Assembling Çatalhöyük

Edited by Ian Hodder and Arkadiusz Marciniak

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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).

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CHAPTER 12

The People and Their Landscape(s)

Changing Mobility Patterns at Neolithic Çatalhöyük

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INTRODUCTION

The Neolithic is a pivotal and dynamic period of Near Eastern prehistory, being marked by changes in the ways that human beings interacted with their environments and with one another. The leading developments included a series of interlinked changes, especially the domestication of plants and animals and subsequent intensification of agricultural practices, increased sedentism, population growth and aggregation, greater entanglement with and dependence upon material resources, and increased emphasis on ritual and symbolic behaviours (e.g. Bar-Yosef & Meadow, 1995; Banning, 1998; Cauvin, 2000; Kuijt, 2000; Simmons, 2007). While each of these aspects has received thorough treatment through archaeological analysis, the processes underlying increased sedentism have been a particular focus of the study. This is due, in large part, to other dramatic changes associated with and possibly precipitated by reduced mobility, including changes in subsistence strategies, storage practices, trade, demographic structure, sexual division of labour, sociopolitical differentiation, and notions of material wealth, privacy, ownership, co-operation, and competition (Kelly, 1992 and references therein).

Bioarchaeologists, in their analyses of human skeletal remains from archaeological settings, have devoted a great deal of attention to explaining examples of reduced mobility among populations in transition—especially the foraging-to-farming transition—because of the largely negative consequences that increased sedentism and population aggregation brought about for human health (Larsen, 2015 and references therein). Through these studies, much has been learned about the general trend of reduced mobility that accompanies the transition from foraging to farming in various places and times. However, less attention has been paid to the factors affecting changing mobility patterns within established farming communities (cf. Larsen & Ruff, 1994; Ruff & Larsen, 2001).

The lengthy occupation, detailed stratigraphy and contextual data, and large assemblage of human remains at Çatalhöyük provide an opportunity to evaluate temporal changes in mobility patterns within a farming community in a way that is difficult or impossible in many other archaeological settings worldwide. In the present analysis, mobility at Çatalhöyük will be analysed at two different scales, first in a broader temporal and geographic context, via comparison with skeletal series spanning the European Upper Paleolithic to the Bronze Age, and second through the local chronology of the site, to capitalize on the unique opportunity provided at Çatalhöyük and discussed above. While we predict that the first scale of analysis will reveal Çatalhöyük to be a relatively sedentary population, it is important to recall the words of Robert Kelly (1992: 60) when considering the second scale of analysis, namely that, 'No society is sedentary [...] – people simply move in different ways'.

THE LANDSCAPE OF ÇATALHÖYÜK

Mobility patterns are greatly influenced by the relationship shared between people and their landscapes—regional, local, physical, and social. Through this relationship, people shape their landscapes, and landscapes, in turn, shape their people. Çatalhöyük is no different in this regard, and before moving into the analyses discussed in the previous section, it is important to consider what is currently known about the landscape within which the site was located.

The landscape reconstruction that emerged during the first phase of the Çatalhöyük Research Project painted a picture of a dynamic, if predictable, environment characterized by continuous seasonally flooded wetlands throughout the site's Neolithic occupation (Roberts et al., 1996, 2007; Rosen & Roberts 2005; Roberts & Rosen, 2009). Under this model, Çatalhöyük is described as having been founded upon a

raised marl hummock next to a branch of the Çarşamba River, such that its location on a topographic 'high' in the landscape set it above the areas most at risk of flood inundation (Rosen & Roberts, 2005; Roberts & Rosen, 2009). Nevertheless, the existence of a large population centre in an undulating landscape of marshy flood basins, raised marl hummocks, and heavy seasonal flooding has major implications for the nature of habitation and land use at the site, as well as the mobility patterns of its residents (Charles et al., 2014).

Roberts & Rosen (2009) outline a model characterized by high logistical, and even residential, mobility in the course of seasonally regulated activity regimes. The spring flood would have left most of the lower-lying landscape around Çatalhöyük inundated, spurring a fission of the population throughout the spring and summer seasons. Through this fission, different segments of the population would have been responsible for different activities related to food and resource procurement, such as harvesting of autumn-sown dryland crops, sheep/goat herding, and collection of timber, obsidian, and other raw materials (Rosen & Roberts, 2005; Roberts & Rosen, 2009). This model has informed broader interpretations of Çatalhöyük as a community that must have pursued cultivation and herding as largely separate activities across the landscape, both at a substantial distance from the site, and in which at least some segments of the population were highly mobile (Charles et al., 2014).

