

**The Production, Circulation and  
Consumption of Ceramic Vessels at  
Early Neolithic Knossos, Crete.**

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## ABSTRACT

Neolithic ceramics in the Aegean have had a history of interpretation, which has seen them employed to address a series of questions, including chronology, cultural origins, technology, production, circulation and consumption. This study critically reexamines this history of interpretation and explores how it has contributed to current understanding of the production, circulation and consumption of ceramic vessels during the earlier Neolithic (c.6500–4500BC). More specifically it is argued that recent advances in the methods used to characterise variation in Neolithic ceramic assemblages have generally not been matched by increased sophistication in the ways such variation is interpreted.

In this study macroscopic and microscopic (petrography, scanning electron microscopy) analyses of Early Neolithic ceramics from Knossos have been combined in order to explore the potential limits of ceramic variation. In the methodology used, the production process is viewed as a series of necessary stages, at each of which the potter exercises choices. From clay choice and processing to vessel forming, finishing and firing, these choices may be revealed through the macroscopic examination of fabric, form and forming and finishing methods, followed by selective sampling for microscopic analysis. Thereby the pottery assemblage may be characterised in terms of its mineralogy, paste preparation and its decorative and firing technology. Additional studies of chronology and changes in site-size have also been produced.

This broad analytical program has generated a considerable amount of new data, which forms the basis for individual studies of ceramic technology, production organisation, ceramic exchange and ceramic consumption. In the final analysis the main conclusions arising from each of these studies are compared and contrasted. In this way detailed macroscopic and microscopic analyses of ceramics are ultimately used to explore the changing ways in which the inhabitants of Knossos materially constructed their social world during the seventh, sixth and fifth millennia BC.

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# ABBREVIATIONS

<b>Ac</b>	<b>Aceramic</b>
<b>B</b>	<b>Burnished</b>
<b>B/S</b>	<b>Brushed/Scribble Burnished</b>
<b>C</b>	<b>Coarse (usually burnished)</b>
<b>C</b>	<b>Combed</b>
<b>EBA</b>	<b>Early Bronze Age</b>
<b>EC</b>	<b>Early Chalcolithic</b>
<b>EM</b>	<b>Early Minoan</b>
<b>EN</b>	<b>Early Neolithic</b>
<b>F</b>	<b>Fine, (usually polished)</b>
<b>FN</b>	<b>Final Neolithic</b>
<b>I</b>	<b>Incised</b>
<b>IL</b>	<b>Incised Lattice</b>
<b>IP</b>	<b>Incised/Pointillé</b>
<b>IV</b>	<b>Initial Vitrification</b>
<b>LC</b>	<b>Late Chalcolithic</b>
<b>LN</b>	<b>Late Neolithic</b>
<b>MBA</b>	<b>Middle Bronze Age</b>
<b>MC</b>	<b>Middle Chalcolithic</b>
<b>mc</b>	<b>monocrystalline</b>
<b>MN</b>	<b>Middle Neolithic</b>
<b>NV</b>	<b>Non Vitrification</b>
<b>OES</b>	<b>Optical Emission Spectroscopy</b>
<b>P</b>	<b>Polished</b>
<b>PB</b>	<b>Pattern Burnished</b>
<b>pc</b>	<b>polycrystalline</b>
<b>R</b>	<b>Ripple</b>
<b>S</b>	<b>Scored</b>
<b>SC/R</b>	<b>Slashed Cordon/Rope</b>
<b>SEM</b>	<b>Scanning Electron Microscopy</b>
<b>TLP/NE</b>	<b>(almost) Total Local Production/Non Exchange</b>
<b>TV</b>	<b>Total Vitrification</b>
<b>V</b>	<b>Vitrification</b>
<b>VC</b>	<b>Vitrification (Calcareous Body)</b>
<b>W</b>	<b>Wiped</b>

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## CHAPTER ONE

### INTRODUCTION

"Then it was in the first year of the excavations at Knossos came a discovery of the greatest importance in this connection: that of the Neolithic People of Crete. The far-reaching consequences that follow from this discovery cannot easily be overestimated" (Mackenzie 1906:224).

Just over one century ago excavations conducted by Arthur Evans below the then recently discovered Bronze Age palace at Knossos brought to light a deeply stratified Neolithic deposit. This was characterised by the presence of stone axes, maces, obsidian and bone tools, figurines as well as a distinctive type of hand-made Neolithic pottery, which clearly pre-dated anything else that had hitherto been discovered on Crete (Evans et al. 1900-1). Although most of Arthur Evans' scholarly energy would inevitably be absorbed by the later Bronze Age Minoan civilisation, he nevertheless had a profound influence on the direction and development of Cretan Neolithic studies. He not only 'created the discipline', but also provided the ideas and set the questions for a whole series of subsequent scholars: chronology, typology, Anatolian cultural origins and the model of gradual growth in isolation are all research themes which begin with Arthur Evans and Duncan Mackenzie (Tomkins 2000). Since these first discoveries and over the last century further study and excavation at Knossos by a series of scholars, above all J.D. Evans<sup>1</sup>, has added considerably more detail and definition with the result that Knossos ranks as one of the longest-inhabited, most well-defined and consequently most important Neolithic sites not just in Crete but within the entire southern Aegean.

During the last century there have been many changes in the way wider scholarship has approached the 'Neolithic phenomenon': as a chronology, a technology, a culture, an economy, a population, a social structure and most recently as a conceptual system (Whittle 1996:4). Some of these developments find expression in previous work on Neolithic Crete, others do not. While there

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<sup>1</sup> All subsequent references to Evans refer to J.D. Evans, unless otherwise indicated (e.g. A. Evans for Sir Arthur Evans).

is no denying that giant steps have been taken in the last century of exploration, arguably there is a need to challenge the old ideas and assumptions and to formulate new questions - to rethink the Cretan Neolithic (Tomkins 2000). As Whitelaw has stressed, this rethinking can only be achieved through new studies of archaeological material (Whitelaw 1992:233-4; cf. Broodbank 1992).

Previous studies of Neolithic ceramic material from Knossos have established and refined a ceramic typology based on form and have combined stratigraphical observations with observations of variation in form and finish to establish a relative chronology, which divides the Cretan Neolithic up into three main phases, Early (EN), Middle (MN) and Late (LN) (Mackenzie 1903; Furness 1953; Evans 1964). Although primarily concerned with the establishment of a relative ceramic chronology, these studies often made comments in passing, which are relevant to study of the production, circulation and consumption of ceramic vessels. In Chapter 2 these previous approaches to Neolithic ceramics at Knossos will be assessed in the light of other studies of Neolithic ceramics from around the Aegean. This comparison suggests that most of such studies have been interested primarily in addressing issues of chronology, typology and cultural origins. More recently a number of detailed studies of specific Aegean Neolithic assemblages, most notably that of Franchthi (Vitelli 1993a), have sought to address questions of ceramic technology. Although largely based on macroscopic forms of analysis, such studies have made limited use of mineralogical and chemical techniques of analysis.

Consideration not only of the ways in which these more recent studies have sought to define and characterise ceramic variation in individual assemblages, but also of how they have interpreted this variation in terms of production, circulation and consumption raises a whole series of issues and contradictions (theoretical, methodological, analytical) which at present remain unresolved (see Chapter 2). Since previous studies of Neolithic ceramics at Knossos did not concern themselves explicitly with technological analysis, the well-excavated and well-defined Neolithic assemblage at Knossos provides an excellent opportunity to re-examine a whole series of questions concerning the

production, circulation and consumption of ceramic vessels during the Neolithic. Since this new study involves the combination of detailed macroscopic analyses with the microscopic study of selected samples both petrographically and using a scanning electron microscope (SEM), considerations of time dictate that the focus be narrowed to ceramic material from the EN phases at Knossos (ENI-II). These phases nevertheless cover a considerably longer period than the EN phase in Greece (Cretan ENI-II = Greek EN-LNI; see Appendix I). Moreover, since questions of production, circulation and consumption can only be addressed using good contextual information, study and analysis will focus on ENI-II ceramic material excavated by J.D. Evans between 1957-1960 and between 1969-1970. This new study will seek explicitly to explore the potential limits of ceramic variation within a single Neolithic assemblage by studying variation in fabric, form, finish and firing. These different dimensions of variation will be studied and characterised in such a way as to allow analysis of how variation in one dimension articulates with that in another.

Studies of the production, circulation and consumption of ceramic vessels all have the potential to inform upon each other. Thus although, as archaeologists, we tend to study each individually - and there is certainly an analytical usefulness in this approach - it is crucial that ultimately they are recombined so that it can be examined how production, circulation and consumption all inter-related in the world of the earlier Neolithic. This in turn requires the fulfilment of three key objectives:

- (1) A 'theory of material culture' with particular reference to ceramics, which not only explores the material and cognitive basis for acts of production, consumption and exchange, but which also seeks to understand how these three categories of action articulate with each other.
- (2) A framework, derived both from comparative ethnography and archaeology, which seeks to explore the ways in which 'Neolithic' societies are constituted, particularly from the three perspectives of production, consumption and exchange.

- (3) A methodology for the practical investigation of ceramic production, consumption and exchange within a single Neolithic archaeological assemblage.

Each of these objectives will be pursued in a separate chapter: Chapter 3 will focus on outlining such a 'theory of material culture', Chapter 4 will seek to build a framework within which some of the possibilities of existence in 'Neolithic societies' can be explored, while Chapter 5 will deal with aspects of methodology.

This study has generated an array of new data relevant to the study of ceramic production, consumption and exchange and Chapters 6-9 will present the results of different types of analysis beginning with petrological and mineralogical data (Chapter 6) and proceeding through form and finish (Chapter 7) and SEM data (Chapter 8) to the results of the quantitative analyses (Chapter 9). These different analyses complement each other and are presented in this way to allow the results of one to be compared and contrasted with those of another. This allows ceramic variation to be studied and characterised at a variety of levels and to be viewed from the different perspective of production, circulation and consumption. In this way the results of these different analyses provide the basis for an examination of some of the issues and problems, first identified in Chapter 2, associated with the production (Chapters 10-11), circulation (Chapter 12) and consumption (Chapter 13) of ceramic vessels at Knossos during ENI-II. Further relevant information and discussion is provided in a series of appendices, which cover chronology (Appendix I), changes in settlement size (Appendix II), geology (Appendix III), south-west Anatolian relative ceramic chronology (Appendix IV), petrographic descriptions (Appendix V), ceramic typology (Appendix VI) and the incidence of features of form and finish per fabric (Appendix VII).

In the final concluding chapter (Chapter 14) the main findings of Chapters 10-13 (production, circulation and consumption) will be restated in summary form in order that they might be compared and contrasted. Through this recombination of separate discussions of the production, circulation and

consumption of ceramic vessels, it is hoped that something further can be learnt about how these three different forms of social and material action may have articulated with each other. In this way new information will be generated regarding the changing ways in which the inhabitants of the Kephala Hill at Knossos materially constructed their social world between c.6400BC and 4500BC.

## CHAPTER TWO

### EARLY CERAMICS IN THE AEGEAN

#### 2.1 Themes and Theories in Early Ceramic Studies

The human transformation of clay, through fire into ceramic has long been hailed as a significant technological leap: from Tylor and Morgan in the nineteenth century to Childe in the first half of the twentieth century, the appearance of pottery has been considered a sign of significant cultural development and an important step towards 'civilisation' (Hoopes & Barnett 1995:4; Rice 1999:3). In early studies of the Neolithic the beginning of potting was linked with other significant developments, such as the appearance of early agriculture and the development of sedentary village societies, as part of a 'Neolithic Revolution' (cf. Childe 1981; see discussion in Moore 1995:39-40). Pottery containers both facilitated the processing of cereal grains and enabled storage in sufficient quantities to feed large sedentary groups. In addition sedentary living was considered to be a prerequisite of pottery production. Thus it was that early ceramics simultaneously enabled and were enabled by early agriculture and sedentism.

##### 2.1.1 *Ceramics, Sedentism and Agriculture*

This close synchronism between early ceramics, agriculture and sedentism long remained axiomatic. Indeed it was only when Kenyon's excavations at Jericho in the 1950s revealed the existence of a long 'Pre-Pottery Neolithic' that it began to become clear that pottery first appeared long after the development of agriculture and village communities. Since then research amongst ceramic-using 'complex' hunter-gatherers, both ethnographic and prehistoric, has made it clear that the appearance of early pottery should be 'decoupled' from deterministic associations with either agriculture or sedentism (Hoopes & Barnett 1995:2, 4-5). Thus, although there is a clear tendency for modern ethnographic pottery-producing societies to be sedentary (see Arnold 1985:109-26), the origins of pottery-production need not be so closely associated with a lack of mobility. To give just a few examples: some of the earliest pottery ever made was produced by



Jomon hunter-gatherers in Japan (Aikens 1995); likewise Ertebølle Mesolithic communities in northern Europe were using pottery centuries before the earliest appearance of domesticates (Gebauer 1995); while in both Mexico and Western Asia the opposite is true, as there domestication preceded ceramic production by millennia (Hoopes & Barnett 1995:5; see below).

That is not to say, however, that no relationship exists between early ceramic use, agriculture and sedentism, only that it is by no means a simple or singular one of cause-and-effect. Pottery production places significant demands on time and energy: ethnographic studies of modern hunter-gatherers tend to show that pottery use occurs in the context of sedentary activity, even if the group is mobile for the rest of the year (Hoopes & Barnett 1995:4; Rice 1999:23-6, 28-9). Thus sedentism, if only seasonal, may have played a significant enabling role in the appearance of early pottery.

### *2.1.2 Ceramics and Food Processing*

Studies of early ceramics have produced a wide range of interpretations, the majority seeking to account for their origins and emergence (cf. review in Rice 1999:2-14). Traditionally these studies have focused on the obvious storage, cooking and serving capabilities of ceramic containers. To a large extent these studies may be characterised as 'adaptionist' or 'enabling' explanations (see Brown 1989:204-5, 210-11): pottery is held to have been an improvement on previous containers and in particular to have increased the adaptive potential of the pottery-using group<sup>1</sup>. The advantages of pottery in this are considered to be the following (see Rice 1999:8; Hoopes & Barnett 1995:5; Arnold 1985:128-44):

- (1) Increased efficiency in processing of 'new' foods, such as cereals, by toasting or by direct/indirect boiling;
- (2) Increased efficiency of long-term storage of grains and pulses;
- (3) Improved nutrition for children, mothers and the elderly through the ability to prepare soft-cooked foods;

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<sup>1</sup> For an extreme expression of the view that ceramic technology is entirely directed towards extending human adaptation to the environment see O' Brien et al. 1994, especially 264-71.

- (4) Extension to the range of food resources which could be exploited, including foods containing toxins which require long soaking and cooking, thus increasing the carrying potential of the local environment;
- (5) Reduction in the time required to oversee cooking in comparison to gourds, stone, bark or basket vessels, which require indirect stone-boiling techniques.

A close connection between pottery and cooking is also suggested by modern ethnographic studies. However, as Vitelli has stressed, "no modern ethnographic context... truly parallels the earliest contexts for pottery use" (Vitelli 1993a:214; cf. Vitelli 1989:24-5). Thus none of the earliest pottery at Franchthi shows any sign of having been used as a cooking pot (Vitelli 1989:24; 1993a:213-4; see also Section 13.3.1) nor does the earliest use of pottery suggest a focus on storage (too few pots of too small a size) (Vitelli 1989:26-7). Rather, the advantages of pottery, so obvious to modern researchers, would have not been so immediately apparent to the earliest users (cf. comments of Sassaman 1995:223-4); the culinary potential of pottery was something which had to be discovered over time and when the need arose. Indeed if traditional foods were judged to be better tasting or more socially-acceptable if cooked using pre-ceramic methods of processing, this may have actually mediated against the early use of ceramics as cooking pots (Vitelli 1993a:214-5). For Rice the popularity of culinary hypotheses illustrates the common tendency amongst Anglo-American archaeologists and anthropologists to view technology, particularly its origins, from an ethnocentric Western perspective, which sees the advantages of new technologies as self-evident to the societies which adopted them (Rice 1999:10).

### *2.1.3 Functional/Economic Efficiency*

The failure of 'self-evident' and adaptionist hypotheses to account of the data for early pottery use has also been noted by Brown (1989:204-212). Brown has proposed an alternative hypothesis that early ceramic containers were produced to supplement or replace existing container forms which could no longer be manufactured sufficiently quickly and in sufficient quantities to cope with an increase in container demand (1989:213-222). This extra demand for

containers is held to arise from an increase in container consumption, such as might occur when new activities involving the use of containers are adopted, such as stone boiling, parching, direct heating or storage (on storage see Moore 1995). This model relies on the presumed economic superiority of ceramic containers over those made from other materials (Brown 1989:218-22): it postulates that it is quicker, easier and more cost-effective in terms of time and labour for the sedentary household to intensify production of ceramic containers, largely because pottery is held to provide greater potential for economies of scale but also because household pottery production is thought to involve low labour costs because it can easily be accommodated within the range of tasks performed by women in the household (see below on gender).

Although this model has been applied to contexts of early ceramic use (e.g. Crown & Wills 1995; Sassaman 1995; Moore 1995), it is by no means without its problems. A key assumption is that early pottery using societies will be economically optimising, that is they will perceive ceramic technology in terms of efficiencies gained in labour and energy expenditure<sup>2</sup>. This in fact seems to be highly unlikely: as Sahlins has noted, modern 'Stone Age' societies tend to be characterised by 'underproduction', an 'under-use of objective economic possibilities' and a more relaxed and flexible attitude to time, far different from the modern notions of economic efficiency and time-management (Sahlins 1974:14-27, 34-5, 41-99; Bourdieu 1977:175-8; see Chapter 4)<sup>3</sup>. Thus, it seems unlikely that ceramic technology would have been adopted because it was perceived to be a 'cheap' craft in economic terms. A related assumption is the notion that ceramic would be perceived immediately to be a superior container material than, for example, wood or basketry. This however is not supported by the available data for Crete and Greece. At both Knossos and Franchthi, as well as at other sites, the first ceramic containers are present in such small quantities

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<sup>2</sup> This over-emphasis on ecological constraints and possibilities seems to result in general from an over-deterministic application of ceramic ecology theory, demonstrated by heavy reliance on the work of D. Arnold (1985) (see especially Brown 1989:213-6). For a critique of this sort of application of ceramic ecology see Chapter 4.

that it is hard to resist the conclusion that a wide range of non-ceramic containers must have remained in use (see Section 13.4.2). Any replacement of non-ceramic containers must have occurred over a very long period of time. Evidence is also lacking for the co-occurrence of the first ceramic vessels with a new range of container-destructive tasks to which pottery was better suited; rather the adoption of pottery in the Aegean seems to have been accompanied by no obvious social, material or economic changes (see below; cf. also Sassaman 1995:223-4 for similar conclusions for the earliest pottery in the American Southeast).

#### 2.1.4 Gender

The economic-efficiency model, as with many theories on the emergence of pottery, is also problematic in terms of the way it fails to deal seriously with the important social dimension to the adoption and maintenance of new technologies (cf. van der Leeuw & Torrence 1989; Sassaman 1995:235-6; see Chapters 3-4). Prominent in this is a failure to problematise the issue of gender. It remains a common assumption that the first "pots were generally made by women and for women" (Childe 1981:86): compare the conclusion of Longacre that "pottery was invented by women and remained a women's technology for millennia" (1995:278) or that of Vitelli that "Neolithic potters were probably women" (Vitelli 1993a:xx).

The principal reason for this long-standing association is the assumption that early pottery production and consumption fell entirely within the range of supposedly female-gendered tasks. Thus women "as gatherers and as the individuals most closely associated with households, might also have been closer to the technologies and materials for making pottery and better able to organise the diverse tasks necessary for manufacturing ceramics" (Hoopes & Barnett 1995:6; cf. Vitelli 1993a:xx; 1995:60-1; see Chapter 4). These ideas are not without considerable ethnographic support. There is a strong link in mixed

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<sup>3</sup> Indeed modern ethnographic studies of hunter-gatherer societies tend to suggest that "the food quest is so successful that half the time the people seem not to know what to do with themselves" (Sahlins 1974:11).

horticultural and foraging economies between female labour and wild plant gathering, daily horticultural tasks, food processing (except butchering and fire-starting), the production of clothing, textiles, basketry and leather products as well as care for infants and the elderly (see discussion and references in Crown & Wills 1995:246-7). However, as Sahlins has stressed, although the most dominant form, the "division of labour by sex is not the only economic specialisation known to primitive societies" (Sahlins 1974:79).

Studies which stress the connection between female labour and early pottery production also rely on the numerous ethnographic studies which describe female pottery production at the household level. Arnold has argued that part-time seasonal pottery production is most efficiently accomplished within the household, to which women are closely attached through the requirements of pregnancy, infant care and the sort of household tasks listed above (Arnold 1985:100-1): pottery production does not require periods of absence from the home, is a relatively safe activity to conduct in the presence of children, is monotonous and does not require excessive concentration, is compatible with cooking and requires the sort of daily attention which suits scheduling with other 'female' household activities.

In response to this Wright has argued that it is not child care responsibilities which tie women to the household and which free men to engage in activities at a distance, since within a household there are a range of alternative child care options and at any rate reproduction and child-care occupy women only at a certain stage in their life-cycle (Wright 1991:200-1; 217; see also Crown & Wills 1995:248). Moreover, in actuality pottery production is far from monotonous, is potentially dangerous (e.g. firing) and in terms of scheduling requires a rhythm of work and considerable amounts of skill, timing and concentration (Wright 1991:n.6). In other cross-cultural studies of gender and activities, pottery production is not so clearly correlated with one gender or another (see Barley 1994:61-6): it has been suggested for ethnographic studies of African potters that it might be more appropriate to draw a line not between male and female, but between fertile women and everyone else (Barley 1994:63).

When males are involved their participation is usually associated with a complex division of labour and a high degree of occupational specialisation, agricultural intensification and complex technologies of production, when women are involved there tends to be a low degree of occupational specialisation and division of labour (Wright 1991:198).

It has been observed that if pottery production were simply added to this extensive range of tasks then it might amount to a "time management crisis for women" and this may serve to prevent the introduction of pottery production in mixed horticultural and foraging societies (Crown & Wills 1995:247-8). However, what is forgotten consistently in studies which emphasise gender and ceramic production, is that the production of pottery, like the production of food, is never simply the responsibility of a single individual (see Chapter 4). Rather, as Wright has emphasised, pottery production involves the co-operation of other people, such as children or the elderly, who often remain invisible in modern ethnographic studies of production (Wright 1991:198-9; Miller 1985:77). Thus household production is not simply female production, but implies the co-operation of "individuals who perform other tasks in the production sequence (e.g. procuring and processing clay, decorating finished vessels, collecting wood...)" (Wright 1991:198; cf. Miller 1985:110; cf. Barley 1994:61-6). In this way pottery production might be compared to agriculture, which similarly requires group co-operation at certain stages in the production process, whether sowing and threshing (often male-dominated) or weeding and other day-to-day activities (female-dominated) (Wright 1991:198-9).

Recognition of the potential involvement of others in early pottery production, encourages one to think beyond the cliché of female labour and early ceramic production<sup>4</sup>. One might speculate regarding the potential special male involvement in certain significant tasks in a production process, which might otherwise have been dominated by female labour, such as bonfire lighting; fire-lighting being potentially symbolic and transformative. Alternatively, one could

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<sup>4</sup> For example Vitelli makes deliberate rhetorical use of the female pronoun to refer to potters (Vitelli 1993a:xx, 4, 92), even though it is not clear whether they were male or female or both.

argue that if early pottery production was something that was adopted from outside the community, as several have argued for the Aegean (see below), it might, as an imported technology, have been more closely associated with those, through whose social contacts beyond the community, this innovation first arrived; the most likely candidates for this being men. In a similar vein Rice has noted that if the earliest ceramics "were associated with ritual and/or shamanic control of production, manufacture could have been by either sex" (Rice 1999:10 n.8).

Thus, studies of early ceramic production, which emphasise one gender over another, are likely to suffer from over-simplification and an over-emphasis on individualism. Household ceramic production is above all likely to be a group activity which could be potentially shared between males *and* females, old *and* young (Wright 1991:199, 201); the point being that the organisation of production in small-scale societies is based on the kinship mode of production, where roles are defined according to age and the life cycle and the organising principles are simultaneously public, economic and political (see Chapter 4). Studies which stress the exclusive female involvement in early pottery production also run the risk of projecting ethnographic presents, where pottery production usually has a long history and is not a 'new' technology, onto an Early Neolithic past, where pottery is something new and most likely of special value (Vitelli 1993a:214).

### *2.1.5 Resource Intensification/Competitive Feasting*

Recent attempts to understand and explain changes in subsistence strategies and an early use of pottery among complex hunter-gatherer groups, have combined culinary and economic optimising theories for early pottery use within an overall model which asserts the importance of resource intensification (see Rice 1999:10-12; cf. Aikens 1995; Sassaman 1995). Increased sedentarisation, the introduction of more intensive methods of food procurement (e.g. agriculture) and the adoption of pottery are all understood in terms of attempts to get more out of specific resource-rich environments. Hayden has

argued that while in resource-poor environments there is likely to be an ideology of communal sharing, resource-rich environments are likely to foster "economically-based competition together with the resultant socio-economic inequalities that this implies" (Hayden 1995:258). Within this context it is considered only natural that 'aggrandising individuals' with 'accumulative personalities' will emerge, who compete for power and status through the organisation of competitive feasts, featuring rare or otherwise desirable foods; such feasts may have served to create indebtedness and display status (Hayden 1995:258, 260-3). In this context there is no guarantee that food containers will necessarily be made of ceramic, for example stone or plaster bowls appear well before pottery in the Near East (Hayden 1995:260; see below). Indeed Hayden argues that the earliest developmental phase of ceramic technology "must have represented a very laborious endeavour with many problems and failures", most likely driven by a desire to master and exploit the symbolic value of a new socially prestigious technology of transformation, which was also capable of producing more exotic container forms and/or allowed new foods to be processed (Hayden 1995:261-2).

This model has a number of attractive features:

- (1) it correctly predicts that the earliest pottery should occur in the form of food-serving vessels, such as bowls and plates, with cooking vessels only being of secondary importance;
- (2) it is able to account for the high value and symbolic importance attributed to early pottery containers (cf. Rice 1999:13-14; Vitelli 1995);
- (3) it provides a coherent, socially and economically grounded means of understanding other subsistence and material changes which may occur in such contexts;
- (4) it can easily be modified to fit 'secondary' scenarios, where ceramic technology may have been adopted through contact with ceramic-producing communities: the idea of early ceramics as a prestige technology and a socially-valued container-form helps to explain the motivation for such technology transfer. It is generally considered likely that such instances of



adoption were much more widespread than cases of independent invention (Rice 1999:41-3).

The weakness of this model, at least in its present form, is the necessary link it proposes between competition and intensification of production, whether of subsistence or ceramics. In this way the model predicts a "rapid evolution toward labor-intensive, specialized production of highly decorated forms" (Hayden 1995:261). In fact the link between competition, arguably a feature of all societies, and intensification, a feature of some, is by no means necessary (see Sections 4.2.2, 11.3). Furthermore, in the context of Anatolia, Crete and Greece, 'evolution' towards specialised production seems in fact to have been far from rapid; indeed there may be good social reasons why the possibilities for specialisation may have been restricted in early ceramic using societies, certainly early agricultural economies do not seem to be characterised by intensive-labour or economic optimisation (see below; see also Sections 4.2.2, 11.3).

## **2.2 Early Ceramics in Anatolia, Greece and the Aegean**

### *2.2.1 Pre-Ceramic Clay Use*

As is often the case in regions of early ceramic technology (cf. Rice 1999:37-9 'software horizon'), the appearance of ceramic containers at sites in Greece, the Aegean and Anatolia (west, south-west, south) does not represent the earliest uses of clay in this area. The period in which pottery first appears is preceded by a pre-ceramic or aceramic phase during which clay was variously used in the construction of dwellings (mudbrick, clay installations) as well as to form figurines and ornaments (beads).

In Anatolia and the Near East this phase of pre-pottery clay use was of extremely long duration. There the use of mudbrick architecture dates to the very beginning of the Neolithic (ninth millennium BC), coinciding with the inception of early agriculture: for example early mudbrick-based architecture is found at PPNA Jericho in the Levant, at Asikli Höyük, Çayönü Tepesi in south and south-east Anatolia and at Hacilar in south-west Anatolia (eighth millennium) (Joukowsky 1996:74-85; Schmandt-Besserat 1977:133-137). In Anatolia

(especially the south-east) during the ninth and eighth millennia, plaster was manufactured to make floors and increasingly at the end of the ninth and into eighth millennium to make a variety of containers, often quite large, which seem to have been used for storage (see Moore 1995:45). The walls of these vessels were built up in thin layers, each being allowed to dry before the next was applied. It has been suggested that the abundance of these containers might indicate a significant increase in the need to store foodstuffs during this period (Moore 1995:45). Clay beads, figurines and geometric objects are also known from some sites in the pre-pottery period: for example at Çayönü Tepesi and Suberde (ninth-eighth millennia BC), but not at Asikli Höyük or Aceramic Hacilar (Schmandt-Besserat 1977:138-142). House models are known from Çayönü Tepesi (Moore 1995:46). The appearance of a similar range of clay objects at around the same time and over a wide area encompassing the Levant, the Fertile Crescent and south-east Anatolia testifies to the existence of a considerable degree of interaction between communities in this region at this time; interaction which can also be glimpsed in the widespread circulation of 'exotic substances', such as 'attractive stones', shells and even metals (Wengrow 1998:784-5).

In mainland Greece, aceramic Neolithic deposits, dating to the first half of the seventh millennium BC, have been isolated at sites in Thessaly (Argissa, Gediki, Soufli Magoula, Sesklo) and at Franchthi and these have produced clay earplugs, figurines and slingshots (Demoule & Perlès 1993:365-9). On Crete clay beads and clay figurines, along with mudbrick architecture, are known from the Aceramic period (c.7000-6400BC) (Evans 1964:141-2; 1971:102, plate III; 1970b:7; Appendix I)<sup>5</sup>. The functions of these early clay objects in Anatolia, Greece and the Aegean were probably various and cannot be determined with

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<sup>5</sup> In addition, amongst unpublished material from the excavation of Aceramic levels (level 26) in sounding X at Knossos, a built clay feature with central pivot hole and smoothed interior, which may be part of a quern. This interesting object has an interior which appears to be smoothed and very roughly burnished. However, it should be stressed that the material from which this is made is not ceramic but resembles a mudbrick fabric and the object is part of a built feature and not a container.

certainty. However, there is a general consensus that most had some sort of symbolic significance (cf. Moore 1995:46).

The aceramic period in Greece and the Aegean, although much shorter in duration than the Anatolian aceramic, nevertheless demonstrates that both early agriculture and early villages were in existence long before the appearance of fired ceramic containers. At the Cyclops Cave (Yioura) there is possible evidence for the early (eighth millennium) domestication of animals (pigs and caprines) (Sampson 1999:21), while at Franchthi (eighth-seventh millennium) there was a probable early exploitation of plants, although these were locally available wild cereals and not domesticates (Perlès 1999a:317). The first domesticates, mainly wheat, lentils and ovicaprids "of Near Eastern origin", appear in the Initial Neolithic (Aceramic) phase alongside a basically 'Mesolithic' tool kit<sup>6</sup>; the following phase (Early Neolithic) differs entirely from the preceding one, is fully Neolithic and indistinguishable from other EN assemblages of southern Greece (Perlès 1999a:317). At Knossos domesticated sheep, goat, cattle and pig are clearly present in the very earliest layers of the Aceramic village (c.7000BC) together with a range of domesticated cereals (Jarman & Jarman 1968; Evans 1968:269-70). Thus, as has been stressed recently, it is crucial that the emergence of pottery is 'decoupled' from deterministic associations with either sedentism or agriculture (Barnett & Hoopes 1995:2). Indeed on the contrary, at Knossos, as at other sites in Greece and the Aegean, the transition from an aceramic to a ceramic Neolithic, apart from the appearance of ceramics, is generally considered to be otherwise without great social, material or ecological change (Evans 1970a; Theocharis 1973:35; Demoule & Perlès 1993:369; *contra* Weinberg 1970:571-2).

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<sup>6</sup> This phase also produced a few sherds of pottery, however it is not clear whether this pottery represents the first limited use of ceramic vessels or is simply intrusive from later EN levels (Perlès 1999a:317; Vitelli 1993:39).

### 2.2.2 Dating the Earliest Pottery

In Anatolia ceramic containers and ceramic technology first appear at approximately the same date at a large number of sites (Schmandt-Besserat 1977:149; Moore 1995:40-4)<sup>7</sup>. Thus the earliest ceramic layers at Çatal Höyük (level XII), Çayönü (phase II) and Mersin all have radiocarbon dates in the range of 8300-8000BP (c.7400-6900BC)<sup>8</sup> (Moore 1995:40-2). These dates also compare closely with those from early ceramic sites in the northern Levant and along the Fertile Crescent (c.8300-8000BP) (Moore 1995:42-4).

In Greece and the Aegean, the earliest pottery appears sometime after this period: the earliest ceramic levels at sites in northern and southern Greece (Franchthi) and Crete (Knossos) have all been dated to around the middle of the seventh millennium BC. Thus, contrary to the claims of Moore (1995:44) that "the earliest pottery found at Knossos in Crete, at sites on the Greek mainland, and farther west... all dates around the same time [as the earliest pottery in Anatolia] or a little later", there is, in the current state of knowledge, a fairly considerable time lag of c.500-800 years between the adoption of pottery in south/south-east Anatolia and the Near East on the one hand, and in mainland Greece, Crete and the Aegean on the other.

It may ultimately prove significant that the earliest ceramic material from the Aegean coast of Anatolia and from most areas of south-west Anatolia dates only to the Anatolian LN, i.e. to no earlier than c.6500BC (see Appendix IV). Earlier EN material is known from only three sites, Kuruçay, Hacilar and Belbasi. The Belbasi ceramic assemblage, although almost certainly the earliest, is tiny and occurs in conjunction with an otherwise Mesolithic toolkit; such circumstances suggest the presence of imported vessels rather than the presence of ceramic technology. The EN material from Kuruçay is unlike that from Belbasi but closely

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<sup>7</sup> NB Schmandt-Besserat *inter alii* dates the Beldibi B pottery to late Palaeolithic or Mesolithic (c.8500-8000BC); however this early date is not supported by radiocarbon dating, but is based on dating of associated 'Mesolithic' lithic assemblages. As demonstrated by the new finds from the Cyclops Cave on Yioura (Sampson 1999), a Mesolithic lithic assemblage, closely comparable to that from Beldibi, was still in use up to c.6500BC. Furthermore, good parallels between the Beldibi B ceramics and Çatal Höyük XII (dated c.7000BC) have been noted (see Appendix IV; Yakar 1991:123). A pre-7000BC date for the Beldibi B ceramics is not accepted by Moore (1995), who does not include it in his survey of early Anatolian pottery.

resembles pottery recently excavated at Hacilar (Duru 1994; see Appendix IV). Absolute dates are only available from Kuruçay, but these indicate a date for this earliest material towards the very end of the Anatolian EN, close to the middle of the seventh millennium (see Appendix IV).

Thus the earliest date for the presence of ceramic technology in the south-west, even including this early material, seems to correspond with the earliest dates from Greece and Crete. If correct, this would mean that ceramics first appear at around the same time on both sides of the Aegean and that the time lag is rather between west/south-west Anatolia and further east. Ultimately, however, the significance of any correspondence between these dates can only be expressed cautiously, since a complete Aceramic to LN sequence, either from south-west or west-central Anatolia, has not yet been isolated and subjected to radiocarbon dating: ultimately there may prove to be earlier EN ceramics at Hacilar, Kuruçay or elsewhere. At present the Belbasi assemblage appears to be an isolated occurrence, but future discoveries could change this. In addition, almost all Neolithic material from south-west Anatolia comes from surface survey and thus at such sites it is impossible to be certain, in the absence of stratigraphical excavations, whether earlier ceramics exist buried beneath later Neolithic deposits.

### 2.2.3 *A Previously 'Developed' Technology?*

A striking feature of the first pottery to appear in south-west Anatolia, Greece and the Aegean, noted independently in a number of regional studies, is its 'developed form'. Thus the early pottery from the Beldibi Cave, level B (south-west Anatolia) is described as a "conspicuously evolved pottery, which does not give the impression of the beginning of a craft" (Schmandt-Besserat 1977:133). A similar judgement was passed upon the earliest pottery excavated by Duru at Kuruçay (level 13) and also at Hacilar (impressed into red plastered floors which would otherwise be dated to the Aceramic) (Duru 1994:103; see Appendix IV). The earliest (EN) pottery from Elateia (Central Greece) was considered by

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<sup>8</sup> Approximate calibrated range given by the OxCal 3 calibration programme.

Weinberg (1962:167-8) to be an 'already well-developed technology' which had been brought to the site by its first settlers. The same author characterised the earliest pottery in Greece in general as "in a tradition already long-established" (Weinberg 1970:583). Similarly, the two excavators of Neolithic Knossos, Sir Arthur Evans and John Evans, have both emphasised how the very earliest pottery at the site "bears all the marks of being the product of a fully developed tradition of potting" likely to have been introduced from elsewhere (Evans 1964:196; 1968:271; cf. A. Evans 1921:35).

It should be noted, however, that the criteria whereby each of these scholars defines 'developed' are rarely ever stated explicitly. Most seem to agree on the presence of a wide range of different forms and finishes (cf. Evans 1964:196; 1968:271; Moore 1995:40). However, it still remains possible that different individuals will view the same assemblages in different ways. Thus for the same Thessalian data it has been variously argued that the earliest pottery is developed and introduced from elsewhere (Bloedow) and that it testifies to the progressive development of a local tradition (Theocharis) (see Demoule & Perlès 1993:368). Indeed to find a region where the earliest pottery appears to be sufficiently simple to be called 'experimental' one must look at least as far east as Çatal Höyük, where the earliest pottery is "of the simplest kind", namely deep bowls and hole-mouth jars with burnished surfaces, and Cayonu, where the pottery is "simple and quite rough", with not all vessels burnished (Moore 1995:40). It should, however, be noted that Mellaart himself considered the pottery at Çatal Höyük to be a 'developed' tradition from the start (Duru 1994:103). Thus it would seem that in many cases evolutionary judgements of ceramic development reveal more about the attitude of the particular scholar concerned than about the real nature of the technology involved.

At many of the Aegean sites, tiny amounts of pottery actually first appear at the top of otherwise aceramic strata (cf. also Kuruçay and Hacilar early pottery). Thus the top of the 'aceramic' strata at each of the Thessalian aceramic sites contained a few small potsherds (Demoule & Perlès 1993:368). At Franchthi, very small quantities of pottery first appear in the grey clay 'Aceramic'

stratum, although it remains a possibility that these may be intrusive (Vitelli 1993a:39). At Knossos the earliest pottery almost certainly appears at the very top of the Aceramic stratum (see Appendix I: sounding AC (stratum X), sounding X). Thus at all these sites 'developed' pottery first appears in 'aceramic' deposits unaccompanied by other obvious material changes in a manner which otherwise suggests continuity.

## 2.2.4 Models for the Origins of Early Ceramics in Anatolia, Greece and the Aegean

### 2.2.4.1 Diffusion

The oldest and most popular model for the origin of ceramic technology in Anatolia, Greece and the Aegean considers pottery to have been first 'invented' in the Near East and then to have spread, as a fully developed technology (see above), through Anatolia to Greece and the Aegean. Thus Weinberg describes "the arrival of Neolithic potters in Greece" as "sudden and widespread" and considers the Greek ceramic Neolithic (EN) to have been an 'import' and the earliest ceramics to have been produced "in a tradition long established" by "experienced potters" (Weinberg 1965:286-7, 1970:571-2, 585). Likewise, the earliest pottery at Knossos is considered to have been developed elsewhere (see above), the implicit model being that it spread by diffusion. The diffusion theory for the origins of pottery production parallels that posited for the introduction of farming and constitutes a second wave of 'influence' after the initial introduction of the Aceramic Neolithic (Vitelli 1993a:39).

In support of the diffusion hypothesis Weinberg points to the remarkable similarity (*koine*) between the earliest pottery (Greek EN) of Thessaly and Peloponnese (1970:584 cf. 1965:287, 290): "Almost everywhere the earliest shapes are hemispherical bowls and globular, collared jars; small pierced lugs, set either horizontally or vertically, are the only form of handle. Flat bases or ring bases, varying from low to high; slightly everted lips, often separated by a groove; the beginnings of a carination at the belly; hole-mouthed jars - all these begin early, if in fact they are not present in the original repertory". Although this

large *koine* disappears by the end of EN, large regional style zones continue to be a feature of EN and MN Greece (cf. Cullen 1985; Vitelli 1993b:250; Wijnen 1993:324).

Moving to the opposite side of the Aegean it is striking that at around the same time (see Appendix I) the earliest Anatolian (LN) pottery from south-west and west-central Anatolia (Hacilar-type) exhibits a similarly widespread homogeneity (Mellaart 1970a:146; Eslick 1992:81-2; see Appendix IV), which likewise did not continue into the next ceramic phase (Early Chalcolithic). These similarities are not shared with pottery from north-west Anatolia (Illipinar-type) (Wijnen 1993:325-6). An interesting and surprisingly an ignored feature of this pottery is the high number of similarities in form and finish which it shares with the earliest Greek EN ceramics (see Appendix IV): here one might consider the prominent presence of hemispherical bowls, collared jars, hole-mouth jars, slightly everted rims, flat bases, ring bases, pierced lugs.

#### 2.2.4.2 *Independent Local Invention*

An early case for an independent local invention of ceramic technology was made by Theocharis, who argued that crude ceramic vessels in Aceramic levels at Sesklo were the "direct and immediate antecedent" of ENI pottery at the site (Theocharis 1963; Weinberg 1970:571). For Knossos, Broodbank has similarly argued that the earliest pottery may have developed from unfired clay containers in use in the Aceramic (Broodbank 1992:49), although there is as yet no evidence for the existence of such Aceramic clay containers. Vitelli has argued for the possibility of a local invention of pottery at Franchthi by women (Vitelli 1993a:xx, 39, 1995:60-1): women as cultivators, gatherers and processors of plant foods and medicines "had expert knowledge about kinds and locations of soils, including clays; had frequent occasion to experience the properties of clay, especially its plasticity; and no doubt often witnessed and brought about the accidental transformation of clay by fire".

Recently Moore, in his review of early ceramic production in Western Asia, has argued that the development of ceramic technology was an 'indigenous



phenomenon', which occurred simultaneously across a wide area, as a response to a common set of needs, in particular "the need to store and prepare the foods obtained from farming and herding in new more effective containers and to prepare them in more varied and palatable ways, that were less damaging to people's health and teeth" (Moore 1995:48). This combination of the cooking and economic optimisation hypotheses is subject to the same criticisms as already outlined above. Furthermore, Moore fails to reconcile the clear evidence for exchange (including ceramics) between sites in Anatolia and the Near East as well as the clear existence of widespread regional similarities in form and finish, with his notion of simultaneous independent invention (see below). Problematic also is the degree to which he seeks to generalise about what was likely to have been a complex process.

#### *2.2.4.3 Diffusion and Local Adoption/Modification?*

Although simple immigration hypotheses, such as Weinberg's original formulation of a second arrival of Neolithic settlers, have been subject to detailed critique (cf. Whittle 1996:39-44; Halstead 1996:299-301), the correspondences in chronology, form, finish and range of distribution, which can now be noted between the earliest pottery on either side of the Aegean provide strong support for the hypothesis that trans-Aegean interaction and movement played a significant part in the development of early ceramic technology in Greece and the Aegean. That said, however, more recent studies of the earliest Greek pottery, while acknowledging the strong similarities between pottery from different sites, have stressed that the subtle local differences between sites, mainly in the area of decoration, should not be overlooked (e.g. Wijnen 1993:324; see Chapter 7). Thus the similarities between contemporary Greek (EN) and west-central/south-west Anatolian (LN) ceramics should be understood in conjunction with the existence of clear local and regional differences: for example although pierced lugs feature on both sides of the Aegean, the earliest on the Anatolian coast tend to be mainly tubular and vertical, while in Greece the earliest lugs tend to be oval (see Section 7.6.3; Appendix IV). In this way it is perhaps more accurate to

model the complex process of technological transfer in terms of diffusion with local adoption or modification also playing a significant part.

## **2.3 Early Ceramic Production, Consumption and Exchange in Anatolia, Greece and the Aegean**

### *2.3.1 Conflicting Views on Ceramic Production and Exchange*

Closely related to questions of diffusion and/or local adoption/invention is the issue of whether or to what degree pots and/or potters might have moved between settlements. This is an area of considerable confusion with hypotheses ranging from the total local production of 'utilitarian' ceramics, apparently considered unsuitable items for exchange, to the movement of ceramics between sites as prestige items within existing exchange networks. Some studies, which emphasise total local production/non-exchange (TLP/NE), have sought to explain the existence of large EN and MN regional style zones in terms of the movement or interaction of potters, within a framework which emphasises either transhumance<sup>9</sup> (Jacobsen 1984) or exogamy (Cullen 1985:95-6). The latter relies on the earliest potters being female and envisages the widespread exchange of female marriage partners between communities. Many more ceramic studies have not even attempted to explain away the contradiction between total local production on the one hand and large regional style zones on the other, but have simply stressed local origins (e.g. Furness 1953; Evans 1964; Vitelli 1993a; Yiouni 1995, 1996a; Jones 1986; Björk 1995). By and large these studies are detailed analyses, whether stylistic, elemental or mineralogical, of individual Neolithic ceramic assemblages.

In contrast, those studies which emphasise the movement of the pots themselves tend to be in the form of more general syntheses. For example Gallis, in a general review of 'The Neolithic World', has argued that "pottery implies the existence of an extensive network of exchange and communication already in the EN", while for MN pottery he has suggested that "it... travelled over considerable

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<sup>9</sup> This hypothesis is highly problematic: there is no hard evidence to support the existence of this form of subsistence in the Greek EN or MN, nor does it seem likely that demographic and economic conditions favoured its emergence at this time (Halstead 1996:301-4).

distances not merely as containers... but as objects with intrinsic value of their own" (Gallis 1996:34). Likewise Perlès, in her study of Neolithic production and exchange in Greece, has suggested a small-scale circulation of non-utilitarian ceramic vessels (1992:149). Demoule and Perlès, in their review of the Greek Neolithic, conclude that although ceramic production was mostly local, there was some restricted circulation of pots (Demoule & Perlès 1993:382, 384). Andreou, Fotiadis and Kotsakis, in their review of the Neolithic of northern Greece, similarly envisage a circulation of specific classes of pottery with production of ceramics in special centres (Andreou et al. 1996:559).

It is significant that these more general syntheses seem to base their discussion of ceramics on data from Thessaly (e.g. Demoule & Perlès 1993; Andreou et al. 1996), where in general detailed stylistic and analytical studies have been more favourable to the movement of ceramics (cf. Schneider et al. 1991a, 1991b)<sup>10</sup>. Thus these syntheses opt for simplicity when they choose to ignore the majority of ceramic studies, which stress TLP/NE. Those general studies, which attempt to be more honest, ultimately suffer from an inability to identify or resolve the contradictions. Thus Moore, in his review of early ceramic technology in Western Asia, first reports that "most of the pottery recovered seems to have been made at the site where it was found, from local clays" (Moore 1995:46). But then later (1995:47), and in contradiction of his earlier statement, he notes that the work of Le Mière and Picon (1987) has demonstrated that "a proportion of the pottery made on sites across the northern Levant and northern Mesopotamia was exchanged". Apparently this movement was restricted to fine wares and most vessels were exchanged between neighbouring sites, "although a few pots were brought in from regions as much as 400km away" (Moore 1995:47). Furthermore, this exchange of ceramics seems to have begun with the production of the first ceramics and to have persisted from then on (Moore 1995:47). To this evidence from areas to the east of the Aegean, one might also consider similar conclusions regarding early ceramics

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<sup>10</sup> However even in Thessaly detailed studies of site assemblages exist which emphasise total or near total local production (see Björk 1995).

from the West Mediterranean, which indicate the long-distance circulation of certain types of early ceramic vessel (cardial) which may have had high social value (see Barnett 1991, 1995).

This contradiction between the majority of analyses which emphasise (but it should be said do not prove) total or near total local production and a very small minority which stress exchange cannot simply be ignored but must be given serious consideration. Could this be a reflection of real regional differences in the production, circulation and consumption of early pottery or does the problem lie somewhere in our own handling and/or interpretation of the data? The problem of interpretation will be a central theme of this thesis and over the next chapters an attempt will be made to understand why such opposing interpretations have been generated (see especially Chapters 5, 10). In anticipation of conclusions to be drawn in future chapters, it can be noted here that the general reluctance in studies of Neolithic ceramics to identify imports or investigate the circulation of ceramic vessels results from two key areas of difficulty, the first methodological, the second theoretical.

This first area of difficulty is very basic. How does one identify and characterise local and non-local vessels within Neolithic ceramic assemblages with sufficient clarity to allow the circulation of pottery to be studied? Most studies of early pottery have been based purely on stylistic analysis (form and finish) (e.g. Wace & Thompson 1912; Kunze 1931; Weinberg 1937; Kosmopoulou 1948; Furness 1953; Weinberg 1962; Evans 1964; Blegen 1975; Phelps 1975; Lavezzi 1978; Renard 1989; Pantelidou Gophas 1995). While such studies have been able to identify the existence of large, regional style zones and have led to the construction of relative regional chronologies, generally they have been unable to identify the circulation of pottery with any sort of certainty. Thus the studies of Furness and Evans both concluded that the entire EN assemblage at Knossos was stylistically homogenous and entirely locally produced (Furness 1953:95, 103, n.16; Evans 1964:194, 1973:133), an interpretation which has encouraged the view, now widespread, that Knossos and Crete remained isolated until the very end of the Neolithic (see Chapter 12 for discussion of the isolation

hypothesis). Even the detailed regional study of southern Greek Neolithic pottery by Phelps (1975) noted only a handful of possible imports at Franchthi, Elateia, Nemea, Chaironeia and Nea Makri, prompting his conclusion that "similarities of wares or traits significant enough to suggest actual imports from one place to another are not common" (Phelps 1986:371; cf. also Wace & Thompson 1912:241). Part of the problem must be the difficulty, within large regional zones of stylistic homogeneity, of recognising imports with any clarity on the basis of form and finish: as Vitelli has acknowledged, "the quantity of pottery that was exchanged within the region [Peloponnese] may have been more extensive in the earlier Neolithic than we have recognised" (cf. Vitelli 1993b:250).

Clearly form and finish on their own may not be the best criteria to investigate the potential circulation of ceramics. More recent studies, which have included macroscopic and microscopic observations of fabric (e.g. Jones 1986; Vitelli 1989, 1993a; Yiouni 1995, 1996a; Björk 1995), have in fact identified considerable variability in the fabrics present within individual site assemblages from all areas of Greece. Thus Vitelli identifies "considerably more variability within the assemblages [Franchthi, Lerna] than has usually been acknowledged" and notes the presence of "five wares defined by the raw materials" (1989:17-18). These 'wares' - or rather fabrics<sup>11</sup> - are consistently present at Franchthi in differing proportions: usually one is dominant with several more present in very small quantities. This pattern is repeated at Lerna to such an extent that even the minor fabrics are the same as the minor fabrics at Franchthi (Vitelli 1989:19-20). Vitelli also notes subtle differences in construction between vessels produced in the different fabrics at Franchthi (Vitelli 1989:21).

Vitelli argues that at both sites site "at any given time within the earlier Neolithic, the potters were making three to five different wares [i.e. fabrics]. They chose most frequently to use one (the dominant) clay body, but occasionally

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<sup>11</sup> Although originally within the type-variety system of classification the concept of ware stood for both surface treatment and paste/fabric, this definition proved problematic not least because fabric and finish refer to different stages in the production process and their combination under a single term leads to confusion. In reality the same finishing method may occur in several different fabrics, or a single fabric may be finished in a variety of ways. As a result it was

chose others with ingredients from different locations and with different working properties" (Vitelli 1989:19).

However, this conclusion is by no means a necessary consequence of the data. It should be noted that the small quantities, in which these fabrics are present, could equally favour exchange; indeed some of these less frequent fabrics are actually hard to reconcile with a local provenance (e.g. 'andesite ware'). Furthermore, the existence of differences in forming and finishing between the different fabric groups indicates the maintenance of traditions of production for each fabric, which must to some extent be considered separate, and which could therefore indicate a more distant production location than simply a neighbouring household.

When one reads through other analyses of Greek Neolithic ceramics, one frequently encounters similar statements: for example,

"there was considerable diversity in the materials used by the (local) potters whose products found their way to the [Kitsos] cave" (Jones 1986:386).

or

"Petrographic analysis has shown that a variety of fabrics were used by the Makri potters" (Yiouni 1995:619);

or

"New classes of pottery now [MN] introduced [at Nea Makri] seem to have required different types of clay. The areas which had provided the clear, gritless or micaceous clay are now abandoned and potters turn to deposits providing clay of limestone composition" (Pantelidou Gophas 1995:304).

or

"The variations in the early pottery within each [Anatolian] settlement suggest that potting was done by a number of people who probably resided in separate households" (Moore 1995:46).

When taken together these statements suggest that diversity in fabric is a feature which unites all Aegean Neolithic ceramic assemblages, which have so far been studied in this way, whether northern (e.g. Makri) or southern (e.g. Franchthi), early (e.g. Nea Nikomedea) or late (e.g. Kitsos). However, they also indicate that this variation is almost always interpreted in terms of local production. Since both Vitelli and Yiouni have suggested that this pattern might prevail at all other Neolithic sites (Vitelli 1989:20; Yiouni 1995:619), the assemblage at Knossos

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proposed that ware and fabric should be separated, with the meaning of ware restricted solely to

provides an opportunity to test both of these conclusions (see Chapters 10-11). Thus one of the main questions which this thesis will seek to address is whether the EN assemblage at Knossos, contrary to the previous observations of Furness and Evans, also exhibits this pattern of fabric diversity, with some fabrics present in large quantities, others in small amounts. In addition petrographic study of the Knossos assemblage provides the opportunity to test whether all fabrics present could really have been produced simultaneously at the site at which they were found (cf. Vitelli 1989:20; Yiouni 1995:619) or whether other interpretations, such as exchange, are possible.

The specifics of interpretation aside, there is a clear problem in the way previous studies of Greek Neolithic ceramics have failed to problematise the issue of fabric diversity. Methodological difficulties clearly play their part in this. General syntheses realise the importance of exchange, both in the theoretical model they follow (see Sections 4.2-3 on the DMP) and in conclusions drawn from the study of the circulation of other types of artefact (e.g. obsidian), and are thus more confident in their conclusions regarding the movement of ceramics. However, when faced with specific ceramic assemblages clearly archaeologists still struggle to define this predicted movement in terms of actual specific sherds or vessels. Chapter 5 will investigate the problems associated with characterisation of Neolithic ceramic assemblages as well as the difficulties involved in combining different types of ceramic data: here there are not only problems associated with relating macroscopic, microscopic and elemental data, but also potential difficulties involved in how one combines data based on form, finish and fabric.

However, the roots of the reluctance to tackle the issue of the circulation or non-circulation of ceramic vessels must go beyond simple problems of methodology. Methodological difficulties do not explain the enthusiasm with which studies seek to explain away all forms of variation, whether in form, finish or fabric, in terms of total or near total local production. Often anything that doesn't easily fit the 'local', usually the most common groups, is explained away

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surface treatment (Rice 1976).

as anomalous and ignored, often because it is assumed to be a product of the failure to appreciate the true diversity in local clay sources (cf. Vitelli 1993a:208). The possibility that some fabrics or some anomalies could result from the exchange of pottery between different producing communities is not always acknowledged, let alone discussed. This reluctance to consider other explanations suggests the existence of a conceptual barrier preventing further exploration of the significance of ceramic variation in all its forms<sup>12</sup>.

To some extent this impasse may result from the survival of some rather old ideas about the Neolithic economy; in particular the old notion that Neolithic farming communities were largely self-sufficient entities, who produced all that they required and whose main focus was the production of subsistence (and surplus) for survival<sup>13</sup>. For example, although Childe recognised the existence of exchange in Neolithic societies, he described the Neolithic economy as almost entirely self-sufficing:

"The simplest food-producing community is not dependant for any necessity of life on imports obtained by barter or exchange from another group. It produces and collects all the food it needs. It relies on raw materials available in its immediate vicinity for the simplest equipment it demands" (Childe 1981:78-9, reprint of 1956 edition).

As recently as 1970, Weinberg in a review of the Neolithic in the Aegean, although noting the presence at Greek sites of Melian obsidian as evidence for

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<sup>12</sup> Day has suggested that there is a general tendency in studies of Neolithic Aegean ceramics to interpret scientific data in terms of what might be acceptable rather than what it might actually imply (1995a:1). One might also compare here the analogous reaction of American archaeologists in the 1930s to the conclusions of Anna Shepard's first petrographic study of Pecos pottery: her discovery that most of the pottery could not have been made locally undermined not only the prevailing interpretative models of the time, but also the paradigmatic validity of the direct historical approach and even challenged prejudice surrounding the capabilities of modern Pueblo people (Cordell 1991:135-139; 144-5). While several notable scholars accepted her findings, there was a general tendency to try to minimise, explain away or simply ignore the impact of her findings, with some even talking of 'archaeological heresy' (Cordell 1991:140-2).

<sup>13</sup> This rather 'pessimistic' view of the possibilities of existence in 'Stone Age' societies has been extensively critiqued (see Sahlins 1974:1-39). Such pessimism largely arises from the emphasis placed in modern economics on economic means (especially scarcity) and the accumulation of capital: since hunter-gatherers are materially poor and must invest more energy in subsisting, they tend to be viewed as economically inefficient and thus poor. However, when judged not by modern criteria but by their own, hunter-gatherers may be viewed, both in the way that their material wants are finite and few and in the way that their technical means are unchanging and generally adequate, as the 'original affluent societies'. In this way some otherwise curious forms of economic behaviour common amongst hunter-gatherers, such as long amounts of leisure time



"sea-borne commerce" stressed that "agriculture and the raising of domesticated animals was the real basis of their economy" (Weinberg 1970:587). More recent studies, however, have stressed how the simple self-sufficiency hypothesis fails to take account of the ample evidence for exchange and craft production (cf. Renfrew 1973:179). Indeed Gallis has recently argued that "apart from the agricultural and stock-raising economy, basic to the Neolithic way of life, systems for the exchange and distribution of goods (trade) over long distances is [sic] attested right from the EN" (Gallis 1996:34-5).

In such statements one can see how the emphasis in our understanding of the Neolithic economy has shifted from a focus on production, mainly of subsistence, purely for local consumption to an awareness of the important role played by exchange. In this way the reluctance to problematise the issue of ceramic exchange suggests a general failure amongst ceramic specialists to be clear about what it is they mean when they refer to the Domestic Mode of Production (DMP) in the context of the Neolithic Aegean. For example, Vitelli, when she states that one should "consider the simplest model of production for the earliest years of pottery-making, that is, *essentially household production for household consumption*" (Vitelli 1993a:208, my italics), seems to view production very much in terms of the old self-sufficiency premise. The persistence of old-fashioned ideas regarding the workings of the 'Neolithic economy' is well illustrated by the notable absence of any reference to Sahlins' *Stone Age Economics* (1974) in the bibliographies of articles, which deal with Aegean Neolithic production, consumption and exchange (e.g. Perlès 1992; Demoule & Perlès 1993; Vitelli 1993a). Indeed the most notable exception to this is the work of Halstead, who has pioneered the application of Sahlins' initial formulation of the 'Stone Age' economy to the Aegean (e.g. Halstead 1995).

