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BEYOND THE SITE

THE SAALIAN ARCHAEOLOGICAL RECORD AT MAASTRICHT-BELVÉDÈRE (THE NETHERLANDS)

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"De wetenschap is geen perfect instrument, maar het is wel het best mogelijke instrument. Net zoals de democratie niet het perfecte, maar wel het best denkbare systeem is."
(van Springel 1999:4).

Contents

1 Introduction

1.1 From Site A to Site N

The former Belvédère gravel- and loess pit is at the present time part of a 280 ha. area situated northwest of the Dutch city of Maastricht. The area, which is called Belvédère in general, is at the moment a hot topic of discussion, as it forms one of the main re-structuring zones for the town of Maastricht (Beek 2001*a* and *b*; Mertens 2001). The local landscape consists in the east of floodplains (*uiterwaarden*) of the river Meuse (Maas) and of the *Zuid-Willemsvaart* canal, and in the west part of the so-called Caberg-plateau edge (Meuse terrace landscape) is present. In the south and north there are, respectively, parts of the old Maastricht defence-walls and former dumping grounds. In this mosaic of housing facilities, industrial grounds, agricultural land, cultural and natural monuments and rubbish dumps, part of the oldest occupation of The Netherlands was documented.

Since the first half of the 19th century until the 1990s the Belvédère area, or better the Caberg region, was intensively commercialized by amongst others 'small-scale' brick-yards, which exploited the local loess and gravel deposits (van Rooij *et al*. 2003). In fact, due to these firms, large parts of the Caberg-plateau edge were quarried away to a depth of 10-15 metres (van Kolfschoten and Roebroeks 1985; Roebroeks 1988; Mertens 2001). In addition the quarries created small 'windows into the past', which enabled geologists, palaeontologists and archaeologists to study the Quaternary deposits. In the light of this research the Belvédère pit was given specific attention between 1980 and 1990, as *in situ* Middle Palaeolithic artefacts and faunal remains were discovered in the Saalian and Weichselian horizons. Inspired by these finds, systematic explorations of the pit sections were carried out and archaeological excavations took place on a yearly basis by Leiden University. This resulted in the documentation of a number of loci (from Site A up to Site N), where Middle Palaeolithic foragers discarded their flint implements during short term activities.

During that period, from 1985 onwards to be exact, the author was fortunate to participate in the annual excavation programme, as a student. Interested in the former presence of an extinct species of early human, fascinated by the lithic reflections of Middle Pleistocene hunter-gatherer behaviour (both typo/ technologically and spatially) and inspired by amongst others Mr Wil Roebroeks, Mr Paul Hennekens and Mr Nathan Schlanger a Master's thesis was written on the flint technology of the 1986-1987 excavations at the Saalian Site K (De Loecker 1988). This exercise in lithic analysis and conjoining of flint knapping sequences resulted eventually in a number of site-orientated publications (De Loecker 1992, 1993, 1994*a* and *b*). The main questions in these articles were, and still are, what can the Site K locus tell us about Middle Pleistocene hominid behaviour in terms of the (functional) character of the site, and what does it say about the settlement system in which the assemblage was formed. Moreover, we came to realize that if we wanted such questions answered, we should leave the 'site-level' and integrate all the available 'contemporaneous' data from the Maastricht-Belvédère sequence in the analysis (an 'off-site' approach *cf.* Foley 1981*a* and *b*; Isaac 1981). In other words, we should treat the find distribution(s) as part of 'one single' system in our search for mobile Middle Palaeolithic foragers, as they performed different activities at different parts of the former landscapes (*cf.* Roebroeks *et al.* 1992, see also De Loecker and Roebroeks 1998). At Belvédère it seems possible, meaningful and legitimate to compare for example Site K with other find occurrences, as they were all recorded from the same fine-grained fluviatile (local) Unit IV-C sediments (see Chapter 2). In addition, it is assumed that the several sites excavated in this unit do indeed belong to one and the same 'cultural system' (Roebroeks 1988:133). The findspots are probably contemporaneous in Pleistocene terms, having been formed during a relatively short phase within the same warm-temperate Saalian 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 and that there are 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 the analysis 'beyond the site' or better the analysis of a technological landscape.

1.2 Beyond sites: theoretical background

In the closing years of the 18th century, in 1797 to be exact, John Frere discovered some flints (Acheulian handaxes) at the small Suffolk village of Hoxne, England (Daniel 1972:10; Roe 1981:19-20; Wymer and Singer 1993*a*:1-22). The implements were deeply buried in undisturbed Pleistocene deposits and were stratigraphically located beneath a bed of sand, containing shells, remains of marine creatures and bones of extinct animals. These observations led Frere to infer that the lithics were man-made and that they must have been of great antiquity. In a small report he concluded:

> "They are, I think, evidently weapons of war, fabricated and used by a people who had not the use of metals.… The situation in which these weapons were found may tempt us to refer them to a very remote period indeed; even beyond that of the present world." (Frere 1800:204-205).

With this last sentence he suggested that the implements dated from earlier than 4004 B.C., then generally considered as the date of creation of the earth (the literal truth of the Bible). Although the full significance did not become apparent for sixty years, Frere's publication set the stage for (Lower) Palaeolithic archaeology as we know it today. Moreover, as the Hoxne artefacts were clustered in time and space, he made an early attempt to interpret the lithics in terms of 'human' behaviour: "The manner in which they [the handaxes, DDL] lie would lead to the persuasion that it was a place of their manufacture and not of their accidental deposit." (Frere 1800: 205).

During the first half of the 19th century, scientists of various disciplines moved slowly towards an acceptance of humanity's distant past. Until the 1850s-1860s archaeological research was mainly focused on the stone tool debate and the search for evidence in favour of the existence of fossil-man (then called pre-Adam man). For this purpose numerous sites across Europe were examined and many stone tools were recovered, sometimes associated with extinct animal bones (see amongst others Daniel 1972 and Roe 1981). In the end it was Jacques Boucher de Perthes who presented the 'key' that opened up the debate. Boucher de Perthes had spent several decades studying the gravel quarries near Abbeville and Amiens in the Somme Valley (Northern France). During his investigations huge quantities of artefacts, including Acheulian handaxes, were recovered at a number of locations (amongst others at Saint-Acheul). Because of their provenance from undisturbed deeply stratified gravel deposits (old river sediments), which also contained bones of extinct animals, he strongly defended the idea that the extinct animals must have lived at the same time as the tool-makers. Consequently fossil-man must have existed. Although Boucher de Perthes' discoveries were ridiculed in France, his claims were taken more seriously across the English Channel. In 1859 the respected British scientists Hugh Falconer, John Evans, Joseph Prestwich and Charles Lyell visited Boucher de Perthes at Abbeville (Daniel 1972:12; Roe 1981:22). They were immediately convinced by the stratigraphic evidence that early humans and extinct mammals co-existed. Moreover they recalled the work of Frere at Hoxne, which convinced them of the high antiquity of humans. All in all, this high academic attention given to northern French 'stones and bones', together with the 'new' findings at Brixham cave (Windmill Hill Cavern) near Torquay in Devon, England (Prestwich 1873; Pengelly 1874; Evans 1897:512; Daniel 1972) and the earlier discovered fossilised human remains at Engis in Belgium (1829-30), Forbes' quarry in Gibraltar (1848) and Feldhofer Cave, Neander Valley near Dusseldorf in Germany (1856), established the general recognition of fossil-man. The same year (1859) Charles Darwin's *On the Origin of Species* was published, and in Glyn Daniel's words "4004 B.C. was forgotten" (1972:12).

From the second half of the 19th century onwards until the 1960s, archaeologists were building mainly on that premise and new evidence of man's physical and cultural develop-ment was presented. By studying the Palaeolithic remains, which were collected and excavated from geological sections, cave sites and open-air sites, research initially focused on the construction of a reasonable chronology in which the recovered material culture could be placed. Prehistorians were in fact filling in the gaps of the time-space continuum and eventually a broad outline of human cultural development, linked to specific stone tool use, was established (*cf.* early hominids and pebble tools, *Homo erectus* and handaxes, and modern humans and blade tools). Although artefact descriptions were loaded with functional terms (based on modern tool analogies), such as borer, knife, axe, spear point, saw, etc…, little attention was actually given to early human behaviour in terms of the functional character of the sites. One of the earliest efforts to translate vast quantities of recovered material into behavioural patterns was made by Worthington George Smith in the 1880s and early 1890s (Wymer 1968; Roe 1981). In fact Smith can be seen as the 'godfather' of modern Palaeolithic archaeology. Like archaeologists today, he collected every fragment of worked flint rather than selecting just the best pieces, he recorded accurately the provenance of the artefacts, he drew sections and commissioned photographs of geological features and he skilfully illustrated his finds. Moreover, he used a very systematic and detailed refitting analysis (*cf.* Spurrell 1880*a* and *b*; Smith 1881) to make inferences on early human behavioural patterns (Smith 1892, 1894; Evans 1897:598-600). In *Man, the primeval savage* (1894:126-128) Smith described amongst others the elaborate conjoining and 'replacing' of the Acheulian flint assemblage at Caddington, on the border between Hertforshire and Bedfordshire (England). He used the gathered information to interpret and reconstruct many aspects of Palaeolithic life.

> "It is remarkable that some of the cores found by me are of a certain colour, or naturally marked in some peculiar way, and that no flakes of a similar colour or marking have been found. I assume that the flakes were struck off these cores for some special purpose, and carried to some other position not lighted on by me. Again, some flakes are of a peculiar colour, or naturally marked in a special way quite distinct from any core; these flakes, I suppose, must have been struck off elsewhere, and brought to the spot examined by me." (Smith 1894:128).

Besides these interpretations on artefact transportation he also made inferences on recycling, (re)sharpening and modes of flake and tool production/manufacture. In fact his analysis was a reconstruction of reduction schemes *avant la lettre*. Smith not only applied refitting to the Caddington site, he also used the method at the so-called 'Palaeolithic floor' or buried land surface in Stoke Newington Common in North London (Smith 1883, 1884, 1894). Again this 'floor' was excavated with great care and consisted of many flint tools and flint-working debris. He concluded that the tools were discarded at close distance to the place where they were last used, suggesting the *in situ* character of the site, and he reconstructed some behavioural patterns which were 'sealed' in the material culture.

Much light has been thrown on many points by Worthington Smith, but his comprehensive working methods and interpretations remained rather unique until the mid 20th century. Although in general a shift was noticed from section based research to the description of artefact distributions recovered from stratigaphically discrete but laterally extensive sedimentary units, behavioural interpretations and their spatial reflections remained rather limited. Until the 1960s, archaeologists were mainly concerned with geological questions, dating problems and artefact descriptions. They primarily recorded what kind of bones and artefacts were found at a site (morphological and typological interpretations) and secondarily described the similarities and differences (kinds and quantities) compared to other sites. In fact this practice did little to explain. Researchers mostly presented their behavioural (and spatial) understanding of the remote past by (re)creating 'dynamic' images of the daily lives of ancient human ancestors. Usually early humans were romantically depicted as groups of skilled hunters, gatherers and/or scavengers. They were mostly visualized during the actual killing of an animal, the dismembering of animal carcasses, flint working activities or as families performing several activities at a kind of base camp. Actually, these reconstruction drawings were sometimes the only behavioural inferences that resulted from years of very intensive research.

In the mid 1960s, many (younger) archaeologists became disenchanted with traditional archaeology. The main complaint was that archaeology described a lot but did not seem to explain very much. At that time the archaeological models were fine for reconstructing the history of the site, but were inadequate when it came to actually explaining the changes that occurred in the past. Moreover, until then research techniques focused on simply accumulating more data. The general idea was that when enough data was accumulated, the interpretation would be clear. The modern approach to the problems of archaeological interpretations was called *New Archaeology* (Binford and Binford 1968). The *New Archaeologists* argued that archaeology was a social science like anthropology and it should therefore explain the past social and economic systems, not just simply describe them. Through deductive reasoning, hypotheses and models were constructed to explain the given changes. These hypotheses and models were tested and only accepted on the basis of hard evidence. This meant that during the 1960s new excavation methods, involving more precise documentation of the finds, were introduced for Palaeolithic sites. Additionally, sampling methods, significance testing, and other methods of statistical computer analysis were initiated. Hypotheses on the reconstruction of past human behaviour and the settlement systems in which the archaeological assemblages were formed, provided directions for theory building in lithic studies. The 'new' sources used in lithic (and spatial) analysis were amongst others:

1. Experimental flint knapping pioneered by Don Crabtree (1972) and François Bordes (1961): Serious attention was given to different knapping techniques to produce ancient artefacts. The work mainly focused on the description of flaking mechanisms and the reproduction of steps in the reduction of specific artefacts. Lithics were placed in groups, based on their role in the manufacturing and use process (discard, rejects, used tools, rejuvenated tools etc…).
2. Refitting analysis: Through the innovative use of the method at Pincevent (Leroi-Gourhan and Brézillon 1966) it became clear that the potential of refitting exceeded reconstructing procedures of flake or blade manufacturing and so the method became crucial in behavioural and site analysis.
3. Use-wear or micro-wear analysis pioneered by Sergei Semenov (1964) and Lawrence Keeley (1980): With the introduction of microscopic traceological analyses archaeologists started answering elementary questions regarding the stone tool function (relationship between tools and worked materials). As a result they were able to identify some of the activities performed by prehistoric humans; the fundamental analytical data for understanding the organization of ancient technological behaviour.

These ‘new’ analytical sources, together with a basic knowledge of anthropology and the use of ethnographic parallels (see amongst others Lee and De Vore 1968; Binford 1980, 1983, 1984*c*, 1986, 1991; Binford and O’Connell 1984), became essential to help explain cultural patterns in the Palaeolithic record. In other words, the so-called ethno-archaeological approach provided opportunities to answer questions on past subsistence strategies and the spatial patterning of activity areas (*e.g*. Cahen *et al.* 1979; Van Noten *et al.* 1980). Moreover, since archaeologists became conscious of the fact that (early) human behaviour is spatially continuous, archaeological interpretation went beyond the ‘site boundaries’ (whatever that means).

The scientific interest in reconstructing dynamic early land use patterns can be traced back to the evolutionary question: what distinguished early members of the modern human genus from apes? Since the 1970s, there has been a tendency to emphasize the uniqueness of human behaviour (Binford 1981; Mellars 1991). In their quest, palaeoanthropologists and archaeologists focused on shifts in diet, foraging strategies and ranging patterns to discriminate the hominid lineage (Stern 1991). Initially, research was concerned with the significance of hunting (‘*Man the hunter*’ or ‘hunting’ hypothesis, *e.g*. Lee and De Vore 1968; Ardrey 1976), but rapidly became extended to other aspects of social organization and behaviour. Fundamental topics in these discussions were amongst others food-sharing, settlement patterns, technological complexity and/or flexibility, resource utilization, spatial patterning of technological behaviour and the presence or absence of symbolic reflections (Isaac 1978*a* and *b*; Mellars and Stringer 1989; Binford 1981; Klein 1992; Gamble 1993).

One of the most influential land use models in Plio-Pleistocene archaeology was presented by Glynn Isaac. In a response to the ‘hunting’ hypothesis, Isaac (1978*a* and *b*) argued in favour of a ‘food-sharing’ model. His statements used to identify the uniqueness of early humans were based on a comparison between the daily movement patterns of modern hunter-gatherers and those of non-human primates. In contrast with the ‘feed-as-you-go’ strategy of non-human primates (*e.g.* Goodall 1986) “the food-sharing hypothesis describes a behavioural system in which more mobile members of a social group ranged over large distances in search of difficult-to-catch and small but high protein packages of food, while less mobile members of the group range over smaller areas gathering staple plant foods. At least some food resources were not consumed as they were acquired, but were transported to a central place for processing and shared consumption.” (Stern 1991:4). Moreover, a sexual division of labour was suggested[1]. The crucial thoughts behind the model were that food and stone technologies were brought back to a predetermined focal point in the landscape for the purpose of various activities (similar to modern hunter-gatherers performances). This central point was classified by Isaac as a ‘home base’ (Isaac 1978*a* and *b*). The activities involved resulted eventually in the accumulation of broken-up animal bones and discarded lithic artefacts, sometimes associated with evidence of early *Homo*.

The research programmes initiated in the 1970s at Koobi Fora and Olduvai Gorge (Great Rift Valley, respectively Kenya and Tanzania) were designed to test Isaac’s proposed ‘food-sharing’ or better ‘home base’ model (Isaac 1984). Previously, excavations in these geographical areas had uncovered vast concentrations of lithic artefacts which were associated with abundant faunal remains. They occurred in distinct volcanic horizon layers and were dated to around 2 million years ago. For years Louis and Mary Leakey had termed these assemblages “living floors” or “living sites”, places where early humans slept, produced tools and butchered animals (Leakey 1971; Isaac 1978*a* and *b*). The social structure of modern hunter-gatherer ‘campsites’ was used as a blueprint for past behaviour. This, however, carried the implications that archaeological debris was deposited on a ground surface within one or more ‘contemporaneous’ events and that different areas functioned simultaneously. Moreover, the ‘living floor’ model was insufficient in explaining the behavioural patterns which created the assemblages. One of the main motives in the development of the ‘food-sharing’ hypothesis in Isaac’s argumentation was amongst others based on a detailed raw material study. The given assemblages suggested that many stone tools were transported by early humans to specific places. In addition, he was sceptic about the idea that the large piles of excavated faunal remains were the result of killings that took place with short time intervals at the specific locations. This led him to the conclusion that the ‘stones and bones’ were transported to the chosen ‘home-base’ localities (Isaac 1978*a* and *b*). Other sites were seen as butchery locations and caches (Potts 1988), while lithic assemblages with few faunal remains were explained as stone tool manufacturing loci.

The ‘home base’ model was instantly attacked by Lewis Binford (1981, 1984*a* and *b*, 1985, 1987*a*, 1988; Binford *et al.* 1988). His detailed (microscopic) analysis of the African animal bones revealed cut marks of stone tools as well as gnawing traces of carnivore teeth. This indicated that both human and predator behaviour (like lions and hyenas) were involved in the formation of the African Lower Palaeolithic record. Additionally, the evidence suggested that the ‘integrity’ of the sites, as undisturbed archaeological ‘living floors’, had not been established. The time period in which the artefacts had accumulated was unknown and therefore the relationship between the lithics and bones was suspect.

Binford assumed that the high densities of discarded material had been built up over a long period of time (*i.e.* palimpsests). A statement which is incompatible with the interpretation as so-called 'central places' or 'home bases' (Binford 1987*a*). Moreover, in his taphonomic reanalysis[2] of the bone assemblages (Binford 1981), he concluded that early humans did not actively hunt and carried meat back to base camps. Instead they scavenged and processed meat and marrow (by breaking open bones) from carcasses of animals that had died either a natural death or had been killed and deserted by predators. In Binford's view scavenging could not have provided the extra food needed for sharing.

All in all, researchers became to realize that inferring the *in situ* character of artefacts, or assuming associations between different find categories are tricky. The archaeological record should not be seen as static, but as part of a dynamic natural system that is constantly being changed and reworked. The processes involved must be understood before the excavated data are used for behavioural interpretations. What is more, the 'home base' ('living floor') – palimpsest dichotomy set the stage for a large number of detailed studies (mainly performed by Isaac's students), directed towards Palaeolithic taphonomy and site-formation processes (*e.g.* Schiffer 1972, 1976, 1983, 1987; Hofman 1986; Schick 1986, 1987; Nash and Petraglia 1987; Goldberg *et al.* 1993). The fundamental questions to answer were (and still are): how and why had the recovered dense assemblages been formed? Had they accumulated in a few hours or days (possible related visits)? Or were they the result of short occasional human and/or animal visits spread over long periods of time (palimpsests of unrelated events)? On the one hand the analytical approaches focused on natural post-depositional processes that could have affected the archaeological record, including biological[3], physical[4] and chemical agents[5]. On the other hand it was realized that also cultural (behavioural) processes can create palimpsests of evidence that accumulated over time. Humans sometimes deliberately or accidentally altered or destroyed the archaeological context[6]. So, motivated by the ongoing Isaac – Binford debate, the newly trained generation of researchers charged at the East African dataset using taphonomy as one of their major 'weapons'. Although no big surprises emerged, several alternative (mostly adaptations of existing) land use models were presented (Sept 1992:9). The general conclusion was that the horizontal patterning of lithic artefacts and faunal remains represented locations in the landscape where early human hunter-gatherer-scavengers carried out a clearly defined set of activities. This positioned them behaviourally apart from their primate ancestors.

The Palaeolithic or technological landscape can be seen as a continuous distribution of archaeological material, in which variable densities spatially occur[7]. 'High' concentrations of debris are mostly present against a background of 'low density' distributions, covering isolated or small sets of artefacts. Moreover, the 'high density sites' are normally the target areas for excavation, while the 'low density' phenomena seem to connect these dense clusters. Quantitative and qualitative characterisations are used to discriminate the different find occurrences from one another. As Holdaway and Fanning stated:

> "The temptation is to see this artifact carpet as the remains of a once active settlement system and, by identifying site types, to attempt to determine the reasons why particular locations were occupied. The result is a functional and largely synchronic view of landscape use wherein a number of locations are seen to operate together as a coherent whole." (Holdaway and Fanning 2004:3).

During the 1970s, while building and testing his 'food-sharing' – 'home base' model, Isaac initiated 'the scatter between the patches' project (Isaac and Harris 1978; Isaac 1978*b*, 1981). The research aims were the documentation of the distribution and nature of lithic artefacts. Essentially, he categorized four or five types of configurations in the East African Plio-Pleistocene landscape (*cf.* Isaac and Harris 1978; Isaac 1978*b*, 1981; Isaac and Crader 1981; Isaac *et al.* 1981; Stern 1993). Due to variations in quantity and composition they were described as different types of 'sites', suggesting distinct behavioural patterns. The diversity ranges from 'high density' patches of stone artefacts associated with bones from several different animal species (Isaac's so-called 'home bases' 1978*b*, 1981), through concentrations of lithics associated with bones from a single large animal, and lithic clusters without the associated bones (or *visa versa*), up to the 'low density scatters' of lithic artefacts and/or bones. Later on, Isaac proposed a hierarchy of levels for structuring and understanding these spatial configurations (Isaac 1981, see also Chapter 5.2). He organised the Early Stone Age relics according to density and spatial patterning, which resulted eventually in four basic levels: isolated artefacts (level 1), single action clusters (level 2, *i.e.* 'mini sites' [Isaac *et al.* 1981]), clusters of clusters or complex groups of level 1 and 2 occurrences (level 3, *i.e.* the dense artefact patches), and the total regional configuration of these 'visiting cards' (*i.e.* patterned set of all scatters and patches, level 4). What Isaac eventually suggested was that there may be significant functional differences between the 'high density' patches (his supposed 'home bases', butchery and/or quarry locations) and the thin, diffuse scattered surface between these places. Focusing on tool compositions, the latter were thought to represent recurrent activities possibly associated with foraging activities.

Like in Binford's earlier attack(s) on the 'home base' model (Binford 1987*a*; see also above), Nicola Stern questioned the 'integrity' of the 'high density' distributions, as undisturbed patches (Stern 1991, 1993, 1994). Stern's study of the 'high *versus* low density' distributions focused amongst others on the composition and characterisation of the assemblages. She suggested that the main discrepancy is density and that there are no functional differences between them (Stern 1993:210). The 'stone and bone' patches should not be seen as records of particular events, but simply as bulky assemblages consisting of archaeological debris (scatters) which accumulated over tens of thousands of years. In conclusion Stern stated:

> "Clearly, it is possible to identify stratigraphically discrete, but laterally extensive sedimentary horizons that contain sufficient archaeological debris that they can be used to study the differential distribution of material remains across an ancient landscape. However, the archaeological materials contained in these horizons are time-averaged palimpsests." (Stern 1994:102).

Although the East African Palaeolithic record can be seen as a palimpsest (Stern 1993, 1994), Isaac's 'scatters and patches' approach stresses at least the analytical (comparative) importance of treating the 'high and low' artefact distributions as parts of 'single system' (see also Foley 1981*a* and *b*). Before interpreting the excavated locations in terms of social organisation and land-use patterns, taphonomical studies should decide whether this system (or part of it) is the product of post-depositional agents or (in combination) the result of early human behaviour. It is however clear that we need to overcome the 'solitary site' focus if we want to learn more about the spatial movements of Palaeolithic hunter-gatherer-scavengers. People exploit(ed) the complete landscape and therefore limited 'site-orientated' views would narrow the understanding of prehistoric life. Consequently, the 'low density scatters' and 'high-density patches' should be treated equally. Moreover, we should realise that "we are probably looking at an archaeological landscape generated episodally and not the remains of a cultural geography wherein populations operated out of 'camps' into an environment, as do modern human populations." (Binford 1987*a*:29).

At Maastricht-Belvédère it seems possible and legitimate to compare the *in situ* Saalian artefact (and minor faunal) distributions. For various reasons mentioned above (see also Chapters 2 and 5.3), the excavated find occurrences appear to be contemporaneous in Pleistocene terms. In addition, this could indicate that we are dealing here with the discarded material remnants of a once active early human land use system.

Research of the local Pleistocene sequence initially started as a small scale project, focusing on individual artefact discoveries, geo-archaeological section observations and 'site' orientated studies. Over the years it developed into a comprehensive and multidisciplinary research project, in which the focal point altered towards the excavation and analysis of large continuous artefact distributions. The long lasting field efforts, which resulted in several excavated areas, showed that there are clear spatial differentiations in the artefact density. Influenced by the work of Isaac (1978*b*, 1981; Isaac and Harris 1978), the recovered assemblages were described as so-called 'high density patches' and 'low density scatters'. Initially the research questions were (and still are) directed towards the 'integrity' of the recovered assemblages[8]. In other words, the information value of the find distributions, for reconstructing early human behaviour, was put into question. Secondarily, if these findspots could indeed be understood as 'undisturbed' archaeological phenomena, what did they teach us about the subsistence settlement system in which they were formed? To obtain answers to such questions an effort was made to 'unlock' the information hidden in the lithic find occurrences. In-depth artefact studies (*i.e.* detailed lithic descriptions and elaborate refitting analysis) proved to be vital, while comparing the created data-sets with one another, subsequently, illuminate the inter-'site' variations.

Spatial variations in artefact density are in general easy to observe. It becomes however more complicated when other discrepancies between the Maastricht-Belvédère 'scatters and patches' are to be traced. At first glance the recovered assemblages look very similar, as typological and technological differentiation is limited. In addition, the overall tool and core quantities are low, and variation is again limited. On top of that, the assemblages show no clear distinction in the used raw materials. The performed lithic exercise showed eventually that the main discrepancies, beside density, 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 in attesting these fine-grained dissimilarities (De Loecker *et al.* 2003). In short, the 'scatters and patches' seem to reflect essentially one technological (flake) strategy that was based on the regular transportation of prepared cores and flakes (Roebroeks 1988; Roebroeks *et al.* 1988*b*). A number of spatial configurations reflect, however, a more expedient technology than others. Conjoining studies demonstrated that some artefact distributions represent core reduction sequences that largely overlap spatially, whereas others represent sequences that succeeded each other both in space and time. On the whole, the assemblages collected from the Belvédère sequence provided a set of valuable comparative data. This detailed information was used to interpret the large-scale and continuous artefact distribution, referred to as a 'veil of stones' by Roebroeks *et al.* (1992), which displays some internal variations in both artefact density and composition. Due to the fact that the majority of

Early Stone Age sites mainly consists of lithic implements, a better understanding of the *chaîne opératoire* (Perlès 1985; Pellegrin *et al.* 1988; Boëda *et al.* 1990; Sellet 1993) is vital in our search for behavioural patterns. Moreover, without the use of a detailed typo-/technological description, in combination with a thorough conjoining study, a large part of the minute differences between the Belvédère 'scatters and patches' would have remained uncovered. Like Stern stressed in her PhD thesis:

> "… improved understanding of the foraging strategies and land use patterns of early tool using hominids will ultimately be based on very fine grained analyses of archaeological debris and its palaeogeographic and micro-environmental context. The goal of future research … is to reconstruct the microhabitat context of archaeological debris in sufficient detail to gain a handle on the spatial and temporal variations of recourses and other factors known to influence the foraging and land use patterns of … hunter gatherers." (Stern 1991:8).

We have come a long way since the first human implement recognition by Frere and de Perthes (Frere 1800; Daniel 1972; Roe 1981). Through the revolutionary work of Smith (1894) and the innovative impulses of *New Archaeology* (Binford and Binford 1966) a setting was created for behavioural theory building. However, the Isaac – Binford debate (see above for references) shed light on taphonomy and site-formation processes and illustrated that we should be very cautious with the integrity and interpretation of early settlement (land use) systems. Nevertheless, it became clear that if we want to understand past behaviour we should leave the 'single site' focus and concentrate on an analysis 'beyond the site'. This can ultimately spotlight the spatial dynamics of lithic artefact technologies, which are in most cases the only behavioural remnants traceable on a palaeo- landscape.

In general, the main target of this work is twofold. On the one hand the elaborate lithic inquiry (*i.e.* artefact descriptions and conjoining) offers a way of understanding and interpreting a technological landscape at Maastricht-Belvédère. The high density Site K patch offers in that way a starting point and can be seen as a 'key site' in this thesis. On the other hand it provides a unique dataset, which can be generally used for future comparative research. Therefore, this study can also be seen as a detailed site-report.

1.3 Tackling the problem: lithic analysis and spatial pattering

As mentioned before, the conjoining of artefacts together with a lithic analysis, that is a careful typo-/technological description of artefacts, proved to be an essential 'tool' in the understanding of the Maastricht-Belvédère flint assemblages. Although refitting analysis has been known to be a valuable tool for site analysis for more than a century (see De Loecker *et al.* 2003 for an overview), it is only seldom being explored systematically for the interpretation of stone age sites and technologies. In most research projects such interpretations are based on lithic analysis alone, or refitting is only applied to a small sample of the assemblage. As conjoining and lithic description programmes are time consuming, and as recent archaeological projects are increasingly being designed to minimise time budgets and costs, the implementation of such an analysis may even be considered less favourable in future stone age research. Where refitting covers integral assemblages, however, its value for reconstructing both site taphonomy and human behaviour is well attested. It may even be argued that refitting is a must for reconstructing prehistoric lithic technologies (De Loecker *et al.* 2003). The elaborate flint artefact description, executed by a single person and having therefore a constant 'error', proved to be mainly valuable to pinpoint the small-scale typo-/technological differences between the so-called 'scatters and patches', as I will demonstrate below. If a lithic analysis only would have been used, the processes of production, use and re-use would have remained hidden, many technological details and peculiarities would not have been observed, and the spatial dynamics of technologies, both on site and inter-site level, would have been overlooked. A combination of both mentioned analytical tools used for the intra-Saalian interglacial find levels at Maastricht-Belvédère shed new light on, amongst others:

1. the reduction processes of Middle Palaeolithic core technologies, including the choices made by early humans when confronted with irregularities in raw materials and flaking;
2. the often complex life-histories of single stone tools in the process of production, use, re-use and recycling;
3. the use of space by early humans on the local level, resulting in a 'veil of stones' (*i.e.* Roebroeks *et al.* 1992) which consists of both high and low density artefact scatters;
4. the spatial organisation of technology when viewed from an inter-site/(micro-)regional level;
5. the taphonomic histories of Middle Palaeolithic artefact distributions, including the post-depositional horizontal and vertical displacement of lithic materials.

The results of Belvédère imply that, although refitting and lithic studies are time consuming, they should be applied, where possible, in combination to improve the quality of interpretation.

1.4 Reconsidering the data

Traditionally, archaeological research has focused on 'sites' to investigate material, economic, social and cultural behaviour (*i.e.* the 'site' as fundamental analytic entity).

When the concept archaeological 'site' is critically examined, its meaning seems to vary depending on the context in which the word is used. A site can, amongst others, be described as: a locus which is intentionally used by (early) humans; or a locus which is characterized by human deposition of activity remains; or a group of stone artefacts, sometimes associated with faunal remains, which were recovered together (*i.e.* an assemblage). Additionally, there are definitions centred around density criteria (quantity per square metres), physical space (geographical area) and even research goals (*i.e.* the research questions direct whether certain phenomena should be documented as sites). The notion 'site' can therefore be regarded as overlapping, controversial and untrustworthy (Binford 1992; Dunnell 1992). Consensus on its definition will probably never be reached, since archaeologist excavate artefacts, bones, features, etc. and not 'sites'. This would suggest that archaeological 'sites' are illusions produced in the minds of archaeologists.

The roots of the 'site' controversy are probably to be found in landscape directed archaeology. Since human behaviour is spatially continuous, Palaeolithic archaeologists came to realize that hunter-gatherer activities have only a very small impact on the landscape. Generally their archaeological visibility can be considered as low. Moreover, it became clear that the excavated 'classic sites' represent only the most densely concentrated artefact distributions, and that palimpsest situations of unrelated events were not uncommon. The frequently neglected find distributions outside the excavated 'site' context suddenly became worthy of study and new complementary data on early human land use patterns were generated (*e.g.* Isaac 1978*b*, 1981; Isaac and Harris 1978). In contrast to the 'site' focus, this landscape perception[9] was orientated towards the archaeological integration of low density phenomena which were excavated 'outside' or 'between' the actual 'points'. In other words the research, commonly referred to as 'mini-site', 'non-site' or 'off-site' archaeology' (respectively Isaac *et al.* 1981; Thomas 1975; Foley 1981*a* and *b*), still focused on the dense artefact clusters, as they were actually seen as equivalents of 'settlements' or 'central points' in a behavioural land use system. The 'off-site' patterns were (and are) often simply described as 'background noise'.

As a result, the palaeo-landscape can be portrayed as non-stop artefact distributions consisting of high densities' ('sites') and 'low densities' ('non-sites'). In Isaac's terminology these are respectively 'patches' and 'scatters' (Isaac 1978*b*; Isaac and Harris 1978). Besides the problem of definition, the 'site' controversy is situated in the question: where do we draw the line between a 'site' and a 'non-site', if we want to analyse a continuous spatial distribution of archaeological remains? The determination of a clear quantitative 'cut-off' point (relative changes in artefact densities) is subjective and usually done by the archaeologist concerned. Such an arbitrary distinction could suggest that the methodological 'site-orientated' framework is founded on intuition, resulting therefore in theory building based on 'fiction'. Moreover, the 'site *versus* non-site' separation creates a black and white situation in which there is little place for the analysis of deviating occurrences, *e.g.* excavated surfaces which eventually turn out to be situated on the periphery of a 'site', or spatial overlaps of both phenomena. And what will happen, for example, if part of a technological landscape is excavated and only the low density 'off-site' patterns are used for analysis? Due to internal density differences we could probably still define a number of phenomena as 'sites'. It should be mentioned that the use of alternative concepts such as Isaac's 'scatters *versus* patches' seems problematic as well, and for the same reasons, *i.e.* they imply the existence of a 'site focus', they represent a black and white situation and a clear 'cut-off' point will have to be defined.

To analyse the cultural remnants of hunter-gatherer-scavenger land use activities, we should endeavour to practise an archaeology in which, at least at the methodological level, the traditional 'site' concept is banned. This means that we will have to regard the spatial distribution of artefacts as a sliding scale on a continuum (Gallant 1986; Roebroeks *et al.* 1992; Holdaway and Fanning 2004). Both high and low density patterns belong to the remnants of a cultural system, so they should be seen as a whole without discriminating one or the other. In this scenario the individual cultural items such as a flake, tool, core, bone artefact, feature, etc. are to be considered as the minimal unit for analysis (Thomas 1975). High density distributions of debris represent the other extreme of the continuum. This site-less archaeology confronts us, however, with a dilemma. In the absence of distinct spatial references that group supposed clusters into 'sites', it becomes very difficult to manage the mapped artefact distributions for the purpose of interpretation and comparison.

At Maastricht-Belvédère the excavated surfaces were traditionally named 'sites' (Site A, B. C, etc. according to the chronology of research). However, it is well clear by now that the 'site terminology' does not offer an adequate framework for analysing and interpreting the nature of the encountered patterns. Clearly these are not pinpointed occurrences (*cf.* Isaac 1978*a* and *b*). As it has become apparent from the excavations, large parts of the interglacial river Meuse valley bottom must have been littered with artefacts. This large-scale and continuous artefact distribution, interpreted by Roebroeks *et al.* (1992) as a 'veil of stones', show some internal variations in artefact density, composition and refitting potentials. However, for the sake of consistency with earlier publications the site-terminology is maintained, but it should be noted that the term 'site' refers here only to excavated surfaces. This applies also to the notions 'locus', 'patch', 'scatter' and 'background noise', as they only refer to higher or lower densities in the continuous 'veil' of artefacts. These concepts must be seen only as useful 'tools' which will be used to analyse and compare the spread of archaeological remains.

Primarily, in this thesis the various excavated Belvédère areas will be treated as basic analytical units. They will be compared with one another secondarily. Careful analytical attention is given to the isolated finds (*i.e.* section finds), low density distributions and high density distributions. The archaeological manifestation of early human behaviour will only be studied after an investigation of taphonomy and site-formation processes. Analysis of the raw materials, technology and spatial configurations may ultimately help to define different functional mechanisms or behavioural episodes. On the basis of percentages, ratios, associated artefact densities and spatial dispersion, the different high and low density distributions will be compared and eventually the 'veil of stones' will be interpreted in terms of early human behaviour. It is important to realize that they represent only a very specific (valley) segment of the total settlement system (Kolen *et al.* 1998, 1999).

Much consideration is given to the 'site' controversy, but ultimately the 'veil' model appeared to be the most suitable for analysing a continuous artefact distribution at Maastricht-Belvédère. It can therefore be stated that the general methodological and theoretical framework should be reconsidered, and not the data.

1.5 Step by step

The Maastricht-Belvédère complex fluviatile deposits of the river Meuse and the younger aeolian sequence have been studied archaeologically and geologically for many years. These studies have resulted in the definition of a number of lithological and lithostratigraphical units, which contained relics of Middle Palaeolithic early human occupation. After a short historical introduction, the Middle and Late Pleistocene sequence at Belvédère is briefly described in Chapter 2; dating and palaeoenvironmental data will be discussed. The most interesting archaeological levels, however, were embedded in fine-grained fluviatile sediments (Unit IV), with an approximate age of 250 ka. These deposits are present on top of a complex of terrace gravels, and are overlain by a series of Saalian silt loams and Weichselian loesses. This Saalian Unit IV will be described in slightly more detail. For a 'complete' picture of the local situation the reader is referred to van Kolfschoten and Roebroeks (1985), Vandenberghe *et al.* (1987) Roebroeks (1988) and van Kolfschoten (1990). These publications mainly represent the results of the first five years of investigation. During the period 1986-1990 additional geological, palaeontological and archaeological data were collected, resulting amongst others in a minor revision of the earlier presented lithological and lithostratigraphical framework (Vandenberghe *et al.* 1993).

As mentioned, the main archaeological level documented a full interglacial fauna associated with a 'rich' Middle Palaeolithic dataset, preserved within various sites over an area of about 6 hectares. Between 1981 and 1990 excavations were carried out every year, often under considerable time pressure and sometimes just ahead of the commercial excavation machines and by the end of 1990 eleven 'sites' had been excavated at the Belvédère locale. Some of these findspots were so well preserved that extensive refitting proved possible, *e.g.* at sites C, F (Roebroeks, 1988) and K (De Loecker, 1992, 1994*a* and *b*), and inferences on former *chaînes opératoires* could be drawn (Schlanger, 1994, 1996). One of 'richest' sites in terms of flint quantities and interpretation value is Site K. This so-called 'classic' site is analysed in Chapter 3 and its study created a scientific setting for a further analysis beyond the 'site-level'. In other words this findspot represents a key-site for this thesis. Chapter 3 presents a typo-/technological review, refitting exercise and spatial analysis of the lithic material. After a geological interpretation of the local sediments, the dating evidence and a discussion of the research methods, a summarized typo-/technological description of the flint artefacts is given. In total 10,912 flint artefacts were collected, consisting mainly of debitage. All stages of the reduction strategy, from collecting the raw material through decortication to the discard of cores and tools, are represented. The reconstructed technology can generally be interpreted as the result of a 'wasteful' reduction of non-prepared cores. Also a number of well-prepared tools, fabricated on 'exotic' flint, was probably transported to the locus, to be used 'on the spot'. Topics like raw material procurement, *ad hoc* production (-modes) of flakes, cores and tool, and transport of lithics will be discussed in different sections. Specific attention is paid to the results of the detailed refitting analysis. Subsequently, the artefacts, including the refitting results, of this 'rich' site are analysed and interpreted spatially. Whether this 'high density' site is exclusively the result of one consistent use of the place, or a palimpsest of several unrelated events is an important issue in the analysis.

For a comparison of the Site K results, Chapter 4 presents an introduction, a typo-/technological review, some refitting and spatial results and an interpretation of the lithic material from all Maastricht-Belvédère Unit IV findspots (Sites A, B, C, D, F, G, H, and N). Besides the artefacts from the excavated areas all stray-finds, collected in several (stratigraphically) different (long) sections and finds recovered during test pit excavations, will be dealt with as well (Sites L, M, O, N [level X] and the 'July 1990' test pit). Furthermore, the 'isolated' section finds recovered during the ca. ten years of research will be described as one group of artefacts. It should be mentioned here that Chapter 4 contains some repetition of Belvédère data presented in earlier publications (*cf.* Roebroeks 1988; Roebroeks *et al.* 1992; Schlanger 1994). This was mainly done to give an overview, as accurately as possible, of the Unit IV archaeological remains. Excavations at Maastricht-Belvédère showed that parts of the former Meuse valley bottom must have been littered with artefacts and bones. This large-scale and continuous artefact distribution (referred to as a 'veil of stones' by Roebroeks *et al.* [1992]) displays some internal variations in artefact density and composition. Chapter 5 presents a survey of these variations and attempts to explain them in terms of early human behaviour. Here, topics such as transport or expedient production of flakes, tools and cores, which played an important role in the formation of inter-assemblage variability, will be treated. This chapter uses some elements of Isaac's (1981) 'scatters and patches' approach and is mainly based on the model published by Roebroeks *et al.* (1992). The model stresses the equal importance of scatters and patches and shows that the find distributions should be treated as parts of 'one' single system in our search for Middle (Lower?) Palaeolithic patterns in the former landscapes.

The information potential of the scatters and patches in the Meuse valley, discovered at Belvédère, may eventually be more fully realized when compared to Middle Palaeolithic find occurrences in nearby regions (see Roebroeks 1988; Kolen *et al.* 1998, 1999, and Verpoorte *et al.* 2002 for an introduction).

notes

1 The 'food-sharing' hypothesis (1978*a* and *b*) was later slightly altered and reformulated into the 'central place foraging' hypothesis' (Isaac 1983*a* and *b*).

2 Binford studied the condition and composition of faunal assemblages (1981, 1987*b*). He compared the animal bones recovered from the African hominid sites with those produced by modern day predators and noticed no big differences between them. Both groups were mainly composed of bones which had little meat value. However, the specimens which showed traces of human modification contained the most marrow.

3 Biological post-depositional processes concern amongst others: carnivore gnawing, consumption and/or disarticulation of carcasses, mole and rabbit digging, earthworm and insect actions and plant and tree root activity.

4 Physical post-depositional processes concern amongst others: geological and fluviatile forces like tectonics, erosion, soil formation, sediment pressure, stream actions, alternate wetting and drying of sediments and frost actions.

5 Changes in chemical composition can destroy or alter some of the archaeological materials.

6 Cultural site-formation processes concern amongst others: trampling activities, removal of manufactured and/or discarded artefacts, use and re-use of lithics and activity loci, and curation and recycling of stone tools.

7 This statement is in fact the basic concept behind 'off-site' archaeology (*e.g.* Foley 1981*a* and *b*; but see also Rossignol and Wandsnider 1992). In Foley's words (1981*b*:2), "an off-site approach is … designed to utilise the spatial continuity to maximise archaeological information."

8 Do the Maastricht-Belvédère 'scatters and patches' represent undisturbed archaeological 'sites', or should they be considered as palimpsests of unrelated events?

9 Previously 'landscape archaeology' had studied the natural environment and its relationships to 'sites' (resource availability, carrying capacity, site-catchment, human adaptation, etc.).

2 An introduction to Maastricht-Belvédère: geology, palaeoenvironment and dating

2.1 INTODUCTION

The Maastricht-Belvédère gravel- and loess pit is situated on the left bank of the river Meuse (Maas), approximately 1 km northwest of the city of Maastricht (The Netherlands, province of Limburg; Figure 2.1). The quarry is located on the northern border of the Northwest European loess-belt, on the edge of the so-called Caberg-plateau of the Meuse terrace landscape. The pit was carved into a steep cliff between the Lower and Middle terrace of the river Meuse.

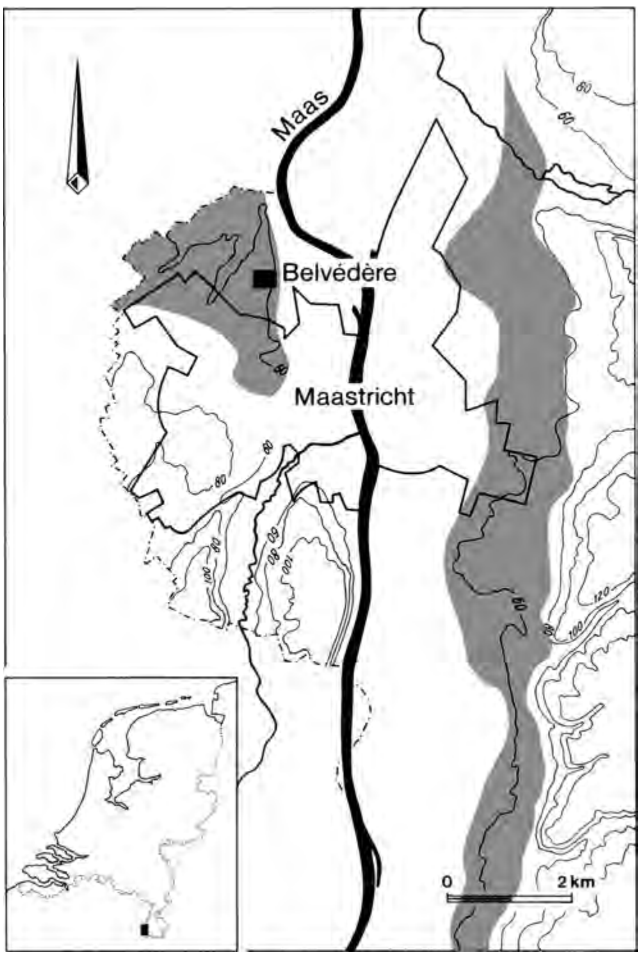


Figure 2.1: Location of the Maastricht-Belvédère pit, with shaded the distribution of the Caberg Middle Terrace sediments. The Caberg-plateau coincides with the western distribution of the Middle Terrace sediments (after Roebroeks 1988).

The complex fluviatile deposits of the river Meuse and the younger aeolian sequence at Maastricht-Belvédère have been studied for many years. This study resulted in the definition of a number of lithological and lithostratigraphical units, published by Vandenberghe *et al*. (1985, 1987, 1993) and Roebroeks (1988).

In this chapter the Middle and Late Pleistocene sequence at Maastricht-Belvédère will be described briefly, and dating and palaeoenvironmental data will be discussed. The most interesting archaeological levels at Belvédère were situated in fine-grained fluviatile sediments (Unit IV), with an approximate age of 250 ka (Roebroeks 1988; Huxtable 1993). These deposits are present on top of a complex of terrace gravels, and are overlain by a series of Saalian silt loams and Weichselian loesses. This Unit IV will be described in more detail, but first a short historical review of the interdisciplinary research at Maastricht-Belvédère will be given, based on Roebroeks (1988).

Before its identification as a Palaeolithic site, mammal fossils had been found in the Quaternary deposits of the Middle terrace Caberg-plateau since the beginning of the 19th century. The quarry became archaeologically well known during the 1920s because of Neolithic excavations by Mr J.H. Holwerda (National Museum of Antiquities, Leiden; 1926, 1927, 1928, 1929, 1930). About 50 years later, Palaeolithic archaeology became the main topic of study of the pit. During a systematic examination of the local stratigraphy and a search for the occurrence of *in situ* Palaeolithic material, Mr W.M. Felder (Geological Survey of The Netherlands, Heerlen) discovered an artefact at the boundary of the Saalian/Weichselian loess deposits in September 1980. This discovery inspired Mr W. Roebroeks, together with a small group of amateur archaeologists, to carry out a thorough investigation of the pit sections, during which several horizons containing artefacts and animal remains were found. Between 1981 and 1990 excavations took place every year. During that period the pit was being exploited by a commercial quarrying firm. Therefore, most of the archaeological sites had to be excavated under considerable time pressure and at times right in front of the machines (Figure 2.2).

Figure 2.2: Maastricht-Belvédère Site J. Photo taken during the excavation of the Weichselian Site J (May 1986).

The Pleistocene sediments with a Saalian and Weichselian age (van Kolfschoten and Roebroeks 1985; Roebroeks 1988; Vandenberghe *et al*. 1993) exposed in the pit, contained several 'horizons' with archaeological material. By the end of 1990, excavations had uncovered a total of twelve 'sites' (Table 2.1, Figure 2.3) located within an area of approximately 6 hectares. Most of the artefacts date to an intra-Saalian interglacial period, correlated with Oxygen Isotope Stage (OIS) 7 (van Kolfschoten *et al*. 1993).

The results of the first five years (1980-1985) of Belvédère research are presented in several synthesizing publications (van Kolfschoten and Roebroeks 1985; van Kolfschoten 1990), whereas further results are presented in Roebroeks 1988 and Vandenberghe *et al*. 1993).

2.2 Geological setting of the Middle and Late Pleistocene deposits at Maastricht-Belvédère

2.2.1 Introduction

Geographically the study area is located in the southernmost part of the Dutch province of Limburg. In the east this area borders onto Nordrhein-Westfalen (Germany), and in the west and south onto the Belgian provinces of Limburg and Liège.

Geologically, the Southern Limburg area is situated within a separate tectonic unit, the 'South Limburg block', consisting of permeable Cretaceous and Tertiary deposits. These deposits are wedged between the 'Midi Aachen thrust' and the southern boundary fault zone (*Feldbiss* fault) of the 'Roer rift valley system'.

During the Quaternary the geomorphological development of the area was dominated by tectonic uplifts, fluvial activity and loess deposition. In an early stage the river Meuse had a northeasterly course, while during the Pleistocene the 'West Meuse' with a northwesterly orientation prevailed. The latter includes the present river course. Fluvial deposits, such as coarse terrace gravels of varying age, have covered most of

Site	Field designation	Date	Excavation area (m^2)	Period of excavation
A	Trench East I	Saalian	5	March 1981
B	Trench North	Saalian	19/23	July-Sept. 1981
C	Trench South	Saalian	264	1981-1983
D	Tench East II	Saalian	–	August 1982
E	Trench WG	Weichselian	50	Nov.-Dec. 1982
F	Trench East III	Saalian	42	June-July 1984
G	Site G	Saalian	50	1984-1985
H	Site H	Saalian	54	March 1987
J	Site J	Weichselian	210	May-June 1986
K	Site K	Saalian	370	Dec. 1986-July 1987
N	Site N	Saalian	765	Feb. 1988-Sept. 1989
July 1990	July 1990	Saalian	7	July 1990

Table 2.1: Survey of the main Maastricht-Belvédère sites (after Roebroeks *et al.* 1993). Some of the 'sites' consist only of small test trenches, where artefacts were recorded in a stratigraphical position.

Figure 2.3: Situation of the main Maastricht-Belvédère archaeological sites mentioned in the text (see also Table 2.1). Scale 1:2500 (the numbers refer to the coordinates of the topographical map of The Netherlands, sheet no. 61F). The aerial photograph dates from May 1986 and is published with permission of KLM Aerocarto (film 0556-photo 8528; after Roebroeks *et al.* 1992).

the Cretaceous and Tertiary formations. Only a small zone in the southeastern part and a larger area in the eastern part (the so-called '*Eiland van Ubachsberg*' along the Waubach anticline) remained outside the fluvial influence of the river Meuse. Both climatic changes and tectonic movements led to periodical changes in fluvial regimes. The Cretaceous and Tertiary plateaus were thus transformed into a terrace land-scape (van den Berg 1996). Tectonic uplift must have played a dominant role in determining terrace preservation and the actual general valley morphology. Climatic changes determined the terrace formation by causing changes in water and sediment supply. Generally the terrace system is divided into a Higher, Middle and Lower Terrace with several subdivisions (for details see amongst others Brueren 1945; Kuyl 1980; Felder and Bosch 1989; Veldkamp and van den Berg 1993; and van den Berg 1996).

During the late Saalian and, in particular, during the Weichselian, loess deposits covered large parts of the terrace landscape. At present loess covers vary in thickness from more than 20 metres on the plateaus to less than one metre on plateau edges and north-facing slopes. Already in the Weichselian, but also during the Holocene (caused by intensive land use; Bouten *et al*. 1985) the steep slopes and plateau edges were affected by erosion. Moreover, the loess cover may have disappeared completely in these landscape sections, and as a consequence older terrace gravels and Cretaceous and/or Tertiary formations may come to the surface here.

At the Maastricht-Belvédère pit mainly Quaternary deposits are exposed. The stratigraphical sequence can roughly be divided into fluvial and aeolian deposits. The lower part of the sequence has a fluvial origin, whereas the upper part is aeolian. The fluvial deposits overlie Paleogene deposits (Unit I), with on top local remnants of Oligocene marine sands (Unit II).

Geological fieldwork carried out in the period 1981-1989 has enabled Vandenberghe *et al*. (1993) to present a detailed reconstruction of the genesis of the Pleistocene sequence at Belvédère. For a general and detailed review of the Middle and Late Pleistocene deposits exposed at Maastricht-Belvédère, the reader is referred to van Kolfschoten and Roebroeks 1985; Roebroeks 1988 and Vandenberghe *et al*. 1993. Only a brief account of the local geological context of the archaeology in the pit is appropriate here. To illustrate the lithostratigraphical succession of the Pleistocene sequence Figures 2.4 and 2.5 have been added. Specific attention will be paid to the Saalian fine-grained fluviatile Unit IV sediments which were deposited by the river Meuse system.

2.2.2 Maastricht-Belvédère: stratigraphy, dating evidence and palaeoenvironment

The base of the Pleistocene deposits at Maastricht-Belvédère consists of a heterogeneous gravel body with inter-bedded small sand lenses (Unit III of the local lithostatigraphy), deposited by a braided river system (Paulissen 1973; Vandenberghe 1993). The cold stage fauna from Unit III is indicative of an open environment in a cold climate and also allows to derive a post-Holsteinian (probably Early Saalian) age for this deposit (van Kolfschoten 1985, 1990, 1993).

The various kinds of fluvial sediments (Unit IV) on top of these gravels consist of sandy and clayey deposits. They represent a striking change in the river system. The lower part of Unit IV was also formed by a braided river system, while the upper parts were deposited by a slightly incising, meandering system. The main archaeological find levels from the pit are present in the fine-grained deposits of this meandering system. The faunal remains in this unit indicate that human occupation occurred in warm-temperate conditions of an interglacial character before the maximal Saalian ice-advance in the Central Netherlands (van Kolfschoten 1985; Meijer 1985). Because the main archaeological find levels, discussed in this dissertation, are situated in Unit IV, this unit will be dealt with in more detail later on.

From the channel/gully deposits of Unit IV a very gradual lithological transition can be observed towards Subunit V-A, an alluvial deposit consisting of a mixture of sands and loams, that could be interpreted as overbank deposits. The relatively large gravels and the high sand content of Subunit V-A suggest a high energy flood-water deposition by the meandering river that had already left the Belvédère site (Vandenberghe *et al*. 1985). The gradual transition suggests that the formation of Unit IV and Subunit V-A was closely related in time, and that they were very probably formed under the same climatic conditions. The top of Unit IV and Subunit V-A have been modified by a continuous period of soil formation (Mücher 1985; Huijzer and Mücher 1993). It concerns a luvisol, generally formed under deciduous forest cover during warm-temperate climatic conditions. The water-laid Subunit V-B sediments, consisting mainly of aeolian silt loams with some admixture of sand, represent a cold phase deposit of loess which was displaced by wind after the original deposition (Mücher 1985). Another period of soil formation is indicated by the remnants of a second luvisol in the top of Subunit V-B, correlated with the so-called *Sol de Rocourt* of Eemian age (Gullentops 1954). This soil marks the boundary between the Saalian (III, IV and V) and the Weichselian Units (VI and VII).

The overlying (Weichselian) Units VI and VII are also loesses. Unit VI consists mainly of reworked loesses of Early Weichselian pleniglacial age (Vandenberghe *et al*. 1985). These sediments were mainly formed under cold humid climatic conditions. The faunal remains from this Unit may reflect an equivalent of the 'Mammoth-steppe' fauna as described by Guthrie (1990) (van Kolfschoten 1993). At the base of Unit VI traces of transported soil constituents are found which resemble the so-called 'Warneton soil' (Paepe 1967). The cryoturbated horizon in the upper part of Unit VI strongly resembles the so-called 'Nagelbeek horizon', a widely distributed marker stratum in the West European loess belt (Haesaerts *et al*. 1981). According to thermoluminescence (TL) analysis the 'Nagelbeek horizon' as well as overlying Unit VII are of late pleniglacial age.

In the same general period the reworked Unit VI deposits were covered by a typical/pure *in situ* aeolian loess (Unit VII), in which the Holocene luvisol developed.

2.2.3 The main archaeological level (Unit IV): stratigraphy, dating evidence and palaeoenvironment

Most of the Pleistocene units mentioned above have yielded flint artefacts, starting from two rolled flakes from the Early Saalian gravels of the braided river system of Unit III. However, the most interesting deposits exposed at Maastricht-Belvédère both from archaeological and palaeontological viewpoints are the fine-grained fluviatile Unit IV deposits, whose archaeology is central to this thesis. They have yielded archaeological remains at two different stratigraphical levels: in Subunits IV-B and IV-C (see Vandenberghe *et al*. 1993[1]).

Based on sedimentological analyses, Vandenberghe (1993) distinguished three consecutive phases of rather 'identical' development of meanders in the Belvédère sequence (Subunits IV-A, -B, -C). The faunal assemblages from the base of Unit IV (-A) indicate a steppe-like environment and rather warm and dry climatic conditions (van Kolfschoten 1993). Data from Subunit IV-B and IV-C are indicative of full interglacial conditions (Vandenberghe *et al*. 1993).

The Unit IV sediments represent a decrease of energy of the meandering river. This is a phase in which part of the underlying Unit III was eroded, followed by accumulation of sediments and a rapid migration of the meanders which resulted in the abandonment and subsequent infilling of the gullies by finer deposits: a low-energy fluviatile environment (Mücher 1985 and Vandenberghe *et al*. 1985). Sedimentary deposition in the form of levees and in backswamps is also noted (Vandenberghe *et al*. 1985). The archaeological occurrences are particularly situated on the levees along the river channel (Figure 2.6).

The presence of archaeological remains at Site A, D, F, H, K and N is confined to the so-called 'mottled zone' within the Unit 5.1 sandy siltloam. Chronostratigraphically this 'mottled zone' can be placed in Subunit IV-C-ß. According to Roebroeks (1988:79, 117) this is only one of a series of possible options. As presently there are no clear arguments that justify opting for another position, Roebroeks' ascription is followed here.

The lower-lying Subunit IV-B archaeological assemblages (sites B, C and G) are found in a greyish-olive green silty

Figure 2.4: Photo of the southern part of the Maastricht-Belvédère pit, summer 1987, showing Units III to VII. The large boulders in the front left come from the Unit III gravels. The 'white band' visible halfway up the section consists of calcareous tufas, present in the Unit IV inter-glacial deposits (after Roebroeks *et al.* 1992).

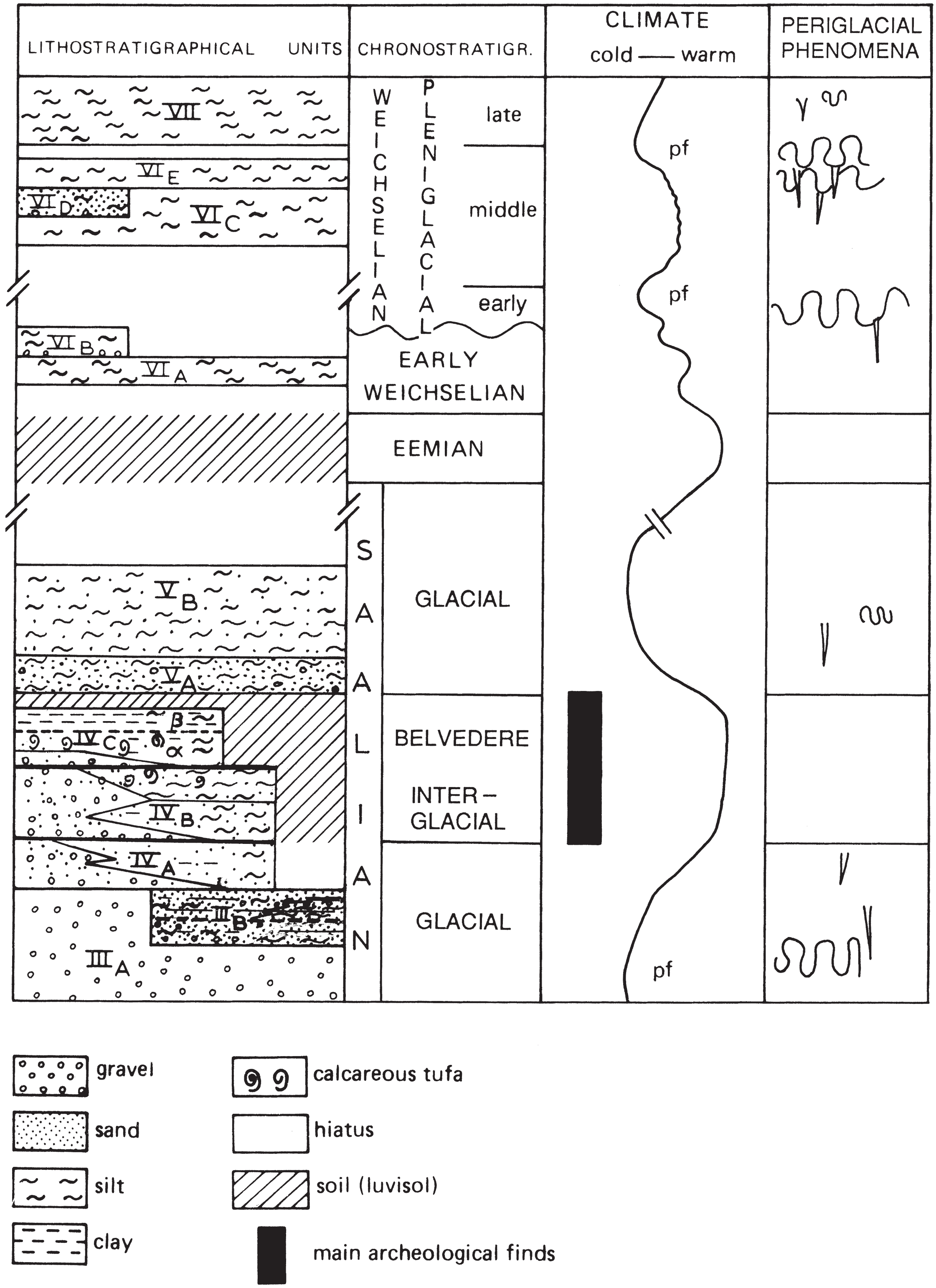


Figure 2.5: Lithostratigraphical succession of the Middle and Late Pleistocene sequence at Maastricht-Belvédère shown together with the palaeoclimatic reconstruction and situation of the main archaeological find levels. Not to scale (after van Kolfschoten *et al.* 1993).

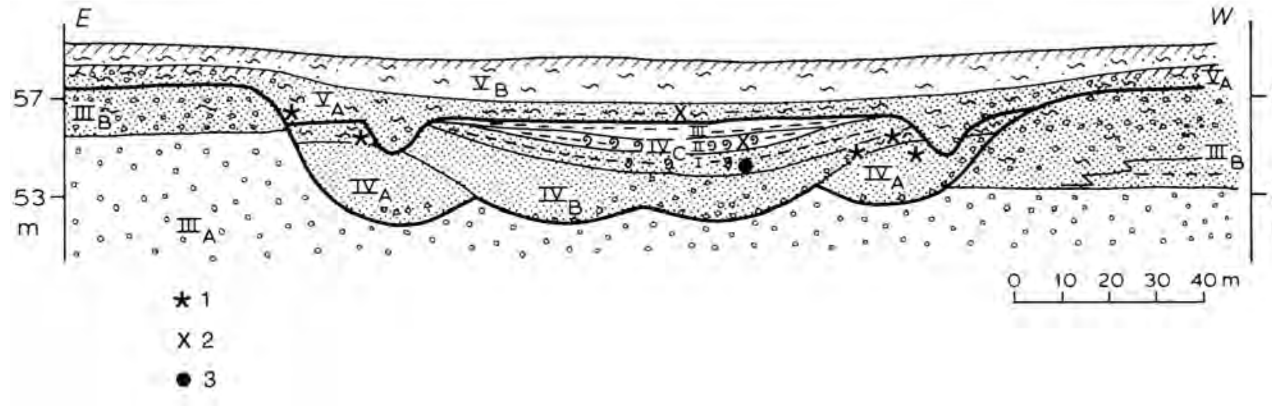


Figure 2.6: Schematic section of the Saalian deposits at Maastricht-Belvédère. The situation of the archaeological finds is indicated. 1: Finds on a high position (like point-bars). 2: Finds in channel fills. 3: Finds in flood plain depression (after Vandenberghe 1995).

clay zone (overlain by calcareous tufas) which gradually changes laterally into the previous 'mottled zone' and could be its chronostratigraphical equivalent.

The Subunit IV-B/C sediments contained a large number of faunal remains, indicating that the Subunit IV-B sites (B, C and G) were formed under full interglacial conditions (Meijer 1985; van Kolfschoten 1985, 1990; Duistermaat 1993; Huijzer and Mücher 1993). The Subunit IV-C-ß sites (A, D, F, H, K and N) have provided no significant faunal remains because their sandy and clayey matrix was decalcified. We therefore have no faunal evidence as to whether the sites were formed in the same warm-temperate phase as the lower level sites. Analysis of the sediments, however, seems to support such an interpretation (Vandenberghe 1993; Vandenberghe *et al*. 1993). Furthermore, on geological grounds the time difference between the formation of the Subunit IV-B sediments (representing infillings of depressions with sands and clays), or better between the different Subunit IV-B sites, can probably be estimated to be at most some hundreds of years (Roebroeks 1988:134). The age difference between Subunit IV-B and Subunit IV-C-ß is more difficult to estimate. There are, however, no geological arguments for assuming large time differences, i.e. thousands of years. Therefore, it is assumed that the Subunit IV-B and the Subunit IV-C-ß sites were formed under more or less the same environmental and climatical conditions and are 'contemporaneous' in Pleistocene terms. Faunal evidence from Subunit IV-B indicates that sedimentation of the upper Subunit IV-C sediments took place during a warm-temperate phase of interglacial character between the Holstein interglacial and the arrival of the Saalian glaciers in the Central Netherlands (Meijer 1985; van Kolfschoten 1985, 1990; Duistermaat 1993; van Kolfschoten *et al*. 1993). TL-dating of burned flint artefacts and Electron Spin Resonance (ESR) dating of a mollusc sample of Subunit IV-C yielded absolute dates of respectively 250 ± 20 Ka and 220 ± 40 Ka (Huxtable and Aitken 1985; Roebroeks 1988; Huxtable 1993). These well-dated sediments are correlated with OIS 7 (Roebroeks 1988; van Kolfschoten *et al*. 1993).

During the period of deposition of the upper Subunit IV-C sediments, the climate was slightly warmer and considerably wetter than is the case in the area today (Meijer 1985, van Kolfschoten 1985). Palaeoenvironmental reconstructions based on the work of Meijer (1985) and Duistermaat (1987) show the Subunit IV-B archaeological sites to have been located at a certain distance from the main river, 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. On still higher grounds this vegetation turned into deciduous forests with a dense undergrowth and locally open areas covered with grasses and herbs (van Kolfschoten 1985; Meijer 1985; Duistermaat 1987).

These fine-grained interglacial river deposits were subsequently covered by a thick sequence of Saalian and Weichselian silt loams (*i.e*. reworked and primary loess).

notes

1 The definition of these units by Vandenberghe *et al*. 1993 differs slightly from Roebroeks 1988 and van Kolfschoten 1990.

3 Reconstructing a Middle Palaeolithic technology: Maastricht-Belvédère Site K

3.1 Introduction

This chapter presents a typo-/technological characterization and spatial analysis of the lithic material from Maastricht-Belvédère Site K. The findspot was excavated in the period 1986-1987, mainly as a rescue dig and since then it has amongst others been studied in the context of this PhD dissertation. Due to the fact that the Site K data had not yet been published properly, and the fact that this findspot represents a key-site for the interpretation of Maastricht-Belvédère hominid behaviour, this chapter will give an extensive description and interpretation of the lithic material. Several papers on the preliminary results have already been published (Roebroeks *et al*. 1988a; De Loecker 1992, 1993, 1994*a* and *b*), and the Site K data has also been used in some synthesizing papers on the Maastricht-Belvédère pit (Roebroeks 1988; Roebroeks *et al*. 1992, 1993; De Loecker *et al*. 2003). These publications form a starting point for this chapter.

After a description of the Site K sedimentary setting, the dating evidence and a discussion of the research methods, a summarised typo-/technological description of the lithic material is given. For a detailed picture the reader is referred to Appendix 9. Topics like raw material procurement, production of flakes and cores and tool-manufacturing will be discussed in different sub-sections (see Sections 3.5 and 3.7). Specific attention will be paid to the results of the detailed refitting analysis (Sections 3.6 and 3.7). Next the lithic material, including the refitting results, of this 'rich' site is analysed in spatial terms (Sections 3.9 and 3.10). In the last section of this chapter (Section 3.11) the results are discussed in the interpretation part.

3.2 Geological setting

Figure 3.1 gives an overview of an east-west section through the Site K excavation. The presence of archaeological remains at this findspot is confined to the so-called 'mottled zone' within the unit 5.1 sandy siltloam (described in Figure 3.1 number 4). Stratigraphically this 'mottled zone' can be placed in the top part of Unit IV-C, that is in Subunit IV-C-ß. As mentioned before (see Chapter 2, Section 2.2.3) these fine-grained sediments were probably deposited in a low-energy fluviatile environment (Mücher 1985, Vandenberghe *et al*. 1985).

All Site K artefacts were located in one archaeological layer with a vertical distribution of 30 to 40 cm within the unit 5 sediments, and almost all were situated between two gravel bands. The gravel layer capping the Site K matrix contained slate plates. At Site F, where a more or less identical geological situation was recorded (see Chapter 4, Section 4.6), slate plates with dimensions of up to 0.5 m^2 were found (Roebroeks 1988:81). In general the lowermost Site K artefacts were recovered ca. 10 cm above the lower ('second') gravel string, although some smaller artefacts were found in, or just underneath, this erosional marker. This could suggest that the finds were deposited on top of, or better after, an erosional phase. Next the findlayer was vertically slightly disturbed/scattered, probably due to bioturbation. The latter also affected/scattered the lower gravel string in a vertical way (see also Section 3.8.2).

3.3 Dating evidence

The site was located in the upper part of the Middle Pleistocene fine-grained interglacial river deposits (Unit IV). These fluviatile sediments were deposited by a meandering river system. As already mentioned the faunal remains collected from this unit date to a temperate period between the Holstein interglacial and the advance of the Saale ice-sheet in the central Netherlands (van Kolfschoten 1985; Meijer 1985). Therefore the site is dated to an intra-Saalian interglacial period which is correlated with OIS 7 (van Kolfschoten 1993). Thermoluminescence dating (TL) of burned flint artefacts from Unit IV gives an average age of 250 ± 20 Ka (Huxtable 1993; see also Roebroeks 1988).

At Site K a large amount of burned artefacts was found (n= 617 or 5.7% of the total number of artefacts). Unfortunately, because of their small size, most of these burned 'flakes' were identified as such only during the typo-/technological analysis of the assemblage, so that their dating value had already been destroyed.

Of all recovered burned artefacts, 36 (5.8% of all 617 burned artefacts) were stored in the appropriate manner for TL dating[1]. Of these samples, six were submitted to the Oxford Research Laboratory for Archaeology and the History of Arts, United Kingdom, for the purpose of TL dating. Three, K22, K23 and K24 (Table 3.1), proved large enough

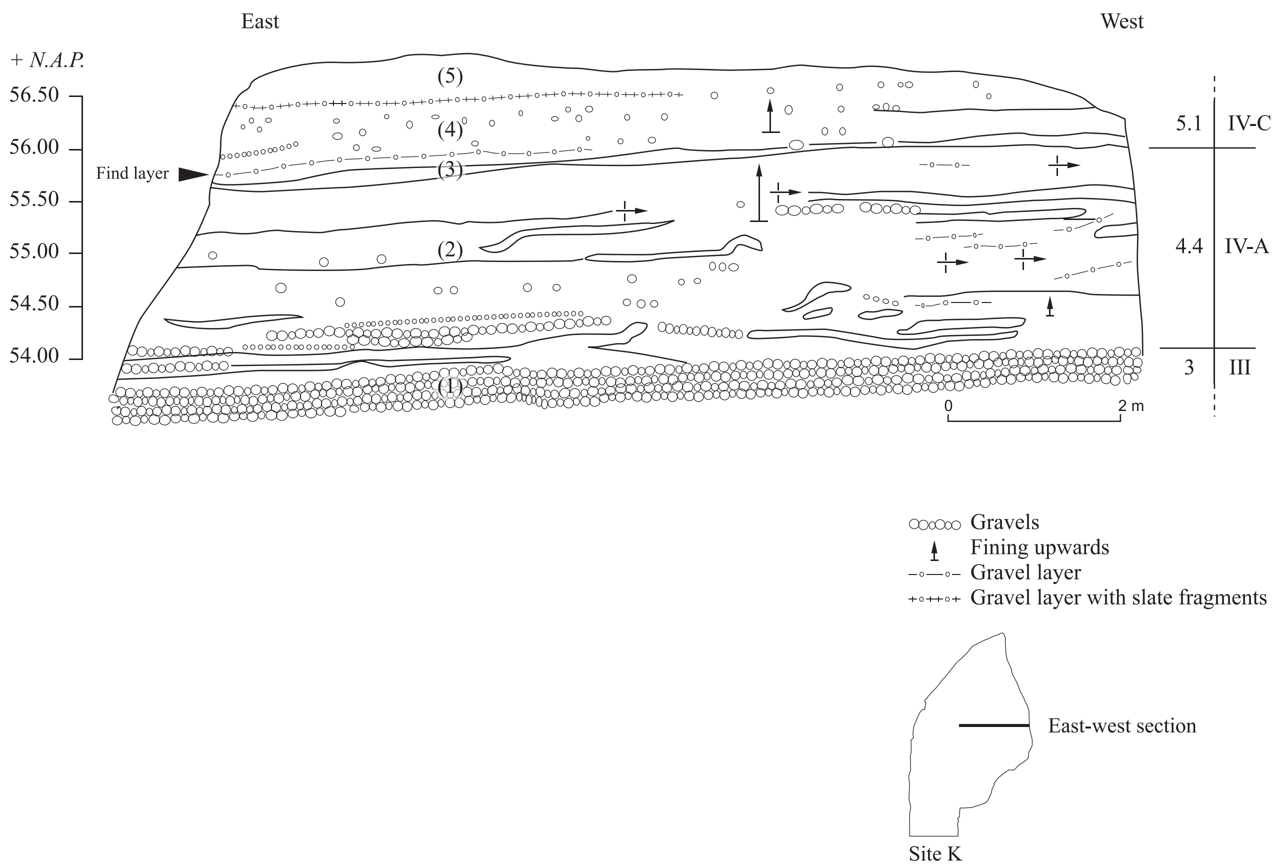


Figure 3.1 Maastricht-Belvédère Site K. East-west section through Site K (description based on unpublished data from Mücher and Roebroeks [1987]).

(1) Top of the Unit 3 gravels, as inferred from the results of borings.

(2) Horizontal laminated fine loamy sands and fine sands with intercalated gravel layers. Calcareous in parts. At the base coarser sand. Abrupt smooth boundary with Unit 3.

(3) (Strong) brown (7.5 YR 5/4-5/6) siltloam to sandy loam with a massive structure. Very friable with many fine and micro pores. Few gravels and stones (Both [2] and [3] represent a fining-upwards sequence].

(4) (Dark) brown (7.5 YR 5/4-4/4) siltloam with a massive structure. Friable to firm. Pores common to abundant (<1 mm). Light gray (10 YR 7/2) vertical bands (≤1 cm) and scattered mottles (<0,5 cm). Very few (<5 %) gravels and stones. Artefacts mainly appear at the base of this horizon (the arrow marks the findlayer). Boundary, abrupt and wavy (a discontinuous gravel layer).

(5) Dark yellowish brown loam (10 YR 4/6) with very few mottles and a massive structure. Friable. Common to many pores (<2 mm) and very fine discontinuous cutans. Gravels occur very occasionally. Boundary, smooth and sharp (a gravel layer containing many slate fragments, observable throughout the pit).
(Within this horizon a light to strong brown [7 YR 6/4-5/8] gley band is present, with grey and reddish [5 YR 6/8-5/8] mottles [<5 mm]. Small manganese nodules [<3 mm] occur. The sediment is described as silt loam with a massive structure and a friable consistency. Abundant pores [<1 mm] and minimum [soft] nodules occur).

Figure 3.2: Maastricht-Belvédère Site K. Map of the site showing the three excavation campaigns. Grid in metre squares. A: During the first winter field campaign ca. 130 m^2 was excavated under considerable time pressure. Finds were therefore collected in metre squares. B: During a second campaign a two by eighteen metre test-trench (36 m^2) was excavated between coordinates 3/218 - 3/219 and 21/218, with finds again collected in metre squares. The purpose of this east-west trench was to survey the horizontal extension of the find scatter. C: A third excavation took place during the summer of 1987, a period of relatively little time pressure. The finds were mainly collected in quarter of metre squares. In order to obtain more detailed information on site formation processes a three-dimensional recording of the distribution of artefacts was made for an area of about 27 m^2. The area in question was situated on row 212, row 211 and half of row 210 from square 7 to 14. Also the metre squares with coordinates 8/213, 8/214 and 8/215 were excavated three dimensionally. D: Section find and finds with fictive coordinates.

Find number	Oxford laboratory reference	TL age
6/203-18	OXTL 712K22	not heated enough
7/203-10	OXTL 712K23	218 ± 24 Ka
8/203-20	OXTL 712K24	poor TL characteristics
7/205-25	–	poor TL characteristics
1/207-35	–	ca. 220 Ka
13/207-186	–	ca. 220 Ka

Table 3.1: Maastricht-Belvédère Site K. Burned artefacts and their TL age (pers. comm. Mrs J. Huxtable [Oxford University] 1987, Huxtable 1993).

for the dating process. Only K23 could be dated, to 218 ± 24 Ka (Huxtable 1993). The palaeodoses of two of the three smaller pieces supported (ca. 220 Ka) the age obtained for K23.

3.4 Excavation-strategy

Site K was discovered during one of the regularly executed profile surveys of the Maastricht-Belvédère quarry-sections. On July 5th 1986, Mr K. Groenendijk (Eckelrade) and Mr J.P. de Warrimont (Geulle) discovered a large flake in the sediments of Unit 5.1. Between July 5th and October 4th 1986 the quarry-section at that particular area was regularly surveyed with positive results. During those months the section was also cut back ca. 15 metres for commercial reasons. In the new section, which was situated about 15 metres southeast of Weichselian Site J (Chapter 2, Figure 2.3), some 40 flint artefacts were found.

In the winter of 1986, when excavations began, Site K was lying in the commercial exploitation zone of the pit. Three excavation campaigns were executed by the Faculty of Archaeology, Leiden University[2] between December 1st 1986 and August 13th 1987[3] (Figure 3.2).

Figure 3.3: Maastricht-Belvédère Site K. Photograph taken during the summer of 1987. Due to time pressure the excavation crew had to work only few metres away from the commercial digging machines.

Since the commercial gravel exploitation could not be halted at that time the excavation had to be carried out in limited length of time and under enormous time pressure. Sometimes the crew had to excavate only a few metres away from the digging machines (Figure 3.3).

Because of this time pressure the decision was made to give priority to excavating an area as large as possible, rather than opting for a more detailed documentation of a ‘small’ part of the artefact cluster. Finds were therefore collected in metre squares and later, in periods of less time pressure, in quarter of metres squares. In order to obtain information on site formation processes, a more detailed picture of the horizontal and vertical distribution of the artefacts was achieved by the three-dimensional recording of an area of about 27 m^2. Altogether an area of approximately 370 m^2 was investigated during the three excavation campaigns (Figure 3.4).

3.5 Technological and typological characterization of the lithic assemblage

3.5.1 Introduction

Apart from some badly preserved possible bone fragments and some scattered particles of charcoal[4], the Site K find material consists of flint artefacts. This flint assemblage includes 10,912 artefacts with a total weight of 97. 8 kg (Table 3.2), made up of 137 complete and fragmented tools with intentional retouch and macroscopic signs of use (1.3%), 91 cores (0.8%) and 10,684 pieces of debitage and non-retouched flakes (97.9%). Within the category of debitage 101 flakes were described as core trimming elements (0.9% of all artefacts). Only two artefacts could be identified as possible hammerstones and/or anvils (0.02%). In total 617 artefacts were identified as burned (5.7%).

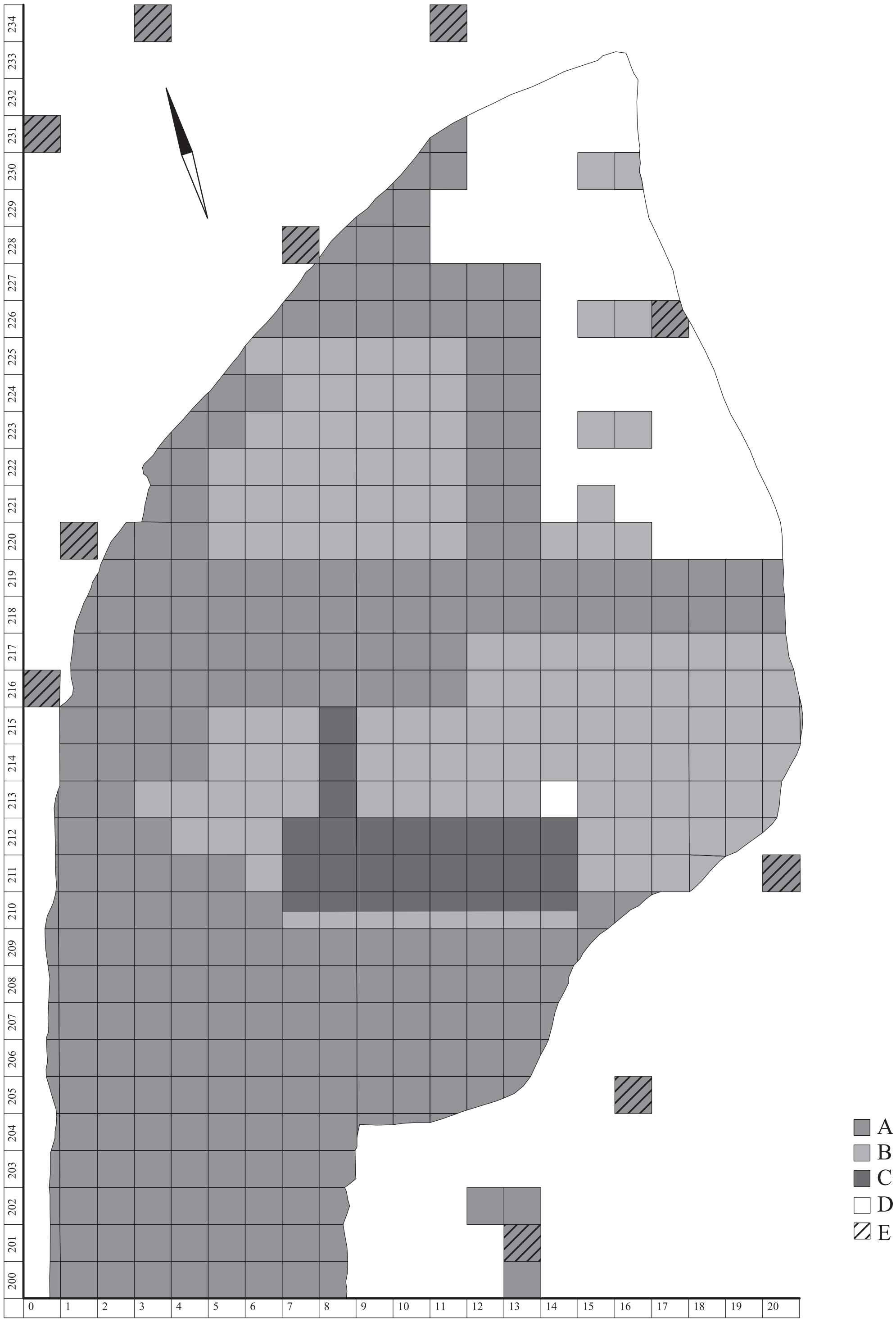


Figure 3.4: Maastricht-Belvédère Site K. Map of the site showing the three excavation methods used. Grid in metre squares. A: Finds collected in metre squares. B: Finds collected in quarter of metre squares. C: Finds collected using three-dimensional recording. D: One metre square that was sieved. E: Section find and finds with fictive coordinates.

Type	n	%
Debitage	9,964	91.3
(Core Trimming Elements)	101	0.9
Cores	91	0.8
Modified artefacts	137	1.3
'Hammerstones'/'Anvils'	2	0.02
Burned artefacts	617	5.7
Total	10,912	100.02

Table 3.2: Maastricht-Belvédère Site K. Some quantitative data on the Site K flint assemblage.

During the spring of 1988 the flint artefacts were described by means of a detailed lithic analysis (see Appendix 1). This detailed attribute analysis was specially developed for the Maastricht-Belvédère sites mainly by Mr N. Schlanger (then at St. Anne's College, Oxford University, United Kingdom) and the author, and was built upon studies by Bordes (1961), Callow and Cornford (1986), Geneste (1985), Goren-Inbar (1990) and Isaac (1977) (see Schlanger and De Loecker 1992; Schlanger 1994, 1996 and Appendix 1). This typo-/technological analysis was carried out on a large sample of the assemblage[5]. As most 'small' artefacts do not give much more technological information than 'larger' ones and, moreover, are more difficult to 'read', only artefacts with a maximum dimension ≥20 mm (n= 3,687 or 33.8% of the total assemblage) were used in the analysis of one part of the excavated area (Figure 3.5-A). Another part of the analysis was executed on artefacts with a maximum dimension ≥30 mm (n= 2,173 or 19.9% of the total assemblage) collected from the southeastern part of the excavation[6] (Figure 3.5-B). To ensure a uniform dataset, the description of all artefacts ≥30 mm will be used in our further discussion.

In this section statements on core-reduction will be based mainly on morphological and technological characteristics of the flakes, cores and tools (see also Appendix 9). First some details on the flint procurement and the used raw materials will be given.

3.5.2 Raw material

The abraded cortex and 'old' (rolled) natural fissures on the majority of Site K flint artefacts indicate that the raw material was probably collected in nearby river deposits. Some of the artefacts show a heavily abraded cortex and 'old' natural fissures (pseudo-cortex), while most of the 'other parts' of the pieces display less, but clear, traces of fluvial abrasion. Regarding the cortical artefacts with fewer traces of fluvial abrasion most of the raw material nodules could have been collected in the nearby river deposits 'shortly' after they were eroded out of cretaceous outcrops. Other evidence for this assumption is given by the large dimensions of the raw material nodules. Some of the refitted nodules, which are for a large part cortex covered, have dimensions of at least 40 cm in cross-section. At Site K, this is the largest example (see Section 3.6.5.2, Refitted composition I).

A significant part of the artefacts (n= 791 or 25.9% of the all artefacts with a maximum dimension ≥30 mm) display rather 'fresh' natural fissures and fossil inclusions, which may be an indication of an unselective choice of raw material or a lack of 'high' quality raw material.

3.5.3 Different flint types

Determining specific flint types is sometimes very problematic and can be an unsuccessful enterprise (*e.g.* Bakels *et al.* 1975; Cowel 1981; Felder, P.J. 1960, 1975, 1998; Kars *et al.* 1990; Lobenstein 1972; McDonnell *et al.* 1991; Rademakers 1995; Thompson *et al.* 1986; de Warrimont 1998; de Warrimont and Groenendijk 1993). Three main reasons can be mentioned for the Site K case.

1. Flint types that appear in primary context in the southern part of The Netherlands (and the northeastern part of Belgium) can often not be assigned to single sources. Texture and colour change away from a type-area. Also within geological strata, variation is huge as described by Felder, P.J. (1981). So, apart from a regional also a stratigraphical difference is noticed (*e.g.* Felder, W.M. 1975b).
2. Within a single flint nodule differences in texture, inclusions and colour can appear (De Grooth 1998).
3. Patination and/or abrasion of flint artefacts can make the attribution to a certain flint type very problematic or even impossible (*cf.* Stapert 1975, 1976; De Grooth 1998).

On the basis of specific properties (texture, cortex, inclusions and 'colour'), at first sight two main groups of flint are recognizable among the lithic material at Maastricht-Belvédère Site K, *i.e.* Rijckholt (Lanaye) flint and Valkenburg flint.

Rijckholt flint clearly dominates the Site K assemblage. This type of flint derives from the Gulpen Formation and belongs to the Younger Cretaceous 'Maastrichtian' (Felder, W.M. 1975a; Felder and Felder 1998; Löhr *et al.* 1977; Zimmerman 1988, 1995). The wide variety of colours can range from light grey and greyish-blue to blue-black and its colour is seldom uniform. Typical for this kind of flint is the combination of light and dark grey stains against a dark background, often with variations in texture. The coarse-grained Rijckholt variations are mostly light grey coloured and homogeneous in texture. In primary conditions the flint occurs as regular nodules with a length of ca. 80 cm and a width of ca. 40 cm (Engelen 1980; De Grooth 1998). Usually the cortex is 'thin'.

Figure 3.5: Maastricht-Belvédère Site K. Map of the site showing the two areas from which the size class samples for the typo-/technological analysis were chosen. Grid in metre squares. A: Northwestern part of the excavation on which the lithic analysis was done on all artefacts with a maximum dimension ≥20 mm. B: Southeastern part of the excavation were the lithic analysis was done on all artefacts with a maximum dimension ≥30 mm. C: Section find and finds with fictive coordinates.

Part of the coarse-grained 'Rijckholt' group resembles Valkenburg flint. Valkenburg flint originates from the Maastricht Formation overlying the Gulpen chalks and also belongs to the Younger Cretaceous 'Maastrichtian' (Felder, W.M. 1975a; Felder and Felder 1998). In primary context it occurs as pipe-shaped or platy nodules and has a light grey to greyish-blue colour. Valkenburg flint is completely opaque. The grey colour often contains white dots. After patination the flint shows a beige or yellow-brown colour (Felder, W.M. 1975b, 1980). It is a mainly coarse-grained flint type. However, according to Brounen *et al*. (1993) weathered Valkenburg flint is in most cases more coarse-grained than fresh looking material.

At Site K it is very difficult to make a distinction between Rijckholt and Valkenburg flint, especially because of the fact that both types can be coarse grained and because most of the artefacts are patinated. Both flint types show also more or less the same geographical distribution (Felder, W.M. 1975a). Therefore 'the two' types are here defined as one group. More important for statements on early human behaviour is the fact that both types of raw material are present in the nearby river deposits/gravel beds of the river Maas, as they were eroded out of the chalk outcrops.

Conspicuously, however, a third (or second) group of flint appears in smaller quantities at Site K, *i.e*. 'exotic' flint. This group is very heterogeneous in composition with a wide variety of colour, texture, inclusions and cortex. 'Exotic' has to be read here as 'not belonging to' the Rijckholt-Valkenburg group, an assessment supported by the results of the refitting analysis.

In general the Pleistocene gravel beds of the river Maas contain pebbles of several different flint types (among others Rijckholt and Valkenburg flint) and may have included the 'exotics'. These Maas gravel beds outcrop at Maastricht-Belvédère (Unit III). At all Belvédère Unit IV findspots most of the artefacts show fluvially abraded cortex. The cortex remains indicate that raw material was probably collected from nearby river deposits (Roebroeks 1988). For that reason it is more appropriate to describe the Maastricht-Belvédère Site K raw material (and all other Unit IV flint assemblages) as one group of flint, deriving from the river Maas. It is, however, striking that according to the local palaeo-geomorphological reconstructions (Vandenberghe *et al*. 1993) no river or gravel beds are present within a radius of 100 to 200 metres around the Site K locus. This could mean that the raw material nodules, more than 90 kilos in weight, were collected at a distance of at least 100 to 200 metres.

At Site K the artefacts were recovered in mint condition. Most of the flakes (and cores) displayed a bluish-black colour, more or less similar to local 'fresh' Rijckholt (Valkenburg) flint. Within a few minutes of exposure to air these 'fresh' looking artefacts obtained a creamy, greyish-yellow/greyish-white colour. Much of the Belvédère Unit IV flint material shows the same creamy, light-yellow colour which appears after a period varying from two days to a few months. Characteristic for these white patinated artefacts is a slight loss of weight, as described by Roebroeks (1988) and van Gijn (1988). In order to study the flint artefacts on usewear traces, in the 'freshest' possible condition, a reflected-light microscope was put up at the site. Magnifications ranging from 50x to 560x were used. This gave Mrs A. van Gijn (Leiden University) an opportunity to examine the flint artefacts as soon as they were excavated. For the first two minutes or so the stone surface appeared fresh. However, it quickly dissolved and became 'sugary' or, better, patinated. The process of patination is irreversible (van Gijn 1988:153).

The possibilities for a microwear analysis at Site K are therefore very limited and only restricted to a few tools and flakes that were examined before patination set in. Mrs van Gijn concluded that some pieces showed some microscopic usewear traces, but she could not determine the exact type (pers. comm. A. van Gijn 1987).

3.5.4 Characterization of the assemblage

3.5.4.1 Introduction

For the typo-/technological description of the Site K assemblage, as for the other Belvédère Unit IV sites (see Chapter 4) a simple distinction between the products and debris of primary and secondary flaking was made. Primary flaking refers to all flakes and cores (including the blanks on which tools were made) which are produced/discarded during the reduction of the raw material nodules. Flakes which were 'selected' and singled out for modification by intentional retouch or by use will be presented in the section dealing with secondary flaking (Section 3.5.4.3; see also Appendix 1).

In the next section the flakes, waste and cores (primary flaking) will be discussed and interpreted. For a detailed picture of the typo-/technological characterization of the flakes and cores, the reader is referred to Appendix 9.

3.5.4.2 The flake and core assemblage (primary flaking)

Beside the 91 cores (see later) and 63 (0.6%) blade-like flakes the find material at Site K consists mainly of chips and flakes, respectively 71.1% and 27.2% of a total of 10,912 artefacts. The size distribution shows that small flakes with a maximum dimension between 10 and 19 mm dominate (35.5%). Chips <10 mm are clearly underrepresented (16.2%). This is most probably a consequence of the chosen excavation method, *i.e*. most of the finds were collected in metre squares and in quarter of metre squares. Chips (<30 mm) are for a large part the remnants of flaking debris. This group of very small flaking debris mainly consists of broken flakes and/or fragments of flakes.

The size distribution of all flakes with a maximum dimension ≥30 mm (n= 3,063) shows that the majority of the artefacts has a length and width between 20 and 49 mm (respectively 62.3% and 70.0%), while flakes between 30 and 39 mm dominate (respectively 27.8% and 30.3%). This would mean that, according to the detailed typo-/technological description, most of the larger flakes have a more or less equal length and width, although in general around the 60 mm boundary a slight change is seen from flakes wider than long to flakes longer than wide. Compared to other Maastricht-Belvédère assemblages (see Chapter 4), the Site K assemblage is as a rule characterized by rather large flake dimensions.

Of all 10,821 flakes, 32.3% shows cortex remains, while for flakes ≥30 mm even 53.3% has cortex. Furthermore, the size distribution shows that cortex appears more frequently on larger flakes than on the smaller ones. This could signify that the first stages of core reduction are present within the excavated Site K area, and that the raw material nodules were introduced without, or with hardly any, decortication or preparation.

About one fourth of all flakes with a maximum dimension ≥30 mm (25.9%) show frost split surfaces. These frost fissure surfaces indicate that the raw material was already affected by frost before knapping. Besides that it could be an indication of an unselective choice of raw material or a shortage of better quality raw material. It also gives an indication of the lack of testing of raw material before it entered the Site K area.

Of all measurable flakes ≥30 mm (n= 2,019) mostly an angle of percussion ≥110° has been described (61.3%), while the most frequently appearing angle is >130° (30.2%). This suggests that the cores from which these flakes were produced have a working edge angle which is ≤70° and often even <50°. The chosen technology for core reduction, mainly disc and discoidal (using bifacial flaking on two working faces of the core, see later), is probably responsible for the large angle of percussion on the flakes. In general flakes become longer and wider the larger the angle of percussion becomes. This could indicate that specific angles were preferred (or sometimes prepared) on the cores, ≤70° (or ≥110° on the flakes), for the production and possible preference of rather large and wide flakes.

On all flakes ≥30 mm plain butts appear most frequently (45.5%), while a dihedral butt is represented by 14.1%. Only some of the flakes show traces of preparation on the butt. The rarity of retouched (1.7%) or facetted (2.3%) butts points in the direction of a minimum preparation of the cores. The scars of flakes from earlier stages in the reduction process are generally used as striking platform (butt). Most of the retouched or facetted flakes have a maximum dimension ≥50 mm. This suggested minimal preparation of the cores is also shown by the rarity of preparation at the angle between the butt and the dorsal side of the flakes (9.6% of all 10,821 flakes). In most cases the angle is prepared by means of facetting/retouching (5.7%). What is noticeable is that 30.8% of all flakes ≥30 mm shows this kind preparation. Therefore it seems, again, that larger flakes are more or better prepared than smaller ones. It could also be suggested that the dimensions of the flakes are influenced (become larger) when the butt and/or the angle between the butt and the dorsal side of the flakes is well prepared.

The dorsal surface (preparation) shows that most of the flakes (36.1% of all flakes ≥30 mm) have a 'parallel' unidirectional pattern, while a centripetal or radial and a convergent unidirectional pattern are scarce (respectively 6.4% and 5.3%). A 'parallel' + lateral unidirectional and a 'parallel' bidirectional dorsal pattern were found on respectively 18.2% and 7.8% of the flakes. In general this suggests that the majority of the flakes display dorsal scars struck from one or two sides (striking platforms) of the core. Mostly these previous flakes were struck from the same striking platform as the actual flake. By comparison with the actual flake, preceding flakes were sometimes also struck from the lateral and/or distal side. This could indicate that the dorsal surface of most of the flakes was not or hardly prepared. Flakes with a maximum dimension ≥50 mm display in general a more complex dorsal surface and/or tend to be more prepared in a centripetal or radial way. Mostly a 'few' (two or three) but large dorsal scars can be counted on the flakes. Most of the flakes with a maximum dimension ≥50 mm have, again, a more complex dorsal pattern, *i.e.* with more dorsal scars.

Altogether data on the butt preparation, preparation at the angle between the butt and the dorsal face, dorsal surface preparation and the number of scars suggest a minimum preparation of the cores. Most prepared flakes are pieces ≥50 mm.

The Site K assemblage consists of a large number of cores. As mentioned before, 91 cores (0.8% of the total number of artefacts, Table 3.3) were recovered from the excavated area.

The types appearing most frequently are disc and discoidal cores (plus high-backed discoidal cores), representing 57.2 % of all cores. Many of these have an irregular shape, fluctuating between irregular disc and discoidal cores (*cf.* Bordes 1961; Isaac 1977). The most regular category, using Isaac's definition of biconvex discoid cores (Isaac 1977:176), are the high-backed discoidal cores.

Typology	n	%
Levallois	–	–
Disc	34	37.4
Discoidal	11	12.1
Prismatic	7	7.7
High-backed discoidal	7	7.7
Pyramidal/conical	1	1.1
Bipyramidal/biconical	–	–
Polyhedral	5	5.5
Multiple platformed	1	1.1
Shapeless or miscellaneous	9	9.9
Single platformed, unifacial	5	5.5
Single platformed, bifacial	2	2.2
Double platformed, opposed	2	2.2
Double platformed, at right angles	7	7.7
Total	91	100.1

Table 3.3: Maastricht-Belvédère Site K. Typological review of the cores.

"… more or less regular centripetal (radial) patterns in which scar boundaries converge toward an ill-defined central pole. They differ from the classic expression of Mousterian disc cores in being bifacial and in having scars of equal size on each face." (Isaac 1977: 176).

Prismatic cores and cores with a double platform at right angles are represented each by seven pieces (7.7%), and polyhedral and single platformed, unifacial cores each by five nuclei (5.5%). Nine (9.9%) cores are shapeless or miscellaneous. The other core types found at Site K are represented only by one or two pieces. Clear Levallois *sensu stricto* cores (Bordes 1961; Boëda 1984, 1986, 1988, 1993, 1994) are completely absent in the assemblage (Table 3.3).

About half of the cores have a maximum dimension/length between 70 and 89 mm (49.5%), while ca. one fifth has a maximum dimension ≥100 mm. The size distribution of the maximum dimension, width and thickness of all Site K cores demonstrates that rather large and thick cores were discarded at the site. In general most cores have a maximum dimension/length which is more or less the same, or about 10 mm longer, as the width. Also, most cores have a thickness which is about half of the maximum dimension/length.

All in all, most of the Site K cores (86.8%) show remnants of the original outer surface (cortex) of the raw material nodules. The high percentage of cortex supports the assumption that nodules were introduced at the excavated area without any, or with hardly any, preparation or better, decortication. Also at Site K the decortication of the nodules/cores was probably minimal. Moreover it shows that not all faces of the cores were reduced or exploited and together with the large dimensions it indicates that rather large voluminous cores were discarded.

Less than half of the cores (39.6%) display remnants of old frost splitting (natural fissures) surfaces. Besides the previously mentioned unselective choice, or lack of better quality raw material and the presumed absence of testing before transport to the findspot, the natural 'errors' in the flint could also indicate that part of the large voluminous cores were abandoned in 'early' stages of the reduction due to flaking problems caused by these frost fissures.

Apart from the natural 'errors' in the flint also technological errors appear in the Site K core reduction. During the 1980s Shelley (1990) studied the differences between the discarded products of experienced flintworkers and those of beginning flintworkers. In his comparison he came to the following conclusions: "…, in flake or blade production, beginners frequently discarded cores as a result of eliminating all approaches to successful detachment when multiple stacked hinge or step terminations occurred. Beginners' cores also exhibited a much higher frequency of unsuccessful flake removal and force applications to the face or front of cores, including battering of hinge or step terminations as well as misplaced blows.

In comparison, experienced flintworkers seldom discarded cores as a result of errors which are common in the beginners' sample. In almost all cases … these flintworkers quit work either as a result of preceived completion, perverse or end shock fracture of the objective piece, or the discovery of a natural imperfection." (Shelley 1990:188-189).

In general Shelley emphasizes that both groups of flintworkers make (the 'same') errors during the reduction process. Only experienced flintworkers more frequently correct their errors by means of 'pick up flakes' with feather terminations (Shelley 1990:191).

If we compare the Site K core data with Shelley's results the following statements can be made. Most of the cores show besides 'natural' imperfections (*i.e.* old frost splitting surfaces, fissures along which splitting has not yet taken place and sometimes large fossil inclusions) also a large number of 'reparable' reduction errors (85.7% of all cores shows hinge negatives, steps, 'face battering' and 'stacked steps', *cf.* Shelley 1990). Therefore the assumption can be made that a large part of the nuclei was discarded due to the 'poor' quality of the raw material. When a technological error occurred during the reduction of a core the flintknapper was forced to repair it or to discard the core. The decision was probably directed by the quality of the raw material. Possibly after facing problems like hinges, steps, 'stacked steps' and 'face battering' the cores were scanned for potential repairing options. As a consequence cores with multiple 'natural' imperfections would have been discarded more easily, while 'good' raw material cores were 'repaired' and further reduced. These reasons could explain the early discard of some of the voluminous cores at Site K (see also Section 3.6, the refitting analysis).

In general the cores are characterized by 'few' but large scars (of previous flaking). Most of the cores have 10 to 29 scars (68.2%). This category consists for the greater part of disc cores.

At least nine cores were made on large and rather thick cortex covered flakes. The average number of flake scars on these flaked-flakes (*cf.* Ashton *et al.* 1992) is low compared to the other 82 cores, respectively 11.8 scars with a standard deviation of 3.6 scars and 24.0 scars with a standard deviation of 9.6 scars. It is assumed that the flaked-flakes are the products of the first stadia of core-reduction. We are possibly dealing with a strategy in which the raw material was 'primarily' divided into large thick flakes to be 'secondarily' used as cores. Frost splitting fissures and fossil inclusions in the flint played a major part in the initial 'flaking' of the raw material (see also Section 3.6, the refitting analysis).

When the different core types are studied in detail it appears that discoidal cores are much larger and show more scars than disc cores. Compared with all other cores (except disc cores), discoidal cores are wider and have almost twice as many scars. In general disc cores exhibit more traces of cortex and natural fissures than the discoidal cores. This is, however, not surprising as disc cores are worked on one striking surface only, whereas discoidal cores are reduced bifacially.

Of all other cores (except disc and discoidal) single platformed unifacial and pyramidal/conical nuclei are by far the largest. They are even larger than discoidal (including high-backed discoidal) cores but possess a considerably smaller number of scars. Beside disc cores, the single platformed bifacial and double platformed opposed nuclei have the smallest dimensions, but disc cores show more scars. Single platformed unifacial and pyramidal/conical together with disc and discoidal cores have the largest mean width. Prismatic and shapeless or miscellaneous cores have a mean thickness which is about half their mean length and width. The large mean thickness of polyhedral cores can be explained by the roughly globular shape of these nuclei. Polyhedral together with disc and discoidal cores have by far the highest mean number of scars. Nearly all other core types (except disc and discoidal) show traces of the original outer surface of the nodules, while on ca. 50% or more of most of these core types no traces of natural fissures are described. Here also errors in the core reduction appear quite frequently. For a more detailed typo-/technological picture of the different core types the reader is referred to Appendix 9.

3.5.4.3 The tool assemblage (secondary flaking)

Flakes bearing traces of post-primary flaking 'modifications' like intentional retouch (tools *sensu stricto*) and/or macroscopic signs of use will be presented in this section. Subsequently the different tool types will be compared and analysed.

As mentioned before, the Site K assemblage contains 137 (1.3% of a total of 10,912 artefacts) complete and incomplete tools, comprising 111 (81.0%) tools *sensu stricto* and 26 (19.0%) artefacts with macroscopic signs of use (Table 3.4). Since the number of tools differs somewhat after refitting, the post-conjoining typological classification is also given in this table. For further analysis the pre-refitted data is used.

What is striking in Table 3.4 is that various types of scrapers dominate (60.6% or n= 83). This also applies to the complete (68.6% or n= 48) and the incomplete tools (52.2 % or n= 35). For the tools *sensu stricto* (n= 111 and n= 112 after refitting), the accent lies even clearer on the scrapers (complete= 80.0 % and incomplete= 68.6%). The numbers after refitting are for complete 78.7% and for incomplete 68.6%.

The high scraper index (SI= 57.7), but rather low percentage of transverse scrapers, the absence of handaxes and the rarity of backed knives points in the direction of a facies of the Mousterian Ferrassie type (*cf.* Bordes 1972). This applies only to the tools, because no clear morphological Levallois component is visible in the total assemblage.

Most of the Site K tools (86.9%) are made on flakes, while 10.9% is produced on chips <30 mm. Neither blade-like flakes nor chunks were used as a blank for tools. Furthermore, three cores (2.2%) could be interpreted as tools. It is obvious that these tools on cores are the most subjective category of tools, because on the one hand retouched parts on the nuclei can be seen as core edge preparation, but on the other the retouching can be interpreted as creation and/or resharpening of a tool edge. After comparison with all other cores we have chosen the last option, classifying one core as single straight side scraper and the other two as retouched pieces.

The size distribution shows that more than half of the tools/blanks have a maximum dimension between 50 and 89 mm (55.5%), while tools with a maximum dimension between 60 and 69 mm dominate (21.9%). In general the length and width of all tools ≥30 mm (n= 119) show that the used blanks are longer than wide. Compared to the rest of the flakes within the Site K assemblage, most of the tools seem to have been produced on larger flakes/blanks.

Of all tools 40.9% shows cortex, whereas only 14.7% shows natural (frost) crack remains. About two thirds of the tools (63.1%) has an angle of percussion ≥120°, while an angle >130° dominates (32.8%) This means that the angle along the

Type		Before refitting						After refitting					
		Complete		Incomplete		Total		Complete		Incomplete		Total	
Bordes 1961		n	%	n	%	n	%	n	%	n	%	n	%
6	Mousterian points	3	4.3	1	1.5	4	2.9	3	4.3	1	1.5	4	2.9
9	Single straight side scrapers	9	12.9	11	16.4	20	14.6	9	12.9	11	16.4	20	14.6
10	Single convex side scrapers	10	14.3	7	10.5	17	12.4	10	14.3	7	10.5	17	12.4
12	Double straight side scrapers	1	1.4	–	–	1	0.7	1	1.4	–	–	1	0.7
13	Double straight-convex side scrapers	3	4.3	1	1.5	4	2.9	3	4.3	1	1.5	4	2.9
15	Double convex side scrapers	5	7.1	3	4.5	8	5.9	5	7.1	3	4.5	8	5.9
18	Convergent straight side scrapers	–	–	3	4.5	3	2.2	–	–	3	4.5	3	2.2
19	Convergent convex side scrapers	1	1.4	–	–	1	0.7	1	1.4	–	–	1	0.7
21	Déjeté (offset) scrapers	10	14.3	5	7.5	15	11.0	10	14.3	5	7.5	15	11.0
23	Convex transverse side scrapers	2	2.9	1	1.5	3	2.2	2	2.9	1	1.5	3	2.2
25	Side-scrapers with inverse retouch	3	4.3	2	3.0	5	3.6	3	4.3	2	3.0	5	3.6
29	Alternate retouched side scrapers	1	1.4	1	1.5	2	1.5	1	1.4	1	1.5	2	1.5
32	Typical burins	1	1.4	–	–	1	0.7	1	1.4	–	–	1	0.7
36	Typical backed knives	–	–	1	1.5	1	0.7	–	–	1	1.5	1	0.7
37	Atypical backed knives	–	–	1	1.5	1	0.7	–	–	1	1.5	1	0.7
38	Naturally backed knives	4	5.7	1	1.5	5	3.6	4	5.7	1	1.5	5	3.6
42	Notched pieces	3	4.3	–	–	3	2.2	5	7.1	–	–	5	3.6
43	Denticulates	4	5.7	2	3.0	6	4.4	4	5.7	2	3.0	6	4.4
45	Pieces retouched on the ventral surface	1	1.4	–	–	1	0.7	1	1.4	–	–	1	0.7
98	Pieces with signs of use	6	8.6	12	17.9	18	13.1	5	7.1	12	17.9	17	12.4
99	Retouched pieces	3	4.3	10	14.9	13	9.5	2	2.9	10	14.9	12	8.8
	Refitted tool fragments	–	–	5	7.5	5	3.6	–	–	5	7.5	5	3.6
Total		70	100.0	67	100.2	137	99.8	70	99.9	67	100.2	137	99.8

Table 3.4: Maastricht-Belvédère Site K. Typological review of the tools before and after refitting.

working edge of the cores, on which the blanks were produced, was usually ≤60° and in most cases even <50°. Moreover, tools/blanks with an angle ≥120° have the largest mean dimensions (maximum dimension, length and width). Altogether this could indicate that at least part of the tools were produced with the same technology (probably disc and discoidal) as the rest of the Site K flakes. Further proof of this assumption is given by the butts and dorsal surface preparation.

More than half of the tools/blanks ≥30 mm (51.3%) show a plain butt, while a dihedral butt is represented by 14.3%. Only 4.2% of the butts is retouched or facetted. This distribution is nearly identical to the rest of the flake assemblage and the data again suggests a minimal preparation of the cores or blanks. Yet a preparation along the angle between the butt and the dorsal face is found on slightly less than half of all tools/blanks (44.5%). In most cases this was done by means of facetting/retouching. This is in contrast with the total assemblage and could indicate that the 'larger' blanks produced, or better selected, for tool production were more frequently prepared in this way.

The dorsal surface (preparation) shows that ca. one third of all tools/blanks ≥30 mm (30.3%) has a 'parallel' unidirectional pattern, while pieces with a 'parallel' + lateral unidirectional pattern are represented by 17.6%. This is, again, more or less the same distribution as for the total flake assemblage. However, convergent unidirectional and centripetal or radial patterns, found on respectively 16.0% and 14.3% of the blanks, seem to appear more often on tools. Additionally these dorsal patterns are more dominant on blanks ≥50 mm. Therefore, it can be suggested that larger tools show (mostly) a more complex dorsal surface and/or are more prepared in a convergent/centripetal or radial way. The majority of the tools/blanks ≥30 mm (20.2%) have three dorsal scars.

According to the detailed typo-/technological description it can be concluded that at least part of the tools/blanks were produced with the 'same' technology as the rest of the Site K flakes. However, most of the tools seem to have been made on larger flakes/blanks, which seem to be better or more often prepared.

During the lithic analysis the tool assemblage was further divided and described in six different groups, respectively scrapers, 'Clactonian' retouched pieces, backed knives, burins, all other retouched tools and pieces with signs of use. This splitting-up, according to specific typo-/technological characteristics and mainly based on Bordes (1961), was done for a comparison of the different tool types. In the next part the separate tool types will be briefly compared and discussed. As mentioned before of a total of 137 tools, 60.6% are scrapers (group II or the Mousterian group [Bordes 1972:51]). Among these scrapers four major classes can be identified (Table 3.5, *cf*. Dibble 1987*a* and *b*). The 'Clactonian' retouched pieces are represented by 6.6% of all tools. This group of tools consists of three notched pieces and six denticulates. Furthermore, there are seven backed knives (5.1%) represented by a typical, an atypical and five naturally backed knives. Only one burin (0.7%) was recovered, while two groups, 'all other' retouched pieces and pieces with signs of use, are represented by respectively 14 (10.2%) and 18 (13.1%) elements.

If these groups of tool types are studied and compared in detail some differences can be noted. According to the mean dimensions (maximal dimension, length, width and thickness) it seems that the 'Clactonian' retouched tools show in general the largest values, though this does not apply to the length. The largest mean length, according to the axis of the blank/flake, is measured on the backed knives. Furthermore, these backed knives show the smallest width. Except for the retouched pieces (with in general the smallest measurements), the scrapers show rather small dimensions.

In general backed knives, followed by 'Clactonian' retouched tools, exhibit more traces of cortex than the other tools. Scrapers show the smallest values for cortex remains. Percentage-wise 'Clactonian' retouched tools, followed by pieces with signs of use, show the highest number of natural (frost) crack surfaces. Natural fissures are the least common on retouched pieces.

Except for the pieces with signs of use and retouched pieces, which consist mainly of fragments of tools, the backed knives are most frequently broken. The 'Clactonian' retouched tools, followed by the scrapers, are percentage-wise the most complete tools. This is probably not surprising as the 'Clactonian' retouched tools are by far the thickest tools and therefore less subject to breakage.

The angle of percussion shows no significant differences between the different groups. Although generally the data on the butts suggest a minimal preparation of the tools/blanks (*i.e*. a plain butt), some differences between the various tool types can be deduced from the *Index Facettage* (IF) and the *Index Facettage stricte* (IFs) (*cf*. Bordes 1972:52). These indices (Table 3.6) show that only the pieces with signs of use followed by the scrapers have a retouched or facetted

Bordes 1961	Type	n	%
Types 9-11	Simple single-edged scrapers	37	44.6
Types 12-17	Double-edged scrapers	13	15.7
Types 6, 18-21	Convergent scrapers	23	27.7
Types 23-29	Remaining scrapers	10	12.0
Total		83	100.0

Table 3.5: Maastricht-Belvédère Site K. Typological review of the different types of scrapers.

Tool types	*Index Facettage*	*Index Facettage stricte*
Scrapers	21.7	3.6
'Clactonian' retouched pieces	11.1	0
Backed knives	0	0
Retouched pieces	0	0
Pieces with signs of use	16.7	5.6

Table 3.6: Maastricht-Belvédère Site K. *Index Facettage* and *Index Facettage stricte* for the different tool types. The only recovered burin is excluded

butt. Furthermore the scrapers followed by the pieces with signs of use and 'Clactonian' retouched tools have most frequently a dihedral butt.

The data on the dorsal surface (preparation) shows that scrapers, 'Clactonian' retouched tools and pieces with signs of use have in most cases a 'parallel' unidirectional pattern. For backed knives a 'parallel' + lateral unidirectional dorsal pattern dominates, while a convergent unidirectional pattern is most frequently described on the retouched pieces. Most dorsal scars are found on 'Clactonian' retouched tools and backed knives, while retouched pieces have the smallest number of dorsal negatives.

Furthermore, according to the mean length of the working edge it seems that scrapers, followed by backed knives, show the largest working edge. Logically, retouched pieces have a considerably smaller (the smallest) retouched working edge. The widest working edge is described on the 'Clactonian' retouched pieces and scrapers. The width of the 'major' working edge of pieces with signs of use (the smallest) and backed knives show the smallest values. This is also quite normal as both tool types show signs of use. For more details on the tools the reader is referred to Appendix 9.

Figure 3.6: Maastricht-Belvédère Site K. 1: 'Transverse Sharpening Flake' (TSF). 2: 'Long Sharpening Flake' ('LSF'). Scale 1:2.

3.5.4.4 Resharpening flakes

A conspicuous find category is the so-called (re-)sharpening flakes. At least two (0.02% of the total number of artefacts) of these flakes were recovered at Site K (Figure 3.6). These resharpening flakes contain a partial working edge of the tool from which they were removed. According to Cornford's description of the lithics from the Saalian Middle Palaeolithic levels at La Cotte de St. Brelade, Jersey (Cornford 1986), the pieces in question can be classified as a 'Transverse Sharpening Flake' (TSF) and a 'Long Sharpening Flake' (LSF). Furthermore the latter resembles a burin spall. The TSF has a length, width and thickness of respectively 9 mm, 8 mm and 2 mm. The figures for the LSF are respectively 22 mm, 4 mm and 4 mm.

3.6 The refitting analysis

3.6.1 Introduction

It has often been stated in earlier publications that refitting of lithic artefacts is essential for the (re)construction of, among others, (core) reduction-strategies and sometimes shows the relativity of typology (see a.o. De Loecker *et al.* 2003). Apart from providing a typo-/technological documentation, the method can, amongst others, be used in the investigation of site formation-processes (both human and non-human) which resulted eventually in the excavated horizontal and vertical distribution of the finds. Combined with distribution maps, it has proved very useful in locating areas where artefacts were made, used and discarded. By doing this, refitting can tell something about spatial patterns and the contemporaneity of different areas within the same 'site'. Also information on transport of tools, flakes and/or cores can be gained by conjoining artefacts (see a.o. Cahen *et al.* 1979; Hofman 1981; Roebroeks and Hennekens 1990; Roebroeks 1988; Roebroeks *et al.* 1997).

Although refitting has a history of more than a hundred years (De Loecker *et al.* 2003) its analytical importance has only been recognized in the last four decades. Especially the investigations and refitting results by Leroi-Gourhan and Brézillon (1966) and Cahen, Keely and Van Noten (1979) at respectively the Upper Palaeolithic sites of Pincevent and Meer II and the 'Big Puzzle' symposium organised at the Castle of Monrepos, Neuwied, in Germany (September 1987, Cziesla *et al*. 1990) proved to be significant milestones in stone-age archaeology. Moreover, they inspired many researchers to go on, or start, using refitting on a systematic/programmatic basis for the interpretation of stone age sites and technologies.

The Site K flint assemblage seemed to have a good conjoining potential, as many artefacts, both 'small' and 'large' ones, could be refitted already during the excavation. Therefore a lot of time and energy was invested in a detailed refitting of all artefacts ≥20 mm[7]. The elaborate refitting analysis resulted in the conjoining of 16.8% (n= 1,828) of the total assemblage (n= 10,912), this means 34.4% of all 5,318 artefacts ≥20 mm. In this section the results of the long-term refitting programme will be looked at in detail. Later the morphological characteristics of the artefacts, earlier discussed in the lithic analysis, will be added and lastly 17 conjoined compositions will be presented, in particular in terms of their technological and spatial characteristics (Section 3.6.5).

To start, the refitting programme used at Maastricht-Belvédère (Site K) will be explained in detail (Section 3.6.2) and the computer applications (Section 3.6.3) plus the visualization of reduction sequences (Section 3.6.4) will be looked at.

3.6.2 The refitting programme used at Site K

Several strategies can be followed when performing a refit analysis. Often the raw material is first divided into different types of flint and subsequently a refitting analysis is executed on every group (*cf*. Rensink 1992, 1993). At other sites it is more feasible to divide the excavated material into different technological stages or types: for instance all decortication flakes or blades and blade fragments can be selected first. Next a refitting analysis is executed on every group, after which mutual conjoinings are attempted.

At Site K a third formula was used. All artefacts ≥20 mm were laid out on laboratory tables according to the metre square in which they were found (roughly the spatial configuration of the assemblage) (Figure 3.7). First of all artefacts were conjoined within the metre squares and subsequently adjacent metre squares were involved in the refitting analysis. We opted for this approach because already during the excavation several fits between artefacts from the same square metre were found. Other arguments for this method of approach are provided by the rather 'negative' results of the flint type determination (amongst others caused by patination), (see Section 3.5.3).

Figure 3.7: Maastricht-Belvédère Site K. photograph (by J. Pauptit, Leiden University) of the actual refitting analysis (1991-1992). All artefacts ≥20 mm were laid out on laboratory tables roughly according to the original spatial configuration of the assemblage.

In contrast to the previous refitting analysis at Maastricht-Belvédère (see Roebroeks 1988), at Site K we could benefit from the 'Cziesla approach' (Cziesla 1986, 1990) (*cf*. Figures 3.8-C and 3.8-D). Because stone artefacts can undergo various stages of 'reduction', Cziesla emphasizes the importance of distinguishing between several types of refits during the reconstruction. He makes a distinction between the following types of refitting (Cziesla 1986, 1990):

1. ***Aufeinanderpassungen*** (refitting of production-sequences) refers to the refitting of all products of 'basic' or 'primary' production/reduction. It concerns only ventral/dorsal conjoinings, *e.g*. flake series in a reduction sequence.
2. ***Aneinanderpassungen*** (refitting of breaks, intentional or not) indicates the reconstruction of 'basic products' like flakes, blanks and tools. It mainly concerns the refitting of broken flake/blade fragments, but also the conjoining of 'split bulbs/cones' (*accidents de Siret*).
3. ***Anpassungen*** (refitting of modifications) concerns the refitting of all products resulting from the modification of a blank into a tool or the resharpening of a tool (see for example Cornford 1986).

As Cziesla (1986, 1990) already mentioned, all flint artefacts originate in a 'basic' or 'primary' production (*Aufeinanderpassungen*), but they can change to other classifications like breaks (*Aneinanderpassungen*) and/or 'secondary' modifications (*Anpassungen*). Besides these three types of refits, a fourth class was introduced (Cziesla 1986, 1990), namely ***Einpassungen*** (inserts). This group concerns the refitting of objects produced by natural processes (frost- and heat-damage).

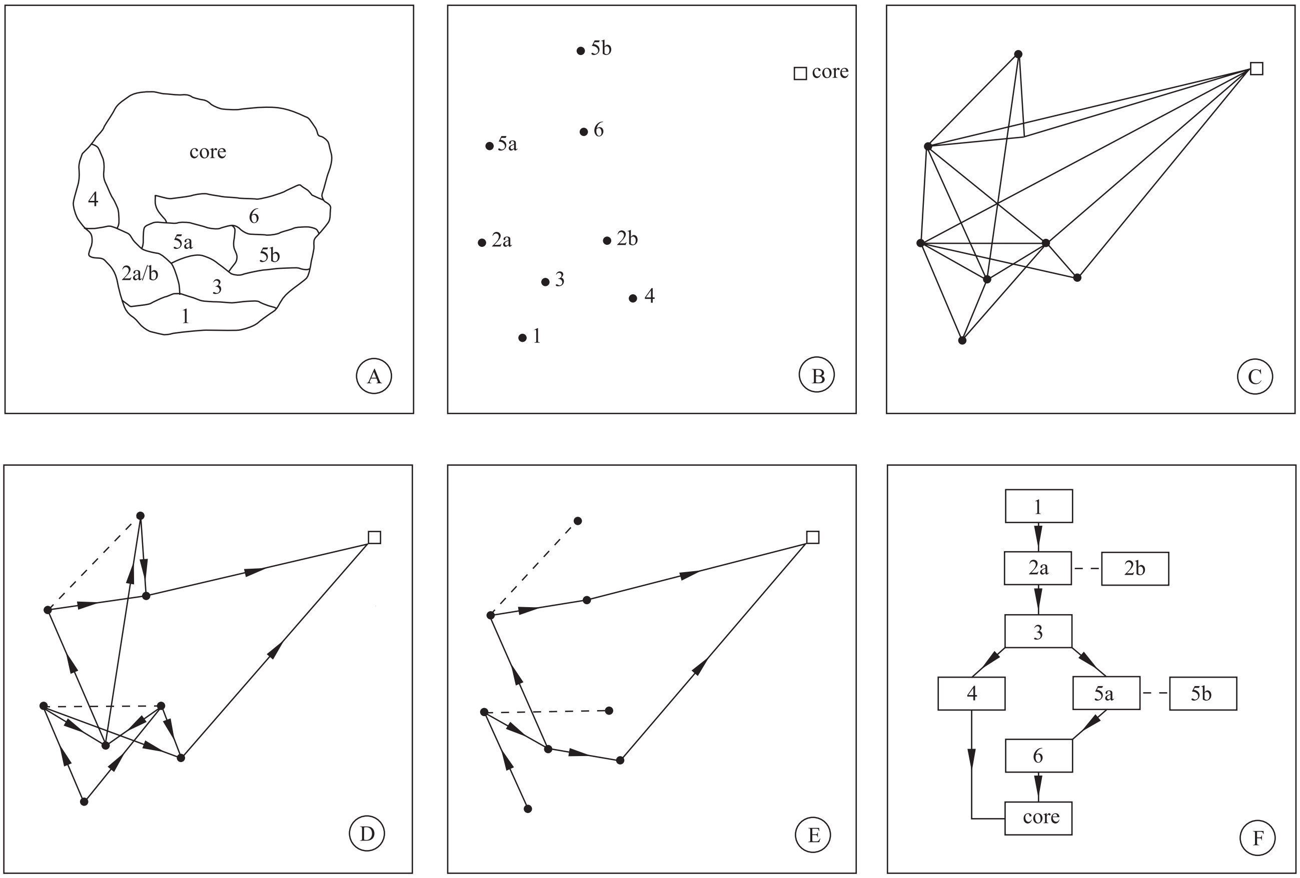


Figure 3.8: The models used for the graphic representation of the Maastricht-Belvédère refitting data (after Cziesla 1986:256, Figure 7, see also Roebroeks 1988:43, Figure 45).

A: Hypothetical example of a flaked core showing the conjoined elements (view of the striking surface).
B: Spatial distribution of the refitted elements (core, 1: flake, 2a/2b: flake broken into two pieces (2a: proximal part, 2b: distal part), 3 and 4: flakes, 5a/5b: broken flake (split cone, *accident de Siret*), 6: flake.
C: All contact surfaces linked by lines. The 'pre-Cziesla approach' (*cf*. Roebroeks 1988).
D: The 'Cziesla approach'. Dorsal/ventral refits are traced back to the core, following the reduction sequence, as indicated by the arrows. Broken artefacts are indicated by dashed lines.
E: The adapted 'Cziesla approach' used at Site K. Here a complete flake is only connected with the proximal or most proximal part of a broken flake. Both broken parts stay connected through a dashed line.
F: Reduction sequence of the conjoined flakes put in a 'Harris-matrix'. The numbers refer to the individual finds. Number 1 is the highest flake in the 'stratigraphical' sequence, the oldest one, or better: the first artefact flaked.

- ● 1. Flake
- □ 2. Core
- ➤ 3. *Aufeinanderpassung* (production sequences)
- – – –

For the refitting analysis of Site K (and other Belvédère sites), the 'Cziesla approach' was mainly used in its authentic design. Only one alteration to this approach was made. If a broken flake (for example consisting of two parts) was conjoined ventrally/dorsally to a complete flake, Cziesla uses two *Aufeinanderpassungen* which go from the complete flake to both broken parts. Because of the quantity of fits at Site K which could make the legibility of the conjoining-maps too complex and as moreover both 'connecting' lines give the same information, it was decided to connect the complete flake only with the proximal or most proximal part of the broken flake. Of course, like Cziesla, both broken parts stay connected with an *Aneinanderpassung* (see Figure 3.8-E).

3.6.3 Computer applications: beyond 'SiteFIT'

Besides refitting itself also the recording and subsequent visualization of the spatial results can be very time consuming. It is even almost impossible to make a manual three-dimensional reconstruction of all spatial conjoining results. To overcome this problem the information revealed by refitting can be computerized with the aid of software packages like 'SiteFIT' (Lindenbeck 1990), 'ANALITHIC' (Stapert 1992; Boekschoten and Stapert 1993, 1996) or 'AutoCAD'.

At Site K initially a graphic software package called 'SiteFIT' was used. 'SiteFIT' was specifically designed to assist the refitting analysis of stone-age sites[8] and according to Lindenbeck (1990) it can be put in the family of CAD-programs (Computer Aided Design program). The program operates with 'dBASE' files and allows size-, location- and orientation-proportional representation of the spatial distribution of finds. 'SiteFIT' is able to make two- or three-dimensional models that can be rotated, tilted or magnified in every direction. All that is needed is the information of the artefact's location (the three-dimensional recordings, *i.e.* X, Y and Z measurements) and the kind of refit established according to the 'Cziesla approach' (1986, 1990). If the dimensions of the artefacts are known (length, width and thickness) even a three-dimensional cube of fixed dimensions of every object can be visualized. Besides that, the artefacts (cubes) can be enlarged and specific technological information can be added. All this information can be displayed in an excavation grid (Lindenbeck 1988, 1990). The 'SiteFIT' software package is also equipped with 'SitePLOT' for graphical print-outs and 'SiteCHCK'; a program for basic statistics concerning the assemblage and its refitting results.

Although 'SiteFIT' is a rather successful program for the task of visualizing and computing conjoined artefacts and because of the fact that it was 'tailored' on the 'Cziesla approach', we encountered some problems with the 1991, 2.2 version. First of all the program was initially designed for the analysis of rather small assemblages. It therefore caused some problems during the processing of a large findspot like Site K with its 10,912 artefacts. A second problem, but harder to overcome, was the fact that with 'SiteFIT' mainly an analysis and visualization of the total assemblage can be done: meaning all artefacts incorporated in all compositions. If more is required, for example the spatial representation of one particular refitted composition, part of the data will have to be reworked and one can easily get into trouble.

These problems, which are probably solved in later updates of the software, forced us at the time to use more flexible and widely used commercial programs like 'dBASE', 'AutoCAD', 'MapInfo', 'Surfer', etc. for further analysis. As a result, the strategy was changed and some special 'dBASE-IV' programs were written by Mr H. Kamermans and Mr M. Wansleben (both Leiden University) to create and maintain the information on the composition of different nodules and the participating artefacts. 'AutoCAD[9]' was eventually used to store and manipulate the graphical representations of the refits. A limited statistical analysis of the lithics was done with a program called 'SPSS'. This brings us to the actual description and visualization of the refitting reduction sequences.

3.6.4 Describing and visualizing the refitted reduction sequences

When detaching flakes from a core there is always a fixed sequence of reduction observable. The placing of the flakes is each time fixed: the 'first' detached flake (the oldest) is always situated on the most exterior part of the core or nodule. Younger or later flakes are always in more interior parts of the core or nodule. So every flake represents a stage in a hierarchy (from old to young). During a refitting analysis (dorsal/ventral fits) an attempt is made to put back all stages (flakes) in their chronological order, working from young to old. The information thus revealed here is in fact the description of the technological reduction sequence. To visualize such a reduction sequence, amongst others a 'Harris-matrix' or -sequence (Harris 1979) is used (Figure 3.8-F).

If we describe and visualize a reduction sequence several stages or parts in it can be identified. In fact these are fragments of what the French call the '*chaîne opératoire*' (Pellegrin *et al.* 1988; Boëda *et al.* 1990; Sellet 1993). The concept '*chaîne opératoire'* originates in the context of French ethnography and was borrowed by archaeologists as a framework for analysing lithic technology. It is an organising principle with internally consistent logic, derived from the morphology of lithic artefacts:

> "*Enchaînement des opérations mentales et des gestes techniques vivant à satisfaire un besoin (immediat ou non), selon un projet qui préexiste*." (Perlès 1991:41).

The operating procedure is rather simple and is nicely described by Chase (not dated).

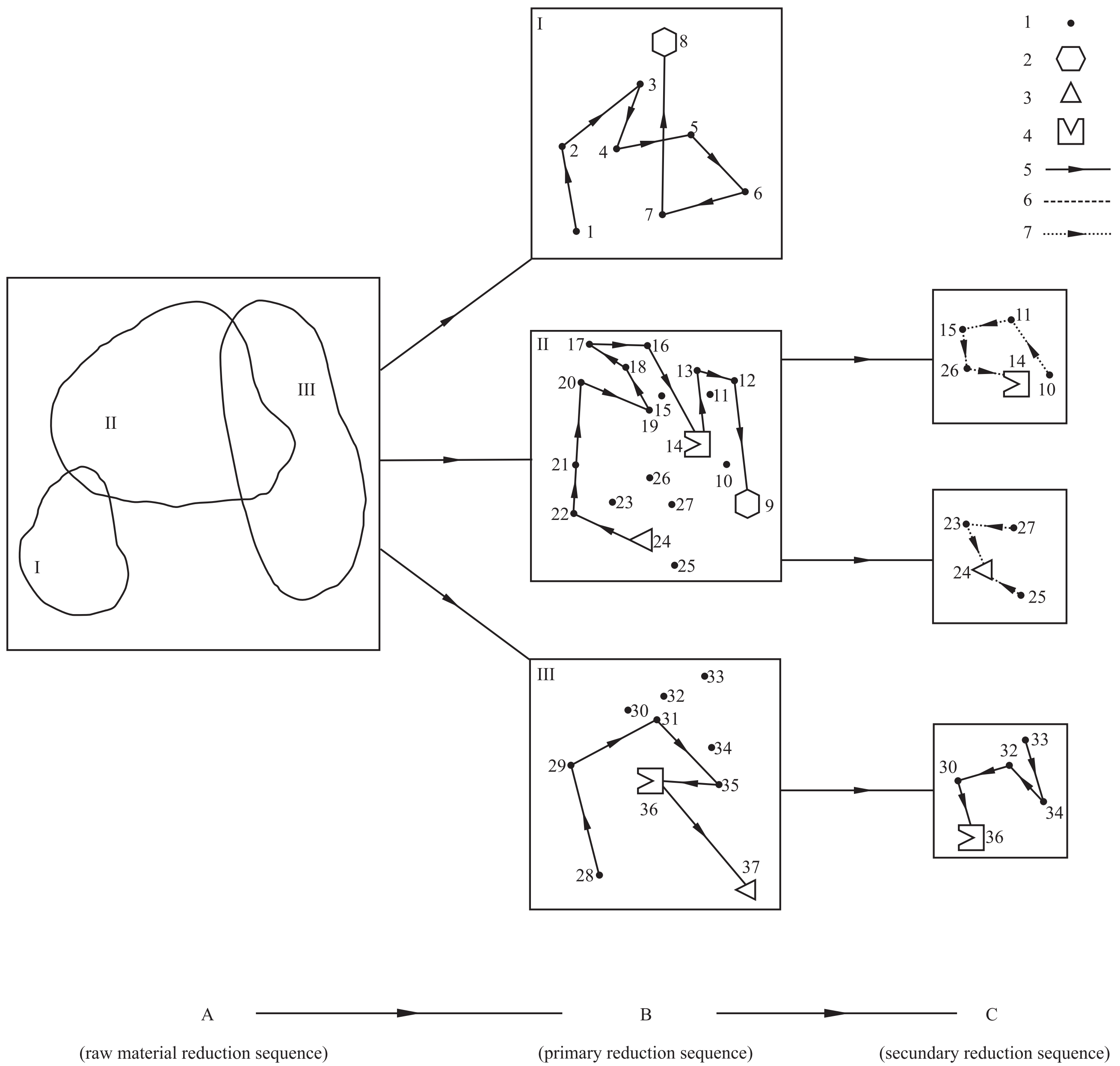
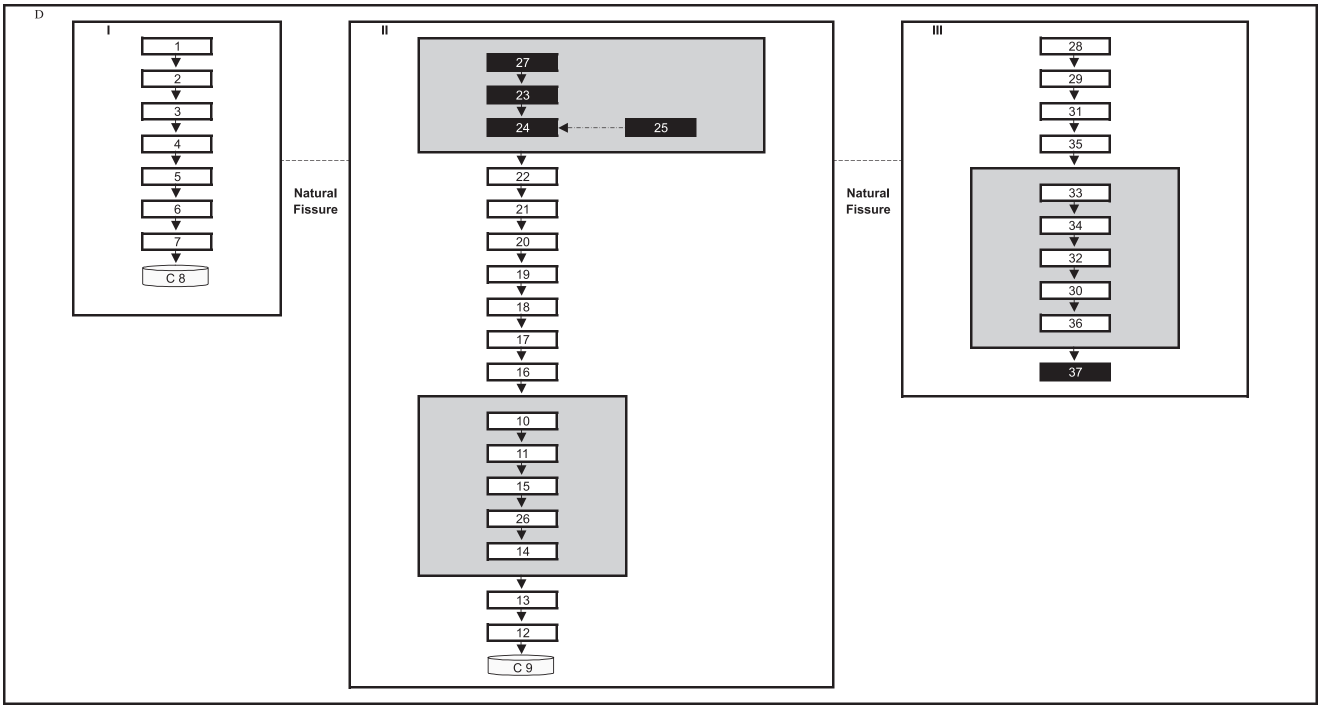


Figure 3.9-A, -B, -C: The three reduction sequences mentioned in the text, together with their spatial visualization.

