica) P(ia) F(idelis). Note the difference between the two; the one below can probably be dated in the third century. The stamp at the top was photographed by ADC Archeoprojecten, Amerfoort, the one below by the author.

Most coins in Naaldwijk can be dated between 260 and 275 AD. This is the period of the so-called Gallic Empire, a breakaway realm of the Roman Empire, that included amongst others the Roman province of Germania Inferior. During this time an increasing reuse of military sites can be observed, based on an inventory of archaeological finds from this period in the Dutch part of Germania Inferior (Kemmers 2000). It seems that the site in Naaldwijk is also part of this activity, although the site was already in use from the 240s AD onwards. If Naaldwijk was a fleet base from AD 240 onwards, it is possible that the *Classis Germanica* became increasingly important in the surveillance of the coastal area of Germania Inferior. The fleet might even have been taking over the monitoring of the Frontier zone of the Roman land army, creating a more mobile way of guarding the Frontier and its hinterland. Around AD 300 the habitation that can be linked with the fleet seems to end in Naaldwijk. This is consistent with the last activities in the Roman town in Voorburg (Driessen and Besselsen (eds) in prep.).

7 Conclusions

Before AD 150, traces of exchange of goods can only be found in the settlement at Goedereede and along the Lower Rhine Frontier. The surrounding region was not incorporated into a larger exchange system, although the creation of the Corbulo channel around AD 50 opened opportunities for the development of shipping between the Rhine and the Meuse. The Naaldwijk plaque from AD 130/131 might indicate the presence of a fleet base near the settlement at Naaldwijk, but can also point to a specific action of the fleet in this area. The fleet is, by its nature, a logical vehicle for connectivity. From AD 150 the region surrounding Goedereede and Naaldwijk shows various changes that indicate that the rural areas were included in a large-scale exchange network, that increased connections between the coastal area of Germania Inferior and surrounding regions, probably as far as Britain, France, Belgium and the German Rhineland. The altars found at Colijnsplaat confirm this picture. At the same time there is evidence for a military build-up along the coast. The Roman fleet, the *Classis Germanica*, played an important role here.

Although the exchange of goods by means of shipping continued until at least AD 230/240, most settlements, whether they had a military character or not, were abandoned. Only the Roman town in Voorburg and Naaldwijk still appeared to be part of a supra-regional network of exchange. It is possible that Naaldwijk overtook the harbour function of Voorburg, although it is also plausible that an important fleet base was located in Naaldwijk. The end of both Voorburg and Naaldwijk marks the end of a period of increasing connectivity along the coast of *Germania Inferior*, although the fourth-century AD habitation in Naaldwijk points to new connections, this time towards areas north of the Lower Rhine Frontier.

For the Roman period along the coast of Germania Inferior can be stated that connectivity increased, but it is clear that this development did not touch every settlement at the same time. Apparently, State or Military investments resulted in processes leading to increasing connectivity in coastal areas of the Roman Empire, but the expansion and sustainability of the connections varied over time.

Acknowledgements

Writing about exchange is not possible without engaging in exchange. I would like to thank Mark Driessen for his information about the important discovery of the Roman harbour at Voorburg and the number of military brick stamps that was collected during his excavations there in 2008. Jean Paul Bakx of the Archaeological Service of the Municipality of Delft helped me with collecting some of the *Classis* stamps from the region around Delft. The drawings in figures 4, 6, 7, 8 and 11 were created by Jeroen van Zoolingen; I modified some of them to fit into this article. Carol van Driel-Murray and Jeroen van Zoolingen read and corrected the initial draft of this paper. Any errors are my own.

Notes

1 For place names, see fig. 1.

2 It is remarkable that the altars found at Domburg do not mention profession or provenance of the people who dedicated the altars there, probably indicating that the sanctuary in Domburg had a more local significance.

3 The inscription on the altar (B30) does not mention the reason why it was dedicated.

4 In his article Bogaers mentions the settlement at Goedereede as one of the possible locations of the capital of the *civitas* of the *Frisiavones* (Bogaers 1971, 230, Fig. 1).

5 The excavation was conducted in cooperation with the Faculty's excavation company Archol in 2007 and 2008.

6 Dhaeze 2011, 75-83. Outside the research area, burnt layers in several Roman towns and sanctuaries, dating from the 170s AD onwards, are traditionally related to raids by Germanic pirates. It is, however, hard to imagine that relatively small groups of pirates were able to siege and destroy large Roman towns that are far away from the sea (Erdrich 2004, 159-161).

7 In contradiction of the suggestion that the Woerden 1 barge sailed via the Scheldt is a Roman shoe, which bore the stamp PS CATATS/M. It is possible that the characters CAT mean Colonia Augusta Treverorum (Trier/Treves) or Civitas Atuatuca Tungrorum, although the last option does not seem plausible (Van Driel-Murray 1996, 496, footnote 70). It is therefore possible that one of the crewmembers of the ship bought his shoes in Germany, indicating that the Woerden I barge might also have been sailing through the Moselle/Rhine.

8 For a further discussion concerning the occurrence of Romano-British brooches outside Britain, see Ivleva 2010.

References

Bakels, C. 2010. De vroegste vondsten van Bolderik (*Agrostemma Githago* L.) in Nederland / The earliest finds of corncockle (*Agrostemma Githago* L.) in the Netherlands. In: C. Bakels, K. Fennema, W.A. Out and C. Vermeeren (eds), *Van planten en slakken / Of Plants and Snails. A collection of papers presented to Wim Kuijper in gratitude for forty years of teaching and identifying*, Leiden (Festschrift), 13-20.

Beunder, P.C. 1987. Vlootschouw. Enkele opmerkingen over de Romeinse vloot (Classis Germanica) in Nederland of het westen van de provincie *Germania Inferior. Westerheem 36*, 207-212.

Bloemers, J.H.F. and M.D. de Weerd 1984. Van Brittenburg naar Lugdunum. Opgravingen in de bouwput van de nieuwe uitwateringssluis in Katwijk. In: *De uitwateringssluizen van Katwijk 1404*-1984, Leiden, 41-51.

Bogaers, J.E. 1962. Meerburgerpolder. *Nieuwsbulletin Koninklijke Nederlandse Oudheidkundige Bond jaargang 16*, 191-195.

Bogaers, J.E. 1971, Germania Inferior, Gallia Belgica en de civitates van de Frisiavones en de Tungri. *Helinium 11*, 228-237.

Brakman, A. and C. van Pruissen 2008. Keramisch bouw-materiaal. In: L. van der Feijst, J. de Bruin and E. Blom (eds), *De nederzetting te Naaldwijk II. Terug naar de sporen van Holwerda*, Amersfoort (ADC Monografie 4, Rapport 1271), 167-170.

Bruin, J. de, G.P.A. Besuijen, H.A.R. Siemons and R.J. van Zoolingen 2012. *Goedereede-Oude Oostdijk. Een havenplaats uit de Romeinse tijd*, Leiden.

Buijtendorp, T. 2010. *Forum Hadriani. De vergeten stad van Hadrianus. Ontwikkeling, uiterlijk en betekenis van het*

“Nederlands Pompeji”, Amsterdam (Ph.D. thesis Free University Amsterdam).

Bult, E.J. and J.-M. Groen 2009. *Leehove I. Een Aanvullende Archeologische Inventarisatie en tracébegeleiding op bedrijventerrein Leehove in De Lier (Gemeente Westland)*, Delft/Leiden, (Delftse Archeologische Rapporten 27).

Carroll, M. 2001. *Romans, Celts & Germans. The German Provinces of Rome*, Stroud.

De Clercq, W. 2009. *Lokale gemeenschappen in het Imperium Romanum. Transformaties in rurale bewoningsstructuur en materiële cultuur in de landschappen van het noordelijk deel van de civitas Menapiorum (provincie Gallia-Belgica, ca. 100 v.Chr-400 n.Chr.)*, Ghent (Ph.D. thesis Ghent University).

Derks, T. 2010. Vier neue Bronzeneinschriften aus Naaldwijk (Niederlande). *Zeitschrift für Papyrologie und Epigraphik*, 283-193.

Dhaeze, W. 2011. *De Romeinse kustverdediging langs de Noordzee en het Kanaal van 120 tot 140 na Chr. Een onderzoek naar de rol van de militaire sites in de kustverdediging en drie casestudies over de militaire versterkingen van Maldegem-Vake, Aardenburg en Boulogne-sur-Mer*, Ghent (Ph.D. thesis Ghent University).

Driel-Murray, C. van 1996. Die Schuhe aus Schiff I und ein lederner Schildüberzug. *Jahrbuch Römisch Germanisches Zentralmuseum Mainz 43, 2. Teil*, 493-498.

Driessen, M.J. and E. Besselsen (eds) in prep. *Voorburg-Arentsburg: Een Romeinse havenstad tussen Rijn en Maas*, Amsterdam (Themata 5).

Erdrich, M. 2004, Anmerkungen zum historischen Hintergrund des Truppenlagers von Maldegem-Vake. In: F. Vermeulen, K. Sas and W. Dhaeze (eds), *Archaeology in Confrontation. Aspects of Roman Military Presence in the Northwest. Studies in Honour of Prof. Em. Hugo Thoen*, Ghent (Archaeological Reports Ghent University 2), 155-164.

Feijst, L. van der 2007. *De vicus van Naaldwijk*, Amsterdam (unpublished MA thesis Free University Amsterdam).

Goossens, T.A. (ed) 2012. *Van akker tot Hooghwerf. Onderzoek naar de bewoning in de ijzertijd, inheems-Romeinse tijd, de middeleeuwen en de nieuwe tijd op de haakwal van Naaldwijk (plangebied Hoogeland, gemeente Westland)*, Leiden (Archol-rapport 167).

Graafstal, E.P. 2002. Logistiek, communicatie en watermanagement. Over de uitrusting van de Romeinse rijksgrens in Nederland. *Westerheem 51*, 2-27.

Haalebos, J.K. (mit Beiträgen von C. van Driel-Murray u. M. Neyses) 1996. Ein römisches Getreideschiff in Woerden (NL). *Jahrbuch Römisch Germanisches Zentralmuseum Mainz 43, 2. Teil*, 475-509.

Heeringen, R.M. van (ed) 1988. *Archeologische kroniek van Zeeland over 1987*, Amersfoort (ROB overdruk 360), 7.

Hees, J. 2006. Altaren en inscripties. In: W. de Jonge, J. Bazelmans and D. de Jager (eds), *Forum Hadriani. Van Romeinse stad tot monument*, Utrecht, 343-347.

Holwerda, J.H. 1912. Opgravingen in het Klein Duin te Katwijk-Binnen, Leiden (Oudheidkundige Mededeelingen uit het Rijksmuseum van Oudheden te Leiden VI), 48-53.

Hondius-Crone, A. 1955. *The temple of Nehalennia at Domburg*, Amsterdam.

Horden, P. and N. Purcell 2000. *The Corrupting Sea: a study of Mediterranean History*, Oxford.

Ivleva, T. 2010. British Emigrants in the Roman Empire: Complexities and Symbols of Ethnic Identities. *TRAC 2010. Proceedings of the Twentieth Annual Theoretical Roman Archaeology Conference Oxford 2010*, 132-153.

Jongejan, G. 1823. *Beschrijving van het Westvoorn, meest bekend onder den naam van: eiland Goedereede*, Sommelsdijk.

Kemmers, F. 2000. *Het Nederlandse Limesgebied tussen 250 en 275. Een inventarisatie van archeologica uit een intrigrerende periode*, Amsterdam (unpublished MA thesis Amsterdam University).

Kemmers, F. 2008. Interaction or indifference? The Roman coin finds from the Lower Rhine delta. In: A. Bursche, R. Ciolek and R. Wolters (eds), *Roman coins outside the empire. Ways and phases, contexts and functions*, Wetteren (Collection Moneta 82), 93-103.

Kort, J.W. de and Y. Raczynski-Henk 2008a. *Plangebied Rietvinklaan 5, gemeente Leidschendam-Voorburg. Archeologisch vooronderzoek: een bureau- en inventariserend veldonderzoek (proefsleuven)*, Weesp (RAAP-Rapport 1428).

De Kort, J.W. and Raczynski Henk 2008b. *Plangebied Honderdland, vindplaats 1: een ontginningsboerderij uit de 10e eeuw te Maasdijk, gemeente Westland; een definitief archeologisch onderzoek (opgraving)*, Weesp (RAAP-rapport 1465).

Luksen-IJtsma, A. 2010. *De limesweg in West-Nederland. Inventarisatie, analyse en synthese van archeologisch onderzoek naar de Romeinse weg tussen Vechten en Katwijk*, Utrecht (Basisrapportage Archeologie 40).

Mattingly, D. 2006. *An Imperial Possession. Britain in the Roman Empire, 54 BC-AD 409*, London.

Morris, F.M. 2010. *North Sea and Channel Connectivity during the Late Iron Age and Roman Period (175/150 BC-AD 409)*, Oxford (BAR International Series 2157).

Pals, J.P. and T. Hakbijl 1992. Weed and insect infestation of a grain cargo in a ship at the Roman fort of Laurium in Woerden (Prov. of Zuid-Holland). *Review of Palaeobotany and Palynology 73*, 287-300.

Precht, G. 2008. Das Forum. In: M. Müller, H.-J. Schalles and N. Zieling (eds), *Colonia Ulpia Traiana. Xanten und sein Umland in römischer Zeit*, Mainz am Rhein (Xantener Berichte Sonderband. Geschichte der Stadt Xanten, Band 1), 341-353.

Pruissen, C. van and E.A.K. Kars 2007. Keramisch bouwmateriaal. In: E. Blom and L. van der Feijst (eds), *Poeldijk Westhof, vindplaats B. Een inheems-Romeinse nederzetting uit de 1^e^ tot de 3^e^ eeuw*, Amersfoort, (ADC Rapport 909), 69-74.

Siemons, H. and J.J. Lanzing (eds.) 2009. *Bewoningssporen uit de Romeinse tijd in het Wateringse Veld, Den Haag*, The Hague (Haagse Oudheidkundige Publicaties nummer 11).

Stuart, P. 2003. *Nehalennia. Documenten in steen*, Zierikzee.

Stuart, P. and J.E. Bogaers 2001. *Nehalennia. Römische Steindenkmäler aus der Oosterschelde bei Colijnsplaat*, Leiden (Collections of the National Museum of Antiquities at Leiden XI).

Trimpe Burger, J.A. 1999. *De Romeinen in Zeeland. Onder de hoede van Nehalennia*, Goes.

Twisch, P.J. 1620. *Chronyck van den ondergang der tyrannen, ofte jaerlijksche geschiedenissen in wereldlijcke ende kerkelijcke saecken van Christi geboorte of tot desen tijd toe*, Deel 2, 1617-1620.

Waasdorp, J.A. 1986. 's-Gravenhage: Scheveningseweg 62-64. In: D.P. Hallewas (ed.), *Archeologische kroniek van Holland over 1985 II Zuid-Holland*, 308-312.

Waasdorp, J.A. 1999. *Van Romeinse soldaten en Cananefaten. Gebruiksvoorwerpen van de Scheveningseweg*, The Hague (VOM-reeks 1999, nr. 2).

Waasdorp, J.A. 2003. *IIII M.P. naar M.A.C. Romeinse mijlpalen en wegen*, The Hague (Haagse Oudheidkundige Publicaties – nummer 8).

Waasdorp, J.A. (ed) 2012. *Den Haag Ockenburgh. Een fortificatie als onderdeel van de Romeinse kustverdediging*, The Hague (Haagse Oudheidkundige Publicaties 13).

Waasdorp, J.A. and K. Zee 1988. *De vergeten verzamelingen van Ockenburgh. Romeinse vondsten uit 's-Gravenhage*, The Hague (VOM-reeks 1988 nummer 4).

J. de Bruin
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
j.de.bruin@arch.leidenuniv.nl

Archaeobotanical evidence of the fungus Covered smut (*Ustilago hordei*) in Jordan and Egypt

René T.J. Cappers, Federica Fantone, Reinder Neef and Clasina J.G. van Doorn

Archaeological evidence for the infection of barley with the fungus Covered smut (Ustilago hordei) was first discovered in the gut contents of two Danish bog bodies dated to the Iron Age. The fungus was recognized by its spores. New evidence, in the form of infected rachis fragments, originates from the Roman sites of Berenike and Shenshef in Egypt, excavated by Leiden University (the Netherlands) and the University of Delaware (USA). Subsequent records of this plant disease relate to additional Roman and post-Roman sites in Egypt: Roman Karanis and the Roman and Islamic ports at Quseir Al-Qadim. However, the recent discovery of Ustilago hordei infection in samples containing charred barley from tell Dayr Alla in Jordan, also excavated by Leiden University, shows that the fungus was already present in the Southern Levant during the Iron Age.

The percentage of infected rachis within samples from Berenike, based on counts of the rachis nodes, varies from 0.3% to 11.7%. All records of infected barley concern the hulled 6-row subspecies (Hordeum vulgare ssp. vulgare).

1 Introduction

Archaeobotanical evidence for barley is based on the recovery of grain kernels and threshing remains. The composition of the threshing remains depends on the husk tightness. In hulled barley, threshing results in grain kernels still enclosed by their chaff (lemma and palea); only the fragile awns and glumes are broken off and become part of the threshing remains. In free-threshing (or naked) barley, the palea and lemma are also separated from the grain and end up in the threshing remains. With both hulled and free-threshing barley, fragments of the culm and the rachis also become part of the threshing remains; the proportion of culm fragments is related to the reaping height.

Rachis fragments are of special interest because they can be used for identifying the subspecies and for quantifying the proportion of recovered cereals. In contrast to the culm, from which only the nodes are solid, in the rachis, both nodes and internodes have a dense structure. Rachis fragments can, therefore, be well preserved even in charred condition. The presence of pedicels on the edges of the nodes can be used to distinguish 2-row Barley (ssp. *distichon*) from 6-row Barley (ssp. *vulgare*). In 2-row Barley, both lateral spikelets are pedicellate (stalked), whereas in 6-row Barley, the lateral spikelets are mostly sessile (for a discussion, see Cappers and Neef 2012, 276). Although a subdivision of barley beyond the species level is not always accepted (*e.g.*, Van der Meijden 2005), in our opinion, identifying barley to the level of subspecies makes sense because it can be indicative of its use and because it can aid in quantifying the proportion of cereals (Cappers *et al*. 2004; Cappers and Neef 2012, 410).

It has only recently been recognized that rachis fragments can also be used to identify former crop diseases. This article deals with the infection of barley with the fungus Covered smut (*Ustilago hordei* [Pers.] Lagerh.). The infection leaves marks on the rachis fragments that are so prominent that the shape of the rachis becomes obscure, and sometimes the rachis is completely covered with the fungus. The morphological transformation of the rachis is most probably the reason why this plant disease is not always recognized. Here, we present the first archaeobotanical evidence for Covered smut from sites that have been excavated by Leiden University, namely, Dayr Alla in Jordan and Berenike and Shenshef in Egypt.

2 Archaeobotanical evidence of Covered smut infection

Crop yields of cereals can be reduced by several plant diseases, including smut fungi. Barley is affected by three different smut fungi, namely, Loose smut (*Ustilago nuda* [Jens.] Kellerm. et Swingle), Black (or False) loose smut (*U. nigra* Tapke) and Covered smut (*U. hordei*). Covered smut produces sori that are covered by a membrane until maturity. Loose smut produces a thin membrane that easily disintegrates when the infected spikes develop, thus releasing the spores. The specific smut fungus present on infected subfossil rachis fragments can be easily identified by examining the surface of the spores. Spores of Covered smut have a smooth surface, whereas those of Loose smut are finely reticulate. J.P. Meffort, of the Plant Protection Service, Ministry of Economic Affairs, Agriculture and Innovation, Wageningen, the Netherlands, checked the spores present on the subfossil rachis fragments discussed here and confirmed the identification of Covered smut.

According to Briggs (1978, 359), infection with Covered smut occurs in the field, when the membranes split and spores are dispersed by the wind to neighbouring spikes, and on the threshing floor, where threshing tools are used to fragment the spikes into individual spikelets. Because the membranes do not break up readily, most of the infection happens during threshing. When the spore masses are released on the threshing floor, they can easily infect healthy grain kernels; the fungus is thus effectively dispersed through seeds used for sowing. Spores present in the topsoil and on the grain kernels germinate and infect the seedlings of barley at an early stage. The fungus grows in the barley plant and produces new spores in the spike, where all or most of the grain kernel and chaff is replaced by fungal spores.

Subfossil spores from covered smut were discovered by Helbaek in the gut contents of two Danish bog bodies, known as Tollund man and Grauballe man, both dated to the Iron Age (Van der Sanden, 1996). Although the spores are indicative of the presence of the fungal infection, they do not allow for an estimate of the infection rate. This is only possible by comparing the proportion of infected rachis nodes to non-infected rachis nodes.

3 Evidence from written sources

Following Theophrastus' (4th–3rd c. BC) classification, phytopathology was regarded as a deviation from the well-being (εὐθένεια) of a plant, that is, a certain fit between plant ecological requirements, the environment and the adopted agricultural practices. References to plant diseases are frequent in classical written sources that describe distinct characteristics of plants and agricultural practices. These include works that provide first-hand botanical observations and evidence of crop husbandry, as well as compilations of previous writings under a different authorship. The first group includes the botanical treatises by Theophrastus and the agricultural treatises by Cato (3rd–2nd c. BC), Varro (2nd–1st c. BC) and Columella (1st c. AD); the second group is well represented by the encyclopaedic work of Plinius the Elder (1st c. AD), which often shows a clear preference for spells and hearsay.

Fungal diseases such as rusts and smuts in particular captured the attention of ancient writers. However, the interpretation of these early records is complicated by their authors' use of general terms, often with overlapping meanings, which means that sometimes little can be deduced from the context. The Greek word ἐρυσίβη (erysibê) is used to define a plant fungal disease that is described as a kind of decomposition due to water, such as rainwater and dew, being retained on the plant surface, and which is promoted by heating (Theophrastus, *C.P.,* IV. 14.3). Related to this belief is the idea of an "aerial or atmospheric origin" of the disease (νόσος τις <ὑξ> ὑέρος, Hesychius, *Lexicon* (A-O), E. 6111.1; cf. "caeleste malum", Plinius, *N.H.*, XVIII, 154). With reference to cereals, ἐρυσίβη is generically translated as rust (viz. Uredinales) or smut (viz. Ustilaginales). Generic terms are sometimes related to diseases of particular plants, such as rot (σφακελισμύς, Theophrastus, *H.P.* VIII. 10.1) for chick-pea and mildew (ὑλμύ, literally "become mildewed", *Ibid.;* cf. Theophrastus, *C.P.* VI.10.5) for cumin. In these cases, a connection might be suggested with highly noxious fungal diseases such as dry root rot in chick-pea and wilt and blight in cumin (for coriander, cf. Theophrastus, *H.P.* VII. 5.4). In other cases, the use of general definitions such as "canker" (ὑνια δύκαύ ψωριύ, Theophrastus, *H.P*. VIII. 10.1) does not even allow us to ascertain the fungal origin of the disease under discussion.

In Latin, the word *rubigo* (or *robigo*) is in general translated as rust (*Puccinia graminis*?), which is regarded as a major disease of cereals ("frugum rubigo, quidem maxima segetum pestis", Plinius, *N.H.*, XVIII, 161), while the words *uredo* and *carbunculus* can be related, respectively, to blight or smut on grasses and to coal-blight, especially in vines (*carbunculus vitis*). Of particular interest is a description provided by Plinius (*N.H.*, XIX, 181 s.) of a poorly defined barley disease that arises when grains that are not yet ripe or are at the first stage of ripening become hollow and empty and fade away in the ear.

While emphasizing the uncertainty surrounding the results of agriculture practices, Xenophon (*Oeconomicus*, V 18.5) mentions ἐρυσέβαι among the major causes of crop loss. Protection against ἐρυσίβη was sought through worshipping divinities considered to be protectors of cereal crops. Strabo (*Geogr*., VIII 3.15) refers to the great importance attached to the worship of Demeter and Core, the cereal harvest goddesses, in the Greek region of Messenia, where often there was no crop yield at all because of the disease. On the island of Rhodos, Apollos *Erythibius* (literally, "averting rust/smut") was propitiated as preventer of the pest (Strabo, XIII 1.64). Among the Romans, the pest itself was worshiped as Robigo/Rubigo.

Theophrastus (*H.P.* VIII, 10.2) mentions different levels of liability of plants to ἐρυσίβη and summarizes the reasons. Cereals are more susceptible than pulses, and among cereals, barley (κριθύ) more than wheat (πυρός). Among barleys, some kinds are more susceptible than others to the infection. This is the case for a variety called "Achillean" (ὑχιλληῗς χριθή), the relatively erected ears of which would have caused rain and dew to remain on the plant longer because the ears stand off from the leaves. In contrast, the barley variety called ἐτεόκριθος (literally, "genuine, good barley") is mentioned as being less susceptible to the disease because its ears are more bent and thus allow the water to be removed, especially in elevated (ἔγκοιλα) and windy locations (Theophrastus, *C.P.* 3.22.2; cf. Theophrastus, *H.P.* VIII 4.2). The "Achillean" is defined as a plump and large variety of hulled barley (Hippocrates, *Diseases III,* 17

(Loeb vol. VI, 59) able to withstand dry conditions and sandy soils (Theophrastus, *C.P.* III.21.3). A possible indication about its origin is given in Galen's *Hippocratic Glossary* (*Linguarum seu Dictionum Exoletarum Hippocratis Explicatio*) (Vol. XIX, p. 87, Kühn), a list of obsolete words or words that are used with a peculiar meaning in Hippocrates' Corpus. According to the glossa, the name might derive from Brauron, located on the eastern coast of Attica (*Ibid*., Loeb vol. V, p. 58). Instead of mentioning its alleged susceptibility to ἐρυσίβη, this source includes Achillean barley in a list of remedies against high fever (Hippocrates, *Diseases*, III, 17). A standard measure of one cotyle of Achillean barley freed of the chaff and boiled in water was regarded as a valuable *rophema* (decoction) with cooling properties, while a richer mixture was obtained by grinding half a cotyle each of barley, white raisins, white chick-peas and safflower and adding celery, mint and coriander.

Among the reasons mentioned for the lower resilience to ἐρυσίβη of barley compared with wheat are not only a higher erectness and a shorter distance of the leaf to the ear, but also a less complete hulledness and a lower softness (closer structure) (Theophrastus, *C.P.*, IV. 14.1–4).

Attention is given in the classical sources to possible remedies against fungal diseases. Among the most common are the treatment of seeds for sowing and the practice of fumigation. The treatment of seeds with vegetal, animal and mineral substances was considered effective also against insects (Columella, *R.R.,* II, 10); the steeping of seeds in a mixture of amurca, a sub-product of olive pressing, and soda or wine is recommended in order to reduce the infection in both the seeds and the roots of germinating seedlings (Plinius, *N.H*., XVIII, 45). Fumigations consisted of making bonfires of trimmings or heaps of chaff and weeds and up-rooted shrubs around the vineyards and fields. The resulting smoke was believed to disperse the disease (*Ibid.,* 293). A remedy less commonly adopted seems to have been the setting on the ground of laurel branches, which was believed to make the infection pass from the fields into the laurel foliage (Plinius, *N.H*., XVIII, 161).

The sources also provide recommendations about how to prepare the threshing floor in order to reduce pest attacks. The desirability of a solid subsurface (Cato, CXXIX) that is levelled and covered with amurca is stressed in order to avoid the formation of cracks and, consequently, the loss of grains and the retention of water. Varro (*R.R.,* LI) states that this treatment was also effective against weeds, ants and moles. However, no explicit mention is made of the potential reduction in plant disease propagation.

The bible contains seven mentions of a plant disease. In each case, the disease can be argued to have been Covered smut. The original Hebrew text uses the noun שדפון (Shdafan), which can be translated as "blight" or "blasting". The root of this word is probably the adjective שדוף (Shadaf) meaning shrivelled or dried up. Based on this root, the word שדפון could refer to the burned appearance of grain infected by Covered smut, but it could also refer to the literal burning of the grain by an extremely hot wind that blows from the Arabian desert, known as *sharav* (Hebrew) or *chamsin* (Arabic), which causes humidity to drop and which literally blasts the grain. This weather phenomenon occurs mostly in spring (May–mid-Jun.) and autumn (Sept.–Oct.) and brings in so much dust that the sky becomes yellowish and hazy for as long as the wind lasts, approximately two to five days. It is interesting to note that this hot wind was able to kill chickens and destroy pasture land, but might also have hastened the ripening of grain, which may have resulted in increased productivity. The Dutch Statenvertaling translates שדפון as "brandkoren" (translation: fire cereal), and a more recent Dutch translation uses the word "korenbrand". *Ustilago Hordei* is today commonly known as *korenbrand* in Dutch. The Dutch translations thus certainly leave room for an explanation of the phenomenon as being some kind of fungus. The English King James translation, on the other hand, which translates the word שדפון as "blasting", has provoked discussion, because this word, like the word שדפון in the original Hebrew, can be interpreted in two ways.

4 Archaeobotanical evidence

4.1 Egypt

Evidence for rachis fragments infected by Covered smut was first discovered among grains from two Roman settlements in the Eastern Desert, namely, Berenike, a harbour located south of Ras Banas, and Shenshef, a mountainous site of which the specific function is still obscure. Both sites were excavated by Leiden University (directed by W.Z. Wendrich) and the University of Delaware (directed by S.E. Sidebotham) between 1994 and 2001. Among the desiccated rachis fragments of Barley were several specimens with a distinctive deformation of the nodes (fig. 1). The asymmetrical hulled grain kernels and the morphology of the non-infected rachis fragments indicate that we are dealing with hulled 6-row Barley.

The infected rachis fragments were found in samples dating to the 1st–2nd, 4th–5th and 5th–6th centuries AD (table 1). The barley from Berenike shows a lower rate of infection than that from Shenshef (0.3–1.3% vs. 11.7%). It has been suggested that barley that was already partly infected with Covered smut was imported from the Nile valley (Cappers 2006).

Subsequently, a re-examination of the subfossil plant remains present in the Dokki Agricultural Museum in Cairo offered the opportunity to check for possible infections in barley from a variety of locations and periods. A total of 442

Figure 1 Desiccated rachis fragments of hulled 6-row Barley (*Hordeum vulgare* ssp. *vulgare*) from Roman Berenike, Egypt, infected by Covered smut.

	BE 1st–2nd	BE 4th–5th	BE 5th	BE 5th–6th	SS 4th–5th
Grain kernels	4 697	267	210	106	206
Rachis nodes (normal)	4 525	1 781	2371	155	769
Rachis nodes (infected)	4	12	63	-	43

Table 1 Breakdown of infected grain kernels and rachis nodes from trash deposits at Berenike (BE) and Shenshef (SS), Egypt, in early and late Roman times (centuries AD).

samples have been checked, including 62 samples containing barley (Cappers and Hamdy 2007).

The re-examination of these samples yielded two samples that contained fragments infected with Covered smut, both originating from Roman Karanis, located in the Fayum. The samples were taken during the excavations performed by the University of Michigan in 1924–1935 and were donated to the museum in 1935 by the Antiquity Department.

Sample 274 consisted of spikelets and a few rachis fragments of hulled 6-Row barley. Other plants present include a grain kernel and rachis fragment of Hard wheat (*T. turgidum* ssp. *durum*); fruit (fragments) of *Raphanus raphanistrum*, *Sinapis* cf. *arvensis*, *Galium aparine*, *Malva nicaeensis*/*sylvestris*, cf. Fabaceae; and a seed of *Lotus*.

Sample 2057 consisted primarily of straw and spikelets of hulled 6-Row barley. In this sample, only a few other plants were present, namely, a fruit of *Galium aparine* and *Zygophyllum* cf. *coccineum* and a seed of *Convolvulus arvensis*.

Other evidence for infected hulled 6-Row barley, discovered by Van der Veen (2011) comes from both the Roman and Islamic ports at Quseir Al-Qadim, located along the Red Sea coast, which were excavated between 1999 and 2003 by the University of Southampton (directed by D. Peacock and L. Blue). Small numbers of infected rachis fragments, preserved by desiccation, were found in samples dated to the Roman period (1st–early 3rd c.; infection rate 0.5%); Islamic period (11th–13th c.; infection rate 7.9%); and Late Islamic period (14th–15th c.; infection rate 3.3%).

4.2 Jordan

Several small fragments of charred rachis fragments of Barley were recently retrieved during the processing of samples from Dayr Alla that were collected in 1996 (Van Doorn, 2011;

Figure 2 Charred rachis fragments of hulled 6-row Barley (*Hordeum vulgare* ssp. *vulgare*) from Iron Age Dayr Alla, Jordan, infected with Covered smut.

Neef *et al*. 2012). A few infected fragments were found in a sample collected near a jar. This jar seems to have been filled with a mixture of flowers from the Rue family (Rutaceae) and seeds from the Cabbage family (Brassicaceae) and of Fenugreek (*Trigonella foenum-graecum*). It is suggested that a spice mixture was stored in the jar (Neef, 1989). It is not clear whether the few grain kernels of Barley (*Hordeum*) and the infected rachis fragments were part of this spice mixture originally or whether they became mixed in afterwards.

Some other infected specimens were found in one of the samples that were taken from a large concentration of burnt seeds present on the floor of one of the rooms of a two-room mud brick building. The house belongs to habitation phase VII (c. 700–650 calBC) and was destroyed by a fire as a result of which the roof, consisting of wooden beams and reed culms, collapsed and fell down.

It has been estimated that some 50–80 kg of seeds covered the floor. Almost 6 kg has been subsampled in four large samples for archaeobotanical analysis. The majority of the burnt material consisted of spikelets of hulled 6-Row barley (*Hordeum vulgare* ssp. *vulgare*). The barley was stored after threshing, as could be inferred from the irregular orientation of the individual spikelets. Other crop plants that were present, though only in small numbers, are emmer (*Triticum turgidum* ssp. *dicoccon*), Hard wheat (*T. turgidum* ssp. *durum*), represented by a single grain kernel and rachis fragment; and flax (*Linum usitatissimum*). In addition, some wild plants were found, most of them being arable weeds, namely, *Hippocrepis*, *Lolium remotum/temulentum*, *Avena*, *Asphodelus*, *Scorpiurus*, *Phalaris paradoxa*, *Bolboschoenus glaucus*, *Convolvulus arvensis*, *Hordeum* (wild species) and some diaspores that have not yet been identified beyond the family level (Poaceae, Apiaceae and Rutaceae).

Only a few rachis fragments of barley were found among the thousands of spikelets, and all of them proved to be infected with Covered smut (fig. 2). The infected fragments consist of the rachis and the lower part of the infected spikelets. The black spore mass is still present within the membranous envelope. That we are dealing with infected rachis fragments only became clear when larger fragments, showing the twisted rachis, were found. Infected rachis fragments consisting of a single rachis node were only recognized during a second inspection of the indeterminate specimens.

So far, records of infected rachis fragments from archaeological contexts are rare. This is probably due to deformation of the rachis fragments, so that they are no longer recognized as such. We hope that through the documentation of desiccated and charred specimens of infected rachis fragments this grain disease will be recognized more often. In this way, a better picture of the spread of this fungal disease and its possible impact on yield loss will be obtained.

References

Briggs, D.E. 1978. *Barley*. London: Chapman & Hall.

Cappers, R.T.J. 2006. *Roman foodprints at Berenike: Archaeobotanical evidence of trade and subsistence in the Eastern Desert of Egypt*. Monograph 55, Cotsen Institute of Archaeology, University of California Los Angeles.

Cappers, R.T.J. and R. Hamdy 2007. Ancient Egyptian plant remains in the Agricultural Museum (Dokki, Cairo). In: R.T.J. Cappers (ed.), *Fields of change: Progress in African Archaeobotany*, Proceedings of the 4th International Workshop of African Archaeobotany, Groningen Archaeological Studies no. 5, Groningen, Barkhuis and Groningen University Library, 165-214.

Cappers, R.T.J. and R. Neef 2012. Manual of Plant Palaeoecology. Groningen: Groningen Archaeological Studies no. 19, Barkhuis and Groningen University Library.

Cappers, R.T.J., T. van Thuyne and L. Sikking 2004. Plant remains from Predynastic El Abadiya-2 (Naqada area, Upper Egypt). In: S. Hendrickx, R.F. Friedman, K.M. Cialowicz and M. Chlodnicki (eds), *Egypt at its origins: Studies in memory of Barbara Adams*. Proceedings of the International Conference "Origin of the State: Predynastic and Early Dynastic Egypt", Krakow, 28th August–1st September 2002, Orientalia Lovaniensia Analecta 138, Leuven: Peeters Publishers, 277-293.

Cato, *De Agricultura*. W.D. Hooper (ed. and transl.) 1999. Loeb Classical Library, Harvard University Press.

Columella, *R.R.* = Columella, *Res Rustica*, Books I-XII. H. Boyd Ash (ed. and transl.) 1960. Loeb Classical Library, Vol. I-III, Harvard University Press.

Doorn, C.J.G. van 2011. *Jordan valley blues: The Tell Dayr Alla Phase VII botanical record and its potential for the study of Iron Age agricultural practices*. MA thesis, Leiden University.

Meijden, R. van der 2005. *Heukels' Flora van Nederland*. Groningen: Wolters-Noordhoff.

Neef, R. 1989. Plants. In: G. van der Kooij and M. Ibrahim (eds), *Picking up the threads... A continuing review of excavations at Deir Alla, Jordan*. Leiden: Leiden University Archaeological Centre, 30-37.

Neef, R., R.T.J. Cappers and R.M. Bekker 2012. *Digital atlas of economic plants in archaeology* (book and website of University Library Groningen). Groningen: Groningen Archaeological Studies no. 17, Barkhuis and Groningen University Library.

Plinius, *Naturalis Historia*, Books I-XXXVII. H. Rackam and W.H.S. Jones (eds and transl.) 1967-2001, Loeb Classical Library, Vol. I-X, Harvard University Press.

Sanden, W. van der 1996. *Vereeuwigd in het veen: De verhalen van de Noordwest-Europese veenlijken*. Amsterdam: De Bataafsche Leeuw.

Strabo, *The Geography*, Books I-XVII. H.L. Jones (ed. and transl.) 1960. Loeb Classical Library, Vol. I-VIII, Harvard University Press.

Theophrastus, *De Causis Plantarum*, Books I-VI. B. Einarson and G.K.K. Link (eds) 1976. Loeb Classical Library, Vol. I-III, Harvard University Press.

Theophrastus, *Historia Plantarum*, Books I-IX. G.P. Goold (ed.) 1980. Loeb Classical Library, Vol. I-II, Harvard University Press.

Varro, *De Re Rustica*, Books I-III. W.D. Hooper (ed. and transl.) 1999. Loeb Classical Library, Harvard University Press.

Veen, M. van der 2011. *Consumption, trade and innovation: Exploring the botanical remains from the Roman and Islamic ports at Quseir al-Qadim, Egypt*. Frankfurt: Africa Magna Verlag.

Xenophon = H.G. Dakyns, *The Works of Xenophon*, Macmillan and Co., 1897.

Thesaurus Linguae Grecae on line**:** http://www.tlg.uci.edu/

R.T.J. Cappers
Groningen Institute of Archaeology
Poststraat 6
NL-9712 ER Groningen
r.t.j.cappers@rug.nl

F. Fantone
Leiden University
Faculty of Archaeology
P.O. Box 9515
NL-2300 RA Leiden
f.fantone@arch.leidenuniv.nl

C. van Doorn
Leiden University
Faculty of Archaeology
P.O. Box 9515
NL-2300 RA Leiden
specuclaas@hotmail.com

R. Neef
Deutsches Archäologisches Institut
D.A.I. Zentrale
Podbieldskiallee 69-71
D-14195 Berlin
rn@dainst.de

Adonis: a Greek ritual and myth in the Etruscan world

L. Bouke van der Meer

Ritual places in and engraved mirrors from Etruria testify to transformations of the Greek Adonis ritual and myth. The mirror images show interest in erotic meetings, mothering, domesticity, identification, fate, and ritualization.

1 Introduction

According to archaeological theorists it is difficult to reconstruct what ancient people thought, especially when literary sources are missing. The following is an attempt to trace mentalities by studying artefacts, many without precise contexts, e.g. find-spot, production centre, workshop, patrons, craftsmen, donors, buyers, and users (for the problems see Serra Ridgway 2000).

Adonis, *Atunis* in Etruscan, was a popular subject in Etruria from c. 500 BC until Augustus's reign. Why? How were his originally Greek rituals, myth and images transmitted, adopted and adapted? Did Etruscans understand and transform them? What about their function and meaning(s)? Are the images polysemantic?

Several events from the myth are visible on the inscribed, engraved reverses of 22 Etruscan bronze mirrors. They can be dated between c. 410/400 and 280 BC (tables 1 and 2). Until now c. 3000 mirrors are known. They were first used mostly by women in daily life (pace Izzet 2007), and later, sometimes much later, deposited in tombs. Around 1500 mirrors have engraved images on the back. More than 300 are inscribed and carry names of mythological figures. After *Hercle* (Heracles), who is depicted around 50 times, *Atunis* is the favourite male 'hero.' All mirrors bearing images of *Atunis* are circular tang mirrors, the usual type in the fourth century BC. The diameters vary from 13.4 to 19.8 cm.

Extensions and tangs, images and border decorations are all different. This means that the engravers of Atunis mirrors were very creative, and probably did not copy images from other mirrors.

First some words about the Adonis myth and the oldest material indications of Adonis rituals in Etruria.

2 The myth

Adonis, the beautiful young lover of Aphrodite, was popular in Etruria from c. 500 BC until the reign of Augustus. The Greek Adonis myth is certainly of oriental origin: the name is derived from the Semitic word (Adon), which means 'Lord' (Detienne 1972; Bremmer 1987; Atallah 1996).

Traces of the oriental origins of the myth can be found in the literary sources.

Apollodorus (*Library* 3.14.3-4), who wrote in the second century AD (but quoted far older authors), after having mentioned Cinyras, founder of Paphos in Cyprus, as father of Adonis, tells the following story:

'And Adonis, while still a boy (Greek *pais*), was wounded and killed by a boar while hunting, through the anger of Artemis. Hesiod, however, affirms that he was a son of Phoenix and Alphesiboea; and Panyasis says that he was a son of Thias, king of Assyria, who had a daughter Smyrna. In consequence of the wrath of Aphrodite, for she did not honour the goddess, this Smyrna conceived a passion for her father, and with the complicity of her nurse she shared her father's bed without his knowledge for twelve nights. But when he was aware of it, he drew his sword and pursued her, and being overtaken she prayed to the gods that she might be invisible; so the gods in compassion turned her into the tree which they call *smyrna* (myrrh). Ten months afterwards the tree burst and Adonis, as he is called, was born, whom for the sake of his beauty, while he was still an infant (Greek *nèpios*), Aphrodite hid in a chest unknown to the gods and entrusted to Persephone. But when Persephone beheld him, she would not give him back. The case being tried before Zeus, the year was divided into three parts, and the god ordained that Adonis should stay by himself for one part of the year, with Persephone for one part, and with Aphrodite for the remainder. However Adonis made over to Aphrodite his own share in addition; but afterwards in hunting he was gored and killed by a boar' (translation by Sir James G. Frazer, Loeb Classical Library 1939).

Apollodorus situates the myth in Cyprus, Phoenicia or Assyria. According to the late author Photius (*Lexicon* s.v. Adonia), the Adonis ritual came to Greece via Cyprus and Phoenicia. Adonis can be compared to the Semitic young herdsman Tammuz, lover of Ishtar. Tammuz was also killed by a boar, and women wept over him (*Ezechiel* 8, 14-15) each year, in the summer. There are strong indications that the wailing took place on sanctuary terraces and house roofs (Di Filippo Balestrazzi 1999). As for the myrrh of the

	H. Rix, *ET*	Reference	Findspot	Date	Diameter
1.	*ET* Ta S. 5	*ES* 5, 25	Tarquinia	350-325	18.0
2.	*ET* Ta S. 6	*ES* 5, 28 *CSE* DDR 1, 31	Tarquinia	350-300	14.5
3.	*ET* Ta S. 9	*ES* 5, 27	Tarquinia	c. 350	18.5
4.	*ET* AT S. 7	*ES* 5, 23	Castel d'Asso	325-300	19.2
5.	*ET* Vs S. 8	*ES* 1, 115	Montefiascone	c. 350	17.0
6.	*ET* Vs S. 10	*ES* 5, 26	Bolsena	350-325	14.9
7.	*ET* Vc S. 14	Amorelli 1952, 191	Montalto di Castro	c. 400	16.0
8.	*ET* Cl S. 11	*MAL* 30, 542	Marcianella	325-300	18.0
9.	*ET* Pe S. 10	Rallo 27, 6	Perugia	350-325	16.5
10.	*ET* Pe S. 11	*ES* 5, 24; *CSE* Italia 2, 1, 4	Perugia	c. 350	16.5
11.	*ET* Ar S. 3	*ES* 1, 50, 2	Castiglion Fiorentino	320-280	14.0
12.	*ET* OI S. 15	*ES* 1, 116 *CSE* BRD 4, 34		400-350	15.9
13.	*ET* OI S. 34	*ES* 1, 111 *CSE* BRD 4, 33		350-325	17.2
14.	*ET* OI S. 44	Cahn 1970, 13, no. 20		325-300	16.0
15.	*ET* OI S. 45	*ES* 4, 1, 322		350-300	19.5
16.	*ET* OI S. 51	Charsekin 79, no. 15 (lost)		350-325	?
17.	*ET* OI S. 71	*CSE* BRD 1, 39		350-300	18.2
18.	*ET* OB S. 3	ES 1, 114		400-350	13.4
19.		Briquel 2010, 6, fig. 2		c. 350	17.0
20.		Feruglio 1997, 299-314	Caldane di Castel Viscardo	400-350	16.3
21.		*CSE* Schweiz 1, 5		350-300	13.8
22.		*CSE* Schweiz 1, 36		350-325	18.0
23.	*ET* Pe S. 12	*ES* 2, 176	Perugia	350-325	19.8
24.	*ET* AH 3.3	*ES* 1, 112; 5, 191	Bisenzio (not Bomarzo)	350-325	17.9
25.		*CSE* France 1, 3, 7	Orbetello	400-350	16.8

Table 1 Epigraphic mirrors showing and mentioning *Atunis* (except damaged no. 23 with lost name and nos 24 and 25 without his name).

balm-tree, this substance was exported from the Semitic to the Greek world in the seventh century BC. Hesiod and Sappho who mention Adonis lived in the same time.

3 The ritual

The oldest traces of a ritual in honour of Adonis in Etruria were found in the commercial sanctuary of Gravisca, harbour place of Tarquinia, once visited by Greeks and Etruscans (Torelli 1997; Fiorini 2008; Fiorini and Torelli 2010). The sanctuary developed gradually since c. 600 BC. It had rooms dedicated to Aphrodite (in Etruscan *Turan*), Adonis, Hera (*Uni*) and Demeter (*Vei*) (fig. 1). The sacred space for Adonis (δ) is connected to the room of Aphrodite/Turan (γ), where a number of finds and an inscription suggest that sacred prostitution took place. Adonis' space contains a paved square and a garden, an empty stone sarcophagus in a stone enclosure in the square, a water-well, two altars, a portico and a tower. To the finds in situ belong a reversed, half ceramic amphora and an Arretine shard bearing a Latin inscription reading *Adon,* dated to the time of Augustus. The building date of Adonis' space (c. 500 BC) can be explained by the fact that Adonis festivals at Athens became gradually popular in the fifth century BC.

1.	*aχvizr atunis θalna* (Achvizr holding *alabastron*, nude A. (with *bulla*) and semi-nude Turan embracing, standing in front of bed, winged Thalna carrying wreath)
2.	*evan atunis mean* (Evan holding twigs seated on rocks, bird carrying necklace or armlet with 3 *bullae*, semi-nude A. alone holding twig, Mean holding *alabastron* and dipstick, seated on rocks)
3.	*atunis turan* (standing semi-dressed, bearded A. with sceptre and sitting, dressed T. in conversation)
4.	*lasa turan atuns menrva amuce* (winged nude *Lasa* carrying hanger with flower, Apollo holding laurel, semi-nude T. and A. standing and embracing, united by ribbon, armed Menrva dancing, fountain labelled Amuce)
5.	*atunis turan lasa sitmica /arm aθ ac l a rn l a* (seated semi-nude A. with knotty stick and standing dressed T. holding twig in conversation, cista, and *Lasa Sitmica* holding staff)
6.	*atunis turan* (A. playing lyre and T., both almost nude, their legs intertwined, sitting on bed)
7.	*atunis turan* (semi-nude A. with knotty stick and dressed T. offering flower, both standing)
8.	*umaele eturpa atunis inue eθial era**x** alpunea / urφe* (oracle of *Urphe*/Orpheus; nude A. and Turan lying and facing in upper exergue)
9.	*atunis lasa aχununa* (swan, dog, seated semi-nude A. and dancing, almost nude, winged Lasa (instead of T.) embracing, in the open air)
10.	*lasa turan atunis* (rosette-like stars, Lasa, dressed T. and nude A. (with *bulla*), standing and embracing, in the open air)
11.	*atun(is) turan* (standing semi-nude A. with spear, nude T. dancing, holding twig, in the open air)
12.	*atunis turan ati* (nude tree, nude winged A. and sitting dressed T. Ati (Mother) together playing with a bird (dove?), cista, mirror)
13.	*pulθisφ atunis turan snenaθ* (semi-nude Apollo Thespios holding lyre and plectrum, swan, semi-nude A. and dressed T. (giving egg or ring to Snenath) standing and embracing, Snenath holding *alabastron* and dipstick)
14.	*turan atunis* (sitting semi-nude T. and standing nude winged A. embracing, small man (with laurels on his head) holding lyre, swan, in the open air)
15.	*tusna atunis turan zipna / alpan aχvisr munθχ mean (munθ?)uχ / haθna* (swan Tusna, semi-nude A. (with 2 *bullae*) and dressed T. standing and embracing, winged dressed Zipna holding *alabastron* and dipstick; surrounded by two rows of three hovering winged personifications: Alpan, Achvisr, Munthch, Mean, Munthuch (?) and a Muse with lyre (unlabelled); satyr Hathna emptying an amphora for two panthers)
16.	*turan atunis munθχ* (lost mirror)
17.	*atunis turan ta(ln)a z(iu)mit(e)* (nude man, bird, nude A. (with 3 *bullae*) embracing sitting dressed T., Talna holding sceptre, Ziumite (Diomedes) holding spear)
18.	*turan atuniś* (bird, laurel, semi-nude A. offering flower to dressed T. sitting on her knees, both sitting on bed and embracing, laurel)
19.	*munθχ turan atunis turnu* (Munthch holding double oboe, swan, dressed A. (with *bulla*) sitting on lap of sitting, dressed T. (head covered), embracing, male Turnu holding lyre)
20.	*turnu apulu turan atunis* (inscr. in cartouches; winged nude male Turnu using *rhombos*, standing Apollo holding laurel branch, standing dressed T. holding *rhombos*, embracing nude A. (with *bulla*) from behind, bird (*iynx*))
21.	*turan atunis* (branch on rock, nude T. (with *bulla*) and nude A. standing and embracing, under a common mantle, branch, in the open air)
22.	*turan atunis* (standing dressed T. and dressed A. in conversation, swan)
23.	*[atunis] tu[ran] aθrpa meliacr atlenta* (nude Atunis (?) embraced by dressed T., Athpra (Greek Atropos) handling hammer and nail, boar head, Meliacr (Meleagros) and Atlenta (Atalanta), both armed)
24.	*tite cale : atial : turce / malstria : cver* (sitting dressed woman with sceptre, dressed T. (?) and nude A. (?) standing and embracing, standing Menerva with inscribed shield: *tite cale* etc., in the open air)
25.	*venos diovem prosepnai* (Venus covering her face, Jupiter holding thunderbolt, turned and pointing to Prosepnai; Prosepnai holding twig and pointing to the closed chest)

Table 2 Atunis mirrors (numbered as above).
Inscriptions and in brackets from left to right persons, attributes and motifs.
A. = Atunis; T. = Turan.

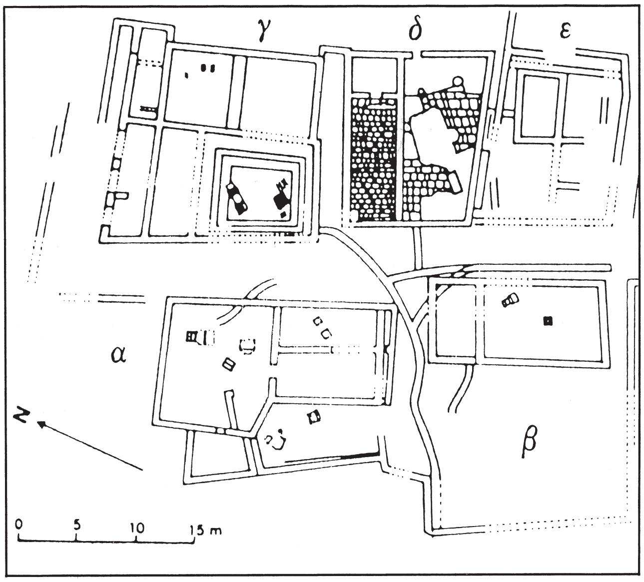


Figure 1 Greek-Etruscan sanctuary at Gravisca (from *Santuari* 1985).

The ritual in Gravisca was probably similar to a private ritual in Athens, probably organized during the hot dog days in July. In Athens women carried broken halves of amphoras, turned upside down, filled with germinating, an-aphrodisiac corn-salads (lettuce) and fennels (called *kèpoi*: 'gardens'), climbing wooden stairs to the roof of their house; in Gravisca the 'gardens' were probably brought up to the roof of the portico. The Athenian *modus operandi* can be seen on ten Attic red figure vases (c. 450-350 BC; Weill 1966; Servais-Soyez 1981, 227-228). They show a woman, semi-nude or dressed, mounting or descending wooden stairs, carrying the broken half of an amphora or plate with tiny vegetables and/or fruits inside. The general atmosphere of the scenes is serious, and not as lascivious as ancient authors such as Aristophanes (413 BC) suggest.

What further happened in Gravisca is virtually unknown. The empty sarcophagus found may have contained a statue of Adonis, which may have been exhibited and then buried again during the ritual. Torelli's attempt (1997) to reconstruct the whole ritual is problematic, since it is based on information from authors like Theocritus (*Idyll* XV), who describes an Adonis feast at the palace in Alexandria around 280-270 BC. It is dangerous to extrapolate the Alexandrian praxis two centuries back. The sarcophagus is oriented east-north-east, curiously not in line with the long axis of the sacred space δ (fig. 1). This can be explained by the fact that the sun rises there at the end of July. In Etruscan cosmology the place of sunrise, during the solstices and equinoxes, was of fundamental importance (Stevens 2009). The remarkable orientation shows that the Greek ritual had become Etruscanized.

The sanctuary at Gravisca was used until 281 BC, when Romans destroyed it. Adonis' space, however, was used again in the Augustan period, which may mean that the ritual continued after the destruction.

A ritual similar to that of Adonis may also have been practised at Pyrgi, a harbour of Caere (Cerveteri). Temple B, dedicated to *Uni* (Iuno)/Astarte in the northern area, yielded three golden tablets, one with a Phoenician and two with Etruscan inscriptions, dated to c. 500 BC (*Santuari* 1985; Maras 2009, 349-354). The Phoenician text tells us that Astarte gave permission to Thefarie Velianas, king of Caere, to reign for three years, "in the month of *krr*, on the day of the funeral of the deity." The latter deity, of course, was Tammuz. The ritual may have been performed as a symbolic, sacred marriage between goddess and king, who in Etruscan was given his Republican title: *zilac-*/*zilath* (cf. Latin *praetor*). Both Gravisca and Pyrgi may have had in common a ritual in which Tammuz/Adonis was symbolically buried, e.g. by burying a statue of him in a tomb. At Pyrgi this probably took place in zone C, the annex of temple B, which was oriented north-east.

In addition, sacred prostitution may have occurred in both places. Some of the terracotta antefixes which probably decorated the twenty sacred love rooms show a repeating cosmic cycle of light and night deities with an oriental character (Krauskopf 1991, 1261-1283).

Ritual elements like tomb, pots or stairs are not visible on Etruscan mirrors.

4 Reception of the myth

An archaeological context sheds light on the reception of the Adonis myth. Dated to the end of the fifth century BC are the grave goods of a woman at Populonia (Piombino), including two splendid Attic red figure *hydriai* of the Meidias Painter. One shows *Adonios* (labelled) sitting in the lap of Aphrodite (fig. 2), the other *Phaon* (labelled), another beautiful man (Burn 1987, 40-44). The latter transported for nothing an old ugly woman, who appeared to be Aphrodite herself in disguise. For that reason the goddess gave him a perfume which transformed him into an irresistible, eternally young lover. Since the vases show two beautiful men in a similar way, they must have been special commissions. The owner was interested in erotic scenes since one of the other grave goods is an Etruscan bronze mirror showing a satyr lifting the dress of a woman reclining on a bed (Romualdi 2000).

In both scenes the main persons are surrounded by personifications. One of them is called *Pannychis*, All-Night Festival. On the Adonis-*hydria*, *Himeros* (Desire) handles a magic wheel (*rhombos; iynx*), and *Eurynoe* (Broad Mind) plays with a wryneck (*iynx*; *iunx torquilla*), a magic bird that could look dead when caught but was still alive. According to Pindar (*Pythian* 4, 214-219) it could make people madly in love.

Figure 2 Hydria of the Meidias painter, drawing (from Burn 1987).

5 Transmission

The magical elements just mentioned are also present in images of *Atunis* (see table 2, no. 20; c. 400-350 BC; fig. 3) and of *Phaun*/*Faun* (Greek Phaon) on mirrors of the fourth century BC. In addition, three Phaon mirrors have personifications with a name beginning with *Eu*-, which remind us of personifications like Eutychia on Meidias vases (Cristofani 1986; Donatella Gentili 2000, 115-141). It is unlikely that mirror engravers copied directly from these two Attic vases. No Atunis mirrors have been found in the region of Populonia. Greek images may have been transferred by textiles and other models.

Mirror no. 18 (c. 400-350 BC), which was engraved by an artisan from Northern Etruria in view of the typical letter *san* (M = ś), shows *Atuniś* (written *dextrorsus*), with a hairstyle in the manner of the Meidias Painter.

Mirror no. 20, found in a robbed *fossa* tomb, shows an embrace similar to that on another mirror found at Vulci of the same form, composition and style, which shows Apollo, holding a laurel, and *Fufluns* (Dionysos) embraced from behind by his mother *Semla* (Greek Semele) (*ES* 1, pl. 83). The scene depicts Dionysos, who has just brought his mother out of the Underworld and taken her up to Apollo's sanctuary in Delphi. As Feruglio (1997) points out, the engraver of both mirrors used an exchangeable scheme. Since *Apulu* on no. 20 has no clear function, the *Fufluns*-*Semla* scheme is older. It has a precedent in a relief of the throne of Zeus at Olympia, made by Pheidias of Athens, showing Niobe embracing one of her dying sons from behind. So the origin of the composition again originates from Athens. The two mirrors were produced in Vulci, but the Atunis mirror was used near Orvieto, which proves the high mobility of mirrors.

Though the presence of *rhombos* and *iynx* on no. 20 shows the influence of the Meidias painter, the presence of an *alabastron* (perfume flask of alabaster) and dipstick, isolated and therefore represented as symbols, is typically Etruscan. Perfume is used for seduction (nos. 1, 2, 5, 13, 15, and 20). The use of music (nos. 6, 13, 14, 15, and 19), however, is of Attic origin as the *hydriai* of the Meidias Painter show.

Another early mirror (no. 7), dated to c. 400 BC, shows *Atunis* and *Turan* in a way that, as Amorelli (1952) points out, is reminiscent of classical Attic grave reliefs. It is another indication that motifs from Athens were transferred to Etruria. The mirror was found at Montalto di Castro, a coastal settlement near Vulci, where many mirrors with an

Figure 3 Mirror no. 20 from Castel Viscardo (from Feruglio 1997).

ivy-leaf border decoration were produced in the fifth and fourth centuries BC.

From another coastal metropolis, Tarquinia, comes mirror no. 3 (c. 350 BC). It is piriform, has a tang handle, and laurel branches as border decoration. The shape is characteristic of mirrors made at Praeneste (in Latium) before c. 350 BC. Later the mirrors had massive handles cast in one piece with the disc, and Latin instead of Etruscan inscriptions.

It seems likely that the myth entered Etruria via the Tyrrhenian coastal sites of Gravisca, Tarquinia, Pyrgi, Vulci, and Populonia. Athens offered schemes, style and motifs.

Mirror no. 25, from Orbetello (c. 400-350 BC), shows the Judgement of Jupiter. Though it has Latin inscriptions, there is Etruscan influence since the name *Prosepnai* (cf. Latin Proserpina) is influenced by Etruscan *Phersipnai* (cf. Greek Persephone). The name *Diovem*, accusative of Jupiter, points to an oral transmission of the myth.

6 The question of choice

Some mirror images show Turan and Atunis in conversation or embracing, usually in the open air, standing or sitting together or with one of them sitting alone on a rock, chair, stool or bed. The primary meaning must have been simple: love between a goddess and a young mortal man. Other images, however, must have been chosen from different perspectives, which are dealt with below.

One of the earliest mirrors (no. 7; c. 400 BC) shows the couple without onlookers. This may mean that it was in the course of the fourth century, often after c. 350 BC, that many scenes were enriched with typically Etruscan minor deities and personifications, belonging to the circle of Turan (Lasa, Achvisr, Munth(u)ch, T(h)alna (probably meaning 'young'), Turnu (from the adj. **Turan-u*: 'belonging to Turan'), and with attributes (Turan's swan, a *cista* (box), mirror, *alabastron*, musical instruments). Some mirrors after c. 350 BC show a border of floral scrolls (nos. 2, 6, 23, 24), ornaments which are frequently present on contemporary Apulian red figure vases.

6.1 Mothering

Some ancient authors call Aphrodite's lover a child, and some mirrors show a very young *Atunis*, smaller than she is (nos. 10, 12, 13, 15, 17, 19). In addition, in some scenes he carries a necklace with a *bulla* (nos. 1, 15, 17, 19, 20). At the age of 14 boys deposited their *bullae* in the rite of passage to adulthood. This implies that *Atunis,* on ten mirrors, is depicted as being under age. *Atunis* sometimes looks effeminate, maybe due to his childhood status.
On mirror no. 2, Turan's assistant *Mean* holds a dipstick in order to perfume him with a liquid from an *alabastron*. Usually, only women, especially brides, were perfumed in this way. On mirror no. 15 *Atunis* opens his mantle in a gesture of *anakalypsis* that was usually made by women who were about to marry, as in Greek wedding scenes.

Why would Etruscan women be interested in meetings between an adult, married goddess and her extremely young lover? Do we have to interpret the scenes as paedophilia, adultery, escapism, in other words wishful thinking of housewives, and/or as maternal love?

On mirror no. 12 (c. 400-350 BC; fig. 4), Turan, who is called *Turan ati* (Turan Mother), and *Atunis*, who has wings like Eros, are playing with a dove. Next to *Turan* are a mirror and a *cista* with *alabastra*, both attributes belonging to Etruscan married women.

On mirror no. 19 Atunis sits as a boy (he wears a *bulla*) on the knees of Turan. This is a reversed position: usually the woman sat on the knees of her lover (cf. no. 18). These details show that Atunis was seen as a half-grown man.

The scenes on nos. 12, 17, 19 and 20, however, are not explicitly sexual, since Turan is dressed and since the partners are not kissing. In my opinion the scenes present Turan's maternal feelings for a too young partner.

Figure 4 Mirror no. 12 showing *Atunis* and *Turan ati* (from Atallah 1966).

Figure 5 Mirror from Praeneste (from *CSE* Italia 6, 40).

The question arises as to why erotic scenes were presented on mirrors. A clue may be found on a mirror from Praeneste (*ES* 379, *CSE* Italia 6, 40; fig. 5), dated to c. 480-450 BC, showing a majestic, standing *Turan* and a seated boyish (!) *Elachsantre* (Greek Alexandros/Paris), who is about to seduce *Elina* (Greek Helena), a married woman who lies in bed under the covers, with her baby *Ermania* (Greek Hermione). Evidently Helena is depicted as a mother, and the very young Paris as victim of the love goddess. The presence of a winged sphinx above the bed, hovering in Turan's direction, symbolizes the arrival of misfortune. The message is clear: Turan is a powerful goddess, and her seduction of a man and a woman into adultery will generate disaster: the Trojan War.

6.2 Domesticity

Several objects, like the bed (nos. 6, 18), chair (1, 12, 17, 19), mirror (12), or *cista* for *alabastra* (5, 12) set the meeting between Turan and Atunis in a domestic context. Most interesting is no. 17 (fig. 6), which shows columns. Architectural backgrounds are frequent on mirrors of the second half of the fourth century BC, and are clearly an Etruscan addition (Wiman 1990, 147-149). Some mirrors showing the Oracle of Urphe/Orpheus (no. 8) have such

Figure 6 Mirror no. 17 showing *Atunis* on *Turan's* knee (from *CSE* BRD 1, 39).

a façade in the background, while on Attic red figure vases showing the same theme and composition (c. 420 BC), a façade is absent. The façade lends a local, Etruscan flavour to the original Greek core.

6.3 Identification

Two mirrors seem to show that a male donor identified himself with Atunis. The inscription on no. 24 reads:

tite : cale : atial : turce
malstria : cver

'Tite Cale to mother has given (this)
mirror: (as) sacred (object)'

Because, as far as we know, sons did not give mirrors to their mothers, and because *ati* (mother), as we have seen, is used as an epithet of Turan, the mirror must have been a votive gift to the goddess (pace Izzet 2005; de Angelis 2002). In addition, the adjective *cvera* means 'sacred', the substantive *cver* 'sacred thing'. Tite's family name Cale may derive from the Greek adjective *kalos* (beautiful). Probably Tite compared himself to Atunis.

Mirror no. 5 shows *Atunis* as seated herdsman facing a standing *Turan* who is accompanied by *Lasa Sitmica*. Among the figures, below, we see parts of proper names, identified by Maggiani (2002, 7-8):

arm aθ ac l a rn l a
in reconstruction:
armas a(rn)θ larnla
which means:
'Arnth Armas to Larnai (has given this).'

Probably Arnth wished to identify himself with Atunis and to compare his wife Larnai to Turan.

The splendid mirror no. 9 shows *Atunis* embracing a winged deity called *Lasa achununa* (an error; it should be read as *achuna*). Lasa, an assistant of Turan, is here obviously substituting for the love goddess. The artifact was found in a tomb of the *Achu* family in the necropolis Sperandio near Perugia; Lasa was seen as protector of the family, and if the mirror was a gift, the male giver may have identified himself with *Atunis* and his wife with a *Lasa*. The aggressive dog on the left may be hinting at *Atunis'* fatal hunting. The context of the mirror is known: within the sarcophagus of a rich lady, as well as on top and in front of it were objects belonging to the symposium and to the *mundus muliebris*. Her golden diadem is decorated with a figure of a Lasa, which means that this goddess was her protector (*Notizie degli Scavi* 1900, 553-561). A woman's tomb with similar grave goods (including a gold relief ring showing Lasa) was found in Todi. Both women may have been priestesses of Lasa.

6.4 Fate, death and return from death

The famous large mirror no. 23, from Perugia (now in Berlin) shows two couples, Atunis (inscription lost) and *Turan*, and *Meliacr* and *Atlenta* (Greek Meleagros and Atalanta). Between them stands *Athrpa* (Greek Atropos), holding a hammer and nail, about to pin a boar's head to an invisible tree. The couples do not appear together in ancient Greek literature. Since the two men die as a consequence of a boar hunt, the engraver knew both stories and intended to make clear that death is unavoidable. Atropos is pictured like the Nikè on coins from Syracuse around 310 BC. The goddess of Victory nails the spoils of battle to a trunk as a *tropaion*, the material turning point in a battle. The winged woman with a *thyrsos* in her right hand emerging from an acanthus calyx on the mirror, however, may contain a positive Dionysian message, rebirth from death. She is visible without *thyrsos* in exergue on two mirrors with birth scenes (*ES* 166; 5, 77). She appears frequently on Apulian red figure vases starting from c. 350 BC.

The very large mirror no. 15, in St. Petersburg, situates the love scene in a cosmic setting. The broad border shows six hovering, winged personifications: from left to right *Alpan*, *Achvisr* and *Munthch*, and from right to left, an unlabelled Muse with lyre, [---]*uch* (probably Munthuch again), and *Mean*. These figures often have interchangeable attributes. *Mean* often personifies victory, *Munthch* (from *Munthuch*) holds her *alabastron* and dipstick. The latter name is akin to the Latin adjective and substantive *mundus* (elegant; heaven; ritual heaven-like pit), which has two meanings, like Greek *kosmos* (ornament; heaven). The presence of the Muse can also be related to heaven; according to Macrobius (*Comment on Scipio's dream* 2.3.4), the Etruscans saw Camenae (Muses) as 'the song of heaven' (pace Briquel 2009). Above the tang a satyr, labelled *Hathna,* is emptying an amphora between two panthers who are stealing upon it. The scene may be symbolic, since similar scenes in Etruscan and Roman art seem to mean that the Dionysian drinking of wine could make souls immortal.

Both mirror images seem to illustrate the hope of return from death.

6.5 Ritualization

Seven mirror scenes show Turan and Atunis as nude or almost nude partners (nos. 1, 4, 6, 9, 11, 14, 21). Here they are the same height and are evidently depicted as adults, clearly not in accordance with the Greek myth. The scenes testify to a realistic *interpretatio etrusca*. On no. 21 they are covered by a common mantle, on no. 4 they are joined by a common fillet around their necks, attributes that stress the union of equal lovers. The covering mantle or blanket symbolizes the Etruscan wedding ceremony as is illustrated on a stone house-model from Poggio Gaiella, near Chiusi, dated to c. 500 BC (Van der Meer 1991).

Exceptional is on no. 8 the presence of *Atunis* lying together face to face with Turan (unlabelled) in the exergue above the main scene representing the Oracle of *Urphe* (Greek Orpheus). Maggiani (1992: 3-4; cf. idem 2002, 12) suggests that if the mirror was a wedding gift, the prophecy scene and the couple in the exergue may be interpreted as forecasting good luck.

7 A late funerary ritual

The last indication of a ritual in honour of Atunis is a funerary terracotta monument which looks like a sarcophagus, representing a wounded Atunis accompanied by his mourning hunting dog (c. 250-200 BC). It never contained a corpse or ashes, however, since the bottom has openings. It was found in a necropolis of Tuscania, a city belonging to the territory of Tarquinia. It has many little holes in the back (fig. 7) and sides. Sannibale (2009) presumes that the holes were used for the evaporation of gasses during the baking process. Torelli (1997, 233-4) suggests, without however offering any supporting arguments, that twigs were inserted into the holes. An Apulian red figure *pelikè*, dated to c. 330 BC, depicts Adonis (labelled) lying on a bed, threatened by a Fury with a torch, foreshadowing his imminent death (fig. 8). Reversed twigs are sprouting from under the bed, which suggests

Figure 7 Terracotta 'sarcophagus' from Tuscania (from Sannibale 2009).

Figure 8 Apulian red figure vase (from Berger-Doer 1979).

rebirth. Interestingly, the neck of the vase shows, as on another Apulian funerary vase, Zeus as arbiter between Aphrodite and Persephone. No baby chest is present but a young, nude Adonis himself stands nearby. It is an indication that apart from the chest story there was a second version, in which Zeus or Hades decided that Adonis, after his fatal hunting had to spend six months with Aphrodite and six months with Persephone (Berger-Doer 1979).

The 'sarcophagus' from Tuscania may have been taken out of a funerary chapel or tomb every year in order to be adorned with short living twigs. When the twigs died, it was brought back to its original place. The ritual may have looked like the sprouting and dying process of plants at Gravisca.

8 Conclusion

In sum, Adonis rituals were present in Etruria from c. 500 BC until the first century AD. The origins can be found in Athens and the Phoenician world.

The rituals at Athens and Gravisca make clear that each year, in the course of the summer, Adonis came alive and died symbolically.

The visual models for the oldest mirror images came from Athens. The scenes got gradually more figures, thus becoming Etruscanized. They were polysemantic, as may be deduced from their symbolism, moralization, domesticity, and identification. Some show erotic meetings, others Atunis as too young lover, maybe warning about unequal love, adultery, hunting, and the inevitability of death. Some may show that a male donor of a mirror associated himself with beautiful Atunis and his wife with Turan or her substitute, Lasa. Atunis mirrors disappeared after c. 280 BC, at the same time and probably due to the end of Greek, Faliscan and Etruscan red figure vase painting, and the Roman conquest of South Etruria.

Acknowledgements

My warm thanks are due to Larissa Bonfante, Henk Versnel and Fernando Gilotta for their very useful comments.

References

Amorelli, M.T. 1952. Nota su uno specchio etrusco inedito. *Archeologia Classica* 4, 91-93.

Atallah, W. 1966. *Adonis dans la littérature et l'art grecs*. Paris.

Berger-Doer, G. 1979. Adonis. *Antike Kunst* 22, 119-125.

Bremmer, J. 1987. Onder de parfum, in de sla, tussen de vrouwen: Adonis en de Adonia. *Hermeneus* 59, 2, 181-187 (also online).

Briquel, D. 2009. Une glose étrusque oubliée. In: *EIPCamporeale* 167-171.

Briquel, D. 2010. New Etruscan Inscriptions on the Web. *Rasenna: Journal of the Center for Etruscan Studies* 2, 1, 1-8 (also online).

Burn, L. 1987. *The Meidias Painter*. Oxford.

Cahn, H.A. 1970. *Art of Ancient Italy. Etruscans, Greeks and Romans*. New York.

Charsekin, A.I. 1963. *Zur Deutung etruskischer Sprachdenkmäler*. Frankfurt am Main.

Cristofani, M. 1986. Faone, la testa di Orfeo e l'immaginario femminile. *Prospettiva* 42, 2-12.

CSE: *Corpus Speculorum Etruscorum* (1981-).

De Angelis, F. 2002. Specchi e miti. Sulla ricezione della mitologia greca in Etruria. *Ostraka* 11, 1, 37-73.

Detienne, M. 1972. *Les jardins d'Adonis*. Paris.

Di Filippo Balestrazzi, F. 1999. Adone, o quando la regalità è finzione. Della terrazza cultuale di Ebla al rito 'sul tetto' nelle Adonie occidentali: storia ed evoluzione di una festa. *Ostraka* 8, 2, 309-342.

Donatella Gentili, M. (ed.) 2000. *Aspetti e problemi della produzione degli specchi etruschi figurati* (Atti dell'incontro internazionale di studio, Roma, 2-4 maggio 1997). Roma.

EIPCamporeale: S. Bruni (ed.) 2009. *Etruria e Italia preromana. Studi in onore di G. Camporeale*. Pisa/Roma.

Emiliozzi, A. and A. Maggiani (eds) 2002. *Caelatores: incisori di specchi e ciste tra Lazio ed Etruria* (Atti della Giornata di studio, Roma, 4 maggio 2001). Roma.

ES: Gerhard, E., A. Klügmann and H. Körte 1840-1897. *Etruskische Spiegel* I-V. Berlin.

ET: see H. Rix (ed.).

Feruglio, A.E. 1997. Uno specchio della necropoli di Castel Viscardo presso Perugia. In: *Etrusca et Italica, scritti in ricordo di Massimo Pallottino*. Pisa/Roma, 299-314.

Fiorini, L. 2008. Il santuario dei mercanti greci e le feste di Adone a Gravisca. In: *Etruschi. Le antiche metropoli del Lazio*, Milano, 1-14.

Fiorini, L. and M. Torelli 2010. Quarant'anni di ricerche a Gravisca. In: *MAER*, 29-49.

Izzet, V. 2005. The mirror of Theopompus: Etruscan identity and Greek myth. *Papers of the British School of Rome* 73, 1-22.

Izzet, V. 2007. *The Archaeology of Etruscan Society*. Cambridge.

LIMC 1981-1999: *Lexicon Iconographicum Mythologiae Classicae*. Zürich.

MAER: van der Meer, L.B. (ed.) 2010. *Material Aspects of Etruscan Religion* (BABESCH Supplement 16). Leuven: Dudley.

Maggiani, A. 1992. Iconografie greche e storie locali nell'arte etrusco-italica tra IV e III a.C. *Prospettiva* 68, 3-11.

Maggiani, A. 2002. Nel mondo degli specchi etruschi. In: A. Emiliozzi and A. Maggiani (eds), 7-22.

MAL: *Monumenti Antichi Lincei*.

Maras, D.F. 2009. *Il dono votivo. Gli dei e il sacro nelle iscrizioni etrusche di culto*, Pisa/Roma.

Rallo, A. 1974. *Lasa. Iconografi e esegesi*. Firenze.

Rix, H. (ed.) 1991. *Etruskische Texte I-II. Editio minor.* Tübingen.

Romualdi, A. 2000. La tomba delle *hydriai* di Meidias. *Ostraka* 9, 2, 351-371.

Sannibale, M. 2009. *L'Adone morente* di Tuscania. In: *EINCamporeale* II. Pisa/Roma, 813-824.

Santuari: G. Colonna (ed.) 1985. *Santuari d'Etruria*. Milan.

Serra Ridgway, F.R. 2000. Etruscan mirrors and archaeological context. *Journal of Roman Archaeology* 13, 407-418.

Servais-Soyez, B. 1981. Adonis. In: *LIMC* 1, 222-229.

Stevens, N.L.C. 2009. A New Reconstruction of the Etruscan Heaven. *American Journal of Archaeology* 113, 153-164 (also online).

Torelli, M. 1997. Les Adonies de Gravisca. Archéologie d'une fête. In: F. Gaultier, F. and D. Briquel (eds), *Les Étrusques. Les plus religieux des hommes*. Paris, 233-291.

Van der Meer, L.B. 1991. Etruscan *rites de passage*. In: *Stips votiva. Papers presented to C.M. Stibbe*. Amsterdam, 119-123.

Weill, N. 1966. Adôniazousai, ou, les femmes sur le toit. *Bulletin de Correspondence Hellénique* 90, 664-698.

Wiman, I.B.M. 1990. *Malstria – Malena. Metals and Motifs in Etruscan Mirror Craft*. Göteborg.

L. Bouke van der Meer
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
l.b.van.der.meer@arch.leidenuniv.nl

Avoiding crop failure in the Iron Age: maslins and emergency crops on the loess soils of western continental Europe, with a special note on oat (*Avena sativa*) and foxtail millet (*Setaria italica*)

Corrie Bakels

Discussed is the possibility that the Iron Age farmers on the loess soils of western continental Europe combated crop failure by growing maslins and emergency crops. This research indeed identified maslins, which consisted of mixtures of emmer wheat and barley or emmer wheat and spelt wheat. Two possible emergency crops were detected: oat and foxtail millet. A relation with the deterioration of the climate around 850-800 BC could not be proven.

1 Introduction

The failure of a crop is one of the worst nightmares for a farmer. This applies to the present, but also holds true for the past. Staple crops, in particular, should never fail.

Farmers have a range of methods at their disposal for preventing this. All aim to obtain the best crop possible. Farmers can apply drainage in case of high water-tables, irrigation in case of drought, manure in case of lack in nutrients, sow more seed per unit of land to improve yields etc., but still adverse conditions can arise causing severe crop damage. An abnormal spell of bad weather or a sudden outbreak of a plant disease may bring about significant losses.

To cope with this kind of failure the farmer may want to spread his risks, for instance by sowing and planting a range of different crops, each plant with quite different requirements. However, if space is limited, and the choice in staple crops is not that large, diversification encounters problems. Such might have been the case in the period and region considered in this article: the Iron Age lasting from 800-20 BC, and the region with loess or comparable soils in the western part of Germany, the Netherlands, Belgium and northern France.

The landscape was shaped by the activities of a farming population. Pollen diagrams show that the presence of humans was felt almost everywhere. The more or less untouched forest which would have covered the land without human interference is no longer in existence. If not actually cultivated, the land was used for pasturing livestock and as a source of wood. Farming combined crop cultivation and animal husbandry.

The land was densely populated with farmers living dispersed throughout the landscape. Only towards the end of the period did farms in the German Rhineland tend to cluster into a kind of proto-hamlets (Simons 1989; Malrain *et al*. 2002, 11; Bakels 2009, 146-147). Most establishments were of moderate size, run by single families. Although in the last centuries BC some hierarchy in farms, with regard to size of yards and number of outhouses, did appear in northern France (Malrain *et al*. 2002, 143), this phenomenon was not recognized elsewhere.

In the period best known, i.e. the last centuries BC, and in the areas archaeologically best known, the distance between individual farms or the proto-hamlets mentioned before is around 1 km (Simons 1989; Thouvenot and Gransar 2000; Bakels 2009, 153). Earlier periods are less well documented, but distances may not have been much larger. This implies that the space available to individual farming households was limited to c. 1 km^2. This space falls surprisingly well within the range mentioned by Chisholm (1968, 46) for modern farms, but it must be kept in mind that this land also had to provide pasture for livestock, areas for cutting fodder to dry as winter fodder, and a load of wood.

The same surface could be used for combinations of these different purposes, but the acreages of land belonging to one household that were destined for crop cultivation could have been lower than one might think. However, it is generally assumed that 1-5 ha was needed for one household (Brinkkemper and van Wijngaarden-Bakker 2005, 508), and even when allowance is made for periods of fallow, the necessary land was available.

Staple crops were mainly cereals. These were emmer wheat (*Triticum dicoccum*), spelt wheat (*Triticum spelta*), bread wheat (*Triticum aestivum*), hulled barley (*Hordeum vulgare*), and broomcorn millet (*Panicum miliaceum*). A sixth cereal, einkorn wheat (*Triticum monococcum*) was a staple of minor importance, only to be found in limited areas. The pulses horse bean, also know as Celtic bean (*Vicia faba* var. *minor*) and pea (*Pisum sativum*) played a role as minor staple as well. Oil was obtained from gold of pleasure (*Camelina sativa*) and linseed (*Linum usitatissimum*), though the latter may have been cultivated mainly for its fibres. Next to these plants, a range of other crop plants was available (Bakels 2009). At first sight there was choice enough. However, true staple crops, the success of which determined the presence or absence of famine, were restricted to only five cereals. But as there must have been regional varieties of these adapted to local conditions, in terms of choice the farmers may not have been badly off. And choices they made, as V. Matterne has demonstrated for the wheats (Matterne 2001; Matterne in Malrain *et al*. 2002).

The conclusion must be that the space for laying out fields was limited, but that a prudent choice of crops should have warded off crop failure. However, a choice may always turn out badly.

One way to anticipate trouble is to sow more than one kind of plant on one and the same field. If one plant fails, the other may still do well. The product of such a crop is called 'maslin'. Sowing maslin is a kind of diversification. According to historical sources from Europe, most maslins are a combination of two cereals (Slicher van Bath 1963, 262). Another way to cope with crop failure is to try for a second crop on the same field, i.e. to sow an emergency crop on the bare patches. Such crops can be harvested in the very same year, as they grow and ripen fast.

2 Maslins

How to detect a maslin in the archaeological record? As it is obviously impossible to study the standing crops on the ancient fields, the products have to be looked for. In practice these are carbonized remnants of harvests. Unfortunately, true remnants of harvests are rare. Most plant remains retrieved during excavations are mixtures of several kinds of waste, combining more than one product. What is needed are closed finds, and even then is not every closed find suitable. The contents of a vessel, for instance, may represent a meal or the ingredients for a meal, and therefore a mixture of a different kind than the one looked for.

The best information comes from stocked harvests charred *in situ* in their place of storage. Such situations are found in underground silos, where in rare cases a black layer of carbonized grain is found on the bottom (fig. 1). In many such cases the surrounding soil shows traces of burning *in situ*. Second choice are burnt-down granaries, provided their contents were smothered by the collapse of the structure. Of course, if several products were stored in the granary, some mixing may have occurred, but careful excavation generally can detect this.

Figure 1 Underground silo with a layer of grain burnt *in situ*.

As already remarked, remnants of single harvests are rare, but in those cases known to me, I looked for maslins. Table 1 summarizes the result. Monocrops prevail. Stored crops of hulled barley, emmer wheat, spelt wheat and, in one instance, horse beans were found. They are not always 'clean', as other products are found mixed in. An explanation may be that many fields contain plants from the crop sown the year before. Some grain may have dropped on the field during harvest, germinated the year after and turned up in the next crop. The spelt wheat and einkorn wheat in the Gondreville samples may derive from such instances: a wheat crop in year one, followed by a barley crop in year two. Another possibility is that some grain got mixed in during the handling of the crop before storage. And, of course, if one component of a maslin failed entirely, the lot will look almost like a monocrop.

Nevertheless, monocrops are not the only crops stored. Some finds clearly represent maslins. A maslin of emmer and spelt wheat and three instances of hulled barley and emmer wheat were found. The high percentage of oat in the Maisnil 7 crop will be discussed below.

All in all, the result of the analysis of the contents of stored products must be that maslin sowing was practised during the Iron Age.

3 Emergency crops

Three of the crops listed in table 1 contain oat, but oat (*Avena* sp.) always gives rise to identification problems. Grains of a wild oat, *Avena fatua*, are indistinguishable from those of cultivated oat species, the most common of which is *Avena sativa*. The wild plant is a common weed in cereal fields. Identification is only possible when a distinct part of the chaff, the floret base, is preserved. In the Neerharen-Rekem and Maisnil samples the chaff remains identify the oat as the cultivated oat *Avena sativa*. In the Compiègne crop the chaff remains found are from the wild weed *Avena fatua*. However, only five floret bases were found there and they may represent a minority of wild oat hidden in a lot of cultivated oat.

Is the oat part of the maslin in the Compiègne and Maisnil crops, and a remnant of a former crop in Neerharen-Rekem? Or are we dealing with another phenomenon: an emergency crop? The history of oat as a crop does not go back as far as wheats and barley, and its origin does not lie in the Near East (Zohary and Hopf 2000). Oat appears first in Europe.

The cultivar is genetically very close to the weedy oat and very probably evolved from the weed that infested wheat and

	context	barley	emmer	spelt	oats	einkorn	horse bean		
		%	%	%	%	%	%		
Acy-Romance 3596	silo	100		-	-	-	-	monocrop	Matterne 2001
Compiègne	granary	86	-	12	2	-	-	monocrop	Bakels 1984
Forest-Monthiers	granary	-	100	-	-	-	-	monocrop	Matterne 2001
Frouard HP	silo	-	-	-	-	-	91	monocrop	Hingh 2000
Gondreville 4214	silo	93	-	2	-	5	-	monocrop	Hingh 2000
Gondreville 4219	silo	90	-	9	-	1	-	monocrop	Hingh 2000
Jaux	granary	-	100	-	-	-	-	monocrop	Matterne-Zech 1996
Louvres Le-Vieux-Moulin 71	silo	69	31	-	-	-	-	maslin	Casadei et al. 1997
Maisnil 7	granary	12	69	-	19	-	-	maslin	Matterne 2001
Maisnil 17	granary	-	100	-	-	-	-	monocrop	Matterne 2001
Menneville	silo	-	50	50	-	-	-	maslin	Bakels 1984
Neerharen-Rekem 123	silo	47	53	-	-	-	-	maslin	Roymans 1985
Neerharen-Rekem 132	silo	6	85	-	9	-	-	monocrop	Roymans 1985
Sittard-Geleen-Hof van Limburg	granary	1	-	99	-	-	-	monocrop	Bakels 2012

Table 1 The composition of stocked harvests.

barley fields. According to Zohary and Hopf (2000, 82) "… such weeds [were] picked up and planted intentionally". Why were they picked up? The general opinion is that farmers saw that they survived when the intended crop failed. They were picked up as an emergency crop.

Oat is regularly found in the region and period considered here, although it is not always clear whether the finds concern cultivated or wild oat. But the cereal was never found as a monocrop. However, instances of monocrops are known from other regions, at least from the second century BC onwards. An example is the carbonized lot retrieved from a silo at Rullstorf, Kr. Lüneburg, Germany, dated to the first century BC (Kroll 1980). This proves that oat was considered a crop plant. In the loess region of western continental Europe oat was possibly seen as second or third rate, a cereal only to be sown on patches in fields where the intended wheat or barley had failed. It may be imagined that such patches were re-sown with a spring-oat. This oat was then harvested together with the main crop. Such practices may explain the occurrence of oat as part of the stored harvest.

Oat is not the only cereal that may have had the status of emergency crop. The second suspect is foxtail millet (*Setaria italica*). Contrary to that other millet, broomcorn or proso millet (*Panicum miliaceum*), it never turns up as a main crop. Its wild forebear is *Setaria viridis*, a field weed. Crosses between the species produce semi-fertile or even fertile hybrids (Jusuf and Pernes 1985). The two resemble each other closely and as a result it is difficult to distinguish between these *Setaria*s where archaeobotanical material is concerned, especially when only a few carbonized grains are available. However, the detection of large numbers of grains in, for instance, the sites of Nettesheim-Butzheim, Köln-Blumenberg and Sittard 'Hof van Limburg' stresses the presence of the cereal foxtail millet (Knörzer 1971; 1992; Bakels 2012).

It is a widely held belief that this small-seeded millet was domesticated in China, where it belongs to the first plants to be cultivated. But genetic analysis has demonstrated that there are clearly distinguishable genetic groups, closely related to geographical origins. Those results are in favour of the hypothesis of two independent centres of domestication, one in Asia and one in central Europe (Schontz and Rether 1999). As a matter of fact, the European foxtail millet may have followed the same path of domestication as oat, starting as a weed, tolerated, valued and subsequently set up as emergency crop. Foxtail millet is spring-sown, has a short growing season and is therefore ideal for combating crop failure.

4 Discussion

It looks as if the Iron Age farmers used maslins to cope with possible crop failure and emergency crops to cope with actual crop failure. Were these measures new inventions? The answer is not easy to provide. The right conditions for detecting maslins are rarely encountered. There is an instance of an Early Neolithic, Linearbandkeramik silo. The Linearbandkeramik is the first farming culture in the region.

The silo excavated at Geleen-Urmonderbaan revealed a mixture of 92% emmer wheat and 8% einkorn wheat (Bakels and Rousselle 1985). This is hardly a maslin. The next instances are dated to the Late Bronze Age, 1100-800 BC. The silo Cuiry-lès-Chaudardes 807, Dept. Aisne, France, was filled with a mixture of 54% hulled barley and 46% oat, and Cuiry-lès-Chaudardes 830 with 20% hulled barley, 32% emmer wheat and 48% broomcorn millet (Bakels 2009). The percentages refer to numbers of grains, not to weight, and as broomcorn millet grains are much smaller than those of the other cereals, they are overrepresented in this kind of calculations. The silo Frouard HP 2091, Dept. Meurthe-et-Moselle, France (De Hingh 2000) revealed a mixture of 50% naked barley and 50% hulled barley, interpreted as maslin because the two varieties of barley were obviously sown, and subsequently harvested and stocked together. These finds show that maslin growing did not start in the Iron Age, but was already practised earlier. The lack of suitable remnants makes it difficult to determine how much earlier.

The same is true for emergency crops. Even the Linearbandkeramik culture mentioned previously is reported to have known an emergency crop, in this instance a brome species (*Bromus secalinus*-type), possibly rye brome (*Bromus secalinus*), though there are indications that field brome (*Bromus arvensis*) is involved as well (Knörzer 2007, 72). These bromes are weeds in cereal fields with grains almost as large as cereal grains, and the large numbers of this wild grass have led Knörzer (1967) to the conclusion that the farmers tolerated, harvested and possibly even promoted the plant. However, brome never developed into a true crop plant.

A Late Bronze Age crop retrieved from a burnt-down granary at Langweiler, Kr. Jülich, Germany, shows an instance of an early presence of oat (Knörzer 1972). Although the crop stored, with 91.5% hulled barley, 3% spelt and/or emmer wheat and 5.5% oat (and two grains of foxtail millet), is strictly speaking a monocrop, the oat is remarkable as half of it belongs to cultivated oat and the other half to wild oat. This site represents, perhaps, a turning point in the history of the crop oat. The oat in Cuiry-lès-Chaudardes 807 mentioned before shows another early instance of this crop.

The broomcorn millet in Cuiry-lès-Chaudardes 830 may be part either of the original maslin or the result of an intervention including a second sowing with an emergency crop. Just like foxtail millet, broomcorn millet has a short growing season and is therefore quite suitable as emergency crop. However, a third explanation of the presence of millet in stocks of larger sized grain is that it was deliberately added to fill space between the cereals, thereby reducing the air content of the silo. As the success of storage underground depends on the lack of oxygen, reducing space would help (Marinval 1992). If this was practised at Cuiry-lès-Chaudardes, the broomcorn millet may represent a separate crop, not necessarily originating from the same field as the other cereals. Indeed, in the Bronze Age broomcorn millet was known as a staple crop in its own right (Bakels 1984, 7; 2009). In that case silo 830 was possibly filled with a maslin of hulled barley and emmer wheat.

The presence of foxtail millet in the Langweiler granary mentioned earlier does not stand alone. Foxtail millet turns up regularly in Late Bronze Age contexts (De Hingh 2000, 188; Zerl 2010). The most important finds belong, however, to the Early Iron Age, 800-500 BC, examples being the lots retrieved from Köln-Blumenberg and Sittard 'Hof van Limburg' (Knörzer 1992; Bakels 2012).

It is often suggested that the rise of oat was triggered by the climate change occurring around 850-800 BC. At that time the climate changed towards the wetter and colder (Van Geel *et al.* 1996; Van Geel and Renssen 1998; Magny 2004). As oat is a crop that does well under such circumstances, its adoption may have been promoted by this climatic turn. However, in the region considered here, oat was already grown before that time. Also, oat had not yet been developed into a main crop. Sowing oat as a main crop was not practised before the Middle Ages, when it became a common cereal (De Vroey 1989; Verhulst 2002, 65; Bakels 2005).

Foxtail millet shows the same pattern as oat, a truly remarkable fact as foxtail millet is not especially fond of cold and wet climates. This small-grained millet never became a main crop in the loess region of western continental Europe. Worldwide it is an important crop, for seed and for fodder and hay, but not here. Taken all together, it looks as though the climate change has nothing to do with the start of oat and foxtail millet growing. Nevertheless, their gaining importance during the Iron Age, i.e. after 800 BC, may have some relation with the 'new' climate. If the change caused the main staple crops to fail more often, farmers may have had to resort more to emergency crops. One of these, oat, was presumably more of a success than the other, foxtail millet, because it stayed whilst the millet disappeared again.

The question whether the sowing of maslins was also promoted by the change in climate cannot be answered at the moment due to a lack of sufficient data. But maslin growing survived the Iron Age as well. It was common practice even in historical times (Slicher van Bath 1963; Bieleman 1992).

Conclusion

Although Iron Age farmers seem to have had a sufficient acreage of arable land, and a reasonable number of crop plants at their disposal, they resorted to two methods of combating crop failure. Both maslin and emergency crop growing were practised. To which extent they applied these methods is unknown because true remnants of harvests are rare in the archaeological record. The practice predates the Iron Age and a link with the deterioration of the climate which set in at the beginning of the period is therefore unlikely. Nevertheless, the use of the methods may have increased, though this could not be proven due to the lack of data.

Acknowledgement

I am grateful to S. van der Vaart for correcting my English.

References

Bakels, C. 1984. Carbonized seeds from Northern France. *Analecta Praehistorica Leidensia* 17, 1-27.

Bakels, C. 2005. Crops produced in the southern Netherlands and northern France during the early medieval period: a comparison. *Vegetation History and Archaeobotany* 14, 394-399.

Bakels, C. 2009. *The Western European Loess Belt, agrarian history, 5300 BC – AD 1000*. Dordrecht, Heidelberg, London, New York: Springer.

Bakels, C. 2012. Sittard-Geleen 'Hof van Limburg', plantenresten uit sporen van de Stein-groep, de Vroege IJzertijd en de Romeinse tijd met speciale aandacht voor het gewas trosgierst (*Setaria italica* [L.] P. Beauv.). In: L.G.L. van Hoof, I.M. van Wijk and C.M. van der Linde (eds), *Zwervende erven op de löss? Onderzoek van een nederzetting uit de vroege ijzertijd en van sporen uit de Stein-groep te Hof van Limburg (gemeente Sittard-Geleen),* Archol Rapport 33, 108-112.

Bakels, C. and R. Rousselle 1985. Restes botaniques et agriculture du Néolithique ancient en Belgique et aux Pays-Bas. *Helinium* 25, 37-57.

Bieleman, J. 1992. *Geschiedenis van de landbouw in Nederland 1500-1950*. Meppel: Boom.

Brinkkemper O. and L. van Wijngaarden-Bakker 2005. All-round farming, food production in the Bronze Age and the Iron Age. In: L.P. Louwe Kooijmans, P.W. van den Broeke, H. Fokkens and A.L.van Gijn (eds), *The prehistory of the Netherlands*, volume 2, Amsterdam: Amsterdam University Press, 491-512.

Casadei, D. and L. Leconte, avec colloboration de G. Auxiette, F. Gransar, V. Matterne et C. Pommepuy 1997. Analyses spatiales d'un établissement rural de La Tène D1 : Louvres 'le Vieux Moulin'. In: S. Marion and G. Blancquaert (eds), *Les installations agricoles de l'âge du Fer en France septentrionale*, Paris: Presses de l'E.N.S., 37-74.

Chisholm, M. 1968. *Rural settlement and land use*. London: Hutchinson University Library.

De Vroey, J.-P. 1989. Entre Loire et Rhin; les fluctuations du terroir de l'épéautre au Moyen Age. In: J.-P. de Vroey and J.-J. van Mol (eds), *L'homme et son terroir*, *l'épéautre* (Triticum spelta), *histoire et ethnologie*, Treignes : Editions Dire, 89-105.

Geel, B. van and H. Renssen 1998. Abrupt climate change around 2,650 BP in North-West Europe: evidence for climatic teleconnections and a tentative explanation. In: A.S. Issar and N. Brown (eds), Water, Environment and Society in Times of Climatic Change, Dordrecht: Kluwer, 21-41.

Geel, B. van, J. Buurman and H.T. Waterbolk 1996. Archaeological and palaeoecological indications for an abrupt climate change in The Netherlands and evidence for climatological teleconnections around 2650 BP. *Journal of Quaternary Science* 11, 451-460.

Hingh, A.E. de 2000. Food production and food procurement in the Bronze Age and Early Iron Age (2000-500 BC). *Archaeological Studies Leiden University* 7.

Jusuf, M. and J. Pernes 1985. Genetic variability of foxtail millet (*Setaria italica* P. Beauv.). *Theoretical and Applied Genetics* 71, 385-391.

Knörzer, K.-H. 1967. Die Roggentrespe (*Bromus secalinus* L.) als prähistorische Nutzpflanze. *Archaeophysika* 2, 30-38.

Knörzer, K.-H. 1971. Eisenzeitliche Pflanzenfunde im Rheinland. *Bonner Jahrbücher* 171, 34-39.

Knörzer, K.-H. 1972. Subfossile Pflanzenreste aus der bandkeramischen Siedlung Langweiler 3 und 6, Kreis Jülich, und ein urnenfeldzeitlicher Getreidefund innerhalb dieser Siedlung. *Bonner Jahrbücher* 172, 395-403.

Knörzer, K.-H. 1992. Pflanzenfunde aus der metallzeitlichen Siedlung Blumenberg (Stadt Köln). *Kölner Jahrbuch für Vor- und Frühgeschichte* 25, 475-487.

Knörzer, K.-H. 2007. *Geschichte der synanthropen flora im Niederrheingebiet*. Mainz: Philipp von Zabern.

Knörzer, K.-H., R. Gerlach, J. Meurers-Balke, A.J. Kalis, U. Tegtmeier, W.D. Becker and A. Jürgens 1999. *Pflanzenspuren, Archäobotanik im Rheinland: Agrarlandschaft und Nutzpflanzen im Wandel der Zeiten*. Köln: Rheinland-Verlag GmbH.

Kroll, H. 1980. Einige vorgeschichtliche Vorratsfunde von Kulturpflanzen aus Norddeutschland. *Offa* 37, 372-383.

Magny, M. 2004. Holocene climate variability as reflected by mid-European lake-level fluctuations and its probable impact on prehistoric human settlements. *Quaternary International* 113, 65-79.

Malrain, F., V. Matterne and P. Méniel 2002. *Les Paysans Gaulois*. Paris: Errance.

Marinval, P. 1992. Archaeobotanical data on millets (*Panicum miliaceum* and *Setaria italica*) in France. *Review of Palaeobotany and Palynology* 30, 259-270.

Matterne, V. 2001. *Agriculture et alimentation végétale durant l'âge du Fer et l'époque gallo-romaine en France septentrionale*. Montagnac: Monique Mergoil.

Matterne-Zech, V. 1996. A study of the carbonized seeds from a La Tène D1 rural settlement, "le Camp du Roi" excavations at Jaux (Oise), France. *Vegetation History and Archaeobotany* 5, 99-104.

Roymans, N. 1985. Carbonized grain from two Iron Age storage pits at Neerharen-Rekem. *Archaeologia Belgica* I, 97-105.

Schontz, D. and B. Rether 1999. Genetic variability in foxtail millet, *Setaria italica* (L.) P. Beauv.: identification and classification of lines with RAPD markers. *Plant Breeding* 118, 190-192.

Simons, A. 1989. Bronze- und eisenzeitliche Besiedlung in den Rheinische Lössbörden. *BAR International Series* 467.

Slicher van Bath, B.H. 1963. *The Agrarian History of Western Europe A.D. 500-1850*. London: Edward Arnold.

Thouvenot, S. and F. Gransar 2000. La gestion du terroir des établissements ruraux de La Tène finale dans la vallée de l'Aisne; un essai de modélasition: le méandre de Bucy-le-Long (Aisne). In: S. Marion and G. Blancquaert (eds), *Les installations agricoles de l'âge du Fer en France septentrionale*, Paris: Presses de l'E.N.S., 157-167.

Verhulst, A. 2002. *The Carolingian Economy*. Cambridge: University Press.

Zerl, T. 2010. *Recent archaeobotanical investigations into the range and abundance of crop plants in Bronze and Iron Age settlements in the Rhineland Area, North Rhine – Westphalia, western Germany*. Poster congress International Workgroup for Palaeoethnobotany,Wilhelmshaven. Electronic document, http://www.palaeoethnobotany.com/download/posters/zerl_poster_whv2010.pdf, accessed May 2012.

Zohary, D. and M. Hopf 2000. *Domestication of Plants in the Old World*. Oxford: Oxford University Press.

C.C. Bakels
Faculty of Archaeology
Leiden University
P.O. Box 9515
NL 2300 RA Leiden
The Netherlands
c.c.bakels@arch.leidenuniv.nl

Hallstatt burials of Oss in context

Harry Fokkens, Sasja A. van der Vaart, David R. Fontijn,
Simone A.M. Lemmers, Richard Jansen, Ivo M. van Wijk and Patrick J.C. Valentijn

This article summarizes 15 years of research in and finds from the Oss-Vorstengraf and Oss-Zevenbergen areas. The results of fieldwork carried out in the area between 1997 and 2007 are presented briefly, including discussion of three monumental Hallstatt C mounds. Recently the finds from the Vorstengraf and the cremated remains of the Vorst were reanalysed, and the results of this work are summarized. Taken together, the research reveals that the three monumental Hallstatt burials are the result of a funerary ritual in which the dead and the accompanying imported objects were deliberately transformed in a highly local manner – with grave goods being dismantled, folded and broken – and consciously interred in an ancestral barrow landscape. The current article is not a final publication, but is intended rather as a prelude to the upcoming publication of a major synthesis on this barrow landscape and other similar burials.

1 Introduction

On 13 February 1933, a cold winter day, workmen were reclaiming heath south of the town of Oss in order to accommodate a group of gypsies who were allocated this place because 'they caused trouble in town'. Since some urns had already been found at this location, the town secretary (Mr Cunen) had arranged with a local antiquarian (Mr Bloemen) for someone with archaeological experience to oversee the reclamation. Mr van Dreumel was sent. He discovered a pit, started digging, found a bronze vessel, and – or so he claimed – saw gold. Since he was from another town, he was afraid that the workmen would kill him for it. So he stopped digging, covered the find with soil, and notified Mr Bloemen, who rang the National Museum of Antiquities in Leiden. The next day dr Bursch of the museum arrived from Leiden with a lorry. He excavated the bronze urn (fig. 1), covered it with plaster and took it to Leiden. There it was 'excavated' in a laboratory, and indeed it proved to contain an iron sword with a hilt inlaid with gold. Cremation remains and numerous other (barely recognizable) metal objects were also found in the bronze *situla*. In the same year Bursch returned to the spot and excavated what was left of the mound. Several years later he also excavated some mounds in the direct vicinity (Holwerda 1934; Bursch 1937).

This is how the richest Early Iron Age grave of the Low Countries was discovered. The find was connected immediately with the Hallstatt culture, and has been known ever since as the *Vorstengraf* (*Fürstengrab*, sometimes also indicated as chieftain's grave) *of Oss*[1]. The situla and the sword were the main focus of Holwerda's (1934) publication of this find. Later some of the other finds were discussed by Modderman (1964) and by Pare (1992) (see section 5.1 below).

Figure 1 The situla as it was excavated on 14 February 1933 under direction of dr Bursch of the National Museum of Antiquities in Leiden. Photo courtesy of Museum of Antiquities.

According to Pare (1992) this was an early (Hallstatt C), and even for Hallstatt norms rich find. Until very recently it was the only one of seven comparable finds from the Netherlands that was more or less decently excavated and documented.

The Vorstengraf barrow group (known as Oss-Vorstengraf), however, was not isolated. Some 450 m to the east there is another barrow group called Oss-Zevenbergen (seven 'hills') (figs 2 and 3). Research into that particular group of burial mounds was initiated in the early 1960s, only a couple years after the establishment of the Faculty of Archaeology, which was still called the Instituut voor Prehistorie Leiden (IPL) at the time. Professor Modderman, who had founded the IPL in 1961, needed projects to train his students. He therefore started to assess areas that were 'threatened', and Oss-Zevenbergen was such a place. In 1964 and 1965 he and his colleague Jan Verwers excavated two mounds with the aid of some students. One of these was Leendert Louwe Kooijmans, who 20 years later would become Modderman's successor. Their research revealed that at least two of the seven mounds present in this area were indeed barrows, and subsequently the whole terrain was protected as a monument (Verwers 1966).

Following this no archaeological activities were carried out in the region until the late 1990s. Since 1933 the Vorstengraf area had been taken over by the gypsies and converted into a huge scrap yard. From 1994 onwards, however, the area was gradually evacuated because it was destined for development. In 1997 it was finally available for research. Since the first author had been working in the region for a decade by then, we were asked to survey the 100 ha of the building site, and search for the original location of the Vorstengraf of Oss which had been 'lost' in the sixty years since it was first excavated by Bursch. In 2004 the barrow group of Oss-Zevenbergen also was re-investigated because it was threatened by road building.

In the past fifteen years the Oss-Vorstengraf and Oss-Zevenbergen areas, and the finds from these areas, have been the subject of much and varied research. This article presents a short summary of the results of fieldwork carried out in the area between 1997 and 2007 (Fokkens, Fontijn, van Wijk, Jansen, Valentijn). This is not a final publication, but a preliminary publication of the results in English. The full report on the Vorstengraf and the first excavation

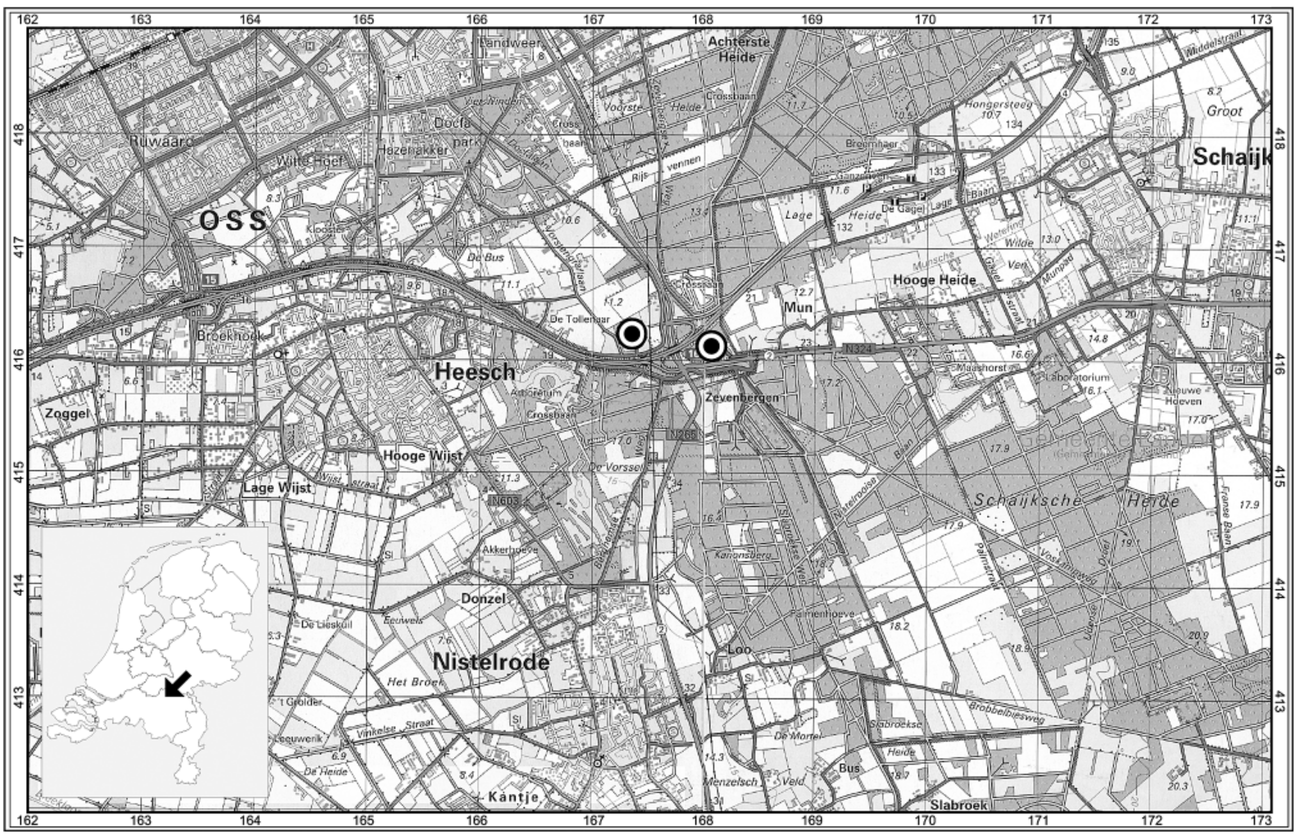


Figure 2 The location of Oss-Vorstengraf (left) and Oss-Zevenbergen (right). Figure by S. van der Vaart.

campaign of the Zevenbergen excavations are available in Dutch (Fokkens and Jansen 2004; Fokkens *et al*. 2009); the excavation of mound 7 will be published in English (Fontijn *et al*. forthcoming). In addition to giving an overview of a decade of fieldwork in the area, this article also includes a short summary of the recent re-analyses of the finds from the Vorstengraf (Van der Vaart) and cremated remains of the Vorst himself (Lemmers), which have started to provide new insights into this burial. The present article is intended as a prelude to the upcoming publication of a major synthesis on this barrow landscape and other similar burials.

2 Geology and location

The Oss-Vorstengraf and Oss-Zevenbergen barrow groups are situated on the northwest edge of a geological formation known as the Peel Blok (fig. 3). This area is one of the few areas in the Netherlands that is actually rising, due to tectonic processes. It is surrounded by fault lines and terrace sides (fig. 3), with various wet areas (see Jansen and Van der Linde forthcoming). The barrow groups overlook the low-lying regions to the north that extend in the direction of the river Meuse. Though the differences in height between the high and low areas are not spectacular, by Dutch standards they are substantial. We might say that the mounds are located in an area that had 'strange' physical characteristics, including wet areas.

The subsoil in this area varies between gravel and wind-blown sand. East and north of the Peel Blok faults, only cover sands are present. Gravels of older Rhine and Meuse deposits surface on the Peel Blok proper, as well as on the sites of both barrow groups. Originally these constituted lower geological strata, but due to the tectonic movements they are now at or near the surface, sometimes covered by a thin layer of cover sand. The mounds of the Zevenbergen group are all located on a small ridge of wind-blown sand and surrounded by gravel beds of former Meuse terraces.

3 Research questions and methods for the fieldwork research projects

As mentioned above, since the 1930s the exact location of the Vorstengraf barrow had been 'lost'. In addition to finding again the barrow's original location, the research also hoped to answer several questions regarding the barrow itself and thereby solve a long-running dispute.

Following the discovery of the bronze vessel in February 1933, dr Bursch returned in the summer in order to document the remains of the mound. Not much was left, but luckily a few excellent photographs were taken which demonstrate that the mound was laid out on a podzolic soil with a thin A horizon and was built with sods cut from a similar soil (fig. 4). Unfortunately the excavation features, including

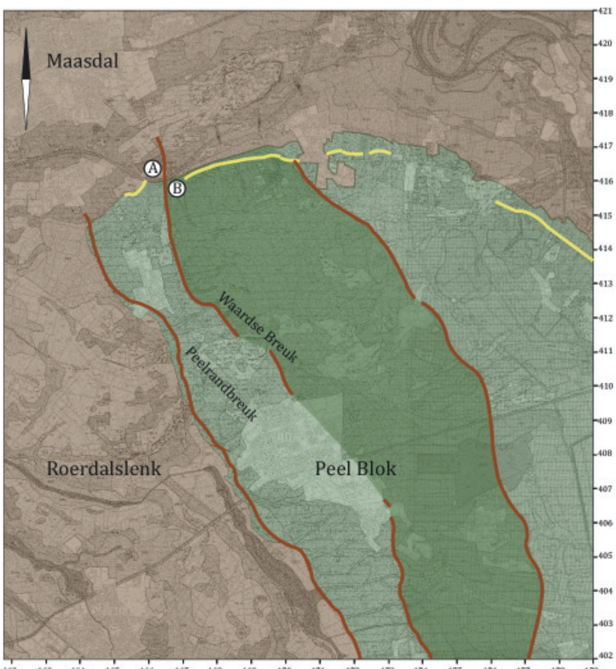


Figure 3 The geomorphological map of the Maashorst showing the high-lying plateau (green). To the west lies the Roerdalslenk, to the north the landscape gradually runs down to the river valley of the Maas. Brown line: fault line; Yellow line: terrace side. A) Oss-Vorstengraf; B) Oss-Zevenbergen. Figure after Jansen and van der Linde forthcoming, Fig. 2.2, adapted by J. van Donkersgoed and S. van der Vaart.