### 2.3.2 *The Organisation of Early Ceramic Production in Greece, Crete and Anatolia: Early Ceramic Specialists?*

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or an inclination to consume all food at once, may be understood as expressions of a more *optimistic* attitude towards resource availability.

Studies which touch upon the organisation of early ceramic production in Greece or Anatolia tend to focus upon the contribution of individuals, almost always women. In many cases early production has been labelled as specialised and/or early potters have been considered specialists. For example Renfrew has stated that "even the simplest Neolithic village economy favoured the existence of casual and part-time specialists" (Renfrew 1972:340, cf. 1973:217; cf. similar remarks of Gallis 1996:34). Likewise for Anatolia Moore has argued that "potting was done by a number of people who probably resided in separate households. These potters possessed particular knowledge and skills and so may be regarded as specialist craftsmen, like other skilled artisans in the same community" (Moore 1995:46).

Vitelli has argued in more detail that even EN ceramic production was in the hands of individual female specialists, who were also healers or diviners (shamans), who nevertheless produced within individual households (cf. Vitelli 1995; Perlès & Vitelli 1999:102). Vitelli arrives at this conclusion through an argument which takes account of the transformative associations of fire, the potentially high symbolic value of early ceramic vessels and a perceived overproduction of pots at Franchthi (Vitelli 1993a:210; Perlès & Vitelli 1999:102). Since the total number of pots consumed at Franchthi in any single year is estimated as extremely low (c.12-13 pots/year) and since these vessels are considered to be the total output of five different local producing groups, the total output from each producing group must have been even lower, that is well within the capability of a single potter. This suggests a somewhat paradoxical<sup>14</sup> situation, where local demand for pots was very low but nevertheless sufficient to support the consistent maintenance of five different producing groups/potters. Unfortunately further archaeological evidence in support of this hypothesis is lacking. Vitelli has also argued for specialisation in the context of MN 'Urf ware'; the shapes of which are said to be "sharply angular, with frequent contour changes, and added bases or high pedestals" and are thus considered "high-risk shapes, elegant and showy, difficult to build and even more difficult to fire

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<sup>14</sup> Equally surprising, is the absence of any further exploration or critique of this paradox.

successfully in the potter's initial fire" (Vitelli 1993a:215-6). In this way Vitelli argues that the producers of MN 'Urf ware' were highly skilled potters, who sought to compete with each other through innovation, experimentation and risk-taking. In contrast for LN, Vitelli has argued that production moved from the hands of specialists to non-specialists (Vitelli 1993b:252). This hypothesis of LN non-specialisation has been recently criticised and rejected by Kalogirou, who argues that LN and FN pots required as much skill and labour investment as EN-MN vessels (Kalogirou 1997).

Unfortunately, this sort of argumentation is disputable and cannot be considered to be a reasonable basis upon which to make an identification of specialisation. As has recently been emphasised regarding the general pursuit of craft specialisation in the context of the prehistoric Aegean: "we need to move beyond simple inferences that because processes are complex or products are finely produced, ceramic production was specialised. Both of these types of assessment are extremely difficult to justify, especially in the absence of detailed comparative ethnographic and experimental models. The dichotomisation of specialisation as against household production also over-simplifies a complex range of different production patterns and contexts." (Whitelaw et al. 1997:266). In this way previous identifications of Neolithic ceramic production organisation as specialised must be considered problematic. Many appear to make unwarranted assumptions regarding the basic ability of the 'average Neolithic potter'; all fail to justify their identifications through the use of 'detailed comparative ethnographic and experimental models', such as the DMP. In this context it is worth noting that Perlès has recently expressed doubts that the "EN production of pots can be classified as craft specialization within the traditional economic definitions" (Perlès & Vitelli 1999:101).

Thus in later chapters this thesis will attempt to explore ways in which specialisation and production organisation can be studied, both in theory and practice, before the employment of a comparative framework within which certain features of ceramic production might be situated (see Chapters 3-5). As a preliminary to this, however, it may be remarked that the idea of EN individual or

household specialists appears to stand in direct contradiction of any ideal of communality and communal sharing, not only because they give individuals or households particular economic and social power, but also because it is hard to see how an emphasis on the individual could be accommodated within an ideology of the collective (see Section 4.4). In addition specialisation could be argued to represent a form of economic intensification which is out of place with evidence for the organisation of subsistence or craft production (cf. shell bead production at Franchthi discussed in Chapter 4). Some of these apparent contradictions will be explored further in Chapter 11. Early craft specialisation has been identified for other artefacts/materials and it has even been suggested that different forms of organisation accompanied the production of different artefacts in different materials (see Perlès 1992). The apparent contradiction between this conclusion and Sahlins' comment that competition (social, political) in early societies was played out not in production but in consumption and exchange will also be explored. Finally, since some scholars have identified craft specialisation in Palaeolithic societies and have even claimed that "specialists' have always existed" (Perlès & Vitelli 1999:96), Chapter 11 will also try to understand what is actually so special about specialisation.

### *2.3.3 The Function of Early Ceramic Containers in Greece, Crete and Anatolia*

#### *2.3.3.1 Cooking*

Vitelli has argued convincingly that ceramic vessels could not have been used for cooking until late in MN (see Vitelli 1989:22-4, 1993a:213-5). The exteriors of earlier EN and MN vessels show no sign of having been in contact with direct sources of heat. Interestingly some sherds from these earlier deposits have sooty deposits on their interiors, which may indicate the use of some form of indirect heating. However, some caution should be maintained since sometimes these soot marks extend over the breaks, i.e. the sherds burnt after breakage, which admits the possible involvement of post depositional processes. A similar situation seems to prevail at EN Nea Nikomedeia and MN Makri. Yiouni notes that although research on cooking pots suggests the benefit of using

inclusions with a low coefficient of thermal expansion, such as feldspars, and although there are fabrics at both sites which appear well-suited for the manufacture of cooking vessels, there nevertheless appears to be little or no conclusive evidence to suggest that vessels produced at either site ever had any direct contact with fire (Yiouni 1995:620, 1996b:190).

Vitelli explains this failure to use pots for cooking as evidence for the persistence of pre-ceramic or Mesolithic methods of cooking, which presumably made use of other containers such as skins, wood, basketry or perhaps relied on pit cooking (Vitelli 1993:215). In this context it is perhaps worth noting the discovery in Aceramic levels at Argissa (Thessaly) of "large quantities of river pebbles which had been subjected to repeated heat and are believed to have been heating stones used in cooking" (Weinberg 1970:568). Weinberg also notes that there was no evidence from the site for the use of stone cooking vessels and thus the vessels used for cooking must have been in some sort of perishable material.

In contrast, Moore has argued that in Anatolia early ceramics performed a range of functions, one of which was cooking (Moore 1995:47), in support of which he mentions hole mouth jars with traces of soot on their exteriors. For Crete Furness has argued that the shapes of large coarse vessels at all times appear more suitable for storage than cooking (see Evans 1964:196).

### 2.3.3.2 *Storage*

The storage hypothesis is a popular one, largely because household storage within an agricultural economy is generally considered crucial to the maintenance of livelihood (cf. Halstead 1989:71). Thus for Anatolia Moore argues that early coarse wares may have been used to store foodstuffs, while some would have been technically capable of holding water (Moore 1995:47). Likewise at MN Makri, storage is considered to be one of several likely functions for early ceramic vessels (Yiouni 1995:620).

However, Vitelli has demonstrated that there are serious problems with the storage hypothesis as it stands (see Vitelli 1989:26-7). By combining an estimation of the total amount of grain required to sow one hectare, with the

range in volume of EN vessels from Franchthi, Vitelli calculated that 30-65 bowls would be required at a time when she estimates that annual consumption for the whole site was 12-13. Also significant is her conclusion that there were no truly large vessels at Franchthi during EN-MN (Vitelli 1989:27). Thus while storage remains a possible function of ceramic vessels, it cannot have been their primary function (see Section 4.4.1). Vitelli's conclusions are echoed by Yiouni, who in a separate calculation for EN Nea Nikomedeia, concluded that "the storage capacity of the Nea Nikomedeia pots was not enough for the annual crop production" and that "containers made from perishable materials and/or storage pits were also used" (Yiouni 1996b:192). The first dedicated ceramic storage jars gradually come into use during the course of the Greek LN (Cullen & Keller 1990; Perlès 1992:144).

### 2.3.3.3 *Display/Serving*

This is the most favoured interpretation of how earlier Neolithic ceramic vessels were consumed. For Anatolia, Moore has argued that much of the earliest pottery consists of fine 'tableware' (Moore 1995:47). For Greece Halstead has argued that the investment of time and skill in the production of fine tableware<sup>15</sup> emphasises the importance and formality of acts of commensality (Halstead 1999:80). Vitelli too suggests that the majority of vessels would have been appropriate as serving vessels on public occasions or ceremonies of social negotiation, which involved feasting (1993a:215-6): relative paucity of closed shapes and of cups or goblets, which prompts her to speculate that liquids may have been served in non-ceramic containers. In addition some shapes, such as Greek MN pedestalled bowls seem to have been designed specifically to display their contents (Vitelli 1993a:215-6). Vitelli has even gone so far as to suggest that different ceremonies called for different pots made from different ingredients with different surface appearance (and different makers), however there is no

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<sup>15</sup> As noted by Sherratt (1991), the presence of flat bases on many early vessels implies the existence of flat surfaces - literally tables - upon which they could stand.

evidence to suggest that modern archaeological fabric divisions correlate with different patterns of ancient consumption.

In general accounts of consumption tend to emphasise that early pottery performed a variety of functions (cf. Moore 1995:47; Yiouni 1995:620; 1996b:185). Certainly early ceramic vessels could potentially have been used for a wide range of tasks involving serving, storage and perhaps occasionally cooking (indirect heating). However of these three, storage and cooking seem to be under-represented and may constitute secondary or rarer uses than serving/display. Many large EN-MN vessels appear to have large diameters but are not particularly deep (unlike a Bronze Age pithos), a design which seems to facilitate shared access to the contents of the vessel; other smaller bowl, mug and cup types would work well as the eating/drinking shapes of individuals.

#### *2.3.4 Changing Levels of Consumption and the Value of Early Ceramic Vessels*

Two recent attempts to estimate the level at which the earliest ceramic vessels were consumed have both concluded that in the earliest phase of ceramic use in Greece relatively few ceramic vessels were in circulation at any one time. Thus for EN Franchthi Vitelli has estimated that 12-13 pots per year were consumed over the entire site, while for EN Nea Nikomedeia Yiouni has produced a higher estimate of 25-90 pots per year over the excavated area (Vitelli 1989:26; Yiouni 1996b:181-5). By combining this with the evidence for high labour investment in production Vitelli has argued that even these small quantities of pottery levels were probably valued, possibly because "their scarcity, novelty, and perhaps function might well have made them precious" (Vitelli 1993a:39).

This hypothesis seems plausible, although one might note in passing that it is hard to reconcile the idea that early vessels were highly valued with an insistence that they were nevertheless not exchanged between communities (cf. Vitelli 1989). It is equally hard to reconcile Moore's conclusion that it was the 'functional potential' of early pottery in Anatolia which contributed to its early development (Moore 1995:48) with his earlier suggestion that fine wares were

exchanged between sites because of their desirability (Moore 1995:47). Moore goes on to draw an explicit contrast "between the essentially practical role that early pottery served in Western Asia and the symbolic and social importance that Vitelli has ascribed to the earliest pots at Franchthi Cave in Greece." (Moore 1995:48). Although regional differences in consumption seem more than likely, the contrast here seems rather to be between different archaeological interpretations<sup>16</sup>: Moore describes the earliest Anatolian contexts of ceramic-use as containing 'few potsherds' (Moore 1995:48), a situation actually very similar to that for EN Greece. This example further emphasises the necessity of prioritising issues of data interpretation.

### *2.3.5 Early Ceramics and Other Non-Ceramic Containers*

Some time ago Childe suggested that the earliest pots were imitations (skeuomorphs) of vessels made from natural forms such as gourds, bladders, skins, baskets even human skulls, and that the earliest decorations helped to reinforce connections between ceramic vessels and earlier materials (Childe 1981:86). This comment has recently been echoed by Rice, who notes that in many areas of the world the earliest pottery mimics the shape of containers made from other, usually perishable materials: gourds are particularly favoured, but similar forms (skeuomorphs) have been noted, such as birchbark bags, animal skin bags, baskets and soapstone bowls (see Rice 1999:7). In addition, as noted by Vitelli, the low numbers of early vessels in circulation and their limited or non-use in cooking and storage, demands the continued production of a range of containers in perishable materials. Thus the ongoing relationship between ceramic containers and other container types cannot be ignored and should play a part in studies of ceramic consumption (see Section 13.4).

## **Summary**

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<sup>16</sup> Other interpretations of the same evidence have been offered. For example Goren et al. (1993:33-40) have argued that the earliest Neolithic pottery in the southern Levant had a dual functional-symbolic role with decorated fine pottery serving a ritual function.



Studies of Neolithic ceramics should provide a unique and clear perspective on how the Neolithic economy worked, however at present there exists instead considerable confusion and contradiction. Detailed ceramic studies continue to affirm that ceramic production was conducted by the household for the household with almost all production local to the place of consumption. However more general syntheses have long stressed the importance of exchange. It was argued that detailed studies of ceramic assemblages struggle to recognise examples of ceramic exchange for two reasons one methodological, one theoretical. Early ceramic studies which rely purely on observation of form and finish are likely to struggle to identify imports in situations where regional zones of stylistic similarity are large and the range of forms and finishes limited. Studies, which also observe variation in fabric, always identify considerable variation in fabric within single site assemblages and this would seem to be a more promising methodology through which to identify examples of ceramic exchange. Unfortunately, however variation in fabric is almost always interpreted in terms of local production, even in those cases where the case for non-local production and thus exchange seems hard to deny (e.g. 'Andesite Ware' at EN Franchthi; see Chapter 11). Such examples raise the issue of interpretation and moreover suggest the influence of a conceptual barrier, forcing studies to interpret scientific data in terms of what might be acceptable rather than what it might actually imply. Thus, at present most ceramic studies simply affirm with no great conviction an old formulation of the Neolithic household and Neolithic self-sufficiency, at a time when more general syntheses favour one which emphasises the importance of exchange (i.e. the DMP).

In this chapter exploration of this important contradiction has revealed a series of problems not only in how ceramic variation is characterised, but also in how this characterisation is then interpreted. In order to seek a solution to this contradiction, the exploration, characterisation and interpretation of ceramic variation will form a central part of this thesis. Since ceramic diversity would appear to be a feature of all Neolithic sites (Vitelli 1989:20; Yiouni 1995:619), the EN assemblage at Knossos provides an ideal opportunity to explore some of

the issues and contradictions raised in this chapter. For example petrographic study of fabric should be able to demonstrate whether this assemblage is entirely locally produced, as Furness and Evans have suggested, or whether at least some vessels could have been produced elsewhere.

Detailed characterisation of ceramic variation will also allow some of the other, more long-standing research questions to be addressed.

(1) *The Adoption of Ceramic Technology:*

How should we explain the appearance of ceramic technology on the western, eastern and southern margins of the Aegean at approximately the same time? How should we model this process of invention and/or adoption? Did the introduction of ceramic vessels really revolutionise the processing or storage of food? Does the introduction of ceramics testify to competitive feasting or resource intensification?

(2) *The Organisation of Early Ceramic Production:*

Was ceramic production really restricted and specialised from the very moment of its introduction into the Aegean? How was early ceramic production organised? Was it an individual, high-status or specifically gendered pursuit?

(3) *The Consumption of Early Ceramic Vessels:*

How were early ceramic vessels consumed? How were early ceramic vessels and ceramic technology valued? What was the relationship between ceramic and non-ceramic containers?

Finally and in addition to these more general issues, re-study of the EN assemblage at Knossos offers the opportunity of addressing more specific issues associated with the interpretation of EN Knossos. As noted above, previous studies of EN ceramics have consistently identified and emphasised homogeneity in vessel form and finish over this long ceramic phase (EN = c.1500 years; see Appendix I). These studies have used this conclusion to infer the existence of technological homogeneity and have consequently identified only one (limestone tempered) fabric. As a consequence more general studies of Neolithic Crete have consistently emphasised Knossos' isolation, not only from the rest of the island

but also from the rest of the Aegean; some have even claimed that Knossos was the only permanent site on Crete at this time (see Section 12.1 for further discussion of the Knossian Isolation Hypothesis).

## CHAPTER THREE

### THE SOCIAL SIGNIFICANCE OF MATERIAL CULTURE

#### 3.1 Production, Consumption, Exchange

Production, consumption and exchange provide three different perspectives on the human relationship with the material world and as such subsume an enormous range of activities involving people and objects. As archaeologists we tend to divide different activities into each of these three categories: for example acts of manufacture or technical acts are production, acts of use are consumption, acts of giving and receiving are exchange. However, it is too easily forgotten that this division is largely an analytical convenience and the imposition of a division of activities, although high-lighting important differences, actually obscures the close relationship between these three types of activity; after all no activity can ever truly take place in isolation from another. What links these three analytical abstractions are social practices and it is the nature of their articulation that is central to any enquiry into production, circulation and consumption. In this way the entire flow of this thesis is directed towards the elucidation of the changing nature of the relationship between certain people (inhabitants of Crete) and certain things (ceramic vessels) during a certain period of time (Early Neolithic). Put in these simple terms, the boundaries between our archaeological classification of activities into production, consumption and exchange dissolve and what becomes more important is an understanding of the social significance of material culture.

#### 3.2 Style, Technology, Function:

##### Past Approaches to the Social Significance of Material Culture

One way to begin thinking about this is to consider some of the ways in which archaeologists have previously sought to understand the social significance of material culture. Exhaustive coverage of all areas of debate within such a general topic would be neither appropriate nor possible within the confines of this thesis. Rather the discussion will address only those issues considered necessary and relevant to the current enquiry. More specifically, this section aims to

understand and critique some of the ways in which ceramic studies have understood (or failed to understand) the social significance inherent in material acts. It is hoped that in the process this discussion will provide some practical illustrations of the relationship between people, values and objects.

For quite some considerable time the relationship between people and material culture was understood in terms of three separate components, technology, style and function (e.g. Braun 1983; Bronitsky 1986; see discussion in Dietler & Herbich 1998:236-244). Technology was viewed as external to and separable from the social sphere; those studies which did address the relationship between the technological and the social tended to study either the *effects* of technology on society or what messages technological behaviours might be communicating (Lemonnier 1993:2). The reasons for this separation are not hard to find: past approaches to ceramic technology have tended to view technology, with environment, as acting as powerful constraints on the ability of potters to exercise choice (e.g. Matson 1965; D. Arnold 1985). These constraints are assumed to take three different forms (Gosselain 1998:80):

<b>1</b>	<p><b>Ecological:</b></p> <ul style="list-style-type: none"> <li>- climate enforces changes in scheduling, tools and facilities (e.g. Rice 1987:315-6);</li> <li>- physical/chemical properties of raw materials demand specific processing techniques (e.g. D. Arnold 1985:20-32);</li> <li>- fuel availability promotes or hinders certain firing technologies (e.g. D. Arnold 1985:214; P. Arnold 1991:59-60);</li> </ul>
<b>2</b>	<p><b>Material:</b></p> <ul style="list-style-type: none"> <li>- the difficulty of transforming clay raw materials into finished vessels effectively limits the potter to a single production sequence: choices made at one stage of production condition the choices available at other stages.</li> </ul>
<b>3</b>	<p><b>Functional Optimisation:</b></p> <ul style="list-style-type: none"> <li>- since ceramic vessels have a range of functions, such as liquid storage, cooking, serving, they are thus subject to a variety of stresses, such as thermal shock or abrasion, which necessitate that different vessels have different physical properties, such as waterproofing or thermal conductivity. The need for functional optimisation is therefore considered to be a guiding influence over various stages of production, from raw material selection, to vessel forming or finishing (e.g. Braun 1983; Bronitsky 1986).</li> </ul>

**Figure 3.1 Supposed Ecological, Material, Functional Constraints on Ceramic Production (after Gosselain 1998:80)**

With such an array of constraints on their action, potters appeared not to have the ability to exercise choice. This denial of choice effectively wrested control

over key stages of the production process out of the hands of potters, making technological decisions appear passive and predetermined by natural (material, ecological) or functional criteria (Van der Leeuw 1993:238-9; Gosselain 1998:80-1; Livingstone Smith 2000:21). This denial of the possibility of human agency led to ceramic studies which emphasised description of technology over its explanation (Van der Leeuw 1993:239). It has even been argued that ceramic technology might be better studied within a framework derived from materials science and engineering than anything that archaeology or anthropology could provide (Kingery 1987:99). In this way with social aspects of technology excluded it became possible to "build a discourse much closer to that of hard science and... draw universal laws of interpretation" (Livingstone Smith 2000:21).

In contrast to technology, style was considered to have a significant social component. Thus, for example, in her examination of the relationship between ceramic style and ceramic technology, Wright argued for a distinction between the two, describing style as the "transmission of traits with specific cultural meanings" and technology as the transmission of traits "that are culturally-neutral" (Wright 1985:23). In this way style came to be defined rather negatively as those aspects of material patterning which remain after function and technology have been accounted for; in this way ceramic style came to be viewed narrowly in terms of variation in form and finish (Dietler & Herbich 1998:237). Despite this narrow definition, style itself has been understood in a variety of ways, as passive reflector of social behaviour and social values, as a cost effective communication device or as an active tool in strategies of social action (see discussion in Dietler & Herbich 1998:238-44; Dietler & Herbich 1994:460-1).

The category of function was generally viewed in similar terms to technology, in that it referred to techniques or objects which were considered utilitarian or 'culturally-neutral', in other words activities or things for which a social function could not be claimed. Thus, Dunnell defined function as "manifest in those forms that directly affect the Darwinian fitness of populations in which they occur" (Dunnell 1978:199 quoted Miller 1985:52-3), i.e. function was seen

in evolutionary terms as part of adaptation. While definitions of style tended to vary, they all tended to have the general sense of that which relates most closely to social or cultural factors, with the result that style tended to be defined negatively and narrowly in terms of what remained after the apparently non-social categories of technology and function had been accounted for (Dietler & Herbich 1998:237). Thus, in ceramic studies style tended to be sought in only the most obviously manipulable stages of ceramic production and became practically synonymous with decoration: after all meaningful variation or style could only reside in those few areas where the potter was considered able to exercise choice between equally viable alternatives<sup>1</sup>. In this way a view of cultural choice was emphasised which saw it as a superficial or surface phenomenon.

This view of technology, style and function, despite its enduring popularity (e.g. D. Arnold 1985) has actually proved to relate very poorly to what is known about actual situations of pottery production and consumption (Livingstone Smith 2000:22). For example:

"Virtually all known prehistoric techniques of pottery-making, and most ethnographically-observed ones, have a rather wide tolerance for the clays and other raw materials, so that almost any of those techniques could probably be implemented almost anywhere, if need be by introducing a few minor modifications... *The non-availability of the appropriate raw material(s) turns out to be only very rarely the limiting constraint in the manufacture of pottery*" (Van der Leeuw 1993:239).

This *potential* freedom to act has been well illustrated by Van der Leeuw's exploration of the relationship between technique and form, in which it becomes clear that ceramic traditions, whether ethnographic or archaeological, can achieve the same basic form (e.g. globular pots) by employing a variety of basic techniques, from paddle and anvil to coiling, in an even greater variety of combinations (Van der Leeuw 1993; see also Gosselain 1998:87-91). When the sequence of actions, which make up a particular forming tradition, are subject to detailed analysis, it becomes clear that no two traditions are perfectly identical.

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<sup>1</sup> cf. definitions of style in terms of conscious choice in David et al. 1988.

1	Controlling the shape of the vessel: 'a dynamic equilibrium between potter and material';
2	Avoiding collapse/deformation;
3	Keeping vessel in a fixed position;
4	Maintaining access to different parts of the vessel;
5	Speed with which vessels can be completed: how many interruptions required?
6	How great a range of shapes can be made using the same basic forming method?

**Figure 3.2 Some of the Major Constructional Problems Posed By Forming**  
(after Van der Leeuw 1993:243)

Thus the basic problems posed by forming (see Figure 3.2) can be solved by a wide range of different techniques (Van der Leeuw 1993:256; Mahias 1993:157-65). The acknowledgement of this potential range of available options restores the crucial elements of choice and control back to potters, revealing them to be *active* employers of different techniques of production, not passive components of ecological and material determinism. Thus within certain ecological and material limits potters enjoy considerable room for manoeuvre and this manoeuvring would appear to be socially informed. This resurrection of human agency is critical to a more meaningful appreciation of technological change: change no longer need be viewed as a simple human response to changes in subsistence or local ecology.

These practical examples also force a reconsideration of the relationship between technology, style and function. Style, if located wherever there is a potential choice between equally viable alternatives, actually emerges, not as a separate category confined simply to decoration, but as a fundamental feature of both technology and function. Thus previous attempts which seek to form discrete categories of style, technology and function have more recently come to be viewed as misguided (see especially discussions by Dietler & Herbich 1989; 1998:236-244; Gosselain 1998:81-3; Lemonnier 1993:10-11; Pfaffenberger 1992:502-7) or even meaningless (e.g. Latour 1993), although, it has been suggested recently that provided the limitations of these distinctions are borne in



mind, they may nevertheless retain an analytical usefulness (see Lemonnier 1993:10).

Regarding style, however, Lemonnier's optimism seems misplaced; in their review of archaeological approaches to style, Dietler and Herbich note that "style has a variety of meanings for archaeologists, although these are often somewhat ambiguously treated and are rarely very clearly or consistently defined" (Dietler & Herbich 1998:237; 236-44). Style therefore means different things to different people, who inevitably identify it and interpret its significance in different ways. This ambiguity may misdirect interpretation. Consequently within this thesis, unless appropriate to the presentation of previous scholarship, a conscious attempt will be made to avoid using the term style whenever a more accurate term is available: for example the characterisation of certain forms of vessel variation as stylistic (e.g. decoration) will be eschewed in favour of labels which are less resonant, but more specific and descriptive (e.g. form, finish).

The concept of function as 'culturally-neutral' Darwinian adaptedness has also suffered when exposed to critical examination (see Pfaffenberger 1992:494-502). Miller has elegantly demonstrated that the range of forms produced by Dangwara potters in India, although divisible into different functional categories, such as cooking, serving, liquid storage/transfer etc., cannot simply be explained as satisfying the demands of ecological necessity or functional optimisation (Miller 1985:54-74). While some 'specific' forms, such as the *chhapa* (ritual pot) or the *nagara* (musical pot) seem to perform their tasks well enough, others such as the *divaniya* (oil lamp) seemed less well-designed:

"If the *divaniya*, used almost entirely as an oil lamp, is compared to lamps in other regions, it is found to possess neither elongation, nor partial closure, nor any form of provision for the wick. Indeed the wick was often observed to slide beneath the surface of the fuel and extinguish itself" (Miller 1985:57).

A similar lack of efficiency can be seen in other forms more closely associated with subsistence, such as cooking pots. Miller notes that although some (e.g. Braun 1983) have argued that the size of vessel orifice, as a restriction at the mouth, should co-vary with frequency of access and the need to secure the contents, in reality Dangwara cooking pots

"pots exhibit a relationship between function and neck size precisely opposite to what might have been expected. It is the rarely used *jhawaliya*, associated with meat, that has the largest mouth and neck diameter, while the more commonly used pots have a smaller diameter" (Miller 1985:60).

Miller concludes that the range of forms exhibited by Dangwara pottery does not represent the evolution of forms adapted to their environment (see Miller 1985:64-5). Indeed much observed variability has little relation to the range of functions or to notions of efficiency, rather the wide range of vessels is characterised by a 'massive redundancy' of form. In other words the entire typology could, if viewed purely in terms of functional necessity, be replaced by a couple of basic forms<sup>2</sup>. As a result it becomes clear that function does *not* constitute a natural, necessary, 'culturally-neutral' environment to which an object is adapted, rather function is dependent upon the *social* creation of that environment through a set of social choices (Miller 1985:54-5; Pfaffenberger 1992:496-502): i.e. functional categories are very much socially-created categories, with biological necessity only serving to set their most extreme limits.

Several points of importance arise from these practical examples. Above all, it would appear that potters enjoy a theoretical range of technological options during the production sequence, from which they actively make choices. These technological choices only partly relate to environmental/material conditions and should rather be viewed in terms of a 'mediation' between social factors and material or ecological demands (Lemonnier 1993:10; Van der Leeuw 1993:261). This perspective on technology is very much that of the French 'Techniques et Culture' school, which, through the development of an anthropological perspective on technology, stresses that techniques are first and foremost social productions:

"Any technique, in any society,... be it a mere gesture or a simple artefact, is always the physical rendering of mental schemas learned through tradition and concerned with how things work, are to be made, and to be used...

But the logic and coherence of this technological knowledge... are not related solely to the physical phenomena that are set in motion by a given technique... In short, the mental processes that underlie and direct our actions on the material world are embedded in a broader, symbolic system" (Lemonnier 1993:3).

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<sup>2</sup> This redundancy in form only further increases when one considers the range of forms also available in non-ceramic media, such as metal or glass (Miller 1985:65-7).

A similar view can be found in the work of Lechtman:

"In asking what is the cultural component of technology, we are also asking what can technology tell us about culture? We must be concerned not only with the bodies of skill and knowledge..., not only with the materials, processes, and products of technology, but also with what technologies express. If we claim that technologies are totally integrated systems that manifest cultural choices and values, what is the nature of that manifestation and how can we read it?" (Lechtman 1977:3-4).

Both these approaches stress that techniques and technological choices are not merely governed by a mediation of material considerations and social factors, but support and in turn are supported by 'culturally accepted rules' or 'mental schemas' 'embedded in broader symbolic systems'; in other words technologies are embedded within an underlying set of social values (Lechtman 1977:10; Dobres & Hoffman 1994:218). The consistent re-enactment of these systems of values through acts of production (and it should be said also through acts of consumption and exchange) thus provides meaning and structure for the actors involved and may also similarly structure other technologies practised within the same social context<sup>3</sup>: in this way "technological acts, whether mundane or spectacular, are a fundamental medium through which social relationships, power structures, worldviews and social production and reproduction are expressed and defined" (Dobres and Hoffman 1994:212).

In a similar way to technology, function can be more accurately characterised, not as pure environmental adaptation, but as a set of socially-constructed categories formed by the exercise of choice (Miller 1985). Like technology these choices may be viewed as a mediation between social factors and biological, ecological or material necessity. Thus, for example, indiscriminate applications of utilitarian/non-utilitarian distinctions to ancient material culture may now be seen as misguided, since these are functional distinctions constructed in our world and are not necessarily applicable to those of the past (for Aegean Neolithic examples cf. Perlès 1992; Perlès & Vitelli 1999). Likewise, attempts to demonstrate that ancient potters were necessarily guided in the selection of raw

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<sup>3</sup> Dobres & Hoffman (1994:218) cite as an example of this Lechtman's detailed study of pre-Hispanic metallurgy, which in its final interpretation made links to key cultural and ideological values and demonstrated the existence of similar set of structuring principles.

materials by a desire to optimize functional performance may also be misguided (see Chapters 4, 5).

These basic points together reveal something fundamental about the social significance of material culture. If producers and consumers of material culture can be recast as active agents making socially-informed decisions about how to produce and use objects, then it becomes clear that the social significance of these objects resides not so much in the 'style' of the objects themselves, but in the ways in which they reveal human choices made during activities of production, consumption or exchange<sup>4</sup>. The recognition of this important distinction between objects and techniques - defined as "those human actions that result in the production or utilisation of things" - is of the utmost analytical and methodological importance, principally because it highlights the crucial importance of techniques in the relationship between people and things, but also because techniques can be archaeologically comprehended via the study of the objects themselves and the contexts in which they were produced and consumed (Dietler & Herbich 1998:235-6; Chapter 5).

### 3.3 Habitus and Material Culture

Several recent studies, all concerned in some way with the relationship between material culture and society, have independently argued that the interactive nature of this relationship between material activities (whether acts of production, consumption or exchange), systems of values and people, can be best understood within a framework derived from Bourdieu's theory of practice (Miller 1985:11-2; Dobres & Hoffman 1994:214; Dietler & Herbich 1998:244-8; cf. Bourdieu 1977). Bourdieu has argued that over time people develop 'dispositions' to act in certain ways through the influence of the material and social conditions (structures) within which they live (see Bourdieu 1977:72-95).

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<sup>4</sup> This broader more socially-contingent view of technology has been discussed in more detail elsewhere (see Dobres & Hoffmann 1994; Lemonnier 1993; Pfaffenberger 1992; Van der Leeuw 1993) and has been applied to ceramic technology (see Gosselain 1998; Livingstone-Smith 2000; Sillar 2000). It should be noted, however, that this perspective has not yet achieved widespread acceptance in ceramic studies and examples can be still found of what Livingstone Smith has termed the 'techno-functional approach' (e.g. O'Brien et al. 1994; see Livingstone Smith 2000:22; Gosselain 1998:79).

These "systems of durable, transposable dispositions", or what Bourdieu has called *habitus*, act as

"structured structures predisposed to function as structuring structures, that is as principles of the generation and structuring of practices and representations which can be objectively "regulated" and "regular" without in any way being the product of obedience to rules" (Bourdieu 1977:72).

In other words these 'systems of dispositions' (*habitus*), which structure future activity, are themselves constructed through the influence of past material and social conditions on past actions. *Habitus* is therefore a system of practical knowledge and may be described as a "practical evaluation of the likelihood of success of a *given action* in a *given situation*... [which] brings into play a whole body of wisdom, sayings, commonplaces, ethical precepts ("that's not for the likes of us")" (Bourdieu 1977:77 my italics). Thus *habitus* not only defines what actions are possible within a given situation, what Bourdieu calls the "objective potentialities in the situation", but is also very much defined by past actions in past situations: i.e. "in short, the *habitus*, the product of history, produces individual and collective practices, and hence history, in accordance with the schemes engendered by history" (Bourdieu 1977:78, 82).

In this way one can see how *habitus*/practical knowledge exists in a dialectical relationship with action and situation. As Bourdieu has put it,

"the virtuoso finds in the *opus operatum* new triggers and new supports for the *modus operandi* from which they arise, so that his discourse continuously feeds off itself like a train bringing along its own rails" (Bourdieu 1977:79).

The dialectical aspect of this arrangement is crucial. If one ignores it then one reduces the relationship between the different social agencies "to the logical formula enabling any one of them to be derived from any other" (Bourdieu 1977:83). In this way actors are not reduced to mechanistic schema where practice is viewed to be determined by antecedent conditions, but nor can they be reconstructed as far-sighted infinitely creative manipulators of their own action operating in an utterly free-willed manner. Rather actors operate within a "system of objective potentialities, immediately inscribed in the present, things to do or not to do, to say or not to say, in relation to a *forthcoming* reality, which... puts itself forward with an urgency and a claim to existence excluding all deliberation"

(Bourdieu 1977:76). Thus individuals act within their own terms and in accordance with their hitherto accumulated wisdom. In this way practice theory allows one to view the relationship, whether in activities of production, consumption or exchange, between the choices made by individuals, the actions which result and the material and social conditions within which these choices and actions take place.

Another important aspect of habitus is that it generates patterned activities which appear to be consciously regulated, but whose performance is largely subconscious, since the 'orchestration of habitus' produces a natural common-sense world 'endowed with objectivity' (see Bourdieu 1977:79-80): habitus action is habitual action. However, although this world is subconsciously constructed and reconstructed by individuals, the circumstances of its constitution, including practical knowledge, are shared with others, so that one might talk of a 'homogenising' of habitus: that is one that is shared by others, who have acquired practical knowledge in similar circumstances operating within similar material and social environments.

It is in fact this subconscious element of habitus which is so important to the study of past actions from material remains. Since such material action is habitual or unconscious it appears to be entirely natural and beyond question; as Bourdieu has put it "it goes without saying because it comes without saying" (Bourdieu 1977:167). However since even at this habitual level material action reproduces social values and social relations, these processes of naturalisation and socialisation conceal a potentially rich source for the study of the reproduction and transformation of social values and relations (cf. Miller 1985:11-12, 67, 191-3). Indeed it has been argued that realisation of this undermines the validity of anthropological studies which base their conclusions solely on what people say about their objects, rather than including also what the objects say about the people (Miller 1985:197-8)

### *3.3.1 The Material Basis of Habitus: Knowledge, Memory, Objectification*

Through its emphasis on the learning process, practice theory provides the key to understanding the social significance of material culture (see Bourdieu

1977:87-95). People acquire practical knowledge (*habitus*) about the material world through their practical experience of it. The very re-constitution of this material world relies on the success of this learning process: the world of objects not only frames future action, but is also at the same time constituted by it. For example, when we enter a room, its contents and their arrangement provide us with information as to how to behave. In this way we are socialised by our material surroundings, which we ourselves have created (see Gosden 1994:10-12; Miller 1985:204-5).

This practical knowledge of the material world is not randomly acquired but is structured by social systems of classification which have their own internal logic or rationale. Successful acquisition of practical knowledge therefore relies on the observation of this *rationale* behind actions (Bourdieu 1977:87-8). In this way "techniques are first and foremost social productions" (Lemonnier 1993:3) because they are formed through the *habitus*, that is they are learnt socially, both through observation of their performance by others and through practical attempts to reproduce them by the learner (cf. Dietler & Herbich 1998:246). The reason that techniques appear to be embedded within broader systems of 'cultural values' is because these social systems of classification provide the rationale or internal logic behind these actions. Thus the key to understanding acts of production, consumption and exchange is an awareness of the potential social values or social systems of classification which might structure such activities and simultaneously be reproduced by them (see Chapter 4). For example acts of production may be organised in different ways according to different values. If one can characterise in detail how production is organised then one should be able to glimpse the principles and values which underlie it.

In his study of potters in southern Cameroon Gosselain demonstrated that of the different stages in the manufacture of ceramic vessel, only forming methods show any correspondence to social boundaries (see Gosselain 1998:91-9)<sup>5</sup>. This correspondence was explained by detailed consideration of the learning

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<sup>5</sup> Unfortunately, this connection between social boundaries and forming methods is not so strong in other ethnographic studies and thus cannot be understood to be a 'general' or 'universal' feature of ceramic systems. For example, in his study of twentieth century East

process. In his case study the transfer of technical knowledge occurs in two stages. In the first the apprentice assists the teacher with one of the stages in the production process e.g. procuring and processing raw materials or building the firing structure. In doing so the apprentice learns the materials, the different transformation processes and the taboos to be respected. In other words he learns the rationale behind the production process. The second phase is more formal and involves the learning of methods of forming. Here the teacher will work beside the apprentice pointing out failures and mistakes and may even take the hands of apprentice to demonstrate correct gestures and postures. As a result such techniques become integrated in the apprentice as motor habits. This second stage may take from anything between 2-3 months to even a year before these techniques are naturalised and habitual. In this way the acquisition of technological knowledge, especially in pre-modern societies, is usually significantly more practical than verbal (Pfaffenberger 1992:507-8).

In this way in small-scale pre-modern societies, such as those of the Early Neolithic, it is largely through habitual action that social values and social systems of classification are maintained. One way of understanding this process is to think about time. It has been recognised that modern concepts of time and memory are a product of relatively recent political, historical and economic developments and as such need not correspond to ancient approaches to time and the transmission of knowledge (cf. Shanks & Tilley 1987:118-136). Shanks and Tilley offer a distinction between chronological/abstract time, that is time that is measured and objective, and human/substantial time, that is time that is experienced and subjective (1987:125ff). They argue that the former is confined to modern capitalism, while the latter is a feature of societies outside the capitalist system. In such non-capitalist societies experienced time is on a human scale, not purely successive and potentially looking both forward and back.

This cyclical form of time has been described by Zimmerman as:

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Cretan potters, Day has shown that is not so much forming methods but choice of raw materials which serve to express such boundaries (Day, forthcoming).



"sacred, with traditional peoples seeing it as periodically regenerating itself *ad infinitum*. Truths were revealed in mythical times, specifically at creation... The aim is thus to arrange one's life so that these sacred acts can be experienced as often as possible. By executing an act as it was done originally, with the ritual passed down faithfully from generation to generation, one can actually project oneself into that 'same primordial mythical moment'" (1987:44).

Communities which view time in this way pass on knowledge in quite different ways to our modern chronologically-driven society. Rowlands has drawn a useful distinction between modern memory systems, which tie memory to linear conceptions of time, where knowledge can be seen as a sequence of events traceable back through time, and memory systems which are objectified in the production and consumption of objects (Rowlands 1993:149-50). Under the latter system production (and consumption) may be seen as a deliberate act of recreation, dynamically linking present with past via the reproduction of past knowledge and techniques, situating the producer in a timeless state which is at once past, present and future. In this way such acts of production reflect a desire to emphasise common memory, ancestry or ownership. Objects thus produced are therefore very much defined and determined by knowledge and techniques resulting from past acts of production; however such objects are also the means by which this knowledge and these techniques are reproduced and themselves will form the past models for future acts of production. Objects are therefore neither passive nor conservative in the way they reflect traditional forms of knowledge, but *active* because the activities behind their production and consumption allow traditional forms of knowledge to be reproduced, contested and re-defined, dynamically linking past and present as well as directing future activity (cf. Miller 1985:204-5).

A good example of how objects objectify values, ideas or even people is provided by the work of David et al. among the Mafa and Bulahay of northern Cameroon (see David et al. 1988). In their study the decoration of pottery is understood by analogy to the decoration of the person: pots may be assimilated to persons and represent human and other spirits. In this way ceramic vessels become powerful items invested with spiritual powers of protection. As a result they note a clear link between pottery decoration and symbolic structures.

And so, within such societies acts of production (and consumption), along with the artefacts and individuals associated with them, are *the* means through which traditional forms of knowledge are maintained. Individuals alone, however, do not constitute stable mechanisms for the transfer of knowledge over countless generations. Rather, such individuals are not thinking and acting alone but are operating within a set of ideas and values which exist and are reproduced within human groups. It is therefore the *shared* reproduction of practical knowledge that provides the stable mechanism for its continued maintenance.

### **3.4 Continuity and Change: Doxa, Orthodoxy and Heterodoxy**

The appreciation on the one hand that there are a range of possibilities available to the actor, but on the other that these possibilities are not infinite, but materially and socially restricted, is fundamental to a reconstruction of past action which allows for continuity of practice but which also leaves room for strategic action and importantly change. This modelling of change as arising from the actions of individuals and groups crucially re-locates change from the generalised level of systems and subsystems (see Barrett 1994:2-5, 157-164) back to the level both at which it is effected and, importantly, at which it can be most effectively studied by archaeologists. The material residues of the past more directly represent actions of individuals and groups than they do the interaction of systems and subsystems. Change from a generalised perspective appears as a *fait accompli*, divorced from the actions and choices of individuals. However, when change is viewed in terms of habitus, it becomes clear that it depends upon past perceptions of the possibility for change or innovation and these perceptions are conditioned by habitus as a "matrix of perceptions, appreciations and actions" (Bourdieu 1977:82-3). In this way continuity and change can only be understood within a wider complex social and material context (see van der Leeuw & Torrence 1989:1-14).

One way of thinking about continuity and change is to adopt Bourdieu's distinction between doxa, orthodoxy and heterodoxy (see Bourdieu 1977:159-

171). Doxa are beliefs in certain social values which are seemingly 'natural' and uncontested, part of the very fabric of existence:

"doing one's duty as a man means conforming to the social order and this is fundamentally a question of respecting rhythms, keeping pace, not falling out of line... These various ways of reasserting solidarity contain an implicit definition of the virtue conformity, the opposite of which is the desire to stand apart from others" (1977:161).

Doxa are therefore 'common-sense' social constructions operating at an unconscious level<sup>6</sup>. In contrast, orthodoxy or heterodoxy implies the "awareness and recognition of the possibility of different or antagonistic beliefs" (Bourdieu 1977:164). Such beliefs are more open to modification and are thus most open to non-conformity and more liable to change. The more fully certain social values are reproduced in the actions of individuals and thus the more stable these values are, then the greater the extent of the field of doxa, i.e. of that which is taken for granted, and the lesser the opportunities for change. Within such societies "the established cosmological and political order is perceived not as arbitrary, i.e. as one possible order among others, but as a self-evident and natural order, which goes without saying and therefore goes unquestioned, the agents' aspirations have the same limits as the objective conditions of which they are product" (Bourdieu 1977:165-6). In this way the potential of a society to change can be seen to be related to the success with which its values are played out in the actions of its individuals. One might argue that one of the reasons for the stability and longevity of earlier Neolithic communities in the Aegean, is the success with which they reproduce the social values which underpin their existence (see Chapter 4).

This perspective on change, which views it not as an event but as a continuous process of reproduction, provides a new angle on the idea of tradition and innovation (see also van der Leeuw & Torrence 1989:1-14). If tradition is defined simply as a shared body of information and practice, then it would seem to equate to shared knowledge, shared values and shared practices, some of which may be doxa, others of which may be contestable. In this way it is wrong

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<sup>6</sup> Recognition of the existence of this form of belief only serves to emphasise how supposed 'common-sense' archaeological interpretations are more likely to be products of the modern world than any world of the past (cf. Miller 1985:51; Edmonds 1999).

to talk of tradition restricting innovation and change. Rather if the potential of a society to change depends on the unconscious performance of its constitutive values through the actions of individuals, then it is those individuals who restrict or promote innovation (cf. van der Leeuw & Torrence 1989:10). In this way, although tradition often appears to be fixed, because it depends on the ongoing actions of individuals for its reproduction it therefore is always malleable. As a result of this non-innovation - or the deliberate resistance of individuals to change - can be seen to be as dynamic and as interesting as innovation (cf. Sørensen 1989). Furthermore, this perspective suggests that the only way in which continuity and change can be understood is through the study of the material and social context within which the strategic actions of individuals and groups took place (Barrett 1994:3; cf. van der Leeuw & Torrence 1989:7-8, 11-13).

The concept of doxa helps to explain why potters, although theoretically able to employ a wide range of different techniques (see above), tend to remain loyal to whatever sequence of techniques they first learnt or first adopted. As Mahias has noted, once a successful solution to the problems posed by ceramic production has been found "the potter cannot change it and he becomes a prisoner of this solution, which now appears to be the only one possible, the most 'natural'" (Mahias 1993:165). This reluctance to change can be seen to derive from the very habitual nature of these techniques. They are so normal, so natural and therefore produced so unconsciously that they pass into the realm of doxa - that which is uncontested and incontestable.

### 3.5 Producing Categories

"Pottery exhibits a plasticity and flexibility that does not end with the sheer number of categories created from the clay itself, but is subject to complex manipulation thereafter" (Miller 1985:140).

It has long been understood that the process of classification, whereby we as humans cope with and make use of our surroundings, is always informed by certain aims or problems, however conscious or unconsciously expressed (see Hill & Evans 1972). By grouping similar entities and by relying on the principle

that such similarity is not accidental, we are able to solve the problem of, and make sense of, the otherwise bewildering bombardment of information which we receive every second. Classification is thus a fundamental human response; a deliberate way of solving the basic problems posed by everyday existence. At the heart of the whole process lies grouping, where the similarity or difference of different entities is assessed, through an assessment of their different characteristics or attributes. Since different criteria of selection will produce different groupings of attributes, there can be no such thing as a 'best' or 'universally useful' typology (Hill & Evans 1972:250). This feature of classification helps to explain why the classifications employed by producers and consumers tend to differ. For example within a small sample of producers and consumers of pottery in a modern Indian village, many ceramic forms may be given a variety of names (Miller 1985:41). Previous approaches to style (see above), which viewed style as communicating cultural identity, have generally paid insufficient attention to this important distinction between the social context of production and the social context of consumption and have tended to explain the creation of a ceramic vessel/material style solely on the basis of observations of consumption (see Dietler & Herbich 1994:461-70). However, the use of objects in one context need not necessarily imply the adoption of the system of values, within which the object was originally produced (Pfaffenberger 1992:511-2).

Recognition of the potential variability of social classifications of material culture has prompted archaeologists into adopting a very cautious approach to the types (e.g. ceramic vessel typologies), which they identify in past archaeological assemblages: the order identified by the analyst is usually not considered to have necessarily had any sort of past significance (cf. Hill & Evans 1972). However, this has recently been seen as an unnecessary retreat into relativism, engendered to a large extent by a failure to situate human agency and social values at the heart of processes of social reproduction (see discussion in Barrett 1991:202-3). As Miller has argued, "producers cannot be disestablished as the creators of the order under study and such order cannot be reduced merely

to the hypotheses of the analyst" (Miller 1985:10-11, see also 50, 169-70; cf. Barrett 1991:201-4).

In other words, acts of production *create and recreate order*, order which is not natural or timeless, but social and contingent. In this way production of material culture can be reconsidered as the production of material categories, which embody elements of the social order of the world within which they are created (Miller 1985:10-11; cf. Barrett 1991:201-3). Bourdieu makes a similar point when he argues that social systems of classification are not just cognitive schema but represent *practical* knowledge: i.e. they do not simply exist in the mind, but are produced and reproduced through practice (see Bourdieu 1977:97-109). In this way material culture is created and interpreted by people and therefore embodies the organisational principles of *social* systems of categorisation.

The ways in which different stages in the production process contribute to the production of material categories have been studied in detail by Miller (1985:34-50). After exploring the possibility that the use of certain techniques might in some way determine the resultant shapes and thus the resultant categories, he concludes that

"techniques do not determine the form of the distinctions used in creating the pottery series. Rather, certain 'dimensions' may be viewed as having been selected, and used as a focus for differentiation, exploiting particular aspects of the production process" (1985:49).

These dimensions of variability are measurable from the vessels themselves and frequently correspond to the dimensions of variability used by archaeologists to construct object typologies, such as rim form and body profile (Miller 1985:162). It is the integrated and coherent selection of these particular dimensions, as well as certain redundant similarities, which incorporate a certain object within a particular social system of categorisation and thus making it recognisable as the product of a certain producer (Miller 1985:49, 162)<sup>7</sup>. In this way the process of human categorisation can be understood to work in terms of contextually-based properties of variation and 'fuzzy' logic, rather than discrete logical classes (Miller

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<sup>7</sup> This distinction between 'dimensions of differentiation' and redundant similarities echoes the distinction drawn in classification studies between essential and inessential attributes (Rice 1987:276).

1985:8-9). And so, since both the procedures and criteria of selection of the modern archaeologist can be understood to operate in a similar way (Miller 1985:162, 202), it becomes more likely that the material object categories recognised by the archaeologist will have some sort of relevance to the social context within which they were first created<sup>8</sup>.

However, identifying past material categories is one thing, understanding how they might have related to past social classifications, be they of the producer or of the consumer, is another matter. Miller has clearly demonstrated that different social classifications of material categories can be understood as dependent on the contexts within which these categories are produced, exchanged and consumed (see Miller 1985:10-11, 161-83; cf. Kempton 1981:123, 127, 138; Dietler & Herbich 1994:466-70). Thus, understanding of past processes of material categorisation and classification requires a commitment to assembling detailed contextual information. This commitment requires the exploration of the sorts of material and social possibilities and constraints active upon those individuals and groups who produced and consumed the categories in question (see Chapter 4 for more details). As an example of how information about social and economic context can help in understanding past classifications, one might consider Miller's case study of a single Dangwara village. Here there appeared to be a correlation between the degree of separation between producers and consumers (large with a minority of producers and a majority of consumers) and the degree of difference between classifications of producers and of consumers (high, with the possibility of entirely different terminology) (Miller 1985:50; see also Appadurai 1986:41).

In this way, in similar past contexts of specialised ceramic production it would be reasonable to expect that similar varieties in classification might have existed. If so, then one might argue in an opposite scenario, where producers are also very much consumers (e.g. the DMP, see Chapter 4) and thus the degree of separation between the two close to non-existent, that the gap between

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<sup>8</sup> NB Nevertheless considerable caution is required in making this link. This link cannot be assumed but must be explored as a possibility through contextual study (cf. comments of Barrett 1991:203-4).

classifications of production and classifications of consumption might be considerably diminished or even non-existent. In such cases material categories of production might have a much closer relationship to the categories in which objects were consumed.

Much insight can also be gained through the detailed characterisation of some of the formal properties exhibited by a system of material categories, a characterisation that can then be further interpreted through reference to a series of contextual possibilities (cf. similar comments of Miller 1985:198-9, 201). One significant form of variation is in the degree of formal order exhibited by a system of categories: systems may be characterised as *informal*, where the variety of forms or finishes within a single production tradition is very high and where typologies are very extensive and difficult to subsume into a simple order, or *formal*, where the variety of forms or finishes is low and where typologies are simple with low variation and often remarkably consistent between sites (Miller 1985:199-200). Some of the potentials of this distinction will be pursued further in Chapter 12 in the context of EN Knossos. Here, however, it is necessary only to sound a note of caution: since it is quite possible for different objects or categories to represent the same concepts (Miller 1985:201), this sort of formal variation can only be assessed in terms of possibilities and only in the light of additional detailed contextual information (see Chapter 4; cf. Barrett 1991:203-4).

### **3.6 Consuming Categories: Frames and Strategy**

If in their production material categories embody elements of the social order of the world within which they are created, then so in their consumption do they contribute to the construction of the consumer's identity, as well as situating the consumer in relation to a series of social values, social categories and social knowledge which together make up the social environment. Regarding ceramics in particular, Miller has suggested that one significant way in which material categories act, is as 'frames' (see Miller 1985:181-2, 204-5). Through the presence of certain material categories, people are directed or cued into



appropriate behaviour. This behaviour in turn acts to re-define the significance of the particular material category involved. In certain instances, such as ritual action, this can be explicit, conscious and symbolic: here one might consider the concern expressed by Dangwara villagers for the presence of the right sort of vessel in a wedding ceremony (Miller 1985:180). More often however the cues are subconsciously given and received. As already noted, the very habitual, mundane nature of most material actions naturalises them to the point at which they are scarcely noticed. That is not to say such actions are meaningless, on the contrary material culture continues to act as a frame for action which, although without conscious consideration or intention, is nevertheless embedded within systems of social values and social relationships. This feature helps to explain why, in ethnographic studies of producers and consumers, function often acts as a label for form but without implications of functional efficiency (cf. Miller 1985:67). Indeed the very functionality of pottery (container, transporter, server and framer) makes it particularly suited to the role of framing action, while its concrete nature makes it suitable for the objectification of social values and concepts (Miller 1985:204).

The dualism between conscious and unconscious in the ways material culture and material categories work has the potential to reveal something important about consumption, namely that the consumption of goods can be seen to be both symbolic and instrumental (cf. Miller 1995b:239). In this way interpretations of consumption can take place on two levels: on one level they can concern themselves with the significance of conscious or symbolic expressions of desire, while on the other they can consider how material culture acts at a more unconscious level in articulating and maintaining social values and social relationships. Both levels, however, can be understood in the same way. As has been emphasised consistently in this chapter, material culture is reproduced through the active intervention of human agency, which at any particular moment must be credited with a rationalisation of its interests with respect to its actions, whether these interests are consciously or unconsciously expressed. Action,

whether that of individuals or groups, is therefore always to some extent strategic or calculated (cf. Bourdieu 1977:171):

"the pursuit of reputation in the eyes of others is the overriding preoccupation of human life, although the means by which reputation is to be achieved are extraordinarily various" (Harre 1979:3 cited by Miller 1985:184-5).

In this way through acts of consumption individuals and groups define their reputation, their identity and their status. However, in addition to the expression of social relations, acts of consumption act more subtly to express certain social values. In this way consumption can be understood not only as a focus for sending social-messages but also as a means of receiving them (Appadurai 1986:31).

In order, however, for these processes to take place acts of consumption must have meaning and value. One way of thinking about this is to trace acts of consumption back to demand. Here it is important to recognise that this demand does not derive from universal human psychological desires, but rather is itself a function of social practices and social classifications (Appadurai 1986:29-31). Demand is thus socially constructed and a variety of social practices and classifications structure the world within which demand is created. As a result demand for goods or services is liable to significant variation in space and time. One consequence of this is that acts of consumption must be understood to be active and specific, the recognition of which demands a commitment in consumption studies to the study of social context (see Miller 1995a:31-3, 1995b:269, 276-9).

Although the rules of consumption are to a large extent context specific, certain generalisations are nevertheless possible regarding the role of material culture in consumption. First and foremost, through Bourdieu's concept of symbolic capital, it is possible to see that economic calculation on the part of individuals or groups goes far beyond simple material goods or wealth but rather extends "to *all* the goods material and symbolic, without distinction, that present themselves as *rare* and worthy of being sought after in a particular social formation" (Bourdieu 1977:178, see pp.171-83). It is through the accumulation, display and exchange of material and symbolic capital that individuals or groups

define their identities and negotiate status or reputation. Such acts, however, especially in small-scale kin-based societies, do not exist in isolation, but are fundamentally historical: in this way, acts of consumption and exchange represent "a heritage of commitments and debts of honour, a capital of rights and duties built up in the course of successive generations and providing an additional source of strength which can be called upon when extraordinary situations break in upon the daily routine" (Bourdieu 1977:178, 178-9; Chapter 4). Indeed, Bourdieu has argued that in agricultural societies, where a short ploughing and harvesting period and limited technical resources conspire to demand collective labour, symbolic capital, in the form of prestige and renown attached to a family, may perhaps be the most valuable form of accumulation (Bourdieu 1977:179). In such societies the two most important means of conserving or increasing reputation through the acquisition of symbolic capital are blood vengeance and marriage (see Bourdieu 1977:180-2).

The broader systems of social values or consumption rules, within which acts of consumption and exchange are embedded (see Bourdieu 1977:182-3) give meaning and render power to symbolic capital. Through certain mechanisms (e.g. taboos, sumptuary legislation) such systems will also direct action towards certain material categories and away from others and may even encourage over-investment in categories, which have no obvious worth when placed in a calculation based on adaptation and the production of subsistence:

"practice never ceases to conform to economic calculation even when it gives every appearance of disinterestedness by departing from the logic of interested calculation (in the narrow sense) and playing for stakes that are non-material and not easily quantified" (Bourdieu 1977:177).

These 'rules of the game' thus direct activity, but importantly also allow some room for manoeuvre and negotiation (see Bourdieu 1977:10-15; cf. Appadurai 1986:17). In this way the world of objects or material categories within past societies is created and recreated by strategic action embedded within a social system of rules and categories. This world is therefore significantly constructed, contextual and contingent.

### **3.7 Categories, Commodities, Classifications: Exchange and the Construction of Value**

One way to break into this contextual world of objects and values is to look at how value is constructed in relation to objects. Value itself can be understood not as an inherent property of objects, but rather as a human judgement made about them (see Appadurai 1986:3-4). In general that which is rare or difficult to access is considered valuable; this difficulty is overcome through the act of exchange, in which the value of objects is reciprocally determined. In this way value is not absolute and fixed to the object, but rather is negotiable and defined on the basis of a real or imaginary exchange. As such it is exchange that "sets the parameters of utility and scarcity, rather than the other way round, and exchange that is the source of value" (Appadurai 1986:4).

It has been argued that when an object is selected for exchange it becomes commoditised, a commodity being defined as any thing intended for exchange, (see Appadurai 1986:6-16; Kopytoff 1986:64-90). This very broad definition of commodity subsumes other forms of exchange such as barter and gift-exchange. Appadurai argues that barter exchange is a particular form of commodity exchange, where money does not play a direct role and where the circulation of things is most divorced from social or political values (Appadurai 1986:10-11). Regarding gift-exchange, he argues that a tendency to romanticise 'pre-capitalist' societies has led to a failure to recognise the degree to which such societies are equally calculative, impersonal and self-aggrandising. In this way gift-exchange, as reciprocal, sociable and spontaneous, has been falsely opposed to commodity exchange, as profit-oriented and self-centred, since both share the important characteristic of calculation (cf. Bourdieu 1977:4-9, 171-183; Appadurai 1986:11-12).

