Assembling Çatalhöyük

Edited by Ian Hodder and Arkadiusz Marciniak

Themes in Contemporary Archaeology

Themes in Contemporary Archaeology provides cutting edge summaries of areas of debate in current archaeological enquiry, with a particular emphasis on European archaeology. The series has a broad coverage, encompassing all periods and archaeological disciplines from theoretical debate to statistical analysis and three-dimensional imaging. The multi-author volumes are based on selected sessions from the well-regarded annual conference of the European Association of Archaeologists.

Forthcoming Volumes:
Volume 2: Tripolye: Megasites and European Prehistory

European Association
of Archaeologists

The European Association of Archaeologists (EAA) is the association for all professional archaeologists of Europe and beyond. The EAA has around 2200 members from 60 countries world-wide working in prehistory, classical, medieval, and later archaeology.

The EAA aims

- to promote the development of archaeological research and the exchange of archaeological information
- to promote the management and interpretation of the European archaeological heritage
- to promote proper ethical and scientific standards for archaeological work
- to promote the interests of professional archaeologists in Europe
- to promote co-operation with other organisations with similar aims.

ISBN: 978-1-910-52600-2

e-ISBN: 978-1-910-52601-9

ISSN: 2056-6174

e-ISSN: 2057-1011

Cover image(s): *Left*: Ochre hand prints on the north wall of Building 77; *Middle*: Bucrania and horned bench associated with the northeast platform of Building 77 (both taken from Taylor pp. 127–50, this volume); *Right*: The incised panel above burial 327 in TP Area (taken from Marciniak et al., pp. 151–66, this volume).

Published for the European Association of Archaeologists by Maney Publishing, Suite 1C, Joseph's Well, Hanover Walk, Leeds LS3 1AB, UK

Maney Publishing is the trading name of W. S. Maney & Son Ltd.

Printed and bound by Charlesworth Press, Wakefield, UK

Maney Publishing

Contents

CHAPTER 11

The Nature of Household in the Upper Levels at Çatalhöyük

Smaller, More Dispersed, and More Independent Acquisition, Production, and Consumption Unit

Arkadiusz Marciniak, Eleni Asouti, Chris Doherty and Elizabeth Henton

Introduction

Until very recently, the occupation at Çatalhöyük East was portrayed as relatively homogeneous and unchanging. The domestic structures were built of loam and clustered in streetless neighbourhoods, which were separated from each other by alleys and courtyards. Buildings had a great degree of continuity, being rebuilt on the same location, with the same proportions and interior arrangements for up to six building levels.

The results from the excavations of the upper strata at Çatalhöyük carried out in the Team Poznań (TP) Area between 2001 and 2008 have revealed a new picture of the Neolithic community at Çatalhöyük. The houses were composed of a series of small, cell-like spaces surrounding a larger central 'living room' and lacked symbolic elaboration. Distinctive intramural burials from the preceding period were replaced by a special burial architecture. A new type of succession also developed where houses followed each other less directly in space and time. Numerous smaller sites in the surrounding area appeared in contrast to few, if any, in the earlier phases of the site (Marciniak and Czerniak, 2007, 2012).

These radical changes in the Late Neolithic in the settlement layout and house architecture appear to indicate the demise of the previously predominant social order and the beginning of the new one. They have been arguably indicative of the emergence of autonomous households inhabited by the kin-based family or extended family at the expense of the preceding communal mode of organization (see Düring & Marciniak, 2006). However, these claims have not been studied by other available datasets, used to extrapolate individual observations upon larger processes and have not been satisfactorily justified. This is mainly due to excessive focus on architecture and burial practices in the Near Eastern Neolithic. However, monumental and evocative as they appear to be, they cannot possibly deliver a firm and solidly grounded evidence to grasp the character of these pivotal social developments.

High-resolution bioarchaeological data of different kinds generated by the archaeological work at the uppermost levels at Çatalhöyük permit not only tracing a wide range of changes in different domains of the life of settlement's inhabitants during this period but more importantly critically evaluate and challenge the hypothesis on the emergence of autonomous household in this period. In particular, the chapter aims to discuss these developments in terms of procurement, production, and consumption of different resources necessary for the functioning of local community. It shall investigate strategies for their acquisition, such as clay for mudbrick production, wood for fuel and timber, modes of caprine herding, and more general changes in land use around the site. The changes in consumption regimes will be investigated by the use of clay and wood in the house construction. Altogether, four different datasets and specialisms will be aligned to address this complicated process. These comprise the settlement layout, clay, wood charcoal, and animal bones.

The Late Neolithic house at Çatalhöyük

The TP Area is located on the top of the East Mound, close to where Mellaart in the 1960s had identified the last phase of tell occupation (Figure 1). The excavation works carried out in the years 2001–2008 led to the discovery of four solid houses, one light structure and one open space. They made up a *c.* 350 years long occupational history of the settlement between *c.* 6300 cal BC and *c.* 5950 cal BC and before its ultimate abandonment. The most distinct category of houses

Figure 1. *TP Area and other excavation areas at Çatalhöyük East.*
Figure created for the Çatalhöyük Research Project by Camilla Mazzucato.

comprise a large and carefully designed dwelling structure (B.81, B.62, and 61) (Figure 2). The houses had similar size, internal layout, and distinctive solid floors made of white pebbles, which appear only in the final centuries of the mound occupation. They were constructed at the beginning and the end of the TP Area stratigraphic sequence and separated by a solidly built house (B.74), light dwelling structure (B.73), and open space (B.72) (Marciniak et al., 2015).

The results of Bayesian modelling revealed that most houses in the TP sequence were occupied for one generation only. This challenges an admittedly largely speculative estimation of an average, *c.* 60–70 years long, life of the house. Additionally, rather than forming sequences of superimposed clusters of dwelling structures, houses in subsequent generations may have been shifting across the neighbourhood area (Marciniak et al., 2015). As a result, an empty space used to emerge where the house was previously standing. It may have a form of a courtyard or some kind of open space, sometimes used to perform different everyday activities, as implied by the presence of ovens, kilns, hearths, etc. From time to time, it went out of use becoming a midden. After some time it may have been rebuilt again. The abandonment did not longer involve the practice of infilling the house interior. Both the inbuilt structures and the walls were either deliberately dismantled or the house got left unoccupied leading the walls and other in-built structures either rot and decay or getting some constructional elements be re-used elsewhere.

Figure 2. *B.81 in the TP Area.*
Photograph by Jason Quinlan.

Changes in new space organization, patterns of architecture and its furnishings, burial practices as well as chipped stone and pottery manufacture (see Özdöl-Kutlu et al., 2015) mark the emergence of new social arrangements. In the Early Neolithic social patterning appears to be based around neighbourhood communities constituted on the basis of both co-residence and economic pooling. Accordingly, the site was characterized by orderliness including the careful regulation of activities and discard directed by the taboos and long-term repetition (Hodder, 2006: 135). These refer to the use of space in the house, location of burials, the distribution of 'art' and symbolism. The dominant mode of organization was using collective- and long-term memories, involving material engagement with the house.

It has been argued that the Late Neolithic marks an emergence of domestic mode of production and consumption around the increasingly independent household as the dominant mode of social organization (see Düring & Marciniak, 2005; Marciniak, 2013). The considerably heterogeneous arrangements were based upon individualized, short-term memory regimes within a predominantly house-based social structure. People might have begun referring to specific pasts of their own houses and genealogies rather than the generic past of the entire settlement (see Whitehouse & Hodder, 2010).

Methods and materials

Clay procurement and use

Understanding changes in clay procurement practices requires a good knowledge of clay availability at Çatalhöyük throughout its occupation. As the Neolithic land surface is buried by 2–4 m of later alluvium, a new programme of sediment coring was undertaken, combined with an examination of clay exposed in deep excavations and soil pits dug into irrigation ditches (Figure 3) (Doherty et al., 2008). This programme identified many of the clay extraction pits around the mound's periphery. The prime source of information here is the KOPAL survey, which established the general archaeo-alluvial sequence at Çatalhöyük, as part of a study of the wider Çarşamba fan (Boyer et al., 2006). A survey of all Çatalhöyük's clay materials shows that a relatively wide range of clay types were used (Figure 4). Allowing for natural variations, there are basically six different materials in play here; (1) marls and softlimes, (2) backswamp clay, (3) reddish silty clays and clayey silts, (4) colluvium (5) gritty calcareous clays, (6) gritty non-calcareous clays (Doherty, 2013).