A: Raw Material Unit reduction sequence: because, sometimes, no hierarchical placing is noticeable a spatial distribution map of the units is used to visualize the raw material unit reduction sequence.
B: Primary reduction sequence: primary reduction refers to all flakes and cores which are produced/discarded during the basic reduction of a core. The 'Cziesla approach' is used to visualize this reduction sequence.
C: Secondary reduction sequence: secondary reduction refers to all debris produced during secondary modification and/or use.

1. Flake	5. *Aufeinanderpassung* (production sequences)
2. Core	6. *Aneinanderpassung* (breaks)
3. Tool	7. *Anpassung* (modifications)
4. Flaked-flake	



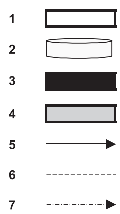


Figure 3.9-D: 'Harris-matrix' including the Raw Material Unit reduction sequence, Primary reduction sequence and the Secondary reduction sequence.

1. Flake
2. Core
3. Tool
4. Flaked-flake
5. *Aufeinanderpassung* (production sequences)
6. *Aneinanderpassung* (breaks)
7. *Anpassung* (modifications)

"The methodology followed in this pursuit is to interpret each (reconstructed) action or gesture of the prehistoric flintknapper as being the result of decisions. This decision was made by applying technological knowledge to particular circumstances in order to move the state of a piece of stone one step closer to the flintknapper's final goal." (Chase, not dated).

Already during the description of the refitting analysis and the spatial visualization of the conjoined pieces several technological actions or decisions, made by the flintknapper, can be distinguished. It is therefore useful to make a distinction between these stages, or fragments, of the '*chaînes opératoire*'.

At Maastricht-Belvédère the refitting evidence of Site J (Roebroeks *et al*. 1997) and Site K (De Loecker 1994a and b) led to the development of a framework which consisted of, or focuses on, three main reduction sequences (or better parts of 'one' large reduction sequence). The following stages are used:

1. **Raw Material Unit reduction sequence**: If a (large) flint nodule enters the site, sometimes the material is split into smaller blocks. These smaller parts, as shown by the Site K data, can be used as cores. The raw material is not only split by the removal of large and thick flakes but sometimes natural fissures caused by frost action helped to split the flint nodules. Splitting of the raw material by means of natural fissures does not result in hierarchical placing in a reduction sequence. Therefore a spatial distribution map of the smaller units (flaked cores) is used to visualize the raw material unit reduction sequence (Figure 3.9-A).
2. **Primary reduction sequence**: Once the raw material is split, the smaller units can be used in the primary reduction sequence. Primary reduction refers to all flakes and cores (including the blanks on which tools were made) which are produced/discarded during the basic reduction of a core. To visualize the primary reduction the 'Cziesla approach' is used. Therefore, only *Aufeinanderpassungen* and *Aneinanderpassungen* will be found in this reduction sequence (Figure 3.9-B).
3. **Secondary reduction sequence**: During or after the primary reduction, flakes can be 'selected' or singled out for

secondary modification and/or use. These flakes or blanks can be retouched into tools *sensu stricto* or secondarily used as cores (flaked-flakes *cf*. Ashton *et al*. 1992). Also resharpening of tools (*cf*. Cornford 1986) is placed in this stage of reduction. The produced debitage will be classified as parts of the secondary reduction sequence. In fact, these sequences are all separate actions of mental activity. In this reduction sequence we find only *Anpassungen* and *Aneinanderpassungen* (Figure 3.9-C).

When the primary (and secondary) reduction sequence is represented in the form of a Harris-matrix all flakes and cores are placed in their hierarchical order. In this sequence a secondarily reduced flake (retouched, resharpened or flaked-flakes) will be presented as a separate action and therefore placed in a rectangle. Inside the rectangle the secondary reduction is 'stratigraphically' described (Figure 3.9-D).

Through the very detailed analysis and visualization of the conjoining results a huge amount of behavioural data was gathered at Maastricht-Belvédère. In the following sections some of the Site K refitting results, together with their implications for the reconstruction of early human behaviour, will be discussed.

3.6.5 *The Site K refitting results: technological information*

3.6.5.1 Introduction

Beside the information revealed by the lithic analysis (see Section 3.5), the results of the conjoining study at Site K creates a unique database which offers many opportunities for technological and typological considerations.

As mentioned before the detailed refitting analysis resulted in the conjoining of 16.8% (n= 1,828) of all 10,912 Site K lithic artefacts (60.368 kg or 61.7% of the total weight of the flint assemblage [97.790 kg]). This means 34.4% of all 5,318 artefacts ≥20 mm. Conspicuously only 15 tools (or 10.9% of a total of 137 pieces) could be conjoined to sequences of production (*Aufeinanderpassungen*), while modification flakes were refitted onto two implements (*Anpassungen*, 1.5% of all tools). Furthermore, 15 broken tools could be rejoined (*Aneinanderpassungen*).

The 1,828 artefacts constitute a total of 1,582 refitting lines (*cf*. Cziesla 1986, 1990) which can be divided into 1,221 or 77.2% *Aufeinanderpassungen* (refitting of production-sequences), 245 or 15.5% *Aneinanderpassungen* (refitting of breaks, intentional or not) and 55 or 3.5% *Anpassungen* (the refitting of modifications). Inserts like heat-damage (*Einpassungen*) are represented by 61 (3.9%) connection lines.

In this way a total of 358 flake (+ core) sequences was achieved, resulting ultimately in a total of 321 refitted compositions (Table 3.7 and Figure 3.10). The discrepancy between the number of flake (+ core) sequences and the final number of compositions is a logical outcome of the fact that several (n= 37) sequences could be conjoined into larger compositions or nodules. It concerns nodules which were split following natural fissures in the flint, *e.g*. 'dorsal/dorsal' conjoinings (see below).

Number of compositions	Number of artefacts
166	2 conjoining elements
54	3 conjoining elements
31	4 conjoining elements
11	5 conjoining elements
6	6 conjoining elements
8	7 conjoining elements
3	8 conjoining elements
6	9 conjoining elements
4	10 conjoining elements
4	11 conjoining elements
4	12 conjoining elements
5	14 conjoining elements
2	15 conjoining elements
2	16 conjoining elements
2	19 conjoining elements
1	23 conjoining elements
1	24 conjoining elements
1	26 conjoining elements
2	28 conjoining elements
1	32 conjoining elements
1	37 conjoining elements
1	39 conjoining elements
1	44 conjoining elements
1	47 conjoining elements
1	48 conjoining elements
1	146 conjoining elements
1	160 conjoining elements
321 compositions in total	1,828 conjoined artefacts in total

Table 3.7: Maastricht-Belvédère Site K. Total number of conjoined compositions together with the number of refitted elements.

Because of the many refitted groups at Site K, 17 examples were selected for further description/analysis and will be looked at in detail in this section. These conjoined compositions show the relevance of refitting in general and in particular for Site K analysis. In addition, most of these refits are

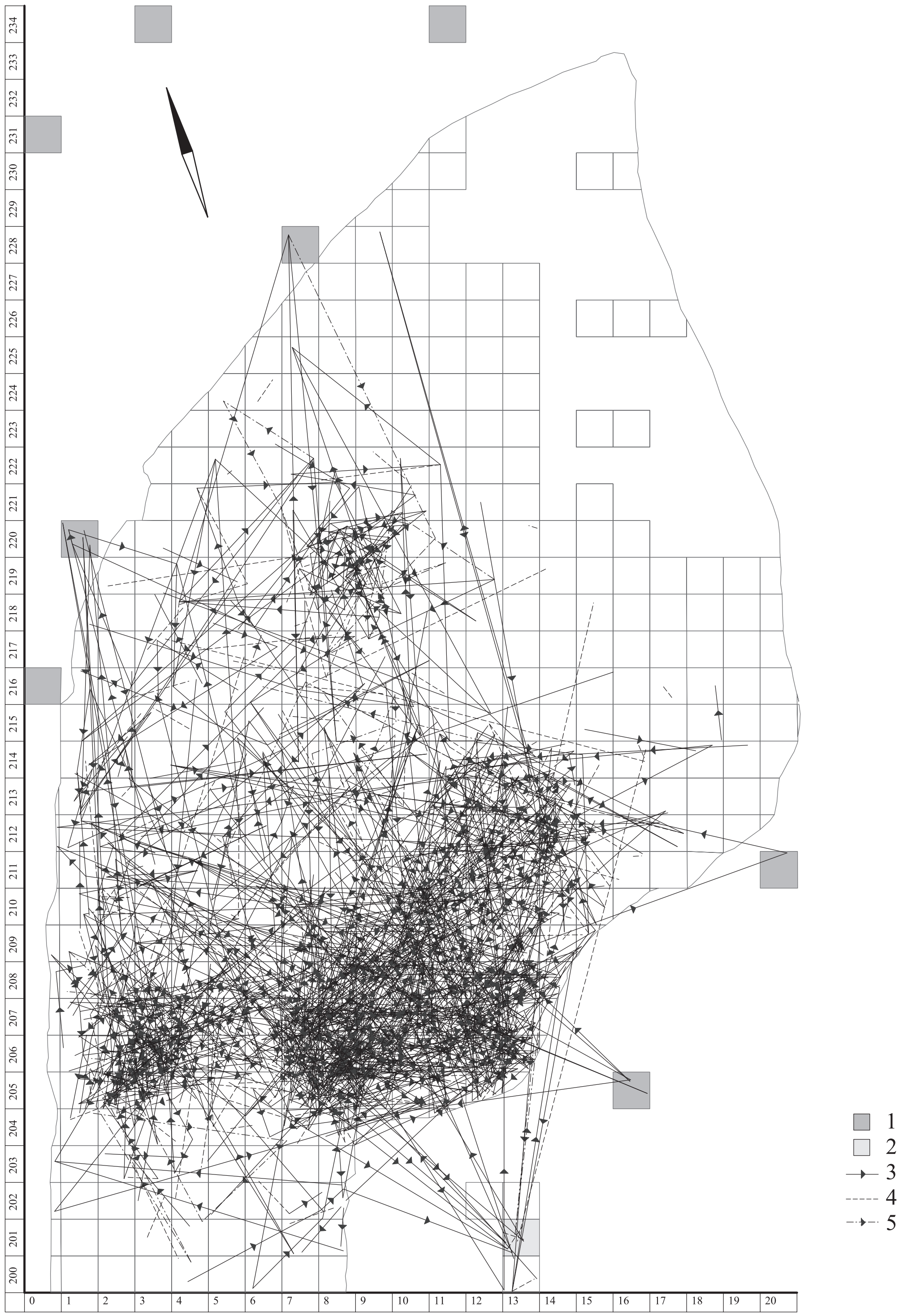


Figure 3.10: Maastricht-Belvédère Site K. Horizontal distribution of all refitted elements (or reduction sequences). The conjoined groups are represented in the ‘Cziesla approach’ (Cziesla 1986, 1990). The excavation grid is in metre squares and the position of (most of) the artefacts are based on random coordinates.

1. Fictitious metre squares to plot the section finds
2. Fictitious metre squares to plot the artefacts which were found within the southeastern area

3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)
5. *Anpassung* (modifications)

representative of the whole assemblage. For each refitted composition a short typo/technological description of the participating lithics is presented. Next, a technological interpretation ('*chaînes opératoires*') of every conjoined composition is given. Some of these descriptions/interpretations will be presented in much detail while others are dealt with more impressionistically. For example, if a core is reduced using only one striking surface it is easier to describe the 'uncovered' reduction sequence than in a continuous working edge example with two striking surfaces or a multiple striking surface core.

After a detailed description of the selected compositions a technological interpretation, based on the previously discussed lithic analysis (see Section 3.5) together with the conjoining evidence, will be given for the total assemblage (Section 3.7). Subsequently, after a discussion on post-depositional processes (Section 3.8), the spatial distribution for the complete lithic assemblage and the spatial patterns of each discussed conjoined group will be dealt with in Section 3.9.

3.6.5.2 Refitted composition I (Figure 3.11)

Composition I has the largest cross-section at Site K (ca. 40 cm after reconstruction) and weighs 9,286 kg (15.4% of the total weight of conjoined artefacts). It consists of 160 artefacts representing nine separately reduced parts/cores (Site K, sequences[10] 2 [part A], 23 [part B], 62 [part C], 85 [part D], 120 [part E], 154 [part F], 218 [part G], 227 [part H] and 356 [part I]; the numbers refer to the worksheets on which the sequences were recorded during the actual refitting analysis [this applies to all refitted sequences mentioned hereafter]). The nine groups consist of respectively 33, 25, 26, 16, 20, 15, 16, 2 and 7 artefacts. Except for seven cores (4.4%) and one core trimming element (0.6%), all artefacts are flakes and pieces of debitage (n= 152 or 95.0%). Two of the latter are blade-like flakes (1.3%). Typologically the cores can be described as a disc core, three high backed discoidal cores, a single platformed opposed core, a double platformed at right angles core and a core fragment. In total two artefacts were burned.

Composition I (n= 153 flakes or 145 flakes ≥30 mm)	
Maximum dimension	Flakes with a maximum dimension between 20 mm and 59 mm dominate (n= 77 or 50.3% of all flakes).
Length	Flakes with a length between 30 mm and 49 mm dominate (n= 60 or 41.4% of all flakes ≥30 mm).
Width	Flakes with a width between 20 mm and 69 mm dominate (n= 115 or 79.3% of all flakes ≥30 mm).
Thickness	Flakes with a thickness between 10 mm and 19 mm dominate (n= 62 or 42.8% of all flakes ≥30 mm).
Cortex	Ca. half of all flakes (n= 79 or 51.6%) show cortex remains, while 38 flakes (24.8%) show 25% or more cortex.
Natural fissures	Natural fissures are described on 43 flakes (28.1%), while 20 flakes (13.1%) show 25% or more natural fissures.
Missing due to breakage	In total 99 (68.3%) flakes ≥30 mm are broken. On ca. one third of these broken flakes a distal part is missing (n= 32 or 22.1%), while a proximal part is missing on 21 flakes (14.5%).
Angle of percussion	Most of the flakes have an angle of percussion ≥120° (n= 84 or 57.9% of all flakes ≥30 mm).
Butt	A plain butt dominates (n= 76 or 52.4% of all flakes ≥30 mm), while only five flakes (3.4%) show a retouched or facetted butt.
The *Index Facettage* (IF) for all flakes ≥30 mm is 15.9	The *Index Facettage stricte* (IFs) for all flakes ≥30 mm is 3.4
Preparation near the butt	Of all 153 flakes, 44 (28.8%) show traces of preparation along the angle between the butt and the dorsal surface. On more than half of them (n= 29 or 19.0%) this was done by means of retouching/faceting.
Dorsal pattern	Most of the flakes have a 'parallel' unidirectional pattern (n= 50 or 34.5% of all flakes ≥30 mm). Five flakes (3.4%) have a convergent unidirectional and 14 (9.7%) a centripetal or radial dorsal pattern.
Flake scars	Ca. half of the flakes ≥30 mm have two or three dorsal scars (n= 58 or 40.0% of all flakes ≥30 mm).

Table 3.8: Maastricht-Belvédère Site K, composition I. Typo-/technological summary of the flake characteristics. The *Index Facettage* and the *Index Facettage stricte* are calculated according to Bordes (1972:52).

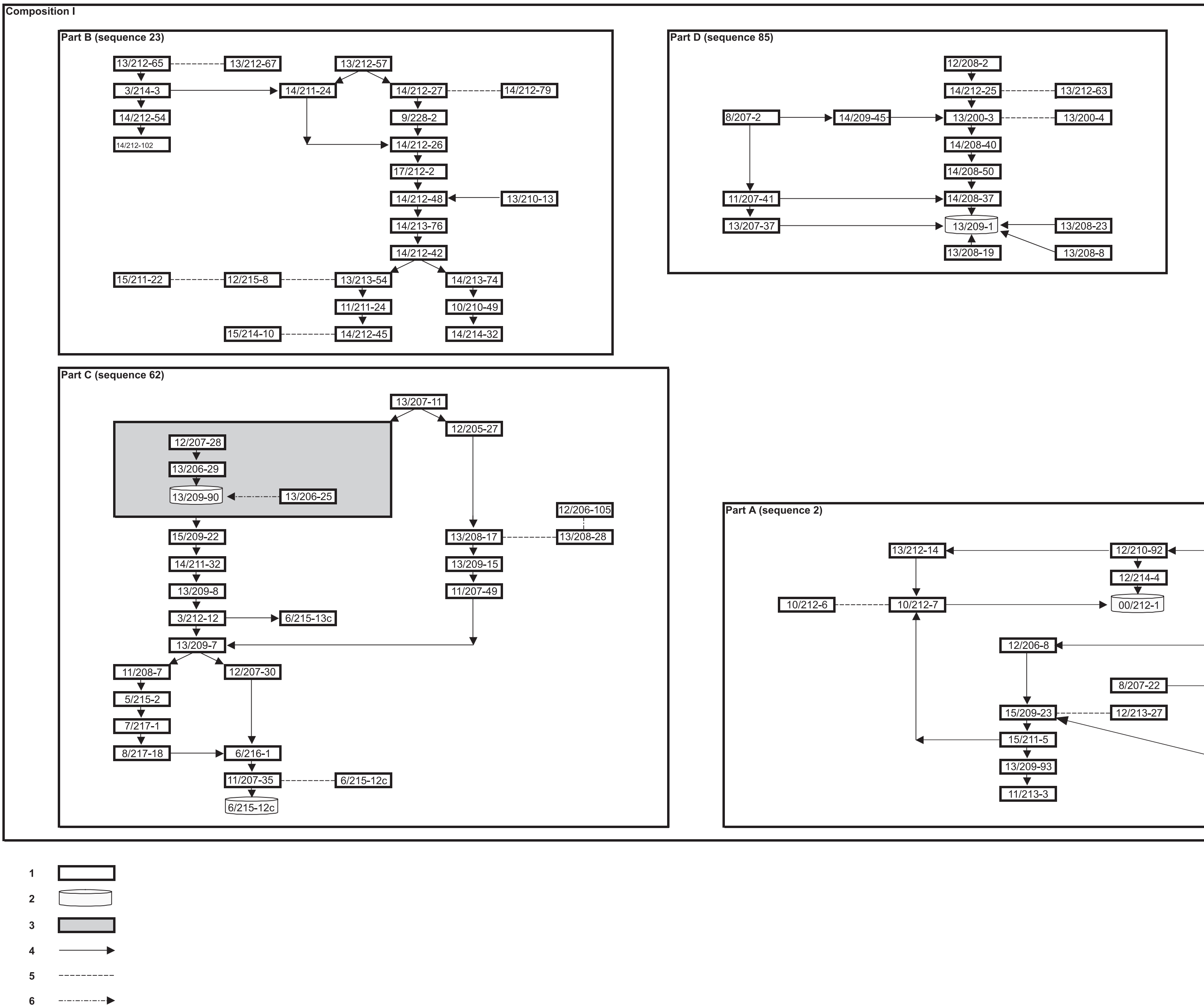
Figure 3.11: Maastricht-Belvédère Site K. Refitted composition I shown from two sides (Length = 253 mm, Width = 330 mm and Thickness = 285 mm).

Groups/parts (+ Nr. of artefacts)	Maximum dimension	S.D.	Length	S.D.	Width	S.D.	Thickness	S.D.	Number of scars	S.D.
Part A (n= 33)	65.5	25.5	44.8	24.2	52.7	29.3	18.4	13.0	4.1	2.3
Part B (n= 25)	60.8	22.2	51.9	25.7	43.9	18.1	12.3	7.8	3.6	1.8
Part C (n= 26)	51.7	30.7	43.1	29.9	38.6	26.4	13.6	12.2	3.2	2.4
Part D (n= 16)	60.2	24.9	49.4	17.6	52.2	23.5	12.0	6.7	2.9	2.9
Part E (n= 20)	52.3	23.5	48.2	19.2	40.1	16.6	11.3	7.7	3.1	1.5
Part F (n= 15)	59.9	19.1	50.5	13.8	54.3	19.7	15.9	9.3	4.2	2.6
Part G (n= 16)	78.5	31.3	68.5	33.3	57.8	21.3	19.6	10.2	4.0	3.1
Part H (n= 2)	–	–	–	–	–	–	–	–	–	–
Part I (n= 7)	66.8	18.5	63.4	20.5	50.0	14.1	11.2	4.6	3.0	2.0
Composition I	62.8	24.7	51.0	24.4	48.5	22.8	15.0	10.2	3.3	2.4

Table 3.9: Maastricht-Belvédère Site K, composition I. Mean maximum dimension, length, width, thickness and number of scars for all flakes ≥30 mm. The numbers are given for the nine different groups as well as for the complete composition. The figures are given in mm. S.D. stands for mean Standard Deviation.

Groups/parts (+ Nr. of artefacts)	Percentage cortex	Non-cortex/ cortex ratio	Percentage natural fissures	Non-natural fissure/ natural fissure ratio	Percentage broken flakes*	complete/ broken ratio*
Part A (n= 33)	51.5	0.1	33.3	2.0	80.6	0.2
Part B (n= 25)	32.0	2.1	32.0	2.1	60.0	0.7
Part C (n= 26)	55.6	0.8	18.5	4.4	69.6	0.4
Part D (n= 16)	43.8	1.3	6.3	15.0	64.3	0.6
Part E (n= 20)	25.0	3.0	25.0	3.0	72.0	0.4
Part F (n= 15)	80.0	0.3	20.0	4.0	76.9	0.3
Part G (n= 16)	53.3	0.9	40.0	1.5	57.1	0.8
Part H (n= 2)	100.0	0	100.0	0	100.0	0
Part I (n= 7)	26.6	2.5	28.6	2.5	20.0	4.0
Composition I	51.6	0.9	28.1	2.6	68.3	0.5

Table 3.10: Maastricht-Belvédère Site K, composition I. Percentage cortex, natural fissures and broken flakes, together with their ratios of all flakes (* all flakes ≥30 mm). The figures are given for the nine different groups as well as for the complete composition.


Composition I
Part B (sequence 23)
13/212-65
13/212-67
13/212-57
3/214-3
14/211-24
14/212-27
14/212-79
14/212-54
9/228-2
14/212-102
14/212-26
17/212-2
14/212-48
13/210-13
14/213-76
14/212-42
15/211-22
12/215-8
13/213-54
14/213-74
11/211-24
10/210-49
15/214-10
14/212-45
14/214-32
Part D (sequence 85)
12/208-2
14/212-25
13/212-63
8/207-2
14/209-45
13/200-3
13/200-4
14/208-40
14/208-50
11/207-41
14/208-37
13/207-37
13/209-1
13/208-23
13/208-19
13/208-8
Part C (sequence 62)
13/207-11
12/205-27
12/207-28
13/206-29
13/209-90
13/206-25
12/206-105
15/209-22
13/208-17
13/208-28
14/211-32
13/209-15
13/209-8
11/207-49
3/212-12
6/215-13c
13/209-7
11/208-7
12/207-30
5/215-2
7/217-1
8/217-18
6/216-1
11/207-35
6/215-12c
6/215-12c
Part A (sequence 2)
13/212-14
12/210-92
12/214-4
10/212-6
10/212-7
00/212-1
12/206-8
8/207-22
15/209-23
12/213-27
15/211-5
13/209-93
11/213-3
1
2
3
4
5
6

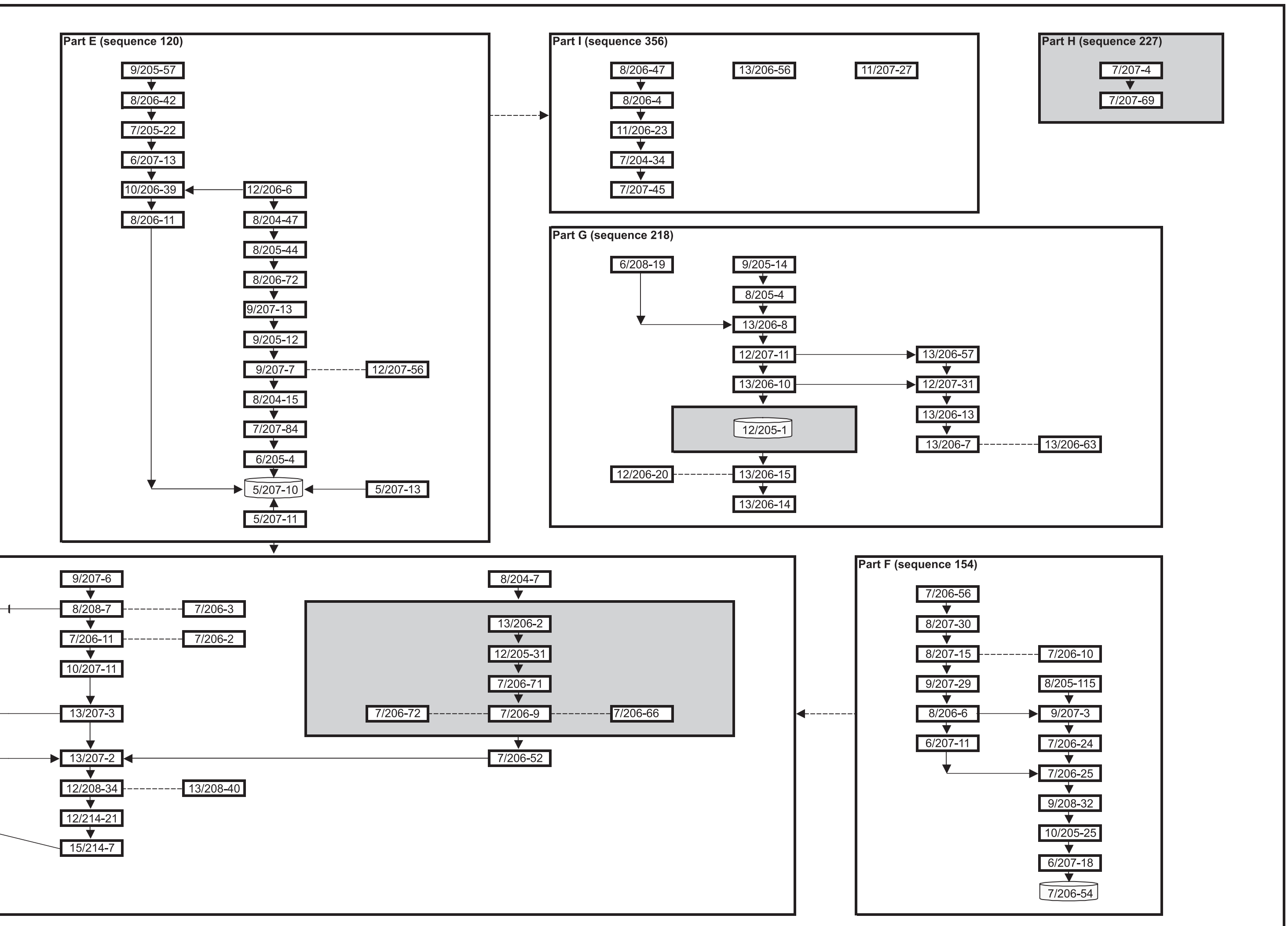


Figure 3.12: Maastricht-Belvédère Site K. Primary and secondary reduction sequences of refitted composition I: the numbers in these 'Harris-matrixes' refer to the individual finds in the reduction sequence, while the shaded areas represent the secondary reduction sequences (flaked-flakes, *cf.* Ashton *et al.* 1992).

1. Flake
2. Core
3. Flaked-flake

4. *Aufeinanderpassung* (production sequences)
5. *Aneinanderpassung* (breaks)
6. *Anpassung* (modifications)

A short typo-/technological profile of the composition I flake characteristics is given in Table 3.8. As there are, moreover, some differences between the nine different parts/ sequences, the reader is also referred to Table 3.9 and Table 3.10.

Refitted composition I (Figure 3.11) indicates that a large flint nodule entered the excavated area, without any or hardly any decortication. At Site K this large cortex covered raw material nodule was probably flattened out to remove all protruding parts which could negatively influence future flaking. This was done by the removal of several large and thick flakes. Subsequently, if these flakes were suitable for future flaking they were secondarily used as cores (flaked-flakes, *cf*. Ashton *et al*. 1992). Part F (sequence 154, see later) represents one of such first flakes which was later used as a core.

Next, the large nodule was further split into at least nine smaller blocks or units. Again these smaller parts were secondarily used as cores. The raw material nodule was not only split by the removal of large and thick flakes, but natural fissures (frost cracks) and fossil inclusions, already present in the flint, also played a major part in the initial flaking or splitting of the raw material. Positive proof for this assumption is given by the fact that several flakes with natural fissure dorsal surfaces and or butts fit dorsal/dorsal, butts onto dorsal surfaces or dorsal surfaces onto natural fissure surfaces on cores. Unlike the large flakes, the splitting of the raw material by following natural (frost) fissures will not show a hierarchical placing in a reduction sequence.

Figure 3.12 shows that at least nine parts of the large nodule were reduced further. This figure also shows that part E (sequence 120) was flaked before parts A (sequence 2) and I (sequence 356). Also, part F (sequence 145) was reduced before part A. In parts A, C (sequence 62) and G (sequence 218) flaked-flake sequences are present, while part H (sequence 227) consists only of a secondary reduction sequence.

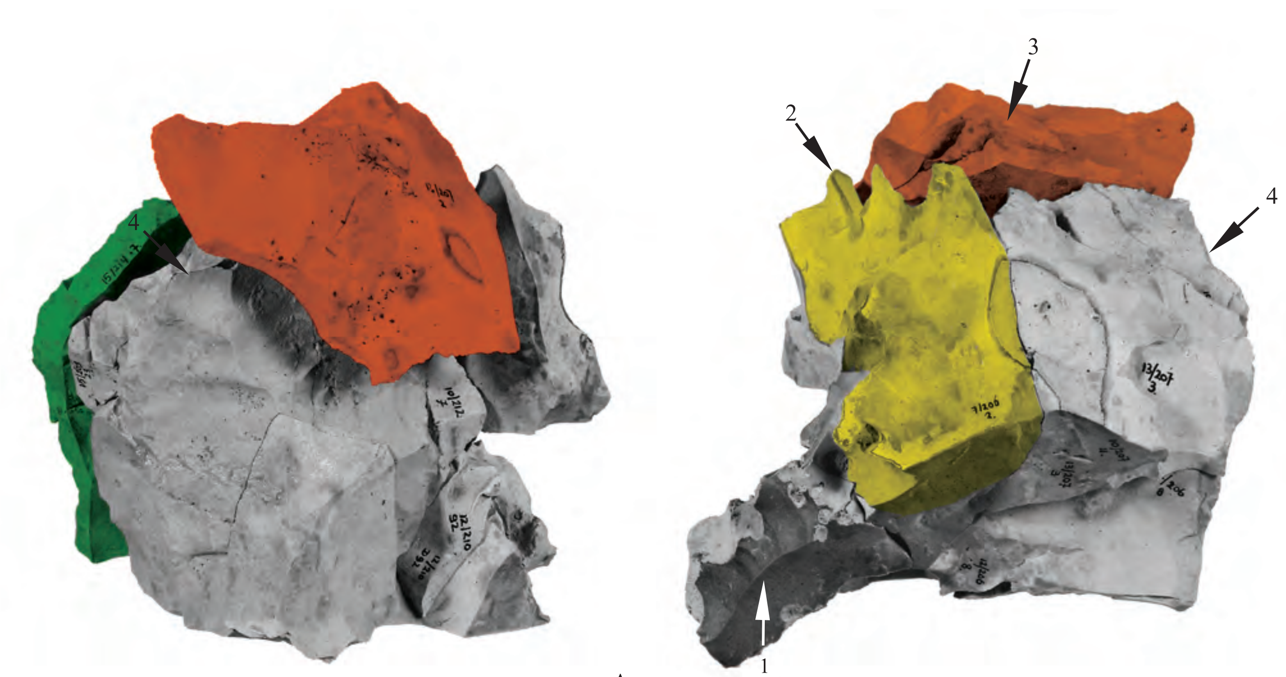
In the next sections the reduction sequences of the smaller units/parts will be discussed briefly.

Refitted composition I, part A (Figures 3.12, 3.13)
After the splitting of the raw material, part A (sequence 2) was further reduced by the removal of rather large flakes. Initially some protruding parts, covered with cortex and natural fissures, were removed from the outermost parts of this block or core (Figure 3.13-A-1). After this rough shaping of the core, a sequence of flakes was produced from one and the same striking platform and striking surface (Figure 3.13-A-2, -B-2). The negative of the last flake in this sequence subsequently created a new striking platform. Next the core was turned 90° and a 'second' sequence of flakes was produced from this newly created striking platform, on a second striking surface (Figure 3.13-A-3, -B-3). Again the negative of the last flake in this sequence created a new striking platform and again the core was turned 90° to produce a 'third' sequence of flakes from the first striking surface (Figure 3.13-A-4, -B-4). One can assume that the production of a series of flakes from a certain striking surface was only interrupted, or better changed to another striking surface, to rejuvenate or maintain a good working edge angle.

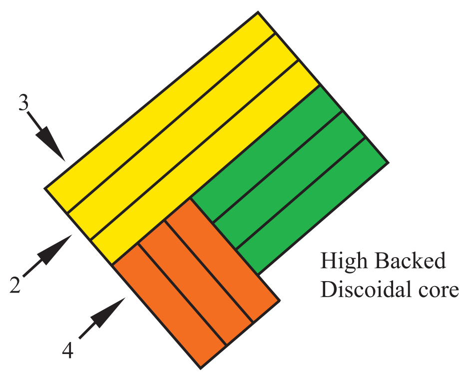
A general characteristic in the reduction sequence of part A is, therefore, that the former striking platform becomes the future striking surface and the other way around. The primary reduction sequence of part A ends with the discard of a rather voluminous high backed discoidal core. One flake was selected for secondary reduction. This flaked-flake (*cf.* Ashton *et al*. 1992) is represented by six artefacts (Figure 3.12, part A).

Refitted composition I, part B (Figures 3.12, 3.14)
Part B (sequence 23) is partially represented by large and thick flakes, which stand for an initial flaking stage of a larger/longer sequence of reduction. The outermost part of this composition shows only natural (frost) fissures and/or cortex remains. In a 'first' stage of reduction the cortex-covered side of the core was reduced. This was done by removing at least seven large and thick flakes (Figure 3.12, part B, numbers 13/212-65 [+13/212-67] up to 14/212-102 and 13/212-67; Figure 3.14-A-1 and B-1), probably to remove all protruding parts and to flatten out this side of the core. These flakes also created a large striking platform and a good flaking edge angle for future reduction. Subsequently, this platform, together with another one situated on the opposite side of the core, was alternately used to produce a sequence of large flakes from one and the same striking surface (Figure 3.14-A-2, -3 and -B-2, -3). The mentioned 'second' striking platform originated from the initial splitting of the nodule and was used without modifications.

Refitted composition I, part C (Figures 3.12, 3.15)
Refitting shows that a large natural hole, covered with cortex, was situated more or less in the centre of the nodule (Figure 3.11). Splitting of the raw material resulted, amongst others, in a smaller block (part C, sequence 62) on which part of this cavity was still visible. In a 'first' stage of reduction some prominent parts, covered with cortex and natural fissures (former part of the cavity), were removed from the core (Figure 3.15-A-1, -B-1). The last flakes in this sequence created a large striking platform and a good flaking edge angle for future reduction. Subsequently, the core was turned 90° and a 'second' sequence of large flakes was produced from a striking platform and working edge angle which



A



B

Figure 3.13: Maastricht-Belvédère Site K. A: Refitted composition I, part A. Scale 1:2. B: Schematic representation of the reduction of refitted composition I, part A. 1: Removing of protruding parts (rough shaping of the core). 2-4: Production of sequences of flakes, using two striking surfaces. The former striking platform becomes the future striking surface and the other way around.

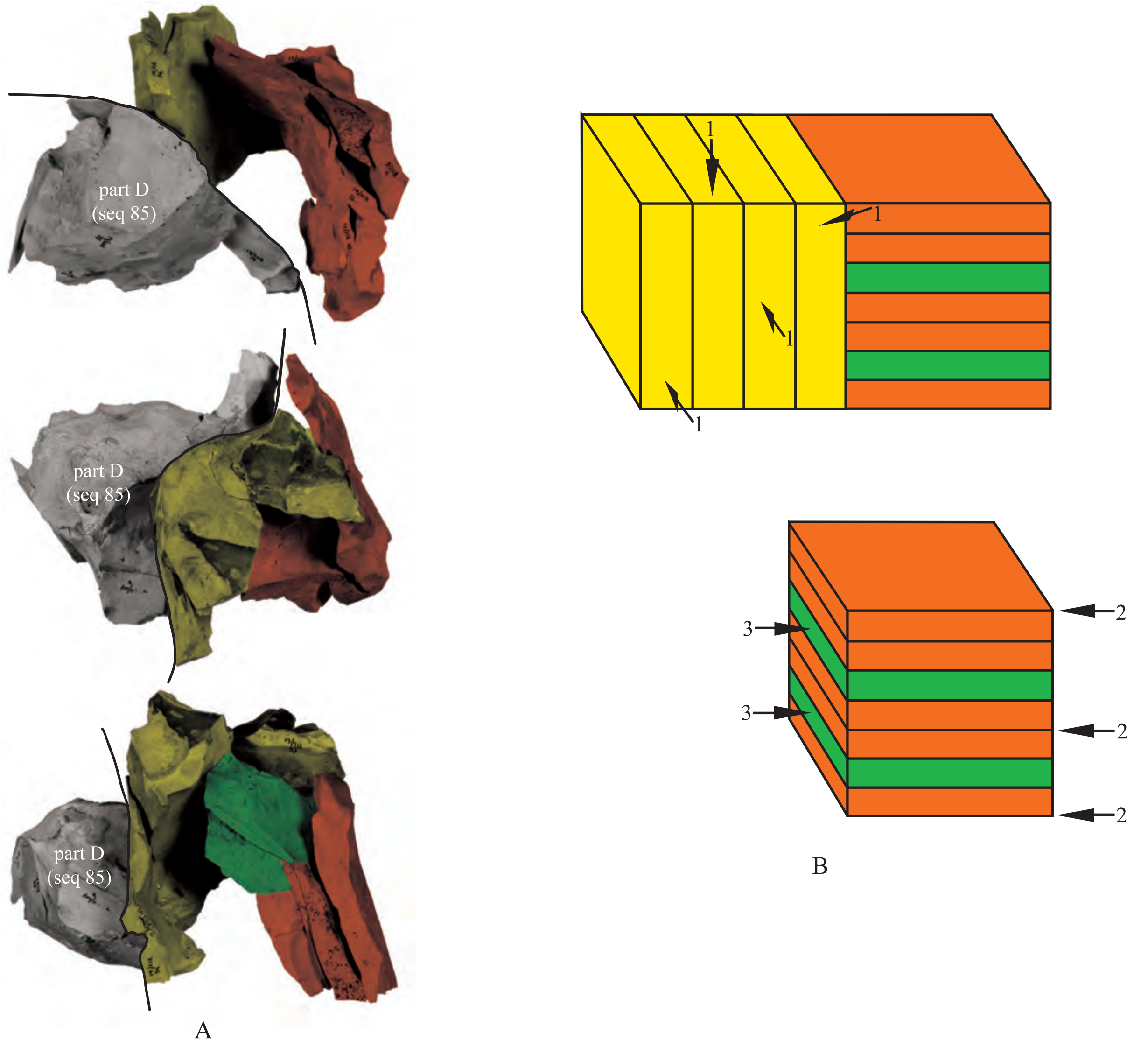


Figure 3.14: Maastricht-Belvédère Site K. A: Refitted composition I, part B (and D). Scale 1:3. B: Schematic representation of the reduction of refitted composition I, part B. 1: Striking platform and flaking edge angle preparation. 2, 3: Production of a sequence of flakes, using two striking platforms (facing one another) and a single striking surface.

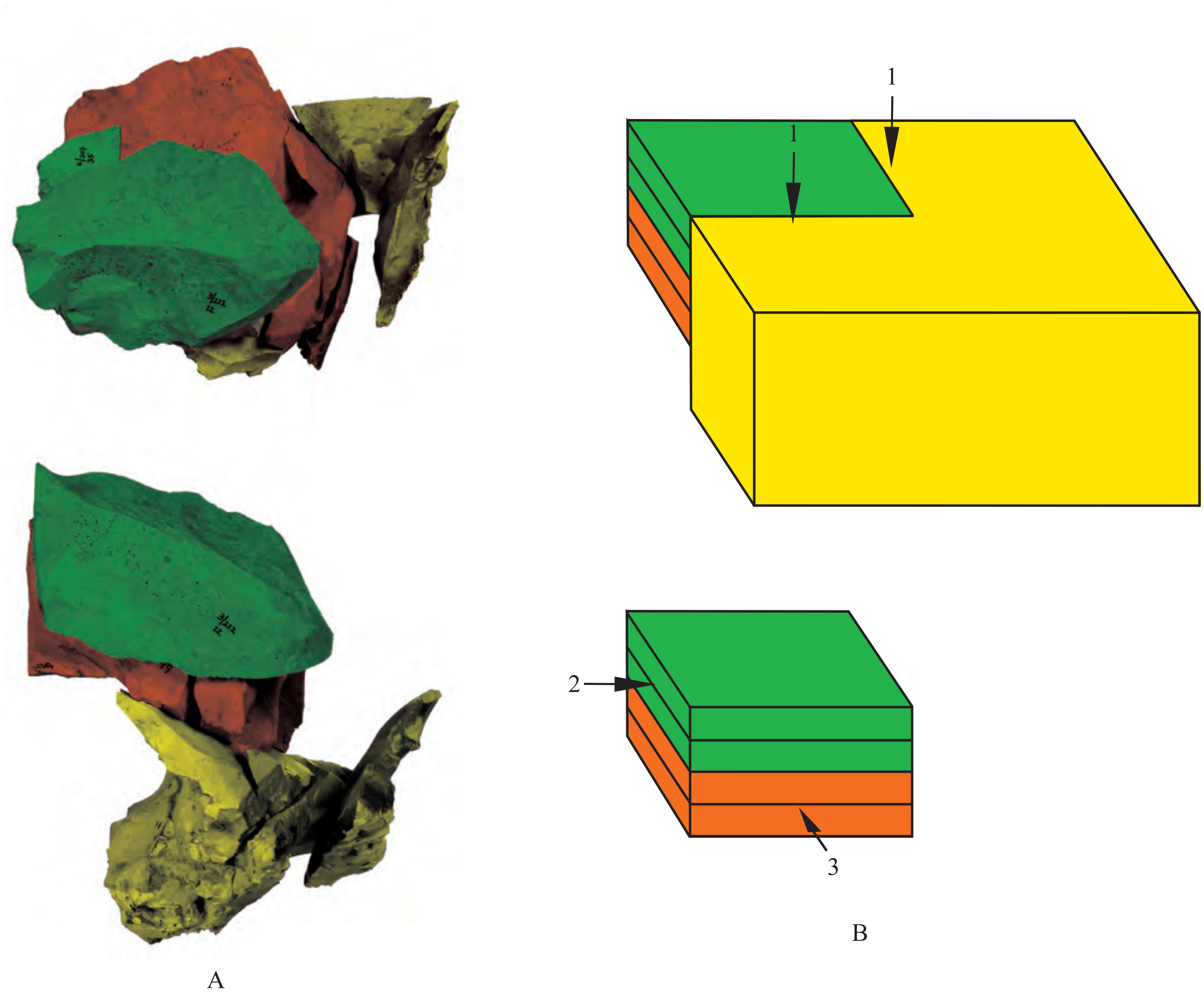


Figure 3.15: Maastricht-Belvédère Site K. A: Refitted composition I, part C. Scale 1:2. B: Schematic representation of the reduction of refitted composition I, part C. 1: Removing of protruding parts. 2, 3: Production of sequences of flakes, using two striking platforms and one striking surface.

originated from the initial splitting of the nodule. This platform was used without any preparation (Figure 3.15-A-2, -B-2). Again the core was turned 90° and a 'third' series of smaller flakes was produced from the striking platform which was created by the 'first' sequence of flakes (Figure 3.15-A-3, -B-3). The latter series of flakes is produced from the same striking surface as 'second' sequence. The reduction of part C resulted in the end in a voluminous high backed discoidal core.

One of the initial thicker decortication flakes was also selected for further reduction (Figure 3.12, part C, numbers 12/207-28, 13/206-29, 13/206-25, and 13/209-90). It concerns a flaked-flake (*cf.* Ashton *et al.* 1992) which is only represented by three flakes and a double platformed at right angles core.

Refitted composition I, part D (Figures 3.12, 3.14, 3.16)
Block D (sequence 85) was initially situated on the outermost face of the large raw material nodule, as this side is completely cortex covered. After splitting the flint nodule, part D was probably scanned for appropriate striking platforms and good flaking edge angles. The former most internal part of the nodule (on block D) was chosen for further reduction. Without any kind of platform or working edge preparation, a sequence of at least eight large flakes was produced from one and the same striking surface (Figure 3.12, part D, artefact numbers 12/208-2, 14/212-25 [+13/212-63], 8/207-2, 14/209-45, 13/200-3 [+13/200-4], 14/208-40, 14/208-50 and 14/208-37; Figure 3.16-1). The production probably went on until the working edge angle had to be rejuvenated. In addition, the scars of the last flakes in this sequence created a new striking platform. Next the core was turned 90° and at least two flakes were struck from the newly shaped platform. These artefacts were produced from a 'second' striking surface (Figure 3.16-2; Figure 3.12, part D, flakes 11/207-41 and 13/207-37). Another three artefacts (flakes 13/208-23, 13/208-8 and 13/208-19) were flaked from other, probably 'less important', faces of the core.

The general characteristic in this reduction sequence is that the former striking platform becomes the future striking surface, just like part A. The reduction resulted eventually in a voluminous high backed discoidal core of which one side is completely cortex covered.

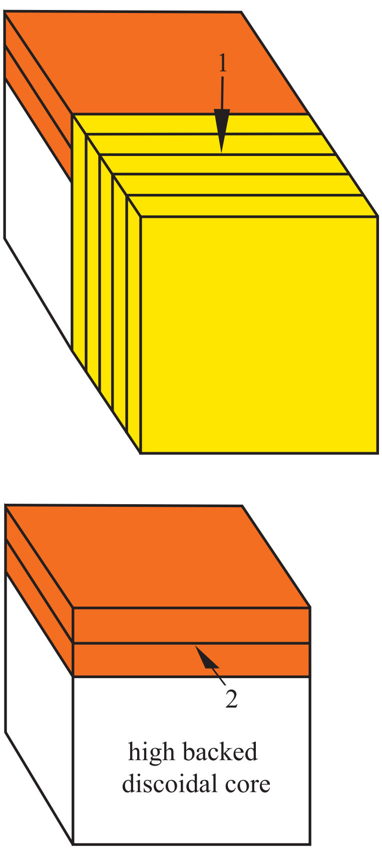


Figure 3.16: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition I, part D. 1 and 2: Production of two sequences of flakes, using two different striking platforms and two different striking surfaces.

Refitted composition I, part E (Figures 3.12, 3.17)
Possibly during the initial splitting of the raw material, the thinnest part of block E (sequence 120) was 'broken off' (Figure 3.12, part E, artefact number 12/206-6; Figure 3.17-A-1, -B-1). This created a more or less triangular core, which was probably scanned for proper striking platforms and edge angles. Subsequently, two series of flakes were produced from one large striking platform that originated from the initial splitting. Neither the platform nor the edge angles were prepared or modified. The flake sequences were reduced from two different striking surfaces, situated at opposite faces of the core (Figure 3.17-A-2, -3; -B-2, -3; Figure 3.12, part E, numbers 9/205-57 up to 6/207-13, 10/206-39, 8/206-11 and numbers 8/204-47 up to 6/205-4). In total two flakes (Figure 3.12, part E, numbers 5/207-13 and 5/207-11) could be refitted to 'less important' faces of the core. In the end a large single platformed, unifacial core was discarded.

Refitted composition I, part F (Figures 3.12, 3.18)
As mentioned before, the large flint nodule was probably first flattened out and all protruding parts were eliminated by the removal of several large and thick flakes. Part F (sequence 154) represents one of these first flakes which was secondarily used as a core (flaked-flake, *cf.* Ashton *et al.*1992).

The reduction sequence of core F starts with a series of decortication flakes which was produced from a striking platform originating from the initial splitting of the nodule

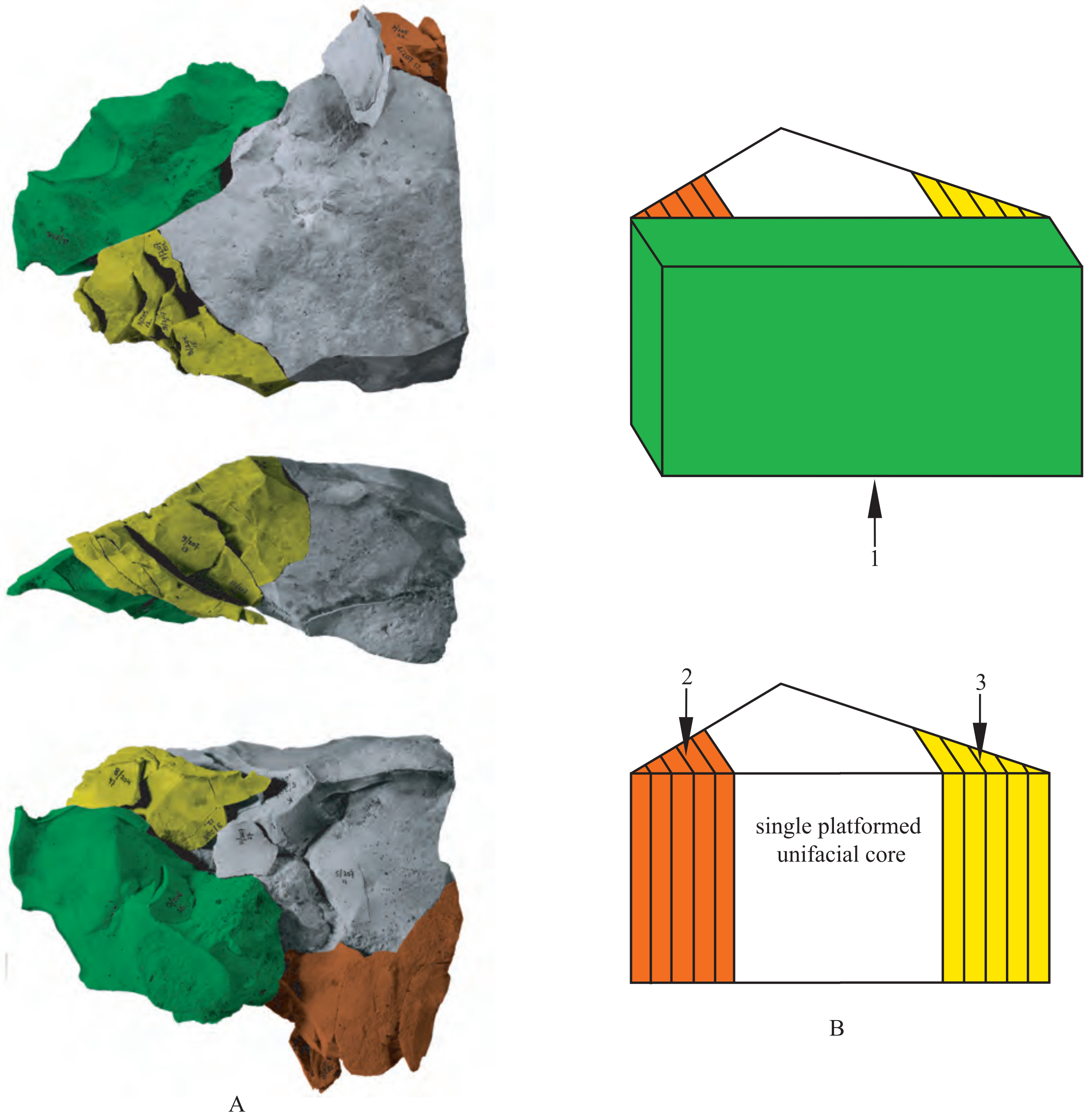


Figure 3.17: Maastricht-Belvédère Site K. A: Refitted composition I, part E. Scale 1:2. B: Schematic representation of the reduction of refitted composition I, part E. 1: Part of block E which probably ‘broke off’ during the initial splitting of the raw material. 2 and 3: Production of two sequences of flakes, using one striking platform and two striking surfaces.

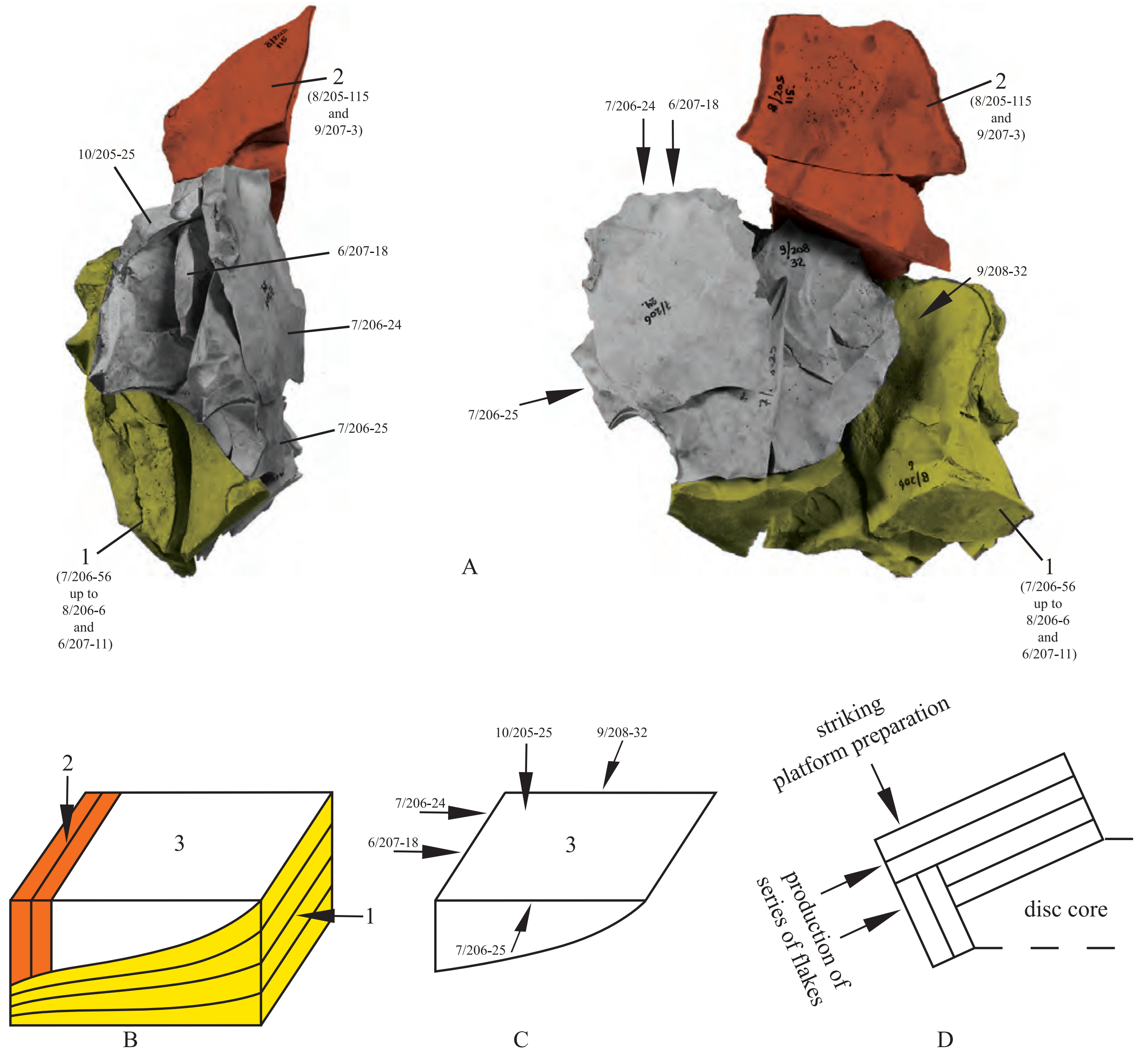


Figure 3.18: Maastricht-Belvédère Site K. A: Refitted composition I, part F. Scale 1:2. B, C and D: Schematic representation of the reduction of refitted composition I, part F. 1, 2: series of decortication flakes, rough shaping of the core. 3: Production of sequences of flakes in a circular direction, using one main striking surface. Numbers 7/206-24 up to 6/207-18 represent the individual refitted artefacts. They correspond with the numbers in Figure 3.18-A.

(Figure 3.12, part F, numbers 7/206-56 up to 8/206-6 and 6/207-11; Figure 3.18-A, -B-1). Next the core was turned 180° and a 'second' series of decortication flakes was produced from an opposite situated striking platform and striking surface. This 'second' platform, situated at right angles to the first one, is the former ventral side of the large flake. (Figure 3.12, part F, flakes number 8/205-115 and 9/207-3; Figure 3.18-A and -B-2). After this rough shapening of the core a sequence of large flakes was produced from one and the same striking surface. The whole core edge was used to remove these flakes in a circular, anti clock-wise direction (Figure 3.12, part F, numbers 7/206-24 up to 9/208-32; Figure 3.18-C-3). The production of this sequence was only interrupted to rejuvenate or maintain a good working edge angle (Figure 3.18-D). As a matter of fact, the negatives of the last flakes in this sequence created a new striking platform. Subsequently, the core was turned 90° and some smaller flakes were produced from the newly created striking platform, on another, 'less important', striking surface (Figure 3.18, part F, number 10/205-25). Again the negatives of the last flakes created a new striking platform and again the core was turned 90° to produce a new sequence of larger flakes from the 'first' striking surface (Figure 3.18, part F, flake number 6/207-18). Similar to part A (sequence 2), the former striking platform becomes the future striking surface and the other way around. The only difference is that for core F the whole reduction is focused on one main striking surface. Eventually a rather flat disc core was discarded.

Refitted composition I, part G (Figures 3.12, 3.19)
Part G (sequence 218) is represented only by large and thick flakes. The last stages of core reduction, including (probably) a discarded core, could not be refitted to this composition. At first a series of flakes was produced from a striking platform (unprepared) which, again, originated from the initial splitting of the large flint nodule (Figure 3.12, part G, numbers 9/205-14 and 8/205-4; Figure 3.19-1). Next the core was turned 180° and at least four flakes were produced from an opposite, 'second', striking platform which also resulted from the initial splitting (Figure 3.12, part G, numbers 6/208-19, 13/206-8, 12/207-11 and 13/206-57; Figure 3.19-2). Subsequently, the core was again turned 180° to the 'first' striking platform and a new sequence of flakes was produced. Only one of these flakes could be refitted (Figure 3.12, part G, artefact number

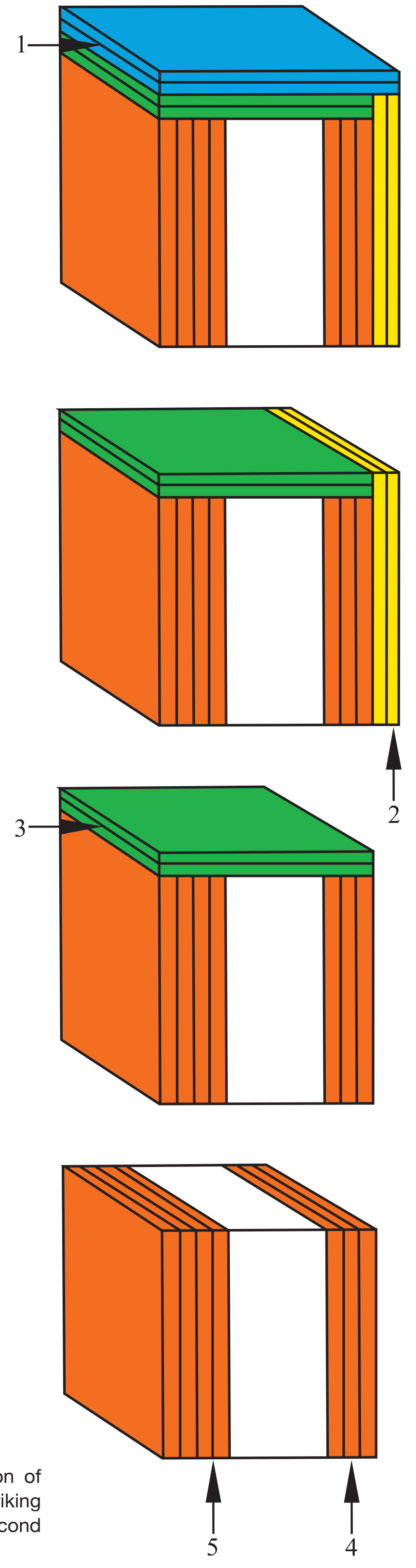


Figure 3.19: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition I, part G. 1-4: Production of sequences of flakes, using two striking platforms but one striking surface. 5: Production of a sequence of flakes, from a second striking surface.

13/206-10; Figure 3.19-3). As a result, the core was alternately used to produce sequences of large flakes from one and the same striking surface. Probably this reduction was aimed at removing all protruding cortex/natural fissure parts and at flattening out this side of the core. For the following two stages of reduction it is difficult to assign the relative position within the sequence of block G. During one of these sequences the core was turned 180° once more and a sequence of at least four flakes was produced from the 'second' striking platform (Figure 3.12, part G, numbers 12/207-31 up to 13/206-7 [+13/206-63]; Figure 3.19-4). A 'fifth' series of flakes was produced from the last mentioned striking platform but on a different striking surface, situated on the opposite side of the core (Figure 3.12, part G, artefact numbers 12/205-1 up to 13/206-14; Figure 3.19-5). From the latter sequence one large and thick flake (flake number 12/205-1) was selected for secondary flaking (*cf*. Ashton *et al*.1992).

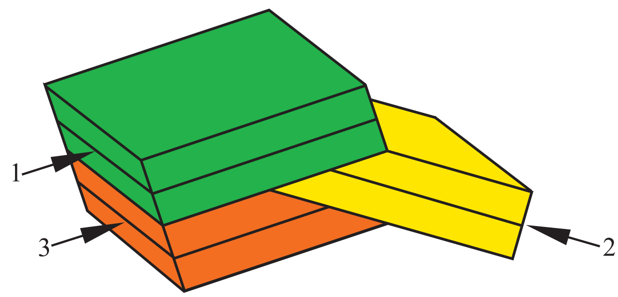


Figure 3.20: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition I, part I. 1-3: Production of sequences of flakes, using two striking platforms, but one striking surface.

Composition II (n= 141 flakes or 125 flakes ≥30 mm)	
Maximum dimension	Flakes with a maximum dimension between 30 mm and 79 mm dominate (n= 94 or 66.7% of all flakes).
Length	Flakes with a length between 20 mm and 59 mm dominate (n= 87 or 69.6% of all flakes ≥30 mm).
Width	Flakes with a width between 20 mm and 59 mm dominate (n= 91 or 72.8% of all flakes ≥30 mm).
Thickness	Flakes with a thickness between 0 mm and 19 mm dominate (n= 99 or 79.2% of all flakes ≥30 mm).
Cortex	Slightly less than half of all flakes (n= 68 or 48.2%) show cortex remains, while 33 flakes (23.4%) show 25% or more cortex.
Natural fissures	Natural fissures are described on only 14 flakes (9.9% of all flakes).
Missing due to breakage	In total 73 (58.4%) flakes ≥30 mm are broken. In most cases the distal part, proximal part or lateral part is missing. The numbers are respectively, 20 (16.0%), 18 (14.4%) and, 17 (13.6%).
Angle of percussion	Most of the flakes have an angle of percussion ≥120° (n= 71 or 56.8% of all flakes ≥30 mm).
Butt	A plain butt dominates (n= 51 or 40.8%% of all flakes ≥30 mm), while 23 flakes have a dihedral butt (18.4%). Only six flakes (4.8%) show a retouched or facetted butt.
The *Index Facettage* (IF) for all flakes ≥30 mm is 23.2	The *Index Facettage stricte* (IFs) for all flakes ≥30 mm is 4.8
Preparation near the butt	Of all 141 flakes, 38 (27.0%) show traces of preparation along the angle between the butt and the dorsal surface. Mostly this is done by means of retouching/faceting (n= 17 or 12.1%) or 'crushed' (n= 14 or 9.9%).
Dorsal pattern	Most of the flakes have a 'parallel' unidirectional pattern (n= 40 or 32.0% of all flakes ≥30 mm), while a 'parallel' + lateral unidirectional pattern is counted on 28 (22.4%). Five flakes (4.0%) have a convergent unidirectional and 12 (9.6%) a centripetal or radial dorsal pattern.
Flake scars	Most of the flakes ≥30 mm have two or three dorsal scars (n= 50 or 40.0% of all flakes ≥30 mm).

Table 3.11: Maastricht-Belvédère Site K, composition II. Typo-/technological summary of the flake characteristics. The *Index Facettage* and the *Index Facettage stricte* are calculated according to Bordes (1972:52).

Refitted composition I, part H and I (Figures 3.12, 3.20)
Part H (sequence 227) consists only of two refitted artefacts which represent a single large flake that was secondarily used as a core (*cf*. Ashton *et al*. 1992, Figure 3.13, part H, numbers 7/207-4 and 7/207-69).

Part I (sequence 356) mainly represents an initial series of (decortication) flakes, belonging to a longer/larger reduction sequence. Technologically this sequence is comparable to that of part B (sequence 23) and part G (sequence 218). Two flakes were produced from a striking platform which originated from the initial splitting of the large flint nodule (Figure 3.12, part I, artefacts 8/206-47 and 8/206-4; Figure 3.20-1). Subsequently, the core was turned 180° and again two flakes were produced from an opposite, 'second', striking platform which also originated from the initial splitting (Figure 3.12, part I, numbers 11/206-23 and 7/204-34; Figure 3.20-2). Then, the core was turned again 180°, to the 'first' striking platform and at least one flake was produced (Figure 3.12, part I, number 7/207-45; Figure 3.20-3). All artefacts were flaked from the same striking surface, except for two (Figure 3.12, part I, numbers 13/206-56 and 11/207-27).

3.6.5.3 Refitted composition II (Figure 3.21)

Refitting resulted eventually in a second large composition (II; De Loecker 1994*a* and *b*; De Loecker *et al*. 2003), which measures 35 cm in cross-section and weighs 0.775 kg (1.3% of the total weight of conjoined artefacts). This conjoined nodule consists in total of 146 artefacts and represents eight separately reduced parts or cores: Site K, sequences 9 (part A), 24 (part B), 84 (part C), 104 (part D), 124 (part E), 133 (part F), 137 (part G) and 141 (part H). The eight sequences or

Groups/parts (+ Nr. of artefacts)	Maximum dimension	S.D.	Length	S.D.	Width	S.D.	Thickness	S.D.	Number of scars	S.D.
Part A (n= 59)	47.5	21.2	39.1	20.1	38.4	18.2	11.5	6.5	3.4	3.0
Part B (n= 23)	66.9	23.7	52.9	28.1	46.1	24.0	18.6	12.9	4.1	3.6
Part C (n= 11)	73.5	28.8	65.3	23.3	55.7	20.5	21.8	14.1	4.4	2.1
Part D (n= 2)	–	–	–	–	–	–	–	–	–	–
Part E (n= 13)	67.8	26.7	61.0	26.6	54.4	20.8	13.6	7.0	5.3	3.6
Part F (n= 26)	45.0	11.3	39.2	12.1	37.6	10.6	9.7	3.5	3.7	2.1
Part G (n= 7)	56.0	13.8	48.8	14.9	51.0	13.3	15.5	7.1	3.2	1.9
Part H (n= 5)	67.7	11.0	57.3	14.0	50.0	5.0	11.0	6.6	2.7	1.5
Composition II	55.4	23.3	46.5	22.7	43.9	19.5	13.8	9.2	3.4	3.0

Table 3.12: Maastricht-Belvédère Site K, composition II. Mean maximum dimension, length, width, thickness and number of scars for all flakes ≥30 mm. The numbers are given for the eight different groups as well as for the complete composition. The figures are given in mm. S.D. stands for mean Standard Deviation.

Groups/parts (+ Nr. of artefacts)	Percentage cortex	Non-cortex/ cortex ratio	Percentage natural fissures	Non-natural fissure/ natural fissure ratio	Percentage broken flakes*	complete/ broken ratio*
Part A (n= 59)	44.1	1.3	1.7	58.0	58.2	0.7
Part B (n= 23)	34.8	1.9	8.6	10.5	66.7	0.5
Part C (n= 11)	45.5	1.2	0	–	40.0	1.5
Part D (n= 2)	–	–	–	–	–	–
Part E (n= 13)	23.1	3.3	30.8	2.3	66.7	0.5
Part F (n= 26)	34.6	1.9	19.1	4.2	52.6	0.9
Part G (n= 7)	85.8	0.2	14.3	6.0	66.7	0.5
Part H (n= 5)	20.0	4.0	0	0	66.7	0.9
Composition II	48.2	1.1	9.9	9.1	58.4	0.7

Table 3.13: Maastricht-Belvédère Site K, composition II. Percentage cortex, natural cracks and broken flakes, together with their ratios of all flakes (* all flakes ≥30 mm). The figures are given for the nine different groups as well as for the complete composition.

Figure 3.21: Maastricht-Belvédère Site K. Refitted composition II. Scale 1:2.

groups consist respectively of 59, 23, 11, 2, 13, 26, 7 and 5 artefacts. Apart from five cores (3.4%), six core trimming elements (4.1%) and one tool (0.7%, a simple-side scraper), all artefacts are flakes and pieces of debitage (n= 134 or 91.8%). Of all flakes, four pieces (2.7%) could be described as blade-like flakes. Typologically the cores are described as two disc cores, one high backed discoidal core, a polyhedral core and a single platformed bifacial core. In total two artefacts are described as burned.

A short typo-/technological profile of the composition II flake characteristics is given in Tables 3.11, 3.12 and 3.13.

According to the conjoined cortex flakes of refitted composition II (Figure 3.21), a large flint nodule entered the excavated area without any, or hardly any, decortication. It is assumed that the raw material was collected from nearby river deposits. In the southern part of the excavated Site K area the nodule was probably flattened out initially to remove all protruding parts. Subsequently, the flint nodule was divided into at least eight parts or cores. Like composition I, this was done by removing large and thick flakes, whereas natural fissures also played a major part in the splitting strategy. All eight parts or cores were further reduced 'on the spot'. Five cores were excavated and could be refitted. It is possible that the three missing cores were discarded in the south-eastern, not excavated, part of the findspot. In contrast to composition I, none of the flakes were 'secondarily' used as cores. In the following part the eight smaller parts will be looked at.

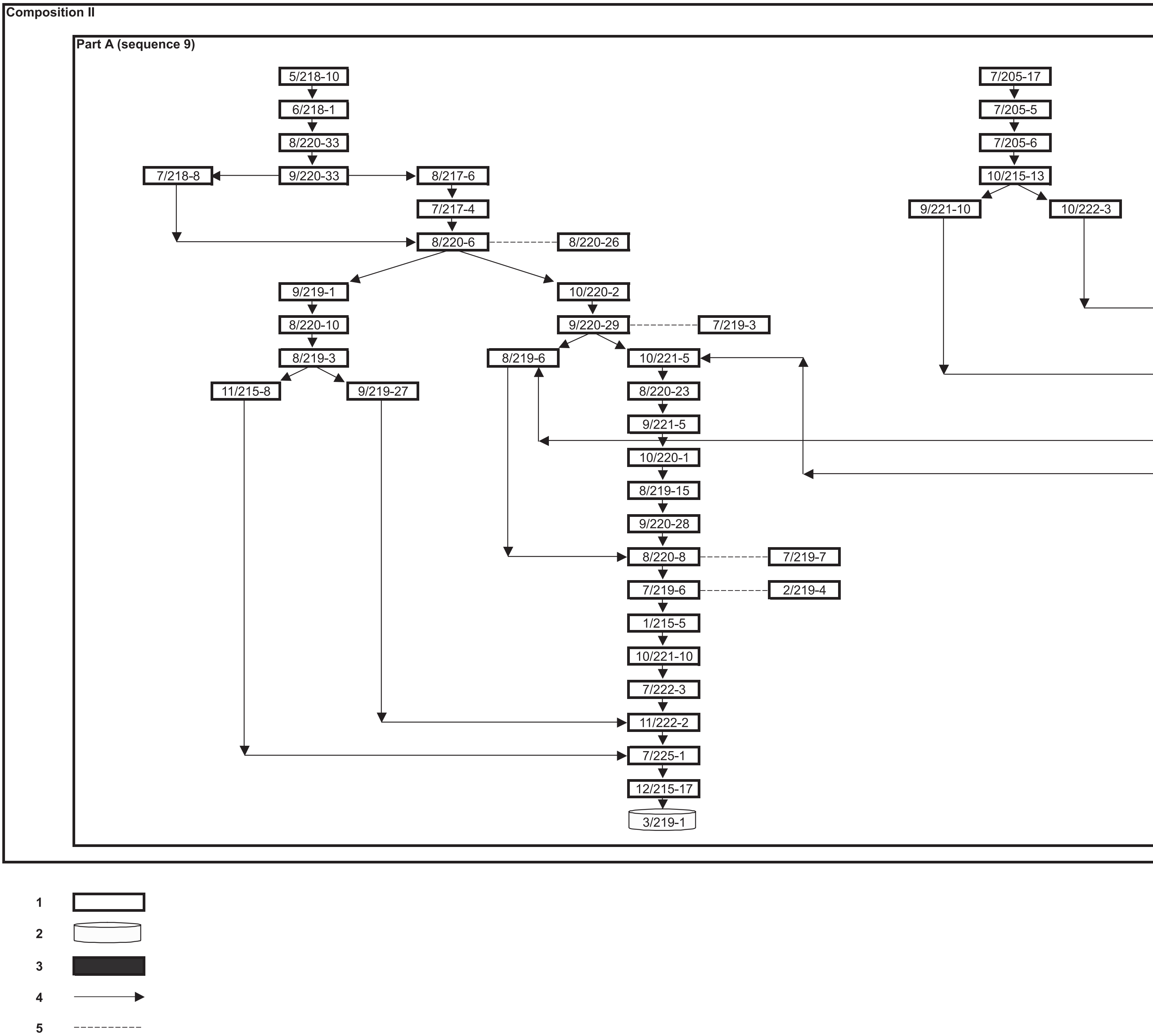
Refitted composition II, part A (Figures 3.22, 3.23)
The splitting of the large nodule resulted, amongst others, in a rather triangular block of flint (part A, Sequence 9), which was reduced by removal of large and rather thick flakes. At first, the core was roughly shaped and some remaining cortex and natural fissure parts were removed from the outermost parts of this block. It can be suggested that this initial shaping was directly aimed at future flake production from one main (large) striking platform.

A 'first' sequence of flakes was produced from a striking surface situated at the opposite side of this main future striking platform (Figure 3.23-A-1, -B-1; Figure 3.22 part A, flake [fragment] numbers 9/206-8 up to 10/218-2 and 9/218-2). A 'second' series of flakes was produced, using the last mentioned striking surface as striking platform (Figure 3.23-A-2, -B-2; Figure 3.22 part A, flake numbers 5/218-10 up to 8/220-33 and 8/217-6). Subsequently, after the core was turned 180°, a 'third' continuous sequence of flakes was produced from the previously mentioned main striking platform, using two sides of the triangular core as striking surface. This long sequence was flaked from two different sides of the core (Figure 3.23-A-3 and -4, -B-3 and -4; Figure 3.22 part A, flake numbers 7/205-17, 7/205-5, etc… and 9/220-33, 7/218-8, etc…). Generally, it is difficult to assign the relative position of the first two series of flakes (and the beginning of the third [Figure 3.23-A-3, -B-3; Figure 3.22 part A, flake numbers 7/205-17, 7/205-5, etc…]) within the reduction sequence of block/core A.

In most cases neither the platform nor the edge angles of the core were prepared or modified. One can also presume that the production of the main flake sequence continued until the 'good' working edge angle was exhausted. Eventually a large and rather voluminous disc core was discarded.

Refitted composition II, part B (Figures 3.22, 3.24)
The outermost part of one side of block B (Sequence 24) shows mainly natural (frost) fissures and/or cortex remains. In an 'initial' stage of reduction this cortex covered side was reduced, by means of at least six large and thick flakes (Figure 3.22, part B, numbers 8/205-9 [+7/204-42] up to 8/205-7; Figure 3.24-A-1 and -B-1). Subsequently, the core was turned 90° and a 'second' sequence of flakes was produced from another striking platform and striking surface. Both were situated at right angles (perpendicular) to the 'first' flake sequence (Figure 3.22, part B, numbers 12/209-3 [+11/213-28] and 11/212-9; Figure 3.24- A-2 and -B-2). Next, the core was turned 90° once more and a 'third' sequence of flakes was produced from yet another striking platform, but using the same striking surface as the initial flake series. This latter striking platform originated from the initial splitting of the nodule and shows no signs of preparation (Figure 3.22, part B, numbers 10/210-80 up to 17/212-8 [+11/214-8]; Figure 3.24-A-3 and -B-3). Eventually a poyhedral core was discarded.

Refitted composition II, part C (Figures 3.22, 3.25)
Composition II, part C (sequence 84), consists of a small block of flint, on which part of a cortex-covered cavity is visible (Figure 3.25). In a 'first' stage of reduction one side of the core was reduced by the removal of large and rather thick flakes. In this way, the thinnest part of the block forming part of the cavity was taken away (Figure 3.25-A-1, -B-1; Figure 3.22, part C, numbers 4/200-5 and 8/202-22). Subsequently, the core was turned 90° and a 'second' sequence of flakes was produced from another striking platform and striking surface: the former striking platform became more or less the striking surface (Figure 3.25-A-2 and -B-2; Figure 3.22, part C, number 8/202-23). After the core was turned 180° a 'third' sequence of flakes was struck from the same striking surface. The striking platform is now situated at the opposite side of the former platform (Figure 3.25-A-3 and -B-3; Figure 3.22, part C, numbers 13/201-1 up to 6/200-2). The last flake(s) in this sequence again created a new striking platform which was used for a 'fourth' sequence of flakes. This final series of


Composition II
Part A (sequence 9)
5/218-10
6/218-1
8/220-33
9/220-33
7/218-8
8/217-6
7/217-4
8/220-6
8/220-26
9/219-1
8/220-10
8/219-3
11/215-8
9/219-27
10/220-2
9/220-29
7/219-3
8/219-6
10/221-5
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9/220-28
8/220-8
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7/219-6
2/219-4
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10/221-10
7/222-3
11/222-2
7/225-1
12/215-17
3/219-1
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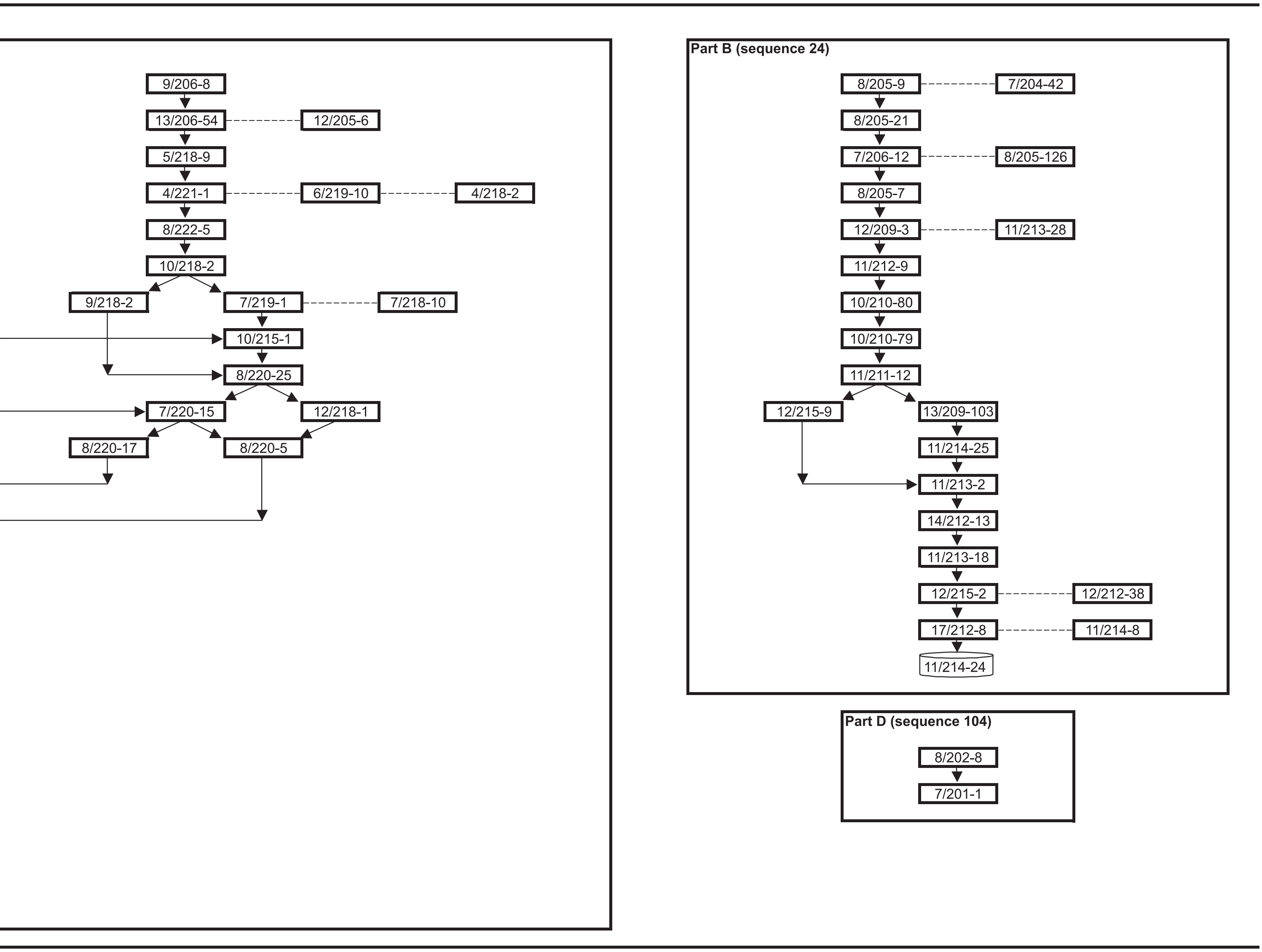
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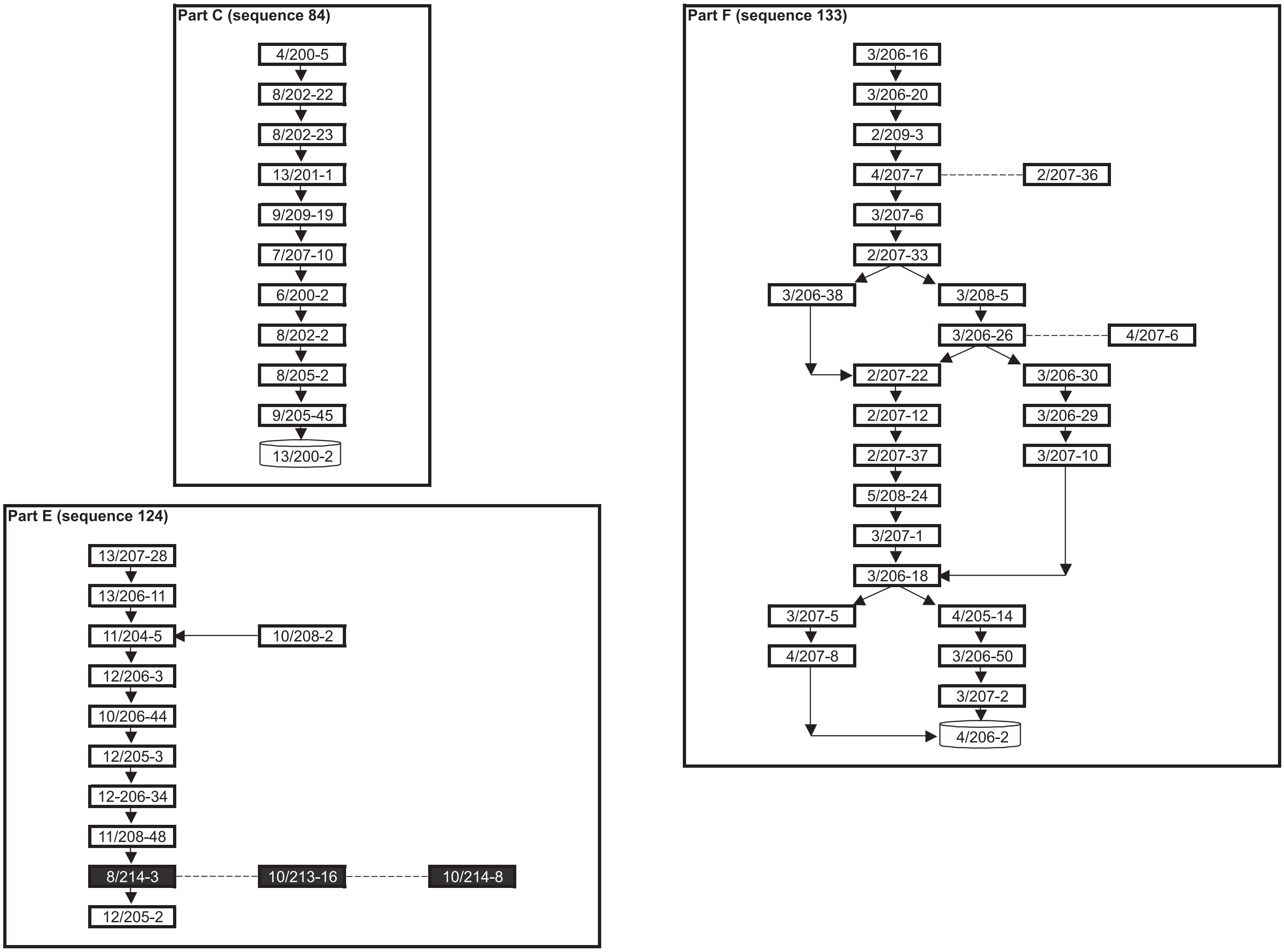
7/219-1
7/218-10
10/215-1
8/220-25
7/220-15
12/218-1
8/220-17
8/220-5
Part B (sequence 24)
8/205-9
7/204-42
8/205-21
7/206-12
8/205-126
8/205-7
12/209-3
11/213-28
11/212-9
10/210-80
10/210-79
11/211-12
12/215-9
13/209-103
11/214-25
11/213-2
14/212-13
11/213-18
12/215-2
12/212-38
17/212-8
11/214-8
11/214-24
Part D (sequence 104)
8/202-8
7/201-1


Part C (sequence 84)
4/200-5
8/202-22
8/202-23
13/201-1
9/209-19
7/207-10
6/200-2
8/202-2
8/205-2
9/205-45
13/200-2
Part E (sequence 124)
13/207-28
13/206-11
11/204-5
10/208-2
12/206-3
10/206-44
12/205-3
12-206-34
11/208-48
8/214-3
10/213-16
10/214-8
12/205-2
Part F (sequence 133)
3/206-16
3/206-20
2/209-3
4/207-7
2/207-36
3/207-6
2/207-33
3/206-38
3/208-5
3/206-26
4/207-6
2/207-22
3/206-30
2/207-12
3/206-29
2/207-37
3/207-10
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3/207-2
4/206-2

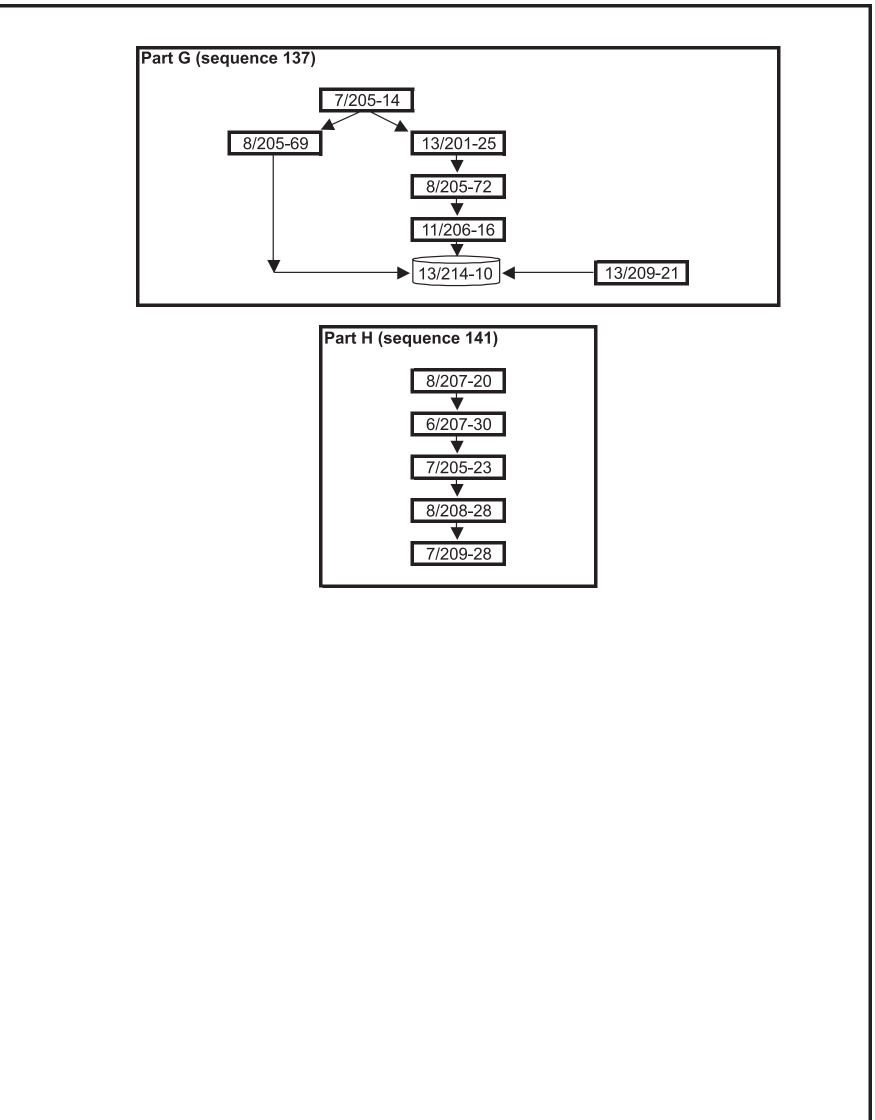


Figure 3.22: Maastricht-Belvédère Site K. Primary reduction sequences of refitted composition II: the numbers in these 'Harris-matrixes' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. Tool

4. *Aufeinanderpassung* (production sequences)
5. *Aneinanderpassung* (breaks)

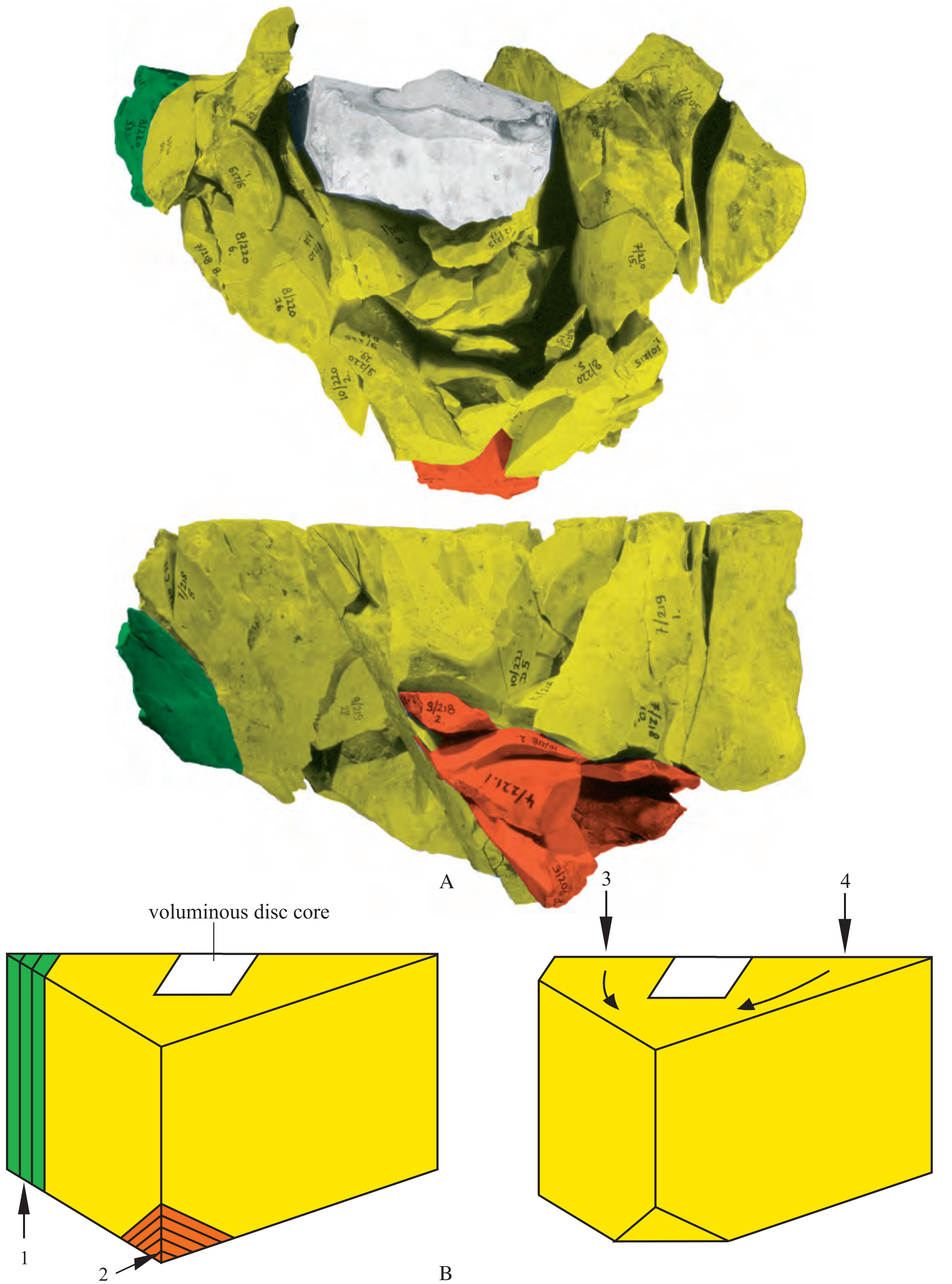


Figure 3.23: Maastricht-Belvédère Site K. A: Refitted composition II, part A. Scale 2:3. B: Schematic representation of the reduction of refitted composition II, part A. 1 and 2: Production of two sequences of flakes (cortex and natural crack removal), using two different striking platforms and striking surfaces. 3 and 4: Production of a long sequence of flakes, starting from two extreme sides of the core, but using a single striking platform and one striking surface.

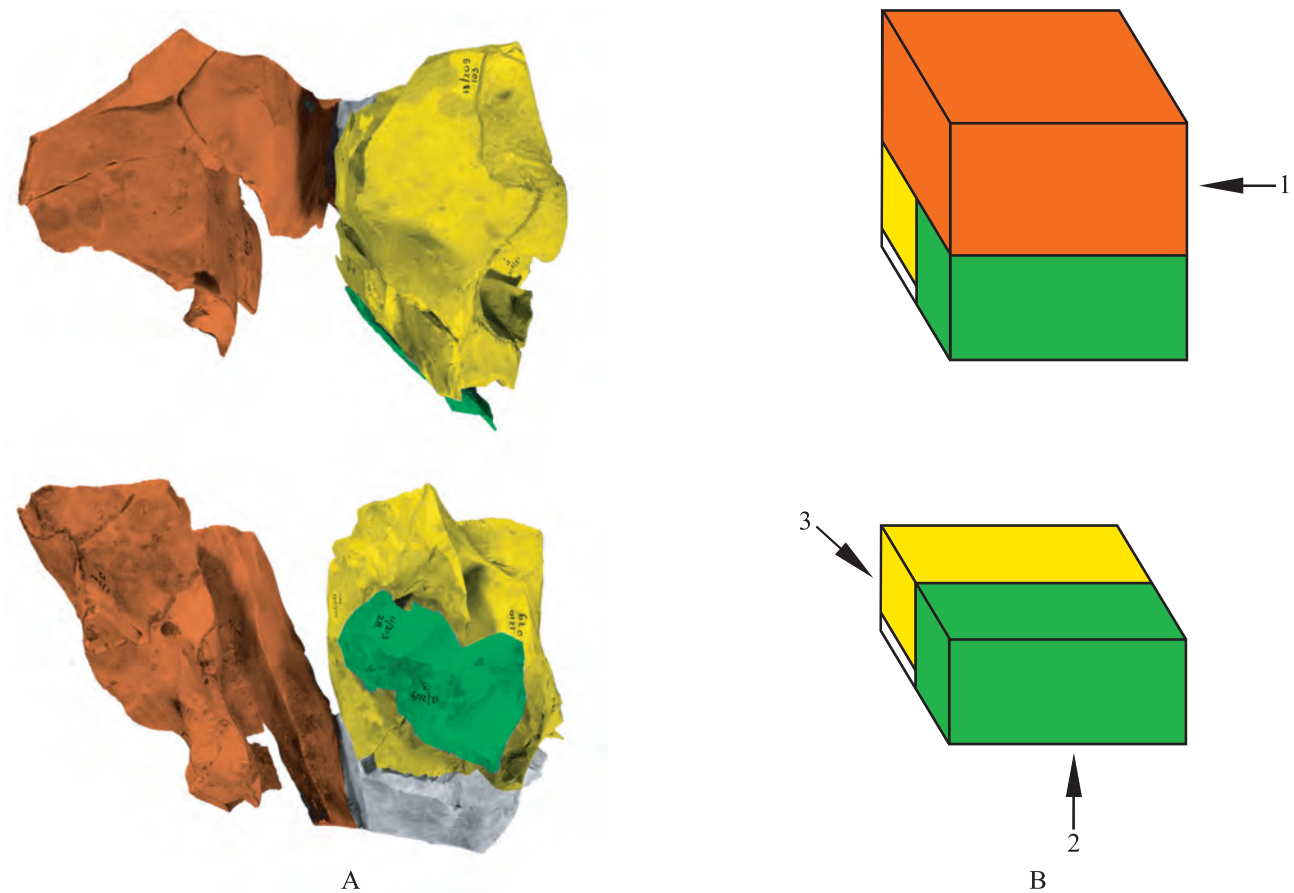
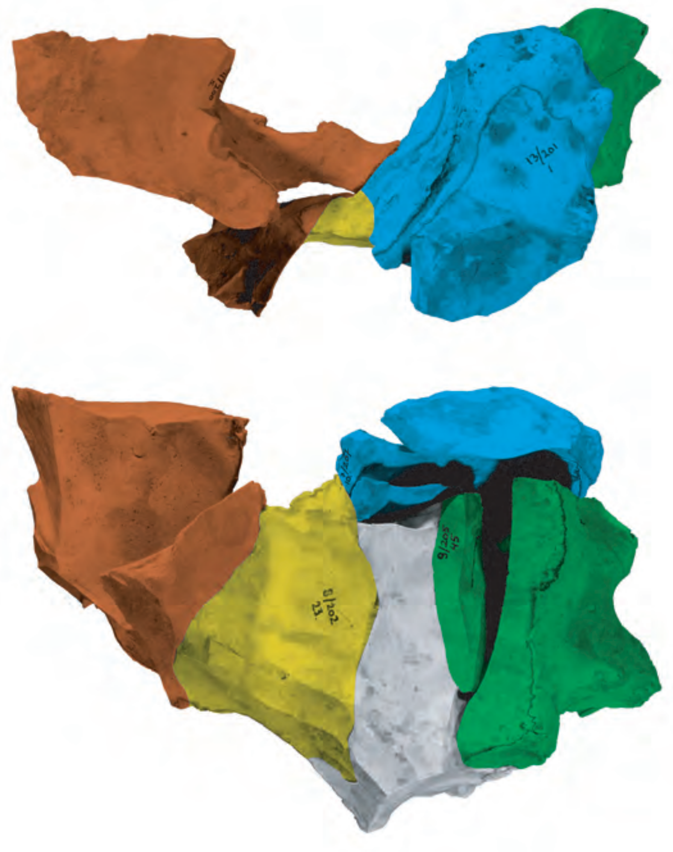
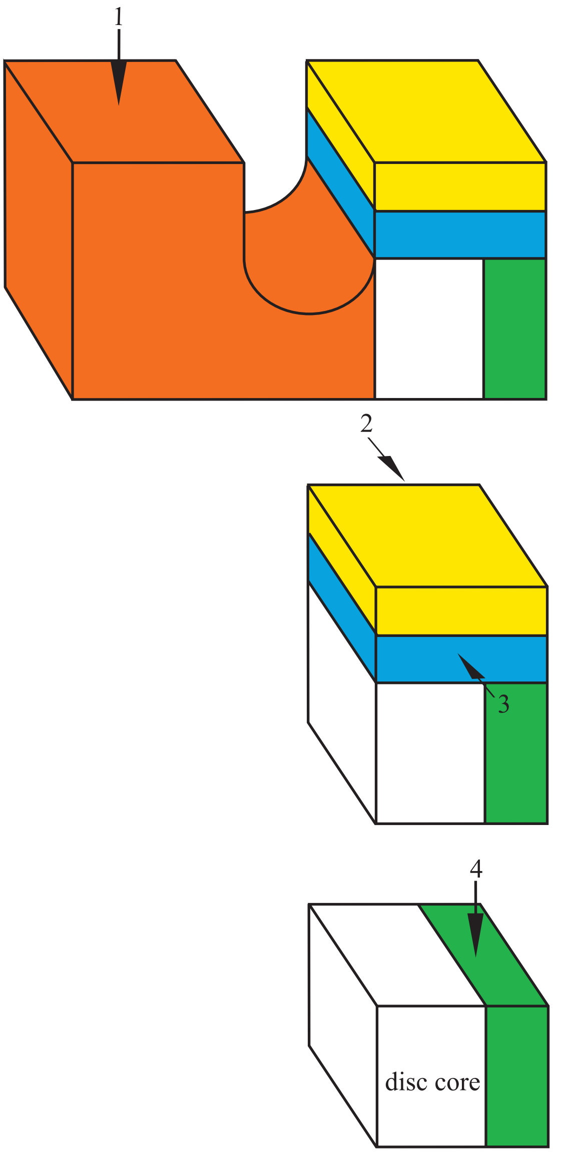


Figure 3.24: Maastricht-Belvédère Site K. A: Refitted composition II, part B. Scale 1:2. B: Schematic representation of the reduction of refitted composition II, part B. 1: Initial sequence of decortication flakes. 2: Production of a sequence of flakes, using another striking platform, situated at right angles (perpendicular) to the first one. 3: Production of a 'third' sequence of flakes, using once more another striking platform, but the same striking surface as for the 'first' sequence.



A



B

Figure 3.25: Maastricht-Belvédère Site K. A: Refitted composition II, part C. Scale 1:2. B: Schematic representation of the reduction of refitted composition II, part C. 1: Production of an initial sequence of decortication flakes. 2 and 3: Production of two sequences of flakes, using the same striking surface but different striking platforms. 4: Sequence of cortex flakes produced in the same direction as the 'first' sequence, but situated at the opposite side of the core.

cortex-covered artefacts was flaked in the same direction as the ‘first’ sequence, but situated at the opposite side of the core (Figure 3.25-A-4 and -B-4; Figure 3.22, part C, numbers 8/202-2 up to 9/205-45).

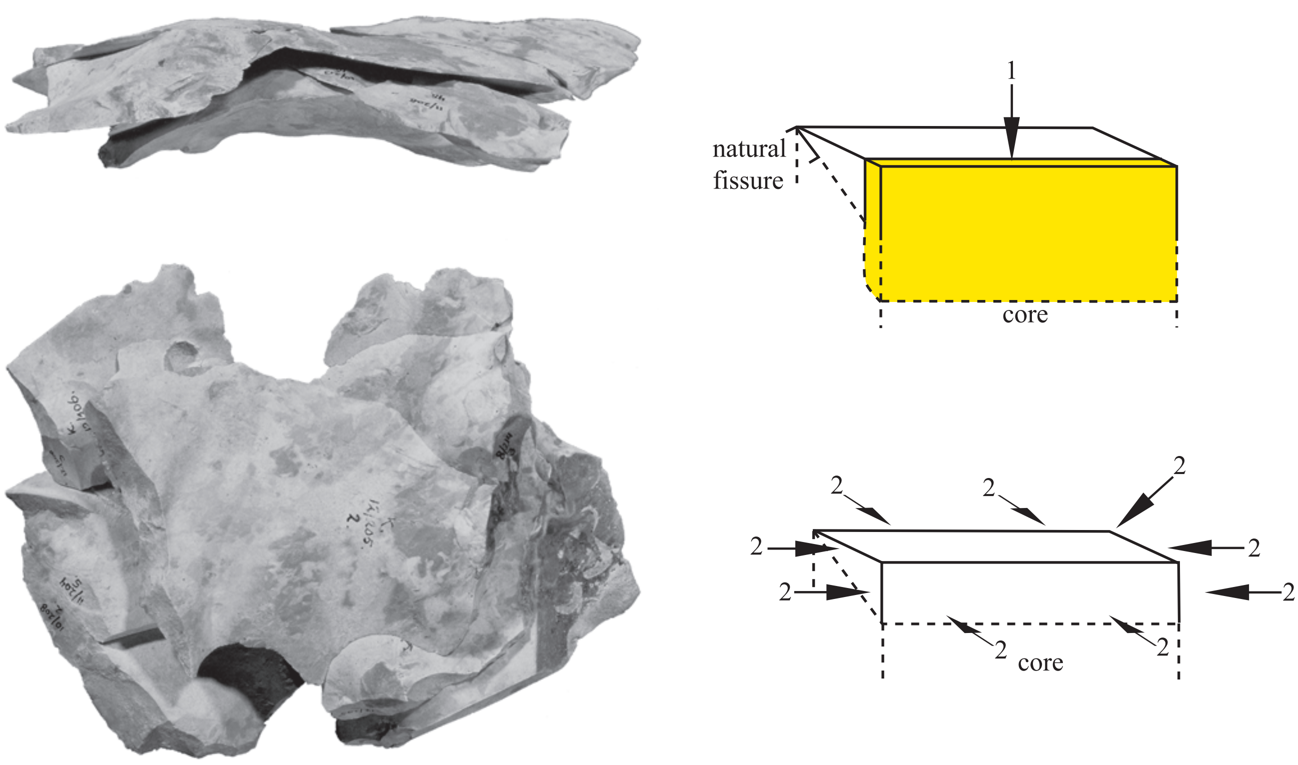
The complete reduction sequence indicates minimal preparation of the nodule and resulted eventually in a disc core.

Refitted composition II, part D and E (Figures 3.22, 3.26)
Part D (sequence 104) is only represented by two large and thick decortication flakes. They represent an early phase of a much longer flake sequence.

Block E (sequence 124) also represents a small refitted part of a much longer sequence. Following the splitting of the nodule, part E was probably scanned for suitable striking platforms and working edge angles. Furthermore, a large ‘convex’ natural fissure surface was selected as ‘main’ striking surface. At ‘first’ a sequences of flakes was struck from one side of the core, using the ‘main’ striking surface as striking platform (Figure 3.26-B-1, this phase of reduction could only be deduced from flake scars). The negatives of the last flakes in this sequence subsequently created a new striking platform. Next, the core was turned 90° and a ‘second’ series of at least 11 large flakes was produced from this newly created striking platform on a ‘main’ striking surface. The whole core edge was used to remove the flakes in a circular, more or less anti-clockwise direction (Figure 3.26-A-2, -B-2; Figure 3.22, part E, all flake numbers). The last flake in this sequence (12/205-2) is ‘overstruck’ (*outrepassé*).

The lithic analysis and refitting studies show, furthermore, a minimal preparation of the striking platforms. Probably the production of flakes went on until the working edge angle had to be rejuvenated. Moreover, the reduction of part E resembles a disc or discoidal technology (*cf.* Boëda 1993).

Out of the produced debitage (from the ‘main’ striking surface) one flake was selected and retouched into a simple-side scraper.



A B

Figure 3.26: Maastricht-Belvédère Site K. A: Refitted composition II, part E. Scale 1:2. B: Schematic representation of the reduction of refitted composition II, part E. 1: Production of a sequence of flakes which created a proper striking platform for future flaking. 2: Production of sequences of flakes in a circular direction, using one ‘main’ striking surface. The whole core edge was used as striking platform.

Refitted composition II, part F (Figures 3.22, 3.27)
Half of the external surface of part F (sequence 133) consists of cortex and natural fissure remains. A 'first' series of flakes was produced from a striking surface which represents an innermost part of refitted composition II. The negatives of the last flakes in this sequence created a new striking platform (Figure 3.27-B-1, this phase of reduction could only be deduced from flake scars). Subsequently, the core was turned 90° and a 'second' flake sequence was produced from this new striking platform. The former striking platform now became the striking surface (Figure 3.27-A-2, -B-2: Figure 3.22, part F, artefact numbers 3/206-16 up to 2/207-33, 3/206-38, 3/208-5, 3/206-26 [+4/207-6], 2/207-22 and 3/206-30 up to 3/207-10). Next, the core was turned 180° and a 'third' sequence of flakes was produced from the same striking surface. The striking platform is, however, now situated at the opposite, cortex/natural fissure covered, side of the core (Figure 3.27-A-3 and -B-3; Figure 3.22, part F, numbers 2/207-22 up to 3/206-18). Again the core was turned 180° and a 'fourth' sequence of flakes was produced from the same striking surface, using the striking platform of the 'second' flake sequence (Figure 3.27-A-4 and -B-4; Figure 3.22, part F, flake numbers 3/207-5 and 4/207-8). Once more the core was turned 180° and a 'fifth' series of flakes was produced from the same striking surface, using the platform of the 'third' sequence again (Figure 3.27-A-5 and -B-5; Figure 3.22, part F, numbers 4/205-14 up to 3/207-2).

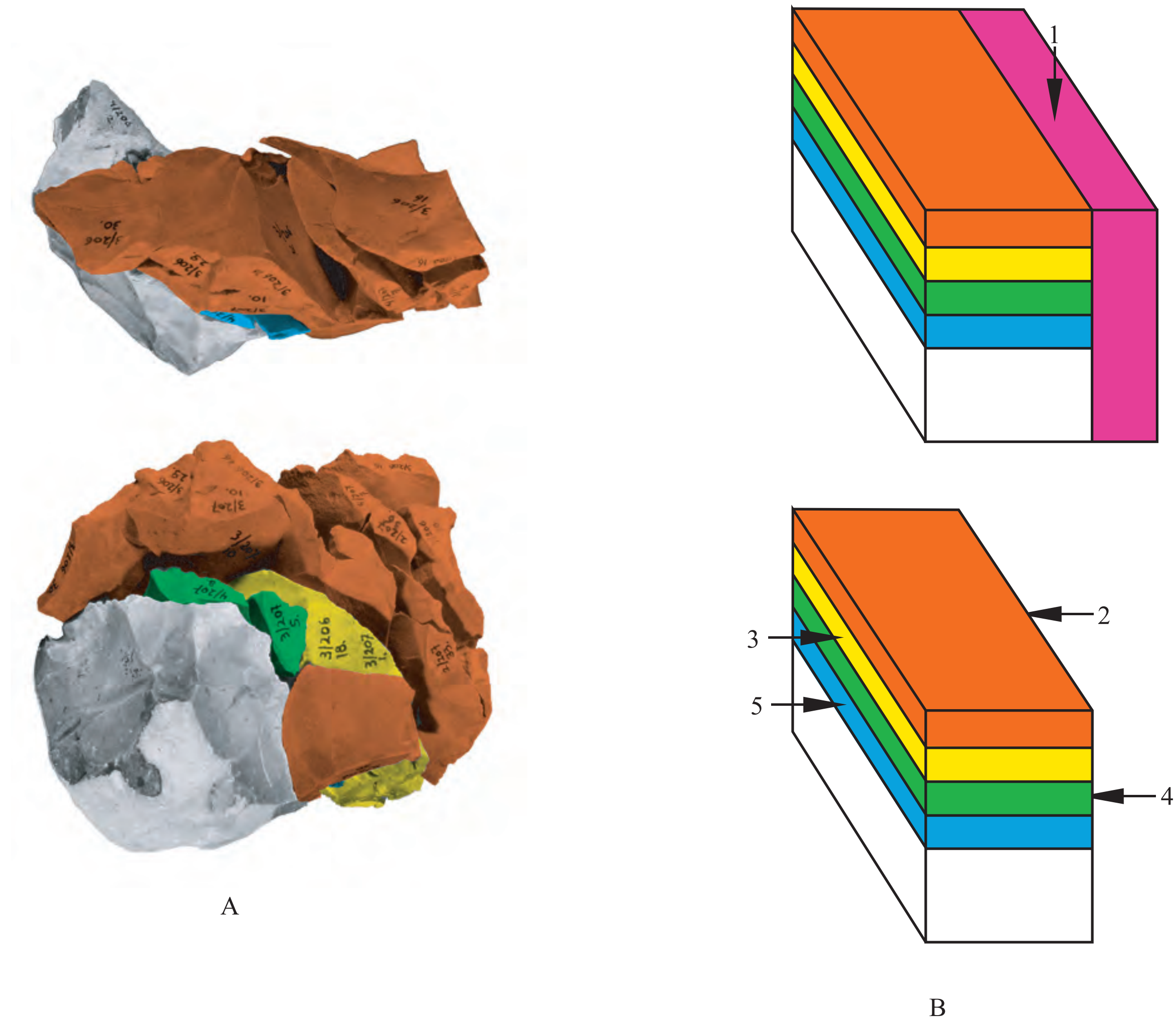


Figure 3.27: Maastricht-Belvédère Site K. A: Refitted composition II, part F. Scale 2:3. B: Schematic representation of the reduction of refitted composition II, part F. 1: Initial series of flakes which created a suitable striking platform for future flaking. 2 to 5: Production of four sequences of flakes, using two striking platforms and one striking surface.

Neither the platforms nor the edge angles were prepared or modified and it seems that the production (direction) of flake sequences was only interrupted (changed) to rejuvenate or maintain good working edge angles and a 'main' (convex) striking surface.

Refitted composition II, part G and H (Figures 3.22, 3.28)
The 'exact' reduction scheme of part G (sequence 137) is difficult to reconstruct. Moreover, the large amount of cortex suggests that a high backed discoidal core was discarded in an early stage of reduction (Figure 3.22, part G; Figure 3.28). Probably, after an initial rough shaping (flattening out), the core was reduced, using the whole (circular) core edge for flake production. The few refits (n= 7) and the high backed discoidal core furthermore indicate that after a sequence of flakes, the core was turned 90° and a 'second' series of flakes was removed from a new striking platform (created by the last flakes in the former sequence). Next the core was turned 90° again to the 'first' striking platform and surface for further reduction. This rotation of the core was repeated a few times. As a result, throughout the whole reduction sequence, (alternately) the former striking platform became the future striking surface and the other way around. It can also be suggested that the emphasis was on one 'main' striking surface and that the production of flakes from that surface was only interrupted, or better changed to another striking surface, to rejuvenate or maintain a good working edge angle. The reduction of part G, therefore, resembles a disc or discoidal technology (*cf*. Boëda 1993).

Figure 3.28: Maastricht-Belvédère Site K. A: Refitted composition II, part G. Scale 1:1.

Figure 3.29: Maastricht-Belvédère Site K. Refitted composition III. Scale 1:2.

Part H (sequence 141) is only represented by a sequence of five artefacts. All flakes are produced from one and the same unprepared striking platform and flaked in the same direction.

3.6.5.4 Refitted composition III (Figure 3.29)

Conjoined composition III consists of 47 artefacts, which represent two separately reduced parts or cores (sequences 116 [part A] and 25 [part B]). The two groups are composed of respectively 37 and 10 artefacts. Except for one piece with signs of use, all artefacts are flakes and pieces of debitage (n= 46 or 97.8%). After refitting, the 'complete' composition has a cross-section of 225 mm and weighs 1.318 kg (2.2% of the total weight of conjoined artefacts).

A typo-/technological profile of the composition III flake characteristics is given in Tables 3.14, 3.15 and 3.16.

Composition III (Figures 3.29 and 3.30) represents only part of a much longer reduction sequence. The initial and final stages of core reduction could not be refitted to the nodule. It can, however, be suggested that they (and especially the initial part) were executed within the Site K area. The refitted group indicates again that a large flint nodule entered the excavated area, without any or hardly any decortication. The nodule was split into at least two smaller blocks or units which were, subsequently, used as cores. Due to the fact that several flakes with natural fissure dorsal surfaces and/or butts fit dorsal/dorsal and butts onto dorsal surfaces, it is suggested that the nodule was split by following natural fissures (frost cracks) and fossil inclusions, which were already present in the flint before knapping. None of the produced flakes were 'secondarily' used as cores.

Like the first two large compositions (I and II) this means that the smaller units or cores show no hierarchical placing in the 'complete' reduction sequence. For a description of the primary reduction sequence of both part A and B the reader is referred to the following part and Figure 3.30.

Composition III (n= 47 flakes or 43 flakes ≥30 mm)	
Maximum dimension	Flakes with a maximum dimension between 30 mm and 69 mm dominate (n= 30 or 63.8 % of all flakes).
Length	Flakes with a length between 20 mm and 79 mm dominate (n= 36 or 83.7% of all flakes ≥30 mm).
Width	Flakes with a width between 30 mm and 69 mm dominate (n= 33 or 76.7% of all flakes ≥30 mm).
Thickness	Flakes with a thickness between 0 mm and 19 mm dominate (n= 41 or 95.3% of all flakes ≥30 mm).
Cortex	About one-fourth of all flakes (n= 10 or 21.3%) show cortex remains.
Natural fissures	Twelve flakes show natural fissure remains (25.5% of all flakes).
Missing due to breakage	Ca. half of the flakes ≥30 mm (n= 22 or 51.2%) are broken. In most cases the distal part is missing (n= 8 or 18.6%).
Angle of percussion	Most of the flakes have an angle of percussion ≥110° (n= 28 or 65.1% of all flakes ≥30 mm).
Butt	A plain butt (n= 15 or 34.9% of all flakes ≥30 mm) together with a dihedral butt (n= 12 or 27.9%) dominate. Three flakes (7.0%), all belonging to part A, have a retouched or facetted butt.
The *Index Facettage* (IF) for all flakes ≥30 mm is 34.9	The *Index Facettage stricte* (IFs) for all flakes ≥30 mm is 7.0
Preparation near the butt	Of all 47 flakes, 15 (31.9%) show traces of preparation along the angle between the butt and the dorsal surface. In 11 cases (23.4%) this was done by retouching/faceting.
Dorsal pattern	Most of the flakes ≥30 mm have a 'parallel' unidirectional pattern or a 'parallel' + lateral unidirectional pattern (both n=12 or 27.9%). Three flakes (7.0%) have a convergent unidirectional and four (9.3%) a centripetal or radial dorsal pattern. Together these seven flakes belong to part A.
Flake scars	Most of the flakes ≥30 mm have less than seven dorsal scars (n= 40 or 85.1% of all flakes ≥30 mm).

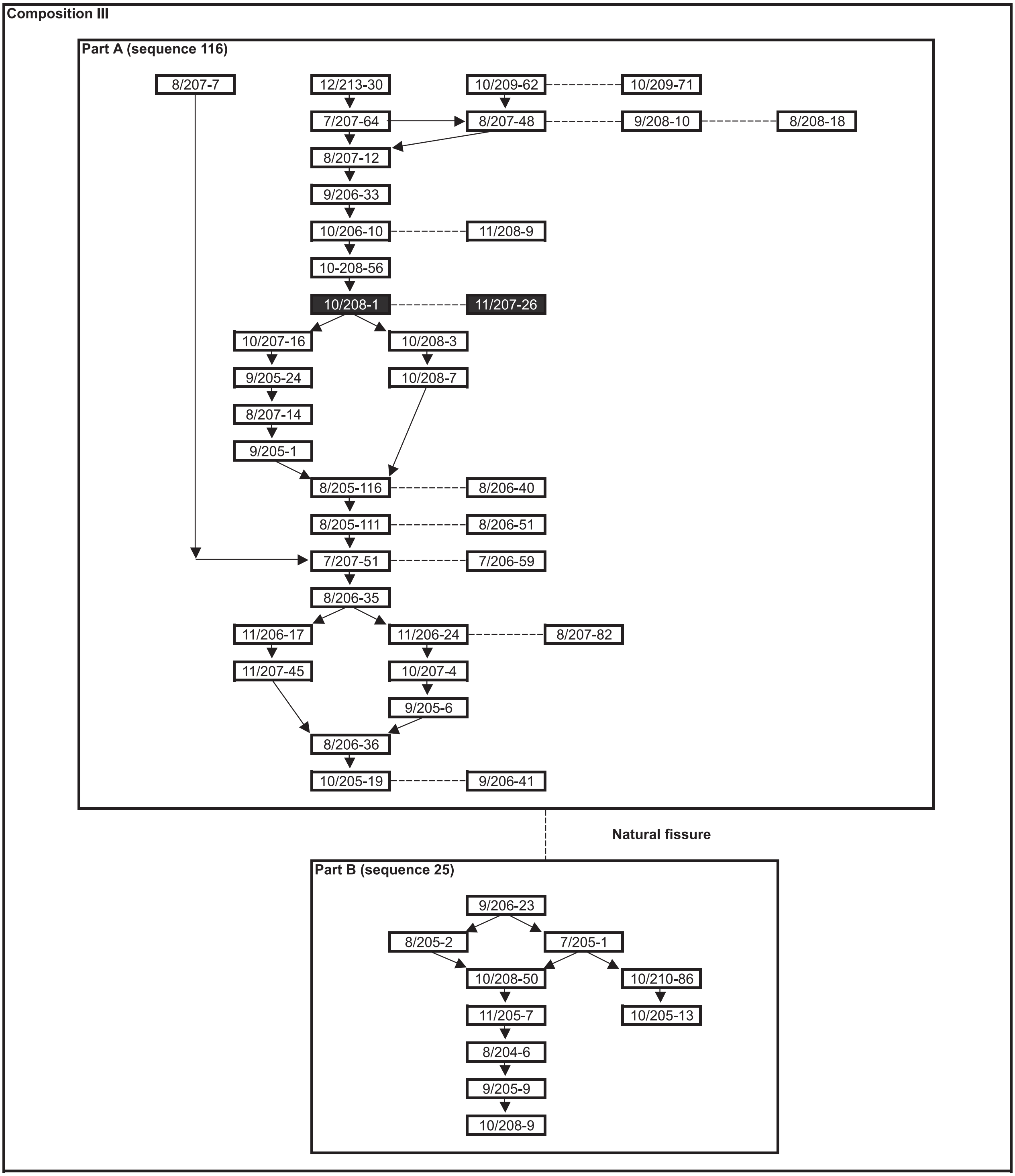
Table 3.14: Maastricht-Belvédère Site K, composition III. Typo-/technological summary of the flake characteristics. The *Index Facettage* and the *Index Facettage stricte* are calculated according to Bordes (1972:52).

Groups/parts	Maximum dimension	S.D.	Length	S.D.	Width	S.D.	Thickness	S.D.	Number of scars	S.D.
Composition III	63.4	23.0	52.1	27.3	49.5	24.8	11.1	5.9	3.8	2.5
Composition IV	58.2	21.9	49.4	22.2	45.5	20.1	15.3	9.2	3.6	2.4
Composition V	47.4	8.9	45.4	7.4	33.0	9.2	9.4	3.4	2.4	0.9
Composition VI	57.5	21.1	46.2	13.8	52.2	24.2	22.8	9.9	2.0	1.8
Composition VII	42.4	19.8	36.2	20.1	30.3	16.4	10.6	8.5	2.2	2.4
Composition VIII	52.3	17.1	47.9	19.5	39.0	12.3	11.6	2.5	3.7	2.7
Composition IX	42.6	12.9	36.3	15.3	37.5	14.7	11.8	11.4	3.5	2.2
Composition X	35.0	9.5	30.1	9.4	30.4	11.9	9.4	2.6	2.3	2.1
Composition XI	54.9	15.0	49.6	20.0	39.8	10.9	9.7	4.3	4.3	1.8
Composition XII	46.7	17.1	43.4	17.4	36.5	13.4	9.8	5.6	3.0	2.5
Composition XIII	48.1	14.1	42.9	13.9	39.6	12.3	8.3	2.5	3.4	1.4
Composition XIV	53.4	20.8	46.0	22.6	39.3	20.1	10.9	7.2	3.1	2.6
Composition XV	64.7	28.7	58.1	27.9	51.2	23.8	17.4	9.2	4.1	4.0
Composition XVI	51.0	17.5	33.0	28.6	24.3	18.8	13.3	7.2	4.3	0.6
Composition XVII	47.1	14.2	37.4	13.4	40.5	15.3	11.3	5.5	2.6	3.2

Table 3.15: Maastricht-Belvédère Site K, all remaining 15 compositions. Mean maximum dimension, length, width, thickness and number of scars for all flakes ≥30 mm. The numbers are given for the complete compositions. The figures are given in mm. S.D. stands for mean Standard Deviation

Groups/parts	Percentage cortex	Non-cortex/ cortex ratio	Percentage natural fissures	Non-natural fissure/ natural fissure ratio	Percentage broken flakes*	complete/ broken ratio*
Composition III	21.3	3.7	25.5	2.9	51.2	0.9
Composition IV	72.5	0.4	37.5	1.7	63.8	0.6
Composition V	100.0	0	0	0	50.0	0.7
Composition VI	71.4	0.4	100.0	0	62.5	5.0
Composition VII	38.5	1.6	65.4	0.5	75.0	0.3
Composition VIII	44.4	1.3	11.1	8.0	33.3	2.0
Composition IX	83.3	0.2	8.3	11.0	50.0	1.0
Composition X	70.0	0.4	10.0	9.0	50.0	1.0
Composition XI	9.1	10.0	0	0	27.3	2.7
Composition XII	73.9	0.4	0	0	47.8	1.1
Composition XIII	5.6	17.0	11.1	8.0	62.5	0.6
Composition XIV	51.6	0.9	22.6	3.4	61.5	0.6
Composition XV	75.0	0.3	38.9	1.6	54.8	0.8
Composition XVI	10.0	9.0	0	0	50.0	1.0
Composition XVII	71.4	0.4	42.9	1.3	50.0	1.0

Table 3.16: Maastricht-Belvédère Site K, all remaining 15 compositions. Percentage cortex, natural cracks and broken flakes, together with their ratios of all flakes (* all flakes ≥30 mm). The figures are given for the complete compositions.



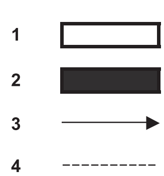


Figure 3.30: Maastricht-Belvédère Site K. Primary reduction sequence of refitted composition III: the numbers in these 'Harris-matrixes' refer to the individual finds in the reduction sequence.

1. Flake
2. Tool
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

Refitted composition III, part A (Figures 3.30, 3.31)
Part A was further reduced by the removal of rather large flakes. Most likely, the core was initially scanned for suitable striking platforms and striking surfaces. Probably the reduction of core A 'started' with a series of at least six large, cortex and natural fissure covered, flakes. They represent the outermost part of this block (Figure 3.30, part A, numbers 12/213-30, 10/209-62 [+10/209-71], 7/207-64, 8/207-48 [+9/208-10 and 8/208-18], 8/207-12 and 9/206-33; Figure 3.31-A-1, -B-1). The negatives of the last flakes in this sequence created a new striking platform. Subsequently, the core was turned 90° and a large sequence of flakes was produced from this new striking platform. The whole core edge was used to remove flakes from one and the same striking surface in a circular, more or less anti-clockwise direction: (Figure 3.30, part A, at least numbers 10/206-10 [+11/208-9], 10/208-56, 10/208-1 [+11/207-26] and 10/207-16; Figure 3.31-A-2, -B-2). In this sequence the two broken flakes can be interpreted as Levallois *sensu stricto* flakes. The largest of these shows macroscopic signs of use. The production of this centripetally orientated series of flakes was only interrupted to rejuvenate or maintain a good working edge angle. Therefore the core was again turned 90°, to the 'first' striking platform and another series of smaller flakes was produced. This stage of reduction was mainly reconstructed on the basis of flake scars, as only one flake could be refitted (Figure 3.30, part A, number 9/205-24: Figure 3.31-A-3, -B-3). Again the core was turned 90° to the 'main' striking surface and another centripetally orientated sequence of flakes was produced. As before the whole core edge was used to remove the flakes in a more or less anti-clockwise, circular direction (Figure 3.30, part A, at least numbers 8/207-14, 9/205-1, 10/208-3, 10/208-7, 8/205-116 [+8/206-40], 8/205-111 [+8/206-51], 7/207-51 [+7/206-59], 8/207-7, 8/206-35, 11/206-24 [+8/207-82] and 10/207-4; Figures 3.31-A-4, -B-4). As previously, this sequence was interrupted and the core was turned 90° to rejuvenate or maintain a good working edge angle (Figure 3.30, part A, artefact number 9/205-6; Figure 3.31-A-5, -B-5). In the 'last' phase of reduction that could be reconstructed, the core was turned 90° once more and a 'last' sequence of at least four flakes was produced from the main striking surface (Figure 3.30, part A, number 11/206-17, 11/207-45, 8/206-36 and 10/205-19 [+9/206-41]; Figure 3.31-A-6, -B-6).

A general characteristic of this core is that the whole reduction was focused on one single striking surface. Moreover, the centripetally or radially orientated production of flakes was only interrupted to rejuvenate or maintain a good working edge angle. It could be suggested that the primary reduction sequence eventually resulted in a disc core.

Refitted composition III, part B (Figures 3.30, 3.32)
Part B (sequence 25) is only represented by 10 large and rather thick conjoined flakes. Like part A, these flakes represent an initial flaking stage of a much larger/longer sequence of reduction. The outermost parts of this composition shows only natural fissures and/or cortex remains. In a 'first' stage of reduction the (partly) cortex covered side of the core was reduced by the removal of at least five large and thick flakes. The used striking platform and working edge angle originate from the initial splitting of the nodule. No modifications were done to this natural fissure striking platform (Figure 3.30, part B, numbers 9/206-23, 8/205-2, 7/205-1, 10/210-86 and 10/205-13; Figure 3.32-A-1 and -B-1). The negatives of the last flakes in this sequence subsequently created a new striking platform. Next the core was turned 90° and a 'second' sequence of flakes was produced from this newly created striking platform on a 'second' striking surface (Figure 3.30, part B, numbers 10/208-50 up to 10/208-9; Figure 3.32-A-2 and -B-2).

3.6.5.5 Refitted composition IV (Figure 3.33)

Refitted composition IV also represents one of the larger conjoined nodules. After refitting, the composition has a maximum dimension of 227 mm in cross-section and weighs 2,600 kg (4.3% of the total weight of conjoined artefacts). The nodule consists of 44 artefacts which represent four (or five) separately reduced parts or cores: Site K, sequences 78 (part A), 130 (part B), 16 (part C) and 164 (part D). The four separate sequences or groups consist respectively of 8, 14, 20 and 2 artefacts. Except for four cores (9.1%) and two core trimming elements (4.5%), all artefacts are flakes and pieces of debitage (n= 38 or 86.4%). Typologically the cores can be described as a discoidal core, a pyramidal or conical core, a polyhedral core and a double platformed at right angles core. A typo-/technological outline of the composition IV flake characteristics is given in Table 3.17 (see also Tables 3.15 and 3.16).

Refitting shows, like for the previously described nodules, that a large flint nodule (refitted composition IV, Figure 3.33) entered the excavated area without any or hardly any decortication. Probably the raw material was collected from nearby river (gravel) deposits. Within the excavated Site K area the nodule was initially flattened out to remove all protruding cortex parts. Subsequently, the nodule was divided into at least four smaller parts or cores. The splits followed the natural fissures which were already in the flint before knapping. The four cores were further reduced 'on the spot'. During reduction, part C (the largest block) was split again by following the natural fissures (cores C-1 and C-2). As a result, a total of five smaller parts were

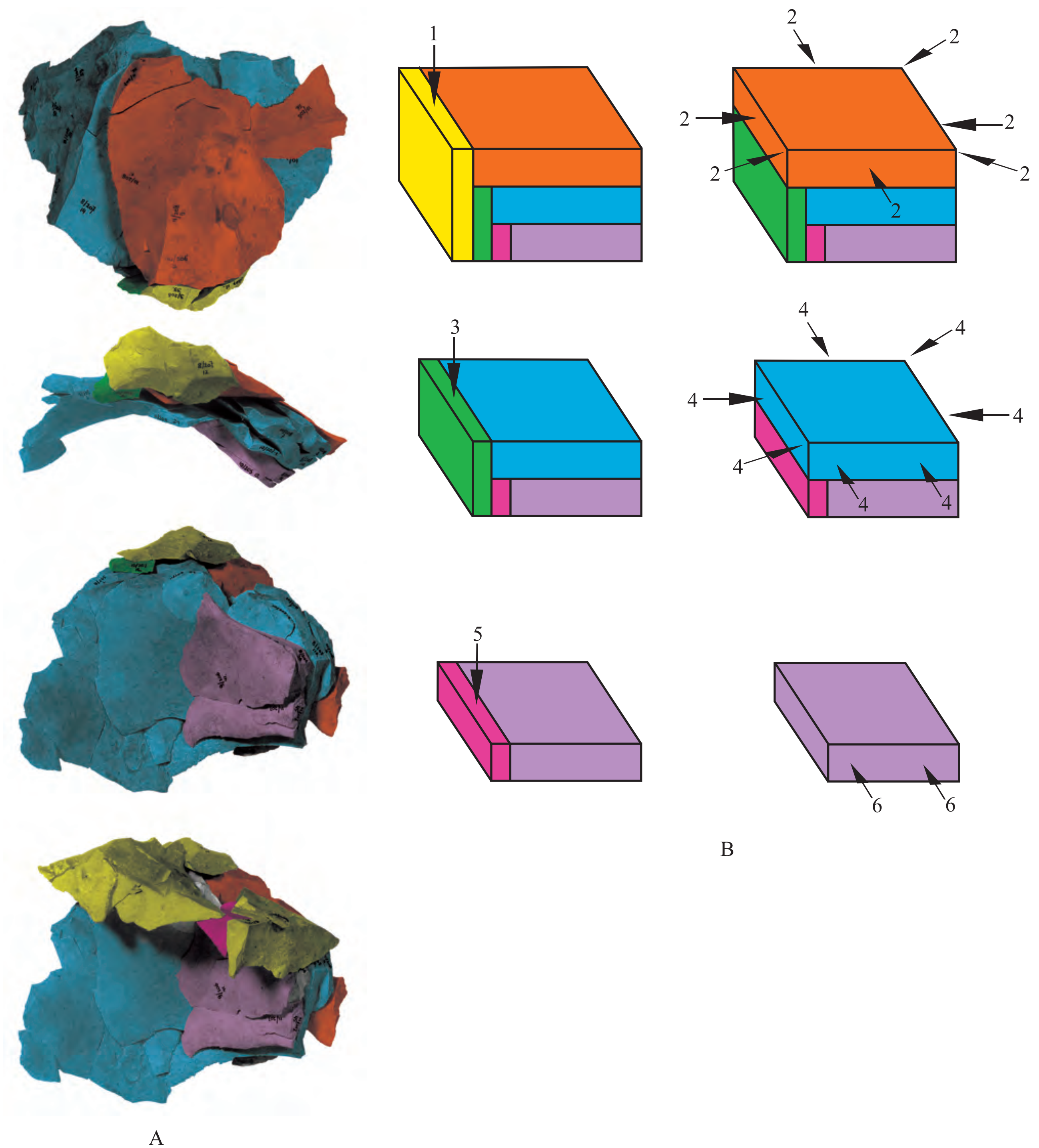


Figure 3.31: Maastricht-Belvédère Site K. A: Refitted composition III, part A. Scale 1:3. B: Schematic representations of the reduction of refitted composition III, part A. 1: Sequence of larger, cortex and natural fissure covered, flakes. They created a new striking platform. 2, 4 and 6: Production of sequences of flakes in a circular direction, using one main striking surface. The last reconstructed sequence consists only of four flakes, struck from one and the same side of the core. 3 and 5: Sequences of flakes, representing the rejuvenation or maintenance of good working edge angles.