Crucial to this view of objects as commodities, is the recognition that things may move in and out of the commodity state (Kopytoff 1986). Kopytoff has illustrated this through a discussion of slavery as social transformation (see 1986:64-5). When taken, slaves lose their previous identity and become commodities. However, once acquired, slaves become re-socialised: over time

they may develop a new social identity and new statuses or alternatively they may resist re-socialisation by retaining their identity in hidden practices, material culture and speech. Nevertheless at any time slaves may be converted back into commodities for resale. In this example human beings are commoditised, then withdrawn but with always the potential for future re-commoditisation. The same is equally true for objects and Kopytoff demonstrates that movements in and out of the commodity state can be fast or slow, reversible or terminal, adhering to social-norms or deviating sharply from them (1986:68-87).

Kopytoff has drawn a very useful distinction between the "drive inherent in every exchange system toward optimum commoditisation - the drive to extend the fundamentally seductive idea of exchange to as many items as the existing exchange technology will comfortably allow" and, singularisation, that is the natural inclination of all cultures towards discrimination and restriction of portions of their material and social environment (Kopytoff 1986:72-7). This tension between the drive to commoditisation and the need for singularisation can be seen in all societies. In general small-scale societies tend to restrict and simplify commoditisation, with their systems of social values largely directing and enclosing economic transactions and providing the need for discrimination. The drive to commoditisation is effectively curtailed both by social values and by the inadequacies of the technology of exchange, in particular the absence of a well-developed system of money. In contrast, in commercialised, monetised and highly commoditised societies, such as our own, "publicly recognised commoditization operates side by side with innumerable schemes of valuation and singularization devised by individuals, social categories and groups, and these schemes stand in unresolvable conflict with public commoditization as well as with another" (Kopytoff 1986:79-80, 87-8).

An example of the drive to commoditisation is the universal acceptance of money when introduced into non-monetised societies (Kopytoff 1986:72). Examples of extreme resistance to commoditisation abound in particular in

premodern societies<sup>9</sup>, exemplified in processes of diversion such as sacralisation and the creation of 'enclaved' or 'terminal commodities' (see Appadurai 1986:17, 22-9; Kopytoff 1986:73-7). In small-scale societies where the flow of commodities is restricted, this restriction of equivalences and exchange to a "stable universe of commodities" acts to protect and reproduce status systems (Appadurai 1986:25): in such systems valuables play the role of tokens through which status is conventionally reproduced (see also Chapter 11). Important also in the context of restrictions upon commoditisation is the notion of 'inalienability'. Within certain forms of exchange, where the exchange above all represents the creation or maintenance of a specific social relationship between the two transactors (e.g. gift exchange), the transactors, their social relationship and the exchange object may become so intimately associated as to render the object symbolic of the successful continuation of that relationship and thus unfit for further exchange (inalienable) (see Thomas 1991:14-22). In this way gifts are inalienable things which move between people who are mutually entangled in an array of rights and obligations (Thomas 1991:14).

In this way what emerges is that the exchangeability of things within any specific context is not defined by time so much as by general social conventions and values and sometimes also the more specific personal associations of the object and owner (Kopytoff 1986:68; Appadurai 1986:13-17; Thomas 1991:20-1). These social classifications not only vary from context to context, but may also vary between the two parties within a single transaction: thus Appadurai suggests that rather than speaking of shared standards of value, it is better to view exchanges as taking place within *regimes of value*, which acknowledge that the degree of value coherence may be highly variable from situation to situation and from commodity to commodity (see 1986:14-15). In this way exchange may take place within a single regime of value or between differing regimes. Moreover different regimes of value may exist within any one society: Kopytoff quotes the example of the Tiv of central Nigeria, who maintain three spheres of

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<sup>9</sup> NB modern Western resistance to the commoditisation of people demonstrates that resistance to commoditisation is also a feature of more complex 'commoditised' societies (Kopytoff 1986:84-7).

exchange (subsistence items, prestige items, rights-in-people), each with its own set of rules and values (1986:71).

A distinction, consistently drawn in archaeological studies of ancient spheres of exchange, has been that between luxury and utilitarian<sup>10</sup> goods (cf. Perlès 1992 for the Neolithic Aegean). Such distinctions are highly problematic (see discussion in Smith 1999:113-4), not least because they require the imposition of modern social categories upon an unknown ancient situation. For example most studies of Neolithic pottery assume that painted pottery had a high value (cf. Mellaart 1970b). However the indifference of modern Indian Dangwara villagers to painted pottery (Miller 1985:98) should caution against a simplistic imposition of modern Western aesthetics. Appadurai has suggested that luxury goods be viewed not so much *in contrast* to necessary goods, but as "goods whose principal use is *rhetorical* and *social*, goods that are simply *incarnated signs*" (see Appadurai 1986:38, 38-41). Here the necessity to which luxury goods respond is fundamentally political and as such constitutes a 'special register' of consumption, which is manifested by special restrictions, complexity of acquisition, complex social message-sending, specialised knowledge as a prerequisite for appropriate consumption, high degree of association between the consumption of luxury goods and the body, person and personality. That is not to say, however, that the exchange of more ordinary goods in any way lacking in strategy or calculation. Rather all exchanges reflect and constitute social relations of various forms (positive and negative, equal and unequal) between individuals and groups (Thomas 1991:7-8).

In his discussion of luxury and ordinary goods, Appadurai points to an important distinction between complex and small-scale societies (see Appadurai 1986:39). In early complex societies the links between luxury and ordinary goods mostly involve the production process: luxury goods tend to have more complex production sequences. In contrast, in less complex societies:

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<sup>10</sup>As Thomas has argued (1991:11-12), early 'Frazerian' ethnographies of 'savage commerce' emphasised pre-modern exchange as primarily or entirely the exchange of utilitarian values; only later through the polemical critique of Malinowski was the role of ceremony and the exchange of luxuries within such 'primitive' systems recognised.

"the connection between luxury goods and goods from other registers of use may involve not the ripples of a complex set of production milieux and forms but critically, the domains of exchange and consumption" (Appadurai 1986:39).

Appadurai also notes that in such societies trade in luxuries may provide a durable framework for the conduct of exchange in other goods (1986-39-40; cf. Smith 1999).

The social arena in which objects are consumed and exchanged also plays its part in defining commodities. The consumption or performance of objects on certain special or ceremonial occasions may often be central to their meaning (cf. Gosden & Marshall 1999:174-5). Marriages may provide the principal occasion on which women are commoditised, while at auctions objects, which normally are considered inappropriate commodities, may become commoditised (Appadurai 1986:15). The competitive nature of auctions and the part they can play in the negotiation of status (cf. art auctions, futures markets) provide a modern example of a common social phenomenon (cf. the medieval trade in relics, the *kula* of Oceania, the potlach) which Appadurai has termed tournaments of value (see Appadurai 1986:21-2, 50-56). Although exchange activities can take place on a variety of occasions, whether regularised and foreseen or opportunistic and by chance, it is during certain special occasions, at special times and in special places that exchanges can have the greatest impact in the strategic and competitive negotiation of power, value and status (tournaments of value) by individuals and groups. On such occasions the objects exchanged act as tokens of value, essentially as signs in a system of status, which can be transformed into other media only by a complex set of steps and only in certain circumstances (Appadurai 1986:50).

### 3.8 Cultural Biographies of Objects

In this way one can argue, with Appadurai (1986) and Kopytoff (1986), that rather than searching for the distinction between commodities and things, one should focus on studying the *commodity-potential* of all things through the total trajectory of their existence from production through exchange to



consumption (Appadurai 1986:13). In this way objects, like persons, are not what they are made, but what they become in their social lives (Thomas 1991:4):

"even though from a *theoretical* point of view it is human actors which encode things with significance, from a *methodological* point of view it is the things-in-motion that illuminate their human and social context" (Appadurai 1986:5).

By focusing in this way on objects rather than on the forms or functions of exchange, it becomes possible to argue that that which creates the link between exchange and value is politics or strategy. Bourdieu's notion of habitus allows one to see the relationship between humans and objects to be viewed as dynamic, with humans as knowledgeable actors dynamically creating/recreating, using and redefining material culture with objects being both the means by which this is achieved and also the frames which guide future activity (see Miller 1985). In this way society constructs people in just the same way as it constructs objects (Kopytoff 1986:90).

The idea that objects have biographies is a particularly useful one since it acts as a metaphor for the re-unification of the three main activities which lie behind the social significance of material culture, namely production, circulation and consumption (see Gosden & Marshall 1999; Tite 1999). During its life an object may be understood to accumulate knowledge at key points in its life (see Appadurai 1986:41-3). Thus, immediately following production an object is likely to reflect, at least to its producer, a fairly standardised set of technical practices as well as a series of social values surrounding its place within a system of material categories. Once an object is exchanged it acquires both value and biography. During its life such an object may increase in value and may acquire an ever more lengthy biography, depending on the number of times it is transacted, the contexts within which it is consumed and the status of the individuals through whose hands it passes. In this way the significance of an object at any one moment in its life may be derived from the persons and events with which it has been associated (Kopytoff 1986; Helms 1993:146-159; Gosden & Marshall 1999). If so then this in turn presupposes that objects acquire oral narratives documenting the individuals and events which have played a role in the life of the object. In this way past exchanges, preserved in oral narrative, maintain

the value of such an object. Thus the object itself, on certain specific occasions of its consumption, may act as a cue for a story which simultaneously enhances the value of the object and the reputation of the owner/storyteller (Helms 1993:160-70). Kopytoff has suggested that within small-scale societies individual social identities are relatively stable and unambiguous with changes in them conditioned more by 'cultural rules' than by 'biographical idiosyncrasies' (see Kopytoff 1986:89). Drastic or unusual changes in status or identity, which defy existing social classifications, be they in object or person are likely to result in either being taken out of circulation, whether sacralised, isolated or cast out: "What one glimpses through the biographies of both people and things in these societies is, above all, the social system and the collective understandings on which it rests."

### Conclusions

It is therefore clear that material culture plays an active role in the reproduction of social relations and social values. In this way the knowledge and techniques which lie behind the production, circulation and consumption of ceramic vessels can thus be understood in terms of social and material possibilities and constraints (cf. Mahias 1993:162). Acts of production create and recreate social categories, which once they enter the world of consumption and exchange become subject to different classifications, are transformed through different estimations of value and acquire different oral biographies (cf. Miller 1985:13). Through this ongoing dialectic process people define and are defined by their material surroundings. Thus the integrated study of production, consumption and exchange has the potential to reveal something about how these material worlds were socially constituted. In this way one might define the aim of material culture studies as the achievement of a

"model capable of representing the complex nature of the interaction between social strategy and artefactual variability and change. It is inevitable that some of this sophistication should be lost with the formation of the archaeological record, but this loss should be regarded as such, rather than minimised by starting with a limited social theory more compatible with the paucity of evidence" (Miller 1985:4).

Realisation of the complex nature of this process forces one to acknowledge the importance of context. Thus in the next chapter an attempt will be made to

outline some of the potential conditions, material and social, within which objects might have been produced, consumed and exchanged in small-scale pre-modern societies, comparable to those of the Neolithic Aegean.

## CHAPTER FOUR

### CONSTRUCTING AN INTERPRETATIVE FRAMEWORK

"It is unlikely that a realistic general understanding... [of material culture] will come easily or that such an understanding will produce some handy simple formula of ready utility to archaeologists... Rather, we must be prepared to commit ourselves to face squarely the complexity of the phenomenon and to commit ourselves to a rigorous long-term pursuit of the anthropological study of material culture" (Dietler & Herbich 1998:234-5).

"An understanding of the variability of material objects... is inseparable from an understanding of those forces which create social variability" (Miller 1985:1-2).

#### 4.1 Typology, Analogy and Interpretative Frameworks

As anthropology and ethnoarchaeology have made abundantly clear, the relationship between the material and the social is one of extraordinary complexity. As Dean Arnold has noted,

"Once an ethnoarchaeologist gets into the thick of a culture through participant-observation and begins examining the cognitive and behavioural variation of potters, for example, the complexities of ceramic production are mind-boggling and seem to defy generalization" (D. Arnold 1992:324).

For the prehistoric archaeologist, faced with archaeological contexts where understanding can no longer be guided by non-material forms of testimony, this sort of realisation might seem to suggest the futility of interpretation. Although anthropology and ethnoarchaeology can provide us with countless cautionary tales, how can we apply this sort of context-specific information to archaeological examples without simply projecting an ethnographic case study into the past?<sup>1</sup>

##### 4.1.1 Typological Models

The way in which anthropologists and archaeologists have sought to resolve this dilemma has been mainly through the search for cultural universals or ideal types (see discussion in Miller 1985:5, 161). Through the study of specific anthropological and ethnographic examples, a wide range of different typologies have been generated, which claim to define different forms of human behaviour, such as forms of social organisation (cf. Fried 1967; Service 1975) modes of

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<sup>1</sup> cf. comments of Miller (1985:198, 203).

production (cf. van der Leeuw 1977; Peacock 1982) or exchange (Renfrew 1975). Neoevolutionary theories of social evolution assert that in cases of pristine development, cultures will pass through a series of stages, from simple to complex, with each stage representing a characteristic set of economic, social and political relationships: e.g. band, tribe, chiefdom, state. Likewise typologies of production organisation, although often employing a variety of dimensions of variability (scale, intensity, degree of specialisation, degree of elite involvement etc.), all move from simple to complex forms, beginning with non-specialised production within the domestic group or household, the so-called Domestic Mode of Production (DMP) (see Costin 1991:6-9). Unsurprisingly, different modes of production are often said to correspond to different stages of social evolution: in this way 'simple' 'egalitarian' 'Stone Age' societies, including those of the Neolithic Aegean, are thought to have produced under the DMP (Sahlins 1974; Halstead 1981). It is a common belief that these stages actually reflect a reality: societies are in equilibrium and when change takes place in one sphere, such as economy, it triggers wholesale change in other spheres so that society moves as a unit to the next stage.

One of the perceived advantages of this approach was that each type was thought to have a distinctive archaeological signature, consisting of a checklist of traits. All one needed to do was to identify the presence of these certain traits in the archaeological record and one could flesh out the rest of the data with an already developed body of anthropological theory. In this way typology may be termed a top-down approach, since it approaches the material record from a higher level of generalisation; its premise being that this sort of generalisation is both possible and useful. Unfortunately, however, the validity of such approaches is called into doubt when attempts are made to see beyond their generalising facade. Thus, when supposedly 'simple' societies are examined in detail through such criteria of complexity as size, variety of specialised roles and the number of mechanisms needed to make them function, it becomes clear that the simple-complex distinction is itself too simple: for example, when later Pleistocene and early Post-Glacial hunter-gatherers, such as the Jomon, are assessed using these

more detailed criteria, they emerge as complex socio-economic entities (see Price 1981:56-63). Likewise, when modes of production are examined in more detail serious weaknesses appear. For example a recent ethnographic study of domestic production among 'nonspecialised traditional potters' in Veracruz (Mexico), although seeking to construct a 'middle-range theory' for domestic ceramic production, actually found that the range of production behaviours was 'startling', forcing the conclusion that "models of pottery-making that ignore this degree of variability may provide very narrow interpretations of the past" (P. Arnold 1991:60).

The existence of considerable variety within types undermines the basic premise of typologies, that ancient situations will always cluster neatly around idealised types. What becomes clear is that to attempt the grouping of this variety in terms of one type of organisation is not only extraordinarily reductive in the way it condemns diversity, complexity and variety to a limited number of stereotypes, but also risks imposing modern ethnographic scenarios upon quite different past situations. Simple applications of idealised modes of production may actually obscure more than they reveal. Thus for example, the levels of production output measured by P. Arnold (1991) amongst the Veracruz potters, supposedly working within the DMP, are far higher than the output estimated for early potters in the Neolithic Aegean (see Chapter 2) and therefore suggests a quite different social and economic context. Costin, in her detailed review of craft specialisation has argued that we must move beyond typologies and work at a greater level of detail: "while typologies are important for their organisational value, what is more basic for archaeological studies is our ability to distinguish among parameter values... and to understand why different parameter values occur under different social, economic, political and environmental conditions" (Costin 1991:9; cf. Barrett 1994:2-5, 32-7). In this way, the potential complexity of the relationship between the material and social worlds is not something to be simplified and generalised, but rather embraced as a rich source of information about past societies (Miller 1985:1-2)

#### 4.1.2 Ceramic Ecology

Within ceramic studies an alternative response to the dilemma of interpretation has been the development of the field of ceramic ecology, which posits that there exists an underlying ecological structure to the complexity of ceramic technology. This approach, most notably through the work of Dean Arnold (see D. Arnold 1985), has produced a rich and extremely useful database of information on the relationship between modern ethnographic potters and their ecological environment. Unfortunately, however, there has been a tendency amongst practitioners to use ceramic ecology as a set of universal rules for the interpretation of archaeological potters. Thus D. Arnold has suggested that "one of the ways to circumvent the problem of the limitation of analogy is to build a ceramic theory based upon the unique physical and chemical characteristics of the ceramics themselves" (D. Arnold 1992:334). However, this sort of application of ceramic ecology imposes an abstract set of rules, which can *in extremis* amount to a form of ecological determinism. Arguably one can view ceramic ecology in reverse. The many examples of environmental constraints can in many cases be reinterpreted as instances of dynamic innovation by potters to cope with extreme conditions: compare, for example, the elaborate methods devised to dry pottery in areas of heavy rainfall or the ways Alaskan Inuit have overcome harsh arctic environments to maintain pottery as a minor craft for centuries (Brown 1989:204). In fact, these examples are extreme exceptions; as has already been emphasised (see Chapter 3; van der Leeuw 1993), most potters have operated in an environment which allowed them a wide range of potential solutions to the task of ceramic production. And so, far from circumventing the problem of analogy, the application of ceramic ecology as a set of cultural universals comprises yet another example of how analogy can be misused. That is not to say, however, that ceramic ecology is without use. Rather the problem lies in the *way* ceramic ecology has been employed to construct a culturally-universal, and therefore ahistorical interpretative framework: here ceramic ecology has been allowed to develop from a heuristic device to become the 'reality' of a given situation.

It is widely recognised that nothing will ever be *proven* about the past using ethnographic analogy (see references in Barrett & Fewster 1998:848). However explicit recognition of this is not the problem but rather the solution: as long as ethnographic analogy, whether through typological models or ceramic ecology, is always presented not as proof, but rather in terms of potential possibilities or constraints on existence, then it remains a powerful tool in the exploration of past societies (see Barrett & Fewster 1998). Thus a commitment to the potential complexity of the material and social world, far from emphasising the futility of the archaeological exercise, is the key to further understanding. As Miller has emphasised, since material culture acts to constitute social relations at the level of the habitual and mundane (cf. Chapter 3) it may be less open to explicit refutation and confrontation and thus detailed study of material culture may be a powerful means of understanding social relations, equal or even superior to direct enquiry as a form of investigation (Miller 1985:11-12, 67, 191-3, 197-8).

In this way Arnold's many examples and calculations, such as average distance of production location to clay or temper source, provide an extremely useful indication of some of the ecological *possibilities* and *constraints* on the activity of potters. They do not in themselves, however, constitute the sort of generalised cross-cultural rules demanded by Middle-Range Theory, nor are they the only constraints and possibilities active upon potters. In Chapter 3 it was argued that social and cultural constraints and possibilities also play their part and an understanding of acts of production, consumption and exchange is not possible without an exploration of this social, political and economic context. Within ceramic studies of production there is widespread agreement that study must proceed beyond the *what* to the *why* and *how* (Stark 1985:172; Rice 1987:17; Arnold, P. 1991:2). For example, Costin has proposed a similarly integrated contextual approach to the study of production organisation, suggesting that production should be characterised in terms of context (social, political, economic), concentration (spatial relationship between producers and consumers, distribution), scale (size, composition of production unit) and



intensity (efficiency, risk, scheduling) (Costin 1991:11-18). These four parameters can be studied through different categories of archaeological data and through a variety of analytical techniques (see Costin 1991:18-43; Chapter 5).

Since the point of contextual analysis is that it relates apparently disparate sources of evidence to make each the context for the other (Miller 1985:201), one of the clear advantages of approaching ceramic material culture from the three different angles of production, consumption and exchange is that each generates a separate picture of the social significance of material culture which at a later stage can be compared, contrasted and finally incorporated with the other two to generate a detailed picture of the socially-significant lives of ceramic vessels. In Chapter 2 a contextual approach was taken to previous studies of early ceramics in the Aegean and Anatolia: by bringing these different interpretations together it proved possible to identify particular areas of difficulty and contradiction. In the next section (as well as in subsequent chapters) a similar approach will be taken: the body of anthropological theory generated around the DMP model will be outlined and its specific application to the Neolithic Aegean compared and contrasted both with the original model and with the archaeological data. This section will focus in particular on outlining the sorts of social processes and structures which might play a part in the production, circulation and consumption of material culture in such societies. In the process a series of themes and concepts will be generated which will form the basis of discussion in Chapters 10-13. In this way, through the careful characterisation of archaeological data alongside a structured use of ethnographic analogy, it is hoped that an understanding can be gained of some of the social and material possibilities and constraints active upon activities of production, consumption and exchange within communities of the Aegean in the earlier Neolithic.

#### **4.2 The Domestic Mode of Production (DMP)**

Household production purely for household consumption, as demanded by the self-sufficiency hypothesis originally proposed for Neolithic societies (see Chapter 2), can in reality only exist as an abstract theoretical impossibility:

"the domestic mode of production can only be "a disarray lurking in the background", always present and never happening. It never really happens that the household by itself manages the economy, for by itself the domestic stranglehold on production could only arrange for the expiration of society. Almost every family living solely by its own means sooner or later discovers it has not the means to live" (Sahlins 1974:101).

The reasons for the basic inviability of the individual household have their origins in a number of features common to 'primitive societies; namely that in general and by nature the DMP is characterised by underproduction oriented only towards the production of livelihood, which leaves the isolated household at risk of extinction due to its own varying productivity, itself a result of fluctuations in available labour and/or potential environmental failure (see Sahlins 1974:41-99 for more detailed discussion).

#### *4.2.1 The Definition of the Household as a Social and Economic Unit (see Sahlins 1974:74-9)*

It should be stressed that the concept of the 'household' or 'domestic group' may not always equate to modern notions of the nuclear family. Family may cover a variety of specific forms and at times the immediate family may be submerged in a variety of more extended kin groupings (e.g. polygamy, matrilineal, patrilineal). In addition households in some communities may be composed not just of families, but also of people of a certain age or status<sup>2</sup>. That said, in most societies the institution of marriage does establish, even in a general way, a social and economic domestic group - the household - "constituted to produce the local conception of livelihood" (Sahlins 1974:79). Within this group the principal relations of production are generally structured by the inner relationships between man and woman, young and old. Through the pooling of goods and services within the household, and particularly the daily ritual of commensality, the household simultaneously identifies and constitutes itself as a unit and differentiates itself from other households within the community (Sahlins 1974:94-5).

4.2.2 *Underproduction, Under-Use of Resources and Household Failure* (see Sahlins 1974:41-74, 82-99)

Through a series of examples Sahlins demonstrates that a singular feature of 'primitive societies' is that their exploitation of productive resources, such as subsistence, always falls far short of what could in theory be possible with their available technologies. Thus, for example, ethnographic studies of slash-and-burn agriculture, which have estimated the potential carrying-capacity of land under cultivation and compared this to actual population figures, have revealed a considerable degree of underproduction. This under-exploitation of resources extends also to labour: although comparative ethnography suggests that some societies work harder, longer or more productively than others, none of these societies ever make full use of the potential labour available. In some cases, such as /Kung Bushmen or Bemba chiefdoms, there is a potentially problematic economic imbalance between 'the indolence of youth and industry of elders' (Sahlins 1974:53). Such a curtailment of the potential lifetime working span must arise out of specific social or cultural values and circumstance rather than out of any desire for economic optimisation. Ethnographic studies of the normal working days and weeks of men and women in 'primitive' agricultural societies, although suggesting considerable variation in the way different tasks are organised between the sexes, always indicate an 'unstrenuous' programme of activity with numerous periods of leisure, which is perhaps only modified during busier periods of the agricultural calendar, such as harvesting (Sahlins 1974:56-68). Thus labour in such societies does not appear to be a scarce resource; although it should not be forgotten that labour still requires mechanisms for its mobilisation and organisation (see below).

It seems therefore that the principal reason for this general underexploitation of resources is that such societies are not structured in ways which seek to maximise their economic effectiveness, but rather the opposite: their social organisation seems actually to be determined by other criteria, which

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<sup>2</sup> In this way individual identity in such communities may be constructed upon a variety of criteria and may be manifest in the simultaneous membership of a series of overlapping groupings, based variously on immediate family, kin, age, gender and status.

may at times even hinder their adaptive potential (Sahlins 1974:48-9, 53-5). Such societies appear to operate under the apprehension of resource abundance, with material wants, which are finite and few, and an available and undiminishing capacity to procure them (see Chapter 2 n.13). This type of production has been described by Sahlins as one directed purely towards the maintenance of the livelihood of the producers (Sahlins 1974:68-9, 82-6). Such societies 'underproduce', through the under-exploitation of their resources and their labour potential, simply because this activity is sufficient to satisfy their material and spiritual needs - any additional increase in labour would be needlessly excessive. Sahlins explains the workings of 'production for livelihood' through a contrast drawn between 'production for use' and 'production for exchange' (Sahlins 1974:82-6). In the former, production is oriented towards the provision of livelihood and not towards the creation of surplus, wealth or profits. Importantly 'production for use' envisages a certain amount of exchange, since people in all societies "remain constant in their pursuit of use values, related always to exchange with an interest in consumption, so to production with an interest in provisioning" (Sahlins 1974:83). In contrast 'production for exchange', does not seek 'determinate and finite objectives', but rather 'as much as possible': as a result 'production for exchange' favours the development of economic intensification (e.g. the accumulation of 'wealth', the investment of capital, increases in economic efficiency), which is best achieved through social structures existing beyond the family (Sahlins 1974:102). 'Production for use' is characterised by underproduction and a satisfaction with sufficiency, 'production for exchange' by the intensification of production and the desire to acquire more.

A third characteristic of the DMP is the tendency amongst some households "persistently to fail to produce their own livelihood, although organised to do so" (Sahlins 1974:69). This failure in part results from varying subsistence yields resulting from a variety of factors from environmental failure, to the inevitable periodic variations in available labour force within the household. In any large community over time it is natural that households will vary in size and composition leaving some individual households particularly at

risk of economic failure. Sahlins argues, however, that this tendency to failure is compounded by an 'antisurplus principle' (Sahlins 1974:86-92): since the DMP is oriented solely towards the production of livelihood, it has the tendency to produce only that which is needed and not that which is above the producers' immediate requirements: "nothing within the structure of production for use pushes it to transcend itself" (Sahlins 1974:86). However, this is something of an overstatement since these immediate requirements will always include a 'normal surplus': producers' perceptions of sufficiency are always likely to exceed the basic level of subsistence, at least in part as a deliberate strategy to offset the risk of failure (Halstead 1989; cf. Sahlins 1974:86).

#### 4.2.3 *Community, Kinship, Household* (Sahlins 1974:92-9, 123-30)

In this way, the DMP is constructed upon a theoretical contradiction (see Sahlins 95-9). Although it describes a society composed of many separate individual producing units, which should in theory encourage a centrifugal tendency towards the fragmentation of communities and the dispersal of individual households, potential household independence is compromised by the long-term inviability of the truly isolated household. Thus, in order to ensure their survival, individual households must be able to mobilise external labour and cultivate external ties of obligation which can be relied upon at times in case of economic failure (cf. Childe 1981:87-8; Halstead 1989) as well as for other reasons. This means that the division of labour within such societies is never purely internal to each household; rather the production of different things may demand different degrees of cooperation, which can result in production being organised "in diverse social forms and sometimes at levels higher than the household" (Sahlins 1974:78). Of these social forms, the most important are kinship relations, since these both act to link individual households, thus countering the centrifugal tendency of the DMP, and serve to give wider expression to the domestic concern for livelihood, thus reducing the centripetal tendency within individual households (Sahlins 1974:123-30). Examples of the

latter are the varied mechanisms employed by households designed to resist the obligation to share, even amongst close kin (see Sahlins 1974:125-7).

This long-term reliance upon the cultivation of external links, either within the community or beyond, effectively forces households to engage in a range of exchanges (cf. Halstead 1989:73), which to some extent places them in competition with each other. Sahlins has argued that the need to create and fulfil social obligations may act as a major incentive towards overproduction or production beyond livelihood, however, as emphasised by Halstead, the normal surplus produced by households seeking only self-sufficiency could have been used competitively in this way without the need for further increases in production (Halstead 1989:73). And so, since in the DMP producers always retain some sort of control over their economic means, social competition tends to be played out in other arenas (Sahlins 1974:94): "The political game has to be played on levels above production, with tokens such as food and other finished goods; then, usually the best move, as well as the most coveted right of property, is to give the stuff away". Thus competition tends to be played out at the level of consumption and exchange. In general anthropologists have tended to focus upon household relations with respect to their place in production rather than consumption (Miller 1995b:274), however it is clear that households will strategically engage in acts of consumption (above all commensality) and a variety of forms of exchange, including sharing, gift-giving, exogamy and even trade, all of which serve to define reputation and status as well as encouraging reciprocity and obligation.

One conclusion to be drawn from this discussion is that within the DMP, acts of production, exchange and consumption all interrelate as part of an integrated social system, based not on economic necessity, but on a series of social values and social relationships (cf. also comments of Bourdieu 1977:175-6). Despite the tension between the duty to share (amongst kin) and the desire to hoard (within the household), instances of serious conflict tend to be rare (see Sahlins 1974:127-9). Indeed the general stability shown by 'primitive' societies must be one of their most remarkable features. Sahlins has described this in terms

of a negative feedback relationship producing a persistent state of equilibrium, which could only change through "an historic conjuncture of additional and external contradictions" (Sahlins 1974:87). However as argued in Chapter 3, it is perhaps better to think of change in terms of a process and to view the main elements of the DMP (small labour force, simple technology, finite objectives, necessity of links beyond the household) not as simply balancing each other out but as elements within a dynamic process of social reproduction, which sought through its own social values and institutions to maintain cohesion.

It should be stressed that the DMP should not be seen as a *single* integrated social system (see Sahlins 1974:74-8). The DMP is not a strait-jacket, but rather a generalised outline of the internal dynamics of such societies. Thus, within the basic model of the DMP there is considerable potential for variation in areas such as social organisation, the organisation of production, the division of labour. For example amongst the many examples given by Sahlins, some societies work considerably harder and are more productive than others (Sahlins p.38-9, 52); in some women are excluded from agriculture and thus have more leisure time, in others women play a more prominent role (cf. Sahlins 1974:54). Such examples emphasise that in the DMP much depends on the myriad different ways in which such societies constitute themselves socially. Thus consideration of the DMP awakens us to the possibilities of and the potential constraints on existence in such societies, it helps prevent us from importing too many modern economic notions and most importantly it provides us with propositions regarding the organisation of production, and the importance of exchange and consumption, which have the potential to form testable hypotheses (see below and Chapter 5).

### **4.3 The Application of the DMP to the Study of Production, Circulation and Consumption in Neolithic Greece**

#### **4.3.1 Identifying the Household in Neolithic Greece**

The most important and influential application of the DMP in an Aegean Neolithic context is found in the work of Halstead (Halstead 1981, 1989, 1995, 1996, 1999). Halstead suggests several converging lines of evidence in favour of

the archaeological identification of the household in Neolithic Greece (Halstead 1999:79-81).

- (1) Variety in size and construction techniques of structures in different settlements and the presence of house models suggest that house type is not simply a function of available raw materials, but reflects something more fundamental about the way Neolithic villages were structured;
- (2) Rare examples of relatively complete interiors preserve a broad tool-kit consistent with a social group of mixed age and sex performing a wide range of tasks;
- (3) Most free-standing structures range in size between 20-70m<sup>2</sup>, suggesting an occupying group consistent in size with individual families.

Although not without its problems (Halstead 1999:81; see below), the likely identification of the household sanctions further study of the archaeological data within a framework based on the DMP.

#### 4.3.2 *Early Agriculture in Greece*

Halstead has argued that the traditional 'Mediterranean' pattern of land use, involving the co-existence of extensive cereal cultivation, local specialisation in vines or olives and pastoralism, could only have emerged during social, environmental and economic conditions which were first prevalent in later prehistory (second millennium BC) (Halstead 1996:301-2). Extensive cereal cultivation involves the working of large landholdings using labour-saving crops, such as cereals, and labour-saving methods, such as animal traction and is marked by inequality of land ownership.

In contrast, early Greek agriculture seems to have involved the labour-intensive year-round<sup>3</sup> cultivation of small plots of land (see Halstead 1989:70-1; 1996:301-3): the archaeobotanical record suggests that labour-intensive pulses were grown as frequently as cereals; the range of crops grown is 'strikingly wide'

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<sup>3</sup> Whittle has argued that settlement in early farming villages in Greece may have been seasonal rather than year round (Whittle 1996:50-54, 69-71); however Halstead has effectively rebuffed this



in comparison with early agriculture sites in Central Europe (Halstead 1996:303); limited study of crop-weeds is consistent with intensive horticulture; there is no evidence for the use of animal traction; there is a lack of evidence in the palynological record for extensive agricultural land clearance until much later in prehistory. In addition, the predominance of sheep (in a relatively wooded environment) and the decrease in the size of domestic cattle and pig over time (suggesting a lack of accidental interbreeding with wild variants) when taken together suggest that stock husbandry was also small-scale with animals under close-supervision, probably confined to cleared areas. Mortality patterns suggest that these animals were managed on a 'meat' production strategy and, although this does not mean that other dairy products were not produced, this suggests that stock husbandry was not geared towards maximising the energy yield (i.e. the 'milk' strategy of pastoralism) (Halstead 1989:70). The manure from these animals, especially if they were confined to cleared areas, would have been a valuable resource maintaining the fertility of small arable land-holdings (Halstead 1989:70).

In this way early Greek agriculture seems to have involved small-scale labour-intensive horticulture. Such a system does not seek to intensify yield, but rather resembles 'production for livelihood'. Although the 'meat' strategy could be described as underproductive, when taken in conjunction with the variety of crops grown, it becomes clear that as a system this form of agriculture provide a very stable diversified base which could effectively minimise the risk of environmental failure (see Halstead 1981:310-11; 1989:72-4; 1996:303). This feature of early Greek agriculture helps to account for the extraordinary longevity and stability exhibited by early farming communities, with some villages apparently in continued occupation for millennia (Halstead 1989:70).

A stable subsistence base on its own, however, does not ensure cohesion and stability. Using Sahlins' formulation of the basic inviability of the single household, Halstead has argued that individual households must have relied on

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interpretation through his demonstration (using faunal and floral remains) of year-round occupation (see Halstead 1999:77-8).

periodic assistance from the wider community, both to offset fluctuating labour availability and as a further measure against environmental failure (Halstead 1989:73-5; 1996:304-5). Such assistance was ensured by the cultivation of social relationships beyond the household, which probably took the form of networks of alliances and obligations between different households and communities, such as marriage alliances, visiting relationships, exchange partnerships (Halstead 1999:89). The nature of these exchanges is likely to have changed with increasing social distance (Halstead 1989:74-5).

Such exchanges within and between communities must have included food, but also probably involved exotic materials, such as obsidian and artefacts such as stamp seals and ceramic vessels (Halstead 1989:73-4). In support of the importance of ceramic vessels Halstead notes the existence of large style zones for EN-MN fine pottery in Thessaly, but is forced to acknowledge that there is little evidence for the actual movement of vessels (1989:74, 1995:14). Halstead suggests that the scale at which such finished goods circulated in the Neolithic, when compared to later prehistoric exchange, was small (Halstead 1981:307). The distances over which stylistic unity was maintained in Thessaly are considered to be less than the distances over which lithic raw materials moved but far greater than those necessary to secure marriage partners (Halstead 1995:14, 1999:78-9).

#### *4.3.3 From Sharing to Hoarding: Changing Emphases on Community and Household During the Neolithic*

Halstead has argued that the transition from a foraging economy to a labour-intensive agricultural economy required a move from an ideology of sharing to an ideology of hoarding (see Halstead 1995:16-19, 1999:80-1). Although the architecture of Greek EN-MN houses may have encouraged domestic isolation, this was countered by the crowding together of houses (Halstead 1996:305) and the location of many cooking facilities in the open spaces between houses, which together suggest the social sharing of food (Halstead 1995:16-17) and perhaps other commodities. Such a sharing of cooked

food is in many modern ethnographic societies an index of kinship, which favours social cohesion and will have contributed to the stability of early farming communities (Halstead 1995:17). It should be noted however that the sharing of food should not be overestimated. As noted by Andreou et al. (1996:559) for northern Greek Neolithic sites, in addition to cooking installations located in open spaces between houses, there are also ash pits within houses. This pattern can also be seen at ENI Knossos, where the data (although limited) suggest that during ENIa-b there were numerous ash pits within structures as well as special built cooking facilities located outside (cf. inside and outside House C; see Chapter 13). These examples indicate that not all food was cooked communally and thus suggest that not every meal was shared. This does not so much detract from the hypothesis of sharing as add to it since it emphasises the special significance of those occasions when food was cooked and shared with other households.

This emphasis on sharing seems to have changed during the course of the Neolithic. The LN-EBA colonisation of agriculturally marginal areas and the concomitant increase in the risk of subsistence failure seems to have been accompanied by changes in the internal organisation of settlements (Halstead 1995:17-18, 1999:80-1). Previously open villages are now organised into courtyard groups, which would have hindered sharing between households; furthermore in many FN-EBA settlements cooking facilities are now placed in internal extensions or in closed yards. It is perhaps significant that this final architectural isolation of the household is at times accompanied by the appearance of house models (Halstead 1996:305-6). In addition this phase sees an increase in deep pits, particularly suitable for the long-term storage of agricultural surplus, which may suggest an increase in hoarding. Finally, it has been argued that an increase in the relative importance of the hunting of wild animals during the EBA may also in part result from the progressive isolation of the household as an economic unit (Halstead 1999:83-6). As Halstead notes, such developments would have facilitated the unequal accumulation of wealth and status; it is perhaps thus unsurprising that this phase sees the first evidence

for such inequalities (see Halstead 1995:18). This use of spatial organisation as an index of changing social organisation has also been variously applied to early farming villages in the Near East (cf. Byrd 1994; Kuijt 2000).

#### **4.4 Problems Associated with the Application of the DMP to the Earlier Greek Neolithic (EN-MN)**

Halstead's interpretation of the evidence for early agriculture within the framework of the DMP represents an important step forward in our understanding of how earlier Neolithic societies were constituted. Significantly, it suggests that within the context of the Aegean Neolithic, exchange was not the epiphenomenon predicted by the old Neolithic self-sufficiency model, but was likely to have been a key feature ensuring the continued existence of early agricultural societies. This helps to explain the heightened awareness of the importance of exchange already noted (see Chapter 2) in recent general syntheses of production, circulation and consumption in Neolithic Greece, Anatolia and the Aegean (cf. Andreou et al. 1996:558-60).

However, perhaps inevitably in work which seeks to understand the economic basis of such societies, Halstead at times overemphasises the economic explanation of behaviour. Thus the emphasis on risk-management as the principle force promoting exchange and social contacts, although important, runs the risk of neglecting the important place, in competitive acts of consumption and exchange, of power, the construction of status and the negotiation of individual and group identity. Problematic also is the assumption that producers necessarily had a right to their own produce. It has been argued that the idea that people have a 'natural' right to the products of their own labour is a core assumption of Western philosophy: in contrast in Melanesia, where people are more interested in exchange than production, products are understood as having a natural relation to their intended destination rather than those who actually produced them (Strathern 1988; Thomas 1991:16).

#### 4.4.1 Searching for Direct or Independent Household Storage in the Earlier Greek Neolithic (EN-MN)

A more serious problem is the contradiction between, on the one hand, the consistent archaeological evidence in earlier Neolithic (Greek EN-MN) communities for the importance of sharing and the slow architectural and ideological isolation of the household, and on the other the tacit assumption that the household was *always* the principal social and economic organisational unit of the Greek Neolithic (cf. Halstead 1999). This assumption can be seen in the consistent emphasis placed on 'direct storage' of normal agricultural surplus, perhaps in ceramic vessels, within even the earliest households (cf. Halstead 1989:71, 1996:304-5). Here Halstead seems to be influenced by Flannery's emphasis that communities architecturally divided into households, as even the earliest farming settlements in the Old and New Worlds appear to have been, reflect the disappearance of an ideology of sharing associated with hunter-gatherers and the manifestation of an ideology of hoarding from the very beginning of the Neolithic (Flannery 1972; cf. Halstead 1995:12-13; 1999).

Crucial to the argument is the supposed evidence for direct and independent household storage of surplus and thereby evidence for direct ownership by producers of their products. Unfortunately, however, and as Halstead admits, this data is 'sparse' (Halstead 1999:82) and Neolithic methods of storage are 'not certain' (Demoule & Perlès 1993:362). What evidence exists is also late in date; the earliest adduced examples date no earlier than MN: for example the carbonised grain within houses at Servia is MN (Halstead 1989:71-2). However, the key issue is not whether storage was taking place within the household at all - households could not have functioned otherwise - but rather whether households stored within their walls all that they required for the year, including their normal surplus. The likely use of non-ceramic containers, such as the clay or dung-lined baskets which may have been used at Tsangli (Halstead 1989:71), means that this question can never be satisfactorily answered. What does seem clear, however, is that storage at the scale required to provision a single household for a year could *not* have taken place using ceramic containers

(see also Chapter 2): two independent studies of EN-MN ceramic vessels both conclude that during this period vessels were neither large enough nor numerous enough to have been able to store all that a household would have required in a year (Vitelli 1989:26-7; Yiouni 1996b:191-2; see Chapter 2). Within this context it may also be significant that the first dedicated ceramic storage jars (pithoi) only gradually come into use during the course of the Greek LN (Cullen & Keller 1990; Perlès 1992:144), a period during which the socio-economic domination of the household is more assured. Further increases in the capacity for individual households to store agricultural produce also occur during LN with an increase in the incidence of deep pits suitable for the long-term storage of agricultural produce (Halstead 1995:17). That is not to say that EN-MN households did not store some produce in ceramic vessels, rather what appears to be absent or at least currently unsupported by the data is the 'direct storage' of all produce required by the household within a year. If such an absence is real, then there must have been some sort of communal storage of agricultural surplus. Admittedly, evidence for such a form of storage is equally sparse, although it is tempting to view as such a cache of carbonised grain at Knossos (stratum X) found in close association with a burnt post-hole structure, which was located *outside* the area of the Aceramic settlement, and thus outside the spatial realm of any individual household.

#### 4.4.2 *Community and Communal Action During the Earlier Greek Neolithic (EN-MN)*

Further support for an early emphasis on the communal, particularly communal ownership, might be the evidence for an unusually large communal building ('clubhouse' or shrine) in a central location in EN Nea Nikomedeia (Demoule & Perlès 1993:386), which contained two very large caches of 'exotic' flint blades, five female figurines, two 'outsized' greenstone axes, two unusual 'gourd-shaped' pottery vessels and several hundred clay 'roundels' of unknown function (Rodden 1964:114; Demoule & Perlès 1993:386; Halstead 1995:n.19). Evidence for burial customs, although invariably late (LN), also suggests an

emphasis on the communal. The rarity of individual inhumations in Neolithic Thessaly and the frequency with human remains are found in a disarticulated state have recently been interpreted as emphasising "the communal and the primacy of *group identity* over the individual" (Triantaphyllou 1999:128, 131-2)<sup>4</sup>. Consideration of the different areas in which communality can be expressed encourages the idea that an erosion of the 'liberal customs of sharing' characteristic of hunter-gatherer societies (Sahlins 1974:10-11), may have taken place more slowly in some areas (e.g. burial) than others (e.g. production), while in others (e.g. commensality) one could argue they have continued to the present day. In this way an emphasis on communality and an emphasis on individuality may simultaneously exist in different areas of practice within the same community.

It should be possible to investigate the slow erosion of customs of communality during the Neolithic and Bronze Age through the consideration of a range of potential archaeological indicators of sharing or hoarding. Thus one might expect within an ideology of hoarding to see a decrease in the popularity of large diameter serving bowls and in the incidence of decorated pottery. At the same time one might expect to find evidence for the appearance of very large storage jars within household contexts<sup>5</sup> and the decline or disappearance of communal burial and/or the appearance of individual interments. One might also expect to see much smaller communities perhaps based on one or two households, since larger-scale storage and an emphasis on hoarding should encourage a 'natural' fissioning process within the DMP (cf. Sahlins 1974). An emphasis on hoarding and accumulation might also be manifest by an increase in

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<sup>4</sup> In a separate study Jacobsen and Cullen (1981) concluded that burial customs during EN-MN, although very diverse, were lacking in elaborate ritual, placed no emphasis on the visibility of the dead and give no indication of social inequality (Demoule & Perlès 1993:385).

<sup>5</sup> It is interesting in this light to consider the Cretan evidence for large specialised storage containers (pithoi), which currently suggest their first appearance during the EBA (David Wilson pers. comm.).

property and/or an extension to the potential range of available material goods, which may ultimately result in the development of forms of social inequality<sup>6</sup>.

Evidence for an early organisation of production beyond the household is provided by Miller's study of shell bead manufacture at EN and LN Franchthi (Miller 1996). Detailed re-analysis by Miller demonstrated that while in EN it required an enormous labour investment to produce a single EN necklace, in LN changes in the production process made it possible for one necklace to be made by relatively few individuals. This has been interpreted by Vitelli as indicating that EN production of bead necklaces was "a collective undertaking by some portion of the Franchthi community", while later LN production, because of greater efficiency, could have been an individual (or household) undertaking (Perlès & Vitelli 1999:104-5). Halstead has come to similar conclusions regarding the patterns of animal exploitation by individual households at LN Dhimini (1992).

Finally it is worth looking beyond the Aegean to recent work on early farming villages in the Near East. Through a detailed analysis of changing spatial organisation at the Neolithic site of Beidha, in the southern Levant, Byrd has argued that during the earlier stages of the Neolithic evidence for a more restricted social network for sharing production and consumption activities (increase in distinction between public and private space, greater architectural discreteness, relation between boundaries, access patterns and open spaces) is accompanied by the development of more regulatory mechanisms for the *integration* of the community as whole (Byrd 1994:639-661). It is argued that the continued role of 'community regulatory mechanisms' is manifested in the construction of non-domestic buildings situated near the centre of the village or bounded open spaces used for group gathering (Byrd 1994:644, 656-8). These non-domestic buildings were distinguished on the basis of their lack of evidence for domestic activities along with a series of attributes which set them apart from other dwellings, such as greater structural complexity, greater labour investment, raised stone-slab platforms. Byrd interprets these buildings as corporate or

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<sup>6</sup> It is interesting that the first potential signs of social inequality within a settlement, manifested at Sesklo in an apparent inequality in access to fine ceramics, occur only in the last sub-phase of MN (MNIIIb) (see references in Demoule & Perlès 1993:384-5).



integrative buildings, which perhaps acted as "a venue for conducting suprahousehold meeting and decision-making activities, and possibly related ceremonial or ritual activities" (Byrd 1994:657). It is tempting to interpret the public building at EN Nea Nikomedeia in a similar light.

When all this is taken in conjunction with evidence for the gradual architectural and ideological emergence of the household during the Neolithic, an alternative proposition emerges: that in Greek EN-MN settlements, the household may not have been the primary social and economic unit, but may have been subordinate to larger groupings, perhaps based on kinship relations or perhaps other ideals of communality, which might in effect constitute forms of production organised beyond the household. If so then the later (approx. LN) architectural and ideological emergence of the household (Halstead) would also be accompanied by the final emergence of the household as the primary social and economic unit. The same period may also have seen the first emergence of direct household (social) storage<sup>7</sup> and thus possibly a new sense in which the household 'owned' the products of its labours. Regarding the possibility of an organisation of production *beyond the household* during the earlier Neolithic, it is worth repeating the comment of Sahlins that within the DMP, production can be organised "in diverse social forms and sometimes at levels higher than the household" (Sahlins 1974:78). In Chapter 11 the ways in which Cretan ENI-II ceramic production might have been organised will be investigated further.

If the earliest farming communities in Greece organised production in a form which perhaps combined household labour with some sort of communal organisation and communal ideology, then this would suggest a slightly different interpretation of the evidence for an ideology of sharing. Bourdieu has noted that within small-scale pre-modern societies collective action of any sort (but especially feasts) contributes powerfully towards group cohesion and group stability:

"Moreover, when the conditions of existence of which the members of a group are the product are very little differentiated, the dispositions which each of them exercises in his

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<sup>7</sup> cf. first appearance of dedicated storage jars during Greek LN (Cullen & Keller 1990; see above).

practice are confirmed and hence reinforced both by the practice of the other members of the group (one function of symbolic exchanges such as feasts and ceremonies being to favour the circular reinforcement which is the foundation of *collective belief*) and also by institutions which constitute collective thought as much as they express it, such as language, myth, and art." (Bourdieu 1977:167).

In this way in communities of the earlier Neolithic, commensality, along with other forms of collective activity such as production, may have been more than mere economic necessity, but actually one of the fundamental ways in which such communities constituted themselves socially: that is *the way* in which they maintained certain social ideals and values. Thus such collective acts may have provided opportunities to reproduce an idealised economic situation where the community was always superior in standing to individual households. Here one might think of such values of sharing and communality during the earlier Neolithic as *doxa* (see Chapter 3), that is as values, reproduced through practice, which appeared somehow natural and beyond dispute. If this was so then it would help to explain the stability and longevity of earlier Neolithic communities.

#### 4.4.3 *Ideals of Communality and Social Competition*

It should be stressed that within this sort of idealised economic scenario individual households would nevertheless have competed for status: a community must have leaders. Here it is perhaps useful to consider again the shell bead necklaces made at EN Franchthi, but this time from the perspective of consumption and exchange. Even if in some idealised sense a necklace 'made by all' was the 'property of all'<sup>8</sup>, only one person could have worn what was likely to have been an object of great value. Likewise, if such an item was exchanged with another community, someone must have represented the producing community in the transaction. Either scenario suggests the existence, within such communities, of individuals of higher social status. In this way, this example is instructive in the way it suggests incentives for individual status-competition even with an ideology of communality.

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<sup>8</sup> As already noted, we should guard against the assumption that producers necessarily 'owned' the products of their labours. Products may have been understood as having a closer relationship with their intended destination.

Halstead has suggested that during the Neolithic individual households could compete with each other in two ways (Halstead 1999:90):

- (1) Since neighbours would be likely to receive their biggest surpluses in the same years, they would inevitably compete for opportunities to 'bank' surplus with other households;
- (2) Households would probably compete to establish marriage alliances or exchange relationships with particularly successful households outside the immediate community.

The arena for both of these forms of competition is likely to have been occasions of commensality. However, if one questions the possibility of direct ownership and direct storage of all normal household surplus within the control of individual households during EN-MN and places it - notionally at least - in the hands of the community then opportunity for the first form of competition disappears. Rather than producing what was sufficient for the individual household, what becomes more significant is the need to produce enough for the community as a whole. This in turn would suggest that the second area of competition may have been more significant. If so, and if food was in some way communally-shared, then the exchange value of food in contests between households may have been reduced. Instead, within such communities significant acts of exchange intended to cultivate important social relationships or to construct and maintain status may have been centred rather upon the possession of (or perhaps the ability to give away) other commodities, whether exotic raw materials, such as obsidian or colorants or finished goods, such as stone axes, ceramic vessels, stone mortars, woodwork and basketry (see Chapter 12). The exchange of food within various container types may therefore have been only of secondary importance to the container itself or else valued more for its symbolism than as a contribution to subsistence livelihood. If so, then archaeologically we may expect to see during the earlier Neolithic a level of exchange of finished goods, such as ceramic vessels, as well as non-local materials, *in excess of that noted for later periods*, where the dominant presence of the household, as principal socio-economic unit might be more assured (see Chapter 12).

Finally it is perhaps worth briefly considering what factors in particular might contribute to the erosion of ideals of communality and which may have contributed to the late emergence of the household as primary economic and social unit in the Neolithic Aegean. It has been widely argued<sup>9</sup> that when societies grow beyond a certain limit (usually a figure in the low hundreds) face-to-face communication becomes impossible and coordination of the society as a single unit or community becomes difficult or impossible. As a result new social structures are likely to emerge. However, this alone is insufficient since in general during the earlier Neolithic communities did not grow beyond around 300 people (Halstead 1995:13). This suggests that they employed methods to keep community size stable, one of which was the option of founding new settlements.

From recent anthropological research which focuses on households as units of consumption, it emerges that there is a relationship between the degree of communality and the degree to which a village is involved in the pursuit of commodities (see Wilks 1990:34-42). In a study of house construction among the Kekchi Maya of southern Belize, Wilks found that where a village was not involved in the pursuit of commodities house construction remained a communal and not merely a household task. It was conducted by the village as a whole and was important in coordinating the relationship between the household and the community. In such villages the sense of corporate community remained very strong. Houses were generally identical in form and did not reflect differences in household income and status. Rather strategic acts of consumption focused on the consumption of individual luxury items such as jewellery or cigarettes. In contrast in the village which had a greater involvement in commodities houses were embellished and those of the wealthy constructed in an entirely new style. In such villages the sense of communality was not so strong, the main priority being household welfare. In this way, one might argue that a more serious threat to ideals of communality and equality than simple population growth is the arrival of new economic opportunities and an extension to a previously stable range of material categories potentially available for strategic acts of consumption. Such

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<sup>9</sup> See discussion and references in Halstead 1981:312-3; cf. 1995:13-14, n.21.

pressures can lead to changes in social values and social relations: within such new material and economic conditions it is likely that previously indisputable *doxic* values such as communality and sharing, might be brought within the realm of that which can be challenged, that is heterodoxy and orthodoxy.

### Summary

It has been argued that considerable caution should be exercised in the ways in which typological models, such as the DMP, or examples of 'Middle Range Theory', such as ceramic ecology, are employed as interpretative frameworks. That is not to say, however, that such models need have no meaningful input into the process of interpretation: indeed Sahlins' formulation of the DMP and Arnold's ceramic ecology model offer extremely rich and stimulating sources for the interpretation of archaeological data. However, what is important to recognise, is that, despite occasional claims to universality, such models reflect *generalised* or *idealised constructions* albeit based on numerous individual ethnographic cases. In this way they can at best only reflect general tendencies rather than universal truths. As a result, interpretation using such models should always caution itself against too reductive and too absolute a reading of the archaeological data: the distant past may have very different from the ethnographic present. Instead such models should serve only to suggest some of the *potential possibilities* and *constraints* influencing past material action.

For example Halstead's use of the DMP model, as a framework within which to situate and understand the evidence for early Greek agriculture, has added considerably to current understanding of production, consumption and exchange during the Greek Neolithic. Perhaps most significantly the DMP offers a means of beginning to understand why exchange may have played such an important role in Neolithic social life. However, as has been argued, this application of the DMP model may have been too absolute and inflexible in its assumption of the primary socio-economic importance of the household during the earlier Greek Neolithic (EN-MN). Rather, during this period it is quite possible that there was greater emphasis on communality and on communal forms

of organisation. In the very least the discussion in this chapter should have shown that there is a great need to think beyond the household and to understand communities in terms of a potential array of overlapping or even nested social groupings, such as kin or community, of which the household is but one.

This conclusion has a number of implications for the study of ceramic production, consumption and exchange. In Chapters 10-13 ceramic production, consumption and exchange at Knossos will be explored in terms of a range of possibilities: organisation based on domestic household or on larger groupings; degree of specialisation involved; possible presence of individuals monopolising knowledge and practice; the role, status and value of ceramic vessels. Also important will be an examination of the degree to which patterns of production, consumption and exchange might change, especially between the earlier Neolithic (Cretan ENIa-b = Greek EN-MN) and the later Neolithic (Cretan ENIc/ENII = Greek LNI) (see Appendix I).

Finally, the possibility that the earlier Neolithic saw the maintenance of certain ideals of sharing and forms of communal organisation more characteristic of hunter-gatherer societies constitutes yet another argument against the idea that the onset of the Neolithic was in all ways a revolution. Rather, along with the possibility that methods of food preparation and values associated with food persisted long beyond the Mesolithic (cf. Vitelli 1989; see Chapter 13) and the possible slow emergence of the independent household it suggests a long process of evolution<sup>10</sup>. As Sahlins has noted (1974:81-2) we tend to prioritise and fetishise the importance of technological developments in our view of human history as progressing through successive technological revolutions (e.g. agriculture; ceramic technology; secondary products revolution; metal technology; complex societies/states). Equally, if not more important is the history of changing social relationships and social values.

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<sup>10</sup> Here it is perhaps worth noting the attitude of one hunter-gatherer - a Bushman - to the idea that he might turn to farming: "Why should we plant when there are so many mongomongo nuts in the world?" (Sahlins 1974:27).

## CHAPTER FIVE

### A METHODOLOGY FOR THE CLASSIFICATION AND CHARACTERISATION OF A NEOLITHIC CERAMIC ASSEMBLAGE

"This study [of EN pottery] has been a long time coming, and not solely because of the quantity of pottery recovered from the Franchthi excavations. Certainly there is an abundance of pottery... But what has really taken time is the slow process of reinventing a way to study pottery from an excavation. I did not realize when I began the study that I would need to do this" (Vitelli 1993a:xix).

Any study of an archaeological assemblage always begins with a mass of material, usually already separated by context. Further study of this material requires that it be broken down, or classified further, into more manageable units. There are many ways in which this might be achieved, producing different units, which are dependent on the nature of each different enquiry. Different archaeological questions may be answered by the explicit selection of different attributes as important and will thus produce different groupings. Methodology is therefore structured by the archaeological questions to be answered, which here relate to how Cretan ENI-II ceramic vessels were produced, consumed and exchanged. This methodology must allow for the classification, characterisation and integration of data in sufficient detail and with sufficient clarity to allow investigation of the theoretical possibilities, problems and contradictions outlined in Chapters 2-4.

#### **5.1 Previous Classifications of Cretan Neolithic Ceramics and their Relevance to Questions of Production and Consumption**

To illustrate the importance of selecting a suitable methodology to answer specific archaeological questions, one might consider the relevance of earlier studies of Cretan Neolithic ceramics to questions of production and consumption. In these studies the central guiding principle was the need to establish a secure relative ceramic chronology. The first study by Mackenzie (1903) established a basic tripartite framework, based on fairly impressionistic observations of stylistic change, the second by Furness (1953) attempted to produce a more detailed typology based primarily on form, but which also noted differences in finish. The type and frequency of variation was noted and an attempt was made to relate this more closely to the stratigraphical information which was then available. In

addition comparisons were made with other Neolithic and Bronze Age assemblages from surrounding Aegean regions, in order that Crete's Neolithic sequence might be linked to those of its neighbours, both for reasons of chronology and an interest in cultural origins (see Appendix I). In this way Furness was able not only to confirm Mackenzie's three Neolithic phases, termed Early, Middle and Late, but also to subdivide the Early Neolithic phase further through the identification of a short ENII phase. The third study by Evans (1964) clarified Furness' typology in the light of a new series of excavations within the Central Court at Knossos and fixed it more securely within the extensive and entirely new stratigraphy which had been produced. This new stratigraphy made it possible to observe variation and form and finish in much more detail. Nevertheless, ultimately Evans felt his study confirmed "to a remarkable degree" the original results of Furness (Evans 1964:194).

