The Çatalhöyük Flint and Obsidian Industry

Technology and Typology in Context

James Conolly

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PREFACE

This monograph presents an analysis and interpretation of an assemblage of knapped obsidian and flint from Çatalhöyük, the largest known Neolithic site in Turkey and one of the largest and most prominent Neolithic sites in the whole of the Near East. It is a modified version of my Ph.D. thesis presented at the University of London in 1997, which has been substantially edited down and made more readable.

The overall aim of the original thesis was to contribute to the increasing trend in lithic studies towards more contextual analysis, in which the wider social framework of knapped-stone production, use and deposition forms the centre of discussion and interpretation (e.g. see Schofield 1996; Edmonds 1995). This basic objective I alluded to (but perhaps didn't explore sufficiently) in my report on the first three seasons of lithic analysis at Çatalhöyük (Conolly 1996). At the same time there were two other aims in the original thesis. First, as Çatalhöyük has figured prominently within our understanding of the Neolithic in Anatolia and the Near East, the study aimed to redress the lack of any comprehensive analysis of the knapped-stone industry. Exploring the technological attributes of the knapped-stone assemblage, particularly methods or strategies of blank and tool production and their changes over time and space, was an integral part of this. Where appropriate, the morphological characteristics of retouched tools were also examined in order to identify typological patterning. Secondly, as a corollary to the technological and typological analysis I explored spatial and contextual patterning both within and between buildings. This monograph retains these aims but is presented in a somewhat abridged (and perhaps more readable) form. One of the major changes is that much of the dicussion relating to intra-building patterning found in the recently excavated 'Building 1', particularly as it relates to the abandonment process, has been removed. A forthcoming publication on the archaeology of this complex structure is planned (Hodder et al: in preparation) where a more detailed exposition of the lithic patterning will be offered.

While the social contexts of production, use, and discard of the obsidian and flint artefacts at Çatalhöyük are the things that I ultimately wanted to examine, without a thorough understanding of the technological and typological parameters of the industry, I felt this would be fundamentally flawed. This monograph can thus be seen as consisting of two parts: the first five chapters take the site itself as the focus of analysis and examine the lithic material from this perspective, whereas the final two chapters explore technological and typological patterns within the smaller temporal and spatial divisions of the site, vis-à-vis the aims of socially oriented analysis.

In more detail, Chapter I (*The Archaeological Background*) presents the setting of the Anatolian Neolithic and reviews the history and findings of previous examinations of the knapped-stone from Çatalhöyük. In Chapter II (*Defining a Methodology*), the theoretical and methodological framework of the analysis is outlined within a review of some of the conventional methods used for knapped-stone analyses in the Near East. Chapter III (*Defining a Technology*) presents the results of the analysis of technological characteristics of the Çatalhöyük knapped-stone assemblage, focusing on techniques of production, whereas the technology and morphological patterning of the retouched debitage is explored in Chapter IV (*Defining Tool Use: The Retouched Debitage*). The technological and typological variability is examined as a system of technological strategies in Chapter V (*Technological Synthesis: Obsidian and Flint Strategies and Regional Patterns*) and compared to what is known about technological and typological variability and relationships among regional settlements of similar chronology. Intra-site patterning is investigated both diachronically and spatially in Chapter VI (*Temporal and Spatial Patterns*) where significant technological changes are observed and consequential relationships between some artefacts and some buildings are identified. Finally, in Chapter VII (*Social, Economic and Symbolic Context*), the roles of knappers in Neolithic society are examined. Technological change and the development of specialisation are discussed within the context of intra-household and extra-household production, as are the wider symbolic associations between technological activity and artefact types.

This study ultimately demonstrates that different technological strategies and tool forms were used at different times and places at Çatalhöyük, some of which appear to correlate quite closely with other elements of material culture and building context. While the results and interpretations are perhaps specific to obsidian and flint technology at Çatalhöyük, I hope this work may also be of interest to those curious about technology and technological change, as well as the context of production, use and discard of stone and other forms of material culture, in the Neolithic.

Finally, I would like to record my thanks to Dr Andrew Garrard who supervised this research, Dr Douglas Baird who made many valuable suggestions, and Dr Sue Colledge who helped with the editing of this volume.

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I
THE ARCHAEOLOGICAL BACKGROUND

The Geographical and Chronological Setting

Anatolia is the western extension of the immense Asian land-mass that forms approximately 95% of the modern Republic of Turkey (figure 1.1). Generally speaking, its climate is Mediterranean continental, characterised by hot dry summers and cold wet winters influenced primarily by the middle to high latitude westerlies, and the high pressure-systems which extend from the Atlantic to the Sahara (Wigley & Farmer 1982:4). More extreme seasonal temperatures exist in inland and higher Atlıtude areas.

The regional focus of this thesis is Central Anatolia – a loosely defined area roughly bounded by the immense Taurus mountains to the south and east, the more humid lakes and forests to the west and the imposing Kızılırmak River to the north. It belongs to the Irano-Turanian phyto-geographical zone, which extends through to Eastern Anatolia, Lake Van, and the highlands of Iran and the Zagros Mountains. It is generally a cold, dry, Irano-Turanian steppic environment (Zohary 1973:174-178), although there are two wetter and warmer Xero-Thermo-Mediterranean enclaves in the Konya Plain and the Tuz Gölü Basin (Todd 1980:18). It is often contrasted to Southeastern Anatolia, which can be considered a geographical extension of the Syro-Mesopotamian landscape, embodying the Euphrates, Balikh, and Tigris river basins with an extreme continental Mediterranean climate. To the west is an area commonly referred to as the Lake District, which is characterised by a slightly more humid climate with Xero-Euxinian steppe-forest cover (van Zeist et al. 1975). Çatalhöyük is located within the Konya Plain region of Central Anatolia and, following Todd (1980) and Roberts (1983), this region can be distinguished from its surrounding environs on the basis of its unique geomorphological and archaeological characteristics.

The Konya Plain is a vast interior drainage basin and alluvial plain enclosed by the Sultandağları Mountains to the west, the Taurus to the south and south-west and the Aladağları range to the east (figure 1.2). Modern climatic conditions characterise it as cold steppe, with an average precipitation around 300mm – well within the limits of dry-farming – but considerably less than some other regions. For example, to the south, coastal Mediterranean precipitation averages are over 1000mm (Todd 1980:27). It was formerly covered by the extensive and shallow Late Pleistocene Konya Lake that recent work has suggested was at its maximum between 23,000 and 17,000 years ago (Roberts *et al.* 1979; Roberts 1983; Ataman 1989:31). Seasonal remnants of this lake may have lasted until fairly recently in this century, although

Figure 1.1 The Republic of Turkey and the Middle East

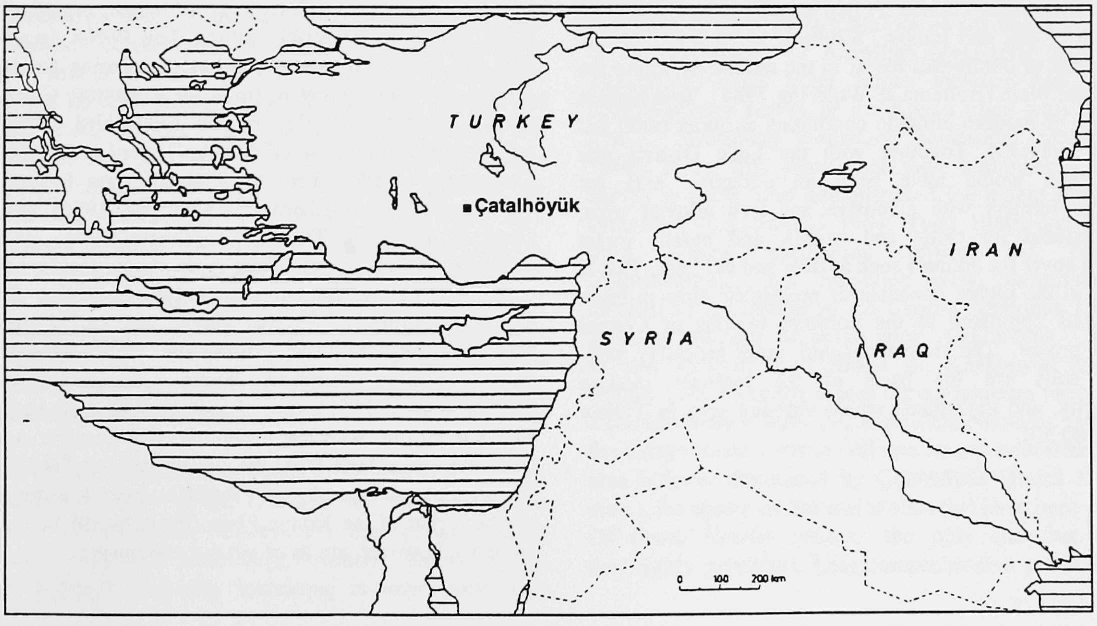
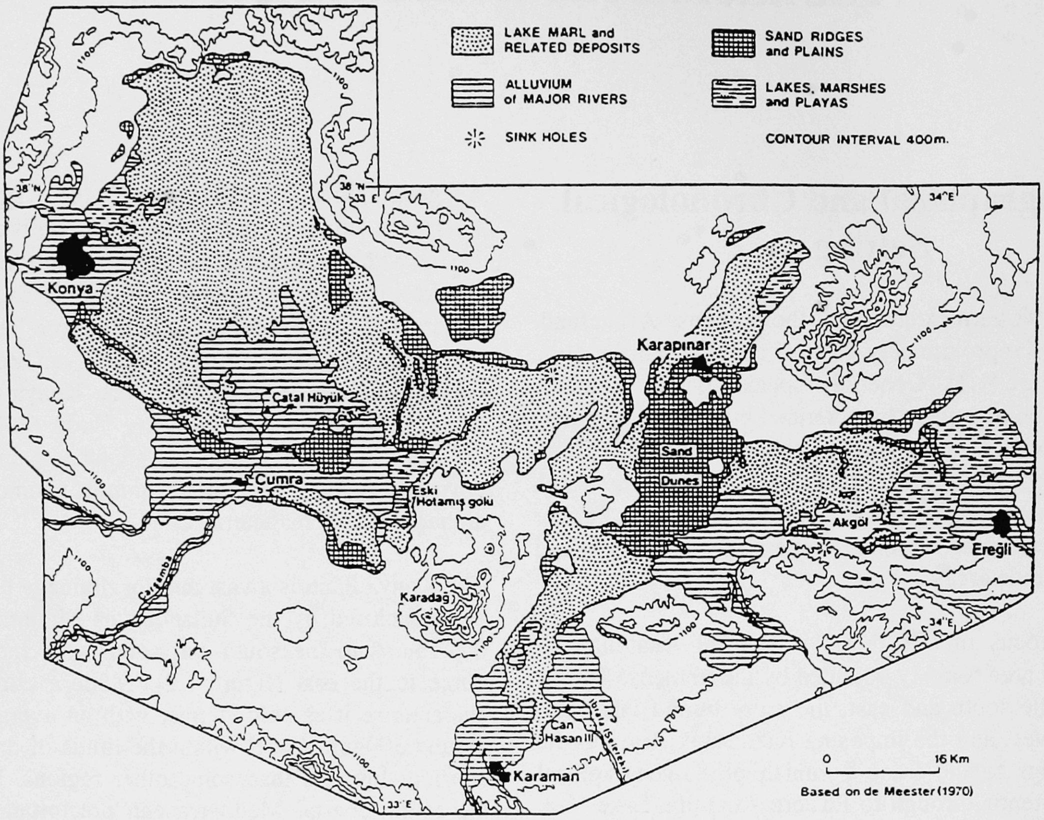


Figure 1.2 The Konya Plain (from Roberts 1983)

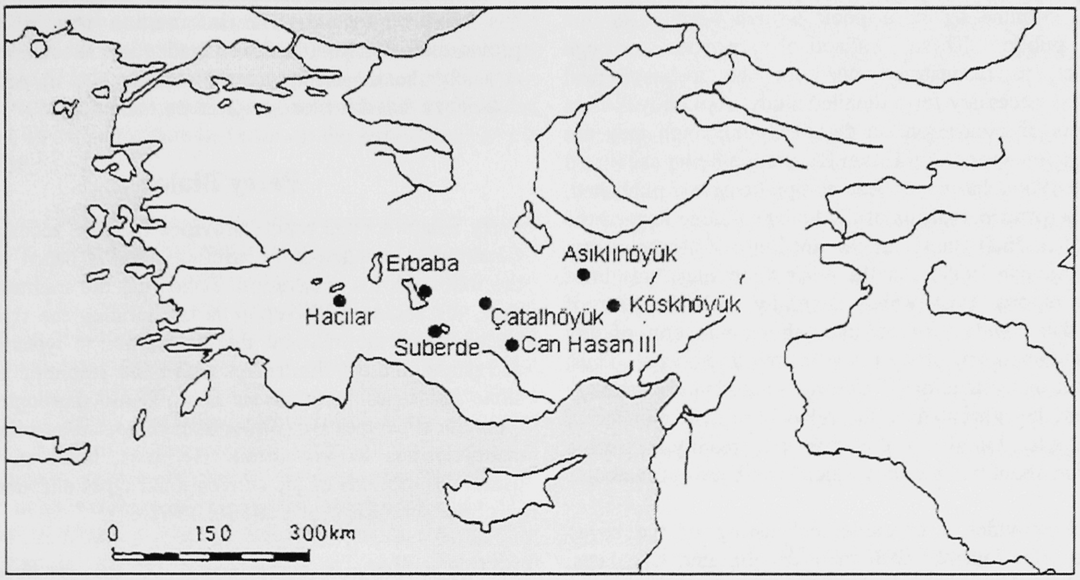


extensive agriculture in the last 50 years has seen the water table drop extensively – perhaps as much as 30 feet between 1993 and 1996 (Roberts 1997: *pers. com.*). In antiquity, the major water source for the plain was the Çarsamba Çay, which runs immediately to the west of Neolithic Çatalhöyük, separating it from the adjacent Chalcolithic site. High levels of alluviation are thought to have occurred since the drying up of the Pleistocene Lake, coinciding with a gradually drying and warming climate. Pollen diagrams show an initial expansion of oak and juniper, followed at 7000 BC by the development of coniferous forest in the mountains along the edges of the plain (Bottema & Woldring 1984). This heralds the arrival of modern climatic conditions at about 6000 BC (Ataman 1989:30). Together with the Lake District, the Konya Plain would have been an attractive area for prehistoric farmers with extensive and rich alluvial soils, open grassland for cattle and equids, and nearby forest providing cover for animals such as deer and wild pig. This is reflected in the higher densities of prehistoric sites in these two regions compared to the northern regions of Central Anatolia proper. The rich and (until quite recently) well-watered soils are the basis of the region's modern productivity, and the largest wheat growing area in Turkey (Todd 1980:20).

Regional Chronology and Culture-History

In the wider context of the Near East the earlier Neolithic is commonly divided into two phases, the Pre-Pottery Neolithic A and Pre-Pottery Neolithic B (PPNA and PPNB), after Kenyon (1957), reflecting general differences in technology, economy, domestic architecture, settlement organisation and other aspects of material culture. The PPNA is associated with the first manifestation of food producing societies, the origins of which appear to lie in the Levantine Corridor and middle Euphrates Valley in the final third of the ninth millennium BC (Harris 1996:554, Garrard *et al.* 1996:207). Contemporary sites from the Upper Tigris Basin such as Qermez Dere in Northern Iraq (Watkins 1995) and Hallan Çemi in Southeast Turkey (Rosenberg 1994; 1995) lack evidence for cultivation. There is no unequivocal evidence of early Neolithic settlement akin to the Levantine PPNA in Central Anatolia or, for that matter, any earlier prehistoric sites. The Epipalaeolithic communities on the Mediterranean Coast of Turkey – primarily Öküzini (Olte 1995) and Beldibi Cave (Bostanci 1959), near the modern city of Antalya, are well known but, with the exception of a possible Acheulian hand-axe from Avla Dağ, the only potentially pre-Neolithic site in Central Anatolia is Pinarbası, near Karaman in the southern part of the Konya Plain (Watkins 1995). Its carbon 14 dates, however, are as of yet not conclusive.

Figure 1.3 Location of Central Anatolian Neolithic Sites



By the middle to the end of the eighth millennium BC, a series of new Neolithic settlement types appear, first in the Northern Levant and somewhat later in Southeastern Turkey, marking the emergence of the second phase of the aceramic Neolithic period in the Near East, conventionally termed the PPNB (Bar-Yosef & Belfer-Cohen 1989:59). Southeastern PPNB sites, such as Çayönü, Nevali Çori, Cafer Höyük, Gritille, and Hayaz Höyük, while sharing many characteristics with their Northern Levantine counterparts, display several unique features that have lead to them being referred to as the 'Taurisian PPNB' (M.-C. Cauvin 1988:93). A few centuries later, by the early seventh millennium, the first evidence of Neolithic settlement in Central Anatolia emerges, first at Aşıklıhöyük, which maintains a distinctive PPNB-like lithic technology, then at aceramic Hacılar and Can Hasan III, which do not. The end of the seventh and beginning of the sixth millennium BC witnesses the decline of PPNB culture, with distinct differences between the northern and southern Levant. In the north, there is a development of larger sites, such as Bouqras, Abu Hureyra, Ras Shamra whereas in the south, a demise of larger PPNB villages and the establishment of smaller settlements is witnessed. 'Ain Ghazal is unusual for its settlement continuity over this period, although there appears to be a significant restructuring of its economy (Moore 1985; Rollefson & Köhler-Rollefson 1993).

The Levantine distinction between aceramic and ceramic Neolithic holds in Anatolia, although the transition is less pronounced. Çatalhöyük displays the first comprehensive evidence of ceramic technology, virtually absent in the earliest levels but steadily increasing in importance over time. However, there are none of the major restructurings, regional abandonment, economic or subsistence changes witnessed in some parts of the Levant. Nevertheless, although the distinction is less conspicuous, Anatolian Neolithic sites can be divided into two roughly equal chronological periods, based somewhat arbitrarily on the introduction of pottery.

Chronology of Central Anatolian Neolithic sites

Compared to the adjacent Levant, our understanding of Anatolian prehistory, and Central Anatolian in particular, is still in its infancy. In part this can be attributed to an absence of any knowledge of Anatolian prehistoric sites until the 1950's, at which point James Mellaart had started his comprehensive survey of the Konya plain with the express aim of identifying prehistoric habitation (Mellaart 1954, 1961). In the fifty years since then, a number of additional survey projects have demonstrated the extent of prehistoric settlement (e.g. Solecki 1964, Todd 1980) and there have been several excavation projects at Palaeolithic, Epipalaeolithic, and Neolithic sites. Nevertheless, our detailed understanding of the Central Anatolian Neolithic is founded primarily on seven sites: Aşıklıhöyük, Çatalhöyük, Erbaba, Suberde, Can Hasan III, Köşkhöyük and Hacılar (figure 1.3). Although recent survey projects have identified a handful more – including additional Neolithic settlement in the Konya Basin – which will redress our understanding of an area hitherto dominated by Çatalhöyük (Baird 1996: *pers. com.*), the above are the major sites that have been excavated. Of these, Hacılar remains the only site that has been thoroughly published. Less comprehensive publishing is the norm elsewhere, although in most cases satisfactory information can be gleaned from collections of published papers and preliminary field reports. During the course of Mellaart's excavation of Çatalhöyük yearly reports were produced culminating in a book written largely for the general public. These collectively provide enough information to reconstruct much of the archaeological information necessary for a detailed study. Aşıklıhöyük is in the process of excavation, so detailed publication may not occur for a few years. Can Hasan III, despite being excavated in the late 1960's has never been comprehensively published, although a detailed analysis of the knapped-stone formed the subject of a Ph.D. thesis at the Institute of Archaeology, London (Ataman 1989). For the other three sites, only brief summary reports exist which generally lack the sort of detailed data needed for an in-depth examination of any particular component of their artefactual assemblage. Thus, our limited understanding of Central Anatolian archaeology can in part be attributed to the relatively small number of excavated sites, but also to the absence of readily accessible information about the few sites which have been excavated.

Table 1.1 provides a chronological listing of the seven excavated sites together with their uncalibrated C_{14} dates. Most of these dates were obtained before refined dating and calibration techniques but the entire sequence lasts approximately two thousand years – roughly between the late eighth/early seventh millennium BC and the late sixth/early fifth millennium BC – with the earlier aceramic sites restricted to the first half of this period. No individual site shows the transition from aceramic to ceramic, but there are no gaps between the final phases of the latest aceramic and the earliest ceramic sites. Çatalhöyük, Köskhöyük, Erbaba, and late Neolithic Hacılar contribute nearly all our information about this period for Central Anatolia and, indeed, the whole of Anatolia north-west of the Taurus mountains. Of these Çatalhöyük provides the most abundant data.

Previous Analyses of the Çatalhöyük Knapped-Stone

As the Çatalhöyük knapped-stone assemblage is the most extensive in Central Anatolia, and as the site often plays a principal role in the wider discussion of Anatolian prehistory, there has been considerable interest in the knapped-stone obtained from Mellaart's excavation. There are three sources of primary information: a report by Bialor (1962) published after the first season of work, an unpublished report by Mortensen (1964) who examined the material from the years 1961 to 1963, and various brief comments by Mellaart contained in reports of the 1963 and 1965 seasons. These are useful but not infallible archives, and in the following paragraphs I provide a synopsis of their results. More recently Balkan-Atlı (1994) has re-analysed the material from the earliest levels which provides some useful, but limited, information which I shall also review. Before embarking on this, I wish to clarify that to date no comprehensive analysis of all of the knapped-stone data from Mellaart's excavation has been completed. The information that is available provides a basic, yet ultimately inadequate account of what is arguably the most important Neolithic site in Anatolia, a deficiency that this monograph in part addresses.

Perry Bialor

Perry Bialor's 1962 report provides the first account of the Çatalhöyük knapped-stone artefacts, and is based solely on the first season's excavation. Following the tradition of the time, the focus of his report is on defining the typological variability of the industry, the distribution of types by room and phase, and the similarities with other Neolithic knapped-stone industries in the Near East. While thorough from a typological perspective, Bialor does not discuss technological characteristics in any detail. He does, however, provide useful descriptions of the conventional types encountered, as this brief synopsis shows (Bialor 1962:69):

> The industry is characterised by the presence of numerous tanged arrow and lance-heads, not very numerous awls, and some drills (there are, of course, many bone awls also), scrapers of various kinds, some which are rather well shaped round or ovoid scrapers, laurel-leaf daggers, the typical parallel-sided blades, a couple of heavily retouched fabricators, some heavy pointed blades, several specialised implements of problematic usage, and rather scanty waste flakes... Equally significant is what is lacking; this includes burins.., chipped axes, adzes, picks, and hoes, microliths and geometrics in any size, barbed or notched arrowheads and sickle blades in any significant amount (only a few have been provisionally identified, although the author admits to an inability to clearly identify sickle blades of obsidian when silica sheen, so omnipresent on flint and chert, is missing).

Within each of his type-categories, but particularly the projectile, scraper, and dagger classes, Bialor describes the range of potential forms: scrapers are divided into seven sub-types, projectiles into four basic and fifteen sub-types. Patterning between levels and rooms is then examined within these parameters. Indeed, the majority of Bialor's report is taken up with descriptions of type distributions across both level and room contexts. Generally, Bialor stressed the homogeneity of the knapped-stone industry over time: "from the bottom (VIII) to the top (II) of the excavated levels there is no break in the tradition and no significant shifts in the proportion of tools relative to each other, size of tools, or techniques of manufacture employed" (Bialor 1962:67). He does, however, identify two potential instances of chronological change, involving both a shift from wider blades to narrower ones, and a tendency towards more bifacial tanged points in later levels (Bialor 1963:69). The latter turned out to be contradicted by data acquired in subsequent years, both by Todd (1976:81), who states that extensive bifacial retouch of obsidian occurs in the earliest levels, but declines later, and Mellaart (1964:111), who asserts that projectile points are "nearly always bifacial... and better done" in earlier levels. What Bialor didn't comment on, although it is contained in one of his data tables (Bialor 1962: table c), is a particularly interesting trend for an increase in the proportion of blades in the later phases of the sequence.

Patterning between room contexts is occasionally noted, providing substantial and impressive evidence for the non-random distribution of particular types of knapped-stone artefacts. This, together with the hints of increases in the proportion of blades in later levels, provides a foreshadowing of exciting and consequential data trends. Throughout his report, Bialor provides interesting reasons for the large numbers of tools – particularly projectiles – found in certain contexts. More often than not, it is attributed to the status of the occupier, such as in one of the cases described above where large numbers of projectiles are ascribed to "the 'master' of House 4 who [possessed] considerable skill or else was a trying connoisseur of only the finest workmanship" (Bialor 1962:90). Bialor also speculates that the apparent 'wealth' of Çatalhöyük was based on "the control, due to its relative proximity, of the obsidian trade at its source" (Bialor 1962:110). This idea has persisted in several later exposés of Çatalhöyük's position in the Anatolian Neolithic, yet has never been fully explored or, indeed, justified. I discus this further in Chapter VI.

In terms of wider cultural affiliations, Bialor suggests, on the basis of the knapped-stone artefacts, that Çatalhöyük can be seen (in general terms) as having similar forms of stone tools to those found at Mersin, which at that time was the nearest excavated Neolithic site in Turkey, as well as several presumed Neolithic surface scatters in the vicinity of the Konya Plain.

James Mellaart

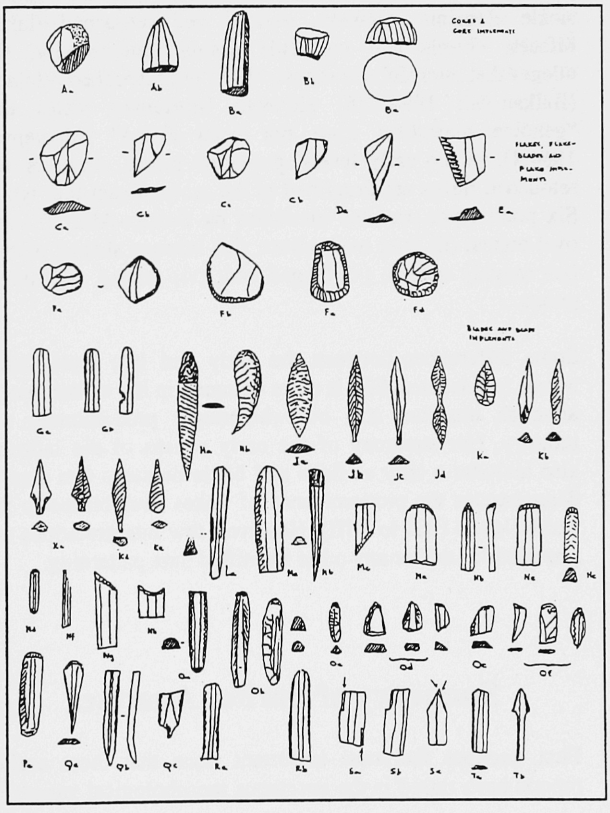
In his 1963 report, Mellaart offers few comments on the material collected in the previous season beyond three general remarks: (i) that there is an absence of any evidence of obsidian or flint working in the areas excavated; (ii) there is a trend for hoards of weapons to be buried beneath floors, probably in bags which have since decayed; and (iii) flint is a small but ubiquitous component of individual deposits of knapped-stone material (Mellaart 1963:101). A few other observations are made concerning projectile point typology, particularly the reduction in the number of projectiles with retouch confined to the tang. Also of note is his suggestion that the size of modified pieces increases in earlier levels. His most substantial contribution to the analysis of knapped-stone comes in his report of the following year where several stratigraphically distinct deposits are separately described and a number of interpretative statements are made concerning the overall nature and spatial patterning of flint and obsidian artefacts. Clear differences between the earlier and later levels had by this time become apparent, particularly the increased use of blades in the later half of the occupation. Earlier levels are described as having a greater dependence on flakes for their tools, although a similar range of tool forms was thought to have existed, including numerous bifacial projectiles (Mellaart 1964:111).

Perhaps the most interesting comments made in these reports involves the distribution of flint and obsidian artefacts, which are argued to occur in four places (Mellaart 1964:103): (i) as offerings in shrines, "usually in large quantities, and often unused"; (ii) hoarded beneath floors, "in the south-east corner of the building near the hearth – probably in bags"; (iii) on the floor, "often broken or used and left as they were at the time of the fire or abandonment of a building"; and (iv) buried with the dead, "below the platforms of the houses and shrines [are] often unused and spectacular weapons". Examples of artefacts from this last context are particularly interesting, with males often buried with numerous projectiles or finely worked flint daggers.

Peter Mortensen

Peter Mortensen's (1964) analysis is by far the most comprehensive, based on 2,844 pieces excavated between

Figure 1.4 Peter Mortensen's Typological Scheme (copy of PM's original)



1961 and 1963. Three main typological groupings were defined, each containing a number of sub-types: (i) cores and core implements (five sub-types); (ii) flakes, flake-blades, and flake implements (eleven sub-types); and (iii) blades and blade implements (forty-two sub-types) (figure 1.4). Each of these types is described in some detail, with their frequency of occurrence examined by level. Raw material patterning and chronological distribution were also examined. Six techno-typological trends are identified by Mortensen: (i) a gradual decrease in the use of flint (1964:14); (ii) an increase in the use of blades, reaching its pinnacle by Level V (1964:15); (iii) preferential use of flint for some tools, particularly daggers, some types of flake scrapers and flake borers, and obsidian for others, such as the blade tools, burins, polishers, and all projectiles (1964:15); (iv) a more economical use of flint (1964:17); (v) larger projectiles (interpreted as spearheads) rare until Level VIA-B, suggesting that bows were more common in the earlier phases of the settlement (1964:7); and (vi) a reduction in tool size and typological variety in the upper levels, coinciding with "a decline in the technical skill" of the knappers (1964:20).

Nur Balkan-Atlı

Nur Balkan-Atlı's (1994) summary of the earlier levels is based on a reanalysis of material from the first three years of excavation at Çatalhöyük. As with the earlier reports, a number of different tool types are described although she devised a modified typological scheme, which included piercers, utilised, retouched, notched and truncated blades, sickle elements, scrapers, utilised and retouched flakes, bifaces, chisels and projectile points. Interestingly, she alleges that microliths compose 7% of the retouched artefacts (Balkan-Atlı 1994:128) although Mortensen states that "genuine microliths have not been found" (Mortensen 1964:4). In the early levels, projectile points, scrapers and retouched flakes are described as the predominant tool types. Six point types are also identified by Balkan-Atlı: (i) short oval points; (ii) long oval points; (iii) lozenge shaped points; (iv) roughly tanged; (v) tanged and; (vi) tanged and finned points.

Some differences between the early and late levels were noted; for instance, flint is more common in the earlier levels, although obsidian still overwhelmingly predominates the industry. Her summary of the early phases of the industry also includes a tally of flake and blade debitage that clearly demonstrates the predominance of flakes over blades in the earlier levels (XII to VIII). However, few interpretations are provided for this or any other identified data patterning.

Summary of Earlier Analyses

First, perhaps the most important issue that these earlier reports have raised is the enormous morphological variety of tool forms at Çatalhöyük. This is a common and recognised phenomenon in Neolithic knapped-stone assemblages throughout the Near East. One approach, the most traditional way of dealing with this and the one followed by Ataman, is to devise a typological scheme that encompasses the variation. However, beyond the 'formalised' tools such as projectile-points or, to a lesser degree, some of the larger scrapers, there is little consensus as to what categories the diversity of 'informal', 'ad-hoc' retouched flakes and blades should be placed in. Ataman's scheme reflects this, for although there are fifteen primary types and a larger number of 'sub' types, categories such as 'retouched flakes' and 'retouched blades' are catch-alls for implements that are not more easily recognisable. These two categories contribute the greatest number of pieces to the stratified sample (Ataman 1989: figure 45).

The earlier analysis of the Çatalhöyük assemblage followed a similar strategy, as there was a greater dependence on broad inclusive categories such as 'retouched flake'. Mortensen's confession that "flakes of obsidian or flint, irregularly retouched along the edges... represent several kinds of tools, but it has not been possible as yet to determine the function of any of the pieces from the differing shapes, the retouch, or from any special traces of wear" (Mortensen 1964:5) highlights the classification problem encountered with non-standardised assemblages. Alternative methodologies, including those designed to specifically to address this issue, are discussed in the next chapter.

Secondly, there appears to be a change in primary debitage techniques. Such a change may indicate a restructuring of the organisation of lithic production and/or may be related to wider changes to subsistence or economic design. While this is hinted at by all three analysts, because no comprehensive analysis has been undertaken it is difficult to either quantify or qualify the specifics of the change. In order to define more clearly such trends, systematic analysis of technological characteristics is required.

Finally, there are several hints at patterns of tool distribution, particularly the disparate quantities of projectiles found in some houses. This is an interesting observation and (providing adequate additional information was available on the nature of the rooms, other artefacts present, etc.) could supply evidence for discussion of symbolic and socio-economic issues connected with particular artefact forms or production techniques. For example, Mellaart speculated that the undamaged condition of many of the projectiles found in burials was because they had never been used. This in itself suggests that while the existence of many of the Çatalhöyük tools can be attributed to functional requirements, other forms, particularly the more ornately retouched tools suggest that production was not undertaken solely for use, but possibly for deposition in ritual contexts.

Although undoubtedly useful, most of these previous analyses of the Çatalhöyük knapped-stone suffer from only examining sub-sets of the full chronological span of the industry. This means that the full span of technological and typological variability has never been examined, and meaningful discussion of temporal transformations within the occupation period of the settlement cannot occur. Secondly, there has been no attempt to understand the technology of the industry, so issues concerning the methods of blank and tool production are poorly understood. Finally, the three reports discussed above have not attempted to examine the spatial patterning of the knapped-stone artefacts in any detail, prohibiting any discussion of the larger social and economic context of the industry. The following chapter outlines a method by which the technological and typological variability of the industry can be examined in order to address issues relating to technological transformation and typological variability.

II

DEFINING A METHODOLOGY

The Analysis of Technology

The term 'technology' may refer to the specific knowledge about the manner in which things are made, as well as the non-discursive 'know-how' (Pelegrin 1990) which consists of the practical implementation of the knowledge of how to make and use technological products. The latter aspect may also be referred to as 'technique', with the term 'technology' restricted to the knowledge component (e.g. Ingold 1990:7). Others use the term to also encompass both the physical products of knowledge and know-how, be they computers, nuclear weapons, or stone tools (MacKenzie & Wajcman 1985:5). The term 'technology' can thus refer to three elements – the knowledge of procedures, practical know-how, and the physical product itself. All three elements of technology emphasise the social imbeddedness of knowledge, action and product. Put another way, technology is the product of social choice, action and structure (Schlanger 1990). As with all material culture, technology possesses social meaning, and both is shaped by, and shapes, society. At the level of the individual, knowledge and know-how can be seen to be both a manifestation of a conception of the social world, and how it should be constructed (Giddens 1979). Consequently, technology (as knowledge, practise and product) can be seen as both determined by and determining the social context in which it is situated.

One well-known example that shows a direct relationship between stone tool technology and its social milieu are the ethnographic studies of western Australian Aborigines by Tacon (1991). Here, the procurement, classification and use of stone tools is to a large degree influenced by the relationship between raw material and ancestral beings. In this sense, the three components of technology can also serve as reference points for social reproduction, providing the cues for the identity and structure of society (Edmonds 1995:11).

Technology can also be seen to have a political quality. Studies of technology in the contemporary world have shown that mundane things such as the height of bridges directly affect the manner in which people carry out their daily lives (Winner 1985:30) and in antiquity, a similar relationship may also be inferred. One example comes from Mesoamerica, where the development of a prismatic blade technology has been directly attributed to the rise of chiefdoms, as the securing of constant supplies of the necessary raw material and the economic support of craft-specialists is thought to be necessarily dependent on an emerging political hierarchy (Clark 1987). One part of the political element of technology also involves gender, insofar as gender relations are often defined and mediated through the access to, the skill involved in, and the knowledge of the techniques of production and use of material culture (Dobres 1995:28). In other words, social relationships directly affect the characteristics and patterning of technology.

The study of technology can therefore be seen as the process of defining the relationship between the social, and the specific knowledge and practical know-how that is needed to produce 'objects'. Emphasising the fluidity of the relationship with the social is in contrast to approaches which tend to emphasise the deterministic nature of technology. The perception that material culture creates society further stresses the inherently social nature of technological products. As such, one aim of analysis becomes the 'making sense', or interpreting, of technology as a social phenomena.

Essential to the process of 'making sense' of technology is an attentiveness to the larger social context, as any individual part cannot adequately be comprehended outside of the whole (Hodder 1986:2; 1991:145). If context is taken to be the totality of the relevant dimensions of variation around any one object (Hodder 1991:143), spatial position and physical relationship to other objects, physical composition, and the wider social context of manufacture, use and discard, all play a part in defining an artefact's meaning. Thus, identical objects may have different meanings in different contexts. This relational fluidity of meaning between object and context is a critical principle of contextual archaeology, and by following networks of associations, the social meanings of objects and their contexts may be defined (Hodder 1986:8). Any interpretative account of the past is thus a hermeneutic spiral, involving constant referral between context and object, moving towards an understanding that accounts for, and makes sense of, the totality of variability (Shanks & Tilley 1992:104).

Practical Implications

How are the basic concepts of contextual archaeology to be translated into a practical methodology for the analysis and interpretation of material culture? At a general level, the belief that 'parts' cannot be understood outside the 'whole' counsels that relevant dimensions of variability must be considered. This necessarily entails the assimilation of as much data as possible in any analytical method prior to interpretation:

> A pot can be classified according to its shape and decoration as of a particular type. But thin-sectioned under a polarising microscope it explodes into another world of micro-particles and mineral inclusions. The pot is not just one thing that can be captured in a single all-encompassing definition. There is always more that can be said or done with the pot. A single post is also multiple. It depends on the trials we make of it, what we do with it, how we experience it – whether we attend to surface and shape or slice it and magnify it. (Shanks & Hodder 1995:9).

Any individual object consists of a number of morphological attributes offering the possibility of defining types by their key characteristics. As defined here, variables are the qualitative and quantitative dimensions of an object that possess different attribute states. For instance, the variable 'length' can possess different states, as can colour. Attributes are mutually exclusive, in the sense that an object cannot be both 40g and 60g. Additionally, variables such as the hardness of a ceramic paste, or the weight of a stone tool can be recorded independently of context variability. Adams & Adams (1991:176), call these 'intrinsic' variables to distinguish them from 'contextual' variables, i.e. those that refer to the context within which an object is found, such as its physical position, its spatial relationship to other objects, and so on. Both intrinsic and contextual variables can be empirically observed and recorded, but should not necessarily be considered as 'objective'. Rather than using one all encompassing term to describe a group of superficially related objects a 'type' based on the combination of their 'intrinsic variables' may be more effective. These in turn can be compared and correlated to 'contextual variables', offering a mechanism for the identification of context-type patterning. This may serve as a starting point for the identification of contextual meaning and variability.

In all cases, the selection of variables needs to be done with consideration of the source and nature of the constituent attributes and the questions being asked of the data. For instance, on a stone tool, a commonly recorded variable is the delineation of the retouched edge. This is in part determined by the original shape of the blank, and in part by the action of retouching. Edge delineation, therefore, is a variable directly related to individual choice – both in the selection of a blank shape and the modification of its edges. A problem arises when we cannot know intuitively what variables are direct reflections, as opposed to indirect reflections, of individual choice. Take, for instance, the case of different types of flint, where variability reflects differences in the exploitation of geographic sources. Different types may have been selected for their physical qualities such a grain size or colour, or there may have been a different reason altogether – one perhaps related to economic factors such as fluctuations in raw material availability and distance to source. We cannot always know what the relevant variables are for the questions we want to answer. Consequently, there is necessarily an element of exploration, involving the search for patterning between variables, one goal being the identification of significant relationships between attributes, objects, and contexts.

However, identifying patterning may not always signify the end of exploratory analysis and the start of interpretation. There is an element of non-fixity in contextual approaches, reflected in the stated understanding that there can be a multiplicity of interpretations of the same data-set. This means that the process of interpretation may itself suggest alternatives. In essence, interpretation can only begin with an interpretation. This is the basis of hermeneutics, and in practice means that there should not be a separation between analysis and interpretation – each is dependent on the other.

The following sections of this chapter review the manner in which knapped stone technology has been analysed, with a particular focus on Anatolia and the Near East. With some exceptions, it will be shown that lithic analysts have recognised the need for interpretation that engages social issues but have not often managed to achieve this goal. Where appropriate I have suggested modified or alternative methods of analysis taking into account the objectives of a contextually aware approach to examining technological variability.

Approaches to the Analysis of Knapped-Stone Technology

Conventional approaches to the analysis of knapped-stone can be grouped into three elementary, yet ultimately interconnected, areas of study: typological analysis, functional analysis, and technological analysis. Typological analysis is concerned with the definition and interpretation of morphological 'types' of artefacts, be they stone tools, ceramic vessels, or bronze axes. Functional analysis involves the identification of the uses of tools, commonly utilising experimental techniques and microscopic study. Technological approaches concentrate on studying the manufacturing methods and techniques involved in the production of stone tools. Near Eastern examples of the application of these three methods are given. Ataman's (1989) study of the Can Hasan III knapped-stone is discussed in detail, as it is one of the most comprehensively studied knapped-stone assemblages in Anatolia. It is also the site most closely related to Çatalhöyük, both geographically and chronologically.

Typological approaches

The use of typology combined with the notion that artefact types could be used to identify 'ethnic' groups and their historical development has changed remarkably little since its inception at the origins of the academic discipline of archaeology when, in 1929, Gordon Childe argued that recurring collections or assemblages of artefacts could be taken as the material remains of a particular group of people

(Trigger 1989:172; Childe 1929:vi). As it applies to knapped-stone artefacts, the best known example is the series established by François Bordes (1950) for the Lower and Middle Palaeolithic of France, where sixty types of stone tools were defined on the basis of manufacturing techniques and morphological characteristics. According to Bordes, the presence or absence of tool types, or differences in the frequency of types between assemblages, were manifestations of cultural differences between ethnic groups. Despite several re-evaluations of Bordes' interpretation of the 'ethnicity' of variations in assemblage type composition, the basic assumption that there is explanatory value in the construction of morphologically defined types of artefacts has remained. For instance, the use of typologies as indicators of chronological and/or cultural affiliations is rarely disputed and is acknowledged as an invaluable analytical tool for this purpose. In Near Eastern prehistoric research there are numerous discussions of projectile-point typologies, sickle elements and, to a lesser extent, tool types such as scrapers and burins. In most cases, stone tools such as these are described by reference to a type-category which is defined by a combination of blank shape, working edge morphology and suspected function. These are used explicitly for the construction of regional culture-histories and the definition of ethnic or cultural histories (e.g. Kozlowski & Gebel 1994; Gopher 1989; Bar-Yosef 1981; Burian & Friedman 1979). Ataman's (1989) study of the knapped-stone from Can Hasan III effectively illustrates one form of typological approach, where a scheme was devised which best accounted for some of the idiosyncrasies of the assemblage. Several categories and sub-categories were constructed (table 2.1), evaluated and re-evaluated. This meant that some of the original types were reclassified; most notably some 'projectile-points' were eventually interpreted as the by-products of tool production (Ataman 1989:64). As is the convention, these were used to identify chronological changes by examining sequential variability in proportions of types, and changes to the kind of raw material used for their construction. In addition, comparisons with other lithic industries were made using the primary types, which suggested that more distant sites had fewer affinities to the Can Hasan III assemblage than closer sites (Ataman 1989:244).

The scheme established by Ataman serves as the most relevant model for the Çatalhöyük assemblage, as it is the most closely related assemblage that has been studied in any detail. It is also fairly similar to tool typological schemes used elsewhere in Central Anatolia, such as Hacilar (Mortensen 1970), Süberde (Bordaz 1965; 1966; 1968), and Asiklihöyük (Balkan-Atli 1991; 1994), in Southeastern Anatolia at Çayönü (Redman 1982), Gritille (Davis 1986), and several sites in the Northern Levant, including those examined by Nishiaki (1992). Indeed, the earlier analysis of small parts of the Çatalhöyük assemblage used a roughly similar classification, as described in Chapter I. However, as is the case with most stone tool typologies, a confusing mix of functional and morphological criteria were used to establish these categories. In general terms, there is often no explicit definition of what constitutes a particular type category – it could be primarily the delineation of the working edge, the blank shape, an equal combination of the two, or reference to a Bordean-like type series based on overall morphology. Even so, controversies emerge as to the applicability or, indeed, the existence, of certain types even with long established typologies. The rigidly defined Bordes' scheme can be cryptic: "In attempting to apply Bordes' typology... there are usually numerous examples of tools which seem to grade almost imperceptibly between 'single' and 'double' edged racloirs; between 'lateral' and 'transverse' racloirs; between 'convergent' or 'déjeté' racloirs and 'Mousterian points' and so on" (Mellars 1989:345). This is even more of a problem in Neolithic lithic research, as there are few established schemes that can deal with the entire range of tool forms encountered in a typical assemblage.

Yet typologies do offer a set of commonly understood terms for the sharing of information about the characteristics of any particular assemblage. It is useful to know about the presence of 'Byblos points' or 'Naviform cores', or 'sickle-blades' in a Near Eastern assemblage, so I am not dismissing the value of conventional typological approaches. There are, nevertheless, challenging problems to overcome. The most obvious of these is that tool type categories often imply a function as, for instance, the term 'projectile-point' does. Yet otherwise unmodified flakes or blades can be hafted as functional projectiles (Ataman 1988; Odell & Cowan 1986) and 'projectile points' can be hafted on a shorter handle and used effectively as a cutting or scraping tool (Ahler 1970). There is a further problem in that tools are made and used in social contexts, bestowing the implement with a social meaning beyond that of what it is used for in a narrow 'functional' sense. Without contextual information, traditional stone tool type-categories like 'projectile point' remain muted. There may be differences between projectile-like objects used and deposited in domestic contexts and non-domestic contexts (e.g. perhaps their manufacturing method); contextual variation that is suggestive of different social uses of one traditional category of object.

Despite my criticisms, I have made extensive use of typological analysis in this study, but in a manner that I hope is both self-aware and justifiably appropriate for the particular objectives of the analysis. Like Baird (1993:138), I have questioned whether the construction of 'types' is a useful or appropriate vehicle for exploring behaviour rather than particularising variation along key attributes. The answer is not straightforward. Typological classification in the conventional sense is certainly useful in some instances, particularly as a mechanism for defining differences between disparate groups of objects. In some cases I have defined and used types in this manner. In other cases, such classification can be argued to be less than appropriate. This is particularly so when examining ranges of variation within broadly similar types of object.

In situations like this, attribute analysis offers a viable alternative method to typologies and, in others, it is a valuable addition. In this manner retouched pieces are either defined by the attribute states of selected variables, or typological classes are formally described by their key attributes. The increasingly widespread acknowledgement of this approach as being better suited for describing those tools that have traditional fallen outside of the established Near Eastern typological schemes is demonstrated by the publication of the Wembach Module (Baird et al. 1995), where an analytical approach is forwarded for 'non-formal' tools (i.e. those tools which fall outside of traditional typological schemes).

I am aware of the dangers of seeing an attribute as a "fossil behavioural element", as this implies intentionality and intrinsic meaning (Clark 1978:154; Baird 1993:138). Meaning may at times be deduced (Baird 1993:139), but cannot necessarily be assumed. Cross-tabulation of attribute states, as well as external parameters, such as blank classes or temporal location may provide a means of deducing meaning and interpreting the source of patterning. This method was used for the examination of irregularly retouched pieces that have traditionally been classified under catchall categories because more refined typological classes are difficult to construct. My inclination is that this offers a stronger and, even if not more rigorous, at least a more systematised scheme than defining new 'sub-types' of irregularly retouched pieces. The specifics of the classification are outlined in Appendix 1, and the elements of function and debitage analysis that were incorporated into this scheme are referred to in the following two sections.

Functional approaches

The functional analysis of stone tools – a term given to a variety of approaches designed with the aim of identifying the use of a stone tool – has witnessed a tumultuous history of "high hopes and broken promises" (Donahue 1993:156). It is not, however, my intention to review the history of the development and subsequent criticisms of techniques: excellent synopses can be found in Levi-Sala (1996), Hurcombe (1992), Odell (1990), Jensen (1988), and Moss (1983). Rather, I wish to outline briefly the basic principals of functional analysis and the uses it is put to in Near Eastern and Anatolian knapped-stone research.

Modern analytical procedures rely to a large degree on the work of Semenov (1964) who outlined methods for the low-power microscopic (x10 to x20) analysis of edge wear. Later approaches have developed alternative low-power techniques (up to x40) (e.g. Grace 1989; Odell & Odell-Vereecken 1981), high-power (up to x400) (Keeley 1980), and SEM analysis of wear traces (Levi-Sala 1996; Unger-Hamilton 1988; Yamada 1986, Hurcombe 1985; Anderson-Gerfaud 1981). With all methods, the principle of identifying a tool's function is based on the argument that the uses to which tools were put in antiquity leave diagnostic damage and/or polish on their working edges (Keeley 1980:173). Although there are debates concerning the physics of both edge polishes and edge damage which draw on the science of tribology, modern microwear analysis usually depends on the comparisons of the edge wear of modern experimental parallels with archaeological and/or ethnographic equivalents (often referred to as 'blind-testing') (Donahue 1993:161). The overall purpose is to provide an accurate and precise analytical instrument for the identification of stone tool function. It is worth noting that the precision of functional identifications may range considerably, from 'scraping soft material' to 'scraping fresh hide for 10 minutes' with a corresponding drop in accuracy as precision increases (Donahue 1993:161). Yet, it has been seen by many functional analysts that the identification of a tool's function is not the final aim of inquiry, but a step in a process of interpreting human behaviour, and a means with which to contribute to wider debates in interpretative archaeology (Hurcombe 1994:145): "use-wear analyses should be programmed to respond to the questions that are currently being asked in socio-economy" and, furthermore, "the meaningfulness of use-wear analysis will only progress if it is allowed to play a role in the current polemics of the human sciences" (Millán 1990:40, 42). The volume *The Interpretative Possibilities Of Microwear Analysis* (Gräslund *et al.* 1990) addressed this issue, with contributions ranging from the identification of tools used for hide working in high-ranking households (Hayden 1990), to the use of microwear analysis for the investigation of domestic activities and craft-specialisation (Yerkes 1990). Hurcombe (1994) has also suggested that functional analysis can significantly contribute to issues concerning the relationship between form and function by critically examining traditional typological classifications within a functional context. In doing so, it can be seen that traditional typological classifications often mistakenly group tools of varying form with similar functions (or vice-versa), or fail to identify tools because there are no macroscopic identifiers suggesting function (as in the case of unretouched, yet utilised, flakes). An excellent example of this is the ubiquitous burin that occurs on so-called 'burin sites' in the dry steppe of eastern Jordan. Functional analysis of these tools by Finlayson (Finlayson & Betts 1990) established that they were actually cores for the production of spalls used for the manufacture of beads and not tools in their own right. The increasing wariness that many lithic analysts now have in assigning functional names on the basis of morphological criteria is also demonstrated by the now common avoidance of the term 'sickle-blade', and its replacement by terms like 'glossed-blade' (e.g. Anderson 1994).

In Anatolia, the contribution functional analysis has made to interpretative archaeology is slight. There have, on the other hand, been several valuable contributions to problems concerned with delineating the function of enigmatic tools, and other 'problem-specific' issues. At Çayönü, an enigmatic yet distinctive type of wear on some obsidian blades was identified by Anderson (1994) as derived from the shaping and polishing of softer stone materials, rather than from harvesting plants, as had previously been thought. Ataman (1988) has suggested that the wear pattern on the upsilon blades characteristic of the aceramic Neolithic site of Hayaz

Höyük in south-east Turkey could be accounted for by the blades being used as projectiles.

Ataman also performed a functional analysis on the Can Hasan III assemblage, although in this instance the results were somewhat disappointing. A fairly sophisticated experimental program was devised, involving the manufacture of twenty-five replica obsidian projectiles. Wear traces from these were compared to archaeological examples, of which only 18 of the 151 displayed similar wear. Nevertheless, Ataman (1989:199) remained convinced that "the wear traces on points in the Can Hasan III assemblage indicate that the pieces were used as projectiles but whether these projectiles were bows and arrows, spears or spear throwers is not so clear". More interesting results were obtained from examination of burins, where evidence of use on only 23 of 66 suggested that many of the 'technical' burins were not intentionally produced. Wear on the few notches was attributed to scraping medium-hard material such as soaked antler or wood or possibly smoothing arrow-shafts (Ataman 1989:201). Functional analysis of scrapers suggested that they were "probably used to scrape soft or medium-hard materials, such as fresh hide, dry hide, wood, or plant material" (Ataman 1989:202). Three separate uses were identified for the piercers: grooving, drilling, and boring. Retouched blades were used for cutting, with some evidence of hafting. One result which is particularly interesting and has wider significance is that the majority of the unretouched blades showed traces of use, again attributed to cutting. The characteristic pièces esquillées were determined to be effective for splitting wood or bone (Ataman 1989:210).

To its proponents, functional analysis has the greatest potential to contribute to a socially interpretative approach. What often holds it back, however, is its prohibitive methodology that restricts its routine application. This is an unfortunate, but unavoidable, consequence of the need for well-founded results. However, because of the stated relationship between accuracy and precision, it is possible to have imprecise, yet accurate descriptions of function; instead of endeavouring to ascertain the specific material or time of use of any given tool, a simple functional assessment based on its macroscopic morphological characteristics can be made. In this way, rather than 'scraping for 20 minutes on soft hide', the term 'scraping edge' could be used. The biggest problem with this, however, is that it can be extremely subjective, and thus may be a source of ambiguity which could increase the overall legitimacy of the analysis. Establishing a method which incorporates some of the approaches and results of functional analysis is one way in which this confusion could be reduced.

I have adopted a method of analysis for tools that incorporates some of the methods used by Grace (1989; 1992) in his 'expert-system' of functional analysis. Although this system is designed to combine macroscopic with microscopic inspection to produce a precise categorisation of working edge function, in practise it is the macroscopic proportion of the analysis which is the most informative. This is clearly shown in Grace's (1992) analysis of a Mesolithic assemblage in Britain, where distributions of broad tool functional categories, defined primarily by macroscopic examinations, were used to appraise variations in the use of space. The details of the method are outlined in Appendix 1.

Technological approaches

Technological analysis is concerned with the examination of the production of knapped-stone artefacts. Here, I wish to discuss the basic yet fundamental, non-dynamic approaches, particularly debitage-typologies and morpho-technological attribute analyses. These are but two of four common technological methods, the others being refitting and experimental reproduction (e.g. Nishiaki 1992:48). However, as the latter two are more concerned with defining actual methods and techniques of core reduction and tool manufacture, they are 'dynamic' in focus, and are associated with the study of the chaîne opératoire, which will be examined after the following discussion.

Debitage-typology and attribute analysis are invaluable methods for the study of knapped-stone technology. The two are often used in conjunction with each other and can be seen as related, yet they differ significantly in their approach. The former refers to the nominal classification of knapped-stone artefacts by one or several morpho-technological terms, such as 'core', 'blade' or 'flake', to provide both a technological 'index', such as the proportion of blades in a given assemblage, which can also be used for inter-assemblage comparisons. The latter is used in a similar manner – both to characterise and compare assemblages – although it is performed not by the construction of types, but by the recording of various morpho-technological attributes, such as 'butt-type' or 'length'. An important difference between the two is that attributes may cross-cut debitage types.

Any classification of debitage is typological, as it rests on the formulation of descriptive categories of debitage products, guided by technical consideration. Nevertheless, it relies on judgement, and is thus unavoidably interpretative and subjective. Many debitage classifications appear to be non-controversial, yet closer examination reveals a level of subjectivity that needs to be taken into account. I shall illustrate with three examples: the common distinctions drawn between tool and debitage, blade and bladelet and blades and flakes.

Often an initial step in debitage analysis is to separate out the tools from the other knapped-stone products. Tixier (1963:32) uses the term 'debitage' to refer to waste by-products of core reduction, which has, in turn been followed by several analysts in the Near East, such as Ataman (1990), Nishiaki (1992), and Baird (1993). 'Debitage analysis' thus becomes the study of non-tool debris. There is a difficulty with this approach, and I have not used this definition in this study, for any attempt to understand manufacturing methods and techniques and reduction sequences through technological analysis that does not fully consider retouched elements will be crucially flawed because important debitage products have been omitted. For instance, if most of the projectile points in an assemblage are made on blades, any calculation of blade proportions that didn't include the tools would be inaccurate – it is conceivable that the total number of unretouched blades may be nearly nil, which would clearly misrepresent the character of the assemblage.

A further problem emerges with the dichotomy between waste (debitage) and non-waste (tools) established solely on the presence or absence of retouch. Often analysts will use conservative guidelines for identifying retouch, as there is a danger of classifying blanks as tools on the basis of spurious edge damage, rather than intentional modification. Paradoxically, not identifying tools because of these conservative guidelines may have an adverse effect on the interpretative value of the analysis. Gero (1991) has effectively shown that by mistakenly classifying unmodified flakes as 'debitage', lithic analysts may under-represent women's activities. The ubiquitous non-retouched and use-modified flakes which dominates many assemblages is an extremely efficient cutting tool suitable for a wide range of domestic tasks – which are often traditionally linked to be women. The proportion of elaborately modified objects such as projectile points, conventionally associated with male activities, is therefore artificially inflated.

This problem cannot be solved by a more considered examination of the artefacts themselves – as noted, there is an acknowledged difficulty in distinguishing between post-depositional damage, wear caused by use, and simple intentional retouch. There are, of course, some strong clues as to what may have been unsuitable for use – size, for instance, is commonly used to distinguish waste 'chips' from other debitage (Newcomer & Karlin 1987). Otherwise, the presupposition of 'waste' based on the absence of obvious intentional retouch is a problem. Because there are no pan-cultural definitions of what constitutes rubbish, one solution lies in the use of context to define the difference. Associations between objects and the nature of the deposits within which they are found may, for instance, suggest that flakes under a particular size, or blades with pronounced curvature, or projectiles with impact fractures, are found in different contexts than larger flakes, straight blades, and so on. If the former contexts also contain things like ash, broken bones, organic debris, then a stronger case – as well as a more accurate one – can be forwarded for the definition of lithic waste than one which relies solely on the characteristics of the objects themselves.

Another issue of traditional debitage typology concerns blades and bladelets, which are commonly differentiated by an arbitrarily decided size limit. But if these terms are to have any significance, they must be based on a real technical, or even social practice – not an arbitrary metric division. This was the basis of Tixier's advice not to use his specific metric criteria (i.e. bladelets are blades with a width of less than 12mm, and a length of less than 50mm, which was devised solely for the Epipalaeolithic-Palaeolithic of the Maghreb), without first taking into account the technological context of the assemblage to which it is being applied (Tixier et al. 1980:90; Tixier 1974:7; Inizan et al. 1992:59). If blades are to be divided into small and large categories, the division should reflect a technical difference (such as different reduction stages and/or intended products), functional differences (such as large blades made for hafting as segments for sickles, small blades for microliths for composite tools), or social differences (large blades as women's tools, small blades as men's tools). In Near Eastern research Nishiaki (1992:79-81) argues that establishing criteria for distinguishing between large and small blades has been a recurrent problem, with some analysts using Tixier's criteria and others devising their own. His own approach, with which I concur, is that:

> ...distinguishing blades from bladelets will be justified only when two independent technologies for producing blades and bladelets, or two distinct selective processes of blanks for larger and smaller tools did exist in the assemblage (Nishiaki 1992:81).

The best mechanism for investigating this is metric analysis of blade attributes, principally length and width, although examination of core distributions may also be suggestive of separate blade technologies.

While the blade/bladelet division is an obvious example, 'blade' and 'flake' can also be questioned. Experimental core reduction has demonstrated that blade debitage requires considerable pre-planning and is a structured process that enables the mass production of blades from a single core, and thus may well have social, political and economic repercussions (e.g. Clark 1987). Although non-blade debitage may also require sophisticated planning (such as Levallois flakes), overall blades represent a significantly different kind of production.

Convention dictates that any flake that has a 2:1 length to width ratio is called a blade (Inizan et al. 1992:58). An immediate difficulty with this is that debitage which is not derived from the structured debitage implied by the term blade can, occasionally, be more than twice as long as wide, thus weakening the interpretative value of the classification. This often gives rise to debitage classes such as 'blade-flake'. Similarly, broken blades are significantly shorter than their original length and may be mistakenly, or intentionally (e.g. Baird 1993), classified as flakes. Just as importantly, the 2:1 ratio does not permit further distinctions; blades 3 or 4 times as long as they are wide are classed with less elongated debitage, despite the fact they may come from completely separate productive methods. Arbitrary size divisions can never be a meaningful means of characterisation. To avoid such problems, a method of analysis based on morphological attributes that reflect technical and productive differences between types of debitage offers a better approach.

Attribute analysis requires fewer interpretative presuppositions. Lithic artefacts are characterised, for example, by the width of flakes, frequency of different types of butts, or range of lateral edge shapes, and so on. This approach seems to be less subjective, as it involves the empirical observation and recording of attributes, rather than the construction of types based on presuppositions of method and techniques. Instead of potentially problematic terms such as 'bladelet', a combination of length, width, scar pattern, edge shape, and profile are used in order to describe debitage. Even so, not every potentially significant variable can be recorded, and some attributes are given priority over others. This is a potential source of error that cannot be resolved, except through the re-evaluation of variables.

There have been very few technological studies of Anatolian knapped-stone assemblages. This is almost entirely due to the lack, until recently, of well-excavated sites with comprehensively collected lithic assemblages. These are almost all from Southeastern Anatolian sites, where there is a closer affinity to the Levant which has a stronger tradition for this kind of analysis. For instance, Hayaz Höyük (Roodenburg 1989) and Gritille (Davis 1988) are two examples of Southeastern Neolithic sites where lithic production has been examined in some detail – beyond simple descriptions of core and debitage types. No attempt has been made to define production at any Anatolian context in the same detail as at some of the northern Levantine sites (such as Abu Hureyra) (in Nishiaki 1992), or the sites in the Azraq Basin in Jordan (Baird 1994). In Central Anatolia, Can Hasan III is the only site where production has been thoroughly examined (Ataman 1989). Attempts were made to establish large-scale organisational strategies, such as in what form the obsidian raw-material was imported, and – with the aid of experimental production and blind-testing – what flaking techniques were used to reduce the Can Hasan III cores.

I have attempted to establish the technical characteristics of the Çatalhöyük assemblage by using a combination of debitage typology and attribute analysis. I have kept in mind that the technical origin of debitage cannot necessarily be ascertained from individual pieces, so technical inferences were not made at the artefact level but at the assemblage level by using typologies based on attribute correlations (Sullivan & Rozen 1985:755). Attributes were selected by a process of trial and error, together with adoption of several attributes used in technological analyses of Neolithic assemblages conducted by Nishiaki (1992) and Baird (1993). The specific criteria and attributes used are outlined in Appendix 1.

The chaîne opératoire

The application of the chaîne opératoire to lithic analysis has had a long history. Originating from the writings of Leroi-Gourhan (1943; 1964-65), the term here describes a process that begins with the acquisition of raw material, through manufacture and use, to the eventual discard of tools (Inizan et al. 1992:12; Pelegrin 1990). This is fundamentally different from the 'static' typological, functional or technological approaches described above: the chaîne opératoire, by definition, is 'dynamic' insofar as it places knapped-stone artefacts within a defined sequence of technical actions. This is the single most significant methodological and interpretative contribution that has recently been made to knapped-stone analysis in the Near East (Bar-Yosef 1994:6).

The chaîne opératoire consists of three elements; the knapped-stone objects themselves, the behavioural sequences that produced the objects, and the specific knowledge possessed by the knapper enabling the production of the objects (Pelegrin et al. 1988:57-58). A higher level of analysis over that offered by static debitage typologies and attribute analysis is therefore made possible: that of the manufacturing process itself, and the choices and decisions of specific technical actions taken in the reductive process of knapping stone by individuals (Edmonds 1990:57; Pigeot 1990:127-128). Two separate research areas consequently emerge: the study of the physical and technical process of manufacture, and the study of cultural technology (c.f. Schlanger 1994:145). The first is concerned with defining and reconstructing the sequences of core reduction and tool manufacture (aided by experimental exercises such as refitting and replication), whereas the second is concerned with the wider social context of choices involved in technical action.

In practical terms, tools and debitage still need to be described and categorised in some manner. Less attention is paid to the formulation of technological 'indexes' as seen in debitage-typology and attribute analysis, more on the identification of the choices and decisions made by knappers in their individual approaches to core reduction and tool manufacture. This provides the basic 'data' with which patterning within a larger spatial and relational context can be sought. In this manner, the interpretative potential is enormously increased and it is possible to examine the reasons why people reduced their cores and made and their tools in the manner they did.

There are fewer obvious concerns with this approach because of the rigorous methods required. Nevertheless, a few comments may be made concerning the distinctions between description and interpretation. A similar differentiation is made by Edmonds (1990:58), where he argues that description – even that afforded by the chaîne opératoire – "does not in itself provide us with a sufficient basis for understanding the broader social contexts in which particular procedures were implemented" for "however detailed our descriptions may be, they contribute little to our understanding of how societies were reproduced under particular material conditions...". To illustrate, Wilke & Quintero (1994) undertook a meticulous analysis of prehistoric Naviform cores and their associated debitage that, combined with experimental reconstruction, permitted the reconstruction of a detailed chaîne opératoire. Undoubtedly this is valuable information and useful for understanding PPNB approaches to knapped-stone production. In itself, however, it does not tell us anything about why Naviform technology was used in preference to others, or what effects this particular approach to reduction had on other aspects of material culture and social life. This is in contrast to Pigeot's

(1990) examination of flint-knapping at Magdalenian Etiolles. Here, spatial patterning observed within the context of several reconstructed chaînes opératoires suggested the work of both specialist knappers and apprentices. The refitting of cores was also used to identify individual approaches to core reduction which provided far more socially-meaningful information than would have been offered by a detailed description of reduction techniques.

I attempted to use the concept of the chaîne opératoire in my analysis, but because of the absence of in situ knapping deposits necessary for detailed reconstruction, I have been limited to general inferences about the dynamic process of the knapped-stone at Çatalhöyük. In this respect, Nishiaki (1992:78-88) offers a useful guide, as he established a general sequence for local flint on Northern Levantine PPNB sites progressing from raw material procurement, initial test flaking and core preparation, to core reduction, maintenance and finally, abandonment. A general set of strategies to knapping has been proposed for the Çatalhöyük assemblage, with additional details concerning the specific means of, for example, core reduction and maintenance. This is described in further detail in Chapter III.

Summary

As this review has shown, the study of Near Eastern prehistoric lithic technology has principally concentrated on physical products, particularly raw-material composition, the mechanical process of manufacture, and morphological variability. Considerably less attention has been placed on the 'social actors' and the social context which gave meaning to technological actions and products, although elsewhere this is increasingly being seen as a focus of analysis (e.g. Dobres 1995, Edmonds 1995, Lemmonier 1993, Gero 1991, Pigeot 1990). In part this may be attributed to an increased awareness of the potential of material culture for the study of social agency, brought about largely by developments in post-processual thought since the mid-1980's.

I have attempted to outline the basic principals of a contextual and socially interpretative archaeology and how these might be applied to lithic analysis. I have also reviewed the basis of the main canons of knapped-stone analysis in light of these principals. In this regard it can be seen that in many cases, the social interpretation of lithic data is high on the agenda, although I feel the potential has not been fully realised in Near Eastern archaeology. Certainly lithic analysis has contributed an unprecedented amount to the understanding of prehistoric cultures in the Near East, arguably more than any other form of material culture. But there appears to be a resistance to using this data to interpret questions concerning social practice. Although this may involve relying on data beyond the traditional sphere of influence of lithic analysts, some would argue that without such interpretations lithic analysis becomes nothing more than a sophisticated form of stamp-collecting: "the link between social practice and material conditions is not an option: it is the intellectual demand of archaeology" (Schofield 1996:6, quoting Barrett 1994:33, original emphasis).

III
DEFINING A TECHNOLOGY

Sample Composition

The knapped-stone artefacts analysed and examined in this monograph are derived from four separate research projects: (i) the 1961-65 excavations; (ii) the 1993-94 surface collection; (iii) the 1993-95 'top-scraping' program; (iv) excavations conducted in 1995 and 1996. The first sample, henceforth referred to as Sample A, is currently stored in the Konya Archaeological Museum and was examined in the summers of 1994 and 1995. The other three, Samples B through D respectively, were examined during the field seasons of years 1993, 1994, 1995, and 1996. The combined total is over 15,000 pieces, providing a solid base from which a detailed reconstruction of the Çatalhöyük knapped-stone industry, as well as its temporal, spatial and contextual relationships, can be achieved. The following paragraphs outline the retrieval process and context of the four samples. Figure 3.1 shows the physical location of these four areas.

1961-65 excavations: Sample A

As discussed in Chapter I, James Mellaart excavated at Çatalhöyük for four years between 1961 and 1965 following the completion of his work at Hacılar. The objective was to discover as much as possible about the overall settlement, with a particular focus on the so-called 'shrines' first uncovered in the 1961 campaign, and the wall paintings for which Çatalhöyük became justifiably famous. Architectural remains were therefore emphasised and, typically for the period, dry-sieves were not used. An impressive array of material culture was collected during these first four years of excavation at Çatalhöyük, including a large sample of knapped-stone tools and unretouched debitage.

The vast majority (upwards of 95%) of the material is stored at the Konya Archaeological Museum. The artefacts are marked with their recovery location, giving association with a level or a specific structure and, if applicable, with information as to whether it was found, for instance, in a burial, on a floor, or within fill. In total almost 5,000 pieces were recorded from the Konya Museum in the summers of 1994 and 1995. This represents approximately 90% of the material stored in the museum – the remaining 10% were derived from indeterminable contexts often unlabelled, or labelled as 'levelling fill', which while ultimately useful, did not immediately contribute to the objectives of this particular analysis. As there were restrictions placed on the amount of time available to examine the material, a choice was made at the beginning of the analysis to concentrate on those samples that would provide the more valuable information.

1993-94 surface collection: Sample B

One aim of the renewed Çatalhöyük research that started in 1993 was to discover, in as much detail as possible, the variability of artefact distribution over the surface of the mound, both as an aid to future excavation, and as a valuable source of information in its own right. Considering the dense surface vegetation, a stratified surface collection was the only viable option. This involved placing a 2 by 2 m square every 20 m over the surface of the höyük, followed by the removal of surface vegetation and the sifting of a uniform 36l of topsoil through 5mm mesh.

1993-95 surface clearance: Sample C

The surface clearance entailed the removal of top-soil and a clean scraping of the surface until the architectural features of the buildings of the uppermost layer of the mound were revealed. This allowed the assessment of the character of the structures immediately sub-surface, and facilitated the decision of where would be most profitable to excavate in 1995. Soil from this exercise was not sifted, although all visible artefacts were collected, forming Sample C.