Wood and timber procurement and use

Wood charcoal presents one of the most ubiquitous types of archaeobotanical remains at prehistoric sites. Intensive and comprehensive sampling of *in situ* preserved charcoal, for example, in burnt structures, was employed in order to provide direct evidence of procurement, processing, and storage practices from contexts with minimal post-depositional disturbance. Due to their derivation from prehistoric firewood gathering and timber procurement activities, they provide a high-resolution record of woodland management activities during this period. It has also been used for the studies of fuel selection and use.

The application of charcoal analysis in palaeoenvironmental research assumes that the fragmentation does not affect proportions of large and small fragments for all taxa. It is necessary to control the duration of human activities associated with fuel consumption as well as take the context of deposition under consideration. In general, to make archaeological charcoal

1. Coring Project

2. Clay mapping: excavation trenches (top and bottom left), irrigation ditches (top right), and field exposures (bottom right).

Figure 3. *Clay use. Matching raw materials and the landscape.*
Figure created for the Çatalhöyük Research Project by Chris Doherty and Kathryn Killackey.

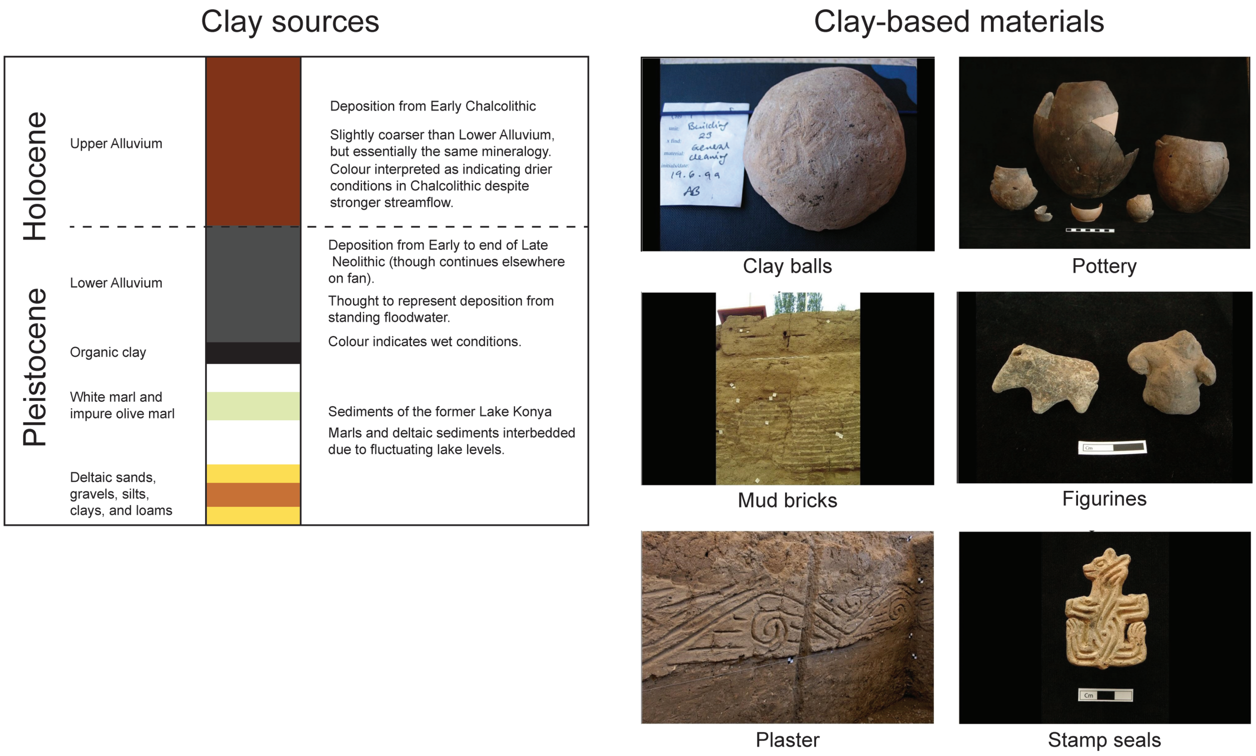

Figure 4. *Clay use at Çatalhöyük. Matching artefacts and raw materials.*
Figure created for the Çatalhöyük Research Project by Chris Doherty and Kathryn Killackey.

assemblage suitable for the study of timber and fuel procurement and use, it is required charcoal deposits be accumulated over a prolonged period of time, be primarily the result of fuel burning activities and contain sufficient quantities of wood charcoal to secure statistically reliable results (Asouti & Austin, 2005: 3).

Herding practices

Modes of caprine herding were evidenced through oxygen isotope and dental microwear analyses (Henton, in press). These comprise management of the birth season, the seasonal herding mobility pattern, and the arrangements for feeding shortly before slaughter (Henton, 2013).

Analysis of oxygen isotopes in sequential intra-tooth enamel samples provides the necessary resolution to identify the seasonality of a yearly cycle in juvenile caprines (Fricke et al., 1998) (Figure 5). In the same tooth, grass-rich and soft browse-rich diets in the weeks before death can be distinguished, through dental microwear on the occlusal surface of the same tooth (Mainland, 1998) (Figure 6).

Using modern local baselines from both wild and traditionally raised domestic sheep, the environmental conditions represented by the datasets are modelled by analogy (Henton, 2012). Specifically, the oxygen isotope ratios are related, through published data (IAEA/WMO, 2006) to local seasonal and altitudinal temperature and precipitation level (Table 1), the unfolding sequence of seasonal values on the oxygen isotope curve constructed from the sequential enamel samples are related, using modern sheep with known birth histories, to birth season (Figure 7). Finally the dental microwear is related through both published (Mainland, 1998; Rivals & Deniaux, 2003, 2005; Solounias et al., 2000) and local modern examples, to seasonal vegetation in the region (Table 2).

Results and interpretation

Procurement of clay resources

Çatalhöyük is located on the Çarşamba alluvial fan formed by the eponymous river as it enters the Konya plain from its southern fringes. It is a former lake bed with very little available stone, and clay was used on a large scale. Two main clay sources were available at Çatalhöyük throughout the Neolithic: those of the former Pleistocene Lake Konya, and the Holocene alluvial clays of the Çarşamba and May rivers, which flowed across this former lake bed.

The Early Neolithic landscape was made of much smaller streams connecting a series of shallow pools (Figure 8). It presented the dark-coloured Holocene

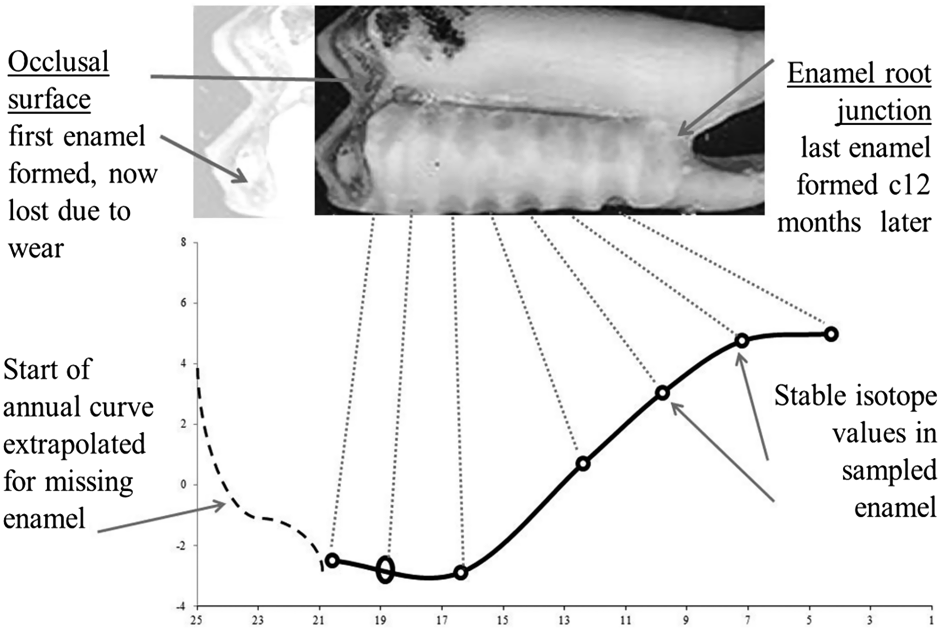

Figure 5. *Diagram of sheep second mandibular molar showing how sequential enamel sampling can provide a 12-month time capsule of isotopic data.*

alluvial clays and the underlying Pleistocene white marls, both of which were heavily used for construction in this period. Progressive extraction of these clays resulted in a zone of depletion around the periphery of the mounds, which had two consequences: (1) it exposed lager areas of the clays and sandier sediment that were inter-bedded with the marl, which began to be used for mudbrick-making and (2) the resulting extraction pits began to accumulate the colluvial sediments that formed increasingly as the mound grew in height and extent, and which were to become the dominant mudbrick raw materials of Çatalhöyük. Drying in the Late Neolithic saw the formalization of streams into a larger channel (the early Çarşamba), with fewer pools (Figure 9) (Doherty, 2013).