It is tempting to criticise these studies for the way that they prioritise detailed descriptions of the exterior appearance of the assemblage (form and finish) over any serious attempt to deal with technological aspects, such as fabric. However this would be to blame them for ignoring questions, which they had never intended to address in the first place. These studies prioritised variation in form and finish to produce a detailed relative chronology, a chronology which still provides the only low technology means of dating sites and assemblages. They did not, at least not in the first instance, seek to provide a new understanding of EN ceramic production or consumption.

However, in their summaries as well as in passing both Furness and Evans drew tentative conclusions about EN production and consumption, albeit based on data collected to answer very different questions. Production, according to Furness and Evans, was entirely local to Knossos: clay was selected from "the immediate vicinity", poorly processed and then tempered with powdered gypsum from the nearby Gypsades Hill to produce the single identifiable fabric (Furness 1953:95, 103, n.16; Evans 1964:194, 196). Clearly Furness believed that the observed homogeneity in form and finish translated simply into technological homogeneity: any variations within the assemblage presumably represented local



variations within this mode over space and time. In this way the assemblage seemed to consist of a wide variety of actual shapes, oscillating around a restricted range of 'ideal types'. Such a model conforms closely to prevailing notions of the time which emphasised Neolithic self-sufficiency (see Chapter 2), that is domestic production purely for domestic consumption. However in the light of new evidence for significant variation within this assemblage (see Chapters 6-7) it would seem that in their technological observations Furness and Evans were particularly influenced by the attributes (form, finish), with which they had chosen to sort the assemblage, by the groupings it had produced as well as by prevailing notions of Neolithic self-sufficiency.

This provides a useful illustration of the importance of examining one's own assumptions about the archaeological questions which one is seeking to answer, since these assumptions will also play a part, consciously or unconsciously, in guiding one's actions during the methodological process. In the previous chapter it was emphasised that there was a need to work in detail from the data upwards, seeking variety and difference wherever it might exist, rather than simply to identify general aspects of a prevailing model. Insights into production and consumption will be most successfully gained by new detailed studies, which place these questions at the heart of their methodology.

## **5.2 Defining Choices and Revealing Categories: Is There Life After Death for Pots?**

In Chapter 3 it was argued that activities of production, consumption and exchange can be understood in terms of the exercise of choice. These choices, whether technological or related to consumption or exchange, are always socially informed and reproduce social values and a social order. The products of the sum total of these choices can be understood, as material categories, to reflect that order. As these material categories are consumed and exchanged they become subject to new classifications and new estimations of value, which in turn contribute to the social biography of the object from birth (production) through life (consumption, exchange) to death (deposition) and even, arguably, life-after-death (archaeological study and display). Although a large proportion of what

happened to an object in its life is irretrievably lost, certain key stages in its life cycle can be studied via the analysis of different attributes and a study of context (Tite 1999). And so, through the detailed classification and characterisation of the major forms of variation with a Neolithic ceramic assemblage it becomes possible to study activities of production, circulation and consumption.

It has long been recognised that the social values and social relations, which lie behind acts of production, may be profitably studied through the application of analytical techniques originally derived from materials science.

"There is no question... that we can excavate artifacts and reconstruct the technologies behind them. In doing so, we may discover specific technological styles which are renderings of appropriate technological behaviour communicated through performance. The culturally accepted rules of the performance are embodied in the events that led to the production of the artifact. We should be able to "read" those events, if not all of them at least those of a technical nature, through laboratory study of the materials that make up the artifacts in question. The history of the manipulation of those materials is locked into their physical and chemical structure: the methods of material science can interpret that technological history" (Lechtman 1977:14).

Technological style, as it was termed then, should have taken ceramic studies in a radical new direction. However, despite having a potential which is quite obvious now, technological style remained on the fringes of mainstream research, to the extent that a decade later (1987) Rice was still able to describe it as having "not yet been systematically investigated in pottery studies" (Rice 1987:245). Indeed a large majority of ceramic studies during this period continued to ignore the social side of technology, preferring to view ceramic production in terms reminiscent of ecological determinism or evolutionary adaptation or functional efficiency (see Section 3.2; Gosselain 1998). Moreover, even when the social dimension to acts of production is accepted, this recognition is often not allowed to fully inform the conclusions drawn. Adopting analytical techniques from materials science enriches archaeological enquiry, but such techniques comprise only one component of archaeological methodology and are not sufficient for understanding technologies of the past. As a result many studies have been compromised by their failure to employ interpretative frameworks explicitly derived from anthropology and not from materials science (see De Atley 1991:223). In the last two chapters just such an interpretative framework has

been developed. In the present chapter specific issues of methodology associated with the characterisation of acts of production, circulation and consumption will be addressed in detail.

### 5.3 Characterising Ceramic Production

The ceramic production process can be understood in terms of a sequence of necessary stages (see Figure 5.1).

Stages in Production
raw material selection
raw material processing
forming methods
finishing/decoration
firing
post-firing finishing

**Figure 5.1 The Stages in the Ceramic Production Process**

At each of these stages the potter exercises choices. From clay choice and processing to vessel forming, finishing and firing, these technological choices may be revealed through the macroscopic and microscopic examination of fabric, form (and forming methods), finish (and finishing methods) and firing. Consideration of these variables effectively encompasses all the various stages in the production process.

#### 5.3.1 Identifying Production Groupings

Since acts of production do not occur randomly or in isolation but in accordance with social and material constraints and possibilities (Chapter 3), they manifest themselves as regularised sequences of techniques. By inter-relating data on fabric, form, finish and firing one can examine the possibility that groupings based on fabric will correlate in some way with groupings based on other technological data: for example, mineralogical consistencies and differences within and between fabrics may find their corollary in differences and consistencies in form, finish or even firing. Rye suggests that such "high correlations between process sequences" may be termed technological traditions

(Rye 1981:5). In Chapter 3 it was shown that tradition, as a body of information and practice, plays an important role in all aspects of production, resulting in a final product with a unique association of characteristics. In this way the recombination of technological data not only enhances group characterisation but also in many instances increases the likelihood that groupings might be identified, which reflect some reality associated with their production (production groupings). Furthermore, under certain favourable conditions, it may prove possible to locate certain production groupings or technological traditions with specific places or regions in the landscape (provenance). In this way the documentation of different production locations and the distribution of their products facilitates understanding of regional chronologies, as well as allowing the movement and exchange of ceramics to be studied in greater detail.

### *5.3.2 Raw Material Selection and Processing*

#### *5.3.2.1 Complimentary Techniques of Analysis Along a Visual Continuum*

Raw material selection and paste preparation can be examined via the detailed study of fabric. Fabric study can be pursued at several levels from the examination of sherd breaks macroscopically in hand specimen, to study of thin sections of individual sherds under an optical microscope or at higher magnification under a Scanning Electron Microscope (SEM). The advantage of all three techniques is that they exist on a visual continuum from high to low to no magnification (Wilson & Day 1994:54). In this way structural and compositional details observed macroscopically can be compared and related to what is seen in thin-section under an optical microscope (petrology). Under the optical microscope there is much greater detail available, much of which is invisible macroscopically, and thus this technique, although still using subjective criteria, may offer greater objectivity, such as in the identification and characterisation of the mineralogy of non-plastic inclusions. When one moves to the higher magnifications possible with an SEM in secondary electron mode, one can study a range of features many of which are invisible not only to the naked

eye, but also to the optical microscope (e.g. individual clay filaments). In general identification and interpretation of features, such as clay vitrification microstructures, is more subjective than those studied petrographically (Kilikoglou pers. comm.).

And so when considered individually, each scale of analysis not only offers different types of information but also operates within different degrees of subjectivity. For example, a wider range of technological and mineralogical detail can be studied at a lower degree of subjectivity under an optical microscope, than is possible either macroscopically or under a SEM. Thus petrographic study of thin sections represents the single most useful technique in the study of fabric as well as being one of the more cost effective analytical methods (Peacock 1977; see Chapter 6; Appendix V). However, since these scales of analysis can provide different types of information, the characterisation of different forms of ceramic variation is best achieved through a combination of all three. For example, many more samples can be studied macroscopically than could ever be processed petrographically or under a SEM. However, study using a SEM in association with Energy-Dispersive X-ray Analysis (EDAX) has the advantage of allowing specific areas within the fabric, such as clay groundmass or non-plastics, to be selected and subjected to semi-quantitative elemental analysis; this can produce useful information about the types of clay, inclusion or slip being used (see Figures 8.2-9).

#### *5.3.2.2 Provenance and Processing*

Through mineralogical characterisation it may become possible to link raw materials, following the identification of their geological type, to specific sources in the landscape using geological maps and sampled clay deposits (Freestone 1991:399; Barnett 1991:19-22; Whitbread 1995:374). Clear correspondences, however, are rare: ancient deposits may be eroded, buried or even worked out and the degree to which raw materials have been modified during paste preparation and pottery manufacture is often high. In addition non-plastic inclusions may simply be insufficiently distinctive to ascribe a source, leaving several options open; in other words analysis may indicate the geological

provenance and not the geographical. Nevertheless in favourable conditions it can prove possible to identify source and also to reveal something of the techniques through which the natural properties of the raw materials have been altered (Barnett 1991:19-22). A number of basic techniques of clay processing are possible such as crushing, grinding, sieving and levigation (cf. Sillar 1996:265-6). Ceramic pastes may be composed of clay from a single spatial location or source; alternatively they may comprise a mix of clays from two or more sources. Frequently the properties of clays are manipulated by the addition of non-plastic material (temper)<sup>1</sup>. All of these processes result in a variety of changes, which can often be visible petrographically, such as the incomplete mixing of clays or differences in the size, angularity and mineralogy of non-plastic inclusions. Further information can be gained by comparing archaeological ceramic samples with sampled clay deposits, which have been processed in different ways (Rye 1981:37; Day 1991; Barnett 1991:18, 27).

In practical terms, techniques of selection and modification can have a variety of effects (see Rye 1976, 1981:31), but in general potters use them to increase or decrease the workability of the clays to facilitate the formation of vessels and to restrict the likelihood of vessel failure during manufacture. In addition, since composition is one of the factors affecting the mechanical performance characteristics of a vessel (Braun 1983:109; Bronitsky 1986:211-8), selection and modification of raw materials may reflect the intended function of the vessel<sup>2</sup>.

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<sup>1</sup> See Rice 1987:409-11 on looseness in the use of the term temper. Here temper will only be used to denote deliberate addition of non-plastic material. In petrographic analysis added temper may be differentiated from naturally-occurring large non-plastics through analysis of grain size, modality and angularity (Freestone 1991:405).

<sup>2</sup> For example thermal shock resistance, important for cooking pots, increases if walls are thin, if the grain size of inclusions is small, if the thermal expansion coefficient of those inclusions is low and if the shape of the vessel is rounded (Braun 1983:118-9, 122-5; Woods 1986). However, it has been argued that a high thermal expansion coefficient may actually be advantageous owing to the formation of micro-cracks (Kilikoglou et al. 1998). In general a ceramic with a high quartz content displays increased toughness at a cost to overall strength and both may be optimised if the amount of quartz temper added is in the region of 20% (Kilikoglou et al. 1998:262-74). As a result cooking pots may often (but not always) be round-bottomed and tempered with crushed calcite, quartz or feldspar (but see archaeological epilogue in Kilikoglou et al. 1998:274-6).

A number of researchers have gathered ethnographic support for the existence of cross-cultural regularities in raw material selection for certain functional vessels as well as for an awareness amongst ethnographic potters of the consequences of their actions upon mechanical performance (see Braun 1983:112). However, too often the significance of this has been overstated (see Woods 1986). As argued in Chapters 3-4, pre-modern societies are unlikely to have perceived acts of production in terms of economic efficiency or functional optimisation. The significant social dimension to the choices made by potters in such societies may even have encouraged them to use materials which were not ideally suited to the way vessels were subsequently used. It is one thing to demonstrate that ethnographic potters have an awareness of performance characteristics, it is quite another to see principles of materials science as the overriding criteria behind clay paste preparation (see Kilikoglou et al. 1998:274-6); rather the factors affecting raw material selection and combination may be variable, encompassing possibilities such as proximity to the place of manufacture (Woods 1986; cf. Arnold 1985:32-52) or habit (Livingstone Smith 2000:36-9). It is probably for these reasons that archaeological attempts to identify functional optimisation have at times struggled to produce convincing evidence from ceramics (De Atley & Bishop 1991:373-4; Woods 1986): often even if some sort of connection can be demonstrated, one cannot be certain whether potters were deliberately trying to achieve these properties or whether these properties were the natural outcome of choices made for other reasons; furthermore paste recipes, which were originally influenced by performance criteria, may over time come to be reproduced because they become part of a strong tradition (Kilikoglou, Vekinis, Maniatis & Day 1998:261, 275).

#### *5.3.2.3 Systems of Fabric Description and Methods of Grouping*

Since macroscopic and microscopic analysis rely on observation and description they are inevitably qualitative and subjective (Rice 1987:309-10; Freestone 1991:399). Systems of description have been devised for the characterisation of fabric in hand-specimen (e.g. Peacock 1977) and thin section

(e.g. Whitbread 1995:365-396). Unfortunately, in hand-specimen it is often extremely difficult to identify, measure and quantify certain key features of fabric (e.g. clay micromass, voids, type of inclusions). Petrology, however, provides a greater array of information and detail, which allows the employment of more complex systems of description. This ultimately can allow more refinement in the formation of groupings based on fabric, reduce the level of subjectivity and enable different fabrics to be described under the same system. Indeed the large amount of information contained within a single section means that some information, however insignificant, will inevitably be neglected (Freestone 1991:400).

The system and terminology used in this study for the petrographic description of fabrics in thin section is modified version of that first proposed by Whitbread (1995:365-396, 1986:79-88). This system combines methodologies and terminology drawn from both sedimentary petrology and soil micromorphology, allowing all features to be recorded without reference to their supposed origin. Whitbread defines fabric as referring to:

"the arrangement, size, shape, frequency and composition of components of the ceramic material. The term is therefore restricted to describing morphology and composition without genetic inferences" (Whitbread 1995:368).

Fabric, therefore, in this study is used in a relatively neutral descriptive sense. It has been used to describe groupings formed at a macroscopic and at a microscopic level. The most obvious drawback with fabric groupings identified macroscopically is that they are based on the observation of relatively few features (basic type, size and packing of largest non-plastic inclusions, orientation of largest voids, colour) and are thus based on fewer variables. However, if the range of observable variation within a macroscopic grouping is sampled and studied petrographically, then petrology can be used to explore the boundaries between these macroscopic groups and thus allow a more detailed characterisation of fabric. In this way macroscopic fabric groupings can be compared directly with petrographic fabric groupings and the degree to which petrographic groupings correlate with macroscopic groupings can be assessed. In the case of EN Knossos it proved possible to correlate almost all petrographic



fabric groupings with a macroscopic equivalent (see Chapter 6; Figure 6.1). And so when macroscopic observations of fabric are combined with petrographic study of selected samples, they can be used together to produce a detailed characterisation of fabric at two scales. This in turn allows the incidence of other macroscopic features, such as form or finish, to be correlated with petrographic fabric groupings. In this way, although this use of the term fabric, whether at a macroscopic or microscopic scale, carries no implication as to how such groups might relate to other groups based on form or finish, this separation does not prevent the equation of some fabrics, at a later stage of study, to specific groupings based on other attributes such as form or finish.

Finally some comment is necessary on the techniques used to form petrographic groupings. The categories formed through petrology are based on the human observation, selection and comparison of specific attributes, whose variation is considered significant. Despite the employment of detailed systems of descriptions, such groupings necessarily retain an element of subjectivity. To a large extent this is a virtue because the groupings formed are not significantly affected by minor chemical and mineralogical changes that can occur during the formation of raw material deposits, firing or burial.

In an attempt to minimise subjectivity still further, the sequence in which samples are grouped and described has come under scrutiny. It has been proposed that use of techniques of grouping, such as 'pairwise comparison' or 'attribute analysis', which describe each sample first and then subsequently group samples based on these descriptions (cf. Middleton et al. 1991:266-71), serve to reduce the ability of the grouper to consciously or unconsciously manipulate the groupings produced. Unfortunately the use of such techniques effectively robs petrological analysis of one of its most powerful features, namely the opportunity it provides of keeping archaeological questions in mind *during* grouping, with the result that the groups, which are produced, better reflect those questions. As a result the technique of grouping first and describing later is preferred here (e.g. Whitbread 1995).

Another technique used to try to minimise the subjective element is the use of standardised grain sampling procedures (see Middleton, Freestone & Leese 1985:64-74), such as point-counting, where fabric is quantitatively assessed through the determination of mineralogy at regularly spaced intervals across a sample area (Freestone 1991:403). However, it has been argued that this time-consuming and monotonous technique should be used very selectively, since under many circumstances grouping is more easily achieved using less absolute techniques (Freestone 1991:403-4). For example, largely because Crete is geologically heterogeneous, previous petrographic studies of Cretan ceramic have generally not used point-counting as a primary means of forming fabric groupings, but have instead used it to support specific technological interpretations<sup>3</sup>. In addition, all EN fabrics represented at Knossos are sufficiently coarse as to allow a more straightforward characterisation in thin section.

### 5.3.3 *Forming Methods*

In a similar way to fabric, the form of a vessel may be understood to result from a sequence of techniques and choices (see Figure 2.2). Unfortunately, simple observation of the sequence in which forming techniques were executed is complicated by the methods used to finish Neolithic ceramics which tend to remove direct evidence of the forming methods used: for example scraping, smoothing and burnishing can remove the sequence of ridges created during the initial construction of a coil-built vessel (Rye 1981:67)<sup>4</sup>. However, even where such finishing methods have been used, forming methods may sometimes be observed either directly in the sherd break or indirectly through the characteristic ways in which vessels have fractured (Rye 1981:59-61; cf. also Yiouni 1995:614). Any hand-built pot, unless formed entirely as a pinch-pot, requires the formation of joins, which are structurally the weakest area of the vessel. Usually a vessel will fracture along them with the result that a coil-built or slab-built vessel will produce highly diagnostic fracture lines. Also the sherd edges of a

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<sup>3</sup> For example, Day has only used grain-size analysis occasionally to investigate specific instances of clay mixing and tempering (e.g. Day 1995b).

<sup>4</sup> cf. similar remarks in the context of wheel throwing (Roux & Courty 1995:17-50).

coil-built vessel tend to fracture irregularly with a meandering contour or occasionally in a step-like manner (Rye 1981:67-8). Patterns of fracture within a sherd break can be studied at high magnification under a SEM (Roux & Courty 1995; Tite 1999:187).

Here a distinction must be drawn between primary fractures, namely fractures which occur during the initial breakage of an intact vessel when the area under stress comprises the whole vessel, and secondary fractures, that is fractures which occur after this initial breakage when the area under stress comprises only the sherd. Primary fractures are on the whole more predictable and are more easily related back to the forming methods used and to the structural integrity of the particular vessel form. Secondary fractures can also provide information about forming methods: for example, large diameter EN bowls and jars tend to fracture in two main areas simultaneously: vertically at roughly equally spaced intervals around the rim and body of the vessel and horizontally along weak coil joins. In addition, after initial breakage, bowl fragments often fracture further along these weaker coils, particularly at the rim if the rim is offset; thus demonstrating that the offset rim was added as a single final coil (see plate P1).

Although forming methods are usually most easily observed macroscopically, the degree to which they can often be obliterated by finishing methods suggests that all possible sources of data be exploited (Shepard 1956:184; Roux & Courty 1995). Rye notes that in hand-specimen inclusions and voids in coil-built vessels show random orientation when cut at right-angles to the direction of coiling, but when cut parallel to the direction of coiling, especially along the centre of the coil, they may show parallel orientation (Rye 1981:68). For pinch-pots inclusions and voids may be vertical in a section cut vertically through a vessel, although orientation generally weak (Rye 1981:70). Unfortunately study of forming through the preferred orientation of inclusions and voids is difficult if elongate inclusions and voids are rare or where grains and voids are equidimensional (Whitbread 1996:413-5). More generally the size range of inclusions can provide hints since hand-building techniques tend to favour coarse fabrics, while wheel forming requires finer fabrics (Rye 1981:61).

The size and orientation of inclusions and voids can also be studied in more detail using thin-section petrology (Whitbread 1996:414). In most cases, forming methods which consist of a gradual accumulation of material to produce a vessel, such as coil-building, create 'structural discontinuities' in the orientation of inclusions, voids and micromass (Pierret 1994:75-91). Evidence for these 'structural discontinuities' may be observed petrographically by comparing the changing orientation of voids and inclusions across a single thin section. Sometimes at the actual point of contact between different elements, the pressure applied when joining coils "may force platy fragments into alignment with the plane of contact of [the] coils" (Shepard 1956:183) and this too may at times be identifiable petrographically. The added advantage of petrology is that if vessels are low-fired (cf. Neolithic vessels) then study of the preferred orientation of the clay micromass can provide further indications of forming, even in the absence of elongate voids and inclusions (see Whitbread 1996:415-25 for details). Whitbread recommends that differential birefringence across a section is best observed using a lambda compensator plate (1996:415). It should be stressed that identification of forming methods, in the absence of obvious indications should proceed with caution. Ideally identification should be based on a variety of converging criteria, combining macroscopic observations with microscopic observations of variation in the orientation of voids, inclusions *and* areas of differential birefringence in the clay micromass.

#### 5.3.4 *Finishing Methods*

The dividing line between a technique which forms a vessel and a technique which finishes a vessel is often difficult to discern or meaningless to pursue. As a result it has been suggested that finishing methods be viewed as secondary forming methods, some of which may partly or entirely have a decorative function (Rye 1981:89, 84-95). Within the category of secondary forming methods fall techniques such as beating, scraping, trimming and shaving. These techniques involve a variety of distinctive gestures and tools, traces of which may be preserved on the surface of the finished vessel and studied through

macroscopic examination (see Rye 1981:84-88). The tools and gestures involved in more decorative techniques, whether involving simple finishing (smoothing, burnishing and polishing), cutting (carving, combing and incising), painting or the addition of further clay (appliqué, modelling), can also be studied in a similar way (see Rye 1981:89-95).

Macroscopic observations may be complemented and clarified by information gained from microscopic analysis. A variety of secondary forming techniques can be studied in thin-section: techniques which add or redistribute clay across the surface of a vessel, such as smoothing or plastic modelling may be visible petrographically as additional layers (see Chapters 6, 10). Information about techniques which remove clay, such as scraping or incising, can also be gained: for example a section through an incised line can provide hints as to the type of tool used (see Chapters 6, 10). Slip, paint and burnish layers can also be observed petrographically. However, these thin surface layers are better studied at higher magnification using a SEM (Tite 1999:187-8; see Chapter 8). Use of SEM in association with an energy-dispersive X-Ray detector is particularly useful because it allows detailed analysis of surface structure to be combined with semi-quantitative elemental analysis of different areas of the surface and body. Through comparison with elemental compositions of the sherd body it may be possible to establish whether or not the slip clay was a refined version of the body clay (Tite 1999:187). This sort of analysis also allows study of the composition of paint layers and other deliberate colour effects.

### *5.3.5 Firing Methods*

#### *5.3.5.1 Distinguishing Between the Effects of Firing and Techniques of Firing*

In the absence of direct testimony, archaeological inferences about firing practices (i.e. choices, techniques, tools) have to be made either directly from evidence for firing environment (e.g. kilns, firing pits etc.) or indirectly from the finished ceramics themselves (vessels, sherds). In reality the luxury of direct evidence of the former is rarely enjoyed; indeed it is questionable whether more

ephemeral practices, such as open bonfires, would ever leave an unequivocal mark in the archaeological record<sup>5</sup>. Thus, inferences regarding firing generally must be made from the ceramics themselves. This is by no means straightforward: simple tests of sherd hardness, which test materials of known hardness against a sherd's surface, tell us very little without additional information on clay chemistry (e.g. refractory/non-refractory) (Shepard 1956:214). Likewise simple inferences regarding firing atmosphere based on colour ignore the degree to which clay composition can naturally promote (if oxidised in its raw state) or hinder (if mixed with carbonaceous material) oxidation.

It is therefore important to make a distinction between *description* of the effects of firing on pottery and *inferences* regarding firing method (Shepard 1956:214)<sup>6</sup>.

"Paradoxical as it may seem on first thought, we can decide *how well* a vessel was fired much more easily than we can learn *how* it was fired" (Shepard 1956:214).

This tension, whether acknowledged or not, runs through all studies of ancient firing technology, recently resurfacing in a critique of the use of analytically determined maximum firing temperatures as the sole basis for inferences of firing method (see Gosselain 1992:243-59). Gosselain argues that too much attention has been devoted to the refinement of analytical techniques for determining firing temperatures and too little to evaluating the significance of firing temperature determinations for archaeological studies of firing practices. Using an array of ethnographic data correlating firing practices with firing temperatures, Gosselain demonstrates firstly that for different firing environments, such as bonfire, pit and kiln, there is a large overlap in temperature range and secondly that within each firing environment and even between the interior and exterior of a single vessel considerable variations in temperature can and do occur. Thus, different firing practices (bonfire, pit, kiln) are unlikely to produce maximum and minimum

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<sup>5</sup> The data for Neolithic Knossos are at best equivocal (see Chapter 10).

<sup>6</sup> For example, different clays will respond similar practices in different ways, with the same firing methods producing different effects; such as causing bloating and deformation in one clay, but leaving another unaffected (Shepard 1956:214).

temperature ranges which cluster so discretely as to allow a simple identification of firing environment.

Firing Context	Av. Time to Reach Max. Temp. <sup>7</sup> (mins.)	Av. Time at Max. Temp. (mins.)	Max. Temp. Range <sup>8</sup> (°C)	Max. Temp. Range for Bafia Firings <sup>9</sup> (°C)	Av. Temp. Difference within firings <sup>10</sup> (°C)
open bonfire	22	<1-10 <sup>11</sup>	270-920	400-950	240°C
pit	41		615-900	-	
updraft kiln	259	30-60 <sup>12</sup>	437-1075	-	180°C

**Figure 5.2. The Performance Characteristics of Different Firing Environments (based on data from Gosselain 1992; Tite 1995)**

Gosselain concludes by advocating the greater relevance of heating rate and time of exposure for determining firing methods (see Figure 5.2). For example, in open bonfire firings it is over these parameters, rather than actual firing temperature, that Bafia potters exercise control, since they can select a fast burning fuel and choose to remove vessels as soon as they reach red heat (Gosselain 1992:257). As a result this control allows them to repeat firings with only minor variations.

Although his argument is strong, Gosselain fails fully to draw out its implications, preferring to express hopes for the future discovery of new archaeometric tests to allow heating rate and soaking time to be quantified. However, one need not invoke the future to study heating rate or soaking time and Gosselain is certainly wrong to caricature current archaeometric approaches to firing as the simple pursuit of maximum or equivalent firing temperatures. This sort of analysis is just one aspect of the broader SEM-based study of the effects of firing on clay micromorphology. The combination of this and other relevant data enhances the *characterisation* of a firing technology. Moreover inferences of

<sup>7</sup> Gosselain 1992:246.

<sup>8</sup> Based on ethnographic data presented by Gosselain 1992:245.

<sup>9</sup> Gosselain 1992: 251-3.

<sup>10</sup> Gosselain 1992: 244.

<sup>11</sup> Based on Gosselain's study of Bafia open firings (1992: 255-6).

<sup>12</sup> Tite 1995:39.

firing method from firing effects can proceed from a detailed understanding of the main variables which govern the effects of firing on a clay vessel, namely temperature, physical/chemical properties of the clay, firing atmosphere, time (see Maniatis & Tite 1981; Shepard 1956:215).

#### *5.3.5.2 Towards the Identification of Heating Rate and Soaking Time*

When a plastic clay is left to dry in air it begins to lose water. The application of heat during firing accelerates this loss of water, until ultimately the mineral structure of the clay is altered. Maniatis and Tite (1975b; 1981) have studied the effects of heat on a ceramic body and have identified a series of vitrification stages which occur during firing (Figure 5.3). The formation of each stage depends largely on the temperature to which the clay body is subjected (see Figure 5.4). However, as Maniatis and Tite have demonstrated, this supposedly simple relationship between temperature and changes in clay micro-morphology is complicated by the physical and chemical properties of the clay, the atmosphere during firing and, most importantly here, time (see Tite & Maniatis 1975a:122; Maniatis & Tite 1981:61, 65-6; Rice 1987:435).



Vitrification Stage [oxidising atmosphere]	Visible Characteristics at High Magnification ( $\times 1000-2000$ )
Non-Vitrification (NV)	Non-Calcareous and Calcareous: no vitrification
Initial Vitrification (IV)	Non-Calcareous and Calcareous: this phase is characterised by sintering beginning at the edges of clay flakes.
Calcareous Vitrification Minus ( $V_{C-}$ )	Calcareous only: isolated smooth-surfaced areas or filaments of glass; vitrification not yet continuous.
Vitrification ( $V/V_C$ )	Non-Calcareous: with increased temperature clays the isolated areas steadily increase in size until they coalesce to form an "essentially continuous smooth vitrified layer, ...visible over the entire fractured surface" (Maniatis & Tite 1981:61). Calcareous: here the isolated areas of glass only increase and link up 'to an extent', with the resulting vitrification structure remaining essentially unchanged over a range of c.200°C (Maniatis & Tite 1981:65).
Calcareous Vitrification Plus ( $V_{C+}$ )	Calcareous only: once the high melting temperatures of the crystalline phases are surpassed, glass increases rapidly (Maniatis & Tite:65).
Total Vitrification <sup>13</sup> (TV)	Non-Calcareous and Calcareous: a glassy phase characterised by the formation of coarse unconnected spherical bloating pores (Maniatis & Tite 1981:61; 65)

Figure 5.3 Stages of Vitrification (based on Maniatis & Tite 1981 with modifications)

Stage of Vitrification	Non-Calcareous (<6% CaO)	Calcareous (>6% CaO)
NV (ox.)	<750°C	<750°C <sup>14</sup>
IV (ox.)	750-800°C	750-800°C
$V_{C-}$ (ox.)		800-850°C
$V/V_C$ (ox.)	800-900°C	850-1050°C
$V_{C+}$ (ox.)		1050-1080°C
TV (ox.)	>900°C	>1080°C

Figure 5.4 The Relationship between Temperature, Atmosphere, Percentage CaO and Changes in Clay Morphology (after Maniatis & Tite 1981 and Aloupi 1993:16)

<sup>13</sup> Following Kilikoglou (1994:70) and Maniatis et al. (1984), the term Continuous Vitrification, favoured originally by Maniatis & Tite (1981), is replaced by the term 'Total Vitrification' (TV).

<sup>14</sup> Although Maniatis and Tite (1981:68) give 800°C as the lower limit of Initial Vitrification, subsequent study (Maniatis et al. 1982:193) favours a lower temperature range of 750-800°C for IV. The reason for this is that, while under laboratory conditions an oxidising atmosphere can be produced at will, under real conditions a purely oxidising atmosphere is only possible after c.800°C. Prior to this point the atmosphere is always either purely reducing or a mixture of oxidation and reduction due to incomplete combustion of the fuel: i.e. combustion produces both CO and CO<sub>2</sub> rather than just CO<sub>2</sub> and excess O<sub>2</sub>. Since Maniatis et al. (1982) backed up their estimations with re-firing, I have accepted their modifications.

Although quantification of the actual rate at which a ceramic was heated and the exact period of exposure to the maximum temperature is currently impossible, the fast heating rates and short soaking times characteristic of open firings (see Figure 5.2), can, in favourable circumstances, leave a number of distinctive and potentially diagnostic effects, which, when combined, can cumulatively provide strong indications of original firing environment (*contra* Gosselain 1992). These effects are observable in hand specimen, thin-section and at high magnification under an SEM; therefore an approach is preferred which combines these three levels of analysis, since different techniques provide information about different effects. At a basic level the colour sequence in a sherd break can provide a crude indication of the oxidation/reduction sequence during firing. The presence of the so-called 'sandwich effect', where the core is darker than the edges, cannot, on its own, prove the occurrence of a fast firing, however it does indicate one of two things (Kilikoglou & Maniatis 1993:438):

- (1) *Fast Firing*: in the early stages of an open firing a reducing atmosphere/presence of unburnt organics turned the ceramic black, then later in a more oxidising atmosphere the ceramic began to oxidise from the edges towards the centre, however the firing was too short for this process to complete a full oxidation;
- (2) *Slow Firing*: a reducing atmosphere was produced near maximum temperature, turning the ceramic black; this was followed by insufficient oxidation during cooling.

Subsequently it may be possible to differentiate between (1) or (2) through a consideration of other criteria. For example, when soaking time is as short as one minute (or even less) quantities of organic material within the clay, visible petrographically, may not be fully burnt out. The coarseness of a ceramic may also act as an indirect indicator of heating rate: coarse-textured pottery is much more suitable for fast heating rates because the large non-plastics facilitate the evacuation of steam formed from the vaporisation of either absorbed or chemically-combined water; fine fabrics are much more likely to crack and fail in an open firing environment (Tite 1995:39, 1999:188).

Maniatis and Tite have demonstrated that variation in the general duration of firing (heating rate + soaking time) has a significant effect on the temperatures at which changes in vitrification occur (Tite & Maniatis 1975a:122; Rice 1987:435): if firing is short (fast heating rate + short soaking time), the temperature may have to be c.50°C higher to produce the same level of vitrification. However, these results were gained in an artificially created oxidising atmosphere, whereas in real open firings fully oxidised vessels are rarely produced (Tite 1999:188)<sup>15</sup>. This is not only because firing atmosphere can change rapidly from oxidising to reducing, but also because of the close proximity of incompletely-combusted fuel which produces carbon-monoxide (flux), the presence of unburnt organic material within the fabric, as well as the speed of the whole process (Tite 1995:39). A fast heating rate may not give enough time for the oxygen to reach the inner part of the ceramic, thus producing a localised reducing atmosphere, which facilitates vitrification. In this way, the presence of a reducing or mixed oxidising-reducing atmosphere in effect lowers the temperature at which vitrification can occur, thus at times partially off-setting the need for a higher temperature. Furthermore, ethnographic examples of non-industrial firings indicate that once peak temperature has been reached vessels may have been allowed to cool immediately; much of the sintering must therefore have taken place at temperatures below the maximum reached during firing (Rice 1987:435).

A fast heating rate and a short soaking time are much more likely to produce localised differences in vitrification. Consequently SEM study of differences in clay micro-morphology at the centre and the edges/surface of a ceramic may allow the identification of vitrification gradients. This phenomenon of localised differences in vitrification within a single ceramic, helps to explain how a ceramic may exhibit vitrification in its body yet still preserve a burnished

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<sup>15</sup> Here one might contrast this with a kiln firing: in a kiln, with the separation of vessels and fuel and the greater predictability provided by a built environment, the firing atmosphere can be more easily manipulated to allow the production of fully oxidised ceramics (see Tite 1999:189).

outer surface<sup>16</sup> (see Chapter 8). A further indication of fast firing, visible under a SEM, is the increased presence of fine bloating pores in non-calcareous clays, which have been fired in a reducing atmosphere (Maniatis & Tite 1981:61): when a fast heating rate is employed (e.g. 800°C/hour + 1 minute soaking time at maximum temperature, compared to 200°C/hour + 1 hour soaking time) the production of fine bloating pores is increased; since open firings may in reality have heating rates well in excess of 800°C/hour, one might expect this effect to be even further enhanced in a real situation.

#### 5.4 Characterising the Circulation of Ceramic Vessels

Characterising and recognising the products of non-local ceramic producers within single site assemblages has proved extraordinarily difficult for Neolithic ceramic studies (see Section 2.3.1). This difficulty was seen to arise largely out of conceptual and/or methodological failings. The methodology proposed here for the study of Neolithic ceramic exchange relies to a large extent on conclusions drawn from the study of ceramic production. Through the detailed classification of a ceramic assemblage in terms of fabric, form and finish, it should become possible to characterise the products of different producers: different fabrics may prove to correlate significantly with different forming and finishing methods and with specific forms and finishes, so as to allow the identification of production groupings.

In favourable circumstances, it may prove possible to identify these production groupings with specific locations in the landscape, in others it may only be possible to demonstrate an incompatibility with a local provenance. Further indication of provenance is provided by a comparison of the form and finish of vessels from the site under study with published assemblages from neighbouring contemporary sites (see Chapter 7). Also useful in the

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<sup>16</sup> Clay vitrification involves changes in both clay chemistry and clay structure both of which affect the decorative properties of burnished surfaces. Burnished surfaces reflect the light partly because the burnishing process causes clay particles to align in parallel; vitrification causes changes in clay structure which destroy that alignment. In addition, burnished surfaces tend to shine due to the presence of illite; since illite breaks down at the lowest temperature of all clay minerals (c.850+°C) it does not survive the vitrification process (V. Kilikoglou pers. comm.).

determination of local or non-local provenance is information on the frequency with which certain fabric-form-finish combinations occur at the site in question (see Chapter 9): a low frequency may hint at a non-local provenance. It should be stressed, however, that in order to realise the full potential of this data the exchange of ceramic vessels needs to be considered more generally within the possibilities and constraints of its social and material context (Chapters 3-4). In addition the comparative study of how other goods circulated (see Chapter 12) also has the potential to inform on the circulation of ceramics.

### 5.5 Characterising Ceramic Consumption

Each pottery context is a mixture of broken vessels in a variety of different shapes, sizes, fabrics and finishes. Using the methods described above different broken vessels may be grouped together on the basis of similarities in fabric, form and finish. Within these larger groupings a range of recurring shape types can be defined and recorded in typological form (see Chapter 7) and through comparison with different contexts, whose stratigraphic relationship is known, changes in these types can be traced over time (see Appendix I). These types, or material categories created by producers, may during their consumption be subject to a variety of social classifications, which tend to be based, through the exercise of a form of 'fuzzy' logic, around certain key 'dimensions of variability' (Miller 1985; see Chapter 3). These dimensions of variability tend to relate to key aspects of form (e.g. neck-profile), finish (e.g. colour) as well as to the context in which they are used (e.g. cooking) (see Figure 5.5). As a result the types defined by archaeologists may prove to bear a close relationship to the categories in which ceramic vessels may have been consumed in the past<sup>17</sup>: material categories frame acts of consumption, but it is also through those acts that these categories are reproduced (see Chapter 3).

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<sup>17</sup> This may be particularly true in small-scale societies, such as those of the EN Aegean, where producers were also very much consumers: thus the categories created in production are likely to reflect categories important to consumption (see Chapter 3).

Production	Consumption
clay selection	-
clay processing	-
forming	form
finishing	finish
firing	finish
post-firing finishing	finish
intended function/ use/valuation	actual functions/ uses/valuations

**Figure 5.5 Stages in the Production Process and their Relationship to Consumption**

Establishing a context for consumption is of paramount importance. This can be achieved in a variety of ways. Potentially the most important source of contextual information is the depositional context itself. However, this utility is always predicated both on the degree to which the context can be spatially and temporally defined and on how the context has been formed and transformed<sup>18</sup>. This in turn requires the employment of quantitative methods (see Chapter 9). Unfortunately, neither the choice of quantitative method nor the interpretation of its results are necessarily straightforward or uncontroversial: much depends on the degree to which real patterns of consumption have been distorted by differential breakage rates as well as subsequent processes of deposition, site formation and excavation (Orton et al. 1993:166-7). Ideally, only when ceramic material within contexts can be related back to equivalent vessels, can different contexts, if formed by different processes, be compared in a manner meaningful in terms of consumption (see Orton et al. 1993:166-72).

Approaches to quantification may also differ in regard to the questions they seek to answer. For example, the majority of previous attempts to quantify ceramic contexts at Knossos were firmly guided by the demands of seriation in the construction of relative chronologies and *not* questions of consumption. Mackenzie counted the incidence of different types of decorated sherds as well as total sherds per metre of deposit and used the figures to compare strata dug below the Central Court and the West Court (Mackenzie 1903:159). Evans, by

<sup>18</sup> The importance of selecting representative deposits is discussed in detail in Chapter 9.

comparing the incidence per context of particular traits, such as shape, handle-type or decoration, sought "to facilitate the objective description of the material as a whole... with the hope that the results might eventually prove useful for purposes of comparison between sites" (Evans 1973:132; 134-5). Since the purpose of quantification, in both these cases, was seriation and since the typology in use has proved to be very coarse (see Chapter 7), one might question the utility of this data for the study of consumption (see discussion in Chapter 9)<sup>19</sup>.

In addition to archaeological context, much information relevant to consumption can be gained from the vessels themselves. Thus, functional analysis, which considers such variables as shape, thickness, resistance to mechanical stress (hardness, strength), thermal behaviour, permeability/porosity/density (see Bronitsky 1986), can have an important role to play in outlining some of the potential uses to which material categories may have been put. However, the variation and flexibility in the ways communities from the ethnographic literature viewed their own pottery should caution against an overly functional interpretation of ancient ceramics (see above and Chapters 3-4). Further indications of context may be provided by study of use-wear, such as soot deposits, type and location of abrasion, evidence for mending as well as analysis of organic residues (Skibo 1992; Bronitsky 1986:220-33; Tite 1999:207-11, 218-22). Since consumption is integrally linked to exchange through the creation of value (see Chapter 3), evidence for the circulation of ceramic vessels may also provide useful information on consumption and on the differing roles ceramic vessels may have fulfilled during their life-cycle. Thus in the final analysis the study of consumption must be related to information gained from the study of production and exchange and set within a general consideration of the material and social possibilities and constraints potentially active in the society in question. It should be stressed, however, that acts of consumption also have a more active

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<sup>19</sup> cf. Broodbank's attempt to use Evans' data in his study of Neolithic ceramic consumption at Knossos and the subsequent critique by Whitelaw (Broodbank 1992; Whitelaw 1992).

meaning, such as in the ways they serve to manifest social strategies or negotiate identity (see Chapter 3).

## 5.6 Creating an Integrated Methodology

"Ceramics is a complex industry and in order to understand its history correctly we need all possible lines of evidence and the closest possible cooperation between those engaged in the study" (Shepard 1966:86).

Classification and characterisation of a ceramic assemblage so as to facilitate the study of production, consumption and exchange requires the integration of a wide variety of data (e.g. fabric, form, finish, firing, frequency, use) collected using a variety of techniques (hand-specimen, petrology, SEM, chemical analysis). The necessity of integration is obvious: as has been consistently emphasised (see above and Chapters 3-4) acts of production, consumption and exchange may not only be studied individually by combining these forms of data in different ways, but may also be used to inform upon each other, since each is inextricably linked to the other as aspects of material and social reproduction.

### 5.6.1 Recording

The need to relate and integrate different types of data places particular demands on methods for collecting and recording data. Since at an early stage in fieldwork it was realised that fabric distinctions cross-cut established ware and shape categories (see Chapter 7), it was decided to sort first by fabric and then to use fabric as the basic unit within which to record variation in form, finish, firing, use-wear (e.g. abrasion, mending, sooting) as well as frequency (cf. Tite 1999:201). The explicit aim in this was to study the relationship between form, finish and fabric and to test whether variation in fabric correlated with variation in any other variables. This recording of inter-relationships between fabric, form and finish allowed variation to be studied at the level of the original vessel (see Chapter 9). This is particularly useful for the reconstruction of different vessel categories which may, as suggested in Chapter 3, have a particular relevance for consumption.



The need to examine these relationships also played a prominent part in the selection of samples for further analysis (petrographic, SEM). While the primary aim was to sample all variation in fabric within the EN assemblage at Knossos, every attempt was made to choose samples which also contained information relevant to form, finish, firing and use. This allowed the examination of these inter-relationships to continue at a microscopic level. Over two field seasons (1997-1998) 240 samples were selected for petrographic examination and of these 56 were examined under a SEM.

### *5.6.2 Integrating Different Techniques of Analysis: Problems and Solutions*

Successful integration also relies on the successful combination of archaeological field-work with archaeometric laboratory work. This task constitutes a long and ongoing struggle within ceramic studies (Widemann 1982:29-33; De Atley & Bishop 1991:359-60; Bishop & Lange 1991:2), the partial failure of which is underlined by the semantic separation of the task of archaeometry from the task of archaeology (van Zelst 1991:346). In their brief review, Bishop & Lange (1991:1-2; cf. Widemann 1982:29-30; De Atley & Bishop 1991) highlight several areas of difficulty, chief among them being the functional separation between scientists and archaeologists and the inevitable communication barriers that arise when research fields becomes multidisciplinary rather than interdisciplinary. The result of this has been an over-emphasis on analytical techniques, an under-emphasis on the development of compatible methodologies and interpretative frameworks<sup>20</sup> and a lack of awareness by archaeologists of analytical error and by scientists of the social/material basis of variation in analytical data. One consequence of this separation is 'appendix syndrome', where results of scientific analyses are relegated to appendices at the end of publications, creating an 'illusion of scientific rigour', but with rarely any

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<sup>20</sup> Adopting analytical techniques from materials science enriches archaeological enquiry, but as they comprise only one component of archaeological methodology they are not sufficient for understanding technology. As a result there is a clear need for interpretative frameworks within which different forms of analysis can be situated (De Atley & Bishop 1991; see Chapters 3-4).

attempt to integrate them within the main body of interpretation<sup>21</sup> (Beaudry 1991:250; De Atley & Bishop 1991:360).

Clearly one important barrier to integration is the range and depth of knowledge required to combine archaeological and archaeometric data successfully (Widemann 1982:30). There is widespread pessimism that a single individual can combine all the skills necessary to conduct to perform pottery analysis (a thorough knowledge of geology, clay mineralogy, manufacturing techniques, training in taxonomy, field and lab processing procedures, research design, problem formulation). It is generally thought more reasonable to envisage groups of individuals from different disciplines collaborating closely (Widemann 1982:32-3; Beaudry 1991:253; Tite 1999:182-3). However, to be successful collaboration requires good *communication* and importantly *continuity*, that is continuity in problem formation, in sample selection and in data interpretation. This requires projects to be carefully structured: collaborative projects should not be planned in terms of equal but separate specialist partners, but must be led by individuals who are closely associated with all stages of the project and all forms of analysis. These individuals must combine knowledge in all of the above areas, although the presence of specialists frees them from the task of acquiring a deep understanding of all techniques. For example all analyses for this doctoral project were run by myself with advice and training supplied by various experts, who also provided advice on the final interpretation. In this way I could always keep in mind the archaeological questions as I compared and contrasted the results of various analyses.

The organisational structure should be a simple reflection of the structured use of different analytical techniques within a single initial research design, specifically aimed to address the archaeological concerns in question (see De Atley & Bishop 1991:370-1). Over three decades ago Shepard stressed that different analytical techniques provide different sorts of information and that

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<sup>21</sup> A good Neolithic example of 'appendix syndrome' is Coghlan's thin-section study of LN and LC pottery from Aphrodisias (Joukowsky 1986:297-302): the study is purely mineralogical and based solely on a small group of samples and unsurprisingly receives little mention in the final interpretation.

archaeologists should therefore evaluate which technique might best answer their particular archaeological questions and preferably "combine different methods in a complementary or supplementary way" (Shepard 1965:viii-xi). However, since this important statement, there has been a consistent failure to correlate method with stated objective. Rather choice of technique seems to relate more closely to its ready availability, rather than a critical assessment of which method might be best suited to which particular question (cf. Widemann 1982:29-30; Beaudry 1991:251). Within Bronze Age Cretan ceramic studies there are several examples of good practice: some of the best work has been conducted by Wilson, Day and Kilikoglou who have successfully integrated macroscopic study with petrographic and SEM analyses to produce important insights into EBA ceramic production, consumption and exchange (e.g. Wilson & Day 1994; Kilikoglou 1994).

### *5.6.3 Integrating Data and Techniques in Studies of Neolithic Aegean Ceramics*

Some of the methodological problems associated with integrating techniques and data may be illustrated by a consideration of some recent studies of Neolithic Aegean ceramic assemblages. In the past two decades, there have been detailed macroscopic studies of fabric, form and finish (e.g. Vitelli 1993a); there have also been large-scale microscopic analyses of Neolithic assemblages, both petrographic (Courtois 1981) and combined petrographic and SEM (Schneider et al. 1991b). However no study of Neolithic ceramics has ever truly succeeded in combining these three scales of analysis within a single integrated research methodology.

Vitelli has argued that the size of sample chosen for chemical and petrographic characterisation may be insufficient to render the greater variability in composition exhibited by Neolithic fabrics (1993a:13-19). However, while Neolithic fabrics in hand specimen may well exhibit a greater variation than later fabrics, at a microscopic level a much broader range of grain sizes are visible and identifiable: indeed all variation should be easily comprehensible within a single thin-section and may be checked through comparison with other thin-sections

from vessels in the same fabric<sup>22</sup> (Day 1995a:3). Regarding optical emission spectroscopy (OES), Vitelli is correct to emphasise the dangers of using percentage CaO to discriminate between calcite tempered and calcareous fabrics: here irregularity in the distribution of non-plastics *will* produce irregular groupings. However the final conclusion drawn is that OES is of no use at all, rather than that is just not best suited to the particular circumstances.

Implicit in this criticism is the assumption that all analytical techniques are essentially equivalent and interchangeable, equally appropriate to the study of technology and provenance. This assumption can be found in other analytical studies of Neolithic ceramics: only rarely are the results of one technique discussed within the context of the results of another (cf. Schneider et al 1991a) and even when this happens analytical data may be treated with suspicion and even rejected, particularly if they contradict initial conclusions drawn from macroscopic study (e.g. Vitelli 1993a:13-19)<sup>23</sup>.

Such problems illustrate the importance of good communication between different fields of expertise. For Franchthi analytical results were given in the form of a final report presented as an end product (see Jones 1980 cited in Vitelli 1993a:266). As a result such data becomes a take-it-or-leave-it proposition, rather than something negotiable. Simple communication can, however, resolve many initial misunderstandings: for example, although petrological study of 'Serpentine Ware' did not show serpentine to be present in large quantities (Vitelli 1993a:19 n.4; Jones 1986:398-9, pl.4.7[a]), this is not so much an example of how "a thin section can miss mineral inclusions present in much of the rest of the sherd", but rather an indication that petrology provides a more accurate

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<sup>22</sup> Even the crudest Neolithic fabric has been subject to several mixing processes which will help to produce homogeneity: naturally occurring clays are all subject to natural sorting, added to this are the inevitable stages in human processing, such as crushing and mixing with water, which usually occur to make a clay workable.

<sup>23</sup> Vitelli appears to have become so suspicious of petrology that when two samples are judged to have "no carbonate inclusions", but are shown by OES to be c.15-17% CaO, then she resists the obvious conclusion that the clay itself is calcareous, preferring to believe that petrology mis-characterised the fabric (1993a:16-17). Ironically the *integration* of petrology with chemical compositional analysis can provide a powerful means of characterising ceramic pastes (Maniatis et al. 1984; Rands & Bargielski Weimer 1992; Stoltman, Burton & Haas 1992).

characterisation of mineralogy than simple macroscopic examination<sup>24</sup>. Dialogue between the different parties would have enabled these supposedly contradicting results to be understood and would also have enhanced the characterisation of this fabric.

However, these interpretative problems also result from a failure to integrate different analyses at the *initial* stage of research design. In an analytical programme designed for Neolithic ceramics, different analytical techniques should *not* be used interchangeably. Rather emphasis should be on the *structured* use of such techniques: that is the use of the technique which is most appropriate to answer a specific archaeological question and the use of techniques which complement each other. To return to the quote which introduces this chapter, it is not a surprise that Vitelli was forced to invent a new way of studying pottery when faced with Neolithic material. As noted in Chapters 2 and 7, conventional ware-based types of classification, successfully used on integrated analytical studies of Bronze Age material (e.g. Wilson & Day 1994), may not be able to characterise the full range of variation within a Neolithic assemblage, largely because the products of different dispersed production locations often appear to be visually indistinguishable (see Chapter 7), a situation quite unlike that encountered in the EBA (e.g. Wilson & Day 2000:57). Clearly the only way to study the full range of variation is to focus first on fabric. Thus, for Franchthi as for other Neolithic assemblages, petrology would represent a better 'front-line' technique than chemical composition analysis. Chemical analysis, although more accurate and 'objective' than petrology, may be particularly unsuitable as a front-line technique for the analysis of highly diverse assemblages, such as those of the earlier Neolithic, because it translates ceramic variability into a compositional continuum and therefore makes it more difficult to judge where the dividing lines are between ceramic groups without the use of complex statistics. Petrology can get round this problem precisely because it is more subjective, since it allows decisions of grouping to be taken by the analyst. Petrology is also highly suitable

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<sup>24</sup> In her description of the section in question Pomoni-Papaioannou mentions "fragments of sandstones... serpentinite and basic igneous rocks" (Jones 1986:396). Thus petrology does show the presence of serpentinite but undermines its presumed dominance.

partly because it is relatively 'low-tech', partly because Neolithic fabrics lend themselves to it through their coarseness, but also because it serves to clarify and control macroscopic observations of fabric by providing more detailed technological and geological information (see above).

### Conclusions

Through the combination of macroscopic and microscopic (petrology, SEM) forms of analysis, it becomes possible to characterise and describe some of the past material actions involved in the production, circulation and consumption of ceramic vessels. A recurring theme in this discussion of methodology has been the importance of relating macroscopic observations of fabric, form, finish and firing to the results of microscopic and elemental analysis. This process of integration must be two-way or dialectic allowing conclusions drawn from study at each level to have their impact at other levels. This requires that different analyses are fully integrated into research design from the outset. The great benefit of this approach is that it characterises variation in great detail but also allows the study of how different forms of variation may articulate with each other at a variety of levels.

In the next four chapters the results of the various analyses conducted will be presented. This will begin with petrographic study of fabric (Chapter 6) and proceed through a macroscopic study of form and finish (Chapter 7), SEM (Chapter 8) to a presentation and discussion of the quantitative data (Chapter 9). The ceramic production process can be understood in terms of a sequence of necessary stages (see Figure 5.1), at each of which the potter exercises choices which are socially-informed and context specific. Therefore, when acts of production, circulation and consumption, as revealed by various analyses, are placed in their wider social, material, spatial and temporal context, they can provide a window upon some of the choices, strategies and values, which lie behind these social activities. In this way the results presented in Chapters 6-9, will form the basis of separate discussions of EN ceramic technology (Chapter



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10), production organisation (Chapter 11), exchange (Chapter 12) and consumption (Chapter 13). In Chapter 14 the conclusions drawn from each of these chapters will be compared and contrasted so as to allow study of how these different types of activity articulate and interrelate. In this way analytical data of a variety of types may ultimately be used to explore some of the many ways in which different people and different ceramic vessels were mutually entangled over the course of the earlier Neolithic at Knossos.



## CHAPTER SIX

### PETROGRAPHIC EXAMINATION

In Chapter 2 the issue of fabric diversity in studies of Neolithic ceramics from the Aegean was isolated as an area of considerable difficulty. What might be the limits of variation within a Neolithic ceramic assemblage? Moreover, if fabric diversity is a feature of all Neolithic assemblages, how should this variation be interpreted? Finding answers to these questions requires a commitment to the pursuit of variation of all forms. Thus in the subsequent three chapters the EN assemblage at Knossos will be characterised in terms of macroscopic variation in form and finish (Chapter 7), microscopic (SEM) study of finishing and firing (Chapter 8) and frequency (Chapter 9). In this chapter mineralogical and textural variation in fabric will be characterised and its significance discussed. This discussion is based on detailed petrographic analysis of 240 samples of ENI-II ceramic material. Full petrographic descriptions with extensive comment can be found in Appendix V. Further discussion of fabric variation and its significance can be found in Chapter 10.

#### 6.1 The Relationship Between Macroscopic and Petrographic Fabric Groupings

Since macroscopic and microscopic observations of fabric operate at different resolutions on a visual continuum, groupings visible at higher resolution under the microscope may not be so easily identified macroscopically. This presents no problem for the study of petrographic groupings *per se*. However, since one of the aims of this thesis is the exploration of the inter-relationship between forms of ceramic variation of a variety of types and at a variety of levels of resolution, it is important to be clear regarding where petrographic groups can and cannot be identified macroscopically. Figure 6.1, which lists macroscopic fabric groups and their petrographic equivalents, reveals that in the majority of cases it is possible to isolate petrographic groupings macroscopically.