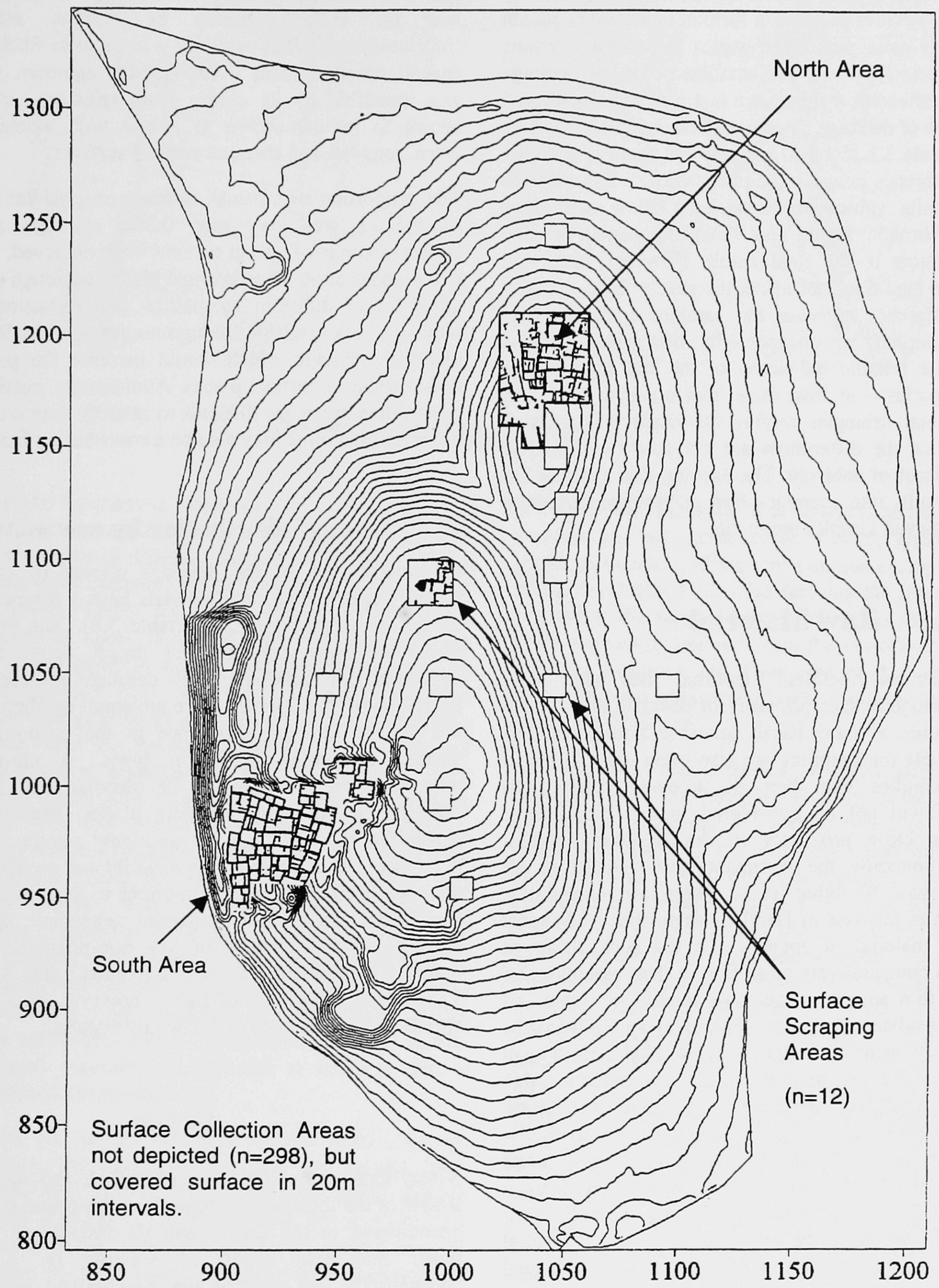
1995-96 excavations: Sample D

Two areas formed the focus of excavations in the years 1995 and 1996, together composing Sample D. The first, referred to as the 'North' excavation area consists of a single building composed of several rooms (or 'spaces' in the parlance of the excavation program) and its external areas. The second, referred to as the 'South' excavation area initially involved the removal of 1960's backfill, then the excavation of several small buildings, spaces and compacted building fill, rubbish deposits and foundation fill. In both areas, all soil was either sieved through 4mm mesh or floated for botanical remains, with the heavy residues sieved through 4mm, 2mm and 1mm mesh. Only >4mm material was used in the analysis.

Differences between sieved and unsieved samples

As is to be expected, there are differences between those samples collected by sieving (B and D), and those collected by visual pick-up (A and C): sieving, even with 5mm mesh, produces significantly larger amounts of smaller debitage.

Figure 3.1 Çatalhöyük East, and the Location of Research Areas



The comparison of the two surface samples provides a reliable indication of the differences encountered in the collection of the pieces under 1 cm^2 (table 3.1). Roughly twice as many sub-1cm^2 pieces were recovered in sieved samples. On sites with a microlithic component this would be a major loss and would drastically bias the assemblage composition. However, at Çatalhöyük, the majority of sub-1cm^2 pieces are typically undiagnostic broken pieces, conventionally termed 'chips'.

If sieving routinely produces a higher proportion of undiagnostic debitage such as chips, then this will have little bearing on certain interpretations provided it is recognised that chips are going to be significantly under-represented in unsieved samples. What is more important is not so much the level of recovery of the unsieved samples, but the consistency between them – a sieve provides a form of control that cannot be mimicked by visual pick-up strategies. In order to examine whether it is primarily only the smallest pieces of debitage that are being affected, a chi-square test was performed on a condensed tally of debitage categories from samples B and C. The results (table 3.2 and 3.3) suggest that there is a highly significant difference between the two ($p<0.01$). Examination of the composite values of the statistic show that chips (followed by broken flakes and flake fragments) are the major contributors to the final result. However, removing chips from the data does not affect the result: there is still a significant difference between the samples ($p<0.01$). The result of this implies, not unexpectedly, that sieved samples provide a more reliable indication of the full spectrum of debitage categories – at least those that are over the mesh size used – than strategies relying on visual pick-up and, furthermore, that the differences are not solely confined to the smallest pieces of debitage. The ensuing data analysis has taken these results into account when comparisons between sieved and unsieved samples are made.

Raw Material

All known Central Anatolian Neolithic sites have lithic assemblages which consist primarily of obsidian and flint in varying quantities. Volcanic basalt, quartz and other siliceous materials suitable for knapping are also often present, but in such low quantities that they are termed 'exotic' raw materials and will not be considered in any detail here. Owing to the close proximity to the obsidian sources, obsidian is commonly the dominant raw material at all Central Anatolian Neolithic sites. There are exceptions, however, such as the case of Hacılar, where flint is the most common raw material; it appears that the sites closer to Beysehir have comparatively more flint in their assemblages, both because flint appears to be more readily available and because the obsidian sources are further away (Balkan-Atlı 1994:37). In all samples a dark-grey to black translucent obsidian formed the vast majority of the raw material (table 3.4). In the analysed assemblage, obsidian constitutes approximately 96%, flint slightly less than 4%, with the remainder made up of very small amounts of knapped quartz and basalt. Weights of knapped stone were taken from a sample of the Sample D material, allowing proportions of raw material by weight to be calculated (table 3.5). In total almost five and a half kilograms of material were collected and recorded from the 1995/96 excavation, and by weight the vast majority, some 93%, was obsidian. Flint, contributing just over 4% by weight, was further classified according to whether it was local cobble-flint or non-local tabular flint, based on its colour, shape of weathered surfaces and overall quality. Non-local tabular flint, typically a honey-yellow to pale-brown, extremely fine grained and translucent material was the most common by weight, although the 'indeterminable' flint category – in practise likely to contain several tabular pieces – has greater numbers. Cobble-flint was identified by its coarse grain structure, grey to light-brown to reddish-brown in colour and, where extant, its worn, rounded and abraded cortical surfaces.

The proportion of cortical surfaces on obsidian in the total assemblage was very low, 0.5%, although substantially higher amounts of cortex on flint were observed, 13.1%. The low number of obsidian cortical pieces, although undoubtedly an effect of different acquisition and reduction strategies, may also be a result of the high numbers of smaller pieces of obsidian debitage which would increase the proportion of non-cortical to cortical pieces. Additionally, cortical surfaces of obsidian are more difficult to identify than on flint, so an observational error may also be a contributing factor.

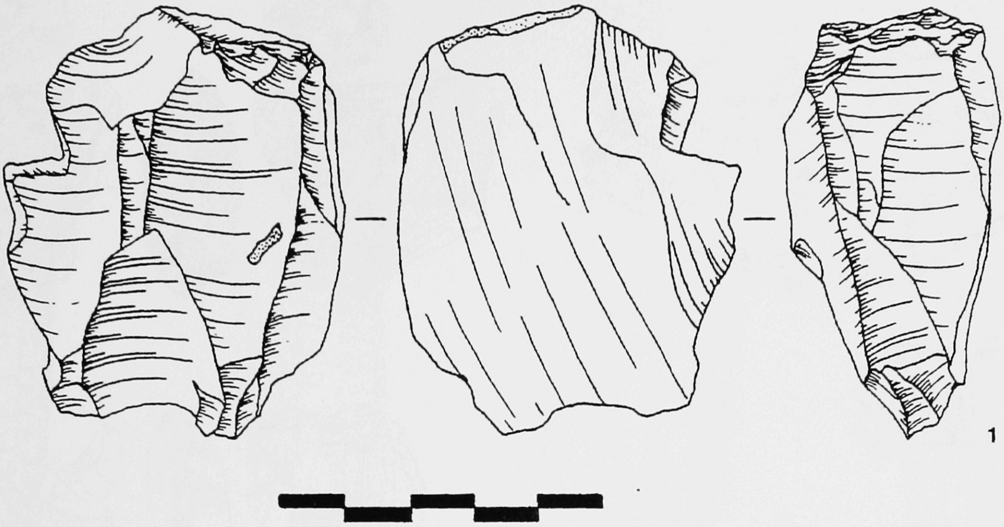
Debitage distribution by raw material

The distribution of the debitage classes by raw material clearly suggests that raw materials have a determining effect on the manner of reduction (table 3.6). The proportion of flakes in each raw material group forms the highest individual contribution of any debitage category (with the exception of basalt where there are equal numbers of shatter), but there is a clear difference in the proportions of the various categories of blade types. A chi-square test performed on the numbers of obsidian and flint flakes, prismatic blades, non-prismatic blades, shatter and chips shows that these differences are highly significant and there is an association between raw material and particular types of debitage ($p<0.01$). The contributions to the statistics indicate that blades are the most material dependent: there are far *more* observed examples of flint non-prismatic blades and obsidian prismatic blades than expected (table 3.7 and 3.8). The overall proportion of flakes, however, does not show a significant relationship to either raw material.

Cores

Ninety-four cores have been identified, and these compose 0.66% of the total assemblage. This proportion is higher than encountered in the Can Hasan III assemblage (c. 0.14%), lower than that found at Suberde (c. 1.87%), and considerably less than in the Aşıklıhöyük assemblage (c. 2.5%). However, at the latter site, given that it is so close to the raw material sources, one would intuitively expect greater numbers. Indeed, the analyst noted the abundance of cores found there (Balkan-Atlı 1991:146).

Figure 3.2 Opposed Platform Flake Core on Former Blade Core (obsidian)



Just over 6% of the cores are made of flint. In general terms, the morphological variation of the Çatalhöyük cores shows that there were several different approaches to the reduction of stone that were partially, but not exclusively, determined by raw material. Tables 3.9 to 3.12 summarise the basic characteristics of cores in the assemblage, including the influence of raw material and illustrations of cores can be found throughout this chapter. Several important observations emerge from these figures. The first is that, as a group, blade cores are the most frequent type encountered with single-platform prismatic cores being the single most common type (figure 3.5). These are almost exclusively made on obsidian, with only two flint examples. Their platforms, where preserved, are typically faceted with angles between the platform and flaking face at, or approaching, 90 degrees and, where present, there is considerable evidence of platform edge preparation in the form of grinding or faceting. Their size is highly variable, with complete examples ranging between 44mm and 120mm in length, with a mean of 63mm and a (predictably) high standard deviation (table 3.12). These very specialised cores, characteristically conical and 'bullet' shaped, represent an approach to debitage that is highly structured and pre-planned.

At the other end of the spectrum are the multi-platform, multi-sequence flake cores. These are the second most common individual types of cores in the assemblage, and are neither highly structured nor pre-planned, but represent the culmination of ad-hoc reduction techniques geared towards the production of flakes with a minimum of preparation. As with the blade cores, they are also produced most commonly on obsidian. Three of the six flint cores are of this type, and the two quartz and one basalt cores, all of which are inferior materials in comparison to the very fine grained obsidian and less amenable to intricate debitage techniques. These cores do not have prepared removal platforms, but simply exploit the surfaces created by previous flake removals. For the most part they are small and highly fragmented. Nevertheless, they still fall in the size range of the blade cores: the majority have a maximum dimension under 40mm, although the mean length of 48mm is inflated by a unique example with a length of 112mm (table 3.12). The fact that the sizes of these cores are within the range of the blade cores suggests that flake cores are simply derived from the reworking of the former. There is, however, one flake core of this type (above) that bears the scars of previous blade removals, so the possibility cannot be dismissed.

Between these two extremes of highly structured blade to expedient flake into which the majority of the cores fall, there are smaller quantities of different forms of both flake and blade cores. The majority of these are also found on obsidian. Flake cores are found in single platform, opposed platform and discoidal varieties (figure 3.3). These possess a range of platform types, from flat to faceted, and are typically small, with mean maximum dimensions under 40mm. As a group they do show some evidence of a loosely planned and structured debitage. Yet their variability leads one to the conclusion, particularly when viewed together with the more amorphous flake cores, that an inseparable range of approaches to flake debitage are in operation which exploit whatever the morphological qualities of the material happen to be. In other words, the few opposed-platform flake cores are not opposed platform because of a 'mental template' followed by the knapper, but because the physical qualities of that particular stone meant that opposed-platform debitage was the most economic way to obtain flakes of a particular size. The one possible exception to this concerns cores classified as pièce esquillée-like. These stand out, insofar as the nature of their platforms and scarring suggest an 'anvil' removal technique which may be a functional approach to obtaining small blanks from a core that is otherwise too small to be knapped by other (direct) percussive methods. As a class of cores they are fairly small and, although the bipolar removal scars are of a potential tool blank size (generally greater than 10mm), their use as tools in themselves cannot

Figure 3.3 Multi-Platform / Sequence Flake Cores (obsidian)

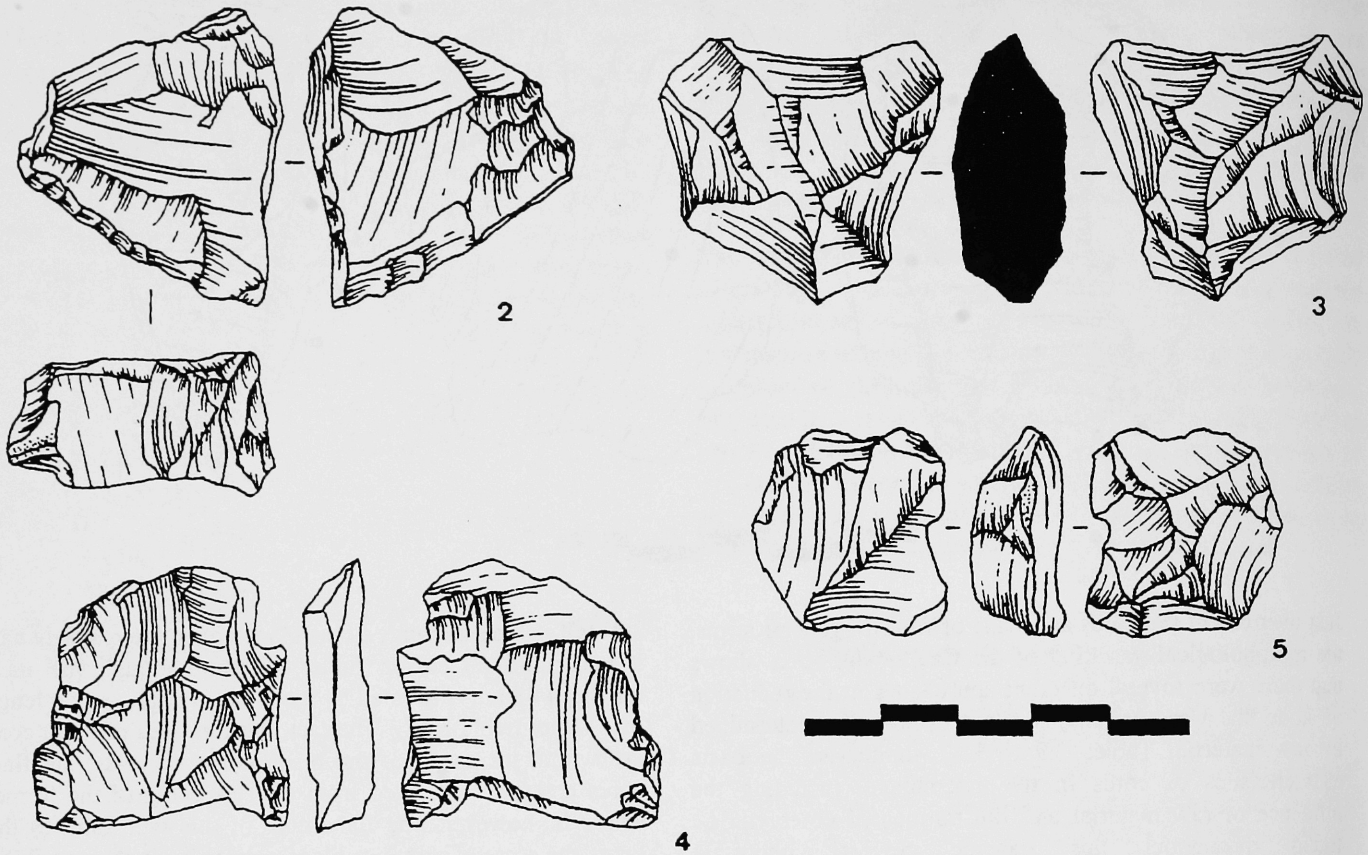
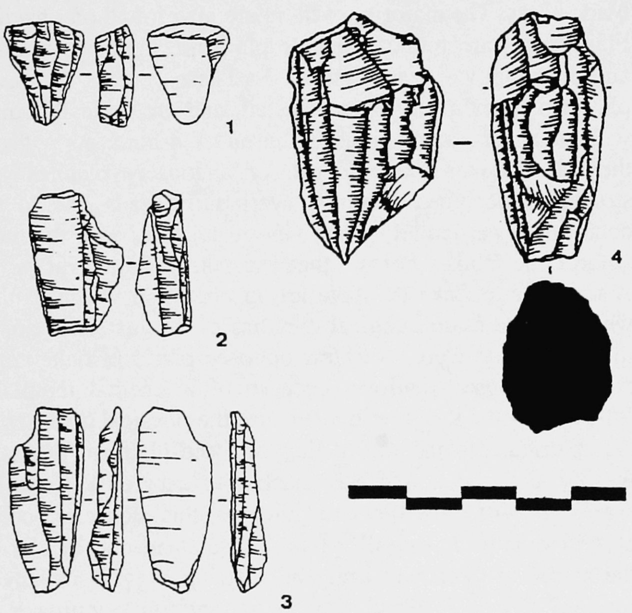


Figure 3.4 Blade Core Fragments (obsidian) (2 & 3 Prismatic?, 1 & 4 Single Platform Non-Prismatic)



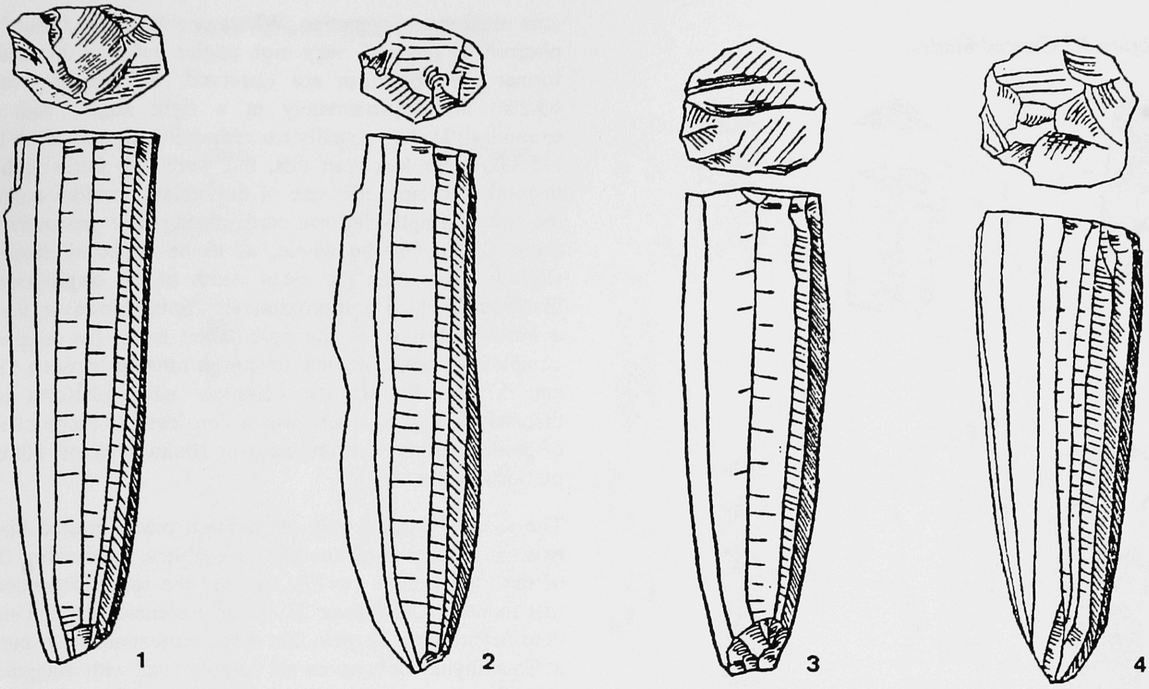
be discounted. (Note that this group does not include the numerous smaller examples which – as will be clarified in Chapter IV – are interpreted as tools rather than cores).

The non-prismatic blade cores are far more irregular than the prismatic variety, and are similar only in their shared display of elongated blank removals . This group includes a small fragment of an opposed platform core that is akin to the Can Hasan III cores, together with five single-platform blade cores (two of which are fragments) that range in length from 19mm to 100mm. Of the three extant platforms of the latter one is flat, the other two faceted. Two of these cores have platform angles that are very steep – approaching 90 degrees – although the smallest example has an acute angle of approximately 45 degrees.

24% of the cores display some evidence of retouch or use-modification. Table 3.13 outlines the occurrence of this by core type, where it can be seen that the single-platform prismatic blade cores show the highest incidence. The majority of the modification consists of edge crushing, which is consistent with the cores having being used as chisels or wedges, or, given the bullet shape of the core, possibly in a manner equivalent to a pestle. Uses such as these may be the significant contributing factor to the fragmentary nature of many of the cores.

From the range of cores identified in these samples, three basic strategies to core reduction can be proposed for the Çatalhöyük knapped-stone: (i) obsidian prismatic blade production from the single-platform prismatic blade cores; (ii) flint and obsidian non-prismatic blade production on the non-prismatic blade cores; (iii) flint and obsidian flake

Figure 3.5 Prismatic Blade Cores (from Bialor 1962)



production on a range of different flake core types. There is a possibility of a fourth strategy of small blank production from opposed platform 'anvil' or 'pièce-esquillée' cores on obsidian and flint, but this will be discussed in Chapter IV. Clearly the first is the most structured and standardised. Examination of the platforms of these cores and their edge preparation, edge angles, shape and the regularity of their removals is very suggestive of pressure debitage techniques (examined in further detail with blade analysis, to follow). The second method, while structured and pre-planned does not appear to be as regular and standardised as the former method, and was possibly executed by indirect percussion although direct soft-stone percussion cannot be discounted. This group includes a fragment of an opposed-platform blade core. This, in a manner similar to the opposed-platform flake core, is likely to be a response to the particular qualities of the original raw material and is, therefore, an expedient rather than a structured opposed-platform method (and quite unlike Aşıklıhöyük Naviform-type cores). However, this is not to deny the fact that certain skills are required to execute such processes. This is not necessarily the case with the final example, which is the most unstructured. Efficient and simple, these cores initially exploit, but ultimately are restricted by the size and shape of their original raw materials.

Core preparation pieces

Two classes of object were identified that are associated with the initial shaping and later maintenance of cores: (i) crested blades and (ii) core platform rejuvenation flakes (figure 3.6, 3.7). Both classes are easily distinguished in the assemblage,

Figure 3.6 Core Platform Rejuvenation Flakes

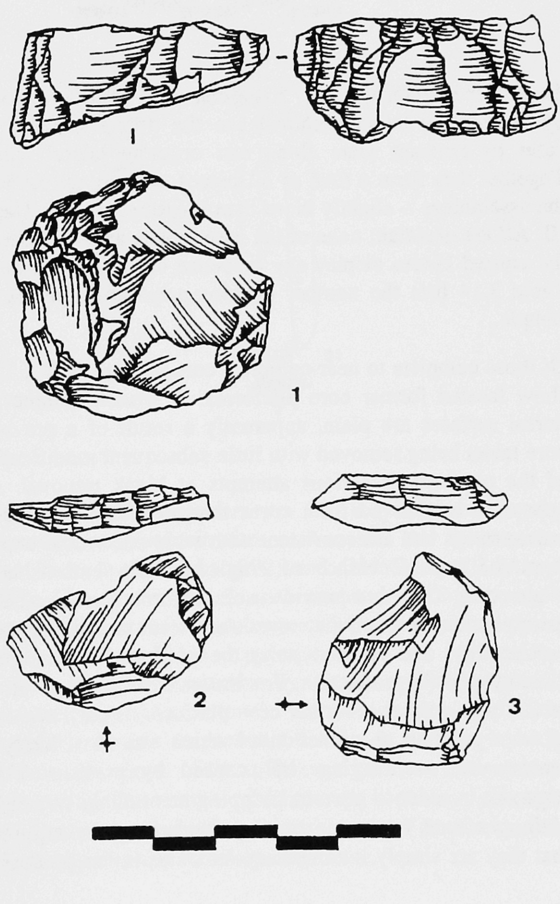
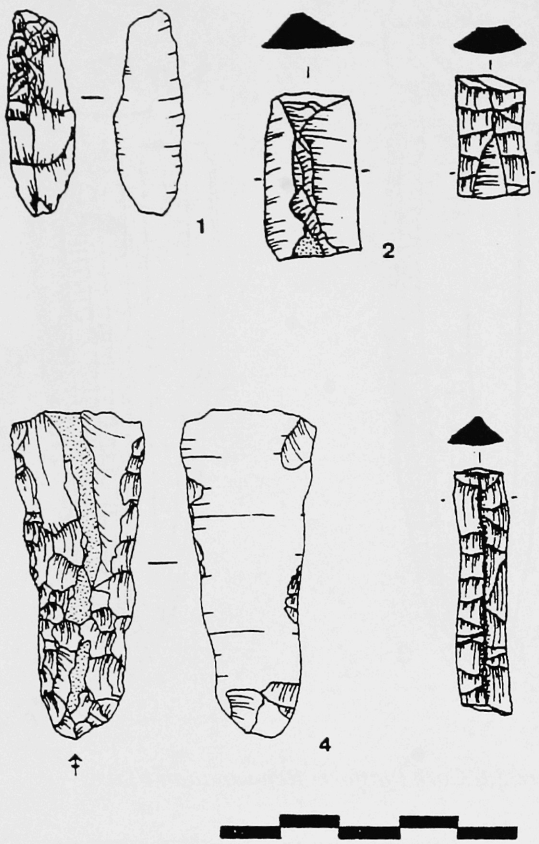


Figure 3.7 Crested Blades



the former by their typically triangular cross-sections created by intersecting lateral removals on the dorsal surface, the latter by remnant scars along one or more lateral edges. Together they form a total of 52 pieces, making up 0.4% of the assemblage – slightly more than identified at Can Hasan III. All are obsidian; none of the core tablets and only one of the crested blades display any evidence of cortical surfaces. Table 3.14 lists the number of core preparation pieces by sample.

Of those complete to near-complete core tablets (n=16), 75% show faceted former core platforms. A smaller number of dorsal surfaces are plain, apparently a result of a previous core tablet being removed with little subsequent modification of the platform or serious attempts at blank removal. All appear to be derived from cores that are oval to round in cross-section and are consistent with what one would expect from the high incidence of single-platform bullet-shaped blade cores. They thus provide useful information concerning the type of preparation that cores underwent to maintain their productivity, and at what point the platform became non-viable for blade production. For instance, all but one of the tablets with a faceted former core platform display evidence of edge grinding, the function of which was most likely to remove the overhanging 'lip' caused by previous blade removals in order to prevent knapping error. Only two of the plain platforms have this trait, strengthening the argument that they are simply intermediary removals in the process of core platform rejuvenation. Where enough of the former core platform is retained, very high angles between this and the former core platform are observed: the majority (n=12, 63.2%) are approximately at a right angle, with four examples (21.1%) actually exceeding 90 degrees. Only three (15.8%) were less than this, but were still fairly high (70 degrees or more). The size of the tablets provides a clue to the size of single-platform cores during their productive life (table 3.15). On the whole, as to be expected, these are slightly larger than the mean width of the single-platform blade cores which is approximately 25mm. However, there is a lot of variation in the core tablet sizes, the lengths of complete to near-complete examples ranging between 11mm and 57mm. So, as the complete single-platform cores themselves suggest, there was a considerable range of sizes of productive cores, from just over 10mm to almost 60mm in platform breadth.

The second type of core preparation piece, crested blades, exists in smaller numbers than core tablets, representing 0.1% of the total sample (n=17), roughly the same proportion as that found at Can Hasan III. Their presence, although small, does nevertheless suggest that core preparation was occurring at Çatalhöyük. Only seven are complete, all with triangular to sub-triangular cross-sections and straight to slightly concave ventral profiles. These range from 29mm to 170mm in length and 9mm to 16mm in width: once again a fairly high degree of variability, as seen in the cores and core tablets. Their typical lateral flaking ranges from a complete covering of the dorsal face, with a straight central ridge, to less complete flaking that exploits what appears to be a natural central ridge. I was able to ascribe only four of these crested blades to prismatic blade core preparation; their length and regularity are suggestive of a high degree of preparation and standardisation. The remainder of the examples, while possibly coming from prismatic blade cores, could only be attributed to general blade core preparation.

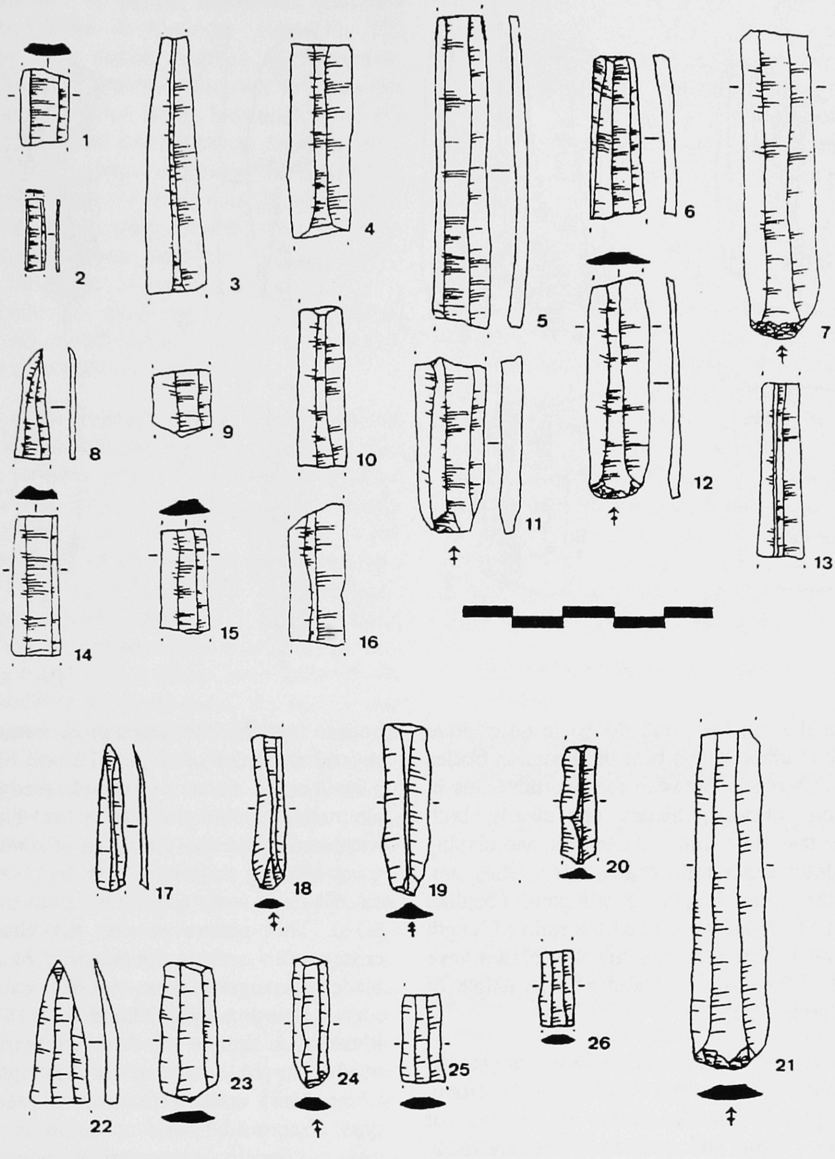
Debitage Products

As outlined in the previous chapter, several classes of debitage have been defined on techno-morphological criteria. In this section the characteristics of the major classes will be examined, and several proposals made concerning the debitage techniques practised at Çatalhöyük.

Blades

Blades make up 28% of the total assemblage, although the proportion varies from a high of 44% for Sample C, to a low of about 9% of Sample D. These differences do not appear to be associated with the different recovery methods used as both Sample D (9%) and Sample B (35%) were sieved. The most likely reason for this variability appears to be that different proportions of blades observed on different areas of

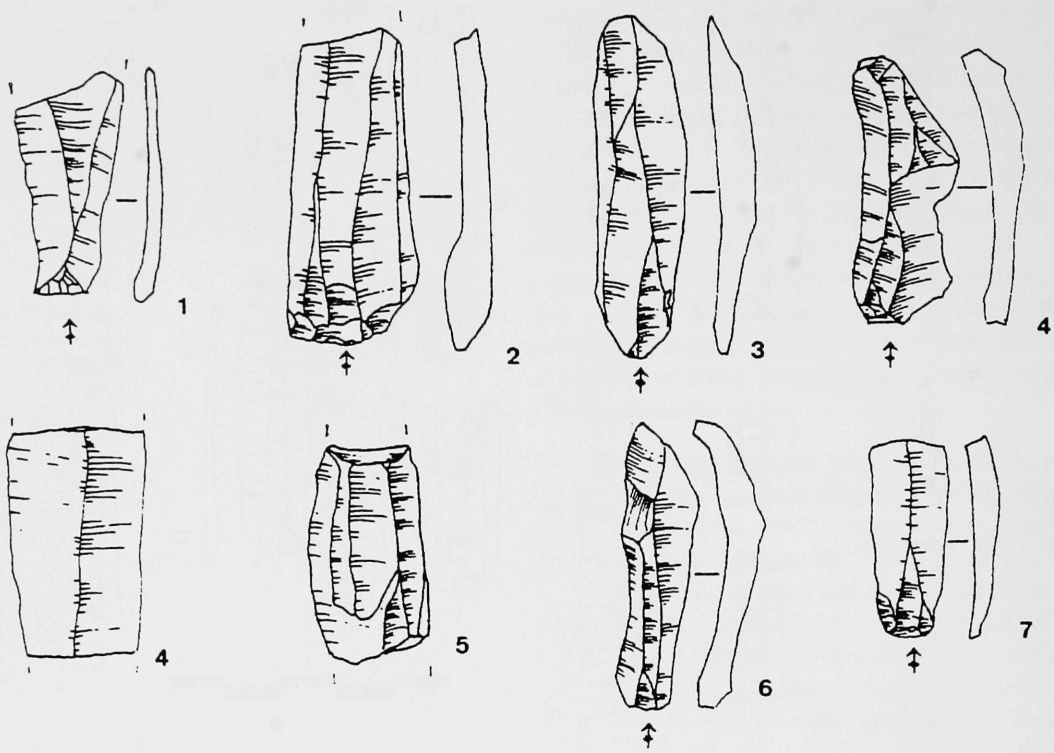
Figure 3.8 Obsidian Prismatic Blade Fragments



the mound relate directly to spatial patterns in the uppermost surface phases of Neolithic occupation. This will be examined in further detail in Chapter V. What is of greater concern here is the examination of the characteristics of blade debitage at a general level. The actual number of blades used in this analysis varies, as not all blades are complete enough to record the needed attributes. Tables 3.16 to 3.21 give the totals used.

First, however, it is worth noting that there are significant differences between numbers of observed obsidian blade fragments, and proximal and distal blade fragments (table 3.21). Where sufficiently detailed recording permits comparison, this appears to be a phenomenon noted elsewhere on Neolithic sites in Anatolia and Syria such as Abu Hureyra (Nishiaki 1992) and Can Hasan III (Ataman 1989). The reasons for this are unclear, although it may be the result of several mid-fragments being produced from a single complete blade. Approximately 45% of the blades show evidence of truncation by simple snapping, side-blow percussion, or polar retouch, with the remaining 55% too irregularly broken to ascertain the cause of their breakage. However the cause of the difference between the number of proximal and the number of distal ends is unclear, although it may be that small and fragile distal ends of blades are being mistakenly identified as flake fragments.

Figure 3.9 Obsidian Non-Prismatic Blade Fragments



Almost 4% of all blades are flint, and the basic descriptive statistics of a sample of unretouched flint and obsidian blades bear witness to the differences between the two materials in terms of production: obsidian blades are clearly both narrower and thinner than their flint counterparts, and display a larger mean width:thickness ratio (table 3.16). They are, however, shorter: the mean length of complete obsidian blades is 86mm (s.d.=40.5mm, n=63) and the ratio of length to width is 3.2 (s.d.=1.1) whereas complete flint blades have a length:width ratio of 2.4 (s.d.=1.1), and a mean length of 100.2mm (s.d.=40.3mm, n=21).

A frequency distribution of obsidian blade lengths is indicative of differences within the obsidian blade group. Although the sample is small, peaks at lengths of approximately 60mm, 120mm and again at 170mm are likely to be symptomatic of two separate techniques for the production of large and small obsidian blades (graph 3.1). However, when width distributions are inspected, no such patterning can be seen (graph 3.2), so the evidence drawn from measurements alone is inconclusive and further variables must be examined. To this end, identification of patterning across several attributes aids in the exploration of blade production techniques. For example, most obsidian blades display a strong tendency towards straight ventral profiles and parallel to sub-parallel lateral edges (table 3.17). Concave profiles (slightly to strongly) are the second most abundant type, also showing a preference for parallel to sub-parallel lateral margins. Converging edges appear to be more closely associated with concave profiles, possibly a result of later stages of a core reduction sequences when blades begin both to taper and converge more frequently, as witnessed on several examples of single-platform blade cores (e.g. figure 3.2). A small cluster of expanding edges suggests the use of alternative techniques, such as bipolar percussion, as witnessed in the scar directions of some blades. However, the overwhelming majority of obsidian blades (upwards of 68%) exhibit three scars originating from the proximal end (table 3.18). This pattern creates the characteristic trapezoidal cross-section seen in the majority of the prismatic obsidian blades. Triangular cross-sections, caused by two proximal scars follow some way behind at 19.18%. Figures 3.8 and 3.9 illustrate a sample of these different blade types. These results can be compared to those presented in table 3.19 where blade cross-sections have been plotted against butt type. Trapezoidal sections co-occur with punctiform butts more frequently than any other association – roughly 44% of cases. The distribution of butts and dorsal lips emphasises the extent of the preparation that blade debitage receives – there are no unprepared, cortical butts on blades (although there are on a small number on flakes, described below). Proximal ends of the blades in the sample are characterised most commonly by small punctiform butts and ground or faceted dorsal lips (table 3.20). Punctiform butts are typically associated with a controlled and directed force being applied to remove blanks, as seen in punch or pressure debitage techniques (Crabtree 1968:451). Linear butts, associated with soft-hammer removal techniques (Inizan et al. 1992:80) are the second most frequent type, which also repeatedly accompany removed dorsal lips. However, as can be seen in the illustrations in figure 3.8, neither the punctiform nor linear butts are isolated from the blade body. These characteristics combined with the remarkable regularity of these obsidian blades are indicative of removal by pressure, as opposed to percussion or punch, techniques (compare Tixier 1982:58, 66; Wilke & Quintero 1994:41). The remaining butt types show similar degrees of preparation prior to the blank's removal: 'crushed' butts are very thin and fragmentary remnants of a once larger butt and, given the high frequency of ground and faceted dorsal lips, are most likely to have come from a highly prepared core platform. Both faceted and ground butts are two instances where small removals or, in the case of the latter, a ground surface on the core platform facilitate striking platform isolation, aiding controlled removal by direct or indirect percussion. It is interesting to note that flat platforms display the lowest incidence of dorsal lip modification, corresponding to the reduced emphasis on core platform preparation.

On the basis of the data presented above, the Çatalhöyük blades can be seen to fall into three broad groups: (i) flint blades, possessing variable characteristics ranging from highly standardised to less typical examples; (ii) very regular obsidian blades, typified by parallel margins, three unidirectional parallel scars, trapezoidal cross-sections, and punctiform to linear butts (fig. 3.8) and; (iii) 'non-prismatic' obsidian blades, principally distinguished by not possessing the attributes of the former; bipolar dorsal scar patterns, sub-parallel to expanding edges, flat (perhaps with some lineal) butts, and a higher incidence of extant dorsal lipping – all the second highest frequencies of blade attributes – are the archetypal characteristics (fig. 3.9). Despite these differences, all three blade groups can be interpreted as the products of structured processes of core-reduction specifically geared towards the manufacture of elongated blanks. In all cases the traditional definition of blades having a 2:1 or greater length:width ratio is exceeded. These three groups can be contrasted with the types of cores recovered in the assemblage, where obsidian prismatic blade cores, which for the most part can be assumed to be the source of the prismatic blades, are correspondingly the most prevalent type. Flint non-prismatic blades can be attributed to the single platform non-prismatic blade cores, although there is a discrepancy between the number of observed flint cores and flint blades. One possible explanation for this is that flint blade cores are more intensively worked, resulting in a transformation from blade to flake in accordance with the continuance of their use. However, there are a small number of extremely long blades on fine-grained tabular flint that are preferentially used for the remarkable hilted 'daggers' (discussed in Chapter IV). Where technical data can be observed, these appear to be derived from single-platform cores (and are therefore distinguished from the typically bipolar-derived large obsidian blades). There are no flint cores which can be attributed to production of this type of blank and the possibility that they were imported into Çatalhöyük as ready-made blanks must be considered.

The relationship between groups (ii) and (ii) is worth considering, for it is not entirely clear on the basis of the data presented thus far whether they represent two discrete reduction processes employing alternative techniques or, alternatively, if there is one chaîne opératoire for obsidian blade production that results in both types of blades being produced at different phases in the core reduction sequence. While this must be to a limited extent true (insofar as a blade core will produce a range of blade forms, only a percentage of which will be 'typical'), circumstantial evidence for the alternative explanation, that of two separate methods, can be found in the distribution of debitage attributes examined above.

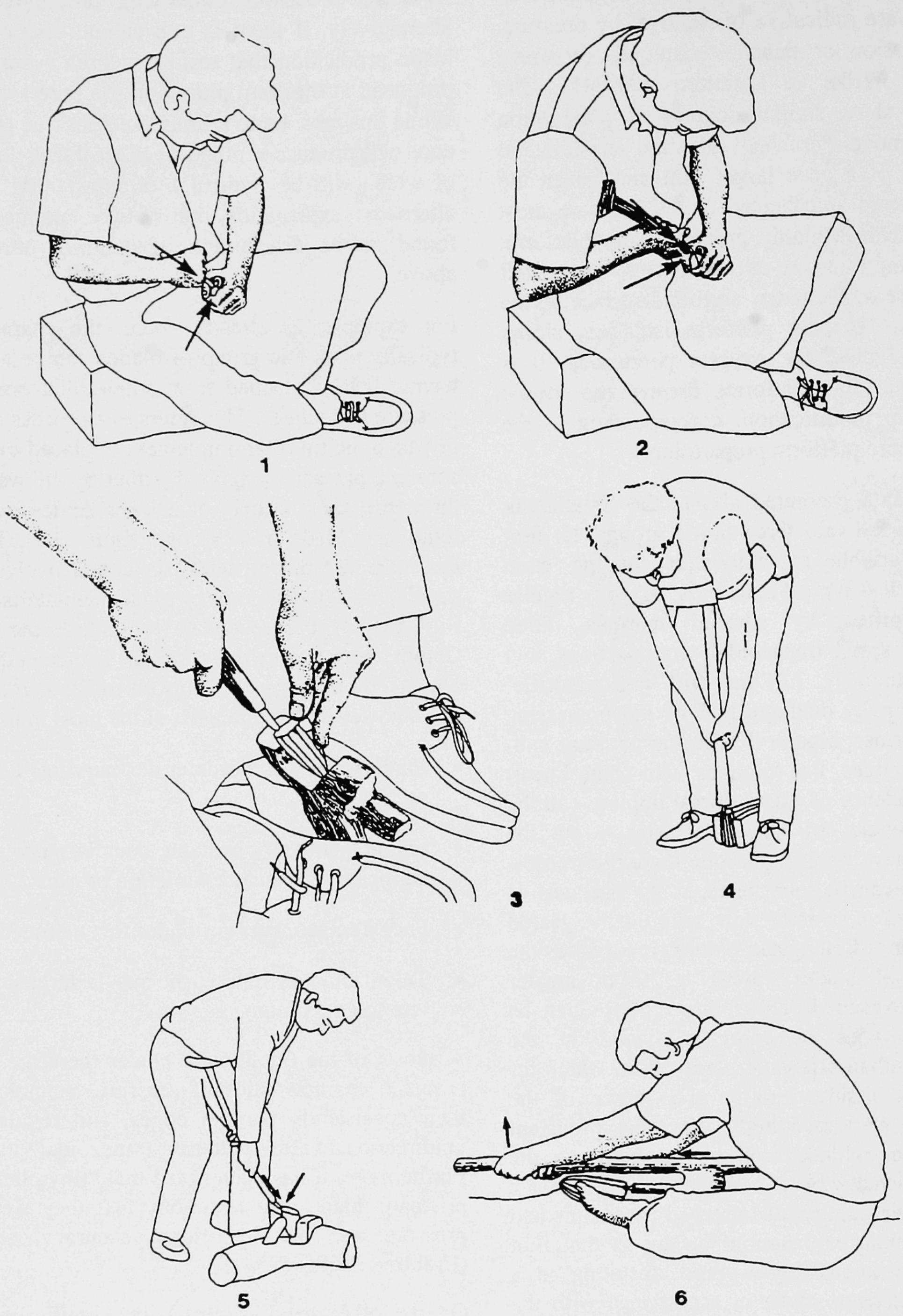
For example, as already noted, the characteristics of the typically prismatic group of blades can be attributed to their having being detached from single-platform bullet cores by pressure techniques. This refers to a process of blade removal in which the tip of an implement is placed on the edge of the core and pressure is applied, either by the weight of the body through a chest crutch, or a lever device, which effectively removes a blade from a core (figure 3.9). Tixier (1984:66) has indicated the difficulty in conclusively identifying this sophisticated technology by blade characteristics alone: "Y a-t-il une clé pour reconnaî le débitage par pression? Non. Comme pour tout ce qui concerne les techniques de taille il y a une série de stigmates plus ou moins caractéristiques". He does, however, provide a list of the most important criteria:

- Parallélisme des bords et des nervures qui tendent à être rectilignes.
- Faible épaisseur constante dans la partie mésiale ou tout au moins sans aucune variation brusque.
- Face d'éclatement sans ondes très marquées.
- Talon toujours plus étroit que la largeur qui atteint très vite son maximum.

A subset of the Çatalhöyük blades therefore exhibits all the requisite characteristics of pressure technology: principally their consistently parallel edges, and regular, straight and unidirectional scar patterns trapezoidal in cross-section. Furthermore, it has been noted that "tiny platforms found on prismatic blades are testimony that they were removed by pressure and with repetition, accuracy, and uniformity" (Crabtree 1968: 451).

On the other hand, a small but significant 3.26% of the obsidian blades exhibit bi-polar scarring – a pattern which is in direct contrast to the majority of the other blades and, indeed, the dominant core type. Given that the incidence of both bipolar cores and bipolar blades is very low, this type of technique does not appear to have been a sizeable component of the whole range of blade production at Çatalhöyük. However, a cache of twelve unretouched bipolar blades was recovered under the floor of 'Building I' excavated in 1996 which are testimony to the significance of non-pressure blade manufacturing techniques (figure 3.10). The significance of caches of this kind this will be discussed in Chapter VII. There are six blanks each from the two platforms – which, judging from the blank proximal end characteristics were

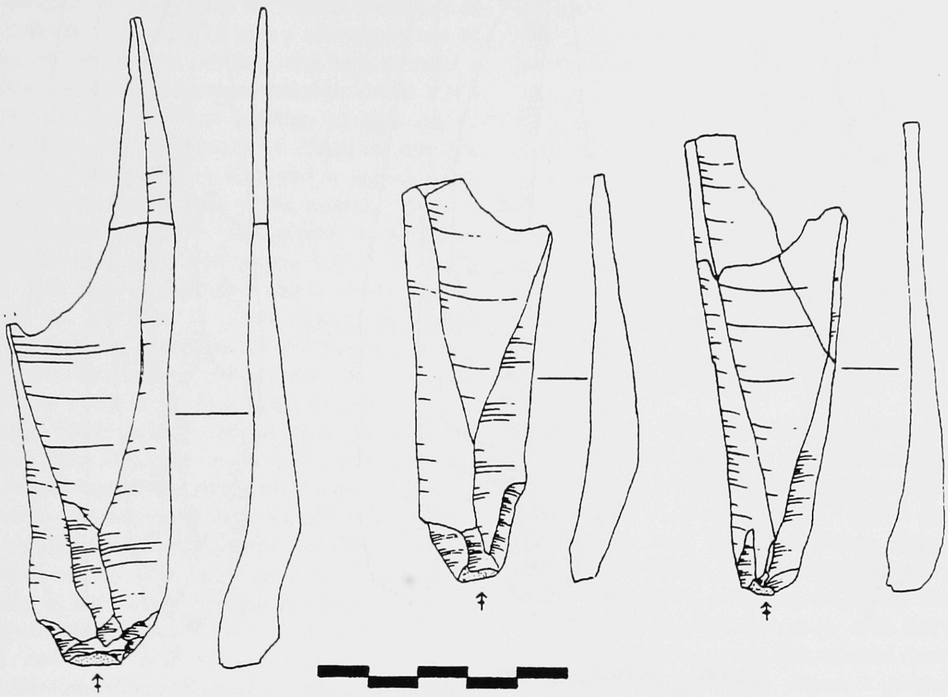
Figure 3.10 Pressure Debitage Production Positions (From Inizan et al. 1992)



Exprimental positions used for pressure blade debitage. Pressure debitage of bladelets, 1 : free-hand, using a grooved support, 2 : using a shoulder crutch, 3 : using a small abdominal crutch and a grooved on the ground. Pressure debitage of blades, 4 : using a pectoral crutch, 5 : using abdominal crutch, 6 : using abdominal crutch with the core held between the feet. 1,2,3 (Pelegrin, 1988). 4 (Crabtree, 1968). 5 (Pelegrin, 1984). 6 (Clark, 1982).

faceted acute-angled platforms. Of particular interest in this case is that no cores can be associated with this type of production. However, their bipolar scarring and acute angle of detachment suggests an bipolar core with an acute platform angle akin to Naviform or Naviform-like cores of Aşıklıhöyük. Their overall morphology – thick and triangular cross-sections and sub-parallel or expanding edges – and their prominent bulbs suggest direct percussion techniques for detachment. None of the blades from the cache have punctiform platforms and considerable effort was going into isolating and grinding platforms on the cached blades. Where a remnant core platform is retained, the angle of removal is

Figure 3.11 Naviform-Like Blades from Cache in Building 1



quite low, and the point of impact is associated with, or actually on, a transverse ridge formed by intersection of the ground ventral side and the core platform. Often the only visible preparation left on the butt is the ground surface. The angle of the striking platform is similar to a Naviform platform and as they are opposed platform, this suggests that the knapping may have been on only one face of the core in order to accommodate the necessary acute angle. This is very typically Naviform, although in this instance, because there aren't any associated cores, whether the cores are directly analogous Naviform-like is uncertain. With regards to the archaeological peculiarities of the cache two additional points can be made: (i) there were six negatives and six positives recovered, with no sign of any other knapping debris; (ii) the blanks do not refit in any way, despite repeated attempts.

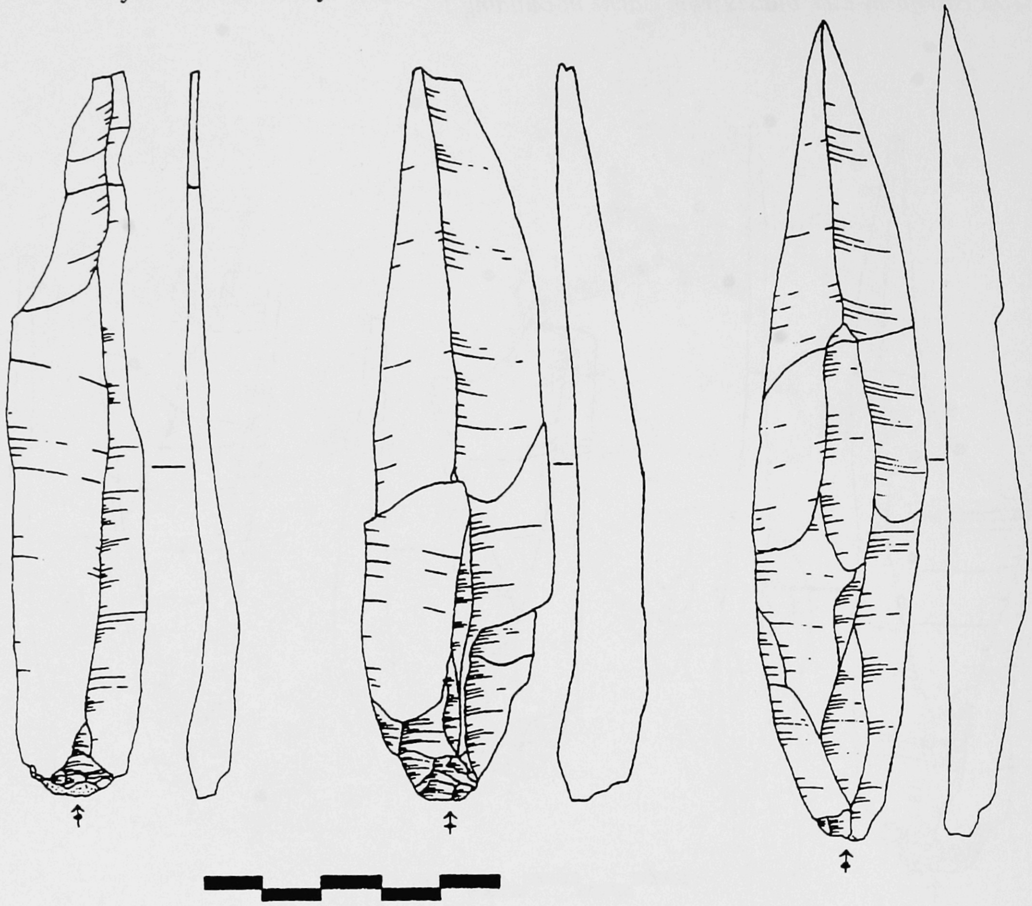
There size of these blades alone points to their 'otherness' (table 3.22) and length:width and width:thickness ratios indicate comparatively longer and thicker blanks (table 3.23). It is reasonable to infer that the peak at 120mm seen in the frequency distribution of blade lengths is in part influenced by bipolar blades of this sort.

Flakes

Flakes are the major class of debitage at Çatalhöyük, forming over 58% of the sample. As with blades, they present considerable morphological variability. In part, some of this variation is a result of different fragmentation: the terms complete flake, broken flake and flake fragment refer to the wholeness of the piece (Appendix 1). The distinction made between broken and fragmentary flakes was based on research which suggested variation in proportion of these categories (including complete flakes and 'debris') may be indicative of production differences (Sullivan & Rosen 1985). This possibility was entertained in the analysis, but no significant patterning was ever identified. Nevertheless, the broken and fragmentary flake classes are still useful as descriptive categories and were during the analysis retained.

Flake fragmentation was examined in relationship to raw material, size and other attributes. For instance, over 20% of obsidian flakes from the sample are complete, in contrast to only 2% of flint flakes (table 3.24). The small sample size of flint flakes warns against drawing definite conclusions but if, as it has been argued, fragmentation types are in part influenced by either core reduction techniques, and/or core versus tool reduction (e.g. Sullivan & Rosen 1985:773), then it is reasonable to infer that differences in the productive

Figure 3.11, cont. Naviform-Like Blades from Cache in Building 1



approach between flint and obsidian – as with blade debitage – play a significant role.

Frequency distributions of maximum dimensions for modified and unmodified obsidian flakes show normal distributions, and strong evidence of size differences (graph 3.3). A two-tailed Students' t-test found a highly significant difference between these two categories of flake ($p<0.01$). As the distribution indicates, there is a wide variety of sizes of flakes at Çatalhöyük, from sub-10mm categories to very large (nearly 200mm) examples. Yet, despite the uni-modal distribution of flake sizes, examination of key diagnostic attributes suggests that flakes are derived from a variety of different knapping procedures, from the maintenance and reduction of cores to the shaping of tools and thinning of bifaces. Contextual differences are also relevant: prime examples of alternative flake forms can be found in the differences between the discrete clusters of small (predominantly under 15mm) flakes found in fire-installations, and the very large flakes found in caches within buildings, such as those found in the corner of a building in the North excavation area in 1993 (figure 3.11). However, the following discussion attempts to differentiate between different classes of flake by examining the patterning of key attributes.

Length to width ratios were also examined. The mean ratio is 1.38, but unretouched flakes show a modal ratio slightly less than the retouched flakes (graph 3.4). There are several instances were ratios are greater than 2, with a small number showing a ratio greater than 3. Some of these can rightly be considered as spalls. Generally, however, the incidence of flakes with spall-like characteristics is very rare (corresponding to the low frequency of burins – see table 4.43).

Examination of non-metric variables allows inferences to be made concerning productive activities. Ventral profiles and edge shape of obsidian flakes show that straight edges and irregular edges are both independently and concurrently the most frequent characteristics, whereas strongly concave profiles and irregular edges are independently the most common, with straight edged and irregular to sub-parallel the most usual joint occurrence (table 3.25). The significance of this becomes more apparent when profiles are considered by platform angle (table 3.26), where strongly concave profiles are most closely associated with low angled platforms.

Analysis of small-sized debitage suggest that low platform angles (less than 45 degrees), convex profiles, and expanding edges are the characteristics encountered preferentially on 'thinning' flakes – those flakes produced during the so-called process of 'thinning-out' bifaces (Whittaker 1994:194-201;

Newcomer & Karlin 1987). To further aid the identification and delineation of thinning flakes from other small sized debitage, the platform angles for flakes with a maximum length of less than or equal to 10mm, 15mm, 20mm and greater than 20mm were examined. Here it can be seen that the smallest category of flakes have the highest incidence of low angled platforms (table 3.27), and a chi-square test of flake sizes by the angles low, medium and high showed a highly significant association between variables (table 3.28). It is interesting that it is the low numbers of high angled 10mm or less flakes, the high count of 15mm or less low angled flakes, and the low number of large low angled flakes which contribute most significantly to the statistic. Many of the smaller flakes (i.e. sub 15mm) can perhaps be attributed to this thinning-out process. However, Newcomer & Karlin also suggest that converging-sided flakes with straight profiles could be ascribed to core edge maintenance (confirmed by a series of experiments conducted by Ataman (1989:82-83)) and, furthermore, that sub-parallel to parallel edged flakes with concave profiles could be derived from pressure-flaking. Table 3.29 examines these attributes on flakes beneath 15mm. If broken and irregular categories are ignored, the distribution shows that straight edged flakes are the most common – as seen on the total sample (table 3.25) – with the sub-parallel to converging flakes possibly related to blade core maintenance. The high numbers of expanding edges clustering in the concave categories could be derived from thinning processes. Many of the smaller obsidian flakes, perhaps 10%, and up to 30% of those beneath 15mm, are possibly derived from bifacial thinning activities where flakes of similar size and morphology have been experimentally replicated. Although they cannot be attributed to any specific process, the other flakes are more likely to be derived from a combination of events that may well include biface production and thinning, but also more ubiquitous blade core shaping and reduction. Also, flakes above the 15mm range show a much higher incidence of retouch. This latter group includes several extremely large obsidian flakes, such as four examples (together with a large blade from a bipolar core) found in a cache on the northern eminence. These artefacts, ranging in length from 143mm to 187mm all have well prepared faceted platforms and prominent bulbs, and represent a small subset of flakes at Çatalhöyük. Interestingly, as with the blade cache found nearby and discussed earlier, there is no evidence for any cores suitable for manufacturing flakes of this kind in the assemblage. While this cannot be used to establish whether or not they were imports, they are – judging from the low numbers of similar large flakes in the assemblage – unique objects that had a restricted production and distribution. The retouch characteristics of blanks selected for modification are discussed in detail in Chapter IV.

Chips and shatter

In contrast to some other lithic analyses (e.g. Baird 1993:150-151; Nishiaki 1993:82-83; Ataman 1989:66), the definition of chips did not necessarily include all small-sized (i.e. sub 10mm, or sub-20mm) flakes as chips. Instead, the term refers only to (admittedly small) debitage that lacked the diagnostic characteristics necessary to describe them as flakes. In practise this meant being unable to distinguish the ventral from dorsal surface or identifying a striking platform. As such, 'chips' in this study refer to small and undiagnostic lithic artefacts that cannot readily be attributed to any particular knapping sequence, method, or technique. They are produced during all stages of lithic reduction, from initial shaping of raw material, though core reduction, and tool shaping, to tool use. The justification of this method, admittedly different to most other analyses, was that I wanted to avoid using potentially arbitrary metric criteria to define debitage classes. Additionally, Ataman (1989:99) was able to distinguish between types of chips derived from blade core reduction and tool manufacture. Consequently, I felt that if I classified all sub-10mm debitage as chips, I would miss the opportunity to compare the attribute characteristics of small flakes against those of larger debitage.

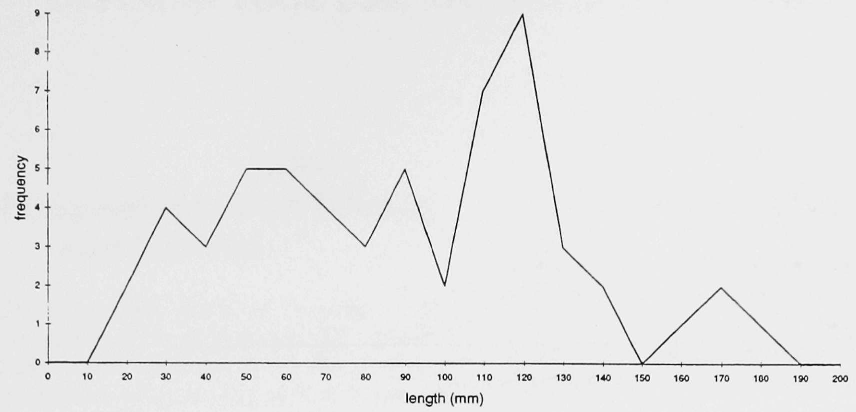
Shatter was identified by its blocky morphology, and distinguished from either an intentional removal or core by its lack of a single interior surface, or coherent removal surface. It is more likely to have derived from core preparation and reduction rather than tool production (Sullivan & Rosen 1985). Although considerable care was taken distinguish true core-fragments from shatter, it is possible that some of the shatter is in fact made up of cores reduced to such an extent that removal faces can no longer be identified. As with chips, shatter is produced as a potential by-product of knapping from a variety of stages of core reduction and tool shaping.

The result of these definitions is that, in contrast to blade and flake debitage, there is relatively little to say about chips and shatter from a technological perspective. Their association with knapping activities does provide a potentially useful source of information, particularly when spatial distribution patterns are examined between different contexts. This is further considered in Chapter VI. In the meantime, it is useful to provide some descriptive details for comparative purposes. First, the effect of raw material influences proportions of chips and shatter, both absolutely and relatively (table 3.6): quantities of obsidian chips and shatter are unsurprisingly much higher than seen in the other types of material. Relative quantities of obsidian chips are also higher than those of flint, which must undoubtedly be an effect of the brittleness of obsidian, but also perhaps an effect of alternative reduction strategies. Frequency distributions of the 'maximum dimension' of flint and obsidian shatter are of similar proportions and breadth suggesting a comparable size range. The differing proportions of cortical surfaces between obsidian and flint shatter once again points to the differences between these two materials (table 3.30): considerably more flint shatter shows 50% or greater cortical surfaces. This may be a product of the different forms in which flint and obsidian raw material enter Çatalhöyük. One likely interpretation is that small pieces of local flint are less comprehensively pre-prepared than obsidian. This may be explained by simple economising behaviour, as the latter raw material was obtained from a much greater distances than the former.

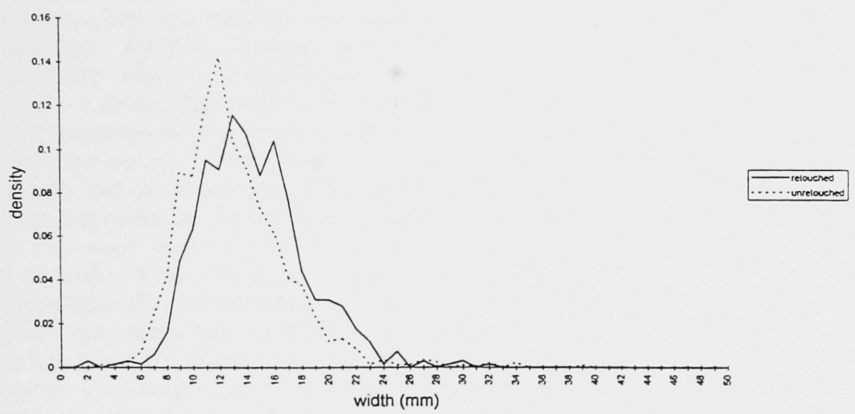
Summary

The objective of this section has been to identify the basic technological characteristics of the assemblage pertaining to techniques of core reduction and blank manufacture, and the influence of raw material. From this, several trends have already been identified, including the presence of several 'technological systems' and sub-systems relating either to blank acquisition or core reduction methods (Nishiaki 1992). These are explained in more detail, and include the findings of the retouched tool analysis, in Chapter V.

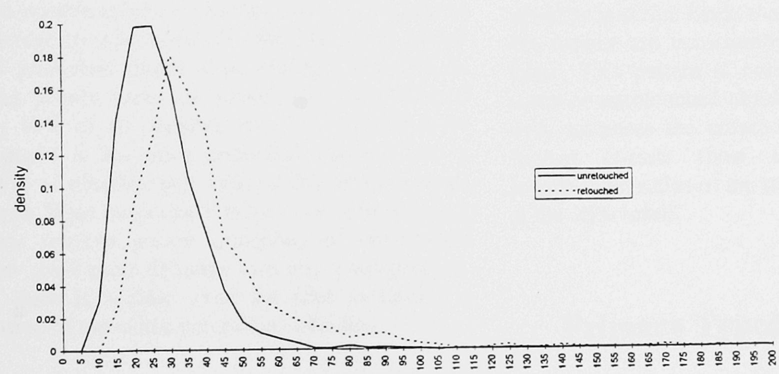
Graph 3.1 Frequency distribution of complete obsidian blade lengths.



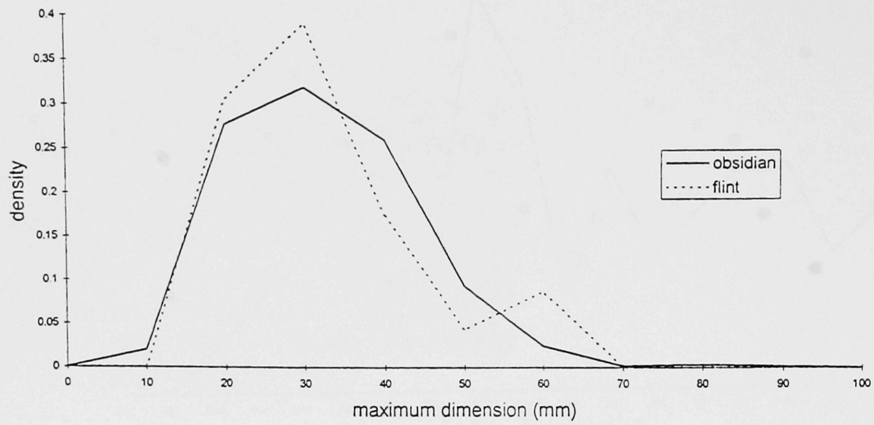
Graph 3.2 Density distribution of obsidian blade widths.



Graph 3.3 Density distribution for modified and unmodified obsidian flakes.



Graph 3.4 Density distribution of flint and obsidian flake maximum dimensions.



IV

DEFINING TOOL USE: THE RETOUCHED DEBITAGE

Sample Composition and the Effect of Raw Material

There are 3,968 retouched pieces of debitage, which represents just over 26% of the total sample. This is a high percentage, inflated by the inclusion of non-sieved samples where a higher proportion of retouched pieces is encountered because of the absence of the more numerous smaller pieces of debitage. A more realistic account of the percentage of retouched debitage is provided by Samples B and D, where sieving was practised (table 4.1, see also Section 3.2). The percentage of retouched debitage in both these cases is much less than in the non-sieved samples (7% and 13% respectively). A chi-square test indicates that there is a significant association ($p<0.01$) between sample and frequencies of retouch which is best explained by the presence or absence of sieving. Sample B, however, is likely to have a reduced proportion because it was collected solely from the surface of the mound, from areas where trampling by humans, animals and machinery was high, ultimately resulting in greater fragmentation. Thus, the most reasonable estimate of the percentage of retouched debitage using a 5mm mesh for retrieval is from Sample D, the aggregate of which was collected from different areas and contexts of the mound. This proportion, about 13%, is slightly more than was recorded at Can Hasan III (roughly 5% of all recovered debitage), but as the Can Hasan sample was obtained from wet sieving, many more chips and smaller unretouched pieces were recovered. It is, however, considerably less than the 26% recorded in the Suberde assemblage, where it is unclear whether sieving was practised. No comparable figures are available for Aşıklıhöyük.

There is a considerable difference between the proportions of retouched debitage by raw material. Flint has a far greater proportion of retouched pieces than obsidian (table 4.2). Predictably this pattern varies by sample as a maximum of approximately 40% of all obsidian and 85% of flint from (unsieved) Sample A has been retouched compared to a minimum of 7% of obsidian and 18% of flint from (sieved) Sample B. Again, these results have more to do with recovery procedures that retrieve greater quantities of unmodified chips and other small-scale debitage than any other process. Nevertheless, there is a clear trend for flint to exhibit a greater proportion of retouched pieces than obsidian.

Debitage Class and Size

It should first be emphasised that there are considerable differences in the selection of blanks between late and early contexts. This issue will be considered in the following chapter: the results presented here are intended as a summary of general retouch characteristics of the industry as a whole.

Flint and obsidian blank selection shows a slight preference for flakes: roughly 50% of all obsidian and flint tools are flake based, approximately 35% blade based, with the remainder on other types of debitage (primarily shatter, although cores and core tablets were also used as tool blanks). This includes only those pieces with retouch – blades that have been truncated by snapping or a single blow are not included in these totals. For comparative purposes, 21% (n=805) of all blades appear to have been truncated by being snapped, or by a 'side-blow', on one or both of their polar ends. Their mean length is 24mm. Of these, 4% have been truncated by a side-blow on both polar ends. Their mean length is 22mm. Of all the truncated blades, 45% (n=362) have been further retouched and have been included in the following discussion.

Where it could be determined, unbroken obsidian blade tools have a mean length of 53mm (s.d.=22mm, n=816), while unbroken flint blade tools are nearly twice as long, with a mean length of 100mm (s.d.=40mm, n=21). Frequency distributions of length measurements for obsidian retouched blades are not multi-modal (graph 4.1). Examination of mean width, thickness and width:thickness provides a larger set of data, for it is difficult to determine in many cases whether obsidian tools are, in fact, complete (table 4.3). Nevertheless, as can be seen, there is a considerable difference between obsidian and flint blade tools along these parameters as well: the former are consistently narrower and thinner than the latter. This pattern is consistent with similar observations taken on unretouched obsidian and flint blades (table 4.4). In both instances the unretouched versions are narrower and thinner (z-tests show significant differences between length:width ratios of the retouched and unretouched samples at the 10% level).