Figure 4 Photograph taken by dr Bursch during his research in the summer of 1933. It was taken from the north. It shows that the remainder of the barrow had been built of sods laid down inverted. Below it the original soil is intact and shows a relatively thin A horizon/plough soil, a clear E horizon (leached) and a well-developed B horizon with iron pan formation. Photo courtesy of Museum of Antiquities.

the profile, were documented in scale 1:200, so the original field drawing shows little more detail than the published drawing (fig. 5). Interestingly, the drawing shows that the burial had a decentral position within a circular ditch with a diameter of about 16 m. A much larger circular ditch with a diameter of 53 m surrounds this inner ditch. The profile shows that the burial pit was dug about a metre into the subsoil.

These observations have always been debated by the founding father of Dutch professional archaeology Professor van Giffen and his students, who thought that Bursch and Holwerda – both trained as classical archaeologists – were bad excavators and knew very little of Prehistory (cf. van Giffen 1937). One of the questions for the research project that started in 1997 therefore was to find out whether Bursch's observations had been correct, and also how the Vorstengraf could be placed in the context of the barrow groups and possible urnfield(s) found in the area, such as several barrows at Oss-Vorstengraf excavated by Bursch in 1935, the Oss-Zevenbergen group and some urnfield finds done during road work in the 1970s (see section 4).

To answer these questions we first started to survey the Vorstengraf area with test trenches 1.5 m wide, leaving 10 m

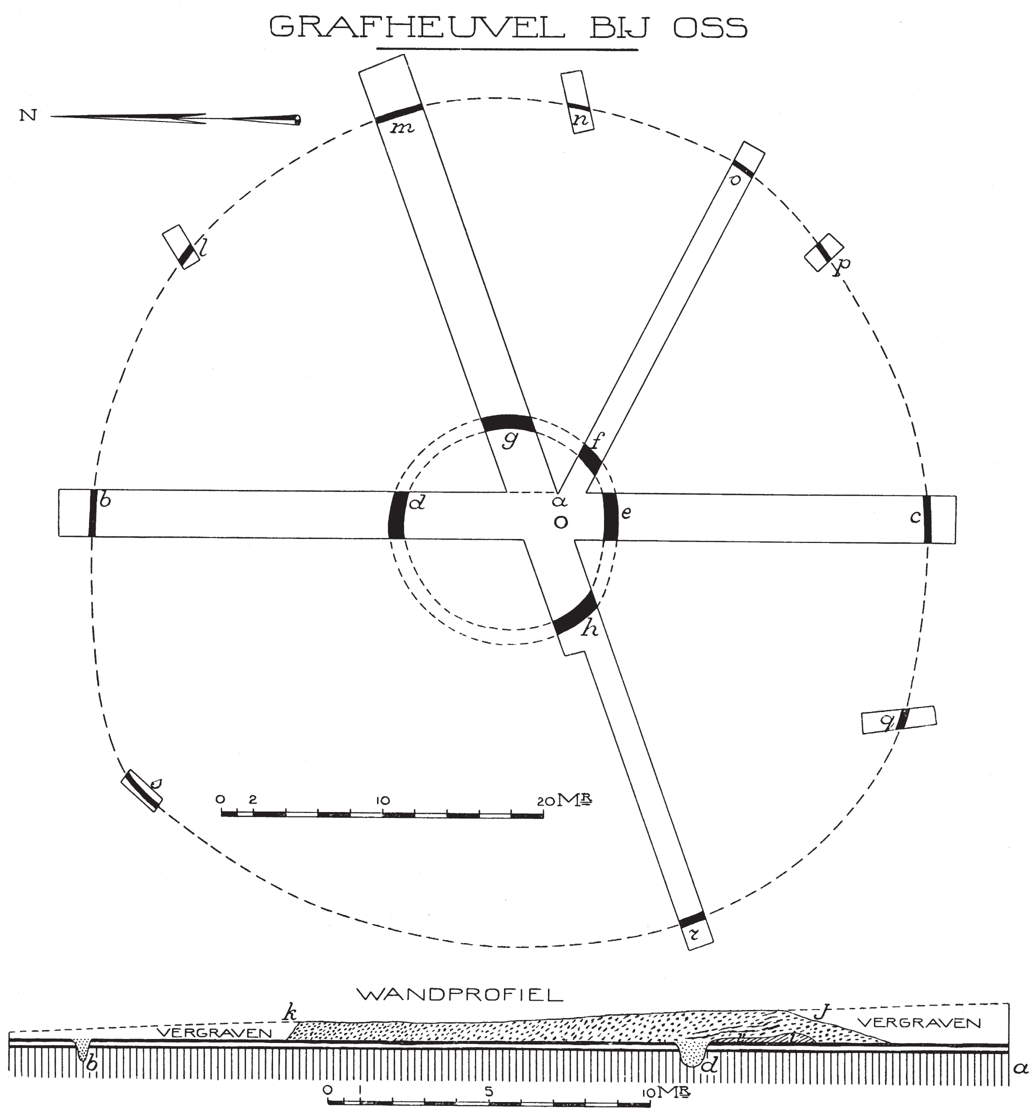


Figure 5 The original drawing as published by Holwerda (1934). Though Holwerda had not excavated the site, as director of the Museum he was entitled to publish this important find himself. The north arrow was actually found to point to the west. The photograph of fig. 4 is taken from trench m-g. Figure after Holwerda 1934, afb. 26.

Figure 6 Location of the Vorstengraf (A) and Zevenbergen (B) excavations. The straight lines represent survey trenches of 1.5 m wide. Figure by Archol BV and J. van Donkersgoed.

between them unexcavated (fig. 6). This way we hoped to locate the remains of the barrow and of other mounds around it, since the exact location had been lost since 1933.

Outside the barrow group, proper survey trenches were spaced wider, leaving 50 m unexcavated. We planned to tighten the network of trenches if we found signs of (pre) historic habitation, but this proved unnecessary. No settlement or other remains were observed in the 80 ha north and northwest of the barrow group (Oss-Vorstengraf) (Jansen and Fokkens 2007).

A severe handicap in researching this area was the fact that it had been used as a scrap yard for several decennia. The area was heavily polluted and had to be excavated in protective suits, while certain areas could not even be surveyed at all. On top of that the area was heavily disturbed. When we rediscovered the remains of the actual Vorstengraf we excavated all surviving traces, though this area was also extremely disturbed.

Several years later, in 2004 and 2007, the Zevenbergen group, located some 400 m to the east of the Vorstengraf, was researched with a comparable strategy (fig. 6). The Vorstengraf excavations had taught us that we might expect other features than burials between the mounds. We therefore planned to excavate as large as feasible an area after having surveyed it with the aid of test trenches. This work was carried out by Archol BV, the excavation company associated with the Leiden Faculty of Archaeology (Fokkens *et al*. 2009).

At the start of our research, the whole Zevenbergen area was covered in light forest with trees of about 60 years old. These were sawn off about 100 cm above the ground and the timber was then removed with horses. It appeared that the remaining stumps could be removed easily with a hydraulic digger, which 'tore' them out of the soil with the help of a chain. The result was acceptable in terms of disturbance, though the uprooted trees and the gravel in the soil made it difficult to read features.

4 New excavations at Oss-Vorstengraf and Oss-Zevenbergen

4.1 Pre-Iron Age burial mounds in the area

In addition to a probable Bronze Age mound underneath the Vorstengraf barrow (see next section), we know of several other pre-Iron Age monuments in the area (fig. 7). At Oss-Vorstengraf three other mounds were excavated by Bursch in 1935, and the Zevenbergen group is only situated some 450 m from there. It is possible that both groups originally formed one coherent landscape of dispersed mounds. We can unfortunately never be sure since the area in between has been largely destroyed by road building. However, observations during roadworks have suggested the presence of further monuments, at least of urnfield burials (fig. 7).

If we take the barrow landscape (Oss-Vorstengraf and Oss-Zevenbergen) in its totality, we now know of six pre-Iron Age mounds. Just south of Oss-Vorstengraf, we find

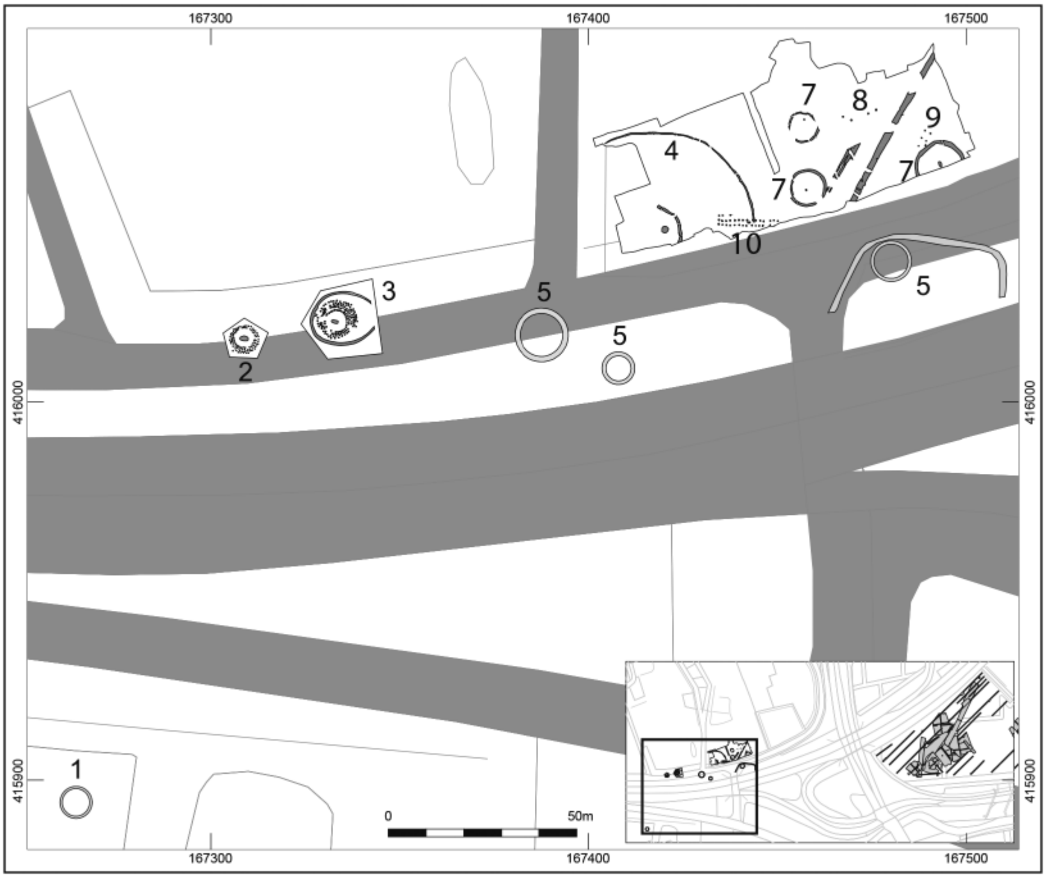


Figure 7 The Vorstengraf barrow group in its entirety. 1) Bell Beaker barrow excavated by Bursch in 1935; 2 and 3) Bronze Age barrows excavated by Bursch in 1935; 4) Vorstengraf barrow; 5) urnfield burials reported from road preparations; 6) Hallstatt burial pit; 7) urnfield barrows; 8) cremation burials (in urns); 9) 6 post structure; 10) post alignment. Figure by Archol BV and H.Fokkens.

the oldest one, dating to the Late Neolithic. It contained a Veluvian Bell Beaker, cremation remains and a flint arrowhead (fig 7: no. 1; fig. 8; Bursch 1937, 1). When it was found, it was the first Bell Beaker find south of the Rhine and of considerable importance. Two other mounds were surrounded by multiple post circles, as was the custom in this region in the Middle Bronze Age. An undecorated Middle Bronze Age urn was found in one of these mounds. In the Zevenbergen cluster Modderman and Verwers excavated a Bronze Age mound with a ring ditch, very much like the one under the Vorstengraf barrow (Verwers 1966). This too yielded an undecorated Bronze Age urn. In 2004 we excavated an additional two Middle Bronze Age mounds, one of which was completely destroyed (fig. 15: mound 4). Another (mound 2) was built in two separate mound phases surrounded by post circles (fig. 9). The central pit underneath this mound turned out to be filled with carefully laid out sods but contained no burial. Yet the excavation of this mound was important because we were able to record the construction with sods in quite some detail, to take pollen samples and to observe the sequences of construction. It became clear that the first row of posts around the mound had already decayed or been removed before the double post circle around the second mound phase was constructed (fig. 9). This implies that probably one or more generations had elapsed before the second phase was built. This mound was reused in the Early Iron Age for the burial of an urn with the cremated remains of an adult female (fig. 9: no. 121).

Of younger date probably are two elongated monuments (fig. 15: mounds 1 and 6) with a surrounding ditch each. Both were severely eroded and in neither was a primary burial found (some cremation remains found in mound 6 in 1964/1964 could not be positively identified as the central burial). Verwers (1966) had already excavated mound 6

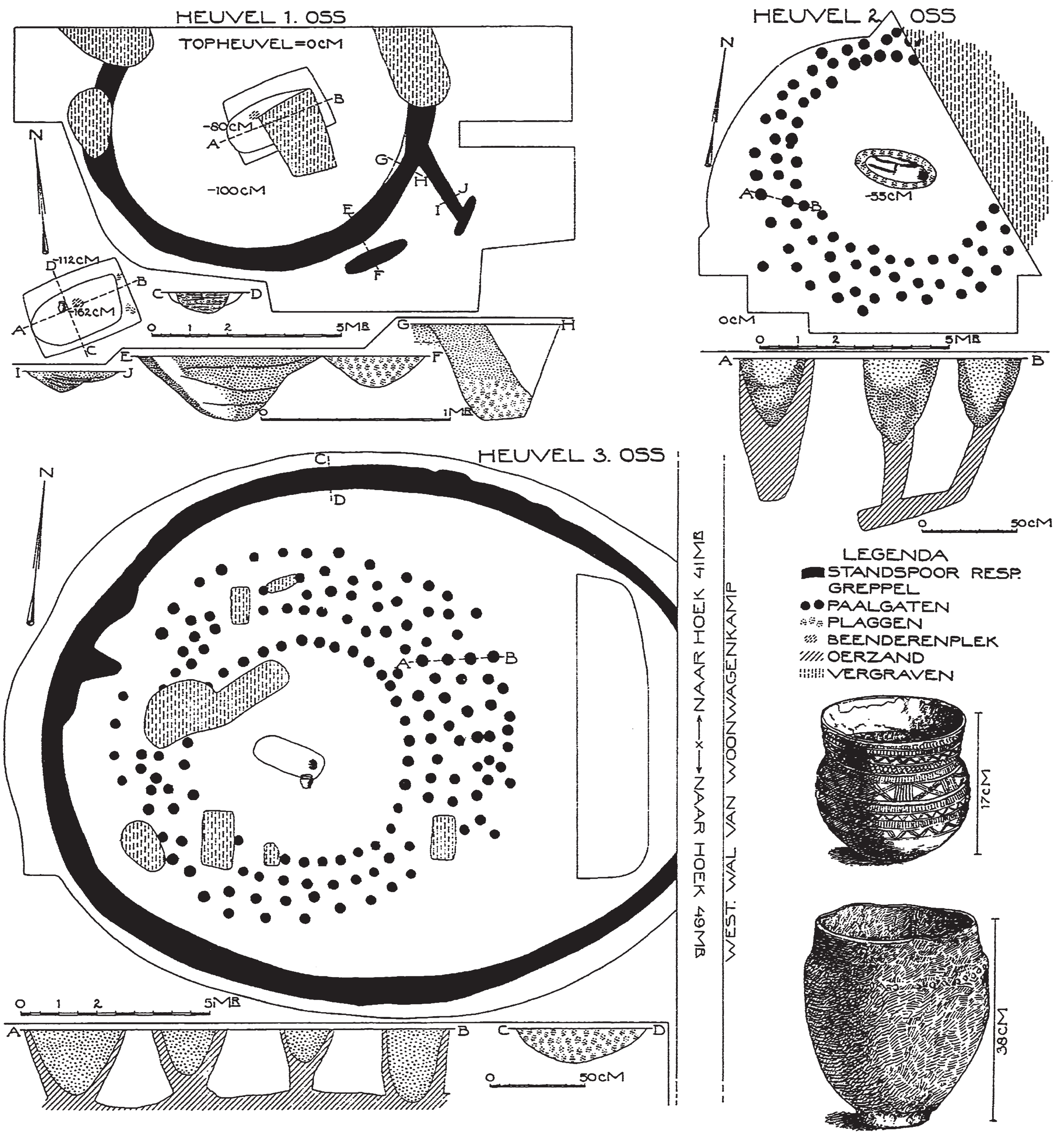


Figure 8 Excavation drawings of the excavations by Bursch in 1935. Figure after Bursch 1937, afb. 1.

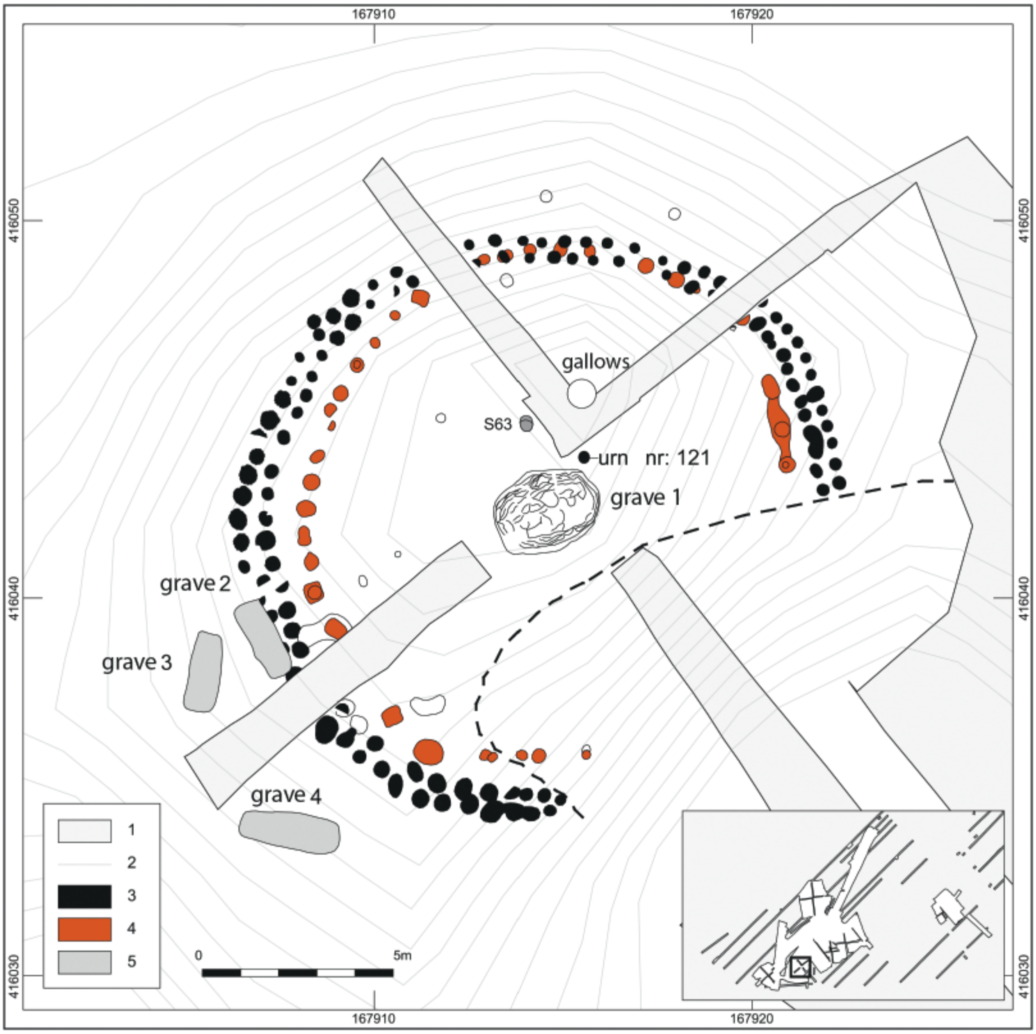


Figure 9 Zevenbergen mound 2. Legend: 1) not excavated; 2) 5 cm contour lines; 3) post circle of phase 2; 4) post circle of phase 1; 5) medieval burials: grave 2-4 associated with the gallows that had been erected in the centre. Urn no. 121 is a secondary Iron Age burial, S63 a post feature, grave 1 is a pit filled with sods, but without a burial. Figure by Archol BV and H. Fokkens.

(28.5 by 8.5 m). In 2004 we first re-excavated the western part, and in 2007 also the eastern part. The latter excavation revealed that the first phase of this monument consisted of a post setting with posts that may have been up to 3 m high. In the second phase an oval ditch (26.5 by 6.5 m) of about 50 cm deep and 70 cm wide was dug at about the same location as the prior post setting. The long mound inside both encircling structures could have been contemporaneous with either phase or even constitute a third phase. This could no longer be established. Monuments of this type are difficult to date, but parallels dating to the Middle or Late Bronze Age have been found for instance at Haps (Verwers 1972). On the basis of indirect evidence we have dated these monuments to the Late Bronze Age, though a Middle Bronze Age B date is also possible (Van Wijk *et al*. 2009; Valentijn forthcoming).

4.2 The Vorstengraf proper

At the end of our survey with test trenches in 1997, we rediscovered the location of the Vorstengraf (fig. 10). But later digging activities and road building had heavily disturbed the area. It turned out that only a quarter of the outer ditch around the mound remained, and nothing of the mound proper. Of the outer ditch in fact only a 'ghost' of iron infiltration underneath the original shallow ditch remained,

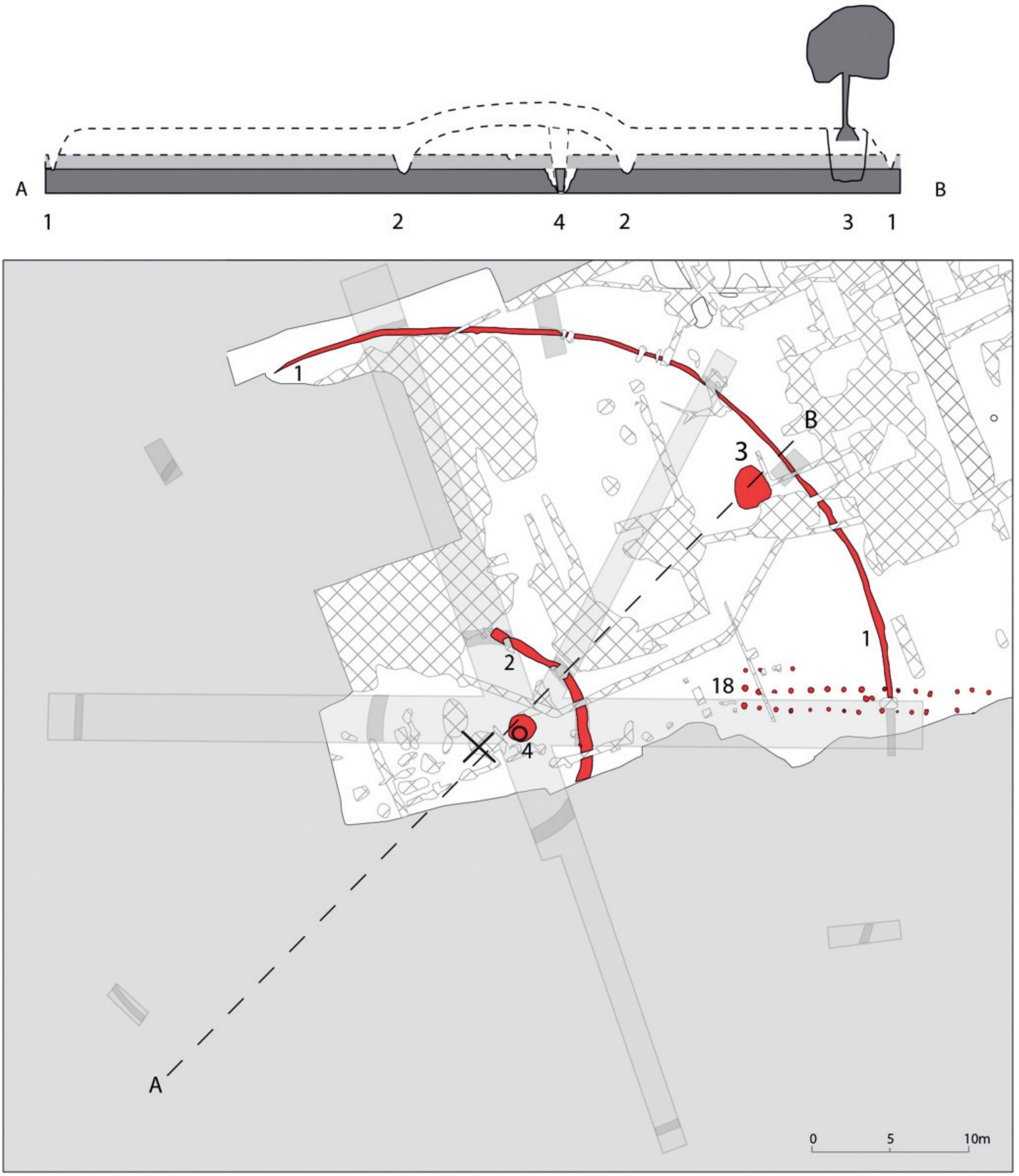


Figure 10 The remnants of the original Vorstengraf barrow as excavated in 1997. Legend: 1) the ditch around the Vorstengraf barrow of 53 m in diameter; 2) the ditch around the older Bronze Age barrow; 3) the pit of a tree fall dating to the Iron Age, which had preserved part of the original barrow and allowed pollen samples of the original sods; 4) the original pit of the Vorstengraf. The X indicates the centre of the Bronze Age mound, which is identical to the centre of the Vorstengraf barrow. At 18 the multiple post alignment that was associated with the Bronze Age barrow is indicated. Figure by H. Fokkens.

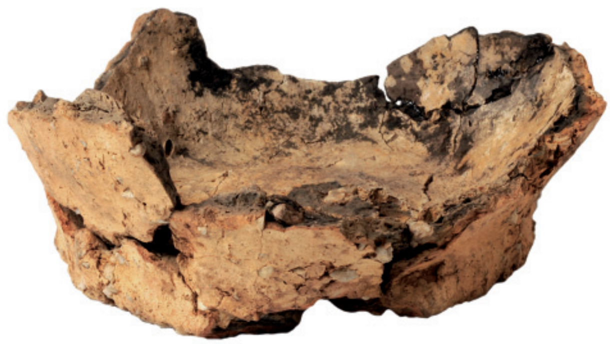


Figure 11 Bottom of a Middle Bronze Age urn, found during the excavation of the Vorstengraf barrow in the summer of 1933. Photo by P.J. Bomhof (© Museum of Antiquities)

but it was there, and 53 m in diameter. It was therefore indeed the largest burial mound in the Netherlands. The inner ditch had been more substantial and could still be excavated. It was found to be 16 m in diameter. Though we have no direct dating evidence, a study of the photographs taken in 1933 gave us the impression that we might be dealing with the ring ditch of an older mound. Confirmation of this idea came from a find that was already recorded in 1933: the bottom of a Bronze Age urn (fig. 11). Though its exact find location is unknown, we suggest that this was either a primary or a secondary burial underneath or in a Middle Bronze Age mound surrounded by a circular ditch, as was customary in the Early Bronze Age and the beginning of the Middle Bronze Age.

This implies that the Hallstatt C Vorstengraf was actually dug into this older mound, which was probably already some 900 to 1000 years old when the later burial took place. It clearly was positioned off-centre, possibly to respect the older grave. Subsequently a large mound was built over the Vorstengraf, and centred on its highest point (fig. 10). We do not know the precise shape of the Vorstengraf barrow, but from its remains we have reconstructed a rather flat body that rose to about 3 m above the older mound.

In our view this incorporation of the older mound was not intended to just make the barrow look bigger. Rather, we believe that it was a conscious choice to use this old ancestral barrow group for the burial of an important individual. That way the connection of the decedent with the ancestors was enhanced and may have served to legitimize his own importance or claims of his successors (Fokkens 2012).

4.3 Two monumental Hallstatt burial mounds at Oss-Zevenbergen

When the Oss-Zevenbergen area was surveyed in 1964 and 1965, seven mounds were recognized. But they were under forest cover then and therefore it was very difficult to survey properly. Only when the forest had been removed, did the massive size of two of the mounds really become visible: one was 30 m in diameter (mound 3), the other 36 m (mound 7).

Both large mounds yielded astonishing and unexpected results. Mound 3 proved to be a large sod-built barrow with a post circle. This type of barrow is typical for the Bronze Age, so we expected a Middle Bronze Age burial underneath it. However, it was four times as large as normal mounds from that period. Our high expectations about a Bronze Age burial did not come true. The centre of the mound only yielded a burnt plank that had to have been cut from a very large tree, a small fragment of a bronze sword (or knife), fragments of one bronze and two iron objects (fig. 12), and one fragment of cremated human bone. That we found only small fragments cannot be due to find circumstances because the whole centre was carefully excavated and all the soil was sieved with a 4 mm mesh. The conclusion must be that these objects were intentionally deposited in this fragmented state. We therefore speak of a *pars pro toto* deposition, meaning that parts of an object can represent a whole object or person. This type of practice is known from many other Bronze and Iron Age burial sites, though so far it has received little attention (cf. Fontijn and Cuijpers 2002).

Interestingly, according to Vermeeren the burnt plank came from a tree that must been at least 180 years old and with a trunk of probably over 2 m wide (van Wijk *et al*. 2009, 93). It must have been an impressive oak tree, and Vermeeren suggested that it might have been struck by lightning. Two dates were obtained of respectively the centre and of the outer rings of the tree (with *c*. 130 tree ring years between them). They suggest a felling date between 680 and 400 cal BC. Given the nature of the finds we suspect a date early in this range to be more likely, which suggests that this mound dates to the Hallstatt C period, just like the original Vorstengraf (see below). Moreover, the presence of a possible bronze sword fragment and the size of the mound place it in a category of Early Iron Age sword graves that in the Netherlands are indicated as *Vorstengraven* too (Roymans 1991; Fontijn and Fokkens 2007).

Mound 7 is the largest mound of the entire Zevenbergen barrow group (diameter 36 m and at present a height of 1.5 m). It had to be left untouched in the first campaign of 2004 because it housed a badger family. Badgers are protected in the Netherlands, so we had to wait until this family had been relocated. In 2007 that last mound could finally be (partly) excavated (Fontijn *et al*. forthcoming). Building on previous experiences, the last barrow, mound 7, was excavated using an additional diagonal profile baulk in each of the two quadrants we investigated (fig. 13). Excavation was done in horizontal levels and mainly by hand. A sample (2.2% of the entire mound) of the mound

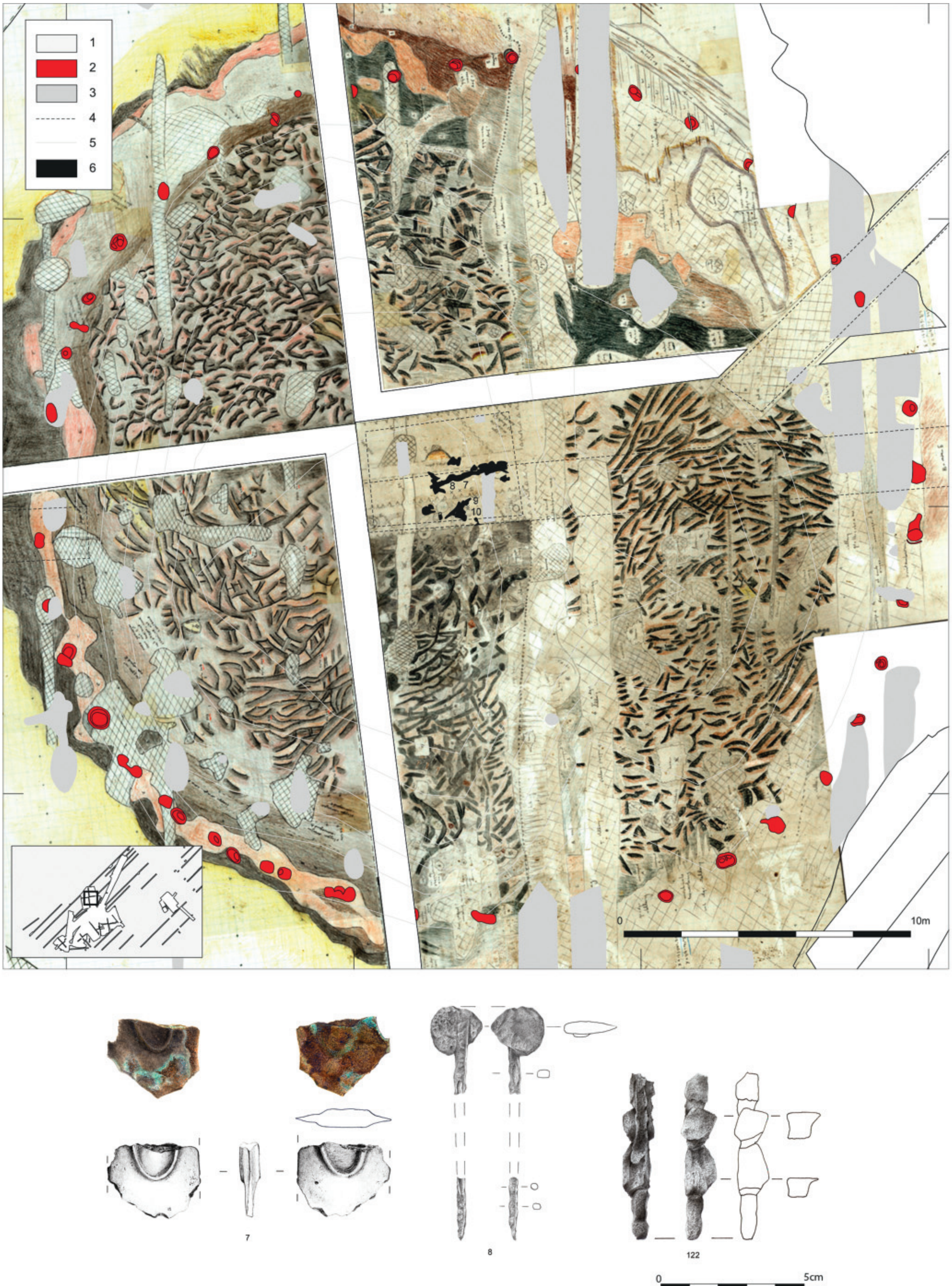


Figure 12 Zevenbergen mound 3. Legend: 1) not excavated; 2) post circle around the mound; 3) modern disturbances; 4) test trench; 5) contour lines (interval of 5 cm); 6) remains of oak plank in the centre of the mound. In the centre of the barrow sods are drawn as seen in the excavation. At this level the post circle was not yet visible, neither were the planks in the centre. These were projected into this drawing later. The numbers relate to the finds: 7 fragment of a bronze sword or knife, 8 fragment of an iron pin, 122 fragment of an iron object (?). Figure by H. Fokkens.

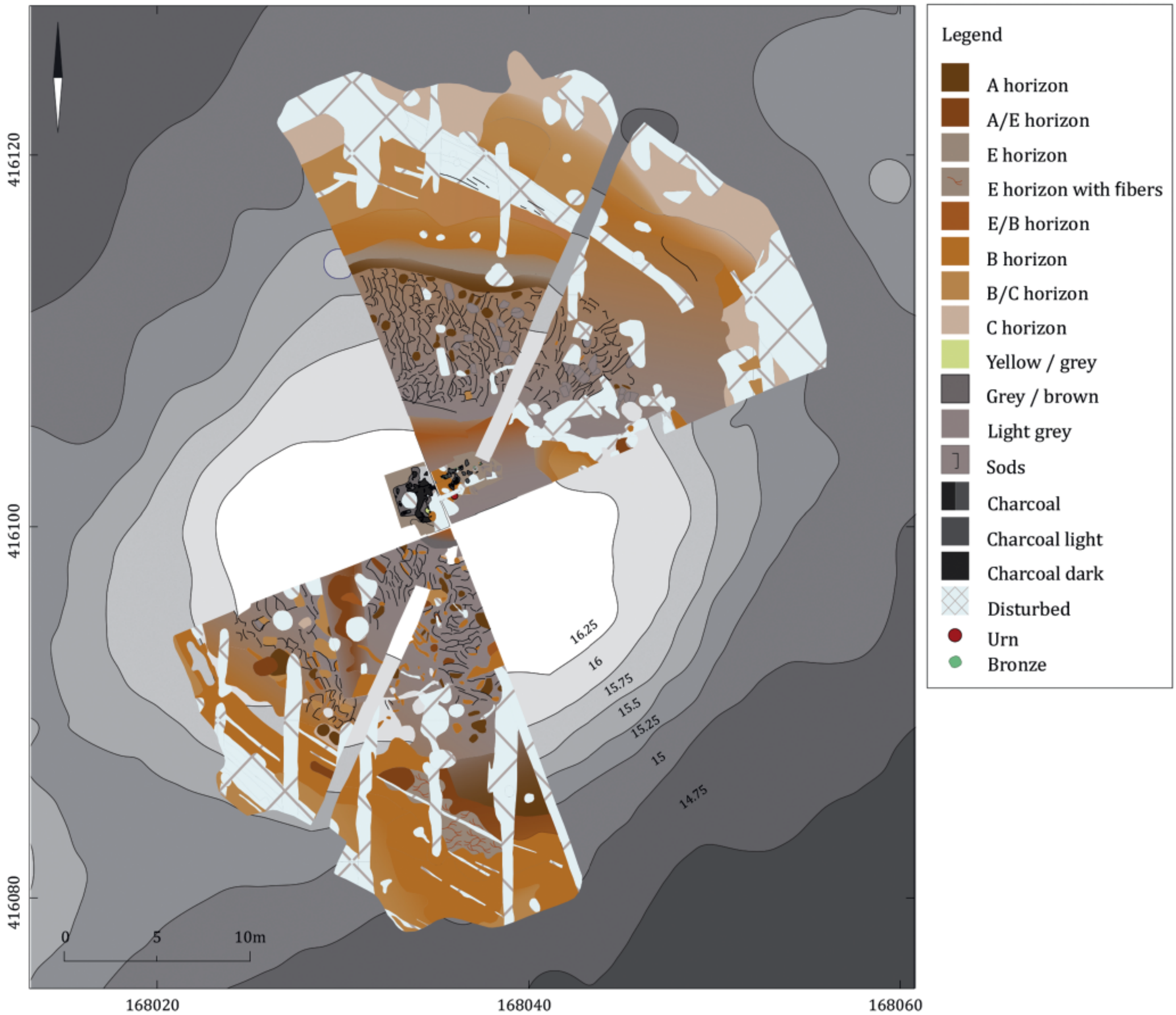


Figure 13 Mound 7, one of the excavated levels. Figure after Fontijn et al. forthcoming, Fig. 4.10.

was sieved over a 4 mm mesh for the recovery of small finds. A 5 by 2 m large zone of charcoal, bronze, ash and cremated bone in the centre was lifted as blocks, which were further excavated in a laboratory. Yielding over a thousand small bronze items in a very complex setting, an entire book is dedicated to this mound alone (Fontijn *et al*. forthcoming). What follows is a preliminary summary of the findings.

The burial mound is situated on a natural elevation. A pit filled with large amounts of charcoal indicates that this dune was the scene for activities during the Middle Bronze Age A, the nature of which remains hidden from us. But it is clear that we are not dealing with the traces of a settlement.

At some point in the Early Iron Age, the top of the elevation was stripped of vegetation and a large pyre was built there. At this exposed location, an individual was cremated: a man between 23 and 40 years old. Organic objects richly decorated with hundreds of tinned bronze studs accompanied him (fig. 14). The burning and subsequent decay of materials make it hard to discern what kinds of objects were burned, but it can be argued that we could be dealing with decorations of a yoke and related horse gear. These objects were carefully dismantled, sometimes broken apart, placed on the pyre and finally deposited (Fontijn and Van der Vaart forthcoming). All material can be dated to the Hallstatt C period and is broadly

Figure 14 Some of the bronze studs from the central find assemblage underneath mound 7. Figure after Fontijn et al. forthcoming, Fig. 7.16.

contemporaneous with the Vorstengraf and mound 3, the two monumental mounds located nearby.

The entire assemblage from mound 7 is extraordinary in the Low Countries and finds its best parallels in Hallstatt graves in southern Germany. As the entire centre was lifted in blocks and investigated in a laboratory, the sequence of events from pyre building, the actual cremation, the searching of the pyre remains and the deposition could be reconstructed in surprising detail. The cremated bones of what we assume to be the individual who was burned here were placed in an urn and dug in immediately south of the pyre debris. Certain items were carefully picked out of the pyre remains, whereas others were deliberately left among the debris, a large charcoal spread of 5 by 2 m. The deposited stud-decorated yoke or horse gear must have been seen as inextricably linked to the social role and status of the individual whose remains were burned and buried here. The entire find assemblage was carefully covered with well-ordered heather sods that were cut in the immediate vicinity. Neatly ordered, horizontally stacked sods were placed in at least four layers on top of the pyre debris. These sods vary in size, but range from 50 to 70 cm, width 20 to 35 cm and thickness from 5 to *c*. 20 cm. Most were placed with the vegetation side downwards. The contours of the original elevation were pragmatically used and smoothed in order to create an impressive, large, round mound. In contrast to the horizontally placed sods on top of the centre, those on the slopes tend to be placed slantwise. In one part, most sods were placed parallel to the radius of the mound, in the other they were usually placed perpendicular to it. There are indications that the construction of this mound was done either by different work parties or at different stages (Fontijn *et al*. forthcoming). Once the mound was finished, the urn was situated exactly in the centre. There is no evidence that the mound was later used for burials or raised later on.

4.4 The urnfield around the Hallstatt mounds

One of the research goals of the fieldwork project(s) was to determine the context of the original Vorstengraf. We have seen that it was built in an already existing ‘ancestral’ barrow landscape, and we now know that there were at least two other ‘rich’, monumental Hallstatt burials in this barrow landscape, but the excavations also showed that a small urnfield had developed around these burial mounds. Urns

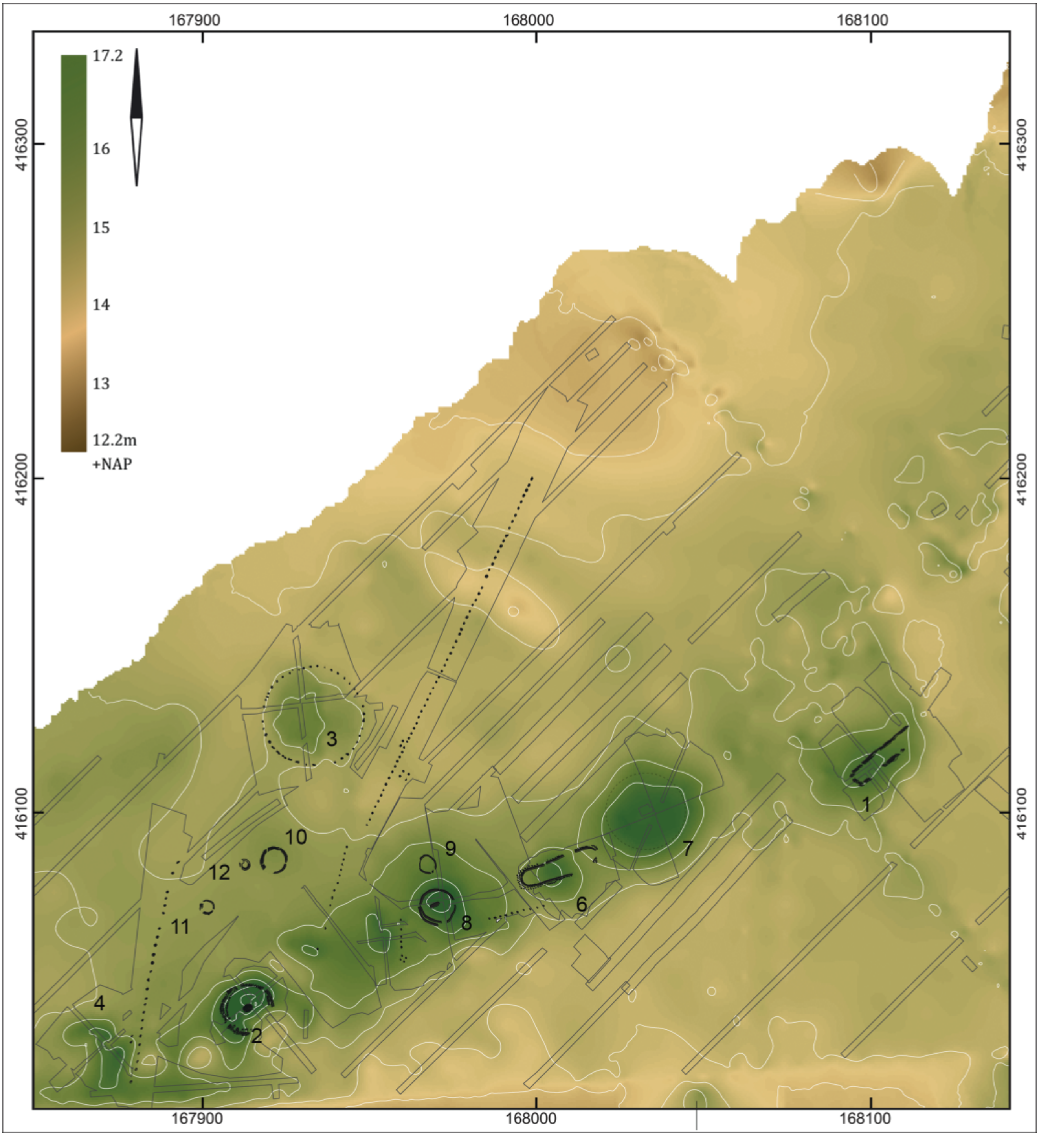


Figure 15 The Zevenbergen group of Middle Bronze Age burial mounds (2, 4, 8), Middle Bronze Age B to Early Iron Age monuments (1, 6), Early Iron Age graves (9, 10, 11, 12 and secondary internments in 8 and 2), monumental Early Iron Age monuments (3, 7). Figure after Fontijn *et al.* forthcoming fig. 2.5 and adapted by H. Fokkens.

found in the 1970s during roadworks already indicated the presence of an urnfield, but no other urnfield monuments had been detected yet. The 2004 and 2007 excavations indeed revealed such monuments, but not as many as might have been expected. At Oss-Vorstengraf we found the remains of three small circular ditches and four urns without monumental structures (fig. 7: 7 and 8). At Zevenbergen the remains of five additional monuments were detected as well as four secondary burials in older mounds (fig. 15: 8-12). The urns that were found do not allow for a detailed dating of the finds, but in general they date to the Early Iron Age, certainly not to the Late Bronze Age. The conclusion therefore must be: yes, there was also an urnfield around the Hallstatt mounds, but this urnfield was very small and probably restricted to the direct vicinity of the large contemporaneous monuments. Moreover, the urnfield monuments are spread out widely, not as tightly packed as we generally find in urnfields. Apparently its use was either selective or very short lived. Of course we do not know whether monuments were destroyed south of the excavated areas, but so far there have been no indications that a large urnfield was destroyed here. North of both groups there certainly were no other monuments present. Our extensive prospective programme would have detected them.

This does not imply that the urnfield was unimportant or only used by a small community. The barrow group as a whole shows long periods of intermittent use during the almost 2000 years of its existence before the Hallstatt mounds were built. It certainly was not the 'cemetery' of a local community that had been used continuously (cf. Fokkens 2012). Apparently it had been 'reactivated' occasionally for special occasions, which does not mean that it had been completely out of use in the interim. Pollen analysis shows that the area was maintained as heath both by grazing and (possibly) burning since the Late Neolithic (De Kort 2009). Several structures were also found that were not directly associated with burial practices, at least not with burials proper.

4.5 Post alignments and post built structures

One of the new discoveries associated with the Vorstengraf and Zevenbergen barrow groups is the result of our strategy to excavate not only the mounds proper, but also the areas in between. This had never been done in the context of barrow landscapes in the Netherlands. This strategy led to the discovery of several structures that were not directly associated with graves, notably post alignments and post-built structures.

Partly underneath the Vorstengraf we discovered a double and partly triple post alignment (fig. 16). It was at least 15 m long and oriented more or less east-west. The space between the rows was limited, only 1 m. We know these post traces must have been visible in the excavation of Bursch in 1933, but he did not record them and probably did not recognize them as such. Yet they were substantial: *c*. 30 cm wide and dug in about 80 cm below the original surface. The posts may have been up to 2.5 or 3 m high. There are a few other examples of such double post alignments in the Netherlands, the Zeijen burial being one of the closest parallels (van Giffen 1949; Drenth and Lohof 2005, fig. 19.4). We distinguish them from single post rows that also occur (cf. below) and that generally are of later date. Double rows probably date to the Middle Bronze Age, though there is very little hard evidence. Similar configurations are also known from the United Kingdom (Dartmoor), but as stone settings associated with cairns (Newman 2011). The Vorstengraf barrow itself provides a *terminus ante quem* dating because the alignment had long disappeared when the Hallstatt mound was built. This is clearly indicated by the soil formation in the post pit features, which was identical underneath and outside the mound. Moreover, the alignment was associated with the older mound underneath the Vorstengraf barrow. The fact that the alignment is not oriented precisely on the centre of that Bronze Age mound is actually a common feature of these 'corridors'. Even in Dartmoor this is often the case.

Interestingly, the features of an identical post corridor, but only consisting of 2 × 4 + 1 posts, were present underneath mound 7 in the Zevenbergen group (fig. 16). The orientation was identical and the dimensions fit one section of the alignment underneath the Vorstengraf mound exactly. This may indicate that rather than being one long alignment, the rows underneath the Vorstengraf mound also may have consisted of sections of 16 posts that were laid out in separate occasions (fig. 16).

Another structure in the Vorstengraf group that was not directly associated with burial was a small six-post structure (fig. 16). It had the same heavy iron pan formation in its post pit features as the post alignment itself, but that does not tell anything about its absolute date. Therefore it is not clear how we should date this six-post structure. Interestingly, the features of two similar structures of four posts were found in the Zevenbergen cluster. They are very similar to four-post 'granaries' that we find in settlements, but also resemble traces of four-post structures that are sometimes associated with multiple burials underneath Middle Bronze Age barrows (Van Vilsteren 1989) as was the case at Zeijen.

At Oss-Zevenbergen these structures were associated with long single post alignments, the longest being over 100 m (fig. 15). Though we have no direct dating evidence, we think that they date to the Early Iron Age, after mound 3 was built, because they avoid all monuments in the barrow group in an equal manner. The alignments seem to compartmentalize the existing barrow landscape. They must have consisted of substantial posts (2.5-3 m high), like at the Vorstengraf group. How we should explain them is not clear. They do

Figure 16 The Vorstengraf excavation with the multiple post alignment. In red the features that are a parallel to the features discovered underneath mound 7. It is possible that the Vorstengraf alignment also consists of several 'compartments' of eight or nine posts. Figure after Fontijn *et al.* forthcoming, Fig. 4.32.

not actually close off areas because the distance between the posts (1.20 m) makes them traversable. Yet they seem to divide the landscape into compartments. Whatever their function may have been, and that of the structures associated with them, we think that they are one more indication of the importance of this region as an ancestral landscape.

5 Finds from the Hallstatt C Vorstengraf of Oss

Even 80 years after their discovery, the contents of the situla from Oss still have more to tell us. In this section some of the findings of new research into the old finds are presented. This research studied the old finds in more detail than ever before and included everything that has been found, not only the 'spectacular' components (Van der Vaart 2011). Any research into the Vorstengraf of Oss, of course, also involves studying the Vorst himself (Lemmers *et al.* in press).

5.1 The grave goods of the Vorstengraf of Oss

Since they were first discovered, both the physical appearance, and our understanding of the Vorstengraf burial goods have changed drastically. When the objects in the bronze bucket were first uncovered and restored in 1933, this resulted in 21 inventory numbers that encompassed the recognizable grave goods. However, in the 1960s, restoration work of a 'rusty lump' from the Vorstengraf uncovered even more objects. In the 1990s a last restoration took place. This work completely transformed the grave goods from Oss. They were thoroughly cleaned and fragments were restored into single or different objects, and

Figure 17 The ‘presentable’ grave goods from the Vorstengraf of Oss. Note that these commonly depicted artefacts are not the entire grave goods assemblage. Photo by P.J. Bomhof (© Museum of Antiquities).

finally made really presentable to the public (fig. 17). At least, for the most part. Recent examination of artefacts stored in the depot of the Dutch National Museum of Antiquities (RMO) revealed that there are even more objects that have never been published or presented, likely due to their corroded and fragmented state (Van der Vaart 2011). In short, since their discovery 80 years ago (a selection of) the grave goods have been restored three times. During each restoration new objects were uncovered, recognized and published. These developments as well as some new findings will be properly published in future, but are shortly summarized here.

Shortly after museum restorer D. Versloot uncovered the cremated remains of the *Vorst* of Oss and his grave goods in the bronze bucket and treated them, they were published for the first time. Almost in passing, Holwerda (1934, 39-40) mentions burned bone material, two oval bronzes, a bronze cross-shaped piece, three small solid bronze rings, two large fragments of daggers or small swords, a whetstone and fragments of cloth, probably deriving from a piece of clothing. He focuses mainly on the bronze situla and iron Mindelheim sword with its spectacular gold-inlayed hilt (fig. 17).

In the 1960s the Vorstengraf finds drew Modderman’s attention because of a study he was conducting into a similar find from Wijchen. Modderman soon realized that Holwerda’s description had become outdated (Modderman 1964, 57). During his examination of the finds his curiosity was spiked by a ‘rusty lump’ which consisted of all kinds of iron bits and rings. He had this rusty lump reconstructed and partially cleaned by J. Ypey, the chief of the laboratory of the State Service for Archaeological Investigations (ROB) in Amersfoort. Ypey uncovered several ‘new’ artefacts in this rusty lump that had previously not been recognizable. This work revealed two iron ‘knives’ which are usually interpreted as razors, as well as an iron socketed axe and two objects made of two separate bronze cones joined by an iron pin, interpreted as dress-pins. There were also several objects the function of which Modderman could not explain. These include an iron rod with a knob and an eye and an iron rod with a rounded cross-section. During the later 1992/1993 restoration these would be revealed to be two matching toggles. The iron tang-end of a knife interpreted by Modderman as an entirely new knife would turn out to belong to the knife-tip already discovered in the 1930s. Eight iron rings were also uncovered. It was, however, the uncovering of two iron horse-bits with cheek-pieces that was the most important discovery. At this time they were corroded into many fragments, but they were still recognizable as horse-bits. They added an entirely new find category to the Vorst's grave goods: horse gear.

In 1992 the Vorst's grave goods were once again given into the care of restorers. The artefacts were in very poor condition and were to be restored for the opening of the renewed exhibit at the RMO (Fokkens and Jansen 2004, 54). J. Kempkens and T. Lupak spent a year and a half restoring the grave goods of the Vorst of Oss to their former (and current) glory (fig. 17). They discovered that several artefacts were in multiple fragments, with some pieces rusted onto other objects. They also determined that some artefacts formerly interpreted as different objects were in fact part of the same artefact.

Modderman's 'rusty lump' yielded even more finds during this restoration, such as an intact bronze and iron dress-pin. Several more iron rings were reconstructed from fragments, and an iron rod with a flattened end and two bronze hemispherical sheet-knobs were revealed amongst corroded ring fragments. During this restoration, however, certain finds also 'disappeared' as fragments of artefacts were restored into single objects. An object that had been interpreted as either another knife or a second sword for sixty years turned out to be part of the Mindelheim sword. The fragment that Modderman had interpreted as the point of the sword turned out to be a 'middle' piece. The object thought to be a second sword was in fact the point of the Mindelheim sword. By recognizing this, Kempkens and Lupak added 26 centimeters to the sword, thereby also putting an end to the idea that the Vorst of Oss might have had two swords.[2]

In 2011 examination of all artefacts from the Vorstengraf revealed that there were several small and 'unattractive' finds in the depot of the RMO that had never been published (cf. fig. 18). These 'new' finds include an iron ring fragment with part of a bronze hemispherical sheet-knob corroded onto it, some lead or tin fragments, and several thin pieces of leather. The most surprising find was in a little cardboard box filled with textile fragments (in and of itself also an interesting 'find'). Amongst the fragments were six gold-sheet fragments from the sword hilt. Several of the fragments were clearly recognizable as the golden triangles that decorate the lower edge of the sword hilt, perpendicular to the blade. The golden triangles are in such perfect condition that the tiny folded edges that would have been used to inlay the pieces into the wooden hilt are still clearly visible (Van der Vaart 2011).

Figure 18 One of the 'new' artefacts from the Vorstengraf of Oss. Depicted are several iron ring fragments that have corroded together and onto a partial bronze hemispherical sheet-knob. The objects have all been left untreated and the iron in particular is covered in corrosion. Photo by P.J. Bomhof (© Museum of Antiquities) and adapted by S. van der Vaart.

The detailed examination of all the finds also revealed new information about objects that already have been published. The bronze bucket in which the Vorst was buried is a striking example. For the last twenty years this bucket has been described as being in a decrepit state and having many repairs, thereby giving rise to the idea that it must be an heirloom that had been in use for generations (Verhart and Spies 1993, 80-83; Fokkens and Jansen 2004, 56). Several pieces of bronze plate, one with punched-in decoration, were supposedly attached to the bucket as repairs. It has even been described as having had a leather handle attached to it as some kind of amateurish repair. Close examination of the bucket, however, revealed only a single repair. A small bronze plate, attached with a single rivet, is covering a tear in the bottom. The base tore when the base ring was being hammered, and was subsequently repaired by riveting on the bronze plate (Kempkens 2011, *pers. comm.*). This means that the only repair present on the bucket occurred during the manufacture of the bucket. The bronze plates described as repairs in most publications are in fact reinforcements underneath rivets. The 'repair plate with punched-in decoration' is part of the original strap-handle.

Through the detailed examination of the artefacts, as well as the restoration report and old X-rays, it was possible to reconstruct certain aspects of the burial ritual that resulted in the Vorstengraf of Oss. First of all, none of the grave goods show clear signs of being burned. Though cremation artefacts can be hard to recognize, in this case it is most likely that the grave goods were never placed on the pyre with the body. By examining how artefacts were originally corroded together in the bucket, it was possible to reconstruct the order and manner in which objects were placed in the bucket. The first thing placed in the bucket was a number of iron rings (at least eight) tightly wrapped in textile. A leather bridle, incorporating an iron horse-bit, a bronze ring and a bronze tubular cross-shaped object, were then placed on the bottom of the bucket, partially resting on the wrapped iron rings. A knife and axe were placed on top of the bridle, possibly both wrapped in textile. The other bridle, incorporating an iron horse-bit and two bronze rings, was placed on top. Leather panels and attachments from a yoke were next, and the two razors were placed on top of the yoke components. The last object to go into the bucket was the curled-up sword. It was placed on top, with the hilt angled downwards (Van der Vaart 2011). The last thing to be placed in the bronze urn appears to have been the Vorst himself.

5.2 The cremated remains of the Vorst

As a result of the fact that the content of the situla was 'excavated' in the laboratory of the National Museum of Antiquities, the entire deposited cremation has been preserved. Due to the remarkable amount of material and the relatively good conservation of the cremated fragments, the human remains are very suitable for analysis. This has created a prolonged research history of physical anthropological assessment. The first time the remains were subjected to analysis was in the 1960s, performed by physical anthropologist Huizinga. He noticed the remarkable amount and high quality of the material and was able to make the first statements concerning demographical characteristics. He stated that the remains in the situla had come from a single, middle-aged individual. Apart from that, he noticed the presence of strong ossification of spinal elements. With this observation, he stated that that the person must have been more or less disabled.

In the 1990s, the remains were re-analysed by Smits. Using the cremated remains of the Vorst of Oss for a blind test at an international conference of physical anthropologists, new results were obtained. Due to the robustness and presence of certain diagnostic skeletal elements, Smits was confident to state that the remains had probably belonged to a male individual. Furthermore, Smits was able to give more detail to the pathological condition noticed by Huizinga. She suggested that it was caused by a condition known as Diffuse Idiopathic Skeletal Hyperostosis (DISH). From this it was concluded that the man had been restricted in his movement, and had difficulties with walking and with performing heavy labour (Fokkens and Jansen 2004, 64). With the diagnosis of DISH, in combination with the results from the blind test, the age estimation of the individual was set to an older adult (at least 40 to 60 years of age) (cf. Smits *et al*. 1997). The condition of DISH was being connected to high calorie intake and diabetes (although the etiology is actually highly debated). This raised ideas about a distinctive appearance of the Vorst of Oss. A disabled man of high age, whose high social status resulted in access to rich foods and a less physically demanding lifestyle, fitted the picture of 'a true Vorst' (Fokkens and Jansen 2004, 67; 170).

In 2012 the possibility to do a reexamination was taken up. This research confirms the diagnosis of DISH, and was able to add a number of comments (Lemmers *et al*. in press). This study points to new morphological data which suggest that the individual may have been younger than previously suggested. The morphological assessment was combined with histological research of thin sections of a femur fragment, as a follow up to the 1997's under-highlighted side of the age-at-death estimation. Furthermore, it points out that there has been a tendency to overemphasize the physical limitations of individuals with DISH. The implications of DISH on mobility and physical capabilities are re-evaluated using modern clinical data, indicating that most individuals with DISH do not have any severe physical limitations. The newly acquired results from this study call for reconsideration of our understanding of the individual's physical appearance and capabilities and with that, our perception of an Iron Age Vorst.

6 Transformed and deposited in an ancestral landscape

This article very briefly condenses 15 years of research into the Oss area and the remarkable finds done here. The Vorstengraf of Oss was not an isolated find. It is one of three monumental Hallstatt C burials that appear to have been deliberately positioned in relation to 'ancestral' burials several thousand years older. The area had been used intermittently, but was kept open through grazing (and possibly burning). Its location on the northern edge of a geological formation that showed relatively steep terraces and wet areas may have been considered special and associated with supernatural or ancestral powers. An additional indication that this was a special place is the discovery of a Middle Bronze Age axe deposited in a wet area just a few hundred metres west of the Vorstengraf (Fokkens and Jansen 2004, 141).

We suggest that in the Early Iron Age this ancestral place was consciously chosen to bury these important people. The imported sword and situla evidence contact with the central Hallstatt region. The objects interred both in the Vorstengraf and mound 7 fit in a tradition of rich graves in that area that contain (to varying degrees) the same set of objects, with the burial of Frankfurt-Stadtwald (Willms 2002) being one of the closest parallels. In their region of origin these objects probably had highly symbolic and ritual connotations (cp. Huth 2003) and possibly served to enhance or confirm relations between a giver and receiver (*e.g.* Godelier 1999). The highly ritualized and almost standardized deposition of such objects in richly furnished graves like the Hochdorf burial indicates that these graves represent more than just the display of the wealth of the owner. Huth (2003) suggests that these burials served to legitimize – through their enactment of mythology – the existing powers and possibly the claim to inheritance of power, of dynasty. Even if that may be considered an interpretive step too far by some, the choice of an ancestral burial place, even the incorporation of an ancestral burial while at the same time avoiding disturbing it, may show similar acts of legitimizing.

However, the manner in which these highly similar objects were deposited in Oss is completely different from how they were treated in the Hallstatt core area. The finds recovered from our three monumental Hallstatt mounds suggest that we have uncovered the results of a highly local interpretation and enactment of a (partially) exotic burial tradition. Imported objects, which in all likelihood carried some kind of meaning or significance, were taken apart, broken, folded and basically *transformed*, just like the dead were through the cremation ritual. They were recontextualized in a highly local manner. Through the construction of the very large burial mounds, impressive monuments were created that not only were remembrances to the individual dead, but also ancestral monuments that were there to last.

This article has given a 'sneak preview' of work recently and currently being carried out in the Oss-Vorstengraf and Oss-Zevenbergen area. It is of necessity rather short and does not do justice to what must have been, and still is, a very special place. We hope that several major publications in the near future will rectify this. At this point we would like to emphasize that the added value of the recent and on-going research lies in our detailed approach. Through meticulous excavation and analysis we are starting to achieve a remarkably detailed resolution of the things that took place here several millennia ago.

Acknowledgements

The fieldwork in 2004 was directed by drs Ivo van Wijk from Archol BV. Though not involved in writing this article he provided us with the data presented in this contribution.

Notes

1 In this publication we have chosen to refer to this burial by its Dutch name as the *Vorstengraf* or in combination as Vorstengraf group or barrow. The man interred in this grave we call the *Vorst*. This is done because the *Vorstengraf of Oss* is an established concept in the Netherlands and abroad. We want to emphasize that we use these terms in a descriptive sense, not in their literal, value-ascribing meaning (roughly translated *Vorstengraf* means royal/ruler grave).

2 Warmenbol (1993, 104) suggested that this dagger could be the point of a second (antenna) sword. Lanting and van der Plicht (2001/2002, 173) used this suggestion to date the Vorstengraf burial in the Hallstatt D period, which is much later than Pare (1992) had concluded on the basis of the other grave finds (Hallstatt C). With the new reconstruction by Kempkens and Lupak a possible Hallstatt D date has become very unlikely.

References

Bursch, F.C. 1937. Grafheuvels te Oss. *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden* 18, 1-3.

De Kort, J.W. 2009. Palynologisch Onderzoek Zevenbergen. In: H. Fokkens, I. van Wijk and R. Jansen (eds), *Het grafveld Oss-Zevenbergen. Een prehistorisch grafveld ontleed*, Leiden (Archol Rapport 50), 155-182.

Drenth, E. and E. Lohof 2005. Heuvels voor de doden. Begraving en grafritueel in bekertijd, vroege en midden-bronstijd. In: L.P. Louwe Kooijmans, P.W. van den Broeke, H. Fokkens and A.L. van Gijn (eds), *Nederland in de Prehistorie*, Amsterdam, 433-454.

Fokkens, H. 2012. Access to origins: about the meaning of continuity and discontinuity in the use of barrow 'cemeteries'. In: D. Bérenger, J. Bourgeois, M. Talon and S. Wirth (eds), *Gräberlandschaften der Bronzezeit. Internationales Kolloquium zur Bronzezeit, Herne, 15.-18. Oktober 2008*, Darmstadt, 553-572.

Fokkens, H. and R. Jansen 2004. *Het vorstengraf van Oss. Een archeologische speurtocht naar een prehistorisch grafveld*, Utrecht.

Fokkens, H., I. van Wijk and R. Jansen (eds) 2009. *Het grafveld Oss-Zevenbergen. Een prehistorisch grafveld ontleed*, Leiden (Archol rapport 50).

Fontijn, D.R. and A.G.F.M. Cuijpers 2002. Revisiting barrows: a Middle Bronze Age burial group at the Kops Plateau. *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek* 45, 157-189.

Fontijn, D.R. and H. Fokkens 2007. The emergence of Early Iron Age 'chieftains' graves' in the southern Netherlands. Reconsidering transformations in burial and depositional practices. In: C. Haselgroove and R. Pope (eds), *The Early Iron Age in northwest Europe*, Oxford, 354-373.

Fontijn, D.R., R. Jansen, Q. Bourgeois and C. van der Linde forthcoming. Excavating the seventh mound. In: D.R. Fontijn, S.A. van der Vaart and R. Jansen (eds), *Transformation through Destruction. A monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*, Leiden.

Fontijn, D.R. and S.A. van der Vaart forthcoming. Dismantled, transformed and deposited – prehistoric bronze from the centre of mound 7. In: D.R. Fontijn, S.A. van der Vaart and R. Jansen (eds), *Transformation through Destruction. A monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*, Leiden.

Fontijn, D.R., S.A. van der Vaart and R. Jansen (eds) forthcoming. *Transformation through Destruction. A monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*, Leiden.

Giffen, A.E. van 1937. *Opgravingen in de provincie Noord-Brabant 1935, Bouwsteenen van de Brabantsche Oergeschiedenis*, 's-Hertogenbosch.

Giffen, A.E. van 1949. Oudheidkundige aanteekeningen over Drentsche vondsten XVI. *Nieuwe Drentse Volksalmanak* 67, 93-148.

Godelier, M. 1999. *The Enigma of the Gift*, Cambridge / Oxford.

Holwerda, J.H. 1934. Een vroeg Gallisch vorstengraf bij Oss (N.B.). *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden* 15, 39-53.

Huth, C. 2003. Poor Belgium, rich Belgium. Some reflections on the nature of metalwork deposits in the Late Bronze Age and Early Iron Age. In: J. Bourgeois, I. Bourgeois and B. Cherretté (eds), *Bronze Age and Iron Age Communities in North Western Europe*, Brussels, 39-60.

Jansen, R. and H. Fokkens, 2007. *Het vorstengraf van Oss re-reconsidered. Archeologisch onderzoek Oss-Vorstengraf-donk 1997-2005*, Leiden (Archol Rapport 49).

Jansen, R. and C. van der Linde forthcoming. The physical and archaeological "landscape" of the Zevenbergen barrow group. In: D.R. Fontijn, S.A. van der Vaart and R. Jansen (eds), *Transformation through Destruction. A monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*, Leiden.

Lanting, J.N. and J. van der Plicht 2001/2002. De ^{14}C Chronologie van de Nederlandse Pre- en Protohistorie IV: Bronstijd en Vroege IJzertijd, *Palaeohistoria* 43/44, 117-246.

Lemmers, S.A.M., M. Janssen, A. Waters-Rist, B. Grosskopf, M. Hoogland and L. Amkreutz in press. The Chieftain of Oss: New perspectives on an Iron-Age individual with DISH.

Modderman, P.J.R. 1964. The chieftain's grave of Oss reconsidered, *Bulletin van de Vereeniging tot Bevordering der Kennis van de Antieke Beschaving* 39, 57-62.

Newman, P. 2011. *The Field Archaeology of Dartmoor*, Swindon.

Pare, C.F.E. 1992. *Swords and Wagon graves of the Early Iron Age in Central Europe*, Oxford (Oxford University Committee for Archaeology Monograph 35).

Roymans, N. 1991. Late Urnfield Societies in the Northwest European Plain and the expanding networks of Central European Hallstatt Groups. In: N. Roymans and F. Theuws (eds), *Images of the Past: Studies on Ancient Societies in Northwestern Europe*, Amsterdam, 9-89.

Smits, E., L.M.B. Verhart, A.G.F.M. Cuijpers and B. Grosskopf 1997. The chieftain's grave of Oss. In: E. Smits, E. Iregren and A.G. Drusini (eds), *Proceedings of the symposium cremation studies in Archaeology, Amsterdam, 26-27 October 1995*, Amsterdam 95-102.

Van der Vaart, S. 2011. *Hail to the Chieftain. A detailed examination of grave goods from Dutch chiefly burials and their role in funerary rituals during the Hallstatt period.* Unpublished Master thesis, Leiden University.

Valentijn, P. forthcoming. "Mound" 6: a post and ditch aligned long barrow. In: D.R. Fontijn, S.A. van der Vaart and R. Jansen (eds), *Transformation through Destruction. A monumental and extraordinary Early Iron Age Hallstatt C barrow from the ritual landscape of Oss-Zevenbergen*, Leiden.

Verhart, L.M.B. and P. Spies 1993. *De Prehistorie van Nederland*, Amsterdam (RMO Reeks).

Verwers, G.J. 1966. Tumuli at the Zevenbergen near Oss, gemeente Berghem, province of North Brabant. *Analecta Praehistorica Leidensia* 2, 27-32.

Verwers, G.J. 1972. *Das Kamps Veld in Haps in Neolithikum, Bronzezeit und Eisenzeit*, Leiden (Analecta Praehistorica Leidensia 5).

Vilsteren, V. van 1989. Heilige huisjes. Over de interpretatie van vierpalige structuren bij grafvelden. *Westerheem* 38, 2-10.

Warmenbol, E. 1993. Les nécropoles à tombelles de Gedinnen et Louette-Saint-Pierre (Namur) et le groupe 'Mosan' des nécropoles à epées hallstattiennes. *Archaeologia Mosellana* 2, 104-114.

Wijk, I. van, H. Fokkens, D. Fontijn, R. de Leeuwe, L. Meurkens, A. van Hilst and C. Vermeeren 2009. Resultaten van het definitieve onderzoek. In: H. Fokkens, I. van Wijk and R. Jansen (eds), *Het grafveld Oss-Zevenbergen. Een prehistorisch grafveld ontleed*, Leiden (Archol Rapport 50), 69-140.

Willms, C. 2002. *Der Keltenfürst aus Frankfurt. Macht und Totenkult um 700 v. Chr.*, Frankfurt (Archäologische Reihe 19).

Harry Fokkens
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
h.fokkens@arch.leidenuniv.nl

Sasja A. van der Vaart
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
s.a.van.der.vaart@arch.leidenuniv.nl

David R. Fontijn
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
d.r.fontijn@arch.leidenuniv.nl

Simone A.M. Lemmers
Laboratory for Human Osteoarchaeology
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
s.a.m.lemmers@arch.leidenuniv.nl

Ivo M. van Wijk
Archol b.v.
P.O. Box 9515,
2300 RA Leiden
The Netherlands
i.vanwijk@archol.nl

Richard Jansen
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
r.jansen@arch.leidenuniv.nl

Patrick J.C. Valentijn
Faculty of Archaeology
Leiden University
P.O. Box 9515,
2300 RA Leiden
The Netherlands
p.j.c.valentijn@arch.leidenuniv.nl

Decorated and 'killed'? The bronze sword of Werkhoven

David Fontijn, Liesbeth Theunissen, Bertil van Os and Luc Amkreutz

In 2011, a bronze sword was found in Werkhoven (the Netherlands) that is remarkable for its uncommon decoration and bent shape. In this contribution we argue that we are dealing here with a Griffplattenschwert that was only partly finished and probably never used. It can be dated to the later part of the Dutch Middle Bronze Age or the early Late Bronze Age. It carries a very uncommon type of decoration consisting of small dots, hatches and large dots. The sword was heavily damaged and bent into an L-shape before it ended up in the ground, and we argue that we are dealing with a sword that was ritually 'killed' by its Bronze Age owners. Investigation of the find spot indicates that it was probably deliberately deposited in a gully afterwards.

1 The discovery history

Whilst out scouring fields with his metal detector in May 2011, Robert van Eerde made an extraordinary find on a field by the *Hollendewagenweg* in *Werkhoven* (Municipality Bunnik, province of Utrecht, the Netherlands). Even though he had his metal detector in his hand, he did not use it to make his discovery. He noticed a metal point sticking out of the clay. When he pulled the piece from the ground it turned out to be a long, bent piece of metal. He initially considered tossing it aside, but decided to take it with him because it was such an odd object. At home he cleaned the metal with water and olive oil, and carefully examined it. There were rows of dots visible on the surface, and the metal appeared old to him. He placed several pictures on an internet forum for metal detectorists. The enthusiastic responses made him realize that he was indeed dealing with a prehistoric object. It turned out he had found a bronze sword.

He subsequently reported the sword to the municipal archaeological service of his hometown of Amersfoort. The sword remained there for an initial phase of documentation and further determination. Employees of the local archaeological service brought the sword to the Cultural Heritage Agency of the Netherlands (RCE), whereupon the first author examined it at the Faculty of Archaeology in Leiden.

In June the sword was examined with XRF twice, and in November the find location was recorded. This involvement of the RCE was the result of a heritage value assessment that had taken place in 2006, also at the *Hollendewagenweg* (Theunissen *et al*. 2008). Two Late Bronze Age socketed axes had been discovered in 2004 and 2005, about 850 m to the south at roughly the same location, some 30 cm below the top soil. The finding of a bronze sword in the same area, with a comparable patina and age, was reason to collectively study the environmental context and meaning. The question we asked ourselves was whether we are dealing here with bronzes from one large hoard or even a Bronze Age metalwork deposition zone (cf. Fontijn 2002, 259-272)? In this contribution we will first describe and date the sword and try to see what people did with swords in the past. Then, we will try to understand how the sword ended up in the ground.

2 Description of the sword

In unbent form the sword is roughly 36.2 cm long (fig. 1). The width is between 2.6 and 2.7 cm, and the blade is between 0.4 and 0.5 cm thick. The sword weighs 337 g. It is now part of the collection of the National Museum of Antiquities (RMO), inv. no. f 2012/4.1.

Shape

The sword can be classified as a short *Griffplattenschwert*, following Schauer's definition (1971, 3). The blade has a plate-shaped, square end which is as wide as the blade. This butt-end was to be inserted in, or attached to an organic handle. This was often done with rivets (holes in the butt-end) or with side-notches. Both are missing here. Assuming that the decoration was visible, *c*. 4 cm of the bronze would have been in the handle. The blade has the "flattened diamond-shape" cross-section typical for all swords. There are slightly flattened parts less than 1 cm to each side of the cutting edge. The width of this flatter part (the onset of the edge to be sharpened) varies over its length and is not symmetrical in relation to the central rib.

Decoration

The upper part of the sword is decorated with small impressed dots on one side (fig. 1: left), and with small impressed dots, small hatches and large dots on the other, more decorated, side (fig. 1: right). Comparing both sides, the less decorated side has the same basal pattern as the other side but lacks the additional decorative elements. The basal pattern to be found

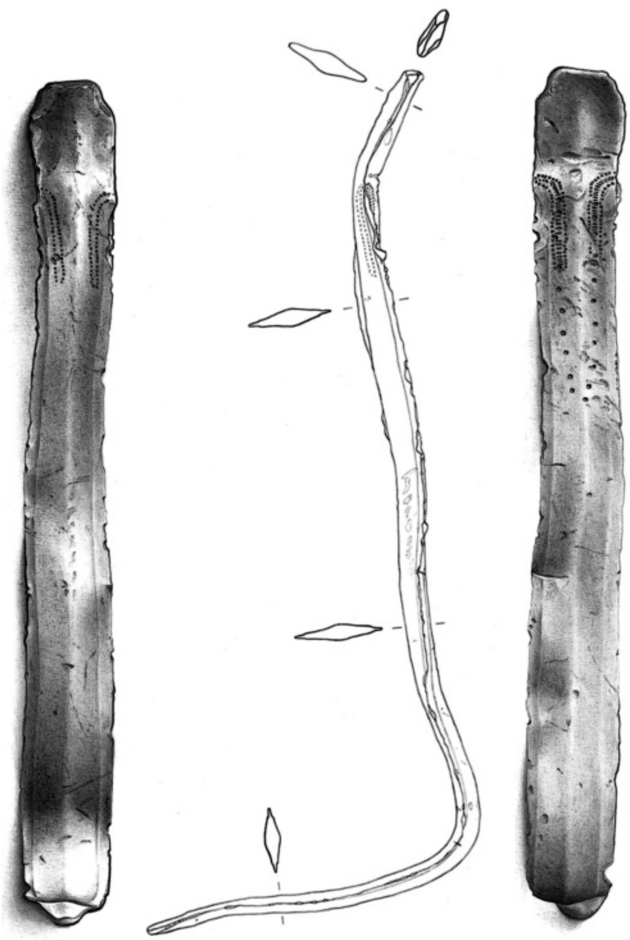


Figure 1 The sword from Werkhoven. When unbent it has a length of 36.2 cm. (Drawing by R. Timmermans. Copyright Faculty of Archaeology, University of Leiden).

on both sides is a double row of dots on either side of the central rib. The double row of dots runs parallel to the cutting edge, at a little less than 1 cm from it, and then angles off to end on the cutting edge (where the butt-end would have been attached to or been inserted into the hilt).

Let us start with the description of the most decorated side (fig. 2). At this side, we can see little hatches (length 0.1 cm) between the dots that nearly connect the pairs of dots (fig. 2). The hatches end about 1 mm before the dots. On one side the hatches end when the double row of dots angle off to the edge, on the other side the hatches bend with the rows of dots (fig. 1: right). On the more extensively decorated side there is also a decoration of larger impressed dots. In some places these run right through the decoration of smaller dots and hatches, as can be seen in figure 2. This is an indication that they were the last decorative addition. The larger dots are somewhat irregularly placed, but also on both sides of the central rib (at *c*. 7-8 mm from the cutting edge). They run roughly parallel to the cutting edge for about 6 cm and then come together in a single dot. Just like the small dots and hatches, the larger ones are not neatly symmetrical. In one of the larger dots there is a small reddish concretion that probably deposited there after the sword came to lie in the ground. In two of the larger dots there is a whitish material that looks very different (fig. 3). Is this material a filling? We will come back to this below.

The other side of the sword is much less richly decorated (fig. 1: left). There is a comparable decoration pattern with double rows of small dots on either side of the central rib, but without the hatches or larger dots. It is striking that on the less decorated side only one of the double rows of dots angles off to the edge. If the intention was to decorate this side in the same manner as the other side, then the decoration was not finished on the less decorated side.

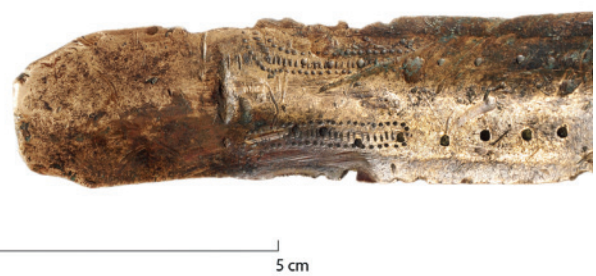


Figure 2 The butt-end of the sword showing the most decorated side. Note the damage at the transition from blade to hilt, and the rectangular notch at the edge. (Photograph by National Museum of Antiquities Leiden (RMO)).

Figure 3 White filling of the larger dots. (Photograph by National Museum of Antiquities Leiden (RMO)).

Manufacturing traces

The butt-end of the sword has various dents on the sides. The casting is rather uneven here. This shows that the sword was not finished further after casting and removal (the breaking off) of the casting plug. On the cutting edge there are several notches that could have formed during casting (air bubbles, sub-optimal flow of bronze). A substantial dent in the cutting edge (length 2 cm, depth *c*. 2-3 mm), a little over 7 cm from the tip was likely also formed during casting. There are similar traces by the butt-end. It is clear that no attempts were made to smooth out the casting traces. Round and oval cavities on the blade were formed by air bubbles. From butt-end to point there are also small and large, crisscross running, oblong cavities. In one spot we see that a 'large' dot was punched in over such a cavity, indicating that these cavities were present as bulges or air bubbles in the original cast. Some are erratic and must have driven the bronze up when it was still liquid. This must have occurred directly after casting, for example by the wiping away of dirt or irregularities on the cast before it had completely cooled. In sword casting experiments, whereby the swords were cast in a clay mould by the experienced bronze smith Jeroen Zuiderwijk of *Archeon*, material from the mould often became attached to the cast. These experiments also revealed that it is well possible to apply delicate decoration such as these small dots and hatches with a metal awl. The fact that the larger dots run through the smaller dots/hatches decoration shows that this type of decoration was probably applied later (fig. 2).

Use-wear

The butt-end does not have holes for rivets nor does it have side-notches. These are sometimes missing with this shape and this does not necessarily mean that the sword was never prepared for use. There are grinding traces visible on one side of the butt-end. The cutting edge is not sharp and the point is blunt. Traces of (prehistoric) sharpening are not convincingly visible. The cutting edge has been somewhat ground, but the absence of patina suggests this was done recently. There are a lot of small dents on the cutting edge. Many of these will have been created during casting. Some may be the later result of a blow. The rectangular notch (2 by 2 mm) right below the butt-end has an unnatural shape for a casting error and is likely man-made (by applying upright pressure – this makes it less likely that this is battle damage; figure 2).

Predepositional damages

The most noticeable damage is the bending, which resulted in the sword's current L-shape. According to the finder, the sword had this shape when discovered. The sword must have been bent with (great) force. The tip side was likely clamped at the bending point whereafter the other end was pushed. In the same manner the butt-end could have been slightly bent. On the spot that must have served as hinge, there are two horizontally running damages that likely occurred through friction (bending, possibly with a hard blow to the end). The patination of the surface indicates that this is old damage.

That the damage occurred after casting (and the first finishing) can be deduced from the fact that vertically running traces are interrupted by the damage. The rectangular notch by the butt-end mentioned earlier is another example of damage that occurred prior to the object ending up in the ground (fig. 2) and so is a long horizontal damage to the middle of the blade, ending in a tear on the cutting edge (fig. 4). A blow (with a metal object) likely landed here, which resulted in a misshaping of the blade (it is also somewhat dented there). Bent swords are known from other parts of Europe, and often these have been bent in a much more extreme manner than the sword we are discussing here. The sword from the Late Tumulus/Early Urnfield Period Penkhof hoard in the Upper Palatinate is a case in point. The sword blade is almost doubled-up (Stein 1979, pl. 97-107; Nebelsick 2000, Fig. 11.6). If one wants to fold a bronze sword like that, it is necessary to heat it. Otherwise it will break (personal communication M. Siedlaczek, Berlin). It is likely that the L-shaped form of the Werkhoven sword also involved heating of the blade. Metallurgical research will be carried out in the near future to shed more light on this. At any rate: it is clear that the Werkhoven sword has been damaged intentionally in prehistory.

Post-depositional damages

On the central rib is a series of diagonal damages, underneath which a dark copper colour is visible. Considering that this colour is not visible in the cavities of other notches and damages, this is likely more recent damage and may have been the result of a plough hitting the sword in recent times. The sword is covered with a black-dark greenish sheen, through which a golden colour shines through. On one side the original bronze colour is much better visible than on the other. How these differences came about remains unclear. According to the finder, they cannot be the result of modern cleaning.

The metal – results of the XRF-measurements

The composition of the sword was determined with a portable X-rayfluorescence-spectrometer, known as XRF. Several measurements were taken first on the lighter side of the sword. This yielded almost exactly the same results for all locations, which indicates the composition is very homogeneous (table 1). The bronze is roughly made up of 87% copper, 10-11% tin, and little lead 0.7-1%, zinc and antimony. These proportions indicate a cast material that is close to the

Figure 4 Large damage at the centre of the blade. (Photograph by National Museum of Antiquities Leiden (RMO)).

Sample		1392	1467
		sword - general	gray inlay
	Unit		
Cu	%	87	-
Sn	%	12	-
Pb	%	0.81	-
Zn	%	0.08	-
Bi	%	0.02	-
Sb	%	0.22	-
Au	%	<0.0	-
Ag	%	0.09	-
Si	%	-	12.66
Ca	%	-	6.70
S	%	-	1.88
Fe	%	0.40	0.96
K	%	-	0.63
Cl	%	-	0.51
P	%	-	0.19
Mn	%	<0.0	0.04
As	%		0.03
Zr	mg/kg	<80.0	<1.9
Rb	mg/kg	-	<0.5
Se	mg/kg	<0.0	<0.2
Mo	mg/kg	<0.0	<0.1
V	mg/kg	153.37	<0.0
Cr	mg/kg	64.11	<0.0
Al	mg/kg	<0.0	<0.0
Ba	mg/kg	<0.0	<0.0
Ni	mg/kg	327.03	823.93

Table 1 Results of XRF measurements. 1392 and 1467 refer to the numbers of the measurements. (By B. van Os, RCE).

original raw material. The bronze was apparently not recycled. A measurement taken on a slightly "darker" (redder) spot gave a value of 1.5% sulphur on the surface. This is an indication of micro formation of the metal sulphide during the stay in the soil.

Secondly, a series of detailed measurements were taken in the small depressions of *c*. 2 mm wide that are visible in a row on one side. A number of these seem to be filled with a specific substance. By setting the XRF on a special micro setting ("mining mode", 8 and 3 mm), it was possible to measure the fill material. This gave a high silicon/calcium content; a value five times as high as the non-filled bronze. This is a very peculiar result as such high Si/Ca values are particularly known from glass. Are we dealing here with a rare example of a glass inlay? More detailed analysis of the filling is necessary before we can say more about this.

Comparison with other swords

The Werkhoven sword is a short sword (using Schauer's (1971, 1) definition of a sword). The unfinished butt-end is hard to classify typologically (cf. Burgess and Gerloff 1981). Its rectangular shape comes close to that of type Rosnoën or type Vernaisson swords (Reim 1974, 6-7; Butler 1987) but it lacks side notches and/or rivet holes. The former type is known in the Low Countries (Butler 1987, 19-23; Fontijn 2002, App. 5.1). The pattern of small dots angling off to the edge below the butt-end finds a parallel in the way *lines* decorated the upper part of Rixheim-type swords. There are a few examples of such swords in the Low Countries, and on one, the sword from the Meuse in Stevensweert (NL), we see asymmetrically incised lines angling off to the edge (Desittere 1961, Fig. 3). Other examples are much further away: from Bilfingen and Mülheim (Schauer 1971, 61 (no. 182, Taf. 24) and 63 (no. 200, Taf. 27)). It is also found on swords with a slightly deviant butt-end (for example the one from Ossenheim, Schauer 1971, 77 (no. 248, Taf. 35)). However, all these swords have two or three rivet holes and there is a decoration with *lines*. We could not find examples on such *Griffplattenschwerter* where the decoration is carried out with small dots as was done here. A comparable decoration pattern just before the blade-hilt transition and carried out with small dots is known from a number of *Griffzungenschwerter* of type Locras (Schauer 1971, 180-1: nos 532, 535, 536, Taf. 80-1; Wüstemann 2004, 63, no. 216, Taf. 32), and on an example of a *westeuropäischen Griffzungenschwert* (Schauer 1971, 187, no. 560, Taf. 87). It is also visible on Hemigkofen-type swords from the river Thames in England (Colquhoun and Burgess 1988, 27, nos 71 and 73, pl. 12) but all these examples are *Griffzungenschwerter,* which have a very different hilt shape. The obvious conclusion is that decoration with small dots is clearly very rare, both in the Low Countries, Britain and in Central Europe. For the combination of small dots with hatches and large dots, the first author could not find any parallel at all.

In general, we can conclude that the shape is reminiscent of swords and rapiers that occur in the Dutch Middle Bronze Age-B and the early Late Bronze Age (reminiscent of but not the same as Rixheim and Rosnoën-type *Griffplattenschwerter).* This suggests that our sword dates in the French Bronze final I/IIa, *c.* 13th-11th century BC (Fontijn 2002, Fig. 1.4). The few examples of *Griffzungenschwerter* mentioned above with a comparable dot decoration are not much younger than that. The combination of small dots, hatches and larger dots, however, makes the Werkhoven sword very uncommon in both the region where it was found, the Low Countries, and in Northwest and Central Europe as a whole.

Discussion: decorated and killed?

Summing up, we are dealing with a sword that in its broad outline fits within what was usual, but which was never finished, not sharpened, decorated in a very special way and treated abnormally after that: it was battered in many places and bent into an L-shape. How are we to make sense of that?

Let us start with the decoration. It is not symmetrical and the dot patterns that we find on each side look similar, but are different. It almost seems to be an experimental combination in which different decorative elements were tried out (one may think here of the large dots that run over the earlier applied decoration). The less decorated side could well be an unfinished version of the pattern we see on the other side. And even the basal pattern does not seem to have been finished there (the left row does not angle off to the edge; figure 1: left). Together with the somewhat crude casting and unfinished state, one might be inclined to think that we are dealing here with the work of an apprentice. On the other hand, this may be too much a modern view on craftsmanship. Quite some time and energy was spent decorating the sword in a way that – at least in the Low Countries – lacks parallels. If this indeed were a practice sword, the apprentice would be allowed individual artistic freedom to create his or her own designs. Although this cannot be ruled out, it perhaps too much reflects the modern notion of the smith/artist as an independent individual creator. There are indications that this sword was more than 'just' some meaningless apprentice practice. One indication for that can be found in the way people treated the sword after it was decorated. Locally it appears that a start was made at finishing, but this was not completed for the whole sword. What did happen is that the sword received a number of heavy blows in prehistory and at least one notch, the rectangular one, cannot be directly correlated to the use of a sword for fighting. Compared with other Dutch swords investigated by the first author, the one from Werkhoven ranks among the most battered and damaged ones (cf. Fontijn 2002). Besides the sides being battered, the sword was purposefully bent into an L-shape with great force (by clamping the bottom part). This probably involved heating. Bending also occurred at the butt-end. A heavy blow was also delivered to the middle of the sword. After misshaping it was still usable as a hook. One explanation is that it was the intention to chop the sword into pieces (fragments of swords are sometimes found in settlement context: for example the hilt of a Rosnoën-sword that was found in the fill of a posthole in Elst (prov. Gelderland; Fontijn 2006)). If that were the case, however, people could have done a more effective job by focusing their blows on one spot. It also raises the question why their work was never finished. What we see on this sword reflects rather arbitrarily used violence: an attempt to make an object, which in reality probably never had been used, unusable. Like in the case of the decoration, this is something that is rarely seen on Bronze Age swords found in the Low Countries. A notable exception is the Late Bronze Age hoard of Pulle in Belgium (Van Impe 1973; Fontijn 2002, 169-70). In a marshy stream valley, eight spearheads, fragments of five different swords and one socketed axe were found, all of which were bent and damaged, showing the impact of fire. Most swords that have come down to us are complete and do not have serious damage (Fontijn 2002, 212). The battering and bending of the sword is known from other parts of Europe though. These are usually interpreted as scrap hoards. However, in an interesting article, Nebelsick (2000) has argued that many such scrap hoards actually evidence substantial transformation and sometimes even deliberate violence. There are many instances of objects that have received blows and/or were made unusual. Both in the catalogues of Schauer (1971) on the south German, Austrian and Swiss finds, as well as in those by Colquhoun and Burgess (1988) on those from Britain we find many examples of swords that were deliberately bent. An extreme example is the doubled-up sword from the Penkhof hoard mentioned before. According to Nebelsick (2000), the transformation and damaging of the artefact should be interpreted as motivated by religious rather than practical ideas. Swords were, so to say, ritually ‘killed’. Although rare in the Bronze Age, systematic and deliberate transformation of objects like swords is a regular feature of subsequent Early Iron Age “princely” Hallstatt C graves from the Low Countries (*cf.* Van der Vaart 2011; Fontijn and Van der Vaart forthcoming).

In conclusion: we cannot simply explain the decoration as some apprentice exercise, and the remarkable treatment of the sword need not necessarily be explained as some failed attempt to create scrap metal for re-melting. The damage done to the object may also be interpreted as a deliberate attempt to ‘ritually’ terminate its life-path. One site in the Low Countries that comes to mind is the hoard from Pulle. As set out before, here we are dealing with an entire set of objects, all of which show traces of transformation by fire and human force. However, as already observed by Van Impe (1973), this seems to have been the prelude to a final act in which all objects were left in a marshy stream valley. At this moment, almost 40 years after Van Impe’s publication, we can conclude that deposition of metalwork in watery places was a regular practice (Fontijn 2002; Verlaeckt 1996; Warmenbol 1992). With the idea of a deliberately ‘killed’ sword in mind, we must return to one last essential question. How did the remarkable Werkhoven sword end up in the ground?

3 Investigating the find location

Werkhoven is situated in the Dutch river area, a region that is known for its rich archaeological heritage of Bronze Age settlements (Arnoldussen 2008). The fluvial landscape that was created by the rivers Meuse, Rhine, and Waal was a dynamic and attractive environment in prehistory. The high, dry and sandy locations such as the river dunes (Dutch: *donken*), but especially the levees of the channel belts and the crevasse splay deposits were often chosen for habitation during the Middle Bronze Age. Nowadays, it is regarded as a typical Dutch flat environment with elevations only spotted by a discerning eye. The find spot is situated in the *Kromme Rijngebied*, on the *Werkhovense* channel belt (Berendsen and Stouthamer 2001). The Werkhovense system silted up around 2000 BC, and became attractive for habitation.

More precisely, the sword was found on the northeastern part of an extensive plot at the Hollendewagenweg (coordinates 145.339/446.671). The arable land plot is *c*. 900 m long, 150 m wide, with a southwest-northeast orientation. At the time of discovery the top soil had just been ploughed and levelled in preparation of sowing grass seed. The tenant of the plot had some time previously added a 20 cm thick layer of sand. He had then ploughed this sandy sediment under the clayey cultivation layer. In this case it concerned *c*. 5000 m^3 from different, private building projects in the surroundings of Doorn. This raising of the surface was necessary because the area was too wet for producing grass. He had ploughed this area deeper than usual, specifically for this ground improvement. The cattle farm of the tenant on the adjacent plot had been started up quite recently. Prior to building the stables in 2009, the excavated soil for the new manure collection area had been spread out over the plot.

If we now try to situate the find spot in its Bronze Age setting, the geomorphogenetic map by Berendsen (1982) indicates the presence of a zone of bank and channel deposits running parallel with the *Hollendewagenweg*, with a single residual gully with northwest-southeast orientation (fig. 5). As remarked before, two socketed axes have been found nearby. Previous field research on the find spot of the socketed axes site in 2006 gave a better insight into the natural, complex environment of point bar deposits. Corings and trial trenches indicated the presence of four parallel residual gullies, with slanted sediments. These lateral accretion deposits were formed by the main stream of a meandering river that over time changed its course to the southwest (Theunissen *et al*. 2008, 49). The result is a

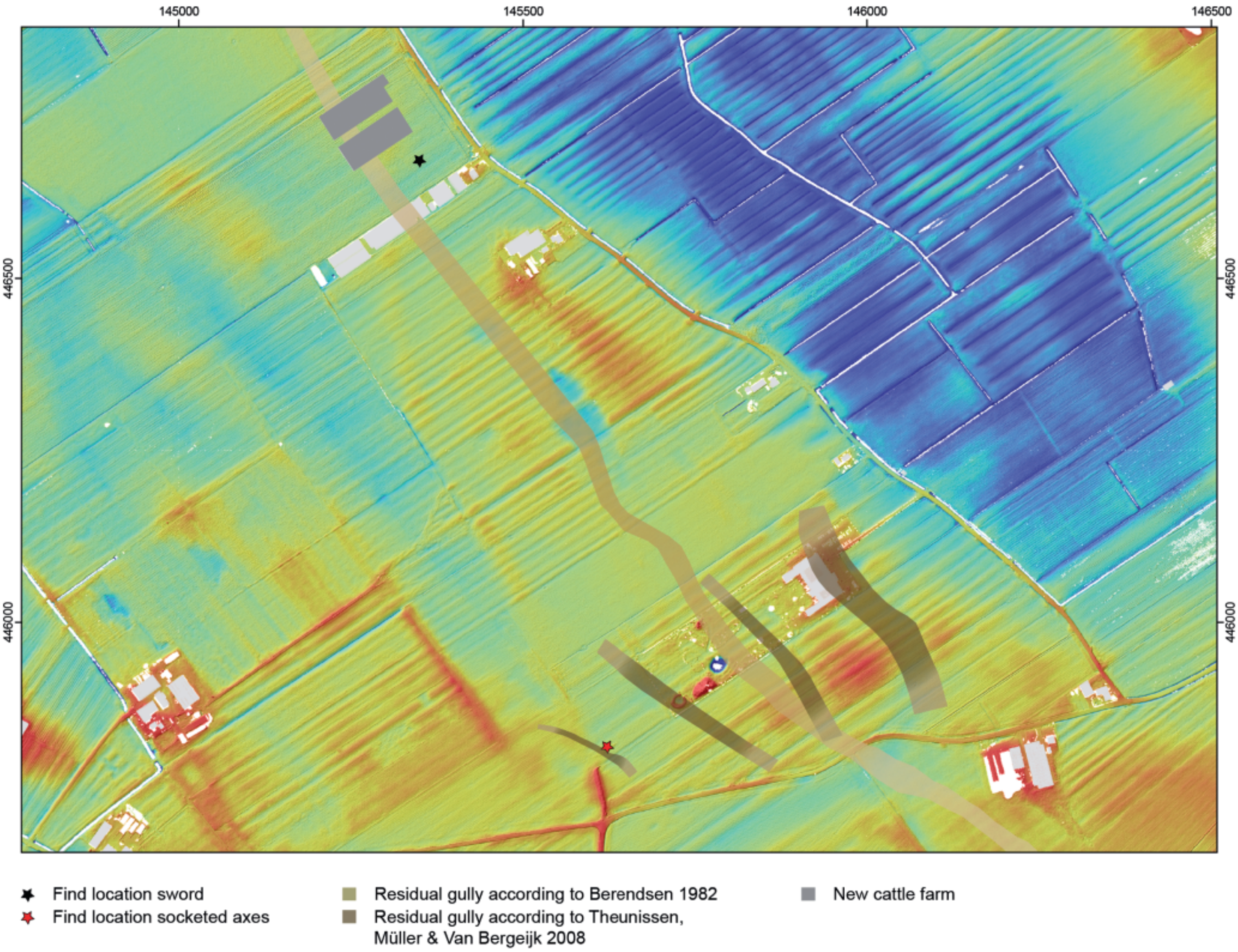


Figure 5 An overview of the fluvial landscape near Werkhoven, shown as a detailed elevation map with four identified residual gullies. (Based on the Aktueel Hoogtebestand Nederland 2 (www.AHN.nl)).

landscape of a former convex river bank characterized by a series of parallel gullies and small elevations. This landscape of point bars can also be discerned on the AHN2 (Digital elevation model). The residual gullies discovered in 2006 can (partially) be extrapolated northwards. It appears that the residual gully indicated by Berendsen can be related to residual gully 2. The find location of the sword appears to coincide with this elongated depression.

As discussed above, the sword has a specific patina, similar to the socketed axes. One side is black/dark green and the other is gold coloured. This indicates an oxygen-free environment which did not trigger corrosion: a wet and calm sedimentation environment. The question quickly arises whether the sword was primarily deposited in the point bar landscape, more specifically in a residual gully, or whether the object was found in a secondary position. As already indicated, however, sediments were deposited at this location twice. Firstly, the sediment derived from excavating a manure collecting area for the new cattle farm was spread over the plot. Then the sand from Doorn was used to raise the lower area by the *Hollendewagenweg*. The smooth and dark patina suggests that the sword came to lie at the surface rather recently. If the sword had lain in the top soil for longer than three months, thereby subjected to weather conditions, this would definitely have had consequences for the surface of the metal. Traces of the first degradation processes would have quickly become apparent. These processes have, however, not set in yet. This makes it most probable that the piece locally and recently came to lie at the surface. The first, most plausible scenario is that the sword came to the surface during the deep ploughing done to work in the sandy sediments from Doorn. Recent damage to the blade of the sword is best explained as resulting from ploughing (see above). It is also possible that the sword derives from a deeper level excavated while creating the manure collection area.

4 Interpretation – an important location in the river area?

When interpreting this discovery, it is tempting to assume that the sword had always been located in the somewhat deeper clayey residual gully fill, right up until the moment that the single event of ground improvement ploughing brought it to the surface. It would seem rather straightforward to label the sword – just like the socketed axes – a deposition. A regional pattern seems to be emerging, whereby the late prehistoric community deliberately deposited bronze objects in the low-lying marshy areas of the point bar landscape and attributed these areas a special meaning (Fontijn 2002). There is a clear difference, however, between the two socketed axes that were both in mint condition, pristine and unused, and the sword which suffered damage and was heated and bent. Although the axes and the swords are not from the same location, ruling out that we are dealing with the remains of a hoard, they ended up in each other's vicinity in the same watery environment. The sword can only be broadly dated, but it may have been somewhat older (MBA B) than the axes (LBA). It might be ventured that we are dealing here with a multiple deposition zone that was repeatedly used to deposit metalwork (Fontijn 2002, 260-265). This zone probably was a remote area in the world of Bronze Age people. Settlement sites are known much further to the north, at a distance of at least two km. Unfortunately, nothing is known on the environment, the vegetation and accessibility of the location at the time the sword was left here. Whether it was an unaltered 'natural' place, or marked by some man-made construction remains an open question.

It is desirable that in the near future a local predictive model for depositions is created for this part of the Werkhovense channel belt. This map could then be tested in collaboration with amateur archaeologists with metal detectors. Only then does proper archaeological heritage management of this kind of special, but difficult to locate areas, become feasible.

5 Summing up

This contribution describes a remarkable bronze sword that was found in 2011 by an amateur archaeologist south of the village of Werkhoven, the Netherlands. It is a *Griffplattenschwert* that can on the basis of its form broadly be dated to the 13th to 11th century BC. XRF measurements show that it is a tin bronze containing a very low percentage of other metals. At the upper part of the blade it carries a remarkable decoration of small dots, hatches and large dots on one side, and of small dots only at the other. For the small dots decoration a few parallels could be found on other swords in Northwest and Central Europe, but the combination with hatches and large dots so far seems to be unique. The sword never seems to have been properly finished, but does show quite some damage that results from blows (with metal implements). It was bent into an L-shape, which probably involved heating. So, we seem to be dealing with an object that was decorated in a highly unusual way, and then ostentatiously damaged and transformed. All the extra efforts suggest that this transformation was not done for purely pragmatic reasons (creating scrap metal for re-melting) but rather for religious/ritual reasons. We wish to suggest that the object was deliberately 'killed'. The location where the object came to rest – probably a gully in the river area – is another argument for ritual motivations. In the Bronze Age specific bronze objects like swords were from time to time removed from society and deliberately deposited in watery places.

Acknowledgements

The first author wishes to thank prof. dr. Anthony Harding (University of Exeter) and Michael Siedlaczek (Free University of Berlin) for their useful comments when this sword was shown to them, and also to dr. Brendan O'Connor for sharing his enormous knowledge of Bronze Age metalwork. Sasja van der Vaart (MA, University of Leiden) read and commented on a draft and translated/corrected the English. Joëlla van Donkersgoed (University of Leiden) helped with the photographic recording of the sword. Special thanks go to the finder, Robert van Eerde, for informing us so quickly of his find and to the National Museum of Antiquities (RMO), Leiden, for purchasing and photographing the sword. Having been misshapen and removed from view for thousands of years, this beautifully decorated object now has found a new public.

References

Arnoldussen, S. 2008. *A living landscape. Bronze Age settlements in the Dutch river area (c. 2000-800 BC)*, Leiden (PhD thesis University of Leiden).

Berendsen, H.J.A. 1982. De genese van het landschap in het zuiden van de provincie Utrecht. *Utrechtse Geografische Studies* 25, Utrecht.

Berendsen, H.J.A. and E. Stouthamer 2001. *Palaeogeografic developments of the Rhine-Meuse delta, The Netherlands*, Assen.

Burgess, C.B. and S. Gerloff 1981. *The Dirks and Rapiers of Great Britain and Ireland*. München (Prähistorische Bronzefunde IV-7).

Butler, J.J. 1987. Bronze Age connections: France and the Netherlands. *Palaeohistoria* 29, 9-34.

Colquhoun, I. and C.B. Burgess 1988. *The swords of Britain*, München (Prähistorische Bronzefunde IV-5).

Desittere, M. 1961. Zwaarden uit de vroege urnenveldenfase uit de Lage Landen. *Helinium* 1, 57-62.

Fontijn, D.R. 2002. *Sacrificial landscapes. Cultural biographies of persons, objects, and 'natural' places in the Bronze Age of the southern Netherlands, 2300-600 BC*. Leiden (Analecta Praehistorica Leidensia 33/34).

Fontijn, D.R. 2006. Het bronzen zwaardfragment. In: S. Knippenberg and E.N.A. Heirbaut (eds), *Wonen en begraven nabij Elst (Gld.)*, Archolrapport 57, 45-7.

Fontijn, D.R. and S.A. van der Vaart 2012**.** Dismantled, transformed and deposited – prehistoric bronze from the centre of mound 7. In: D.R. Fontijn, S.A. van der Vaart and R. Jansen (eds), *Transformation through Destruction, a monumental and extraordinary Early Iron Age Hallstatt C barrow from the prehistoric ritual landscape of Oss-Zevenbergen*, Leiden.

Impe, L. van 1973. Enkele wapens uit de Bronstijd te Pulle. *Archaeologica Belgica* 150.

Nebelsick, L. 2000. Rent asunder: ritual violence in Late Bronze Age hoards. In: C.F.E. Pare (ed.), *Metals make the world Go Round. The Supply and Circulation of Metals in Bronze Age Europe*, Oxford, 160-175.

Reim, H. 1974. *Die spätbronzezeitlichen Griffplatten-, Griffdorn- und Griffangelschwerter in Ostfrankreich*, München (Prähistorische Bronzefunde IV-3).

Schauer, P. 1971. *Die Schwerter in Süddeutschland, Österreich und der Schweiz I (Griffplatten-, Griffangel- und Griffzungenschwerter),* München (Prähistorische Bronzefunde IV-2).

Stein, F. 1979. *Katalog der vorgeschichtlichen Hortfunde in Süddeutschland*, Saarbrücken (Saarbrücker Beiträge zur Altertumskunde 24).

Theunissen, E.M., A. Müller and G. van Bergeijk 2008. *Twee kokerbijlen van de 'Hunze-Eems'-industrie uitgelicht. Archeologische waardering van een mogelijke depositie-locatie aan de Hollendewagenweg te Werkhoven (gemeente Bunnik)*, Amersfoort (Rapportage Archeologische Monumentenzorg 161).

Vaart, S.A. van der 2011. *Hail to the Chieftain*, MA thesis, University of Leiden.

Verlaeckt, K. 1996. *Between river and barrow. A reappraisal of Bronze Age metalwork found in the province of East-Flanders (Belgium)*, Oxford (British Archaeological Reports International Series 632).

Warmenbol, E. 1992. Le matériel de l'âge du bronze: le seau de la drague et le casque du héros. In: E. Warmenbol, Y. Cabuy, V. Hurt and N. Cauwe (eds), *La collection Edouard Bernays. Néolithique et âge du bronze, époque Gallo-Romaine et médievale*, Bruxelles, 67-122.

Wüstemann, H. 2004. *Die Schwerter in Ostdeutschland*, München (Prähistorische Bronzefunde IV-15).

David R. Fontijn
Faculty of Archaeology
University of Leiden
P.O. Box 9515
2300 RA Leiden
D.R.Fontijn@arch.leidenuniv.nl

Liesbeth Theunissen and Bertil van Os
Rijksdienst voor Cultureel Erfgoed RCE
Postbus 1600
3800 BP Amersfoort
L.Theunissen@cultureelerfgoed.nl
B.van.Os@cultureelerfgoed.nl

Luc W.S.W. Amkreutz
Rijksmuseum van Oudheden
Postbus 11114
2301 EC Leiden
L.Amkreutz@rmo.nl

Master and apprentice? A short note on wall construction in Ancient Syria

Diederik J.W. Meijer

Ethno-archaeology opens our eyes to possible explanations of questions raised by our excavations. The present contribution shows how architectural details of the 18th century BC may be interpreted, by comparison with present-day techniques.

One of the most important supports for an archaeologist's interpretation of the world he or she excavates is the architecture. The very human inclination to create shelter leads us to think that we understand, almost *a priori*, what was meant by this or that construction. It is, however, not often the case nowadays that archaeologists have architectural training, and although technical details are in most publications treated as just that, details, they can provide deeper insight into the world behind them. A case in point is the architect Hansjörg Schmid's comprehensive overview of early Near Eastern architecture, where, for instance, pilasters in Tell es Sawwan are analyzed not as necessary supports but as status symbols (Schmid 2009, 62f.). Debatable or not, such insights pave the way for new interpretations of the architecture we dig up. Another well-known drawback of the archaeologist's perception of ancient architecture is the fact that only a small percentage of a building is found, often only consisting in (part of) the plan, and wall stubs. Matters of height, proportion and decoration often remain unknown, and yet they are necessary elements in one's experience and appreciation of buildings. Now how we perceive buildings in general is a hotly debated matter with philosophical aspects (cf. Hill 1999, esp. Ch. 3), but the sensory experiences of touch, sight and even smell are very important, and without those impressions a building is for us not a building but an un-fleshed and incomplete skeleton.

Not only are technical details interesting for our understanding of the ancient builders' artisanship, but through them we may attempt to reconstruct at least the formal characteristics of the missing parts of the constructions we excavate. For such reconstructions we can use various means, among which of course ancient textual material.[1] In these technical matters, ethno-archaeology may also help us. Ethno-archaeology is a fascinating approach to the solution of problems of interpretation in one's excavation. Comparisons with present-day situations or phenomena cannot be used as one-to-one solutions, as everyone knows, but an open eye for today's traditional ways of life in many regions does give an opportunity to investigate whether a model based on such phenomena might fit the ancient data.

In the first volume on the excavations of Tell Hammam al-Turkman, a large site on the left bank of the Balikh river in Northern Syria (figs 1, 2), some of the details of construction techniques, wall plaster and timber used in the Late Bronze Age palace at the site were discussed (Van Haaften 1988). There, the bonding methods of the mud bricks in the walls were shown to be variable. Our present theme deals with such construction details. The Late Bronze Age palatial building, the western half of which might be reconstructed as a so-called *bit hilani*,[2] replaced a Middle Bronze Age complex of rooms provisorily described as “Administrative Complex” by virtue of some finds of cuneiform texts as well as a “scribal quarter” (Meijer 2004).

This Middle Bronze Age complex proved to have had a c. 400 year long history of rebuilding and refurbishment without major upheavals, from c. 2000 – 1600 bc. This circumstance, unfortunate for the archaeologist who much prefers conflagrations and other sudden disturbances through which finds can be found *in situ*, was responsible for a dearth of datable objects in the remains: at every occasion in antiquity the rooms had been emptied out in order to be refurbished. The very end of the building came softly, witnessed by a short period of desertion. (Meijer 1988, 88; in preparation).