Petrog. Fabrics	Macrosc. Fabrics	Description
1a	1	calc., rare quartz, fine-grained sparite (97/4, 97/7, 97/22, 97/49, 97/51, 97/62, 97/107, 97/118, 98/1)
1b	2	calc., rare quartz, crushed fine-grained sparite (97/53, 97/55, 97/81, 97/83, 97/116, 97/117, 97/130, 97/135, 97/136, 98/71, 98/97)
1c	2	calc., rare quartz, coarsely/finely crushed fine-grained sparite (97/65, 97/103, 97/119, 97/120)
1d	3	calc., rare quartz, biomicrite/micrite, +/- grog (97/84, 97/105, 97/109, 97/111, 97/115, 98/51, 98/53, 98/54, 98/70, 98/85, 98/98)
1e	4	calc., rare quartz, crushed euhedral calcite, biomicrite (97/50, 97/121, 97/126, 97/127, 97/132, 98/79, 98/82, 98/86, 98/95)
1f	5	calc., rare quartz, crushed coarse-grained sparite (97/125, 97/131, 97/134, 98/76, 98/81)
1g	4	calc., rare quartz, euhedral calcite, coarse-grained sparite, biomicrite (97/133)
1h	3	calc., rare quartz, biomicrite/micrite + sandstone (97/122)
1i	3	calc., rare quartz, grog, sparite/micrite (97/40, 98/68, 98/69, 98/75)
2a	6	low/non calc., fine quartz-rich, chert, sparite (97/24, 97/37, 97/64, 97/85, 98/2, 98/5, 98/24, 98/34, 98/37, 98/42, 98/50)
2b	6	low/non calc., fine quartz-rich, chert, micrite/biomicrite (97/2, 97/3, 97/5, 97/44, 97/54, 97/63, 97/66, 97/82, 97/104, 97/106, 97/110, 98/3, 98/6, 98/36, 98/38, 98/49, 98/56, 98/77, 98/84)
2c	5	low/non calc., fine quartz, chert, crushed coarse-grained sparite (97/42, 97/58, 98/58, 98/72)
2d	6	low/non calc., fine quartz, biomicrite, calcareous sandstone (98/74)
2e	6	low/non calc., fine quartz-rich, biomicrite, grog (97/46)
3	-	Fabric 1b + Fabric 1d (97/140)
4	7	low/non calc., rounded quartz and chert, micrite (97/25, 98/25, 98/73)
5a	8	low calc., fine quartz, micrite/calcmudstone biotite/muscovite, (97/9, 97/15, 97/23, 97/29, 97/48, 97/52, 97/87, 97/93, 97/95, 97/98, 97/99, 97/112, 97/113, 97/114, 97/123, 97/128, 97/129, 98/39, 98/41, 98/52, 98/63)
5b	9	low/non calc., fine quartz, micrite/calcmudstone, foraminifera, (98/9)
5c	10	low/ non calc., calcareous sandstone/siltstone (98/57)

**Figure 6.1 The Relationship Between Macroscopic and Petrographic Fabric Groups for Early Neolithic Knossos**

Petrog. Fabrics	Macrosc. Fabrics	Description
6	11	non-calc., quartz-rich, altered volcanic, siltstone/sandstone, dolerite (97/8, 97/13, 97/21, 97/45, 97/67, 97/68, 97/74, 97/80, 97/96, 97/97, 98/12, 98/13, 98/14, 98/15, 98/16, 98/18, 98/23, 98/31, 98/61, 98/64, 98/100)
7	12	non calc., dolerite, fine-grained sparite (97/6, 97/14, 97/17, 97/26)
8	13	non-calc., quartz-rich, siltstone/pelite, micrite (97/1, 97/19, 97/20, 97/31, 97/35, 97/47, 97/69, 97/70, 97/75, 97/94, 98/8, 98/11, 98/19, 98/27, 98/28, 98/30, 98/45, 98/46, 98/55, 98/59, 98/60, 98/66, 98/93)
9	14	non-calc., quartz, pelite/phyllite (97/34)
10	15	non-calc., quartz-rich, serpentinite, silt/sandstone, mafic rocks (97/56, 97/71, 97/108, 98/40, 98/47, 98/48)
11	16	non-calc., quartz-rich, fine-grained phyllite (97/16, 97/18, 97/78, 97/102, 98/7, 98/17, 98/62, 98/67)
12	17	non-calc., feldspars, quartz, biotite, altered igneous rocks, phyllite (97/27, 97/41, 97/137, 97/138)
13	18	non-calc.(?), fine quartz, chlorite, calcite, phyllite (97/12, 98/4)
14	19	non-calc., quartz-rich, biotite, quartz-biotite phyllite/schist (97/10, 97/28, 97/32, 98/7, 98/65, 98/94)
15	20	low/non calc., fine quartz, organics, foraminifera (97/57, 97/88)
16	21	non calc., quartz-rich, crushed euhedral calcite (97/91, 97/100)
17	22	non calc.(?), quartz-rich, calcareous siltstone (98/77, 98/99)
18	23	low calc., fine quartz, micrite/biomicroite, shell, sand (97/11, 97/89, 97/90)
19	24	calc., quartz-rich, microfossils, pelite/phyllite (97/30, 97/72, 97/92)
20	10	calc., rare quartz, siltstone/pelite/phyllite (98/33)
21	25	non-calc., quartz-rich, bioclastic limestone/marl, chert, phyllite, biotite (97/33, 98/20, 98/35)
22	39	non-calcareous(?), fine quartz, marl, sandstone, phyllite, igneous rocks (97/124)
23	26	calc.(?), quartz, micrite, foraminifera (97/60, 97/61)

Figure 6.1 (Continued) The Relationship Between Macroscopic and Petrographic Fabric Groups for Early Neolithic Knossos

Petrog. Fabrics	Macrosc. Fabrics	Description
24	27	low calc.(?), micrite, phyllite, opaques (97/39, 98/29, 98/43, 98/44)
25	28	non calc., fine quartz, white mica, phyllite/coarse siltstone (98/92)
26	29	non-calc., fine quartz, siltstone/pelite, metamorphics, opaques (97/73, 97/76, 98/91)
27	30	calcareous, grog, organics, rounded phyllite (98/26, 98/83)
28	31	non calc., large quartz, grog, quartz-biotite phyllite/schist (97/36, 97/79, 98/21, 98/22, 98/87, 98/89, 98/96)
29	32	low/non calc., fine quartz, grog, limestone, phyllite (97/86)
30	33	low/non calc., fine quartz, biotite, siltstone/pelite (98/90)
31	34	non calc., siltstones, biotite (97/101)
32	35	non calc., quartz-epidote phyllite/schist (98/78)
33	36	non calc., quartz-rich, amphibolite, altered igneous, phyllite (97/59)
34	37	non calc., quartz-rich, dolerite, altered igneous, phyllite/schist (98/80, 98/88)
35	38	non calc., quartz and biotite-rich, blueschist (97/43, 98/10)
-	40	non-ceramic calcareous, quartz-rich, foraminifera, micrite (97/38)

**Figure 6.1 (Continued) The Relationship Between Macroscopic and Petrographic Fabric Groups for Early Neolithic Knossos**

Petrographic groups, which resist macroscopic identification tend to be those which comprise one or two samples which are very closely related whether mineralogically and/or technologically to one of the main petrographic groups: petrographic group 1c is closely linked petrographically to group 1b and together they comprise macroscopic group 2; petrographic groups 1g and 1h are closely linked petrographically to group 1d and together these comprise macroscopic group 3; petrographic groups 2a, 2b, 2d and 2e are closely linked and together comprise macroscopic group 6. Throughout the thesis wherever fabrics are referred to, these are the *petrographic* fabric groupings.

## 6.2 Inter-Group Relationships: Mineralogy, Technology, Provenance

The pursuit of variation in the petrographic study of ceramics in thin-section involves a delicate balancing-act between giving proper consideration to mineralogical and textural *differences* on the one hand and on the other seeking always to identify *similarities* wherever possible. In addition, this research is one of the first major, multi-sample petrographic studies of Neolithic ceramics to be conducted and as a result there were no prior indications as to what the best criteria for group formation might be. A conscious attempt was made throughout to maintain a strict consistency in the criteria employed in the forming of petrographic groups. Thus, prior to their description, samples were grouped into fabrics on the basis of similarities and differences observed *both* in non-plastics *and* in clay groundmass.

Although in most cases fabrics may be defined by the consistent association of a particular suite of large non-plastic inclusions with a particular clay groundmass, this does not prevent the existence of links between different fabric groups. Consideration of these links is important because their significance may vary. Some fabrics may be grouped together because of general mineralogical similarities in their non plastic inclusions, such as the presence in several fabrics of low grade metamorphic rocks (e.g. Fabrics 5a, 8, 14, 19, 21). Although demonstrating a common geological origin, this need not necessarily translate into a single source since most Cretan geological formations are repeated across the whole island (see Appendix III). Other fabrics, however, may have a closer relationship: some have similar groundmasses and/or large non-plastics and only differ in terms of their texture and packing (e.g. Fabrics 8 and 9); others differ only in the presence of additional large non-plastics. An example of the latter is Fabric 1h, which is otherwise identical to Fabric 1d, except that it also has large sandstone inclusions. Links of this sort between fabrics may well indicate a shared source or a related ceramic technology. In the following discussion the degree to which different fabrics relate to each other and the nature of any relationship will be assessed. More detailed discussion of these

relationships can be found in the comment section at the end of each fabric description (see Appendix V).

*(1) Limestone/Marl*

By far the largest group of fabrics are rich in calcareous non-plastic inclusions of a variety of types (cf. Fabrics 1a-i, 2a-e, 3, 4, 5a-c, 7, 16, 17, 18, 21, 22, 23, 24). Of these fabrics, perhaps the most important are Fabrics 1a-i and 2a-e, since together they comprise at least half of any EN deposit (see Chapter 9). These fabrics share a number of close similarities (see Plates 1-10). Fabrics 1a-i share a very similar groundmass (calcareous, rare quartz, ostracods) and generally differ only in the form and packing of their limestone non-plastics (see Section 10.2.1). Likewise Fabrics 2a-e share a similar clay groundmass (non-calcareous, quartz-rich), which is different to the groundmass of Fabrics 1a-i; Fabrics 2a-e only differ from each other in the form and distribution of their limestone inclusions. The form and distribution of limestone non-plastics also links some fabrics in Fabrics 1a-i to those of Fabrics 2a-e: for example the limestone in Fabric 1f is similar to that of Fabric 2c (well-packed, crushed, coarse-grained sparite), the principle difference being that Fabric 2c is red-firing and richer in quartz; in a similar way (cf. Plates 6 and 9); Fabrics 1d and 2b sometimes share comparable types of bioclastic limestone (cf. Plates 3 and 8). In general these similarities support the existence of close technological links between Fabrics 1a-i and 2a-e, which may indicate a common origin. A single sample of an untempered piece of clay (see Appendix V, sample 97/38), indicating the mixing of a calcareous clay rich in micrite and foraminifera with a red, quartz-rich clay, might also support a connection between these fabrics. Although the mineralogy of Fabrics 1a-i and 2a-e is not indicative of provenance it would be compatible with a source within the immediate area of Knossos (<5km) (cf. calcareous clays, bioclastic limestone; see Appendix III).

\* Other fabrics dominated by limestone exhibit more marked differences from Fabrics 1a-i and 2a-e.

*Fabric 4* has a different form of limestone (micrite with iron concentrations and quartz) and also contains larger rounded quartz grains and lacks foraminifera. The micrite in *Fabric 4* shares some similarities with that in *Fabric 24* although lacks its silty component; moreover the groundmass of *Fabric 24* is different (opaques, phyllite, fine quartz)

*Fabric 5a* may be distinguished on the basis of its distinctive form of limestone (calcimudstone) and groundmass (quartz-rich containing mica, chert and often quartz-mica schist) (see Plate 11). *Fabric 5b* only differs from *5a* in having more foraminifera and is therefore considered closely related to *Fabric 5a*. *Fabric 5c* is dominated by calcareous siltstones of a type which do not find close parallels in other fabrics; however its groundmass is similar to that of *Fabric 5a* (fine quartz, mica, chert, quartz-biotite schist).

*Fabric 7* contains fine-grained sparite which is very similar to that found in *Fabrics 1a-c*, however its groundmass is different (red firing, quartz-rich, doleritic rocks, sandstone) (see Plate 12). It remains unclear whether this similarity is coincidental or whether there is a link between *Fabrics 7* and *Fabrics 1a-c*. The groundmass of *Fabric 7* is very similar to one of the clay components of *Fabric 6* (red-firing, quartz-rich, doleritic rocks, sandstone) and suggests that a technological link exists between these two fabrics. This may mean that they share a common provenance.

*Fabric 16* contains crushed euhedral calcite not unlike that found in *Fabric 1e*; however *Fabric 16* differs in both groundmass (red-firing, quartz rich, quartz-biotite schist) and in the presence also of quartz sand, which was possibly also added as temper.

*Fabric 17* contains calcareous siltstones in a red-firing groundmass, which is rich in quartz and also contains chert, biotite, quartz-biotite phyllite. In general there is quite some variation in the form of the calcareous siltstones between the two samples of this group. Stronger similarities exist in the groundmasses of these two samples (very rich in quartz); however this remains a poorly defined group. Its separation from other groups may be justified on the basis of the combination of a quartz-rich groundmass with calcareous siltstone. Some of the calcareous

siltstones resemble those found in Fabric 5a, although others do not; moreover the groundmass of Fabric 17 appears different (more quartz).

*Fabric 18* contains a distinctive form of fossiliferous or 'shelly' limestone in a groundmass, which contains fine quartz and sand (quartz, chert, siltstone and phyllite). Fabric 18 has no close parallels.

*Fabric 21* has a calcareous component which varies from large shell fragments to foraminifera, micrite and sparite. Since the form of calcite may vary between samples, this is a somewhat varied group. The main feature which links all samples is the presence of a very quartz-rich groundmass, which also contains some low grade metamorphic rocks (siltstone/pelite). These low grade metamorphic rocks generally resemble those that occur in other fabrics (e.g. Fabric 8; see (2) below).

*Fabric 22* is characterised by yellow/brown-firing clay groundmass, which contains rounded micrite together with fine quartz, biotite, siltstone/sandstone, rounded phyllite and igneous rock fragments. It is not clear whether the micrite was added as temper or forms part of the clay component.

*Fabric 23* contains micrite and microfossils which are similar to those found in other fabrics (e.g. Fabric 2b). This fabric differs from others in having large rounded quartz grains in the groundmass.

*Fabric 24* contains micrite, with iron concentrations, which appears similar to some of the micrite found in other fabrics. However, this micrite differs in sometimes having a silty component. Moreover the groundmass of Fabric 24, which contains fine quartz, chert, feldspar, phyllite and opaques finds no close parallels.

In general, therefore, this group of fabrics exhibits sufficient differences from each other in the nature of their calcareous inclusions and/or the composition of their groundmass to allow their confident separation. Thus, unlike Fabrics 1a-i and 2a-e, there appears to be no strong reason to associate them in terms of provenance. That is not to say, however, that they exhibit no relationship with each other. Indeed several recurring elements within these groups suggest that they might have a related geological origin: one might



compare the frequent presence of large bioclastic limestone inclusions and/or foraminifera, ostracods, micrite with iron concentrations and epidote in the groundmass. None of these features are diagnostic of a specific origin and therefore the provenance of these fabrics must remain open. However, all would in general be consistent with an origin in north-central Crete (bioclastic limestones, marls).

## *(2) Low Grade Metamorphic Rocks*

A number of fabrics are characterised by the presence of low grade metamorphic rocks.

*Fabric 8* is dominated by phyllite rock fragments (see Plate 13). Often these exhibit the relict texture of a siltstone (pelite). The groundmass of *Fabric 8* is rich in quartz and also contains biotite mica, chert, quartz-biotite schist as well as a calcareous component (micrite, biomicrite, sparite). The siltstone/pelite in *Fabric 8* resembles the siltstone/pelite in *Fabrics 6* (see (3) below), 9, 19, 20 and 21 (see (1) above). The closest similarities are with *Fabric 9*, which appears to be a technological variant.

*Fabric 9* is also dominated by phyllite rock fragments, which are indistinguishable from those in *Fabric 8*. In addition, there are also similarities in the groundmasses of these two fabrics (quartz, biotite, rare chert) and these two groups differ only slightly in terms of texture. It is therefore considered likely that *Fabric 9* is a technological variant of *Fabric 8* and that they both share a common provenance.

*Fabric 11* contains phyllite rock fragments. In general these lack any trace of a relict siltstone texture and thus do not resemble the phyllite rocks in *Fabrics 8*, 9, 20 and 21. The groundmass of *Fabric 11* also differs from that of other fabrics in Group 2: it is rich in quartz, biotite and contains also chlorite pseudomorphs as well as other metamorphic rocks. *Fabric 13* (see (3) below) also contains chlorite and phyllite, however the chlorite is dominant and the phyllite rare; moreover the groundmass is poorer in quartz than examples of *Fabric 11*.

*Fabric 14* is dominated by a type of quartz-biotite schist, which finds few parallels in other fabrics. The closest parallel is the quartz-biotite schist in one of

the clay components of Fabric 5a (see Section 6.4). The groundmass of Fabric 14 contains quartz, biotite, opaques and rounded phyllite. Comparison of Fabric 14 with later EBA material from Knossos indicates links with an EMII low grade metamorphic cooking pot fabric (i.e. Group 4, Wilson & Day 1999:38-9, 50-2).

*Fabric 19* combines large phyllite non-plastics with a yellow-firing groundmass which is generally rich in foraminifera and ostracods. The phyllite may be compared to pelite/phyllites in Fabrics 8, 9, 20 and 21.

*Fabric 20* contains phyllite in a yellow-firing groundmass, which also contains calcite, opaques and rare quartz. This combination of groundmass and non-plastics finds no close parallels in other fabrics. The phyllite would appear to link in general to similar low grade metamorphic rocks in Fabrics 8, 9, 19 and 21.

*Fabric 25* contains large phyllite and siltstone non-plastics in a groundmass which also contains white mica. These inclusions are not particularly distinctive and the fabric is best defined by the association of phyllite and siltstone in a groundmass containing white mica. It remains unclear how Fabric 25 may or may not relate to other fabrics.

*Fabric 26* also contains siltstone/pelite, however this differs from that found in other fabrics, such as Fabric 8, in frequently having opaque areas, which are oriented parallel to the bedding plane. In addition the groundmass of Fabric 26 differs from that of Fabric 8 in containing finer quartz grains, more metamorphic rock fragments, more opaques and no calcareous component.

*Fabric 30* contains large siltstone/pelite non-plastics in a groundmass rich in biotite and quartz. The degree to which Fabric 30 resembles other fabrics is masked by the isotropic nature of the sample.

In general this group comprises a mixture of fabrics. Several (i.e. Fabrics 8, 9, 19, 20, 26, 30) contain phyllite, which in general preserves relict siltstone textures (pelite), while others contain phyllite, which is consistently more fully altered (i.e. Fabrics 11, 14). Several other fabrics also contain small quantities of pelitic rocks (i.e. Fabrics 6, 21). All of these rocks would seem to originate in low grade metamorphic deposits, such as those which characterise the Phyllite-Quartzite series of Crete. The nearest outcrops of this to Knossos are to the east

or west of the Herakleion basin or possibly around Iouktas (see Appendix III). Therefore none of these fabrics are likely to have a provenance within the immediate area (<5km) of Knossos.

### *(3) Igneous and Altered Igneous Rocks*

A small group of fabrics are characterised by the dominant presence of igneous and/or altered igneous rocks.

*Fabric 6* is characterised by the distinctive combination of doleritic and altered basaltic(?) rocks (see Plate 14). The doleritic rocks closely resemble those in Fabric 7 and suggest a close relationship between these two Fabrics, which may indicate a common provenance. Comparison with later EBA material from Knossos suggests a close link between Fabric 6 and an EMIB cooking pot fabric (i.e. Group 3, Wilson & Day 1999:48-50).

*Fabric 10* contains a distinctive combination of large serpentinite inclusions in a groundmass containing mafic rock fragments. This fabric has no close parallels with other fabrics.

*Fabric 13* is dominated by chlorite rock fragments in a clay groundmass containing fine quartz. The chlorite is intercalated with calcite. This fabric has no close parallels with other fabrics. Chlorite is present in small quantities in Fabrics 10 and 11.

*Fabric 34* contains large doleritic and altered igneous rocks in a groundmass that also contains quartz-biotite schist and siltstone/pelite. The presence of doleritic and altered igneous rocks suggests comparison with Fabric 6. Unlike Fabric 6 Fabric 34 also contains more metamorphic rocks of a different texture (quartz-biotite phyllite/schist)

The altered volcanic and doleritic inclusions in Fabrics 6 and 34, the serpentinite and mafic rocks in Fabric 10 as well as the chlorite in Fabric 13 may have an origin within the ophiolite series of Central Crete, the nearest outcrops of which are in the foothills of mount Ida or near Galeni and Roukani to the south of Iouktas (see Appendix III). Altered igneous rocks are common in both modern and ancient pottery from the site of Kanli Kastelli, which also lies to the south of

Iouktas. The closest source for the serpentinite in Fabric 10 would appear to lie further afield in the region of Gories on the eastern flanks of Mount Ida (Riley 1983:289-90; see Appendix III).

#### *(4) Granodiorite Rocks*

Fabric 12 is a distinctive fabric characterised by the presence of granodiorite rocks (large grains of feldspar, quartz and biotite mica) together with altered basic igneous rocks and phyllite (see Plate 15). These various components are inconsistent with an origin in the area of Knossos. The presence of granodiorite rock fragments, altered basic igneous rocks and phyllite in Fabric 12 compares closely to EM and later fabrics for which an origin has been established in the Isthmus of Ierapetra, East Crete (see Day 1991; Day et al. in press). Although granitic rocks occur elsewhere on Crete, such as in the Asteroussia, the combination of granodiorite, altered basic igneous rocks and phyllite only finds parallels in the Isthmus. In addition comparison of examples of Fabric 12 with Neolithic material from the site of the modern village of Kavousi (Locus 92/17, see Haggis 1995:173-4; see Appendix I), situated on the northern coast of the Isthmus (Bay of Mirabello), suggests that the two are so close as to be indistinguishable (cf. Kavousi 93/69). This would serve to support a provenance for Fabric 12 in the Mirabello Bay area of East Crete.

#### *(5) Organic Material*

Although most fabrics contain small quantities of burnt or partially burnt organic material, only two fabrics appear to have been deliberately tempered with organics. These appear as distinctive voids, which preserve the shape of the organic material after it has been burnt away during firing.

*Fabric 15* is dominated by such voids (see Plate 16). The groundmass shares close similarities with the groundmass of Fabrics 2a-e (red-firing, quartz, biotite, chert, rare foraminifera, occasional altered igneous and sandstone rocks). It therefore remains possible that the provenance of Fabric 15 relates closely to that of Fabric 2a-e.

*Fabric 27* is tempered with a mixture of grog and organics (see (6) below).

## (6) Grog

A group of rare fabrics are grog tempered.

*Fabric 27* contains grog and organic temper in a fine calcareous groundmass, which also contains rounded phyllites. Fabric 27 shares no close similarities with other fabrics. Although the clay is calcareous and in this sense resembles calcareous clays in Fabrics 1a-i, the presence of rounded phyllite rock fragments mark it out as different and moreover suggest that Fabric 27 is inconsistent with a provenance within the immediate area (<5km) of Knossos. Provenance remains open.

*Fabric 28* contains grog in an orange to brown firing clay groundmass, which also contains large quartz grains, chert and some quartz-biotite schist. Like Fabric 27 this fabric shares no close similarities with other fabrics. The closest fabric is Fabric 29. Provenance remains open.

*Fabric 29* contains grog in a groundmass, which is rich in fine quartz and which also contains biotite, chert and quartz-biotite phyllite. Fabric 29 differs from Fabric 28 in having finer quartz. Provenance remains open.

These fabrics all share the distinctive combination of grog temper in a groundmass that also contains metamorphic rocks. Their mineralogy contains nothing diagnostic of source and thus a specific provenance cannot be ascribed. Grog tempering is also a rare feature of Fabrics 1a-i and 2a-e (i.e. Fabrics 1d, 1i, 2b and 2e). It remains possible that some relationship exists between Fabrics 1d, 1i, 2b and 2e and the grog-tempered fabrics of Group 6, however the groundmasses of Fabrics 1a-i lack the type of metamorphic material that is found in Fabrics 27-9.

## (7) Unique Fabrics

The final category considered here consists of a mixed group of fabrics, which bear little or no resemblance either to each other or to other fabrics at EN Knossos.

*Fabric 31* contains large siltstone non-plastics in a groundmass which is rich in lath-like biotite mica (see Plate 17). Clays rich in biotite mica are rare on Crete (cf. area of the Isthmus of Ierapetra) and moreover none contain the type of lath-like biotite which is such a feature of Fabric 31. The closest known parallels for this fabric occur in a fabric from Mochlos, for which an off-island provenance has been suggested (Day et al. in press). It is therefore considered likely that the source for Fabric 31 lies beyond Crete.

*Fabric 32* contains quartz-epidote schist in groundmass, which is rich in quartz and white mica. Provenance remains open, but cannot be within the immediate area (<5km) of Knossos.

*Fabric 33* contains amphibolite in a groundmass which contains quartz, biotite, amphibole, phyllite and altered igneous rocks. Provenance remains open.

*Fabric 35* contains glaucophane-schist (blueschist) in a groundmass rich in quartz, biotite and quartz-biotite schist (see Plate 18). Although blueschists do occur on Crete (e.g. Preveli, West Crete), they are far more common in the Cyclades and also occur in coastal Anatolia (e.g. Knidian peninsula). The only blueschist fabrics found in a recent study of EM pottery on Crete come from the site of Poros to the north of Knossos and are considered to have an off-island provenance (P.M. Day pers. comm.).

### 6.3 Secondary Calcite Formation

In several of the petrographic groups listed in Figure 6.1, the primary form of large calcareous non-plastic inclusions was used as one of the main criteria by which samples were grouped or separated (see Fabrics 1a-i, 2a-e, 3, 4, 5a, 5b, 5c, 7, 16, 17, 18, 21, 22, 23, 24). The classification of limestone by form that was followed in this study is that first proposed by Folk (1974:156ff.) and is based on a primary distinction between sparry and micritic calcite (i.e. micrite = grain-size of <0.05mm). Since the primary or original form of calcite may become altered through a variety of processes active either during or after firing, it is important, when using the form of calcite present as one of the main criteria of grouping to distinguish between primary and secondary forms of calcite and also,

in the case of the latter, to explain how such alteration might have occurred. Ultimately this information may prove useful in the study of firing behaviour and firing environment (see Chapter 8).

The different circumstances in which secondary calcite formation occurs may be grouped into two categories (see references in Cau Ontiveros et al., forthcoming):

- (1) *Allochthonous*: where secondary calcite enters the ceramic from an entirely allochthonous source, that is it does *not* derive from alteration of calcitic material originally present within the ceramic. Examples of this include the contamination of ceramics with calcareous material during use or by percolating groundwater following burial.
- (2) *Partially Allochthonous*: where the secondary calcite formation derives from the alteration of calcitic material originally present within the ceramic. Examples of this include alteration of calcite as a consequence of the firing process.

Many features of secondary calcite formation are visible under the polarising microscope, which may be grouped into a series of categories (Maggetti 1982; Cau Ontiveros et al., forthcoming):

- (1) *Infilling of Voids*: where calcite has become concentrated in open spaces (cracks, voids) within the ceramic. When the crystals show clear well-defined forms (geodetic) and when the border around the edge of the void shows no alteration in colour then it is likely that this results from an allochthonous contribution. However when the secondary calcite resembles a micrite and microsparite and when this is accompanied by a lighter-coloured border around the void, then this may result from a partially allochthonous contribution with percolating groundwater acting to alter calcitic material originally present in the ceramic. The frequency with which void infilling occurs increases in higher or over fired ceramics.

(2) *Micritic Clots*: this term describes a crypto-microcrystalline mass of calcite (micrite), which to a variable extent may display the form of the original carbonate grain, which has been transformed, or otherwise may present a porous structure with only some remains of decomposed primary carbonates. In this way this sort of secondary calcite alteration preserves the shape of the original inclusion, but changes its original internal structure. More rarely the microcrystalline calcite in micritic clots may be partially replaced by sparite. In their recent study Cau Ontiveros et al. (forthcoming) argue that micritic clots derive from the transformation of calcareous non-plastic material during firing and therefore are a strong indication of secondary calcite deriving from a partially allochthonous contribution.

It should be stressed that it is quite possible for allochthonous and partially allochthonous forms of secondary calcite formation to be present within a single ceramic. As a result identification and interpretation of secondary calcite formation must be based on consideration of all available information: for example identification of the alteration of calcite due to firing at higher temperatures (i.e. >c.800/850°C) should be supported by evidence for higher firing, such as low optical activity in the groundmass; likewise identification of an allochthonous contribution to secondary calcite formation should be supported by a more general understanding of how and from where such an allochthonous contribution might originate. For detailed discussion of the behaviour of calcite during firing see the discussion of Fabrics 1a-i, 2a-e and 7 in Chapter 8.

Petrographic study resulted in the identification of probable calcite alteration in several fabrics.

*Fabrics 1a-c*: in one or two samples of Fabrics 1a-c thin red striations were observed in an otherwise yellow (calcareous) groundmass. In one example (sample 97/65) these striations were observed in close association with a micritic clot (see Plate 19). Micrite with iron concentrations is a rare but consistent feature of Fabrics 1a-c. It would appear likely therefore that these striations result from the migration of iron from iron concentrations in the micrite probably during firing.



*Fabrics 2a-c*: a frequent feature of samples of these fabrics is the presence of sparitic limestone inclusions, which exhibit only a relict primary grain texture (see Plate 20); in other words the interstices between the individual grains within a sparite cluster are blurred and the grains do not exhibit extinction, but rather have a texture similar to micrite. Some inclusions retain an angular outline, but have a fully micritic internal structure. The identification of micritic clots strongly suggests that this calcite alteration occurred as a consequence of firing. Further support for a partially allochthonous origin for the calcite alteration is provided by the general absence of the infilling of voids with calcite and the results of SEM analysis which suggest that most if not all samples of Fabrics 2a-c were fired beyond c.800°C (see Chapter 8). The identification and explanation of calcite alteration in Fabrics 2a and 2b is particularly important because it helps to explain how these two fabrics, which are separated petrographically by the presence or absence of coarse-grained sparite, may actually grade into each other (cf. Plates 7 and 8)r. Thus the many examples of Fabric 2b where micrite is dominant may originally have been tempered with sparite, which was then altered to micrite during firing.

*Fabrics 7 and 21*: in several examples of Fabrics 7 and 21 the limestone inclusions retain only a relict primary sparite structure. The identification of micritic clots suggests that some alteration has occurred to the calcite during firing. Further support for this is provided by the results of SEM analysis, which suggest that vessels in Fabrics 7 and 21 could be fired above c.900°C.

#### **6.4 Paste Preparation and Clay Mixing**

During grouping careful study was made of the groundmass of samples. As a result it was noticed that some fabrics exhibit quite a degree of variation in their groundmass. This variation is generally not observed within a single sample, but rather results from the comparison of different samples of the same fabric. It is perhaps for this reason that such inhomogeneities between samples within a fabric group were most frequently observed in groupings that were based on

large numbers of samples (see Appendix V, Fabrics 1d, 2b, 5a, 6, 8). For example, in samples of Fabric 1d the groundmass may be very rich or very poor in ostracods or foraminifera; in Fabric 2a the groundmass may vary from being quartz rich to relatively quartz poor; in Fabric 5a the groundmass may be rich or poor in quartz, biotite and schist; in Fabric 6 the groundmass may be rich or poor in igneous rocks, while some samples are richer in sandstone or siltstone/pelite; in Fabric 8 the groundmass may be rich in quartz and biotite or poor in quartz and biotite.

It should be stressed that this variation is never so much as to threaten the coherence of the grouping. Rather a continuum of variation is usually observable within different samples. In addition samples within each fabric are all closely linked by the shared presence of a distinctive form of temper: for example Fabric 1d (biomicrite), 2b (biomicrite/sparite), 5a (calcimudstone), 6 (altered igneous rocks), 8 (siltstone/pelite). In this way such variation would seem to exist *within* otherwise coherent fabric groupings.

Such variation, however, requires explanation. Possible reasons include inhomogeneity in the clay source used or clay mixing. Evidence of clay mixing may be identified in a variety of ways. The most obvious cases are those where two clays are incompletely mixed, which in thin-section appear as two discrete areas of different composition, such as clay swirls or streaks (e.g. Fabric 19, 97/92). In most cases, however, such obvious indicators are absent and the identification of clay mixing must proceed via the study and comparison of clay pellets and groundmass. For example, in Fabric 5a study of clay pellet composition suggested the use of two clays: a fine red clay containing only rare fine quartz and mica and a coarser red clay rich in quartz and mica and containing also chert and quartz-mica schist (see Plates 21-2; cf. Plate 11). This latter clay would therefore seem to be the most likely source for the large rounded quartz-mica schist inclusions found in some, but not all, samples. In a similar way clay pellets in samples of Fabric 8 suggest the mixing of a red-firing clay rich in angular quartz, which also contains biotite, chert, quartz-biotite schist, and a fine yellow/orange firing clay, which contains few inclusions usually fine discrete

rounded clasts of quartz, some fine biotite, opaques and biomicrite. The latter clay would also seem to be the most likely source for the majority of the calcareous component of Fabric 8 (biomicrite, sparite, micrite with iron concentrations, foraminifera), although the angular coarse-grained sparite and the large individual calcite grains probably derive from the calcareous component of the siltstone/pelite temper. In this way, the variation observed in the groundmass of individual samples of Fabric 5a (see above) may most plausibly be explained in terms of the mixing of two clays in varying proportions. In a similar way study of clay pellets in samples of Fabrics 1d, 2b and 6 also indicated the likely mixing of two different clays in varying proportions (see Appendix V).

### 6.5 Forming Methods

Although macroscopic study of sherds and vessels remains the richest source of information regarding forming methods, it is nevertheless possible in some cases to identify forming methods petrographically (see Sections 5.3.3, 10.3). Forming methods, such as coil or slab-building, inevitably require the joining of different elements, which results in the creation of 'structural discontinuities' in the orientation of inclusions, voids and b-fabric. These may be observed petrographically (Pierret 1994:75-91; see Chapter 5). Perhaps the clearest example of coil-joining is found in sample 97/140 (Fabric 3), where a coil of Fabric 1b can be seen to join a coil of Fabric 1d (see Plate 23). Coil-joining can also be clearly seen in samples 97/79 (Fabric 1e) and 97/12 (Fabric 13) (see Plates 24-5). In most samples, however, coil-joins were not so obvious. Thus, although inclusions, voids and b-fabric<sup>1</sup> frequently exhibit locally parallel orientation and although the angle of this orientation may vary from perpendicular to parallel to vessel margins, sometimes across a single sample, these features alone cannot demonstrate coil-forming, although they would be

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<sup>1</sup> Observation of the differential orientation of b-fabric was aided by the use of a lambda compensator plate (Whitbread 1996:415).

consistent with it. Thus, from a petrographic perspective, one can only demonstrate coil-forming for a small minority of cases, while for the majority one can at best point to a consistency with coil-forming.

## 6.6 Finishing Methods

The petrographic study of surface structure and composition can provide a wealth of information about the types of finishing methods used (see Section 5.3.4). When combined with the SEM study of surface microstructure and composition, these data can provide a very detailed characterisation of methods of surface treatment (see Chapter 8 and Section 10.4 for more detail). Petrographic study resulted in the isolation of the following key features.

### 6.6.1 *Surface Compaction*

The surfaces of many samples show little or no difference in composition, texture or structure from the body. In a number of such cases study of birefringence allowed the identification of an area parallel to the surface edge of the sample, which exhibited a different orientation to that of the body (see Plate 26). Often this area could be traced along the full length of the surface of the sample. This would be consistent with the compaction of the surface of the vessel as a consequence of burnishing or polishing. Burnished or polished examples of this are found in Fabrics 1a, 1b, 1d, 2a, 2b, 2c, 5a, 6, 8, 12 and 14 (see Appendix V).

### 6.6.2 *Slips*

On the surfaces of some samples thin layers were identified, which generally lacked non-plastic inclusions and which exhibited differential orientation from the rest of the sample. The birefringence of these layers was invariably parallel to the vessel margins and indicated a sharp boundary with the body. These layers would appear to be slips added to the surface of the vessel prior to burnishing or polishing, since in some cases compaction can also be identified (see Plate 27).

In most cases slip layers are red and lack any trace of calcite; these were interpreted as non calcareous slips. Examples of these were noted in Fabrics 1a, 1b, 1d, 1e, 2a, 2b, 8 and 21 (see Appendix V). By far the majority of these examples show a clear correlation between the use of slips and the production of polished vessels. Perhaps the most interesting cases where a non calcareous slip has been used are Fabrics 1a-e (see Plate 27). These fabrics are calcareous and thus the deliberate application of a non calcareous slip would appear to represent a deliberate attempt to ensure a dark polished surface (see Sections 10.4.1, 13.2.1). More rarely slip layers exhibit a more yellow colour and/or contain traces of calcite. These might correspond to calcareous slip layers. Examples of these are found in Fabrics 1a, 1b and 25.

In some very rare cases these layers are too thin (c.0.01-0.02) to allow an identification of a deliberately added slip. Examples of this may be found in Fabrics 5a and 14. Since in both these Fabrics there is no clear evidence for the use of slips, it is possible that these thinner layers may represent the artificial creation of a finer clay fraction as a direct consequence of burnishing or polishing.

### *6.6.3 Clay Layers*

A number of samples of Fabric 28 (i.e. 97/36, 98/87 and 98/89) have non-calcareous clay layers added to the surface (see Plate 28). These layers are often in association with features, which have been added to the original surface of the vessel, such as tubular lugs or plastic decoration. These layers contain fine quartz and biotite and may derive from a different clay from the body. They do not represent a fine fraction and do not, therefore, correspond to conventional slip layers.

### *6.6.4 Incision*

Occasionally a thin-section cuts through surface incision and allows detailed observation of the shape of the tool used. For example in sample 97/99 (Fabric 5a) the incision appears to have been done with a tool with square-shaped

tip, while in sample 97/98 (Fabric 5a) the scoring was done with a tool with a rounded tip.

## 6.7 Firing

In most fabrics the comparison of colour and optical activity between samples suggested that vessels were exposed to a variety of temperatures and that firing atmosphere could vary from mixed oxidising/reducing to reducing. Sometimes some fabrics appear to be more consistently fired: for example all three samples of Fabric 21 are reduced. However, this seems more likely to result from small sample size than any real consistency in firing behaviour. Certainly, whenever a fabric is represented by a large group of samples (cf. Fabrics 1a-i, 2a-e, 5a, 6, 8), a much wider range of variation can usually be identified.

In some samples the identification of micritic clots has been used to infer the secondary alteration of calcite as a consequence of firing (see Section 6.3). In such cases it would seem that firing temperatures exceeded c.800/850°C. The frequent preservation of relict primary sparitic textures may indicate that the conditions under which calcite alteration took place did not persist long enough for complete alteration to micrite to take place. This would be consistent with fast firing (see Chapter 8). Similarly consistent with fast firing is the consistent presence in most samples of small quantities of burnt or partially burnt organic material. A particularly obvious example of this can be seen in sample 97/33 (Fabric 21). Although organic material may occasionally survive the longer firings (gradual heating rate, longer soaking time), which are characteristic of the use of kilns, the consistency with which organic material is preserved in EN fabrics would seem to suggest that the firing conditions were more frequently favourable to the preservation of this material. This too would be consistent with fast-firing. Further discussion of firing behaviour and inferences regarding firing environment can be found in Chapter 8.

## Summary

Consideration of the relationship between macroscopic and petrographic groupings has suggested that in the majority of cases it is possible to correlate macroscopic fabric groups with fabric groupings observed in thin-section. Moreover, most of the instances where such a correlation could not be achieved correspond to fabrics which appear to be closely related in mineralogy and/or in texture (e.g. Fabrics 1d, 1g, 1h and 1i). This conclusion is extremely important because it means that variation in ceramic features best observed macroscopically, such as form, finish, forming methods or use-wear, *can* be correlated with variation observed at a microscopic level (petrology, SEM). The ability to correlate these two levels of ceramic variation significantly enhances group characterisation as well as allowing study of the ways in which groupings based on form or finish articulate with groupings based on fabric (see Chapter 7).

Petrographic fabric groupings were formed on the basis of consistencies observed in *both* non-plastic inclusions *and* groundmass. A consistent attempt was made to apply the same criteria to all groups. Consideration of the nature of the relationship between different fabrics indicated a variety of possibilities. Some fabrics exhibit a close relationship with one another (e.g. Fabrics 1a-i, 2a-e) and usually this takes the form of strong similarities in the composition of the groundmass. In such cases the differences, which define the groups as separate, usually relate specifically to the nature and distribution of their large non-plastic inclusions. Although this means effectively that such groupings are based on only one of the two criteria outline above, the separation is justifiable, not only because it might tell us something interesting about technological variation (see Chapter 10), but also because it ensures that the groupings produced are more coherently and more tightly defined.

Other fabric groupings may exhibit more general mineralogical or technological connections: in some cases, such as Fabrics 8, 9, 11, 14, 19, 20 and 21, this reflects a compatibility with a single type of geological formation, here low grade metamorphic rocks of the Phyllite-Quartzite series; in others, such as

Fabrics 27, 28 and 29, fabrics may share technological features, here grog tempering. This type of connection is suggestive of a general relatedness and need not necessarily reflect a common source.

Consideration of mineralogy, technology and provenance suggests that some fabrics are compatible with an origin within the immediate area of Knossos (<5km). These generally comprise fabrics dominated by limestone or marl (e.g. Fabrics 1a-i, 2a-e, 4), although other fabrics, which seem to share close links with one or more of these, such as Fabric 15 (organic tempered), may also derive from this area. However, many other fabrics, although compatible in general with a source in north-central Crete (e.g. Groups 2, 3 and 6), are nevertheless incompatible with a source within the immediate area of Knossos (<5km). In addition to these, there is a small group of Fabrics, which are incompatible with a provenance in north-central Crete (e.g. Fabrics 12, 31, 35) and whose source must lie elsewhere. In the case of Fabric 12 the location of production is likely to correspond to the area between Kalo Chorio and Gournia in the Mirabello Bay, East Crete, while for Fabrics 31 and 35 an off-island provenance is considered likely.

In several fabrics evidence was identified for the secondary alteration of calcite during firing. This proved to be important in at least two ways. Firstly, the identification of secondary calcite alteration can help to explain variation in the form of calcite within and between different fabrics. This further enhances group characterisation as well as indicating how different petrographic groups may relate to each other (see above on Fabrics 2a and 2b). Secondly, this can provide important information about the temperature to which such fabrics had been fired. In general, very little can be inferred with certainty about the nature of the firing environment for different fabrics. However, observation of variability in optical activity (i.e. firing temperature) and colour (i.e. firing atmosphere) within fabric groups, the identification of relict primary textures in altered calcite as well as the regular presence of partially burnt organic material would all be consistent with fast-firing in an open environment (see Chapter 8 for further discussion of this).



In a similar way, consideration of forming methods could, in the majority of cases, only demonstrate at most a consistency with coil-forming. Clear evidence for coil-forming could only be identified for a minority of cases. These data, however, correspond well to the results of macroscopic study (see Section 10.3). Study of finishing methods demonstrated that a variety of methods were used. Some samples displayed evidence for surface compaction as a consequence of burnishing or polishing. Others provided evidence for the use of non calcareous or more rarely calcareous slips (see Section 10.4).

In short, this petrographic study has provided a wealth of new data, much of it of great importance for the way it challenges current assumptions regarding ceramic technology, production and exchange during the EN. The wider implications of this will be explored in Chapters 10-13. The range of variation in fabric that has been identified is surprising and directly contradicts previous studies of Neolithic ceramics, which have been based on the observation of form and finish and have emphasised stylistic and technological homogeneity. In the next chapter the nature of the relationship between form, finish and fabric will be explored in depth.

## CHAPTER SEVEN

### FORM AND FINISH

#### 7.1 Previous Analyses of the Form and Finish of Early Neolithic Ceramics from Knossos

Previous studies of EN ceramic material have focused exclusively on form and finish as the principal indices of variation within the assemblage at Knossos. Although a very general description of the Neolithic ceramic sequence was provided by Mackenzie as early as 1903, it was only after the careful study of Furness (1953) that the first detailed stylistic description of Neolithic ceramics appeared. Furness' stated intention was to work within the tripartite structure proposed by Mackenzie and defined by A. Evans in terms of Early, Middle, and Late Neolithic (A. Evans 1921). However, it would appear that in defining a new EN phase (designated ENII) Furness may have strayed into what Mackenzie originally defined as MN (see Winder 1991).

Furness originally divided ENI-II ceramics into seven wares or groups based on surface treatment, four common to both phases (coarse burnished, fine burnished, incised, plastic), one specific to ENI (pointillé) and two specific to ENII (coarse buff smoothed, rippled) (Furness 1953:96-99). In addition to these, Furness noted some instances of "scribblings", but chose not to separate these into an eighth category (1953:103). The excavations of Evans produced only minor additions and revisions to this list: pointillé was found to continue in some form throughout the Neolithic sequence and scribble burnished ware and 'black-topped' ware were also noted (Evans 1964:194, 196, 205). In his conclusions Evans, in common with all other scholars, chose to emphasise the 'extraordinary homogeneity' of the long ENI phase (Evans 1964:194; cf. Mackenzie 1903:158-9; Furness 1953; Manteli 1993a:42).

The boundaries between these ware groups were allowed to be quite fluid. Furness, and later Evans, acknowledged that no clear distinction was possible during EN between coarse burnished and fine burnished (the two most common ware types), but rather that there was a continuum of variability between the two (Furness 1953:109; Evans 1964:196). However this is by no

means the limit to the overlap: it was clear that incised/pointillé decoration favoured fine burnished vessels, while plastic decoration tended to occur on more coarsely burnished vessels (Furness 1953:114-5; Evans 1964:210). In this way plastic ware merges with coarse burnished, incised or pointillé with fine burnished.

The Furness shape typology divided EN ceramics into eight types based on form (see Appendix VI for details) (Furness 1953:103-120). This schema was adopted by Evans, although not without several modifications (Evans 1964:196-201, 212-4). In all Evans added seven new types, the majority of which correspond to unusual types first identified by Furness. Thus Evans introduced a Type 1A to distinguish open bowls (Type 1) from open bowls with a beaded or slightly offset rim and a Type 4A to distinguish bowls with an offset rim (Type 4) from carinated bowls with offset rim (Evans Type 4A = Furness Type 4). In addition Evans defined flat-based mugs (cf. Furness 1953:fig.7.17); oval dishes with pairs of ears at each end (cf. Furness 1953:pl.29a.18, fig.9.13); shallow rectangular vessels/'trays' with pointillé; pedestalled bowls; large rectangular troughs on four legs<sup>1</sup> (cf. Furness 1953:fig.13b.10 - 'legged receptacles'). Evans, however, chose not to extend Furness' numbering system to include these new types.

A glance through the profiles which Furness and Evans use to illustrate the various types confirms that there is considerable variation within each type (see Appendix VI). As noted above for ware groups, this fluidity was something Furness, and later also Evans acknowledged:

"Many intermediate shapes occur [within the typology], and the division into types is, of course, arbitrary" (Furness 1953:110);

"the main shapes [in the typology], ...are relatively few and tend to merge into each other, so that distinctions are inevitably arbitrary at times" (Evans 1964:196).

It is clear that Furness considered fluidity within and between ware and/or shape categories to be entirely appropriate to the material in question, describing it as being "usually the case with hand-made pottery" (Furness 1953:102). Although Furness never explicitly discusses her production model, when this statement is

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<sup>1</sup> See Chapter 11 for a reinterpretation of these vessels as house models.

taken in conjunction with her stated belief that most if not all EN pottery from Knossos was produced at the site (Furness 1953:103), it becomes likely that Furness understood stylistic variation, whether subtle or striking, to be explicable purely in terms of intra-site variation, perhaps between different local producers. This might be termed a self-sufficiency model of household production for household consumption (see Chapter 2). Under such a model the degree of stylistic variation within each of Furness' types would be the natural result of different producers (households?) having slightly different interpretations of what might be called basic socially-accepted forms or mental templates. If so, then it is unsurprising that Furness chose to simplify this variation, by creating a rather coarse typology consisting of relatively few idealised vessel types.

## 7.2 The Furness-Evans Ware Groups Reconsidered

The Furness-Evans ware/shape typology remains the only available guide to EN ceramics. Thus it was with this typology that re-study of the assemblage began in the summer of 1997, with the principal aim of re-examining its relevance and usefulness for the intended technological study. The EN material under study came primarily from sounding AC from Evans' 1957-1960 series of excavations below the Central Court of the Palace at Knossos. Particular priority was given to the exploration of the ways groupings based on the existing typology mapped or failed to map onto groupings based on fabric.

It was immediately apparent that there was not one but many fabrics present (*contra* Furness 1953:103-117) and that these different fabrics entirely cross-cut the eight or nine EN ware groups. Closer inspection revealed that by far the majority of fabrics were finished in ways which were, in terms of ware, identical; that is the coarse burnished or fine polished versions of each of the most frequently represented fabric groups appeared to be finished in very similar ways; in other words, although a range of fabrics were employed in EN ceramic production, only a much more limited range of finishes are apparent.

Generally, within any single fabric group, vessels are *either* burnished *or* polished with little continuum of variation between the two (cf. Plates 29 and

30). Therefore, contrary to the statements of Furness and Evans (Furness 1953:109; Evans 1964:196) a coarse/fine distinction may be applied to the treatment of vessel surfaces in ENI. In general polished vessels are distinguished from burnished vessels by the absence of marks left by the tool used to burnish. The quality of the finish seems to depend on the size of the vessel: coarser burnishing is usually reserved for larger thicker walled large diameter bowls or jars, polish is confined to smaller thinner walled vessels; however these are by no means absolute distinctions and some overlap is possible. Although within any single context colour might range from buff or orange to brown or black, in no case was a specific colour of finish found to be fabric specific; rather within each fabric group a range of colour was observable<sup>2</sup>. Those fabric groups with calcareous base clays exhibit more of a range, than those which are non-calcareous. The former may range from cream or buff to brown or black (see Slide 31), while the latter are almost always red to dark brown burnished or polished in finish (see Chapter 10). In the case of calcareous Fabrics 1a-e, this dark polished finish was created by the application of a non-calcareous slip (see Chapters 6, 8, 10).

### 7.3 The Furness-Evans Shape Typology Reconsidered

The Furness-Evans shape typology similarly proved to be cross-cut by fabric. However, as will be demonstrated, no single fabric group encompassed the full range of shape types. Although some shape types, such as flat-based mugs or eared bowls, proved to correspond to certain fabrics, in the majority of cases the existing typology proved too coarse to allow closer correlations to be made between stylistic groupings and technological/mineralogical groupings. This conclusion compares well with the remarks of Phelps on previous shape typologies for Neolithic Southern Greece:

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<sup>2</sup> This further underlines the unsuitability of using colour as a criterion for breaking down a Neolithic assemblage, a point elegantly made by Vitelli in her review of early typological study of EN mainland Greek assemblages (Vitelli 1993a:xix-xx, 3)

"minor variations of shape are important for distinguishing chronological and geographical relationships, and a system using only a few general categories is inadequate; the significant nuances are masked" (Phelps 1975:64).

Several factors suggested that an improved EN typology might be possible (and preferable), which ultimately would allow closer correlations to be made between form, finish and fabric:

- (1) The variety of different forms within each of Furness' idealised types, strongly undermines the coherence of her typology. Particularly surprising is the occurrence of overlaps between her types, despite the coarseness of her typology (see Appendix VI). For example, coarse straight-sided vertically carinated bowls are placed in Type 2 and not Type 3; in addition there is a duplication of forms between Type 3 fine profiled carinated bowls and Type 4 fine carinated bowls with offset rim.
- (2) Existing Furness-Evans handle-types proved highly sensitive to fabric, with some rare types, such as tubular lugs, proving to be fabric-specific. This in turn suggests that if more profiles could be reconstructed, different fabric-specific forms might be similarly be identified.
- (3) Re-sorting by fabric enabled several shape types to be restored or identified, such as flared cups, which could not be easily fitted into the existing Furness-Evans typology.

On reflection, it is perhaps not surprising that Furness produced such a coarse typology, when one considers that the only other variable collected, against which morphological variation might be measured, was ware and, as argued above, ware provides a poor index of variation in comparison to fabric. By measuring form and finish against fabric a greater range of shapes and surface treatments can be identified, allowing the construction of a much more detailed shape typology (see Appendix VI).

#### **7.4 Dimensions of Variability**

The different form-types presented in Appendix VI can be studied in terms of the specific attributes (dimensions of variability) which define each type

as different from another (see Chapter 3). Thus at a fundamental level one can see that the presence or absence of an offset rim separates the basic typology of forms into two groups. Once separated, it becomes clear that these two groups comprise a more or less identical range of forms (shallow bowls, deep bowls, curved bowls, carinated bowls, hole-mouth jars etc.) and it is only the presence or absence of the offset rim that separates them. Within these groups different vessel types are distinguished according to their depth (shallow-medium-deep), the accessibility of their interiors (open-closed), the position of their carination (high-medium) and the shape of their body profiles (curved-flared-straight). A further dimension of variability is the overall size of the vessel, since the same basic form-type may be created in a variety of sizes from large to small. Good examples of this are the large and small deep bowls or the large collared jars with flared strap handles on the shoulder and the smaller curved jars with offset rims with false miniature flared strap handles on the shoulder.

Therefore, it becomes clear that the basic range of EN forms is created through deliberate selection from a limited set of dimensions of variability. In this way quite a wide range of shapes is created through the simple combination of a number of different forming sequences: e.g. a flared carinated bowl combines a straight-sided bowl lower half with a flared bowl upper half; a curved jar with offset rim combines a curved bowl lower half with an incurved bowl upper half and is finished with an offset rim.

### **7.5 Variation in Form, Finish and Frequency Per Fabric**

In Appendix VII variation in form and finish is expressed in a series of tables, which document the presence and absence of features of form and finish per fabric per ceramic phase. As these tables demonstrate, the degree to which form and finish differs between fabrics varies considerably from those fabrics, which despite being very well represented exhibit relatively few differences in form and finish (e.g. Fabrics 2a/b and 5a)<sup>3</sup>, to those fabrics, which share no

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<sup>3</sup> For example Fabrics 2a/b and 5a both have near identical types of flat-based mug with near identical incised/pointillé decoration.

similarities in form and finish (e.g. Fabrics 1a and 25)<sup>4</sup>. However, this broad continuum of variation in form and finish between fabrics is not random, but has an internal logic, which seems to relate to the frequency with which different fabrics occur. When grouped in terms of frequency, variation in form and finish per fabric falls into three basic groups (see Figures 9.3-4):

- (1) *Fabrics which individually account for between c.5% and c.40% of any single context*: this comprises a small group of fabrics, namely Fabrics 1a-i, 2a-e, 5a, 6 and 8, which nevertheless together account for c.85-98% of any stratum. Although there are some differences in form and finish between these fabrics (see Appendix VII) these are generally subtle and are largely confined to finish<sup>5</sup>. Moreover, what is most striking about these fabrics is that, despite the relatively large quantities in which they occur, the isolation of these subtle differences requires considerable effort (see Plates 32-3).
- (2) *Fabrics which individually only account for between c.0.01% and c.4.5% of any single context, but which nevertheless exhibit a close relationship in form and finish with those more frequent fabrics in Group (1)*: this comprises a much larger group of fabrics, namely Fabrics 4, 5b, 5c, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23, which together account for no more than c.3-11% of any stratum. All features of form and finish find good parallels amongst fabrics in Group (1) (see Appendix VII; cf. Plates 32-34). Although there are greater differences in form and finish between these fabrics, this is most likely to be a result of the small sample size.
- (3) *Rare or unique fabrics, which individually only account for between c.0.02% and c.1.5% of any single context and which exhibit no significant similarities in form or finish with fabrics in Groups (1) or (2)*: this comprises a group of fabrics, namely Fabrics 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34

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<sup>4</sup> For example vessels in Fabric 1a are burnished, polished or incised, while the single vessel in Fabric 25 is dark-on-light painted with a cross-hatched pattern.

<sup>5</sup> For example incised/pointillé decoration occurs on flat-based mugs in Fabrics 2a-e and 5a, but on other forms in Fabrics 6 and 8. Punched decoration is confined to Fabric 8, barbotine decoration to Fabrics 1d-e and 5a.



and 35, which together account for no more than c.0.1-2.5% of any stratum. The correspondence between rare or unique types of form and finish and rare or unique fabrics is the most striking feature of this group.

And so, when variation in form and finish per fabric is viewed in terms of frequency, an interesting picture emerges. It would seem that c.97.5-99.9% of the EN assemblage at Knossos is comprised of fabrics whose forms and finishes bear a close resemblance to one another, while the most significant variation in form and finish is actually confined to a group of very rare or unique fabrics, which together comprise only c.0.1-2.5% of any EN context. In no way could the fabrics in this latter group be said to be well-represented, it is therefore likely to be significant that they nevertheless exhibit greater variation in form and finish than those fabrics which are well-represented. The most likely explanation for the greater degree of variation of fabrics of Group (3), is that they represent imports. However, such a statement cannot be made with confidence until consultation has been made of all available data relevant to the discussion of provenance (see Section 7.6).

### **7.6 Provenance: Fabric, Form, Finish, Frequency**

In this section all data on form, finish, fabric and frequency will be combined in order to attempt to assess the likely provenance of Fabrics 1-35. This discussion of provenance is divided into three groups, which reflect the three groups based on variation in form, finish and frequency, which were identified in Section 7.5. Those which recur most frequently (Group 1) and which therefore provide most information are described first (Section 7.6.1). Rarer fabrics (Group 2), which nevertheless exhibit a close relationship in form and finish to those in Group 1, are discussed in Section 7.6.2. In Section 7.6.3 variation in form and finish will be described for the remaining rare or unique fabrics of Group 3. Comparisons will be sought for unusual features of form or finish in sequences from sites around the southern Aegean. This will be combined with mineralogical and technological data to attempt to provenance these very rare vessels.

### 7.6.1 Group 1: Frequently-Attested Fabrics<sup>6</sup>

In general a basic range of forms may be said to characterise the frequent fabrics of Group 1 (see Appendices VI-VIII, especially Figures VIII.2-19): curved bowls, deep curved bowls, shallow bowls, hole-mouth jars (both curved and straight-sided), 's' profile jars, flared bowls, curved bowls with offset rim, collared jars, incurved jars with offset rim, strap handles, flared strap handles, wishbone handles, flat bases and concave bases (ENIc-II). Types of finish common to all fabrics are burnish, polish, plastic cordon decoration, pellet/lump decoration and scribble burnishing. In addition to these common features, there are also features of form and finish that are found in only some of these Fabrics. These are discussed below.

#### *pedestalled stands/bowls*

A single example of this form occurs in ENIb in 2a-e. A similar form also occurs during ENIb in Fabric 11.

#### *shallow curved offset bowls*

During ENIa-b shallow curved offset bowls only occur in Fabrics 2a-e and 5a. In ENII they are also found in Fabric 1e.

#### *carinated bowls*

During ENIa-b carinated bowls are very rare occurring only in Fabrics 2a-e and 5a. Later (ENIc-II) carinated bowls of a variety of types become much more frequent.

#### *flat-based mugs*

During ENIa-b flat-based mugs occur only in Fabrics 2a-e, 5a and 6. A single example is also known in Fabric 23. Flat-based mugs frequently have a loop or a strap handle attached directly to the rim. During ENIb rim straps are found only

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<sup>6</sup> Frequency data can be found in Figures 9.3-4.

in Fabrics 2a-e, 5a, 5c, 6. Later (ENII) they also occur in Fabrics 1b, 1d, 1e, 1f and 5a.

*flared cups*

These occur during ENIb-c and are confined to Fabrics 1b, 1d and 5a.

*flared rim jars*

These occur during ENIb-c and are confined to Fabrics 5a and 6.

*carinated jars with offset rim*

During ENIa-b these are found only in Fabrics 1a and 2a/b.

*internally thickened rims*

During ENIc-II curved bowls with internally thickened rims are found in Fabrics 1e, 1f and 2a/b.

*miniature offset rims*

These occur during ENIc-II and are confined to Fabric 1b.

*house models*

During ENII house models are found in Fabrics 1e and 1f.

*'trays' and palettes*

These rare forms only occur during in ENIa-b in Fabrics 2a/b and 6.

*squared handles*

Squared handles are a rare feature of ENI-II contexts and are found in Fabrics 1e, 1f, 2a/b, 6 and 8. They are also found in Fabrics 11 and 16.

*tubular handles*

Tubular handles are confined to ENIa-b and are found in Fabrics 2a/b, 5a, 6 and 8. They also occur in Fabrics 7 and 21.

*pierced/unpierced ears*

Pierced or unpierced ears on the rim of open bowls occur during ENIa-b in Fabrics 2a/b, 5a and 8.

*incised line below rim*

During ENIa-b rare examples of this occur in Fabrics 8 and 16. In ENIc a single example is known in Fabric 1e.

*oblique/'v' punched decoration*

Rare examples of this are found throughout in Fabric 8.

*wiped decoration*

This is found in Fabrics 1e and 2a/b.

*incised/pointillé decoration*

During ENIa-b incised/pointillé decoration is found on flat-based mugs and curved bowls with offset rim in Fabrics 2a/b, 5a and 6. It also occurs more rarely on flared bowls in Fabric 5a and on pedestal bowls/stands in Fabrics 2a/b and 11. During ENIc-II it occurs in Fabrics 1b, 1d, 1e, 1f, 2a/b, 5a, 6.

*slashed cordon/rope decoration*

Examples of this are found during ENIb-c in Fabrics 2a/b and 5a. This is also found in Fabric 10.

*incised lattice/ladder decoration*

During ENIb-c incised lattice or ladder decoration is mostly found on flat-based mugs in Fabrics 2a/b, 5a and 6. During ENIc it also occurs on curved bowls with offset rim in Fabric 1b.

*barbotine decoration*

During ENIb-c barbotine is found only in Fabrics 1d and 5a and during ENII in fabrics 1e and 5a.

*ripple decoration*

Ripple decoration first occurs during ENIb in Fabrics 8 and 11. During ENIc-II it is found in Fabrics 1d, 1e, 1f, 5a, 6 and 8. During ENII it is also found in Fabrics 10 and 12.

*incised diagonal/chevron decoration*

This form of incised decoration is largely confined to ENII, where it is found in Fabrics 1d, 1e, 1f, 2a/b, 5a and 8.

*'barbed wire' decoration*

This occurs during ENIc-II in Fabrics 1d, 1e, 1f, 2a/b and 8.

*brushed decoration*

During ENIc-II this is found in Fabrics 1d and 1e.

*dribble painting*

During ENIb-c dribble painting is confined to Fabrics 1d and 1e. A single example is known in Fabric 17.