Primary Typological Composition

For reasons outlined in Chapter II, typological analysis has been complemented with a detailed examination of key retouch attributes. It is nevertheless worthwhile providing a primary breakdown of the general characteristics of the retouched blanks vis-à-vis conventionally used typological definitions. As will be seen this was only viable using very broad categories. The retouched component of the assemblage can be broken into six broad classes of object: (i) points and bifacials; (ii) flint daggers; (iii) obsidian mirrors; (iv) very large retouched obsidian flakes; (v) pieces with edge crushing and pièce esquillée; (vi) retouched blades and retouched flakes (table 4.5). This is only an elementary division, which provides no more than an initial indication of the variety encountered in the assemblage. To a certain extent depositional evidence justifies these groupings, insofar as groups (i) to (iv) are known to occur in clusters, hoarded beneath floors, or in other contextually prominent places such as burials. The justification for the creation of group (v) comes from its distinctive and congruous morphological characteristics that, as will be explained, are significantly different from those seen in group (vi). This latter group is the 'catch-all' category for the rather more amorphous and non-formalised retouched tools in the assemblage. It can be further subdivided by blank type, but it is not without some difficulty that further divisions are created (although broad sub-categories can be constructed on the basis of co-occurring groups of attributes). Although this group includes what, in the past, have been treated as standardised tools such as scrapers, piercers, notches, etc., I felt that when the retouched blades and flakes were viewed collectively (after the separation of pieces falling into the other five primary categories), no clear dividing lines between 'standardised' and 'non-standardised could be unambiguously drawn. To a certain extent, all five groups display morphological variability that challenges the validity of theses primary groups as coherent categories. Nevertheless, the six groups share at least some morphological, functional or technical characteristics that suggest they are 'emic', natural classes of object. In most cases further sub-divisions were created after extensive attribute analysis. The following sections outline the characteristics of these six primary types, together with the manner in which they can be sub-divided.

Points and Bifaces

The first group is distinguishable using conventional criteria for the identification of 'projectiles' insofar as these pieces are typically thin, narrow, roughly symmetrical, elongated, pointed objects, often with tangs or other basal modifications to (presumably) facilitate hafting in some manner. All previous analysts of the Çatalhöyük assemblage have noted the occurrence of several different morphological groups, ranging from tanged to untanged, shouldered to unshouldered, and large to small varieties. Because of this exceptional diversity, I have used the term 'point' or 'biface', instead of terms like arrow-head or projectile, to refer to them all, as this category of object probably included examples of spear/lance, and arrow-heads (Roodenberg 1986; Cauvin 1968). This is confirmed by several of the wall paintings which depict both arrows and what appear to be spears being used by men in hunting related activities. Nevertheless, I have not attempted to distinguish between the two. Occasionally the term 'bifacials' has been used to describe objects that lack any sort of obvious hafting modifications such as tangs and/or shoulders; these are also present in large numbers at Çatalhöyük. A number of these exhibit modification of a sort that suggests that they may have been point preforms, as their basic shape, size and retouch morphology is suggestive of rough shaping. I have, therefore, retained the term point to refer also to untanged bifacials. All are very distinct from the hilted, dorsally flaked, flint daggers that are considered in more detail below.

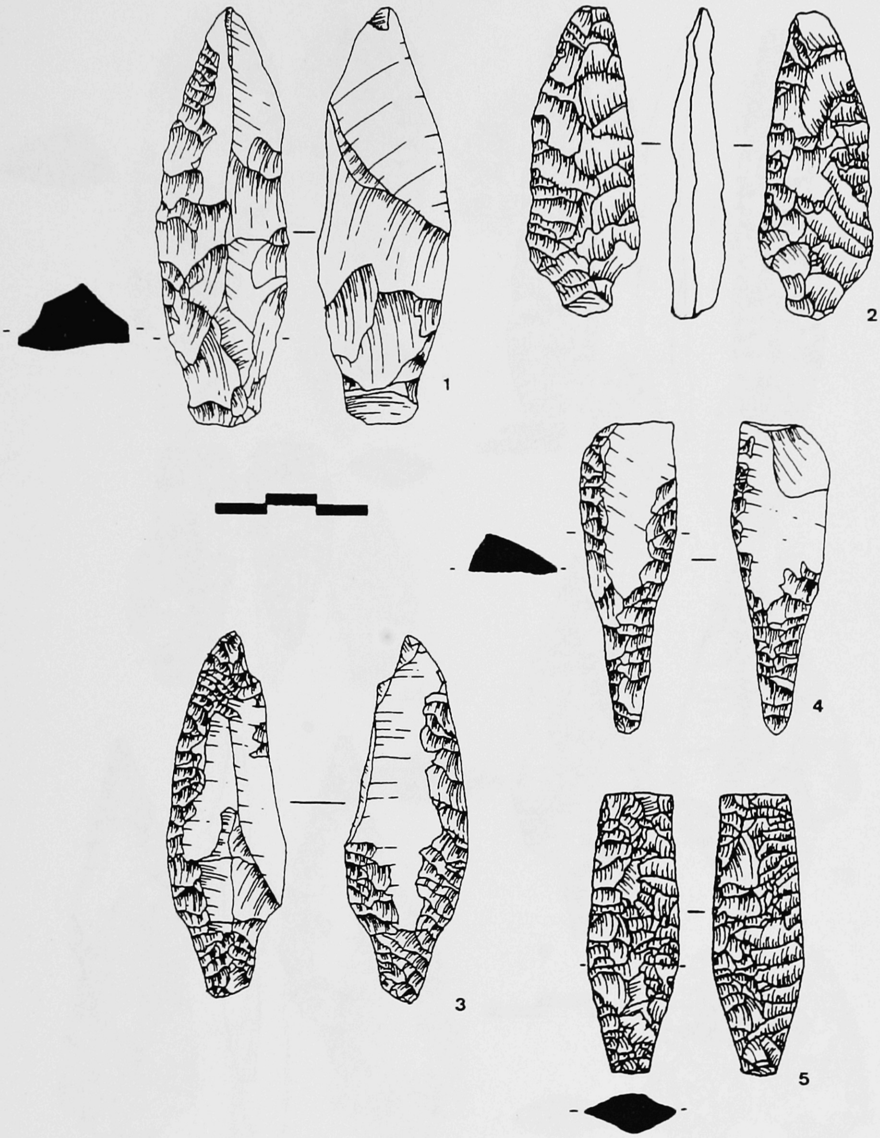
There are clearly several different types of points (figure 4.1), and I have differentiated between these groups using a Cluster Analysis, a statistical device for identifying and establishing groups of related objects. Once groups were identified, their relationships were explored using Principal Components Analysis, and tested using multiple-means testing (explanation of all statistical procedures used here and elsewhere in the thesis are described in Appendix 2).

Sample size and general characteristics

There are 675 points and point fragments, which represent roughly 5% of the assemblage and 17% of all retouched pieces. Nearly 97% are obsidian (n=654), the remaining 3% (n=21) flint. The majority of the points are well made, although there is considerable morphological variation. Complete to near complete examples (n=374) range from 19mm to 193mm in length, with a mean of 89mm (s.d.=32mm). A frequency distribution of complete point lengths does not show a convincing bi- or multi-modal curve, so a normal dispersion can be assumed (graph 4.2). Similarly, plots of point lengths by widths do not show any clear patterning, and a linear relationship between the two variables is apparent (graph 4.3). If, on the other hand, the length by width of tanged and untanged points is plotted separately, two different relationships emerge. Tanged points have a much tighter grouping and are generally thinner in relation to their length than untanged points (graph 4.4). Untanged points are thicker in relation to length, and more varied in overall shape along these parameters. However, if the differences between mean length:width ratios are compared statistically, no significant differences emerge (two tailed t-test returns $p<0.60$).

Examination of blank characteristics is usually extremely difficult because of extensive retouch, so detailed identification of dorsal scar removal patterns cannot easily be made. However, one characteristic that may provide a clue to the original shape of the blank is the cross-section of the point. To this end, the complete to near-complete points were tabulated by size (small: length less than 80mm, medium: 81mm to 130mm, and large: 131mm and greater) and cross-section (table 4.6). A chi-square test showed a significant association between cross-section and size ($p<0.01$). Examination of the differences between observed and expected frequencies suggests that the statistically relevant

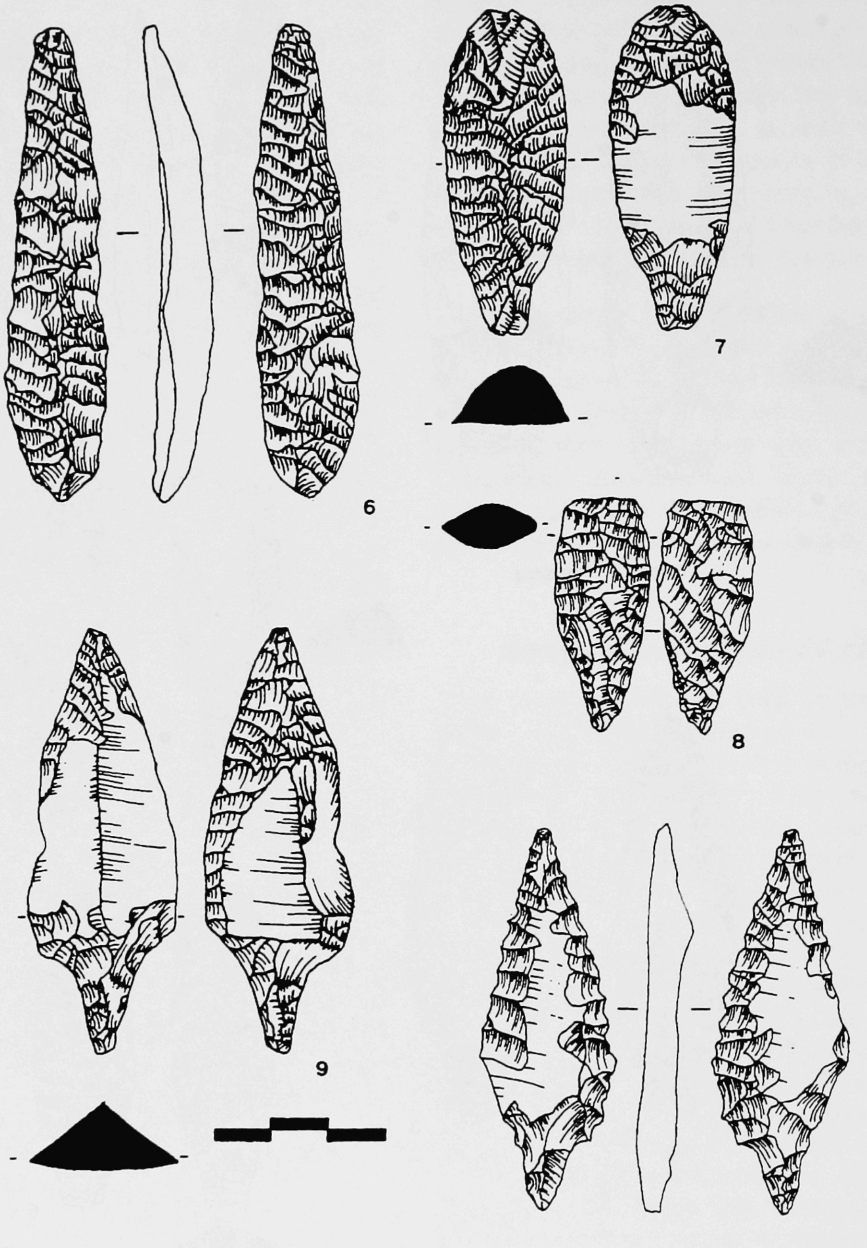
Figure 4.1 Obsidian Point Variability



associations occur between medium sized points with triangular cross-sections, with a corresponding drop in the number of medium sized plano-convex occurrences (table 4.7). The former situation can perhaps be attributed to the high incidence of medium-sized points that showed little or no retouch on their bodies. Indeed, these form a distinct type of point where – in contrast to the other point forms – the method of manufacture can be reconstructed. This is further discussed below. It is clear that these points are made on blades that have been knapped from a bipolar core. The result of this is a pointed blade with a prominent triangular cross-section. A small number of blanks of this kind have been recovered, allowing greater examination of the blank removal technique, principally from the cache in Building 1. Alteration of these blanks to form points is relatively minor, consisting of modifying the proximal end into a tang. Interestingly, none of the so-called 'snapped-bulbar-pieces' witnessed at Can Hasan III and considered waste products of this process (Ataman 1989:129) have been identified in the Çatalhöyük assemblage.

Plano-convex, trapezoidal and triangular point cross-sections can also be attributed to blade blanks insofar as the cross-sections seem to suggest an original shape akin to that of a relatively thick blade. Plano-convex points can be interpreted as instances where there has been further dorsal thinning than on more prominently triangular specimens. This may account for the higher proportion of smaller examples. Points with

Figure 4.1, cont. Obsidian Point Variability (no. 7: hafted scraping tool?)

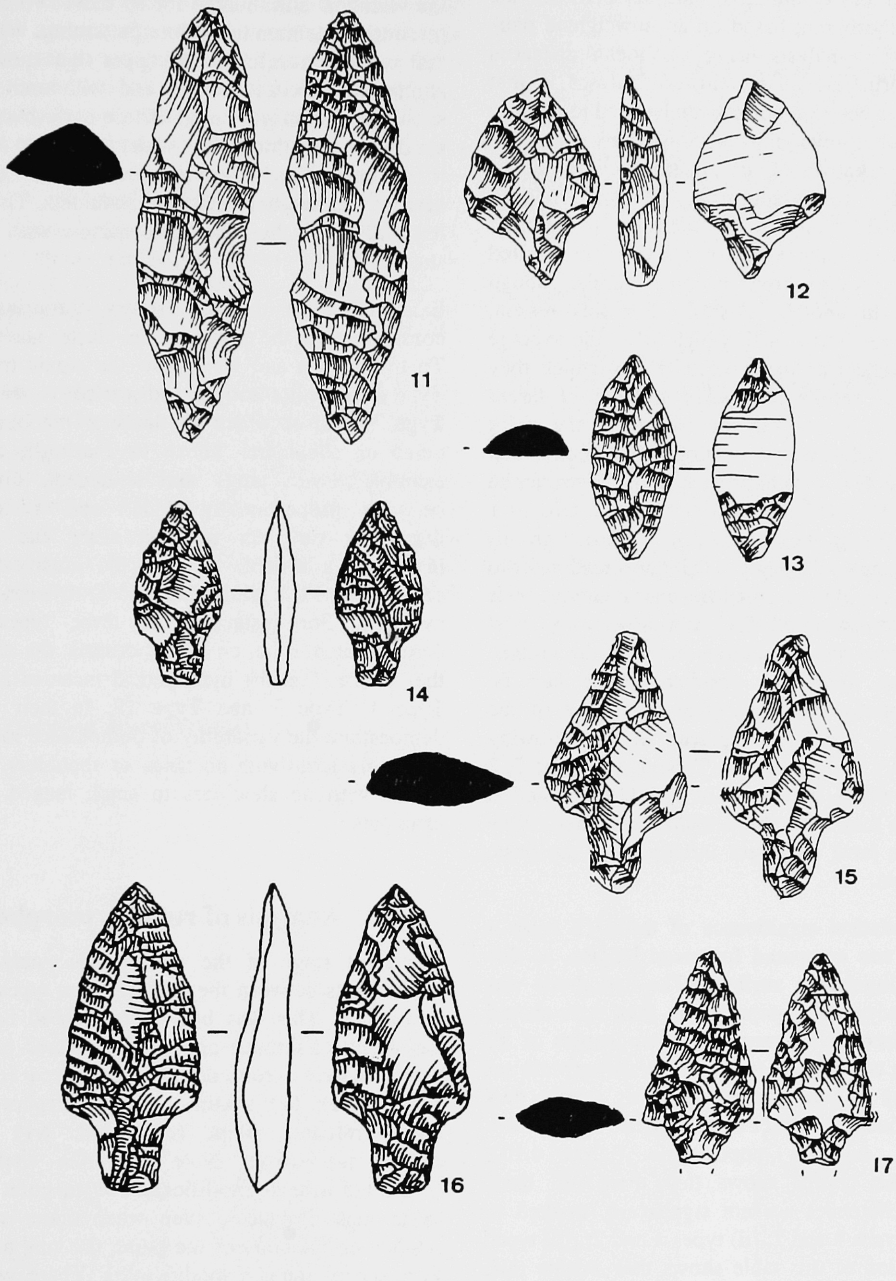


oval cross-sections cannot for the most part be convincingly associated with any particular type of blank. However, in the case of the largest specimens – given their length and narrowness – they are most likely to be blade derived, but have been subject to an extreme amount of thinning retouch that has removed much of the 'triangularity' seen on the lesser retouched pieces. This, too, could be the source of the small and medium oval points, but in these specific cases appropriately shaped flakes cannot be discounted as the source of the blanks. So, while there aren't any pieces which appear to be unfinished points in the assemblage and which may provide direct clues as to the technology of point blanks, it seems most likely that the non-prismatic blade debitage and bipolar blade debitage were the source of the vast majority of the points.

Quantitative cluster analysis

In the first instance, an exploratory analysis of the point data was conducted using metric variables. The overall objective was to discover and define groupings of points on the basis of their metric attributes. It should be noted that two points were omitted from the statistical analysis because they were clearly

Figure 4.1, cont. Obsidian Point Variability



not Neolithic, but Chalcolithic transverse arrowheads. These were found in association with Chalcolithic pottery in matrices close to the surface on the top of the mound and it was felt that their inclusion would skew the analysis and effect the results of the Neolithic point groups. Because this depended entirely on metric analysis of form, only complete points and bifacials were selected (n=253: obsidian n=246, flint n=7).

Three separate analyses were performed: (i) unweighted pair-group Cluster Analysis; (ii) Principal Components Analysis (PCA) and; (iii) multi-sample t-tests. When used in conjunction with each other, they provide an effective means to explore, identify and test associations between metrically defined objects. There were five variables used in the analysis: (i) length; (ii) length:width ratio; (iii) thickness; (iv) tang length and (v) shoulder width. None of these variables show significant correlation (i.e. $R > 0.7$) with any other, suggesting that their values are independently determined (table 4.8).

The initial phase of the quantitative analysis involved the construction of a dendrogram based on an unweighted pair-group average cluster analysis using Euclidean distances (graph 4.5). The principle of all cluster analyses is that calculated differences between objects can be used to identify relationships between similar objects. Single-link clustering is perhaps the better known of the cluster analyses, and I experimented with this approach. This produced unacceptable extended 'chains' of small clusters, common in large datasets because links between clusters are created when any one object in each group becomes similar enough to any one object in another cluster. For this reason, unweighted pair-groups were used, which takes the average linkage score of clusters as the mechanism by which they become linked. This results in smaller number of larger clusters, which *a priori* reflects the nature of the point variability. On this basis, a metric typology of the points and bifacials was constructed. Two basic groups of points can be identified based on their overall size, referred to as Groups 1 and 2 (graph 4.5). Within these, a further 12 nested groups were defined (also graph 4.5), which I will henceforth refer to as Types 1 to 12. As this is a metric classification, their respective means and standard deviations (table 4.9) best express the differences and similarities between the groups. Differences between flint and obsidian points can be examined by examining the typological patterning of the seven flint examples, which were placed in the following groups: 2 in Type 2, 1 in Type 3, 1 in Type 5, 1 in Type 7, 2 in Type 8. In other words, they occur in both Group 1 and 2, taking forms which may have tangs and/or shoulders. Raw material appears to have no direct influence on the basic morphology of points.

To test for the statistical significance of these 12 types a probability matrix was computed for mean lengths, as this was the major distinguishing attribute. The hypothesis was that if these were independent populations, then there should be significant differences between the mean lengths of all type groups using a two-tailed t-test. Critical values were set at 0.05: probability values greater than this would thus suggest that the variables couldn't reasonably be said to have come from two separate populations (table 4.10). Computation of the matrix shows that there are three instances where differences are not significant (marked in bold): (i) between types 9 and 7; (ii) types 4 and 2; (iii) types 4 and 3. Examination of this table shows that despite this, these types can still be considered valid, as in these specific cases the distinguishing variable is not overall length, but tang and shoulder characteristics.

The relative relationships between the point groups is clarified by using a principal components analysis (PCA). At the same time this allows further insights to be drawn into the integrity of the quantitative typology. The PCA analysis reduced the five-dimensional data to two principal components (Factor 1 and Factor 2, graphed respectively as the *x* and *y* axes). The weights of the individual variables to the composition of the two axes show that length and thickness are the prime contributors to Factor 1, with width ratio and tang length to Factor 2 (table 4.11). About 66% of the variation is accounted for by these two axes, providing a reasonable medium to explore patterning. What this means is that values clustering in the upper right quadrant tend to be shorter, thinner and wider, and will tend to exhibit wide shoulders and longish tangs. Those in the bottom right will be similar, except for being wider than the former and with longer tangs. The bottom left quadrant will be long, thick and narrow with smaller tangs and shoulders. Those in the upper left will be smaller, thin, and narrow with large tangs and shoulders.

Examination of the plot shows clustering in a manner consistent with the results of the cluster analysis (graph 4.6). To the far left and just below the *x*-axis lies Type 1, with Type 2 towards the right and just above the *x*-axis, as does Type 7 – all of which are large to medium sized, without tangs or shoulders. Those to the right are the smaller examples, with tangs and shoulders, divided primarily between proportionally wider and narrower examples depending on their position along the *y*-axis. Beyond providing a reliable test of the quantitative typological scheme, the PCA allows 'distances' between groupings to be assessed. For instance, the three types that can be demonstrated to be, on metric criteria, the most distant from the 'centre' (i.e. the hypothetical mean of all variables) are Type 1, Type 3, and Type 12. In their own way these demonstrate the variability of point/biface morphology: from extremely large with no tangs or shoulders, to large tanged pieces with no shoulders to small tanged and shouldered examples.

Analysis of retouch morphology

The final stage of the point/biface analysis was to test associations between the defined form types and their types of retouch. This was best accomplished by tabulating the variability of retouch against the defined point types. Four variables were used to define retouch type: (i) ventral retouch extent (*vre*); (ii) ventral retouch morphology (*vrm*); (iii) dorsal retouch extent (*dre*) and; (iv) dorsal retouch morphology (*drm*). Note that this analysis was only concerned with the modification of the point body, not tangs, as in most instances, even when there is an absence of retouch on the body of the point, the tang necessarily shows evidence of retouch modification. There were 72 different combinations of retouch on the sample of nearly 300 points. Of these, 30 combinations occurred more than once and complete and bifacial covering with scalar retouch is the most prevalent with 102 observances (36%) of the total sample (n=280). Completely unmodified bodies are the second most prevalent at almost 7% of the sample. Retouch forms that occur on more than one point are provided in table 4.12, in the format '*vre & vrm*' : '*dre & drm*'.

In certain instances, clear differences can be seen between the retouch styles on the twelve metric types. Covering scaled bifacial retouch is most commonly associated with Type 1 and Type 2 points – the two largest types in the scheme – and over 60% of all points with no ventral or dorsal retouch fall into Type 5. However, a more useful means to demonstrate the pattern is to examine the retouch extent by metric type (graph 4.7). This shows several interesting associations. Type 1 and 2 points are all bifacially retouched, completely covered with retouch in the case of the former. Types 3, 4, 5 and 6 show the only occurrences of no retouch, although they also possess some completely bifacial to unifacial examples. Types 7 and 8 are predominantly bifacially retouched, although this varies between complete and partial bifacial retouch. Type 9 shows the highest proportion of unifacial retouch. Types 10 to 12 show mainly covering bifacial retouch, with fewer instances of partial bifacial and unifacial retouch.

Certain of these patterns are suggestive of relationships between some point shapes; because the types were defined using a cluster analysis there are, by definition, sub-clusters of related point types (see figure 4.8). The distribution of retouch form matches these relationships. For example, types 3, 4 and 5, which form a sub-cluster, show the highest incidence of no retouch. Types 1 and 2, 7 and 8, and 9 to 12 also form sub-clusters and share similar retouch characteristics.

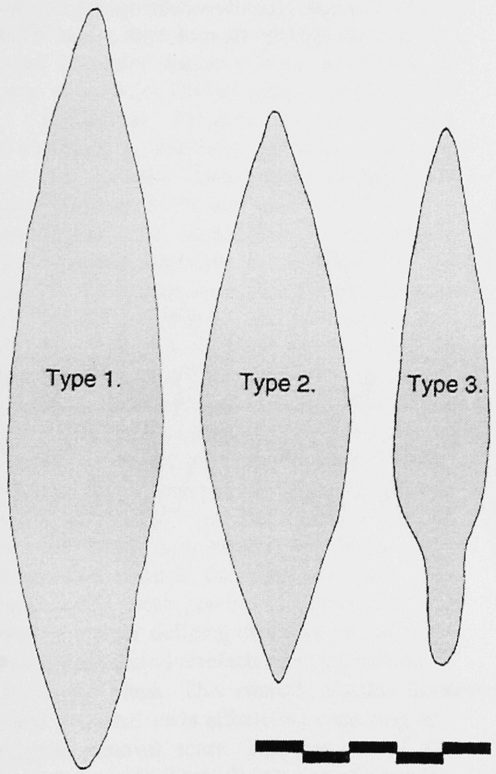
This analysis does support the creation of 12 distinctive and statistically valid types of points in the assemblage, based primarily on shape variability, but also retouch styles.

Qualitative description of Çatalhöyük point types

On the basis of these quantitative tests, the 12 point types can be qualified in the following manner. Illustrations of the basic outline of these types are provided in figure 4.2.

1. Type 1 consists of large (mean length roughly 163mm) untanged, unshouldered objects. As a group they are the largest objects. They are always bifacially retouched, typically scalar covering retouch on both the ventral and dorsal faces.
2. Type 2 points are smaller examples of Type 1, with a mean size of approximately 120mm. Retouch is always bifacial, typically scalar and covering.
3. Type 3 are close to the size of the former (mean length roughly 114mm), but have tanged and unshouldered, bases. Most of these don't have any retouch on their dorsal surface. 60% are retouched on only one surface

Figure 4.2 Çatalhöyük Point Typology



(typically ventral), the other 40% show parallel to scalar bifacial retouch.

4. Type 4 are large tanged and shouldered points which are on average 120mm in length. This type has the smallest number of members, but was felt to be necessary because of the significant size difference between its members and those in the Type 5. This type has no retouch on either face.

5. Type 5 are wide points, with an average width over a quarter of total length. Their mean length is just under 100mm, and they have tangs and shoulders. Unlike other basal-modified pieces, the widest point occurs mid-body rather than at the shoulder. About 52% have no facial retouch at all, fewer have unifacial retouch on their ventral surfaces. A small number show bifacial retouch.

6. Type 6 points are medium-sized (mean=88mm), tanged but not shouldered, and relatively narrow. Retouch is variable: it is mainly bifacial, sub-parallel to scaled and long to invasive, but occasional unifacial examples are encountered.

7. Type 7 consists of points without tangs or shoulders, medium lengths (c. 80mm), that on average are very wide in relation to length. They are typically bifacially retouched with scalar to sub-parallel retouch that is covering to long in extent.

8. Type 8 are relatively small points, with tangs and without shoulders that are on average over 20mm smaller than Type 6 points (c. 65mm). They are mostly bifacially retouched, varying between sub-parallel to scalar retouch on both faces. The dorsal surface typically shows covering to invasive retouch, the ventral face varies between short to covering retouch.

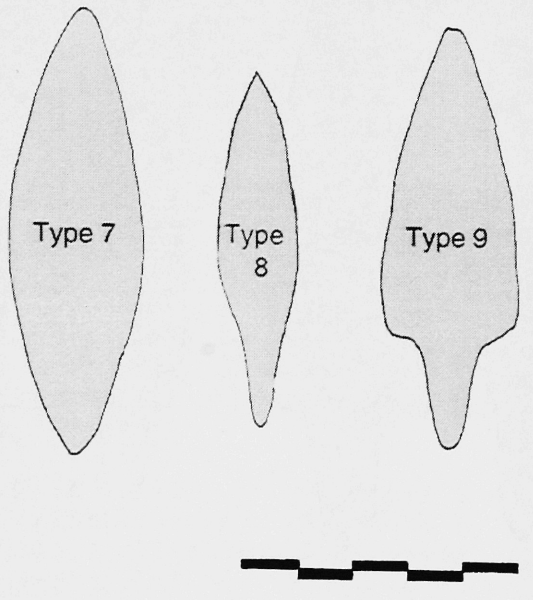
9. Type 9 points are tanged and shouldered points of medium size (c. 76mm), about 20mm shorter in length than the next largest tanged/shoulder variety (Type 5). These are also among the widest points, with a mean width more than one third that of mean length. Retouch is variable: 50% have unifacial retouch (only on the dorsal surface), the other 50% show bifacial (sub-parallel to scalar) retouch.

10. Type 10 are tanged and shouldered, although fairly small size (c. 58mm) – on average nearly 20mm shorter in length than Type 9 – and with a proportionally very wide and long tang. Their retouch is predominantly bifacial, although about 30% have no ventral modification. Otherwise retouch is typically covering to long, and sub-parallel to scaled.

11. Type 11 points are the second smallest in the typology (mean length=45mm), none of which are shouldered, although some have tangs. This group was not sub-divided into tanged and untanged varieties, as in my opinion its distinctiveness from other types is meaningful without further separation. Where present, the tangs on average constitute approximately one quarter of total length. Retouch varies mainly between completely bifacial scaled to sub-parallel, to short and scaled bifacial, although a small number of unifacial examples were encountered.

12. Type 12 are the smallest points in the typology with a mean length under 40mm and proportionally the widest pieces. They are tanged and shouldered, with long tangs, on average just short of 50% of total length. The overwhelming majority are bifacially and completely covered with scalar retouch. A smaller

Figure 4.2, cont. Çatalhöyük Point Typology



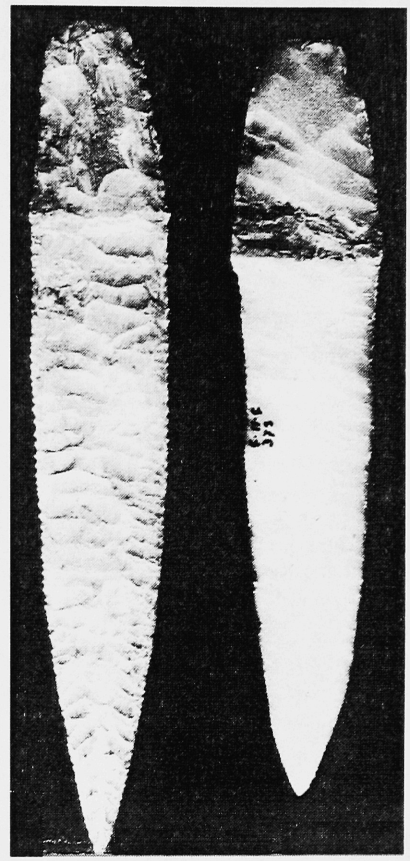
number show bifacial sub-parallel and invasive scaring and a few unifacial examples were found.

The archaeological value of this statistical exploration is that some semblance of order has been placed on what was originally a disparate set of objects. This represents the first attempt at a statistically derived point type definition for any Central Anatolian Neolithic site. The 12 types of points were established using a combination of statistical methods, which offers a reliable mechanism for exploring morphological variability. Statistical viability of the types were established and some forms were correlated with retouch styles. Although in no way 'contextual', this was necessary for the establishment of a mechanism by which data patterning by context could be initiated. However, as will be seen in Chapters VI, these 12 types show significant regional and contextual patterning which strengthens their validity.

Flint Daggers

This group contains those pieces of fine-grained translucent tabular flint blades which have been retouched in such a way that they appear to have been hand-held, hilted, implements. As they are double-edged, the term dagger seems most appropriate. There are only eight pieces in the analysed assemblage that can be reasonably distinguished from other retouched flint blades (particularly the category of blades 'retouched to a distal point' examined in more detail later). Examination of Mellaart's reports suggests that there are at least two additional examples that have been removed from the Konya Museum collections. One of these is on display in the Anatolian Civilisations Museum in Ankara, the whereabouts of the other is unknown. However, sufficient information can be gleaned from their descriptions, photographs and/or drawings in the site reports to contribute to this discussion. As mentioned, these pieces are exclusively manufactured on fine-grained tabular flint that must be an imported raw material. One example displays some marginal remnant cortical surfaces (figure 4.3), and cortical surfaces are known from other types of artefacts manufactured on similar raw material. However, the lack of any cores, significant amounts of production-associated debitage or other blank-types of tabular flint suggests that these objects were imported either as blanks or as ready-made objects. Complete examples of daggers range in length from 100mm to 219mm, and are on average over four times as long as wide (widths between 26mm and 49mm). Six of the eight pieces have fine parallel retouch, the other two have sub-parallel, and are generally more precisely knapped than the finest of the points. A further defining characteristic of these exceptionally well-manufactured artefacts is a constriction of the proximal end of the blank. This retouch radiates from both the lateral and proximal ends effectively removing any trace of the original removal scars. The purpose of the constriction appears to be to facilitate the placing of a handle, as two examples actually retain pommels of bone that socket

Figure 4.3 Flint Daggers (upper, Mellaart 1963)



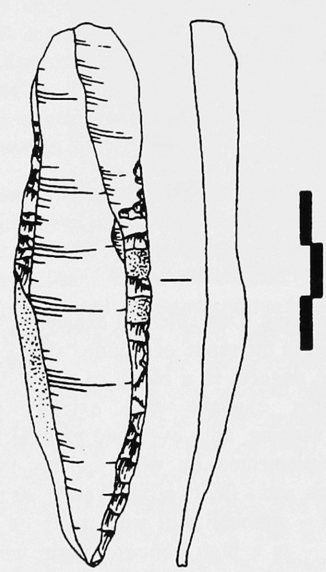
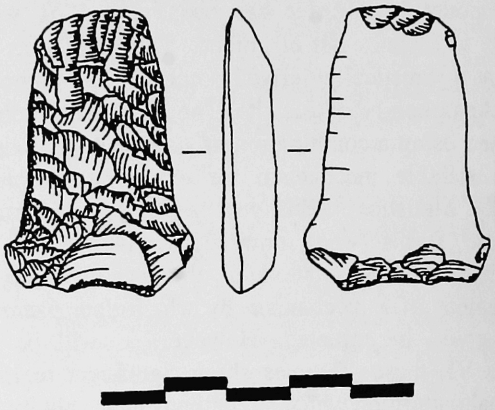


Figure 4.4 Hafted Flint Dagger

Figure 4.5 Dagger Haft



over the narrowing. One splendid example of this is a bone handle, carved in the shape of a coiled snake, found with the largest of the daggers in a burial of Level VI (figure 4.4). This particular example also exhibits perfected and symmetrical shaping, with even and parallel dorsal pressure retouch, complemented by what appears to be a ground ventral surface, and a finely serrated edge. At the other end of the spectrum – although still well made on imported fine-grained flint – is a high concave blade with short dorsal retouch, an unmodified ventral face, and a remnant cortical surface. This piece retains some dorsal scarring, its butt and bulb of percussion, the morphology of which shows that it was knapped from a large single platform core by percussive methods. On a single piece it is impossible to say whether this was direct or indirect (i.e. punch) retouch. Such diagnostic technological details are lacking on the other examples, but given their overall similarity, they were likely to have been manufactured using the same process.

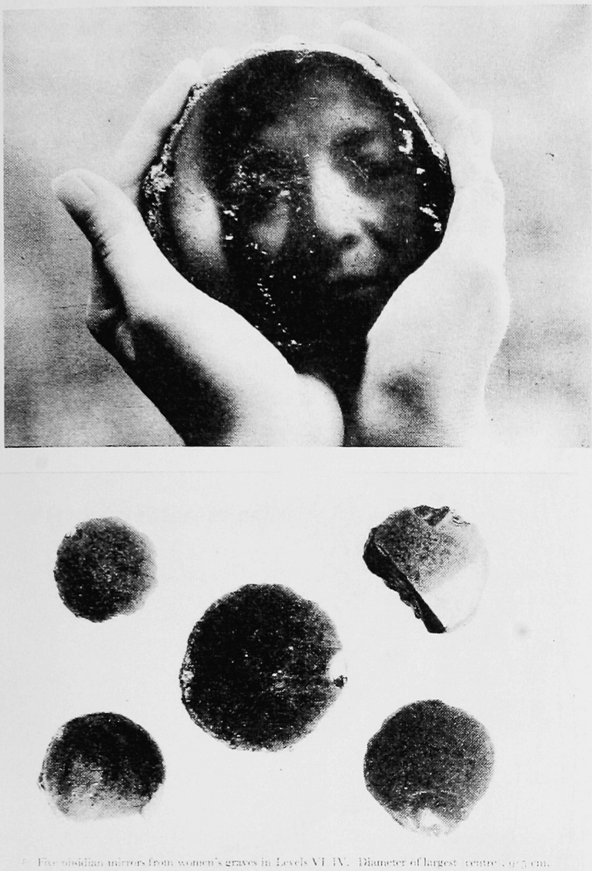
There are also two flint objects that appear to be the hilted proximal ends of broken but originally similarly shaped daggers (e.g. figure 4.5). These, however, have been subsequently modified into what appear to be some form of scraping tool as they have semi-abrupt scalar retouch scars one their broken ends.

Obsidian Mirrors

The second group of objects is recognisable by the presence of large, often round, artificially flat, polished and reflective surfaces. There are seven examples constituting only 0.18% of all retouched/use-modified debitage. There is a possibility that this group can be confused with single-platform flake cores, as to produce the rounded plano-convex shape, parallel flakes were taken from what was to become the reflective surface (figure 4.6). The maximum dimension across the face of the complete mirrors ranged from 69mm to 80mm, with a mean thickness of 38mm.

Examination of five finished mirrors and two preforms suggests that the objects were manufactured using a large block of obsidian that was fractured in such a way as to produce a secondary block that possessed a relatively flat area which was to become the reflective area. If needed, further flakes were removed from this face to make it flatter, and the body of the mirror was shaped by parallel flaking using the flat face as a platform before the surface was polished. Mellaart queried the technology needed to produce a highly reflective mirror surface nearly thirty years ago and

Figure 4.6 Obsidian Mirrors (Museum of Anatolian Civilisations, upper, and Mellaart 1963, lower)



the exact techniques used at Çatalhöyük are still enigmatic. My examination of the surface of two unfinished examples suggests that initial polishing was performed using an abrasive of sufficient coarseness to produce macroscopically visible etching and abrasion, visible as an grey opaque colouring on the surface. This was sufficient to create a very flat surface that could be polished using a fine-grained abrasive (such as silt), followed by a very fine polishing buff (such as leather).

These objects are unique to Çatalhöyük: there are, to the best of my knowledge, no other similar examples in the Near East. Their use as mirrors, in the sense that a reflective surface was the 'functional' property cannot be disputed. In some instances, limestone paste was applied to the edges, which suggest that they were portable objects, intended to be held rather than being placed in walls. Their occurrence in burials also supports the idea that they were portable objects. Their depositional context will be further examined in the Chapter VI.

Large Retouched Obsidian Flakes

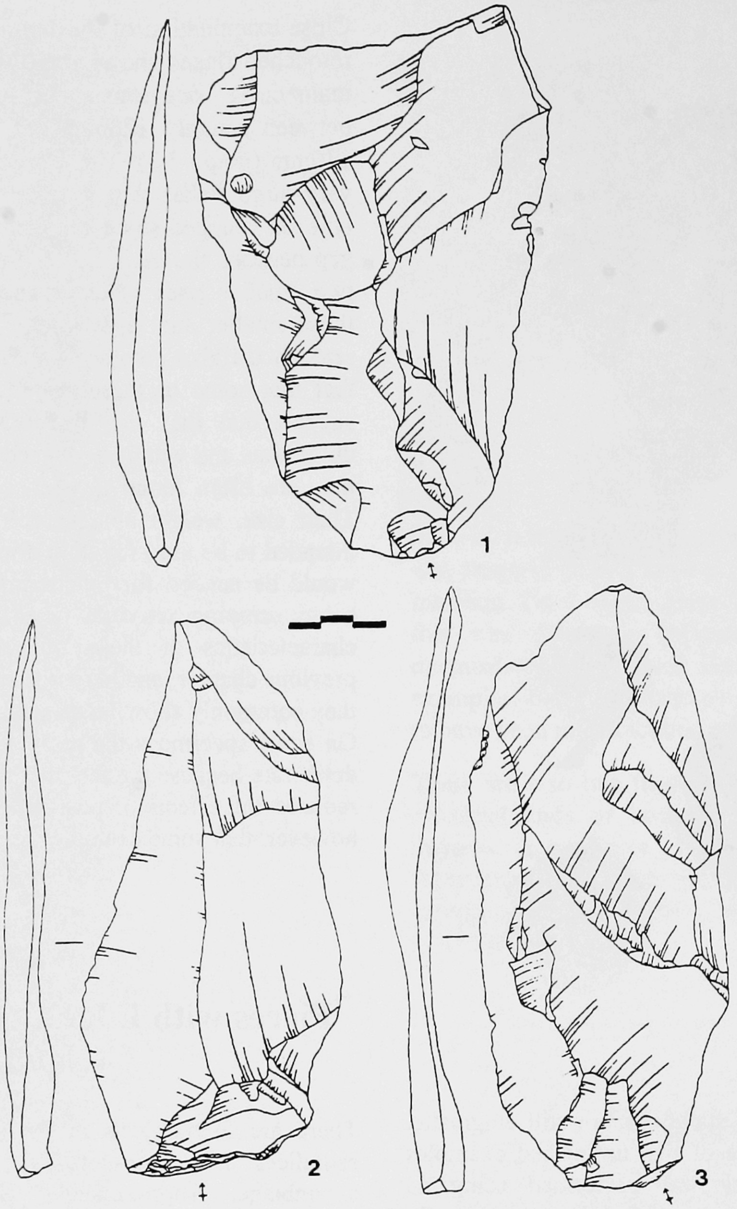
Close examination of the frequency distribution of obsidian retouched flakes shows three small rises to the right of the main curve: one starting at approximately 90mm, another between roughly 120mm and 140mm, and yet another at 170mm (graph 3.3). These are caused by a small number of very large flakes that together constitute the third primary type of knapped-stone artefact (e.g. figure 4.7). There is a gap between the main body of the distribution curve and the two smaller rises which argues for a distinction between those smaller and larger than 110mm in size. There are 14 retouched flakes greater than 110mm in the assemblage. The fact that some of these are found together in caches does suggest that they can be considered separately from the ubiquitous and widely dispersed smaller flakes. For example, they are often found in caches underneath building floors. Their size, weight and retouch suggest they were used or intended to be used for some form of 'heavy' cutting, such as would be needed for butchering large animals, or similarly heavy scraping activities (e.g. figure 4.13:6). The technical characteristics of these objects were considered in the previous chapter, and here it is sufficient only to reiterate that they commonly show large, well-prepared, and faceted butts. On some specimens the retouch is marginal, but apparently deliberate because the fact that they were cached would have reduced the effects of post-depositional damage. It may be, however, that some examples represent raw material hoards.

Pieces with Edge Crushing and Pièces Esquillées

There are 599 objects in the sample identified as pièces esquillées. This represents 15% of the retouch/use-modified assemblage. Approximately 1.2% (n=6) are flint, the remainder obsidian. Of the total sample of 599 pieces, 355 were subject to an attribute analysis and form the basis of the following discussion.

Pièces esquillées are commonly found in Neolithic Anatolia and the Near East, and are one of the few clearly recognised 'types' in the Çatalhöyük assemblage that has parallels beyond the Konya Plain. Tixier's definition (1963:146) is the most commonly followed for these enigmatic objects: "Pièce generalement rectangulaire ou carée parfois de tres petites dimensions, presentant à deux de ses extremités (rarement a une seule) des esquillements le plus souvent bifaciauz, causés par percussion violente". There is some concern that they can be confused with bipolar cores (Hayden 1980, Perlès 1981), although Newcomer & Hivernel-Guerre (1971) suggest that this is unlikely given the generally small size of the scars on pièce esquillée (Ataman 1989:208-9). The latter have been the subject of a microwear analysis by Ataman (1989:209-210), who found that experimentally they were best suited for splitting dry and green wood, although the resulting wear

Figure 4.7 Large Obsidian Flakes from North Area Cache (note scale)



patterns could not be distinguished from (unsuccessful) attempts to split bone and antler.

Fortunately this debate concerns only their function – definition of the category is well defined and accepted (Baird 1993:145). However at Çatalhöyük it is unlikely that the pièces esquillées were cores, because of their small size. Close examination of their characteristics suggests that they were used as chisel or wedge type implements. Note, however, that a small number of bipolar anvil cores have been identified that have been termed 'cores of pièce esquillée type' (see previous chapter).

The Çatalhöyük pièces esquillées can be separated into two sub-groups. The first consists of pieces with crushing and scarring on one or both sets of opposed ends. The second group is made of irregularly shaped pieces that also show evidence of crushing and scaring, but only on a single edge. The former can be considered as 'true' pièces esquillées, matching Tixier's description, the latter as a related group of objects, termed 'pieces with edge crushing'. Both are considered in further detail.

'True' pièces esquillées

Approximately 33% of the sample (n=117) can be considered as true pièces esquillées. Extensive scarring make blank identification difficult or impossible, although where it can be determined there is a preference for flake blanks (approximately 70%) (table 4.13). Pièce esquillée lengths show a relatively normal distribution with a range from approximately 10mm to 42mm (graph 4.8). Widths range between 2mm and 10mm and also show relatively normal distribution although there is a small peak to the right of the distribution at 17mm (graph 4.9). The mean length to width ratio is 1.4, with a distribution suggestive of a tri-modal population (although admittedly superficial): the majority have a length to width ratio between 0.6 and 2.1, a smaller number are more elongated with ratios between 2.2 and 3, and at the extreme right of the distribution a small peak at 3.9 can be seen (graph 4.10). The scatter-plot of length:width ratios by thickness suggests that as the ratio increases, so too does thickness (graph 4.11). On the basis of this information combined with a more impressionistic evaluation of the pièces esquillées, it seems reasonable to classify them into two different forms: (i) distinctive thin, 'gun-flint' shaped examples with a sub-square to square outline and scars covering the ventral and dorsal faces, with length:width ratios less than 1.5 (figure 4.8); (ii) thicker lozenge-shaped to elongated rectangular examples which also have bipolar crushing and scaring, but have length:width ratios in excess of 1.5 (figure 4.9). Approximately 54% (n=63) of the pièces esquillées fall into the 'gun-flint' category . They are very distinctive – parallels of these beyond Çatalhöyük are difficult to find although, of course, examples of less well formed examples can be seen in most Neolithic assemblages.

With regards to the manufacturing process of pièces esquillées, once again Tixier (1963:146) is enlightening insofar as he suggests that there are three stages to the formation of pièces esquillées: the process typically begins with a small blade or flake with short to long bipolar removals, followed by invasive to covering bipolar removals, finally leading to a completely covered specimen with both bipolar and bilateral scarring. This pattern could also explain some of the differential scarring seen in the gun-flint pieces. In most cases it was relatively easy to identify the direction of removal of the blank because even those with ostensibly bipolar covering retouch often left small areas toward the lateral edges which provided an indication of blank orientation. The observed patterning indicates that there are very few bilateral examples – most of the scarring is located

Figure 4.8 Pièces Esquillées of 'Gun Flint' Variety

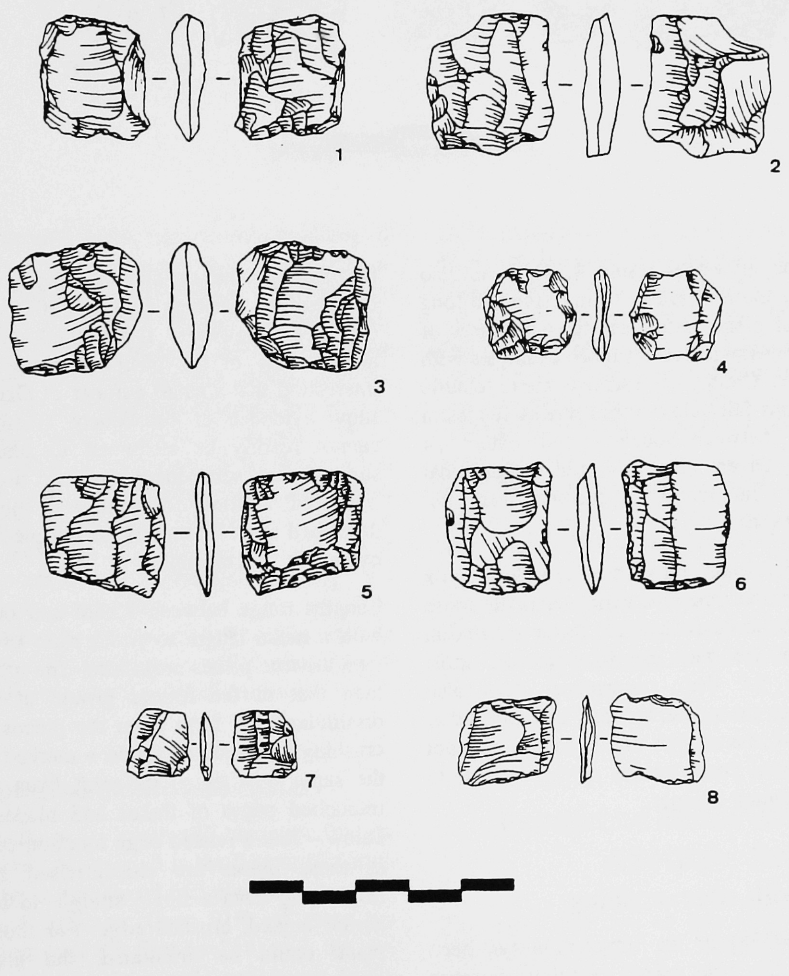
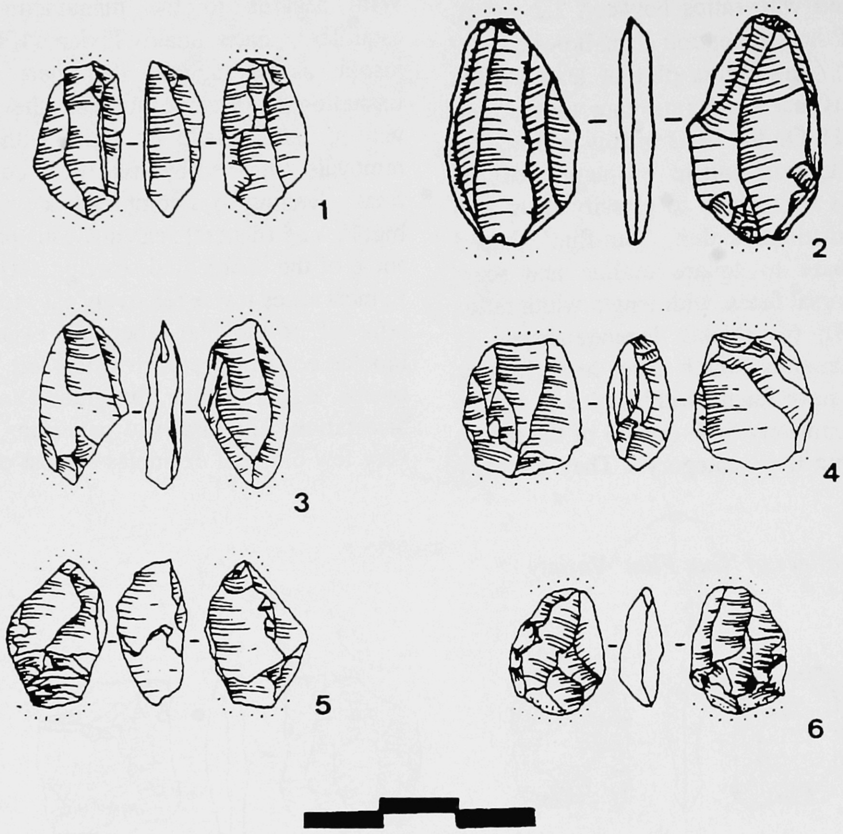


Figure 4.9 Pièces Esquillées of 'Elongated' Variety



on either bipolar or on all edges (table 4.14). It is also interesting that there are more instances of invasive and long retouch scars on bipolar pièces esquillées than instances of covering retouch. The reverse is true for those examples with modification on all edges. Chi-square tests become unreliable when several observations fall below 5, but results suggest a significant association between location and extent of modification ($p<0.01$). Given this, it would appear that Tixier's assessment of the formation process does not contradict these observations.

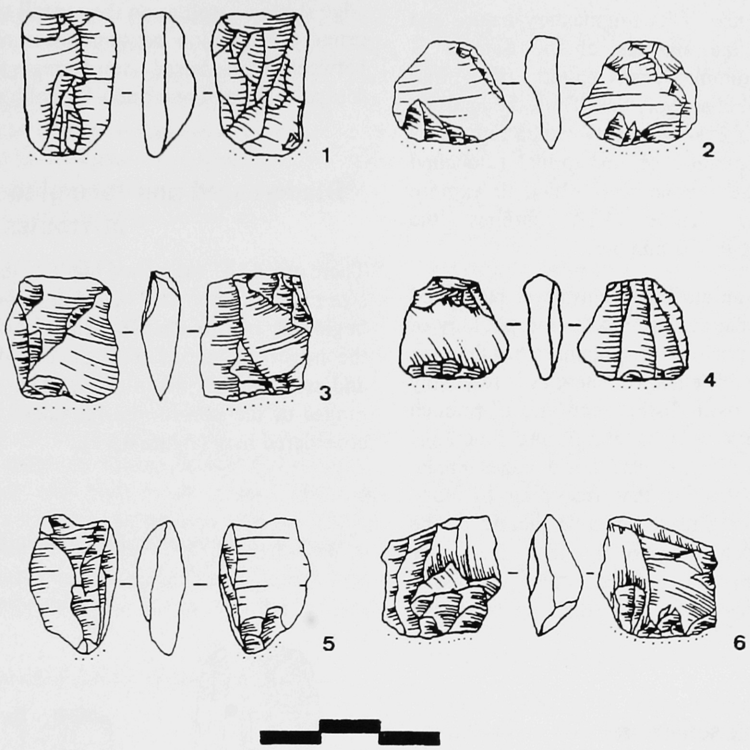
The small size of both the tools and scars of the Çatalhöyük pièces esquillées – both the gun-flint variety and the more irregular examples – is comparable with those from Can Hasan III, where tool use was identified as the most reasonable explanation for their occurrence. This also strongly argues for these pieces being used as tools rather than cores. The actual process of their use, however, may not be that different than anvil cores insofar as they appear to have been used in a 'wedging' manner.

Pieces with edge crushing

Approximately 67% (n=238) of the sub-sample has been classed separately from the 'true' pièces esquillées because they show neither the same regularity of form, nor the typical opposed-end crushing (figure 4.10). As with the true pièces esquillées, however, flake blanks are favoured, forming almost 68% of the obsidian examples (table 4.15). It is interesting that a small number of blade and flake cores also show evidence of subsequent crushing and scarring that cannot readily be attributed to blank production, which suggest that subsequent to their use as cores they were 'recycled' as tools comparable to the flake-based examples described here. In contrast to the pièces esquillées, there are numerous flint examples.

Lengths range between 12mm and 60mm (mean 25.9mm), with a mean length to width ratio of 1.6 – slightly greater than the true pièces esquillées. The mean width is also larger than that of the former group, at 9.6mm. Despite their dissimilarity of form from the pièces esquillées, their edge crushing and scarring shows a marked resemblance – and, at the same time, is so different from the more traditionally retouched edges of flakes and blades considered in detail below – that a related edge function seems likely. The edges of these pieces are characterised by extensive scarring originating from a single straight to irregular, low to semi-abrupt angled, crushed edge. For those cases in which the blank could be orientated, the majority have scarring originating from one of the polar ends rather than a lateral

Figure 4.10 Pieces with Edge Crushing



edge (table 4.16). In several cases, there is also evidence of damage – although without the same degree or type of scarring – on an opposed and abrupt surface. This could be attributed to a platform suitable for percussion. Given this morphology, it may be that some of these artefacts are more akin to heavy 'wedging' and more forceful striking than the thinner and less robust pièces esquillées. Whether this is at all related to the material being worked is uncertain. It is possible that the separation of pièces esquillées from pieces with single crushed and scarred edges does not make functional sense insofar as they both appear to be used for percussive splitting, wedging, or chiselling activities. It is also possible that these objects are at the beginning stage of a process which ultimately results in a 'true' pièce esquillée. However, given that the two groups are so morphologically distinct, I believe the differentiation is useful even though they may represent two ends of a functional continuum.

Other retouched blades and flakes

This final class serves as a 'catch-all' category for the majority of the retouched debitage. It is the largest of the six basic retouched tool types, totalling 2,665 pieces, or just over 67% of all retouched debitage. Over 91% of these are obsidian (n=2,439), just over 8% flint (n=218) with the tiny remainder divided between quartz (n=6) and basalt (n=2). The contribution of the basic debitage categories that form the blanks for this large and generally non-standardised array of tools can be found in table 4.17. Here it can be seen that, overall, there are approximately 10% more retouched blades than flakes. The category designated as 'other' consists primarily of shatter and indeterminable debitage, although these contribute only a small percentage to the total. These artefacts take highly variable forms and in all probability represent a near complete range of the functional activities stone tools can possibly be used for. For reasons outlined earlier, it was felt that the best way to characterise this collection was by an attribute analysis of the morphology of the retouched edges. As the attribute analysis requires a relatively in-depth analysis of recorded data, and is a relatively novel approach to the analysis of retouched pieces, it has been presented as a separate section in the chapter.

Retouched Blade and Flake Edge Attribute Analysis

The basic objective in this section is to characterise the assemblage based on selected attributes of retouch morphology – this offers a much more systematised way to describe retouch characteristics than using broadly defined type categories. Definitions of variables and retouch attribute states can be found in Appendix 1. The data subject to this analysis comes from Samples A, C and D. The Sample B material was omitted because of its fragmentary nature and the objective governing the analysis of the Sample B collection was solely to examine density patterns on a gross scale, not debitage and tool characteristics. Thus, the analysis was conducted on a total of 2,043 artefacts, which represents nearly 77% of the total number of non-formal retouched pieces, providing an ample sample with which to explore morphological variability. Table 4.18 outlines the contribution of each sample to this number.

One of the advantages of an attribute analysis of retouched debitage is that it focuses the analysis on the morphology of the retouched edge and its position on a blank rather than the blank itself. The benefit of this emerges when, as is relatively common, there are two or more distinct episodes of retouch on a single blank that may well have differing functions. Blanks with, for example, scraper and burin edges create immediate typological difficulties that recording by edge overcomes. It also provides a more accurate picture of the total variability of retouch morphology than the more conventional methods allow. To this end, there are 2,875 discrete (i.e. non-continuous) retouched edges on the 2,043 pieces in the sample.

Blank selection

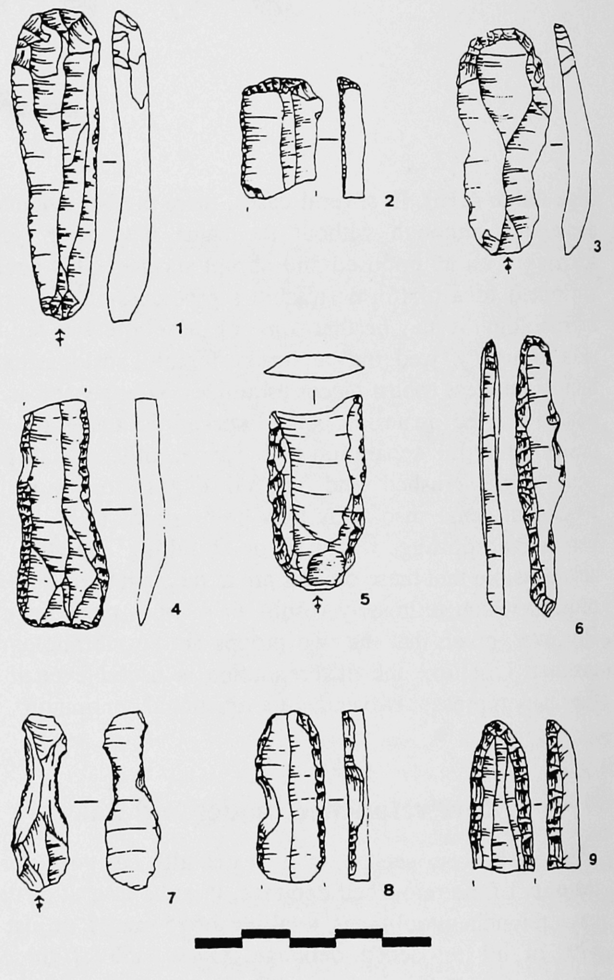
The 2,043 blanks can initially be divided into their basic debitage categories (table 4.19). Given the obvious morphological differences between different forms of debitage, it seems a reasonable proposition that debitage type (i.e. the selection of the blank) has a determining effect on both the overall shape of the tool, and the overall delineation of a retouched edge. Flakes, for instance, often have a much greater surface area to total edge length ratio than blades, because they are naturally rounder than the latter. This alone alters the basic shape of the tool, and may play a role in the selection of flake blanks for certain tool functions. As prismatic blades have straighter edges and are thinner than non-prismatic blades, this too will influence the final form of the retouched piece. Similarly, shatter has a different set of qualities that makes tools on this form of debitage morphologically distinct from those on other forms of debitage. Although I am not assuming a direct correlation between blank form, edge morphology and tool function, a relationship between the three can at times be demonstrated insofar as edge shape is partially determined by the original shape of the blank, and function is related to edge shape (Grace 1989). This is illustrated by the data presented in table 4.20, where the different delineations of the retouched edges are more frequently associated with particular debitage categories. As can be seen, there are substantial differences between the two blade groups and the flakes: the two highest delineated edge categories for the former are irregular and denticulated edges, whereas irregular and convex edges typify the latter. Together, these three delineations constitute 83% of all modified edges.

Given the proposition that debitage has an effect on final edge shape as well as on the overall morphology of a tool, the primary distinction between these retouched pieces will be between blade-based non-formal tools, flake-based non-formal tools, and other non-formally retouched debitage.

Blade-based non-formal tools: description of attributes

There are 1,187 retouched blades (58.1% of the sample). The size range of retouched blade debitage was discussed in at the beginning of this chapter. This, however, included some of the larger categories of retouched debitage such as points, and so cannot be taken to represent the more restricted size ranges of the non-formal retouched debitage that are being considered here (figure 4.11).

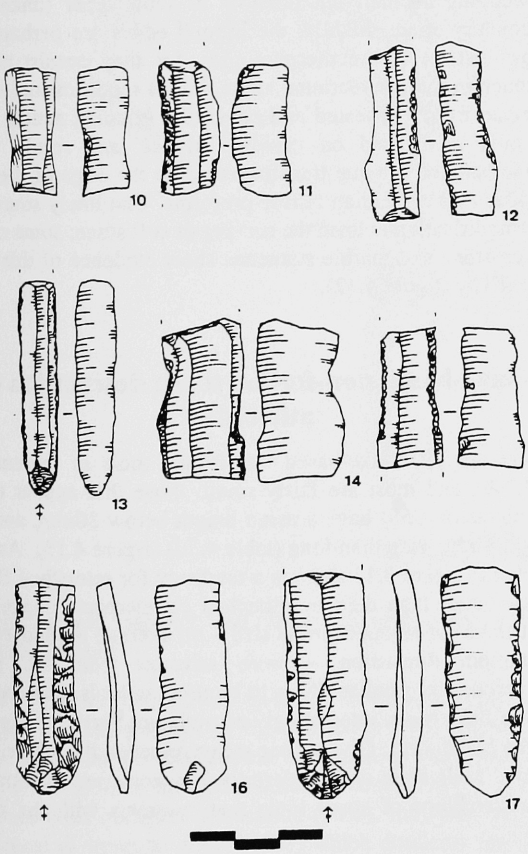
Figure 4.11 Retouched Blade Variability



As there are a number of snapped and fragmentary pieces, and an even larger number where it is difficult to ascertain whether they are complete or not, width provides the best measure of size for comparative purposes. Comparisons of these measurements suggest that non-prismatic blade tools are on the whole wider and thicker, both absolutely and relatively, than prismatic blade tools (table 4.21). The diagnostic measurements of those tools that can be reasonably confidently identified as complete are provided in table 4.22, where it can be seen that non-prismatic blade tools are also, on average, approximately 10mm longer with a greater length:width ratio than prismatic blade tools.

Although there are 1,926 discrete retouched edges, 672 of these make more sense considered in conjunction with one another because they occur on the left and right hand side of a blade. If these are grouped together, 1,253 instances of retouch can be identified on sixteen different areas (table 4.23). The location of modification is characteristically on the left and right side of blanks for all four raw material types. There is also a good correlation between the location of retouch on obsidian and flint blade blanks, with the possible exception of a tendency in the case of the latter for slightly high proportions of retouch to be occur on the left side. Proximal end retouch occurs on both flint and obsidian blades, but never extends down the left or right sides. There are, however, two instances of distal retouch extending to the lateral edges. This is in contrast to flake blanks, where continuous proximal to lateral edge retouch is more common.

Figure 4.11, cont. Retouched Blade Variability



There are some conspicuous differences between the delineations found on flint and obsidian, the most notable being the much higher prevalence of convex and absence of denticulated edges on flint pieces in contrast to that seen on obsidian (table 4.24). As convex edges are the sort usually associated with scrapers (in a typo-functional sense), and flint is a more robust material and better suited to scraping activities, this difference is comprehensible. In the same way, different physical properties may be an important factor in the higher proportion of denticulated edges observed on obsidian, as this may be caused by extended use of the obsidian tools, rather than of deliberate shaping.

If we now begin to look at combinations of retouch attributes on blade blanks, several patterns emerge. For instance, cross-tabulation of retouch location by retouch position clearly shows that most retouch (roughly 39%) is both direct and concentrated on the left and right edges (table 4.25). This is also the case for inverse retouch, although at the same time, there are far more incidences of single edge retouch than occur with direct retouch. Bifacial and alternating retouch occurs far more frequently on both edges than any one edge. It is an interesting point that retouch over all edges (i.e. both lateral and polar edges) is most often direct.

Cross-tabulation of edge delineations by edge location on blade blanks also shows interesting associations (table 4.26). Although for the most part irregular and denticulated delineations are the most frequent across all locations, there are some interesting exceptions and variations to this. Retouch on proximal edges, for example, is as likely to be beaked as it is to be irregular, whereas on the distal end it is more likely to be convex. The former can be explained by a preference for piercers and (the very small number of) burins on the proximal end, whereas the latter appears to be caused by a predisposition for scraper-type modifications to be located distally. However, in those instances of retouch on both the proximal and latter edges, it is principally irregular or rectilinear. Individual instances of retouch on the left and right edges show close similarity, although combined left and right retouch has greater cases of 'retouch-to-a-point'. The low number of pieces with all of their edges modified show a proclivity towards convex delineations.

Approximately 60% of retouched edge angles are semi-abrupt, with the remaining majority low angled (table 4.27). Cross-tabulations show that the former angle class is most commonly associated with irregular and denticulated edges (approximately 78%), with convex and retouched-to-a-point edges following some way behind (approximately 11%). This trend is emphasised in low angled edges, with roughly 87% of the edges irregular or denticulated, followed by regular then convex edges (together about 8%). In comparison, abrupt edges appear to have a lower correlation with irregular edge delineations (64%), and slightly higher with the denticulated edges (17%). Crossed-abrupt angles, perhaps low enough in frequency to be considered anomalous are, nevertheless, again slightly different that the other angle classes because of their greater tendency towards rectilinear edges.

Burin angles predominantly form burin edges – here meaning acute angled edges formed by the removal of a (typically) single facet on a transverse break. However, the three 'beaked' edges formed by burin angles are conventionally known as 'axis' burins (Inizan et al. 1992:77). Burins do not form an important or particularly visible component of the Çatalhöyük tool assemblage.

The majority of blade retouch is short (55%), followed by nibbling (24%) and long (17%) retouch. Examination of the extent of retouch in conjunction with edge delineation also provides some insights into the character of blade tools (table 4.28). This shows the dominance of irregular and denticulated edges, with the exception of covering retouch, which overall has a relatively low occurrence. There are, however, a small number of other interesting associations, notably in the similar frequencies of short and long retouch on retouched-to-a-point delineations, and of covering retouch on both short and long tanged delineations. Concave edges are almost exclusively short but convex edges have nearly as many instances of long retouch. The 14 burin facets are predominantly long or invasive (i.e. the facets extend a considerable depth down the blank).

Figure 4.12 Carved Green-Stone Figure (Mellaart 1967: fig. 75, 76) with evidence of cutting

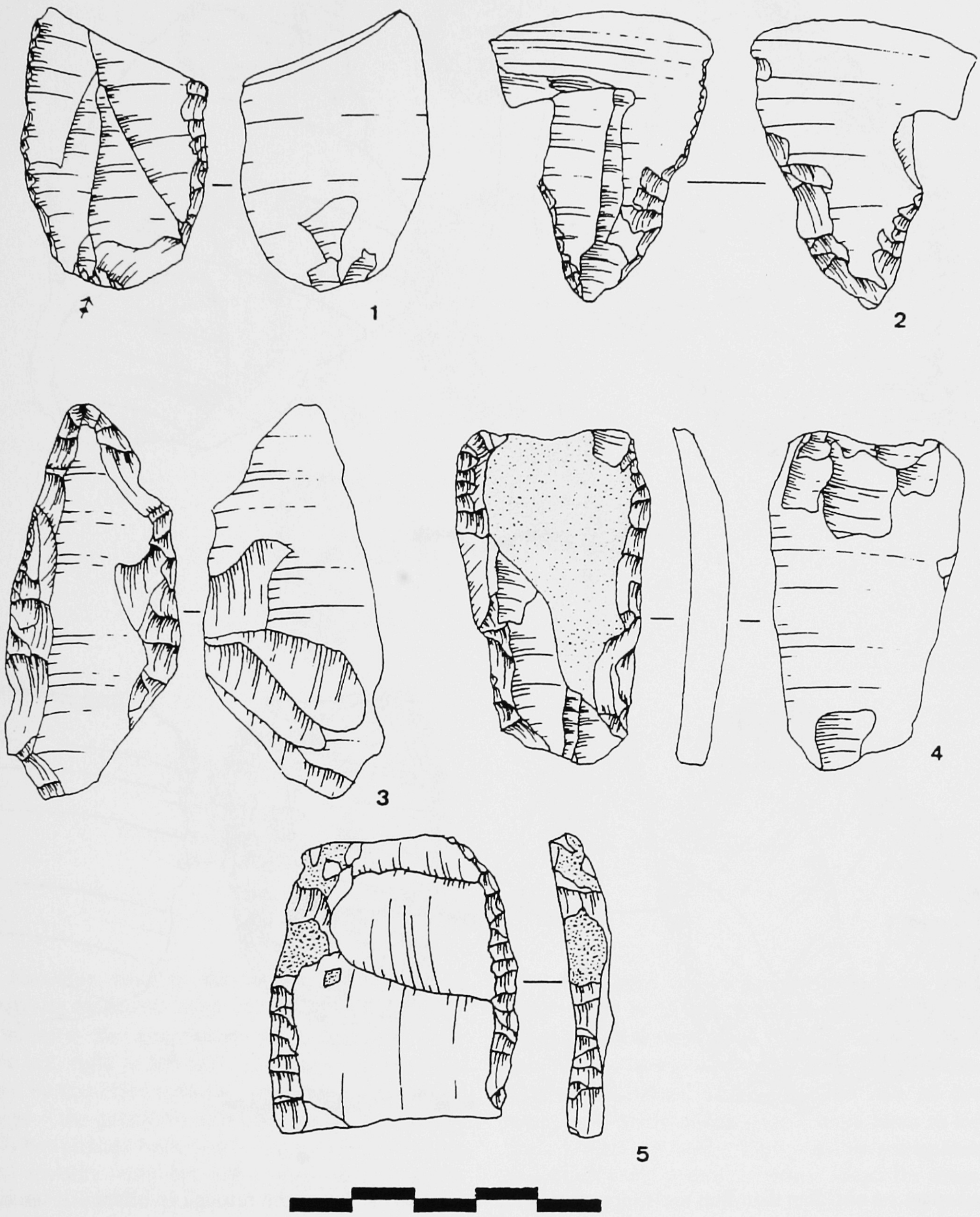
Finally, the differing morphology of retouch can be examined, as this gives an even further indication of the characteristics of these pieces (table 4.29). The three most common morphologies are sub-parallel, irregular and stepped/scaled retouch which are perhaps the products of the simplest forms of retouching actions. However, several facts need to be explained about the other, relatively infrequent, morphologies, as each in their own way is significantly distinct from the typical pattern.