As happens so often in the Near East nowadays, also in antiquity building processes did not always proceed entirely according to plan. Half-finished constructions often remain standing for years, only parts of them are lived in, or they are sometimes not even used because the money for finishing them ran out or some such reason. An interesting example of such an unfinished construction was found in the Tell Hammam Middle Bronze age Administrative Complex.

In squares K23-22 (fig. 3) an initially enigmatic mud brick construction came to light. It consisted of a set of walls enclosing a square chamber measuring roughly 4 × 4 m on

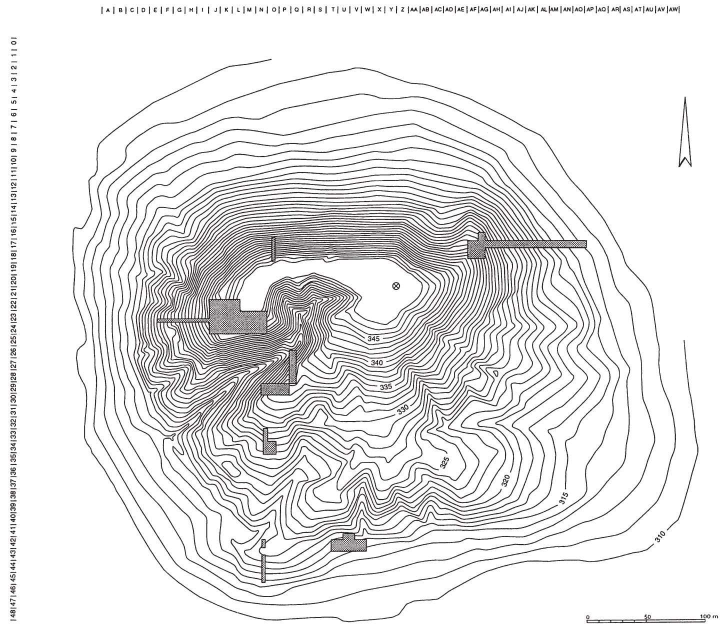


Figure 1 Tell Hammam al-Turkman with the main excavation areas indicated.

Figure 2 Tell Hammam from the air (ca. 1964).

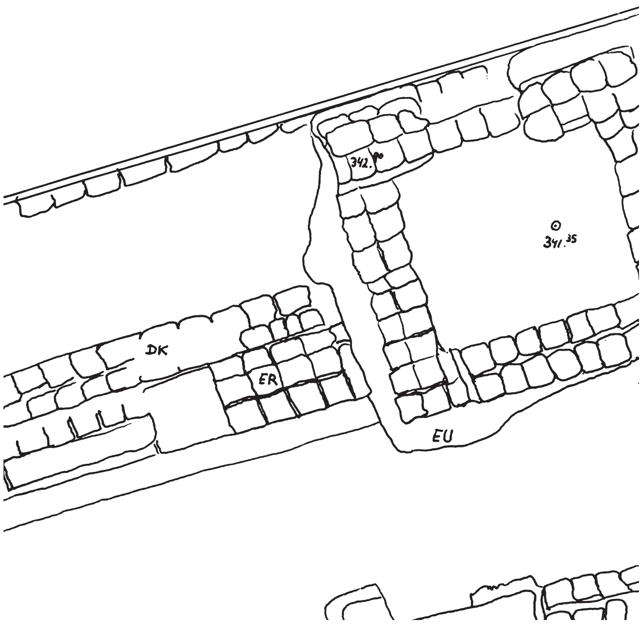


Figure 3 The cut-in chamber. The outline of foundation pit EU clearly cuts wall DK-ER.

the inside, and c. 5 × 5 m on the outside (fig. 4). The well-made bricks measured 35 × 35 cm, usual for the period, and were laid in a very regular fashion with considerable amounts of mud mortar in between. The bonding where the walls met was carefully executed, and the general impression is of a construction well planned. One striking feature was the fact that the chamber had been built into a pit excavated into earlier Middle Bronze Age (I) remains during one of the phases of rebuilding: the sides of the foundation pit were quite clear. The walls as extant showed no doorway (the minimum height of the wall remains was 65 cm), which indicates that the room had been planned to be entered from above. A thin coat of normal mud plaster adhered to part of the inside of the walls and the floor, but had clearly not yet been applied to all the necessary surfaces. In short, the construction was never finished; it was subsequently filled in and overbuilt with the next phase of the Administrative Complex.

The function of the planned but not fully finished room is not quite clear. It may have been planned as a cellar (indeed to be entered from above). The flimsy plaster precludes a water-related function. The room was, of course, empty. However, given the relative monumentality of the complex and the generally solid execution of its walls and doorways, perhaps this built-in room may have been planned as a burial chamber for an important person involved in the administration of this site, which may be seen as a regional centre of some importance (cf. Meijer 2000; in press). Such burial chambers occur in more archaeological sites, such as Alalakh and Qatna etc., both in the Middle and in the Late Bronze Age (Woolley 1955, 95ff; Pfälzner 2011 *passim*). On the

Figure 4 The cut-in chamber, facing NW. The foundation pit is clearly visible along the west and south walls.

other hand no stairway had yet been installed, and a simple wooden ladder may of course have been planned as means of access, thus perhaps invalidating the option of the solemn character of a burial chamber. No clear context of the planned surface from which the room was to be entered has been found, since recent fox holes had greatly disturbed the area. The room's planning and subsequent non-use make one all the more curious about the historical circumstances under which the construction took place. The next locally recognizable building phase consisted in a northern exterior wall with a glacis, which protected the Middle Bronze Age complex in its last two sub phases (Meijer in preparation).

The most eye-catching feature that emphasized the unfinished character of this built-in room was the fact that great care had been taken in constructing the room corners: the bonding of the bricks was excellent, their very consistency also very good – but the wall space between the corners showed a slightly lesser degree of proficiency. Moreover, those spaces (which, as mentioned, had a minimum height of 65 cm) had never reached the height of the corner parts which stood up to c. 1.70 m. All this suggests that an experienced craftsman had been involved in the setting-up of the room, concentrating on the important corner work to ensure greatest stability, leaving the much easier 'filling up' of the wall body with bricks for later or to his apprentice.

This suggestion finds excellent support in present-day traditional mud brick architecture in Syria. During our excavations we often witnessed the building of modern mud brick houses in the neighboring villages, and sometimes here also the builder constructed the corners of the walls first, the rest being filled in later by younger boys; for resulting unevenly fitting patches people simply used half bricks or larger amounts of mortar to fill spaces. A very good illustration of this can be seen in fig. 5.

This illustration of the longevity of building traditions, mundane as it may be, suggests a further insight into the Middle Bronze Age situation in the complex. If we suppose that the Administrative Complex was indeed the seat of a regional ruler or administrator, his relatively lofty social position led him to employ a builder with the latter's apprentice. This emphasizes the tiered society that we know from cuneiform texts, but in those texts workmen and artisans always remain underexposed, except in terms of their rations or salaries.[3] In our instance, the physical evidence makes them slightly more tangible.

Notes

1 For more on the interpretation of architectural remains, cf. Meijer 2006 and 2008.

2 For a short discussion of the *bit hilani*, see Meijer 1989.

3 The tiered character of the society in Tell Hammam was also emphasized by the find of a sealed bulla together with the responsible seal, cf. Meijer 1995. Further sealings emphasizing the existence of a hierarchy of civil-servant control will be published in Meijer (in prep.).

Figure 5 A modern builder concentrates on the corners of the walls.

References

Hill, R. 1999. *Designs and Their Consequences. Architecture and Aethetics*. New Haven.

Meijer, D.J.W. 1988. Tell Hammam: Architecture and Stratigraphy. In: M.N. van Loon (ed.), *Hammam et-Turkman I*, Istanbul, 69-127.

Meijer, D.J.W. 1989. Ground Plans and Archaeologists: On Similarities and Comparisons. In: O Haex et al. (eds), *To the Euphrates and Beyond: Archaeological Studies in Honour of Maurits N. van Loon*, Rotterdam, 221-236.

Meijer, D.J.W. 1995. A Cylinder Seal and Some Ramifications. In: Th.P.J. van den Hout and J. de Roos (eds), *Studio Historiae Ardens (Studies Presented to Philo H.J. Houwink te Cate on his 65th Birthday)*, Istanbul, 195-209.

Meijer, D.J.W. 2000. Ecology and Archaeology: Perceptions and Questions. In: L. Milano et al. (eds), *Landscapes, Territories, Frontiers and Horizons in the Ancient Near East*, Padova, 203-212.

Meijer, D.J.W. 2004. A Scribal Quarter? In: J.G. Dercksen (ed.), *Assyria and Beyond. Studies Presented to Mogens Trolle Larsen*, Leiden, 387-393.

Meijer, D.J.W. 2006. Some thoughts on symbolism in architecture. In: P. Butterlin et al. (eds), *Les espaces syro-mésopotamiens. Volume d'hommage offert à Jean-Claude Margueron*, Turnhout, 529-532.

Meijer, D.J.W. 2008. Cracking the Code? Aspect and Impact in Mesopotamian Architecture. In: H. Kühne et al. (eds), *Proceedings of the 4th International Congress on the Archaeology of the Ancient Near East*, Wiesbaden, 431-436.

Meijer, D.J.W. (in press). Marginal and steppic areas as sources for archaeological debate: a case for "active symbiosis" of town and country. In: E. Cancik-Kirschbaum and J. Eidem (eds), *Constituent, Confederate, and conquered Space in Upper Mesopotamia: The Case of the Mitanni Transition*, Berlin.

Meijer, D.J.W. (in prep.). *Hammam al-Turkman II*.

Pfälzner, P. 2011. *Interdisziplinäre Studien zur Königsgruft von Qatna*. Wiesbaden.

Schmid, H. 2009. *architecturae fundamentum*. Berlin & Basel.

Van Haaften, C.J. 1988. Details of Architecture and Construction. In: M.N. van Loon (ed.), *Hammam et-Turkman I*, Istanbul, 129-141.

Woolley, C.L. 1955. *Alalakh, An Account of the Excavations at Tell Atchana 1937-1949 (Reports of the Research Committee of the Society of Antiquaries of London)*. Oxford.

Diederik J.W. Meijer
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
d.j.w.meijer@arch.leidenuniv.nl

The materiality and social value of amber objects during the Middle Jomon in Japan

Ilona R. Bausch

This exploratory paper features ongoing research, focusing on the interregional, long-distance exchange networks during the Middle Jomon (c. 3500~2500 BC), with regards to an important but frequently overlooked exchange item: amber, which was often made into beads or pendants. In Japan, a great deal of important research on beadstone ornament exchange has focused on sourcing and establishing the extent of the circulation (by means of compiling production and distribution sites), and reconstructing the production processes and typologies. However, although much information is present in excavation site reports concerning structures and artefacts at these sites, relatively little attention has been devoted to the social context in which these ornaments circulated, and the reasons for the appeal of the ornaments leading to such high demand, or the motivation behind the production activities. This paper deals with the materiality of amber, suggesting how its unique physical attributes and the use of ornaments made of this specific material may have mediated social relations in the hunter-gatherer communities of Jomon Japan, as well as their possible role in creating specific identities. Some preliminary evidence will be presented to support the hypothesis that amber ornaments from Awashidai at the Pacific Coast were made by and for hunters, creating social relations among hunters as a group, and may have been used both for sympathetic magic and a sign of personal identity. A brief comparison with the materiality and use context of jade items will be made.

1 Introduction

This paper will focus on the social aspects of exchange relations in the prehistoric forager society of the Jomon period in Japan, particularly from the point of view of the producers of rare products that were widely distributed over large parts of Japan: ornaments made of amber, specifically. The word 'ornament' may sound misleadingly like 'accessory', but I do not use it in this sense. These rare, exotic items were produced for the purpose of creating social relations, sometimes locally, sometimes over long distances. What does the character of the production contexts tell us about the artefact producers? What is their motive for wishing to engage in specific relations? What role does the materiality of their products play in the structuring and maintenance of long-distance relations?

Jomon foragers lived in the diverse landscapes and eco-systems that comprise the Japanese archipelago, seasonally exploiting the specific resources found in their region. As will be shown below, no community could be entirely self-sufficient, and long-distance exchange relations were essential for survival. The spatial and temporal scope of this paper is Central Honshu (fig. 1) during the Middle Jomon (3500~2500 calBC). This period is generally considered the apex of the Jomon in this region; an abundance of craftsmanship and ritual activities was accompanied by an unprecedented population increase. There is ample evidence for the rapidly expanding exchange networks, including an immediate increase in the production and circulation of jade and amber ornaments. It will be argued here that these rare and precious items were indeed used for the creation and maintenance of interregional and interpersonal relationships, with a special focus on amber. Both these scarce minerals are good subjects for research on exchange mechanisms; they are derived from distinct, spatially limited source areas within Japan, and their distribution is archaeologically visible, frequently in contexts of intentional deposition, such as burial. To illustrate the ubiquity of jade and amber ornaments in Central Honshu during this phase: it has been calculated that of the 200 Middle Jomon jadeite pendants recorded from all over Japan in 1995, a whopping 70% were found in Central Honshu (Teramura 1995, 122), and according to Yoshioka (2003) almost two thirds of distribution sites with amber ornaments belong to this region and period.

As will be shown below, jade and amber have similar distribution spheres, but they may have been used in different social contexts, and been perceived in different ways due to their specific physical attributes.

1.1 Objects and the creation and mediation of social relations and identities

In terms of exchange, a distinction is usually made between contrasting types of exchange relations: reciprocal gift exchange (social relations) versus 'ordinary' market exchange (economic relations). Since the seminal anthropological research of Malinowski (1922) and Mauss (1925), there is

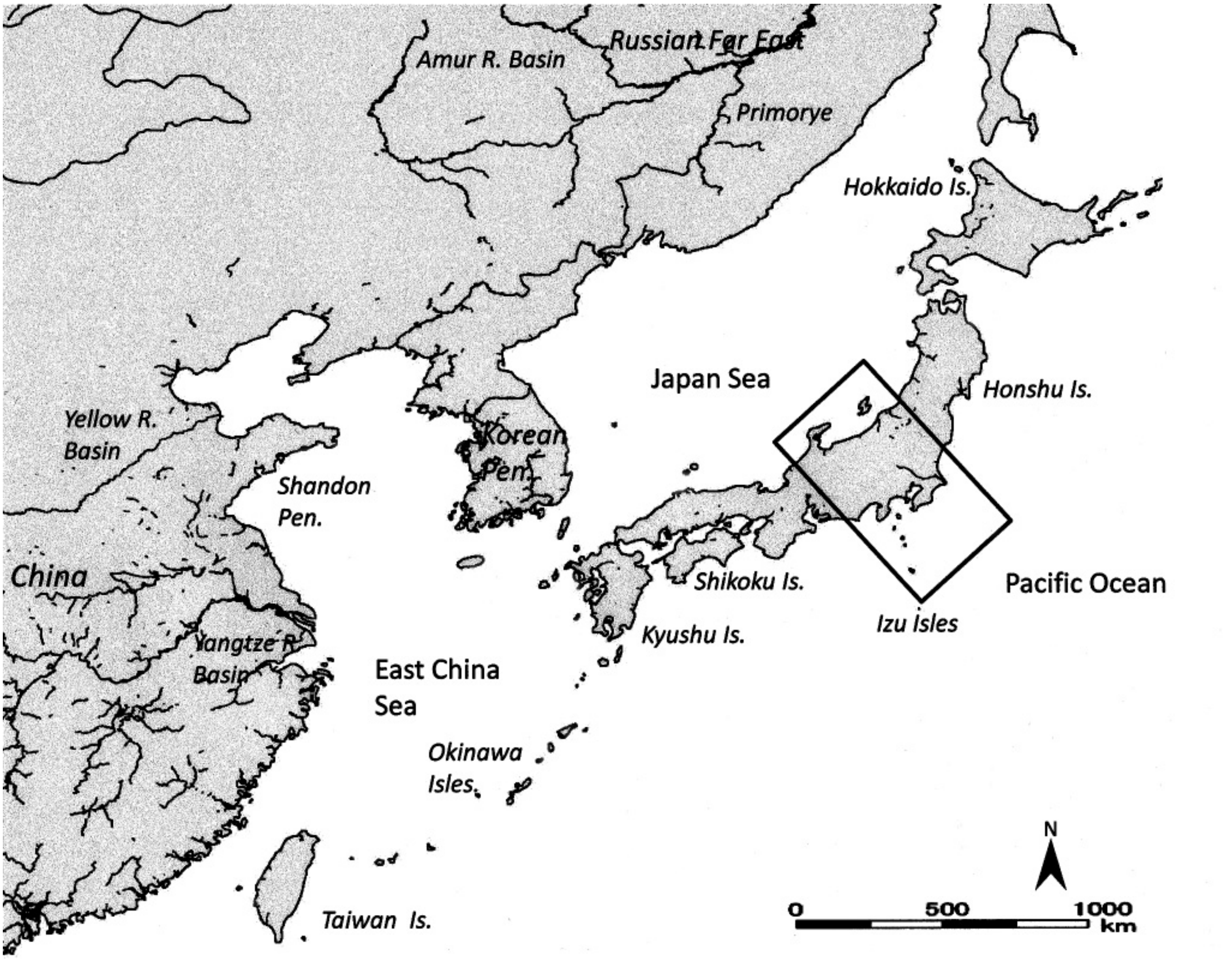


Figure 1 Overview map of Japan in a regional context, indicating the research area.

much awareness of the vital role of 'gifts' in the creation and maintenance of social relations, and how expansive these can be, both spatially and temporally. At different ends of the value spectrum, we find 'inalienable goods' and 'commodities'. Commodities can be exchanged for other commodities of equivalent value; such value can range from the ordinary (*e.g.* daily utilities) to the very high, like luxury items, or prestige goods (*e.g.* Appadurai 1986). However, inalienable goods (called 'singularities' by Kopytoff 1986) are unique, have a culturally-subjective value, are vessels for symbolic and economic power, and are intrinsically connected to social identity, cosmology and authority (*e.g.* Weiner 1992, 6, 11). Such objects, conferring identity, are suitable for a parallel ceremonial gift exchange, in which objects may symbolize persons ("objectification"; Strathern 1988, 176-178). Fontijn (2002, 26-27) makes an important distinction between the role of such objects in the construction of identities: specific *personal* identities versus *communal* identities, an insight which is also highly relevant to this paper, in interpreting the role of amber. Of course, due to social interaction, all human beings have multiple identities.

The process also works the other way around: the idea of an object biography, whereby identities accrete to the object as well. In the words of Gosden and Marshall (1999, 169): "As people and objects gather time, movement and change, they are constantly transformed, and these transformations of person and object are tied up with each other".

The seminal research of Alfred Gell (1998) makes that dialectical relation particularly clear in his argument about the agency of material culture and how it can mediate and create social relations and identities. Although he mainly references "art", I also find some aspects applicable to other object types, such as the Jomon jade and amber pendants. Gell explains how objects ("indexes") are designed by their creators for the purpose of social interaction, objectifying their intentions in order to elicit some type of emotional response from the "recipients" (*e.g*. fear, religious awe, solidarity or admiration). He demonstrates the various ways in which material objects can have a profound social and/or cognitive impact on the recipient (and sometimes even on the "artist"), being ascribed certain characteristics by persons. This is salient to this paper, which hypothesizes that certain powers or identities are attributed to amber objects during the Jomon. Moreover, also relevant, is his concept of "captivation", in which a recipient is overcome by awe for an object, through not being able to comprehend its origin or production process (Gell 1998, 68-72).

As Hoskins (2006, 77) rightfully points out, Gell mostly focuses on the agency of material objects as derived from their "visual power". However, as I will argue below, the simultaneous stimulation of other senses through the 'physicality' of a material or object may also form an essential factor in the construction of the social (and possibly cognitive) value of objects. The inclusion in the *Handbook of Material Culture* of several exploratory chapters on the relation between material culture and various senses (*e.g*. Young 2006 on the visual impact of colour; Howes 2006 on scent, sound and tactile sensations) indicates that this insight is gradually acknowledged in recent research. In short, these concepts may help to understand the agency of the producers of amber in their dealings with the recipients of their products, as well as the effect that the materiality of an object can have.

Of course, as Kopytoff (1986) remarked, the social values attributed to material culture are anything but constant, but are subject to change at any time along a scale from inalienable (singular) object to commodity or vice versa. Unfortunately there is little scope in this paper to fully investigate the changes in Middle Jomon ornament social values over time (but see Bausch 2010a).

1.2 Exchange and social value in Jomon archaeology

Among Japanese archaeologists, recently research on Jomon exchange also has started to regain popularity. However, most studies are highly localized in scope (because the researchers are employed by prefectural institutes), and only tend to concentrate on one single item or material, merely identifying the source area and subsequent distribution within one prefecture. Some studies have considered the mechanisms behind the (re)distribution of goods (*e.g*. Kurishima 1985; Kanayama 1998) or put the exchange networks in a wider perspective, viewing interregional exchange of a variety of exchange goods as part of the "total subsistence system" (Kosugi 2003, 27).

In the past few years, there has been a surge of interest in Japan – scientific as well as popular – in Jomon jadeite and amber pendants. Particularly jade studies have taken flight (perhaps at the expense of amber studies), with annual conferences and the scientific journal *Gyoku Bunka (Journal of Jade Ornament Culture Studies)* which has yearly publications since 2004. In addition to its scarcity, the hard, endurable quality of jadeite and its green colour are often characterized as reasons behind its perceived value. According to Kobayashi (2004, 161) the colour green had a psychological effect on the Jomon, who, like people elsewhere, "were enticed by the bewitching and calming deep colour green" of jade, while many other scholars have interpreted the colour green as symbolizing universal values like plant ecology, fertility and renewal (*e.g*. Kurishima 1985**,** 42; Teramura 1995, 137-139). There is less speculation about the reasons for the appreciation of amber, but it is also assumed to have been a prestige object, based on its frequent occurrence in burials (*e.g*. Yoshioka 2003, 246; Kurishima 2012). Noshiro (2004, 41) has suggested that amber possessed an "intrinsic value" in Jomon society, as seen in the fact that unprocessed amber nodules also circulated at sites.

However, although Jomon jade and amber items are both commonly and implicitly assumed to have been used as prestige objects and/or magical items, most research focuses on 'Processual' approaches concerning production processes, typology and distribution scope – instead of on context – and so far the reasons behind these attributed 'social values' have been left underexplored. I will make an attempt to explore this issue here, focusing mainly on amber, inspired by Gell (1998) and Weiner (1992).

My argument on the social value of amber during the Jomon is founded on a few hypotheses concerning certain intrinsic properties of this material – especially in the realm of the visual and the tactile senses – which may have made it extra suitable as potential medium, imbued with social and/or cognitive 'agency' in the eyes of the Jomon foragers. Additionally, I will also take a brief look at the production and subsequent exchange of amber 'ornaments' during the Middle Jomon in the Central Honshu region, to see how they mediate social relations and local identities. The main focus area is the Pacific Coast area at Choshi Peninsula, Chiba prefecture, which is the location of the Choshi amber source. A very brief comparison is made with jade items, which originated in one small source/production area along the Hokuriku Japan Sea Coast and also entered wide distribution networks.

The main distribution areas under consideration are 1) the Central Mountain area, encompassing Nagano and Yamanashi prefectures; a mountainous area with high-quality obsidian sources; and 2) the Kanto Plains around present-day

Tokyo, covering Tokyo, Kanagawa and Chiba prefectures (fig. 1). The locations of Choshi source area and sites mentioned in the text are depicted on the map in figure 9.

2 Jomon environment, subsistence and social organization

With the recent publication of several excellent and extensive English-language syntheses on Jomon culture research (Habu 2004; Kobayashi 2004), the lavish Jomon data has become much more accessible to non-Japanese scholars.

Japan consists of four main islands (Hokkaido, Honshu, Shikoku and Kyushu), as well as many smaller islands including Okinawa. Due to its elongated shape, Japan covers various climate and vegetation zones, from sub-arctic to subtropical, from conifer to evergreen forests. Our target area, Central Honshu, has a temperate climate and deciduous broadleaf forests. A very mountainous country, there is a great deal of diversity in landscape, micro-climates and natural resources, even among nearby regions. Nevertheless, however isolated a community, long-distance contact and exchange of resources have always been a defining feature of Jomon society, as seen in the long history of long-distance distribution of exchange items like obsidian.

The Jomon period in Japan precedes the introduction of wet-rice cultivation, metallurgy, and social stratification from the mainland. Named after one of the earliest ceramic traditions in the world, with great spatial and temporal stylistic variation, the Jomon are often referred to as “affluent foragers” (*e.g.* Barnes 1993, 77) due to the diversity of their material culture. Subsistence was mostly based on hunting, fishing and gathering, seasonally exploiting different resources. Zooarchaeological analysis shows that hunters particularly favoured large mammals such as wild boar and deer. However, there is also scattered evidence for small-scale plant husbandry, notably cultigens such as bottle gourd, burdock, buckwheat, barley, barnyard millet, spicy herbs like shiso and egoma, and several species of beans (Habu 2004, 59). Throughout the period, the Eastern part of Japan was more densely populated than the West, probably due to a more productive and predictable ecosystem (Akazawa 1986).

2.1 Periodization

The Jomon is generally divided into six periods, based on distinct developments in overall pottery styles and technology (see table 1). Although the very earliest pottery, found in Northern Japan, was dated at 16,500 cal BP (*e.g.* Habu 2004, 28-32), such dates are still exceptional. Moreover, the results of calibrated dating in Japan are very controversial (Habu 2004, 37-41). The synthesis of the most recent dating analyses presented by Kobayashi (2008) is representative for the Jomon phases in Eastern Japan in general (which centres on Central Honshu Mountain area and the Kanto Plains around Tokyo). Being based on a limited number of samples, the dates remain of course approximate.

Period phase	data Kobayashi (2008)	BC
Incipient Jomon	15,700~11,600 cal BP	13,700~9600 cal BC
Initial Jomon	11,500~ 7000 cal BP	9500~5000 cal BC
Early Jomon	7000~ 5470 cal BP	5000~3470 cal BC
Middle Jomon	5470~ 4420 cal BP	3470~2420 cal BC
Late Jomon	4420~ 3220 cal BP	2420~1220 cal BC
Final Jomon	3220~ 2350 cal BP	1220~ 350 cal BC

Table 1 Chronology of Jomon Phases in Eastern Japan (after K. Kobayashi 2008, 896-903). The dates are calibrated AMS radiocarbon dates.

2.2 Middle Jomon subsistence and exchange

Tool composition in Central Honshu settlements during the Middle Jomon suggests that plant foods such as nuts and roots occupied a relatively important part of the diet, especially in the Inland Mountains area – an impression confirmed by isotope analysis on human bone collagen (Kobayashi 2004, 85). Although theories on ‘Jomon agriculture’ as an explanation for maintaining such a large population density during the Middle Jomon keep cropping up, there is no evidence for this yet, beyond the limited plant husbandry. I follow Barnes (1993, 80-90) in postulating the importance of elaborate exchange networks as an explanation for the Middle Jomon ‘affluence’. Although of course not limited to these areas, there appear to have been especially strong relations between the three major eco-zones of Central Honshu: the coastal area of Tokyo Plains Coast and Hokuriku Japan Sea Coast (providing marine products and bead stones like amber and jade, respectively) and the mountain area (nuts and obsidian for tools).

2.3 Jomon Society

Permanent settlements with pit dwellings surrounding a central open plaza with burial pits developed in most areas by the Early Jomon, and the Middle Jomon period in Central Honshu is characterized by a drastic and unprecedented increase in population density (archaeologically visible both in terms of settlement numbers, and house numbers), particularly during the latter half of this period (Imamura 1996, 93-96). It also has a very rich material culture, featuring regionally diverse styles of abundantly decorated ceramics, and an increase in the occurrence of various presumably ceremonial paraphernalia, including anthropomorphic clay figurines (*e.g.* Kaner 2009; Bausch 2010b) and stone phalli, as well as a marked increase in the production and circulation of jade and amber ornaments.

Apart from the occasional occurrence of (very small quantities of) jade and amber at large-scale long-term settlements, there is no variability in burial goods or in the size and location of burials and houses. Archaeologists generally agree that there was no significant institutionalized social stratification during the Middle Jomon, but that people with special skills, such as religious experts and hunters, may have had distinguished social roles (*e.g.* Habu 2004, 138). However there is some discussion about the development of social complexity. Using ethnographic parallels of strongly hunting-oriented societies like the First Nations of the American Northwest Coast and the Ainu people from Hokkaido, Watanabe (1990) has postulated some degree of hereditary social differentiation in favour of hunters in Northern Japan, based on occupational differentiation during the Later Jomon period. Moreover, on the basis of a statistical study on the presence of grave goods in burial contexts through time, Nakamura (2000) suggests a slight increase in social differentiation during the Late and Final Jomon, particularly in Northern Japan, where "precious ornaments" were found in the burials of children. However, Pearson (2007) finds no evidence of ascribed social hierarchy in Jomon Japan; instead he observes that due to the spatially heterogeneous resource distribution, landscape elevation and subsequent "packing", no single group could monopolize resources, having had to rely on exchange and solidarity in order to ensure their access to resources. He explains the occurrence of "luxury goods" such as fine pottery and ornaments as part of the creation of social networks through gift exchange (Pearson 2007, 382), rather than signalling personal status and identity. However, I would suggest that such gifts gain more 'biography' through exchange, and conversely may also confer identity upon the recipient.

3 The 'social agency' of exotic objects

I would argue that both jade and amber have several intrinsic, unique qualities which would make them a suitable vessel for social identities and cognitive projections. However, these properties are quite distinct, and in some ways perhaps even complementary. There is no scope in this paper to deal in detail with the social role of jade (but see Bausch 2004; 2005; 2010a).

3.1 The physical qualities of amber

Amber, an organic material consisting of fossilized pine resin, occurs as irregular nodules in recent sediments deposited under estuarine (shallow water) conditions. Inclusions of flora and fauna (*e.g.* the famous insects) or inorganic matter: minerals, liquids and gasses are fairly rare. Amber can be found worldwide; the best-known sources with a long history of exploitation include the Baltic, Rumania and Sicily in Europe, and Burma, Mexico and the Dominican Republic (Fraquet 1987, 2-3). The oldest amber use in Japan is during the Palaeolithic in Hokkaido (Noshiro 2004, 40), but its use in the Central Honshu area started in the Early Jomon, and reached its peak during the Middle Jomon.

As an organic material, amber is comparatively very soft (and brittle); its hardness on Mohs' Scale is *c.* 2.0~2.5. (In fact, this probably is one of the main reasons why so few objects are recovered archaeologically, let alone in an undamaged state). Moreover, with a very low Specific Gravity ('density') of *c.* 1.1, it is a remarkably light material – light enough to be easily transported by water.

Optically, the material is very striking. Its visual appearance may also be described as 'lively': amber can be clear or opaque ('cloudy'), and potentially its colours range from almost colourless, a variety of yellow, gold-brown and reddish-brown shades, to deep red and even (almost) black. At the Choshi source, transparent amber with golden- or reddish-brown shades is most common. The examples in figure 2 (from Awashimadai itself) and figure 3 (from recipient Sakai A site) are golden-brown and a dark red (the colour of dried blood – although it is possible that the colour darkened due to erosive processes) respectively.

Very distinctive tactile properties are the facts that amber feels warm to the touch, and may attract small objects through static electricity when rubbed. Both phenomena are caused by the very low thermal and electrical conductivity of amber – hence the fact that the word 'electricity' originated from the Greek name for amber, *electron* (Fraquet 1987, 1-2).

Finally, when heated, amber emits a scent – a characteristic unique to living organisms like animals, people and plants, not to 'lifeless' objects.

To me, the combined visual and tactile properties are very evocative, imbuing amber items with an almost 'alive', zoomorphic quality. It is not impossible that such characteristics also presented a unique appeal to a certain category of the Jomon people, and may have allowed them to project certain 'psychological intentionality' onto such items (*sensu* Gell), reflecting their cognitive understanding of the world. Of course, this is speculation, but below I will present some arguments for a possible interpretation as 'hunting amulet', as well as an emblem of more personal as well as interpersonal identity, based on both the circumstances at the Awashimadai production site, and some of its recipient site contexts.

3.2 Amber sources

In Japan, there are only three active amber source areas in the Middle Jomon period, all along the Pacific Coast of Eastern Honshu. The largest one (past and present) is located about 500 km north of Tokyo, in north-eastern Honshû near

Figure 2 Amber from Choshi source, found at the Middle Jomon amber processing site of Awashimadai, Choshi Peninsula, Chiba Prefecture. Figure 2a shows an amber fragment; Figure 2b an unfinished ornament which broke during the hole-drilling stage. (Photograph taken by Junzo Uchiyama, at the Chiba Prefectural Archives).

Figure 3a and b Two angles of a broken amber bead (probably produced at Awashimadai), that was surface-collected at the jade-producing site Sakai A at the Japan Sea CoaSt. Note the reddish colour. (Photo taken by Ilona Bausch, at the Toyama Prefectural Archaeology Centre).

Kuji, Iwate prefecture. The second amber source is Iwaki in Fukushima prefecture (*c*. 200 km north of Tokyo), while the third, Choshi – the focus of this paper – is located off the tip of Choshi Peninsula, Chiba prefecture, within a distance of 100 km from Tokyo, and is indicated by the star in figure 9).

Sourcing amber artefacts to their original source remains problematic. Theoretically, amber from different source areas can be distinguished through chemical analysis of its components – Infrared Absorption Spectrum analysis – since 1974 (Matsushita 1995, 194), but in practice such analysis is rarely carried out. Moreover, there are many problems with unreliable sourcing results, due to the organic nature of the material (*e.g*. Yoshioka 2003; Noshiro 2004). Nevertheless, the picture emerging from the few available source analyses indicates that from the Middle Jomon onwards, there are two main distribution spheres. The Kuji source supplied northern Japan, with production increasing from the late part of the Jomon onwards, while the Choshi source predominantly supplied Central Honshu, and appears to have been most heavily used during the Early and Middle Jomon periods (Yoshioka 2003, 246-7). Therefore, in this paper it will be assumed that a majority of the amber found in Central Honshu was derived from the Choshi source.

Figure 4 A modern view of the 'Amber Coast', Choshi Peninsula, Chiba prefecture.

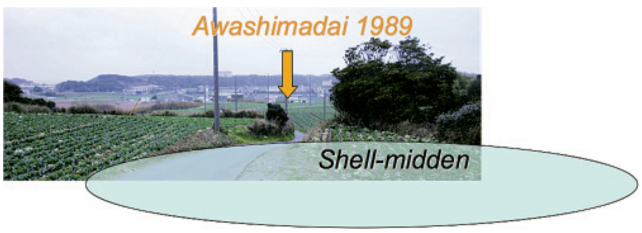


Figure 5 The modern location of Awashimadai 1989 (Photograph by Junzo Uchiyama). Foreground: area with the shell midden; down the terrace at the bottom the deposit with animal bones, amber and lackered pottery.

Because the outcrop of the Choshi amber is located in sediments just off the coast, small pebbles are usually eroded and transported to the beach – jokingly referred to by mineralogists as the 'Amber Coast' (fig. 4). During spring and summer, larger pieces could – in the past – be collected from the sediment at low tide (Yamada 2000, 394-395). This source is located at a distance of about 2.5 km from the Jomon period production site Awashimadai (fig. 5) which will be described later. It is very likely that the source of the amber was jealously kept secret from 'outsiders' by those who exploited them; possibly a group of hunters based near the source area, as I will argue later, with the example of the Awashimadai site near Choshi.

4 The Choshi 'Amber Coast' production

So far, the only known Choshi amber processing site that has yielded evidence of all stages of bead production (plus the appropriate manufacturing tools) is Awashimadai site on the Choshi Peninsula, at the Pacific Coast, *c.* 100 km east of Tokyo.

4.1 Special activity deposits

This site complex consists of a larger residential site with an Early Jomon house and a small Middle Jomon shell midden on top of a terrace, with several smaller affiliated sites nearby (see fig. 5). The section excavated in 1989 is an early phase Middle Jomon lowland peat waterlogged site, comprising a special activity site, with evidence of both hunter-related activities and amber ornament production. Despite its small size, this deposition area contained unprecedented quantities of amber, including half-finished items, cores and flakes (figs 6a and b); tools, finely crafted Middle Jomon lacquered ceramics (fig. 7); an abundance of animal bones (particularly the Sika Deer; fig. 8); and bone pendants and spears (Awashimadai Site Excavation Group 1990). In his analysis of the faunal remains, Uchiyama (1996; 1999) found that the site was only used from spring to summer, and postulated its use as a seasonal deer hunting camp.

Amber production evidence contained various 'failures' due to its brittle nature, also including various roughly shaped half-finished items with multiple attempts at drilling. It has been suggested that these multiple attempts on a single piece are an indication of the scarcity and value of amber as a material (Naumann 2000, 54). Alternatively, such 'failures' could also have been re-used for practice or teaching purposes. The forms of Middle Jomon amber ornaments (in so far as they have been well preserved) appear to be far more diverse than those of contemporaneous jadeite pendants, and also less 'processed'. Middle Jomon amber pendants also appear to be generally smaller in size than jades: even the larger amber pendants are usually less than five centimetres long.

Interestingly, all these deposits were associated with Middle Jomon pottery; moreover, they were not associated with any nearby contemporaneous domestic context. Most amber was recovered from a slope and a lowland special activity spot (which, as pointed out by Uchiyama 1999, was strongly related to hunting and butchering activities). Both these findings suggest that a large proportion of amber production evidence at Awashimadai remains yet to be discovered; and that at this point it is difficult to infer the temporal and spatial scale of amber production.

It is tempting to assume that the same people were responsible for the butchering evidence and the amber production. The presence of the finely crafted ceramics suggests that this deposition area was not a mere waste area, but that ceremonial practices (possibly involving both amber and animal remains) may also have been carried out, implying a hunting-related ritual.

Located in a relatively flat and open part of Japan, this site was located in the immediate vicinity of the Pacific Ocean, with the availability of a great variety of marine resources:

Figure 6a Evidence of amber processing at Awashimadai 1989: a sample of cores, flakes and unfinished ornaments. (Photograph courtesy of Choshi Municipal Board of Education 2000, colourplate 159).

Figure 6b A close-up of one of the discarded unfinished pendants, showing two drilling holes. (Photograph taken by Junzo Uchiyama, at the Chiba Prefectural Archives).

shellfish, fish (including the large and nutritious salmon and trout), and sea mammals. Moreover, luscious deciduous forests ensured the availability of both plant foods and large hunting game such as boar and deer. Strangely, evidence of marine resource consumption is relatively scarce (Uchiyama 1996). Moreover, since deer and boar meat appears to have been the preferred source of protein, it is possible that the hunting activity was a conscious choice, and an important aspect of the personal identity. Part of this may be based on cultural preferences for meat over fish; but the hunting of large mammals may also have been seen as a more dangerous 'masculine' activity, conferring peer group status as well as social prestige. For example, ethnographic records describe how in the Ainu society in Hokkaido, prestige hunting of dangerous game was intricately linked with the privilege of carrying out rituals that mediated supernatural power (Watanabe 1973).

4.2 The agency of the hunter-artisan-trader?

Based on the associated faunal evidence and possibly ritual evidence of the lacquered pottery, Uchiyama (1996, 42) has suggested that Awashimadai site amber production discovered so far may have represented the seasonal activities of a small group of rather prestigious, specialized game hunters, who also engaged in part-time amber production and perhaps even managed the amber resources. The discovery of a completed amber pendant (albeit surface-collected) at another section of the Awashimadai site implies that the producers also did use the ornaments themselves. Since the establishment of exchange relations as a socio-economic 'safety net' does not seem to be the primary reason behind the production and circulation of amber ornaments, the motivation may have differed from that of the Jadeite Coast. Uchiyama and Bausch (2010, 93) have postulated that "amber ornaments may have functioned as special hunting amulets made by and exchanged among hunters along long distances." In this scenario, the amber pendants may have been carried as emblems of personal 'hunter' identity by the Awashimadai hunters and given as tokens of friendship in exchange to other hunter groups, thus possibly acquiring hunting rights in alien territories.

Interestingly, the exchange of distinctive amber artefacts as way of forging long-distance relationships between prestigious hunters has also recently been proposed in the case of Mesolithic Scandinavia (*e.g.* Nash 1998), a region with a subsistence base very similar to that of the Jomon in Japan. As several of the beautifully worked Mesolithic Scandinavian items – derived from the Baltic amber source – were manufactured in the form of game animals (fowl, deer, etc.), they are often interpreted as hunting amulets. Indeed, as has been tentatively suggested above, perhaps the particular 'dynamic' qualities of amber make it especially suitable as a 'hunting amulet': its specific colouring (various hues of gold-brown, sometimes with a reddish tinge), its lack of weight (so light it can float), its electricity (attracting small objects), and its warmth to the touch – almost as if 'alive'.

Figure 7 Finely crafted lacquered piece of ceramics (outside and inside) found at Awashimadai (Photograph courtesy of Choshi Municipal Board of Education 2000, colourplate 145, nr 24).

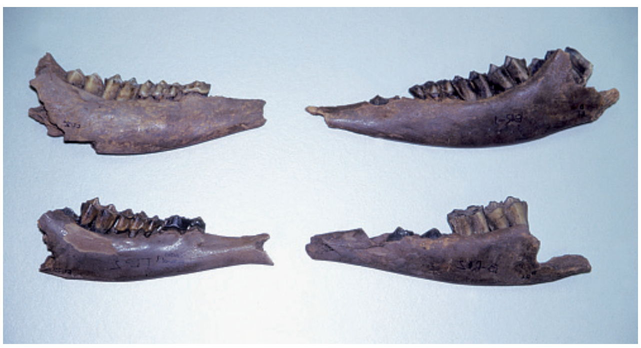


Figure 8 *Sika* deer bones found at Awashimadai 1989. (Photograph taken by Junzo Uchiyama, at the Chiba Prefectural Archives).

Unfortunately no nearby settlement or cemetery has been found, so amber cannot be directly associated with individuals, nor can a gender analysis be carried out. Theoretically, it is possible that the amber ornament was a female ornament, but considering the find context together in relation to physicality of amber and crudeness of form, this is less likely. Furthermore, we also suggest the possibility that hunters as a specialized sub-group within Middle Jomon communities may have engaged in long-distance trade activities themselves, on the premise that specialized hunters may frequently travel beyond the boundaries of the known world and have the social prestige and esoteric skills to do so (cf. Helms 1993, 74-75; Uchiyama and Bausch 2010, 95).

4.3 Awashimadai 'imports'

So far, a tentative case has been made for the hypothesis on the social identity of the amber ornament producers, based on circumstantial evidence. However, further types of evidence might provide a further argument in its support – for example, if exchange items related to hunting attributes (*e.g*. obsidian, arrowheads) were to be present in associated contexts at both production and distribution sites. According to the Awashimadai site reports, indeed a considerable quantity of obsidian – a material highly suited for arrowheads – was found at the Awashimadai site. Although a very small quantity was derived from the high-quality 'Shinshu' obsidian source in the proximity of Suwa Lake area (one of the core Middle Jomon areas, with very high population densities, where relatively many amber ornaments are distributed), the majority of the samples were sourced to another important obsidian source: Kozu Island, one of the Izu islands in Tokyo Bay (Choshi Municipal Board of Education 2000, 435-439).

Of course, there may be an as yet undiscovered village nearby, which was settled throughout the year, and where amber processing activities were also performed. If so, the possibility exists that production was not monopolized by a specific occupational group (or gender), but carried out by a larger village group. Moreover, it is also possible that access to amber was free instead of regulated by a specific group; the Choshi source location was not particularly inaccessible for people with boats. However, preliminary research supports the 'hunter amulet' hypothesis.

5 Amber recipient sites

Examples of 'recipient' sites may offer a further clue. Although the occurrences of amber are much scarcer due to bad preservation, as the percentages in table 2 show, both jade and amber are distributed in the same areas in Central Honshu, notably at Central Mountain area where the ornaments are usually found inside burials. However, although the distribution area of amber ornaments frequently overlaps with that of jades, and even frequently occurs at the same site, the exact contexts are different, as will be argued below.

5.1 Amber distribution in Central Japan

Figure 9 shows a distribution map by Kurishima (2012, 11), with drawings representing the variety in size and shape

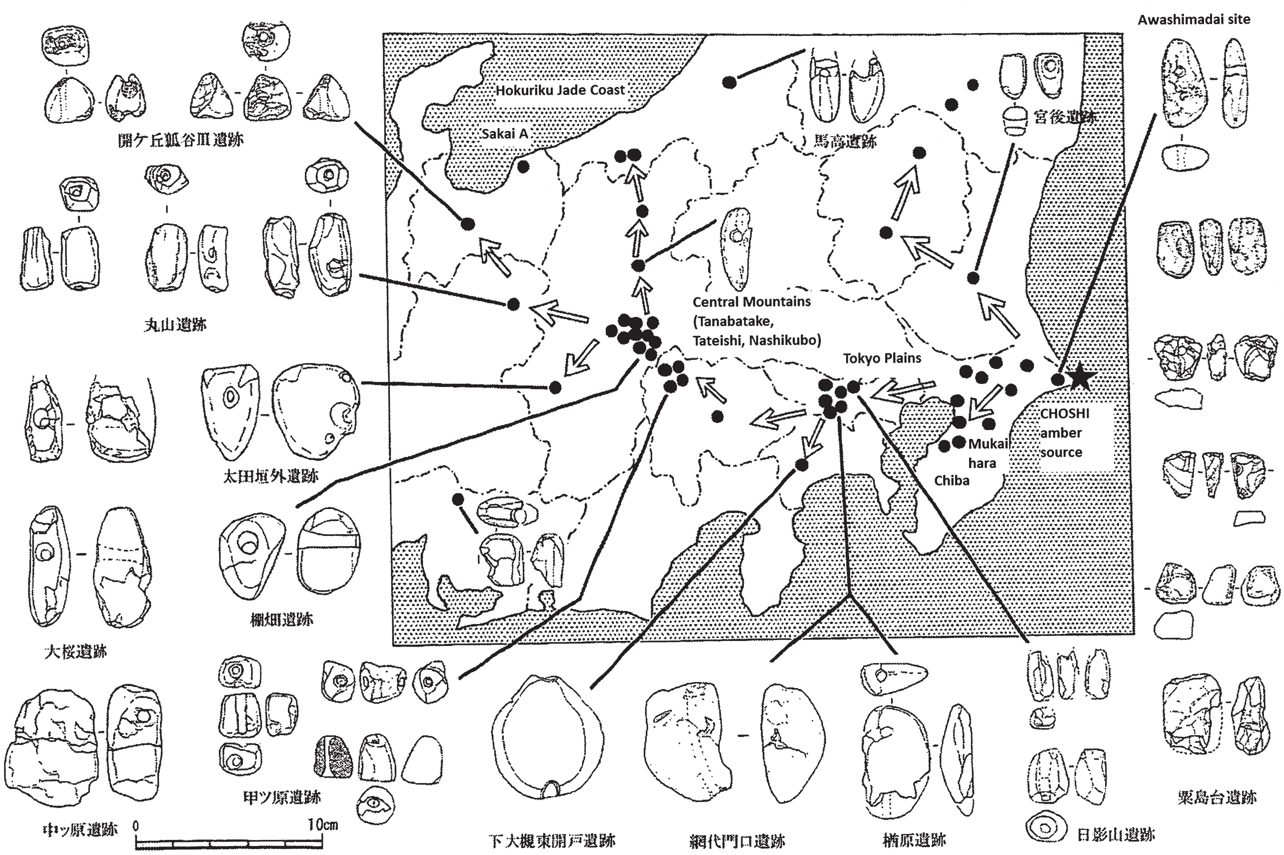


Figure 9 Distribution map of amber in Central Japan (Taken from Kurishima 2012, 11). The Choshi source is indicated with a star; the locations of the sites mentioned in the text are also indicated.

Central Honshu Region	Sites with Amber	Sites with Jade
Chiba Pacific Coast (Chiba; amber source)	12 (29%)	20 (11%)
Tokyo Plains (Tokyo and Kanagawa)	7 (17%)	29 (16%)
Central Mountains (Nagano and Yamanashi)	18 (43%)	80 (44%)
Hokuriku Japan Sea (Toyama and Niigata; jade source)	5 (12%)	54 (30%)
Total sample	42 (100%)	183 (100%)

Table 2 Distribution per region: numbers of distribution sites with Middle Jomon amber (after Kurishima 2012, 11) and jade (after Takahashi 2005, 42-54)

among the distributed amber ornaments. The distance from Awashimadai to the Tokyo Plains sites was *c.* 150 km; to the Suwa Lake sites in the Central Mountain area *c.* 250 km, and further north *c.* 350 km; Kurishima also notes that the sizes of many increase with distance from the source (ibid. 10). This is indeed significant, since it does imply that amber played a prestigious role as a ceremonial gift, objectifying social relations with members of more distant but influential communities (who may or may not have been directly linked with hunters). From the illustrations (fig. 9) it also becomes clear that there is no ‘standardization’ in processing shape; aesthetic appeal was not the first requirement.

Figure 10 An example of a Middle Jomon site in the Central Mountain area which featured both jade pendants and a piece of amber: Tateishi site, Nagano Prefecture. (Photograph taken by Ilona Bausch, at the Togariishi Site Museum, Nagano prefecture).

5.2 Hunter exchange

In the case of amber gift recipients, it is remarkable that they are often based at settlements which are potentially relevant for hunters (Bausch 2004). This is manifested in various ways. First, amber distribution frequently seems associated with the proximity of high-quality obsidian sources. For example, large-scale settlements in the Central Mountains such as the Nashikubo, Tanabatake and Tateishi sites near Suwa Lake (Nagano prefecture) exploited and processed large quantities of the local high-quality obsidian source (Nashikubo Site Research Group 1985; Tanabatake Site Research Group 1990). At many Suwa Lake sites, jades and amber ornaments are both found at the site (see the ornaments from the Tateishi site in figure 10) – but interestingly, never in the same burial, indicating that the social identities of the two were unrelated.

Furthermore there is also an example of a distributed amber ornament at the Izu Islands, *c.* 150 km distant from Kozu Island, which is another regional source with widely-distributed, high quality obsidian: "Amber believed to be from the Choshi source was found on Kurawa site on Hachijo Island, one of the more distant Izu Islands – *c.* 300 km from Choshi-city area. This amber consists of small beads, and was found in burial pits belonging to the final part of the Early Jomon until the start of the Middle Jomon" (Gomi 1993, 15). This indicates that the exchange relation with this island chain may have existed since before the start of the Middle Jomon.

Amber distribution within Chiba was very dense. Closer to Awashimadai (*c.* 50 km away), a small settlement, the Mukaihara site in Chiba, featured only a few pit dwellings, but yielded a remarkably high quantity of arrowheads, as well as an amber ornament. This site is usually interpreted as a specialized arrow production site, because of the enormous quantities of debitage and unfinished arrowheads (Chiba Prefectural Centre for Cultural Properties 1989).

5.3 The agency of amber

Finally, unlike jade ornaments, amber is almost exclusively deposited in burial contexts, giving a stronger indication that the amber was linked to the personal identity of the recipient. Unfortunately, no associated bones have been recovered in Central Honshu burials so far; therefore there is no available information on gender. Moreover, during the Middle Jomon, arrowheads were apparently not considered as suitable grave goods, so the burial context offers no further clue to the social identity of the amber owner. The evidence for the speculation that amber owners may have been connected with a subgroup of hunters is strictly circumstantial.

However, I believe I have presented several arguments to support the hypothesis that amber pendants may have been produced and exchanged by and between members of a specific occupation, namely hunters. Perhaps such amber pendants had multiple identities too; they may have functioned as an amulet of sympathetic magic (cf. Gell 1998) to ensure a good hunt; worn as a badge of hunter personal identity, and occasionally functioned as a kind of 'passport' membership token among a group of (probably intercommunal) peers, probably paving the way towards establishing relations between different groups of hunters, enabling the exchange of important information about game migrations, of stone materials for making arrowheads, or permission for visiting hunters to temporarily use one's own hunting grounds. As described above, in Central Japan circulation appears to have taken place especially towards the end of the Early Jomon and during the earlier part of the Middle Jomon. This is consistent with the fact that hunting still played a vital role then, while during the latter half of the Middle Jomon the explosive population growth in Central Japan led to a greater nutritional dependence on plant foods. This subsistence shift is reflected in the composition of the tool kit at the sites; the percentage of plant processing tools increased drastically, at the expense of hunting evidence like arrowheads and pit traps (Imamura 1996, 90).

5.4 Jade agency

Conversely, this subsistence shift may also be the reason that the circulation of jadeite pendants started to expand strongly from the Middle Jomon onwards. From the middle phase onwards, jadeite pendants start to appear more frequently at Central Japanese sites. In earlier papers (Bausch 2004; 2010a) I have argued that the middle phase – the start of the population growth – was the time for creating long-distance exchange relations; large jadeite pendants were passed on between 'linked' settlements.

Although the exact meaning of these pendants is of course unknown, it is possible that these were valued – on the basis of characteristics such as green colour and durability – as regenerative amulets, transmitted through generations with a communal identity as inalienable good representing a settlement, perennially stimulating the natural environment, particularly the flora. The new trend to deposit jadeite large pendants in mortuary contexts, which took place during the late phase of the Middle Jomon in the Suwa Lake/Central Mountain area in particular, may perhaps be interpreted in the context of ecological deterioration. It is possible that these burial contexts represent attempts by over-large settlements to ritually cultivate exchange relations with the 'other world'; a kind of sacrifice of a valued object in order to halt the decline of their main subsistence base – plant foods (Bausch 2004; 2010a). In any case, after the Middle Jomon the occurrence of amber also sharply decreased – perhaps due to a change in social value, or lack of access to the material.

6 Conclusion

It has been suggested that both jadeite and amber were used for the creation and maintenance of long-distance exchange relations, and simultaneously conferring an identity on both the producers and the recipient. These relations were necessary for creating a context for other forms of exchange, such as artefacts, marriage partners, information – and access to important subsistence resources in other territories, be these plant foods, obsidian or hunting rights. Such wide-ranging contacts were essential for survival in the Jomon world.

Currently, there is an increasing awareness of the cultural importance of Jomon finds in Japan, at several levels. In academic circles, conferences and publications on jade (and to a lesser degree, amber) have increased in the last decade. At local and national government levels, awareness of the importance of heritage management, and increase of public interest and pride in the Jomon Culture as part of national history, has led to the protection of both material culture and landscape. The Cretaceous formations at Choshi in Chiba, which contain the amber source, have recently been named Natural Monuments (Noshiro 2004). The jadeite outcrops at the mountains in Omi in Niigata have been declared National Monuments, as well as – very recently – the jadeite production sites of Sakai A and Teraji, including their entire collection of finds. These objects are now admired by the general public, who travel far to visit special exhibitions at museums. So, in the spirit of Gosden and Marshall (1999), the Jomon ornaments, production sites and their source areas have been revived, and provided with a new, different social value, are still connecting people through time and space, and possibly conferring a new social identity.

Acknowledgements

I started this research during my PhD in Durham, and owe great thanks to my former mentor Gina Barnes for her advice. Without Junzo Uchiyama and the NEOMAP project in the Research Institute of Humanity and Nature in Kyoto I would not have been able to continue this research. I owe him a great debt of gratitude for the chances to continue visiting my research area, and especially for his ongoing encouragement and advice – which are priceless. My fellow NEOMAP members such as Carlos Zeballos Velarde and Oki Nakamura have done a great deal of work on the maps, and have encouraged me throughout the existence of the NEOMAP project. Thanks to NEOMAP I was able to visit a great many archaeological institutes in Japan during my yearly visits. Among those, I especially would like to thank Masatoshi Kishimoto and Masatoshi Yamamoto of the Archaeological Institute of Toyama Prefecture, for welcoming me during my frequent research trips, and showing me the precious Sakai A collections again and again, for permission to take photos and especially for their patience and kindness in answering my many questions. Furthermore, the archaeological institutes at the Chiba Prefectural Archives (which keeps Awashimadai finds); Togariishi Museum in Nagano Prefecture; Rebun Island, Hokkaido; and the Archaeological Institute at Tokyo also kindly showed their collections, answered my questions and gave permission to take photographs. I owe them all great thanks, particularly to Katsuhiko Yamada at the Chiba Archives.

Finally, I would like to thank my colleagues at Leiden University, particularly David Fontijn and John Bintliff, for their ongoing support and discussions on archaeological topics. Last but not least, Corrie Bakels and Hans Kamermans kindly invited me to submit my article; I owe them a great debt of gratitude for their encouragement, advice and especially patience.

References

Akazawa, T. 1986. Hunter-gatherer adaptations and the transition to food production in Japan. In: M. Zvelebil (ed.), *Hunters in Transition*, Cambridge: Cambridge University Press, 151-166.

Appadurai, A. 1986. Introduction: commodities and the politics of value. In: A. Appadurai (ed.), *The Social Life of Things*. Cambridge: Cambridge University Press, 3-63.

Awashimadai Site Excavation Group (Awashimadai Iseki hakkutsu chosakai) (eds) 1990. *Choshi-shi Awashimadai Iseki Hakkutsu Chosa Hokokusho—supa-ma-ketto kensetsu ni* *tomonau maizobunkazai hakkutsu chosa [Choshi-city Awashimadai site report: the report of the excavation prior to the supermarket construction]*. Choshi: Awashimadai Site Research Group.

Barnes, G.L. 1993. *China, Korea and Japan: The Rise of Civilization in East Asia*. London: Thames and Hudson.

Bausch, I.R. 2004. *Jade, Amber, Obsidian and Serpentinite: the social context of exotic stone exchange networks in Central Japan during the Late Middle Jomon period,* Durham (unpublished Ph.D. thesis University of Durham).

Bausch, I.R. 2005. Some considerations on Jomon serpentinite polished adze and jadeite ornament production sites along the Japan Sea Coast. *Bulletin of the International Jomon Culture Conference* 1, 15-24.

Bausch, I.R. 2010a. Jade Landscapes: changing social values of jade in Jomon Japan. In: Neomap Project (ed.), *Studies of Landscape History on East Asian Inland Seas*, Kyoto: Research Institute for Humanity and Nature, 57-68.

Bausch, I.R. 2010b. Fragmentation Practices in Central Japan: Middle Jomon Clay Figurines at Shakado. In: D. Gheorghiu and A. Cyphers (eds), *Zoomorphic Miniature Figures in Eurasia, Africa and Meso-America. Morphology, materiality, technology, function and context*, Oxford: Archaeopress, 99-112.

Chiba Prefectural Centre for Cultural Properties [Chiba-ken Maizo Bunkazai Senta] (ed.) 1989. *Sakura-shi Mukaihara Iseki—Sakura Daisan Kogyodanchi dosei ni tomonau maizobunkazai hakkutsu hokukusho 6 [Sakura-city Mukaihara site: Site report of the excavation prior to the road works at Sakura Daisan, report no. 6]*. Sakura: Chiba-ken Kyoikuiinkai.

Choshi Municipal Board of Education [Choshi-shi Kyoikuiinkai] (eds) 2000. *Awashimadai iseki—Choshi-shi Awashimadai iseki 1973 & 1975nen no hakkutsu chosa hokokusho* [*Awashimadai site—the extensive report of the 1973-75 excavations*]. Choshi: Choshi Municipal Board of Education.

Fontijn, D.R. 2002. *Sacrificial Landscapes: Cultural biographies of persons, objects, and 'natural' places in the Bronze Age of the southern Netherlands, c. 2300—600BC*. Leiden (Analecta Praehistorica Leidensia 33/34).

Fraquet, H. 1987. *Amber*. London: Butterworth ((Butterworths gem books).

Gell, A. 1998. *Art and Agency: an Anthropological Theory*. Oxford: Oxford University Press.

Gomi, S. 1993. Kohakusei suishoku ni tsuite [Concerning the amber pendants]. In: S. Yamamoto and S. Gomi (eds), *Yamanashiken Kitakyoma-gun Oizumi-mura Kabutsuppara iseki gaiho, 4th chosa* [*Site Outline of the 4th Survey of Kabutsuppara site, Oizumi, Kitakyoma, Yamanashi prefecture]*, Nakamichi: Yamanashi Board of Education, 15.

Gosden, C. and Y. Marshall 1999. The cultural biography of objects. *World Archaeology* 31, 169-178.

Habu, J. 2004. *Ancient Jomon of Japan*. Cambridge: Cambridge University Press.

Helms, M. 1993. *Craft and the Kingly Ideal. Art, trade and power*. Austin: University of Texas Press.

Hoskins, J. 2006. Agency, Biography and Objects. In: C. Tilley, W. Keane, S. Küchler, M. Rowlands and P. Spyer (eds), *Handbook of Material Culture*, London: Sage, 74-84.

Howes, D. 2006. Scent, Sound and Synaesthesia: intersensoriality and material culture theory. In: C. Tilley, W. Keane, S. Küchler, M. Rowlands and P. Spyer (eds), *Handbook of Material Culture*, London: Sage,161-173.

Imamura, K. 1996. *Prehistoric Japan: new perspectives on insular East Asia*. London: UCL Press.

Kanayama, Y. 1998. Shurakukan no koryu to koeki [Exchange and trade between settlements]. *Kikan Kokogaku* 64, 59-63.

Kaner, S. (ed.) 2009. The Power of Dogu: ceramic figures from ancient Japan. London: The British Museum Press.

Kobayashi, K. 2008. Jomon doki no nendai (higashi Nihon) [The periodization of Jomon Pottery (East Japan)]. In: T. Kobayashi and the Publication Committee of the Handbook of Jomon Pottery (eds), *Soukan Jomon Doki [Handbook of Jomon Pottery]*, Tokyo: UM Promotion, 896-903.

Kobayashi, T. 2004. *Jomon Reflections. Forager life and culture in the prehistoric Japanese archipelago*. Oxford: Oxbow Books.

Kopytoff, I. 1986. The cultural biography of things: commoditization as process. In: A. Appadurai (ed.), *The Social Life of Things*, Cambridge: Cambridge University Press, 64-91.

Kosugi, Y. 2003. Seigyo to shite no koeki katsudo [Reevaluation of the exchange of goods in the Jomon period as a subsistence activity]. *Kokogaku Kenkyu* 50/2, 10-29.

Kurishima, Y. 1985. Kogyokusei taishu no kodai na bunpuken [The wide distribution sphere of jadeite large beads]]. *Kikan Kokogaku* 12, 39-42.

Kurishima, Y. 2012. Kohaku no riyo to Jomon Shakai: Awashimadai iseki to kohaku [The use of amber and Jomon society: Awashimadai site and amber]. *Kokogaku Jaanaru* 627, 8-12.

Malinowski, B. 1922. *Argonauts of the Western Pacific: an account of native enterprise and adventure in the archipelagoes of Melanesian New Guinea*. London: Routledge.

Matsushita, W. 1995. Kohaku [Amber]. In: S. Kato, T. Kobayashi and T. Fujimoto (eds), *Jomon Bunka no Kenkyu vol. 8, Shakai to Bunka [Studies of the Jomon Culture vol. 8: Society and Culture]*, Tokyo: Yuzankaku, 193-204.

Mauss, M. 1925. *The Gift: forms and functions of exchange in archaic societies*. London: Routledge & Kegan Paul.

Nakamura, O. 2000. Saishu shuryomin no fukuso koi—Jomon bunka [The burial traditions of hunter-gatherers: the Jomon culture]. *Kikan Kokogaku* 70, 19-23.

Nash, G. 1998. *Exchange, Status and Mobility: Mesolithic portable art of southern Scandinavia*. Oxford: British Archaeology Reports (BAR International series no. 710).

Nashikubo Site Research Group [Nashikubo Iseki Chosadan] (ed.) 1985. *Nashikubo iseki—chubu sangakuji no jomonjidai shurakushi—Nashikubo iseki 5~11 hakkutsu chosa hokokusho. [Nashikubo site: Jomon settlement site in the Chubu mountains, report of Nagano Pref. Okaya-city Nashikubo site excavations no. 5-11]*. Okaya: Okaya-shi Kyoikuiinkai.

Naumann, N. 2000. *Japanese Prehistory. The material and spiritual culture of the Jomon period*. Wiesbaden: Harrassowitz Verlag.

Noshiro, Y. 2004. Kohakudama [Amber beads]. *Kikan Kokogaku* 89, 40-42.

Pearson, R. 2007. Debating Jomon social complexity. *Asian Perspectives* 46, 361-388.

Strathern, M. 1988. *The gender of the gift*. Berkeley: University of California Press.

Takahashi, K. (ed.) 2005. *Hisuiseihin no ryutsu to koeki keitai ni kansuru keizai kokogakuteki kenkyu [Economic Archaeology Research concerning the circulation and trade aspects of jade objects]*. Toyama: Toyama University Humanities Faculty *(Research report topic no. 15720180)*.

Tanabatake Site Research Group [Tanabatake Iseki Chosadan] (ed.) 1990. *Tanabatake—Yatsugadake seisanroku ni okeru Jomonjidai Chuki no shuraku iseki [Tanabatake site: Late Middle Jomon settlement site at the foot of the Western Yatsugadake mountains]*. Chino: Chino-shi Kyoikuiinkai.

Teramura, M. 1995. *Nihon no hisui—sono nazu wo saguru [Japanese Jade—exploring its riddles]*. Tokyo: Yoshikawa-kobunkan.

Uchiyama, J. 1996. *From Jomon to Star Carr. Comparative reconsideration of Star Carr with new zooarchaeological evidence from Jomon Japan and recent research in the Vale of Pickering*, Durham (unpublished MA thesis University of Durham).

Uchiyama, J. 1999. Seasonality and Age Structure in an Archaeological Assemblage of Sika Deer (*Cervus nippon*). *International Journal of Osteoarchaeology* 9, 209-218.

Uchiyama, J. and I.R. Bausch 2010. Beyond the Landscape of "Affluent Foragers": the role of long-distance trade among complex foragers. In: Neomap project (ed.), *Studies of Landscape History on East Asian Inland Seas*, Kyoto: Research Institute for Humanity and Nature, 91-98.

Watanabe, H. 1973. *The Ainu Ecosystem: Environment and Group Structure*. Washington: University of Washington Press (American Ethnological Society Monograph 54).

Watanabe, H. 1990. *Jomonshiki Kaisoka Shakai [Jomon Stratified Society]*. Tokyo: Rokko.

Weiner, A. 1992. *Inalienable Possessions: the paradox of keeping-while-giving*. Berkeley: University of California Press.

Yamada, K. 2000. Choshi-shi no kohaku gensanchi [The amber source area of Choshi-city]. In: Choshi-shi Kyoikuiinkai [Choshi Municipal Board of Education] (ed.), *Awashimadai iseki—Choshi-shi Awashimadai iseki 1973 & 1975nen no hakkutsu chosa hokokusho* [*Awashimadai site—the extensive report of the 1973-75 excavations*], Choshi: Choshi-shi Kyoikuiinkai, 394-398.

Yoshioka, H. 2003. 504ji chosa SK2509J doko shutsudo no kohaku ni tsuite [Concerning the amber found in Pit no. 2509J during the 504th survey of Musashino Kokubunji site]. In: Kokubunji Site Excavation Group (ed.), *Musashino Kokubunjiseki Hakkutsu Chosa Gaiho 29 [Musashino Kokubunji site Excavation Outline 29]*, Tokyo: Kokubunji-shi Kyoikuiinkai, 236-247.

Young, D. 2006. The colour of things. In: C. Tilley, W. Keane, S. Küchler, M. Rowlands and P. Spyer (eds), *Handbook of Material Culture*, London: Sage, 173-185.

Ilona Bausch
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
i.r.bausch@arch.leidenuniv.nl

Workshop sites in a Neolithic quarry landscape (Geul valley, Southern Limburg, the Netherlands)

Alexander Verpoorte

A sample of Middle Neolithic workshop sites from Southern Limburg (the Netherlands) indicates the exploitation of mined Valkenburg flint for the production of axes. The paper addresses the geography of production through an analysis of the composition of survey material. The workshops are discussed with respect to settlement activities and the ordered use of the landscape.

1 Introduction

This contribution describes a small collection dominated by so-called Valkenburg flint from Limburg, Southern Netherlands. The collection consists of surface finds from surveys between 1990 and 1992 in the area around Valkenburg where several extraction sites of Valkenburg flint were excavated by the former Institute of Prehistory in Leiden (IPL) (Brounen and Ploegaert 1992; Brounen 1998). This paper will focus on 'workshops', localities with collections dominated by unretouched and frequently cortical flakes, mostly from the production of flint axes. They are generally dated in the Middle Neolithic (following the Dutch periodization, see Van den Broeke *et al*. 2005, 28).

The baseline for this paper is provided by current knowledge about the use of Valkenburg flint. It can be summarized in the following points:

1. The geological source of Valkenburg-type flint is the Upper Cretaceous Maastricht Formation of south-western Limburg and adjacent Belgium (see Felder and Bosch 2000 for details on the geology of the limestone). Flint nodules are most frequent in the Emael and Schiepersberg Members of the Maastricht Formation. The Geul valley forms the northern limit of its distribution.
2. Exploitation of Valkenburg-type flint is documented by open-cast mining as well as the use of shafts and galleries. Shafts and galleries have been excavated at Biebosch and Plenkertstraat in Valkenburg aan de Geul (Brounen and Ploegaert 1992; Brounen 1998).
3. The use of Valkenburg-type flint is documented from the Early Middle Palaeolithic onwards. The use for flint axes is first documented in the older Michelsberg of Koslar 10 (Marichal 1983, 8). However, the use of *mined* Valkenburg-type flint is known only from the late Michelsberg phase IV/V and the Middle Neolithic B (Brounen and Ploegaert 1992; Brounen 1998; Schreurs 2005).
4. The extracted flint is mostly used for the production of polished axes of S3 type with an oval to pointed-oval cross-section (Hoof 1970).
5. The distribution of artefacts of Valkenburg-type flint reaches from the Northern Netherlands (Drenthe) to Luxemburg and from Central Belgium to Westphalia in Germany (Marichal 1983; Brounen and Ploegaert 1992). The distribution in different phases is not well known, but the most distant finds are all undated flint axes and fragments or flakes of flint axes.
6. The distribution of Valkenburg axes in the Meuse valley shows clusters (Verhart 2010). The distribution pattern does not seem to be consistent with classic down-the-line exchange. The clusters can reflect the spatial distribution of collection and research activity, but they can also reflect patterning in past discard behaviour.
7. Almost all Valkenburg axes are surface finds with limited spatial information. The axes have been frequently re-used as hammerstones and as cores for flakes. There are no documented cases of special depositional contexts such as burials. One long, wide and thin unpolished axe has a light-brown patina suggesting a possible marshy depositional context in the vicinity of Montfort (Limburg) (Mans 2011).

The wider framework is formed by the cultural changes in the Middle Neolithic of Northwestern Europe (Augereau 1996; Fabre 2001; van Gijn and Louwe Kooijmans 2005; Thirault 2005; Zimmermann *et al*. 2006; Bradley 2008; Petrequin *et al*. 2008; Vanmontfort *et al*. 2009; van Gijn 2010a; 2010b; Wentink *et al*. 2011). In the culture-historical sequence for the study region, the Middle Neolithic entails the Michelsberg culture (Middle Neolithic A) and the Stein group (Middle Neolithic B). The Stein group is more or less contemporary with the Seine-Oise-Marne and Escaut-Deule groups in Belgium and the *Spätneolithikum* of the German Rhineland. One of the changes in the fourth to third millennium BC is a shift in the role of flint axes as valuables. The distribution patterns of flint axes decrease in size from a supraregional to a regional scale. It is accompanied by the growth of exploitation of new, local lithic sources such as

Valkenburg and Lousberg. If stone axes were distributed through exchange networks, the shorter distances suggest that either the networks changed or that the role for axes in these networks changed. Several authors have attributed the decline of stone axes to competition of other items of value, in particular the arrival of copper in northwestern Europe (e.g. Thirault 2005).

The changes in exchange networks coincide with a shift in the rest of the flint tool kit. Large blades and imported tools are almost entirely replaced by a less diverse tool kit dominated by small flake scrapers and simple retouched working edges (van Gijn 1998; 2010a; 2010b; Beugnier and Crombé 2007; Vanmontfort *et al*. 2009). The dichotomy in the Late or Final Neolithic between basic skill in stone-working for every day domestic tools and craftsmanship for special, prestigious artefacts such as fine daggers seems to develop from the organization of Middle Neolithic flint technology.

The primary goal of the paper is descriptive as none of the many known Valkenburg workshops have been described and compared in some detail. But the workshops raise many more questions. Why are there only workshops for axes and not for other tool types or general-purpose cores? Why is there a distinct and spatially segregated operational scheme for the production of axes, but undifferentiated production of other tool types? Are the axes of high economic, social and symbolic value when they normally end as flake core or hammerstone? Is the exploitation of flint and production of axes organized in response to immediate or delayed need of tools of a regional population, embedded in the seasonal cycle of agricultural practice or related to the needs to participate in exchange networks?

The following research questions have been formulated to analyse the collection:

1. What is the size and composition of the collected samples?
2. Are all the workshops dominated by flint axe production or are there also other products?
3. What stages of reduction of a flint axe can be identified?
4. What is the degree of variability between the workshops?
5. Is there any typochronological dating evidence?
6. Are there indications for the presence of workshops in a settlement context?

The paper will first consider the main approaches to the study of workshops. Subsequently I will describe the materials and methods used in this study. After the description of the collection, I will discuss the results in their regional archaeological context.

2 Approaches to workshops

Quarry and workshop studies frequently start with a quote from Ericson (1984, 2) about the “shattered, overlapping, sometimes shallow, nondiagnostic, undatable, unattractive, redundant, and at times voluminous material record”. The nature of quarry and workshop studies has changed considerably since. Davis and Edmonds (2011) and Cooney (2011) provide recent reviews of research projects, the progress in the scientific techniques of sourcing and the overarching framework of a biographical approach to objects. For the purposes of this paper, I single out two different theoretical perspectives on the archaeological study of the quarry landscape (Heldal 2009).

The significant role of stone as “animate, alive, with rich symbolic potential” is particularly emphasized by Cooney (2011, 145). He argues that, therefore, the source of stone is a place of special meaning and stone-working an activity of metaphysical meaning as much as functional value. Bradley (2000, 88) has referred to the significance of chert sources by considering artefacts such as axes not only as objects with a history of their own, but as “pieces of places”. Whittle (1995) described Neolithic flint axes as “gifts from the earth” in a paper focusing on the symbolic dimensions of the use and production of axes. In this perspective, the quarry landscape is full of social and symbolic meaning and the working of stone mobilizes a web of meanings in a cosmological as well as socio-political sense.

A very different approach to the quarry landscape is represented by economic approaches to the supply of stone. A study of North-American bifacial points by Beck *et al*. (2002) provides a good example of this approach. They show how transport costs impact the variability of quarry assemblages. Their results suggest that bifacial points are further processed near the quarry if the distance to the residential site is greater. Decisions to transport nodules or remove low-utility cortex at the procurement site depend on the trade-off between the time spent on decortification and the cost of transporting low-utility weight. Bamforth and Bleed (2007) suggest that risk is a more important factor determining the variability in quarries and workshops. Risk consists of two components – the probability that a problem will occur and the costs if the problem actually occurs. In terms of procurement of raw materials, the risks lie in the absence of appropriate material when needed and the costs of not having new material for the replacement of tools. In terms of production of tools, the risks lie in failures during production and the consequence of additional time spent on production, including perhaps getting new raw material. Bamforth and Bleed (2007) suggest that technologies have different options to reduce the risk of failure during procurement, production or use of tools. By caching roughouts, production by specialists and/or production at a quarry site, the risks and costs of failure during the production of stone axes can be reduced. From the perspective of supply economics, the quarry landscape reflects the accumulated costs-and-benefits in terms of time, energy and risks for users of the quarried raw materials including the socio-economic organization to deal with them.

The ethnographic axe studies in Irian Jaya by Petrequin and Petrequin (1993; 2011) show that both economic and symbolic approaches are important and that they can be united. The symbolic potential of stone resonates strongly with ideas that 'raw material' is in fact a sacred material in a sacred place and should only be dealt with by initiated people and after appropriate rituals have taken place. Petrequin and Petrequin (1993; 2011) show that the meaning of the source and the materials is pervasive in the access to the quarry by initiated men, in the rituals taking place and in the place-names (cf. Basso 1996). The procedures of stone working that take place at the quarries, in workshops or in settlements also make sense in economic terms. The episodes of high risk are all realized at the extraction sites with easy access to new material in case of breakage during testing and first shaping. Roughly shaped nodules are further reduced into pre-forms to reduce the weight for transport. Petrequin and Petrequin (1993; 2011) emphasize a third element – the demand for rock is determined by the cycles of ceremonial exchange between villages for renewing marriage alliances, establishing peace or for funerary payments. Expeditions to extract raw materials are not a response to the direct need for a tool nor for creating a store or reserve, but to the direct demand to participate in the social life of the community through exchange. This is very similar to what Spielmann (2002) has described as the "ritual mode of production". The "ritual mode of production" is clearly distinct from production for elites – it is not for the political aspirations of a few, but for the participation of many in exchanges that are at the heart of small-scale societies (Spielmann 2002, 202). The wider social context is critical for a better understanding of the organization of the quarry landscape (cf. De Grooth 1991; 1998).

In this study I have tried to approach the material first of all from an economic perspective. This helps to identify the stages of production that actually took place at the workshop locations. However, these economic practices are not a goal in themselves. The decisions in terms of risk and transport costs are part of a wider system.

3 Materials and methods

3.1 Materials

The materials studied for this paper were collected during surface surveys in agricultural areas. The documentation from the time of collection is limited, but additional information was provided by one of the surveyors (F. Brounen). Most sample locations were only visited once. The spatial information was documented on find cards. Coordinates in the Dutch grid system were derived from 1:25,000 topographic maps. A total of 57 localities with over 3000 artefacts were studied. I should emphasize here that this collection is only a small sample of the material that has been collected by numerous amateur archaeologists in the region over the past decades (some of the collections were studied by Marichal (1983), others were published by amongst others Pisters (1983; 1986; 2008) and Pepels (2009), many await analysis).

3.2 Methods

Collections with more than 10 artefacts of Valkenburg flint were counted in basic categories. The flakes of Valkenburg flint were described individually for selected samples. A list of the categories and variables used is given in table 1.

4 Results

4.1 Spatial distribution

The sample locations were plotted on a digital elevation map to inspect their spatial distribution visually (fig. 1). There are five main clusters of workshop sites: Waterval, Raar-Amstenrood, Vilt, Groot-Welsden, and Kloosterbosch. The sites are located on plateaus and plateau edges. All clusters are associated with dry valleys. Many workshops are found within or on the northern boundary of the geological distribution of the Maastricht Formation. Some samples near Waterval are located more north of the Maastricht Formation.

4.2 Sample size

The collections are relatively small – all samples are smaller than 320 pieces (fig. 2). Following Bradley and Edmonds (1993), the sample size is limited to the classes 1 to 6. The

Categories	Variables
Artifacts	Fragmentation
Artifacts of Valkenburg-flint	Length
Flakes	Width
Cores	Thickness
Roughouts	Platform width
Retouched flakes	Amount of cortex
Axes	Cortex location
Ax flakes	Platform preparation
Hammerstones	Dorsal preparation
Extraction tools	Distal end
Raw material blocks	
Rijckholt-type flint	
Lousberg-type flint	
Simpelveld-type flint	

Table 1 Categories and variables used for the description of the samples.

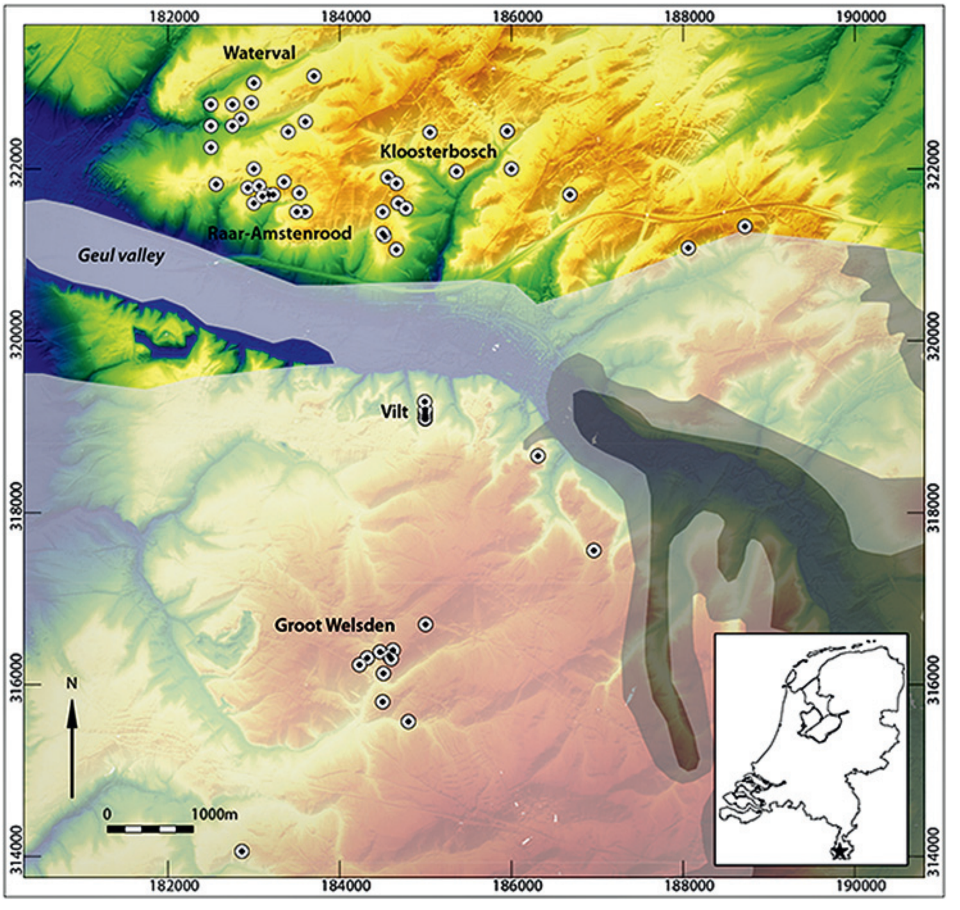


Figure 1 The distribution of sample locations plotted with the distribution of the Cretaceous limestone in grey-tones, based on Felder and Bosch (2000). Background: AHN.

majority of the samples consist of less than 10 artefacts – most of them must be considered as collections of dispersed, single finds. A second group of samples contains 40 to 160 pieces. If we consider the samples from the locality Vilt as representing one large accumulative flake scatter, then the sample size of Vilt raises to less than 450 pieces (class 7).

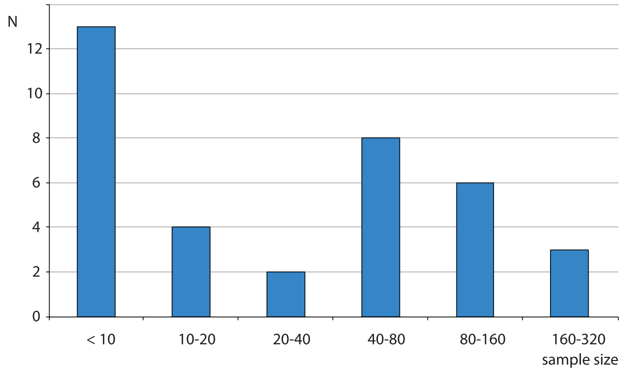


Figure 2 Histogram of sample sizes; classification following Bradley and Edmonds (1993).

4.3 Composition (table 2; figs 3 and 4)

Most samples consist for 80 to 100% of Valkenburg flint. However, 8 samples contain larger proportions of artefacts from other flint sources. The most frequent are Rijckholt-type flints. Cortical pieces usually show rolled cortex and it is likely that most of the flint is derived from local fluvial gravels (Meuse terrace flints). Twelve samples contain a small amount of Simpelveld flint, including a flake core. Two samples contain 1 piece of Lousberg flint including one flake core. A large flake scraper of Wommersom quartzite was found in a sample from the Groot-Welsden cluster. Flakes of so-called "Belgian light-grey" flint are also present.

The majority of samples consists of flakes and their fragments (fig. 5). Raw material blocks with a few flake

SampleID	Cluster	Toponym	Weight	Nf	NVK	% VK	Nflake	Ncore	Nrough	Nret	Nax	Naxfl	Nhammer	Nextract	Nrawmat	Rijckholt	Lousberg	Simpelveld
1	GW	Holleweg		55	22	40.0	14	2	0	2	1	0	1	1	0	y	n	n
6	RA	Amstenrood I		23	10	43.5	10	0	0	0	0	0	0	0	0	y	n	n
9	GW	Groot-Welsden		15	11	73.3	10	0	0	0	0	1	0	0	0	y	n	n
10	KB	Kloosterbosch Holswick		21	3	14.3	2	0	0	0	0	0	1	0	0	y	n	y
12	GW	Groot-Welsden		15	7	46.7	6	0	0	1	0	0	0	0	0	y	n	y
13	KB	Broemkuilweg		11	6	54.5	4	1	0	0	0	0	1	0	0	y	n	n
16	RA	Amstenrood		11	5	45.5	5	0	0	0	0	0	0	0	0	y	n	n
20	WA	Waterval III	850	85	85	100	82	0	1	0	0	1	0	0	1	n	n	n
21	KB	Haasdal-Op den Billick		28	9	32.1	8	0	0	1	0	0	0	0	0	n	n	n
23	RA	Amstenrood II	4540	303	264	87.1	245	0	1	16	0	1	1	0	0	y	n	y
24	GW	Groot-Welsden		107	84	78.5	79	0	0	2	0	0	1	0	2	y	y	n
25	KB	Haasdal-Elsenweg	2895	199	164	82.4	161	0	0	1	0	1	1	0	0	y	n	y
26		Klimmen-Hellebeuk	4040	215	151	70.2	133	2	0	13	0	1	1	0	1	y	n	y
27	RA	Raarveld	1450	83	69	83.1	65	1	0	2	0	1	0	0	0	y	n	y
28		Sibbe	2390	63	36	57.1	36	0	0	0	0	0	0	0	0	y	n	y
29	GW	Groot-Welsden Kop Kaap		163	105	64.4	103	0	1	1	0	0	0	0	0	y	n	y
30	RA	Raar		102	74	72.5	69	1	1	2	0	0	0	1	0	y	n	n
31	RA	Raar-Amstenrood		336	195	58	185	1	2	1	1	3	0	0	2	y	n	y
32	KB	Ravensbosplateau	5440	321	117	36.4	95	2	3	16	0	0	1	0	0	y	n	y
34	VI	Vilt-Scouting 1	1275	72	72	100	71	0	0	1	0	0	0	0	0	n	n	n
35	VI	Vilt-Scouting 1uitlopers	1890	81	72	88.9	64	0	0	7	0	0	1	0	0	y	n	y
36	VI	Vilt-Scouting 1A	3045	72	65	90.3	61	0	1	3	0	0	0	0	0	y	n	n
37	VI	Vilt-Scouting 1B	1880	73	72	98.6	67	1	0	3	0	0	0	1	0	y	n	y
38	VI	Vilt-Scouting 1C	3080	95	95	100	87	1	1	5	0	1	0	0	0	y	y	n
39	VI	Vilt-Scouting 3	1200	41	41	100	36	0	0	4	0	0	1	0	0	n	n	n
40	VI	Vilt-Lijkweg	1725	72	71	98.6	67	0	0	2	0	0	0	2	0	y	n	n
		total	35700	2662	1905		1765	12	11	83	2	10	10	5	6			

Table 2 Composition of all samples with 10 or more artifacts of Valkenburg-type flint. GW = Groot-Welsden, RA = Raar-Amstenrood, WA = Waterval, KB = Kloosterbosch, VI = Vilt.

removals are found at five localities. Roughouts are also rare and only found at 8 localities. Four fragments of polished Valkenburg axes have been documented from 4 localities. Eight samples contain flakes from polished Valkenburg axes. In addition, there are 18 fragments of polished axes of Rijckholt-type flint (fig. 6). Fifteen hammerstones have been documented, most of them in workshop context, but several are single finds. Four clusters of workshops (Raar-Amstenrood, Vilt, Groot-Welsden, Kloosterbosch) are associated with extraction tools such as *Kerbschlägel*. Most larger workshops contain small amounts of simple retouched Valkenburg flakes, dominated by flake scrapers. Three samples have larger numbers of retouched flakes and blades on other flint types, but none has more than 30 retouched pieces.

4.4 Products

The broad, cortical flakes, roughouts of axes and partially worked blocks indicate that axe production is the dominant goal of the production at all workshop locations. No blade cores are documented in the samples. Only three 'macrolithic' blades of Valkenburg flint were documented: two at the locality Vilt and one scraper on a macro-blade for Ravensbosplateau. Flake cores (N=13) are relatively frequent and present in 10 samples.

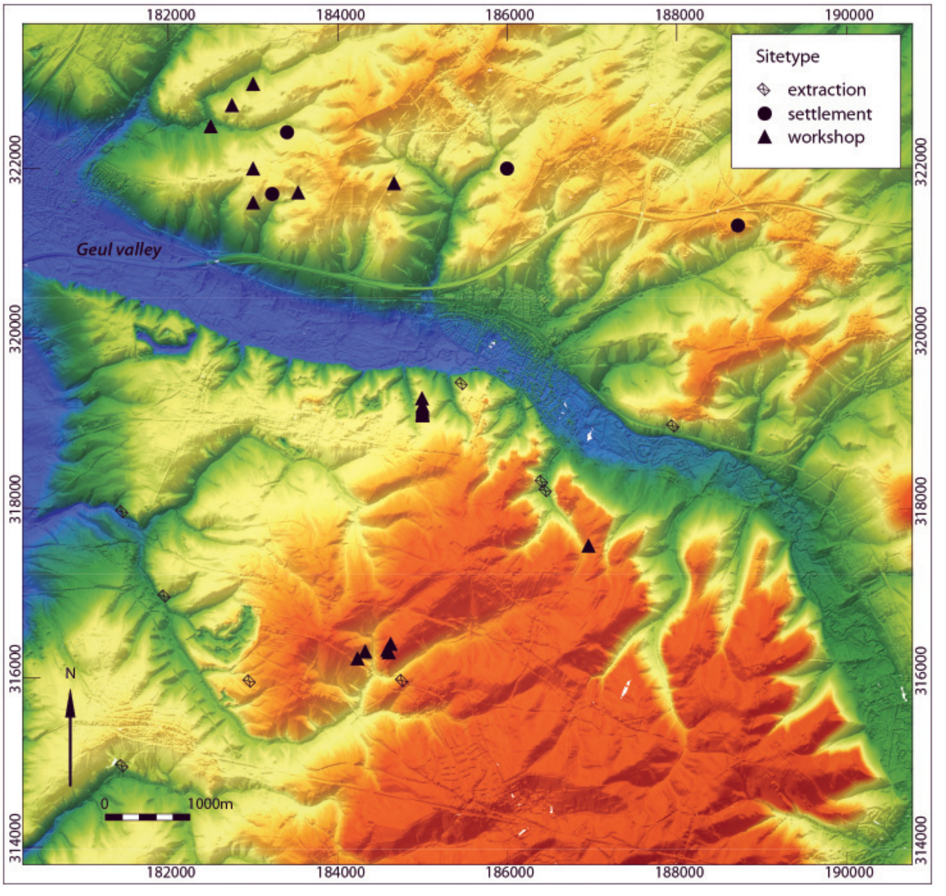


Figure 3 The distribution of site types.

4.5 Dating elements

Elements of typochronological value are very rare in the samples (table 3). Where they are present, the association of the 'tooltypes' with the rest of the sample material cannot be taken for granted. An additional problem are the diagnostic types for the Middle Neolithic. The *Michelsberg* flint technology is generally characterized by retouched tools on large flakes and blades, but very few types are diagnostic for the Middle Neolithic B or Late Neolithic. A dominance of small scrapers on flakes, a low percentage of blades and transverse and stemmed arrowheads are frequently mentioned, but few excavated and well-dated assemblages are available from Belgium, the Netherlands and adjacent Germany (e.g. Vanmontfort *et al.* 2009). It is not possible on current evidence to distinguish lithics from the Stein group, the Seine-Oise-Marne group or the German *Spätneolithikum*.

Despite these limitations, the few typochronological elements in the collection all indicate the Middle to Late Neolithic period. The presence of a few large 'macrolithic' blades, a large flake scraper and a basal fragment of a point with ventral retouch probably indicate land-use by *Michelsberg* groups. The small flake scrapers and an atypical transverse arrowhead are provisionally assigned to the Middle Neolithic B or Late Neolithic.

4.6 Comparison of samples

Twelve larger samples were selected for more detailed technological description of the Valkenburg flakes (table 4). Two samples from Vilt were combined because they are part of a single scatter and four samples are only analysed for a few variables at the moment.

The flakes are generally as broad as long – samples vary from broader flakes to somewhat longer flakes. Mean length of flakes is between 40 and 50 mm. Mean width varies between 40 and 60 mm. The mean elongation ranges between 0.88 and 1.14 mm. The ratio of length to thickness ranges around a mean value of 4 – values vary between 3.1 and 4.5. Mean platform widths are generally between 17 and 34 mm. Relative platform size, the ratio of platform width to length, varies from 1.3 to 2.9. Samples also differ

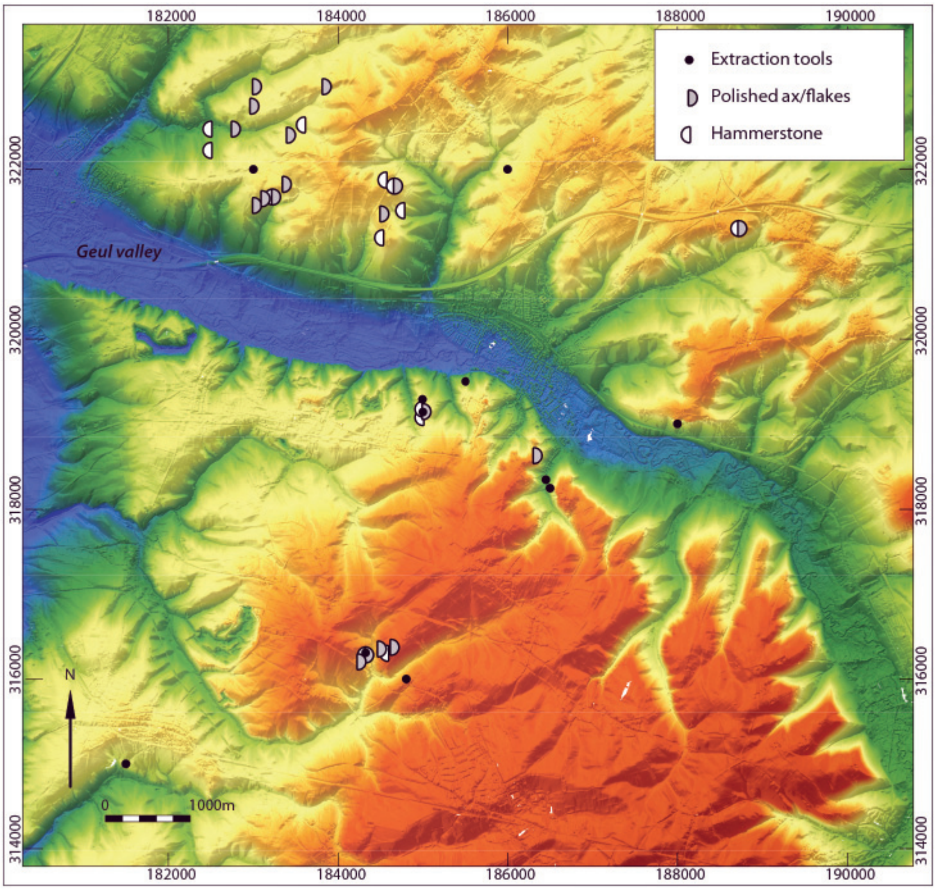


Figure 4 The distribution of extraction tools, fragments and flakes of polished axes, and hammerstones.

Sample ID	Cluster or Location	Tool types	Period
1	Groot-Welsden	Thick large flake scraper (Wommersom quartzite)	Middle Neolithic A?
12	Groot-Welsden	Transverse arrowhead	Middle Neolithic B (or A)
23	Raar-Amstenrood	Point, basal fragment, straight base with ventral retouch Retouched blade	Middle Neolithic A?
26	Klimmen-Hellebeuk	Small flake scrapers Notched pieces	Middle Neolithic B or Late Neolithic?
32	Ravensbosplateau	Small flake scrapers Endscraper on denticulated macrolithic blade	Middle Neolithic A or B?
35	Vilt	Flake scraper	Middle Neolithic B or Late Neolithic?
36	Vilt	Macrolithic blade	Middle Neolithic A (Michelsberg?)
39	Vilt	Macrolithic blade, notched	Middle Neolithic A (Michelsberg?)

Table 3 List of diagnostic artifacts identified in the collection.

Cluster or Location	**Groot-Welsden**			**Klimmen-Hellebeuk**	**Raar-Amstenrood**		**Vilt**			**Kl.**	**Ra.**
SampleID	*1*	*24*	*29*	*26*	*23*	*27*	*35+37*	*34*	*40*	*25*	*32*
N	14	79	99	133	36	63	102	72	71	164	117
elongation	0.88±0.16	0.97±0.31	1.14±0.42	1.00±0.32	0.89±0.2	1.09±0.48	1.14±0.59				
thinning	3.06±1.0	4.25±1.42	4.48±1.84	4.06±1.23	3.53±0.95	4.29±1.38	4.18±1.61				
relative platform size	1.3±0.3	2.9±2.3	2.8±2.3	2.7±6.1	1.8±1.2	2.5±1.2	2.6±1.6				
cortex											
absent	7	48	58	74	43	52	54	75	60	64	52
present	93	52	42	26	57	48	46	25	40	36	48
> 75%	36	6	5	1	9	6	11	3	4	7	8
cortexlocation											
proximal	14	6	6	4	0	6	10				
distal/lateral	33	39	28	24	54	27	19				
platform preparation											
facetted/diedric	21	18	24	28	40	21	25				
plain	21	48	31	13	43	29	20				
dorsal preparation	21	39	52	42	46	40	26				
% hinge	14	4	5	6	1	2	5				
chips < 2 cm				x	present	x	present				

Table 4 Summary data on technological aspects for selected samples (Kl. = Kloosterbosch; Ra. = Ravensbosplateau).

in the amounts of cortex. One sample, though small, contains almost only cortical flakes, many of which have more than 75% cortex. The presence of cortex in the other samples ranges from 25 to 57%. Flakes with more than 75% cortex vary between 1 and 11%. Cortex is usually located on the distal and/or lateral part of a flake. Percentages are between 19 and 54% for cortical flakes. Samples also differ in the preparation of platforms. Platforms frequently contain evidence of faceting by two or more flakes, but the frequency varies from 18 to 40%. Plain platforms, i.e. using one flake scar as platform for removal, are also frequent, but vary between 13 and 43%. Many flakes are also prepared on the dorsal face – the proportions range between 21 and 52%. Many flakes are fragmented and the fragmentation is greater among smaller and thinner flakes. Among the preserved distal ends, the number of hinges was noted – the percentages vary between 1 and 14%. Finally, there are also differences in the presence of chips smaller than 20 mm. Only two samples contain substantial amounts of small flakes.

5 Discussion

5.1 Dating

The dating of workshop sites remains highly problematic. Indications such as the presence of a few ‘macrolithic’ blades and small scrapers on flakes all hint at (rather than date to) the Middle and/or Late Neolithic. Moreover, the integrity of the workshop material and the association of

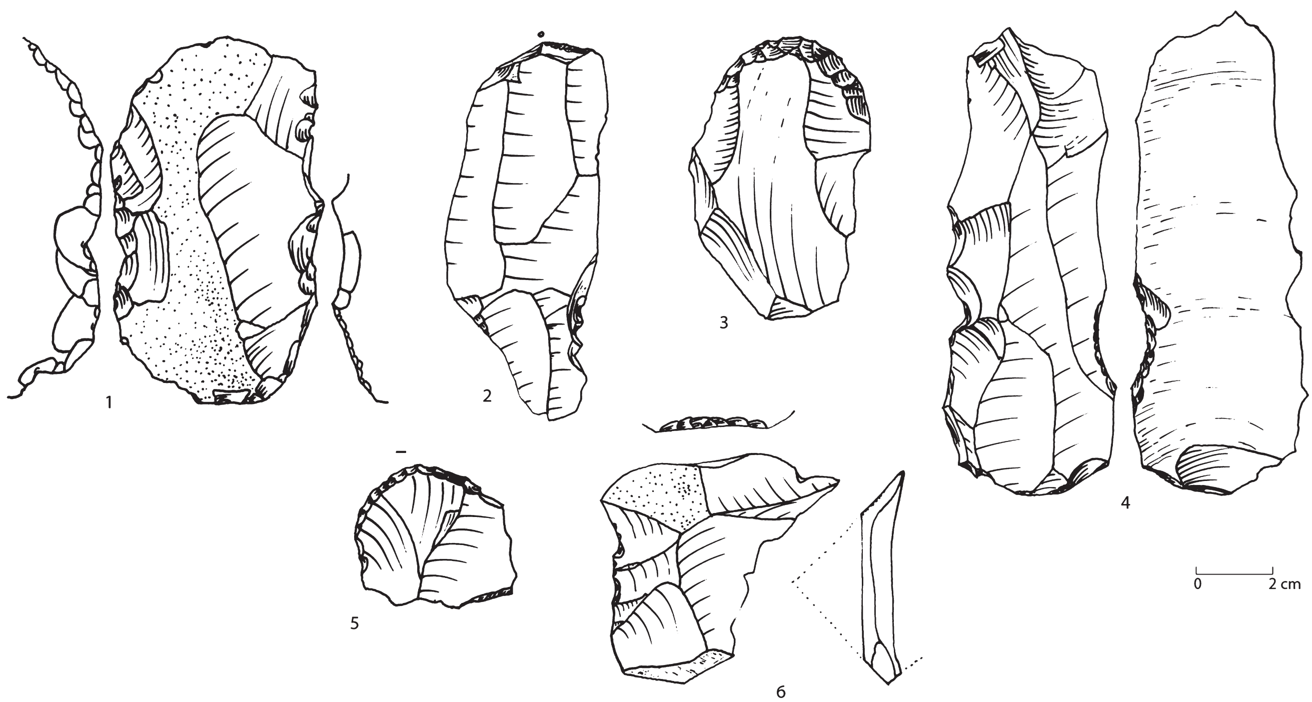


Figure 5 Selected artefacts of Valkenburg flint from different locations. 1 notched flake with ventral retouch (Vilt-Lijkweg); 2 endscraper with denticulate edge on blade (Ravensbosplateau); 3 flake endscraper (Ravensbosplateau); 4 macrolithic blade with lateral notch (Vilt-Scouting); 5 flake endscraper (Ravensbosplateau); 6 denticulated flake with distal ventral retouch (dotted is the reconstructed outline of angular raw material block) (Amstenrood II).

Site	Material	Lab number	14C-age	CalBC (95%)
Plenkertstraat, mine II	Charcoal (*Corylus* or *Buxus*)	GrN-19831	4670±60	3634-3350
Plenkertstraat, mine IV	Charcoal (*Corylus* or *Buxus*)	GrN-19830	4610±80	3631-3095
Biebosch	Charcoal (*Alnus*), fireplace	GrN-19832	4330±60	3312-2778
Sangen	Antler tool	GrN-6782	4385±60	3329-2894
Geboschke	Antler tool	GrN-6783	4235±45	2921-2669
Keerderbosch	Antler tool	GrN-10463	4150±60	2889-2577

Table 5 14C dates for extraction sites of Valkenburg flint.

typochronological indicators with Valkenburg flakes cannot be taken for granted.

Additional evidence for the dating of the workshops comes from six ^{14}C-dates from extraction sites of Valkenburg flint (table 5). Some comments are necessary: 1 the charcoal samples may suffer from the old wood effect, that could explain the relatively old dates for the two Plenkertstraat mines (cf. Schyle 2006 for similar effects at the Lousberg); 2 the context of the charcoal is the infill of the shafts – in a strict sense, it dates a point in time prior to infilling, but it is not clear how it relates to the construction of the pit and the extraction of flint; 3 the exact relationship of the dated antler tools to extraction features is unknown – the dates refer to the time of death of the deer. In other words, the six dates indicate some points in time during the exploitation of Valkenburg flint, but they date neither the beginning nor the end nor the duration of mining activities (cf. Ambers 1998).

The relatively early dates for the Plenkertstraat mines have been argued to indicate exploitation in the Late Michelsberg phase (MK IV/V) (Brounen and Ploegaert 1992). There are two reasons to question this interpretation: on the one hand, the possibility of an old wood effect, and on the other hand,

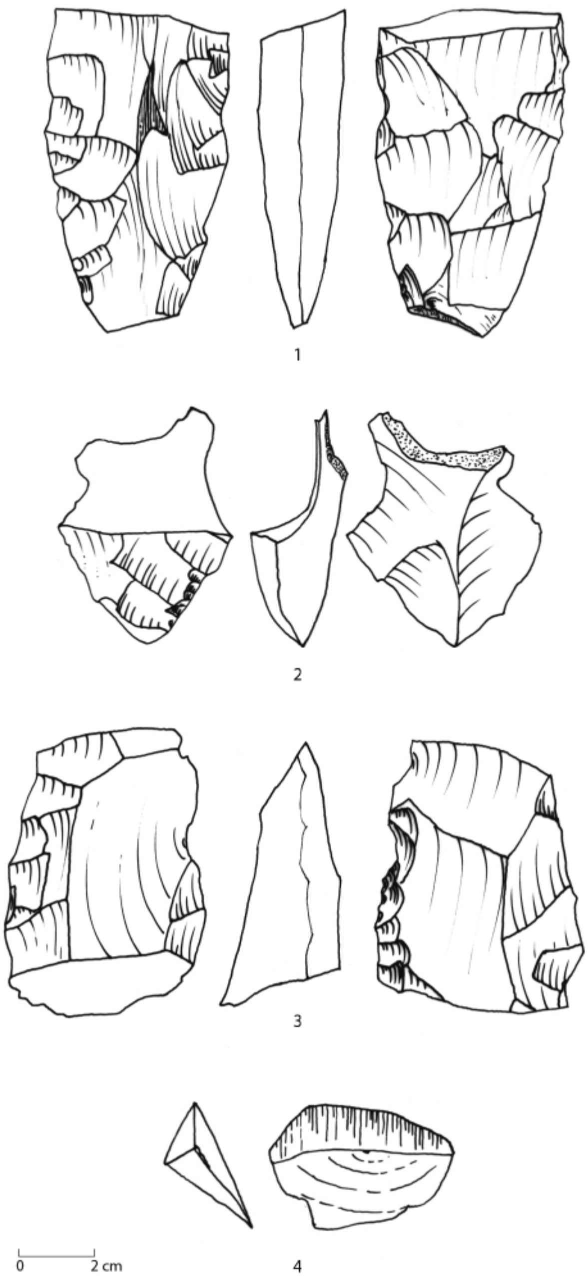


Figure 6 Fragments of axes of Valkenburg flint from different locations. 1 fragment of ax, with small polished part indicating later bifacial reworking, on thick elongated flake (Vilt-Scouting); 2 bifacially worked distal fragment (Vilt-Scouting); 3 asymmetrical bifacially worked distal fragment (Waterval III); 4 cutting edge of polished ax (Vilt-Scouting).

the overlap with dates for the Stein burial vault. The alternative would be that the mining of Valkenburg flint is limited to the Middle Neolithic B (*Stein* group). However, the current dating evidence of the Stein group is also limited and questionable (table 6; van Hoof *et al*. 2012): 1 the unidentified wood charcoal from the Stein burial vault can also be affected by the old wood effect (Verhart 2010), and 2 the other samples are all from pit infillings and it is not clear how the age relates to the beginning or end of occupation. The presence of two *Michelsberg*-like macrolithic blades of Valkenburg flint in the cluster of Vilt and one in Ravensbosplateau at least suggests mining during the Middle Neolithic A period. A better knowledge of the beginning and end of the mining of Valkenburg flint requires more dates from better provenanced samples.

Finally, a clear distinction should be made between the dating of the exploitation/production and the cultural affinities of the exploiters/producers. The similarity of the current dates for the exploitation of Valkenburg-type flint and the Stein group is only an indication of the period of exploitation and production of axes, but not an indication of the identity of the producers. The producers of flint axes could be from the southern Seine-Oise-Marne-groups or *Spätneolithikum*-inhabitants of the German Rhineland – as their lithic technologies are virtually unknown, it is impossible to attribute workshops and flint scatters to a specific archaeological group.

5.2 Production and products

The evidence from the extraction sites, the workshops and the products can be organized in a schematic operational scheme for Valkenburg flint. The dominant scheme is for the production of axes. Angular nodules are selected. The nodules are then coarsely shaped by bilateral bifacial knapping into roughouts. Some large, thick and elongated flakes are shaped into roughouts; others are shaped into *Kerbschlägel*. The roughouts are regularized by bifacial removal of small flakes around the periphery. The regularized axe is ready to be polished. The large flakes resulting from the shaping and roughing-out stages are frequently retouched into scrapers, notches and bruised flakes. Nodules of any shape as well as axes are also turned into flake cores to produce relatively small flakes. These small flakes are retouched into scrapers including thumbnail scrapers, becs, borers, notches and other retouched pieces. Both axes and flake cores are frequently re-used as hammerstones. Similar operational schemes are described for other flint mines, such as Hallencourt (Fabre 2001) and Jablines-Le Haut Château (Bostyn and Lanchon 1992).

A realistic estimate of the output is impossible for the samples in this collection. Still the size of the samples is indirectly also related to the number of axes that were

Site	Material	Lab number	14C-age	CalBC (95%)
Stein, burial	Charcoal	GrN-4831	4780±60	3660-3375
Stein, burial	Cremation	GrN-16185	4570±60	3517-3092
Ittervoort	Charcoal	UtC-1478	4303±40	3023-2877
Randwyck	Charcoal	GrN-14237	4180±60	2900-2582
Hof van Limburg	Charcoal	GrN-27837	4140±60	2887-2506
Hof van Limburg	Charcoal	Poz-14566	4095±35	2866-2497

Table 6 14C dates for the *Stein* group.

produced. Based on the weight of Valkenburg flint, I calculated minimal numbers of axe semi-products for a number of workshop locations. The weight of the 13 largest samples was determined. The total weight is almost 30 kilograms. Taking a rough estimate of 1000 gram of debris for the production of 1 axe (derived from Schyle 2006), the 13 samples represent a minimum of 30 axes. Though this is a serious underestimation of the actual production, it does suggest that the workshops are generally small scale and limited to an output of 5 to 10 axes.

It is also impossible to reconstruct the size and shape of the axes that were produced at the workshops. The available data for roughouts (Marichal 1983) and for the Montfort region (Mans 2011) suggest that most axes conform to a narrow range of width-to-thickness ratios (fig. 7). However, there is one outlier - a regularized, unpolished, 247 mm long axe (Mans 2011) with an exceptionally large width-to-thickness ratio, meaning the axe is exceptionally thin for its width. Current evidence does not allow us to evaluate the frequency of such axes or to identify workshops where such relatively thin axes may have been produced.

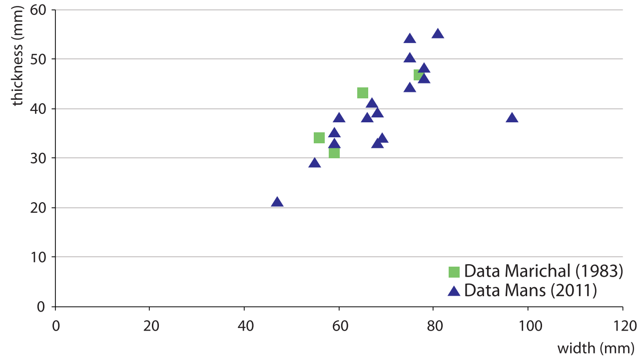


Figure 7 Scatterplot of width and thickness of axes of Valkenburg flint based on data from Marichal (1983) and Mans (2011).

5.3 Variation among workshops

Both the composition of the samples and the technological description of the Valkenburg flakes show variation among the workshops. The interpretation of the variability is limited by several factors: 1 sample sizes differ; 2 the representativeness of the samples differs for example in the amount of small flakes; 3 description was performed by multiple persons, yet checked by the author. Therefore it remains open to what extent the samples as well as the technological analysis actually monitor variability in prehistoric knapping routines. Perhaps the most prudent way to interpret the data is to formulate hypotheses for future work:

1 The variation between samples from the Groot-Welsden cluster are consistent with spatial differentiation between locations for testing of nodules and initial shaping (near the extraction site?) (sample 1) and locations for the stages of initial shaping and roughing out (samples 24 and 29).
2 Most workshops contain evidence of initial shaping and the production of roughouts. Only two samples have small chips interpreted as the debris from regularization of roughouts. Regularization as well as polishing usually took place elsewhere, presumably at settlements. The variation in the degree of regularization near the source can be interpreted as indication for further transport of these roughouts – this would mean that the settlements to which the roughouts were transported were located at larger distance from the Valkenburg source area.
3 Workshops vary considerably in terms of indications of knapping skill (percentages of dorsal and platform preparation, percentages of hinge negatives interpreted as knapping errors). Experimental and comparative studies need to be performed to evaluate whether this indicates average skill levels available to most practitioners or not (cf. Labriffe *et al*. 1995; Augereau 1996).
4 The workshops of the Waterval cluster do not contain extraction tools and they are probably located outside the geological distribution of Valkenburg flint. Most samples of the Waterval cluster are however too small and not representative for further statements. It is worth noting that Pepels (2009) has also found ‘polissoirs’ at one of the workshops near Waterval.

