Newsletter

I _ 1983

Department of Pottery Technology

UNIVERSITY OF LEIDEN - THE NETHERLANDS

NEWSLETTER

Department of Pottery Technology

I-1983

Address:
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After September 1983:
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Leiden
Holland

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By means of this Newsletter the Institute of Pottery Technology addresses itself in the first place to persons making use of the facilities of the Institute so as to keep them informed about recent developments. We hope that through the Newsletter fresh contacts will be established with archaeologists and Institutes interested in aspects of the ancient pottery craft as well as in the part which pottery plays in ethno-archaeological research.

ABOUT THE INSTITUTE

The Institute of Pottery Technology has a small staff, consisting of two archaeologists, Professor H.J. Franken, Director, and Drs. A. van As, who will take over the duties of Prof. Franken as Director of the Institute in 1983, when he is expected to have finished his doctoral thesis. Attached to the Institute are a professional potter and teacher of the craft, Mr. L.F.H.C. Jacobs, a draughtsman, Mr. A.E.A. van Driel, and a part-time secretary, Mr. J.J. Hoff.

The Institute has a laboratory and a workshop equipped with apparatus designed for the research work performed by the Institute, and a small library.

Provisionally, the Institute is housed in two old buildings at Rapenburg 129. By the end of 1983 it will move to the Archaeological Centre of the University, now under construction. That site is located in the centre of the town where the Doelen barracks once housed the army's cook school.

SCOPE OF THE INSTITUTE'S RESEARCH WORK. A SHORT INTRODUCTION

The type of research carried out by the Institute is based on a fairly straightforward question. How does one explain why a pot made in antiquity has its specific shape, or colour, or hardness or whatever one sees when looking at such a pot? Pottery classifications are based on observation of such features, for which, however, no explanations are found. Would not the study of classifying pottery become more rewarding, if these features were supported by explanations?

In 1960 I realized that the answers to such questions could only be given by an experienced professional potter. The pioneer work was done by Jan Kalsbeek, and his contributions proved to be indispensable for a systematic approach to analysis of the potter's craft in antiquity.

During our attempts to find new ways of studying the pottery from the excavations at tell Deir ^{c}Allā in Jordan new perspectives were found, opening up wider fields of study with pottery as the primary source of information. The exploration of these fields is the subject of study in the Institute.

Our main concern is studying the craft in its entire scope, including the production of and trading in the products. We are also dealing with such questions as how to recognize and define production centres or workshops, pottery traditions and the history of traditions.

When analyzing pottery one is often asked to make chemical and petrographic analyses of sherds. This type of analysis has become somewhat fashionable among a number of excavators, and it certainly has its merits. But it also has its limitations when the question of the potter's craft is raised. Although chemical and physical properties of the raw materials should be taken into account, there is a clear distinction between a chemical or petrographic analysis on the one hand, and properties of the raw materials in relation to potmaking on the other. It is the aspect of the properties of the raw materials which must be studied if one wants to appreciate the finished product. How do the raw materials behave during treatment? Why did potters use certain types of clay and not other ones? Why did they use the non-plastics which they added? Why, for instance, did they use dung and not quartz sand, while both sand and dung were available? What were the advantages of using dung, and what were its limitations in relation to the manufacturing method, shape, and size of the pots and to the drying and firing methods applied by the potters?

When analyzing the craft one may be faced with problems which can only be solved by a physical/chemical analysis of the clay composition or the filler. Many results have been obtained from research carried out in modern ceramic laboratories concerning the part played by numerous elements in ceramic bodies, their behaviour at certain temperatures, and their interactions. This is extremely useful for our purpose. Nevertheless, there are a number of archaeologists who tend to think of such analyses only in relation to the provenance of the raw materials: "Where does my pot come from?". However, our first objective is to study the product in order to understand its genesis. We are not satisfied with knowing the kind of filler which the potter added to his clays, but we want to know its effect on the manufacturing method of the pots. Then we also know why it was added (see p. 6 in this Newsletter). Colour is another feature which is studied for the same purpose. Colour is seen in relation to temperature, and also in relation to attempts to decorate. A summary of the applied research methods is given on page 34.

Analyzing the craft in the manner as referred to above not only provides a more objective pottery classification system of one pottery tradition. Another asset is that quite often indications of short-distance trade are found on the basis of certain shapes that were not locally made but may have come from workshops specializing in one or a few shapes made for special purposes. Examples are the cooking pots in the Early Iron Age in Palestine, and the pots made for the sugar culture in the Islamic Period.

Pottery and the manufacture of pottery are extremely complicated affairs. With the fired products as the only source of information a great deal of experience in making pots and in experimenting with raw materials is required for the investigator to be able to deduce the craft in antiquity. This is why the Institute collects evidence from traditional potteries wherever they still exist. It should be clear that reports on pottery written by ethnologists who are not acquainted with the craft are often not very helpful. Ethno-archaeology is a more promising discipline for our purpose. Here the tradition of the craft is studied in relation to natural and human environment, leading to a better understanding of the importance of the potter to the social and economic life of a community, and of the fact that each pottery has its own characteristic way of working. Retrieving some of these characteristic ways is the aim of our studies. This explains why we gladly accepted the opportunity to introduce the research of Mrs. Dr. M.B.

Geertman-Annis on Sardinia. This research is complementary to the work done in the Institute, not only because of the information it gives about practical aspects of the potteries on Sardinia but also as a challenge for a further exploration of the potentialities of research into the ancient craft.

H.J. Franken

FOUR LARGE PROJECTS OF THE INSTITUTE

In the reports for our customers we have carefully separated the analytical pottery studies from the archaeological work proper. The relation between such analytical studies and archaeological work is best demonstrated by our report on the Deir ^{c}Allā excavations[1], being the first large project to which such a study was applied.

The Deir ^{c}Allā excavations will continue in close co-operation with the Department of Antiquities and the Yarmouk University of Jordan, under the supervision of Drs. G. van der Kooij and Dr. M. Ibrahim. Much technological work has already been performed in respect of the Iron Age pottery from the most recent phases on the tell. The analytical studies are being extended to the Deir ^{c}Allā pottery from the Late Bronze Age.

The second project deals with excavations which took place in the Tabqa Area in northern Syria from 1972 to 1974. Drs. A. van As has completed a manuscript on the technology of the medieval pottery from tell Ta'as and tell Hadidi on the Euphrates and on the Bronze Age pottery from tell Hadidi. The scope of this work has been restricted to analytical pottery research. In accordance with an agreement with Dr. R. Dornemann from Milwaukee, USA, Dr. Dornemann will publish the archaeological report on the work done by the Dutch team and his own team on tell Hadidi. It is expected that the studies performed by Van As will be ready for publication in 1983.

The findings of the third large project will also appear shortly. At the request of Mrs. C.M. Bennet, the Director of the British Institute for Archaeology and History in Amman, Dr. Franken prepared a manuscript on the technology of pottery from the Amman Citadel excavated in 1976 by the Dept. of Antiquities of Jordan and the British

Institute. This report deals with pottery from the Byzantine and Early Islamic levels and will be published as soon as a decision has been made upon the publication of the entire excavation work.