First, parallel retouch implies a greater degree of care and sophistication in the edge shaping process. Its low frequency (1.76%) in this context is to be expected because of the irregular and expedient nature of many of these tools. In comparison, parallel retouch dominates the flint daggers. It is, however, only slightly more common on the points (2.27%). Secondly, the retouch morphology described as 'burin blow' refers to single facets removed to produce a burin edge, and is thus distinguished from other morphologies because it refers to a edge creation process that is considerably different to a typical sequence of blows placed to delineate and angle lateral (or polar) edges. Thirdly, 'crushed edges' describe instances where the modification appears to be derived from repeated and inexact blow to the edge of a tool. Although there is a separate class of tool that exhibits this form of edge, in these eight instances it could not be confidently attributed to the tool being used in a wedging manner, but possibly to some other (unknown) secondary effect. Finally, the ground edges are perhaps the most distinct of the morphologies, for they consist not of retouch in the conventional sense, but of modification that is derived from a repeated and consistent grinding action. This is only recognised on obsidian blanks, and results in a smoothed and opaque transformation to the edge of the tool similar to the obsidian mirror preforms. One likely source of the modification is from the carving of soft stone: some of the green-stone and marble statuettes show evidence of this type of activity (figure 4.12).

Flake-based non-formal tools: description of attributes

There are 791 flake-based non-formal tools in the sample (38.7%), and most are fairly small: those that appear to be complete (n=558) have a mean length below 30mm, and are slightly less wide than long (table 4.30) (figure 4.13). As was shown in figure 3.11 there is a tendency for retouched flakes to be larger than their unretouched counterparts, suggesting that flakes of an appropriate size – on average around 30mm maximum dimension – were selected from the more numerous and smaller flakes to be used as tools. The lengths of the flake tools, interestingly enough, are very close in size to the blade tools. Given these measurements, the whole non-formal tools class can be described in non-specific terms as an assemblage of small tools that contrasts with the much

Figure 4.13 Retouched Flake Variability (1-3 obsidian, 4 & 5 flint)

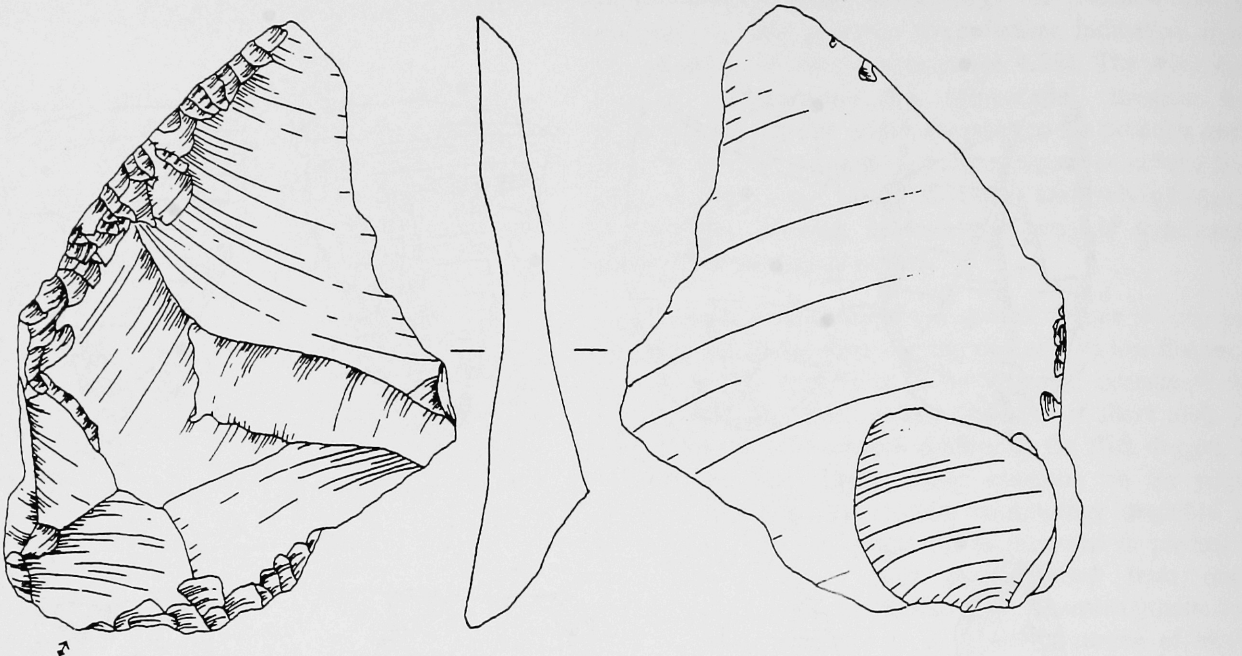


larger points, mirrors and large retouched and cached obsidian flakes.

The 791 flake tools have a total of 880 discretely retouched edges. The morphology of the retouched areas shows some interesting, but not unexpected, comparisons with blade non-formal tools. For instance, although convex edges are the second most common delineation (34%), they are nearly as frequent as irregular edges (37%) which dominate the blade tools (table 4.31). This is possibly a result of the natural rounded edge characteristics of many flakes, so cannot be taken as necessarily representing deliberate alteration of edge shape; as such it appears that blank selection was in part influenced by the desired final edge shape.

Raw material appears to have little influence: the differences between flint and obsidian edge delineations are minimal. The only point worthy of note is the trend for more

Figure 4.13, cont. Retouched Flake Variability (6-8 obsidian)



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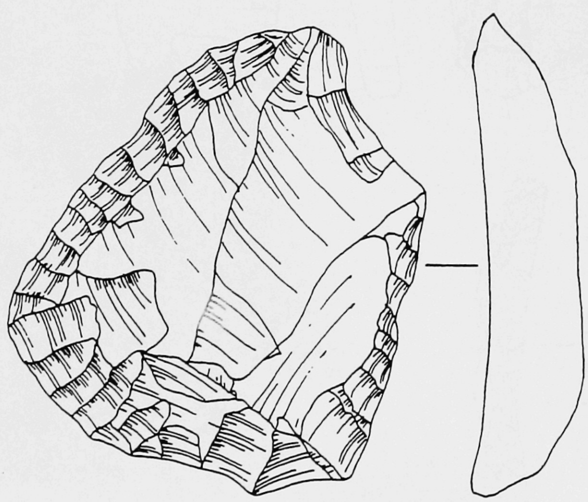

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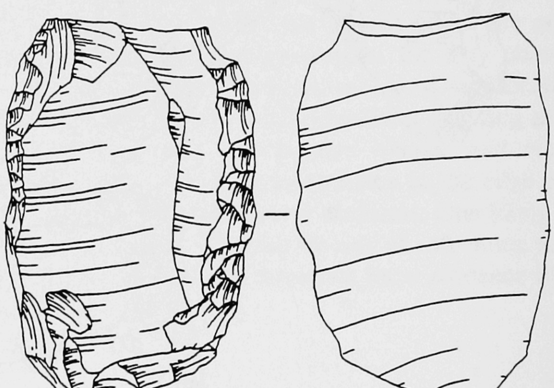

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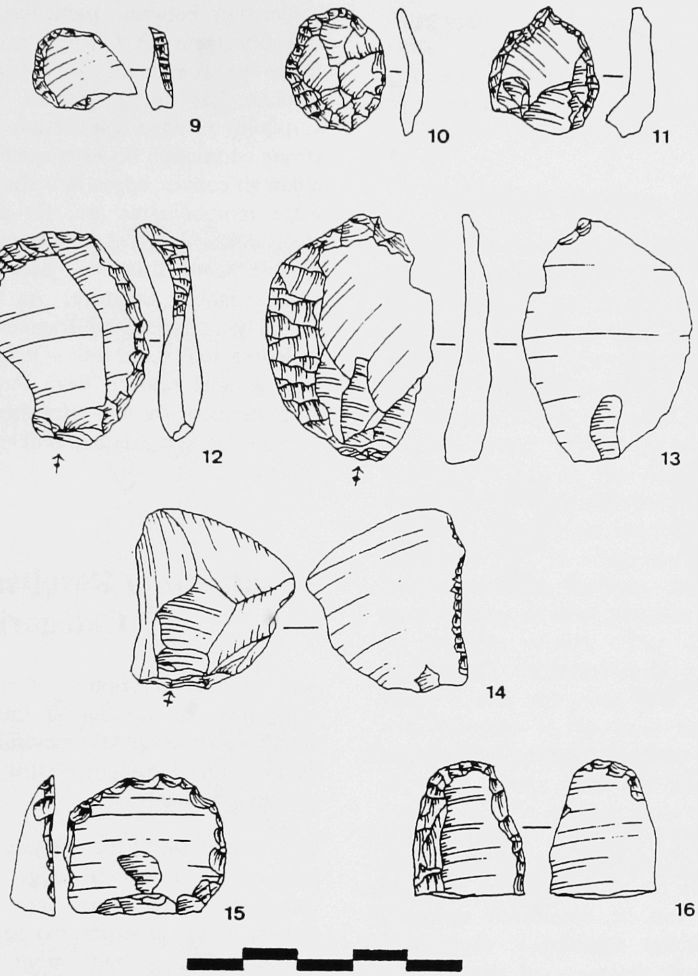
denticulated edges on obsidian than flint tools (approximately 2% versus 7%), which was also seen on the blade non-formal tools. There are no significant differences in the location of retouch between raw material groups, although there is an interesting trend for obsidian flakes is to have been retouched on the left in preference to the right (25% to 18%). The opposite is observed for flint flakes (table 4.32). The majority of retouch on flake tools is direct and occurs on lateral edges (n=452, or 52% of all retouched edges) (table 4.33). For those that have been directly and inversely retouched, there is a tendency for the modification to be located on the left of the blank, but if the retouch is bifacial it tends to be located on both the lateral edges. In all cases proximal edge retouch is significantly rarer than on the distal edge. Of note is the tendency for burin facets to originate from lateral edges in preference to proximal or distal edges. Cross-tabulation of retouch location by delineation shows that for most blank locations, irregularly delineated edges are the most common (table 4.34). Notable exceptions include retouch on the distal edge, which is most frequently convex. A similar association – although not as pronounced – was noted for the blade tools and interpreted as a tendency for distally retouched tools to

Figure 4.13, cont. Retouched Flake Variability (9-16 obsidian)



be scrapers. However, most of the convex delineations on flakes are found on the lateral edges. There are no significant differences between the proportions of delineation types located on the left, right or left and right edges. Some minor differences can be identified between retouch on the proximal and distal edge – the proclivity towards convex retouch on the distal ends has already been noted; but proximal ends are more inclined towards irregular rather than convex edges, followed by beak-shaped delineations.

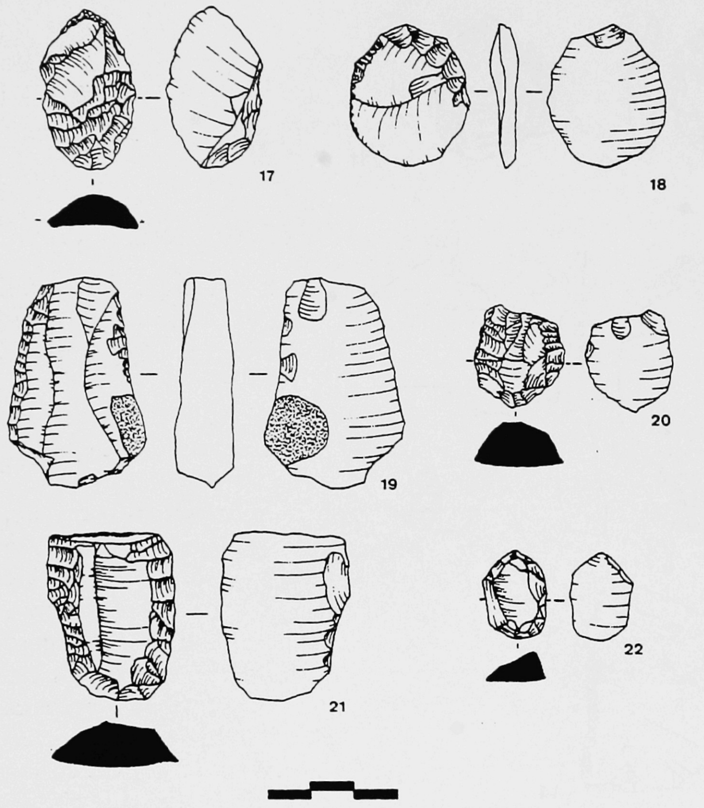
The angles of the delineations supply further evidence of associations, especially concerning the correlation between convex edges and semi-abrupt angles (table 4.35). In other respects the patterning appears to be minimal, although it is worth noting the differences in delineation proportions between the low angled and the semi-abrupt to abrupt groups – over 50% of low angled edges are irregular compared with roughly 35% and 25% of the semi-abrupt and abrupt groups, respectively.

The proportion of sub-parallel retouch on flake tools and blade tools is almost identical, although the incidence of stepped/scaled retouch on flakes is nearly twice as high on the latter as on the former (8.5% to 15.6%) (table 4.36). The biggest difference, however, is the rate of occurrence of irregular retouch, which is over three times as high on blade tools (13.2% to 4.0%). One possible explanation of this is that blade tools possess a greater scope for irregular retouch than flake tools by virtue of their potentially preferential use as hafted tools. This may produce irregular morphologies (and irregularly and denticulated edges) through use, rather than deliberate retouch.

Metric analysis of non-formal blade and flake retouch attributes.

For comparative purposes, I have calculated the mean lengths and widths for blade and flake blanks with different attribute

Figure 4.13, cont. Retouched Flake Variability (17 & 18 obsidian, 19 flint, 20-22 obsidian)



states under the variables 'retouch position' and 'retouch delineation' (tables 3.37 and 3.38).

There are only minor differences within each blank group across the range of observed attributes for retouch position. The high standard-deviation for all the samples means that none of the differences can be considered statistically significant. A broadly similar situation is observed for retouch delineation, although the range of sizes for non-prismatic blades is slightly higher in this case (e.g. from a high of 56mm for blades with convex edges, to a low of 22mm for blades with notched edges). The variation between different delineations for flake and prismatic blade blanks, however, is not as prominent.

Non-formal tools on other debitage types: description of attributes.

This category has fewer members than flake and blade based non-formal tools, and contributes only 3.18% to the sample of 2043 (n=65). It consists of a disparate set of tools on crested blades (n=4), core tablets (n=5), shatter (n=36) and indeterminable debitage (n=20). Because of these low numbers it is impractical to examine the cross-tabulations between particular attributes; it is more useful to describe the patterning of two key attributes – retouch delineation and morphology – by debitage type.

There are 69 retouched edges on these pieces as one of the crested blades, one of the core tablets and two of the indeterminable pieces of debitage have two discrete instances of retouch. Retouch delineations show an (expected) association between particular delineations and debitage category (table 4.39). This is pronounced in the core tablets, where the six examples are either denticulated or irregular. In contrast, the crested blades show a higher amount of variability of edge delineations over fewer cases. There is a strong correlation between shatter and irregular delineations, although convex edges also show a pronounced occurrence. Edge morphologies are, for the most part, irregular or stepped/scaled across all categories (table 4.40). The only notable correlation is between parallel retouch and indeterminable debitage. As this debitage category is probably composed of fragments of once larger pieces - including tool fragments – it is possible that the examples with parallel retouch were formerly points (where higher proportions of parallel retouch were observed), but are now so badly broken it is impossible to assign them to any other category.

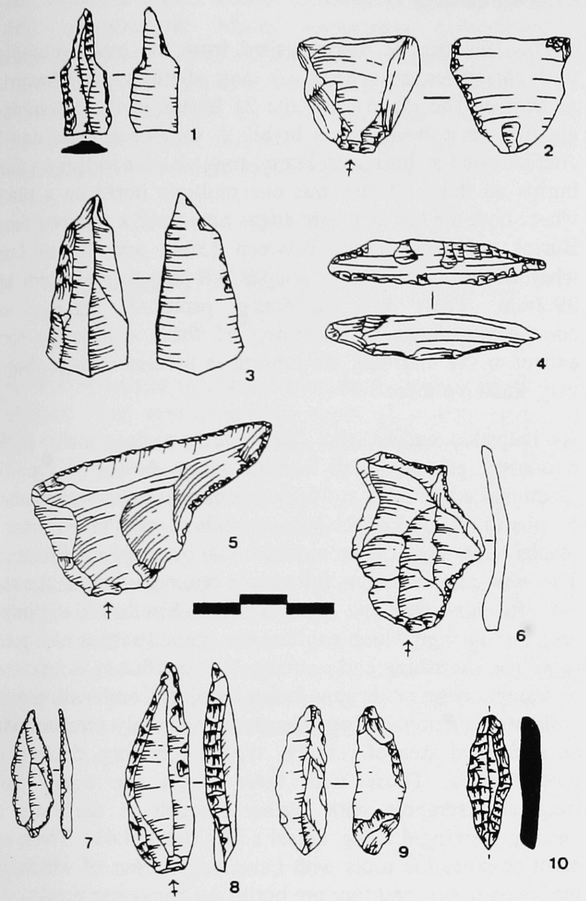
Synthesis of Results: Typo-Functional Categorisation

Although the description of retouch attributes provides a comprehensive account of the morphology of retouched debitage, it is nevertheless useful to synthesise the results into typo-functional categories that can be compared to more conventional analyses.

This component of the analysis was based on the functional assessment of several edge properties. The functional categories used here are intentionally broad and encompassing: precision has been sacrificed for the sake of accuracy. This permits gross functional groupings to be inferred along the lines of 'scraping edge', 'cutting edge', etc. This scheme provides an elementary but measured assessment of retouched debitage groups. To a certain extent, it can be compared to typological schemes developed to characterise Central Anatolian assemblages (particularly Can Hasan III), insofar as there is some shared basic vocabulary, such as 'scraper' and 'notch'.

The method is based largely on methods developed, and successfully implemented, by Grace (1989; 1992), with some further suggestions taken from Hurcombe (1992). Its basic principal is that within certain constraints, edge morphology and blank shape have a direct bearing on edge function. In some cases this is logical and apparent – pointed edges, for example, are inappropriate for scraping or cutting. Distinctions between cutting and scraping edges, however, are less obvious although the latter will be typically characterised by steeply angled edges, whereas the former will be more inclined to show low angled, and possibly bifacial, edges. As I have used it, the methodology is not faultless; Grace envisioned macroscopic data being

Figure 4.14 Examples of Non-Formal Piercing Tools



correlated with microscopic data to provide an accurate assessment of edge use at a relatively precise level. I am only interested in the broadest categories of use – primarily scraping, cutting, and piercing/drilling – so my assessment included only macro edge attributes. When distinct edge properties such as notches or denticulated edges were encountered these were incorporated in the functional classification, such as 'notched scraping edge' or 'denticulated cutting edge'. As such, this cannot be considered a functional analysis – hence, my use of the term 'typo-functional categorisation'.

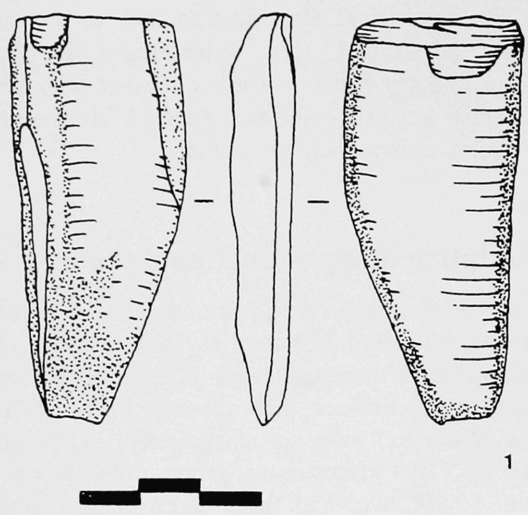
When two or more edge functions were recorded on the same blank, the tool was recorded as 'multi-tool'. This classification, when combined with blank information, provides a reasonable summary of 'type' along the lines of 'flake scraper', 'blade denticulated cutting tool', etc. It is worth noting that with regards to this classification, the whole tool is greater than the sum of its individual retouch attributes. In other words, some additional attributes – thickness and ventral curvature of the retouched edge, for instance – were impractical or impossible to measure accurately, but occasionally had a defining influence on the typological category into which a tool was placed. The retouch attributes are valuable, not so much as a guide or checklist for typological classification, but as a means to characterise non-formal tool assemblages by retouch morphology. In a sense, the contrast is between technological and typological analysis – the two have different aims, but can nevertheless complement each other.

Description of typo-functional categories

Overall, the most common typo-functional class identified is what has generally been described as 'cutting tools'. These include pieces where the modification is generally low angled and located in a manner that appears to facilitate the movement of the tool edge in a (typically) lateral cutting motion. Of the 1,094 pieces in this group, 46% had one area of retouch, 53.9% two, and 0.1% three distinct areas of retouch. Almost 80% of this tool class are blade-based (see, for example, 4:11 10-17). This broad group also includes two types conventionally referred to as 'backed knives' and sickle elements. The former stands out as some of the retouch appears not to be connected with a cutting edge, but a modification to facilitate the handling of the blade: modifications on 67 pieces (6% of all cutting tools) appear to be backing retouch. The latter group can only be convincingly identified by the recognition of glossed edges. There is only one piece in the entire analysed assemblage with evidence of the gloss that is typically attributed to cutting siliceous plant materials. This is a flint blade, and as there are several other flint blades of similar morphology without gloss, it appears to be an anomaly. This leaves only obsidian blades as potential sickle elements, but as gloss cannot be recognised on obsidian, unequivocal identifications could not be made.

The other categories are more straightforward, as conventional criteria were used for their classification. Scraping tools, for instance, are typically characterised by the presence of semi-abrupt to abrupt retouch, usually on convex edges, although irregular, occasionally concave or denticulated delineated edges were identified. 87.8% of scraping tools had one discrete area of retouch, 11.6% two, 0.4% three, and 0.2% had four discrete areas of retouch. Just over 19% of scrapers are made on blades (see, for example, figure 4:11 1-3). Scraper retouch on blades occurs most frequently on the lateral margins, but approximately 16% of blade scrapers can be considered as end-scrapers. Flake scraping tools are also customarily retouched on the lateral margins, although 25% show distal modifications (see, for example, figure 4:13 6-8, 9-10, 12-13, 15-16). There is considerable size variation in this group, more than in any other of the non-formal tool categories. The sizes of the complete examples range between 13.9mm and 107.3mm (n=333). The larger pieces often display more regular and 'structured' edges, insofar as the retouch is well executed and creates a well-defined convex delineation. A frequency distribution shows a positively skewed curve, with a

Figure 4.15 Obsidian Stone Carving Tool



possibility of a second mode at approximately 50mm. Generally, however, the distribution reveals that despite a considerable size range, there is no clear division between larger and smaller flake scrapers.

Piercing/drilling tools are typically small, with areas modified to make awl-like tangs that are suitable for punching, drilling or otherwise piercing small holes in a variety of materials (figure 4:14). The edge delineations for these tools fall into the categories beaked, short- and long-tanged, and retouched-to-a-point. Of the 85 pieces, only two had more than one discrete area of retouch. Approximately 41% of piercing/drilling tools are manufactured on blades. The length of complete pieces ranges between 15mm and 75mm (mean=21.2mm, n=33). Those on prismatic blades are the largest in the group, with a mean of 28.4mm.

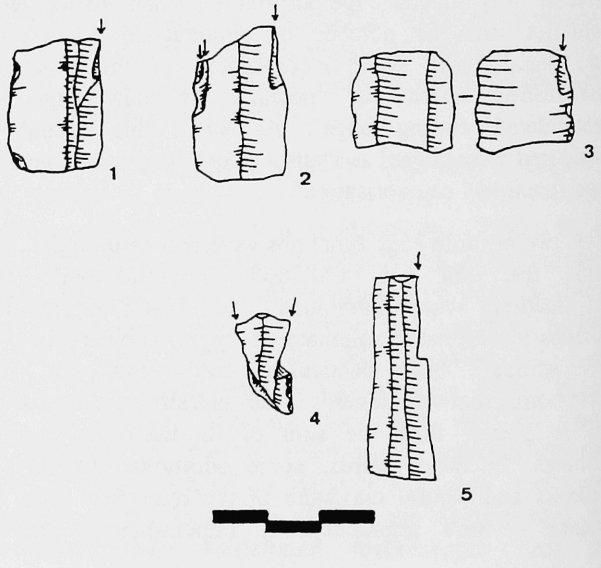
Notched tools are found on both blades and flakes, with a slight majority on prismatic blades. The notches tend to be singular indentations created by direct sub-parallel to scaled removals along the lateral edges. Only three had more than one notch. Less common, although present are notches at the distal or proximal ends. Approximately 59% of notches are blade-based tools. Complete notched tools range in length between 9.4mm and 38.7mm (mean=23.8mm, n=33), but with a group mean of 25.6mm, the notches on flakes are the largest in this category.

Stone carving tools' are a unique group of objects for they do not exhibit traditional retouch, but modification that can only be attributed to grinding (figure 4.15). This occurs more frequently on blades, although it was also recorded on flakes. The rounded and worn edges appear to be the result of their extended use on hard abrasive materials such as the green-stone, or on other soft stone materials which occur in abundance at Çatalhöyük. As a group of tools, they are the largest in the non-formal assemblage, ranging between 28.9mm and 65.9mm, with a mean of 44.8mm. Three of the four examples are made on blades. There is little qualitative difference between the edge damage on the blade and flake varieties, although the flake tool has substantially more evidence of wear.

Burins can also be distinguished from the other retouched tool categories by virtue of their distinct manufacturing technique. The majority of the 21 burins in the assemblage are transverse burins on a break. A smaller number can be characterised as burins on lateral retouch, in addition to the 6 burins on flakes. There was one multiple burin on a blade, where both the left and right edges possessed a removal facet. Burins on blades range between 15mm and 30mm long, whereas the larger flake varieties fall between 21.9mm and 39.2mm. Their low incidence prohibits making any conclusions about the meaning of these distinctive tools except to say that they are present in the assemblage, but in very small numbers.

As indicated earlier, the combination tools consist of 93 retouched pieces which exhibit more than one type of functional edge. Almost 40% of combination tools are made on blades. A total of 84 pieces exhibit two, and a further 9 blanks have three different functional areas of modification. The edge classifications follow the criteria used for the tool classifications with the exception of 'chisel', which simply refers to an edge which exhibits the characteristics of a pièce esquillée – crushing and scarring – except that it is restricted to a single edge rather than being bipolar. Combination tools with two functional edges are most commonly scrapers with an additional area of retouch, typically cutting, drilling, or chisel edges. Those with three edges are again most frequently scrapers with further retouch in the form of cutting, piercing/drilling, chisel edges (table 4.41). There are eight combination tools with burin edges, four of which are burins on flakes, and four are burins on transverse breaks.

Figure 4.16 Obsidian Burins

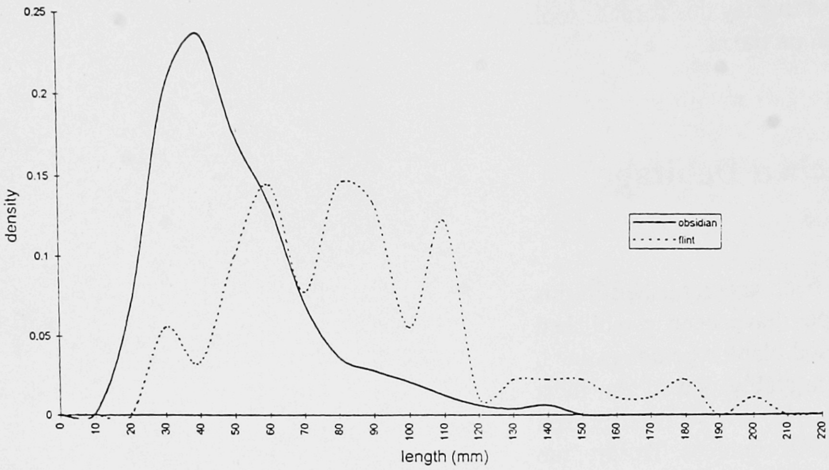


There is a striking association between debitage types and typo-functional class. Notable differences include the significantly higher percentages of scraping tools on flakes, and cutting tools on blades. Differences between prismatic and non-prismatic blades encompass proportions of drilling/piercing tools, although non-prismatic blades show the highest proportion of indeterminate types. The few burins occur most frequently on prismatic blades, although two flakes and two pieces of shatter also display this form of tool. Combination tools occur most often on flakes.

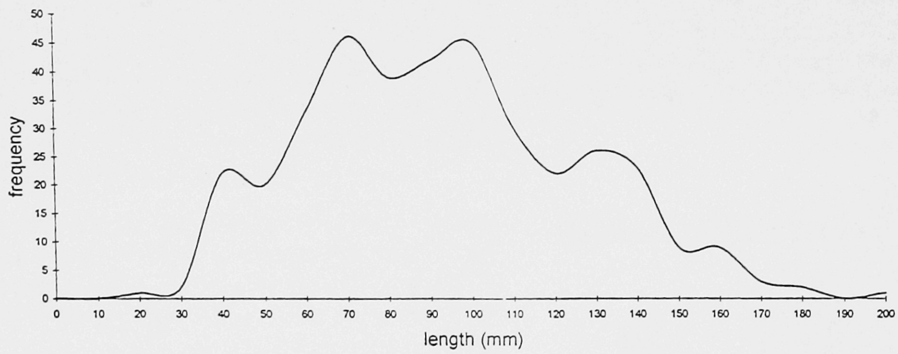
Summary of Retouched Debitage Analysis

Several important objectives have been accomplished in this chapter. First, several primary types have been established and the influences of raw material and blank type determined. Secondly, the projectile points – arguably one of the most important classes of tool at Çatalhöyük – have been broken into 12 distinct types using statistical techniques. Thirdly, the retouched characteristics of the large collection of other retouched blade and flakes have been comprehensively described and correlations of key attributes were identified for blade-based, flake-based, and other debitage. Finally, these pieces were classed into broad typo-functional categories, providing an overview of the functional variation of this component of the assemblage.

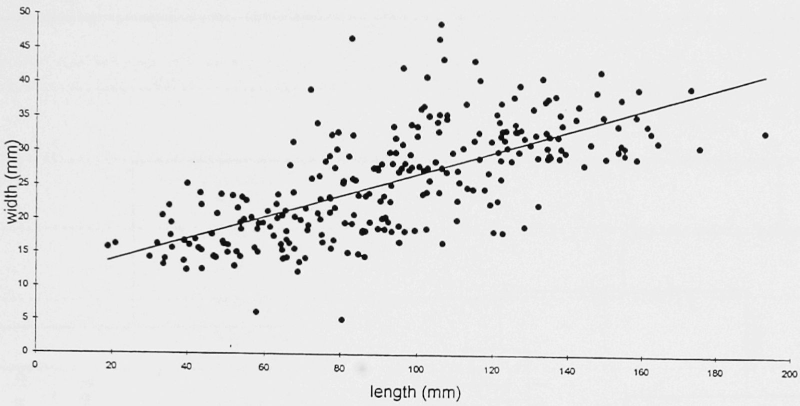
Graph 4.1 Frequency distribution of obsidian and flint retouched blade lengths..



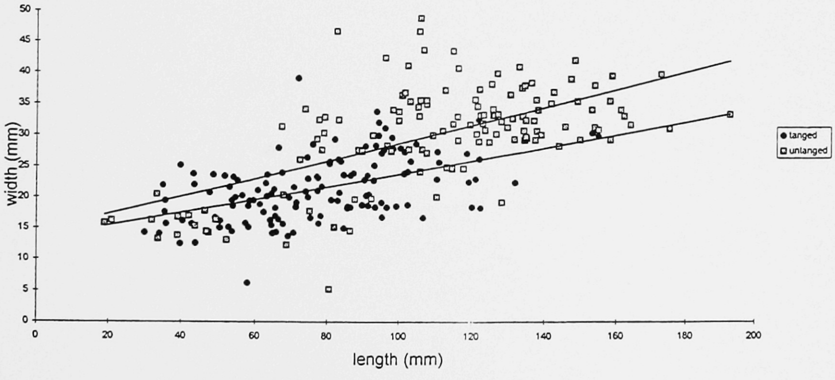
Graph 4.2 Frequency distribution of point lengths.



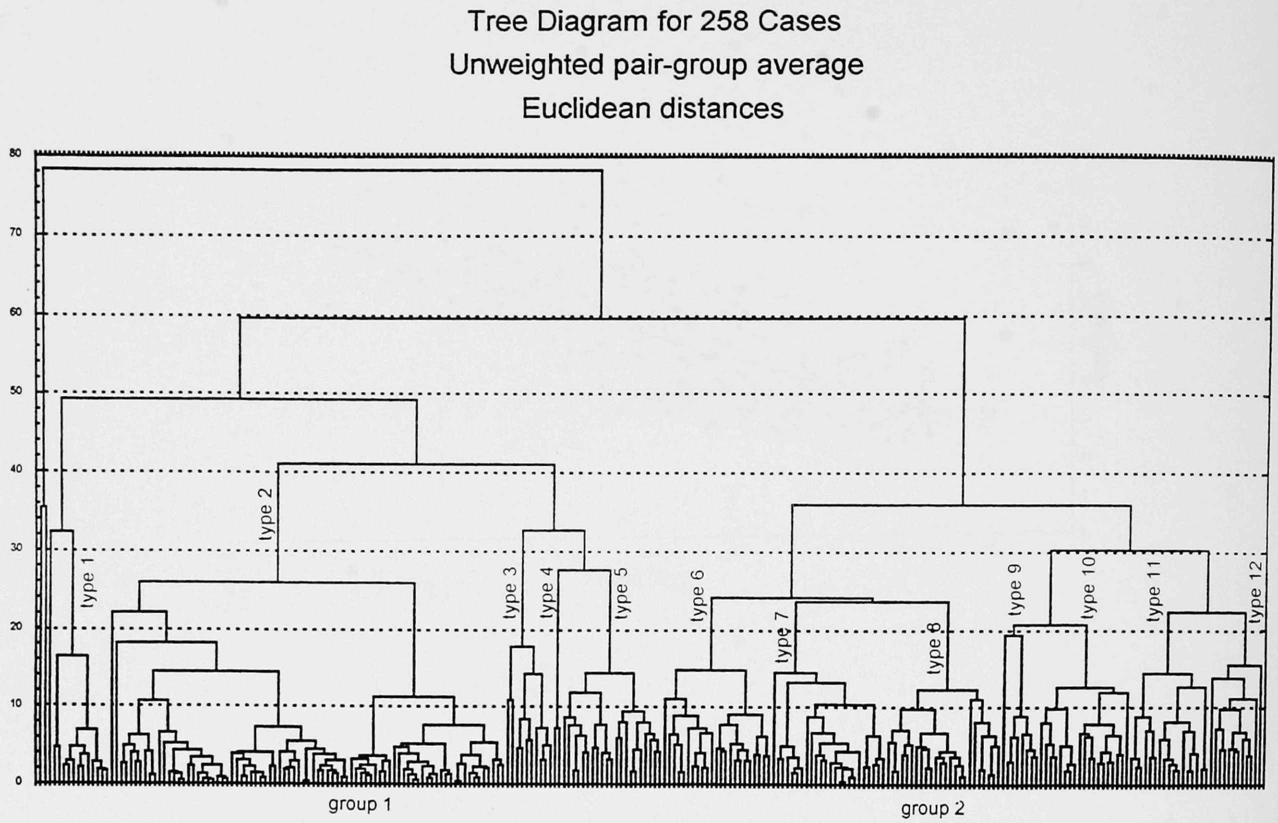
Graph 4.3 Relationship between point lengths and widths.



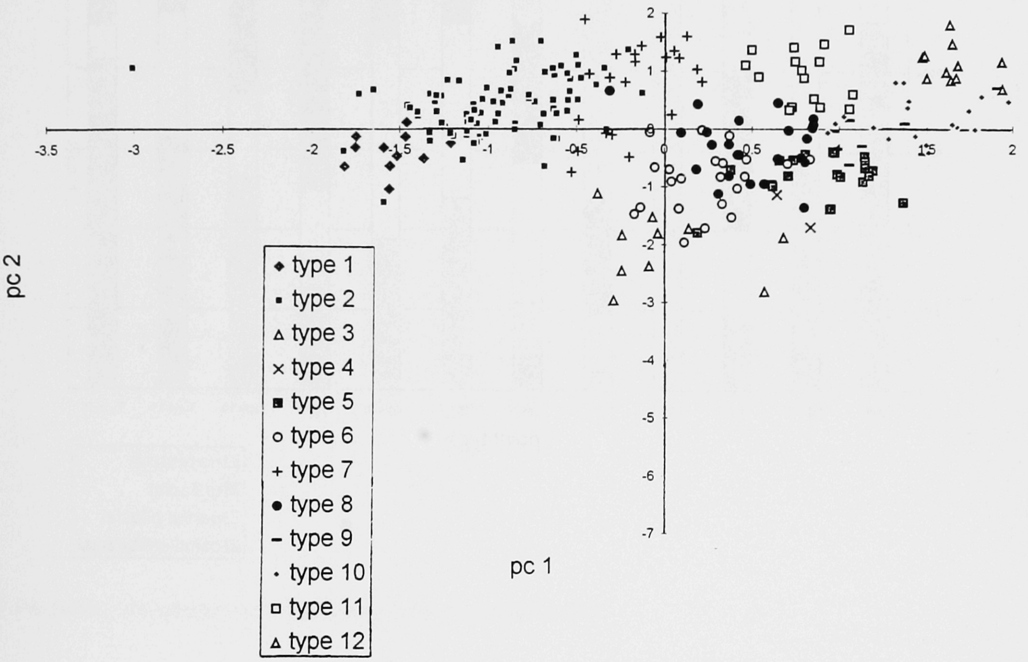
Graph 4.4 Comparison of tanged and untanged point lengths by widths.



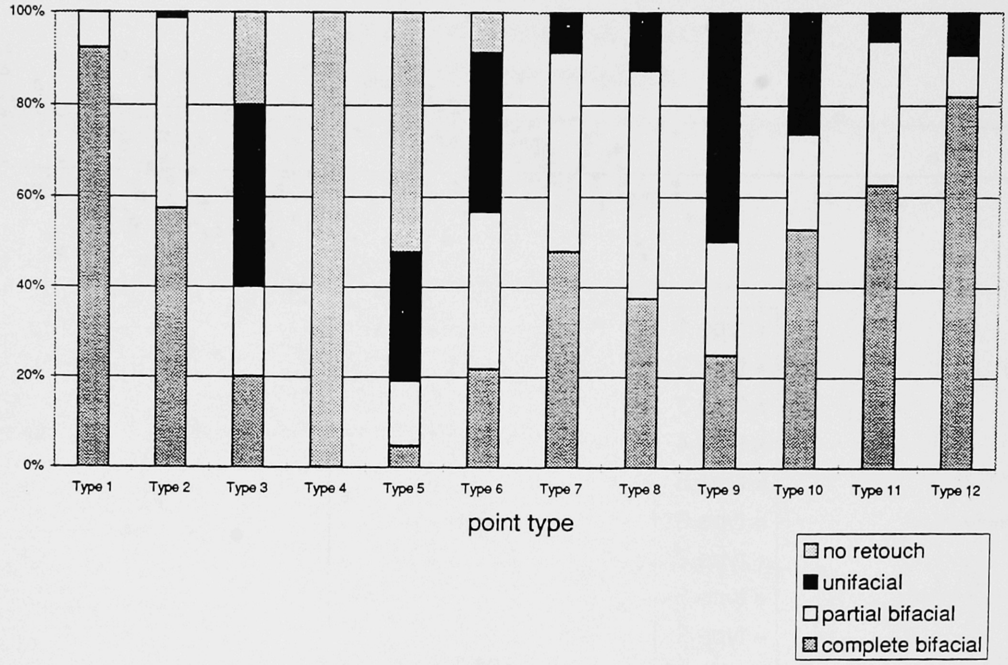
Graph 4.5 Point cluster diagram.



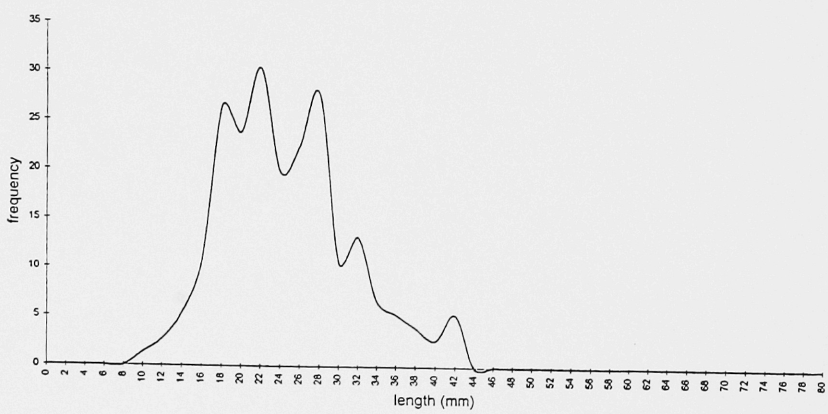
Graph 4.6 Point principal components analysis.



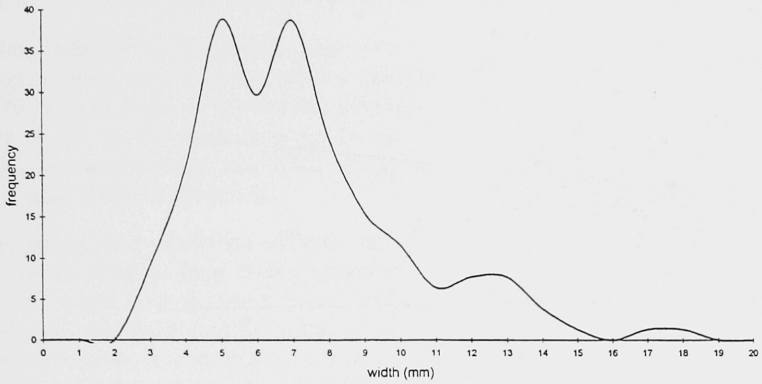
Graph 4.7 Point type retouch morphology variability.



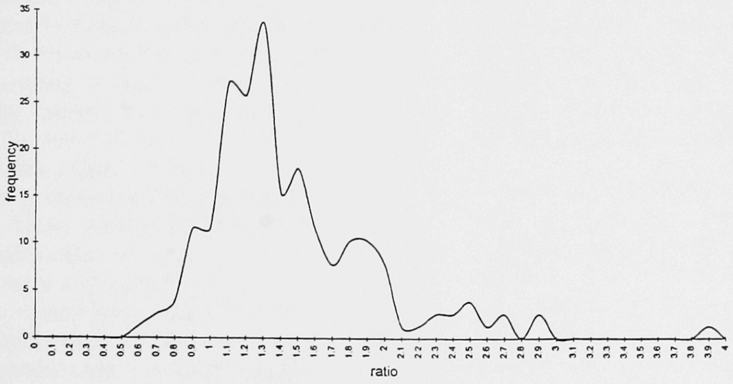
Graph 4.8 Frequency distribution of pièce esquillée lengths.



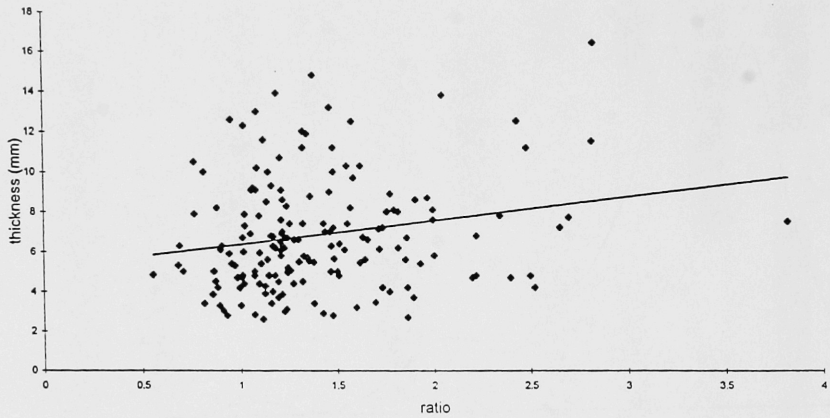
Graph 4.9 Frequency distribution of pièce esquillée widths.



Graph 4.10 Frequency distribution of pièce esquillée length:width ratios.



Graph 4.11 Relationship between pièce esquillée length:width ratios and thicknesses.



V

TECHNOLOGICAL SYNTHESIS AND REGIONAL COMPARISONS

The Obsidian Technological Strategies

I here use the term 'strategy' to suggest that there was an identifiable logic to different ways in which obsidian and flint were exploited. To this end, there are at least four strategies, and possibly five or six, to the production and/or use of obsidian. These can be equated to the idea of the operational chain, described in some detail in Chapter II.

Overall, given the general lack of cortical surfaces, much of the obsidian can be assumed to have been imported in a preformed state. The actual state, however, varies between methods. For example, the large bipolar blades show no evidence of associated cores or core-derived products and may have been imported ready made. They may have been produced on site in an unexplored portion of the mound. In any event, their bipolar technology is sufficient to distinguish them from the other two groups and justifies this being called Obsidian Strategy I. Blanks from this system are either retouched to form a type of projectile, or are cached in an unmodified form.

The presence of obsidian crested blades, however, points to some blade core preparation occurring on site, either by pressure (Obsidian Strategy II) or percussion (Obsidian Strategy III) techniques. In the case of the former, preparation apparently involved manufacturing a platform by a series of overlapping removals creating a faceted platform with an angle at, or approaching, 90 degrees. Reduction was carried out around the complete circumference of the core using pressure, after immobilising the core in some fashion (refer to figure 3.10 for examples). Removals of blades were facilitated by grinding and/or faceting the core edge, removing the lips caused from previous removals, and isolating places for removal devices to be placed. When platform/removal face angles were in excess of 90 degrees, the platform could be rejuvenated by removing a tablet with a (typically) single blow, thereby enabling further removals. Discard, or abandonment, of some cores occurred when further removals were still possible, whereas other pressure blade cores were turned into flake cores. Because of the immobilisation requirements for pressure debitage, it may be that the time of abandonment was dictated by the width of the core dropping to such a size that the immobilisation device could no longer securely hold it (Migal 1994: *pers. com.*). This may explain the occurrence of a few larger flakes cores that bear the scars of former pressure blade removals. The removals were subsequently truncated and/or selected for a variety of non-formal tools. This was the almost exclusive use of prismatic pressure blades.

Obsidian blade cores which were not reduced by pressure techniques, Obsidian Strategy III, are not as standardised. Given that some are of a fairly small size, it may be that a few are former prismatic blade cores. The presence of some large non-prismatic single-platform blades shows that in other cases this does not appear to be the situation, and a decision had been taken to use percussive methods from the start. Their variation prevents any generalisation that would encompass all instances. There is little evidence to show that these cores were prismatic blade cores, which were abandoned, sometime in the reductive process, suggesting that they were directly selected for percussive blade production. There is little evidence of maintenance or rejuvenation activities, but examination of the proximal edges of single-platform non-prismatic blades often shows that considerable edge preparation occurred – principally grinding and faceting of the proximal removal face. Blades from these cores were typically truncated by snapping or side-blows and selected for 'non-formal' modification, pièces esquillées or, with some of the larger pieces, point production.

Finally, there is abundant evidence for non-standardised obsidian flake cores and associated debris, which form Obsidian Strategy IV. In earlier levels, before the introduction of pressure techniques, raw material can be assumed to have been imported for this purpose. In later levels, flake cores in some instances were abandoned blade cores, although my inclination is that a small amount of material was still being imported and used immediately for flake production. Flakes were used for a variety of non-formal tools, pièces esquillées, and some points. It is common to find that these cores show evidence of considerable battering and crushing, so their end use may have been as wedge or chisel like implements.

There is also the possibility of a fifth and sixth strategy. One concerns the large obsidian flakes with well-prepared platforms (V) that are often turned into heavy scraping tools and possibly some of the smaller bifacial pieces. As with the large bipolar blades, no cores have been associated with these, so they may have been introduced as ready knapped blanks or tools. The other is the possibility of large pieces of material being introduced for the manufacture of obsidian mirrors (VI). Finished mirrors have several requirements that may not have been met by more ubiquitous material used for flake cores. Additionally, the quality of the raw material would need to match that of the prismatic blade cores, whereas flake cores could use nodules with flawed interiors. The likely scenario is that, in addition to material preselected for blade core manufacture, a variety of other material was imported, the better pieces being taken for large flake cores and mirror production, the smaller, inferior pieces being used for standard flake production.

The Flint Technological Strategies

In contrast to obsidian, the flint technological system is relatively straightforward. At least four flint strategies can be identified. The first involves the acquisition and working of large blade blanks. Unlike the obsidian examples, these are not bipolar blades, but appear to be derived from single-platform cores made of fine-grained tabular flint. These are the source of the flint daggers, which are selected from the largest and finest-grained raw material, whereas lesser quality flint was often used to create 'retouched-to-a-point' implements. It is interesting that some of these blades do retain evidence of cortical surfaces. There is no evidence for these blanks having being produced on site.

Flint Strategy II appears to be a functioning pressure blade system, suggesting that this technique was not exclusively restricted to obsidian. Flint crested flint blades have been found, which show that some elements of blade core preparation were being conducted on site. Examination of the flint core indicates that the process of reduction was likely to have been much the same as for obsidian. It is interesting to note that the single example of a flint pressure blade core has been abandoned at roughly the same stage as some of the obsidian cores. These blades also appear to have been truncated and/or used for non-formal tool manufacture.

Other flint blade production forms Flint Strategy III, although like Obsidian Strategy III, there is considerable variation in this group. Platforms appear to have been generally well prepared, although no evidence of rejuvenation flakes were found. Blades from this sub-system were used for a variety of non-formal tools, pièces esquillées, and projectile points.

Finally, Flint Strategy IV consists of flake core reduction and flake tool manufacture. Local flint appears to have been the focus of this reduction strategy, as there are a large number of cortical surfaces on these cores that are indicative of the use of low quality cobble flints. Flakes from these tools were routinely used for non-formal flake tools, particularly scrapers and pièces esquillées. In most cases, when the core reached a stage where it was too small to be worked normally, it was turned into a chisel/wedge type implement. It is possible that in some instances debitage resulting from this process were used as tool blanks (hence, 'cores of pièce esquillée type').

Comparative Technology and Typology

Of concern here are comparisons between debitage techniques at Çatalhöyük and the other Central Anatolian sites described in Chapter I, and broader comparisons with the Near Eastern Neolithic. Unfortunately, of the excavated central Anatolian sites examined, few reports of the knapped-stone artefacts discuss technological characteristics in sufficient detail for specific techniques of knapping to be compared to Çatalhöyük. Can Hasan III is an exception, and reports on the Aşıklıhöyük and Suberde material provide sufficient details on core morphology for some aspects of debitage techniques to be compared.

Neolithic lithic assemblages have been most comprehensively examined from Levantine sites, providing an impressive corpus of data with which the less thoroughly examined Anatolian sites can be compared. In general terms, PPNB lithic industries in the Levant are typically based on the manufacture of blades from double ended elongated cores, termed the Naviform method. Suzuki and Akazawa (1971) and more recently Wilke & Quintero (1994) have demonstrated that this sophisticated method of core reduction involves a number of structured reduction stages requiring much skill and knowledge of flint fracture dynamics (Nishiaki 1992:100). The dominant raw material used for Naviform blade production was fine-grained tabular flint. Nishiaki has demonstrated that on many northern Levantine sites this flint was a non-local material which was imported into many PPNB sites (Nishiaki 1993). Locally available course-grained flint, unsuitable for blade cores was used for the production of flake tools, and required considerably less expenditure in raw material procurement and core preparation. For the most part Southeastern Anatolian PPNB sites are broadly comparable to their Northern Levantine neighbours, sharing Naviform techniques and similar tool forms, including projectile point types. Analysis of late PPNB and early ceramic Neolithic flint production in the Northern Levant suggest that the use of fine-grained flint is replaced by an increased use of local course-grained flint and a rise in flake based production technology. It has been argued that this is a direct result of the shift from the PPNB economy of hunting and agriculture towards herding and agriculture, as the collection of the fine-grained flint necessary for Naviform core production was an activity embedded in the movement of hunting parties (Nishiaki 1990).

As with aceramic Anatolian knapped-stone, the Southeast shows broad similarities to the Northern Levant, but Central Anatolian knapped-stone industries exhibit several important differences. Most important of these is an increase in blade-production technology, particularly pressure-blade, and an emphasis on the production of large projectiles and bifacially retouched pieces. What evidence exists suggests that all the Central Anatolian Neolithic sites display this tendency to some degree, although unfortunately little detailed information exists for any site of this period, except for Çatalhöyük. The following paragraphs compare the key characteristics of debitage technology and tool composition for the main Aceramic and Ceramic Neolithic sites in Central Anatolia to the Çatalhöyük industry.

Aşıklıhöyük

Aşıklıhöyük is the earliest Central Anatolian Neolithic industry that can be compared in any detail to Çatalhöyük. Ian Todd's collection of obsidian and flint artefacts from Aşıklıhöyük provides most of what is known about the material, but the knapped-stone industry from current excavations is being studied by Nur Balkan-Atlı, and some additional details are available (Balkan-Atlı 1991; 1994). The site is located in close proximity to the Central Anatolian obsidian sources and large numbers of blocks and primary preparatory pieces are present, suggesting that core preparation took place on site. Nearly a third of the material is described as waste and can be attributed to initial reduction stages. Cores are common (2.5%), of which bipolar blade cores are the most frequent (Balkan-Altı 1991:146). Flake and blade blanks constitute approximately one half of the knapped-stone assemblage and worked pieces appear to have a restricted variety of forms. The results of Todd's surface collection (Todd 1966) also demonstrate the paucity of projectile points (4% of Todd's tool assemblage), while scrapers are the most common retouched group. 'Heavy' scrapers on flakes with a circular or semi-circular shape are common, as are end- and double-ended scrapers, and scrapers on blades. In this regard, there is some similarity with the larger heavy scrapers from Çatalhöyük. One pronounced difference, however, is that at Aşıklıhöyük there is a microlithic element in the industry, comprising 4% of Todd's analysed sample of tools. Burins are infrequent at both sites, but while there are few piercers and borers at Aşıklıhöyük, they are numerous at Çatalhöyük. It is surprising that there are so few retouched flakes from excavated contexts (Balkan-Atlı 1991:149). Until the full publication of the excavation is available, this is the only information that is currently available concerning the specifics of the Aşıklıhöyük lithic industry.

In general terms, Aşıklıhöyük shares characteristics with PPNB sites in Southeastern Anatolia and the Northern Levant, particularly its reliance on double-ended or bipolar cores which resemble those of the Naviform technique (Esin 1991: plate 12). At the same time it differs enormously because of the overall paucity of projectiles, and the few that have been found are dissimilar to typical Levantine forms. Both these characteristics – bipolar cores and few projectiles – suggest a fundamentally different obsidian industry from that at Çatalhöyük.

Suberde

At Suberde, the knapped stone is approximately 90% obsidian, with flint and smaller amounts of quartz and basalt making up the remainder (Balkan-Atlı 1994:123). Approximately 1.4% of which were cores and core-fragments. Most cores were broken – although 11% of the complete examples were pyramidal, 2% discoidal and 0.5% described as tabular (Bordaz 1968:52). Roughly, 15.9% of the assemblage consists of specialised tools, or fragments of specialised tools. A further 10.4% of the assemblage comprises retouched blades and flakes (Bordaz 1968:52). The projectile points and projectile point fragments, were the largest single class of artefact recovered at Suberde after irregularly retouched blades and flakes, but only 32 complete specimens were found. Notched and denticulated tools, piercing tools and backed blades have no clear patterning in their distribution, nor do circular, end and side scrapers – the most common group of formally retouched artefacts after projectiles. Sickle-blades are made of flint, with sheen on at least one edge. Microliths, including geometric microliths, were also found. Prismatic rods, thought by Bordaz to be tools used to retouch stone, have also been identified. Irregularly retouched flakes and blades, however, are the most common type of stone implement, numbering over 4,000 pieces with flint contributing approximately 25% to the total. Bordaz distinguishes between retouched for use and retouched by use on the basis of the regularity of the scarring, concluding that the majority are retouched by use (Bordaz 1968:56). He classified the majority of these irregularly retouched pieces as cutting or light scraping implements. Based on this description, Suberde is much more closely related to Çatalhöyük than Aşıklıhöyük, particularly because of the predominance of blade cores and what can be described as non-formal tools. The high percentage of retouched to unretouched debitage is also similar, although this may owe more to collection strategy than to cultural phenomenon. However, although projectiles are described as abundant – and have some parallels with Çatalhöyük – not nearly as many were found at Suberde. This is particularly interesting, as Suberde has routinely been described as a (potentially seasonal) settlement oriented towards hunting, whereas Çatalhöyük is a community that is dependant on agriculture. Other important differences concern the presence of microliths and flint sickle-blades at Suberde, neither of which are present at Çatalhöyük. As with many of these assemblages, however, the lack of more detailed information makes comparisons difficult.

Can Hasan III

The Can Hasan III knapped-stone assemblage was comprehensively studied by Kathy Ataman for her Ph.D. research at the University of London (Ataman 1989). The excavation used water sieving, and over 70,000 pieces of knapped-stone were recovered, of which almost 70% were small chips normally overlooked or lost through traditional dry sieving or pick-up recovery techniques. Approximately 14,000 pieces were from phased contexts (roughly 4,200 of which were non-chip macro-debitage). Ataman's study focused on the typological, technical, and functional characteristics of the assemblage and it represents a very thorough and detailed analysis of a Central Anatolian lithic assemblage. However, while the artefacts do have a stratigraphic position, there is little other information about the context from which they were recovered, prohibiting any discussion of patterning between houses or areas. Nonetheless, Ataman's study does have value in that it is a comprehensive analysis of a knapped-stone technology. It is important for this thesis, because it comes from a site that is both geographically and chronologically the closest excavated site to Çatalhöyük.

As is the norm for this region, obsidian is the main material used for the knapped-stone artefacts, forming over 97% of the assemblage. Most of the Can Hasan III assemblage consists of small chips (about 68%) and flakes (over 27%). Other debitage forms are cores and core fragments, of which there were 92 pieces in the assemblage (21 phased), the vast majority of which were small, fragmentary and irregular (Ataman 1989:68). The most numerous of these were opposed platform obsidian cores, although eleven different types of cores on both obsidian and flint were identified. The opposed platform blade cores appear to be broadly similar to those from Çatalhöyük, in that they are generally small and irregularly formed. Some of the opposed platform flake and irregular flake cores are also similar but, beyond this, there are very few differences. In addition to the huge amounts of chips and unretouched flakes, several other debitage categories were found, including core tablets, trimming flakes and crested pieces. The core tablets are not nearly as well formed as the Çatalhöyük examples, and trimming flakes could not be conclusively identified in the Çatalhöyük assemblage. The Can Hasan III crested blades appear to be somewhat larger than the Çatalhöyük examples, but otherwise are similar. Unretouched blades, shatter, pièces esquillées, as well as a special type of debitage termed 'snapped bulbar piece', a by-product of projectile-point manufacture, formed the remainder of the Can Hasan III debitage. This last piece was not detected in the Çatalhöyük assemblage, although shatter and pièces esquillées were found in abundance and are very similar in quantity and quality.

There are also some differences between the blades from the two sites: an analysis of debitage to determine the flaking mode employed in the debitage process was conducted by Ataman, which suggested that direct (soft hammer) percussion, as opposed to a punch or pressure mode was employed for the majority of the debitage (Ataman 1989:72, 87). It is very likely that some of the Çatalhöyük blades were also manufactured using soft hammer techniques, particularly the large non-prismatic blades, but no evidence of the pressure techniques which characterise the later levels were found at Can Hasan III. Unfortunately there was no comprehensive metric analysis of debitage, so detailed comparisons cannot be made along these parameters. There is, however, a histogram of blade widths which shows that blades are smaller. This corresponds to the cores, which are also much smaller than those from Çatalhöyük. Blade widths range from about 5 to 21 mm, with a modal value of 7mm, and a smaller secondary peak at 12mm. This was considered inconclusive evidence for a separate bladelet industry, but it is interesting that the widths of Çatalhöyük blades are equivalent to the secondary peak of blade widths.

As is the trend at Çatalhöyük, there are considerable differences in the manner in which obsidian and flint were used at Can Hasan III, although manifested in slightly different ways. Tabulation of debitage classes by raw material show that 20% of all blades are made of flint, despite flint contributing less than 3% to the total debitage count (Ataman 1989:75). At Çatalhöyük, the ratio of flint to obsidian for all blades is comparable to the overall ratio of flint to obsidian, yet over 24% of the non-prismatic blades are flint. At Can Hasan III, there are also more flint cores and core tablets (roughly 14% and 17% of all cores and core tablets respectively), than one would expect given the small contribution that flint makes to the total industry. Obsidian, however, comprises the vast majority of all other classes of debitage. The high numbers of obsidian chips were attributed to pressure flaking of projectile points, which are primarily made on obsidian (Ataman 1989:75). In addition, pièces esquillées and snapped bulbar pieces are exclusively on obsidian. These differences can possibly be attributed to different locations of production of these two materials over the settlement, affecting the proportions recovered in excavation or, alternatively, to discard behaviour. Given the large numbers of flint blades, it does appear that flint was used preferentially for some forms of blades both at Can Hasan III and at Çatalhöyük.

The tool typological scheme at Can Hasan III was exhaustive and included numerous sub-types of projectile points and a variety of blade and flake tools. As at Çatalhöyük, burins were found infrequently. Descriptions of certain functional categories of retouched blades and flakes show some similarities. Scrapers, for instance, occur mainly on flakes, although blade based scrapers also occur. Their irregularity is noted (Ataman 1989:120). Piercers occur more frequently on flint, as at Çatalhöyük, and are formed mostly on blade blanks. Blades retouched to a point were present in the assemblage, as were combination tools. Ataman's 'blades with retouch on both edges' type is common, but not as frequent as at Çatalhöyük. Her largest categories, however, are 'retouched flakes', followed by 'retouched blades', the specific characteristics of which cannot be compared to the Çatalhöyük assemblage. In general, however, there appears to be a close affinity between the Can Hasan III and Çatalhöyük tool assemblages – particularly so with the earlier levels at Çatalhöyük.

Unlike Çatalhöyük there appears to be little change in the production technology over time except for a slight increase in the proportion of flint, and possibly a smaller proportion of cores in later phases. There may also be some variation in the proportion of blades, bladelets and chips in the assemblage, with more being found in the upper phases, although in all cases, the differences are slight (Ataman 1989:76). Generally, however, differences between phases at Can Hasan III are few; no significant change in technology, raw-material, or tool forms were identified. This observation highlights the remarkable change in technology at Çatalhöyük.

Hacılar

The eleven pieces of knapped-stone from the aceramic levels of Hacılar were studied by Peter Mortensen and consist of a conical blade core, two flakes, four blades and blade fragments, a fragmentary projectile point, a possible fragmentary dagger, a retouched core which was thought to have been used as a knife, and a notched blade (Mortensen 1970:154). Little can be deduced from this assemblage because of the extremely low number of pieces collected. The later Neolithic material, from which only 533 pieces were recovered, consists of 26 blade cores, 2 flake cores, together with 4 flakes and 451 blades, including a hoard of 363 flint micro-blades. A very small amount of retouched tools were found, which include flake scrapers, serrated blades, sickle blades, micro-points, and irregularly retouched blades and flakes (Mortensen 1970:156).

There are several similarities in reduction technique and tool composition between earlier and later Neolithic Hacılar and Çatalhöyük. In particular, the flint blade cores of the later Neolithic at Hacılar appear to be prismatic pressure blade cores. The fact that these are not present in the earliest levels of either site strongly suggests that it is a later development that begins in what can be considered the middle Neolithic, and extends into later Neolithic period in Central Anatolia.

The few differences between the two assemblages are that projectile points are absent at Hacılar, and serrated sickle blades are absent at Çatalhöyük, although many of the truncated obsidian blades could easily have been hafted and used in a similar manner to those at Hacılar. Perhaps the most obvious difference, however, is that only 42% of the assemblage at Hacılar is obsidian. The most likely explanation of this is the settlement's location; at the same time further away from the obsidian sources and closer to suspected flint sources, Hacılar may not have been as active a participant in the economic process of obsidian acquisition as the sites further east.

Erbaba

Knapped-stone artefacts from Erbaba are not numerous, consisting only of approximately 1,800 pieces, of which 1,400 are unretouched blades, flakes, chips and debitage. Projectile points are not abundant, although sickle blades, notched and denticulated tools are common (Yakar 1991:149). End and flake circular scrapers, backed blades and piercers were also found, mainly on flint. On the basis of available information few comparisons can be made, although it is interesting to note that, as at Hacılar, but unlike Çatalhöyük, flint sickle blades are common.

Mersin (Yümüktepe)

The site of Mersin, near the Southeastern Mediterranean coastal city of the same name, is frequently compared to the Çatalhöyük material as a large obsidian industry was recovered during excavations in the early part of this century (Garstang 1953). However, the subsequent loss of dig-records prevents comment in any detail, save to say that the two assemblages share the presence of pressure blade production and a abundance of large obsidian points. These two traits alone suggest a close link between the two assemblages, both technological and typological.

Typological Comparisons

For the same reason that an all-encompassing typological analysis is difficult to apply to the Çatalhöyük assemblage, conventional typological comparisons with other Neolithic sites are equally problematic. With the exception of two or three highly distinctive and standardised types of artefacts, the immense variability of the tool assemblage is better accounted for by attribute analysis and technological comparisons. The bifaces and 'points' are effectively the only class of obsidian object where standard typological comparisons can effectively be made.

Can Hasan III (Ataman 1989: fig. 53) and Suberde (Bordaz 1966) share some similar point forms, particularly with Çatalhöyük Types 8, 9, 10 and 11. The large Group 1 points (i.e. Types 1 to 5) from Çatalhöyük are not represented at these sites. One or two points recovered from Aşıklıhöyük have parallels with Çatalhöyük Type 6. However the characteristic 'single-shouldered' point from Aşıklıhöyük is not seen at Çatalhöyük. Several of Ian Todd's survey collections from Central Anatolia also contain small to medium bifacial, tanged and occasionally shouldered points that are similar to those in the Çatalhöyük assemblage: e.g. those from Kumluk Tepe (Todd 1980: fig. 16), Değirmen Özü (Todd 1980: fig. 17), Pınarbası-Bor (Todd 1980: fig. 28), Sapmaz Köy (Todd 1980: fig. 32, 33), and Tepecik-Çiftlik (Todd 1980: fig. 35). Overall, there appears to be a shared tradition of small to medium bifacial pressure point manufacture in Central Anatolia. Given the similarity between these and Byblos-like points, it may have its origins in the Levant. However none of these sites show evidence of any of the very distinctive larger Group 1 projectiles (Types 1 to 5). Only three sites beyond Çatalhöyük and the Konya Plain possess evidence of these forms. These are Köskhöyük (Silistreli 1985) and Ilicapinar (Todd 1980; Mellaart 1958) to the north and Mersin (Garstang 1953) to the south, all of which are either contemporary with, or slightly later, than Çatalhöyük. There are similarities with larger points from even further afield. Some parallels can be drawn with the larger points from Cafer Höyük (Balkan-Atlı 1994: fig. 57, 58), and Neolithic Levantine sites such as Bouqras contain evidence of larger spear-like points (Roodenberg 1986). Despite this, the remarkable proliferation and dominance of large projectiles during the later history of Çatalhöyük suggest that there was a largely independent tradition for the production of such objects, further contributing to the sites idiosyncratic nature and divergence from its more typical early Neolithic characteristics.

I recognise, however, that these assumptions entail the adoption of a fairly normative view of what style means. Specifically, that different styles of projectile points exist in time and space because different ideas about how to make and use projectile points were held by different groups of people. The converse, that similar styles denote shared ideas about design, is also assumed (cf. Conkey 1990:9). Whether this is justifiable from a theoretical viewpoint is debatable as the question of whether similar design always implies cultural affinity is a thorny one:

> From the rootedness of style inquiry in culture-history, and thus in the history of our archaeological practise, it is not surprising to see – despite subsequent reconceptualisations of the archaeological record and of the uses of style in archaeology -- the persistence of attempts by archaeologists to try to account for 'similarity-relations' that appear to obtain among artefacts and cultural products... We have remained 'forever hopeful' that such similarity-relations may be taken as evidence for historical and cultural relatedness of artefacts -- and by extension, of their makers – so that we might read history, if not culture, from styles (Conkey 1990: 8, in part quoting Davis 1990).

This cannot be adequately resolved in the context of this discussion. It is perhaps suffice to note that stylistic affinities do not necessarily *imply* direct cultural relationships, but are at least *suggestive* of a common cultural phenomena that is rooted in some form of historical association.

Raw Material Use and Acquisition

Although obsidian provides the raw material for most of the lithic assemblage in western central Anatolia, flint is a small, but important component of most assemblages. At Çatalhöyük, what can be assumed to be local (or at least regional) cobble flint was used as well as non-local imported tabular flint. The former was likely to have been obtained from local wadis or erosional deposits, including gravel beds and other alluvial deposits within a day's walk north of Çatalhöyük. Fine-grained tabular flint, particularly the translucent variety used to manufacture the daggers, does not exist on the Konya plain and would needed to have been imported. Tabular flint sources are found in the Beysehir region and in the Taurus mountains (Balkan-Atlı 1994:37), Karamanmaraş and Gazientep provinces (Garrard *et al.* 1997), and northern Syria to the south-east (Nishiaki 1993).

The apparent tendency at Çatalhöyük for flint to have been selected over obsidian for the manufacture of different classes of debitage and tool also occurs at other Anatolian Neolithic sites: sickle-blades and piercers were mainly manufactured from flint blanks at Suberde, and flint was used preferentially for scrapers and piercing tools at Can Hasan III. Flint is a structurally more robust raw material than obsidian, and it appears to have been selected for implements that required a stronger and less brittle edge than obsidian could provide. One additional example of differential selection includes the finely pressure flaked and ground hilted daggers, which represent some of the finest examples of knapping expertise at Çatalhöyük. These only occur on very fine-grained honey flint. At Suberde, Can Hasan III and Çatalhöyük, coarse-grained flint is generally more intensively worked than obsidian; proportions of retouch on the former consistently outweigh the former. This suggests that flint may have, as has often been suggested, been more difficult to acquire than obsidian, particularly if obsidian was being imported to Neolithic sites on a regular basis through some form of exchange network. As outlined in the following paragraphs, this hypothesis is in part supported by the observation that obsidian is extensively prepared before its introduction into the on-site technological system. At Çatalhöyük, cortical surfaces on coarse-grained flint are far more common than on obsidian, suggesting that preparation of at least some 'raw' flint was occurring on site. However, there were far fewer instances of cortical surfaces on the finer-grained material, supporting the claim that this too was a pre-prepared, imported material.

Turning to obsidian, it is well established that separate geological outcrops of obsidian contain distinct proportions of trace elements. In principal, therefore, it is possible to identify the source of individual pieces of obsidian occurring in archaeological contexts on the basis of their elemental composition. The archaeological implications of this caused much excitement throughout the 1960's and 1970's and the pioneering work on obsidian in the Near East was conducted during this period by Renfrew, Cann and Dixon who, within a more general framework of examining the mechanisms of obsidian distribution throughout the Near East and Aegean, also worked on identifying and characterising the various geological sources of obsidian in Southeastern Europe and Anatolia (Dixon 1976; Dixon *et al.* 1968, Renfrew *et al.* 1968).