Table 3 shows how the Late Neolithic TP levels compare with the early and middle occupation phases for the three principal uses of clay in the

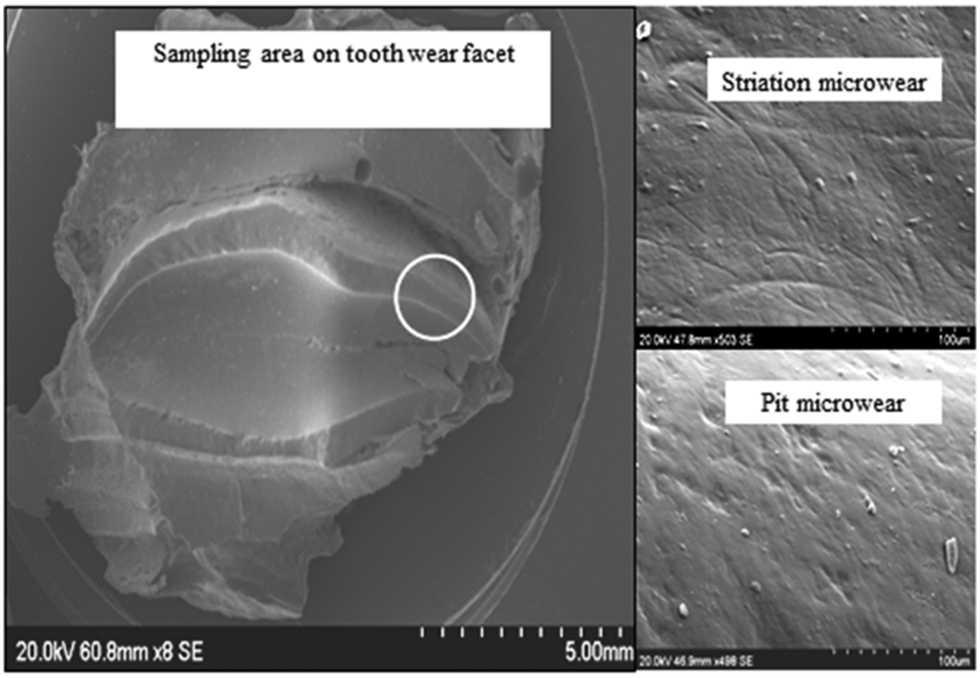

Figure 6. *Sheep tooth occlusal surface (×8 resolution) showing area of dental microwear studied with examples of diet-generated striations and pits (×500 resolution).*

***Table 1.** The modelled use of oxygen isotope values in sheep teeth in identifying herding location during the first year of life*

Shape of curve	Summer $\delta^{18}O$ values	Range in $\delta^{18}O$ values	Associated conditions of ingested water	Modelled interpretation of herding
Sinusoidal	Within or above modelled inter-annual variability	±6‰	Cold, wet winters	Sheep raised year-round near settlement
			Hot, exposed, arid summers	Marl steppe, alluvial fan, sand-ridges
Sinusoidal	Below inter-annual variability	<6‰	Both winters and summers less extreme	Sheep raised year-round in perennial stream valleys, cutting through terraces and lower hill-slopes
Flat, undulating	Below inter-annual variability	<6‰	Summer signature greatly reduced	Vertical transhumance to higher hill-slopes in summer **or** Pasturing near springs fed by averaged ground-water

site: mudbricks, plaster, and pottery. Mudbricks in TP continue the earlier trend of using colluvial clays. The period does not mark a real change as colluvium was increasingly the only immediately available mudbrick clay. It was represented both by an apron of fine deposits spreading out from the mound's periphery, and by abandoned buildings whose mudbricks could be recycled *in situ* (perhaps by soaking in small pits next to the source buildings).

In contrast, a change in the use of plaster materials does show a change in preference, as this is not related to decreasing raw material availability. Thick white marl plasters were used in the early levels, and were replaced by multiple thin layers of very white soft lime-based plasters in mid-occupation (Hodder, 2006). Both high purity white plaster materials were extensively to enhance houses, and would have taken careful collection, with the soft lime requiring a 10-km round trip. But by the later levels, such high brightness materials, while still being used, did not seem to have the same importance.

Procurement of wood resources

The anthracological record dating from the late 8th millennium cal BC indicates the presence of diverse *Juniperus-Quercus-Pistacia-Rosaceae-Maloideae* semi-arid woodlands on the lower upland zone and the hills surrounding the Konya plain (Figure 10). The regular presence of *Celtis* (hackberry) fruit stones and charcoal at the sampled aceramic levels at Çatalhöyük and the abundance of *Ulmus* charcoal during all sampled phases at Çatalhöyük also suggest that *Ulmaceae*, alongside *Salicaceae* and *Fraxinus*, formed a significant component of (presently all but extinct) riparian and wet woodland habitats.

The transition to the ceramic Neolithic anthracological dataset shows that deciduous oak charcoal values rose dramatically at the end of the 8th millennium cal BC (Figure 11). This increase continued until around the middle of the 7th millennium cal BC, when oak gave way to juniper as the dominant charcoal taxon, while by the end of the 7th millennium juniper also declined to be substituted by elm and *Salicaceae*. At first sight this pattern would appear to suggest a shift from oak to juniper wood that could be attributed to increasing aridity and/or human impacts on the availability of oaks in Neolithic woodland vegetation. However, a consideration of the changing patterns of timber and fuel use at Çatalhöyük during the 7th millennium cal BC furnishes important insights on the factors that determined fuel and timber species selection through time, affecting taxon representation both in the anthracological assemblage and in the Neolithic vegetation catchments.

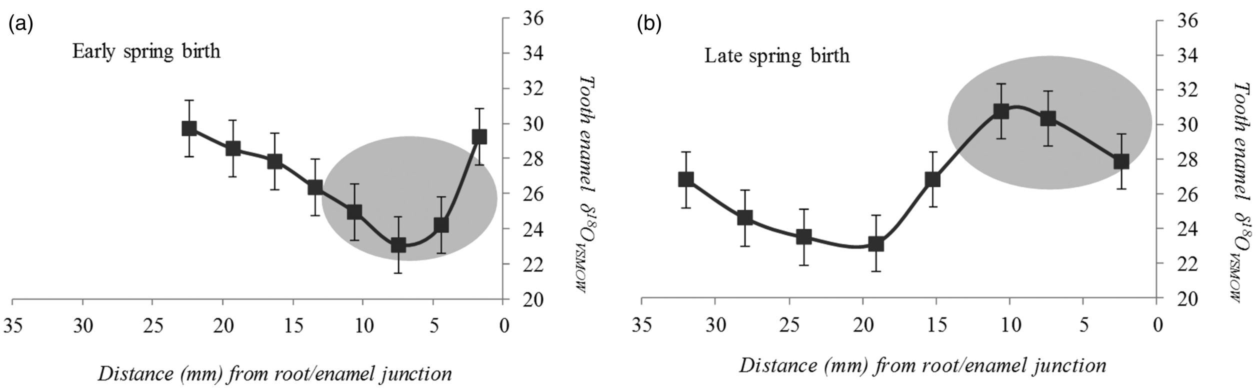

***Figure 7.** Oxygen isotope curves constructed from sequential samples taken from second mandibular molars of modern sheep born in March and in May.*