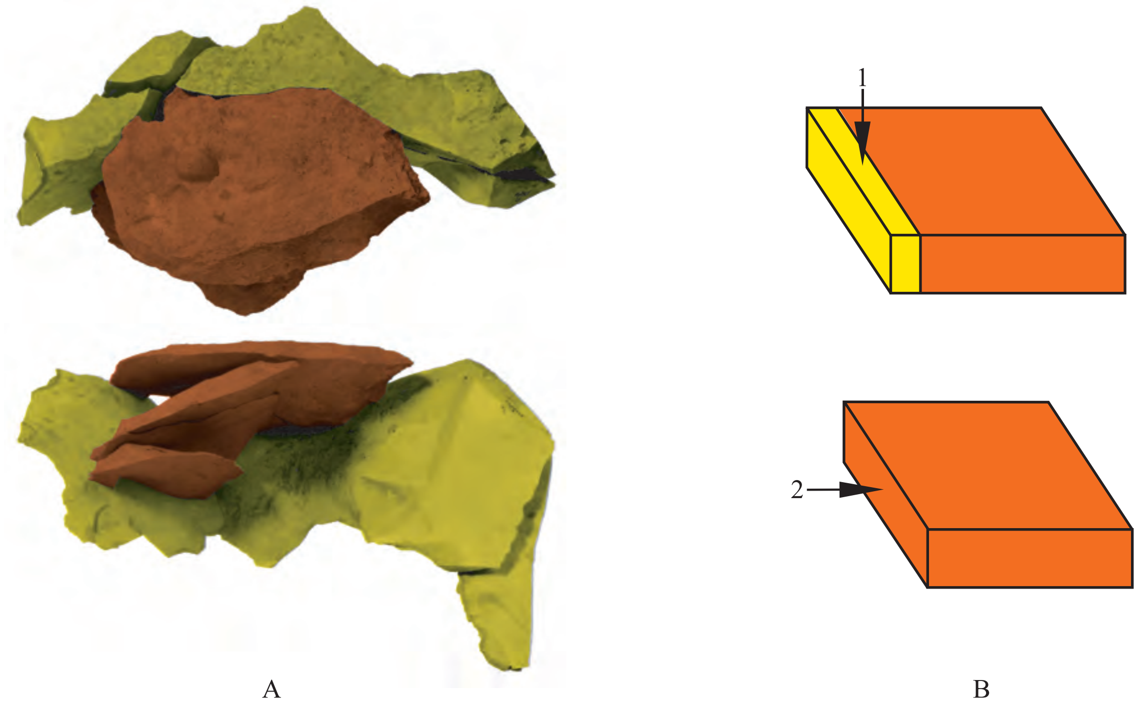


Figure 3.32: Maastricht-Belvédère Site K. A: Refitted composition III, part B. Scale 1:2. B: Schematic representation of the reduction of refitted composition III, part B. 1: Sequence of larger, cortex and natural fissure covered, flakes. They created a new striking platform for further reduction. 2: Production of a sequence of flakes, using the newly created striking platform and another striking surface.

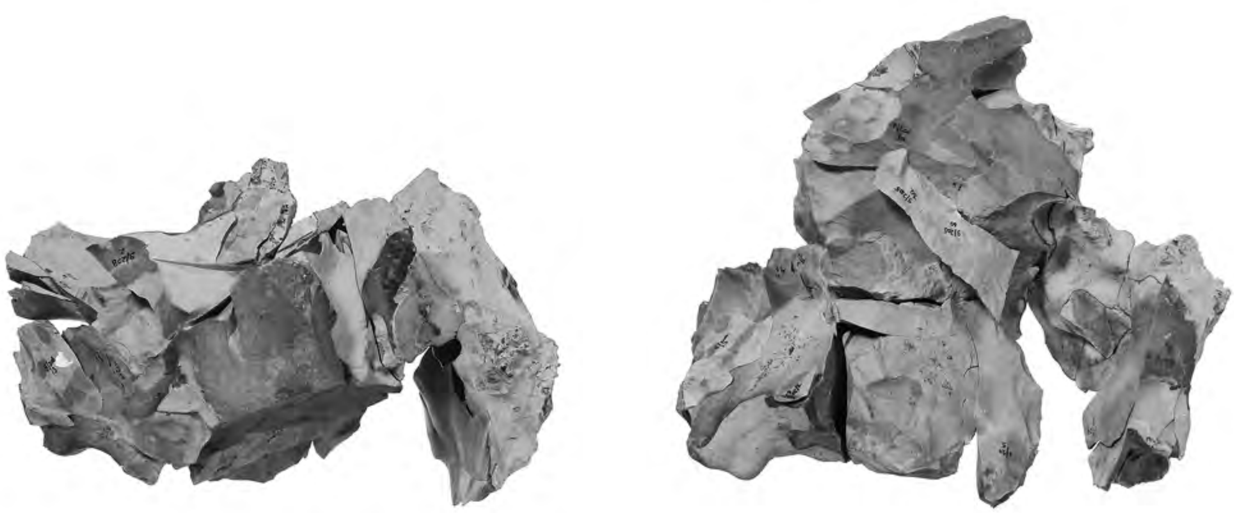


Figure 3.33: Maastricht-Belvédère Site K. Refitted composition IV. Scale 1:3.

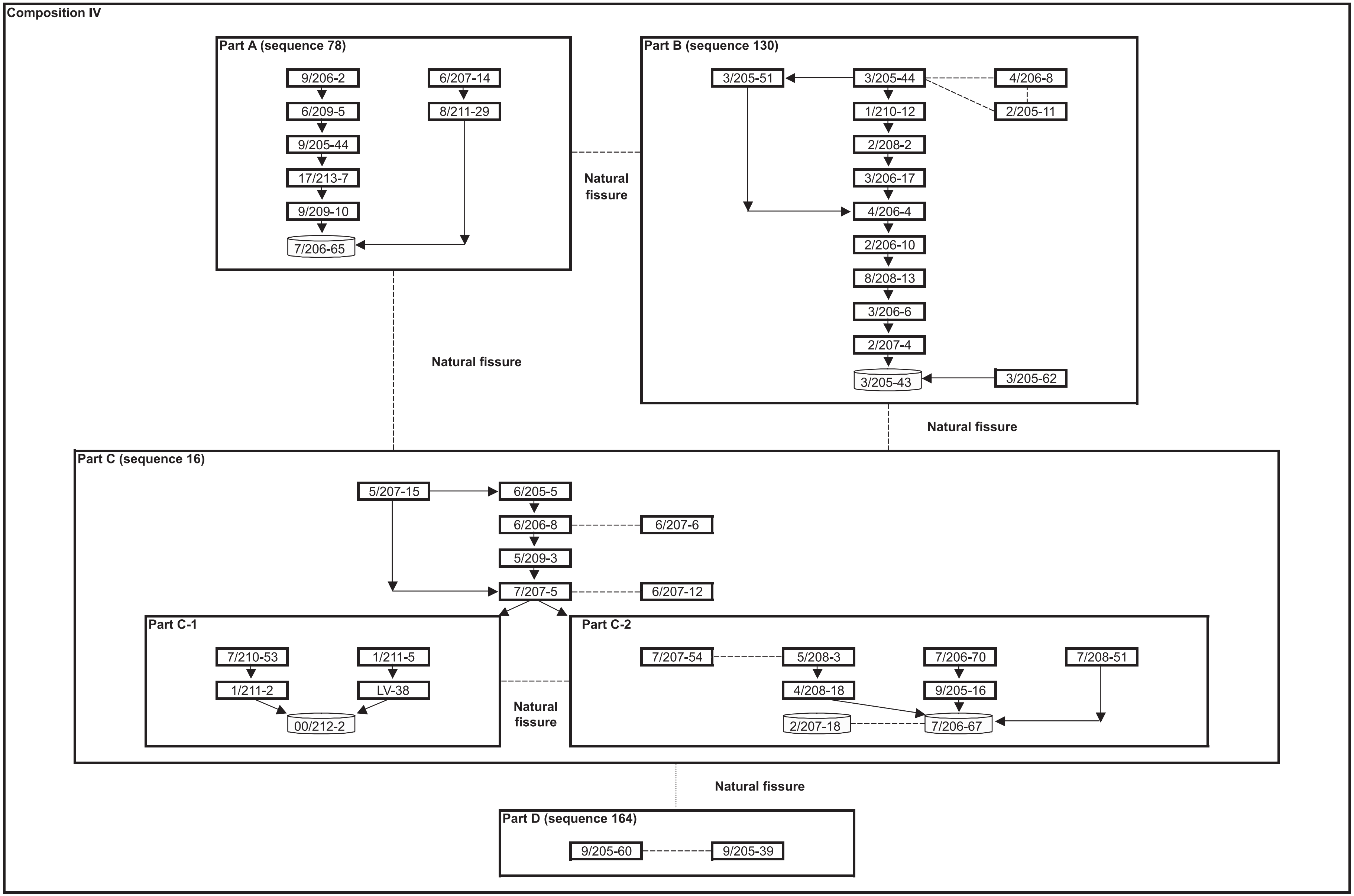
Composition IV (n= 40 flakes or 36 flakes ≥30 mm)		
Maximum dimension	Flakes with a maximum dimension between 30 mm and 59 mm dominate (n= 25 or 62.5% of all flakes).	
Length	Flakes with a length between 30 mm and 59 mm dominate (n= 25 or 69.4% of all flakes ≥30 mm).	
Width	Flakes with a width between 20 mm and 49 mm dominate (n= 20 or 55.6% of all flakes ≥30 mm).	
Thickness	Flakes with a thickness between 10 mm and 19 mm dominate (n= 21 or 58.3% of all flakes ≥30 mm).	
Cortex	About three-fourth of all flakes (n= 29 or 72.5%) show cortex remains, while only seven flakes (17.5%) show 25% or more cortex.	
Natural fissures	In total 15 flakes display natural fissure remains (37.5% of all flakes). Seven of these (17.5%) show 25% or more natural fissure remains.	
Missing due to breakage	Of all flakes ≥30 mm, 23 pieces are broken (63.8%).	
Angle of percussion	Most of the flakes have an angle of percussion ≥130° (n= 17 or 47.2% of all flakes ≥30 mm).	
Butt	Most of the flakes ≥30 mm (n= 22 or 61.1%) have a plain butt, while none of the flakes have a retouched or facetted butt.	
The *Index Facettage* (IF) for all flakes ≥30 mm is 5.6		The *Index Facettage stricte* (IFs) for all flakes ≥30 mm is 0
Preparation near the butt	Of all 44 flakes, 10 (25.0%) show traces of preparation along the angle between the butt and the dorsal surface. In 7 cases (17.5%) this was done by retouching/faceting.	
Dorsal pattern	Most of the flakes ≥30 mm have a 'parallel' unidirectional pattern (n= 13 or 36.1%) . Two flakes (5.6%) have a convergent unidirectional and one (2.8%) has a centripetal or radial dorsal pattern.	
Flake scars	Most of the flakes ≥30 mm have two or three dorsal scars (n= 19 or 43.2% of all flakes ≥30 mm).	

Table 3.17: Maastricht-Belvédère Site K, composition IV. Typo-/technological summary of the flake characteristics. The *Index Facettage* and the *Index Facettage stricte* are calculated according to Bordes (1972:52).

further reduced. Four cores were recovered from the excavated area and could be incorporated into the refits. The missing fifth core was probably discarded just outside the excavated area, in that section of Site K that was destroyed by commercial activities. In the following, all five smaller parts will be looked at, while the primary reduction sequence is visualized in Figure 3.34.

Refitted composition IV, part A (Figures 3.34, 3.35, 3.36)
Part A (Sequence 78, Figure 3.35) represents a rather short sequence of reduction, which resulted eventually in the discard of a discoidal core. As this core shows some technological 'errors', like hinge negatives and stacked steps (*cf.* Shelley 1990), it can be suggested that the core was discarded in an 'early' stage of reduction. The seven conjoined flakes indicate that, after the large nodule was split, most of the cortex and natural fissure covered parts were removed from part (core) C. In this stage of reduction flakes were struck from two opposite striking platforms. One originated from the initial splitting, while the other one was probably a cortex-covered side of the large nodule (Figure 3.34, part A, numbers 9/206-2 up to 9/209-10, 6/207-14 and 8/211-29; Figure 3.36-1 and -2). The negatives of the last flakes in this sequence subsequently created a new striking platform. The flake scars on the core indicate that after this rough shaping, the nucleus was turned 90° and sequences of flakes were struck from the newly created striking platform. Additionally, flakes were mainly produced from a 'major' striking surface (Figure 3.36-3), while some flakes were produced from an opposite 'minor' striking surface (Figure 3.36-4).

Refitted composition IV, part B (Figures 3.34, 3.37)
In a 'first' stage of reduction the natural fissure and/or cortex covered side of part B (sequence 130) was reduced by the removal of large and thick flakes. These flakes created a large striking platform and a good flaking edge angle for future reduction (Figure 3.34, part B, numbers 3/205-44 [+ 4/206-8 and 2/205-11] up to 2/206-10 and 3/205-51; Figure 3.37-A-1 and -B-1). Subsequently, the core was turned 90° and a 'second' sequence of flakes was produced



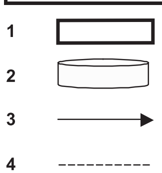


Figure 3.34: Maastricht-Belvédère Site K. Primary reduction sequences of refitted composition IV: the numbers in these ‘Harris-matrixes’ refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

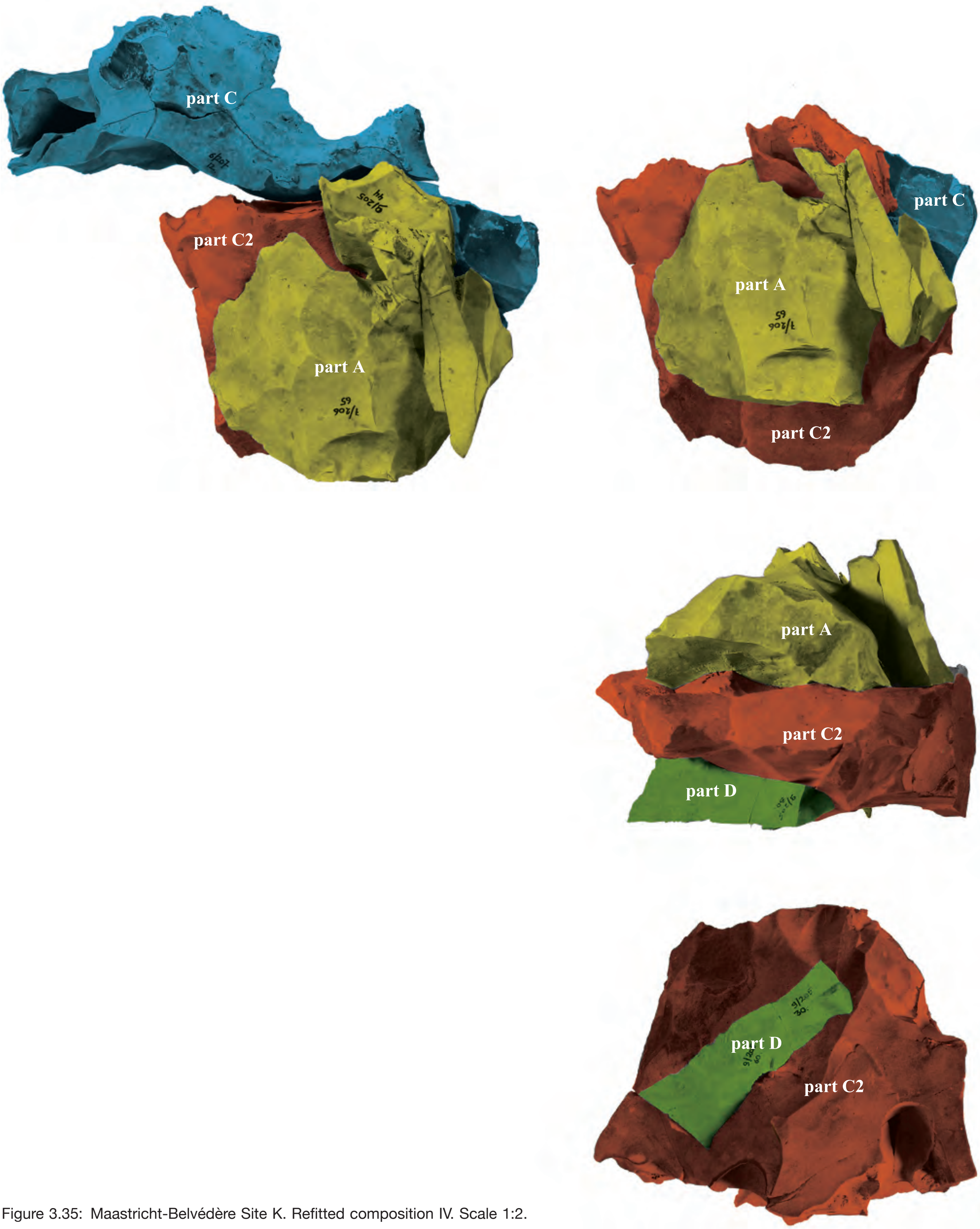


Figure 3.35: Maastricht-Belvédère Site K. Refitted composition IV. Scale 1:2.

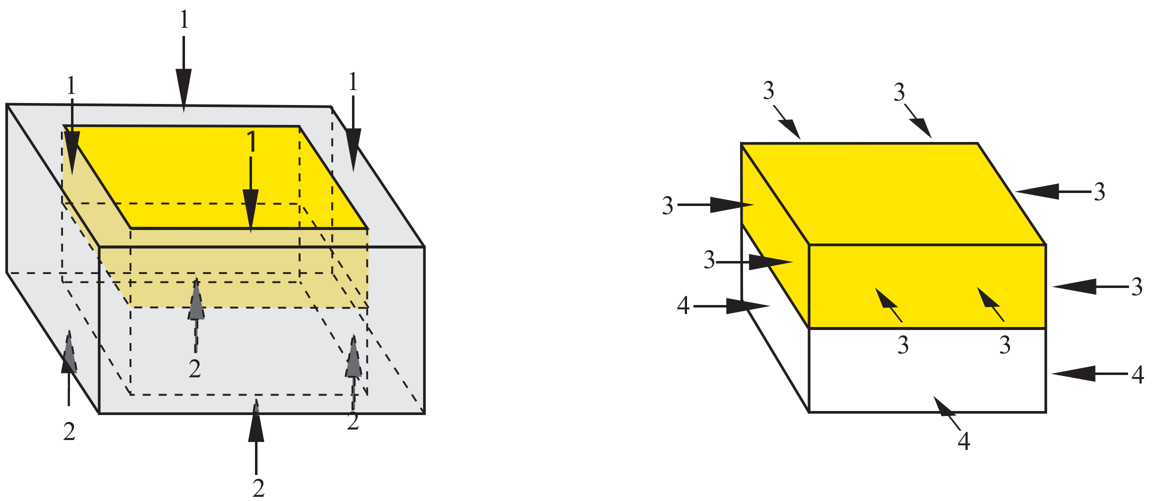


Figure 3.36: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition IV, part A. 1 and 2: Initial stage of reduction in which cortex and natural fissure covered flakes were produced from two opposite striking platforms. 3 and 4: Production of sequences of flakes, using a 'major' striking surface (3) and an opposite 'minor' striking surface (4).

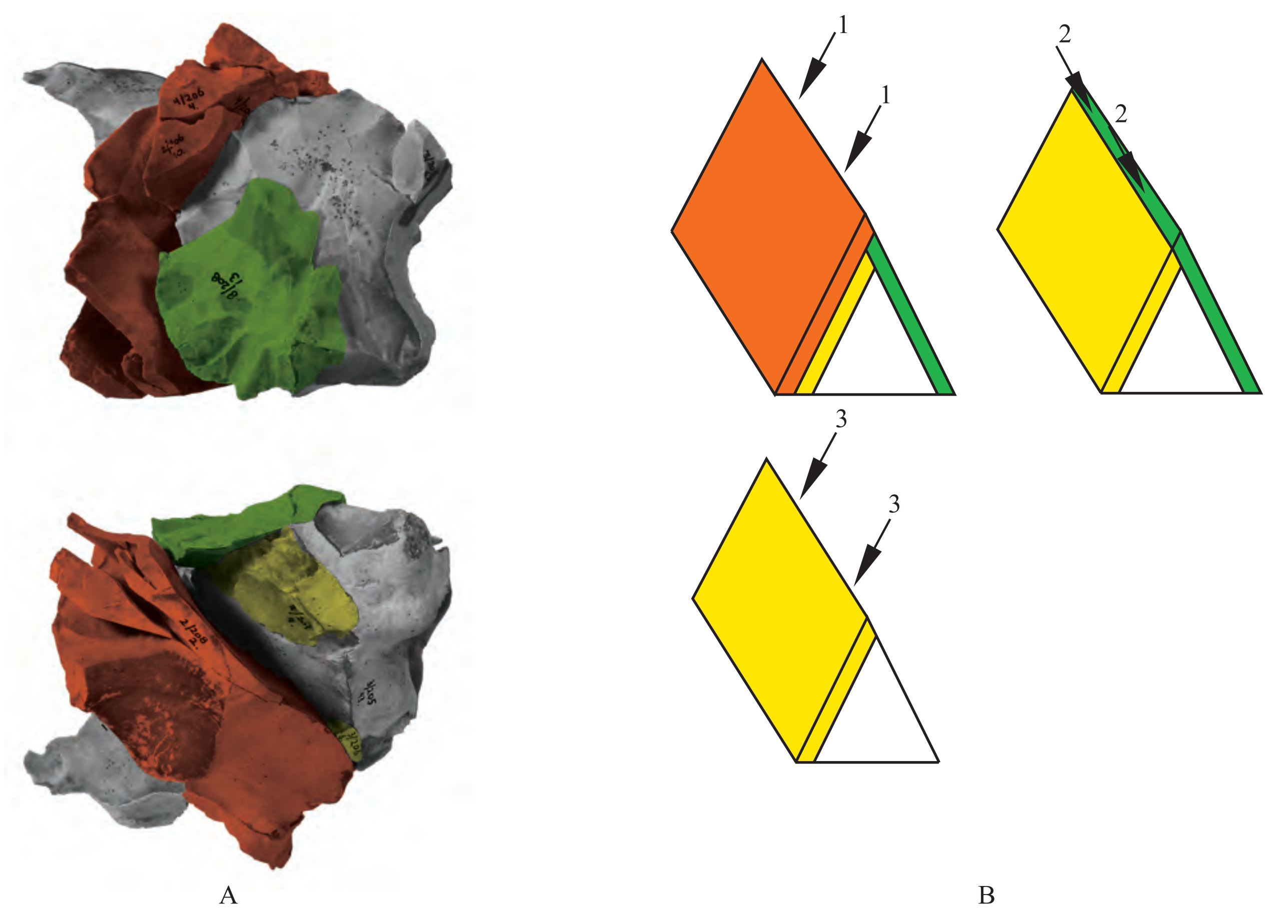


Figure 3.37: Maastricht-Belvédère Site K. A: Refitted composition IV, part B. Scale 2:3. B: Schematic representation of the reduction of refitted composition IV, part B. 1: Production of a 'first' series of cortex and natural fissure flakes. 2: Production of a 'second' sequence of flakes. The former striking platform becomes the future striking surface. 3: Production of a 'third' sequence of flakes from the 'first' striking surface. Again the former striking platform becomes the future striking surface.

from the newly created platform and a 'second' striking surface. This sequence is only represented by one refitted element (Figure 3.34, part B, number 8/208-13; Figure 3.37-A-2 and -B-2). Again the negatives of the last flakes in this sequence created a new striking platform. Once more, the core was turned 90° to produce a 'third' sequence of flakes from the 'first' striking surface (Figure 3.34, part B, numbers 3/206-6 and 2/207-4; Figure 3.37-A-3 and -B-3).

Throughout the whole reduction of part B, the former striking platform becomes, generally, the future striking surface and the other way around. The core also shows some minor scars, indicating that other striking platforms/surfaces were used as well. Eventually all this resulted in the discard of a double platformed at right angles core.

Refitted composition IV, part C and D (Figures 3.34, 3.35, 3.38)
The largest refitted sequence of artefacts is represented by part C (sequence 16). After the initial splitting of the nodule a series of large and thick flakes, covered with cortex and natural fissures, was produced from one and the same striking platform. This platform originated from the initial splitting (Figure 3.34, part C, numbers 5/207-15, 6/205-5, 6/206-8 [+ 6/207-6], 5/209-3 and 7/207-5 [+ 6/207-12]; Figure 3.35-2; Figure 3.38-B-1). Subsequently, part C was split, once more, into two parts or cores (parts C-1 and C-2). Both cores were further reduced within the excavated area.

Refitted composition IV, part C-1 (Figure 3.38-A)
Judging from the outermost flake scars on this refitted block, the core was reduced in the same manner as part B. Mainly one side of the core was reduced following a strategy in which the former striking platform becomes the future striking surface and the other way around. No flakes could be refitted to these sequences (Figure 3.38-B-2 and -B-3). The last flakes in these sequences ended in hinge negatives which made further reduction more difficult. Subsequently, a large and thick core trimming flake was struck at right angles to the former series of flakes. This flake, which eliminated the hinge negatives, was followed by at least two more flakes from the same direction (Figure 3.34, part C-1, numbers 7/210-53 and 1/211-2; Figure 3.38-A-4 and -B-4).

The same kind of scheme, but without the technological errors, can be suggested for the reduction of the opposite (less reduced) side of the core (Figure 3.34, part C-1, numbers 1/211-5 and LV-38; Figure 3.38-A-5 and -B-5, -6). Finally, a rather polyhedral core was discarded.

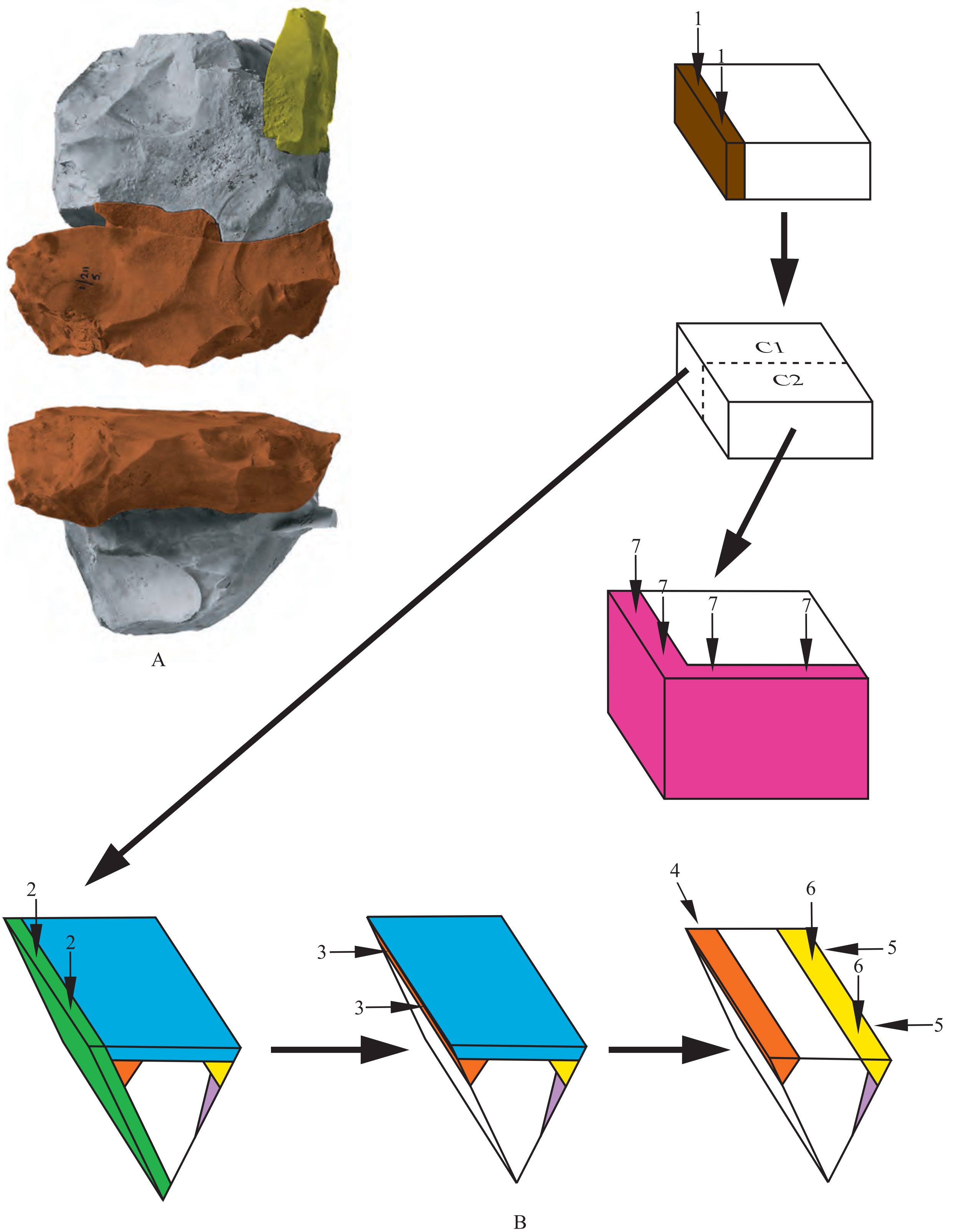
Refitted composition IV, part C-2 (Figure 3.35, 3.38-B)
The splitting of Part C resulted also in a rather flat core (part C-2), from which only a few, but large flakes were produced. All these flakes were struck from one and the same striking platform, which originates from the initial splitting of the large nodule. For reduction only two sides of the core were used (Figure 3.34, part C-2, numbers 5/208-3 [+ 7/207-54], 4/208-18, 7/206-70, 9/205-16 and 7/208-51; Figure 3.35; Figure 3.38-B-7). Probably after a very limited reduction, a pyramide-like core was discarded.

As part D only consists of one broken flake, no further inferences can be made on the reduction of this core (Figure 3.34, part D, number 9/205-60 [+9/205-39]; Figure 3.35).

3.6.5.6 Refitted composition V (Figure 3.39)
In total composition V (sequence 56) consists of six artefacts and weighs 0.118 kg (0.2% of the total weight of conjoined artefacts). After refitting, this composition has a maximum cross-section of 65 mm (Figure 3.39-A). Except for one single platformed, unifacial core all artefacts are flakes and pieces of debitage with a maximum dimension between 20 mm and 69 mm. All five flakes show cortex remains (25% or more cortex), while none show natural fissures. Each measurable flake has an angle of percussion ≥120°. A plain butt is described on three flakes, while one flake has a dihedral butt. Furthermore three artefacts show traces of preparation (facetting/retouching) along the angle between the butt and the dorsal side. The data on the dorsal surface (preparation) show that four flakes ≥30 mm have a 'parallel' unidirectional pattern and one flake a cortex dorsal pattern. Additional typo-/technological information on the composition V flakes is given in Tables 3.15 and 3.16.

Refitted composition V represents an initial cortex flake which was secondarily used as a core. The reduction sequence of this composition is given in Figure 3.40. The numbers refer to the individual flakes and core while the Roman numbers refer to the individual steps in the secondary reduction sequence which are described in the text (see also Figure 3.39-B).

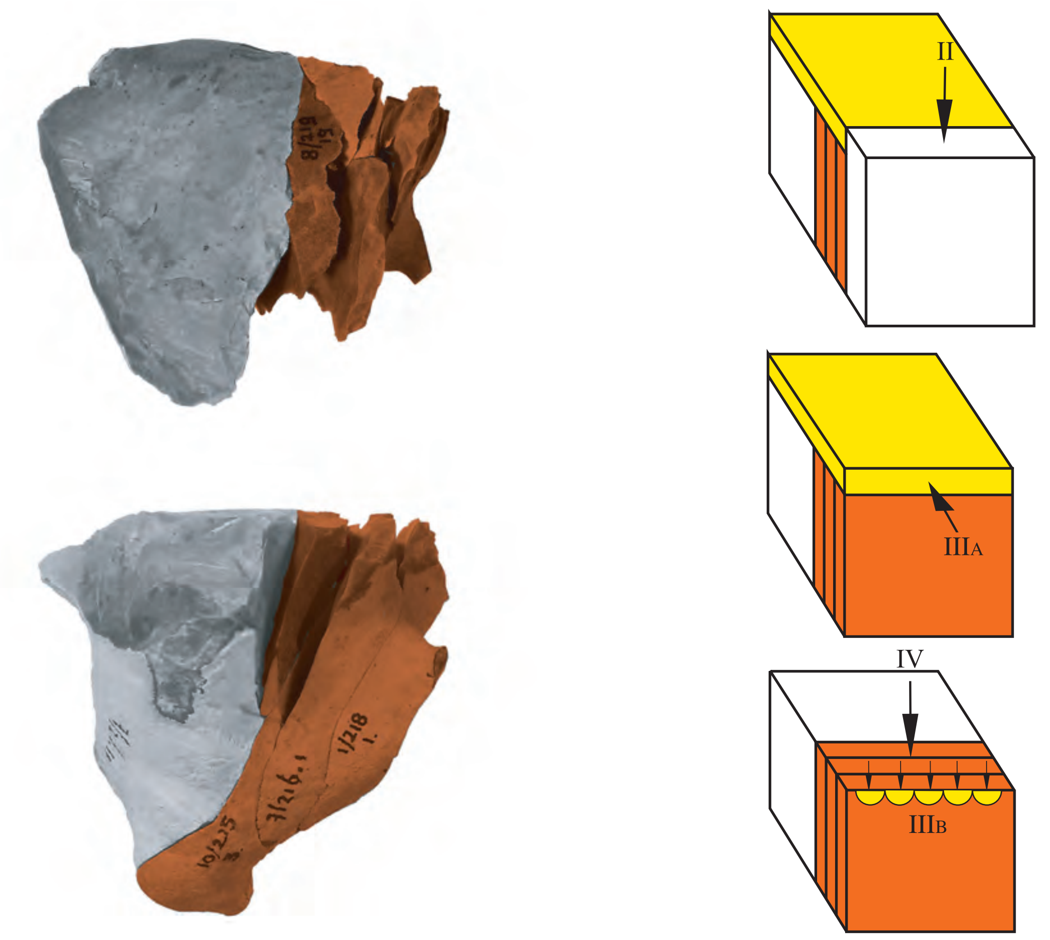
Figure 3.38: Maastricht-Belvédère Site K. A: Refitted composition IV, part C-1. Scale 1:1. B: Schematic representation of the reduction of refitted composition IV, part C. 1: Series of large cortex and natural fissure covered flakes, produced from one and the same striking platform. Subsequently, the core was split into two parts (C-1 and C-2). 2, 3, 5 and 6: Part C-1, production of sequences of flakes in which the former striking platform becomes the future striking surface and the other way around. 4: Part C-1, amongst others a core trimming flake, struck at right angles to the former series of flakes. 7: Part C-2: Series of flakes produced from one and the same striking platform and using two sides of the core.


1
1
C1
C2
7
7
7
7
A
2
2
3
3
4
6
5
6
5
B

I. Production of the core: Of all Site K cores, al least nine were made on large and rather thick flakes. The dorsal surface of this core (on flake) is after refitting almost 100% cortex covered. Judging by the cortex, this flake can be seen as a product of the first stages of core reduction. Furthermore, it is possible that in this case a protruding cortex part (the future core) was removed from a large flint nodule to flatten it out. Subsequently, this cortex-covered flake was secondarily used as core (flaked-flake, *cf*. Ashton *et al*. 1992). The butt of the flake (core) shows natural fissures and its distal part was missing before further reduction took place.

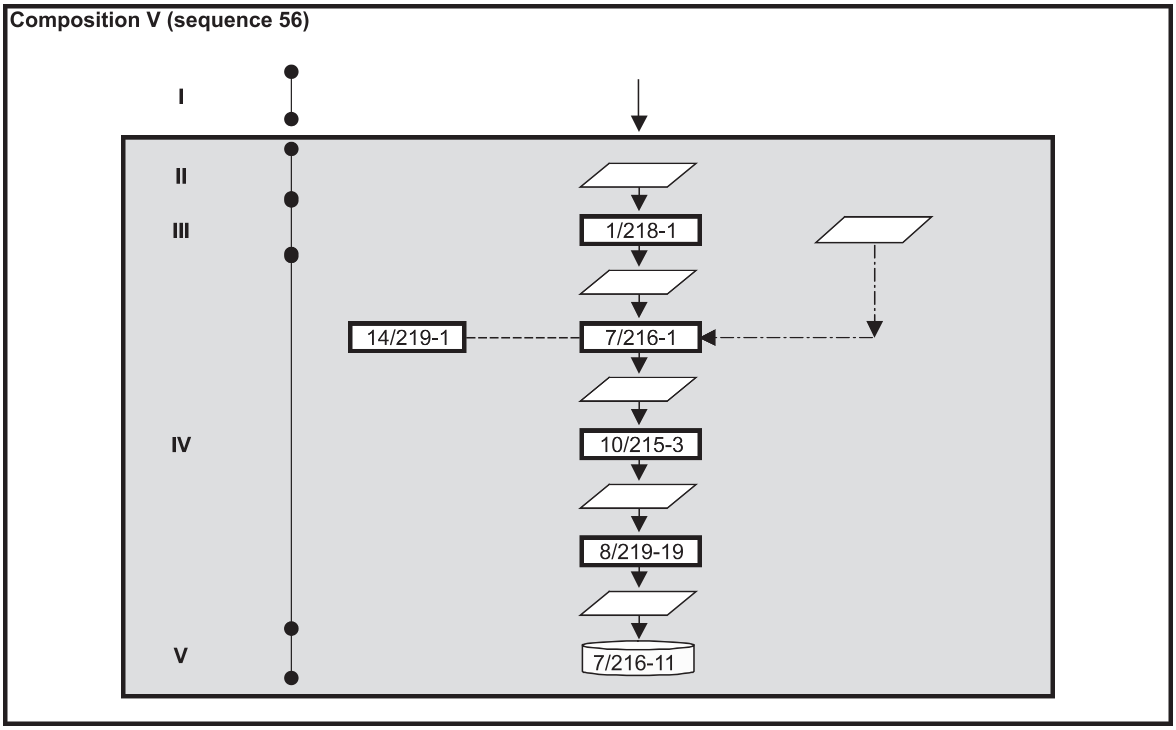
II. Removing protruding parts of cortex from the core: The core (former flake) shows a small protruding cortex part which was 'initially' eliminated. This could only be reconstructed on the basis of one flake scar which has more or less the same orientation as the rest of the flakes. It is however possible that this protruding part was removed from the large flint nodule before the flaked-flake was produced.

III. Preparing a good working edge angle: Next the core was scanned for a good working angle and a suitable striking platform. In general the former ventral side of the flaked-flake was used for this purpose. To improve the working edge angle, a flake was removed using this ventral side as a striking surface (Figure 3.39-B III-A). Next the core was turned 90° and a subtle preparation near the striking platform was executed (Figure 3.39-B III-B). This was done by 'retouching' the working edge of the core (the edge between the striking platform and the 'dorsal' face of the core on flake). After this preparation a 'first' flake was knapped (Figure 3.40, flake 1/218-1).



A B

Figure 3.39: Maastricht-Belvédère Site K. A: Refitted composition V. Scale 1:1. B: Schematic representation of the reduction of composition V. The Roman numerals refer to individual steps in the reduction sequence. These steps are described in the text (see also Figure 3.40).



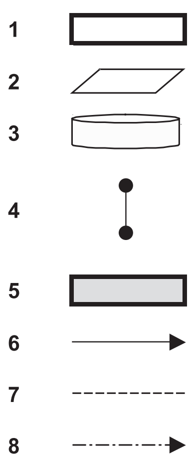


Figure 3.40: Maastricht-Belvédère Site K. Reduction sequence of refitted composition V. The numbers in the 'Harris-matrix' refer to the individual flakes and core, while the Roman numerals refer to the individual steps in the reduction sequence which are described in the text. Number 1/218-1 is the first refitted flake in the 'stratigraphical' reduction sequence.

1. Flake
2. Scar from previous flake
3. Core
4. Described steps
5. Flaked-flake
6. *Aufeinanderpassung* (production sequences)
7. *Aneinanderpassung* (breaks)
8. *Anpassung* (modifications)

IV. Reducing the core: The core was further reduced without any additional preparation of the working edge or striking platform. A sequence of at least seven flakes was struck from one and the same striking platform and striking surface as the 'first' flake. Three of these could be refitted to the composition. Broken flake 7/216-1 [+14/219-1] (Figure 3.40) is a split cone, while flake 10/215-3 is *outrepassé* or overstruck. This flake more or less ruined the core, after which only three smaller flakes were produced (amongst others flake 8/219-19, Figure 3.40).

V. Discard of the core: The final phase in the reduction sequence is the discard of the core (Figure 3.40, core 7/216-11). This was possibly done at the spot where the core was reduced.

3.6.5.7 Refitted composition VI (Figure 3.41)
Refitted composition VI (sequence 44) consists of eight artefacts and weighs 1.135 kg (1.9% of the total weight of conjoined artefacts). This group of refits represents one reduced part, or better core, of a larger flint nodule and has a maximum cross-section of 145 mm. Except for a single platformed, unifacial core all artefacts are flakes and pieces of debitage with a maximum dimension between 20 mm and 99 mm. Five flakes show cortex remains, while all show natural fissure remains. Most of the flakes ≥30 mm have an angle of percussion between 120° and 130° and a plain butt. Only one artefact among all composition VI flakes shows traces of preparation (facetting/retouching) along the angle between the butt and the dorsal side. Three flakes ≥30 mm show a 'parallel' unidirectional dorsal pattern, while a 'parallel' + lateral unidirectional, a lateral + opposed unidirectional and a cortex dorsal pattern are each found on one flake. Further typo-/technological information on the composition VI flakes is given in Tables 3.15 and 3.16.

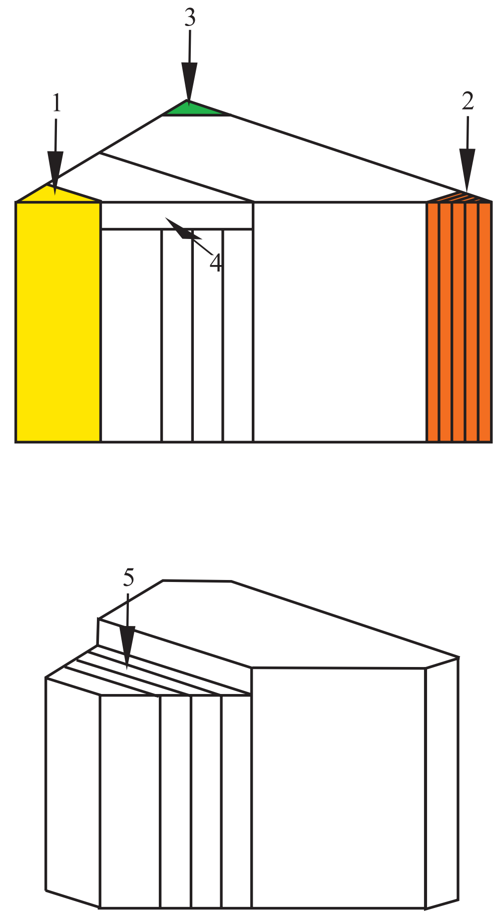
Conjoined composition VI (Figure 3.41) also indicates that a large flint nodule entered the excavated area, without any or hardly any decortication. The large (cortex-covered) raw material nodule is supposed to have been split into smaller blocks by following the natural fissures and fossil inclusions, already present in the flint before knapping. Positive proof for this assumption is given by the fact that some sides of the core, amongst others the future striking platform, consist mainly of natural fissures, while other (outer) surfaces are cortex covered. Initially the splitting created a more or less triangular core. Subsequently, three series of flakes were produced from one large striking platform, which originated from the initial splitting, using three different faces (striking surfaces) of the core. Neither the platform nor the edge angles of two sequences were prepared or modified (Figure 3.41-A-2, -3; -B-2, -3; Figure 3.42, numbers 2/208-23 up to 2/206-37 and 8/201-7). The 'third' and longest/largest sequence, although only one large flake could be refitted (Figure 3.41-A-1; -B-1, Figure 3.42, number 8/202-29), consisted of more than 10 flakes, as could be concluded from the flake scars. About five cortex-covered flakes were produced from the striking platform. The negative of the last large flake subsequently created a new striking platform. Next the core was turned 90° and a sequence of flakes was produced from this newly created striking platform and on another striking surface: the former striking platform (Figure 3.41-B-4). Again the negatives of the last flakes in this sequence created a new striking platform and again the core was turned 90° to produce a further sequence of flakes from the 'first' striking surface (Figure 3.41-B-5). Like for earlier compositions, it can be concluded that the former striking platform becomes the future striking surface and the other way around. Eventually a large single platformed, unifacial core was used as a hammerstone or anvil and, subsequently, discarded on the spot.

It can therefore be suggested, although impossible to prove, that a large cortex-covered piece of flint was roughly shaped to be directly used as hammerstone or anvil. Alternatively, it is possible that the core was 'primarily' used to produce a series of flakes, after which it was 'secondarily' used as hammer stone or anvil.

3.6.5.8 Refitted composition VII (Figure 3.43)
Composition VII consists of two separately reduced parts/cores and is made up of 28 flakes and flaked-flakes (*cf.* Ashton *et al. 1992*). Part A (sequences 13) has 25 artefact while part B (sequences 11) consists only of three artefacts. The refitted composition has a maximum dimension of 170 mm in cross-section and weighs 0,746 kg (1.2% of the total weight of conjoined artefacts). Except for three flaked-flakes, consisting amongst others of two disc cores (part A), one core trimming element and a composite tool (an atypical burin and a notched piece), all artefacts are flakes and pieces of debitage.

Most of the flakes have a maximum dimension between 20 mm and 59 mm (n= 23 or 88.5% of all flakes). A total of ten flakes (38.5% of all flakes) show cortex remains, while natural fissure remains are found on 17 flakes (65.4%). Ten of the latter artefacts (38.5%) have 25% or more natural fissure remains. Eighteen flakes ≥30 mm are broken (75.0%), mostly the proximal part is missing. The majority of the flakes ≥30 mm have an angle of percussion ≥110° and a plain or dihedral butt (each 25.0% or n= 6). The *Index Facettage* (IF) is 29.2, while the *Index Facettage stricte* (IFs) is 4.2 (*cf.* Bordes 1972:52). Of all 28 flakes, only five show traces of preparation along the angle between the butt and the dorsal side (19.2%). In four cases this was done by facetting/retouching. The data on the dorsal surface (preparation)

A



B

Figure 3.41: Maastricht-Belvédère Site K. A: Refitted composition VI. Scale 1:2. B: Schematic representation of the reduction of refitted composition VI. 1-3, 5: Production of sequences of flakes, using one striking platform and different striking surfaces. 4: Striking platform and flaking edge angle preparation by the removal of several flakes.

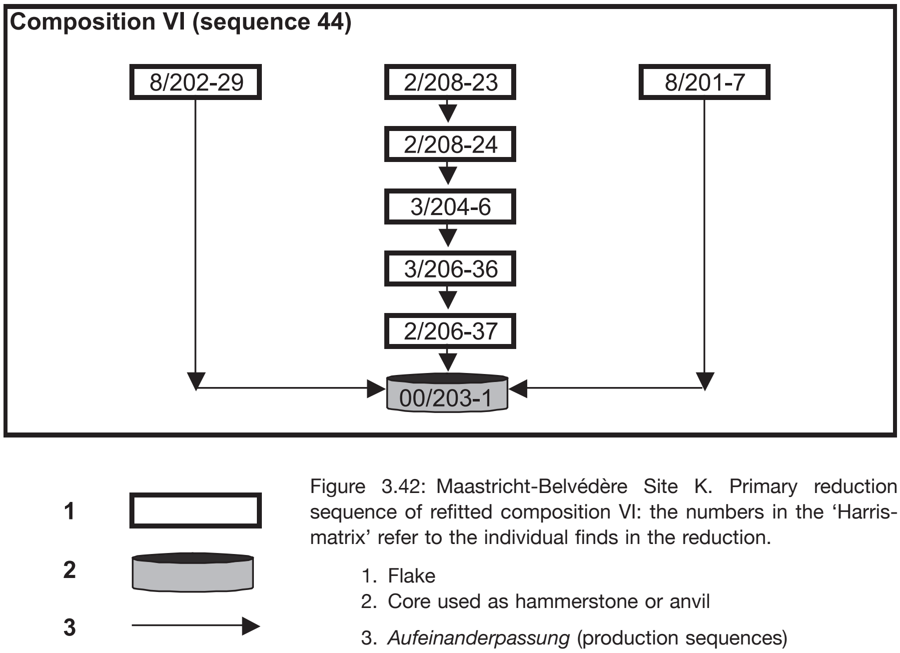


Figure 3.42: Maastricht-Belvédère Site K. Primary reduction sequence of refitted composition VI: the numbers in the 'Harris-matrix' refer to the individual finds in the reduction.

1. Flake
2. Core used as hammerstone or anvil
3. *Aufeinanderpassung* (production sequences)

show that six flakes ≥30 mm (25.0%) have a 'parallel' unidirectional pattern and five have a natural fissure dorsal pattern. One flake shows a centripetal or radial dorsal pattern. For additional typo-/technological information on the composition VII flakes the reader is referred to Tables 3.15 and 3.16.

Composition VII (Figure 3.43) represents the remnants of a larger raw material nodule which probably entered the site without any (or with limited) preparation. Refitting shows that the nodule was initially divided into at least two smaller blocks of flint. This was done by flaking and mainly by following the natural fissures, which were already in the flint before knapping. Moreover, the outermost face of the nodule consists mainly of natural fissures. Subsequently, both smaller parts (A and B) were used as cores. Some of the produced flakes were selected for a secondary reduction (flaked-flakes, *cf.* Ashton *et al.* 1992). The primary and secondary reduction sequences are visualized in Figure 3.44. In the next part both smaller units will be looked at

Refitted composition VII, part A (Figures 3.43, 3.44)
Part A (170 mm in cross-section) was further reduced by the removal of at least eight large and thick flakes. These flakes in fact represent an initial flaking stage of a much larger/longer sequence of reduction. The outermost part of this composition shows natural fissures and some cortex remains which were, at the start, used as striking platform and working edge angle. In a 'first' stage of reduction at least two large flakes, one of which could be refitted, were produced from the platform (Figure 3.43-A-1 and -B-1; Figure 3.44, part A, flaked-flake including core 9/219-4). The negatives of these flakes created a new striking platform. Next the core was turned 180° and a 'second' flake sequence was produced from a striking platform on the opposite side of the core (at right angles to the former sequence). This striking platform and working edge angle also originates from the initial splitting of the nodule (Figure 3.43-A-2 and -B-2; Figure 3.44, part A, numbers 9/217-26, 7/211-9 and 7/214-2). Again the core was turned 180° and at least two large flakes were produced from the striking platform, which was earlier created by the 'first' series of flakes. The flakes were struck from another striking surface (Figure 3.43-A-3 and -B-3; Figure 3.44, part A, number 4/218-5 [+4/218-4] and flaked-flake including core 6/221-3 [+8/216-3 and 9/219-10]. Once more, the core was turned (90°) and a 'fourth' sequence of flakes was produced from the last platform, using also a 'fourth' natural fissure covered striking surface (Figure 3.43-A-4 and -B-4; Figure 3.44, part A, numbers 8/214-10 and flaked-flake including numbers 12/215-1 and 6/217-10). Neither the striking platforms nor the edge angles were prepared.

Out of the produced debitage at least three flakes were selected for further reduction (*cf.* flaked-flakes, Figure 3.44). This secondary flaking led to the production and discard of

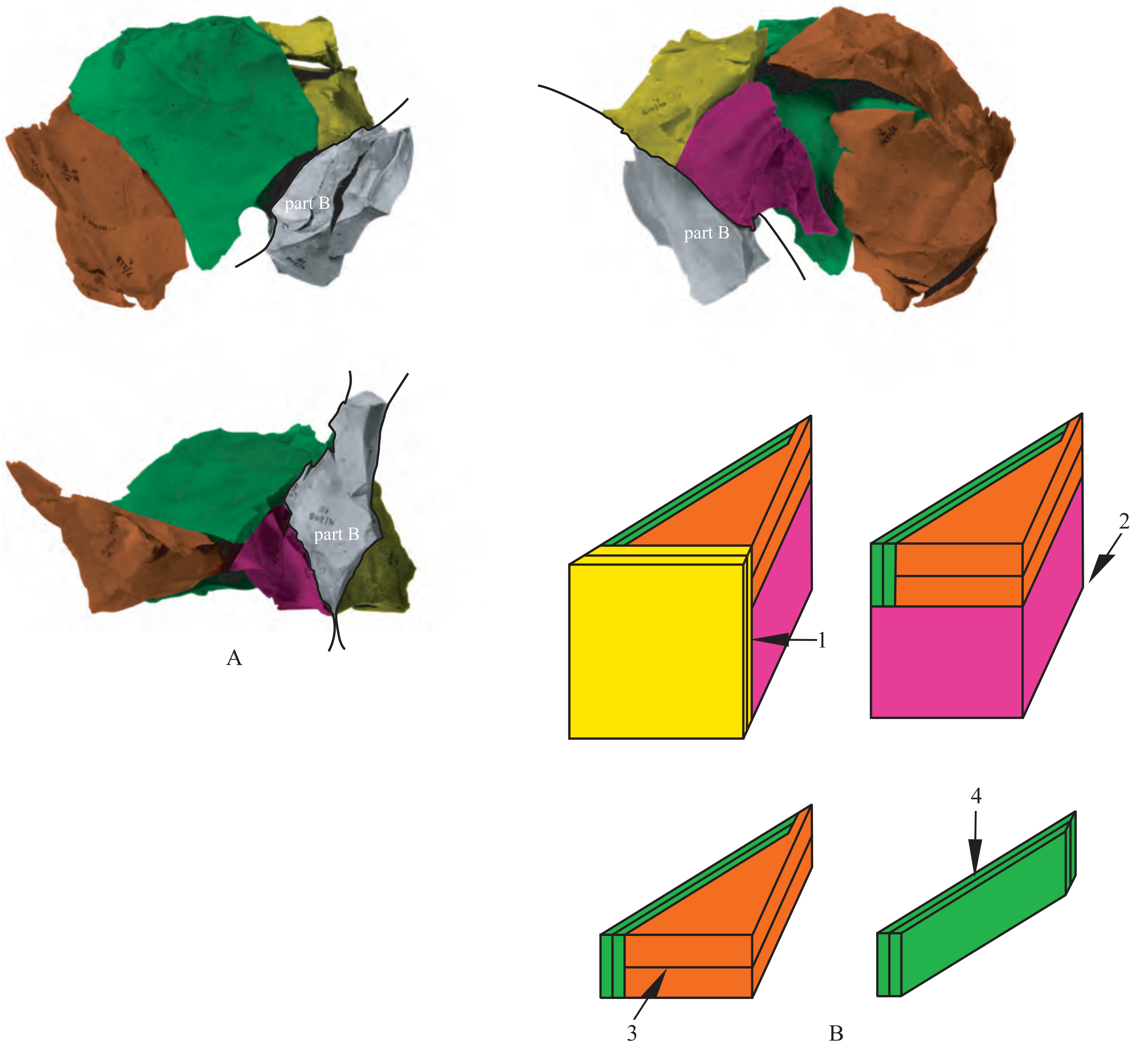


Figure 3.43: Maastricht-Belvédère Site K. A: Refitted composition VII. Scale 1:2. B: Schematic representation of the reduction of refitted composition VII. 1-4: Production of sequences of flakes, using different striking platforms and one 'main' striking surface.

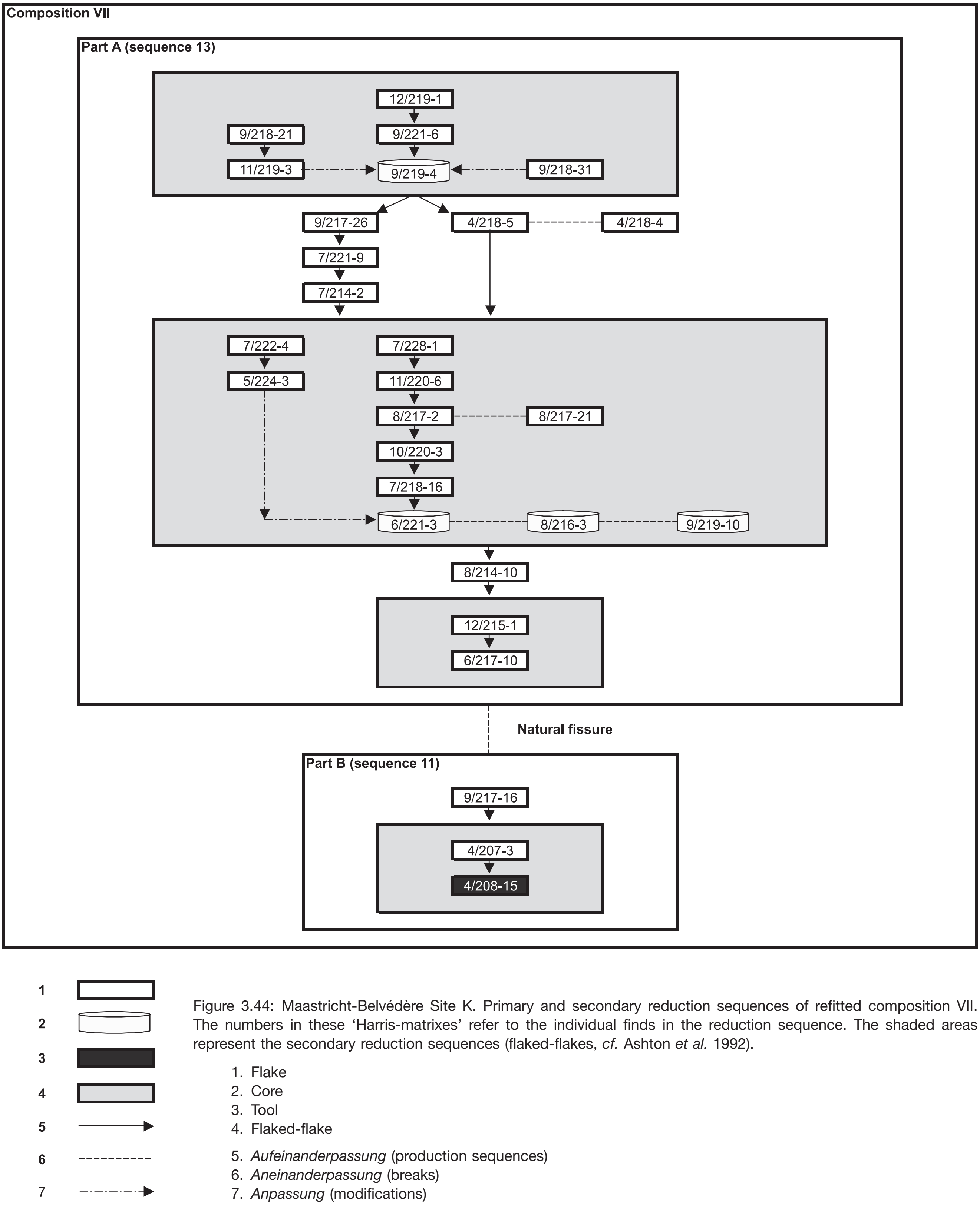


Figure 3.44: Maastricht-Belvédère Site K. Primary and secondary reduction sequences of refitted composition VII. The numbers in these 'Harris-matrixes' refer to the individual finds in the reduction sequence. The shaded areas represent the secondary reduction sequences (flaked-flakes, *cf.* Ashton *et al.* 1992).

1. Flake
2. Core
3. Tool
4. Flaked-flake
5. *Aufeinanderpassung* (production sequences)
6. *Aneinanderpassung* (breaks)
7. *Anpassung* (modifications)

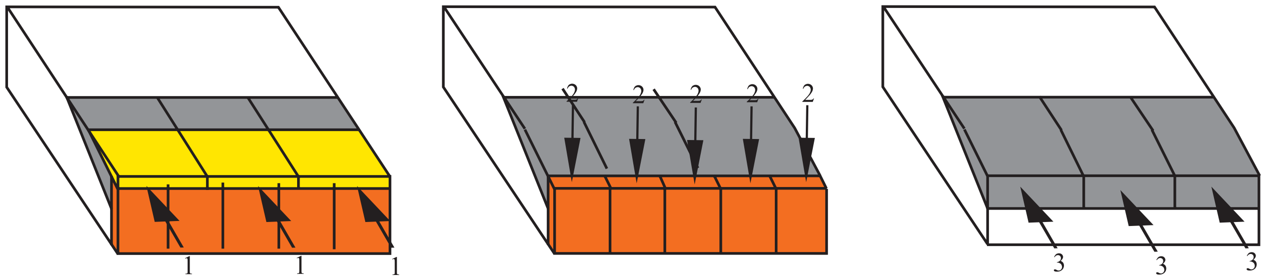


Figure 3.45: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition VII, part A, flaked-flake including core 6/221-3 [+8/216-3 and 9/219-10]. 1 and 3: Production of sequences of flakes, using the former ventral side of a large flake as striking surfaces. 2: Production of a sequence of flakes, using the former ventral side as striking platform. Throughout the whole reduction sequence the former striking platform becomes the future striking surface and the other way around.

some smaller flakes and two disc cores. One of these flaked-flakes is described in the following part.

Of the flaked-flake which includes core 6/221-3 [+8/216-3 and 9/219-10] (Figure 3.44) a 'first' series of smaller flakes was struck, using the former ventral side as striking surface. Only one artefact could be refitted (Figure 3.45-1, Figure 3.44, part A, number 7/228-1). The negatives of the last flakes created a new striking platform. Subsequently, the core was turned 90° and again some smaller flakes were produced from the newly created striking platform and on another striking surface: the former lateral side of the large flake/core (Figure 3.45-2, Figure 3.44, part A, numbers 7/222-4, 5/224-3, 11/220-6 and 8/217-2 [+8/217-21]). As a matter of fact the whole lateral edge on one side of the core was used to remove these smaller flakes. Again the negatives of the last flakes created a new striking platform and again the core was turned 90° to produce a new sequence of smaller flakes from the 'first' striking surface (the former ventral face, Figure 3.45-3, Figure 3.44, part A, numbers 10/220-3 and 7/218-16).

It can be suggested that the entire reduction was focused on one 'main' striking surface, the former ventral face of the large flake. Eventually a flat disc core was discarded.

Refitted composition VII, part B (Figures 3.43, 3.44 and 3.46)
The second reconstructed part of large nodule VII (part B) was probably also reduced by removal of large and thick flakes. This flake sequence consists only of three artefacts and has a maximum dimension of about 85 mm. One large flake was selected and secondarily transformed into an atypical burin by removing one single flake, a burin spall (Figure 3.46-1, Figure 3.44, part B, number 4/207-3 and 4/208-15). Next, perhaps after use, the burin itself was modified into a notched piece and discarded on the spot. This notch was created by removal of one large and a 'second' smaller flake (Figure 3.47-2). The transformation from an atypical burin into a notched piece indicates that at Site K some tools went through different typological phases during their production or perhaps during use.

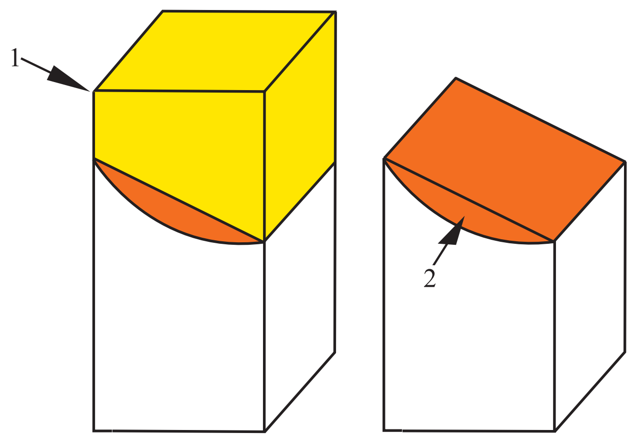


Figure 3.46: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted composition VII, part B, flaked-flake including tool number 4/208-15. 1: Production of an atypical burin by removal of one single burin spall. 2: Transformation of the burin into a notched piece by removal of two flakes.

3.6.5.9 Refitted composition VIII (Figure 3.47)
In total, refitted composition VIII (sequence 76) is made up of 19 artefacts, consisting of 17 flakes and pieces of debitage, one naturally backed knife and one multiple platformed core. This conjoined group has a maximum cross-section of 161 mm and weighs 0.511 kg (0.9% of the total weight of conjoined artefacts) after refitting. Most of the flakes have a maximum dimension between 30 mm and 59 mm (n= 11 or 61.1%). Less than half of all flakes show cortex remains (n= 8 or 44.4%), while natural fissures are found on only two flakes (11.1%). Five of the flakes ≥30 mm (33.3%) are broken. Mainly flakes with an angle of percussion >130° are described, while a plain butt dominates (80.0% or n= 12). One third of all 18 flakes show traces of preparation along the angle between the butt and the dorsal side (n= 6 or 33.3%). In five

cases this was done by facetting/retouching (27.8%). The data on the dorsal surface (preparation) show that five flakes ≥30 mm (33.3%) have a 'parallel' unidirectional pattern and four flakes (26.7%) have a 'parallel' + lateral unidirectional dorsal pattern. More typo-/technological information on the composition VIII flakes is found in Tables 3.15 and 3.16.

It could be suggested that composition VIII represents only a small part of a much larger raw material nodule, which was initially split by following the natural fissures or fossil inclusions. This splitting created a more or less triangular core with a large fossil inclusion in the centre. 'First' some protruding cortex parts were removed from the outermost surface of this block or core. This could have been done however before the splitting (Figure 3.48, flake number 6/208-22).

Next the core was scanned for a proper striking platform and edge angle. Subsequently, a series of large flakes was produced from one large natural fissure striking platform, which originated from the initial splitting (Figure 3.47-A-1, -B-1; Figure 3.48 numbers 4/216-17 [backed knife], 3/206-2, 2/206-6, 2/205-59, 6/206-6 and 5/208-16). Neither the platform nor the edge angles show signs of preparation. From these larger flakes a naturally backed knife was selected for use (see Appendix 9, Figure 9.19-1). After that, the core was turned 90° and a 'second' sequence of few but large flakes was produced. The former striking platform becomes the future striking surface (and the other way around). No flakes could be conjoined to this stage of reduction (Figure 3.47-A-2, -B-2). Again the core was turned 90° to the 'first' striking platform and striking surface and a 'third' sequence of flakes was produced (Figure 3.47-A-3, -B-3; Figure 3.48 numbers 4/206-15 [+4/207-13], 4/208-17, 6/208-18, 4/204-9, 3/209-9 and 3/206-19). This sequence was probably stopped because of the fossil inclusion. A 'fourth' series of flakes was produced, at a right angle to the last sequence, on the opposite side of the core. It is difficult to assign the relative position of this last flake series within the reduction sequence of composition VIII. In total four flakes (Figure 3.47-A-4, -B-4; Figure 3.48 numbers 2/205-57 and 11/205-19 up to 1/205-14) could be refitted to 'less important' faces of the core. Eventually a multiple platformed core was discarded.

3.6.5.10 Refitted composition IX (Figure 3.49)

Composition IX consists of two separately reduced parts/cores (sequences 100 [part 1-1] and 135 [part 1-2]) and is

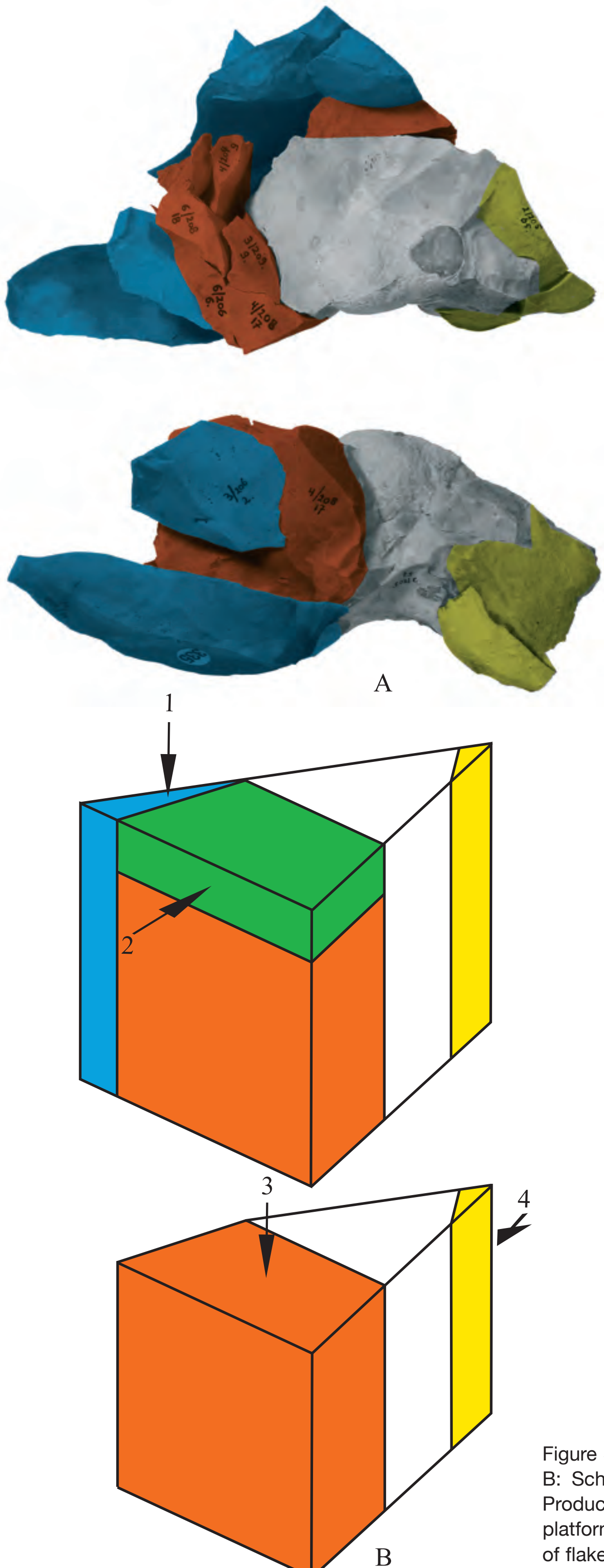


Figure 3.47: Maastricht-Belvédère, Site K. A: Refitted composition VIII. Scale 1:2. B: Schematic representation of the reduction of refitted composition VIII. 1-3: Production of sequences of flakes, using two striking surfaces. The former striking platform becomes the future striking surface and the other way around. 4: Series of flakes produced on the opposite side of the core and knapped at right angle to the 'third' sequence.

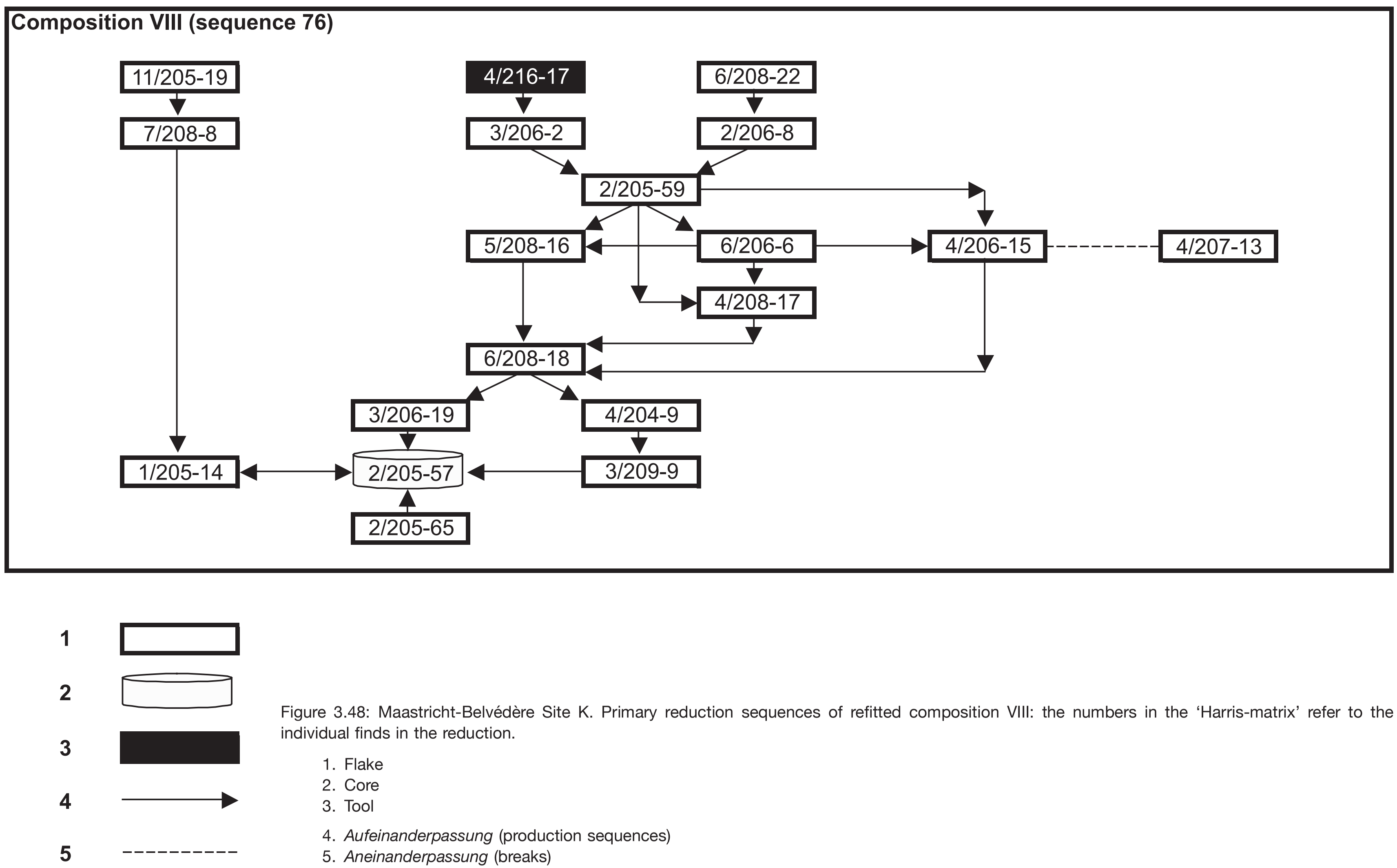


Figure 3.48: Maastricht-Belvédère Site K. Primary reduction sequences of refitted composition VIII: the numbers in the 'Harris-matrix' refer to the individual finds in the reduction.

1. Flake
2. Core
3. Tool

4. *Aufeinanderpassung* (production sequences)
5. *Aneinanderpassung* (breaks)

composed of 14 artefacts. Part 1-1 shows ten artefacts while part 1-2 has only four artefacts. The composition has a maximum cross-section of 154 mm and weighs 0.633 gram (1.1% of the total weight of conjoined artefacts). Except for a double platformed at right angles core and a shapeless or miscellaneous core, all are flakes and pieces of debitage. All flakes are <70 mm while most have a maximum dimension between 30 mm and 39 mm (n= 5 or 41.6% of all composition IX flakes). The majority of these (n= 10 or 83.3% of all flakes) show cortex remains, while natural fissures are found on one flake only (8.3%). Half of the flakes ≥30 mm are broken (n= 5 or 50.0%), of which in three cases the lateral part is missing. Four flakes ≥30 mm (40.0%) have an angle of percussion which is >130° while a dihedral butt appears most frequently (n= 5). The *Index Facettage* (IF) is 70.0, while the *Index Facettage stricte* (IFs) is 20.0 (*cf.* Bordes 1972:52). Only two flakes show traces of facetting or retouching along the angle between the butt and the dorsal side (16.7% of all flakes). The data on the dorsal surface (preparation) show that half of the flakes ≥30 mm (n= 5) have a 'parallel' + lateral unidirectional pattern. Also half of the flakes ≥30 mm have two or three dorsal scars. Additional typo-/technological information on the composition IX flakes is given in Tables 3.15 and 3.16.

The established refits of composition IX indicate, again, that a large cortex covered raw material nodule entered the excavated area without (hardly) any preparation. It can be suggested that at site K the nodule was initially flattened out to remove all protruding cortex parts which could influence future flaking in a negative way. This rough shaping was probably done by removal of large and thick flakes. One of these large primary flakes (composition IX, Figure 3.49-A; Figure 3.50) was 'secondarily' spit into two parts or cores (Figure 3.50, part 1-1 and 1-2). Both cores were further reduced within the excavated area and will be described in the next part.

Refitted composition IX, part 1-1 and 1-2 (Figures 3.49, 3.50)
The refitted elements of part 1-1 (sequence 100) represent the last stages of reduction of a much longer flaked sequence. Three refitted artefacts and the outermost flake scars would suggest that a series of flakes was produced from a 'main' striking surface. These flakes were struck in a circular and centripetally orientated direction, using the whole core edge as striking platform (Figure 3.50, part 1-1, numbers 3/202-3, 2/206-1 and 3/207-9; Figure 3.49-A-1, -B-1). The negatives of the last flakes in this sequence created a new striking platform. Subsequently, the core was turned 90° and a 'second' series flakes was produced on one side of the core. The former striking surface now becomes the striking platform (Figure 3.50, part 1-1, numbers 4/207-36 and 3/208-1 up to 6/207-15; Figure 3.49-A-2, -B-2). Next, the core was again turned 90° to the 'first' striking platform and striking surface, and another series of smaller flakes was produced. This stage of reduction was mainly reconstructed on the basis of flake scars, as only one flake could be refitted (Figure 3.50, part 1-1, number 4/207-34; Figure 3.49-A-3, -B-3). Eventually the reduction sequence ended in a double platformed at right angles core.

Part 1-2 (sequence 135) represents a very short sequence of reduction, which resulted eventually in the discard of a shapeless or miscellaneous core (Figure 3.49-A; Figure 3.50, part 1-2, numbers 5/208-8, 7/205-15 and 13/201-38 [+ 13/201-23]). This suggests that in an 'early' stage of reduction core 1-2 broke and was directly discarded.

3.6.5.11 Refitted composition X (Figures 3.51, 3.52)
After refitting, composition X (sequence 355; De Loecker 1994*a*) has a maximum dimension of 113 mm, weighs 0.232 kg (0.4% of the total weight of conjoined artefacts) and consists of 11 artefacts. Except for a single platformed unifacial core, all artefacts are flakes and pieces of debitage. More than half of all flakes have a maximum dimension between 20 mm and 39 mm (n= 6 or 60.0%). Seven pieces (70.0% of all flakes) show cortex remains, while only one shows natural fissures. Half of the flakes ≥30 mm is broken (n= 4 or 50.0%). Again half of these flakes have an angle of percussion >130°, while ca. one third have a plain butt. One flake ≥30 mm shows a facetted butt (12.8%). The *Index Facettage* (IF) and the *Index Facettage stricte* (IFs) is therefore, respectively, 25.0 and 12.5 (*cf.* Bordes 1972:52). Of all composition X flakes, only two show traces of preparation (20.0%, facetted/retouched) along the angle between the butt and the dorsal side. All flakes ≥30 mm show a different dorsal pattern. More typo-/technological information on the composition X flakes is given in Tables 3.15 and 3.16.

Refitted composition X represents, like composition IX, a large initial decortication flake which was secondarily used as a core. The reduction sequence of this composition is given in Figure 3.52. The numbers refer to the individual flakes and core, while the Roman numbers refer to the individual steps in the reduction sequence. They are described in the text as well (see also Figure 3.51).

I. Production of the core: The dorsal surface of this core on flake (flaked-flakes, *cf.* Ashton *et al.* 1992) is between 25% and 50% cortex covered. Judging from its dimensions and the high percentage of cortex, the flake can be seen as a product of the first stages of core reduction. As mentioned before one could think of a strategy where the raw materials was roughly divided into large and thick flakes which were secondarily used as cores (Figure 3.51, step I; Figure 3.52-I).

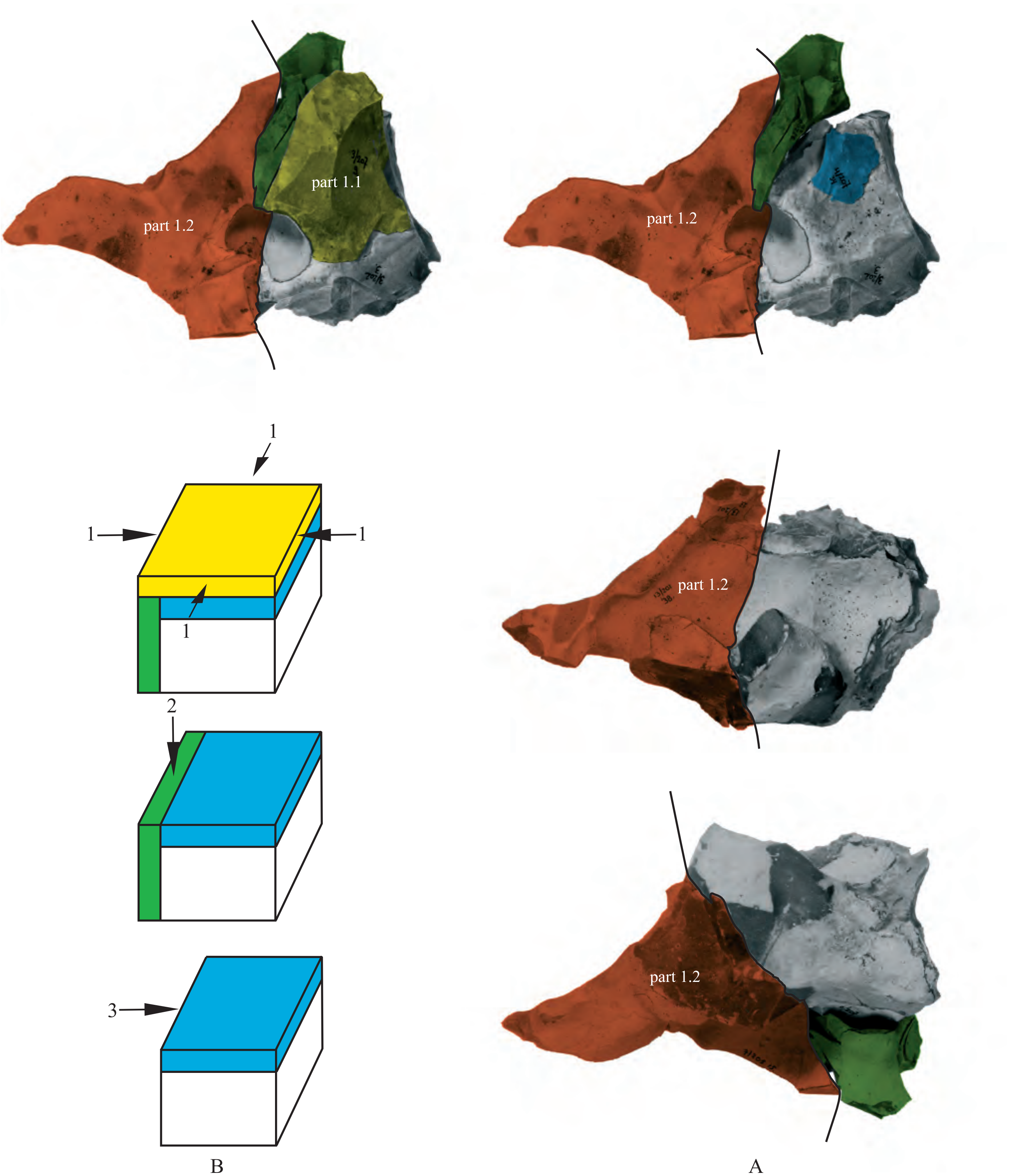
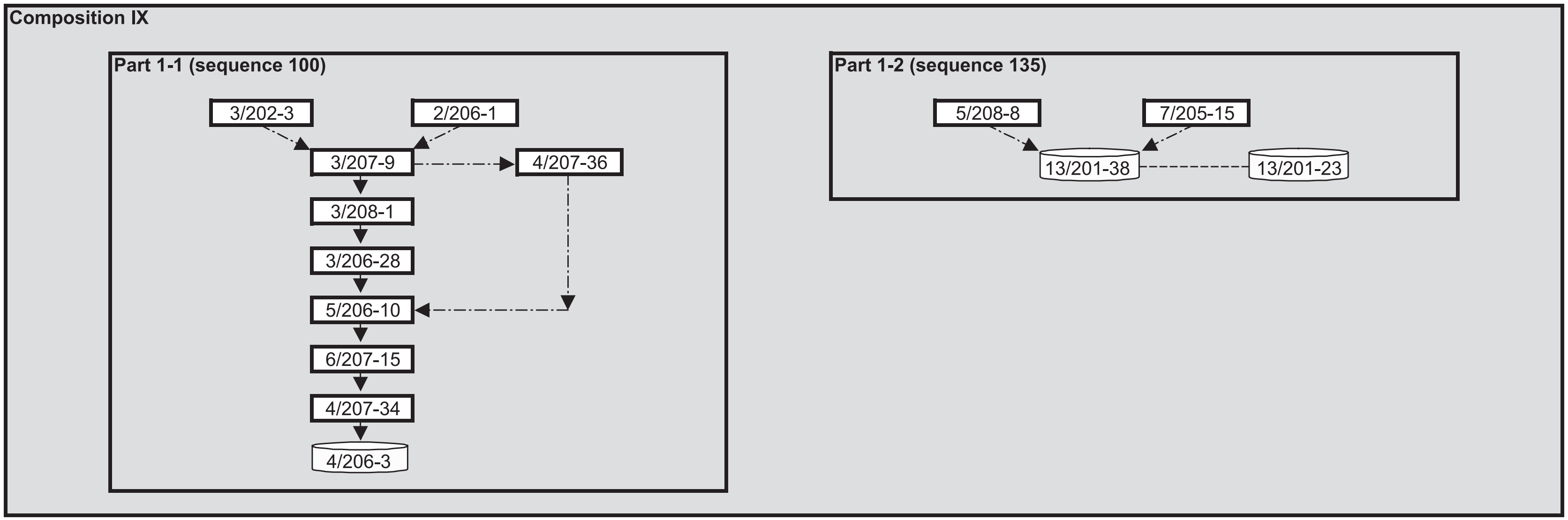


Figure 3.49: Maastricht-Belvédère Site K. A: Refitted composition IX. Scale 1:2. B: Schematic representations of the reduction of refitted composition IX, part 1-1. 1: Production of a sequence of flakes in a circular direction, using one main striking surface. 2: Production of a 'second' sequence of flakes. The former striking surface becomes the future striking platform. 3: Final series of smaller flakes, again produced from the 'first' striking surface.



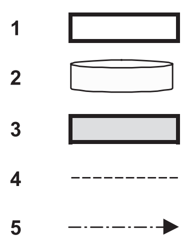


Figure 3.50: Maastricht-Belvédère Site K. Reduction sequences of refitted composition IX: the numbers in these ‘Harris-matrixes’ refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. Flaked-flake
4. *Aneinanderpassung* (breaks)
5. *Anpassung* (modifications)

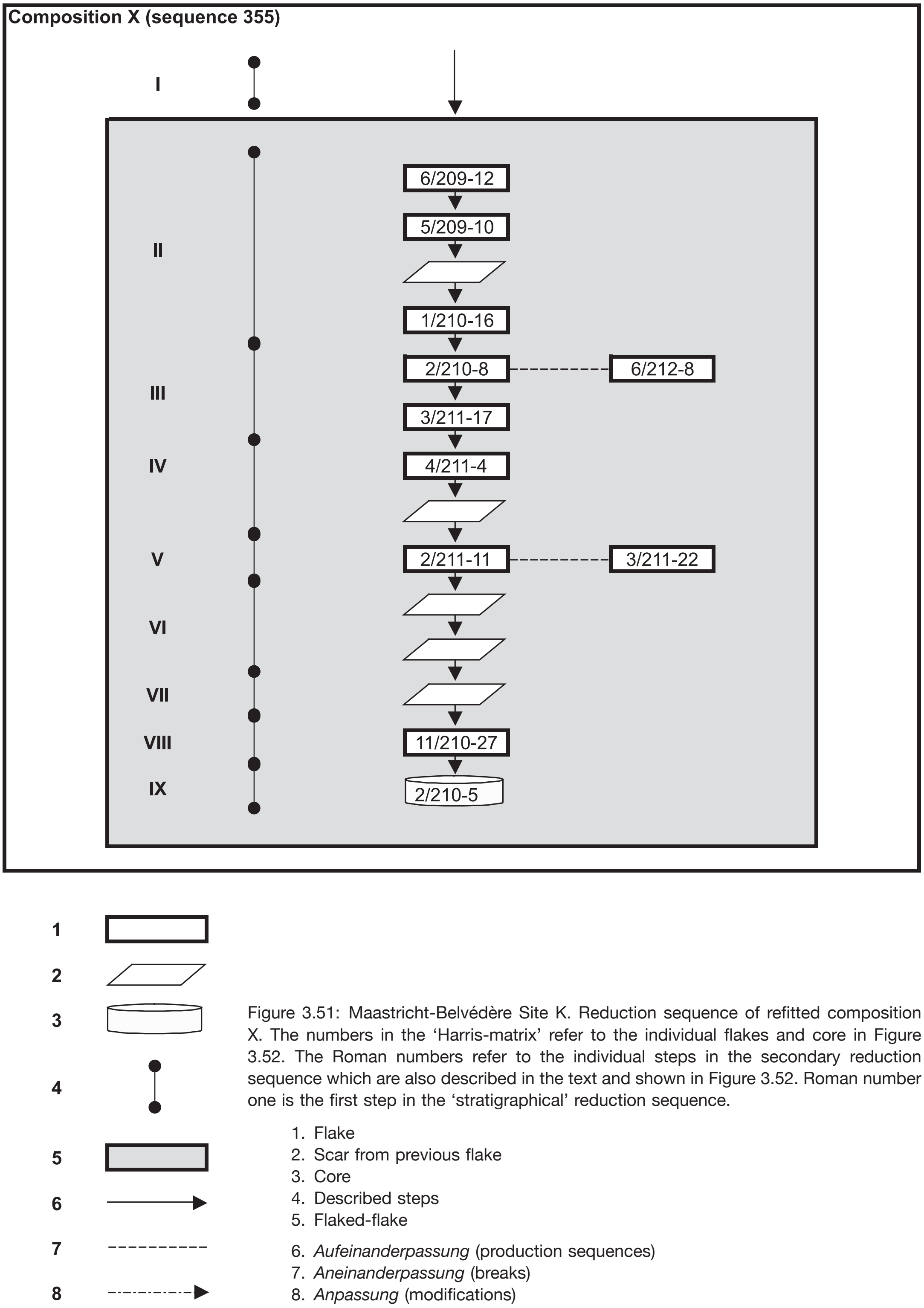
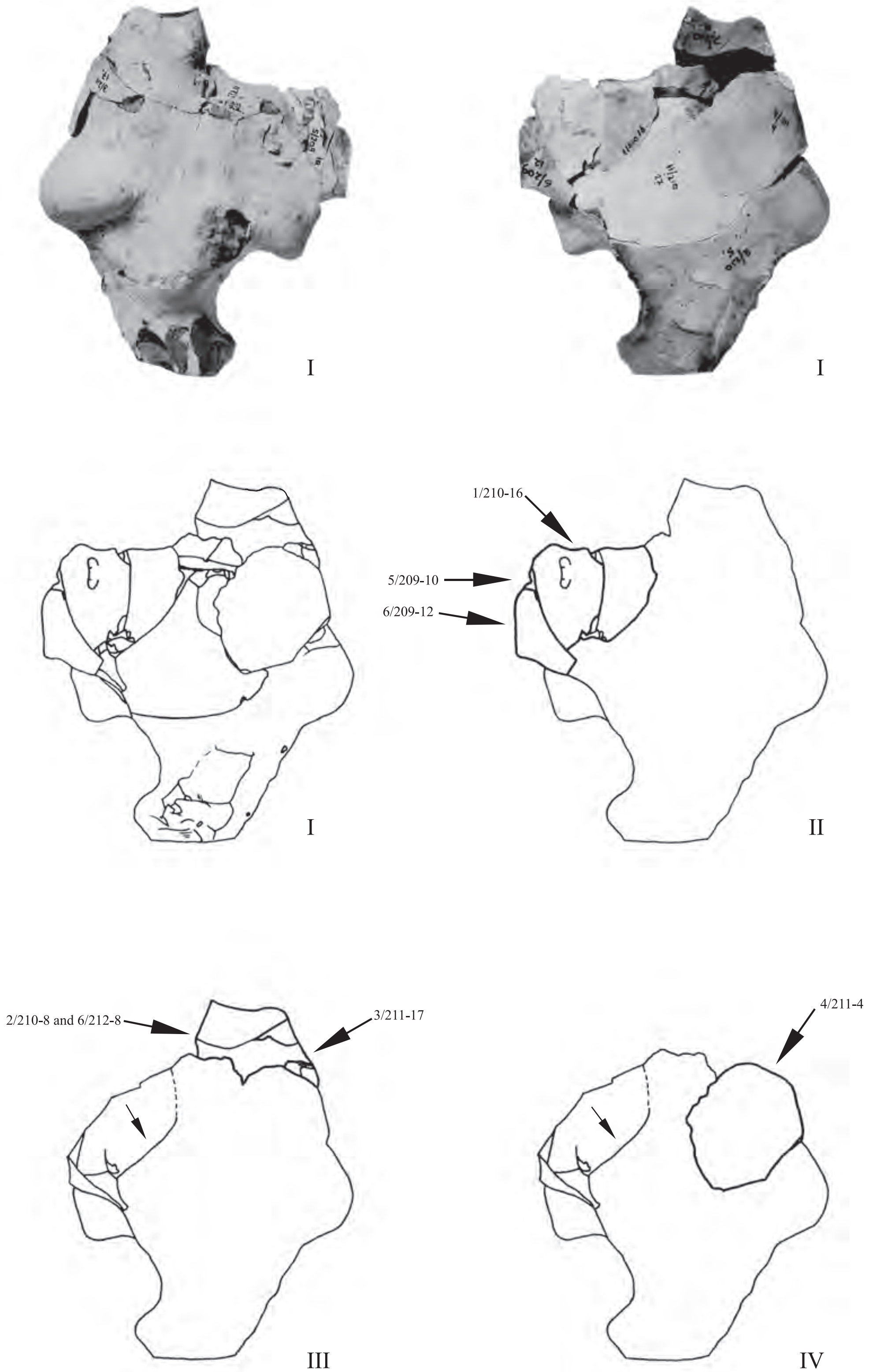


Figure 3.51: Maastricht-Belvédère Site K. Reduction sequence of refitted composition X. The numbers in the 'Harris-matrix' refer to the individual flakes and core in Figure 3.52. The Roman numbers refer to the individual steps in the secondary reduction sequence which are also described in the text and shown in Figure 3.52. Roman number one is the first step in the 'stratigraphical' reduction sequence.

1. Flake
2. Scar from previous flake
3. Core
4. Described steps
5. Flaked-flake
6. *Aufeinanderpassung* (production sequences)
7. *Aneinanderpassung* (breaks)
8. *Anpassung* (modifications)


I
I
I
1/210-16
5/209-10
6/209-12
II
2/210-8 and 6/212-8
3/211-17
III
4/211-4
IV

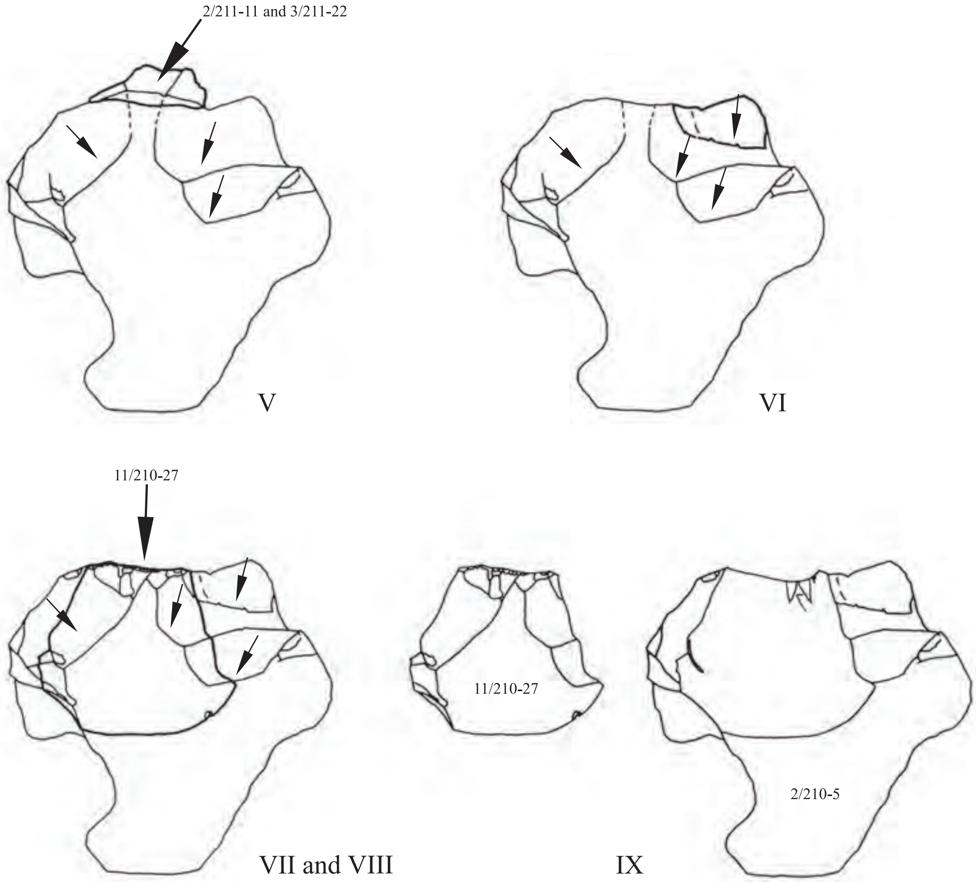


Figure 3.52: Maastricht-Belvédère Site K. Refitted composition X in different stages of reduction/refitting. The Roman numbers refer to the text, as well as to Figure 3.51. Roman number I is the complete conjoined group (photograph: dorsal face on the left, ventral face on the right). Roman number IX is the core and the 'preferential flake'. Scale 1:2.

II. Creating the convexity of the 'left' side of the striking surface: The ventral face of the large flake/core (the future striking surface) displays a convex surface. This surface seemed to be insufficient for further reduction. Therefore, by means of four flakes orientated to the centre of the core, the convexity of the striking surface was enlarged. Three of these flakes could be refitted (Figures 3.52-II and 3.51, flakes 6/209-12, 5/209-10 and 1/210-16).

III. Creating a striking platform: Next, the core was turned 90° and a few flakes were produced, using the ventral face of the large flake or better the previous striking surface as striking platform. These flakes were intended to create a new striking platform on the 'distal' end of the core. Two of these flakes could be refitted. One flake was struck from the lateral side (Figures 3.52-III and 3.51, broken flake 2/210-8 [+ 6/212-8]) and one from the 'ventral' side of the core (Figures 3.52-III and 3.51, flake 3/211-17).

IV. Creating the convexity of the 'right' side of the striking surface: Again, the core was turned 90° and a few flakes were produced using the earlier newly created striking platform. Thus the convexity of the 'right' side of the striking surface of the core was enlarged. This happened by removal of at least two flakes. One of these, also orientated to the centre of the core, could be refitted (Figures 3.52-IV and 3.51, flake 4/211-4).

V. Further preparation of the striking platform: Once more, the core was turned 90° and again attention was paid to the preparation of the striking platform. The only broken flake indicating this preparation (Figures 3.52-V and 3.51, broken flake 2/211-11 [+3/211-22]), is flaked from the 'ventral' side of the core, using the 'main' striking surface as striking platform.

VI. Again, attention is paid to the convexity of the 'right' side of the striking surface: This could only be reconstructed by two flake scars which are orientated to the centre of the core (Figures 3.52-VI and 3.51).

VII. Subtle preparation near the striking platform: After creating the convexity of the striking surface on the core and creating/preparing the striking platform, a subtle preparation near the striking platform was executed. This was done by retouching the working edge of the core (the edge between the striking platform and the ventral face of the flake [core]).

VIII. Production of a large flake: Subsequently a last large flake was removed from the core (Figures 3.52-VIII and 3.51, flake 11/210-27). This flake can be interpreted as a 'preferential flake'.

IX. Discard of the core and 'preferential flake': The final phase in the reduction sequence is the discard of the core and 'preferential flake' (Figures 3.52-IX and 3.51, flake 11/210-27 and core 2/210-5), possibly after use. This was done at the same spot where the core was reduced.

In general this conjoined group of artefacts (refitted composition X) indicates that, in contrast to the majority of the refitted Site K compositions, much attention was paid to the preparation of the core (flaked-flakes *cf*. Ashton *et al*. 1992). Especially the convexity of the striking surface, near the striking platform, and the platform itself were given particular attention. During this 'preparation' the core was turned several times 90° to and fro. Accordingly, the former striking platform becomes the future striking surface and the other way around.

3.6.5.12 Refitted compositions XI, XII and XIII. (Figures 3.53, 3.54, 3.55)

In this section three refitted compositions will be dealt with at the same time, as they show more or less the same reduction sequence and the same technological characterizations.

Composition XI consists of 12 artefacts which represent two separately reduced parts or cores (sequences 15 [part A] and 47 [part B]). Part A consists of 11 artefacts, and part B of only one. All artefacts are flakes, pieces of debitage and one blade-like flake. The only nucleus in this composition can be described as a disc core. The conjoined composition has a maximum cross-section of 176 mm and weighs 0.497 kg (0.8% of the total weight of conjoined artefacts). Flakes with a maximum dimension between 40 mm and 49 mm dominate (n= 5 or 45.5% of all flakes). Of all flakes only one piece, the flake of part B, shows cortex remains (9.1%), while none of the artefacts show frost fissures. In total three flakes ≥30 mm are broken (27.3%). More than half of the flakes ≥30 mm (n= 8 or 72.7%) have an angle of percussion ≥110°, while nine pieces show a plain butt (81.8%). The *Index Facettage* (IF) is 9.1, while the *Index Facettage stricte* (IFs) is 0 (*cf*. Bordes 1972:52). Six artefacts (54.5%) show traces of preparation (36.4% is facetted/retouched) along the angle between the butt and the dorsal side. The data on the dorsal surface (preparation) show that four flakes ≥30 mm (36.4%) have a 'parallel' unidirectional pattern. A 'parallel' bidirectional and a 'parallel' + lateral unidirectional pattern is found on respectively two (18.2%) and three flakes (27.3%).

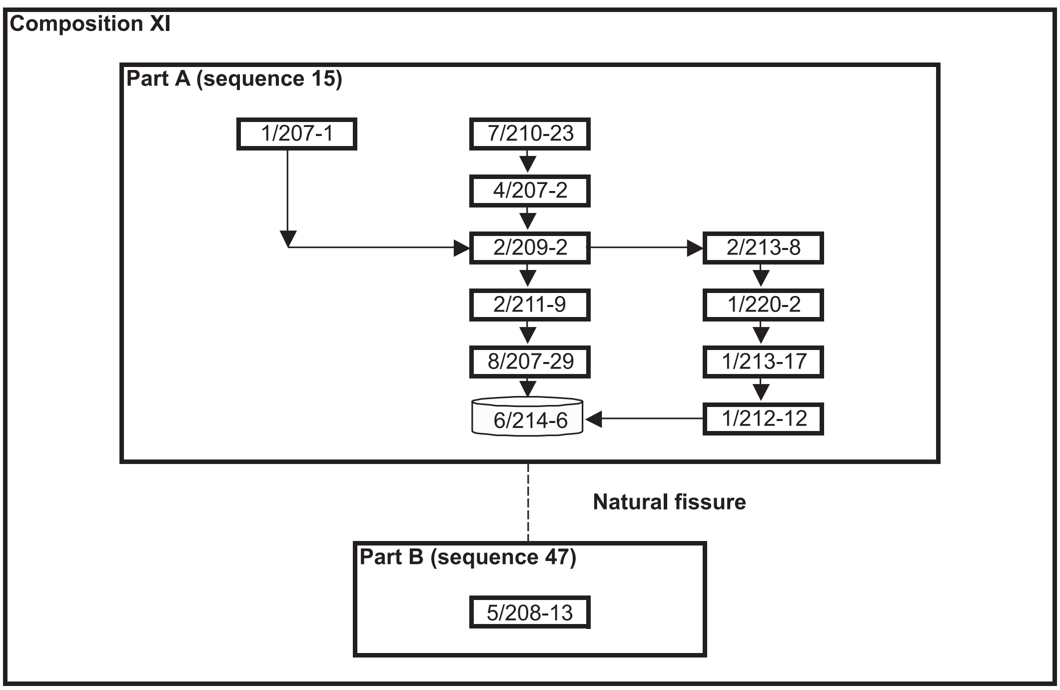
Composition XII consists of 24 artefacts (sequence 21), has a maximum dimension of 141 mm and weighs 0.578 kg (1.0% of the total weight of conjoined artefacts). Except for two core trimming elements (8.3%) and a discoidal core, all artefacts are flakes and pieces of debitage (n= 21 or 87.5%). Flakes with a maximum dimension between 30 mm and 39 mm dominate (n= 9 or 39.1% of all flakes). Of all flakes a total of 17 pieces show cortex remains (73.9%), none of these show frost fissures. In total 11 flakes ≥30 mm (47.8%) are broken. Most of these artefacts (n= 16 or 69.6%) have an angle of percussion ≥110°, while 12 pieces show a plain butt (52.2%). The *Index Facettage* (IF) is 21.7, while the *Index Facettage stricte* (IFs) is 0 (*cf*. Bordes 1972:52). About one fifth of all flakes (n= 5 or 21.7%) show traces of preparation (facetted/retouched) along the angle between the butt and the dorsal side. In total 11 flakes ≥30 mm (47.8%) have a 'parallel' unidirectional dorsal pattern, while only one flake has a convergent unidirectional pattern and one artefact a centripetal or radial dorsal pattern (each 4.3%).

For conjoined composition XIII a total of 19 artefacts were counted (sequence 1). All artefacts are flakes and pieces of debitage, except for a discoidal core (5.3%). After refitting this composition has a maximum cross-section of 149 mm and weighs 0.544 kg (0.9% of the total weight of conjoined artefacts). Most of the flakes have a maximum dimension between 30 mm and 59 mm (n= 14 or 77.8% of all flakes). Only one flake shows cortex remains (5.6% of all flakes), while two (11.1%) show frost fissures. In total 10 flakes ≥30 mm (62.5%) are broken. All flakes ≥30 mm have an angle of percussion ≥110°, while more than half of the flakes show a plain butt (n= 9 or 56.3%). The *Index Facettage stricte* (IFs) is 6.3, while the *Index Facettage* (IF) is 18.8 (*cf*. Bordes 1972:52). Of all flakes, five (27.8%) show traces of preparation along the angle between the butt and the dorsal side. Half of the flakes ≥30 mm (n= 8 or 50.0%) have, again, a 'parallel' unidirectional dorsal pattern, while four flakes (25.0%) show a 'parallel' + lateral unidirectional pattern. One flake has a convergent unidirectional and one a centripetal or radial dorsal pattern (each 6.3%).

Additional typo-/technological information on the composition XI, XII and XIII flakes is given in Tables 3.15 and 3.16.

Like many previous examples, conjoined composition XI (Figure 3.53) indicates that a large flint nodule entered the excavated Site K area where it was subsequently split into at least two smaller blocks or units. Although refitting gives no proof, this can also be suggested for compositions XII and XIII (respectively Figures 3.54, 3.55). If this assumption is correct, natural fissures, already present in the flint before knapping, may also have played a major part in the initial splitting of at least the raw material nodules of compositions XI and XIII. Next, the smaller parts were secondarily used as cores and further reduced.

Composition XII indicated that an 'initial' sequence of flakes removed the outermost cortex parts from the core. Although these 'initial' stages of reduction are missing, this can also be suggested for composition XI and XIII. Refitting shows that a 'first' series of flakes was produced from one and the same striking platform and striking surface (Figure 3.53, composition XI-A flakes 7/210-23, 4/207-2, 2/209-2, 1/220-2, 1/213-17 and 1/212-12; Figure 3.54-A and -B, composition XII flakes 7/207-52, 10/208-55, 9/211-33 and 5/215-4; Figure 3.55, composition XIII flakes 12/208-44 up to 7/210-2, 13/210-4 up to 9/207-18 and 00/202-1; Figure 3.56-1). The negatives of the last flakes in these sequences subsequently created a new striking platform. Next the core was turned 90° and a 'second' sequence of flakes was produced from this newly created striking platform on a 'second' striking surface (Figure 3.53, composition XI-A flakes 1/207-1, 2/211-9 and 8/207-29; Figure 3.54-A and -B, composition XII flakes 14/208-6 up to 10/209-11; Figure 3.55, composition XIII flakes 11/205-2 up to 8/206-37, 11/206-1, 6/204-8 and 1/207-6; Figure 3.56-2). Again the negatives of the last flakes in these sequences created a new striking platform and again the core was turned 90° to produce a 'third' sequence of flakes from the 'first' striking surface (Figure 3.53, composition XI-A flake 2/213-8; Figure 3.54-A and -B, composition XII flake 13/211-8 [+12/207-60], 10/210-82, 9/207-1, 5/210-8, and 5/213-3; Figure 3.55, composition XIII flake 6/206-36; Figure 3.56-3).



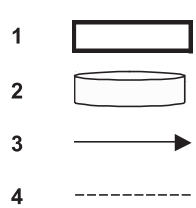
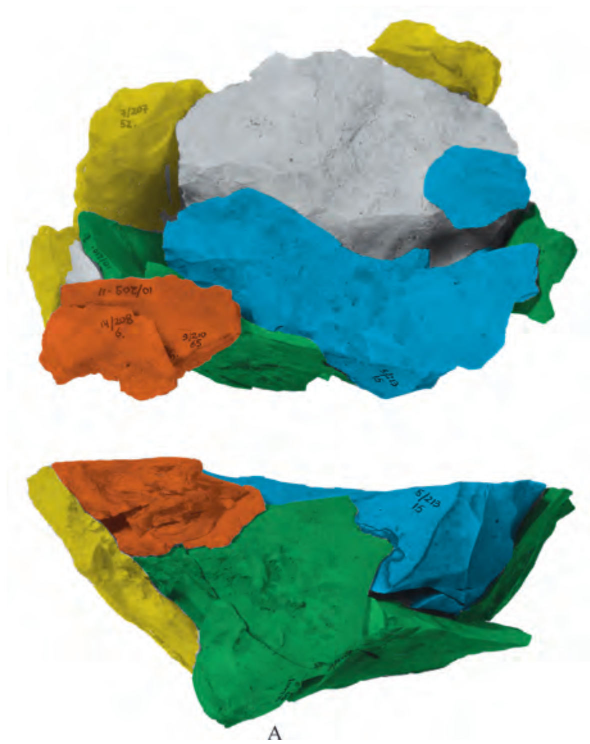
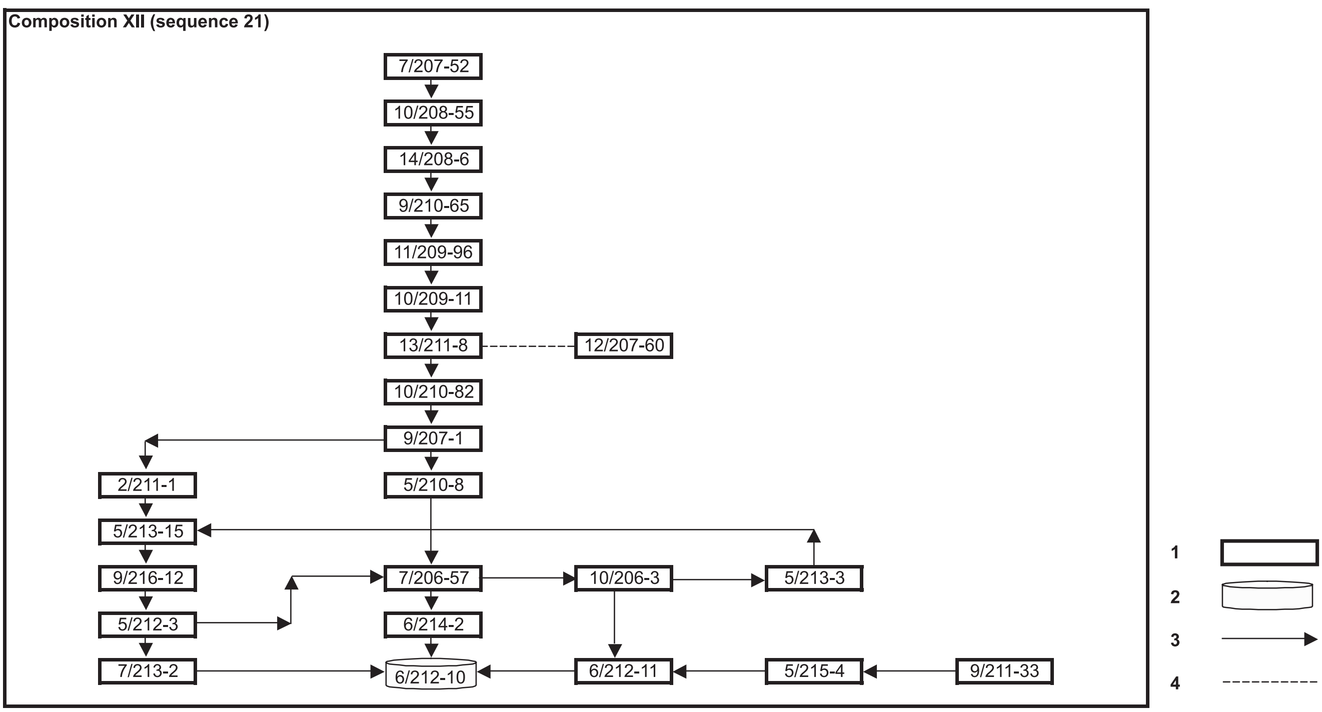


Figure 3.53: Maastricht-Belvédère Site K. Reduction sequences of refitted composition XI. The numbers in these 'Harris-matrixes' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)



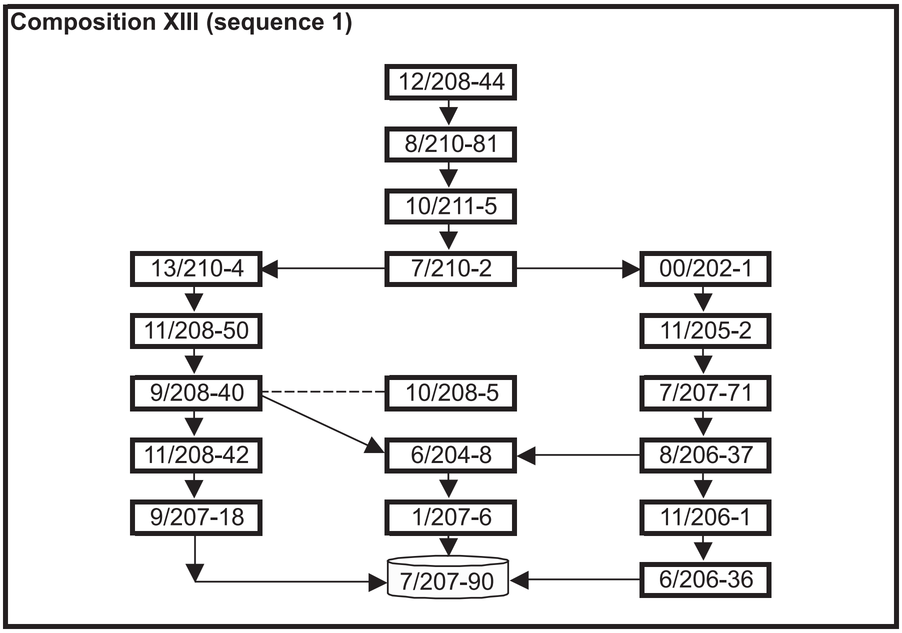
A



B

Figure 3.54: Maastricht-Belvédère Site K. A: Refitted composition XII. Scale 1:2. The colours in this figure refer to the numbers in Figure 3.56 (see also text). B: Primary reduction sequence of refitted composition XII. The numbers in the 'Harris-matrix' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)



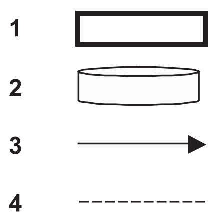


Figure 3.55: Maastricht-Belvédère Site K. Reduction sequences of refitted composition XIII. The numbers in the 'Harris-matrix' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

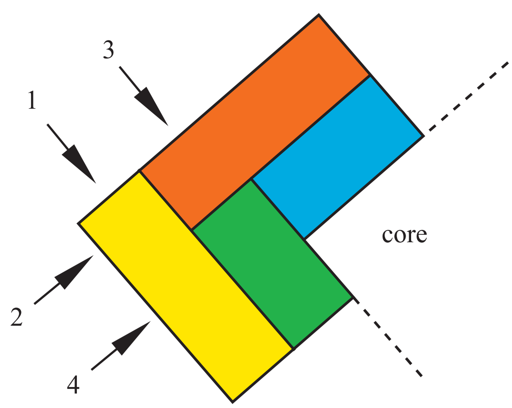


Figure 3.56: Maastricht-Belvédère Site K. Schematic representation of the reduction of refitted compositions XI, XII and XIII. The numbers and colours in this figure refer to the colours in Figure 3.54-A. 1-4: Production of sequences of flakes, using two striking surfaces. The former striking platform becomes the future striking surface and the other way around.

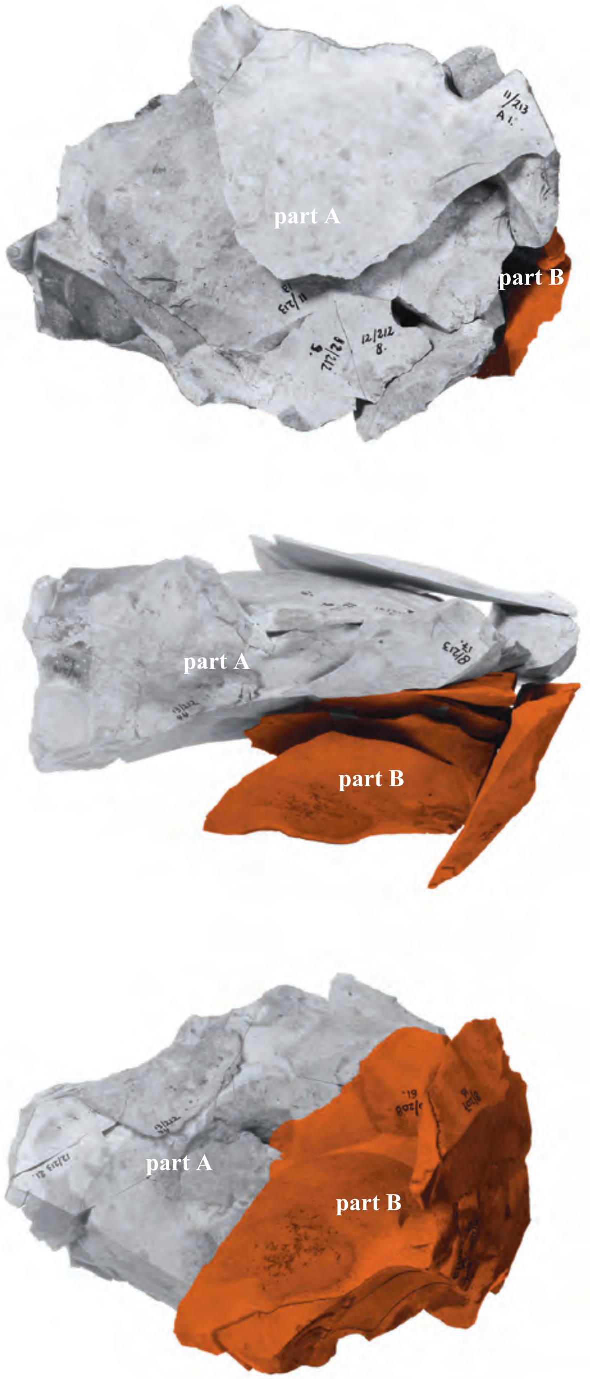


Figure 3.57: Maastricht-Belvédère Site K. Refitted composition XIV, part A and B. Scale 1:2.

According to the refits of composition XII, this core was turned 90° once more to produce a ‘fourth’ sequence of flakes (Figure 3.54-A and -B, composition XII flakes 2/211-1, 5/213-15, 9/216-12, 5/212-3, 7/213-2, 7/206-57, 10/206-3, 6/214-2 and 6/212-11; Figure 3.56-4). As mentioned already before, the production of a flake series from a striking surface was only interrupted, or changed, to another striking surface, to rejuvenate or maintain a good working edge angle. Alternately, the former striking platform becomes the future striking surface and the other way around. Preparation of the striking platform is rather rare for all three cores. The reduction sequences end with the discard of rather voluminous disc and discoidal cores. For composition XI and XIII these cores show some hinge fractures.

3.6.5.13 Refitted composition XIV (Figure 3.57, 3.58)

Conjoined composition XIV consists of 32 artefacts which represent two separately reduced parts or cores (sequences 306 [part A] and 163 [part B]). The two groups are composed of respectively 22 and 10 artefacts and have already been described by Langbroek (1996). Except for one blade-like flake and a chunk (each 3.1%), all artefacts are flakes and pieces of debitage (n= 30 or 93.8%). This composition also has a disc core. Composition XIV has a maximum cross-section of 151 mm and weighs 0.820 kg (1.4% of the total weight of conjoined artefacts).

Most of the flakes have a maximum dimension between 30 mm and 59 mm (n= 17 or 54.8% of all flakes).

Ca. half of all flakes (n= 16 or 51.6%) show cortex remains, while seven show natural fissures (22.6%). Nearly two-thirds of the flakes ≥30 mm are broken (n= 16 or 61.5%). Half of the flakes ≥30 mm have an angle of percussion ≥120°. A plain butt is described on 12 flakes (46.2%), while one flake (3.8%), belonging to part B, has a facetted butt. The *Index Facettage* (IF) and *Index Facettage stricte* (IFs) are respectively 15.4 and 3.8 (*cf.* Bordes 1972:52). Nine flakes of all the pieces in this composition (29.0%) show traces of preparation along the angle between the butt and the dorsal side. In seven cases (22.6%) this was done by facetting/retouching. The data on the dorsal surface (preparation) show that nine flakes ≥30 mm (34.6%) have a ‘parallel’ unidirectional pattern and six flakes (23.1%) have a ‘parallel’ + lateral unidirectional pattern. Four flakes (15.4%) have a convergent unidirectional or a centripetal/radial dorsal pattern. The latter four flakes belong to part B. More typo-/technological information on the composition XIV flakes is given in Tables 3.15 and 3.16.

Like many other compositions, nodule XIV (Figure 3.57) indicates that a large flint nodule entered the excavated area, without any or hardly any decortication. Within the excavated area the raw material nodule was split, into at least two

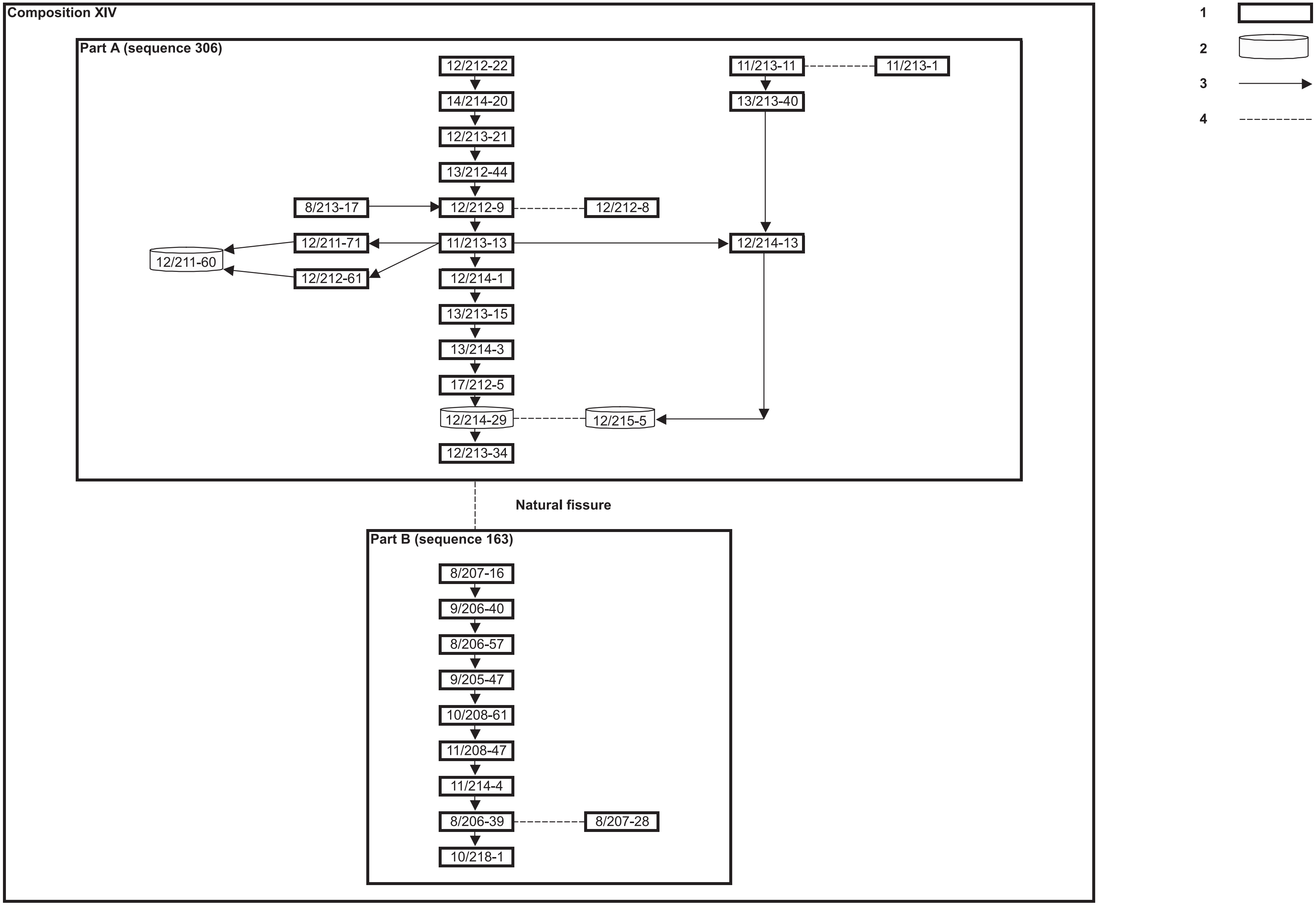


Figure 3.58: Maastricht-Belvédère Site K. Reduction sequence of refitted composition XIV: the numbers in these ‘Harris-matrixes’ refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

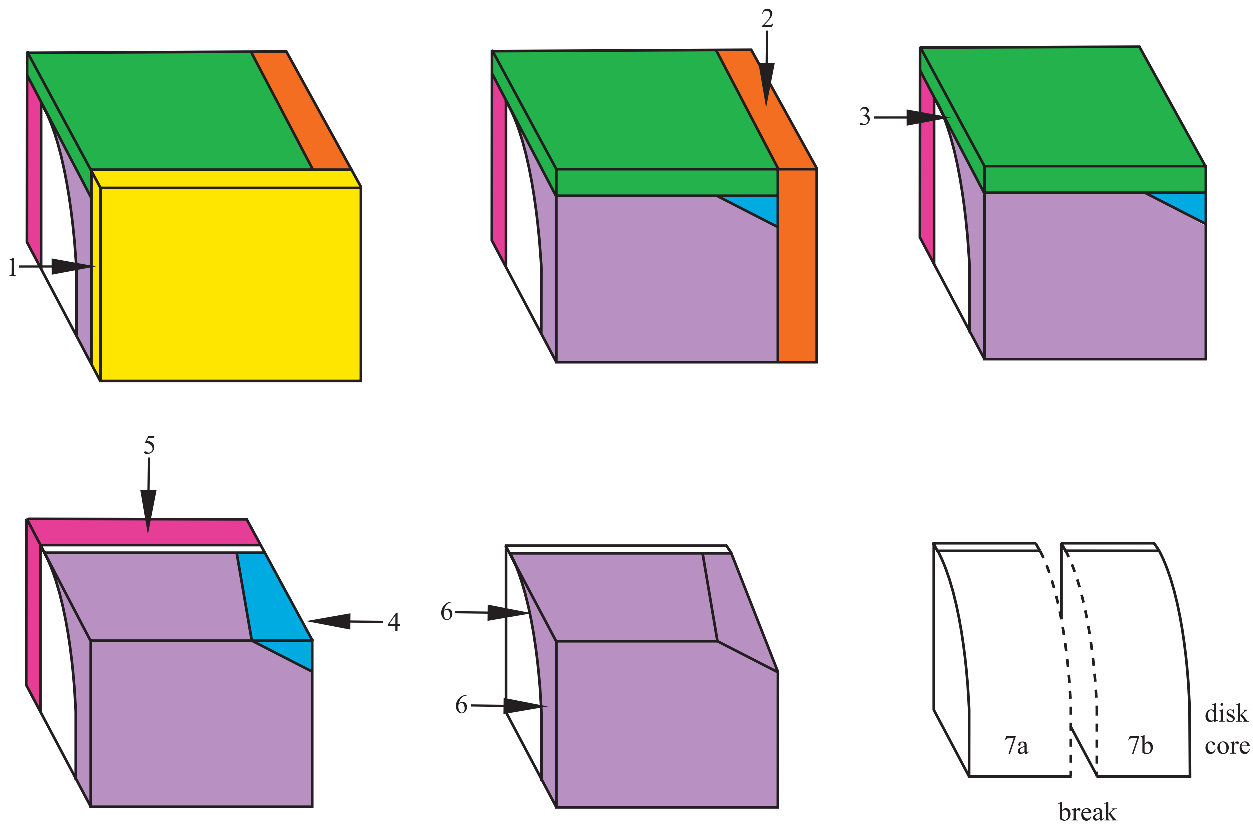
smaller blocks, by following natural fissures and fossil inclusions. Positive proof for this assumption are the flakes with natural crack dorsal surfaces and/or butts which fit dorsal/dorsal or butts onto dorsal surfaces. Subsequently, these smaller parts were used as cores. For the reduction scheme of both cores the reader is referred to Figure 3.58 and the following text.

Refitted composition XIV, part A (Figures 3.58, 3.59)
The core reduction of part A 'started' with a series of at least four cortex and natural fissure covered flakes. They probably represent an initial rough shaping of the nucleus (Figure 3.58, part A, flakes 12/212-22 up to 13/212-44; Figure 3.59-A-1). From another side of the core a 'second' series of flakes was produced at right angles to the first one. The future 'main' striking surface now becomes the striking platform (Figure 3.58, part A, flake 8/213-7; Figure 3.59-A-2). Next, the core was probably turned to the 'first' striking platform and at least one large flake was produced from the 'main' striking surface (Figure 3.58, part A, flake 11/213-11 [+11/213-1]; Figure 3.59-A-3). Subsequently, the core was turned 180° and a 'fourth' series of flakes was produced from the same striking surface. The striking platform is now again situated at the opposite side of the core (Figure 3.58, part A, numbers 12/212-9 [+12/212-8] and 12/214-13; Figure 3.59-A-4). A 'fifth' series of flakes was produced, using the 'major' striking surface as striking platform. This sequence is situated at the other side of the core, facing the 'first' flake series (Figure 3.58, part A, flake 13/213-40; Figure 3.59-A-5). No hierarchical placing is possible between the 'fourth' and 'fifth' sequence of flakes. Therefore, the 'fifth' sequence could have been produced before the 'fourth'. Eventually, the core was turned again to the same striking platform which produced the 'first' and 'third' sequences, and a 'sixth' series of flakes was, amongst others, produced from the 'main' striking platform (Figure 3.58, part A, flakes 11/213-13 and 12/214-1 up to 17/212-5; Figure 3.59-A-6). The first flake (number 11/213-13) in this 'last' sequence revealed a large fossil of a sea urchin, which negatively influenced future knapping. Ultimately, and probably due to the production of flake 17/212-5, the core broke on this sea urchin into at least two smaller parts (Figure 3.59 part A-7a and A-7b). The flake scars on part 7a show that this piece of the broken core was further reduced by the removal of rather small flakes. Probably the reduction went on until part 7a broke anew (Figure 3.58, part A, numbers 12/213-34, 12/214-29 and 12/215-5). The smaller 7b part was also further reduced, as can be reconstructed from the conjoined elements, and resulted in the discard of a very small disc core (Figure 3.58, part A, numbers 12/211-71, 12/212-61 and 12/211-60).

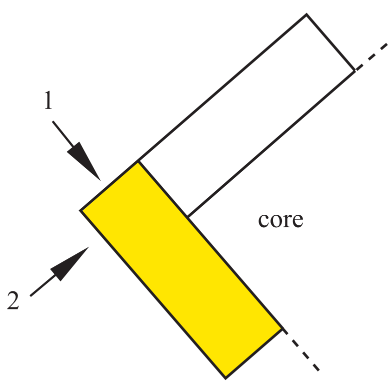
Refitted composition XIV, part B (Figures 3.58, 3.59)
Part B (sequence 163) is only represented by 10 large conjoined flakes. These flakes represent an initial stage of a much larger/longer sequence of reduction. The outermost parts of this composition show natural fissure and cortex remains. In a 'first' stage of reduction, a natural fissure covered side of the core was reduced by the removal of at least three flakes. The used striking platform, working edge angle and striking surface originated from the initial splitting of the nodule. No modifications were made to the striking platform (Figure 3.58, part B, flakes 8/207-16 up to 8/206-57; Figure 3.59-B-1). The negatives of the last flakes in this sequence subsequently created a new striking platform. Next the core was turned 90° and a 'second' sequence of at least six flakes was produced from the newly created striking platform, on a second and main striking surface (Figure 3.58, part B, numbers 9/205-47 up to 10/218-1; Figure 3.59-B-2). A further reconstruction of the followed reduction was not possible.

3.6.5.14 Refitted composition XV (Figure 3.60)
Refitted composition XV (sequences 38) has a maximum cross-section of 190 mm and weighs 1.943 kg (3.2% of the total weight of conjoined artefacts). This composition consists of 37 artefacts and represents one of the most complete conjoined nodules at Site K. Except for two blade-like flakes (5.4%) and four core trimming flakes (10.8%), all artefacts are flakes, pieces of debitage and a double platformed opposed core (n= 31 or 83.8%). Flakes with a maximum dimension between 30 mm and 59 mm dominate (n= 16 or 44.4% of all flakes). Of all flakes, 75.0% (n= 27) show cortex remains, while 14 flakes show natural fissure remains (38.9%). More than half of the flakes ≥30 mm are broken (n= 17 or 54.8%). In most cases the distal or lateral part is missing. An angle of percussion ≥130° is described on 15 (48.4%) flakes ≥30 mm. A plain butt is also described on 15 flakes ≥30 mm, while eight flakes have a dihedral butt (25.8%). The *Index Facettage* (IF) is 25.8 and the *Index Facettage stricte* (IFs) is 0 (*cf.* Bordes 1972:52). About one fourth of all flakes show traces of preparation along the angle between the butt and the dorsal side (n= 9 or 25.0%). The data on the dorsal surface (preparation) show that seven flakes ≥30 mm (22.6%) have a cortex dorsal pattern, while four pieces have a natural fissure pattern (12.9%). A 'parallel' unidirectional and a 'parallel' + lateral unidirectional dorsal pattern are respectively represented by five (16.1%) and six (19.4%) artefacts. Three flakes (9.7%) have a centripetal or radial dorsal pattern.

