

Livestock and people in a Middle Chalcolithic settlement: a micromorphological investigation from Tel Tsaf, Israel

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Round and rectangular buildings with grain silos at a Copper Age site in Israel suggested social stratification to the excavators. Using micromorphology, the author demonstrates that while the rectangular building was occupied by people, the round ones had contained animals, perhaps as providers of milk, and dung for fuel. While this removes the direct indication of social variance, it strengthens the argument that animals, as well as grain, formed the basis for the creation of surplus.

Method

Keywords: Levant, Chalcolithic, animal pens, micromorphology, social structure, surplus

Introduction

The relationship between humans and animals is one of the key indicators of changing social and economic structures in human history. As Garfinkel *et al.* note in their recent *Antiquity* article, the first stage in the accumulation of wealth is the production of surplus of grains and livestock (Garfinkel *et al.* 2009). The authors refer to the work of Childe (1950), and place their discussion within the context of surplus facilitating the development of full-time craft specialisation, socio-economic stratification, and the ultimate rise of urbanism. Their article presents a thorough discussion of the potential economic significance of grain silos at the Middle Chalcolithic site of Tel Tsaf, Israel. However, their discussion was not

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able to address the other acknowledged element of surplus accumulation: livestock. New micromorphological evidence presented in this article highlights an interesting distinction between human and animal occupation at the site, furthering our knowledge of the accumulation and distribution of livestock at sites of this kind.

Based on recent radiometric dates, it is believed that Tel Tsaf was occupied between 5200 and 4600 cal BC during the Middle Chalcolithic period (Garfinkel *et al.* 2009). Prior to the 2004–2007 excavations at Tel Tsaf, there had been no large-scale excavations of sites from this period. The Middle Chalcolithic lies between the earlier Wadi Rabah phase (*c.* 5800–5200 cal BC) and the Late Chalcolithic (*c.* 4500–3900 cal BC) (Banning 2007). The Wadi Rabah has been investigated as the period of transition away from early agricultural villages of the Near Eastern Neolithic, while the later or Ghassulian Chalcolithic is largely defined by the extensive excavations at the type site of Teleilat Ghassul (Mallon *et al.* 1934; Koepfel *et al.* 1940; North 1961; Hennessy 1969; Bourke *et al.* 1995, 2000). The later Chalcolithic culture is argued by some to represent the earliest chiefdoms in the region (Levy 1986, 1998; Gal *et al.* 1996), however, there is ongoing debate surrounding the extent of social stratification (Gilead 1988; Bourke 2001; Blackham 2002). The excavations at Tel Tsaf are important in advancing our understanding of the transition towards socio-economic stratification, especially through understanding the accumulation and distribution of surpluses (Childe 1950; Sahlins 1958; Flannery 1969; Cowgill 1975). However, some of the initial interpretations of various structures at the site should be revised in light of micromorphological data collected during the 2006–2007 seasons.

Middle Chalcolithic buildings at Tel Tsaf

Large-scale excavations at the site of Tel Tsaf, Israel, from 2004 to 2007 have revealed well-preserved mud-brick architecture, presenting a variety of forms and raising several important questions about the origins and use of these constructions. The 2006 season uncovered an area of about 400m² that appears to represent two distinct buildings, including rooms and courtyards (Figure 1), that the excavators have assigned to stratigraphic phase 3 (Garfinkel *et al.* 2007b). Unfortunately, the excavations have not revealed the full extent of either building and it cannot be ruled out that each building may have other features not currently exposed. This discussion is based on the current evidence, and only further exposure will be able to endorse or rebut the research presented.

Building I contains a rectangular structure and a number of paved circular features that the excavators interpret as silos (Garfinkel *et al.* 2009). There are also several cooking installations within the courtyard, including roasting pits and ovens. These features do not appear out of place in the southern Levant, with similar evidence from the Wadi Rabah and Chalcolithic periods (Kaplan 1958; Gopher & Gophna 1993; Gopher 1998; Bourke 2001). Although these features warrant further discussion, it is Building II that currently presents the more enigmatic architecture. Two paved circular silo features are present within the courtyard of Building II, in addition to two circular rooms measuring approximately 3–4m in diameter. There are no roasting pits in the courtyard.