Through the integrated analysis of multiple lines of evidence carried out during the most recent phase of the Çatalhöyük Research Project (Charles et al., 2014), a new reconstruction of landscape and taskscape has emerged that challenges the model outlined by Roberts & Rosen (2009). Whereas the earlier landscape reconstruction (Rosen & Roberts, 2005; Roberts & Rosen, 2009) suggested that Çatalhöyük was located on a raised marl hummock, a review of the known elevations of the local marl surface has shown that Çatalhöyük actually occupied a relatively low-lying area, despite the availability of higher ground immediately to the north and south of the site (Doherty, 2013; Charles et al., 2014), a finding that goes against the idea that site location was predicated upon reducing risks associated with seasonal flooding.

Strontium isotope analyses of modern plants and macrobotanical remains from Building 52 indicate that distant (*c.* 13 km) limestone terraces were not included among the areas of plant cultivation (Bogaard et al., 2014), in contrast to earlier interpretations that identified these areas as the primary location of agricultural production (Roberts & Rosen, 2009). Furthermore, examination of the weed taxa in the Çatalhöyük assemblage suggests that plants were cultivated under conditions ranging from dry to moderately wet (Charles et al., 2014). Rather than suggesting that the activity regimes of Çatalhöyük's inhabitants were largely determined by the pressures of seasonal flooding (Rosen & Roberts, 2005; Roberts & Rosen, 2009), the macrobotanical evidence suggests that the people of Çatalhöyük successfully managed the challenges of variable soil drainage and were able to cultivate crops closer to the site than was previously thought possible (Charles et al., 2014).

Oxygen and strontium isotope analyses of sheep tooth specimens (Henton, 2013; Bogaard et al., 2014) indicate that the vast majority of caprine herding occurred year-round at lower elevations on the local alluvium or on the surrounding marl plain near the site, in contrast to earlier interpretations that herds were moved to drier locations farther afield for pasturing during the spring flooding season (Roberts & Rosen, 2009). Thus, results from both the macrobotanical and faunal assemblages suggest that Çatalhöyük was situated at an advantageous location on the Konya Plain that accommodated long-lived cultivation plots as well as a range of possible pasturing locations for caprine herds (Charles et al., 2014). Rather than requiring seasonal fissioning of the site's population, with different groups carrying out different tasks in different locations away from the site, Charles et al. (2014: 89) argue that Çatalhöyük 'represents a successful embedding of the relatively new "sheep + crop" farming package into a landscape with diverse foraging options'. The implications for human mobility, at least in relation to subsistence practices, are quite different under this new model of landscape use, as the roughly 'concentric' taskscapes outlined by Charles et al. (2014) would likely have been accomplished with a lower degree of logistical mobility, and certainly a lower degree of residential mobility, than the disparate and distant activity regimes associated with the model constructed by Roberts & Rosen (2009).

Inferring Mobility at Çatalhöyük: The Bioarchaeological Evidence

The most direct way to measure the degree of mobility among past populations is via the remains of the humans who once lived as members of those populations. Interpreting the results of these analyses within the broader context of the archaeological record can provide a more complete picture of human behaviour and human–landscape interactions in the past. Bone is a living tissue that is highly responsive to physical stresses, adapting to those stresses in ways that reflect an individual's exposure to various mechanical forces, such as those encountered through walking or running (Ruff et al., 2006a; Ruff, 2008; Larsen, 2015). Bioarchaeological analysis of human long bones (e.g. the femur) can

provide insight into relative degrees of mobility between distinct populations and changing patterns of mobility within a single population over time. Specifically, cross-sectional geometric properties of the femoral midshaft called section moduli (Z_x, Z_y) provide a measure of the bone's adaptation to bending stresses along different planes, where Z_x reflects bending strength in the anterior–posterior (A–P) plane, and Z_y reflects bending strength in the medial–lateral (M–L) plane (Ruff, 2008; Larsen, 2015). The ratio of A–P bending strength to M–L bending strength (Z_x/Z_y) can be used as an index of the types of mechanical forces exerted on the femoral midshaft, and although interpretation of this index is complex (Ruff et al., 2006b), higher ratios are considered to be indicative of higher mobility (Ruff, 1987; Larsen, 2015).

For the Çatalhöyük skeletal series, relative degree of mobility was assessed at two scales, first in a broader temporal and geographic context, and second through the local chronology of the site. At the first scale of analysis, a total of sixty-one adults (thirty males and thirty-one females) were included in the Çatalhöyük sample (Larsen et al., 2013, 2015). Comparative samples include Late Pleistocene and Early Holocene European populations, spanning the Early and Late Upper Paleolithic, Neolithic, and Bronze Age (Holt, 2003; Ruff et al., 2006b; Sládek et al., 2006). This analysis reveals a marked decline in the ratio of Z_x/Z_y through time across these samples (Figure 1) (Larsen et al., 2013, 2015). This temporal decline in relative A–P/M–L bending strength has been interpreted as reflecting reduced levels of mobility in later, more sedentary agricultural populations (Holt, 2003), but changes in body shape may also be a contributing factor to the observed pattern (Ruff et al., 2006b). Nevertheless, based on the cross-sectional geometric properties of the femoral midshaft analysed here, mobility levels appear to have been relatively low at Çatalhöyük. Çatalhöyük males and females both fall within the Neolithic-Bronze Age range, indicating a relatively sedentary population compared to the highly mobile groups of the European Upper Paleolithic (Larsen et al., 2013, 2015). These results are hard to reconcile with the initial reconstruction of Çatalhöyük's landscape, with its expectation of high seasonal, and even residential, mobility among the site's inhabitants (Rosen & Roberts, 2005; Roberts & Rosen, 2009). On the other hand, these results sit well with the landscape reconstruction of the latest phase of the Çatalhöyük Research Project, with the roughly 'concentric' taskscapes of the 'sheep + crop' farming package (Charles et al., 2014) and the inclusion of some tasks requiring heightened mobility (e.g. travel to and from distant sources of raw materials) within a relatively sedentary activity regime.