5.4 *Other activities?*

One common question regarding the geography of production concerns the relation with settlements. Many samples contain some tools, especially flake scrapers. Three samples stand out because of the number of retouched tools in other flint types (mostly Meuse terrace flint). The locality of Amstenrood contains over 300 pieces of which 87% is Valkenburg flint representing debris from axe production, including small chips from regularization. Sixteen retouched tools were found among the Valkenburg flakes. Among the other flint types, there are 13 flake scrapers, 1 retouched blade and a basal fragment of a point. The locality of Ravensbosplateau also contains over 300 pieces, but here Valkenburg flint counts for only 36% of the total. The Valkenburg flint includes two flake cores and 16 retouched pieces. The majority of the sample consists of other flint types and at least 33 retouched tools were recognized. Most are simple retouched flakes and flake scrapers. There are also one scraper on a denticulated 'macrolithic' blade, one large borer, a burin, a flake from a polished axe and a few blade fragments. The sample of Klimmen-Hellebeuk, not located in one of the five clusters, consists of 215 pieces. Seventy percent is Valkenburg flint, including 2 flake cores and at least 13 retouched flakes. More retouched tools are present among the other flint types: 19 flake scrapers, 3 borers, 2 notched pieces, 1 splintered piece, 4 retouched blades and 1 flake from a polished axe (fig. 8a and b).

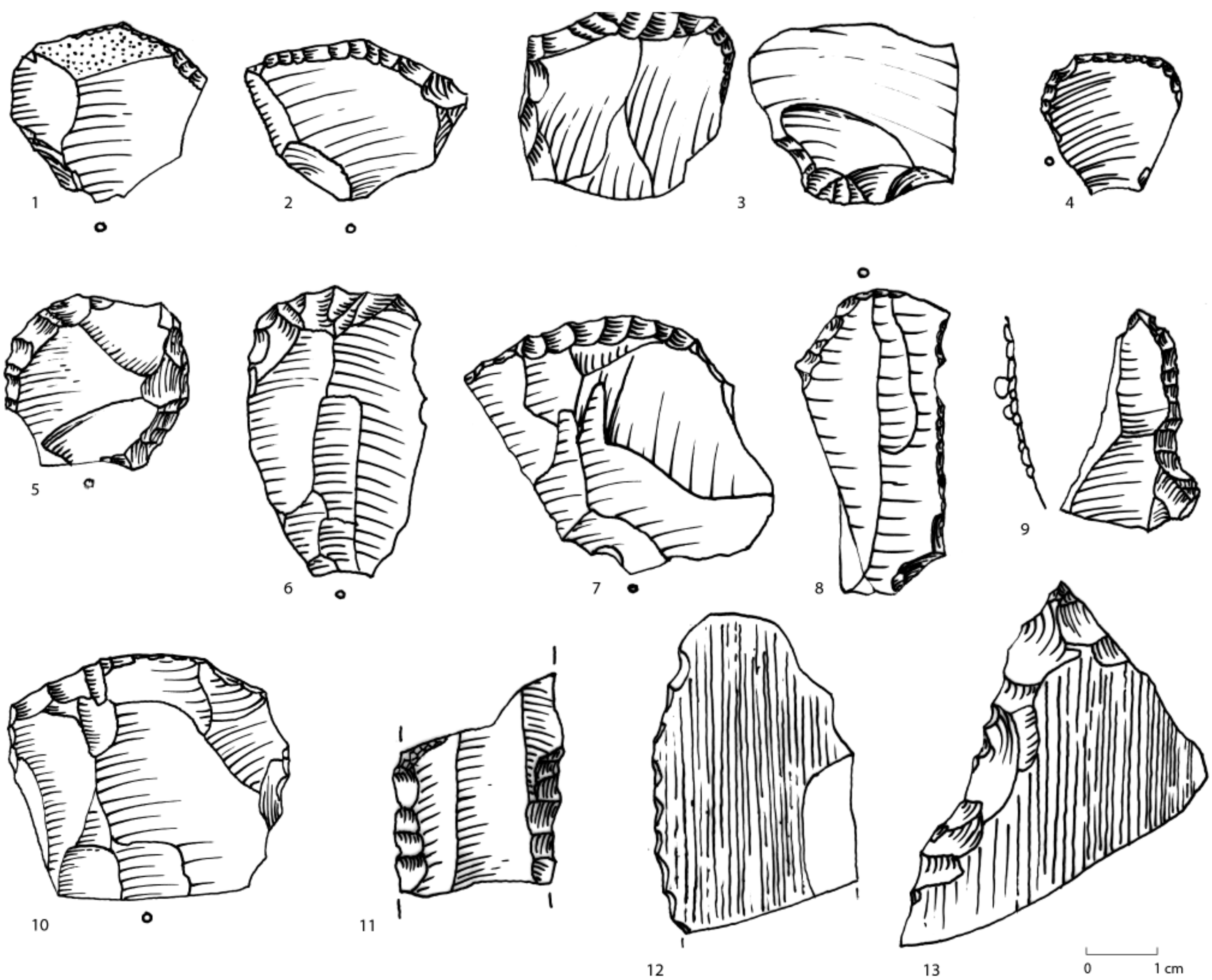


Figure 8a Selected artefacts from Klimmen-Hellebeuk. 1-8, 10 flake endscrapers; 9 borer? on fragment; 11 retouched blade (burned fragment); 12 flake from polished ax; 13 retouched flake from polished ax (borer?). Valkenburg flint: 1, 2, 12 (ax-manufacturing flake:12); Simpelveld flint: 7, 10; 'light-grey Belgian' flint(?): 4, 13; 'Rijckholt'-type flint: 3, 5, 6, 8, 9; indeterminate: 11.

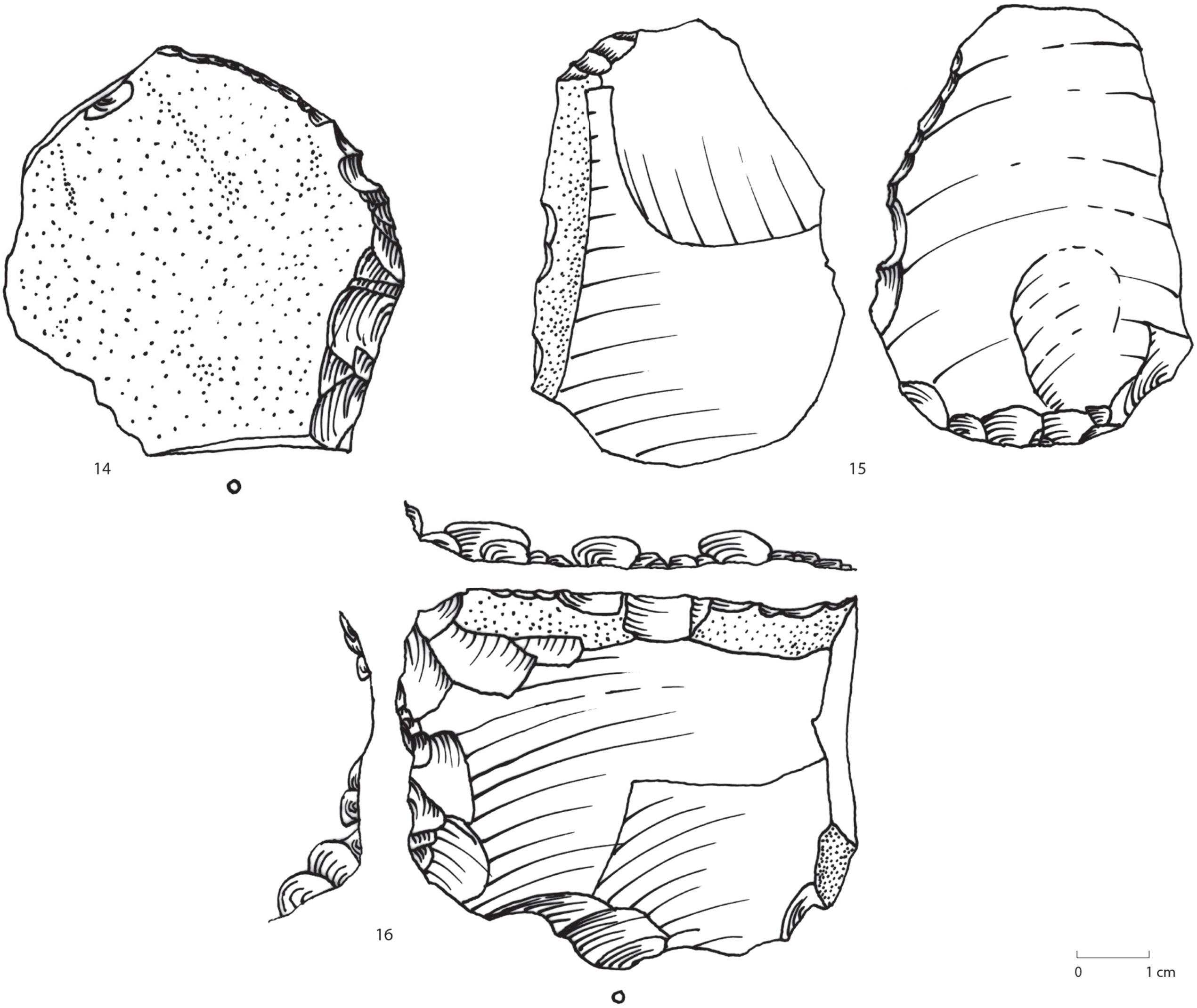


Figure 8b Selected artefacts from Klimmen-Hellebeuk. 14 sidescraper; 15 scraper with denticulated edge; 16 scraper with lateral notch. Valkenburg-flint 14, 15, 16 (axe-manufacturing flakes: 14, 15, 16).

I interpret the samples of Ravensbosplateau and Klimmen-Hellebeuk as indicating settlement debris: the proportion of other flint types relative to Valkenburg workshop debris is relatively large, the number of retouched tools is larger than in other samples and the tool assemblage contains different tool types in addition to flake scrapers. The presence of a blade endscraper, some large blade scrapers and blade fragments suggest a possible Middle Neolithic A attribution for (some of) Ravensbosplateau. For Klimmen-Hellebeuk, the flake scrapers and absence of large flake tools and macrolithic blades is consistent with a date in the Middle Neolithic B. Amstenrood is probably different. The sample is dominated by workshop material and the tools are limited to flake scrapers – some other activities, perhaps in the frame of the acquisition of stone, have taken place here, but it is limited compared to the other two samples.

5.5 *Geography of production*

De Grooth (1998) has proposed eight models for archaeological inferences about the organization of production. Key to the models is the spatial relationship between the four main stages of production: acquisition of stone, the production of blanks, the production of tools, and the use of tools. The focus of the spatial relationships of the stages of production is a useful analytical tool for the Valkenburg area. The geography of production in the Valkenburg area is most similar to De Grooth's model C:

1 the production of blanks c.q. axe roughouts (more or less regularized) is separated from the production of tools c.q. the finishing of the axe roughout by polishing;
2 the production of blanks is clustered around acquisition sites;
3 the presence of discarded polished axes and flakes from polished axes could indicate that the tools were also used in the vicinity of the extraction sites and workshop clusters.

The geography of production indicates that the most risk-prone stages of production – the testing, initial shaping and roughing out of stone axes – dominate the workshops.

The position of the workshops in the landscape is characterized by the vicinity of dry valleys. Perhaps it can be explained by the strategy of prospecting for raw materials that was observed by Petrequin in Irian Jaya and then applied to the region of Plancher-les-Mines in the Vosges (Petrequin and Jeunesse 1995). The strategy involves searching for and testing of raw material blocks in fluvial and slope deposits. Where good quality material was found, the upslope area was prospected for primary outcrops.

5.6 A settled landscape?

Bradley (2000) and others have argued that lithic sources are often located in remote places that are difficult or hazardous to reach. The choice of raw material in such places as Langdale in Northumbria suggests that even some lower quality sources were selected because they were difficult to reach. Such qualities of the sources are embodied by the stone axes. Their value as "pieces of places" is circulating in wide-ranging exchange networks. Similar arguments have been used with regard to mining for flint. De Grooth (1997) explains the laborious mining activities to obtain Arnhofen flint with reference to the distinctive characteristics of the flint itself – an object of Arnhofen flint is distinctive. Rudebeck (1998) refers to the presence of small remnants of cortex on Scandinavian axes. The cortex allows the identification of the source – the axe can be identified as a piece from a specific quarry place. According to Bradley (2000), the flint mines have to be seen in the context of the significant role of pits and shafts in Neolithic ritual life (Thomas 2000). The special nature of mining is emphasized in the distribution of flint mines of southern England that avoids the distribution of settlement sites.

How do the Valkenburg flint sources fit in this discussion? Are the workshops located in a settled landscape or "well beyond the limits of the settled landscape" (Bradley 2000, 87)? The Neolithic quarry landscape of Valkenburg flint is formed by a number of extraction locations with clusters of workshops. The workshops are specialized in the production of flint axes, sometimes, perhaps, for exceptionally thin axes. Settlement debris is limited – only two samples may represent workshop material in a settlement context.

Rather than a *Fundlücke*, the Middle Neolithic B and Late Neolithic are better characterized by a *Befundlücke* (Schyle 2006). Despite the absence of house plans and settlements – not a single *spätneolithische Siedlung* is presented in ten years of the journal *Archäologie im Rheinland* - flint scatters, sometimes with some ceramics, are frequent in the German loess area (Nehren 2001; Zimmermann *et al.* 2006; Matzerath 2007). Estimates of the production and consumption of Lousberg axes also suggest a substantial human presence in the loess area. Schyle (2006) estimated a population density of 2.8 households per km^2. In addition, the lack of features is not limited to the Middle Neolithic B or Late Neolithic, but also for the Michelsberg group and the Bronze and Iron Ages. The recent excavation of a late neolithic house plan in Waardamme (Flanders, Belgium) (Beugnier and Crombé 2007) is a warning against underestimating the combination of post-depositional processes and research intensity. The scarcity of features in the loess area could be mainly determined by post-depositional factors.

Another line of evidence about the settled landscape is provided by the evidence of human impact on the landscape. For the loess region of Southern Limburg, the impact of human settlement must have been limited, because the regional pollen records indicate a high degree of forestation during the Early and Middle Holocene. This is supported by dating of the sediments in the Geul valley. The dates indicate low sedimentation rates probably because the vegetation fixed the sediments and limited the availability for erosion (de Moor *et al.* 2008). Lechterbeck *et al.* (2009) and Verstraeten *et al.* (2009) argue that the Middle Holocene human impact on vegetation is too small scale to be recorded in regional pollen records and that opening of the vegetation caused only local colluvial sedimentation in dry valleys and at the foot of hillslopes, but did not impact sedimentation rates in the entire catchment area.

Indications of small-scale local impact were noticed in a pollen record from Maastricht-Randwyck dating between 5000 and 1750 cal BC. Shifts in woodland taxa indicate human impact between 3000 and 2000 cal BC (Bakels *et al.* 1993; Bakels 2008). Wessel and Wohlfarth (2008) refer to an increase in birch and hazel from 3800 cal BC in the German Rhineland. They relate the change to the use of the forest for keeping livestock such as pigs.

There is both archaeological and paleobotanical evidence to support an interpretation of almost continuous occupation of the Meuse valley area from the Early Neolithic B (*Rössen*) onwards (Bakels 2008). A good analogy for the Valkenburg area and perhaps Southern Limburg is provided by the evidence from the Somme valley in Northern France (Fabre 2001). The mine of Hallencourt is located on a plateau adjacent to a dry valley. Evidence of settlement in the immediate surroundings of the mine is limited – the main settlement sites are predominantly located in the river valley itself. A similar pattern is documented for the Bergerac region in Southwest France (Delage 2004). Rather than acquisition of stone "well beyond the settled landscape", the evidence indicates the acquisition of stone from the forested plateau edges near the settled landscape. I would expect that the Meuse valley is the most likely area to search for Middle Neolithic and/or Late Neolithic settlement sites, but the forested plateaus were used for subsistence activities and inhabited as well.

5.7 An ordered landscape?

The Middle Neolithic B is characterized by a very ephemeral archaeological record of small find scatters and pits, with few structures like houses, earthworks, field systems or fences (Van Gijn en Bakker 2005; Schreurs 2005; Zimmermann *et al*. 2006; Vanmontfort *et al*. 2009; Amkreutz 2010; Verhart 2010). Is this an indication of higher levels of mobility of groups and the importance of wild resources in an 'extended broad spectrum economy'? Does this mean that 'nature' was valued as an important resource rather than feared as a wild and dangerous place? Does it indicate the 'Mesolithic' roots of the Middle Neolithic? Or is it a bias due to site formation processes and are we dealing with fully agricultural societies making a sharp contrast between the cultivated lands of fields and farms and uncultivated, wild places, similar to the Middle Bronze Age (Arnoldussen and Fontijn 2006)?

To what extent, then, can we speak of an 'ordered' landscape in the Middle Neolithic? Arnoldussen and Fontijn (2006) refer to an "ordered" landscape when there is evidence of the categorization of place. The landscape is ordered for example into zones for the living and zones for the dead. Places are differentiated by the deposition of specific find categories such as axes, swords or razors - in other words, "everything in its right place" (Fontijn 2008). The evidence from the Southern Netherlands for the Middle and Late Neolithic is limited. Not more than hints are available at the moment. Finds of single Vlaardingen and Stein pots suggest deposition practices related to high and dry coversand ridges away from settlements (Arts 2010; Louwe Kooijmans 2010). A few complete flint axes suggest selective deposition related to wet, marshy places (Mans 2011), whereas most axes end their life cycle as hammerstone or flake core. The location of workshops on the edge of plateaus is consistent with the idea of an 'ordered' landscape, where also production of flint axes has its right place.

6 Conclusion

Middle Neolithic flint axes were probably important as tools for maintaining small-scale fields and managing woodland, as general woodworking and cutting tools, and as valuables. The sample of workshop material from the Valkenburg area indicates that the exploitation was almost entirely focused on the production of flint axes. The production of axes was organized spatially with the most risky stages taking place in the vicinity of the raw material source. Roughouts were processed to reduce the weight of transport to settlements or other locations for finishing regularized roughouts by polishing. Workshops vary in technological characteristics that could indicate some differences in skill. The evidence is consistent with a clear-cut division in the organization of flint technology: on the one hand, production of flint axes from mined flint dominating in separate workshop locations, and on the other hand, production of the domestic tool kit from raw materials collected at the surface, presumably taking place in settlement context. However much remains conjecture and hypothetical. Only more intensive fieldwork, including excavations of workshops and possible settlement sites, can provide us with a clearer picture of the Middle Neolithic landscape in the loess region.

According to Whittle (1995), the axe is first of all significant as symbol of control over nature. In my view, it is this interpretation of the Neolithic as control over nature which needs to be extended because it is too one-sided. Not that domestication of animals, the growth of crops, the clearing of forest for fields and settlements do not involve control over nature. Not that prehistory cannot be described as a process of imposing cultural order on nature. But it is the ambiguous power of nature that needs to be acknowledged (Oudemans and Lardinois 1987, 61): "on the one hand all that is natural is condemned as being wild, raw, unsophisticated and therefore polluted. On the other hand the garden of civilization needs to be fed with nature's power, which is polluting but lifegiving as well." Rather than a symbol of control, the axe is a symbol of ambiguous nature, its unlimited power that is feeding culture and civilization, its ambiguity that undermines the unity of categories such as the clear differentiation of place. The axe is tragic – the very instrument of civilization for imposing order upon nature requires the very power of nature that it has to subdue: to make an axe is all too human.

Acknowledgements

The study of the lithics was inspired by the silence of the past in the landscape of the present, by the abyss between the science of prehistory and the land of early agrarian societies, neglected, forgotten and lost in the loudness of the heritage industry. This paper is dedicated to the skeptical bachelor students who described the material during practical work. They frequently questioned the archaeological value of the surface material – what can you do with just a bag of stones? This is my attempt to an answer. Special thanks to Ron Mans for information and to David Fontijn for constructive criticism.

References

Ambers, J. 1998. Dating Grimes Graves. *Radiocarbon* 40-2, 591-600.

Amkreutz, L.W.S.W. 2010. De laatste der Mohikanen? Enige gedachten over de positive van de Vlaardingen-cultuur in het neolithisatieproces. *Westerheem* special 2, 12-25.

Arnoldussen, S. and D. Fontijn 2006. Towards familiar landscapes? On the nature and origin of Middle Bronze Age landscapes in the Netherlands. *Proceedings of the Prehistoric Society* 72, 289-317.

Arts, N. 2010. Spoorloze boeren in Noord-Brabant? Aardewerk en andere neolithische vondsten in Meerhoven (gemeente Eindhoven). *Westerheem* special 2, 186-193.

Augereau, A. 1996. Première approche de l'évolution de l'industrie du silex du Ve au IVe millénaire avant Jésus-Christ dans le sud-est du bassin parisien. *Bulletin de la Société Préhistorique Française* 93, 225-233.

Bakels, C. 2008. Maastricht-Vogelzang, the Netherlands, a Michelsberg site in the valley of the Meuse seen from a botanical angle. *Analecta Praehistorica Leidensia* 40, 111-122.

Bakels, C., M.J. Alkemade and C.E. Vermeeren 1993. Botanische Untersuchungen in der Rössener Siedlung Maastricht-Randwijck. *Archaeo-Physika* 13, 35-46.

Bamforth, D.B. and P. Bleed 2007. Technology, flaked stone technology, and risk. *Archaeological Papers of the American Anthropological Association* 17-1, 109-139.

Basso, K. 1996. *Wisdom sits in places*.

Beck, C., A.K. Taylor, G.T. Jones, C.M. Fadem, C.R. Cook and S.A. Millward 2002. Rocks are heavy: transport costs and Paleoarchaic quarry behavior in the Great Basin. *Journal of Anthropological Archaeology* 21, 481-507.

Beugnier, V. and Ph. Crombé 2007. L'outillage commun du premier site d'habitat néolithique découvert en Flandre (Belgique). Étude fonctionnelle de l'industrie lithique taillée du site de Waardamme (3e millénaire av. J.-C.). *Bulletin de la Société Préhistorique Française* 104, 525-542.

Bostyn, F. and Y. Lanchon 1992. *Jablines – Le Haut Château (Seine-et-Marne). Une minière de silex au Néolithique*. Paris.

Bradley, R. 2000. *An archaeology of natural places*.

Bradley, R. 2008. The end of the beginning: changing configurations in the British and Irish Neolithic. *Analecta Praehistorica Leidensia* 40, 43-50.

Bradley, R. and M. Edmonds 1993. *Interpreting the axe trade. Production and exchange in Neolithic Britain.* Cambridge.

Broeke, P. van den, H. Fokkens and A. van Gijn 2005. Een prehistorie van deze tijd. In: L.P. Louwe Kooijmans, P.W. van den Broeke, H. Fokkens and A. van Gijn (eds), *Nederland in de prehistorie*, 17-31.

Brounen, F.T.S. 1998. Vergeten land. Het onderzoek naar prehistorische vuursteenwinning in de regio Valkenburg aan de Geul. In: J. Deeben and E. Drenth (eds), *Bijdragen aan het onderzoek naar de Steentijd in Nederland. Verslagen van de 'Steentijddag' 1*, 75-96.

Brounen, F.T.S. and P. Ploegaert 1992. A tale of the unexpected: Neolithic shaft mines at Valkenburg aan de Geul (Limburg, the Netherlands). *Analecta Praehistorica Leidensia* 25, 189-223.

Cooney, G. 2011. Introduction: transformations at the quarry face, *World Archaeology* 43, 145-148.

Davis, V. and M. Edmonds 2011. Studying stone axes. In: V. Davis and M. Edmonds (eds). *Stone axe studies III*, 1-5.

Delage, J.-Ph. 2004. *Les ateliers de taille néolithiques en Bergeracois*. Toulouse (Archives d'Ecologie Préhistorique 15).

Ericson, J.E. 1984. Towards the analysis of lithic production systems. In: J.E. Ericson and B. Purdy (eds), *Prehistoric quarries and lithic production*, 1-11.

Fabre, J. 2001. L'économie du silex dans la moyenne vallée de la Somme au Néolithique Final: l'exemple de la minière d'Hallencourt et des sites périphériques. *Revue archéologique de Picardie* 2001-3/4, 5-80.

Felder, W.M. and P.W. Bosch 2000. *Krijt van Zuid-Limburg*. Delft/Utrecht (Geologie van Nederland 5).

Fontijn, D. 2008. Everything in its right place? On selective deposition, landscape and the construction of identity in later prehistory. In: A. Jones (ed.), *Prehistoric Europe: theory and practice*, 87-106.

Gijn, A. van 1998. Craft activities in the Dutch Neolithic: a lithic viewpoint. In: M. Edmonds and C. Richards (eds), *Understanding the Neolithic of North-Western Europe*, Glasgow, 328-350.

Gijn, A. van 2010a. *Flint in focus*. Leiden.

Gijn, A. van 2010b. Het gebruik van vuursteen in de Vlaardingentijd. *Westerheem* special 2, 81-89.

Gijn, A. van and J.A. Bakker 2005. Hunebedbouwers en steurvissers. Midden-neolithicum B: trechterbekercultuur en Vlaardingen-groep. In: L.P. Louwe Kooijmans, P.W. van den Broeke, H. Fokkens and A. van Gijn (eds), *Nederland in de prehistorie*, 281-306.

Gijn, A. van and L.P. Louwe Kooijmans 2005. Vroeg- en midden-neolithicum: inleiding. In: L.P. Louwe Kooijmans, P.W. van den Broeke, H. Fokkens and A. van Gijn (eds), *Nederland in de prehistorie*, 203-218.

Grooth, M.E.Th. de 1991. Socio-economic aspects of Neolithic flint mining: a preliminary study. *Helinium* 31, 153-190.

Grooth, M. de 1997. Social and economic interpretations of the chert procurement strategies of the Bandkeramik settlement at Hienheim, Bavaria. *Analecta Praehistorica Leidensia* 29, 91-98.

Grooth, M. de 1998. The flint mines at Rijckholt-Sint Geertruid and their socio-economic interpretation. In: M. Edmonds and C. Richards (eds), *Understanding the Neolithic of North-Western Europe*, Glasgow, 351-369.

Heldal, T. 2009. Constructing a quarry landscape from empirical data. General perspectives and a case study at the Aswan West Bank, Egypt. In: N. Abu-Jaber, E.G. Bloxam, P. Degryse and T. Heldal (eds), *QuarryScapes: ancient stone quarry landscapes in the Eastern Mediterranean* (Geological Survey of Norway Special Publication 12), 125-153.

Hoof, D. 1970. *Die Steinbeile und Steinäxte im Gebiet des Niederrheins und der Maas*.

Hoof, L.G.L. van, I.M. van Wijk and C.M. van der Linde (eds) 2012. *Zwervende erven op de löss? Onderzoek van een nederzetting uit de vroege ijzertijd en van sporen uit de Stein-groep te Hof van Limburg (gemeente Sittard-Geleen)*, Leiden (Archol Rapport 33).

Labriffe, P.-A., A. Augereau, I. Sidera and F. Ferdouel 1995. Villemaur-sur-Vanne "Les Orlets" (Aube): quatrième et dernière minière de l'autoroute A5. Resultats préliminiaires. *Revue archéologique de Picardie* special 9, 105-119.

Lechterbeck, J., A.J. Kalis and J. Meurers-Balke 2009. Evaluation of prehistoric land use intensity in the Rhenish Loessboerde by canonical correspondence analysis – A contribution to LUCIFS. *Geomorphology* 108, 138-144.

Louwe Kooijmans, L.P. 2010. De VL-pot van Kootwijk en enkele andere potdeposities uit de tweede helft van het vierde millennium v. Chr. *Westerheem* special 2, 194-207.

Mans, R. 2011. *Depositiepatronen van Neolithische vuurstenen bijlen in Zuid-Nederland* (unpublished BA-thesis Leiden University).

Marichal, H. 1983. De exploitative, de verspreiding en het gebruik van Valkenburg-vuursteen tijdens het Neolithicum in Zuid-Limburg, Nederland. *Archeologie in Limburg* 18, 6-23.

Matzerath, S. 2007. Das mittlere Rurtal – eine jungneolithische Siedlungskammer im Schatten der Aldenhovener Platte. *Archäologie im Rheinland* 2006, 63-65.

Moor, J.J.W. de, C. Kasse, R. van Balen, J. Vandenberghe and J. Wallinga 2008. Human and climate impact on catchment development during the Holocene – Geul River, the Netherlands. *Geomorphology* 98, 316-339.

Nehren, R. 2001. Neolithische Fundstellen und Funde. In: H. Koschik (ed.), *Archäologische Talauenforschungen*, 106-126.

Oudemans, Th.C.W. and A.P.M.H. Lardinois 1987. *Tragic ambiguity. Anthropology, philosophy and Sophocles' Antigone*. Leiden.

Pepels, J. 2009. *Prehistorische en Romeinse vondsten in en rondom Ulestraten, gemeente Meerssen*. Maastricht.

Petrequin, P. and C. Jeunesse 1995. *La hache de pierre. Carrières vosgiennes et échanges de lames polies pendant le Néolithique (5400-2100 av. J.-C.)*. Paris.

Petrequin, P. and A.-M. Petrequin 1993. *Ecologie de l'outil: la hache de pierre en Irian Jaya (Indonésie)*.

Petrequin, P. and A.-M. Petrequin 2011. The twentieth-century polished stone axeheads of New Guinea: why study them? In: V. Davis and M. Edmonds (eds), *Stone axe studies III*, 333-350.

Petrequin, P., A. Sheridan, S. Cassen, M. Errera, E. Gauthier, L. Klassen, N. Le Maux and Y. Pailler 2008. Neolithic alpine axeheads, from the continent to Great Britain, the Isle of Man and Ireland. *Analecta Praehistorica Leidensia* 40, 261-279.

Pisters, H. 1983. Het gebruik van Valkenburgvuursteen in de prehistorie (vervolg). *Archeologie in Limburg* 16, 5-8.

Pisters, H. 1986. Werd door vuursteendelvers van de Lousberg ook Valkenburgvuursteen geëxploiteerd? *Archeologie in Limburg* 30, 193-196.

Pisters, H. 2008. De relatie tussen de neolithische vuursteenwinning van de Lousberg bij Aken, Simpelveld en Valkenburg a/d Geul. *Archeologie in Limburg* 109, 14-23.

Rudebeck, E. 1998. Flint extraction, axe offering, and the value of cortex. In: M. Edmonds and C. Richards (eds), *Understanding the Neolithic of North-Western Europe*, Glasgow, 312-327.

Schreurs, J. 2005. Het Midden-Neolithicum in Zuid-Nederland. In: J. Deeben, E. Drenth, M.-F. van Oorsouw and L. Verhart (eds), *De steentijd van Nederland*, 301-332. (Archeologie 11/12).

Schyle, D. 2006. Die spätneolithische Beilproduktion auf dem Lousberg in Aachen. Eine Hochrechnung von Angebot und Nachfrage und Rückschlüsse auf die spätneolithische Bevölkerungsdichte. *Archäologische Informationen* 29, 35-50.

Spielmann, K.A. 2002. Feasting, craft specialization, and the ritual mode of production in small-scale societies. *American Anthropologist* 104-1, 195-207.

Thirault, E. 2005. The politics of supply: the Neolithic axe industry in Alpine Europe. *Antiquity* 79, 34-50.

Thomas, J. 2000. *Understanding the Neolithic*.

Vanmonfort, B., H. Collet and Ph. Crombé 2009. Les industrie lithiques taillées des IVe et IIIe millénaires dans les bassins de l'Escaut en de la Meuse (Belgique). In: *Les industries lithiques taillées des IVe et IIIe millénaires en Europe* (BAR S1884), 11-39.

Verhart, L. 2010. De zuidelijke tegenhangers van de Vlaardingen-cultuur: een schamel spoor van scherven. *Westerheem* special 2, 208-223.

Verstraeten, G., T. Rommens, I. Peeters, J. Poesen, G. Govers and A. Lang 2009. A temporarily changing Holocene sediment budget for a loess-covered catchment (central Belgium). *Geomorphology* 108, 24-34.

Wentink, K., A. van Gijn and D. Fontijn 2011. Changing contexts, changing meanings: flint axes in Middle and Late Neolithic communities in the northern Netherlands. In: V. Davis and M. Edmonds (eds), *Stone axe studies III*, 399-408.

Wessel, I. and C. Wohlfarth 2008. *Archäologische Forschungen auf der Rheinbacher Lössplatte. Ein Projekt zur Prospektion in einem geographischen Kleinraum.*

Whittle, A. 1995. Gifts from the earth: symbolic dimensions of the use and production of Neolithic flint and stone axes. *Archaeologia Polona* 33, 247-259.

Zimmermann, A., J. Meurers-Balke and A.J. Kalis 2006. Das Neolithikum. In: J. Kunow and H.-H. Wegner (eds), Urgeschichte im Rheinland, 159-202.

Alexander Verpoorte
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
a.verpoorte@arch.leidenuniv.nl

The archaeological practice of discovering Stone Age sites

Milco Wansleeben and Walter Laan

Stone Age sites only rarely show the 'ideal' intra-site spatial distribution pattern of a single round area with one clear concentration of artefacts. The actual spectrum of site variation is so great as to prohibit any realistic modelling of the chance of discovery during a survey. It is well-nigh impossible to calculate one single optimal prospection strategy for finding these archaeological sites as Verhagen et al. (2011) try to accomplish. Despite this, our experience with spatial analysis of various Stone Age sites shows that there are a number of practical steps that can be formulated. These buried sites are indeed difficult to find but with a well-chosen stepwise approach the task can be both possible and economically viable.

1 Introduction

In 2011 the report Rapportage Archaeologische Monumentenzorg (RAM) 197 on the optimal strategies for the detection of Stone Age sites using core sampling in a statistical perspective was published by the State Service for Cultural Heritage (Verhagen *et al.* 2011). This report gave a excellent overview of the spatial distribution of flint on a number of Stone Age sites. The case studies presented are evenly spread over the entire Stone Age period and the various geological landscapes of the Low Countries. Dominant however is a statistical approach, heavily based on publications from the period of the 'New Archaeology'. During one of the first lessons in data analysis we inform our archaeology students that if an author requires a lot of statistics to support his argument, it might cause a feeling of "this is complicated..... it must be correct". This should however be replaced by a critical attitude instead. Why are simple maps and diagrams alone not enough to support the archaeological conclusions?

Archaeological (spatial) data do have very specific attributes and biases. We, as archaeologists, always remain conscious and cautious of this fact. A purely statistical analysis hardly ever pays enough attention to this though. The spatial properties of a Stone Age site cannot be modelled by the ideal of one single diameter and one average finds density. The different finds concentrations within one archaeological site and the variations in form and size between sites are simply too great. Furthermore, a single arithmetic generalization is redundant now that a cartographic abstraction is possible with modern GIS software. Interactive assessment and visual interpretation of a distribution map can, for example, easily take into account the fact that part of the site is affected by erosion and that one part clearly shows clustering and another part does not.

Admittedly, finding an optimal strategy for discovering buried Stone Age sites is no simple matter at all. There are a great number of factors influencing the chance of coming across finds in core samples or small test trenches. On the one hand there are the properties of the archaeology itself: the character of a site as a consequence of human behaviour in the past. 'Measurable' with parameters like the size and shape of the site, the average density and finds clustering. On the other hand we have the characteristics of the sampling strategy such as the distance between sampling points, size of the samples, method of gathering and treatment, form of the area of investigation and distribution of the sampling points. The approach chosen by Verhagen *et al.* (2011) based on a number of actual finds distributions at excavated Stone Age sites is excellent. The effectiveness of different sampling strategies is simulated as if these sites had not yet been excavated. A statistical calculation is made with the aim of a minimum detection chance of 75%, i.e. that the chosen sampling strategy should yield one flint item in one of the corings for at least 3 out 4 sites.

In this article however a more practical sampling approach is proposed based on the known spatial distributions from a number of sites in the RAM 197 report, supplemented by recently excavated sites by the Faculty of Archaeology (Leiden University) and Archol BV. Actually, in practice, many different sampling strategies have already been tried out at these sites. All confirming the theory that the bandwidth of variation of finds patterns is simply too great for one single optimal discovery method. From one location to the next a stepwise approach is necessary. At first a 'coarse' sampling of the area of investigation will give sufficient insight to optimize the next sampling phase(s) in terms of time, cost and increase in archaeological knowledge.

2 Stone Age sites characteristics

In report RAM 197 Verhagen *et al.* make use of two important parameters: the size and average density of finds of the Stone Age sites. Simultaneously the distribution maps presented make it clear that there is a large variation between the sites. Though site size and finds density determine, in their calculations, the chances of discovery, it will be shown that these statistical parameters cannot be determined unambiguously so as to yield realistic statistical modelling.

The character of Stone Age sites is simply too variable for that. On the one hand there are sites such as the river dunes (*donken*), for instance near Hardinxveld-Polderweg (Louwe Kooijmans 2001) and Hardinxveld-De Bruin (fig. 7 in Verhagen *et al*. 2011). Here a waste layer is imbedded in the surrounding clay and bog. A cultural layer that usually has a contiguous character with a relatively high finds density. Only a small portion of these river dunes were excavated (just as at Brandwijk; Van Gijn and Verbruggen 1992). However an extended ring of test trenches and pits have been laid down around the Hazendonk (fig. 1, after Amkreuz in prep.). The entire area of the site of Schipluiden (fig. 2; Louwe Kooijmans and Jongste 2006) was excavated and revealed an almost continuous presence of finds on both the dune and the low lying surrounding marshes. The original find patterns are, through processes of anthropogenic (e.g. trampling) and/or natural (e.g. animals, roots, wind, wave-action) origin, altered to an almost contiguous layer. Sites like A27-Hoge Vaart (Hogestijn and Peeters 2001) and the more recently excavated Dronten-N23 (Archol in prep.) can also be characterized by such rich find layers above the first features level. The amount of homogenization is hard to estimate but it is assumed that the vertical and/or horizontal displacement is limited and that the distribution of finds is still reasonably representative of human behaviour. There is often a clear relationship between the finds density and either the thickness of the cultural layer (e.g. Schipluiden) or the elevation of the river dune (e.g. Dronten-N23).

On the other hand there are sites such as Geldrop-Aalsterhut (fig. 5 in Verhagen *et al*. 2011) or Sweikhuizen-Groene Paal (fig. 19 in Verhagen *et al*. 2011) that largely conform to the ‘classic’ idea. In the undisturbed subsoil one isolated, round concentration of flint artefacts with one clear and unambiguous centre was found. This, however, seems to be an exception. Most sites display a succession of concentrations within the excavated area. Examples are Eyserheide (fig. 3 in Verhagen *et al*. 2011), Hempens-N31 (fig. 9 in Verhagen *et al*. 2011), Oudenaarde-Donk (fig. 15 in Verhagen *et al*. 2011), Verrebroek-Aven Ackers 2007 (fig. 23 in Verhagen *et al*. 2011) and A27-Hoge Vaart (fig. 11 in Verhagen *et al*. 2011).

At all these sites there are also sub-concentrations of varying sizes and richness. We can take the excavation at Hempens-N31 (Noens 2011) as an example here (fig. 3). First of all the extent of the excavation is larger than what is shown by Verhagen *et al*. (2011). Test trenches, shovel pits and core samples were part of the excavation strategy as well and these make it clear that there is much more information and spatial variation within this larger area. Alas, Verhagen’s simplification of the distribution maps of other sites too, does not always do justice to the actual spatial distributions. In general the investigators of Hempens-N31 distinguished three concentrations within the main research area of roughly 60 by 35 m. Concentration 1 (north) is smaller, round and less rich than the more elongated concentrations 2 (middle) and 3 (south). The southern concentration is the largest and is in fact composed of two overlapping sub-concentrations (3a and 3b) (see fig. 81, Noens 2011, 137).

It is also clear that a fair amount of flint was found outside this main area in both isolated squares and in small concentrations. This picture also emerges from the original publication of a site like A27-Hoge Vaart (Hogestijn and Peeters 2001). A much larger area was sampled or excavated than the main location of 50 by 20 m (fig. 4). For a substantial part of the, roughly 100 by 120 m, excavation area soil samples were taken with a 20 cm core in a 2 by 2 m grid. On the basis of these results it was decided to not only excavate the whole main area but also many sample squares of 2×2 m (with some extensions) in the periphery. And indeed, in this periphery, small, rich concentrations turned up. The main concentration itself, in general, consists of three concentrations of varying richness and each, again, made up of yet smaller sub-concentrations. Dronten-N23 also shows that the spatial distribution is a palimpsest of individual activities upon each other leading to a distribution pattern with clusters within clusters within clusters (fig. 5). The size and shape of the concentrations are related to the scale of observation (multi-scale spatial model). Sub-concentrations are each composed of one or more sub-concentrations of varying size and richness.

Numbers of finds trail off near the edges of a Stone Age site but almost never completely disappear. A27-Hoge Vaart illustrates perfectly that local concentrations of finds can exist outside the main one, even with an almost comparable high finds density. Off-site patterns (Foley 1981) have been a topic in Stone Age research for some time. Occasionally much time is consciously spent on trying to recover individual artefact in the periphery (Maastricht-Belvédère site N, De Loecker 2004). The idea is an archaeological landscape where sites have no definite end or border: the entire landscape was used in the past after all. Sometimes for activities which have left an enduring material deposit of either high or low density. Sometimes for activities that have left no traces at all.

It is difficult to discern discrete archaeological sites in the discontinuous distribution of flint over the landscape. How big actually is the site of Eyserheide (fig. 3 in Verhagen *et al*. 2011) (see fig. 6, according to fig. 6.3 in Rensink 2010)? Where does it end? Along the edges are grid squares both

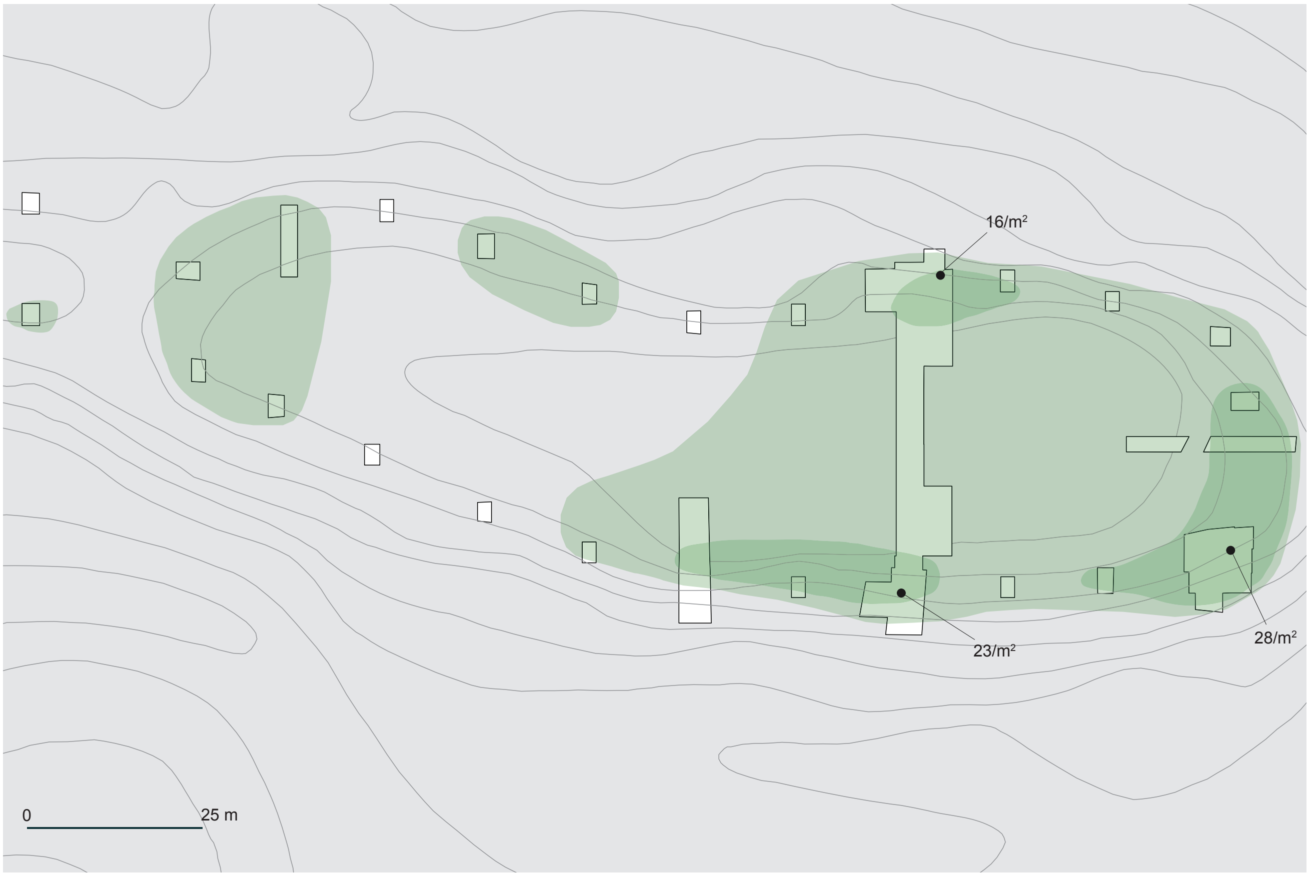


Figure 1 Standardized global distribution map of Hazendonk (manual find recovery spade/trowel) (after Amkreutz in prep.).

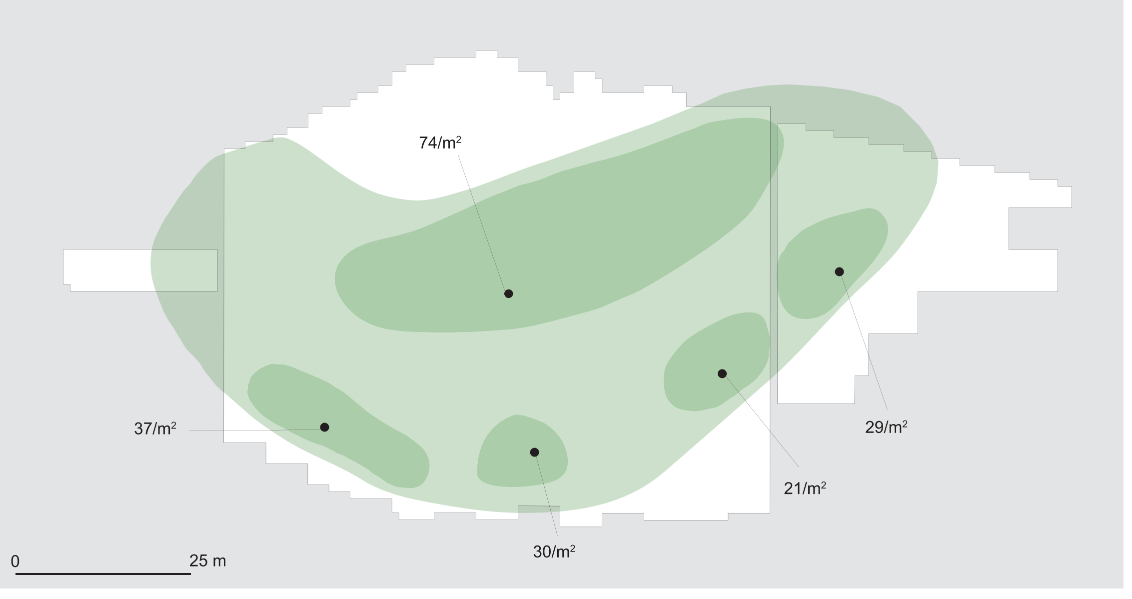


Figure 2 Standardized global distribution map of Schipluiden (wet sieving 4 mm) (after Louwe Kooijmans and Jongste 2006).

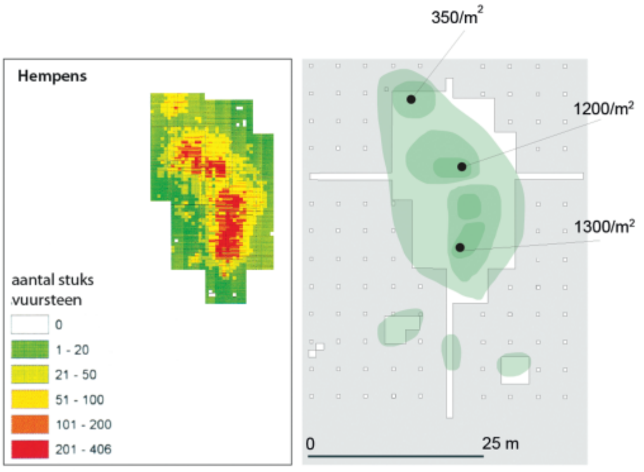


Figure 3 Standardized global distribution map of Hempens-N21 (wet sieving 3 mm) (after Noens 2011 and Verhagen *et al*. 2011).

with and without finds. The archaeological site itself is neither the excavated part nor the grid squares that had one or more finds. The border has a much more diffuse open character, certainly if the results of the test pits of 1×1 m are also taken into account. For our interpretations we usually demarcate a site with a sort of oval on the map, incorporating the general features and leaving the coincidental details to one side. Thus looking at the distribution map with a somewhat 'out of focus view', so to speak. In this manner we can also distinguish smaller clusters within the site. A GIS technique that is very useful for visualization of the 'bigger picture' is the so-called 'moving average technique' (examples are available for Schipluiden and Dronten-N23, respectively Louwe Kooijmans and Jongste 2006; Archol in prep.).

Stone Age sites thus appear not to be clear circles with one neat diameter but rather unpredictable *blobs* with one or several internal peaks of high density (e.g. Verrebroek-Aven Ackers, fig. 7, after Sergant *et al*. 2007). A seemingly simple statistic parameter like the average number of finds turns out

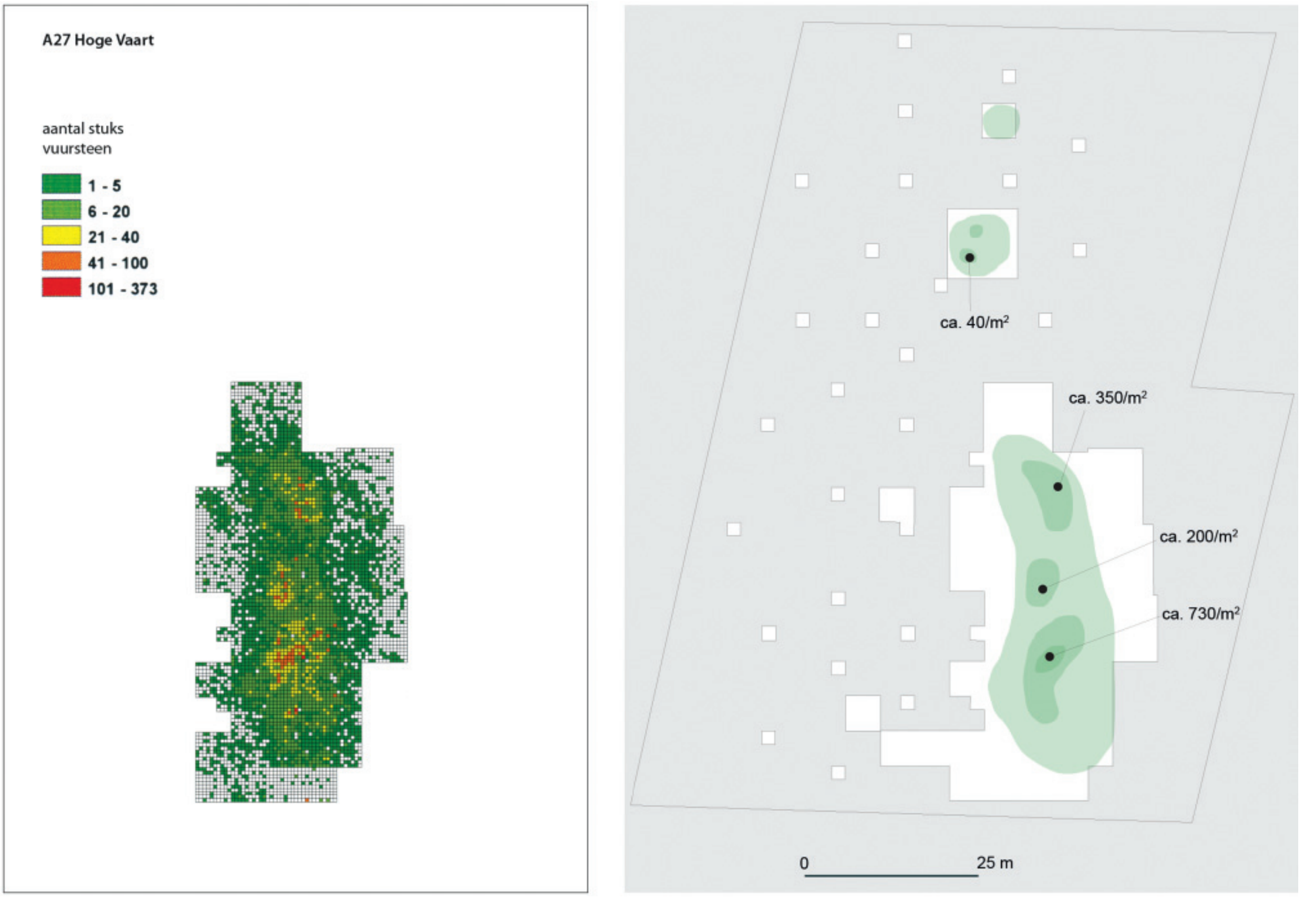


Figure 4 Standardized global distribution map of A27-Hoge Vaart (wet sieving 2 mm, the distribution maps only contain the flint artefacts > 1 cm^2) (after Hogestijn and Peeters 2001 and Verhagen *et al*. 2011).

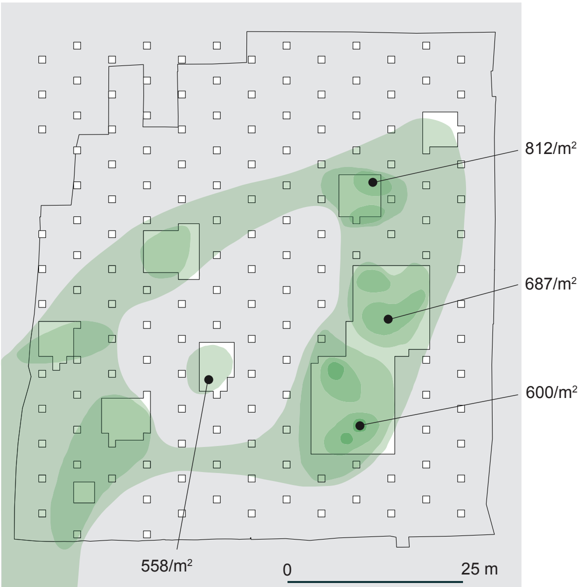


Figure 5 Standardized global distribution map of Dronten-N23 (wet sieving 2 mm) (after Archol in prep.).

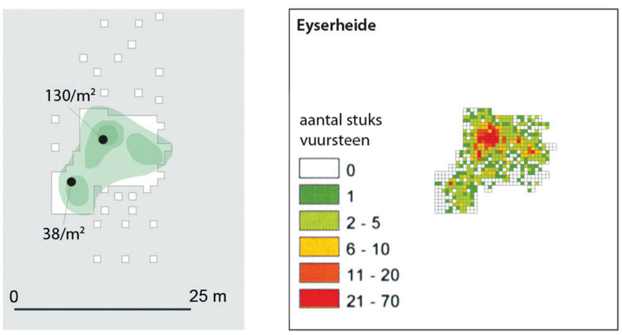


Figure 6 Standardized global distribution map of Eyserheide (trowelling) (after Rensink 2010 and Verhagen *et al.* 2011).

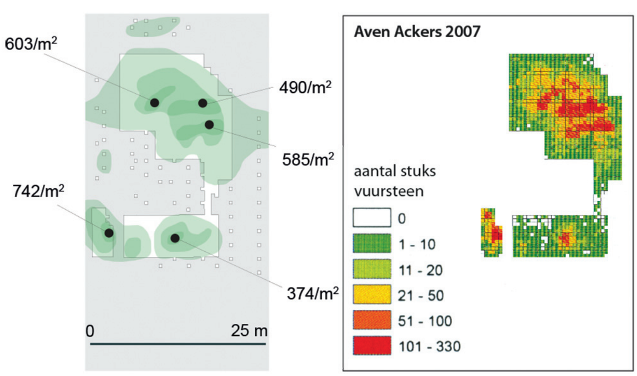


Figure 7 Standardized global distribution map of Verrebroek-Aven Ackers 2007 (wet sieving 2 mm) (after Sergant *et al.* 2007 and Verhagen *et al.* 2011).

not to be so. Indeed the arbitrarily chosen demarcation determines both the size (m^2) and the number of finds within the site. So, other limits will result in different average densities. This makes the statistical calculation of the chances of discovery very troublesome.

To sum up, it can be concluded that the excavated sites, with a few exceptions, have an unpredictable nature with a diffuse open 'limit'. The finds densities have a multi-scale character with multiple, partially overlapping concentrations of differing size, shape and density. Sites were often used for an extremely long period with activities of varying duration, extent and function, in a (partial) spatial overlap (palimpsests). Lastly, landscape and off-site archaeology made us aware that we can expect loose finds and small concentrations in a very wide area around the main concentration(s). These observations have important consequences for the discovery of buried Stone Age sites. The starting point of circular sites with neatly defined diameters and an average finds density is not realistic. The distribution of flint on a Stone Age site does simply not allow such a simplistic description (see the maps of Stone Age sites in this article).

3 Sampling approach

The factors determining the success of a sampling strategy have been well highlighted by Verhagen *et al.* (2011). Whilst the 'statistical' parameters of Stone Age sites do have a positive or negative effect on the probabilities of detection, they are completely beyond our control. As argued above, we cannot assume that Stone Age sites have neat average properties (shape, size, density, clustering etc.). In the following we will attempt to come to grips with the three factors affecting survey sampling over which we can have influence:

– sample size,
– sample treatment and
– sample density.

We should bear in mind that the overarching factor still is the available budget. Of course, one of the best pictures of flint densities is obtained if the entire research area is divided up into a fine grid of 'shovel pits' (25×25 cm squares) and the soil samples are wet sieved over a fine mesh (2 mm).
A much coarser grid of Edelman cores (10 cm diameter) and dry sieving over a more open mesh (5 mm) is considerably cheaper and faster but also gives a less reliable representation of the actual sites.

3.1 Sample size

Here it is assumed that samples are taken from the entire (sediment) layer holding flint artefacts. Therefore the sample size merely has to do with the area sampled. A coring with a diameter of 15 cm samples only 176 cm^2, whereas a 1×1 m test pit has an area of 10,000 cm^2. Since the goal is to estimate the finds density in a square metre such a test pit is no longer a 'sample', since the number of finds is the actual density for that square metre (100% sample). In comparison, the coring is only a less than 2% sample giving a very rough estimate of the actual number of finds. It is very well possible that nothing will be found in the coring when sampling the very centre of a site. Conversely, relatively many finds may mislead as to the richness of the sample square. Research in Dronten-N23 has demonstrated that interpolations from samples can lead to strong over- and underestimates of the actual numbers of finds later excavated (Archol in prep.).

The larger the sample taken, the higher the reliability

Especially with low finds density, a relatively small sample will often result in no finds in the core sample although there are artefacts present in that square metre. Naturally we want to avoid such an underestimation as much as possible, since the site is not discovered! Simply put, a mega-core with a diameter of 20 cm gives a much better result than an Edelman bore of 10 cm diameter. If affordable, a shovel pit of 25×25 cm is better still and ultimately exceeded by a full 1×1 m test pit.

3.2 Sample treatment

The size of flint artefacts on a Stone Age site usually displays a strong skewed distribution. In the sense that very many, really small pieces of flint are found in the sediment (micro-debitage) but that number dips dramatically as the size of artefacts increases. We usually find only a few large artefacts. This means that the method of find recovery has a big influence on the eventual numbers of finds in a square metre. Mechanized recovery yields fewer finds than recovery by hand with a spade, trowelling less than (wet) sieving, and sieving over a 4 mm mesh less than over a 2 mm mesh. In principle, an increasingly finer sample treatment yields (exponentially) more and more finds.

The finer the recovery method used, the higher the reliability

This assumption has a downside however. In practice, searching for micro-debitage, certainly in deposits that naturally contain flint, is very troublesome. The fraction is so small that it becomes increasingly difficult to distinguish pseudo-artefacts from real ones. There are instances where it afterwards became clear that the counts of artefacts in this tiny fraction actually produced a distribution map of the naturally occurrence of river gravel (St. Odilënberg-Neliske, Verhart 2000). A mesh of 1 mm could well produce more 'noise' than an actual anthropogenic signal. A practical lower limit seems to be 2 mm. By the way, with a decrease in mesh size only a small increase in the amount of extra work and costs occurs.

3.3 Sample density

It is obvious that the more samples are taken, the better the insight into the buried flint distribution. With a high core-density the distance between samples is smaller. The discussion about whether a regular or staggered grid performs better (Tol *et al*. 2004) has become less relevant now. With the erratically shaped Stone Age sites the advantage of a staggered grid, theoretically already trivial (Kintigh 1988), is virtually nil. The maximum diameter of a round site that could exactly fit between the core samples is in practice not relevant at all.

What does seem important is that, in general, archaeological spatial data displays a high degree of spatial autocorrelation. That is to say that sample points that are next to each other show reasonably similar results. If we have many finds in a particular square metre then the square metre next to it will very often also have a high density. This autocorrelation can be helpful in discovering sites. We can be fairly sure that when we come across two adjacent samples containing flint that we are homing in on a site.

The question whether an optimal sampling distance between samples exists, considering the irregular character of Stone Age sites, must firmly be answered with a No. These sites (with or without a culture layer) and the off-site concentrations, are indeed so varying in size and shape that any attempt fails to calculate beforehand how distant sample points should be in order not to miss a site. In practice the reverse should be considered: given the sampling spacing, we can reason what minimum size the detected sites have.

The smaller the sample spacing applied,
the smaller the detected sites

Here also experience does not fully conform to theory. Flint fragments are found everywhere, but a single artefact in a single coring does not mean we are talking about an archaeological site yet. The existence of an off-site distribution pattern plays, of course, a conscious role in this interpretation. A single, loose find is not usually regarded as significant. Only if relatively high numbers of finds in (adjacent) samples occur is there sufficient motivation to investigate a location more closely. Based on this, our rule of thumb is that a sampling distance of 5×5 m renders a fairly trustworthy insight into sites or concentrations of roughly 10 m size.

4 Discussions

In the detection of buried Stone Age sites the characteristics of the sites themselves play a role. The following plain and simple rules seem to hold:

- the bigger the site the easier it is to find
- the richer the site the easier it is to find
- the less clustered the finds on the site the easier it is to find

At the start of a survey we have no influence on these factors however, as the sites are yet to be discovered. We only know for certain that there will be an extremely wide variation in size, shape and degree of clustering.
Where we do have influence can be seen in the following rules:

- the more samples the greater the chance of detection
- the larger the samples the greater the chance of detection
- the finer the recovery method the greater the chance of discovery

It is, however, unrealistic to expect an unlimited budget needed to apply these rules. At the beginning of a survey we therefore face a choice like: do we set out 10 test pits of 1×1 m or do we carry out 100 coring samples of 10 cm diameter? With the widely spaced test pits there is a big chance of missing sites though; on the other hand, if we actually land on a site then the size of the sample gives great assurance of actual discovery. That is not the case if we work with the small cores. Right in the middle of a site we could still come up with nothing! With smaller samples chance plays a greater role, sample results sometimes will suggest something totally different to the actual situation.

Not only the way of sampling (spacing, type) is important, but also the treatment of the soil sample. The de-facto standard for surveying Stone Age sites is sieving. Depending on the availability of water, wet sieving over a 2 mm mesh seems the most practical and informative approach.

In daily practice the budget determines it all: we try to optimize the archaeological information according to what is available (time, money, personnel). A step-wise approach has already been the common practice in Dutch archaeology. Indeed we don't just open an excavation trench anywhere these days. In the Quality Standards for Dutch Archaeology (KNA) an agreed series of steps is laid out: desk assessment, field prospection, test trenches and the final excavation. This step-wise approach also holds true for the discovery of Stone Age sites.

From our experience over the last years, we therefore propose the following practical approach. First carry out a coring investigation using a relatively coarse grid, gathering the biggest possible samples (e.g. 20 cm mega-core) and sieving over a fine mesh (e.g. 2 mm). The choice of sampling technique is determined by pre-existing knowledge of the research area, for example on the basis of desk assessment or similar research nearby. If we are expecting large, rich Stone Age sites with a cultural layer such as a number at Hoge Vaart sites, then the first phase of the survey can be somewhat coarser. Evaluate the results of that first phase on its merits. Interpret the results in a relative but specific way, just for the present research area. The fact that during another project somewhere else regularly five flint fragments in a coring were discovered is no measure to expect the same at this location. Perhaps the soil conditions or those of preservation were simple better there. Judge the results not only in a quantitative but also a qualitative way. A coring with one arrowhead has a different interpretative value than a coring with a tiny unsure flint flake. And consider not only flint but also other material categories such as charcoal, stone, bone or pottery (for Neolithic sites) for the demarcation of the sites.

The interpretation of the first phase of sampling (see example, fig. 8) guides and triggers the second phase. This next step leads to a denser sample grid and/or enlargement of the samples. In between the existing samples, new (mega) corings are taken or shovel pits/ small test pits are laid down. Where relatively many finds were discovered we go, for

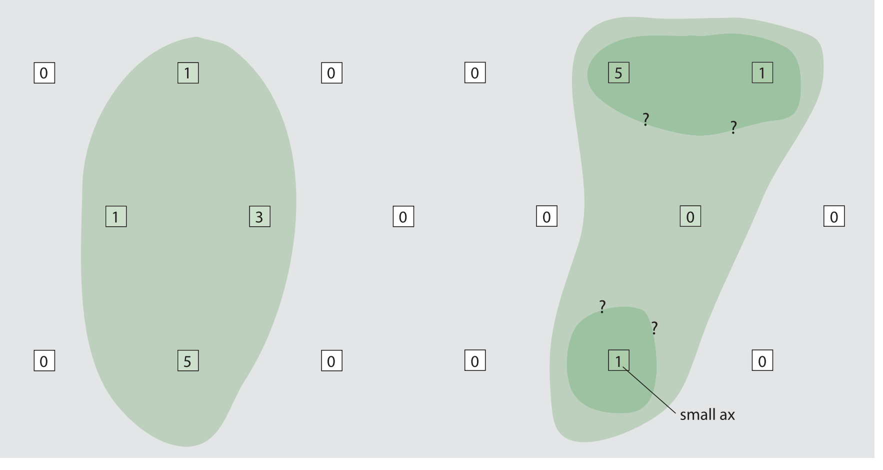


Figure 8 Results of a fictitious first phase coring sampling of a small research area, showing that the demarcation of the archaeological sites, as possibly discovered, is not unambiguous.

example, from a 10×10 m core grid to a 5x5 m grid of shovel pits. The more expensive techniques are thereby applied to a limited extent but in a highly targeted manner.

This proposed step-wise process can happen in multiple steps, an evaluation and interpretation always followed by an even more intensive sampling. So, in the end only the best locations are determined for the time and energy intensive complete excavation.

What we have learned over the years, by trial and certainly error, is that over the entire trajectory of sampling phases, the treatment of the samples should remain constant. Coring samples sieved over a 2 mm mesh and test pits sieved over 4 mm mesh create an extremely difficult to interpret distribution map of flint on a Stone Age site (e.g. Hanzelijn-Oude Land, Wansleeben *et al*. 2011). With one uniform method of sample treatment, we will make it much easier for ourselves (e.g. Dronten-N23, Archol in prep.) to reconstruct past behaviour on the basis of spatial distribution. With that, it does not really make any difference whether we have opted for manual recovery with a spade, for trowelling or for sieving over a specific mesh size. The spatial distribution within a single site is always evaluated relatively: where are the areas with more and fewer finds of a particular category?

In order to make excavated Stone Age sites better comparable with each other it is recommended to oblige researchers, in any case, to give a standardized number of finds from one of the richest areas. The actual artefact counts must be referrable to, for instance, the number of finds per square metre over a 3 mm sieve mesh. Therefore we propose that during an excavation, a limited number of sample units should also be sieved over 3 mm, so that for this site a conversion factor can be determined. 'If we hadn't used manual find recovery, but had sieved over a 3 mm mesh then we estimate that 2.7 times as many finds would have been found'. With this conversion factor the richest areas could have been calibrated to comparable maximum densities. Unfortunately, this was not possible when preparing the maps in figures 1 to 7. This might be a point of attention for the next revision of the KNA.

References

Amkreutz, L. in prep. *Negotiating Neolithisation. A long-term perspective on communities in the process of Neolithisation in the Lower Rhine Area (6000-2500 cal BC)*. PhD thesis Leiden.

Archol, in prep. *Dronten N23/N307 – vindplaats 5* (Archol rapport 174).

De Loecker, D. 2004. *Beyond the site. The Saalian archaeological record at Maastricht-Belvédère (the Netherlands)*, Leiden (Analecta Praehistorica Leidensia 35/36).

Foley, R.A. 1981. Off-site archaeology: an alternative approach for the short-sited. In: I. Hodder, G. Isaac and N. Hammond (eds), *Pattern of the Past: Essays in Honour of David Clarke*, Cambridge: Cambridge University Press, 152-184.

Gijn, A.L. van and M. Verbruggen, 1992. Brandwijk: Het Kerkhof. In: J.-K.A. Hagers and W.A.M. Hessing (eds), *Archeologische Kroniek van Holland 1991*, Holland 24, 349-352.

Hogestijn, J.W.H. and J.H.M. Peeters (eds) 2001. *De mesolithische en vroeg-neolithische vindplaats Hoge Vaart-A27 (Flevoland)*, Amersfoort (Rapportage Archeologische Monumentenzorg 79).

Kintigh, K.W. 1988. The effectiveness of Subsurface Testing: A Simulation Approach. *American Antiquity* 53(5), 686-707.

Louwe Kooijmans, L.P. (ed.) 2001. *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v. Chr.)*, Amersfoort (Rapportage Archeologische Monumentenzorg 83).

Louwe Kooijmans, L.P. and P.F.B. Jongste (eds) 2006. *Schipluiden. A Neolithic settlement on the Dutch North Sea coast c. 3500 cal BC*., Leiden (Analecta Praehistorica Leidensia 37/38).

Noens, G. 2011. *Een afgedekt mesolithisch nederzettingsterrein te Hempens/N31 (gemeente Leeuwarden, provincie Friesland, Nl.)*, Gent (Archaeological Reports Ghent University 7).

Rensink, E. 2010. *Eyserheide. A Magdalenian open-air site in the loess area of the Netherlands and its archaeological context*, Leiden (Analecta Praehistorica Leidensia 42).

Sergant, J., M. Bats, G. Noens, L. Lombaert and D. D'Hollander 2007. Voorlopige resultaten van noodopgravingen in het afgedekte dekzandlandschap van Verrebroek – *Aven Ackers* (Mesolithicum, Neolithicum). *Notae Praehistoricae* 27, 101-107.

Tol, A.J., J.W.H.P. Verhagen, A.J. Borsboom and M. Verbruggen 2004. *Prospectief boren. Een studie naar de betrouwbaarheid en toepasbaarheid van booronderzoek in de prospectiearcheologie*, Amsterdam (RAAP-rapport 1000).

Verhagen, J.W.H.P, E. Rensink, M. Bats and Ph. Crombé 2011. *Optimale strategieën voor het opsporen van Steentijdvindplaatsen met behulp van booronderzoek. Een statistisch perspectief*, Amersfoort (Rapportage Archeologische Monumentenzorg 197).

Verhart, L.B.M. 2000. *Times fade away. The neolithization of the southern Netherlands in an anthropological and geographical perspective*, Leiden (ASLU 6).

Wansleeben, M., W. Laan and S. Knippenberg 2011. Ruimtelijke analyse. In: E. Lohof, T. Hamburg and J. Flamman (eds), *Steentijd opgespoord. Archeologisch onderzoek in het tracé van de Hanzelijn-Oude Land*, Leiden (Archol rapport 138) / Amersfoort (ADC rapport 2576), 79-113.

Milco Wansleeben
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
m.wansleeben@arch.leidenuniv.nl

W. Laan
Archol
P.O. Box 9515
2300 RA Leiden
The Netherlands
w.laan@archol.nl

A causewayed enclosure near Ermelo?

Hans Kamermans, Joanne Mol, Eric Dullaart and Miranda de Kreek

Causewayed enclosures are large earthworks dating from the period 4500 - 3500 cal BC. They are quite common in Europe, and only one is known from the extreme southern part of the Netherlands. Shortly after the introduction of the AHN (Actueel Hoogtebestand Nederland), a LIDAR image of the whole of the Netherlands, a structure looking like a causewayed enclosure was discovered on the image of the Veluwe (Central Netherlands). Precise measurements in the field and geological research showed however that the structure for the largest part has a natural origin.

1 Introduction

Causewayed enclosures, or "Erdanlagen" in German and "enceintes interrompues" in French, are large earthworks dating from the period 4500 – 3500 cal BC and are quite common in Europe. They belong to the Michelsberg and contemporaneous cultures. Examples are known from South Scandinavia, Germany, Belgium, France and the British Isles (Andersen 1997; Burgess *et al*. 1988). Only one is known from the Netherlands (Schreurs 2005, 311).

A causewayed enclosure is oval in form, often close to a circle, between 0.4 and 10 hectares in extent and (most of the time) consists of one or more concentric ditches and banks at intervals interrupted by gaps (causeways) (Oswald 2011). They can be situated both on hilltops and in lowland areas, often on sloping ground and near watercourses. They are the earliest example of the enclosure of a large open space. In general no features are found in the interior, only a few pits and postholes, but from the banks and ditches various objects have been recovered, like pottery, flint, food remains and in some cases human bones in the form of skulls. Often the form of the enclosures has been frequently modified and the banks and ditches recut. Often recurrent deposition took place during recutting.

The function of these enclosures is still under debate (Gibson 2002). They were not habitation sites, nor was defence their primary purpose. Some researchers see them as trade centres, cattle compounds or fairgrounds. Others argue that the construction of the enclosure itself was the main purpose of building them. In any case, in the Michelsberg culture they are considered by most researchers as communal ceremonial centres of a society on a higher level than the individual settlements.

2 Discovery

The introduction in 2003 of the AHN (Actueel Hoogtebestand Nederland), a LIDAR image of the whole of the Netherlands, proved to be a treasure trove for archaeologists (Waldus and van der Velde 2006). LIDAR stands for Light Detection And Ranging. It is a remote sensing technique that, in the case of the AHN, measures the distance between an airplane or a helicopter and the surface of the earth using pulses from a laser. These measurements can be transferred into a Digital Elevation Model (DEM). Many features like barrows (De Boer 2007) and Celtic fields are easily recognized on these DEM images. In 2004 de Kreek wrote her MA thesis on the use of LIDAR images for the recognition of Roman structures in the Dutch landscape (de Kreek 2004). While searching in the AHN data for a Roman marching camp from the 2nd or 3rd century AD, known to be situated on the heath near Ermelo (fig. 1, Ermelosche Heide, the Netherlands), a large oval feature was discovered that resembles a causewayed enclosure (fig. 2).

The Limes, the frontier of the Roman Empire, was situated along the river Rhine, but the Roman army would now and then venture into enemy territory. In the evening the Romans constructed a temporary camp with rampart and ditch. The camp on the heath near Ermelo is situated 35 km north of the Limes along an important route from the border to the Flevo Lake. It has the shape of a rhombus with sites of *c*. 300 to 350 metres. The enclosed area is *c*. 9 hectares. The rampart is *c*. 6 metres wide and less than a metre high; the ditch is 3 metres wide and 50 cm deep (Klok and Brenders 1981, 9-10). Part of it was excavated in 1923 (Holwerda 1923). Additional research has been carried out in 1987 (Bechert and Willems 1995, 79; Hegener 1995, 48). The camp is clearly visible on the LIDAR image, but it intersects a much larger, oval-shaped structure (fig. 3).

This oval structure measures 50 hectares and resembles a causewayed enclosure with one bank, a number of times interrupted. The banks are 6 to 8 metres wide and several decimetres high. In the northeast the bank is missing, a small river valley (Leuvenumse Beek) forms the boundary of the

Figure 1 The location of Ermelo in the Netherlands.

enclosure. A part of it is covered by forest. A road (Flevoweg) cuts through the structure. In order to establish the nature of the large structure, fieldwork was carried out during the summer of 2004.

Only part of the enclosure was available for field research. The part NE of the road Flevoweg is private property and research in that part of the structure was not possible. The part SW of the road is a former military training area. In this part we tachymetrically measured more than 2,400 elevation points and augered 60 boreholes up to a depth of 2 meters.

3 The landscape

The present, undulating landscape is the result of glacial deformation by large ice masses that dominated the northern and central part of the Netherlands during the Saalian glacial stage. While in the northern part of the Netherlands glacial till was laid down, the front of the ice cover in the Central Netherlands was dominated by glacial erosion. Glacial surge of the ice lobes created deep glacial basins and ice-pushed ridges several tens of metres high. Underlying fluvial deposits were pushed forward by the advancing ice and ridges with imbricated fluvial deposits were the result.

The study area is located on the eastern slope of the Garderen ice-pushed ridge, which is part of the larger Veluwe ice-pushed ridge system. To the west lies the

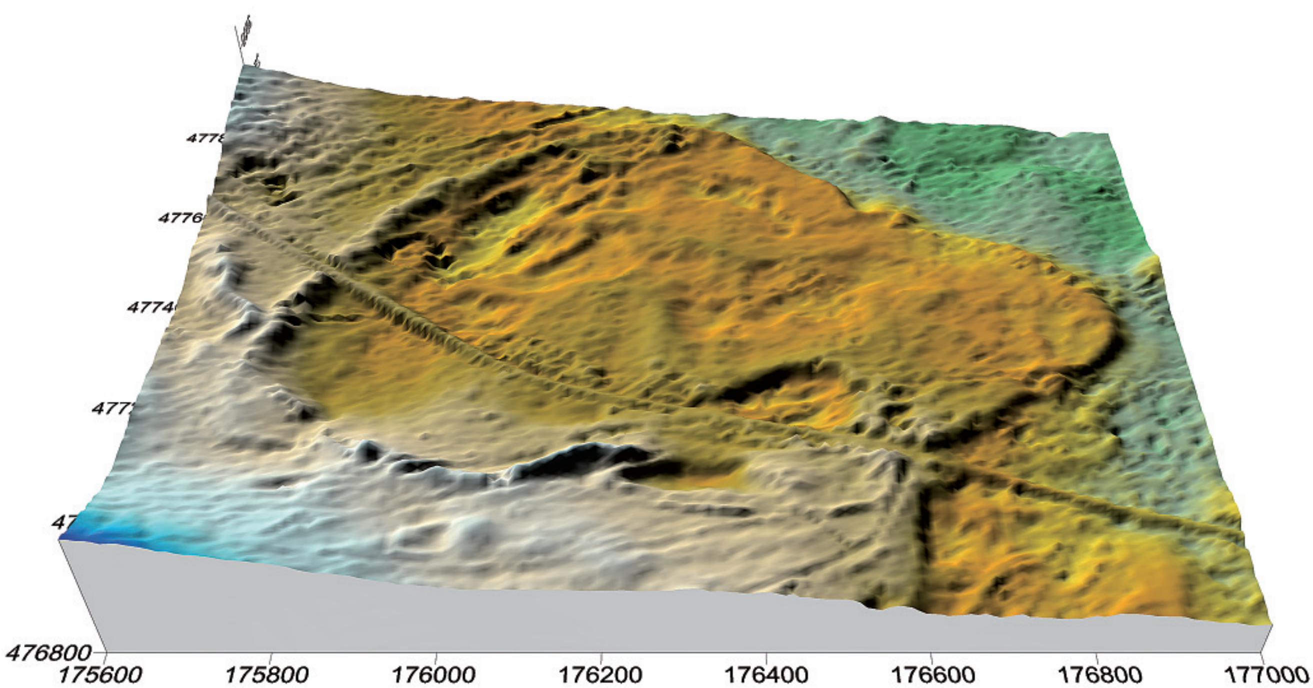


Figure 2 Oblique Digital Elevation Model of the Ermelosche Heide, based on the LIDAR-image (AHN) of the Netherlands. Both the Roman March Camp (the rhombus on the left) and the supposed causewayed enclosure (the oval shape) are visible.

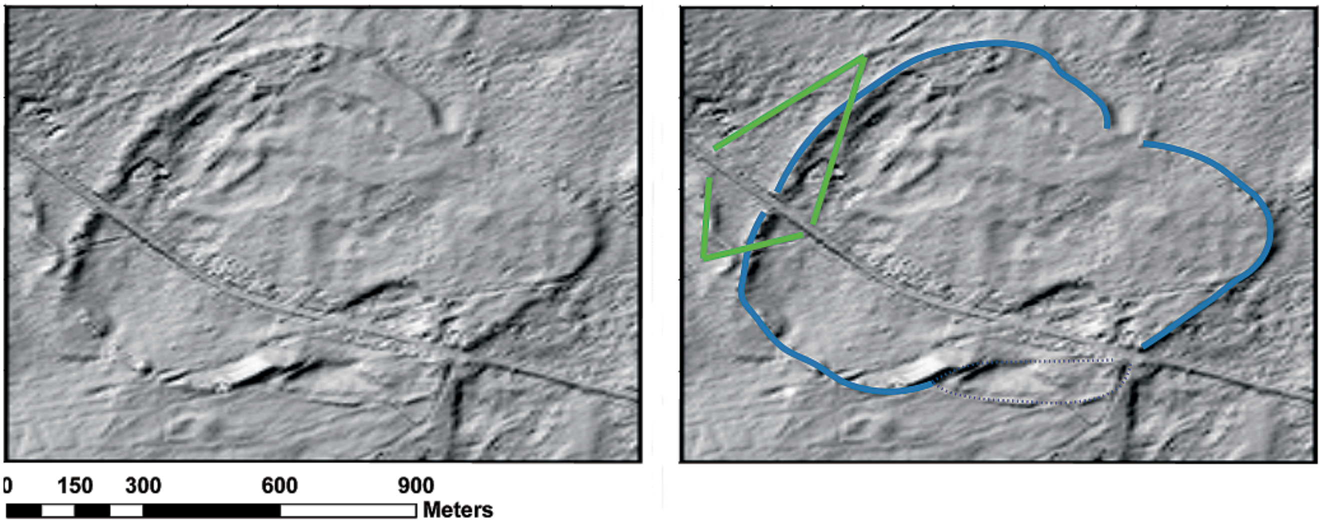


Figure 3 Digital Elevation Model of the possible causewayed enclosure, based on the LIDAR-image (AHN) of the Netherlands. On the left the Roman March Camp.

extensive glacial basin of the Gelderse Vallei. The area is marked by the presence of an eastward sloping kame terrace, composed of gravelly glaciofluvial deposits. It was formed during a melting phase, when an ice lobe formed a small glacial basin in the present valley of the Leuvenumse Beek. The meltwater became trapped between the high Garderen ice-pushed ridge and the ice lobe, resulting in the deposition of an extensive sheet of glaciofluvial sand and gravel between the ice lobe and the Garderen ridge (Eilander *et al*. 1982, 15; Berendsen 2005, 47). More eastward in the small glacial basin, meltwater clay was deposited (van der Straaten 2008). The latter resulted in wet conditions, because this clay blocked the percolation of the rain water and groundwater flowing in from uphill. This created a damp depression with small streams, at present occupied by the Leuvenumse Beek. It is a very uncommon phenomenon in this dry, sandy region.

During the Weichselian, the kame deposits were partly redeposited as solifluction lobes on both sides of the valley of the Leuvenumse Beek. More uphill aeolian sand sheets and dunes were deposited (Eilander *et al*. 1982, 18).

The present surface in the study area is characterized by a gentle east-sloping terrain with low, elongated ridges. For a long time, the ridges were interpreted as eskers, but nowadays they are regarded as aeolian in origin (Berendsen 2005, 47).

4 Geology and soil formation

The Garderen ice-pushed ridge is composed of Early and Middle Pleistocene fluvial deposits of the river Rhine and an eastern river system, called 'Eridanos'. These sediments are the source for both the glaciofluvial and the aeolian deposits. The study area is located in an area in which both fluvial sediments can occur (Eilander *et al*. 1982, 13). The Rhine deposits are slightly richer in minerals and clay content than the deposits of the Eridanos system, which are very poor in nutrients and clay. It results in the formation of different types of soils, 'normal' podzol soils in the deposits of the Eridanos system and brown podzol soils in the deposits of the Rhine river. The glaciofluvial and the aeolian deposits are characterized by 'normal' podzol soils (Eilander *et al*. 1982).

Normal podzol soils can be distinguished by their typical white-grey eluviation horizon (also referred to as 'ash-layer') and a dark, mull-type humus-enriched B-horizon. The brown podzol soils generally contain more gravel than the normal podzols and have a less visible eluviation horizon and a less well-defined brown B horizon, due to a more intense biological activity (Locher and de Bakker 1990, 117).

According to the soil map, the normal podzol soils are present in the study area, while *c*. 1 km to the west brown podzol soils developed (fig. 4).

At present the study area is a nature reserve. Google Maps reveals parallel stripes on the present surface. This indicates stripping of the upper vegetation layer (cutting of sods, Dutch: plaggen) to encourage heath growth in this nature reserve. The upper soil horizons were probably either removed, or disturbed by this recent disturbance.

5 Fieldwork

The fieldwork comprised of two parts. The first part was the measurement of the topography, the second part of the fieldwork was the mapping of the subsurface.

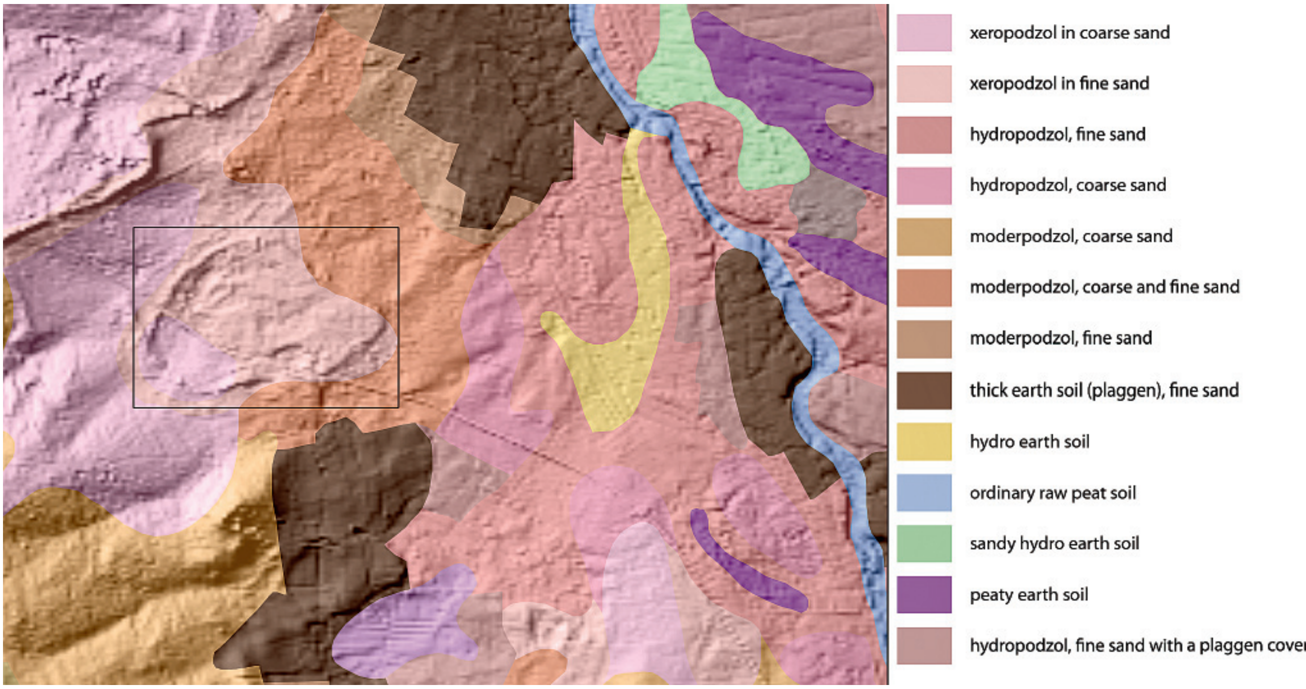


Figure 4 The soil map of the Ermelose Heide; the rectangle indicates the location of the supposed causewayed enclosure.

5.1 Digital Elevation Models

The LIDAR-based Digital Elevation Model of the south-western corner of the Ermelo enclosure has been verified in the field with the use of a Total Station. We took more than 2400 measurements and created one DEM on the basis of these measurements and one on the basis of the LIDAR data (fig. 5). A visual comparison of the two resulting DEMs shows little difference between the two models; the Total Station data shows slightly more detail. In fact, the difference in quality must be considered too small to compensate for the enormous amount of handwork needed to gather Total Station data of this, relatively small, part of the structure. Additionally, at the time of this investigation only the first version of the AHN, AHN1 was available. Future comparison of the tachymetric model with the AHN2 data set might even tip the balance of quality towards the LIDAR data.

A cross section along several axes of the structure hint at the existence of a (double?) ditch, at least in the south-western part. This feature however may have a vast number of possible causes and any suggestion of its relationship to the enclosure must be verified by further investigation (see below).

Another interesting detail of the structure is the occurrence of two depressions near the banks on the inner side of the north-western and southern parts of the structure. The depression in the south seems to have been larger in the past and its mid-section is now filled to accommodate the Flevoweg. If some of the banks are indeed man-made, the material to create them must have come from somewhere. Further investigation may shed a light upon whether the material of the banks originated from these depressions or elsewhere.

5.2 The transects

The mapping of the subsurface was focused on the mapping of soil horizons. By augering up to a depth of 2 metres, the soil horizons, but also the sediment type were established.

The interpretation of the sections is based on the assumption that the soils differ in a natural and a man-made elevation. An increase in thickness of the top soil, the A-horizon, indicates a anthropogenic cover, since a natural A-horizon is never thicker than 30 cm in the Netherlands (Locher and De Bakker, 1990). On the other hand, the absence of the top soil horizon(s) indicates that the original surface has been lowered, either by natural erosion (aeolian deflation) or removal by humans.

Five different transects (fig. 6) show the various sediments and the soils that were formed in the top.

Transect 1 shows the sedimentary sequence (fig. 7). Sedimentologically, the transect can be subdivided into two main units: fine sand with occasional gravel that is well

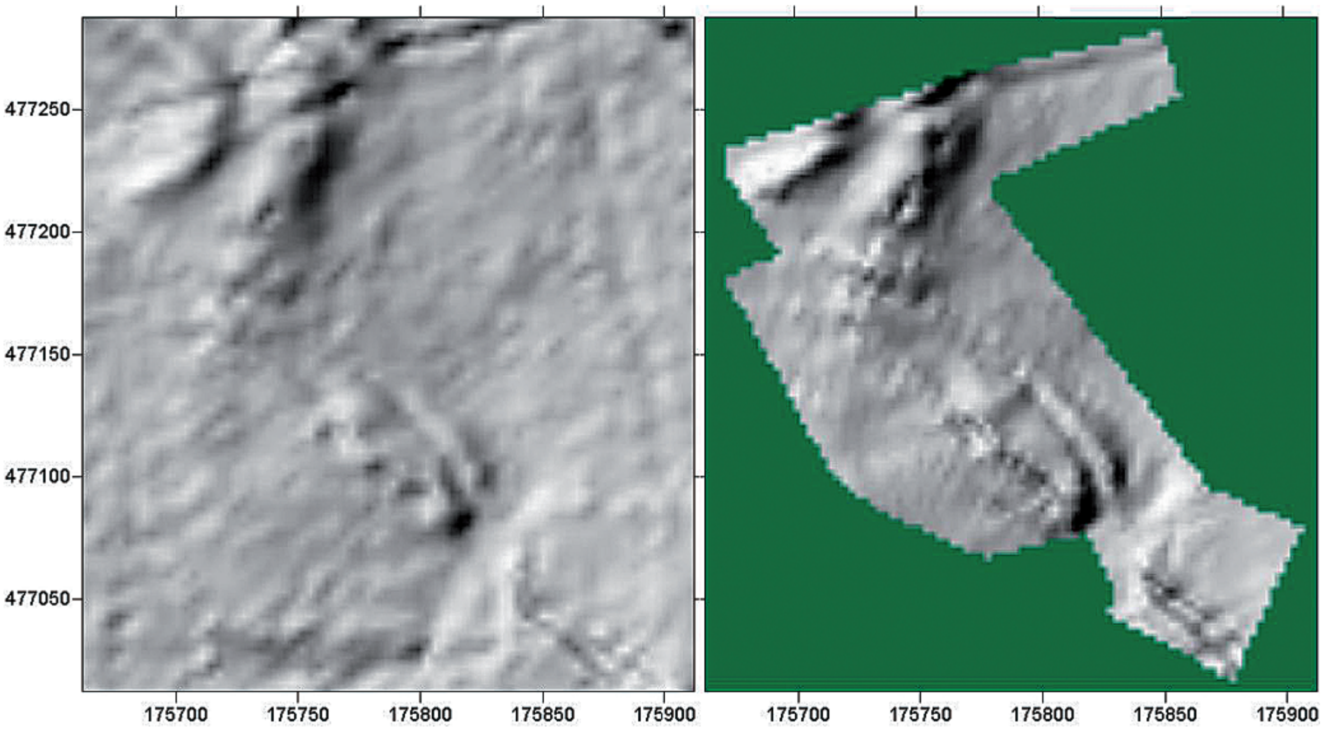


Figure 5 Digital Elevation Models. The one on the left is based on the AHN, the one on the right on Total Station measurements.

sorted, on top of medium to coarse sand with slightly larger gravel (up to 1.5 cm) that is poorly sorted. The well-sorted sand is interpreted as aeolian (cover)sand, the poorly sorted sand is likely to be fluvial in origin.

The difference between the glaciofluvial meltwater deposits and the glacially deformed fluvial deposits is difficult to establish, based on these data. However, the transect shows the slope of the topography well. The top of the lower unit slopes downvalley towards the Leuvenumse Beek. Therefore, the lower unit is most likely to have a glaciofluvial origin, forming a kame terrace (*cf*. Eilander *et al*. 1982).

Furthermore, since the ridge is mainly composed of the top unit, the aeolian deposits, this transect undisputedly indicates an aeolian origin for this part of the structure.

In general the soils in transect 1 are well developed and have thicknesses of 50 cm on average. The soils are characterized by well-developed leached (E-)horizons, usually mixed with the A-horizon, and humus and iron-enriched B-horizons. The soils in this transect could all be characterized as humuspodzol soils.

Boring 31 is located in a depression that could have pointed to the presence of a ditch, as postulated above. However, it shows no podzol soil formation. Therefore, it is likely to be caused by a recent disturbance, possibly related to the military practices of several decades ago.

Boring 33 shows a rather thick A-horizon, of which the top is interpreted as a plaggen soil. This soil will be discussed below, in transect 5.

Transect 2 shows a similar sequence, poorly sorted glaciofluvial sediments at the base and aeolian deposits on top (fig. 8). Here, the aeolian deposits not only form the ridge, but also cover the glaciofluvial deposits towards the centre of the structure. The soils in the top of the aeolian deposits are well developed, though almost all A- and E-horizons have been mixed (except in core 12).

Transect 3 confirms the picture of transects 1 and 2: the ridge consists of aeolian deposits, located on top of glaciofluvial deposits (fig. 9). The northern slope in this transect has a thin top soil, which is probably due to slope erosion. The southern slope is disturbed: the natural soil is absent and a cover of dark brown, humic poorly sorted medium sand with a spotted appearance is present on top of a finer grained aeolian sand cover. This disturbance can be explained by the presence of a former military tank-road nearby.

Transect 4 has a similar topography as transect 1: a small depression or ditch within the ridge (fig. 10). Also this depression is relatively recent: soil formation is limited, there

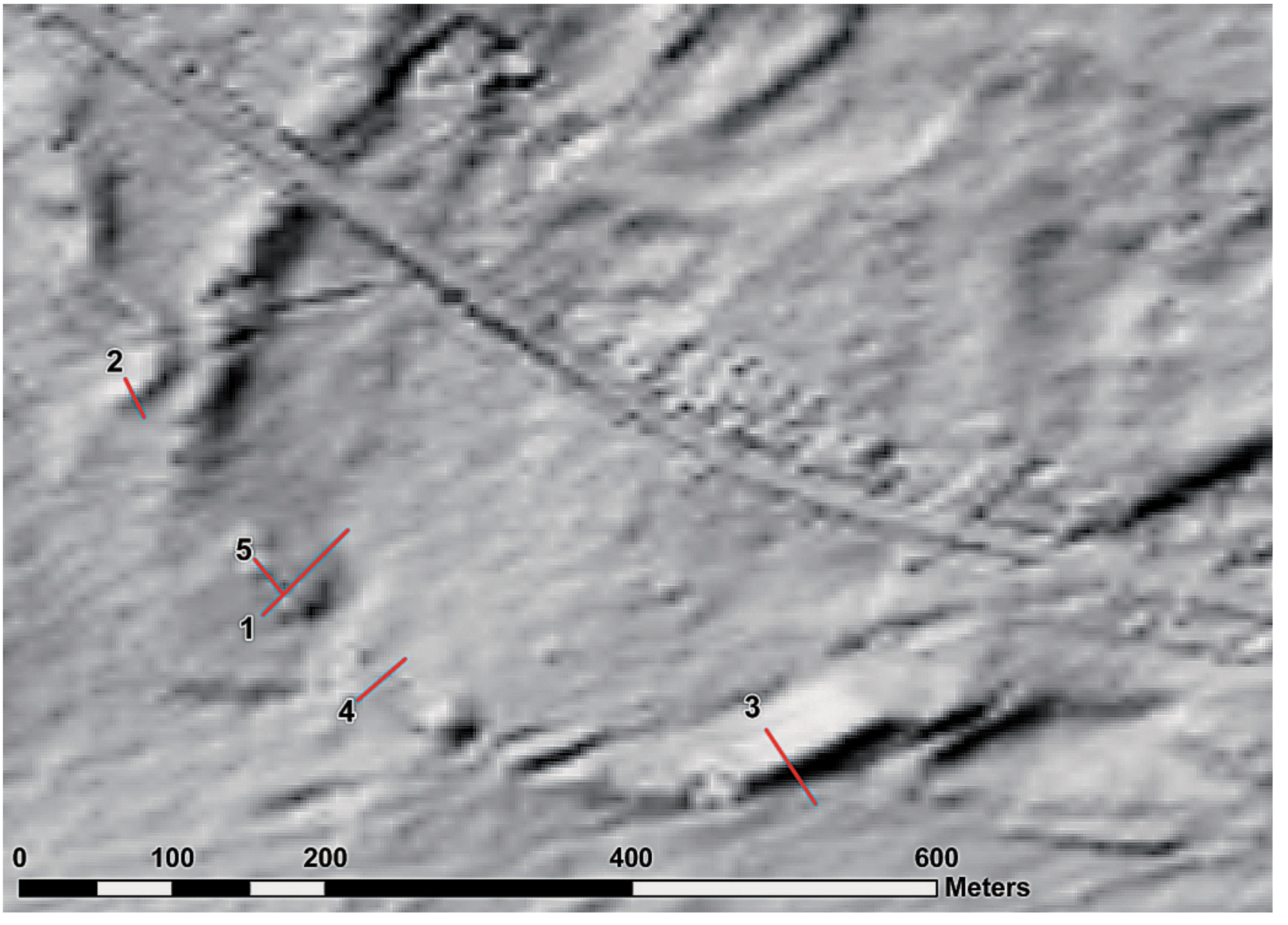


Figure 6 The location of the five transects.

is no podzol-B horizon. The ridge has a similar formation as well: it consists of well-sorted sand that lies on top of poorly sorted sand. A well-developed podzol soil is present in the top.

Also this ridge can be regarded as formed by aeolian deposition on top of the glaciofluvial deposits. A thin plaggen cover is present on its top. This cover though is likely to be the pile that was formed during the digging of the ditch, since it shows no soil formation in the top.

Transect 5 shows the top of the same ridge as transect 1, but perpendicular to boring 33 of transect 1 (fig. 11). In this transect, the A-horizon lies directly on top of the humus B-horizon and is thicker than usual: its thickness ranges from 35-50 cm. It has a light brown colour and shows several humic intervals. The ash-grey E-horizon is missing (fig. 12). This thick horizon does not appear natural. It is interpreted as an anthropogenic (plaggen) horizon that covers the top of this part of the structure.

6 Discussion

The Ermelo enclosure partially fits the characteristics of a Neolithic causewayed enclosure. The structure is lying on sloping ground near a watercourse (the Leuvenumse beek). The shape is oval but nearly a circle, and it looks as if the form has been modified. It is an area surrounded by a bank and a rather steep slope with gaps in the bank. However, no clear traces of ditches were found and the enclosed area is vast (50 hectares).

Extensive, circular enclosures, surrounded by walls are common phenomena in Germany, Belgium and Northern France. The enclosures of Mayen and Urmitz (Germany, both close to Koblenz) are remarkably similar to the structure near Ermelo. The Mayen enclosure is oval in shape and measures circa 290 × 170 m, and was surrounded by a ditch and a palisade (Andersen 1997, 188; Meyer 2002). The enclosure in Urmitz is considerably larger (1275 × 840 m) and consisted in its earliest phase of a palisade with two ditches

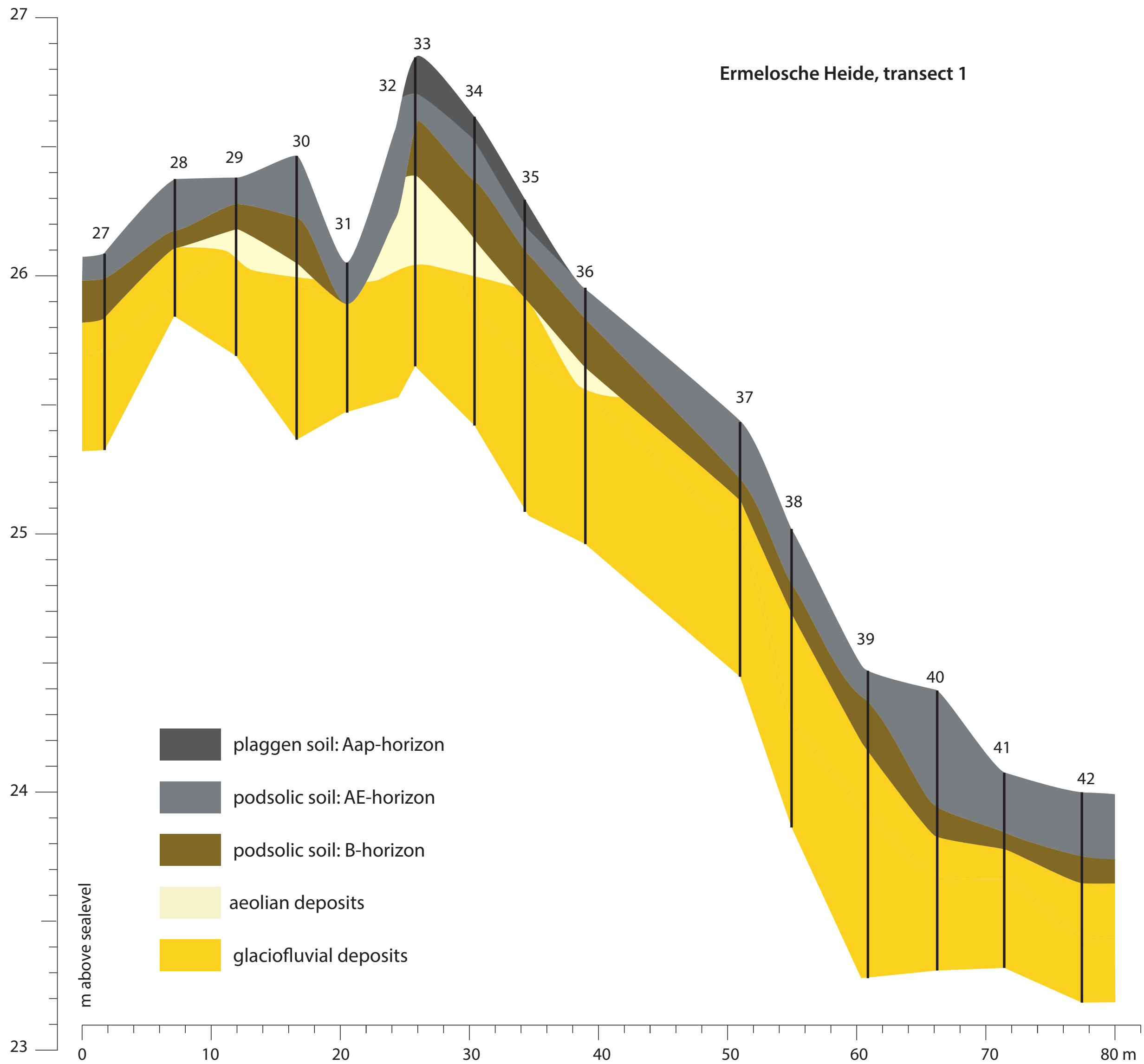


Figure 7 Transect 1, the south-east of the structure.

(Boelicke 1977; Andersen 1997, 188; Meyer 2002). Both enclosures date from the German 'Jungneolithikum 1' and belong to the Michelsberg culture. Other enclosures from the Michelsberg culture in the vicinity of the Netherlands are Ottenburg near Brussels (50 hectares) (Vanmontfort 2003) and Thieusies (also in Belgium) (Andersen 1997, 188). In the Netherlands, sites from the Michelsberg culture are known all along the Meuse river in the province of Limburg. However they are lacking enclosures, except one site (Schelsberg) in the löss zone near Heerlen (Schreurs 2005, 311).

The geological fieldwork shows that the NW and SE banks are natural phenomena dating from the Weichselian. All five transects undisputedly point to an aeolian origin of the ridges. The aeolian deposits cover the kame terrace only partly. Towards the centre of the structure, the aeolian sands become thinner or even disappear (transect 1, fig. 7).

Man-made modification has been established in three transects (figs 7, 10 and 11). The modifications in transect 4 (fig. 10) are likely to be recent. Figures 7 and 11 show that the banks in the SW are man-made. It shows the presence

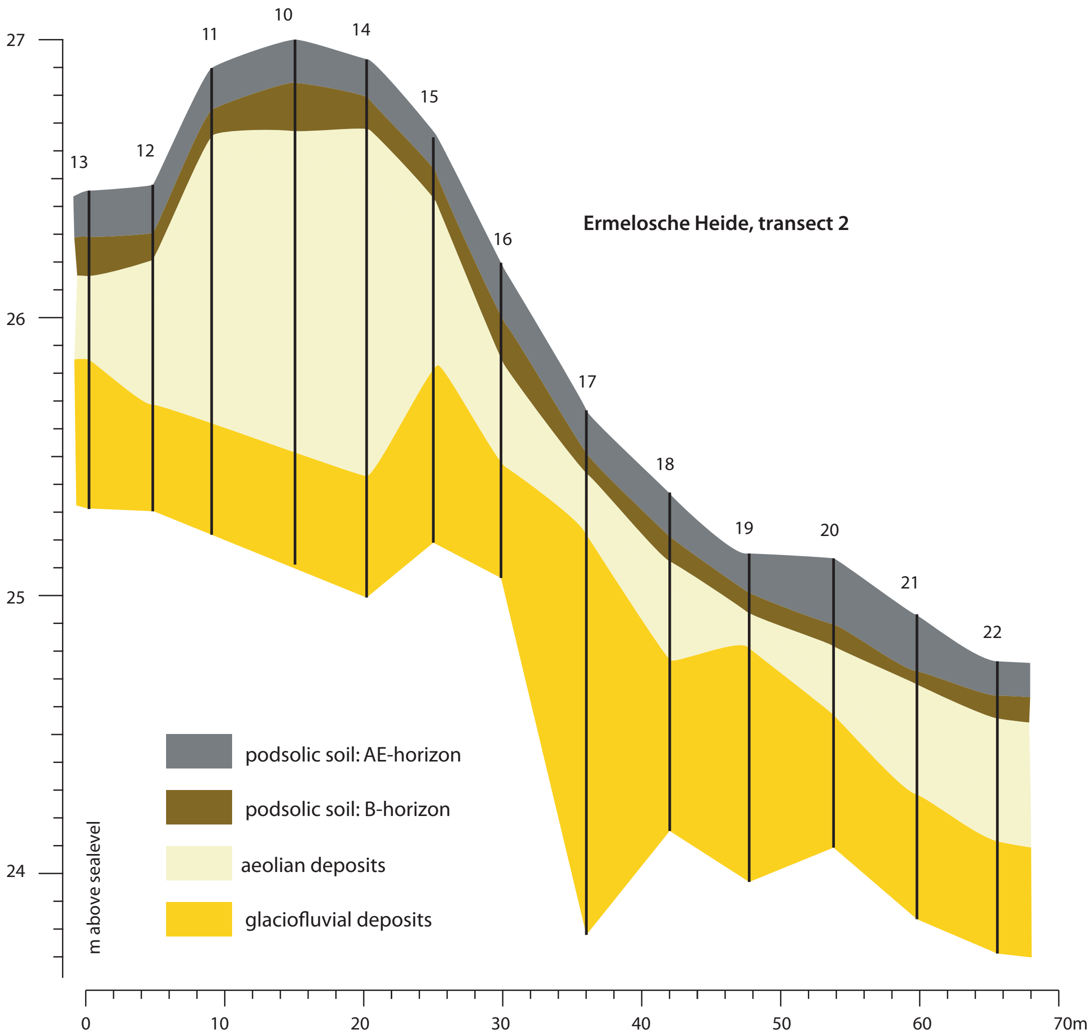


Figure 8 Transect 2, the north-west of the structure.

of a plaggen cover. It is impossible to date these banks; they could be prehistoric, they could be constructed by the military in the 20th century or at any time in-between. However, a very old origin is not likely, because in that case one would assume a clear podzol in the top of the plaggen.

7 Conclusion

All causewayed enclosures in north-west mainland Europe are situated on the löss. Given the fact that the Ermelo structure is not situated on the löss, that it is very large, has no clear ditches, and consists for the largest part of natural ridges, an identification as a causewayed enclosure is not very likely. However, there are examples of causewayed enclosures that are as large (Ottenburg is also 50 hectares) or even larger (Urmiz is 100 hectares), and there are more enclosures that used natural phenomena as part of the circuit. Sometime in the past, the building of banks in the south-east closed the structure and it is unfortunate that it was not possible to date the construction of these banks in a reliable way. To be able to do this an excavation of sections of the banks will be necessary.

So, without further research it is impossible to come to a final conclusion. Although it is unlikely that we discovered the second causewayed enclosure on Dutch soil, we cannot rule out the possibility that it is one of these strange phenomena dating from the transition phase from hunter-gatherers to sedentary farmers.

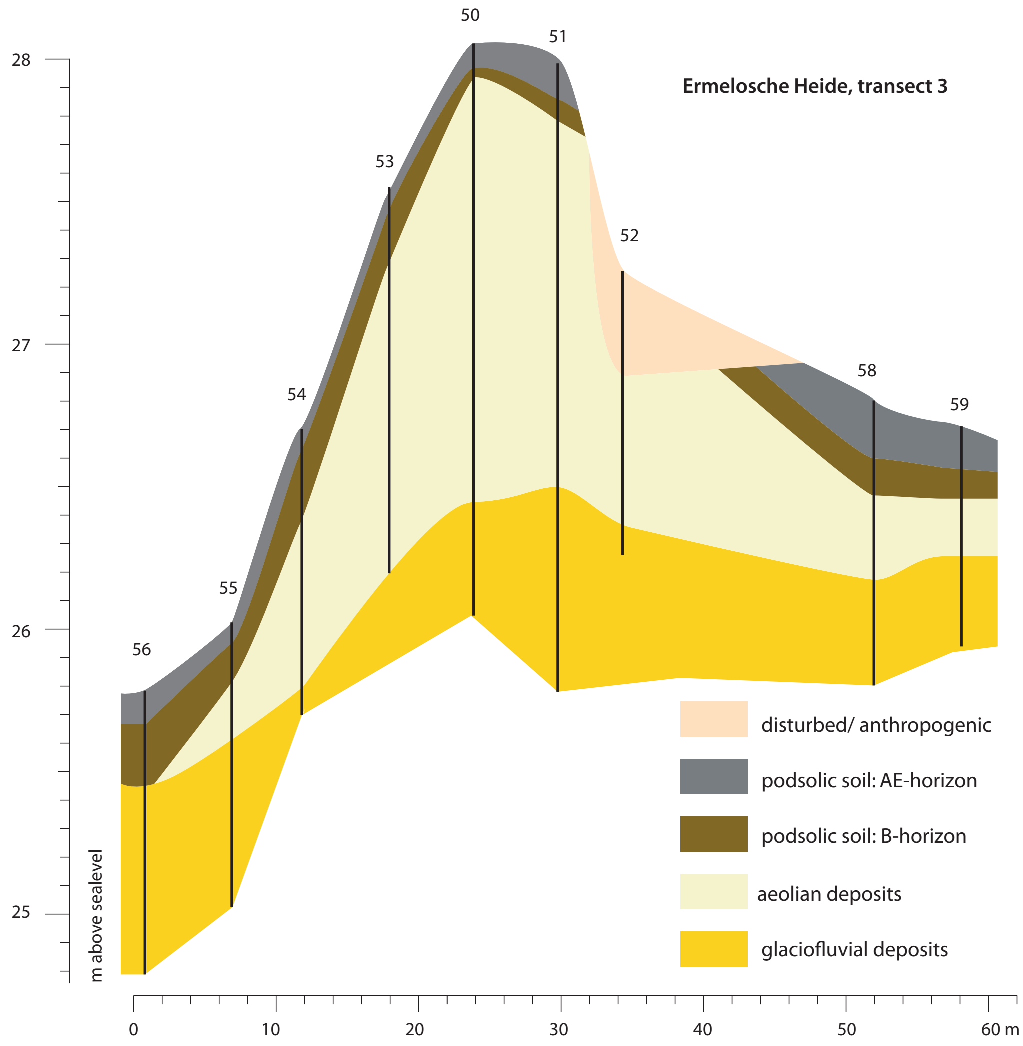


Figure 9 Transect 3, the south of the structure.

Acknowledgements

We would like to thank Corrie Bakels and Leendert Louwe Kooijmans for their valuable remarks on the topic of causewayed enclosures, Marianne Hendriks, Jonathan Prins and Jeffrey Bex for participating in the fieldwork, and Kelly Fennema for correcting our English.