The subject of the fourth project are the excavations on the Ophel hill in Jerusalem, executed by the British School of Archaeology in Jerusalem under the supervision of the late Dame Kathleen Kenyon. The study of the pottery excavated from this site is still in progress and the report to be published on this subject will be entirely based on the results of analytical research. Especially the work on the Iron Age material, which seems to form the bulk of the excavated pottery, may provide an opportunity of obtaining some information about the potters workshops in or near Jerusalem, the origin of the raw materials used, and such questions as what was made in the workshops, what was the relation between the different shapes, etc. By this working method explanations can be given of developments in shape. It is expected that from the results of this project the introduction of a heavy potter's wheel can be established which enabled the potter to throw pots and to rationalize production. A tremendous amount of work on the pottery typology has already been carried out by Mrs. M. Tushingham during the excavations from 1962-67. This was done in the traditional "Kenyon approach", an approach that seemed rather magical to those who lacked Kenyon's experience and feeling for distinguishing wares. By our analytical studies we shall to a certain extent be able to demonstrate objectively the value of her observations. The large quantities of pottery from the Jerusalem excavations provide an opportunity of testing large samples in an inexpensive way by methods that have been developed over the years and are still being improved and rationalized as research proceeds. We need for instance far less thin-sections for ware analysis than we needed when we started and firing tests can be undertaken with large samples.

Note

1. *Excavations at tell Deir ᶜAllā, the Iron Age*, Leiden 1969.

L. Jacobs

NOTES ABOUT THE RELATION BETWEEN FILLER AND CLAY, AND FILLER AND SHRINKAGE, RESPECTIVELY

When filler is used as a criterion for the classification of pottery, a number of problems will arise as to how to measure the amount and size of the non-plastic grains contained in the clay. In many cases large quantities of sherds have to be studied and compared in respect of the nature of their filler, which requires a quick and fairly accurate working method. Taking into account the way in which filler was added to the clay and mixed with it, it does not seem appropriate to make measurements extremely accurate. Mixing was not done more thoroughly than strictly necessary, and during shaping a certain amount of demixing may have taken place. One can use the microscope or microscopic photographs to count grains and measure their size, but this is rather time-consuming and the results cannot be easily evaluated in terms of pottery manufacture. It is preferable to express the amount of filler and the size of the grains in percentages and to establish their effect on the workability of the paste.

Such a method requires a reference collection of fillers in various sizes and quantities. We made a large number of test bars, using one type of clay (Vingerling K 142) and a filler of quartz river sand in different quantities and sizes (see tables 1 and 2). Clay and filler were thouroughly mixed. Fourteen different percentages of river sand of a grain size between 0.3 and 0.5 mm were each added to 1000 grams of clay. In the grain size between 0.4 and 0.6 mm seven different percentages were used and from the following four fractions increasing in grain size, six, five, six and thirteen different percentages, respectively, were added to 1000 grams of clay each. By so doing 52 times 1000 grams of clay were used. From each lump of prepared clay, three test bars were made which were fired at three different temperatures. After the firing was completed there were 52 bars fired at 850 °C, the same amount fired at 950 °C and the last group at 1050 °C. The remainder of each quantity of prepared clay was set aside and will be used for a throwing test, consisting of throwing a standard-size bowl, in order to get an impression about the relation between filler and workability of the clay. This test program will also be enlarged by experiments with other sizes and percentages of filler and with different non-plastic materials. To enable us to measure shrinkage a length of 100 mm marked on each bar immediately after the bar was made. After firing a small piece was broken off and mounted with others on a carton strip (fig. 1) for inspection under the microscope.

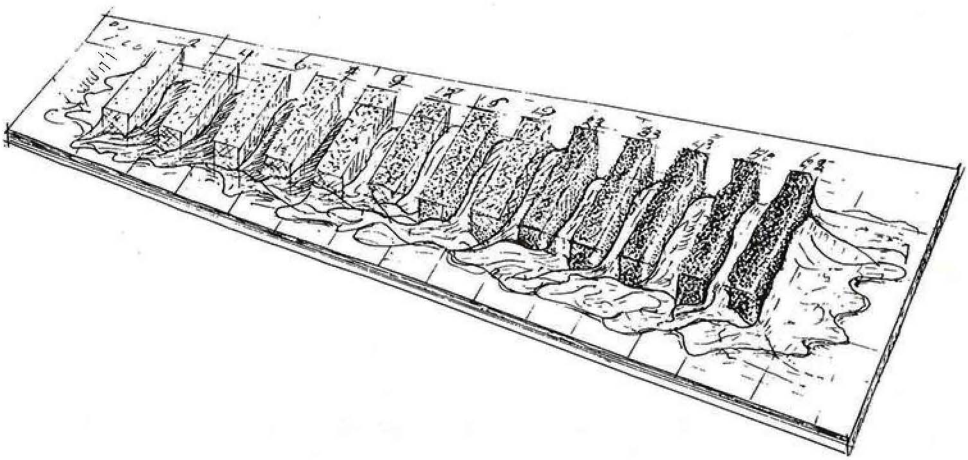

Fig. 1

These carton strips, forming the basis of the reference collection, serve to estimate the amount and size of filler in sherds from antiquity. On the right hand side of each bar a small piece was broken off showing the print of the author's right hand forefinger. This was done for an anthropologist who struggled with the shrinkage of finger prints on earthenware (fig. 2).

Though our aim was to build up a reference collection as mentioned above the preparations enabled us to study a number of aspects, such as for instance, how does filler influence shrinkage or how does it change the properties of a clay in respect of its workability. Of special interest was the question of the relation between grain size and shrinkage and between grain size and porosity.

The shrinkage tests (table 1)

Allowance must be made for minor deviations caused by slight differences in the moisture contents of the various test bars, and by the different forces exerted on them during their preparation, although this was done as much as possible in a uniform way. Therefore shrinkage was measured to half a millimetre; the same applies to the porosity, which was measured to half a percent. The shrinkage table roughly shows that 10 % filler reduces shrinkage by ca. 10 %, from 4.5 % to 4 %, regardless of the grain size. With 50 % filler shrinkage is reduced by half. This gives a regular correlation for all percentages below 50 %.

Porosity and shrinkage (table 2)

Table 2 shows that, in general, the test sherds are most porous at 850 °C, with decreasing values at 950 °C and 1050 °C respectively. It is remarkable that the graphs showing the porosity values obtained at the three respective temperatures (see fig. 3) do not run parallel and that the values vary considerably at regularly increasing percentages of filler. The variations are however not really striking. Slight differences in moisture content or pressure could not be avoided as mentioned. Even in a small test kiln there are different temperatures in different parts. On the other hand one has to remember that such disturbing effects occur on a much larger scale when potters are at work. Even when clay from one source is used the moisture content of the different pots will vary when the pots are stacked in the kiln ready to be fired; there is the degree to which the clay is allowed to rot and the increase in temperature in a given space of time. All this influences the porosity of the final product. To this may be added that different parts of a pot may have different densities depending on the method of shaping. This is obvious in the case of handmade pottery but it also applies to thrown pottery.