Trace element analysis of obsidian from Can Hasan III, Aşıklıhöyük, Hacılar, and Çatalhöyük suggests that the Neolithic inhabitants of Central Anatolia obtained their obsidian primarily from the various sources in the Cappadocian region of Central Anatolia (Wright 1969; Dixon 1976; Todd 1980; Bloedow 1987; Ataman 1989) (figure 6.3). There are also several obsidian sources in the Lake Van region of eastern Turkey that supplied both eastern Anatolian and Levantine settlements from the aceramic Neolithic onwards, but there is no evidence that these were used by Central Anatolian Neolithic groups. Analysis has determined that obsidian from Can Hasan III was obtained primarily from sources of the Çiftlik region of Central Anatolia (Ataman 1989:50), as do the analysed samples from Aşıklıhöyük. Obsidian from later Neolithic Hacılar, however, comes from the Acigöl area of central Anatolia. Similarly, a number of researchers have analysed obsidian from Çatalhöyük, and the results suggesting that Acigöl was the primary source, although one piece does appear to have come from the Çiftlik area (Gale 1981).

Despite the advantages of the technique, analysed samples are often so small (for instance, thirteen analysed pieces from Çatalhöyük) as to be statistically meaningless for making general statements on the specific sources exploited by a prehistoric group. Given that there are several known sources in Central Anatolia, including the areas of Çiftlik, Acigöl, and Niğde (Todd 1980:30-37; Cauvin & Balkan-Atlı 1996), and probably many which are as yet uncharacterised, it would seem possible, if not probable, that prehistoric exploitation of obsidian was not restricted solely to one source but made use of several. To suggest based on a minutely small sample the exact source of any particular site's obsidian is problematic. Without a comprehensive sampling program that examines obsidian both within and between phases, little is gained beyond identifying the general region the obsidian came from. More recent work undertaken by M.-C. Cauvin and N. Balkan-Atlı at the sources themselves promises to remedy our lack of detailed knowledge about the processes involved in obsidian acquisition (Cauvin & Balkan-Atlı 1996). But at this point it is sufficient to note that current evidence shows that the Central Anatolian sources were the exclusive source of obsidian, and Çatalhöyük is simply one settlement in a series that was dependent on these sources.

As noted, the inhabitants of Central Anatolian sites obtained their obsidian in a variety of ways. At Aşıklıhöyük, the large quantities of blocks and primary pieces suggests that obsidian was imported into the site in a relatively unmodified state, and that the primary stages of core production took place on site (Balkan-Atlı 1992). As this site is located quite close to the obsidian sources, the transportation of unmodified blocks of obsidian into the settlement would not have required a huge effort. This accounts for the significant core preparation and reduction debris on site.

At Suberde, however, which lies a considerable way from the central Anatolian obsidian sources, Bordaz notes the high proportion of tools to debitage (around 25%) and the small size of the implements suggesting that little of the obsidian was wasted (Bordaz 1968:52). In addition, as the vast majority of the cores were fragments, and some of these were used as implements, obsidian appears to have been used efficiently.

At Can Hasan III the lack of large debitage and the small size of cores suggests that the complete debitage process is not completely represented, with the initial shaping, raw-material testing and core preparation stages apparently absent (Ataman 1989:77). This is attributed to one of five possible reasons: (i) the initial preparation of material may have been conducted at source, presumably to minimise transportation costs; (ii) the original pieces of raw-material may have been small and unsystematically worked; (iii) knapping may have been conducted in an area of the site that was not excavated; or (iv) carried out in the excavated area but the debris discarded outside the excavated area or, finally; (v) all stages of the debitage process are present, the debitage process being extremely efficient in its use of material. Consideration of the debitage distributions led Ataman to the conclusion that all stages of reduction following initial core preparation are represented in the assemblage. Thus, it appears that initial testing and shaping of raw-material was conducted at the its raw-material source (Ataman 1989:84).

At Çatalhöyük, the earliest stages of debitage are also absent, for a similar reason. The effect of differential distributions can be discounted, as the assemblage includes excavated material from two widely separated areas of the mound in addition to the surface material. It is true that the top-scrape and excavation samples did identify areas of higher density (associated particularly with high ash concentrations) that can be attributed to discarded knapping waste, but even in these areas the early stages of core reduction are missing. Most of the cores at Çatalhöyük, particularly the larger prismatic blade cores, would have required extensive preparation and shaping resulting in at least some evidence of cortical surfaces, even if the debitage from such preparation was further modified. The only explanation is that obsidian was imported into the site in a de-cortexted and roughed-out state. The presence of crested blades in the assemblage is evidence that the preparatory phases of blade core manufacture were occurring at Çatalhöyük, although the low numbers may be indicative of some cores being brought in at the stage where blade manufacture could proceed with a minimum of additional preparation. Given that there is no evidence for cores or core preparation debitage for the large tabular flint blades, the bipolar obsidian blades, or the large obsidian flakes, it seems likely that these were imported as ready made objects (see Chapter III and IV).

Given the differences between Aşıklıhöyük and the group of sites further west of the obsidian sources, it would appear that the degree of preparation of obsidian prior to its importation into Neolithic sites in Central Anatolia is influenced by its proximity to the source of raw material. Those sites further away from the sources – and thus with higher obsidian transportation costs – would seek to obtain obsidian that was as close to a productive stage as possible. Obsidian was prepared at source to minimise transportation costs by reducing the weight and, by pre-forming the material, reducing the probability of poor quality and unworkable obsidian. This would reduce the incidence of on-site errors in the initial (and often difficult) shaping of blade cores. In some instances, particularly PPNB sites in the Northern Levant, this logic may have been taken to an extreme, and may be the reason for the apparent trend of ready-made obsidian blade imports. This model fits the data to a certain extent, insofar as Çatalhöyük, Can Hasan III and Suberde have fewer incidences of core preparation pieces than Aşıklıhöyük. This model, however, does not take into account the different acquisition mechanisms that develop through trade and exchange or direct access, and has the potentially deleterious effect of reducing economy to the least common denominator of transportation and productive efficiency.

Regular acquisition of obsidian was undoubtedly crucial to the well being of the Central Anatolian sites. It is reasonable to suppose that without a steady supply, the phenomenon of large, permanently occupied communities in an area more or less devoid of substantial siliceous stone materials could not have occurred.

The mechanism of obsidian acquisition has been addressed in the past; Renfrew and Dixon, in separate articles published in 1968 (Renfrew *et al.*:1968; Dixon et al.:1968), attempted to elucidate the mechanism of obsidian distribution in the Near East by plotting the percentage of obsidian found at sites in several different regions against their distance from the obsidian source. The resulting shape and slope of some of the lines (the 'fall-off curves') were thought to be diagnostic of types of exchange mechanisms (Renfrew *et al.*:1968:329-30; Renfrew 1969:157; 1972:465-6; 1975:47-8). One of these was termed 'down-the-line', where Renfrew envisioned villages keeping a proportion of obsidian that they received before passing the rest on to other villages. This was an important step for studies of prehistoric exchange, as it correlated material patterning with an established anthropological model (Sahlins' "balanced reciprocity" 1972:194) (Torrence 1986:14). The shape of the fall-off curve for sites in Central Anatolia was suggestive of a similar exchange system. On the other hand, the fall-off curve for sites in the Levant using the eastern Anatolian sources was suggestive of a different form of acquisition. In this instance, Renfrew proposed that nomadic groups travelling throughout the desert regions were responsible for the distribution of obsidian to Neolithic settlements (Renfrew et al. 1968; McDaniels et al.:1980:7; Bloedow 1987:117).

In general terms, Hodder (1976) has questioned the relationship between calculated 'fall-off curves' and exchange systems. He effectively shows that several different forms of trade or acquisition can result in similar types of patterning. This counsels that caution should be used in accepting Renfrew's results. My own opinion is that there is insufficient data to convincingly develop any model of obsidian exchange for Central Anatolia. Quantities of obsidian found at Central Anatolian Neolithic settlements do drop off the further one moves away from the obsidian sources, but these sites (i.e. Hacılar, Suberde, Erbaba) are also respectively closer to flint sources. In other words, the lesser quantities of obsidian may not be due to their peripheral position in regards to obsidian sources, but rather their central proximity to flint sources.

For other reasons, neither 'down-the-line' nor direct access models seem probable for Çatalhöyük. A 'down-the-line' system depends on a regional population density high enough that regular contact could be maintained between sites within the exchange mechanism. While there is some new evidence suggesting that there are additional sites surrounding Çatalhöyük (see below), these are thought to have been very much smaller. The logic of the down-the-line model depends on balanced reciprocity, but because Çatalhöyük is the largest known Neolithic site in Central Anatolia (and the whole of the Near East) its obsidian requirements would have prohibited such a system from working. Any smaller sites between Çatalhöyük and source would have had to export a quantity of obsidian many time greater than its own intake. This does not seem a likely scenario.

It is perhaps more likely that Çatalhöyük acted as a regional distribution centre. There is some evidence for the development of regional centres in the Near Eastern Neolithic – 'Ain Ghazal, Jericho, Abu Hureyra and Çatalhöyük have all been suggested as potential contenders (Rollefson 1987). Until recently, there was little evidence to support this, as Çatalhöyük stood in isolation on the Konya Plain. There were some early suggestions that Çatalhöyük acted as a regional centre, but these were poorly substantiated (e.g. Bartel 1972). As part of a current research project, however, Baird has presented some preliminary results that suggest several smaller Neolithic sites exist around Çatalhöyük. This new evidence lends itself to the idea that Çatalhöyük was a redistributive centre, providing subsidiary communities with obsidian and other goods (Baird 1996). What it doesn't answer, however, is the mechanism by which obsidian came to Çatalhöyük in the first place.

Ruling out 'down-the-line' acquisition leaves two other options, both of which have already been raised: direct access and the 'wandering pastoralists' model. With regards to the former, I think it unlikely given the distance to the sources, but not impossible, that the inhabitants of Çatalhöyük (or Can Hasan III, Hacılar and the other Neolithic sites, for that matter) obtained their obsidian by direct access. Intuitively, it seems improbable that every family would have had to send someone out to the obsidian sources to acquire their modest requirements. It has, however, been argued elsewhere in the Near East that acquisition of raw material may well have been an imbedded activity. Nishiaki (1992), for instance, asserts that the acquisition of the fine-grained flint used for Naviform core production in the Northern Levant was imbedded in hunting activities and movements. So, while the concept of 'single purpose direct access' seems unlikely, the possibility that obsidian was obtained at source by individuals from Çatalhöyük as one component of a series of activities requiring relatively long-distance travel is a possibility. One piece of evidence that may argue against this, however, is the nature of flint exploitation.

It has been argued that the coarse-grained flint material used by central Anatolian sites is of local origin. At Çatalhöyük, this flint is of poor quality; it shows a high incidence of cortical surfaces, and likely derives from relatively nearby gravel deposits. Direct access, therefore, is the likely acquisition mechanism. Although it never outnumbers its obsidian counterparts, it is used preferentially for the manufacture of particular forms of retouched edge. What is particularly interesting, is that despite its closer proximity, it is also more intensively used than obsidian. One explanation for this phenomena is that flint is a comparatively more 'expensive' material to obtain precisely because it is acquired by direct access, whereas if obsidian is being brought into Çatalhöyük by an established and consistent mechanism, it is easier to procure.

This takes me to the second of the two default exchange options – the 'wandering pastoralists'. Anthropological studies have shown the role of itinerant peoples in supplying special services and exotic goods, and an exchange model has been forwarded by Perlès (1989) that depends on exactly such a phenomena. She argues that obsidian pressure-blades found on mainland Greek Neolithic sites were obtained by trade with specialised groups of "itinerant lithicians". The homogeneity of high quality, but low-density, blade production across Neolithic sites is used as evidence to support her argument of itinerant traders. The primary argument, however, is that obsidian cores are predominantly preformed when introduced into these sites (Perlès 1989:13).

Some similarities can be made with Çatalhöyük. Although the form in which obsidian was imported has been shown to vary, in all cases some degree of core-preparation appears to have taken place prior to its introduction. It could be, therefore, that there were itinerant groups responsible for the transport of modified, prepared blocks of obsidian to Çatalhöyük, and possibly the inhabitants of other Central Anatolian sites (with the obvious exception of Aşıklıhöyük). Further support for this model comes from the significant amounts of other non-local raw materials found at Çatalhöyük. These include copper, green-stone, dentalium shells, fine-grained honey flint, gypsum and vesicular basalt all of which are suggestive of some form of trading mechanism, rather than direct access.

In terms of the latter, the 'specialised' component of the traders is particularly important in the later phases of Çatalhöyük, for the primary preparation of a core requires a certain degree of knapping skill and, in the case of pressure-blade debitage, is a critical stage in the debitage sequence. It is temping to see the inhabitants of Çatalhöyük depending on individuals skilled both in the arts of travelling (Helms 1992) and stone-working for their obsidian requirements. Ultimately, however, the form of evidence available does not lend itself to a convincing argument for any one dominant mode of raw material acquisition. It also seems unlikely that there was only one mode in use for the whole of the occupation; a more realistic picture may be a combination of modes ranging from trade with neighbouring communities, direct access and perhaps the use of 'specialised traders' based on the wandering pastoralist models proposed for the Greek Neolithic.

Summary

Based on evidence presented in Chapter III and IV, several different technological systems appear to have been in operation at Çatalhöyük, although not all at the same time. Technological comparisons with the major Neolithic Anatolian sites show that although there are broad similarities between the earliest levels of Çatalhöyük and its pre-ceramic predecessors (principally Suberde and Can Hasan III), there are more differences than similarities between the later levels and these earlier sites. This is primarily because Çatalhöyük shows the first manifestation of pressure blade technology in Central Anatolia. Importantly, Çatalhöyük is the only site to exhibit an unbroken sequence of change between a flake-based technology to a blade-based technology. Typological comparisons with point forms from sites neighbouring Çatalhöyük show some basic similarities, although the closest parallels are seen only at a small sub-set of sites that are either contemporary or slightly later in time than Çatalhöyük.

VI

TEMPORAL, SPATIAL AND CONTEXTUAL PATTERNING

Sample Constitution

The data used for this examination are exclusively obtained from Sample A and D. The former sample is derived from the 1960's excavation, and provides the greatest time depth, enabling the identification of long-term changes in the industry. The latter sample comes from the 1995 and 1996 excavations, and is used to discuss the changes between different architectural phases within a single building.

As was noted in Chapter I, there are a few problems with Sample A that might effect the outcome. Specifically, Mellaart states that the twelve building-levels "represent twelve different cities, not phases or repairs of single buildings" (Mellaart 1967:49). However, researchers currently investigating the stratigraphy of Çatalhöyük, including the standing sections of the 1960's, suggest that Mellaart's levels are a simplification of extremely complex phenomena (see, in particular, W. Matthews *et al.* 1996). It is not at all certain that they represent 'cities' or even particularly unified rebuilding events.

Despite these concerns, however, there is value to Mellaart's levels for examining temporal patterns – if used cautiously. All archaeological phasing is necessarily a simplification of complex processes – but one cannot dismiss it because of this, as this is precisely the objective. In this context, the case can be made that Mellaart's levels represent accumulations of *relatively* contemporaneous building deposits over time. Part of this is borne out by several (uncalibrated) radiocarbon dates taken from the twelve levels that, with one or two exceptions, demonstrate a gradual chronological change from the lowest to the highest strata (table 6.1). As my initial objective here is only to examine broad temporal patterning, Mellaart's levels serve this purpose well. More detailed discussion of aspects of temporal patterning between phases within a single building is currently being studied (see Hodder *et al.*: in preparation).

Approximately 97% (n=4,749) of Sample A was given a 'level' designation by Mellaart and all of Sample D can be viewed within this general framework. The total provides a relatively large body of material that can be used to study long-term changes in Early Neolithic lithic technology in Central Anatolia.

It is worth drawing attention to the evidence for Chalcolithic settlement on at least a small portion of the mound, immediately beneath the surface. This was briefly noted in the discussion of points, where two Chalcolithic transverse-arrowheads were noted. The only unequivocal signs of this come from a sub-sample of the Sample D material, although it is possible that there is a Chalcolithic element in the surface collected samples (i.e. Samples B and C). There is, however, no evidence for a Chalcolithic element in Sample A, which forms the focus of the next section.

Long-term Changes

There are two related aspects which I wish to consider: (i) technical (i.e. productive) changes over time and; (ii) tool typo-functional changes over time. The data for this comes from Sample A. As described earlier, there are a total of twelve building levels that have phased lithic material (as follows: II, III, IV, V, VIA, VIB, VII, VIII, XI, X, XI, and XII). The subdivision of VI rests on the identification of a destruction event, thought to be a conflagration of the VIA settlement, rebuilt as VIB (Mellaart 1967:63). There is a considerable difference in the extent of the excavated areas for each of these levels, with the smallest areas at the bottom of the sequence. The plans of Levels XI and XII (Mellaart 1966:168-169) suggest that the former may have three and the latter four buildings, but none were completely excavated. Tabulation of the buildings found between Levels II and X show that VIA and VIB have the greatest number (table 6.2) and also the largest areas of excavation. Unfortunately detailed information on the volumes of excavated areas are unavailable. The quantity of material allocated to each Level is summarised in table 6.3. Level VI ('all' plus those that can be placed to 'A' or 'B') has the highest percentage of phased material, roughly 20% of the total, followed by Levels V and VII.

Changes in production technology

As described in Chapter III, upwards of 95% of the assemblage consists of a translucent grey to black obsidian. Flint, both coarse-grained cobble and fine-grained tabular varieties, was used in lesser quantities. Knapped quartz and basalt, although present, are very rare. The proportion of flint to obsidian fluctuates insignificantly over time. Levels VIA/B and XI both have over 6% flint, Level VIA is the third highest with 6.7%, which is in turn followed by Level II with 4.6% (graph 6.1). These figures suggest that there is no apparent trend towards the greater or lesser use of flint over time.

There are, however, a small number of extremely important identifiable changes in debitage production techniques over time. Table 6.4 lists the various debitage categories by level. One clear difference that can be identified between levels using these data is the shifting proportion of the various debitage products, particularly the change in proportions of blades and flakes (graph 6.2). Here it can be seen that there is a sudden increase in the percentage of blade debitage between Levels VII and VI, and a corresponding decrease in the percentage of flakes. In Chapter III it was shown that prismatic blades could be distinguished from other blades by their characteristically thin, regular form, unidirectional scars and trapezoidal cross-sections, their small punctiform to linear butts and well prepared proximal ends. It was argued that these were most likely produced using a pressure technique. Graph 6.3 displays the ratio of prismatic blades to flakes by level, and it can be seen that there is also a sudden increase in the proportion of the former between Levels VII and V. Non-prismatic blades, less regular in form and most likely percussive rather than pressure derived, similarly show an abrupt increase between Level VII and VI, although a difference between VIB and VIA can be noted (graph 6.4). This trend is reflected in the changing proportions of core types between levels (table 6.5): single-platform prismatic and non-prismatic cores only emerge in Level VI, whereas flake cores dominate the earlier levels and are low to non-existent in the later. The increased emphasis on highly prepared cores is reflected in the higher incidence of core edge platform grinding in later levels (table 6.6).

Changes in tool characteristics

The proportions of the six major tool classes do not appear to follow any identifiable trend over time (table 6.7). Temporal patterning in the relative proportions of the three major groups, points, pièces esquillées and retouched blades and flakes is similarly equivocal (graph 6.5). There does appear to be a gradual increase in the relative proportion of points (and corresponding decrease in retouched blades & flakes) from Levels XII to VI, but these decline in Level V and IV, and again in Levels III and II. Proportions of pièces esquillées remain fairly uniform over time until Level II, when there is a noticeable decline in numbers. The distribution of the admittedly small numbers of mirrors and the single phased dagger in the sample suggest this is a phenomenon of Levels V and VI. However, illustration of a additional dagger in Mellaart (1964:fig.52) labelled "weapons of Levels X-VII" suggest that earlier examples may exist.

The twelve statistically determined 'point and biface' groups can also be examined over space and time. Unfortunately, there are only 182 typed points that can be assigned to any particular level, so actual frequencies are fairly low. However, a review of counts by level suggests that there are temporal changes in point types (table 6.8). Three major trends can be identified: (i) there is a difference between Group 1 (Types 1 to 5) and Group 2 (Types 6 to 12) points insofar as the occurrence of those in the former group tends to be restricted to levels VIII and above, whereas point types in the latter group occur through-out the sequence; (ii) within Group 1, Type 2 is the most widespread, but the others are restricted to the middle levels (V, VI, and VII); (iii) within Group 2, frequencies of Types 6, 7, and 8 tend to be higher in early and middle levels, but 9, 10, 11, and 12 more common in later levels. If the type references are converted to more meaningful descriptions, these trends can generally be interpreted as a tendency for large points to be more popular in later levels, with the largest variety occurring exclusively in Levels V, VI and VII. Large tanged points occur more often in the later levels, but the smaller tanged and shouldered points are more prevalent earlier. In other terms, examination of point retouch-extent by Level shows little patterning, in contrast to earlier suggestions by Mellaart and Todd (table 6.9).

The non-formal tool group provides a more difficult dataset to explore because of its inherently disparate nature, it does not therefore fall into the typological categories so easily used for pattern exploration.

For comparative purposes, I have tabulated the relationship between three retouch variables – edge delineation, angle and morphology – and level (tables 6.10 to 6.12). The distributions show that denticulated edges become far more common in later levels, with a corresponding decrease in convex edge. The former delineation is most closely associated with blade debitage, which has been show to increase in frequency over time. Other delineations, and angle and morphology distributions remain relatively stable over time. In other words, it appears that the major effect of the technological transformation to a blade industry was the relative increase in the presence of denticulated edges, and a corresponding decrease in proportions of convex edges.

The distribution of different retouch positions on blade and flake blanks has been presented in table 6.13. Here it can be seen that in all Levels and blank types, direct retouch is the most common position. In the case of flake blanks, the proportion of bifacial to inverse retouch fluctuates over time, but generally is marginally higher. Non-prismatic blades also show consistently higher proportions of this form of modification over inverse retouch, although the difference is not as pronounced as in prismatic blades, where bifacial retouch is usually at least twice as high as inverse retouch, in all Levels. Alternate and alternating retouch are infrequent for all blanks, in all Levels, with the possible exception of prismatic blade blanks in Levels II and IV.

A rather more synthesised approach is offered by the non-formal tool typo-functional classification. Tabulation of the six categories by level is suggestive of an increase in the numbers of cutting tools at the expense of scraping tools (table 6.14). This trend is mimicked in the blade group insofar as cutting tools increase over time (table 6.15). This is undoubtedly also a function of the more fundamental increase in the proportion of blades over time, and the fact that blade tools were predominantly classified as cutting implements. It is interesting that flake non-formal tools do not show as major a change as the blade non-formal tools (table 6.16). Proportions fluctuate, but there are no unequivocal changes in the type categories over time.

Correspondence Analysis of Debitage, Tool and Temporal Data

In order to clarify the relationship between level and assemblage characteristics, a Correspondence Analysis was performed. Correspondence Analysis is a multivariate statistical analysis that is suited to categorical data of this kind. Its applicability to archaeological analysis is outlined in some detail in Bolviken *et al.* (1982:41:60) and a brief summary of its principals and procedures can be found in Appendix 2. In this particular instance the values were standardised, which resulted in roughly 58% of the variability being contained in the first dimension (the *x*-axis) and 23.01% in the second dimension (the *y*-axis), the sum of which affords very good two-dimensional representation of the relationships between both levels and debitage categories. The resulting plot of the values shows a close affinity between particular debitage type and levels (graph 6.6).

Several other relationships are also validated by this analysis. First, based on debitage categories alone, it is possible to confirm statistically a meaningful temporal relationship between the levels, insofar as they consistently plot in their stratigraphic order. Secondly, the association between all forms of blade debitage and the later levels is clarified. Conversely, flake debitage is strongly allied with the earlier levels. The cores show a variety of relationships, both to other forms of debitage and to the levels. Most exceptionally is the position of the opposed platform blade and flake cores to the far left of the graph, unmistakably related to the earliest levels in the sequence.

In more detail, six groups of level designations and/or debitage categories can be distinguished: Group 1 has already been mentioned and contains opposed platform flake and opposed platform blade cores. Group 2 consists of the earliest two levels, XI and XII, positioned in the upper left quadrant and thus delineates the later temporal range of the plot. Flakes and multi-platform/sequence flake cores form Group 3, together with Levels X, IX, VIII, VII, and VIB. Their location towards the left side is indicative of their early temporal position. Below this is Group 4, containing the single-platform flake cores and chips that, as outliers, are identified as non-temporal and ubiquitous debitage products. Group 5 consists of shatter, plunging blades, spherical flake cores and the indeterminate debitage with Level VIA. The upper right quadrant contains he largest assortment of debitage and levels, the sum of which suggests a propinquity between all blades, single-platform prismatic and non-prismatic blade cores, crested blades, and Levels VIA/B, V, IV, III and II.

It will be noted that Levels VIA, VIB, and VIA/B fall into three separate groups that range between the left and right of the graph, the first more closely allied to flake debitage, the latter two, particularly VIA/B, to blade. The meaning of this is unclear and VIA/B is assumed to represent contexts that contained a mix of the pre-and post-conflagration phases, but clearly shows little resemblance in debitage composition to VIB. It may be the case that the mixed level contains greater quantities of A than B. If this is indeed the situation, then the sudden shift in production techniques noted earlier may have its origins in post-conflagration Level VI.

A similar analysis was performed on the tool types established for the retouched debitage. A total of 1380 tools over 28 type groups were used to examine changes over the 12 levels (table 6.17). The result is as significant as the debitage correspondence analysis for clarifying the differences between the earlier and later levels in the assemblage. In this instance, however, the major difference appears to be between the earlier levels up to and including Level VIII and those of VII and above. In one sense differences exist along the flake:blade parameters, which has already been discussed. However, when viewed in terms of tool composition additional details are attained that permit further interpretation. For instance, the earlier levels cluster closely together with seven particular tool types: all of the flake tools with the exception of those classified as indeterminate, and point types 11 and 12 (graph 6.7). Point types 11 and 12 are the smallest in the assemblage and are both tanged, and for the most part shouldered. They also represent the least equivocal class of arrowheads insofar as the other classes are for the most part larger and/or lack any evidence of hafting modifications. The remainder of the tool types, with the exception of pièces esquillées, indeterminate flake tools, blade scraping tools, and flint daggers, are loosely but unambiguously clustered with Level VII and later. The four noted exceptions that occur beyond the reasonable boundaries of these two groups appear to be more closely allied with the later cluster.

In summary, the evidence from both the debitage and tool correspondence analysis shows that there is a clear and indisputable change in the assemblage over time. At the most general level this appears to be best represented by a change in production techniques from a flake to blade technology, highlighted by the increase of pressure-produced prismatic blades around Levels VI. This is mirrored in the more detailed changes that have been recognised, with the flake tools and small points most closely associated with the earlier levels giving way to a much wider range of blade tools, points as well as the introduction of unique items such as obsidian mirrors and flint daggers. Tools such as blade scrapers and pièces esquillées appear all the way through the assemblage, and are arguably basic components of the Neolithic tool kit.

One interpretation of this remarkable techno-typological change is that there is a change from an industry that bears all the hallmarks of the later aceramic Neolithic – comparable to the aceramic Can Hasan III assemblage – to an industry that becomes increasingly more dependent on blade technology, and produces very large points and bifaces,. On the basis of this evidence, it is reasonable to consider the Çatalhöyük assemblage as consisting of at least two distinct temporal phases, with the major changes occurring between Level VII and VI. This observation will be further explored in the following chapter.

It is again worth drawing attention briefly to the Chalcolithic component of the assemblage within Sample D (from the so-called 'Summit' excavation area). This can be compared to the Neolithic components of sample D (from the 'North' excavation area), highlighting the differences between the two periods. The main difference that can be identified involves the proportion of blade debitage, as the ratio of blades to flakes in the Neolithic sub-sample is almost 1 to 9, whereas in the Chalcolithic sample, it is 1.4 to 1. It is interesting to note that the blade to flake ratio of Level II is 1.8 to 1. This suggests that there may be a slight decline in blade production in the Chalcolithic. It is unclear how long the break in occupation was between the two periods, although this basic technological comparison shows that there appears to have been a strong technological similarity between the latest evidence of Neolithic activity and the earliest evidence of Chalcolithic settlement on the east mound of Çatalhöyük.

Surface Spatial Patterns

In contrast to the previous section, I am here concerned primarily with the distribution of artefacts collected from the surface of the east mound found in Samples C and D of the assemblage. Given the diagnostic potential of the lithic artefacts vis-à-vis chronological change, it is possible to identify significant differences between different parts of the mound.

Distributions of lithic artefacts show some minor variations in density which can be correlated to distributions of ceramic and bone densities collected as part of the same program. The southern part of the mound, particularly the southern slope of the main eminence, displays a reduced density of flint and obsidian artefacts (figure 6.8). Evidence from the ceramics suggests that this may be the focus of classical occupation deposits, which thus mask earlier, Neolithic, deposits resulting in the lower densities of knapped-stone (Last 1996). Lower overall densities of lithic material are also seen at the north-west corner of the mound. The distributions of various debitage categories were also examined for any spatial variation, however because of the extremely low overall densities, patterns are difficult to identify.

The distribution of blades over the surface is uniform, varying in density only between zero and three blades per 2x2 unit (graph 6.9). The distribution patterns of the smallest pieces of lithic artefacts recovered from the surface collection – the small chips of obsidian – were also examined for patterning. Here too there is a low density on the southern slope of the larger eminence, possibly because of classical overburden. Generally, higher densities of obsidian chips are found extending onto the lower slopes, presumably as the result of selective downslope movement of smaller items.

Interestingly, some of the temporal patterns identified above can be seen to exist on the surface of the mound, as discovered by investigations conducted between 1993-1995 (Conolly 1996). Differences in the percentage of blades in the total east-west transect sample show a gradual decrease in the percentage of blades in the northern area (figure 6.10). Given that blades supersede flakes approximately midway through the occupation, the pattern observed in the surface data is thought to relate to temporal variation in the occupation of the mound. Although sample sizes are very low, this remains the clearest example of spatial patterning in Sample B.

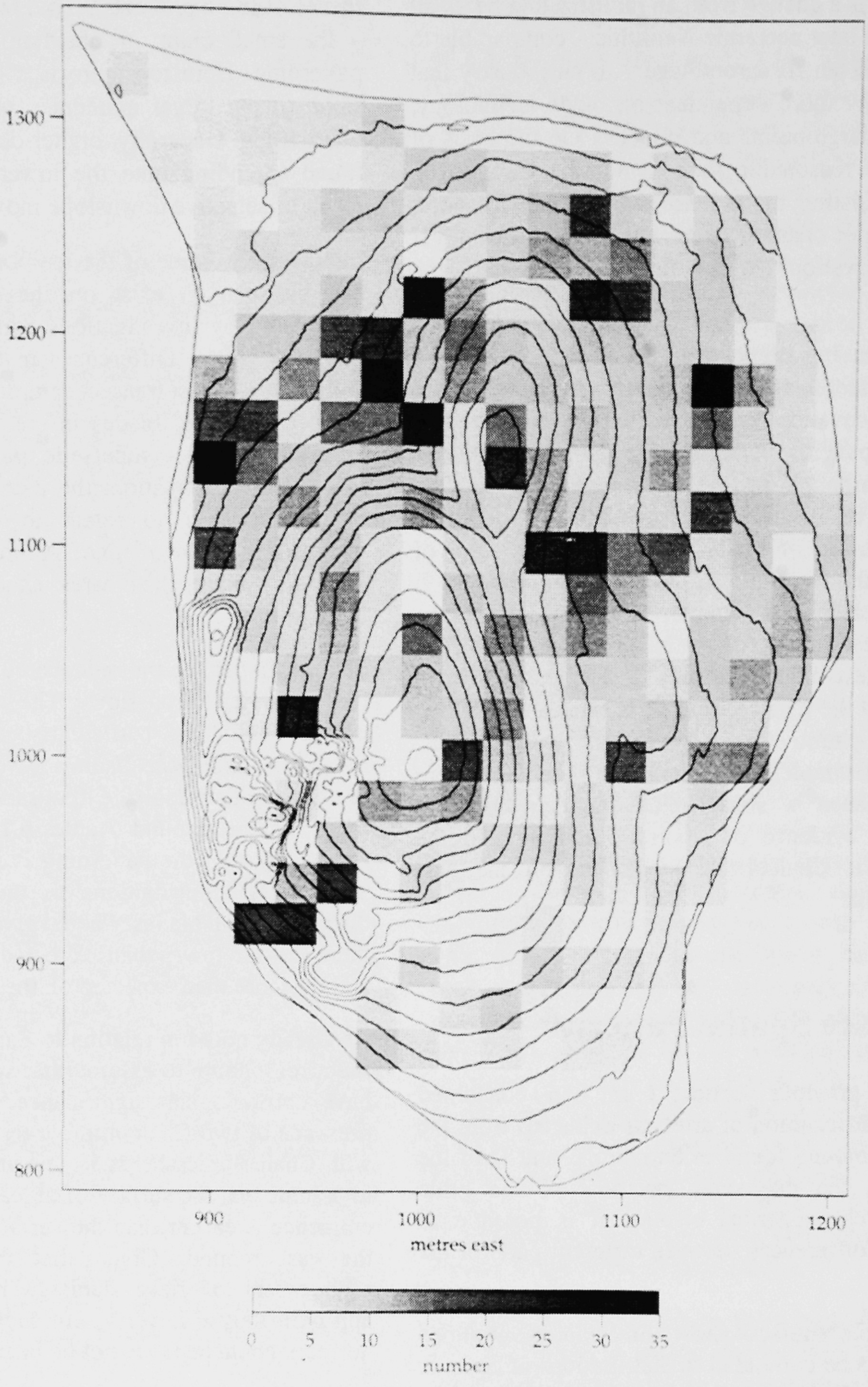
Sample C, despite the reduced control over recovery, affords more detailed discussion. The material collected from the northern eminence, particularly on the top and north slope of the north eminence, display lower proportions of blades to flakes and other debitage than samples derived from the other areas of the mound (table 6.18). A chi-square statistic establishes that the patterning is significant at the 1% level. The largest contributions to the statistic come from the distribution of blades where, given the overall distribution, there are far fewer than expected on the northern eminence and far more than expected on the main mound.

As already noted in relation to Sample B patterning, it would seem reasonable to assume that such differences in debitage have chronological significance. I have already noted the presence of two Chalcolithic transverse-arrowheads, together with Chalcolithic sherds in this area, so it seems reasonable to assume that the surface of at least a portion of the northern eminence is earlier than the surface of the main eminence of the east mound. Given that the major change in the replacement of flake debitage by blade debitage occurs approximately at Level V, this suggests that the surface of the northern eminence may not be later than Level VI.

Contextual Patterns and Relationships

In Chapter II, I discussed the value of examining the relevant dimensions of variation when searching for contextual patterning around any particular object or group of objects. Ideally, this would involve examining architectural structure and layout, the variation both between and within separate buildings, suspected building function, information which could be obtained from contexts such as burials, other material cultural patterning, and any other potential relevant data such as artistic expression. Developments in archaeological data collection can now provide very detailed

Figure 6.1 Distribution of Lithic Artefacts over East Mound (from Conolly 1996)

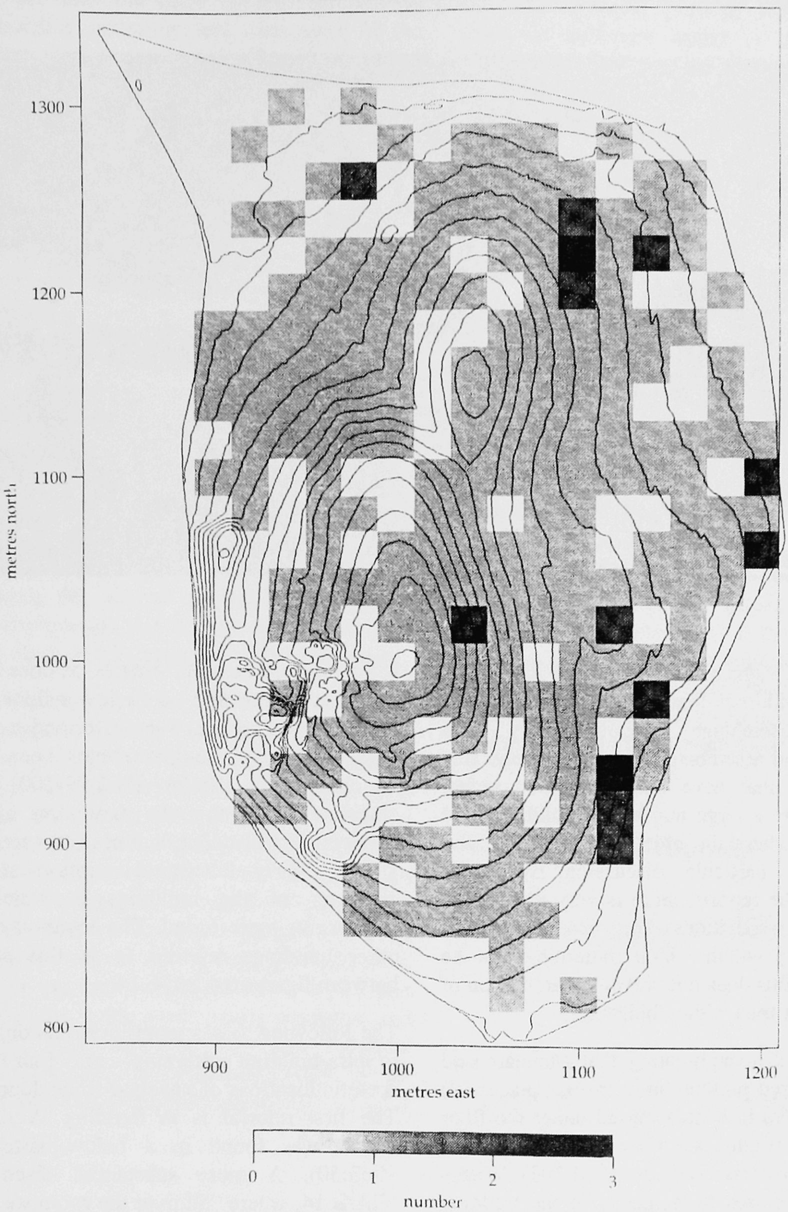


information concerning organic residues and soil chemical composition. In practice, the remarkable abundance of possible 'relevant dimensions' prohibits comprehensive examination of all potential aspects of contextual patterning. In this study there were other limitations, largely connected with the lack of original excavation records and resultant ambiguities concerning the precise context of some of the artefacts excavated in the 1960's at Çatalhöyük. The current excavations, however, have supplied excellent data control, enabling suspected contextual patterning identified in the 1960's material to be investigated more thoroughly.

Patterning within and between buildings

A number of brief comments need to be made concerning the methodology of what can be termed household archaeology. First, whereas some deposits, such as accumulated fire-installation, burial, or other sealed pit-like contexts, can be unambiguously attributed to depositional events during the use of a house, other contexts pose more of a problem. Even those artefacts found on floors may not relate to the activities that actually occurred in the house, but abandonment behaviour. It is even more difficult to extrapolate behaviour from artefacts found within between floor fill as the evidence suggests that fill could have come from several external

Figure 6.2 Distribution o f Obsidian Blades over East Mound (from Conolly 1996)

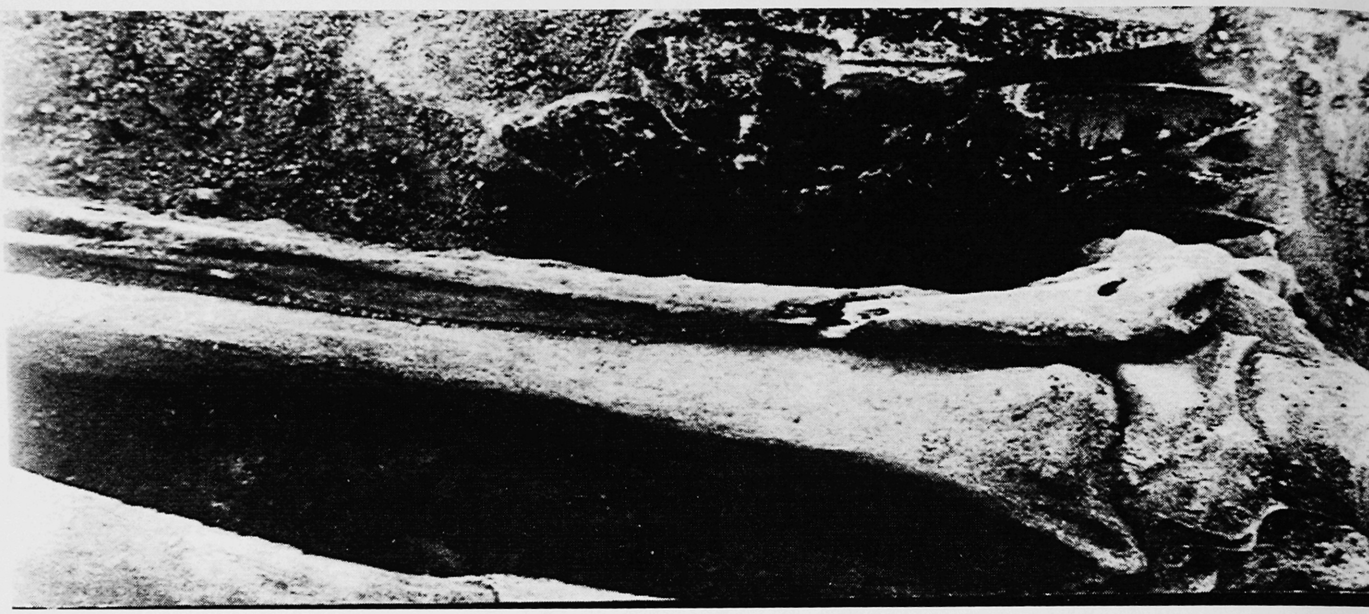


contexts, potentially bringing in artefacts that had no relationship to any activity except the abandonment. Except for certain unique contexts, a direct correlation between any building and whatever assortment of tools and debris it contains is difficult to make because of the process involved in the transformation to a second construction phase or in a structure's abandonment. Yet even as supreme a processualist as Binford has argued that "it does not follow, however, that the location of artifacts has no structure and therefore carries no information about the character of the past cultural system. Quite the reverse..." (Binford 1983:149). Correspondingly, in most circumstances at Çatalhöyük the 'process' that is most easily correlated to artefact patterning within buildings is abandonment behaviour. The exceptions to this are the aforementioned instances of cached or otherwise intentionally sealed deposits; but these too, can be seen as part of abandonment behaviour in a general sense, insofar as they may have been intentionally left as suitable deposits for a 'closed' building.

Intra-building patterning

Although there was a rich and varied array of buildings excavated by James Mellaart, the general characteristics of which were described in Chapter I, there are actually very few direct descriptions of the position of the knapped-stone artefacts found within structures. In all of the reports

Figure 6.3 Obsidian Points in Internment, Adjacent to Lower Leg Bone (Mellaart 1967: fig. 115)



presented by Bialor and Mellaart between 1962 and 1966, there are a total of 38 buildings that have some element of their knapped-stone assemblage described. My own examination of the curated assemblage, however, shows that there are 110 buildings that have knapped-stone artefact collections. Thus there are a large number of buildings that lack any description of where the objects were found, and cannot contribute to this particular discussion. Even with buildings referred to in the reports, there is very little detail as to point positions or associations. This severely reduces the number of structures within which patterning can be examined. Nevertheless, this does not prevent examination of patterning between, rather than within, buildings.

First, however, it is worth recapitulating that Mellaart said tools and weapons occurred preferentially in four places: (i) in the so-called shrines, (ii) in hoards buried under the floor of buildings (often in the south-east corner), (iii) on the floor of buildings, (iv) and in burials (Mellaart 1964:103). Within these broad parameters, closer examination of the building descriptions in the early reports reveals only slightly more detailed patterning.

For example, in Bialor's 1962 report the context of the deposition is given in a few cases. Most of these concern special deposits ubiquitously referred to as caches, as in the case of V.7[1], where four (prismatic) blade cores were recovered. In Level VIII, no specific building is mentioned, but five of the eleven points examined are said to come from a pit (Bialor 1962:74). In VI.1 it is stated simply that ten points were 'found together' (Bialor 1962:78). Building III.2 had a large cache of 12 bifaces, as does II.1 where 14 bifaces were found clustered on the lower floor of what was thought to be the storeroom. These "formed a neat pile" and were, quite reasonably, thought to "have been contained by a string or cloth bag" (Bialor 1962:99-100). Mellaart does not elucidate any further the particulars of these or any other deposition of obsidian or flint in this report of the same year, although fairly elaborate descriptions are provided about the character of the buildings in which these and other implements were found. The location of each of these and other buildings referred to in this section are provided between figures 6.4 and 6.14.

The following year's report contains only slightly more clues to intra-building patterning – only four instances are given of specific locations of knapped-stone deposits within buildings. The first referral is in building IV.1, where an obsidian mirror was found in a below-platform burial (Mellaart 1963:50). A more substantial discovery was made in VIA/B.14, where "all over the room we found small deposits of obsidian weapons and mace-heads as well as a few pots... In all about 100 tools, weapons and blades were found in this shrine alone, many of them in the storeroom". Also interesting was "the tiny body of a minute unborn (or stillborn) baby which came out of a brick set somewhere high in the wall", "provided with a chip of obsidian and a shell" (Mellaart 1963:77, 99). In building VIA/B.1, the place of the remarkable horn-core bench, "the floor was covered with matting of mash grass... the carbonised remains of two circular baskets... a wooden meat dish... two polished stone maceheads... and a number of obsidian and flint weapons" (Mellaart 1963:52). Finally, in VIA/B.10, "some obsidian lance-heads and flint daggers (one in its leather sheath!) and a coarse clay figurine were found in the deep storerooms beyond" (Mellaart 1963:73).

[1] I follow the convention in the published reports of referring to individual buildings by their level (in Roman numerals) followed by their particular number.

The 1963 season provides the most copious information regarding within-building pattering, and here some of the depositional patterns are strengthened. Two burials are referred to, one in VIB.20 where eight points were enclosed as burial goods (figure 6.3). Some of the most spectacular knapped-stone objects – the flaked and ground flint hilted daggers – also come from burials. The example with the carved bone snake-like pommel was found in a burial in VIA.29. More generally, the inclusion of flint and obsidian points, daggers and other tools in burials is described as also occurring in buildings VIA/B.20, 29 and VII.12 (Mellaart 1964:95), while deposits in hoards in the south-eastern corners of rooms are found in buildings VII.8, VIA/B.1, V.7, III.1, and II.1. Two other deposits are described that are notable for their contents. The first is a deposit of small blade tools "found near a hearth on the floor of a small room, just south-west of the main shrine [A.II.1]" (Mellaart 1963:105). The second is a cluster of about 50 small mainly obsidian flake tools found beneath the floor in VII.8. Both are particularly interesting as they represent clear instances of non-formal blade and flake tools being deposited not as rubbish or in building fill, but as a curated collection of presumably useful implements and as such are distinct from the more prominent deposits of elaborate points or daggers.

In the preliminary report of the final 1965 season, only a single deposit of knapped-stone has only been located in one building – VIB.70 – where three points are said to have been placed on the floor. In his summary book a few other depositional details are given: VIB.12 and IV.4 both apparently had weapons buried in pits (Mellaart 1967:78). Several other instances of burials with daggers are mentioned, as are the buildings that contained (presumed) female burials with mirrors as grave goods (Mellaart 1967:79). There is also mention of "groups of figurines of animals... wounded or maimed in effigy... found in pits near shrine VIB.12... together with some intact weapons and numerous clay balls" (Mellaart 1967:78). The available assemblage for VIB.12 showed little evidence of this, but the association between (wounded) animal figures and points is significant.

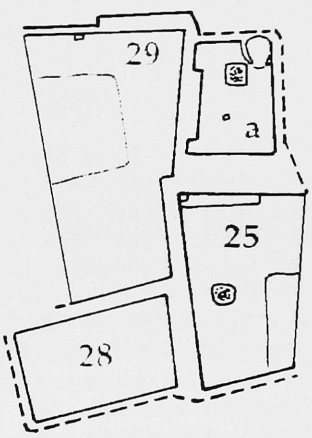
Inter-building patterning

What I aim to do in this section is identify the patterning and relationships of lithic artefacts distributions between buildings. As noted, there are 110 buildings that have associated lithic artefacts. Table 6.21 identifies the number of these buildings per level. The buildings have been examined by level so that changes over time in the distribution of debitage and tool classes can be identified (technical and typological differences in the assemblages by level have already been considered). As I mentioned earlier, a proportion of the points, mirrors, and daggers in the Konya Museum lack labelling of a sort that enables them to be placed back in their excavated context (and it is essentially confined to these, 'prestige' items[2]). Fortunately, however, there is sufficient detail in the preliminary reports to reconstruct the inter-building patterning of these objects. Overall, these objects only have a significant effect in Level VI and Level IV, where they in fact strengthen identifiable patterning. To distinguish those items identified only in the reports from those actually recorded, they have not been included in the quantitative analysis, but are included in the descriptions. Levels XI, X, and IX have been omitted from the analysis because there are insufficient buildings.

Level XII

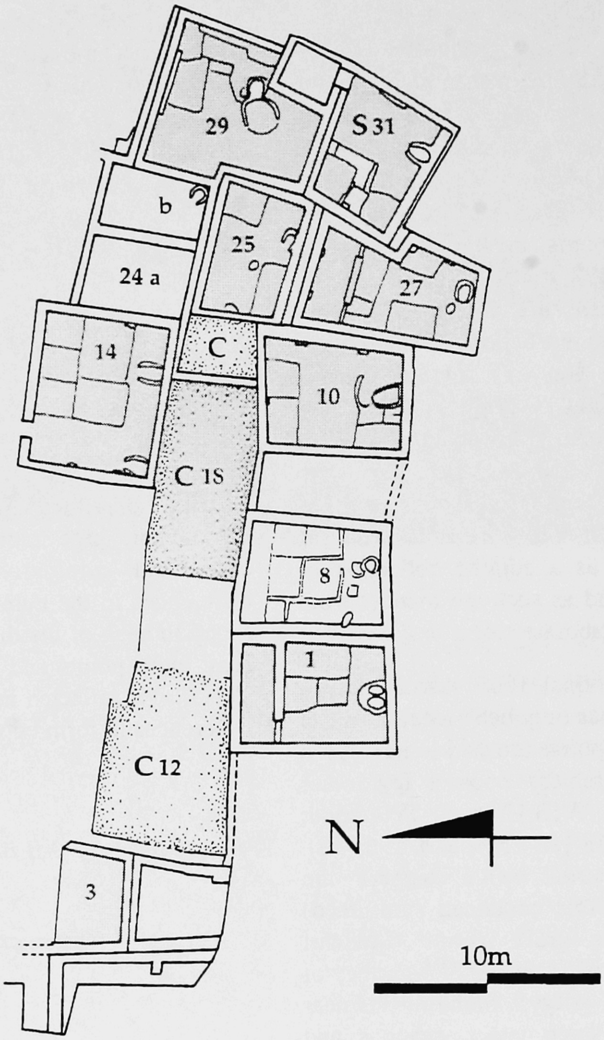
As only three buildings were excavated there is very little that can convincingly be said concerning inter-building spatial patterning (figure 6.4). The impression of the distribution of debitage classes, and primary and non-formal tool classes, is that there are no marked differences between the three buildings. All have a modest non-prismatic blade component, large numbers of flakes, and small amounts of cores and core-derived pieces (graph 6.9). There are differences in the numbers of the three primary tool classes found in each of the three buildings: XII.25 and XII.29 both have more points and other tools than XII.28 (graph 6.10). This is also reflected in the ceramic assemblage, where some differences in form between these rooms is also evident (Last

Figure 6.4 Level XII Building Plan



[2] This is, ironically, a product of the Museum's practise of separating out those artefacts deemed to be important, and valuable on the antiquities market, for special classification, evaluation, and storage. While this is perhaps understandable due to a rife black-market, it does cause particular problems for any post-excavation analysis.

Figure 6.5 Level VIII Building Plan (in this and subsequent plans, unshaded buildings = no data)



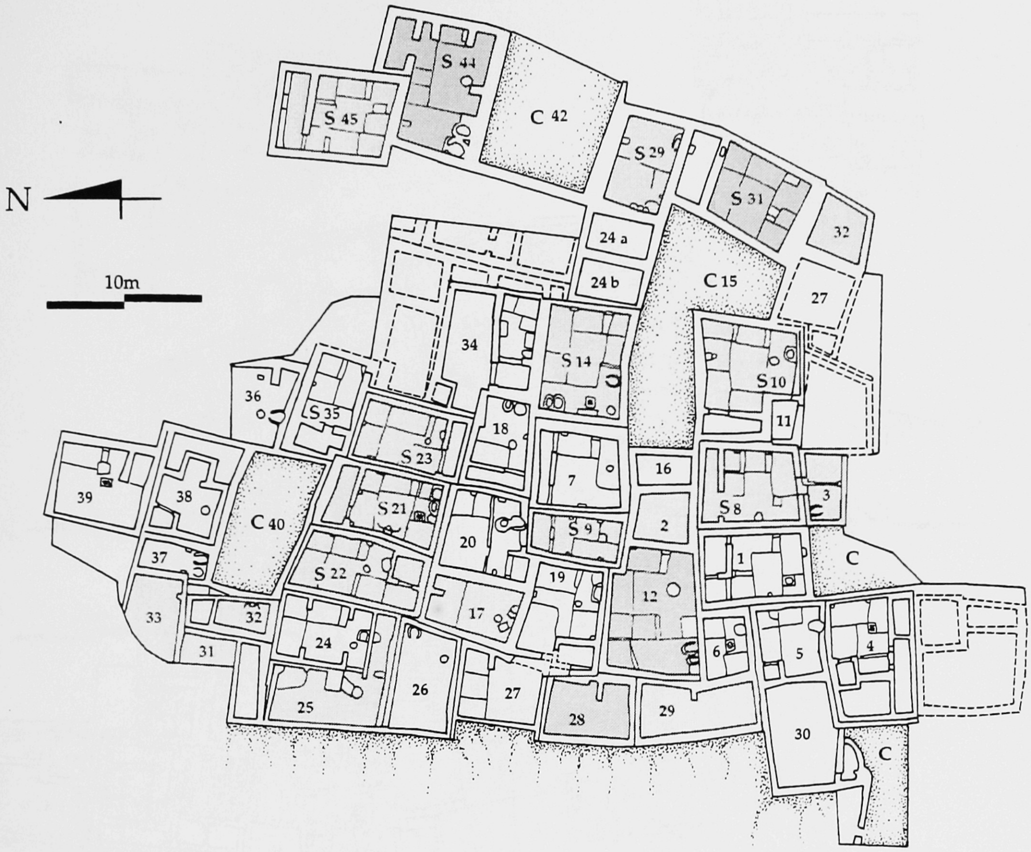
1996). While the quantitative differences may have more to do with excavation area, it is nevertheless interesting (although I am hesitant to call it significant), that the absence of points in XII.28 corresponds to an absence of any structural embellishment; the other two buildings show evidence of platforms, red paint and other features that led Mellaart to consider at least one of them as being a shrine.

Level VIII

Small numbers of prismatic and non-prismatic blades are seen in several of the Level VIII buildings, but no one type in particular dominates in this area (graph 6.11). This is not the case for flakes and flake fragments, as two buildings, VIII.10 and VIII.31, show significantly greater amounts, and therefore show the highest overall quantities of debitage (figure 6.5). The former was described as a house (adjacent to VIII.18, which was 'filled with rubbish', but evidently not fully collected judging by the low artefact counts in the Museum). The latter is the so-called 'Red Shrine', distinguished principally by a red-burnished lime-plaster floor, paintings and modelled bullheads (Mellaart 1966:181). VIII.29 is the only building that possesses a core (a multi-platform/sequence flake core) but its assemblage is otherwise unremarkable. It is, however, close to the Red Shrine, with a suspected access point through a hole in the eastern end of the south wall (Mellaart 1966:180). The highest quantities of tools are also found in VIII.27, VIII.29 and 31 (graph 6.12). Building VII.27 has a leopard relief on one of its walls, together with net or textile motifs. Points are found in all analysed buildings, but not the courtyard (VIII.18), with the largest numbers found in VIII.1, VIII.14 and VIII.31 (6, 5 and 6 respectively). All three are elaborate buildings and were described as shrines[3], but overall differences between their assemblages and the designated non-shrine buildings are slight. There are some differences in their ceramic assemblages, in that these buildings have primarily closed

[3] VIII.1was only called a shrine in *A Neolithic Town in Anatolia*, not in the original reports.

Figure 6.6 Level VII Building Plan (in this and subsequent plans, darker shading = notable deposits, explained below)



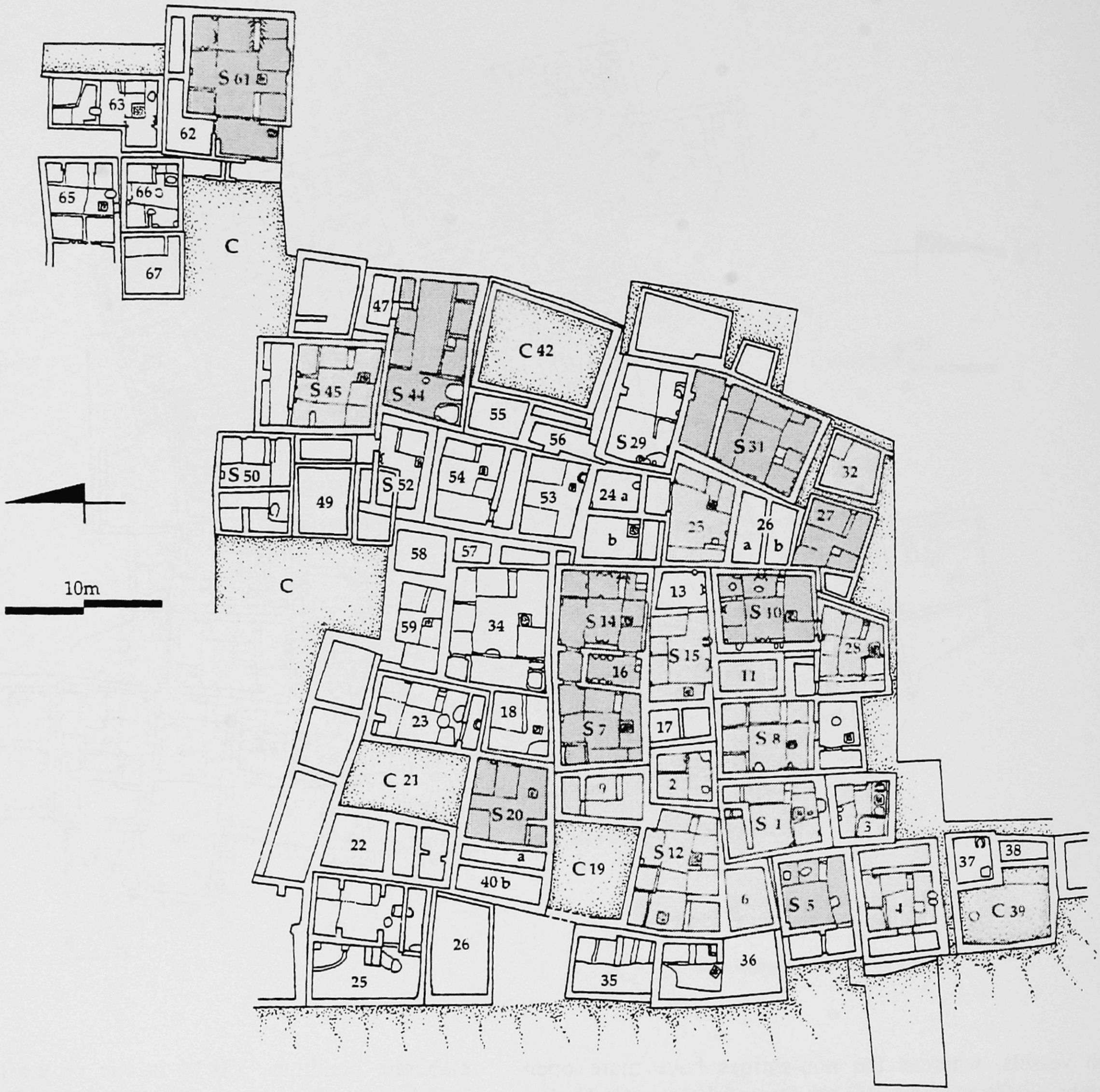
mouth vessels, whereas the non-shrines have more open-mouth bowls (Last 1996). All but four of the ten typed points from this level are small tanged and/or shouldered varieties. Those in VIII.31, however, form a distinct group of large unshouldered points (one Type 2, two Type 7).

Level VII

Many of the 24 Level VII buildings analysed have small assemblages: 20 have fewer than 50 knapped-stone artefacts (graph 6.13). Two buildings, VII.14 and VII.31 (formerly classed as VIB.31[4]), however, stand out for having larger collections (n=178 and 368 respectively). By this period one frequently finds that within the area excavated by Mellaart between one and three buildings contain significantly greater numbers of particular kinds of debitage. Often, these are very elaborate buildings. VII.14 is one of the most remarkable buildings at Çatal, as it contains the 'volcano' painting: a nine-foot long mural of what has been interpreted as an erupting volcano overlooking a series of houses that resemble a typical Çatalhöyük building plan (see Mellaart 1964: plate VIa). VII.31, is also remarkable for its plastered wall sculptures of stylised females and bull's heads (see Mellaart 1964: plate IVb). Only three buildings possess cores, VII.12, VII.15 (actually a courtyard) and VII.44, of which only the last building was considered complex enough to be designated a shrine. This was the location of the only prismatic blade core, as well as the well-known paired leopards wall sculpture (Mellaart 1966: plate XXXIXa). Despite the presence of a small number of blade cores, the numbers of blades is fairly low, although they are more common than in earlier levels. The courtyard (VII.15) is the only area with notable amounts of prismatic blades (n=18). The distribution of tools shows a similar pattern of distribution to the debitage (graph 6.14): VII.31 has the highest number, but VII.14 has very few tools in contrast to its abundant debitage. The former also has the most points (n=17) – nearly twice as many as the buildings with the next

[4] Although VI.31 appears on plan as being in Level VI, in 1965 Mellaart reclassified this and a series of other buildings as actually belonging to Level VII.

Figure 6.7 Level VIB Building Plan



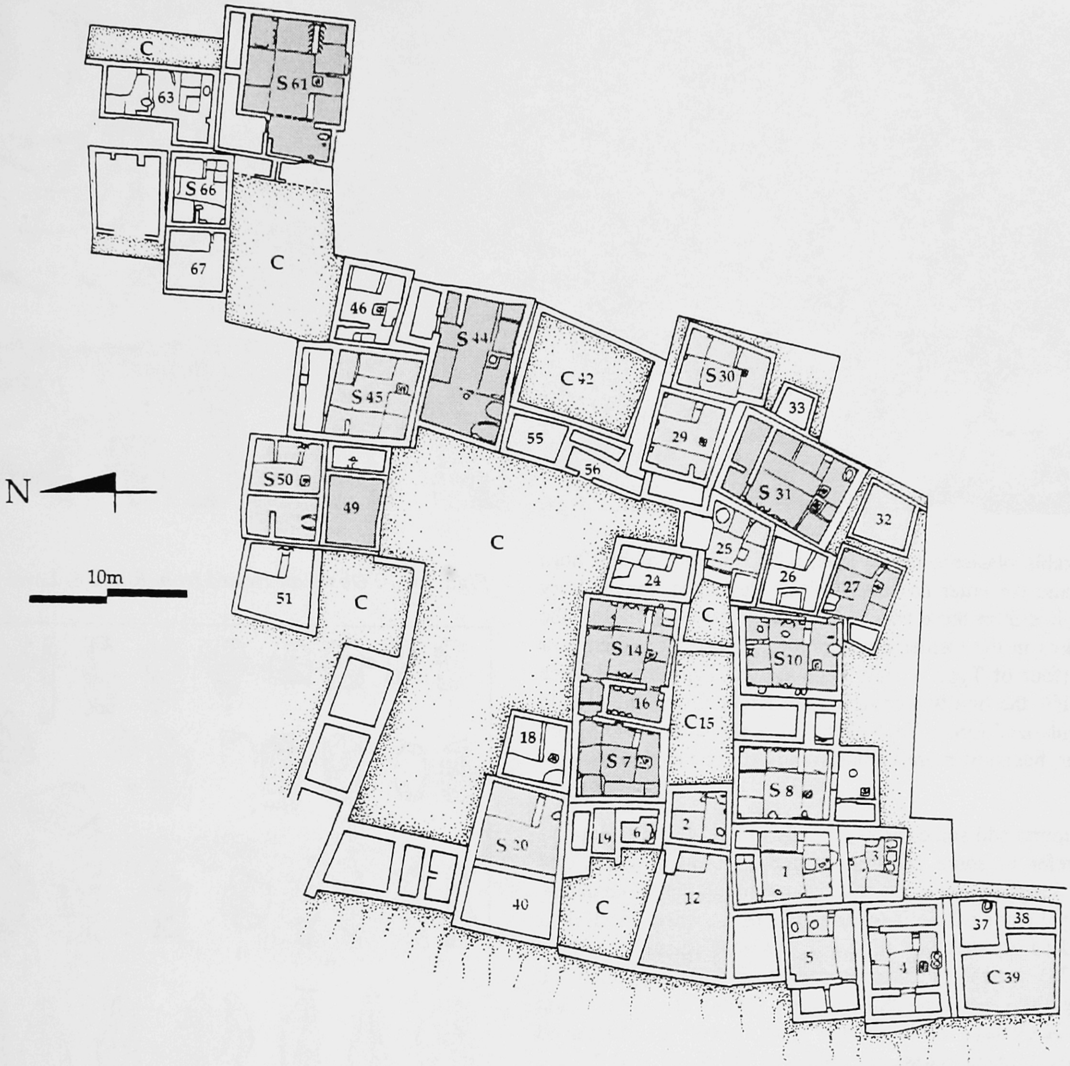
highest amounts. However, only one was complete, and was classified as Type 12. Buildings VII.12 and VII.28 have the next highest amounts (n=8). The former, although not classed as a shrine, is fairly large with red-painted panels and modelled wall bucrania. The latter does not appear to have any embellishments. Seven of the eight points from here can be typed, three of which are Type 2 and are thus among the largest and most elaborate group of bifaces. Two of the VII.12 points are also of this variety.

There is a reported hoard of small retouched tools in VII.8, which was not located in the Museum's collection but is illustrated in Mellaart (1964:100) (figure 6.10). If this is added to the VII.8 assemblage, it would increase its significance within this level. Earlier in its life (perhaps a century before its abandonment) it was the setting of the purported 'vulture shrine' showing seven vultures "swooping down on six human corpses" (Mellaart 1964:64 and plate IXb). Plaster sculptures of bulls and possibly women were placed over this at a later date, but were apparently removed when the building was abandoned (Mellaart 1964:61).

Level VI

For the purpose of examining inter-building patterning, I have condensed Levels VIA, VIB and VIA/B onto one graph, although there are two building plans (figures 6.7 and 6.8). There are some similarities between Level VI and Level VII: the distribution of debitage classes shows that one building, VIB.13/15, contains significantly higher amounts of material than its contemporaries (graph 6.15). Although not particularly elaborate, there is mention of a panel with at least sixty imprints of children's hands (Mellaart 1963:81 and

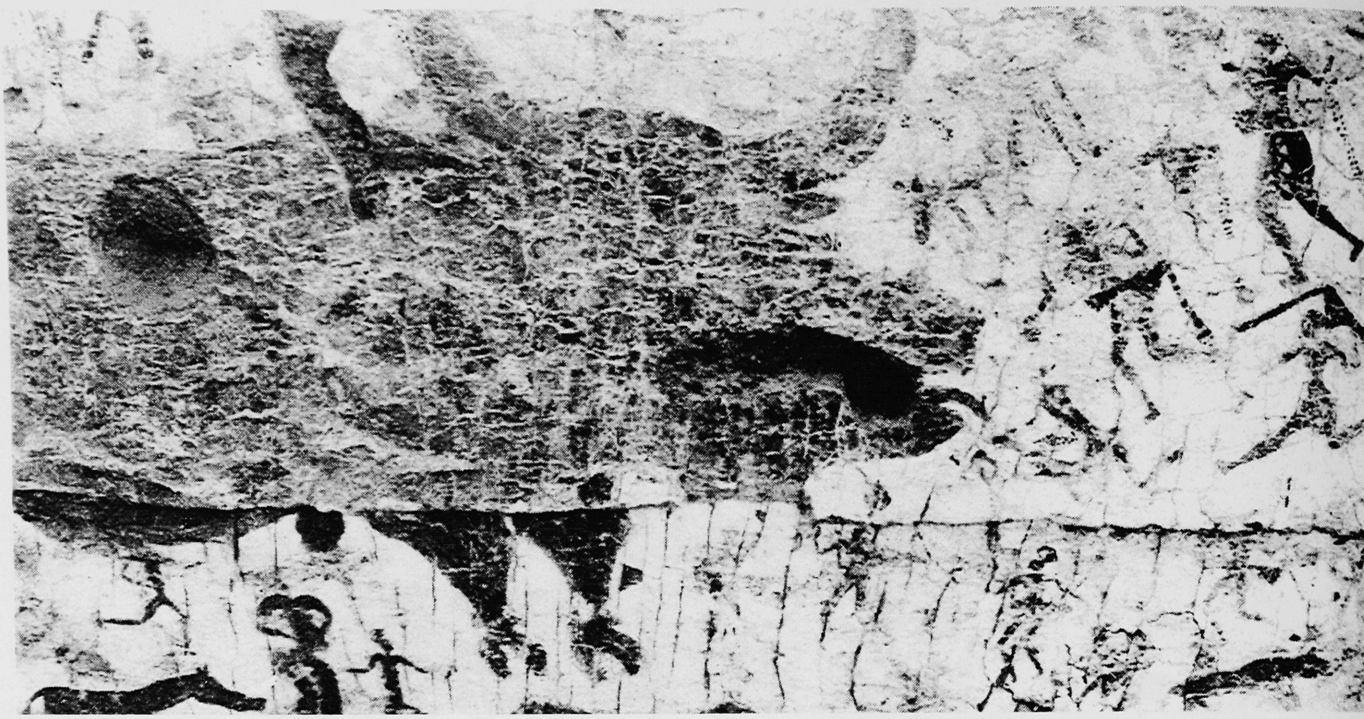
Figure 6.8 Level VIA Building Plan



1963: plate XVIIIb). It is adjacent to several elaborate buildings, one of which, VIA/B.10, also has much debitage including numerous blades and two prismatic blade cores. This was a fairly elaborate building, with several instances of wall sculpture, horned pillars and red-painted walls (Mellaart 1963:70-73). At least 14 figurines were also found in this room, and it is adjacent to VIA/B.11, termed a storeroom, where several additional points were reportedly found, including a remarkable sheathed dagger (Mellaart 1963:73). Building VIA/B.71[5] also has substantial quantities of debitage, comprising the highest numbers of prismatic blades and several cores (seven prismatic and one non-prismatic blade cores). Cores were found in 10 of the 20 buildings analysed, but this had the highest concentration. There is, however, no mention of any elaborate characteristics associated with this cluster: "buildings (VI.71-77) were evidently houses and lacked any of the special decoration such as distinguishes the shrines from the ordinary dwellings" (Mellaart 1966:172). This is not the case in at least two instances where there are large concentrations of points. Buildings VIA/B.61/62 and VIA/B.10 have twice to three times as many as most others (n=27 and 23 respectively) (figure 6.16). The former building is the location of a

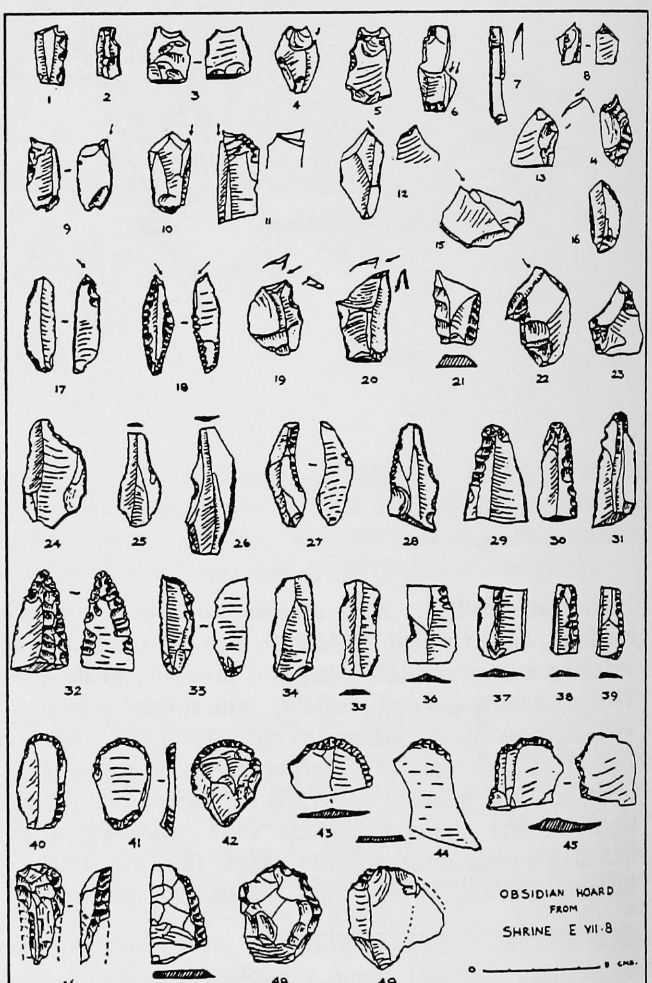
[5] Not planned.