The large amount of cortex and natural fissure surfaces indicate that a flint nodule XV (Figure 3.60) entered the excavated area without any, or hardly any, preparation and/or decortication. At Site K this raw material nodule was initially



A



B

Figure 3.59: Maastricht-Belvédère Site K. A: Schematic representation of the reduction of refitted composition XIV, part A. 1: Sequence of cortex and natural fissure flakes. 2: ‘Second’ series of flakes, produced at right angles to the ‘first’. The ‘major’ striking surface becomes the striking platform. 3: ‘Third’ sequence of flakes, knapped from the ‘first’ striking platform and the ‘main’ striking surface 4: ‘Fourth’ series of flakes, produced from the ‘main’ striking surface. The striking platform is now situated at the opposite side of the core. 5: ‘Fifth’ series of flakes, using the ‘major’ striking surface as striking platform and facing the ‘first’ series of artefacts. 6: ‘Sixth’ series of flakes, produced from amongst others the ‘main’ striking platform. 7a and 7b: Broken parts of a core, which were further reduced.
B: Schematic representation of the reduction of refitted composition XIV, part B. 1: Sequence of cortex and natural fissure flakes. They created a new striking platform for further reduction. 2: Production of a sequence of flakes, using the newly created striking platform and another striking surface.

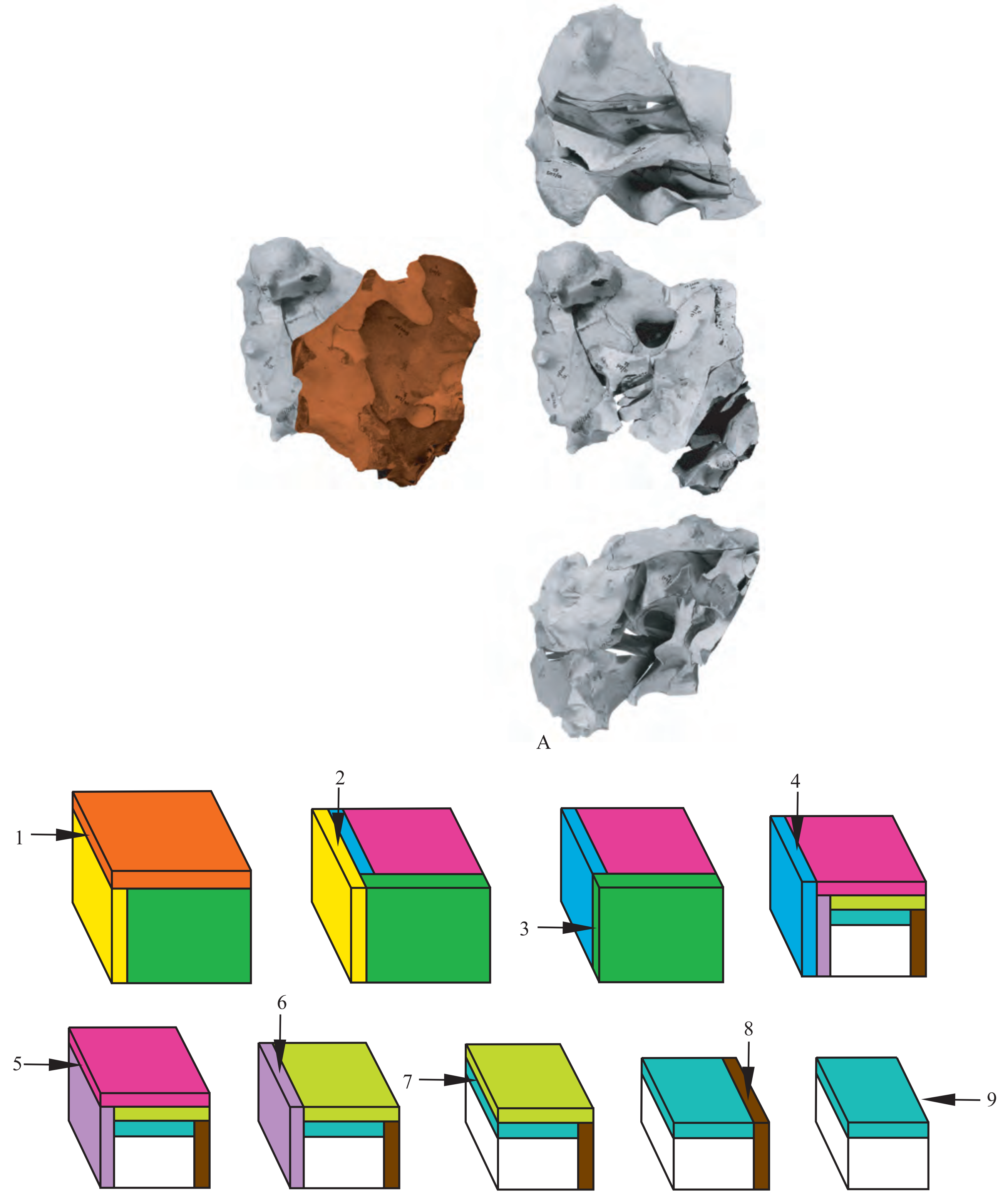


Figure 3.60: Maastricht-Belvédère Site K. A: Refitted composition XV. Scale 1:3. B: Schematic representation of the reduction of refitted composition XV. 1: Sequence of larger cortex and natural fissure flakes. They created a new striking platform. 2: 'Second' sequence of cortex and natural fissure flakes. 3: sequence of flakes from a 'third' striking surface. 4 to 7: Series of flakes, alternately flaked from the first two striking platforms and striking surfaces. 8: Series of decortication flakes, produced from a striking platform (core edge), facing the one previously used. 9: Final sequence of flakes, produced from the striking surface used for the 'first' flake series.

flattened out to remove all protruding parts which could negatively influence future flaking (Figure 3.61, numbers 13/207-8, 12/208-32, 10/209-61 and 12/208-35). Subsequently, one side of the core (the future 'main' striking surface) was 'decorticated', by the removal of several large and thick flakes (Figure 3.61, numbers 14/210-9 [+13/206-45] up to 11/214-1; Figure 3.60-A-1, -B-1). The negatives of the last flakes created a new striking platform. Subsequently, the core was turned 90° and a 'second' sequence of cortex and natural fissure covered flakes was produced from this newly created striking platform (Figure 3.61, numbers 10/207-2 [+9/209-17] up to 12/207-8; Figure 3.60-B-2). Next, the core was again turned 90° to the 'first' striking platform and a 'third' series of flakes was produced from a 'third' striking surface (Figure 3.61, flake 13/208-4; Figure 3.60-B-3). The 'fourth' (Figure 3.61, flakes 11/207-19 up to 12/207-9; Figure 3.60-B-4), 'fifth' (Figure 3.61, flakes 12/205-32, 11/207-18 and 12/206-10; Figure 3.60-B-5), 'sixth' (Figure 3.61, number 12/205-22; Figure 3.60-B-6) and 'seventh' sequence of flakes (Figure 3.61, numbers 13/207-45 and 13/209-4; Figure 3.60-B-7) were alternately flaked from the first two striking platforms and striking surfaces. Probably the production of series of flakes was only interrupted to rejuvenate or maintain a good working edge angle. After that, the core was turned 180° and a new series of decortication flakes was produced from a striking platform and core edge facing the one previously used . The 'major' striking surface is again used as striking platform (Figure 3.61, numbers 12/207-13 and 11/206-22; Figure 3.60-B-8). Once again the core was turned 90° and a final sequence of flakes was produced from the 'main' striking surface. Once more the former striking platform becomes the future striking surface (Figure 3.61, numbers 12/206-11 and 12/205-16; Figure 3.60-B-9).

3.6.5.15 Refitted compositions XVI and XVII

To end this section, two smaller compositions will be presented. In both cases at least one tool is present. As these conjoined groups consist only of few artefacts, and especially pieces <30 mm, only a limited typo/technological description is given in Tables 3.15 and 3.16.

Refitted composition XVI (Figures 3.62, 3.63)

Composition XVI (sequences 126; De Loecker 1992, 1994*a*) consists of 11 artefacts and represents a large flake which was selected for secondary reduction (Figure 3.62; Figure 3.63-A, *cf.* Ashton *et al.* 1992). Except for one typical burin and a notched piece (18.2%), all artefacts are flakes and pieces of debitage (n= 9 or 81.8%). The complete composition has a maximum dimension of 94 mm and weighs 0.084 kg (0.1% of the total weight of conjoined artefacts).

According to the flint type determination the large flake can be classified as 'exotic', meaning 'not belonging to' the rest of the Site K flint assemblage. Moreover, no other primary flake could be refitted to this artefact. This could mean that a large flake (flaked-flake), produced elsewhere, entered the excavated area, where it was further reduced. Moreover, its distal part was probably already missing before the flake entered Site K. This plane (distal) surface was initially selected as future striking platform and subsequently the 'core' edge, at the former ventral side of the flaked-flake, was prepared by retouching. Next, two flakes were produced from this striking platform (Figure 3.62; Figure 3.63-A). Roughly stated, both flakes can be interpreted as large burin spalls. One of these artefacts was discarded immediately, while the other one was further reduced into a tool (Figure 3.62, numbers 4/206-21 and 1/206-31). According to refitting and flake scars, both the distal and proximal ends were transformed into a notched piece (Appendix 9, Figure 9.17-1).

The remaining part ('core'), from which the two flakes were struck, was also transformed into a tool (Figure 3.63-A and -B). A first series of at least five burin spalls was flaked from the lateral side of the artefact (Figure 3.62, numbers 4/208-10, 2/205-67, 2/206-3 and 1/205-13; Figure 3.63-B-1). Next, the artefact was turned 90° and 'second' series of at least five burin spalls was produced on the other lateral side, using the scars of the previous flakes as striking platform (Figure 3.62, numbers 1/206-3 and 3/205-69 [+ 4/207-35]; Figure 3.63-B-2). This reduction transformed the artefact into a typical burin (3/205-49), which was eventually discarded at the area of production (Appendix 9, Figure 9.20).

Refitted composition XVII (Figures 3.64, 3.65)

Composition XVII (sequences 22) represents the final stages of a much longer sequence. In total this refitted composition consists of 14 artefacts and weighs 0.294 kg (0.5% of the total weight of conjoined artefacts). The complete composition has a maximum dimension of 118 mm. Except for a convex transverse side-scraper and a disc core (each 7.1%), all artefacts are flakes and pieces of debitage (n= 12 or 85.7%).

According to the cortex and natural fissure surfaces on the outermost sides of this composition, a rather small and flat flint nodule was selected for reduction. Although there is no proof, it is possible that this nodule belongs to a much larger block of flint which was initially split. Likely, the core-reduction 'started' with a series of large, cortex and natural fissure covered, flakes. They represent the outermost part of this composition (Figure 3.64, numbers 8/207-23 and 10/206-6; Figure 3.65-A-1, -B-1). The negatives of the last flakes in this sequence created a new striking platform. Subsequently, the core was turned 90° and a 'second' sequence of large, cortex and natural fissure covered, flakes was produced from

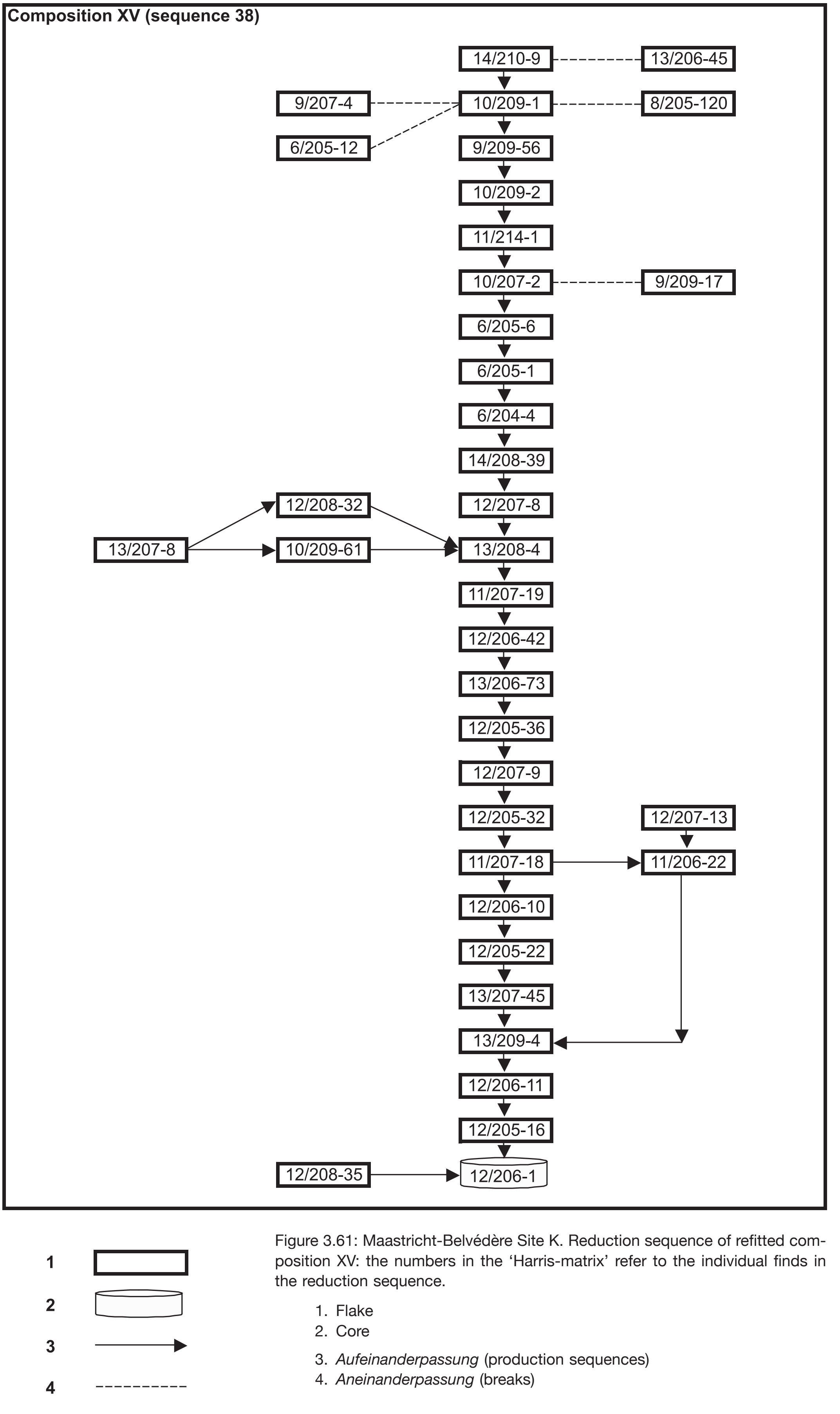


Figure 3.61: Maastricht-Belvédère Site K. Reduction sequence of refitted composition XV: the numbers in the 'Harris-matrix' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

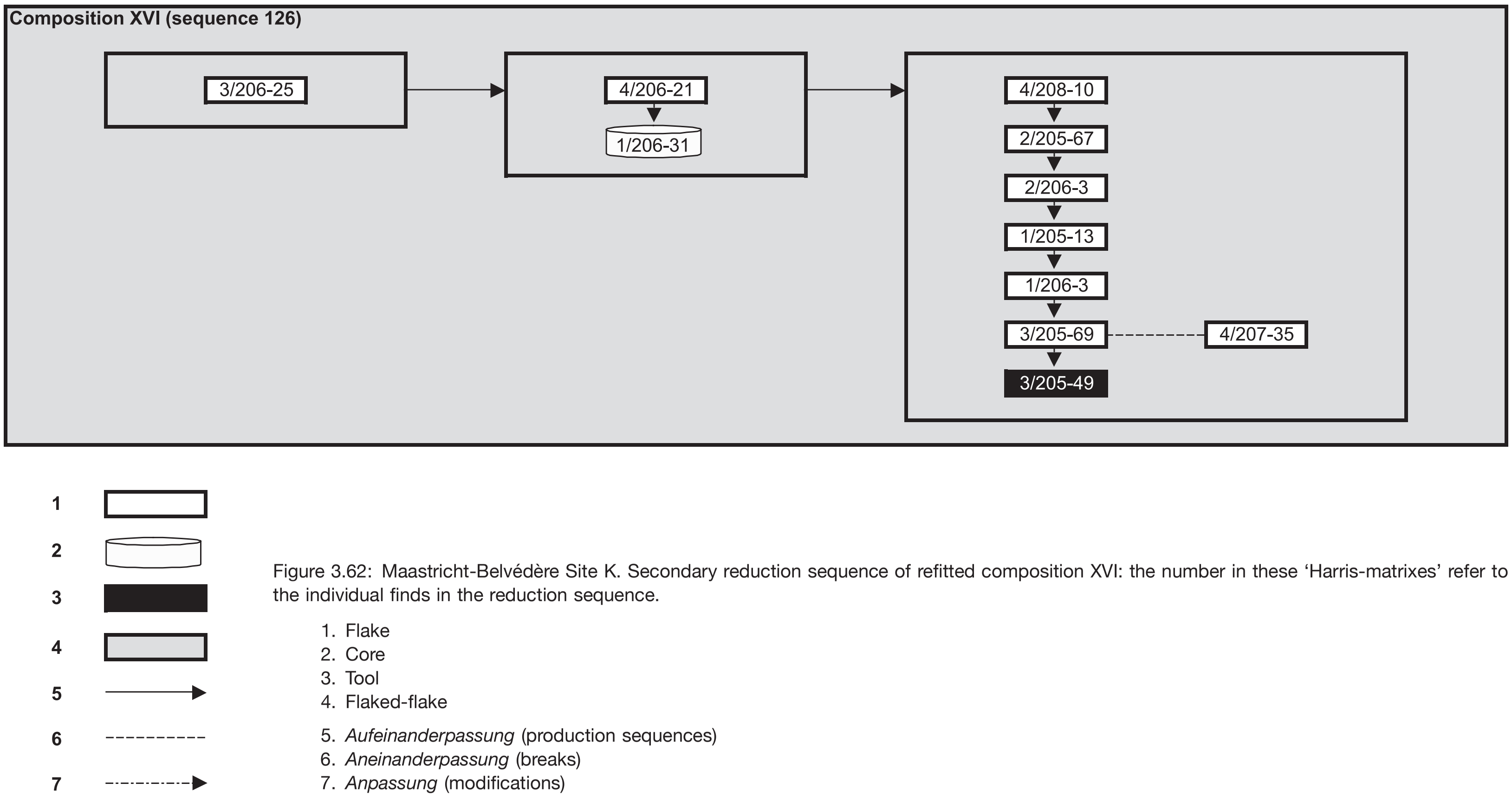


Figure 3.62: Maastricht-Belvédère Site K. Secondary reduction sequence of refitted composition XVI: the number in these 'Harris-matrixes' refer to the individual finds in the reduction sequence.

1. Flake
2. Core
3. Tool
4. Flaked-flake

5. *Aufeinanderpassung* (production sequences)
6. *Aneinanderpassung* (breaks)
7. *Anpassung* (modifications)

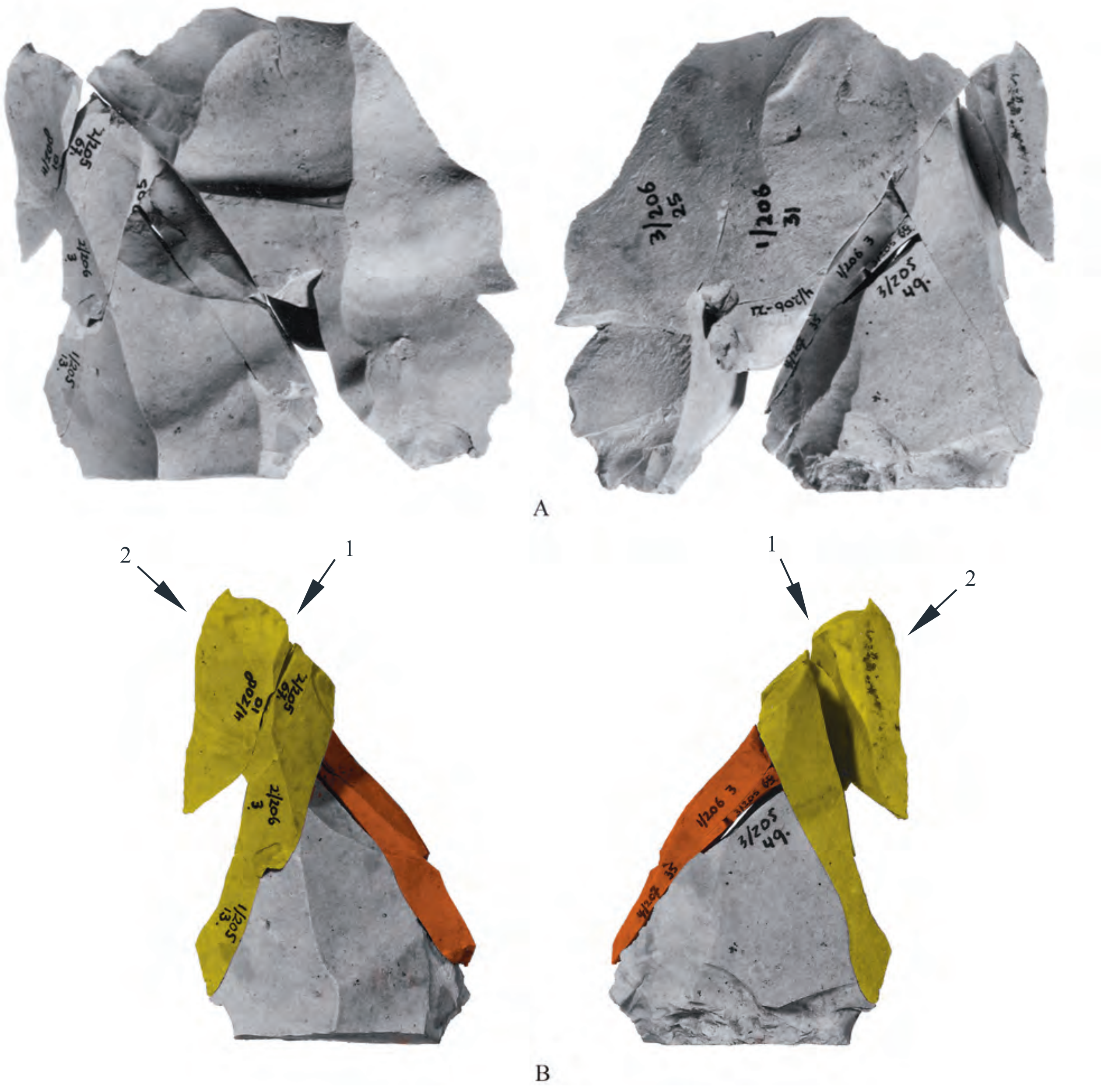


Figure 3.63: Maastricht-Belvédère Site K. A: Refitted composition XVI. Scale 1:1. B: Burin production from a refitted (composition XVI) flake. 1: Sequence of burin spalls, flaked from a lateral side of the artefact. 2: 'Second' series of burin spalls, produced from the other lateral side, using the scars of the previous flakes as striking platform.

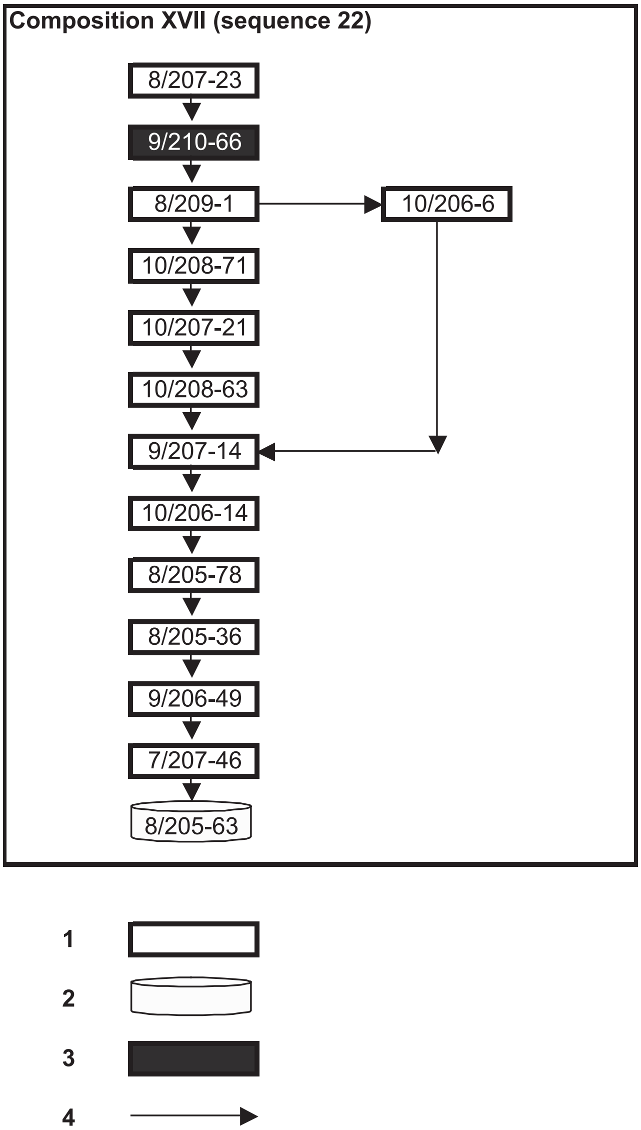


Figure 3.64: Maastricht-Belvédère Site K. Primary reduction sequence of refitted composition XVII: the numbers in the 'Harris-matrix' refer to the individual finds in the reduction sequence

1. Flake
2. Core
3. Tool

4. *Aufeinanderpassung* (production sequences)

this new platform on a 'main' striking surface (Figure 3.64, numbers 9/210-66 and 8/209-1; Figure 3.65-A-2, -B-2). One of these flakes was selected and 'secondarily' retouched into a convex transverse side-scraper. Next, the core was again turned 90° to the 'first' striking platform and a new series of smaller flakes was produced (Figure 3.64, numbers 10/208-71, 10/207-21 and 10/208-63; Figure 3.65-A-3, -B-3). After that the core was yet again turned 90° and some more flakes were produced from the 'main' striking surface. These flakes were mainly struck from two opposite situated sides of the core. This stage of reduction could only be reconstructed on the basis of flake scars (Figure 3.65-B-4). The core was turned 90° a 'fourth' time (the main striking surface becomes the striking platform) and a 'fifth' series of smaller flakes was produced at right angles to the first three sequences (Figure 3.64, number 9/207-14 Figure 3.65-A-5, -B-5). Again the core was turned (90°) and a 'sixth' series of larger flakes was struck from the previously mentioned two opposite sides of the 'main' striking surface (Figure 3.64, numbers 10/206-14 and 8/205-78; Figure 3.65-A-6, -B-6). Once more the core was turned 90° and a series of flakes was produced from a core edge opposite to sequence 'five' (Figure 3.64, numbers 8/205-36 and 9/206-49; Figure 3.65-A-7, -B-7). Subsequently, a final flake was produced from the 'main' striking surface, using the scars of the previous flakes as striking platform. This flake was, however, overstruck (*outrepassé*) and ended the core reduction (Figure 3.64, number 7/207-46; Figure 3.65-A-8, -B-8).

3.7 Typo-/technological interpretation of the Site K lithic assemblage

3.7.1 Introduction

This section gives a short review and interpretation of the technology and typology of the lithic assemblage at Site K. It has to be stressed that statements on core-reduction are partly based on the morphological and technological (qualitative and quantitative) characteristics of the flakes, cores and tools. Apart from the previously discussed lithic analysis (Section 3.5), technological inferences are mainly based on the elaborate conjoining study (Section 3.6). The spatial aspects of the used technology will be dealt with in detail in Section 3.9.

The large amount of chips, flakes and cores recovered close to each other point clearly to a locus of on-site knapping/core-reduction activities. Further positive proof of this assumption is given by the large amount of conjoined artefacts (both large and small) together with the rather short refit distances. Moreover, two flint hammerstones were identified. The largest of these, which can also be interpreted as an anvil, was part of a refitted group (see refitted composition VI, Section 3.6.5.7).

A

B

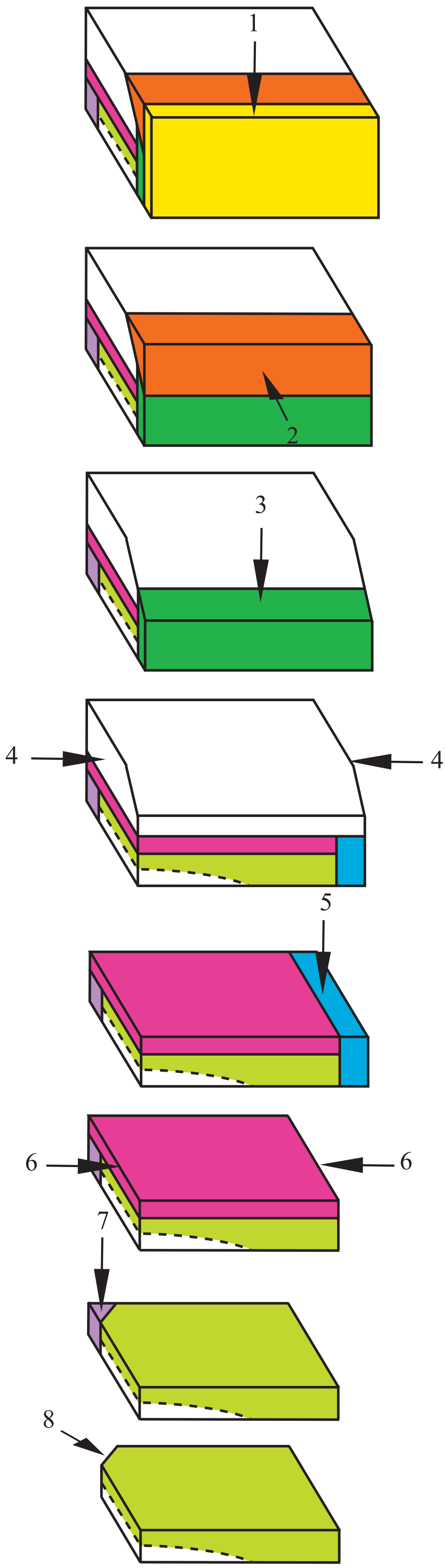


Figure 3.65: Maastricht-Belvédère Site K. A: Refitted composition XVII. Scale 1:2. B: Schematic representations of the reduction of refitted composition XVII. 1: Sequence of larger, cortex and natural fissure covered, flakes. They created a new striking platform for further reduction. 2: 'Second' sequence of larger, cortex and natural fissure covered, flakes. 3, 5, 7: Series of flakes, struck from different sides of the core and using the 'main' striking surface as striking platform. 4, 6: Production of sequences of flakes from the 'main' striking surface. Two opposite sides of the core are used as striking platform. 8: Final and overstruck flake (*outrepassé*) which ruined the core.

The large butts, well-pronounced points of impact, well-developed bulbs of percussion, deep dorsal scars and the presence of many split cone breakages indicate that flakes were mainly produced by hard-hammer flaking. This assumption is again supported by the presence of the flint hammer-stones.

3.7.2 From the supply of raw materials to the production of cores and flakes

As mentioned in Section 3.5.2, the abraded cortex on the majority of the artefacts and the large dimensions of the conjoined nodules indicate that the used raw material was probably collected in nearby river deposits. Within a radius of at least 100 to 200 metre around Site K, no raw material source, *i.e.* river or exposed gravel beds, were present though (Vandenberghe *et al.* 1993). This implies that the many large and 'heavy' nodules (at least 97.8 kg in total) were transported to the Site K activity locus, from a minimum distance of 100 to 200 metre. Moreover, the conjoined reduction sequences, together with the high percentages of cortex on both cores and flakes, indicate that flint nodules were introduced at the excavated area without any, or hardly any, preparation or decortication. The majority of the refitted groups described in Section 3.6.5 also show that at Site K the large, cortex-covered raw material blocks were initially flattened out to remove all protruding parts. This rough shaping of the nodule (pre-core) was done by the removal of several large and thick flakes (for example refitted composition I, Section 3.6.5.2).

Refitting, furthermore, shows that a number of cores is made on large, and rather thick flakes (for example refitted composition V and X, respectively Sections 3.6.5.6 and 3.6.5.11). In view of their sizes, the high percentage of cortex and especially the refitting results, it is assumed that these flakes are the products of the first stages of core-reduction. We are dealing here with a strategy in which the raw material, after a rough shaping, was 'primarily' divided into large and thick flakes which were used as cores (flaked-flakes, *cf.* Ashton *et al.* 1992). Besides flaking, also natural fissures (interpreted as frost cracks) and fossil inclusions, along which nodules broke during flint knapping, played a major part in the initial splitting of the raw material: several flakes with natural fissure dorsal surfaces could be conjoined with their striking platform onto other striking platforms, with the dorsal sides to the butts and with the dorsal side to the core (for example refitted compositions I to IV [Section 3.6.5.5]). These natural fissures initially simplified the splitting of the nodules but sometimes, due to these fissures and/or fossil inclusions, problems occurred during further core reduction. Therefore the flint knapper(s) was/were forced to adapt the knapping strategy, in an *ad hoc* way, responding to the opportunities provided and imposed by the quality of the raw material (for example refitted composition VIII and XIV, respectively Sections 3.6.5.9 and 3.6.5.13). It can also be suggested that some of the voluminous cores were discarded in an 'early' stage of reduction due to the presence of these natural 'errors' or flaws. The natural fissures and large fossil inclusions could also indicate an nonselective choice of the raw material, or a lack of 'high' (better) quality raw material, or it could mean that the early humans simply did not require 'better' quality flint. Furthermore, it suggests the absence of testing the nodules before they entered the excavated area. An nonselective choice of raw material is also reflected by the refitted composition shown in Figure 3.66. From this heavily abraded small cobble, which contained a number of internal frost fissures, at least two flakes were produced from one and the same striking platform. This conjoined group could also indicate that there was no particular preference for large nodules.

Figure 3.66: Maastricht-Belvédère Site K. Heavily abraded flint cobble, which contained a number of internal frost fissures and from which at least two flakes were produced. Scale 1:2.

The strategy of dividing raw material up into smaller and more manageable blocks was followed again by a rough shaping of the cores (smaller parts). Yet again, some of these 'larger' flakes were 'secondarily' used as cores (flaked-flakes, see for example refitted composition I, part F and VII [Section 3.6.5.8]).

After eliminating the irregularities, generally, uninterrupted series of flakes were produced (up to 15 conjoined pieces for composition II, part F [Section 3.6.5.3]). The dorsal scars and refitting data show that most of these flake sequences were struck from one and the same striking platform and striking surface and more or less in the same direction. Traces of preparation on the butt, by means of retouching or facetting, are rarely present on the flakes. Mainly flake scars of earlier stages in the reduction process are used as striking platform. Most of the flakes with retouched or facetted butts have a maximum dimension ≥50 mm. This minimal preparation of the cores is also shown by the rarity of preparation at the angle between the butt (striking platform) and the dorsal surface of the flakes. The dorsal surface preparation shows that only a few flakes have a centripetal or radial pattern. A 'parallel' unidirectional pattern prevails. This again suggests a 'minimal preparation' reduction-strategy. However, when flakes are larger, they in general show a more complex dorsal surface and/or are more prepared in a centripetal or radial way. Altogether the data on the butts, the preparation at the angle between the butt and the dorsal face, the dorsal pattern and the number of scars suggest a reduction-strategy with minimal attention for core preparation. Most of the 'well' prepared flakes are pieces ≥50 mm. According to the lithic analysis most of the produced flakes have a more or less comparable length and width. However a slight change is noticed, around the 60 mm boundary, from flakes wider than long to flakes longer than wide. Compared to other Maastricht-Belvédère findspots (see Chapter 4), the Site K assemblage is characterized by rather large dimensions and 'few' but large dorsal negatives on flakes (and cores). The large quantity of small-sized flakes probably constitutes for a large part the remnants of the flaking debris, striking platform 'preparation' and the maintenance of good angles between the striking surface and the working surface of the cores.

Following the rough shaping of the smaller blocks, the cores were probably scanned for suitable striking surfaces, striking platforms and good flaking edge angles. In most cases the natural flaws, which show up by the initial splitting, were chosen as striking surface or platform. As mentioned before, series of flakes were in general produced from one and the same striking platform and striking surface and without any kind of preparation. The scars of the last flakes in these sequences created a new striking platform and a 'good' flaking edge angle for future reduction. Subsequently, the core was twisted 90° to start a new sequence of flakes from the newly created striking platform on a 'second' striking surface. A general technological characteristic at Site K is therefore that throughout the whole core-reduction the former striking platform becomes the future striking surface and the other way around.

For some cores though the emphasis was on one major striking surface. After the production of a sequence of flakes, the core was turned 180° to a new striking platform which was at the opposite side (or at right angles) of the former one. Subsequently, a new sequence of flakes was produced from the same striking surface. In some cases this main striking surface was alternately used from two sides (for example refitted composition I [part B and C] and II [part F]).

In other cases the whole core edge was used to remove radially orientated flakes in a circular direction (mostly anticlock wise) from one and the same striking surface (for example refitted composition I [part F], II [part E] and III [part A]). It can be suggested here, that the complete core-reduction was focused on one main striking surface.

Other refitted groups show that, after a series of flakes was removed, the core was turned and a complete new striking platform and striking surface was used for further flaking (for example refitted composition I [part E] and VI).

In general the continuous flake production was made possible through an emphasis on a constant turning and twisting of the core, and the reduction was not aimed at the production of specific 'predetermined' flakes (*cf.* Levallois, see below). Furthermore, the production of a series of flakes from a striking surface was only interrupted, or better changed to another striking surface, to rejuvenate or maintain a good working edge angle. In a sense this could mean that the same striking surface and striking platform of a core was used for the production of flakes for as long as possible. The angles of percussion measured on the flakes indicate that the angle along the working edge of the cores was for the greater part ≤70° and often even ≤50°. As most of the Site K cores have disc or discoidal forms, which were flaked in a more or less centripetal way and the working edges of which were created by 'alternated' flaking on two striking surfaces, it is to be expected that most of the flakes have a large angle of percussion, or better that the cores have a small working edge angle. By reducing the cores 'bifacially', small working edge angles are created and maintained.

Eventually most of the core reduction resulted in the production of a large group of flakes, of which some were again selected for 'secondary' knapping, tool production and use (for example refitted composition VIII and XVI [Section 3.6.5.15). The flake/core ratio indicates that on average 117 flakes and chips were produced per core. For flakes ≥30 mm the figure is about 32. It is worth mentioning that mainly disc and (high backed) discoidal cores were discarded. The size distribution of these cores demonstrates, however, that rather large and thick cores were discarded at Site K. Moreover, the high percentage of cortex shows that not all surfaces of the cores were reduced or exploited. Most of the cores show, beside the earlier mentioned 'natural' imperfections, also a large number of 'reparable' flaking errors. Of all cores 85.7% shows hinge negatives, steps, 'face battering' and/or 'stacked steps' (*cf*. Shelley 1990). Therefore the assumption can be made that a large part of the nuclei was discarded due to a combination of flaking errors and 'low' quality raw material. Possibly after facing flaking errors the cores could have been scanned for potential repairing options. As a consequence nuclei with numerous 'natural' imperfections would have been discarded more easily, while 'good' raw material cores were 'repaired' and further reduced. In this scenario the decision to repair or to discard the core is directed by the quality of the raw material. The many core trimming elements and, for example, refitted composition IV (part C, Section 3.6.5.5) show that cores were indeed repaired, while refitted composition XIV (part A) indicates that some of cores were rejected due to 'natural' imperfections in the flint. Altogether, these factors could be an explanation for the 'early' discard of some of the voluminous cores at Site K and could explain why the raw material was treated in a less economical way than for example at Site C (see Chapter 4).

3.7.3 A typical disc/discoidal core-reduction and the presence of some Levallois flakes

The high percentage of disc and discoidal cores is the result of a continuous, sometimes radial, removal of flakes. For disc cores one main striking surface is exploited, with 'minimal' preparation on a 'second' one, while for discoidal cores two striking surfaces are exploited. As mentioned before refitting showed that the 'first' flake is at the same time the dorsal preparation (or butt 'preparation') for the 'second' one, the 'second' for the 'third', etc. This manner of core-reduction resembles *le débitage discoïde* as described by Boëda (1993).

Boëda has pointed out that a discoidal technology is a production sequence in which a continuous series of flakes is produced. The flakes are knapped towards the centre of the core and one or two working surfaces of the core are used in the production. In general he distinguishes two main stages in the reduction sequence: an initial flaking stage or a rough shaping of the core (this could also be the recycling of a Levallois core) and an exploitation stage. In his definition of a discoidal core-reduction, Boëda gives six technological criteria which interact (Boëda 1993:393-395). In short he emphasizes that changing the function of the working surfaces, which is a specific characteristic of discoidal cores, is not obligatory and can be executed at every moment. Keeping the convexity of one or both striking surfaces is seen by Boëda as one of the main targets in the discoidal reduction strategy. He stresses also that the angle of percussion secures the mode of knapping plus its products and therefore also the convexity of the core. Hence, discoidal cores show a 'conical' or 'biconical' silhouette. According to these criteria, several optimal 'recurrent' discoidal methods are distinguished which allow variations in qualitative and quantitative aspects of future flakes. The convexity of the core controls the flaking and therefore (almost) no preparation is required to produce a number of flakes (*cf*. Levallois *récurrent sensu* Boëda [1986]). A discoidal reduction strategy is marked by a sort of 'self-acting' preparation. Different discoidal strategies are distinguished by the number of produced flakes on each working surface (one or more) as well as by the number of used working surfaces. When applying Boëda's definitions it appears that disc and discoidal cores are the products of one and the same reduction strategy in which variation occurs. Three main variations are distinguished.

First of all there is a '**unifacial' disc(oidal) approach** in which each working surface keeps its function throughout the whole reduction sequence. One working surface is used as striking platform and one as striking surface (Figure 3.67-I).

Secondly an **interchanging bifacial discoidal approach** can be recognized. Here the function of the two working surfaces can be changed at any time within the sequence. The reduction begins on one striking surface, after the production of several flakes it changes to the second striking surface, then returns to the first one, etc. (Figure 3.67-II).

Thirdly a **successive bifacial discoidal approach** is distinguished. One flake is produced on the first striking surface, a second on the second striking surface, a third again on the first striking surface, and so on. This continues until the reduction ends (Figure 3.67-III).

The differentiation between an interchanging and a successive bifacial discoidal approach is only recognizable when the reduction sequence (or parts of it) can be reconstructed by means of refitting.

The core typology and conjoining analysis at Site K shows that the first two discoidal approaches are present. The 'unifacial' approach resulted eventually in disc cores and the interchanging approach in discoidal and high-backed discoidal cores. It can, however, be suggested that the high-backed discoidal cores are the outcome of a centripetal direction of flaking in which the angle along the working edge (angle of percussion or Boëda's [1993] *convexité périphérique*) was not respected any longer at the end of the reduction sequence. As a consequence an 'ideal' angle of percussion could have been totally exploited and ruined without any kind of rejuvenation for future reduction. On the other hand for discoidal cores an 'ideal' angle along the working edge

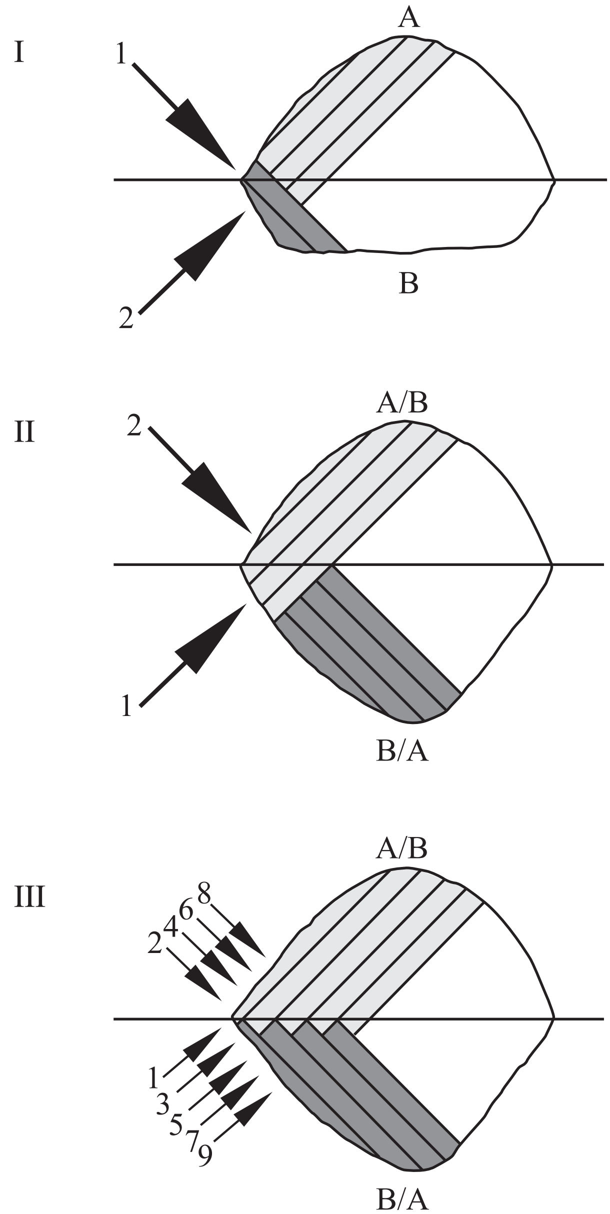


Figure 3.67: Schematic representation of different discoidal approaches. I: 'Unifacial' disc(oidal) approach. II: Interchanging bifacial discoidal approach. III: Successive bifacial discoidal approach. The numbers refer to the production of sequences of flakes or individual flakes. A: Striking surface. B: Striking platform (after Boëda 1993).

was controlled and maintained until the end of the reduction. It should be mentioned, and is confirmed by the Site K refitting analysis, that both discoidal approaches can produce a wide range of specific flake types, from pseudo-Levallois points and *éclats débordants* to flakes wider than long and flakes whose length and width is more or less equal. Even Levallois *sensu stricto* like artefacts can be produced 'accidentally'.

According to the typological description of the lithics, several 'classic' Levallois flakes are present amongst the debitage and especially amongst the tools. This is remarkable as no clear Levallois *sensu stricto* cores were described in the Site K assemblage. Moreover, the raw material of most of these tools is slightly different (*i.e.* 'exotic') from the other artefacts, *e.g.* more fine grained, deviating in colour, etc. Therefore it can be assumed that the majority of the Levallois flakes, and especially the tools, entered the site as end products. This assumption is supported by refitting. In total only one tool made on a Levallois flake *sensu stricto* could be refitted to the rest of the assemblage: a piece with signs of use, described in refitted composition III (part A, Section 3.6.5.4). The negative results of conjoining debitage to Levallois *sensu stricto* flakes shows also that previously assumed scenarios (De Loecker 1992) like transport of Levallois cores to the excavated area, production of Levallois flakes at Site K and subsequent transport of the cores away from the findspot, or a transformation of Levallois cores into other types like disc and/or discoidal nuclei (*cf.* Boëda 1993:393; Vynckier *et al.* 1988:135), can be excluded.

Roughly speaking, the Levallois technique is a strategic reduction sequence in which flakes, blades or points (*éclats préférentiel*) can be obtained by preparing a core in a specific way. The shape, size and thickness of these products are predetermined and normally uniform (Bordes 1961; Boëda 1984, 1986, 1988, 1991, 1994; Van Peer 1992). In general the following typological characteristics are used to attribute a certain flake to the Levallois *sensu stricto* category. The dorsal pattern on Levallois *sensu stricto* flakes should be radial or centripetal, while the dorsal surface shows a convexity. Sometimes the butt (or striking platform on the core) can be prepared by retouching or facetting. Normally no cortex is described and hard percussion is used. The classic, *sensu stricto*, definition refers to the production of only 'one' single Levallois flake (*éclat préférentiel*), knapped from a specially prepared 'tortoise' or 'horse shoe' core. However, a Levallois core can be used to produce several (a)typical Levallois flakes in a recurrent manner, *sensu* Boëda (1986). Irrespective of the strategy used, the Levallois products are obtained by selective and patterned knapping, *i.e.* by the removal of a series of 'wasteful' preparation flakes for the sake of the premeditated end-products. In view of these technological criteria, and certainly on the basis of the refitting analysis, the use of a Levallois *sensu stricto* technology can, as mentioned before, be excluded for the Site K assemblage. However, with respect to the presence of Levallois products, two compositions look remarkable (refitted composition III, part A and X [Section 3.6.5.11]).

Compared to the rest of the refitted nodules, composition III (part A) is produced on a rather 'fine' grained flint. The core reduction is for the greater part the result of a 'unifacial' disc(oidal) approach and the complete reduction of this core was mainly focused on one major striking surface. Flakes orientated to the centre of the core were removed from the major striking surface in a circular direction, using the whole core edge as striking platform. These sequences of flakes were only interrupted to rejuvenate or maintain the working edge angle. Two of the larger flakes, produced from the main striking surface, are interpreted as typical Levallois *sensu stricto* flakes. Both flakes were struck in the same direction, using the same spot on the working edge as striking platform. The flakes are rather thin and their dorsal surface shows a convex radial or centripetal pattern. Furthermore, their shape is more or less identical and the butts show traces of preparation. All this could suggest that most of the flakes, knapped from the main striking surface, were focused on, or better dorsally 'prepared', the two Levallois flakes.

Composition X (De Loecker 1994*a*) is also produced on a rather 'fine' grained flint. In contrast to most of the refitted compositions, much attention was paid to the preparation of the core. Especially the convexity of the striking surface and the striking platform received special attention. Like composition III (part A) the complete core-reduction was focused on one major striking surface. The few and small flakes produced from this striking surface were orientated to the centre of the core and show the predetermination of a future flake. After the preparation of a single platform and the retouching of the working edge (on the striking surface) a final and large flake (the largest in this sequence) was removed from the core. This flake can be interpreted as a 'preferential flake' and the core-reduction strategy resembles a 'classic' Levallois strategy *(à éclat préférentiel*). Morphologically, however, the core and the final large 'preferential flake' are not Levallois products. It can therefore be suggested that a similar operating procedure was applied, but the end-products (core and final flake) are atypical. These observations could only be revealed by refitting.

As we have seen before, the Site K assemblage consists mainly of 'inferior' quality raw materials. Apart from the many frost fissures and fossil inclusions, the flint also looks rather coarse grained. Although the natural fissures helped in the initial splitting of the nodules, they can be mainly seen as a 'handicap' to future knapping. Given the multiple natural 'flaws' in the flint it is, however, not surprising that a discoidal technology was applied for the reduction of the cores. As pointed out by Boëda (1993), a discoidal approach is a very flexible flaking strategy in which technological errors can be 'easily' repaired and natural imperfections can be surmounted quite economically. A rather large set of 'uniform'/'monomorphic' flakes can still be produced. By comparison, these natural 'errors' could ruin an entire Levallois reduction sequence and/or its end-product(s) in an irreparable way. Therefore it can be suggested that at Site K a discoidal approach was applied in response to inferior quality raw material. However, when a finer grained and less frost affected flint type (nodule) was used, it seems that the knappers adjusted their technological strategy slightly. The core reduction now resulted in a better preparation of the striking platform and mainly of the striking surface. It can also be suggested that reduction was more orientated towards the production of 'preferential flakes'. In this sense the technology resembles a Levallois strategy.

Worth mentioning, and confirming this hypothesis, is that at Maastricht-Belvédère Site C, a very fine-grained flint core was also used for a Levallois *recurrent* reduction (*i.e*. Raw Material Unit 4, Roebroeks 1988:30, 47-52; see also Chapter 4), while in the same assemblage a discoidal core was produced on a coarse-grained type of flint. A technological approach linked to the quality and availability of sufficient raw material is also assumed for the Saalian site of La Borde in the French Central Pyrenees (Boëda 1993; Jaubert 1990). At this site the raw material consists, besides a small percentage of imported flint (ca. 3.5%), mainly of local quartz (ca. 96%). What is striking is that a discoidal approach was executed on the crystalline structured quartz while a Levallois reduction strategy was performed on the more fine-grained flint.

3.7.4 The tools: a dominance of the scrapers

The Site K material contains 137 tools and tool fragments, consisting of 111 tools *sensu stricto* and 26 artefacts with macroscopic signs of use (see Table 3.4). Refitting proved that only a few blanks were selected from the produced debitage to be 'secondarily' used for the production of tools (*sensu stricto*). Amongst others some pieces with macroscopic signs of use and single-edged scrapers could be refitted (dorsal/ventral) to the rest of the assemblage. Compared to the bulk of the Site K flakes, most of the tools seem to have been produced on larger flakes. Moreover, the typo-/technological description indicates that at least part of the blanks were produced in a 'similar' technological strategy, with minimal attention for core-preparation, as the rest of the Site K assemblage. Yet a preparation along the angle between the butt and the dorsal surface and a convergent unidirectional and centripetal (radial) dorsal pattern appear more frequently on tools. Conspicuously the 'larger' blanks produced and selected for tool production seem to be better, or more frequently, prepared in this way. Furthermore, it can be mentioned that only the pieces with signs of use and the scrapers have a retouched or facetted butt.

As we have seen before, various types of scrapers dominate the assemblage (group II or the Mousterian group [Bordes 1972:51]). In general these scrapers consist of three major classes (*cf.* Dibble 1987*a* and *b*). The first class consists of simple single-edged scrapers (Types 9-11, Bordes 1961) that have one laterally retouched edge. This group is represented by about 45% of the Mousterian group. About one third of these tools are manufactured on blanks with a convergent or centripetal dorsal pattern while none of these have a retouched or facetted butt. Levallois flakes *sensu stricto* account for ca. 30%. The second class consists of double-edged scrapers with two non-joining laterally retouched edges (Types 12-17, Bordes 1961). The working edges are mostly regular and not steep. Two of these double side scrapers show a facetted butt, while most have a complex dorsal pattern. About 38% of this type is manufactured on flakes originating from a prepared reduction strategy (Levallois *sensu stricto*). The third class represents the convergent side scrapers, with two edges that usually come together to form a point. Most frequently this point is situated at the distal end of the flake (Types 6, 18-21, Bordes 1961). This class is represented by ca. 28% of the scrapers. The working edge is in most cases regular and not steep. One convergent scraper has a retouched butt. Again most of these tools show a more complex dorsal surface preparation. The angle formed by the convergence is on average 77°, and about 20% of these convergent tools is manufactured on Levallois *sensu stricto* flakes.

Dibble (1987*a* and *b*) has tried to explain Middle Palaeolithic assemblage variability to a large extent as a function of reduction of the tools through continuous resharpening and (re)modification of the working edge. During this process the use life of tools is extended, and these modifications often lead to a typological transformation of a tool. Two distinct reduction sequences are suggested. On the basis of one of these reduction models Dibble defines a sequence from single-edged side scrapers through double-edged side scrapers to convergent and pointed side-scrapers. Convergent scrapers are expected to become shorter than the single- and double-edged side scrapers as a result of continuous reduction (re-use). It is remarkable that on the basis of the maximum dimension of the Site K material the complete convergent side scrapers through double-edged side scrapers are on average about 15 mm longer than the single-edged side scrapers (and on the basis of length ca. 17 mm). If the complete reduction sequence took place on the spot, this could mean that in the case of Site K, Dibble's model (1987*a* and *b*) does not work. However, since the raw material of the scrapers (especially the convergent side scrapers) appears somewhat different from the rest of the assemblage, these tools may have entered the site as end-products so that their transformation could have taken place outside the excavated area. Further support for this assumption is given by the fact that none of the convergent and double-edged side scrapers could be refitted to the rest of the Site K material. Many of these scrapers are produced on Levallois *sensu stricto* flakes. So, it can be suggested that the Site K assemblage includes data for a link between a Levallois component, produced on transported raw materials, and the occurrence of convergent (including Mousterian point) and double-edged side-scrapers (*cf.* Geneste 1985). Lithic and raw material analysis may furthermore lead to hypotheses on transport of stone material, expedient use of tools, etc.

3.7.5 Distilling inter-site information from the Site K data

As pointed out before, technology, refitting and raw material evidence suggest that Levallois *sensu stricto* flakes, and especially tools, were implements that entered the excavated Site K area as end-products, which were discarded on the spot. These end-products, mostly convergent and double-edged side scrapers, were probably already transformed into their final form outside the excavated area. Positive proof is given by the fact that no (re)sharpening or modification flakes could be fitted to them. It can be assumed that a toolkit on 'exotic' flint entered the site for subsequent use or maintenance.

Apart from the tools, also 'tool trimming elements' were found. These (re)sharpening flakes (*cf.* Cornford 1986) represent one of the few clear remnants of tool-maintenance/modification that occurred at Site K (*cf.* the Weichselian Site J at Maastricht-Belvédère, Roebroeks *et al.* 1997). In one case a retouched tool was brought to the site. Here, perhaps during or after some use, a kind of long sharpening flake (burin-spall) was removed from a parent tool. The tool was subsequently transported away from the excavated area.

Beside this limited resharpening behaviour, Site K also shows evidence for the recycling of imported tool fragments. One of the few blade-like flakes was probably introduced to the findspot as a finished item, as no debitage could be refitted to it (see Appendix 9, Figure 9.15). Moreover, the raw material looks rather 'exotic'. Within the excavated area the 'flake' was broken into two fragments (*Aneinanderpassungen*). As indicated by the fact that both parts have a retouched edge, the breakage was probably the result of use. The proximal part shows more intensive retouching than the distal fragment, suggesting that this part was recycled for further/future use. However in an alternative scenario it can be suggested that the blade-like flake was used (?), broken and recycled outside the excavated area and that subsequently both parts were introduced to Site K.

Another example of material transport to the site is provided by a small group of conjoined artefacts, found in an area with a diameter of 3 metres and representing a large 'exotic' flake (refitted composition XVI). Again this flake could not be refitted to the rest of the material. Out of the flake a heavy burin and a notched tool was fabricated. In general the 'exotic' material and the refitted burin-spalls suggest that a flake was transported to the site. Subsequently, the flake was transformed into tools and discarded, perhaps after use, at the place of production.

The Site K data provides sufficient evidence to indicate early humans' transportation of lithic material either to or from the excavated area. It can be assumed that a 'toolkit' with flakes and scrapers, and partly made on 'exotic' Levallois *sensu stricto* flakes, entered the excavated area perhaps for subsequent use or maintenance. Part of the 'toolkit' was discarded on the spot, while another part was transported away from the site. Whether the latter group was augmented by newly-made tools is a more difficult question to answer. Although we have a good impression of the used technological strategy, it is hard to prove that specific flakes are missing from the conjoined sequences (*cf*. RMU 4, Site C, Roebroeks 1988:30, 47-52). Some arguments can be mentioned. As part of the Site K area was not excavated due to commercial activities, we know for certain that a number of artefacts (reduction sequences) is missing. Furthermore, the technological emphasis was generally on the production of continuous series of flakes and not on the production of specific 'predetermined' artefacts (*cf*. Levallois), which appear more frequently in the incoming 'toolkit'. In addition, the few 'preferential flakes' which were actually produced on the spot, are mainly morphologically atypical, could mostly be interpreted as such by refitting and were discarded at the place of production (*i.e*. composition III, part A and composition X). There is also no evidence that locally produced flakes were transformed into tools *sensu stricto*, to be subsequently transported away from the excavated area, *i.e*. small retouching debris (on local flint) which could not be refitted to blanks or tools produced at Site K. If specific artefacts (tools) were selected for transportation they were probably larger flakes, locally produced by means of disc(oidal) core approaches, as they are generally better prepared. This statement is however quite speculative.

Nevertheless, transportation of lithic material (to or away from the site) could suggest an interaction between the Site K patch and other findspots. As Roebroeks *et al*. (1992) already mentioned, in this discussion Isaac's distinction (1981) between locations where technology was maintained and locations where technology was used in 'non-maintenance' activities could make sense. In this scenario Site K could have been a locus where technology was primarily maintained, while the technology was used elsewhere in direct subsistence activities such as butchering, scavenging or hunting (see Chapter 5).

3.8 Post-depositional processes

3.8.1 Horizontal disturbance of the artefact distribution

To make sensible inferences about the spatial patterns of flint artefacts it is important to first study the natural site-formation processes. These post-depositional processes can 'pollute' statements on early human behavioural interferences in the formation of the archaeological record (Schiffer 1972, 1987). This section will deal with the natural processes that could have affected the cultural material at Site K. Mainly the data of the refitting analysis and the size distribution of the artefacts are used, but first some statements on the burial stage will be made.

The Site K assemblage was embedded in a loamy, fine sandy matrix (Unit 5.1), which may reflect a quiet fluviatile deposition of sediments (Roebroeks 1988:79). In such a deposition it is highly likely that disturbance by embedding processes is minimal and artefacts may still be in a 'primary' archaeological context. This actually seems to be the case at Site K.

The size distribution shows that the majority of the artefacts consists of small flakes (chips) with a maximum dimension <20 mm (51.7% of the total number of flakes), while chips smaller than 10 mm are represented by only 16.2% of all flakes. This last percentage would have been larger had all the Site K sediments been sieved and the findspot not been subjected to a rescue excavation. Nevertheless the recovered small artefacts were found in spatial association with the larger flakes.

Moreover, refitting shows that many conjoined artefacts, both small and large, were recovered at small distances from one another. A group of very small burin-spalls refitted to a heavy burin and was found in an area of about three metres in cross-section (refitted composition XVI) and the horizontal distribution of the conjoined burned artefacts (Section 3.9.2.3) provides good examples of spatially clustered refitted material. The conjoining study also shows that the products of different technological sequences/stages, like decortication, appear to be spatially clustered. These arguments suggest that Site K has been subjected to a minimal horizontal post-depositional disturbance only, and that the spatial configuration may be used for behavioural inferences. However it must be mentioned that the refitted elements, burned as well as not burned, recovered from the northern part of the excavated area seem to show a larger spatial distribution (larger refit distances) than the ones from the south. Therefore it could be suggested that the northern part of Site K was slightly more affected by post-depositional processes. See for example the horizontal distribution of conjoined compositions II (part A), V and VII (Section 3.9.3). In another scenario, however, the southern part could reflect an area where primary flaking dominated (denser refit distances), while the northern zone represents an area where artefacts were 'transported' to and primarily usage prevailed (larger refit distances).

3.8.2 Vertical disturbance of the artefact distribution

As mentioned before, the artefacts were vertically dispersed over 30 to 40 cm, and were present between two erosional levels (thin gravel strings). During excavation we gained the distinct impression that larger artefacts tended to lie near the lower margin of the vertical distribution.

Moreover, Tables 3.18-A, -B and -C show that when the total number of three-dimensionally recorded artefacts (n= 1,024) is visualized by seven centimetre spits, nearly half of the finds (49.8% or n= 508) are situated between 55.61 and 55.67 m +*N.A.P.* (*Normaal Amsterdams peil*, elevation above Dutch Ordnance Level). This also applies to all three-dimensionally recorded flakes ≥40 mm and ≥70 mm; respectively 52.0% (n= 103) and 50.8% (n= 32). For all three tables the quantity of artefacts decreases gradually the higher or lower one goes in the 'section'. Furthermore the lowermost Site K artefacts were recovered ca. 10 cm above the lower ('second') gravel level, although some smaller artefacts were found in, or just underneath this erosional marker. During the excavation we also noticed that the pebbles of the lower gravel string were vertically scattered. Altogether this could mean that both the artefacts and the lower lying gravel string were slightly disturbed/scattered in a vertical way, probably due to bioturbation. Moreover, this feature is not unusual in open air sites from the Western European Loess area (*cf*. Roebroeks 1988; Thieme 1983).

Because of time pressure only one metre square[11] (14/213) could be sieved for lithics (including the little macro-debitage, *cf*. Fladmark 1982; Clark 1986) and gravels. The artefact distribution in this sample supports the interpretation described above (see Table 3.19).

The vertical distribution of the conjoined elements in the three-dimensionally recorded area (Figures 3.68-A and -B), shows that most of the refitted artefacts were spread over a maximum vertical distance of 33 cm (between 55.47 and 55.80 m +*N.A.P*). This applies to refits between flakes in a reduction sequence (*Aufeinanderpassungen*), refits of broken pieces (*Aneinanderpassungen*, between 55.53 and 55.74 m +*N.A.P*) and refits of modifications (*Anpassungen*, between 55.50 and 55.66 m +*N.A.P*). Larger vertical distances will, however, not be exceptional, especially when we keep in mind that a lot of the smaller artefacts (>20 mm) were not incorporated in the refitting analysis. Furthermore, the degree of vertical displacement of conjoining elements at Site K corresponds more or less with the findings at other Belvédère sites in a similar loamy, fine sand matrix (Roebroeks 1988).

In general the archaeological evidence suggests that horizontal displacement of the lithic material must have been minimal, while vertically the flint artefacts may have been slightly scattered. It is, however, not possible to pinpoint one agent as primarily responsible for this vertical dispersal of the Site K artefacts. Like Roebroeks (1988:58) mentioned for Site C, the post-depositional vertical movement of artefacts at Site K was probably caused by a cumulative effect of several agents. The weight of the artefacts, frost action on the site matrix, alternate wetting and drying of sediments, earthworm activity, plant roots, etc., and perhaps even some trampling activity can be mentioned (Hofman 1986). What is clear is that larger artefacts seem to have been less susceptible to vertical migration than smaller pieces, which strongly points in the direction of small-scale processes such as bioturbation.

To conclude, we may assume that the archaeological debris at Site K was hardly disturbed during or before the burial stage and that a detailed analysis of the spatial patterns would make sense.

Square	Number of artefacts by seven centimetre spits*							
	55.40-55.46	55.47-55.53	55.54-55.60	55.61-55.67	55.68-55.74	55.75-55.81	55.82-55.89	Total
7/210	–	19	5	1	3	–	–	28
8/210	1	9	11	5	1	5	–	32
9/210	–	1	15	14	3	1	–	34
10/210	–	–	12	25	–	1	–	38
11/210	–	2	11	30	3	–	–	46
12/210	–	–	1	38	16	–	1	56
13/210	–	–	–	5	13	6	1	25
14/210	–	–	–	5	9	9	–	23
7/211	–	11	7	7	1	3	–	29
8/211	–	7	21	5	4	3	–	40
9/211	1	2	16	14	7	–	–	40
10/211	–	–	4	13	1	–	–	18
11/211	–	–	8	38	1	1	–	48
12/211	–	1	3	55	21	–	–	80
13/211	–	–	2	3	20	5	–	30
14/211	–	–	–	3	36	11	1	51
7/212	1	4	5	3	–	–	–	13
8/212	–	1	8	1	2	1	–	13
9/212	–	1	7	11	–	–	–	19
10/212	–	1	4	31	1	–	–	37
11/212	–	–	–	28	4	–	–	32
12/212	–	2	5	59	3	2	–	71
13/212	–	–	4	43	18	4	–	69
14/212	–	1	17	65	18	2	–	103
8/213	–	2	15	4	–	–	–	21
8/214	–	–	13	–	–	–	–	13
8/215	2	6	5	2	–	–	–	15
Total	5	70	199	508	185	54	3	1024
%	0.5	6.8	19.5	49.8	18.1	5.3	0.3	100.2

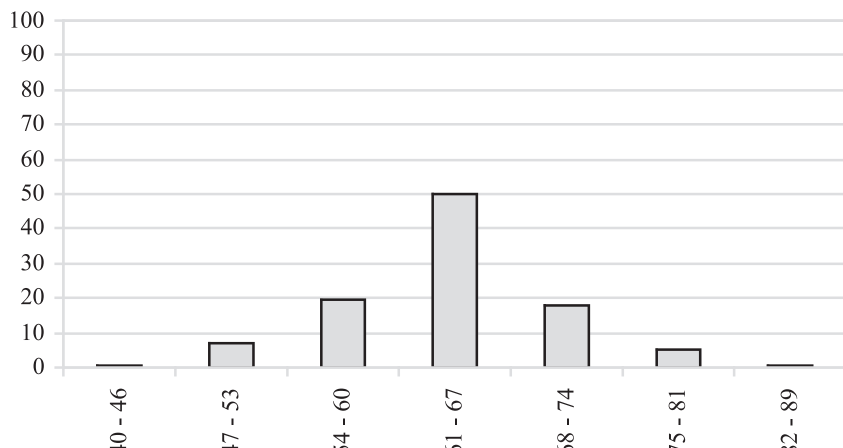


Table 3.18-A: Maastricht-Belvédère Site K. Total number of three-dimensionally recorded artefacts per square metre and by seven centimetre spits.
* The seven centimetre spits are given in relation to the elevation (metres) above Dutch Ordnance Level (*Normaal Amsterdams peil*).

Square	Number of artefacts ≥40 mm by seven centimetre spits*							
	55.40-55.46	55.47-55.53	55.54-55.60	55.61-55.67	55.68-55.74	55.75-55.81	55.82-55.89	Total
7/210	–	5	–	–	–	–	–	5
8/210	–	1	3	–	–	–	–	4
9/210	–	–	1	1	–	–	–	2
10/210	–	–	2	10	–	–	–	12
11/210	–	–	2	10	1	–	–	13
12/210	–	–	–	3	–	–	–	3
13/210	–	–	–	1	5	1	–	7
14/210	–	–	–	–	3	–	–	3
7/211	–	1	1	1	–	1	–	1
8/211	–	–	2	–	–	–	–	2
9/211	–	–	4	5	–	–	–	9
10/211	–	–	1	5	–	–	–	6
11/211	–	–	4	10	–	–	–	14
12/211	–	–	1	4	–	–	–	5
13/211	–	–	–	1	5	–	–	6
14/211	–	–	–	–	12	3	–	15
7/212	–	2	2	1	–	–	–	5
8/212	–	–	1	1	–	1	–	3
9/212	–	–	–	–	–	–	–	–
10/212	–	–	–	9	–	–	–	9
11/212	–	–	–	8	2	–	–	10
12/212	–	–	–	10	–	–	–	10
13/212	–	–	–	8	4	–	–	12
14/212	–	1	3	12	4	–	–	20
8/213	–	–	6	3	–	–	–	9
8/214	–	–	6	–	–	–	–	6
8/215	1	2	1	–	–	–	–	4
Total	1	12	40	103	36	6	0	198
%	0.5	6.1	20.2	52.0	18.2	3.0	0	100.0

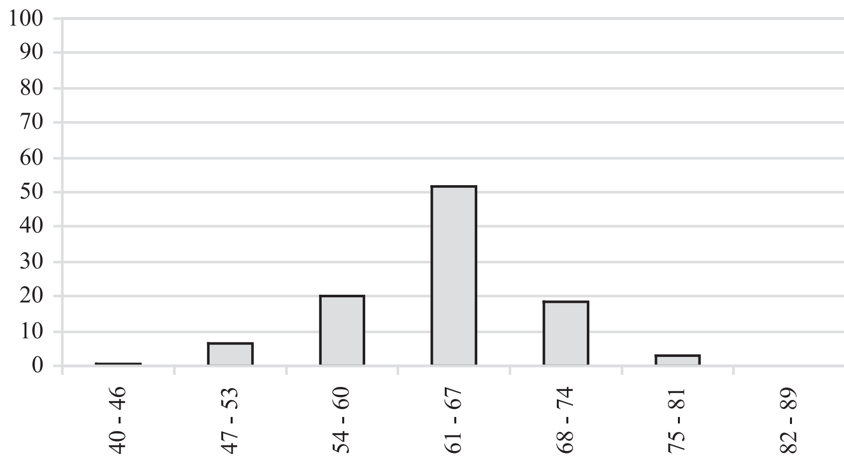


Table 3.18-B: Maastricht-Belvédère Site K. Total number of three-dimensionally recorded artefacts ≥40 mm per square metre and by seven centimetre spits. * The seven centimetre spits are given in relation to the elevation (metres) above Dutch Ordnance Level (*Normaal Amsterdams peil*).

Square	Number of artefacts ≥70 mm by seven centimetre spits*							
	55.40-55.46	55.47-55.53	55.54-55.60	55.61-55.67	55.68-55.74	55.75-55.81	55.82-55.89	Total
7/210	–	2	–	–	–	–	–	2
8/210	–	–	1	–	–	–	–	1
9/210	–	–	–	–	–	–	–	–
10/210	–	–	–	5	–	–	–	5
11/210	–	–	–	2	–	–	–	2
12/210	–	–	–	–	–	–	–	–
13/210	–	–	–	–	4	–	–	4
14/210	–	–	–	–	1	–	–	1
7/211	–	1	–	–	–	–	–	1
8/211	–	–	1	–	–	–	–	1
9/211	–	–	–	–	–	–	–	–
10/211	–	–	–	4	–	–	–	4
11/211	–	–	2	3	–	–	–	5
12/211	–	–	–	–	–	–	–	–
13/211	–	–	–	1	1	–	–	2
14/211	–	–	–	–	6	–	–	6
7/212	–	–	1	–	–	–	–	1
8/212	–	–	–	1	–	–	–	1
9/212	–	–	–	–	–	–	–	–
10/212	–	–	–	1	–	–	–	1
11/212	–	–	–	3	1	–	–	4
12/212	–	–	–	6	–	–	–	6
13/212	–	–	–	1	–	–	–	1
14/212	–	1	1	4	–	–	–	6
8/213	–	–	3	1	–	–	–	4
8/214	–	–	3	–	–	–	–	3
8/215	1	1	–	–	–	–	–	2
Total	1	5	12	32	13	0	0	63
%	1.6	7.9	19.1	50.8	20.6	0	0	100.0

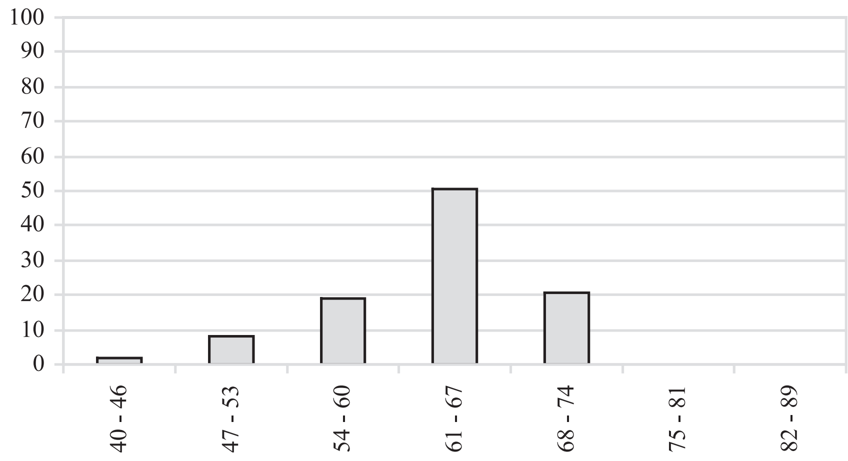


Table 3.18-C: Maastricht-Belvédère Site K. Total number of three-dimensionally recorded artefacts ≥70 mm per square metre and by seven centimetre spits. * The seven centimetre spits are given in relation to the elevation (metres) above Dutch Ordnance Level (*Normaal Amsterdams peil*).

Square 14/213 (number of artefacts by five centimetre spits[*])		
Spit number + Dutch Ordnance Level	n	%
Spit 1 (55.96 - 56.00)	–	–
Spit 2 (55.91 - 55.95)	1	0.2
Spit 3 (55.86 - 55.90)	–	–
Spit 4 (55.81 - 55.85)	3	0.6
Spit 5 (55.76 - 55.80)	12	2.4
Spit 6 (55.71 - 55.75)	26	5.2
Spit 7 (55.66 - 55.70)	90	18.1
Spit 8 (55.61 - 55.65)	162	32.7
Spit 9 (55.56 - 55.60)	136	27.4
Spit 10 (55.51 - 55.55)	42	8.5
Spit 11 (55.46 - 55.50)	24	4.8
Total	496	99.9

Table 3.19: Maastricht-Belvédère Site K. Total number artefacts by five centimetre spits for metre square 14/213. [*] The five centimetre spits are given in relation to the elevation (metres) above Dutch Ordnance Level (*Normaal Amsterdams peil*).

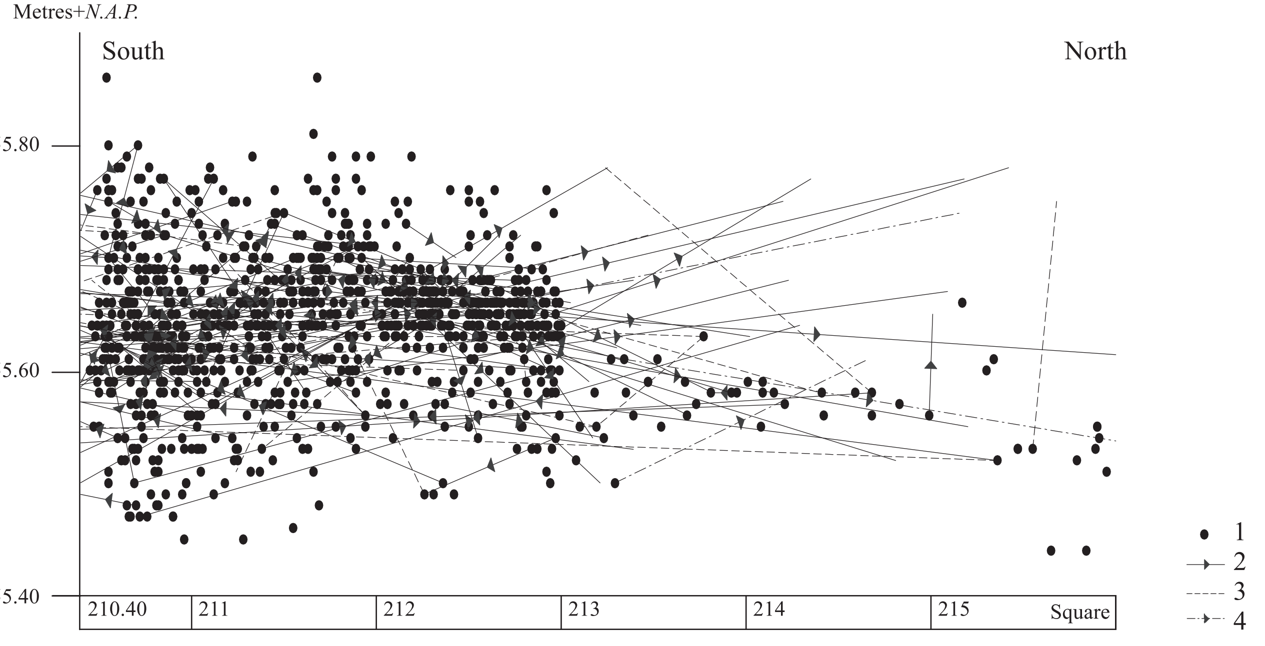


Figure 3.68-A: Maastricht-Belvédère Site K. South-north orientated section of the three-dimensional recorded area together with the vertical distribution of the artefacts and conjoined elements.

1. Artefact
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)

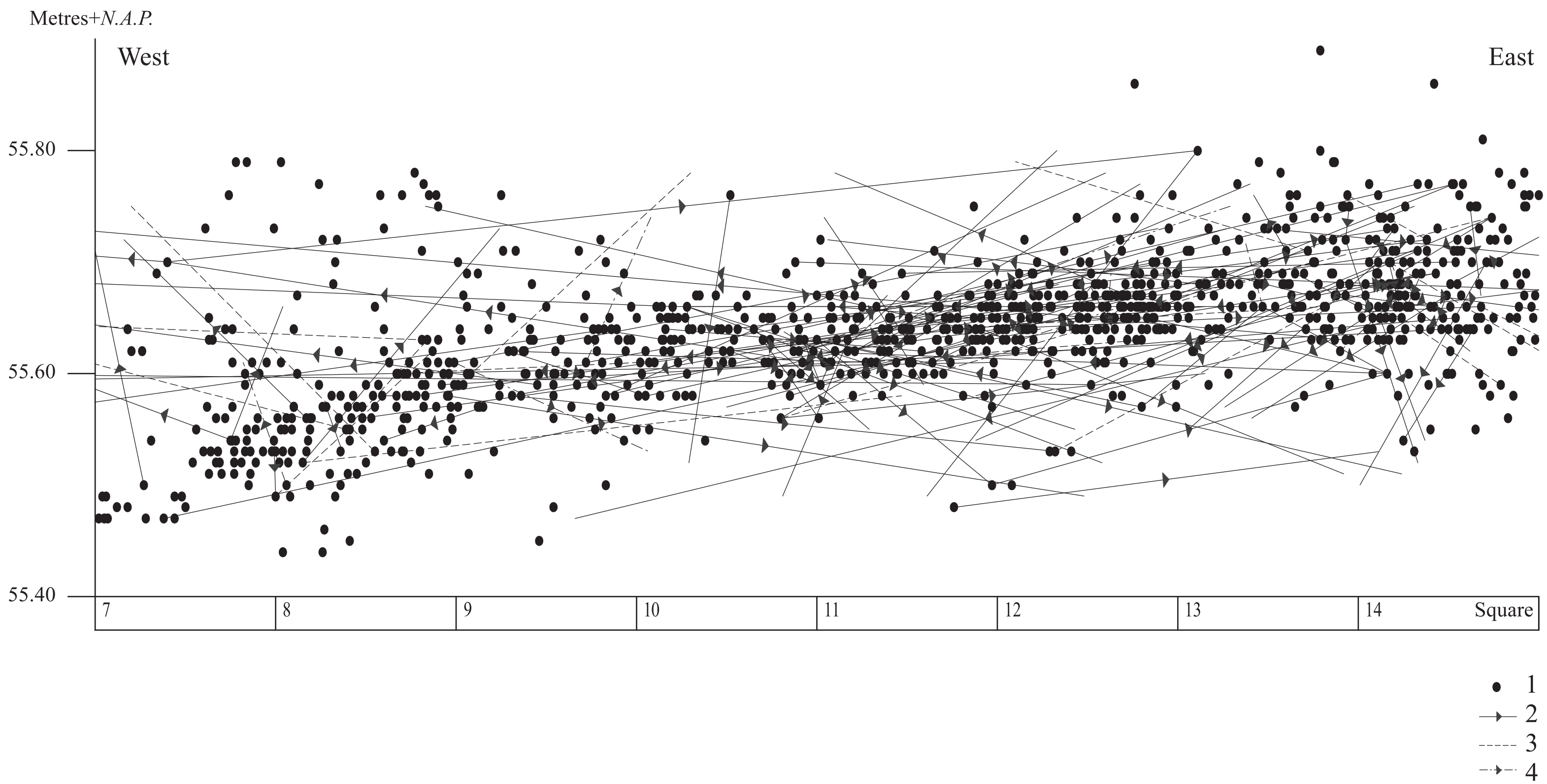


Figure 3.68-B: Maastricht-Belvédère Site K. West-east orientated section of the three-dimensional recorded area together with the vertical distribution of the artefacts and conjoined elements.

1. Artefact
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)

3.9 Spatial distribution of the lithic material

3.9.1 Introduction

This section deals with the horizontal distribution of the Site K artefacts, which may reflect the spatial use of technology. The spatial evaluation relies amongst others on the information gained during the lithic characterisation (artefact morphology and technology; Section 3.5) and especially the refitting analysis (Section 3.6). Moreover the potentially meaningful attributes, or combinations of attributes, that can be used for a horizontal interpretation are almost infinite. There are also some limitations to analysis and interpretation. First of all it should be borne in mind that part of the original flint cluster, mainly the southwestern area, was destroyed by the commercial exploiter of the quarry. Secondly, most of the archaeological relics do not have exact spatial positions within the excavated area. They were mainly recorded within a metre square or a quarter of a metre square, instead of by a more detailed three-dimensional recording. Therefore random coordinates, within the actual (quarter of a) metre square, were attributed to the finds[12]. This could mean that two conjoined artefacts within the same (quarter of) metre square were located very near to each other (even on top of each other), or in opposite corners of the (quarter of) metre square. Therefore the given distances (lengths of the refitting lines) between the conjoined Site K artefacts could have been somewhat shorter or longer. All this considerably limits the use of possible techniques for further analysis (*cf.* Hodder and Orton 1976; Hietala 1984). Thirdly, the artefact distribution and refitting analysis, within the three-dimensional recorded area, made it clear that the finds were vertically dispersed due to post-depositional processes. This phenomenon suggests that the spatial patterns created by early human behaviour were, at least vertically, to some degree re-arranged by a variety of natural processes. A fourth limitation which influences our statements on spatial behaviour is the possible lack of organic remains, like bones, as a result of decalcification of the findlayer. The horizontal evaluation of Site K will therefore be one-sided, or better, based on the flints only.

In general archaeologists deal with huge amounts of information. The spatial nature of this data, artefacts within a site, sites within a region, etc., normally requires special techniques and software (like GIS) for the handling and manipulation of the horizontal find distribution. However, due to the earlier mentioned limitations the observed archaeological features will be presented here, as accurately as possible, by means of several thematic maps. These maps were mainly used because they can be obtained very rapidly and they allow a first interpretation of the data. Moreover, the spatial relationships between various phenomena can easily be recognized when they are viewed in map form. The enormous amount of recent site publications shows, furthermore, that thematic find distribution maps still remain the primary goal of information storage and display. Finally it has to be pointed out that the thematic maps can suggest a simultaneous production/use of different flint categories/clusters. In other words the portrayed data gives the impression that the site K flint assemblage was produced and discarded in one continuous and very brief period of activity. While this view is certainly attractive, more pessimistically the Site K spatial pattern can be the cumulative product of several events spread in time: a palimpsest (*cf.* Roebroeks [1988] for Maastricht-Belvédère Site C and Kroll and Isaac [1984] for East Africa). Although the problem of 'contemporaneity' is often overlooked, the limited spatial analysis presented in this section is based on the assumed contemporaneity of the different artefact scatters and find categories. The assumed single occupation for Site K is considered here only as a working hypothesis as will be argued in Section 3.10.2.

After the spatial presentation of the complete assemblage, different find categories will be dealt with. Subsequently, the previously selected and technologically described 17 conjoined compositions will be considered separately. In Section 3.10 the possible recurrent horizontal patterns and their presumed interrelationship will be evaluated and interpreted.

3.9.2 Spatial distribution of different find categories (thematic maps)

3.9.2.1 Spatial distribution of the total artefact assemblage

The horizontal distribution of the total lithic assemblage shows a main dense cluster of artefacts in the southeastern part of the excavated area (Figure 3.69, roughly the area between coordinates 7/204-13/205 and 7/211-16/211). Within this concentration, which covers an area of about 50 square metres, artefacts occur in high densities. A hundred or more artefacts per square metre are not exceptional. The cluster consists mainly of cores, flakes and chips of which many could be conjoined. Moreover, many cortex flakes were recovered from this area, indicating that we are dealing here with an area where primary flint working took place. It can also be suggested that this concentration extends in a westerly and northerly direction. Figure 3.69-A shows furthermore that probably a much smaller and considerably less dense flint cluster was situated in the 'northern' part of the excavated area (roughly the area between coordinates 7/217-10/217 and 7/221-10/221). Here the artefact densities are mainly between 20 up to 45 pieces per metre square. It is noticeable that the 'central' part of Site K, roughly the area situated between the clusters (approximately between coordinates 4/211-11/211 and 4/217-11/217), shows a less dense find distribution. In the most northern/northeastern and most southern part of the excavated area artefact densities drop sharply. The spatial distribution for all artefacts with a maximum dimension <30 mm shows more or less the same pattern (Figure 3.70).

3.9.2.2 Spatial distribution of the total conjoined assemblage

The refitting analysis resulted in the conjoining of 1,828 artefacts. The horizontal distribution of refitted artefacts shows also a similar spatial pattern to the one for the total assemblage (see Section 3.9.2.1). However, according to Figure 3.71-A, it seems that the previously mentioned main dense cluster, with its western and northern extensions, can be subdivided into at least four smaller clusters. This becomes even more noticeable when the artefact densities are visualized by means of a contour map (Figure 3.71-B) The four smaller clusters are roughly situated between coordinates 2/205-5/205 and 2/209-5/209, between coordinates 6/204-10/205 and 6/209-10/209, between coordinates 10/205-14/206 and 10/211-14/211 and between coordinates 11/211-15/211 and 11/215-15/215). Again the small lithic scatter in the ‘north’ and the rather ‘empty’ zone between the clusters is noticeable.

The refitted artefacts represent, as mentioned before, a total of 1,582 connection lines (*cf*. Cziesla 1986, 1990). The mean length[13] of all refitting lines is 2.9 metre with a standard deviation of 2.7 metre. The average length of all *Aufeinanderpassungen*, *Aneinanderpassungen*, *Anpassungen* and *Einpassungen* (heat-damage) is respectively 3.2 metre with a standard deviation of 2.8 metre, 1.8 metre with a standard deviation of 2.1 metre, 2.8 metre with a standard deviation of 2.0 metre and 1.7 metre with a standard deviation of 1.6 metre.

The distribution plan of these conjoining elements/lines (see Figure 3.10) shows a ‘spider web-like’ pattern, in which the ‘northern’ and especially the main dense cluster (with its western and northern extensions) are clearly appreciable. Moreover the previously mentioned (at least) four smaller clusters become ‘star-like’ constellations, which partly or completely overlap and interact. The relatively ‘empty’ area is still detectable, although it is crossed by numerous conjoining lines. Please note that the refitting lines which connect artefacts from the main excavated area with finds in the ‘random’ plotted square metres (containing finds recovered from pre-excavation geological sections) will have to be interpreted as artificial. Due to the recording system some of the refit lines, within the excavated area and situated directly (parallel) along the artificial borders of the findspot, could look conspicuous. Moreover they could give the wrong impression that the complete site, whatever is meant by that, was excavated. This phenomenon, called ‘boundary’ (Hodder and Orton 1976) or ‘edge-’ effect (Upton and Fingelton 1985:70), appears especially at sites with many refits.

To end this section on the spatial distribution of the total conjoined assemblage, Figures 3.72-A and -B are given. The distribution plans for *Aufeinanderpassungen* (production sequences, Figure 3.72-A) and *Aneinanderpassungen* (breaks, Figure 3.72-B) are ‘identical’ or better, they suggest the same spatial clustering as for the total refitted assemblage.

3.9.2.3 Spatial distribution of the burned artefacts

At Site K a total of 617 artefacts (5.7% of the total assemblage) were identified as burned. Quantitative data on the identified groups of burned artefacts is given in Table 3.20.

Type	n	%
Potlid	165	26.7
‘Parent’ piece	41	6.7
‘Craquelé’	334	54.1
Colour/fire patina	41	6.7
TL dating	36	5.8
Total	617	100.0

Table 3.20: Maastricht-Belvédère Site K. Review of the burned artefacts.

The burned artefacts (Figure 3.73) appear to be mostly present in the southern part of the excavated area. They seem to be mainly overlapping with the previously mentioned main dense cluster and its western extension. This zone with ‘high’ densities of burned artefacts (up to 30 pieces per metre square) consists of two peaks. One smaller cluster can be seen in the southeast, another in the southwest (respectively and roughly between coordinates 10/209, 15/209 and 13/205 and between coordinates 1/208-5/208 and 1/205-5/205). It can even be suggested that the horizontal distribution of all burned artefacts represents a large circular cluster with in its centre a conspicuous zone without any burned pieces. At the southern boundary between the empty zone and the circular cluster a burned convergent straight side scraper was found.

Generally, the spatial distribution of the burned artefacts resembles the distribution described for all artefacts (Section 3.9.2.1), and therefore no localized ‘fireplace’ is suggested.

The refitted burned artefacts represent a total of 61 *Einpassungen* (heat-damage/inserts, *cf*. Cziesla 1986, 1990). The spatial distribution of these conjoining elements/lines (Figure 3.74) shows again the southern zone with ‘high’ densities of burned artefacts. The two smaller clusters are also detectable. The largest refitted group of burned artefacts, a large ‘exotic’ flake consisting of 15 elements and measuring 85 mm, was recovered from the southwestern smaller cluster (sequence 354; Figure 3.75).

Figure 3.69-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of artefacts (n= 10,912) per metre square.

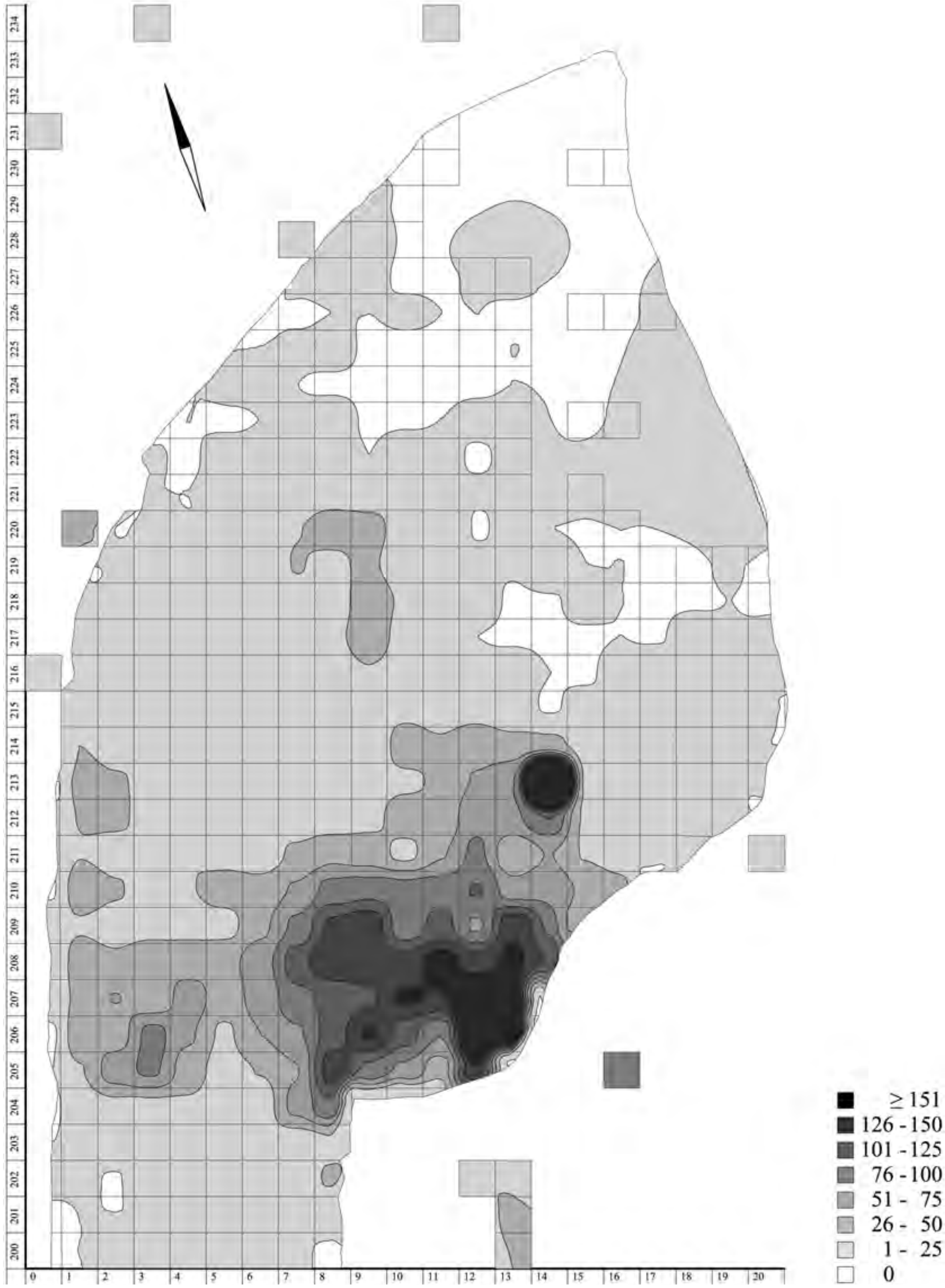


Figure 3.69-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.69-A. Excavation grid in metres square.

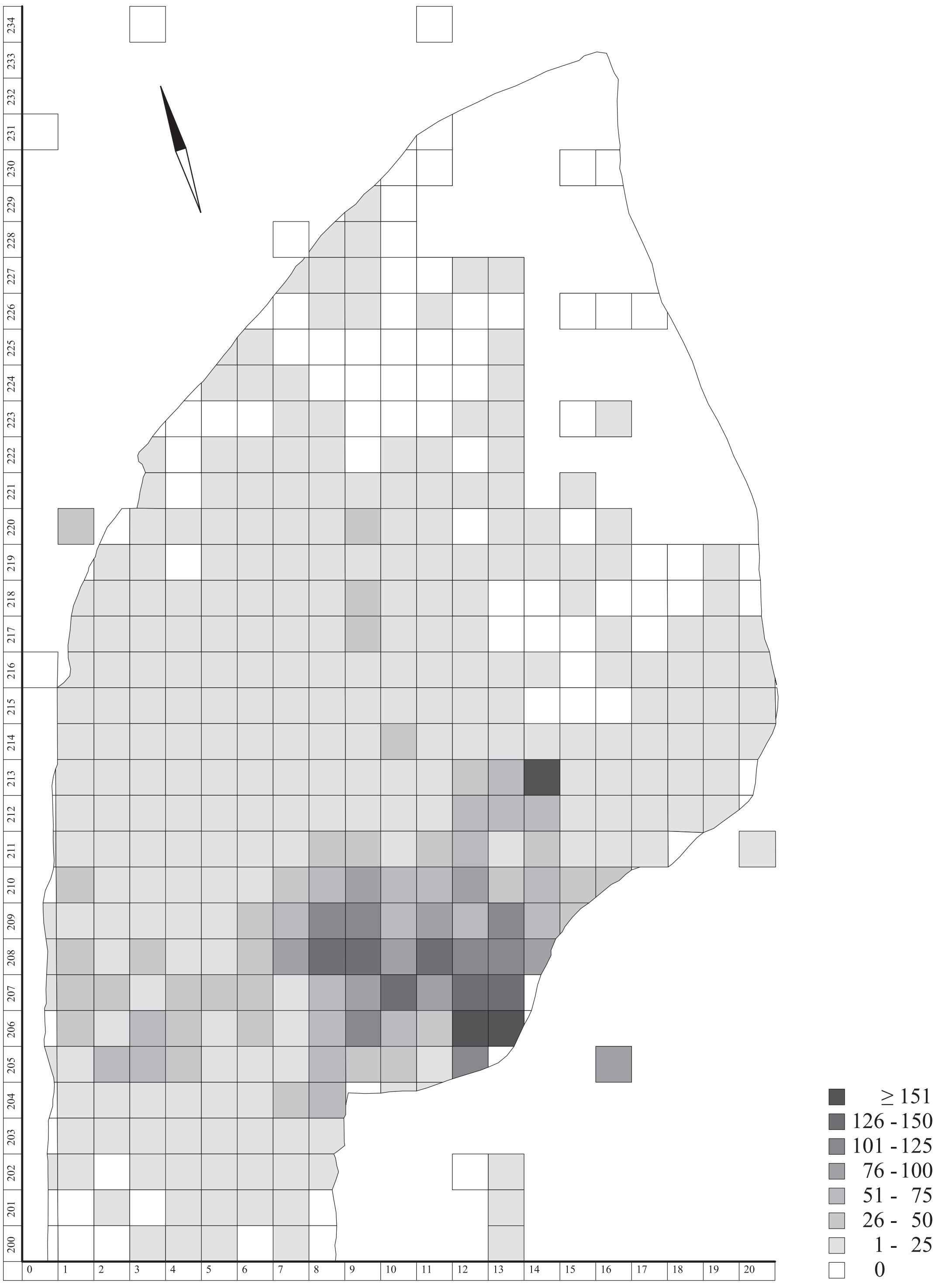


Figure 3.70-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of artefacts <30 mm (n= 7,758) per metre square.

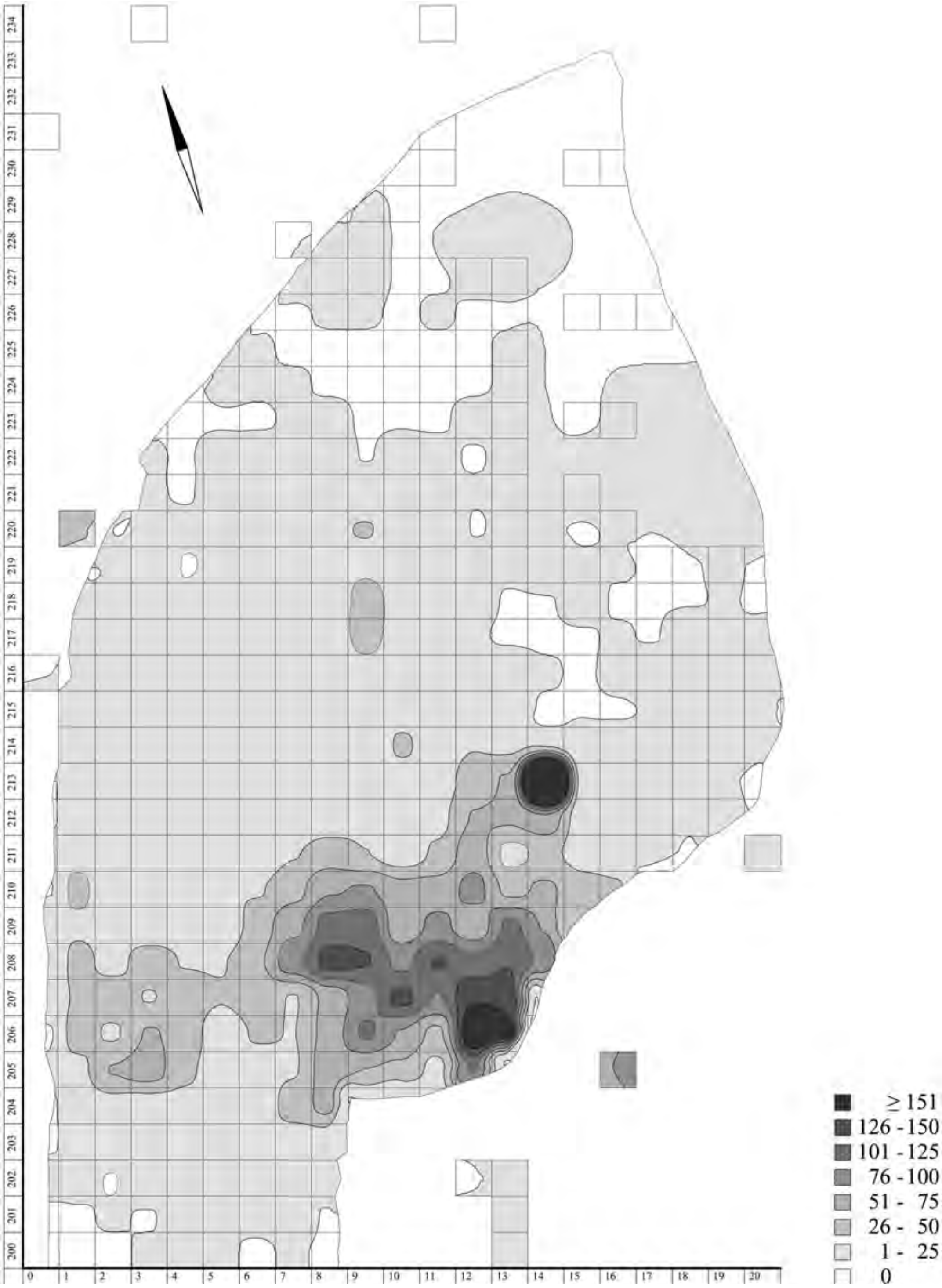


Figure 3.70-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 70-A. Excavation grid in metres squares.

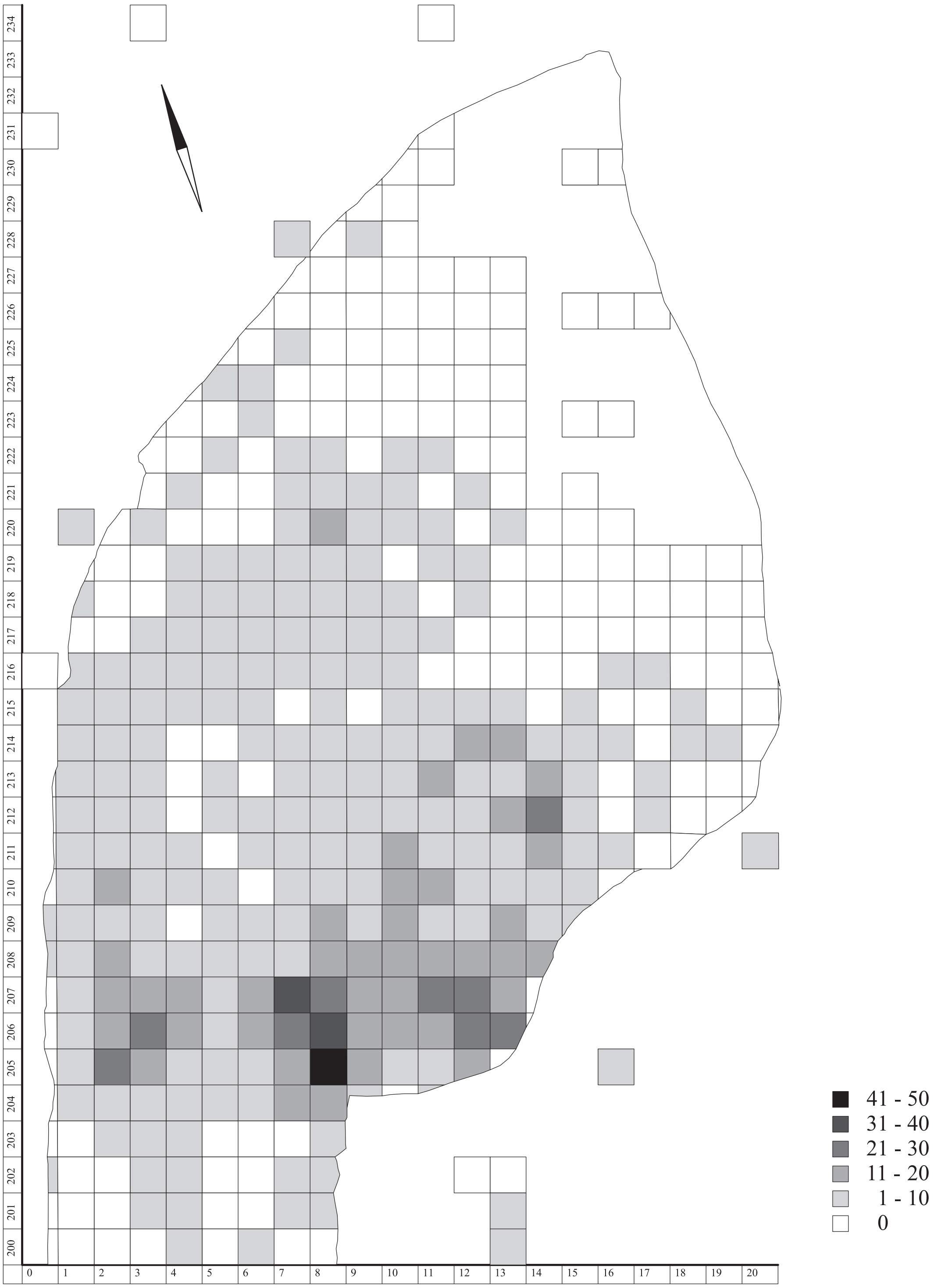


Figure 3.71-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of conjoined artefacts (n= 1,828) per metre square.

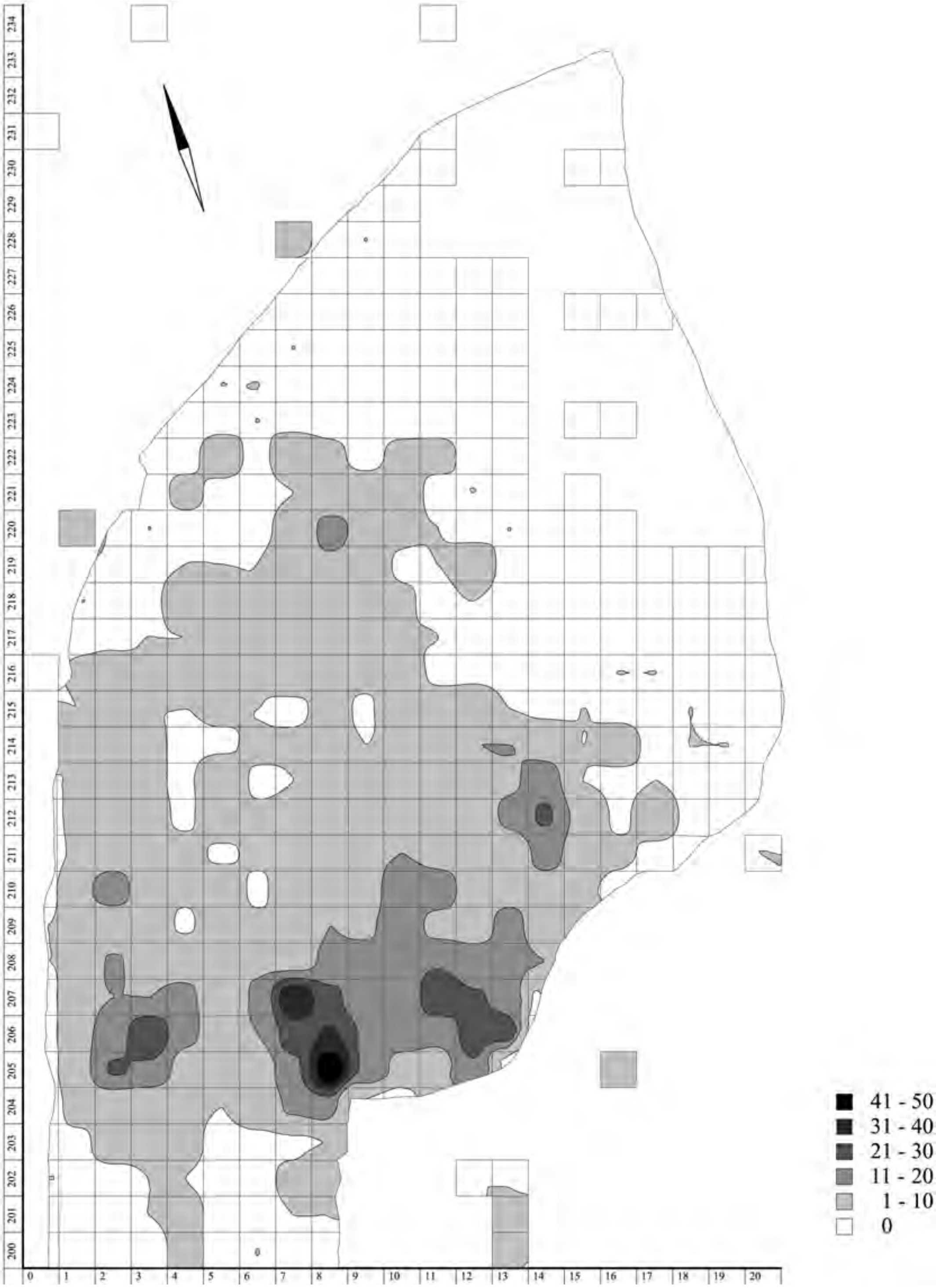


Figure 3.71-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.71-A. Excavation grid in metres square.

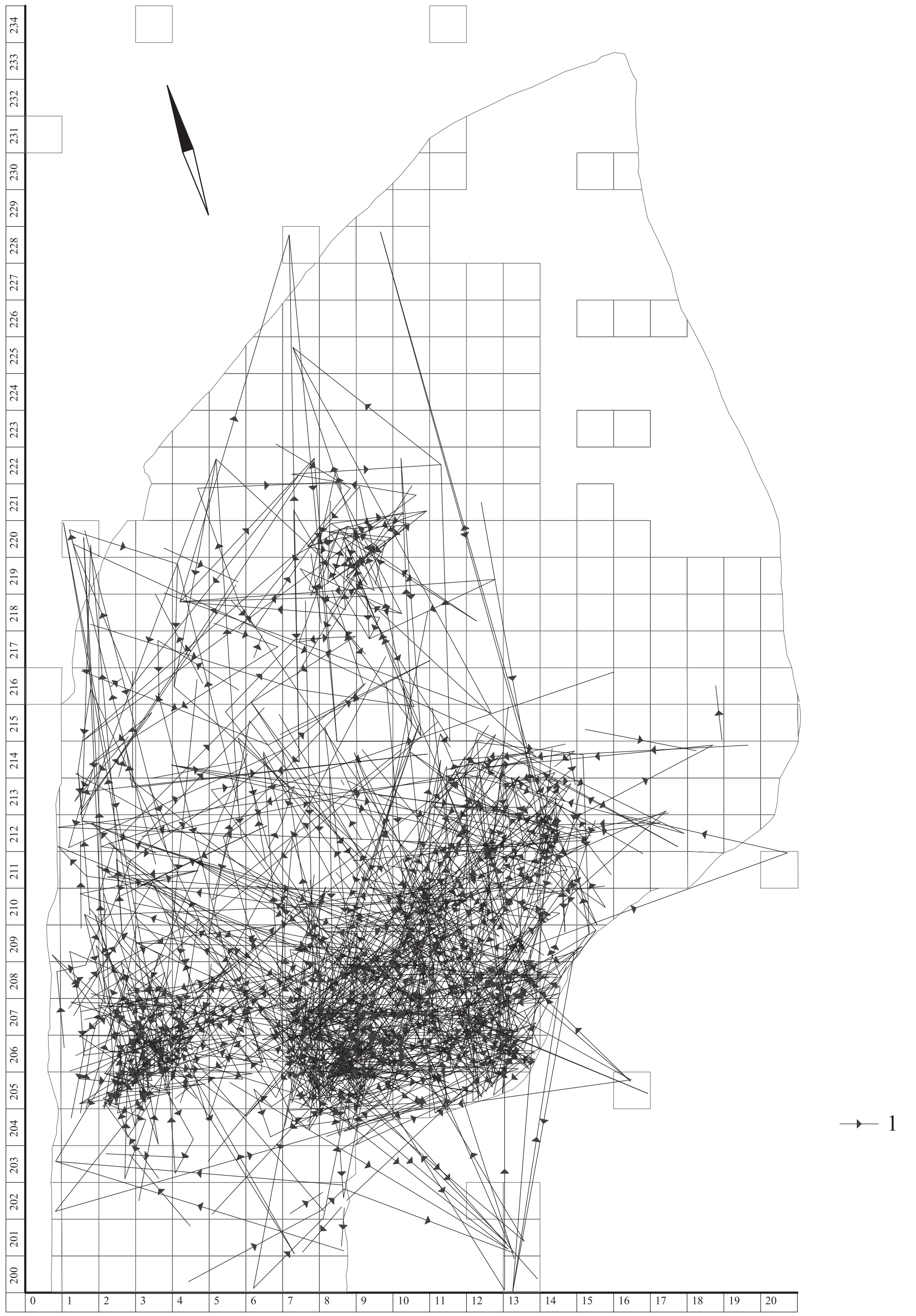


Figure 3.72-A: Maastricht-Belvédère Site K. Horizontal distribution of *Aufeinanderpassungen* (production sequences, n= 1,221). The conjoined groups are represented in the ‘Cziesla approach’ (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts are based on random coordinates within the metres square.

1. *Aufeinanderpassung* (production sequences)

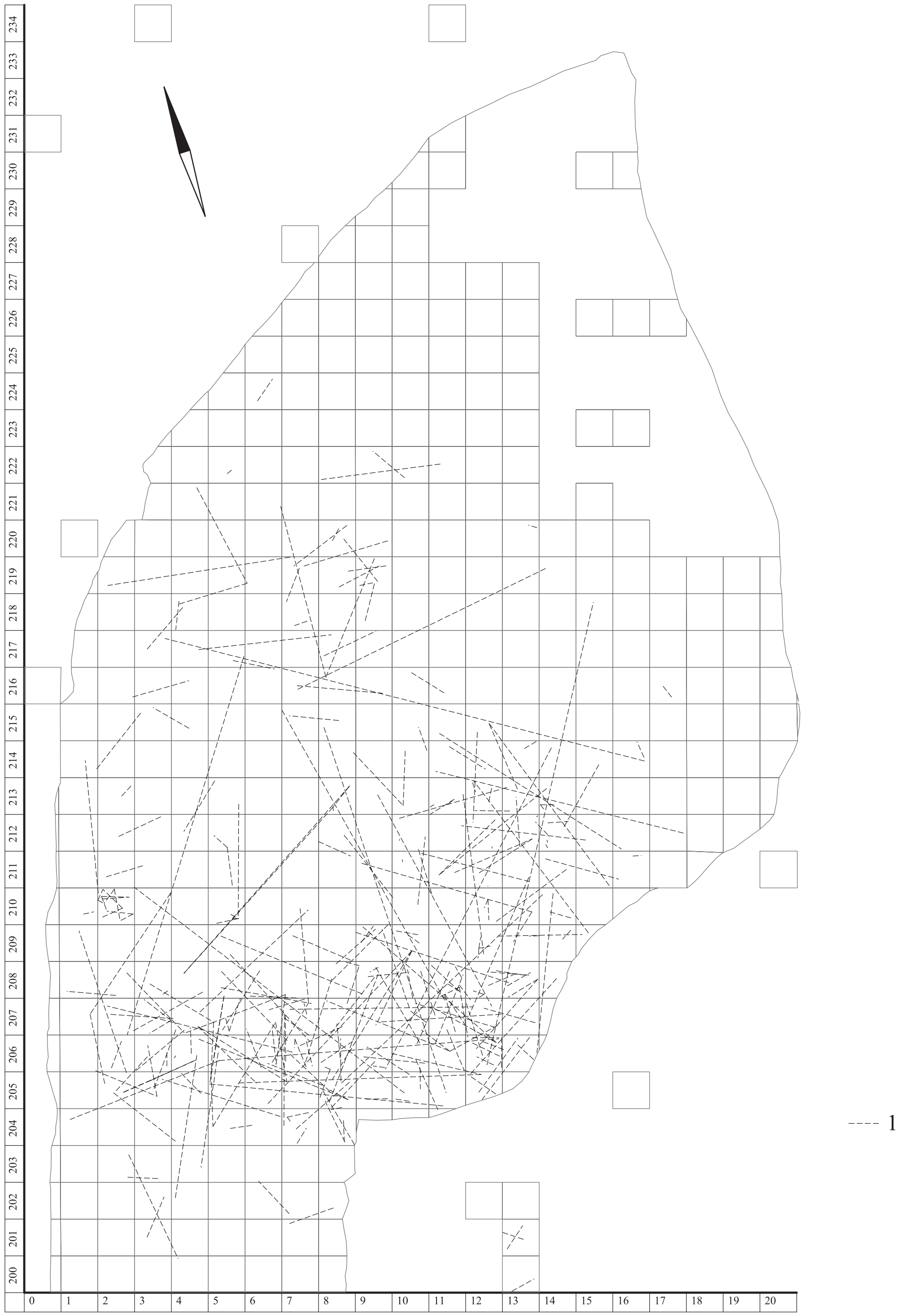


Figure 3.72-B: Maastricht-Belvédère Site K. Horizontal distribution of *Aneinanderpassungen* (breaks, n= 306 [including 61 *Einpassungen* or heat-damage]). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts are based on random coordinates within the metres square.

1. *Aneinanderpassung* (breaks)

Figure 3.73-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of burned artefacts (n= 617) per metre square.

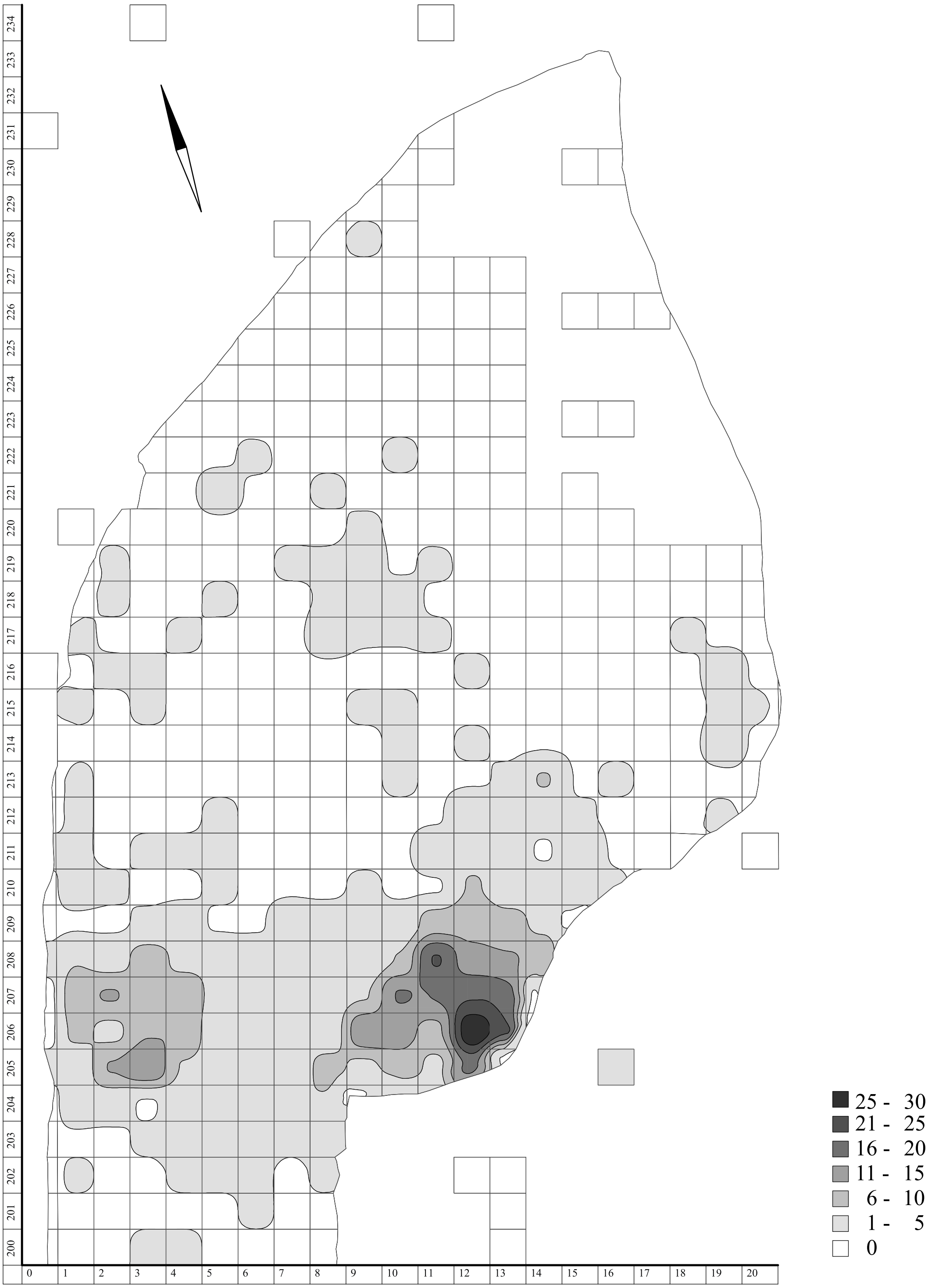
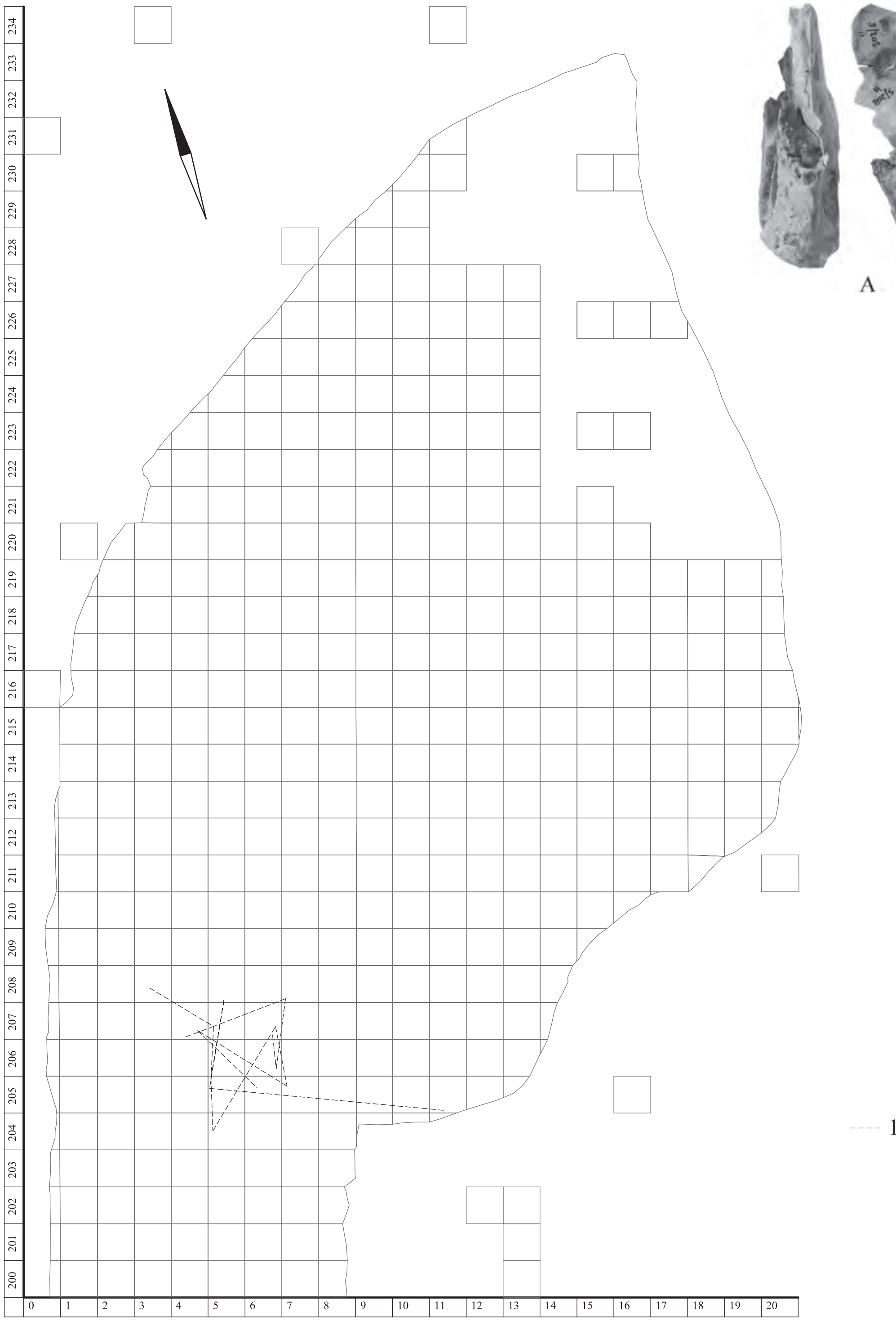


Figure 3.73-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.73-A. Excavation grid in metres square.

Figure 3.74: Maastricht-Belvédère Site K. Horizontal distribution of all refitted burned artefacts (n= 98). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metre squares and the position of the artefacts are based on random coordinates within the metre square.

1. *Einpassung* (heat-damage)

A



B

Figure 3.75: Maastricht-Belvédère Site K. A: Largest conjoined group of burned artefacts (sequence 354). Scale 1:2. B: Horizontal distribution of the largest conjoined group of burned artefacts at Site K (n= 15). The conjoined group is represented in the ‘Cziesla approach’ (Cziesla 1986, 1990). The excavation grid is in metre squares and the position of the artefacts are based on random coordinates within the metre square.

1. *Einpassung* (heat-damage)

3.9.2.4 Spatial distribution of the cores

In the distribution pattern of the 91 cores (Figure 3.76) a clear concentration is visible in the southeastern part of the excavated area (roughly between coordinates 11/206-14/206 and 11/210-14/210). In this area up to five cores per square metre are counted. A smaller cluster is detectable in the 'central' southern area where one square metre also contains five cores (the area between coordinates 7/205-9/205 and 7/208-9/208). The adjacent central zone of site K shows only very few cores. The general layout of this thematic map coincides very well with the image of the complete scatter, the refitted assemblage and especially the burned artefacts.

3.9.2.5 Spatial distribution of the tools

The 137 tools form in general a large concentration which is more or less situated in the centre of the excavated area (Figure 3.77, roughly the area between coordinates 1/205-13/205-16/210 and 1/219-8/219-16/214). This cluster shows in the centre a relative high density. The horizontal distribution furthermore shows that within this 'rich' tool zone at least two peaks are detectable. One of these smaller clusters is situated in the southeastern part of the Site K area (between coordinates 8/207-13/207 and 8/209-13/209). It coincides partly with the main dense cluster of debitage and up to four tools per square metre are counted. It can be suggested that this cluster extends in a westerly direction. In fact this western extension is represented by an eastwest orientated row of square metres of which squares 4/210 up to 9/210 contain two or three tools. This row of tools is situated at the boundary between the western extension of the previously mentioned main dense cluster of debitage and burned artefacts and the rather empty zone in the centre of the excavated area. North of this row about eight square metres show a complete absence of tools. Furthermore the northern flint configuration is again appreciable by the presence of five tools which were recovered from two square metres (6/217 and 7/216). Although this northern cluster seems to disappear, the spatial distribution for tools *sensu stricto* (n= 111) shows a similar pattern (see Figure 6, De Loecker 1992:458). This applies more or less also to scrapers (Figure 3.78). Moreover, it seems that denticulates, notched pieces, backed knives and flakes with signs of use have a rather scattered horizontal distribution. However when all these typological categories are plotted together, it can be suggested that their distribution overlaps (except for the south) with the areas where most of the debitage (flakes and cores) and burned artefacts were situated (Figure 3.79). In other words, they conspicuously appear at the edges of the large scraper cluster, creating a rather 'empty' circular zone in the middle.

3.9.3 Spatial distribution of the 17 conjoined compositions

3.9.3.1 Introduction

In this section the spatial data of previously selected and technologically described 17 conjoined compositions (see Section 3.6.5) will be presented separately. These groups show the relevance of refitting in general (technologically as well as spatially) and in particular for Site K. Furthermore, their horizontal distribution is representative for the complete configuration of the Site K assemblage. Each composition will be spatially described briefly. However some compositions will be discussed in detail while others are treated in a more impressionistic way. The spatial explanation will mainly follow the described reduction sequence of every individual composition. For figures of the refitted compositions the reader is referred to Section 3.6.5. After this descriptive part the general spatial patterns will be interpreted in Section 3.10.

3.9.3.2 Spatial distribution of refitted composition I

The largest refitted nodule at Site K (composition I) consists of 160 artefacts. From a refitter's point of view this conjoined group is definitely the most spectacular result achieved in this assemblage (Figure 3.80-A). This group of refits gives positive proof of on-site core reduction and flake discard. It also indicates a possible flake selection (for use?) and clearly demonstrates intra-site transport of lithic materials. Moreover the horizontal patterning of the refitting results suggests that at distinct areas, different stages of core reduction were performed. The large amount of cortex on the outermost surface of this flint block shows that a raw material nodule entered the excavated area without any, or hardly any, preparation. At Site K the nodule was split into at least nine parts or cores by means of large thick flakes and natural fissures that were already in the flint before knapping. This initial splitting was done at the southeastern part of the excavated area. The many refitted flakes and seven cores that could be incorporated in this composition show that all nine parts/cores were further reduced within the excavated area. It can be suggested that the two missing cores were discarded in the southeastern part of the site, which was destroyed by commercial activities. In the next part some of the nine smaller parts will be described in terms of their horizontal distribution.

Spatial description of the different parts of refitted composition I

The general distribution map of composition I shows that for all nine cores the reduction starts, and sometimes ends (discard), in the southeastern part of the excavated area: the location where the nodule was initially divided into smaller parts (Figure 3.80-A). For three groups it can be suggested that a core and possibly some flakes were transported to other 'activity areas', where further reduction and discard took place.

One of the cores (Figure 3.80-B, refitted composition I [part C], sequence 62) was initially reduced in the southeastern part of the excavated area. This is shown by a small cluster of flakes (partly decortication flakes) recovered in an area of about nine metres square. From the debitage one flake was selected to be further reduced and discarded on the same spot. Next the core was transported about eight metres northwest, where the final reduction took place and where the nucleus was discarded among the last produced flakes. One flake produced in the southeastern area was recovered in this northwestern zone (about four metres southwest of the core). Because the flake was 'sealed' in a sequence of artefacts produced in the southeastern area, it can be suggested that this piece was transported, as a selected item, to the northwestern locus. A similar interpretation can be given for the proximal part of a broken flake which was produced in the northwestern area and discarded in the southeastern part of Site K. A different interpretation, and in the author's opinion a less logical one, would suggest that after the initial reduction in the southeast the core could have been transported 'to and fro' between the two loci, to produce in some cases only one flake at a time.

Another core (Figure 3.80-C, refitted composition I [part B], sequence 23), was completely reduced by removal of large flakes in the southeastern part of the excavated area. This cluster, which covers an area of about 12 metres square, was found ca. two metres north of composition I, part C (sequence 62). From the produced debitage at least two flakes were selected and transported in different directions. One flake was transported about eight metres to the west, more or less the area where the final reduction of composition I, part C took place. This is also the area where one of the possibly transported, and previously discussed, part C flakes was found. A second flake seems to have been transported to the most northern part of the excavated area. The place of recovery of this piece lies about 15 metres from the rest of the debitage.

Another example was completely reduced and discarded, including a selected and worked flaked-flake, in the southeastern zone of Site K. The participating flakes in this refitted group (Figure 3.80-D, refitted composition I [part A], sequence 2) were recovered from a rather large area, covering the southeastern areas of both parts previously discussed. The core, of high backed discoidal type, was found at the western edge of the excavated area. It can be suggested, although this is very speculative, that this voluminous core was transported to another area to be further reduced. It is even possible that the core was indeed further reduced in this western area, as it was recovered in a zone directly bordering on a commercially destroyed part of the site. Possible participating artefacts (for refitting) could in this scenario have been lost.

For the horizontal distribution of the other six cores belonging to refitted composition I the reader is referred to Figure 3.80-A (*cf.* [part D], sequence 85; [part E], sequence 120; [part F], sequence 154; [part G], sequence 218; [part H], sequence 227 and [part I], sequence 356). All these parts were reduced and discarded in the 'southeastern' part of the excavated area, the place where the large nodule was divided. Furthermore it seems that the debitage of these cores coincides with the western extension of the previously mentioned main dense cluster (see Section 3.9.2.1).

Summarizing, it can be suggested that nodule (composition) I was divided into at least nine smaller blocks or cores. This splitting took place in the southeastern part of the excavated area. Subsequently a number of cores was completely reduced at the same spot. After some flake production in the southeastern part one core and some flakes were transported in a northwesterly and northerly direction, where further reduction, possible use and discard took place. The spatial distribution of the complete refitted nodule (Figure 3.80-A) shows that the participating artefacts again more or less coincide with the main dense cluster and its northern and western extensions, as described for the total artefact assemblage

Furthermore this figure indicates that some parts of the nodule seem to respect each other. The southeastern and northwestern 'activity zones' are separated by an area in which there is a complete lack of artefacts. This zone corresponds with the area in which there were no cores and no burned artefacts, and from which many tools were recovered.

3.9.3.3 Spatial distribution of refitted composition II

Another large refitted group of artefacts is represented by refitted composition II (De Loecker 1994*a* and *b*; De Loecker *et al.* 2003). This nodule, consisting of 146 flakes and cores, gives apart from positive proof of on-site core reduction also indications of tool (*sensu stricto*) manufacturing and discard, and transport of lithics within the excavated area. These intra-site patterns create distinct areas with different stages of core reduction. From a spatial point of view composition II is probably the most spectacular example at Site K (Figure 3.81-A).

The abraded cortex on much of the refitted flakes indicates that the raw material was collected from nearby river-deposits and entered the site as a large block, with hardly any preparation. During the initial flaking, in the southeastern part of the excavated area, the flint nodule was divided into at least eight parts or cores. The nodule was split following a strategy in which the raw material was divided into large thick flakes. Natural fissures played a crucial part in this

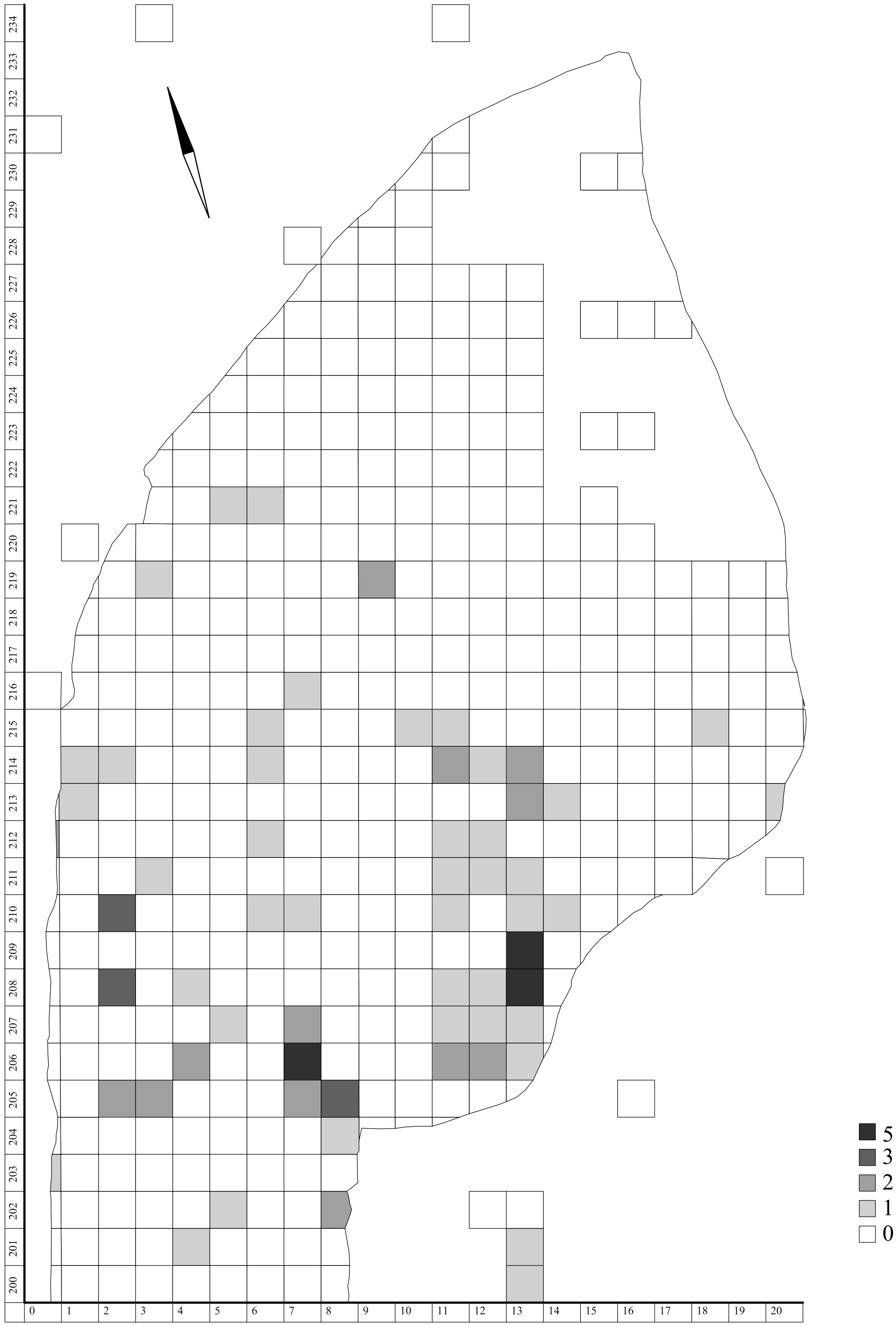


Figure 3.76-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of cores (n= 91) per metre square.