Table 2. *Modelled use of dental microwear analysis in the interpretation of archaeological domestic sheep diets just before death*

Pit % <35% indicate diets of mature grasses and cereals
High all-feature numbers indicate diets of mature winter pasture, or wetland edge grasses or reeds, where wet soil is also ingested
Low all-feature numbers indicate diets of dry grass pastures or stubble, and fodder of hay or cereal chaff
Pit % >35% indicate diets on soft, leafy browse, or new growth of grasses and weeds
High all-feature numbers indicate diets of new, soft growth of grass, reeds, or weeds where wet soil is also ingested
Low all-feature numbers indicate diets of soft leafy browse, either as fodder of clean weeds or legume straw, or from trees and shrubs

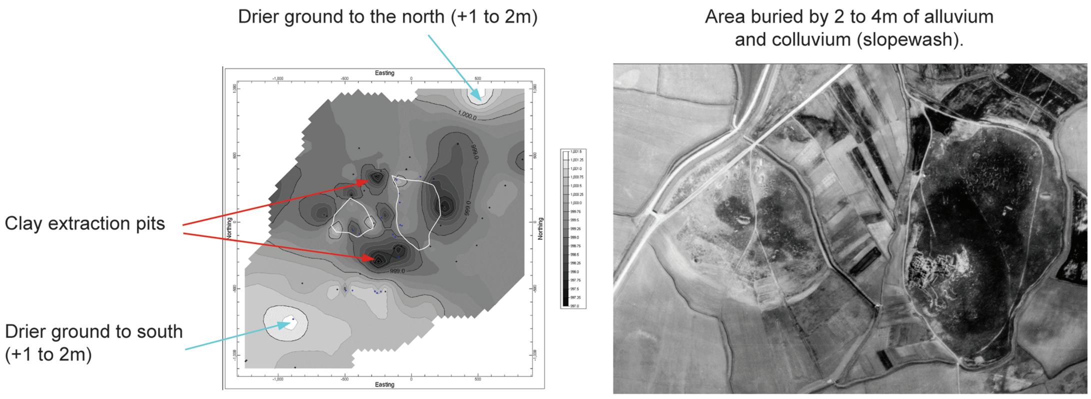

Figure 8. *Modelling the Çatalhöyük landscape topography in the Early Neolithic.*
Figure created for the Çatalhöyük Research Project by Chris Doherty and Kathryn Killackey.

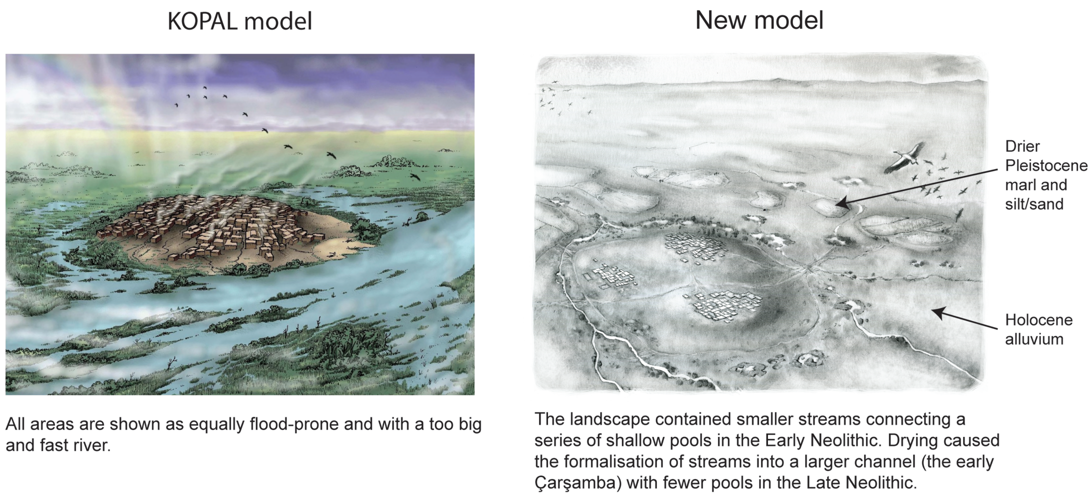

Figure 9. *Modelling the Çatalhöyük landscape topography in the Late Neolithic.*
Figure created for the Çatalhöyük Research Project by Chris Doherty and Kathryn Killackey.

Table 3. *Uses of clay for mudbrick, plaster, and pottery production at Çatalhöyük*

	Early occupational sequence	Middle occupational sequence	Late occupational sequence
Mudbrick	Dark alluvial clays	Deeper clays; colluvium	Colluvium
Plaster	White marl	Marl and softlime	Mainly non-white marl
Pottery	Local clay, few fabrics	Dominated by non-local clays	Increasing return to local clays and greater fabrics variation