Figure 6.9 Hunting Scene from Room 1, Level V.



remarkable plastered bench inset with six pairs of bull horn cores and the latter has been briefly described above. Very few points from these two clusters could be typed: 10 of the 27 points in the former building were divided between four types (four of Type 3, one Type 4, two Type 9, and three Type 10), the first two of which are larger forms, the second two mid-sized forms. Four of the 23 in the latter building are smaller, but show more variation in form (one each of 6, 7, 8, 11).

Figure 6.10 Obsidian Hoard from Room 8, Level VII



The reports add some further details to the Level VI data, as they refer to some additional buildings where points and other knapped-stone objects were found in abundance. Principal among these is (shrine) VIA/B.14 where "well over a hundred obsidian and flint weapons were found" (Mellaart 1967:78) in an extensively decorated building. Included among these are four flint daggers (Mellaart 1963:75 and plate XXVIIa). Two burials from Level VI contained obsidian mirrors. These are found in buildings VIB.20 and VIB.5, both of which Mellaart regarded as shrines by 1967, but which appear to have unremarkable architecture and lithic assemblages. The former also contained eight points in a burial, placed against the leg bone of a male skeleton (Mellaart 1967: plate 115) (figure 6:3).

Level V

The buildings of this level are poorly preserved (Mellaart 1966:184) (figure 6.11). Prior to 1965, when some better preserved examples were uncovered, this prohibited much discussion of internal composition. The knapped-stone assemblages of six of these buildings (E.V.2, 3, 5, 6, 7, 8) are fairly unremarkable, although the last two contained three prismatic blade cores between them (graph 6.17). Bialor's

Figure 6.11 Level V Building Plan

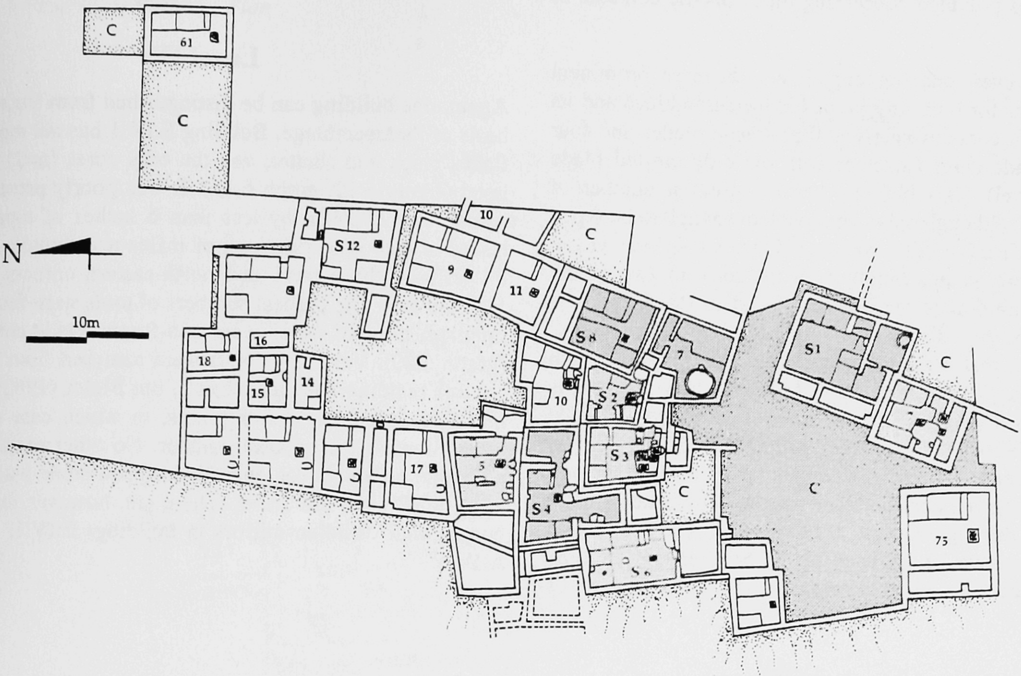
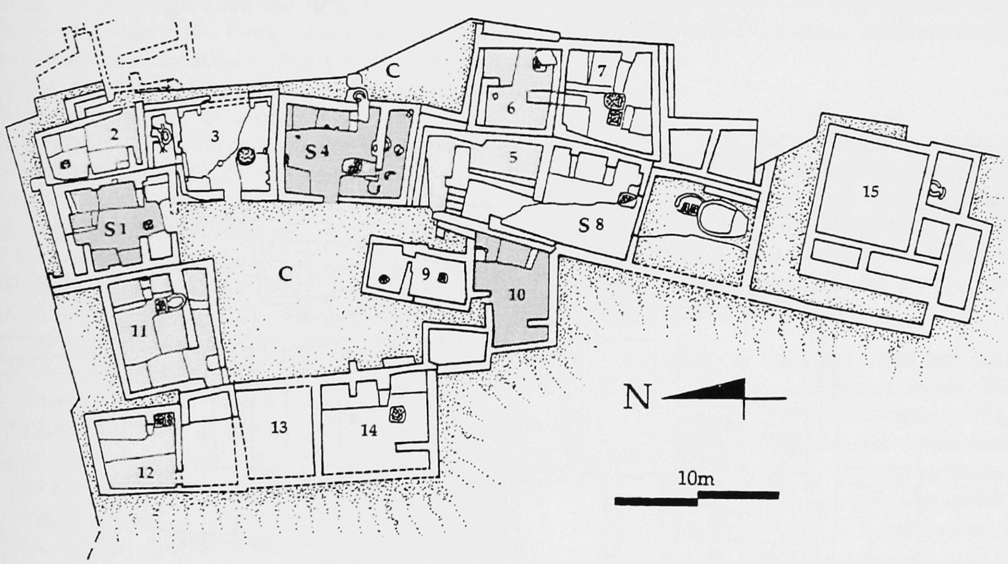


Figure 6.12 Level IV Building Plan



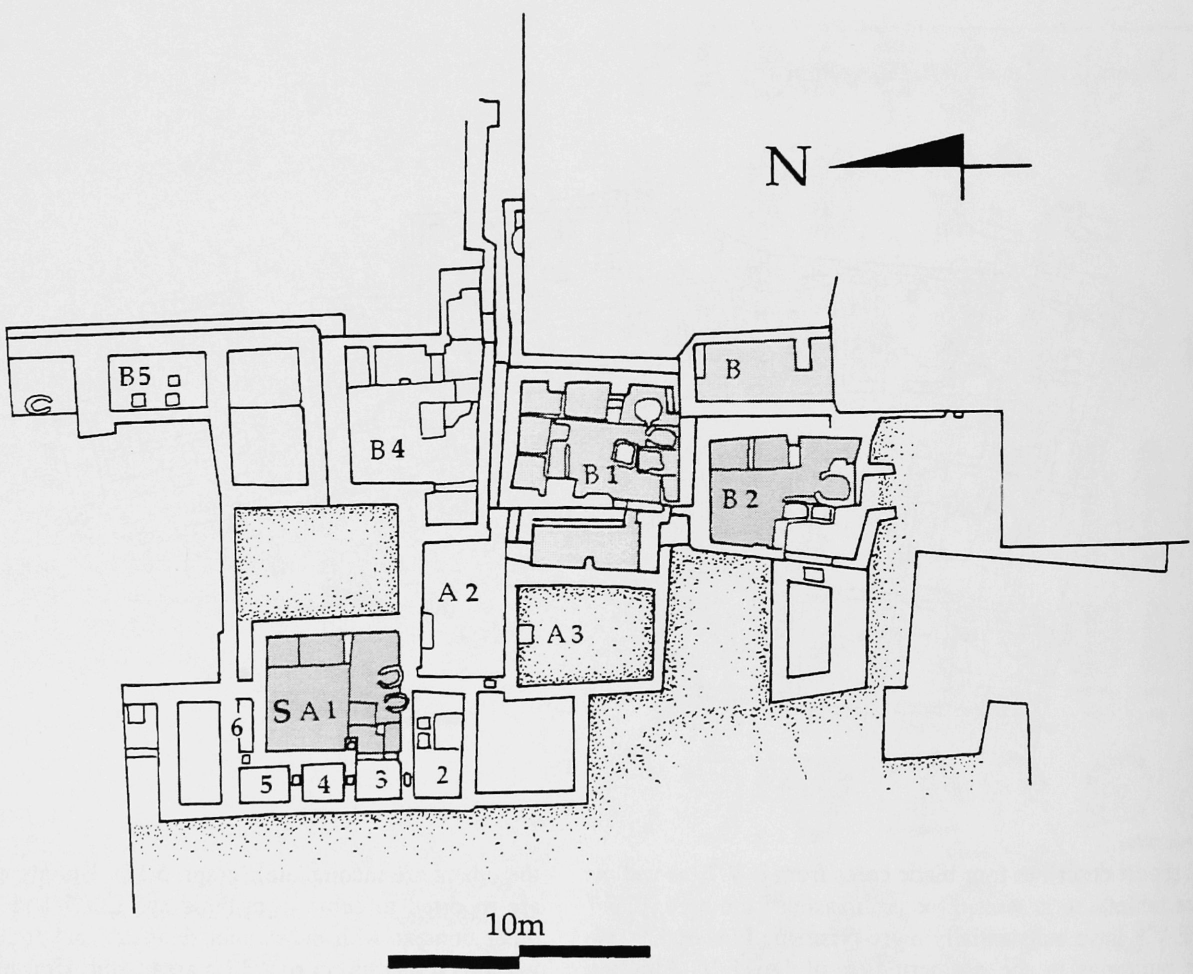
1962 report describes four blade cores from E.V.7 (as well as a core tablet), so at least three are missing from here. E.V.7 and E.V.8 have substantially more prismatic blades than the other buildings in the northern part of Level V. Building E.V.8 also possesses 11 points (three Type 9, one Type 11, the others are incomplete) (graph 6.18). Burials with mirrors are reported to come from buildings E.V.7 and E.V.4. The other context with substantial debitage and tools is F.V.2, which is the large courtyard (in area, approximately one third of Level V). Over 75 prismatic blades, three prismatic blade cores and nine points were recovered from this area but no information is provided concerning their specific contexts of recovery.

Overall, however, one building, F.V.1, is more prominent than any other for both its knapped-stone assemblage and its elaboration. It contains nearly 150 prismatic blades and four prismatic blade cores (together with the only crested blade from this level). This building has the greatest number of points (n=16) although only one complete enough to be typed (Type 10). There is also some evidence of special vessel types occurring in this building, in the form of two of the three lugs with double perforations found in this Level (the other is from the adjacent building of E.V.7) (Last 1996). Extensive internal wall paintings were found here, which show animals, ranging from bulls, to boars, dogs and equids and humans engaging in some form of hunting ritual (Mellaart 1966:184-191 and plates LI-LXIII). These paintings include the remarkable and well-known giant bull and a giant stag and boar both being taunted by dancing men. Several of the figures are holding what can be safely interpreted as bows, and at least one holds what appears to be a spear (figure 6.9). None, however, depict actual arrows or any form of knapped-stone point.

Level IV

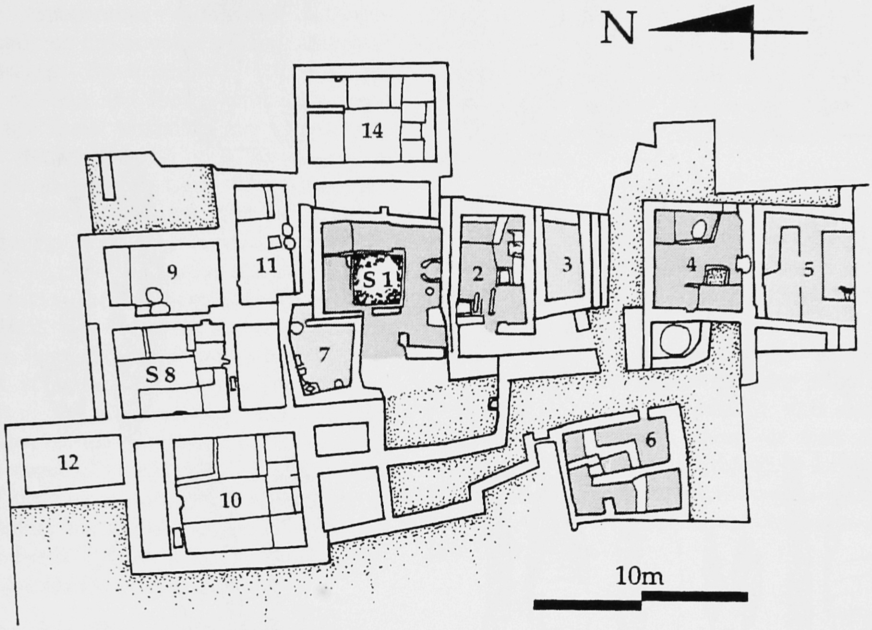
Again, one building can be distinguished from the rest on the basis of its assemblage. Building E.IV.1 has the most blades, flakes chips and shatter, and the only cores (n=2) from this level (figure 6.12, graph 6.19). It was poorly preserved – in some cases overlain by less than 6 inches of topsoil – but traces of elaborate paintings of males and females remained on walls in the eastern and north-eastern corners (Mellaart 1962:59-60). The highest numbers of tools were found in this building, most of which were non-formal blade cutting tools (graph 6.20). Very few points were analysed from this level. No one building has more than 5, but Bialor (1962:86) notes that E.VI.1 had at least 6 points, in which case this room would contain the greatest number. No other extraordinarily elaborate buildings (or, indeed, knapped-stone assemblages) were noted from this Level. There are, however, accounts of burials with obsidian mirrors in buildings E.IV.1, 4, 10 and A.IV.1[6].

Figure 6.13 Level III Building Plan



[6] Not planned. Underlies III.1 north-east of main Level IV plan.

Figure 6.14 Level II Building Plan



Level III

In this level, two buildings stand out from the rest, A.III.1 and A.III.13, which have the highest numbers of prismatic blades (n=82 and 39, respectively) (figure 6.13, graph 6.21). A.III.1 had the most prismatic blade cores (n=6) and A.III.13 shares the highest number of points (n=12) with Building A.III.2 (see below). A.III.13 also has the highest number of ceramic sherds and lugs from this level. As it happens, they are adjacent to one another, the latter described as the storeroom to the former, which was named the 'Painted Hall' as all but one wall were covered with pictures of deer hunting rituals (Mellaart 1962:62 and plate XVI). These include men depicted with bows (but not arrows, nor are any bows held in a 'release' posture) and (throwing?) sticks. The only other assemblage of note from this level is from A.III.4, where four prismatic blade cores were recovered, as well as eleven points – the highest density of points in any building of this level. Indeed, this building "proved to be a rich one in many respects, providing a necklace of fish vertebrae beads, a number of well-made pots, a red-painted bench, and a burial under another sleeping platform with the head separated and placed about a foot away from the rest of the body" (Bialor 1962:90). A.III.2 is also important as it contains (with A.III.13) the highest number of points (n=12) (Bialor 1962:95) (graph 6.22). All but two of these lack any hafting modification (but the absence of a scale in the 1962 drawing prohibits my attempting to type them). Although Mellaart doesn't provide a detailed description for this building, these objects plus the presence of some 'raw-material' led him to see it as a 'stone-worker's shop' (Mellaart 1962:55). The plan shows that its size and internal arrangement are similar both to A.III.1 and A.III.4 (and different from A.III.7 and 6) where large numbers of points were also found.

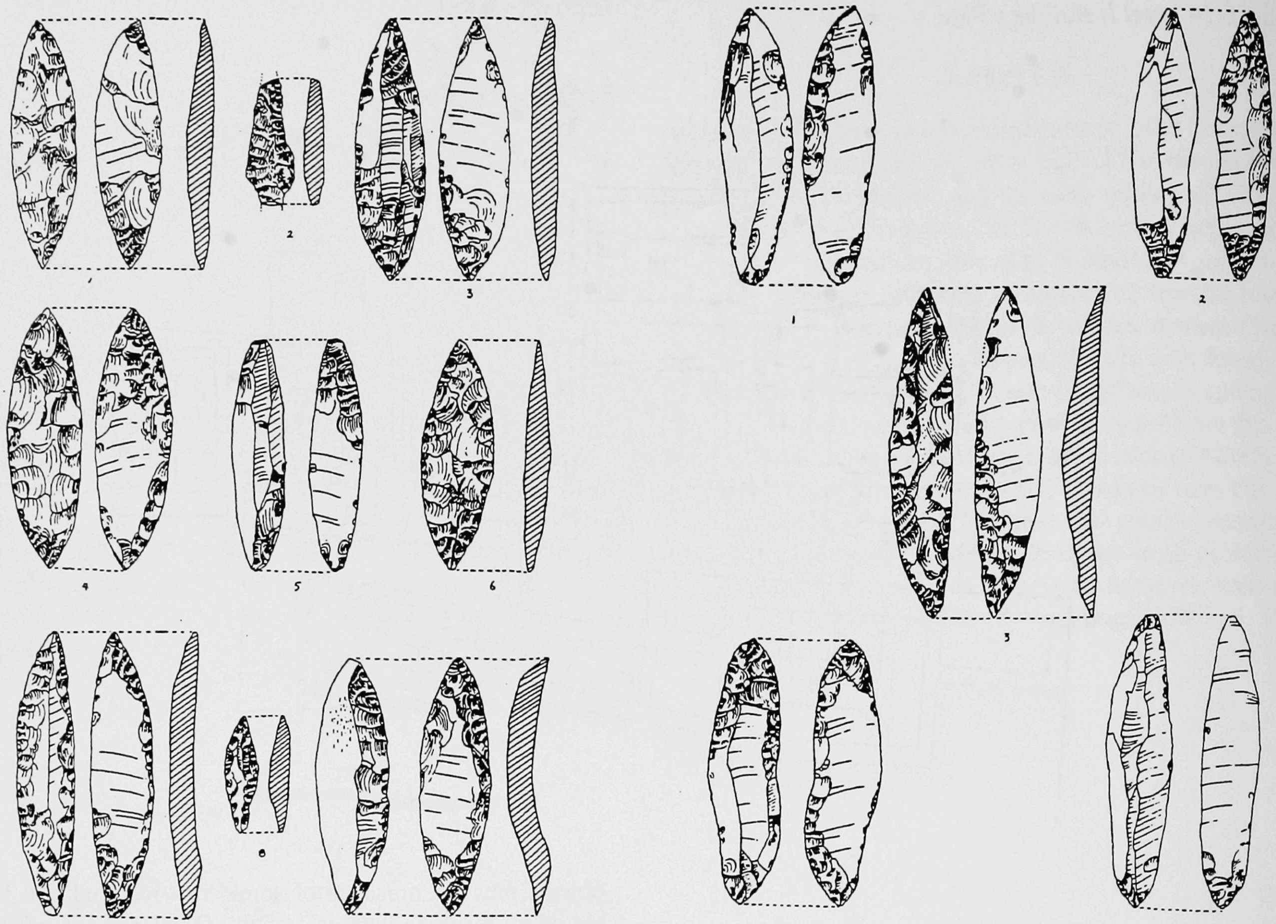
Level II

In this level one of the five buildings, A.II.1[7], stands out primarily for having the most debitage, blades, and all the cores, and most of the points (n=25) for this level (figure 6.14, graph 6.23, 6.24). In addition to possessing an above average lithic assemblage, it was a remarkable structure as Mellaart indicates (1963:46):

> The contents of the room confirmed the impression that this was not an ordinary house. Between two coats of red plaster there were remains of grain, which has evidently been burnt on the ceremonial hearth. All round the hearth lay the scattered remains of a group of seven clay figurines; whereas an eighth and much larger figure was found in the grain-bin of the south storeroom (the nearest to the south wall of the main room). A ninth figure, broken and made of white limestone, was found in the opposite storeroom against the north side of the building. Scattered all

[7] Not planned. To the north of building A.III.7 in figure 6.X (see Mellaart 1963:45).

Figure 6.15 The Level II Building I Cache (from Bialor 1962, figure 11). The point in the upper left is 11.4 cm long.



> over the floor of the main room as well as in the storerooms along the west side of the building were at least seven small deposits of grain, and legumes, giving the impression of individual offerings. Four 'stamp-seals' of baked clay with incised designs and about a dozen pottery vessels together with much obsidian, some chert and flint and several hundred palettes, pounder, querns and polishers (mainly from the north store) completed the inventory. The building had been destroyed by fire, like all the surrounding houses. No burials were found below the floor.

The other buildings from this level are considerably less elaborate, both architecturally and with regards to their knapped-stone contents. B.II.1 contains the next largest assemblage, and had the largest number of ceramic sherds, but is otherwise unremarkable. There are no detailed descriptions of these rooms in the preliminary reports. A.II.1 appears to be the only embellished building in the excavated area of this level.

Shrines and 'Special Deposits'

In the above building plans the shaded rooms indicate that an assemblage was available for analysis in the Konya Museum. Buildings with darker shading demarcate assemblages with unusually high proportions (on that level) of points, flake cores, prismatic blade cores and prismatic blade core tablets, unretouched debitage, retouched debitage, and prismatic blades shows (i.e. higher than what was understood to be the mean frequency for that level). With the notable exception of flake cores, there are higher frequencies of all these artefact types within buildings designated as shrines than non-shrines (graph 6.25). It is also significant that points and prismatic blades cores and tablets show the greatest difference between mean numbers found in shrines and other buildings – this observation will be further discussed in the final chapter.

To better delineate the patterning of points, a histogram of point 'density', where the numbers of points occurring in buildings was calculated. This suggests that one to eight points is the range encountered in most buildings (graph 6.26). Fewer buildings have any more than this number, and those that do can be considered exceptional. Examination shows that buildings with large point deposits often have other large deposits of pots, figurines, and ground-stone axes. These buildings are often called shrines, and special, 'prestige' burials with mirrors or daggers and cores seem to occur preferentially in these contexts.

If the relationship between these special deposits/objects and shrines is examined over time, it its noticeable that there is an increasingly qualitative and quantitative difference between the knapped-stone assemblages of buildings. Between Level XII and VIII differences between buildings are not particularly remarkable and there are no notable deposits of cores or points. By Level VII and continuing to Level II, however, there are conspicuous differences between buildings, based primarily on higher concentrations of points and cores in some buildings. Those buildings with 'special' or otherwise notable obsidian and flint artefacts are often shrines, suggesting that these artefacts may have been important criteria for the designation of a building as a 'shrine' by Mellaart. For example, in Level VI there are six shrines, five of which possess unusual flint or obsidian objects or clusters of objects. Only two of the fourteen non-shrines (three in Level VIA) have distinctive assemblages. In Level V, this pattern is not so clear, as several buildings have notable obsidian artefacts, but only one was considered a shrine (F.V.1). Overall, however, this shrine's assemblage is quite different because of the large numbers of points found here. In Level IV one of the three buildings with 'special' lithic artefacts is a shrine, but the assemblage in this building is distinctive mostly because of its higher numbers of blades and cores. In Level III there are at least three buildings out of eleven analysed, including the shrine, which have special deposits of objects. In Level II there is clearly a monopoly: the shrine contains all the notable pieces.

As a final point, given the ambiguous distinction between architecturally elaborate and less-elaborate buildings, it appears that portable material culture plays an important role in identifying differences in the use of buildings at Çatalhöyük. Although I have noted problems in assuming ritual vs. non-ritual space, the evidence presented here does support Mellaart's identification of some buildings (i.e. 'shrines') as ritually more complex than others. I would again, however, draw attention to the evidence that suggests buildings fluctuated between stages of greater and lesser architectural elaboration. This suggests that that there were no rigid differences between sacred and secular space at Çatalhöyük, although at any given time (including at the time of abandonment) some buildings were ritually more complex than others.

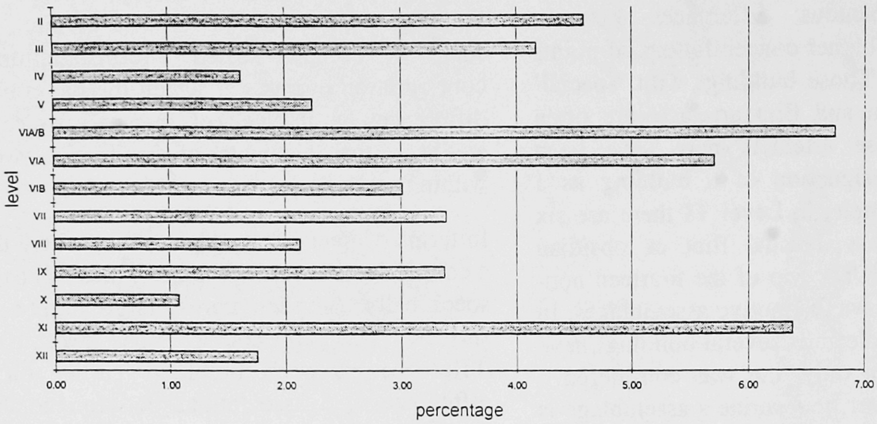
Summary

The description of patterning presented in this chapter shows that the distribution of knapped-stone artefacts over space and time is not homogenous. Significant technical changes in the industry occur over time, affecting the characteristics of the retouched assemblage. Statistical analysis of classes of debitage and tools and their temporal position show that in the earlier levels at Çatalhöyük, obsidian and flint were used in a very different manner than those later in the occupation. This facilitated the comprehension of some of the patterning derived from surface survey, where variations in composition were shown to be directly related to differences in the final occupation of the surface of the mound.

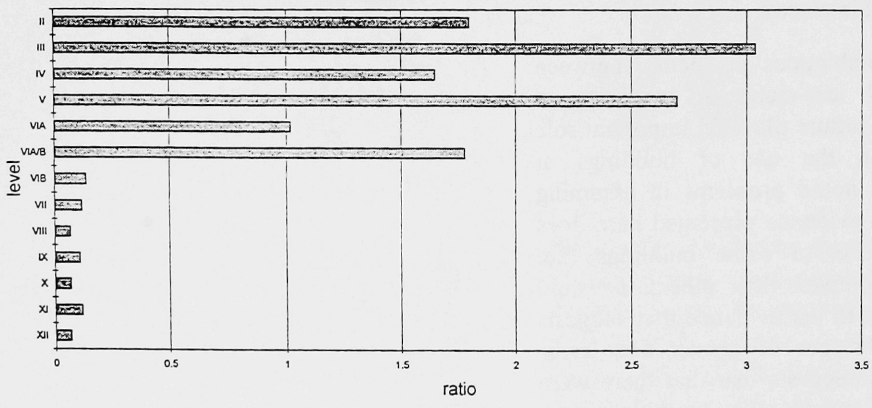
Within individual buildings, relationships between the distribution of lithic artefacts and architectural phases can be observed, relating to changes in the use of internal space. Intra-building patterning of lithics may be best related to abandonment behaviour and only indirectly to the use of the building. The exception may be certain 'special' deposits, such as caches, sealed fire-installations and possibly conflagration events, for which the patterning brings to light differences in the use of internal space. There is strong evidence that elements of production were taking place within buildings.

In terms of inter-building patterning, there does appear to be a connection between large quantities of knapped-stone, more specifically, between cores, large numbers of points and shrines. This appears to vary over time, with fewer differences between buildings earlier on, but increasing differences and associations between notable obsidian and flint artefacts with shrines later. Many of the shrines are very complex and decorative buildings, with elaborate paintings and plaster features that demarcate them from other, less complex structures. The continuity of building architectural elaboration is not reflected in the material cultural patterning, where clear differences along the shrine/non-shrine boundary have been observed.

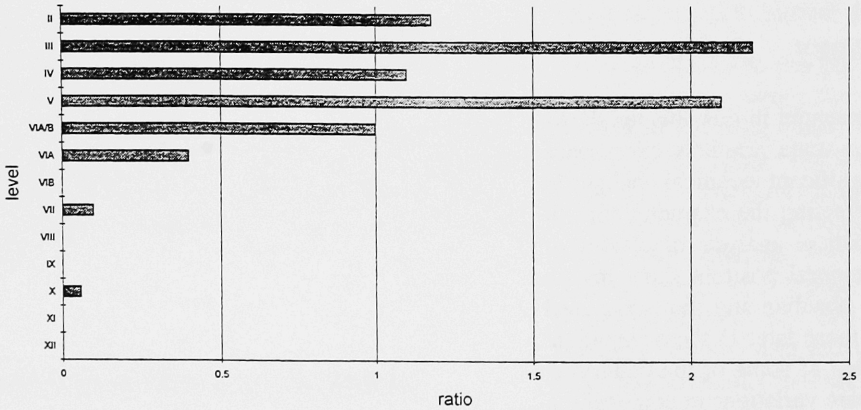
Graph 6.1 Proportion of flint by Level.



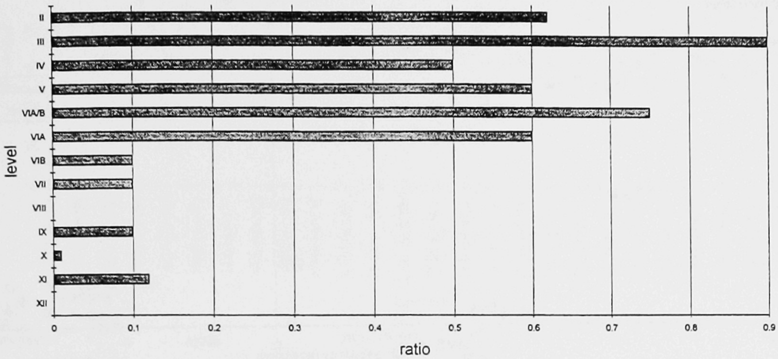
Graph 6.2 Proportion of blades to flakes by Level.



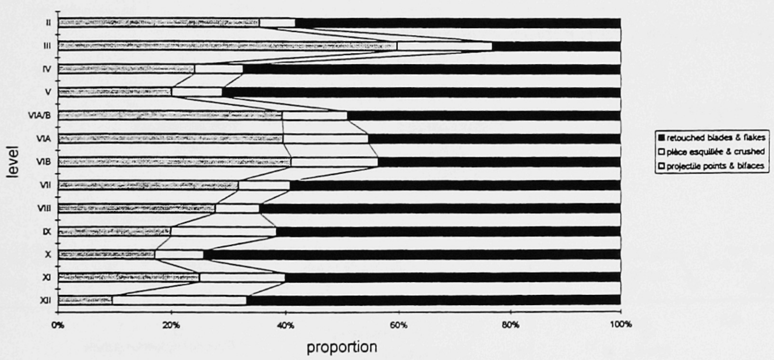
Graph 6.3 Proportion of prismatic blades to flakes by Level.



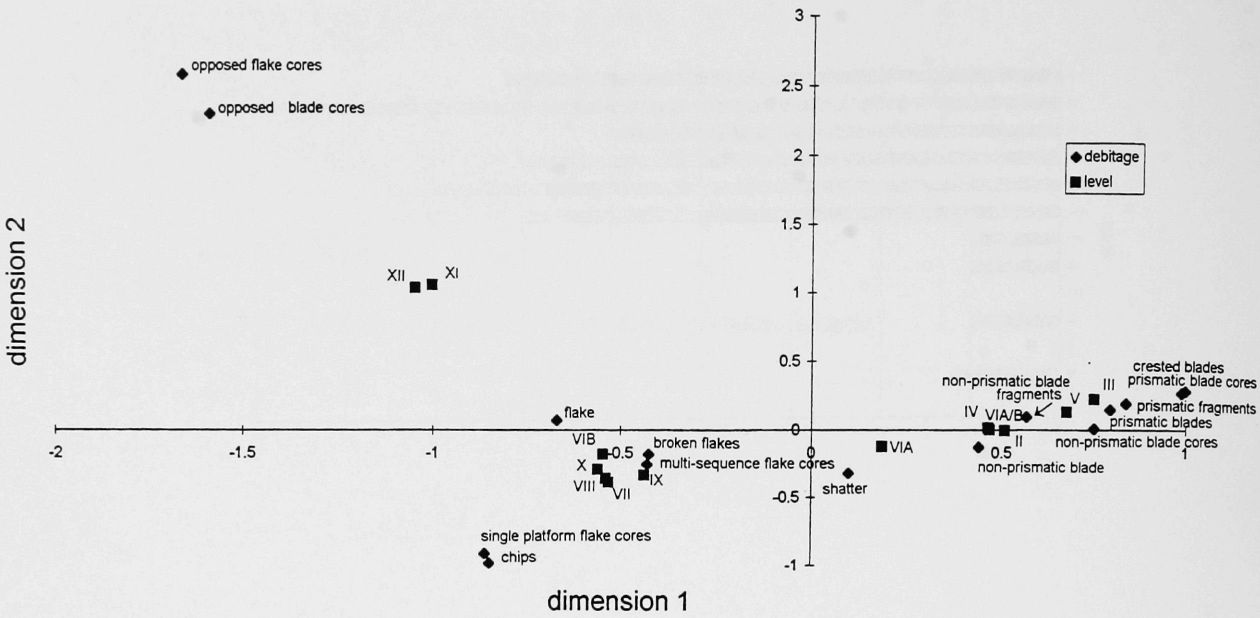
Graph 6.4 Proportion of non-prismatic blades to flakes by Level.



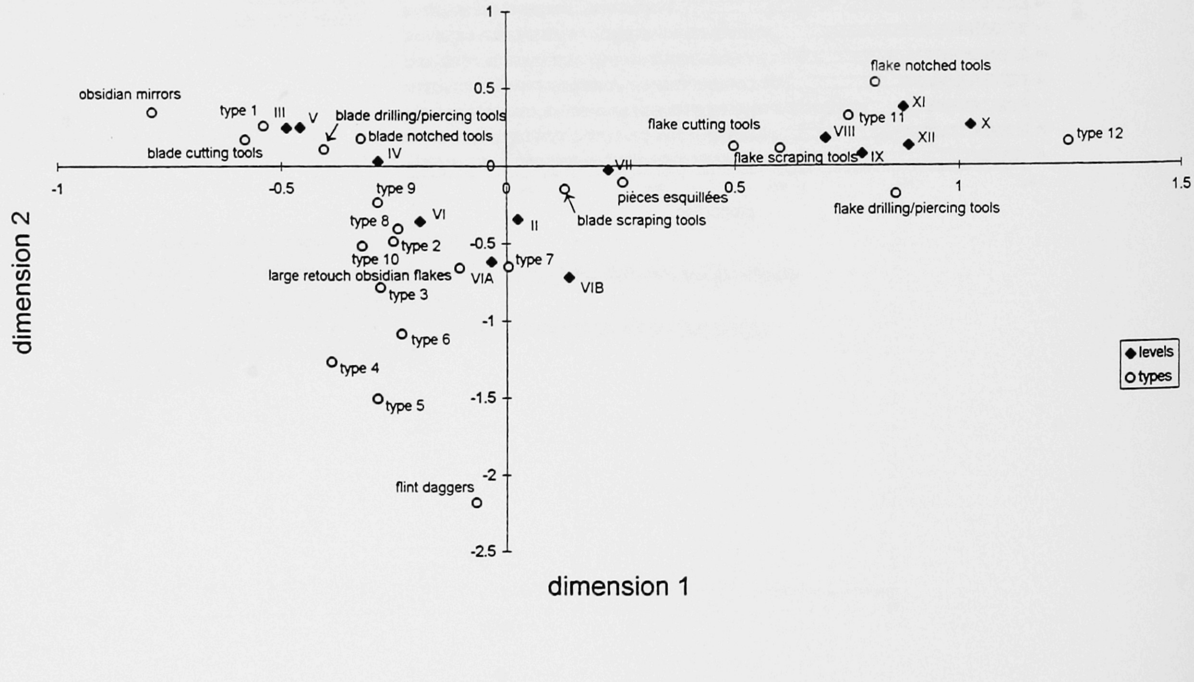
Graph 6.5 Proportions of major tool classes by Level.



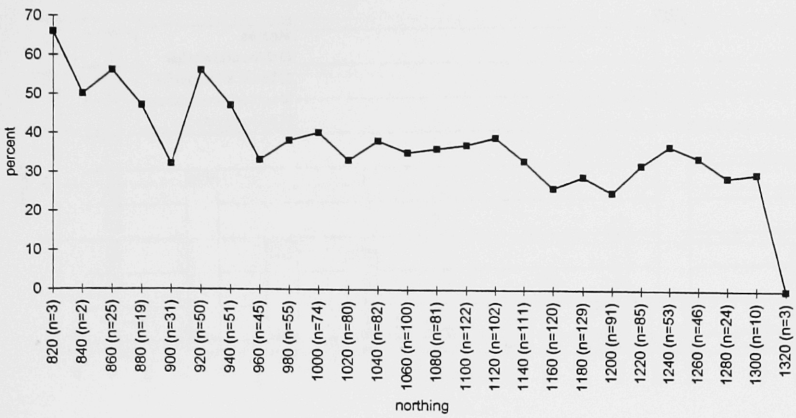
Graph 6.6 Correspondence analysis between stratigraphic level and debitage class.



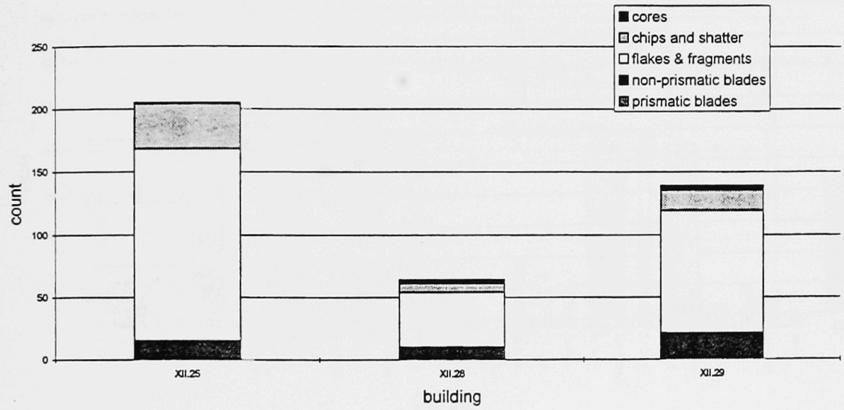
Graph 6.7 Correspondence analysis between stratigraphic level and tool class.



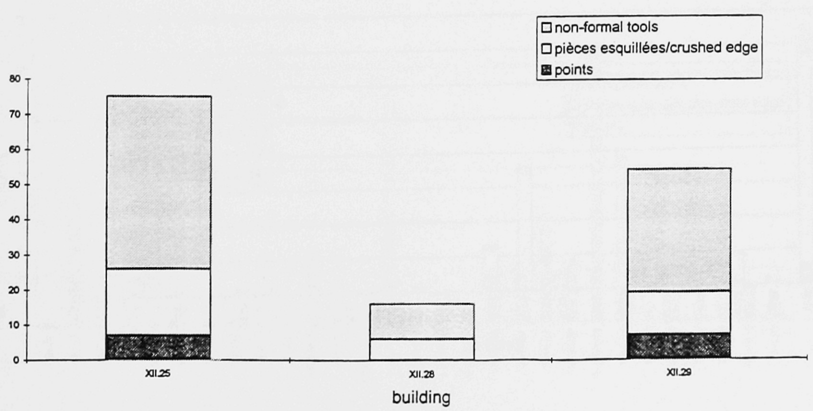
Graph 6.8 Blade proportions per surface units, east-west transect.



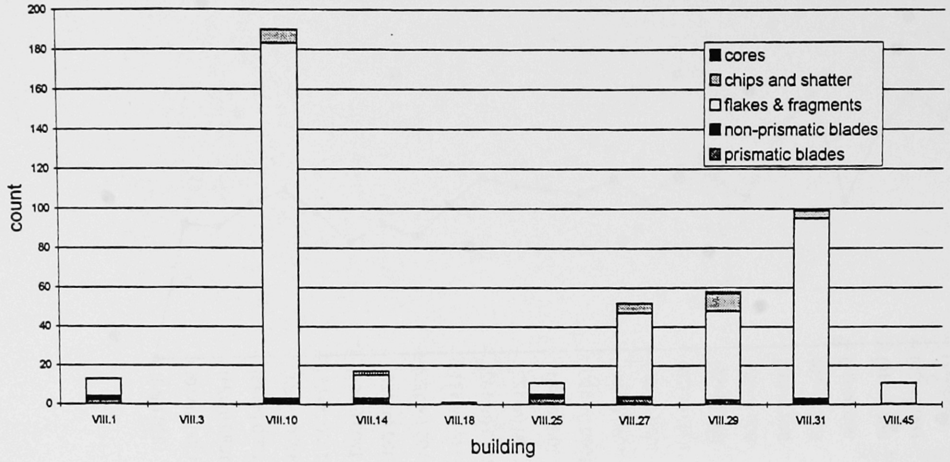
Graph 6.9 Level XII debitage class distribution.



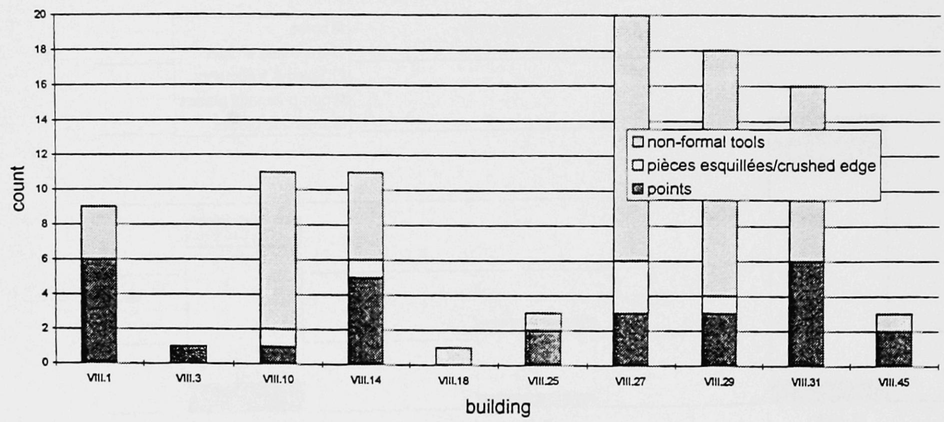
Graph 6.10 Level XII tool class distribution.



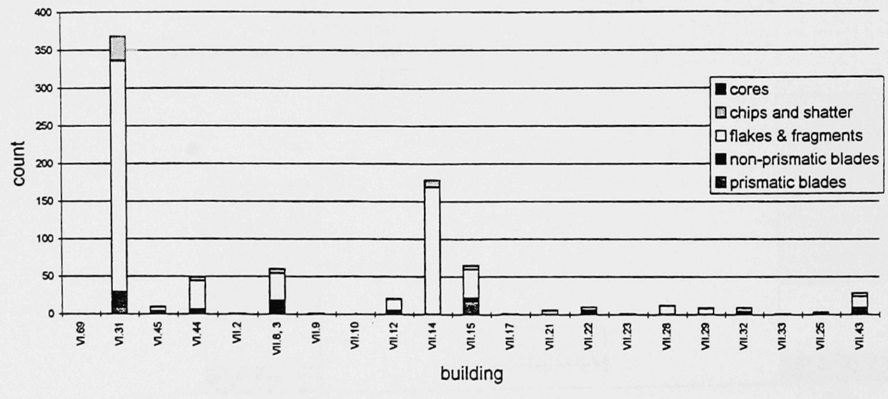
Graph 6.11 Level VIII debitage class distribution.



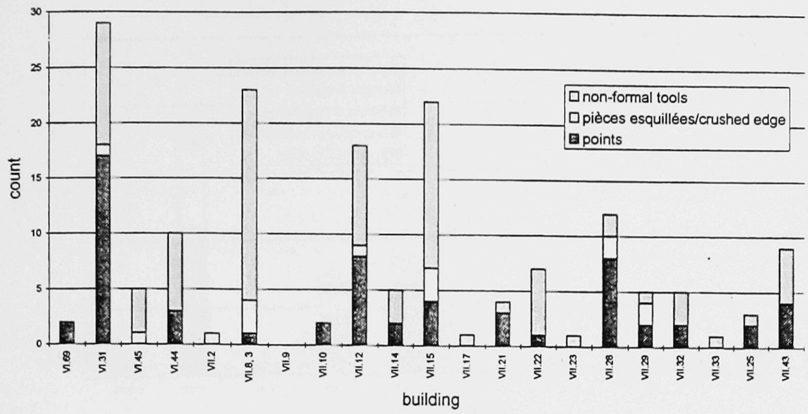
Graph 6.12 Level VIII debitage class distribution.



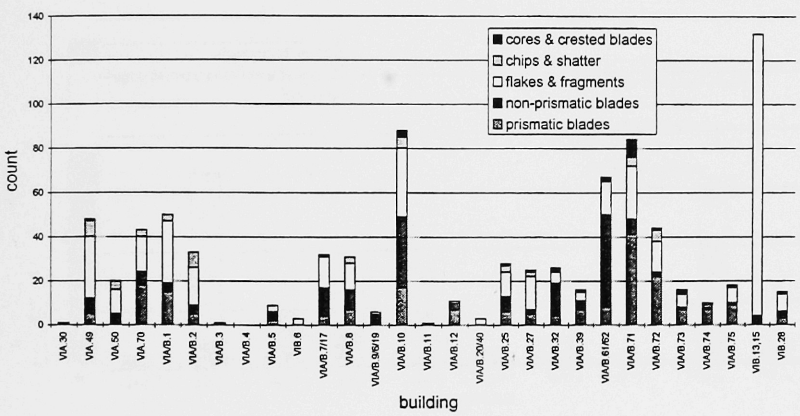
Graph 6.13 Level VII debitage class distribution.



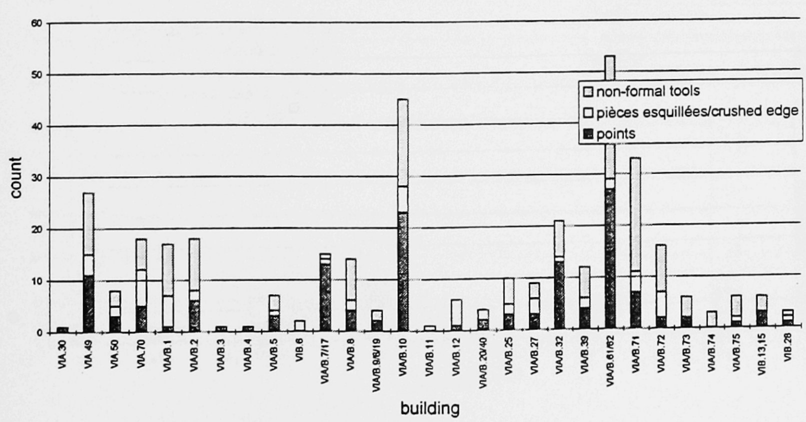
Graph 6.14 Level VII tool class distribution.



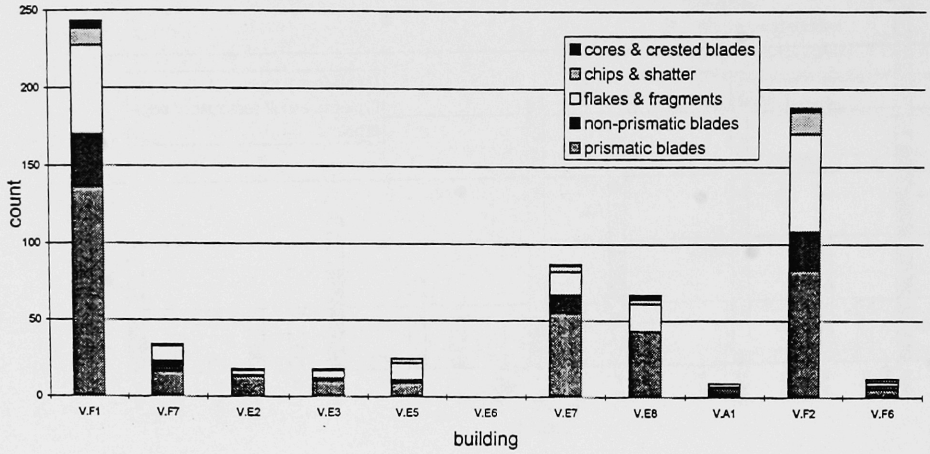
Graph 6.15 LevelVI debitage class distribution.



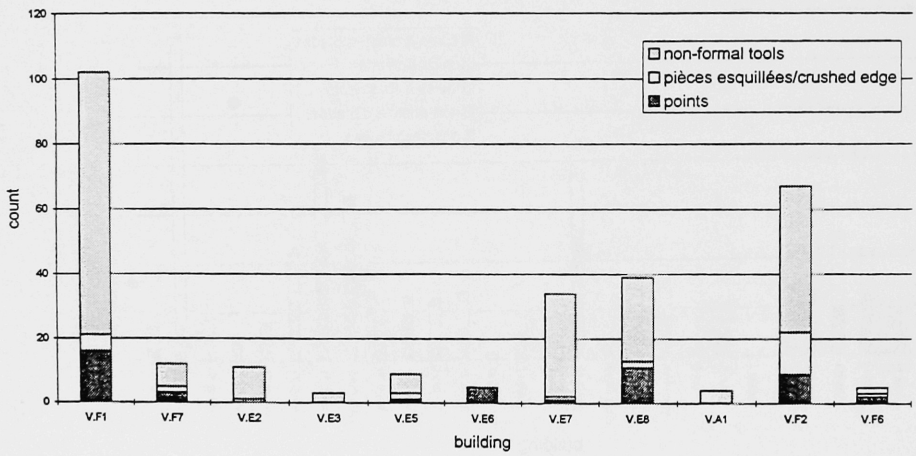
Graph 6.16 Level VI tool class distribution.



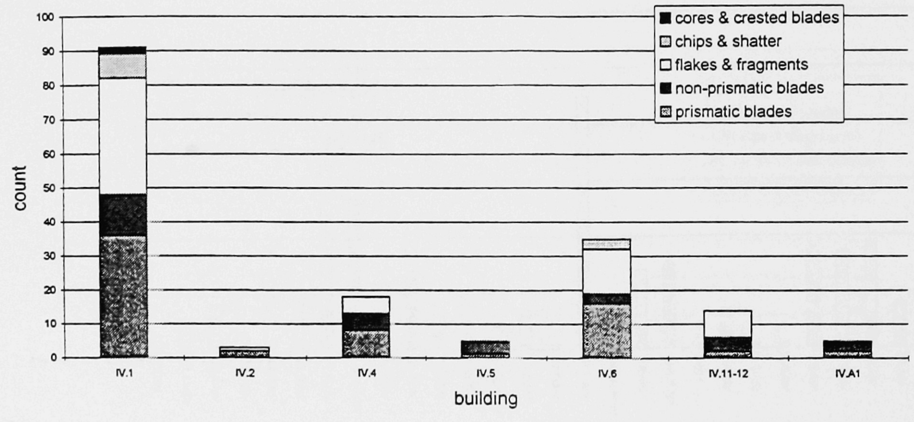
Graph 6.17 Level V debitage class distribution.



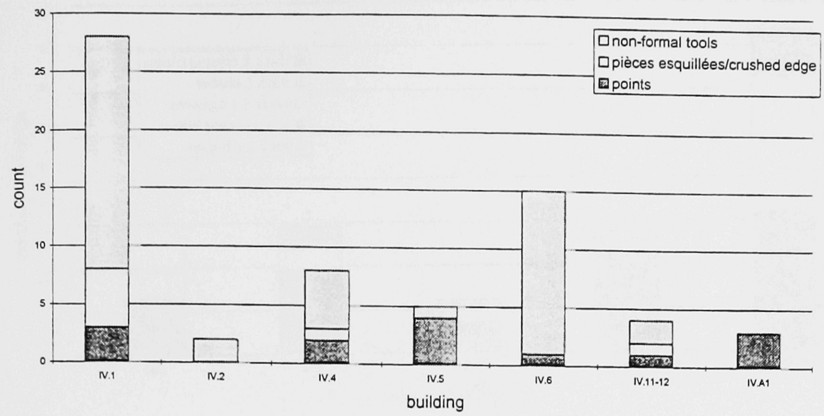
Graph 6.18 LevelV tool class distribution.



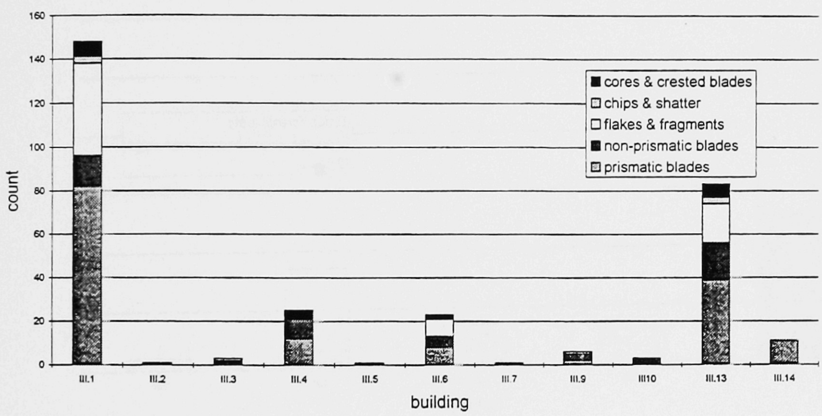
Graph 6.19 Level IV debitage class distribution.



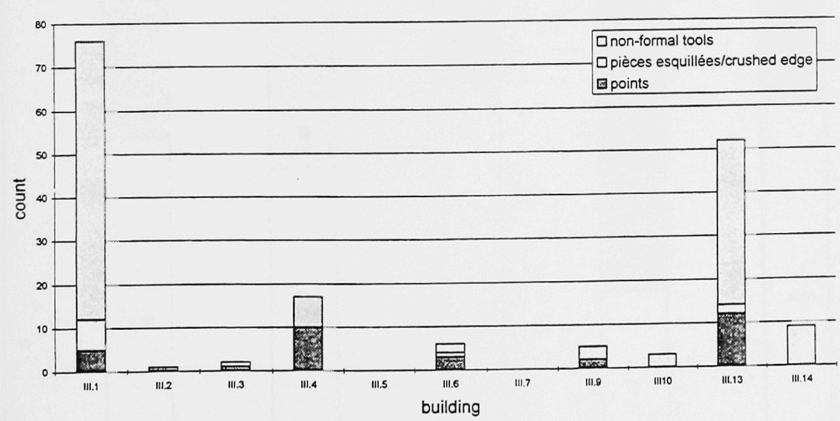
Graph 6.20 Level IV tool class distribution.



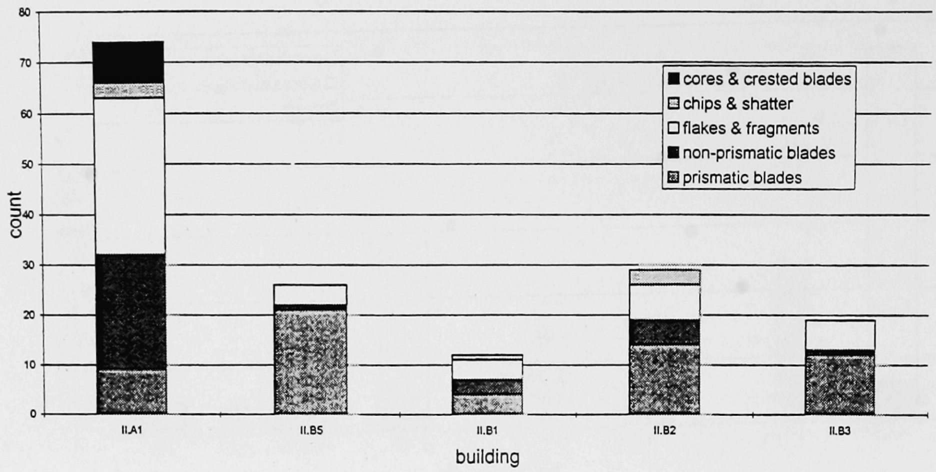
Graph 6.21 LevelIII debitage class distribution.



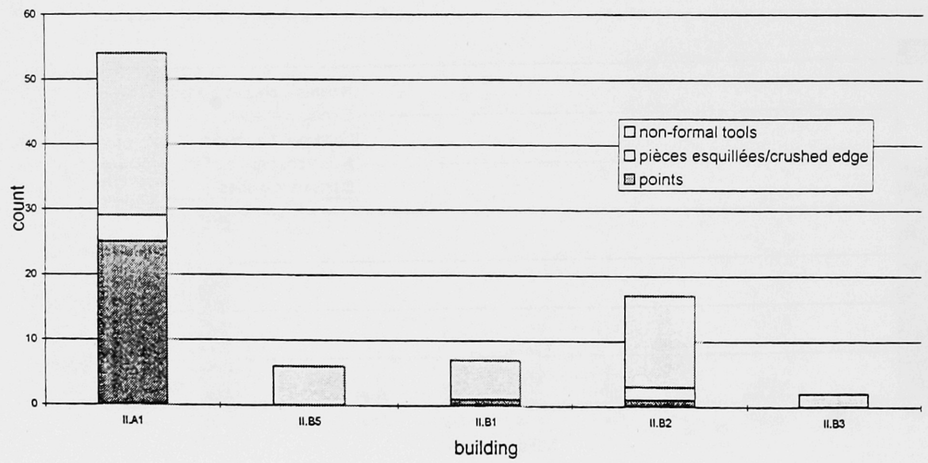
Graph 6.22 Level III tool class distribution.



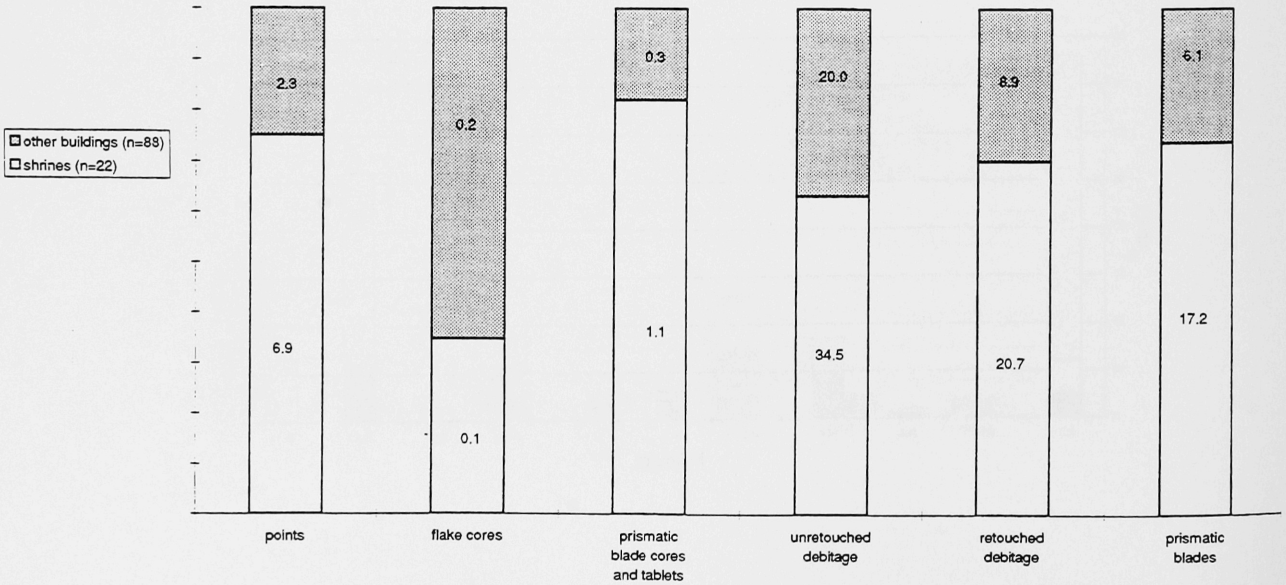
Graph 6.23 Level II debitage class distribution.



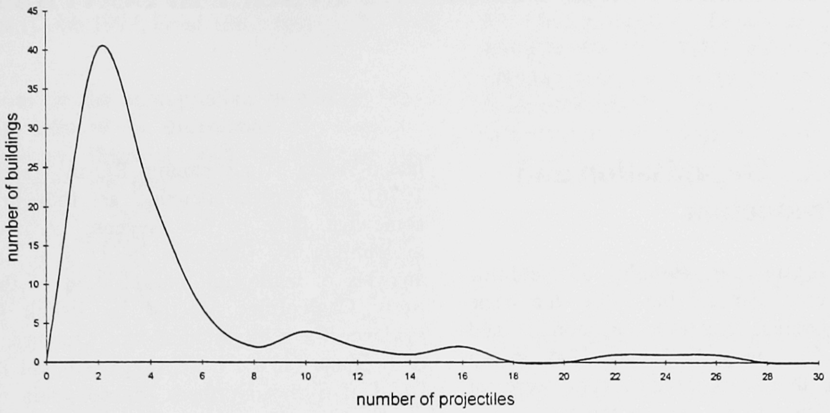
Graph 6.24 Level II tool class distribution.



Graph 6.25 Proportions of mean numbers of artefacts found in shrines and other buildings (n=mean number per building type).



Graph 6.26 Frequency distribution of numbers of points per building, all Levels.



VII

TECHNOLOGY AND TYPOLOGY IN SOCIAL CONTEXT

Models of Social Organisation and Production

I am not so concerned here with specifics of Neolithic subsistence or productive economies but rather the basic structure and logic behind Neolithic economic and productive behaviour. Ultimately this may lead to an understanding of what the roles of knappers were at Çatalhöyük, both in an economic and a social sense.

Social organisation structures production in all societies. Identifying the socio-economic structure of archaeological societies is a notoriously difficult exercise and uncritical use of anthropological models causes particular problems. Nevertheless, I will attempt to construct a general model of the organisation of production at Çatalhöyük as a means to aid the interpretation of the lithic data described in the previous section. Whereas the most widely used are Service's (1962) and Fried's (1967) evolutionary models of social organisation, more recent, explicitly non-evolutionary devices, use marriage patterns (Collier 1988), residence systems (Wills 1992), or differences in modes of production (Southall 1988; Woodburn 1982) to distinguish between social structures. Service's and Fried's remain the most widely known and commonly followed by archaeologists. As heuristic devices, both are anachronistic and, indeed, soon after their publication, both were criticised for being either simplistic, idealistic, evolutionary, or all three (e.g. Helm 1968, Service 1975, Renfrew 1982). While their evolutionary perspective has come under attack for propagating the idea that complex state societies (i.e. western) are more advanced or superior than non-state (i.e. non-western), it is, however, generally accepted that in western Asia non-egalitarian societies succeeded egalitarian societies (Eslick 1988:12).

In regional perspective, the onset of settled communities in the Near East, perhaps during the later Epi-Palaeolithic but certainly by the early Neolithic, was a source and cause of major changes to community social structure, linked to the associated intensification of production, increases in storage, and delayed returns on labour investments (Byrd 1994:642). It is with the early settled communities of the Neolithic of the Near East that kinship based productive systems also appear to have arisen (Flannery 1972, Southall 1988, Upham 1990). The narrowing or even removal, of community-wide sharing of production and consumption in favour of household-based economies is a major effect of this structural transformation (Byrd 1994:642; Netting 1990; Wilk & Netting 1984:11). However, the development of institutionalised social hierarchies is not thought to have occurred until *at least* the Late Neolithic/Chalcolithic transition, perhaps around the late 6th/early 5th millennium BC in Western Asia (Redman 1978) and 'ranked societies' are thought to have occurred somewhat later in the Aegean, perhaps around the 3rd millennium BC (Renfrew 1972). It is perhaps telling that analysis of settlement organisation of the somewhat later Early Chalcolithic Hacılar by Eslick (1989) shows no evidence for a hierarchical-like structure. Although Watson & LeBlanc (1973) have suggested that the Late Neolithic Halaf of Syrian Northern Mesopotamia represented simple chiefdoms, more recently Akkermans (1993:292) has convincingly argued against this, suggesting that hierarchical, ranked societies cannot be seen to exist in this region until the Late Chalcolithic, about 3500 BC (Akkermans 1989) (although perhaps somewhat earlier in southern Mesopotamia).

Despite contrasting claims by Mellaart otherwise, Çatalhöyük must first be seen within its chronological context of existing well *before* the appearance of any visible signs of hierarchical societies elsewhere in the Near East. Indeed, Wason (1994), after an exhaustive study of the evidence can see no conclusive evidence for ranking at Çatalhöyük, although he admits that there may well be evidence of social inequality. The paragraphs that follow, however, suggest that this is typical of small kinship-based societies. Thus Çatalhöyük, while perhaps exhibiting more outward signs of this, is only manifesting a social structure typical for its time and place.

Production in small-scale societies

The differences between settled and mobile social systems has been described by terms such as 'foraging and kinship modes of production' (Southall 1988), 'communal and household systems' (Wills 1992:160) and 'immediate and delayed economies' (Woodburn 1982, in Byrd 1994:642). These terminologies are far more informative than either Service's and Fried's classification, and at their heart they are concerned with the structure, mechanisms and organisation of production.

Anthropological studies of sedentary small-scale societies have demonstrated that the household is the principal unit of production and consumption (Wills 1992). Following Byrd (1994:642-3) and others, households can be defined "as a task-oriented residence unit that shared a combination of production, co-residence, reproductive and consumptive tasks". As kinship forms the basis of the household, it also forms the structure of what can be termed the "domestic mode of production" (Sahlins 1972). As the kinship system usually structures access to goods and the mobilisation of labour this dilutes the ability of leaders to manipulate production for economic and political gain (Tilley 1984:112). For that reason, some attribute the origins of social stratification to restricted and independent ownership of basic resources (Cobb 1993; Fried 1967; Haas 1982; Wolf 1982:94).

Despite restrictions on the appropriation of surplus labour there are discrepancies in the distribution of authority in kinship-based systems. Drawing again on anthropological studies, kinship heads are often elderly males who can control and manipulate both junior male and female individuals in a variety of ways; for instance, the authority of elders to decide marriage partners can be a powerful control of both individual and kinship relations; the restriction of access to necessary knowledge or artefacts for the well-being of the group is also a source of power of elderly patriarchs (Bender 1990:262; Collier 1988; Tilley 1984). Of importance here is the personal social link between the producers and consumers which is based on kin ties, as contrasted to the non-personal link seen in modern capitalist societies (Tilley 1984:112).

There are several reasons to suppose that, at least in the early stages of Çatalhöyük, its socio-economy and production were organised around the household in much this way. Chief among the archaeological evidence for this is the plan of the settlement. All of the levels Mellaart excavated, which span several centuries, as well as recently investigated parts of the mound, share the same agglutinative plan of buildings without communal walls and with restricted access. In itself this is characteristic of a restricted social network for production and consumption (Byrd 1994:643). W. Matthew's micromorphological analysis has also shown that a wide range of productive and consumptive behaviours occurred within most buildings (W. Matthews *et al.* 1996). There is also ample evidence for domestic storage at Çatalhöyük, strengthening the case for domestic independence, but with hints of some more communal activities:

> Most houses have a storeroom and in some of these grain-bins of dried clay, about a metre high, were found in pairs or rows... In other storerooms grain was stored in coiled baskets or in skins... One is given the impression that each family baked its own bread, but in Levels IV and V huge bread-ovens with diameters of 1.5-1.8 metres and built of bricks set on edge were found in a courtyard which suggests a bakery (Mellaart 1976:62-63).

There are hints of at least the beginnings of an extra-household productive organisation at several Neolithic sites, of which Jarmo and 'Ain Ghazal (discussed below) show possible specialised activity areas, as do parts of Levels II and III at Beidha (although interestingly, not the earlier levels) (Kirkbride 1966:25). These may well represent the very beginnings of production for exchange and a redistributive economy[1]. For the most part, however, essential utilitarian productive behaviour – i.e. the *basic* production of food, and simple utensils such as pottery, bone tools, wooden and simple stone tools – seems to remain focused on the household. This much holds true at least for the early occupation Levels at Çatalhöyük. By Level V, however, the remarkable and sudden shift in technology in obsidian production is suggestive of a reorganisation of the basic structure of production on a par with that witnessed or suspected at other Neolithic communities in the Near East.

The Household Knapper

To summarise from the evidence presented in Chapter IV, all Neolithic sites in Central Anatolia have varying degrees of blade and flake industries. Debitage methods appear to have been based around direct percussion, with possible use of punch, at the earlier sites in the sequence (Aşıklıhöyük, aceramic Neolithic Hacılar, Can Hasan III, Suberde, Çatalhöyük XII-VII), with punch or pressure common in the later phases (Çatalhöyük VI-II, late Neolithic Hacılar, Erbaba). Given that households were the focus of economic production, it seems reasonable to assume that most of the basic forms of lithic production occurred within these contexts. While this may mean actually within the confines of the domestic structure, I also mean it in a broader sense in which the household takes responsibility for its production requirements. In some instances, particularly PPNB Levantine contexts, there is reason to suspect that this is not the case for all elements of the industry – obsidian artefacts show a notably different form of technology and, for the most part, evidence for the production does not occur within domestic contexts nor, for that matter, within settlements (Copeland 1995; Nishiaki 1992). In these cases, it seems probable that obsidian prismatic blades, rather than the raw material, were imported. Also, there is additional evidence from Anatolian contexts that the early stages in the manufacture of obsidian cores occurred at the raw material sources, possibly by individuals also involved in the subsequent regional distribution of obsidian (Cauvin & Balkan-Atli 1996), although there is little evidence that this included advanced preparation of what were to become prismatic blade cores.

Unfortunately contextual analyses of lithic industries are regrettably scarce – and as yet non-existent in Anatolia – so direct evidence of domestic production is lacking. It is reasonable to suppose, however, that large deposits or concentrations of knapping-debris of the sort indicative of non-domestic production would be noted in lithic reports, of which there are very few. Two important exceptions have already been noted: Jarmo, where there is evidence of

[1] This is not to imply that community based and simple kinship based economies are not redistributive. Labour is routinely pooled, tasks shared, and gifts exchanged which all lessen the economic load on the household (Sahlins 1972). Redistribution in these Neolithic contexts is indicative of some form of production for exchange, rather than production for gift-giving.

localised obsidian knapping areas (Braidwood 1983:287), and 'Ain Ghazal where evidence derived from the study of knapping-floors and experimental knapping of replica Naviform cores suggests that there is specialisation in blade manufacture occurring outside of domestic contexts (Rollefson 1996; Quintero & Wilke 1995).

The pattern of Neolithic production appears to be centred on the household, but perhaps with movements towards a more segmented, redistributive system that go back at least to the PPNB. The ubiquity and abundance of obsidian in all contexts at Çatalhöyük argues that general production was not restricted, although it may have been limited by the mechanism of acquisition. Keeping in mind the difficulties of defining *in situ* as opposed to post-abandonment behaviour, the evidence presented earlier suggests that lithic production was occurring on site – cores, quantities of unretouched flakes, debris, occasional crested blades and core rejuvenation tablets were all found in the buildings analysed. In the earlier levels, from XII to VII, there are some minor differences in the distribution of lithic artefacts, but there was no clear patterning as to production differences. As such, it seem likely that households were producing their own tools, assuming a constant supply of raw material. However, corresponding to the point where prismatic blade production dramatically expands, there seems to be a nucleation of production. While this is not absolute, the evidence from Levels VI to II does suggest that some 'strategies' of production becomes more confined than in earlier levels.

For instance, in Level VI, building 71 shows the first significant evidence of a concentration of cores, and thus the earliest evidence for production that is not evenly spread across contemporary households. By Level V, cores are found in at least three buildings, but one in particular stands out for its high quantities of cores and blades, as do individual buildings in Levels IV, III, and II. Most of the buildings examined display evidence of some forms of productive activities – even if these surface as concentrations of unretouched flakes and debris – but after Level VI, this evidence is restricted to use of non-formal tools and unstandardised flake core reduction except for a limited number of buildings that contain more cores than their contemporaries.