### *7.6.2 Group 2: Rarer Fabrics Which Exhibit a Close Relationship in Form and Finish with Group 1*

Fabrics in Group 2 occur infrequently and thus each fabric provides only a very incomplete picture of its potential variation in form and finish. As a result features of form and finish will be discussed separately for each fabric.

#### **Fabric 4**

Vessels in Fabric 4 generally have a white or grey burnished surface, created by the application of a calcareous slip (see Chapter 8). Owing to their very fragmentary state it is difficult to identify forms (but see Plate 54). During ENIa-b diagnostic sherds indicate the presence of straight-sided hole-mouth jars, strap handles and rounded bases. During ENIc-II curved bowls, deep curved bowls, straight-sided bowls, 's' profile jars, curved bowls with offset rim and carinated bowls with offset rim are also found together with strap handles, flat bases and curved bases. In ENII there is also an example of scribble burnishing.

All of these features of form and finish find good close parallels amongst fabrics in Group 1 (e.g. Fabrics 1a-i, 2a-e etc.). Fabric 4 is consistently present in ENI-II contexts, although in proportionately small quantities. The mineralogy of Fabric 4 suggests a link with Fabrics 1a-i and moreover, although not diagnostic of provenance, would be consistent within an origin within the immediate area of Knossos (<5km) as well as the general area of north-central Crete. Provenance remains open, although a north-central Cretan provenance seems quite possible.

#### **Fabric 5b**

Fabric 5b is represented only by body sherds (see Figure VIII.20). These are thick-walled with a burnished outer surface and a smoothed or unburnished interior. They would appear to come from large type of closed vessel, possibly a straight-sided hole-mouth jar. Petrographic study suggested a close link with Fabric 5a and it seems likely that the two Fabrics share a common provenance, within the general area of Knossos (>5km).

### **Fabric 5c**

Fabric 5c is a rare feature of ENIa and ENIb and comprises a straight-sided hole-mouth jar straight-sided, strap handles and a flared bowl with rim strap (see Figure VIII.20). Close parallels for these can be found in most fabrics in Group 1 (cf. Fabrics 5a, 8). Mineralogy is not distinctive of provenance, but not incompatible with an origin within north-central Crete. Provenance remains open.

### **Fabric 7**

Fabric 7 comprises two incurved hole-mouth jars, one with a rim lump and one with a small tubular loop attached to the rim (ENIa) (see Figure VIII.20). Hole mouth jars, rim lumps and tubular loop handles are a feature of most fabrics of Group 1, particularly during ENIa. Petrographic study suggested that Fabric 7 might link to Fabric 6 (similar doleritic rocks in the groundmass) and to Fabric 1a (fine-grained sparite temper). It would seem likely that Fabric 7 shares a common origin with Fabric 6.

Provenance remains open, although it is likely to be within north-central Crete.

### **Fabric 9**

Fabric 9 is largely confined to ENIa-b contexts and comprises the following features of form and finish: deep curved bowl (sometimes with rim lumps or U/V cordon decoration), straight-sided hole mouth jar, flared bowl (sometimes with U/V cordon decoration, strap handle, wishbone handle, flat base, punched oblique decorated rim. Close parallels for all of these features can be found in fabrics in Group 1. Fabric 9 is particularly close in terms of form and finish to Fabric 8 (punched oblique decoration, U/V cordon, straight-sided hole-mouth jar). Petrographic study also suggested that Fabrics 8 and 9 had a close relationship, the differences between the two being primarily textural than compositional. It therefore seems likely that Fabrics 8 and 9 share a common provenance. The low-grade metamorphic rocks in both fabrics would seem to link to the Phyllite-Quartzite series of north-central Crete, which outcrops on the east and west sides of the Herakleion basin as well as around Iouktas (see

Appendix III). Provenance remains open, although in view of the frequency with which Fabric 8 occurs at Knossos this is likely to be within the general area of (>5km) of the site.

### **Fabric 10**

During ENIa-b Fabric 10 comprises the following features: deep bowl (sometimes with incised cordon/rope decoration), 's' profile bowl (sometimes with incised cordon/rope decoration), curved bowl with offset rim (sometimes with a false flared strap handle), flared strap handle (see Figure VIII.22; Plate 64). During ENII there is an incurved hole mouth jar and a vertical carinated bowl. Close parallels exist for all of these features in fabrics of Group 1. Indeed on most occasions vessels in Fabric 10 are indistinguishable from vessels in more frequent fabric (Group 1): for example flared strap handles in Fabric 10 are indistinguishable in size, shape and finish from similar handles in Fabric 8. Sometimes familiar features are combined in unfamiliar ways: for example a small curved bowl with offset rim has a very large false flared strap handle (see Plate 64 upper left). Fabric 10 is not compatible with a provenance within the immediate area of Knossos (<5km). The presence of serpentinite in a groundmass containing mafic rocks suggest a link with rocks of the Ophiolite series, the nearest sources of which lie to the south of Iouktas and in the area of Tyliisos in the western half of the Herakleion basin (see Appendix III. Provenance remains open, although a north-central Cretan origin remains the most likely.

### **Fabric 11**

Fabric 11 is a consistent if very rare feature of EN deposits at Knossos and comprises the following features: curved bowl, collared jar with flared strap handle, square sectioned strap handle, pedestal bowl/stand with incised and pointillé decoration, flared cup with plastic cordon decoration, ripple decoration, steep-sided flat base (see Figure VIII.24). All of these features find parallels in the more frequently occurring fabrics in Group 1. Sometimes, familiar features are combined in unfamiliar ways: for example a flared cup from ENIb with plastic



cordon decoration. The square sectioned handle only finds parallels later in strata V and IV (Fabrics 1e, 1f, 6, 8, 16). The low-grade metamorphic rocks (phyllite) in Fabric 11 would seem to link to the rocks of the Phyllite-Quartzite series of Crete. Provenance remains open.

### **Fabric 12**

Petrographic study of Fabric 12 suggests that this nearest compatible source for the raw materials of this fabric is the Bay of Mirabello. The likelihood that this area is the source of Fabric 12 is increased by the comparison of Fabric 12 in thin-section with thin-sections taken from Neolithic material from the site of Kavousi<sup>7</sup> in the Bay of Mirabello. Sample 97/27 (Fabric 12) proved to be almost indistinguishable in composition and texture from Sample 93/69 (Kavousi).

In the light of the likely source of Fabric 12 at some distance from Knossos (c.70km), it is interesting to note that Fabric 12 exhibits scarcely any variation in form and finish from fabrics whose source must be in the area of Knossos (cf. Fabrics 1a-i, 2a-e, 5a): e.g. curved bowls with offset rim, wishbone handle; vessels in Fabric are burnished (e.g. 97/41) or polished (e.g. 97/27) (see Plate 34).

### **Fabric 13**

Only two examples of Fabric 13 were identified. Sample 97/12 comes from a dark burnished body sherd. Sample 98/4 is a dark polished wishbone handle (see Figure VIII.25). Parallels for wishbone handles are confined to fabrics of Groups 1 and 2 (e.g. Fabrics 1a-i, 2a-e, 5a, 6, 8, 9 etc.). The closest possible source to Knossos for the chlorite rock temper in Fabric 13 would be to the west of Herakleion in the eastern foothills of Mount Ida (Tylissos).

### **Fabric 14**

Examples of Fabric 14 are very rare at EN Knossos: the only forms to be identified were curved bowl, flared bowl and strap handle (see Figure VIII.25).

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<sup>7</sup> See discussion of Kavousi in Appendix I.

One example of Fabric 14 is dark polished with a unique type of grooved decoration. The design is typical for incised/pointillé decoration in fabrics of Group 1 (e.g. Fabrics 2a/b, 5a), however the tool used had a wider, more blunt tip. Since parallels exist for all features of form as well as the design of the decoration a link with the fabrics of Group 1 is considered probable. The mineralogy of Fabric 14 is inconsistent with a provenance local to Knossos. Comparison with later material suggested a close link between Fabric 14 and an EMIIB cooking pot fabric (quartz-biotite schist) from Knossos. Provenance of both of these fabrics remains open, although both would seem to link to rocks of the Phyllite-Quartzite series of Crete.

### **Fabric 15**

Fabric 15 is consistent if very rare feature of ENIb-II deposits at Knossos. Normally examples are too fragmentary to preserve evidence for shape (but see Plate 45). Almost all surviving diagnostic examples come from the rims of large diameter deep bowls. There is also a shallow curved bowl and a vertical carinated bowl from an ENII context. The only example of decoration are a series of large pellets below the rim of a deep bowl (see Plate 45). Parallels for all of these features can be found in fabrics of Group 1. Particularly close parallels exist for the pellet decorated deep bowl (e.g. Fabric 2a/b). The mineralogy of Fabric 15 is not distinctive of a specific origin, but would be compatible with an origin within the immediate area of Knossos. In view of the links shared with Fabric 2a-e (see Appendix V), it seems possible that Fabric 15 and Fabrics 2a-e share a common origin. Provenance remains open.

### **Fabric 16**

Only three examples of Fabric 16 were noted, all dating to ENIb (see Figure VIII.25): from stratum VI came an example of a dark polished curved bowl. Sample 97/100 (stratum VII) is an orange burnished deep bowl with offset rim, which has traces of a square-profiled handle. There are numerous parallels for form (deep bowl with offset rim) amongst fabrics of Group 1. A single example

of a rectangular-profiled strap handle in Fabric 11 is known from stratum IX, however many more examples of rectangular profiled handles are known from strata V and IV (Fabrics 1e, 1f, 6, 8). Sample 97/91 is a dark polished curved bowl (stratum VI) with an incised line below rim. Numerous parallels for the form can be noted in other fabrics in Group 1. The use of incised lines to differentiate the rim finds good parallels in Fabrics 6 and 8. The mineralogy of fabric 16 is not distinctive of provenance, but would be compatible with a source in north-central Crete. Provenance therefore remains open, but in view of the links in form and finish to fabrics in Group 1 is likely to be within Crete.

### **Fabric 17**

Only two examples of Fabric 17 were identified. Sample 97/77 comes from a coarse burnished or wiped body sherd. Sample 98/99 is brown polished body sherd, which has a dribble of darker brown paint (see Plate 55). In appearance this painted decoration closely resembles the 'dribble-painted' sherds in Fabrics 1d and 1e, which date to late ENIb/ENIc. The date of sample 98/99 is broadly compatible with these (late ENIb, West Court Sounding AABB). The mineralogy of this fabric is not distinctive of a specific source, but is compatible with a provenance within north-central Crete.

### **Fabric 18**

Fabric 18 comprises an incurved hole mouth jar, a straight-sided bowl, a vertical carinated bowl, a flat base, U/V cordon decoration. All of these features find parallels in fabrics of Group 1. The presence of cordon decoration seems to suggest a close link. The mineralogy of Fabric 18 is not distinctive of specific origin (quartz sand). Provenance remains open.

### **Fabric 19**

Fabric 19 is a very rare feature of ENIa-b contexts. Sherds diagnostic of shape are rare and the only vessel shape identifiable with certainty is a buff burnished thick-walled deep bowl with lumps below the rim; strap handles and dark

polished vessels are also found (e.g. 97/30). Parallels for the deep bowl with lumps below the rim are found in fabrics of Group 1. The mineralogy is not distinctive of a specific origin (fossiliferous calcareous clay, quartz-rich red clay, phyllite), but would be consistent with an origin within north-central Crete.

### **Fabric 20**

The only example of Fabric 20 identified (sample 98/33) comes from an ENIa context and is from a flat-based vessel (see Plate 69). Parallels for flat bases exist in fabrics of Group 1. The mineralogy of Fabric 20 is not distinctive of a specific origin. Provenance remains open.

### **Fabric 21**

Fabric 21 is a rare feature of ENIa-b deposits. Features found in this fabric include straight-sided hole-mouth jar with a flat base, straight-sided hole-mouth jar with horizontal loop handle (sample 98/20), high carinated small diameter jar with offset rim, wishbone handle (see Plates 29, 65). Parallels for all of these forms can be found in fabrics of Group 1; closest is Fabric 8 which has parallels for all of these features (straight-sided hole mouth jars, flat bases, loop handles, jars with offset rim, wishbone handles). The mineralogy of fabric 21 is not distinctive of a specific origin. The presence of low grade metamorphic rocks, similar to those in Fabric 8, suggests a link with the Phyllite-Quartzite series of Crete. Provenance remains open.

### **Fabric 22**

Fabric 22 only occurs in ENII contexts and comprises a flared bowl (97/24; see Figure VIII.26) and a strap handle. Parallels for these exist with fabrics of Group 1. Mineralogy is not diagnostic. Provenance remains open.

### **Fabric 23**

Examples of Fabric 23 occur in ENIa-b contexts (see Plate 59). Sample 97/60 comes from a flat-based mug with an unusual type of incised/pointillé decoration

(dots and wavy lines) and with the upper torso of a human figurine moulded into the rim. Sample 97/61 comes from a high carinated bowl with offset rim. Parallels for both forms and for the incised/pointillé technique can be found in fabrics of Group 1. The mineralogy of Fabric 23 is not distinctive of origin. Provenance therefore remains open.

### 7.6.3 Group 3: Rarer Fabrics with Rare or Unique Forms or Finishes

In this section only relative regional dates are given for the comparative ceramic material cited from sites around the southern Aegean. A detailed discussion of how the Knossian EN sequence relates to those of surrounding regions can be found in Appendix I. On the basis of this discussion a comparative table was produced (see Figure I.6); a simplified version of this table is provided below (see Figure 7.1). A map of the distribution of the most important sites mentioned in the text is also provided (see Figure 7.2)

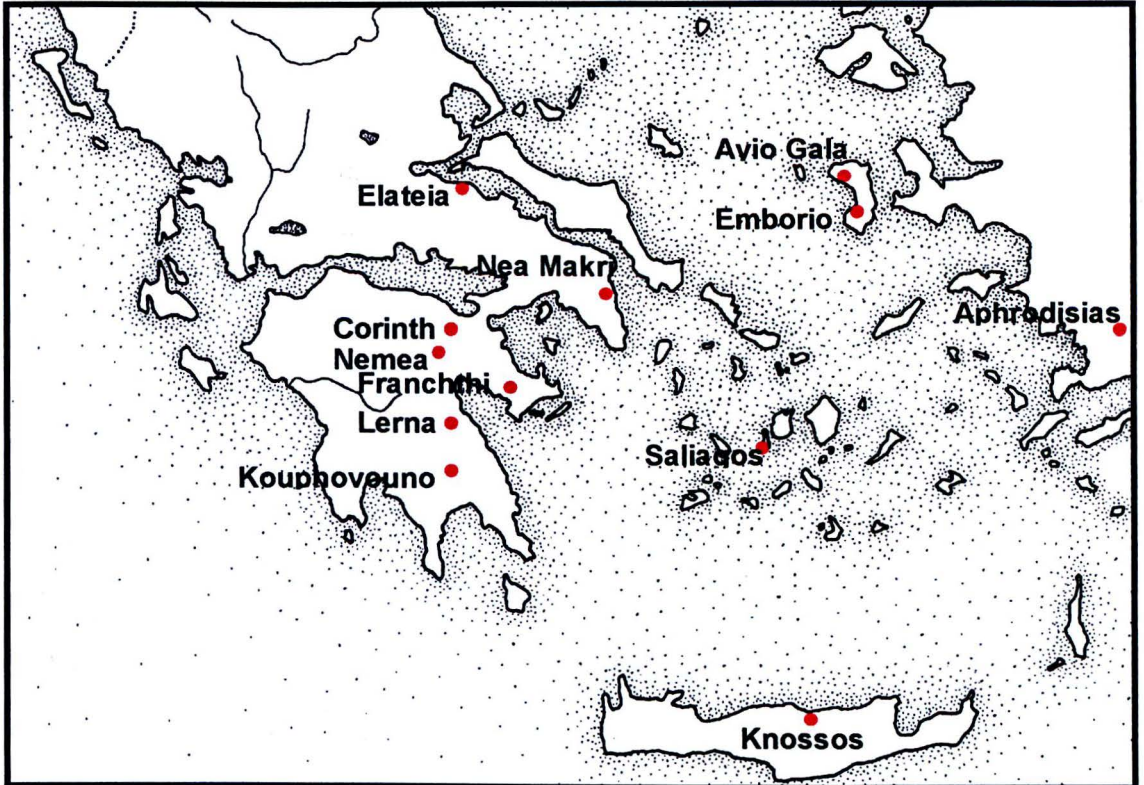
Approximate Dates	Knossos	Greece/ Cyclades	South-West Anatolia
>7000	Aceramic?	Mesolithic	EN
c.7000 - c.6500	Aceramic	Aceramic	EN
c.6500 - c.6400	Ac/ENIa	Ac/EN	EN
c.6400 - c.5800	ENIa	EN	LN
c.5800 - c.5300	ENIb	MN	EC
c.5300 - c.5100	ENIb	LNI	MC
c.5100 - c.4900	ENIc	LNI	MC/LC transition
c.4900 - c.4500	ENII/MN	LNI	LC
c.4500 - c.4000	LN	LNII/FN	LC
c.4000 - c.3300	FN	FN	LC

**Figure 7.1 The Chronological Relationship Between the Cretan Neolithic, the Greek Neolithic and the South-West Anatolian Neolithic (See Appendix I)**

#### **Fabric 24**

##### *pierced oval lug*

The single example of this (98/43) comes from an ENIa context (VIII) and is without parallel at Knossos (see Plate 68). In south-west Anatolia oval lugs are known from EN Kuruçay (Duru 1994:pl.38.12) pierced vertically and LN



**Figure 7.2 Map of the Main Aegean Sites Mentioned in the Text**

Kuruçay pierced horizontally (Duru 1994:pl.44.10; 61.10; 77.16;84.12-13) and vertically (Duru 1994:pl.52.5-6;62.12). They are also a feature of LN sites in West-Central Anatolia (see Meriç 1993:fig.3.3) and of the lower cave (LN?) at Ayio Gala (Chios), where they are found on deep bowls with slightly everted rims and on shallow bowls; they are not as common as vertical tubular lugs (see below) and are all pierced vertically (Hood 1981:20, fig.5.6, 9). In the lower levels of the upper cave at Ayio Gala horizontally-perforated oval lugs outnumber tubular lugs (Hood 1981:34).

In the EN Peloponnese "both horizontally and vertically perforated lugs are the standard Period I [EN] form of handle" (see Phelps 1975:98, 98-9; cf. Caskey 1958:pl.37a, f [Lerna]; Holmberg 1944:39, fig.37.a-e [Asea])<sup>8</sup>. They are most frequent on the coarser wares, but are also be found on fine vessels, and are usually placed close to or above the middle of the bowls, but never directly under the rim, either two or four to a vessel. Phelps notes that there is a development in lug types from earliest EN (rounded both in plan and section, which projects less from the body (e.g. Phelps 1975:fig. 9.30) to later EN lugs which become thinner (e.g. Phelps 1975:fig. 9.31) and often more profiled. Latest EN lugs tend to be triangular or rectangular as becomes common in MN. In the MN Peloponnese vertically/horizontally perforated lugs are less frequent than in EN: both types continue to occur on closed shapes, especially 'piriform' jars, low collar jars and closed bowls (Phelps 1975:157; cf. MN/LN Kouphovouno Renard 1989:xxiv.2; xxviii.1, 2, 6).

#### *incurved bowl/pellet decoration*

Although examples abound of pellet decoration on the rim and pellet decoration on the main body of a vessel, sample 98/44 (stratum VIII/VII) is the only example of single pellet decoration which occurs near but some distance below the rim (see Plate 68). Pellet decoration in this area of the vessel is however common for the EN Peloponnese (Phelps 1975:109-110), where the most typical

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<sup>8</sup> Oval lugs are also known from EN Nea Makri (Pantelidou Gophas 1995:fig.2.1-26, 1-27; fig.5.2-35; fig.7.2-31, 2-36, 2-68, 2-69, 2-94).

form of decoration applied pellets (round or oval) usually placed close to the widest diameter or close to the rim although but *never immediately below* it<sup>9</sup>. Like oval lugs (see above) pellets may be two or four to a pot. In MN there is "very little plastic decoration" (Phelps 1975:168).

Sample 98/43 (pierced oval lug) and 98/44 (incurved bowl/pellet decoration) are most likely from the same context and could well be from the same vessel. Oval lugs, identical to sample 98/43, are also found on incurved jars of this period (cf. EN Franchthi Vitelli 1993a:fig.1.j, fig.2.a, d, j, k; Phelps 1975:fig. 9.29-36, fig. 9.29). The closest parallels for the form and finish of samples 98/43 and 98/44 are therefore to be found at Greek EN sites in the Peloponnese.

#### *ring bases*

A single example of a ring base in Fabric 24 comes from stratum VII (Evans 1964:fig.24.16). Otherwise unknown at Knossos, ring bases are a feature of LN sites in south-western Anatolia (see Appendix IV) and EN-MN sites in Greece. Examples exist at EN/MN(early) Nemea (Blegen 1975:fig.3) and EN Elateia (Weinberg 1962:170;fig.7.1). In the Peloponnese the most common EN bases are concave feet and are occasionally perforated (Phelps 1975:95, fig. 9.20-22, 25). These are to be distinguished from true ring feet (e.g. Phelps 1975:fig.9.24, 26), since each is formed differently. True ring feet when found outside an FN context are diagnostic of MN where they are common (Phelps 1975:96, 120) and along with pedestals comprise the "majority of all vessel bases" (Phelps 1975:155; cf. also MN Nea Makri, Pantelidou Gophas 1995:fig 16).

#### *flat bases*

A single example of a flat base in Fabric 24 is known from ENIa (VIII). Flat bases are a feature of most fabrics represented at Knossos and are known from

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<sup>9</sup> Compare however examples from Elateia (Weinberg 1962:171) which do have pellets immediately below the rim.



EN assemblages in the Peloponnese and LN assemblages from south-western Anatolia (see below).

### *strap handles*

There are no good parallels outside Crete for the early use of strap handles (see below).

### *Conclusion*

On balance, the closest parallels for the form and finish of Fabric 24 come from the EN-MN Greek Peloponnese. Although the existence of a strap handle in Fabric 24 may hint at a Cretan provenance, all other features are without Cretan parallels (i.e. pierced oval lugs, incurved bowls/jars with pellets a little distance below the rim, ring bases). Although the mineralogy and technology of Fabric 24 would be compatible with a north-central Cretan provenance (limestone-tempered), they would also be compatible with other similar geological environments in the Peloponnese and elsewhere in the southern Aegean. It is therefore considered possible that Fabric 24 has its origins in the Peloponnese. Although not diagnostic, it is perhaps worth noting that technological parallels for the use of limestone-based paste recipes can be found at Neolithic sites such as Lerna and Franchthi (cf. Vitelli 1993a:208).

### **Fabric 25**

The single example of Fabric 25, sample 98/92 (ENIb), comes from the body of a vessel which has been painted with a cross-hatched pattern. The surface of the sherd has fired to a grey colour and the paint has fired to a dark grey/black: it seems likely that this colour combination is the product of a heavily reducing atmosphere during firing and that the intended finish was dark-on-light painted.

Parallels for dark-on-light painted decoration can be found in Fabrics 1d and 1e, however these date to ENIc and moreover none are painted in the sort of linear design found on this single example. In Anatolia the earliest examples of painted pottery date to the LN: cf. Kuruçay (Duru 1994:pl. 81.13-15) and

Hacilar (VI) (Mellaart 1970b:fig.59.1, 11). Cross-hatched designs are rare, first appearing during the LN/EC transition and disappearing before the end of EC (i.e. pre-Hacilar IIA): cf. EC Kuruçay (Duru 1994:pl.109.10, 12; 145.12) and EC Hacilar (V-III) (Mellaart 1970b:fig.62.7; fig.66.26; fig.74.20). The Anatolian parallels for cross-hatched painted vessels are therefore both very rare and at some considerable distance from Knossos: no sites closer than the inland sites of Hacilar and Kuruçay have any parallels.

In the EN Peloponnese painted sherds are rare, first appearing late in EN (see Phelps 1975:100-2; Blegen 1975:267, pl.66.1-7, 9-10): paint and ground are usually burnished, with the ground varying from buff to red and paint from red to brown/black. Linear patterns dominate: simple multiple-line chevrons and zigzags and crosshatched triangles and wide bands. Blegen noted for EN/early MN Nemea that "in some instances zig-zag patterns overlap and thus produce an area of crosshatching; but crosshatching is frequently the main pattern itself, appearing in triangles, diamonds and other figures" (Blegen 1975:267, pl.65.3, 66.13-17, 19-23; cf. Vitelli 1993a:fig. 20.q). During MN patterns are rectilinear and geometric with cross-hatching dominant (Phelps 1975:160, 167; fig.12.2; fig.13.6; fig.15.10; fig.16.15; fig.17.5; fig.18.15; fig.19.12; fig.23.33, 35, 36, 37, 40, 43; cf. [MN Franchthi] Vitelli 1993a:fig. 30.e, g; 31.a; 32.l; 38.k; 41.c, h; 49.l, m; 51.i; 53.a, b; 62.a[3], e; 63.a, f; 64.a, c, f, g; 65.a, c, d; 68.d; 69.g; 70.d, e, g, h, i; 71.b, c, g, h; 72.e, f; 73.a; 74.b; 76.d, f; 83.b). Late in MN there is a sharp decline in the proportion of painted wares and an increase in 'stroke firnis' (Phelps 1975:121, 158).

The majority of the MN Peloponnesian examples of crosshatching closely parallel sample 98/92 (see especially Phelps 1975:fig.15.10, fig.18.15, fig.19.12, fig.23.33, 36). There is even a very close parallel for an (accidental?) reduction firing: at Nemea Blegen notes and illustrates a sherd with a "crosshatched pattern in jet black on a dark gray ground... Its appearance here, in remarkable contrast to the red-painted ware, is presumably due solely to a reducing treatment during or after firing" (1975:268, pl.65.3). The numerous contemporary (ENIb approx. = Greek MN; see Appendix I) close parallels from the Peloponnese make this

area the most likely origin of Fabric 25. The mineralogy of Fabric 25 is not distinctive of origin, but would be compatible with a source in the Peloponnese as well as Crete.

### **Fabric 26**

This group has produced two horizontal lugs (see Plate 66), one pierced (97/76) (stratum VII), the other unpierced (98/91) (ENIb), both of which have little low-profile 'tails' extending below the lug. This fabric (and the first horizontal lugs) appears at Knossos in stratum VII (ENIb). The confinement of these pierced and unpierced horizontal tubular lugs to ENIb, means that their first appearance at Knossos approximately corresponds to the period in which horizontal tubular lugs first appear in the Peloponnese (MN) and at Ayio Gala in the Eastern Aegean and at Barakli near Izmir (EC) (Hood 1981:34; see Appendix I; see also Fabric 28 below). Elsewhere in south-west Anatolia tubular lugs are not found after the initial LN/EC transition. Thus for the period in which they occur at Knossos (ENIb) a provenance is possible in either the Peloponnese (cf. especially region of Kouphovouno) or the east Aegean (especially region of Chios). Further discrimination is difficult. All examples of Fabric 26 are red burnished, which compares well with eastern Aegean examples, but also does not exclude Peloponnesian examples: for example tubular lugs are frequent in ceramics of a lustrous 'Urfirnis' brown at Kouphovouno (Renard 1989:114).

Pierced and unpierced horizontal tubular lugs in Fabric 26 have 'tails' which continue below the actual lug, a practice which finds parallels on both sides of the Aegean where horizontal tubular lugs are known. Thus Hood notes the presence of 'lugs with tails' at Ayio Gala (lower cave) and at Emporio IX-VIII, while Phelps notes a similar practice for the MN Peloponnese. However, the lugs in Fabric 26, resemble neither earlier Ayio Gala lugs, which have a single thick tail projecting from one side of the lug, nor later Emporio lugs which have four thick tubular tails projecting from the lug in a star-like formation (Hood 1981:287). Rather the low-profile tails below the horizontally-pierced lugs in Fabric 26 appear to be closer to the MN Peloponnesian practice of moulding a

horizontal lug into plastic cordon decoration, as noted on a MN sherd from Argos (Phelps 1975:158; 168).

Unfortunately the mineralogy of Fabric 26 is not distinctive of a specific source. The provenance of Fabric 26 therefore remains open, with perhaps southern Greece more likely than east Aegean.

### **Fabric 27**

Fabric 27 is represented by two sherds, 98/26 and 98/83 (see Plate 66). Sample 98/83 (stratum VII) has an incised chevron design, which is unparalleled amongst ENIb fabrics. Incised chevrons are only known from ENII in Fabrics 1e and 1f. The only general contemporary parallel within the Knossos sequence is to be found on a single example of Fabric 28 (98/90; see below). Approximate parallels can be found at EC Hacilar (Mellaart 1970b:fig 109.26) and LN/EC Ayio Gala (lower cave) (Hood 1981:pl.6.40, pl.7[c]) (see Section 7.8 on incised decoration for the occurrence of incised chevrons outside Crete).

Unfortunately the only other example of Fabric 27 (98/26, stratum VIII) is a coarse burnished body sherd and thus preserves no evidence for form. The presence of grog in its paste technology may indicate the possibility of a relationship with other grog-tempered fabrics, such as Fabric 28 (see below). However in no other fabric at Knossos are large quantities of organic material present as temper in conjunction with another deliberately-added non-plastic (i.e. grog). The only contemporary parallel for this practice comes from LN sites in West-Central Anatolia, where fabrics are generally 'grog' and/or organic tempered (e.g. Tepeköy, Meriç 1993:145). Later Anatolian parallels for this practice of grit and organic tempering are also available from MC-LC Emporio (X-VI) (Hood 1981:167) as well as MC pottery of the Kizilbel/Lower Bagbasi Group (see Eslick 1980:8-9). The provenance of Fabric 27 remains open, although in view of the eastern Aegean and south-west Anatolian parallels for the incised decoration and the combined vegetal and rock temper, an origin in this area is considered possible.

## Fabric 28

### *pierced/unpierced tubular lugs (red/brown slipped and burnished)*

Samples 97/36 and 98/87 are pierced tubular lugs, red slipped and burnished, mounted vertically or perhaps at a slight angle, on the upper half of closed vessels (jars?); sample 98/22 is a smaller unpierced lug (see Plate 67). Several more examples of tubular lugs were also identified in Fabric 28. The only other fabric at Knossos in which a form of tubular lug occurs is Fabric 26 (see above). There is an isolated and much later (ENII) example of a horizontal tubular lug in Fabric 5a. Examples in Fabric 28 are either red or brown slipped and burnished: this slip layer is visible in thin-section in the form of clay of different composition (see Chapter 6; Appendix V).

Pierced vertical tubular lugs (especially red slipped and burnished) have a wide distribution in early pottery from south-west Anatolia from Çatal Höyük to the Akhisar area (see French 1965:24 fig.5.1-3; Mellaart 1961:165.fig.3). They are known from late EN Kuruçay (Duru 1994:pl.34.1; 35.6,9,11-14; 38.9-10; 39.3; 48.6; 51.3) and are a characteristic feature of LN sites: cf. Gökpınar (Eslick 1992:pl.79.3-4), Hacilar (Mellaart 1970a:103-104; 1970b:fig.46.1-16), Kilzilkaya (Mellaart 1961:170, fig 6.35-9), Kuruçay (Duru 1994: pl.59.9; 62.9; 70.3; 74.4; 75.4) as well as sites in West-Central Anatolia (Meriç 1993:fig.3.3). The general absence of tubular lugs from EC or later assemblages makes them one of the main diagnostic features of LN sites. This absence is confirmed at Chalcolithic Kuruçay, Hacilar and sites in the Elmalı Plain, where they are rare to absent in Hacilar V and absent by Hacilar IV.

A distinctive form of vertical tubular lug from the Ayio Gala lower cave (Chios) has also been dated to LN (Hood 1981:19-20; fig.5.12-10). However in the lower levels of the upper cave *horizontal* tubular lugs seem to characterise EC deposits (Hood 1981:34). This as well as the discovery of similar red burnished horizontally-pierced lugs at Barakli, south of Izmir, which have been dated to EC, suggests that *horizontally-pierced* tubular lugs may characterise EC assemblages at Aegean coastal sites of Anatolia (see Appendix IV). This may be compared to the similar and contemporary MN practice in Greece (see below).

In the EN Peloponnese the first small tubular lugs, usually vertical, begin to appear in the EN/MN transition phase (Lerna, Franchthi, Nemea) (Phelps 1975:99, 120, 158; Blegen 1975:pl.65.7, 64.3; Caskey 1954, pl. 37d). In MN they become "relatively common" on closed shapes such as 'piriform jars' (cf. 's' profile jars) or small collar jars. These lugs may be tubular or square in section and can be short or very long (max. 9cm) (Phelps 1975:fig. 19.15). Although generally rare at other Peloponnesian sites, horizontally-pierced tubular lugs are frequent at MN Kouphovouno, where they are red/brown slipped and polished to a lustrous ('Urfirnis') finish (Renard 1989:114; pl. xxiv.5; cf. also pl.xxviii.3).

The EN/MN transitional date (c.5800BC) for their first appearance in the Peloponnese rules out the possibility that these tubular lugs may be related to the tubular lugs in Fabric 28 (but see Fabric 26 above), since these first appear in stratum IX (late seventh millennium) and disappear during stratum VII. Thus the last vertical tubular lugs in Fabric 28 disappear at Knossos at about the time that the first horizontal Peloponnesian tubular lugs appear. For the period at Knossos during which the lugs in Fabric 28 occur (c.6400-c.5800?BC), the closest, indeed the only comparanda come from the LN of the east Aegean/south-west Anatolia. Furthermore, the disappearance of vertical tubular lugs in south-west Anatolia, after around 5800BC, compares well with their disappearance at Knossos during the course of stratum VII, the majority of which must date before the middle of the sixth millennium BC (see Appendix I).

#### *hole-mouth jar with adjoining pellet decoration*

Hole-mouth jars are found in other EN fabrics at Knossos as well as at contemporary sites on both sides of the Aegean (see below on hole-mouth jars). However sample 98/89 (stratum VIII/VII) is unusual in having a row of adjoining pellets situated just below the rim (see Plate 68). No parallels for adjoining pellet decoration exist at Knossos. Rare examples of pellet decoration are known from LN Kuruçay and the Ayio Gala lower cave as well as from EC Kuruçay and LC sites in the Elmalı Plain (see below on pellet decoration). In late EN Peloponnese and EN Central Greece pellet decoration is uncommon but widespread (Phelps

1975:111). Sometimes it is found moulded into the rim of hole-mouth jars in a similar manner to sample 98/89 (Phelps 1975:fig.9.3-4 [Lerna]; Kunze 1931:fig.35 [Orchomenos]).

#### *unusual incised zigzag pattern*

Incised decoration is a feature found in many fabrics at Knossos, however the design and execution of the zigzag incised decoration on sample 98/96 (EN1b) is completely unparalleled at Knossos (see Plate 68). Incision on sample 98/96 is from a finer tool, is not as deep and is more compact; it has also been filled with a white paste. Incised decoration can be found in assemblages on both sides of the Aegean (see Section 7.8 on incision decoration for parallels outside Crete). It is rare at southern Greek EN sites, becoming rarer in MN. At sites in south-west Anatolia incision decoration is more common; indeed recent discoveries of LN material from Aegean coastal sites hint at the possibility that incision may be particularly frequent here (cf. Miletus area, see below and Appendix IV). The closest published parallel for the design comes from a single example from LN Kuruçay (Duru 1994:pl.81.4).

#### *Conclusion*

The early presence at Knossos (late seventh millennium) of red slipped tubular lugs in Fabric 28 currently rules out the possibility that they originate in the Peloponnese and suggests an origin in south-west Anatolia. Other features in Fabric 28 are less unequivocal, such as pellet decoration on hole-mouth jars. Although close parallels for the form of incised decoration on sample 98/96 could not be found, the extreme rarity of incised decoration in the Peloponnese and the greater frequency with which it is found at coastal sites in south-west Anatolia, despite the general lack of research in this region, also point in an Anatolian direction. In this context it is worth considering a striking technological feature exhibited by sherds in Fabric 28: although represented by relatively few sherds in strata IX-VI the majority of sherds - a much higher proportion than in other fabrics (although cf. also Fabric 31) - have a black core in their break (cf.

'sandwich effect', Chapter 5). The frequency with which this occurs suggests the possibility that this is caused by the use of a particular firing practice. No mention is made of this distinctive feature in studies of EN-MN Peloponnesian fabrics, however studies of LN ceramics from south-west and west-central Anatolian sites consistently refer to black cores with orange or red outer layers. Thus, Eslick notes that among LN fabrics from the Elmalı Plain black cores are 'common' (Eslick 1992:81). Similarly around three-quarters of the pottery from sites along the Gediz and Büyük Menderes exhibit a black core 'sandwiched' between red (French 1965:18; Meriç 1993:146). This feature has also been noted as common in 'MC' fabrics from the Elmalı Plain (Eslick 1980:8-9). When taken together this suggests that the distinctive firing horizon noted in examples of Fabric 28 may also link this group to south-west Anatolia.

### **Fabric 29**

There are no parallels, either within the Knossos assemblage or outside, for the combed decoration in sample 98/86 (stratum VI). Like Fabrics 27 and 28, Fabric 29 is grog tempered. This technological link between Fabric 29 and Fabrics 27 and 28 may hint that Fabric 29, which is represented only by two sherds in the EN Knossos assemblage, may also have an origin in the East Aegean or south-west Anatolia. This however remains speculative.

### **Fabric 30**

Fabric 30 is represented by a single body sherd (98/90, EN1b), which preserves no distinctive information about the original form of the vessel (see Plate 69). The finish is buff burnished. The provenance of Fabric 30 remains open.

### **Fabric 31**

Sample 97/101 (stratum VI) is from a small fine dark polished bowl (see Figure VIII.26). Parallels for this form are ubiquitous. However, the large quantities of biotite in Fabric 31 make it difficult to find a compatible source on Crete and would seem to suggest that its source probably lies somewhere beyond the island.



Sample 97/101 has a distinct dark core, a technological feature which may or may not link it to the East Aegean (see above on Fabric 28), where parallels can also be found for the micaceous fabric: for example much of the pottery at Ayio Gala (lower cave) is in micaceous (both gold and silver) fabrics<sup>10</sup> (Hood 1981).

### **Fabric 32**

Sample 98/78 (stratum VI) is from the body of a vessel painted with red and white lines on an orange burnished background (see Plate 70). The white paint is very thin and scarcely visible. Contemporary parallels for white painted decoration are hard to find. At LN/EC Ayio Gala (lower cave) some painted sherds have white painted striped decoration (Hood 1981:21, pl.7[b].30): like sample 98/78 the paint is a thin "dirty white" which has been applied after the surface of the vessel had been burnished and like sample 99/78 these occur in metamorphic fabrics. In the EN Peloponnese white-on-red painted decoration is rare (except Asea, Phelps 1975:105) and this white paint is crusty in contrast to that on 98/78. In MN white paint is very rare (Phelps 1975:160) and none of the examples cited resemble the linear design on 98/78. The provenance of Fabric 32 therefore remains open.

### **Fabric 33**

Sample 97/59 is a body fragment from a small diameter (incurved?) bowl (see Figure VIII.26). Parallels for such a form are ubiquitous and thus provenance remains open.

### **Fabric 34**

*carinated bowl with flared offset rim with diagonal slashed rim decoration*

The only close parallel for the form of sample 98/80 (stratum V; see Figure VIII.26) in any sequence of the southern Aegean, is a unique vessel also from Knossos in Fabric 35 (see on 97/43, 98/10 below), although the example in

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<sup>10</sup> Compare also the predominantly micaceous (silver) fabrics at LN sites in the nearby Izmir region (R. Tuncel pers. comm.).

Fabric 35 dates considerably earlier (stratum VIII). Sample 98/80 is burnished using the same distinctive horizontal burnish as found on 98/10, although the leading edge of the rim differs from 98/10 in being decorated with diagonal slashes. The closest parallel for the diagonal design are with 98/88, also Fabric 34 (see below), although here the design is painted. Although slashed rims are a rare feature of MN Nea Makri and Elateia (Pantelidou Gopas 1995:pl.8.3-17, pl.24.5-16, pl.37.8-8; Weinberg 1962:175, pl.54(d).3-5, 7-9), these are all *vertically* slashed and found on different forms. In view of the close similarities in form and burnishing technique between 98/90 (Fabric 34) and 98/10 (Fabric 35) it is possible that these two fabrics originated in the same general area. The closest parallels for this form outside Knossos are almost entirely from south-west Anatolia.

*curved bowl with flared offset rim with double cordon decoration*

A similar vessel with flared offset rim and double horizontal cordon decoration is known from stratum VI (cf. Evans 1964:fig.22.10). See below on plastic decoration.

*bowl with dark-on-brown/orange painted and burnished decoration*

Sample 98/88 (stratum VIII/VII) is from a thin-walled bowl decorated below the rim with diagonally painted dark-on-brown/orange lines, which were then burnished (see Figure VIII.26). Parallels for the form are ubiquitous. Closest parallels for the diagonal design are found in 98/80 above, but these are incised. Contemporary painted wares (Greek EN/MN or Anatolian LN/EC) can be found on both sides of the Aegean. However Greek EN/MN examples tend to be more often slipped and painted (see above on Fabric 25). Dark-on-orange/brown unslipped, painted and burnished sherds are a particular feature of LN/EC Anatolia: cf. LN Hacilar (Eslick 1992:p.68 n.18) and LN/EC sites in the Elmali Plain, such as Akçay, where unslipped painted and burnished sherds with linear designs are noted and compared to LN Hacilar (Eslick 1992: 60, 68, pl. 31, pl. 77.32). It should be stressed that sample 98/88 cannot be compared to later

Anatolian EC Hacilar-style slipped and painted vessels, rather the parallels are with LN and LN/EC wares. However, any such parallel with EC Hacilar (IV-II) painted wares would be unlikely in view of the very narrow distribution of this type of pottery within south-west Anatolia (see Appendix IV).

### *Conclusion*

The provenance of Fabric 34 remains unclear, although the east Aegean or south-west Anatolia remain the most likely possibilities.

### **Fabric 35**

*large round-based carinated bowl with flared offset rim and strap(?) handles*

This form is almost as unique in the EN assemblage at Knossos as the blueschist fabric in which it occurs. All sherds come from stratum VIII (97/43, 98/10) and are almost certainly from a single vessel with a dark exterior burnished or polished with horizontal strokes and an interior which has been scraped/smoothed (see Plate 71). The only parallels for the shape at Knossos are in Fabric 34 (see above) and these are almost as scarce.

The form may be compared to frequent examples from south-west Anatolia: cf. late EN Kuruçay (Duru 1994:pl.38.4-5; 48.10; 51.6), LN Kuruçay (Duru 1994:pl.90.5; pl.61.4-5; pl.64.1; 83.5; 69.11-12), LN Hacilar (IX, VI) (Mellaart 1970b:fig.45.2-3; fig.50.3, 26;60.3, 5, 14-17, 21) and LN Gokpinar and Akçay (Eslick 1992; cf. Mellaart 1961:fig.6.26-7). Many of these LN examples resemble the vessel in Fabric 35 quite closely (cf. especially Duru 1994:pl.64.1; 83.5; Mellaart 1970b:fig.45.2-3), however none of these have strap handles, although an example from LN Kuruçay has handles which could approximate a strap (cf. Duru 1994:pl.73.9, 11). When painted wares first become common at LN Hacilar (VI) very good parallels for the Fabric 35 form remain very common in the monochrome wares; some of these have small horizontally-pierced lugs, which may be compared in form and position on the vessel to the vessel in Fabric 35 (Mellaart 1970b:fig.50.3, 26;60.3, 5, 14-17, 21). In absolute terms Hacilar VI is broadly contemporary with stratum VIII at Knossos (see Appendix I).

This form continues into the Anatolian Chalcolithic: cf. EC Kuruçay (Duru 1994:pl. 118.8;160.3; 177.2), LC Bagbasi (Eslick 1992:pl. 54.223) and LC4 Beycesultan (Lloyd & Mellaart 1962:fig. P.10.3-8; levels XXIII-XXIV). However these are much later than the example in Fabric 30 and are almost always vessels of a much smaller diameter (e.g. Eslick 1992:pl.54.223).

This form is less well paralleled in the EN Peloponnese. Examples are less close and these are considered rare transitional EN/MN forms by Phelps (1975:87; fig. 6.7.10). In MN 'flaring rim bowls' are very common (Phelps 1975:138, 141; fig. 14.7-10, 13, 16, 17), however the examples illustrated by Phelps are not close to the example in Fabric 35. Only in late MN/LN do carinated shapes become slightly more common and one can find closer parallels but these have ring bases, whereas the vessel in Fabric 35 is round-based (Phelps 1975:fig.16.5, 6; Vitelli 1993a:fig.59.e-h; fig. 85.k-l). The closest Greek parallel for the form is with a vessel from MN Corinth, which also is finished with a similar horizontal burnish (Weinberg 1937:501, fig. 8b; fig.11); unfortunately the shape is incomplete with no information as to whether it is ring or round-based.

Thus the closest contemporary parallels (i.e. late EN Greek/LN Anatolia) for the vessel in Fabric 35 come from south-west Anatolia. The fabric is dominated by blueschist, which is found throughout the Cyclades and parts of coastal Anatolia (e.g. Knidian peninsula).

#### *7.6.4 Unique Unsourced Sherds*

(i) Dark polished curved bowl with offset rim with incised triangle filled with a diagonally-incised lattice in a schist fabric (stratum VIII):

Although incised lattice decoration is known at Knossos in Fabrics 2a, 2b and 5a, the lattice is always horizontal, never acts as a filling for geometric shapes and occurs in later contexts (stratum VII-VI). Very good parallels for this type of decoration can be found at EN/early MN Nemea, where diagonally-incised lattice decoration acts as filling for diamonds and other shapes (see Blegen 1975:267, pl.65.13). Nemea is also one of the few sites in southern Greece to have good parallels for the form (Phelps 1975:fig. 3.2-3, 6, 8, 15; see below). These

parallels from Nemea also have the virtue of being broadly contemporary with the example from Knossos (stratum VIII = late Greek EN).

(ii) Unburnished/smoothed with broken stump of a tubular handle from a thin-walled vessel (stratum VI); soft, very fine, pale white fabric, no large non-plastics:

There are similarly preserved broken tubular handles on thin-walled vessels from southern Greece (Phelps 1975:447 fig. 1.11; 512:fig. 66.33, 38). The fabric is unique at Knossos. Possible parallels may exist with the "exceedingly fine" "gritless" fabric noted as a feature of Peloponnesian EN and early MN deposits (Phelps 1975:72): this fabric is always pale in colour, often with "cream, yellowish or slightly pink tones" and is sometimes unburnished and 'wet-smoothed', a feature which would compare well with the example from Knossos (Phelps 1975:73, 75). One might also make a comparison with the white wares which are a rare feature of some southern and central Greek sites. At Nea Makri, white ware is an early MN to early LN feature (i.e. contemporary with stratum VI) and very fine and thin-walled, in contrast to white ware in Thessaly and Peloponnese, but very much like the example from Knossos (Pantelidou Gophas 1995:305-6; 313 fig.1; Phelps 1998:433-4). X-Ray Diffraction analysis has shown the Nea Makri white ware to be almost pure clay (c.90% metakaolinite and illite) with quartz, mica and calcite; microscopic study concluded that the inclusions were volcanic and indicated an origin for the clay on Melos (Pantelidou Gophas 1995:322 Appendix 2). In his review Phelps concludes that the Nea Makri white ware was "imported from Melos, no doubt with the obsidian" (Phelps 1998:433-4).

(iii) Unburnished(?) bowl with rows of horizontally-spaced notches; schist fabric with silver mica (stratum V):

An identical example comes from Emporio VIII (Hood 1981:pl.42.418), the fabric of which is described as "sandy brownish grey-black clay with occasional large lumps of grit; silvery mica showing in surface" (Hood 1981:297). However,

the origin of this parallel remains unclear since it is considered by Hood to be imported to Emporio.

(iv) Dark-on-light painted and burnished body sherd with linear pattern (parallel lines); fabric is pink with very fine calcite (stratum IV):

Closest parallels are with MN Peloponnese painted Urfinis, which usually has a similarly fine fabric (Phelps 1975:124): cf. MN Kouphovouno (Renard 1989:xxv.2, 4, 6, 7; xxvi.1, 3-8; xxx.1).

### **7.7 Defining Variation in Cretan Early Neolithic Forms and Finishes in the Wider Context of the Southern Aegean**

In Section 7.6 provenance was assessed in terms of variation in form, finish and frequency per fabric. All fabrics belonging to Group 1 (frequently-attested fabrics) are considered to have a provenance close of Knossos (Herakleion area). Fabrics belonging to Group 2 (rare fabrics), were shown to have good parallels in form and finish with fabrics of Group 1 and as a result these are also considered to have a provenance within the general area Knossos. However, as the presence of Fabric 12 in this group shows, this area should probably include regions as distant as the Mirabello Bay in East Crete. As a result the extent of this zone of overall similarity in form and finish is considered to be large probably encompassing much if not all of Crete. When taken together Groups 1 and 2 account for c.97.5-99.9% of the EN assemblage at Knossos. This leaves a very small group of rare or unique fabrics which exhibit rare or unique forms and/or finishes. In two cases (i.e. Fabrics 31 and 35) petrographic study of these fabrics has indicated a provenance beyond Crete. In several others (i.e. Fabrics 24-8, 32, 34) comparison of these rare or unique forms with ceramic material from other regions of the southern Aegean has also indicated the possibility or even probability of a provenance beyond Crete.

And so if one excludes the fabrics of Group 3, one is left with a large group of fabrics, whose provenance is almost certainly within Crete and which share a range of types of form and finish. Taken together these forms and finishes

may be understood at a general level to define the Knossian/Cretan EN in ceramic terms. In this section, in order to understand the degree to which this range of forms and finishes is distinct or similar to those found outside Crete, each form and finish type will be subject to a detailed comparative study based on published assemblages from south-western Anatolia, the eastern Aegean and southern and central Greece. In addition and wherever possible these EN forms and finishes, as defined at Knossos, will be compared to published material from other known, claimed or suspected EN sites around Crete<sup>11</sup>. From this full and detailed discussion of the available comparative material it will ultimately prove possible to isolate a smaller range of forms and finishes which are distinctively Cretan.

### **BOWLS AND JARS:**

#### *deep curved bowl/deep curved bowl with flattened rim*

Simple curved bowls of various types are a feature of Neolithic assemblages all around the Aegean. Open flat-based types can be found at EN sites in northern and southern Greece, where they are generally outnumbered by types with raised or ring bases (see below). In south-western Anatolia they are common at late EN Kuruçay (Duru 1994:pl.36.1; 37.5; 46.3-5; 47.1-4; 51.1) and are known from LN Kuruçay (Duru 1994:pl.63.2-3) and LN Hacilar (VIII) (Mellaart 1970b:fig.48.29-30).

In south-western Anatolia deep curved bowls are found at EN? Beldibi (Bostanci 1959: pl. IV.3, 5) and late EN Kuruçay (Duru 1994:pl.37.3; 43.8). They are also a general feature of LN sites: cf. Akçay (Eslick 1992:pl.77.17-24), Hacilar (Mellaart 1970b:figs. 45.25, 47.6-7, 48.13) as well as sites in West-Central Anatolia (French 1965:fig.3.11-12, 15-16, 18-20). Flattened rimmed examples from EN Ia Knossos also have good parallels in contemporary LN levels at Hacilar (Eslick 1992:68; see Mellaart 1970b:fig.48.29-30), Akçay (Eslick 1992:pl.77.25) and at sites in West-Central Anatolia (French 1965:fig.11-13,15; Meriç 1993:fig.3.2).

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<sup>11</sup> For a discussion of possible and certain EN sites on Crete see Appendix I.

Medium to deep bowls are the 'leitmotif' of the EN Peloponnese (Phelps 1975:82; cf. EN Elateia (Weinberg 1962:169-70); cf. EN/early MN Nemea (Blegen 1975:fig.3; 262). Like the Cretan examples these often have a slightly incurved rim; however while at Knossos more open versions are equally if not more common, in the Peloponnese they are rare outside Corinth and Nemea. In addition examples from the Peloponnese often have ring bases or concave footed bases and perforated lugs (cf. Phelps 1975:figs. 1.17, 18; 2.4, 10), which all examples from Knossos lack (except Fabric 24, see above). Simple medium to deep bowls are rare in the Peloponnese after EN having been replaced by straight, shouldered and carinated forms (Phelps 1975:135-6; fig.12.3, 4, 11).

#### *shallow curved bowl*

In south-western Anatolia these are known from EN Kuruçay (Duru 1994:pl.36.2; 43.1; 44.2; 47.5) as well as LN Kuruçay (Duru 1994:pl.55.5; 61.2; 68.3; 82.1-3), LN Hacilar (VIII) (Mellaart 1970b:fig.48.18) and LN Ayio Gala (lower) (Hood 1981:14, fig.5.2-3), where shallow bowls dominate the assemblage and are either curved or straight-sided. Shallow curved bowls are also known from EC Kuruçay (Duru 1994:pl. 122.1-3) and 'MC' Lower Bagbasi (Eslick 1992:pl.63.4-5).

In the Peloponnese examples are known from EN Akkrata, Tarsina, Phlius, Nemea, Franchthi, Lerna, Ayioritika (Phelps 1975:80; fig.1.7; Blegen 1975:fig.3.a). In MN the 'dominant type' has a concave foot or ring base; pedestal-bases are rare (Phelps 1975:132-3; fig. 11.4, 7, 8, 10, 12, 14).

#### *shallow straight-sided bowl*

In Anatolia, flat-based examples are known from EN Kuruçay (Duru 1994:pl.37.6; 52.3-6), LN Kuruçay (Duru 1994:pl.68.5-9) and are especially common at LN Ayio Gala (lower) (Hood 1981:14, fig.5.4-5). Examples can also be noted at EC Kuruçay (Duru 1994:pl. 122.4-5;124.1). In contrast in the EN Peloponnese they are very rare (two from Nemea, one or two from Lerna, all with red or red-brown slip), although these rare examples are very similar to



those from Crete (Phelps 1975:80, fig.1.2, 3; Blegen 1975:fig.5.a, b, c). They become more common in MN, however these are always with ring or pedestal bases (Phelps 1975:fig.11.1, 2, 13).

#### *flared rim bowl*

Flared rim bowls are known from EN? Beldibi (Bostanci 1959: plate IV.7) and cf. EN Kuruçay (Duru 1994:pl.50.8-9). They are common also at LN Anatolian sites: see LN Aphrodisias (Joukowsky 1986:fig 297.2,3), Akaçay (Eslick 1992:pl.76.9-12, 77.28), Hacilar (Mellaart 1970b: 47.37-8; 48:29, 50:12, 18, 51.1-5, 6, 53:2, 50:26), Kuruçay (Duru 1994:pl.58.5; 65.3, 10-12), LN Gökpınar (Eslick 1992.pl.79.6-7), Kizilkaya (Mellaart 1961:170 fig 6:26-7) as well as sites in West-Central Anatolia (French 1965:fig.3.2, 6, 7, 9; 5.6-8, 12, 14; Meriç 1993:fig.3.1). They are also known from 'MC' Kizilbel (Eslick 1992:pl.74.10) and LC Bagbasi (Eslick 1992:pl.54.225).

Flared rim bowls are less common in EN Peloponnese than in Central Greece (Phelps 1975:94) and are known from Lerna, Franchthi and Nemea (Phelps 1975:fig. 2.8-11). In the MN Peloponnese they are equally rare and differ from the Cretan and Anatolian examples in being shallow with ring bases (Phelps 1975: 154, fig.11.3, 6, 14.5).

#### *carinated bowls*

Carinated bowls are generally not common in Neolithic south-western Anatolia: compare the single vertically carinated bowl from EN Kuruçay (Duru 1994:pl.37.8). However both flared carinated and vertically carinated bowls are very common amongst the monochrome wares from EC Hacilar (I) (see Mellaart 1970b:fig.111.1-2, 4-7 [flared], fig 111.3, 8-12 [vertical]) and are known also from EC Kuruçay (Duru 1994:pl. 159.10-12). Indeed several examples from Hacilar have pellet decoration on the carination, which recalls ENIc-II examples from Knossos (Mellaart 1970b:fig.111.1, 4-5). Also from EC Hacilar (IIB-III) are several examples of carinated bowls with rounded bases (Mellaart 1970b:fig.70.17-19), which resemble an ENII bowl in Fabric 1b at Knossos as

well as examples from Elateia (see below). Carinated bowls are however uncommon in LC south-western Anatolia (Eslick 1992:85), although they are well represented at Emporio IX onwards as well as at Aphrodisias and in the Dinar and Burdur regions.

In the Peloponnese carinated bowls only become popular in MN, where they often have ring feet or pedestals (Phelps 1975:120). Vertically carinated bowls, similar to late ENI examples at Knossos, are actually quite rare in MN (only occurring in Corinth), only becoming more common in late MN/LN (Phelps 1975:142; fig. 16.7). Shallow flared carinated bowls are known from Corinth (Phelps 1975:142; fig. 12.10; 16.5, 8, 10). Carinated bowls with rounded bases are a late MN/LN feature of the Argolid (Phelps 1975:142; fig. 16.3, 9). Carinated bowls are also a feature of MN/LN Elateia (Weinberg 1962:10.4, 5, 7, 10, 11) where they are common, sometimes with rounded bases (e.g. in Fabric 1b [ENII]), one of which is rippled (Weinberg 1962:188; pl.60(d).8).

The synchronism between the popularity of carinated bowls at Knossos in late ENIb/ENII (especially flared carinated bowls) and their late MN/LN popularity on the Greek mainland has been noted by Evans (1971:109). However at Knossos, unlike Mainland Greece, these have a local ancestry going back to ENI (Broodbank 1992:48). This general synchronism is confirmed in Appendix I. However, what has not been noted previously is the synchronism with the appearance of these bowl types at late EC sites in south-western Anatolia. Anatolian late EC, Greek late MN and Cretan late ENIb/ENIc all occur in the latter half of the sixth millennium (c.5300BC; see Appendices I, IV). Under such circumstances it is impossible to speak of the influence of one area over another (although Knossos does have a longer history of carinated bowls), but the possibility is raised of contacts between these three areas.

#### *curved/carinated bowl with offset rim*

In Anatolia there occur occasional examples that are close to those from Knossos: for example at LN Kuruçay (Duru 1994:pl.55.8, 12; 68.10; 71.6, 8), LN Hacilar (IX, VI) (Mellaart 1970b:fig.45.29, 34; 47.17-18, 50.5) and LN Ayio

Gala (lower cave) (Hood 1981:fig. 5.12, 6.13-18). However in general Anatolian bowls do not have sharply offset rims, but instead curve out gradually to form an 's' profile.

Curved or carinated bowls with offset rims are even more rare in the EN Peloponnese (Phelps 1975:93-4). The closest is a form of offset rim found chiefly on the glossy burnish rib and groove decorated black ware from Nemea (Phelps 1975:fig. 3.2-3, 6, 8, 15). Beaded or offset rims are more common at EN sites in Central Greece (e.g. Nea Makri, Elateia) as well as further north in Thessaly (Phelps 1975:94). Some examples from EN Elateia are quite close to examples from Knossos (see Weinberg 1962:fig.5.6-10; pl.52(a).2-6), although Weinberg suggests that overall the closest similarities are with the earliest pottery from Thessaly, where 'everted rims' are common (1962:171; cf. Theocharis 1973:figs.29-30; Milojcic & Milojcic 1971:pl.A.2, 3; pl. G.1-11; fig. I.3; fig. II.3-15; VII.1-24). During MN and LN, curved or carinated bowls with offset rims continue at Elateia and at Nea Makri (Weinberg 1962:fig.6.6-9; fig.8.2, 3, 6; fig.11.1-5, 7; pl.58(b); 62(c); Pantelidou Gophas 1995:fig.12.3-33, 3-34, 3-37, 3-42, pl.53.11-93, 11-94, 11-95). Some of the later MN and LN examples from Elateia closely resemble examples from Knossos: cf. Weinberg 1962:fig.8.6, 11.1-5, 7, pl.54(a), which are flat-based high curved/carinated bowls with offset rim, one of which is even pellet decorated. Several of these are Black-on-red painted and others have the Urfirnis lustrous slipped surface. Therefore the closest parallels for the offset rims at Knossos come from Central Greece.