Of the sixty-one adults included in the above analysis, forty-five could be assigned to site level, allowing for the assessment of changing mobility patterns through time based on the local chronology of the site. For the purposes of this analysis, the sample was divided into three broad periods—Early, Middle, and Late—roughly corresponding to periods of population growth, peak population, and population decline, respectively (Table 1). Although the sample size is small, there is a consistent increase in the Z_x/Z_y ratio from the Early period through the Late period among

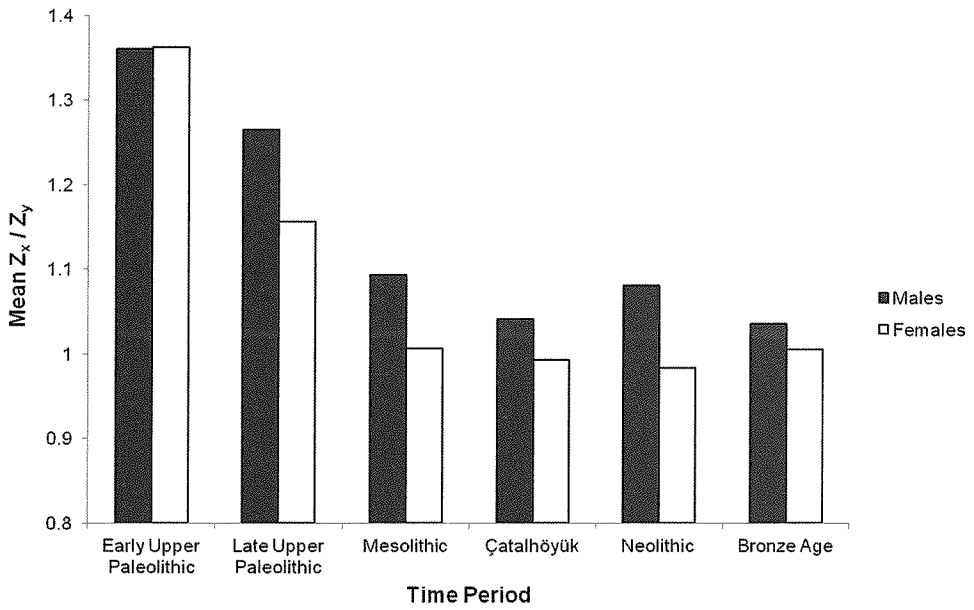

Figure 1. *Femoral midshaft A–P/M–L bending strength (mean Z_x/Z_y) in males and females at Çatalhöyük and comparative Pleistocene and Holocene European samples.*

Table 1. *Levels corresponding to the three time periods used in this analysis*

Time period	Hodder levels*
Late ('post-peak')	South O, P, Q, R, S, T, North H**
Middle ('peak')	South M, North G
Early ('pre-peak')	South H, J, K, L

**As outlined by Farid (2014).*
***Note that the Late period as defined here does not include the TP area of Çatalhöyük, which represents the latest phases of Neolithic occupation at the site. For a detailed discussion of changes occurring in the Late Neolithic TP levels, see Marciniak et al., 2015.*

females that approaches statistical significance (Kruskal–Wallis test: $p < 0.08$; Figure 2), which is suggestive of increasing mobility throughout the site's occupation, at least for females (Larsen et al., 2013, 2015; Charles et al., 2014). A similar trend is observed in males when using a shape index derived from external breadth measurements: $(T_{ml} \times 100)/T_{ap}$, where T_{ml} represents the total diameter in the medial–lateral plane and T_{ap} represents the total diameter in the anterior-posterior plane. In this case, lower values reflect higher mobility, and values in males decrease in a manner that nears statistical significance (Kruskal–Wallis test: $p < 0.06$; Table 2) (Larsen et al., 2013, 2015; Charles et al., 2014). Although based on a smaller sample and less precise measurements than those derived from cross-sectional geometric properties (Stock & Shaw, 2007), analysis of these external breadth measurements can nevertheless provide a useful indication of the relative degree of mobility (Larsen, 2015). In combination, cross-sectional geometric analysis and external bone morphology reveal a record of increasing mobility through time among women and men at Çatalhöyük (Larsen et al., 2013, 2015; Charles et al., 2014).