Furthermore, not every Çatalhöyük adult made, or could have made, prismatic blades. The technological demands that dictated a period of apprenticeship and extended practice would have made it socially impossible and logically untenable (c.f. Perlès 1992:135; Clark 1987:270). The sheer efficiency of its technique meant that one core would produce far too many blades – several hundred for some macro-cores – for the needs of a single household (Clark 1987:267; Sheets & Muto 1972). Although one could envisage a curated core being used to produce blades on demand, the actual physical control needed to produce error-free blades dictates a continual removal sequence that flows from start to finish (Clark 1987:272). The logical interpretation is that there was a change to a more restricted, redistributive, and non-household productive system in some areas of the obsidian industry. The possibility of non-domestic production of prismatic blades at Çatalhöyük is exciting, for it presents an instance when a clear technical change occurs in conjunction with a shift in the basic structure of village economy.

It is interesting to note that there is also a corresponding trend towards concentrations of large numbers of projectile points within some buildings and burials, as well as a few burials with flint daggers or obsidian mirrors. This suggests that some classes of obsidian and flint artefacts held a special social status (in some cases as prestige items) more or less at the time that some elements of obsidian production were becoming increasingly specialised. This is further substantiated and explored in the following sections.

Models of Craft-Specialisation

Craft-specialisation is typically defined as a "differentiated, regularised, permanent, and perhaps institutionalised production system in which producers depend on extra-household exchange relations at least in part for their livelihood, and consumers depend on them for acquisition of goods they do not produce themselves" (Costin 1991:4) or, more simply "production of alienable, durable goods for nondependent consumption" (Clark & Parry 1990:297). Distinctions are occasionally made between full and part-time specialists to distinguish between types or intensities of specialisation (Clark & Parry 1990:298). This is difficult to recognise archaeologically (Roux 1990:144), but not for want of trying (e.g. Torrence 1986). Intensities of specialisation range from small household industries to retainer workshops (see, for example, Costin's eight-fold classification (1991:8-9), or Peacock's eight 'modes of production' (1982)). Roux (1990:144) makes a simpler distinction between technical specialisation, where production is not the source of economic gain, and techno-economic specialisation, which is profit motivated. Rathje (1975:414) also makes a useful distinction between 'craft production' and 'mass replication of artefacts'. Typical of the former is a craftsperson with a low output of high quality, complex products for limited distribution. The latter implies high-output, standardised profit-oriented production. All these have been searched for in the archaeological record.

The archaeological correlates of craft-specialists are defined cross-culturally in much the same way as the correlates of ranked societies, chiefdoms or other social organisations are defined. The typical criteria cited as indication of specialised production includes direct evidence, such as discovering high densities of production debris and unfinished and finished artefacts, separate production centres, or other signs of intensity of production (Costin 1991:21; Clark 1987:43; Spence 1981; 1985). Indirect evidence such as skill of the producers (the complexity of 'know-how' required), efficiency of production, and standardisation of assemblage variability are also used to assess degrees of specialisation

(Perlès 1992; Costin 1991; Torrence 1986; Arnold 1985; 1987; Rice 1981).

These definitions tend to stress the effects of specialisation as the economic justification for specialisation. Economic efficiency, consumption and reduction of labour costs are implicitly, sometimes explicitly, called upon as explanations for the presence of specialisation. Costin, for instance, concludes her review of specialisation by clearly emphasising the economic profitability of such behaviour as responses to 'external' influences:

> Under certain circumstances, the products of specialised production systems will exhibit certain features... The key to using these data effectively to argue for the presence of specialist production is in demonstrating that they are appropriate *economic* responses to social, political, and environmental conditions (Costin 1991:44, original emphasis).

At the extreme, this has led to claims that independent specialists in non-industrial societies are motivated by profit (Costin 1991:11-12). Analysis of the Phylakopi blade industry by Torrence is also an example of overemphasis on labour, efficiency, and output:

> The first problem that must be faced when using the size or quantity of stone-working waste as the primary determinant of craft specialisation is just how much waste constitutes adequate proof of full-time labourers. One way to answer this question is to evaluate the scale of production by estimating the number of hours which it would have taken one knapper to create the quantity of waste by-products in the deposit under consideration... In order to facilitate the interpretation of the scale of the industry which the figures represent, I have converted the estimated person-hours for Phylakopi into eight hour work-days and 300 day work-years (Torrence 1986:145).

This concern with the mercantile and marketable considerations of specialisation has been attacked by Cobb (1993:67):

> It is highly questionable whether this thinly disguised microeconomic rendering of specialisation characterises the motives of producers in small-scale societies, where production is rationalised by one's position in the kin system, competition for prestige, expectations of generosity, debt obligations, and a host of other interrelated variables not easily reduced to assumptions about economic rationality.

This last point is well illustrated by an example drawn from Sahlins (1972), and provides a counter to the economic explanation of specialisation:

> The Fish Creek group maintained a virtually full-time craftsman, a man 35 or 40 years old, whose true speciality however seems to have been loafing... "*Wilira* was an expert craftsman who repaired the spears and spear-throwers, made smoking pipes and drone-tubes, and hafted a stone axe (on request) in a skilful manner; apart from these occupations he spent most of his time talking, eating and sleeping (McCarthy & McArthur 1960:148)" (in Sahlins 1972:19).

The fact that Wilira didn't work the eight-hour day, five-day a week schedule that Torrence thinks reasonable for the title 'full-time', is irrelevant – he was a full-time specialist in his eyes, and those of his fellow villagers. To this end an alternative, less functional, understanding of craft-specialisation is needed. I am not questioning the implication that craft specialisation implies production for exchange, but I want to remove the economic explanation of such production. To this end the term 'specialised production' is perhaps more appropriate to refer to activities that depend on access to and use of a restricted set of knowledge. This may also require possession of a manual dexterity – 'know-how' – that is similarly restricted for the production of goods. Emphasising specialised knowledge and know-how as the defining characteristics of specialised production is beneficial for two reasons. First, it emphasises the social basis of the phenomena insofar as knowledge and know-how are socially defined characteristics. This has the effect of blurring distinctions between the purely economic and the social. It raises the question of socially significant ways of doing things, such as particular techniques of knapping stone. Secondly, moving specialisation away from its close association with economic behaviour permits interpretations that emphasise the social use of surplus produce and specialised goods. At its heart, specialisation is cultural activity that is actively created and manipulated (Giddens 1984; c.f. Cross 1993:64). One of the potential problems this revised definition brings is that because specialised knowledge and production is culturally specific, the definition of a craft-specialist is entirely relative. No universal, cross-cultural, or absolute definitions of what constitutes specialised knowledge or production can be used without due regard to the cultural context in which they are being applied. Specialists in non-industrial societies are defined not by the amount of time they spend labouring on their (non-subsistence) tasks, but by their possession and application of specialist knowledge and skills. The objects they produce are seen as different, and beyond the proficiency of most other people. At times, specialised producers and their objects take on an other-worldly quality:

> ...in traditional societies crafting is believed to involve far more than technical expertise; that skilled artisans are in some manner or to some degree inevitably associated with exceptional powers. Since such powers originate and exist in cosmological realms outside settled society, so artisans, like other specialists in extraordinary powers that may harm as well as help society; that they evidence exceptional knowledge and intelligence and hence may be harmful magicians or adept at the occult and the demonic as well as being helpful bards, diviners, curers, and crafters of beneficial materials and activities (Helms 1993:53, citing others).

Knapping Skills and Specialised Production at Çatalhöyük

If craft-specialisation is defined not so much by economic criteria, as by the skill of the producer in applying special techniques, then some aspects of the knapped-stone industry at Çatalhöyük are strongly suggestive of a restricted, specialised, production strategy. Although some other elements of Çatalhöyük's material culture are also indicative of this – some of the textiles and wooden boxes, for instance – knapped-stone provides the best corpus of material for investigating production techniques because of its superior capacity for displaying technological information pertaining to its manufacture. In particular, the rise of prismatic blade debitage using pressure techniques presents a strong case. Admittedly, direct evidence for full-time labour is missing: there is no strong indication of high densities of production debris, or separate production centres similar to those seen at Phylakopi (Torrence 1986) and at some of the Mesoamerican production centres examined by Clark & Lee (1984). There are, however, clear signs of intensity of production insofar as blade production increases significantly over time. But all this shows is a significant restructuring of production technology and in itself does not suggest a restructuring of the production economy itself. It is difficult to convincingly argue for the presence of 'craft-specialists' using these criteria. In some respects, however, this is irrelevant: there is no reason to suspect there were persons at Çatalhöyük whose livelihood depended on the manufacturing and selling of consumer obsidian products. On the other hand, there is considerable evidence to show that there was specialised production of obsidian artefacts. Skilful manufacture is manifest in some elements of the industry; two classes of object display markedly superior knapping skills: (i) the prismatic pressure blades and (ii) the flint daggers. Two other classes show highly developed skills: (iii) obsidian mirrors and (iv) most of the projectile points, but particularly the larger types (i.e. Group 1, particularly Types 1 and 2). The prismatic blades offer the most convincing argument for *in situ* specialised production. This is because there is evidence for their production within the excavated areas, evidence which is lacking for the flint daggers and the projectile points. However, the symbolic significance of the latter three classes of object will be examined in the following section.

Experiments have shown that pressure debitage requires specialised knowledge and know-how, and considerable skill and practice to perfect:

> Recent studies indicate that pressure flaking [of blades] is a difficult, demanding practice, which requires an extensive knowledge of rock flaking properties as well as good neuromuscular co-ordination. The latter takes several years to acquire, but allows thereafter a very high productivity... Consequently, pressure flaking conforms to the typical criteria one associates with the highly skilled and productive practice of a specialist (Perlès 1989: 11; citing Inizan 1986; 1988; Pelegrin 1988).

Similar accolades for the skills of 'lithicians' comes from several other sources. J. E. Clark, for instance, notes that:

> ...there are three major requirements for making pressure blades. A knapper must have access to suitable raw material, be it a nodule or a pre-formed core. He must also have mastered the knowledge and skill needed to reduce a core into suitable blades; this implies a period of personal instruction or apprenticeship. Finally, a knapper needs adequate tools and equipment and a suitable work place. Assuming these minimal prerequisites are met, blade making involves precise tool placement, controlled force application, proper core immobilisation, and the ability to correct errors and to remove flaws. In other words, blade making requires planning, skill, and consistency. Admittedly, individual consumers could conceivably produce their own blades, nevertheless... blades were probably made by specialists – not solely because of the skill or equipment required, but also as a consequence of restricted access to raw material or pre-formed cores (1987: 269)[2].

On the other hand, experimental work conducted by Pelegrin (1988) has demonstrated that pressure blades can be produced by a range of different methods resulting in blades that exhibit the characteristics of removal by pressure, but range in overall quality depending on the actual method employed. So, in some instances:

> The production of bladelets by pressure-flaking implies only limited new knowledge on the part of the normal percussion knapper. Given an appropriate material (fine siliceous rock, obsidian), and given a desire for productivity and regularity, pressure-flaked bladelets are easily imitated (Pelegrin 1990:124).

He does, however, distinguish between blades produced from less skilled and those from more skilled techniques:

> The same cannot be said for the production of longer blades by pressure flaking. This production necessitates know-how of a markedly superior degree for the preparation of bigger cores and for the achievement of controlled sequences of blade removals. Given these demands, the production of longer blades by pressure flaking is less easy to copy and more constrained in its diffusion. For these reasons, and granted a favourable socio-economic context, this particular production becomes a good candidate for "specialisation" (Pelegrin 1990: 124).

As a guide to whether blades can be said to be 'high-quality' or not, Pelegrin suggests that blades 60mm or more in length show markedly superior production skills, while less skilled manufactures will produce blades usually well under 50mm

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[2] Clark (1987) outlines these and other important characteristics of pressure-blade technology, and compares it to flake technology. This is particularly informative of the benefits and prerequisites of the new technique, and has been reproduced in table 7.1.

in length (Pelegrin 1988: 47). There is a danger of categorising an entire technology on the basis of characteristics of a few artefacts, but on aggregate the Çatalhöyük blades certainly fall into Pelegrin's 'markedly superior' category – the mean length of complete obsidian prismatic blades is 78mm, and the mean length of prismatic blade cores (the source of the pressure blades) is 63mm, with some examples as long as 120mm. Also, although most of the prismatic blades recovered from the four separate samples are fragmentary, they show the regularity and consistency of form that exacting and skilled production exemplifies.

There is sufficient evidence to argue convincing that specialist production in some elements of the obsidian industry was occurring at Çatalhöyük. My inclination, however, is that the specialisation was less of an economic transformation than a social phenomena. Yet in economic terms, given the structure of the Neolithic economy, I neither can envisage full-time specialists, nor attached, nor sponsored obsidian production at Çatalhöyük, or any other Neolithic community. What evidence there is, overwhelmingly suggests that specialisation was the prerequisite of part-time, independent, producers (c.f. Perlès 1992:135). As evidence both from here and elsewhere in the Near East is suggestive of kinship based relationships that extend beyond the immediate household, perhaps one idea to entertain is that there was a rise of specialist production within the level of the kinship group. In other words, specialised produciton was an extra-household, but intra-kinship phenomenon, and the subsequent redistribution of prismatic blades may have occurred initially at the level of the extended family. Whether the model I've proposed is accurate or not, the effects of specialised production on a kinship based and generally non-hierarchical society are interesting, particularly the social and symbolic implications of technical changes in production strategies.

Social implications of Technical Change

> The real relevance of production specialisation to the study of the political economy is that it represents the creation and transfer of surplus. Thus, questions of intensity, degree, and scale of specialisation must ultimately relate to those social factors structuring the organisation of production of a specific type of goods in a particular society. In that regard, the central questions of interest for the political economy are What inducements stimulate a surplus? and Who controls the surplus product? As we have seen, the means of production most often is in the hands of producers in non-stratified societies, and the motivations for promoting a surplus can range from familial obligations to a desire to participate in prestige- enhancing exchange systems... To appreciate fully the political- economic dimensions of specialisation, production must be placed in some larger social context that requires moving beyond considerations of technology (Cobb 1993:69).

The issue of technical change is a particularly complex one. In more formal economic analysis, technical change is usually interpreted in one of two ways: it is either conceived of as a goal-directed rational choice, the outcome of a decision between a set of possible options, or technical change is seen as an evolutionary process, a trial and error experimentation with modifications that eventually culminate in a new modal production process. The first explanation sees technical change as an active process, encouraged by goals and objectives, and socially purposeful. The second is not goal-driven and is more akin to biological natural selection, as the most adaptive technologies survive (Elster 1990:9-10). In a sense, the debate between substantivist and formalist economic schools is embodied by these two explanations – the former school sees a difference between the economic structure of contemporary and past economies, the latter arguing that modern economic theory is universally applicable. Viewed in this light, the 'evolutionary' explanation of technical change tends towards the formalist school, insofar as modern capitalistic theories depend on this form of thinking. The political economist Polanyi offers perhaps the most insight to analysis of prehistoric economies. He effectively shows how the economy of small-scale societies is not something that can be separated or examined beyond the particulars of the social context, which necessarily means understanding the mechanisms of kinship, and the social relationships and obligations this brings (Polanyi 1968). With this in mind, my own view is that technical change requires an explanation that is relativistic, contextual and substantive: At Çatalhöyük, what does the change to a prismatic blade industry mean, and why does it occur? In what social context did this change come about?

Similar technological changes occur in Mesoamerica, and one suggestion sees the origins of prismatic blade technology in these contexts as a function of political changes connected to the rise of chiefdoms and social hierarchies (Clark 1987). And, in the Aegean;

> As for pressure-flaking, the high quality and extreme regularity of which might seem superfluous in terms of functionality, it is easily explained in the Greek context (as elsewhere) by a demand for maximum returns on a foreign, hard-to-obtain material (Perlès 1992:134, citing Clark 1987; Binder and Perlès 1990).

The other context where technical specialisation and change has been well studied is at 'Ain Ghazal. This provides an interesting set of data, for there are similarities to what appears to be happening at Çatalhöyük. The foundation for this claim is the technical competence displayed in the Naviform cores combined with evidence of 'chipping floors' interpreted as possible 'specialised activity areas' (Rollefson 1993:35; Quintero & Wilke 1995:28). I am comfortable with their interpretation of specialised production on this basis. Their explanation of its origins is largely based on the reasoned assumption that there was an increased need for regular blades to meet increasing agricultural and hunting tool requirements, for which Naviform blades were particularly suited (Quintero & Wilke 1995:27). In this interpretation, the development of specialised blade technology was a response to ecological and subsistence changes, fostered by increased population density and the new village economics of the PPNB.

I think the situation may have some parallels at Çatalhöyük, although with a slightly different emphasis. As was outlined in Chapter IV, the pattern of modification of obsidian blades is generally restricted to bilateral retouch of a sort that can be attributed to their use as cutting tools. The absence of sickle-gloss prohibited any more specific clarification of use for this task, although one can assume that, in fact, they played an important role as reaping implements – perhaps in a manner akin to those blades found embedded in a bone sickle at Hacılar (Mellaart 1970). Obsidian pressure blades imported into Levantine PPNB sites were evidently modified to be hafted as sickle elements (Nishiaki 1992). It may be, therefore, that agricultural intensification played a role in the origin of the new blade technology. Recently Roberts (1997: *pers. com*) has suggested that there appears to be an increase in the amount of grain pollen found in swampy deposits adjacent to Çatalhöyük dating roughly to mid-way through the Neolithic occupation. While this may eventually suggest that there was an increase in the use of crops and therefore the demand for sickle-blades, this is but one example of a range of uses to which prismatic blades were undoubtedly put.

Other, more personal uses are suggested from the wall paintings, where it is clear that the men are shaven. Prismatic obsidian blades are key elements in Aegean Late Neolithic and Early Bronze Age toilet kits, where they are also cardinal elements of burial assemblages. In these instances, their significance has been suggested to stem not only from the utilitarian value, but the mystery and 'otherness' of the production process (Carter 1994).

However, whether prismatic blade tools replaced the more utilitarian non-formal household flake tools of the earlier levels is debatable. The calculation of mean numbers of non-formal flake tools actually found in building contexts does not show any significant decrease over time (with the exception of the step between Level XII and XI, but Level XII has only three buildings, two of which contained over a hundred flake tools between them and are probably not representative of that Level) (table 7.2). Nor does the mean number of blade tools per building increase significantly over time. In other words there do not appear to be any major changes in the types of non-formal tools used per household over time. There is an obvious problem with this regarding the connection between artefacts that may not be *in situ*, and the toolkit of the former household. This is, in fact, probably reflected by the very low numbers encountered – as it is seems inconceivable that a typical building in Level VII had a toolkit that consisted of four flakes and two blades; the abandonment of buildings obviously involved the removal of tools and clearing of floors, as recent work in Building 1 shows (Hodder *et al.*: in preparation). However, by taking a mean value of all buildings within a level, this gives at least a general idea of the relationship of flake to blade tools per building over time. If there were significant changes in this relationship, I would expect them to show up here. The fact that they don't suggests to me that the rise of prismatic blade technology has less to do with the changing functional requirements of households, and more to do with social and symbolic issues of technology.

Finally, by definition specialised production implies exchange of objects and, as such, it has been argued that it represents a shift towards objects having not only a use-value but an exchange-value (Perlès 1992; Cobb 1993). Although there is a distinct possibility that the commodification of perishable goods occurred during the Epipalaeolithic, representing the origins of economic inequality and a 'political economy' (Bender 1989; Testart 1982), specialised production provides a point of entry into a discussion of political economic issues. In theory, it is directly connected to exchange which, in turn, leads to discussions of surplus labour and its manipulation for the inequitable distribution of wealth, power and thus genesis of social inequality. I am unable to explore these ideas satisfactorily, and can only offer the proposition that specialised lithic production – at Çatalhöyük, and possibly in earlier contexts such as 'Ain Ghazal – marks a profound shift in Neolithic society, and may be both a product of, and a contributor to, the social inequality that led to the institutionalised hierarchies of the post-Neolithic.

At Çatalhöyük, my inclination is not to see the technical change and any possible associated shift in economic structure occurring because of impetus from any emerging political elite, nor as a maximising response to a hard-to-get material, nor as a causal response to changes in subsistence strategies. I prefer the argument that it arose because there was a desire for specialised production to meet, and possibly to encourage, an increasing desire for socially valuable items and production techniques. In other words, some obsidian artefacts and techniques of production took on an important social and symbolic role. Production of these blades seems to occur outside the technological and productive repertoire of the individual household, although it may well have stayed within the productive sphere of the kin-group. Prismatic blade production, as an extra-household product, may well have been important as an element in an emerging redistributive economy, where exchange-value and surplus were increasingly important in the social relations of within and between kin-groups.

Reconsidering the Social and Symbolic Role of Knapping at Çatalhöyük

What I wish to examine in this section are some of the more symbolic aspects of some of the technological activities and tool manufacturing patterns identified at Çatalhöyük. At the onset it is worth reiterating one of the arguments made in

Chapter II, namely that technological activity has an inherent social component.

> It is worth noting that, in the case of raw materials, the meaning of certain elements play a role in the status of the craftsmen that produce it. In turn, mythology legitimates the origin of particular technical operations, and a tool may be worshipped in lieu of a goddess. In short, technical variants are diversely embedded in the larger symbolic framework that underlies society (Lemmonier 1990:19-20).

> Another aspect of blade making merits brief comment. It is quite possible that knowledge or this craft was restricted and that special ritual observances (such as fasting, chants, seclusion, sexual abstinence, etc.) were part and parcel to the manufacturing process. If so, ritual prerequisites would have further restricted the craft. Such rituals are common among advance tribal or chiefly societies the world over for crafts of this type... Any ideological concerns would only multiply the requirements of blade making, thus making the costs of blade technology even more prohibitive (Clark 1987:268-269).

Prismatic blade technology had been used for some time in the Near East before adoption by the peoples of Çatalhöyük. It is certainly in existence by the early PPNB in the Levant, at roughly 7,600 BC, and so at least a millennium before it emerges as the dominant technology at Çatalhöyük. It appears to have been treated as a secondary, and probably special, material. It seems to have also been used for sickle blade manufacture at several sites in the Levantine PPNB (Nishiaki 1992). In these contexts its development and meaning is shrouded in mystery – the term 'phantom traders' has recently been applied to describe the unknown mechanism by which it found its way onto the settlements of this period in the Jazirah (Copeland 1995). For this reason, and the lack of good contextual studies of lithic production and use, little can be said about any possible symbolic legacy this technology possessed by the time it was employed at Çatalhöyük. Assuming, of course, that there was a legacy to import; independent innovation is a possibility, but in the absence of the needed intermediary sites between the northern Levant and Central Anatolia no conclusions can be drawn. So, what we are left with is examining the context of production at Çatalhöyük.

At risk of repeating myself, technology is not independent of wider social process. Technical innovation does not 'just' occur – it is a choice governed by the social context of the producer. A technique may appear to be just a means to achieve a given goal, but in the creative process of innovation, 'technical' elements may in fact chosen mostly in accordance with various social strategies and meanings – and sometimes it is not an artefact that marks a particular social status or identify, but entire sets of technical processes (Lemmonier 1990:19).

Interesting comparisons can be made with a similar transformation that occurred at the Middle/Upper Palaeolithic boundary, when blade production replaced flake production as the dominant technology. One interpretation forwarded by Mellars (1989) where he sees social, symbolic and 'cognitive' issues playing a significant role in the technological transformation. In particular he notes that "formalised, perceptually-defined differences in the forms of stone and bone artefacts could have been tied into a much wider framework of symbolism and symbolically defined behaviour embracing many different aspects of the social and economic organisation of Upper Palaeolithic groups" (Mellars 1989:359). He also notes the potential of plant *versus* animal tools, tools used in different seasons, and tools used by men and women in accounting for tool patterning (Mellars 1989:359). Although not a model for the social context of technical change and variablity, it is nevertheless interesting that as early as the Upper Palaeolithic there are suggestions that social and symbolic issues played a role in technical change. At Çatalhöyük, where we have rich evidence for the social and symbolic components of the inhabitants' daily life, it is possible to postulate the extent of their role in technological transformation.

At a fundamental level, there is a certain amount of evidence to suggest that women are symbolically connected to the domestic sphere of Neolithic life, whereas men are symbolically associated with the wild (Hodder 1990). Production within the household, such as food preparation and cooking are thus within the influence of women, whereas activities outside the household, such as hunting, are within the influence of men. A number of sources of evidence support this idea, such as material culture patterning in general, ritual iconography in the form of plaster reliefs, and wall paintings depicting both men and women in different (symbolic) roles. Despite the assumption that lithic technology and production is a male activity, Gero (1993) has argued that it is inconceivable that women depended on men for the production of tools; women represent half the population of prehistoric societies and account more often than not for over half the labour. Furthermore, biological strength is not an issue of production, where technique rather than force is determinate:

> ...there are no compelling biological, historical, sociological, ethnographic, ethnohistorical, or experimental reasons why women could not have made – and good reason to think they probably did make all kinds of stone tools, in all kinds of lithic materials for a variety of uses and contexts (Gero 1993:176).

The production of tools in the earlier levels at Çatalhöyük is centred in the household, and is generally what can be called non-formal tools: they are based on flake technology and are not significantly modified by retouching, but rather simply employ the natural edge of the flake blank with little additional modification, save for strengthening or backing retouch. Production of these tools appears to be done within the domestic setting where, presumably, much of their use took place. Without doubt women were making and using some or all of these tools. The range of tasks that the non-formal tools represent is enormous, but there aren't, unfortunately, the rich associations between flake tools and other artefacts and phenomena that McGhee (1977) was able to find, and subsequently model the remarkable symbolic structure that encompassed and transcended the Inuit toolkit. Çatalhöyük offers only a single building for sophisticated contextual analysis of this kind; the necessary detail is lacking from the 1960's excavation. Nevertheless, some broad points founded on some of the patterning identified can be made.

The depositional context of the projectile points and daggers offers some insights into their meaning. In contrast to the non-formal tools and flake blank production, biface thinning seems to have occurred preferentially within contexts called shrines. Also, the deposition of these tools is fundamentally different from that of many of the non-formal flake tools, and includes ritual deposits occurring *in situ* with animal figurines. Iconographic evidence suggests that men were at the least symbolically associated with hunting, and clusters of bifaces and projectiles are often found with male burials. Some interesting comparisons can here be made with the evidence presented by T. Loy from Çayönü, where traces of both human and *Bos primigenius* blood have been found on "a large [c. 20cm] black flint knife" and a large (2m by 2m) stone slab in a building that contained *Bos* bucrania and over 90 human skulls (Loy & Wood 1989:457).

On the basis of this evidence, I would argue that at Çatalhöyük the technology of biface and projectile point manufacture is beyond the confines of the domestic sphere. Furthermore, a case can be made that it was symbolically associated with men, hunting, and wild animals – in other words, the agrios side of the bipartite domus-agrios opposition proposed by Hodder. The production of projectiles and daggers, is structurally different from that of non-formal tool manufacture. It requires considerable investment in time to develop the advanced skill so evident in the projectiles from Çatalhöyük. It is possible, though less certain than in the case of the prismatic blades, that the production of these implements was also the domain of specialists. There is, however, no direct evidence to support this and while the skill of the pieces is unquestionably advanced, they are not beyond the expertise of any adept person. Much of the following is therefore conjecture based on the context of use, deposition and association of these artefacts.

First, whether all projectile blanks were actually produced on-site is debatable – there is no evidence for the cores needed to produce the blades required for some types of projectile. This serves to emphasise the 'otherness' or distinctiveness of these tools, so their presence in deliberate caches or hoards associated with food production areas and thus the domestic heart of the house, as was shown in the description of Building 1 pattering, is all the more provocative. The possibility that these are ritual deposits clearly emerges. If so, then one interpretation is that they were deposited to found food production areas, and so challenge female power in the domus. This, of course, is speculation, and only one possible interpretation. Discovering why hoards were deposited is more difficult than unearthing the context of their deposition (Bradley 1990:20-21).

There are also large deposits of projectile points and occasionally very large deposits numbering in the hundreds, that are not hoarded but placed on the floor, within some buildings. There is a correlation between these larger deposits and the so-called shrines that show higher frequencies of wall paintings, elaborate plaster features, and other decoration. With this in mind, it is difficult to ignore their relationship to the rich hunting symbolism of these rooms. Lewis-Williams (1996) has proposed that these shrines are the products of a cosmology in which animal 'spirit-helpers' manifested themselves to shamans. This was facilitated by the wall paintings, as they acted as membranes separating the two realms of the over and underworld. The associated power and influence shamans acquired by manipulating this imagery may have strengthened the symbolic aspects of the hunt and hunting paraphernalia, including projectile points. It is not beyond possibility that these proposed shamans were responsible also for the production of the elaborate bifaces, further imbibing the objects with symbolic meaning. Certainly many of the bifaces could not have played a functional role in hunting events – the length and thinness of many of the larger pieces gives them a fragility that would prohibit effective use as anything but symbolic weapons. Inclusion of some smaller, more functional, weapons in burials also suggests that they are items of prestige as much as tools.

The prismatic blades ultimately lack the rich symbolic significance of more elaborate projectiles, daggers and mirrors. Their technical development and methods of production are more easily identified than their contextual associations and social meaning. Prismatic blades and their 'finished' cores, may well have held a special status within the gamut of obsidian and flint objects, as their depositional patterning seems to suggest, by virtue of the technique or the persons that made them as much as the physical characteristics of the blades themselves. Although their rise may have been connected with functional requirements such as increasing demands for highly standardised blades for use as sickle elements, I feel that this is only one side of a story that is connected with the social significance of new techniques and specialisation and, ultimately, the interface between culture and technology.

If it is the social role of tools that is being explored, then the technical process may be as important a 'component' of the artefact as the artefact itself. Yet in the case of the daggers, projectiles and obsidian mirrors, the former two produced from outside the domestic unit and some elements of the latter suggestive of the same, their social importance is perhaps better more easily seen in light of their links to animals, hunting and hunting symbolism, or awareness of the self, rather than as technically unique objects. Nevertheless, by virtue of the fact that some components of this type of object are the product of specialised techniques and are subsequently exchanged, this suggests that knapping skill is an important component of symbolically or socially 'special' objects.

Ultimately, as all these objects are produced by people using a variety of socially-structured techniques and technical goals, the objects themselves are only the end-product of a string of actions and behaviours that may have had as much social relevance as the finished product. When attempting to understand the social position of both the objects and the producers, this needs to be taken into account if a fully contextual understanding of the meaning of things is to be achieved.

VIII

SUMMARY

This monograph has presented a comprehensive technological and typological analysis of a large body of knapped-stone from Çatalhöyük. The spatial, temporal and contextual patterning of the industry has also been investigated, permitting the exploration of the role of the knapper and the social and symbolic conditions within which he or she produced flint and obsidian artefacts. I feel that this monograph not only makes a useful contribution to knapped-stone research in a poorly investigated region of the Near East by furthering our understanding of the complex site of Çatalhöyük, but also may provide some ideas about the 'larger picture' of production and its role in society.

By establishing the basic technological characteristics of the industry, the primary methods of blank production at Çatalhöyük have been defined. Retouched pieces have been exhaustively examined using a profitable combination of attribute analysis and multivariate statistical methods, the result of which is the illumination of the basic typological and technological structure of what is a very diverse and challenging body of material. Typo-functional synthesis of the non-formal tools enabled comparisons with other sites where less detailed presentation of the technological characteristics of tools had been performed.

An important finding came from the temporal analysis of the assemblage. This has shown that there were considerable changes over time in the Çatalhöyük assemblage, particularly manifest in basic production technology, but also visible in tool technology and typology. Regional comparisons demonstrated that only the earlier levels of Çatalhöyük are comparable to late aceramic Neolithic sites such as Can Hasan III and Süberde. Later levels at Çatalhöyük are very different and are more akin to later ceramic Neolithic sites in Anatolia.

As all these change are encapsulated within an unbroken sequence of deposits and a variety of different contexts, the potential for contextual analysis of the knapped-stone was high. This formed another important part of the analysis. The contextual and spatial analysis resulted in the identification of several interesting patterns, including the identification of intra-building lithic patterning linked to the changing use of internal space, and the identification of several differences between the buildings referred to as shrines and other buildings. The symbolic qualities of some obsidian and flint artefacts were recognised.

Ultimately, the sum of the knapped-stone technological characteristics, temporal transformations, and its spatial and contextual relationships, formed the basis for the socio-economic analysis and interpretation of the industry. It was proposed that specialised production played a key role in the development of a prismatic blade production at Çatalhöyük. Additionally, it was argued that the social importance of specialised production techniques and the symbolic meanings of artefacts possibly played a significant role in creating the observed patterning.

I believe that an important gap in our knowledge concerning the basic technological characteristics of Central Anatolian Neolithic knapped-stone technology has been filled. Methodologically, by examining the social foundations of technology, and by forwarding the 'contextual' analysis of knapped-stone, this study has also directly contributed to our understanding of the archaeology of Çatalhöyük. The findings will be of long-term significance to current research at the site and, because of Çatalhöyük's unrivalled prominence in Anatolian prehistory, to other researchers interested in the Neolithic of Central Anatolia.

As a final note, I would like to stress that there can never be a final 'conclusion'. Alternative interpretations of the knapped-stone industry will eventually be forwarded, no doubt based on the recovery of new data from the ongoing research at Çatalhöyük and from projects at other Anatolian Neolithic sites. Yet, as interpretation can only begin with interpretation, I hope this thesis will act as a stimulus for additional readings of the data.

DATA TABLES

Tables for Chapter 1

Table 1.1 Earliest and latest C_{14} dates of Central Anatolian Neolithic sites in relative order

site	earliest date	latest date	reference
Asiklihöyük	7008 +/- 130 BC	6661 +/- 108 BC	Esin 1991
Aceramic Hacilar	6750 +/- 180 BC	N/A	Mellaart 1970
Can Hasan III	6584 +/- 65 BC	5710 +/- 70 BC	Yakar 1991:196
Suberde	6570 +/- 140 BC	5634 +/- 85 BC*	Bordaz 1968
Çatalhöyük	6240 +/- 96 BC	5549 +/- 93 BC*	Todd 1976
Köskhöyük (?)	N/A	N/A	
Late Neolithic Hacilar	5820 +/- 180 BC	5390 +/- 94 BC	Mellaart 1970
Erbaba	5620 +/- 700 BC	5000 +/- 600 BC	Bordaz 1973

*using 5568 +/- 40 half-life

Tables for Chapter 2

Table 2.1 Can Hasan III tool typology.

primary type-category	no. of sub-categories
projectile points	7
burins	3
notches	1
scrapers	3
piercers	1
reworked tools	1
combination tools	1
tools made on bladelets	7
miscellaneous tools	1
blades retouched to a point	1
blades with abrupt or semi-abrupt retouch along one edge	1
blades with retouch on both lateral edges	1
retouched flakes	1
retouched blades	1
pieces with gloss	5

Tables for Chapter 3

Table 3.1 Percentage of pieces < 1 cm^2 in sieved and unsieved collection strategies

	% of pieces < 1 cm2 in sample
Sample B (sieved)	16.0%
Sample C (unsieved)	8.0%

Table 3.2 Frequency of debitage for sieved and unsieved samples

	Sample B	Sample C
complete flakes	93	204
broken flakes & flake fragments	335	1166
complete blades	6	6
blade fragments	560	1450
cores	1	5
core fragments	1	12
core tablets		13
chips	447	92
shatter	131	240
indeterminable	21	95
total	**1595**	**3283**

Table 3.3 Chi-square contributions for sieved vs. unsieved samples

	Sample B	Sample C
complete flakes	0.17	0.08
broken flakes & flake fragments	49.45	24.03
complete blades	1.10	0.53
blade fragments	14.38	6.99
cores	0.47	0.23
core fragments	2.49	1.27
core tablets	4.25	2.06
chips	415.97	202.09
shatter	0.77	0.38
indeterminable	7.56	3.67

X^2=737.89, df=9, P = 0.00

Table 3.4 Raw material counts and proportions by sample

	obsidian		flint		quartz		basalt		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
Sample A	4716	95.91	192	3.90	8	0.16	1	0.02	**4917**	**100.00**
Sample B	1534	96.24	59	3.70	1	0.06			**1594**	**100.00**
Sample C	3155	96.10	108	3.29	5	0.15	15	0.46	**3283**	**100.00**
Sample D	5258	98.28	92	1.64	4	0.07			**5354**	**100.00**
total	**14663**	**96.89**	**451**	**2.98**	**18**	**0.12**	**16**	**0.11**	**15148**	**100.00**

Table 3.5 Sample D raw material weights

Raw Material	n=	%	Weight (g)	%	Mean Weight
obsidian	4394	98.01	5289.43	93.61	*1.01*
tabular flint	30	0.67	146.66	2.60	*4.89*
cobble flint	16	0.36	66.77	1.18	*4.17*
indeterminable flint	39	0.87	72.60	1.28	*1.73*
quartz	4	0.09	74.76	1.32	*18.69*
total	**4483**	**100.00**	**5650.22**	**100.00**	**100.00**

Table 3.6 Debitage class by raw material

	obsidian		flint		quartz		basalt		total
	n=	%	*n=*	%	*n=*	%	*n=*	%	n=
flakes	8463	57.72	228	50.55	7	38.89	5	31.25	**8703**
prismatic blades	3304	22.53	42	9.31					**3346**
non-prismatic blades	702	4.79	110	24.39	5	27.78	2	12.50	**819**
crested blades	17	0.12							**17**
core tablets	35	0.24							**35**
blade cores	53	0.36	2	0.44					**55**
flake cores	32	0.22	3	0.67	2	11.11	1	6.25	**38**
shatter	945	6.44	35	7.76	4	22.22	5	31.25	**989**
chips	617	4.21	12	2.66			3	18.75	**632**
indeterminable	495	3.38	19	4.21					**514**
total	**14663**	**100.00**	**451**	**100.00**	**18**	**100.00**	**16**	**100.00**	**15148**

Table 3.7 Expected values for debitage by raw material

	obsidian	flint
flakes	8434	257
prismatic blades	3247	99
non-prismatic blades	788	24
shatter	951	29
chips	610	19

Table 3.8 Chi-square contributions for debitage by raw material

	obsidian	flint
flakes	0.097513	3.204217
prismatic blades	0.994257	32.67078
non-prismatic blades	9.389612	308.5378
shatter	0.038573	1.267502
chips	0.070859	2.328389

X^2 = 358.60, d.f.=4, p=0.00

Table 3.9 Core types by sample

Core Type	Sample A	Sample B	Sample C	Sample D	totals
multi-platform, multi-sequence flake	16		3	6	**25**
opposed-platform, flake	5		1	2	**8**
single-platform, flake	1				**1**
opposed-platform, pièce-esquillée type				2	**2**
discoidal flake				1	**1**
flake core fragments		1	2		**3**
opposed-platform, blade	1				**1**
single-platform, non-prismatic blade	3		1	1	**5**
single-platform, prismatic blade	36		6	2	**44**
blade core fragments		1	3		**4**
totals	**62**	**2**	**16**	**14**	**94**

Table 3.10 Core types by raw material

	flint		obsidian		quartz		basalt		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	***n=***	**%**
multi-platform, multi-sequence flake	3	3.19	19	20.21	2	2.13	1	1.06	**25**	**26.59**
opposed-platform, flake	1	1.06	7	7.45					**8**	**8.51**
single-platform, flake			1	1.06					**1**	**1.06**
opposed-platform, pièce-esquillée type			2	2.13					**2**	**2.13**
discoidal flake			1	1.06					**1**	**1.06**
flake core fragments			3	3.19					**3**	**3.19**
opposed-platform, blade			1	1.06					**1**	**1.06**
single-platform, non-prismatic blade			5	5.32					**5**	**5.32**
single-platform, prismatic blade	2	2.13	42	44.68					**44**	**46.81**
blade core fragments			4	4.26					**4**	**4.26**
totals	**6**	**6.38**	**85**	**90.43**	**2**	**2.13**	**1**	**1.06**	**94**	**100.00**

Table 3.11 Core platform types

core type	crushed	faceted	flat	non-prepared	indeterminable
multi-platform, multi-sequence flake		2	2	3	18
opposed-platform, flake	1	1	1	1	4
single-platform, flake					1
opposed-platform, pièce-esquillée type	1				1
discoidal flake				1	
flake core fragments		1			2
opposed-platform blade					1
single-platform, non-prismatic blade		2	1		2
single-platform, prismatic blade		20			24
blade core fragments					4
totals	**2**	**27**	**4**	**4**	**57**

Table 3.12 Core length, width and thickness measurements of cores (mm)

core type	length		width	
	mean	*s.d.*	*mean*	*s.d.*
multi-platform, multi-sequence flake	49	25	40	24
opposed-platform, flake	37	17	26	12
opposed-platform, pièce-esquillée type	25	7	17	8
discoidal flake	31		28	.
single-platform, non-prismatic blade	46	31	31	30
single-platform, prismatic blade	63	24	28	12
[blade core fragments]	23	3	14	8
[flake core fragments]	22	6	17	6

Table 3.13 Incidence of retouch/use-modification by core type

core type	no	yes
multi-platform, multi-sequence flake	21	4
opposed-platform, flake	7	1
single-platform, flake	1	
opposed-platform, pièce-esquillée type		2
discoidal flake	1	
opposed-platform, non-prismatic blade	1	
single-platform, non-prismatic blade	5	
single-platform, prismatic blade	37	7
blade core fragment	1	3
flake core fragment	2	1
totals	**76**	**18**

Table 3.14 Core preparation pieces by sample.

	core tablets	crested blades	**total**
Sample A	21	9	**30**
Sample B		2	**2**
Sample C	13	3	**16**
Sample D	1	3	**4**
total	**35**	**17**	**52**

Table 3.15 Means and standard deviations of core tablet lengths, widths and thickness' (mm).

	length	width	thickness
mean	31.9	30.6	15.3
standard deviation	13.0	10.9	13.2

Table 3.16 Descriptive statistics for obsidian and flint blades.

		width		thickness		width:thickness	
	n=	*mean*	*stdev*	*mean*	*stdev*	*mean*	*stdev*
obsidian	2096	12.6	3.2	3.1	1.1	4.3	1.2
flint	142	21.8	9.4	5.7	1.4	3.7	1.1

Table 3.17 Blade ventral profiles by lateral edge morphology

	converging		expanding		parallel		sub-parallel		irregular		broken		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
slightly concave	6	0.51	8	0.68	22	1.87	15	1.28					**51**	**4.34**
concave	49	4.17	4	0.34	93	7.91	113	9.62	15	1.28	8	0.68	**282**	**24.00**
strongly concave			2	0.17	2	0.17	2	0.17					**6**	**0.51**
slightly convex							1	0.09					**1**	**0.09**
convex	2	0.17	1	0.09	1	0.09	1	0.09					**5**	**0.44**
straight	42	3.57	7	0.6	348	29.62	276	23.49	78	6.64	52	4.43	**803**	**68.35**
twisted	1	0.09			1	0.09	3	0.26					**5**	**0.44**
irregular profile	1	0.09					4	0.34	17	1.45			**22**	**1.88**
totals	**101**	**8.6**	**22**	**1.88**	**467**	**39.75**	**415**	**35.34**	**110**	**9.37**	**60**	**5.11**	**1175**	**100.05**

Table 3.18 Blade dorsal scar counts by dorsal scar removal pattern

	lateral		all edges		proximal		proximal & distal		irregular		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	n=	%
two					218	19.26	2	0.18	1	0.09	**221**	**19.53**
three					772	68.2	16	1.41	1	0.09	**789**	**69.7**
four	3	0.27			77	6.8	12	1.06			**92**	**8.13**
five	2	0.18			13	1.15	6	0.53			**21**	**1.86**
greater than five	1	0.09	4	0.35	3	0.27	1	0.09	2	0.18	**11**	**0.98**
totals	**6**	**0.53**	**4**	**0.35**	**1083**	**95.5**	**37**	**3.26**	**4**	**0.35**	**1134**	**99.99**

Table 3.19 Blade cross-sections by butt type

	crushed		faceted		flat		ground		linear		punctiform		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
rhomboid											6	0.70	**6**	**0.70**
trapezoid	27	3.16	9	1.05	21	2.46			96	11.23	372	43.51	**525**	**61.40**
centre ridge	18	2.11	3	0.35	33	3.86	9	1.05	27	3.16	99	11.58	**189**	**22.11**
left ridge			3	0.35			3	0.35	6	0.70	12	1.40	**24**	**2.81**
right ridge					9	1.05	3	0.35	3	0.35	21	2.46	**36**	**4.21**
irregular	15	1.75	3	0.35	21	2.46	15	1.75	6	0.70	15	1.75	**75**	**8.77**
totals	**60**	**7.02**	**18**	**2.11**	**84**	**9.82**	**30**	**3.51**	**138**	**16.14**	**525**	**61.40**	**855**	**100.00**

Table 3.20 Obsidian blade butt types and dorsal lip treatment

	no lip		present		removed		totals	
	n=	%	n=	%	n=	%	n=	%
crushed	15	1.98	6	0.79	45	5.93	**66**	**8.70**
faceted	3	0.40	3	0.40	6	0.79	**12**	**1.58**
flat	21	2.77	12	1.58	33	4.35	**66**	**8.70**
ground			9	1.19	21	2.77	**30**	**3.95**
linear	6	0.79	3	0.40	69	9.09	**78**	**10.28**
punctiform	66	8.70	33	4.35	408	53.75	**507**	**66.80**
totals	**111**	**14.62**	**66**	**8.70**	**582**	**76.68**	**759**	**100.00**

Table 3.21 Proportions of mid, proximal and distal obsidian blade fragments

	obsidian		flint		totals	
	n=	%	n=	%	n=	%
complete blades	63	1.70	21	14.79	**84**	**2.19**
proximal blade fragments	846	22.86	13	9.15	**859**	**22.36**
distal blade fragments	157	4.24	4	2.82	**161**	**4.19**
mid-blade fragments	2634	71.19	104	73.24	**2738**	**71.26**
totals	**3700**	**100.00**	**142**	**100.00**	**3842**	**100.00**

Table 3.22 Means and standard deviations (mm) of obsidian blade cache (n=12).

	length	width	thickness
mean	103.9	29.2	9.17
standard deviation	18.4	4.8	1.7

Table 3.23 Length:width and width:thickness ratios of obsidian blade cache (n=12).

	length:width	width:thickness
mean	3.6	3.3
standard deviation	0.8	0.6

Table 3.24 Flake classes by raw material

	broken		complete		fragment		totals	
	n=	%	n=	%	n=	%	n=	%
obsidian	1513	17.88	1780	21.04	5169	61.08	**8463**	**100.00**
flint	36	15.89	5	1.99	187	82.12	**228**	**100.00**
quartz					7	100.00	**7**	**100.00**
basalt	1	20.00	1	20.00	3	60.00	**5**	**100.00**
totals	**1551**	**17.82**	**1786**	**20.52**	**5367**	**61.66**	**8703**	**100.00**

Table 3.25 Flake ventral profiles and edge shape by raw material

i) obsidian

	converging		expanding		parallel		sub-parallel		irregular		broken		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
slightly concave	52	0.61	229	2.70	5	0.06	229	2.70	26	0.31	218	2.58	**759**	**8.96**
concave	94	1.10	452	5.34	21	0.25	442	5.22	509	6.02	182	2.15	**1699**	**20.07**
strongly concave	68	0.80	255	3.01			166	1.96	52	0.61	104	1.23	**644**	**7.61**
slightly convex	16	0.18	68	0.80			10	0.12	5	0.06	47	0.55	**145**	**1.72**
convex	26	0.31	161	1.90			68	0.80	192	2.27	47	0.55	**494**	**5.83**
strongly convex	5	0.06	26	0.31			10	0.12					**42**	**0.49**
straight	166	1.96	629	7.43	21	0.25	738	8.72	946	11.17	1143	13.51	**3642**	**43.03**
twisted	31	0.37	109	1.29			145	1.72	73	0.86	73	0.86	**431**	**5.10**
irregular profile	5	0.06	21	0.25	5	0.06	26	0.31	452	5.34	99	1.17	**608**	**7.18**
totals	**462**	**5.46**	**1948**	**23.02**	**52**	**0.61**	**1834**	**21.67**	**2255**	**26.64**	**1912**	**22.59**	**8463**	**100.00**

ii) flint

	convergin g		expanding		parallel		sub-parallel		irregular		broken		**total**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
slightly concave			2	0.91			2	0.91			2	0.91	**6**	**2.73**
concave	6	2.73	2	0.91			6	2.73	17	7.27			**31**	**13.64**
strongly concave							2	0.91	2	0.91			**4**	**1.82**
slightly convex			2	0.91			0						**2**	**0.91**
convex			4	1.82			4	1.82			2	0.91	**10**	**4.55**
strongly convex	6	2.73	25	10.91			19	8.18	15	6.36	29	12.73	**93**	**40.91**
straight	4	1.82	10	4.55			23	1	25	10.91	12	5.45	**75**	**32.73**
twisted											2	0.91	**2**	**0.91**
irregular profile							2	0.91	2	0.91			**4**	**1.82**
totals	**17**	**7.27**	**46**	**20.00**	**0**	**0.00**	**58**	**25.45**	**60**	**26.36**	**48**	**20.91**	**228**	**100.00**

Table 3.26 Obsidian flake ventral profiles by platform angles

	low		medium		high		right		obtuse		indetermin.		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
slightly concave	95	2.88	100	3.04	159	4.82	11	0.32	5	0.15	318	9.65	**687**	**20.86**
concave	106	3.22	48	1.46	100	3.04			6	0.18			**260**	**7.90**
strongly concave	392	11.90	95	2.89	38	1.15			11	0.32	244	7.40	**779**	**23.66**
slightly convex			11	0.32	74	2.25					21	0.64	**106**	**3.22**
convex			21	0.64	32	0.96							**53**	**1.61**
strongly convex	11	0.32	11	0.32	11	0.32			11	0.32			**42**	**1.29**
straight	64	1.93	148	4.50	233	7.07	21	0.64	32	0.96	349	10.61	**847**	**25.72**
twisted	116	3.54	42	1.29	138	4.18					169	5.14	**466**	**14.15**
irregular profile					11	0.32					42	1.29	**53**	**1.61**
totals	**784**	**23.79**	**476**	**14.47**	**794**	**24.12**	**32**	**0.96**	**64**	**1.93**	**1144**	**34.73**	**3293**	**100.00**

Table 3.27 Flake size categories by flaking angle

	low		medium		high		right		obtuse		indeter.		**totals**	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*	***n=***	***%***
<10mm	118	30.44	73	18.84	57	14.58					141	36.14	**389**	**100.00**
<15mm	246	28.43	92	10.59	161	18.58	11	1.22			356	41.18	**865**	**100.00**
<20mm	210	20.79	137	13.64	274	27.20			21	2.10	366	36.27	**1008**	**100.00**
>20mm	210	20.32	174	16.89	303	29.35	21	2.04	42	4.11	281	27.28	**1031**	**100.00**
totals	**783**	**23.79**	**476**	**14.47**	**794**	**24.12**	**32**	**0.96**	**64**	**1.93**	**1144**	**34.73**	**3293**	**100.00**

Table 3.28 Chi-square test of flake size and flaking angle: contributions to the statistic

	low	medium	high
<10mm	5.78	4.21	15.81
<15mm	16.25	4.81	5.32
<20mm	3.06	0.33	4.74
>20mm	10.36	1.39	5.21

X^2=77.27 (d.f.=6): p=0.00

Table 3.29 Edge shape and ventral profile distribution for flakes less than 15mm

	slightly convex	convex	strongly convex	slightly concave	concave	strongly concave	straight	twisted	irreg.	totals	
	%	%	%	%	%	%	%	%	%	%	*n=*
converging	0.40	0.20	0.20	1.20	0.60	0.80	1.20	0.60		**5.21**	**61**
expanding	1.20	1.20	0.40	3.61	4.41	4.41	7.82	1.00		**24.05**	**282**
parallel					0.20		0.20		0.20	**0.60**	**7**
sub-parallel	0.20	0.80	0.20	4.01	4.61	2.40	8.22	1.40		**21.84**	**256**
indeter.	0.80			2.20		1.00	3.81	0.20	0.60	**8.62**	**101**
irregular		1.80		0.40	3.01		11.02	0.20	3.21	**19.64**	**230**
broken	0.40	0.20		2.20	2.20	1.00	12.83	0.80	0.40	**20.04**	**235**
totals	**3.01**	**4.21**	**0.80**	**13.63**	**15.03**	**9.62**	**45.09**	**4.21**	**4.41**	**100.00**	**1171**

Table 3.30 Shatter cortical cover by raw material

	0%		1-50%		50%+		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%
obsidian	912	92.73	14	1.45	7	0.73	**934**	**94.91**
flint	24	2.47	3	0.29	10	1.02	**37**	**3.78**
quartz	3	0.29	3	0.29			**6**	**0.58**
basalt	4	0.44	3	0.29			**7**	**0.73**
totals	**944**	**95.93**	**23**	**2.33**	**17**	**1.74**	**984**	**100.00**

Tables for Chapter 4

Table 4.1 Frequencies of retouched and non-retouched debitage

	non-retouched	retouched	% retouched	total
Sample A	2936	1981	40.29	**4917**
Sample B	1482	112	7.03	**1594**
Sample C	2105	1178	35.88	**3283**
Sample D	4657	697	13.02	**5354**
totals	**11180**	**3968**	**26.19**	**15148**

Table 4.2 Number of retouched/modified pieces by raw material

	non-retouched	retouched	% retouched	totals
obsidian	10956	3707	25.28	**14663**
flint	198	253	56.10	**451**
quartz	12	6	33.33	**18**
basalt	14	2	12.50	**16**
totals	**11180**	**3968**	**26.19**	**15148**

Table 4.3 Retouched pieces by raw material and gross debitage category

	flint		obsidian		quartz		basalt		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
blades	96	37.94	1238	33.40	4	66.67			**1338**	**33.72**
flakes	137	54.15	1834	49.47	2	33.33	2	100.00	**1975**	**49.77**
other	20	7.91	635	17.13					**655**	**16.51**
totals	**253**	**100.00**	**3707**	**100.00**	**6**	**100.00**	**2**	**100.00**	**3968**	**100.00**

Table 4.4 Mean of diagnostic measurements for retouched blades & flakes (mm)

	width	thickness	width:thickness
obsidian blades	14.0	4.1	3.7
flint blades	22.8	8.3	3.1
obsidian flakes	19.6	5.7	3.9
flint flakes	22.9	8.2	2.9

Table 4.5 Primary typological composition

	obsidian	flint	quartz	basalt	totals
projectiles/bifaces	654	21			**675**
flint daggers		8			**8**
obsidian mirrors	7				**7**
large retouched obsidian flakes	14				**14**
pièces esquillées/pieces with crushed edges	593	6			**599**
retouched blades and flakes	2439	218	6	2	**2665**
totals	**3707**	**253**	**6**	**2**	**3968**

Table 4.6 Projectile/biface size-categories by cross-section

cross-section	large	medium	small	totals
oval	4	14	18	**36**
plano-convex	34	73	96	**203**
trapezoidal	1	6	9	**16**
triangular	8	72	39	**119**
totals	**47**	**165**	**162**	**374**

Table 4.7 Differences between observed and expected frequencies: point size by cross-section

cross-section	large	medium	small
oval	-0.52	-1.88	2.41
plano-convex	8.49	-16.56	8.07
trapezoidal	-1.01	-1.06	2.07
triangular	-6.95	19.50	-12.55

Table 4.8 Correlation matrix for point metric variables (n=258)

	length	width ratio	thickness	tang length	shoulder
length	1.00	0.39	0.66	-0.27	-0.31
width ratio		1.00	0.08	0.08	-0.27
thickness			1.00	-0.29	-0.21
tang length				1.00	0.49
shoulder					1.00

Table 4.9 Means and standard deviations of variables (mm): all point types

type	length		width		thickness		width ratio		tang		shoulder		count
	mean	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*	*mean*	*s.d.*	*n=*
type 1	163.12	11.31	33.98	3.37	13.05	1.54	4.84	0.56					**13**
type 2	121.90	14.63	33.28	5.37	12.99	2.98	3.76	0.77					**82**
type 3	114.71	7.23	22.00	3.77	9.77	1.95	5.35	0.93	28.45	6.90			**10**
type 4	120.45	2.33	29.80	3.82	12.15	2.19	4.07	0.44	28.25	1.77	27.90	3.54	**2**
type 5	94.82	5.57	25.89	4.29	10.92	1.63	3.76	0.67	22.88	4.98	22.84	4.46	**24**
type 6	88.32	7.55	21.43	4.12	9.83	1.57	4.24	0.77	20.99	4.44			**23**
type 7	80.27	7.22	25.22	8.98	10.52	1.82	3.91	2.73					**24**
type 8	66.28	5.69	17.31	3.83	9.08	1.78	4.07	1.31	16.77	4.04			**23**
type 9	75.54	3.30	25.93	5.94	9.63	1.15	3.03	0.59	18.04	2.93	23.38	7.03	**8**
type 10	57.82	5.58	20.07	3.47	7.63	1.60	2.95	0.48	14.60	3.82	19.07	3.74	**19**
type 11	44.58	5.30	15.80	2.67	6.99	1.67	2.88	0.53	11.98	2.57			**16**
type 12	38.11	5.31	19.30	3.90	7.31	1.18	2.02	0.33	9.69	3.32	18.45	4.00	**11**

Table 4.10 Probability matrix for independent lengths between point types

	11	2	10	8	6	7	5	9	3	12	4	1
11	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00
2		-	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	**0.84**	0.00
10			-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8				-	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00
6					-	0.01	0.04	0.00	0.00	0.00	0.00	0.00
7						-	0.00	**0.27**	0.00	0.00	0.00	0.00
5							-	0.00	0.00	0.00	0.00	0.00
9								-	0.00	0.00	0.00	0.00
3									-	0.00	**0.47**	0.00
12										-	0.00	0.00
4											-	0.00
1												-

Table 4.11 Contributions to the principal components for point metric variables

variable	factor 1 (x)	factor 2 (y)
length	-.840623	-.197565
width	-.414972	-.827629
thickness	-.743832	.120327
tang length	.625799	-.596967
shoulder	.673808	-.068918
proportion of total	*.455555*	*.219920*

Table 4.12 Point retouch morphology combinations with more than one occurrence

retouch morphology	no.	% of total
covering & scaled : covering & scaled	102	36.43
not retouched : not retouched	19	6.79
covering & scaled : long & scaled	13	4.64
covering & sub-parallel : covering & sub-parallel	13	4.64
covering & scaled : invasive & scaled	10	3.57
invasive & scaled : invasive & scaled	8	2.86
covering & scaled : covering & sub-parallel	6	2.14
long & scaled : long & scaled	6	2.14
short & sub-parallel : short & sub-parallel	6	2.14
covering & sub-parallel oblique : covering & sub-parallel oblique	4	1.43
long & scaled : not retouched	4	1.43
long & sub-parallel : not retouched	4	1.43
covering & sub-parallel : invasive & sub-parallel	3	1.07
invasive & scaled : covering & scaled	3	1.07
invasive & scaled : long & scaled	3	1.07
invasive & scaled : not retouched	3	1.07
invasive & scaled : short & scaled	3	1.07
long & scaled : short & scaled	3	1.07
not retouched : covering & scaled	3	1.07
covering & parallel : covering & parallel	2	0.71
covering & parallel oblique : covering & parallel oblique	2	0.71
covering & scaled : short & sub-parallel	2	0.71
covering & stepped : not retouched	2	0.71
covering & sub-parallel : covering & scaled	2	0.71
covering & sub-parallel : not retouched	2	0.71
invasive & sub-parallel : not retouched	2	0.71
long & sub-parallel : long & sub-parallel	2	0.71
not retouched : invasive & scaled	2	0.71
not retouched : long & scaled	2	0.71
short & scaled : short & scaled	2	0.71

Table 4.13 Pièces esquillées: blank type

	n=	%
blades	4	3.42
flakes	82	70.09
shatter	7	5.98
indeterminable	24	20.51
total	**117**	**100.00**

Table 4.14 Pièces esquillées: scarring extent by scarring location

	covering	invasive	long	short	totals
all edges	13	2	2	1	**18**
bilateral	2	0	3	3	**8**
bipolar	19	26	31	5	**81**
indeterminable	4	3	3		**10**
totals	**38**	**31**	**39**	**9**	**117**

Table 4.15 Pieces with edge crushing: raw material by blank type

	flint		obsidian	
	n=	*%*	*n=*	*%*
flake	1	25.00	159	67.95
blade	2	50.00	11	4.70
shatter			40	17.09
core	1	25.00	6	2.56
indeterminable			18	7.69
totals	**4**	**100.09**	**234**	**100.09**

Table 4.16 Pieces with edge crushing: scarring extent by modification location

	covering	invasive	long	short	indeterminable	totals
proximal	1	4	7	1		**13**
distal	2	7	20	9		**38**
proximal or distal	40	44	62	10		**156**
left	1	4	2	1		**8**
right				1		**1**
left or right	1	1	3	1		**6**
indeterminable			4		11	**15**
totals	**45**	**60**	**98**	**24**	**11**	**237**

Table 4.17 Non-formal tools: raw material by basic debitage category

	flint		obsidian		quartz		basalt		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
blade	113	51.71	1340	54.93	3	50.00	1	50.00	**1456**	**54.65**
flake	100	45.85	993	40.70	3	50.00	1	50.00	**1097**	**41.15**
other	5	2.44	107	4.37					**112**	**4.20**
totals	**218**	**100.00**	**2439**	**100.00**	**6**	**100.00**	**2**	**100.00**	**2665**	**100.00**

Table 4.18 Attribute analysis sample size

	Sample A	Sample C	Sample D	total
n=	1174	726	143	2043

Table 4.19 Non-formal tools: raw material by debitage category

	flint		obsidian		quartz		basalt		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
flake	76	43.68	713	38.23	2	66.67			**791**	**38.72**
prismatic blade	17	9.77	864	46.33			1	100.00	**882**	**43.17**
non-prismatic blade	78	44.83	226	12.12	1	33.33			**305**	**14.93**
crested blade			4	0.21					**4**	**0.20**
core tablet			5	0.27					**5**	**0.24**
shatter	1	0.57	35	1.88					**36**	**1.76**
indeterminable	2	1.15	18	0.97					**20**	**0.98**
totals	**174**	**100.00**	**1865**	**100.00**	**3**	**100.00**	**1**	**100.00**	**2043**	**100.00**

Table 4.20 Non-formal tools: debitage category by retouched edge delineation

	flakes		prismatic blades		non-prismatic blades		crested blades		core tablets		shatter		indeterminable		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear edge	43	4.89	70	4.88	14	2.85	2	40.00			1	2.78	4	18.18	**134**	**4.66**
irregular edge	328	37.27	793	55.30	250	50.81	1	20.00	4	66.67	16	44.44	8	36.36	**1400**	**48.69**
denticulated edge	60	6.82	397	27.68	91	18.50	1	20.00	2	33.33					**551**	**19.17**
notched edge	21	2.39	33	2.30	6	1.22	1	20.00					1	4.55	**62**	**2.16**
concave edge	39	4.43	31	2.16	4	0.81					2	5.56			**76**	**2.64**
convex edge	300	34.09	59	4.11	58	11.79					10	27.78	3	13.64	**430**	**14.96**
beaked edge	39	4.43	9	0.63	4	0.81					1	2.78			**53**	**1.84**
burin edge	6	0.68	11	0.77	2	0.41					2	5.56	1	4.55	**22**	**0.77**
cran	5	0.57	1	0.07	1	0.20									**7**	**0.24**
tongued edge	10	1.14	4	0.28	1	0.20					1	2.78			**16**	**0.56**
retouched to point	13	1.48	15	1.05	43	8.74							2	9.09	**73**	**2.54**
short tang	6	0.68	4	0.28	6	1.22					1	2.78			**17**	**0.59**
long tang	7	0.79	5	0.35	11	2.24					1	2.78	3	13.64	**27**	**0.94**
indeterminable	3	0.34	2	0.14	1	0.20					1	2.78			**7**	**0.24**
totals	**880**	**100.00**	**1434**	**100.00**	**492**	**100.00**	**5**	**100.00**	**6**	**100.00**	**36**	**100.00**	**22**	**100.01**	**2875**	**100.01**

Table 4.21 Mean widths and thicknesses for non-formal blade tools (mm)

	width		thickness		width:thickness		n=
	mean	*stdev*	*mean*	*stdev*	*mean*	*stdev*	
prismatic blade tools	13.62	3.65	3.76	1.37	3.83	1.06	**882**
non-prismatic blade tools	16.09	5.24	5.39	2.65	3.24	0.85	**305**

Table 4.22 Length and length:width ratios of non-formal blade tools (mm)

	length		length:width		n=
	mean	*stdev*	*mean*	*stdev*	
prismatic blade tools	28.31	10.65	2.30	1.23	**497**
non-prismatic blade tools	39.18	14.57	2.47	0.88	**188**

Table 4.23 Non-formal blade tools: location of retouch by raw material type

	flint		obsidian		quartz		basalt		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
proximal	1	0.98	19	1.65					**20**	**1.60**
distal	6	5.88	32	2.79					**38**	**3.03**
proximal & distal	1	0.98	4	0.35					**5**	**0.40**
proximal or distal			3	0.26					**3**	**0.24**
left	17	16.67	219	19.06					**236**	**18.83**
right	5	4.90	172	14.97					**177**	**14.13**
left & right	61	59.80	657	57.18	1	100.00	1	100.00	**720**	**57.46**
left or right	3	2.94	33	2.87					**36**	**2.87**
proximal and left										
proximal and right										
proximal left and right										
distal and left			1	0.09					**1**	**0.08**
distal and right										
distal left and right			1	0.09					**1**	**0.08**
all edges	8	7.84	7	0.61					**15**	**1.20**
indeterminable			1	0.09					**1**	**0.08**
totals	**102**	**100.00**	**1149**	**100.00**	**1**	**100.00**	**1**	**100.00**	**1253**	**100.00**

Table 4.24 Non-formal blade tools: retouch delineation by raw material

	flint		obsidian		quartz		basalt		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear	8	5.13	76	4.30					**84**	**4.36**
irregular	79	50.64	960	54.36	2	100.00	2	100.00	**1043**	**54.15**
denticulated	8	5.13	480	27.18					**488**	**25.34**
notched	2	1.28	37	2.10					**39**	**2.02**
concave	1	0.64	34	1.93					**35**	**1.82**
convex	35	22.44	82	4.64					**117**	**6.07**
beaked			13	0.74					**13**	**0.67**
burin	1	0.64	12	0.68					**13**	**0.67**
cran			2	0.11					**2**	**0.10**
tongued	1	0.64	4	0.23					**5**	**0.26**
retouched to point	16	10.26	42	2.38					**58**	**3.01**
short tang			10	0.57					**10**	**0.52**
long tang	5	3.21	11	0.62					**16**	**0.83**
indeterminable			3	0.17					**3**	**0.16**
totals	**156**	**100.00**	**1766**	**100.00**	**2**	**100.00**	**2**	**100.00**	**1926**	**100.00**

Table 4.25 Non-formal blade tools: retouch location by position

	direct		inverse		bifacial		alternate		alternating		burin		indeterminable		total	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
proximal	18	2.04	1	0.98							1	9.09			**20**	**1.60**
distal	27	3.06	7	6.86	3	1.83					1	9.09			**38**	**3.03**
proximal & distal	3	0.34	1	0.98	1	0.61									**5**	**0.40**
proximal or distal	1	0.11	1	0.98	1	0.61									**3**	**0.24**
left	182	20.54	29	28.43	19	11.59			3	16.67	3	27.27			**236**	**18.83**
right	126	14.30	27	26.47	14	8.54			2	11.11	6	54.55	2	50.00	**177**	**14.13**
left & right	484	54.94	32	31.37	119	72.56	72	100.00	13	72.22					**720**	**57.46**
left or right	27	3.06	4	3.92	5	3.05									**36**	**2.87**
proximal and left																
proximal and right																
proximal left and right																
distal and left	1	0.11													**1**	**0.08**
distal and right																
distal left and right	1	0.11													**1**	**0.08**
all edges	12	1.36			2	1.22							1	25.00	**15**	**1.20**
indeterminable													1	25.00	**1**	**0.08**
totals	**882**	**100.00**	**102**	**100.00**	**164**	**100.00**	**72**	**100.00**	**18**	**100.00**	**11**	**100.00**	**4**	**100.00**	**1253**	**100.00**

Table 4.26 Non-formal blade tools: modified edge delineation by location

	proximal		distal		proximal & distal		proximal or distal		left		right		left & right		left or right		all edges		indetermin.		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear edge			2	5.26					18	7.63	15	8.47	43	3.02	5	13.89	1	6.67			**84**	**4.36**
irregular edge	5	25.00	8	21.05	5	100.00	2	66.67	140	59.32	83	46.89	775	55.72	21	58.33	4	26.67			**1043**	**54.15**
denticulated edge	1	5.00							34	14.41	31	17.51	419	30.14	3	8.33					**488**	**25.34**
notched edge	2	10.00	1	2.63					12	5.08	14	7.91	7	0.50	3	8.33					**39**	**2.02**
concave edge									4	1.69	8	4.52	22	1.58	1	2.78					**35**	**1.82**
convex edge	3	15.00	13	34.21			1	33.33	18	7.63	13	7.34	55	3.96	3	8.33	9	60.00			**117**	**6.07**
beaked edge	5	25.00	3	7.89					2	0.85	2	1.13	1	0.07							**13**	**0.67**
burin edge	1	5.00	1	2.63					3	1.27	7	3.95	1	0.07							**13**	**0.67**
cran			1	2.63					1	0.42											**2**	**0.10**
tongued edge	1	5.00	1	2.63					2	0.85			1	0.07							**5**	**0.26**
retouched to point	1	5.00	2	5.26					1	0.42			52	3.74							**58**	**3.01**
short tang	1	5.00	3	7.89							2	1.13	4	0.29							**10**	**0.52**
long tang			2	5.26					1	0.42	1	0.56	11	0.79			1	6.67			**16**	**0.83**
indeterminable			1	2.63							1	0.56							1	100.00	**3**	**0.16**
totals	**20**	**100.00**	**38**	**100.00**	**5**	**100.00**	**3**	**100.00**	**236**	**100.00**	**177**	**100.00**	**1391**	**100.00**	**36**	**100.00**	**15**	**100.00**	**1**	**100.00**	**1926**	**100.00**

Table 4.27 Non-formal blade tools: edge delineation by edge angle

	low		semi-abrupt		abrupt		crossed-abrupt		burin blow		indeterminable		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear edge	33	4.98	39	3.48	9	8.04	3	21.43					**84**	**4.36**
irregular edge	379	57.25	599	53.48	58	51.79	4	28.57			3	60.00	**1043**	**54.15**
denticulated edge	200	30.21	272	24.29	14	12.50	2	14.29					**488**	**25.34**
notched edge	7	1.06	24	2.14	6	5.36	2	14.29					**39**	**2.02**
concave edge	9	1.36	22	1.96	4	3.57							**35**	**1.82**
convex edge	21	3.17	85	7.59	10	8.93	1	7.14					**117**	**6.07**
beaked edge	2	0.30	11	0.98									**13**	**0.67**
burin edge									13	100.00			**13**	**0.67**
cran			1	0.09	1	0.89							**2**	**0.10**
tongued edge			4	0.36	1	0.89							**5**	**0.26**
retouched to point	7	1.06	42	3.75	7	6.25	2	14.29					**58**	**3.01**
short tang			10	0.89									**10**	**0.52**
long tang	3	0.45	11	0.98	2	1.79							**16**	**0.83**
indeterminable	1	0.15									2	40.00	**3**	**0.16**
totals	**662**	**100.00**	**1120**	**99.99**	**112**	**100.00**	**14**	**100.00**	**13**	**100.00**	**5**	**100.00**	**1926**	**100.00**