Variations of curved/carinated bowls with offset rim include:

(i) deep bowl with offset/beaded rim: examples of deep bowls are known from EN Kuruçay (Duru 1994:pl.44.6), LN Hacilar (VIII & VI) (Mellaart 1970b:fig.48.28), EC Kuruçay (Duru 1994:pl. 159.13-14) and LC Bagbasi (Eslick 1992:pl.47.140, 142).

(ii) shallow curved bowl with offset rim: examples are known from LN sites in Anatolia: for example Kuruçay (Duru 1994:pl.55.14) and Hacilar (VIII) (Mellaart 1970b:fig.48.15).

(iii) high carinated bowl with offset rim (ENIc/ENII): a particular variety of this bowl type, frequent at Knossos in ENIc/ENII has particularly close parallels with some LN bowls from Paradimi, Greece (French 1961:fig.6.17, 27): note in particular the presence of strap handles on carination and just below the rim and decoration in the form of "grooving or rippling" (French 1961:fig.6.12-15, 7.1-9).

*curved jar with offset rim*

As with curved/carinated bowls, close Anatolian parallels are rare; compare, however, EN Kuruçay (Duru 1994:pl.36.7; 51.8-9), LN Hacilar (VI) (Mellaart 1970b:fig.52.6-8), LN Kuruçay (Duru 1994:pl.57.6; 71.7) and LN sites in West-Central Anatolia (Meriç 1993:fig.3.1). Usually however rims are not sharply offset and resemble more an 's' profile (see below).

In the EN Peloponnese curved jars with offset rims are not common (Phelps 1975:86; Blegen 1975:fig.5.e, f, g, N19), but become more common in MN, where offset rims are more sharp and are thus closer to the Cretan examples (cf. Phelps 1975:fig.5.1-4, 6, 8-10 - from Nemea, Gonia, Franchthi). However the majority of these rims are much more flared than Cretan types. Actual Cretan-style beaded rims are 'exceptional' in MN contexts (Phelps 1975:154;cf. fig.14.3).

*incurved bowl/hole-mouth jar*

Hole-mouth jars are found at EN Kuruçay (Duru 1994:pl.37.1-2; 43.2, 5-7; 44.11-12) as well as at a large number of LN sites in Anatolia: Akçay (Eslick 1992:68, pl.76.4-5) Hacilar (Mellaart 1970b:fig. 46.15, 48.14, 18), Gökpinar (Eslick 1992:pl.79.8), Kizilkaya (Mellaart 1961:170 fig.6.4, 9-10), Kuruçay (Duru 1994:pl.57.1-2; 64.2; 66.6-7; 71.2-3) as well as at other LN sites in West-Central Anatolia (French 1965:fig.3.21-3; 4.15). Usually these are curved in profile, however straight sided hole-mouth jars are known from sites on the Elmalı Plain (Eslick 1992; see Appendix IV). These may be compared to ENI examples at Knossos in Fabrics 6 and 8.

Incurved bowls/jars are equally common at sites in the EN Peloponnese, such as Asea, Nemea, Ayioryitika, Franchthi (Phelps 1975:fig. 4.5, 10, 16, 17, 20; Blegen 1975:fig. 3, 5.i, j, k, m;5.d). Many of these have oval lugs and ring bases. In MN this 'dominant' EN form plays only a minor role (Phelps 1975:137-8; fig.13.13, 14.1, 3, 4, 6; fig.14.2, 12).

*'s' profile jar/'necked' jar/collared jar*

This form type differs from curved/carinated bowls with offset rims in the way that the rim is not sharply offset but gradually curves out to form an 's'. On some examples this curve is more sharp or 'necked', on others it is more elongated and resembles a collar.

In Anatolia 's' profile bowls are known from late EN Kuruçay (Duru 1994:pl.34.1-7,9-11; 36.5-9; 43.3-4; 45.1-8) and are a well-known feature of LN sites: e.g. Aphrodisias (Joukowsky 1986:fig 297.4), Akçay (Eslick 1992:pl.76.1-2), Kuruçay (Duru 1994:pl.57.3-4; 64.4-6; 84.6-7), Hacilar (IX, VII, VI) (Mellaart 1970b:fig.45.30-35; 47.19-25; fig.49.8-13, 17; fig.52.1-5) and LN sites in West-Central Anatolia (French 1965:fig.3.6, 8; fig.4.1-4; fig.5.5; Meriç 1993:fig.3.1). 'S' profile bowls are also known from 'MC' Lower Bagbasi, 'MC' Kizilbel and LC Bagbasi (Eslick 1992:pl.63.2-3; pl.74.9, 76.1-2; pl.70.10-14). 'S' profile bowls with 'necked' or 'collared' rims are known from EN and LN Kuruçay (Duru 1994:pl.34.8; 48.11; 50.5-7; 57.4; 58.1-2; 74.5-8) and at LN sites in West-Central Anatolia (French 1965:fig.4.16-17, 19-20; fig. 5.17); they are also known from EC Akçay, LC Bagbasi and LC Karaburun (Eslick 1992:pl.68.17-18, pl.71.a, pl.76.13-14). Examples of very high collared or 'funnel-necked' jars are known from LN Hacilar (VI) (Mellaart 1970b:fig.54.2, 4).

'S' profile bowls are also known from the EN Peloponnese (see Phelps 1975: fig. 4.21, 22; 5.5, 7, 11) and in MN they become a 'dominant form' (see Phelps 1975:135-6; fig. 13.2, 3, 8-11, 14): they are particularly common at Lerna. Medium sized vessels are usually painted, such as at Corinth, Gonia, Kefalari, Lerna, Ayioryitika and Kouphovouno. There are also a number of

variants, such as a deeper type at Lerna, a narrower diameter 'tulip' vase (Phelps 1975:137; fig.13.12) and a variant which Phelps calls 'piriform jars' (1975:139; fig. 15.1-11; 17.3, 6, 8, 9). Sometimes these curve out into a carination (fig.15.9) others have an 's' profile; often they have round bases.

In the EN Peloponnese more collared versions of this type are rare and transitional to MN (Nemea, Lerna) (Phelps 1975:87): low-collars [ $<2.5\text{cm}$ ] are known from Phlius, Prosymna and Franchthi, medium [ $2.5\text{-}5.0\text{cm}$ ] from Nemea, Prosymna, Franchthi and Lerna and high collars [ $>5.0\text{cm}$ ] from Akrata, Nemea, Lerna and Ayioryitka (Phelps 1975:fig.7.11; fig. 7.1-4; fig.7.5-10). Collared types are prominent at EN Elateia (Weinberg 1962:169-70; fig.5.17-20). In the MN Peloponnese collared jars become more common and necked-jars become rare (Phelps 1975:120; 144).

#### *flat-based mug*

There are few parallels for this form outside Crete. The only contemporary or earlier example come from LN Kuruçay in Anatolia: two low flat-based vessels, one with a slightly flared rim (Duru 1994:pl.68.2, 82.5). Other parallels are very late: cf. a LC flat-based vessel with rim attached loop/narrow strap from Bagbasi (Eslick 1992:120.38, 39, 41, 42, pl.99.f), a MN/LN incised vessel from Kouphouvouno (Renard 1989:pl. xxxii.6) and a LN flat-based shallow steep-sided bowl from Paradimi in Greece (French 1961:fig.7.18). However, it is perhaps worth noting the possibility of a connection at Knossos between incised flat-based mugs and incised 'trays', since these are the main ENIb decorated forms and both are shallow with steep sides (see below for LN Anatolian parallels).

#### *rectangular 'trays'*

Rectangular vessels with short feet, some of which have deeply incised decoration are known from LN sites in west-central Anatolia as well as along the coast to the north (Meriç 1993:145, fig. 3.5; see Appendix IV). Shallow rectangular vessels are also known from LC Bagbasi (Eslick 1992:pl.54.227, pl.56.242-9). However, it should be noted that several of these 'trays' are

decorated on their bases (cf. Evans 1964:27.24, 26) and their interior are only very roughly finished. This may indicate that these 'trays' were actually used upside-down and could not have functioned as containers. One alternative would be that they were perhaps models of decorated tables. See also above for possible link in form, finish and potentially significance for 'trays' and flat-based mugs.

*pedestalled bowl/pedestalled stand*

In the EN and early MN Peloponnese pedestal bowls are rare, although such vessels are more common in the Magoulitsa culture of Thessaly (Phelps 1975:97, fig.9.27-8). However by mid-MN carinated bowls on pedestals are common and by late MN pedestals with fenestrated decoration are found (Phelps 1975:120-1, 155; cf. also MN Elateia Weinberg 1962:fig.9).

*flared rim cups (and internal piercing)*

Small diameter bowls/jars with internally-pierced rims are known from LN Kuruçay (Duru 1994:pl.56.2, 70.9-10; 72.7; 75.9). Examples of unpierced internal rim lugs are also known from LN (Duru 1994:pl.66.4-5) and EC Kuruçay (Duru 1994:pl.128-9). Sometimes these lugs are also pierced: e.g. EC Kuruçay (Duru 1994:pl.107.4; 140.15). However none of these are close parallels for the flared cups in strata VI-V at Knossos.

*shallow bowls with internally thickened rim*

This is a very late EN feature at Knossos (ENIc, ENII). Similar internally thickened rims are known from a large number of contemporary or near contemporary LC sites in south-west Anatolia: cf. LC Boztepe (Eslick 1992:pl.67.2-3, 5, 7-9), LC Arapkave Höyük, near Metropolis (Meriç 1975:fig. 106.6-9), LC Akhisar, Manisa, Balıkesir (French 1961:fig.5.35-8, 41-6), LC Aphrodisias (Joukowsky 1986:fig 35:13, fig. 33.3) and also LC Beycesultan (Lloyd & Mellaart 1962:fig. P2:15). However the parallels from Beycesultan are not as close as those from the other sites.

### *spoons*

Spoons are a rare feature of the EN Peloponnese (Phelps 1975:91; fig. 8.7 [Lerna, Nemea]).

## **BASES:**

### *round bases*

Examples of round bases are known from EN Elateia (Weinberg 1962:170) and are common at sites in the EN and MN Peloponnese (Phelps 1975:94-5, 154-5).

### *flat bases (shallow, steep)*

Shallow and steep sided flat bases are known from many Neolithic sites in south-west Anatolia: cf. EN Beldibi (Bostanci 1959: plate IV.1 [steep]), late EN? Kuruçay (Duru 1994:pl.34.12; 45.13; 49.12-13 [shallow]), LN Kuruçay (Duru 1994:pl.65.13-14; 76.6-7), LN Hacilar (IX) (Mellaart 1970b:fig.45.17; 47.34), LN Kizilkaya (Mellaart 1961:fig.6.43-9) and at LN sites in west-central Anatolia (French 1965:fig.4.21, 5.16). Flat bases are also common in the LN/EC Ayio Gala Lower Cave (Hood 1981:20; fig.5.10, 12; fig.6.13) and at LC Bagbasi (Eslick 1992:pl.51.e.g. 177-180, 183, 195, pl. 52-3)

Flat bases are also common in the earliest monochrome pottery at EN Elateia, but these often have a slight concavity (see concave bases) (Weinberg 1962:170;fig.7.1). In the EN Peloponnese flat bases are common on large heavy bowls, but are otherwise rare (Phelps 1975:95; Blegen 1975:fig.3 N12). In MN "apart from a few instances where the round base has been partly flattened, true flat or concave bases are rare on fine wares" (Phelps 1975:154). In general flat bases are rare at sites in Greece, ring bases are much more common. At LN Saliagos most bases are flat (Evans & Renfrew 1968).

### *concave bases*

Flat bases which are slightly concave are a consistent feature of LN Hacilar (IX-VI) (Mellaart 1970b:fig.47.33, fig.48.2-3, fig.49.4, fig.50.6, 10, 31, fig.52.3), LN Aphrodisias LN (Joukowsky 1986:348, fig.297.6,8) and LN Kuruçay (Duru



1994:pl.61.13; 62.15-16). They are also known from EC Hacilar (Mellaart 1970b:fig.109.13). Thus in south-west Anatolia parallels predate the examples from Knossos (ENIb-ENII).

Concave bases are a feature of EN Elateia (Weinberg 1962:fig.7.2) although here ring bases and concave footed bases also occur. Concave bases, comparable to those from Knossos, do not occur in the EN-MN Peloponnese; instead concave footed bases occur (cf. Phelps 1975:95, fig. 9.18). During MN the concave foot is replaced by the ring foot (Phelps 1975:120, 154). There is an example of a concave base comparable to Knossian types from LN Saliagos (Evans & Renfrew 1968:fig.53.12), which is unique and thus a possible import.

## **HANGLES:**

### *wishbone handles*

Wishbone handles are known from several sites on Crete. It was originally believed that this type of handle was restricted to EN at Knossos (Dawkins 1905:260-8; Evans 1964:204 fig.45; cf. Vagnetti, Christopoulou & Tzedakis 1989:88-89) and thus could be used to identify EN assemblages around the island (e.g. Treuil 1970:20 for Agios Ioannis Cave; see Appendix I). However, it is clear now that this handle form had a much longer life: later examples are known from LN Knossos (Manteli & Evely 1995:pl.1(b)), although these are not as common as in EN (Manteli 1993a:47). Since wishbone handles appear to be absent from pure FN assemblages, this would seem to indicate that they go out of use after LN. If this pattern proves to be island-wide, then the wishbone handles in supposedly pure FN assemblages at Phaistos (Vagnetti 1972-3:71 figs. 69, 76; Furness 1953: 105, n.20, 108, 112) and Nerokourou may indicate that some of this material should be dated to LN<sup>12</sup>. Outside Crete there are no good contemporary examples of wishbone handles (cf. Furness 1953:108, 112). The

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<sup>12</sup> NB The few incised sherds at Nerokourou have parallels in the LN strata at Knossos (Vagnetti et al. 1989:88). The parallels between pottery from LN Knossos and that found in the lowest level at Phaistos are well-known (Evans 1971:3-4; Vagnetti 1972-3:75) and suggest an LN date for the earliest occupation at Phaistos.

closest parallel is with the practice of attaching tubular handles to the rims of shallow curved bowls at LN Kuruçay (Duru 1994:pl.67.5-6, pl.247.4).

#### *pierced/unpierced ears on the rim*

These disappear at Knossos after stratum VI (i.e. after ENIb); however a similar form re-occurs at some Cretan FN sites: e.g. Lebena (Vagnetti & Belli 1978:pl.VII.2), Eileithya Cave (Amnisos) and Nerokourou, where they are common (Vagnetti, Christopoulou & Tzedakis 1989:fig.15.2; 16.13; 17.27, 31; 20.66). These FN examples also appear on open bowls, but, unlike the neat squat small triangles of ENIa-b, tend to project to a greater height above the rim. Outside Crete parallel examples of triangular ears on open curved bowls are later than ENI: e.g. LN Saliagos (Evans & Renfrew 1968:39, fig.58.3).

#### *strap handles*

In the southern Aegean outside Knossos there are a few early examples of strap handles. At LN Hacilar (VII) some large tubular lugs approximate strap handles (e.g. Mellaart 1970b:fig.49.16), however these are rare exceptions. For example from the LN/EC Ayio Gala Lower Cave there is not a single strap handle. Indeed the first possible Anatolian examples do not occur until the MC/LC period at sites on the Elmalı Plain, Chios and at Saliagos, where at the latter strap handles are the most common handle forms (Evans & Renfrew 1968:39).

For EN sites in Greece one must go as far north as the Cyclops Cave on Yioura to find early examples of strap handles (Sampson 1999:8) and elsewhere in the northern Aegean strap handles are rare or absent (e.g. EN Nea Nikomedeia, Pyke & Yiouni 1996:98). At EN sites in southern and central Greece strap handles are unknown (Phelps 1975:99; Weinberg 1962:170-1). Some large perforated lugs could be considered close to strap handles (Phelps 1975: e.g. fig 9.36). When strap handles first appear in the MN Peloponnese they are generally rectangular in section (see below) and are used first on collared jars.

### *rectangular-sectioned strap handles*

These first appear in the Peloponnese in the latter half of MN and mark the first appearance of strap handles in this area; they are not common and are found on collar jars, pitchers and large storage jars (Phelps 1975:158; fig.22.15, 16).

### *flared strap handles*

There are no close parallels for these outside Crete. However some early Anatolian jars have flared vertically-pierced tubular lugs: cf. late EN Kuruçay (Duru 1994:pl.45.10) and LN Kizilkaya (Mellaart 1961:fig.6.38). It thus remains a possibility that the flared straps on collared/necked jars at Knossos are a variation on this theme.

### *above rim strap*

Above rim straps, approximately contemporary with ENIb examples are known from EC Kuruçay (Duru 1994:pl. 177.3-5) and MC/LC Emporio (Hood 1981:pl.35.262; pl.38.341).

### *tubular loop handles*

Loop handles are known from LN south-western Anatolia: cf. Gökpinar (Eslick 1992:67, pl.79.1-2), Hacilar (Mellaart 1970b:fig. 46.6), Kuruçay (Duru 1994:pl.77.19). A form of horizontal loop handle is also known from EN Elateia (Weinberg 1962:170; pl.53b) and Chaironea (Weinberg 1962:pl.55.e-h). Horizontal loop handles are known from EN Nea Makri, where in MN they are the usual handle form (Pantelidou Gophas 1995:307; fig.2.1-29; fig.7.2-69; fig.11.3-79; fig.18.3-106-110). At EN/early MN Nemea, there is an example, which occurs on a jar at the point of largest diameter (Blegen 1975:266, fig.5.f, pl.64.22). Some examples at Nemea are monochrome, but the majority are painted, with examples found as far south as Hageortika in Arcadia (Blegen 1975:266). Blegen also notes (1975:269) that this form of handle is common on coarsewares. Non-contemporary horizontal loop handles are known from

MN/LN Kouphovouno where they are common in coarsewares (Renard 1989:pl.xli.1-6, 9-10).

*pierced long handle ('spout')*

A unique 'double-spouted' bowl from Saliagos (Evans & Renfrew 1968:fig.39) finds a close parallel with a unique vessel from stratum V at Knossos in Fabric 1d or 2a/b.

**DECORATION:**

*Incised decoration*

At Knossos, aside from occasional examples in rare or unique fabrics and one example of incised decoration on the base of an incised/pointillé flat-based mug (Fabric 5a), pure incised decoration is a feature of ENic and above all ENII. Thus similarly decorated examples from Katsambas, near Knossos must date to the same period (Alexiou 1956:308, fig.7; 1957:373, fig.4; see Appendix III).

In south-west Anatolia incised decoration is consistently represented but rare: e.g. LN Hacilar (IX, I) (Mellaart 1970b:fig.47.28; fig.109.8,9,10, 22, 24, 25; fig.112.2-3), LN Akçay (Eslick 1992:fig.76.14-15), LN Kuruçay (Duru 1994:pl.81.1-6), at LN sites in west-central Anatolia and at MC Kizilbel (Eslick 1992:pl.75.18-20). These incised examples have mostly geometric designs (triangles, zigzags, chevrons), which mirror the motifs found on painted vessels: e.g. late EN Kuruçay (Duru 1994:pl.42.13-14), EC Hacilar (I) (Mellaart 1970b:fig.109.20, 22, 5-26). Rather more incised sherds are known from both lower (LN/EC) and upper (EC/MC/LC) caves at Ayio Gala (Chios), where the designs are largely diagonal lines and multiple chevrons (Hood 1981:23, 36, 60-1; cf. 232 for Emporio X-VIII). Incised sherds also appear to be more common at coastal sites further south, such as the Miletus area (cf. Niemeier et al. 1997).

Incision is very rare at Saliagos (one sherd) (Evans & Renfrew 1968:43-4), although a number of sherds have incised/pointillé decoration. Incision is also rare in the EN-MN Peloponnese, where it is considered "a rare eccentricity" (Phelps 1975:168; cf. Vitelli 1993a:fig.55.1-p). However at EN/MN Nemea

several sherds are incised, usually with zigzags or triangles filled with diagonal cross-hatching (Blegen 1975:267, pl.65.5). Incision also more common at MN/LN Kouphovouno (Renard 1989). At EN sites in Central Greece incision is also rare or absent. At MN Elateia incision is restricted to short notches cut in outer edge of rim of bowls, sometimes at an angle (Weinberg 1962:175, pl.54(d).3-5, 7-9). At Nea Makri incision first appears early in MN (Pantelidou Gophas 1995:306). Although the incised designs link the examples from Nea Makri with light on dark painted designs on vessels from Saliagos as well as Naxos, Santorini and the East Aegean (Pantelidou Gophas 1995:306, n.22-3), these comparanda are all LN or later in date and have been taken to indicate that Nea Makri "had a decisive influence on Cycladic pottery" (Pantelidou Gophas 1995:306). None of the MN designs from the Greek Mainland find a close counterpart in contemporary Cretan ENIb/c incised pottery.

The first close comparanda occur in ENII deposits at Knossos, which are contemporary with Greek LNI (see Appendix I): for example compare multiple incised chevrons, characteristic of Nea Makri (Pantelidou Gophas 1995:pl.Γ.8-87, pl.45.9-32, 9-35), with much rarer examples at ENII Knossos (Evans 1964:pl.48(1).4). It should be stressed, however, that the majority of ENII incised designs do not find close parallels at Nea Makri or elsewhere. Much closer parallels for ENII designs can be found amongst incised wares from Emporio VIII (see Appendix I).

#### *incised lattice decoration*

The only parallels are from the nearby EN Cretan site of Katsambas (Alexiou 1956:308, fig.7; 1957:373, fig.4; see Appendix I).

#### *incised slashed decoration (first appears ENIc)*

One example illustrated from MN/LN Kouphovouno (Renard 1989:pl.xxxiv.4) is similar in design to examples from ENII Knossos.

### *incised/pointillé decoration*

Pointillé or incised/pointillé decoration is rare in south-west Anatolia: cf. LN Kuruçay (Duru 1994:pl.81.10), EC Hacilar (I, III) (Mellaart 1970b:fig.109.24, 25), LC Bagbasi (Eslick 1992:pl.54.228). It is possibly even more scarce during EN-MN in southern and central Greece, absent even from EN/MN Nemea and MN/LN Kouphovouno, both sites where incised decoration is more common. None of the rare Aegean examples resemble Cretan incised/pointillé. However, very close contemporary parallels are possible with rare examples of incised/pointillé from EC/MC Ayio Gala and Emporio (X-IX). Indeed these are so close and rare for the east Aegean as to suggest the possibility of Cretan imports (see Appendix I). The only other contemporary parallels are from the site of Katsambas, near Knossos (Alexiou 1956:308, fig.7; 1957:373, fig.4; see Appendix I).

Intriguingly it is only when incised/pointillé becomes rare at Knossos (ENII), that Aegean parallels increase and similar forms of incised/pointillé decoration are found at many sites over a large area. At LN Saliagos several examples have incised bands containing pointillé and filled with white paste, one of which is from a fruitstand/chalice (Evans & Renfrew 1968:43-4, fig.56.9-13, pl.xxv.a-b). These compare well with the few examples of incised/pointillé at LN Nea Makri, at LN/FN Kitsos cave and at LN Tharrounia cave (Pantelidou Gophas 1995:144; 306, n.23). LN examples of incised/pointillé are also known from Crete. There are some unpublished "incised and punctuated sherds" from LN/FN Skaphidia (Lasithi) (Pendlebury et al. 1938:5), LN Magasa (Dawkins 1905; Manteli 1993b) as well as LN Knossos (Manteli 1993a:47; Manteli & Evely 1995:6; pl.2.a-c).

### *ripple decoration*

There are no good contemporary parallels anywhere in the Aegean for the earliest few examples of ripple decoration at Knossos (ENIb). It is only when ripple decoration becomes more common at Knossos (ENII/MN), that contemporary parallels can be found outside Knossos. Phelps notes that rippling

is found on a small number of black ware and grey ware sherds from Greek LN and FN deposits (Phelps 1975:233-4). Although the exact form of ripple design does not find parallels on Crete, the forms on which it occurs are reminiscent of Cretan ENIc and ENII shapes, such as vertical carinated bowls and curved bowls with offset rims. Although small quantities are known from Delphi, Elateia, Attica and Euboia, the main centre of distribution appears to be Corinth (Phelps 1975:234; Weinberg 1962:188; pl.60(d).8). Although ripple decoration is absent from LN Saliagos, flattened rims on 's' profile jars, which at ENII Knossos would be decorated with ripple, are slashed, thus creating a similar effect (Evans & Renfrew 1968:43; fig.42.10, 11). Conventional dates for the Greek LN and FN indicate that this is a phenomenon of the fifth millennium BC, thus making ripple decoration in Mainland Greece broadly contemporary with Cretan ENII/MN ripple.

During LN at Knossos ripple becomes increasingly rare, disappearing in the very latest LN West Court phase prior to the beginning of FN (Manteli 1993a:47, 49, 54; cf. Evans 1973:146). Outside Knossos, MN/early LN style ripple is found at several caves in West Crete, i.e. the Lentaka Cave (Hood 1965:112), the Lera Cave (Guest-Papamanoli & Lambraki 1980), the Platyvola Cave (Vagnetti 1996:37) and at Ellenospilia (Marinatos 1928:100-1). It is also known from Mitropolis in the Mesara (Vagnetti 1996:37), the Eileithyia Cave at Amnisos (study collection in the Stratigraphical Museum at Knossos) and the Skaphidia Cave and Kastellos, both on the Lasithi plateau (Pendlebury et al. 1938:17; pl.V.18). Judging by the rest of the material in these deposits it seems likely that most of these examples of rippled ware date to LN, with the possible exception of Mitropolis which has other MN forms and finishes.

#### *grooved decoration*

Rare examples of grooved decoration can be found on both sides of the Aegean: cf. LN Kuruçay (Duru 1994:pl.81.8), EC Hacilar fig 109.20, 26), EC/MC/LC Ayio Gala (Hood 1981:60-1) as well as from the EN Peloponnese (Nemea, Tarsina, Lerna) and Nea Makri (Phelps 1975:113).

*plastic decoration: pellets*

Furness (1953:114) suggested that the 'closest parallels' for EN Cretan pellet decoration were to be found at LC Büyük Güllücek in Central Anatolia. However other spatially and temporally closer examples are now possible, although the significance of parallels is often diminished by the frequency with which pellet decoration recurs across the Aegean (Eslick 1992:n.49).

*single pellets*

Rare examples of single applied pellets are known from LN Kuruçay (Duru 1994:pl.61.14), LN/EC Ayio Gala (Hood 1981:pl.6), EC Kuruçay (Duru 1994:pl.164.18) and MC/early LC Emporio (X-VIII) (Hood 1981:pl.42.430). In the EN Peloponnese applied pellets (round or oval) are the most typical form of decoration and are usually placed close to the widest diameter, sometimes close to the rim but never immediately below the lip (Phelps 1975:109-110; Blegen 1975:266-7). At EN/early MN Nemea most deep bowls have some oval or round knobs "either singly or in groups of two, three or more"; at EN Franchthi there is single similar example of three pellets arranged in a triangle on the body of a curved bowl (Blegen 1975:264; Vitelli 1993:fig.19.n). This arrangement parallels contemporary examples on carinated jars in Fabric 1a from stratum VIII at Knossos. Pellet decoration is also known from EN Elateia (Weinberg 1962:pl.53(c),(d).1-3). In the MN Peloponnese plastic decoration is rare: round pellets occur infrequently on the bellies of 'piriform' jars or bowls (Phelps 1975:168).

*rows of pellets*

Rows of pellets are known from EC Hacilar (Mellaart 1970b:fig 109.23), EC Kuruçay (Duru 1994:pl. 164.19 [vertical]) and LC Boztepe and Karaburun in the Elmalı Plain (Eslick 1992:71).



### *below rim pellets/lumps*

In the EN Peloponnese pellets may be simply stuck on or moulded into the lip to produce a wavy effect (Phelps 1975:11, fig. 9.2-4). There are also examples of this from Nea Makri and Orchomenos (Kunze 1931:fig.35). There is a single example of a deep bowl from MN Kouphovouno with lumps below the rim, which closely parallels ENI examples from Knossos (Renard 1989:pl. xxviii.7). This type is frequent at Kouphovouno and occurs in a grey fabric with limestone temper (Renard 1989:115). There are examples of below rim pellets from Elateia (Weinberg 1962:171). At LN Saliagos applied decoration is usually in the form of rows of pellets below the rim; sometimes these are finger impressed giving them a dimpled appearance (Evans & Renfrew 1968:43, fig.42.1).

### *above rim lumps*

One example known from LN/EC Ayio Gala Lower Cave on a shallow bowl (Hood 1981:fig.5.3). Knobs or lumps projecting above the rim, similar to ENIa examples from Knossos, are known from EN Elateia (Weinberg 1962:pl.52(d)).

### *plastic decoration: cordons*

Plastic cordon decoration is common on large 'storage jars' at LN/EC Ayio Gala (lower) and EC/MC/LC Ayio Gala (upper). These are applied to the surface of the vessel and not imbedded within it; diagonal, curving and straight cordons are found in both high and low relief (Hood 1981:24, 36, 61-2). In later (EC/MC) deposits (Ayio Gala upper cave lower deposit) curved cordon decoration is also found on fine burnished jars (Hood 1981:36). These examples closely parallel contemporary ENIb cordon decoration on polished vessels at Knossos. Plastic cordon decoration is also common at MC/early LC Emporio (X-VIII) and continues into levels VII-VI (Hood 1981:238).

In the Peloponnese plastic cordon decoration is a late EN feature which continues into MN (Phelps 1975:112). At EN/early MN Nemea plastic cordons are found and motifs include crescent, chevrons, zigzags, horizontal bands,

slanting stripes (Blegen 1975:264, pl.64.11). In the MN Peloponnese, the use of cordons is rare (Phelps 1975:168). Plastic cordons are more common in Central Greece; they are known from EN Elateia, where single and double cordons are used to form simple lines and zigzags (Weinberg 1962:171). They also occur at MN Nea Makri (Pantelidou Gophas 1995:pl.21.4-147). Plastic cordon decoration at LN Saliagos is almost exclusively found on coarse wares and is normally concentrated near the rim (Evans & Renfrew 1968:42-3). More rarely (c.2%), cordons are found on fine wares (Evans & Renfrew 1968:fig.43.1-10). One of these (no.10), which consists of three near parallel cordons, is identical to an example in stratum IV (Fabric 1e) at Knossos.

*plastic decoration: slashed cordons/'rope'*

Slashed cordons or 'rope' decoration are very rare to absent at sites in the southern Aegean outside Crete:

- from EN/MN(early) Nemea comes a single example of slashed cordon decoration (Blegen 1975:264, pl.68.4), which is very close to EN1b examples from Knossos. Phelps considers this "unique" for the EN Peloponnese (1975:fig. 9.14).
- also from EN/early MN Nemea is a black burnished sherd with fingernail incised decoration which closely resembles EN1b examples in Fabric 10. Phelps considers this 'odd' (1975:114; fig. 9.13).
- from the LN/EC Ayio Gala lower cave comes a single example from a well-burnished deep jar (Hood 1981:pl.7(d).24, fig.7.24): the cordon has regular neat incision, which closely resembles examples of incised 'rope' decoration in Fabric 10 at Knossos, and is in association with incised/pointillé decoration. The co-occurrence of two features diagnostic of Cretan EN1b in a deposit broadly contemporary with EN1b makes this a very likely import from Crete (see Appendix I).
- from a mixed EC/MC/LC deposit in the Ayio Gala Upper Cave comes an example of slashed cordon decoration which Hood considers 'unique' and a probable import (Hood 1981:61, fig.42.308).

These examples are so rare or unique at the sites at which they are found and moreover are so similar to Cretan examples that it is likely that some or all of these are imports from Crete (see Appendix I).

*plastic decoration: barbotine*

A form of barbotine, known as 'crowded pellet decoration', occurs at sites in Central Greece (Phelps 1975:111): cf. EN Elateia (Weinberg 1962) and late EN Nea Makri (Pantelidou Gophas 1995:pl.1.1-24, pl.14.3-103, pl.22.4-32, pl.25.5-108, pl.41.9-19). 'Crowded pellet' at Nea Makri consists of small irregularly-formed pellets, which are close but always have spaces between them. These form a coherent local group, which lasts until early LN (Phelps 1975:111). It should be stressed that, although the earliest examples precede ENIb barbotine, none of these resemble Cretan barbotine, which in contrast always consists of larger, more carefully modelled rounded lumps set so close as to be partially-overlapping.

- one example of barbotine at Nea Makri from an early LN context differs markedly from all other examples at the site (Pantelidou Gophas 1995:pl.41.9-23). It consists of larger, more carefully rounded pellets which partially overlap. In form and execution it is so close to contemporary ENIb and ENIc examples (Fabric 1d) at Knossos as to suggest the possibilities of an import from Crete (see Appendix I).

- a single example of barbotine is known from Emporio VIII, where it is noted as 'unique' and considered an import (Hood 1981:299, pl.41(d).421). Hood notes general parallels with barbotine from Nea Makri, but dismisses these since the Nea Makri pellets are not touching or overlapping. Hood notes examples of 'denser barbotine' at Saliagos (see below) as well as those from stratum IV (ENII) at Knossos (Evans 1964:214 pl.47(3):6; Furness 1953:115 pl.30, a:10, 11). The ENII parallels from Knossos are in Fabric 5a and are identical to the example from Emporio VIII.

- two examples of barbotine are known from LN Saliagos (Evans & Renfrew 1968:43, fig.43:15, 16): no.15 is very irregular but very dense and overlapping and finds close parallels in single example from Emporio VIII and in Fabric 5a in stratum IV; no.16 on a curved body sherd shows the interface between barbotine and an undecorated zone and finds an exact parallel with an example in Fabric 1e in stratum IV. These two examples are otherwise unique at Saliagos and the close contemporary parallels with ENII Knossos suggest the possibility of imports.

#### *brushed ware*

Brushed ware at Knossos first appears in stratum V in Fabric 1e and consists of streaky brown or orange brush strokes. Isolated streaky examples are also known in Fabric 1b from stratum VI. In south-west Anatolia at EC and EC/LC transition sites on the Elmali Plain many of the brown or orange wares from sites are decorated with a "brush-applied streaky slip, most often coloured scarlet ranging to brown, and burnished" (Joukowsky 1996:134). For the Peloponnese, Phelps notes that a feature of late EN wares is the characteristic application of slip with a brush in such a way as to leave streaks or brush marks, a practice which becomes very common on MN Urfirnis (Phelps 1975:77-8). Phelps argues that this is not found elsewhere, however the examples from Knossos and sites in the Elmali Plain suggest that this practice, although beginning at an earlier period in the Peloponnese, had a much wider Aegean distribution in the latter half of the sixth millennium BC.

#### *scribble burnishing*

At Knossos scribble burnishing is a general ENI feature found especially in Fabrics 2a/b, 6, 8. However scribble burnish ware (Fabrics 1d, 1e) first appears in stratum V and is common in stratum IV.

Scribble burnish ware begins in Emporio VIII (MC/LC) and is common in VII-VI (LC) (Hood 1981:305; see Appendix I). Hood describes it as a light

brown burnished ware and compares MN Greek Urfirnis (1981:305-7), however Urfirnis parallels are too early. Moreover illustrated examples show a scribble burnish which is almost indistinguishable from red scribble burnished ware found in tiny quantities in Knossos V and in much larger quantities in IV (ENII). This parallel has the virtue of being both close and synchronous. In addition the range of forms is very similar to that found in red scribble burnished ware at Knossos: curved jars with 's' profile and 'necked' jars, long loop handles (Hood 1981:pl.43.a, b). Hood (1981:304) notes that it is used mostly for jugs, but there also a few bowls and jars. The fabric, as described by Hood, seems to be different from Fabric 1e.

### *pattern-burnishing*

In the MN Peloponnese (Phelps 1975:167-8) 'stroke burnish' on late monochrome Urfirnis is of three kinds: scribble, regular and undulating. All three found on monochrome wares and where patterns are identifiable they are usually simple and often carelessly executed. Simplest are one or more vertical stripes, others are simple curvilinear patterns, "a product of the technique itself" (Phelps 1975:fig.16.9), others have exact counterparts in painted decoration (Phelps 1975:fig.16.3; 23.60-1, 63-4). It is found on shallow carinated bowls and 'piriform jars'. At LC sites in the Elmali Plain in south-west Anatolia pattern burnishing is one of the main forms of decoration (Eslick 1992:84, 86)

#### *7.7.1 Summary and Conclusions: Dimensions of Variation*

Based on the above discussion of the Aegean parallels for Cretan forms and finishes a number of conclusions can be drawn:

- (1) *Cretan forms in general find closer parallels with contemporary or earlier forms from LN south-west Anatolia.*

This area provides the best, earliest or only parallels for:

**flat-based deep curved bowls**, especially those with flattened rims, have many EN/LN Anatolian parallels. EN Peloponnesian examples are more often incurved with ring-bases.

**flat-based shallow (curved) bowls** have parallels on both sides of the Aegean, however EN Greek examples have ring bases.

**flat-based shallow (straight-sided) bowls** are common at EN/LN Anatolian sites (especially Ayio Gala) but rare in the EN Peloponnese.

**flared rim bowls** are common at EN/LN Anatolian sites, but rare in the EN Peloponnese.

**incurved bowl/hole-mouth jars** are common in EN/LN Anatolia and in EN Peloponnese.

**'s' profile jars** are common in EN/LN Anatolia and in EN Peloponnese.

**incised 'trays'** are a rare feature of LN sites in west-central Anatolia.

**flat-bases** are found on both sides of the Aegean, but are more common in south-west Anatolia.

**concave bases** are common at LN-EC sites in Anatolia but are scarcely ever found at sites in the EN-MN Peloponnese.

**incised geometric decoration** - when pure incision decoration first appears in quantity at Knossos (ENII) it closely parallels incision at Emporio VIII in design and execution. Incised geometric patterns such as chevrons have a long history in south-west Anatolia beginning in LN.

(2) *Some Cretan forms and finishes have good contemporary parallels on both sides of the Aegean*

**plastic cordon decoration** - parallels can be found in LN Anatolia and EN Greece.

**pellet decoration** - parallels can be found in LN Anatolia and EN Greece.

**carinated bowls** are rare at Knossos until ENIb and common from ENIc-ENII; likewise they are rare at EN/LN Anatolian sites but are very common in late EC (Hacilar I) and at MC and LC sites (Emporio IX-VI, Aphrodisias). In the Peloponnese they are common from MN.

**shallow bowls with thickened rims** appear at Knossos during ENIc-ENII; they are likewise common in LC south-west Anatolia and can also be found at LN Greek sites.

*(3) Some Cretan forms or finishes lack any good contemporary parallels:*

**sharply offset rims** are scarcely ever found at sites on either side of the southern Aegean; earliest and closest are from Central Greece.

**flat-based mugs** have almost no contemporary parallels; there may be a link between this form which is frequently incised and the earlier incised 'trays' at Knossos and at LN sites in Anatolia.

**flared cups with or without internal pierced rim lugs** are unique, although parallels for internal pierced rim lugs can be found in LN Anatolia.

**wishbone handles** are not found outside Crete.

**strap handles** are not found at sites in the southern Aegean outside Crete until much later (Greek MN, Anatolian MC).

**flared strap handles** are not found outside Crete.

**pierced/unpierced ears** are not found at sites in the southern Aegean outside Crete until Greek LN (Saliagos).

**incised/pointillé** is not found in any quantity at sites in the southern Aegean outside Crete until Greek LN.

**incised lattice** is not found outside Crete.

**dribble-painted** decoration is not found outside Knossos.

**ripple burnish** first appears at Knossos in ENIb and does not appear at Greek sites until much later (LN).

**barbotine** - although 'crowded pellet decoration' in Central Greece precedes Cretan barbotine, its resemblance to 'Cretan' barbotine is not close.

**slashed cordon decoration** is scarcely ever found outside Crete. Indeed examples are so rare or unique at the sites where they occur, yet so close to Cretan types, as to suggest imports.

In general it would appear that Cretan forms find closer contemporary or earlier parallels with forms from south-west Anatolia than from southern Greece. However, the presence of numerous unparalleled features demonstrates that the Cretan sequence is also highly distinct. When analysed these features suggest

that, rather than operating through a distinctive range of forms<sup>13</sup>, this distinctiveness breaks down into the selection of three specific 'dimensions of variability', namely rims, handles and forms of decoration. Thus EN Cretan vessels are most easily distinguished within the wider southern Aegean in terms of form by their use of sharply offset rims, wishbone handles, strap handles, flared strap handles and pierced triangular ears and in terms of finish by the use of incised/pointillé, incised lattice, dribble-painting, ripple burnish, barbotine and slashed cordon decoration. Thus, for example, while collared or necked jars can be found on both sides of the Aegean, what makes EN examples at Knossos distinct above all is the application of flared strap handles on the shoulder of the vessel. Likewise shallow bowls and curved bowls at Knossos find widespread parallels, but what makes them unique is the use of wishbone handles or pierced triangular ears.

The selection of similar dimensions of variability also serves to distinguish different sequences around the southern Aegean. Thus vertical tubular lugs are distinctive of EN and LN south-west Anatolia, while horizontal spouts and rib/groove decoration are specifically an EN Peloponnesian feature (cf. Nemea, Phlius, Akrata, Corinth, Lerna, Louka) (Phelps 1975:88-9, 116; fig. 8.3, 5, 8, 11-13, 16-18; Blegen 1975:pl.63, pl. 64.16, 17, 19, 20). In a similar way the features that distinguish Neolithic Attic vessels are based on variations in rim (bead rims, thickened rims), handle (large plain lugs, nail-impressed lugs) or finish (white-filled incised, 'overall pellet decoration') (see Phelps 1975:116). As at Knossos there are also a small number of unique forms: for example a unique feature of EN-MN sites in southern Greece are painted askoid jugs, 'husking bowls' and crucibloid vessels (Phelps 1975:116, fig. 8.19, 22-3, 26).

### Summary

In this chapter variation in form and finish has been explored in some considerable detail. The existing Evans-Furness typology of shape and categories

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<sup>13</sup> Although there are a small number of unique forms, such as flat-based mugs or flared cups.



of ware were reconsidered using fabric as an index of variability. It was found that all types of shape and ware were cross-cut by fabric. In addition, the degree of variation apparent within existing form types suggested that a new, less coarse typology of form would be preferable (see Appendix VI). Consideration of this new typology of form suggested that variation in form was generated by the selection of a limited number of dimensions of variability: rim (type and size), profile (curved, carinated, straight, flared), handle (type, size and location), base (flat, curved, concave).

Variation in form and finish was explored for each fabric, the results of which are presented in a series of tables in Appendix VII. These tables demonstrate a considerable degree of variation within and between fabrics. However, this variation is not random, but instead seems to be structured by the frequency with which different fabrics occur. When grouped in terms of frequency, variation in form and finish per fabric was seen to fall into three basic groups:

- (1) Frequent fabrics that, despite being well represented, nevertheless comprise a very similar range of forms and finishes;
- (2) Rare fabrics that exhibit a close relationship in form and finish with those more frequent fabrics in Group (1)
- (3) Rare or unique fabrics, which exhibit no significant similarities in form or finish with fabrics in Groups (1) or (2).

In this way c.97.5-99.9% of the EN assemblage at Knossos may be understood to be comprised of fabrics whose forms and finishes bear a close resemblance to one another (Groups 1 & 2), while the most significant variation in form and finish is actually confined to a group of very rare or unique fabrics (Group 3), which together comprise only c.0.1-2.5% of any EN context. Detailed consideration of variation in form and finish among fabrics of Group 3 concluded that the closest comparanda for many of these vessels were to be found in sequences in south-west Anatolia (e.g. Fabric 28) or southern Greece (e.g. Fabric 25). In some cases the mineralogy of these fabrics also suggested an off-island provenance (e.g. Fabrics 31 and 35). It was therefore tentatively concluded that

the likely provenance for at least some of the fabrics in Group 3 must lie beyond Crete. In contrast the strong similarities in form and finish between fabrics of Group 1 and 2 and their general compatibility with a Cretan provenance were taken to indicate that these fabrics share a Cretan provenance. However as a comparison between Fabric 12 (Mirabello Bay) and Fabrics 1a-i (local Knossos) shows, similarity in form and finish need not translate into spatial proximity.

In this way consideration of fabrics in Groups 1 and 2 allows the isolation of a range of features of form and finish, which can be said to define Cretan Neolithic ceramic production. In view of previous theories, which have suggested an exogenous origin (Anatolia) for Cretan ceramic forms (see Section 2.2.3), this range of Cretan features was compared to assemblages from the Peloponnese, the Cyclades, the east Aegean and south-west Anatolia. It emerged that although parallels for many of these forms could be found on both sides of the Aegean, the most one can say is that in general Cretan forms find closer contemporary or earlier parallels among assemblages from south-west Anatolia. However, what would appear to be more significant is that this wider comparison allowed a number of specific features to be isolated, which lacked contemporary parallels outside Crete. These distinctive features break down into three main dimensions of variability, namely rims, handles and decoration: offset rims, wishbone handles, strap handles, pierced triangular ears, incised/pointillé, incised lattice, dribble painting, ripple burnish, barbotine and incised cordon/rope decoration.

Many of these distinctive features of form and finish appear on ceramics belonging to the earliest phase of ceramic production (ENIa, stratum IX)<sup>14</sup>. In this way, and contrary to what A. Evans and Childe claimed (see Appendix I), comparative stylistic study does not allow Knossos (and Crete) to be simply reduced to an 'offshoot' of the Anatolian Neolithic and Chalcolithic, but rather this exploration of variation in ceramic form and finish suggests that even the very first ceramic vessels mark this region out as distinct. Moreover, the continued absence of these feature from areas outside Crete would appear to

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<sup>14</sup> Compare the early presence of wishbone handles, strap handles, flared strap handles, triangular lugs.

undermine the current hypothesis that this range of Cretan forms had an exogenous origin (see Section 2.2.3). Simple diffusion alone would therefore appear to be an inadequate explanation for the origins of EN ceramic production (see Section 13.4 for further discussion of this).

## CHAPTER EIGHT

### SCANNING ELECTRON MICROSCOPY

The examination of a freshly fractured ceramic surface under a SEM<sup>1</sup>, provides information on the degree of vitrification of a ceramic through the examination of the clay microstructure that develops during firing (e.g. Maniatis & Tite 1981; see Chapter 5). This information may be compared with known morphologies of similar clays/ceramics to produce an estimation of firing temperature. Study of the micromorphology of the body and surface of samples also provides information on surface treatment, including the identification and chemical characterisation of slip or paint layers. Certain studies of Bronze Age ceramics (e.g. Wilson & Day 1994; Kilikoglou 1994) have been successful in combining the results of SEM analysis with macroscopic and microscopic (thin-section petrography) studies of fabric, form and finish. These would seem to suggest that firing behaviour may correlate with groupings based on fabric, form and/or finish. This study, however, represents the first time that a combined analytical programme of this sort of size and complexity has ever been applied to a single Neolithic assemblage. In this way this study is to an extent experimental with the intention of exploring the potential and relevance of SEM-based analysis of finishing and firing in studies of Neolithic ceramics.

#### **Finishing and Firing Per Fabric**

In order to explore the degree to which finishing methods or firing behaviour might correlate with fabric, all samples studied using SEM have been grouped and discussed in their petrographic groups. Although this risks giving too much emphasis to the latter, it is necessary to allow evaluation of the degree to which finishing methods and firing behaviour might or might not correlate with other groupings. Information relevant to the discussion of each sample is

presented in a series of tables (see Figures 8.2-9), which list the samples studied in their petrographic groups. Also included is an estimation of firing temperature of each sample. These temperatures generally correspond to a 'normal' kiln firing (oxidising atmosphere), where there is sufficient time for the relevant chemical reactions to take place. They are therefore *equivalent* firing temperatures. However, if the context of firing had been open (e.g. bonfire), where the atmosphere is rarely purely oxidising and often strongly reducing and the duration of firing shorter, then the actual temperature to which these samples had been fired could have been a little higher if only for a very short period of time. As a result estimates of firing temperature in Figures 8.2-9 have been given broader temperature ranges in order to accommodate this effect. These estimates of firing temperature are also displayed on a graph allowing the comparison of firing behaviour per sample and per fabric group (see Figure 8.1). In the discussion that follows, SEM data on finishing (surface compaction, slips) and firing will be discussed in combination with other relevant macroscopic and petrographic data. This discussion will form the basis for the discussion of EN firing practices in Chapter 10.

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<sup>1</sup> The SEM used in this study was a Philips 515 with an EDAX 9900 energy-dispersive detector, housed at the National Scientific Research Centre 'Demokritos', Aghia Paraskevi, Athens.

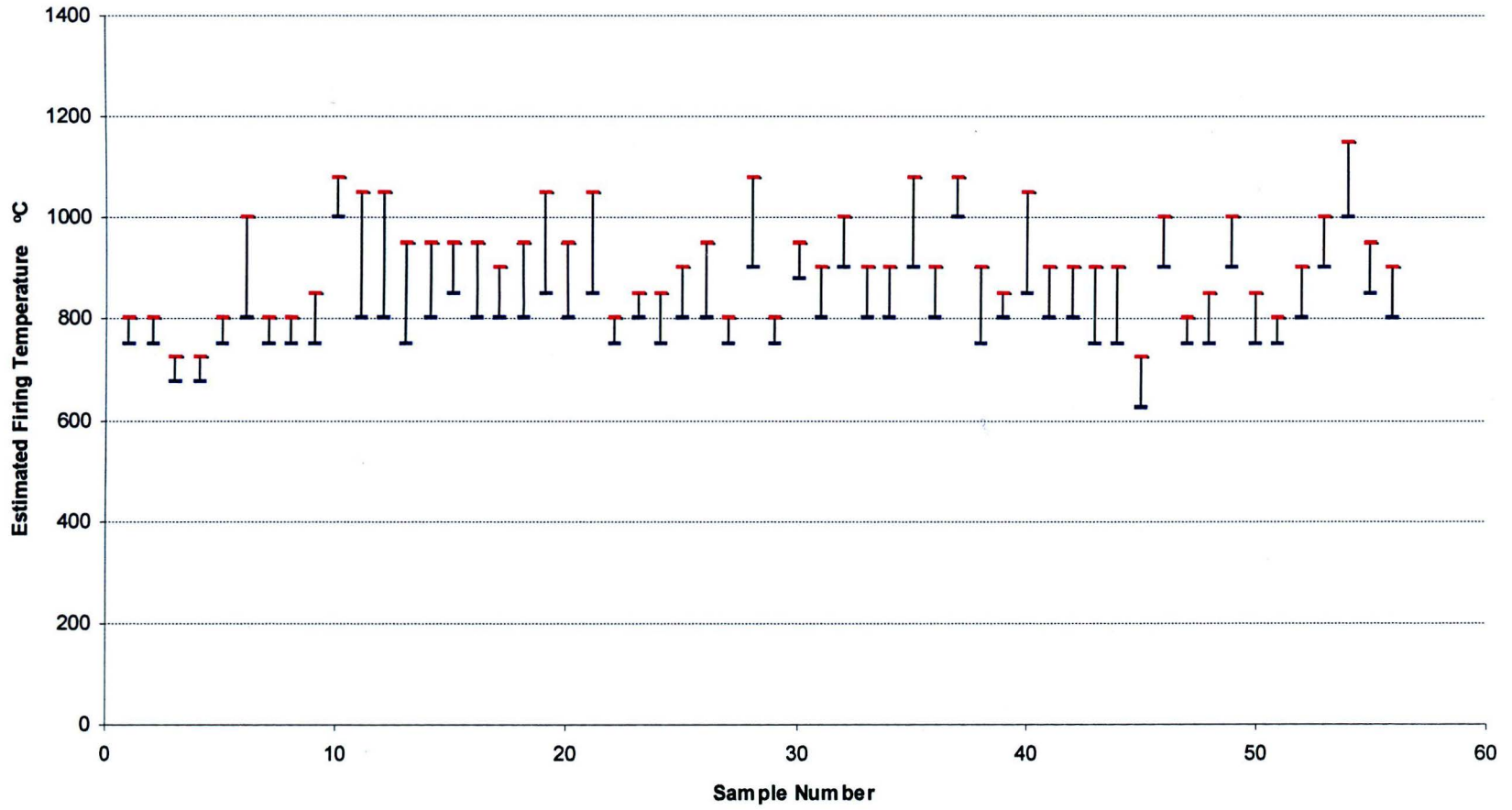


Figure 8.1 Estimated Equivalent Firing Temperature Per Sample

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
1	1a	97/4	IX	brown	brown burn. ext; black burn. int	F	O/R	med-high calc	IV/V <sub>C</sub> -	low-non calc. (int. & ext.); no slip, compacted layer	P	750-800
2	1a	97/7	IX	grey	fine brown polish	F	R	v. high calc. (>20%)	IV	low calc; Al <sup>↑</sup> ; compacted slip layer <sup>1</sup>	P	750-800
3	1a	97/62	VII	orange /buff	black polish	F	O/R	extra high calc; (Mg in sparite inclusions)	NV/IV	medium calc; Al <sup>↑</sup> , K <sup>↑</sup> ; compacted layer	NV	~750
4	1a	97/107	V	grey	yellow/brown polish	F	O/R	v. high calc. (>20%)	NV/IV	same as body - no slip	?	~750
5	1a	97/118	V	brown	grey/brown burn.	C	O/R	v. high calc.; organics (smell)	IV	same as body - no slip; compacted layer	P	750-800
6	1b	97/55	VIII	grey /brown	dk. brown polish; fine wipe marks	F	O/R	med-low calc.	V <sub>C</sub> - - V <sub>C</sub>	Al <sup>↑</sup> ; K <sup>↑</sup> ; non calc.; visible compacted slip layer	V?	800-1000
7	1b	97/117	V	grey	yellow brown polish	F	R-O	med-low calc.	NV/IV?	calc. K <sup>↑</sup> ; compacted layer - finer fraction of body?	V?	750-800
8	1b	97/136	IV	red	fine red/orange polish	F	O/R	v. high calc. (>20%)	IV	non calc.; Al <sup>↑2</sup>	P	750-800
9	1c	97/119	V	red/brown	black wiped	C	O/R	low calc.; Al <sup>↓</sup> , K <sup>↓3</sup>	IV/V <sub>C</sub> -	low calc.; no slip; compacted layer	P?	750-850

Figure 8.2 Fabrics 1a-c

<sup>1</sup> 97/7: slip (fine) for both exterior and interior surfaces is same clay, but different clay from body.

<sup>2</sup> 97/136: slip (fine) is different clay from body (cf. also 97/55; 97/117; 97/62).

<sup>3</sup> 97/119: body is hard cf. 'step-wise' fracture (V. Kilikoglou pers. comm.).

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
10	1d	97/84	VI	grey	grey burn.	C	R	high calc.	V <sub>C</sub> <sup>+</sup> FB	high calc.; Al <sup>↑</sup> ; K <sup>↑</sup> ; thin (5-8µm) compacted layer	V	1000-1080
11	1d	97/109	V	red/brown; thin dark core	red/brown burn.	F?	O/R	med-low calc.	V <sub>C</sub>	low-non calc.; same as body - compacted burn. (10-15µm)	V	800-1050
12	1e	97/121	V	grey	red/brown on light painted	F	O/R	v. high calc. (>20%)	IV/V <sub>C</sub> - (ext.); V <sub>C</sub> - + (int.) <sup>4</sup>	low calc.; Al <sup>↑</sup> , K <sup>↑</sup> ; Fe <sup>↑</sup> ; visible compacted slip layer (ext); visible slip (int.)	Incomplete (ext) V+ (int)	800-1050
13	1e	97/132	IV	grey	buff burnished & incised	F	O/R	v. high calc. (>20%)	IV/ V <sub>C</sub>	same as body; thin (10-15µm) compacted burn.	P	750-950
14	1h	97/122	V	buff/brown	buff burnished	C	O/R	low calc.; K <sup>↓</sup>	V <sub>C</sub> - or V <sub>C</sub> -/V <sub>C</sub>	K <sup>↑</sup> ; same as body? thin (15µm) compacted burn.	V	800-950

Figure 8.3 Fabrics 1d-h

<sup>4</sup> 97/121: bowl may have been fired filled with fuel (V. Kilikoglou pers. comm.).



### *Fabrics 1a-i*

Study of the structure and composition of the surfaces of samples of Fabrics 1a-i, revealed the existence of several finishing techniques.

- (1) A large number of samples exhibited a compacted surface and lacked any evidence of slip layers (i.e. 97/4, 97/107, 97/118, 97/119, 97/84, 97/109, 97/122, 97/132). Almost all of these samples come from burnished vessels; only 97/107 is polished.
- (2) Other samples exhibit a compacted surface in combination with the application of a *non-calcareous slip* (i.e. 97/7, 97/55, 97/62, 97/136, 97/121). The use of this slip in each case corresponds to vessels with dark brown or red polished surfaces.
- (3) In one example (97/117) it is possible that a *calcareous slip* was applied to the vessel surface. This example was then polished.

The existence of these three basic finishing techniques was also suggested by petrographic study (see Chapter 6). The dark brown or red surfaces which result from (2) are created through the reduction or oxidation of iron.

As Figure 8.9 demonstrates there is considerable variation in firing within and between the subgroups of Fabric 1 with the maximum estimated temperature varying from around 750°C to over 1000°C. Variety was also suggested by petrographic observation of variation in optical activity of the groundmasses of different samples.

Fabrics 1a-i are all tempered with some form of limestone. Under normal firing conditions (mixed O/R atmosphere, gradual heating rate, 1hr soaking time), limestone begins to decompose at temperatures exceeding c.800/850°C to form lime and carbon dioxide:



After firing the lime hydrates to form portlandite:



This reaction involves an increase in volume and leads to the phenomenon of lime blowing/spalling. Normally if the clay contains calcite grains which exceed 100 microns in size, this expansion in volume leads to the structural failure of the vessel. In time portlandite recarbonates to become fine-grained calcite (see Section 6.3 on secondary calcite formation).

This inevitably prompts the question of why those samples of Fabrics 1a-i, which have estimated firing temperatures of 800-1080°C (97/55, 97/84, 97/109, 97/121, 97/122), show no signs of vessel failure. If these samples had been fired under normal conditions (see above) they should have disintegrated. Petrographic study of Fabrics 1a-i in a number of cases identified micritic clots with relict primary textures, which would indeed suggest that some form alteration took place as a consequence of firing (e.g. 97/84, 97/109), which would also suggest firing beyond c.800/850°C.

Potters may minimise the problem of spalling by using lower firing temperatures, having shorter firing times, inducing a reducing atmosphere during firing or adding salt (Laird & Worcester 1956:545-55; Rye 1976; Woods 1986:165-8). The addition of salt to a clay paste may be identified in thin-section by the presence of yellow reaction rims surrounding calcareous inclusions (Middleton & Woods 1990:4-5). These rims are caused by salt reacting with calcite in the presence of heat and prevent its decomposition to lime:



None of the calcareous inclusions within samples of Fabrics 1a-i contained such rings, making it unlikely that salt was used in this case. Since in these examples lower firing temperatures are also not in evidence, this leaves the possibility that a reducing atmosphere and/or a shorter firing time acted to prevent limestone decomposition. Higher fired examples, such as 97/84, 97/109 and 97/121, exhibit clear evidence of reduction (grey colour; dark cores), making it likely that reduction was a factor in preventing limestone decomposition. However, a reducing atmosphere only delays limestone decomposition for about 50°C. Thus in the case of 97/84, where the

temperature must have been at least 1000°C, a reducing atmosphere alone would not have been sufficient to prevent decomposition. This example therefore suggests that another factor, namely fast firing, must have also been in operation.