Table 2. *Inferring mobility through the femoral midshaft index**

	Early	Middle	Late	*p*-value
Males	1.0	0.9	0.84	0.06**
Females	1.0	0.99	0.9	0.36

**$(T_{ml} \times 100)/T_{ap}$; lower values indicate higher mobility.*
***Approaches a statistically significant increase in mobility through time for males.*

These analyses suggest that the population of Çatalhöyük was a relatively sedentary one overall, but some evidence exists for an increase in mobility over time, especially in the Late period of the site's occupation. Previous interpretations have largely attributed this increase to environmental and subsistence-related factors, such as increasing aridity and diminishing resources in the immediate vicinity of the site (Larsen et al., 2013). While these factors may have played a role, the aim of the remainder of this chapter is to reinterpret this increase in mobility through a contextualized approach that integrates ecology, technology, subsistence, and social identity, all of which, as will be detailed further below, could have contributed to changing patterns of mobility through time at Çatalhöyük.

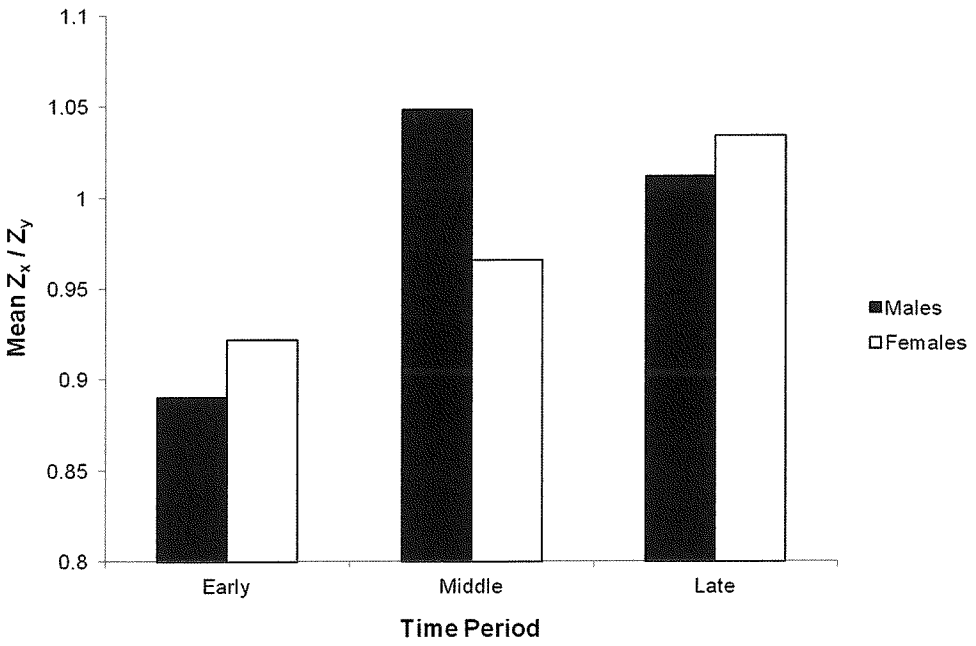

Figure 2. *Femoral midshaft A–P/M–L bending strength (mean Z_x/Z_y) in males and females across the three time periods of Çatalhöyük's occupation.*

Increasing Mobility in Context

Ecology

The sheer size and density of Çatalhöyük's population, combined with the intensity of agricultural and architectural activities among the site's inhabitants, contributed to a profound impact on the local environment. The degree to which this impact on the landscape may have influenced changing patterns of mobility through time is worth exploring further through a review of recent wood charcoal, clay sourcing, and phytolith analyses. Asouti's (2013) analysis of the Çatalhöyük wood charcoal assemblage indicates a pattern of wood use, both for timber and fuel, in which oak was the dominant taxon during the Early and Middle periods of the site's occupation. The representation of oak begins to decline in Level South P, and by South Q, juniper becomes the dominant taxon in the charcoal sequence. The northern and southern zones of the site can be linked through the charcoal sample composition, as Level North G is similar to South M, and North H is similar to South Q, suggesting broadly comparable trends across the site through time (Asouti, 2013).

Rather than being the result of overexploitation of oak woodlands, Asouti (2013) explains the substitution of oak by juniper in the Late period as resulting from changing practices in timber harvesting and a cultural preference for juniper in the construction of roof timbers due to its durability and longevity. Although the Neolithic distribution of oak and juniper woodlands was likely much more extensive than the modern distribution, perhaps reaching the borders of the Konya plain, both oak and juniper would have been procured from similarly distant upland locales some 12–25 km from the site (Asouti, 2012, 2013; Charles et al., 2014). Thus, despite this shift in timber harvesting practices and increased exploitation of juniper, the influence of wood use on changes to human mobility was likely negligible, as both taxa were being procured from locations roughly equidistant to Çatalhöyük.