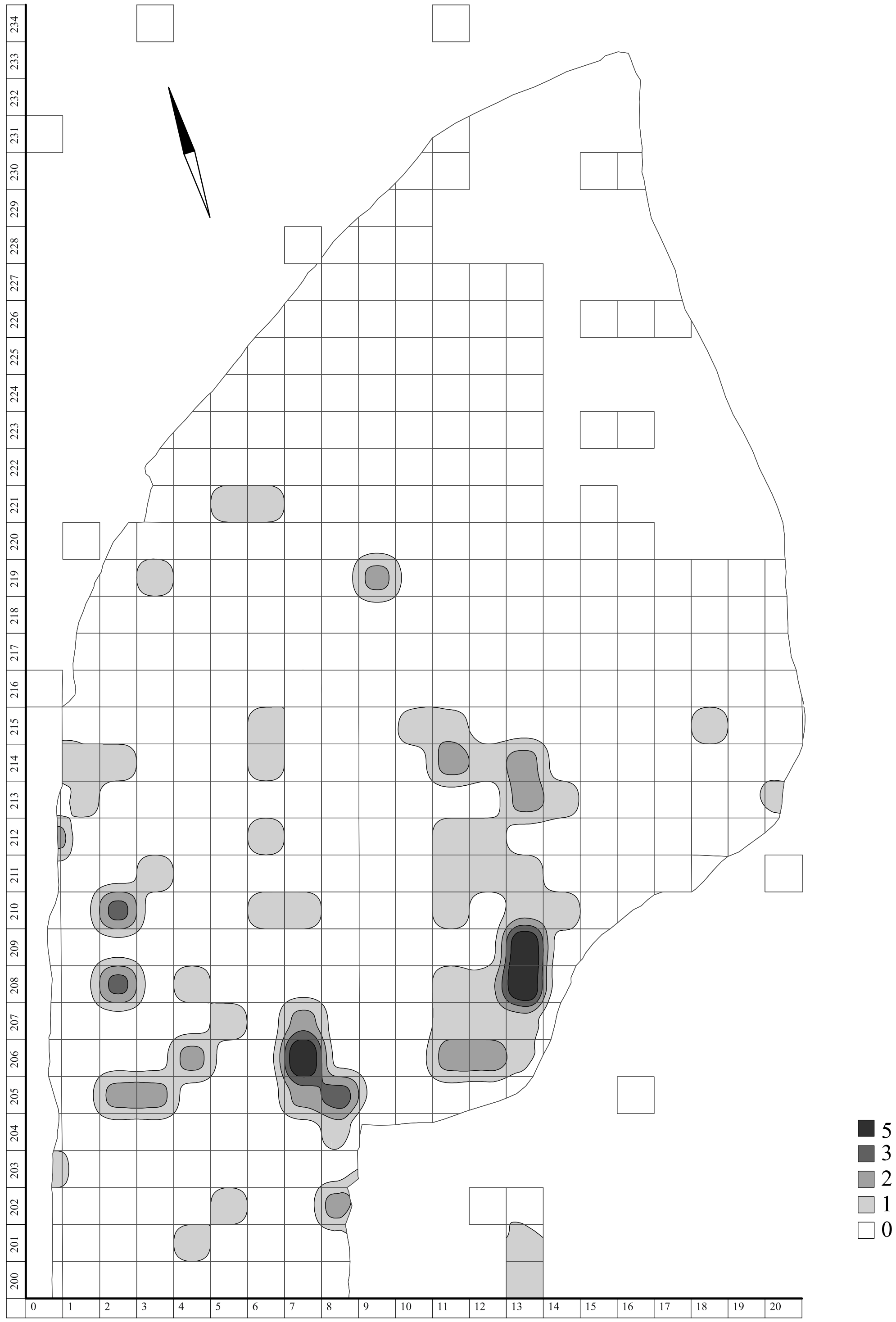


Figure 3.76-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.76-A. Excavation grid in metres square.

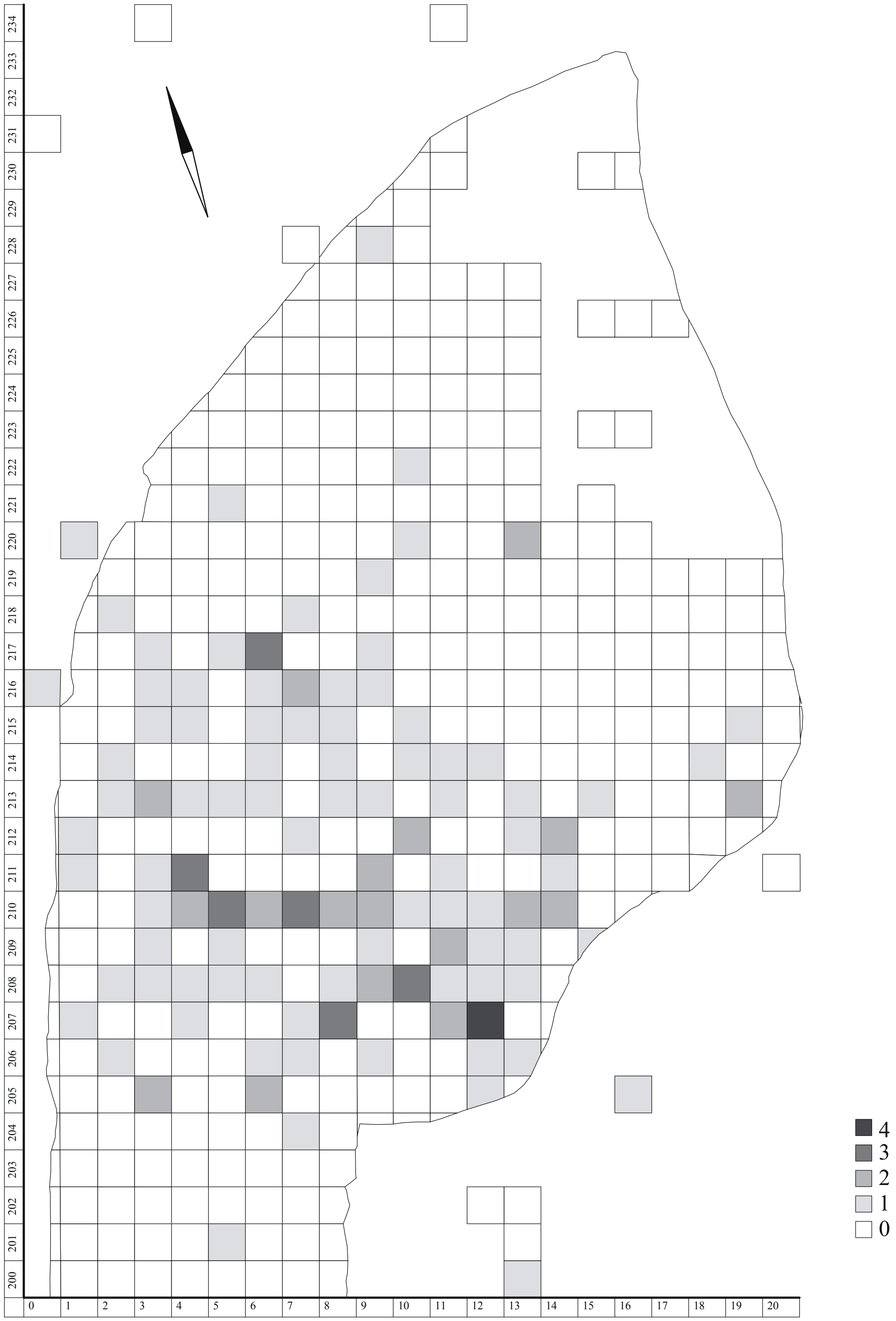


Figure 3.77-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of tools (n= 137) per metre square.

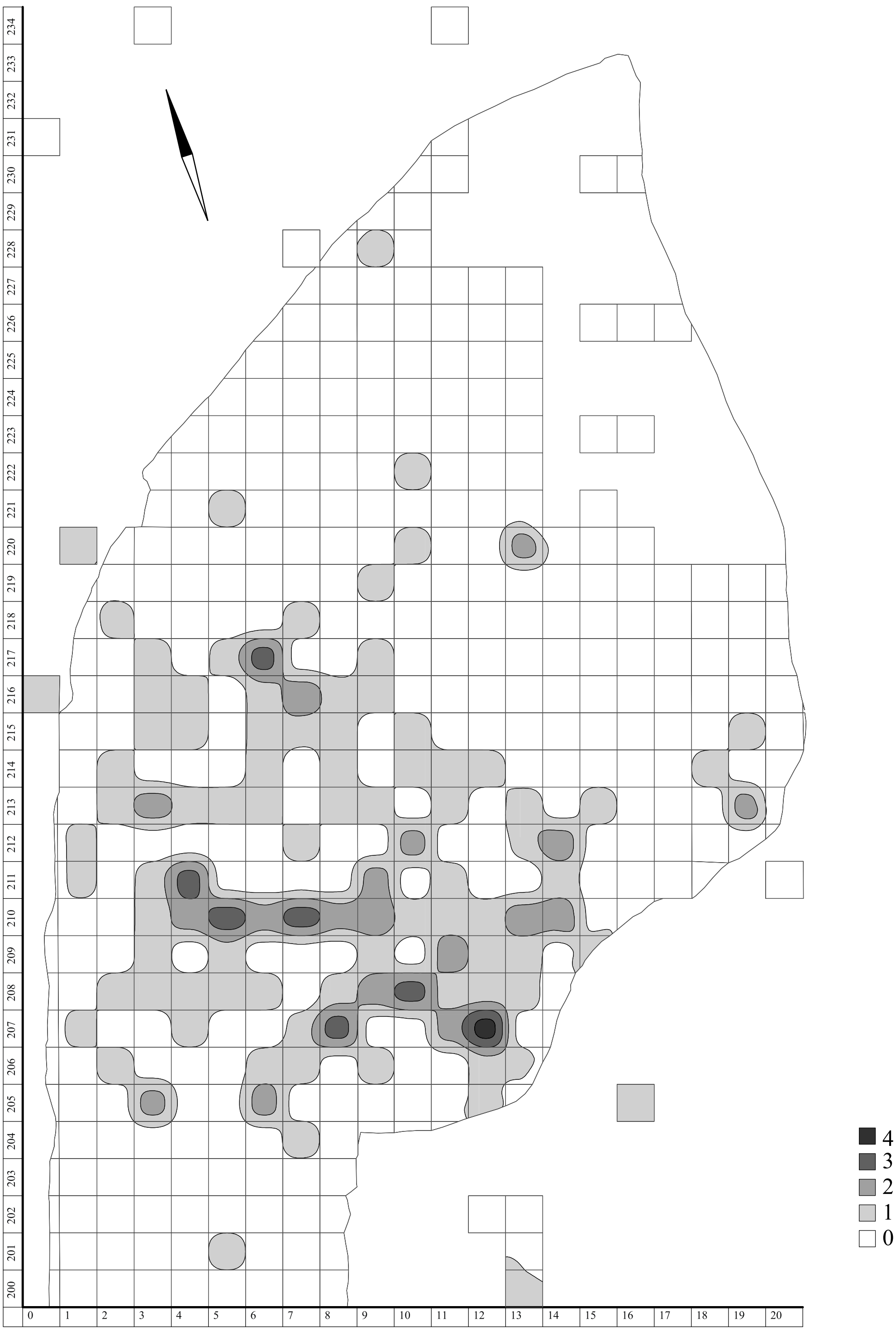


Figure 3.77-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.77-A. Excavation grid in metres square.

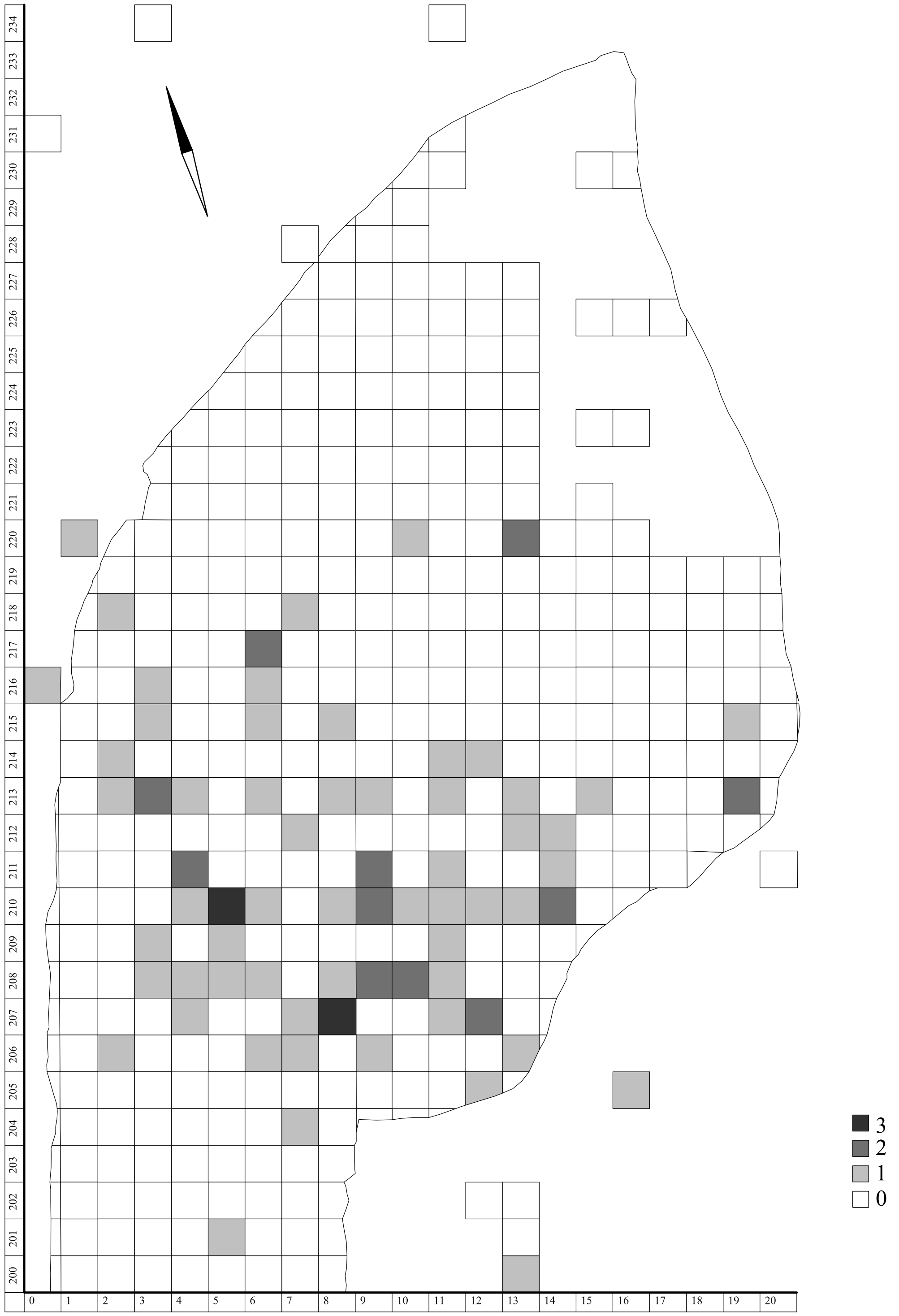


Figure 3.78-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of scrapers (n= 83) per metre square.

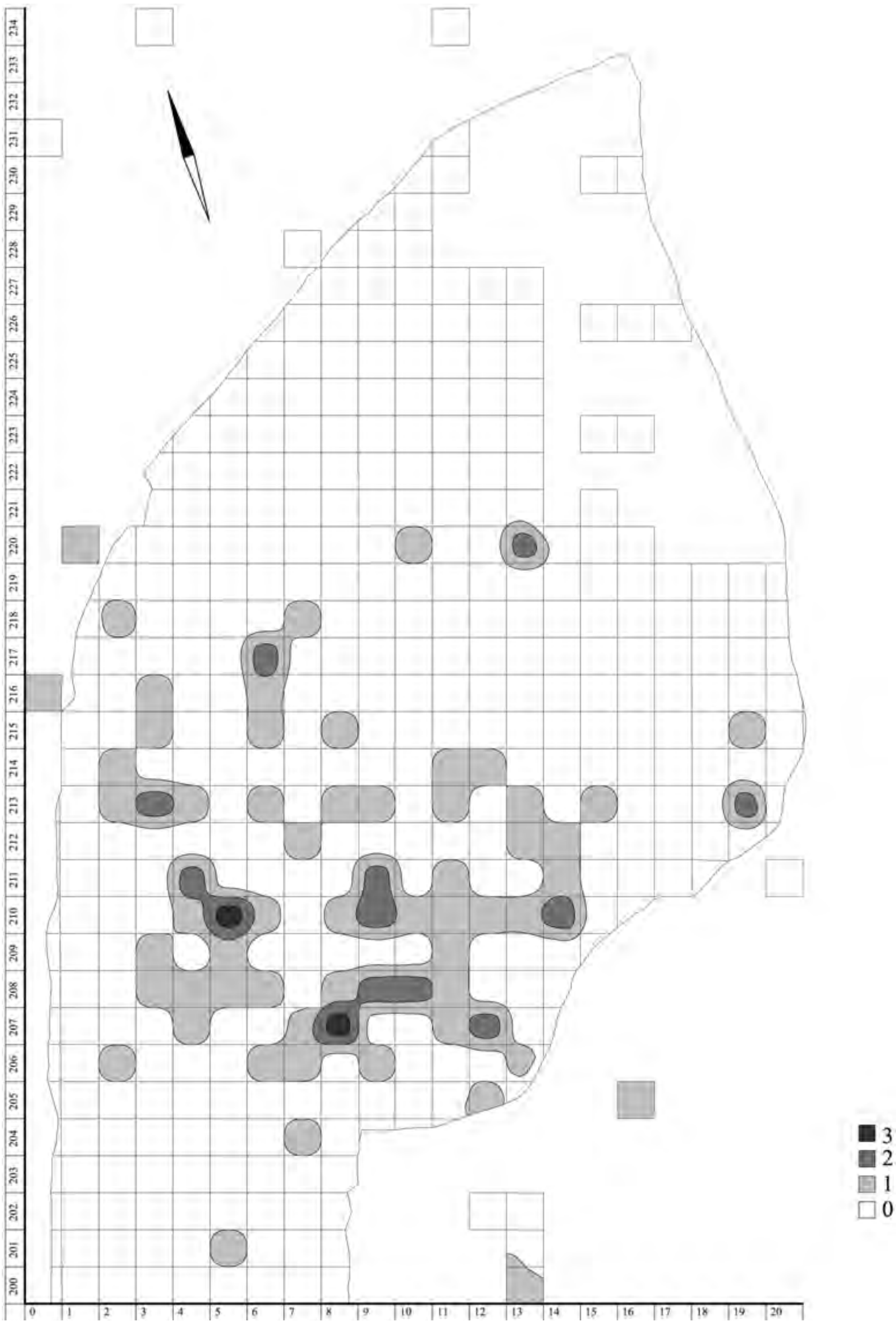


Figure 3.78-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.78-A. Excavation grid in metres square.

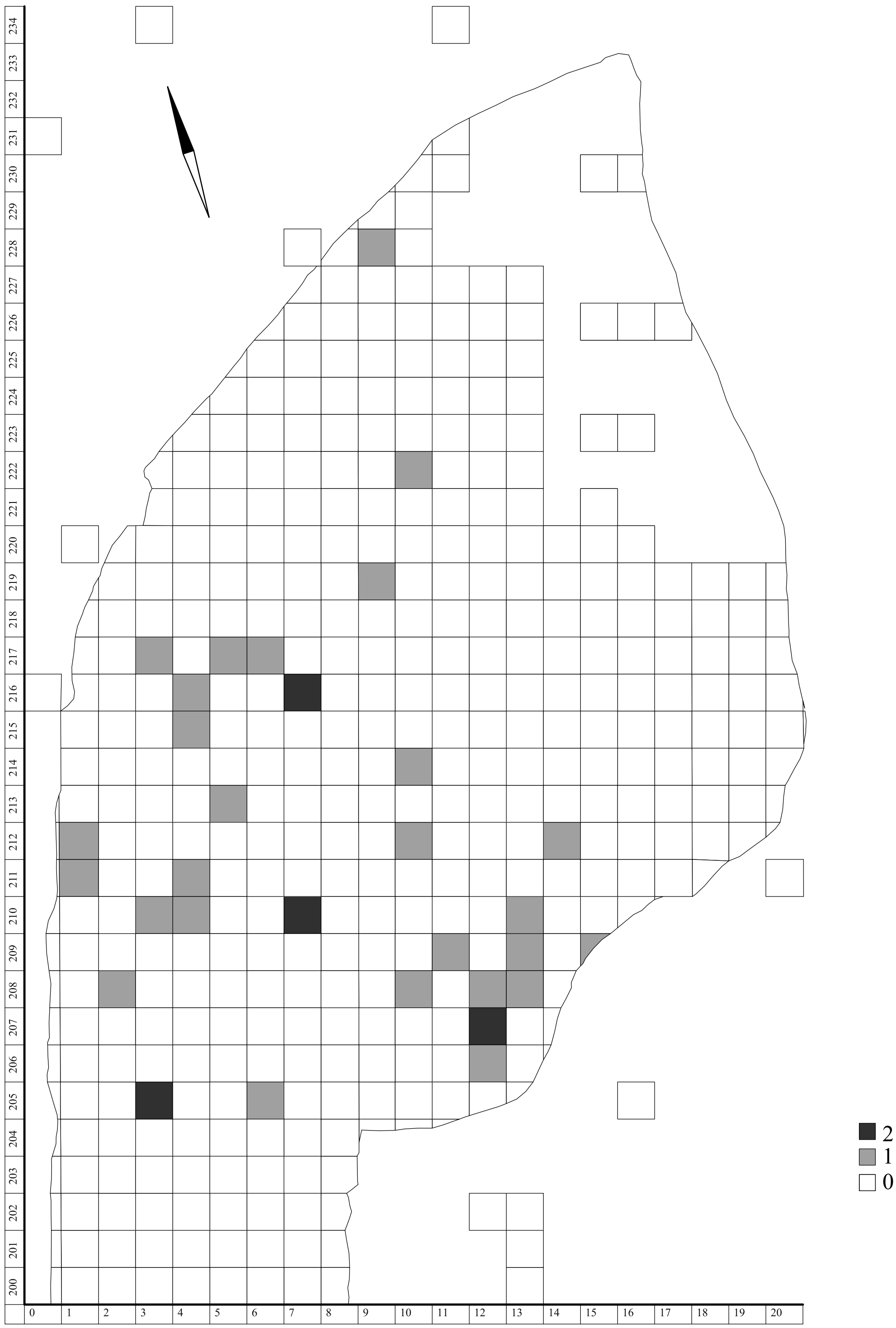


Figure 3.79-A: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of notched pieces, denticulates, backed knives and pieces with signs of use (n= 35) per metre square.

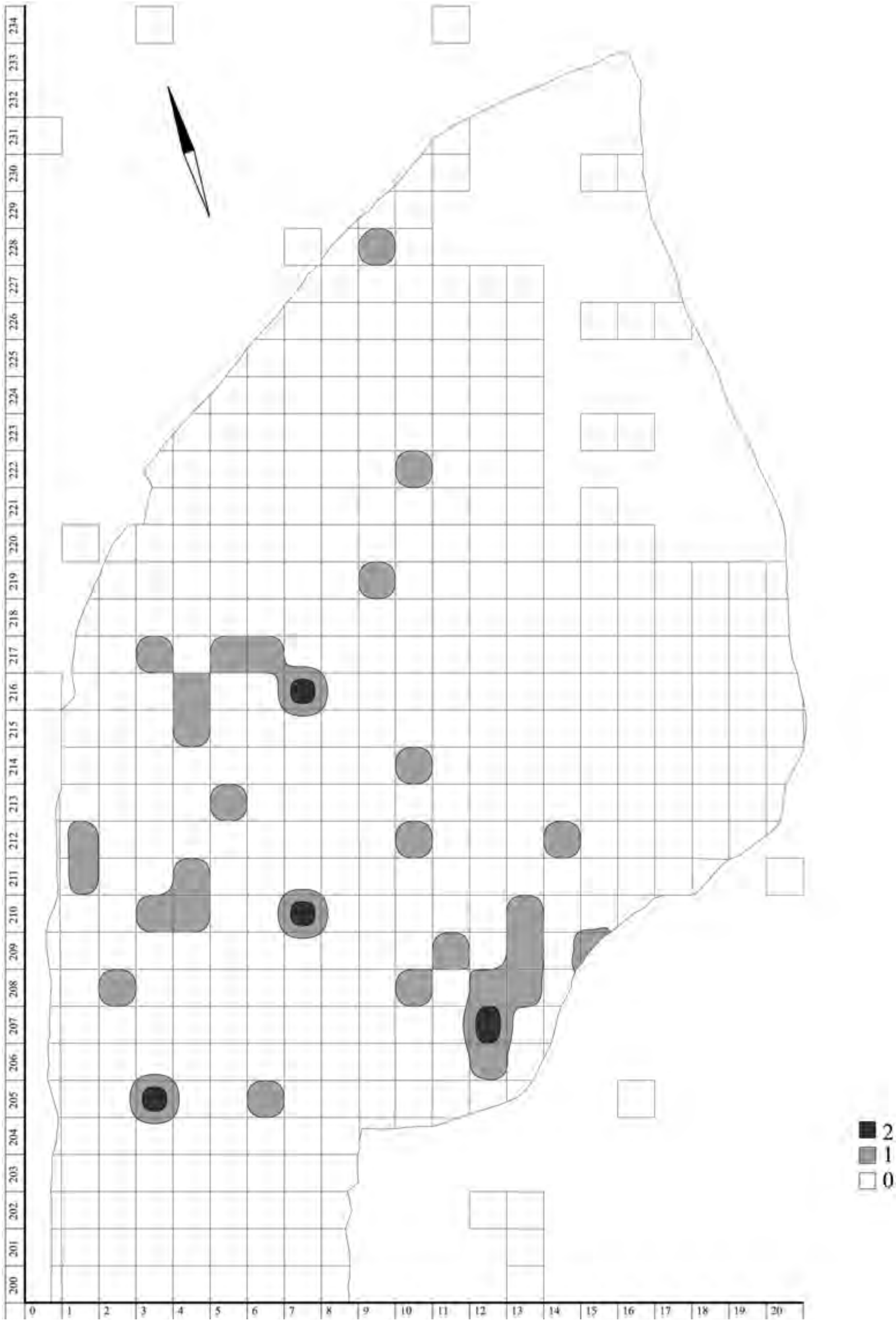


Figure 3.79-B: Maastricht-Belvédère Site K. Contour map based upon the data shown in Figure 3.79-A. Excavation grid in metres square.

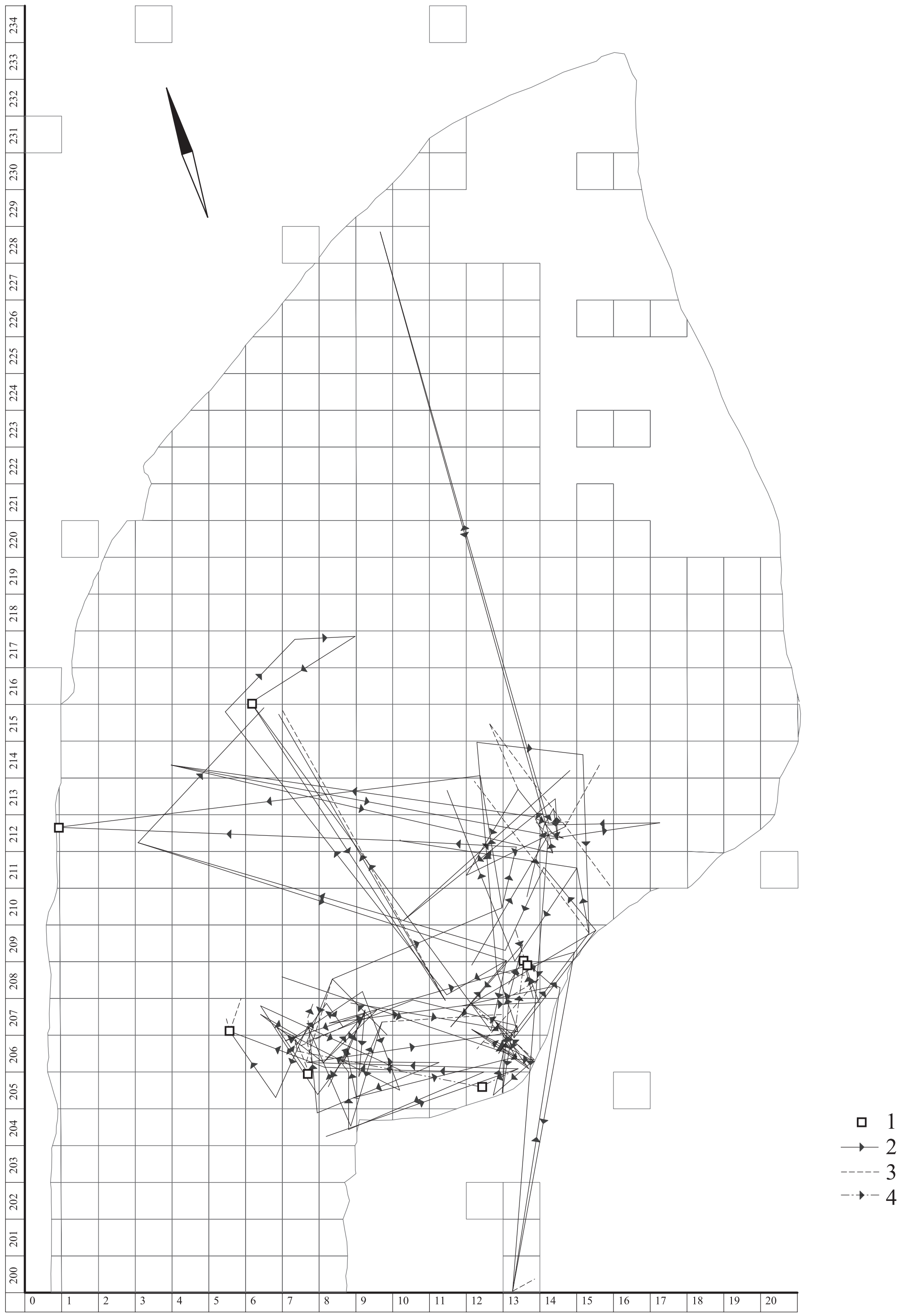
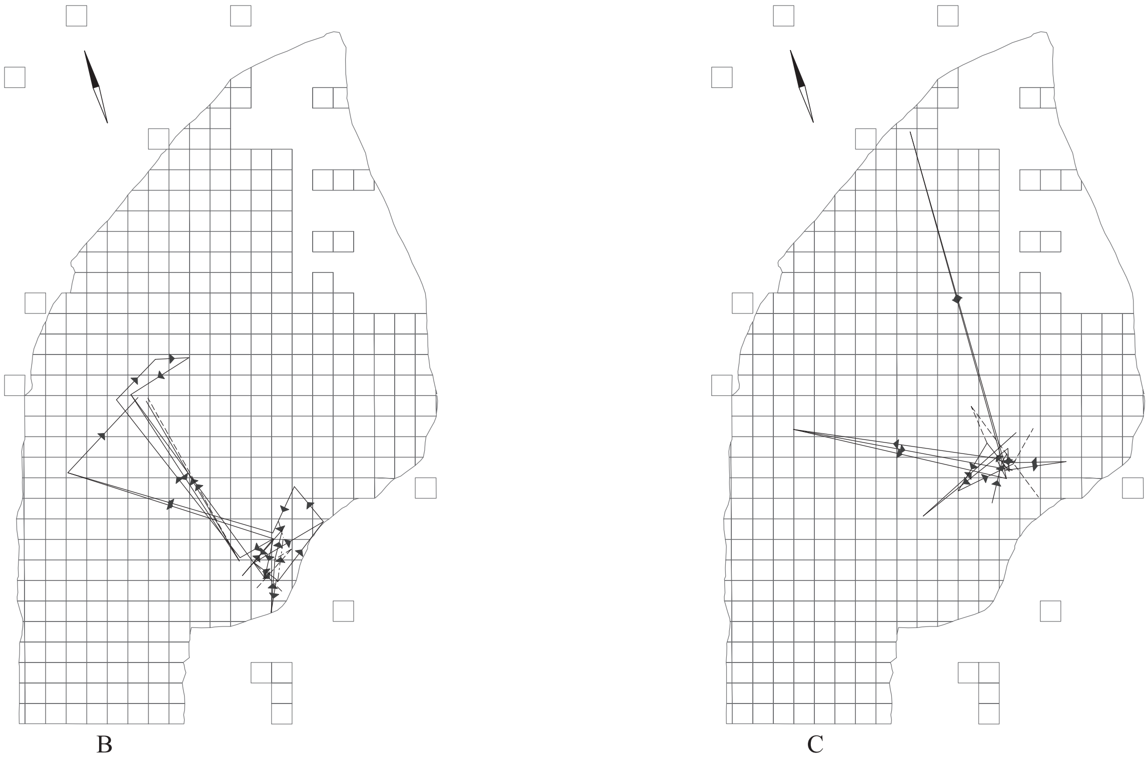
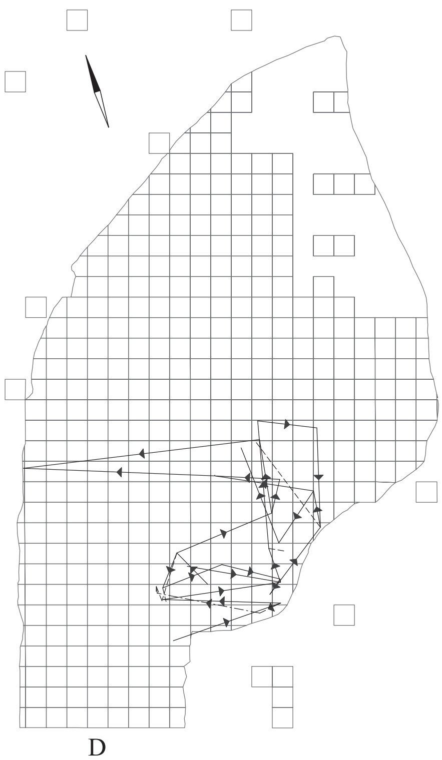


Figure 3.80-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition I. Map representing the spatial distribution of all refitted artefacts of composition I (Raw Material Unit reduction sequence). The conjoined groups are represented in the ‘Cziesla approach’ (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)





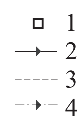


Figure 3.80-B, -C, -D: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition I. B: Spatial distribution of part C. C: Spatial distribution of part B. D: Spatial distribution of part A. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)

Figure 3.81-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition II. Map representing the spatial distribution of all refitted artefacts of composition II (Raw Material Unit reduction sequence).The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

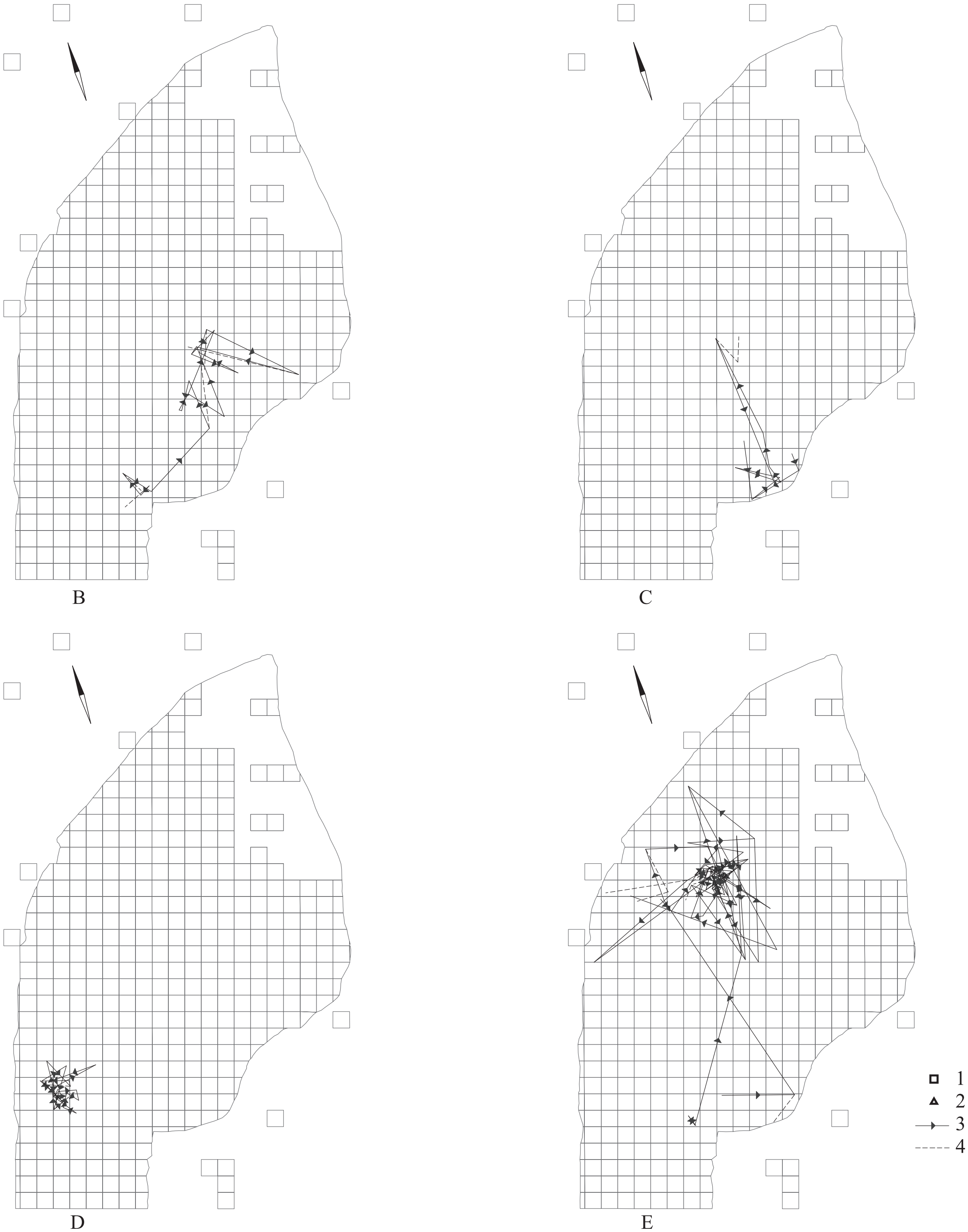


Figure 3.81-B, -C, -D, -E: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition II. B: Spatial distribution of part B. C: Spatial distribution of part E. D: Spatial distribution of part F. E: Spatial distribution of part A. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

strategy. Refitting shows that all eight parts were further reduced in the excavated area. This is amongst others shown by the many refitted flakes and by five cores that could be incorporated in this group. It is possible that at least three missing cores were discarded in the southeastern part of the site, which was destroyed by quarrying activities. Some of the eight reduced cores will be discussed below in terms of the spatial distribution of different stages of core-reduction.

Spatial description of the different parts of refitted composition II

The distribution map of composition II shows that five cores where more or less reduced and discarded at the 'same' location where the nodule was initially split (Figure 3.81-A). From the other three groups the cores and one tool were transported to other activity areas, where further reduction and discard took place.

Of one core (Figure 3.81-B, refitted composition II [part B], sequence 24) several large and thick flakes were removed in the southern part of the excavated area. This is shown by a small cluster of six large flakes (partly decortication flakes). Next the core was transported about five metres northeast, where further reduction took place. The core was discarded among the produced flakes. This composition consists of 23 artefacts.

Another part of the large block, consisting of 13 elements (Figure 3.81-C, refitted composition II [part E], sequence 124), was completely reduced in the southeastern part of the excavated area by removal of large flakes. From the produced debitage one flake was selected and retouched into a simple side scraper. This scraper was found some six metres to the north. The place of recovery coincides with the circular 'empty' zone, discussed above, or better the area where most of the other scrapers are found. Probably due to sediment pressure, the tool was found broken into three parts.

After dividing the large flint nodule in the southeastern part of the excavated area one part, consisting of 26 artefacts, was completely transported to a southwestern zone (Figure 3.81-D, refitted composition II [part F], sequence 133). There the core was reduced by removal of smaller flakes (than the other parts of the nodule) and discarded within an area with a cross-section of about three metres.

From the core shown in Figure 3.81-E, which consists of 59 artefacts (refitted composition II [part A], sequence 9), a number of large decortication flakes were removed in the southeastern part of the excavated area. Next the core was transported eight metres to the north, where again some large flakes were produced. Another four metres further north the core was completely reduced by the production of smaller flakes and was discarded on the spot. The main part of debitage, amongst others, represents the smaller flint cluster which was described in the 'northern' part of the excavated area (see Section 3.9.2.1). Of interest is also the fact that the discarded core was recovered about four metres to the west of the bulk of material.

All other parts belonging to this large composition, or raw material nodule (refitted composition II [part C], sequence 84; [part D], sequence 104; [part G], sequence 137 and [part H], sequence 141) were reduced and discarded in the 'southeastern' part of the excavated area, the place where the large nodule was divided. The core of part H was recovered about five metres north of its most northern flake.

In short one could say that this block was divided into at least eight parts or cores. This splitting of the nodule took place in the southeastern part of the excavated area. Next a number of cores and a tool were transported in a northerly and westerly direction, where further reduction and discard took place. If we look at the spatial distribution of the complete nodule (Figure 3.81-A), all eight parts seem to respect each other. Remarkable is that the small 'activity zones' form part of a circle. The western empty zone corresponds with the area in which there is a lack of cores and burned artefacts.

3.9.3.4 Spatial distribution of refitted compositions III and IV

Refitted nodule III, which consists of at least two parts ([part A], sequence 116 and [part B], sequence 25), was initially split, the smaller cores were further reduced and all debitage was discarded in the southeastern part of the excavated area (Figure 3.82). The two parts/cores show a perfect horizontal overlap in an area of about five by five metres. None of the discarded cores could be recovered while one flake from part A was found ca. four metres north of the rest of the debitage. This flake is not one of the two, previously mentioned, broken Levallois *sensu stricto* flakes (see Section 3.6.5.4).

Composition IV consists of 44 artefacts and the horizontal distribution suggests again that in distinct areas, different stages of core reduction were performed. The raw material nodule entered the excavated area without any, or hardly any, preparation and was split into at least four parts. This initial stage of core reduction of three cores was performed at the southern end of the excavated area (Figure 3.83-A). For the fourth core (refitted composition IV [part D], sequence 164) this information is absent, as this part is only represented by one broken flake (also found in the south). At least two parts were discarded at the same location where the nodule was initially split. For another group it can be suggested that a core, and possibly a flake, were transported to other 'activity areas', where further reduction and discard took place.

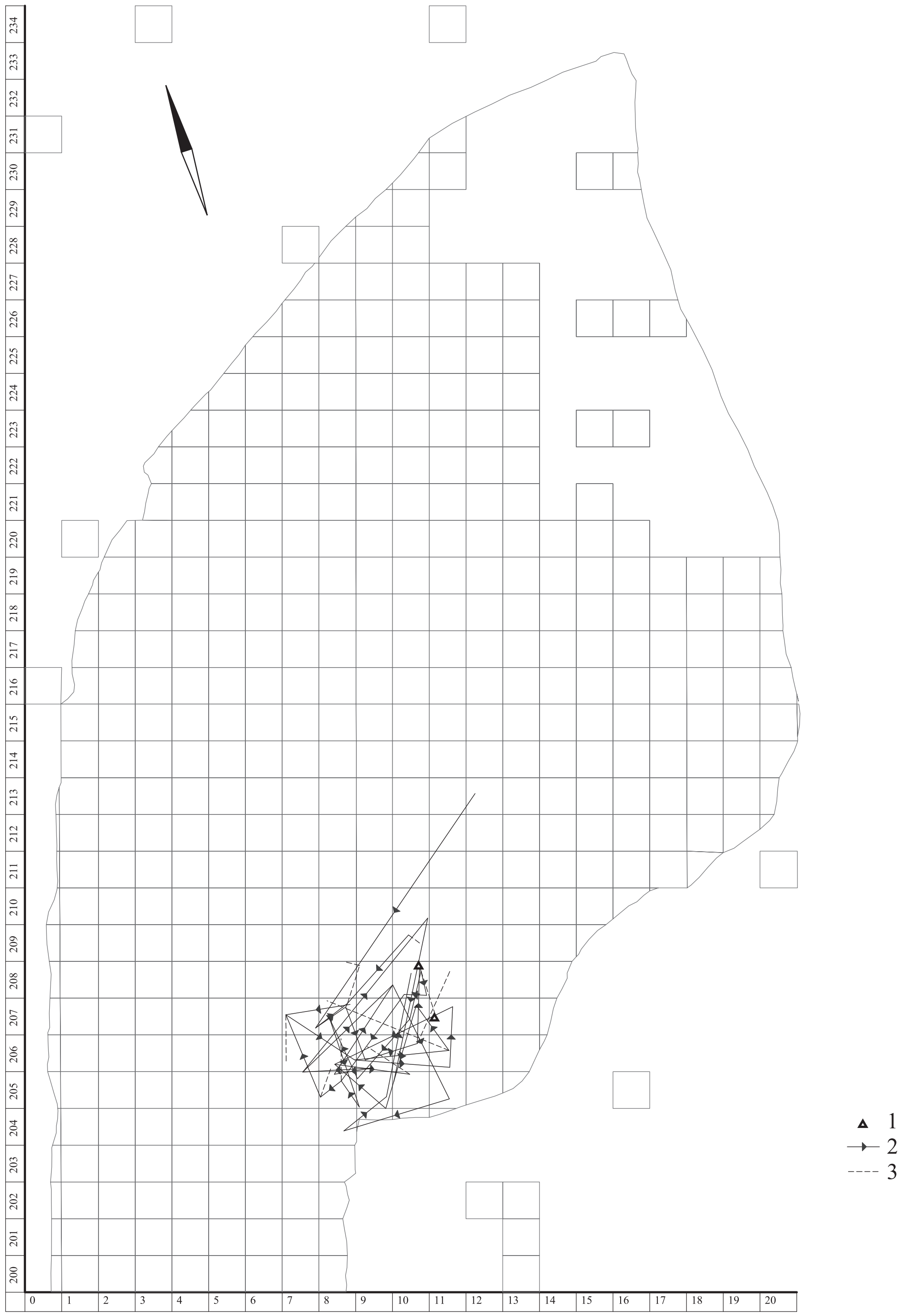


Figure 3.82: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition III. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Tool
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

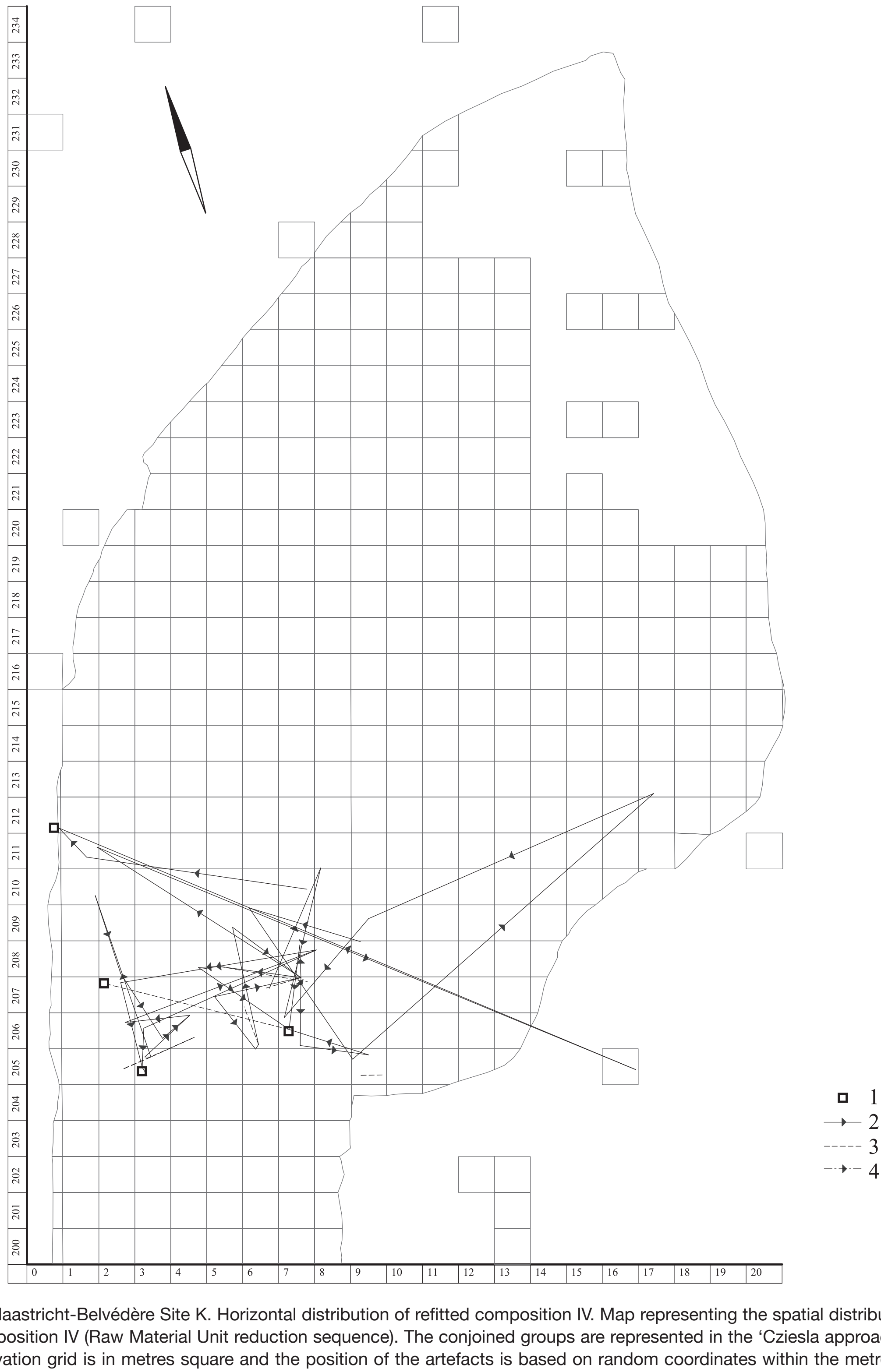
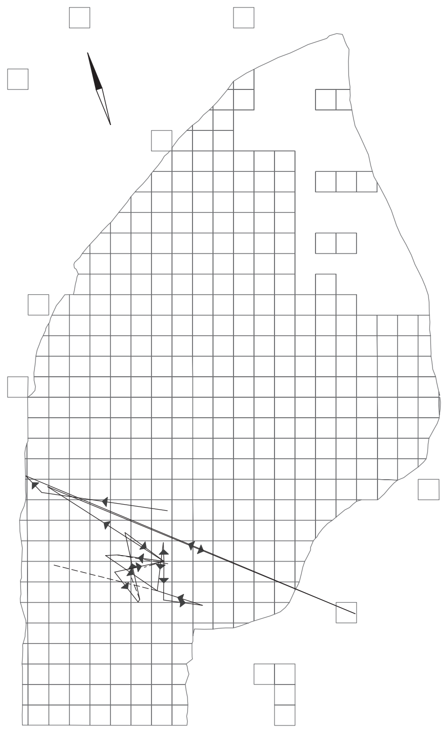
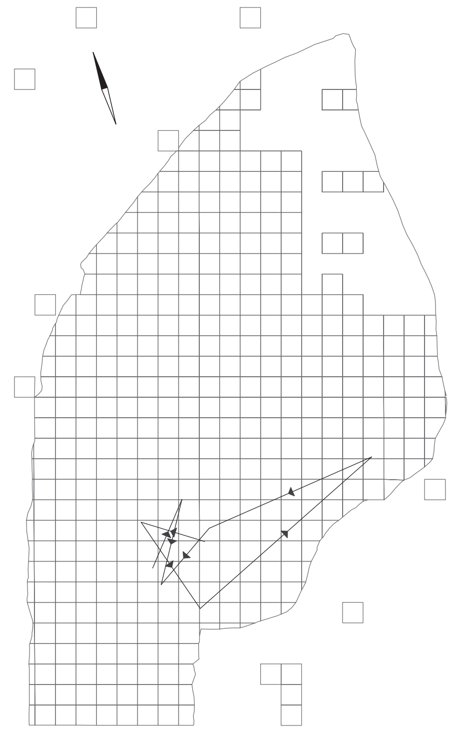


Figure 3.83-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition IV. Map representing the spatial distribution of all refitted artefacts of composition IV (Raw Material Unit reduction sequence). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

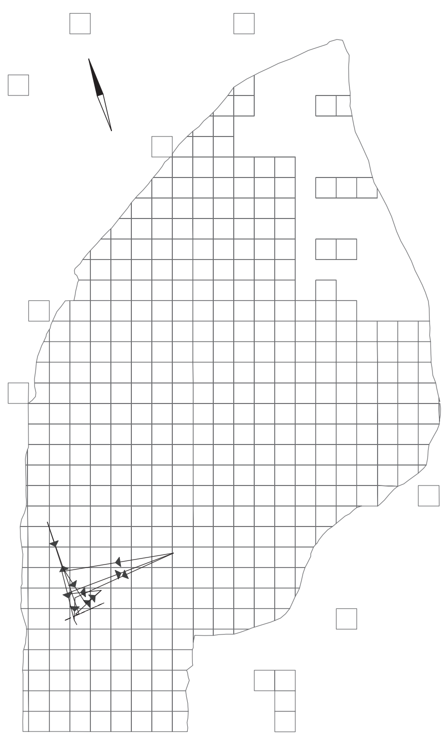
1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)



B



C



D

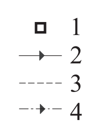


Figure 3.83-B, -C, -D: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition IV. B: Spatial distribution of part C. C: Spatial distribution of part A. D: Spatial distribution of part B. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)

The distribution map of composition IV, part C, (Figure 3.83-B, sequence 62) shows that core reduction started in the (central) southern part of the excavated area. This is shown by a cluster of large and thick decortication and natural fissure flakes, found in an area of about nine metres square. One flake (flaked-flake) was selected to be further reduced in the same spot. Also at this location the core was again split into two parts. Core C-2 was further reduced and discarded in the same zone, while core C-1 was transported about four metres northwest. The latter core and its debitage was recovered at the same location as the voluminous high backed discoidal core of composition I, part A (Section 3.9.3.2). Based on refitting it can be suggested that a flake was selected from the debitage and was transported (about 11 metres) to a southeastern area.

Composition IV, part A, (Figure 3.83-C, sequence 78) was totally reduced and discarded at the southern location (as part C) where the nodule was initially split. Again, it can be suggested that a flake was transported to another zone. The flake in question was recovered about eight metres northeast. The 'centre' of the flaking locus of composition IV, part B, (Figure 3.83-D, sequence 130) lies ca. two metrers west of the two previously described parts. Eventually the core was discarded among its debitage. One of the participating flakes was found in the northwestern area of Core C-2.

In general, composition IV was split into at least four smaller cores. This splitting of the nodule took place in the southern part of the excavated area. Subsequently some cores were reduced at the same spot. One part was split into two cores, one of which was subsequently transported in northwesterly directions. Transport can also be suggested for some flakes. The spatial distribution of the complete refitted nodule (Figure 3.83-A) shows that the artefacts were recovered from the western extension of the main dense cluster, described for the total artefact assemblage. This figure also indicated that there is a clear interaction between at least two 'activity areas'. Between these areas again an 'empty' zone is described.

3.9.3.5 Spatial distribution of refitted compositions V and VI

Refitted composition V (sequence 56) consists of only six artefacts. The participating artefacts were recovered from an area which coincides with the northern cluster and the group shows a rather large vertical distribution (Figure 3.84). Technologically this composition represents a large initial decortication flake which was secondarily used as a core (flaked-flake). The conjoined sequence represents a final stage of a core-reduction. However, the 'first' flake in this sequence looks conspicuous as it was located about six metres from the rest of the debitage: at the western edge of the excavated area. It can be suggested, although this is very speculative, that the 'first' stages of core reduction were performed in a western area, destroyed by quarrying activities, and that the core was subsequently transported to the place of recovery. One part of a split-cone broken flake was situated ca. four metres to the east of the 'main' knapping area.

A similar pattern is suggested for composition VI (sequence 44), which consists of eight artefacts. The core, probably belonging to a much larger split nodule, was completely reduced at the southern part of the excavated area (Figure 3.85). The spatial distribution of the core and its debitage borders a commercially destroyed zone in the southwest of Site K. However two of the last flakes in the sequence were found about eight metres (to the east) from the core. These were recovered at the boundary between the excavated and the destroyed area. The latter two flakes were struck from another striking surface than the rest of the debitage. Given this, the following scenario can be suggested. A core was initially reduced in the southeast, to be secondarily transported to the southwest for further flake production from another striking surface. Furthermore it seems that in this area the core was eventually used as a hammerstone or anvil.

3.9.3.6 Spatial distribution of refitted composition VII

Composition VII represents only part of a much larger production sequence. This nodule consisting in total of 28 artefacts gives positive proof of on-site core reduction, tool (*sensu stricto*) manufacturing and discard. The composition furthermore indicates transport of a flake/tool within the excavated area (Figure 3.86-A). Like amongst others compositions I and II (respectively Sections 3.9.3.2 and 3.9.3.3), the intra-site patterns show distinct areas with different stages of core reduction (and use?). A raw material nodule was split by removal of large and thick flakes (and flaws), 'exceptionally' in the northern part of the excavated area. This zone corresponds with the spatial distribution of, amongst others, refitted composition II, part A, (sequence 9). During this initial flaking the flint nodule was divided into at least two blocks. Both parts were further reduced on the spot where the splitting took place. However the actual cores could not be refitted to the composition.

Spatial description of the different parts of refitted composition VII

The spatial distribution map of composition VII, part A (sequence 13; Figure 3.86-B), shows that a core was reduced by removal of several large and thick flakes. At least three of the 'first' flakes were selected and secondarily used as flaked-flakes. The cores and debitage were discarded among the other produced flakes. This composition consists of 25 artefacts and shows a rather large spatial distribution.

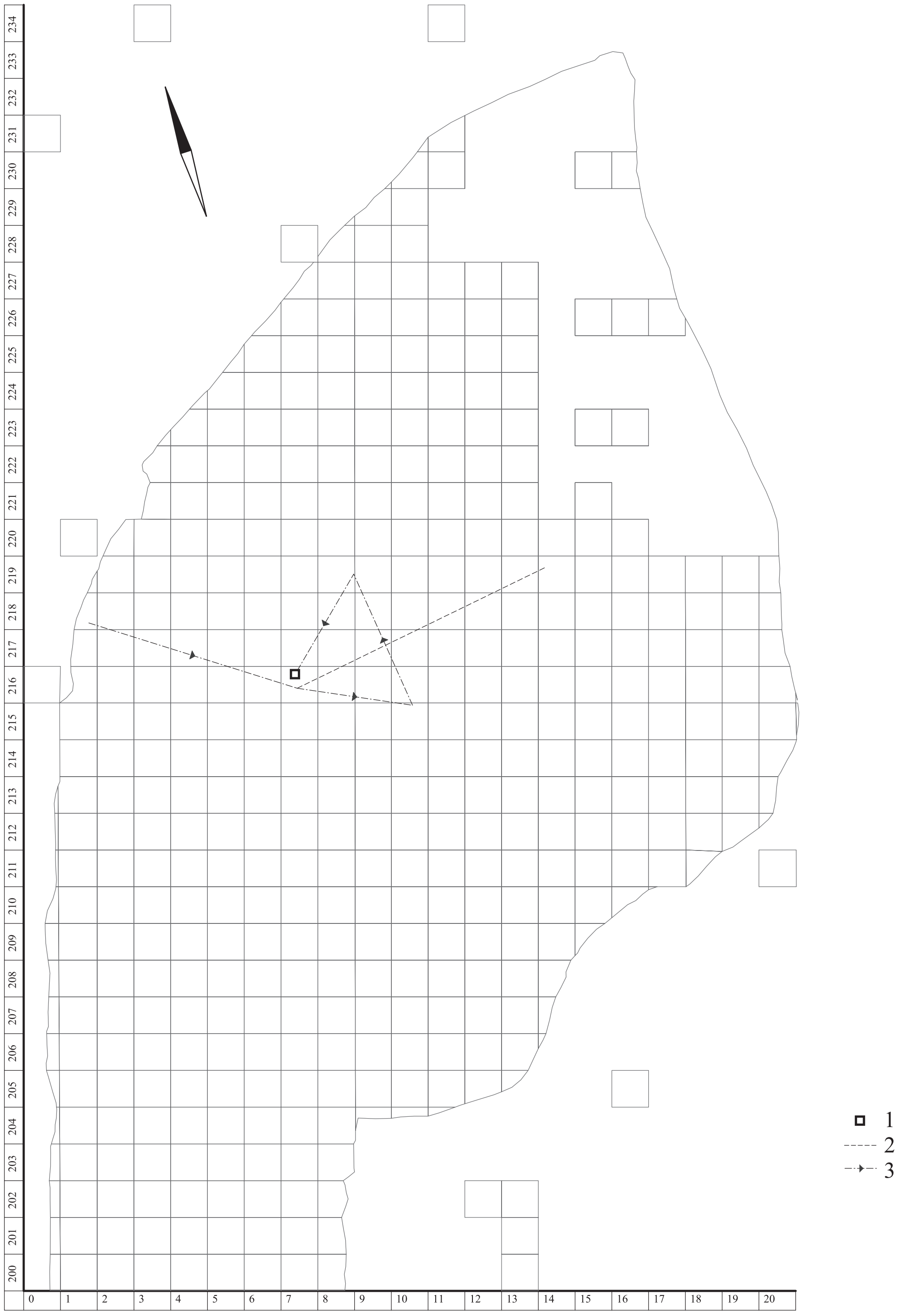


Figure 3.84: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition V. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990).The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aneinanderpassung* (breaks)
3. *Anpassung* (modifications)

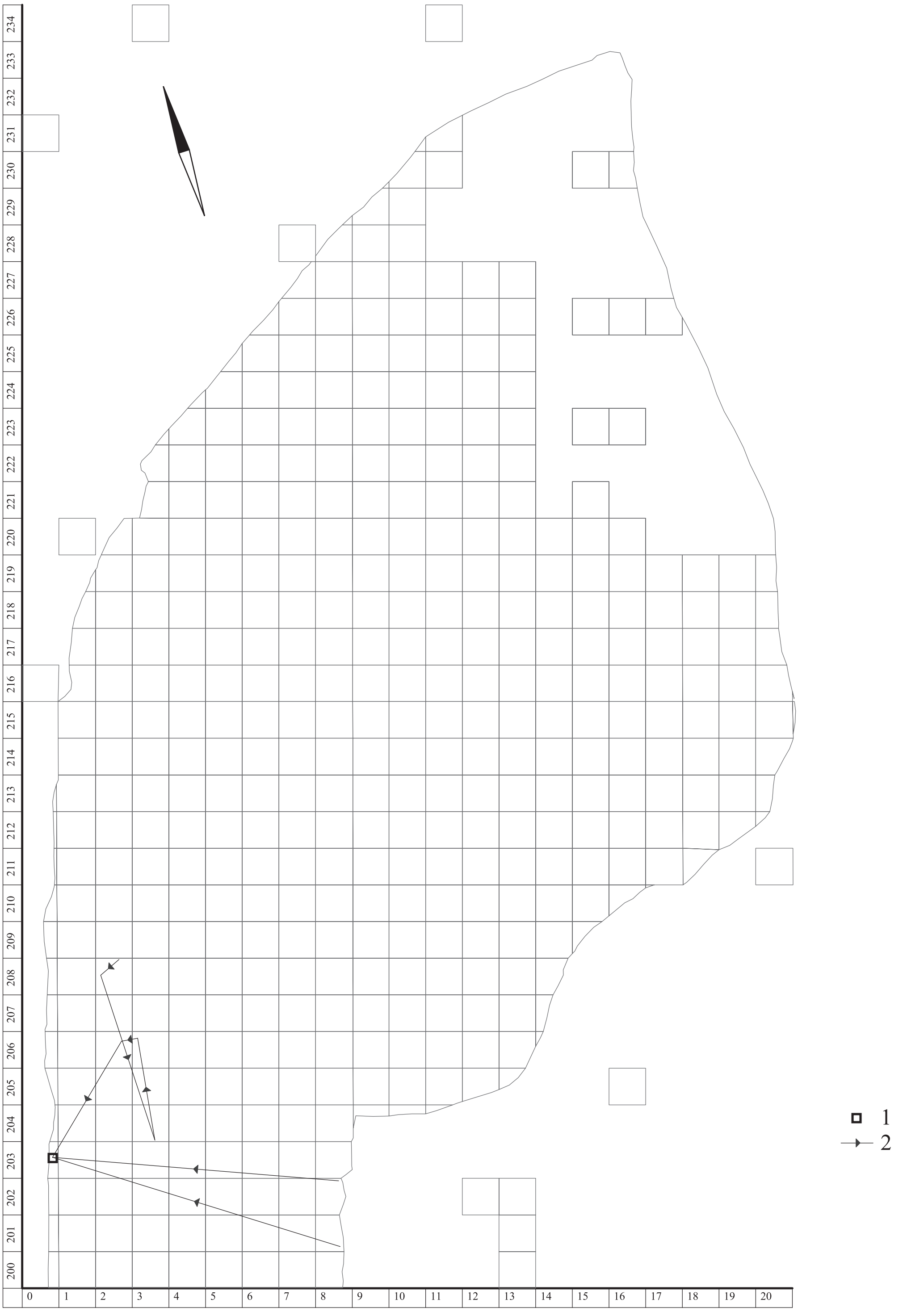


Figure 3.85: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition VI. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core 'secondarily' used as hammerstone or anvil
2. *Aufeinanderpassung* (production sequences)

Part B (sequence 11; Figure 3.86-C) is only represented by one initial natural fissure covered flake (three artefacts) and it seems that the core was first reduced in the same way as part A (production of large and thick flakes, to be secondarily used as flaked-flakes).

One of these large flakes was selected and transported about ten metres to the southwestern part of the excavated area. There the flake was transformed into an atypical burin by removal of one single burin-spall. The tool and its production flake were recovered from two adjacent metres square. As can be deduced from previous flake scars this burin was subsequently modified, perhaps after use, into a notched piece. This atypical burin, or better notched piece, was found in spatial relation with a heavy typical burin and a notched artefact produced from the 'exotic' flake which represents refitted composition XVI (sequence 126, Section 3.9.3.13).

In general this example, again, shows that a large raw material nodule was divided into at least two smaller blocks. These units were further reduced in the northern part of the excavated area. One large flake was selected and transported to the southwestern part of the site, where it was transformed into a tool.

3.9.3.7 Spatial distribution of refitted composition VIII

The 19 artefacts of conjoined composition VIII (sequence 76) indicated that this core was completely reduced in the southwestern part of the excavated area (Figure 3.87). Spatially the flakes and core were found in an area with a diameter of about four metres and their distribution is almost identical to that of composition XVI (sequence 126, Section 3.9.3.13). One of the first flakes in the sequence, struck from a 'less important' core surface, was recovered in a southeastern zone. This artefact was found about five metres from the rest of the flakes. It can therefore be suggested, although this is very speculative, that a 'first' stage of core reduction was performed in a southeastern area that was destroyed by quarrying. Next the core was transported to the place of recovery, to be further reduced from a 'main' striking surface. Probably one of the first flakes of this reduction phase was selected to be used as a tool. Positive proof for this assumption is given by the fact that this tool, a naturally backed knife, stands out spatially. In fact this backed knife was lying about eight metres north of the 'main' southwestern flaking area. Worth mentioning is that the tool was recovered only three metres north of two possibly transported flakes, belonging to refitted composition I part B and C (Section 3.9.3.2).

3.9.3.8 Spatial distribution of refitted composition IX

Refitted composition IX consists of 14 artefacts and represents a large and thick flake which belongs to a much longer sequence. It can be suggested that a large raw material flint nodule entered the excavated area where it was initially split in the southern area (Figure 3.88-A). Subsequently, a very large initial flake was chosen from the debitage and divided once more into two parts.

The distribution map of composition IX, part 1-1 (sequence 100) shows that one of these 'second generation' flaked-flakes was completely reduced and discarded in the southwestern zone of Site K (Figure 3.88-B). Most of the flakes and core were recovered from an area of about six metres square. Again this zone corresponds with the distribution of amongst others composition XVI (sequence 126, Section 3.9.3.13). One of the first artefacts in this refitted series of flakes was spatially located ca. three metres south of the rest of the debitage.

It seems that the other 'second generation' flaked-flake (composition IX [part 1-2], sequence 135) was reduced at the same location as part 1-1 (Figure 3.88-C). However the core was recovered broken in the southeastern, commercially destroyed, area.

3.9.3.9 Spatial distribution of refitted composition X

Refitted composition X (sequence 355) represents a large initial decortication flake which was secondarily used as a core (flaked-flake). The large flake or better core was completely reduced and discarded in a western zone of the excavated area (Figure 3.89). As mentioned before this composition stands out against most of the other refitted groups by the close attention that was paid to the preparation of the core (see Section 3.6.5.11). Especially the convexity of the main striking surface and the striking platform received special attention. Eventually the reduction sequence ended with the production of a larger flake which can be interpreted as a 'preferential' piece. This flake also looks conspicuous on the spatial distribution map of composition X. Although most of the flakes and the core were recovered in a western area, with a maximum cross-section of about six metres, the so-called 'preferential' flake was situated about five metres east of the debitage. It can, therefore, be suggested that the flake was transported to the place of recovery (place of use?).

3.9.3.10 Spatial distribution of refitted compositions XI, XII and XIII

The horizontal distribution of refitted composition XI shows a flint nodule which entered the excavated area and was subsequently probably split on the spot (Figure 3.90). Composition XI consists of 12 artefacts and the nodule was divided into at least two parts ([part A], sequence 15 and [part B], sequence 47). The two smaller cores were further reduced and the debitage was discarded in a western zone. Their spatial distribution coincides with the one of refitted composition X (Section 3.9.3.9). Furthermore it has to be

Figure 3.86-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition VII. Map representing the spatial distribution of all refitted artefacts of composition VII (Raw Material Unit reduction sequence). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool

3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)
5. *Anpassung* (modifications)

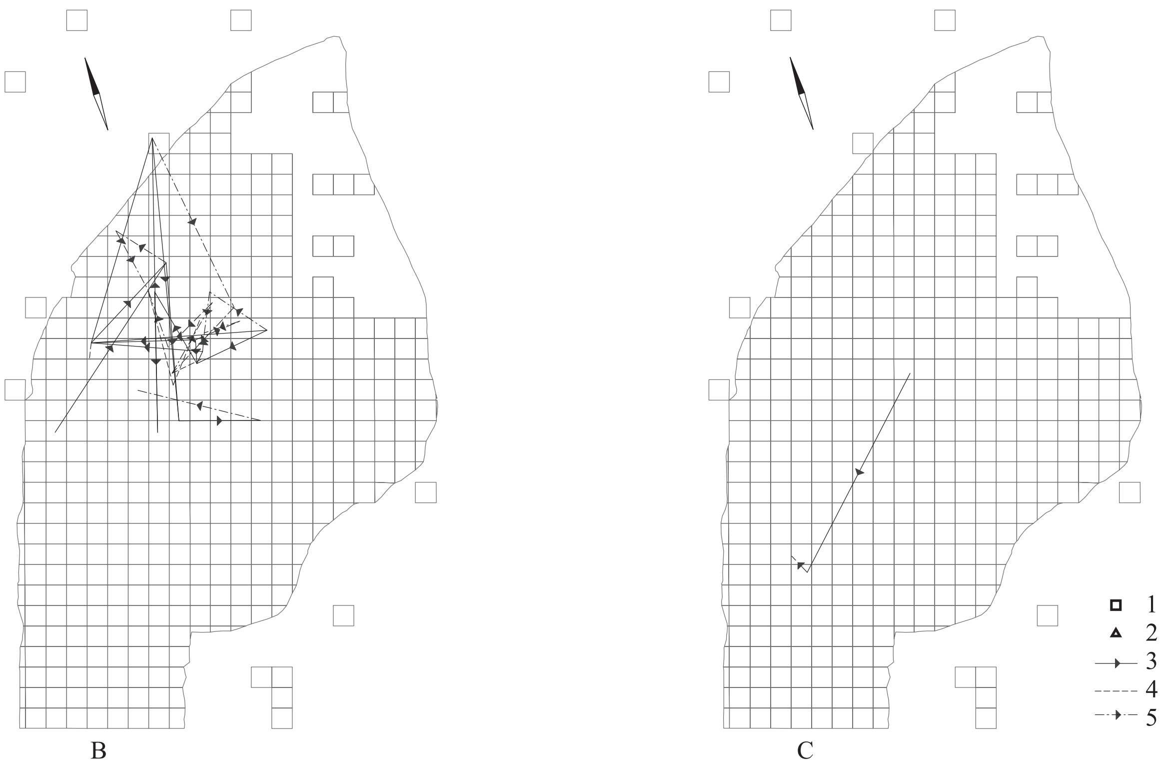


Figure 3.86-B, -C: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition VII. B: Spatial distribution of part A. C: Spatial distribution of part B. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)
5. *Anpassung* (modifications)

mentioned that part B is only represented by one large flake and that the core of part A was recovered about four metres north of the rest of the artefacts.

Although there is no proof, it can be suggested that refitted composition XII (sequence 21) belongs also to a large raw material nodule which was split into smaller parts. Refitting shows that first a sequence of cortex flakes was removed from one side of the core. These flakes were reduced and discarded in the southeastern part of the excavated area (Figure 3.91). Next the core was transported about four metres northwest where it was further reduced by removal of larger flakes and it was eventually discarded there. This second 'activity area' corresponds more or less with the spatial distribution of refitted compositions X and XI.

In general, composition XIII (sequence 1) shows a rather large spatial distribution which covers the southern part of the excavated surface (Figure 3.92). However, it can be suggested that small groups of flakes seem to cluster. This could indicate, although this is very speculative, that during reduction the core was carried around within the southern area.

3.9.3.11 Spatial distribution of refitted composition XIV

The next refitted nodule (composition XIV) consists of 32 artefacts and has already been described by Langbroek (1996). This block again indicates a possible flake selection and an intra-site transport of lithic materials. The horizontal distribution of the refitted elements suggests distinct activity areas where different stages of core reduction were performed (Figure 3.93-A). Generally this block of flint shows

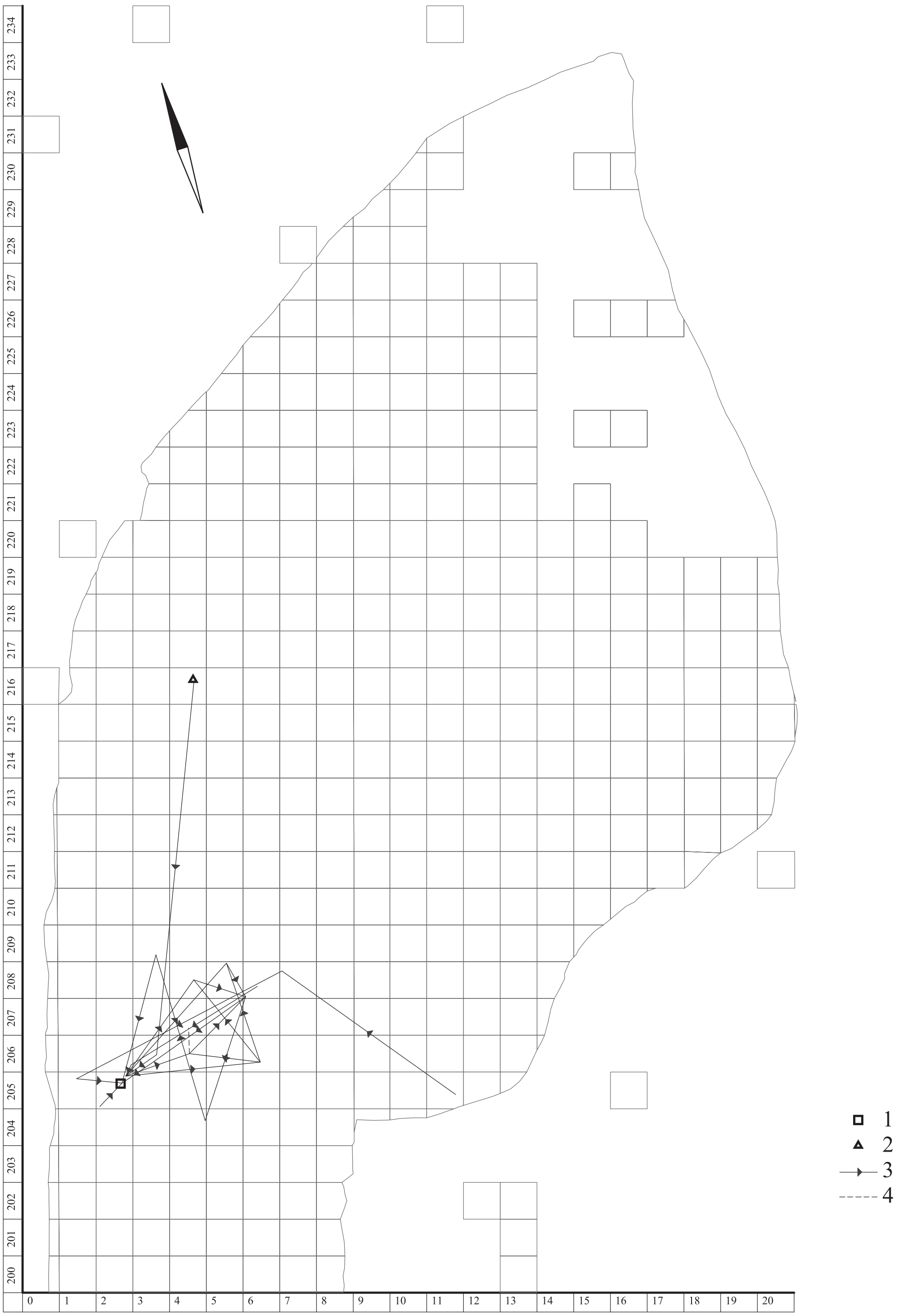


Figure 3.87: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition VIII. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aufeinanderpassung* (production sequences)
4. *Aneinanderpassung* (breaks)

Figure 3.88-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition IX. Map representing the spatial distribution of all refitted artefacts of composition IX (Raw Material Unit reduction sequence). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aneinanderpassung* (breaks)
3. *Anpassung* (modifications)

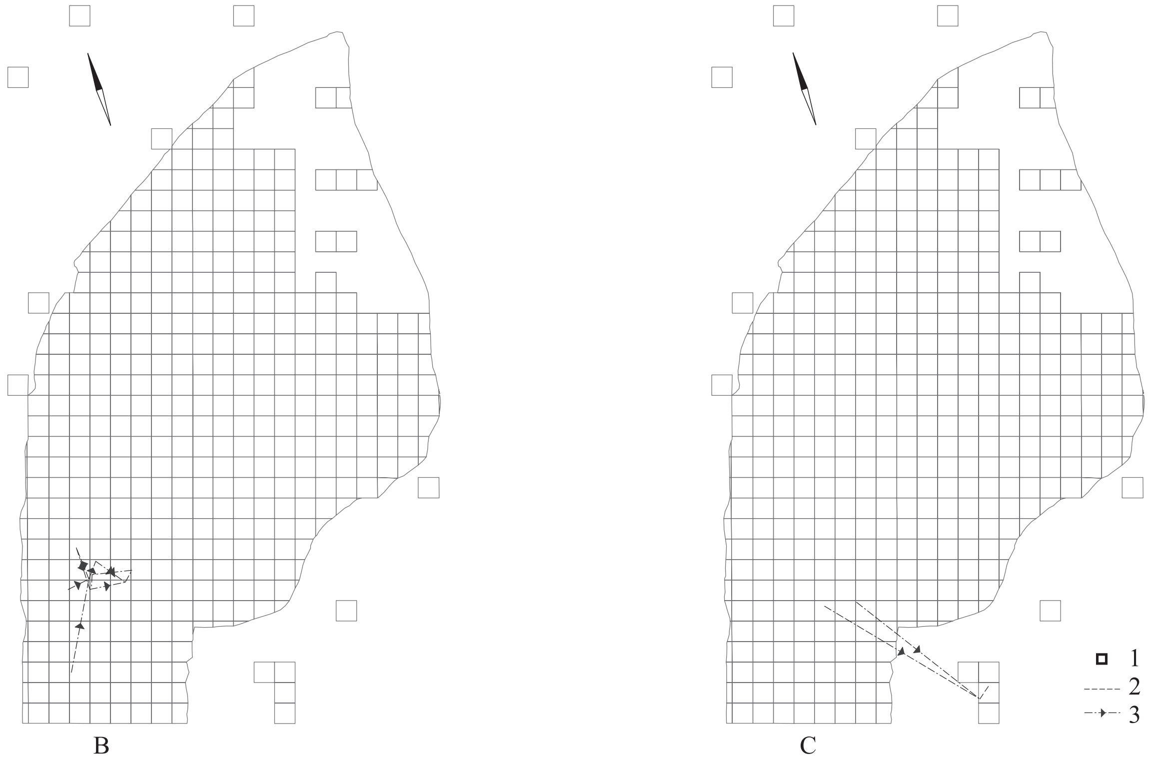


Figure 3.88-B, -C: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition IX. B: Spatial distribution of part 1-1. C: Spatial distribution of part 1-2. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aneinanderpassung* (breaks)
3. *Anpassung* (modifications)

that a raw material nodule entered the excavated area without any, or hardly any, preparation. At Site K the nodule was split into at least two parts by removal of natural fissures. Both cores were further reduced within the excavated area.

The spatial distribution map of composition XIV, Part A, shows that most of the flakes were recovered from an area of about nine metres square (Figure 3.93-B). This area was situated more or less in the centre of the eastern part of the excavated Site K area. Two flakes were recovered, respectively ca. two metres to the west and about four metres to the east.

Composition XIV, part B was mainly reduced about five metres south of part A. Spatially most flakes were found in an area of ca. four metres square (Figure 3.93-C). Yet, two larger flakes look conspicuous. One of these artefacts was recovered between the debitage of part A, which could indicate that a flake was selected from the produced part B flakes to be subsequently transported about five metres north. However, in an alternative scenario it is possible that during reduction the part B core was transported to the part A area. There at least one flake was produced. Next the core was transported to the south.

Another artefact that stands out is the last flake in the part B conjoined sequence. This piece was probably transported to another 'activity area' about 12 metres north of the rest of the debitage (ca. five metres north of part A). Morphologically, this artefact can be described as a naturally backed knife, although no clear macroscopic use-wear traces were specified.

3.9.3.12 Spatial distribution of refitted composition XV

Refitted composition XV (sequence 38) is represented by 37 artefacts and indicates that a large flint nodule entered the excavated area without any, or hardly any, preparation/decortication. At Site K the nodule was completely reduced and discarded in a southeastern zone (Figure 3.94). The horizontal distribution of the refitted elements could indicate

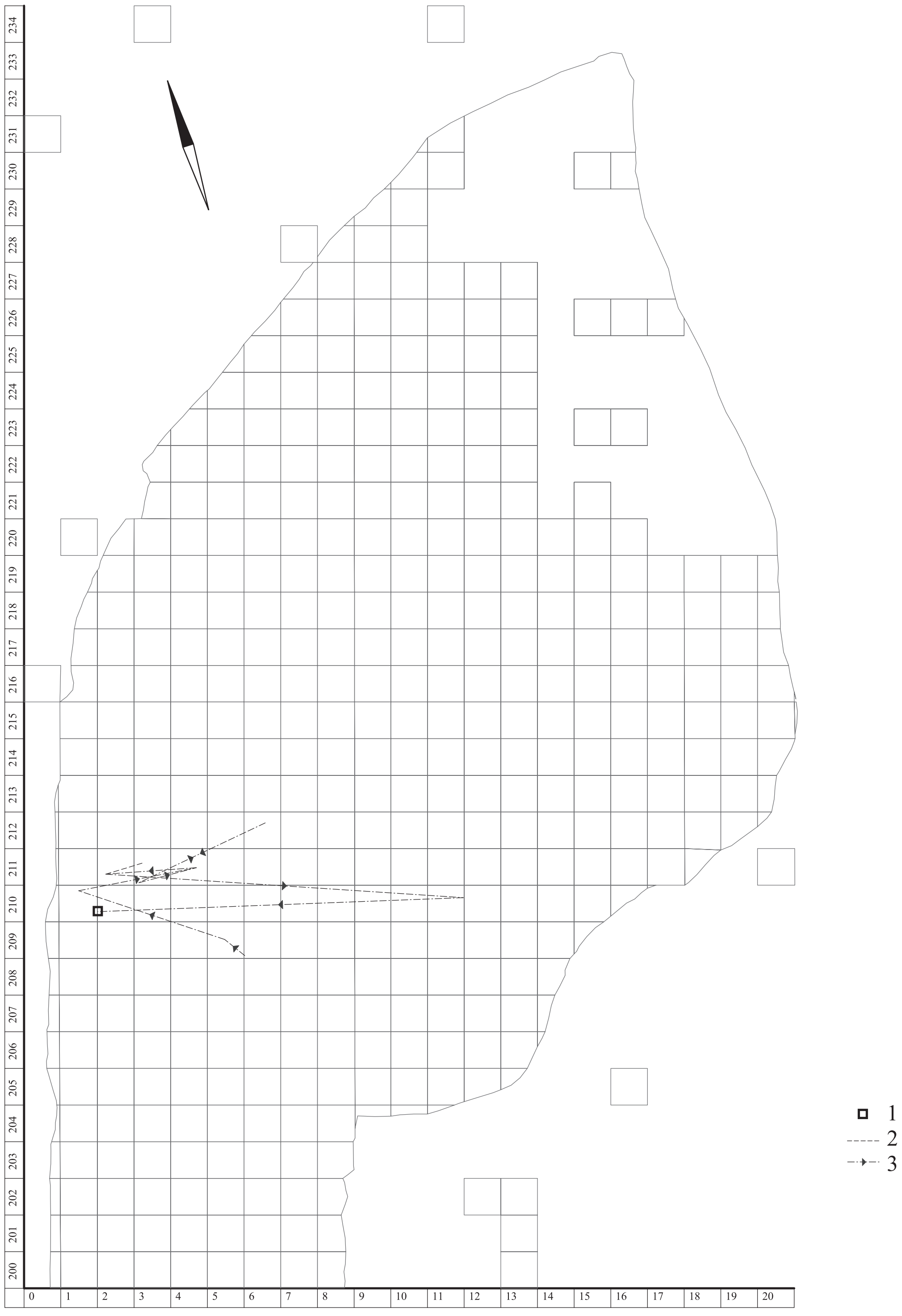


Figure 3.89: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition X. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aneinanderpassung* (breaks)
3. *Anpassung* (modifications)

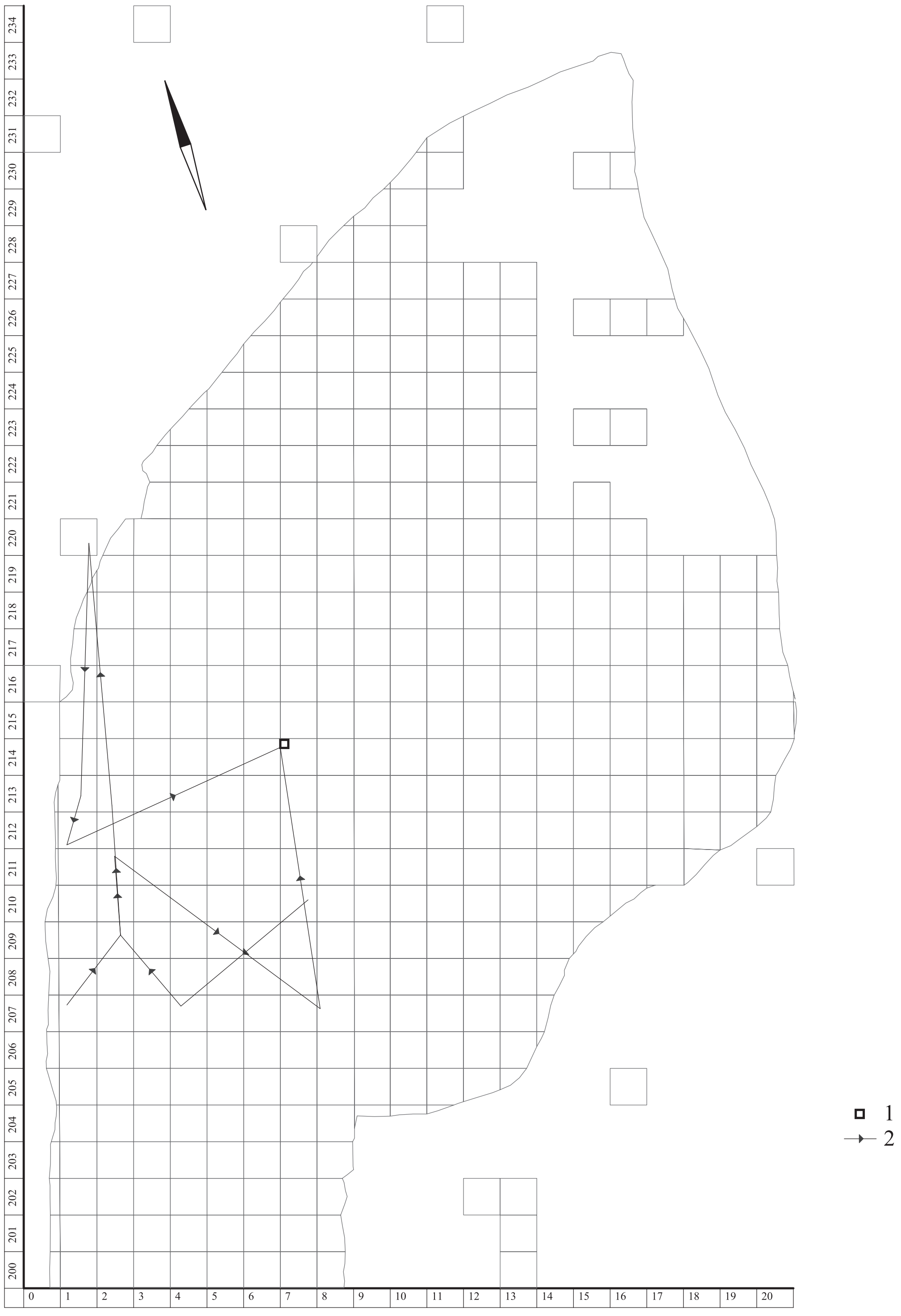


Figure 3.90: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XI. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)

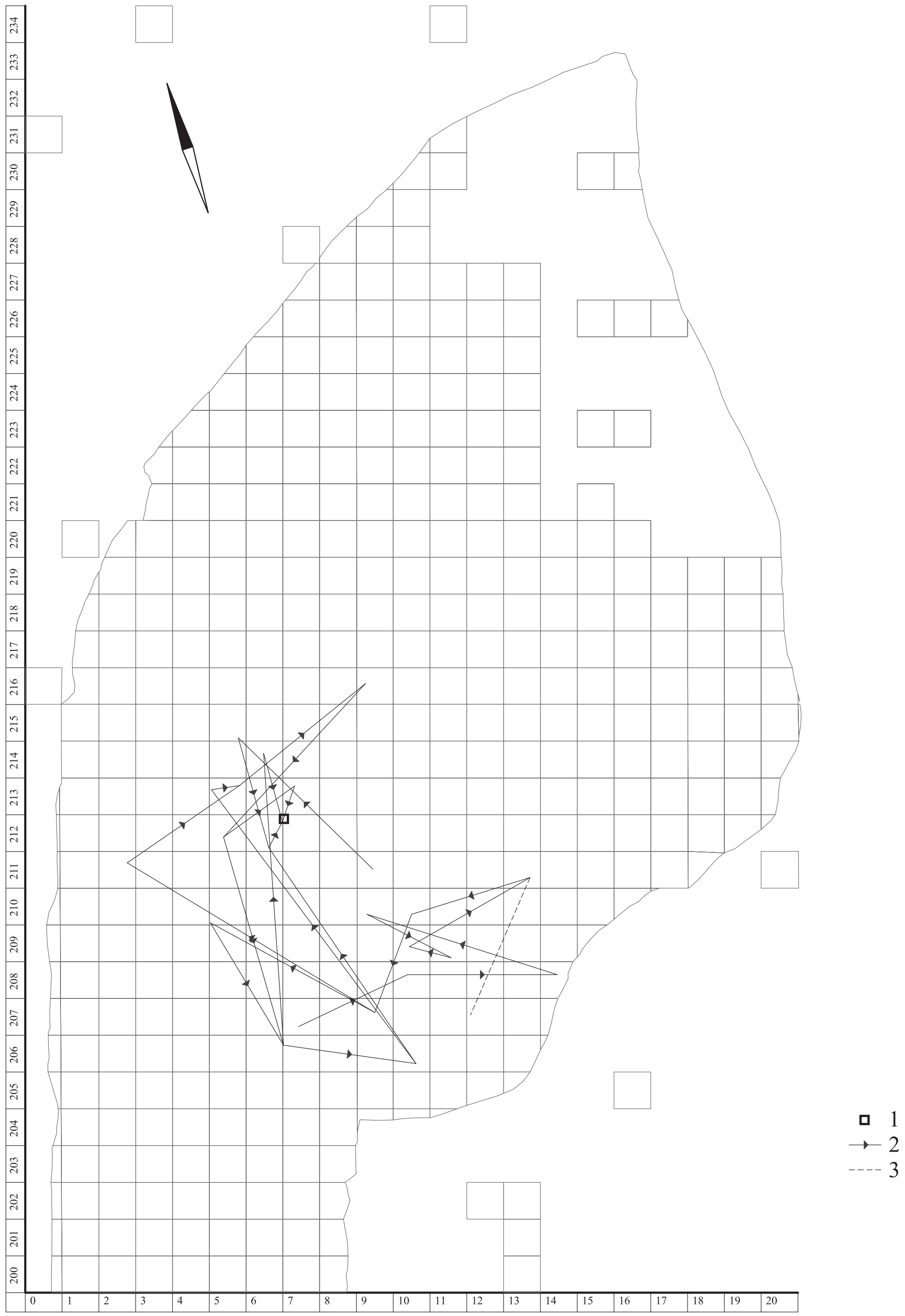


Figure 3.91: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XII. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

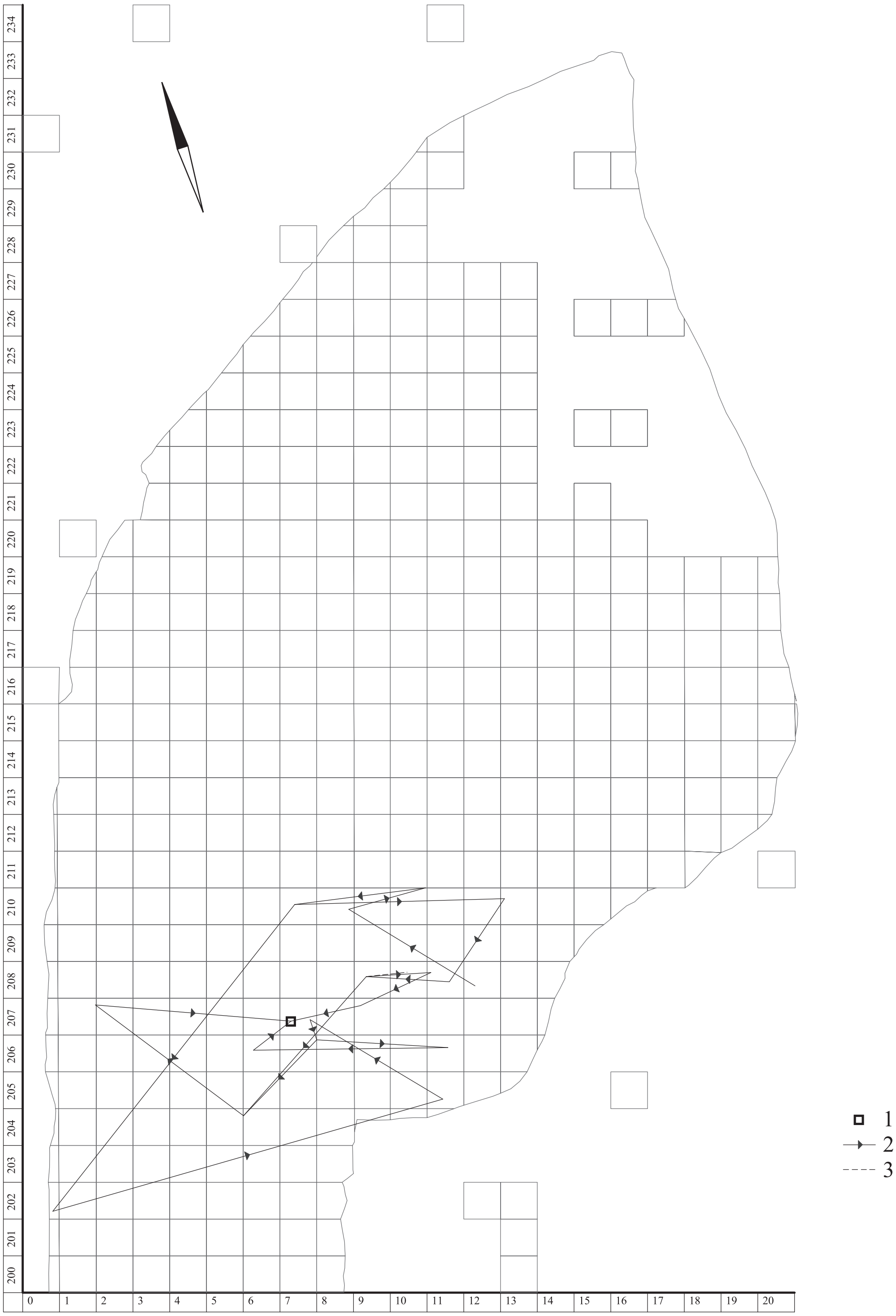


Figure 3.92: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XIII. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

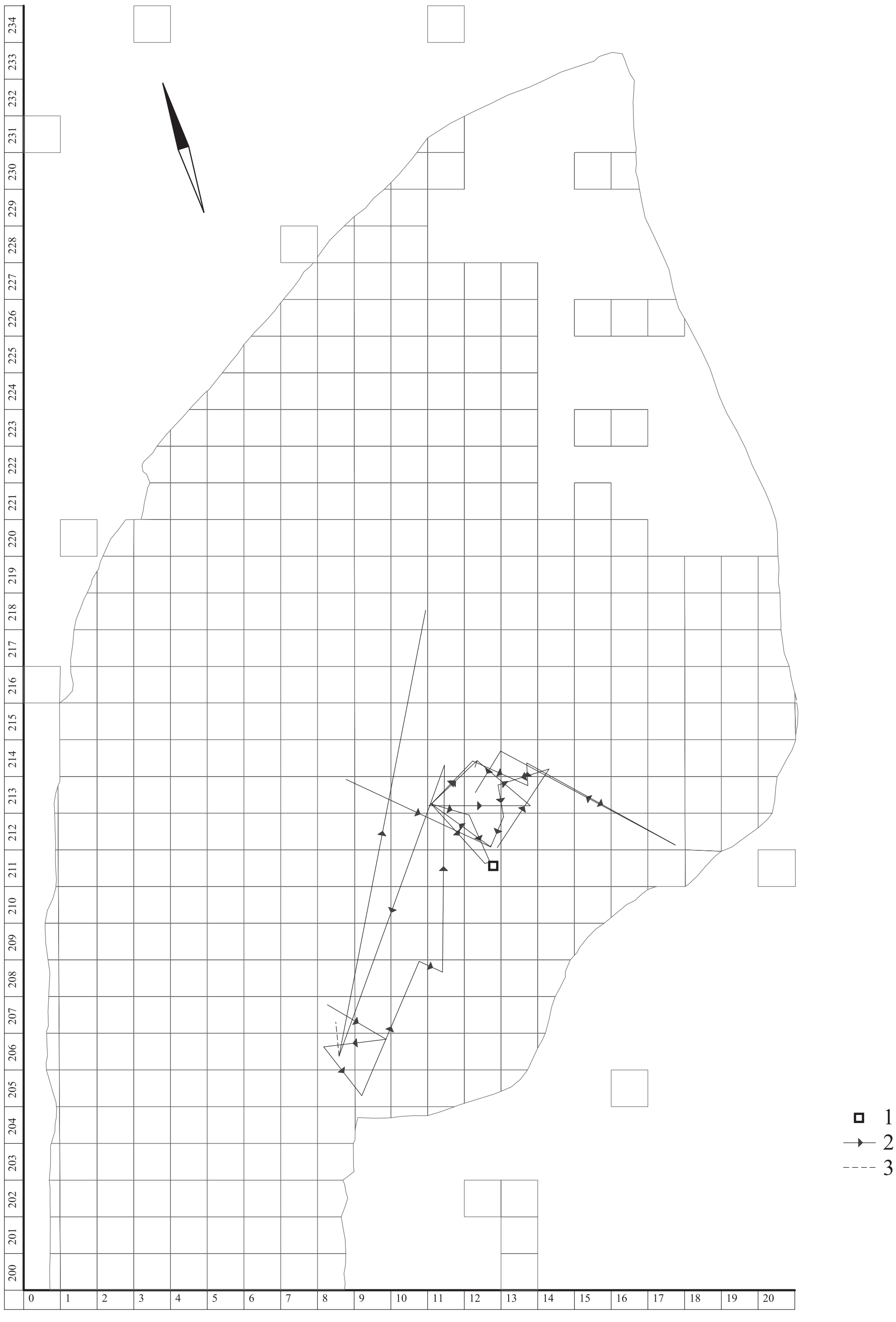


Figure 3.93-A: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XIV. Map representing the spatial distribution of all refitted artefacts of composition XIV (Raw Material Unit reduction sequence). The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

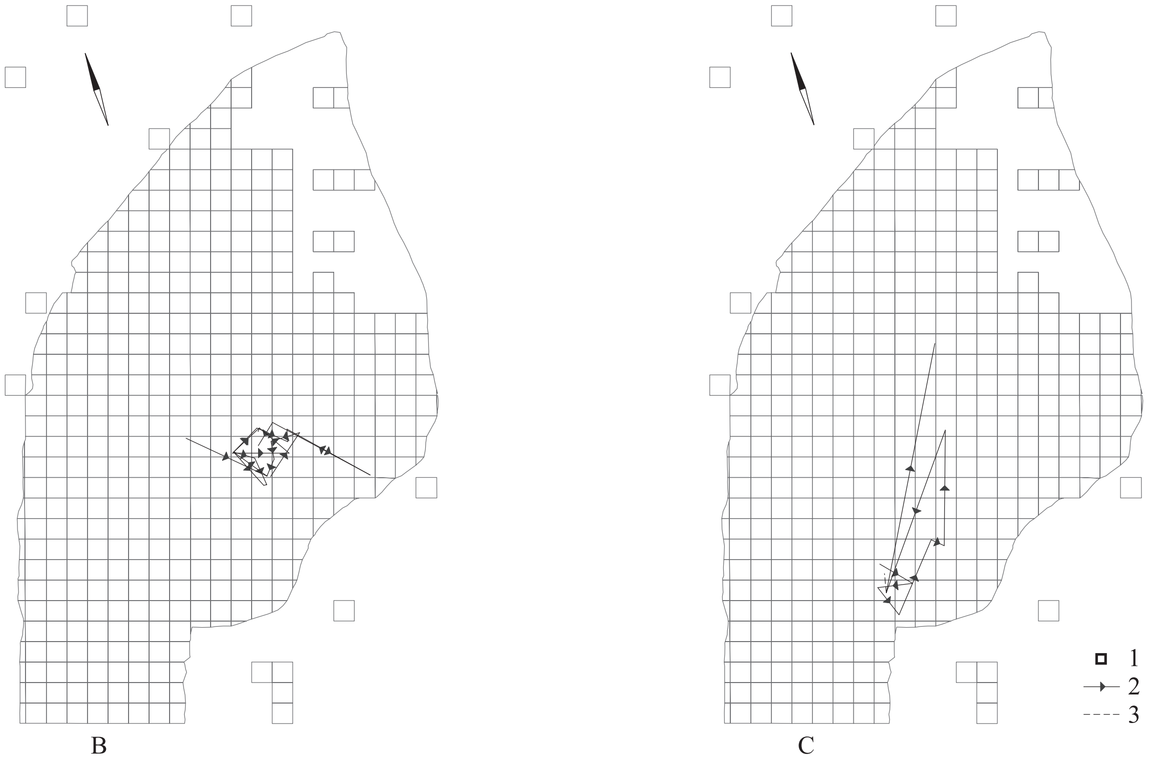


Figure 3.93-B, -C: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XIV. B: Spatial distribution of part A. C: Spatial distribution of part B. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

that the first stages of core-reduction were carried out in a more 'western' part of the cluster. These flakes also show a more scattered pattern than the rest of the debitage of this composition. Especially a flake recovered about five metres north looks conspicuous. It was found in close relation with one of the two possibly transported flakes from refitted composition XIV (Section 3.9.3.11).

After this initial series of flakes the core was further reduced in the 'eastern' part of the cluster. Most of these artefacts cover an area of about nine metres square.

3.9.3.13 Spatial distribution of refitted compositions XVI and XVII

Composition XVI (sequence 126) consists of a small group of 11 conjoinable artefacts which were found in the southwestern part of the excavated surface (Figure 3.95). Spatially the artefacts were found in an area with a diameter of about three metres and their distribution is nearly identical to that of composition II, part F (sequence 133, Section 3.9.3.3). This conjoined group represents a large flake which was secondarily used for tool production (flaked-flake). According to raw material properties this artefact is 'exotic' and could not be refitted to the rest of the material. The actual flake was reduced by removal of small flakes (burin-spalls) and a heavy typical burin and a notched piece were produced. The atypical burin, which was secondarily modified into a notched piece, integrated in refitted composition VII (part B) and was found nearby (see Section 3.9.3.6). The three tools were recovered from squares 3/205, 1/206 and 4/208 respectively.

In general the 'exotic' material and the refitted burin-spalls suggest that a large flake was transported to the site. Here, the flake was transformed into tools and discarded together with another typologically similar implement, perhaps after use, at the place of production.

Figure 3.94: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XV. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. *Aufeinanderpassung* (production sequences)
3. *Aneinanderpassung* (breaks)

All artefacts of refitted composition XVII were recovered from the southeastern Site K surface (sequence 22; Figure 3.96). The conjoined elements cover an area of about 10 metres square. From the produced debitage one flake was selected and subsequently transformed into a convex transverse side-scraper. This tool, which was found ca. one metre square south of the broken simple side-scraper of composition II (part E, Section 3.9.3.3), was recovered at the most northern limit of this cluster.

3.10 Spatial interpretation of the Site K lithic assemblage

3.10.1 Introduction

Apart from providing information on aspects of site formation processes and technology, the method of refitting, combined with distribution maps, proves very useful in the analysis of the horizontal distribution of lithic artefacts. In general the study of the Site K assemblage clearly demonstrated that early humans were involved in the formation of the spatial distribution of the lithics. Mainly core reduction, and to a lesser extent tool production took place within the excavated Site K area.

One of the main questions of the analysis was whether the findspot was formed in one consistent use of space or in several depositional/occupational phases (De Loecker 1992, 1994*b*). In view of the technological character and the spatial relationship between the many conjoined groups (see Section 3.10.2), it can be suggested that most of the lithic material was deposited during ‘one short’ visit. The limited spatial analysis, discussed above, shows that the spatial distribution of different artefact categories and especially the refitted elements give precious information on locating areas where flakes were produced, tools were made and possibly used, and where different categories of artefacts were discarded. If we describe and spatially visualize the Site K reduction sequences, several stages or parts of it can be identified. Moreover refitting shows that fragments of *chaînes opératoires* are tied to specific areas.

It has to be stressed that the following spatial discussion/interpretation is mainly based on the 17 refitted compositions which were spatially presented in the previous section. Of course the refitting analysis showed that much more was conjoined at Site K (321 compositions in total, see Figure 3.10). Although the spatial patterns in general stay more or less the same, including these other refitted groups would certainly make the picture more complex.

After a discussion on the contemporaneity of the flint material, the described horizontal patterns and their interrelationship will be interpreted.

3.10.2 Contemporaneity of the flint assemblage

As mentioned before in Section 3.9.1, the spatial analysis presented here is based on the assumed contemporaneity of the different artefact types and flint clusters. However, before a ‘final’ interpretation of the spatial pattern can be given the assumed contemporaneity, or better the chronological resolution, of the Site K assemblage will have to be discussed. Combined with distribution maps, refitting can sometimes yield some clues to the simultaneity of different find categories and/or activity areas within the same ‘site’. The topic of contemporaneity is an important one in palaeolithic archaeology, though often overlooked. Kroll and Isaac (1984) stressed the problem already in the mid 1980s when they made a distinction between organized and compound entities:

> “… the early sites may have formed as **complex organized entities** in which the total configuration is now indicative of associated uses of space, or may have formed as **compound entities** in which the meaningful behavioral patterns can best be determined if the separate site uses can be resolved.” (Kroll and Isaac 1984:14).

Other authors have already noted (Cahen *et al*. 1979; Van Noten *et al*. 1980; Roebroeks 1988) that independent depositional events can create the same spatial configuration as an organized use of a place.

In general, refitting evidence can inform us about relations between individual flint scatters, but the absence of conjoined links between flint scatters does not necessarily indicate a lack of spatially organized activities. Thus before interpreting a findspot in terms of hominid behaviour, one should search for archaeological clues in answering the question: are individual flint scatters within a certain findspot exclusively the result of one single consistent use of a location or are they the result of several independent and unrelated short visits over time?

Firstly information on natural site formation processes can be used in our argumentation on contemporaneity. Yet, like Roebroeks *et al*. (1997:150) mentioned already, this information is only useful to some degree here, as we are dealing at Site K (and the other Unit IV findspots) with significantly finer time units than we can distil from the geology. Moreover, it could be the case that these well-preserved findspots do not represent the preserved buried remains of specific ‘moments of the past’, but have to be treated as buried surface collections (*cf*. Binford 1987*a*).

Nevertheless some clues can be found, which at least do not contradict a simultaneous appearance of artefacts. In this respect the vertical distribution of the finds can be mentioned. Most of the Site K artefacts were dispersed over a vertical distance of about 30 to 40 cm, while refitting suggests that the lithic assemblage was originally stratigraphically concentrated in one single archaeological level. However, depositional processes always cover a certain time span and therefore the different flint nodules and tools could still have been brought in, reduced and discarded during several unrelated

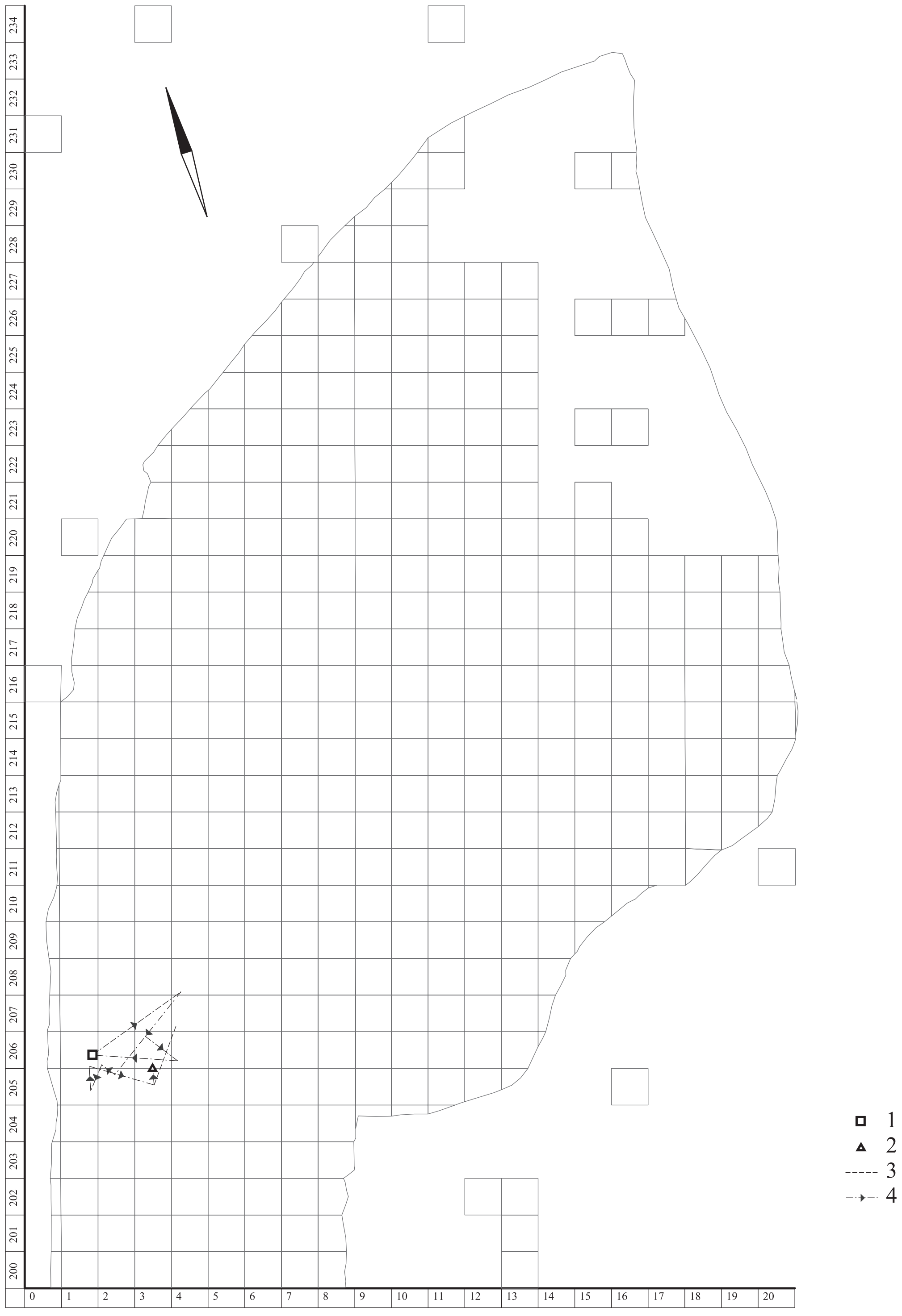


Figure 3.95: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XVI. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aneinanderpassung* (breaks)
4. *Anpassung* (modifications)

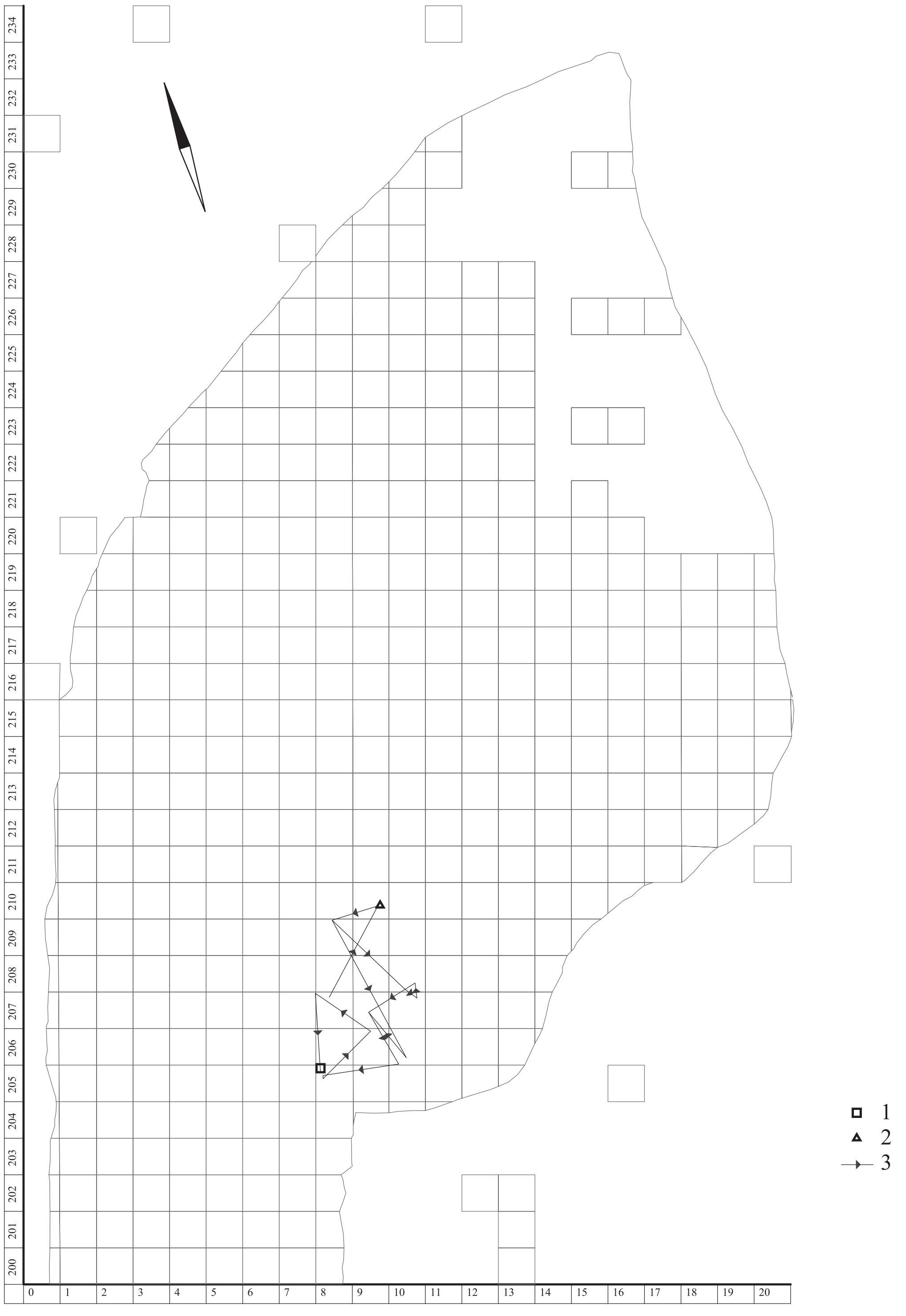


Figure 3.96: Maastricht-Belvédère Site K. Horizontal distribution of refitted composition XVII. The conjoined group is represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts is based on random coordinates within the metres square.

1. Core
2. Tool
3. *Aufeinanderpassung* (production sequences)

and 'short' visits, spread in time. Such a scenario is for example suggested for the low-density scatter of Site N (Roebroeks *et al*. 1992; see also Chapter 4). In other words, as cultural formation processes can be, like natural phenomena, very complex and cumulative we have to search for other clues to the co-occurrence of the several Site K features.

According to the raw material study almost exclusively a 'Rijckholt'-Valkenburg type of flint, procured from nearby river beds, was used for flaking. The typo-/technological description and conjoining study of the assemblage shows that mainly large untested and unprepared raw material nodules entered the excavated area. Characteristic for Site K is the fact that these flint blocks were divided into smaller units, to be secondarily used as cores. Beside large flakes, mostly natural fissures were utilized in this splitting strategy. Moreover, the cores and flakes are in general the result of a very uniform disc/discoidal core approach (*cf*. Boëda 1993). All this reflects a very homogeneous reduction strategy, that can be used as an argument to state that we are indeed dealing with the archaeological remnants of one single use of the location or at least a series of related usages.

The fact that large raw material nodules were introduced, split and reduced in a comparable way at the same location, together with the fact that lithic objects were transported over and over again to the same loci within the excavated area, indicates that many 'activity' areas could have been functioning contemporaneously. Compare for example the spatial distribution map of refitted composition II (Section 3.9.3.3) with that for all conjoined artefacts (Figure 3.10).

As mentioned before inter-locus refitting can be seen as one of the most important tools in 'establishing' the contemporaneity of spatially differentiated clusters of artefacts within the excavated area. In total 1,582 connection lines, representing 321 refitted compositions, could be established at Site K. Beside the refit lines which connect artefacts within the clusters itself, many connections could be made between the several concentrations. To quantify these results, the number of refitted groups connecting the different defined areas was calculated. For this analysis the contour map of all conjoined artefacts was used as point of departure (Figure 3.71-B). On this map a number of clusters and zones were defined. As a rule the clusters represent the areas where higher densities of conjoined artefacts were found, while the zones represent areas where considerably fewer refitted artefacts were situated (Figure 3.97). The definition of these areas is rather subjective, but at least they show a clear network of inter-unit relations, connecting most of the defined concentrations (clusters) and/or zones. Figure 3.97 shows a total of five smaller flint concentrations in the southern part of the excavated area (cluster A up to E). These loci cover the earlier mentioned main dense cluster, with its western and northern extensions (a U-shaped configuration), described in Section 3.9.2.1. A sixth cluster (F) is situated in the northern part of the excavated area. Furthermore, four rather 'empty' zones are defined in the south, centre, east and north of Site K (respectively zones 1 up to 4).

Table 3.21 shows two diagrams in which the total number of refitted compositions, or parts of these, are calculated per defined cluster and zone. The figures are given for all participating artefacts and for all refitted lithics, excluding the 'score' for areas where only one participating artefact of a certain sequence was found. In these tables a separation was made between compositions which include the first or oldest flake[s] in the reconstruction, and the remaining conjoined sequences. Refitted reduction sequences can 'start' in several clusters and/or zones, as the chronology of some of these 'first' knapped artefacts is sometimes unknown. Both tables indicate that the majority of the nodules was reduced in clusters A and B and in zone 2. It, furthermore, seems that most of the conjoined sequences 'start' in these areas. Clusters C and D are also represented by high frequencies. The fact that many refitted compositions are situated in the rather 'empty' zone 2 can partly be explained by the subjectivity of the area definition. Most of the given groups are parts of much larger sequences and the participating artefacts can be found especially at the boundary between zone 2 and clusters A up to E. A similar explanation can be given for zone 1. For further details see Table 3.21. In general these intra-locus patterns show that a large part of the refitted blocks overlap spatially. Furthermore it can be concluded that most of the conjoined sequences 'start' in the southeastern clusters of the excavated area. All this suggests a rather homogeneous spatial use of the place, in which the same areas were used over and over again for specific flint knapping tasks. Again this is an argument that can be used to indicate a contemporaneous use of the Site K findspot.

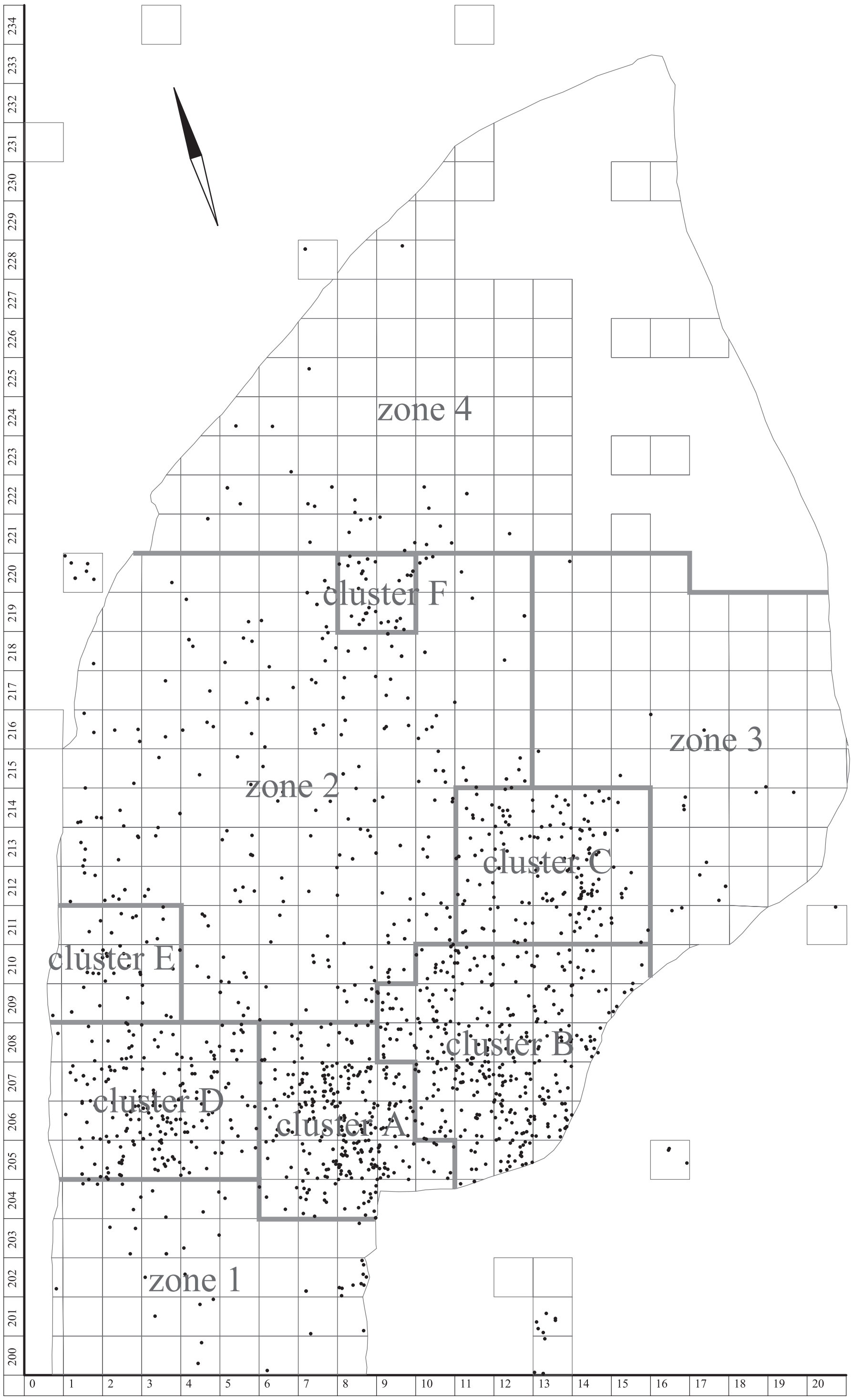


Figure 3.97: Maastricht-Belvédère Site K. Map of the excavation area showing the total number of conjoined artefacts (n= 1,828) per metre square, together with the defined clusters (A up to F) and zones (1 up to 4). The definition of these areas is based on the contour map (Figure 3.71-B). The position of the artefacts is based on random coordinates within the metres square.

A

Clusters and zones	A	B	C	D	E	F	1	2	3	4
Total number of refitted compositions (or parts of these), including the first flake (s) in the sequence	62	72	27	24	8	1	10	49	4	5
Total number of the remaining refitted compositions (or parts of these)	52	73	27	35	21	10	17	50	15	9
Total	114	145	54	59	29	11	27	99	19	14

B

Clusters and zones	A	B	C	D	E	F	1	2	3	4
Total number of refitted compositions (or parts of these), including the first flake (s) in the sequence	49	59	16	21	1	–	7	33	2	2
Total number of the remaining refitted compositions (or parts of these)	24	40	18	17	7	5	5	19	6	5
Total	73	99	34	38	8	5	12	52	8	7

Table 3.21: Maastricht-Belvédère Site K. Two diagrams showing the total number of refitted compositions, or parts of these, per defined cluster and zone (respectively A up to F and 1 up to 4; see Figure 3.97). The figures are calculated on a total of 321 refitted compositions. A: Diagram showing the figures for all participating artefacts B: Diagram in which the figures are given, excluding the 'score' for areas (clusters and zones) where only one participating artefact was found.

More secure positive proof of a simultaneous use of the Site K area (or at least a series of related usages) is found in the inter-locus conjoinings, presented in Table 3.22. These tables show that all defined clusters and zones are 'connected' by at least one refitted group. Most of the conjoined sequences, however, cover cluster A up to D and/or zone 2. The large number of conjoinings between the four southern clusters (the U-shaped configuration) is no surprise, as these loci border each other and they represent the main primary flaking areas. Moreover this is the locus where the large flint nodules were split and most of the decortication was done. Besides their connection, especially clusters A and B with zone 2 look conspicuous. Although these relationships can again be partly explained by the subjective cluster and zone definition, some cores, flakes and tools were indeed transported from one area to another, as is shown by the 17 conjoined compositions. For further details on the number of refitted groups that connect the defined areas, the reader is referred to Table 3.22. Altogether these links between clusters (and/or zones) indicate that the Site K area probably represents a rather contemporaneous use of spatially differentiated flint knapping areas within the excavated area.

Although refitting is probably the most secure 'tool' for giving positive proof of a contemporaneous appearance of artefacts, we have to be careful with the interpretations. For example analysis of the well-preserved Site C has shown that occasionally one can see that an (unknown) amount of time passed between the production of one lithic concentration and a second overlapping one (Roebroeks 1988:58, see also Section 4.4). However, given a certain intra-space, overlapping flint clusters could still have been related in terms of the use of a place.

It has to be stressed that a lack of inter-locus refits does not exclude a simultaneous occupation, as activities could be executed separately with no exchange of lithic materials taking place.

A final clue in our argumentation on contemporaneity is the fact that different flint scatters inside the excavated area, at least if only the 17 presented compositions are used, seem to 'respect' each other. The 'complete' picture of all 321 conjoined compositions shows, on the other hand, a more complex, overlap dominated, spatial pattern. Nevertheless, the analysis (mainly based on the 17 examples) might indicate a spatial organization of activities and points to a simultaneous production of different flint clusters as an interrelated series of activities.

Although the bulk of lithic material seems to have been discarded during a 'single' episode of use of the Site K area, there are also some indications for a number of unrelated events. Among the recovered artefacts several flakes were identified which do not belong to the rest of the assemblage.

A

clusters/ zones	A	B	C	D	E	F	1	2	3	4
A		55	17	25	14	2	15	29	5	3
B			31	16	10	1	12	35	7	3
C				4	3	1	4	18	7	4
D					16	2	16	19	2	4
E						1	7	16	3	2
F							1	5	1	4
1								8	1	3
2									9	8
3										1
4										

B

clusters/ zones	A	B	C	D	E	F	1	2	3	4
A		22	6	7	2	1	4	9	0	1
B			8	4	2	1	3	11	0	1
C				2	1	1	2	4	1	1
D					5	2	5	6	0	2
E						1	2	6	0	1
F							1	3	0	3
1								2	0	1
2									0	4
3										0
4										

Table 3.22: Maastricht-Belvédère Site K. Two cross tables showing the number of refitted groups that connect the defined clusters and zones (respectively A up to F and 1 up to 4; see Figure 3.97). The figures are calculated on a total of 321 refitted compositions. A: Table showing the figures for all participating artefacts B: Table in which the figures are given, excluding the 'score' for areas (clusters and zones) where only one participating artefact was found.

Most of these artefacts were produced on 'exotic' flint (see Section 3.5.3) and were especially notable in the most northern/northeastern and southern part of the excavated area. In others words, they were mainly conspicuous outside the most extreme boundaries of the main dense clusters of artefacts. Moreover these finds are the products of several different flaking stages and none of these could be refitted. The spatial distribution of these pieces looks comparable to the low density scatters excavated at Sites G and N (Roebroeks 1988; Roebroeks *et al*. 1992; De Loecker and Roebroeks 1998). In their 'veil of stones' article Roebroeks *et al*. (1992) suggested that the 'rich' Maastricht-Belvédère flint patches seem to be present against a background scatter of isolated artefacts. In view of this interpretation, the 'exotic' flakes could indicate that the main excavated Site K flint patch was superimposed on an already existing low density scatter (or *vice versa*).

Interpreting the recovered 'exotic' artefacts as a background scatter can put the non-conjoinable (exotic) tools, which were sometimes made on Levallois flakes, in a totally different light. However, in view of the spatial arguments (see Sections 3.9.2.5 and 3.10.3) these tools are here interpreted together with the rest of the Site K assemblage as the remnants of 'one and the same' behavioural event. The tools entered the excavated area as ready-made end-products and they were subsequently discarded (perhaps after use) and possibly replaced by new ones.

In conclusion, there are some arguments to suggest that the different knapping phases, in which most of the Site K flint clusters were produced, were probably contemporaneous. The homogeneity of the raw material, technology, tool and core types and the numerous inter-locus refits all point to a 'single' occupation phase. In such a scenario considerable overlapping of simultaneous activities related to the flake and tool manufacture, use(?) and discard is suggested.

So, despite some minor post-depositional displacement of the artefacts, especially in the northern part of excavated area, we can assume that the spatial configuration of Site K may be regarded as a more organized entity on an organized/compound continuum (Kroll and Isaac 1984).

3.10.3 Spatial movement of technology: intra-site transport of lithics and activity areas

According to the horizontal distribution, tools seem to form a large circular concentration in the middle of the excavated area. This cluster shows in its own 'centre' (and especially more to the south: metres square 4/210 up to 10/210) a relatively high density and is situated mainly in a zone where remarkably few cores and burned artefacts were found (the 'empty zone'). To visualize this pattern more clearly Tables 3.23 and 3.24 are given. It can even be suggested that in the southern part of this clustered tool zone scrapers dominate, while other tool types (denticulates, notched pieces, backed knives and flakes with signs of use) appear more frequently in the northern part (for details the reader is referred to Table 3.24). Speculatively, it can even be suggested that other tool types emerge more often between the cores, their debitage and the burned artefacts and show a more scattered horizontal distribution. Remarkably, the non-scrapers tools are most frequently integrated in the refitted compositions. Slightly north of the highest density of scrapers a rather empty zone (without tools) can be described. In short one could say that the scraper cluster is surrounded by cores and burned artefacts. On this basis some activity related areas may be assumed.

Not only the spatial distribution of the various find categories suggests activity-related loci, but the detailed spatial analysis of conjoined artefacts also provides precious evidence of transport of lithic materials and the use of contemporary areas of activity-related artefact discard within the site boundaries. When we take a closer look at the distribution of the various refitted compositions, some spatial patterns can be noticed.

As mentioned before (see Section 3.9.3), the spatial distribution of the 17 selected, and technologically described, refitted compositions is probably representative for the complete configuration of the Site K assemblage. Therefore, the following general description will be based on that sample only. To help to distil some of the patterns, the horizontal distribution of these conjoined nodules are represented superimposed on one and the same map (Figure 3.98). This Figure 3.98 shows, beside the areas where the bulk of produced debitage and waste flakes was recovered (shown in grey), also the location of the most conspicuous artefacts. The latter are so due to their typology, or to the fact that they were found at some distance from their place of production. The presumably transported pieces are shown together with refit lines, which 'connect' them with the main areas of production.

In general the 17 refitted groups clearly indicate that in distinct areas, different stages of core reduction were performed. Mostly the large raw material flint nodules entered the site without any, or hardly any, preparation and were split into smaller units in the southeastern part of the excavated area. This area is also typified by a large quantity of (refitted) cortical flakes, suggesting an initial decortication phase and/or an elimination of protruding parts of the flint nodules. Subsequently, as refitting shows, some of the smaller parts were further reduced at the same spot, while other cores were transported in a westerly to northwesterly direction. In these areas of (activity-related) discard, sometimes tens of metres from the 'splitting areas', the cores were further reduced (decorticated) and eventually discarded together with the produced debitage. The horizontal distribution of the debitage covers in general a large part of the Site K area (shown in grey in Figure 3.98). Yet none of the artefacts were recovered from the most northern-northeastern and the extreme southern part of the excavated area. Also the distribution map shows two empty areas in the 'centre' of the excavation. The most western of these empty zones covers an area of about 10 metres square, while the second, situated ca. two metres to the east, covers an area of about 20 metres square. The latter corresponds perfectly with the previously described 'empty' zone, north of the highest density of scrapers (see thematic maps, Section 3.9.2.5).