In one or two cases comparison of clay microstructure in different areas of a sample indicated that the microstructure was not homogenous throughout the sample. This was most severe in sample 97/121, where a IV/VC<sup>-</sup> (c.800°C) exterior grades into a VC<sup>+</sup> (c.1050°C) interior (see Plates 35-7). A less severe example is 97/84, where a fully vitrified body (VC<sup>+</sup>) has a surface which retains its shiny burnished surface. Since under normal conditions vitrification should destroy a burnished surface by ensuring illite decomposition (>850°C) and by destroying the parallel alignment of clay particles (see Section 5.3.5.2, n.16), the survival of the burnished surface in sample 97/84 would suggest the existence of a vitrification gradient between body and surface. A gradient in vitrification effectively means an uneven distribution of heat within the ceramic body during firing. Such an uneven distribution is most likely to occur consistently when firing is fast and/or the firing environment unpredictable. Since 97/121 is an open vessel (deep bowl), the most likely explanation for the steep vitrification gradient between exterior and interior is that during firing the interior of the vessel was in contact with the fuel. These two examples would therefore suggest that firing most probably took place in an open environment, such as a bonfire.

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo -sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
15	2a	97/37	VIII	red/dark red	red/brown	F	O/R	non calc.; Al↓, K↓ (high refractory?)	V	non calc; K↑; Al↑ a little; compacted layer	NV	850-950
16	2a	97/64	VII	red/grey	grey/brown wiped ext. dark burn. (int.)	C	O/R	non calc.	V	same comp as body; visible compacted layer	V	800-950
17	2a	97/85	VI	orange /grey sandwich	orange-brown polish	F	O/R	non calc.; K↓	IV/V	non calc.; Al↑ & K↑ a little; visible (8-18µm) compacted layer	V	800-900
18	2b	97/54	VIII	red/grey	brown polished & incised	F	O/R	non calc.; K↓, Fe↓ (high refractory?)	V	K↑; Al↑; compacted (10-15µm) slip layer	NV V?	800-950
19	2b	97/66 <sup>5</sup>	VII	grey/red brown	black burn.	C	O/R-R	low-non calc.	V	-	-	850-1050
20	4	97/25	VIII	red w. blackened interior	white/grey slip & burn.	C	O	non calc.	V	high calc.; K↓; Al↓; slip (10-15µm) different clay	V?	800-950

Figure 8.4 Fabrics 2a-b and 4

<sup>5</sup> Study of sample 97/66 could not be completed because of technical problems with the SEM (blown filament).

### *Fabrics 2a-e*

All samples of Fabrics 2a-e exhibit visible compacted surface layers suggestive of heavy burnishing or polishing. In sample 97/64 this compacted layer is of the same composition as the body and thus suggests that following the construction of the vessel the surface was smoothed and burnished. However, the surface composition of other samples would seem to indicate the presence of a finer fraction (cf. higher Al and K), which would be consistent with an added non-calcareous slip layer, which could have been a finer fraction of the body (see 97/37, 97/54, 97/85). Some confirmation of this identification of a slip layer is provided by petrographic study, which noted the presence of non-calcareous slip layers in 97/54 and 97/85 as well as in other samples not examined by SEM. All samples with this added slip layer were then polished, which suggests that the use of a non-calcareous slip was confined to polished vessels.

Samples of Fabrics 2a-e exhibit a range of firing temperatures from 800°C to over 950°C. Since Fabrics 2a-e are dominated by large limestone inclusions, the lack of evidence for any failure of the ceramic body due to lime spalling, despite a firing range which consistently exceeds 800°C, necessitates comment. Petrographic study of samples of Fabrics 2a-e also consistently identified evidence for secondary calcite alteration in the form of limestone inclusions which exhibit a relict primary grain texture (see Chapter 6). The partial survival of the primary grain texture suggests that the firing conditions under which calcite alteration took place did not persist long enough for complete alteration to take place. This would hint at the possibility that firing was fast. An additional factor in the lack of total limestone decomposition is also the presence of a mixed oxidising/reducing atmosphere. As with Fabrics 1a-i, these features would be consistent with fast firing in an open environment.

### *Fabric 4*

The surface of sample 97/25 provides clear evidence for the presence of a calcareous

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
21	5a	97/9	IX	red outer, grey core	burnished: red/grey patches	C	O/R	med-low calc.; Al↑, K↓	V <sub>C</sub> +/TV <sub>FB</sub> (centre), V <sub>C</sub> -/V <sub>C</sub> (edges)	low calc.; Al↑ (a little); K↑; Fe↑; compacted layer (5-15μm)	V <sup>6</sup>	850-1050
22	5a	97/23	IX	red /orange	orange polish	F	O	low calc.	IV	Al↑ & K↑ a little; visible compacted layer (5-10μm)	P	750-800
23	5a	98/63	VI	grey body	dark brown polish	F	R?	low-non calc.; K↓	V <sub>C</sub> -	K↑; Al↑; Fe↑ (a little); well-compacted layer (15-30μm)	?	800-850
24	5a	97/114	V	red	red/brown polish	F	O/mild R	non calc.; K↓	IV/V	K↑; Al↓; Fe↑ (a little); well-compacted layer <sup>7</sup> (5-10μm)	?	750-850
25	5c	98/57	VI	grey/red	dark burn.	C/F	O/R	non calc.; (high refractory?)	V	compacted surface	NV	800-900

Figure 8.5 Fabrics 5a and 5c

<sup>6</sup> 97/9: sheen of burnish destroyed.

<sup>7</sup> 97/114: compacted surface well bonded with body.

slip layer. Since the body of this sample is non-calcareous, this slip must derive from another more calcareous clay. The use of a calcareous slip seems to be a general feature of vessels in Fabric 4: all have a burnished surface, which varies in colour from grey to white. Sample 97/25 was fired to c.850-950°C.

### *Fabric 5a*

In contrast to Fabrics 1a-i, 2a-e and 4, study of surface structure and composition in samples of Fabric 5a failed to identify any evidence for the use of slips. The surfaces of all samples showed a clear compacted layer varying in thickness from 5-50µm (see Plate 38). Some samples showed a slight rise in K, Al and Fe in these layers, however this was not sufficient to suggest a slip, but instead may represent a slightly finer clay fraction produced as a direct consequence of burnishing or polishing. These conclusions compare well with the petrographic analysis of Fabric 5a, which concluded that there was no clear evidence for the use of slips and that areas of differential birefringence observed near the surfaces of some samples were consistent with compaction due to burnishing or polishing.

Comparison of the different firing ranges of samples of Fabric 5a (see Figure 8.1) suggests a wide range of firing temperatures (750-1050°C; IV-TV). Firing atmosphere seems to have varied from mixed oxidising/reducing to purely reducing (e.g. 98/63). In sample 97/9 there is a clear distinction in vitrification between the centre (VC<sup>+</sup>/TV) and the edges (VC<sup>-</sup>/VC), where all trace of burnish have been lost. This distinction corresponds to a reduced core (grey) and more oxidised (red) outer layer (cf. 'the sandwich effect'). Such a gradient in vitrification in conjunction with evidence for very local reduction within the ceramic indicates that firing was not homogenous throughout. This may be most easily explained if the firing was fast and if there was contact between the vessel and fuel, such as would be the case in an open firing (see above on 97/121).

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
26	6	98/15	IX	red	red/brown burn.	C/F	O - mild R	non. calc.; K↓	V	K↑ (a little) no slip; visible compaction (10-70µm) <sup>8</sup>	NV	800-950
27	6	98/16	IX	red	red polish	F	O	non calc.; Al↓, K↓ (high refractory?)	IV	slip K↑, Al↑, Fe↑ - same clay?; visible compacted layer (10-15µm)	?	750-800
28	6	97/21	IX	grey	orange polish	F	R-O	non calc.; Al↓; K↓ (high refractory)	V/TV <sub>FB</sub>	Al↑ (a lot); K↑ visible slip layer (10-15µm)	V?	>900
29	6	98/23	VIII	red w. dark core	dark red scribble burn.	C	O/R	non calc.; K↓ (high refractory?)	IV	variable composition - visible (compacted) layer; but cannot confirm presence of slip chemically	?	750-800
30	6	97/96	VI	red/black	black rough burn.	C	O/R	non calc.; K↓	V	K↑ & Al↑ a little; visible thin (c.10µm) compacted layer <sup>9</sup>	? V	850-950
31	6	98/100	IV	dark red /brown	dark brown burn.	C	O/R	non calc.; K↓	V?	Al↓; K↑; Fe↑; compacted slip? layer (K not always so high)	V	800-900
32	7	97/14	IX	red/grey	dark brown burn.	F	O/R	non calc.; K↓, Fe↓ (high refractory?)	V	no slip; compacted surface layer	V	900-1000

Figure 8.6 Fabrics 6 and 7

<sup>8</sup> 98/15: compaction through burnishing creates a smooth surface by filling in irregularities in sub-surface.

<sup>9</sup> 97/96: surface has visible tool marks criss-crossing at angles.



### *Fabric 5c*

The surface of sample 97/57 shows no trace of slip and instead indicates the sort of compaction that would be a consequence of burnishing. Petrographic study also failed to identify any evidence for a slip. Sample 97/57 shows advanced vitrification with an estimated firing temperature of 800-900°C.

### *Fabric 6*

All samples of Fabric 6 have evidence for surface compaction. In some cases (97/96, 98/15, 98/23) this is not accompanied by any trace of a slip layer, suggesting that these vessels were simply smoothed and burnished. Under a SEM, sample 97/96 showed visible tool marks indicating burnishing in a criss-cross motion. In other samples there is some evidence for the addition of a slip layer (97/21, 98/16, 98/100). Thin section petrography also indicated the existence of non-calcareous slip layers on some samples (including 98/16). The slip layer is clearest in 97/21 where there is a substantial difference in composition between surface and body. Such a slip would nevertheless be consistent with being a finer fraction of the body clay. It would appear that in general the application of a slip was confined to the finishing of polished vessels (cf. 97/21, 98/16). However sample 98/100, which dates to a later phase of EN (ENII), shows that a slip could also be used in combination with a rough burnished surface.

Samples of Fabric 6 vary from IV to TV with an estimated temperature range of 750->900°C. Estimated firing atmosphere ranges from oxidising (e.g. 98/16) to reducing (e.g. 97/21). Sample 97/21 exhibits a vitrification gradient between centre (V/TV) and surface (V?). The presence in the centre of fine bloating pores is suggestive of intense localised reduction. This is confirmed by a predominantly grey core. These features indicate that 97/21 is not homogeneously fired (cf. 97/9, 97/84, 97/121) and may be most easily explicable if the firing was fast in an open firing.

### *Fabric 7*

The surface of sample 97/14 shows no trace of any slip layer, but instead appears to have been compacted due to burnishing. Fabric 7 contains large limestone non-plastics (see Chapter 6), which in the case of 97/14 nevertheless appear to have survived intact despite exposure to temperatures in the region of 900-1000°C. Petrographic study of Fabric 7 identified evidence for secondary calcite alteration in the form of relict primary grain structures. Moreover, during lime blowing small spalls of clay are pushed out of the surface of fired vessels by hydration and concomitant expansion of the lime particles. Macroscopically this appears as pits in the vessel surface, each with a white or yellow lump at its base. This was observed to be a feature of some sherds in Fabric 7, suggesting that in some cases at least partial limestone decomposition has taken place. However, the absence of evidence for structural failure and the partial survival of the primary structure of the limestone non-plastics, when viewed in thin section, suggests that the firing conditions under which limestone decomposition took place did not persist for very long. This would seem to suggest that the duration of firing was short.

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
33	8	97/1	IX	red/grey sandwich	red/grey burn.	C/F	R - mild O	non calc.; Al↓, K↓ (high refractory)	V	non calc.; Al↑, K↑; fine slip diff. clay.	NV	800-900
34	8	98/27	VIII	orange /red	brown burn. (slip?)	C	O/R	non calc.; K↓ (high refractory?)	IV/V	non calc.; K↑	NV	800-900
35	8	97/69	VII	grey	red/grey burn.	C/F	R	non calc.; Al↓, K↓ (high refractory)	V/TV <sub>FB</sub> <sup>10</sup>	non calc.; K↑	V	>900
36	8	97/70	VII	grey; thin orange layer	grey burn. blackened interior	C	R - mild O	non calc.	V	non calc.; Al↑ (a little); no visible slip layer <sup>11</sup> ; irregular surface	NV	800-900
37	8	97/94	VI	red/black (burnt)	red/orange burn.	C	O	non calc.; K↓ (high refractory?)	TV	non calc.; K↑; Al↑; thick (15-50µm) compacted layer	V	>1000
38	10	97/71	VII	grey	brown polish	F	O/R	non calc.; K↓	IV/V	Al↑; K↑; visible thin (5-10µm) compacted slip? layer <sup>12</sup>	NV	750-900

Figure 8.7 Fabrics 8 and 10

<sup>10</sup> 97/69: fine bloating is due to intense reduction. Slip must be different from body clay.

<sup>11</sup> 97/70: very variable surface composition readings. High Cl & S suggest contamination (cf. black charring on the interior of the sherd).

<sup>12</sup> 97/71: compacted surface not well bonded with sub-surface.

### *Fabric 8*

In samples 97/1 and 97/94 there is visual and compositional evidence for the application prior to burnishing of a fine slip of a different composition (illitic) to the body (see Plate 39). In both samples this slip layer is compacted due to burnishing. In samples 97/69, 97/70 and 98/27 there is no visual or compositional evidence for a slip layer, although all three samples do exhibit surface compaction due to burnishing. The slight increase in the proportion of K in the surface composition noted for 97/69 and 98/27, probably reflects the accidental creation of a slightly finer clay fraction as a direct consequence of the burnishing process. Petrographic study was only able to identify the presence of slip layers on the surfaces of some polished samples. However, as the SEM data suggest, some of the burnished vessels could also have been treated in this way (e.g. 97/1, 97/94).

The samples studied are consistently highly fired (800-→1000°C) with a clay microstructure that varies from IV/V to TV, with the majority of samples being V or more. Firing conditions often appear to have been non-homogeneous: in all samples a more highly vitrified body is found in conjunction with a less vitrified surface; this is particularly clear in 97/1 and 97/70. In general firing atmosphere shows considerable variation from mostly oxidising (e.g. 97/94) to reducing (97/69). The confinement of fine bloating pores to the body of 97/69 is suggestive of intense localised reduction and this is confirmed by the entirely grey colour of the sherd break. Sample 97/1 also shows signs of localised reduction (grey core). As was suggested for samples 97/9, 97/84, and 97/121, intense localised reduction and non homogeneous firing within a single ceramic body may be associated with fast firing within an open firing environment, where there is contact between vessel and fuel.

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
39	11	97/78	VII	red	brown burn.	F	O/R	non calc.; K↓ (refractory?)	IV	compacted burn - no slip	NV	800-850
40	11	97/102	VI	grey	brown/grey polish & ripple	F	R	non calc. <sup>13</sup>	V	low-non calc.; Al↑; K↑; Fe↑; compacted (5-15µm) slip? layer	?	850-1050
41	12	97/27	IX	grey/black	black polish	F	R	non calc.; K↓	V	same as body; compacted layer	NV	800-900
42	12	97/41	VIII	red/black (burnt)	grey/brown burn.	C	O/R	non calc.	V	same as body; compacted layer	V	800-900
43	14	97/10	IX	dark brown	black polish	F	O/R	non calc.	IV/V	same as body; compacted layer (10-20µm)	?	750-900
44	14	97/28	VIII	red body	brown burn.	C	O/R	non calc.; K↑	IV/V	same as body; compacted layer (20µm)	NV	750-900
45	15	97/88	VI	red	-	C	O	low calc.	NV/IV	-	-	c.750
46	16	97/91	VI	red	black burn.	F	O-R	non calc.; K↓, Fe↓ (high refractory?)	V	K↑; Fe↑; visible slip layer (12-30µm)	NV	900-1000

Figure 8.8 Fabrics 11, 12, 14, 15 and 16

<sup>13</sup> 97/102: compositional data indicates unusually high amount of magnesium and iron, which may suggest that the compositional scan is incorrect.

### *Fabric 10*

Sample 97/71 has a visible compacted surface layer. A proportionate increase in Al and K with respect to the body may indicate the presence of a slip layer. Sample 97/71 is IV/V with an estimated firing temperature of c.750-900°C.

### *Fabric 11*

Sample 97/78 has a compacted surface layer, which in composition was almost identical to the body. This would thus seem to be evidence for burnishing or polishing without the use of a slip. Sample 97/102 also has a compacted surface layer, however this showed increased Al, K and Fe in comparison to the body and may represent a slip layer. Samples 97/78 and 97/102 vary from IV to V with an estimated temperature range of 850-1050°C.

### *Fabric 12*

Both samples of Fabric 12 (97/27, 97/41) show no sign of added slip layers, but do exhibit compaction due to burnishing or polishing. The absence of slip layers is also suggested by petrographic study. Thus the fine black polished surface, which is such a feature of polished vessels in Fabric 12 (e.g. 97/27), would seem to have been created by smoothing and polishing the vessel surface. When a sample of 97/27 was refired in an oxidising atmosphere it turned red, confirming that the dark finish was created through iron reduction. All ENI polished examples of Fabric 12 have a black finish suggesting the possibility that this black finish was deliberately produced by inducing a reducing atmosphere during firing. Both samples are vitrified with an estimated firing range of 800-900°C. A sample of 97/27 was refired to 950°C (oxidising). When compared with the original sample the refired sample appeared more highly fired. This would be compatible with an estimated range of 800-900°C.

#### *Fabric 14*

Samples 97/10 and 97/28 both exhibit compacted surfaces and have no visible or compositional evidence for the use of slip. Petrographic study of 97/10, as well as of other polished examples (e.g. 97/32, 98/65), identified the presence of very thin, fine, non-calcareous clay layers at the vessel surface: both slip layers and accidental self-slip as a consequence of the burnishing process were considered possible explanations. Since no slip could be identified under SEM, it would appear that such layers result from the polishing process. Both samples are IV/V with an estimated range of 750-900°C.

#### *Fabric 15*

The surface of sample 97/88 appears to be very irregular with no clear evidence for surface treatment. The most notable feature of this sample when examined at high magnification (x2000) were the clear imprints and voids left by the organic temper which characterises this group<sup>15</sup>. Sample 97/88 is relatively low-fired (NV/IV) with an estimated temperature around 750°C.

#### *Fabric 16*

Sample 97/91 has a visible layer, which in its composition resembles a non calcareous slip (higher K and Fe) and shows compaction due to polishing. The presence of such a slip layer in this sample was also suggested by petrographic study. Sample 97/91 is relatively highly fired (V) with an estimated temperature range of c.900-1000°C.

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<sup>15</sup> Although beyond the scope of the present project, it would be interesting in future to see if these distinctive impressions could be used to identify some of the types of organic temper used.

	Fab. Grp.	Sample	Date	Colour of Break	Surface Finish	Surface Quality	Atmo-sphere	Clay Composition (point scan)	Vitrif. Body	Surface Composition	Vitrif. Surface	Temp. (°C)
47	18	97/11	IX	red/grey split	red/grey burn.	C	O/R	non calc.; K↓	IV	Al↑; K↑; visible compacted slip layer	?	750-800
48	20	98/33	VIII	grey	dark brown (ext.) buff (int.)	F	O/R	low-med calc.; K↓	IV/V <sub>C</sub> -	K↑; Al↑; Fe↑; visible compacted layer (15-35μm)	NV?	750-850
49	21	97/33	VIII	grey/black	grey burn.	F	R	non calc.; K↓ (high refractory?)	V?	low calc.; K↑; Fe↑; different clay?	P	900-1000
50	22	97/124	IV	red/grey	red/brown burn. (ext.), slipped? (int)	C	O/R	low-non calc.; Al↓, K↓	IV/V <sub>C</sub> -	Al↑; K↑; compacted (10-15μm) slip? layer	?	750-850
51	23	97/61	VIII	grey/brown	dark brown burn.	F	R	med. calc.	IV	low calc.; K↓; Al↑; visible compacted thin (c.10μm) layer	?	750-800
52	28	97/36	IX	red	red burn.	C	O	low calc.; Fe↑	V	K↑; Fe↑; visible compacted layer	?	800-900
53	29	97/86	VI	dark grey	dark wiped	C	R	non calc.; K↓ (high refractory?)	V	med. calc.; K↑; Fe↑; diff. clay? visible slip layer (15-20μm)	?	900-1000
54	30	98/90	ENIb	grey	buff	F	R?	med-high calc.; K↓	TV <sub>FB</sub>	low calc; K↑; visible slip layer (15-20μm)	V	1000-1150
55	31	97/101	VI	orange; grey core	brown polish (gold mica)	F	O/R	low-non calc.; K↓	V	compacted surface (10-20μm)	?	850-950
56	35	97/43	VIII	red w. darker core	dark brown burn.	C	O/R	non calc.; K↓	V	Al↑ & K↑ & Fe↑; compacted layer	V?	800-900

Figure 8.9 Fabrics 18, 20-23, 28-31, 35 and 36



### *Fabric 18*

Sample 97/11 would appear to have a slip layer (higher Al and K), which has been compacted due to burnishing. This sample exhibits IV and has an estimated firing range of 750-800°C.

### *Fabric 20*

Sample 98/33 has a surface compacted by polishing. Comparison of surface composition with that of the body suggests the possibility of a slip (less calcareous, higher Al, K, Fe). The application of a low calcareous iron-rich slip to a more calcareous body may explain the production of the dark polished outer surface of this sample. Comparison between external (dark polished) and internal (buff polished) surfaces would thus suggest that the internal surface was not treated in this way. Sample 98/33 is IV/VC with an estimated range of 750-850°C.

### *Fabric 21*

Sample 97/33 has a clear slip whose composition is quite different from the body (low calcareous, high K and Fe). Petrographic study of Fabric 21 identified traces of a non-calcareous slip layer on the surface of sample 98/20. Sample 97/33 is high refractory and vitrified, suggesting a relatively high firing temperature of c.900-1000°C. Petrographic study also indicated that all samples show low optical activity (high fired) and appear to have been fired in a predominantly reducing atmosphere. Frequently, large calcareous non-plastics show evidence of secondary alteration (micritic clots, relict primary textures), however there is no evidence for complete decomposition or failure of the ceramic. This would be consistent with fast firing.

### *Fabric 22*

Sample 97/124 has a possible slip layer (slightly higher Al, K and Fe) that has been compacted due to burnishing. This observation accords with

macroscopic study of this sample. Sample 97/124 has a vitrification microstructure of IV/VC with an estimated firing range of 750-850°C.

#### *Fabric 23*

Sample 97/61 has a visible low calcareous slip layer, which has been compacted through burnishing. This slip layer has reduced to create a dark burnished surface. Since the body of 97/61 is more highly calcareous, this use of a low calcareous slip may have been a deliberate attempt to ensure a dark finished surface. Sample 97/61 is IV with an estimated temperature of c.750-800°C.

#### *Fabric 28*

Sample 97/36 has a compacted surface, which in composition does not suggest the presence of a slip. This is consistent with petrographic study, which identified the existence of a coarse red-firing non-calcareous clay layer on sample 97/36. The coarseness of this layer helps to explain why in composition it did not appear to be a fine fraction. The surface is iron-rich, which explains the red colour of the sample. Sample 97/36 has a vitrification microstructure of V with an estimated firing temperature of 800-900°C.

#### *Fabric 29*

Sample 97/86 has a visible slip layer, which is very distinct in composition (calcareous, high K, Fe) and may derive from a different clay from the body. This sample has a vitrification microstructure of V with an estimated firing temperature of 900-1000°C.

#### *Fabric 30*

Sample 98/90 has a visible slip layer, which unlike the body is low calcareous. This sample seems to have been very highly fired (TV; 1000-1150°C) in conditions which created non-homogeneity in the body: the centre is TV, while the surface is only V. The presence of fine bloating pores in the body is

suggestive of intense reduction. This is also indicated by the grey colour of the sherd break.

### *Fabric 31*

Sample 97/101 has compacted surface with no evidence (visual, compositional) for the use of a slip. This contradicts petrographic observation of a non-calcareous slip layer. This sample has a vitrification microstructure of V with an estimated firing temperature of c.850-950°C.

### *Fabric 35*

Sample 97/43 has a compacted surface, which is only a slightly finer fraction than the body. Petrographic observation of 98/10 also suggested the possibility of a non-calcareous slip layer. This sample has a vitrification microstructure of V with an estimated firing temperature of 800-900°C.

## Summary

Study of the surfaces of samples using SEM resulted in the identification of a range of different finishing techniques. To a large extent these results confirm and enhance the results provided by petrographic and macroscopic study. A frequent feature of the surfaces of the samples studied was the presence of a compacted area, which varied in thickness from 10-50µm (see Plate 38). In most cases this does not result from vitrification, as one might suppose from its microstructure, but results from the compaction, which the surface clay has undergone as a consequence of intense burnishing or polishing. In some cases, there was also evidence (visual and/or compositional) for the application of a slip layer (see Plate 39). In the majority of cases the slips used were non calcareous, however calcareous slips were also identified. The use of slips appears to be largely confined to the production of polished vessel, although examples of burnished vessels were noted in some fabrics (e.g. Fabrics 4, 8). However, not all

polished vessels testified to the use of slips: in some fabrics there was no evidence for the use of slip (e.g. Fabrics 5a, 6 and 12). The absence of slip layers from these fabrics was also supported by petrographic study. This would seem to suggest that subtly different finishing techniques were employed in different fabrics to create essentially the same finish (see Section 10.4).

Study of how the range of estimated firing temperatures (see Figure 8.1) suggests that there exists a considerable variation both within and between fabric groups (see Plates 40-3). This would therefore indicate that the use of SEM-based estimations of firing temperature do not constitute a productive means of exploring potential differences in firing behaviour between Neolithic fabrics. This difference between Neolithic and Bronze Age pottery may be explained at least in part by the more regular use during the Bronze Age of kilns, which in general allow more control over firing (heating rate, soaking time, atmosphere) and thus are more likely to produce more discrete patterning.

Although the greater variability in behaviour observed within Neolithic fabric groups would be most consistent with firing in an open environment, in most cases one further more reasoned insight is not possible. However, as argued in Section 5.3.5, inferences of firing method and firing environment *can* in certain favourable circumstances proceed from a detailed understanding of the main variables which govern the effects of firing on a clay vessel, namely temperature, physical/chemical properties of the clay, firing atmosphere and time. For example, several samples, which had been shown through petrographic study to exhibit calcite alteration as a direct consequence of firing, proved to have been fired to temperatures exceeding 900°C. Under such circumstances, the only explanation for the absence of total limestone decomposition (spalling) is that the firing was fast. It has been suggested that there exists an inverse relationship between speed of heating and the separation of vessel and fuel (Gosselain 1992:246). If so, this identification of a fast heating-rate would also be a strong indication that firing took place in an open environment, such as a bonfire (see Section 10.5.4.1).

Inferences regarding firing environment are also possible through a consideration of non homogenous firing. In one example (97/121) comparison of clay microstructure in different areas of the ceramic body indicated that the microstructure was not homogenous throughout with a gradient in vitrification between a less vitrified exterior and more vitrified interior (e.g. 97/121). In effect such a gradient in vitrification means that there was an uneven distribution of heat within the ceramic body during firing. Such an uneven distribution is most likely to occur consistently when firing is fast and/or the firing environment unpredictable (atmosphere, temperature range): for example the most likely explanation for the gradient in sample 97/121 is that the interior of the vessel was in contact with the fuel, as would be the case in an open firing (cf. Kilikoglou & Maniatis 1993).

In this way, inferences regarding firing environment are possible in a small number of cases. These consistently suggest that firing took place in an open environment, such as bonfire, and that the overall duration of firing was short. Unfortunately, the majority of samples studied do not allow such inferences and the most one can argue is that they remain consistent with an interpretation of firing as fast and open.

## CHAPTER NINE

### QUANTIFYING PRODUCTION AND CONSUMPTION

#### 9.1 The Relevance of Existing Quantitative Data for the Study of Ceramic Consumption

For his study of the 1957-60 excavations Evans collected an impressive array of quantitative data, recording the frequency with which different ceramic types and traits recurred in the different strata (see Evans 1964:192-229; 1973:139-49). The aim of this was to use the new relative stratigraphy defined by these excavations (strata X-I) as a more accurate check on ceramic variation and change. The results of this quantitative analysis of seriation "confirmed to a remarkable degree" the original ceramic phasing produced by Furness on the basis of A. Evans' more arbitrary stratigraphy (Evans 1964:194; Furness 1953). More recently an attempt has been made to interpret Evans' quantitative data in terms of consumption (see Broodbank 1992). This study identified a number of very basic patterns, several of which, such as the MN increase in carinated bowls, had been noted by Evans himself.

Although not without its own problems of interpretation (see Whitelaw 1992), Broodbank's study is notable for being the first serious attempt to consider the EN pottery from Knossos in terms of consumption and social strategy. That said, however, it must be stressed that any 'simple' reading of consumption from Evans' data is extremely problematic, largely because such a direct reading relies on the integrity of several key assumptions, which are open to question:

- (1) *The breakage of pots occurs at a regular rate.* It is in fact extremely unlikely that all pots will have the same breakage rates; rather life-spans are relative to the construction, use and perceived value of various ceramic vessels. Such information is context specific and *a priori* unknowable.
- (2) *Each studied deposit has the same level of brokenness.* This omits to take into account how the measurement of the proportion of types between assemblages in terms of sherd quantity may be further distorted if one type in one assemblage happens to be particularly broken or particularly whole in

comparison to other types within the assemblage, and to the same type in other assemblages.

- (3) *All contexts within each stratum are characterised by similar depositional practices.* This is even more debatable when one considers the variety of depositional factors, which may be influential on the composition and character of an archaeological deposit.

Evans recognised the problems associated with these assumptions but argued that they were largely negated by the high degrees of mixing and brokenness within each context as well as the likelihood (to Evans) that almost all the pottery was locally produced (Evans 1973:133). Such issues regarding depositional context matter much less for a study of seriation than they do for a study of consumption and Evans cannot be blamed for not pursuing them further. These assumptions will however be explored further below. Certainly in at least one of these assumptions, Evans can now be shown to be wrong. As Chapters 6-7 demonstrate, the Knossos EN assemblage is characterised not by homogeneity and a single production location, but rather by considerable variation in fabric, form and finish, which seems to represent a number of sources. As a result the different relative proportions in which different fabrics and their respective forms and finishes recur lie buried within Evans' basic quantification data. This lack of homogeneity also increases the likelihood that there will be different breakage rates and different patterns of deposition within a single context (cf. (2) and (3) above).

From the perspective of consumption, rather than seriation, there are also problems with the level at which Evans chose to measure ceramic variation. A feature of seriation studies is that they study variation at the level of the single sherd and thus it is usually sufficient (as Evans did) to count and weigh sherds and to base analysis of seriation on simple percentages of sherds in different contexts (Orton et al. 1993:21). However, consumption studies, because they are largely interested in information about the use of pottery prior to destruction and deposition, require variation to be studied at the level of the original vessel. Thus

Evans did not explore how different traits, such as types of form and finish, might relate together at the level of the vessel. Indeed further elaboration of the recording procedure to allow for the measurement of the relatedness of certain attributes was deemed too time-consuming and unlikely to produce results which would justify such effort (Evans 1973:135). However, although wasted effort in terms of seriation, the relatedness of certain attributes is important to the study of consumption, since it restores emphasis to the original vessel. Moreover such relationships clearly exist: Evans noted in passing that ripple decoration seemed to be confined to carinated bowls, and incised/pointillé decoration to vertical-sided dishes (Evans 1973:135).

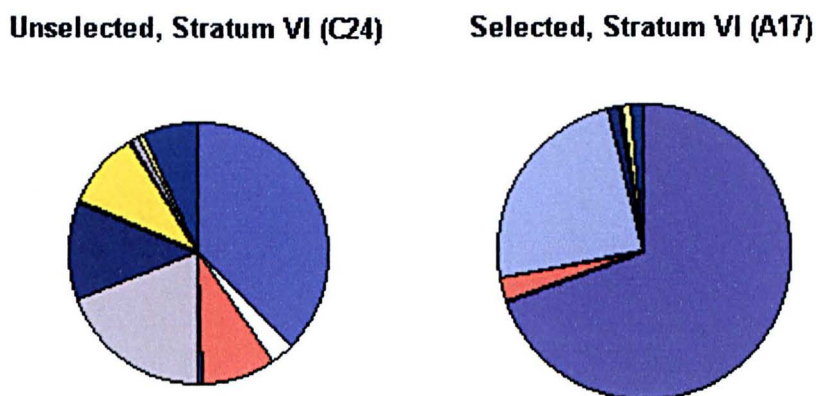
And so, what emerges is that Evans' seriation data cannot be used as a straightforward measure of consumption. Instead further study of EN ceramic consumption requires the collection of new data, which not only relates form, finish and fabric in an overall study of production but also, through quantification, measures the frequencies and proportions in which these different production groupings occur in different contexts over space and time. However, a prerequisite of such a study is the isolation of potentially meaningful deposits through a consideration of some of the processes which contributed to their formation.

## 9.2 Defining Meaningful Contexts

It is an unfortunate general feature of the Knossos Neolithic sequence that occupation surfaces are either completely clean when internal (houses) and contain little direct evidence for consumption or else, if external (yards, pathways), are filled with a generally undifferentiated mixture of broken pottery, bone, ash, stone, organic matter, and resemble rubbish deposits (Evans 1994:7, 14). Sherd size is usually small, as one would expect on well-trampled surfaces, and contexts are usually highly mixed with completed vessels or profiles either very rare or absent. Only occasionally do some deposits (e.g. stratum VIII) contain larger sherds, which mend up into profiles or even semi-complete vessels, and such deposits are likely to have accumulated *in situ* (see Appendix I).



In general, therefore, the EN sequence is characterised by an absence of 'destruction' deposits, where an occupation surface is fortuitously preserved intact. As a result study of consumption is restricted both spatially and temporally in the extent to which it can define individual acts of consumption. The undifferentiated mixed deposits, which characterise much of the EN sequence, therefore force consumption to be viewed at a broad spatial (i.e. community) and temporal resolution (i.e. a single ceramic phase). The only exceptions to this being a number of pit deposits, which are suggestive of more spatially and temporally restricted acts of consumption (see Appendix I). One might wish to argue that mixed rubbish deposits, which lie immediately outside an otherwise 'clean' house, are very likely to have originated from a single household within it. Unfortunately, however, owing to the small size of the EN soundings, it is not possible to even guess at how many architecturally discrete structures could have been disposing rubbish into the same area.



**Figure 9.1 Comparison of Range and Proportion of Fabrics Represented in Parallel Selected and Non-Selected Deposits (Stratum VI).**

A further restriction on resolution is imposed by alterations to the integrity of deposits through post-excavation activities. Due to restrictions on storage space many contexts excavated during 1957-60 were immediately strewn, studied, the feature sherds selected and the rest discarded. All sherds were, however, retained from area AC (strata X-VII) and trench C (strata VI-I) (Evans 1964:192). As an experiment to test just how much data has been lost through post-excavation selection of assemblages, the range and relative proportions of

different fabric groups were measured using sherd counts in both a selected and unselected assemblage (see fig.9.1). Both contexts were from the same highly mixed stratum (stratum V) and should show broadly the same range and proportions<sup>1</sup>. Each slice of the pie chart represents a single fabric, the size of the slice being dependent upon the relative quantity of that fabric present in the context. As Figure 9.1 demonstrates, post-excavation selection has had an irredeemable effect both upon the number of fabrics represented and their relative proportions and as a result only non-selected assemblages were targeted for detailed study.

### **9.3 Developing a Methodology for Quantification: Vessel Equivalents, Sherd Counts, Sherd Weights?**

Central to any form of quantification is the selection of an appropriate measurement of variation. Ideally, only when ceramic material within contexts can be related back to equivalent vessels, can different contexts, if formed by different processes, be compared in a manner meaningful in terms of consumption (see Orton et al. 1993:166-72). However in reality, relating broken sherd material back to the original vessels is extremely difficult. This is particularly so with large visually homogenous assemblages (high similarity in form and finish between vessels in different fabrics), such as Neolithic Knossos, where joins are rare or at least very difficult and time-consuming to make, making it extremely difficult to be sure how many different vessels are represented.

Orton et al. (1993:169-173) suggest several possible methods of estimating vessel counts:

- (1) *Sorting into 'Sherd Families'*: i.e. collect together all the sherds from the same pot. However the potential for a single pot to be represented in different contexts and the practical difficulty of actually assigning non-joining sherds to single vessels make this technique difficult to apply.

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<sup>1</sup> All unselected contexts within this stratum, as with other contexts within a single stratum, proved to be highly comparable/identical in composition, suggesting a generally high degree of mixing.

- (2) *Estimate of Vessels Represented*: estimate the minimum number of vessels by assigning unattached sherds to the same pot wherever feasible; then estimate the maximum number of vessels by assigning unattached sherds, whenever there is doubt, to different vessels; finally take average of the two figures.
- (3) *Estimated Vessel Equivalents*: estimate the percentage in which different types are represented by calculating the percentage of vessel represented by each rim sherd and then adding up the quantities for each type.

Of the three methods (2) and (3) seem to be the most useful, with (3) the most preferable. However, during preliminary sorting of the Knossos EN assemblage, it rapidly became clear that idealism was set to clash with practicality. The general rarity with which sherds mended up into profiles or vessels (see above) made a simple pursuit of (2) or (3) an extremely lengthy process, too time-consuming in fact to be accommodated within the time available for fieldwork.

A version of (2) was tried on EN1a deposits, which contain considerably smaller quantities of pottery in comparison to later deposits. Instead of calculating maximum and minimum quantities and averaging, only a minimum count was taken. It was found that even with relatively small deposits, such as stratum IX (total 542 sherds), the restriction of vessel quantification to a minimum count still took too long, when balanced against the need to collect other types of information. Unfortunately, this problem was never fully resolved. That is not to say that estimating equivalent vessels is by any means difficult, it is just that it remains a very time-consuming activity, which would require much greater resources of time and/or manpower.

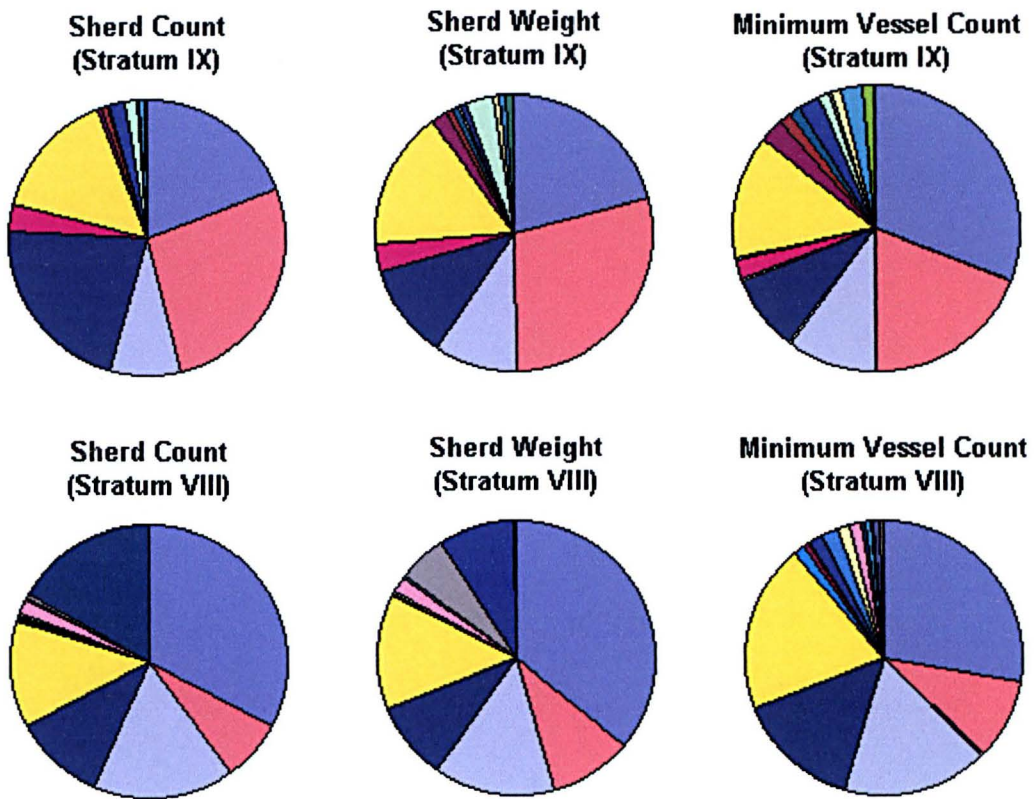
Disappointment at this failure may nevertheless be partly offset by the recognition that data relevant to consumption can be gathered through more time-efficient measures. Where contexts are very large, very mixed and very broken, representing many different acts of consumption over a very long period of time (one ceramic phase), all but the most general patterns of consuming behaviour have been lost, victims of mixing and the undifferentiated nature of the contexts. In such circumstances, if contexts are large, truly mixed, with different

types exhibiting similar degrees of brokenness<sup>2</sup>, then simple average proportions of different types of shape and decoration per fabric and per context can give a very crude idea of basic trends in ceramic consumption. Thus although vessel equivalents remain the ultimate goal, meaningful data can, under certain circumstances, be provided by studying basic proportions of sherds.

Much of this relies on the demonstration that EN deposits at Knossos really are very mixed and very broken. A crude but effective way of gaining an appreciation of the degree of mixing and brokenness, is to compare the representation of different fabrics within a single context in terms of sherd counts, sherd weights and vessel counts. Figure 9.2 compares the proportions of fabrics represented in strata IX and VIII variously produced by sherd counts, sherd weights and maximum vessel counts. The most obvious feature of this comparison is the similarity in the overall proportions produced by each measure. This strongly suggests that these contexts exhibit a high level of brokenness and mixing and that in general each fabric group exhibits similar patterns of breakage. Macroscopic observations of sherd size and fracture would also support this.

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<sup>2</sup> cf. Orton et al (1993:169) note that within any single context, sherd counts reflect two things: "(1) the proportion of the type counted in the population; and (2) the average number of sherds into which pots of that type have broken (known as their *brokenness*)". Thus if all pots of all types show similar degrees of brokenness then the proportions of types represented by sherd counts will reflect the actual proportions of different types within that context.



**Figure 9.2 Comparison of the Proportionate Representation of Different Fabrics in Terms Of Sherd Counts, Sherd Weights and Maximum Vessel Counts (Strata IX-VIII)**

Of the three measures, sherd count and sherd weight seem to parallel each other most closely. In stratum IX minimum vessel count is proportionally quite close to the sherd counts and weights. This is also true in stratum VIII for the well represented fabrics. However, the minimum vessel count for those fabrics which are rare (10 o'clock-12 o'clock) is quite different. This anomaly can be explained with regard to the special nature of stratum VIII: unlike other strata, sherds in stratum VIII often mend up into complete profiles and even semi-complete vessels. Normally a rare fabric will be represented by one or two sherds, however in stratum VIII several rare or unique fabrics are extremely well-represented (e.g. single vessel in unique fabric 35 represented by 25 sherds weighing 2400g). This seems to support an interpretation of stratum VIII as having accumulated *in situ* (see Appendix I).



	1a	1b/c	1d <sup>4</sup>	1e	1f	2a/b <sup>5</sup>	2c	4	5a	5b	5c	6	7	8	9	10	11	12	13	14
IX	193.7	0	0	0	0	218.2	0	29.5	103.3	7.4	0	232.5	15.1	119.9	0	0	14.8	3.7	3.7	12.9
VIII	311.5	0	0	0	0	73.7	0	15.8	160.8	0	4.9	171.8	0	119.1	7.6	0.3	1.2	0.3	0	0.9
VII	365.6	0	0	0	0	53.1	0	23.8	101.8	0	8.7	197.6	0	91.7	43.3	1.1	0.3	0.3	0	0.3
VI	373.6	0	29.4	0	0	94.3	0.3	0	186.8	0	5.8	118.7	0	86.6	13.2	0.7	0	0	0	0.3
V	0	135.2	314.3	49.6	79.1	215.4	12.4	45.9	71.3	0	1.4	27.8	0	33.3	0.7	1.0	0.5	2.6	0	0
IV	0	233.2	22.8	406.6	86.8	62.2	38.5	22.9	27.9	0	0.1	5.6	0	25.4	0.7	1.3	0	5.5	0	0

Figure 9.3 Frequency/1000 of Fabrics 1-15 in Sounding AC

	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	unid/intrusive
IX	0	0	0	12.9	0	0	2.3	0	0	0	0	0	0	7.4	1.9	0	0	0	0	0	0	20.8
VIII	2.4	0	0	0	0.9	0.3	3.7	0	0	15.8	0	0	0.3	1.2	0.3	0	0	0	0.3	0	7.6	99.3
VII	3.7	0	0	0	0.5	0	5.3	0	0	4.2	0	0.5	0	1.9	0	0	0	0	0.3	0.5	95.5	
VI	2.2	1.5	0	8.2	0.2	0	6.5	0	0.3	0.3	0	0	0	0	0.2	0	0.2	0.2	0	0	0	70.5
V	5.5	0.5	0.2	0.5	0	0	0	0	0	0.3	0	0	0	0	0	0	0.2	0	0	1.6	0	0
IV	2.2	0	0	0	0	0	0	3.0	0	0.2	0	0	0	0	0	0	0	0	0	0	0	55.1

Figure 9.4 Frequency/1000 of Fabrics 16-37 in Sounding AC

<sup>4</sup> Since these figures were collected, the presence of Fabric 1d in stratum VII has been established through restudy of sherds originally assigned to Fabric 1a. Thus the frequency figure for Fabric 1a in stratum VI is likely also to include Fabric 1d. NB Fabrics 1g, 1h and 1i are not measured separately: instead the figure for Fabrics 1h and 1i are included within Fabric 1d, while that for Fabric 1g is included in Fabric 1e.

<sup>5</sup> NB Restudy of sherds, originally assigned to Fabric 1a, in strata VIII-VI suggests that the frequency figures for Fabric 3a in Figure 9.3 are artificially low and the value for Fabric 1a consequently too high. NB Fabrics 2d and 2e, which are not included in this table are incorporated with the figures for Fabrics 2a/b.

The high degree of equivalence between the various measures of quantity therefore suggests that simple vessel counts or even weights can give a crude indication of the proportions in which vessels in different fabrics are represented at Knossos within a single stratigraphic phase. These proportions may be expressed in terms of the frequency with which different fabrics occur in different strata (see Figures 9.3-4). Unfortunately, however, these measures on their own do not give an idea of the quantities of *vessels* in use at any one time. In order to investigate the possibility that sherd counts or weights might be converted to meaningful vessel counts through the use of a multiplier (vessels/sherd count; vessels/sherd weight), a comparison was made between strata IX-VII (see Figure 9.5).

	Total Sherds	Total Weight (g)	Total Vessels	Sherds /Vessel	Weight /Vessel (g)
Stratum IX	542	7170	78	6.95	91.92
Stratum VIII	3281	43820	205	16.01	213.76
Stratum VII <sup>5</sup>	3785	54130	302	12.53	179.24

**Figure 9.5 A Comparison of Average Sherds Per Represented Vessel and Average Weight Per Represented Vessel for Strata IX-VII**

Strata IX, VIII and VII exhibit striking differences in sherds/vessel and weight/vessel and produce very different multipliers. This would seem to suggest that different contexts exhibit different degrees of brokenness. To some extent these differences can be related to the observed characteristics of the different deposits. Strata IX and VII are extremely broken and mixed and appear to be secondary deposits (see Appendix I), whereas stratum VIII is probably the least broken deposit in the entire EN sequence in sounding AC and most likely accumulated *in situ* (see Appendix I). Therefore in order to gain some appreciation, however crude, of the total vessels represented *within the excavated area of sounding AC* for each ceramic phase, it was decided to apply minimum and maximum multipliers<sup>6</sup> to Evans' original sherd counts and sherd weights per stratum (see below and Figure 9.2). Once again, it must be stressed

<sup>5</sup> NB not all contexts in stratum VII were studied in the level of detail necessary for these calculations.

<sup>6</sup> i.e. maximum sherds/vessel = 7, minimum sherds/vessel = 15; maximum weight/vessel = 100g, minimum weight/vessel = 200g.

that this sort of calculation produces only a very crude estimate since, above all, it assumes that later deposits exhibit a range of mixing and brokenness, which fits within the range established for strata IX-VII.

#### 9.4 Estimating Vessels in Circulation

##### 9.4.1 *Past Approaches to Quantifying Neolithic Ceramic Assemblages in the Aegean*

Previous attempts to quantify the total vessels in circulation for Neolithic assemblages have varied considerably in both method and results. For EN Franchthi Vitelli used the weight of typical middle-sized EN vessel (c.1kg) together with the total weight of pottery from EN contexts (c100kg) and then adjusted these figures to take account of the estimated percentage of site excavated (c.2%) and length of time represented by EN deposits (min. c.400 years) to produce a figure of c.12.5 pots per year *for the whole site* (Vitelli 1993a:210). The same method for MN produced an estimate of 125-150 pots per year. In contrast for EN Nea Nikomedeia Yiouni used an existing measurement of the total surface area of excavated ceramic material, divided this by a calculated average surface area for a single vessel, adjusted this figure to take account of the estimated recovery rate and then divided this total by an estimation of the total duration of occupation to arrive at a figure of c.25-90 pots per year *for the excavated area* (Yiouni 1996b:181-5). Since Yiouni's estimate is only for a proportion of the total area of the site, while Vitelli's estimate is for the whole of Franchthi these estimates are likely to be even further apart from each other than they first appear. Inevitably these estimates are crude and open to criticism. Of the two, Vitelli's calculation is most problematic since it assumes a 100% recovery rate for vessels and is therefore likely to grossly underestimate the total number of vessels represented. However, these calculations are nevertheless useful for the indications they give, however general, of the scale at which ceramics were consumed during EN.

##### 9.4.2 *Estimating Total Vessels Per Stratum Within Sounding AC*

For EN Knossos yet another variation was used. Using Evans' own figures for the total weight of sherds per stratum in sounding AC (Evans



1973:tables I) and by applying a maximum and minimum multiplier as described in Section 9.3, a maximum estimated vessel count and a minimum estimated vessel count was made of the total vessels represented in each stratum of sounding AC<sup>7</sup> (see Figure 9.6).

Stratum	Weight (g)	Minimum Vessels (weight/200)	Maximum Vessels (weight/100)
IX	10,000	50	100
VIII	45,000	225	450
VII	135,000	675	1350
VI	270,000	1350	2700
V	385,000	1925	3850
IV	630,000	3150	6300

**Figure 9.6 Estimated Minimum and Maximum Vessels Per Stratum Based on Data in Evans 1973:table I)**

#### *9.4.3 Estimating the Maximum Total Vessels in Circulation Per Ceramic Phase for the Whole Site*

On their own these figures seem to suggest that different strata saw quite different levels of ceramic consumption. However, in their present format a simple comparison between strata is not possible since the various strata accumulated over different periods of time, in different densities and may have been subject to different formation processes. In order to try to get beyond the problem of non-comparability, it was decided to use these figures as the basis of an estimate of the *maximum* total vessels in circulation *for the whole site* within each ceramic phase (see Figure 9.7). This was achieved by dividing the estimated maximum site size per ceramic phase (see Appendix II) by the size of sounding AC (5m x 11m = 55m<sup>2</sup>) and then multiplying by the estimated maximum vessel count for sounding AC. By working at the level of the site and within ceramic phases rather than strata, one must inevitably accept a loss of potential resolution as well as a greater risk of substantial error. In order to offset partly the risk of

<sup>7</sup> Unfortunately a similar calculation using Evans' figures for total sherds proved problematic since Evans' figures for strata IX-VII do not correspond in any way to the total sherd counts produced for this study. Since the figures for weight do correspond, the only explanation for this difference is that significant amounts of breakage have occurred since Evans made his original study.

error it was decided to abandon a minimum estimated vessel count and to pursue only a maximum estimate.

The most likely source of error lies in seeking to extrapolate to the level of the site on the basis of a single excavated context, since such an estimate assumes that sherd density per stratum will be the same across the entire site. That this is not true is demonstrated by the significantly different densities noted by Evans for EN deposits in the Central Court and West Court soundings (Evans 1973:tables I, III; 134)<sup>8</sup>. Evans' calculations suggest that sherds are more frequent in Central Court soundings than in West Court soundings. Thus by calculating on the basis of the Central Court data, the total estimate produced is more likely to over-estimate than under-estimate the total vessels in circulation in any one year. Since only a maximum estimate was sought this increases the likelihood that the final estimate represents a true maximum.

Phase	Max. Size (m <sup>2</sup> )	Max. Site Size /55m <sup>2</sup>	Max. Est. Vessels/Phase (sounding AC) <sup>9</sup>	Max. Est. Vessels For Site
ENIa	3000	54.55	275	15001.25
ENIb	15000	272.73	2025	552278.25
ENIc	25000	454.55	3850	1750017.5
ENII	30000	545.45	6300	3436335

**Figure 9.7 Maximum Estimated Total of Vessels/Ceramic Phase For the Whole Site**

#### *9.4.4 Estimating Average Maximum Vessels in Circulation Per Year For Each Ceramic Phase*

Ceramic phases are of course relative measures and in absolute chronological terms, different phases will have different durations. As a result the maximum estimates per phase expressed in Figure 9.7 cannot be considered comparable until some account is taken of the different periods of time over

<sup>8</sup> The degree to which vessels are under or over-represented may be closely related to how rubbish was disposed. Thus if most rubbish was dumped near occupation areas then areas within the settlement but outside houses are likely to have higher sherd densities than areas on the edge of the settlement (see general discussion in P. Arnold 1991:120-137). This would be a plausible explanation for the lower densities in the West Court soundings, since only the upper ENI contexts contained evidence for built structures.

<sup>9</sup> The figures for ENIa were arrived at by taking an average of the maximum estimates for strata IX and VIII. A similar average was taken for ENIb (strata VII and VI).

which ceramic material could potentially accumulate during each phase. An attempt was made to account for this by dividing the maximum estimated vessel count *for the whole site* by the estimated duration of each ceramic phase (see Appendix I), thus producing a crude estimate of average maximum vessels per year per phase (see Figure 9.8).

Phase	Estimated Duration of Phase (yrs.)	Max. Est. Vessels For Site	Est. Average Max. Vessels /year
ENIa	600	15001.25	25.0
ENIb	700	552278.25	788.9
ENIc	200	1750017.5	8750.1
ENII	400	3436335	8590.8

**Figure 9.8 Estimated Average Maximum Vessels/Year For Each Ceramic Phase**

This figure may also be expressed in terms of maximum vessels per person by dividing by the estimated minimum and maximum population for each phase (see Appendix II) (see Figure 9.9).

Phase	Est. Average Max. Vessels /year	Min. Population /Phase	Max. Population /Phase	Average Est. Max. Vessels /Year/Person
ENIa	25.0	30	60	0.42-0.83
ENIb	788.9	150	300	2.63-5.26
ENIc	8750.1	250	500	17.5-35.0
ENII	8590.8	300	600	14.32-28.64

**Figure 9.9 Estimated Average Maximum Vessels/Year/Person For Each Ceramic Phase**

#### 9.4.5 Problems of Interpretation

Obviously such estimates can only give a very crude idea of the total number of ceramic vessels in circulation at any one time. Since they are based on not one estimate but several (total vessels in excavated area, area of settlement, duration of phase, estimated maximum population) there are many points at which errors can enter the calculation. The most obvious drawback is that these figures extrapolate data from one, admittedly large, sounding to produce figures for the whole site. This assumes that the vessels and vessel fragments deposited

within each stratum in sounding AC are somehow representative of site-wide patterns of consumption and deposition.

In addition some comment must be made about how these estimates are interpreted in terms of production and consumption. Previous studies have used such estimates as a direct indication of the rate of production (Vitelli 1989:21; 1993a:210; Yiouni 1996b:184-5). In doing so they assume that all or almost all pottery deposited was produced at the respective sites in question (Franchthi, Nea Nikomedeia). However, at least for EN Knossos this assumption does not hold since, as demonstrated in Chapters 6-7, a significant proportion of the vessels consumed at Knossos were not produced at the site. In this way, an estimate of the total vessels in circulation at any one time is likely to reflect the scale at which ceramic vessels were *consumed* rather than produced. Indeed if any locally-produced ceramic vessels were exchanged out of Knossos and deposited at other sites, it then becomes even more difficult to estimate the rate at which vessels were produced at Knossos. Only by assuming that the general rate of consumption also reflects the scale of local production can one arrive at an indirect indication of production rate. For example, if the total number of vessels (local and non-local) consumed at Knossos in any one year during ENIa was in the region of 25 (see Figure 9.8), then this may suggest that the rate of production of ceramic vessels was equally low. In contrast, in strata ENIc and ENII, the numbers of vessels in circulation are significantly higher at the same time as the proportion of non-local vessels are significantly lower (see Chapter 12), which together seem to suggest a significant increase in the scale of production (see Chapter 11).

### Summary

Although the quantitative data, originally collected by Evans for seriation purposes, has been used as a straightforward measure of patterns of consumption (cf. Broodbank 1992), such a use entails the acceptance of a number of key assumptions, which, although of low importance for seriation, are of considerable relevance for the study of consumption. Moreover, it was argued that the level at which Evans chose to measure ceramic variation (the sherd), although suitable for seriation studies, is quite inappropriate to studies of consumption, where

variation should be studied at the level of the original vessel. As a result it was concluded that study of EN ceramic consumption required the collection of additional quantitative data detailing ceramic variation in terms of vessel quantities. A number of methods were tried, but owing to restrictions of time and labour a compromise method was employed, which *estimated* minimum and maximum vessels in circulation per stratum using Evans' original sherd weights.

Consideration of the particular nature and formation of EN deposits suggested that consumption could only be studied at a very broad spatial and temporal resolution. In other words, although one would like to be able to isolate individual acts of consumption to a particular time and place, one can only at best characterise basic trends in consumption occurring over the course of a ceramic phase and at the level of the entire site. In this way the basic vessel estimates per stratum for sounding AC are relatively meaningless on their own. Moreover vessel estimates for one stratum cannot be simply compared with those of another. As a result the original maximum estimated vessels per stratum for sounding AC were used as the basis for additional calculations, which for the whole site estimated maximum vessels per ceramic phase, maximum vessels per year and maximum vessels per year per person; thus yielding very crude figures, which nevertheless could be compared with each other.

Although the potential for error in this second round of calculations is especially high, it is considered likely that the estimates produced represent an absolute maximum and that such figures overestimate rather than underestimate the actual levels of consumption. This factor is very important since it suggests that the figure of approximately 25 vessels per year for ENIa, however incorrect, is nevertheless unlikely to have been higher. This would therefore seem to indicate a very low level of ceramic consumption for this phase. Also worthy of comment are the relatively high figures produced for ENIc and ENII. Even if these figures were to overestimate the actual level of consumption by a factor of two or three, they would still suggest a substantial increase in the level of ceramic consumption in comparison to ENIa or ENIb. Moreover, it may be more than simple coincidence that the maximum figure arrived at for ENIc is so close to that of ENII. The possible implications of these estimates will be further explored in the context of EN ceramic production and consumption in Chapters 11 and 13.