As a matter of course the grain size of the added sand influences the porosity. Quartz sand is not porous itself. When used as a filler it would reduce the porosity of the paste if the clay were not subject to shrinkage during drying and firing, causing hair cracks radially around the non-plastic grains. Moreover coarse quartz grains may cause hair cracks as well. This is due by the so-called quartz change, occurring at a range of temperature from 550 °C to 573 °C. Between these temperatures the quartz particles increase in size, a process which comes to a climax at 573 °C. When the temperature in the kiln drops below 573 °C their original size is restored, leaving room around the quartz grains in the sherd. As a result the porosity increases. It is interesting to see that according to fig. 3, porosity is not significantly different when 2 % sand is added or 50 %, when half of the paste consists of non-porous material. This is caused by the fact that, with 50 % filler, there are far more grains with hair cracks formed radially around them. An increase in the amount of non-porous grains goes with an increase in hair cracks and apparently this balances the porosity in this case. Of course this depends on the shrinkage behaviour of the clay used. A plastic clay, shrinking much, will give a relatively higher porosity, because more and larger hair-cracks develop around the non-porous particles. On the other hand a lean clay with a non-porous filler will give a relatively lower porosity for this reason. As shown by table 1 the pure clay without any filler used in the tests notes a shrinkage of 4.5 % after drying and firing at 1050 °C. Compared with other clays this is rather low.

Fig. 2

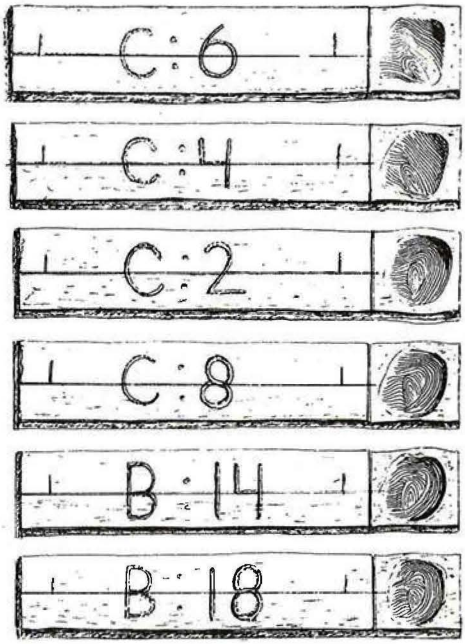

Fig.3

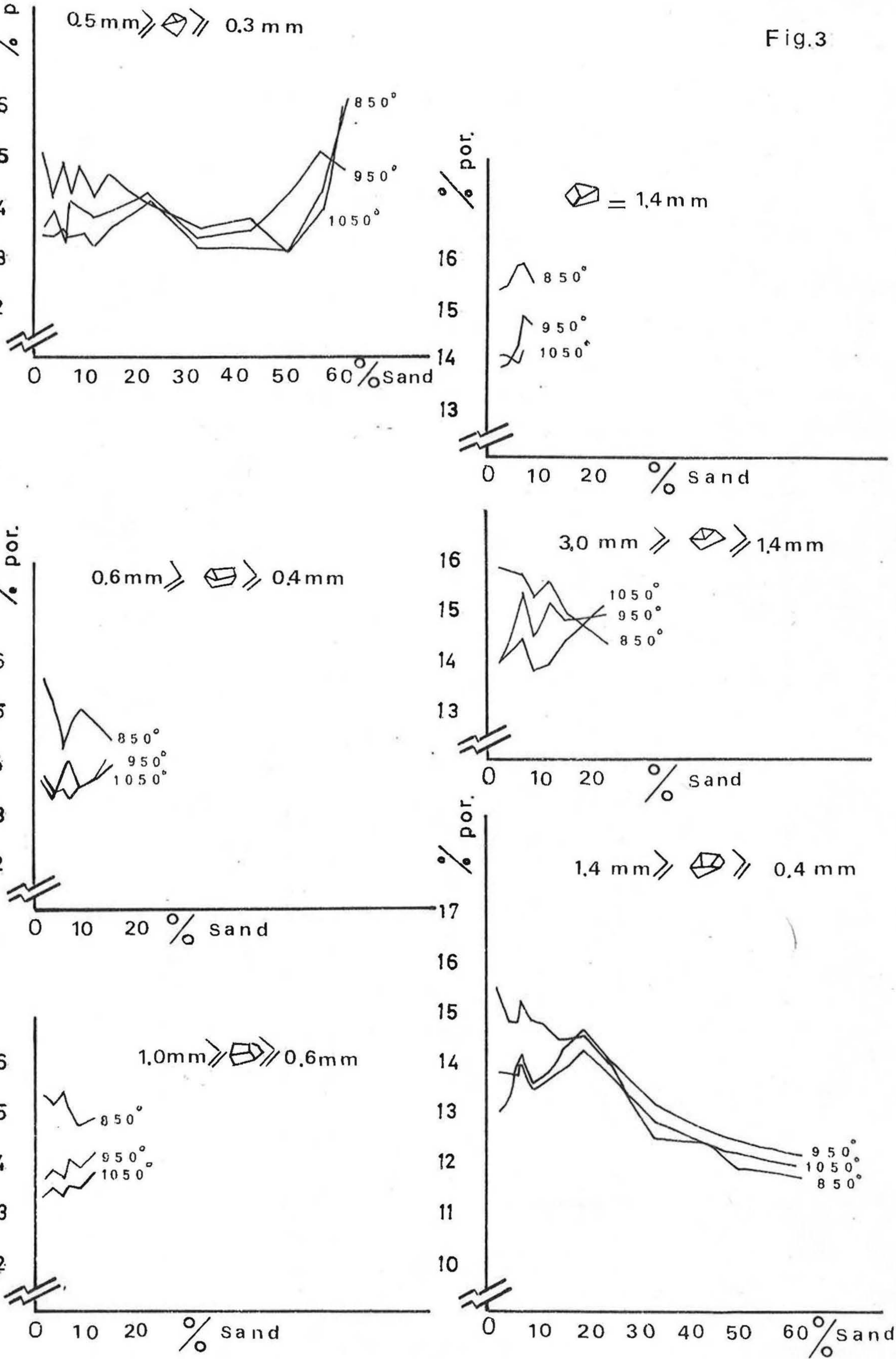
% por.
0.5 mm ≫ ≫ 0.3 mm
850°
950°
1050°
0 10 20 30 40 50 60 % Sand
% por.
= 1,4 mm
850°
950°
1050°
0 10 20 % Sand
3,0 mm ≫ ≫ 1,4 mm
1050°
950°
850°
0 10 20 % Sand
% por.
0,6 mm ≫ ≫ 0,4 mm
850°
950°
1050°
0 10 20 % Sand
% por.
1,4 mm ≫ ≫ 0,4 mm
950°
1050°
850°
0 10 20 30 40 50 60 % Sand
1,0 mm ≫ ≫ 0,6 mm
850°
950°
1050
0 10 20 % Sand