As with the harvesting of wood for timber and fuel, the acquisition of clay for mudbrick construction is a marker of the impact made by Çatalhöyük's inhabitants on their local environment. Doherty (2013) notes a sharp transition in mudbrick colour occurring in Level South M, with the dark grey mudbrick characteristic of the site's Early period being replaced by more reddish varieties in the Middle and Late periods. This transition in the type of clay used for producing mudbricks has largely been interpreted to be the result of overexploitation of the darker backswamp clays. Continued extraction of these clays led to a situation in which remaining deposits were located too far from the site to allow for practical mudbrick construction or were located in areas primarily used for other activities. The sandier, reddish clays became available once the deposits of darker backswamp clays had been dug through, and from this point forward, they also became the preferred raw material for making mudbricks at Çatalhöyük (Doherty, 2013).

The sourcing of clay in the areas immediately adjacent to the site reflects the fact that, due to their size and weight, it is largely impractical to make mudbricks farther than a few hundred metres from the locations to which they will eventually be transported. Doherty (2013) denotes this as a factor that constrained the sources of clay available to Çatalhöyük's inhabitants. Furthermore, the eventual shift to the reddish varieties that became available after the overexploitation of the darker backswamp varieties precluded any need for increased mobility in association with the production of mudbricks. Both varieties of clay could be extracted from deposits in the immediate area of the site, one after the other. Thus, like the shift in preferred sources of wood, the shift in clays used for making mudbrick likely had little impact on the changes observed in human mobility through time at Çatalhöyük.

While the shifts observed for wood use and clay sources are unlikely to have directly contributed to changes in mobility, a third marker of human–landscape interactions could have played a more substantial role. Phytolith evidence clearly indicates a substantial encroachment of the invasive species *Phragmites australis* (common reed) onto the site during the later phases of occupation, as a corollary of anthropogenic disturbance (Cronk & Fennessy, 2001; Ryan, 2013). One possibility is that the continued extraction of clay by the site's inhabitants, such as that described by Doherty (2013) for the production of mudbricks, created a network of extraction pits and pockets of wetter areas conducive to invasion by wetland plant species (Roberts et al., 2007; Ryan, 2013). Although present throughout the occupation of the site, the quantity of *Phragmites* phytoliths increases dramatically beginning in Level South P, becoming dominant over other categories (sedges and grasses) from South Q onwards (Ryan, 2013).

One major negative impact of *Phragmites* invasion is that the expansion of this species can lead to a significant reduction in plant biodiversity (Silliman & Bertness, 2004). At Çatalhöyük, the substantial increase in *Phragmites* phytoliths coincides with a decrease in the amount of phytoliths from some other species, such as wild panicoid grasses (Ryan, 2013). The impact made by Çatalhöyük's inhabitants on the local environment could have had serious implications for levels of plant biodiversity and land use potential (Butzer, 1982). The distribution of wild plant taxa collected for both food and non-food purposes was altered, either through the overexploitation of these

taxa or the creation of conditions that encouraged *Phragmites* invasion, which in turn likely influenced changes in resource procurement strategies (Ryan, 2013). Of the ecological factors discussed in this section, alterations in wild plant distribution and a reduction in biodiversity are the most likely to have contributed to the increase in human mobility seen during the Late period, by creating a need for the site's residents to forage farther afield for preferred plant resources.

Technology

Just as certain ecological factors could have played a part in altering patterns of human mobility in the Late period, the role of technological factors, including changes in the pottery and chipped stone assemblages, should also be considered. Although the Level South M transition in clay varieties used in the production of mudbricks is unlikely to have impacted human mobility as discussed above, the same cannot be said for shifts in clay sourcing related to pottery production at Çatalhöyük. In their recent work, Doherty and Tarkan (2013) combined field geography and petrographic analysis to gain a deeper understanding of the clay sources and raw materials used in pottery production throughout Çatalhöyük's lengthy occupation.

Petrographic analysis indicates that pottery from Çatalhöyük's Early period was produced using several different varieties of local clays, first the dark backswamp clays and later the silty and sandy varieties. Beginning in Level South M, the proportion of pottery with volcanic mineral fabrics rises dramatically (Doherty & Tarkan, 2013). Clay sourcing analyses indicate that this sharp transition marks a switch to the use of non-local clays, as the volcanic inclusions observed point to source areas in the Erenler Dağ-Alcadağ volcanic uplands at a distance of *c.* 60 km to the west of the site between Beyşehir-Seydişehir and the southern Konya Plain (Temel et al., 1998; Doherty, 2013; Doherty & Tarkan, 2013). Last (2005) has suggested that the transition to gritty, volcanic fabrics reflects a change in pottery function, specifically the use of pottery as cooking vessels. While durable cooking wares would have been difficult to produce using the local backswamp varieties, volcanic clays allowed for stronger fabrics, thinner walls, and better heat transfer properties for cooking (Doherty & Tarkan, 2013).