References

Andersen, N.H. 1997. *The Sarup Enclosures: The Funnel Beaker Culture of the Sarup site including two causewayed camps compared to the contemporary settlements in the area and other European enclosures*. Jutland Archaeological Society Publications XXXIII: 1. Moesgaard: Jysk Arkaeologisk Selskab.

Bechert, R. and W.J.H. Willems 1995. *De Romeinse Rijksgrens tussen Moezel en Noordzeekust*, Meppel.

Berendsen, H.J.A. 2005. Landschappelijk Nederland. *De fysisch-geografische regio's*. Assen: Koninklijke van Gorkum.

Boelicke, U. 1977. Das neolithische Erdwerk Urmitz. *Acta Praehistorica et Archaeologica* 7/8, 73-121.

Boer, A. de 2007. Using pattern recognition to search LIDAR data for archaeological sites. In: A. Figueiredo and G. Velho

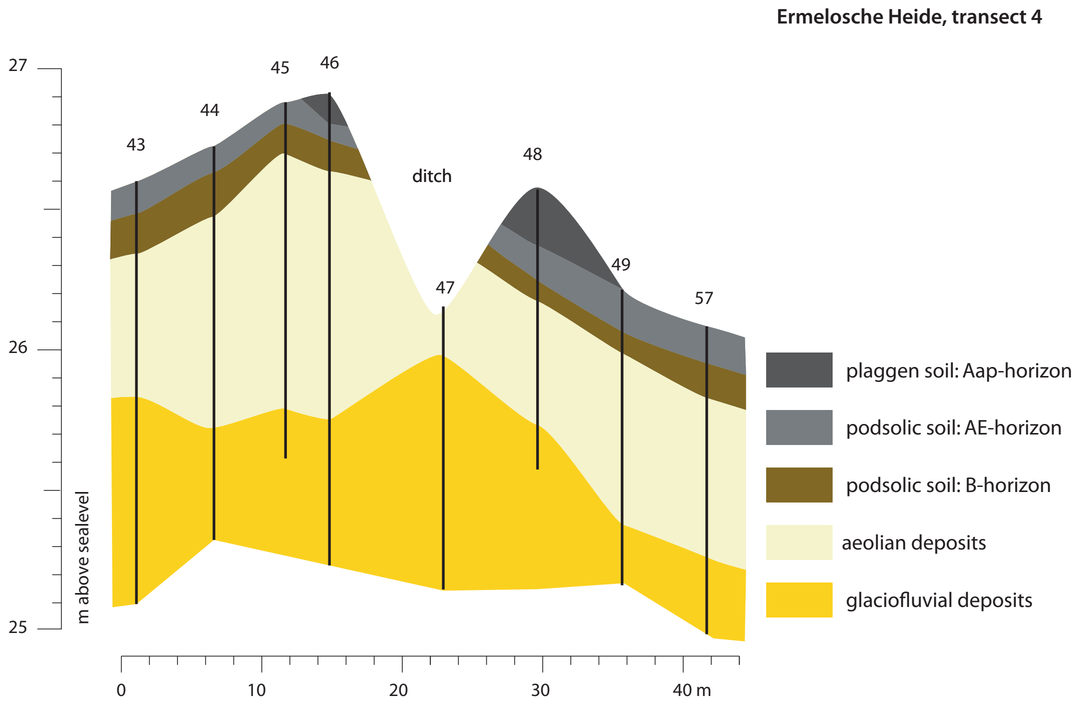


Figure 10 Transect 4, the south-western corner of the structure.

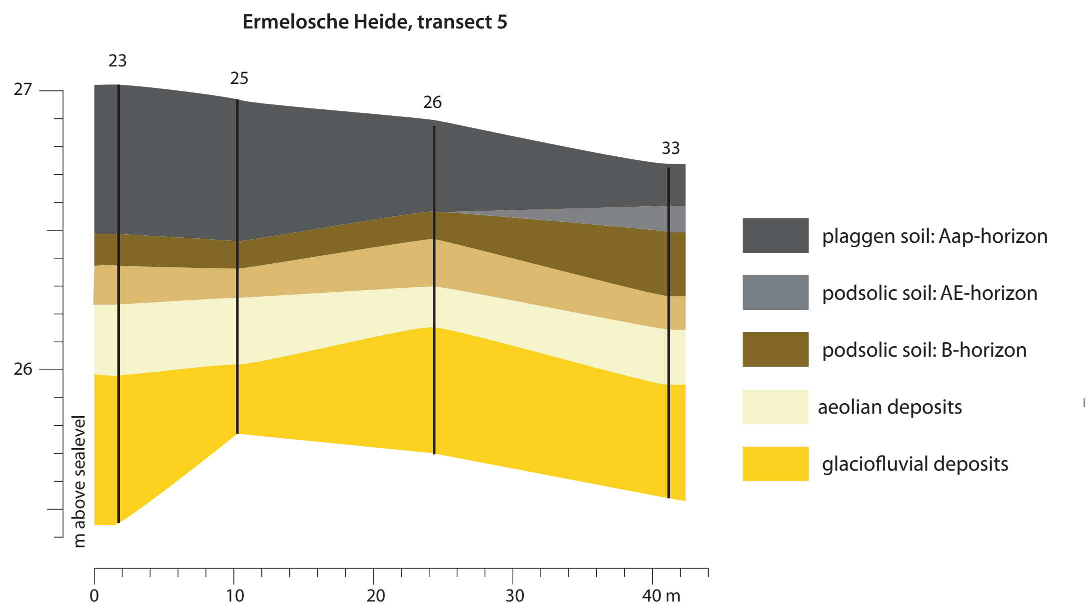


Figure 11 Transect 5, the south-west of the structure.

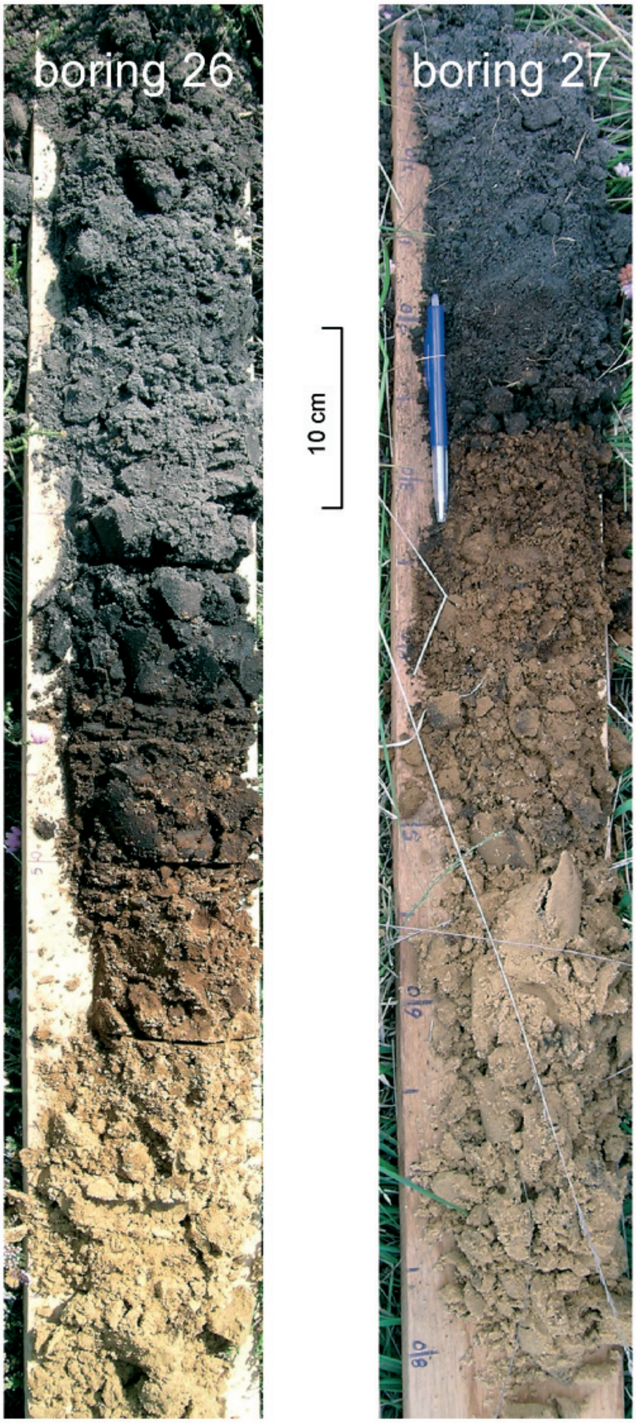


Figure 12 Boring 26 (transect 5) on the left shows a thickened A-horizon on top of a clear B-horizon, with humus and iron. It points to a plaggen cover. Boring 27 on the right shows the normal type of podzol, as often encountered during the field work. Here, a veldpodzol is shown.

(eds), *The World is in your Eyes. Proceedings of the XXXIII Computer Applications and Quatitative Methods in Archaeology Conference (March 2005 – Tomar, Portugal)*. 245-254. Tomar: CAAPortugal.

Burgess, C., P. Topping, C. Mordant and M. Maddison (eds) 1988. *Enclosures and Defences in the Neolithic of Western Europe*, Oxford: BAR International Series 403 (i en ii).

Eilander, D.A., J.L. Kloosterhuis, F.H. de Jong and J. Koning 1982. *Bodemkaart van Nederland 1:50,000. Toelichting bij de kaartbladen 26 Oost Harderwijk en 27 West Heerde*. Wageningen: Stichting voor Bodemkartering.

Gibson, A. 2002. Introduction. In: A. Gibson (ed.), *Behind Wooden Walls: Neolithic Palisaded Enclosures in Europe*, Oxford: BAR International Series 1013, 1-5.

Hegener, M. 1995. *Archeologie van het landschap*. Uitgeverij Contact.

Holwerda, J.H. 1923. Romeinsche legerplaats bij Ermelo. *Oudheidkundige Mededelingen uit het Rijksmuseum van Oudheden te Leiden 4,* 40-44. Leiden.

Klok, R.H.J. and F. Brenders 1981. *Reisboek voor Romeins Nederland en België*, Unieboek b.v.: Bussum.

Kreek, M. de 2004. *Verder dan het oog rijkt. GIS- en RS-toepassingen in de Nederlandse archeologie*. MA thesis Leiden University.

Locher, W.P. and H. de Bakker 1990. *Bodemkunde van Nederland. Deel 1, Algemene Bodemkunde. Tweede druk,* Den Bosch: Malmberg.

Meyer, M. 2002. Palisaded Enclosures in the German Neolithic. In: A. Gibson (ed.), *Behind Wooden Walls: Neolithic Palisaded Enclosures in Europe*, Oxford: BAR International Series 1013, 59-92.

Oswald, A. 2011. *Introductions to Heritage Assets: Prehistoric Linear Boundary Earthworks*, English Heritage. Available at: http://www.english-heritage.org.uk/publications/iha-prehist-linear-boundary-earthworks/linearboundaryearthworks.pdf.

Schreurs, J. 2005. Het Midden-Neolithicum in Zuid-Nederland. In: J. Deeben, E. Drenth, M.-F. van Oorsouw and L. Verhart (eds), *De Steentijd van Nederland*. Archeologie 11/12. Meppel: Stichting Archeologie, 301-332.

Straaten, R. van der 2008. De Leuvenumse Beek. *Grondboor en Hamer* 6, 139-143.

Vanmontfort, B., J. De Man, R. Langohr, B. Clarys and A. Van Rompaey 2003. De neolithische site van Ottenburg /

Grez-Doiceau geëvalueerd. Een archeologische toepassing van het Digitaal Hoogtemodel (DHM)-Vlaanderen. *Notae Praehistoricae* 23, 129-133.

Waldus, W.B. and H.M. van der Velde (eds) 2006. *Archeologie in vogelvlucht. Toepassingsmogelijkheden van het AHN in de archeologie*. Geoarchaeological and Bioarchaeological Studies 6.

Hans Kamermans, Joanne Mol and Eric Dullaart
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
h.kamermans@arch.leidenuniv.nl
j.a.mol@arch.leidenuniv.nl
e.g.c.dullaart@arch.leidenuniv.nl

Miranda de Kreek
Bureau Oudheidkundig Onderzoek van de Gemeentewerken Rotterdam (BOOR)
Ceintuurbaan 213b
3051 KC Rotterdam
The Netherlands
mca.goutdekreek@rotterdam.nl

New perspectives for microwear analysis

Annelou van Gijn

Microwear analysis developed within a typical processual approach in the 1970s, addressing questions about form and function and site typology. Recent theoretical developments in material culture studies, centred on the role of materiality in cultural encounters, offer new perspectives to which microwear studies can contribute significantly. It is argued that microwear analysis can play a key role in the study of the interconnectivity of crafts combined with a biographical approach towards transformations of materials in cultural encounters. This approach would be perfectly positioned to shed new light on the neolithization process in the Lower Rhine Basin.

1 Introduction

Materials, and more specifically objects, play a vital role in human interaction and form of old the centre of archaeological research. However, for the most part, interest has focused on typology and the possibilities for relative dating. Much less research was invested in the technological process involved in the making and using of objects. It was not until the term *chaîne opératoire* became influential that an interest developed in the technological aspects of artefacts, and how form developed. It also became increasingly clear that objects went through different stages. Schiffer distinguished between procurement, manufacture, use, maintenance and discard, an approach that allowed a dynamic study of material culture in which there was also room for recycling and re-use (Schiffer 1972). In a famous and often cited article, Kopytoff proposed that objects had a biography analogous to that of human beings (Kopytoff 1986). Of great importance was the increased anthropological interest in technology and material culture in the last decades. Lemonnier argued that people, from the plethora of possible technological alternatives, made specific choices which were in accordance with their socio-cultural system (Lemonnier 1986).

Nowadays many researchers are taking materials more and more seriously (Ingold 2007; Boivin 2008; Conneller 2011). The focus on the finished product as a static entity (tool type) is shifting towards an approach that takes material properties into account and that looks into the varied human-material interactions, as reflected in the life trajectory of an object. At the same time a range of scientific methodologies was developed with which to study the biography of objects (Sillar and Tite 2000; Jones 2002; 2004). One of those is microwear analysis, which forms the focus of this paper.

Microwear analysis as initially developed by Semenov constituted a holistic approach encompassing a microscopic analysis of objects made of different raw materials (Semenov 1964). When introduced in the West most research in this field concentrated on flint and chert (a.o. Keeley 1980; Odell 1980; Beyries 1988; Van Gijn 1990). Only later did researchers turn to the study of bone, antler (a.o. Maigrot 1997; Van Gijn 2007), shell (Lammers 2007; Cuenca Solana *et al*. 2011), coral (Kelly and Van Gijn 2008) and ceramic tools (Van Gijn and Lammers-Keijsers 2010). Unfortunately, archaeology has a tradition of specialists in different material culture categories: a person is a lithic specialist or a ceramic technologist and will rarely be involved in the study of both. This attitude also pervaded microwear analysis: studies concentrated on one material category only, usually flint or chert, which overlooked the fact that flint constitutes only a limited part of complex technological systems. Admittedly, the focus on one material category can to some extent be justified by the fact that microwear studies rely on the presence of relevant experimental reference collections. Each new material requires experimental exploration.

I too started with the microscopic study of flint tools, but turned to 'other' materials with the find of large numbers of bone and antler objects in the Late Mesolithic sites of Hardinxveld Polderweg and De Bruin (Louwe Kooijmans 2001a; 2001b), excavated in the late 1990s by Archol and the Leiden Faculty of Archaeology. Not only were the flint implements studied microscopically, but also a sample of the bone and antler tools. The results made me acutely aware of the interconnectivity of different activities and the need for a more holistic approach towards microwear analysis. Such an approach was applied to the Middle Neolithic site of Schipluiden (Louwe Kooijmans and Jongste 2006) where I explicitly searched for tool kits: "set of tools used in the same *chaîne opératoire*" (Van Gijn 2008b, 219; see also Van Gijn and Lammers-Keijsers 2010). In Schipluiden a range of different tool kits could be distinguished, each consisting of objects made of different raw materials. However, even though the concept tool kit allows for a holistic microwear study of different material categories, it remains a somewhat static concept that does not convey the complexity of past technology and the interconnectivity of the different *chaînes opératoires*.

In this paper I therefore want to explore briefly the possibilities of applying some concepts and ideas, recently developed in especially Late Bronze Age studies in the Eastern Mediterranean, to the Late Mesolithic and Neolithic wetland sites of the Lower Rhine Basin. In recent publications Brysbaert and others have proposed the term "cross-craft interactions" to examine the various relationships between different crafts, both within settlements but also as seen from a regional and even supra-regional perspective (Brysbaert 2007; 2011; Brysbaert and Vetters 2010; Tsoraki 2011). Other researchers have addressed the role of material culture in cultural encounters (Hahn 2012; Knapp 2012; Stockhammer 2012). These authors argue that we should study in detail the context of consumption of imported objects and how this differed from the context from which they originated. This could shed light on the role of material culture in the construction of new "hybridised" (Knapp 2012, 34) identities in contact situations. Such an approach can potentially be very fruitful in studying the neolithization process, the long period during which hunting-fishing-gathering societies transformed as a result of contact with the farmers of the Linear Bandkeramik and later periods.

Microwear and residue analysis is perfectly suited to study the interconnectivity of different craft activities and the transformations objects may undergo when moving from one cultural context to another (Van Gijn 2008a; 2010; Wentink 2008). Although in egalitarian societies, such as we assume for the Late Mesolithic and most of the Neolithic, crafts are likely to have been organized at the local level, studying the interrelatedness of different crafts can potentially reveal much about specific technological choices made by people through time and across space. Such a study would require a biographical approach, first of all including determining the provenience of raw materials, or the context exotic objects originate from. Long-distance mobility of stones has repeatedly been demonstrated for the Mesolithic and earlier Neolithic (a.o. Verhart 2000; Vanmontfoort 2008). Moreover, it is in the Mesolithic that we see the appearance of composite tools. Such composite tools always involve different raw materials: the flint, bone, antler, wood, binding materials, and bark for producing tar have to be procured at different places, to be brought together in one tool. All these materials require specific ways of processing, treatment, times of harvesting and so forth. The second step in a biographical approach would involve a technological study: what is the production sequence, how much skill and knowledge are necessary, which kinds of tools and equipment are needed to carry out the task and how do different materials 'react'. It is here that we can explore the interconnectivity of different craft activities by means of experimentation (fig. 1). Next, use wear and residue analysis could shed light on the actual life of the object, the transformations it underwent through time and possibly also what happened to it upon deposition, loss or discard. And lastly, the context in which an object ends up will tell us much about the possible meaning and role the object had in its lifetime.

Figure 1 Experimental hide working tool kit, including implements made of different raw materials (Photo Laboratory for Artefact Studies, Leiden).

2 The interconnectivity of craft activities at the Late Mesolithic sites of Hardinxveld Polderweg and De Bruin

In the 1990s rescue excavations took place in the Late Mesolithic wetland sites of Hardinxveld Polderweg and De Bruin, situated in the Lower Rhine Basin of the present-day Netherlands, close to the city of Rotterdam (Louwe Kooijmans 2001a; 2001b). Habitation layers at the two sites date from c. 5500-4500 BC. In addition to a techno-morphological study, samples of both the flint and the bone/antler tool assemblage were studied for traces of use (Van Gijn *et al*. 2001a; 2001b; Louwe Kooijmans *et al*. 2001a; 2001b). Unfortunately, at that time large, non-flint, stones could only be studied by stereomicroscope due to the absence of appropriate equipment at the Leiden laboratory. Still, the technological and microwear research of the flint and bone and antler tools showed that craft activities included plant processing, hide working, wood working and the manufacture of bone and antler tools.

Traces from contact with siliceous plants predominated in both sites and were always found on regular, unretouched blades. It concerns a smooth polish with a clear transverse directionality, indicating that the blades were used in a transverse motion (Van Gijn *et al*. 2001a) (fig. 2). Despite extensive experimentation, we still do not know which kinds of plants were worked with these blades. The closest match was produced by scraping *Phragmites* stems in order to make them supple for weaving. Producing garments and blankets of plant fibres requires skills and a considerable input of time (Barber 1994; Turner 2007) and the amount of plant stems that needs to be processed is enormous. The fact that so many blades display this type of wear can be seen in this context. Other tools involved in plant processing are the bone awls, most likely used for basket making or textile production. These awls were made by means of the metapodium technique, a production technique in which flint tools are instrumental (Maarleveld 1985; Van Gijn 1990). In terms of its biography the bone awl is thus linked to flint, both in its production stage and during its life. Both flint blades and bone awls form part of a tool kit directed at collecting, preparing and processing plant fibres and incorporating them into craft items.

Another type of bone tool involved in plant-based crafts is the bone needle, two of which were found at the site of Hardinxveld De Bruin (fig. 3b). They were made from the ulna of a swan and experiments have shown that they are easily made with a simple flint flake. Both needles displayed a strongly developed polish from contact with siliceous plants. An experiment with a replica used for making a carrying bag from twined nettle rope (*Urtica*) produced traces that were very similar. To make this bag the technique of knotless netting was used and, interestingly enough, rope fragments made of plant fibres found at the site of Hardinxveld Polderweg display this technique (Louwe Kooijmans *et al*. 2001c, 401-405) (fig. 3a).

Especially at the site of Polderweg were traces of hide working seen on only very few flint tools (Van Gijn *et al*. 2001a). Surprisingly, it was on bone and antler tools that such traces were present most frequently: they were used both for scraping and piercing hides. Again, flint tools form part of the *chaîne opératoire* of these bone and antler tools

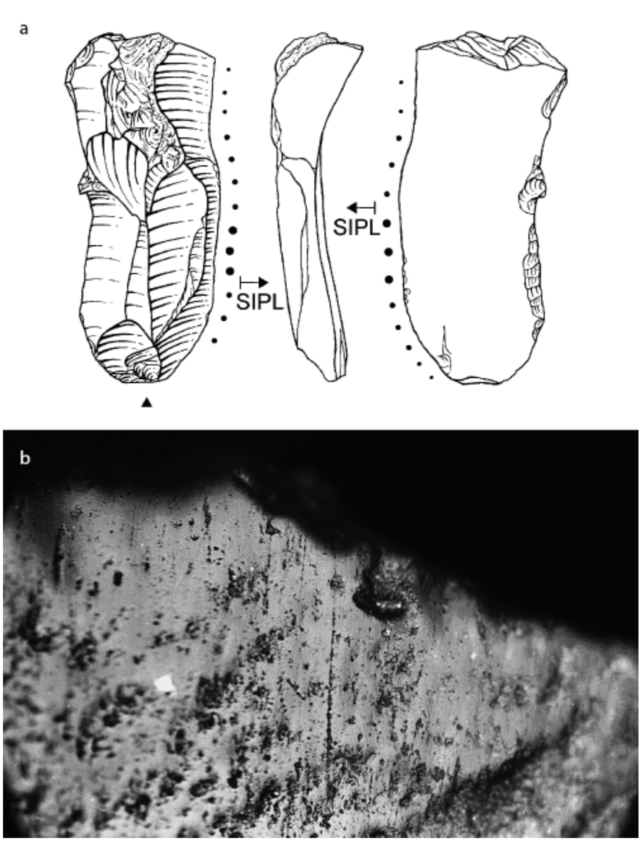


Figure 2 a) Flint blade from Hardinxveld Polderweg phase 1 (nr. 13.354) displaying traces of scraping or planing siliceous plants (scale 1:1). b) Polish from contact with siliceous plant seen on flint blade Polderweg 4000 (original magnification 200x) (from Van Gijn *et al*. 2001a).

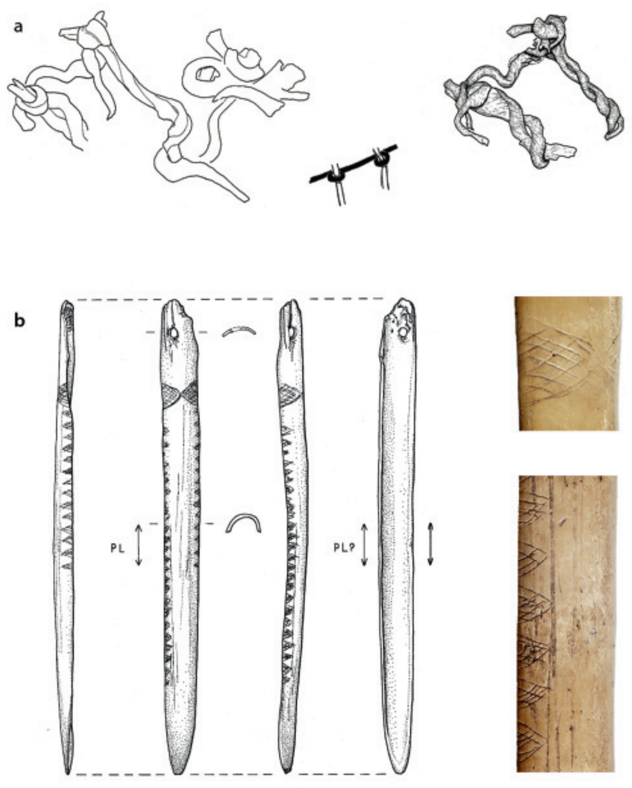


Figure 3 a) Fragment of a piece of a net made in 'knotless netting' technique from Hardinxveld Polderweg phase 1 (from Louwe Kooijmans *et al.* 2001c, fig. 13.18).
b) 'Needle' made of an *ulna* of a swan, probably used for net making from Hardinxveld De Bruin phase 2 (findnr. 6990) (from Louwe Kooijmans *et al.* 2001b, fig. 10.15).

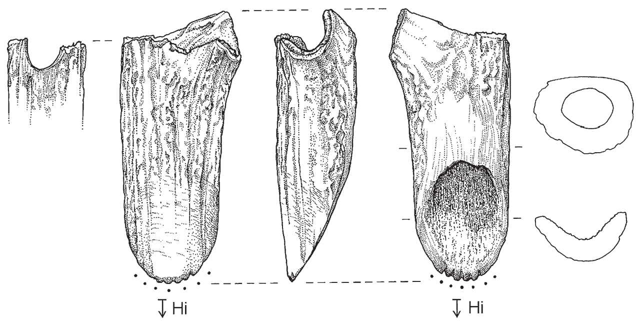


Figure 4 Recycled broken T-axe of red deer antler, modified into a toothed scraper used for cleaning hide, found at Hardinxveld De Bruin (from Louwe Kooijmans *et al.* 2001b, fig. 10.7).

as we have evidence for the use of flint in their production in the form of cut marks. It is also interesting to note that many of the hide working tools made of bone or antler actually are recycled implements, which were most likely first used for other purposes, like chopping wood. A good example is formed by the antler T-axes which tend to break at the perforation, especially if they are dry: the half with the cutting edge was not thrown away but used as hide scraper. The cutting edge was made more effective for cleaning hides by serrating the edge with a flint tool (fig. 4).

Another craft activity demonstrated at the Hardinxveld sites is wood working. Wood working was done both by means of flint implements and bone and antler tools, as evidenced by the use wear traces. We can assume that some of the wood working involved the preparation of hafts for flint and bone/antler tools, as some such tools were found both in Polderweg and De Bruin (Louwe Kooijmans *et al.* 2001c). Interestingly, even though the excavations yielded abundant evidence for the production of bone and antler tools in the form of waste, rejects and cut marks, very few flint implements with traces from contact with bone and antler were found. Admittedly, only a small percentage of flint implements were studied, so it is possible that none were included in the sample, but it remains strange considering the enormous amount of bone and antler working that must have taken place on the sites. Further research can hopefully make clear whether this absence is reflective of a specific technological choice (*sensu* Lemonnier 1986), like seems to be the case with the preference for bone and antler tools for hide working, or whether it is due to sampling.

Despite the limited amount of microwear study carried out so far, the results nevertheless show that the Hardinxveld settlements formed the nodes where different materials came together to be modified and joined. Many of the crafts are related and intertwined, with numerous technological and functional links between flint, bone, antler, wood, skin and various plants. This is something that can be explored in much more detail in the future. Additional material is currently being studied by Aimée Little (Marie Curie fellowship) and RMA student Sara Graziano, and with new equipment available and other technical possibilities, it is likely that further evidence for the interconnectivity of the various craft activities will appear. Instrumental will also be a different theoretical perspective, aimed more at materials and their properties, and less at standard classification issues.

3 Materiality and cultural encounters: the case of the Middle Neolithic Hazendonk sites of Schipluiden and Ypenburg

The sites of Schipluiden and Ypenburg are dated to c. 3750-3400 BC and are attributed to the Middle Neolithic Hazendonk group (Louwe Kooijmans and Jongste 2006; Koot *et al.* 2008). The sites are located just to the east of the present-day town of The Hague in a micro-region where quite an abundance of sites and finds from this specific period and cultural group have been found. Microwear analysis was done on samples of the flint tools, the ground stone assemblage, implements of bone, antler and tooth, as well as the ornaments of amber, jet and bone (Van Gijn 2006a; 2006b; Van Gijn and Boon 2006; Van Gijn and Houkes 2006; Van Gijn and Verbaas 2008; Van Gijn *et al.* 2006). As already mentioned above, the reconstruction of tool kits used in different *chaînes opératoires* formed a key objective of these studies. Schipluiden and Ypenburg were, like the Hardinxveld sites, contract excavations with only relatively limited money available for detailed research. Therefore, although a range of different tool kits could be distinguished (Van Gijn 2008b; Van Gijn and Verbaas 2008), there is still much to gain from a detailed examination of cross-craft interaction, searching for specific interconnections between *chaînes opératoires* within both sites. In addition, there are prospects for a more regional, inter-site perspective on cross-craft interaction. Ypenburg and Schipluiden display some curious differences in terms of their material culture which would merit further examination. For example, the large grinding stones, associated with the production and maintenance of stone axes, form a major artefact category in Schipluiden, but are completely lacking in Ypenburg. 'Mapping out' cross-craft interaction in detail within this micro-region may provide some explanations for this remarkable inter-site variation in find composition.

Both Schipluiden and Ypenburg also offer good prospects to study the role of materiality in cultural encounters. They form key – that is, transitional – sites in the study of the neolithization process of the wetlands of the Lower Rhine Basin, a region which had an (extended) broad-spectrum economy long after farming had been introduced in the southern part of the present-day Netherlands around 5300 BC (see Louwe Kooijmans 2007 for details). The two sites have not only provided the earliest solid evidence for local cropping of cereals within the Lower Rhine Basin, at the same time the biography of the bone and antler objects displays a remarkable technological continuity with the Mesolithic (Van Gijn 2006a). It is also clear that there must have been interaction with communities further south, as evidenced by the presence of 'exotic' flint implements imported from the farming communities in the south. Most of the flint was, however, of more local origin, although the exact provenience is still unknown. The exotic implements were imported as finished objects but were given a 'special place' in the local technological system. Microwear analysis showed that the inhabitants of Ypenburg and Schipluiden selected this exotic flint for specific tasks: cereal harvesting, fire making and ornament production (fig. 5). It was argued that these three tasks carried a special significance for the local community (Van Gijn 2008a; 2010). Cereal harvesting was special because it was new, precarious and must have run to some extent counter to the ancient lifestyle, as it required the destruction of the life-giving forest. The long period of tending the fields and waiting for the crops to grow must have been perceived as unpredictable and precarious. The, probably intentional, destruction of the flint sickles by means of fragmentation and burning is interpreted as an act to return the harvesting tools back to nature (Van Gijn 2008a; 2010, fig. 7.3). Fire making was seen as a special activity because the burial of a man within the settlement of Schipluiden contained flint strike-a-lights. They were held in the hand of the deceased, along with a piece of pyrite, in front of the mouth, as if blowing a spark (Van Gijn 2010, fig. 6.6). Lastly, ornament making was argued to be of special significance as ornaments were given along to the dead as evidenced by the cemetery of Ypenburg (Koot *et al.* 2008). The life history of these exotic tools was thus very different from that of locally made flint implements. Clearly, the consumption of these import goods in the local wetland context seems to have been surrounded by special circumscriptions, ensuring their use in specific tasks, but nevertheless embedded in the recipient technological system. The use of the exotic implements by farmers for special tasks in the wetlands can be interpreted as a way of negotiating the transition to a new Neolithic way of life (for details see Van Gijn 2008a; 2010).

Stone may have played a special role in cultural encounters. It has specific material properties in terms of colour, weight, translucency, texture, workability and so forth. It is thus usually very clear to the knowledgeable observer whether a stone was available locally or not. Stone is also very durable, outlasting human generations, and people must have been well aware of this. Lastly, it is also portable and can be exchanged or traded in small quantities. The variability, portability, and durability of stone make it an ideal carrier of symbolic meaning to be moved from one cultural context to another. Such a transition would inevitably leave evidence in terms of technological features, traces of use and treatment, and indications for the context and associations with other types of objects. As the wetlands are largely devoid of stone sources, most of the stone material in the Lower Rhine Basin must have been brought in from elsewhere. The stone artefacts of Schipluiden and Ypenburg, but also of the Hardinxveld sites, thus provide ideal study material to look in detail for evidence of material transformations that can be linked to cultural contacts with the farmers in the south.

Figure 5 Exotic flint tools used in the production of ornaments of jet and artefacts of jet (from Van Gijn 2006b, fig. 9.2).

4 Concluding remarks

Microwear analysis developed within a typical processual approach in the 1970s. Questions about the relationship between form and function, the detection of possible activity areas and site typology predominated and are still important, especially in site-oriented contract excavations. With the increased interest in the relationship between people and their material surroundings, microwear analysis became more integrated in the *chaîne opératoire* approach (a.o. Plisson and Beugnier 2007). There was also a growing interest in the biographical study of artefacts, to which microwear analysis could make key contributions (a.o. Wentink 2008; Van Gijn 2010). The research of artefacts from the Hardinxveld sites, Schipluiden and Ypenburg has shown that it is profitable to incorporate as many categories of material culture as possible in order to shed light on otherwise invisible craft activities and the tool kits involved in these. However, despite the fact that microwear analysis has clearly been contributing to larger research questions, the approach remains somewhat static. Looking at cross-craft interaction, both from an intra- and inter-site perspective, could potentially give much information about craft organization in the past and about cross-cultural interaction. This would require the detailed study of the interconnectivity of various crafts, a task which will involve an extensive amount of experimentation. Each technological choice will require experimental exploration in order to assess the associated macro- and microscopic traces of manufacture, use, treatment and discard. Although this may seem a formidable task, it can be done within the context of public archaeology, making experimental research a twin-edged sword. Experimental archaeology forms a perfect bridge between scientific material analysis and public engagement and as such is not only a research tool, but has merits in and by itself.

The study of the interconnectivity of crafts combined with a biographical approach towards transformations of materials in cultural encounters is perfectly positioned to shed light on the neolithization process. Distribution studies of Late Mesolithic and Neolithic Rijckholt flint, stone adzes and flint axes have shown them to be widely distributed across the wetlands (a.o. Verhart 2000; Vanmontfort 2008). However, these imported stone tools were seen as finished objects, not as objects in transition, having a specific biography. Moreover, their presence in the wetlands was examined from a presence/absence perspective. Little attention was paid to the possible transformations in form, function or role the objects may have undergone in moving from one cultural context to another, transformations that may be linked with the construction of a new identity in the encounters with the farmers to the south. By carefully studying the materiality and biography of these southern exotics, how they were treated in the recipient communities, we may obtain a better understanding of the gradual incorporation of a new Neolithic lifestyle and identity by the inhabitants of the wetlands (Van Gijn 2008a). Microwear research, embedded in a biographical study of materials, is perfectly placed to study such transformations and shed light on cross-craft interaction. It just needs a shift in theoretical perspective, a sensitivity to materials and a closer look.

Acknowledgements

I am grateful to the people in the Laboratory for Artefact Studies, especially Eric Mulder, Yvonne Lammers-Keijsers and Annemieke Verbaas, for all their work in making the lab into what it is now. Jaap Beuker, Ans Nieuwenburg (†), Ton van Grunsven and Diederik Pomstra are thanked for making so many of our experimental tools. Lastly, I want to thank all students who were part of the lab through the years. They enthusiastically participated in many, sometimes rather unpleasant, experiments and quite a number of them undertook technological or functional studies of different artefacts. I thank Aimée Little for reading an earlier draft.

References

Barber, E.W. 1994. *Women's work: the first 20,000 years. Women, cloth and society in early times*, New York.

Beyries, S. 1988. *Industries lithiques, tracéologie et technologie*, Oxford (British Archaeological Reports International Series 328).

Boivin, N. 2008. *Material cultures, material minds*. Cambridge.

Brysbaert, A. 2007. Cross-craft and cross-cultural Interactions during the Aegean and eastern mediterranean Late Bronze Age. In: S. Antoniadou and A. Pace (eds), *Mediterranean Crossroads*, Athene, 325-359.

Brysbaert, A. (ed.) 2011. *Tracing prehistoric social networks through technology: A diachronic perspective on the Aegean*. London.

Brysbaert, A. and M. Vetters, 2010. Practicing identity: a crafty ideal? *Mediterranean Archaeology and Archaeometry* 10, 25-43.

Conneller, C. 2011. *An archaeology of materials, substancial transformations in Early Prehistoric Europe*. New York.

Cuenca Solana, D., I. Gutierrez Zugasti and I. Clemente Conte 2011. The use of mollusc shells as tools by coastal human groups; the contribution of ethnographical studies to research on Mesolithic and early Neolithic technologies in northern Spain. *Journal of Anthropological Research* 67, 77-101.

Hahn, H.P. 2012. Words and things: reflections on people's interaction with the material world. In: J. Maran and P.W. Stockhammer (eds), *Materiality and social practice; Transformative capacities of intercultural encounters*, Oxford, 4-12.

Ingold, T. 2007. Materials against materiality. *Archaeological Dialogues* 14(1), 1-16.

Jones, A. 2002. *Archaeological Theory and Scientific Practice*. Cambridge.

Jones, A. 2004. Archaeometry and materiality. Materials-based analysis in theory and practice. *Archaeometry* 46, 327-338.

Keeley, L.H. 1980. *Experimental determination of stone tool wear. A microwear analysis*. Chicago.

Kelly, H. and A. L. Van Gijn 2008. Understanding the function of coral tools from Anse a la Gourde: an experimental approach. In: C.L. Hofman, M. Hoogland and A.L. van Gijn (eds), *Crossing disicplinary boundaries and national borders. New methods and techniques in the study of archaeological materials from the Caribbean*, Tuscaloosa, 115-124.

Knapp, A.B. 2012. Matter of fact: transcultural contacts in the Late Bronze Age Eastern Mediterranean. In: J. Maran and P.W. Stockhammer (eds), *Materiality and social practice; transformative capacities of intercultural encounters*, Oxford, 32-50.

Koot, H., L. Bruning and R.A. Houkes (eds) 2008. *Ypenburg-lokatie 4. Een nederzetting met grafveld uit het Midden-Neolithicum in het West-Nederlandse kustgebied*. Leiden.

Kopytoff, I. 1986. The cultural biography of things. Commoditization as process. In: A. Appadurai (ed.), *The social life of things. Commodities in cultural perspective*. Cambridge, 64-91.

Lammers, Y. 2007. *Tracing traces from present to past: a functional analysis of pre-columbian shell and stone artefacts from Anse à la Gourde and Morel, Guadeloupe*. Leiden (ASLU 15).

Lemonnier, P. 1986. The study of material culture today. Toward an anthropology of technological systems. *Journal of Anthropological Archaeology* 5, 147-186.

Louwe Kooijmans, L.P. (ed.) 2001a. *Hardinxveld-Giessendam De Bruin. Een kampplaats uit het Laat-Mesolithicum en het begin van de Swifterbant-cultuur (5500-4450 v.Chr.)*, Amersfoort (Rapportage Archeologische Monumentenzorg 88).

Louwe Kooijmans, L.P. (ed.) 2001b. *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v.Chr.)*, Amersfoort (Rapportage Archeologische Monumentenzorg 83).

Louwe Kooijmans, L.P. 2007. The gradual transition to farming in the Lower Rhine Basin. *Proceedings of the British Academy* 144, 287-309.

Louwe Kooijmans, L.P. and P.F.B. Jongste (eds) 2006. *Schipluiden - Harnaschpolder. A Middle Neolithic Site on the Dutch Coast (3800-3500 BC)*, Leiden (*Analecta Praehistorica Leidensia* 37/38).

Louwe Kooijmans, L.P., J.F.S. Oversteegen and A.L. van Gijn 2001a. Artefacten van been, gewei en tand. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v. Chr.)*, Amersfoort, 285-323.

Louwe Kooijmans, L.P., A.L. Van Gijn, J. Oversteegen and M. Bruineberg 2001b. Artefacten van been, gewei en tand. In: L.P.Louwe Kooijmans (ed.), *Hardinxveld-Giessendam De Bruin. Een kampplaats uit het Laat-Mesolithicum en het begin van de Swifterbant-cultuur (5500-4450 v.Chr.)*, Amersfoort, 327-367.

L.P. Kooijmans, C.E. Vermeeren and A.M.I van Waveren 2001c. Artefacten van hout en vezels. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v. Chr.)*, Amersfoort, 379-418.

Maarleveld, T.J. 1985. *Been en tand als grondstof in de Vlaardingen-cultuur*. MA thesis, Leiden University, Leiden.

Maigrot, Y. 1997. Tracéologie des outils tranchants en os des Ve et IVe millénaire av. J.-C. en Bassin Parisien. Essai méthodologique et application. *Bulletin de la Societé Préhistorique Française* 94, 198-216.

Odell, G.H. 1980. Towards a more behavioral approach to archaeological lithic concentrations. *American Antiquity* 45, 404-431.

Plisson, H. and V. Beugnier 2007. Technical use and symbolic values of Pressignian daggers. *Arkeotek Journal* 1 no.2 (online journal).

Schiffer, M.B. 1972. Archaeological context and systemic context. *American Antiquity*, 37, 156-165.

Semenov, S. 1964. *Prehistoric technology*, London.

Sillar, B. and M.S. Tite 2000. The challenge of 'technological choices' for materials science approaches in archaeology. *Archaeometry* 42, 2-20.

Stockhammer, P.W. 2012. Entangled pottery: phenomena of appropriation in the Late Bronze Age Eastern Mediterranean. In: J. Maran and P.W. Stockhammer (eds), *Materiality and social practice; transformative capacities of intercultural encounters*, Oxford, 89-103.

Tsoraki, C. 2011. Disentangling Neolithic networks: Ground stone technology, material engagements and networks of action. In: A. Brysbaert (ed.), *Tracing prehistoric social networks through technology: a diachronic perspective on the Aegean*. London, 12-29.

Turner, N.J. 2007. *Plant technology of the first peoples in British Columbia*, Victoria.

Van Gijn, A.L. 1990. *The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic assemblages*, Leiden (Analecta Praehistorica Leidensia 22).

Van Gijn, A.L. 2006a. Implements of bone and antler. A Mesolithic tradition continued. In: L.P. Louwe Kooijmans and P.F.B. Jongste (eds), *Schipluiden - Harnaschpolder. A Middle Neolithic site on the Dutch coast (3800-3500 BC)*, Leiden, 207-224.

Van Gijn, A.L. 2006b. Ornaments of jet, amber and bone. In: L.P. Louwe Kooijmans and P.F.B. Jongste (eds), *Schipluiden - Harnaschpolder. A Middle Neolithic site on the Dutch coast (3800-3500 BC)*, Leiden, 195-206.

Van Gijn, A.L. 2007. The use of bone and antler tools. Two examples from the Late Mesolithic in the Dutch coastal zone. In: C. Gates St.-Pierre and R.Walker (eds), *Bones as tools. Current methods and interpretations in worked bone studies*. Oxford, 81-92.

Van Gijn, A.L. 2008a. Exotic flint and the negotiation of a new identity in the 'margins' of the agricultural world. The case of the Rhine-Meuse delta. In: H. Fokkens, B. Coles, A.L. van Gijn, J. Kleijne, H. Ponjee and C. Slappendel (eds), *Between foraging and farming. An extended broad spectrum of papers presented to Leendert Louwe Kooijmans*, Leiden (Analecta Praehistorica Leidensia 40), 193-202.

Van Gijn, A.L. 2008b. Toolkits and technological choices at the Middle Neolithic site of Schipluiden, The Netherlands. In: L. Longo and N.Skakun (eds), *Prehistoric Technology' 40 years later. Functional studies and the Russian legacy. Proceedings of the International Congress Verona (Italy), 20-23 April 2005,* Oxford, 217-225.

Van Gijn, A.L. 2010. *Flint in focus. Lithic biographies in the Neolithic and Bronze Age*, Leiden.

Van Gijn, A.L. and J.J. Boon 2006. Birch bark tar. In: L.P. Louwe Kooijmans and P.F.B. Jongste (eds), *Schipluiden - Harnaschpolder. A Middle Neolithic Site on the Dutch Coast (3800-3500 BC),* Leiden, 261-266.

Van Gijn, A.L. and R. Houkes 2006. Stone. Procurement and use. In: L.P.Louwe Kooijmans and P.F.B. Jongste (eds), *Schipluiden - Harnaschpolder. A Middle Neolithic Site on the Dutch Coast (3800-3500 BC),* Leiden, 167-194.

Van Gijn, A.L. and Y. Lammers-Keijsers 2010. Toolkits for ceramic production: informal tools and the importance of high power use-wear analysis. *Bulletin de la Société Préhistorique Française* 107, 755-762.

Van Gijn, A.L. and A. Verbaas 2008. Het technologische systeem van Ypenburg. Een gebruikssporenanalyse van diverse werktuigtypen. In: H.Koot, L. Bruning and R.A. Houkes (eds), *Ypenburg-lokatie 4. Een nederzetting met grafveld uit het Midden-Neolithicum in het West-Nederlandse kustgebied*, Leiden, 289-314.

Van Gijn, A.L., V. Beugnier and Y. Lammers 2001a. Vuursteen. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam Polderweg. Een mesolithisch jachtkamp in het rivierengebied (5500-5000 v. Chr.)*, Amersfoort, 119-161.

Van Gijn, A.L., Y. Lammers and R. Houkes 2001b. Vuursteen. In: L.P. Louwe Kooijmans (ed.), *Hardinxveld-Giessendam De Bruin. Een kampplaats uit het Laat-Mesolithicum en het begin van de Swifterbant-cultuur (5500-4450 v.Chr.)*, Amersfoort, 153-191.

Van Gijn, A.L., V. Van Betuw, A. Verbaas and K. Wentink 2006. Flint. Procurement and use. In: L.P. Louwe Kooijmans and P.F.B. Jongste (eds), *Schipluiden - Harnaschpolder. A Middle Neolithic Site on the Dutch Coast (3800-3500 BC),* Leiden, 129-166.

Vanmontfort, B. 2008. A southern view on north-south interaction during the Mesolithic-Neolithic transition in the Lower Rhine area. In: H. Fokkens, B. Coles, A. L. van Gijn, J. Kleijne, H. Ponjee and C. Slappendel (eds), *Between foraging and farming. An extended broad spectrum of papers presented to Leendert Louwe Kooijmans*, Leiden (Analecta Praehistorica Leidensia 40), 85-98.

Verhart, L.B.M. 2000. *Time fades away. The neolithization of the southern Netherlands in an anthropological and geographical perspective*, Leiden (ASLU 6).

Wentink, K. 2008. Crafting axes, producing meaning. Neolithic axe deposition in the northern Netherlands. *Archaeological Dialogues* 15(2), 151-173.

Annelou van Gijn
Faculty of Archaeology
P.O. Box 9515
2300 RA Leiden
The Netherlands
a.l.van.gijn@arch.leidenuniv.nl

Radiocarbon and fossil bones: what's in a date

Hans van der Plicht

The Radiocarbon dating method has developed into a reliable dating method for organic sample materials, including fossil bone. More than any other material, this category is the subject of discussions concerning the validity of dates, in particular for the older part of the ^{14}C time scale.

1 Introduction

The Radiocarbon dating method happens to be just a few years older than the Faculty of Archaeology of Leiden University. The method has contributed significantly to archaeology, since it provides a physical yardstick of time independent of cultural assessments (Libby 1952). Organic samples such as charcoal, bone, wood, peat, shells, plant remains etc. can be directly dated back to about 50,000 years ago. Since the conception of the method in the 1950s, it has continuously been improved; the most significant ones being the introduction of AMS enabling small sample analysis (Tuniz *et al*. 1998), and the establishment of a calibration curve for the complete dating range which makes the dating method more or less absolute (Reimer *et al*. 2009).

Chronological questions have been solved by Radiocarbon dating over the years, spawning 'revolutions' in archaeology. However there always have been debates concerning the acceptance of ^{14}C dates (Renfrew 1999). These continue to the present day – witness, to mention a few prime examples, the dating of the Santorini volcanic explosion (Balter 2006a), "low or high" Bronze/Iron Age chronology debates in the Levant (Holden 2003) as well as the larger Mediterranean region (van der Plicht *et al*. 2009 and references therein), and the dating of the cave drawings from the Chauvet cave (Balter 2008). Radiocarbon clashes here with traditional pottery chronologies and the science of parietal art.

In this contribution, the focus will be mainly on a specific category of ^{14}C dating: fossil bones. Also here are sometimes vehement discussions concerning validity of dates, sample quality, and methodology. This is also caused by recent developments of the ^{14}C method, in particular AMS and sample treatment improvements like the so-called ultrafilter method. The latter was also counted a revolution, in particular for the Neandertal/modern human transition chronology during the Palaeolithic (Mellars 2006).

Bone is the most difficult (or sensitive) material to date, compared with for example charcoal or wood. The literature is polluted by many invalid bone dates; the older the samples, the worse this becomes (e.g., Graf 2009).

The danger of circular reasoning is present. When an improvement in the method produces dates that fit expectations of the archaeologist (usually in the older direction), that does not necessarily mean that the dates are correct. Also, when bone dates are different from expectations (usually in the younger direction), that does not automatically mean they are wrong.

When two independent age assessments are not consistent with each other and there is no obvious objective reason or solution, then all we can say is: at least one of them must be wrong.

All of this concerns collagen, the organic fraction of bones. In this contribution, the present state of the above mentioned affairs will be discussed.

But also the mineral inorganic fraction of fossil bone (apatite) is of interest to the archaeologist. It has been neglected largely because this material too often produces wrong dates. But it works quite well for a special category of archaeological samples: cremated bone.

2 The history of bone dating

2.1 Collagen vs. apatite

Bone dating proved to be difficult in the early days of Radiocarbon. Dating of 'bulk' carbon was practised, often giving young ages. Bone samples were originally not even listed among sample materials to be used (Olsson 2009). Sometimes, the dating of bone apatite was successful. But secondary calcite from the burial environment can infiltrate the bone. This obviously hampers bone ^{14}C dating based on the inorganic fraction, which must be based on primary (biogenic) and not secondary (diagenetic) carbonate. Longin (1971) therefore developed a collagen extraction technique, enabling ^{14}C dating of the organic bone component. Collagen does not exchange carbon with the environment. This therefore has become the main dating tool for bone ever since.

Illustrative examples of bone collagen vs. apatite dating are shown in the table below (table 1). This methodological test was done to gain insight into possible reservoir effects,

lab number	sample	location	extracted	^{14}C (BP)
GrA-11815	human bone	Hardinxveld	collagen	6530±50
GrA-11442	"Elvis"	Netherlands	apatite	6600±80
GrA-11816	human	Hardinxveld	collagen	6710±50
GrA-11444	"Henk"	Netherlands	apatite	6440±70
GrA-12184	human	Tomba Alica	collagen	325±50
GrA-12062		Italy	apatite	320±60
GrA-14109	human	Jardinga	collagen	6235±40
GrA-14076		Netherlands	apatite	6560±40
GrA-13526	human	Norrismount	collagen	4460±50
GrA-13336		Ireland	apatite	3300±40
GrA-14881	human	Topped Mountain	collagen	3340±45
GrA-13333		Ireland	apatite	3520±40
GrA-14635	duplo		apatite	3480±50
GrA-11812	mammoth	Shestakovo	collagen	17720±120
GrA-11679		Russia	apatite	9930±50
GrN-24483	mammoth	Molodova	collagen	20840±310
GrA-14009		Ukraine	apatite	13420±60

Table 1 Dating results for collagen and apatite for the same bone.

and because of the renewed interest in apatite as datable fraction for cremated bone (discussed below).

From the Late Mesolithic Early Swifterbant excavation Hardinxveld-Giessendam (Louwe Kooijmans 2001), human remains were excavated from two male individuals known as Henk and Elvis.

Bone consists of long chains of proteins (collagen) in which particles of poorly crystallized inorganic material are embedded. This inorganic material is known as bio-apatite which incorporates carbonate.

The carbonate originates from the blood of the individual; it is directly related to food intake of the organism. Collagen has its origin solely in proteins in the diets.

Thus, in case of reservoir effects, collagen should date older than apatite (assuming the latter is reliable). Indeed such is the case for Henk. For Elvis, both materials show the same date, within error. There is no measurable reservoir effect here. Could Elvis have eaten (lots of) fish, whereas Henk did not? (see 2.3) Theoretically, that is possible. It assumes that the apatite dates are correct. Both apatite dates differ, but not very significantly considering the relatively large measurement errors.

Apparently there is quite often a slow exchange of carbonate between bone and environment. For samples younger than about 4000 years there is no measurable offset. The difference between carbonate- and collagen dates becomes larger for older samples.

In particular, for the two Pleistocene samples (Siberia and Molodova) are the apatite results bizarre.

Biological apatites can be used for dating under special circumstances. Most notably, post-depositional changes are not a factor in desert environments. This has recently been thoroughly reviewed by Zazzo and Saliège (2011).

2.2 *Cremated bone*

Cremated bone does no longer contain organic remains such as collagen. The fact that cremated bone could not be dated (until recently) was regarded as a serious drawback for prehistoric chronological assessments. Cremation burials are often associated with pottery and artefacts of diagnostic types.

Previous attempts to date cremated bone failed because it was treated as charred bone. Such material has been heated to relatively low temperatures (200-300 °C). Cremated bones have been heated at much higher temperatures (above 600 °C).

Some collagen may survive in charred bone, but none survives cremation.

It appears that at temperatures >600 °C, the bioapatite recrystallizes forming a stable compound. Most of this structural carbonate disappears, but enough material survives prehistoric pyres and can be used for dating by AMS (Lanting *et al*. 2001).

Before adding cremated bone to the list of datable materials, the method has been tested extensively for known age samples from the Netherlands and Ireland. By "known age" is meant mainly ^{14}C dated by charcoal; but also collagen (from unburnt bone) and bones with a historic age have been used. The datelists can be found in Lanting and Brindley 1998 and Lanting 2001.

The success is best illustrated as a plot of charcoal vs. cremated bone dates from the same context (fig. 1).

The dating of cremated bones appears to be generally without a problem for Holocene (post-Mesolithic) sites. Paired dates (cremated bones vs. associated unburnt bone or charcoal) for Holocene/Mesolithic/Palaeolithic sites reveal problems which are not yet understood.

There is one Mesolithic paired set available from the Groningen database. From Oirschot, a charcoal sample was dated to 7790±130 BP (GrN-14506). This was a small conventional sample, and could only be partly chemically pretreated (A only). Later, cremated bone remains were dated by AMS: 8320±40 BP (GrA-13390). In this case, the deviation can theoretically be explained by the incomplete pretreatment.

A few paired dates are available from Federmesser cultural sites from Germany and the Netherlands: Doetinchem, Bad Breisig, Kettig, and Reichswalde. In general, these dates yield satisfactory results. This is in sharp contrast with Late Palaeolithic sites (Hamburger culture) from Poland (Olbrachcice, Hamburger culture) and Germany (Andernach, Federmesser culture). There is here a linear trend between cremated bone dates and the 'real' dates (obtained for other sample materials), but the cremated bone dates are far too young (fig. 2). The deviation becomes smaller for older dates. This effect remains to be explained.

2.3 *Reservoir effects*

Bone collagen has its origin solely in proteins in the diet, and is therefore liable to reservoir effects when these proteins are derived largely from fish and/or shellfish. These food sources show apparent ages on the ^{14}C time scale, which is by definition terrestrial. For marine organisms, this effect is caused by upwelling of deep and old ocean water (and the dissolved CO_2 it contains). This causes an offset of 400 ^{14}C years for marine organisms; therefore, modern fish and shellfish date 400 BP.

For freshwater reservoirs (rivers and lakes) a reservoir effect also applies, but this is caused by dissolved carbonate of geological age (i.e. does not contain measurable amounts of ^{14}C). Such reservoir effects can be much greater; for example, fresh fish from the river Rhine date c. 1300 BP.

Reservoir effects also apply to terrestrial organisms consuming marine food, including humans. In such cases, bone collagen shows apparent ages. For archaeological bone in the Netherlands, this has been studied in detail by Lanting and Van der Plicht (1995/1996). For medieval samples from

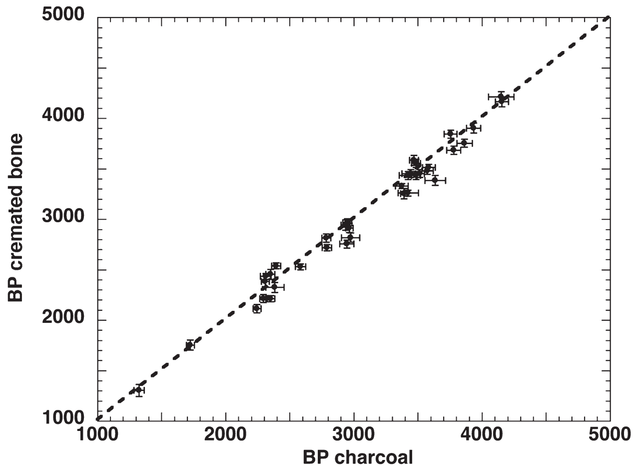


Figure 1 Paired Radiocarbon dates of cremated bone vs. charcoal for the age range 1000-5000 BP.

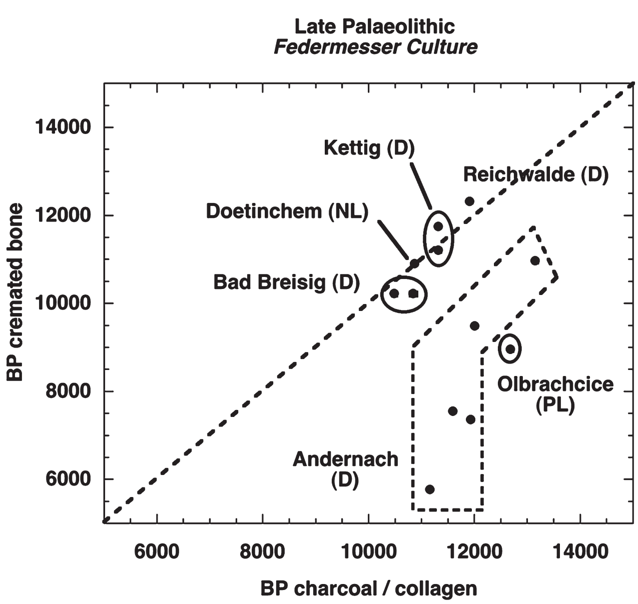


Figure 2 Paired Radiocarbon dates of cremated bone vs. other datable materials (charcoal or unburnt bone) for the Late Palaeolithic.

people with a known date of death (nobles and saints) a systematic study of ^{14}C dates shows reservoir effects up to a few centuries. Stable isotope ratios (^{13}C and ^{15}N) for bone collagen can be used to investigate reservoir effects for ^{14}C. For a Neolithic case study in the Netherlands, see Smits and Van der Plicht (2009).

2.4 Collagen quality and reliability

The ^{14}C laboratories investigate reliability and reproducibility by means of mutual intercomparisons. The most recent one is known as VIRI (Fifth International Radiocarbon Intercomparison). The results of this intercomparison (as well as earlier ones) can be found in the literature (e.g., Scott 2003) and on www.radiocarbon.org.

We show here the results for the fossil bone samples (named E-I) from both Groningen laboratories (conventional and AMS) (table 2). The table shows ^{14}C ages in BP, with 1-sigma measurement errors. The consensus value is the average ^{14}C date calculated from all participating laboratories.

The results of most laboratories (including Groningen) are good to satisfactory; there are only few exceptions. The intercomparison is 'blind' which means the laboratories only know their own results, which they can publish (like is done here for Groningen), but not each other's results.

The conclusion is that in general, bone dating works for good-quality sample material.

For fossil bones, the main quality parameters are the $\delta^{13}C$ value and the organic carbon content of the collagen (C%). These are generally in the range -18 to -22 ‰ and 40 to 45%, respectively (Mook and Streurman 1983). Impurities generally result in lower $\delta^{13}C$ values, since the insoluble compounds have $\delta^{13}C$ values of -22 to -29‰.

More recently, Nitrogen analysis results have become additional quality parameters: $\delta^{15}N$, N% and the C/N value.

sample	**species**	**conventional (GrN)**	**AMS (GrA)**	**consensus value**
E	mammoth	37850 (+1100,-950)	39950 (+410,-360)	39305
F	horse	2540±20	2570±30	2513
G	human	n/a	970±30	969
H	whale	9545±35	9485±45	9528
I	whale	8295±35	8355±40	8331

Table 2 Intercomparison results for bone dating: Groningen and international consensus values.

The N% value should be in the range 12.5-16%. Such values are based on those valid for fresh animal bone.

The acceptable range for the C/N ratio (which is C%/N% corrected for the atomic mass ratio 14/12) is 2.9-3.6 (DeNiro 1985). Note that the stable isotope ratios $\delta^{13}C$ and $\delta^{15}N$ for bone collagen also depend on the food source of the organism (Kohn 1999).

Further, the same general rules apply to bone as to other samples submitted by archaeologists for dating. These comprise questions such as

- what is the ^{14}C event for the sample material;
- how is the ^{14}C event associated with the human event;
- does the material for which the ^{14}C event has been identified meet the requirements for a conventional ^{14}C age?

For a thorough discussion the reader is referred to van Strydonck *et al*. (1999), and to an earlier publication by Mook and Waterbolk (1985).

3 Calibration

Originally (during the early 1950's), ^{14}C dates were reported in years BP (Before Present), as is common practice in other dating techniques, most notably in the earth sciences. Early dates were significant, often revolutionary, but crude with 1-sigma errors often a few hundred years BP (Libby 1952).

The radioactivity was measured relative to a standard corresponding to values of the "present day", 1950 at the time, which is a chemical substance called oxalic acid. The half-life value of 5568 years, as determined by Libby, was used.

It was soon discovered that there was a problem with both. Modern values appeared to have been changed because of fossil fuels (which do not contain ^{14}C), so that the 1950 oxalic acid has 5% less ^{14}C than the natural value before the anthropogenic effects, affecting atmospheric CO_2 (and its isotopic values). Also, de Vries (1958) discovered that significant natural variations occur in the atmospheric ^{14}C content. These are caused by a changing cosmic ray flux which produces the cosmogenic isotopes such as ^{14}C.

Further, the half-life was later accurately determined as 5730 years.

And finally, mass dependent effects (isotope fractionation) were discovered which influence the ^{14}C content of a sample (and thus their age).

In order to solve these problems the ^{14}C laboratories have agreed to the following convention:

1. The ^{14}C activity (i.e. the $^{14}C/^{12}C$ ratio) is measured relative to that of an international standard (the oxalic acid)
2. It is corrected for fractionation using the $^{13}C/^{12}C$ ratio of the sample to a standard value
3. The ^{14}C age is calculated using the original half-life (5568)
4. The ^{14}C age is reported in the unit "BP".

Thus, the ^{14}C time scale is *defined*. Note that the time scale is 'elastic' because of natural variations in the ^{14}C content of nature. The defined ^{14}C time scale needs to be connected to the calendar time scale by calibration. This calibration automatically takes into account natural ^{14}C variations and the half-life uncertainty. The convention cleverly takes into account these ambiguities. The only uneasy element in this definition is BP which does *not* mean Before Present in the literal sense. But the use of this term had been so widespread that all attempts to change it failed.

Calibration of the ^{14}C time scale is possible by measuring ^{14}C in tree rings, which are dated absolutely by dendrochronology. This is presently possible back to about 12,500 years ago (Friedrich *et al*. 2004).

Only recently, calibration curves became available covering the complete Radiocarbon dating range of 50,000 years (Reimer *et al*. 2009). This calibration curve intcal09 is shown in figure 3. The older part of the curve is derived from marine samples: U-series dated corals and foraminifera. The ^{14}C ages are reported in BP, and the calendar time scale is shown in calBP. This is defined as absolute years relative to AD 1950, i.e. calBP = 1950-AD = 1950+BC (Mook and van der Plicht 1999).

Note that therefore it has to be established that the U-series dates are absolute. In addition, the samples are marine, which means the ^{14}C dates have to be corrected for the reservoir effect. Some uncertainties in both time scales remain.

In theory, there are prospects for an extension of the dendrochronological record for the complete dating range. Large amounts of Kauri wood from New Zealand are available (Balter 2006b). But it will take many years before this will be established. In the meantime, a varved lake sediment from Japan (Lake Suigetsu) which covers the complete ^{14}C dating range is yielding calibration information (Staff *et al*. 2012). The importance of both Kauri wood and Lake Suigetsu varves is that the ^{14}C measurements are done on terrestrial material. Thus, they are independent of marine reservoir effect uncertainties.

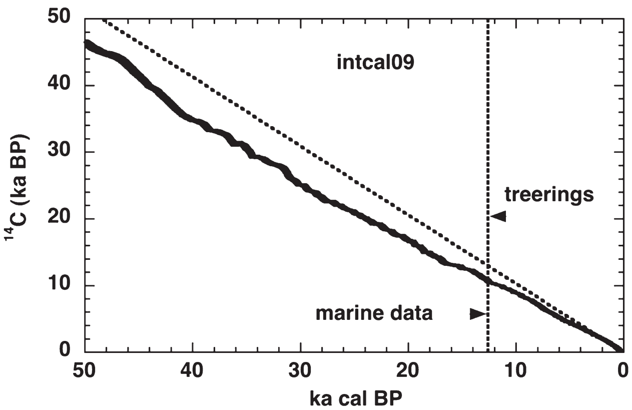


Figure 3 The Radiocarbon calibration curve Intcal09 for the complete 50.000 years.

It is also noteworthy that the possibility of large fluctuations in the ^{14}C content around 40,000 years has been refuted recently (Talamo et al. in press).

4 The oldest part of the ^{14}C time scale

4.1 General

The natural concentration of cosmogenic isotopes like ^{14}C is extremely small. The relative $^{14}C/^{12}C$ content in modern material is 10^{-12}; for 50,000 (50 ka) year old samples, this is decreased to c. 10^{-15}. To illustrate this extreme sensitivity of the method: the latter number corresponds to one hair of the present human world population, based on 10^{10} inhabitants on our planet and an average number of 10^5 hairs per person. Such low concentrations make the method very sensitive to contamination. Problems with ^{14}C dates (in particular bone) are 'amplified' towards the oldest part of the dating range, 30-50,000 BP.

Contaminants become more important when the sample is older. These are usually modern materials, making the samples date too young when not adequately removed. A 45,000 year old sample will be measured as 35,000 BP, when there is 1% modern contamination. For the conventional method, quantitative examples are discussed by Mook and Waterbolk (1985).

For AMS, this effect is more problematic than for the conventional method because of the intrinsically small samples (by a factor of 1000) used. Examples are given by Lanting and van der Plicht (1993/1994), and below (the baby mammoth Lyuba).

In fact, contamination is the most likely cause for the 50 ka dating limit for AMS. The 50 ka limit for the conventional method, which is based on radiometry, is understood as caused by remaining background radiation still able to penetrate the shielding. AMS, however, is not sensitive to allochthonous radioactivity. In fact the background of the machinery proper corresponds to ^{14}C ages older than 100,000 years. Nevertheless, samples with infinite age on the ^{14}C scale (background material) show ages in the range of 45-50 ka BP. This can be explained by the chemical treatment of the materials, which apparently are not free of C containing contaminants at this level. Various laboratory contributions during sample preparation are investigated by Aerts *et al*. (2001).

This is the ^{14}C methodology perspective. But also from an archaeological point of view, 'old bone' samples can easily be problematic. Because of their age, they are rarer, and more easily degraded. The latter makes them then also more sensitive to contamination. For example, dating Neandertal bones is difficult because (1) only a minimal amount of material is available for dating, which is destructive; (2) some degradation means not an optimal collagen content so that the bones are more susceptible to contamination; and (3) contamination is more problematic for ages close to (or beyond) the 50 ka BP barrier than for samples from more recent periods.

There are various parameters determining the outcome of ^{14}C dating (correct or wrong) of fossil bone, easily causing confusion. There are good bones and bad bones (in terms of sample quality), and there are good measurements and bad measurements (in terms of ^{14}C laboratories). But there is not a simple one-to-one correlation between these.

To mention one example: the Muirkirk mammoth, found in 1895 in southern Ontario is the most complete woolly mammoth known from Canada. Two conventional ^{14}C dates were available: 8390 and 6510 BP. They are very different which is already suspicious. But more importantly, they are unrealistically young, which requires further investigations. Recently, two new samples of the mammoth were taken and re-dated by AMS in Groningen, both yielding 12,190 BP (Harington *et al*. 2012) which is considered much more realistic.

4.2 Backgrounds

One important issue to consider is the background of the ^{14}C measurement. The usual background material for ^{14}C dating is anthracite. This material has geological age, which is infinite for the ^{14}C time scale. Dating this material yields finite ages, because both the chemical treatment and physical measuring processes cannot be done completely ^{14}C free. The remaining ^{14}C counts are a measure of the 'noise' or 'background' which in practice corresponds to ages of around 50,000 BP. This works fine for the vast majority of samples. However, for bone of high ^{14}C age one has to be careful with interpretation of the measurements. Infinitely old charcoal is not necessarily the same as infinitely old bone collagen. It could happen that one takes 50,000 as the laboratory background (based on anthracite) but that the background for collagen with the same quality as the sample is 40,000 BP.

It does not help to use infinitely old bones as backgrounds, such as mid-Pleistocene megafauna bones from Siberia. These can be excellent quality materials while the sample can be degraded. Such backgrounds are then not a proper blank. One might just as well use anthracite; as indeed the laboratories do in practice.

For this reason, the background for bone dates is often stated as 45,000, i.e. no bone dates older than 45,000 BP are reported as finite. Unless it is justified to do so – such as for the Arilakh mammoth, discussed below.

4.3 The permafrost

Most reliable are well-preserved bones from the permafrost. A prime example is the Arilakh mammoth, which yielded extremely well-preserved samples (considering its age) for ^{14}C dating and other research like ancient DNA. A large piece of bone could be dated in Groningen to 55 ka BP, employing both conventional and AMS methods. For details, we refer to Mol *et al*. (2006).

Another illustrative example is the celebrated baby woolly mammoth "Lyuba". A piece of bone was dated by AMS in Groningen to 42 ka BP (Kosintsev *et al*. 2010). The mammoth was also subjected to further methodological testing, illustrating the difficulties of ^{14}C dating practice. Skin samples yielded dates in the range 31-37 ka BP; plant remains found in the intestines of the animal yielded dates in the range 26-42 ka BP (Fisher *et al*. 2012). Only the oldest plant date is consistent with the bone collagen date. It was obtained after very rigorous pretreatment. It is not unlikely that the younger plant dates (which were less thoroughly pretreated) were rejuvenated because bacterial activity within the intestine, based on survival of live, but dormant microbes from Lyuba's life. Such effects have been observed before in American Mastodonts (Rhodes *et al*. 1998).

4.4 The Palaeolithic

Bones which are not as well preserved as in the permafrost are often questionable in terms of their ^{14}C date. Usually they are too young, which must be caused by modern contamination apparently not removed by the collagen preparation procedure. For this reason, the Oxford ^{14}C laboratory has developed the so-called ultrafilter method. Ultrafiltration is used to purify the collagen, separating out the smaller and lower molecular weight fractions which seem to have been the major source of more modern organic contaminants (Bronk Ramsey *et al*. 2004). Indeed application of this refinement made impossibly young dates older and consistent with their "desired age" (e.g., Jacobi *et al*. 2006). That may be so, but matters are more complicated. There is the danger of circular reasoning. How do we *know* which age is correct – only if it meets our expectations? What is subjective, what objective?

Also from the physical measurement point of view, matters turned out not to be as easy as presented. In the first place, ultrafiltration is dangerous since the filters themselves can easily (and are known to have done so) introduce contaminants. Furthermore, extensive testing by the Kiel ^{14}C laboratory showed that filtration does not necessarily produce a better date (Hüls *et al*. 2009).

Thus far, ultrafiltration has not been applied in Groningen. Instead some projects are designed to have it both ways: in a collaborative effort, selected samples are dated with ultrafiltration in Oxford, and without in Groningen. This way, Neandertal bones from various locations are dated; both methods show consistent results, ranging between 32 and 36 ka BP (Semal *et al*. 2009; Crevecoeur *et al*. 2010; Maroto *et al*. 2012). It is important to note that these were all well-preserved bones, yielding good quality collagen, and there were apparently no contaminants removed by ultrafiltration.

4.5 The North Sea

The North Sea is well known for its unique finds of Late Pleistocene mammal fossils – among which most notably mammoth (*Mammuthus primigenius*) and woolly rhinoceros (*Coelodonta antiquitatis*). Most fossils are collected during fishing expeditions (e.g., Mol *et al*. 2008; Mol and Post 2010). A difficult issue has always been the proper geological setting of the finds. Only recently, finds from the Eurogeul region of the North Sea can be studied in a well-developed stratigraphic framework (Hijma *et al*. 2012).

This framework raises questions on ^{14}C dates available for selected fossils. It would mean that all Late Pleistocene terrestrial mammals dating older than around 30,000 years must have been redeposited from their original location. In addition, Late Pleistocene marine mammals must be 60-85,000 years old; the available ^{14}C dates, however, are much younger.

All dates for mammoth fossils from the Eurogeul region and adjacent area of the North Sea are older than c. 34,000 BP (Mol *et al*. 2008). According to Hijma *et al*. (2012), that would mean that these fossils must have been transported.

That seems impossible for a particular juvenile skull, known as NO 4513. This was dated 28,740 BP (GrA-50454) by means of fly pupae (Van der Plicht *et al*. in press). In addition, other finds from the Eurogeul such as large mammoth skulls including tusks must be in situ finds. Thousands of mammoth bones are collected, indicating the presence of articulated skeletons in the Eurogeul region. Following the geological analysis of Hijma *et al*. (2012), these mammoths must be younger than 30,000 BP. Such young dates have not been observed thus far in the Eurogeul and North Sea.

Based on these latest findings, apparently either mammoths lived longer (up till less than 30,000 years ago) in the Rhine/Meuse delta region than previously thought, or that the flies settled in the mammoth skull cavities much later than the mammoth's time of death.

As mentioned above, there is a second discussion item concerning the stratigraphic analysis of Hijma *et al*. (2012) and available ^{14}C dates: those of marine mammals. Also here, the ^{14}C dates are younger than expected. This fits in with other discussions on 'too young' ^{14}C dates and their validity: shells. The datable fraction for these samples is their carbonate. Fossil corals and shells can recrystallize, enabling exchange of Carbon, including ^{14}C. Foraminifera of Eemian age can produce dates significantly younger than 50,000 BP. This open system behaviour is also known to be species dependent (Nadeau *et al*. 2001; Busschers et al. in prep.).

This was already known in the early days of Radiocarbon. Olsson (1989) described that infinitely old shells date 33,700 BP, corresponding to 1.5% contamination with modern Carbon. This was observed in samples stored for a long time. Most contamination remains in the outer part of the shells.

In addition, note that also for shell dating the proper background for ^{14}C dating (infinite age material) must be considered. Using anthracite easily yields similar interpretation problems as for fossil bones discussed above.

But all of this does not mean that obtaining good ^{14}C dates for carbonate organisms are impossible, witness the very existence of the calibration curve intcal09. The fact that the calibration curve goes back to 50,000 years ago alone is proof of that.

The backbone of the calibration curve for the time frame discussed here (the later Pleistocene) is based on marine samples, in particular the unique and thoroughly measured dataset from the Cariaco Basin (off the coast of Venezuela). These are pristine planktonic foraminifera samples (Hughen *et al*. 2004). This means that for these carbonates, the ^{14}C content has been measured without problems as discussed above, to even beyond 50,000 BP. Apparently these shells do *not* show open system behaviour. The Radiocarbon intcal committee has established unambiguous criteria for marine sample materials (Reimer *et al*. 2002).

The North Sea brings together many aspects of the subject of this paper: validity of ^{14}C dates, degradation, open system behaviour, background questions, different behaviour of different sample materials, calibration, unknown geophysical aspects and, above all: context.

Truly interdisciplinary research no doubt will increase our understanding of this important heritage.

5. Beyond the ^{14}C time scale

5.1 Schöningen

Schöningen is a well-known Pleistocene site in Lower Saxony, Germany, about 90 km east of Hannover. It is an open-cast brown-coal mine that revealed ample paleontological and palaeolithic objects. Most spectacular is the find of 8 wooden spears with an age of 300-400,000 years (Thieme, 2007). Thousands of faunal bones have been collected over the years, which are being investigated in Leiden. The structural quality of some of the bones appeared very good, inspiring the author to test for the presence of collagen, with positive results. This spawned a study (financed by Leiden University Foundation (LUF)) to investigate the stable isotopes ^{13}C and ^{15}N in collagen from selected bones. This was successful, and stable isotope ratios from 5 species (Bovidae, Cervidae, Elephantidae, Equidae and Rhinocertidae) were obtained from this remarkably old bone collagen (Kuitems et al. 2012).

Here we only mention a ^{14}C dating test we performed on the Schöningen bones. Of course the samples are an order of magnitude older than the ^{14}C dating range. But the excellently preserved collagen is of interest for background testing.

We have dated six Schöningen bone samples by AMS. Indeed, five samples showed dates >45-50,000 BP.

One bone dated 37,910 (+360-320) BP (GrA-49108). Detailed inspection showed that this particular bone consisted of fragments which were glued together. Glue (and some conservatives as well) is often collagen based. Apparently, we dated a mixture of bone collagen and glue collagen. This is confirmed by the peculiar $^{13}\delta$ value which is -33.73‰, whereas the other five bones showed more common values of around -21‰. Also the C content of the collagen was higher (54%) than the usual values for bone.

Extremely old bone collagen such as found in Schöningen is very rare. There are a handful of other sites known. Only the most extreme case is mentioned here: collagen has been extracted once from a Dinosaur bone (Bocherens *et al*. 1988).

5.2 Enrichment

Enrichment of ^{14}C in samples (isotope separation, through which ^{14}C is concentrated in a fraction of the original sample) is a method to extend the possible age limit of ^{14}C dating.

The enrichment process has been used for very large samples using thermodiffusion of CO (Grootes et al. 1977). However background problems remain problematic.

A recent method applied in Groningen is based on ultracentrifuge (originally developed for uranium enrichment for the nuclear power industry). These ultra high vacuum machines offer a very clean environment, and enable the direct enrichment of CO_2. This fact, together with extreme care in the other sample and standard preparation steps, resulted in a clear extension of the age limit. In a first test, enrichment was still relatively modest (about a factor of 2.5). Indeed the theoretical age extension of 7500 years was realised, as our background level before and after enrichment was virtually the same.

As a first demonstration of the possibilities of this enrichment technique, we dated a Khatanga mammoth, which (before enrichment) was on the edge of significantly different from background, resulting in a ^{14}C age of 50,800 (+950-850) BP (de Rooij *et al*. in prep.). The background variability level we achieved corresponds to a theoretical age limit of 63,000 BP.

The experiment to push the ^{14}C barrier back in time is shown to work in principle. However the complex nature of the laboratory procedures will not make this a feasible service as dating method.

6. Conclusions

The Radiocarbon dating method has developed during the last 60 years into a reliable dating method for organic sample materials. Since recently, the method has even become absolute for the complete dating range of 50,000 years by establishing the calibration curve known as intcal09.

The datable sample material includes fossil bone. More than any other material, this category is the subject of discussions concerning validity of the dates, in particular for the older part of the ^{14}C time scale.

In general, ^{14}C dating of fossil bone works well when the bone is of good quality, i.e. not degraded.

Not all problems have been solved but it is not justified to reject dates in general when they do not meet expectations.

Relatively new is the discovery that cremated bones, lacking organic materials, can be dated using the inorganic apatite fraction.

This contribution discusses difficulties, strategies and misinterpretations.

References

Aerts, A.T., J. van der Plicht and H.A.J. Meijer 2001. Automatic AMS sample combustion and CO_2 collection. *Radiocarbon* 43, 293-298.

Balter, M. 2006a. New carbon dates support revised history of Ancient Mediterranean. *Science* 312, 508-509.

Balter, M. 2006b. Radiocarbon dating's final frontier. *Science 313*, 1560-1563.

Balter, M. 2008. Going deeper into the Grotte Chauvet. *Science* 321, 904-905.

Bocherens, H., M. Fizet, J.P. Cuif, J.J. Jaeger, J.G. Michard and A. Mariotti 1988. Premières mesures d'abondances isotopiques naturelles en ^{13}C et ^{15}N de la matière organique fossile de Dinosaure, *Comptes Rendus de l'Académie des Sciences Paris* 306, 1521-1525.

Bronk Ramsey, C., T. Higham, A. Bowles and R. Hedges 2004. Improvements to the pretreatment of bone at Oxford. *Radiocarbon* 46, 155-163.

Busschers, F.S., *et al*., in prep.

Crevecoeur, I., P. Bayle, H. Rougier, B. Maureille, T. Higham, J. van der Plicht, N. de Clerck and P. Semal 2010. The Spy VI child: a newly discovered Neandertal infant. *Journal of Human Evolution* 59, 641-656.

DeNiro, M.J. 1985. Postmortem preservation and alteration of in vivo bone collagen isotope ratios in relation to palaeodietary reconstruction. *Nature* 317, 806-809.

Fisher D.C., A.N. Tikhonov, P.A. Kosintsev, A.N. Rountrey, B. Buigues and J. van der Plicht 2012. Anatomy, death, and preservation of a woolly mammoth (*Mammuthus primigenius*) calf, Yamal Peninsula, northwest Siberia. *Quaternary International* 255, 94-105.

Friedrich M., S. Remmele, B. Kromer, J. Hofmann, M. Spurk, K.F. Kaiser, C. Orcel and M. Küppers 2004. The 12,460-year Hohenheim oak and pine tree-ring chronology from Central Europe - A unique annual record for radiocarbon calibration and palaeo-environment reconstructions. *Radiocarbon* 46, 1111-1122.

Graf, K.E. 2009. The good, the bad, and the ugly: evaluating the radiocarbon chronology of the middle and late middle Upper Palaeolithic in the Enisei river valley, south central Siberia. *Journal of Archaeological Science* 36, 694-707.

Grootes, P.M. 1977. Thermal diffusion isotopic enrichment and Radiocarbon dating beyond 50,000 BP. PhD thesis, University of Groningen.

Harington, C.R., D. Mol and J. van der Plicht 2010. The Muirkirk Mammoth: A Late Pleistocene Woolly Mammoth (*Mammuthus primigenius*) Skeleton from Southern Ontario, Canada. *Quaternary International* 255, 106-113.

Hijma, M.P., K.M. Cohen, W. Roebroeks, W.E. Westerhoff and F.S. Busschers 2012. Pleistocene Rhine-Thames landscapes: geological background for hominin occupation of the southern North Sea region. *Journal of Quaternary Science* 27, 17-39.

Holden, C. 2003. Dates boost conventional wisdom about Solomon's splendor. *Science* 300, 229-230.

Hughen K., S. Lehman, J. Southon, J. Overpeck, O. Marchal, C. Herring and J. Turnbull 2004. ^{14}C activity and Global Carbon Cycle changes over the past 50,000 years. *Science* 303, 202-207.

Hüls, C.M., P.M. Grootes and M.J. Nadeau 2009. Ultrafiltration: boon or bane? *Radiocarbon* 51, 613-625.

Jacobi, R.M., T.F.G. Higham and C. Bronk Ramsey 2006. AMS Radiocarbon dating of Middle and Upper Palaeolithic bone in the British Isles: improved reliability using ultrafiltration. *Journal of Quaternary Science* 21, 557-573.

Kohn, M.J. 1999. You are what you eat. *Science* 283, 335-336.

Kosintsev, P.A., E.G. Lapteva, S.S. Trofimova, O.G. Zanina, A.N. Tikhonov and J. van der Plicht 2010. The intestinal contents of a baby mammoth (*Mammuthus primigenius* Blumenbach 1799) from the Yuribey River (Yamal Peninsula). *Doklady Biological Sciences* 432, 209-211.

Kuitems, M., J. van der Plicht, T. van Kolfschoten, et al., in prep.

Lanting, J.N. and A.L. Brindley 1998. Dating cremated bone: the dawn of a new era. *Journal of Irish Archaeology* IX, 1-7.

Lanting, J.N. and J. van der Plicht 1993/1994. 14C-AMS: pros and cons for archaeology. *Palaeohistoria* 35/36, 1-12.

Lanting, J.N. and J. van der Plicht 1995/1996. Wat hebben Floris V, skelet Swifterbant en visotters gemen? *Palaeohistoria* 37/38, 491-519.

Lanting J.N., A.T.Aerts-Bijma and J. van der Plicht 2001. Dating of cremated bones. *Radiocarbon* 43, 249-254.

Libby, W.F. 1952. *Radiocarbon dating*. Chicago: University Press. Re-issued 1965.

Longin, R. 1971. New method of collagen extraction for radiocarbon dating. *Nature* 230, 241-242.

Louwe Kooijmans, L.P. 2001. *Archeologie in de Betuweroute: Hardinxveld-Giessendam De Bruin. Rapportage Archeologische Monumentenzorg 88*. Amersfoort: Rijksdienst voor het Oudheidkundig Bodemonderzoek.

Maroto, J., M. Vaquero, A. Arrizabalaga, J. Baena, E. Baquedano, J. Jorda, R. Julia, R. Montes, J. van der Plicht, P. Rasines and R. Wood 2012. Current Issues in Late Middle Palaeolithic Chronology: the Curious Case of Northern Iberia. *Quaternary International* 247, 15-25.

Mellars, P. 2006. A new Radiocarbon revolution and the dispersal of modern humans in Eurasia. *Nature* 439, 931-935.

Mol, D. and K. Post 2010. Gericht korren op de Noordzee voor de zoogdier paleontologie: een historisch overzicht van de uitgevoerde expedities. *Cranium* 27, 14-28.

Mol, D., A. Tikhonov, J. van der Plicht, R.D. Kahlke, R. DeBruyne, B. van Geel, J.P. Pals, C. de Marliave and J.F.W. Reumer 2006. Results of the Cerpolex/Mammuthus expeditions on the Taimyr peninsula, arctic Siberia, Russian federation. *Quaternary International* 142-143, 186-202.

Mol, D., J. de Vos, R. Bakker, B. van Geel, J. Glimmerveen, J. van der Plicht and K. Post 2008. *Kleine encyclopedie van het leven in het Pleistoceen: mammoeten, neushoorns en andere dieren van de Noordzeebodem*. Diemen: Veen.

Mook, W.G. and J. van der Plicht 1999. Reporting ^{14}C activities and concentrations. *Radiocarbon* 41, 227-239.

Mook, W.G. and H.J. Streurman 1983. Physical and chemical aspects of radiocarbon dating. *PACT Publications* 8, 31-55.

Mook, W.G. and H.T. Waterbolk 1985. *Handbook for Archaeologists no. 3, Radiocarbon Dating*. Strasbourg: European Science Foundation.

Nadeau, M.J., P.M. Grootes, A. Voelker, F. Bruhn, A. Duhr and A. Oriwall 2001. Carbonate ^{14}C background: does it have multiple personalities? *Radiocarbon* 43, 169-176.

Olsson, I.U. 1989. The ^{14}C method, its possibilities and some pitfalls. *PACT Publications* 24, 161-177.

Olsson, I.U. 2009. ^{14}C dating history: early days, questions, and problems met. *Radiocarbon* 51, 1-43.

van der Plicht, J., H.J. Bruins and A.J. Nijboer 2009. The Iron Age around the Mediterranean: a high chronology perspective from the Groningen Radiocarbon database. *Radiocarbon* 51, 213-242.

van der Plicht, J., K. Post and D. Mol 2012. Over aasvliegen en een mammoetkalf uit de Eurogeul. *Cranium*, in press.

Reimer, P.J., K.A. Hughen, T.P. Guilderson, G. McCormac, M.G.L. Baillie, E. Bard, P. Barratt, J.W. Beck, C.E. Buck, P.E. Damon, M. Friedrich, B. Kromer, C.Bronk Ramsey, R.W. Reimer, S. Remmele, J.R. Southon, M. Stuiver and J. van der Plicht 2002. Report of the first workshop of the IntCal04 Radiocarbon Calibration/Comparison working group. *Radiocarbon* 44, 653-661.

Reimer, P.J., M.G.L. Baillie, E. Bard, A. Bayliss, J.W. Beck, P.G. Blackwell, C. Bronk Ramsey, C.E. Buck, G.S. Burr, R.L. Edwards, M. Friedrich, P.M. Grootes, T.P. Guilderson, I. Hajdas, T.J. Heaton, A.G. Hogg, K.A. Hughen, K.F. Kaiser, B. Kromer, F.G. McCormac, S.W. Manning, R.W. Reimer, D.A. Richards, J.R. Southon, S. Talamo, C.S.M. Turney, J. van der Plicht and C.E. Weyhenmeyer 2009. IntCal09 and Marine09 radiocarbon age calibration curves, 0 - 50,000 years cal BP. *Radiocarbon* 51, 1111-1150.

Renfrew, C. 1999. *Before civilization: the Radiocarbon revolution and prehistoric Europe*. London: Pimlico.

Rhodes, A.N., J.W. Urbance, H. Youga, H. Corlew-Newman, C.A. Reddy, M.J. Klug, J.M. Tiedje and D.C. Fisher 1998. Identification of Bacterial Isolates Obtained from Intestinal Contents Associated with 12,000-year-old Mastodon Remains. *Applied and Environmental Microbiology* 64(2), 651-658.

de Rooij, M., C.P. Groen, A.T. Aerts-Bijma, H.A. Been, H.G. Jansen, J. van der Plicht and H.A.J. Meijer. ^{14}C enrichment in samples by ultra-centrifuge: finally a real extension of the age limit, in prep.

Scott, E.M. 2003. The Third International Radiocarbon Intercomparison (TIRI) and the Fourth International Radiocarbon Intercomparison (FIRI), 1990-2002. *Radiocarbon* 45, 135-408.

Semal, P., H. Rougier, I. Crevecoeur, C. Jungels, D. Flas, A. Hauzeur, B. Maureille, M. Germonpre, H. Bocherens, S. Pirson, L. Cammaert, N. de Clerck, A. Hambucken, T. Higham, M. Toussaint and J. van der Plicht 2009. New data on the Late Neandertals: direct dating of the Belgian Spy fossils. *American Journal of Physical Anthropology* 138, 421-428.

Smits, E. and J. van der Plicht 2009. Mesolithic and Neolithic human remains in the Netherlands: physical anthropological and stable isotope investigations. *Journal of Archaeology in the Low Countries* 1, 55-85.

Staff, R.A., T. Nakagawa, G. Schlolaut, M.H. Marsahall, A. Brauer, H.F. Lamb, C. Bronk Ramsey, C.L. Bryant, F. Brock, H. Kitagawa, J. van der Plicht, R.L. Payne, V.C. Smith, D.F. Mark, A. Macleod, S.P.E. Blockley, J.L. Schwenninger, P.E. Tarasov, T. Haraguchi, K. Gotanda, H. Yonenobu and Y. Yokoyama 2012. The multiple chronological techniques to the Lake Suigetsu (SG06) sediment core. *Boreas*, in press.

van Strydonck, M., D.E. Nelson, P. Combre, C. Bronk Ramsey, E.M. Scott, J. van der Plicht and R.E.M. Hedges 1999. *What's in a ^{14}C date*. Proceedings, third conference on ^{14}C and Archaeology, Lyon, 433-440.

Talamo, S., K.A. Hughen, B. Kromer and P.J. Reimer 2012. Debates over Palaeolithic chronology - the reliability of ^{14}C is confirmed. *Journal of Archaeological Science*. in press.

Thieme, H. (ed.) 2007. *Die Schöninger Speere. Mensch und Jagd von 400.000 Jahren*. Stuttgart: Konrad Theiss Verlag.

Tuniz, C., J.R. Bird, D. Fink and G.F. Herzog 1998. *Accelerator Mass Spectrometry: ultrasensitive analysis for global science*. Boca Raton: CRC Press.

de Vries, H. 1958. Variatio in concentration of radiocarbon with timeand location on earth. *KNAW proceedings* 61B, 1-9.

Zazzo, A. and J.F. Saliège 2011. Radiocarbon dating of biological apatites: a review. *Palaeogeography, Palaeoclimatology, Palaeoecology* 310, 52-61.

Hans van der Plicht
Center for Isotope Research
Groningen University
Nijenborgh 4
9747 AG Groningen
The Netherlands
and
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
j.van.der.plicht@arch.leidenuniv.nl

Chronology of the Dutch Neolithic Bandkeramik Culture: a new attempt

Pieter van de Velde

in memory of prof.dr P.J.R. Modderman

An analysis and statistical comparison of the ceramics from 23 LBK sites in the Netherlands resulted in a chronological scheme based exclusively on the evolution of the pottery decoration. This scheme is meant to replace the Modderman 1970 scheme, which mixes heterogeneous data sets. My analyses consistently point to spatula forms, zonation and components of the decoration, and complexity of the rim decoration as indicators of the evolution of the pottery decoration over time. Chronological ordering of the finds yields the important result that the earliest LBK sites in the Netherlands occur on both sides of the Meuse River, equal scores suggesting a single colonization event. The ordering also suggests a slightly later end to the Dutch LBK than the closure of the Elsloo cemetery; again, 'latest' finds occur on both sides of the Meuse River. The quantitative distribution of the find units on the chronological axis confirms the division into two periods of the north-western LBK.

1 Introduction

Recently I had the opportunity to analyse the ceramics from twelve older unpublished or under-published Bandkeramik excavations in the Netherlands (a so-called Odyssey Project; Van Wijk and Amkreutz, in print), among them the 1925 excavations by Holwerda on the Belvédère headland near Maastricht. This provided the occasion for an updated chronological overview of the Dutch branch of the Early Neolithic Linear Pottery Culture (or 'LBK', for Linearband Keramik), as in the preceding years I had been analysing, counting and coding most published ceramic complexes of this culture in the Southern part of the Netherlands, from the cemetery at Elsloo to the settlement on the Janskamperveld near Geleen, and several more (sources are listed separately below).

2 The present state of the Dutch and north-western LBK-chronology

Research into the Early Neolithic Bandkeramik in the Netherlands (and the north-western LBK (NW-LBK) between Cologne and Brussels in general) is hampered by a wiggle in the calibration curve (5210-5060 BCE) right in the centre of the chronological distribution of this culture; only its earliest beginnings and latest manifestations can be reliably dated. Moreover, organic materials have been badly preserved in the decalcified loess soil of the area, hence dendrochronological dating is not feasible either. In the German Rhineland, immediately to the east of the Dutch LBK territory and home to closely related LBK groups, the well at Erkelenz-Kückhoven provided firm tree ring dates, from which the beginning of the LBK in the area was estimated at around 5230 BCE. This was later amended to 5220 BCE through six AMS readings on grain from the bottom of pits along the earliest houses at the Geleen-Janskamperveld site (Van de Velde 2008a, 217). The demise of the LBK is also fixed by reference to the same Kückhoven well to around 5000 BCE (Lanting and Van der Plicht 2002, 44; Lüning 2005). It is generally agreed that the graves in the Elsloo cemetery constitute the latest traces of this culture on Dutch soil (Brinkman and Modderman 1970). The recently excavated Beek Erdwerk stands a chance of being even younger, but it only yielded a typological dating of a decorated sherd to the final LBK-2d phase, yet no "scientific" proof can be quoted (Van de Velde *et al*. 2009).

Within these chronological bounds of the local LBK, developments and facts have to be interpolated by other means, ^{14}C being of no avail (discussion in Lanting and Van der Plicht 2002). Traditionally the decoration on the sherds left by this culture is invoked to this end. Buttler and Haberey (1936) described the first systematic attempt in the Köln-Lindenthal publication. Mainly on choro-stratigraphic arguments, they worked out a chronological scheme based on the classification of the ribbons in the decoration. After his excavations at Elsloo and Stein in the 1950s, the Buttler and Haberey scheme was (unintentionally[1]) reworked by Modderman to a means to chronological differentiation for the NW-LBK that has been in general use until recently (Modderman 1970, esp. p. 122). Like its predecessor, it was largely based on a phenomenological analysis of the strips or ribbons (hence Linear Band Keramik) that make up the decoration on the bellies of the pots of this culture. For the older parts of the scheme, where the differences in decoration were not so clear cut, it relied on developments in the architecture of the longhouses (Modderman 1970, 125-131). Still implicit in Modderman's account, the statistical implications and possibilities were fully developed by Dohrn-Ihmig, then one of the research fellows attached to the Aldenhovener Platte Project of the Archaeological Institute of the University of Cologne (Dohrn-Ihmig 1974; 1976). When computers were introduced into archaeological research, Stehli – similarly working on the Aldenhovener Platte Project – refined and extended the Modderman scheme to incorporate larger amounts of data, first only towards local relative chronologies (Stehli 1982; 1988), later also in interregional comparative studies (Stehli and Strien 1986). Others followed suit (e.g. Claßen 2006), modifying and extending the framework of the 14 'types' originally defined by Buttler and Haberey, to 18 in the Modderman classification, and 30+ in Stehli's early setup, to over eight hundred "characteristics" (Kneipp 1998; his definitions of these marks take up a full 54 pages). The Stehli-scheme was quite influential in other areas and adjacent periods as well (e.g. Spatz 1996, with 81 pages (!) of "type" definitions to analyse southern German Middle Neolithic pottery).

Several objections to this development can be framed, both from methodological and from practical viewpoints. Practically, the more recent classificatory schemes are hardly or not manageable by other researchers than their authors, if only because of their formidable extent. Therefore, the results cannot readily be checked, a scientific original sin. Of course, this sticks much less to the Buttler/Modderman/early-Stehli schemes, which can easily be mastered by anyone interested in LBK problems. The main methodological problem, however, is that one never knows whether all possibilities have been included, whence overlaps or in-betweens tend to be incorporated in the type-lists until counting 800-plus "types" – some of which being indicative of one single pot's decoration only. Then, as already recognised by Dohrn-Ihmig, the reference by Modderman to house architectural details to underpin the first phases is awkward, as the latter are frequently unavailable and substantially questionable as they presuppose neat and synchronic transitions from one type of construction to another.

Contemporaneous with Dohrn-Ihmig's and Stehli's reworking of the Modderman scheme, Modderman encouraged me to take another direction and to set up a classificatory scheme, which would answer my objections to his'. Inspired by analyses of geometrical decorations at large (e.g. Shepard 1954, 255-305) on the one hand, and the structuralists' basic notion that social life is patterned in space and time (Lévi-Strauss 1955; 1958), I developed an analytical classificatory scheme which answered all mentioned problems (Van de Velde 1976; 1979, 13-25) – yet it was not accepted by the wider community. Without entering into specialities, my basic point was (and is) that decoration is a systematic composition of different independent variables each with its own independent development over time. In the case of Bandkeramik pottery decoration, the layout or format of the field of decoration, the auxiliary constructions, techniques of application, main motif definition and structure, the different elements, which are part of the decoration, are conspicuous variables. Each of these variables has alternative manifestations or mutually exclusive attributes, e.g. single or twin- or multi-dented spatula define the execution of the technique variable, presence or absence of neck decoration (next to the ever present belly decoration) make up the variable zonation, etc. As it appeared when confronted with real data, many of these variables had no clear meaning outside the decoration. Two of them, however, could be tied to important social dimensions (esp. kinship; this was recently followed up and extended by a.o. Claßen 2006; Frirdich 2005). In addition, three or four of these newly defined variables proved chronologically relevant: techniques, general layout or zonation, the components of the decoration, and the differentiation of the rim decoration. The attributes of these variables vary systematically and independently over time and space; instead of variables, they also could be called 'habits of decorating the pots', their single attributes expressing their frequencies over time in so-called "battleship curves" (e.g. Dohrn-Ihmig 1976). Below, I will restrict my writing to these four variables.

Time can be imagined as a sequence of things happening one after another, and the act of decorating a pot can be framed as an expression of how this should be done at that place and moment in time. Therefore, difference in the decorative repertoire is an indicator of a difference in place and/or time. This implies that by quantifying the differences, it should be possible to obtain a relative ordering in time through statistical manipulation (I will not consider spatial variation here: most sites in this text are only a few kilometres apart). With more observations, this manipulation seeks to arrange the quantified descriptions of the individual complexes in such a way that differences between neighbouring rows are as small as possible so that smooth transitions appear and no 'jumps' remain – which should be the mirror of the 'systematic change' referred to in the previous paragraph. Applying this procedure to all of the LBK pottery decoration available then yields a (pseudo-) chronological ordering of the units.

3 On statistical methods

To obtain an ordering of the counts as indicated above, several statistical methods are available (see, e.g. Ihm 1978; 1983; Thomas 1986); the oldest one is seriation, developed in the early years of the 20th century by Sir Flinders Petrie as a means to sequence a set of Egyptian graves. In a table with the graves on the rows and their contents in the columns, columns and rows are shifted in order to get the largest counts of the characteristics on a diagonal; the sequence of the rows is their chronological (relative) order, so it is claimed. Though laborious, this method can be manually executed when the number of rows and features is not too large; punch cards and knitting needles are indispensable to achieve a result (a late and very explicit example is given in Dohrn-Ihmig 1976, the German label for seriation is *Goldmannsches Verfahren*). With the coming of computers in the 1970s, the procedure was soon programmed, and larger files could be handled relatively easy as well. Yet, both in manual and electronic form, the problem with this method remains to determine the meaning of the ordering: the sequence may just as well signal a gradient of status, or of wealth, as of chronology.

The meaning of the characteristics is not (or at best, hardly) reflected upon either when Correspondence Analysis (CA; in German: KA) is applied, which is a newer and much more sophisticated method of ordering. It is simply stated, not argued that the first or main axis emerging from the computations reflects the chronological ordering of the data. In its theoretical foundations, Correspondence Analysis is quite similar to Principal Components Analysis, discussed below: from a table with finds on the rows and characteristics in the columns new variables ('axes', also 'Eigenvectors') are computed, which group characteristics that have similar distribution patterns in the data. Admittedly, in LBK archaeology chronology is nearly always the most dominant source of variation in the data, given intra-regional datasets, and therefore the chronologies published by Stehli and his successors can be accepted; however, inter-regional analyses are much less reliable. Thus, in Stehli and Strien (1986), SW-German and NW-LBK do not synchronize on the same Eigenvector, and recourse is taken to a reduction of the set of characteristics to the common ones, without much effect, though. In a later publication, Stehli compares a number of data sets – among which Elsloo-Koolweg and Geleen-De Kluis – one by one with the Merzbach (=Aldenhovener Platte) sequence and finds few differences: even the Merzbach settlement phases can be recognized in all datasets involved (Stehli 1994). Again, there is no discussion of either why selection of the characteristics of the vessel decoration or the variation on the second Eigenvector apparent in his graphs.

Correspondence Analysis has been available from very early on in German computer libraries; in the Netherlands those years we had to make do with the SPSS package in which (then) CA did not figure, and Principal Components Analysis (PCA) was the best approach to the same end. PCA and CA are nowadays widely available, also in the public domain (e.g. in the PAST package employed here). As with CA, PCA seeks to reduce the variation on many variables to a smaller number of axes or 'principal components'. The contribution of each of the original variables to the newly defined components allows interpretation of the latter. For instance, the component (not necessarily the first one) which has high contributions of twin- and multi-dented spatulas, presence of rim decoration, increasing counts of ribbon fillings with hatching or stab-and-drag on the one hand, and single dented spatula, absence of rim decoration, and preponderance of lines in the decoration on the other identifies a component with a strong chronological stamp. In my opinion this explicit dissection of the variability in the data is the main methodological advantage of PCA (and to a lesser extent, of CA as well) over all other methods of data analysis that have been applied to chronological problems. Evidently, Stehli misses the point entirely when he writes, "Surely, the depiction of the facts [by PCA] is pluri-dimensional and does not conform to our idea of the uni-dimensionality of time" (Stehli 1988, 453).

Whatever statistical method of ordering the data is chosen, its result is a relative ordering, and an absolute chronology does not follow. An approximation is possible through the incorporation of associated, well-dated finds on which the ordering can be pinned down. To that end, the finds from Geleen-Janskamperveld, with six reliable AMS-readings of 5220 BCE, may serve as an anchor for the early part of the scale; and the Elsloo cemetery with probably the latest LBK in this area may provide an anchor at about 5000 BCE on the other end of the scale; both datasets have been incorporated in the analysis below.

4 On counting and figures

Statistics is the manipulation of numbers; for reliable results, comparable numbers are required. The units of collection identified by find numbers consist of all things collected from a single archaeological feature like a post hole or a side pit; they are supposed to have been deposited together, or at least within a short time of one another, the so-called 'homogeneous' or 'closed find'. Their contents may differ importantly from one unit to another, in kind as well as quantity, which renders numerical comparison knotty. Moreover, homogeneity is but an assumption, not a fact, admixture cannot be excluded. For that reason not collective pits but individual pots might better be employed to this end (cp. Spatz 1994), with the additional boon that they are comparable in size. Normally, sherds of the same vessel can be singled out without much difficulty; only in the case of very large pits, this poses problems. Yet, complete pots do not occur in LBK settlement debris, only small fractions of the original vessels remain – which again poses problems of comparability. In a pilot study, the surface areas of the sherds deriving from the same pots ('sherd families'; Orton *et al*. 1993) were measured, in order to refer the counts to a fixed standard surface area. It then turned out that the differences between the individual vessels were too large to allow an ordering of them in a continuous array, decoration is apparently too much a matter of either/or – it is executed either with a single-dented or another type of spatula, it consists either of hatchings or of stab-and-drag points, etc. Therefore, this project had to be dropped. Composite units like finds fare much better in this respect: they assemble different pots with different decorations, which were discarded at about the same date in prehistory, and they tell of the decorative spectrum current at that moment.

What is counted in practice: sherds are first grouped into sherd families (remains of a single pot, each) based on their appearances and feel. Per sherd family, the number of sherds is recorded as a kind of index of the reliability of the counts. In addition, the spatula type with which the decoration has been applied is recorded, as is the general structure of the decoration (i.e. with or without distinct rim decoration). Every single line, point, stab, or hatched line is counted, taking fitting sherds into account as singles; and the set-up of the rim decoration (if any) recorded. These figures constitute the basis of the present analysis. To do away with the undesired consequences of different sizes of the finds, the counts per find are converted to percentages per variable: five sherd families decorated with a simple spatula, three with a twin-dented and two with a five-pronged spatula register as 50%, 30% and 20% respectively on the variable technique of decoration. Similarly so for zonation, components of the decoration, and structure of the neck decoration. Of course, other models of standardization are conceivable: the number of pots represented or sherds present, sherd area, and some more, probably. Percentages have been selected here because they are more easily computed from the raw counts, and allow rapid and simple comparison with other collections than the present one with possibly different conditions of retrieval.

5 On validity, a pilot computation

Table 1 presents the factor loadings meant to convey the structure of the chronological ordering. 'Factor loadings' are the correlations of the original attributes with in this case one of the newly defined 'principal components'; they may take values from +1 (complete agreement as to content and direction) via 0 (no relation, neither in content nor in direction) to -1 (complete agreement, yet in opposite direction). The loadings in the column PCA1 have been computed from 421 finds with full rows of data from eight LBK excavations in Dutch Limburg that have been published previously. Those headed PCA2 derive from 170 full rows in the twelve excavations encompassed by the Odyssey Project referred to above. The loadings in the column PCA3, finally, were obtained from the earlier and Odyssey-related excavations, augmented by a few unpublished, recent data sets, together from 23 excavations with 334 finds with more than ten decorated sherds.

variable	attribute	PCA1	PCA2	PCA3
technique	simple	-0,51	-0.55	-0.63
	2-tuple	+0.32	+0.26	+0.36
	multiple	+0.42	+0.44	+0.52
zonation	none	-0.87	-0.86	-0.88
	continuous	-0.19	-0.04	-0.10
	separate	+0.91	+0.82	+0.86
components decoration	lines	-0.80	-0.67	-0.80
	pointlets	+0.42	+0.10	+0.18
	stab-and-drag	+0.43	+0.47	+0.58
	hatchings	+0.34	-0.02	+0.25
structure of rim dec'n	absent	-0.91	-0.87	-0.90
	single row	+0.22	-0.13	+0.04
	2 rows	+0.60	+0.18	+0.57
	>2 rows	+0.38	+0.56	+0.49
of total variance		33.2%	26.9%	33.8%

Table 1 Loadings of the chronologically relevant attributes in three Principal Components Analyses. (see text).

Originally, several other attributes of other variables were included in the computations; their low to negligible loadings on the supposed chronological component (and conversely, the low loadings of the attributes in the table on the components where the other variables loaded high) served to pinpoint relevant and irrelevant attributes relative to chronological computations. The structures of the three principal components that can be associated with chronology are clearly very much alike in the table. Thus, single-dented execution of the decoration, absence of zonation (or: no decoration on the vessel rim), and a preponderance of lines – as indicated by the higher negative coefficients – are opposed by moderate to highly positive loadings of multi-dented spatulas, explicit zonation (i.e., separately decorated rims next to belly decoration on the pots), and complex fillings of the ribbons by means of stab-and-drag components. Everybody familiar with LBK archaeology will agree that the three components shown here have everything to do with chronology, negative values pointing to the beginnings, positive loadings to the younger parts of that culture. More importantly, the agreement of the outcomes computed from different data sets with few (PCA1) and with strong restrictions (PCA3) argues for the robustness of the obtained chronological ordering.

6 The relative ordering and absolute chronology of the sites

In figure 1, the spreads are shown of the scores of the finds over the chronological factor of the different complexes. As

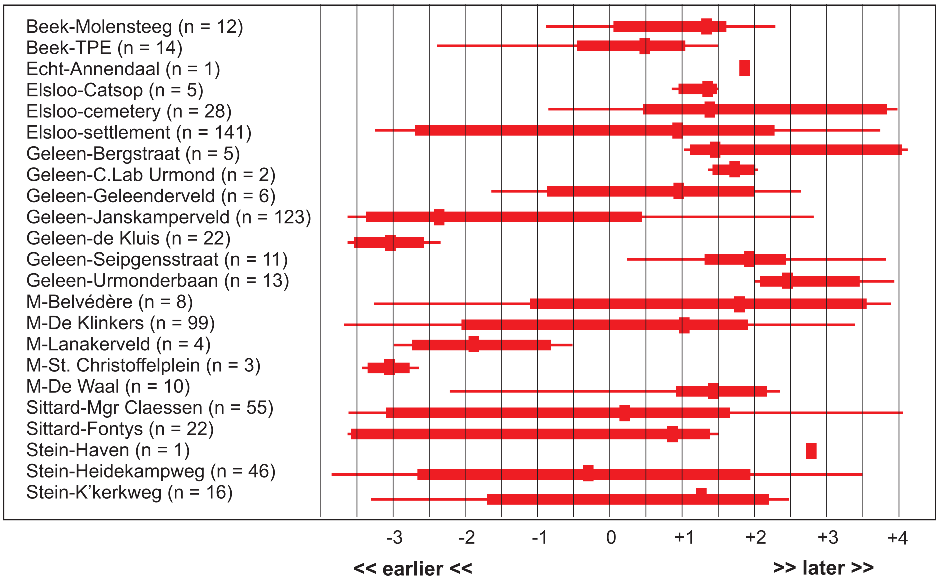


Figure 1 Spreads of the finds per excavation over the chronological axis (n = 649) (thin lines: all finds, thick lines 10/90% of the finds, crossbar: median of spread of finds)
("M", municipality of Maastricht).

the restrictions have been relaxed for the computation, 649 finds are represented here with well over 13,000 sherds representing 4570 sherd families. The largest complexes (Elsloo-settlement, Geleen-Janskamperveld, Maastricht-de Klinkers, Sittard-Mgr Claessenstraat to be grouped with Sittard-Fontys) together neatly span the full range, with the smaller excavations scattered in between. The earliest scores are accorded to Geleen-Janskamperveld, Geleen-de Kluis, Maastricht-de Klinkers, Sittard and Stein-Heidekampweg; they may have been the first agricultural colonies on Dutch territory. By the AMS-readings from Geleen-Janskamperveld, this event should have occurred around 5220 BCE. It should especially be noted that this first settlement occurred also on the left bank of the Meuse (the De Klinkers site). At the other end of the scale, the cemetery of Elsloo did not yield the latest score as expected, the Geleen-Bergstraat and Sittard settlement sites had even slightly later scores. Given the generally accepted c. 5000 BCE date for the closure of that cemetery, the LBK-occupation may have continued by another decade or so if it can be assumed that decorated pots in a grave are part of the same stock as regular household ware.

The bars in the box plot of figure 1 are very dissimilar in actual contents: some represent over a hundred finds, while others barely account for ten such units. Figure 2 depicts the spread of the individual finds with more than four sherd families each on the computed (chronological) factor scale. The 'phases' in the graphic are nothing but equal intervals in

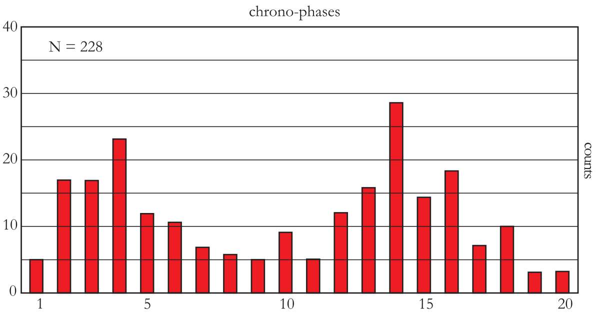


Figure 2 Distribution of the finds over the chronological axis, arbitrary phases (phases: 1 = oldest, 20 = youngest).

the factor scores, there are no equal time lapses implied, and the graph of figure 2 can be appended to figure 1 with but a little contraction due to the different widths.