TABLE I

Grain size	Dry sand %	Drying shrinkage %	% total shrinkage at 850 °C	950 °C	1050 °C
0.5 mm ≧ sand ≧ 0.3 mm	2	4.5	-	-	-
	4	4.5	-	-	-
	6	4.5	-	-	-
	7	4.0	-	-	-
	9	4.0	-	-	-
	12	4.0	-	-	-
	15	4.0	-	-	-
	19	3.5	-	-	-
	23	3.5	-	-	-
	33	3.0	-	-	-
	43	2.0	-	-	3.0
	50	2.0	-	-	2.5
	57	1.5	-	-	2.0
	62	1.0	-	-	1.5
0.6 mm ≧ sand ≧ 0.4 mm	2	4.5	-	-	-
	4	4.5	-	-	-
	6	4.5	-	-	-
	7	4.0	-	-	-
	9	4.0	-	-	-
	12	4.0	-	-	-
	15	4.0	-	-	-
1.0 mm ≧ sand ≧ 0.6 mm	2	4.5	-	-	5.0
	4	4.5	-	-	-
	6	4.5	-	-	5.0
	7	4.5	-	-	-
	9	4.0	-	-	-
	12	4.0	-	-	-
sand = 1.4 mm	2	4.5	-	5.0	5.0
	4	4.5	-	-	5.0
	6	4.5	-	-	5.0
	7	4.5	-	-	-
	9	4.0	-	-	-
3.0 mm ≧ sand ≧ 1.4 mm	4	4.5	-	-	-
	7	4.5	-	-	-
	9	4.0	-	-	-
	12	4.0	-	-	-
	15	4.0	-	-	-
	23	3.0	-	-	3.5
1.4 mm ≧ sand ≧ 0.4 mm	2	4.0	-	-	4.5
	4	4.0	-	-	4.5
	6	4.0	-	-	-
	7	4.0	-	-	-
	9	4.0	-	-	-
	12	4.0	-	-	-
	15	3.5	-	-	-
	19	3.0	-	-	3.5
	23	3.0	-	-	3.5
	33	2.5	-	-	-
	43	2.5	-	-	-
	50	2.0	-	-	-
	62	1.0	-	-	-
	0	4.5	-	-	-

TABLE II

Grain size	Sand %	% porosity		
		850 °C	950 °C	1050 °C
0.5 mm ≧ sand ≧ 0.3 mm	2	15.01	13.58	13.39
	4	14.14	13.86	13.39
	6	14.86	13.28	13.52
	7	14.24	14.09	13.39
	9	14.82	13.98	13.43
	12	14.16	13.76	13.18
	15	14.65	13.89	13.60
	19	14.30	14.05	13.78
	23	14.02	14.29	14.11
	33	13.54	13.38	13.20
	43	13.75	13.55	12.13
	50	13.14	14.20	13.14
	57	13.96	15.10	14.25
	62	16.13	14.70	15.98
0.6 mm ≧ sand ≧ 0.4 mm	2	15.59	13.58	13.67
	4	15.06	13.22	13.39
	6	14.20	13.74	13.41
	7	14.69	13.98	13.22
	9	15.01	13.45	13.46
	12	14.76	13.64	13.61
	15	14.46	14.07	13.89
1.0 mm ≧ sand ≧ 0.6 mm	2	15.32	13.66	13.36
	4	15.17	13.84	13.53
	6	15.42	13.67	13.35
	7	15.02	14.09	13.53
	9	14.71	13.89	13.48
	12	14.89	14.21	13.83
sand = 1.4 mm	2	15.37	13.82	14.04
	4	15.43	13.86	14.05
	6	15.86	14.29	13.92
	7	15.85	14.85	14.15
	9	15.55	14.62	14.13
3.0 mm ≧ sand ≧ 1.4 mm	4	15.82	13.91	13.93
	7	15.67	15.33	14.39
	9	15.25	14.48	13.79
	12	15.53	15.14	13.92
	15	14.95	14.81	14.38
	23	14.41	14.92	15.03
1.4 mm ≧ sand ≧ 0.4 mm	2	15.49	13.02	13.81
	4	14.78	13.24	13.81
	6	14.74	13.95	13,67
	7	15.21	13.96	14.15
	9	14.81	13.56	13.46
	12	14.68	13.75	13.60
	15	14.43	14.27	13.82
	19	14.53	14.66	14.26
	23	14.08	14.03	13.85
	33	12.48	13.18	12.77
	43	12.38	12.66	12.33
	50	11.90	12.43	12.17
	62	11.71	12.11	11.89
	0	14.72	13.10	12.40

M. Beatrice Annis

POTTERS FROM SARDINIA

An interim report, March 1982.

1. Introduction

Some years ago I decided to dedicate part of my attention to the present-day pottery production in the plain of Oristano and Cagliari (Sardinia). It was one of those initiatives that stem from negative feelings. Feelings of perplexity, of doubt and finally of disagreement that may occur to a classical archaeologist from the "traditional" school[1] who is confronted with the material from an excavation[2].

This reference to the origin is not an introduction to a description of the entire genesis of an investigation which has meanwhile concentrated itself largely on methodological aspects of pottery studies. However, I do wish to mention briefly those sources of inspiration and instruction that influenced and continue to stimulate the development of my studies: talks with my colleague, the prehistorian Diderik van der Waals; the contacts with the Institute of Pottery Technology in Leiden, its Director Henk Franken and with Jan Kalsbeek, potter and sculptor; the publications by Anna Shepard, Frederick Matson, the anthropologists Hélène Balfet and George Foster; finally, the growing response in the field of Roman archaeology to studies such as initiated by Maurice Picon, David Peacock and Andrea Carandini[3]. These are only a few names of a number of scholars who during the past twenty years of renewal of archaeological theory have contributed to the recognition of ceramics as one of the historical sources with the richest informative value, when properly studied and exploited in its different aspects[4]. To me this seems to be the heart of the question: the different aspects and, even more, the interplay of determinants of those features that characterize a production. All this begins with the raw material and its properties and ends with the dissemination and distribution of the products. It concerns producers and users in their context. A wide scope, and the more complex when it refers to historical entities such as the Greek and Roman world.

With this in mind it seems to me to be the first task of the archaeologist to *distinguish* between the various aspects that are comprised in this concept. His second task would be to *define* these aspects, such as they express themselves in the product. And finally he has to *reconstruct the interaction* of elements that governs these features in order to make the latter explainable and to render them their own historical value. This explains my desire to investigate a complete entity, not a fragmentary one like the ancient, an entity where all the elements are present or recoverable, and to learn from this confrontation to distinguish, to define and to recognize relationships.