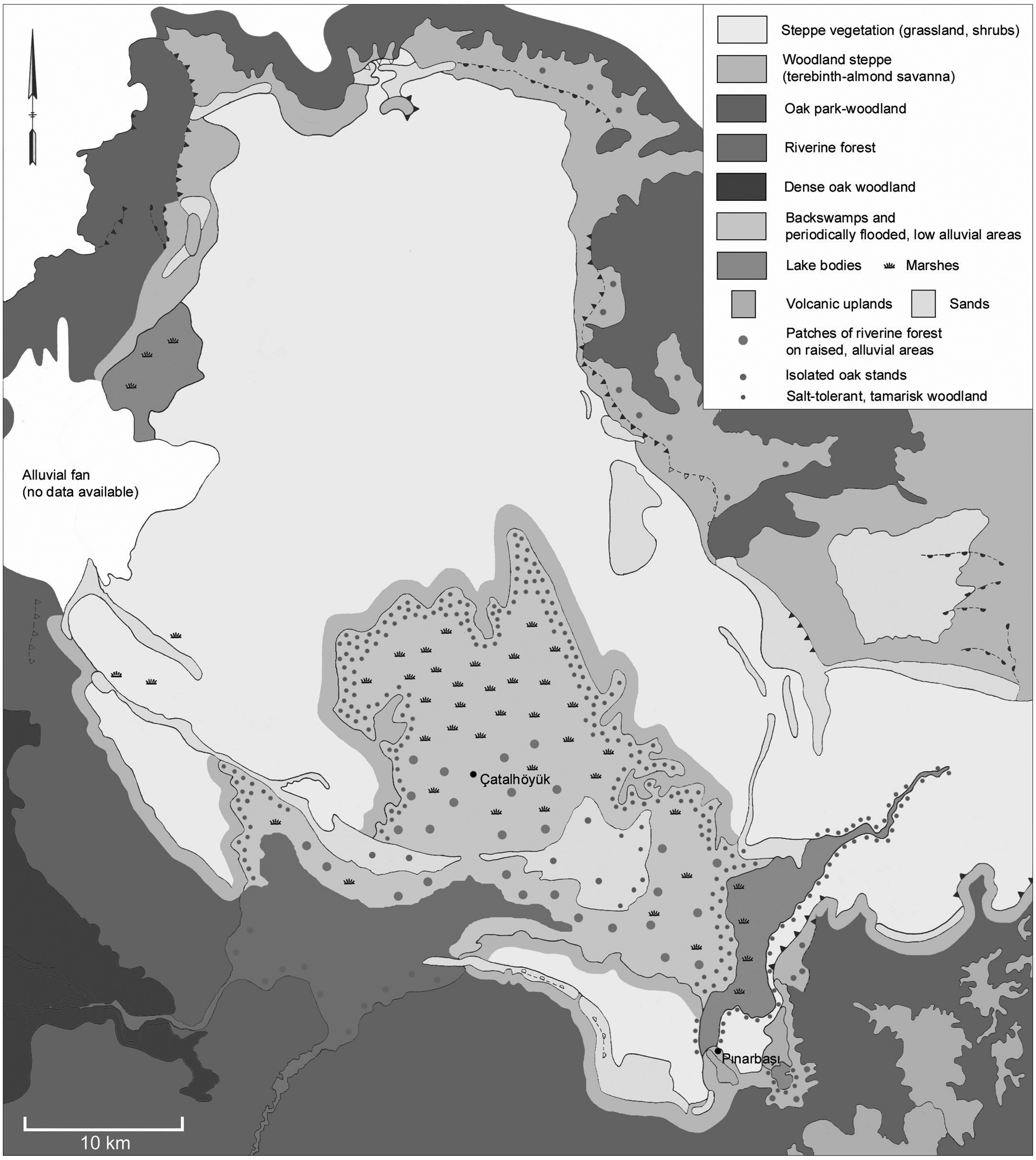

Figure 10. *Vegetation zones in the Konya Plain.*

During the later phases of the site (post-6500 cal BC) it is possible that fewer yet larger oak trunks from old-growth trees were harvested, while more and smaller diameter juniper trunks were used. This resulted in the increasing frequencies of juniper charcoals in the anthracological assemblages, indicating the regular pollarding of juniper trees (a practice attested presently in the vicinity of villages on the Taurus foothills) and/or the thinning of juniper stands in past vegetation (Figure 12). When both oak and juniper charcoal values finally regress during the latest phases of Neolithic habitation in the TP Area towards the end of 7th millennium cal BC, this is unlikely to be the result of the disappearance of these taxa from the lower upland zone; as this is the period corresponding to the first AP peak in the Eski Acigöl pollen record (Roberts et al., 2001; Woldring and Bottema, 2001/02). This is unrelated to climate-induced changes in woodland composition and species availability and can only be explained by

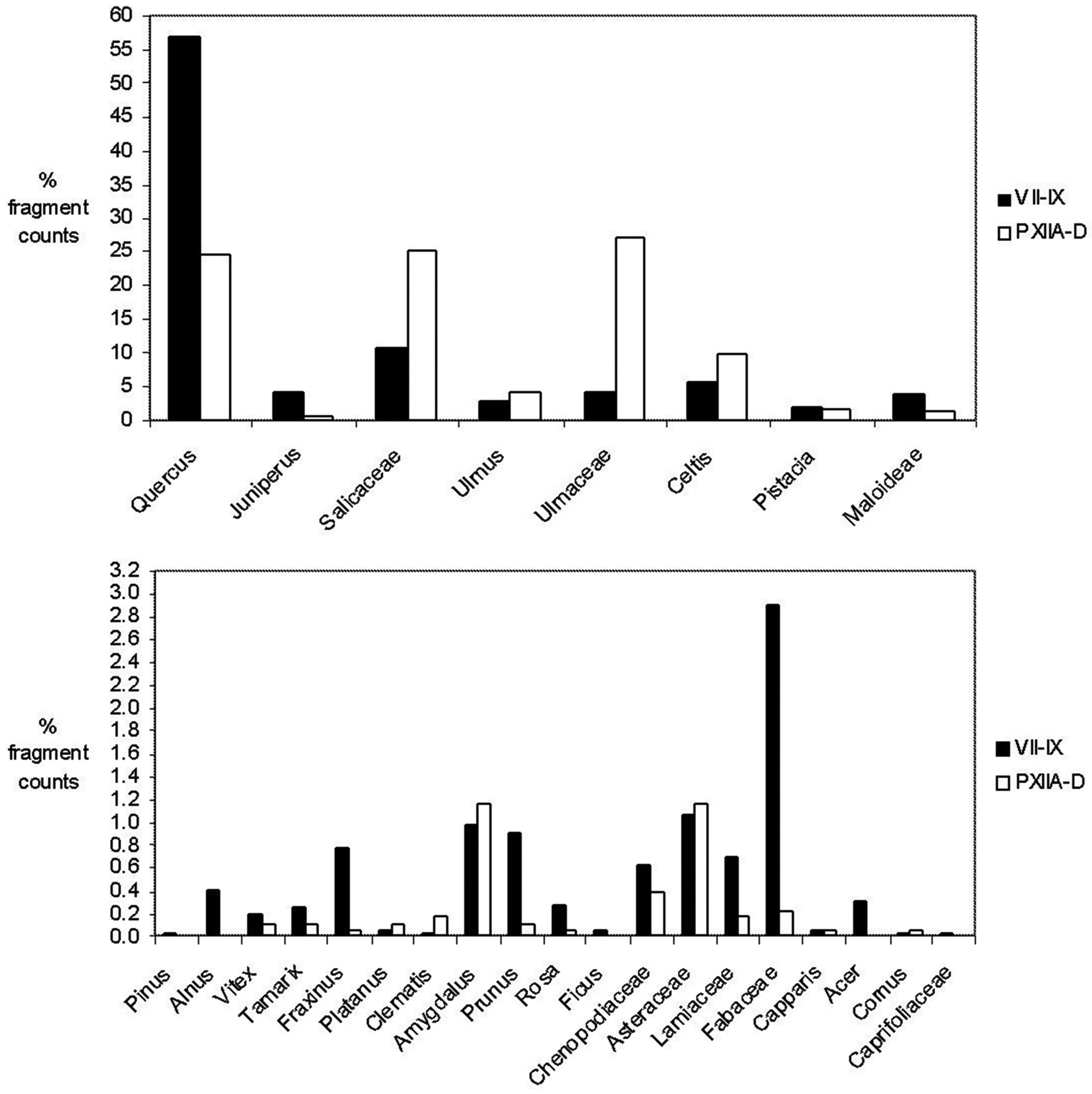

Figure 11. *Frequency of charcoal values of different wood species in the Early Neolithic.*

changes in the fuel and firewood economy of the site (Asouti & Hather, 2001). Their abrupt reduction in the charcoal sequence may represent instead the switch of wood gathering activities from the surrounding uplands to the locally available riparian vegetation that was probably intensively managed through the lifetime of the site. This is also suggested by the narrower range of riparian taxa present in the TP charcoal samples including *Salicaceae*, ash wood, elm, and (with lower frequencies compared to earlier periods) hackberry too.

Herding strategies

A summary of the dental isotope and microwear results are presented in Table 4. Animal production, based mainly on domestic sheep with a few goats, would have followed a seasonal cycle, demanding time for herding flocks and providing fodder (Henton, 2013). Local to Çatalhöyük, wild sheep, now confined to the Bozdağ Reserve, follow a seasonal cycle of birth and movement to optimal pasture or shelter locations that is in synchrony with natural resources (Kaya et al., 2004). Any deviation from this pattern in domestic herds would be controlled by their herders, and might be due to climate-led resource changes, or to changes in economic practices or in social mores (Table 5).

Birth season

Interpretation of the oxygen isotope data suggests that the Late Neolithic is characterized by a shift to the early birth season in March (Figure 13). This was the second attempt to introduce this important herding strategy; while an early attempt to change the birth season failed or was rejected, the second attempt in the Late Neolithic was successful.

Local wild sheep have late May births (Kaya et al., 2004) which are in synchrony with optimal grass-rich

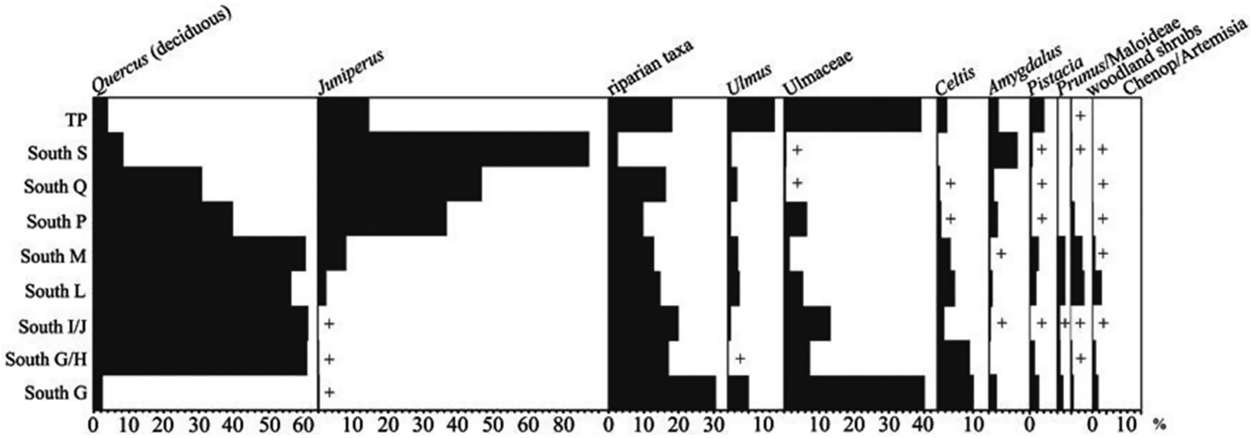

Figure 12. *Frequency of charcoal values of different wood species at the end of the Early and in the Late Neolithic.*

resources providing the necessary high nutritional plane for successful breeding (Hofmann, 1989: 445–8). This means that the introduced changes that advanced birthing earlier would take the breeding herds out of synchrony with resources. However, an early March birth season is more convenient for mixed farmers so that young lambs are old enough to be moved away before they might damage growing crops and is the preferred practice in mixed farms today (N. Kayan & M. Sivaş, pers. comm., July 2007). This suggests that at the end of the mound occupation in the Late Neolithic, ample supplementary fodder resources were available to overcome losses arising from breaking natural resource synchrony.