The most salient feature of figure 2 is the near divide between an earlier and a later part of the sequence, respectively the phases 1 – 9 and 9 – 20. Checking the descriptions of the finds aside this divide, the latter coincides with the LBK-1 / LBK-2 transition, with pot decoration consisting in lines and points, with only simple neck decoration, and exclusive use of single-dented spatula technique before, and more complex fillings of the motifs, more complex rim decoration, and rapid increase of the use of multi-dented spatulas after. At the same time, the graph is much like the distribution of the *houses* of the Aldenhovener

Platte LBK over time (Stehli 1989, 67; Lüning 2005), although there, houses are counted, and here, in the present text groups of decorated pottery are. One would certainly expect correspondences between the two series, but on closer inspection, I could not lay my hands on it. Thus, the Geleen-de Kluis site, which is known for its five houses of an early type, has only one find unit in the first ceramic phase, five in the second, four in the third, and two in the fourth phase – a spread somewhat larger than hoped for. Similarly, the Elsloo graveyard – on extra-ceramic grounds expected to have incorporated selected deceased from the three (at most, four) final human LBK generations – yields ceramic dates from phase 10 onward right to the end, full ten ceramic phases (see also, Van de Velde 2011). When Stehli wrote that he recognized similar chronological patterns in the finds from two sites in the Dutch LBK as from the Aldenhovener Platte (Stehli 1994) the likeness will not have gone much beyond this general two-peaked distribution of the finds. In all likelihood, the juxtaposition of data from many excavations as here has obscured what patterns there are at the individual site level.

A cautionary note: the scales in the figures/factor scores cannot be translated directly into calendar years: equal differences in scores represent equal differences in counts on the pottery decoration (which equate with equal changes in the decoration), whereas real-world social change is sometimes fast, sometimes slow. There is no direct conversion possible: the first (left hand) eight or nine bars of figure 2 are probably representative of the first LBK period (i.e., phases 1-b, 1-c, and 1-d), whereas the later (right hand) eleven bars group the changes in the second LBK period (i.e., phases 2a to 2d). The Aldenhovener Platte Project has demonstrated that the two phases differ in length by some 20 years only (Lüning 1991, 63), seemingly less than suggested by counting the bars in the graph above.

7 (Dutch) LBK pot decoration over time

Figure 3 graphically depicts the calculated changes in selected attributes of the LBK's pot decoration over computed time; table 2 presents the figures. As noted above, the House Generations that have been established for the Aldenhovener Platte LBK cannot be derived from the (aggregated) Dutch material. Together with the arbitrary nature of the factor scores, this is the reason that the chronological scale has been divided arbitrarily into twenty

phase	technique			components				rim decoration		
	simple	double	multi	lines	points	st-&-dr	hatch	none	1 row	≥2 rows
1	100	0	0	88	12	0	0	100	0	0
2	100	0	0	77	23	0	0	100	0	0
3	100	0	0	63	37	0	0	96	3	1
4	100	0	0	55	45	0	0	88	10	2
5	100	0	0	52	48	0	0	74	22	4
6	100	0	0	50	50	0	0	59	35	6
7	100	0	0	48	52	0	0	47	46	7
8	100	0	0	45	55	0	0	36	54	11
9	100	0	0	43	55	2	0	25	65	11
10	100	1	0	36	60	3	1	17	69	14
11	99	2	0	25	70	4	1	13	62	25
12	98	1	0	18	73	6	3	7	51	42
13	99	0	1	14	66	16	4	2	34	64
14	94	2	4	10	58	28	4	0	16	84
15	84	3	13	8	48	38	6	0	9	91
16	71	7	22	7	43	40	10	0	7	93
17	58	12	30	7	30	50	13	0	13	97
18	43	12	45	6	17	61	16	0	1	99
19	24	5	71	4	11	71	14	0	0	100
20	9	1	90	2	8	73	7	0	0	100

Table 2 Attributes of pottery decoration *vs.* chronological factor, percentages per variable (st-&-dr: stab-and-drag).

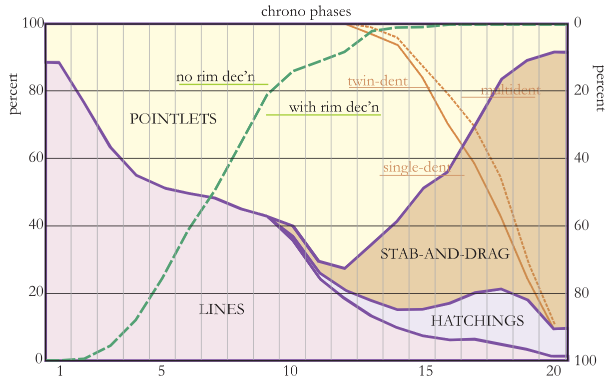


Figure 3 Attributes of pottery decoration *vs.* chronological factor, percentages per variable.

'phases', equivalent each to a fixed interval in the scores, i.e., a mathematical construct. The trends in the variables of the decoration are clear, yet the alignment to a 'true' chronology may compress or stretch parts of the graph. Specifically, the green interrupted line separates off the early pottery decoration, which was restricted to the potbellies only, a style already starting to decline quite early in the succession, to disappear about halfway the time factor scale. This is very much in line with Modderman's observations: in his scheme, undecorated rims occur until phase LBK-2a (Modderman 1970, 199). Regarding the separate components, the decline of the lines attribute (purple field) is conspicuous though possibly misleading. This is because both the graph and the table are given in percentages that are relative to the total counts; the raw counts of the lines may very well be approximately constant per decorated pot, it is only the number of points (yellow field), stabbed-and-dragged points (l. brown field) and hatchings (violet field) that really soar in the later part of the LBK period. Hatchings, the fourth component of the decoration depicted in figure 3, starts to appear slightly before the demise of the pots with no rim decoration, by the looks of the graph hatching has never been very popular in the Southern Netherlands. Modderman's account, however, puts the first appearance of this component later, by phase LBK-2c, also in use right to the end of the Dutch LBK (his ribbon types A-III / 30, B-III / 32, and C-II / 37; Modderman 1970, 122, 199). The double-dented spatula (brown line) appears two or three arbitrary factor chrono-phases later than the emergence of hatched ribbons in the LBK's decorative repertory, and quickly replaces its single-dented predecessor – in Modderman's scheme, multi-dented spatulas ("gezahnte Spatel") (interrupted brown line) are reported only when occurring in the rim decoration, in the final sub-phase of the Dutch LBK.

As a summary of the above and a lead to further research, table 2 presents the smoothed percent values of the attributes in LBK pottery decoration that are most sensitive to the course of time – counts will be off by less than five percent, provided a sufficient number of sherd families (say, at least ten per case) is incorporated. Within this pottery decoration's evolution, the main difference occurs around phase 9, best visible in figure 2 in the dip in the counts of the finds. It is not a break as all series are continuous, and some remain stationary around this phase (all technique attributes, also components more or less) as illustrated by the columns of table 2. Before this divide, the pottery decoration is executed exclusively with single dented spatulas, with lines and points only, lines counting for at least 45% of the sum of the components; also, pots without rim decoration are mostly restricted to the first half of the time range accompanied by an increasing number of pots with rim decoration. After the divide, nearly all pots have decorated rims, all types of spatula are in use (with increasing counts of double and multi-dented spatulas), hatching and increasingly stab-and-drag do occur, replacing points; the relative number of lines decreases to a few percents at the end.

It does not seem stretching the evidence too much to suggest that the first nine of the calculated phases equate with the first LBK period as defined by Modderman and Dohrn-Ihmig, and the group of eleven ceramic phases following to the second period. This suggests an investigation of further similarities between the two schemes. For the LBK-1 period Modderman's periodization rests mainly upon developments in the architecture of the houses[2] (Modderman 1970, 195-200), which are emphatically not considered in the present text: any subdivision here is exclusively based upon the behaviour over time of the various attributes of the pottery decoration. Thus a first split may be applied between the phases 2 and 3 (refer to table 2), leaving finds with exclusively pottery without rim decoration as a defining feature for a possible parallel to the customary LBK-1b phase. In my calculated phases 3-6 a minority of pots feature decorated rims, and their belly decoration shows small numbers of points (less than 50% of this variable's count) – not too different in description from Modderman's LBK-1c phase. My phases 7-9 equate readily with Modderman's LBK-1d ("emphatically a transitional phase towards the Younger LBK"; Modderman 1970, 196) in that there are more points than lines in the decoration (Modderman's D-II ribbon type) sometimes together with a little more complex (than a simple line of points) rim decoration.

The LBK-2a phase is described by Modderman as "clearly transitional" (as was the preceding 1d phase), he lists many characteristics pertaining to the LBK-1 that have disappeared altogether by then, with the occasional absence of rim decoration on the pots as an exception. Added here are the still exclusive use of simple spatulas, and (negatively) the (near) absence of hatching or stab-and-drag ribbon fillings – my chrono-phases 10-12. Phases 13-15 of table 2 seem to group into the LBK-2b phase, with "many new variations in the way the ribbons are filled": stab-and-drag, and rarely hatched components, all rims decorated, and off and on a twin-dented spatula are the distinctive characteristics. Modderman's definition of the LBK-2c phase points to the rapidly increasing use of multi-dented spatulas, and hatched ribbon fillings, to which the almost explosive increase in the application of stab-and-drag points should be added to bring my chrono-phases 16-18 under this heading. The remainder, chrono-phases 19-20, of necessity equates with Modderman's LBK-2d phase, defined indirectly (through his ribbon types C-II, D-III, F-II) by the manifold use of the multi-dented spatula, almost exclusively employed I would add, as are complex rim decorations.

It will be observed that the first and last Modderman-phases equate with two ceramic phases as defined here, while the other LBK-phases in between are equivalent to three such phases each. Several reasons can be invoked, most important among which is the purely qualitative nature of Modderman's descriptions as opposed to my fully quantified definitions. Also and just as consequential, statistical methods are based on the equivalence of calculated differences between numbers, which implies that rapid change is spread over more intervals than is stagnation. Therefore, the two ceramic 'phases' 1-2 computed from the differences in pottery decoration (LBK-1b) might span even more chronological time than e.g., the phases 16-18 equivalent to the 2c phase. Given the unreliable nature of ^{14}C-determinations for the LBK period, only dendrochronological measurements can point a sure way out, with probably sociological assumptions as especially the concept of House Generation a good approximation. In other words, ceramic phases can be used for relative dating purposes only.

Even so, the table above may provide a lead to further research, such as which LBK settlement was last to be abandoned (or, rather, where did they stop making LBK-type decorated pottery). Conversely, which sites in this area did LBK-decorating people settle first? Similarly, were the Belgian Hesbayan LBK sites an offspring of the early Dutch sites on the left bank of the Meuse? It might also serve in an investigation of the different LBK trajectories on both banks of the Meuse River with intensification on the right bank and dispersion on the left, yet both followed by societal collapses. Internal settlement histories will also profit from sharper relative chronologies through application of the table's values, which then may result (or not!) eventually in a definition of House Generations in this part of the NW-LBK. There may be more …

8 By way of conclusion: a ceramic chronology is but that

The 'old' generalized Modderman-Dohrn-Ihmig LBK-chronology can be specified and refined through the analysis and quantification of the pottery decoration of that culture, at least in Dutch Limburg Province. The 'new' Stehli LBK-chronology of 15 House Generations spanning the LBK period on the Aldenhovener Platte in Germany, only forty kilometres to the east, did not show up in the present data (consisting of 13,355 decorated sherds from 4547 sherd families, counted in 649 find units from 23 excavations). Statistical ordering of characteristics of pottery decoration by means of abstract/numerical intervals instead of counts in years or decades may be one cause of this, as will be the probably subtle differences between the regional cultures of Limburg and Platte (Van de Velde 1995). However, in my analysis of the Geleen-Janskamperveld settlement (Van de Velde 2008b), such entities could well be established – four such "HG"s in the first and one "HG" in the second occupation of the site – which suggests that the concept of House Generation may be applicable to individual sites rather than to a region like Dutch Limburg in its entirety. This latter hypothesis is supported by an argument I made above in another context: houses and House Generations apply to the built-up environment; pottery decoration is a very distinct field of discourse, only remotely coupled through the social. Houses are relatively long-lived entities occurring in relatively low numbers, whereas decorated pottery is relatively short-lived and occurs in relatively large numbers; demographic incidents will have different outcomes in both fields. Consequently, the net result was likely to be a divergence between the two series, and House Generations do not always map onto pottery decoration sequences. It is therefore that in regional comparisons the Modderman/Dohrn-Ihmig periodization of the north-western LBK is to be preferred over the House Generations count by Stehli and his successors. The latter may and will have its use in individual settlement analyses, perhaps even within settlement clusters – but should not be applied in a strict sense to a region.

Notes

1 "Wir haben sehr bewußt keine typologische Chronologie aufstellen wollen. Wenn sich herausstellt, daß die Verzierungen sich typologisch entwickeln, so betrachten wir das höchstens als eine Stütze für die relative Chronologie, wie diese sich aus den Ergebnissen der Grabungen ablesen läßt" (Modderman 1970, 121).

2 In that he assumes homogeneous types per sub-phase without allowing for conservatism or innovation in house construction this background is methodically invalid.

References

Bakels, C.C. and R. Rousselle 1985. Restes botaniques et agriculture du Néolithique ancien en Belgique et aux Pays Bas. *Helinium* XXV, 37-57.

Beckers Sr., H.J. and G.A.J. Beckers Jr 1940. *Voorgeschiedenis van Zuid-Limburg*. Maastricht: Veldeke.

Brinkman, E.J. and P.J.R.Modderman 1970. "Das Gräberfeld." *Analecta Praehistorica Leidensia* 3 (I), 45-76.

Brounen, F.T.S. 1985. HVR 183: Vroeg-, Midden- en Laatneolithische vondsten te Echt-Annendaal. *Archeologie in Limburg* 24, 66-71.

Brounen, F.T.S. 1986. HVR 183: *Mesolithische, Neolithische en IJzertijd-vondsten te Echt-Annendaal en het belang van de vindplaats in het licht van de relatie tussen LBK- en Limburg aardewerk*. Leiden: Instituut voor Prehistorie (unpublished MA-thesis).

Bursch, F.C. 1937. Bandkeramische Wohngruben bei Geleen, Provinz Limburg, Holland. *Germania* 21(1), 5-6.

Buttler, W. and W. Haberey 1936. Die bandkeramische Ansiedlung bei Köln-Lindenthal. *Römisch-Germanische Forschungen* 11 (2 Bnd).

Claßen, E. 2006. *Die bandkeramische Siedlungsgruppe bei Königshoven*. Köln (unpublished PhD thesis University of Cologne).

Dijkman, W. 2000. Weer Bandkeramiek op de Caberg! *Archeologie in Limburg* 84, 31-33.

Disch, A. 1972. Dr. J.H. Holwerda over Pre- en protohistorische vondsten op de Caberg te Maastricht. *Jaaroverzicht Archeologische Werkgemeenschap Limburg* 1971/1972, 33–47.

Dohrn-Ihmig, M. 1974. *Untersuchungen zur Bandkeramik im Rheinland*. (Rheinische Ausgrabungen, Bnd 15), 51-142.

Dohrn-Ihmig, M. 1976. Die Anwendung statistischer Prüfverfahren bei der Stilanalyse und bei Erkennung von Typen am Beispiel verzierter bandkeramischer Gefäße. *Praehistorische Zeitschrift* LI(1), 1-25.

Frirdich, C. 2005. Struktur und Dynamik der bandkeramischen Landnahme. In: J. Lüning, Chr. Frirdich and A. Zimmermann (eds), *Die Bandkeramik im 21. Jahrhundert – Symposium in der Abtei Brauweiler bei Köln vom 16.9-19.9.2002*. Espelkamp: Marie Leidorf, 81-109.

Glasbergen, W. 1953. Twee 'hutkommen' van de cultuur der Bandceramiek te Sittard, Gem. Sittard. In: E. della Santa, H. Angelroth and C. Ophoven (eds), *Mélanges en hommage au professeur Hamal-Nandrin*. Bruxelles: Société Royale Belge d'Anthropologie et de Préhistoire, 61-71.

Groenendijk, H.A. 1989. Flitsen uit een bandkeramisch dorp; het onderzoek Beek-Molensteeg 1979(I). *Becha [Tijdschrift van de Heemkunde-vereniging Beek]* 3(4), 49-53.

Hendrix, W.P.A.M. 1999. De bandkeramische nederzetting Stein-Heidekampweg. *Archeologie in Limburg* 80, 21-24.

Holwerda, J.H. 1927. Aus Holland. *16. Bericht der Römisch-Germanischen Kommission* 1925/1926, 119-163.

Holwerda, J.H. and A.E. Remouchamps 1928. Nederzettingen bij Stein aan de Maas. *Oudheidkundige Mededeelingen uit 's Rijksmuseum van Oudheden te Leiden* 9, 3-50.

Ihm, P. 1978: *Statistik in der Archäologie*. Köln: Rheinland-Verlag.

Ihm, P. 1983. Korrespondenzanalyse und Seriation. *Archäologische Informationen* 6, 8-21.

Kneipp, J. 1998. *Bandkeramik zwischen Rhein, Weser und Main – Studien zur Stil und Chronologie der Keramik*. Bonn: Habelt (Universitätsforschungen zur prähistorischen Archäologie No. 47).

Lanting, J.N. and J. van der Plicht 2002. De 14C-Chronologie van de nederlandse pre- en protohistorie – III: Neolithicum. *Palaeohistoria* 41/42 (1999/2000), 1-110.

Lévi-Strauss, C. 1955. *Tristes tropiques*. Paris: Plon.

Lévi-Strauss, C. 1958. *Anthropologie structurale*. Paris: Plon.

Lüning, J. 1991. Frühe Bauern in Mitteleuropa im 6. und 5. Jahrtausend v. Chr. *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz* 35(1), 1988, 27-93.

Lüning, J. 2005. Bandkeramische Hofplätze und absolute Chronologie der Bandkeramik. In: J. Lüning, Chr. Frirdich and A. Zimmermann (eds), *Die Bandkeramik im 21. Jahrhundert – Symposium in der Abtei Brauweiler bei Köln vom 16.9-19.9.2002*. Espelkamp: Marie Leidorf, 94-74.

Meurkens, L. and I.M. van Wijk (eds) 2008. *Wonen en begraven op de Caberg van vroeg neolithicum tot vroege middeleeuwen. Inventariserend Veld Onderzoek van een cultuurlandschap te Maastricht-Lanakerveld*. Leiden: Archol.

Modderman, P.J.R. 1950. Onderzoek van een bandceramische nederzeting te Elsloo (L.). *Berichten R.O.B.* I(19), 4-6.

Modderman, P.J.R. 1955. Een bandceramische nederzetting te Sittard, Limburg. *Berichten R.O.B.* VI, 13-21.

Modderman, P.J.R. 1959. Die bandkeramische Siedlung von Sittard. *Palaeohistoria* VI/VII, 33-120.

Modderman, P.J.R. 1970. Linearbandkeramik aus Elsloo und Stein. *Analecta Praehistorica Leidensia* 3 (3 Bnd).

Orton, C.P., P.A. Tyers and A. Vince 1993. *Pottery in archaeology*. Cambridge: Cambridge University Press.

Shepard, A.O. 1954. *Ceramics for the archaeologist*. Washington, D.C.: Carnegie Institution.

Spatz, H. 1996. *Beiträge zum Kulturenkomplex Hinkelstein-Großgartach-Rössen - der keramische Fundstoff des Mittelneolithikums aus dem mittleren Neckarland und seine zeitliche Gliederung*. (2 Bnd.) Stuttgart: Theiss (Materialhefte Arch. Baden-Württemberg 37).

Stehli, P. 1982. Zur Methode der chronologischen Gliederung des bandkeramischen Siedlungsplatzes Langweiler 8. *Siedlungen der Kultur mit Linearkeramik in Europa* (Nitra-1981 Symposium), 271-278.

Stehli, P. 1988. Zeitliche Gliederung der verzierten Keramik. In: U. Boelicke, D. von Brandt, J. Lüning, P. Stehli and A. Zimmermann (eds), *Der bandkeramische Siedlungsplatz Langweiler 8, Gemeinde Aldenhoven, Kreis Düren*. Köln/Bonn: Habelt (Rheinische Ausgrabungen, Bnd 28), 441-482.

Stehli, P. 1989. Merzbachtal – Umwelt und Geschichte einer bandkeramischen Siedlungskammer. *Germania* 67(1), 51-76.

Stehli, P. 1994. Chronologie der Bandkeramik im Merzbachtal. In: J. Lüning and P. Stehli (eds), *Die Bandkeramik im Merzbachtal auf der Aldenhovener Platte*. Köln/Bonn: Habelt (Rheinische Ausgrabungen, Bnd 36), 79-191.

Stehli, P. and H.-C. Strien 1986. Die zweite Dimension der Korrespondenzanalyse: geographische und zeitliche Ordnung bandkeramischer Inventare. *Archäologische Informationen* 9(2), 146-148.

Thanos, C. 1994. *Caberg-Maastricht – opgravingen door het Rijksmuseum van Oudheden 1925–1934*. Leiden: Instituut voor Prehistorie (unpublished BA-thesis).

Theunissen, E.M. 1990. *Maastricht-Klinkers, een opgraving op de Caberg*. Leiden: Instituut voor Prehistorie (unpublished MA-thesis).

Theunissen, E.M. 1990. Maastricht-Klinkers, een opgraving op de Caberg. *Archeologie in Limburg* 46 (december 1990), 325-328.

Thomas, D.H. 1986. *Refiguring Anthropology – first principles of probability & statistics*. Prospect Heights, Ill.: Waveland Press (2nd rev edn).

Velde, P. van de 1976. Ein paradigmatisches Klassifikationsschema zur Verzierung der Bandkeramik in Bayern. *Archäologisches Korrespondenzblatt* 6, 109-116.

Velde, P. van de 1979. *On bandkeramik social structure*. Leiden: Universitaire Pers (PhD thesis University of Leiden).

Velde, P. van de 1995. Dust and ashes: the two Neolithic cemeteries of Elsloo and Niedermerz compared. *Analecta Praehistorica Leidensia* 25, 173-188.

Velde, P. van de 2008a. "On chronology – -pot sherds, house ghosts, and carbonized seeds." In: P. van de Velde (ed.), *Excavations at Geleen-Janskamperveld* 1991/1991. *Analecta Praehistorica Leidensia* 39, 205-222.

Velde, P. van de 2008b. The Bandkeramik settlement. In: P. van de Velde (ed.), *Excavations at Geleen-Janskamperveld* 1991/1991. *Analecta Praehistorica Leidensia* 39, 223-244.

Velde, P. van de 2011. Aspects du monde funéraire rubané: à propos de l'organisation des cimétières danubiens nord-occidentaux. In: A. Hauzeur, I. Jadin and C. Jungels (eds), *5000 ans avant J.-C., La grande migration? – Le Néolithique ancien dans la collection Louis Éloy*. Fédération Wallonie-Bruxelles: Service du Patrimoine Culturel, 57-63.

Velde, P. van de (ed.) 2008. *Excavations at Geleen-Janskamperveld* 1991/1991. *Analecta Praehistorica Leidensia* 39 (2007).

Velde, P. van de and C.C. Bakels 2002. *Beek-Geverikerveld 2000 – een noodopgraving in een prehistorisch boerendorp*. Leiden: Archeologisch Centrum.

Velde, P. van de, E. Lohof and S. Wyns 2009. A LBK Earthwork at Beek (Prov. Limburg) – le modèle rosheimois in the Netherlands. *Archäologisches Korrespondenzblatt* 39 (2009/4), 455-470.

Waterbolk, H.T. 1959. Die bandkeramische Siedlung von Geleen. *Palaeohistoria* VI/VII, 121-162.

Wijk, I.M. van 2001. *Sittard revisited*. Leiden: Faculty of Archaeology (unpublished MA-thesis).

Wijk, I.M. and L.W.S.W. Amkreutz, in print: *Terug naar de bandkeramiek – 'Vergeten' onderzoeken van de bandkeramiek*. Leiden: Archol.

Listing of the sites discussed in this text

Beek-TPE, mun. Beek, excavations 2000 by H. Vromen; publ. Van de Velde and Bakels 2002.

Beek-Molensteeg, mun. Beek, excavations H.A. Groenendijk; publ. Groenendijk 1989; Van Wijk and Amkreutz in print.

Echt-Annendaal, excavations 1987; publ. Brounen 1985; 1986; Van Wijk and Amkreutz in print.

Elsloo-Koolweg, mun. Stein-Elsloo; excavations 1930s by H.J. Beckers and G.A.J. Beckers, 1950, 1958-1959, 1963 by P.J.R. Modderman; publ. Beckers and Beckers 1940, 103-112; Modderman 1950; 1970, 2-44; Van de Velde 1979, 137-153.

Elsloo-Catsop (also Elsloo-spoorweg), mun. Elsloo; excavations 1933 by F.C. Bursch; publ. Van Wijk and Amkreutz in print.

Elsloo cemetery, mun. Stein-Elsloo; excavations 1966 by P.J.R. Modderman; publ. Brinkman and Modderman 1970, 45-74; Van de Velde 1979, 79-119.

Geleen-Bergstraat, mun. Sittard-Geleen; excavations 1932 by F.C. Bursch; publ. Bursch 1937; Van Wijk and Amkreutz in print.

Geleen-Centraal Laboratorium, mun. Sittard-Geleen; excavations 1989 by W.P.A.M. Hendrix; publ. Van Wijk & Amkreutz in print.

Geleen-Janskamperveld, mun. Sittard-Geleen; excavations 1989/1990 by L.P. Louwe Kooijmans; publ. Van de Velde (ed.) 2008.

Geleen-de Kluis, mun. Sittard-Geleen; excavations 1950 by H.T. Waterbolk; publ. Waterbolk 1959.

Geleen-Urmonderbaan, mun. Sittard-Geleen; excavations 1982-1983 by W.P.A.M. Hendrix and H. Vromen; publ. Van Wijk and Amkreutz in print.

Geleen-Seipgensstraat, mun. Sittard-Geleen; excavations 2001 by H. Vromen; publ. Van Wijk and Amkreutz in print.

Maastricht-Belvédère, mun. Maastricht; excavations 1925/1926, 1933 by J.H.Holwerda, F.C. Bursch; publ. Holwerda 1927; Disch 1971/1972; Thanos 1994; Van Wijk and Amkreutz in print.

Maastricht-de Klinkers, mun. Maastricht; excavations 1989 by E.M. Theunissen, J.P. de Warrimont and others; publ. Theunissen 1990; Van Wijk and Amkreutz in print.

Maastricht-Lanakerveld-fietspad, mun. Maastricht; excavations 2008 by I.M. van Wijk; publ. Meurkens and Van Wijk 2008.

Maastricht-St. Christoffelplein, mun. Maastricht; excavations 1999 by W. Dijkman; publ. Dijkman 2000.

Maastricht-De Waal, mun. Maastricht; excavations 1933 by J.H. Holwerda/F.C. Bursch; publ. Disch 1970/1971; Thanos 1994; Van Wijk and Amkreutz in print.

Sittard-Mgr. Claessenstraat and Sittard-Fontys, mun. Sittard-Geleen; excavations Mgr. Claessenstraat 1949 by W. Glasbergen; 1953, 1954, 1956 by P.J.R. Modderman, and Sittard-Fontys 2000 by I.M. van Wijk; publ. Glasbergen 1953; Modderman 1955; 1959; van Wijk 2001.

Stein-Heidekampweg, mun. Stein-Elsloo; excavations 1999 by W.P.A.M. Hendrix, 2011 by I.M. van Wijk; publ. 1999, and unpubl.

Stein-Keerenderkerkweg, mun. Stein-Elsloo; excavations 1927 by A.E. Remouchamps; 1962, 1963 by P.J.R. Modderman; publ. Beckers and Beckers 1940; Modderman 1970, 77-99.

Stein-Haven, mun. Stein-Elsloo; excavations 1925-1928 by A.E. Remouchamps; publ. Holwerda and Remouchamps 1928; Van Wijk and Amkreutz in print.

Pieter van de Velde
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
p.van.de.velde@arch.leidenuniv.nl

APPENDIX: Counting LBK pottery decoration

To establish the chronological position of a set of decorated LBK sherds, only a limited set of variables has to be evaluated: the instrument with which the decoration has been applied, the existence or not of rim decoration and if so its complexity, and the several components of the decoration. On the assumption that all pots that have gone into a stratigraphical unit/pit are equally important in a chronological perspective, this counting is best done separately per "sherd family" (i.e., all sherds remaining from a pot), afterwards to be averaged per find unit. Of course, less reliable results will be achieved when all sherds from a pit are treated jointly. To demonstrate the counting procedure, below three sherd families will be analysed accordingly.

The first sherd family consists of four sherds remaining of a pot from the Maastricht-De Waal site (MW-122, # 072). They have been coded as follows: 45 cm^2 surface area, multi- (5-) dented spatula, independent rim decoration in five rows, belly decoration consisting of 2 lines, 2 pointlets, and 335 stabbed-and-dragged pointlets.

The single sherd from Maastricht-De Klinkers (MK-059, #520) depicted second here, has been coded as 30 cm^2 surface area; it has been decorated by means of a single-dented spatula, there is no separate rim decoration (rather a secondary motif between the main motifs on the potbelly), from the belly decoration only four lines and four pointlets remain.

The third example, 5 sherds of a pot also from Maastricht-De Klinkers (MK-015, #508), with an area of 85 cm^2, has been coded as: decorated by means of a single-dented spatula, with an independent rim decoration consisting of a single row of pointlets, the belly being decorated by 5 pointlets and 23 hatched lines.

The second analytical step is the conversion of the counts into percentages per variable per pot. These percentages are presented in the accompanying table; it is the basis for the third step, a comparison with table 2 in the main text. The first row (MW-122, #072) of this table easily agrees with the bottom row of the 'master table', indicative of a very late (phase 20) position in time. The second row (MK-059, #520) is less clear –if only because of the small size of the referent sherd. Here, the absence of rim decoration suggests a relatively early date, whereas the lines and the pointlets of the components variable are suggestive of phases 6 and 7; this is not contradicted by the other figures. Finally, the sherd family decorated with hatches (MK-015, #508) should apparently be placed in phase 10 at the earliest because of this component, while the other percentages for this decoration pose no objection to this 'date'.

Figure A1 Maastricht-De Waal. Sherd family no. 072, part of find MW-122.

Figure A2 Maastricht-De Klinkers. Sherd family no. 520, part of find MK-059.

Figure A3 Maastricht-De Klinkers. Sherd family no. 508, part of find MK-015.

find	ref	n (shds)	area cm^2	1-dent	2-dent	m-dent	lines	pntlets	st&dr	hatch	no row	1 row	2 row	>2 row
MW-122	072	4	45	0	0	100	1	1	98	0	0	0	0	100
MK-059	520	1	30	100	0	0	50	50	0	0	100	0	0	0
MK-015	508	5	85	100	0	0	0	18	0	82	0	100	0	0

Table A1 Percentage counts of decoration of pottery in Appendix figs 1-3.

The examples presented here are restricted to individual sherd families. Their counts demonstrate quite clearly that percentages (i.e. converted to counts per hundred) are suggestive of a much higher precision than ever can be justified: several variables are more of a qualitative than quantitative nature (consider the technique of decoration: *either* 1-, *or* 2-, *or* multi-dent; similar to the complexity of rim decoration with only four alternatives). That is, the chronological positioning of individual sherd families/pots is quite problematic, and only the combination of the variables (as here) poses some counterweight to this objection. Find complexes such as the pottery derived from a single pit are methodically better in this respect as higher total counts allow for more precision in the averaged percentages.

One final remark: The methodological background of the present analysis can be found in Van de Velde 1979, where many more variables of the decoration are considered, and where some non-chronological (mainly sociological) correlates of aspects of it are established.

Burning down the house: the burnt building V6 at Late Neolithic Tell Sabi Abyad, Syria

Peter M.M.G. Akkermans, Merel Brüning, Neeke Hammers, Harmen Huigens, Lennart Kruijer, Anna Meens, Olivier Nieuwenhuyse, Andrea Raat, Esther F. Rogmans, Corijanne Slappendel, Sofia Taipale, Sophie Tews and Eva Visser

This article presents the remains of a T-shaped burnt building found in trench V6 in Operation II at Late Neolithic Tell Sabi Abyad, Syria. The burnt building closely resembles the so-called Burnt Village excavated earlier at Tell Sabi Abyad in Operation I, level 6, but is slightly older. Many objects were discovered in the ruins of the burnt building, but the most striking discovery was the burial of a young woman. In this paper we present the V6 burnt building and its remains. We argue that the building was purposely set ablaze as part of a ritual related to fire and death.

1 Introduction

Tell Sabi Abyad is an 8000 year-old settlement mound in the expanse of steppe in northern Syria, close to the Syro-Turkish border (fig. 1). Extensive excavation at the five-hectare site since 1986 has exposed substantial occupation layers from between roughly 7000 and 5800 BC. The research has provided a wealth of new data on Late Neolithic ways of life in the rolling plains of Syria and beyond, from settlement histories and subsistence practices to material culture and the treatment of the dead.

Excavation in 2004 over an area of roughly 100 square metres in the northeastern part of Tell Sabi Abyad (trench V6, see fig. 2) revealed the well-preserved remnants of a wholly-burnt T-shaped building, full of ashes and other incinerated material, dating from the very end of the seventh millennium BC (see table 1). An astonishingly large number of artefacts of all kinds have been recovered from the burnt fill in the building, comprising, among many other things, complete or fragmentary ground-stone tools, bone implements, clay tokens in various shapes and of different dimensions, and several dozen clay sealings with stamp-seal impressions. In addition, there was a crouched inhumation burial in the building. Although different in layout and somewhat earlier in date, the building closely resembles the structures of the so-called Burnt Village at Tell Sabi Abyad, not only because of its destruction by fire but also because of the distribution and richness of its contents (cf. Akkermans and Verhoeven 1995; Verhoeven 1999).

Initially, the available evidence may seem relatively straightforward, suggesting an unforeseeable, accidental burning of the house with its inventory still in it. However, a closer examination reveals many ambiguities allowing for the data to be interpreted in different ways. Several questions come to mind, such as: was the fire that reduced the building to ashes indeed an unfortunate accident or was it perhaps a conscious act of destruction? Was the house still in use for daily living and working at the time of the fire or was it specifically prepared to be burnt? And how did the many hundreds of artefacts end up in the burnt fill? Was there a connection between the fire and the nature and number of these finds, and perhaps with the burial that was found inside the building? This article[1] aims to present the burnt building and the many finds in it, elaborating on issues such as the intentionality of the conflagration and the evidence for ritual in the form of burial and abandonment.

2 The Burnt Building V6

The rectangular burnt building, measuring approximately 10 by 7 metres, has been excavated almost in its entirety; only its northern extremes are still hidden in the unexcavated north baulk. The highly regular and symmetrical structure was T-shaped in plan and consisted of three parallel rows of small rooms with a long but narrow room (divided into two smaller compartments) at a right angle in front of them. Each row consisted of a narrow, elongated room measuring about 3 by 1 m, with a much smaller square room at the back. Only the easternmost row seems to have been subdivided into smaller cubicles, each no more than 1.5 square metres (fig. 3).

The walls, partly still standing to a height of 1.5 m and tapering towards the top, were made of sizeable, irregularly-shaped clay slabs up to 1 m long, 35-40 cm wide and between 5 and 12 cm thick, joined with grey mortar. In several places they carried a thick mud plaster, which, due to the fire, had an orange to greenish-grey colour. The floors in the building were simply made of compact, trodden earth. No hearths or other installations were found inside the building, except for some heavy stone working platforms on the floor in rooms 1, 2 and 4, each roughly square in shape and measuring about 40 by 40 by 10 cm. In rooms 1 and 2, they were positioned about half-way down the room against the western wall. In room 4 were two platforms, one against the walls in the southwestern corner, the other in the southeastern corner.

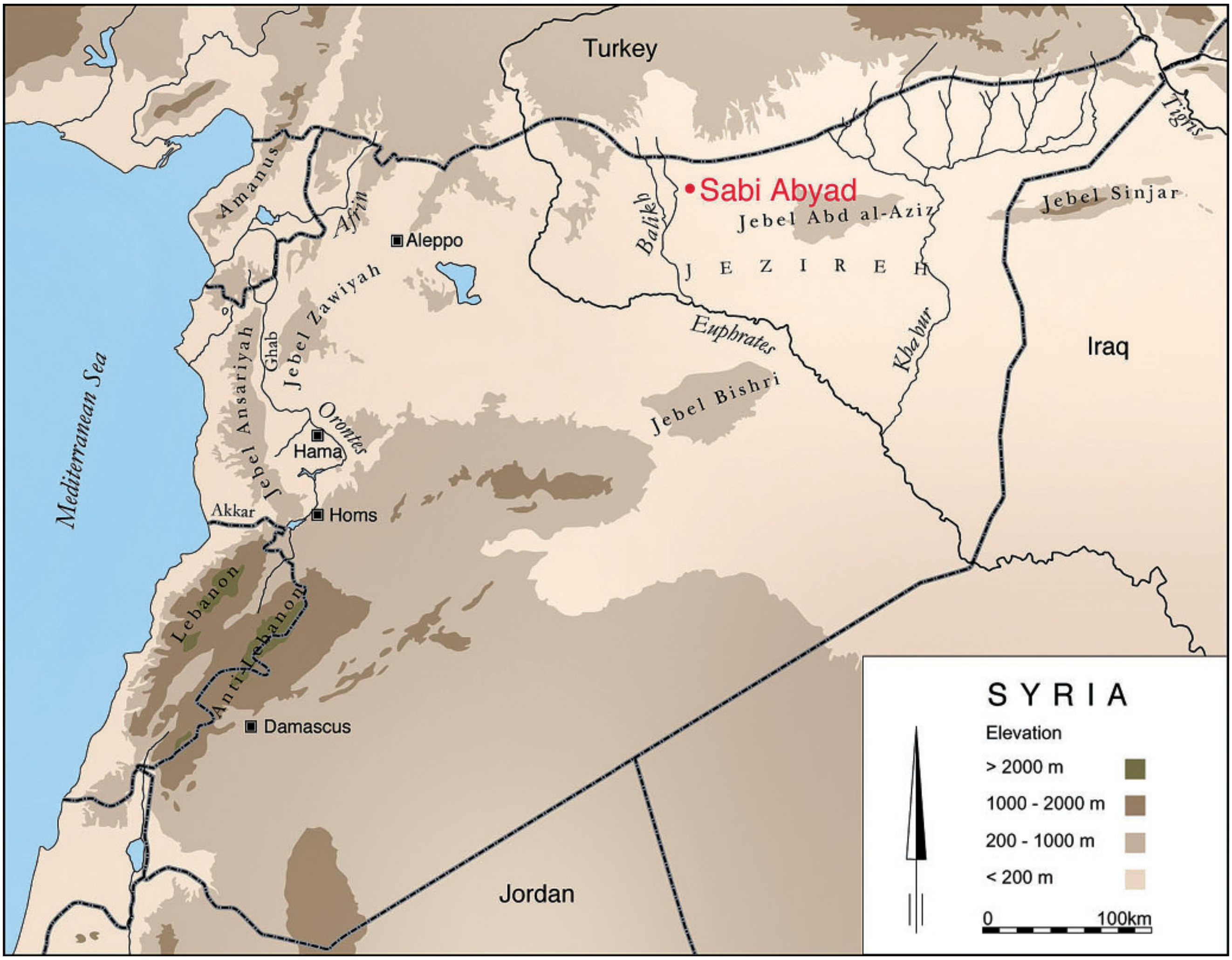


Figure 1 Map of Syria, showing the location of Tell Sabi Abyad marked in red.

Remarkably, the walls showed no evidence of entrances at floor level, except for a small, low opening (about 30 cm wide and 45 cm high) in the eastern wall of room 5 (fig. 4). This porthole contained a large flat stone measuring about 45 by 30 by 5 cm. The building and the rooms in it must have been accessible either through openings high in the walls or through passages in the roof. These openings may also have provided light and air in the rooms. Although there is the possibility of an upper storey, there is no unambiguous evidence for it.

The thick burnt deposits inside the building contained many fragments of what must have been roofing materials, in the form of charred wooden beams and hard-burnt clay fragments with impressions of reeds and circular wooden poles. They suggest that the building still had its roof at the time of the conflagration (or at least part of its roof; see the discussion below). The finds provided insight into the nature of the superstructure, indicating that the (assumedly flat) roof most probably consisted of timbers laid at regular intervals and covered with reed mats. A layer of clay was added on top for insulation (similar to the buildings in the so-called Burnt Village at Tell Sabi Abyad; cf. Akkermans and Verhoeven 1995, 11).

Originally the building must have been entirely free-standing, with relatively clean, open yards around it. Only at a later stage, when it had already been burnt and left to its fate, the structure became surrounded along its southern and south-western sides by small-scale rectangular auxiliary features, including some hearths and other installations. However, the ruins of the original building must have stood prominently

Lab No.	Material	Context	14C BP	1ð calBC	2ð calBC
GrA-26924	Charred seeds	In fill of oven AN, outside the burnt building	6930 ± 45	5870-5860 (2.1%) 5850-5740 (66.1%)	5970-5950 (1.5%) 5910-5720 (93.9%
GrA-26925	Charcoal	In fill of hearth 80, outside the burnt building	7025 ± 45	5990-5870 (68.2%)	6010-5800 (95.4%)
GrA-33546	Charcoal	From ashes on floor in room 1 of burnt building	7765 ± 45	6650-6560 (58.5%) 6550-6510 (9.7%)	6660-6470 (95.4%)
GrA-33547	Charcoal	From ashes on floor in room 1 of burnt building	7090 ± 40	6015-5970 (38.5%) 5950-5915 (29.7%)	6050-5890 (95.4%)
GrA-31880	Charcoal	In fill of room 5 of burnt building, c. 60 cm above floor	7250 ± 45	6210-6130 (38.2%) 6110-6060 (30.0%)	6220-6020 (95.4%)
GrA-32057	Charred seeds	In fill of room 3 of burnt building, c. 20 cm above floor	7260 ± 45	6210-6130 (41.8%) 6120-6060 (26.4%)	6230-6030 (95.4%)
GrN-29726	Charcoal	Piece of wood in fill of room 1 of burnt building, c. 22 cm above floor	7170 ± 35	6060-6010 (68.2%)	6090-5980 (95.4%)
GrN-29727	Charcoal	In ashes of room 1 of burnt building, on the floor	7320 ± 30	6230-6100 (68.2%)	6240-6080 (95.4%)
GrN-29728	Charcoal	Piece of wood in fill of room 5 of burnt building, c. 50 cm above floor	7270 ± 35	6210-6130 (47.1%) 6110-6070 (21.1%)	6230-6060 (95.4%)
GrN-29729	Charcoal	In ashes in room 3 in burnt building, c. 30 cm above floor	7100 ± 50	6030-5970 (42.3%) 5960-5910 (25.9%)	6070-5880 (95.4%)
GrA-32999	Charcoal	In ashes in room 3 in burnt building, c. on floor	7195 ± 35	6075-6015 (68.2%)	6210-6140 (6.0%) 6110-5990 (89.4%)

Table 1 Tell Sabi Abyad. Radiocarbon dates from the burnt building V6 and its surroundings.

amidst these newly erected structures, in the shape of a solidly filled-in block of burnt waste, contained within the limits of its still-standing, tall outer walls.

A series of radiocarbon samples has been obtained from the burnt building, ranging in date between roughly 6230 and 5880 BC at the 2-sigma level, with a best date around 6050-6020 BC and a few (unexplained) outliers of much earlier date (cf. table 1).

3 The burning of the building

The fire must have been intense, as it penetrated the walls of the building throughout, causing the clay walls to sinter and giving them an orange to grey-black or greenish colour. The rooms were entirely filled in with burnt waste of varying consistency. The lowest of these deposits, directly situated on the floors, mainly consisted of fine, black to grey and white ashes, representing fully-burnt organic material.[2] The vertical distribution of the ash layer varied within each room, with the ashes often sloping across the room (fig. 5). The ashes were mostly present in rooms 1, 3 and 5, less in rooms 2, 6 and 7, and absent in rooms 4 and 8. In room 5, the ash layer was up to 1.10 m thick in the southwest corner, from where it gently sloped towards the east, gradually becoming thinner until it finally disappeared only a few centimetres from the eastern wall of the room. Although no clear-cut stratigraphy was observed, the complex mixture of ashes of different colours in many irregular lenses and spots may point towards multiple, slanting deposits on top of each other, instead of a single, homogeneous layer. In the neighbouring room 1, the ashes appeared to slope as well, from the southwest corner, where the layer was about 35 cm thick, to the northern part of the room, where it was nearly absent. A similar situation was found in rooms 2, 6 and 7, where irregular layers of black ashes between about 15 and 35 cm thick sloped from south to north, each smoothing and vanishing towards the northern ends of the rooms. Room 3 is rather exceptional in the sense that it was entirely filled up to a height of about 70 cm with greyish-black ashes, very rich in artefacts of all kinds.

The ash layers in the rooms were covered with significant deposits of hard-burnt crumbly clay pieces (probably parts of the mud roof cover) and wall fragments, greyish-brown to greenish in colour, intermingled with ashes. Considerable roof fall in the form of hard-burnt clay impressions of reeds

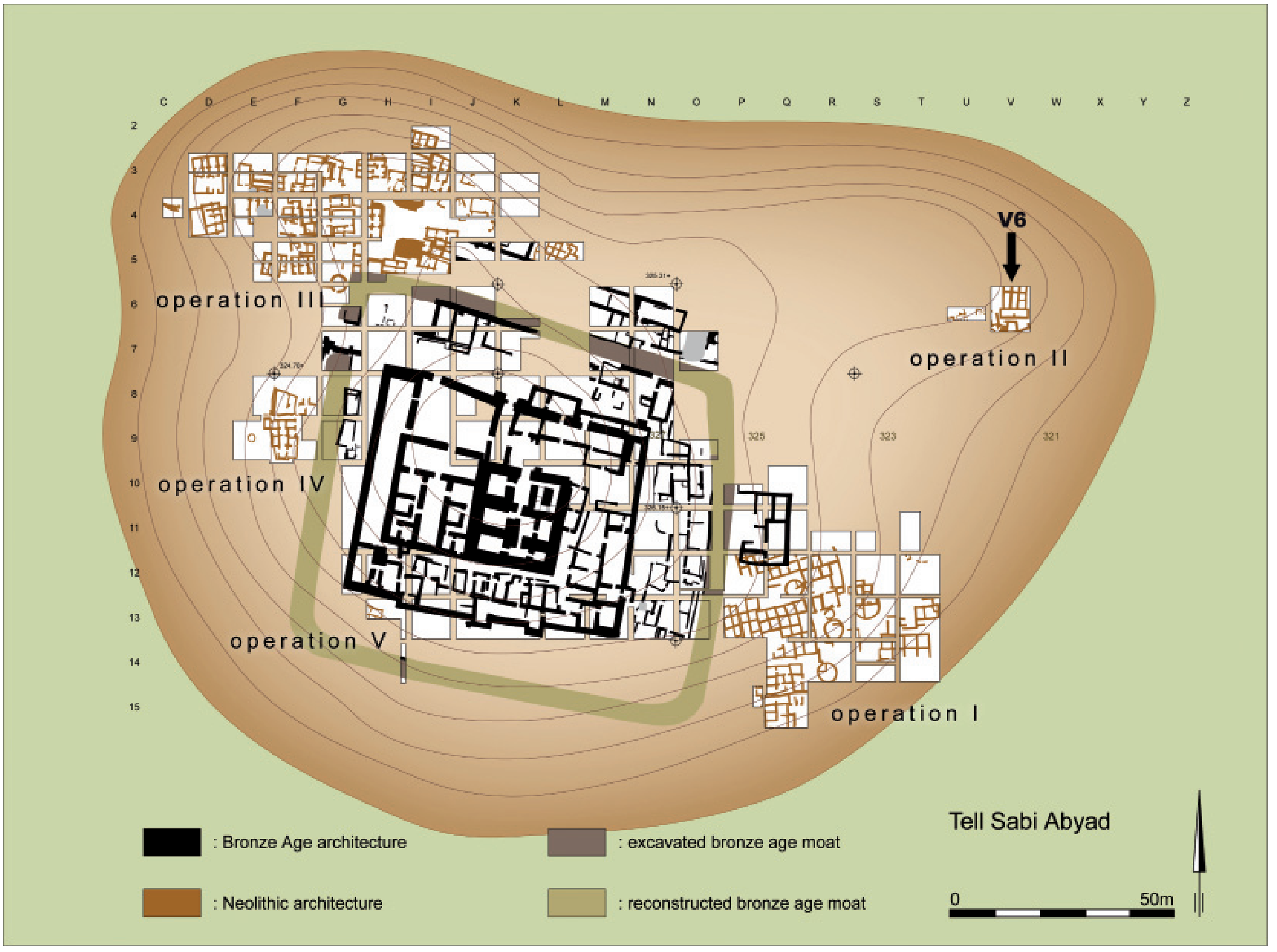


Figure 2 Plan of Tell Sabi Abyad I, showing the location of trench V6 in the north-eastern area (Operation II).

and wooden poles was found in the rooms. It was found either at the interface of the ashes and sintered clay or higher in the burnt fill, but never in the ashes proper (see below). The many dozens of roofing fragments suggest that at least part of the building still had its roof at the time of the fire. Although the number of impressions is considerable, it is still far too small to account for the roof in its entirety. Buildings with flat mud-covered roofs do not burn easily, unless provisions are made for extra fuel and adequate draught (see below). It is possible that openings in the roof (air vents) were created or that parts of the roof were deliberately removed prior to the fire. In any case, the quantities of organic materials (wood, reeds) which were used for roof construction were insufficient to produce the very large quantity of ashes in the building (cf. Dennis 2008).

Interestingly, the stratigraphic sequence in the burnt building of V6 is very much in agreement with modern experimental conflagrations of clay-made, flat-roofed structures: first, a layer of highly burnt fine ashes on the floor, then lumpy compact deposits representing later roof and wall collapse, and, finally, a layer of charred roof timbers, burnt-out reed imprints and clumps of mud (cf. Dennis 2008, 172ff).

There is good reason to believe that the building in area V6 ended in an intentional conflagration, rather than in accidental burning. First, the fire was almost entirely confined to the building proper, with hardly any ashes or burnt debris beyond the structure's exterior walls. It seems that precautions were taken to contain the fire under strictly controlled, regulated conditions. In his account on colonial warfare in the Afghan borderlands, Gordon notes: "A house with mud and rubble walls and a flat mud covered roof has to be prepared for burning or it will not burn at all: the two essentials being extra fuel and a good draught. These houses

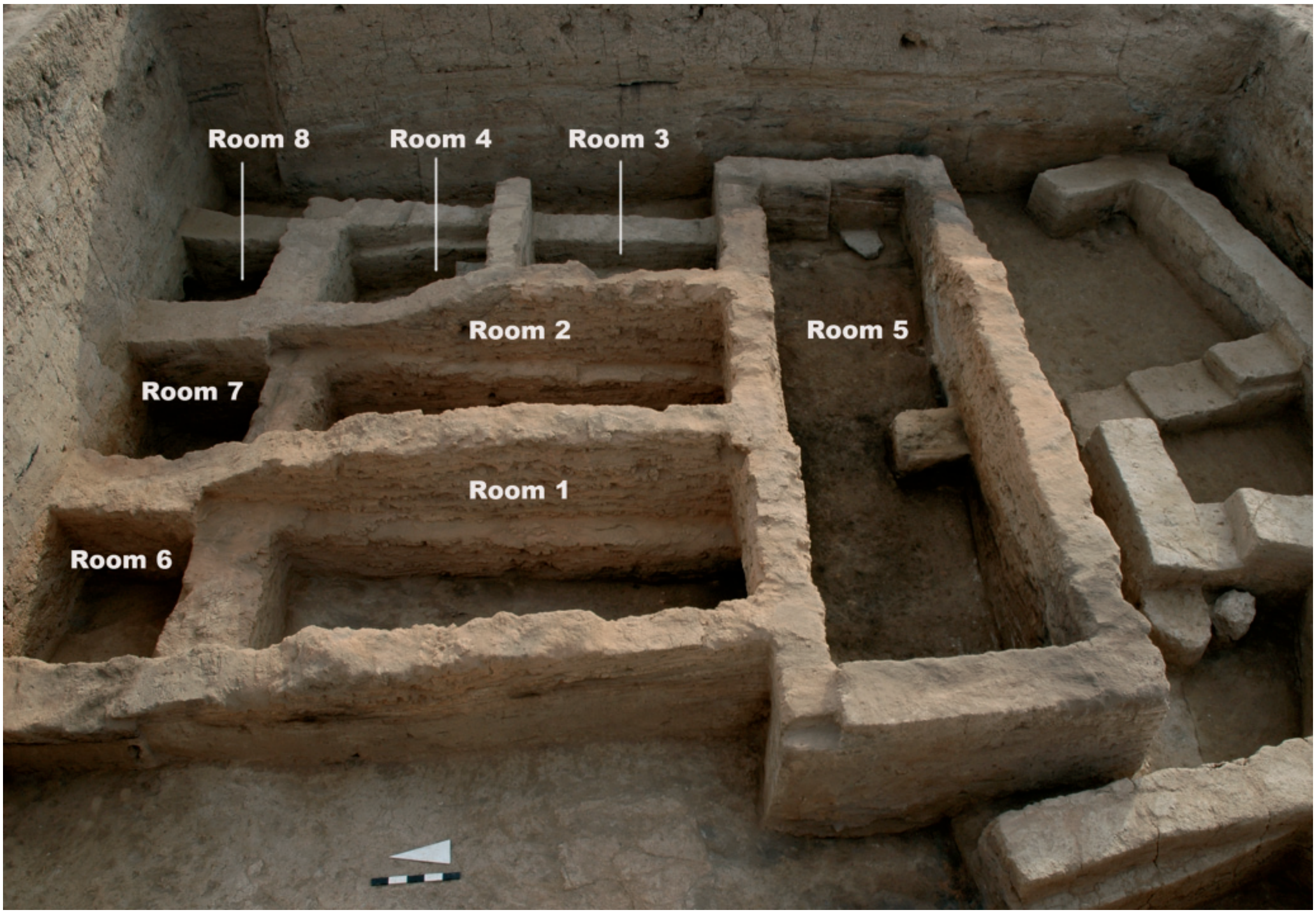


Figure 3 Tell Sabi Abyad. The burnt building V6 during excavation.

will not burn by the simple application of the torch to such woodwork as forms part of their fabric; elaborate preparation must be made if they are to be even rendered uninhabitable." (Gordon 1953, 149).

Secondly, the V6 structure contained exceptionally large quantities of ashes and other burnt waste, up to 1.10 m in some places – much more than one would expect in the case of an ordinary, accidental burning. The experimental conflagration of a Neolithic building at Beidha in Jordan revealed interior debris to a height of no more than about 35 cm (Dennis 2008, 176).

Thirdly, the walls of the V6 building were baked and sintered throughout, which is another sign of a fierce and prolonged fire when taking into account that walls at Beidha exposed to severe heat for 45 minutes were only fired to a depth of 2 to 3 mm (Dennis 2008, 163). A simulated burning of wattle-and-daub buildings in Calabria confirmed that accidental fires of modest intensity and short duration, even if they are allowed to smoulder for a long time after the initial blaze, result in very little sintering of mud walls. Only a more substantial blaze with extra wood fuel and lasting for at least five hours hardens the house walls in a significant manner (Shaffer 1993). In the case of an experimental burning of an abandoned wattle-and-daub house in Serbia, it appeared that, apart from the thatched roof that caught fire with ease and started to collapse within 20 minutes, the building itself suffered relatively little damage, with only a thin layer of fallen burnt thatch and debris from the roof in and around the house. Also very little wall sintering had occurred during the fire (cf. Bankoff and Winter 1979, 13, who conclude: "It would have taken relatively little effort to repair the roof, clear the house of burned debris and restore it to a habitable condition"). Mirjana Stevanović argues that, in the case of the Neolithic burnt houses at Opovo in Bulgaria, the complete firing of clay walls to a state of sintering required a vast amount of combustibles exceeding the capacities of the building itself: " (…) the quantities of wood needed as fuel must have been larger than the wood

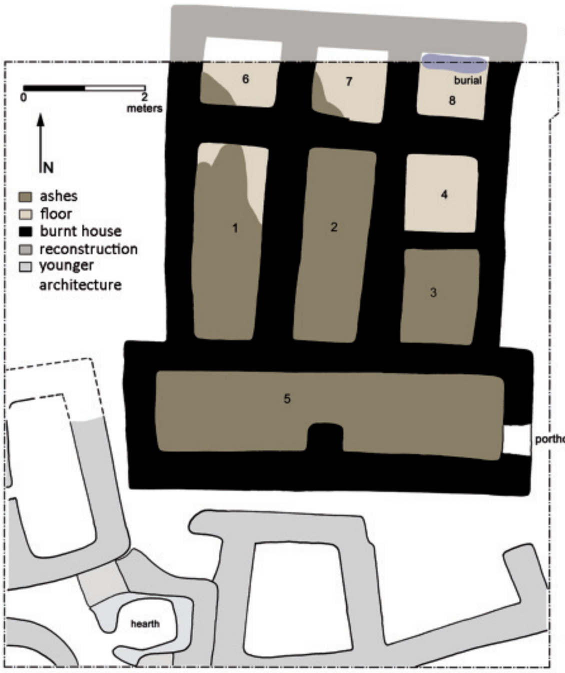


Figure 4 Tell Sabi Abyad. Map of the burnt building V6, showing the distribution of ashes.

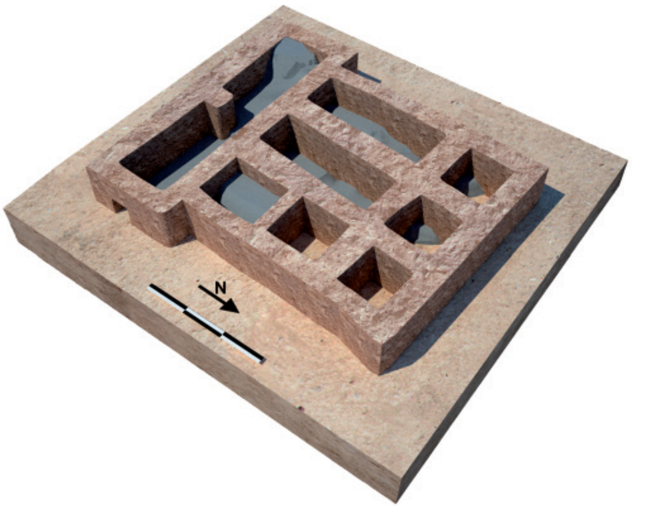


Figure 5 Tell Sabi Abyad. Partial reconstruction of the burnt building V6, showing the distribution of ashes in grey.

incorporated in the house construction. Consequently, in order to burn down the houses at Opovo the Neolithic people needed an additional source of fuel to that provided by the wood used in house construction." (Stevanović 1997, 373).

Although the burning of the V6 house very likely resulted from its having been filled with combustibles and its deliberately having been set alight, it is difficult to establish the order of events that led to the destruction. The burning must have been carefully planned, with extensive preparations having been made for a long and sustained ferocity of fire. Because of the vast quantities of ashes in the building as well as the sintering of the walls, the fire must have been very substantial (a small brush fire or such like results in only very thin ash layers and minimal sintering). Many cubic metres of brush wood and other combustibles were undoubtedly brought in (cf. Stevanović 1997, 372), probably in several replenishments. When it was fully ablaze and the heat had probably risen to about 500-1000 °C, the building would have been difficult to approach, even though the walls may have acted as insulating shields. But when the fire had subsided and was turning into smouldering debris, new materials for the fire may have been added.

Ignition (and refuelling) probably took place at several points in the corner of rooms, in view of the substantial piles of ashes in these areas (cf. DeHaan 1991, 109).[3] Taking the many roofing fragments into account, the roof must have been still intact, although openings may have been created to ensure an adequate draught. In the case of room 5, the draught was probably further enhanced by the low porthole in the eastern wall. Since most of the heat would have been directed upwards (by the very nature of fire; cf. DeHaan 1991), the roof with its wooden poles and dry reed mats is likely to have caught fire easily and a (partial) collapse may have happened quickly. The fire-dried mud cover of the flat roof would have come apart from the reeds and beams (some of which left their burnt-out impressions in the clay) and would have fallen into the rooms below in irregular chunks – hence the roof imprints. Subsequent reloads of fuel may have kept the fire going for many hours, if not for days, until the wood and other fuel were entirely consumed, the walls were burnt throughout, and an extensive fill had accumulated in the rooms.

The obvious next question is: why was the building in area V6 set alight intentionally? Part of the answer may rest in the burial found in one of the rooms of the burnt house.

4 THE BURIAL IN THE BURNT BUILDING V6

The primary grave of a young woman, between 14 and 20 years old, was found in room 8, at the back of the building. She had been laid on her left side in a crouching, east-west position, parallel to the back wall of the building,[4] with the head towards the east, facing southeast (fig. 6). The right arm was folded in front of the body, while the left arm was extended and positioned underneath the body, with the left knee resting on the hand. The back of the hand lay upon one half of a basalt mace head. Underneath the skull a small piece of yellow ochre was found, together with a large

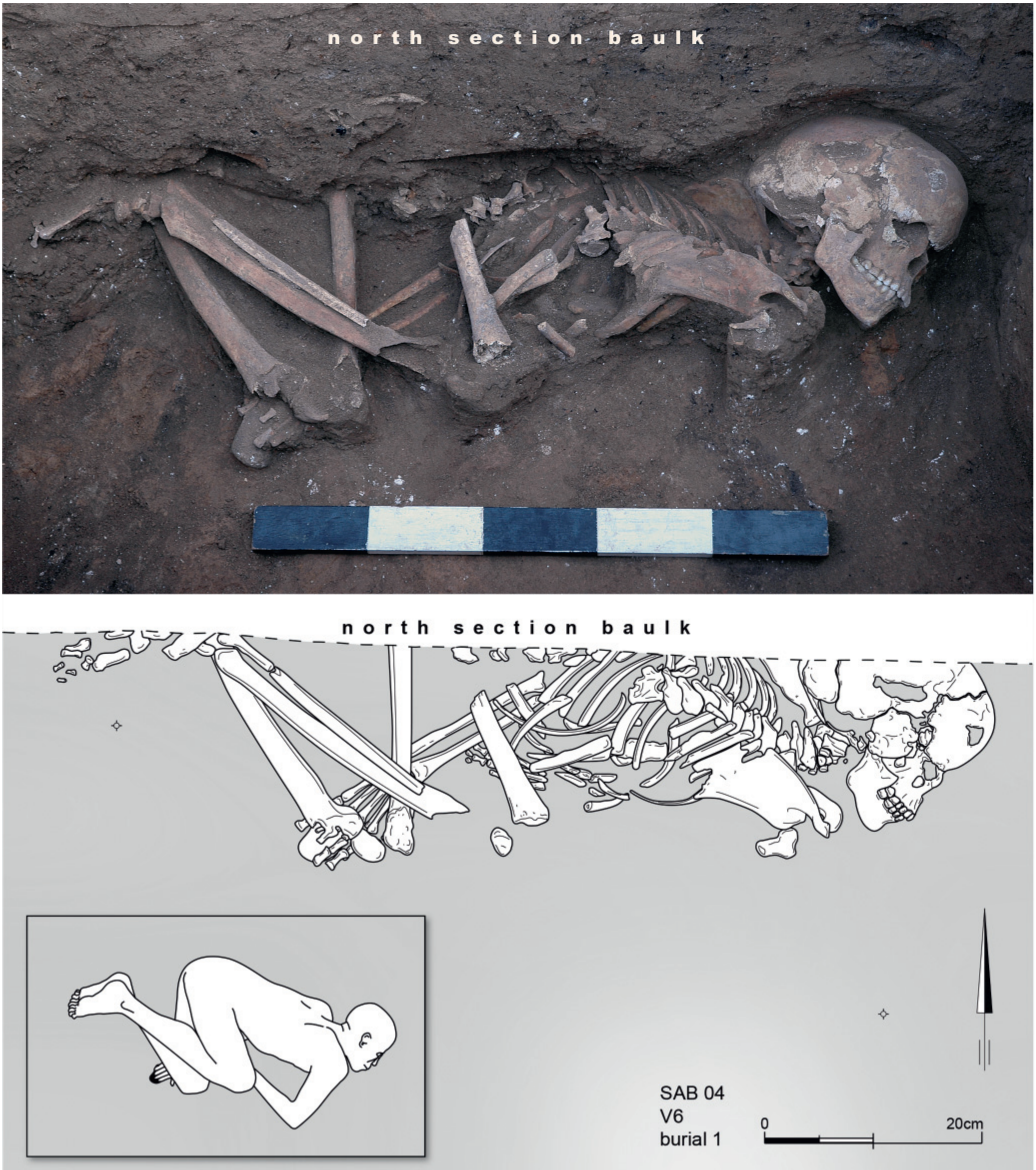


Figure 6 Tell Sabi Abyad. The burial in the burnt building V6 (room 8).

mammal bone. In its complete form the mace head probably had a diameter of 7.5 cm. It was pierced in the centre, creating a hole with a diameter of 2 cm. Mace heads are a rare find in the Neolithic occupation layers at Tell Sabi Abyad (Collet and Spoor 1996), which suggests that this mace head had been placed with the burial on purpose, rather than being a chance find.[5] One might wonder whether the mace head got broken by accident or as part of a funerary ritual involving the breakage or 'killing' of artefacts, often related to the removal of the impurity and ill effects of death (cf. Hodder 1980, 164; Parker Pearson 1999, 26).

Evaluation of the dentition showed that the young woman suffered from dental hypoplasia – a defect in the development of tooth enamel, possibly a hereditary trait, but also associated with local trauma and systemic metabolic disruption through dietary deficits or disease (Goodman and Armelagos 1985, 1; White and Folkens 2005, 329). Two teeth showed traces of caries, and several teeth and molars had been affected by attrition. Furthermore, there was proof of Allen's fossa, *i.e.* stress-induced atrophy of the bone.[6]

Apart from its position within a burnt building, the burial is not strikingly different from other burials of the same period at Tell Sabi Abyad (Akkermans 2008). The grave contained no gifts other than the associated mace head. Thus the inconspicuous nature of the burial itself does not leave us many clues that associate it with the burning of the building. Furthermore, the skeleton does not display any traits that might indicate that the person in this room held a special position or had been subject to any extraordinary treatment. As the room associated with the burial contained no other objects, we are left to wonder what the function of this small room was and why the young woman was placed here in death.

In this respect, it is important to emphasize that the deceased was not buried underneath the floor of the room but had been placed on it, after which the room was partly filled with soil, covering the corpse (there was no evidence whatsoever of a burial pit sunk into the room). Moreover, the burial took place *prior* to the burning of the building. Although it is technically possible that the room was once filled with burnt debris, then emptied, and subsequently used for interment, this option is highly unlikely since neither the fill nor the inner walls of this room show traces of extensive burning. Unlike most of the other rooms, the small cubicle seems to have stayed untouched by the fire. Therefore, it is more plausible that the deceased had been placed on the floor in the room on purpose and had been covered with soil prior to the onset of fire. Although the time elapsed between the burial and the fire remains unclear, it is not unlikely that the building met its end through conflagration shortly after the construction of the grave. Or, phrased differently, the building may have been crammed with fuel and set alight, precisely *because* of the burial in it (cf. Akkermans 2008). A similar explanation has previously been suggested for the Burnt Village at Tell Sabi Abyad, linking the skeletal remains of two individuals to the intentional burning of buildings, as part of an extended ritual act of death and abandonment (cf. Verhoeven 2000).

5 The artefactual finds in the burnt building V6

If, indeed, a link can be established between the grave of the young woman and the deliberate destruction of the building, the question comes to mind whether or not the other finds in the building support this conclusion. In total there were 371 objects of all kinds in the ruins of the burnt building, including very large numbers of ground-stone tools, as well as (much) smaller quantities of bone tools, spindle whorls, pierced pottery discs, clay sling missiles, jewellery, clay tokens, jar stoppers, sealings with stamp-seal impressions, and so on (cf. figs 7 and 8; table 2).[7] We shall give a short description of the various groups of artefacts and their possible meaning.

Ground-stone tools. Altogether 142 (or 38% of the total assemblage) ground-stone tools were found in the burnt house, comprising pestles, mortars, palettes, grinders,

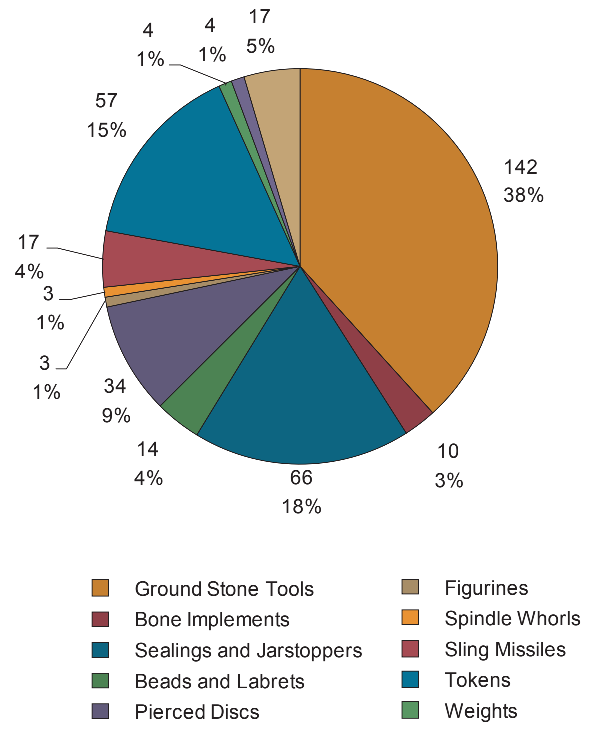


Figure 7 Tell Sabi Abyad. The composition of the small finds assemblage recovered from the burnt building V6.

Figure 8 Tell Sabi Abyad. A selection of artefacts found in the burnt building V6. (A) Pestles and mortars. (B) Pierced discs. (C) Sealings. (D) Ground-stone tools.

	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Total
Ground stone tools	53	5	36	2	45	0	0	1	142
Bone implements	3	0	3	1	3	0	0	0	10
Sealings, jar stoppers	14	0	22	0	30	0	0	0	66
Beads, labrets	5	2	0	1	2	4	0	0	14
Pierced discs	14	4	2	2	9	3	0	0	34
Figurines	2	0	1	0	0	0	0	0	3
Spindle whorls	2	1	0	0	0	0	0	0	3
Sling missiles	6	1	7	1	2	0	0	0	17
Tokens	15	0	34	3	5	0	0	0	57
Weights	2	0	0	0	2	0	0	0	4
White Ware	2	0	2	0	0	0	0	0	4
Miscellaneous	6	0	5	2	3	0	1	0	17
Total	124	13	112	12	101	7	1	1	371

Table 2 Burnt building V6. The quantitative distribution of objects per room.

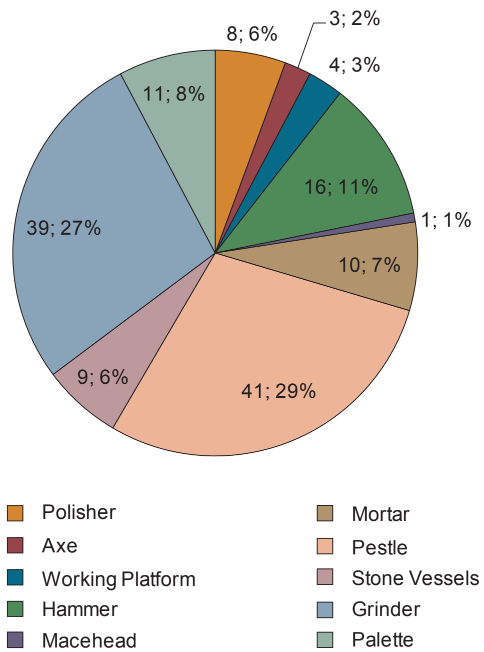


Figure 9 Tell Sabi Abyad. Composition of the ground-stone industry from the burnt building V6.

working platforms, axes, hammers, polishers and vessels (fig. 9). Two groups were predominant: pestles and grinding slabs. There were 41 pestles mainly made of basalt, of which 27 were complete. This seems to be more than one would expect in an ordinary domestic assemblage at the single household level, certainly when taking into account that only 10 mortars were found. Half of the pestles was found in room 1, the others were divided over rooms 2 (n = 7), 3 (n = 5) and 5 (n = 15). Another group of ground-stone tools which seems overrepresented is that of the grinding slabs and hand grinders, of which 39 were found (including 5 complete or nearly complete specimens). They occurred in rooms 1 (n = 13), 2 (n = 2), 3 (n = 19) and 5 (n = 5).

Sealings and jar stoppers. Sealings are pieces of clay either pressed on the fastening of a container or closing this container entirely when the clay is still plastic. They served administrative purposes, to control the distribution and ownership of the sealed containers (cf. Akkermans and Duistermaat 1997 on the sealings earlier found at Tell Sabi Abyad). There was a relatively large number of clay sealings inside the burnt building: 36 of them were found in rooms 1 (n = 8), 3 (n = 8) and 5 (n = 20). All sealings showed stamp-seal impressions and/or finger prints. They were all fragmented, which indicates that the originally sealed objects had been opened. Among the sealings there were also four *bullae* with the impressions of tokens inside them found in rooms 3 (n = 3) and 5 (n = 1). In addition, a total of 30 clay jar stoppers was found, distributed over rooms 1 (n = 6), 3 (n = 14) and 5 (n = 10). The jar stoppers came in a variety of shapes, from ovoid and conical to, less common, rounded or mushroom-shaped.

Tokens. Small clay tokens – counters for administrative purposes – occurred in spherical, oval and conical shapes. Altogether 57 tokens were found, distributed over rooms 1 (n = 15), 3 (n = 34), 4 (n = 3) and 5 (n = 5). The quantity of both sealings and tokens might suggest that (part of) the building was used for extensive storage.

Spindle whorls. Three spindle whorls of baked clay were found in rooms 1 (n = 2) and 2 (n = 1). Two of these had a biconical shape and were 2.7 cm in diameter. The third specimen was incomplete and had an irregular shape.

Pierced discs. There were 34 pierced discs inside the burnt structure, each roughly circular in shape, pierced in the centre and made of a re-used pottery sherd. Two of them were made of unbaked clay and three others were made of stone. The discs may have served as spindle whorls. They were found in rooms 1 (n = 14), 2 (n = 4), 3 (n = 2), 4 (n = 2), 5 (n = 9) and 6 (n = 3).

Beads and labrets. Only four stone beads were found in the burnt building, in rooms 1 (n = 2), 2 (n = 1) and 4 (n = 1). In addition, there were ten labrets: small ear or lip ornaments made of clay (n = 7) or stone (n = 3). They occurred in rooms 1 (n = 3), 2 (n = 1), 5 (n = 2) and 6 (n = 4).

Bone implements. Bone tools occurred in very small quantities, comprising seven awls in room 1 (n = 2), 3 (n = 2), 4 (n = 1) and 5 (n = 1) and two spatulas, one in room 1, the other in room 3. In addition, there was one bone fragment in room 5, believed to be a tally stick, with cut marks of varying lengths at small intervals. If so, an administrative purpose may be indicated, perhaps in relation with the many tokens and sealings found in the building; cf. Spoor and Collet 1996, 453.

Sling bolts. There were 17 oval or biconical sling bolts of unbaked clay in the burnt structure, in rooms 1 (n = 6), 2 (n = 1), 3 (n = 7), 4 (n = 1) and 5 (n = 2).

White ware. Four fragments of so-called white ware or *vaisselle blanche* were found in rooms 1 (n = 2) and 3 (n = 2), some of them with impressions of basketry.

Figurines. Three unbaked-clay figurines were found, one of an anthropomorphic shape and the other two zoomorphic in form. They are very small; their size does not exceed 5.5 cm. They occurred in rooms 1 (n = 2) and 3 (n = 1).

Miscellaneous objects. In addition to the above, there were a number of finds in the building which could not be assigned to a specific category, including four stone objects which may have served as weights and a number of clay lumps or unidentifiable objects.

Pottery. Almost two thousand fragments were counted, weighing some 80 kilogrammes (table 3). This material was

	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Total
Complete	0	0	0	0	0	0	0	0	0
Section	2	0	1	0	3	0	0	0	6
Rim fragment	90	5	4	12	55	13	7	0	186
Body sherd	555	74	40	80	600	99	99	31	1578
Base fragment	23	0	1	1	12	0	2	0	39
Other	1	0	0	0	2	0	0	0	3
Total	671	79	46	93	672	112	108	31	1812

Table 3 Burnt building V6. The quantitative distribution of pottery finds per room (frequency counts).

most unequally distributed over the various rooms. Most sherds came from room 5 (n=672) and room 1 (n=671), while room 6 and room 7 yielded much less (n=112 and n=108, resp.). The other rooms yielded almost nothing (table 3). In terms of its typology, this assemblage corresponds well to the later Pre-Halaf ceramic assemblage recovered from domestic contexts in Operation I, level 8 (Nieuwenhuyse 2007). No special, 'ritual' types could be identified.

Lithics. The building yielded lithic finds, distributed in different quantities across the various room fills. The composition of this lithic assemblage suggests this was mostly secondary or tertiary material. No *in situ* finds could be identified either on the floors or higher up in the fills. No concentrations of either raw materials or tools or even obsidian clusters (Astruc *et al*. 2007) were found to suggest that lithics had been stored in the building (Astruc pers. comm. May 2012).

A crucial question is whether or not the hundreds of artefacts found inside the burnt structure constitute an ordinary domestic assemblage. And if not, do they perhaps represent extensive storage, or an intended (ritual?) deposition, or even mere rubbish? Answers to these questions may shed light on the nature of the structure itself as well as on the fire that devoured it. An evident problem is that it remains unknown what a 'normal' domestic assemblage looks like. So far, none of the houses excavated at Tell Sabi Abyad has provided a complete, primary inventory. Once the houses were in the process of abandonment, most of their inventories must have been taken away. The deserted buildings became ruins, either left entirely to their fate or used for the disposal of waste (*i.e*. secondary deposits).

While most of the finds were highly useful for daily domestic tasks,[8] it is difficult to believe that a single household, whatever its size, would be in need of the extraordinary quantity of tools and so on found inside the building. Hence, it seems more likely that the building served communal purposes, as a repository for objects of all kinds used by many people. Support for this comes from the numerous sealings and jar stoppers, indicative of extensive storage in often controlled (*i.e*. sealed) circumstances. Together with the tokens and the single bone tally stick, the sealings suggest some form of administration of stored properties (cf. Akkermans and Duistermaat 1997). In short, the burnt building in area V6, it seems, was a storehouse in the first place, and not a structure for ordinary living and working.

However, it is difficult to establish whether or not the finds in the building were part of the structure's original inventory. Only very few objects occurred (*in situ*?) on the floor in the building; the many hundreds of other finds were all in the fill at different elevations, with most of them below the fallen roofing debris (see below). If they were in the house prior to the fire, some of these may have been stored originally either on shelves or in containers high against the wall or on top of the roof. It cannot be excluded that there were also commodities made of perishable materials (wooden receptacles, baskets, textiles, etc.) in the building, which by their very nature were entirely consumed by the fire.[9]

There is, however, another option to explain the large number of finds in the building: they may have been intentionally added because of the anticipated destruction by fire, even *during* the event, in a ritual setting. The circumstance that many objects in the burnt waste of the V6 building were complete suggests that no attempt was made to rescue these tools and other items either during or after the fire. This is a rather astounding observation, because they are implements which were not only for a very large part still fully usable but which were also a basic, day-to-day requirement for village life (for example, the many ground-stone tools). Moreover, the tools were often made of non-local stones, *i.e*. they were relatively rare, valuable import items brought to Tell Sabi Abyad over a distance of many dozens or even hundreds of kilometres. The experimental house burnings in Serbia and Jordan have made it clear that within the first 20 minutes or so, either before or after the (partial) roof collapse, it was still possible to enter the smouldering buildings and retrieve valuable items (Bankoff and Winter 1979, 13; Dennis 2008, 177-78). In this respect it seems that the decision *not* to recover the items from the V6 building, was not based on practical objections but must have been deliberate and imbued with symbolic meaning.

More than half of all the items (57%) in the building was complete or virtually complete; they certainly must have been still useful. The very few objects found directly on the floors of the building, for instance, were all complete. Possibly these were deposited inside the building before the fire began. The remainder, however, was found in various states of preservation. Although occasionally fragments could be refitted into larger pieces, none of them resulted in complete or even nearly complete objects[10]. Many items, it appears, ended in the fill of the building as broken and often highly fragmentary pieces from the very beginning. Interestingly, the proportion of complete versus fragmentary items in the fill, both in the ashes immediately above the floor and in the subsequent wall and other debris at higher elevations, was roughly equal. It appears that large numbers of broken objects were deposited in the building *during* the fire.

The fragmentation patterns observed on the ceramic finds perhaps shed further light on what happed to the V6 building. Intriguingly, not a single complete vessel was recovered from any of the rooms (table 3).[11] Either no pottery containers had originally been stored inside the building, or they had all been taken out before the fire began. The ceramic assemblage, furthermore, does not suggest that people deliberately smashed sets of pottery containers and then deposited the resulting fragments in the building. Available fragmentation indices suggest that this may be secondary, perhaps even tertiary material. The percentages of rims versus bases and body sherds, the average sherd weights, even the proportion of the rims and bases preserved are virtually indistinguishable from ceramic fragmentation statistics computed for material from secondary and tertiary depositions excavated previously in Operation I (Nieuwenhuyse 2007). Did people deposit handfuls of sherds in the building during the fire?

6 The distribution of finds inside the building

Most objects inside the building were found in the ash layers, which were most extensive in rooms 1, 3 and 5. The layer of wall and other debris shows a more even distribution, with objects found in all of the rooms (fig. 10).

Although the building yielded several hundreds of objects, only very few of these (n = 14) were found on the floor of the building. Floor finds occurred only in rooms 1, 2, 3, 5 and 6 (fig. 10). In room 1 were two clusters of ground-stone tools, the first (in the southeast corner) consisting of three complete grinders and the second (further north) comprising a complete mortar, two pestles and what may have been a polisher. In room 2 was a complete stone pestle together with a pierced pottery disc in the northeast corner. Other objects were found isolated on the floors of various rooms, including a damaged pierced pottery disc in room 5, and a complete labret as well as another damaged pierced pottery disc in room 6. Although these objects may have been part of the building's original inventory, the relative scarcity of objects on the floor suggests either that most of the content was taken away prior to the fire or that most of the inventory was placed in containers, on shelves or hung from the walls or the ceiling of the building. Very few sherds were found in a floor context; as floors were simply made of beaten earth, these sherds may just have been residual in the soil making up the floor.

The greater majority of objects and pottery sherds came from the layers of ash piled up inside the rooms (particularly in rooms 1, 3 and 5) and from the deposits of red-burnt debris above them. Although the ash and debris layers appear to be stratigraphically separated to some extent, this is hardly reflected in the distribution of small finds (fig. 10). In rooms 1 and 5 the finds were found in the ashes, as well as in the debris layer above it, albeit in slightly smaller numbers. Room 3 contained hardly anything apart from a thick deposit of ash, in which a very large number of small finds was found. The other rooms (nos. 2, 4, 6-8), where the blaze seems to have been less given the small quantity of ash found here, yielded considerably fewer small finds. Although most finds thus seem to have been found in the areas most affected by the fire, a direct correlation between the intensity of the fire and the number of finds found there does not seem to hold entirely. It appears that in the areas where most ashes had piled up, i.e. in the south of room 1 and in the west of room 5, only a few objects were found, even though directly adjacent to those areas objects were abundant.

There is a difference between the distributions of objects and sherds inside individual rooms. Room 1 revealed a scatter of objects in the black ash at the lowest levels in the northern part of the room, including a cluster of pestles along the western wall, above which a mixed deposit revealed a variety of items, while the northern end of the room was without objects in both layers. The southern half of the room contained another cluster of finds in black ash, including many tools at the lowest levels, a mixed debris layer in between, and more black ash above it containing lighter items, such as discs and tokens. To the west of this cluster a scatter of items was found in the mixed deposit, including a vessel and a grinder, continuing vertically towards the north of the cluster, above the black ash. Room 2 showed a clear distinction between the two layers, with the northern part of the room having objects only in the ash layer and the rest of the room only in the debris layer. Room 3 had a large number of finds in the ash layer across the whole room,

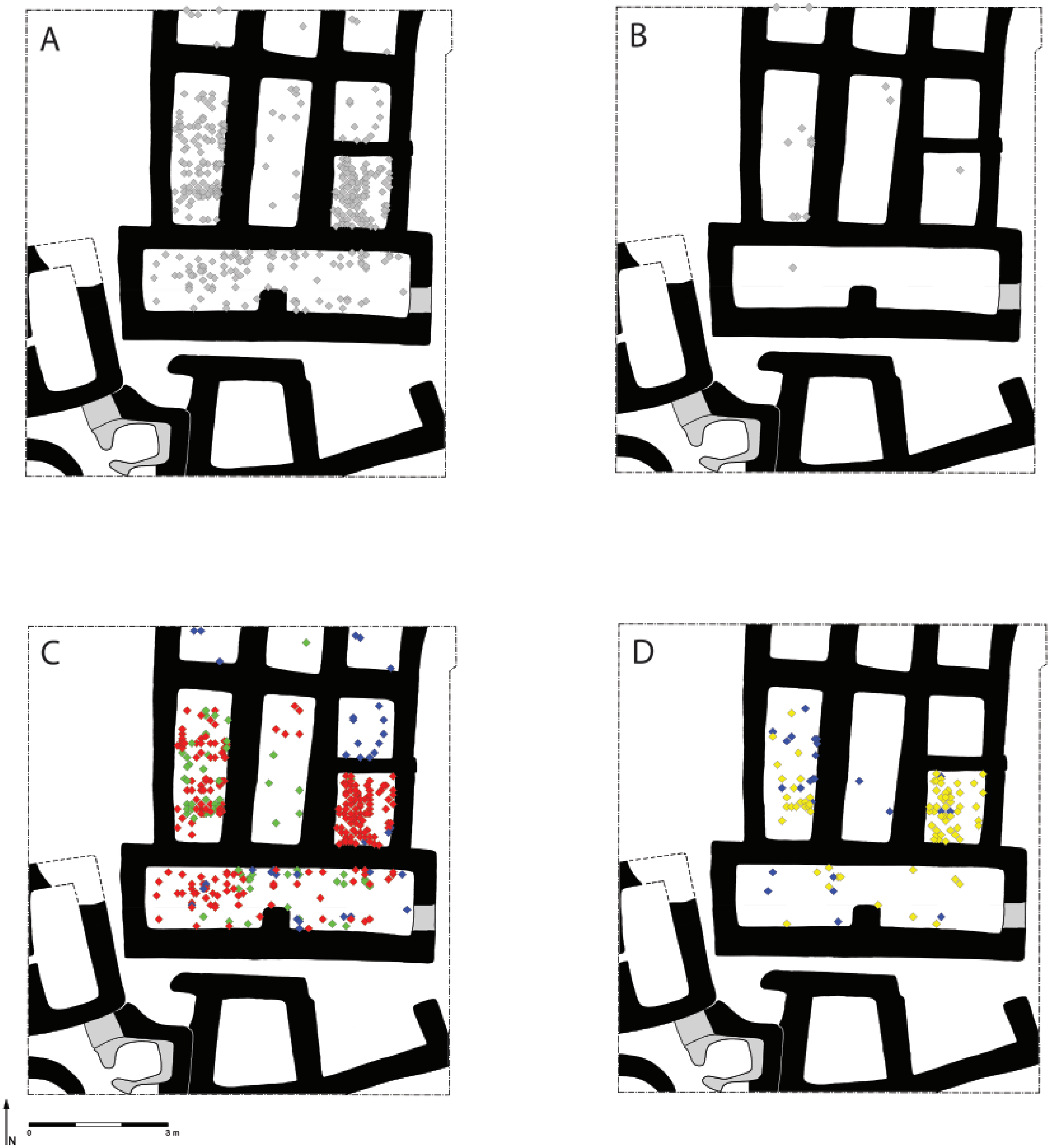


Figure 10 Tell Sabi Abyad. Distributions of objects inside the burnt building V6. (A) All objects found inside the building. (B) Objects found on the floor of the building. (C) Objects found in black ash (red), in red-burnt debris (green), and in unburnt debris (blue). (D) Distribution of pierced discs and spindle whorls (blue) and tokens and jar stoppers (yellow).

mainly clustered towards the west of the room and including many grinders, pestles, tokens, jar stoppers and sealings, amongst others, continuing vertically, increasing in number, and covering almost the entire room. The highest level also revealed three grinders in the mixed debris against the southern and eastern walls of the room. In room 4 objects were found only in the debris layer with a prominent distribution along the eastern and southern parts of the room. In room 5 most items were found along the long walls in both layers (as if they had been on shelves originally), with the southeast corner devoid of finds, although the ash layer had an additional concentration of objects at the western end of the room, with tools such as hammers, pestles, palettes and vessels, but also some smaller items such as tokens and sealings, in a cluster rising vertically with lighter items increasing in the higher levels. All the clusters contained some small items in mixed debris, mainly along the walls, especially at the eastern end of the room where they increased above the ash layer. Rooms 6 and 8 had only two objects in the southwestern part of the rooms; in room 7 one object was found in its eastern half in the debris layer; and only one object was found in the ashes in the southwestern part of room 6.

Furthermore, when differentiating between various find categories found in the ashes and burnt debris layers, it appears that although most objects show a more or less random distribution, some find categories seem to cluster in specific rooms. Pierced discs and spindle whorls were mainly found in room 1, whereas tokens and jar stoppers seem to be somewhat overrepresented in room 3 (fig. 10).

A small amount of finds was found in more or less clean fill layers sometimes located on top of the burnt debris or in the fill of rooms unaffected by the fire, such as rooms 4 and 8. Therefore, these objects do not seem to bear a direct relationship to the fire. Rather, they seem to have been deposited here at a later stage.

The distribution of charred wood and the many roof imprints in clay in the building showed a number of relevant patterns. The wood (as yet unspecified as to species) comprised fragments of charred beams, as well as (in room 1) two pieces of flattened, possibly worked wood or shelves, one only being some 10 cm in length but the largest measuring 70 by 5 by 2 cm. The charred wood occurred in the burnt deposits of rooms 1 and 4, between 30 and 80 cm above the floor, never actually on the floor. It mainly represents the remnants of either fuel for the fire or of the roof beams. This find high above the floor is in accordance with the documented conflagration experiments where the (charred) timber was usually near the top of the debris sequence (cf. Dennis 2008, 175).

The clay roof impressions, together 48 pieces of various size (fig. 11), were primarily found in the western and southwestern rooms 1 (n=19), 2 (n=14) and 5 (n=11), while only a few pieces were found in rooms 6 (n=2) and 7 (n=2) and none in the northeastern rooms 3, 4 and 8 (cf. fig. 12). They were widely distributed throughout the fill in these rooms, with some of them close to the floors (but never in the ashes immediately on the floors) and others higher up in

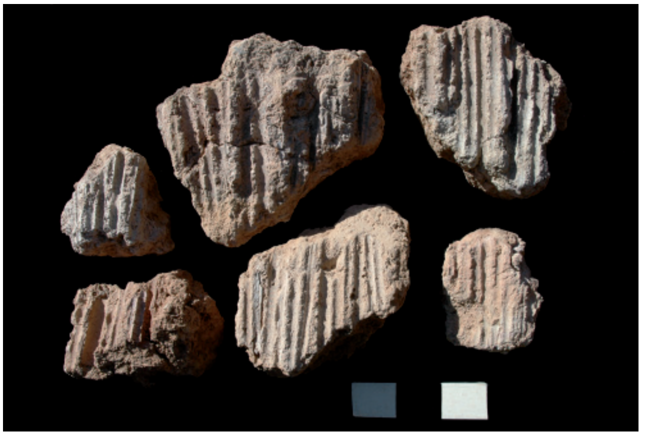


Figure 11 Tell Sabi Abyad. Clay fragments with reed impressions from the fill of the burnt building V6.

Figure 12 Tell Sabi Abyad. Distribution of roof material fragments in the burnt building V6. Clay roof fragments with reed imprints (red triangle), wood remains (green circle).

the fill. Debris was also found on top of the impressions, burying them below crumbly, sintered wall fragments.

Significantly, the superstructure debris in rooms 1, 2 and 5 occurred in roughly two layers, with one layer of roof impressions at an elevation between about 80 to 120 cm above the floor and the other slightly lower at an elevation of 40-50 cm above the floor. While most imprints in room 1 were found in the upper layer, in the other rooms they were mainly in the lower layer. The occurrence of the impressions in layers suggests that the collapse of the roof in these rooms was not a single event but that it took place in a series of episodes. In the nearby room 6 the roof imprints were close to the floor, with wall debris on top of them. In the debris in the northwest corner of this room there was an ash midden; it is very likely that one part of the roof collapsed at a given moment, leaving the clay impressions, while another part kept burning, resulting in the midden. In all rooms the artefacts were found mainly in the fill below the roof imprints, while in the rooms with multiple levels of roofing material they were below and amidst both layers.

7 Discussion and conclusions: burning down the house

In view of the above, we may conclude, first, that the T-shaped building at Tell Sabi Abyad was intentionally burnt down, given the fact that the amount of fuel needed to burn the house so intensely would not be present in a regular house inventory. Second, the reason for the building's intentional destruction by fire may be that it was part of a ritual associated with the burial of a young woman, prior to the fire, on the floor of the building. Third, the unusually large quantity of objects found in the building as well as their location in the burnt fill of the building instead of on its floor may suggest that the objects do not represent a 'normal' household inventory, but an unusual assemblage perhaps deposited in the building as part of the burning event. Finally, it seems that many of the artefacts deposited inside the building during this event were not complete, but already very fragmented.

How then may we reconstruct the events that may have resulted in the unusual archaeological context discussed here? The following scenario seems most likely given the evidence presented above. It appears that somewhere between 6050 and 6020 BC a young woman died at Tell Sabi Abyad. We assume that her death was of natural causes, perhaps related to an infectious disease as suggested by the dental hypoplasia. In any case, her bones showed no evidence of a violent death. Her body was laid on the floor of the T-shaped building, with one half of a mace head placed in her hand, and covered with soil. It remains unclear what the relation of the woman was to the building. The relative scarcity of objects found on the floor of the building may suggest that by the time of the woman's burial the building was relatively empty, although it is possible that goods were stored on shelves or hanging from the walls and ceilings.

At some point after the internment, the building was set on fire, which burnt the walls throughout and left behind thick deposits of ash and burnt debris. Although it is uncertain how much fuel, temperature and burning time was needed to achieve the degree of burning attested in the T-shaped building, these must have been considerable. It is likely that the building was literally crammed with fuel, resulting in a fire that reached very high temperatures once the fuel was set alight and that burnt for many hours, if not days. It is possible that more fuel was added to keep the fire going, although there is no direct evidence to support this. The distribution of clay roof imprints in several rooms of the building suggests that when the fire was lit, the roof of the building was still in place in those areas, but that it gradually collapsed as a result of the intense fire.

It is unlikely that the hundreds of objects found in the ashes and burnt debris inside the building were all deposited there in the same manner. The distribution of some objects along the walls of the building, especially in room 5, may suggest that these objects were hanging from the walls or had been placed on shelves there – perhaps as part of the original inventory – and that they fell down when touched by the fire. However, this is much less likely for the large number of objects that were found in the centres and much higher up in the fills of the rooms. Alternatively, we propose that these objects, most of them broken, were placed within the fuel stacked up inside the building. Objects that were found superimposing the roof material either may have been placed on top of the roof originally and fallen down after the roof collapsed, or were thrown into the fire during the burning event.

Why a large number of objects was placed inside the building either prior or during the burning event is difficult to determine. If the burning event was indeed a ritual act, the objects placed inside must have been of significance to the ritual in some way. What is striking in this respect is that the entire artefact corpus normally found at Tell Sabi Abyad is represented in the T-shaped building. All material categories, such as ground-stone tools, bone tools, clay objects, administrative objects, pottery containers, objects of personal adornment, and so on, were found. Some of these were only fragments, while others were complete and still usable. It appeared that most of the objects were distributed more or less randomly over the rooms, with the exception of only a few clusters. Therefore there is no clear association between any material category and the proposed ritual act. What might have been the meaning then of the deposition of these objects? A conclusive answer to this question cannot be given, although Chapman has proposed, for burnt-house contexts associated with the dead in southeast Europe, that the occurrence of both complete and fragmentary objects may reflect a ritual in which "(a) individual objects which form part of artifact sets of other households, or (b) fragments of objects whose other parts would be kept outside the burnt house" (Chapman 1999, 121) were deposited inside the house with the deceased.

When the fire had died, there was no attempt to rescue any of the valuables inside the building, nor to restore the house to a habitable condition. Although new architecture was raised around it, the V6 building, it seems, was entirely left in its final state of destruction, barred from any possible future utilitarian use for dwelling or storage. The burnt building thus stood out as a conspicuous landmark within the village as it continued to develop. This may well have been deliberate, as a means to extend social memory. Tringham (2005, 106ff) discusses the useful terms domicide and domithanasia for this process of the deliberate destruction – the 'killing' - of the house by fire as a means to enhance or disrupt the continuity of place. Although the actors and purposes differ, domicide and domithanasia "hold in common important results for social memory and community that are accentuated by the process and meaning of fire" (Tringham 2005, 107). While we cannot reconstruct with any certainty what the significance of this landmark may have been to the inhabitants of the village, or even for how long it served as such, we believe that the deliberate, violent destruction of the building by fire had an important symbolic meaning to the villagers.

Fascinatingly, this newly found burnt building and its ritual connotation proposed here closely resemble the Burnt Village at Tell Sabi Abyad, where architecture destroyed by fire, their fills of ashes and burnt debris packed with artefacts, and human skeletal remains were found as well. Marc Verhoeven proposed a ritual involving death and fire as well as the abandonment of the village for the Burnt Village (Verhoeven 1999; see also, for example, Stevanović 1997; Chapman 1999; Tringham 2005; Verhoeven 2010 on the social and ritual aspects of house burnings). This suggests that the burnt building in trench V6 was not an isolated incident, but perhaps reflects established symbolic practices.

Some reservations, however, should be made before proposing a direct parallel between the two cases. Although more burnt architecture may be buried in the unexcavated areas around the T-shaped structure, for the moment our case consists of a single burnt building, hardly comparable to the scale of the Burnt Village. Furthermore, it was proposed that the objects found in the Burnt Village either reflected the original inventories of the buildings, or refuse left there prior to the abandonment of the village (Verhoeven 1999, 201), whereas we suggest that many if not most of the objects found in the T-shaped structure were placed there on purpose as part of the ritual act. Nevertheless, proposing a parallel between the Burnt Village and the burnt T-shaped V6 building in more general terms seems warranted: a ritual dealing with the burial of people inside architecture or, in the case of the Burnt Village, on top of architecture, and the destruction of the architecture by fire, creating socially meaningful and decisive landmarks of some kind.

Notes

1 This article is a result of the 2011-2012 Research Master Class entitled *The Archaeology of a Neolithic Community* at Leiden University's Faculty of Archaeology, under the guidance of the first author. The co-authors all participated in the class activities. Our thanks go to Ries Slappendel for useful advice. Sincere thanks are also due to Daniella Vos, Beatrijs de Groot and Elisabeth de Campenhout, who contributed significantly to the class project at an earlier stage. Laurence Astruc kindly provided some first results from her study of the lithic material recovered from the burnt building V6.

2 A situation identical to the finds in the so-called Burnt Village on the southeastern mound; see Akkermans and Verhoeven 1995, 11.

3 This holds in particular for rooms 1 (southwest corner) and 5 (northwest corner). Alternatively the piles may represent ashes blown into sheltered corners and in the lee of walls in the building by the draught during the fire.

4 There is some uncertainty as to the precise position of the north wall of the room, but the body was probably resting with its back against it. During excavation, the skeleton protruded from the northern section; the back wall had not yet been exposed.

5 Only four mace heads or parts thereof have been recovered in the past 25 years of extensive excavation in different phases of settlements at Tell Sabi Abyad.

6 Sincere thanks are due to Dr. Elisabeth Smits (University of Amsterdam) for providing the physical-anthropological data.

7 In addition to the artefactual material, there were large numbers of animal bones inside the Burnt building. This bone material has not yet been studied.

8 For example, the many ground-stone tools may have served predominantly in the preparation of food, while spindle whorls, bone implements and, perhaps, pierced discs were associated with the processing of textiles or hides. The clay sling bolts probably served in the hunt. The few beads and labrets point towards body adornment.

9 In the form of imprints of basketry containers in so-called white ware and impressions on the reverse of clay sealings, Tell Sabi Abyad has yielded evidence of many hundreds of baskets in the late seventh millennium settlements at the site, cf. Duistermaat 1996; Akkermans *et al*. 2006.

10 It is very unlikely that significant parts of fragmented objects were lost during excavation. In the field all room contexts were

carefully sampled to reassemble broken artefacts as much as possible.

11 During the find processing a thorough search was made for fitting sherds. Several fits were indeed found. However, these yielded larger sherds but not a single complete vessel. Fits were found only with sherds from the same room, never with sherds coming from different rooms.

References

Akkermans, P.M.M.G. 2008. Burying the dead in Late Neolithic Syria. In: J.M. Córdoba, M. Molist, M.C. Pérez, I. Rubio and S. Martínez (eds), *Proceedings of the 5th International Congress on the Archaeology of the Ancient Near East, Madrid, April 3-8 2006,* 621-45. Madrid: Universidad Autónoma de Madrid (UAM Ediciones).

Akkermans, P.M.M.G. and K. Duistermaat 1997. Of storage and nomads – The sealings from Late Neolithic Sabi Abyad, Syria. *Paléorient* 22(2), 17-44.

Akkermans, P.M.M.G and M. Verhoeven 1995. An image of complexity: the Burnt Village at Late Neolithic Sabi Abyad, Syria. *American Journal of Archaeology* 99(1), 5-32.

Akkermans, P.M.M.G., R. Cappers, C. Cavallo, O.P. Nieuwenhuyse, B. Nilhamn and I. Otte 2006. Investigating the Early Pottery Neolithic of Northern Syria: new evidence from Tell Sabi Abyad. *American Journal of Archaeology* 110(1), 123-56.

Astruc L., B. Gratuze, J. Pelegrin and P.M.M.G. Akkermans 2007. From production to use: a parcel of obsidian bladelets at Sabi Abyad II. In: L. Astruc, D. Binder and F. Briois (eds), *La diversité des systèmes techniques des communautés du Néolithique pré-céramique: vers la caractérisation des comportements sociaux, 5e colloque international sur les industries lithiques du Néolitique pré-céramique,* 327-42. Antibes: Éditions APDCA.

Bankoff, H.A. and F.A. Winter 1979. A house-burning in Serbia. *Archaeology* 32(5), 8-14.

Chapman, J. 1999. Deliberate house-burning in the prehistory of Central and Eastern Europe. In: A. Gustafsson and H. Karlsson (eds), *Glyfer och arkeologiska rum-en vänbok till Jarl Nordbland*, 113-26. Göteborg: University of Göteborg Press, Gotarc Series A(3).

Collet, P. and R. Spoor 1996. The ground-stone industry. In: P.M.M.G. Akkermans (ed.), *Tell Sabi Abyad – The Late Neolithic settlement,* 415-38. Istanbul: Nederlands Historisch-Archeologisch Instituut.

DeHaan, J.D. (ed.) 1991. *Kirk's fire investigation*. Upper Saddle River: Prentice-Hall, 3rd edition.

Dennis, S. 2008. *The use of experimental archaeology to examine and interpret Pre-Pottery Neolithic Architecture: a case study of Beidha in Southern Jordan*. Edinburgh: University of Edinburgh, PhD Thesis.

Duistermaat, K. 1996. The seals and sealings. In: P.M.M.G. Akkermans (ed.), *Tell Sabi Abyad – The Late Neolithic Settlement*, 339-402. Istanbul: Nederlands Historisch-Archeologisch Instituut.

Goodman, A.H. and G.J. Armelagos 1985. Factors affecting the distribution of enamel hypoplasias within the human permanent dentition. *American Journal of Physical Anthropology* 68(4), 479-93.

Gordon, D.H. 1953. Fire and the sword: the technique of destruction. *Antiquity* 27(107), 149-52.

Hodder, I. 1980. Social structure and cemeteries: a critical appraisal. In: P. Rahtz, T. Dickinson and L. Watts (eds), *Anglo-Saxon cemeteries 1979: the fourth Anglo-Saxon symposium at Oxford*, 161-69. Oxford: British Archaeological Reports, British Series 82.

Nieuwenhuyse, O.P. 2007. *Plain and painted pottery. The rise of Neolithic ceramic styles on the Syrian and Northern Mesopotamian Plains*. Turnhout: Brepols PALMA Series 3.

Parker Pearson, M. 1999. *The archaeology of death and burial*. Phoenix Mill: Sutton Publishing.

Shaffer, G.D. 1993. An archaeomagnetic survey of a wattle and daub building collapse. *Journal of Field Archaeology* 20(1), 59-75.

Spoor, R.H. and P. Collet 1996. The other small finds. In: P.M.M.G. Akkermans (ed.), *Tell Sabi Abyad – The Late Neolithic settlement*, 439-73. Istanbul: Nederlands Historisch-Archeologisch Instituut.

Stevanović, M. 1997. The age of clay: the social dynamics of house destruction. *Journal of Anthropological Archaeology* 16(4), 334-95.

Tringham, R. 2005. Weaving house life and death into places: a blueprint for a hypermedia narrative. In: D. Bailey, A. Whittle and V. Cummings (eds), *(Un)settling the Neolithic,* 98-111. Oxford: Oxbow Books.

Verhoeven, M. 1999. *An archaeological ethnography of a Neolithic community – Space, place and social relations in the Burnt Village at Tell Sabi Abyad, Syria*. Istanbul: Nederlands Historisch-Archeologisch Instituut.

Verhoeven, M. 2000. Death, fire and abandonment. Ritual practice at Late Neolithic Tell Sabi Abyad, Syria. *Archaeological Dialogues* 7(1), 46-83.

Verhoeven, M. 2010. Igniting transformations: on the social impact of fire, with special reference to the Neolithic of the Near East. In: S. Hansen (ed.), *Leben auf dem Tell als Soziale Praxis, Beiträge des Internationalen Symposiums in Berlin vom 26.-27. Februar 2007*, 25-43. Bonn: Dr. Rudolf Habelt GmbH.

White, T.D. and P.A. Folkens 2005. *The human bone manual*. London: Elsevier Academic Press.

corresponding author:
Peter M.M.G. Akkermans
Faculty of Archaeology
P.O. Box 9515
2300 RA Leiden
The Netherlands
p.m.m.g.akkermans@arch.leidenuniv.nl

The trouble with stratigraphy: case studies from the Near East

Bleda S. Düring

The idea of stratigraphy is at the very foundation of the archaeological endeavour. The use of this concept that was developed in geology enabled archaeologists to establish relative chronologies using the principle of superposition. Stratigraphical reasoning together with the method of seriation formed the basis upon which archaeology as a scientific discipline could be established (Trigger 1989, 73-94). It is perhaps due to the fact that stratigraphy is part of the core paradigm of archaeology: that is that we can study how societies change over time through stratigraphic analysis and seriation studies, that the concept of stratigraphy has not received much scrutiny and has been "overdescribed and undertheorized" (McAnany and Hodder 2009, 2). Publications dealing with stratigraphy have focused primarily on methodology and technical procedures for recording stratigraphy (Kenyon 1952; Wheeler 1954; Harris 1979; Gasche and Tunca 1983; Harris et al. 1993; Warburton 2003), and one recent paper has advocated that we should study stratigraphy in social as well as technical terms (McAnany and Hodder 2009). In this paper, however, my concern is with the idea of stratigraphy itself, and how it distorts our understanding of sites. I will argue that we need to re-think the way we use stratigraphy both in the field and in analyses thereafter.

1 The concept of stratigraphy

The concept of stratigraphy originates in the discipline of geology and took shape in the late 18th to early 19th centuries AD (Harris 1979, 3-7; Rapp and Hill 2006, 5-10). One of the first ideas was that geological strata could be dated through the fossils they contained, and that strata with similar fossils were of similar date. Subsequently it was argued by Charles Lyell that the older the strata were, the fewer fossils would have living counterparts in the world today. In this manner a relative sequence could be set up. Finally, it was argued that strata were deposited in sequential order, the so-called 'law of superposition' and that the youngest deposits were to be found on top, although later processes of erosion, uplift, or tilting could distort what were originally horizontal and continuous strata.

These ideas could be applied with great effect in the emerging discipline of archaeology, where likewise sites could be dated through their associated artefacts, and the law of superposition provided evidence for chronological sequences. Famously, Boucher de Perthes established the antiquity of stone tools by demonstrating their stratigraphic association with extinct animals in a stratigraphic section (Trigger 1989, 91-94; Rapp and Hill 2006, 5-6). From those days onwards the concept of stratigraphy has been of key importance in archaeology. Subsequent studies have focused on how stratigraphy can best be documented in large-scale excavations of complex sites.

One approach is the 'Wheeler-Kenyon' method in which excavation proceeded in square or rectangular trenches, often in artificial spits, and in which baulk sections augmented the stratigraphical information obtained during the excavations in the trench (Kenyon 1952; Wheeler 1954). This system has proven its value and has remained in use in Near Eastern archaeology up to the present (Warburton 2003), including in Leiden expeditions to sites such as Deir 'Alla, Hammam et Turkman, and Tell Sabi Abyad. The critique sometimes voiced that this method is colonial and excludes excavators from their role in the construction of knowledge (McAnany and Hodder 2009, 5-6), confuses the origins of an excavation and recording method with its application. By way of parallel, the metric system was imposed on Europe in the time of Napoleon but nobody today would argue that metres continue to enforce French domination. Likewise, the 'Wheeler-Kenyon' method can be usefully applied on excavations where only skilled archaeologists work and aid them in their efforts to reconstitute complex stratigraphies.

An important innovation for recording and reconstructing complex stratigraphies was the Harris matrix (Harris 1979), which provided a graphic method for ordering stratigraphic units. This recording tool could be combined with section drawings but also facilitated the development of excavation methods that did not use baulks, such as the British 'single-context recording method' in which each stratigraphic unit (layer, feature or cut) is described separately and linked to adjacent stratigraphic units by means of a Harris matrix (Harris *et al.* 1993; Chadwick 1998). This method is sometimes hailed as a more democratic approach towards the construction of stratigraphy (McAnany and Hodder 2009, 6), although others have argued that the 'single context recording method' still privileges those who end up writing the site synthesis (Andrews *et al*. 2000).

It appears then that archaeologists have by and large taken the concept of stratigraphy for granted and that it has indeed been "overdescribed and undertheorized" (McAnany and Hodder 2009, 2). Instead, McAnany and Hodder have argued that we should analyse the activities that lead to stratigraphic sequence as in part constituted by social activities. They certainly have a point in that many culturally determined practices, such as how a house should be deconstructed, and where and how people are buried, to mention but two examples, in the end result in the stratigraphies we encounter on our sites. However, here I want to reflect on a more fundamental issue: whether the current concept of stratigraphy distorts our understanding of the past.

2 The trouble with stratigraphy

The origin of the concept of stratigraphy has implications for the ways in which this idea took shape. In geology there were three laws (Harris 1979, 7): first, that of superposition, which determines that the youngest deposits were to be found on top; second, that of original horizontality, which purports that strata were formed in horizontal layers although later processes of tilting could distort this orientation; and, third, that of original continuity, which means that strata were originally continuous but that later processes of erosion, tectonic and volcanic activities could result in gaps in strata. In archaeology only the first law seems to hold. Certainly many stratigraphic units were not formed in horizontal layers (for example cuts and upstanding walls). More importantly, archaeological strata were not originally continuous and stretching across entire landscapes. Instead, archaeological stratigraphic units are always local, even if we take into consideration very large monumental structures such as the pyramids of Egypt which measure up to 230 metres and are atypical for archaeology.

On the wall in my hallway at home is a map of Leiden that is about ten years old. It shows areas of the city that will be built in the near future at the time the map was printed and have by now been constructed. Otherwise it shows the existing buildings in the city, some of which were built recently, but others date back up to nine centuries ago (the Burcht) (fig. 1). Thus, the city of Leiden as it exists today is a composite of buildings of very diverse ages. However, as any inhabitant of the city of Leiden will be able to tell you the old buildings in the city are not simply old. Structures such as the Pieterskerk, the Burcht, the Hooglandse kerk and the Academie need to be renovated every decade or so, and one could question how much of the present structures is in fact centuries old and to what degree these buildings merely resemble old buildings. Similarly, private houses in Leiden, whether fifty or five hundred years old, are constantly being redeveloped and modernized, and the picturesque historic inner city we all appreciate is in many ways a façade sheltering modern apartments, offices, and stores. The city of Leiden is best described then as being in a state of constant flux, in which certain historic buildings are actively maintained and redeveloped because they are culturally appreciated. Maintaining a historic city centre requires much hard work, determination and great resources

Figure 1 De Burcht of Leiden. Source: Wikimedia Commons. Author: Ellywa.

in the present. The map of Leiden in my hallway is an extreme simplification of a very complex situation of a city with components dating to various periods originally but constantly being reworked in the present.

The contrast with an archaeological stratigraphical plan could hardly be greater. Archaeological phase plans typically aspire to the following principles. First, all buildings on the plan are contemporaneous. Second, they are not simply in use at the same time, but should also have been constructed and abandoned at more or less the same time. Thus, archaeologists ideally produce a series of stratum plans in which each stratum shows a discrete set of buildings belonging to that particular phase *only*. For example, at Çayönü, a well-known Early Neolithic site in southeastern Turkey, a series of discrete phase plans was produced each with distinct building types, such as “the round building phase”; “the grill building phase”; and “the channeled building phase” (Özdoğan 2007). Likewise a recent publication of Beidha presents a series of discrete phase plans labeled A1; A2; B; C1 and C2 (Byrd 2005). Many more examples could be presented of similar field reports.