The excavators suggest that the combination of rectangular and circular forms is characteristic of the Halafian culture in Mesopotamia and northern Syria and that their

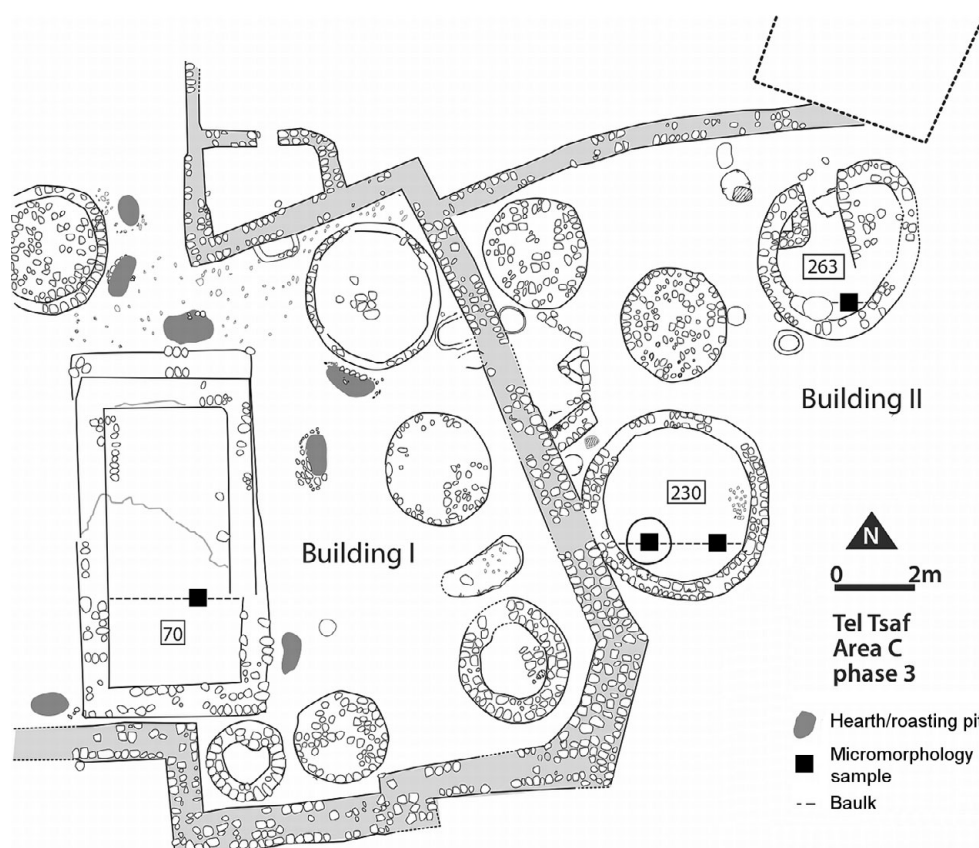


Figure 1. Map of Tel Tsaf phase 3 (after Garfinkel *et al.* 2007a). Building I: the six round features are silos, the roasting pits (dark grey) are spread throughout the courtyard, micromorphology samples (black squares) were collected from the interior of room 70. Building II: two silos are visible, the courtyard lacks roasting pits, micromorphology samples were taken from the interior of rooms 230 and 263.

presence in this later period in the southern Levant may represent a northern influence or perhaps migration of people from that region towards the south (Garfinkel *et al.* 2007a). Despite the variation in the architectural forms and sizes, Garfinkel *et al.* (2009) suggest that Building I and Building II represent distinct households, probably housing one nuclear family each. Furthermore, Garfinkel *et al.* present the hypothesis that the difference in architecture, combined with the difference in the number of silos in each building, indicates a social or class differentiation between the occupants of the two buildings (Garfinkel *et al.* 2007b, 2009).

It is tempting to look to well-excavated, published sites from northern Syria and Mesopotamia such as Tell Sabi Abyad, Arpachiya, Tepe Gawra, Yarim Tepe and Tell Halaf for parallels to the architecture at Tel Tsaf (Aurenche 1981; Merpert & Munchaev 1987; Akkermans & Verhoeven 1995; Verhoeven & Kranendonk 1996). However, a number of difficulties arise. The circular and rectangular buildings at Sabi Abyad are in close proximity, often abutting each other, in contrast to the completely separate courtyards at

Tel Tsaf. In the burned village level at Tell Sabi Abyad, the rectangular buildings range in size from 90–120m² (Verhoeven 1999: 25) while the rectangular structure at Tel Tsaf is significantly smaller at approximately 50m² (Garfinkel *et al.* 2007a: 13). Most importantly, the rectangular buildings at Tell Sabi Abyad, Yarim Tepe and other Halaf-related sites are divided into small compartments and were possibly used, at least in part, as storehouses (Verhoeven & Kranendonk 1996; Verhoeven 1999). In contrast, the rectangular structure (70) in Building I at Tel Tsaf is one large, open room with no internal subdivisions (Garfinkel *et al.* 2007a, 2009). This form is much more similar to the ‘broad room’ houses of the Late Chalcolithic in the southern Levant, as well as to similar buildings of the earlier, local Wadi Rabah culture (Kaplan 1958; Banning 2003). This immediately suggests that Halafian sites do not provide a good analogy for Tel Tsaf.