The problem of transferability of data from a present-day reality to the reality of the past is not of primary concern in this investigation. But although not a specific point of discussion it is implicitly present. Firstly, in the continuous observation of phenomena from the point of the archaeological value of these data and, secondly, in the testimony that such an investigation makes archaeologists aware of the problems inherent to a production and provides them with factual - and I would almost say technical - knowledge which is indispensible for those who study the material culture of a society. It is indeed an established fact that anyone who has direct knowledge of the craft will often be able to test it on ancient material and, consequently, to draw appropriate conclusions about the archaeological value of his ethnographic information.

Bibliographical note to the Introduction

In listing the following titles, selected from a far more complete bibliography, I have intended to offer a picture of the questions from which my studies have originated and developed. Particularly those titles are presented which have been especially instructive and stimulating for the general theoretical aspects as well as for the conception and the realization of an ethno-archaeological investigation such as the one conducted in Sardinia.

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2. Sardinia, a short description

The island, part of Italy and since 1948 an Autonomous Region with Cagliari as the Capital, lies in the centre of the western Mediterranean Sea basin at considerable distance of the surrounding mainland[5]. It has a surface of 24,089 km^2 and a population of about 1,500.000 inhabitants concentrated in towns and villages. Due to historical causes scattered habitation of the countryside hardly occurs[6]. Nowadays the island is amply linked by sea and air routes with Italy, France, Spain and Africa, and it has a good road system. Industry and tourism have been developed; agriculture is in a critical period notwithstanding far-reaching reforms, but cattlebreeding and especially sheep raising maintain themselves well[7].

My study of the activities of potters in the plain of Oristano and Cagliari was encouraged and rendered possible by the particular character of Sardinia. Still in the early sixties this world could rightly be defined as archaic and a treasury of ancient customs and habits[8], and it is only since the last thirty years that the effects of far-reaching changes have become visible. This exceptional character, which, in some respects, is still recognizable at the present time, was caused by the natural environment of the island and by its history[9].

2.1. The natural environment

Petrography: Sardinia has a geological history beginning in the Cambrium. Thus it is much older than most of the Italian peninsula. The petrography is markedly varied: volcanic rock in which granite predominates, sedimentary rock and metamorphic rock[10].

Relief: The relief is untypical for the Mediterranean Sea and points to geological age: it lacks high mountain tops, there are heavy plateaus built stepwise and separated by deep and almost impassable gorges, filled in winter and spring with rain brooks.

The coast: Along the coastline of approximately 1900 km Sardinia has high barriers of rock and sandy bays not deep enough for mooring large ships. The east coast opposite Italy shows the highest relief. Only Cagliari in the south has a natural harbour, not large but good and safe. The capital of the island is rightly located in this harbour site with its hinterland of salt pans, fertile hills and mines[11].

Climate: The climate is the maritime mediterranean climate prevailing in a large part of the mediterranean area. The total unpredictability of the rainfall is very important because of its numerous effects on agriculture and stock breeding. The only fixed point is the absence of rain from about May to September. Otherwise the averages are nowhere so deceptive as in Sardinia[12]. Important are the force and the frequency of the winds: the Mistral from the north-west and the Sirocco from the south-east[13]. Because of the uncertainties of the intermediate seasons Sardinia's climate is often defined as a steppe climate and compared with the climate of northern Africa between the Atlantic and the Sahara[14].

Soils: The surface of really good soil is small. There are several reasons: the numerous climatic features; the sparsity of gentle slopes that preserve good soil and water, the presence at the surface of much volcanic rock which causes rainwater to run off taking away fertile soil while at intervals rock rubble comes down and destroys the fields (*erema* = desert).

The soil composition is poor and would provide good grazing for livestock if rainfall was not so unreliable. Herdsmen always have to search for grass for their flocks, and their nomadism is permanent which is characteristic for the steppe. And this again causes the shepherds to be hostile to agriculture[15].

Forests are few in number and limited in extent as a result of the climate, fires and systematic destruction. Omnipresent is a variegated pattern of maquis, the evergreen mediterranean vegetation of low shrubs[16].

2.2. The historical environment

Under the circumstances it is not surprising that Sardinia is reckoned to those mediterranean countries where the natural circumstances have had a direct and far-reaching influence on their history. The sociogeographer Le Lannou from Paris, one of the best authors on Sardinia, writes that the history of the island starts with its tectogenesis. The breaking up of the area caused a number of geological faults and grooves which, even more than the mountains, watch over the isolation of the various regions and prevented the formation of a homogeneous society on the island. Insulation, and even more isolation, not only because of the inaccessible coasts but particularly due to the geological configuration of the inland[17]. Important for Sardinia's history was also the contrast between the mountains with their hard and poor soils and the southern and north-western hills and lowlands, which are pleasant and fertile[18].

Conversely, the history of Sardinia has also influenced its natural environment. From prehistoric times a long series of successive dominations has only strengthened the isolation and the contrasts[19]. Sometimes the population preferred to inhabit the upland plains or the sheltered lowlands far in the interior for reasons of security. At other times, such as during the Punic and Roman domination, one preferred the plains, the hilly country and the coastal land, where corn growing and trade flourished. During the Middle Ages the invasions of Saracens caused the Sardinians to "turn their backs to the sea", to leave the coast and establish their settlements in the interior since water and good soils became less important than security. From that time dates what is called the "civiltà dei villaggi", the village culture which lasted into the last century and of which the traces are still visible. This culture was based on independency and autarchy of the individual villages. Forced by the unpredictable climate and the poor soils the farmers and shepherds of these villages developed a system of communal land management which was at the same time a kind of agreement for mutual conservation[20].

"Land of farmers and shepherds" is indeed the right name for Sardinia of the twenties and thirties, the first period covered by my investigations. At that time Sardinia had a population of approximately 850,000, mainly concentrated in 364 villages. The working population consisted for two-thirds of shepherds and farmers. The few towns were small. Malaria was endemic until 1947. Apart from the salt pans and the mines (coal, lead containing silver, zinc, iron and copper) there was hardly any industry. There were no good main roads, so trade was very scarce. Nor were there regional markets of any importance. The external trade was in the hands of non-Sardinians and was connected with the exploitation of the few minerals of the island. Consequently Sardinia lacked a real middle-class of producers and manufacturers, lacked a real intellectual class, and showed a high rate of illiteracy[21].

Between oppressor and oppressed no osmosis took place, as we see again and again. Also in the most recent history of Sardinia, the Sardinians underwent initiatives from above without actively or creatively taking part in reforms such as the drainage works in the period of fascism, and the re-allotment, soil improvement and road construction of the post-war regional government which was directed towards extension of agriculture outside the village areas[22].

Another and to me significant example of this Sardinian dichotomy is the bilingualism, Sardinian is an early isolated branch of the Romance languages. Its vocabulary is rich in concrete notions and technical terms related to the life of farmers and shepherds. Abstract notions and expressions from outside the agropastoral realm are lacking. When they do exist they are neologisms derived from the Italian[23].

The autarchy of the villages was the source of a flourishing craftmanship, organized on family basis, dependent on the local raw materials and practized in addition to the normal agropastoral activities. This general rule has only a few exceptions, such as the copper smiths from Isili, a large family of gipsies which had settled there, and the potters of the Campidano, who had organized themselves on the basis of workshops[24].