Such examples suggest that many archaeologists have unwittingly adopted aspects of geology that make no sense in archaeology: namely that archaeological strata can be determined which form more or less continuous and discrete occupation phases across the site, as if they are equivalent to a geological horizontal and continuous layer. Indeed, some archaeologists working in the Near East have excavated in the so-called ‘phone booth’ strategy: excavating small trenches spread across the tell site, under the assumption that they would be able to link the stratigraphic sequences in the individual mini trenches (Bordaz 1968; Watson and LeBlanc 1990), which suggests that they were working from the idea of continuous archaeological strata. This particular type of excavation strategy was quickly abandoned in Near Eastern archaeology because it proved impossible to construct convincing stratigraphical reconstructions in this manner. Nonetheless, a subsequent project on stratigraphy in Near Eastern archaeology proposes that our methods should be brought in line with those of geology and that geological and archaeological strata are: “subject to similar rules and axioms” (Gasche and Tunca 1983, 326).

The idea that archaeological stratigraphies consist of continuous and discrete occupation phases that seems to be implicit in the concept of stratigraphy as is current in archaeology does not prove problematic for most archaeologists in the field. The reason is simple. The large majority of excavations in the Near East consist either of soundings and excavations of a few adjacent trenches at most or focus on large monumental buildings such as palaces or temples. In the first case construction of a stratigraphic sequence of phases is relatively unproblematic, as the local stratigraphy is usually relatively straightforward. In the second case the stratigraphy is also relatively straightforward because although large areas are excavated, these monumental buildings are renovated or rebuilt in their entirety on a regular basis.

Only in the case of large-scale excavations of non-monumental buildings does the incompatibility of stratigraphy, conceived of as continuous and discrete occupation phases and the archaeological data, become apparent. While large-scale excavations will provide a much richer understanding of the settlement as a whole and changes therein over time (Düring 2006; Özdoğan 2006), a point well exemplified by the Leiden excavations at Tell Sabi Abyad (Akkermans *et al.* 2006), they will also present problems for a stratigraphic understanding of the site in question. At present we are working on the Late Bronze Age stratigraphy of Tell Sabi Abyad in the framework of the ERC funded *Consolidating Empire* research project, trying to work out stratigraphical correlations between more than twenty trenches. This exercise is forcing us to rethink our stratigraphic understanding in very fundamental ways, but it is too early to report on this. In the next section I will therefore discuss some examples I have studied in earlier research on the Neolithic of Central Anatolia.

2.1 Çatalhöyük

The well-known Neolithic site of Çatalhöyük is situated in Central Anatolia on the Konya Plain and can be dated between about 7400 and 6200 BC (Cessford 2001). It was first investigated in the 1960s by James Mellaart and from 1993 onwards a new research project at the site is directed by Ian Hodder (Mellaart 1967; Hodder ed. 1996; 2005a; 2005b; 2006; 2007). The two projects that have been undertaken at Çatalhöyük differ in a great number of respects. The 1960s excavations were designed to obtain the maximum exposures possible with limited resources. In the four campaigns that Mellaart undertook at Çatalhöyük approximately 400 rooms were excavated. The actual digging was mainly executed by Turkish workmen, while the supervision and documentation of the excavations were done by the British field team. It appears that on average 1.7 rooms were excavated per day. The speed with which these rooms were excavated precluded the possibility of careful sampling, excavating building fills stratigraphically, or studying the renovations and modifications these structures went through. By contrast, the Çatalhöyük Research Project has endeavoured to extract a maximum of high-quality data while focusing on smaller excavation areas. A clear example of the labour intensity of this approach is the excavation of building 3. The excavation of this structure, comprising four rooms, by a team from Berkeley took seven campaigns (Stevanovic and Tringham 2003).

Given these differences in excavation strategies, it is perhaps understandable that the new Çatalhöyük research project regarded the Mellaart stratigraphy as suspect. There was, at least initially, a widely shared view amongst the members of the new project that the 1960s data were both biased and unreliable (*e.g*. Hamilton 1996; Cessford 2001, 722). During the 1960s Mellaart distinguished 15 building levels at Çatalhöyük, numbered from top to bottom 0 – XII. Level VI was later subdivided into VIA and VIB, VIA being the more recent occupation. Mellaart's stratigraphy of Çatalhöyük developed considerably over the course of the 1960s excavations and several readjustments were made as new data emerged in the course of the ongoing project, in which buildings were re-assigned to other building levels. Until the 1963 campaign the stratigraphy was not altered, but after that it was decided to alter the relative position of some buildings previously assigned to levels VII and VI (Mellaart 1964, 40). Level VI was subdivided at this point into VIB (older sub-phase) and VIA. It was stated that the buildings of level VIA were all burnt, and contained pottery, whereas only some of the level VIB buildings were burnt and these buildings lacked pottery. In this process of sub-dividing level VI some buildings were assigned exclusively to VIB or VIA, but the majority of buildings were drawn on the plans of both VIB and VIA. This later group of buildings was drawn for the most part with identical ground plans and floor elevations on both plans, suggesting that they were 'generic' level VI, rather than VIB or VIA. Given these circumstances, it seems that the VIB/VIA distinction applies to only a minority of the buildings involved, rather than representing a complete 'redevelopment' of the area. These alterations took the form of: first, abandonment and transformation into midden areas; and, second, renovation and/or rebuilding. These modifications of individual buildings dispersed over the excavated area were then lumped by Mellaart into 'level VIA', but it is far from clear whether they actually represent a single horizon. Subsequently, in the 1966 report it was stated: "it now appears that level VI shows two phases of building only in the houses. Those shrines built in level VIB that were still in use in VIA were remodelled, but not rebuilt." (Mellaart 1966, 166). Moreover, during the final 1965 campaign at Çatalhöyük, Mellaart excavated a group of buildings in Area F that do not seem to have been affected by fire and were simply labelled "level VI" (Mellaart 1966, 172). In the 1967 monograph Mellaart likewise designates many buildings as level VI, rather than VIB/VIA, indicating that the distinction was often not easy to draw (Mellaart 1967, 81, 102). Similar problems seem to have arisen during Mellaart's final excavation seasons concerning the delineation of levels VII and VIB. A group of buildings formerly assigned to level VII (in the 1962 report) were reassigned to level VIB in the 1964 report (Mellaart 1964, 40). Subsequently, in the 1966 report, a group of level VIB buildings were reassigned to level VII (see Düring 2006, 142-145 for details on all these issues).

It appears that the distinctions between levels VII, VIB, and VIA became increasingly difficult to draw in the course of the 1960s excavations, a point that emerges from the many re-assignations of buildings from one level to the next, and the conceptual problem of distinguishing sub-phases within level VI that are valid for some buildings only. It is evident that these problems became more pronounced with the expansion of the excavated area, in the course of which it became increasingly difficult to accommodate the data into the existing stratigraphy. The problem here is not in the quality of the fieldwork, but rather in a conceptual framework that is geared to isolating discrete occupation phases in vernacular village buildings. In the words of one project member of the new excavations at Çatalhöyük: "The recent excavations have demonstrated that levels do not form absolutely contemporary events as individual structures have their own unique life histories and that a degree of overlap between levels is probable." (Cessford 2001, 722).

However, as a heuristic tool and an approximation of contemporary horizons Mellaart's stratigraphy has been vindicated. In the initial stages of the new project, the extant profiles in the Area excavated by Mellaart were cleaned, drawn and analysed. From this it was concluded that on the whole Mellaart's stratigraphical divisions can be corroborated, even if some problematic details remain (Matthews and Farid 1996, 287-288). Thereafter the results obtained in the present excavations have been fitted into Mellaart's pre-existing stratigraphy, and the discussion of the 'South Area' – where Mellaart excavated previously - was organized along Mellaart's stratigraphical divisions and buildings and deposits are on a level-by-level basis (Hodder and Cessford 2004; Farid 2007). Only after fifteen years of new excavations was Mellaart's stratigraphy finally replaced by a new stratigraphy (Farid 2008) (fig. 2). The main reason for proposing this new stratigraphy was that as the excavation area increased in size it became increasingly difficult to link the newly excavated buildings with the Mellaart stratigraphy, mainly because it was realized that each building had its own stratigraphy and these stratigraphies could not be fitted into a few levels that represented continuous and discrete occupation phases. Instead of Mellaarts stratigraphy, an alphabetic phasing is proposed per excavation area, and these area stratigraphies can be correlated with each other to some degree by means of absolute dating. Some buildings may occur in various of these phases and in other cases a level may be skipped in the overall sequence. Thus, strata are no longer continuous and discrete occupation phases: they may be present in some areas and absent in others and buildings can exist in several stratigraphic phases. In effect, the new Çatalhöyük

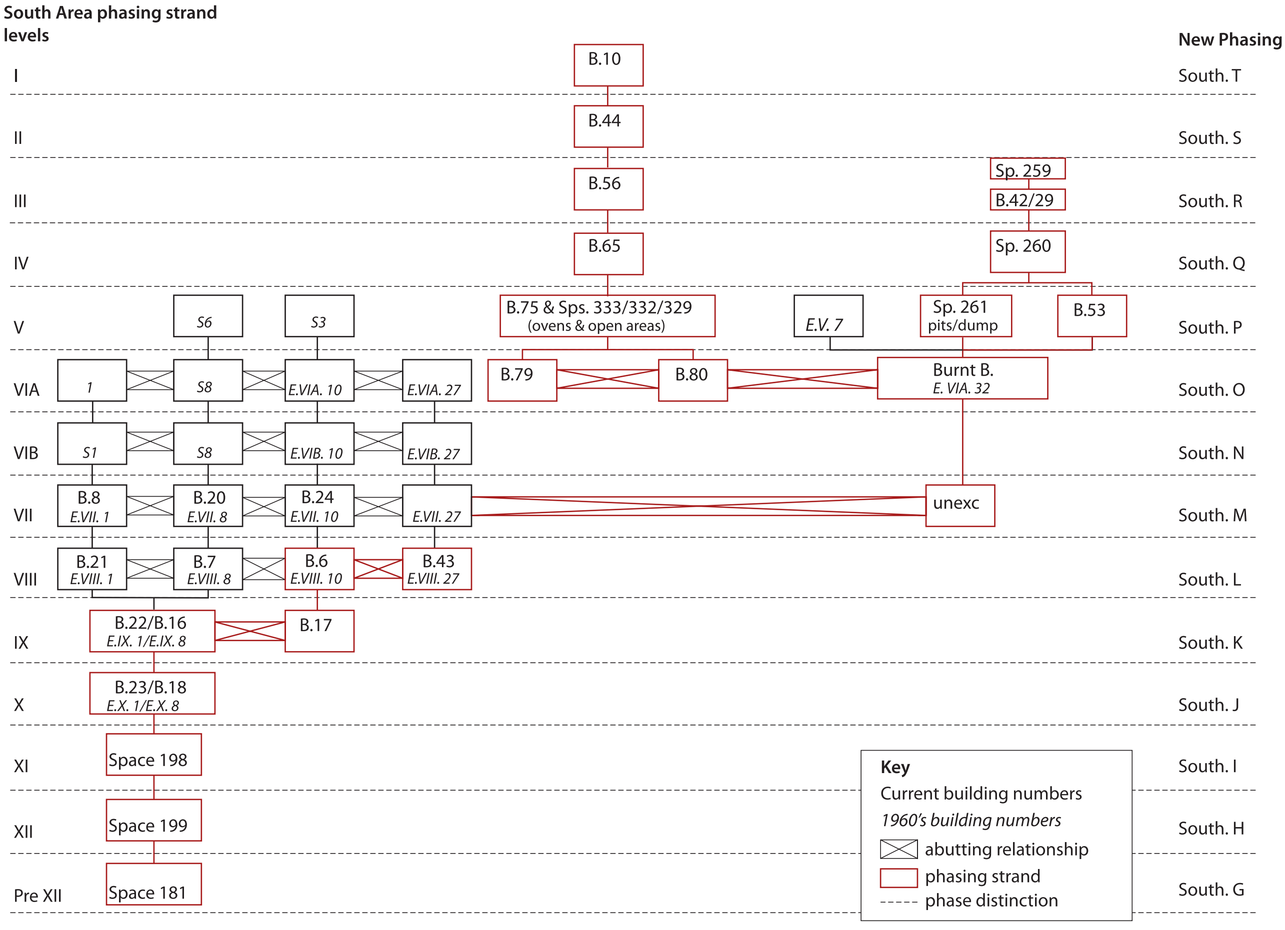


Figure 2 New chronology for South Area in Çatalhöyük. copyright Catalhoyuk Research Project (figure credited to Shahina Farid).

stratigraphic scheme has managed to break free from the geological biases inherent in the stratigraphy concept.

2.2 *Canhasan I*

Canhasan I, like Çatalhöyük, is located in Central Anatolia, and the sequences of both sites overlap. Excavations took place in the 1960s, and they have been published in three volumes (French 1998; 2005; 2010). The sequence spans the Late Ceramic Neolithic (layers 7-4), Early Chalcolithic (layers 3, 2B, and 2A), and Late Chalcolithic (layer 1). There is some controversy over the layer 2B/2A chronology at Canhasan 1. Radiocarbon dates from layers 2B and 2A give a range of 6000 – 5500 BC, which is Early Chalcolithic in local culture history (Thissen 2002). The older layers 7-4 probably date to the second half of the seventh millennium BC.

Layers 7 and 6 at Canhasan have been investigated over an area of 2 by 3 metres only, and little is known about them. Layer 5 was excavated over 4 by 4 metres, and a confusing array of walls and internal division walls was found. Layer 4 is likewise poorly documented. The single excavated building had multiple floor surfaces made of high-quality plasters which rested on wooden beams. On the floors various domestic features were found, including two hearths, a series of six bins, and two embedded querns. Besides, floor compartments with plaster ledges were found similar to those documented at Çatalhöyük East. Subsequent layer 3 was excavated over 10 by 10 metres, and in this area one poorly preserved structure was found. In this layer the first mould-made mud bricks occur and walls became more massive. Another innovation in layer 3 is the use of internal buttresses.

The most extensive exposure at Canhasan I is that of layers 2A and 2B (fig. 3). A neighbourhood of approximately 15 buildings was excavated in which buildings were completely surrounded by other structures. The buildings unearthed in layer 2 at Canhasan 1 were initially interpreted as constituting one layer, but were later subdivided into layers 2B (older) and 2A, both of which were argued to encompass several building

Figure 3 Plan of layers 2B and 2A (grey) at Canhasan I. (Produced by author and Medy Oberendorff).

levels. This sequence is in many ways problematic and difficult to conceptualize (Düring 2006, 261-264). From the outset of the excavations at Canhasan, French recognized a 'Middle Chalcolithic' 2A layer with distinctive pottery that was found in a variety of deposits, including pits and deposits of debris and ash. Many of these deposits were found over and within buildings of the earlier layer 2B buildings, but no substantial structures could be associated with layer 2A. In 1966 French noted for layer 2A: "The problem which still remains unsolved after five years of excavation over an area of more than 1100 square metres is: where was this settlement?" (French 1966, 115). The problem was partly solved in the following season, when it was postulated that some of the structures that had been assigned to layer 2B, could in fact be assigned to layer 2A, and this brought about the transfer of a whole series of structures located on the western edge of the plan to layer 2A. It appeared that all these layer 2A structures were superimposed on top of layer 2B buildings (French 1968, 169). In the final report on the stratigraphy and structures of the site French explains the rationale behind these re-assignations. He argues that some of the layer 2A buildings were "inserted" into existing layer 2B structures. This "insertion" was achieved by constructing new structures within extant older buildings, although in some cases this procedure involved removing some of the earlier walls and features. The inserted structures that were built in this way did not damage the surrounding buildings, and followed the alignment of the settlement in general.

The prime issue that French does not solve in his final publication on the stratigraphy and structures of Canhasan I is the relationship between the building remains of layers 2A and 2B. The issue is whether the 2B buildings that were not replaced by 2A insertions continued to be in use alongside those of layer 2A, or whether they were no longer inhabited. French opts for the latter position (French 1998, 65). This interpretation has one important problem, however. If it was indeed the case that the buildings of layer 2B were already in disuse and falling apart, why were the layer 2A buildings inserted carefully into the older settlement structure? The sort of insertion procedure described by French would only make sense if the 2A structures replaced some of the older 2B structures while coexisting with others. If true, the division between the two layers is less rigid than envisaged by French. Rather than a wholesale reconfiguration of the settlement, buildings were renovated by inserting a new set of walls in front of the existing walls of a building, possibly because a particular structure was no longer structurally sound.

3 Discussion and Conclusion

In this paper I have argued that the concept of stratigraphy as it is used by archaeologists still bears the hallmarks of its origin in geology. More specifically, archaeologists often conceive of their stratigraphy as consisting of a series of continuous and discrete occupation phases. While such a conceptualization is not problematic where archaeologists dig relatively small exposures, or focus on large monumental structures, archaeologists that have excavated large areas of village or towns in the Near East have run into problems, as I have demonstrated both for Çatalhöyük and Canhasan I. The reason for this is that a settlement is best described as being in a state of constant flux, in which certain historic buildings are actively maintained and redeveloped. While the example of Leiden discussed earlier may not be completely relevant for the Near East, because loam buildings cannot be preserved and renovated for centuries as some historic buildings in Leiden are, the idea of more or less constant and fragmented changes in the built environment certainly holds. Unlike the solid structures built in most of North-Western Europe, a loam building cannot be considered a finished product, fit for occupation until the end of its use-life, after its construction is at an end. The upkeep of such a building requires constant care and effort. In most cases this takes the form of re-plastering of wall surfaces and of repairing weak spots on the roof. Furthermore, such buildings can be modified and expanded relatively easily: rooms can be added without much ado, interior walls can be added or removed, doors and windows can be opened or closed without much effort (see Stone 1981; Peters 1982; Horne 1994 for more details).

How can archaeologists capture such dynamic changes in their stratigraphy? Part of the solution has already been developed in projects such as Çatalhöyük – discussed above – and Tell Sabi Abyad (Kaneda in prep.). At both projects the idea of stratigraphy as consisting of a series of continuous and discrete occupation phases has been abandoned. Instead stratigraphies are constructed for specific excavation areas in which not all buildings and trenches have all stratigraphic phases and some buildings may survive over several phases. The stratigraphic sequences of excavation areas are linked with one another through stratigraphic reasoning if direct stratigraphic relationships exist or by means of a good series of radiocarbon dates.

Archaeologists will continue to publish stratigraphic phase plans. While we need such plans to construct our understanding of the past, we should emphasize more that they are at best a simplification of a complex series of irregular processes and changes that constitute the settlement at any one time. And, many of the small changes occurring in buildings cannot be represented on them. To some degree this can be ameliorated by the use of digital technologies: it is possible to start producing dynamic 'movie-like' stratigraphic reconstructions showing small changes in the settlement rather than static plans. However, we will also have to concede that there is no way of directly linking many of the minor changes in one building with those occurring elsewhere. Thus, we should come to terms with stratigraphies that are messier and less secure than what we see in many standard publications. On the other hand, such stratigraphies will be a much better description of what past settlements were like and how they changed over time.

Acknowledgements

As an archaeologist who was trained in Leiden and did my PhD there I feel much gratitude to all those colleagues and teachers who supported me throughout my career and brought me where I am today. It is thus with great pleasure that I offer this paper for this celebratory volume. I would also like to thank Tijm Lanjouw en Victor Klinkenberg for reading and commenting on a draft of this paper.

References

Akkermans, P.M.M.G., R. Cappers, C. Cavallo, O. Nieuwenhuyse, B. Nilhamn and I.N. Otte 2006. Investigating the Early Pottery Neolithic of Northern Syria, New evidence from Tell Sabi Abyad. *American Journal of Archaeology* 110, 123-156.

Andrews, G., J.C. Barret and J.S.C. Lewis 2000. Interpretation not record, The practice of archaeology. *Antiquity* 74, 525-530.

Bordaz, J. 1968. The Suberde excavations, southwestern Turkey, an interim report. *Türk Arkeoloji Dergisi* 17/2, 43-71.

Byrd, B.F. 2005. *Early village life at Beidha, Jordan. Neolithic spatial organization and vernacular architecture. The excavations of Mrs. Diana Kirkbride-Helbaek*, Oxford.

Cessford, C. 2001. A new dating for Çatalhöyük. *Antiquity* 75, 717-725.

Chadwick, A. 1998. Archaeology at the edge of chaos, Further towards reflexive excavation methodologies. *Assemblage* 3, www.shef.ac.uk/assem/3/3chad.htm.

Düring, B.S. 2006. *Constructing Communities, Clustered Neighbourhood Settlements of the Central Anatolian Neolithic, ca. 8500-5500 Cal. BC*, Leiden.

Farid, S. 2007. Introduction to the South Area Excavations. In: I. Hodder (ed.), *Excavating Çatalhöyük, South, North and KOPAL Area reports from the 1995-1999 seasons,* Cambridge**,** 41-58.

Farid, S. 2008. A review of the Mellaart Level system and the introduction of a new phasing system at Çatalhöyük 2008. *Çatalhöyük Archive Reports*, http://www.catalhoyuk.com/archive_reports/.

French, D. 1966. Excavations at Can Hasan, Fifth preliminary report, 1965. *Anatolian Studies* 16, 113-123.

French, D. 1968. Excavations at Can Hasan, Seventh preliminary report, 1967. *Anatolian Studies* 18**,** 45-54.

French, D. 1998. *Canhasan sites I, Stratigraphy and structures*, London.

French, D. 2005. *Canhasan I: The pottery*, London.

French, D. 2010. *Canhasan I: The small finds*, London.

Gasche, H. and Ö. Tunca 1983. Guide to archaeostratigraphic classification and terminology: Definitions and principles. *Journal of Field Archaeology* 10, 325-335.

Hamilton, N. 1996. Figurines, clay balls, small finds and burials. In: I. Hodder (ed.), *On the Surface, Çatalhöyük 1993-5*, Cambridge**,** 215-264.

Harris, E.C. 1979. *Principles of archaeological stratigraphy.* London.

Harris, E.C., M.R. Brown and G.J. Brown (eds) 1993. *Practices of archaeological stratigraphy*, London.

Hodder, I. (ed.) 1996. *On the surface, Çatalhöyük 1993-95*, Cambridge.

Hodder, I. 2005a. *Inhabiting Çatalhöyük: Reports from the 1995-1999 seasons*, Cambridge.

Hodder, I. 2005b. *Changing materialities at Çatalhöyük: Reports from the 1995-99 seasons*, Cambridge.

Hodder, I. 2006. *Çatalhöyük perspectives: Themes from the 1995-9 seasons*, Cambridge.

Hodder, I. 2007. *Excavating Çatalhöyük: South, North and KOPAL Area reports from the 1995-1999 seasons*, Cambridge.

Hodder, I. and C. Cessford 2004. Daily practice and social memory at Çatalhöyük. *American Antiquity* 69, 17-40.

Horne, L. 1994. *Village spaces, Settlement and society in Northeastern Iran*, Washington and London.

Kaneda, A. in prep. *Development and change in the organization of settlement and architecture in the Late Neolithic,* Leiden, PhD Thesis.

Kenyon, K. 1952. *Beginning in archaeology*, London.

Matthews, W. and S. Farid 1996. Exploring the 1960's surface. The stratigraphy of Çatalhöyük. In: I. Hodder (ed.), *On the surface, Çatalhöyük 1993-95*, Cambridge**,** 271-300.

McAnany, P.A. and I. Hodder 2009. Thinking about stratigraphic sequence in social terms, *Archaeological Dialogues* 16, 1-22.

Mellaart, J. 1964. Excavations at Çatal Hüyük, Third preliminary report, 1963. *Anatolian Studies* 14, 39-119.

Mellaart, J. 1966. Excavations at Çatal Hüyük, Fourth preliminary report, 1965. *Anatolian Studies* 16, 165-191.

Mellaart, J. 1967. Çatal *Hüyük, A Neolithic town in Anatolia*, London.

Özdoğan, A. 2007. Çayönü. In: M. Özdoğan and N. Başgelen (eds), *Anadolu'da uygarlığın doğuşu Avrupaya yayılımı Türkiye'de Neolitik* dönem. *Yeni kazılar, yeni bulgular*, Istanbul**,** 57-98.

Özdoğan, M. 2006. Hypothetical approaches and realities, Research strategies in defining space and context. In: D. Papaconstantinou (ed.), *Deconstructing context, A critical approach to archaeological practice,* Oxford**,** 159-175.

Peters, E. 1982. Ländliche bauweisen im Keban-Gebiet. *METU – Keban Publications* 7, 217-232.

Rapp, G. and C.L. Hill 2006. *Geoarchaeology. The earth-science approach to archaeological interpretation*, New Haven.

Stevanovic, M. and R. Tringham 2003. The excavation of the BACH 1 Area 2003, *Çatalhöyük Archive Reports*, http://www.catalhoyuk.com/archive_reports/

Stone, E.T. 1981. Texts, architecture and ethnographic analogy, Patterns of residence in Old Babylonian Nippur, *Iraq* 43, 19-33.

Thissen, L. 2002. Appendix I, The CANeW 14C databases, Anatolia 10,000-5000 cal BC. In: F. Gerard and L. Thissen (eds), *The Neolithic of Central Anatolia*, Istanbul**,** 299-337.

Trigger, B.G. 1989. *A history of archaeological thought*, Cambridge.

Warburton, D.A. 2003. *Archaeological stratigraphy, a Near Eastern approach*, Neuchatel.

Watson, P.J. and S.A. LeBlanc 1990. *Girikihaciyan, A Halafian site in Southeastern Turkey*, Los Angeles.

Wheeler, M. 1954. *Archaeology from the earth*, London.

Bleda S. Düring
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
b.s.during@arch.leidenuniv.nl

Stable isotopes of Upper Weichselian land snails from Lakitelek (Hungary): a contribution to understanding the climatic context of the Upper Palaeolithic of the Hungarian basin

Alexander Verpoorte, Simon Troelstra, Kay Beets and Pál Sümegi

The occupation history of the Hungarian basin between 30,000 and 15,000 ^{14}C yr BP is important for understanding the refugia during the last glacial maximum and the subsequent recolonization of the mid-latitudes of Europe. The stable isotope record from land snail shells is reported here as a pilot study of its contribution to our knowledge of the ecological conditions in this period. Land snail shells from the Lakitelek section in Hungary cover the period of 11,000 to 30,000 ^{14}C yr BP. Values for $\delta^{13}C$ and $\delta^{18}O$ have been measured for Pupilla muscorum specimens from 18 separate layers. Average $\delta^{13}C$ values range from -5.9 to -10.2‰. Though there is no clear long-term trend, two distinct peaks with depleted values are present, suggesting periods of increase in C_3 vegetation. Average $\delta^{18}O$ values range from -1.8 to -5.4‰. The weak cyclic pattern in the data can be explained by a time lag between temperature and relative humidity effects. The stable isotope data do not correspond in a consistent manner with the main ecological trends based on land snail assemblage composition.

1 Introduction

The climatic downturn of the last glacial maximum (LGM) had a clear impact on the human settlement history of Europe. The initial expansion of early modern humans from about 35 ka BP onwards into northern latitudes stopped and human populations started to retreat into refugia in southwestern Europe, the Mediterranean and the southern Balkans. The impact of global climatic change on the timing and extent of the range contraction differs from region to region. The settlement history of the Hungarian basin shows a distinct pattern for this period (Otte 1998; Dobosi 2000; Verpoorte 2004; 2009; Lengyel 2009). Only a few sites are known for the period preceding the last glacial maximum. The main occupation phase is dated between 21 and 17 ka BP, when settlement of regions north of the Hungarian basin was sparse and widely dispersed. The current evidence suggests that the basin was deserted shortly after 17 ka BP. Recolonization took place around 13 ka BP with the onset of climatic amelioration in the Late Glacial.

The paleoenvironment of pleniglacial Hungary is mainly known from detailed malacological and anthracological studies (Krolopp and Sümegi 1995; Willis *et al*. 2000; Rudner and Sümegi 2001; Sümegi and Krolopp 2002). In this paper we report on a stable isotope record of land snail shells from Lakitelek brickyard to enhance our understanding of the environmental conditions in the Hungarian basin.

2 Climate, stable isotopes and snail shells

Stable isotope studies of land snail shells can contribute to our understanding of the local climatic conditions (Goodfriend 1992; 1999; Bonadonna *et al*. 1999; Goodfriend and Ellis 2000; Balakrishnan and Yapp 2004; Balakrishnan *et al*. 2005b; Zanchetta *et al*. 2005; Beets *et al*. 2006; Colonese *et al*. 2007; 2010; Yanes *et al*. 2011). The snail shell aragonite is primarily derived from amino acids from the diet of the snail. Shell formation takes place only when the snail is active. The active period depends on moisture and temperature. Most land snails are active during or after rain events and at temperatures between 10 and 27 ºC, most likely late spring and summer conditions (Balakrishnan *et al*. 2005). The stable oxygen and carbon isotopes of the snail shell reflect local conditions during these active periods.

The relationship between climatic conditions and stable isotope composition is not straightforward, but mediated by snail activity. Stable carbon isotopes have been shown to depend predominantly on the plant diet derived from the local vegetation combined with atmospheric carbon dioxide and physiological effects (Goodfriend and Ellis 2000; Liu *et al*. 2007). The isotopic composition of the vegetation differs mainly according to the photosynthetic pathway utilized by the plants. Plants with C3 photosynthetic pathways, mainly trees and forbs (Ehleringer *et al*. 1997), have average $\delta^{13}C$ values of -27‰, whereas C4 plants, in particular grasses, have characteristic values of about -13‰. In addition, snails eat dead and decaying plant material which has an offset of 0-3‰ (Liu *et al*. 2007).

The interpretation of stable oxygen isotopes is more complicated. Zanchetta *et al*. (2005) found a fairly good relationship between oxygen isotopic composition of local rainfall and living land snail shells in Italy. However, the relationship does not apply under arid conditions (Zanchetta *et al*. 2005, 31). Balakrishnan *et al*. (2005) argue that the shell $\delta^{18}O$ values are controlled by a combination of local temperature, relative humidity and the isotopic composition of available water (local rainfall and ambient water vapour). Kehrwald *et al*. (2010) have used $\delta^{18}O$ values to gain insight into the source and trajectory of precipitation in modern and LGM Europe. Changes in stable oxygen isotopes seem to depend on at least two climatically relevant parameters.

3 Materials and methods

3.1 Location

The Lakitelek brickyard (46°50'N, 20°E) is located near the Tisza river in the Tisza-Danube interfluvial zone in the southern part of the Hungarian basin. The samples were taken from section No 1 in 1985 by P. Sümégi. Lakitelek I is the type section for two biozones of molluscan assemblages: the mild and humid Vallonia costata zonule and the cold Pupilla sterri zonule. Average annual rainfall in the area is about 560 mm with the peak in precipitation in June. Average monthly temperatures vary from a minimum of -1.4 °C in January to a maximum of 21.2 °C in July (fig. 1).

3.2 Lithology

The section has a depth of 6 metres below the surface. The sequence consists of floodplain sediments of the Tisza at the base. The fluvial sediment is covered with wind-blown sands (3.80-5.80 m) in which two paleosols have developed. Loesses were deposited on top of the wind-blown sands. The basal part (3.20-3.80 m) of the loess sequence contains more clay than the upper part. The basal and upper parts of the loess are separated by a calcareous, clayey horizon (3.00-3.20 m) with *Pinus sylvestris* charcoals and *Microtus arvalis* teeth. The upper 0.60 m of the section consists of wind-blown sand in which a Holocene soil has developed.

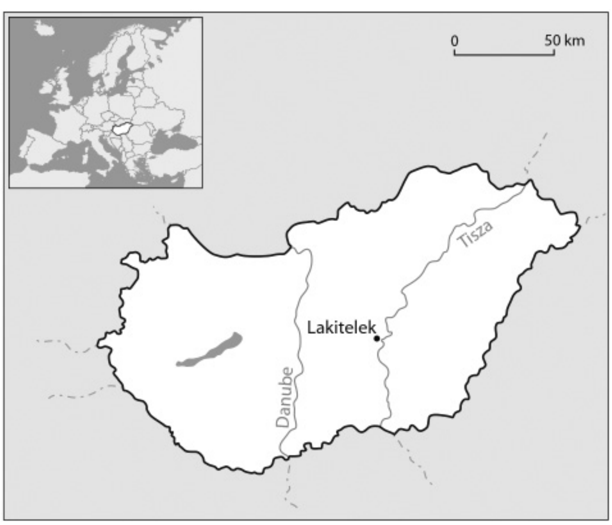


Figure 1 Location of the Lakitelek section in the Tisza Danube interfluvial zone.

3.3 Chronology

The sequence is dated by a series of five ^{14}C dates and dated between 30 and 11 ka ^{14}C yr BP (table 1). Age resolution for layers of 20 cm is estimated at about 1000 years.

3.4 Samples

The sequence was sampled for molluscs in layers of 20 cm from 0.60 m to 4.20 m depth below surface (fig. 2: see Krolopp and Sümegi 1995 and Sümegi 2005 for a description of the methodology and interpretation of molluscan faunas). For the measurements of stable isotopes of oxygen and carbon, we selected specimens from the species *Pupilla muscorum* Linnaeus 1758 that occurred throughout the section.

Pupilla muscorum is a holarctic, highly tolerant species. Its temperature resistance range is between 10 and 22 °C, with the optimum at 16 °C. The species prefers dry meadows and open, exposed, chalky locations. It lives of plant material and dead organic matter. The snail has a short lifespan of one or two summers. We assume that the fossil snails have similar feeding habits as living snails. We also assume that the isotope signal of *Pupilla muscorum* represents most of the variety of local conditions and provides an average of the wider 'neighbourhood' and that the species bias to local conditions is limited.

For a pilot project, one well-preserved specimen per layer was measured, giving eighteen data-points between 0.60 m and 4.20 m below surface. After this pilot, we measured four to five individual shells per level in a series of 18 layers from 0.60 to 4.20 m below surface, with a total of 88 samples (table 2). Only complete shells were selected for the analysis, when available from the layer. One local, modern specimen was measured as a reference.

3.5 Measurements

The selected shells were individually crushed first and then cleaned by repeated ultrasonification in distilled water and ethanol before stable isotope analysis. The entire shell was grounded to average changes in diet and physiology during its lifetime. Oxygen and carbon isotopes were measured on a Finnigan GasBench II. All values are expressed as per mille PDB.

4 Results

The $\delta^{13}C$ and $\delta^{18}O$ results for all samples and all layers are presented in appendix 1.

There is no correlation between carbon and oxygen isotopes of individual samples (fig. 3). The average values per layer are only weakly correlated (fig. 4). The values for layer 1, 12, 13 and 18 clearly differ from the main cluster of values.

4.1 Stable carbon isotopes (figs 5 and 6)

$\delta^{13}C$ values of individual shells range from a maximum of -5.9‰ to a minimum of -10.2‰. This is about three-fold the

Depth (m)	Lab no.	14C Age (yr BP)	δ^{13}C ‰	Cal BP(95.4% prob)
0.60-0.80	DEB-1092	11,770 ± 250	-6.05	14470-13100
1.40-1.60	DEB-1075	14,840 ± 300	-8.41	18650-17250
2.20-2.40	DEB-1562	16,720 ± 200	-7.45	20300-19450
3.00-3.20	DEB-1536	21,940 ± 400	-7.99	27690-25220
5.80-6.00	DEB-1095	30,000 ± 550	-8.49	36240-33300

Table 1 Radiocarbon dates on shells for Lakitelek (Krolopp and Sümegi 1995; δ^{13}C-data from Hertelendi *et al*. 1992). Calibration using OxCal4.1 with IntCal09 (Bronk Ramsey 2009).

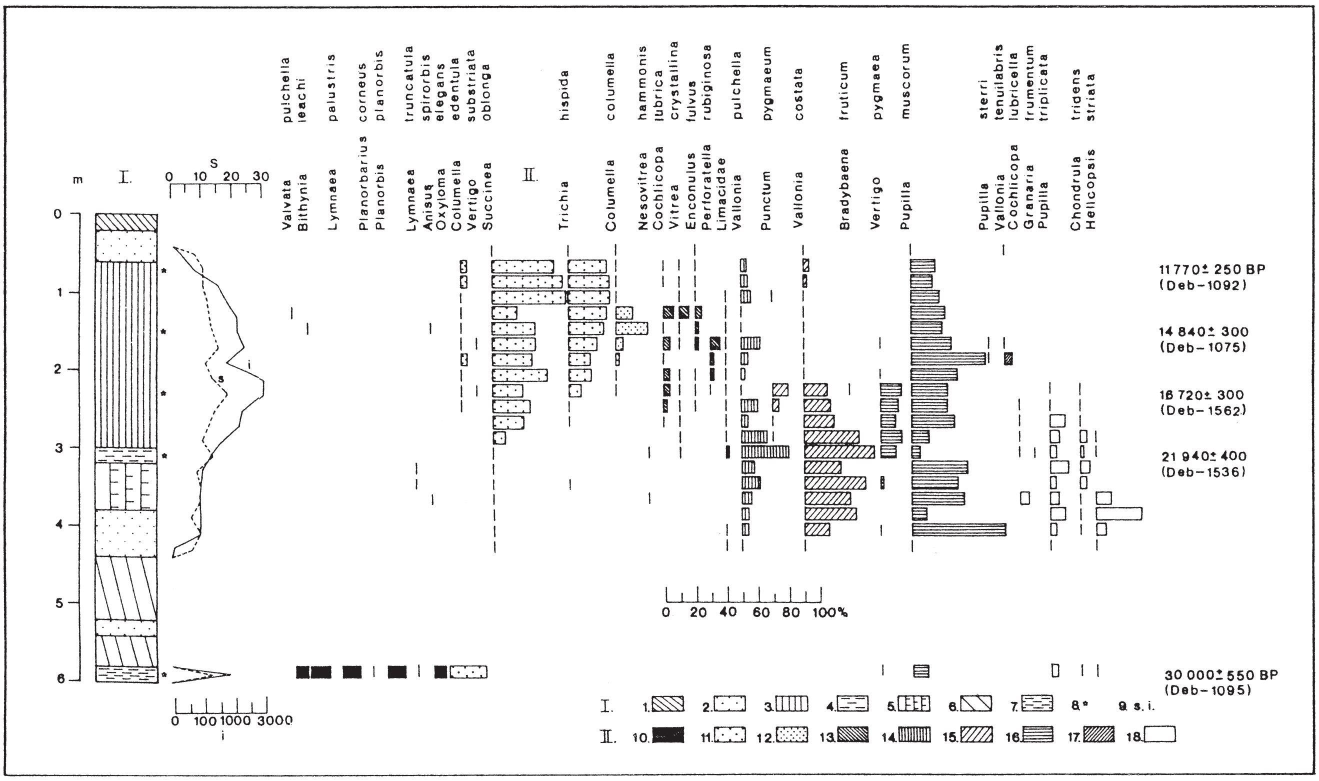


Figure 2 Molluscan faunal composition of Lakitelek (after Krolopp and Sümegi 1995)

I Lithology: 1 Holocene soil, 2 wind-blown sand, 3 loess, 4 humic horizon, 5 clayey loess, 6 soil horizon, 7 floodplain sediments, 8 radiocarbon samples, 9 s = number of species; i = number of individuals.

II Molluscan ecological groups: 10 aquatic species, 11 cold tolerant, hygrophilous species preferring open habitats, 12 frigophilous, hygrophilous species preferring open habitats, 13 highly tolerant, subhygrophilous species preferring transitional zones between open and closed vegetation, 14 subhygrophilous species preferring milder climate and transitional zones between open and closed vegetation, 15 highly tolerant, mesophilous species living in transitional zones between open and closed vegetation, 16 highly tolerant, mesophilous species preferring open areas, 17 frigophilous, aridity tolerant species preferring open habitats, 18 xerophilous species preferring milder climate living in open steppic environments.

average range of 1.3‰ within the layers. The range within layers varies between 0.6‰ and 3.7‰. Ranges of over 2‰ are found for layers with one or two outliers (layers 8, 13 and 16). Average values per layer range from -6.7‰ to -9.8‰. Standard errors for the layers average 0.5‰.

There is no clear trend in the data. Only two layers stand out with exceptionally depleted values: layer 12 has a value of -9.1±0.65‰ and layer 18 has a value of -9.8±0.5‰. Two layers have slightly enriched average values: layer 7 (-6.8±0.25‰) and layer 16 (-6.8±0.4‰, dismissing the outlier value of sample 16-05).

4.2 *Stable oxygen isotopes* (figs 7 and 8)

The values for δ^{18}O range between –1.8‰ and –5.4‰. The range of values within layers varies between 0.7‰ and 2.9‰, with an average of 1.8‰. The range of values within

Layer	Depth (m)	N	Comments
1	0.6-0.8	2+3 fragments	layer with fragmented shells, only two complete P.m. shells
2	0.8-1.0	4	
3	1.0-1.2	5	
4	1.2-1.4	5	
5	1.4-1.6	5	
6	1.6-1.8	5	
7	1.8-2.0	5	
8	2.0-2.2	5	
9	2.2-2.4	5	
10	2.4-2.6	4	
11	2.6-2.8	5	
12	2.8-3.0	5	
13	3.0-3.2	3+2 fragments	13.4 blue/grey colour, layer with fragmented shells
14	3.2-3.4	5	
15	3.4-3.6	5	
16	3.6-3.8	5	16.2 reddish/brown stains, 16.5 small shell
17	3.8-4.0	5	17.3 greenish stains
18	4.0-4.2	5	

Table 2 Sample information and number of samples per layer.

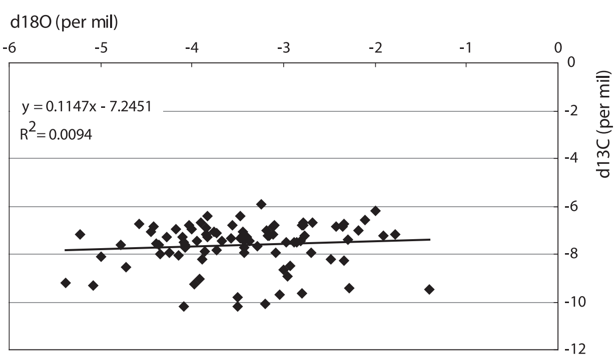


Figure 3 All individual datapoints for carbon and oxygen stable isotopes.

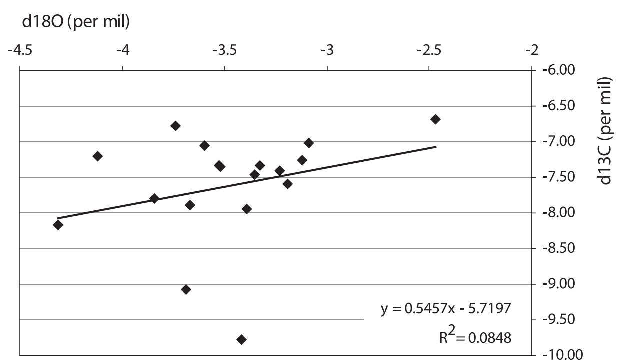


Figure 4 Average values for carbon and oxygen isotopes for each layer.

layers is half of the range in all δ^{18}O data. Average values per layer range from -2.5‰ to -4.3‰. The average standard deviation is 0.70. Layers 13 and 15 have relatively depleted average values, whereas layer 1 is relatively enriched in ^{18}O. There are no clear long-term trends in the data. However, the average values for layers 12 to 2 display a weak cyclic pattern. The values vary between more depleted values of c. -3.7‰ in layer 2, 7 and 11 and enriched values of c. -3.1‰ in layers 5 and 9. The layers 12 to 2 consist of eolian loess deposits.

5 Interpretation and discussion

5.1 Sampling and taphonomic effects

The samples derive from 20 cm levels and clearly are time-averaged samples to some degree. Two layers contain additional indications for a mixed assemblage of shells. Layers 1 and 13 consist mainly of fragmented shells; there were not sufficient complete shells available for 5 samples. This may explain the outlying average values for δ^{13}C and δ^{18}O for these two layers. Layer 1 is located immediately below the coversand with the Holocene soil. It probably

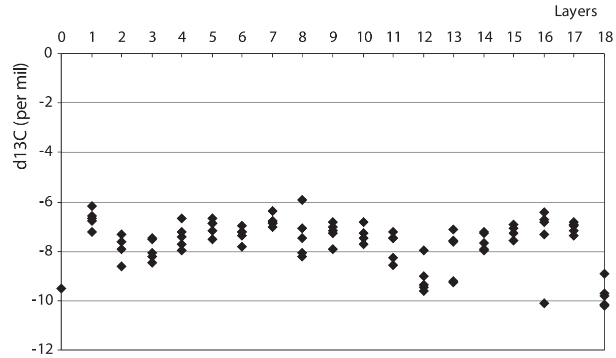


Figure 5 Carbon isotope values for all layers (0 denotes 'modern' value for comparison).

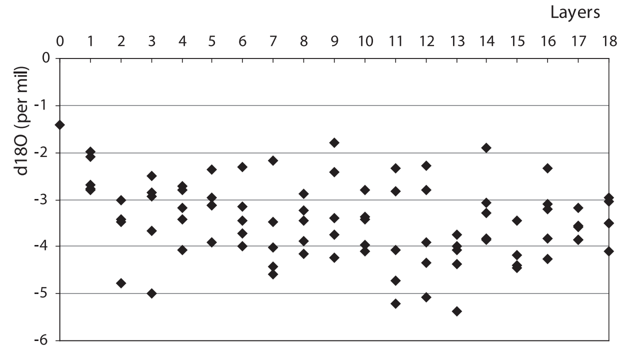


Figure 7 Oxygen isotope values for all layers (0 denotes 'modern' value for comparison).

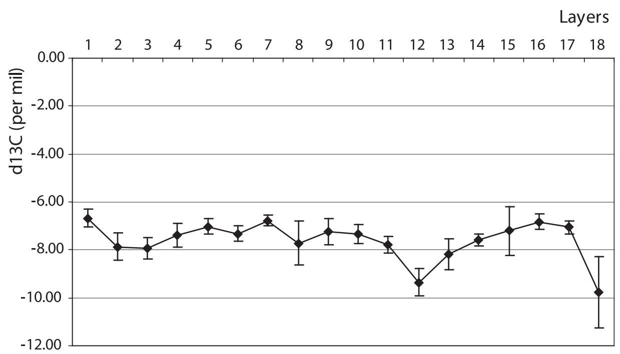


Figure 6 Average carbon isotope values with one standard deviation for all layers.

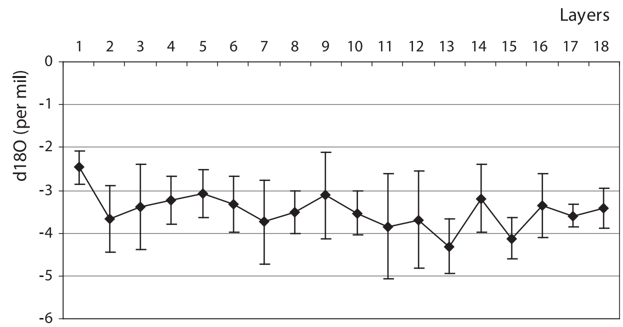


Figure 8 Average oxygen isotope values with one standard deviation for all layers.

consists of mixed material from the late glacial to Holocene transition, with a wide range of potential values for both carbon and oxygen.

Layer 13 is a humic horizon formed in the top of clayey loess dated to 21940±400 BP (DEB-1536). The five measured shells clearly fall into two groups. The two lower values of about -9.2‰ correspond with the values for layer 12 on top, whereas the three higher values of about -7.5‰ correspond with the values for the underlying layer 14. These results also affect the reliability of the radiocarbon date. It is not clear whether it dates the overlying eolian loess or the formation of a weak soil or the underlying clayey loess.

One other $\delta^{13}C$ outlier could be due to taphonomic processes. The value of sample 16-05 is -10.1‰, deviating more than 3‰ from the average for the remaining four samples (-6.8±0.4‰). Sample 16-05 was measured on a relative small shell, that could be intrusive, perhaps from the lowest layer 18.

There is no correlation between stable isotope values and the proportion of *Pupilla muscorum* in the molluscan fauna. There is also no significant difference in values between the three lithological units loess, clayey loess and coversand.

5.2 *Variation in the Pleistocene $\delta^{13}C$ and $\delta^{18}O$ values*

Stable carbon and oxygen isotope values were measured for 88 samples from Lakitelek. The $\delta^{13}C$ values range between -5.9 and -10.2‰. In a previous study on the quaternary paleoclimate in Hungary, Hertelendi *et al.* (1992) reported $\delta^{13}C$ values measured on shell samples for radiocarbon dating (fig. 9). The Pleistocene values range between -10.8‰ and -6.1‰. No other shell data for Central Europe are available at present. From a more southern location, Colonese *et al.* (2007) reports $\delta^{13}C$ values from late glacial levels (12.5-11 ka BP) in the Grotta del Romito in southern Italy. The values are measured on two different species. The specimens of *Discus rotundatus* have values between -12.1‰ and -7.5‰. The few values for *Helix* cf. *ligata* vary from -9.6‰ to -8.7‰. Late glacial data on *Vallonia* sp. shells from Folsom (New Mexico, USA) range from -13.7 to -8.2‰ (Balakrishnan *et al.* 2005a). The current data from Lakitelek are in good accordance with the previous data from Hungary. Relative to the data from late glacial southern Italy and New Mexico, the Lakitelek values are slightly higher.

The $\delta^{18}O$ values for Lakitelek range between –1.8‰ and –5.4‰. Shell data for the LGM of Hungary range from

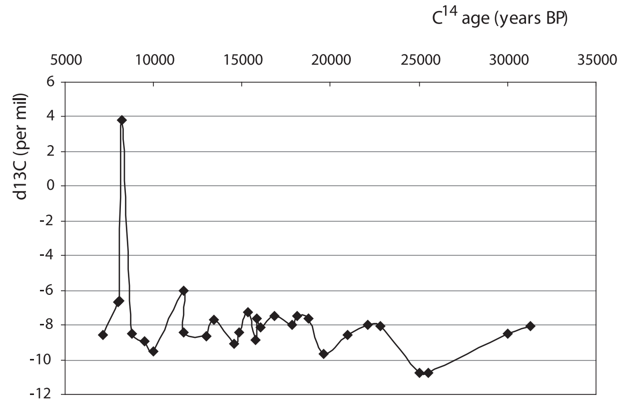


Figure 9 Published carbon isotope values against radiocarbon years as reported in Hertelendi *et al*. (1992) (note the low values at 25 ka BP, similar to layer 18 in Lakitelek).

-1.50‰ to -7.17‰ (Kehrwald *et al*. 2010). The values for Lakitelek are generally consistent with these data.

5.3 Interpretation of stable carbon isotopes

The range of $\delta^{13}C$ values between -5.9 and -10.2‰ corresponds to dietary values of approximately -18‰ to -22‰ (based on a constant offset of 12‰). The values indicate a dominantly C3 vegetation. Two clear peaks in layers 12 and 18 of depleted values of -9‰ could indicate two phases of increased dominance of C3 vegetation in the snail diet during its active period averaged over about one millennium. The layers 7 and 16 with enriched values of -6.8‰ could indicate an admixture of local C4 vegetation.

However, these interpretations are not consistently supported by the other evidence.

Layer 12 is dated to about 21 ka BP (circa 26000 cal BP). It is located just above the humic horizon of layer 13 correlated with the h2-initial soil of the Hungarian loess stratigraphy. The humic horizon is associated with a molluscan assemblage typical of the Vallonia costata zonule that signals a mild and relatively humid environment. It corresponds with a peak in molluscan species with a preference for the transitional ecozone between open and closed vegetation.

This correspondence is not the case for layer 18. Layer 18 must be older than 22 ka BP and younger than 30 ka BP. The sediment consists of coversand. There is no indication of soil formation associated with the layer and there is no distinct increase in species associated with more closed environments.

Layer 7, dated between 14.8 and 16.7 ka BP, is associated with the Pupilla sterri zonule. The faunal assemblage contains species that prefer open habitats and are adapted to cold and dry conditions. It is correlated with the Older Dryas. However, layer 16, with an age between 22 ka and 30 ka BP, is associated with a snail assemblage containing species of both open and more closed vegetation.

Several other proxies indicate a general shift in the environment from more closed to more open habitats around 16-17 ka BP. In Lakitelek, snail species of the transitional zone between open and closed vegetation such as *Vallonia costata* are well represented in the lower layers 18 to 9. Species that prefer open habitats such as *Succinea oblonga* and *Trichia hispida* are dominant in the layers 8 to 1. Charcoal data from the entire Hungarian basin (Willis *et al*. 2000; Sümegí and Rudner 2001) suggest a similar change. They indicate the presence of coniferous trees such as *Pinus* and *Picea* sp. in the Hungarian basin under glacial conditions. Dates range from 32 ka to 16.5 ka BP, but the charcoal evidence is absent for the period after 16.5 ka BP until the Late Glacial. This general change in vegetation is, however, not reflected in $\delta^{13}C$ values. The average value for layers 18 to 9 is -7.9 ± 1.1‰, whereas the average for layers 8 to 1 is -7.3 ± 0.6‰. The peak values in layers 7, 12, 16 and 18 are not correlated with vegetation changes (as reflected in snail species) in a consistent manner either. It suggests that the $\delta^{13}C$ record from Lakitelek reflects variation in diet of *Pupilla muscorum* in the local environment near the meandering and/or braiding Tisza river, rather than regional vegetational changes in the Hungarian plain.

5.4 Stable oxygen isotopes

The $\delta^{18}O$ values for Lakitelek range between –1.8‰ and –5.4‰. There are no clear long-term trends or distinct peaks in the data. The range of values is large throughout the section. It can indicate seasonal fluctuations in temperature and/or precipitation. Following Balakrishnan *et al*. (2005), snail shell $\delta^{18}O$ values are dependent on a combination of temperature, isotopic composition of rainfall and relative humidity. The composition of the land snail assemblage provides independent information of trends in temperature and humidity in the Lakitelek sequence. Species like *Vallonia costata* prefer moister conditions, whereas other species like *Pupilla triplicata* are highly aridity tolerant. The composition of the fauna in Lakitelek shifts around layer 11 from a dominance of mesophyl and arid tolerant species in the lower layers to a dominance of hygrophyl and subhygrophyl species in the upper part. There is no evidence in the $\delta^{18}O$ values that reflects this shift in local humidity.

The temperature tolerance of the species suggests that the shift in humidity is accompanied by a shift from milder to colder climatic conditions. The increase of *Columella columella* and *Pupilla sterri* indicates very cold conditions in layers 7 to 5. $\delta^{18}O$ values for layers 5 and 6 are relatively high (-3.1‰ and -3.3‰), but layer 7 has a low value of -3.7‰. *Vertigo pygmaea* and *Vallonia pulchella* indicate relatively mild conditions in layers 13 to 9. The corresponding $\delta^{18}O$ values for layers 13 to 10 are relatively low (-4.3‰ to -3.5‰), but the average for layer 9 is relatively high (-3.1‰).

One explanation for the lack of change in average $\delta^{18}O$ values, despite changes in temperature and humidity reflected in the molluscan fauna, is that the effects of a decrease in temperature and an increase in relative humidity and/or rainfall on the $\delta^{18}O$ values are counterbalanced (Balakrishnan *et al*. 2005).

Kehrwald *et al*. (2010) demonstrate a gradient with $\delta^{18}O$ declining towards the ENE in LGM land-snail shell data. They interpret the gradient to indicate a mid-latitude Atlantic source for the rainwater in Europe. Their data from Hungary and Serbia show another gradient. Here, $\delta^{18}O$ decreases in a northward direction, implying a Mediterranean source of precipitation. This is consistent with a southward displacement of the North Atlantic Drift during the last glacial maximum. Our Lakitelek data fit well within this pattern.

6 Conclusion

The record of $\delta^{13}C$ and $\delta^{18}O$ values of *Pupilla muscorum* shells from the Lakitelek section covers the period from 11,000 up to 30,000 ^{14}C yr BP. This period is poorly represented in environmental datasets from Central Europe such as pollen records or speleothems (e.g. Constantin *et al*. 2007). However, the climatic signal of the stable isotope values is complicated. A comparison with environmental trends, as reflected in the composition of the land snails, shows that the main shifts in local and regional vegetation, temperature and moisture regime are not reflected in the $\delta^{13}C$ and $\delta^{18}O$ values. The peaks in the average values for both stable isotopes are also not consistently associated with specific molluscan indicators of open/closed vegetation, temperature or moisture. The variation in $\delta^{13}C$ values is interpreted as local variation within the vegetation zone exploited by *Pupilla muscorum* rather than regional patterns of vegetation change. The $\delta^{18}O$ values hardly change over time in the Hungarian basin, but the values are consistent with a Mediterranean source for precipitation and a southward displacement of the North Atlantic Drift determining the climatic and environmental conditions in the Hungarian basin.

Acknowledgements

We like to thank Ed Kas for the laboratory preparation of the samples.

References

Balakrishnan, M. and C.J. Yapp 2004. Flux balance models for the oxygen and carbon isotope compositions of land snail shells. *Geochimica et Cosmochimica Acta* 68, 2007-2024.

Balakrishnan, M., C.J. Yapp, D.J. Meltzer and J.L. Theler 2005a. Paleoenvironment of the Folsom archaeological site, New Mexico, USA, approximately 10,500 14C yr B.P. as inferred from the stable isotope composition of fossil land snail shells. *Quaternary Research* 63, 31-44.

Balakrishnan, M., C.J. Yapp, J.L. Theler, B.J. Carter, D.G. Wyckoff 2005b. Environmental significance of 13C/12C and 18O/16O ratios of modern land-snail shells from the southern great plains of North America, *Quaternary Research* 63, 15-30.

Beets, C.J., S.R. Troelstra, P.M. Grootes, M.-J. Nadeau, K. van der Borg, A.F.M. de Jong, C.L. Hofman and M.L.P. Hoogland 2006. Climate and pre-Columbian settlement at Anse à la Gourde, Guadeloupe, Northeastern Caribbean. *Geoarchaeology* 21-3, 271-280.

Bonadonna, F.P., G. Leone and G. Zanchetta 1999. Stable isotope analyses on the last 30 ka molluscan fauna from Pampa grassland, Bonaerense region, Argentina. *Palaeogeography, Palaeoclimatology, Palaeoecology* 153, 289-308.

Bronk Ramsey, C. 2009. Bayesian analysis of radiocarbon dates. *Radiocarbon* 51-1, 337-360.

Colonese, A.C., G. Zanchetta, A.E. Fallick, F. Martini, G. Manganelli and D. Lo Vetro 2007. Stable isotope composition of Late Glacial land snail shells from Grotta del Romito (Southern Italy): palaeoclimatic implications. *Palaeogeography, Palaeoclimatology, Palaeoecology* 254, 550-560.

Colonese, A.C., G. Zanchetta, A.E. Fallick, F. Martini, G. Manganelli and R.N. Drysdale 2010. Stable isotope composition of Helix ligata (Müller, 1774) from Late Pleistocene-Holocene archaeological record from Grotta della Serratura (Southern Italy): Palaeoclimatic implications. *Global and Planetary Change* 71-3/4, 249-257.

Constantin, S., A.-V. Bojar, S.-E. Lauritzen and J. Lundberg 2007. Holocene and Late Pleistocene climate in the sub-Mediterranean continental environment: A speleothem record from Poleva Cave (Southern Carpathians, Romania). *Palaeogeography, Palaeoclimatology, Palaeoecology* 243, 322-338.

Dobosi, V. 2000 Interior parts of the Carpathian Basin between 30,000 and 20,000 bp. In: W. Roebroeks, M. Mussi, J. Svoboda and K. Fennema (eds), *Hunters of the Golden Age: the mid-upper Palaeolithic of Eurasia 30,000-20,000 BP*, Leiden, 231-239.

Ehleringer, J.R., T.E. Cerling and B.R. Helliker 1997. C4 photosynthesis, atmospheric CO2, and climate. *Oecologia* 112, 285-299.

Goodfriend, G.A. 1992. The use of land snail shells in paleoenvironmental reconstruction. *Quaternary Science Reviews* 11, 665-685.

Goodfriend, G.A. 1999. Terrestrial stable isotope records of Late Quaternary paleoclimates in the eastern Mediterranean region. *Quaternary Science Reviews* 18, 501-513.

Goodfriend, G.A. and C.L. Ellis 2000. Stable carbon isotope record of middle to late Holocene climate changes from land snail shells at Hinds Cave, Texas. *Quaternary International* 67, 47-60.

Hertelendi, E., P. Sümegi and G. Szöör 1992. Geochronologic and paleoclimatic characterization of Quaternary sediments in the Great Hungarian Plain. *Radiocarbon* 34-3, 833-839.

Kehrwald, N.M., W.D. McCoy, J. Thibeault, S.J. Burns and E.A. Oches 2010. Paleoclimatic implications of the spatial patterns of modern and LGM European land-snail shell $\delta^{18}O$. *Quaternary Research* 74, 166-176.

Krolopp, E. and P. Sümegi 1995. Palaeoecological reconstruction of the Late Pleistocene based on loess malacofauna in Hungary. *GeoJournal* 36.2/3, 213-222.

Lengyel, G. 2009. Radiocarbon dates of the “Gravettian entity” in Hungary. *Praehistoria* 9-10, 241-264.

Liu, Z.X, Z.Y. Gu, N.Q. Wu and B. Xu 2007. Diet control on carbon isotopic composition of land snail shell carbonate. *Chinese Science Bulletin* 52-3, 388-394.

Otte, M. 1998. Aspects du Gravettien Hongrois. *Acta Archaeologica Academiae Scientiarum Hungaricae* 50, 1-27.

Rudner, Z.E. and P. Sümegi 2001. Recurring Taiga forest-steppe habitats in the Carpathian Basin in the Upper Weichselian. *Quaternary International* 76/77, 177-189.

Sümegi, P. 2005. *Loess and upper paleolithic environment in Hungary: an introduction to the environmental history of Hungary*, Nagykovácsi: Aurea.

Sümegi, P. and E. Krolopp 2000. Palaeoecological reconstruction of the Ságvár-Lascaux interstadial (Upper Weichselian). In: Z. Mester and A. Ringer (eds), *À la recherche de l’homme préhistorique*, 103-111 (ERAUL 95).

Sümegi, P. and E. Krolopp 2002. Quatermalacological analyses for modelling of the Upper Weichselian palaeoenvironmental changes in the Carpathian Basin. *Quaternary International* 91, 53-63.

Sümegi, P. and Z.E. Rudner 2001. In situ charcoal fragments as remains of natural wild fires in the upper Würm of the Carpathian Basin. *Quaternary International* 76/77, 165-176.

Verpoorte, A. 2004. Eastern Central Europe during the Pleniglacial. *Antiquity* 78, 257-266.

Verpoorte, A. 2009. Limiting factors on early modern human dispersals: the human biogeography of late Pleniglacial Europe. *Quaternary International* 201-1/2, 77-85.

Willis, K.J., E. Rudner and P. Sümegi 2000. The full-glacial forests of Central and Southeastern Europe. *Quaternary Research* 53, 203-213.

Yanes, Y., C.J. Yapp, M. Ibanez, M.R. Alonso, J. De-la-Nuez, M.L. Quesada, C. Castillo and A. Delgado 2011. Pleistocene-Holocene environmental change in the Canary Archipelago as inferred from the stable isotope composition of land snail shells. *Quaternary Research* 75-3, 658-669.

Zanchetta, G., G. Leone, A.E. Fallick and F.P. Bonadonna 2005. Oxygen isotope composition of living land snail shells: data from Italy. *Palaeogeography, Palaeoclimatology, Palaeoecology* 223, 20-33.

AlexanderVerpoorte
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
a.verpoorte@arch.leidenuniv.nl

Simon Troelstra
Department of Paleoclimatology and Geomorphology
Faculty of Earth and Life Sciences
Vrije Universiteit
De Boelelaan 1085
1081 HV Amsterdam
The Netherlands

Kay Beets
Department of Paleoclimatology and Geomorphology
Faculty of Earth and Life Sciences
Vrije Universiteit
De Boelelaan 1085
1081 HV Amsterdam
The Netherlands

Pál Sümegi
Department of Geology and Palaeontology
P.O. Box 658
6701 Szeged
Hungary

Appendix

Supplementary material
Individual data for the samples from Lakitelek, Hungary

Identifier	^{13}C			^{18}O		
		Average	**s.d.**		**Average**	**s.d.**
ek/01-01	-6.18			-1.99		
ek/01-02	-6.55			-2.10		
ek/01-03	-6.79			-2.79		
ek/01-04	-7.21			-2.77		
ek/01-05	-6.68			-2.68		
layer 1		**-6.68**	**0.37**		**-2.47**	**0.39**
EK-2.2	-8.64			-3.00		
ek/02-03	-7.61			-4.78		
ek/02-04	-7.32			-3.47		
ek/02-05	-7.94			-3.42		
layer 2		**-7.88**	**0.57**		**-3.67**	**0.77**
ek/03-01	-7.52			-2.86		
ek/03-02	-7.48			-3.67		
EK-3.3	-8.09			-4.99		
ek/03-04	-8.19			-2.49		
ek/03-05	-8.48			-2.93		
layer 3		**-7.95**	**0.44**		**-3.39**	**0.99**
ek/04-01	-7.70			-4.07		
EK-4.2	-7.23			-3.18		
EK-4.3	-7.43			-3.43		
ek/04-04	-6.66			-2.78		
ek/04-05	-7.97			-2.70		
layer 4		**-7.40**	**0.50**		**-3.23**	**0.55**
ek/05-01	-7.51			-2.97		
ek/05-02	-6.86			-3.12		
EK-5.3	-7.17			-3.11		
ek/05-04	-6.69			-3.91		
ek/05-05	-6.86			-2.35		
layer 5		**-7.02**	**0.33**		**-3.09**	**0.56**
ek/06-01	-7.83			-3.73		
ek/06-02	-7.23			-3.45		
ek/06-03	-6.96			-4.00		
ek/06-04	-7.24			-3.16		
ek/06-05	-7.38			-2.30		
layer 6		**-7.33**	**0.32**		**-3.33**	**0.65**
ek/07-01	-6.39			-3.47		
ek/07-02	-6.87			-4.42		

Identifier	^{13}C			^{18}O		
		Average	s.d.		Average	s.d.
ek/07-03	-6.81			-4.03		
ek/07-04	-7.03			-2.18		
ek/07-05	-6.76			-4.58		
layer 7		**-6.77**	**0.24**		**-3.74**	**0.97**
ek/08-01	-7.49			-2.89		
ek/08-02	-7.05			-3.44		
ek/08-03	-5.92			-3.24		
ek/08-04	-8.08			-4.15		
ek/08-05	-8.24			-3.89		
layer 8		**-7.36**	**0.93**		**-3.52**	**0.50**
without 08-03		**-7.72**	**0.55**			
ek/09-01	-7.15			-1.78		
ek/09-02	-7.94			-4.24		
ek/09-03	-6.83			-2.42		
EK-9.4	-7.27			-3.40		
ek/09-05	-7.05			-3.76		
layer 9		**-7.25**	**0.42**		**-3.12**	**1.00**
EK-10.1	-7.26			-4.10		
ek/10-02	-7.45			-3.95		
EK-10.3	-7.70			-3.43		
EK-10.4	-7.46			-3.37		
ek/10-05	-6.81			-2.80		
layer 10		**-7.34**	**0.33**		**-3.53**	**0.52**
ek/11-01	-7.49			-4.08		
EK-11.2	-8.27			-2.34		
ek/11-03	-8.54			-4.72		
ek/11-04	-7.45			-2.81		
EK-11.5	-7.20			-5.23		
layer 11		**-7.79**	**0.58**		**-3.84**	**1.23**
ek/12-01	-7.99			-4.35		
ek/12-02	-9.02			-3.91		
ek/12-03	-9.45			-2.29		
EK-12.4	-9.62			-2.80		
ek/12-05	-9.34			-5.08		
layer 12		**-9.08**	**0.65**		**-3.69**	**1.14**
without 12-01		**-9.36**	**0.25**			
ek/13-01	-7.59			-4.08		
ek/13-02	-7.63			-4.36		
ek/13-03	-9.23			-5.38		
ek/13-04	-7.14			-3.73		
ek/13-05	-9.26			-3.98		
layer 13		**-8.17**	**1.00**		**-4.31**	**0.64**

Identifier	^{13}C			^{18}O		
		Average	**s.d.**		**Average**	**s.d.**
ek/14-01	-7.89			-3.86		
ek/14-02	-7.26			-3.83		
ek/14-03	-7.23			-1.91		
ek/14-04	-7.95			-3.08		
ek/14-05	-7.68			-3.29		
layer 14		**-7.60**	**0.34**		**-3.19**	**0.79**
ek/15-01	-6.94			-4.17		
EK-15.2	-7.25			-3.44		
ek/15-04	-7.57			-4.40		
EK-15.5	-7.07			-4.45		
layer 15		**-7.21**	**0.27**		**-4.12**	**0.47**
EK-16.1	-7.30			-4.27		
EK-16.2	-6.43			-3.84		
ek/16-03	-6.81			-3.10		
ek/16-04	-6.72			-2.34		
ek/16-05	-10.10			-3.20		
layer 16		**-7.47**	**1.50**		**-3.35**	**0.74**
without 16-05		**-6.82**	**0.36**			
ek/17-01	-6.81			-3.56		
EK-17.2	-6.99			-3.19		
ek/17-03	-7.37			-3.57		
ek/17-04	-7.17			-3.84		
ek/17-05	-6.90			-3.84		
layer 17		**-7.05**	**0.22**		**-3.60**	**0.27**
ek/18-01	-9.70			-3.04		
ek/18-02	-10.17			-4.10		
EK-18.3	-8.92			-2.96		
ek/18-04	-9.83			-3.50		
ek/18-05	-10.22			-3.50		
layer 18		**-9.77**	**0.52**		**3.42**	**0.46**

Confirmation of the presence of *Cucubalus baccifer* L. (Caryophyllaceae) in the British Pleistocene

Michael H. Field

A late Middle Pleistocene temperate stage plant macrofossil assemblage extracted from fluvial sediments collected from Belhus Park, Aveley, Essex, UK contained a seed of Cucubalus baccifer *L. (a member of the Caryophyllaceae family). It is an interesting record because today this species is not regarded to be native in Britain (Stace 1997). The species was recorded from an Ipswichian site near Ilford, Essex, UK (West* et al. *1964), but was not mentioned when Godwin (1975) catalogued the occurrence of plant taxa in the British Pleistocene. This may have caused confusion about the history of this species. The record from Belhus Park confirms that this species was present during the British Pleistocene.*

1 Introduction

Excavations made in 1979 at Belhus Park, Aveley, Essex, UK during the construction of the M25 Motorway exposed fluvial sediments (OS Grid Reference TQ 575810). These sediments were overlain by a clayey gravel deposit which contained archeological remains in the form of lithic artefacts (Gibbard 1994). Palynological analysis of the fluvial sediments revealed a single pollen assemblage biozone dominated by *Quercus*, *Alnus* and *Pinus* (Gibbard 1994). Other thermophilous deciduous tree pollen were represented (e.g. *Acer*, *Fraxinus* and *Tilia*) suggesting temperate conditions. A correlation was made with the first half of the Ipswichian Stage (the last interglaciation) (Gibbard 1994). More recently a multidisciplinary investigation of the fluvial sediments has been undertaken. A diverse plant macrofossil assemblage was recovered during this study. Woodland and shade tolerant taxa were well represented including *Acer campestre*, *Alnus glutinosa*, *Clematis vitalba*, *Cornus sanguinea*, *Frangula alnus*, and *Viburnum opulus*. A reedswamp existed at the margin of the channel composed of, for example, *Butomus umbellatus*, *Eupatorium cannabinum*, *Lythrum salicaria*, *Sparganium erectum* and *Typha*. The water-body was inhabited by a diverse submergent (e.g. *Ceratophyllum demersum* and *Groenlandia densa*) and emergent (e.g. *Azolla filiculoides* and *Trapa natans*) aquatic vegetation. The plant macrofossil data supports Gibbard's conclusion that conditions were fully temperate at the time of deposition but suggests that the sediments are older than the Ipswichian Stage. The megaspores of the heterosporous pteridophyte *Azolla filiculoides* were present in the sediments. *Azolla filiculoides* does not occur in the Late Pleistocene in north-west Europe (Field 1999). Amino acid racemization (AAR) data supports a pre-Ipswichian age. AAR ratios from the opercula of *Bithynia* recovered from the sediments allow correlation with Marine Isotope Stage (MIS) 9 (Penkman *et al*. 2011).

2 The fossil *Cucubalus baccifer* L. seed from Belhus Park

One sediment sample from Belhus Park (BP AB 5-25) yielded a seed of *Cucubalus baccifer* L. The seed is fractured but has retained its shape which is roughly ellipsoid (fig. 1a). The specimen is 1.95 mm long and 1.62 mm wide. On one side is a distinctive hilum which consists of a raised rim surrounding a deep depression (fig. 1b). The depression is 381 μm in diameter. Relatively small elongated cells run up the sides of the hilum. Under a light microscope the larger, almost circular, slightly domed surface cells can be clearly seen. Unfortunately, on the scanning electron micrograph the surface cells are not so pronounced, but can be seen (fig. 1c). For comparison a modern seed of *Cucubalus baccifer* L. (from the Halle Botanic Garden collection, Germany) is shown in figures 1d, 1e and 1f. The cracking on the surface of this modern seed occurred when it was placed in the scanning electron microscope.

3 Discussion

West *et al*. (1964) investigated organic sediments from a borehole that was located next to Seven Kings Station at Ilford, Essex, UK. Palynological data suggested that deposition of the sediments had taken place during the first half of the Ipswichian Stage. The plant macrofossil investigation of these sediments yielded one seed which was "of a comparable size, similar surface and matching cell pattern" to seeds of the extant *Cucubalus baccifer*. For whatever reason when Godwin (1975) compiled a list of the plant taxa represented in British Pleistocene sediments this species was not mentioned. Although dated, Godwin's *History of the British Flora* (1975) is still a useful starting point when establishing the presence or absence of a plant taxon in the British Pleistocene. An omission in Godwin's

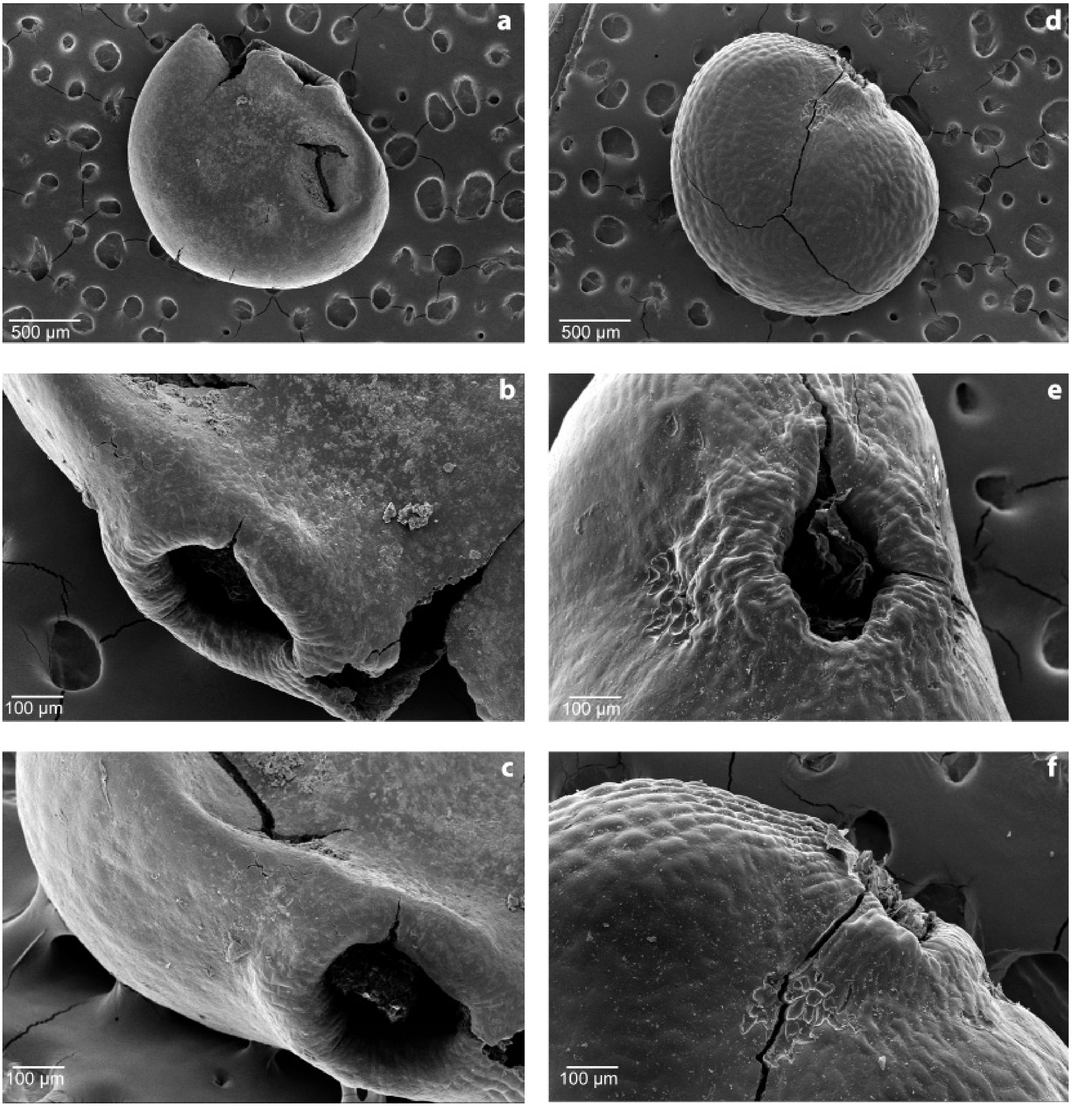


Figure 1 a, b and c the seed of C*ucubalus baccifer* L. extracted from late Middle Pleistocene fluvial sediments found at Belhus Park, Aveley, Essex, UK (sample BP AB 5-25); d, e and f – a modern seed of C*ucubalus baccifer* L. from the Halle Botanic Garden collection, Germany (Collected in 1979 at Wittenberg by Jage).

book may lead a researcher to conclude that a plant taxon had not been identified prior to its publication. To avoid confusion a note on the Belhus Park specimen is used to confirm this species' occurrence in the British Pleistocene record.

This Eurasian and North African species has been described as 'introduced' to Britain by Stace (1997). If this is the case the records from Ilford and Belhus Park would indicate that the range of this species has expanded and contracted at various times in NW Europe during the late Middle and Late Pleistocene, probably as a result of fluctuating climatic conditions. However, Clement and Foster (1994) and Lousley (1961) have considered whether it has native status in eastern England today. This can only be determined with certainty if Holocene records of *Cucubalus baccifer* are forthcoming. So far no Holocene records of this species have been made in the British Isles.

4 Conclusion

The presence of a seed of *Cucubalus baccifer* from fluvial sediments dated to MIS 9 at Belhus Park, Aveley, Essex, UK is confirmation that this species did occur in Britain during the Pleistocene.

Acknowledgements

The author would like to thank Prof.dr. Corrie Bakels for reading the manuscript, and Bertie Joan van Heuven (National Herbarium of the Netherlands, Leiden) for taking the SEM images.

Michael H. Field
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
m.h.field@arch.leidenuniv.nl

References

Clement, E.J. and M.C. Foster 1994. *Alien plants of the British Isles*. London: Botanical Society of the British Isles.

Field, M.H. 1999. Variations in *Azolla* section *Azolla* megaspore apparatus and their implications for palaeotaxonomy and European Pleistocene biostratigraphy. *Review of Palaeobotany and Palynology* 105, 85-92.

Gibbard, P.L. 1994. *Pleistocene History of the Lower Thames Valley*. Cambridge: Cambridge University Press.

Godwin, H. 1975. *History of the British Flora* (Second Edition). Cambridge: Cambridge University Press.

Lousley, J.E. 1961. The status of *Cucubalus baccifer* in England. *Proceedings of the Botanical Society of the British Isles* 4, 262-268.

Penkman, K.E.H., R.C. Preece, D.R. Bridgland, D.H. Keen, T. Meijer, S.A. Parfitt, T.S. White and M.J. Collins 2011. A chronological framework for the British Quaternary based on *Bithynia* opercula. *Nature* 476, 446-449.

Stace, C. 1997. *New Flora of the British Isles* (2nd Edition). Cambridge: Cambridge University Press.

West, R.G., C.A. Lambert and B.W. Sparks 1964. Interglacial deposits at Ilford, Essex. *Philosophical Transactions of the Royal Society of London* 247, 185-212.

Beyond '15-minutes': revisiting the late Middle Pleistocene archaeological record of Maastricht-Belvédère (The Netherlands).

Dimitri De Loecker and Wil Roebroeks

The record from the late Middle Pleistocene site complex Maastricht-Belvédère has been studied for more than three decades, with new analyses still ongoing. The 1980s excavations uncovered a series of well-preserved find distributions, which reflect episodic short-term occupation of parts of the river Maas valley during a full interglacial period. While Middle Palaeolithic technologies are often envisaged as '15-minute cultures', the Maastricht-Belvédère studies of specific find categories, e.g. flint raw materials, possibly hafted artefacts, hematite finds and heated artefacts, suggest that early Neandertal behaviour may have gone beyond the limits of '15-minute' flint knapping episodes or short butchering events.

1 Prologue

Neandertals are generally seen as having had a very mobile lifestyle, characterized by a high residential mobility (Binford 1980). In fact, until the later phases of the Palaeolithic, Pleistocene foragers in general invested very little in camp layout, in dwelling structures, or in the construction of formal hearths. The late Middle Pleistocene (Marine Isotope Stage [MIS] 7, see below) Maastricht-Belvédère-evidence is also generally seen as reflecting episodic and short-term occupation of parts of the river Maas valley, minimally 250,000 years ago, in line with the dominant view of Middle Palaeolithic technologies as '15-minute cultures' (cf. McCrone 2000; Hallos 2005).

More than three decades after the start of the excavations (Roebroeks 1988), the study of the Maastricht-Belvédère record is still ongoing. Specific find categories, e.g. lithic raw materials in relation to different technological approaches (De Loecker 2006), hafting/microwear analysis of pointed tools (Rots, in press; Rots and De Loecker, in prep.), studies of hematite finds (Roebroeks *et al*. 2012), and spatial interpretation of heated artefacts and charcoal particles (Stapert 1990; 1992; 2006; 2007a and b), suggest that some of the activities performed there may have gone beyond the limits of opportunistic '15-minute' flint knapping episodes or short butchering events (cf. Roebroeks and Tuffreau 1999); instead, some data suggest that considerable time, energy and skill was invested at certain localities, in order to execute specific technology (or food) related maintenance and production tasks.

This paper integrates data from these recent Maastricht-Belvédère studies and demonstrates that we are only dealing with a 'hit-and-run' record at first sight: at Sites C, G, K and N, early Neandertals entered the localities with finished tools, well-prepared technological products as well as with raw materials, in anticipation of tasks to be performed on the spot. Each of these elements required special consideration, time investment and control of raw materials. While equipped with tools produced elsewhere, these foragers also used locally available raw materials to produce 'situational gear' (De Loecker 2006). We will focus here on the use and organization of technology, to illustrate and explain the complexities of the artefact distributions recorded at Maastricht-Belvédère. After a brief introduction to the Maastricht-Belvédère site and the studies thereof, a summary of the local Pleistocene archaeology is given. Next, the specific find categories are presented, together with their interpretations. We will end with a brief discussion of the results.

2 Introduction to the Maastricht-Belvédère setting

The former Maastricht-Belvédère loess and gravel pit is located on the left bank of the river Maas (or Meuse), approximately one km north-northwest of the Dutch town of Maastricht (50° 52'09.40''N, 5°40'27.33''E). The early Middle Palaeolithic site complex, which has been under study since the 1980s, is situated on the northern border of the Northwest European loess-belt. Fieldwork at this locale focused on an interdisciplinary study of flint distributions, which occasionally were associated with faunal remains (Roebroeks 1988; De Loecker 2006). The hominin traces, in the form of artefact scatters and patches (cf. Isaac 1981), were generally preserved in a primary archaeological context in fine-grained sediments of the Middle Pleistocene River Maas. High rates of sedimentation created assemblages of a very limited time-depth (in Pleistocene terms) and enabled extensive refitting, spatial analyses and interpretations beyond the site-level. By the end of 1990 excavations had uncovered a total of eight archaeological sites, together with a series of test pits (see table 1). In total, a surface of 1577 m² was excavated of an area of approximately six hectares of quarry (Roebroeks 1988; Roebroeks *et al*. 1992; De Loecker 2006).

Site	Area dug (m²)	Total number of artefacts	Heated artefacts		Heated-natural-flints	Charcoal
			n	%	n[2]	
A	5	80	1	1.3	-	-
B	20	6	-	-	-	-
C	264	3067[1]	132[1]	4.3[1]	27	Many (>5800) particles, clusters
D	-	11	-	-	-	-
F	42	1177	15	1.3	-	Few particles
G	61	75	-	-	32	-
H	54	270	1	0.4	-	-
K	370	10,912	617	5.7	-	Few particles
N	765	450	1	0.2	-	-

[1] Site C figures after Roebroeks (1988; n= 3067).
[2] Not counted as artefacts.

Table 1 Maastricht-Belvédère. A comparison of fire related relics from the Unit IV primary context sites. (The figures are mainly after De Loecker 2006).

The Middle Pleistocene river deposits yielded a full interglacial vertebrate fauna with 26 species (van Kolfschoten 1993) and a rich mollusc fauna containing more than 70 land and freshwater species (Meijer 1985). The terrace and loess stratigraphy, as well as the mammal and mollusc biostratigraphical evidence, indicate an age before the next-to-last glacial, *i.e.* prior to MIS 6 (van Kolfschoten *et al.* 1993). Thermoluminescence dating of heated flint artefacts yielded an age of 250 ± 20 ka (Huxtable 1993), and electron spin resonance dating of shells gave an age of 220 ± 40 ka, all corresponding to MIS 7 (van Kolfschoten *et al.* 1993). However, amino acid racemization dating of *Corbicula* shells from the interglacial deposits as well as biostratigraphically important elements of the mollusc fauna itself suggest an earlier, MIS 9 age for the Belvédère interglacial and its associated archaeology (Meijer and Cleveringa 2009). For this paper it is sufficient to say that the archaeological material from the main find-bearing sediments, Unit IV, was recovered in the upper fine-grained part of a series of sediments deposited by a meandering river during MIS 7 (or possibly MIS 9). These fine-grained late Middle Pleistocene river deposits were subsequently covered by a thick sequence of Saalian and Weichselian silt loams (*i.e.* reworked and primary loesses).

3 Theoretical background: from east Africa to southern Limburg

While documenting the spatial distribution and the nature of Lower Palaeolithic stone artefacts and faunal remains in the Koobi Fora area (East Turkana, Kenya), Isaac and his colleagues observed that "... concentrated, localised accumulations of refuse …." (Isaac 1981, 133) were mostly present against a background of diffuse find scatters. Their 'scatters-between-the-patches' project proposed a hierarchy of levels for structuring and understanding the spatial configurations across Palaeolithic landscapes. The diversity of recovered artefact (and bone) distributions ranged from high-density patches of stone artefacts associated with bones from several different animal species, through concentrations of lithics associated with bones from a single large animal, and lithic clusters without the associated bones (or *vice versa*), to the low-density scatters of lithic artefacts and/or bones. Isaac (1981) eventually suggested that there may have been significant functional differences between the high-density patches and the diffuse scatters between these places. Focusing on tool compositions, the latter were thought to represent recurrent activities possibly associated with foraging activities. As a result of these variations in quantity and composition, the examined surfaces were described as different types of 'sites', suggesting distinct behavioural patterns (*e.g.* Isaac and Harris 1978; Isaac 1978; 1981; Isaac and Crader 1981; Isaac *et al.* 1981; Stern 1991). Although these 'site types' readings of the record have been criticized (cf. Stern 1993; 1994), Isaac's scatters and patches model stresses at least the analytical (comparative) importance of treating the 'high and low' artefact distributions as parts of a 'single system' (see also Foley 1981a and b). It was amongst others through the work of Stern (1991; 1993), Roebroeks *et al.* (1992) and Conard and Adler (1997), that Isaac's notion of spatial, quantitative and typo-/technological artefact variations in a palaeo-landscape gained attention in the 1990s. Archaeologists came to realize that they needed to overcome the 'solitary site' focus in order to learn more about the spatial movements and activities of Palaeolithic foragers. Hunter-gatherers operate in a landscape and therefore both the low-density scatters and high-density patches should be studied as the output of former mobile systems, not only the highly visible 'rich' sites. On top of that, archaeologists also needed to keep in mind that they were probably looking at archaeological landscapes "generated episodically and not (at) the remains of a cultural geography wherein populations operated out of 'camps' into an environment, as do modern human populations." (Binford 1987, 29).

In an effort to explain the spatial distributions at Maastricht-Belvédère, Isaac's scatters and patches approach was used as a heuristic device. This resulted in the excavation of a 'non-site', Site N. Here, a surface of 765 m² was meticulously excavated and recorded with the explicit aim of studying the 'background scatter' of flint artefacts and bones present in the interglacial river deposits. The information from this low-density scatter was used to interpret the large-scale and continuous artefact distribution, both in low and high densities, referred to as a 'veil of stones' by Roebroeks *et al.* (1992). A comprehensive lithic analysis showed that the main differences between the various sites, apart from differences in find densities, were to be found in fine-tuned typo-/technological variations (differences in percentages and ratios). At the same time, quantitative and qualitative refitting studies proved to be fundamental for the study of these subtle yet important differences (De Loecker *et al.* 2003; De Loecker 2006).

4 Analyses 'beyond the site-level'

At Maastricht-Belvédère an effort was made to transcend the individual 'site-level' by integrating all the available data into an 'off-site' approach (Foley 1981a and b; Isaac 1981). The several find distributions were treated as part of 'one single' system, in which different activities were performed in different parts of the landscape (cf. Roebroeks *et al.* 1992; De Loecker and Roebroeks 1998). At least at Belvédère it seemed legitimate to compare the different lithic scatters and patches, all recorded from the same fine-grained Unit IV sediments and probably contemporaneous in Pleistocene terms – having been formed during a relatively short phase within the same warm-temperate interglacial period. Furthermore, the find distributions were documented in a rather small area, which would suggest that they were formed under the 'same' micro-environmental conditions, with no reasons to assume that any significant changes in raw material availability had taken place. Precisely these research conditions were the inspiration for the long-lasting field efforts, and created the right setting for high-resolution analyses and interpretations of a technological landscape.

5 Characterization of the Maastricht-Belvédère 'Veil of stones'

The artefact distributions at Maastricht-Belvédère documented a number of well-preserved 'on-site' activities which left a continuous artefact distribution on the palaeo-surface (Roebroeks *et al.* 1992). Generally, two different kinds of find distributions can be distinguished within this spatial continuum. On the one hand, there are the 'high density patches' Sites C, F, H and K. These are characterized by clusters of flint knapping debris, with many dorsal/ventral refits realized during conjoining studies (Roebroeks 1988; Schlanger 1994; 1996; De Loecker 2006). At the other end of the density scale are the low density 'off-site' distributions of Sites G and N. These predominantly consist of isolated and/or small groups of flakes, tools which yielded relatively few dorsal/ventral refits. Tools are far more important in the scatters than in the patches. Site K stands out as relatively high numbers of tools were recorded here. Most of these tools may have arrived at the findspot as well-prepared finished (Levallois) products. The high number of cores at Site K is also striking, with all produced on the spot. The fact that cores were discarded in large quantities suggests that they were probably intended for local use only (De Loecker 2006). The Site K, F and H assemblages are mainly the result of a disc/discoidal reduction strategy (cf. Boëda 1993) with limited attention for core preparation. It can be concluded that these 'high density patches' are characterized by an *ad hoc* (expedient) technology.

A completely different kind of 'high density' find distribution was excavated at Site C (Roebroeks 1988). Here, several 'smaller' clusters were situated close to each other. The Site C flint assemblage is characterised by a well-prepared core approach, with several 'classic' Levallois flakes and the products of a *débitage Levallois recurrent* (*cf.* Boëda 1986; 1993; 1994). Refitting showed that several cores (and tools and flakes), in various stages of reduction, were introduced at the Site C location to be further worked on, and subsequently transported away from the excavated area. This is in clear contrast to Sites K, F and H where most of the reduction sequences started and ended within the excavated area.

Between the large clusters of artefacts, a diffuse artefact distribution was present all through the fluvial sediments at Maastricht-Belvédère. Segments of this low density distribution have been excavated at Sites G and N (Roebroeks 1988; Roebroeks *et al.* 1992). No clear artefact concentrations could be described. The mean artefact density was very low, ranging between 0.58 (Site N) and 1.22 (Site G) artefact/m². The highest percentages of tools were recorded at these scatters, with the tools recovered as stray finds and 'worn out'. These implements are considered to represent the discarded parts of transported 'tool kits'. Only very few refits could be established, which represent small parts of spatially fragmentized reduction/retouching sequences, while more than half of the Site G and N conjoinings consist of broken artefacts. Moreover, the flakes from these low density scatters are larger than the ones from the rich sites, and beyond being voluminous, they have the highest mean number of scars and they show low cortex and flaw percentages. Their butts and dorsal surfaces are better or more often prepared, while the faceting indices are among the highest at Belvédère. The used raw materials show a large heterogeneity, which is also clear from the rather negative refitting results: *i.e. Aufeinander-passungen* (cf. Cziesla 1986; 1990). This seems to suggest that the 'low density' scatters reflect a series of non-related activities (separated in time and space) of early Neandertals in the river valley landscape during various foraging trips.

All in all, compared to the 'high density' patches, these 'low density' scatters show distinct differences in the spatial patterning of the finds, in typology, technology and in raw material composition (for an overview of the inter-site differences, see, Tables 5.1 up to 5.20 in De Loecker 2006).

6 Organization of technology: data collection

Besides flint knapping, other activities may have been performed at the Maastricht-Belvédère locales. It is however impossible to indicate the exact nature of these other site functions, as we are dealing here with a number of analytical limitations. For instance, only limited amounts of (usually badly preserved) bone material were recovered. This could simply mean that at certain localities (*e.g.* Site K) there never were faunal remains present, or it could be an outcome of decalcification of the site-matrix. Post-depositional processes were also responsible for the virtual absence of unambiguous use-wear traces. Some artefacts did display microscopic traces of use, but weathering prevented determination of the exact type of former use (van Gijn 1988; 1989). However, there is some data indicative of the character of some activities, *e.g.* food (meat) acquisition, as suggested for Site C and especially for Site G (Roebroeks 1988).

6.1 Lithic raw material acquisition in relation to different technological approaches: Sites K and C

The Middle Palaeolithic record indicates that Neandertals were continuously transporting lithic equipment across the landscape. Since the 1980s a wide variety of studies showed that a broad assortment of morphological forms, usually made on non-local materials, was part of the mobile tool kit, *e.g.* scrapers, Levallois flakes/cores and handaxes (Geneste 1985; Roebroeks *et al.* 1988; Féblot-Augustins 1993; 1999). In addition, several authors (Roebroeks *et al.* 1992; Meignen *et al.* 2009) stated that irregular flakes, cortical flakes, flake fragments, *éclats debordants* and even small chunks (Roebroeks *et al.* 1992; Floss 1994) were transported as well. Raw material studies also suggested that the travelled distances sometimes exceeded 100 kilometres (Roebroeks *et al.* 1988; Roebroeks and Tuffreau 1999).

Understanding the initial choice and selection of raw materials for production of specific tools and cores and/or tasks is a difficult endeavour. Contextual factors such as raw material quality, abundance and accessibility, as well as thoughts about activities to be carried out in the future are amongst the determinants in raw material procurement and consumption processes (Dibble 1995; Ashton and White 2003). Each type of raw material required a separate evaluation, or better, a different 'conceptual scheme', to predict the eventual suitability for specific activities (Andrefsky 2009).

At Maastricht-Belvédère Site K an extensive refitting programme resulted in the conjoining of 1828 artefacts (16.8% of the total number of artefacts), *i.e.* 60.4 kg (61.7%) of the total weight of the flint assemblage (97.8 kg). These conjoinings, together with high percentages of cortex, indicate that several flint nodules entered the area without any (or hardly any) preparation, decortication or testing (figs 1 and 2). Within the excavated area the flint blocks were initially split into smaller units and decorticated. Intra-site spatial patterning shows that the individual parts or cores were subsequently transported to other zones within the excavated area. There further core-reduction and finally discard took place (De Loecker 2006). Although occasionally larger flakes were used as cores, natural flaws clearly played a major part in this initial 'flaking' or splitting of the nodules. Together with some technological 'flaking failures' (cf. Shelley 1990), this could indicate an unselective choice of raw material or a lack of better quality raw material. The Site K assemblage is generally characterized by large dimensions and few but large dorsal negatives on both cores and flakes, with minimal attention for core preparation. Usually the negatives of flakes from an earlier stage in the reduction process are used as striking platform. The elaborate refitting study shows a strategy in which long 'uninterrupted' sequences of flakes were produced by means of a 'unifacial' and/or an interchanging bifacial disc(oidal) core approach (cf. Boëda 1993). Cores were constantly turned and twisted to maintain good flaking angles. As a result the assemblage can be described as reflecting a continuous, sometimes radial, removal of flakes. This makes it very difficult, or even impossible, to distinguish separate groups of flakes as 'waste' or as 'desired' products.

Strikingly, Levallois products (cf. Bordes 1961; Boëda 1984; 1986; 1988; 1993; Van Peer 1992) are virtually absent in the Site K assemblage. Refitting results show however that for a limited number of nodules, and/or phases in reduction sequences, more attention was paid to the preparation of the core. This concerned higher-quality, 'finer' grained flint and

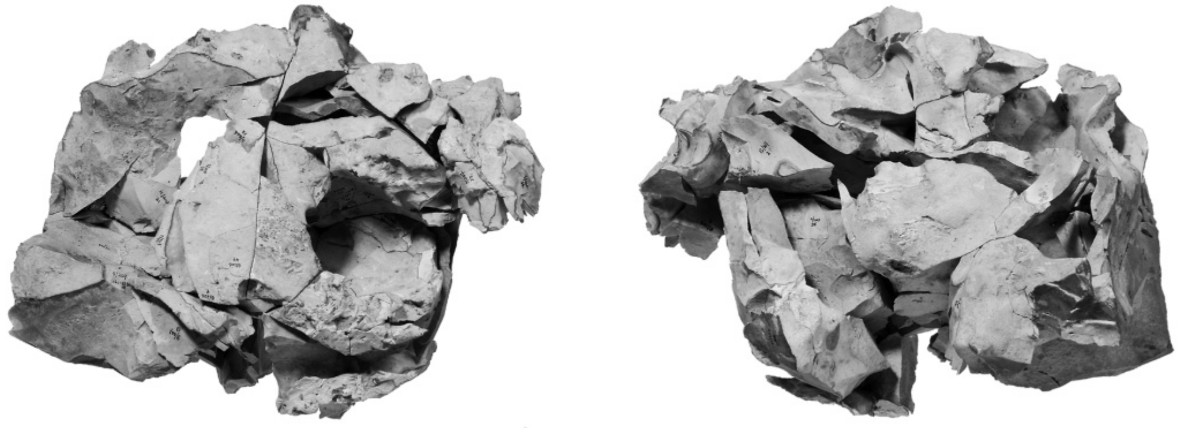


Figure 1 Maastricht-Belvédère Site K. Refitted composition I shown from two sides (length = 253 mm, width = 330 mm, thickness = 285 mm). The nodule weighs 9.286 kg (15.4% of the total weight of all conjoined Site K artefacts) and consists of 160 artefacts. It represents nine separately reduced parts or cores. (Figure after De Loecker 2006, 41).

Figure 2 Maastricht-Belvédère Site K. Refitted composition II measures 350 mm in cross-section and weighs 0.775 kg (1.3% of the total weight of all conjoined Site K artefacts). The nodule consists in total of 146 artefacts and represents eight separately reduced parts or cores. (Figure after De Loecker 2006, 54).

some of these products can even be interpreted as 'preferential' Levallois-like flakes (*e.g.* De Loecker 2006, composition X). One could suggest that at Site K a disc/discoidal core approach was applied as an immediate response to 'inferior' quality raw material. By means of this flexible reduction strategy, technological errors can 'easily' be repaired and natural imperfections surmounted quite economically (Boëda 1993). However, when a 'finer' grained flint nodule (or part of it), less affected by flaws, was used it seems that the technological strategy was slightly adjusted. Striking platforms and especially striking surfaces are now better prepared and the core-reduction strategy seems more oriented towards the production of 'desired products' (*éclats préférentiels*).

Such a technological adaptation to flint quality is also suggested by the Site C assemblage (Roebroeks 1988). Here, a *débitage Levallois recurrent* core approach (Boëda 1986; 1993; 1994) was used for the reduction of very 'fine' grained flint cores, while a discoidal one was used in the reduction of more 'coarse' grained flint. It should be mentioned though that the technological behaviour as described for Site K, is different from that at Site C (Roebroeks 1988), where most of the cores were carefully prepared and reduction reflects a more economical behaviour than at Site K. Moreover, the amount of cortex and refitting showed that at Site C a number of cores (and flakes) were introduced into the excavated area in already reduced forms, while at Site K all stages of the core reduction were performed on-the-spot. Beside some backed knives, notched pieces, denticulates and pieces with signs of use, various types of scrapers dominate the Site K tool assemblage. Refitting and a raw material study showed that only few flakes were selected from the bulk of debitage to be used for tool (*sensu stricto*) production. For tools produced on-the-spot the emphasis was clearly on implements other than scrapers: virtually all scrapers were introduced at Site K as ready-made objects. These products, mostly convergent and double-edged side scrapers, were already retouched into their final form outside the excavated Site K area (fig. 3a and 3b), made on 'fine' grained and well-prepared (Levallois *sensu stricto*) blanks. Hence, the transported Site K tool assemblage shows a clear relationship between a Levallois *sensu stricto* core approach, performed on transported 'fine' grained raw materials, and the occurrence of convergent (including Mousterian point) and double-edged side scrapers (cf. Geneste 1985). Other inter-site information is given by the few non-conjoinable (re)sharpening flakes (cf. Cornford 1986). They represent tools which were introduced and maintained at Site K, and subsequently transported away from the excavated area. Refitting also shows that some of the introduced flakes (blanks) were on-the-spot transformed into tools and discarded at the place of their production (fig. 4).

In summary, a 'tool kit' consisting of well-prepared flakes and scrapers entered the excavated Site K area, perhaps for subsequent use or maintenance. Part of the 'tool kit' was discarded on the spot. Another part, possibly supplied with newly-made tools, was transported away from the site. All this suggests a technological interaction between Site K and other locations in its surroundings. Moreover, the main Site K reduction strategy was not directly aimed at the production of well-prepared cores to be transported to other locations, as suggested for Site C (Roebroeks 1988). On the contrary, the intensive local knapping was mainly concentrated on the production of flakes and to a minor degree on tool manufacture. The many technological 'flaking failures/errors', together with the coarse-grained flint quality and the many natural imperfections, could support this assumption. Site K can, therefore, be seen as a space where technology was produced and maintained, while most of the technology was used elsewhere in direct subsistence and 'non-maintenance' activities (Isaac 1981; Roebroeks *et al.* 1992). However, beside flake production, a range of other activities, involving the use of flint tools (mainly scrapers and possibly hafted implements, see sub-section 6.4), could have been practised on the spot as well. This is suggested by the locally produced flakes and tools, which sometimes ended up at some distances from their production debris. Perhaps controlled fire was involved as well (see sub-section 6.2).

We have mentioned striking differences in raw material quality between locally produced items (more 'coarse' grained flint with abundant natural imperfections and flaws) and transported Levallois (-like) objects (predominantly 'fine' grained flint). Since the Levallois technique has a complicated *chaîne opératoire*, it can be stated that time and energy have been invested in the procurement and selection of suitable raw materials. In general the Pleistocene gravel beds of the river Maas (Unit III in the local sequence) contain pebbles of several different types of flint, and in that sense all Maastricht-Belvédère flints are 'local', as the gravels also contained the finer grained flint. At all Maastricht-Belvédère Unit IV sites fluvially abraded cortex was present. This indicates that raw materials (*i.e.* large flint cobbles at Site K) were probably collected from nearby river Maas deposits (Roebroeks 1988). According to palaeoenvironmental reconstructions based on the work of Meijer (1985) and Duistermaat (1987), the Unit IV archaeological sites were located at *c.* 100 to 200 metres from the main river stream, located near a shallow pool with gently flowing or stagnant water surrounded by abundant marshy vegetations, changing into alder forests with ash trees higher up in the landscape (van Kolfschoten 1985; Meijer 1985; Duistermaat 1987). This means that no gravel beds (raw material sources) were present within a radius of at least 100 to 200 metres around Site K. This possibly also means that after procurement, energy and time was invested in transporting the large and 'heavy' nodules, at least 97.8 kg in total weight (De Loecker 2006),

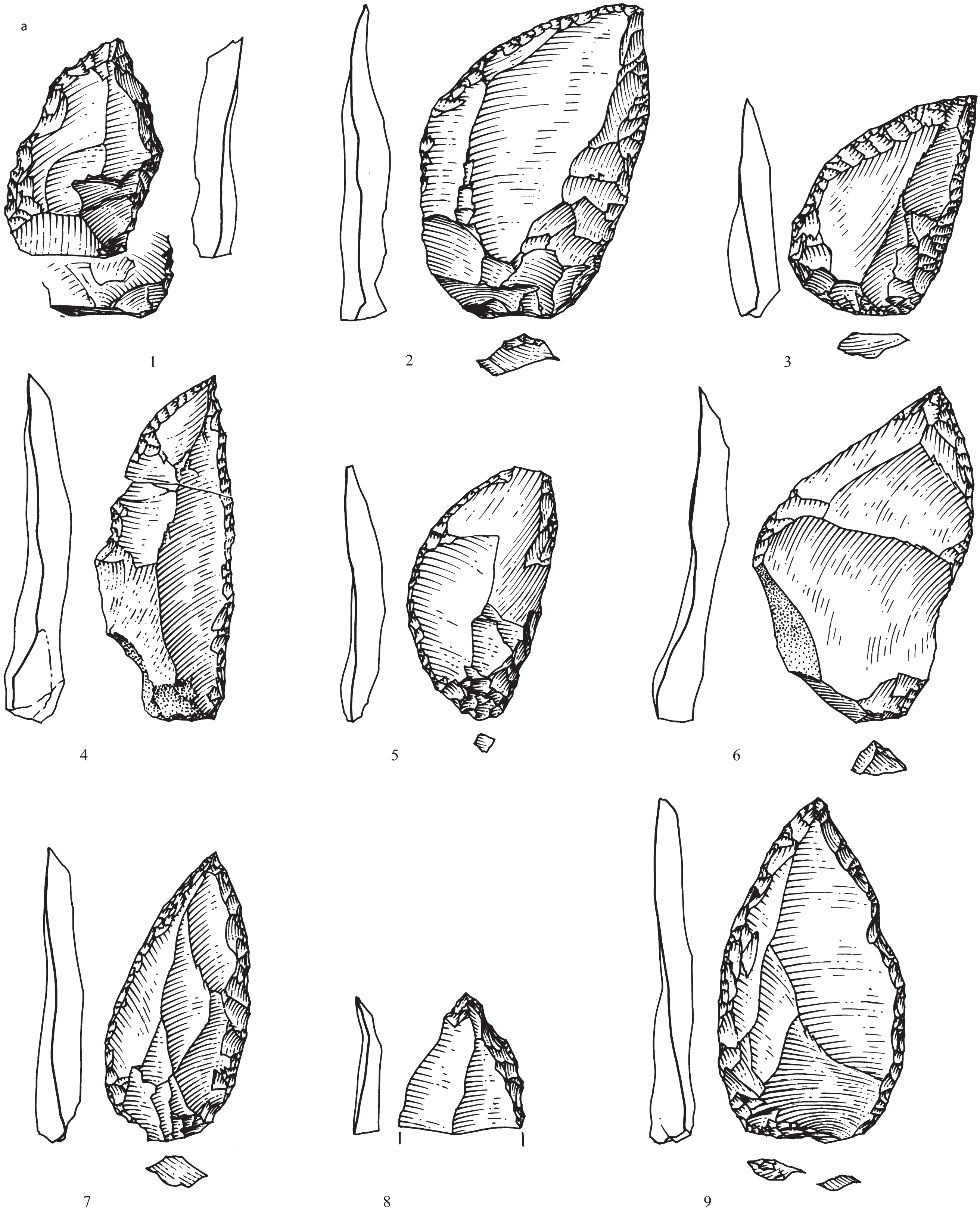


Figure 3a Maastricht-Belvédère Site K. Some of the 111 retouched tools *sensu stricto* (déjeté scrapers). The tools show a rather triangular morphology and could not be incorporated in one of the many refit sequences from Site K. Scale 2:3. (Figure after De Loecker 2006, 509).

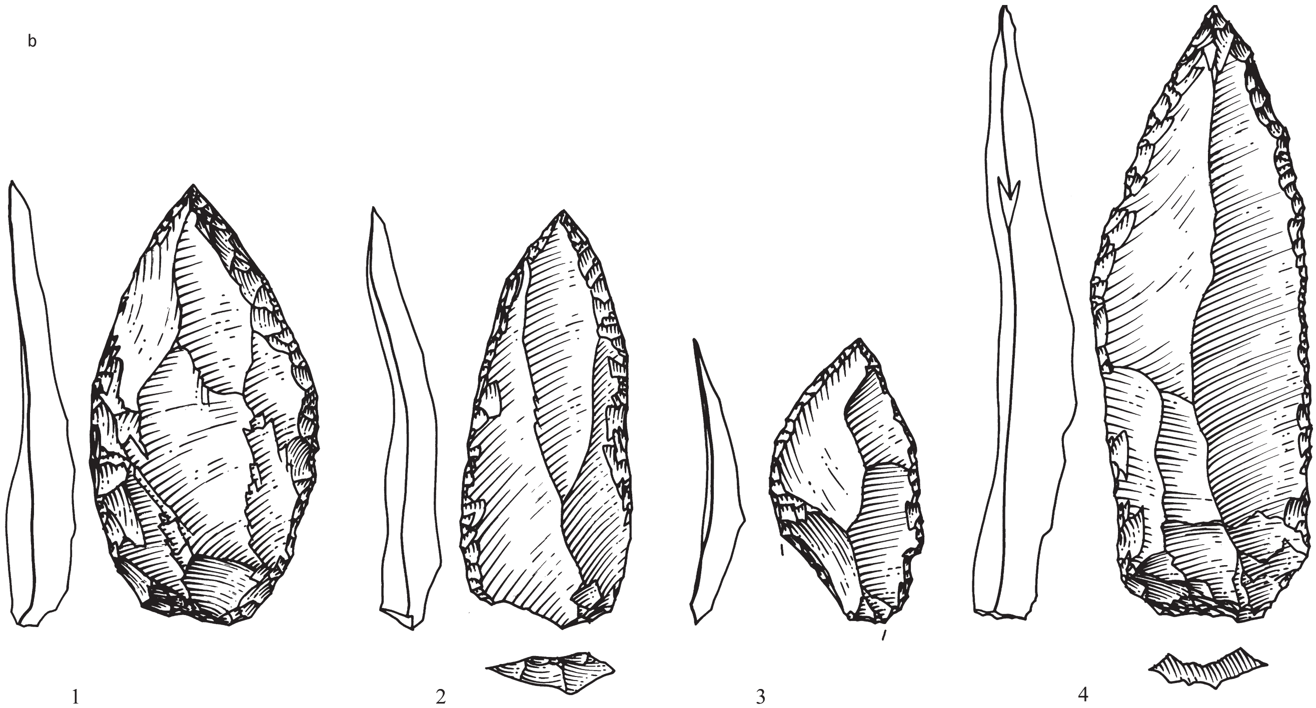


Figure 3b Maastricht-Belvédère Site K. Some of the 111 retouched tools *sensu stricto* (Mousterian points/convergent side scrapers). The tools show a rather triangular morphology and could not be incorporated in one of the many refit sequences from Site K. Scale 2:3. (Figure after De Loecker 2006, 507).

over a minimum distance of 100 to 200 metres, to the Site K locus. The fact that these nodules entered the area without any (or hardly any) preparation, decortication or testing implies a rather opportunistic behaviour, parallel to, or complementary to, the well-planned activities suggested by proper-prepared mobile (Levallois) items. At least it can be assumed that Site K was of such importance to early Neandertal foragers, that a considerable amount of energy and time was invested in carrying large and heavy flint nodules to the activity area. Together with the transported tool kit this emphasizes a capacity to anticipate needs and suggests that sometimes longer periods of time were spent at a certain location.

6.2 Clustered heated artefacts, charcoal particles and heated-natural-flints at Sites C, G, F and K

Especially the rich artefact clusters of Sites K and C, and to a lesser degree Site F, yielded considerable numbers of heated flint artefacts (table 1). In all three cases they were recovered together with (some) charcoal particles. Site C produced two dense concentrations of charcoal fragments, up to one cm in size (Roebroeks 1988). Heated-natural-flints were found at Site C, but the largest counts were realized at the low-density Site G.

At Site G a total of 75 flint artefacts were excavated together with poorly preserved faunal remains (Roebroeks 1988; van Kolfschoten 1990; 1993). The Site G spatial distribution shows a scattered occurrence of flint artefacts, together with a more clustered appearance of different faunal remains (mostly molars). None of the recovered artefacts showed signs of heating, but 32 heated-natural-flints were excavated, concentrated in the north-western part of the site (see figure 72 in Roebroeks 1988). It is impossible to say whether these heated-natural-flints are related to human activities or not. Roebroeks (1988, 69-70) stated that “the rather concentrated character of the distribution of these finds indicates that we may be dealing with the consequences of a fire that burned inside or close to the area sampled in the Site G excavation”, but did not go any further than this observation.