Although there is a return to the use of local clay sources beginning in Level South R, perhaps corresponding to the period of experimentation suggested by Last (2005), pottery produced from non-local, volcanic clays continued to make up a significant proportion of the assemblage throughout the Late period. Doherty & Tarkan (2013) offer several potential explanations for the relatively sudden arrival of volcanic fabrics at Çatalhöyük in Level South M and their sustained presence throughout the remainder of the site's occupation: (1) the people of Çatalhöyük were travelling to the Erenler Dağ-Alcadağ area to make pottery, (2) they were bringing clays back to site for pottery production, (3) finished pottery made in the region was being transported to the Konya Plain as part of an exchange network, or (4) some combination of the above. Each of these alternative scenarios suggests the need for increasing mobility among the residents of Çatalhöyük in the Late period of the site's occupation, whether that travel be for raw materials, finished products, or maintenance of regional trade relations.

As with changes observed in the pottery assemblage over time, changes seen in the chipped stone assemblage also may have influenced heightened mobility during Çatalhöyük's Late period. Obsidian is the dominant raw material used throughout the occupation of the Neolithic East Mound, despite the closest used sources being located *c.* 190 km to the northeast of the site, in Cappadocia (Carter & Milić, 2013). Through a series of obsidian sourcing studies, Carter et al. (2005, 2006, 2008), Carter and Shackley (2007), and Carter & Milić (2013) have documented major temporal shifts in the raw materials used in chipped stone tool production at Çatalhöyük. Throughout the Early and Middle periods (i.e. through Level South M and North G), the community primarily procured obsidian from the East Göllü Dağ (EGD) source. However, from South N through South P, and also in North H, there is a gradual shift to an increasing reliance on obsidian from the Nenezi Dağ (NNZD) source. Whereas EGD obsidian constituted 90% of the assemblage during the Early and Middle periods, by Level South Q_2 there is a complete reversal in raw material proportions, with NNZD obsidian constituting 90% of the assemblage (Carter & Milić, 2013).

According to Carter & Milić (2013: 434), this shift in raw material preferences is both 'contemporary with, and integrally related to' shifts in the technical practices of obsidian tool production. Beginning in Level South M, pressure-flaked blades first appear at Çatalhöyük, and by South Q_2 their relative proportion in the assemblage has increased dramatically, replacing the lower skilled percussive technologies characteristic of the site's earlier levels. While most of these blades are made of NNZD obsidian, smaller quantities of pressure-flaked blades made from Bingöl and Nemrut Dağ obsidian procured from the Lake Van region, some 650–800 km to the east of the site, are found in the assemblage (Carter & Milić, 2013). This fits both a pattern of an expansion in the range of raw materials used (Carter et al., 2008; Carter & Milić, 2013) and a broadening of the interaction networks in which Çatalhöyük's inhabitants participated.

The obsidian assemblage of Çatalhöyük's Late period is characterized not only by the arrival and adoption of more highly skilled modes of production, but also the emergence of more specialized crafts, such as the working of stone figurines, and their associated toolkits (Carter & Milić, 2013). For instance, the Late period levels include the first examples of locally produced 'Çayönü tools', highly distinctive blades that were used for stone carving in southeastern Anatolia and the northern Levant (Anderson, 1994; Caneva et al., 1994; Özdoğan, 1994). These tools and the changes observed in technical practices discussed above provide evidence for the idea that access to particular raw materials and, perhaps more importantly, access to specialized technical knowledge became more exclusive in the later levels of Çatalhöyük's occupation (Conolly, 1999; Carter & Milić, 2013; Hodder, 2014). With obsidian sources located between 190 and 800 km away from the site, as well as the increasing diversity of raw materials and exclusivity of technical knowledge and blade production over time, the changes observed in the chipped stone assemblage are indicative of, and likely a driving force behind, the broadening interaction networks and need for increased mobility among Çatalhöyük's inhabitants in the Late period.

Subsistence

Beyond the various ecological and technological factors previously discussed, there are a number of subsistence-related factors that likely contributed to the increase in human mobility observed during Çatalhöyük's Late period. In their analysis of the site's faunal remains, Russell et al. (2013) discuss two such factors. First, in the later levels of both the South and North areas, the relative proportion of sheep/goat remains compared to other taxa increases dramatically. The detailed examination of the densities of taxa represented in midden deposits reveals that cattle numbers remain relatively constant between the Middle and Late periods in the South and North areas, while sheep/goat numbers rise sharply. Rather than being a result of the decreased exploitation of other taxa, the increase seen in the proportion of sheep/goat remains is the result of a substantial intensification of caprine herding in the Late period (Russell et al., 2013). Second, multiple lines of evidence, including metrical analysis, sex ratios, mortality profiles from daily consumption contexts, pathologies indicative of nutritional stress, and the emergence of a new male horn type, indicate that morphologically domesticated cattle began to be herded at Çatalhöyük during the Late period, specifically in the later levels of the North area and South P-T (Twiss & Russell, 2009; Russell et al., 2013). In combination, the appearance of domesticated cattle and the intensification of caprine herding would have necessitated expansion of the areas used for herding activities, likely pushing some herds to areas of pasture farther afield and contributing to increased mobility among the groups tending them.