3. The Pottery Production

To the above general picture which in broad lines remains valid until the fifties corresponds the picture of the pottery production. The pottery is utilitarian as one is used to say because practical usage is its prime function. It is made of ordinary clay (red clay or earthenware clay) in an empirical technique based on oral and artisanal tradition, without sophistication or secrets. Vessels for the collecting, transporting and storing of water are most numerous , although there are several other shapes. A separate group form the fireproof pots: they are a prerogative of one of the centres.

This production is in the first place destined to meet the demands of the agropastoral community, both at home and at work. It is the only indigenous production; fine (glazed) wares or pottery which demands a special technique, such as large storage jars, are imported.

Production is small because of the limited market and the sparse density of the population, as well as the fact that other materials are used too, especially in mountainous areas in the interior. The number of potters does not exceed 5 % of the local working population. However, the distribution area is large and comprises the whole island. Even if the potter's craft is not a full-time occupation, it is for the producers an irreplaceable source of subsistence.

From the fifties until the present day the picture of Sardinia has thoroughly changed and so has the pottery production. Some aspects disappear, some are subject to changes, new features turn up and others persist. Likewise the world of the producers changes, their techniques and their organization, and the customers change too.

4. The Investigation[25]

The investigation into the activities of the potters has its geographical and chronological limitations. The geographical limitation is given by the Campidano with production centres located, from north to south, in Silì, Oristano, Pabillonis, Decimomannu, and Assemini, partly still active and partly extinct. The chronological limits are formed by the years 1920 and 1980. Various reasons have led me to these limitations.

The geographical limit. The Campidano forms originally part of a gigantic geological depression which in the course of time was differently filled up[26]. It is the largest plain of the island: about 100 km long and 15 to 20 km wide. It stretches obliquely across the island from north-northwest to south-southeast. In this alluvial clay area, the largest of Sardinia[27], the centres are found in which to our knowledge for a long time potteries have been established of a certain size and organization. The surrounding slopes of mountains and hills are covered with maquis and provide a wealth of fuel.

The chronological limit. There are two reasons for this limitation. The memories of potters and customers go back to about 1920. In the period elapsed since then important changes have been brought about, which have strongly influenced the activities. I shall not elaborate this aspect. It is enough for the moment to point to the fact that in the twenties all production centres under investigation were very moderate places with an agricultural economy. In the past fifty years these places have become involved in large-scale agricultural reforms conducted in the Campidano, and in addition to this, industry has been incorporated in their economic organization.

5. The pottery production

In the period under review the pottery production has been subjected to the process of: extinction - Silì, Pabillonis, Decimomannu;
adaptation - Oristano (partly), Assemini (partly);
change - Oristano (partly), Assemini (partly).

By adaptation is meant a development which in certain respects and under certain conditions remains within the traditional framework. By change is meant any new production which, with respect to appearance (form, decoration, paste, technology), seems to be divorced from the previous traditional production. But in reality there may remain some links with the past: the potter who received his training in the tradition; part of the raw materials (not always but often one uses the same local clays differently prepared); and part of the customers.

Production-oriented investigation.

The production-oriented investigation is based on observation; graphic and photographic documentation of products and workshops, and on interviews with potters and other persons involved in pottery production, with members of their families and with customers. The object of this part of the investigation is to come to:

a. a description of the product in its various aspects, at the present time and in the past: form and decoration, techniques of production, function, distribution radius.
b. a description of the makers, at the present time and in the past, how they look at themselves and how they appear to the investigator: as a group, as individuals, in relation to their work, in relation to their customers.

This part is designed as a document to lay the foundations of the information. This aspect will be given ample space in the planned publication and will be dealt with as accurately as possible. Place and function of this part are based on the conviction that knowledge of the technological and psychological world of those who made the products is indispensible for a proper interpretation of the material phenomena because they influence the products.

Environment-oriented investigation.

This part of the investigation is directed to the study of the physical and social environment of the production.

The physical environment comprises:

a. the geographical and climatological characteristics of Sardinia and the geological configuration related to clays and soils;
b. the raw materials used in the production (clay, fillers, engobes).

The social environment comprises:

a. the technology of the potters, before and after World War II;
b. the socio-economic organization of the potters, before and after World War II;
c. the consumers: before World War II a world on a agricultural basis; after that the same farmers and shepherds but now "adapted"., the middle-class, the tourist industry;

d. the mutual influence between potters, producing basically a utilitarian product, and artists (ceramists, painters, sculptors);
e. the role of the government (restrictive and stimulating legislation).

6. Final goal of the investigation

Confronted with the phenomena mentioned above, investigation of their reflection in the product: form and decoration, function, technology, terminology, distribution.

Confronted with the extinction of activities: investigation of the causes.

Confronted with the resistence of the agropastoral tradition in the production, investigation of the causes. At the same time looking for an answer to the question what may be called "continuity".

Confronted with breaks in the tradition, investigation into the circumstances which caused the phenomenon or rendered it possible. And at the same time looking for an answer to the question to what extent one is justified to talk about a "break".

Notes

1. Carandini 1979: 29; 34-38.
2. Geertman 1968/69. Annis 1976.
3. See Bibliographical Note.
4. Renfrew 1977: 1-20.
5. 41°15'42"lat.North (Capo Falcone).
   38°51'52"lat.North (Capo Teulada)
   8°8'10"long.East Greenwich (Capo Comino).
   9°50'8"long.East Greenwich (Capo Comino).
6. Atlante della Sardegna 1980: 170-177; Tav. 57, 59.
7. T.C.I. 1967: 71-108; 123-124. Sabattini e Moro 1973.
8. Dessì 1967: IX-XVI.
9. Pira 1969. Caizzi 1969: 7-12. Cavallari 1969: 13-24. Cirese 1969: 165-176. Angioni 1974: 10-20. Le Lannou 1979: 349-375. Atlante della Sardegna 1980 passim.
10. Atlante della Sardegna 1971: 6+11; Tav. 3, 4.
11. Le Lannou 1941: 9-13; 19-22. Atlante della Sardegna 1971: 1-2; Tav. 1; 13-16; Tav. 7.

12. Le Lannou 1941: 27-37. Atlante della Sardegna 1971: 54-55; Tav. 24.

13. Le Lannou 1941: 37-42. Atlante della Sardegna 1971: 39-41; Tav. 17.

14. Le Lannou 1941: 46

15. Le Lannou 1941: 47-56. Atlante della Sardegna 1971: 12-13; Tav. 5, 6.

16. Le Lannou 1941: 57-71. Atlante della Sardegna 1971: 70-72; Tav. 29.

17. Le Lannou 1941: 13-19. Atlante della Sardegna 1971: 13-16; Tav. 7.

18. Le Lannou 1941: 49-56. Atlante della Sardegna 1971: 12-13; Tav. 5,6.

19. Boscolo e.a. 1977.

20. Le Lannou 1941: 49-56. Atlante della Sardegna 1980: 81-136; Tav. 35-46.

21. Brigaglia 1976: 313-331.

22. Cabitza 1968. Lilliu 1971. Le Lannou 1979.

23. Wagner 1921. Idem 1940. Idem 1952.

24. Imeroni 1928. Le Lannou 1941: 285-288. Tavolara 1951.

25. The field work is conducted in collaboration with the Department of Classical Archaeology of the Leiden University which deals with the graphic and photographic documentation.