Table 4.28 Non-formal blade tools: retouch extent by delineation

	nibbling		short		long		invasive		covering		indeterminable		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear edge	30	6.45	40	3.77	12	3.58			2	10.53			**84**	**4.36**
irregular edge	289	62.15	587	55.27	141	42.09	19	42.22	7	36.84			**1043**	**54.15**
denticulated edge	129	27.74	282	26.55	70	20.90	7	15.56					**488**	**25.34**
notched edge			23	2.17	16	4.78							**39**	**2.02**
concave edge	3	0.65	27	2.54	4	1.19	1	2.22					**35**	**1.82**
convex edge	9	1.94	52	4.90	50	14.93	5	11.11	1	5.26			**117**	**6.07**
beaked edge	3	0.65	10	0.94									**13**	**0.67**
burin edge			1	0.09	7	2.09	6	13.33					**13**	**0.67**
cran	1	0.22	1	0.09									**2**	**0.10**
tongued edge			3	0.28	2	0.60							**5**	**0.26**
retouched to point			29	2.73	22	6.57	6	13.33	1	5.26			**58**	**3.01**
short tang	1	0.22	4	0.38	2	0.60			3	15.79			**10**	**0.52**
long tang			3	0.28	7	2.09	1	2.22	5	26.32			**16**	**0.83**
indeterminable					2	0.60					1	100.00	**3**	**0.16**
totals	**465**	**100.00**	**1062**	**100.00**	**335**	**100.00**	**45**	**100.00**	**19**	**100.00**	**1**	**100.00**	**1926**	**100.00**

Table 4.29 Non-formal blade tools: retouch morphology

	n=	%
sub-parallel	1439	74.68
parallel	34	1.76
stepped/scaled	164	8.51
irregular	254	13.18
burin blow	13	0.67
crushed	8	0.42
ground edge	15	0.78
totals	**1927**	**100.00**

Table 4.30 Non-formal flake tools: sizes and ratios (mm) (n=558)

	mean	stdev
length	28.26	13.01
width	23.67	10.23
thickness	6.29	3.26
length:width	1.36	0.94
width:thickness	4.29	1.83

Table 4.31 Non-formal flake tools: raw material by delineation

	flint		obsidian		quartz		totals	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*
rectilinear	6	7.06	37	4.67			**43**	**4.89**
irregular	32	37.65	296	37.33			**328**	**37.27**
denticulated	2	2.35	58	7.31			**60**	**6.82**
notched	1	1.18	20	2.52			**21**	**2.39**
concave	4	4.71	35	4.41			**39**	**4.43**
convex	30	35.29	268	33.80	2	100.00	**300**	**34.09**
beaked	4	4.71	35	4.41			**39**	**4.43**
burin			6	0.76			**6**	**0.68**
cran	1	1.18	4	0.50			**5**	**0.57**
tongued	1	1.18	9	1.13			**10**	**1.14**
retouched to point	1	1.18	12	1.51			**13**	**1.48**
short tang	2	2.35	4	0.50			**6**	**0.68**
long tang	1	1.18	6	0.76			**7**	**0.80**
indeterminable			3	0.38			**3**	**0.34**
totals	**85**	**100.00**	**793**	**100.00**	**2**	**100.00**	**880**	**100.00**

Table 4.32 Non-formal flake tools: raw material by location of retouch

	flint		obsidian		quartz		totals	
	n=	*%*	*n=*	*%*	*n=*	*%*	*n=*	*%*
proximal	2	2.35	20	2.52			**22**	**2.50**
distal	12	14.12	149	18.79			**161**	**18.30**
proximal & distal	1	1.18	10	1.26			**11**	**1.25**
proximal or distal	2	2.35	17	2.14			**19**	**2.16**
left	10	11.76	199	25.09			**209**	**23.75**
right	13	15.29	141	17.78			**154**	**17.50**
left & right	23	27.06	131	16.52			**154**	**17.50**
left or right	12	14.12	73	9.21	1	50.00	**86**	**9.77**
proximal and left			1	0.13			**1**	**0.11**
proximal and right			1	0.13			**1**	**0.11**
proximal left and right	1	1.18	1	0.13			**2**	**0.23**
distal and left			2	0.25			**2**	**0.23**
distal and right			2	0.25			**2**	**0.23**
distal left and right	1	1.18					**1**	**0.11**
all edges	8	9.41	32	4.04	1	50.00	**41**	**4.66**
indeterminable			14	1.77			**14**	**1.59**
totals	**85**	**100.00**	**793**	**100.00**	**2**	**100.00**	**880**	**100.00**

Table 4.33 Non-formal flake tools: modification position by location

	direct		inverse		bifacial		alternate		alternating		burin		indeterm.		total	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
proximal edge	17	2.65	2	1.83	3	3.13									**22**	**2.50**
distal edge	116	18.07	31	28.44	12	12.50			1	9.09			1	25.00	**161**	**18.30**
proximal & distal edge	1	0.16	1	0.92	8	8.33	1	9.09							**11**	**1.25**
proximal or distal	6	0.93	3	2.75	7	7.29					3	50.00			**19**	**2.16**
left edge	156	24.14	34	31.19	16	16.67			2	18.18	1	16.67			**209**	**23.75**
right edge	120	18.69	20	18.35	11	11.46			2	18.18	1	16.67			**154**	**17.50**
left & right	107	16.67	11	10.09	22	22.92	10	90.91	4	36.36					**154**	**17.50**
left or right	70	10.90	5	4.59	8	8.33					1	16.67	2	50.00	**86**	**9.77**
proximal and left	1	0.16													**1**	**0.11**
proximal and right	1	0.16													**1**	**0.11**
proximal, left and right	2	0.31													**2**	**0.23**
distal and left	2	0.31													**2**	**0.23**
distal and right	2	0.31													**2**	**0.23**
distal, left and right	1	0.16													**1**	**0.11**
all	33	5.14	2	1.83	4	4.17			2	18.18					**41**	**4.66**
indeterminable	8	1.25			5	5.21							1	25.00	**14**	**1.59**
totals	**643**	**100.00**	**109**	**100.00**	**96**	**100.00**	**11**	**100.00**	**11**	**100.00**	**6**	**100.01**	**4**	**100.00**	**880**	**100.00**

Table 4.34 Non-formal flake tools: retouch location by delineation

	proximal		distal		proximal & distal		proximal or distal		left		right		left & right		left or right		proximal, left and/or right		distal, left and/or right		all edges		indetermin.		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear	1	4.55	5	3.11			1	5.26	13	6.22	12	7.79	5	3.25	6	6.98									**43**	**4.89**
irregular	7	31.82	36	22.36	10	90.91	9	47.37	83	39.71	56	36.36	83	53.90	32	37.21					6	14.63	6	42.86	**328**	**37.27**
denticulated			6	3.73					13	6.22	12	7.79	19	12.34	5	5.81	1	25.00			3	7.32	1	7.14	**60**	**6.82**
notched	1	4.55	3	1.86	1	9.09			8	3.82	5	3.25			3	3.49									**21**	**2.38**
concave	2	9.09	7	4.35					11	5.26	8	5.19	5	3.25	4	4.65					1	2.44	1	7.14	**39**	**4.43**
convex	6	27.27	81	50.31			2	10.53	67	32.06	53	34.42	21	13.64	28	32.56	3	75.00	5	100.00	29	70.73	5	35.71	**300**	**34.09**
beaked	4	18.18	16	9.94			2	10.53	4	1.91	4	2.60	4	2.60	4	4.65							1	7.14	**39**	**4.43**
burin							3	15.79	2	0.96					1	1.16									**6**	**0.68**
cran			1	0.62					2	0.96	1	0.65									1	2.44			**5**	**0.57**
tongued			1	0.62			2	10.53			3	1.95	2	1.30	1	1.16					1	2.44			**10**	**1.14**
long tang			2	1.24					1	0.48			4	2.60											**7**	**0.80**
retouched to point			3	1.86					2	0.96			8	5.19											**13**	**1.48**
short tang	1	4.55							2	0.96			3	1.95											**6**	**0.68**
indeterminable									1	0.48					2	2.33									**3**	**0.34**
totals	**22**	**100.00**	**161**	**100.00**	**11**	**100.00**	**19**	**100.00**	**209**	**100.00**	**154**	**100.00**	**154**	**100.00**	**86**	**100.00**	**4**	**100.00**	**5**	**100.00**	**41**	**100.00**	**14**	**100.00**	**880**	**100.00**

Table 4.35 Non-formal flake tools: retouch angle by delineation

	low		semi-abrupt		abrupt		crossed abrupt		burin		indeterminable		totals	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear edge	9	5.11	16	2.89	18	13.24							**43**	**4.89**
irregular edge	90	51.14	197	35.56	36	26.47	4	80.00			1	33.33	**328**	**37.27**
denticulated edge	12	6.82	40	7.22	7	5.15	1	20.00					**60**	**6.82**
notched edge	2	1.14	12	2.17	7	5.15							**21**	**2.39**
concave edge	5	2.84	22	3.97	12	8.82							**39**	**4.43**
convex edge	51	28.98	216	38.99	33	24.26							**300**	**34.09**
beaked edge	4	2.27	22	3.97	13	9.56							**39**	**4.43**
burin edge									6	100.00			**6**	**0.68**
cran			4	0.72	1	0.74							**5**	**0.57**
tongued edge	2	1.14	7	1.26	1	0.74							**10**	**1.14**
retouched to point			6	1.08	7	5.15							**13**	**1.48**
long tang			7	1.26									**7**	**0.80**
short tang	1	0.57	5	0.90									**6**	**0.68**
indeterminable					1	0.74					2	66.67	**3**	**0.34**
totals	**176**	**100.00**	**554**	**100.00**	**136**	**100.00**	**5**	**100.00**	**6**	**100.00**	**3**	**100.00**	**880**	**100.00**

Table 4.36 Non-formal flake tools: retouch morphology

	n=	%
sub-parallel	657	74.66
parallel	17	1.93
stepped/scaled	137	15.57
irregular	35	3.98
burin blow	9	1.02
crushed	22	2.50
ground edge	3	0.34
totals	**880**	**100.00**

Table 4.37 Mean length and widths of blanks types by retouch position

blank type	retouch position	length		width		
		mean	*stdev*	*mean*	*stdev*	*n=*
flake	alternate	26.0	21.4	9.1	9.5	15
flake	alternating	32.0	17.0	10.0	3.5	7
flake	bifacial	29.8	20.1	14.1	8.2	96
flake	direct	27.2	21.0	12.8	10.3	642
flake	inverse	24.4	22.6	8.9	8.7	109
non-prismatic blade	alternate	54.7	15.0	21.1	3.6	10
non-prismatic blade	alternating	48.8	14.8	17.7	3.5	6
non-prismatic blade	bifacial	34.2	17.5	18.4	3.5	48
non-prismatic blade	direct	36.2	16.1	15.9	5.6	244
non-prismatic blade	inverse	34.0	17.2	11.9	2.3	15
prismatic blade	alternate	26.2	13.4	10.2	3.3	62
prismatic blade	alternating	27.0	14.0	6.4	3.1	12
prismatic blade	bifacial	28.4	13.1	14.3	3.1	116
prismatic blade	direct	25.9	14.1	10.1	4.1	638
prismatic blade	inverse	23.9	13.1	8.5	3.2	87

Table 4.38 Mean lengths and widths of blank types by retouch delineation

blank type	retouch delineation	length		width		
		mean	*stdev*	*mean*	*stdev*	*n=*
flake	beaked	23.9	8.5	19.5	5.5	39
flake	burin	26.3	2.3	17.2	8.0	6
flake	concave	25.5	9.6	20.0	9.0	39
flake	convex	30.1	18.0	25.6	13.4	300
flake	cran	28.3	5.7	20.0	6.1	5
flake	denticulated	24.4	7.2	18.4	4.5	60
flake	irregular	26.3	11.3	19.6	9.0	328
flake	long tang	29.5	7.8	17.5	6.4	7
flake	notched	25.0	7.3	22.1	9.1	21
flake	rectilinear	32.1	13.2	23.4	9.1	43
flake	retouched to point	28.5	17.2	22.8	5.7	13
flake	short tang	20.0	3.2	46.0	4.7	6
flake	tongued	25.0	5.9	29.7	12.1	10
non-prismatic blade	beaked	40.0	24.0	19.0	7.1	4
non-prismatic blade	burin	23.8	5.5	15.6	3.3	2
non-prismatic blade	concave	41.0	7.3	14.0	3.8	4
non-prismatic blade	convex	55.8	8.2	20.8	1.7	58
non-prismatic blade	cran	44.0		12.0		1
non-prismatic blade	denticulated	34.9	13.0	16.8	3.7	91
non-prismatic blade	irregular	38.1	17.8	16.7	5.8	250
non-prismatic blade	long tang	45.6	8.9	22.4	7.8	11
non-prismatic blade	notched	21.5	9.2	18.5	9.2	6
non-prismatic blade	rectilinear	24.2	8.9	13.4	3.4	14
non-prismatic blade	retouched to point	33.3	22.3	10.0	4.4	43
non-prismatic blade	short tang	37.3	4.8	20.2	3.5	6
non-prismatic blade	tongued	26.5		18.6		1
prismatic blade	beaked	24.6	8.9	13.8	2.0	9
prismatic blade	burin	23.3	5.0	13.4	3.4	11
prismatic blade	concave	22.8	9.3	12.3	3.3	31
prismatic blade	convex	27.2	8.4	16.9	5.2	59
prismatic blade	cran	46.0		11.0		1
prismatic blade	denticulated	28.0	9.6	14.0	3.8	397
prismatic blade	irregular	26.0	10.2	13.9	3.9	793
prismatic blade	long tang	22.0	7.2	8.3	3.2	5
prismatic blade	notched	24.7	11.7	12.9	3.4	33
prismatic blade	rectilinear	21.6	11.8	13.5	3.3	70
prismatic blade	retouched to point	33.0	12.7	9.5	2.1	15
prismatic blade	short tang	37.5	3.5	17.5	2.1	4
prismatic blade	tongued	22.0	5.2	13.8	3.3	4

Table 4.39 Other non-formal tools: debitage type by retouch delineation

	crested blades		core tablets		shatter		indeterminable		totals	
	n=	%	n=	%	n=	%	n=	%	n=	%
rectilinear	2	40.00			1	2.78	4	18.18	**7**	**10.15**
irregular	1	20.00	4	66.67	16	44.44	8	36.36	**29**	**42.03**
denticulated	1	20.00	2	33.33					**3**	**4.35**
notch	1	20.00					1	4.55	**2**	**2.90**
concave					2	5.56			**2**	**2.90**
convex					10	27.78	3	13.64	**13**	**18.84**
beaked					1	2.78			**1**	**1.45**
burin					2	5.56	1	4.55	**3**	**4.35**
cran					1	2.78			**1**	**1.45**
retouched to point							2	9.09	**2**	**2.90**
short tang					1	2.78			**1**	**1.45**
long tang					1	2.78	3	13.64	**4**	**5.80**
indeterminable					1	2.78			**1**	**1.45**
totals	**5**	**100.00**	**6**	**100.00**	**36**	**100.00**	**22**	**100.00**	**69**	**100.00**

Table 4.40 Other non-formal tools: retouch morphology by debitage category

	crested blades		core tablets		shatter		indeterminable		totals	
	n=	%	n=	%	n=	%	n=	%	n=	%
sub-parallel	3	60.00	2	33.33	19	52.78	10	45.45	**34**	**49.28**
parallel					1	2.78	3	13.64	**4**	**5.8**
stepped/scaled	2	40.00	2	33.33	11	30.56	7	31.82	**22**	**31.88**
irregular			1	16.67	2	5.56	1	4.55	**4**	**5.8**
single burin blow					2	5.56	1	4.55	**3**	**4.35**
crushed			1	16.67					**1**	**1.45**
ground edge					1	2.78			**1**	**1.45**
totals	**5**	**100.00**	**6**	**100.00**	**36**	**100.00**	**22**	**100.00**	**69**	**100.00**

Table 4.41 Combination tools with two different functional areas

first edge	second edge	n=	%
cutting	drilling	7	8.33
cutting	notched	6	7.14
cutting	scraping	16	19.05
drilling	chisel	1	1.19
drilling	scraping	13	15.48
burin	cutting	4	4.76
burin	scraping	1	1.19
chisel	scraping	13	15.48
chisel	cutting	12	14.29
notched	scraping	2	2.38
cutting	indeterminable	2	2.38
scraping	indeterminable	4	4.76
burin	indeterminable	1	1.19
indeterminable	indeterminable	2	2.38
totals		**84**	**100.00**

Table 4.42 Combination tools with three different functional areas

first edge	second edge	third edge	n=	%
cutting	chisel	burin	1	11.11
cutting	chisel	notched	1	11.11
cutting	scraping	notched	1	11.11
burin	scraping	scraping	1	11.11
chisel	piercing	scraping	1	11.11
chisel	scraping	scraping	1	11.11
piercing	scraping	scraping	3	33.33
totals			**9**	**100.00**

Table 4.43 Non-formal tools: debitage category by typo-functional classification

	prismatic blade		non-prismatic blade		flake		crested blade		core tablet		shatter		indeterminable		**totals**	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
cutting tool	732	82.99	140	45.90	211	26.68	1	25.00	1	20.00	8	22.22	1	5.00	**1094**	**53.55**
scraping tool	34	3.85	60	19.67	380	48.04			2	40.00	11	30.56	2	10.00	**489**	**23.94**
drilling/piercing tool	15	1.70	20	6.56	44	5.56					3	8.33	3	15.00	**85**	**4.16**
notched tool	25	2.83	4	1.31	18	2.28	1	25.00					1	5.00	**49**	**2.40**
carving tool			3	0.98	1	0.13									**4**	**0.20**
burin	10	1.13	2	0.66	6	0.76	1	25.00			2	5.56			**21**	**1.03**
combination tool	24	2.72	13	4.26	53	6.70	1	25.00	1	20.00			1	5.00	**93**	**4.55**
indeterminable	42	4.76	63	20.66	78	9.86			1	20.00	12	33.33	12	60.00	**208**	**10.18**
totals	**882**	**100.00**	**305**	**100.00**	**791**	**100.01**	**4**	**100.00**	**5**	**100.00**	**36**	**100.00**	**20**	**100.00**	**2043**	**100.00**

Tables for Chapter 6

Table 6.1 Çatalhöyük radiocarbon dates using 5730 half-life (from Mellaart 1963:116)

Level	material	date b.c.
II	grain	5797+/- 79
III	timber	5807 +/- 94
IV	timber	6329 +/- 99
V	timber	5920 +/- 94
VIA	grain	5781 +/- 96
	timber	5800 +/- 93
	grain	5815 +/- 92
	timber	5850 +/- 94
VIB	timber	5908 +/- 93
	timber	5986 +/- 94
VII(?)	timber	6200 +/- 97
VIII		n.d.
IX	charcoal	6486 +/- 102
X	charcoal	6385 +/- 101

Table 6.2 Total number of rooms by Level (from Mellaart 1967:70)

Level	no. of rooms
II	5
III	9
IV	13
V	14
VIA	31
VIB	45
VII	31
VIII	4
IX	2
X	2

Table 6.3 Count and proportions of lithic material by Level

level	n=	%
II	196	4.13
III	359	7.56
IV	184	3.87
V	892	18.78
VIA/B	741	15.60
VIA	105	2.21
VIB	199	4.19
VII	825	17.37
VIII	563	11.86
IX	148	3.12
X	92	1.94
XI	47	0.99
XII	398	8.38
totals	**4749**	**100.00**

Table 6.4 Count and proportion of debitage categories by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%
flakes	7	3.57	18	5.01	4	2.17	38	4.26	29	3.91	6	5.71	58	29.15	125	15.15	85	15.10	30	20.27	18	19.57	10	21.28	97	24.37
broken & fragmentary flakes	48	24.49	62	17.27	58	31.52	176	19.73	199	26.86	39	37.14	105	52.76	523	63.39	381	67.67	75	50.68	54	58.70	24	51.06	198	49.75
prismatic blades			2	0.56	1	0.54	5	0.56	1	0.13	1	0.95					1	0.18								
prismatic blade fragments	65	33.16	171	47.63	68	36.96	453	50.78	234	31.58	17	16.19	8	4.02	33	4.00	18	3.20	4	2.70	4	4.35			9	2.26
non-prismatic blades	1	0.51	3	0.84	1	0.54	5	0.56	14	1.89	1	0.95	1	0.50	6	0.73	1	0.18								
non-prismatic blade fragments	33	16.84	67	18.66	32	17.39	115	12.89	156	21.05	27	25.71	14	7.04	38	4.60	12	2.13	8	5.41	1	1.09	4	8.51	12	3.02
crested blades			2	0.56			3	0.34	3	0.40																
cores	8	4.08	24	6.69	2	1.09	11	1.23	17	2.29	1	0.95			2	0.24	2	0.36	2	1.35	2	2.17			8	2.01
chips															31	3.76	1	0.18							1	0.25
shatter	7	3.57	9	2.51	10	5.43	44	4.93	41	5.53	8	7.62	7	3.52	31	3.76	33	5.86	18	12.16	11	11.96	7	14.89	58	14.57
indeterminable	27	13.78	1	0.28	8	4.35	42	4.71	47	6.34	5	4.76	6	3.02	36	4.36	29	5.15	11	7.43	2	2.17	2	4.26	15	3.77
totals	**196**	**100.00**	**359**	**100.00**	**184**	**100.00**	**892**	**100.00**	**741**	**100.00**	**105**	**100.00**	**199**	**100.00**	**825**	**100.00**	**563**	**100.00**	**148**	**100.00**	**92**	**100.00**	**47**	**100.00**	**398**	**100.00**

Table 6.5 Core types by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%
multi-sequence/platform flake			3	12.50					1	5.88					1	50.00	1	50.00	1	50.00	1	50.00			7	87.50
opposed platform flake																	1	50.00								
single platform flake																			1	50.00						
spherical flake									2	11.76	1	100.00									1	50.00				
opposed platform blade															1	50.00									1	12.50
prismatic blade	8	100.00	21	87.50	2	100.00	11	100.00	13	76.47																
non-prismatic blade									1	5.88																
totals	**8**	**100.00**	**24**	**100.00**	**2**	**100.00**	**11**	**100.00**	**17**	**100.00**	**1**	**100.00**	**0**	**0.00**	**2**	**100.00**	**2**	**100.00**	**2**	**100.00**	**2**	**100.00**	**0**	**0.00**	**8**	**100.00**

Table 6.6 Incidence of core platform grinding by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%	*n*=	%
no	1	12.50	4	16.67					3	17.65	1	100.00			1	50.00	2	100.00	2	100.00	2	100.00			8	100.00
yes	3	37.50	9	37.50			1	9.09							1	50.00										
indeterminable	4	50.00	11	45.83	2	100.00	10	90.91	14	82.35																
totals	**8**	**100.00**	**24**	**100.00**	**2**	**100.00**	**11**	**100.00**	**17**	**100.00**	**1**	**100.00**	**0**	**0.00**	**2**	**100.00**	**2**	**100.00**	**2**	**100.00**	**2**	**100.00**	**0**	**0.00**	**8**	**100.00**

Table 6.7 Primary tool type by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
projectile points	39	35.45	49	23.11	20	24.10	80	19.95	150	38.86	21	38.89	16	41.03	52	31.52	36	27.69	13	19.70	6	17.14	5	25.00	15	9.55
pièce esquillée & crushed	7	6.36	14	6.60	7	8.43	35	8.73	44	11.40	8	14.81	6	15.38	15	9.09	10	7.69	12	18.18	3	8.57	3	15.00	37	23.57
retouched blades & flakes	64	58.18	149	70.28	56	67.47	282	70.32	186	48.19	24	44.44	17	43.59	97	58.79	84	64.62	40	60.61	26	74.29	12	60.00	105	66.88
flint daggers											1	1.85														
obsidian mirrors							3	0.75	1	0.26																
obsidian flakes							1	0.25	5	1.30					1	0.61			1	1.52						
totals	**110**	**100.00**	**212**	**100.00**	**83**	**100.00**	**401**	**100.00**	**386**	**100.00**	**54**	**100.00**	**39**	**100.00**	**165**	**100.00**	**130**	**100.00**	**66**	**100.00**	**35**	**100.00**	**20**	**100.00**	**157**	**100.00**

Table 6.8 Point type by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
type 1							6	24.00	2	3.70					2	10.53										
type 2	10	40.00	4	25.00	1	14.29	12	48.00	15	27.78	4	44.44	1	16.67	8	42.11	2	22.22								
type 3	1	4.00					1	4.00	4	7.41					1	5.26										
type 4									1	1.85																
type 5									10	18.52	2	22.22	1	16.67												
type 6	1	4.00	1	6.25	1	14.29			6	11.11			2	33.33	1	5.26										
type 7	9	36.00	1	6.25	1	14.29	1	4.00	3	5.56					1	5.26	2	22.22								
type 8	2	8.00	5	31.25	2	28.57	1	4.00	4	7.41	2	22.22	1	16.67	1	5.26	1	11.11	1	11.11						
type 9					1	14.29	2	8.00	3	5.56									1	11.11						
type 10			3	18.75	1	14.29	1	4.00	5	9.26	1	11.11	1	16.67	3	15.79										
type 11	1	4.00	2	12.50			1	4.00	1	1.85					1	5.26	3	33.33	4	44.44			1	100.00	1	100.00
type 12	1	4.00													1	5.26	1	11.11	3	33.33	1	100.00				
totals	**25**	**100.00**	**16**	**100.00**	**7**	**100.00**	**25**	**100.00**	**54**	**100.00**	**9**	**100.00**	**6**	**100.00**	**19**	**100.00**	**9**	**100.00**	**9**	**100.00**	**1**	**100.00**	**1**	**100.00**	**1**	**100.00**

Table 6.9 Point retouch type by Level

	II		III		IV		V		VIA		VI		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
covering bifacial	10	26.32	24	48.98	11	55.00	41	52.56	9	45.00	55	40.74	4	80.00	33	57.89	24	77.42	10	83.33	3	60.00	1	20.00	7	63.64
partial bifacial	21	55.26	12	24.49	8	40.00	14	17.95	3	15.00	28	20.74			12	21.05	4	12.90	2	16.67			2	40.00	3	27.27
unifacial	5	13.16	13	26.53	1	5.00	19	24.36	8	40.00	31	22.96			8	14.04	3	9.68			2	40.00	2	40.00	1	9.09
not retouched	2	5.26					4	5.13			21	15.56	1	20.00	4	7.02										
totals	**38**	**100.00**	**49**	**100.00**	**20**	**100.00**	**78**	**100.00**	**20**	**100.00**	**135**	**100.00**	**5**	**100.00**	**57**	**100.00**	**31**	**100.00**	**12**	**100.00**	**5**	**100.00**	**5**	**100.00**	**11**	**100.00**

Table 6.10 Retouched blade & flake edge delineation type by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
rectilinear			1	0.63	1	1.79	12	4.08	3	1.55	1	3.57	1	5.88	1	0.97	2	2.27			2	7.41			10	8.40
irregular	22	33.33	71	44.94	21	37.50	158	53.74	96	49.48	8	28.57	5	29.41	32	31.07	27	30.68	21	51.22	5	18.52	9	60.00	47	39.50
denticulated	20	30.30	40	25.32	14	25.00	68	23.13	31	15.98	3	10.71	3	17.65	20	19.42	7	7.95	4	9.76	2	7.41	1	6.67	5	4.20
notched	1	1.52	2	1.27			3	1.02	1	0.52					2	1.94	1	1.14	1	2.44					2	1.68
concave	1	1.52	7	4.43	2	3.57	1	0.34	6	3.09	2	7.14			2	1.94	1	1.14			1	3.70	1	6.67	3	2.52
convex	19	28.79	25	15.82	8	14.29	40	13.61	41	21.13	11	39.29	5	29.41	33	32.04	46	52.27	10	24.39	16	59.26	3	20.00	41	34.45
beaked	1	1.52	1	0.63	2	3.57	1	0.34	3	1.55			1	5.88	4	3.88	1	1.14							9	7.56
burin			1	0.63			1	0.34							1	0.97			1	2.44						
cran			1	0.63											1	0.97										
tongued					1	1.79			1	0.52					2	1.94	1	1.14								
retouched to point			6	3.80	7	12.50	6	2.04	9	4.64	1	3.57	1	5.88	2	1.94					1	3.70				
short tang	2	3.03	2	1.27			1	0.34	2	1.03			1	5.88	2	1.94									2	1.68
long tang			1	0.63			3	1.02	1	0.52	2	7.14			1	0.97	2	2.27	4	9.76			1	6.67		
totals	**66**	**100.01**	**158**	**100.00**	**56**	**100.01**	**294**	**100.00**	**194**	**100.00**	**28**	**100.00**	**17**	**100.00**	**103**	**100.00**	**88**	**100.00**	**41**	**100.00**	**27**	**100.00**	**15**	**100.01**	**119**	**99.99**

Table 6.11 Retouched blade & flake edge angle class by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
low	18	27.27	45	28.48	15	26.79	107	36.39	57	29.38	4	14.29	6	35.29	22	21.36	22	25.00	6	14.63	6	22.22	7	46.67	30	25.21
semi-abrupt	45	68.18	110	69.62	38	67.86	177	60.20	128	65.98	16	57.14	11	64.71	72	69.90	66	75.00	34	82.93	20	74.07	8	53.33	73	61.34
abrupt	3	4.55	1	0.63	3	5.36	6	2.04	4	2.06	4	14.29			9	8.74					1	3.70			13	10.92
crossed abrupt							3	1.02	5	2.58	3	10.71							1	2.44					2	1.68
indeterminable			2	1.27			1	0.34			1	3.57													1	0.84
totals	**66**	**100.00**	**158**	**100.00**	**56**	**100.01**	**294**	**99.99**	**194**	**100.00**	**28**	**100.00**	**17**	**100.00**	**103**	**100.00**	**88**	**100.00**	**41**	**100.00**	**27**	**100.00**	**15**	**100.00**	**119**	**100.00**

Table 6.12 Retouched blade & flake edge morphology by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
sub-parallel	51	77.27	128	81.01	42	75.00	218	74.15	154	79.38	22	78.57	13	76.47	81	78.64	74	84.09	37	90.24	25	92.59	13	86.67	99	83.19
parallel					3	5.36	6	2.04	4	2.06	1	3.57			2	1.94	2	2.27			1	3.70			2	1.68
stepped/scaled	8	12.12	8	5.06	8	14.29	27	9.18	24	12.37	1	3.57	2	11.76	11	10.68	9	10.23	2	4.88	1	3.70			13	10.92
irregular	5	7.58	19	12.03	3	5.36	34	11.56	10	5.15	3	10.71	2	11.76	6	5.83	3	3.41							4	3.36
burin blow			1	0.63			1	0.34							1	0.97			1	2.44						
crushed							4	1.36	1	0.52	1	3.57			1	0.97			1	2.44			2	13.33	1	0.84
ground	2	3.03	2	1.27			4	1.36	1	0.52					1	0.97										
totals	**66**	**100.00**	**158**	**100.00**	**56**	**100.01**	**294**	**100.00**	**194**	**100.00**	**28**	**100.00**	**17**	**99.99**	**103**	**100.00**	**88**	**100.00**	**41**	**100.00**	**27**	**99.99**	**15**	**100.00**	**119**	**99.99**

Table 6.13 Blank retouch position by Level

blank type	position	II		III		IV		V		VIA		VI		VIB		VII		VIII		IX		X		XI		XII	
		n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
flake	alternate							2	3.39			2	3.39			2	3.03	1	1.52	1	3.45					2	2.11
flake	alternating											1	1.69			1	1.52	2	3.03							2	2.11
flake	bifacial	2	7.69	6	16.22	1	6.67	8	13.56	3	30.00	6	10.17			7	10.61	9	13.64			1	4.35	3	23.08	13	13.68
flake	direct	21	80.77	28	75.68	14	93.33	41	69.49	7	70.00	46	77.97	2	100.00	53	80.30	49	74.24	23	79.31	19	82.61	9	69.23	60	63.16
flake	inverse	3	11.54	3	8.11			8	13.56			4	6.78			3	4.55	5	7.58	4	13.79	3	13.04	1	7.69	18	18.95
flake	burin																			1	3.45						
total		**26**	**100.00**	**37**	**100.00**	**15**	**100.00**	**59**	**100.00**	**10**	**100.00**	**59**	**100.00**	**2**	**100.00**	**66**	**100.00**	**66**	**100.00**	**29**	**100.00**	**23**	**100.00**	**13**	**100.00**	**95**	**100.00**
non-prismatic blade	alternate	1	5.56	2	11.11			3	4.41							1	2.56										
non-prismatic blade	alternating	2	11.11					1	1.47							1	2.56							1	50.00		
non-prismatic blade	bifacial	4	22.22	1	5.56	2	13.33	17	25.00	1	11.11	7	14.29			7	17.95	1	14.29							1	7.69
non-prismatic blade	direct	10	55.56	14	77.78	13	86.67	46	67.65	8	88.89	42	85.71	3	100.00	30	76.92	5	71.43	6	75.00			1	50.00	9	69.23
non-prismatic blade	inverse	1	5.56	1	5.56			1	1.47									1	14.29	2	25.00					3	23.08
total		**18**	**100.00**	**18**	**100.00**	**15**	**100.00**	**68**	**100.00**	**9**	**100.00**	**49**	**100.00**	**3**	**100.00**	**39**	**100.00**	**7**	**100.00**	**8**	**100.00**			**2**	**100.00**	**13**	**100.00**
prismatic blade	alternate	3	15.00	7	6.93	2	8.00	8	4.91			2	2.50			2	13.33	1	7.69								
prismatic blade	alternating			1	0.99			4	2.45							1	6.67			1	25.00						
prismatic blade	bifacial	3	15.00	13	12.87	7	28.00	37	22.70			12	15.00			2	13.33	2	15.38			1	33.33				
prismatic blade	direct	11	55.00	74	73.27	15	60.00	105	64.42	6	100.00	62	77.50	2	100.00	9	60.00	9	69.23	3	75.00	2	66.67			2	66.67
prismatic blade	inverse	2	10.00	5	4.95	1	4.00	8	4.91			4	5.00					1	7.69							1	33.33
prismatic blade	burin			1	0.99			1	0.61							1	6.67										
total		**20**	**100.00**	**101**	**100.00**	**25**	**100.00**	**163**	**100.00**	**6**	**100.00**	**80**	**100.00**	**2**	**100.00**	**15**	**100.00**	**13**	**100.00**	**4**	**100.00**	**3**	**100.00**			**3**	**100.00**

Table 6.14 Retouched blade & flake typo-functional category by Level

	II		III		IV		V		VIA		VIA/B		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
combination tool	1	1.56	4	2.68			9	3.19	1	4.17	3	1.61			5	5.15	3	3.57	1	2.50			2	16.67	7	6.67
cutting tool	28	43.75	111	74.50	33	58.93	195	69.15	12	50.00	106	56.99	6	35.29	37	38.14	24	28.57	6	15.00	2	7.69	4	33.33	28	26.67
drilling/piercing tool	1	1.56	1	0.67	3	5.36	7	2.48	1	4.17	7	3.76	2	11.76	5	5.15	2	2.38	4	10.00			1	8.33	8	7.62
indeterminable	8	12.50	9	6.04	8	14.29	21	7.45	2	8.33	16	8.60	4	23.53	17	17.53	5	5.95	6	15.00	1	3.85			5	4.76
notched tool	1	1.56	2	1.34			3	1.06			1	0.54			2	2.06			1	2.50					1	0.95
scraping tool	25	39.06	22	14.77	12	21.43	47	16.67	8	33.33	53	28.49	5	29.41	31	31.96	50	59.52	22	55.00	23	88.46	5	41.67	56	53.33
totals	**64**	**100.00**	**149**	**100.00**	**56**	**100.00**	**282**	**100.00**	**24**	**100.00**	**186**	**100.00**	**17**	**100.00**	**97**	**100.00**	**84**	**100.00**	**40**	**100.00**	**26**	**100.00**	**12**	**100.00**	**105**	**100.00**

Table 6.15 Non-formal blade tool typo-functional categories by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
combination tool			1	0.86			5	2.23	1	0.78	1	6.67			2	4.88			1	9.09						
cutting tool	22	59.46	102	87.93	31	77.50	177	79.02	95	73.64	8	53.33	4	44.44	24	58.54	11	55.00	2	18.18	1	33.33			3	23.08
drilling/piercing tool			1	0.86	1	2.50	7	3.13	3	2.33	1	6.67			1	2.44			1	9.09			1	50.00		
indeterminable	8	21.62	6	5.17	6	15.00	16	7.14	13	10.08	1	6.67	3	33.33	10	24.39	3	15.00	4	36.36					1	7.69
notched tool	1	2.70	2	1.72			2	0.89	1	0.78					2	4.88										
burin			1				1								1											
scraping tool	6	16.22	4	3.45	2	5.00	17	7.59	16	12.40	4	26.67	2	22.22	2	4.88	6	30.00	3	27.27	2	66.67	1	50.00	9	69.23
totals	**37**	**100.00**	**116**	**100.00**	**40**	**100.00**	**224**	**100.00**	**129**	**100.00**	**15**	**100.00**	**9**	**100.00**	**41**	**100.00**	**20**	**100.00**	**11**	**100.00**	**3**	**100.00**	**2**	**100.00**	**13**	**100.00**

Table 6.16 Non-formal flake tool typo-functional categories by Level

	II		III		IV		V		VIA/B		VIA		VIB		VII		VIII		IX		X		XI		XII	
	n=	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%	*n=*	%
combination tool	1	4.00	3	10.00			3	5.45	2	3.64					3	5.36	3	4.76					2	20.00	7	8.24
cutting tool	5	20.00	7	23.33	2	13.33	17	30.91	10	18.18	4	44.44	2	28.57	13	23.21	13	20.63	4	14.29	1	4.55	4	40.00	22	25.88
drilling/piercing tool					2	13.33			4	7.27			2	28.57	4	7.14	2	3.17	3	10.71					8	9.41
indeterminable			2	6.67	1	6.67	4	7.27	2	3.64	1	11.11			7	12.50	2	3.17	2	7.14					2	2.35
notched tool							1	1.82											1	3.57					1	1.18
burin																							1			
scraping tool	19	76.00	18	60.00	10	66.67	30	54.55	37	67.27	4	44.44	3	42.86	29	51.79	43	68.25	18	64.29	21	95.45	4	40.00	45	52.94
totals	**25**	**100.00**	**30**	**100.00**	**15**	**100.00**	**55**	**100.00**	**55**	**100.00**	**9**	**100.00**	**7**	**100.00**	**56**	**100.00**	**63**	**100.00**	**28**	**100.00**	**22**	**100.00**	**10**	**100.00**	**85**	**100.00**

Table 6.17 Frequency of individual tool classes used in temporal CA

basic type	n=
projectile type 1	10
projectile type 2	57
projectile type 3	7
projectile type 4	1
projectile type 5	13
projectile type 6	12
projectile type 7	18
projectile type 8	20
projectile type 9	7
projectile type 10	15
projectile type 11	15
projectile type 12	7
pièces esquillées	201
obsidian mirrors	4
flint daggers	1
large retouched obsidian flakes	8
blade cutting tools	480
blade scraping tools	74
blade piercing/drilling tools	16
blade notched tools	8
blade combination tools	11
blade indeterminate tools	71
flake cutting tools	104
flake scraping tools	281
flake piercing/drilling tools	25
flake notched tools	3
flake combination tools	24
flake indeterminate tools	23

Table 6.18 Proportion of flake and blade debitage from north and south areas of the mound

	blades	flakes	other debitage	**total**
northern eminence (areas 1 to 5)	672	886	287	**1845**
main mound (areas 6 to 13)	782	486	170	**1438**
total	**1454**	**1372**	**457**	**3283**

Table 6.19 Building I debitage class distribution by raw material

	flint	obsidian
flakes & flake fragments	12	749
prismatic blades		55
non-prismatic blades	3	30
crested blades		1
core tablets		1
blade cores		
flake cores		2
shatter		110
chips		36
indeterminable debitage	2	11
totals	**17**	**995**

Table 6.20 Building 1 lithic artefact frequency distribution by Space

Space	n=	%
71	479	47.33
71/110	1	0.10
71/111	5	0.49
71/70	10	0.99
70	370	36.56
110	50	4.94
111	28	2.77
69	13	1.28
73	51	5.04
indeterminable	5	0.49
totals	**1012**	**100.00**

Table 6.21 Number of buildings with lithic assemblages, by Level

building level	n=
II	5
III	11
IV	8
V	11
VIA	4
VIA/B	23
VIB	2
VII	25
VIII	10
IX	7
X	
XI	1
XII	3
total	**103**

Tables for Chapter 7

Table 7.1 Comparison of technological prerequisites and subsequent benefits of flake and pressure blade technology (from Clark 1986:264-265)

> more than   < less than   * needed Ø absent

attribute	blades	flakes
high quality obsidian	>	<
mining, quarrying	>	<
selection of stone	*	<
large pieces	*	<
quarry testing	*	<
quarry preforming	>	Ø
quarry specialist	*	Ø
packaging for transport	>	<
load size	>	<
specialist at site	*	Ø
apprenticeship	*	Ø
periodic practice	>	<
controlled fracture	>	<
special manufacturing tools	*	<
large manufacturing tools	>	<
number of knapping tools	>	<
special materials for knapping tools	*	<
manufacture of knapping tools	*	Ø
knapping tool maintenance	>	<
set manufacturing procedure	>	<
risk of ruining stone	>	<
special work area	>	<
mass production	>	<
low error rate per tool	>	<
portability of technology	<	>
flexibility or expediency	Ø	>
quality of stone product	>	<
standard shape of product	>	<
standard size of product	>	<
standard edges of product	>	<
tool versatility	>	>
reusability	>	>
potential to recycle	<	>
manufacturing time per item	>	<

Table 7.2 Mean number of flake and blade tools per building, by level

level	non-formal blade tools	non-formal flake tools
II	7.2	5.0
III	11.0	3.1
IV	4.6	2.3
V	17.0	6.4
VI	3.6	3.2
VII	1.9	3.4
VIII	1.4	4.9
IX	1.6	5.1
X	N/A.	N/A.
XI	N/A.	N/A.
XII	4.3	38.0

APPENDIX 1
DEFINITION OF TERMS

The Variables: Objectives and Basic Structure

The variables and attribute states described in this section form the backbone of the analysis. The contextual variables – i.e. those that relate to depositional context and relationships with other objects – are not defined here, but were described in more detail in Chapter V. I aim here to provide some idea of the process by which the material was recorded. To this end, the variables are listed in the manner that they existed in the database (which itself is described in more detail below). The guiding principle behind variable selection was the desire to be able to identify methods and techniques of core reduction, tool and modified edge morphology, and biface and projectile forms. Comparable objectives have been followed in the analysis of Near Eastern Neolithic assemblages conducted by Baird (1993), Ataman (1989), and Nishiaki (1992), all of which, to some extent, share analogous variable selection. Appropriate methods for acquiring such information are also discussed in Inizan *et al.* (1992). These methods are reflected in the variables selected here. An additional aim was to establish, where possible, the operation sequence running from raw material acquisition, through core reduction, blank selection, modification, and discard. In his study of Northern Levantine PPNB assemblages Nishiaki (1992:87-111) has outlined criteria by which such information could be obtained, which has also influenced my selection of variables.

Not all variables defined here were used in the final analysis. Those that were omitted are clearly marked.

Basic debitage technology

Raw material. Lithic raw material has an immediate bearing on knapping quality and ultimately the characteristics of the tools produced. Six basic types were defined:

obsidian
tabular flint:
cobble flint
indeterminable flint
quartz
basalt

Debitage category. Here individual pieces are categorised according to their visible or assumed morphology and technology. Nineteen groups were defined, each of which was, where possible, further characterised by the other variables in this table.

complete flake: a piece of struck debitage exhibiting a clear single ventral surface, visibly intact proximal, distal and lateral margins. Does not include debitage which meets the descriptions (below) for blades or core tablets (16).
broken flake: as above, except that the proximal end is missing.
flake fragment: as *complete flake* except distal and/or lateral edges are missing.
prismatic blade: as *complete flake* except that the margins are parallel, the dorsal scaring is even and parallel, and equal thickness is maintained from proximal to distal termination and the piece appears to be the product of a structured reductive sequence producing similar pieces both before and after the piece in question.
prismatic proximal blade fragment: as above except that the distal end of the blade is missing.
prismatic distal blade fragment: as *prismatic blade* except that the proximal end of the blade is missing.
prismatic blade fragment: as *prismatic blade* except that the distal and proximal ends are missing.
non-prismatic blade: as *complete flake* except that the margins are sub-parallel and/or the dorsal scaring is uneven or sub-parallel, and thickness is variable.
non-prismatic proximal blade fragment: as above except that the distal end is missing.
non-prismatic distal blade fragment: as *non-prismatic blade* except that the proximal end is missing.
non-prismatic blade fragment: as *non-prismatic blade* except that the distal and proximal ends are missing.
crested blade: blade with ridge formed by the intersection of lateral removals.
proximal crested blade fragment: as above with distal end missing.
distal crested blade fragment: as *crested blade* with proximal end missing.
crested blade fragment: as *crested blade* with both proximal and distal end missing.
core platform rejuvenation flake: a flake which contains the former platform and proximal scar surfaces of a blade core, removed to rejuvenate the platform.
core: those pieces which do not possess a single ventral surface, but which clearly show dorsal scarring caused by the removal of flakes or blades from a knapping face.
shatter: angular chunks without clear ventral surfaces or dorsal scarring indicative of its use as a core.
chip: Small undiagnostic fragments of knapped stone less than <1cm. This does not include micro-shatter, which was classified as *shatter* and measured. This category was used as a catch-all for all debitage beneath a certain size, as followed by both Ataman (1989) and Nishiaki (1992), but only for undiagnostic debitage – for the most part those that lacked either an identifiable single interior surface.

Length. Measured according to convention: the maximum distance from the proximal to distal ends, in the direction of removal. In the case of shatter, the length is taken as the widest distance between two edges. 'Chips' were not measured.

Width. The maximum distance between the two lateral edges, at right angles to the direction of removal.

Thickness. The maximum thickness between the ventral and distal faces measured at right angles to length and width.

Modification. A yes/no indicator of whether there appears to be some form of *post-removal* modification to the original blank originating from intentional reshaping (modification) or as a by-product of use. Ambiguities are noted in the subsequent table.

Percentage of cortex. The amount of cortex on the ventral surface of debitage provides an immediate indication of what stage in the reduction sequence they are derived. Five groupings were used to characterise the amount of cortex present on dorsal surfaces:

0%
1-33%
34-66%
67-99%
100%

Dorsal scar pattern. Here the origin of previous removals visible on the dorsal surface are described by reference to the removal direction of the piece in question. This is indicative of the method of previous removals prior to the blow that produced that piece. There were twelve groups:

proximal
distal
proximal and distal
left
right
left and right
left or right
proximal and one lateral
distal and one lateral
proximal and left and right
distal and left and right
all edges

Dorsal scar count. The number of major scars (i.e. not trimming scars) visible on the dorsal surface. This provides a means of determining the number of previous removals, which can also be used to assess methods of reduction.

Distal termination. The manner of the distal termination of debitage.

feather
hinge
retouched
side-blow
snapped
irregularly broken

Proximal termination. The manner in which the proximal end terminates. There were seven categories:

retouched
side-blow
snapped
irregularly broken
butt

Lateral edge profile. The relative shape of the right and left edges in relation to each other, described in relation to the direction of the blow that removed the piece. This gives one indication of overall blank shape. There were six categories:

converging: edges which start from a wide proximal end and butt, and converge towards the distal end.
expanding: edges which originate from a narrow butt, and expand to a proportionally wider base.
sub-parallel: edges which maintain a roughly equal width along their trajectory.
parallel: edges which maintain an equal width along their trajectory.
irregular: edges which were intact, yet have variable form.
broken: unclassifiable because of breakage.

Ventral profile. The curvature of the ventral face between the proximal and distal ends. There were seven categories:

straight
slightly concave
strongly concave
slightly convex
strongly convex
twisted
indeterminable

Butt type. The morphology of the remnant striking platform is directly related to the preparation the platform receives prior to removals as well as the technique (such as hard vs. soft hammer) of removal. The Çatalhöyük butts appear to be restricted to six basic forms, although the potential for additional types emerging is there.

punctiform: a very small (<1mm maximum dimension) yet intact remnant striking platform.
linear: a very narrow (<1mm in width) and elongated remnant striking platform.
crushed: the absence of a visible remnant striking platform because of its removal during the process of knapping.
flat: a plain (non-faceted) remnant striking platform.
faceted: on the basis of scarring on the striking platform.
dihedral: a butt which shows evidence of being struck on the central ridge formed by the intersection of two scars on the striking platform.

Angle. This variable provides a rough indication of the angle between the remnant striking platform and the dorsal face of the blank. Five groupings were used:

low: under 30 degrees
medium: between 30 and 60 degrees
high: greater than 60, less than 90 degrees
right: 90 degrees
obtuse: over 90 degrees

Bulb characteristics. Variability in the morphology of the bulb of percussion. This may denote different techniques of removal, such as hard vs. soft, or direct vs. indirect percussion. To this end a general assessment is made of the bulb shape, by describing it in one of two ways:

prominent: a visible and well-defined protuberance.
diffuse: a bulb which varies from nearly non-existent to one which is low and expansive.

Ventral lip. As with bulb characteristics, the presence of a lip on the ventral face, immediately beneath the remnant striking platform may provide an indication of variation in knapping technique. This lip is recorded as either:

present: where a small overhang is visible.
absent: where no evidence of an overhang is visible.

Blade technology

Dorsal lip. In order to better control the direction of blade debitage and reduce the incidence of potentially detrimental knapping errors, the 'overhang' or lip on the upper dorsal face caused by the negative scar of the previous removal's bulb of percussion is often removed. This process, generally referred to as platform preparation, thus suggests a greater concern for the creation of 'ideal' conditions for the removal of blade blanks. For the time being, the lip is recorded as being either:

absent: where no evidence of a lip ever being present is observed.
present: where a lip can be observed.
removed: where the presence of scarring and faceting suggests that a lip was present and has been removed.

Cross-section. This variable provides a rough indication of the technique and process of removal for the blade and serves as one means to distinguish between different blade forms. There were six categories:

symmetric trapezoid: where the cross-section displays four sides forming a trapezoid (i.e. one ventral and three dorsal surfaces) and is approximately symmetrical along the central axis.
asymmetric trapezoid: as above, although asymmetrical along the central axis.
symmetric triangular: where the cross-section is triangular and is approximately symmetrical along the central axis.
asymmetric triangular: as above, although asymmetrical.
symmetric rhomboid: as *symmetric trapezoid* although four dorsal surfaces were present.
asymmetric rhomboid: as above although asymmetrical
irregular: any blade that possesses scarring that is irregular in form (non-parallel, etc.).

Blade scar run*. This variable serves to characterise previous sequences of blade removal. In doing so, it may be possible to identify specific approaches to core reduction. In this instance, the stratigraphy of the dorsal scarring examined and described in ways equivalent to the following four examples:

2-1-2: A typical trapezoidal blade where the two outer dorsal scars overlie a central scar and do not touch each other, thus prohibiting the assessment of removal sequences, except to say that both the outer scars must post-date the central scar.
3-2-1-2: A rhomboidal blade similar to the 2-1-2 example, except for the addition of a further removal on the left margin.
3-2-1: A trapezoidal blade where a clear sequence of removals can be determined running from the left to right, with each removal overlying the other.
1-d2-3: A bipolar blade, with a sequence starting from a left proximal removal, in turn overlain by a dorsal removal, and finally a further proximal removal on the right.

Inferred removal technique. This variable is distinguished by others in the recording scheme insofar as it is expressly inferential as opposed to descriptive. A distinction is made only between pressure and percussion derived blades, *not* hard vs. soft or indirect vs. direct techniques, as the diagnostic characteristics of pressure debitage were more easily recognisable. Furthermore, a technological disparity, rather than the continuum witnessed between hard vs. soft techniques, etc., can be drawn between these two approaches to blade production. Accordingly, there were two categories for this variable:

pressure: those objects which meet the criteria of prismatic blades described above, particularly a regularity of dorsal scarring, parallel edges, thin with even dimensions. When a platform is present, the butt will generally be punctiform or linear, with a compressed proximal end.
percussion: blades where the scarring, edge morphology and/or dimensions were non-prismatic, and were on the whole proportionally thicker. When a platform is present, the proximal end will often be elongated.

Core technology

Core type. This variable describes the technology and technique of production for the core. There were potentially a

* Not used in final analysis

large number of categories, although thus far only five either have, or were expected to be, encountered:

single-platform, prismatic blade: cores that possess a well defined circular to near-circular cross-section, a removal surface covering 100% of the core, and parallel blade scars that terminate in a point.
single-platform, non-prismatic blade: cores that possess blade removals originating from one platform, but which do not otherwise meet the above definition.
opposed-platform blade: cores that possess blade removals from opposed platforms.
multi-platform, multi-sequence flake: flake cores which have more than one flaking surface and platform, and for which no evidence of more than one removal in sequence can be detected.
single-platform flake: a flake core with a single removal platform.
discoidal flake: a flake core with bifacial removal from the circumference of the margin.
opposed platform flake: a flake core with two opposed platforms of removal.
opposed platform pièce esquillée type: as the tool category, but where the scarring is sufficiently regular and substantial to have conceivably been used as blanks. By definition these were opposed-platform cores, but because they were sufficiently distinctive, the term has been retained.

Platform angle. This corresponds to the variable of the same name recorded in *III. Debitage Proximal End Characteristics*.

Platform type. Core platform preparation has an immediate bearing on the method and technique of reduction as it forms the area in which the force is applied during debitage. There were two in this variable:

faceted: for those platforms which have evidence of scaring predating blank removals.
flat: for those platforms which do not have any scarring predating removals.

Platform lip grinding. A yes/no variable that corresponds to the variable *dorsal lip* in *III. Debitage Proximal End Characteristics*.

Platform crushing/grinding. A simple yes/no variable to indicate whether the platform has been ground or crushed as a function of its use as a core (i.e. as a function of attempted or actual debitage removal).

Core battering. A yes/no variable indicating whether there is evidence of any battering damage, either post- or contemporary with its use as a core.

Re-used core. A yes/no variable indicating whether the core has been modified by modification to create a functional edge following its original use as a core.

Modified edges

Modification location. This variable describes the location of episodes of continuous modification on a blank. There were seventeen basic locations recorded, in addition to an indeterminable category:

all edges
distal
distal and left
distal and right
distal, left and right
left
left distal
left and right
left or right
left proximal
proximal
proximal and left
proximal and right
right
right distal
right proximal
distal or proximal
indeterminable

Modification position. Here the position of modification within individual locations was recorded. There were five categories.

alternating: modification that alternates between the direct and inverse.
bifacial: modification on both the ventral and dorsal sides of a modified edge.
direct: modification that is restricted to the dorsal face.
inverse: modification restricted to the inverse face.
indeterminable: where the position could not be accurately ascertained.

Modification distribution. Four categories were defined to describe the 'connectivity' of removal scars:

continuous: an uninterrupted sequence of removal scars along the defined edge(s).
discontinuous: an interrupted sequence of removal scars along the defined edges(s).
partial: where the modification exists only partially on the defined edge.
indeterminable: describes modification where the connectivity cannot be determined because of breakage or other reasons.

Modification delineation. This variable describes the shape of the modified edge. Many of the ten categories used were based on Inizan *et al.* (1992), with a few minor modifications.

concave: modification that results in a concave impression into the body of the blank.

convex: modification that results in a convex modified edge.
cran: a concave edge that has a pronounced 'hook' at one end of the sequence of removals.
denticulated: a sequence of removals resulting in a rough, jagged edge.
irregular: an irregularly undulating modified edge.
notch: one or a sequence of removals creating a small concavity in the edge of a blank.
regular: a sequence of modifications that produces a straight edge.
small point: modification resulting in a small, acute angled, projection.
retouched to point: bilateral removals that converge to an acutely angled point.
indeterminable: a sequence of removals where the overall morphology cannot be accurately ascertained.

Modification extent. This variable records the extent the modification extends into the face of the tool. There were six categories:

covering: where the modification scars completely covers the face of the blank.
invasive: modification scars that cover the majority of the face of the blank.
long: scars the extend a significant distance into the face of the blank, but not a majority.
short: scars which do not penetrate a significant distance.
marginal: scars which were very small and do not penetrate at all into the face.
indeterminable: where because of breakage or damage, the extent of the modification scars cannot be determined.

Modification angle. Here the angle of the modified edge is measured. An assessment was made visually, so only four angles were defined:

low: an edge angle that was less than approximately 45 degrees.
semi-abrupt: an edge angle that was approximately 45 degrees.
abrupt: an edge with an angle greater than approximately 45 degrees.
crossed-abrupt: an edge that was approximately right-angled created by removals originating from both faces of the blank.
indeterminable: an edge angle that through breakage or other reasons could not be classified.

Modification morphology. This variable attempts to account for differences in the shape of the modification scars that may be related to different methods of shaping or use. Five types of scar shape were defined, again based largely on Inizan *et al.* (1992).

crushed: modified edges that display a sequence of scars that appears to have been caused by crushing or battering.
irregular: edges that cannot be classified by any of the other categories because they consist of erratic and varied removals scars.
parallel: scars that were roughly the same width and length and were positioned in a parallel sequence along an edge.
sub-parallel: scars of variable width and length positioned along-side each other but not in a parallel manner.
scaled: scars of different sizes, usually wider distally than proximally, that overlie each other.
indeterminable: a modified edge that because of breakage, the modification morphology cannot be determined accurately.

Edge functional classification. This variable differs in its manner and method of characterisation than the previous seven, as it is far more inferential rather than purely descriptive. The governing principle of the classification of edges into functional categories is based on the understanding that, with certain limitations, the shape of an edges in some way has a bearing on either what functional task the edge was designed to do, or what it actually did do. For instance, as has been noted in one form or another by various functional analysts that it is difficult to imagine making a hole in piece of leather with an edge that lacks any pointed edge or, conversely, removing fat from a hide with a notched edge. Because of these physical constraints – which, it must be said were relatively minor – modern functional analysis usually begins with a macroscopic consideration of edge morphology to establish the broad parameters of potential use *before* proceeding to microscopic analysis and specific uses. Hurcombe (1992) and Grace (1989) discuss several macroscopic characteristics that can be used to infer potential function, particularly edge angle, edge length, edge thickness, and edge profile. Together, these provide a basic indication of the potential functional use of the edge (Grace 1989:74). On this basis, eight types were defined, influenced in part by those proposed in the Wembach Module (Baird *et al.* 1995).

backed edge: a blunted and relatively flat edge which appeared to have been produced in order to provide a surface against which pressure could be applied.
chisel/wedge edge: an edge which varies from thick and robust to acute, but it characteristically scarred by repeated crushing.
striking platform: a flat surface with evidence of battering and crushing suggesting it has been used as striking platform.
drilling/piercing edge: a modified area that is typically pointed and suitable for creating small holes in objects either by rotary or non-rotary movement.
knife/cutting edge: an acute surface suitable for cutting tasks.
notched scraping edge: a notched edge suitable for scraping/cutting small rounded objects such as bone, wood or fibrous plants.
scraping edge: a robust semi-abrupt to abrupt edge, often convex, suitable for the scraping of wood, hides or other material.
indeterminable: a category used to describe edges whose function could not be ascertained.

Modified blanks

Implement classification. This is an explicitly inferential field that is based on the collation of sum of the functional edges of the blank. If an individual blank possessed two or more different functional categories of working edges, then it was recorded as a 'combination tool'. Two additional groups were defined on the basis of additional characteristics: *pièce esquillée*, and *biface/projectile*. The *biface/projectile* group was distinguished on the . Eight classes of tool functional were defined. It will be apparent that the functional classification 'sickle blade' is absent, despite the fact that it has been mentioned as a tool form at Çatalhöyük in the past and has received much attention in the Near East as an important tool type. Much recent work on this tool group (e.g. Anderson 1994) suggests that there could be considerable variability in the manner in which tool classified as sickles could have been used, and suggests that the term 'glossed tool' is more appropriate. However, because of the different physical qualities of the raw material, silica gloss is not visibly deposited onto obsidian tools, thus preventing the identification of any sickle elements and distinguishing them from other blade cutting tools. Consequently, the functional class 'cutting tool' includes blade segments that may have been used as sickle elements, but cannot at this point be identified as such. The poor storage conditions of the 1960's material prohibits any microscopic functional analysis, so the clarification of potential sickle elements must await further investigation.

biface/projectile: These were defined by examining the overall shape of the piece and, if it met either conventional definitions of 'arrowheads' or 'spearheads' was classified to this group. Although this is arbitrary, and there can be some questionable pieces (always noted), in practice the identification was straightforward.
pièce-esquillée: distinctive types found elsewhere in Neolithic Anatolia and the Near East, easily distinguished by their often invasive bipolar crushing and scarring and thin, elongated to square blank shape. The bipolar crushing suggests that they were most likely used as wedges or chisels, which has been supported by some microwear analysis performed on specimens from Can Hasan III by Ataman (1989). Because they were quite distinct from the chisel/wedge group (which tend to be much thicker, and exhibit a flat 'striking-platform', however, the term and classification has been retained.
chisel/wedge: a tool exhibiting one or more chisel/wedge functional edges.
knife: a tool exhibiting one or more knife/cutting edges.
notched scraper: a tool exhibiting one or more notched edges.
piercer/driller: a tool with one or more drilling/piercing edges.
scraper: a tool with one or more scraping edges.
combination tool: a tool with two or more edges of different functional classes.
indeterminable: a tool of indeterminable function.

Portion represented. This variable contains information on the completeness of the implement. There were four categories:

complete: where the implement appears not to have been broken by pre- or post-depositional activity.
near complete: where the implement is broken, but not to an extent where the original shape and modification morphology cannot be determined.
broken: where the implement's original form is indeterminable because of pre- or post-depositional damage.
indeterminable: a modified blank where it is unclear whether it is complete or broken.

Points and bifaces

Integrity. This variable is similar to *portion represented* described in *Modified Blanks*, although it expands the 'broken' category to include several more detailed descriptions of what is represented in terms of the (assumed) original shape.

complete: a complete projectile
near complete: a projectile that retains its original shape, but may be missing the very tip, base, or portion of an edge.
distal fragment: the distal part (tang or base) of a projectile/biface.
proximal/distal fragment: a tip of a biface
mid-fragment: a portion of a projectile/biface missing both the proximal and distal ends.
impact spall: a flake-like piece retaining the proximal end of a projectile/biface, thought to have been produced by an impact of some description at the proximal end.
other fragment: any other piece of what can confidently be identified as a projectile or biface.

Cross-section. This variable describes the shape of the projectile/biface in cross-section, approximately mid-way along its length. The differences in shape again may be related to one or more of the effects of differing manufacturing methods, function, hafting and style.

crescent: a cross-section that is flat on the ventral surface and moderately convex on the dorsal.
plano-convex: a slightly convex ventral and moderately convex dorsal face.
flat-oval: a flat ventral and strongly convex dorsal surface.
oval: convex on the ventral and dorsal surface.
pronounced oval: strongly convex on both the ventral and dorsal surfaces.
trapezoidal: a cross-section with a three-sided (trapezoidal) dorsal surface.
triangular: a cross-section with a triangular dorsal surface.
indeterminable: where the cross-section cannot be accurately identified because of breakage.

Diagnostic measurements. In addition to those basic dimensions (length, width and thickness) recorded on all debitage, retouched or otherwise, three further measurements were taken whenever possible on bifaces/projectiles to the nearest tenth of a millimetre:

tang length: the length of the tang from, in the case of a shouldered point, the restriction immediately beneath the shoulder. Or, if there is no shoulder, from the beginning of the break in edge profile that produces the tang.
shoulder width: the maximum width of the shoulders immediately above the constriction that forms the neck.
point of maximum width: the length from the proximal end to an imaginary line at the widest point of the projectile/biface.

Dorsal/ventral body modification extent. This variable records (in separate fields) the extent the modification scars penetrate onto the ventral and dorsal faces. There were six categories whose definitions were identical to those found in the variable *Modification Extent* in the table *Modified Edges* (above), with the exception of the category *absent* which, as the name implies, signifies an absence of retouch.

covering
invasive
long
short
marginal
absent
indeterminable

Dorsal/ventral body modification morphology. Here the shape and relative arrangement of the removal scars in relation to each other is recorded. This provides an indication of the methods of thinning and shaping blanks, which is related to both functional and stylistic considerations.

parallel: scars roughly the same length and width lying parallel to each other and roughly at a right angles to the lateral edge.
parallel oblique: as above, except the removal scars were positioned obliquely to the lateral edge.
scaled: scars of different sizes, usually wider distally than proximally, that overlie each other.
sub-parallel: scars of variable width and length positioned along-side each other but not in a parallel manner, that were at roughly at a right angles to the lateral edge.
sub-parallel oblique: as *sub-parallel*, although at an oblique angle to the lateral edge.
variable: scaring which exhibits characteristics of more than one of the categories listed above.

Tip/base retouch type. As the variables retouch extent and morphology pertain only to the body of the biface/projectile, these two additional variables provide and indication of the type of retouch found at the tip and base. There were three types:

absent: signifies an absence of retouch.
bifacial: retouch occurs on both faces.
unifacial: retouch occurs only on one face.

APPENDIX 2
DATA EXPLORATION AND STATISTICS

The Database

All the recorded data was entered into a relational database[1] which, in essence, was a collection of related tables containing data cross-linked by one or more shared variables. To work properly relational databases demand a rigid structure of recording. Nevertheless they were flexible and versatile tools that, provided they were designed correctly, provide an unequalled means of exploring relationships between variables. Computerised relational databases have been used extensively in archaeology since at least the early 1980's as they provide a unparalleled means of data exploration.

The database devised for this analysis consisted of tables of data containing the lithic variables defined above, linked information to the archaeological context of the data. This enabled relationships between attributes of the lithic data to be examined with 'contextual' data. Additional exploration and testing of the strength and confidence of identified relationships was conducted using established statistical techniques, described below.

Statistical Methods

In addition to basic statistical description of metric data, six statistical methods were used to explore and test relationships of both quantitative and qualitative data: (i) Student's t-test and z-test (ii) Chi-Square Test; (iii) Principal Components Analysis; (v) Correspondence Analysis; and (vi) Correlation Analysis. All are well-know (and extremely useful) techniques so I shall only briefly summarise them. In all cases, whenever a statistical procedure was used, the process was fully documented. More in-depth discussion of their intricacies as they relate to archaeological data can be found in Orton (1980), Bølviken *et al.* (1982), Shennan (1988), and Fletcher & Lock (1991).

<u>*Student's t-test and z-test*</u>[2]. Both these common methods can be used to test if two samples of measurements come from the same or different populations. A *z*-test compares the distribution of the means of the two samples to be tested using the standard-deviation as the unit of measurement (i.e. the *z*-unit). Calculation of the of the standard error of the differences between the means returns a value that can be related to proportions of a normal distribution, returned as a probability (the *P* value) that the two samples come from separate populations. Z-tests, however, are only accurate for large samples (usually taken to mean above 30) (Rowntree 1981:139). With smaller samples, but working equally well with larger, the t-test offers better inferential security, as it does not assume that the standard deviation of the sample represents the standard deviation of the population. Instead, it uses its own distribution (the *t*-distribution) which varies according to the size of the sample. In other respects, however, the test works in much the same way as the *z*-test (Rowntree 1981:139).

<u>*Chi-square test*</u>. This is a well-known method for estimating the statistical significance of data organised as count of objects by context (contingency tables). The statistic is based on differences between the actual (observed) distribution with a calculated expected data distribution. The expected values are based on the formula *expected value = (row total) (column total) /(overall total)*, and the X^2 statistic is equal to $\sum((observed\text{-}expected)^2 / (expected))$. The X^2 value represents the probability that the distribution of variable counts is significantly different than what could have been expected, given the overall distribution of counts and the size of the dataset (designated by the *degrees of freedom*). In other words, the statistic examines the probability that the values of any particular variables are influenced by the particular units they are in.

<u>*Principle Components Analysis*</u> (PCA)[3]. This multivariate statistic is useful for exploring data relationships in quantitative data. The statistic involves the reduction of records consisting of several variables to two dimensional co-ordinates suitable for plotting on an *x,y* graph to visually explore data-relationships:

...so long as it [PCA] is used on data for which it is appropriate it can provide a great deal of archaeologically relevant information about a given data set which would not necessarily be accessible or apparent to an intuitive approach

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[1] Microsoft Access 7.

[2] t-tests and z-tests were preformed using the built-in functions of Microsoft Excel 7, running under Windows 95 on a Pentium PC.

[3] PCAs were performed using the statistical package Statistica 5, running under Windows 95 on a Pentium PC.

to the same data, especially if the number of cases was large (Shennan 1988:270).

The analysis produces a number of axis, which represent variation within the dataset. The axis along which there is the highest variation is called the *first principal component*, that with the second highest variation the *second principal component*, and so on. These can be treated as axes in an *x,y* plot. The strength of the representation of the multi-dimensional variability combinations of axes possess can be calculated, as can the relative contribution of the individual variables to each axis. The PCA also returns *x,y* co-ordinates for individual objects, and the resulting plot on the axis of greatest variation (typically the first two principal components) can be interpreted both in terms of their relationships to each other, but also their relationships to the two axes. Because the relative contribution each variable makes to the axes is known, the procedure is useful for examining both the relationship of objects and the basis for their patterning.

A typical archaeological use of this procedure involves examining relationships between a series of artefacts on the basis of several defining metric measurements (such as length, width, thickness, weight, etc.) (see, for example, Shennan 1988:268-270). In sum, the test scales a complex series of metric data down to a level where associations between artefacts, and the basis for those associations, are more easily defined and interpreted.

Correspondence Analysis (CA)[4]. This multivariate statistic is designed to analysis counts of occurrences of variables on units, such as are contained in contingency tables. CA thus differs from PCA in that it uses a chi-squared metric rather than Euclidean distance to calculate the position of objects in *n*-dimensional space. Like PCA, however, the CA algorithm calculates axes of greatest variations and reduces a multi-dimensional dataset to two-dimensions. Co-ordinates are returned for both variables and units which are typically plotted on an *x,y* graph, allowing a visual assessment of the relationships *between* variables and units. In other works, the two datasets are symmetrical and can be directly compared with each other. The closer the position of individual points, whether variables or categories, the closer the correlation. Also like PCA, the relative strengths of the axes (here called *factors*) in representing multi-dimensional patterning in two dimensions are provided, allowing one to assess the relative accuracy of the resulting plot.

A further aspect of the interpretation of the output of the CA involves examining the contribution of individual variables and units to the axis. In this way the spatial patterning between individual points plotted on the *x,y* grid can be assessed as to what is causing them to either cluster or separate:

by projecting the variables on to the co-ordinate axes and studying their locations with respect to the origin, a picture emerges showing which variables are 'responsible' for the axes. This picture may sometimes be archaeologically meaningful and interpretable as an archaeological effect such as chronology or function (Bølviken *et al.* 1982:44).

In sum, the strength of CA is that it permits both units and variables to be examined as the same time. The classic application of this in archaeology, is if unit are contexts, and variables artefact classes (e.g. Bølviken *et al.* 1982:47). CA therefore allows two-way relationships, such as between stratigraphy and artefact classes, to be assessed in an archaeologically meaningful way.

Correlation Analysis[5]. This test measures the strength of the relationship between two data sets that are scaled to be independent of the unit of measurement.

The correlation coefficient has probably been the most important single mathematical tool for investigating patterns of covariation in archaeological data (Shennan 1988:126).

The correlation calculation returns the covariance of two data sets expressed as an *R* value between -1.0 and 1.0. A correlation of -1.0 shows that there is a negative relationship between two values; as one value increases, the other proportionally decreases. A returned value of 1.0 show as direct correlation; as one value increases, so to does the other, in direct proportion to the first. A value of 0 show no correlation between the two data sets. A value greater or less than 0 shows a correspondingly positive or negative correlation, although not an absolute relationship.

There are numerous archaeological uses for this statistical test. Shennan (1988:127) provides a good example of its use to examine the relationship between quantities of a ceramic found at sites at various distances from its source. It can also be used to assess the relationship between measured variables (such as length and width) to examine the effect one has on the other for particular classes of object.

[4] CAs were performed using the statistical package Statistica 5, running under Windows 95 on a Pentium PC.

[5] Correlation calculations were preformed using the built-in functions of Microsoft Excel 7, running under Windows 95 on a Pentium PC.

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