The idea that expansion of the areas used for herding activities occurred in the Late period is supported by analysis of oxygen stable isotopes in sheep. Because oxygen in animal tissue derives mainly from ingested water (Kohn et al., 1998), oxygen isotopes captured during tooth formation reflect both a history of water intake and the seasonal/locational information of water sources associated with herd movement and management (Henton, 2013). Through an isotopic analysis of fifty-eight sheep molars, Henton (2013) shows that the vast majority of Çatalhöyük's sheep were herded year-round on the Konya Plain. This interpretation is further supported through a pilot study of sheep strontium isotopes (Bogaard et al., 2014) and contrasts with that of Roberts and Rosen (2009), in which they inferred that herding activities throughout the site's Neolithic occupation took place away from the site due to heavy spring flooding. The oxygen isotope data do suggest that some sheep were herded year-round away from the Konya Plain in the well-watered, sheltered valleys cutting into the surrounding hills or in tree-fringed hollows, such as on the alluvial fan of the Çarşamba River. However, this shift in herding locations does not occur until the latest levels of the South area sequence, specifically Levels South S and T (Henton, 2013). Such a shift in herding practices would also almost certainly have led to increased mobility among those tending the herds, and in this way could have contributed to the increased human mobility seen in the Late period.

Like the oxygen isotope data, the sheep carbon isotopes are also indicative of an expansion of the areas used for caprine herding in the Late period, as the dietary range broadens so that some sheep have diets dominated by C_3 plants while others have diets dominated by C_4 plants (Pearson et al., 2007). Further analysis has supported this earlier interpretation, as the dietary range of sheep appears to be the broadest in Levels South Q-T, suggesting that herders were moving their flocks over increasingly wider territories and encountering a more diverse range of isotopically distinctive plant communities in the process (Pearson, 2013). With little evidence of herding as a specialist activity at Çatalhöyük, and the oxygen isotope data indicating that the vast majority of herding took place close to the settlement or in nearby outfields (Henton, 2013), it is certainly possible that herding activities were not limited to men, but practised by women and children as well (Beck, 1980). In this way, the

broadened sheep dietary range and the widened landscape upon which caprines were herded in the Late period (Pearson et al., 2007; Pearson, 2013) may have contributed to increased mobility of both males and females.

Social identity

Social and symbolic behaviours in which the people of Çatalhöyük engaged, especially those related to personal adornment, provide some insight into the networks of interaction and exchange in which the site's residents participated. It is worth exploring the shell ornament and stone bead assemblages further to learn more about these networks and their implications for human mobility patterns throughout the site's occupation. At Çatalhöyük, the raw number of shell ornaments derived from marine and fossil species increases through time, but the distribution based on source fluctuates. Bar-Yosef Mayer (2013) notes that all marine shells present at the site originate from the shores of the Mediterranean Sea, with the species *Columbella rustica*, *Nassarius gibbosulus*, *Conus mediterraneus*, and *Antalis* spp. forming approximately 90% of the marine shell assemblage.

The predominance of *Columbella* and *Antalis*, in particular, seems to reflect a continuation of a Paleolithic tradition and connections with the Levant and Eastern Mediterranean, as these are the dominant species found there during the Upper Paleolithic and Epi-Paleolithic periods (Bar-Yosef Mayer, 2005, 2013; Colonese et al., 2011). We previously saw from the analysis of human remains, however, that the degree of mobility at Çatalhöyük appeared to be much lower than that of comparative samples from the European Upper Paleolithic. The Paleolithic nature of this assemblage, then, may be both a general indication of the mobility of Çatalhöyük's residents and an indication of the scale of their interactions with members of other communities located far from the site. The presence of the marine genera *Cerastoderma* and *Cypraea*, although in low numbers at Çatalhöyük, further reflects connections with the Levant, where ornaments made with these shells became more prominent during the PPNB (Bar-Yosef Mayer, 2013).