The elaborate Site K refitting analysis also indicates a possible flake selection and clearly demonstrates an intra-site transport of lithics. From the areas of production, flakes, tools and cores were selected and subsequently transported in different directions. The longest conjoining lines, covering distances of 10 to 15 metres, are represented by three flakes belonging to refitted compositions I (part B) and

	Site K (370 m²)		‘Empty zone’ including row 210 (49 m² between coordinates 4/217-11/217 and 4/210-11/210)		Site K excluding the ‘empty zone’ and metres square 4/210-10/210 (312 m²)		‘Empty zone’ excluding row 210 (42 m² between coordinates 4/217-11/217 and 4/211-11/211)		Site K excluding the ‘empty zone’, but including metres square 4/210-10/210 (328 m²)	
	n	Mean density	n	Mean density	n	Mean density	n	Mean density	n	Mean density
Density of artefacts per metre square	10,912	29.49	1,104	22.53	9,808	30.55	692	16.49	10,220	31.16
Density of cores per metre square	91	0.34	7	0.14	88	0.26	5	0.12	86	0.26
Density of burned artefacts per metre square	617	1.67	9	0.18	608	1.89	7	0.17	610	1.86
Density of tools per metre square	137	0.37	42	0.86	95	0.3	27	0.64	110	0.34
Density of scrapers per metre square	83	0.22	21	0.43	62	0.19	12	0.29	71	0.22
Density of tools (other than scrapers) per metre square	54	0.15	21	0.43	33	0.1	15	0.36	39	0.12

Table 3.23: Maastricht-Belvédère Site K. Mean density of artefact types per metre square for Site K in total (370 m²) and separately for the mentioned ‘empty zone’ including row 210 (49 m² between coordinates 4/217-11/217 and 4/210-11/210), Site K excluding the ‘empty zone’ and metres square 4/210-10/210 (321 m²), the ‘empty zone’ excluding row 210 (42 m² between coordinates 4/217-11/217 and 4/211-11/211) and Site K excluding the ‘empty zone’, but including metres square 4/210-10/210 (328 m²).

‘Empty zone’ (49 m² between coordinates 4/217-11/217 and 4/210-11/210)	Metres square 4/210-10/210 (7 m²)		Metres square 4/211-10/211 (7 m²)		Metres square 4/212-10/212 (7 m²)		Metres square 4/213-10/213 (7 m²)		Metres square 4/214-10/214 (7 m²)		Metres square 4/215-10/215 (7 m²)		Metres square 4/216-10/216 (7 m²)	
	n	Mean density	n	Mean density	n	Mean density	n	Mean density	n	Mean density	n	Mean density	n	Mean density
Density of artefacts per metre square	412	58.86	189	27.0	123	17.57	117	16.71	82	11.71	82	11.71	99	14.14
Density of cores per metre square	2	0.29	0	0	1	0.14	0	0	1	0.14	2	0.29	1	0.14
Density of burned artefacts per metre square	2	0.29	2	0.29	1	0.14	1	0.14	1	0.14	2	0.29	0	0
Density of tools per metre square	15	2.14	5	0.71	3	0.43	5	0.71	3	0.43	5	0.71	6	0.86
Density of scrapers per metre square	9	1.29	4	0.57	1	0.14	4	0.57	0	0	2	0.29	1	0.14
Density of tools (other than scrapers) per metre square	6	0.86	1	0.14	2	0.29	1	0.14	3	0.43	3	0.43	5	0.71

Table 3.24: Maastricht-Belvédère Site K. Mean density of artefact types per metre square for the mentioned ‘empty zone’ including row 210 (49 m² between coordinates 4/217-11/217 and 4/210-11/210). The figures are given per row of 7 m².

IV (part A and C). These artefacts were transported in respectively northerly (form metre squares 14/212 to 9/228), northeasterly (from metre squares 9/205 to 17/212) and southeasterly directions (from metre squares 1/211 to 16/205). It seems that these flakes were discarded at the northern and eastern boundaries of the main debitage distribution. Beside these three flakes, most of the other transported lithics were recovered close to the 'central' empty spaces. These artefacts seem to be mainly present at the edges of the actual 'empty' areas.

Around the western empty zone two transported flakes and a core were recovered (metre squares 3/214, 3/212 and 0/212). All these artefacts belong to refitted composition I (part A, B and C). According to the refitting analysis these lithics were produced in the southeastern 'splitting area' (metre squares 14/212, 13/209 and 10/212) and were transported over a distance of about 10 metres. Interesting is the fact that the core (composition I, part A) was found right beside another nucleus belonging to refitted composition IV (part C, metre square 0/212).

A more conspicuous pattern is noticed around the eastern empty zone. From the blanks of the 17 nodules only two scrapers were produced, or better: recovered within the excavated area. Moreover the horizontal patterning suggests that these refitted scrapers were fabricated and discarded close to the empty zone. A convex transverse side scraper (refitted composition XVII) was found between the rest of the participating flakes of that nodule, at the southern edge of the empty space (metre square 9/210). The second piece, a simple side scraper (refitted composition II, part E), was also produced in that area (metre square 11/208), but was subsequently transported about six metres to the northern edge of the empty space. Here the scraper was recovered broken into three pieces (metre squares 9/214, 10/214 and 10/213). A similar spatial pattern is suggested for two flakes of compositions XV and XIV (part B). Both were found close to the latter scraper (both in metre square 11/214) and were produced about five (metre square 10/209) and seven metres (metre square 8/205) to the south, *i.e.* the other (southern) side of the empty area. In this zone two other transported flakes were recovered. One possible 'preferential' flake (refitted composition X) was produced near the two cores from the western empty space (metre square 2/210) and was transported to the east over a distance of about nine metres (metre square 11/210). The second flake (refitted composition I, part C) was produced north of the empty zones (metre square 6/215) and was transported over a distance of ca. eight metres to a southeastern area (metre square 11/208).

Another conspicuous pattern is noticed for the two possible Levallois flakes produced at Site K. According to refitting, both 'Levallois' flakes (refitted composition III, part A), of which the largest example shows macroscopic signs of use, were possibly used and discarded at their place of production (approximately between coordinates 7/207-8/207 and 7/205-8/205). They were found close to one another, slightly south of the eastern empty ('scraper') zone. Refitting suggests that no transport was involved.

About three metres west of the 'Levallois area' another interesting spatial pattern, involving completely different tool types, was noted. Here, a small group of 11 conjoinable artefacts (refitted composition XVI), representing a large 'exotic' imported flake, was found in an area with a diameter of about three metres. The flake was secondarily flaked by the removal of burin-spalls and eventually a heavy typical burin (metre square 3/205) and a notched piece were produced (metre square 1/206). A second (atypical) burin, produced about 10 metres north (metre square 9/217), was found very close to the previous one (metre square 4/208). This burin, which belongs to refitted composition VII (part B), was after transportation secondarily modified into a notched piece.

Remarkable is also the fact that the only two (conjoined) backed knives were recovered from an area north of the empty zones. One backed knife (refitted composition VIII) was produced in the southwestern 'burin/notch area' (metre square 3/206) and was transported over ca. 10 metres to the north (to metre square 4/216). The second backed knife (refitted composition XIV, part B) was produced in the southeastern 'Levallois area' (metre square 8/206) and subsequently also transported, about 11 metres to the north (metre square 10/218).

To summarise this section, refitting shows that within the excavated area, cores, tools and flakes were transported from one ('activity-related') area to another. After this phase of intra-site transport the artefacts where further reduced, possibly used and eventually discarded. Beside the several primary flaking loci, at least five other types of 'activity-related areas' can be suggested (Figure 3.99). Two of these areas are situated around the described 'empty' zones in the centre of the excavation. The performed activities there involved the use of scrapers and flakes, for the main eastern area, and flakes and cores for the western area. In the southern part of the excavated area again two 'activity-related areas' are described. One of these is conspicuous by the fact that the only Site K burins and notches seem to cluster here, while in the other area the only two on the spot produced 'Levallois' flakes were recovered. A fifth northern 'area' is marked by the clustered presence of backed knives.

Although the Site K area was mainly excavated by the metre square and quarter of a metre square recording method, it is still possible to distil important spatial (behavioural) patterns from the recorded lithic material. Moreover several colleagues

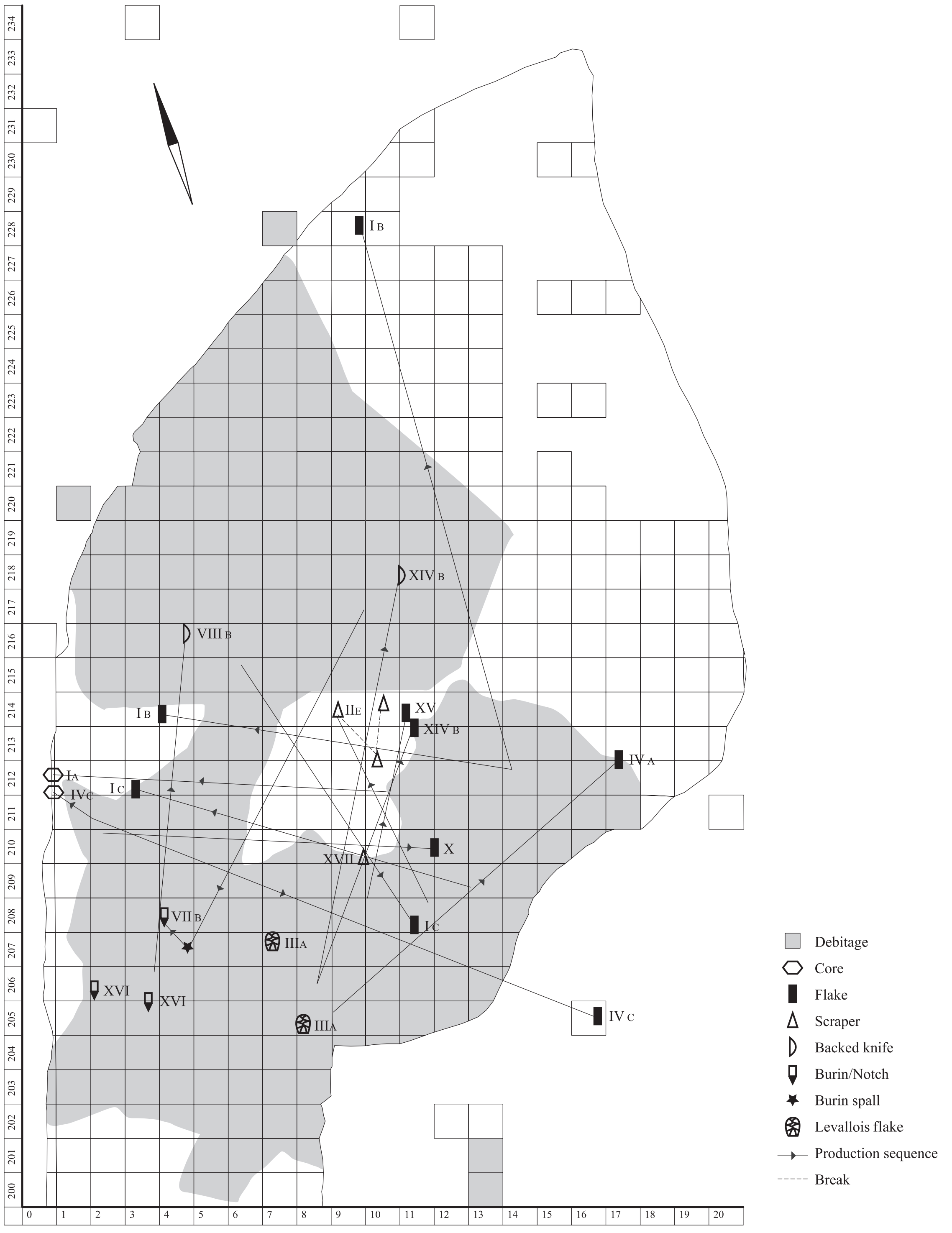


Figure 3.98: Maastricht-Belvédère Site K. Map of the excavated area showing the horizontal distribution of the 17 selected, and technologically described, refitted compositions (Roman numbers). The areas where the bulk of produced debitage was recovered is shown in grey. The location of the most conspicuous artefacts (due to their typology or intra-site transport) are given together with refit lines, which 'connect' them with their place of production. The conjoined artefacts are represented in the 'Cziesla approach' (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts are based on random coordinates within the metres square.

Figure 3.99: Maastricht-Belvédère Site K. Map of the excavated area showing the horizontal distribution of the 17 selected conjoined compositions. Beside the several primary flaking loci, at least five other types of 'activity areas' can be suggested. The areas where the bulk of produced debitage was recovered is shown in grey, and the excavation grid is in metres square.

have recently suggested that a three-dimensional recording of artefacts can easily be replaced by a collective recording, without a great loss of information (*cf.* Roebroeks *et al.* 1987 *a* and *b*; Cziesla 1990; Verhart 1995). In the author's opinion this is an acceptable solution for excavations executed under considerable time stress, as a surface approximately three times as large as a three-dimensional recorded area can be excavated (Roebroeks *et al.* 1987*a* and *b*, 1997; De Bie 1998).

In conclusion, it can be suggested that an internal structuring in the technological use of space was 'preserved' at Site K. The repeated actions and movements for parts of different reduction sequences and the clustering of certain artefact types ('activity-related discard') give positive proof of this assumption. It seems therefore legitimate to tentatively present an interpretative scenario for Site K in terms of one of the site 'types' as described by several authors (*e.g.* Binford and Binford 1966; Clark and Haynes 1970; Binford 1987*b*; Villa 1990). A speculative scenario for the functional interpretation of Site K will be presented in the discussion part (Section 3.11).

3.11 Summary and discussion

The excavated Site K area is characterized by a high density distribution of archaeological remains. Except for some badly preserved (possible) bone fragments, faunal remains are lacking completely. This 'rich' flint assemblage consists mainly of debitage and compared to other Saalian Maastricht-Belvédère sites, a large number of tools, cores and burned artefacts are present. The large amount of flaking debris and cores together with the considerable quantity of established refits (both small and large pieces) clearly indicates on-site knapping activities. Both core reduction and minor tool production took place within the excavated area. The Site K analysis shows generally that 'all' stages of the reduction ('consumption') strategy, from splitting the raw material through decortication to the discard of cores, flakes and tools, are represented. As a general characterization the assemblage can be interpreted as the result of a 'wasteful' reduction of non-prepared cores. However, a limited number of well-prepared tools and flakes, fabricated on 'exotic' flint, were found as well. The latter were probably introduced to the findspot as finished items.

The used raw material was probably collected in nearby river deposits. However, according to the reconstructions of the local palaeogeomorphology (Vandenberghe *et al.* 1993) no raw material sources were present within at least 100 to 200 metres around Site K. This possibly means that after procurement, energy was invested in transporting the many large and 'heavy' nodules, over a minimum distance of 100 to 200 metres, to the Site K locus. Refitting, together with the high percentages of cortex, indicate that several flint nodules entered the excavated area without any (or hardly any) preparation, decortication or testing. At Site K the raw materials were initially split into smaller units and decorticated. Moreover, intra-site spatial patterning shows that the individual parts or cores were transported to other loci within the excavated area. There further core-reduction and discard took place. We are probably dealing with a specific strategy of the division of raw materials into large thick flakes, or blocks, to be secondarily used as cores. Although occasionally larger flakes have been used as cores, the many natural fissures, already in the flint before knapping, clearly played a major part in this initial 'flaking' or splitting of the nodules. All this is convincingly shown by the conjoining studies. The natural flaws together with some technological 'flaking failures' (*cf.* Shelley 1990), on both cores and flakes, could also be an indication of a certain amount of unselective choice of raw material or a lack of high quality raw material. This might have been the reason for an early discard of some of the voluminous cores.

The Site K assemblage is in general characterized by large dimensions and 'few' but large dorsal negatives of the cores and flakes. It can therefore be suggested that the emphasis was mainly on the production of large and thick flakes, using a hard hammer technique. The core classification and especially the refitting analysis clearly indicates a 'unifacial' disc(oidal) core approach and/or an interchanging bifacial discoidal core approach (*cf.* Boëda 1993), in which the cores were constantly turned and twisted to maintain good flaking angles. As a result of this approach the assemblage can be described as reflecting a continuous, sometimes radial, removal of flakes. It seems that the cores and flakes are the result of a reduction strategy with minimal attention for core preparation. Traces of preparation on the striking platform, by means of retouch or facetting, are rarely found on the cores and flakes. Usually the negatives of flakes from an earlier stage in the reduction process are used as striking platform. The reconstructed *chaînes opératoires* show that this technological strategy was probably intended for the production of long 'uninterrupted' sequences of flakes. In this sense the used Site K flaking mode shows a considerable number of similarities with the much younger, Early Weichselian, Maastricht-Belvédère Site J assemblage (*cf.* Roebroeks *et al.* 1987*a* and *b*, 1997). At both findspots the reduction sequences, as reconstructed by refitting, all fit into 'one' major, and very uniform, operational scheme. It is very difficult to make a distinction between well-defined stages in the core reduction strategy, *e.g.* decortication, striking platform and core edge corrections, flaking angle adjustments etc. As a matter of fact the continuous production of artefacts makes it in general very difficult, or even impossible, to distinguish a separate group of flakes as 'waste'. Like Site K the continuous flake production at Site J was made possible by a constant turning and twisting of the core. However, unlike Site K, only few flakes were produced in a continuous sequence from one and the same striking platform and from the same striking surface. A multidirectional flaking approach was applied here. As a rule new negatives were used as platforms for each new flake removal. This was done in such a regular and consistent way that Roebroeks *et al*. (1997) suggest that the complete Site J reduction process was extremely systematic, be it in a non-'classical' way. The same suggestion can, however, be made for the Site K reduction sequences.

Another similarity between Site K and Site J is the fact that Levallois products are virtually absent. At both findspots clear Levallois cores (*sensu stricto*, *cf.* Bordes 1961; Boëda 1984, 1986, 1988, 1993; Van Peer 1992) are completely missing from the assemblages. At Site K, however, some flakes and especially tools (scrapers), made on well-prepared 'exotic' Levallois *sensu stricto* blanks, were introduced into the excavated area as ready-made objects. In addition, refitting shows that for a limited number of nodules, and/or phases in reduction sequences, more attention was paid to the core preparation. These knapping stages were performed on 'finer' grained flint with fewer natural 'errors', and some of their products can even be interpreted as 'preferential' Levallois-like flakes. In conclusion it can therefore be (speculatively) suggested that at Site K a disc/discoidal approach was applied as a response to 'inferior' quality raw material. By means of this flexible reduction strategy, technological errors can 'easily' be repaired and natural imperfections can be 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 orientated towards the production of 'preferential flakes' (*éclat préférentiel*). This hypothesis, assuming a technological adaptation as a consequence of the used flint quality, can also be suggested for the Maastricht-Belvédère 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 core approach was used for the reduction of more 'coarse' grained flint. (see Section 4.4). It has to mentioned, however, that the technological behaviour, as described for Site K, generally contradicts that described for Site C (Roebroeks 1988). There most of the cores were very carefully prepared and the reduction reflects a much more economical behaviour than at Site K. Moreover, the amount of cortex and refitting showed that at Site C a large number of cores (and flakes) were introduced into the excavated area in already reduced form, while at Site K all stages of the core reduction were performed on the spot and preparation is rare. As both findspots are situated in the same geological Unit IV-C layer, it can be suggested that the 'same' early humans, under very similar conditions, clearly dealt with the raw materials in different ways. One of the agents, responsible for this phenomenon, could be the mentioned flint quality.

A typological classification of the Site K tools shows that beside some backed knives, notched pieces, denticulates and pieces with signs of use, various types of scrapers dominate the assemblage (group II or the Mousterian group [Bordes 1972:51]). Refitting and a raw material study proved, furthermore, that only few flakes were selected from the bulk of debitage, to be 'secondarily' used for tool (*sensu stricto*) production. It can be suggested that if a tool was fabricated on the spot the emphasis was clearly on implements other than scrapers.

As pointed out before mainly scrapers, fabricated on 'fine' grained (Levallois *sensu stricto*) flakes, were introduced at Site K as finished items. These products, mostly convergent and double-edged side scrapers, were already retouched/transformed into their discarded form outside the excavated area. It seems, therefore, that the Site K tools assemblage shows a 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) found within the excavated area. Although these 'tool trimming flakes' constitute the few clear remnants of tool-maintenance/modification that occurred at Site K, they clearly show that resharpened tools were subsequently transported away from the excavated area. In general the Site K data gives abundant evidence for assuming early human transport of lithics into the excavated area (*e.g.* 'exotic' flakes and tools), while evidence for transport of flint artefacts away from the site is rather limited (*e.g.* [re]sharpening flakes). The executed typo-/technological analysis indicates that, if locally produced artefacts (tools) were selected for transportation, they were probably larger flakes, as they are generally better prepared. It can be suggested that a 'toolkit' consisting of well-prepared flakes and scrapers entered the excavated area perhaps for subsequent use or maintenance. Part of the 'toolkit' 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 findspots in its surroundings (see Chapter 5).

It can, however, be generally concluded that the Site K reduction strategy was not aimed at the production of well-prepared cores to be transported to other locations, as suggested for Site C (Roebroeks 1988). To the contrary, the very intensive local knapping was mainly concentrated on the production of flakes and to a minor degree on tool manufacture.

As refitting and the spatial distribution show, the produced items were probably aimed at immediate use at the location. Moreover, the slightly-prepared and non-exhausted (voluminous) cores, discarded in large numbers, could suggest that the nuclei were intended for local use only. 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 locus where technology was maintained, while most of the technology was used elsewhere in direct subsistence and ‘non-maintenance’ activities (Isaac 1981; Roebroeks *et al.* 1992; see also Chapter 5). However, beside the flake production a range of other activities, involving the use of flint tools (mainly scrapers), could have been practised on the spot as well. Beside the imported ‘toolkit’ further positive proof of this assumption is given by the locally produced flakes and tools, which sometimes ended up at some distances from the pile of debitage.

Beside some vertical displacement, the archaeological evidence suggests that the Site K flaking debris was hardly disturbed before, during or after the burial stage. It can therefore be concluded that a detailed analysis of the spatial configuration(s) could give precious information on behavioural patterns.

The horizontal distribution of the total Site K artefact assemblage shows in general a concentration which decreases in density towards the northern-northeastern and southern periphery of the cluster. This large flint concentration consists of several ‘high’ density artefact peaks, while the area between the clusters, roughly the ‘central’ part of Site K, shows a less dense find distribution. A large circular concentration of tools was found in this ‘central’ part of the excavated surface, where the overall artefact numbers are relatively low and where few cores and burned artefacts were recovered. Stated differently, the tool cluster is surrounded by a zone with high densities of primary flaking debris (and burned flints). Moreover, this clustered tool zone consists largely of scrapers and it seems that other tool types are more often recovered between the cores, their debitage and the burned artefacts. Conjoining showed that the latter tool types are also most frequently integrated in the refitted compositions. North of the highest density of scrapers a rather conspicuous ‘empty’ zone (without tools) is described.

Besides the spatial distribution of various find categories, also the conjoining results suggest a number of activity areas. The horizontal distribution of the refits shows that locally produced artefacts were transported from one locus to another, within the Site K boundaries. The various refitted compositions, furthermore, point to a contemporaneous use of the different activity areas. Based on 17 refitted compositions it is suggested that different stages of core reduction were performed in distinct areas. Moreover, these compositions probably indicate that the spatial clustering of certain artefacts was related to an actual association in use.

Most of the large flint nodules that entered the site were split and decorticated in the southeastern part of the excavated area. According to refitting some of the (smaller) cores were further reduced on the same spot, while others were selected and transported in a westerly to northerly direction. At these ‘activity-related loci’, sometimes tens of metres from the initial ‘splitting area’, further core reduction (decortication) and discard took place. It is remarkable that these small knapping areas form part of a circle, while the conjoined artefact clusters seem to ‘respect’ each other spatially. The spatial distribution of the 17 conjoined compositions also shows two empty areas in the ‘centre’ of the excavation (between the ‘primary’ knapping areas). The most eastern one corresponds perfectly with the previously mentioned ‘empty’ zone, north of the highest density of scrapers. Refitting furthermore shows that there is a close relationship between several production and possible ‘consumption’ zones and that we are dealing here with activities that are most likely spatially contemporaneous.

From the ‘primary’ production areas a number of flakes, tools and cores were selected and subsequently transported in different directions. Most of these intra-site transported lithics were, however, recovered at small distances (the boundary of) from the ‘central’ empty spaces. On the basis of the intra-site transported artefacts and the spatial distribution of different tool types, the following patterns are described (see also Figure 3.99). Beside the several ‘primary’ flaking/production loci at least five other (consumption?) ‘activity-related’ discard areas are suggested. Two of these areas are situated around the described empty zones in the centre of the excavation. The performed activities there involved the use of scrapers and flakes, for the main large eastern area, and flakes and cores for the western area. Slightly to the south of these zones again two ‘activity-related’ discard loci are suggested. The most western of these is marked by the fact that the only Site K burins and notched pieces seem to cluster here. About three metres east of this ‘burin/notch zone’ an area, with the only locally produced (and used) ‘Levallois’ flakes, is described. A fifth ‘activity-related’ discard area, conspicuous by the presence of clustered backed knives, is situated a few metres north of the empty zones.

It can be concluded that the Site K analysis, and especially the refitting programme, provided clear evidence of the dynamics of flint processing in- and outside the excavated surface. Within the excavated area different cores, tools and flakes were horizontally transported from one ‘activity area’ to another, where they where further reduced, possibly used and eventually discarded. The repeated actions and movements for parts of different reduction sequences and the clustering of certain artefact types ('activity-related discard') indicate that the internal structuring in the technological use of space was 'preserved' at Site K.

It has to be stressed that there are good arguments to suggest that the previously presented behavioural patterns could indeed make sense, as most of the materials studied were probably deposited in 'one' consistent and continuous use of the place. In view of the homogeneity of the raw material, technology, tool and core types, the numerous inter-locus refits and the 'uniformity' of the intra-site spatial patterning I am more inclined to think of a 'single' occupation phase during a certain period, than of a multiple use scenario. In such a 'single' occupation situation refitting suggests a number of simultaneous activities related to flake and tool manufacture, use and discard. At most some repeated short-term visits, with 'identical' activities and with the same horizontal distribution, could have been performed.

Although most of the Site K lithics seem to have been discarded during a 'single' episode of site use, there are some indications that a small fraction of the recovered artefacts may be considered as a 'Site N-like background scatter' (*cf.* Roebroeks *et al.* 1992; Chapter 5). A limited number of non-conjoinable finds, representing the products of different reduction stages, are clearly not related to the main flaking activities which produced the major find concentration. Moreover, these artefacts are produced on 'exotic' materials. This could indicate that the main Site K knapping episode, and its spatial output, was superimposed on an already existing low density artefact scatter (or *vice versa*). Alternatively, and in the author's opinion more speculative, these artefacts could have been brought in as finished items (like the scrapers) and could have been related to use with the bulk of material.

The suggested contemporaneity of the different activity-related discard areas, implying a 'single' major episode of intensive use during a rather 'short' period of time, could suggest that Site K was a more organized entity on an organised/compound continuum (*cf.* Kroll and Isaac 1984; Roebroeks 1988). The 'organized' *versus* 'compound' entity discussion is essential for the behavioural interpretation of the Site K data (and all other Palaeolithic sites). As stated by Roebroeks (1988), interactions between individual flint scatters have often been established for Upper Palaeolithic sites, *e.g.* Meer and Rekem in Belgium and Pincevent in France (*cf.* Cahen *et al.* 1979; De Bie 1998; Leroi-Gourhan and Brézillon 1966; Leroi-Gourhan 1984). Moreover, refitting indicates that these sites probably represent the 'single occupation phases' necessary for interpretation. The situation for Middle Palaeolithic findspots is in general slightly different.

"Relations between flint scatters comparable to those recorded at Meer and Pincevent have not been published as yet for Middle and Lower Palaeolithic sites. The structures recognizable at Lower and Middle Palaeolithic sites are separate debris concentrations, generated in depositional phases which cannot be convincingly related to one another. This state of affairs may, of course, be due to our selection of sites from the earlier time periods; so far only relatively few early primary context sites have been discovered. Another explanation is that the differences in spatial patterns are related to basic differences in organizational capacities between hominids of different time periods." (Roebroeks 1988:65).

Although there were probably differences in the organizational capacities of early humans and *Homo sapiens sapiens* (*cf.* Binford 1987*a*; Stringer and Gamble 1993; Noble and Davidson 1996), the spatial and refitting data of Site K clearly shows that relationships between the several suggested 'activity-related' discard areas are well established. The recognized structures of this high resolution horizontal distribution are therefore probably suitable for making inferences on spatial behaviour. It should be realised, however, that the rather organized appearance of the Site K structures could well be an exception.

The interpretation of Middle Pleistocene behaviour, in terms of the functional character of the Site K assemblage, is probably one of most difficult problems of this thesis. Generally a broad range of possible scenarios can be constructed. One should, however, be alert not to end up with a series of very speculative hypotheses, for which insufficient proof is present. Although we were aware of the danger, and prefer the more straightforward explanations, this is sometimes unavoidable.

The Site K analysis seems to indicate that we are dealing here with the remnants of two different, but related, technological strategies. This binary pattern consists, on the one hand, of an expedient behaviour in which intensive knapping episodes created a 'high density' find distribution. An huge amount of large flakes together with a limited number of tools (mainly non-scrapers on locally fabricated flakes) were produced, used, and discarded on the spot. Seemingly the produced items were mainly intended for local use only. Moreover, a technological interaction between different/specific (activity) areas is suggested.

On the other hand, a number of flakes and especially tools (mainly scrapers) entered the excavated area as ready-made products and were subsequently discarded. Presumably this was done in the context of use. These transported items, clearly produced from different and more fine-grained raw materials, are sometimes associated with Levallois products. A limited number of tools was produced on the spot, using imported flakes as blanks. Moreover, tools were very seldom remodified or resharpened at Site K. If resharpening occurred, it was mostly on imported finished tools, which were after reworking again transported away from the excavated area.

It also seems that no cores entered, or left, the excavated surface. As most of the produced cores were probably intended for local use only, it can be suggested that the 'toolkit', that passed through Site K, mainly consisted of scrapers and flakes. In a more speculative scenario however, cores could well have been part of the 'passing-through toolkit', but they were simply not used on the spot. For example at Sites C and N refitting clearly showed that well-prepared and already reduced cores were introduced into the excavated areas, scarcely worked on the spot, and subsequently taken away to other locations (Roebroeks 1988; Roebroeks *et al*. 1992).

Generally it can be suggested that the transported and expedient components tend to vary in flint quality, technological approach and artefact composition. In view of the spatial arguments and refitting it seems, however, legitimate to suppose that both parts of the binary pattern belong to one and the same period of occupation.

The transported 'toolkit' and especially the manipulation of scrapers before arriving at, or leaving from, the Site K area, could, furthermore, be indicative of some form of 'planning depth'. Like Villa (1990) stated for the Spanish Middle Palaeolithic site of Aridos, this planning depth "might have been short-term, i.e., with the duration of a few hours (or few days) as might be expected in humans living in non-extreme environments providing a relative abundance of lithic resources." (Villa 1990: 302; but see also Binford 1989).

All these arguments seem to suggest that besides the 'primary' and 'secondary' flint knapping episodes, other behavioural activities may also have been responsible for the excavated Site K configuration. It is, however, very difficult or even impossible to indicate the exact nature of these other site functions, as we are dealing here with a number of analytical limitations. Unfortunately no bone material was recovered. This could simply mean that there never were faunal remains at the locality, or it could be an outcome of non-preservation. Compared to other Maastricht-Belvédère sites from the same geological Unit IV, one is more inclined to explain the lack of bones to post-depositional processes (decalcification of the site-matrix). These processes were also responsible for the rather negative use-wear results. In general van Gijn concluded (pers. comm. 1987) that some pieces actually showed microscopic traces of use, but she could not determine the exact type due to a very fast patination. Although this gives us a rather negative picture, there are clearly some clues which could be indicative of the character of other behavioural activities. These can be summarized as follows:

1. Energy was invested in the procurement and subsequent transportation (at least 100-200 metres) of many large and 'heavy' raw material nodules. This could indicate that 'fresh' flint was required for local flake production, to be used in other subsistence activities.
2. A well-prepared, scraper-dominated, 'toolkit' was brought in and subsequently some parts of it were resharpened on the spot. Moreover, an 'exotic' imported flake was locally transformed into tools (a burin) and perhaps after use discarded within the excavated area. Information on lithic transport indicates that scrapers, backed knives, well-prepared flakes (and cores) are items that are most frequently transported at Maastricht-Belvédère (Roebroeks 1988; Roebroeks *et al*. 1992).
3. Clark and Haynes (1970) noticed that unretouched artefacts exceeded the sharpened tools at many Palaeolithic findspots where an association between large mammals and stone artefacts is found. The intensive knapping episodes at Site K, in which large flakes with good cutting edges were produced, clearly show a predominance of cutting 'equipment' which could again be indicative of activities other than maintenance of technology.
4. A large number of flakes and some tools were locally produced, used (*e.g*. pieces with macroscopic signs of use) and discarded. Some of these tools (mainly non-scrapers) were resharpened as well.
5. According to van Gijn (pers. comm. 1987) some of the locally produced artefacts also showed microscopic traces of use. In line with the Site C and especially the Site G results it can, therefore, be suggested that at least some of the Site K tools and flakes could have been discarded in direct relation with food 'producing' activities like meat procurement/processing activities (*cf*. Roebroeks 1988; van Gijn 1988, 1989).
6. On the spot produced lithics were transported from one locus to another, within the excavated area.
7. The limited spatial analysis clearly showed a circular outline of the several typological groups. Especially scrapers seem to cluster in the 'central' Site K area. They are surrounded by cores and groups of refittable debitage.
8. Spatial and refitting data combined (17 compositions) indicate that the presence of tools and intra-site transported artefacts more or less coincides with the two described 'central' empty zones. Moreover, these items are mainly present at the boundaries between the debitage distribution and the actual empty areas.
9. Beside the several 'primary' flaking zones at least five other 'activity-related' discard areas are suggested. Two of these areas involved the use of scrapers and flakes, and flakes and cores. They are situated around the described empty zones. Two southern areas are marked by the presence of burins and notches, and locally produced (and used) 'Levallois-like' flakes. The presence of backed knives is described for the northern pattern.

Given these material and spatial reflections it seems possible that, beside the many and intensive knapping episodes, we are dealing at Site K with patterns which may reflect activities other than maintenance of technology ('blank'-production). Although the interpretation is very speculative, one could think of food (meat?) acquisition as is suggested for Site C and especially for Site G (Roebroeks 1988). If this is indeed the case than it can be suggested that the early humans could process the food in a non-competitive situation. As Villa stressed for Aridos 1 (Villa 1990:301) the evidence of flint acquisition (procurement at 'close' distance), intensive knapping, tool manufacture, resharpening and reworking clearly indicates unhurried conditions. Moreover, the flint accessibility and the fact that a lot of lithic material was locally produced could indicate that the actions (flint and possible food procurement) were embedded in 'daily' trips.

A logical next question is whether the activities were related to the use of fire on the spot. As mentioned before, at Site K a large quantity of (conjoinable) burned artefacts was recovered from the excavated area. In general the horizontal distribution of all burned artefacts seems to represent a large circular cluster, covering most of the Site K surface. Within its centre a conspicuous zone without any burned piece coincides with the scraper cluster and the 'empty' artefact zone (based on the 17 refitted compositions) north of it. As a matter of fact a burned side scraper was recovered at the boundary of the 'empty' artefact zone. Given this pattern the highest densities of burned artefacts are found in the southern part of the excavated area, exactly the area were the bulk of flaking debris was present. All this is confirmed by refitting, as some of the small potlids could be refitted to their 'parent' pieces. It can, therefore, be suggested that the burned artefact distribution is in line with the spatial patterns described for other typological groups, *e.g.* the cores. Moreover, the few excavated tiny charcoal particles were scattered over the entire excavated area. These horizontal patterns and especially the conjoining results clearly give evidence for burning 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 indicative here. First of all, at Site K there are no features claimed as fireplaces, *e.g.* areas of reddened sediments, clustered charcoal remains, clusters of burned (reddened) pebbles and/or depressions with burned material which are sometimes surrounded by rocks. The burned flint artefacts were found over larger areas and no 'real' concentration could be detected. Secondly, burned artefacts are found among different typological classes, *e.g.* small and large flakes, cores and tools. In addition, locally produced as well as imported ('exotic') material shows traces of heating. Thirdly, beside the conjoined compositions exclusively consisting of burned artefacts, some of these flakes could be integrated into refitted compositions I and II. Moreover, compositions I and II show that the burned artefacts were refitted into separately reduced parts/cores and that there is no evident relationship between the knapping stages and the burning of the artefacts. The latter means that, at least for compositions I and II, the burning occurred after the flint knapping. This could possibly also indicate that there is a chronological difference between an earlier production of compositions I and II (plus the conjoinings exclusively consisting of burned artefacts), their burning and a later production of the unburned nodules. Time differences may, however, have been very short (*e.g.* hours or a night). Nevertheless, according to these observations it can be suggested that if there was an artificial fireplace it must have burned in the southern part of Site K, outside the recorded artefact distribution, *i.e.* the area destroyed by commercial quarrying. Alternatively, if we are dealing here with a natural fire it must have 'passed through' the site after occupation.

In general it can be concluded that besides some imported artefacts the Site K findspot reflects an *ad hoc* ('expedient') maintenance of technology. The flaking strategy was for the most part focused on activities to be performed on the spot (Figure 3.100). Moreover, the area indicates an organised use of space which functioned for a limited period of time as a kind of 'magnet-location' where besides flintworking possibly other activities, like food (meat) procurement, were performed as well (this applies to Maastricht-Belvédère in general). Anyhow, the locus was apparently important enough for the early humans to invest energy in a 'short-distance' transport of large (heavy) quantities of flint to the excavated area. The 'low' raw material quality and the rather 'wasteful' core reduction could, furthermore, indicate that we are dealing here with a rather expedient exploitation of resources that presented 'themselves' on 'daily' trips. More specific flint procurement and maintenance of technology could have been embedded in other activities like meat processing. This strategy included some forms of planning depth as is shown by the transported items. The early humans probably planned their 'daily' subsistence practices and introduced a well-prepared toolkit, consisting of (prepared) flakes, scrapers and backed knives (and cores at Sites C and N), into the river Maas valley (see Kolen *et al.* 1998, 1999). These Maastricht-Belvédère early humans can therefore be described as 'equipped mobile people' (Binford 1987*a*). It is clear that these 'equipped people' were certainly involved in different activities like maintenances of technology (*cf.* Site F, H and K) and meat procurement behaviour (*cf.* Site C and G). The behaviour of transporting material culture, moreover, suggests that there is a clear interaction between several sites or better, between what Isaac calls scatters and/or patches (Isaac 1981). In this way one should not only use the Site K

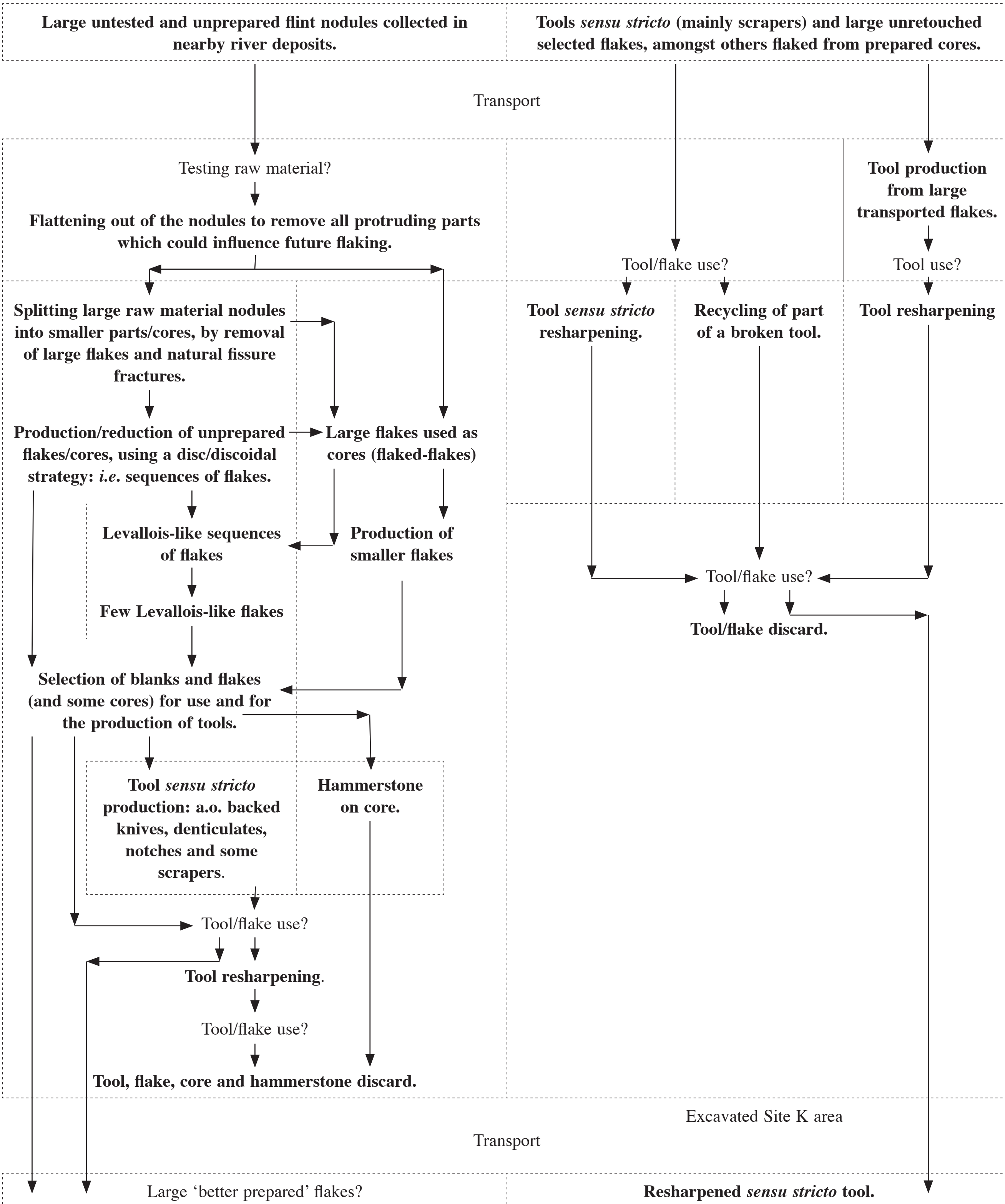


Figure 3.100: Maastricht-Belvédère Site K. Schematic representation of 'horizontal behaviour' as derived from the flint assemblage.

'high density' patch in the interpretation, but incorporate other scatters and patches from the same geological Unit IV, or better the same 'cultural' system (Roebroeks 1988:133), as well. For this discussion the reader is referred to Roebroeks *et al*. (1992) and to Chapter 5.

notes

1 The 36 artefacts in question were directly, within a few seconds after recovery, kept out of daylight. They were stored in black plastic film containers. In this way they were catalogued and stored for possible TL dating.

2 The excavation crew consisted mainly of 'amateur-' archaeologists, students of Leiden University and members of the *Nederlandse Jeugdbond ter Bestudering van de Geschiedenis* (N.J.B.G.). The daily supervision at the excavation consisted of Mr R. Frank (Leiden University), Mr P. Hennekens (Maastricht), Mrs M. van Ieperen (Leiden University) and the author. The entire excavation was coordinated by Mr W. Roebroeks (Leiden University).

3 The three excavation campaigns were carried out between December 1st 1986 and January 9th 1987, between April 20th and 25th 1987 and between July 1st and August 13th 1987.

4 The Site K excavation revealed only few and scattered particles of charcoal. All specimens large enough to be analysed (n= 7) were submitted to Mrs C. Vermeeren (Leiden University) for further analysis. The particles were broken and the fresh cracks were studied under an incident light microscope with a magnification of 50x to 200x. The poor state of preservation allowed only a very general interpretation of one piece of the sample. Of this piece a few features were noticed which were indicative of pine wood. The kind of species was impossible to discern. The other six particles are amorphous, sometimes layered, and it looks as if sediment pressure has transformed these pieces (written comm. Mrs C. Vermeeren 1993).

5 The lithic analysis was executed by the author together with Mrs M. van Ieperen (Leiden University).

6 In the first instance the boundary of 20 mm was chosen for analysis, as this made an easy comparison with other Middle Palaeolithic sites possible (*cf*. Callow and Cornford 1986). During this description however it became clear that also artefacts <30 mm hardly carry more or different kinds of technological information than the larger ones. Therefore the decision was made to analyse only artefacts ≥30 mm. This had also a practical advantage. The smaller the artefact the more difficult to describe and so the more the category indeterminate is chosen on the 'answer' sheet.

7 The detailed refitting analysis was mainly done by the author with assistance of Mr P. Hennekens (Maastricht) and Mrs M. van Ieperen (Leiden University).

8 'SiteFIT' is actually based on Mr J. Lindenbeck's programming work carried out for the analysis of the Palaeolithic site of San Quintin de la Mediona in Spain (Lindenbeck 1990).

9 'AutoCAD' is a very popular Computer Aided Drafting package used mainly by architects but also by many archaeologists. It can create and modify easily many types of archaeological drawings in two and three dimensions and has powerful digitizing possibilities. In addition, special applications can be programmed with the program language called 'LISP'.

10 Flakes and cores were rejoined, forming series or sequences of 'hierarchically' placed artefacts. Eventually some of these sequences could be refitted to one another, creating 'larger' blocks or nodules of flint (the complete composition).

11 The sampled metre square was excavated by the quarter of metres square method. The sediments of every 5 cm thick spits (per quarter) were collected and sieved through a sieve with a mesh of 2 mm.

12 Computerization of the random coordinates was done by Mr J. Lindenbeck (Linden soft, Köln).

13 It has to be stressed again that, except for the three-dimensionally documented area, most finds have been given random coordinates within the their actual square- or quarter of a metre square. It is therefore impossible to assign exact distances to the refits.

4 Maastricht-Belvédère, the other Unit IV sites and finds[1]

4.1 INTRODUCTION

This chapter presents an introduction, a typo-/technological characterization, some refitting and spatial results and an interpretation of the lithic material from all Maastricht-Belvédère Unit IV sites except Site K, described in the previous chapter. Besides the lithic material from the excavated areas, all stray finds, collected in several (stratigraphically) different (long) sections and finds recovered during test pit excavations, will be dealt with in a separate section (Section 4.10). The section finds recovered during the ca. ten years of fieldwork will be described as one group of artefacts.

The flint artefacts were described by means of a detailed lithic analysis (see Appendix 1). This typo-/technological study was carried out on a sample of the assemblages, *i.e.* all artefacts ≥30 mm, and similar to Site K, a simple distinction between the products and debris of primary and secondary flaking was made. In the following only a brief characterization of the several Maastricht-Belvédère assemblages is given. For a detailed description of these lithic analyses the reader is referred to Appendices 2 to 11. Before the Unit IV sites are described, it should be noted that most of the data (especially relating to refitting and spatial results) have already been reported in earlier publications (*cf.* Roebroeks 1988; Roebroeks *et al.* 1992; Vandenberghe *et al.* 1993). In general, the different findspots will be dealt with here in alphabetical order: *i.e.* in more or less the chronological order of discovery.

4.2 MAASTRICHT-BELVÉDÈRE SITE A

4.2.1 Introduction

The investigations of the pit, following the first finding in September 1980, led to the discovery of Site A, a small concentration of *in situ* flint artefacts situated in the Saalian Subunit IV-C-ß sediments. The primary aim of the excavation (in March 1981) was to determine the exact stratigraphical position of the flint artefacts, rather than to excavate a large area. For a detailed picture of the Site A stratigraphy the reader is referred to Roebroeks (1988:88). Most of the data of Site A have already been published in two preliminary reports (Modderman and Roebroeks 1981, 1982) and particularly in Roebroeks' monograph (1988). Due to commercial quarrying activities, Site A could not be excavated properly and only a trial trench of ca. five metres square was studied. In total 80 artefacts were uncovered during the fieldwork. Only 34 (42.5%) artefacts were found within the excavated area (see Roebroeks 1988: 89, Figure 100), while 46 (57.5%) were found in nearby sections. As one of the section finds could be conjoined with material from the excavated area, both find categories will be dealt with together.

The Site A find material consists only of flint artefacts. As mentioned earlier, the assemblage is composed of 80 fresh-looking artefacts (Table 4.1), made up of one non-prepared core and 77 pieces of debitage and non-retouched flakes (96.3%). In total two tools, one with macroscopic signs of use and one with intentional retouch, could be identified. Within the category of debitage, two flakes were described as core trimming elements and one artefact was possibly burned. In total 20 artefacts (25.0%) could be conjoined.

In the next sections the Site A flint assemblage (primary and secondary flaking) will be technologically discussed and interpreted briefly. For a detailed typo-/technological description of the Site A flakes, core and tools the reader is referred to Appendix 2.

Type	n	%
Debitage	74	92.5
(Core Trimming Elements)	2	2.5
Cores	1	1.3
Modified artefacts	2	2.5
'Hammerstones'	–	–
Burned artefacts	1	1.3
Total	80	100.1

Table 4.1: Maastricht-Belvédère Site A. Some quantitative data on the Site A flint assemblage.

4.2.2 Characterization of the assemblage

The majority of Site A finds are chips and flakes, respectively 58.8% and 37.5%. The small flakes (<30 mm) are for a large part the remnants of flaking debris. According to Roebroeks (1988), a total of five blade-like flakes were counted. He also described a Levallois blade-like flake *à talon lisse* which was possibly retouched on its distal end. According to the measurements of the descriptive scheme used here, only one blade-like flake is described (1.3%). The four other so-called blades are in fact somewhat elongated larger flakes (two of these are tools).

Most of the flakes have a maximum dimension <50 mm (84.9%), while artefacts <10 mm are few in number (6.3%). According to the detailed typo-/technological description, the Site A flakes are in general slightly longer than wide. Of all flakes ≥30 mm just under two thirds of the sample shows cortex remains, while on ca. one third frost split (natural fissures) surfaces are described. As mentioned in Chapter 3, these natural fissures indicate that the raw material nodules out of which the artefacts were produced were already affected by frost before knapping. Again on ca. one third of the sample parts are missing due to breakage. In most cases the proximal part is missing. The Site A assemblage is clearly dominated by flakes with a plain butt (50.1%) and/or a 'parallel' unidirectional pattern (40.6%). Pieces with a facetted or retouched butt and/or a centripetal dorsal pattern are rather scarce. More than half of the flakes ≥30 mm have three or four dorsal scars. Altogether the data on the butts, the dorsal surface (preparation) and the dorsal scars indicates that we are dealing at Site A with a technology in which there is only limited attention for core preparation. This is also confirmed by the only core recovered from the excavated area, *i.e.* a double platformed, opposed core (see Appendix 2, Primary flaking: the cores).

Besides a retouched piece and a naturally backed knife with macroscopic signs of use (see Appendix 2, Secondary flaking: the tools), among the chips a so-called (re-)sharpening flake was found (Figure 4.1). This resharpening flake contains a partial working edge of a tool from which it was removed. Following Cornford (1986), the piece in question can be classified as a 'Transverse Sharpening Flake' ('TSF').

Figure 4.1: Maastricht-Belvédère Site A. 'Transverse Sharpening Flake' ('TSF'). Scale 2:1.

4.2.3 The refitting results

The refitting programme carried out resulted in the conjoining of 20 artefacts (25.0% of all artefacts). All 20 conjoined artefacts represent 11 refitting lines, which can be divided into nine (81.8%) *Aufeinanderpassungen* (refitting of production-sequences) and two (18.1%) refittings of breaks *Aneinanderpassungen*. The mean length of these *Aufeinanderpassungen* and *Aneinanderpassungen* cannot be given because the required data was not accessible for study. In total nine compositions were achieved (*cf.* Cziesla 1986, 1990). Altogether the nine conjoined compositions can be divided into:

8 groups of 2 conjoining elements
1 group of 4 conjoining elements

According to the established dorsal/ventral refits of both small and large artefacts, at least some flaking took place in the sampled area. The presence of a so-called core trimming element/flake, amongst the refits, which rejuvenated the working edge angle of a core, supports this assumption. Seven of the conjoined groups (including the core) contain cortical flakes. This could mean that the initial flaking of the nodules/cores took place at the site. Furthermore it indicates that the cores or raw materials entered the Site A area without much preparation. One refitted break shows a flake which was broken (probably during flaking) on a natural fissure. This 'flaw' could indicate that the raw material was not tested before it was used at the site. Most of the larger elongated flakes (including the two tools) must have been knapped outside the excavated area as no flaking debris could be refitted to them. The fact that only a trial trench of ca. five metres square was excavated, while most of the artefacts were found in a nearby section, does not directly indicate that the artefacts in question were produced elsewhere and were transported to the Site A area. In addition, the only recovered blade-like flake was actually produced on the spot as it could be refitted (dorsal/ventral) to a smaller flake (see Roebroeks 1988:90, Figure 102-5, -6 and -7).

4.2.4 Spatial distribution

It is clear that during the fieldwork at Site A only a small part of the original flint distribution was sampled and that therefore statements on the spatial distribution of the artefacts must be limited. To give an indication of the artefact density only the mean number of artefacts per metre square are given for the excavated area (excluding the 46 section finds): 6.8 artefacts per metre square, 0.2 cores per metre square, 0.4 core trimming elements per metre square, 0.4 tools per metre square and 0.2 burned artefacts per metre square.

4.2.5 Interpretation

The presence of a high percentage of small flaking debris and the established refits of both small and large flakes (including a core) give an indication that on-site knapping activities were performed within the excavated Site A area. Judging from the finds found in the excavated area and the sections, we are dealing here with a findspot consisting mainly of debitage and a few tools. The appearance of natural fissures on part of the artefacts suggests an unselective choice or a lack of better quality raw materials. According to the technological characteristics and the refitting analysis, some large elongated flakes, including tools, must have been struck from a larger core somewhere outside the excavated area.

At Site A some stages of the reduction strategy can be reconstructed. At least from one core or raw material nodule the initial cortex flakes were reduced within the sampled area (decortication). Furthermore some smaller flakes and one blade-like flake were produced on the spot. The refitted core trimming element indicates that the working edge angle of at least one core was rejuvenated for future flaking. Some flakes and a core plus the tools and elongated flakes, produced outside the excavated area, were discarded within the excavated Site A area.

The assemblage can most probably be interpreted as the result of an unprepared core reduction strategy. Only few flakes show a retouched or facetted butt, and a centripetal or convergent dorsal pattern is rare. On the other hand about one fourth of the flakes shows a dorsal preparation near the butt. It can therefore be suggested that good working edge angles were created, used and maintained on the cores to produce sequences of flakes.

The 'Transverse Sharpening Flake' (*cf.* Cornford 1986) indicates that a tool was rejuvenated, perhaps after use, on the spot. After this resharpening of a working edge, the tool was probably transported outside the excavated area.

In functional terms Site A represents the production of flakes, possibly associated with tool use, tool rejuvenation and discard. To conclude, a schematic representation of 'horizontal behaviour' (*cf. chaîne opératoire*) is given in Figure 4.2.

4.3 MAASTRICHT-BELVÉDÈRE SITE B

4.3.1 Introduction

During the summer of 1981 (July) a flint artefact was found in the greyish-olive silt loams of Subunit IV-B. A subsequent study of the exposures produced some more artefacts in various stratigraphical positions. In general two archaeological levels could be identified at Site B. The lowermost was situated in the silty loam of Subunit IV-B, while the uppermost was situated in an erosional level, about 35 cm higher, at the base of Subunit V-B. Only the Saalian Subunit IV-B lithics will be dealt with here (see Roebroeks 1988:97-98, Chapter 6, for the Subunit V-B archaeological remains). For a detailed description of the Site B stratigraphical situation and excavation strategy the reader is also referred to Roebroeks 1988:76.

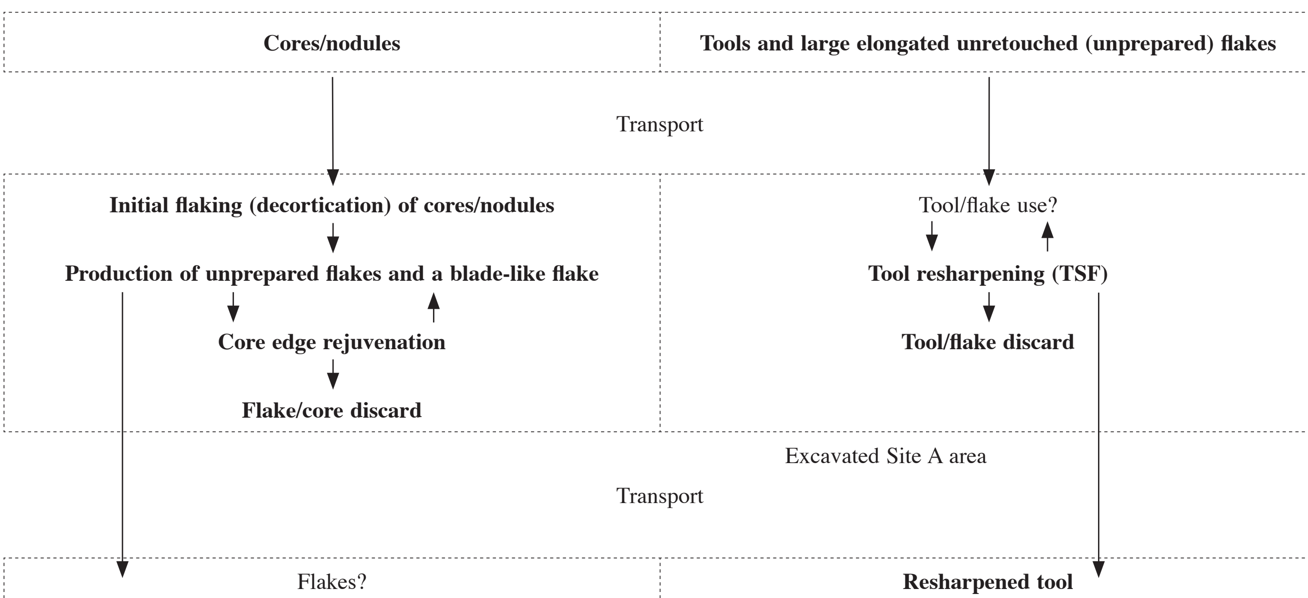


Figure 4.2: Maastricht-Belvédère Site A: Schematic representation of 'horizontal behaviour' as derived from the flint assemblage.

Between August and September 1981 an area of 20 metres square was excavated. Besides faunal remains (molluscs and small/large mammals) and some charcoal particles, the find material excavated at Site B consists only of five flint artefacts. In the section immediately east of Site B at least one more artefact was found in association with faunal remains. The artefact was conjoined (dorsal/ventral) to a larger flake from the excavated area. Therefore this section find will be dealt with together with the finds from the excavated area.

All six artefacts are pieces of debitage and non-retouched flakes: amongst others a blade-like flake (Table 4.2; see also Roebroeks 1988:78, Figure 84-1). In general the flakes have larger dimensions (≥50 mm). Most show a preparation at the angle between the butt and the dorsal surface, a more complex dorsal pattern (‘parallel’ bidirectional, centripetal or radial and ‘parallel’ + lateral unidirectional patterns) and three up to five dorsal scars. All this could be indicative of a somewhat more prepared core technology. However, in view of the small number of artefacts, the reader is referred to Appendix 3 for a more detailed typo-/technological characterization.

Type	n	%
Debitage	6	100.0
(Core Trimming Elements)	–	–
Cores	–	–
Modified artefacts	–	–
‘Hammerstones’	–	–
Burned artefacts	–	–
Total	6	100.0

Table 4.2: Maastricht-Belvédère Site B. Some quantitative data on the Site B flint assemblage.

4.3.2 The refitting results and spatial distribution

According to the only established refit, some knapping could have taken place at Site B: a ventral/dorsal conjoining (*Aufeinanderpassungen*, *cf.* Cziesla 1986, 1990) of two artefacts which were found one to two metres from each other. One flake was found in the excavated area and one in the section where the first artefacts were found. These two refits indicate that only part of a larger flint distribution was excavated.

Besides the statement that all flint artefacts were recovered from the southeastern part of the excavated area (see Roebroeks 1988:78, Figure 83) and due to the small Site B cutting, it is clear that further statements on the spatial distribution of the artefacts are not possible. However, to give an indication of the artefact density, only the mean number of artefacts per metre square for the excavated area is given (0.3).

4.3.3 Interpretation

The data of Site B shows that most flakes were made of several different raw material nodules. One flake possibly shows evidence that it was struck from a prepared core (see Roebroeks 1988:78, Figure 84-2), while four flakes are slightly more prepared, meaning a more complex dorsal pattern or some kind of preparation at the angle between the butt and the dorsal surface of the flake. Only one refit could be established. This could suggest that larger flakes were introduced and discarded at the excavated area. On the other hand, the two conjoined artefacts could indicate that a core entered the excavated area, where at least two flakes were knapped, and was subsequently transported away from the Site B spot. Judging from the variety of raw materials present, almost all artefacts were probably introduced to the site as isolated pieces. As a result, the flakes may have been introduced to the spot to be used in some kind of activity. As mentioned before all flint artefacts were recovered from the southeastern part of the excavated area which formed a border zone of a concentration of larger mammal bones (amongst others red deer, giant deer), found in the section immediately east of Site B. The fine-grained sediments at Site B, indicating a calm sedimentary environment, suggest that there might be a relationship between the human activities (flint artefacts) and the remains of a young red deer. However, the only relationship visible to us is that they were found ‘close’ to each other. In this sense the interpretation could be in the same line as the one for the Site G (see Section 4.7). Figure 4.3 gives a schematic representation of ‘horizontal behaviour’ as derived from the Site B flint assemblage.

4.4 Maastricht-Belvédère Site C

4.4.1 Introduction

The Site C flint scatter was discovered in August 1981 during the excavation of Site B, and was excavated between September 1981 and June 1983. Like Site B and Site G (see Section 4.7), the Site C flint assemblage was recovered from the fine-grained Unit IV-B deposits, situated underneath the calcareous tufa of Unit IV-C-α. Although the investigated area was affected by karst-generated disturbances, which complicated the excavation, only the peripheries of the flint scatter were affected. For a detailed picture of the recorded stratigraphy the reader is referred to Roebroeks (1988:28-29; see also Vandenberghe *et al.* 1993 for a more updated definition of the units), while most of the Site C data have already been published in several papers (Roebroeks 1982, 1984, 1986, 1988; Roebroeks and Hennekens 1990; Roebroeks *et al.* 1993; Schlanger 1994, 1996; Stapert 1990).

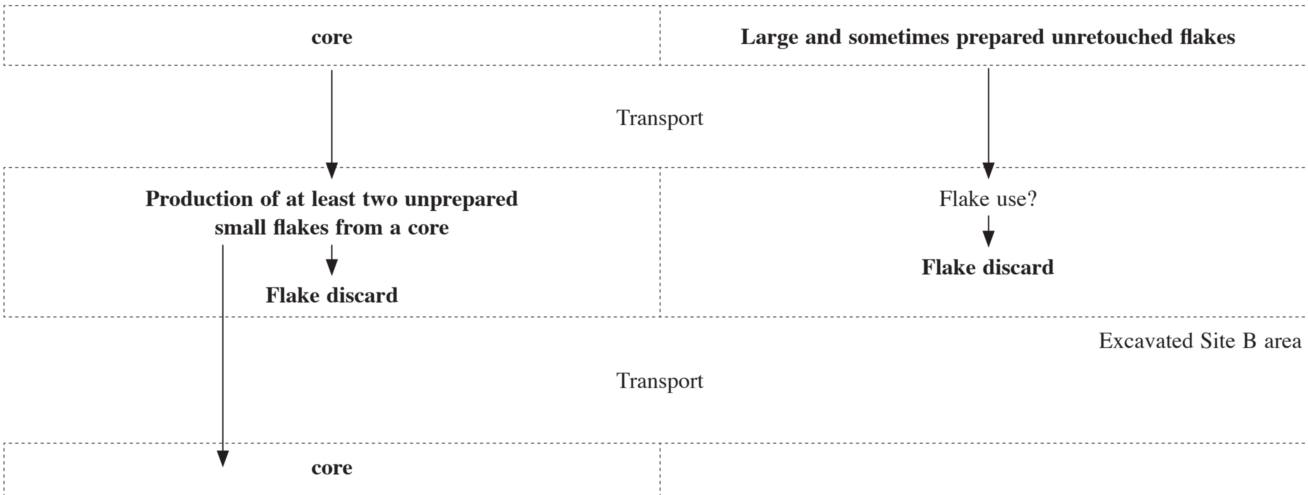


Figure 4.3: Maastricht-Belvédère Site B. Scenario for the 'horizontal behaviour' as derived from the flint assemblage.

The extensive study of Site C yielded very detailed information on amongst others the transportation of cores, flakes and tools. This triggered an interest in the spatial aspects of Lower and Middle Palaeolithic early human behaviour and set the agenda for fieldwork in Maastricht-Belvédère. Moreover it resulted in studies on patterns of raw material distribution, planning depth and the organization of Middle Palaeolithic technology (a.o. Roebroeks *et al*. 1988*b*; Rensink *et al*. 1991).

At Site C a total of 264 metres square was recorded three-dimensionally and the sediment of 38 metres square was sieved (see Roebroeks 1988, separate map Figure 27). Besides 3,067 flint artefacts (including burned pieces) the excavation yielded poorly preserved bone material, a large quantity of clustered charcoal particles and some dots of reddish haematite. Although several flint artefacts show hardly any macroscopic surface modifications, most of the pieces show a light colour-patination or display a soil-sheen.

The flint assemblage consists in total of 3,040 (99.1%) pieces of debitage and non-retouched flakes and four cores (Table 4.3). These cores are described as a discoidal core, two heavily reduced disc cores, of which one is 'elongated', and a nearly exhausted 'Levallois' core. According to Roebroeks (1988), the 'elongated' disc core is a multi-platformed core. Only few tools could be identified amongst the flakes. Most of these (n= 18) show only macroscopic signs of use and no intentional retouch. The five *sensu stricto* tools are a single and a double convex side scraper and three backed knives. Also 12 core trimming elements and 132 burned artefact were identified. The total weight of the excavated Site C flint assemblage is 7.23 kg (Roebroeks 1988).

A considerable amount of information on technological aspects, post-depositional processes and horizontal distribution was obtained by an elaborate refitting programme. In total 659 artefacts (21.5% of the total number of three-dimensionally recorded pieces) were conjoined. In the next sections a brief technological characterization of the Site C flint assemblage (primary and secondary flaking) is given, while for an overview of the refitting and spatial data the reader is mainly referred to Roebroeks (1988). For this lithic exercise the primary flaking data is predominantly based on the studies executed by Mr W. Roebroeks and especially Mr N. Schlanger for their PhD theses (respectively 1988 and 1994). The analysis of secondary modified artefacts is based on the work carried out by the author.

For a detailed picture of the typo-/technological characteristics of the Site C flakes, cores and tools the reader is referred to Appendix 4.

Type	n	%
Debitage	2,896	94.4
(Core Trimming Elements)	12	0.4
Cores	4	0.1
Modified artefacts	23	0.7
'Hammerstones'	–	–
Burned artefacts	132	4.3
Total	3,067	99.9

Table 4.3: Maastricht-Belvédère Site C. Some quantitative data on the Site C flint material (after Roebroeks 1988 and Schlanger 1994).

4.4.2 Characterization of the assemblage

On the basis of the specific properties of the flint material (texture, cortex, inclusions, colour), the majority of artefacts could be attributed to six different Raw Material Units (RMUs). These RMUs were interpreted and described by Roebroeks (1988) as the products of six different flint nodules. Five larger artefacts, including the single convex side scraper, were probably produced from other flint nodules. For this technological characterization, however, the lithic material will be mainly treated as one group, while some general characteristics of the different RMUs are given. For details on the different RMUs the reader is referred to Roebroeks (1988) and Schlanger (1994).

According to Roebroeks (1988:30, Table 5), the majority of Site C finds (87.1%) are small artefacts or 'chips' <30 mm, while 12.8% are described as larger flakes. Roebroeks' study furthermore shows that the bulk of the material (44.6%) covers artefacts <10 mm. In general the Site C flakes are slightly longer than wide. Less than one fifth of the 3,067 artefacts show cortex remains, while flakes with frost split surfaces (natural fissures) are nearly absent.

According to a sample of 462 artefacts, described by Schlanger (1994), ca. two thirds of the flakes are complete. His sample also shows that, like most Maastricht-Belvédère assemblages, plain butts dominate (36.8%). The *Index Facettage stricte* (IFs; *cf*. Bordes 1972:52) for all flakes ≥30 mm is 13.6. There is, however, a considerable discrepancy between this figure and the one given in Roebroeks' thesis (1988). According to the latter, the *Index Facettage stricte* (IFs) for all flakes >20 mm is 43.7. There are some explanations possible for this discrepancy. First of all, as most of the artefacts are smaller flakes it is possible that most of the flakes with a facetted/retouched butt have a maximum dimension between 20 mm and 29 mm (see amongst others RMU 5, Roebroeks 1988:52). Secondly, both authors could have been using slightly different definitions of the concept facetted/retouched. In a third explanation it is possible that flakes with well-prepared butts are represented less in Schlanger's chosen sample (see also Appendix 4 for the *Index Facettage stricte* (IFs) of flakes ≥50 mm). Nevertheless, the author's description shows that the *Index Facettage stricte* (IFs) for tools ≥30 mm is 30.4. Remarkable is that all these tools with facetted/retouched butts are flakes with macroscopic signs of use and a naturally backed knife.

At Site C hard hammer percussion as well as soft hammer percussion were used. In general the assemblage is clearly dominated by flakes with a 'parallel' unidirectional dorsal pattern (45.5%), while slightly less than half of the tools (≥30 mm) show a centripetal (radial) dorsal pattern. However, it can be suggested that larger flakes and tools were more often and 'better' dorsally prepared, *i.e*. in a centripetal (radial) or a 'parallel' + lateral unidirectional way. Like Site A the majority of the flakes ≥30 mm shows three or four dorsal scars.

In general the data on the butts and the dorsal surface (preparation), together with the presence of several 'classic' Levallois flakes (n= 47 according to Schlanger 1994) and an exhausted 'Levallois' core (see Appendix 4.3, Primary flaking: the cores) indicates that at Site C we are dealing with a technology in which there is clearly attention for core preparation. Furthermore, it can be suggested that this preparation was orientated towards production of larger flakes and tools.

A closer look at the different Raw Material Units shows that RMU 1 consists mainly of flaking debris, with some cortical flakes and flake fragments. Much more debris is represented by RMU 2. The products of this flint nodule include amongst others a large number of cortex flakes, a few larger flakes which could be interpreted as products of a 'Levallois' core (n= 10, Schlanger 1994), two cores (amongst others the 'elongated' disc core) and some core fragments. Compared with other Site C RMUs, facetted butts are less common and the flint nodule seems to have been worked in a 'rougher way'. The latter could be a consequence of the flint's coarser grain size. Besides small flaking debris, RMU 3 is mainly represented by cortical flakes and a few larger regular flakes. RMU 4 again shows a clear quantity of fine debris. Also 19 larger Levallois flakes (>50 mm, Schlanger 1994) and the exhausted 'Levallois' core could be attributed to this group. The RMU 4 flakes rarely show cortex. The artefacts of RMU 5 are mainly flakes <50 mm and only few cortex flakes were counted. Most of the burned artefacts mentioned above can be ascribed to this RMU. RMU 6 is, amongst others, represented by a few dozen cortex flakes and larger flakes. According to Schlanger (1994), eight Levallois flakes could be identified. Furthermore, some of these larger (Levallois) flakes, including the double convex side scraper, were recovered outside the RMU 6 concentration.

To explain the presence of technological variations between the six RMUs, Schlanger (1994:36-59, Chapter 2) made a distinction between Levallois and non-Levallois components of each nodule. In general he concludes that some technological observations (*cf*. Appendix 1) made on the non-Levallois flakes of the four 'main' RMUs (2, 3, 4 and 5) appear quite similar, while others show variations. More important are the large (metric) differences between the identified Levallois flakes and non-Levallois elements. The Levallois products of all RMUs show larger values and look more standardized.

4.4.3 *The refitting results*

A substantial amount of time and energy was invested in conjoining the Site C assemblage[2]. This refitting analysis gave clear indications on technological aspects, post-depositional processes and the spatial distribution of the lithics. As mentioned before, a total of 659 flint artefacts were refitted (21.5% of a total of 3,067), *i.e.* 70.4% of the total weight of the Site C assemblage (Roebroeks 1988). 457 conjoined artefacts are ≥20 mm (14.9%). Due to the fact that the refitting study was performed in a 'pre-Cziesla' period (*cf.* Cziesla 1986, 1990) only limited attention was paid to distinguishing specific types of conjoinings, notably *Aufeinanderpassungen*, *Aneinanderpassungen*, *Anpassungen* and *Einpassungen*. To get an impression of the horizontal distribution of all refitted elements the reader is referred to Roebroeks 1988 (separate map Figure 47), and only a general impression is presented here. The members of conjoining groups lay close together. A detailed investigation of the horizontal distribution of a number of conjoined fragments of broken flakes (*Aneinanderpassungen*, amongst others indicative of non-human spatial disturbance) showed that in 64.9% of the sample the refitted members were recovered within a radius of 1.5 metre (Roebroeks 1988:55-56). However, the refitting analysis also showed that there are conjoined elements lying up to 6.40 metres apart.

As most of the Site C refitting data has already been published (Roebroeks 1988:40-59; Schlanger 1994), it should be sufficient to give here only a brief overview of the RMU-specific observations (see also Figure 4.4 and 4.5). However, the RMU 6 results are given in a more detailed form as, according to the author of this thesis, different scenarios for interpretation are possible.

Most of the conjoined Site C groups are represented by 'small' sequences of flakes and broken fragments of flakes, though some large compositions were established as well. Especially the conjoining of RMUs 3, 4 and 5 resulted in some spectacular results, respectively blocks with 40, 29 and 162 elements. In a quantitative sense the latter is the largest refitted group established at Maastricht-Belvédère. In a technological sense the elaborate refitting programme showed that the six RMUs are represented by specific stages in the core reduction. Of some flint nodules (RMUs 1 and 3) the initial decortication stages are present (for RMUs 2 and 6 partly present), while for other RMUs these stages are missing. According to the flake scars on the outermost striking surface of RMU 5, a core must have produced several larger flakes before it was imported into the excavated area. Within the Site C area, small flakes were produced in an uninterrupted reduction cycle, using a continuous working edge and one major striking surface. The core itself (not recovered inside the excavated area) was probably a very flat disc core. Disc and discoidal cores have been described amongst the RMU 2 artefacts, while the RMU 2 and 4 debris consists of some flakes which could be interpreted as 'classic' Levallois *sensu stricto* products (Bordes 1961; Boëda 1986) and products belonging to a recurrent form of Levallois (*cf.* Boëda 1986, 1993, 1994). The refitting results of RMU 4 are, technologically seen, probably the most interesting at Site C. A core must have entered the excavated area in an already prepared form. The core produced a rather regular alternation of smaller 'preparation' flakes and larger 'Levallois' flakes (Schlanger 1996:241-242). This cyclical pattern of distinctive phases clearly shows that technology was not directed towards the production of one single Levallois *sensu stricto*, but towards a whole series of prepared 'Levallois' flakes. In general this type of reduction, which is based on careful preparation of the convexity of the core's working surface, can be described as *débitage Levallois recurrent* (Boëda 1986, 1993, 1994). Eventually the exhausted 'Levallois' core was discarded on the spot. For a photographical representation of the actual reduction the reader is referred to Roebroeks (1988:48, Figure 56). A few larger flakes are absent in the refitted reduction sequence, and a number of larger flakes (belonging to this RMU) could not be conjoined to the core. Seven of these flakes show use-wear traces, while none of the refitted flakes shows signs of use. Also RMU 6 is represented by larger flakes which could not be refitted to the bulk of that nodule's debris.

RMU 6 (Roebroeks 1988:54, 55, Figures 62, 63) consists mainly of two refitted groups. The nodule found its way into the excavated area in an already flaked condition. Inside the excavated area the outermost parts of the nodule was removed by the removal of large (cortex) flakes. In one refitted group (block 1, *cf.* Roebroeks 1988), which consists mainly of decortication flakes, there are two artefacts incorporated which show a natural fissure surface. Moreover, these two flakes fit dorsal surface against dorsal surface. In one scenario (Figure 4.4, RMU 6, scenario A) this could suggest that at the excavated Site C area an 'introduced' larger raw material nodule was split by following an internal cleavage plane (natural fissure) in at least two parts. These smaller and more manageable parts could have served, secondarily, as cores. However, in another scenario (Figure 4.4, RMU 6, scenario B) the large nodule could have been split into smaller units outside the excavated area. Subsequently the two blocks were introduced at Site C to be decorticated. These natural fissures, which were already present in the flint before knapping, give an indication that the raw material nodule was probably not tested before entering the excavated area. In this sense RMU 6 is quite different from RMUs 2, 4 and 5 and resembles more the reduction strategy used at Site K (see Chapter 3). The nodule also yielded some flakes with facetted butts which could not be conjoined to the rest of the flaking debris. It can, therefore, be suggested that these larger flakes, struck from a prepared core, were produced outside the excavated area and brought in as ‘finished’ artefacts. This leaves us again with two scenarios. A flint nodule entered the Site C area, where it was roughly worked into a core. Subsequently this core was taken outside the excavated area where the larger flakes were produced (and used?). Next some of the flakes returned to Site C (see Figure 4.4, RMU 6, scenario A). In another scenario (Figure 4.4, RMU 6, scenario B) the large nodule was split into at least three smaller units. One of these blocks was decorticated, prepared and produced the larger flakes outside the excavated area. Subsequently only the ‘finished’ flakes entered Site C. It has to be mentioned that within the RMU 6 flaking debris no cores were found, which could suggest that the prepared core(s) was/were transported outside the excavated area.

4.4.4 Spatial distribution

At Site C there are some convincing arguments which indicate that post-depositional displacement of the archaeological materials must have been minimal, *i.e*. a low-energy deposition of fluviatile sediments, large and small flint artefacts were recovered lying side by side, a large quantity of conjoined pieces which tend to cluster spatially and the results of a sieve residue analysis (see Roebroeks 1988:57, 59-61). These arguments could signify that the spatial configuration may be used for behavioural inferences. However, most of the conjoined artefacts were distributed over a vertical distance of 5 to 20 cm. Small-scale processes such as bioturbation were probably responsible for this vertical movement of the artefacts.

The horizontal distribution of flint artefacts shows in general three clusters, namely in the central, eastern and southern part of the excavated area (see Roebroeks 1988, separate map Figure 27). The spatial distribution of conjoined elements form four (or five) ‘star-like’ concentrations, which correspond roughly to the earlier observations. The fourth and fifth, smaller, cluster refits are respectively situated between the central and southern concentrations and in the north of the excavated area (see Roebroeks 1988, separate map Figure 47). Within the central and southern clusters there is no clear direction visible in the patterning of the refit-lines. This is in contrast to the eastern and the smaller concentrations where east-west orientated lines seem to dominate. Larger refit-lines appear to connect the different clusters. The clusters consist mainly of flaked debitage and few tools. The mean number of artefacts, cores, core trimming elements, tools and burned artefacts per metre square are respectively 11.61, 0.015, 0.05, 0.087 and 0.5.

As indicated by Roebroeks (1988), the horizontal distribution of the different RMUs and their products show ‘dynamic’ patterns of early human behaviour. According to the elaborate refitting analysis, lithics ‘frequently’ entered the excavated area in different stages of reduction. Within the Site C excavated area some of the cores were (further) reduced and maintained (RMU 1), while well-prepared flakes (and cores) were transported from one locus to another, to be further reduced or used (RMUs 2, 3 and 6). Subsequently, part of the well-prepared artefacts were transported away from the excavated area (RMUs 3-6), whereas others were discarded on the spot. For a detailed description and interpretation of RMU-specific spatial patterns the reader is referred to Roebroeks (1988) and Figure 4.5, which is mainly based on Roebroeks’ argumentation.

The horizontal lithic distribution of several RMUs overlaps. For example in the southern flint cluster, the remains of RMUs 3, 5 and 6 were recovered, while the central concentration consists of RMUs 3 and 4. The different flint scatters also seem to ‘respect’ each other, which could be indicative of a spatial organization of the activities. However, this spatial clustering of artefacts does not automatically mean that the archaeological remains of the ‘six different’ RMUs were discarded during one consistent use of the Site C area. Moreover, the refitting (RMU) analysis indicates a chronological difference between an earlier core-reduction of RMU 5 and its burning, and a later reduction of the RMU 6 nodule. As Roebroeks stated (1988:58), the time difference may have been as short as only one night (or less). This chronological difference between RMUs, or even between different find categories (for example lithics and charcoal), also shows that one has to be very careful with interpreting intra-site horizontal patterns. Although it is tempting to regard the Site C archaeological material as the remnants of one simultaneous use of a place, at least the southern concentration of lithic artefacts suggests a cumulative process of events. In the context of this discussion a critical note should be placed to Stapert’s spatial analysis of Site C (Stapert 1990). In his analysis, based on his ‘rings and sectors method’ (Stapert 1992), he treats the southern concentration as a single event feature in spite of Roebroeks’ arguments against such an interpretation (1988:58).

To end this section on the horizontal distribution of the Site C archaeological material, it has to be mentioned that a limited spatial analysis carried out by Roebroeks (1988:61-63; see also van de Velde 1988) demonstrated that early humans might have been involved in the formation of the bone and stone distribution. The question whether it concerns several depositional phases or one consistent use of space remained, however, unsolved. Nevertheless use-wear analysis suggests that at least some of the flint artefacts at Site C were discarded in meat procurement activities (van Gijn 1988, 1989).

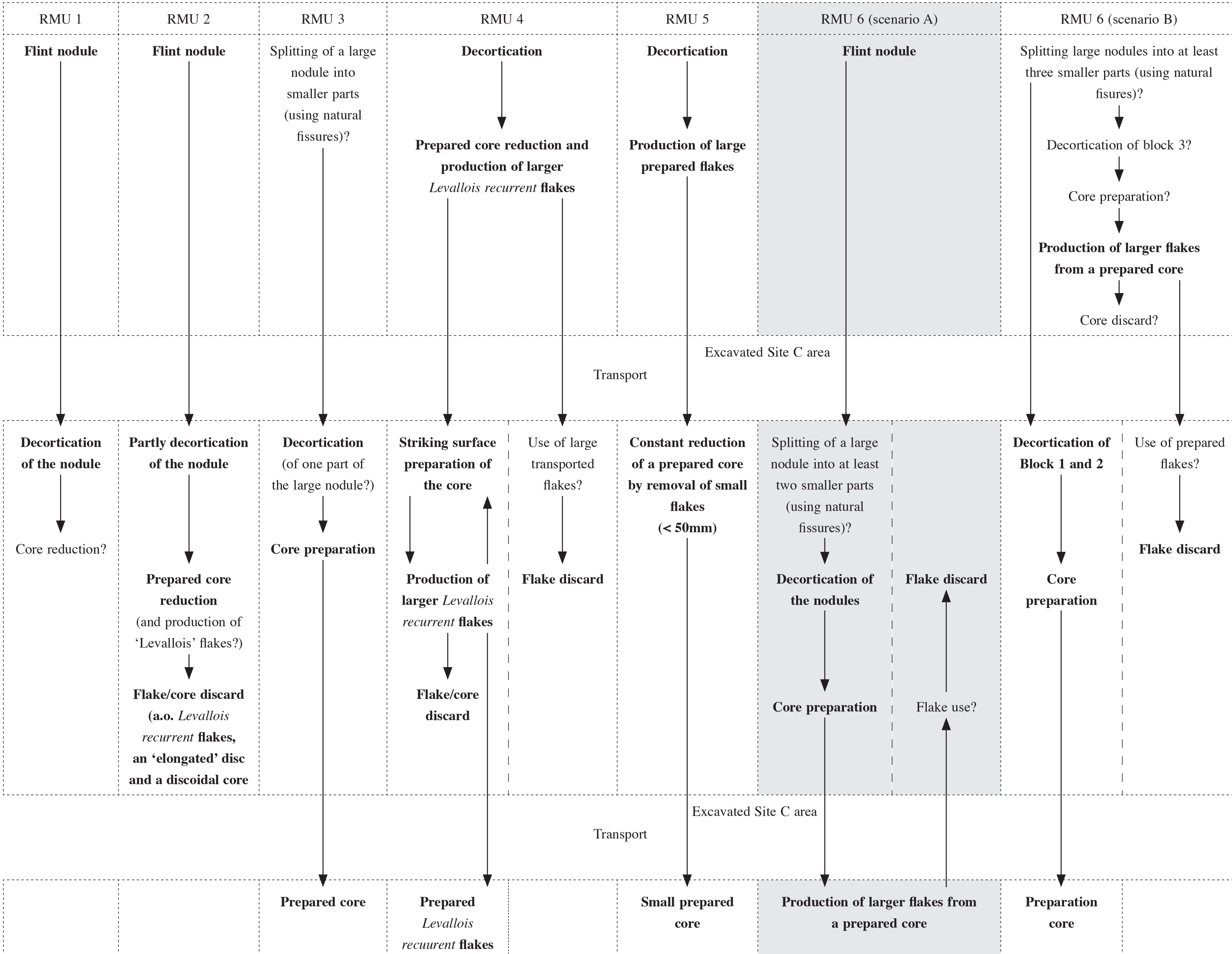
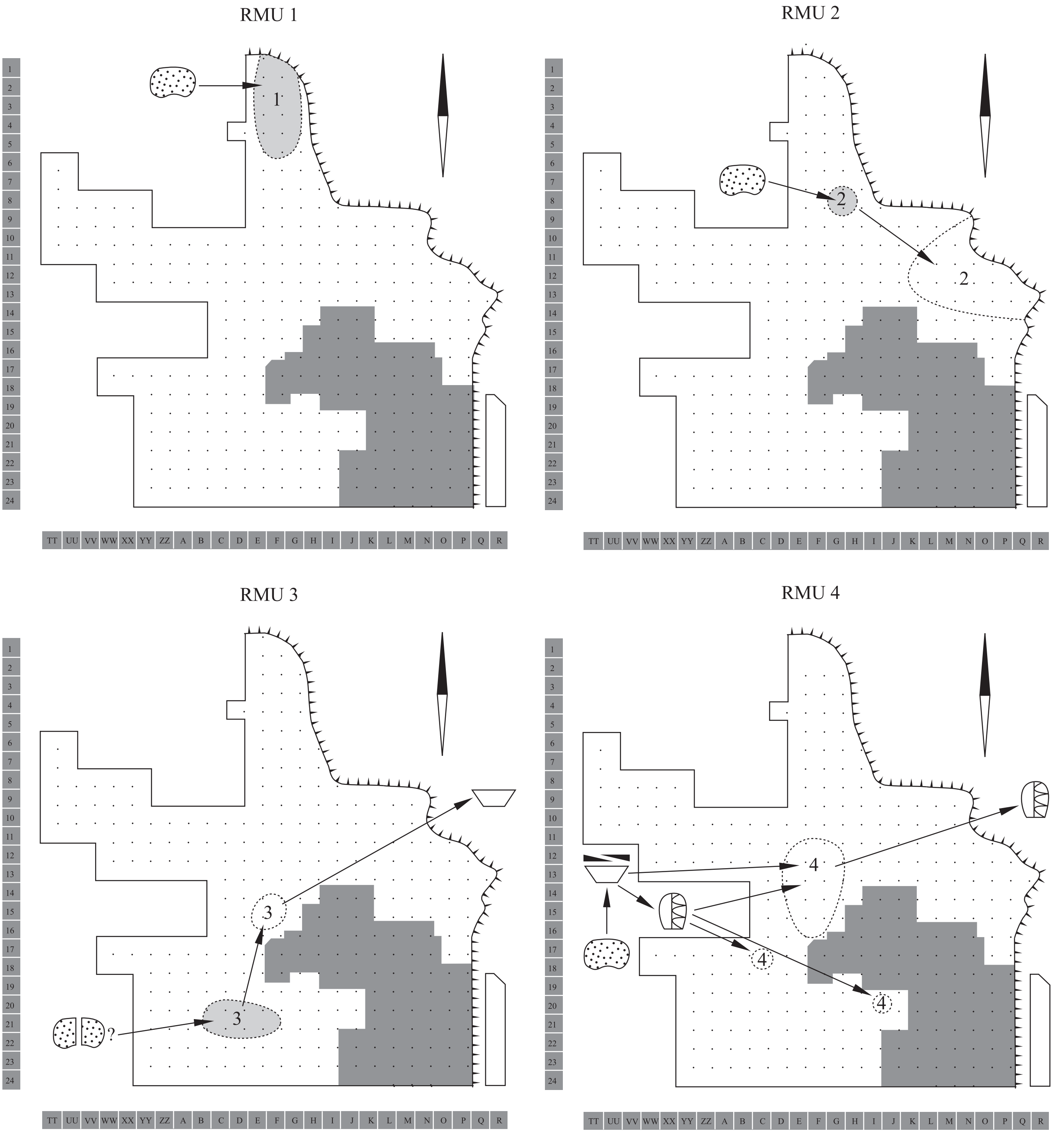


Figure 4.4: Maastricht-Belvédère Site C. Schematic representation of 'horizontal behaviour' as derived from the flint assemblage. RMU 6, scenario A, is given in grey.


RMU 1
RMU 2
RMU 3
RMU 4

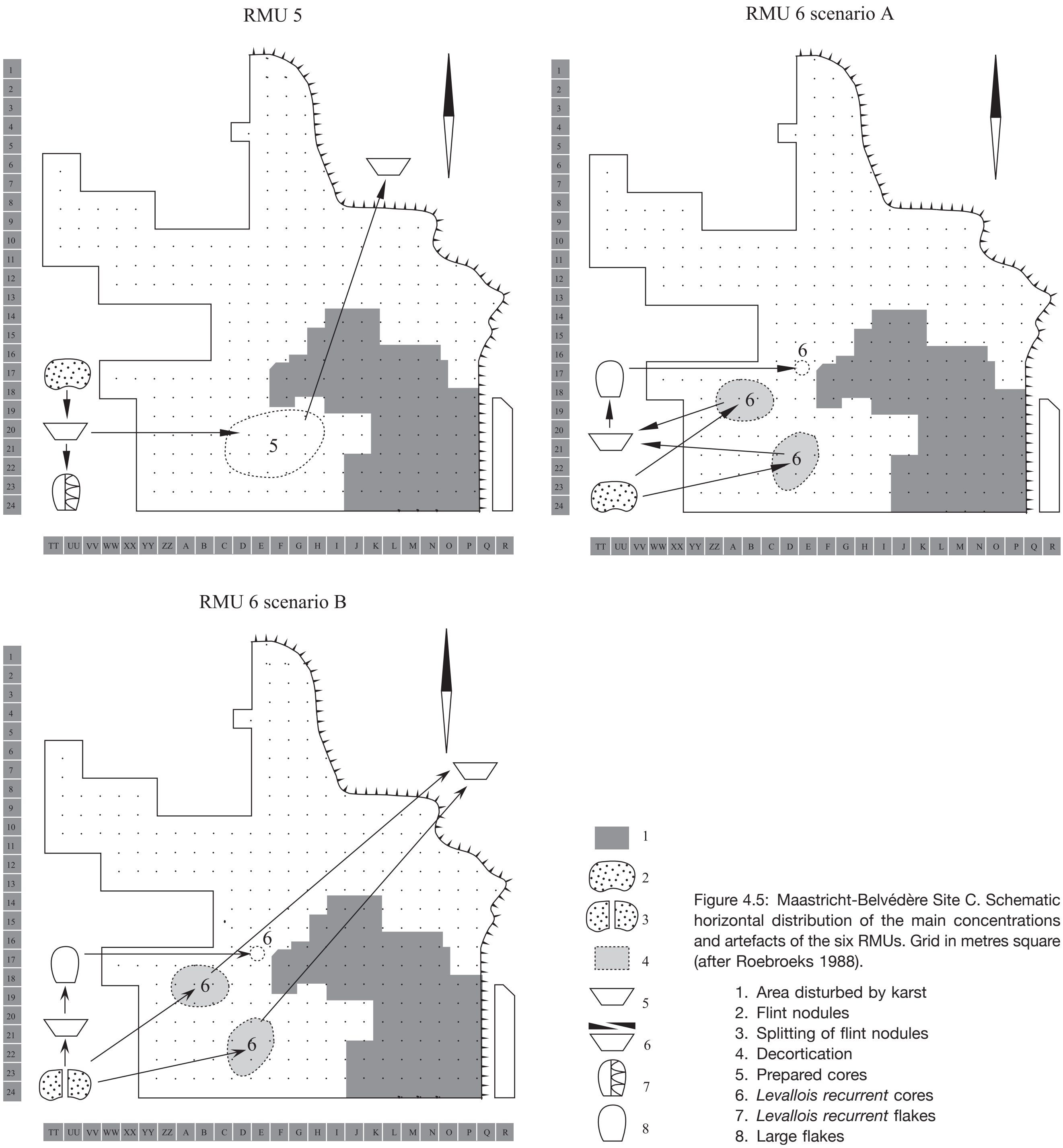


Figure 4.5: Maastricht-Belvédère Site C. Schematic horizontal distribution of the main concentrations and artefacts of the six RMUs. Grid in metres square (after Roebroeks 1988).

1. Area disturbed by karst
2. Flint nodules
3. Splitting of flint nodules
4. Decortication
5. Prepared cores
6. *Levallois recurrent* cores
7. *Levallois recurrent* flakes
8. Large flakes

4.4.5 Interpretation

The large amount of small flaking debris together with a considerable quantity of refits, including small and large flakes and cores, indicate on-site knapping activities within the excavated Site C area. The archaeological remains mainly consist of core reduction debris and few tools. In line with Roebroeks' data, the smaller fraction of artefacts cover probably to a large extent the remnants of flaking debris, striking platform preparation and the maintenance of good angles between the striking surface and the working surface on cores. According to the 'small' number of cortical flakes and the refitting analysis, it can be suggested that for some of the six nodules the initial stages of core reduction (decortication) were performed outside the Site C area. Furthermore, natural fissures and refitting evidence could indicate that some larger nodules were split into smaller units before entering, or within, the excavated area. These fractures could also indicate that some nodules were not tested before entering the site, a pattern also described for Site K (see Chapter 3). In general the Site C assemblage is the result of a prepared-core technique which resulted in disc, discoidal and Levallois cores. Moreover, it includes several 'classic' (centripetal) Levallois flakes and products from a *débitage Levallois recurrent*. It is clear that technology was not directed towards the production of one 'single' flake, but aimed at the production of a whole series of carefully prepared flakes. The various refitted flint nodules/cores also reflect different stages/ways of on-site core reduction which sometimes overlap spatially, *i.e*. working a nodule into a prepared core or the production of larger flakes from imported cores. Site C is especially interesting in the light of these transported lithic items. The refitting programme showed that prepared cores and large (Levallois) flakes were transported from and to the excavated area. Many of these imported flakes were recovered near large bone fragments and show use-wear traces, which probably indicate flake/tool use on the spot.

We can conclude that the excavated Site C area represents a locus where mainly technology was maintained. However, some curated cores, flakes and tools entered and left the area as well. The Site C analysis, therefore, shows us precious evidence on a complex dynamic system of flint processing in terms of horizontal transport/organization of lithics. Moreover, Site C occupies a major position in the discussion on possible interactions (inter-site patterns) between the several Unit IV scatters and/or patches (Isaac 1981) excavated at Maastricht-Belvédère (see Roebroeks *et al*. [1992] and here Chapter 5).

4.5 Maastricht-Belvédère Site D

4.5.1 Introduction

In August 1982 three flint artefacts were found in a stratigraphical position as that of Site A (the 'mottled zone' of Subunit IV-C-ß: see Roebroeks [1988:88, 91] for details on the stratigraphy). As Site D was threatened with immediate destruction by commercial quarrying activities, only one day was available to investigate the findspot. Restricted by this problem, the decision was made to screen a 30 metre long section and a total of 11 artefacts[3] was recovered over a distance of ca. 8.5 metres.

Only flint artefacts were found at Site D. The 11 artefacts consist of 10 pieces of debitage and non-retouched flakes and one core. No tools (intentionally retouched or with macroscopic signs of use) and no burned artefacts could be identified (Table 4.4). Five artefacts could be conjoined.

In the following sections the Site D flint assemblage will be technologically characterized, discussed and interpreted very briefly. For a detailed picture of the typo-/technological description of the Site D flakes and core the reader is referred to Appendix 5.

Type	n	%
Debitage	10	90.9
(Core Trimming Elements)	–	–
Cores	1	9.1
Modified artefacts	–	–
'Hammerstones'	–	–
Burned artefacts	–	–
Total	11	100.0

Table 4.4: Maastricht-Belvédère Site D. Some quantitative data on the Site D flint material.

4.5.2 Characterization of the assemblage

Except for one core, the Site D lithics consist only of flakes and chips. The majority of the flakes have a maximum dimension between 30 and 49 mm (70.0%). All other artefacts are <30 mm. Moreover, most of the flakes are slightly longer than wide. Only very few pieces show cortex remains, while none of the flakes show frost split (natural fissure) surfaces. Some of the flakes show a retouched or facetted butt and/or traces of preparation (facetting/retouch or 'crushed') at the angle between the butt and the dorsal side. This, together with data on the dorsal surface pattern (convergent unidirectional, centripetal or radial and 'parallel' + lateral unidirectional patterns), suggests some preparation of flakes. The number of scars could also point in that direction. Most flakes have three or four dorsal scars (71.5%), while the remaining pieces show five or six dorsal negatives. The Site D core can be described as a very thin, exhausted disc core with some technological errors like 'hinge' and 'step, negatives (*cf*. Shelley 1990).

4.5.3 The refitting results

Five artefacts could be conjoined, representing three refitting lines. All are *Aufeinanderpassungen* (refitting of production-sequences, *cf*. Cziesla 1986, 1990). The mean length of these *Aufeinanderpassungen* cannot be given because the Site D section was screened very quickly an no exact recordings of the artefacts could be made. In total two compositions were achieved which can be divided into:

1 group of 2 conjoining elements
1 group of 3 conjoining elements

According to the established dorsal/ventral artefacts at least some flaking took place at the Site D area. Although we are dealing here with only a few section finds, recovered during a one day investigation, the conjoined elements suggest that the findspot/assemblage was in a good state of preservation and that displacement has been minimal.

Refitting also gives some clues on technology. One refitted group represents a sequence of two flakes which were flaked from one and the same striking platform and in the same direction. None of the butts were prepared by facetting or retouching. Furthermore, the dorsal scars on these flakes suggest that earlier flakes were knapped from at least two other directions. The refitted flakes/core incorporated in the second conjoined group show(s) that a flake was knapped from one face of the disc core (Figure 4.6 number 1). The purpose of this flake was to create a suitable striking platform for future reduction. Next, the negative of this flake was used as striking platform to produce a series of flakes from the core's striking surface. None of these flakes could be refitted (Figure 4.6 number 2). Probably the production of this sequence stopped as a consequence of an unsuitable working edge angle. After that the core was turned 90° and a new series of flakes (one could be refitted) was produced from a 'second' striking platform (Figure 4.6 number 4). Possibly this 'second' striking platform was prepared in the same way as the previous one (number 3, not in Figure 4.6). The last three flakes in the core reduction ruined the already very thin core as they produced 'hinge' and 'step' negatives.

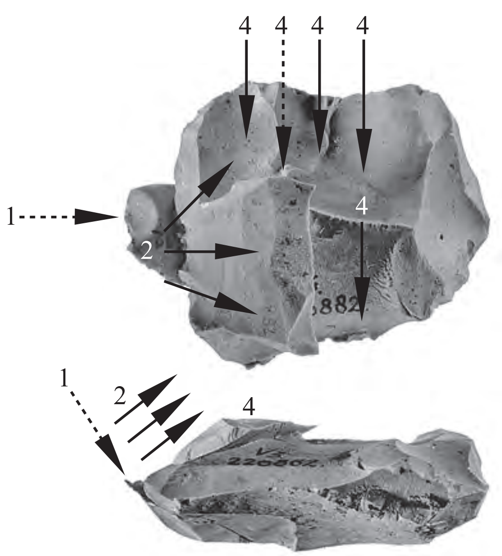


Figure 4.6: Maastricht-Belvédère Site D. Heavily reduced disc core with two conjoined flakes. The dashed arrows indicate the flaking direction of conjoined flakes, while the solid arrows represent the direction of the flake scars. The youngest sequence is indicated by '1', subsequent reduction faces by '2'- '4'. Scale 2:3.

4.5.4 Spatial distribution

Due to the fact that at Site D we are dealing with section finds, it is clear that statements on the spatial distribution of the artefacts are not possible.

4.5.5 Interpretation

Core technology and refitting shows that at Site D we are dealing with a 'unifacial' disc(oidal) approach (*cf*. Boëda 1993) in which each surface of the core holds its function throughout the whole reduction sequence. One core face is considered as striking platform and one as working (striking) surface.

The raw material analysis of the assemblage shows that nine artefacts (including the five refits) were probably produced from one and the same flint nodule. The other two artefacts were made from different raw material nodules. Furthermore, the dorsal pattern of the flakes suggests some preparation, meaning a more complex dorsal pattern or some kind of preparation at the angle between the butt and the dorsal face of the flake. Except for one surface on the core, none of the conjoined artefacts show cortex remains. On the one hand this could imply that an already heavily reduced (possibly 'prepared') disc core entered the site, where it was subsequently further reduced and discarded on the spot. On the other hand, due to the fact that only few artefacts were recovered from the Site D section we could be dealing here with the last stages of core reduction. Remnants of former stages could have been there but were not retrieved. Preference is given here to the first scenario. Judging from the raw materials, the two other flakes in the assemblage could have been introduced to the excavated area as isolated pieces, where they were subsequently discarded on the spot. To conclude, Figure 4.7 is added which shows the previously mentioned preferred scenario for 'horizontal behaviour'.

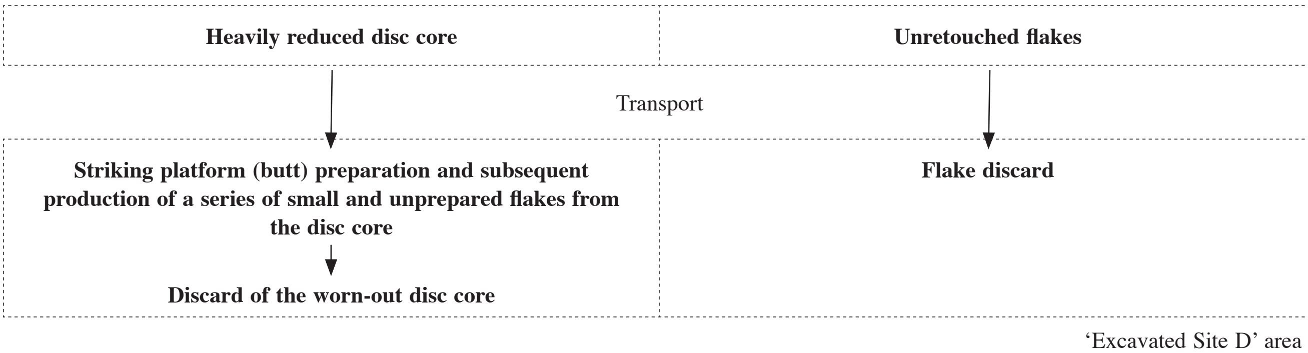


Figure 4.7: Maastricht-Belvédère Site D. Scenario of 'horizontal behaviour' as derived from the Site D flint assemblage.

4.6 Maastricht-Belvédère Site F

4.6.1 Introduction

In June 1983, while cleaning a section in the southeastern part of the pit, W. Roebroeks discovered a flake in pre-Weichselian deposits. Further inspection of this spot resulted in the discovery of 30 more artefacts. The Site F excavation was executed between June and July 1984. The geological study of the sections at the boundary of the excavated area pointed out that Site F was situated in the top part of a channel fill (*cf.* Vandenberghe 1993). In general the artefacts were recovered from a silt loam matrix with greyish specks. This so-called 'mottled zone' can be classified as Unit 5.1 sediments of lithostratigraphical Subunit IV-C-ß. The study of thin sections indicated that the matrix containing the archaeological assemblage was possibly deposited by running water (rill wash or afterflow?). For a detailed interpretation of the stratigraphical position of the Site F finds the reader is referred to Roebroeks (1988:79-82).

Before the description and interpretation of the flint assemblage is given, it should be mentioned that some data on the flint material has already been published by Roebroeks (1988).

At Site F an area of 42 metres square was excavated and all finds were recorded three-dimensionally. Besides some charcoal particles only flint artefacts were found. At least 1,177 artefacts[4] with a very fresh appearance were recovered from the excavated area. The horizontal distribution of the artefacts, presented by Roebroeks (1988:81, Figure 87), also shows that the northern part of the Site F cluster was already destroyed before excavation. This can have some influence on the eventual interpretation.

The Site F flint assemblage (Table 4.5) consists of 1,147 pieces of debitage and non-retouched flakes and two cores. In total eight complete and incomplete tools could be described. These can be divided into three tools *sensu stricto* and five artefacts with macroscopic signs of use. Also five core trimming elements and 15 burned artefacts were identified. The total weight of the Site F flint assemblage is 2.169 kg (Roebroeks 1988). To obtain information on technological aspects and natural site-formation processes, the assemblage was subjected to a refitting programme, which resulted in the conjoining of 153 artefacts[5] (13.0% of the total number of artefacts). In the next sections the Site F flint assemblage will be technologically discussed and interpreted. For a detailed picture on the typo-/technological description of the Site F flakes, cores and tools the reader is referred to Appendix 6.

Type	n	%
Debitage	1,147	97.5
(Core Trimming Elements)	5	0.4
Cores	2	0.2
Modified artefacts	8	0.7
'Hammerstones'	–	-
Burned artefacts	15	1.3
Total	1,177	100.0

Table 4.5: Maastricht-Belvédère Site F. Some quantitative data on the Site F flint material.

4.6.2 Characterization of the assemblage

The Site F assemblage consists mainly of chips <30 mm (86.7%), while larger flakes are only represented by 13.2% of the total number of described artefacts. Moreover, chips <10 mm clearly dominate (74.1%). Like the Site C assemblage the smaller fraction represents to a large extent the remnants of flaking debris. In general it seems that most of the larger flakes have a length and width which is nearly equal. However, some of these flakes are a little bit longer than wide. The average maximum dimension of all tools ≥30 mm is slightly larger than the rest of the assemblage. About one fourth of the artefacts ≥30 mm shows cortex remains, while somewhat less than half of the flakes show natural fissures. Like Site K these natural fissures (flaws) indicate that the raw material from which the artefacts were produced was already affected by frost before knapping. This could suggest that the nodule(s) were not tested before entering the excavated area, or that there was a lack of raw material without flaws, or that 'better' quality flint was simply not essential in future flaking activities. Another resemblance with Site K is the fact that most of the described Site F butts are plain, while facetted or retouched butts are scarce. The majority of the flakes have a 'parallel' unidirectional dorsal pattern. Altogether this indicates that the preparation of flakes/cores was limited. This is also suggested by the tools and cores. The majority of the tools show a plain butt and a 'parallel' unidirectional pattern. In total only two cores were found at Site F. The cores in question are a heavily reduced disc and a nearly exhausted shapeless or miscellaneous core. Both cores show technological errors like 'hinge' and 'step' negatives (*cf*. Shelley 1990). For further details the reader is referred to Appendix 6.

4.6.3 The refitting results

In order to obtain information on technological aspects and to have an indication of the natural site-formation processes, the Site F lithic material was subjected to a refitting programme[6]. The refitting analysis resulted in the conjoining of 153 artefacts (13.0% of all artefacts), about 66.0% of the total weight of the Site F assemblage (Roebroeks 1988). The 153 artefacts represent 105 refitting lines (*cf*. Cziesla 1986, 1990) which can be divided into 81 or 77.1% *Aufeinanderpassungen* (refitting of production-sequences) and 24 or 22.9% *Aneinanderpassungen* (refitting of breaks, intentional or not). The mean length of these *Aufeinanderpassungen* and *Aneinanderpassungen* cannot be given because the required data was not accessible for study. For an impression of the horizontal distribution of all refitted compositions/artefacts the reader is referred to Roebroeks (1988:85, Figure 92). In total 45 compositions were achieved:

23 groups of 2 conjoining elements
9 groups of 3 conjoining elements
5 groups of 4 conjoining elements
3 groups of 5 conjoining elements
1 group of 6 conjoining elements
1 group of 7 conjoining elements
2 groups of 8 conjoining elements
1 group of 16 conjoining elements

Most of the refitted groups at Site F represent sequences of two to four flakes which were knapped from one and the same striking platform and in the same direction. None of the striking platforms were prepared by facetting or retouching. In general natural fissure surfaces or the negatives of flakes from earlier stages in the reduction process were used as striking platform. One could presume that in most cases the production of a series of flakes was only interrupted to rejuvenate the working edge angle or striking platform. In a sense this could mean that the same striking surface and striking platform of a core was used as long as possible for the production of flakes. Figure 4.8 shows a sequence of flakes knapped from one and the same striking platform of a core. No butts are prepared by facetting or retouching. Many of the artefacts incorporated in the refitted composition show a natural fissure or cortex dorsal surface. This indicates that probably the first stages of core reduction are present at site F. Furthermore, three conjoined groups show several dorsal/dorsal refits. The dorsal surfaces of all these dorsal/dorsal refitted flakes show natural flaws. This suggests that at the excavated Site F area larger raw material nodules were divided into smaller and more manageable parts, to serve secondarily as a core. The splitting of the nodules was initially simplified by the natural fissures, however, due to these flaws problems would have occurred during further core reduction. In addition, the knappers(s) would have been forced to adapt the knapping strategy. These fractures also indicate that the raw material nodules were not tested before the actual core-reduction started.

Another conjoined group of artefacts, representative of the Site F assemblage, has been published by Roebroeks (1988:86, Figure 95). The figure shows a small disc core, onto which five flakes could be refitted. This composition shows that a large cortex-covered flake (decortication flake) was secondarily used as core (flaked-flake, *cf*. Ashton *et al*. 1992). If we compare this example with the results of the elaborate conjoining study at Site K (Chapter 3), it can be suggested that also at Site F large cortex-covered raw material nodules were initially flattened out to remove all protruding parts which could negatively influence future flaking. Secondly, the nodules were split into smaller units by removal of large and thick flakes or by following the natural fissures. Refitting also proved that at least four tools were produced on the spot. Three tools (two pieces with signs of use and one naturally backed knife) could be refitted to the rest of the material, *i.e*. *Aufeinanderpassungen* (Cziesla 1986, 1990). On one part of a large broken flake, consisting of four parts, a straight transverse scraper was made.

4.6.4 Spatial distribution

The Site F lithics were embedded in a silt/fine sand matrix. These sediments indicate a low-energy deposition of

Figure 4.8: Maastricht-Belvédère Site F. A sequence of eight conjoined flakes. The dorsal surface of these flakes shows natural fissures while none of the butts are facetted or retouched. Scale 2:3.

sediments in which the artefacts may have been preserved in primary archaeological conditions. According to the horizontal distribution of conjoined elements (see Roebroeks 1988:85, Figure 92), the distances between the refitted artefacts are relatively small. Together with the occurrence of both small and large artefacts near to each other, this seems to confirm that the excavated spatial arrangement was related to hominid activities rather than to post-depositional disturbances. However, some rearrangement, due to natural/biological processes/activity, is suggested (Roebroeks 1988:87).

For the interpretation of the spatial Site F configuration it has to be stressed again that at the time of discovery part of the findspot was already destroyed due to commercial quarrying activities. According to the artefact density in the excavated area, it seems that the most northern part of the site was destroyed. The horizontal distribution, furthermore, shows that artefacts are more clustered in the northern, richer, part (Figures 4.87, Roebroeks 1988:81). This concentration consists mainly of flaked debitage and some *ad hoc* produced tools. The mean number of artefacts, cores, core trimming elements, tools and burned artefacts per metre square are respectively 28.0, 0.1, 0.1, 0.2 and 0.4. The distribution map (Figures 4.92, Roebroeks 1988:85) shows that the conjoined artefacts form one ‘star-like’ concentration. No clear direction is visible in the patterning of the lines.

4.6.5 Interpretation

The established conjoined sequences of small and large flakes, together with cores and the presence of small flaking debris, indicates that on-site knapping activities were performed within the excavated area. We are dealing here with a findspot which consists mainly of debitage and few *ad hoc* made tools. Possibly, most stages of the reduction strategy are represented, *i.e.* from splitting the raw material into smaller blocks through decortication, or better rough shaping of large flint nodules to the discard of flakes, cores and tools. The appearance of the cortex suggests that the original flint nodules were transported a short distance by water and were therefore most probably collected from nearby gravels deposits of the river Meuse. According to the raw material study, the artefacts were probably struck from at least two different nodules.

In general the assemblage can be interpreted as the result of a reduction strategy with limited attention for core preparation. Almost no flake shows a retouched or facetted butt, and centripetal or convergent dorsal patterns are scarce. Furthermore only few flakes have a dorsal preparation near the butt.

Refitting shows that large blocks entered the site with hardly any preparation at all. Unselective choice of raw material can be assumed. The nodules were initially flattened out to remove all protruding parts to be secondarily split into smaller parts. The individual parts or cores were further reduced and discarded within the excavated area. Sequences of flakes were produced from unprepared ‘good’ working angles on the cores. The angles were used and maintained throughout the whole reduction. This manner of reduction, together with the appearance of disc cores, resembles a disc/discoidal approach as described by Boëda (1993). In technological terms we could conclude that the Site F core reduction resembles Sites H (see Section 4.8) and K (see Chapter 3). Some larger flakes were selected from the flaking debris, to be used as tools. Besides a 'naturally backed knife', most of the pieces with signs of use are more or less triangular in cross-section and have a sharp cutting edge on one margin and an oblique back on the other, rather similar to 'backed knives'. There are 3 of these tools present in the assemblage. A preliminary use-wear analysis of some randomly selected larger flakes turned out rather negative. However, according to van Gijn (Roebroeks 1988), if the flakes had indeed been used, it must have been on boneless meat or to work on fresh hide. It is possible that some of the selected larger flakes were transported away from the excavated area. The latter statement is however very speculatively.

There are some indications for the presence of fire at Site F. Some tiny charcoal particles and 15, mostly small, burned flint artefacts were found in the excavated area. It is however difficult to say whether these burned artefacts are related to human activities or to wildfire. To conclude a schematic scenario of 'horizontal behaviour' is given, as derived from the Site F lithic assemblage (Figure 4.9).

4.7 Maastricht-Belvédère Site G

4.7.1 Introduction

In November 1984 the Unit IV-B sediments of the Maastricht-Belvédère sequence were sampled in the context of an Electron Spin Resonance (ESR) dating programme of fossil material (molluscs). During the sampling a concentration of bone fragments was discovered. Because of their 'good' preservation and their association with flint artefacts (n= 5) a small test pit of 11 metres square was excavated. About seven metres to the south a second bone concentration was found in December 1984. Due to the fact that both concentrations were situated in the commercial exploitation zone of the quarry, an undisturbed area of about 50 metres square (Site G) was excavated, between June and August 1985, in the immediate western neighbourhood of the test pit. All finds were recorded in the usual three-dimensional way and 14 metrers square of the site-matrix were sieved.

Most of the Site G flint artefacts and faunal remains were found in the upper part of the fine-grained fluviatile sediments (Unit IV-B). Possibly due to post-depositional processes, a minor quantity of the finds was recovered from the on top

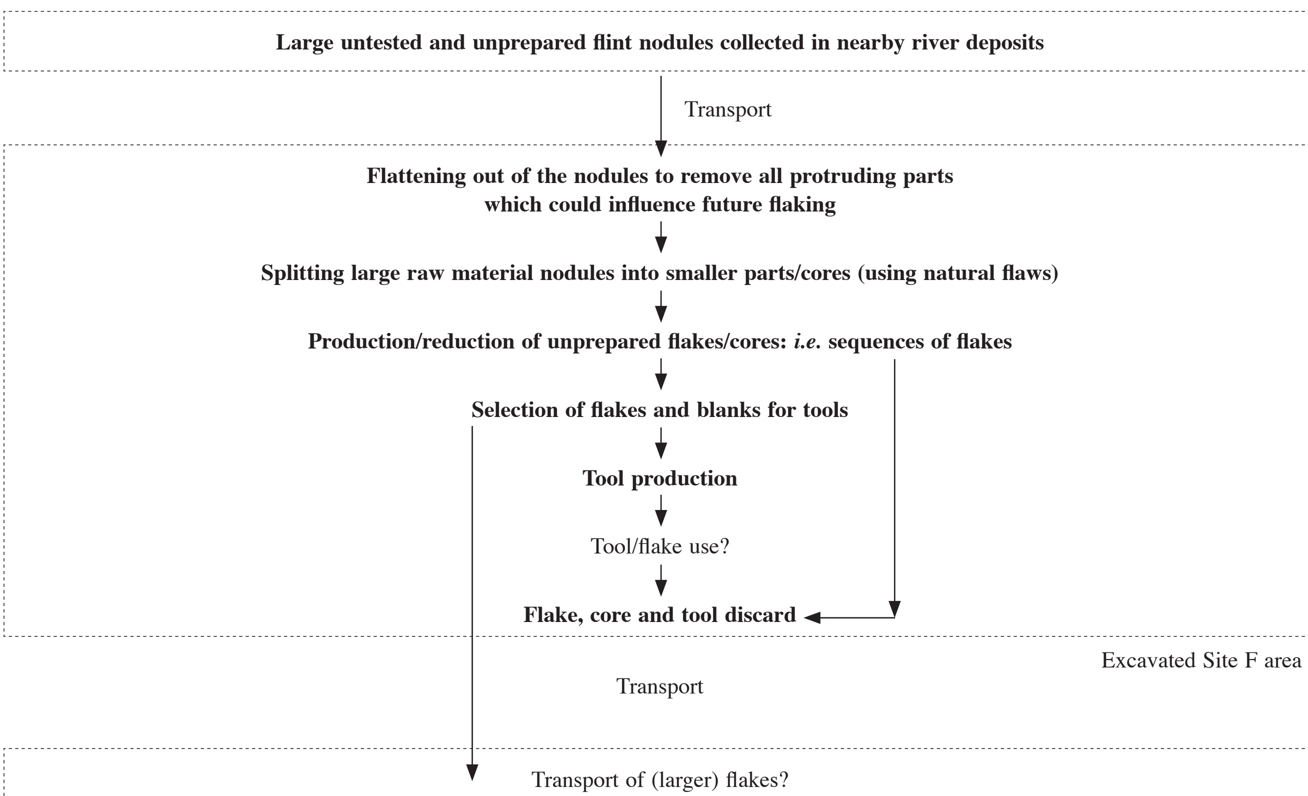


Figure 4.9: Maastricht-Belvédère Site F. Scenario of 'horizontal behaviour' as derived from the Site F flint assemblage.

lying calcareous tufa of Unit IV-C-α. Moreover, karst processes disturbed parts of Site G (the same phenomenon is found at Site C). For a more detailed geological interpretation of the Site G sediments the reader is referred to Roebroeks (1988:66) and Vandenberghe *et al*. (1993). Most of the Site G data have already been published by van Gijn 1988; Rensink 1987; Roebroeks 1988; Roebroeks and Hennekens 1990; and Roebroeks *et al*. 1986, 1992, 1993.

Besides a large quantity of faunal remains (rhinoceros, roe deer, red deer, straight-tusked elephant and bovid; see van Kolfschoten 1990, 1993 for details) and burned flints, a total of only 75 flint artefacts were identified as such at Site G (Roebroeks 1988:68, Figure 72). These data differ somewhat from earlier publications[7]. The Site G assemblage consists mainly of pieces of debitage and non-retouched flakes (Table 4.6).

However, a total of eight complete and fragmented tools could be identified as well. These tools can be divided into three tools *sensu stricto* and five artefacts with macroscopic signs of use. None of the artefacts showed signs of burning, although 32 burned-natural-flints were recorded mainly in the northwestern part of the excavated area (Roebroeks 1988). It is difficult to say whether these burned finds are related to human activities or not. According to Roebroeks:

> "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." (Roebroeks 1988:69-70).

The refitting programme eventually resulted in the conjoining of 25 artefacts, which represent 33.3% of the total number of artefacts.

In the next section a short technological characterization and interpretation of the lithic material will be given. For a detailed picture of the typo-/technological description of the Site G flakes and tools the reader is referred to Appendix 7. The results of the refitting analysis, the spatial distribution of the flint assemblage, and a brief interpretation will be given thereafter.

Type	n	%
Debitage	67	89.3
(Core Trimming Elements)	–	–
Cores	–	–
Modified artefacts	8	10.7
'Hammerstones'	–	–
Burned artefacts	–	–
Total	75	100.0

Table 4.6: Maastricht-Belvédère Site G. Some quantitative data on the Site G flint assemblage.

4.7.2 *Characterization of the assemblage*

The Site G find material consists mainly of chips and flakes. However, an atypical backed knife is produced on a blade-like flake. The size distribution of all pieces, based on maximum dimensions, shows that the majority of finds are <30 mm (70.7%). They are for a large part the remnants of flaking debris. According to the measurements the Site G flakes are slightly longer than wide. Of all 75 flakes only 12.0% shows cortex remains, while ca. one fourth of all flakes ≥30 mm show natural fissures. Most of the flakes ≥30 mm have a plain butt. Flakes with a 'parallel' uni-directional dorsal pattern dominate (40.9%), while more than half of the artefacts (59.1%) have three or four dorsal scars.

The Site G tools are in general larger than the rest of the flakes. Almost none of them show cortex or natural fissure remains. In addition, some of the tools, and especially the backed knives, seem to be better prepared than others. They have a retouched or facetted butt and a centripetal/radial or convergent unidirectional dorsal pattern. For a more detailed description of the tools the reader is referred to Appendix 7.

It is worthwhile mentioning the presence of a so-called (re-)sharpening flake (Figure 4.10). This 'Transverse Sharpening Flake' (*cf*. Cornford 1986) contains a partial working edge of a tool from which it has been removed.

4.7.3 *The refitting results*

As mentioned before the refitting analysis at Site G resulted in the conjoining of 25 artefacts, representing 15 refitting/connection lines (*cf*. Cziesla 1986, 1990). These lines can be

Figure 4.10: Maastricht-Belvédère Site G. 'Transverse Sharpening Flake' ('TSF'). Scale 2:1.

divided into seven (46.7%) *Aufeinanderpassungen* (refitting of production-sequences) and eight (53.3%) *Aneinanderpassungen* (refitting of breaks, intentional or not). The mean length of these *Aufeinanderpassungen* and *Aneinanderpassungen* cannot be given because the required data was not accessible for study. In this way a total of 10 compositions was achieved (see Roebroeks 1988:72, Figure 76):

7 groups of 2 conjoining elements
1 group of 3 conjoining elements
2 groups of 4 conjoining elements

Refitting indicates that some flint knapping was done at Site G. At least two larger flakes must have been knapped inside the excavated area as some fine flaking debris (<10 mm) could be refitted to them (ventral/dorsal, *Aufeinanderpassungen*). A maximum of three artefacts was incorporated in these kinds of compositions. One of these produced flakes shows signs of use. It can therefore be suggested that some tools were produced on the spot. Additionally, more than half of the conjoined artefacts consist of refitted broken artefacts. Most of these are larger flakes and/or tools. A good example of a broken tool is a blade-like flake consisting of two fragments and lying ca. 20 cm apart in horizontal direction. The proximal fragment shows signs of more intensive use than the distal part (see Roebroeks 1988:70, Figure 74-1). This could suggest a continued use of the proximal part after the flake was broken, or better one part of a larger tool was recycled for further/future use. The two refitted parts of another broken tool were found in adjacent square metres. For the first example (and the recycled part), we can conclude that a tool was broken possibly due to use. On the other hand for the remaining refits of breaks (*Aneinanderpassungen*), scenarios like sediment pressure or trampling cannot be excluded.

4.7.4 Spatial distribution

For the interpretation of the spatial distribution of both lithic artefacts and faunal remains at Site G, it is worthwhile mentioning again that only 61 m^2 was excavated. Amongst others the finds documented during the ‘two’ test pit excavations showed that the excavated Site G area formed part of a larger flint and bone distribution. The site formation processes will have to be studied carefully to make reasonable statements on possible associations between faunal remains and lithic artefacts.

The Site G flint assemblage shows that small and large artefacts were recovered ‘near one another’ and a high percentage of refits was obtained. The conjoined groups of artefacts show that a considerable quantity of fine flint debris (<10 mm) could be refitted to the larger flakes, while in some cases the distances between the conjoined (broken) artefacts were small. All these observations suggest only a minor displacement of the flint artefacts. This assumption is supported by the fact that the artefacts (and bones) were embedded in a fine loamy sand matrix, which indicates a low-energy deposition of sediments in which the artefacts may have been preserved in a primary archaeological context. In addition a ‘cluster’ of (young) rhinoceros dental remains, in the northern part of the excavated area, could also suggest a primary context. However other faunal remains, like the dental parts of a roe deer, are more widely scattered over the excavated area. Probably they are related to an erosional phase preceding the formation of the rhinoceros cluster and perhaps the flint assemblage. It can be concluded that both human and non-human factors were responsible for the excavated spatial arrangement of Site G.

The horizontal distribution of the artefacts shows no clear cluster (Roebroeks 1988:68, Figure 72). The artefacts are more or less scattered over the excavated area. The mean number of artefacts per metre square for the excavated area (61 m^2 including the small trial pit of 11 m^2) is 1.2, while the average number of tools per metre square is 0.1.

Most of the bone material recovered at Site G was in a poor state of preservation. In general only dental elements could be identified (this applies to most of the Unit IV sites). However some of the faunal remains seem to cluster, *i.e.* the mentioned rhinoceros and red deer molars in respectively the northern and southeastern part of the excavated area. Nevertheless, roe deer remains were recovered from the whole western part of the site (see Roebroeks 1988:72, Figure 77).

4.7.5 Interpretation

At Site G we are dealing with a scattered occurrence of flint artefacts recovered together with a more clustered appearance of different faunal remains (mostly molars). The differences in raw materials show that the flakes were produced from at least three nodules. Refitting proves that at least one core entered the excavated area, where at least two larger flakes were produced, as some very fine knapping debris could be refitted to them. Subsequently, the core was transported away from the excavated area. The different raw materials together with the refitting results show that at least six flakes, including the broken retouched blade-like flake and the large ‘backed knife’, were introduced in the Site G excavated area after having been produced elsewhere. Some of these imported larger flakes were struck from prepared cores.

One of the most fascinating finds is the previously mentioned 170 mm long, fresh-looking, ‘backed knife’. The back of this tool consists of a lateral edge of the prepared core from which it was struck (an *éclat debordant*, *cf.* Beyries and

Boëda, 1983). Use wear analysis showed that it may have been used to cut the skin of an animal with a thick hide (van Gijn 1988, 1989). Besides that, the 'backed knife' was found among the clustered remains of the young rhinoceroses in the northern part of Site G. Consequently, this tool gives, at least at Maastricht-Belvédère, the best possible archaeological evidence for translating a spatial association of flints and fauna into behavioural terms. However, this positive link between bones and stones cannot automatically be generalized for the complete assemblage. The other faunal remains could still have been deposited independent of the formation of the flint assemblage. For a more detailed discussion on the spatial relation of flint artefact and faunal remains at Site G the reader is referred to Roebroeks (1988:72-76).

It can be concluded that the Site G assemblage probably represents only a small non-quantifiable part of a larger horizontal continuum characterized by a low flint artefact density and faunal remains. A well-prepared 'toolkit', consisting of larger flakes and tools and at least one core, entered the excavated area to be used in, amongst others, meat-related (butchering) activities. Within the Site G area few larger flakes were produced and at least one imported tool was resharpened. Subsequently, part of the 'toolkit' was discarded on the spot (flakes and tools), while other parts (at least the core and the resharpened tool) were transported away from the excavated area (Figure 4.11).

4.8 Maastricht-Belvédère Site H

4.8.1 Introduction

By the end of 1984 about 15 flint artefacts were found in a section along the 'exploitation front' of the quarry. Because of the fact that the find containing section in question (later called Site H) was not acutely threatened by the advancing draglines, priority was given to excavate two more threatened findspots: at that time the Weichselian Site J (Roebroeks *et al*. 1987*a* and *b*, 1997) and the Saalian Site K (Chapter 3) were lying in the exploitation zone of the pit and had to be excavated immediately.

Unfortunately, during the excavation of Site K (spring 1987) part of Site H was destroyed for commercial reasons. Forced by this emergency situation, the decision was made to excavate the remaining part of the site. As a result only a global description of the local geology was achieved (see Timmermans, not dated, for details). Like at Sites A, D, F, K and N the flint artefacts of Site H were situated in the so-called 'mottled zone' within the unit 5.1 sandy siltloam. This unit, which can be placed in lithostratigraphical Unit IV-C-ß, is described in Vandenberghe *et al.* (1993) and Chapter 2. Part of the lithic data has already been presented in two internal (preliminary) rapports (Timmermans, not dated; Langbroek 1998).

In March 1987, during a period of two weeks, a rescue excavation was executed at Site H. In total an area of

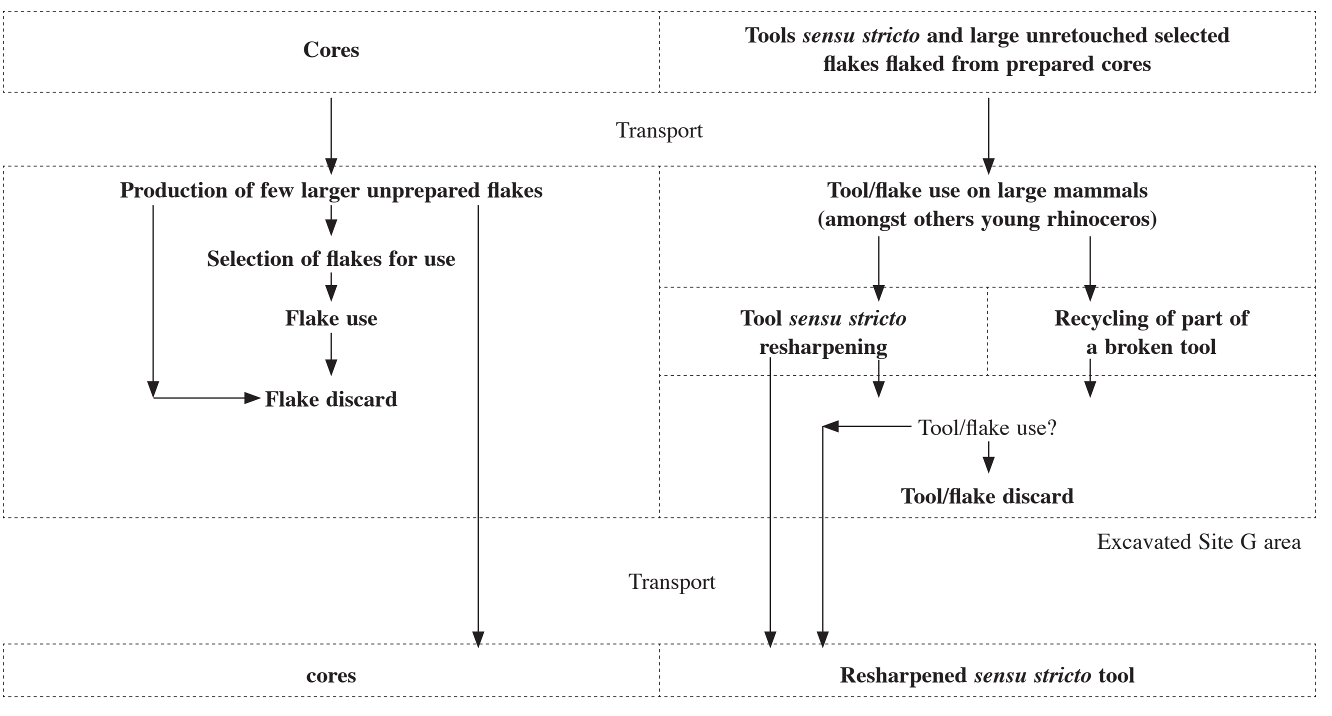


Figure 4.11: Maastricht-Belvédère Site G. Schematic representation of 'horizontal behaviour' as derived from the Site G flint assemblage.

54 metres square was excavated and, because of time pressure, artefacts were collected in metres square (see Langbroek 1998:16, Figure 7). The find material consists only of 270 flint artefacts. The majority of these finds (n= 213 or 78.9%) derived from the excavated area and the remainder came from two sections, one directly adjacent to the northern limits of the excavated surface (section 2, n= 42 or 15.6%) and another five metres further to the north, *i.e.* the original section in which the first artefacts had been discovered during the winter of 1984-1985 (section 1, n= 15 or 5.6%). According to Timmermans' (not dated) preliminary technological analysis, there is no difference between excavated artefacts and section finds. For this reason, although there are no direct links (conjoined artefacts) between section 1 and the excavated area, both section finds and excavated finds will be treated as one assemblage here.

The raw materials used to produce the Site H flakes look rather heterogeneous, but in general all artefacts could be described as relatively fine-grained light grey Rijckholt (Lanaye) flint. Judging from the rolled cortex, the flint nodules must have been collected from the gravel beds of the river Meuse.

Of all Site H artefacts (n= 270), 95.9% could be described as pieces of debitage and unretouched flakes (Table 4.7). In total 10 complete and incomplete tools were counted. These can be divided into four tools *sensu stricto* and six artefacts with macroscopic signs of use. Cores are lacking completely and one artefact was burned. Forty artefacts (14.8% of the total number of flakes) could be conjoined. In the following sections the Site H flint assemblage will be technologically discussed and interpreted. For a detailed picture of the typo-/technological description of the Site H flakes and tools the reader is referred to Appendix 8.

Type	n	%
Debitage	259	95.9
(Core Trimming Elements)	–	–
Cores	–	–
Modified artefacts	10	3.7
'Hammerstones'	–	–
Burned artefacts	1	0.4
Total	270	100.0

Table 4.7: Maastricht-Belvédère Site H. Some quantitative data on the Site H flint assemblage.

4.8.2 *Characterization of the assemblage*

At Site H the lithic artefacts consist mainly of chips and flakes, respectively 66.7% and 31.1%. About 75% of the assemblage has a maximum dimension between 10 and 39 mm, while most of the tools are between 60 and 89 mm. Like Sites C and F the smaller fraction of finds represents the remnants of flaking debris. Flakes <10 mm are underrepresented, probably as a result of the excavation method (finds collected in metres square). Like most of the Maastricht-Belvédère Unit IV assemblages, the Site H flakes are in general slightly longer than wide. Of all 270 flakes ca. one fifth (21.5%) shows cortical remains. Natural fissure surfaces are present on 38.9% of all flakes ≥30 mm. On the majority of flakes a plain butt is described, while facetted or retouched butts and signs of preparation at the angle between the butt and the dorsal side are scarce. This applies also to larger flakes. Furthermore, the flakes are clearly characterized by a 'parallel' unidirectional dorsal pattern. A centripetal or radial pattern is seldom described. Altogether this indicates a flake technology in which there is only minimal attention for core preparation. Although the Site H tools are somewhat larger, they show the same characteristics as the rest of the assemblage: a scarce appearance of cortex and/or natural fissures and almost none of the flakes have a facetted/retouched butt and/or centripetal dorsal pattern. Like the flakes, tools are dominated by a 'parallel' unidirectional pattern. For a detailed description of the tools the reader is referred to Appendix 8.