Fallow herding location

The oxygen isotopic data suggest that most caprines were not experiencing the benign conditions to be found at higher elevations but were exposed to the high summer typical of the lower elevations on the plains and the alluvial fan (Figure 14). Whereas the wild sheep move uphill in summer, it would appear that the herders were keeping their flocks lower down, probably near the settlement on the outskirts of the arable fields, as happens in the nearby farming villages today.

This again suggests a commitment to integrated arable economy. In addition, by maintaining herds relatively close to the settlement it would have been possible to schedule in less skilled family members such as children, or those only available for short work periods such as older family members or women with babies (Grayzel, 1990: 49).

Pre-slaughter diet

The microwear evidence (Figure 15) shows that there was a remarkable change in final diet over time, from a reliance on dirty grass-rich resources such as are found in winter pasture, to an increased reliance on grass-rich foods that were cleaner such as are found in summer pastures, cereal stubble, or in hay fodder. Then, in the final centuries of the mound occupation, the evidence shows a move to the novel dependence on soft, clean foods such as are found in tree leaves or pulse plants given as fodder.

The earlier shift from dirty to dry fibrous food has three possible interpretations: (1) a shift from winter slaughter to summer slaughter, (2) increasing climate aridity where winter pastures were dryer, and (3) the introduction of hay or straw fodder. The increase in soft food in upper levels implies the use of fodder whatever the slaughter season. This could be legume straw, dry weeds, or dry tree leaves. At this time, cattle herding was a relatively new introduction to the farming economy (Russell et al., 2013). Cattle need more reliable high-quality grass availability than

Table 4. *Summary of dental isotope and microwear results*

Summary of TP results (Çatalhöyük South Area)			
Birth season	Early spring 40% (18)	Mid-spring 0% (23)	Late spring 60% (59)
Movement during the first year	Summer uphill or by springs 10% (11)	Year-round sheltered, watered locations 20% (8)	Alluvial fan, steppe, terraces 70% (81)
Diet before slaughter	Dry weeds, legume straw 36% (23)	Clean grass, hay, chaff, stubble 55% (31)	Dirty grass, reeds, sedges 9% (46)

Table 5. *Two models of herd resource requirements associated with the breeding cycle, product goals, and labour demands*

	March	April	May	June	July	August	September	October	November	December	January	February
							X years pass					
Breeding	Late gestation period		Birth	Early lamb growth and sucking		Later lamb growth, less sucking, and weaning		Rutting		Mating	Early gestation period	
Feeding	Spring grass		Young grass			Dry grass, least food		Autumn grass re-growth		Winter grass, less food		
Movement	Family herds in sheltered parts of lower slopes, male herds further uphill			Movement of all herds parts further uphill to cooler locations		Remain uphill		All herd parts return to lower locations and form one group			Herds split again but stay in lower more sheltered locations	
Condition	In ewes, good condition necessary for foetal growth, milk production. In lambs, good condition necessary to survive poor weather					Conditions at its poorest, encouraging weaning. Less food prevents over-heating		Ewes and rams need to be in good condition for rutting and maximum fertility			Condition poor, but maintained by spells of grass re-growth	

A. Bozdağ wild sheep

Breeding	**Birth**	**Early lamb growth and sucking**	**Later lamb growth, less sucking and weaning**	**Rutting, mating conditions**	**Mating**	**Early gestation period**	**Late gestation period**
			X years pass				
Breeding herds	Early field-edge weeds might be convenient to protect lambing closely. If so, nutritious fodder supplement needed		Could be moved to pasture. If no uphill movement, young grass withers early, field-edge weeds finished, crops stubble later. Poor condition begins early	Nutritious fodder needed, crop stubble less nutritious. Water to offset over-eating and-heating	After mating could be returned to pastures with autumn grass re-growth		In byres or folds when cold, nutritious fodder needed for ewes
Fallow herds	Could be moved away from growing crops onto good spring pasture			Graze on poor crop stubble or pasture. Poor condition continues	Autumn growth grass on pasture	In byres or folds when cold, or deep snow. In good weather grazed on poor pasture	

C. Modelled domestic sheep herd bred primarily for meat and born in early spring

caprines, providing an additional explanation for the increasing reliance on fodder for the caprines.

In summary, the evidence suggests that in the Late Neolithic caprine herds were not being moved away from the settlement seasonally. They were kept relatively close, but now the breeding season was adjusted to accommodate the scheduling between arable and pastoral demands. To meet the shortfall in food resources that this incurred, the evidence shows that the use of fodder, probably provided by arable waste, was introduced.

Clay and wood use

Mudbrick was a major house construction material. It required quarrying of clay, mixing with temper (in the early levels), and a long-drying period. Any time

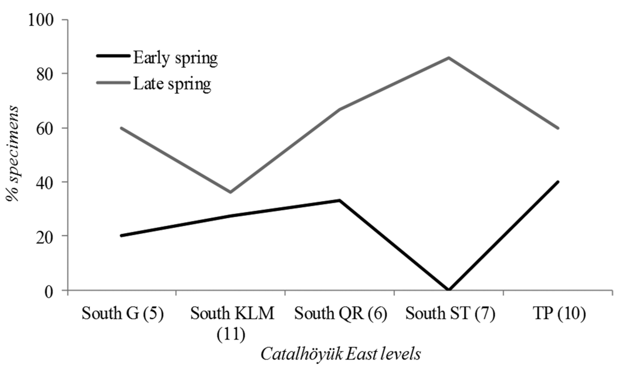

Figure 13. *Chart showing temporal trends in the birth month of TP and South Area sheep, based on modelled oxygen isotope evidence.*

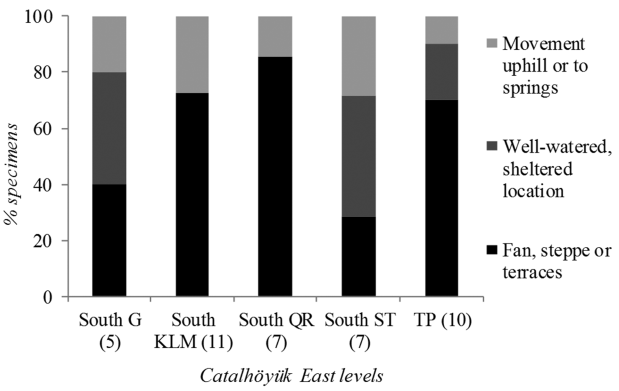

Figure 14. *Chart showing temporal trends in the first year movement of TP and South Area sheep, based on modelled oxygen isotope evidence.*

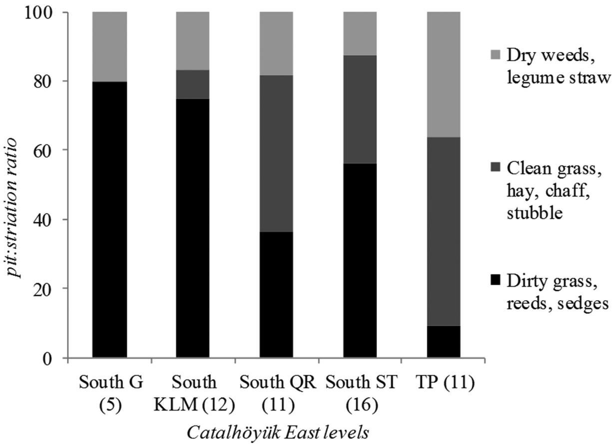

Figure 15. *Chart showing temporal trends in the final dietary regime of TP and South Area sheep, based on modelled dental microwear evidence.*

through the warmer season would have been suitable for such activities, although spring seems most likely. Buildings were made of mudbrick and earthen plaster, with walls and specific floor areas finished with white calcareous clays (marls) and soft lime. The large volume of the building materials requires that they would have been sourced very close to the site.