26. Atlante della Sardegna 1971: 8-9.

27. Atlante della Sardegna 1971: 11.

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H.J. Franken and L. Jacobs

DECORATED POTTERY FROM THE EARLY LA TÈNE PERIOD FROM FRIESLAND, THE NETHERLANDS

In 1961, Professor H.T. Waterbolk of Groningen University published a short note dealing with three sherds, found in Friesland and attributed by him to the period of early La Tène pottery. In 1980 a student of Professor Waterbolk, who came to Leiden for pottery studies, brought one of these sherds (Fig. 4:1) together with a small collection of other sherds for analysis.

Waterbolk's description is as follows:

> "The decoration consists of greyish-yellow rather broad lines and round dots against a dark leather-brown and somewhat olive-coloured background. In the sub surface the light colour is found everywhere right below the dark top surface, which suggests that the potter had some material which was applied before firing took place and which prevented the pot from colouring dark. The nature of the dots and lines possibly suggests the use of a thin fluid which was applied with a stylus. Here are some interesting aspects for further technological studies." (*Helinium* I, 1961, 2)

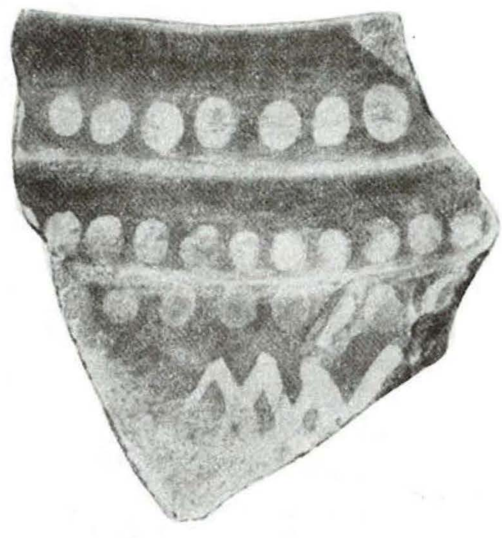
According to this description the sherd has a dark surface. Below this dark surface the sherd shows a much lighter colour which is greyish yellow. The same light colour also shows up on the decorated parts of the dark surface.

For obvious reasons Waterbolk calls this painted pottery. However, when the sherd was examined under 20x magnification it became clear that there was no question of a layer of paint. The surface of the sherd is entirely burnished, and the explanation for the differences in colour seen on the surface and immediately below must be found in the firing conditions. Firing was done in an open fire and not in a kiln with a separate room for the pottery. This is evidenced by the continuous light colour zone just below the dark surface. When black sherds of this kind are refired in an oxidizing atmoshpere to 750 °C, which temperature should be maintained for some time, the light colour will show up at the surface and in the core of the sherd. The light colour marks the first stage of oxidation which takes place in the paste when the carbonaceous matter is burning away, followed by incipient oxidation of iron. This burning out of carbonaceous (organic) matter naturally takes place from outside to the core of the sherd.

In the collection of sherds that came with the "painted" one there were many with a blackish surface covering a light zone just below the surface. Such a black surface is caused by soot from the fire in which the pot is fired. Whereas the temperature is high enough to burn away the organic matter in the sherd - though usually not high enough to cause the core to oxidize -, the constant "rain" of organic fuel on certain parts of the pot creates the black surface. If, for instance two pots lean against each other during firing, the place where they touch each other will take on the light colour. If the iron is to colour red, higher temperatures and more oxygen are required. However, the place where the pots touch each other will show the grey colour only, independent of the height of the temperature or the duration of the firing process at a certain temperature. Since the black surface is due to the "rain" of soot during firing and the black colour is only maintained as long as there is sufficient soot, light spots can be created by covering the surface with non-burning materials, such as clay. As for the collection of sherds referred to above we may conclude that strips in a trellis pattern were applied to the surface of the finished and burnished pot before firing. If such plastic "ornaments" are lightly pressed onto the surface, they will come off due to shrinkage either during firing or afterwards. However, the sherd at the bottom of (fig. 4:2) shows that here and there the surface of the sherd had come off with the clay strips. On the lower righthand side of this sherd the light coloured lines indicate where the surface is gone, whereas it is still present at the dark areas.

Exactly the same result was obtained when this explanation was verified by a test for which a black-coloured clay was used containing a high amount of carbonaceous matter. From an unfired pot which was made from this material a sherd was taken and clay strips were applied onto the surface in a trellis pattern. At the same time a sherd from the Groningen collection was used to see what the result would be after firing in a reducing atmosphere and with a high soot production. This second sherd had already a slightly oxidized surface, partly reddish and partly grey. For the experiment a small test kiln with gas fire was used. Damp organic matter from the garden was used to create the soot. Firing was quick, the temperature went up in approx. 2 hours to 800 °C; at this temperature more damp organic matter was fed into the

Fig. 4



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kiln, whereupon the fire was turned off and the kiln closed. After firing the reddish part of the Groningen sherd had turned into dark grey and the grey part had turned into black. Reduction had been strong and there had indeed been a good deal of soot during the process of firing.

The sherd with the applied clay trellis came out largely black with some grey patches along one edge. The clay trellis came off partly smoothly, and partly with bits of the surface of the sherd stuck to it. It had left the trellis shape as a light coloured pattern in the black surface of the sherd.

This technique of decorating pottery completely depends on the hazards of the firing technique. It is virtually impossible to obtain good results. And yet it must be recognized that the attempts to decorate pots in such a manner point to some understanding on the part of the ancient potter of the causes of the black discolouration of the surface when pots were fired. Decorated pots of this type, when used as cooking pots on a fire, may gradually have lost their decoration. Many more pots from the Early La Tène period may originally have been decorated. Cooking pots that are black on the lower half and show signs of oxidation below the rim on the upper half, have repeatedly undergone the processes described above which both cause and delete the traces of the attempts to decorate. It is possible that in the area where the sherds are found a certain potter tried to embellish his products in this way.

The editor thanks Professor Dr. H.T. Waterbolk for his permission to publish the report on the sherd from Tritsum forming part of the collection of the Bioarchaeological Institute in Groningen, and Drs. A. Peddemors from the Rijksmuseum van Oudheden in Leiden for his permission to study the sherd from Hichtum.

A. van As

TWO CERAMOLOGICAL CONFERENCES

Last year two ceramological conferences have taken place in the Netherlands, in which the Institute of Pottery Technology of the State University of Leiden was one of the participants. The proceedings of these conferences will be published in the near future. Following are some brief comments.