4.8.3 *The refitting results*

An intensive refitting programme was carried out by Mr P. Hennekens, who conjoined 40 artefacts (14.8% of the 270 artefacts). The refitted artefacts represent a total of 27 refitting lines (*cf.* Cziesla 1986, 1990) which can be divided into 16 *Aufeinanderpassungen* (refitting of production-sequences), 10 *Aneinanderpassungen* (refitting of breaks, intentional or not) and one *Anpassung* (refitting of a modification of a flake, a so-called flaked-flake [*cf.* Ashton *et al.* 1992]). Compositions consisting of broken artefacts are amongst others, a broken *déjeté* scraper and a broken piece with signs of use (see Appendix 8). A total of 14 compositions was achieved (see Figure 4.12 for the horizontal distribution):

8 groups of 2 conjoining elements
3 groups of 3 conjoining elements
1 group of 4 conjoining elements
1 group of 5 conjoining elements
1 group of 6 conjoining elements

With respect to a possible post-depositional disturbance of the artefact distribution, it can be noted that the distances between the conjoining artefacts are generally quite limited[8]. The mean length of these *Aufeinanderpassungen* and *Aneinanderpassungen* cannot be given because the required

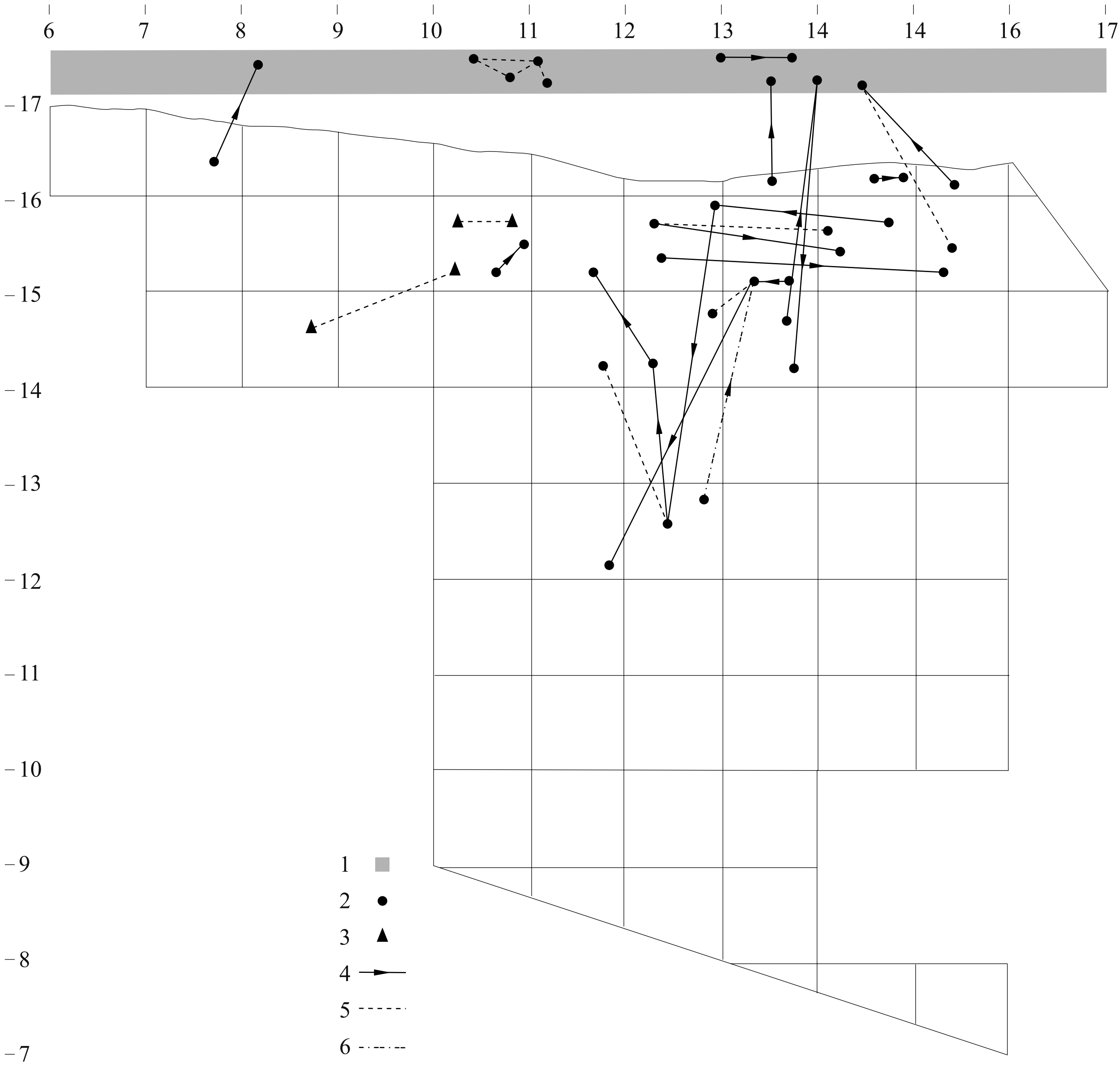


Figure 4.12: Maastricht-Belvédère Site H. Horizontal distribution of the refitted elements. The conjoined groups are represented in the ‘Cziesla approach’ (Cziesla 1986, 1990). The excavation grid is in metres square and the position of the artefacts are based on random coordinates within the metres square.

1. Section with section finds
2. Flake
3. Tool

4. *Aufeinanderpassung* (production sequences)
5. *Aneinanderpassung* (breaks)
6. *Anpassung* (modifications)

data was not accessible for study. Ca. two thirds of the refitting lines equals or is shorter than two metres, all being shorter than five metres. Furthermore there is no clear direction visible in the patterning of the lines.

Together with the occurrence of both small and large artefacts near to each other, the refitting data suggest that post-depositional disturbance of the horizontal artefact distribution must have been limited.

Besides the information revealed by the lithic analysis (see above and Appendix 8), technological information can be distilled from the refitting data. The majority of the dorsal/ventral refits consists of sequences of two or three flakes which were struck from the same direction, using the same striking platform on the core. About half of these sequences show cortex remains. One composition of three artefacts shows that during the reduction the core was turned ca. 90° and another striking platform was used for further reduction: the second flake is orientated at right angles to the first one.

Together with the fact that almost no artefacts show a retouched or facetted butt, this could mean that sequences of flakes were reduced from suitable unprepared core edge angles. Once an angle was unsuitable for reduction, the core was turned and the reduction went on, on another working face, using the scars of flakes from earlier stages in the reduction as striking platform. This general picture will be illustrated by the two largest conjoined groups. These groups of conjoined artefacts are more or less representative of the whole refitted Site H assemblage.

Refitted composition I

In total composition I is made up of six flakes and has a maximum cross-section of 89 mm. This composition represents a small series of flakes belonging to a much larger/longer sequence of reduction. The composition is shown in Figure 4.13, while the reduction sequence is visualized in Figure 4.14. The numbers refer to the individual flakes, while the Roman numerals refer to the individual steps in the reduction sequence.

I. Production of a series of flakes from the same striking platform: Judging from the dorsal scars and one refitted flake (Figure 4.14, flake H14/15-2), the first four large flakes from this composition were struck from the same striking platform and in the same direction. 'Stratigraphically' it is, however, not clear whether step II or III follows step I.

II. Production of a flake from the opposite side: Next the core was turned ca. 180° and at least one flake was struck from an opposite striking platform. This could be deduced from one dorsal negative.

III. Rejuvenating the striking platform: The working edge angle and striking platform from where the 'first' four flakes were knapped (step I) was rejuvenated by removal of one flake, which was placed at right angles to the former striking surface. Because of that the former striking surface changed function and served as striking platform.

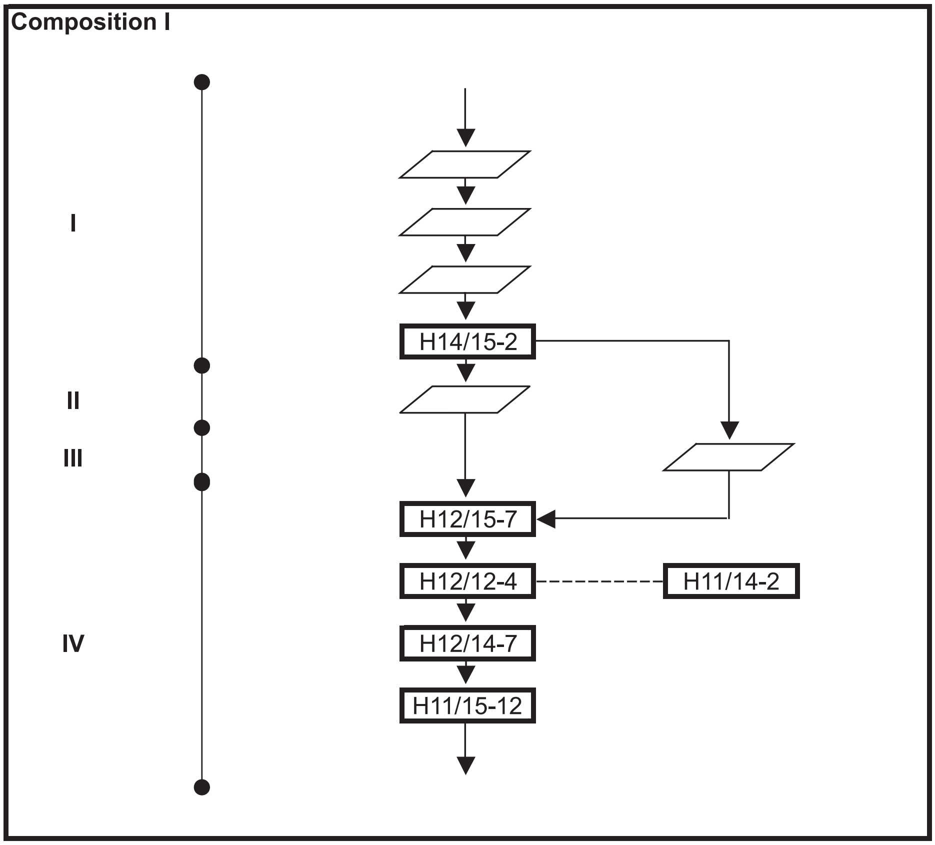
IV. Again production of a series of flakes from the 'first' striking platform: After the preparation of the core's working edge, by retouching, four more flakes were struck from the same striking surface as in step I (flake H12/15-7, broken flake H12/12-4 - H11/14-2, and flakes H12/14-7 and H11/15-12, Figure 4.14). Except for a very small flake (number H12/14-7), all three larger flakes show heavily retouched butts, which make them more or less exceptional for the Site H assemblage. The last flake in this sequence (flake H11/15-12) can be seen as a core trimming element, which probably rejuvenated the working edge angle of the core again.

Refitted composition I probably indicates that the same striking surface and striking platform of a core were used as long as possible for the production of 'large' flakes. In general one could say that a production of a series of flakes was only interrupted to rejuvenate the working edge angle and to prepare/retouch the striking platform. Subsequently, again a sequence of flakes was knapped in the same direction and using the same, but by now rejuvenated, striking platform as the earlier series of flakes. This could have continued until the core was worn-out. This reduction strategy resembles, therefore, a disc/discoidal approach (Boëda 1993), which is also described for Site K (see Chapter 3).

Refitted composition II

Refitted composition II has a cross-section of 121 mm and consists of five artefacts. Like composition I, this conjoined

Figure 4.13: Maastricht-Belvédère Site H. Refitted composition I. Scale 2:3.



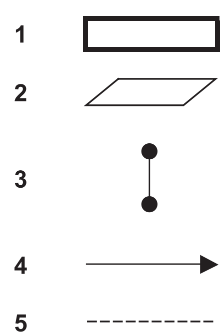


Figure 4.14: Maastricht-Belvédère Site H. Primary reduction sequence of refitted composition I. The numbers in the 'Harris-matrix' refer to the individual refitted flakes, while the Roman numbers refer to the individual steps in the reduction sequence, which are also described in the text. Number H14/15-2 is the first flake in the 'stratigraphical' reduction sequence.

1. Flake
2. Scar from previous flake
3. Described steps
4. *Aufeinanderpassung* (production sequences)
5. *Aneinanderpassung* (breaks)

group consists of a small series of flakes belonging to a much larger/longer sequence of reduction. The composition and visualized reduction sequence are shown in Figures 4.15 and 4.16.

I: Splitting the raw material: The outermost surface of this composition consists of natural fissures which were already present in the flint before the reduction started. Judging from these surfaces (and the Site K analysis, see Chapter 3), it is plausible that larger raw material nodules were divided into smaller and more manageable parts or cores. This splitting could have been simplified by the natural fissures. It is, however, impossible to say whether this splitting of the raw material was done inside the excavated area (like at Site K) or somewhere else.

II: Production of a series of flakes: The obtained smaller unit(s)/core(s) were further reduced. After the production of two flakes, a large and a small one, the core was turned ca. 180° and three flakes were knapped from an opposite striking platform. This could be deduced from five dorsal scars.

III: Production of a large flake from the 'first' striking platform: Next a large flake was produced from the same striking platform and direction as the 'first' flakes (step II). This flake (Figure 4.16, broken flake H13/15-5-H12/14-2) was secondarily used as core (a flaked-flake *cf*. Ashton *et al*. 1992).

III': Striking platform preparation on the flaked-flake: At the proximal part of the large flake/core (the thickest part of the flake) a new striking platform was prepared by removal of at least five flakes, three of them very small. This step in the reduction sequence removed the former butt of the flaked-flake. To produce these five flakes, the former ventral side of the large flake was used as striking platform. This could be deduced from five dorsal negatives.

III": Reducing the proximal part of the flaked-flake: After the preparation of a new striking platform the core, or better the flaked-flake, was reduced at its proximal part. This action eliminated the former bulb of percussion on the ventral side and flattened the flaked-flake. This was done by removing at least five flakes, concluding from four scars and one refitted flake (Figure 4.16, flake H13/15-10). The flaked-flake was turned and one more flake was flaked from the former dorsal side (Figure 4.16, flake H12/12-3). However, this flake could have been flaked in the initial stage of the main reduction sequence, before the flaked-flake was undone from the main core (step II). Again the flaked-flake was turned to produce a last flake from the former ventral side.

IV: Production of a blade-like flake: After the production of the flaked-flake, the main reduction continued from the same striking platform. This is shown by a blade-like flake (Figure 4.16, flake H11/12-1) which is 'stratigraphically' the youngest of this group of artefacts.

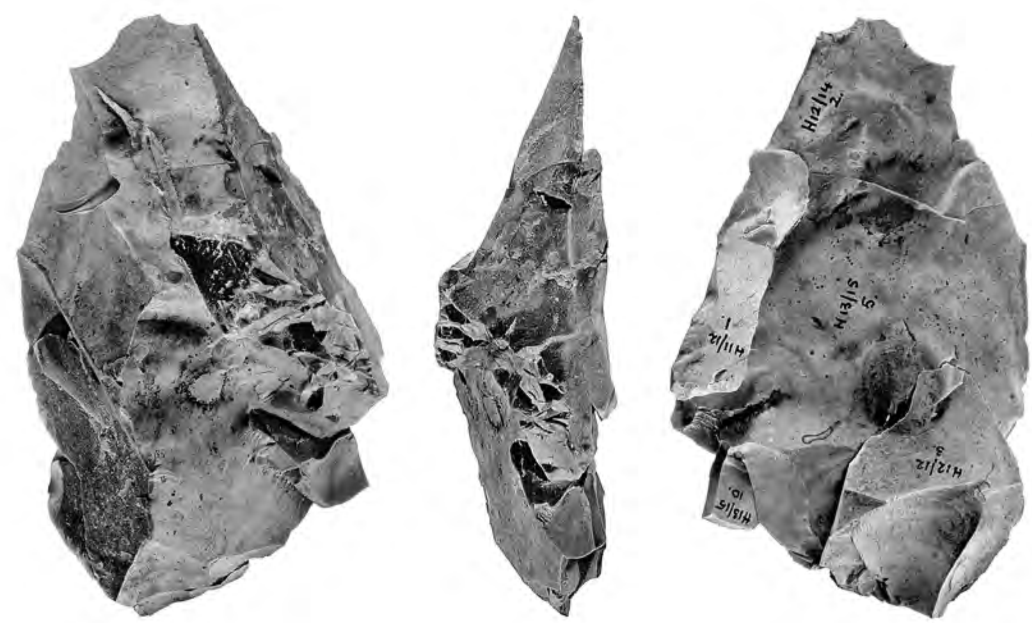
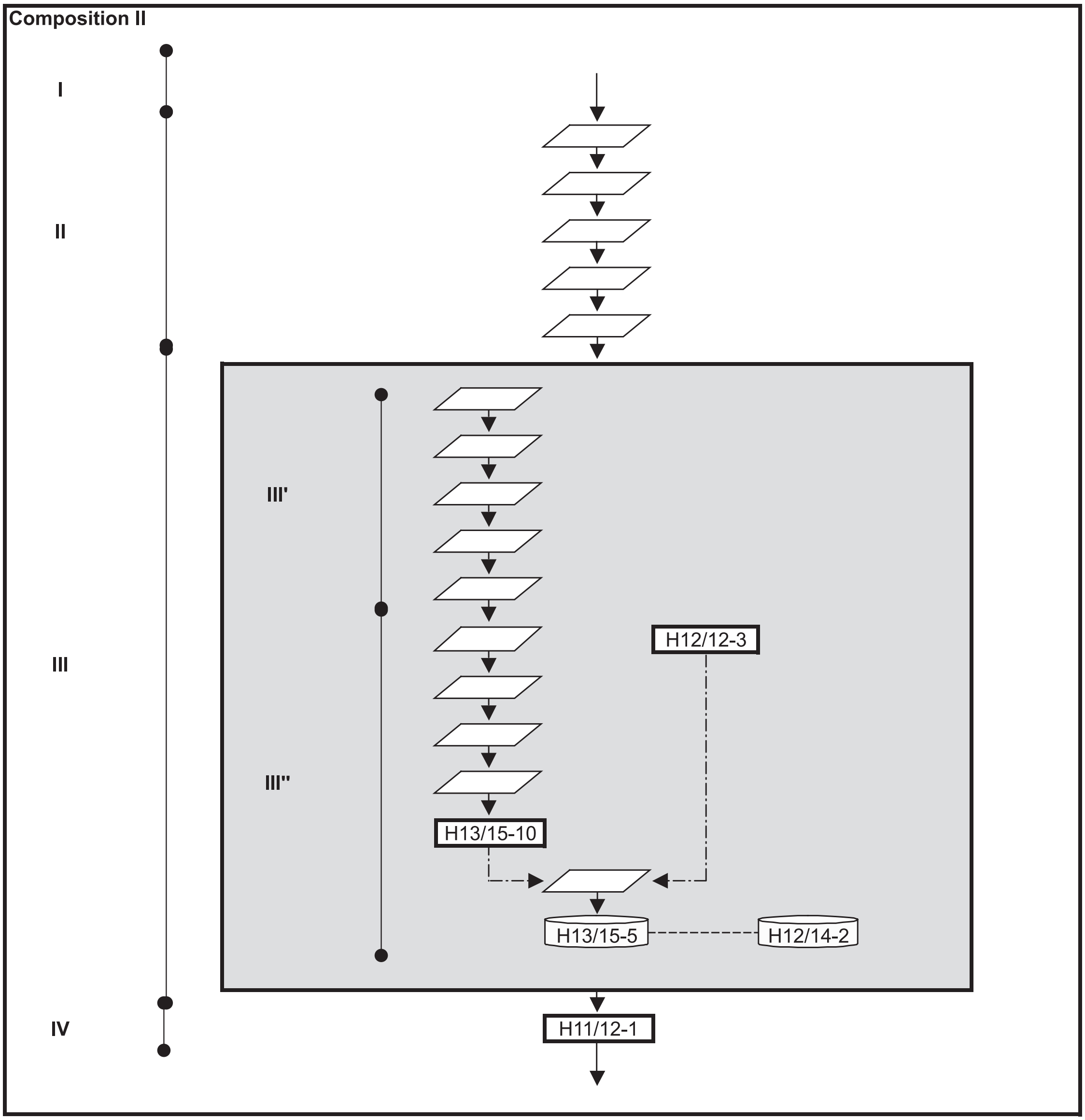


Figure 4.15: Maastricht-Belvédère Site H. Refitted composition II. Scale 2:3.



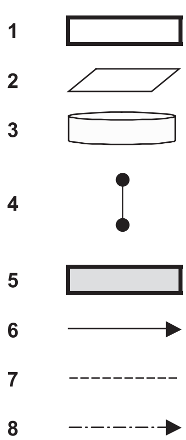


Figure 4.16: Maastricht-Belvédère Site H. Reduction sequence of refitted composition II. The numbers in these 'Harris-matrixes' refer to the individual refitted flakes, while the Roman numbers refer to the individual steps in the reduction sequence, which are also described in the text. Number H12/12-3 and/or H13/15-10 are the first refitted flake(s) in the 'stratigraphical' reduction sequence.

1. Flake
2. Scar from previous flake
3. Core
4. Described steps
5. Flaked-flake
6. *Aufeinanderpassung* (production sequences)
7. *Aneinanderpassung* (breaks)
8. *Anpassung* (modifications)

This conjoined group (II) suggests that a larger raw material nodule was divided into smaller and more manageable parts or cores. The splitting was simplified by following natural fissures, which were already present in the flint before knapping. Refitting gives no answer to the question whether this was done inside or outside the excavated area; for example at the location where the flint material was collected. From a series of 'unidirectional' flakes, reduced from two opposite striking platforms, a large and rather thick flake was selected to serve secondarily as a core, a flaked-flake. Considering the dimension and the high percentage of natural fissures, this flake can be seen as a product of the first stages of core reduction. Subsequently, a striking platform and a good, but minimally prepared, working angle was created on the flaked-flake to produce a new sequence of smaller flakes.

4.8.4 Spatial distribution

The spatial distribution of the Site H assemblage shows a cluster of artefacts in the northern part of the excavated area (Langbroek 1998:16, Figure 7). This concentration consists only of debitage and a few tools. The southern part of the excavated area, however, is remarkably empty and indicates that the excavation was situated at the periphery of the artefact cluster. The mean number of artefacts, tools and burned artefacts per square metre is respectively 5.0, 0.2 and 0.02. Most of the refits (including compositions I and II) are also concentrated in the northern central part of the excavated area. Moreover, two conjoinings could be established in section 1, situated further north.

4.8.5 Interpretation

For the interpretation of the Site H data, we will have to keep in mind that an unknown area of the findspot was destroyed by commercial quarrying activitities. Nevertheless, the lithic technological evidence provides us with some clues to hominid behaviour.

The presence of small flaking debris and irregular pieces of flint, together with the established refitted sequences of small and large flakes, suggests that most of the Site H assemblage was the result of on-site knapping activities. In technological respect the assemblage is characterized by the production/reduction of unprepared flakes/cores, *i.e.* minor occurrence of retouched or facetted butts, centripetal or convergent dorsal patterns and dorsal preparation near the butt. Good working angles were created, used and maintained to produce sequences of flakes. This manner of reduction resembles a disc/discoidal approach (Boëda 1993) like used at Sites K and F (respectively Chapter 3 and Section 4.6). The appearance of natural fissures on part of the artefacts suggests an unselective choice of raw material, while large flakes were secondarily used as cores.

The fact that only a minor part of the flakes shows cortex remains indicates that the first stages of core reduction were executed outside the excavated area. This also applies to the presumed splitting of larger raw material nodules into smaller parts. Interesting is also the fact that cores are completely lacking from the excavated area. Possibly this may imply that the major part of the *ad hoc* flint knapping was concentrated in the northern, unexcavated, part of the findspot. There is, however, no proof for this assumption.

Besides on the spot reduction of larger flint nodules, there are some indications for the import of artefacts, especially tools. The analysis of the raw materials shows that only few artefacts deviate from the relatively homogeneous character of the flint. One such artefact is a single convex side scraper made of dark grey flint with a heavy, steeply retouched edge. It was recovered in the southern part of the excavated area. Probably we are dealing with a tool fabricated elsewhere and transported into the excavated area where it was subsequently discarded. A further indication for a possible import of tools is given by refitting. None of the recovered tools could be refitted to the rest of the assemblage. Whether the transported items/tools were discarded 'contemporaneously' with the rest of the assemblage is impossible to answer.

In functional terms Site H documents the production of flakes, possibly associated with tool use/discard and therefore resembles to some degree Site K. To conclude Figure 4.17 is given. This figure shows two possible scenarios for 'horizontal behaviour' as derived from the assemblage.

4.9 Maastricht-Belvédère Site N

4.9.1 Introduction

Site N, discovered in November 1987, was excavated between February 1988 and September 1989. In contrast to most of the other Maastricht-Belvédère sites, this findspot could be excavated without much time pressure. During the discovery of the site only a few but large and well-prepared flakes were found. In fact the site did not look promising in terms of quantities of finds. However, the decision was made to record this distribution in order to document the 'off-site' character of the former usage of the river valley at Belvédère. By doing this we hoped to gain an impression of the overall lithic 'output' of Middle Pleistocene early humans within a small segment of the river valley. Former research indicated already that two types of findspots existed at Belvédère: the 'high density' sites, *i.e.* the 'classic' sites and the so-called 'low density' sites (see Chapter 5). The main objective of the Site N excavation was to get an impression of what happened spatially between the 'classic' sites, and to compare them techno-/typologically and in terms of raw material with the Maastricht-Belvédère 'high density' assemblages.

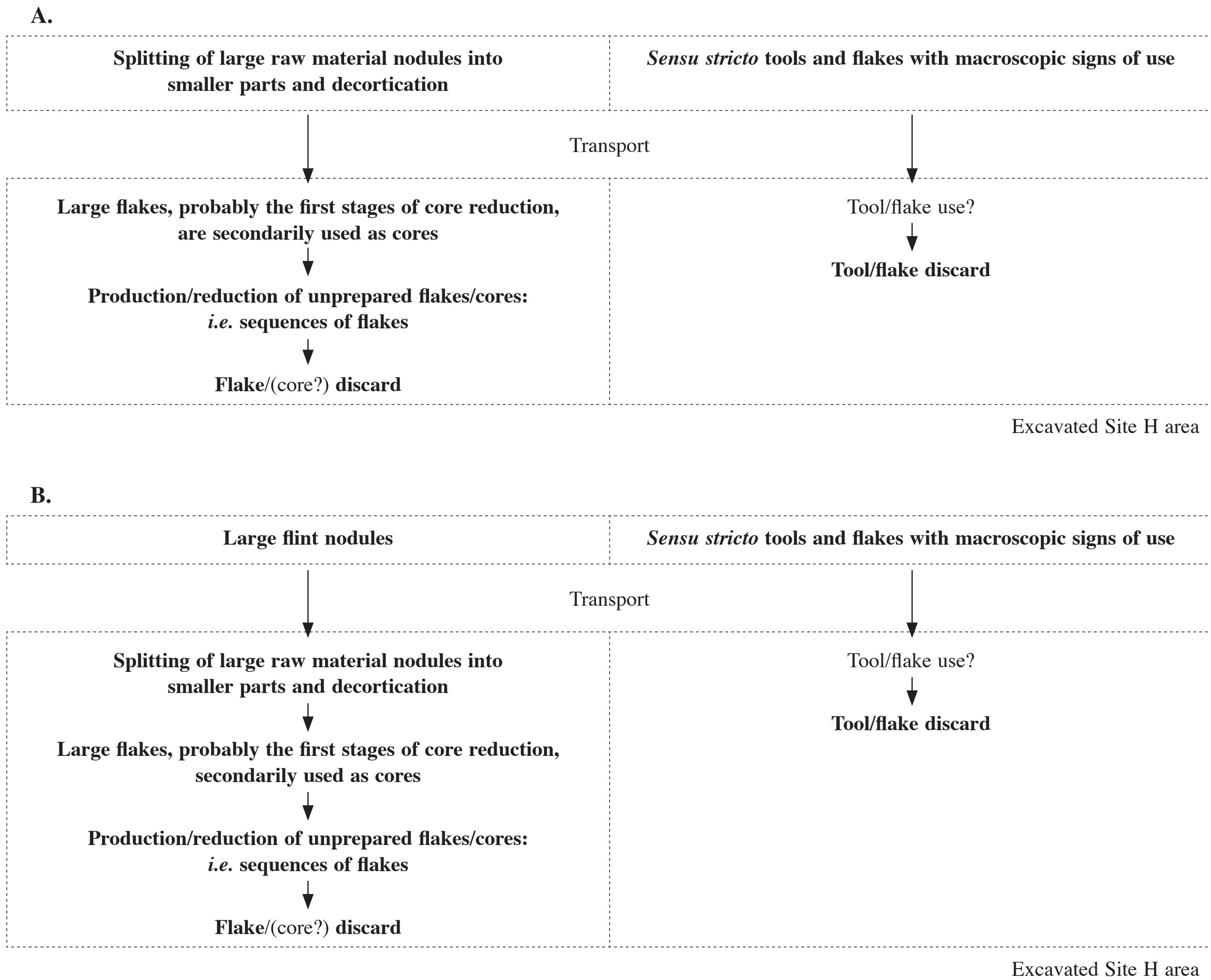


Figure 4.17: Maastricht-Belvédère Site H. Two possible scenarios for 'horizontal behaviour' as derived from the Site H lithics.

The Site N artefacts were present in clayey silts matrix. This layer can be situated in Unit IV-C-ß (Roebroeks *et al*. 1992). The large desiccation cracks and abundant traces of biological activity present in these deposits indicate that the meander would have run dry occasionally (*cf*. Vandenberghe 1993). It is possible that the artefacts were discarded on temporary dry surfaces in what had become a very shallow meander loop. A detailed picture of the local Site N stratigraphy is given in Roebroeks *et al*. (1992). Furthermore, data on the flint material have been published in Hennekens and van Ieperen (1990) and Roebroeks *et al*. (1992, 1993).

In total an area of 765 metres square was excavated and all finds were recorded three-dimensionally (Roebroeks *et al*. 1992:7, Figure 7). The excavation yielded in total 450 flint artefacts (included tiny chips <10 mm), and some badly preserved faunal remains (red deer, horse and bovid). More than 500 metres square did not contain any artefact at all. The flint analysis (texture, inclusions, cortex and colour) showed that the Site N artefacts were made of at least eight different raw material nodules. Compared to other artefact distributions at Belvédère, this is a high number, especially when the low number of artefacts per metre square is taken into consideration.

Of all 450 flint artefacts, 93.3% could be described as debitage and non-retouched flakes, while only one core was recovered (Table 4.8). In addition, a total of 26 complete and incomplete tools were counted. These tools can be divided into 12 tools *sensu stricto* and 14 artefacts with macroscopic signs of use. In addition, two core trimming elements/flakes and one burned artefact were identified. In total 73 artefacts (16.2% of the total number of artefacts) could be conjoined. In the following sections the Site N flint assemblage will be technologically discussed and interpreted. For a detailed picture of the typo-/technological description of the Site N flakes, core and tools the reader is referred to Appendix 10.

Type	N	%
Debitage	420	93.3
(Core Trimming Elements)	2	0.4
Cores	1	0.2
Modified artefacts	26	5.8
'Hammerstones'	–	–
Burned artefacts	1	0.2
Total	450	99.9

Table 4.8: Maastricht-Belvédère Site N. Some quantitative data on the Site N flint material.

4.9.2 *Characterization of the assemblage*

The Site N lithic assemblage consists mainly of chips and flakes, respectively 80.2% and 19.3%. One piece with microscopic signs of use is a blade-like flake. Flakes with a maximum dimension between 0 and 9 mm clearly dominate (52.0%), while six artefacts (1.3%), including a double convex side scraper, a double concave-convex side scraper and an atypical backed knife are ≥100 mm. Tools, and especially scrapers, are slightly larger than the rest of the assemblage. In general the Site N flakes have a length and width which is nearly equal, although flakes with a maximum dimension ≥100 mm are longer than wide. Of the total assemblage only few flakes and tools show cortex remains and/or natural fissures. Interesting is also the fact that on 64.6% of the flakes ≥30 mm some parts are missing due to breakage. A plain butt is described most frequently, while a retouched or facetted butt is still represented by 21.6%. Most of the scrapers also have a retouched butt. The dorsal surface shows that the majority of the flakes have a 'parallel' unidirectional or a 'parallel' bidirectional pattern. A centripetal or radial pattern occurs on 13.6% of all flakes ≥30 mm. For tools, pieces with a 'parallel' + lateral unidirectional and a 'parallel' bidirectional dorsal pattern dominate. Furthermore, 42.0% of the flakes ≥30 mm have four or five dorsal negatives. The previously mentioned technological characteristics indicate that a large part of the Site N assemblage, and especially the tools (scrapers), are the result of a reduction strategy in which there is clearly attention for core preparation. Further positive proof for this assumption is given by the only core found at Site N. The piece in question is described as a very thin, nearly exhausted, disc core.

4.9.3 *The refitting results*

As mentioned before the refitting analysis executed at Site N resulted in the conjoining of 73 artefacts[9] (16.2% of all 450 artefacts). The total number of conjoined elements represents 49 refitting lines (*cf.* Cziesla 1986, 1990). These lines can be divided into 11 *Aufeinanderpassungen* (refitting of production-sequences) and 38 *Aneinanderpassungen* (refitting of breaks, intentional or not). The mean length of these *Aufeinanderpassungen* and *Aneinanderpassungen* cannot be given because the required data was not accessible for study. A total of 25 compositions was achieved (see Roebroeks *et al.* 1992:12, Figure 11 for the horizontal distribution):

16 groups of 2 conjoining elements
3 groups of 3 conjoining elements
4 groups of 5 conjoining elements
2 groups of 6 conjoining elements

Most of the refitted Site N compositions consist of large broken flakes. Furthermore, none of the tools *sensu stricto* or flakes with macroscopic signs of use could be integrated into dorsal/ventral conjoinings. These *Aufeinanderpassungen* represent a total of five compositions. A group of five conjoined flakes is the largest established dorsal/ventral refitted group (see later). All dorsal/ventral refits are composed of sequences of two to five flakes which were mainly struck from the same direction, and using the same striking platform on the core. Together with the fact that none of these artefacts show a retouched or facetted butt, this could mean that sequences of flakes were reduced from suitable unprepared core angles, using the scars of previous flakes in the reduction as striking platform. On two of these sequences cortex remains (less than 25%) were described.

One composition, consisting of two large and thick flakes, shows that the working edge of (probably) a double platformed, opposed core was rejuvenated on the spot. The first flake in this sequence was typologically described as a core trimming element which shows technological errors like 'hinge' and 'step' negatives (*cf.* Shelly 1990).

The largest refitted dorsal/ventral composition, built up of five flakes (Roebroeks *et al.* 1992:13, Figure 12), is rather an exception for the refitted Site N assemblage. This composition has a cross-section of 74 mm and represents a series of flakes belonging to a much larger/longer sequence of reduction. All flakes show cortex remains. Judging from the dorsal scars on the outermost part of the composition, at least six flakes were struck from the same striking platform and in the same direction, outside the excavated area. Next, the already reduced core entered the Site N area where at least five flakes were produced from the same (previously mentioned) striking platform and in the same flaking direction. None of these flakes show retouched or facetted butts and probably the scars of previous flakes in the core reduction were used as striking platform. Only the first flake in the sequence shows some traces of modification/preparation at the angle between the butt and the dorsal surface (retouching/facetting). Altogether, this indicates that the same striking platform of a core was used as long as possible for the production of unprepared 'smaller' flakes.

This applies to the flakes produced inside as well as outside the Site N area. Generally this sequence of flakes can be interpreted as the result of a core edge rejuvenation. After the production of these flakes, which were discarded on the spot, the core was transported outside the excavated area.

4.9.4 Spatial distribution

The sedimentary matrix of the Site N assemblage consists of a silty clay, deposited in a very low-energy environment in shallow, almost standing water, within a depression that occasionally fell dry. While the geological evidence indicates that the assemblage may have been recovered in primary context, the refitting results indicate that some horizontal displacement of the artefacts took place. The rather large distances between the conjoined broken fragments and between dorsal/ventral refits can be seen as indicating some reworking of the material in the shallow meander depression (Roebroeks *et al.* 1992:12, Figure 11). The distribution of faunal remains supports this interpretation. For example, the (dental) remains of a lower jaw of a red deer are displaced in the same order of magnitude as that recorded for the flint artefacts (Roebroeks *et al.* 1992). On the other hand, some parts of the excavated Site N area may be less disturbed than others. Positive proof for this assumption is given by the five previously discussed dorsal/ventral refitted flakes, which were recovered clustered in the north-eastern part of the excavated area and represent a small knapping event. Besides the five refitted flakes another 10 artefacts, produced from the same brown coloured raw material nodule, were found in the same cluster.

In general the horizontal distribution of the Site N artefacts shows no clear cluster, although, especially in the eastern part of the excavated area, some flaking debris (partially refitted) was recovered in small 'clusters'. Furthermore, the artefacts are more or less dispersed/scattered over the excavated area. The horizontal distances between refitted elements in the eastern part of the excavated area are considerably smaller than those of the western half. The mean number of artefacts per metre square for the excavated area (765 metres square) is 0.6. The average number of cores, core trimming elements, tools and burned artefacts per metre square is respectively 0.001, 0.002, 0.03 and 0.001.

4.9.5 Interpretation

Like Site G, we are dealing at Site N in general with a scattered occurrence of flint artefacts, although some flaking debris is more clustered. The lithic artefacts were recovered together with some badly preserved faunal remains (mostly molars). The question whether human behaviour was one of the agents responsible for the formation of the Site N faunal remains is rather difficult to answer, as no use wear analysis could be performed on the artefacts[10] (*cf.* Site G). Geological, refitting and spatial evidence indicate that the lithic and faunal assemblages may have been recovered in primary context, although some horizontal reworking of the artefacts and bones (presumably in the same order of magnitude) took place. Therefore we may exclude the possibility that lithic artefacts and faunal remains were washed together by fluvial activities or other natural depositional processes. However, besides a spatial 'relationship', no clues could be found for human involvement in the formation of the faunal assemblage.

The typo-/technological analysis indicates that the first stages of the core reduction most probably occurred outside the excavated area, as decortication flakes are virtually absent in the assemblage. Judging from the variety of raw materials and the refitting data of the small assemblage, a large part of the artefacts discarded were introduced into the excavated area as finished pieces. Among them are tools *sensu stricto* that had been previously resharpened many times. For example, a double concave-convex side scraper shows on its left proximal side a dorsal scar from a previous flake (flaked in the same direction as the actual flake) which partially removed the working edge (Roebroeks *et al.* 1992:8, Figure 8-b). The scar possibly originated from a 'Long Sharpening Flake' ('LSF'). This tool entered the excavated area probably after it was resharpened. As the newly created working edge shows some macroscopic signs of use, it is clear that this tool was used again after resharpening. Whether it was used inside or outside the excavated area is unclear. In general all tools were made elsewhere, and discarded away from their place of manufacture. Besides the tools also large flakes, selected from the products of previous knapping episodes outside the excavated area, were introduced at Site N. This makes the presence of so-called core trimming flakes, struck from the side of the core's working surface, conspicuous. They present a sharp cutting edge on one margin and a back, a surface perpendicular to the flaking surface of the blank, on the other. Struck from Levallois-like cores, these are called *éclats débordants* (Beyries and Boëda 1983, *cf.* Site G). There are two of these typical *éclats débordants* present in the assemblage, and nine flakes with a comparable form, *i.e.* triangular in cross-section and with a clear back, resembling 'backed knives' (although not all cutting edges show [macroscopic] traces of utilization). Judging from the variety of their raw materials, they derive from at least six different cores, and must have been struck outside the excavated area as no debris could be refitted to them. Refitting also proves that heavily reduced cores entered the excavated area, where the core edges were rejuvenated. Subsequently, the cores were transported away from the excavated area. One exhausted disc core was transported inside the Site N area, where it was discarded without any further reduction. Just as for Site G, it can be suggested that the Site N assemblage probably represents only a small part of a larger horizontal continuum characterized by low densities of flint artefacts and faunal remains. Both 'low density scatters' are interpreted by Roebroeks *et al.* (1992) as part of a 'veil of stones' (see also Chapter 5).

To conclude Figure 4.18 is given which schematically summarizes two possible scenarios of 'horizontal behaviour', as derived from the Site N flint assemblage.

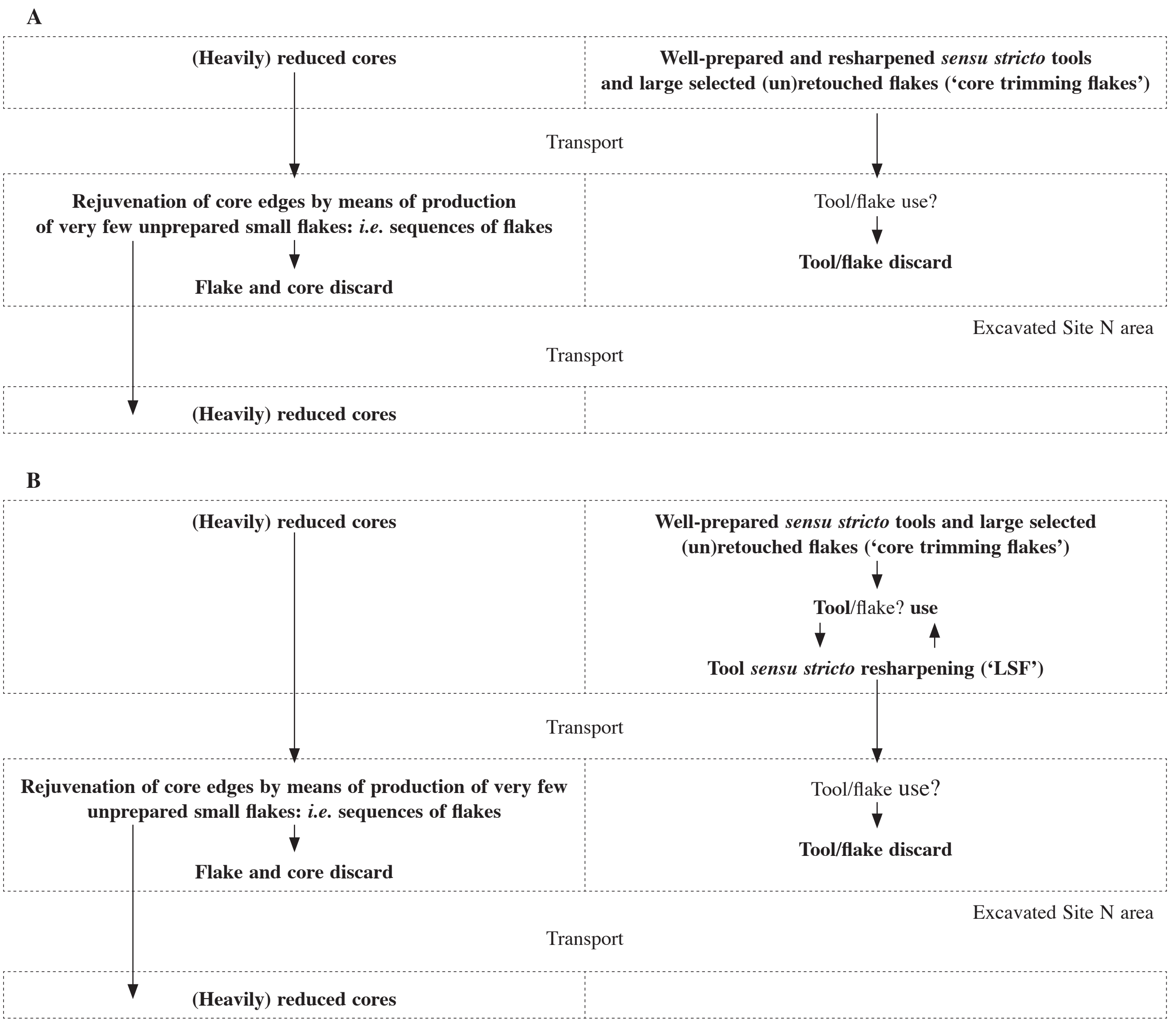


Figure 4.18: Maastricht-Belvédère Site N. Two schematic scenarios for 'horizontal behaviour' as derived from the Site N flint assemblage.

4.10 Maastricht-Belvédère flint material found during different section studies and small test pit excavations: 1980-1990

4.10.1 Introduction

To end this chapter, a typo-/technological review of the lithic material, found during several Unit IV section studies and small test pit excavations, is given (Table 4.9). Statements on refitting and spatial distribution of the artefacts will be added if necessary. It has to be emphasized that some of these assemblages were coined 'sites' during their discovery[11]. The word 'site' was only used to point out that a larger quantity of flint artefacts and/or bones were found within a specific area. After a more detailed research of the geological 'envelope', the archaeological material of some of these locations (Sites L and M and Site N: Level X) turned out to be situated in erosional levels. Therefore further excavation did not seem worthwhile, although the content of some of these 'sites' could have been deposited on top of the erosional levels. As a consequence they still could have been in a primary archaeological context. Furthermore, due to the scattered occurrence of the erosional levels, it was difficult or sometimes impossible to give these assemblages a well-defined place in the Maastricht-Belvédère chronostratigraphical framework.

For other so-called 'sites' and/or test pits, there was not enough time available to execute a proper excavation. As a result only a small zone, probably belonging to a larger artefact (and bone) rich zone, was investigated. This applies to Site O and to the 'July 1990' test pit excavation. The lithic artefacts recovered from these two find locations were situated in the so-called 'mottled zone' within the unit 5.1 sandy siltloam (like at Sites A, D, F, H, K and N). This unit, which can be chronostratigraphically placed in Unit IV-C-ß, is described in Vandenberghe *et al*. (1993) and Chapter 2.

All isolated 'single' finds, found during several section studies between 1980 and 1990, were assigned and described to/in one group of artefacts: the section finds. This group of artefacts could give an indication of technological behaviour between the 'excavated' areas. Some of the lithics from these different find situations have already been published in Roebroeks' thesis (1988).

4.10.2 Maastricht-Belvédère Site L

As mentioned before, the Site L lithic material was recovered from an erosional level. Chronostratigraphically this level can probably be placed in Unit IV-C. It is difficult or even impossible to place this level, and therefore the assemblages, more precisely in the Maastricht-Belvédère sequence.

The Site L assemblage was discovered on 29th May 1987 and the section was further studied during a few days in January 1988. In total only eight flint artefacts, representing several raw materials, were recovered. All artefacts could be described as debitage and non-retouched flakes, while none of them could be conjoined.

The assemblage consists of chips and some larger flakes, all <60 mm. Four of the eight flakes show cortex remains, while none of them show natural fissures. Only one flake has a retouched butt and some artefacts show a preparation (facetting/retouching) at the angle between the butt and the dorsal face. All three Site L flakes ≥30 mm have a more complex dorsal pattern, *i.e*. a 'parallel' + lateral unidirectional, a 'parallel' bidirectional and a centripetal or radial pattern. They have also four or five dorsal negatives. For a detailed picture of the typo-/technological description of the flakes the reader is referred to Appendix 11.

Interpretation

As mentioned before, the Site L section finds were recovered from an erosional level. The question whether the lithic artefacts were washed together by natural processes, or were discarded by human activities on top of this erosional level is impossible to answer.

Judging from the variety of the raw materials, all flakes were probably produced from different nodules. Furthermore, technology shows that all flakes ≥30 mm have a more complex dorsal pattern, and one flakes has a retouched butt. This could mean that the larger flakes were more carefully prepared.

4.10.3 Maastricht-Belvédère Site M

At Site M flint artefacts and some badly preserved faunal remains were recovered from an erosional level. Again, it is

'Site'	Situation	Period of research
Site L	Section	29th May 1987 and January 1988.
Site M	Section/test pit	15th November 1987, 31st March, 2nd April, 4th, 9th and 17th October, 9th November, 12th December 1988 and February 1989.
Site O	Section	21st, 23rd and 28th May and 4th and 19th June 1988.
Site N: Level X	Test pit	During the Site N excavation but especially March-July 1989.
'July 1990'	Section/test pit	July 1990, 2nd September, 13th, 18th and 19th October 1990.

Table 4.9: Maastricht-Belvédère. Survey of the section 'sites' and the test pit excavations.

difficult to place this level exactly in the Maastricht-Belvédère chronostratigraphical sequence. However, the limited geological study indicates that this erosional level, and therefore also the finds, was situated below the so-called 'mottled zone' of Unit IV-C-ß.

The first Site M finds were discovered on 15th November 1987 and the section was studied further on several occasions between March 1988 and February 1989 (Table 4.9). In this period (particularly in April) a small test pit of about nine metres square was excavated and a total of nine flint artefacts and two bone fragments were recovered.

In total 44 lithic artefacts were found in the Site M section and test pit excavation. Most of the artefacts (n= 41 or 93.2%) are pieces of debitage and non-retouched flakes. Three pieces (6.8%) were described as tools. Two of these are tools *sensu stricto* (a notched piece and a denticulate), and one is described as a piece with macroscopic signs of use. In total four artefacts (9.1% of the total number of artefacts) could be conjoined. Two artefacts could be refitted dorsally/ventrally (*Aufeinanderpassung*), while the other two represent a broken artefact (*Aneinanderpassung*, Cziesla 1986, 1990).

The Site M section and test pit assemblage consists, again, mainly of flakes and chips, respectively 59.1% and 34.1%. Furthermore, three blade-like flakes (elongated flakes) were described. Flakes with a maximum dimension between 30 and 39 mm dominate the assemblage. More than one fourth of the artefacts show cortex remains, while only one flake ≥30 mm shows natural fissures. Facetted or retouched butts and a dihedral butts appear most frequently, respectively on 24.1% and 20.6% of the flakes. One fourth of all 44 flakes is prepared at the angle between the butt and the dorsal face. This was mostly done by facetting/retouching. Most of the flakes have a 'parallel' + lateral unidirectional (27.6%) or a 'parallel' bidirectional (24.1%) dorsal pattern. A centripetal/radial dorsal pattern is, however, still represented by 13.8%. For a further typo-/technological details of the Site M flakes and tools the reader is referred to Appendix 11.

Interpretation

For the Site M section and test pit artefacts, we encounter the same interpretation problems as for Site L. Were these finds, recovered from an erosional level, washed together by natural processes or were they discarded on top of this erosional level? Although this question is difficult to answer, the find data give us some clues to the latter option. In general the raw materials on which the artefacts were produced show a large variety; according to specific properties like texture, cortex, inclusions and colour three main groups of flint can be recognized. Two artefacts from one of these groups could be conjoined dorsal/ventrally (*Aufeinanderpassung*). This could mean that at least some flakes were discarded on the spot during flint knapping activities.

Most of the larger flakes (≥30 mm) have a prepared butt and/or a more complex dorsal pattern. This, together with the fact that the angle between the butt and the dorsal face on some of these flakes is prepared, could suggest that a (large) part of the Site M flakes was produced from well-prepared cores. Moreover, amongst the artefacts three rather thin Levallois *sensu stricto* flakes were found. One of these consists of two conjoined broken parts. A retouched butt is described on two of these flakes. It is worth noting that these Levallois flakes are produced on a very fine-grained flint type.

4.10.4 Maastricht-Belvédère Site O

The Site O artefacts were recovered from a section between 21st May and 19th June 1988 (Table 4.9). This Site O section was situated about 50 metres east of Site N. Due to the fact that the section in question was situated in the commercial exploitation zone of the quarry, only limited time was available to document the artefacts. Geology showed that the finds were situated in the so-called 'mottled zone' of the unit 5.1 sandy siltloam (Unit IV-C-ß).

In total only 10 artefacts, representing a large diversity of raw materials, were found. All artefacts are described as pieces of debitage and non-retouched flakes. None of these could be refitted.

The finds consists only of flakes and chips. Half of them are pieces with a maximum dimension between 40 and 89 mm. All flakes ≥30 mm have a plain butt or a cortical butt, while most of them show a 'parallel' unidirectional dorsal pattern, suggesting minimal attention for core preparation (see Appendix 11).

Interpretation

The Site O find material was recovered from a fluviatile low energy environment. In such sediments the lithic assemblages might have been recovered in primary context, although no proof for this assumption was found, as for example none of the artefacts could be conjoined. All 10 artefacts represent different raw material nodules. So, if the finds were indeed situated in a primary archaeological context, they probably entered the Site O area as isolated pieces after being produced somewhere else.

4.10.5 Maastricht-Belvédère Site N: Level X

Like Sites L and M the lithics from Site N, Level X were recovered from an erosional level. The Site N main find level was situated in the so-called 'mottled zone', which consists of clayey silts. This zone can be placed chronostratigraphically in Unit IV-C-ß (Roebroeks *et al.* 1992). The Level X artefacts, however, were situated underneath the Unit IV-C-ß 'mottled zone'.

The first Site N, Level X finds were discovered while deepening some of the Site N main level metres square (March-July 1989). This resulted in the excavation of a test trench of ca. six metres square. From this test pit several artefacts were recovered and it was observed that the erosional find level did not occur (or was not visible) continuously. In total an area of about 15 to 20 metres square was investigated in which a total of 29 artefacts were recovered. These artefacts represent a large diversity of raw materials. Nearly all artefacts (96.6%) were classified as debitage and non-retouched flakes, while one core trimming element/flake was described. None of the finds could be conjoined.

The Site N, Level X finds consists only of flakes (69.0%) and chips (31.0%). Nearly all flakes have a maximum dimension <70 mm and about one fourth of the assemblage shows cortex remains. Natural fissures are found on 56.3% of all flakes ≥30 mm. Half of the Site N, Level X flakes (≥30 mm) show a plain butt, while facetted or retouched butts are lacking. A 'parallel' unidirectional pattern and a 'parallel' + lateral unidirectional dorsal patterns clearly dominate. The majority of these flakes have one to three dorsal scars (see Appendix 11).

Interpretation

Again, there is little data for making inferences on the site formation processes. According to unpublished data (pers. comm. F. Timmermans 1995), at least three kinds of flint raw material were used. However, for this analysis a much larger variety of raw material nodules is described. The majority of the flakes were probably produced from rather unprepared cores.

4.10.6 Maastricht-Belvédère 'July 1990' test pit

In July 1990, while studying a geological section, four artefacts were found in the so-called 'mottled zone' of the unit 5.1 sandy siltloam (Unit IV-C-ß). This section was located south of the Site N excavation. On 2nd September 1990 another seven artefacts were recovered from the same section and unit. By mid-October the section in question was situated in the commercial exploitation zone of the quarry and the decision was made to execute a small test pit excavation (18th and 19th October 1990). In total an area of about seven metres square was excavated and a further four artefacts were recovered. In total only 15 artefacts, representing a least three raw material units, were found. The majority of the artefacts (93.3%) was described as pieces of debitage and non-retouched flakes, while one tool was classified as a single convex side scraper. Four flakes (26.7% of the total number of flakes) could be refitted.

The assemblage recovered from the 'July 1990' test pit consists only of chips (53.3%) and flakes (46.7%). All 15 flakes are <60 mm, while the majority shows cortex remains (80.1%). Most of the artefacts ≥30 mm have a plain butt and a 'parallel' unidirectional dorsal pattern (see Appendix 11).

Refitting results and spatial distribution

The archaeological material discovered in and around the 'July 1990' test pit excavation was embedded in a sandy siltloam matrix. These sediments indicate a low-energy deposition of sediments and therefore the artefacts may have been preserved in a primary archaeological context. The established refits of both small and large artefacts, situated more or less near to each other, do not contradict this possibility.

As mentioned before, four artefacts were refitted for the 'July 1990' section and test pit excavation. These conjoined elements represent two refitting lines (*Aufeinanderpassungen*, *cf.* Cziesla 1986, 1990). A total of two compositions was achieved, each consisting of two conjoined elements. Three of these refitted flakes were recovered in September from the geological section, while one flake was found during the test pit excavation (see Figure 4.19 for the horizontal distribution of the excavated artefacts and refits). According to the established dorsal/ventral refits, at least some flaking took place in and around the excavated area. Specific properties like texture, cortex, inclusions and colour show that all four refitted elements could be assigned to one and the same flint nodule. Furthermore, three other flakes were probably also flaked from the same raw material nodule. In total all seven flakes are cortex covered. This could mean that the initial flaking (decortication) of a core took place on the spot. Furthermore, it indicates that the core (or raw material) entered the 'July 1990' area without any or limited preparation.

Interpretation

The 'July 1990' section/test pit assemblage represents probably 'primary' context artefacts, recovered from a few metres square during a limited period of time. The established dorsal/ventral refits (small and larger artefacts) could indicate that at least some on-site knapping/core-reduction was executed at and around the 'July 1990' test pit area.

The raw material and refitting analysis shows that seven artefacts (including the four refitted elements) were produced from one and the same core/flint nodule. Furthermore, none of these artefacts show a retouched or facetted butt which could suggest that flakes were reduced from suitable unprepared core angles, using the scars of previous flakes in the reduction as striking platform. All this could imply that a marginally prepared cortex-covered core/nodule entered the 'site', where it was subsequently further reduced. Because only a small area was investigated the core may have been discarded nearby. Judging from the different raw materials

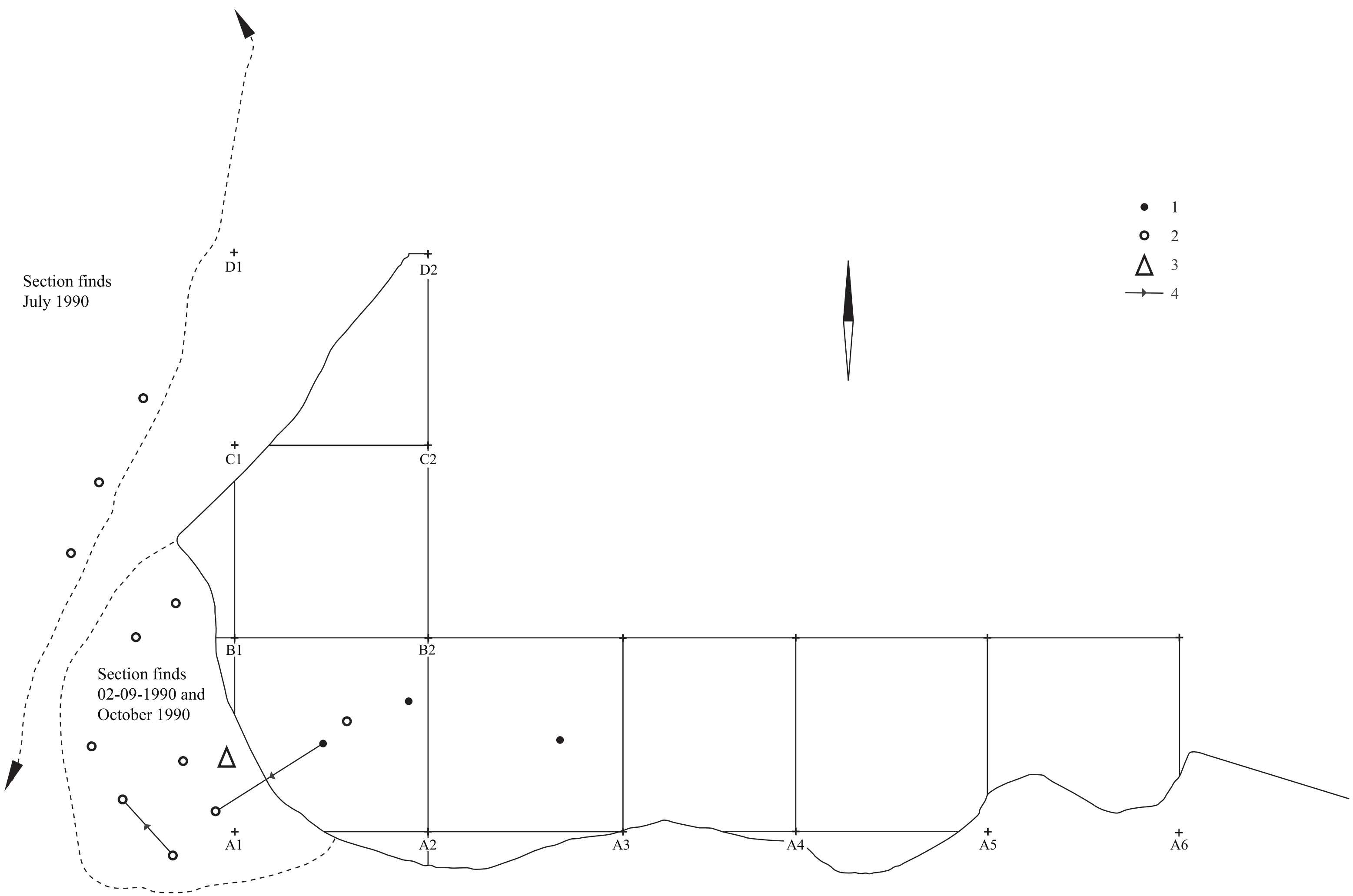


Figure 4.19: Maastricht-Belvédère 'July 1990' test pit. Horizontal distribution of the excavated artefacts and refits. The conjoined groups are represented in the 'Cziesla approach' (Cziesla 1986, 1990) and the excavation grid is in metres square.

1. Flake
2. Flake (fictive coordinates)
3. Tool (fictive coordinates)
4. *Aufeinanderpassung* (production sequence)

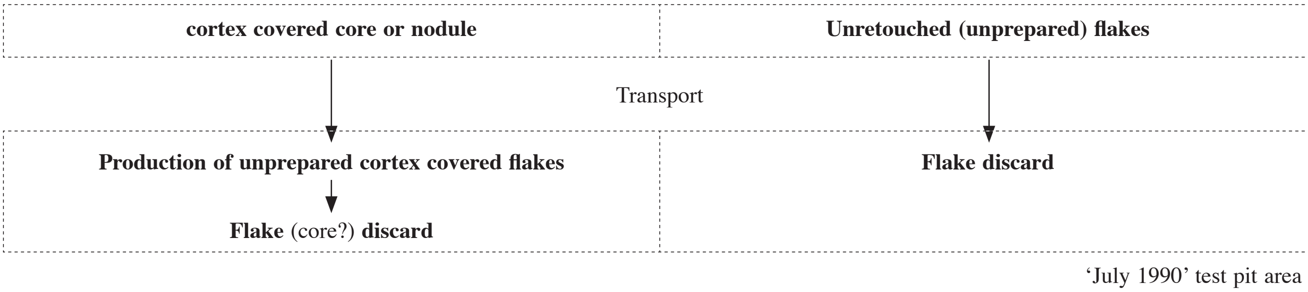


Figure 4.20: Maastricht-Belvédère 'July 1990' test pit. Schematic representation of 'horizontal behaviour'.

and the lack of refits, the other flakes in the assemblage (not belonging to the previously mentioned group) could have been introduced into the 'July 1990' area as isolated pieces where they were subsequently discarded. To conclude Figure 4.20 is added, which shows the schematic representation of 'horizontal behaviour' as derived from the 'July 1990' flint assemblage.

4.10.7 Maastricht-Belvédère Section finds

Between 1980 and 1990 several systematic studies of the local stratigraphy were carried out at Maastricht-Belvédère. Moreover, the large geological sections were intensively surveyed for the occurrence of *in situ* Palaeolithic material on a regular base. All this resulted in the discovery of several horizons containing artefacts and animal remains. Besides the more or less horizontally clustered artefacts recovered from the sites, sections and test pit excavations, the Saalian fine-grained river deposits also contained isolated finds. Although the latter were retrieved from different lithological units, they were assigned and described as one group of artefacts: the Section finds. When treated as one assemblage this group of scattered pieces could give an impression of the archaeology of the area between the 'excavated' surfaces, *i.e.* somewhat similar to the objective of the Site N excavation (see Section 4.9).

In total 67 artefacts were found in the different sections. The majority of the artefacts (92.5%) were described as pieces of debitage and non-retouched flakes. Four artefacts could be classified as tools (6.0%). Three of these are tools *sensu stricto* (a single convex side scraper, a *déjeté* scraper and a retouched piece), while one tool shows macroscopic signs of use (a naturally backed knife). For illustrations of these tools the reader is referred to Appendix 11, Figure 11.5. In total only one core (a very small, heavily reduced, disc core) was found amongst the section finds (see Appendix 11, Figure 11.2).

The 67 section finds are dominated by larger flakes and chips, respectively 59.7% and 35.8%. In total two blade-like flakes (elongated flakes) were counted. The majority of the artefacts (65.2%) has a maximum dimension between 10 and 49 mm, while flakes between 0 and 9 mm are clearly under-represented. The latter is probably caused by the fact that larger artefacts are more easily found/recovered in sections than very small artefacts. Slightly less than half of the flakes show cortex remains and about one fifth of the flakes ≥30 mm shows natural fissures. About half of the larger flakes have a plain butt, while facetted or retouched butts are scarce. However, on ca. one fourth of all flakes a preparation at the angle between the butt and the dorsal surface is recorded. The figures for the dorsal surface preparation show that less than half of all flakes ≥30 mm has a 'parallel' unidirectional pattern. A convergent unidirectional pattern and a centripetal or radial pattern are scarce. Details on the typo-/technological aspects of the lithic section finds can be found in Appendix 11.

Interpretation

Like the very low-density flint distribution at Sites G and N (see Section 4.7 and 4.9), the studied section finds could give an impression on the lithic 'output' of Middle Pleistocene early humans in areas between the 'excavated' patches. As a large part of these section finds were probably discarded as isolated pieces or as small groups of artefacts, they may represent different, but complementary, information on early human subsistence behaviour. Moreover, it can be suggested that part of the isolated lithic finds represent elements of 'toolkits' which were discarded after being transported.

The majority of the section finds are unmodified flakes. In total three tools were described. Apart from that, only few flakes show traces of preparation (*i.e.* facetted/retouched butts and or centripetal/radial dorsal pattern), while most of them show cortex remains. This is rather conspicuous and clearly contradicts the technological characterization of the Site G and Site N assemblages. In those assemblages a large part of the flakes, and especially the tools, are the result of a reduction strategy in which there is clearly attention for core preparation. Furthermore, flakes with cortex remains are rather rare in these scatters.

To conclude, it has already been stated in earlier publications (Roebroeks *et al*. 1992; De Loecker and Roebroeks 1998) that the Site G and N flint distributions reflect the discarded remnants of an elsewhere produced/prepared, and subsequently transported, technology. According to the section find data it can be suggested speculatively that the emphasis was not only on well-prepared flakes and tools, but could have been also on scarcely prepared flakes which were selected from all stages of core reduction. However, in an other scenario the section finds could represent the remnants of partially reworked flaking scatters where primary flaking took place.

4.11 Conclusion

During the 1980s archaeological excavations at Maastricht-Belvédère documented 250,000-year-old traces (OIS 7) of interglacial occupation on the banks of the Middle Pleistocene river Meuse (Roebroeks 1988; Vandenberghe *et al*. 1993). Archaeological and geological studies showed that fine-grained fluviatile sedimentation had led to the preservation of concentrations of flint artefacts which occasionally were associated with faunal remains. These stratigraphically 'sealed' and well-excavated remains informed us on a number of different 'on-site' activities and provided a better understanding of early human behaviour in a very small segment of the old riverine landscape (Roebroeks 1988; Roebroeks *et al*. 1992, 1993). As a matter of fact large parts of the intra-Saalian stream valley bottom, at least at Maastricht-Belvédère, must have been littered with artefacts and bones, indicating that the area was frequently visited. This large and continuous artefact distribution, referred to as a 'veil of stones' by Roebroeks *et al*. (1992) and representing a technological landscape, displays some internal variations. They can be summarized as follows:

1. Variations in conservation: most of the Maastricht-Belvédère site data indicates that post-depositional displacement of the archaeological materials must have been minimal. However, small-scale processes such as bioturbation were probably responsible for some vertical movement of artefacts. It has to be mentioned that, according to the conjoined artefacts, some rearrangement of the horizontal Site F (and part of the Site N) distribution is suggested, *i.e*. due to natural/biological processes/activity.
2. Variation in artefact density: the continuous artefact distribution shows, on the one hand, large and dense clusters of lithic artefacts, like Sites C, H and K. The excavated areas and documented sections show, on the other hand, spots where the overall lithic distribution is low, consisting only of isolated pieces and/or small clusters of artefacts, *i.e*. Sites G, N and possibly Site B, the 'July 1990' area and the section finds.
3. Variation in artefact composition: the Maastricht-Belvédère excavations showed that there are areas where primary flaking debris dominates (Sites C, F, H and K) and where cores appear frequently (Site K). Other areas are characterized by high percentages of tools (Sites G and N) and few flaking debitage. A binary pattern (roughly stated, transported *versus* expedient use of technologies) is generally suggested.
4. Variation in the quantity and quality of conjoined artefacts: mainly at Sites C, F and K large quantities of refits were established. The majority of these refitted groups is represented by *Aufeinanderpassungen* (refitting of production-sequences), while at the low density distributions of Site G and especially at Site N primarily *Aneinanderpassungen* (refitting of breaks, intentional or not) were conjoined. Also discrepancies between the 'biography' of refitted compositions are documented. At Sites F and K mainly 'complete' reduction sequences could be reconstructed, *i.e*. from decortication, through flake production, to the discard of flakes and cores. Some limited tool production is suggested as well. At other findspots only specific stages of the *chaînes opératoires* could be reconstructed (amongst others Sites C, H, G and N). The refitted assemblages also show diverse spatial configurations. For example the spatial patterns of the different refitted compositions at Site K show that artefacts were transported, over and over again, between specific loci within the excavated area (multi-connections between a decortication/'splitting' locus and other activity-related discard areas). At Site C, on the contrary, lithics generally 'moved' from one locus to another, where they were abandoned and where a new reduction sequence 'started'. Subsequently, the lithics from the latter sequence were transported to a third locus, to be discarded, etc. ('locus-hopping' of 'single'-connections). For a further discussion the reader is referred to Section 5.6.4.
5. Variations in the used core-approach: Sites F, H and K are dominated by a disc and/or discoidal core-approach, while at Site N and especially at Site C the presence of Levallois products is clearly documented, *i.e. débitage Levallois à éclat préférentiel, débitage Levallois recurrent, éclats débordants*. A Levallois *sensu stricto* component is also recognized within the Site K tool assemblage. A relationship between Levallois products and transport is suggested.
6. Variations in the grain size of the used flint: remarkably, the mentioned Levallois products are predominantly produced on fine-grained flint types (Sites C, N and K). On the contrary, lithic artefacts characterized by a

disc(oidal) core approach show a more coarse-grained flint (sites C, D, F, H and K). It can therefore be suggested that differences in grain size of the used flint possibly led to differences in technology.

7. Variations in the preparation of flakes (and/or cores): although the majority of the Belvédère artefacts are dominated by unprepared flakes, some variation is noticed. Especially the flakes from Sites C, G and N seem to be better prepared that those described at Sites F, H and K. Moreover, transported tools, flakes (especially ≥50 mm) and cores are in general better prepared than those produced on the spot (see Site K, Chapter 3).

It could be suggested that the differences between the Belvédère assemblages are related to specific early human activities, *i.e*. technological and spatial response or adaptation to specific situations. In spite of this statement, it can be concluded that the analysis of the lithics shows generally two kinds of find distributions. Besides the findspots with a high archaeological visibility (the 'high density' distributions, *i.e*. Sites C, F, H, and K), the Belvédère-project documented parts of a continuous 'low density' distribution of flint artefacts (*i.e*. Sites G and N) against which the 'rich' sites were present. Part of the research interests were especially concerned with the distribution of these isolated (or small groups of) finds and with comparing them spatially, technologically, typologically and in terms of raw materials with the large assemblages from the Belvédère patches. An effort is made in Chapter 5 to explain these variations (patterns of behaviour) in the technological landscape.

notes

1 This chapter covers for a large part the earlier archaeological work done at Maastricht-Belvédère (a.o. Roebroeks 1988; Roebroeks *et al*. 1992, 1993). Additionally the author, together with Mr W. Roebroeks (Leiden University) and Mr P. Hennekens (Maastricht), will publish this chapter in a synthesizing paper on the archaeological interpretation of the Maastricht-Belvédère pit.

2 The refitting work was mainly done by Mr P. Hennekens and Mr W. Roebroeks with occasional assistance of Mr K. Groenendijk (Eckelrade) and Mrs M. de Grooth. (Bonnefanten museum). The refitting analysis was executed over a period of ca. two years (1983-1985). During his study of the Site C material (ca. 1989-1990), Mr N. Schlanger (Oxford University) was able to conjoin a dozen more artefacts to RMUs 2 and 4.

3 According to Roebroeks (1988) 20 artefacts were recovered at the Site D section. Due to the fact that some of these artefacts are described in this analysis as pseudo-artefacts (n= 2) and the fact that some flakes were not accessible for study (n= 7), a total of 11 artefacts is used for further analysis here.

4 In his thesis, Roebroeks (1988) counted a total of 1,215 flint artefacts, while for this lithic exercise only 1,177 pieces have been described.

5 In his analysis of the Site F lithic material, Roebroeks (1988) counted 156 conjoined artefacts. This discrepancy can be explained by the fact that three broken (natural fissure) flakes are here interpreted as 'recently' broken artefacts.

6 Most of the refitting work was done by Mr P. Hennekens and Mr W. Roebroeks.

7 The number of artefacts shows a discrepancy with earlier publications (*cf*. Rensink 1987; Roebroeks 1988; and Roebroeks *et al*. 1986 with 54 artefacts, Roebroeks and Hennekens 1990 with 52 artefacts, and Roebroeks *et al*. 1993 with 51 artefacts). Two main reasons can be mentioned for these differences. First of all, for this dissertation the artefacts deriving from the actual excavation and the test pit concentration are seen as one assemblage. Secondly, during the first descriptions of the Site G lithics, certain artefacts were differently interpreted (smaller artefacts with natural fissures *versus* pseudo-artefacts).

8 As mentioned before none of the artefacts deriving from the excavated area or from section 2 (the directly adjoining section) could be refitted to artefacts deriving from the northernmost section 1.

9 The actual refitting analysis was performed by Mr P. Hennekens.

10 The Site N flint artefacts display in general a white patination.

11 Most of the assemblages that are dealt with in this section were discovered by Mr J-P. de Warrimont.

5 Patterns of behaviour: spatial aspects of technology at Maastricht-Belvédère, Unit IV

5.1 Introduction

The well-excavated findspots at Maastricht-Belvédère (Roebroeks 1988; Vandenberghe *et al*. 1993; Chapters 3 and 4) documented a number of well-preserved 'on-site' activities. Generally, the main archaeological level (Unit IV) seems to indicate that at least a small segment of the intra-Saalian Meuse valley bottom was frequently visited by Middle Pleistocene early humans. These early humans possibly left a continuous artefact distribution behind on the palaeo-surface of the riverside landscape. In this technological landscape, referred to as a 'veil of stones' by Roebroeks *et al*. (1992), different kinds of artefact distributions have been discarded during 'limited' periods of time. The excavated areas show internal variations in artefact density and composition, *i.e*. the 'high' and 'low' density distributions. Both provide different but complementary information for a better understanding of early human behaviour.

In this chapter a presentation of the variations in the local Saalian record is given, focusing mainly on Sites C, G, F, H, K and N. The comparison is followed by a discussion of the implications this 'off-site' research may have for our understanding of the Middle Palaeolithic record. This chapter is based on the 'veil of stones' model, published by Roebroeks *et al*. (1992; see also De Loecker and Roebroeks 1998), and supplied with additional data obtained in more recent analyses. A detailed review of the used site data is given in Appendices 2 to 11. Moreover the numbers, percentages and ratios used here differ slightly from the figures given in previous Belvédère publications (amongst others Roebroeks 1988; Roebroeks *et al*. 1992, 1993). This is mainly the result of the re-examination of the flint artefacts in the context of this PhD dissertation.

5.2 Isaac's hierarchical model for structuring spatial artefact distributions

Most excavated Palaeolithic sites are "… concentrated, localised accumulations of refuse which represent acts of discard repeated by numbers of individuals over a span of time." (Isaac 1981:133-34). These concentrated patches of artefacts and bones, with a high archaeological visibility, are still the main focus of Palaeolithic fieldwork. However, mainly because of Isaac's (1981) work at Koobi Fora (Kenya) archaeologists came to realize that these 'classic' sites are mostly present against a background of 'low density' scatters, covering isolated or small sets of artefacts. It is clear that if one wants to study past behaviour, all available archaeological data should be used for interpretation. Therefore the scatters with their low visibility and the 'high density' patches should be treated equally in the study of Palaeolithic artefact patterns.

In his 'Stone Age Visiting Cards' article, Isaac (1981) proposed a hierarchy of levels for structuring spatial distribution of Early Stone Age relics (see Isaac 1981:138, Figure 5.4). The previously mentioned isolated artefacts, the kind of items one occasionally encounters when surveying sections (*i.e*. cross-sections through former land surfaces), represent the first level of his model. A next level is formed by single action clusters, for instance a set of conjoinable flakes from one knapping episode. The third level can be of variable scale, but it is always a complex cluster of first and second level occurrences, representing a number of episodes or a number of different actions. Most archaeological sites are composed of materials at this third level, *i.e*. clusters of clusters. Isaac sees sites, or *locales* (Gamble 1995) consisting of scatters and patches, as forming a patterned set across the face of a region (palaeo-landscape) with locations determined by such factors as distribution of resources, networks of communication and population density (*cf*. Gamble 1986; Roebroeks and Tuffreau 1999). This fourth level is commonly referred to as a 'settlement pattern' or 'regional system'.

The model stresses the importance of treating the distribution of patches and of isolated artefacts as parts of one single system (see also Foley 1981*a* and *b*) in our search for movements of Palaeolithic foragers through former landscapes. Although the 'scatters and patches' approach received little attention in the 1980s, in the last decade it gained some interest through the work of amongst others Stern (1991, 1993) Roebroeks *et al*. (1992) and Conard and Adler (1997).

This chapter takes up some elements of Isaac's approach by presenting (see Chapters 3 and 4) and discussing the results of the different Saalian Maastricht-Belvédère studies. In general two main questions will be tackled:

1. How informative are the recovered assemblages for reconstructing Middle Pleistocene early human behaviour in terms of the functional character of these sites.
2. And what do these findspots indicate about the subsistence settlement system in which they were formed.

To obtain answers to these questions, the Unit IV lithic distributions of the Belvédère sequence will be compared with one another initially. Subsequently, the inter-site variations will be interpreted in terms of past behaviour. Here, topics like transport of lithic material and/or expedient use of technology will be dealt with. A short note on the 'contemporaneity' of the different assemblages is given before the comparison.

5.3 Contemporaneity of the Unit IV artefact distributions

As discussed in previous chapters, the Saalian lithic artefacts at Belvédère were recovered from two distinct major find levels: *i.e*. the lower Subunit IV-B (Sites B, C and G) and the upper Subunit IV-C-ß (Sites A, D, F, H, K and N). If we want to evaluate the (inter-)site data of these levels, and make meaningful inferences on past behaviour, we will have to justify that the excavated material belongs to one and the same 'cultural system'. This subject of research is already discussed in detail by Roebroeks (1988) and he gives the following conclusion:

> "…, in all probability, they [the Unit IV findspots, DDL] can be interpreted as the remains of one and the same cultural system, which were created under more or less the same environmental conditions, over a relatively short period of time. The sites are contemporaneous in Pleistocene terms, having been formed in the same warm-temperate period. The Unit IV-C-I sites [this is Subunit IV-B (Vandenberghe *et al*. 1993), DDL] are very probably contemporaneous in terms of age differences of several hundreds of years. The age difference between the lower- (IV-C-I) and upper-level (IV-C-III) [this is Subunit IV-C-ß (Vandenberghe *et al*. 1993), DDL] sites is more difficult to estimate, … There are, however, no geological arguments for assuming large time differences, i.e. thousands of years." (Roebroeks 1988:133).

More importantly, Roebroeks emphasizes that there are no reasons to assume that significant changes in raw material availability (amongst others distance to the flint and food sources, flint quality, etc.) had taken place during the relatively short period of assemblage formation. In fact the artefact occurrences have been documented within an area of about 6 hectares, indicating that the assemblages were formed in comparable local environments (Roebroeks 1988; Vandenberghe *et al*. 1993). All these arguments, suggesting a 'contemporaneity' of the Saalian findspots, indicate that the variations in assemblage characteristics might be due to other factors than time differences. Mainly early human behaviour and minor natural site formation processes can be mentioned. Precisely these research conditions were the inspiration for the long-lasting field efforts, which resulted in the several excavated areas, test trenches and section observations.

5.4 Comparing the Unit IV Saalian assemblages

5.4.1 Introduction

The sample of individual assemblages excavated at Maastricht-Belvédère provides a good overview of the technological landscape discarded as a result of early human behaviour. Moreover the archaeological material recovered from the excavated surfaces provides a precious set of behavioural data which can be placed in a distinct intra-Saalian interglacial environment. As these assemblages were probably all formed in the same climatic optimum, it can be suggested that some of the inter-site differences are the result of cultural site formation processes. The variability may, for example, be due to the kind of activities performed at certain places. Flint procurement and/or testing, flake and/or tool production, tool- and/or core-edge rejuvenation and food (meat) procurement can be mentioned. Directly related to these activities could be the manner in which early humans anticipated the situations they came across. An expedient (*ad hoc*) production and use of technology can show completely different archaeological patterns than a transported ('curated') technology. Geneste (1985, 1988), for example, has described such a binary pattern in his regional study of the Middle Palaeolithic Aquitaine area (France). Other factors responsible for variations could be the number of (different) activities involved, the number of (different) visits, the duration of activities and the number of people involved. Archaeological proof for the last two factors is probably the most difficult, or even impossible, to find.

At Belvédère distinct differences in the used core reduction strategies are described. These technological approaches range from a very well-prepared *Levallois recurrent* reduction at Site C to a more 'wasteful' reduction of non-prepared disc/discoidal cores at Sites F, H and K. Although these differences are 'easy' to spot, they are difficult to quantify. This is amongst others one of the reasons why much time and energy was spent in creating and executing the very detailed lithic analysis (Schlanger and De Loecker 1992; Appendices 1 to 11) in support of the conjoining study.

In the next sections the variation (and resemblance) between the previously described Unit IV findspots (see Chapters 3 and 4) will be studied. However, there are some analytical research limitations concerning this inter-assemblage study which will be discussed first.

5.4.2 *A survey of research limitations*

Before the individual assemblages are compared, we will have to deal with the presence of certain limitations which could influence the outcome of the study. These limitations are especially connected with differences in site preservation, contemporaneity of the artefacts, excavation techniques and the amount of excavated surface. Directly related to the latter is the degree to which empty square metres were incorporated in the analysis. This becomes especially important when mean artefact densities (per square metre) are calculated. Although these limitations are sometimes difficult or impossible to overcome, they have been considered in the analysis. In other words an effort has been made to 'calibrate' the assemblages for comparison.

First of all, the documentation of the archaeological occurrences at Belvédère were always the result of a compromise between the goals of the commercial exploiter of the pit and the research aims. Moreover, from 1986 onwards the emphasis was on the documentation of large surfaces, instead of focusing on a very detailed documentation of small areas. Sites A, B, C, D, F, G and N were excavated using a detailed three-dimensional documentation of the finds, while at Sites H and K the artefacts were recovered in a totally different way. As only a limited period of time was available to excavate, a general documentation of an area as large as possible was chosen. Due to the large quantities and the clustered appearance, finds were collected by metre squares and to a lesser extent (at Site K) by quarters of a metre square. Smaller areas inside these excavated areas were documented three dimensionally, in order to obtain a more detailed picture of the horizontal and vertical distribution of the finds.

Secondly, besides the cultural site formation processes (see later) there are a number of post-depositional factors which may have been responsible for the site differences. The results from different excavated findspots (and geological units) indicate that part of the archaeological data is missing. This applies especially to the organic material. The lower Unit IV-B sediments (Sites B, C and G) contained a large number of faunal remains, while no significant mammal remnants were recovered from the Unit IV-C-ß sites (A, D, F, H, K and N). The latter is mainly a consequence of decalcification of the site matrix.

Thirdly, at some of the Belvédère sites a certain amount of the smaller artefact fraction is missing as well. To evaluate the kind of processes involved, it is necessary to compare the archaeological dataset with complete experimentally produced assemblages. For this analysis the work of Schick (1986, 1987) was consulted.

During the late 1970s and early 1980s Schick and Toth (Schick 1986) performed a series of 107 separate tool manufacturing experiments to develop a set of expectations regarding the characteristics of knapping residues. Hard hammer percussion was used, while the end products of the flaking episodes were artefacts characteristic of Early and Middle Palaeolithic assemblages. Regardless of the stone knapping target or technology a large quantity of flaking debris, in the form of minute, amorphous fragments of shattered or broken flakes, was usually produced in the experimental flaking process. Every sample was screened using a 5 mm mesh sieve. Besides the lost lithic 'dust' or micro-debitage (<1 mm, *cf.* Fladmark 1982), most of the debris (ranging from approximately 60.0% to 75.0%) consisted of the smaller elements of the macro-debitage <20 mm. The largest flakes reached a maximum dimension of ca. 200 mm. Besides some minor variations, the result is remarkably constant for a variety of raw materials. The experiments showed that large quantities of small size debitage result directly from the mechanism of stone fracture during the process of detaching flakes from cores (and/or bifaces): each blow produces not only a flake but also a whole range of fragments as by-products.

If we compare the experimentally collected data of Schick and Toth (Schick 1986) with the Maastricht-Belvédère results, the following statements can be made. The size distribution curves of Sites K, H, and F are essentially identical except for the smaller 'spalls' and some irregularities (see Figure 5.1-A and -B). The 'minor' quantity of artefacts <20 mm, and especially artefacts <10 mm, at Site K (respectively 51.7% and 16.2%) and H (respectively 42.2% and 7.6%) could for a large part be explained by the chosen excavation strategy, *i.e.* finds collected in metres square and in quarters of metre squares. This faster way of excavating also meant a loss of information, including very small artefacts. Besides that, no screening procedures were executed at these findspots (*cf.* Schick 1986). The minor irregularities in the Site H curve can probably be explained by the fact that only a certain area of the cluster was excavated, while a major part of the original assemblage was lost. Also at the well-excavated Site F (three-dimensional recording) only part of the original concentrated flint scatter could be excavated. In general the horizontal distribution of the artefacts does not point to post-depositional sorting processes, as pieces <10 mm randomly occur among the larger ones. Refitting, however, showed that the Site F flint distribution was probably slightly rearranged by fluvial activities. A total of 74.1% of the artefacts has a maximum dimension <20 mm. These are amongst the highest rates at Belvédère. The smaller sized artefacts (36.9% of the artefacts is <10 mm) are more dominant than in Schick's 107 manufacturing experiments. The curve is furthermore nearly identical to Site K and Schick's (1986) experiment. The three-dimensionally recorded Site G also shows a 'Schick-like'

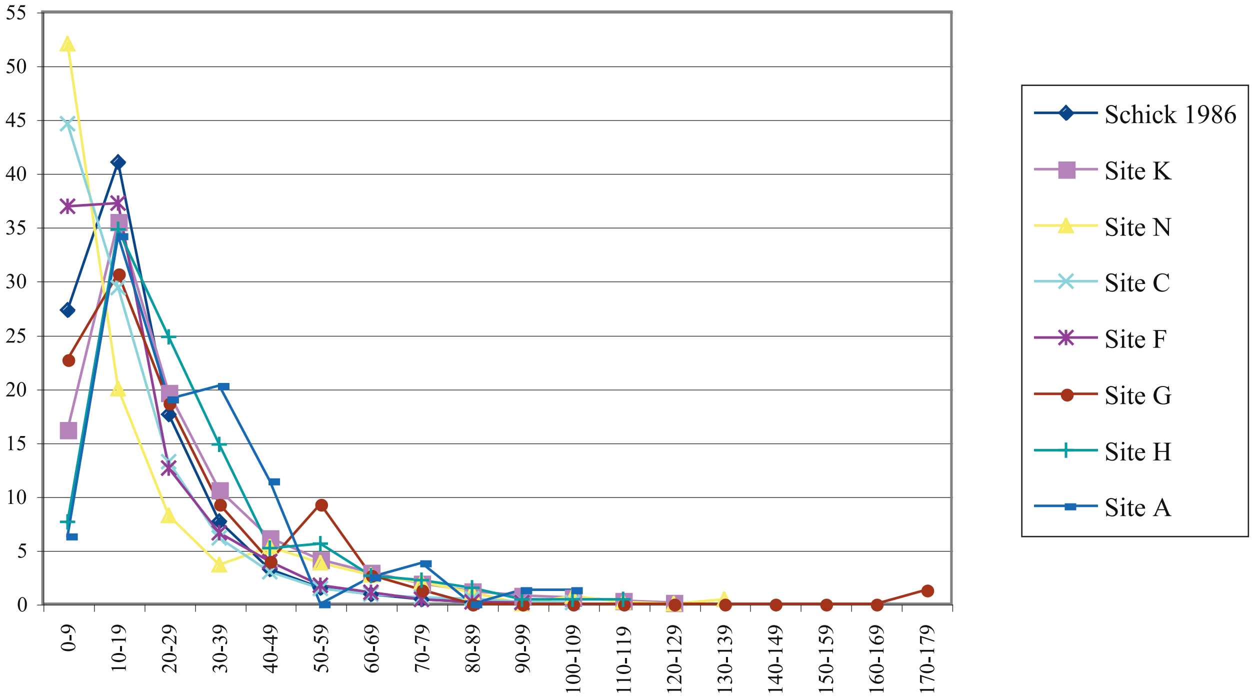
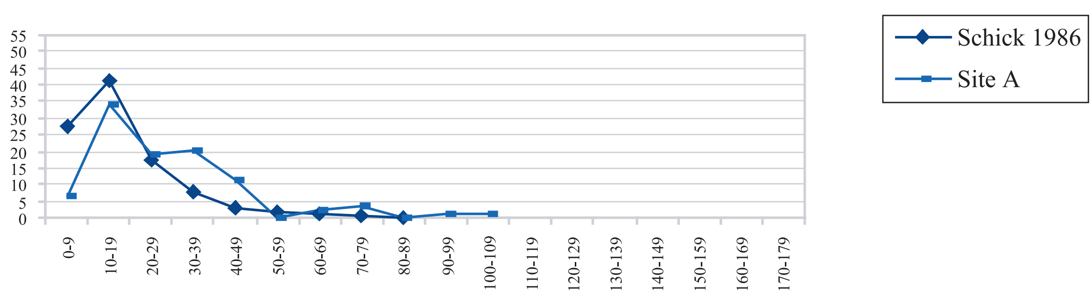
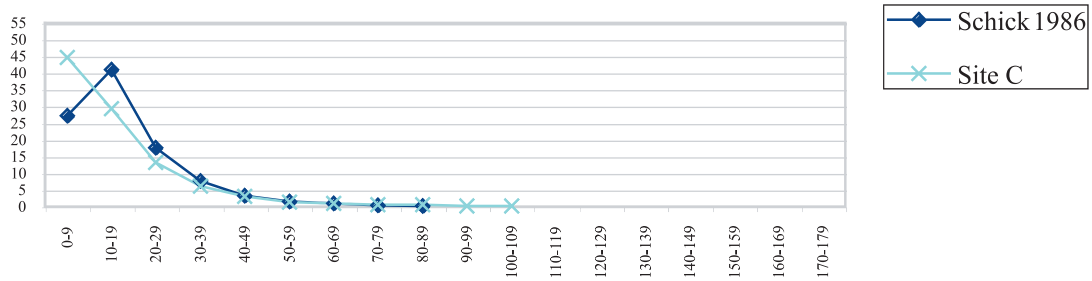


Figure 5.1-A: Maastricht-Belvédère. Size class distribution of some Saalian Unit IV assemblages, without the cores (Sites A, C, F, G, H, K and N). The figures are based on maximum dimensions and compared with the mean size distribution of the 107 experimental flaking residues of Schick and Toth (Schick 1986). For details the reader is referred to Table 5.1-B and Appendices 2 up to 11.





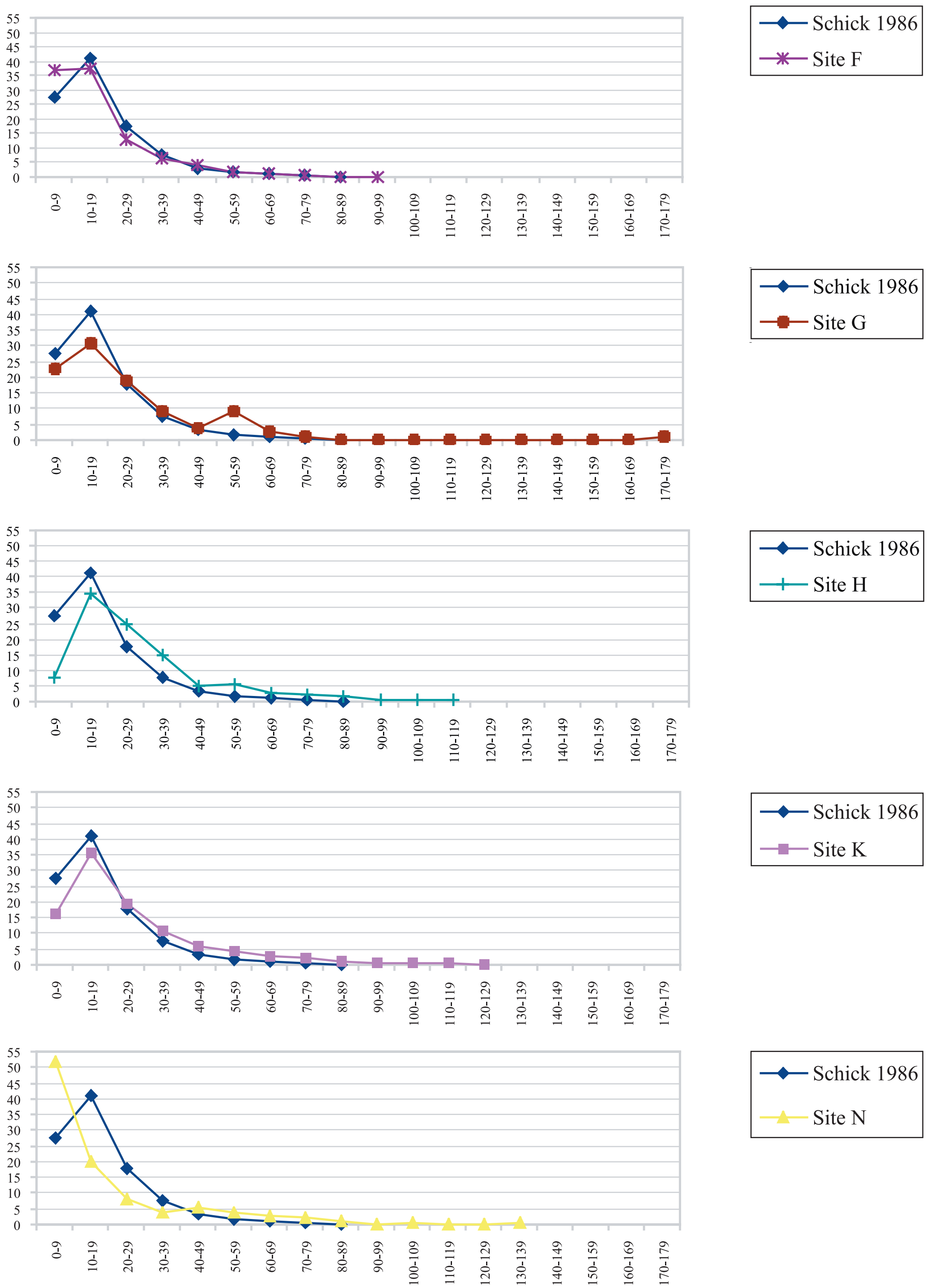


Figure 5.1-B: Maastricht-Belvédère. Size class distribution of the Site A, C, F, G, H, K and N assemblages (presented separately), without the cores. The figures are based on maximum dimensions and compared with the mean size distribution of the 107 experimental flaking residues of Schick and Toth (Schick 1986).

distribution, although the peak of spalls <20 mm (53.4%) and <10 mm (22.7%) is less pronounced. More conspicuous is the fact that flakes measuring about 50 mm (9.3%) represent a second peak in the distribution. Compared to the size distribution of the experiments, Sites C and N (three-dimensionally recorded) show a different curve. The percentages of flakes <20 mm, and especially artefacts <10 mm, are the highest at Belvédère, respectively 74.0% and 44.6% at Site C and 72.0% and 52.0% at Site N. Here flakes <10 mm clearly represent the highest peak in the curve and than the curve drops sharply under 7.0% for artefacts measuring 30 mm or larger. Like Site G, the Site N curve shows some irregularities for flakes measuring >30 mm. In the evaluation of the size variations between Sites F, G, C and N, the excavation technique (being the same) can be left out of consideration. The differences and irregularities (Sites G and N) can therefore possibly be explained in technological or behavioural terms.

Following Schick (1986), the Belvédère assemblages show in general size class distributions which clearly point to loci where fluviatile winnowing processes only 'slightly' influenced the flint occurrences. Besides differences in behavioural activities, part of the variations could have been caused by the amount of excavated surface, *e.g.* partly excavated flint clusters (Sites F and H) *versus* the recording of more 'complete' concentrated flint assemblages (Sites C and K). The used excavation method certainly played a role, but probably a minor one.

Fourthly, the lack of sedimentation episodes between a number of repeated visits (artefact depositions) at the same location precludes a differentiation between several behavioural episodes. Individual flint scatters within a certain findspot may therefore be exclusively the result of one consistent use of a space, or an accumulation of several independent and unrelated 'short' visits over time. A palimpsest scenario is for example assumed for the 'low' find distributions at Sites G and N (Roebroeks *et al*. 1992). Here a complex and cumulative process of discarding flakes, core(s) and tools during several unrelated and 'short' visits is suggested. This is possibly also the case for the larger Site C. Although these finds are more clustered, and therefore show a completely different horizontal distribution than at Sites G and N, we are possibly dealing here with the remnants of several behavioural episodes. Refitting and spatial data showed that at least two phases of flint knapping were chronologically separated by a period of fire (Roebroeks 1988). Only at the large Site K cluster we have some good arguments to suggest that most of the finds were deposited in 'one' consistent and continuous use of the place. Positive proof of 'contemporaneity' is given by the homogeneity of the used technology, typology, the large quantity of inter-locus refits and the 'uniformity' of the intra-site spatial patterning (see Section 3.10.2). Generally, the high resolution Site K assemblage suggests that the findspot was a more 'organized' entity on an 'organised - compound' continuum (*cf*. Kroll and Isaac 1984; Roebroeks 1988). Site C and especially Sites G and N might represent 'compound' entities which could have been accumulated over minutes, hours, months, years or even hundreds of years.

A fifth limitation to analysis is related to the differences in the amount of excavated surface. Due to commercial quarrying, most of the Belvédère flint scatters were excavated under considerable time pressure. This sometimes resulted in the frustrating fact that only parts of certain flint clusters could be excavated, while other rich areas of the same findspot were quarried away. A loss of information due to time pressure was for example experienced at Site K and especially at Sites H and F (and the Weichselian Site J; Roebroeks *et al*. 1987*a* and *b*, 1997). In general it can be stressed that when more or larger (fewer or smaller) surfaces had been excavated, the analytical outcome would probably have been different. This applies to Sites A, B, D, 'July 1990', L, M, O and Site N (Level X) not only regarding the quantity of recovered finds but also regarding the recorded spatial patterns. It can therefore be suggested that for the latter findspots the presented site interpretations are directly related to the small amount of excavated surface. It also has to be mentioned that, regardless of the quantity of artefacts, every excavated metre square (or part of it) was incorporated in the site analysis.

5.4.3 Inter-assemblage variability: a comparison of the data

5.4.3.1 Introduction

The long-lasting excavations at Maastricht-Belvédère provided a unique opportunity to examine the nature of variation, in terms of technology, typology and spatial distribution, within the local Saalian record. Moreover, the 'controlled' excavation strategies ensured rather good artefact recovery, justifying a comparison of the several assemblages. It has already been explained in Section 5.4.2 that we have to be careful, however, with comparing quantities or size distributions, as some of the sites were excavated under much more time pressure than others.

In order to 'tackle' the inter-site differences in a less 'impressionistic' way, the recovered assemblages were submitted to a very detailed and systematic lithic analysis (Schlanger and De Loecker 1992; Appendices 1 to 11). Tables 5.1 to 5.20 give a detailed overview of the assemblage quantities, mean measurements and ratios. Moreover, these tables clearly provide and quantify the evidence for fine-tuned inter-site differences.

An important factor contributing to this inter-assemblage variability seems to be transport of lithics between certain areas (sites). At almost all excavated surfaces a number of transported cores, blanks and/or tools has been used(?) and/or discarded in combination with on-site produced items. Some of the findspots show a high percentage of artefacts made on locally procured raw materials (Sites F, H and K), while at other 'sites' large quantities of flakes were produced from transported cores (Site C). At yet other assemblages the artefacts consist only of transported flint and the local knapping activities were limited (Sites G and N). This illustrates the fact that also within the assemblages there may be a considerable amount of variability. Especially the Site C analysis demonstrated that various flint nodules were reduced by means of different core approaches (a *débitage Levallois recurrent versus* a disc/discoidal core reduction). Moreover these flaking modes seem to have been executed on distinct flint 'qualities' ('fine' *versus* 'coarse' grained). All this may reflect different ways of organizing flint working in anticipation of given problems at certain localities. Although these internal variations are well documented in the several site publications (*cf*. Roebroeks 1988; Schlanger 1994; De Loecker 1992), they become more blurred when we start comparing assemblages with one another. This is especially the case where mean measurements and ratios are used for a general characterization of the lithic material. It can also be seen as another limitation of this specific study (see also Section 5.4.2).

In the next sections the Saalian Belvédère assemblages are compared and the inter-site differences, or resemblances, will be described. This part of the analysis starts with an examination of the basic site variations. Subsequently, we will focus on debitage specific differences, while a tool-orientated comparison is presented in a following section. It also has to be mentioned that data recovered from the small-scale excavations, test pits and section finds will only be used sporadically. These assemblages contain very low numbers of artefacts. This applies to Sites A, B, D, L, M, O, N (Level X), and the 'July 1990' test pit.

5.4.3.2 Comparison of the basic assemblage variations. As mentioned before, the Unit IV assemblages were geologically 'sealed' by more or less the same sedimentary regimes: they were recovered from fluvial low-energy deposits. Although there are some 'conservation' differences (*cf*. Site F *versus* Site K), it can generally be stated that the Saalian find distributions were subjected to minimal post-depositional disturbance. The excavated find configurations might therefore reflect different spatial aspects of technology. If we compare the Belvédère assemblages, distinct differences in the horizontal 'lay-out' of the recovered find distributions are noticed. For illustrations of the spatial distribution maps of the several excavated surfaces the reader is referred to Roebroeks (1988), Roebroeks *et al*. (1992) and Chapter 3 (*i.e*. Site K). First there are a number of findspots with dense clustered appearances of archaeological remains. Some of these consist of 'one' large find concentration, like at Sites F and K and possibly also at Site H, while others (Site C) are composed of several 'smaller' clusters situated at close distance to one another. The assemblage sizes vary between 1,177 artefacts at Site F, 3,067 pieces at Site C, to 10,912 finds at Site K (Table 5.1). The quantity for Site H is considerably lower (270 artefacts). At most of these findspots, however, only part of the cluster(s) were excavated. The mean artefact densities for these surfaces can be described as relatively high (Table 5.1). They range from 11.6 artefacts per metre square at Site C to 29.5 and 28 artefacts at respectively Sites K and F. The average artefact density for Site H is 5. Divided into different typological groups (chips <30 mm, flakes, blade-like flakes, chunks, burned artefacts, cores, 'core trimming elements' and tools) these clustered artefact appearances still result in the highest mean densities. Generally it seems that Sites K and F, directly followed by Site C, always show the highest values at Belvédère. The densities for Site H are slightly lower. The mean tool density at Site C is more in line with the Site N distribution.

A completely different kind of artefact configuration was excavated at Sites G and N (respectively 75 and 450 artefacts). Here the horizontal distribution shows no clear clustered appearance of archaeological remains. The finds were recovered as isolated items, or as very small groups which sporadically could be conjoined (*cf*. Site N). Seemingly no major changes would have occurred in the spatial patterns if we had excavated larger or more areas of this type (Roebroeks *et al*. 1992). The mean artefact densities per metre square at Site G (1.5), and especially at Site N (ca. 0.6), are the lowest within the Saalian Belvédère sample (Table 5.1). The figure for the 'July 1990' test pit (ca. 2.1) is somewhat higher. For the different typological groups the same low density patterns are described: Site N, followed by Site G, scoring the lowest values. The average Site G tool density is, however, comparable to the ones of Sites F and H.

Generally it can be stated that Site N and Site K represent two ends of a continuum of artefact densities. More details on the mean densities of different find categories can be found in Table 5.1.

Before the Belvédère assemblages are further compared, in terms of distinct quantitative and technological differences, some remarks regarding the used raw materials will be made. At all Unit IV findspots the majority of recovered artefacts show fluvially abraded cortex, indicating that the raw materials were probably collected from nearby river deposits (Roebroeks 1988). According to specific properties, like texture, cortex, fossil inclusions and 'colour', a relatively

Site	Area dug (m^2)	Total number of artefacts	Density per square metre						
			Total number of artefacts	Chips <30 mm	Flaked artefacts ≥30 mm	Flakes	Blade-like flakes	Chunks	Burned artefacts
A	5	80[2]	16.0/6.8	9.4	6.4	6.0	0.2	0.2	0.2
B	20	6	0.3	–	0.3	0.25	0.05	–	–
C	264	3,067	11.61	10.11[3]	1.5[3]	1.48[3]	–[4]	0.071[4]	0.5[4]
D	–	11	–	–	–	–	–	–	–
F	42	1,177	28.0	24.28	3.69	3.19	0.14	0.35	0.35
G	50[1]	75	1.5/1.22	1.06/0.89	0.44/0.36	0.4/0.32	0.02/0.016	0.02/0.016	–
H	54	270	5.0	3.33	1.66	1.55	0.055	0.055	0.018
K	370	10,912	29.49	20.96	8.27	8.01	0.17	0.091	1.66
N	765	450	0.58	0.47	0.11	0.11	0.0013	–	0.0013
July ’90	7	15	2.14	1.14	1.0	1.0	–	–	–
L	–	8	–	–	–	–	–	–	–
M	–	44	–	–	–	–	–	–	–
O	–	10	–	–	–	–	–	–	–
Site N: Level X	–	29	–	–	–	–	–	–	–
Section finds	–	67	–	–	–	–	–	–	–

Site	Area dug (m^2)	Total number of artefacts	Density per square metre					
			Cores	Core Trimming Elements *sensu sticto*	Tools	Tools *sensu stricto*	Long Sharpening Flakes	Transversal Sharpening Flakes
A	5	80[2]	0.2	0.4	0.4	0.2	–	0.2
B	20	6	–	–	–	–	–	–
C	264	3,067	0.015[3]	0.05[4]	0.087	0.018	–	–
D	–	11	–	–	–	–	–	–
F	42	1,177	0.047	0.12	0.19	0.071	–	–
G	50[1]	75	–	–	0.16/0.13	0.06/0.049	–	0.02/0.016
H	54	270	–	–	0.19	0.074	–	–
K	370	10,912	0.25	0.27	0.37	0.3	0.0027	0.0027
N	765	450	0.0013	0.0026	0.033	0.016	–	–
July ’90	7	15	–	–	0.14	0.14	–	–
L	–	8	–	–	–	–	–	–
M	–	44	–	–	–	–	–	–
O	–	10	–	–	–	–	–	–
Site N: Level X	–	29	–	–	–	–	–	–
Section finds	–	67	–	–	–	–	–	–

Table 5.1: Maastricht-Belvédère. A comparison (basic count) of the Unit IV primary context sites and section/test pit assemblages.

[1] The excavated Site G area together with the test pit measures 61 m^2.
[2] Within the excavated Site A area only 34 artefacts were found.
[3] Site C figures after Roebroeks (1988; n= 3,067).
[4] Site C figures after Schlanger’s sample (1994; n= 1,438).

homogeneous group of Rijckholt/Valkenburg-like flint dominates the assemblages. Moreover, part of these artefacts show a heavy patination. As a result it was very difficult, or even impossible, to ascribe individual artefacts to specific flint nodules (or types), unless refitting was involved (*cf*. Sites C, F, H and K). Generally, only few artefacts from the Belvédère sample deviate from this main flint characterization. For example at Site K, a number of items (mainly tools) were produced on 'exotic' flint[1], an assessment supported by the negative refitting results. These items were interpreted as imported. More striking are the results of raw material analyses at Sites G and N. At these 'low density' find distributions many artefacts represent different flint nodules/types. These assemblages are therefore very heterogeneous in raw material composition and show a wide variety of colour, texture, inclusions and cortex. Moreover, the refitting percentages (*Aufeinanderpassungen*, *cf*. Cziesla 1986, 1990; see later) are strikingly low and the completely excavated assemblages are interpreted as transported.

Although the 'exotic' artefacts at Belvédère are interpreted as imported items, it gives only little, or no, information on transport distances. In general the Pleistocene gravel beds of the river Meuse contain pebbles of several different flint types, *e.g*. Rijckholt and Valkenburg, and may have included the 'exotics'.

5.4.3.3 Debitage specific inter-assemblage variations

Except for some possible soft hammer flakes at Site C (Roebroeks 1988), the complete Saalian Unit IV assemblage represents hard hammer percussion. Moreover, technology was only orientated towards the reduction of cores or better towards the production of flakes. Evidence for the use of a bifacial technology is completely absent, as no handaxes or handaxe-related artefacts ('handaxe sharpening flakes', tranchet flakes) were recovered. In that sense the Belvédère data is rather homogeneous. The detailed inter-site analysis shows, however, that between the several assemblages there are some fine-grained differences with regard to the various characterizations of flint debitage.

As mentioned before some excavated surfaces contain higher mean densities of artefacts than others (*e.g*. Sites F and K *versus* G and N). When we examine the percentages of flaked artefacts ≥30 mm, a difference between Sites H, G and K, on the one hand, and Sites N, F and C, on the other, is noticed (Table 5.2). The first group of findspots shows values between 28.1% at site K and 33.3% at Site H. For Site N the quantity of flaked artefacts ≥30 mm is only 19.9%, while at Sites F and C the numbers are considerably lower (respectively 13.2% and 12.8%). These differences in percentages are for a major part the result of the presence, or absence, of large quantities of chips <30 mm. Especially the very small sized debitage (<10 mm) seems to influence the variability. The latter is very common at Sites F, C and N (respectively 36.9%, 44.6% and 52%), while rather 'scarce' at Sites G (22.7%), K (16.2%) and H (7.6%). This is partly a consequence of the excavation strategy. For more details on the size class distributions the reader is referred to Section 5.4.2 and Figure 5.1.

Table 5.2 also shows that when only flakes ≥30 mm are studied (excluding the blade-like flakes and chunks), the same variation between the same groups of assemblages can be described. Due to the small numbers of blade-like flakes and chunks the figures are probably not sufficient for a meaningful inter-site comparison. At most it can be said that these items mainly occur at the clustered find occurrences where there are high densities of flaking debris, *e.g*. at Sites C and H, and mainly at Sites F and K. They can therefore be interpreted as 'lucky shots' and errors which appeared during core reduction. The limited number of 'blades' also indicate that technology at Belvédère was certainly not orientated towards a *débitage laminaire* (*cf*. Révillion and Tuffreau 1994).

Generally, very few cores and/or 'core trimming elements' were recovered from the Saalian find occurrences (Table 5.2). If these artefacts were found at all, they appear mainly at the 'high density' distributions. The numbers vary between 1 and 4 for cores and 2 and 5 for 'core trimming elements'. As an exception Site K has to be mentioned. Here a total of 91 (0.8%) cores and 101 (0.9%) 'core trimming elements' was excavated.

For tools the situation seems to be completely different. Although the highest number of tools was found at Site K (n= 137), they represent one of the lowest percentages at Belvédère (1.3%). Only at Sites C and F are the values lower (each 0.7%). Conspicuously, the highest tool percentages are found in the 'low density' Site N and G artefact distributions (respectively 5.6% and 10.7%). The Site H data occupies an intermediate position. A comparable distribution applies to tools *sensu stricto* as well as for pieces with macroscopic signs of use. Site G, followed by Site N, always shows the highest percentages (see Table 5.2 for more details).

A different approach to these specific inter-site variations is given by the calculated ratios. Table 5.3 shows that the lowest tool/waste ratios are represented by the 'low density' find distributions at Sites G (1:8) and N (1:16), while the 'high density' clusters have a considerably higher ratio. The numbers vary between 1:79 for Site K to 1:146 for Site F. The Site H ratio (1:26) again occupies an intermediate position between the two previously mentioned groups. A nearly identical distribution is given for the tool *sensu stricto*/waste ratios (see Table 5.3). Due to the large quantity of cores, Site K shows the lowest core/waste ratio (1:117), while the figures for Sites N, F and C are respectively 1:423, 1:584 and 1:760. Moreover the 'high density' Site K, F and C findspots clearly have the lowest core/tool ratios:

Site	Area dug (m^2)	Total number of artefacts	Chips <30 mm		Flaked artefacts ≥30 mm		Flakes		Blade-like flakes		Chunks		Burned artefacts	
			n	%	n	%	n	%	n	%	n	%	n	%
A	5	80[2]	47	58.8	32	40.0	30	37.5	1	1.3	1	1.3	1	1.3
B	20	6	–	–	6	100.0	5	83.3	1	16.7	–	–	–	–
C	264	3,067[3]	2,670[3]	87.1[3]	393[3]	12.8[3]	393[3]	12.8[3]	–	–	–[3]	–[3]	132[3]	4.3[3]
		1,438[4]	972[4]	67.6[4]	462[4]	32.1[4]	443[4]	30.8[4]	–	–	19[4]	1.3[4]	–[4]	–[4]
D	–	11	3	27.3	7	63.6	7	63.6	–	–	–	–	–	–
F	42	1,177	1,020	87.7	155	13.2	134	11.4	6	0.5	15	1.3	15	1.3
G	50[1]	75	53	70.0	22	29.9	20	26.7	1	1.3	1	1.3	–	–
H	54	270	180	66.7	90	33.3	84	31.1	3	1.1	3	1.1	1	0.4
K	370	10,912	7,758	71.1	3,063	28.1	2,966	27.2	63	0.6	34	0.3	617	5.7
N	765	450	361	80.2	88	19.9	87	19.3	1	0.2	–	–	1	0.2
July '90	7	15	8	53.3	7	46.7	7	46.7	–	–	–	–	–	–
L	–	8	5	62.5	3	37.5	3	37.	–	–	–	–	–	–
M	–	44	15	34.1	29	65.9	26	59.1	3	6.8	–	–	–	–
O	–	10	3	30.0	7	70.0	7	70.0	–	–	–	–	–	–
Site N: Level X	–	29	9	31.0	16	55.2	20	69.0	–	–	–	–	–	–
Section finds	–	67	24	35.8	42	62.7	40	59.7	2	3.0	–	–	–	–

Site	Area dug (m^2)	Total number of artefacts	Cores		Core Trimming Elements *sensu stricto*		Tools		Tools *sensu stricto*		Macroscopic signs of use		Long Sharpening Flakes		Transversal Sharpening Flakes	
			n	%	n	%	n	%	n	%	n	%	n	%	n	%
A	5	80[2]	1	1.3	2	2.5	2	2.5	1	1.3	1	1.3	–	–	1	1.3
B	20	6	–	–	–	–	–	–	–	–	–	–	–	–	–	–
C	264	3,067[3]	4[3]	0.1[3]	–[3]	–[3]	23[5]	0.7[5]	5[5]	0.2[5]	18[5]	0.6[5]	–[5]	–[5]	–[5]	–[5]
		1,438[4]	4[4]	0.3[4]	12[4]	0.4[4]										
D	–	11	1	9.1	–	–	–	–	–	–	–	–	–	–	–	–
F	42	1,177	2	0.2	5	0.4	8	0.7	3	0.3	5	0.4	–	–	–	–
G	50[1]	75	–	–	–	–	8	10.7	3	4.0	5	6.7	–	–	1	1.3
H	54	270	–	–	–	–	10	3.7	4	1.5	6	2.2	–	–	–	–
K	370	10,912	91	0.8	101	0.9	137	1.3	111	1.0	26	0.2	1	0.01	1	0.01
N	765	450	1	0.2	2	0.4	26	5.6	12	2.7	14	3.1	–	–	–	–
July '90	7	15	–	–	–	–	1	6.7	1	6.7	–	–	–	–	–	–
L	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–
M	–	44	–	–	–	–	3	6.8	2	4.5	1	2.3	–	–	–	–
O	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Site N: Level X	–	29	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Section finds	–	67	1	1.5	–	–	4	5.9	3	4.5	1	1.5	–	–	–	–

Table 5.2: Maastricht-Belvédère. A comparison (basic count) of the Unit IV primary context sites and section/test pit assemblages.

[1] The excavated Site G area together with the test pit measures 61 m^2.
[2] Within the excavated Site A area only 34 artefacts were found.
[3] Site C figures after Roebroeks (1988; n= 3,067).
[4] Site C figures after Schlanger's sample (1994; n= 1,438).
[5] Site C figures after this lithic exercise. The percentages are calculated according to Roebroeks' (1988) total number of artefacts.

Area		Number of artefacts					Ratio			
Site	Area dug (m^2)	All tools and fragments	Tools and fragments *sensu stricto*	Cores	Flakes and chips	Total	Tool: waste	Tool *sensu stricto*: waste	Core: waste	Core: tool
A	5	2	1	1	77	80[2]	1:39	1:78	1:77	1:2
B	20	–	–	–	6	6	–	–	–	–
C	264	23	5	4	3,040	3,067[3]	1:132	1:609	1:760	1:6
D	–	–	–	1	10	11	–	–	1:10	–
F	42	8	3	2	1.167	1,177	1:146	1:389	1:584	1:4
G	50[1]	8	3	–	67	75	1:8	1:22	–	–
H	54	10	4	–	260	270	1:26	1:65	–	–
K	370	137	111	91	10,684	10,912	1:79	1;97	1:117	1:2
N	765	26	12	1	423	450	1:16	1:35	1:423	1:26
July '90	7	1	1	–	14	15	1:14	1:14	–	–
L	–	–	–	–	8	8	–	–	–	–
M	–	3	2	–	41	44	1:14	1:21	–	–
O	–	–	–	–	10	10	–	–	–	–
Site N: Level X	–	–	–	–	29	29	–	–	–	–
Section finds	–	4	3	1	62	67	1:16	1:21	1:62	1:4

Table 5.3: Maastricht-Belvédère. A comparison (basic count and ratios) of the Unit IV primary context sites and section/test pit assemblages.

[1] The excavated Site G area together with the test pit measures 61 m^2.
[2] Within the excavated Site A area only 34 artefacts were found.
[3] Site C figures after Roebroeks (1988; n= 3,067).

respectively 1:2, 1:4 and 1:6. For the ‘low density’ Site N assemblage the value is slightly higher (1:26).

Inter-assemblage variations are also notable when the mean metrical data is compared (Table 5.4). According to the average maximum dimensions for flakes ≥30 mm, the ‘low density’ Site G, and especially the Site N scatter, show the largest measurements (respectively 52.1 mm and 57 mm). At Site K the mean value (51.5 mm) is comparable to the one of Site G, while for the other ‘high density’ patches the figures are lower: between 48.5 mm at Site C and 44.5 mm at Site F.

A nearly identical distribution is given for the mean length of all (and all complete) flakes ≥30 mm. The latter table also shows that the complete Site G flakes are on average somewhat larger than the Site N ones (see Table 5.4 for details). Except for Site K (39.6 mm), the widest flakes are again described at the ‘low density’ Site N and G findspots, respectively 38.7 mm and 37.6 mm. The average Site H, F and C values are between 32.8 mm and 31.7 mm.

Sites K (11.1 mm) and N (9.3 mm) furthermore show the highest mean measurements for thickness, while the thinnest means were recorded at Site G (8.6 mm) and Site C (7.2 mm). Generally it can be concluded that the ‘low density’ scatters show the largest mean measurements, directly followed by the ‘high density’ Site K findspot. The average measurements for the other patches are somewhat smaller. The mean measurements for the section finds are among the highest values at Belvédère (Table 5.4). Compared with Sites G and N, this could indicate that most of these flakes represent the isolated remnants of the continuous and widespread ‘low density’ scatter of artefacts. Moreover, if these ‘low density’ find distributions are correctly interpreted as mainly transported ‘toolkits’, the emphasis was clearly on the use of large and wide flakes.

Table 5.5 shows the mean flake volume, the elongated index and the massivity index, which are calculated using the average measurements of Table 5.4. The table indicates that Site K, directly followed by Sites N and G, has the most voluminous flakes (respectively 1960.4 mm^3, 1846.3 mm^3 and 1484.2 mm^3). The flake volumes for Sites F and H are nearly identical, while the Site C flakes show the smallest volume (947.2 mm^3). The elongated index shows on the one hand that the ‘low density’ Site N (132.6) and G (122.1) scatter, together with Site C (130.9), have the highest values. The Site K patch, on the other hand, is represented by the lowest index (112.6). The massivity index gives a totally different picture. The ‘high density’ Site K, F and H assemblages represent the highest values (respectively 24.9, 23.5 and 23.4), while the figures for Sites G and N are considerably lower (18.7 and 18.1). The Site C massivity index is one of the lowest at Belvédère (17.3). The mean flake volume, elongated index and massivity index of the section finds are again amongst the highest.

The cortex percentages for all flakes (Table 5.6) also show a clear difference between the ‘high’ and ‘low density’ artefact distributions. At Sites C, H and K the percentages range respectively from 16.6% and 21.5% to 32.2%. The figures for Sites N (15.4%) and G (12%) are amongst the lowest in the Belvédère sample. Only the Site F ‘high density’ distribution can be seen as an exception (11.6%). For flakes with 25% cortex or more the lowest percentages are again recorded at Sites G (5.3%) and N (4.9%), while Site K still has the highest percentage (14.8%). If after decortication the raw material at Site K had been dealt with more ‘economically’ (smaller and thinner flakes), the percentage of cortex flakes would have been remarkably smaller. Compare for example the non-cortex/cortex flake-index of Site K (2.1) with that of Site C (5.0). At the latter findspot, the ‘same’ humans under very similar conditions obviously dealt with the raw material in a different and less wasteful way. The index differences between Site K and the ‘low density’ scatters at Sites N (5.5) and G (7.3) can largely be explained by the presence or absence of flaking activities, and specifically the primary flint knapping (decortication) stages. The cortex percentages for all flakes ≥30 mm show in general the same distribution as for all artefacts. As a exception Site N can be mentioned. This assemblage represents one of the highest figures (36.3%) at Belvédère. However, most of these flakes have less than 25% cortex. For more details the reader is referred to Table 5.6.

A differentiation between ‘high’ and ‘low’ density scatters is also described for the amount of natural fissure surfaces on flakes (Table 5.6). Percentage-wise these fissures, already present in the flint before knapping, appear most frequently at Sites F, H and K (respectively 42%, 38.9% and 25.9%), while lower values were recorded at Site G (22.7%) and especially at Site N (5.7%). According to Schlanger’s sample, natural fissures appear only sporadically at Site C (2.7%). Only the ‘high density’ patches (Sites K, H, F and C) consist of flakes with more than 25% natural fissures. Altogether the high percentages of rather ‘fresh’ natural fissures could be indicative of an unselective choice of raw material or a lack of ‘high’ quality raw material. The fact that the lowest percentages were described at the ‘low density’ findspots could, on the one hand, be explained by the absence of major flaking activities. On the other hand it could suggest that better quality blanks were selected for transport and/or use. Transportation of ‘good’ quality raw materials could probably also explain the low natural fissure percentage at Site C.

Site	Mean measurements of flakes ≥30 mm									
	Maximum dimension		Length		Length complete flakes		Width		Thickness	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	45.3	18.9	41.2	19.6	44.4	23.1	32.2	13.0	8.5	5.0
B	51.8	13.0	49.5	12.7	50.3	4.9	33.5	12.5	8.3	2.9
C	48.5[1]	18.5[1]	41.5[1]	21.1[1]	41.6[1]	21.9[1]	31.7[1]	15.9[1]	7.2[1]	5.3[1]
D	38.3	5.6	35.0	6.1	33.5	5.3	28.0	7.2	5.7	2.5
F	44.5	12.7	38.8	13.0	41.8	13.1	32.2	11.4	9.1	5.8
G	52.1	29.7	45.9	32.3	58.3	41.9	37.6	18.2	8.6	5.0
H	48.0	18.7	38.4	20.9	45.1	16.5	32.8	15.7	9.0	6.0
K	51.5	20.4	44.6	20.2	48.9	21.4	39.6	16.7	11.1	7.1
N	57.0	22.0	51.3	24.4	55.8	20.0	38.7	14.4	9.3	4.3
July '90	47.7	8.8	45.1	9.0	43.2	10.1	28.3	6.8	7.0	3.4
L	40.3	14.4	38.7	15.9	29.5	0.7	29.3	11.0	6.0	2.0
M	49.9	23.1	44.8	25.6	48.1	34.5	36.9	10.8	7.9	3.2
O	55.1	21.3	53.2	25.6	48.1	31.2	48.7	12.3	14.2	7.5
Site N: Level X	52.2	14.9	44.2	15.7	44.3	16.7	44.9	16.0	12.1	6.6
Section finds	55.7	18.7	50.4	19.5	56.1	20.2	41.1	13.1	11.6	6.4

Table 5.4: Maastricht-Belvédère. A comparison of the average measurements of the Unit IV primary context sites and section/test pit assemblages. S.D. stands for standard deviation.

[1] Site C figures after Schlanger's sample (1994; n= 1,438).

Site	Flakes ≥30 mm		
	Mean flake volume[1] (mm^3)	Elongated index[2]	Massivity index[3]
A	1127.6	128.0	20.6
B	1376.3	147.8	16.8
C	947.2[4]	130.9[4]	17.3[4]
D	558.6	125.0	16.3
F	1136.9	120.5	23.5
G	1484.2	122.1	18.7
H	1133.6	117.1	23.4
K	1960.4	112.6	24.9
N	1846.3	132.6	18.1
July '90	893.4	159.4	15.5
L	680.3	132.1	15.5
M	1306.0	121.4	17.6
O	3679.0	109.2	26.7
Site N: Level X	2401.3	98.4	27.4
Section finds	2402.9	122.6	23.0

Table 5.5: Maastricht-Belvédère. A comparison of the mean flake volume, the elongated index and the massivity index of the Unit IV primary context sites and section/test pit assemblages. The calculations are based on the figures in Table 5.4.

1 Length x Width x Thickness.
2 (Length x 100)/ Width.
3 (Thickness x 100)/ Length.
4 Site C figures after Schlanger's sample (1994; n= 1,438).

Table 5.7 shows that the highest percentages of broken flakes ≥30 mm are recorded at Sites N, H and K, respectively 64.6%, 59.9% and 57.5%. The percentages at Sites G and F are about 10% lower, while only one fourth (24.4%) of the Site C sample is described as broken. The section finds results are once more in line with the Site N percentages. The table also clearly indicates that for all Belvédère assemblages, the distal flake part is most frequently missing, while the angle of percussion is mostly ≥120°. As an exception Site C can be mentioned where the angle is generally between 100° and 119°. For details on the angle of percussion one is referred to Table 5.7.

Although a plain butt dominates in nearly all Belvédère assemblages, the flakes from the 'low density' scatters (Sites N and G), together with the Site C ones, show most frequently a prepared butt. The *Index Facettage* (IF) and *Index Facettage stricte* (IFs) for flakes ≥30 mm indicate that facetted butts are very common at Site C, respectively 50.4 and 43.7. The indexes at Sites N (IF= 27.3, IFs= 21.6) and G (IF= 22.7, IFs= 13.6) are still considered high, while for the 'high density' Site H and K assemblages lower values are recorded (respectively, IF= 20, IFs= 8.9 and IF= 18.1, IFs= 4). The almost complete lack of facetted butts at Site F (IF= 12.8, IFs= 1.2) compared to the all-over presence at Site C clearly illustrates the 'absence' of major core (flake) preparation stages at the first assemblage. The Indexes for flakes ≥50 mm show generally the same distribution as for flakes ≥30 mm. Site C followed by Sites G and N show the highest indexes, while the lowest figures are again recorded at Site F (see Table 5.8 for further details). This table also shows that at the 'low density' scatters the lowest percentages of dorsal preparation near the butts is recorded (2.7% for Site G and 6.7% for Site N). The highest percentages are now recorded at Sites H (10%), K (9.6%) and F (9%). For Site C no data was available.

The data on the dorsal surface preparation shows that a 'parallel' unidirectional pattern appears most frequently in

Site	All flakes					All flakes ≥30 mm									
	Cortex		25% or more cortex		Non-cortex/ cortex ratio	Cortex		25% or more cortex		Non-cortex/ cortex ratio	Natural fissures		25% or more natural fissures		Non-natural fissure/ natural fissure ratio
	n	%	n	%		n	%	n	%		n	%	n	%	
A	31	39.2	14	17.7	1.5	20	62.5	8	25.0	0.6	10	31.3	4	12.5	2.2
B	2	33.4	2	33.4	2.0	2	33.4	2	33.4	2.0	3	50.0	2	33.4	1.0
C	509[1]	16.6[1]	?[1]	?[1]	5.0[1]	?[1]	?[1]	?[1]	?[1]	?[1]	–[1]	–[1]	–[1]	–[1]	–[1]
	325[2]	22.7[2]	144[2]	10.1[2]	3.4[2]	193[2]	41.8[2]	87[2]	18.9[2]	1.4[2]	13[2]	2.7[2]	5[2]	1.0[2]	33.8[2]
D	2	20.0	–	–	4.0	1	14.3	–	–	–	–	–	–	–	0
F	136	11.6	69	5.9	7.6	37	23.9	19	12.3	3.2	65	42.0	37	23.9	1.4
G	9	12.0	4	5.3	7.3	5	22.7	1	4.5	3.4	5	22.7	–	–	3.4
H	58	21.5	17	6.3	3.7	28	31.1	11	12.2	2.2	35	38.9	18	20.0	1.6
K	3,498	32.2	1,596	14.8	2.1	1,636	53.3	731	23.8	0.9	791	25.9	335	11.0	2.9
N	69	15.4	22	4.9	5.5	32	36.3	7	7.9	1.8	5	5.7	–	–	16.6
July '90	12	80.1	6	40.1	0.3	6	85.8	3	42.9	0.2	1	14.3	–	–	6.0
L	4	50.0	–	–	1.0	2	66.7	–	–	0.5	–	–	–	–	0
M	13	29.5	6	13.0	3.4	10	34.5	6	20.7	1.9	1	3.4	–	–	28.0
O	4	40.0	3	30.0	1.5	4	57.2	3	42.9	0.8	3	42.9	1	14.3	1.3
Site N: Level X	7	24.0	2	6.8	3.1	6	37.6	2	12.6	1.7	9	56.3	2	12.5	0.8
Section finds	30	45.4	10	15.1	1.2	23	54.8	7	16.6	0.8	9	21.4	5	11.9	3.7

Table 5.6: Maastricht-Belvédère. A comparison (technological information) of the Unit IV primary context sites and section/test pit assemblages.

[1] Site C figures after Roebroeks (1988; n= 3,067).
[2] Site C figures after Schlanger's sample (1994; n= 1,438).

Sites	All flakes ≥30 mm					
	Broken Flakes		Complete/broken ratio	Most frequently missing part	Most frequently appearing angle	Angle of the largest flakes
	n	%				
A	12	37.5	1.7	Proximal	120°-130°	110°-119°
B	2	33.3	2.0	Distal	>130°	>130°
C	–[1]	–[1]	–[1]	–[1]	–[1]	–[1]
	113[2]	24.4[2]	2.8[2]	Distal, proximal[2]	100°-109°, 110°-119°[2]	–[2]
D	3	42.9	1.3	Distal	120°-130°	–
F	76	48.9	0.9	Distal	>130°	120°-130°, >130°
G	11	49.9	0.9	Distal + proximal	>130°	110°-119°, >130°
H	54	59.9	0.5	Distal	120°-130°	110°-119°
K	1,766	57.5	0.6	Distal	>130°	>130°
N	57	64.6	0.5	Distal	120°-130°	>130°
July '90	2	28.6	2.5	Distal, distal + proximal	120°-130°	120°-130°
L	1	33.3	2.0	Lateral	110°-119°, 120°-130°, >130°	–
M	17	58.6	0.7	Distal	120°-130°	110°-119°
O	3	42.9	1.0	Distal	>130°	120°-130°
Site N: Level X	8	50.0	1.0	Distal, proximal, lateral, more than one side	>130°	110°-119°
Section finds	26	61.9	0.6	Distal	>130°	120°-130°

Table 5.7: Maastricht-Belvédère. A comparison (technological information) of the Unit IV primary context sites and section/test pit assemblages.

[1] Site C figures after Roebroeks (1988; n= 3,067).
[2] Site C figures after Schlanger's sample (1994; n= 1,438).

Sites	All flakes ≥30 mm							
	Most frequent butt	IF ≥30 mm	IFs ≥30 mm	IF ≥50 mm	IFs ≥50 mm	Dorsal preparation near butt		Most frequent dorsal preparation near butt
						n	%	
A	Plain	12.6	6.3	28.6	28.6	19	24.1	Facetted/retouched
B	Plain	33.4	16.7	40.0	20.0	4	66.6	Facetted/retouched, combination ‘crushed’ and facetted/retouched
C	–[1]	50.4[3]	43.7[3]	62.8[1]	55.3[1]	–[1]	–[1]	–[1]
	Plain[2]	14.9[2]	13.6[2]	15.2[2]	13.9[2]	–[2]	–[2]	–[2]
D	Plain	28.6	14.3	–	–	3	30.0	‘Crushed’
F	Plain	12.8	1.2	10.3	0	105	9.0	‘Crushed’
G	Plain	22.7	13.6	36.4	27.3	2	2.7	Facetted/retouched
H	Plain	20.0	8.9	23.5	8.8	27	10.0	‘Crushed’
K	Plain	18.1	4.0	21.3	5.2	1,046	9.6	Facetted/retouched
N	Plain	27.3	21.6	33.4	23.0	30	6.7	‘Crushed’
July ‘90	Plain	14.3	14.3	0	0	2	13.3	‘Crushed’
L	Plain	33.3	33.3	0	0	3	37.5	Facetted/retouched
M	Retouched/ facetted	44.7	24.1	60.0	30.0	11	25.0	Facetted/retouched
O	Plain	0	0	0	0	2	20.0	Facetted/retouched
Site N: Level X	Plain	18.8	0	33.3	0	4	13.8	‘Crushed’
Section finds	Plain	19.1	7.2	18.2	9.1	16	24.2	Facetted/retouched

Table 5.8: Maastricht-Belvédère. A comparison (preparation of the butt or near the butt) of the Unit IV primary context sites and section/test pit assemblages. IF and IFs stand for respectively *Index Facettage* and *Index Facettage stricte*.

[1] Site C figures after Roebroeks (1988; n= 3,067).
[2] Site C figures after Schlanger's sample (1994; n= 1,438).
[3] Site C figures after Roebroeks (1988; n= 3,067). The *Index Facettage* is given for all flakes.

the different Belvédère assemblages (Table 5.9). However, the highest percentage of radial/centripetal dorsal patterns are clearly recorded at Sites N and G, respectively 13.6% and 9.1%. For the 'high density' Site F (8.4%) and K (6.4%) patches the percentages are slightly lower, while at Site C (4.1%) and especially at Site H (1.1%) the lowest figures are described. The Site N scatter, directly followed by Sites F, H and K, also shows the highest rates of convergent dorsal patterns. The percentages are respectively 9.1%, 8.4%, 6.7% and 5.3%. Here, Site G (4.5%) and again Site C (3.5%) have the lowest values. According to the butt and dorsal surface preparation it seems generally that the 'low density' assemblages are better, or more often, prepared than the 'high density' artefact distributions. Due to the fact that the highest percentages of complex dorsal patterns (radial and convergent) were described at Sites N and G, these scatters also show the highest mean number of scars. This applies to flakes ≥30 mm as well as to flakes ≥50 mm, see Table 5.9.

To end this section on débitage specific inter-assemblage variations, some differences in terms of the quantity and types of refit observations are discussed below (Table 5.10). Excavated 'high density' areas such as Sites F, C and K contained high numbers of conjoined artefacts (respectively 153, 659 and 1,828 artefacts). The numbers of refitted items at the 'low density' scatters are considerably lower, respectively 73 at Site N and 25 at Site G. The low number of 40 refits at Site H can be seen as an exception, as we are probably dealing here with only a very small excavated part of a much larger distribution. Percentage-wise, however, the 'low density' Site G and N scatters, together with Sites C and K show the highest figures (respectively 33.3%, 16.2%, 21.5% and 16.8%). Due to the large quantity of conjoined artefacts at Sites K, C and F, these patches also show the highest numbers of refitted compositions and connection lines. Moreover, these distributions are identical to the one for the number of conjoined artefacts (see Table 5.10 for details). The 'low density' assemblages are only represented by relatively small conjoined groups, while the 'high density' patches contain very large compositions (*cf.* Sites C and K). The refitted artefact group size is therefore directly related to the absence (*cf.* Sites N and G) or presence of major flint knapping activities. This also influenced the quantity of different refit types. The percentages of conjoined production sequences (*Aufeinanderpassungen*, Cziesla 1986, 1990) are generally low for the 'low density' scatters at Sites G (46.7%) and N (22.4%), where refits of broken artefacts (*Aneinanderpassungen*, Cziesla 1986, 1990) are more frequently established, respectively 53.3% and 77.6%. In the 'high density' Site K, F and H distributions, the *Aufeinanderpassungen* (respectively 77.2%, 77.1%, and 59.3%) are more dominant than the *Aneinanderpassungen* (respectively 15.5%, 22.9%, and 37%). Only at Site H, and mainly at Site K, a number of flake/tool modifications (*Anpassungen*, Cziesla 1986, 1990) was refitted.

The conjoining results at Belvédère also show some horizontal differentiations. Some of the findspots represent flaking (core reduction) sequences that largely overlap spatially (Site K), whereas others represent sequences that succeeded each other both in space and time (Site C). At yet other artefact occurrences (Sites G and N), the short flaking sequences, like core edge rejuvenations, do not overlap or succeed spatially.

As mentioned before the Site K spatial conjoining results clearly show that the flint configuration does not resemble an accumulation of a number of assemblages such as those of other sites with clear artefact concentrations (*cf.* Site C). Moreover, an accumulation of scatters without clear clusters, such as the 'low density' Sites G and N, could not possibly have resulted in a distinct concentration with large quantities of refittable material (*cf. Aufeinanderpassungen*, Cziesla 1986, 1990).

5.4.3.4 Tool specific inter-assemblage variations

It has already been said before that the overall tool percentages at Belvédère are generally rather low (see Table 5.2). This becomes even more obvious when the percentages are compared with the ones from the surface scatters and loess-covered sites in the surrounding higher landscapes (see Kolen *et al.* 1999 for details). Tools are far more important at the 'low density scatters' (10.7% at Site G and 5.6% at Site N), than at the 'high density patches' (between 0.7 and 3.7 for Sites C, F, K and H). Although only representing 1.3%, the Site K patch consists of the most important number of tools (n= 137) and archaeological data indicated that most of these implements were imported as finished items (De Loecker 1992, 1994*b*, Chapter 3). Moreover, the majority of the Site K tools (like at Site N) are well-made scrapers. The Belvédère findspots show in general only minor variations with respect to tool typology. Where tools are present, pieces with signs of use, scrapers and backed knives form the major classes, and variation is limited. Only at Site K a certain percentage of denticulates and notched pieces was recorded. More details on the tool typology can be found in Table 5.11.