The Late Neolithic from the TP Area sees the abandonment of this practice of using white marls to demarcate burials, such as those under the northern floor platforms of classical Çatalhöyük houses. The incised panel above burial 327 (Figure 16) uses just ordinary impure marl of the type ubiquitously used as general fill at all levels of the East Mound. This is despite the continued availability of white marls nearby. Further, no evidence for the use of soft lime plaster has yet been found in the later levels, implying that it was no longer thought sufficiently important to collect this material from areas 5 km to the west.

Figure 16. *The incised panel above burial 327 in TP Area.* Photograph by Andrzej Leszczewicz.

It is not that less effort went into enhancing later buildings but that fixed ways of doing so were abandoned in favour of greater individual expression. A new tradition is the pebble-inlaid floors found in a few of the TP houses. Pebbles of up to 3 cm are mostly of limestone, and would have been intentionally picked from the mixed pebble sources of the Çarşamba-May alluvial system. Pebbles of this size have not yet turned up in any of the fifty-plus cores and sections made to date, and indeed would not be expected this far out into the Konya plain. The implication is that a special effort had to be made to source these pebbles, probably from where the Çarşamba enters the Konya Plain (around Cumra today).

Similarly there are changes in pottery in the later levels that reflect a departure from the relatively fixed pattern of clay use of the previous levels. Early pottery was made of local clay but was largely replaced in the middle levels by wares whose mineralogical composition shows them to have been made in the volcanic areas, between Beyşehir–Konya and the upper Çarşamba (Doherty and Tarkan, 2013). These are likely to have been technologically much better suited to cooking than were the local fabrics, although non-functional reasons may equally have been influential in their adoption. Whatever the reason, these non-local mineral-gritted fabrics became dominant throughout the middle levels, but this dominance began to wane in the later levels. While still the main fabric type, the Late Neolithic pottery at Çatalhöyük becomes more variable in composition, pointing to a period of renewed experimentation with local clays.

Due to the absence of burnt structures from the earlier part of the Neolithic sequence at Çatalhöyük, it is not possible to determine accurately the specifics of timber choice and use (e.g. timber size, manner of timber preparation, choice of species). However, a more diverse woody flora was utilized as fuel, including (from the beginning of the ceramic Neolithic period) a significant component of oak wood that was also used as timber.

In contrast, the Late Neolithic phases preserve *in situ* evidence of burnt timber use. From the examination of the timber fittings of a number of burnt buildings, it has been ascertained that timber use was highly structured (see Asouti, 2013). Vertical juniper posts were used for fittings that might have served some symbolic and/or decorative purpose lacking an obvious structural function. They were often plastered over and set against the walls, but did not extend all the way to the roof and were not high and large enough to support a second storey. The diameter of the *in situ* preserved juniper posts was also considerably smaller than that of oak burnt timbers. Yet, the durability of juniper wood obviously played a role in its selection as roof timber instead of oaks or locally available taxa such as the *Salicaceae* or the *Ulmaceae*. At the same time, the study of burnt timber fittings from Building 77 has shown that very large (~1 m in diameter) longitudinally split oak trunks might have been preferred for vertical posts that had some structural function (see also Taylor et al. 2015). Modern comparisons with oak trees sourced in the Çarşamba catchment suggest that such large trees could have grown to a height of 15–20 m, while the shaping of the preserved archaeological timbers has also indicated that a single trunk of this size appropriately split could have provided all the vertical oak posts required for Building 77 (Asouti, 2013).

A shift in the narrower range of riparian taxa in the Late Neolithic was accompanied by culturally determined changes in architectural practices and construction techniques which, unrelated to wood availability, were less timber-dependent compared to earlier periods (Asouti, 2013).

Final Remarks

High-resolution archaeological and bioarchaeological data permit tracing changes in procurement, production, and consumption strategies of the Çatalhöyük inhabitants in the final centuries of its occupation. Charcoal studies revealed that it is only at the end of the 7th millennium cal BC that we can talk about full-scale management pattern, in terms of territory definition, allocation of land use rights, and the closing down of previous, spatially extensive subsistence procurement systems. The charcoal data suggest that the catchment of wood extraction activities shrank through time, eventually becoming strictly localized on the riparian habitats that were closest to the site. Landscape change (e.g. continuous rising of the alluvial plain or even colluvial deposition) might have been a contributing factor, but does not appear (everything else considered) to be the driving force behind this shift at any particular stage of the lifetime of the site.

Assuming that distant procurement of oak and juniper timber was by logistical necessity a communal undertaking, there are thus grounds to suggest that this was probably less of a need towards the end of the Neolithic habitation on the East Mound. Households could undertake these tasks independently. This may corroborate a shift away from broadly defined kin- or clan-based systems to a pattern focusing on the household *sensu stricto*, and this shift sees all the activities tied in finally with arable production needs and requirements. Moreover, riparian woodlands had been converted by then (at least wood-wise) into completely managed, distinctly anthropogenic habitats.

As implied by the study of oxygen isotope analysis and dental microwear, there was a high degree of arable/pastoral integration and dependence emerging in the Late Neolithic. It indicates high labour costs to control the breeding cycle, to move fallow herd-parts and breeding herd-parts between pastures, and to cut and dry fodder necessary for slaughter herds. It is argued that a more fragmented household-based society would have allowed more flexibility and integration in labour scheduling. It is where Çatalhöyük occupants find the confidence to deal with dependency and labour costs. Further, these herding practices imply a commitment to the local area; one where clay pits, riverine wood and timber extraction, and arable farming all combine to confirm a sense of territorial ownership.

It is worth stressing that none of the changes observed in the charcoal, clay, and oxygen isotope record can be directly associated with (assumed) climate impacts on Neolithic woodland vegetation.

The recognized changes in the procurement, production, and consumption pattern provide a valuable insight into the nature of a major change in the course of the Neolithic involving a shift from some kind of communal organization (house society, neighbourhood community) requiring collective labour to more autonomous house units performing individualized and diverse activities. The life in the Early Neolithic was concentrated in and around clusters of elaborated houses that were set to establish historical and ritual ties. These large groupings organized acquisition, production, and possibly consumption. This typically Neolithic system came to an end sometime after the middle of the 7th millennium cal BC and became gradually replaced by smaller, more dispersed, more independent, and more self-sufficient houses (see also Marciniak, 2015). They initially developed as an intrinsic component of the Early Neolithic neighbourhood system and eventually contributed to their demise.

References

Asouti, E. 2013. Woodland Vegetation, Firewood Management and Woodcrafts at Neolithic Çatalhöyük. In: I. Hodder, ed. *Humans and Landscapes of Çatalhöyük: Reports from the 2000–2008 Seasons*. Los Angeles: Cotsen Institute of Archaeology Press, pp. 129–62.

Asouti, E. & Austin, P. 2005. Reconstructing Woodland Vegetation and its Exploitation by Past Societies, Based upon the Analysis and Interpretation of Archaeological Wood Charcoal Macro-Remains. *Environmental Archaeology*, 10:1–18.

Asouti, E. & Hather, J. 2001. Charcoal Analysis and the Reconstruction of Ancient Woodland Vegetation in the Konya Basin, South-Central Anatolia, Turkey: Results from the Neolithic Site of Çatalhöyük East. *Vegetation History and Archaeobotany*, 10(1):23–34.

Boyer, P., Roberts, N. & Baird, D. 2006. Holocene Environment and Settlement on the Çarşamba Alluvial Fan, South Central Turkey: Integrating Geoarchaeology and Archaeological Field Survey. *Geoarchaeology*, 21:675–99.