The first conference, a symposium of one week sponsored by the Wenner Gren Foundation, the Netherlands Museum for Anthropology and Prehistory and the University of Amsterdam, dealt with "Multidimensional Approaches to the Study of Ancient Ceramics". Circa 20 researchers from Europe, the United States and Australia met to discuss the ethnographical/anthropological, technological/physico-chemical and archaeological aspects of ceramic studies of a relatively wide geographical area. This symposium, organized by S.E. van der Leeuw (University of Amsterdam, the Netherlands), was the continuation of the 1961 Burg Wartenstein Symposium on Ceramics and Man (Matson 1965). Three of the former participants were present at the 1982 conference. Matson, who had organized "Ceramics and Man", opened the symposium with a retrospect and some thoughts for the future. He pointed out that

> "the differences in the approaches to ceramic studies presented in 'Ceramics and Man' and now reflect the increasing sophistication in the selection of problems by active scholars ...".

This being the case, the various specialized researchers run the risk of losing sight of the entire scope. Therefore, a conference focussed on the different approaches to pottery research is of the utmost importance. Matson pleaded that

> "care must be taken to ensure that the synthesis of many approaches is attained, if the archaeological ceramic products' value is to be understood within their own cultural confines".

This is not the place to discuss each contribution to the symposium. Except for the theoretically oriented paper of S.E. van der Leeuw, all lectures could be classed among the disciplines of archaeology, technology, natural sciences, ethnology/anthropology and ethno-archaeology. The sharp division between archaeology and anthropology made in European university education and not known in American universities, appeared to be untenable for an appropriate study of ancient ceramics.

At the closing meeting all participants fully endorsed the need of a clear terminology in pottery studies expressed by Hélène Balfet (Musée de l'Homme, Paris, France). During the symposium this lack of a clear terminology caused quite some trouble to H. Löbert (Museum Uelzen, BRD) in his translating the German names of different types of potters wheels into English. In the course of the symposium a remarkable difference became evident between the American scholars - in particular the younger generation - and the European. Whereas European researchers only very cautiously come to models of explanation through extensive scrupulous research of the available sources, the young American researchers are enthusiastic model builders on - according to European ideas - a weak basis.

During the second ceramological conference another problem presented itself in the form of too few statistical analyses required to build up a solid archaeological picture. This conference, organized by J.A. Brongers of the State Service for Archaeological Investigations, Amersfoort, the Netherlands, focussed on the physicoscientific approach to ancient pottery. Ten lectures of Dutch scientists offered a representative picture of what happens in this field in the Netherlands: X-ray diffraction, neutron activation, diatoms research, etc. Both L. van der Plas (Agricultural University, Dept. of Soil Science and Geology, Wageningen, the Netherlands) and A. van As (Institute of Pottery Technology, Leiden, the Netherlands), welcomed in their lectures the increasing introduction of physicochemical analysis methods into archaeological pottery research. They also pointed at the risk of including the results of laboratory analyses as appendices in archaeological publications for reasons of fashion. If well integrated in the technological and archaeological researchwork the physicoscientific approach to ceramics will be a valuable contribution to the solving of archaeological problems. Expensive laboratory analyses are only justified if they serve to find answers to archaeological questions. And, even then, only in those cases where the archaeologist cannot give a reply to or confirmation of such questions.

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L. Jacobs

A SUMMARY OF THE RESEARCH METHODS

The Institute of Pottery Technology carries out comparative studies into the production methods of ancient pottery and follows the developments of these methods on the basis of chronologically arranged pottery from one source. This involves a detailed investigation into and explanation of the techniques applied by the potters, followed by experimental tests with appropriate clays.

These activities result into a pottery classification, which is based on shape techniques and other standardized procedures of the craft, such as the preparation of the paste and the drying and firing processes. Each pottery tradition leaves characteristic traces of the manufacturing process on the finished product. With the aid of the experimental tests referred to above special problems can be solved, such as the question of how a certain type of clay reacts to varying amounts of filler of varying sizes. The results are related to different pottery production techniques. Research in modern technical literature is part of these studies and serves partly to "verify" the study of ancient pottery, partly to solve some general pottery problems.

The study of potsherds from ancient pottery involves the following aspects:

- Comparative study of the colours, followed by explanations.
- Determination of the original firing temperatures.
- Explanation of traits at the original temperatures and changes in these traits when such sherds are refired at higher temperatures under monitored conditions.
- Microscopic determination of filler, for the purpose of studying the nature, size and amount of such filler. The results obtained are evaluated with the aid of reference collections and translated into practical knowledge of the processing properties of the paste used. This knowledge is of prime importance for the reconstruction of the craft. The reference collections are also used to express the ratio between filler and clay in weight percentages.
- Determination of porosity, comparison and explanation of the measuring results.

- Microscopic study of the sherd surface to determine hardness, sinter processes, scum, slip and decoration.
- Chemical tests to detect lime, magnesium, lead and other elements.
- Melting range tests.

If the original clay or any other clay comparable to the clay used by the ancient potters is available, the following tests are carried out:

- Typical potter's tests, such as the Atterberg test, throwing test, squeeze and finger groove test, pigletstail test, all designed to test the workability of the paste. In this way it is possible to incorporate important properties such as degree of plasticity and water absorption in the explanation of why and how certain construction techniques were used. These tests play an important role in the composition of pastes for reconstruction purposes.
- Tests to determine the drying shrinkage and total shrinkage percentages at different temperatures.
- Breaking strength tests for which standard-size tablets are used, and comparison of the results obtained at different temperatures.
- Melting range tests.
- Tests to measure density and precipitation for the purpose of comparing the clay fractions of different clays in relation to their plasticity.
- Acid tests.

Ian Edwards, Senior Lecturer, ceramics, Victoria College, Burwood (Vic) Australia who spent six weeks at the Institute in 1981 showed us in this period various methods how to test clays for practical purposes. He devised these methods in his school for potters. We owe him thanks for having built for us a small and very practical test kiln to be used on excavations. On this subject he delivered a paper, "A Portable Test Kiln for Field Use on Archaeological Sites" on the Australian Archaeometry Conference, Australian Museum, Sydney, February 1982.

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LIST OF REPORTS NOT (YET) PUBLISHED

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1. Iron Age pottery from Haren, Brabant, the Netherlands; for The Institute of Prehistory, Leiden University.
2. Neolithic beakers from the Netherlands; for the Bioarchaeological Institute. University of Groningen, the Netherlands.
3. Technical Aspects of pottery from Petra; for the Archaeological Department, University of Amman, Jordan.
4. 12th-14th century pottery from Tellem, Mali (Africa); for the Institute of Anthropobiology, University of Utrecht, the Netherlands.
5. Medieval pottery from Qalat Jaber on the Euphrates; for the Department of Antiquities, Syria.
6. Bronze Age pottery from Selenkahiye, Euphrates, Syria; for the Department of Near Eastern Archaeology, University of Amsterdam, the Netherlands.
7. Flat-bottomed pots of the Late Third Millennium from Jericho and environs, by J. Kalsbeek and G. London. (Collection Dept. of Palestinian Archaeology Leiden.)
8. Drinking vessels from Indonesia, for the Department of Far Eastern studies, University of Leiden.