The maximum dimensions of all Belvédère tools ≥30 mm are between 7 and 25 mm larger than the measurements for all flakes ≥30 mm. Moreover, Sites C, G, K and N show the largest mean maximum dimensions, respectively 73.6 mm, 73.1 mm, 73 mm and 69.1 mm. The Site H (66.7 mm) and F (52 mm) tools are represented by the smallest dimensions. For the average length the distribution remains exactly the same, while tools are now between 8 and 29 mm larger than

Sites	All flakes ≥30 mm						
	Most frequent dorsal pattern	Convergent		Radial		Mean number of scars ≥30 mm	Mean number of scars ≥50 mm
		n	%	n	%		
A	'Parallel' unidirectional	2	6.3	2	6.3	3.9	6.7
B	'Parallel' bidirectional	–	–	1	16.7	3.8	4.6
C	–[1]	–[1]	–[1]	–[1]	–[1]	–[1]	–[1]
	'Parallel' unidirectional[2]	116[2]	3.5[2]	19[2]	4.1[2]	3.4[2]	4.2[2]
D	'Parallel' + lateral unidirectional, convergent, radial	2	28.6	2	28.6	4.0	–
F	'Parallel' unidirectional	13	8.4	13	8.4	3.3	3.5
G	'Parallel' unidirectional	1	4.5	2	9.1	4.2	5.3
H	'Parallel' unidirectional	6	6.7	1	1.1	2.9	4.0
K	'Parallel' unidirectional	161	5.3	197	6.4	3.4	4.5
N	'Parallel' unidirectional	8	9.1	12	13.6	4.9	6.3
July '90	'Parallel' unidirectional	1	14.3	–	–	2.9	4.0
L	'Parallel' bidirectional, 'parallel'+ lateral unidirectional, radial	–	–	1	33.3	4.3	–
M	'Parallel' + lateral unidirectional	2	6.9	4	13.8	4.0	4.5
O	'Parallel' unidirectional	1	14.3	–	–	3.1	4.0
Site N: Level X	'Parallel' unidirectional	1	6.3	1	6.3	3.2	4.0
Section finds	'Parallel' unidirectional	4	9.5	3	7.1	3.4	3.8

Table 5.9: Maastricht-Belvédère. A comparison (dorsal preparation and number of scars) of the Unit IV primary context sites and section/test pit assemblages.

[1] Site C figures after Roebroeks (1988; n= 3,067).
[2] Site C figures after Schlanger's sample (1994; n= 1,438).

Site	Number of refitted artefacts		Number of compositions	Number of connection lines	*Aufeinanderpassung* (production sequences)		*Aneinanderpassung* (breaks)		*Anpassung* (modifications)		*Einpassung* (inserts like heat damage)	
	n	%			n	%[1]	n	%[1]	n	%[1]	n	%[1]
A	20	25.0	9	11	9	81.8	2	18.1	–	–	–	–
B	2	33.3	1	1	1	100.0	–	–	–	–	–	–
C	659[2]	21.5[2]	?[3]	?[3]	?[3]	?[3]	?[3]	?[3]	?[3]	?[3]	–	–
D	5	45.5	2	3	1	100.0	–	–	–	–	–	–
F	153	13.0	45	105	81	77.1	24	22.9	–	–	–	–
G	25	33.3	10	15	7	46.7	8	53.3	–	–	–	–
H	40	14.8	14	27	16	59.3	10	37.0	1	3.7	–	–
K	1,828	16.8	321	1,582	1,221	77.2	245	15.5	55	3.5	61	3.9
N	73	16.2	25	49	11	22.4	38	77.6	–	–	–	–
July '90	4	26.7	2	2	2	100.0	–	–	–	–	–	–
L	–	–	–	–	–	–	–	–	–	–	–	–
M	–	–	–	–	–	–	–	–	–	–	–	–
O	–	–	–	–	–	–	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–	–	–	–	–	–	–
Section finds	–	–	–	–	–	–	–	–	–	–	–	–

Table 5.10: Maastricht-Belvédère. A comparison or the refitted data of the Unit IV primary context sites and section/test pit assemblages.

[1] The percentages are calculated from the total number of refits.
[2] Site C figures after Roebroeks (1988; n= 3,067).
[3] No data available due to the fact that the assemblage was refitted in a pre-Cziesla period (*cf.* Cziesla 1986, 1990).

	Bordes 1961	Site A		Site C		Site F		Site G		Site H		Site K		Site N		July '90		Site M		Section finds		Total	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
6	Mousterian points	–	–	–	–	–	–	–	–	–	–	4	2.9	1	3.8	–	–	–	–	–	–	5	2.3
9	Single straight side scrapers	–	–	–	–	–	–	–	–	–	–	20	14.6	–	–	–	–	–	–	–	–	20	9.0
10	Single convex side scrapers	–	–	2	8.7	–	–	–	–	2	20.0	17	12.4	6	23.1	1	100.0	–	–	1	25.0	29	13.1
12	Double straight side scrapers	–	–	–	–	–	–	–	–	–	–	1	0.7	–	–	–	–	–	–	–	–	1	0.5
13	Double straight-convex side scrapers	–	–	–	–	–	–	–	–	–	–	4	2.9	1	3.8	–	–	–	–	–	–	5	2.3
15	Double convex side scrapers	–	–	1	4.3	–	–	1	12.5	–	–	8	5.9	1	3.8	–	–	–	–	–	–	11	5.0
17	Double concave-convex side scrapers	–	–	–	–	–	–	–	–	–	–	–	–	1	3.8	–	–	–	–	–	–	1	0.5
18	Convergent straight side scrapers	–	–	–	–	–	–	–	–	–	–	3	2.2	–	–	–	–	–	–	–	–	3	1.4
19	Convergent convex side scrapers	–	–	–	–	–	–	–	–	–	–	1	0.7	–	–	–	–	–	–	–	–	1	0.5
21	Déjeté (offset) scrapers	–	–	–	–	–	–	–	–	1	10.0	15	11.0	–	–	–	–	–	–	1	25.0	17	7.7
22	Straight-transvese side scrapers	–	–	–	–	1	12.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.5
23	Convexe transverse side scrapers	–	–	–	–	–	–	–	–	–	–	3	2.2	–	–	–	–	–	–	–	–	3	1.4
25	Side scrapers with inverse retouche	–	–	–	–	–	–	–	–	–	–	5	3.6	–	–	–	–	–	–	–	–	5	2.3
29	Alternate retouched side scrapers	–	–	–	–	–	–	–	–	–	–	2	1.5	–	–	–	–	–	–	–	–	2	0.9
32	Typical burins	–	–	–	–	–	–	–	–	–	–	1	0.7	–	–	–	–	–	–	–	–	1	0.5
34	Typical borers	–	–	–	–	1	12.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.5
36	Typical backed knives	–	–	1	4.3	–	–	1	12.5	–	–	1	0.7	–	–	–	–	–	–	–	–	3	1.4
37	Atypical backed knives	–	–	1	4.3	–	–	1	12.5	–	–	1	0.7	3	11.5	–	–	–	–	–	–	6	2.7
38	Naturally backed knives	1	50.0	1	4.3	2	25.0	–	–	–	–	5	3.6	1	3.8	–	–	–	–	1	25.0	11	5.0
42	Notched pieces	–	–	–	–	–	–	–	–	–	–	5	3.6	–	–	–	–	1	33.3	–	–	6	2.7
43	Denticulates	–	–	–	–	–	–	–	–	–	–	6	4.4	1	3.8	–	–	1	33.3	–	–	8	3.6
45	Pieces retouched on the ventral surface	–	–	–	–	–	–	–	–	–	–	1	0.7	–	–	–	–	–	–	–	–	1	0.5
98	Pieces with signs of use	–	–	12	52.2	3	37.5	3	37.5	5	50.0	17	12.4	8	30.8	–	–	1	33.3	–	–	49	22.1
99	Retouched pieces	1	50.0	–	–	1	12.5	–	–	–	–	12	8.8	–	–	–	–	–	–	1	25.0	15	6.8
	Refitted tool fragments	–	–	2	8.7	–	–	2	25.0	2	20.0	5	3.6	3	11.5	–	–	–	–	–	–	14	6.3
	Tools unavailable for description	–	–	3	13.0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	1.4
	Total	2	100.0	23	99.8	8	100.0	8	100.0	10	100.0	137	99.8	26	99.7	1	100.0	3	99.9	4	100.0	222	100.9

Table 5.11: Maastricht Belvédère. A tool comparison (basic count) of the Unit IV primary context sites and section/test pit assemblages. For Sites B, D, L, O and N (Level X) no tools were described.

all flakes ≥30 mm. According to the average length of all complete tools, the 'low density' Site G scatters (93 mm), together with Site C (76.6 mm), show the largest dimensions. Here tools are between ca. 35 mm larger than the flakes. The complete Site N and Site H tools show the smallest mean values (respectively 69 mm and 70.3 mm). This is probably due to the fact that a large percentage of these tools is broken (see Table 5.15). However, they are still between 13 and 25 mm larger than the flakes. The Site K (50.6 mm), G (46.3 mm) and N (44.1 mm) assemblages consist also of the widest tools, while the smallest width is recorded at Site F (35.5 mm). Sites K (13.1 mm) and G (12.3 mm) furthermore show the thickest mean tool measurements, while the thinnest means were recorded for Site F (10 mm) and Site C (8.9 mm). For details on the mean tool measurements the reader is referred to Table 5.12. Generally it can be concluded that the 'low density' Site G and N scatters, together with the 'high density' Site C and K patches, show the largest mean tool measurements. The Site C tools are among the items with the smallest width and thickness. As these four assemblages consist of the highest quantities of tools and/or transported lithics (flakes and cores), it can be said that when blanks or tools were selected, produced, transported and/or used, the emphasis was clearly on items with large and wide dimensions, or better on items with large cutting edges (see later).

The mean volumes and elongated indexes for tools ≥30 mm at all Belvédère assemblages are much larger/higher than for all flakes ≥30 mm, whereas the massivity indexes are always smaller (Table 5.13). Like for flakes ≥30 mm the most voluminous tools were recovered at Site K and in the 'low density' Site G and N find distributions (respectively, 4454.4 mm^3, 3980.7 mm^3 and 3043.2 mm^3). The smallest mean tool volume was calculated for Site F (1679.2 mm^3). Also the elongated index distribution for tools shows similarities with the one for all flakes. Here, Site C (174.4), together with Sites G (151), N (147.6) and H (146.8), have the highest values. Sites F and K are represented by the lowest indexes (respectively, 133.2 and 132.8). The massivity index gives again a very different picture. The 'high density' Site F and K assemblages represent the highest values (respectively 21.1 and 19.5), while the figures for Sites G (17.6), H (17.2) and N (16.3) are somewhat lower. Like for all flakes ≥30 mm the Site C massivity index is one of the lowest at Belvédère (12.7).

The tools recovered from the 'high density' patches show generally the highest amounts of cortex. The percentages range from 30.4% at Site C and 40.9% at Site K to 50% at Site F. The 'low density' Site N (23%) and G (12.5%) figures are amongst the lowest in the sample. For the distribution of tools with 25% cortex or more one is referred to Table 5.14. Although most of the Belvédère tools were probably part of transported 'toolkits', refitting indicates that a limited number was selected or produced at the 'high density' findspots as well. This could explain the higher cortex percentages on the Site F, K and C tools. A comparable explanation can be given for the high percentage (71.4%) of natural fissures at Site F. A much lower percentage of flaws was recorded at Sites G, K, N and C (respectively 25%, 14.8%, 8.7% and 4.3%), while only the 'high density' Site F and K patches consist of tools with more than 25% natural fissures (Table 5.14). The fact that the lowest percentages of natural fissures were described at the assemblages where the highest number of imported tools was found (Sites K, N, C and G) could indicate that mainly blanks/tools on 'better quality' raw materials (less effected by flaws) were selected for transport and/or use.

The highest percentages of broken tools are recorded at Sites F, N and H, respectively 71.4%, 69.1% and 66.6% (Table 5.15). Although most of the broken tools were recovered from the Site K patch, they represent one of the lowest percentages at Belvédère (40.4%). Only at Site C (21.6%) a lower figure was described. As for all flakes the distal tool part is most frequently missing, while the angle of percussion is mainly ≥120°. Only at Site H is the proximal part most frequently missing and the angle is here mainly between 100° and 119°. See Table 5.15 for details.

At Sites C and N most of the tools display facetted or retouched butts. A punctiform and polyhedral butt appear often at Sites G and H, while a plain butt dominates the Site F and K tool assemblages. According to the different indexes in Table 5.16 the Site C tools, together with the 'low density' Site G and N ones, show most frequently a prepared butt. The *Index Facettage* (IF) and *Index Facettage stricte* (IFs) at these tool assemblages are respectively (IF=) 47.8, 28.6, 30.4 and (IFs=) 30.4, 28.6, 21.7. The indexes at the 'high density' Sites F (IF and IFs each 14.3), H (IF= 22.2, IFs= 11.1), and especially K (IF= 18.5, IFs= 4.2) are considerably as lower. For tools ≥50 mm the indexes generally show the same distribution. Site C, followed by Sites N and G always show the highest indexes, while the lowest figures are recorded at Sites K and F.

Most of the tool assemblages are dominated by blanks with a 'parallel' unidirectional dorsal pattern (Table 5.17). At Site N, however, a 'parallel' + lateral unidirectional pattern appears most frequently. This is only logical as this 'low density' assemblage consists of a relatively high number of imported 'core trimming flakes', struck from the side of the core's working surface. The sharp edges on one margin of these blanks often show macroscopic traces of utilization, indicating that they were used as cutting equipment. Some of the items were described as typical *éclats débordants*

Site	Mean measurements of tools ≥30 mm									
	Maximum dimension		Length		Length complete tools		Width		Thickness	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
A	–	–	–	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–	–	–	–
C	73.6[1]	18.1[1]	70.1[1]	18.6[1]	76.6[1]	18.3[1]	40.2[1]	11.9[1]	8.9[1]	3.0[1]
D	–	–	–	–	–	–	–	–	–	–
F	52.0	15.4	47.3	15.3	–	–	35.5	11.4	10.0	4.8
G	73.1	43.7	69.9	44.6	93.0	65.0	46.3	11.8	12.3	6.1
H	66.7	13.7	62.1	13.9	70.3	14.0	42.3	6.8	10.7	4.2
K	73.0	23.0	67.2	26.1	71.4	25.0	50.6	15.8	13.1	6.5
N	69.1	26.9	65.1	28.3	69.0	21.2	44.1	12.4	10.6	4.8
July '90	–	–	–	–	–	–	–	–	–	–
L	–	–	–	–	–	–	–	–	–	–
M	–	–	–	–	–	–	–	–	–	–
O	–	–	–	–	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–	–	–	–	–
Section finds	–	–	–	–	–	–	–	–	–	–

Table 5.12: Maastricht-Belvédère. A comparison of the average measurements on tools of the Unit IV primary context sites and section/test pit assemblages. S.D. stands for standard deviation.

[1] Based on 18 tools.

Site	Tools ≥30 mm		
	Mean tool volume[1] (mm^3)	Elongated index[2]	Massivity index[3]
A	–	–	–
B	–	–	–
C	2508.0[4]	174.4[4]	12.7[4]
D	–	–	–
F	1679.2	133.2	21.1
G	3980.7	151.0	17.6
H	2810.7	146.8	17.2
K	4454.4	132.8	19.5
N	3043.2	147.6	16.3
July '90	–	–	–
L	–	–	–
M	–	–	–
O	–	–	–
Site N: Level X	–	–	–
Section finds	–	–	–

Table 5.13: Maastricht-Belvédère. A comparison of the mean tool volume, the elongated index and the massivity index of the Unit IV primary context sites and section/test pit assemblages. The calculations are based on the figures in Table 5.12.

[1] Length x Width x Thickness.
[2] (Length x 100)/ Width.
[3] (Thickness x 100)/ Length.
[4] Site C figures based on 18 tools.

(Beyries and Boëda 1983, *cf.* Site G), while others are comparable in form, *i.e.* triangular in cross-section and with a clear back, resembling 'backed knives' (Roebroeks *et al.* 1992). The dominance of a radial/centripetal dorsal pattern on the Site C tools (43.5%) can be explained by the fact that these were produced from transported cores; the assemblage is mainly the result of a prepared core technique, including several 'classic' Levallois flakes and products of a *débitage Levallois recurrent* (Boëda 1986, 1993, 1994). Table 5.17 also shows that the highest number of radial patterns was recorded at Site K (n= 17). They represent, however, only 14.3 %, which is within the range of most other tool assemblages. Site K also shows the highest number of convergent patterns (n= 19 or 16%). Together with Site F (28%) they represent the highest percentages at Belvédère. For the Site N (8.7%) and C (4.3%) tools the lowest percentages were recorded. According to the dorsal surface preparation, and especially the butts, it seems (as for all flakes) that the tools of the 'low density' assemblages, as well as the Site C ones, are better, or more often, prepared than the others. Probably this is the main reason for the high mean number of scars described at Sites N, G and C. This applies to tools ≥30 mm as well as to tools ≥50 mm. See Table 5.17 for more details.

Most frequently a convex tool edge was described at Belvédère. Only at Sites K and G other edge forms dominate the tool assemblages, respectively straight and wavy. In most cases the working edges are located on the left and/or right dorsal side of the tools. The pattern of retouch is most frequently continuous. The largest mean working edge lengths were described at Sites H (73.9 mm) and G (72 mm), while the smallest measurements were recorded at Site C (42.7 mm) and especially at Site F (25.1 mm). For the mean

Site	All tools									
	Cortex		25% or more cortex		Non-cortex/cortex ratio	Natural fissures		25% or more natural fissures		Non-natural fissure/ natural fissure ratio
	n	%	n	%		n	%	n	%	
A	–	–	–	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–	–	–	–
C	7[1]	30.4[1]	3[1]	13.0[1]	1.6[1]	1[1]	4.3[1]	–[1]	–[1]	17.0[1]
D	–	–	–	–	–	–	–	–	–	–
F	4	50.0	1	25.0	1.0	5	71.4	1	14.3	0.4
G	1	12.5	–	–	7.0	2	25.0	–	–	3.0
H	2	20.0	–	–	4.0	–	–	–	–	–
K	56	40.9	20	14.6	1.4	20	14.7	7	5.2	5.9
N	6	23.0	1	3.8	3.3	2	8.7	–	–	10.5
July '90	–	–	–	–	–	–	–	–	–	–
L	–	–	–	–	–	–	–	–	–	–
M	–	–	–	–	–	–	–	–	–	–
O	–	–	–	–	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–	–	–	–	–
Section finds	–	–	–	–	–	–	–	–	–	–

Table 5.14: Maastricht-Belvédère. A comparison of the tools (technological information) of the Unit IV primary context sites and section/test pit assemblages.

[1] Based on 18 tools.

Sites	All tools ≥30 mm				
	Broken tools		Complete/broken ratio	Most frequently missing part	Most frequently appearing angle
	n	%			
A	–	–	–	–	–
B	–	–	–	–	–
C	5[1]	21.6[1]	2.6[1]	Distal[1]	110°-119°, 120°-130°[1]
D	–	– 71.4	–	–	–
F	5	57.2	0.4	Distal	>130°
G	4	66.6	0.8	Distal	120°-130°
H	6	40.4	0.5	Proximal	110°-119°
K	48	69.6	1.4	Distal	120°-130°, >130°
N	16		0.4	Distal	120°-130°
		–			
July '90	–	–	–	–	–
L	–	–	–	–	–
M	–	–	–	–	–
O	–	–	–	–	–
Site N: Level X	–		–	–	–
		–			
Section finds	–		–	–	–

Table 5.15: Maastricht-Belvédère. A comparison of the tools (technological information) of the Unit IV primary context sites and section/test pit assemblages.

[1] Based on 18 tools.

width the largest measurements were recorded at Sites K (3.3 mm) and N (3.1 mm), while Site F (2.5 mm) and Site C (1.6 mm) again show the smallest dimensions. Macroscopic signs of use and 'fish scale' are the most frequently appearing retouches in all Belvédère tools assemblages. For further details the reader is referred to Table 5.18 and 5.19.

To end the section on tool specific inter-assemblage variations, the scrapers of Sites K and N are compared. At these findspots the highest number of scrapers was recovered. They in fact dominate the tool assemblages in question, with respectively n= 83 or 66.6% and n= 10 or 38.3%. The mean scraper measurements, given in Table 5.20-A, are almost identical. This applies as well to the mean scraper volume, the elongated index and the massivity index (Table 5.20-B). Although the Site N scrapers are on average slightly larger and wider than the Site K ones, the only clear difference is given by the butt preparation. The *Index Facettage* (IF) and *Index Facettage stricte* (IFs) show that at Site N (IF= 54.6, IFs= 26.4) the scrapers are better, or more often, prepared than at Site K (IF= 21.4, IFs= 3.6). The mean length of the working edges is again remarkably identical, while the working edges at Site N are somewhat wider.

As discussed before, nearly all scrapers at Belvédère were introduced at the findspots as finished items. According to the blank measurements a number of rather identical flakes was produced and/or selected to be retouched into scrapers with similar mean working edge measurements. Although some of the blanks (*cf.* Site N) were better prepared than others, it can be suggested that the scraper-part of the transported Saalian 'toolkits' was very standardized.

5.4.3.5 Conclusion

In general a total of 16,221 flint artefacts was recovered from the Saalian Unit IV level at Maastricht-Belvédère (together ca. 1,577 m^2 of 'excavated' surface). This comes to 10.3 artefacts per metre square. Furthermore only 222 tools were recorded (1.4% of all Saalian artefacts), giving an average

Sites	All tools ≥30 mm							
	Most frequent butt	IF ≥30 mm	IFs ≥30 mm	IF ≥50 mm	IFs ≥50 mm	Dorsal preparation near butt		Most frequent dorsal preparation near butt
						n	%	
A	–	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–	–
C	Facetted[1]	47.8[1]	30.4[1]	52.4[1]	33.3[1]	–[1]	–[1]	–[1]
D	–	–	–	–	–	–	–	–
F	Plain	14.3	14.3	0	0	1	12.5	–
G	Punctiform	28.6	28.6	28.6	28.6	–	–	–
H	Polyhedral	22.2	11.1	25.0	12.5	–	–	–
K	Plain	18.5	4.2	19.0	5.0	61	44.5	Facetted/retouched
N	Retouched	30.4	21.7	33.4	22.3	–	–	–
July '90	–	–	–	–	–	–	–	–
L	–	–	–	–	–	–	–	–
M	–	–	–	–	–	–	–	–
O	–	–	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–	–	–
Section finds	–	–	–	–	–	–	–	–

Table 5.16: Maastricht-Belvédère. A comparison of the tools (preparation of the butt or near the butt) of the Unit IV primary context sites and section/test pit assemblages. IF and IFs stand for respectively *Index Facettage* and *Index Facettage stricte*.

[1] Based on 18 tools.

Sites	All tools ≥30 mm						
	Most frequent dorsal pattern	Convergent		Radial		Mean number of scars ≥30 mm	Mean number of scars ≥50 mm
		n	%	n	%		
A	–	–	–	–	–	–	–
B	–	–	–	–	–	–	–
C	Radial[1]	1[1]	4.3[1]	10[1]	43.5[1]	6.1[1]	6.2[1]
D	–	–	–	–	–	–	–
F	'Parallel' unidirectional	2	28.6	1	14.3	4.2	5.5
G	'Parallel' unidirectional	1	14.3	1	14.3	6.1	6.1
H	'Parallel' unidirectional	1	11.1	1	11.1	4.4	4.6
K	'Parallel' unidirectional	19	16.0	17	14.3	5.1	5.5
N	'parallel' + lateral unidirectional	2	8.7	3	13.0	6.2	6.7
July '90	–	–	–	–	–	–	–
L	–	–	–	–	–	–	–
M	–	–	–	–	–	–	–
O	–	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–	–
Section finds	–	–	–	–	–	–	–

Table 5.17: Maastricht-Belvédère. A comparison of the tools (dorsal preparation and number of scars) of the Unit IV primary context sites and section/test pit assemblages.

[1] Based on 18 tools.

Sites	All tools			
	Most frequent edge form	Most frequent location of the working edge	Most frequent location of the retouch	Most frequent pattern of the retouch
A	–	–	–	–
B	–	–	–	–
C	Convex	Left and right	Dorsal	Continuous
D	–	–	–	–
F	Convex	Left	Dorsal	Continuous
G	Wavy	Left and right	Dorsal	Continuous
H	Convex	Right	Dorsal	Continuous
K	Straight	Left	Dorsal	Continuous
N	Convex	Left	Dorsal	Continuous
July '90	–	–	–	–
L	–	–	–	–
M	–	–	–	–
O	–	–	–	–
Site N: Level X	–	–	–	–
Section finds	–	–	–	–

Table 5.18: Maastricht-Belvédère. A comparison of the tools of the Unit IV primary context sites and section/test pit assemblages.

Site	All tools					
	Length working edge		Width working edge		Most frequent type of retouch	The second most frequent type of retouch
	Mean	S.D.	Mean	S.D.		
A	–	–	–	–	–	–
B	–	–	–	–	–	–
C	42.7	23.9	1.6	1.2	Macroscopic signs of use	'Fish scale' retouch
D	–	–	–	–	–	–
F	25.1	19.9	2.5	1.7	Macroscopic signs of use	'Fish scale' retouch
G	72.0	59.8	2.7	1.0	Macroscopic signs of use	'Fish scale' retouch
H	73.9	66.9	2.8	2.5	Macroscopic signs of use	'Fish scale' retouch
K	63.5	56.5	3.3	2.0	'Fish scale' retouch	Macroscopic signs of use
N	52.3	36.7	3.1	2.6	Macroscopic signs of use	'Fish scale' retouch
July '90	–	–	–	–	–	–
L	–	–	–	–	–	–
M	–	–	–	–	–	–
O	–	–	–	–	–	–
Site N: Level X	–	–	–	–	–	–
Section finds	–	–	–	–	–	–

Table 5.19: Maastricht-Belvédère. A comparison of the average measurements and type of retouch on tools of the Unit IV primary context sites and section/test pit assemblages. S.D. stands for standard deviation.

A

Site	Mean measurements of scrapers ≥30 mm													
	Maximum dimension		Length		Width		Thickness		Butt		Length working edge		Width working edge	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	IF ≥30 mm	IFs ≥30 mm	Mean	S.D.	Mean	S.D.
K	72.0	24.6	67.0	26.5	49.2	15.7	12.0	6.0	21.7	3.6	74.5	58.5	3.5	1.7
N	74.3	26.1	69.1	28.0	48.4	11.6	11.9	4.3	54.6	36.4	75.0	43.1	5.2	2.6

B

Site	Scrapers ≥30 mm		
	Mean Tool volume[1] (mm^3)	Elongated index[2]	Massivity index[3]
K	3955.7	136.2	17.9
N	3979.8	142.8	17.2

Table 5.20: Maastricht-Belvédère. A: A comparison of the average measurements and butts on scrapers of the Unit IV primary context sites and section/test pit assemblages. S.D. stands for standard deviation. IF and IFs stand for respectively *Index Facettage* and *Index Facettage stricte*. B: A comparison of the mean scraper volume, the elongated index and the massivity index of the Unit IV primary context sites and section/test pit assemblages. The calculations are based on the figures in Table 5.20-A.

[1] Length x Width x Thickness.
[2] (Length x 100)/ Width.
[3] (Thickness x 100)/ Length.

of 0.1 per metre square. The latter consist of 145 tools *sensu stricto* and 77 pieces with macroscopic signs of use, respectively 0.9% and 0.5% of all finds. Cores are only represented by 101 pieces (0.6 of all artefacts) and give a mean distribution of 0.06 per metre square. In total 2,809 (or 17.3%) of all Unit IV artefacts could be conjoined. The executed lithic and refitting analysis shows that the described inter-site variations are indicative of a relative 'rich' interpretation potential.

According to some variations in artefact density, composition and conjoining potentials it is, generally, possible to distinguish two different kinds of find distributions at Belvédère. On the one hand there are the 'patchy' occurrences or the so-called 'high density' find distributions like Sites C, F, H and K. These findspots, representing the 'classic' sites or level three in Isaac's classification (Isaac 1981; see also Section 5.1), are characterized by dense clustered appearances of large quantities of artefacts. The patches show a striking dominance of flint knapping debris and turned out to be 'a refitter's paradise' (De Loecker *et al*. 2003). Some were so well preserved that through a detailed refitting study, for example at Sites C, F (Roebroeks 1988) and K (De Loecker 1992, 1994*a* and *b*), inferences on former reductions schemes could be produced (Schlanger 1994, 1996, see also Chapters 3 and 4). On the other end of the density scale there are a number of very 'low density off-site' distributions, like Sites G and N. These scatters predominantly consist of isolated and/or small groups of flakes, tools and relatively few dorsal/ventral refits. They represent Isaac's (1981) levels one and two (Isaac 1981; see also Section 5.1). For a brief generalization of the 'high and low density' find distributions, focusing on the described technological and morphological inter-site differences, the reader is referred to Section 5.5. However, tools are far more important in the 'low density' Site G and N scatters, than in the 'high density' Site C, F, K and H patches. Pieces with signs of use, scrapers and backed knives dominate the Belvédère tool assemblages. Generally the Unit IV tools are larger and more voluminous, but less massive, than the flake assemblages. Especially at the 'low density' scatters, together with Sites C and K, the largest mean tool measurements were recorded. These tool assemblages also show the lowest percentages of natural fissures, while the dorsal surfaces, and especially the butts, are more frequently, or better, prepared (*cf*. Sites G, N and C). The tool assemblages consist of the highest quantities of transported items. It can, therefore, be concluded that when tools/blanks were selected for transportation and/or used, the emphasis was clearly on well-prepared items with large and wide dimensions (large cutting edges) and produced on better quality (and finer-grained flint) raw materials. Moreover, it seems that part of the transported 'toolkits' was very standardized as is shown by the Site K and N scrapers.

5.5 'Scatters and patches': a model for inter-assemblage variability

5.5.1 Introduction

The Maastricht-Belvédère Unit IV excavations recorded an 'all over' presence of discarded lithic material within a small segment of the old Middle Pleistocene (Saale inter-glacial) river Meuse valley. Section 5.4.3 convincingly demonstrated that the continuous artefact distribution or 'veil of stones' (Roebroeks *et al*. 1992) has yielded assemblages that show striking differences when compared with one another. In defining these, sometimes, fine-grained, inter-site (and intra-site) differences, refitting combined with a detailed lithic characterization of the assemblages proved to be essential. The fact that a number of 'high density' patches are presented against an all-over background of 'low density' scatters could be related to differences in land-use by the Middle Pleistocene early humans (*cf*. Binford 1987*a*). Moreover, the site variations provide some arguments for understanding the palaeo-record at Maastricht-Belvédère. After a brief generalized 'definition'/characterization, based on Section 5.4, of the 'high and low density' find distributions, the differences will be discussed in terms of early human behaviour. Transport of lithics will play a crucial role in the interpretation of the local Saalian record.

5.5.2 The 'high density' find distributions or patches: Sites K, F H and C

As mentioned before the Belvédère excavations uncovered a number of 'high density' flint distributions, which show a striking dominance of flint knapping debris (Site C, F, H and K). The spatial find configurations consist of a 'single' and large artefact cluster, which is completely lacking at the 'low density scatters'. These 'patchy' find occurrences mainly consist of enormous quantities of flint debitage, *i.e*. small chips/spalls and non-retouched (decortication) flakes. The number of dorsal/ventral conjoinings is high. Generally, the 'high density' patches are found in association with few tools and cores. Site K can be seen as an exception, as relatively 'high' numbers of tools and cores were recorded here. It is suggested that most of these tools (60.6% are scrapers on 'exotic' flint) arrived at the findspot as well-prepared (sometimes produced on Levallois blanks) finished products of a 'transported toolkit'. The 'few' Site F and H tools, on the other hand, were probably for the greater part produced on the spot. The 'high' number of Site K cores represents another exception at Belvédère. It seems that all were produced on the spot. The fact that (limited-prepared) cores were discarded in large quantities suggests that they were probably intended for local use only.

The analysis of the Site F, H and K patches, furthermore, shows that most stages/phases of the reduction strategy are represented in the excavated areas. The operational schemes show that 'locally' collected and non-prepared (non-tested) raw material nodules were introduced to the excavated surfaces, to be decorticated and split (*i.e*. by removal of large flakes and flaws) on the spot. Subsequently, the individual parts, or cores, were used for the production of flakes. Few of the larger blanks were selected and transformed into, or used as, tools. The remnants of all these reduction stages were discarded on the spot, a statement that is confirmed by the high number of dorsal/ventral conjoinings.

In general the mentioned assemblages are mainly the result of a disc/discoidal reduction strategy ('unifacial' disc[oidal] and interchanging bifacial discoidal, *cf*. Boëda 1993) with limited attention for core preparation. The dominance of 'waste' from all core reduction stages, the large numbers of cores at Site K, and especially the detailed refitting analysis imply that flint knapping was a main activity at the Site F, H and K locations. Logically, this activity was responsible for the 'patchy' nature of the distribution. It can therefore be concluded that this type of 'high density patch' is characterized by the 'local' (expedient) character/maintenance of technology.

According to refitting, the reduction sequences overlap spatially. At Site K it even seems that the internal structuring in the use of space was 'preserved' and the excavated material may therefore represent one continuous and consistent occupation of the area. The homogeneity of the Site K raw materials, technology, typology, the many inter-locus conjoinings and the 'uniformity' of the spatial layout, all point to a 'single' occupation phase and not to a palimpsest of several unrelated events. As a result this findspot can be seen as a more organized entity.

A completely different kind of 'high density' find distribution was excavated at Site C (Roebroeks 1988; Roebroeks and Hennekens 1990). Although this assemblage can be described as a 'patch', it contrasts clearly with Sites K, F and H. Instead of one big artefact concentration we are dealing here with 'smaller' clusters which were situated close to each other. The find occurrence mainly consists of flint debitage together with very few tools *sensu stricto* (all of them scrapers and backed knives) and some flakes with macroscopic signs of use. Again a large number of dorsal/ventral conjoinings were established.

The Site C technological characterization shows in general a different core reduction strategy than Sites K, F and H. The assemblage is to a large extent the result of a well-prepared core approach, with several 'classic' Levallois flakes and the products of a *débitage Levallois recurrent* (*cf*. Boëda 1986, 1993, 1994). Besides this Levallois reduction strategy, it seems that a smaller part of the assemblage also involved a disc/discoidal core approach (Boëda 1993). The latter products are produced on a more 'coarse' grained flint type than the rest of the raw materials.

Refitting showed that several different flint nodules/cores (and tools and flakes) entered and left the excavated Site C area in various stages of reduction (Roebroeks 1988). Moreover, the excavated Raw Material Units represent distinct spatial patterns. In this way the Site C 'patch' differs completely from the ones at Sites K, F and H. On the one hand a number of (prepared) cores was introduced at the Site C location to be further reduced and subsequently transported away. On the other hand most of the Site K, F (and H) reduction sequences must have started and ended within the excavated area. The degree of import at the latter findspots can be considered as low.

The Site C spatial layout does not provide evidence for an 'organized' use of space (Roebroeks 1988), all the various scatters can be seen as isolated flint knapping events spread in time. Whether or not these clusters belong to one continuous episode of use remains an open question. However, according to refitting, the lack of spatial repetition (*cf*. Site K) may indicate that Site C is a palimpsest of different activities spread in time.

Generally, it can be concluded that flint knapping was one of the main activities carried out at the Site C location, as the majority of the (refitted) lithic assemblage consist of debitage and some cores. In contrast to Sites K, F and H, the Site C technology was clearly orientated towards the production or maintenance of prepared flakes and cores, to be transported to other locations. In other words, refitting shows that the excavated area mainly reflects a 'coming and going' of well-prepared cores and flakes which were worked or produced at other locations. Moreover, the manufacturing techniques seem to reflect a much more economical behaviour than the Site K, H and F 'high density' distributions.

5.5.3 *The 'low density' find distributions or scatters: Sites G and N*

It is clear that the dense patches of artefacts have a high archaeological visibility and that they represent the most frequent excavated surfaces (the 'classic' site) in the Palaeolithic record. However, between the large clusters of artefacts, like Sites C, F, H and K, stray finds have been recorded all over the pit (amongst others the section finds). Here, flint artefacts appear to have been discarded as isolated objects, or in a small group of one to a few dozen. Especially during the last years of Belvédère research, the emphasis was on the excavation of so-called 'low density' patterns, in order to record the nature of the archaeology 'surrounding' the 'high density' patches. This shift of interest highlighted the importance of the 'off-site' scatters for the interpretation of the Belvédère locality (Roebroeks *et al*. 1992).

Generally, it seems that, at least at Maastricht-Belvédère, large parts of the distribution patterns in the intra-Saalian interglacial river valley bottom were characterized by low densities of artefacts and faunal remains. Compared to the 'high density' patches, these 'low density' scatters show distinct differences in the spatial patterning of the finds, typology, technology and raw material composition (see Section 5.4.3).

Segments of this suggested 'continuous low density' distribution were excavated at Sites G (Roebroeks 1988) and N (Roebroeks *et al.* 1992). At both scatters a rather small number of artefacts was recovered in association with faunal remains. The artefacts were more or less evenly distributed among sparse bone fragments and no clear artefact concentrations could be described. The mean artefacts density can be considerate as (extremely) low. Conspicuously, and in contrast with the patches, the highest percentages of tools were recorded at these scatters. They were recovered as isolated and 'worn out'. The most commonly appearing tool types are heavily reduced and sometimes broken scrapers (mainly at Site N), many large flakes with macroscopic signs of use and (unretouched) backed knives. These implements are considered to represent well-prepared parts of imported 'toolkits'.

Although the excavations recorded some small debitage areas, refitting generally indicates a lack of evidence for substantial primary flint-working activities and tool production. Only some very fine knapping debris could be conjoined to a few larger flakes. These scarce dorsal/ventral refits occasionally represent small parts of reduction/retouching sequences. However, more than half of the Site G and N conjoinings consist of broken artefacts. The fact that decortication flakes are scarce and only one (exhausted and prepared) disc core was excavated at Site N also supports a lack of major flint knapping activities inside the excavated 'low density' areas. Moreover, the flakes from the scatters have generally the largest measurements, they are rather voluminous, they have the highest mean number of scars and they show low cortex and natural fissure percentages. Their butts and dorsal surfaces are better or more often prepared. The Facetting Indexes 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. Aufeinanderpassungen*.

All this could indicate that the 'low density' scatters were not formed in one continuous sequence of (related) activities. Instead it seems more likely that we are dealing here with palimpsests of many small scatters and/or isolated artefacts which were formed separately in space and time.

In conclusion, Section 5.4.3 clearly showed that the technological and typological characteristics of the tool dominated Site N assemblage, as well as the Site G one, differs in a number of aspects from those of for example Sites F, H and K (see also Roebroeks *et al.* 1992). Generally, this could be an indication that specifically selected and well-prepared tools and blanks were brought to the 'low density' locations for possible use (*cf.* Site G). Also the relatively large number of unretouched chips and few larger flakes seem to have been produced from transported cores (*cf.* Site C). The area was probably visited over and over again, during a number of 'short' unrelated events. Remarkable in the light of the 'taphonomic' heterogeneity is the technological and typo-logical uniformity of the tools. A statement that becomes even more conspicuous if one takes all transported implements at Belvédère into account. Compare for example the scraper-part of the Site N and K 'toolkits' (Section 5.4.3.4).

According to the above presented Belvédère data, it seems legitimate to conclude that early human behaviour was probably responsible for the main inter-assemblage variations. In the following section these behavioural patterns will be discussed in more detail.

5.6 Explaining the inter-assemblage variability

5.6.1 Introduction

The 'scatters and patches' at Belvédère seem to represent 'ideal' conditions for interpreting early human behaviour. The excavated interglacial land surfaces in the river Meuse valley bottom were sealed in a 'short' period of time, and in a calm sedimentary environment, leaving the archaeological remains of human occupation almost 'untouched'. This resulted in a promising research situation where many artefacts could be refitted, tools exhibit microscopic traces of use, and various faunal remains were still present. As a result the Saalian archaeological levels present precious information on the used technological strategies (Roebroeks 1988; Roebroeks *et al.* 1992, 1993; Schlanger 1994, 1996; De Loecker 1992, 1993), palaeo-environments (Vandenberghe *et al.* 1993), and sporadically early human food procurement (Roebroeks 1988; van Gijn 1988, 1989).

It should be realized that the mentioned 'high and low density' distributions do not form separate and clearly defined spatial units. In fact, all Belvédère artefact distributions take a position on a sliding scale somewhere between the areas with the highest densities at Site K and the areas with lowest densities at Site N. The patches may therefore represent spatial accumulations of lithics, which were discarded during several different and unrelated events. Alternatively, however, the typo-/technological characterization and the refitting analysis showed that there are some striking qualitative and qualitative differences between both 'types' of findspots, (Roebroeks *et al.* 1992; Section 5.4.3). Therefore, it can be said that the Maastricht-Belvédère find distributions do indeed reveal specific and valuable information on the spatial organization of Middle Palaeolithic humans (technology), but only on a more 'generalized' level.

In general two major factors seem to be responsible for the discrepancies between the 'high and low density' distributions. In the first place refitting evidence showed that the scatters and patches represent different trajectories within the life histories of Middle Palaeolithic flake technologies, *i.e.* of tools, flakes and cores. At one end of the continuum are Sites K, F and H where reduction sequences 'started' and the degree of importation is relatively low, except for some well-prepared scrapers and points (Site K). At the other end there are the 'low density' Site G and N scatters, were well-prepared and imported flake technologies came to their end ('worn-out' tools and cores). As an 'intermediate' stage Site C can be mentioned. At this patch the refitted raw mate-rials reflect different ways of on-site knapping, *i.e.* working a flint nodule into a prepared core, production of flakes from imported and well-prepared cores and export of large well-prepared flakes and cores. It can therefore be suggested that the 'high density' patches and 'low density' scatters reflect different places in the spatial organization of the technologies.

Secondly, it seems reasonable to assume that the observed discrepancies are related to the execution of different activities. On the one hand, it can be suggested (Roebroeks *et al* 1992) that the 'high density' patterns predominantly reflect the maintenance of technology (*i.e.* preparation and production of new cores, flakes and tools) in combination with some minor tool/flake use. The 'low density' scatters, on the other hand, might be related to the actual use of these technologies in direct food procurement or 'non-maintenance' activities (*cf.* Isaac 1981) like scavenging or hunting. The fact that nearly all the Site N (and G) lithics were discarded away from their place of manufacture, together with the butchering event of a young rhinoceros at Site G (Roebroeks 1988), supports this hypothesis.

5.6.2 Typo-/technological and raw material patterns in the inter-assemblage variability

A systematic study of the lithic technology and the used raw materials (see Chapters 3 and 4) can provide precious information on the 'economic' and technological activities which were carried out in specific areas of the Belvédère locale. Moreover, the strategies by which the local raw materials sources were exploited and the manner in which produced and selected lithic artefacts were distributed over the landscape could give important clues to the observed inter-assemblage variability. The latter items which documented, without doubt, early human patterns of movement will be dealt with later (see Section 5.6.3). To illustrate the Maastricht-Belvédère situation, Table 5.21 is given as an overview (guideline) of lithic behaviour. This illustration will be (can be) constantly referred to (consulted).

The typo-/technological analysis of the excavated scatters and patches at Belvédère shows generally two 'different' core reduction strategies which were simultaneously applied in the same Saalian 'cultural' system (*cf.* Roebroeks 1988). For both approaches the emphasis was clearly on the production of flakes and flake-tools.

Firstly, at most of the find occurrences the use of a *débitage discoïde*, marked by a 'self-acting' preparation, was documented (Boëda 1993; *i.e.* Sites F, H and K). Especially at Site K the disc/discoidal core approach ('unifacial' disc[oidal] and interchanging bifacial discoidal) is well documented by means of refitting (see Section 3.7.3).

Secondly, besides this *débitage discoïde* some of the find distributions are characterized by the presence of *débitage Levallois* products (Bordes 1961; Boëda 1984, 1986, 1988, 1993). Generally two different modes of operation can be discriminated. On the one hand, there is the 'classic' Levallois technique (*éclat préférentiel*), which is rather seldom represented in the Belvédère sample. In fact its presence could mainly be documented by a number of 'isolated' transported flakes and especially scrapers (*i.e.* Sites N and K). On the other hand, technology and refitting indicate the application of a *débitage Levallois recurrent* at Site C. From the initial stages of core preparation on this approach is intended to produce a 'continuous' series of predetermined flakes. The latter are knapped from one and the same carefully prepared striking surface of a core. In this sense the *recurrent* approach is much more economical than the 'classic' approach.

Furthermore, it has to be mentioned that only the Site C assemblage (and possibly also the Site K one) shows evidence of preparation and production of Levallois (*recurrent*) flakes on the spot, be it on well-prepared transported cores (Roebroeks 1988; Schlanger 1994, 1996).

Given these two 'different' core reduction strategies (disc/discoidal *versus* Levallois), the Belvédère data shows that the observed technological patterns are not tied to specific findspots. Moreover, it seems that the disc(oidal) technique was often employed alongside the Levallois method. For example at Site K, where the reduction was basically focused on a disc(oidal) core approach, clear Levallois *sensu stricto* products were described as well. They appear in the assemblage as 'isolated' transported items, or were possibly scarcely produced on the spot (Section 3.7.3). Also the Site C analysis confirms the fact that a Levallois *recurrent* method was used alongside a less dominant disc(oidal) core approach (Roebroeks 1988).

If the (conjoined groups of) artefacts, recovered within the same excavated areas and representing a Levallois or a disc(oidal) core reduction, were indeed discarded during short contemporaneous activities, which at Site K is (probably) the case, then the following questions can be relevant for the observed differences:

1. In how far can the Levallois technique, documented at Sites C, N and K, really be discriminated from a disc(coidal) core technology (Sites K, F, H and C)?
2. And what were the crucial factors for opting for one of the previously described technological approaches?

It has already been mentioned in earlier publications (Boëda 1993; Mellars 1996) that most technological aspects of disc(oidal) core techniques are in fact very similar to Levallois core approaches (or *visa versa*). In this context Mellars (1996) can be quoted:

"The disc-core techniques were reliant on precisely the same basic sequences of core preparation as that in the classic Levallois techniques, involving the initial preparation of a continuous striking platform around the perimeter of this nodule, followed by successive removals of flakes from the upper (striking, DDL) surface of this nodule. The only criterion for differentiating between the two techniques (Levallois on the one hand, and disc-core on the other) seems to lie in the varying degrees of special preparation applied to the upper (striking, DDL) surface of the core. … (it is therefore more, DDL) a matter of degree rather than of kind." (Mellars 1996:73).

It can also be suggested that both mentioned reduction strategies were designed (at least at Belvédère) for the production of rather 'large and wide' flakes. Moreover, Levallois as well as disc(oidal) core approaches can produce a wide range of specific and similar flake types, from pseudo-Levallois points and *éclats débordants* (backed knives) to ordinary flakes with large cutting edges as shown at Site K. Even Levallois *sensu stricto* flakes can be produced, using a disc(oidal) technique. It seems therefore again plausible that the observed discrepancy between the two modes of production lies more in the conscious efforts of systematically shaping/preparing the core, which obviously was used for future main flake removals.

Besides the technological possibility that disc(oidal) core approaches might be classified under a wider grouping of Levallois approaches, there is more proof of a direct link between both techniques of flaking. The Middle Palaeolithic data-set provides some examples which show core types intermediate between typical Levallois and disc cores. Apparently the latter seem to represent the heavily reduced end-products of flaking strategies in which well-prepared Levallois cores were transformed into other types like disc(oidal) nuclei (*cf.* Boëda 1993:393; Vynckier *et al.* 1988:135). In other words, the cores/nodules were reduced from larger and more complex to smaller and more simple. Alongside transporting behaviour, this could explain the fact that in some cases Levallois *sensu stricto* flakes are clearly represented, although their parent cores are completely lacking. As an example the possible Levallois (-like) flake sequence at Site K, which appears in a 'unifacial' disc(oidal) core reduction, can be mentioned (see composition III [part A], Section 3.6.5.4).

If it is correct to interpret the disc(oidal) and Levallois techniques as belonging to one and the same group of core approaches, which basically represent different degrees of core preparation, what were then the factors for opting for one of them? Answers to this question could amongst others, possibly, be found in the grain-size and quality of the used raw materials. A technological approach linked to the grain-size, quality and availability of sufficient raw material is amongst others assumed for the Site K assemblage. As mentioned before (Section 3.7.3), analysis of this 'high density' patch shows that the bulk of used raw materials was procured from local secondary sources (*i.e.* fluviatile transported material). Virtually all these raw materials show natural imperfections like frost fissures and fossil inclusions. The flint looks rather coarse-grained and can therefore be described as 'inferior' quality raw material. A disc(oidal) technology was mainly applied for the reduction of these nodules/cores. All this also applies to the Site H and F assemblages. The use (choice) of this technique is, however, not surprising as it is a very flexible flaking strategy in which technological errors can be 'easily' repaired and the multiple natural imperfections can be surmounted quite economically (*cf.* Boëda 1993). When a finer-grained and less frost-affected part of a flint nodule was used, it seems that the striking surface and striking platform of the core were better or more often prepared, resulting in Levallois (-like) sequences (*éclats préférentiel*). It can therefore be suggested that the early humans slightly adjusted their technological strategy to the given raw material quality. The few imported Site K Levallois flakes *sensu stricto* were produced on rather fine-grained raw materials, which scarcely show natural fissures. With respect to the presence of Levallois products, again the use of very fine-grained flint (with very few 'flaws') at Site C can be mentioned. Here the 'better' quality raw materials were used for the production of *débitage Levallois recurrent* items (Roebroeks 1988:30, 47-52; see also Chapter 4). The products were imported as finished flakes or locally produced from imported and well-prepared cores. Remarkably, a less dominant disc(oidal) technique, applied on coarser-grained flint cores, was employed alongside the Levallois approach. The several 'isolated' Levallois flakes, recovered from the 'low density' Site N area, seem to be also produced from rather fine-grained raw materials with few natural fissures.

Sites	On the spot				Import			Export		
	Decortication	Flake production	Tool production	Resharpening, recycling	Flakes	Cores	Tools	Flakes	Cores	Tools
A	'Moderate'	'Moderate'	Absent	Rare	Rare	Absent	Rare	Absent	Absent	Rare (resharpened tool)
B	Absent	Rare	Absent	Absent	Rare (prep.)	Rare	Absent	Absent	Rare	Absent
C	Moderate	Intensive (few nodules)	Rare	Absent	Rare (well-prep.)	Frequent (well-prep.)	Rare	Rare (well-prep.)	Frequent (well-prep.)	Absent
D	Absent	'Moderate'	Absent	Absent	Rare	Rare (disc core)	Absent	Absent	Absent	Absent
F	Intensive	Intensive	Rare	Absent	Absent	Absent	Absent	Absent	Absent	Absent
G	Absent	Rare	Rare	Rare	Frequent (well-prep.)	Rare	Frequent (prep.)	Absent	Rare	Rare (resharpened tool)
H	Absent	Intensive	Absent	Absent	Absent	Absent	Rare	Absent	Absent	Absent
K	Intensive	Intensive (many nodules)	Rare	Rare	Rare	Absent	Moderate (well-prep.)	Absent	Absent	Rare (resharpened tool)
N	Absent	Rare	Absent	Absent	Frequent (well-prep.)	Rare (disc core)	Frequent (well-prep.)	Absent	Rare (prep.)	Absent
July '90	'Intensive'	'Intensive'	Rare	Absent	Rare	Rare	Absent	Absent	Absent	Absent

Sites	Technology and 'site function'				
	Core reduction strategy	**Levallois reduction strategy**	***Chaînes opératoires***	**Flake/tool use**	**Interpretation**
A	Unprepared	Absent	Some stages	?	Flake production, possibly associated with minor flake/tool use and tool rejuvenation
B	Prepared?	Absent	Some stages	?	Minor flake production, possibly associated with minor flake use
C	Disc/discoidal (moderate)	Frequent (Lev. recurrent)	Several stages (on different nodules)	Meat procurement	Core preparation and episodes of flake production, associated with minor flake/tool use (palimpsest of several events)
D	Disc/discoidal	Absent	Some stages	?	Minor flake production
F	Disc/discoidal (frequent)	Absent	All stages	Meat procurement?	Flake production, possibly associated with minor tool use
G	Prepared	Absent	Some stages	Meat procurement	Core-edge rejuvenation and minor flake production, associated with flake/tool use and tool rejuvenation (palimpsest of several events)
H	Disc/discoidal (frequent)	Absent	Several stages	?	Flake production, possibly associated with minor flake/tool use
K	Disc/discoidal (frequent)	Rare (mainly on scrapers)	All stages	?	Flake production, possibly associated with minor flake/tool use and tool rejuvenation ('Single event' + 'background scatter')
N	Well-prepared	Moderate (mainly on scrapers)	Some stages	?	Core-edge rejuvenation, possibly associated with flake/tool use (palimpsest of several events)
July '90	Unprepared	Absent	Several stages	?	Flake production, possibly associated with minor tool use

Table 5.21: Maastricht-Belvédère. Summary of lithic behaviour for the Unit IV assemblages. The areas in grey are 'low-density' distributions.

In conclusion the following statements can be made. Generally, it seems that most of the 'high density' assemblages (*i.e*. Sites H, F and K), representing major flint knapping activities on the spot, were made from locally available, but 'inferior' quality, raw materials. Moreover, disc(oidal) core reduction strategies were predominantly used. When a Levallois core-approach could be described, it was mostly on 'fine' grained and/or transported materials. In contrast to the earlier mentioned patches, there are a number of findspots where the majority of the assemblages is characterized by the presence of imported items. The latter were made on a large variety of 'better' quality raw materials, deriving from some unknown distance (*i.e*. Site C and the 'low density' G and N scatters). The items were brought to the excavated areas as selected flake blanks, finished tools (Sites G, N and K) or as cores intended for future flake/tool production (Site C). Some of these artefacts were introduced as Levallois products, which were predominantly made of fine-grained flint types.

It can therefore be suggested that 'high' quality flint material, meaning fine-grained and without fissures, was presumably preferred and highly valued for its superior flaking qualities. Seemingly, it allows maximum control over the precise form and intensions of knapping. The mentioned natural 'errors' in the locally available flint could ruin an entire Levallois reduction sequence and/or its end-product(s) in an irreparable way. Stated differently, the fact that most of the locally procured flint nodules were made of such an 'inferior' raw material quality could generally explain the rather limited presence of a Levallois core approach at Maastricht-Belvédère. Apparently the local flint, deriving from the river/gravel beds, seem to have been avoided for Levallois applications. The early humans possibly focused on a disc(oidal) core approach in which flaking errors could have been more easily restored. It can, furthermore, be suggested that the use of a disc(oidal) core approach at the Belvédère locale was mainly applied as a response to the 'inferior' quality raw materials. The use of large quantities of local and inferior quality flint could be seen as a largely predictable aspect of procurement strategies which were 'embedded' in more general patterns of carried-out subsistence activities.

The presented data indicates a relationship between particular kinds of raw material and the use of certain flaking techniques/modes. The varying frequencies in which different raw materials were transported across the landscape shows, furthermore, a link with the morphology of these items (amongst others prepared cores, Levallois flakes and/or retouched tools) and the different patterns of use at specific findspots (*cf*. Roebroeks *et al*. 1988*b)*. In the next section the Maastricht-Belvédère data on lithic transport will be discussed in more detail.

5.6.3 Early human transport of lithics

The refitting and raw material studies at most of the Belvédère patches, and especially the scatters, indicate that typo-/technological differences may well have been related to aspects of early human mobility. The analysed assemblages show that a number of large flakes and tools entered the excavated surfaces as 'isolated' and finished items. Some tools had previously been resharpened many times (*i.e*. Sites K and N). Moreover, there are areas where (prepared) cores were introduced, which were subsequently further reduced and/or prepared 'on the spot'. Sometimes these cores were discarded as worn out items (*i.e*. Sites C, D, and N), while in other cases they were transported to other locations (*i.e*. Sites B, C, G and N) for further/future use (Table 5.21). This might well be one of the reasons why most of the find occurrences contain few cores. The Site A, D, N and Section finds are only represented by one (exhausted) example, while Sites H, G as well as the 'July 1990' test pit, do not contain any cores at all. Transport of tools and/or flakes away from the excavated findspots is more difficult to prove. Only the non-conjoinable (re)sharpening flakes at Sites A, G and K clearly indicate that tools were recycled for future use somewhere else. Refitting also shows that some of the larger and locally produced Site C flakes were transported to other areas. In this context Roebroeks (1988:135) speaks of "cores, flakes and tools [which, DDL] were manufactured, transported, used and discarded at rates dictated by the anticipation of activities on the one hand and the needs of the moment on the other". Judging from their morphology it can be assumed that most of the items were transported from one area to another in anticipation of future needs of suitable 'cutting edges'. The Site G micro-wear analysis gives supporting evidence for this hypothesis (Roebroeks 1988; van Gijn 1988, 1989).

The typo-/technological Belvédère data shows that in most cases a specific selection of items was transported from one place to another, *e.g*. well-prepared cores, large (Levallois) flakes, backed knives and scrapers. In the next part some of these find categories will be dealt with in the context of inter-assemblage variability. Initially the scrapers and Levallois products will be looked at.

According to the typological classification of the tools, most of the assemblages consist of few scrapers (Table 5.11). However, at Sites K and N a relatively large number of well-made Mousterian points and (convergent) side scrapers was found. All were produced on rather fine-grained and 'exotic' flint types. This together with the fact that only two scrapers of all 104 Belvédère examples could be conjoined to the rest of the assemblages (*i.e*. Site K, refitted composition II part E and XVII, respectively Sections 3.6.5.3 and 3.6.5.15), indicates that these tools were most probably part of a transported 'toolkit'. At Belvédère specific forms of large, wide and sometimes well-prepared blanks were either produced or selected for the production of side scrapers (transversal forms are very scarce). It can even be suggested that the 'scarcely' appearing 'classic' Levallois flakes were selectively used, to be retouched in rather standardized scrapers with equal forms, similar measurements and long 'cutting edges'. Compare for example the scraper assemblages of Site K and Site N (Section 5.4.3.4). The fact that these items appear in different numbers at certain locations, together with the variations in scraper morphology, could possibly explain the inter-site differences.

Scrapers are very elementary tools, which are characterized by two basic features (Bordes 1961; Mellars 1996). The (major) retouched edges are mostly located along one of the longest margins of the used blank, while the actual retouch was clearly intended to produce a regular and 'sharp' working edge. Several use-wear studies (amongst others Beyries 1987, 1993 and Roebroeks *et al*. 1997) confirmed the fact that the retouched parts were indeed intended as working edges. It has, furthermore, been demonstrated by regional and site-oriented analyses that typological variations occurring in and between Middle Palaeolithic assemblages are frequently related to re-use of tools (Dibble 1987*a* and *b*). During the process of intentionally extending the 'use-lives' of tools, re-modifications can occur repeatedly. This progressive resharpening of the edges (during use) often leads to a typological transformation of a tool (Fonton *et al*. 1991; Roebroeks *et al*. 1997). According to some authors (Dibble 1987*a* and *b*; Dibble and Rolland 1992) specific scraper types may, therefore, be interpreted as subsequent stages in the 'use-lives' of tools (*cf*. Section 3.7.4). In an idealized scenario, scrapers could have started their 'use-life' as unretouched flakes, which were only systematically retouched as their originally sharp edges became 'worn out' and/or damaged. During repeated phases of resharpening, single side scrapers could have been reduced to double side scrapers and subsequently to convergent and/or pointed side scrapers. Logically, this remodification and/or reuse reduces the scrapers in size, while the edges become steeper, leading eventually to tools displaying a 'Quina-like' retouch. In Dibble's (1987*a* and *b*) model, assemblages consisting of large numbers of simple side scrapers could be interpreted as reflecting less intense utilization (and reduction) of tools, while assemblages with large numbers of double and convergent side scrapers may reflect a more intensive use of the implements. In other words, the degree to which the resharpening processes were carried out could explain the variations in scraper forms and the frequencies in which they appear at different Middle Palaeolithic locations.

Several publications showed that there is also a relationship between the intensity of retouch and the distance of transport (Geneste 1985, 1988; Roebroeks *et al*. 1988*b*). As an example the spatial distribution of Middle Palaeolithic artefacts produced from phtanite in the Belgian Meuse area was mentioned by Roebroeks *et al*. (1988*b*). Here retouched flakes were generally discarded at much larger distances from the flint source than non-retouched flakes and cores. In a number of cases, like the cave sites of Trou Magrite and Trou du Diable (Ulrix-Closset 1975), transport involves distances exceeding 50 kilometres from the source area. Similar relationships between the intensity of retouch and the distance of transport have been documented for other Middle Palaeolithic locations, such as the Grotte Vaufrey in southwestern France (Geneste 1985, 1988) and the volcano sites in the German Neuwied Basin (Floss 1990, 1994). It is worth mentioning that besides scrapers also for other select typological groups of items a relationship between the intensity of retouch and the distances of transport is noticed (*i.e*. bifacial implements, *cf*. Bordes 1972; Bosinski *et al*. 1986; Kröger 1987). For the Middle Palaeolithic of the Aquitaine area in France, Geneste (1985) actually collected data for a link between Levallois products fabricated on transported raw materials and the occurrence of Mousterian points and side scrapers. All this implies that specific technologies executed on particular raw materials, together with sequences of re-use and typological transformations, often show a spatial distribution which is significant for our understanding of early human behaviour.

The previous statements offer some plausible explanations for the described differences in and between the 'high and low' density find distributions at Maastricht-Belvédère. The heavily reduced Site K and N scrapers, which are in many cases well produced, well prepared (Levallois), mostly on 'exotic' raw materials and above all non-conjoinable, are probably 'curated' items (Binford 1973; Bamforth 1986; Odell 1996). Apparently the blunted or damaged scraper edges were systematically (re)sharpened over and over again. This together with the few mentioned (non-conjoinable) 'transversal and long sharpening flakes' at Sites A, G and K gives positive proof that scrapers were indeed recycled in the system and that they were taken from one locus to another. Moreover, the intra-Saalian evidence does not support the idea that blanks were reduced into characteristic scraper forms as a consequence of continuous and intensive tool retouching/maintenance at the location of primary flake production (*cf*. [Weichselian] Site J, Roebroeks *et al*. 1997). It can probably also be concluded that this recycling behaviour was not intended to anticipate a scarcity of local raw materials. For example, in the 'high' density Site K distribution it is difficult to understand why intensive retouched and resharpened scrapers were introduced when there were sufficient unretouched flakes (assuming that they are contemporaneous) with large 'cutting edges' readily available. Additionally Sites H, F and K could suggest that raw material nodules in the vicinity of these findspots were plenty and immediately accessible. Supposedly the early human expertise on the local flint quality was developed to such an extent that, amongst others, scrapers on 'first-rate' materials, were carried through the landscape to support (Site K) or substitute (Site N) the 'lesser' quality flint found in the Pleistocene gravel beds of the river Meuse. It can therefore again be suggested that 'high' quality flint material was preferred and specially selected for the production of well-prepared items, which were probably intended to function for a longer time in the system. The fact that at Sites K and N a mixture of single-, double-sided and convergent scrapers were recovered could indicate that some were discarded after less intense use and remodification, while others were extensively used and eventually disposed of as 'worn out' implements (*i.e.* convergent side scrapers and Mousterian points). In other words the scrapers could have been dumped during different stages of the resharpening (use-live) processes.

Refitting and raw material studies also show that besides scrapers also cores and large unretouched flakes were transported. Especially the Site C analysis indicates that well-prepared cores (amongst others *Levallois recurrent*) entered the excavated area in an already reduced form. Some were further reduced and eventually discarded on the spot as 'worn out' items. Heavily exhausted cores were also recovered at Sites D and N (*débitage discoïde*). Other examples entered the excavated surfaces in a flaked form, where they were further prepared and/or reduced, to be subsequently transported to other locations (Sites B, C, G and N). In yet other cases (Site C) 'new' flint nodules were initially decorticated and prepared to be exported for future use. Like for the scrapers these patterns indicate that artefacts (cores) were carried around and discarded during different stages of reduction. All this is clearly in contrast with core reduction sequences at the 'high' density Site F, H and K assemblages. Here, the flint nodules were decorticated, scarcely prepared, reduced and eventually discarded at one and the same place. Unlike the latter occurrences, core preparation and core morphology at Sites C, G and N is generally related to transport of artefacts. In this sense the use of a Levallois technique (and especially the *recurrent* type at Site C) could represent an economizing behaviour towards the transported raw materials.

Part of the transported Belvédère 'toolkits' also consisted of large unretouched flakes of which a few are described as Levallois *sensu stricto* (Sites C, K and N). Mainly at Site C, analysis showed that Levallois *recurrent* flakes, produced outside the excavated area, entered the locus (together with the cores?) to be used and rejected on the spot. Moreover at nearly all findspots large flakes were recovered which differ in raw material than the rest of the assemblages. In addition they could not be refitted (dorsal/ventral) and often show macroscopic signs of use. This suggests that flakes, selected from previous knapping episodes, were transported to other areas for immediate/direct use (without modifications). At Site K one of these large imported flakes was used for the production of tools. The artefact was 'split' and modified into a burin and a notched implement (refitted composition XVI, Section 3.6.5.15).

The Maastricht-Belvédère data also shows that not only well-prepared cores, scrapers and ordinary (Levallois) flakes were transported. At Site G, and especially at Site N, a number of *éclats débordants* (*cf*. Beyries and Boëda 1983) were described. Technologically these flakes, struck in an 'offset-axe' direction, are vital in the 'preparation' and 'maintenance' of suitable core edge angles (*i.e.* disc[coidal] as well as Levallois *recurrent* core approaches). As mentioned before the raw material study together with the negative refitting results clearly show that within these 'low density' scatters almost all artefacts were imported. They were selected from the products of previous knapping episodes outside the excavated areas (Roebroeks *et al*. 1992). This makes the mentioned *éclats débordants* rather conspicuous and indicates that something else is going on as well with these 'core trimming element-like' flakes. There are two very typical examples present in the Site N assemblage, and nine flakes with a comparable form, *i.e.* flakes with a straight and sharp cutting edge, a back consisting of the side of a core and triangular in cross-section. Morphologically all these flakes can also be considered as 'backed knives'. In the context of Sites N and G (see the large 'backed knife', Roebroeks 1988) it seems, therefore, that the *éclats débordants* were obviously more than just waste. One could assume that this category of flakes, produced during core maintenance activities (as at Sites F, H and K), were singled out to be transported to other locations where technology was used. Such observations can put, according to Roebroeks *et al*. (1992), the whole practice of ordering debitage products into 'preparation' and 'selected' items into question.

In conclusion, the Belvédère data probably shows that well-prepared toolkits, mainly on 'first-rate' flint (fine-grained and without natural fissures), were transported from one location to another through the Meuse valley bottom landscape. The presence of already reduced and prepared *débitage Levallois recurrent* cores at Site C, the relatively few retouched items on non-conjoinable 'exotic' flint (*i.e.* scrapers and Mousterian points made on Levallois *sensu stricto* flakes) at Sites K and N, the selected 'backed knives' at Sites G and N and the unretouched 'isolated' (Levallois) flakes at Sites C, G, K and N give significant evidence for this assumption. It is, however, clear that in all cases we are dealing with discard of (prepared) 'finished' items and not with transport of larger (unprepared) raw material blocks/

nodules. The short distance transportation of large unprepared and untested raw material nodules at Site K can probably be regarded as an exception for the Belvédère situation. In addition, these blocks were probably not intended to serve longer periods of time in the 'transportation-circuit'. They were 'selected' for nearby expedient use.

It can, furthermore, be suggested that the mentioned cores, scrapers, 'backed knives' and (Levallois) flakes were introduced to the excavated areas to support (Sites C and K) or substitute (Sites G and N) the locally available, 'inferior' quality, raw materials during use. It seems that tools and cores may represent the 'intermediate' stages in the 'use-life' histories of Middle Palaeolithic technologies. After being used (and resharpened) at certain loci some implements were probably transported to other areas, where further use (and modification) took place. Eventually some of the artefacts were discarded in a final 'worn-out' form. This could point to the Belvédère locations reflecting different stages within a 'single' technological cycle of flake, tool and core use. It also indicates a certain anticipation of future use and therefore some kind of 'planning-depth' is suggested (Binford 1989).

As Roebroeks *et al.* (1988*b*) already mentioned specific artefacts were occasionally transported over large distances (up to 100 km) from their geological sources in the Middle Palaeolithic. This is probably one of the factors which affected the continuous transformation of the morphology of lithic artefacts. Generally resharpening (and/or knapping) events along the way were responsible for the fact that heavily retouched (and/or flaked) items were discarded at greater distances than non-retouched items (*cf.* Geneste 1985, 1988; Ulrix-Closset 1975). In the context of the Belvédère sites it is, however, very difficult, or even impossible, to assign distances to this transport. In fact this may have been very limited as most of the recovered flint types occur in the local gravel beds of the Pleistocene river Meuse.

All in all, the Belvédère 'tool' assemblages show a correlation between the import of items, the raw material characteristics, the used core approach (technology) and the intensity of retouch (tool typology). Moreover, the 'dynamic' model, centred around the differential transport of flint artefacts for future use, or for further reworking, partly offers an explanation for the Middle Palaeolithic inter-assemblage differences.

5.6.4 Expedient patterns in use of technology

As mentioned before, relationships between particular kinds of raw materials, particular technologies and specific kinds of retouched tools, linked to transporting behaviour, is not unique for the Belvédère situation. It has been frequently described for the Middle Palaeolithic record (Geneste 1985, 1988; Roebroeks *et al.* 1988*b*). Moreover, according to Geneste's study of the French Aquitaine area (1985), there is an unambiguous distinction in terms of typology and technology between locally produced, 'expedient' components, on the one hand, and the transported implements on the other hand. Geneste noticed that scrapers occurring on Levallois products were scarcely produced on local materials. Local raw materials were more often used for the production of morphologically simpler and smaller tools, *i.e.* denticulates, abrupt and irregularly retouched tools and notched pieces. This may possibly reflect the *ad hoc* nature of the latter tools. They could have been made from what lay immediately to hand during episodes of primary flint knapping and were discarded very close to their production areas (Geneste 1985).

Similar patterns are for example known from the upper (Saalian) levels E-5 at La Cotte de St. Brélade on the island of Jersey (Callow and Cornford 1986). Again, there is a clear relationship between the import of 'good' quality flint and the occurrence of well-made scrapers, points and handaxes. Denticulates and notched tools from these levels are often made from other materials, like quartz. The latter must have been collected in the surroundings of the cliff location. At Saint-Vaast-la Hougue, Normandy (France), two different strategies are identifiable in the archaeological levels dating from the late Eemian interglacial and/or Early Weichselian (Fosse *et al.* 1986). The lithic assemblages from the *Horizons Inférieurs*, situated in beach deposits, are made of a coarse-grained flint that was probably collected in the vicinity of the location. Prepared cores and/or flakes are rare, while denticulates and notched pieces dominate among the retouched tools. In the *Horizons Supérieurs*, stratigraphically situated in a loess head, assemblages made of fine-grained 'exotic' flint, imported from outcrops some 20 kilometres away, were described. It concerns here Levallois cores and flakes *sensu stricto*, and most of the retouched tools are well-made scrapers (some with Quina retouch). Furthermore, comparable patterns are observed for the Early Weichselian location of Sclayn (Otte 1992; Otte *et al.* 1988, 1998) in the Belgian Meuse area, close to Southern Limburg region.

Compared to these northwest European examples, it seems possible that such a 'binary pattern' (*cf.* Geneste 1985, 1988; Roebroeks *et al.* 1988*b*; Dibble and Rolland 1992) is also present within the Maastricht-Belvédère Unit IV levels (Table 5.21). Besides the previously described transported implements on fine-grained and minor flaw influenced 'exotic' flint (Section 5.6.3), the expedient nature of technologies is indicated by the lithic strategies employed at Sites F, H and K. These locations are characterized by intensive knapping episodes and the use of local materials, which were procured at close distance to the primary flaking areas. That these raw materials were indeed collected from nearby sources (gravel beds of the river Meuse) is pointed out by the large and heavy nodules, which could be almost entirely conjoined at Site K. Refitting also shows that 'complete' technological sequences were discarded at their place of production; *i.e.* from the initial decortication stages, through the production of flakes and tools up to the discard of these flakes, cores and 'worn-out' tools.

In addition, it seems sometimes possible to detect a 'binary pattern', or at least inter-assemblage differences, in the spatial distribution of the refitted compositions. 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 time (Site C). At Site C the spatial configuration seems to represent flint-working events of which the products were transported from one locus to another, where they were then abandoned and where a new reduction sequence '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'. This went on until a sequence left the excavated area. This chain of 'single' connections or 'locus-hopping' can be described as spatially diachronic and reflects a certain mobility (Figure 5.2). At Site K, on the other hand, the spatial layout of the conjoined nodules echoes a more static and contemporaneous pattern. Here, the different activity loci are connected by multi-connections of refits and the sequences actually stay 'within' the site boundaries. It seems that lithic technology was transported, over and over again, between the 'same' activity areas within the excavated area. The horizontal configurations at Site K can therefore be described as spatially synchronic (Figure 5.2).

As illustrated in previous sections, the rather sophisticated form of Levallois *recurrent* documented for Site C contrasts conspicuously with the non-prepared (non-Levallois) core reduction practised at Sites H, F and K. These patches could indicate a relationship between the expedient use of 'poorer' and coarser-grained raw materials, the use of disc(oidal) core reduction techniques and the production/use of 'morphologically simpler' implements. Denticulates, notched pieces, burins, and borers rarely occur in the assemblages. However when they do occur, it is mostly in the patchy find distributions and in most cases they could be refitted (*Aufeinanderpassungen*). Table 5.11 shows that of a total of six Belvédère notches, five were recovered at Site K and one at Site M. The single borer and burin were excavated at respectively Sites F and K. Furthermore, six denticulates came from the Site K area and one from the Site N area. The latter implement seems to be an exception in the context of this supposed expedient pattern, as it comes from a low density scatter. It is, however, possible that we are dealing here with a transported 'worn-out' tool, which was re-modified many times and was transformed morphologically (*cf.* Roebroeks *et al.* 1997) through time and space (*cf.* Dibble 1987*a* and *b*). It could also not be refitted. Especially at Site K we can (spatially) see that notches and denticulates (and the burin) were *ad hoc* produced to possibly assist the more sophisticated and mostly imported 'toolkit'. It can be suggested that notches and denticulated tools, in contrast to the transported implements, impose far fewer demands on the skill of the flint worker or the used raw materials.

It seems that at least part(s) of the Belvédère assemblages, and especially the high density patches, represent expedient events of which the products were in direct support of the main transported 'toolkits'. In other words the implements which reflect highly mobile behaviour were *ad hoc* supported by locally procured and produced materials. The use of local flints, collected from river beds, could have provided an almost unlimited and immediately accessible source of raw materials. The *ad hoc* produced 'cutting implements' and cores were at Belvédère of a lesser quality flint (flint with many natural fissures and coarse-grained) and were a direct technological response to a given situation during 'daily' foraging activities. Nevertheless, these expedient lithics were almost immediately discarded after use, at the location of manufacture and/or use (*cf.* Site K, Chapter 3). The 'higher quality implements', on the other hand, were deliberately transported further for future use.

5.6.5 Conclusion

It can be concluded that the flint scatters and patches at Belvédère Unit IV contain elements of both 'expedient' and 'curated' technologies. Although some scatters (Maastricht-Belvédère Sites F, H and K) reflect more expedient technologies than others (Sites C, G and N), a 'binary pattern' is clearly present in these Meuse valley find distributions. In attesting the fine-tuned differences, typo-/technological and refitting studies proved to be essential (Chapters 3 and 4; Appendices 2-11). It has to be mentioned, however, that typologically this 'binary pattern' is not so obvious, as most assemblages consist mainly of similar kinds of 'tools': *i.e.* several types of scrapers and points, backed knives and large well-prepared (Levallois) flakes which show limited variations. It is more a matter of overall 'tool' percentages and the presence of 'exotic' raw materials. Moreover, all find distributions at Belvédère can be seen as reflecting essentially a technological strategy, that was flake oriented and that was based on an almost 'continuous' transportation of prepared cores, flakes and relatively few tools. The few retouched tools mostly reflect the discarded relics of 'intermediate' phases in the use-histories of flakes and tools, while intensive re-use of lithics seems to have been an exception. Typological differentiation could have been limited as we are dealing here with assemblages which were mainly discarded during

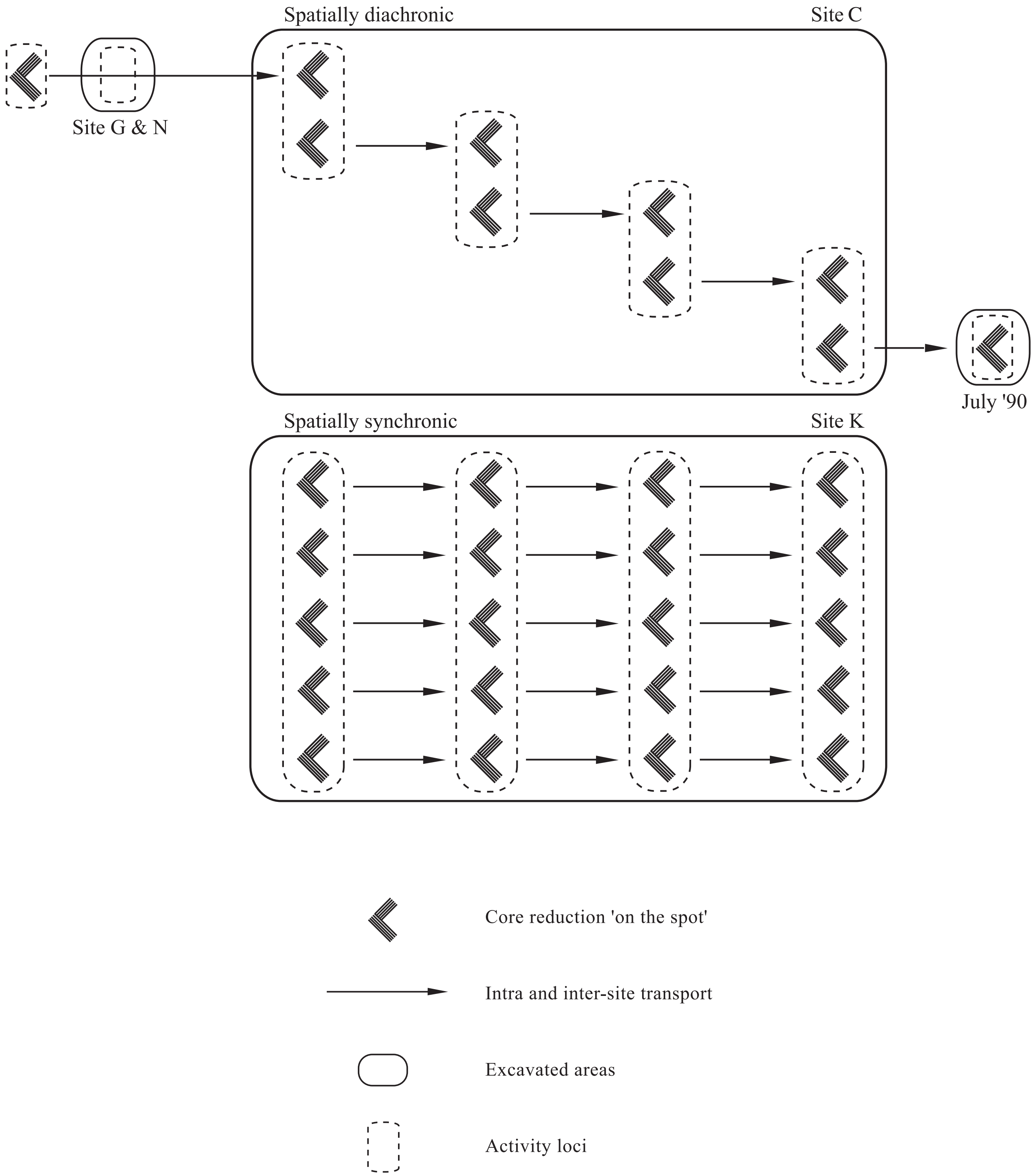


Figure 5.2: Maastricht-Belvédère. Schematic 'differences' between the spatial distribution of the refitted compositions (synchronic *versus* diachronic) of the Unit IV sites.

'short' periods of visit in an area with a 'high' sedimentation rate, as compared to the find occurrences outside the valley bottom (see Kolen *et al*. 1998, 1999; Verpoorte *et al*. 2002).

Technologically the 'binary pattern' is more clear. Although the used lithics reflect mainly a very mobile technology, at certain loci (*cf*. Sites C, F, H and K), the transported toolkit seems to have been replenished with an expedient *ad hoc* produced component. Besides the differences in lithic densities, some are higher (Sites F and K) than others (Sites G and N), the more dominant expedient assemblages show, amongst others, the use of local raw materials, larger quantities of decortication flakes, more technological errors (*cf*. Shelley 1990) and large sequences of conjoined artefacts (dorsal/ventral). Moreover, the use of a disc(coidal) technology seems to prevail on locally procured coarser-grained raw materials, while Levallois (*recurrent* as well as *préférentielle*) products on 'exotic' finer-grained flint are more prominent in the transported toolkits.

5.7 Discussion and conclusion

The data collected from ethno-archaeological research (*cf*. Binford 1980, 1982) provides a starting point for studying the spatial organization of settlement and subsistence activities of Palaeolithic hunter-gatherers. At least these studies showed that the behavioural patterns of non-sedentary communities are spatially continuous and that the subsistence activities, executed during mobile strategies, have a direct relation to the discarded materials ('toolkits'). Additionally, these transported and/or *ad hoc* produced relics represent only a very small (material) part of the system in which they functioned and are mostly our only information on 'fossil' behavioural patterns.

Ethno-archaeological research also illustrated that if we want to analyse the 'daily' activities of early human societies we should practise an 'off-site' archaeology (Foley 1981*a*; Isaac 1981).

The study of Middle Palaeolithic off-site patterns at Maastricht-Belvédère showed that when all possible information is integrated in the analysis and if we focus on archaeological landscapes rather than on the 'classic' sites, the potential of small parts of a (micro-)landscape can be rather promising for studying early human behaviour (Roebroeks *et al*. 1992).

When the 'individual actions' (isolated artefacts, single action clusters and clusters of clusters, *cf*. Isaac 1981) are studied on a more (micro-)regional scale, some differences between the sites can be described. The observed differences are probably not only related to taphonomic or post-depositional features but early humans possibly used various places in the landscape for a variety of activities, using and producing 'different' material components.

Excavations of the 250,000 years old Unit IV levels showed that parts of the valley bottom at Belvédère must have been littered with artefacts and bones, indicating that the local environment was frequently visited by early humans during short subsistence activities. This large-scale and 'continuous' artefact distribution, referred to as a 'veil of stones' by Roebroeks *et al*. (1992), looks rather uniform in terms of typology. The find distributions predominantly consist of unmodified flakes and flint knapping debris. When retouched tools do occur, it is generally in small numbers and typological variation is limited. Flakes with microscopic signs of use, backed knives and scrapers are by far the most frequent tool types. The most important inter-site differences at Belvédère are related to variations in artefact density, raw materials and fine-tuned technological features, which were only detected by elaborate refitting and lithic analysis (*cf*. Appendix 1).

The Belvédère analysis, based on Isaac's work in Africa (1981), eventually resulted in the definition of so-called 'high density patches' and 'low density scatters' (Roebroeks *et al*. 1992). Apparently the excavated low density distributions seem to have originally covered large surfaces of the Meuse valley bottom. It is likely that these ('continuous') scatters were formed during many episodes of early human activity, involving the use and discard of 'few' lithics (small 'toolkits'). Within these extensive 'background distributions' one occasionally encounters clearly recognizable concentrations, formed by locally higher densities of artefacts, *i.e*. the 'classic' sites, which mainly consist of waste products of core reduction.

According to raw material qualities, core reduction modes and tool typology (*cf*. Geneste 1985; Roebroeks *et al*. 1988*b*; Féblot-Augustins 1993, 1997, 1999), it has been suggested that the 'sites' contain elements of both 'expedient' and 'curated' strategies. On the one hand there are assemblages made almost exclusively on local raw materials, characterized by a dis(coidal) core approach and sometimes consisting of denticulates, notched pieces and scrapers (Sites F, H and K). On the other hand there are technologies consisting of prepared cores and flakes (Levallois *sensu stricto*) and predominantly well-made scrapers (amongst others Mousterian points) which were produced on 'exotic' materials (Sites C and N). These strategies were not mutually exclusive and were apparently not used in different periods of time.

We were able to find a rough correlation between the occurrence of scatters or patches and the use of, respectively, transported or local raw materials, dis(coidal) or Levallois technologies and scrapers, backed knives and well-prepared flakes or morphologically less sophisticated tool types. The patches consist of vast quantities of *Aufeinanderpassungen* (*cf*. Cziesla 1986, 1990), while the few conjoined artefacts at the scatters are mainly *Aneinanderpassungen*. In this setting the high density Site K, H and F assemblages can be interpreted as mainly *ad hoc* or 'expedient' technologies, focused on activities to be performed 'on the spot'. Locally procured raw materials were systematically reduced to large quantities of suitable blanks ('cutting equipment') for direct flake use or for minor tool production. These patches predominantly reflect maintenance of technology.

Raw material study and refitting suggested that the majority of the recovered Belvédère Unit IV tools *sensu stricto* are part of a transported toolkit. For example (convergent) scrapers, (unretouched) backed knives and Levallois products were extensively transported from one place to another, possibly in anticipation of future use (Roebroeks *et al*. 1992). The latter were mostly well prepared, though sometimes heavily reduced, were made from fine-grained raw materials and were discarded at 'some' distances from their place of production. Together with few well-prepared cores they must have been brought to locations where the tools were sometimes resharpened and core edges were sporadically renewed. These spatially scattered implements probably circulated for a longer period of time in a cultural system. The areas where only the transported items were used and discarded and where no major additional flint equipment was produced are represented by the Site G and N low density scatters, as well as by the isolated section or test pit finds. It can be suggested that these transported technologies were used in direct food procurement.

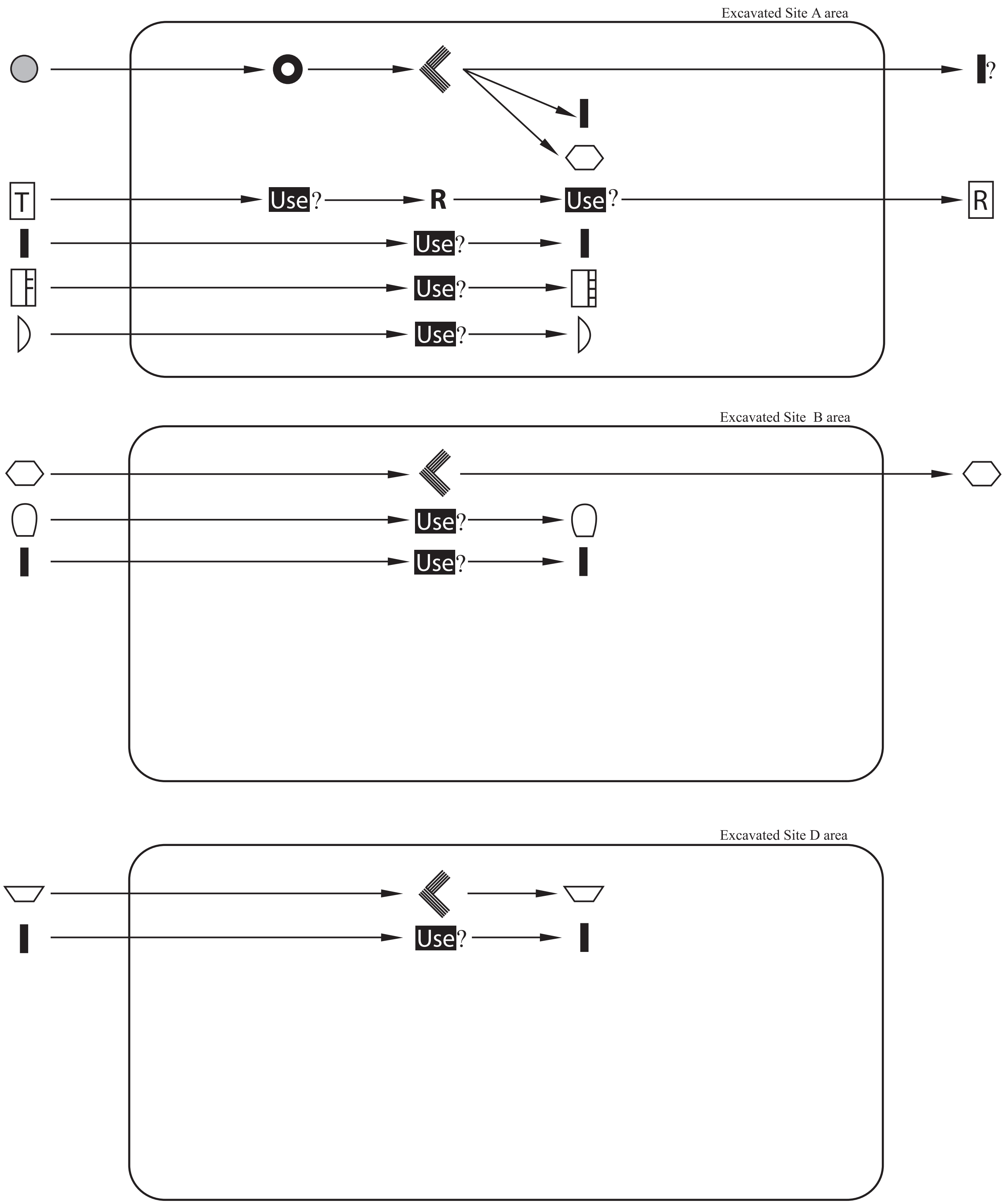
Although there is a similarity in density and (probably) main activity, the Belvédère high density patches differ regarding typology, technology and spatial distribution. This might suggest that two kinds of patches are present (Site C *versus* Sites F, H and K). The differences are mainly depending on the amount of transported material (flakes and cores). The Site C patch, where a transported technology (well-prepared cores) was brought to and from which expedient 'cutting implements' were produced for local and/or future use, can therefore be considerate as an in-between situation.

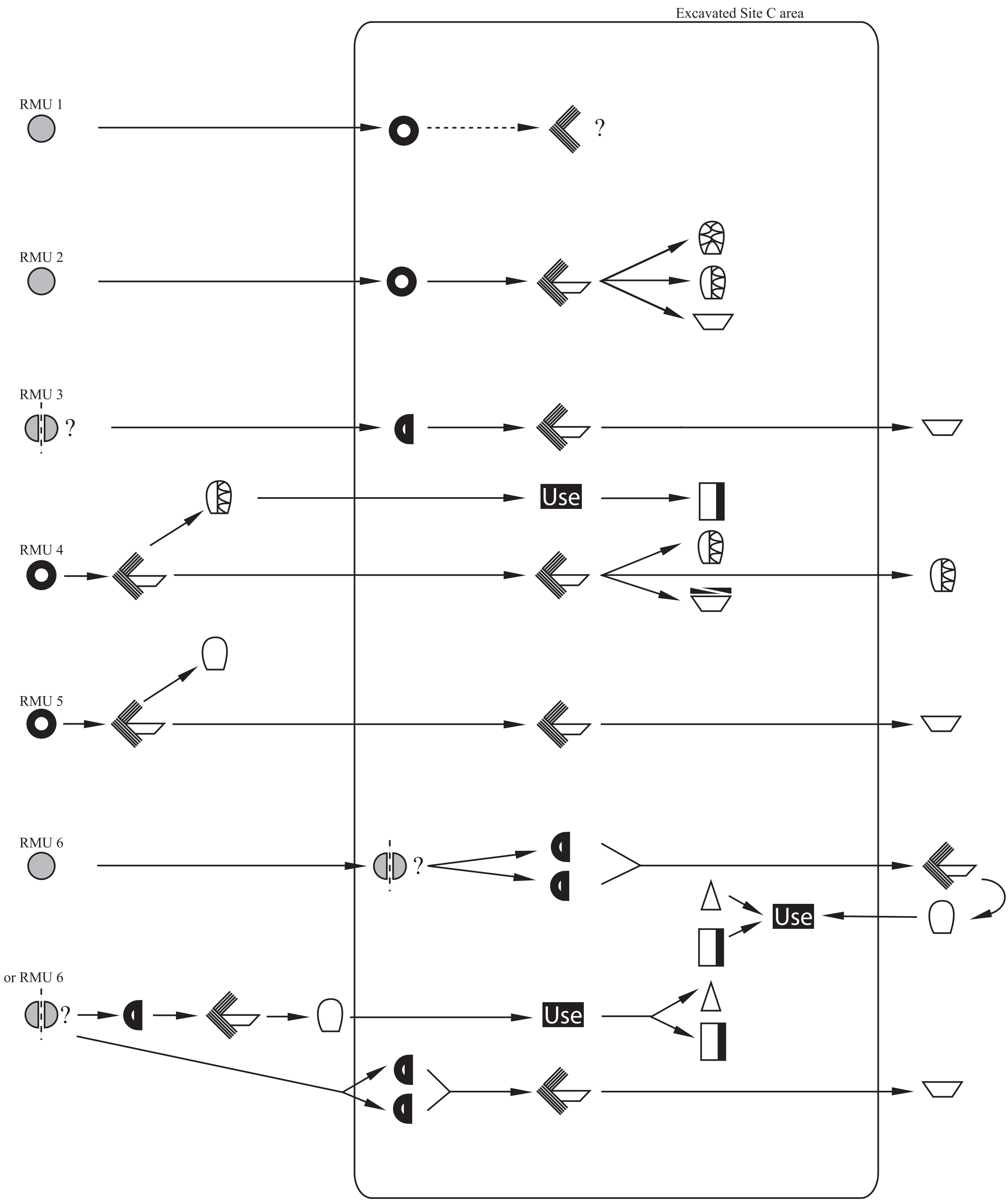
In general the Belvédère data indicate that we are actually dealing here with the remnants of 'binary strategy' (*cf*. Geneste 1985). It is however not a 'black and white' situation but more a matter of scale as all Belvédère scatters and patches contain some flaking activities; *i.e*. complete reduction sequences, from the procured raw material nodules to the discard of the produced flakes, cores and tools, at the high density patches Sites F, H and K, and the production of 'single' or small series of flakes and the rejuvenation of core edges at the low density scatters of Sites G and N. In addition all Belvédère locations show a certain amount of transported material, in the form of cores, flakes and/or tools. Percentage-wise there are more transported items at Sites C, G and N (see Figure 5.3 for a summary of lithic behaviour). In the patches these transported 'toolkits' were locally replenished or renewed with *ad hoc* procured and produced flint artefacts, to be used 'on the spot'. Moreover, the described 'binary pattern' indicates that the observed technological differences may have been mainly related to different aspects of Middle Palaeolithic mobility (Roebroeks *et al*. 1988*b*).

Although the high- and low-density distributions give different but complementary information, it has to mentioned again that they do not form separate and clearly defined spatial units; all Belvédère find distributions have a position somewhere on a sliding scale between the areas with the highest densities at Site K and the areas with lowest densities at Site N. It can therefore be concluded that all excavated areas produced remnants of a 'single' mobile strategy in which flint cores, blanks and finished tools were constantly produced, carried around and maintained in preparation of various activities. The scatters and patches probably represent different places in the spatial organization of Middle Palaeolithic equipment and the executed activities eventually resulted in a spatial fragmentation of various phases of the '*chaînes opératoires*' (*cf*. Roebroeks 1988:58-59).

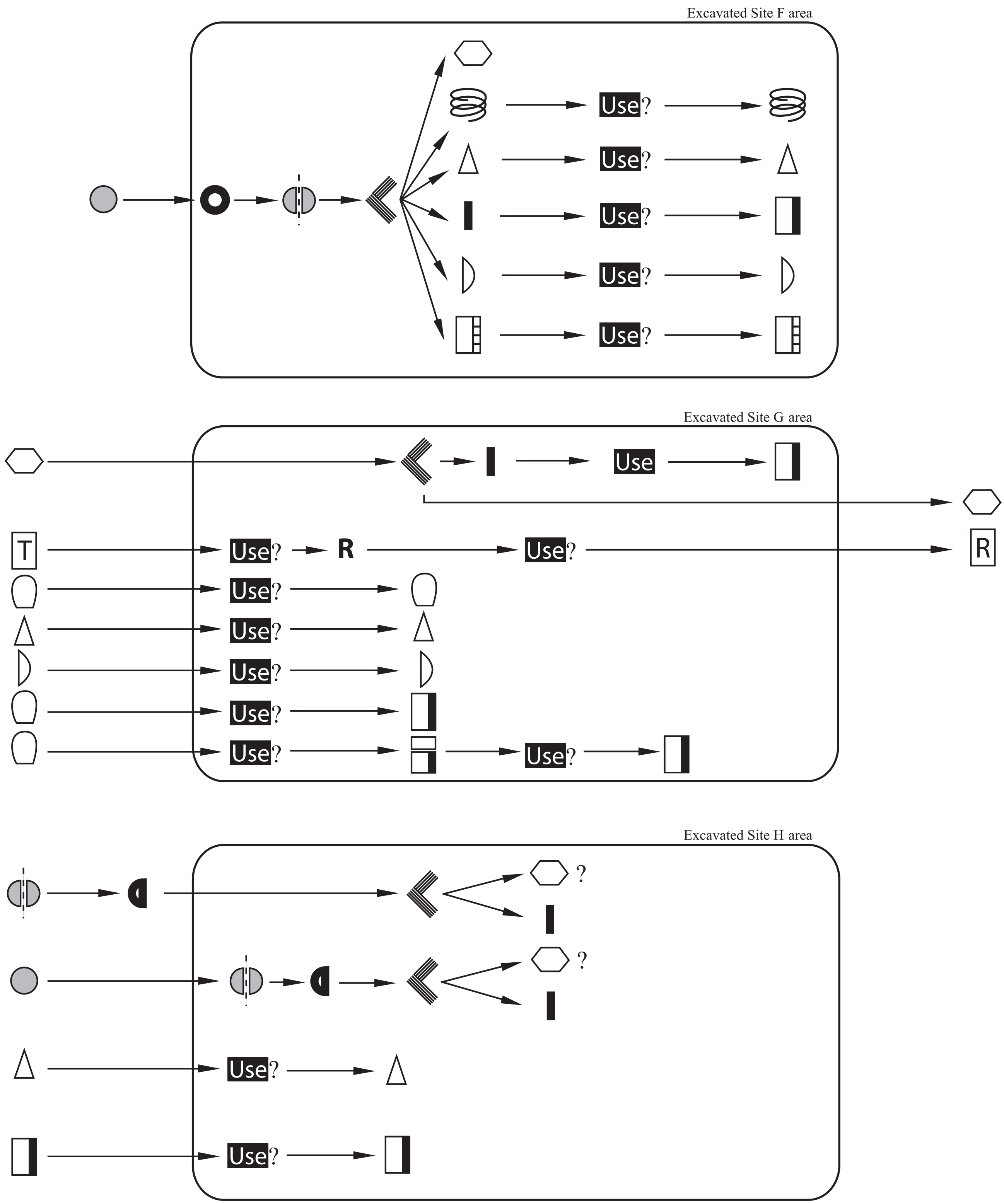
This introduces us to the next question. If the Maastricht-Belvédère (Unit IV) scatters and patches represent spatially different places where Middle Palaeolithic early humans organized, maintained and/or used their foraging equipment, which kind of activities/tasks might have been practised at the locale?

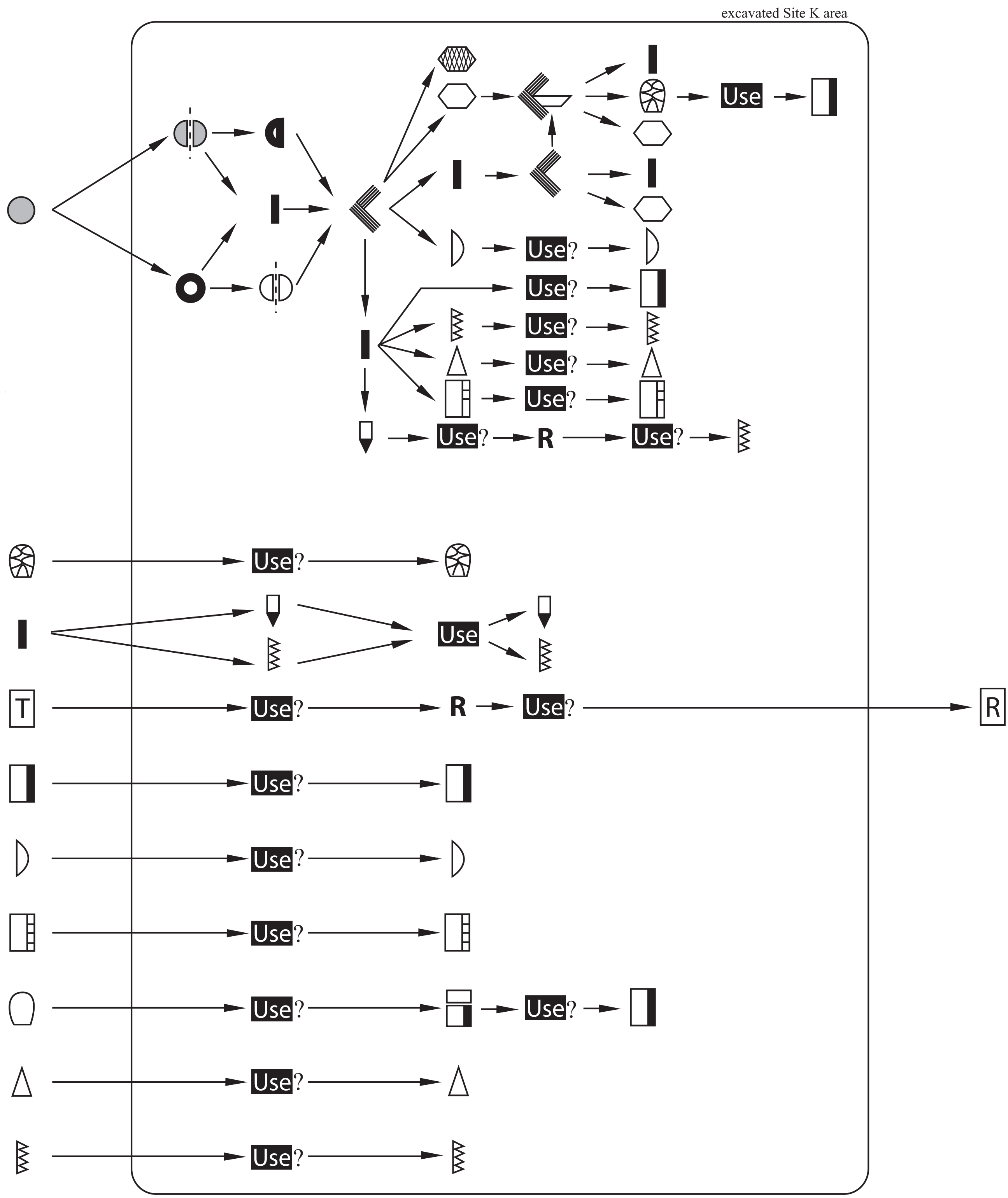
In our search for answers to this question, it is important to realize that the executed activities were probably not only technological in nature and that they possibly also involved materials other than flint. Organic artefacts like wood (*cf*. Lehringen [Thieme and Veil 1985] and Schöningen [Thieme and Maier 1995; Thieme 1996, 1997, 1999]), bone and/or antler (*cf*. Salzgitter-Lebenstedt [Tode 1953, 1982; Gaudzinski and Roebroeks 2000]) can be mentioned. Despite the fact that most of the recovered Unit IV faunal remains were poorly preserved, some clues can be found to the Belvédère situation. The co-occurrence of lithics and faunal remains and the information derived from use-wear analysis (van Gijn 1988, 1989; Roebroeks 1988; Roebroeks *et al*. 1997) are of specific interest for making inferences on local early human activities. As mentioned before (Roebroeks 1988:75-76; Chapter 4), the nature of Middle Pleistocene activities in this small part of the Meuse valley bottom may be best indicated at Maastricht-Belvédère Site G. There, a large backed knife with micro-wear traces recovered amongst a concentration of faunal remains pointed to the butchering of a rhinoceros. That the processing of animals was a main activity carried out in the 'veil of stones' is also supported by

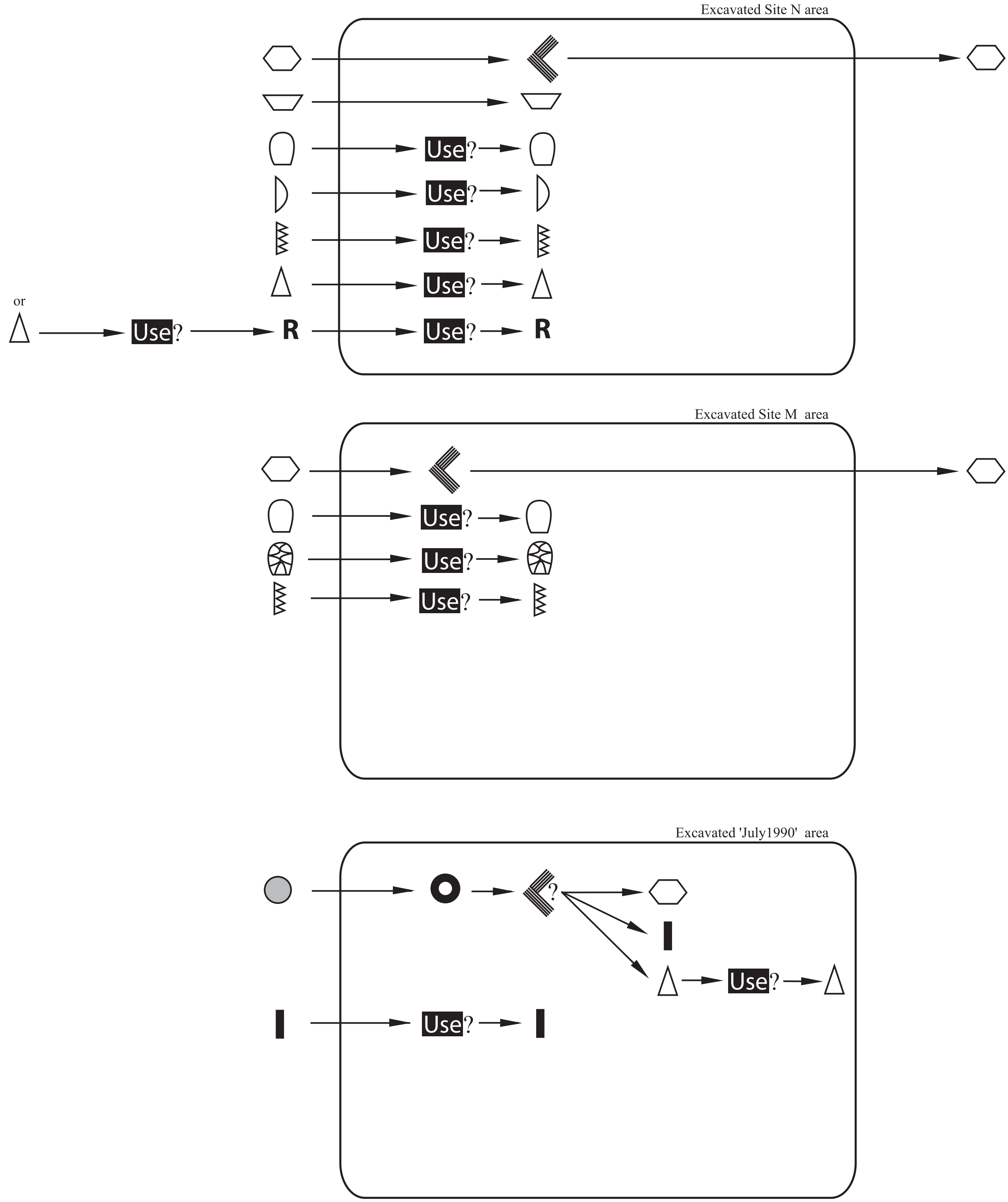

Excavated Site A area
T
Use?
R
Use?
R
?
Use?
Use?
Use?
Excavated Site B area
Use?
Use?
Excavated Site D area
Use?



Excavated Site C area
RMU 1
?
RMU 2
RMU 3
?
Use
RMU 4
RMU 5
RMU 6
?
Use
or RMU 6
?
Use


Excavated Site F area
Use?
Use?
Use?
Use?
Use?
Excavated Site G area
Use
T
Use?
R
Use?
R
Use?
Use?
Use?
Use?
Use?
Use?
Excavated Site H area
?
?
Use?
Use?


excavated Site K area
Use
Use?
R
T


Excavated Site N area
or
Use?
R
Excavated Site M area
Use?
Excavated 'July1990' area
Use?

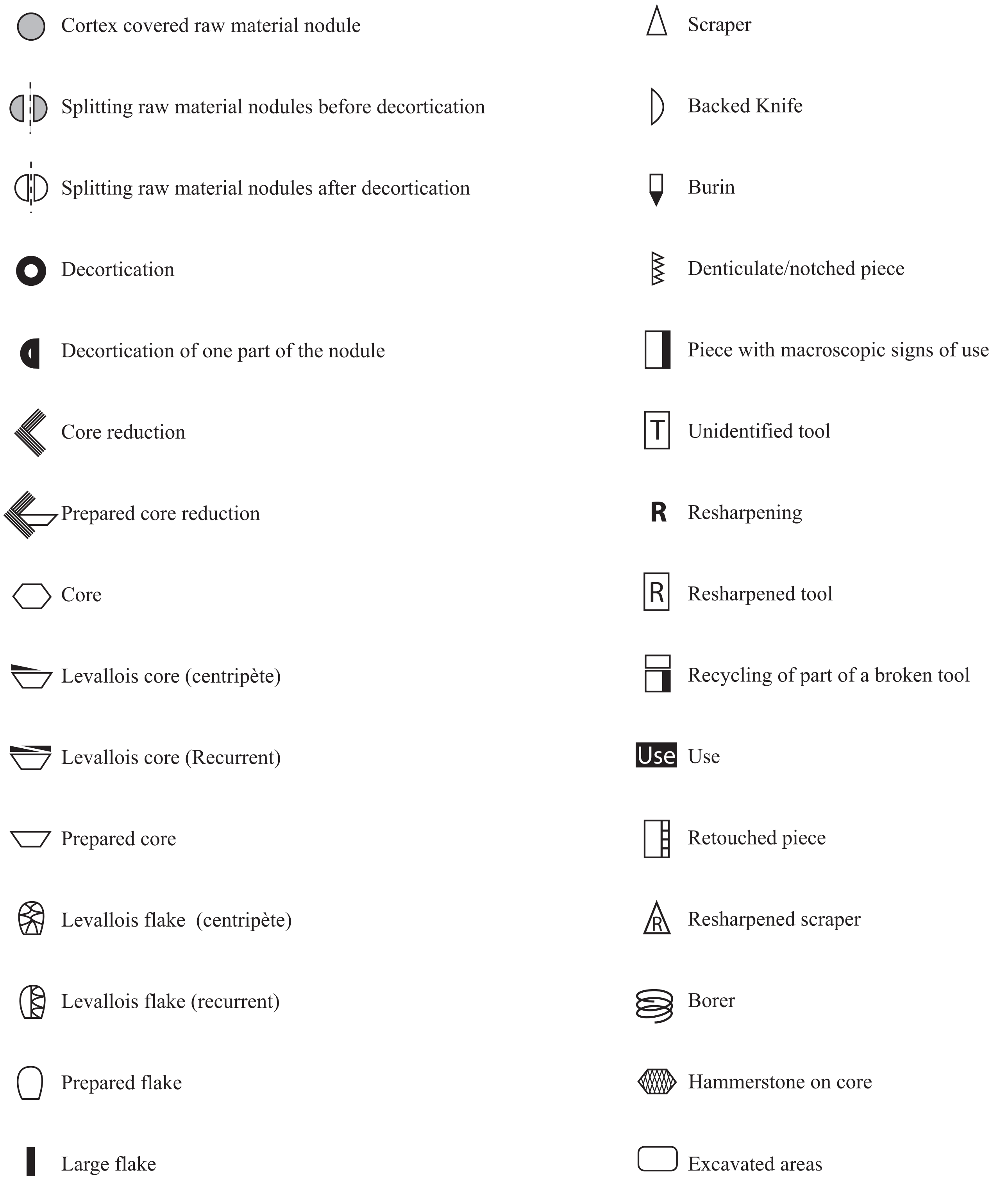


Figure 5.3: Maastricht-Belvédère. Schematic summary of lithic behaviour for the Unit IV sites.

the scarce micro-wear results of other Belvédère scatters (*cf.* Site C). These indicate the use of simple (unmodified) flake(s) (tools) for the cutting (procurement) of meat and the processing of hides (van Gijn 1988, 1989). The lithic analysis indicated that the principal flaking strategy was probably geared toward the production of long and wide flakes with large 'cutting edges'. The latter well-prepared and/or selected lithics seem to have been also a major component of the transported 'toolkits' (amongst others the backed knives, *cf.* Sites G, N and K). According to the use-wear results, these could be the implements that were most often used for meat processing.

It can therefore be concluded that a major part of the 'expedient' and/or 'curated' technologies was probably used in meat related activities, which appear to have been one of the major reasons for the human presence at the Belvédère locale. Whether the majority of faunal remains found inside the excavated areas owed their presence to early human activities, which at Site G probably was the case, or should be considered as 'background fauna' (Roebroeks 1988) and whether these activities were related to scavenging (Gamble 1986, 1987) or hunting (Binford 1985) are questions for which the data is insufficient or lacking at Belvédère. Nevertheless, the spectacular results of the excavations at Schöningen in Germany (Thieme and Maier 1995; Thieme 1996, 1997, 1999), *i.e.* the finds of several wooden javelins, clearly showed that early humans were technologically capable to hunt some 350,000 years ago.

It is clear that the lithic strategy applied at Belvédère reflects 'short term, episodic and highly mobile' (Roebroeks and Tuffreau 1999:128) spatial behaviour, suggesting only very brief visits to the riverine Meuse area. In addition, there are probably no indications for a longer and consistent use of one and the same location. In other words it seems that early humans did not operate out of a 'central place' or 'base-camp' for their 'daily' subsistence practices in the river valley. If there were such camps, they were probably not present or recognised at Belvédère.

One of the crucial questions in this discussion is how to archaeologically identify a 'base camp'. Several authors (amongst others Binford and Binford 1966; Isaac 1978*b*; Binford 1991) suggested that some physical structures (*cf.* Gamble 1986) and specific activities should be present and performed 'on the spot', *i.e.* activities involving technological maintenance, sharing, preparing and consumption of brought-in foods, production of tools and cores for future use at other places, social interactions involving mature and juvenile individuals, etc. It is however clear that some of these activities are virtually impossible to trace archaeologically.

The issue of organized *versus* compound entities is essential in a discussion on possible land-use models of Middle Pleistocene hunter-gather populations (*cf.* Binford 1987*a*). As suggested before (Roebroeks 1988), the majority of the well-preserved Belvédère findspots represent taphonomic enigmas, in which meaningful behavioural relationships between (groups of) artefacts could not be made. Most sites probably represent accumulations of materials (activities), formed during several independent depositional events spaced in time. A palimpsest scenario is most probably responsible for the low density scatters at Sites N and G but possibly also for the majority of the high density assemblages (Roebroeks 1988; Roebroeks *et al.* 1992).

For example at Site C the occurrence of burned artefacts provided, on the one hand, some indications for the chronological relationships of some of the flint-knapping activities. On the other hand these burned lithics, which could be refitted to particular nodules or cores, indicate a certain time-depth in the deposition of the artefacts (see Roebroeks 1988 for details).

In the context of this palimpsest debate, Site K seems to be an exception. Although burned artefacts could suggest some time differences of deposition, in view of typology, technology, refitting and intra-site spatial patterning one is more inclined to think that this patch was created during one single use phase of activity (Section 3.10.2). Additionally, this high density assemblage can be interpreted as a rather organized use of space. This of course does not immediately mean that we are dealing here with the remnants of a base-camp.

Generally it can be concluded that Maastricht-Belvédère shows no clear indications which could identify certain scatters, and especially patches, as base-camps, whatever that means in terms of lithic reflections. Even the Site K artefact distribution, where there are some 'signals' for an organized use of space, probably represents a 'brief' visit related to the maintenance of technology in combination with other activities like food procurement (*cf.* Binford's [1978] 'hunting' stands). As a result, it is possible to use the Belvédère Unit IV situation as an indication that early human groups did not operate out of central places. It has to be stressed again, however, that we are dealing here only with a very small part of a landscape (ca. 6 ha of a valley bottom location) and that we are probably missing evidence to answers such questions.

River valley bottom locations like Maastricht-Belvédère were probably of interest due to their raw material availability. Local flint supplies were relatively abundant in the gravel-beds of the river Meuse and available in the form of relatively large coarse-grained nodules which show many flaws (*cf.* Site K). Such locales also provided easy access to fresh water, were ecologically varied, rich in plant food and attracted different species of large mammals (van Kolfschoten and Roebroeks 1985; van Kolfschoten 1990; Vandenberghe *et al*. 1993 and van Kolfschoten *et al*. 1993), including early humans.

In general places like Maastricht-Belvédère could have functioned as Middle Palaeolithic ‘shopping and/or chopping centres’ where on a ‘regular’ basis food and raw materials were obtained for ‘daily’ early human subsistence. Lithic analysis and conjoining showed that well-prepared toolkits entered the Belvédère valley bottom location(s), where they may have been used for activities of short duration and directed primarily towards the procurement of meat (*cf*. Roebroeks 1988:75-76, for Belvédère-Site G). Furthermore, the Belvédère analysis could suggest that the procurement of flint had an ‘embedded’ character, *i.e*. was ‘embedded’ in the ‘daily’ movements and activities of Middle Palaeolithic groups (*cf*. Binford 1980). One can imagine that when these toolkits were not adequate enough for a certain activity, they were replenished, assisted or replaced by *ad hoc* produced ‘cutting edges’ on locally found flint (for example at Site K). By using different technological modes (Levallois *versus* Disc/discoidal), they were apparently capable of surmounting different types (fine- *versus* coarce-grained) or qualities (with flaws *versus* without fissures) of flint and could directly anticipate certain problems. Moreover, the incoming lithic implements (scrapers, large and well-prepared Levallois cores and flakes) could indicate a certain amount of planning-depth.

The ‘veil’ model (*cf*. Roebroeks *et al*. 1992) and Roebroeks (1988) indicated already that the Belvédère Unit IV ‘scene’, in which different find patterns occur, could have functioned as a ‘fixed point’ in a dynamic system of continuous transport of artefacts, *i.e*. prepared cores, finished flakes and tools.

Such a hypothesis is for example suggested for the Middle Palaeolithic levels at La Cotte de St. Brelade (Callow and Cornford 1986), Biache-Saint-Vaast (Tuffreau and Sommé 1988) and Seclin (Tuffreau *et al*. 1994). Analysis showed that these northwest European locations must have been visited ‘briefly’ on a frequent base and over longer periods of time. This resulted in the documentation of several find levels where one can see a consistent technological response to local raw material availability. It has been suggested that these locales were visited over and over again, thanks to prior knowledge of the raw materials, or better, the natural environmental situation (Roebroeks and Tuffreau 1999). Roebroeks and Tuffreau (1999:129) speak of “fixed points on the mental maps of Middle Palaeolithic foragers” which were visited intentionally, by means of well-planned trips. According to the time-depth of these multi-level locations, the information on particular points of interest must have been shared over several generations (Féblot-Augustins 1999; Roebroeks and Tuffreau 1999).

The question, whether the Belvédère locale (on its own) functioned as a ‘fixed point’, can probably be answered negatively. As the location represents only a very tiny part of a riverside landscape, one is more inclined to suggest that the complete river valley bottom, or at least part of it, could have functioned as a ‘fixed point’. Early humans could have focused their ‘daily’ foraging trips on these waterside settings as they probably represent Palaeolithic ‘shopping centres’, for various reasons mentioned above. Moreover, “these open corridors through forested areas must have acted as a kind of highways for Pleistocene hunter-gatherers” (Roebroeks and Tuffreau 1999:127), who briefly stopped to execute a number of food and/or non-food related activities.

In conclusion, the main archaeological level at Maastricht-Belvédère, that is Unit IV, seems to indicate that the banks of the river Meuse were frequently visited by Middle Pleistocene early humans. These hunter-gatherers left behind a ‘veil of stones’ in the riverside landscape. In this landscape different kinds of artefact distributions were discarded during ‘limited’ periods of time. Although both high- and low-density patterns give different but complementary information concerning the aspects of artefact density, typology, technology, raw material, spatial distribution, and so on, it can be concluded that the Belvédère scatters and patches mainly reflect the ‘intermediate’ stages in the use-life of transported technologies. Brought-in ‘toolkits’ were replenished, assisted or replaced by locally produced implements and used during food (meat) processing activities. The technological variations (disc[oidal] *versus* Levallois) were probably for a large part related to the used (or availability of) raw materials. Technology can therefore be described as very flexible.

Although the ‘continuous’ archaeological find distribution (*i.e*. scatters and patches) was the centre of attention, it was realized that the information revealed could be one-sided and therefore representing only information on the valley bottom occupation, or better on the Belvédère situation. In Roebroeks’ words:

> “Focusing our archaeological attention to the -usually better preserved- fine-grained ‘sites’ may eventually result in the construction of land-use models based on the -generally short-term-sites produced in areas with a high rate of sedimentation.” (Roebroeks 1988:168).

Moreover, one should even ask the question whether the Belvédère data is representative for a valley bottom landscape, or at least the stream valley of the river Meuse. ‘Long-term’ research at amongst others Mesvin IV (Cahen and Haesaerts 1984; Cahen and Michel 1986) in Belgium, Biache-Saint-Vaast (Tuffreau 1978*a*, 1986; Tuffreau *et al*. 1977, 1982; Tuffreau and Sommé 1988) and Cagny (Tuffreau 1978*b*;

Tuffreau *et al*. 1986; Antoine and Tuffreau 1993; Tuffreau and Antoine 1995) in France and Salzgitter-Lebenstedt (Tode 1953, 1982; Busch and Schwabedissen 1991), Markkleeberg (Grahmann 1955; Baumann *et al*. 1983) and Wallertheim (Conard *et al*. 1995*a* and *b*; Adler and Conard 1997; Conard and Adler 1997) in Germany clearly shows that valley bottom occupations in other northwest European regions are characterized by 'different' technological outputs than Belvédère. On the one hand, this could indicate that different valley bottoms do reflect completely different behavioural, and therefore technological, patterns. The investigated ca. 6 hectares at Belvédère could, on the other hand, be seen as reflecting essentially only a fraction of a much broader technological strategy in (and around) the Meuse valley bottom. If the latter is correct, than only the relics of highly mobile behaviour were excavated.

Given the spatially continuous character of activities of hunter-gatherers, it can be assumed that the identified Middle Palaeolithic find occurrences (campsites) were associated with other sites in both similar and other geomorphic zones, representing similar or complementary components of former settlement-subsistence systems. The information potential of the scatters and patches in the Meuse valley discovered at Belvédère may therefore be more fully realized when they are compared to Middle Palaeolithic find occurrences in nearby regions. To create a picture as accurately as possible, future research should be shifted to a more (micro-)regional scale. Consequently, find occurrences in the higher landscapes outside the river valley (*cf*. plateaus and plateau edges), mostly surface scatters, should be compared to the Belvédère Unit IV archaeological situation. According to some preliminary typo-/technological studies (see amongst others Kolen *et al*. 1998, 1999 and Verpoorte *et al*. 2002) the artefact occurrences in the higher parts of the Southern Limburg landscape do indeed seem to contain information that is complementary (different) to the valley bottom 'scatters and patches'. Such variations have also been described for other regions, such as the Belgian Meuse area (Ulrix-Closset 1975) and the stream valley area of the river Ruhr (Schol 1973, 1974, 1979).

Finally, it should be stressed (again) that the Belvédère archaeology, on the one hand, only represents Middle Palaeolithic activity remains of a very specific segment of the total settlement system and that they may not be representative for the (Meuse) valley bottom in general. In fact, they cover only a small unit in time and space and often show taphonomic enigmas. On the other hand, surface scatters in the 'higher' landscapes usually have been treated as "the Cinderella of Palaeolithic archaeology: they were commonly viewed as inextricable palimpsests, as extremely 'coarse-grained' assemblages formed by many unrelated events - widely spaced in time, and as 'container sites' of low cultural integrity." (Kolen *et al*. 1999:187). The latter may, however, be too pessimistic as Middle Palaeolithic surface scatters can be informative (Kolen *et al*. 1998, 1999) and are sometimes even our only information on patterns of early human land use outside the valley bottom locations. Integrating both types of data (*i.e*., from surface scatters and from 'buried' land surfaces) into testable models of Palaeolithic usage of landscapes should become an important avenue in future studies of early hominids.

notes

1 'Exotic' has to be read here as 'not belonging to' the Rijckholt/ Valkenburg group.

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Abstracts

1 Introduction

The Maastricht-Belvédère gravel- and loess quarry is situated on the left bank of the river Meuse (Maas), near the Dutch city of Maastricht (province of Limburg). Research of the local Pleistocene sequence initially started as a small scale project, focusing on individual artefact discoveries, geo-archaeological section observations and 'site' orientated studies. Over the years it developed into a comprehensive and multidisciplinary research project, in which the focal point altered towards the excavation and analysis of large continuous artefact distributions.

Chapter 1 produces a general historical, theoretical and methodological framework for the interpretation lithics in terms of spatial 'human' activities. Since the first human implements were recognised by Frere and de Perthes (Frere 1800; Daniel 1972; Roe 1981), through the revolutionary work of Smith (1894) and the innovative impulses of *New Archaeology* (Binford and Binford 1966) a setting was created for behavioural theory building. However, the Isaac – Binford debate shed light on taphonomy and site-formation processes and illustrated that we should be very cautious with the integrity and interpretation of early settlement (land use) systems. Nevertheless, it became clear that if we want to understand past behaviour we should leave the 'single site' focus and concentrate on an analysis 'beyond the site'. This can ultimately spotlight the spatial dynamics of lithic artefact technologies, which are in most cases the only behavioural remnants traceable on a palaeo-landscape.

In general, the main target of this thesis is twofold. On the one hand the elaborate lithic inquiry (*i.e.* artefact descriptions and conjoining) presents a way of understanding and interpreting a technological landscape at Maastricht-Belvédère. The high density Site K patch offers in that way a starting point and can be seen as a 'key site' in this thesis. On the other hand it provides a unique dataset, which can be generally used for future comparative research. Therefore, this study can also be seen as a detailed site-report.

Conjoining of artefacts together with a lithic analysis proved to be an essential 'tool' in the understanding of the Maastricht-Belvédère flint assemblages. A combination of both mentioned analytical tools shed new light on, amongst others: the reduction processes of core technologies; the complex life-histories of single stone tools in the process of production, use, re-use and recycling; the use of space by early humans on the local level; the spatial organisation of technology when viewed from an inter-site/(micro-)regional level and the taphonomic histories of artefact distributions.

2 An introduction to Maastricht-Belvédère: geology, palaeoenvironment and dating

The Maastricht-Belvédère complex fluviatile deposits of the river Meuse and the younger aeolian sequence have been studied archaeologically and geologically on many occasions. These studies resulted in the definition of a number of lithological and lithostratigraphical units, which contained relics of Middle Palaeolithic early human occupation.

After a short historical introduction, the Middle and Late Pleistocene sequence at Belvédère is briefly described in Chapter 2; dating and palaeoenvironmental data are discussed. The most interesting archaeological levels, however, were embedded in fine-grained fluviatile sediments (Unit IV), with an approximate age of 250 ka. These deposits are present on top of a complex of terrace gravels, and are overlain by a series of Saalian silt loams and Weichselian loesses. The geological situation of the main archaeological level (Saalian Unit IV) is described in slightly more detail.

3 Reconstructing a Middle Palaeolithic technology: Maastricht-Belvédère Site K

The main archaeological level documented a full interglacial fauna associated with a 'rich' Middle Palaeolithic dataset, preserved within various sites over an area of about 6 hectares. Between 1981 and 1990 excavations were carried out each year, often under considerable time pressure and sometimes right in front of the machines and by the end of 1990 eleven 'sites' had been excavated at the Belvédère locale. Some of these findspots were so well preserved that extensive refitting proved possible, *e.g.* at sites C, F and K, and inferences on former *chaines opératoires* could be drawn.

One of 'richest' sites in terms of flint quantities and interpretation value is Site K. This so-called 'classic' site is analysed in Chapter 3 and its study created a scientific setting for a further analysis beyond the 'site-level'. In other words this findspot represents a key-site for this thesis. Chapter 3 presents a typo-/technological review, refitting exercise and spatial analysis of the lithic material. After a geological interpretation of the local sediments, the dating evidence and a discussion of the research methods, a summarized typo-/technological description of the flint artefacts is given.

In total 10,912 flint artefacts were collected, consisting mainly of debitage. All stages of the reduction strategy, from collecting the raw material through decortication to the discard of cores and tools, are represented. The reconstructed technology can generally be interpreted as the result of a 'wasteful' reduction of non-prepared cores. Also a number of well-prepared tools, fabricated on 'exotic' flint, was probably transported to the locus, to be used 'on the spot'. Topics like raw material procurement, *ad hoc* production (-modes) of flakes, cores and tools, and transport of lithics are discussed in different sections. Specific attention is paid to the results of the detailed refitting analysis. Subsequently, the artefacts, including the refitting results, of this 'rich' site are analysed and interpreted spatially. Whether this 'high density' site is exclusively the result of one consistent use of the place, or a palimpsest of several unrelated events is an important issue in the analysis.

4 Maastricht-Belvédère: the other Unit IV sites and finds

For a comparison of the Site K results, Chapter 4 presents an introduction, a typo-/technological review, some refitting and spatial results and an interpretation of the lithic material from all Maastricht-Belvédère Unit IV findspots (Sites A, B, C, D, F, G, H, and N). Besides the artefacts from the excavated areas all stray-finds, collected in several (stratigraphically) different (long) sections and finds recovered during test pit excavations, are dealt with as well (Sites L, M, O, N [level X] and the 'July 1990' test pit). Furthermore, the 'isolated' section finds recovered during the ca. ten years of research are described as one group of artefacts. It should be mentioned that Chapter 4 contains some repetition of Belvédère data presented in earlier publications (*cf.* Roebroeks 1988; Roebroeks *et al.* 1992; Schlanger 1994). This was mainly done to give an overview, as accurately as possible, of the Unit IV archaeological remains.

Excavations at Maastricht-Belvédère showed that parts of the former Meuse valley bottom must have been littered with artefacts and bones. According to the executed analyses, the large scale and continuous artefact distribution (referred to as a 'veil of stones' by Roebroeks *et al.* [1992]) displays some internal variations in artefact density and composition.

5 Patterns of behaviour: spatial aspect of technology at Maastricht-Belvédère, Unit IV

Chapter 5 presents a survey of these variations and attempts to explain them in terms of early human behaviour. Here, topics such as transport or expedient production of flakes, tools and cores, which played an important role in the formation of inter-assemblage variability, are treated. This Chapter uses some elements of Isaac's (1981) 'scatters and patches' approach and is mainly based on the model published by Roebroeks *et al.* (1992). The model stresses the equal importance of scatters and patches and shows that the find distributions should be treated as parts of 'one' single system in our search for Middle (Lower?) Palaeolithic patterns in the former landscapes.

According to some variations in artefact density, composition and conjoining potentials it is, generally, possible to distinguish two different kinds of find distributions at Belvédère. On one end of the density scale there are 'low density off-site' distributions, predominantly consisting of well-prepared scattered (isolated and/or small groups of) flakes, 'worn out' tools, minor cores and faunal remains. These scatters predominantly consist of relatively few dorsal/ventral refits. They mainly suggest a transported technology (*cf.* Site G and N).

On the other end are 'high density patches' which represent the 'classic' sites and are characterized by dense clustered appearances of large quantities of artefacts. The patches show a striking dominance of primary flint knapping debris and relatively few tools. They turned out to be 'a refitter's paradise' (*cf.* Site C, F, H and K).

These scatters and patches represent different trajectories within the life histories of Middle Palaeolithic flake technologies, *i.e.* of cores and flakes. At one end of the continuum is Site K, where reduction sequences 'started' and the degree of importation is low, except for some scrapers. At the other end there are the low density scatters of Site G and N, were flake technologies came to their end. Cores were already strongly reduced and transported flakes were transformed into retouched and worn out tools. Stated differently, the high and low density scatters may reflect different places in the spatial organisation of the technologies. It may well be, however, that this was related to the execution of different activities. The high density patches may predominantly reflect the maintenance of technology (*i.e.* the preparation of new cores, flakes and tools), while the low density scatters might relate to the actual use of these technologies in direct food procurement. It has to be stressed that this is not a 'black and white' situation as most of the Belvédère patches also reflect the 'intermediate' stages in the use-life of transported technologies. Moreover, brought-in 'toolkits' were constantly replenished, assisted or replaced by local produced implements (*cf.* Site K) and used during food related activities (*cf.* Site C). The observed technological variations between the Unit IV find occurrences (disc[oidal] *versus* Levallois) were probably for a large part related to the used (or availability of) raw materials. Technology can therefore be described as very flexible and 'binary' (*cf.* Geneste 1985). In other respects Belvédère sites show only minor variations, despite the fine scale differences. All scatters and patches can be perceived as belonging to a technological strategy, which was flake orientated and which was based on the regular transportation of items.

The information potential of the scatters and patches in the Meuse valley, discovered at Belvédère, may eventually be more fully realized when compared to Middle Palaeolithic find occurrences in nearby regions.

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Between 1994 and 1999 I was privileged to be part of the NWO (the Netherlands Organisation for Scientific Research) 'Pionier' Project Paleolithicum, at the Institute of Archeology of Leiden University. This interdisciplinary research Programme, 'Changing Views of Ice Age Foragers', was aimed at a better understanding of Palaeolithic societies and their environments. It focused on the cultural adaptations of Pleistocene hunter-gatherers in Northern Europe during the last 500,000 years. Here the climatic fluctuations of the Pleistocene had a severe impact, and resulted in an ebb and flood of hominid presence.
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Curriculum Vitae

On September 17th, 1963 I was born in Deurne (satellite town of Antwerp), Belgium. During my adolescence my parents and I lived in Deurne, as well as in Borgerhout (satellite town of Antwerp), Belgium. Between 1975 and 1982 I went to Secondary school (high school) at the *Koninklijk Atheneum Deurne* (Belgium), obtaining my Lower and Higher Secondary school diplomas on respectively June 30th, 1979 and June 18th, 1982.

Thanks to the financial support of my parents, I was fortunate to start an academic education in September 1982 in The Netherlands. I enrolled in the first year studies in History of Art and Archaeology (Leiden University, Faculty of Letters), gaining my *Propedeuse* diploma on September 21st, 1984. I then continued an archaeological study in Leiden with a specialization in Prehistory. My Masters degree in Cultural Pre- and Protohistory (Leiden University, Faculty of Archaeology) was obtained on September 29th, 1988.

Following my graduation in 1988, I did compulsory national service in the Belgian army. I signed up in June 1989 and was trained in the medical service in Gent (Belgium), to be eventually stationed in Aken (Germany). I had fulfilled my national service obligations in March 1990.

From June until December 1990 I was appointed as *Onderzoeksondersteunend assistent* (assistant) to Prof. Dr W. Roebroeks (Leiden University, Faculty of Archaeology) and continued working on the description and documentation of the Maastricht-Belvédère excavation results until the end of 1991.

Between January 1992 and May 1996 I was fortunate to start an *Assistent In Opleiding* (A.I.O., assistant) position at Leiden University (Faculty of Archaeology). During my appointment I began working on this PhD dissertation and was involved in some lecturing, fieldwork and excursions.

From May 1996 until the end of April 1998 I worked as a *gastmedewerker* (guest co-worker) at Leiden University (Faculty of Archaeology).

Moreover, between 1994 and 1999 I was privileged to be part of the NWO (the Netherlands Organisation for Scientific Research) 'Pionier' Project Paleolithicum, at the Institute of Archeology (Leiden University). This interdisciplinary research Programme, 'Changing Views of Ice Age Foragers', was aimed at a better understanding of Palaeolithic societies and their environments. It focused on the cultural adaptations of Pleistocene hunter-gatherers in Northern Europe during the last 500,000 years.

From May 1998 until September 2000 I was appointed Research Fellow at the Institute of Archaeology (University College London, United Kingdom). During this period I worked as a member of the Boxgrove Project. At the Middle Pleistocene site of Boxgrove (West Sussex, United Kingdom), a number of localities have been excavated since the early 1980s. These places of Palaeolithic activity provided detailed insights into the life and palaeoecology of the earliest 'colonisers' of Northern Europe. I was mainly involved in the lithic and refitting analysis of a locality designated Q1/B.

Between May 2001 and May 2004 I have been working as an archaeologist (*Deelprojectleider*) for the Ministry of Transport, Public Works and Water management: Project Organisation '*De Maaswerken*' (Limburg, The Netherlands). The main goals of this *Maaswerken* Project were, and still are, to reduce the probability of floods together with the development of large-scale nature areas and the extraction of gravel in the river Meuse valley of the Dutch province of Limburg. In general this means that over a distance of ca. 200 kilometres the river Meuse valley will be intensively restructured and quarried. In addition these large-scale environmental impacts create a number of 'windows into the past', which enable archaeologists to systematically investigate parts of the landscape. As a member of the Project Team Archaeology ('*De Maaswerken*'), I was mainly engaged in the planning and management of archaeological research.