The fossil shell ornaments can be divided into two main groups based on source location. Fossil gastropod and bivalve shells likely derived from the shallow, marine units of the Karaman-Mut Basin of the Taurus Mountains, whereas fossil scaphopods (also known as *Dentalium* shells) likely came from the Hatay region, which is over 300 km to the southeast of the site (Bar-Yosef Mayer et al., 2010; Bar-Yosef Mayer, 2013). The vast majority of fossil shells at Çatalhöyük were recovered from Middle and Late period levels, although some fossil scaphopods were found in Early period levels. This suggests that contacts with the distant Hatay region existed throughout the site's occupation but intensified with time, as evidenced by the large number of *Dentalium* shells found in the latest levels, particularly in the North area (Bar-Yosef Mayer, 2013). Whereas at least some scaphopods are found in earlier levels, most fossil gastropods and bivalves were recovered from Level South P upwards and in the North area, as well as even later into TP area levels (Bains et al., 2013; Bar-Yosef Mayer, 2013). This suggests that 'expeditions' into the Karaman area, about 50 km away from the site, seem to have developed only in the Late period of Çatalhöyük's occupation (Bar-Yosef Mayer, 2013: 333). These circumstances, then, likely contributed to an increase in mobility during this time.

Compared to the shell ornament assemblage, less is currently known about the specific source areas for the different stones and minerals utilized in stone bead production, which come from a potentially vast number of sources but especially the limestone hills 15–20 km to the north, south, and west of the site (Bains et al., 2013). Nevertheless, like the shell assemblage, the changing composition of the stone bead assemblage has implications for patterns of human mobility. According to Bains et al. (2013), the raw materials used for the production of stone beads from Levels South G to M, corresponding to the Early and Middle periods of Çatalhöyük's occupation, are surprisingly limited. These raw materials, which consist mainly of limestone, marble, serpentinite, steatite, and schist or phyllite, were collected from various sources close to the site and 'could easily be retrieved during a day trip or collected while out shepherding' (Bains et al., 2013: 333).

Although these raw materials continue to be exploited throughout Çatalhöyük's occupation, a marked shift occurs in the Late period, specifically in Levels South P-T and in the North area, as a more diverse array of raw materials come into use (Bains et al., 2013). Preferences for serpentinite and steatite change, with increased emphasis on the green-coloured minerals largely available in outcrops, and beads made of more exotic stones and minerals such as calcite, fluorapatite, carnelian, hematite, travertine, barite, and turquoise increase in frequency (Bains et al., 2013). While some of these raw materials may have been found within a short distance from the site, the sources for others could range from as close as the Erenler Dağ volcanic uplands near Beyşehir to as far away as Antalya or Cappadocia (Bains et al., 2013). The increased use of these raw materials in the production of stone beads, then, would have required travel to distant sources, inclusion within an exchange network of communities with ties to these sources, or both. Each of these scenarios would have contributed to the heightened

mobility seen among the residents of Çatalhöyük during the Late period of the site's occupation.

Conclusions

The present research highlights the complex web of factors that would have influenced the mobility patterns of the people of Çatalhöyük. At one scale of analysis, that of a broader temporal and geographic context, Çatalhöyük can be characterized as a relatively sedentary population, as might be expected for a large, early farming community. At another scale of analysis, that of the local chronology of the site, it becomes clear that even in a relatively sedentary population, people engaged in a wide array of activities, many of which required some degree of mobility, and increasingly so through time. As practices within the community changed over time, so did the mobility patterns of the people who comprised it.

In a recent publication synthesizing a number of the analyses from the most recent phase of the Çatalhöyük Research Project, Hodder (2014) notes that the transition between the Middle and Late period levels of the site is characterized by radical change. Focus shifts from household and neighbourhood continuity and the pooling and sharing of resources to a greater independence of productive units and exchanges of food, hospitality, and goods between individual houses (Hodder, 2014). As households increasingly took charge of their own production of food and material goods, the use of the landscape around the site became more extensive, as indicated through the analyses of sheep isotopes discussed above (Pearson et al., 2007; Henton, 2013; Pearson, 2013). New networks of exchange did not only develop within the community, rather the diversity of material resources found on the site and the distances from which they were procured also increased in the site's later levels, as evidenced by the pottery (Doherty & Tarkan, 2013), chipped stone (Carter & Milić, 2013), shell bead (Bar-Yosef Mayer, 2013), and stone bead datasets (Bains et al., 2013). Heightened degrees of mobility revealed through analyses of the human skeletal remains (Larsen et al., 2013, 2015) suggest these materials travelled to the site through both direct access by the people of Çatalhöyük and through expanding ties within a regional exchange network (Hodder, 2014).

Each of the above factors relating to ecology, technology, subsistence, and social identity shaped the landscapes—physical, social, regional, and local—that the people of Çatalhöyük navigated not only on a daily basis, but in different ways throughout the course of the site's occupation. This finding is underscored especially by the increase in mobility observed in the Late period. Viewed in isolation, many of the datasets discussed in this chapter might appear to be unrelated. The property that unites them is that they all shaped and were shaped by human behaviour. Through the nexus of the human skeletal remains, these disparate datasets have converged to allow for a highly contextualized bioarchaeological analysis of mobility at Çatalhöyük.

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