Doherty, C. 2013. Sourcing Çatalhöyük's Clay. In: I. Hodder, ed. *Substantive Technologies at Çatalhöyük: Reports from the 2000–2008 Seasons*. Los Angeles: Cotsen Institute of Archaeology Press, pp. 51–66.

Doherty, C., Charles, M. & Bogaard, A. 2008. *Preliminary Sediment Coring to Clarify Clay Sources and Potential Landuse around Çatalhöyük*. Çatalhöyük 2008 Archive Report. http://www.Çatalhöyük.com/downloads/Archive_Report_2008.pdf

Doherty, C. & Tarkan, D. 2013. Pottery Production at Çatalhöyük: A Petrographic Perspective. In: I. Hodder, ed. *Substantive Technologies at Çatalhöyük: Reports from the 2000–2008 Seasons*. Los Angeles: Cotsen Institute of Archaeology Press, pp. 183–92.

Düring, B. S. & Marciniak, A. 2006. Households and Communities in the Central Anatolian Neolithic. *Archaeological Dialogues*, 12:165–87.

Fricke, H., Clyde, W. & O'Neil, J. 1998. Intra-Tooth Variations in $\delta^{18}O$ (PO_4) of Mammalian Tooth Enamel as a Record of Seasonal Variations in Continental Climate Variables. *Geochimica et Cosmochimica Acta*, 62:1839–50.

Grayzel, J. 1990. Markets and Migrations: A Fulbe Pastoral System in Mali. In: J. Galaty & D. Johnson, eds. *The World of Pastoralism: Herding Systems in Comparative Perspective*. New York: Guildford Press, pp. 35–68.

Henton, E. 2012. The Combined Use of Oxygen Isotopes and Microwear in Sheep Teeth to Elucidate Seasonal Management of Domestic Herds: the Case Study of Çatalhöyük, Central Anatolia. *Journal of Archaeological Science*, 30:3264–76.

Henton, E. 2013. The Contribution of Herding to Settlement Identity in the Central Anatolian Neolithic: Herding Decisions and Organisation in Çatalhöyük Elucidated through Oxygen Isotopes and Microwear in Sheep Teeth. In: B. De Cupere, V. Linseele & S. Hamilton-Dyer, eds. *10th Archaeozoology of South West Asia (ASWA) 2011 Proceedings*. Leuven: Peeter's Press, pp. 69–99.

Henton, E. In press. Domestic Herd Management in the Closing 200 Years of Çatalhöyük East, Elucidated through the Combined Use of Oxygen Isotopes and Microwear in Sheep Teeth. In: A. Marciniak & L. Czerniak, eds. *Late Neolithic at Çatalhöyük East. Excavations of the Upper Levels in the Team Poznań Area*. Los Angeles: Cotsen Institute of Archaeology Press.

Hodder, I. 2006. *The Leopard's Tale: Revealing the Mysteries of Çatalhöyük*. London: Thames and Hudson.

Hofmann, R. 1989. Evolutionary Steps of Ecophysiological Adaptation and Diversification of Ruminants: A Comparative View of Their Digestive System. *Oecologia*, 78:443–57.

IAEA/WMO. 2006. Global Network of Isotopes in Precipitation. *The GNIP Database* [accessed 15 December 2009]. Available at http://isohis.iaea.org

Kaya, M., Bunch, T. & Konuk, M. 2004. On Konya Wild Sheep *Ovis Orientalis Anatolica* in the Bozdağ Protected Area. *Mammalia*, 68:229–32.

Mainland, I. 1998. Dental Microwear and Diet in Domestic Sheep (*Ovis Aries*) and Goats (*Capra Hircus*): Distinguishing Grazing and Fodder-fed Ovicaprids Using a Quantitative Analytical Approach. *Journal of Archaeological Science*, 25:1259–71.

Marciniak, A. 2013. The Society in the Making. The House and the Household in the Danubian Neolithic of the Central European Lowlands. In: T. Kerig & A. Zimmermann, eds. *Economic Archaeology. From Structure to Performance in European Archaeology*. Bonn: Habelt, pp. 47–63.

Marciniak, A. 2015. The Neolithic House as a Procurement, Production and Consumption Unit. The Case of the Late Neolithic at Çatalhöyük. In: K. Brink, S. Heyden, K. Jennbert, L. Larsson & D. Olausson, eds. *Neolithic Diversities. Perspectives from a conference in Lund, Sweden*. Lund: Department of Archaeology and Ancient History.

Marciniak, A., Barański, M.Z., Bayliss, A., Czerniak, L., Goslar, T., Southon, J. & Taylor, R.E. 2015. Fragmenting Times: Interpreting a Bayesian Chronology for the Late Neolithic Occupation of Çatalhöyük East, Turkey. *Antiquity*, 89(343):154–76.

Marciniak, A. & Czerniak, L. 2007. Social Transformations in the Late Neolithic and the Early Chalcolithic Periods in Central Anatolia. *Anatolian Studies*, 57:115–30.

Marciniak, A. & Czerniak, L. 2012. Çatalhöyük Unknown. The Late Sequence on the East Mound. In: R. Matthews & J. Curtis, eds. *Proceedings of the 7th International Congress on the Archaeology of the Ancient Near East. Volume I Mega-cites & Mega-sites. The Archaeology of Consumption & Disposal, Landscape, Transport and Communication*. Wiesbaden: Harrassowitz Verlag, pp. 78–85.

Özdöl-Kutlu, S., Carter, T., Czerniak, L. & Marciniak, A. 2015. The End of the Neolithic Settlement Çatalhöyük and its Neighbours. In: I. Hodder & A. Marciniak, eds. *Assembling Çatalhöyük*. EAA Monograph Series: Themes in Contemporary Archaeology, pp. 179–195.

Rivals, F. & Deniaux, B. 2003. Dental Microwear Analysis for Investigating the Diet of an Argali Population (*Ovis ammon antiqua*) of Mid-Pleistocene Age, Caune de l'Argo Cave, Eastern Pyrenees, France. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 193:443–55.

Rivals, F. & Deniaux, B. 2005. Investigation of Human Hunting Seasonality through Dental Microwear Analysis of Two Caprinae in Late Pleistocene Localities in Southern France. *Journal of Archaeological Science*, 32:1603–1612.

Roberts, N., Reed, J., Leng, M.J., Kuzucuoglu, C., Fontugne, M., Bertaux, J., Woldring, H., Bottema, S., Black, S., Hunt, E. & Karabiyikoglu, M. 2001. The Tempo of Holocene Climatic Change in the Eastern Mediterranean Region: New High-Resolution Crater-Lake Sediment Data from Central Turkey. *Holocene*, 11:719–34.

Solounias, N., McGraw, W., Hayek, L. & Werdelin, L. 2000. The Paleodiet of the Giraffidae. In: E. Vrba & G. Schaller, eds. *Antelopes, Deer and Relatives: Fossil Record, Behavioural Ecology, Systematics, and Conservation*. New Haven: Yale University Press, pp. 84–95.

Russell, N., Twiss, K.C., Orton, D.C. & Demirergi, G.A. 2013. More on the Çatalhöyük Mammal Remains. In: I. Hodder, ed. *Humans and Landscapes of Çatalhöyük: Reports from the 2000-2008 Seasons*. Los Angeles: Cotsen Institute of Archaeology Press, pp. 213–258.

Taylor, J., Bogaard, A., Carter, T., Charles, M., Knüsel, Ch.J., Mazzucato, C., Mulville, J., Tsoraki, Ch., Tung, B. & Twiss, K. 2015. 'Up in Flames'. A Visual

Exploration of a Burnt Building at Çatalhöyük in GIS. In: I. Hodder & A. Marciniak, eds. *Assembling Çatalhöyük*. EAA Monograph Series: Themes in Contemporary Archaeology, pp. 127–149.

Whitehouse, H. & Hodder, I. 2010. Modes of Religiosity at Çatalhöyük. In: I. Hodder, ed. *Religion in the Emergence of Civilization. Çatalhöyük as a Case Study*. Cambridge: Cambridge University Press, pp. 122–145.

Woldring, H. & Bottema, S. 2001/2. The Vegetation History of East-Central Anatolia in Relation to Archaeology: The Eski Acigöl Pollen Evidence Compared with the Near Eastern Environment. *Palaeohistoria*, 43/44:1–34.