Besides some charcoal particles, Site F yielded 1177 lithic artefacts. Most artefacts were clustered in the northern part of the excavation, partly already destroyed by quarrying activities. The flint material includes 15, mostly small, heated artefacts which, together with a few charcoal particles, could indicate the presence of fire at the site. Again, it is difficult to say whether these heated artefacts relate to human activities or to natural fire.

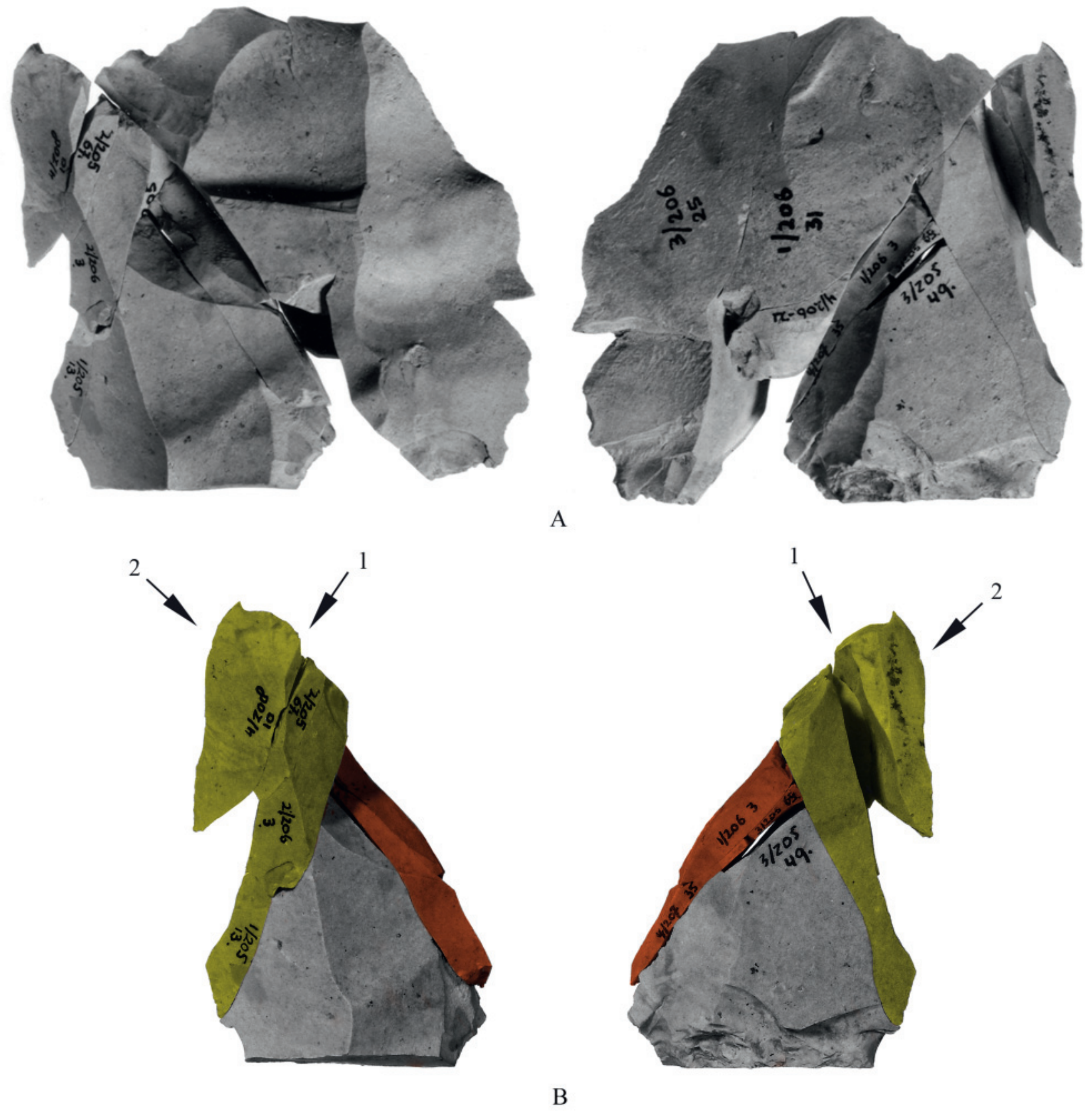


Figure 4 Maastricht-Belvédère Site K. Refitted composition XVI has a maximum dimension of 94 mm and weighs 0.084 kg (0.1% of the total weight of all conjoined artefacts). The large flake (A) consists of 11 artefacts and represents a transported item. Subsequently the flake was reduced into a typical burin (B) and a notched piece. 1 (yellow): Sequence of burin spalls, flaked from a lateral side of the artefact. 2 (orange): 'Second' series of burin spalls, produced from the other lateral side, using the scars of the previous flakes as striking platform. Scale 1:1. (Figure after De Loecker 2006, 106)

Between December 1986 and July 1987 Site K was excavated. Apart from some badly preserved possible bone fragments and some scattered particles of charcoal, the Site K assemblage consisted of 10,912 lithic artefacts. The flint assemblage includes 137 tools (mostly scrapers), 91 cores (mostly disc and discoidal) and 10,684 pieces of flaking debris. As discussed above, the refitting programme resulted in the conjoining of 1828 artefacts. The spatial distribution maps show a very dense cluster of artefacts in the south-eastern part of the excavated area. This concentration consists mainly of cores and conjoinable *débitage*. Tools *sensu stricto* are clustered in the centre of the excavated area (De Loecker 2006).

A total of 617 artefacts (5.7% of the total number of artefacts) were identified as heated. The highest densities of heated artefacts occur in the southern part of the excavated area, exactly the area where the bulk of flaking debris was present (fig. 5). Two zones with relatively high densities of heated artefacts (up to 30/m²) are in the south-eastern and south-western part of the site. Amongst the heated artefacts, two pieces with macroscopic use-wear and a convergent straight side scraper were identified in the south-eastern cluster. A heated core (tool?) was located in the north-west. The refitting exercise resulted in the conjoining of small potlids onto their ‘parent’ pieces. In total 61 *Einpassungen* (heat-damage/inserts, cf. Cziesla 1986; 1990) were established, which spatially coincide with both southern clusters. The largest refitted group of heated elements, a large imported (‘non-local’) flake consisting of 15 elements and measuring 85 mm, was recovered from the south-western smaller cluster (see figures 3.74 and 3.75 in De Loecker 2006). In addition, a few charcoal particles were scattered over the entire excavated area of 370 m² (see table 1).

The horizontal patterns and especially the conjoining results suggest that a fire burnt on the spot. It is, however, difficult to distinguish between natural (wild) fires and those for which early humans were responsible. Some observations could be relevant here though. First of all, at Site K there are

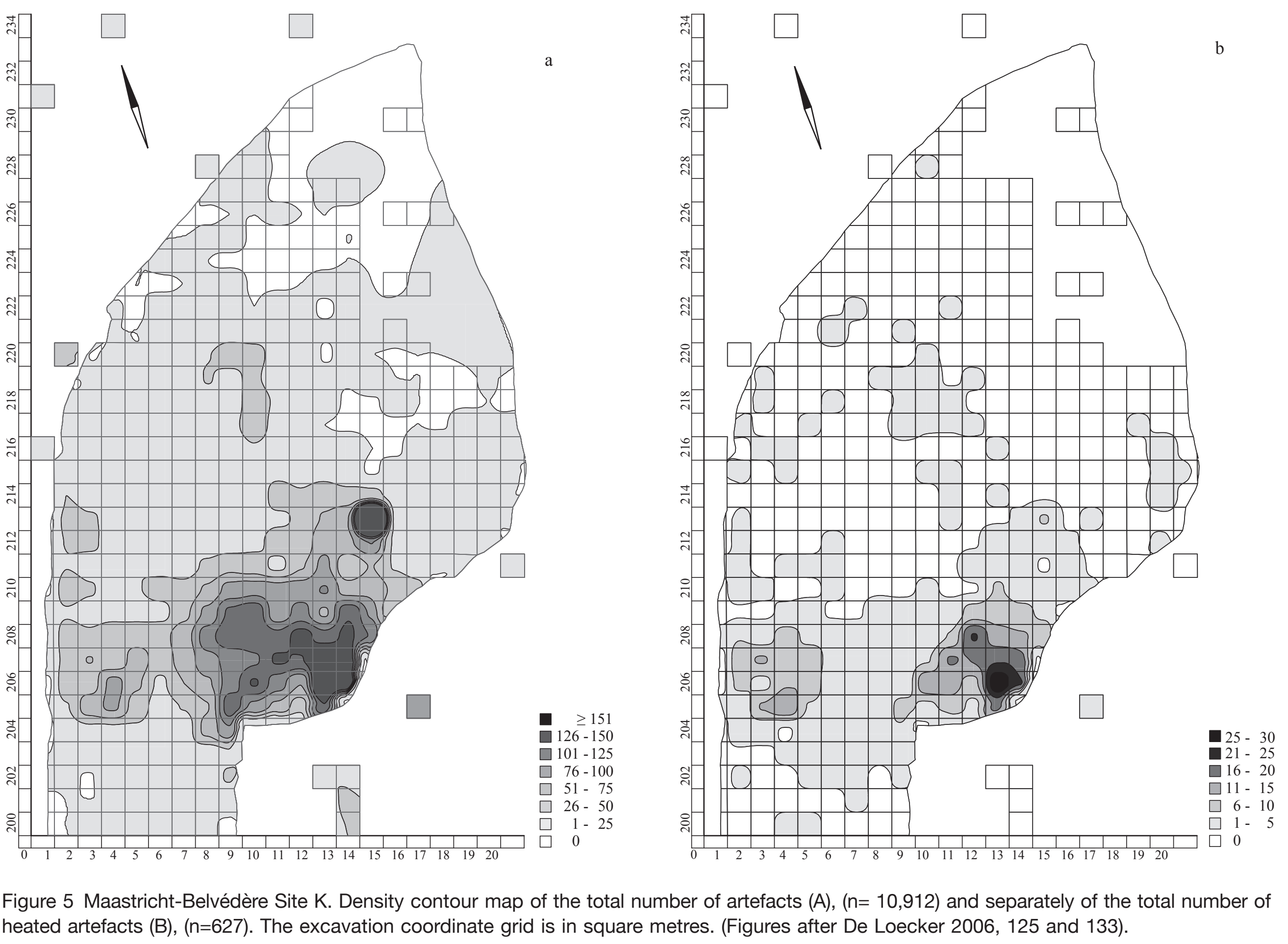


Figure 5 Maastricht-Belvédère Site K. Density contour map of the total number of artefacts (A), (n= 10,912) and separately of the total number of heated artefacts (B), (n=627). The excavation coordinate grid is in square metres. (Figures after De Loecker 2006, 125 and 133).

no features that could be seen as reflecting fireplaces, such as lenses of reddened sediments, clustered charcoal remains, clusters of heated-natural-flints, concentrated charred bone fragments, and/or depressions with heated material surrounded by rocks (cf. discussion in Roebroeks and Villa 2011). Secondly, heated artefacts are found among different typological classes, *e.g*. small and large flakes, cores and tools. In addition, locally produced as well as imported ('non-local') material shows traces of heating. Thirdly, beside the refitted groups exclusively consisting of heated artefacts, some of the heated flakes could be integrated into two refitted compositions (De Loecker 2006, 40-66). Compositions I and II (figs 1 and 2) show that the heated artefacts were refitted into separately reduced parts or cores (of the large nodule) and that there is no evident relationship between the knapping stages and the heating of the artefacts. The latter implies that, at least for compositions I and II, heating occurred after flint knapping. This could also indicate a chronological gap between an earlier production of compositions I and II, their heating and a later reduction of the non-heated nodules in the same area. Time differences, however, may have been limited (*e.g*. a few hours or a night). Nevertheless, if there was an anthropogenic fire, it must have burnt in the southern part of the excavated Site K surface. In an alternative scenario the heated elements can be interpreted as the remnants of a spontaneously combusted natural fire that rapidly 'passed through' the site after occupation (cf. James 1989), or at least after some stages of flaking were executed.

Beside 3067 flint artefacts (*c*. 74% is <2 cm), which included four cores and 23 tools, the Site C excavation yielded poorly preserved bone material, a large quantity of clustered charcoal particles and some dots of reddish material, haematite. The lithic debris was recovered from three separate concentrations (the southern, northern and eastern, *i.e*. Roebroeks 1988; Stapert 1990), while the charcoal particles were clearly clustered in the western part of the excavated area. A second smaller charcoal cluster was situated at the periphery of the eastern flint concentration. The assemblage amongst others consisted of 132 heated flakes (4.3% of the total number of artefacts), which were mainly recovered in the southern concentration (see figures 27 and 40 in Roebroeks 1988). A density contour map of the heated artefacts from the southern concentration (see figure 5 in Stapert 1990) shows that the heated pieces clustered (see figure 3 in Roebroeks *et al*. 2012; figure 27 in Roebroeks 1988). There are only few scattered pieces of charcoal and some faunal remains in this area. Interestingly, flint artefacts of two different Raw Material Units (RMUs) were recorded in the southern part of Site C. The majority of the heated artefacts belong to RMU 5 (Roebroeks 1988), while none of the RMU 6 artefacts are heated. RMU 5 entered the excavated area as a partly reduced core. Within the Site C area it was further exploited, but the actual core was not found within the excavation boundaries. About 10% of the 162 elements that formed the refitted RMU 5 'core' was heated (fig. 6) and the heated flakes were randomly distributed within the southern concentration of the RMU 5 debris. At exactly the same location RMU 6 was partly reduced. This implies that some time elapsed between the initial flaking of RMU 5, the presence of fire at the same time or later, and the subsequent reduction of RMU 6 when the

Figure 6 Maastricht-Belvédère Site C, Raw Material Unit 5. The refitted composition consists of 162 elements and shows the flaking debris of a flat disc(oidal)-like core. The actual core was not recovered within the excavation boundaries, but must have been nearly exhausted. The initial flaking and decortication occurred outside the excavated area. About 10% of the elements were burned. (Figure after Roebroeks 1988, 53).

fire had died down. Again, time differences may have been limited. According to Stapert (1990), it is unlikely that the latter scenario had a natural cause.

Within the western charcoal concentration (heated) lithic artefacts are lacking and only few heated-natural-flints were recovered. Moreover, two heated-natural-flints, shattered during heating, could be refitted (*Einpassungen*, cf. Cziesla 1986; 1990). This led Roebroeks (1988) to conclude that the charcoal concentration was very probably formed as a result of a fire on the spot. However, this fire burned outside the main flint artefact and bone distribution. Again, it is difficult to say whether humans were involved or not. In an alternative scenario the charcoal elements could for example be considered as remnants of fluvial deposited charred driftwood. The latter could possibly also explain the smaller charcoal patch in the western part of the excavation. Conspicuously, the spatial distribution of the hematite concentrates more or less coincides with that of the southern heated flints and that of the western charcoal cluster (see below).

During the early 1990s Stapert (1989; 1990; 1992; Boekschoten and Stapert 1993; 1996; Stapert and Johansen 1995) introduced a relatively simple technique for intra-site spatial analysis of Stone Age sites. The idea was based on the analysis of several Late and Upper Palaeolithic *structures évidentes* (Stapert 1989). This 'ring and sector' method was amongst others intended to determine the presence or absence of dwellings, in the absence of clear physical structures. It was designed especially for sites characterized by the presence of a central hearth, closely associated in space with artefact clusters. However, since visual fireplaces are rarely recovered from the Middle Palaeolithic, other indicators, like heated artefacts, can be applied to calculate the position ('centres') of former 'phantom' hearths (cf. Alperson-Afil *et al*. 2007; Villa 2010).

At Sites C and K larger quantities of heated artefacts co-occurred with dense clusters of debitage, tools and sometimes cores. To investigate the possibility that maintenance and production related tasks were associated with (inferred) anthropogenic fires, Stapert (1990; 1992; 2006; 2007a and b) performed a number of 'ring and sector' analyses at Maastricht-Belvédère. In the absence of physical structures he used the density contour maps (centroids) of the heated artefacts to (re)construct and pinpoint the centre of these former hearths. For Site C the southern concentration was used, at Site K the south-eastern and south-western clusters.

In total 186 artefacts were included in the Site C analysis and the produced histogram showed a unimodal distribution. According to Stapert (1990; 1992) this is characteristic of man-made hearths in the open air. He further concluded that flint-working was done near a campfire, and more precisely at the southwest and south of it. Due to the fact that a considerable amount of faunal remains were recovered at some distance to the northwest, together with the use-wear results by van Gijn (1988; 1989), he further suggested that butchering activities were possibly performed in the vicinity of the hearth.

At site K a proportion map of heated artefacts (Stapert 2007a, figure 4) showed two distinct clusters in the south, located about five metres from each other. The significance of the proposed clusters was statistically grounded by chi-square and binomial tests (Stapert 2007a, 26). The analysis also showed a weak signal in the north, where the heated core was found (see above). Next, centroids were calculated for both southern clusters. All in all, this resulted in Stapert's (2007a and b) interpretation of at least two anthropogenic 'phantom' hearths in the south. If there was a third fire place in the north, it was probably used less intensively or only briefly. Another indication in support of the southern hearths is the spatial pattern of larger unheated artefacts (≥ 60 mm) which seem to 'avoid' the burned clusters. Apparently they concentrate halfway between the two projected hearths. This is also an area where a denser cluster of cores is present (cf. see figure 3.76 in De Loecker 2006; figure 6 in Stapert 2007a). Moreover, refitting showed intense knapping around the conceivable fire places. While tools generally show a scattered appearance across the Site K surface, there is a cluster in the vicinity of the south-eastern 'hearth'. This cluster also includes a single convex side scraper, which was possibly used for woodworking (see sub-section 6.4). Eventually the southern Site K situation was interpreted as a location where flint knapping activities were performed near fires, since "…, the two presumed hearth locations are associated with the artefact-densest parts of the site." (Stapert 2007a, 30).

6.3 Ochre-rich liquid substance (drops) at Site C and Site F

Between 1981 and 1983 Site C was excavated and documented over an area of 264 m², which included a three-dimensional recording of several thousands of charcoal particles (>5800 fragments) and 15 tiny concentrates of red material (Roebroeks 1988, 38). To study the physical properties of the reddish material, in the late 1980s samples were submitted to a variety of analyses. As an outcome of these studies, the red stains were interpreted as hematite (red ochre), (Arps 1988; Roebroeks 1988). A few more pieces of red material were documented at Site F, an area (42 m²) situated *c*. 300 m southeast of Site C. Despite the carefully excavated surfaces at the low-density scatters of Site G (50 m²) and Site N (765 m²), no further ochre particles were recorded over the years. This applies also to Site H (54 m²) and the rich Site K artefact distribution (370 m²). Given current debates on the use of ochre during the Palaeolithic (see Roebroeks *et al*.

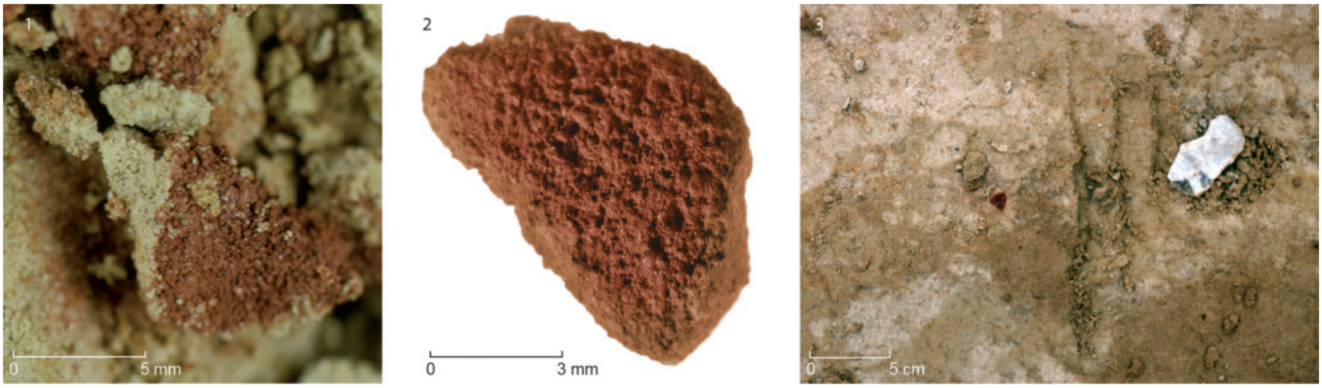


Figure 7 Maastricht-Belvédère Site C. Two of the selected hematite concentrates, which were submitted for further analysis. (1) Concretion Dz23-16 against the background of the fine-grained fluvial deposit from which it was recovered. Dessication of the matrix caused breakage of the concentrate. (2) Concretion Bv-894, ~2 mm thick. (3) A flint flake was recovered next to hematite concentrate Bv-894. (Figures after Roebroeks *et al.* 2012, 1890).

2012 for references) and the new high resolution identification methods that have become available since the late 1980s, three of the Site C finds and from Site F, were submitted to a range of detailed studies in 2010-2011 (see Roebroeks *et al.* 2012 for details), (fig. 7). These investigations confirmed earlier interpretations: we are indeed dealing with hematite dots. Roebroeks *et al.* (2012) concluded that the red ochre stains did not belong to the natural sedimentary environment, but had entered the matrix after formation, with the non-local material introduced to the sites by early Neandertals. The nearest natural sources of hematite are situated in the German Eifel region and in the Belgian Ardennes (Liège-Dinant-Namur vicinity), *i.e.* at a distance of at least 40 km from Maastricht. However, since the Belgian Ardennes are positioned in the catchment basin of the river Maas and its tributaries, small quantities of hematite could have been collected from the late Middle Pleistocene point bars of the meandering stream, even though this is considered highly improbable (see Roebroeks *et al.* 2012 for discussion). Overall, the combined evidence of on-site observations, studies on raw material provenance, and the character of the red concentrates, justifies the inference that the hematite fragments at Sites C and F were related to early human activities.

Roebroeks *et al.* (2012, 1891) hypothesized that the fine hematite material was originally concentrated in a liquid solution, and that blobs of this ochre-rich substance became embedded in the sediments during use of the liquid, spilled on the soil surface. To test this interpretation, they performed an experiment to observe the impact of drops of a hematite-rich liquid on the site C sediment. The similarity of the experimentally produced concentrates to the archaeological concentrates at both macroscopic and microscopic levels was remarkable and hence supported the interpretation of how the material became embedded in the Site C matrix.

The spatial and functional data from Site C and Site F did not yield any clear-cut evidence on the possible use of the red ochre, as no traces of hematite were detected on any of the Maasticht-Belvédère artefacts. Strikingly however, the hematite was recovered at sites with evidence of fire and where subsistence- and maintenance-related tasks may have taken place (*e.g.* Keeley 1980; Phillibert 1994; Wadley *et al.* 2009). At the very least, the reported small hematite concentrates represent a very early case of red ochre use and manipulation, which minimally dates to MIS 7 (Roebroeks *et al.* 2012, 1893).

6.4 Hafted implements at Site K?

During the late 1980s limited functional analyses were performed on artefacts (n = 55) recovered from several Maastricht-Belvédère sites (*i.e.* Sites B, C, E, F and G). Eventually seven flakes appeared fresh enough for interpretation, while only three tools actually showed wear traces. Amongst these pieces is a large *éclat débordant* (cf. Beyries and Boëda 1983), recovered at the low-density Site G (Roebroeks 1988). The flake was interpreted as a ‘backed knife’ and functional analysis suggested cutting activities on an animal with a thick skin (van Gijn 1988; 1989).

In the context of a study on hafting and site function during the Middle Palaeolithic (Rots, in press; Rots and De Loecker, in prep.), in 2010 another attempt was made to study the possible use-wear traces on the Belvédère material. Because of the ‘large’ quantity of triangular (pointed) tool forms at Site K, the focus was on the Site K implements (fig. 3a and 3b). The assemblage contains 137 (1.3% of a total of 10,912 artefacts) complete and fragmented tools, including 111 (81.0%) tools *sensu stricto* and 26 (19.0%) artefacts with macroscopic signs of use. Various types of scrapers dominate (60.6% or n= 83) and the scraper index (SI)

Figure 8 Maastricht-Belvédère Site K. Single straight side scraper (Type 9, *i.e.* Bordes 1961), which is interpreted by Rots and De Loecker (in prep.) as projectile point. The implement was possibly hafted on a thrusting spear. (Figure after Rots in press).

is 57.7 (De Loecker 2006). A total of 103 tools were selected by Veerle Rots for further functional analysis. Her study is still in progress and hence the following results are preliminary. So far 52 tools have been examined; as stated by van Gijn (1988, 152-153), their preservation is poor as a result of de-silification and patination. Thusfar (Rots, in press; Rots and De Loecker, in prep.) 14 tools show evidence of use (27% of a total of 52 tools). Interestingly, at least one piece, a single straight side scraper (fig. 8) has been identified as a possible projectile or spear point (likely a thrusting device). The wear-pattern observed on this implement shows a combined presence of an end-on and rotating impact (cf. Rots 2009). According to Rots (in press) this typical wear-pattern is often described on hafted implements used to finish-off prey, when spears (or knives) were twisted upon insertion (Frison 1978; 1989; Hughes 1998). The point was recovered from the eastern edge of the excavated surface, together with two other tools. Less certain is the interpretation of an artefact possibly used for woodworking. The latter, a single convex side scraper, was located in a central area where considerably more tools were recorded. Apart from some minor scraping and grooving activities, the Site K functional analysis suggests that butchering activities were predominant (see table 2). Site K thus seems to have been a place where subsistence-related as well as tool maintenance-related tasks were executed. This interpretation is supported by the presence of two so-called (re-)sharpening flakes (cf. Cornford 1986), (fig. 9). Given the large quantity of *ad hoc* produced flakes with large potential cutting edges (De Loecker 2006) and the 'small' amount of (used) tools, it is clear that flake production activities were predominant.

The functional analysis indicates that hafting practices occurred at Site K. The stone tool at stake was probably mounted at the extremity of a (wooden?) shaft, and probably attached with bindings (*e.g.* sinew, leather or vegetal). The use of adhesives for fixation can however not be excluded

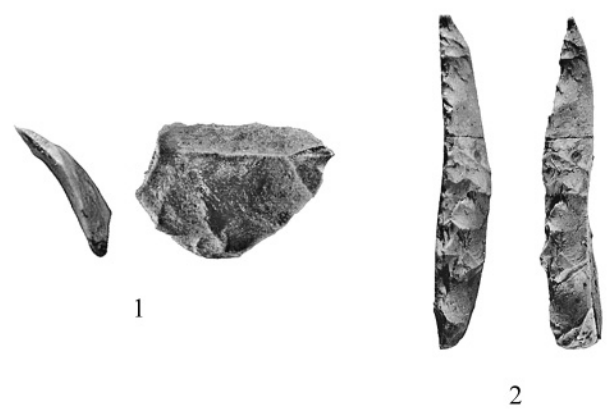


Figure 9 Maastricht-Belvédère Site K. 1: 'Transverse Sharpening Flake' (TSF). 2: 'Long Sharpening Flake' ('LSF'). Scale 1:2. (Figure after De Loecker 2006, 32).

Site	Sample	Subsistence				Tool manufacture						Uncertain			
		Animal hunting	Animal processing	Vegetal processing	% of identified tool uses	Wood percussion	Wood working	Grooving / perforating	Scraping hide	Other scraping	% of identified tool uses	Briquet	Other cutting	Other	% of identified tool uses
Maastricht-Belvédère	52	1	4		36	1	1	3		2	50		2		14

Table 2 Maastricht-Belvédère Site K. Results of a preliminary use-wear study (after Rots, in press).

(Rots, in press), as the Middle Palaeolithic record contains a number of examples of the use of adhesives. The earliest of these are the finds from the Campitello quarry in Italy, where flakes were found still enveloped in birch-bark pitch (Mazza *et al*. 2006), dating to minimally MIS 7. These (and later) finds are a good demonstration of Neandertal pyrotechnological knowledge (Roebroeks and Villa 2011).

The above presented studies allowed a more detailed insight into the potentially different activities that took place at the Maastricht-Belvédère scatters and patches, beyond the well-documented flint knapping episodes. Stone artefacts probably played a major role in animal procurement and food processing activities, but beyond these subsistence-related activities we infer that at the excavated locales time was also invested in the maintenance of technology. A variety of tasks were executed close to a fire and some of these involved the use of 'liquid' ochre; some of these activities, involving the use of transported materials, were probably well planned for execution at known places in the landscape.

7 Discussion and conclusion

Large-scale excavations at the open-air sites of Maastricht-Belvédère and the subsequent typo-/technological, refitting and spatial analyses allowed detailed interpretations of late Middle Pleistocene Neandertal behaviour (Roebroeks 1988; De Loecker 2006). The find distributions are the outcome of episodic visits to a riverine landscape, where flint artefact discarding behaviour eventually resulted in a number of 'high and low density' find distributions, with clear quantitative and qualitative variations. The data suggest that a considerable amount of time, energy and skill were invested at certain localities, to carry out all sorts of subsistence and maintenance tasks. Moreover, they give detailed insights into the spatial organization of raw material acquisition, production, usage and discard of a variety of artefacts (and raw materials) in a Middle Palaeolithic landscape. For this paper we mainly focused on Sites K and C.

The spatial and refitting data of Site K show that the various 'activity-related' discard areas were related. Functional and typo-/technological analyses indicate that retooling (hafting) could have been one factor in artefact distribution. At least one recovered tool, a single straight side scraper can be interpreted as a hafted projectile point (Rots, in press; Rots and De Loecker, in prep.). If butchering indeed occurred at the Site K locale, the meat was processed with large cutting edges. The latter were, on the one hand, produced on the spot using large raw material nodules, which were collected at a minimum distance of about 100 to 200 metres from the site. On the other hand large ready-made cutting tools were introduced to the excavated area, as part of a mobile tool kit (*e.g*. well-prepared scrapers, backed knives and large flakes at Sites K, G, N and C). In addition, the hunting gear was directly maintained on the spot. Points were dismounted from their shafts and subsequently 'new' tools were made (or were part of the mobile tool kit). The raw material of the (supposedly) hafted side scraper as well as of a large quantity of other tools (mainly scrapers, see figure 3a and 3b, differs from the rest of the assemblage. Moreover, none of these pieces could be incorporated in one of the abundant refit sequences at Site K. The recovered (re)-sharpening flakes positively indicate that, within the excavation boundaries of site K (and Sites A and G), at least some maintenance activities took place.

Exhaustive conjoining studies combined with spatial analysis show that each refitted sequence, each *chaine opératoire*, has its own specific history and complexity. Some of the Belvédère sites represent core reduction sequences that largely overlap spatially (Site K), whereas others represent sequences that succeeded each other both in space and in time (Site C). At Site C the refitted spatial configurations seem to represent flint-working events, the products of which were transported from one area to another, where they were then abandoned and where a new reduction sequence of another RMU 'started'. Next, this new flaking sequence (or core) was transported to a 'third' locus where its use-life again ended and where yet again a new one 'started', etcetera. The Site C (and Site K) analysis indicates that we are dealing here with the remnants of two different, but related, technological strategies. On the one hand, a number of well-prepared *Levallois recurrent* cores and flakes (cf. Boëda 1986; 1993; 1994), produced on finer grained flint, entered the excavated Site C area in already reduced forms. This means that the initial flaking sequences were executed at other places in the landscape. Within the 'site' boundaries they were, subsequently, further reduced, parts of the *chaines opératoires* were discarded on-the-spot, while reduced cores and produced flakes were transported to other locations (Roebroeks 1988; Roebroeks *et al*. 1992). On the other hand, a disc(oidal) core approach (cf. Boëda 1993), with minimal attention for preparation, was used for the reduction of more 'coarse' grained local flint. Most of these products were probably intended for *ad hoc* use only. The occurrence of a considerable amount of poorly preserved bones (Roebroeks 1988; van Kolfschoten 1993), together with the limited results of a functional analysis (van Gijn 1988; 1989), suggests that both transported and expedient lithic components were intended for butchering activities. Theoretically these tasks could have been related to the presence of a hearth, and could have involved the manipulation of red ochre (Roebroeks *et al*. 2012), but there is simply no proof to link these various find categories in such a way.

At some of the Maastricht-Belvédère sites (*e.g*. Sites C and K) a variety of specific tasks was carried out at one and the same location. The Site K high-density artefact distribution, with some 'signals' for an organized use of space, probably represents a passing visit related to the maintenance of technology in combination with other activities like food procurement and tool kit maintenance. The well-equipped Late Middle Pleistocene foragers may have been attracted to the area by its diversity of natural resources, which included flint, fresh water, fuel for fires and food supply. Investigations of the spatial layout of lithic artefact distributions (*i.e.* raw materials and technology) show that these Neandertals were highly mobile indeed (in the 'residential' sense of Binford). Moreover, the spatial artefact distributions can be portrayed as fossils of their 'foraging trails' in the landscape. Although the scatters and patches generally reflect short-term visits, some time was clearly invested at specific locations. This agrees with data obtained in larger-scale studies, e.g. those of Neandertal raw material transport behaviour and the environmental background of their presence in northwestern Europe: "All evidence suggests that Middle Palaeolithic groups were highly mobile, and ranged over the northern areas over distances sometimes exceeding 100 km. Recurrent patterns, in both raw material procurement and the specific use of locations, over very long periods of time indicate that knowledge on specific landmarks was transmitted over many generations, probably including knowledge necessary for coping with a wide range of environments. Despite all the resolution problems …, it is clear that Middle Palaeolithic groups were able to cope with a wide range of environments, from cold and open, windswept, mammoth steppes to the more forested interglacial environments, where open river valleys may have formed the main focus of their wanderings." (Roebroeks and Tuffreau 1999, 129).

The early Neandertals who created the Maastricht-Belvédère archaeological record by their episodic visits to the river Maas area, were well-equipped foragers, carrying stone tools, probably including hafted ones, flakes and cores, fire (or even: fire production tools), pieces of ochre and, most importantly, the knowledge to put these items to good use in a wide range of environments. The 'catchment area' of their technology, the know-how needed to turn birch-bark into glues, and in general terms their long-term survival in Pleistocene Europe are simple illustrations of a mobile adaptation which was based on a way of life which greatly surpassed the 15-minute culture often envisaged for these hunter-gatherers.

Acknowledgements

The authors would like to thank Jan-Albert Schenk (Leiden, the Netherlands) for the line drawings, Jan Pauptit (Leiden, the Netherlands) for most of the photographic work and Gilles Leroy (Amiens, France) for the drawings of the flint artefacts. We thank Veerle Rots (Liège, Belgium) for supplying figure 8 and table 2. We dedicate this paper to a friend and colleague, the late Paul Hennekens, a great refitter and archaeologist, and one of the 'hard core' members of the Maastricht-Belvédère project.

References

Alperson-Afil, N., D. Richter and N. Goren-Inbar 2007. Phantom hearths and the use of fire at Gesher Benot Ya'aqov, Israel. *PaleoAnthropology* 2007, 1-15.

Andrefsky Jr., W. 2009. The analysis of stone tool procurement, production, and maintenance. *Journal of Archaeological Science* 17, 65-103.

Arps, C.S. 1988. Appendix III - The identification of haematite as the colouring agent in red ochre from the Middle Palaeolithic site C at Maastricht-Belvédère, The Netherlands, by means of x-ray diffraction analysis. In: W. Roebroeks (ed.), *From Find Scatters to Early Hominid Behaviour. A Study of Middle Paleolithic Riverside Settlements at Maastricht-Belvédère (The Netherlands)*, Leiden, Leiden University Press (Analecta Praehistorica Leidensia 21), 163-165.

Ashton, N. and M. White 2003. Bifaces and raw materials: flexible flaking in the British Early Paleolithic. In: M. Soressi and H.L. Dibble (eds), *Multiple Approaches to the Study of Bifacial Technologies*, University of Pennsylvania Museum of Archaeology and Anthropology, Philadelphia (University Museum Monograph 115), 109-124.

Beyries, S. and E. Boëda 1983. Etude technologique et traces d'utilisation des 'éclats débordants' de Corbehem (Pas-de-Calais). *Bulletin de la Société Préhistorique Française* 80, 270-275.

Binford, L.R. 1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45, 4-20.

Binford, L.R. 1987. Searching for Camps and Missing the Evidence? Another Look at the Lower Palaeolithic. In: O. Soffer (ed.), *The Pleistocene Old World. Regional Perspectives*, New York/London, 17-32.

Boëda, E. 1984. Méthode d'étude d'un nucléus Levallois à l'éclat préférentiel. *Cahiers géogr. physique* 5, 95-134.

Boëda, E. 1986. Le débitage de Biache-Saint-Vaast (Pas de Calais): première étude technologique. *Bulletin Association Française pour l'Etude du Quaternaire suppl*. 26, 209-218.

Boëda, E. 1988. Le concept Levallois et évaluation de son champ d'application. In: M. Otte (ed.), *L'homme de*

Néandertal, 4: LA TECHNIQUE, Liège (Etudes et recherches archéologiques de l'Université de Liège 31), 13-26.

Boëda, E. 1993. Le débitage discoïde et le débitage Levallois récurrent centripète. *Bulletin de la Société Préhistorique Français* 90 (6), 392-404.

Boëda, E. 1994. *Le Concept Levallois: Variabilité des Méthodes*, Paris (Monographie De CRA. 9).

Boekschoten, G.R. and D. Stapert 1993. Rings and Sectors: a computer package for spatial analysis; with examples from Oldeholtwolde and Gönnersdorf. *Helinium* XXXIII (1), 20-35.

Boekschoten, G.R. and D. Stapert 1996. A new tool for spatial analysis: 'Rings and Sectors 3.1 plus Density Analysis and Trace Lines'. In: H. Kamermans and K. Fennema (eds), *'Interfacing the Past'. Computer applications and quantitative methods in Archaeology. Proceedings of the 23rd CAA conference held at Leiden University, Leiden 31st March – 2nd April 1995*, Leiden (Analecta Praehistorica Leidensia 28), 241-250.

Bordes, F. 1961. *Typologie du Paléolithique ancien et moyen*, Bordeaux.

Conard, N.J. and D.S. Adler 1997. Lithic reduction and hominid behaviour in the Middle Palaeolithic of the Rhineland. *Journal of Anthropological Research* 53, 147-175.

Cornford, J.M. 1986. Specialized resharpening techniques and evidence of handedness. In: P. Callow and J.M. Cornford (eds), *La Cotte de St-Brelade, Jersey. Excavations by C.M.B. McBurney 1961-1978*, Norwich, 337-351.

Cziesla, E. 1986. Uber das Zusammenpassen von geschlagener Steinartefakte. *Archäologisches Korrespondenzblatt* 16, 251-265.

Cziesla, E. 1990. On refitting stone artefacts. In: E. Cziesla, N. Eickhoff, N. Arts and D. Winter (eds), *The Big Puzzle: International Symposium on Refitting Stone Artefacts*, Bonn, 9-44.

De Loecker, D. 2006. *Beyond the Site. The Saalian Archaeological Record at Maastricht-Belvédère (the Netherlands)*, University of Leiden, Leiden (Analecta Praehistorica Leidensia 35/36).

De Loecker, D. and W. Roebroeks 1998. Excavating 'empty' square meters at Maastricht-Belvédère, Site N (The Netherlands): implications for our understanding of the Middle Palaeolithic record. *Proceedings of the XIII U.I.S.P.P. Congress (8-14 September 1996, Forli, Italy) Volume 6 - Tome I*, 269-278.

De Loecker, D., J. Kolen, W. Roebroeks and P. Hennekens 2003. 'Refitter's Paradise: on the conjoining of artefacts at Maastricht-Belvédère (The Netherlands). In: N. Moloney and M.J. Shott (eds), *Lithic Analysis at the Millennium*, London, 113-136.

Dibble, H.L. 1995. Middle Paleolithic scraper reduction: Background, clarification, and review of the evidence to date. *Journal of Archaeological Method and Theory* 2, 299-368.

Duistermaat, H. 1987. *Voorlopig resultaat van een malacologische analyse van een profiel uit Site G van de Belvédère*, Leiden (unpublished typescript, Institute of Archaeology, University of Leiden).

Féblot-Augustins, J. 1993. Mobility Strategies in the Late Middle Palaeolithic of Central and Western Europe: Elements of Stability and Variability. *Journal of Anthropological Archaeology* 12, 211-265.

Féblot-Augustins, J. 1999. Raw material transport patterns and settlement systems in the European Lower and Middle Palaeolithic: Continuity, change and variability. In: W. Roebroeks and C. Gamble (eds), *The Middle Palaeolithic Occupation of Europe*. University of Leiden, Leiden, 193-214.

Floss, H. 1994. *Rohmaterialversorgung im Paläolithikum des Mittelrheingebietes*, Habelt, Bonn (Monographien des Römisch-Germanischen Zentralmuseums Mainz 21).

Foley, R. 1981a. Off-site archaeology: an alternative approach for the short-sited. In: I. Hodder, G. Ll. Isaac and N. Hammond (eds), *Pattern of the Past: Studies in Honour of David Clarke*, Cambridge, 157-183.

Foley, R. 1981b. A model of regional archaeological structure. *Proceedings of the Prehistoric Society* 47, 1-7.

Frison, G.C. 1978. *Prehistoric Hunters of the High Plains. New York*, Academic Press.

Frison, G.C. 1989. Experimental use of Clovis weaponry and tools on African elephants. *American Antiquity* 54, 766-784.

Geneste, J.M. 1985. *Analyse lithique d'industries moustériennes du Périgord: une approche technologique du comportement des groupes humaines au Paléolithique moyen*, Bordeaux (Thèse Sc., University of Bordeaux, Bordeaux I).

Gijn, A.L. van 1988. Appendix I. A functional analysis of the Belvédère flints. In: W. Roebroeks (ed.), *From Find Scatters to Early Hominid Behaviour. A Study of Middle Paleolithic Riverside Settlements at Maastricht-Belvédère (The Netherlands)*, Leiden, Leiden University Press (Analecta Praehistorica Leidensia 21), 151-157.

Gijn, A.L. van 1989. *The wear and tear of flint, principles of functional analysis applied to Dutch neolithic assemblages*, Leiden, Leiden University Press (Analecta Praehistorica Leidensia 22).

Hallos, J. 2005. "15 Minutes of Fame": exploring the temporal dimension of Middle Pleistocene lithic technology. *Journal of Human Evolution* 49, 155-179.

Hughes, S.S. 1998. Getting to the Point: evolutionary change in prehistoric weaponry. *Journal of Archaeological Method and Theory* 5, 345-408.

Huxtable, J. 1993. Further thermoluminiscence dates for burnt flints from Maastricht-Belvédère and a finalised thermoluminiscence age for unit IV Middle Palaeolithic sites. *Mededelingen Rijks Geologische Dienst* 47, 41-44.

Isaac, G.Ll. 1978. Food sharing and human evolution: archaeological evidence from the Plio-Pleistocene of East-Africa. *Journal of Anthropological Research* 34, 311-325.

Isaac, G.Ll. 1981. Stone age visiting cards; approaches to the study of early land use patterns. In: I. Hodder, G. Ll. Isaac and N. Hammond (eds), *Pattern of the Past: Studies in Honour of David Clarke*, Cambridge, 131-155.

Isaac, G.Ll. and J.W.K. Harris 1978. Archaeology. In: M.G. Leakey and R.E.F. Leakey (eds), *Koobi Fora Research Project. Volume 1, The Fossil Hominids and an Introduction to their Context, 1968-1974*, Oxford, 47-76.

Isaac, G.Ll. and D. Crader 1981. To What Extent Were Early Hominids Carnivorous - An Archaeological Perspective. In: R.S.O. Harding and G. Teleki (eds), *Omnivorous Primates: Gathering and Hunting in Human Evolution*, New York, 37-103.

Isaac, G.Ll., J.W.K. Harris and F. Marshall 1981. Small is informative: the application of the study of mini-sites and least-effort criteria in the interpretation of the early Pleistocene archaeological record at Koobi Fora, Kenya. In: J.D. Clark and G.Ll. Isaac (eds), *Las Industrias más Antiguas. X Congreso de la Unión Internacional de Ciencias Prehistóricas y Protohistóricas, México*, 101-119.

James, S.R. 1989. Hominid use of fire in the Lower and Middle Pleistocene: A review of the evidence. *Current Anthropology* 30, 1-26.

Keeley, L.H. 1980. *Experimental Determination of Stone Tool Uses: A Microwear Analysis*, University of Chicago Press, Chicago.

Kolfschoten, T. van 1985. The Middle Pleistocene (Saalian) and Late Pleistocene (Weichselian) mammal faunas from Maastricht-Belvédère (Southern Limburg, the Netherlands). *Mededelingen Rijks Geologische Dienst* 39 (1), 45-74.

Kolfschoten, T. van 1990. The evolution of the mammal fauna in The Netherlands and the middle Rhine area (Western Germany) during the late Middle Pleistocene. *Mededelingen Rijks Geologische Dienst* 43 (3), 13-21.

Kolfschoten, T. van 1993. The mammal fauna from the interglacial deposits at Maastricht-Belvédère. *Mededelingen Rijks Geologische Dienst* 47, 51-60.

Kolfschoten, T. van, W. Roebroeks and J. Vandenberghe 1993. The Middle and Late Pleistocene sedimentary and climate sequence at Maastricht-Belvédère: The type locality of the Belvédère interglacial. *Mededelingen Rijks Geologische Dienst* 47, 81-91.

Mazza, P.P.A., F. Martini, B. Sala, M. Magi, M.P. Colombini, G. Giachi, F. Landucci, C. Lemorini, F. Modugno and E. Ribechini 2006. A new Palaeolithic discovery: tar-hafted stone tools in a European Mid-Pleistocene bone-bearing bed. *Journal of Archaeological Science* 33 (9), 1310-1318.

McCrone, J. 2000. Fired up: Theory on when prehistoric man first used fire. *New Scientist* 166 (2239), 30-35.

Meignen, L., A. Delagnes and L. Bourguignon 2009. Patterns of lithic material procurement and transformation during the Middle Paleolithic in Western Europe. In: B. Adams and B.S. Blades (eds), *Lithic Materials and Paleolithic Societies*, Blackwell Publishing, 15-24.

Meijer, T. 1985. The pre-Weichselian non-marine molluscan fauna from Maastricht-Belvédère (Southern Limburg, the Netherlands). *Mededelingen Rijks Geologische Dienst* 39 (1), 75-103.

Meijer, T. and P. Cleveringa 2009. Aminostratigraphy of Middle and Late Pleistocene deposits in The Netherlands, with notes on published data from the southern part of the North Sea Basin. *Global Planet Change* 68, 326-345.

Phillibert, S. 1994. L'ocre et le traitement des peaux: Révision d'une conception traditionelle par l'analyse fonctionelle des grattoirs ocrés de la Balma Margineda (Andorre). *Anthropologie* 98, 447-453.

Roebroeks, W. 1988. *From Find Scatters to Early Hominid Behaviour. A Study of Middle Paleolithic Riverside Settlements at Maastricht-Belvédère (The Netherlands).* Leiden, Leiden University Press (Analecta Praehistorica Leidensia 21).

Roebroeks, W. and A. Tuffreau 1999. Palaeoenvironment and settlement patterns of the Northwest European Middle Palaeolithic. In: W. Roebroeks and C. Gamble (eds), *The Middle Palaeolithic Occupation of Europe*. University of Leiden, Leiden, 121-138.

Roebroeks, W. and P. Villa 2011. On the earliest evidence for habitual use of fire. *Proceedings of the National Academy of Sciences* 108 (13), 5209-5214.

Roebroeks, W., J. Kolen and E. Rensink 1988. Planning depth, anticipation and the organization of Middle Palaeolithic technology: the 'archaic natives' meet Eve's descendants. *Helinium* 28, 17-34.

Roebroeks, W., D. De Loecker, P. Hennekens and M. van Ieperen 1992. 'A veil of stones': on the interpretation of an Early Middle Palaeolithic low density scatter at Maastricht-Belvédère (The Netherlands). *Analecta Praehistorica Leidensia* 25, 1-16.

Roebroeks, W., M.J. Sier, T.K. Nielsen, D. De Loecker, J.M. Parés, C.E.S. Arps and H. Mücher 2012. Use of red ochre by early Neandertals. *Proceedings of the National Academy of Sciences* 109 (6), 1889-1894.

Rots, V. 2009. The functional analysis of the Mousterian and Micoquian assemblages of Sesselfelsgrotte, Germany. Tool use and Hafting in the European Late Middle Paleolithic. *Quartär* 56, 37-66.

Rots, V. in press. Hafting and site function in the European Middle Palaeolithic. In: N. Conard (ed.), *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age*, Vol. 4, Kerns Verlag, Tübingen.

Rots, V. and D. De Loecker in prep. *Functional analysis of site K at Maastricht-Belvédère*.

Schlanger, N. 1994. *Flintknapping at the Belvédère: Archaeological, Technological and Psychological Investigations at the early Palaeolithic Site of Maastricht-Belvédère (Limburg, The Netherlands)*, Cambridge (unpublished PhD thesis University of Cambridge).

Schlanger, N. 1996. Understanding Levallois: Lithic Technology and Cognitive Archaeology. *Cambridge Archaeological Journal* 6 (2), 231-254.

Shelley, P.H. 1990. Variation in Lithic Assemblages: An Experiment. *Journal of Field Archaeology* 17, 187-193.

Stapert, D. 1989. The Ring and Sector Method: Intrasite Spatial Analysis of Stone Age Sites, with Special Reference to Pincevent. *Palaeohistoria* 31, 1-57.

Stapert, D. 1990. Middle Palaeolithic dwellings: Fact or fiction? Some applications of the ring and sector method. *Palaeohistoria* 32, 1-36.

Stapert, D. 1992. *Ring and Sectors: Intrasite Spatial Analysis of Stone Age Sites*, Groningen (unpublished PhD thesis University of Groningen).

Stapert, D. 2006. Jeugdige vuursteenbewerkers bij het kampvuur: een andere visie op Maastricht-Belvédère, Site K. (L.). *Paleo-Aktueel* 17, 9-17.

Stapert, D. 2007a. Youngsters knapping flint near the campfire: an alternative view of Site K at Maastricht-Belvédère (the Netherlands). *Archäologisches Korrespondenzblatt* 37, 19-35.

Stapert, D. 2007b. Neanderthal children and their flints. *PalArch's Journal of archaeology of northwest Europe* 1, 2, 16-39.

Stapert, D. and L. Johansen 1995. Ring & sector analysis, and site 'IT' on Greenland. *Palaeohistoria* 37/38, 29-69.

Stern, N. 1991. *The Scatters-Between-the-Patches: A Study of Early Hominid Land Use Patterns in the Turkana Basin, Kenya*, Massachusetts (unpublished PhD thesis Harvard University Cambridge).

Stern, N. 1993. The Structure of the Lower Pleistocene Archaeological Record. A Case Study from the Koobi Fora Formation. *Current Anthropology* 34, 201-225.

Stern, N. 1994. The implication of time-averaging for reconstructing the land-use patterns of early tool-using hominids. *Journal of Human Evolution* 27, 89-105.

Van Peer, Ph. 1992. *The Levallois Reduction Strategy*, Madison Wisconsin (Monographs in World Archaeology 13).

Villa, P. 2010. A view from Western Europe. In: N. Alperson-Afil and N. Goren-Inbar (eds), *The Acheulian Site of Gesher Benot Ya'aqov, Volume II. Ancient Flames and Controlled Use of Fire*, Springer, London, 9-13.

Wadley, L., T. Hodgskiss and M. Grant 2009. Implications for complex cognition from the hafting of tools with compound adhesives in the Middle Stone Age, South Africa. *Proceedings of the National Academy of Science* 106 (24), 9590–9594.

Dimitri De Loecker
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 TRA Leiden
The Netherlands
dimitri.loecker@pandora.be

Wil Roebroeks
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300 RA Leiden
The Netherlands
w.roebroeks@arch.leidenuniv.nl

Schöningen: the history and results of 20 years archaeozoological research

Thijs van Kolfschoten

Since the discovery in 1992 of the first Palaeolithic artefacts in Quaternary deposits exposed in the Schöningen open-cast lignite mine, the Faculty of Archaeology (Leiden University) has been involved in the Schöningen Palaeolithic project initiated by Dr Hartmut Thieme (Niedersächsisches Landesamt für Denkmalpflege, Hannover). The locality Schöningen became world famous after one of the highlights of the Schöningen project, the discovery in 1995 and publication in 1997 of the Palaeolithic wooden throwing spears. The spears were found among thousands of remains of butchered horses in deposits referred to the locally defined Reinsdorf Interglacial. During the past two decades it has become clear that different stratigraphical horizons, exposed at a large number of sites, yielded Palaeolithic artefacts and archaeozoological finds. The larger mammal remains have been collected during the archaeological excavations. Special campaigns to collect smaller vertebrate fossils from the different outcrops have been organized since 1992. The analyses of the fossil vertebrate record by a large number of students of the Faculty of Archaeology, Leiden University, yielded important data that contribute to the reconstruction of the palaeoenvironment during hominin occupation of the region, to the (bio)stratigraphical dating of the sites and the long-distance correlation with other Palaeolithic sites, and above all to the debate on hominin subsistence and their hunting and exploration strategies. In addition, a number of other research projects with a focus on material from Schöningen (the study of insects, stable isotopes, aDNA, meso- and micro-wear study of molars and the application of Amino Acid Racemization data for stratigraphical purposes) have been initiated.

1 Introduction

The village of Schöningen is located between Hannover and Berlin, c. 10 km south of the city of Helmstedt (fig. 1). The border checkpoint Helmstedt–Marienborn was until 1990 the largest and most important border crossing along the former border between East and West Germany and traffic going from West Germany to e.g. West Berlin, East Germany and Poland used this crossing. The village of Schöningen is located just west of the former border between West Germany and the former German Democratic Republic or East Germany.

The present-day landscape of the area between Schöningen and Helmstedt, east as well as west of the former Inner German Border, is characterized by the presence of remnants of huge quarries; the results of open-cast lignite exploitation (fig. 2). The open-cast mining of the Tertiary lignite in the region was started in 1874 by the company *Braunschweigische Kohlen-Bergwerke AG (BKB)* (Thieme and Maier 1995). In 1978 the BKB began to exploit the area (c. 6 km long and 1 km wide) east-north-east of the village of Schöningen. The so-called Schöningen open-cast lignite mine consisted initially of two separate quarries: a northern (*Baufeld Nord*) and a southern one (*Baufeld Süd*) (fig. 3).

In order to have access to the Tertiary lignite, the overlying Quaternary deposits had to be removed. Opening previous lignite quarries in the region and digging away the Quaternary sediments revealed many interesting archaeological finds. However, there was no systematic archaeological study of the destroyed areas until 1983 when Dr Hartmut Thieme, former student of Professor Dr G. Bosinski (Cologne) and employed at the *Niedersächsisches Landesamt für Denkmalpflege* (Hannover) since 1982, started the long-term project entitled: *Archäologische Schwerpunktuntersuchungen im Helmstedter Braunkohlrevier (ASHB)*. During the first decade of the project, when the mining activities were restricted to the northern quarry, large areas (more than 350,000 m^2) have been investigated and many interesting archaeological finds (for example pottery but also (human) skeletons) of e.g. Neolithic and Bronze Age have been discovered and a number of (rescue) excavations have been carried out (Thieme and Maier 1995).

Early 1992 the *BKB* started to exploit the southern quarry of the Schöningen open-cast lignite mine and in March 1992 Dr Hartmut Thieme discovered the first Palaeolithic large mammal bones and artefacts in sediments 8-15 m below the surface. In the summer of 1992 a three month rescue excavation at the Palaeolithic site Schö 12 was undertaken. The author was invited by Hartmut Thieme and together with Wil Roebroeks, Wim Kuijper and Kelly Fennema, he visited the excavation. Since then the Faculty of Archaeology, Leiden University has taken part in the Schöningen research and the author is since 1992 a member of the formally established Research Team (Dr H. Thieme (fig. 4), (Project

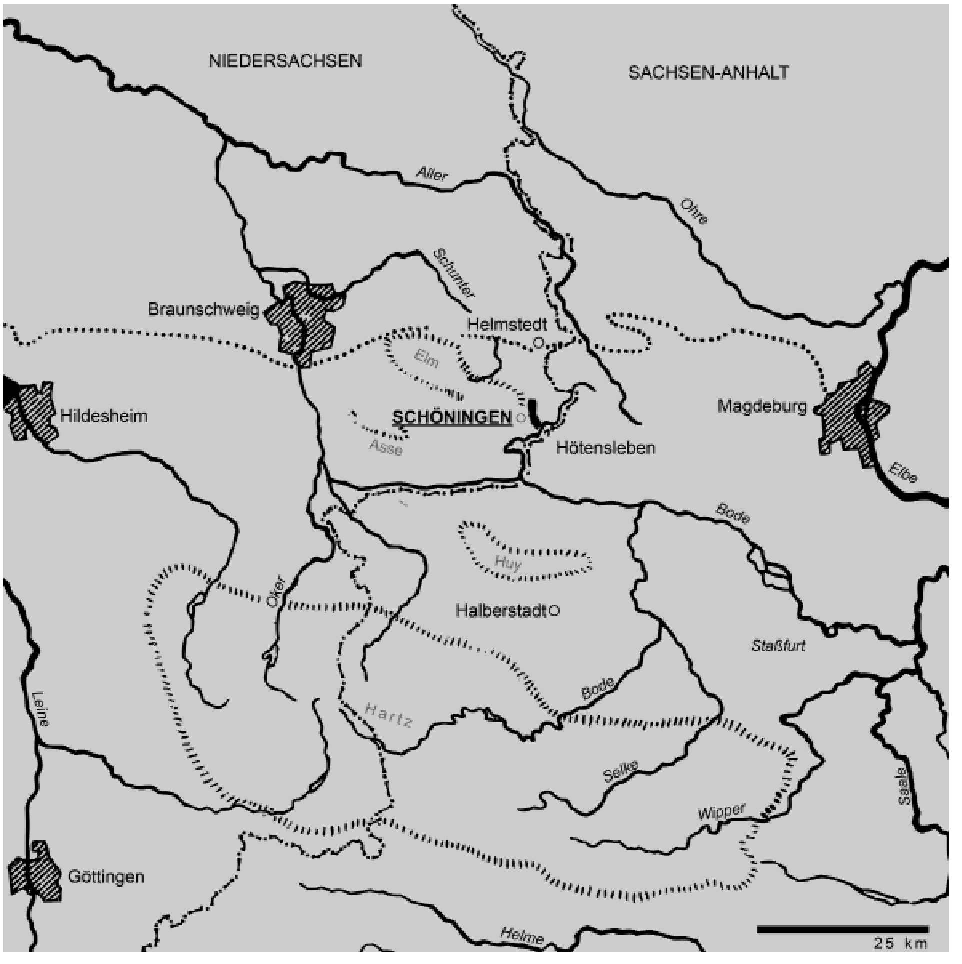


Figure 1 Location of the village of Schöningen. (from Thieme and Maier, 1995).

Figure 2 The Schöningen open-cast lignite quarry. (Photo Thijs van Kolfschoten).

leader, Archaeology), Professor Dr D. Mania (Geology, Malacology), Professor Dr B. Urban (Botany) and Professor Dr Th. van Kolfschoten (Zoology). The Leiden contribution should concentrate on the study of the vertebrate remains from the Pleistocene deposits and focus on archaeozoological as well as paleoenvironmental and biostratigraphical questions.

The larger mammal remains have been collected during the past 20 years in the frame of the archaeological excavations conducted by Dr H. Thieme and his team, and in addition special campaigns to collect smaller vertebrate remains were organized by the author almost every year since 1992. The result so far is more than 20,000 Palaeolithic larger mammal fossils and over 7000 identifiable smaller mammal remains; a record that offers the possibility to investigate the (biostratigraphical) age of the find horizons, the environmental conditions during the hominin occupation of the region, and hominin subsistence and hunting strategies.

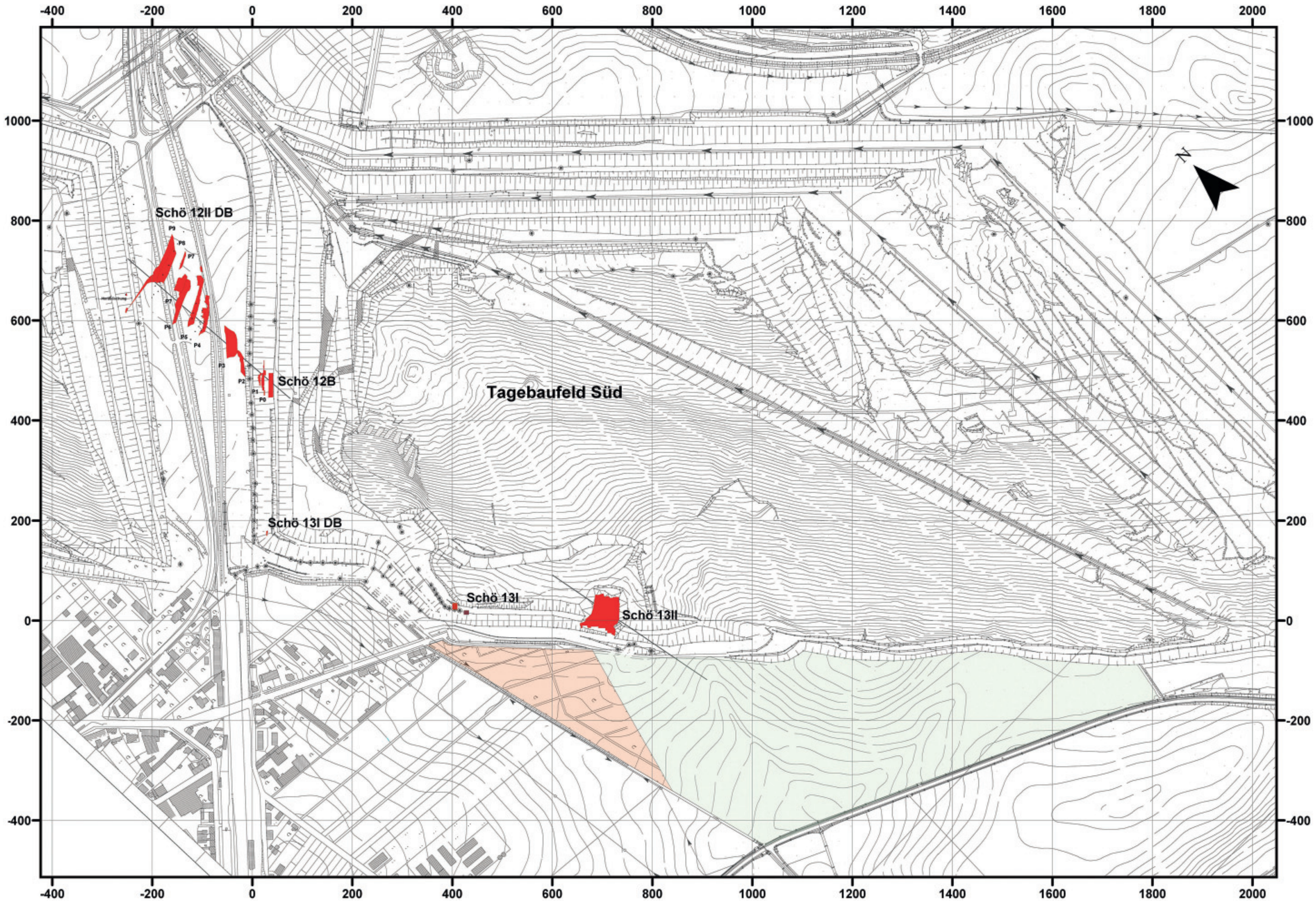


Figure 3 Map of the southern quarry and the position of the different archaeological sites. (map produced by Utz Böhner, NLD – Hannover).

Figure 4 Dr Hartmut Thieme. (Photo Thijs van Kolfschoten).

2 Geological setting

To put the finds/assemblages in a broader perspective, the geological setting of the Quaternary deposits exposed due to the mining activities is summarized. Unconsolidated lignite-bearing Palaeogene deposits form the base of the sequence. These deposits are, in the area of the Schöningen open-cast lignite quarry, covered by late Quaternary sediments with at the base Elsterian till deposits. The Scandinavian ice sheets covered the area during the Elsterian as well as the Saalian (Drenthe) glaciation (fig. 5). Dietrich Mania investigated in great detail the Quaternary deposits and recorded in the period from 1992 until 2008 many exposed sections (several are more than 100 m long). According to his model, there is on top of the Elsterian till a series of erosional channels (Mania 1995; Thieme 1999) (fig. 6). The Schöningen Channels I-III date from the period between the Elsterian and the Saalian (Drenthe) glaciations and the infill of the succeeding channels covers three interglacial/glacial cycles. Best exposed in the past 20 years are the deposits of the second channel (Schöningen II), filled with sediments that date from the Reinsdorf Interglacial and the ensuing cold stage. The depositional sequence contains five levels of organic muds and peats with loess deposits on top (figs 7 and 8). The lowermost mud and peat deposits (level 1) represent the interglacial optimum of the Reinsdorf Interglacial, whereas the upper levels (4 and 5) represent cool temperate phases. Levels 1-4 yielded archaeological as well as zoological remains. The famous spears are from level 4 of the Schöningen II sequence. The notation of the different sites and levels (e.g. Schö 13 II-4) refers to a specific geographical position in the investigated area (13), to a particular channel (II) and to a specific level within the sedimentological sequence.

During the past decades Brigitte Urban studied the botanical record from the Quaternary deposits in the area of the northern as well as the southern quarry. Based on distinctive botanical features, she referred the interglacial deposits in the three channels exposed in the southern quarry (fig. 6), to the Holsteinian Interglacial, and the locally defined Reinsdorf

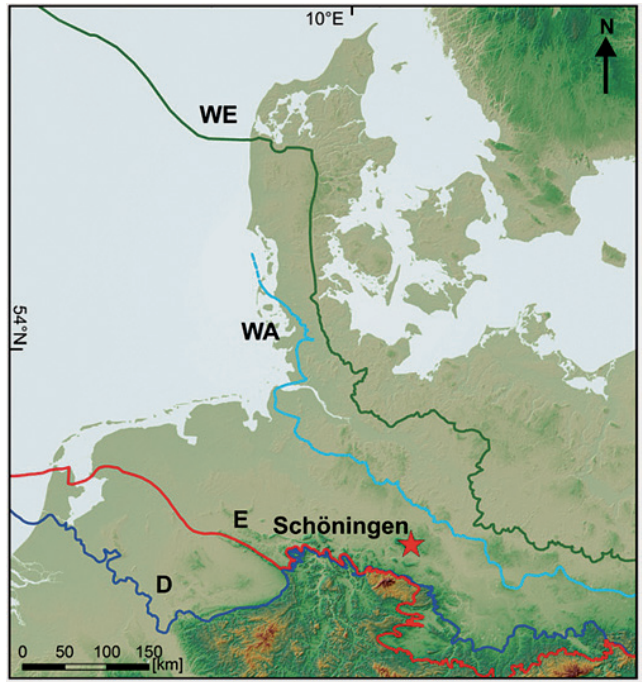


Figure 5 Location of Schöningen and the maximal extent of the Middle and Late Pleistocene ice sheets E = Elsterian glaciation; D = Saalian - Drenthe glaciation; WA = Saalian-Wacke glaciation; WE = Weichselian glaciation) (modified after Lang *et al.* 2012).

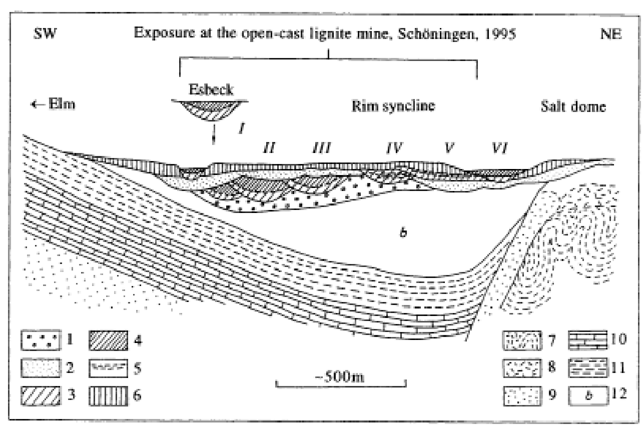


Figure 6 Schematic section through the Quaternary sedimentary cycles Channel I-VI of open-cast lignite mine Schöningen (modified after Mania 1995).

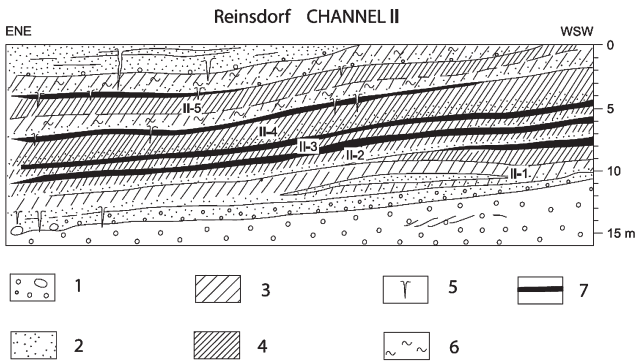


Figure 7 Scheme of the Reinsdorf sediment sequence (Channel II, levels II-1 to II-5) discordantly overlying Elsterian glacial sediments. Legend: 1: Till, gravel and fluvioglacial sediments (Elsterian); 2: sand; 3: basin silt; 4: silty and calcareous mud; 5: ice wedges; 6: solifluction layers; 7: fen peat. Lithology of Channel II sediment levels: II-1, sands and silts, fen peat, wooden remains; II-2, II-3, II-4, silty and calcareous mud, intercalated peat layers (black); II-5, basin silt, silty and calcareous mud, peat (black) (from Urban *et al.* 2011).

Interglacial and Schöningen Interglacial (Urban, 1995). The Schöningen sections have also been studied by Kier van Gijssel (Faculty of Archaeology, Leiden University) and he regards these sections as one of the key stratigraphical sequences for the Middle Pleistocene of Northwest and Central Europe. In his thesis entitled "*A continent-wide framework for local and regional stratigraphies: application of genetic sequence and event stratigraphy to the Middle Pleistocene terrestrial succession of Northwest and Central Europe*" he correlates the Holsteinian Interglacial with Marine Isotope Stage (MIS) 11, the Reinsdorf Interglacial with MIS 9 and the Schöningen Interglacial with MIS 7 (van Gijssel 2006) (table 1).

Jörg Lang studied the Pleistocene deposits in the Schöningen area during more recent years and integrated the data of only four outcrop sections, 744 borehole logs and high-resolution shear wave seismics. He and his co-authors concluded that the Elsterian and overlying deposits are located in an elongated trough formed as a tunnel valley below the Elsterian ice sheet. During the following interglacial a lake was formed, and lacustrine sediments accumulated and laterally stacked in a shallow-water deltaic setting (Lang *et al*. 2012). Lang *et al*. (2012) correlate the deposits overlying the Elsterian till, including those exposed at the sites of Schö 12 II and Schö 13 II (referred to the Reinsdorf Interglacial by Urban (1995) and others), to the Holsteinian Interglacial and they regard the Holsteinian as the continental equivalent of MIS 9. A hypothesis that is heavily disputed, and also the mammalian data do not support this interpretation (van Kolfschoten in press). The age of the deposits including the spear horizon is still a matter of debate.

Figure 8 Picture of the site Schö 13 II with the levels 1 to 4. (Photo J. Serangeli).

		MIS	NW European stages	Schöningen sequence
HOLOCENE		1		
PLEISTOCENE	late	5d-2	Weichselian	
		5e	Eemian	
	middle	6	Saalian	
		7		Schöningen Interglacial
		8		
		9		Reinsdorf Interglacial
		10		
		11	Holsteinian	Holsteinian Interglacial
		12	Elsterian	
		13	Cromerian Complex	
		14		
		15		
		16		

Table 1 Stratigraphical position of the Holsteinian, Reinsdorf and Schöningen Interglacials and the correlation with the Marine Isotope Stages (MIS) according to van Gijssel (2006).

3 The Schöningen project - historical highlights

During the first 9 years (1983 – 1992) of the Schöningen project (*Archäologische Schwerpunktuntersuchungen im Helmstedter Braunkohlrevier*) the archaeological research and large-scale excavations were restricted to the Holocene deposits and finds in the northern quarry. In that period, palaeobotanist Brigitte Urban, involved in the Schöningen project since the start, investigated together with Hartmut Thieme also the Pleistocene outcrops exposed in that quarry and recorded different interglacial sequences. However, no Palaeolithic artefacts were recovered during that period. Only after Pleistocene deposits in the southern quarry became exposed, were the first Palaeolithic artefacts, associated with vertebrate remains, discovered. That discovery was the start of so far 20 years of Palaeolithic archaeozoological research in Schöningen; a period of 20 years with a number of historical highlights.

1992 The discovery of the **first Palaeolithic artefacts** in the Schöningen region in Middle Pleistocene deposits. The stone artefacts and artificially modified pieces of wood were found in association with a large number of mammalian fossils. The discovery resulted in a rescue excavation (site Schö 12) that took three months. During that excavation more artefacts could be collected and also a large number of bones from large mammals. Several bones show clear indications of hominin butchering activities.

1994 In June 1994 a new archaeological site (**Schö 13 I**) was discovered. The site is located at the south-western edge of the southern quarry, about 500 m south of the Palaeolithic site Schö 12. The deposits that yielded the artefacts and bones are from Channel I and are stratigraphically older than the Schö 12 finds from Channel II.

1994 Excursions, organized in the frame of the general meeting of the International Union for Quaternary Research (**INQUA**) in Berlin (August 1994), visited the excavations at Schöningen.

1994 The mining activities continued in a south-eastern direction and in September 1994, in an area about 250 m southeast of the site Schö 13 I, artefacts and bones were discovered in a Channel II exposure (site **Schö 13 II**). One of the most spectacular finds at that moment was the discovery of a throwing stick (fig. 9). Hartmut Thieme recognized the importance

Figure 9 Schö 13 II-4 – throwing stick. (from Thieme 2007).

of the find and he was able to convince the mining company that the site should be excavated properly, and an area of about 3000 m^2 became available for long-term archaeological research.

1995 A first (semi-popular) **book** with an overview of the results of the Schöningen project and the discovered archaeological, botanical and faunal finds and with e.g. detailed information of the 88 cm long Palaeolithic throwing stick was published by Hartmut Thieme and Reinhard Maier. The publication entitled *Archäologische Ausgrabungen im Braunkohltagebau Schöningen, Landkreis Helmstedt* contains also contribution of e.g. Mania, Urban, van Kolfschoten and Schoch (Thieme and Maier 1995).

1995 The most spectacular finds were discovered in autumn 1995: **wooden spears** (fig. 10) that resemble modern javelins, made as projectile weapons rather than thrusting spears or lances. The well-elaborated throwing spears were found amongst a large number of butchered animal bones (mainly horse).

1997 The publication of the wooden spears from Schö 13 II-4 in **Nature** (Thieme, 1997) made the site world famous and many archaeologists regarded the wooden spears as one of the major discoveries in Palaeolithic research in the past decades. It was concluded, and generally accepted, that these spears were used to hunt large mammals. The discovery had significant implications for Palaeolithic archaeologists. The assumption that Early and Middle Palaeolithic hominins were scavengers, a model that was fashionable since the early 1980s, was since the discovery of the Schöningen spears “definitely” replaced by a hunting scenario with considerable depth of planning combined with sophisticated and efficient hunting technology (Dennell 1997).

2007 The spectacular archaeological finds were displayed for a larger public in a temporary **exhibition** set up in the *Braunschweigischen Landesmuseum* (24.11.2007 – 24.2.2008) and in the *Niedersächsischen Landesmuseum Hannover* (28.3.2008 – 27.7.2008). In the frame of this exhibition, Hartmut Thieme wrote (with support and contributions of many colleagues) a **book** entitled *Die Schöninger Speere - Mensch und Jagd vor 400.000 Jahren*. The book has 248 pages and presents many spectacular finds (e.g. the wooden spears) but also the preliminary results achieved by the different (sub)disciplines taking part in the Schöningen project. Summarizing information about e.g. the botanical remains, the molluscs, the fish, reptiles, amphibians and mammalian record is presented (Thieme 2007).

2007 The federal state of *Niedersachsen* established a **scientific commission** that should act as an advisory board and conduct the Schöningen project. The commission decided that more time should be invested in the scientific publication of the Schöningen data and they agreed that it is impossible for Dr Hartmut Thieme to combine the coordination of the excavation and the publication of the data from the previous 15 years. Hartmut Thieme was given the choice, either to continue his leadership of the excavation and give the data of the previous years to someone who will publish these data, or to transfer the responsibility and coordination of the excavation to someone else and focus the last five years before his retirement on the publication of the fantastic results he achieved. In the end he decided to accept the second option. For Hartmut Thieme this was a difficult decision and it is obvious that for him the establishment of the commission and the decisions they took (e.g. the

Figure 10 Schö 13 II-4 – wooden spear no. III. (Photo Thijs van Kolfschoten).

choice that commission gave him), cannot be classified as historical highlights of the Schöningen project.

2008 The commission decided that Professor Dr Nick Conard (Tübingen) (member of the commission) should take over the excavations in Schöningen, and **Dr Jordi Serangeli** was appointed as scientific leader and coordinator of the excavations in Schöningen starting 1st June 2008.

2009 In 2009 it was decided to build a **research and experience centre (paläon)** in Schöningen at the edge of the southern quarry not far from the site Schö 13 II. The official opening will be in the spring of 2013.

2009 The age of the Palaeolithic finds has for many years been a matter of debate. In order to clarify this issue, a **workshop** was organized in Hannover (30.10.2009) where the different disciplines involved in the debate presented their data and views. The general feeling was that there is a kind of consensus that the spears have an age of about 300 – 325 ka. However, there is still debate about the stratigraphical position of the finds in a broader European context. The proceedings of the workshop will be published in a special volume that is part of the newly established series of publications that will present the scientific results of the Schöningen project.

2012 Since the University of Tübingen has been involved in the Schöningen project, the Schöningen team has expanded and different studies have been initiated, e.g. the investigation of the postulated fireplaces. The preliminary results of the research so far, including the results of the extensive geological research by Jörg Lang (Hannover), the archaeozoological analyses conducted by Thijs van Kolfschoten and his team, and the isotope analyses (Margot Kuitems et al.) were presented at the annual meeting of the **Society for American Archaeology** (SAA) in April 2012 in Memphis (USA).

There will certainly be new highlights in the near future, for instance the opening of the *paläon*, the new research and experience centre in Schöningen (Spring 2013). Although not a highlight, the retirement of Dr Hartmut Thieme in November 2012 and the appointment of a successor, combined with the establishment of the research and experience centre will lead to major changes in the Schöningen project but hopefully also result in new, scientific highlights.

4 The Archaeozoological contribution in the past 20 years

The Palaeolithic excavations in the past 20 years are restricted to the western edge of the southern quarry (fig. 3), starting in 1992 with the site Schö 12B, followed in 1994 by excavations at the site Schö 13 I, and later that year a start was made with the excavation of the site Schö 13 II. The site Schö 13 II-4 has been the main focus of the Schöningen project since 1994. Several years ago, the mining company decided to terminate their mining activities in the area. No further expansion of one of the quarries; the company will only dig away the dam that separates the southern from the northern quarry and exploit the lignite that forms the lower part of that dam; a process that should be finished in 2013. The Quaternary deposits of the dam area yielded two clusters of sites, Schö 13 I DB and Schö 12 II DB.

A permanent team of at least 5-6 excavators have been digging these sites, 9 months a year, for the past 20 years and they collected apart from artefacts thousands of mammalian fossils. At the site, the fossils were removed from the sediment. Bigger specimen or delicate remains were taken out in blocks of sediment. During the first years all finds were transported to Hannover for conservation. Later, when the conservation capacity in Hannover proved to be not large enough, it was decided to store the botanical and vertebrate finds (including the blocks of sediments with finds) in cold storage in Barsinghausen, near Hannover with the consequence that the material was no longer accessible for further investigation. That situation changed in 2007 when it was decided that the material should be investigated. The fossils vertebrate remains, except for a number of larger finds (e.g. a horse skull and a bison skull) that are still in the sediment blocks, were transported from cold storage in Barsinghausen to Leiden for conservation, numbering, identification and data input of the more than 15,000 specimens; a process that is almost finished. This offered the possibility to investigate the entire fossil large mammal record excavated from 1992 until June 2008, when Tübingen University took over the excavation, as well as the study of the excavated finds.

The different sites and exposed deposits appeared to be also rich in smaller vertebrates that could be relevant for palaeoenvironmental reconstructions and for biostratigraphical correlation between the different sites within the Schöningen area, as well as the correlation between the Schöningen sites and other Palaeolithic sites. Special campaigns to collect smaller vertebrate remains from the different outcrops have therefore been organized since 1992. Every year a group of students of the Faculty of Archaeology, Leiden University visits Schöningen and under supervision of André Ramcharan and Thijs van Kolfschoten, they take sediment samples from specific layers (fig. 11), soak these sediments for a few hours (fig. 12), and fractionate the sediment samples using a set of sieves and water (fig. 13). The sediment fraction smaller than 1 mm will be washed away and the larger fractions will be dried and sorted either at the site or at the institute in Leiden.

Figure 11 Taking sediment samples (May 2009). (Photo Thijs van Kolfschoten).

Figure 12 Soaking the sediment samples in buckets (June 2010). (Photo Thijs van Kolfschoten).

Figure 13 Fractionating the sediment samples using a set of sieves and water (June 2012). (Photo Thijs van Kolfschoten).

4.1 The Schöningen fossil vertebrate record

The oldest Quaternary fossil remains have been excavated at the site Schö 13 I. The Channel I site yielded a small amount of small mammal remains (not very well-preserved molars of the genera *Arvicola* and *Microtus*) as well as 161 large mammal fossils: mammoth, horse, red deer and bison. Preliminary investigations suggest rather open conditions but the material is still under study. The site Schö 13 I DB did not yield any vertebrate remains.

The vast majority of the vertebrate fossil remains are from deposits in Channel II with its five depositional phases (1-5). Within this channel there are two concentrations of sites: a) Schö 12 (with the sites/levels Schö 12 A, Schö 12 B, Schö 12 II-1, Schö 12 II-2, Schö 12 II-3, Schö 12 II-4, Schö 12 II-5) and b) Schö 13 (with the sites/levels Schö 13 II-1, Schö 13 II-2, Schö 13 II-3, Schö 13 II-4, Schö 13 II-Berme).

The sites Schö 12 A and Schö 12 B, excavated in 1992, yielded more than 800 large mammal remains and several hundred molars of small mammals. The site Schö 12 B in the lower part of the Channel II infilling yielded a fauna including e.g. *Sorex minutus*, *Sorex (Drepanosorex)* sp., *Sorex* sp. (cf. *Sorex araneus*), *Desmana* sp., *Castor fiber*, *Lemmus lemmus*, *Clethrionomys glareolus, Arvicola terrestris cantianus, Microtus (Terricola) subterraneus, Microtus arvalis, Microtus agrestis, Microtus oeconomus, Apodemus* sp., *Ursus* sp., Mustelidae, *Elephas antiquus, Dicerorhinus kirchbergensis, Equus mosbachensis, Sus scrofa, Cervus elaphus, Capreolus capreolus, Bos/Bison*, indicating interglacial conditions and a forested environment (van Kolfschoten 1993; 1995; 2007; van Zijderveld 1995; Fennema 1996; Voormolen 1996).

The Quaternary deposits in the Schö 12 area became accessible again after 15 years when in 2007 a start was made to dig away the dam that separated the northern from the southern quarry. All the levels (1-5) exposed in Channel II appeared to yield artefacts and vertebrate remains. The new excavations in the Schö 12 area yielded a number of spectacular finds, for example an incomplete skull with both antlers of a giant deer (*Megaloceros giganteus*) (fig. 14), an incomplete skull with horn cores of a water buffalo *(Bubalus* cf. *murrensis)* (fig. 15) and an incomplete skull of an Aurochs associated with an almost complete postcranial skeleton (Böhner *et al*. 2010). The faunal assemblages from the dam area have not yet been investigated in detail.

Most of the larger mammal material was collected from the site Schö 13 II and in particular from deposits referred to channel II depositional phase 4 (Schö 13 II-4), the horizon with the famous wooden spears. More than 12,000 large mammal remains are recorded from the site Schö 13 II-4 representing a variety of species (table 2) (van Kolfschoten *et al*. 2007). The material is not equally distributed over the

Figure 14 The giant deer *Megaloceros giganteus*: posterior part of the skull with right antler excavated at site Schö 12 II-1. (Photo Wolfgang Mertens).

Figure 15 Lateral view of the posterior part of the water buffalo *Bubalus* cf. *murrensis* excavated at site Schö 12 II-1. (Photo Wolfgang Mertens).

excavated area; there is an area with a high concentration with up to 150 specimens per square metre (fig. 16). The lower levels at the site (Schö 13 II-1, Schö 13 II-2 and Schö 13 II-3) also yielded large mammal remains but the numbers are much lower. This is partly due to the fact that only a restricted part of these levels has been excavated but also due to a lack of big concentrations as we know from Schö 13 II-4. Several students from the Faculty of Archaeology, Leiden University studied parts of the fossil assemblages from these sites and presented the results in their BA or MA theses (van Asperen 2004; Matze 2010; Berkholst 2011).

Faunallist Schö 13 II-4	**nr. specimen**
Aves	57
Carnivora	7
Proboscidaea	1
Stephanorhinus kirchbergensis	2
Stephanorhinus hemitoechus	1
Stephanorhinus indet.	2
Equus mosbachensis	3693
Equus hydruntinus	1
Sus scropha	1
Cervus elaphus	116
Megaloceros giganteus	7
Cervidae indet.	43
Bos primigenius	9
Bison priscus	9
Bos/Bison	129
Large mammal	4080
Medium mammal	210
Indet.	1889

Table 2 List of taxa recorded at the site Schö 13 II-4.

All the investigated archaeological find horizons yielded remains of smaller vertebrates. To collect these remains special campaigns have been organized in the past 20 years; campaigns that resulted in several thousand identifiable fossils representing fish, reptiles, amphibians, birds and mammals. A number of Bachelor and Master theses are devoted to the Schöningen small mammal record (e.g. Huyghebaert 2003; van der End 2008; Knul 2009). Merel Herzberg studied, supervised by Dr G. Böhme (Berlin), part of the herpetofauna from Schö 12B (Herzberg 2000).

4.2 The results so far …

Part of the fossil mammalian remains from Schöningen have been studied and analysed. The scope of the main research is four fold: palaeoenvironmental, biostratigraphical, archaeozoological and paleontological.

4.2.1 Palaeoenvironmental research

The palaeoecological analyses of the Reinsdorf Channel II sequence 1-5 showed a number of interesting results. The mammalian faunal record from the base of Channel II indicates that the infilling of Channel II started during an interglacial optimum. The occurrence of species such as the dormouse *Eliomys* sp. and the wild boar *Sus scrofa* confirm

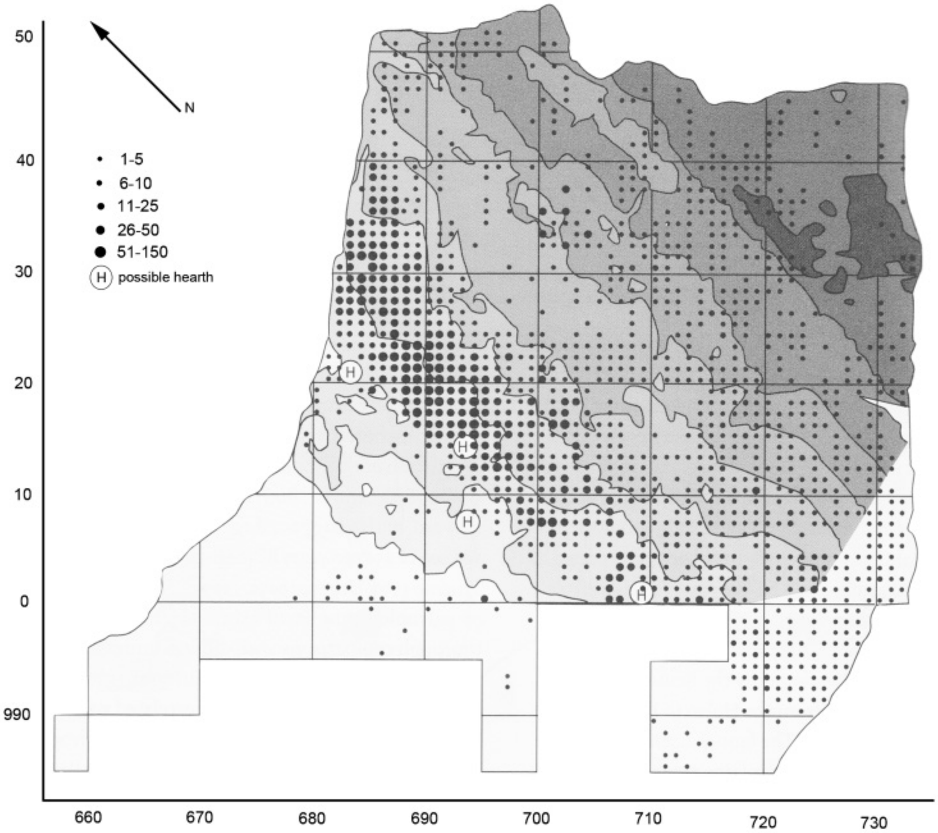


Figure 16 Map of the site Schö 13 II-4 showing the distribution of the recorded larger mammal remains. (map produced by Utz Böhner, NLD – Hannover).

the interglacial character of the fauna. The mammalian record clearly shows that early interglacial phases are not recorded and that there is a stratigraphical hiatus between the Channel II deposits and the underlying Elsterian sediments. Only at the very base of the Channel II sequence, a few remains of the collared lemming *Dicrostonyx* sp., indicative of glacial climatic conditions, have been found. These finds are regarded as re-deposited remnants dating from a glacial phase pre-dating the Reinsdorf Interglacial.

The fossil remains from the Channel II sequence 1-5 are from a period of changing climate, from the transition from an interglacial optimum at the base to the beginning of the following cold stage at the top of Channel II. However, the changes in the mammalian record are not as obvious as one would expect. The faunal assemblages from level 1 indicate interglacial conditions and a forested environment alternated with areas of more open, steppe vegetation. Several forest dwellers (e.g. *Stephanorhinus kirbergensis, Sus scrofa*) that occur in Channel II level 1 have also been recorded in the faunal assemblage of Channel II level 4 (table 2). The sequence did not yield assemblages that clearly indicate climatic deterioration and the occurrence of glacial conditions. The fact that other proxies indicate climate change (Böhme 2007; Urban 2007) might indicate that the faunal changes were relatively minor and/or that the mammalian fauna had a high degree of resilience for these changes.

4.2.2 (Bio)stratigraphical research

From the start of the project there has been a debate on the age of the archaeological finds. Crucial in this debate is first of all the geological setting. The Reinsdorf Interglacial deposits with the spears are stratified between deposits of the Elsterian and Saalian glaciations, indicating that they are late Middle Pleistocene in age. Mammal fossils are important for detailed biostratigraphical dating because specific species evolve rather fast and others became extinct. In addition, with the mammalian remains long-distance correlation can be established and the locally defined stratigraphical units such as the Reinsdorf Interglacial can be incorporated in broader, European stratigraphical framework.

R. Musil (Brno, Czech Republic) studied a selection of the horse skulls from Schö 13 II-4 and put the results in a biostratigraphical framework based on the evolution of horses. He concluded that the horses from Schöningen 13 II-4 are clearly younger than the horses from Bilzingsleben II (Musil 2002). Eline van Asperen investigated the majority of the horse remains from the different stratigraphical horizons of the Schöningen sequence and showed that, compared to the horses from Bilzingsleben II, Schö 12 II-1 and Schö 12 II-2, the material from Schö 13 II-4 is relatively small and she confirmed Musil's assumption about the difference in age between Bilzingsleben II and Schö 13 II-4. (van Asperen 2003; 2004). In a recent publication van Asperen states that the Bilzingsleben II assemblage and those of the Schö 12 II and Schö 13 II sites most probably date from two separate interglacials and correlates the Bilzingsleben II fauna with MIS 11 and the Schö 12 II/ Schö 13 II faunas with MIS 9 (van Asperen 2012).

Other students from Leiden also focused their investigations of the Schöningen material on stratigraphical questions (Huyghebaert 2003; van der End 2008; Knul 2009; Berkholst 2011) and concluded, based on e.g. the evolutionary stage of the *Arvicola terrestris cantiana* molars, that the Reinsdorf assemblages post-date the Lower Palaeolithic finds from Boxgrove (UK) and pre-date the Middle Palaeolithic/MIS 7 remains from Maastricht-Belvédère (the Netherlands). The SDQ-values[1] of the Schöningen water voles, one of the best represented species in the Schöningen record, indicate that a correlation between the Channel II faunal assemblage and the British MIS 11/Hoxnian (=Holsteinian) faunas is very unlikely. The Schöningen SDQ values are clearly much lower and also the rare occurrence of a so-called *Mimomys*-fold in the Schöningen record indicates that the populations from MIS 11 sites such as Barnham and Beeches Pit (Parfitt 1998; Preece *et al*. 2007), where the *Mimomys*-fold frequencies are much higher than in Schöningen, are more primitive and, hence, stratigraphically older. A correlation with younger (MIS 9) faunas seems to be most plausible.

4.2.3 Archaeozoological and taphonomical research

Shortly after the discovery of the first Palaeolithic vertebrate remains from Schöningen, Boudewijn Voormolen, a student of the Faculty of Archaeology Leiden, started to investigate the material with an archaeozoological focus. He investigated first of all the Schö 12B remains (Voormolen 1996; 1997). Subsequently he started his PhD research for which he studied and analysed part[2] of the fossils from Schö 13 II-4, and concentrated his research e.g. on the preservation of the material and on the well-preserved marks: butchering or cut marks, gnawing marks and impact scars. His results were presented in a PhD thesis (Voormolen 2008a) and are published in an issue of Journal of Taphonomy (Voormolen 2008b).

Large mammals Schö 13 II-4	**N**
bones with cutmarks	1104
bones with impact marks	1040
bones with cut- & impactmarks	442

Table 3 The number of bones from the site Schö 13 II-4 with cut marks and/or impact features.

In the past few years almost all material (> 12,000 records) excavated at the Schö 13 II-4 site became available for detailed investigation. The distribution of the Schö 13 II-4 fossil vertebrate remains is shown in fig. 16. Analyses of the fauna show that a variety of species are represented at the site (table 2) and that many bones show traces of hominin interference (table 3) (Afkir 2011). The marks on the (horse) bones indicate skinning, dismembering, (restricted) filleting, removing of the periosteum, marrow extraction, and the use of bones as tools (figs 17 and 18). The fossil material is very well preserved and does not show large variation in the degree of weathering. This suggests that we are dealing with material that has been accumulated during a relatively short period of time and not with a palimpsest of material from different (butchering) episodes.

4.2.4 Palaeontological research

The identification of the variety of species represented in the different faunal assemblages is also an interesting challenge for vertebrate palaeontologists. R. Musil (Brno, Czech Republic) studied the horse skulls from Schö 13 II-4. Eline van Asperen examined the horse remains from the different levels and published part of the results (van Asperen 2012). In order to compare the horse from Schöningen with the fossil horses from Eastern Europe and Asia, Dr Tatiana Kuznetsova (Moscow, Russia) recently measured part of the material from Schöningen. The red fox *Vulpus vulpus* (Carnivora, Canidae) from Schö 13 II-4 has been studied and the details published (van Kolfschoten 2003). The characteristics of other taxa are being investigated by Leiden students, e.g. the Rhinocerotidae by Boxmeer (2011) and the Cervidae by den Engelsman (2011).

5 Additional projects

Apart from the archaeozoological studies listed above, a number of other research projects with a focus on material from Schöningen has been initiated. The projects vary from a) the study of insects, b) the reconstruction of palaeo-diet using stable isotope data and meso- and microwear data, c) the search for molecular (aDNA) data, and d) measuring Amino Acid Racemisation data for stratigraphical purposes and for long-distance correlation between sites.

Figure 17 Bone fragment from site Schö 13 II-4 with long scraping marks and green bone fractures indicating removal of the periosteum and marrow processing. (Photo Thijs van Kolfschoten).

Figure 18 Distal end of a metatarsus from a horse *Equus mosbachensis.* The damages indicate that the bone was used as hammer during stone tool production or curation. Bar = 1 cm (Photo Monika Knul).

5.1 Entomology

The occurrence of insect remains in the Schöningen deposits is obvious and the late Russell Coope and other entomologists indicated that the study of insects (Coleoptera in particular) can be successfully applied to collect detailed (local) environmental data on temperature, humidity, the occurrence of specific plants or dung etc. (Coope 2010). However, only a few sediment samples have been investigated so far by I. Benjamins (Leiden University) under supervision of Professor P. Buckland (Sheffield, UK) (Benjamins 2005). Samples for further research have been taken and are stored.

5.2 Isotope research

The fact that most of the Schöningen fossil remains are so extremely well preserved triggered the idea that the bones, despite their age, might contain collagen that potentially could be used for isotope research in order to collect additional environmental data, information about diet of the various taxa, and information about the migration of species. Karen van der Veen (Leiden) tested (supervised by Professor Dr J. van der Plicht, Center for Isotope Research, Groningen University and Faculty of Archaeology, Leiden University) the presence of collagen in the Schöningen bones and the impact of the preservative Mowilith on the results. She indicated the presence of collagen and showed that there is no significant difference between the isotope data from bones treated with Mowilith and from untreated bones (van der Veen 2010). Reason enough to start a pilot and investigate in more detail the bones from Schöningen. Margot Kuitems (Leiden), financially supported by the Leiden University Foundation (LUF), sampled 90 bones from different taxa (Elephantidae, Equidae, Rhinocertidae, Cervidae and Bovidae) and from different stratigraphical horizons. The stable isotope (^{13}C, ^{15}N) signals are surprisingly good; they vary and the different taxa show clear clusters (Kuitems *et al.* in prep.). One of the remarkable preliminary results is the indication that the Schöningen horses are predominantly browsers. In order to verify this, the meso- and microwear characteristics of the (pre)molars of the Schöningen horses are being investigated in close cooperation with Florent Rivals (Tarragona, Spain). The preliminary results have been presented at the annual meeting of the Society for American Archaeology (SAA) (2012 April, Memphis, Tennessee, USA). The isotope research will be continued by Margot Kuitems in the frame of a PhD project (supervisors: Professor Dr J. van der Plicht / Professor Dr M. van Kolfschoten and Professor Dr H. Bocherens (Tübingen University).

5.3 aDNA research

The fact that the collagen of the Schöningen bones is so well preserved, taking the age of the bones into account, offers the possibility of retrieving aDNA from the fossils remains. However, the test carried out by Aline Nieman and Dr Klaas Vrieling (DNA Marker point, Faculty of Sciences, Leiden University) did not yield positive results so far.

5.4 Amino Acid Racemisation (AAR)

The AAR method is generally and successfully applied in Quaternary Research in the United Kingdom, France and the Netherlands in the establishment of the stratigraphical position of sites and the long-distance correlation between sites. Molluscs and in particular the opercula of *Bythinia* appeared to be very useful. Mollusc remains have been collected from the sediment samples taken for palaeozoological research and Professor Dr K. Penkman (York, UK) analyses the samples. Only preliminary results are available so far.

6 Summarizing conclusions and the future

The Schöningen project is in many aspects unique and the involvement of the Faculty of Archaeology in the investigations of the Palaeolithic finds in the past 20 years was important, not only for the Schöningen project itself but also for the faculty. Many students participated in the annual field work organized by the faculty (and several students extended their stay in Schöningen to excavate longer). The huge amount of finds formed the base for many bachelor and master theses with a variety of topics, as well as a PhD thesis discussing the Schöningen 13II-4 Kill and Butchery site. The investigations yielded important data for the reconstruction of the palaeoenvironment during hominin occupation of the region, the (bio)stratigraphical dating of the sites, the long-distance correlation with other Palaeolithic sites and above all data on hominin subsistence and their hunting and exploration strategies. For a number of reasons mentioned above, taking the number of sites and the huge amount of finds into account, only little has been published so far. However, the "old" material is now accessible and the flow of new material is decreasing. This offers the possibility to merge the data presented in the Bachelor and Master theses with unpublished data and to prepare for international journals a number of manuscripts presenting the Schöningen material and discussing different topics. A special issue of the Journal of Human Evolution with contributions devoted to the Schöningen Palaeolithic finds is in preparation and due to appear in 2013.

6.1 Future Research

In the near future, the Faculty of Archaeology will still be involved in the Schöningen project and participate in the archaeozoological research. Most of the larger mammal remains, excavated before the University of Tübingen became involved (i.e. May 2008), have been identified and analysed but the material from a number of sites/levels still has to be studied in detail which will take at least a few years. This is also the case with the smaller mammal remains, collected in the past 20 years. The stable isotope research project started a few years ago and will continue in close cooperation with Tübingen University. However, changes in the organization (e.g. the fact that colleagues from Tübingen University are now leading the excavation and analysing the larger mammal remains) and the opening of the research and experience centre *paläon* will finally change the role of Leiden in the project. The involvement of Leiden in the research of hominin subsistence and their hunting and exploration strategies will decrease and the Leiden focus might be more on taphonomical, palaeoenvironmental and biostratigraphical questions. For the future it is important to continue the organisation of the annual field school in order to collect small vertebrates from newly exposed deposits. One very important issue is to merge the environmental results obtained by the different disciplines: botany (pollen as well as botanical macro remains), malacological data, data based on the fish, reptile and amphibian record, geological (sedimentological) data and so on. The same applies to the biostratigraphical research, where merging of the data from the different disciplines is one of the most important issues for the near future. Next to this the study of the zoological remains from a paleontological point of view will be continued. It is obvious that also in the future the Leiden research in Schöningen will take place in close cooperation with the institutions involved, in particular the *Niedersächsisches Landesamt für Denkmalpflege* (NLD, Hannover) (Professor Dr S. Winghart, Dr H. Thieme, Dr U. Böhner) and *Abteilung für Ältere Urgeschichte und Quartärökologie, Institut für Ur- und Frühgeschichte und Archäologie des Mittelalters, Universität Tübingen* (Professor Dr N.C. Conard, Dr J. Serangeli and others) and also in close cooperation with many scientists that played a role so far and those who will play a role in the future, e.g. Professor Dr B. Urban (Lüneburg), Professor Dr D. Mania (Jena), Professor Dr M. Frechen (Hannover), and Professor Dr Jutta Winsemann (Hannover).

Acknowledgements

The author would like to thank first of all Dr Hartmut Thieme (NLD, Hannover) for his cooperation and the stimulating discussions we have had in the past decades. I appreciated the valuable contribution of André Ramcharan (Fac. of Archaeology, Leiden University) who supported the Schöningen archaeozoological research during the past 16 years. Furthermore I would like to express my gratitude to Professor Dr Brigitte Urban (Lüneburg), Professor Dr Dietrich Mania (Jena), Dr Jordi Serangeli (Tübingen), Dr Utz Böhner (NLD, Hannover), and Professor Dr Nick Conard (Tübingen) for their contribution to the archaeozoological part of the Schöningen Project. Fieldwork in Schöningen was always a big pleasure thanks to the team that excavated all the sites: Wolfgang Mertens, Jörg Neumann Giesen, Neil Hajcock, Wolfgang Berkemer, Martin Kursch, and the late Klaus Köhler. Last but not least I want to thank Elfi Buhrs, Monika Knul, Margot Kuitems, Rianne Simons, Karen van der Veen and all the other students of the Faculty of Archaeology (Leiden University), who participated in the Schöningen archaeozoological research project, for their valuable contributions.

Notes

1 Representatives of the genus *Arvicola* are an important biostratigraphic marker for the Middle and Late Pleistocene. The molars of the water vole show evolutionary changes in their enamel. During this period the thickness of the enamel of the trailing edges, compared to the leading edges, changes. The differences in enamel thickness are expressed in so-called *Schmelzband-Differenzierungs-Quotient* (SDQ)-values (Heinrich 1978).

2 About 4600 mammal remains from Schö 13 II-4 were conserved and numbered in Hannover before 2000 and were available for Voormolen's archaeozoological analyses.

References

Afkir, S. 2011. *The Palaeolithic butchers of Schöningen: an investigation into the butchery marks, methods and strategies at the German Early Palaeolithic site Schöningen 13 II – 4*, Leiden (unpublished BA thesis University of Leiden).

Benjamins, I. 2005. *Help, there is a bug in my sample! Insects and their use in archaeological research: The Coleopteran Fauna of the Schöningen Eastern profile assemblage*, Leiden (unpublished BA thesis University of Leiden).

Berkholst, B.E. 2011. *The large mammal fauna of the Pleistocene site Schöningen 13 II; the levels Schö 13 II-1, 13 II-2 and 13 II-3,* Leiden (unpublished MA thesis University of Leiden).

Böhme, G. 2007. Fisch-, Amphibien- und Reptilien-Reste aus der Schichtenfolge des Reinsdorf-Interglazials von Schöningen. In: H. Thieme (ed.), *Die Schöninger Speere; Mensch und Jagd vor 400.000 Jahren*, Stuttgart, 105-111.

Böhner, U., J. Lehmann, M. Meier, G. Schulz, J. Serangeli and T. van Kolfschoten 2010. Ein über 300.000 Jahre alter Auerochse aus den See-Sedimenten von Schöningen. Befund, erste zoologische Interpretation, Bergung und Restaurierung. *Berichte zur Denkmalpflege 2010* 3, 89-94.

Boxmeer, T. 2011. *The genus* Stephanorhinus *(Mammalia, Rhinocerotidae) at the late Middle Pleistocene site Schöningen (Niedersachsen), Germany,* Leiden (unpublished BA thesis University of Leiden).

Coope, G.R. 2010. Coleopteran faunas as indicators of interglacial climates in central and southern England. *Quaternary Science Reviews* 29, 1507-1514.

den Engelsman, E. 2011. *De Cervidae van de Paleolitische site Schöningen, Duitsland,* Leiden (unpublished BA thesis University of Leiden).

Dennell, R. 1997. The world's oldest spears. *Nature* 385, 767-768.

Fennema, K. 1996. *Tanden des Tijds (Arvicolidae van Schöningen 12B FS1),* Leiden (unpublished BA thesis University of Leiden).

Heinrich, W.D. 1978. Zur biometrischen Erfassung eines Evolutionstrends bei *Arvicola* (Rodentia, Mammalia) aus dem Pleistozän Thüringens. *Säugetierkdl. Inform.* 2, 3-21.

Herzberg, M. 2000. *The Herpetofauna of Schöningen 12B,* Leiden (unpublished BA thesis University of Leiden).

Huyghebaert, I. 2003. *Small mammals of Schöningen 13II 2-4. Indication of a post-Holsteinian age based on the biostratigraphical use of the genus* Arvicola, Leiden (unpublished MA thesis University of Leiden).

Knul, M. 2009. *Voor de Kiezen, Onderzoek naar de Pleistocene kleine zoogdierfauna van Schöningen 12II en Schöningen 13III*, Leiden (unpublished BA thesis University of Leiden).

Lang, J., J. Winsemann, D. Steinmetz, U. Polom, L. Pollok, U. Böhner, J. Serangeli, C. Brandes, A. Hampel, and S. Winghart 2012. The Pleistocene of Schöningen, Germany: a complex tunnel valley fill revealed from 3D subsurface modelling and shear wave seismics. *Quaternary Science Reviews* 39, 1-20.

Mania, D. 1995. Die geologischen Verhältnisse im Gebiet von Schöningen. In: H. Thieme and R. Maier (eds), *Archäologische Ausgrabungen im Braunkohlentagebau Schöningen*, Hannover, 33-43.

Matze, L. 2010. *The Middle Pleistocene fauna from Schöningen (Lower Saxony, Germany). What do the large mammals tell us?,* Leiden (unpublished MA thesis University of Leiden).

Musil, R. 2002. Morphologische und metrische Differenzen der Pferde von Bilzingsleben und Schöningen. *Praehistoria Thuringica* 8, 143-148.

Parfitt, S. 1998. The interglacial mammalian fauna from Barnham. In: N. Ashton, S. Lewis and S.A. Parfitt (eds), *Excavations at the Lower Palaeolithic Site at East Farm, Barnham, Suffolk, 1989–94*, Occasional Paper of the British Museum 125, 111-147.

Preece, R.C., S.A. Parfitt, D.R. Bridgland, S.G. Lewis, P.J. Rowe, T.C. Atkinson, I. Candy, N.C. Debenham, K.E.H. Penkman, E.J. Rhodes, J.-L. Schwenninger, H.I. Griffiths, J.E. Whittaker and C. Gleed-Owen 2007. Terrestrial environments during MIS 11: evidence from the Palaeolithic site at West Stow, Suffolk, UK. *Quaternary Science Reviews* 26, 1236-1300.

Thieme, H. and R. Maier 1995. *Archäologische Ausgrabungen im Braunkohlentagebau Schöningen*, Hannover.

Thieme, H. 1997. Lower Palaeolithic hunting spears from Germany. *Nature* 385, 807-810.

Thieme, H. 1998. Altpaläolithische Wurfspeere von Schöningen, Niedersachsen. *Praehistoria Thuringica* 2, 22-31.

Thieme, H. 1999. Altpaläolithische Holzgeräte aus Schöningen, Lkr. Helmstedt. Bedeutsame Funde zur Kulturentwicklung des frühen Menschen. *Germania* 77, 451-487.

Thieme, H. 2007. *Die Schöninger Speere; Mensch und Jagd vor 400 000 Jahren,* Stuttgart.

Urban, B. 1995. Palynological evidence of younger Middle Pleistocene Interglacials (Holsteinian, Reinsdorf, Schöningen) in the Schöningen open cast lignite mine (eastern Lower Saxony, Germany). *Mededelingen Rijks Geologische Dienst* 52, 175-186.

Urban, B. 2007. Quartäre Vegetations- und Klimaentwicklung im Tagebau Schöningen. In: H. Thieme (ed.), *Die Schöninger Speere; Mensch und Jagd vor 400.000 Jahren*, Stuttgart, 66-75.

Urban, B., M. Sierralta and M. Frechen 2011. New evidence for vegetation development and timing of Upper Middle Pleistocene interglacials in Northern Germany and tentative correlations. *Quaternary International* 241, 125-142.

van Asperen, E. 2003. De paarden van Schöningen 13II-4, Leiden (unpublished BA thesis University of Leiden).

van Asperen, E. 2004. *The large mammal fauna of Schöningen 13II-4*, Leiden (unpublished MA thesis University of Leiden).

van Asperen, E. 2012. Late Middle Pleistocene horse fossils from northwestern Europe as biostratigraphic indicators. *Journal of Archaeological Science* 39, 1974-1983.

van der End, S. 2008. *Palaeoecology and evolution of Rodentia from late Middle Pleistocene deposits at Schöningen, Germany*, Leiden (unpublished MA thesis University of Leiden).

van der Veen, K. 2010. *Does the preservative Mowilith influence the δ13C and δ15N values of fossil bones?*, Leiden (unpublished BA report University of Leiden).

van Gijssel, K. 2006. *A continent-wide framework for local and regional stratigraphies: application of genetic sequence and event stratigraphy to the Middle Pleistocene terrestrial succession of Northwest and Central Europe*, Leiden (unpublished Ph.D. thesis University of Leiden).

van Kolfschoten, T. 1993. De Vertebraten des Interglazials von Schöningen. *Ethnographisch-Archäologisch Zeitschrift* 34, 623-629.

van Kolfschoten, T. 1995. Faunenreste des altpaläolithischen Fundplatzes Schöningen 12 (Reinsdorf-Interglazial). In: H. Thieme and R. Maier (eds), *Archäologischen Ausgrabungen im Braunkohlentagebau Schöningen, Landkreis Helmstedt*, Hannover, 85-94.

van Kolfschoten, T. 2003. A Red Fox *Vulpus vulpus* (Carnivora, Canidae) from the Middle Pleistocene spear horizon at Schoningen (Germany). *Veröfffentlichungen des Ländesamtes für Archäologie* 75, 321-334.

van Kolfschoten, T. 2007. Die Kleinsäugerreste aus dem Reinsdorf-Interglazial von Schöningen. In: H. Thieme (ed.), *Die Schöninger Speere; Mensch und Jagd vor 400.000 Jahren*, Stuttgart, 112-117.

van Kolfschoten, T., E. van Asperen and B. Voormolen 2007. Die Grosssäugerfauna von Schöningen. In: H. Thieme (ed.), *Die Schöninger Speere; Mensch und Jagd vor 400.000 Jahren*, Stuttgart, 76-86.

van Kolfschoten, Th. in press. The Schöningen mammalian fauna in biostratigraphical perspective. In: K.-E. Behre (ed.), *Die chronologische Einordnung der paläolitischen Funde von Schöningen,* Hannover.

van Zijderveld, K. 1995. *De grote zoogdierresten uit Schöningen uit vindplaats 12B*, Leiden (unpublished BA thesis University of Leiden).

Voormolen, B. 1996. *Schöningen 12 B. Een onderzoek naar de taphonomie van een Midden Pleistocene archeofauna*, Leiden (unpublished BA thesis University of Leiden).

Voormolen, B. 1997. *The vertebrate taphonomy of the Middle Pleistocene site Schöningen 12B, Niedersachsen, Germany*, Leiden (unpublished MA thesis University of Leiden).

Voormolen, B. 2008a. *Ancient Hunters, Modern Butchers. Schöningen 13II-4, a Kill-Butchery Site Dating from the Northwest European Lower Palaeolithic*, Leiden (Ph.D. thesis University of Leiden).

Voormolen, B. 2008b. Ancient Hunters, Modern Butchers. Schöningen 13II-4, a Kill-Butchery Site Dating from the Northwest European Lower Paleolithic. *Journal of Taphonomy* 6, nr. 2.

Thijs van Kolfschoten
Faculty of Archaeology
Leiden University
P.O. Box 9515
2300RA Leiden
The Netherlands
t.van.kolfschoten@arch.leidenuniv.nl