The circular structures at Tel Tsaf also differ greatly from the Halafian model upon which Garfinkel *et al.* (2007a & b, 2009) have based their interpretations. Not only are the circular structures at Halafian sites closely associated physically with the rectangular buildings, they too often have internal partitions, which is not the case at Tel Tsaf. Despite these differences, Garfinkel *et al.* (2007a & b, 2009) suggest that the open circular structures (230, 263) located in Building II were residential units. The lack of evidence of roasting pits in Building II presents a problem with this interpretation, as it seems unlikely that the dwellings should be physically separated from everyday domestic tasks such as cooking. Garfinkel *et al.* (2009) cite the presence of cooking installations within Building II, but their nature or location is not indicated in any of the publications, while the roasting pits are clearly indicated in Building I (Garfinkel *et al.* 2007a & b, 2009).

Evidence from micromorphology

These problems can be addressed by means of micromorphology samples taken by the author from Tel Tsaf during the 2006 and 2007 seasons. Sampling focused on providing information directly related to the structures on site. Where baulks were not already present, areas were specifically marked out within buildings to allow sampling. Figure 1 indicates where the samples discussed in this paper originated. Rectangular blocks were cut with a knife, removed by hand and wrapped in paper towel and packing tape. The sediment blocks were impregnated under vacuum with clear epoxy resin at Spectrum Petrographics (Vancouver, WA) and cut to 5 × 7cm slides of the standard geological thickness of 30μm. Analysis was conducted using polarising petrographic microscopes at both the University of Toronto, Canada, and the University of Reading, UK.

The unpaved circular features 230 and 263 (Figure 1) were uncovered in Building II during the 2006 season. The baulk transecting the southern portion of 230 bisected a large pit in the floor of the room (feature 346) (Figure 2). The section was approximately 20cm in height from the floor level and presented whitish and orangey-brown layers across the eastern portion of the section. These layers, however, were not visible in the portion of the baulk located over the pit on the west side of the building. The area above the pit appeared to contain four compressed mud levels of the same colour, but with different density to the ‘fill’ levels between.

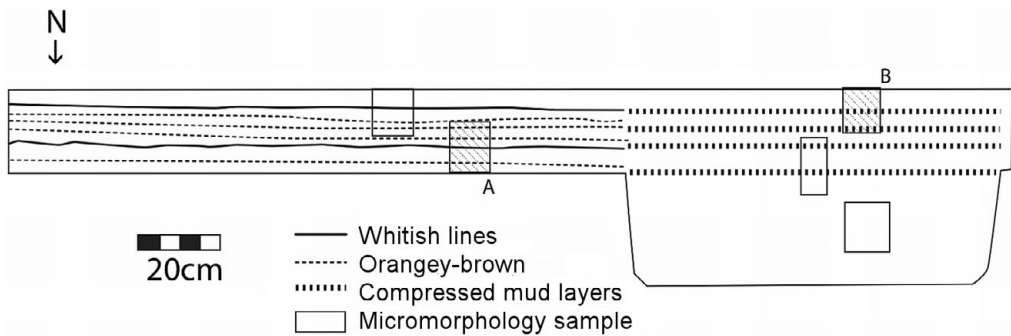


Figure 2. C230 section drawing. The area left of the pit consisted of the main whitish levels, interspersed with orangey-brown levels. While they appear very clean and neat in this drawing, the layers were not as structured or consistent in the section. The section above the pit indicates where the presumed compressed mud layers were located. Micromorphology samples A and B are illustrated in Figure 4.

The micromorphology slides created from the samples taken from above the pit contain unconsolidated fill of sand and silt, mixed with some organic material and charcoal. The compressed mud levels were not immediately distinguishable in the micromorphology slides, and did not represent any significant difference from the rest of the material (Figure 3). All three slides contain small fragments of mud-brick, as well as bone, shell, basalt and flint fragments. The consistency of structure between those slides above and within the defined pit and lack of any correlated orientation for this material confirms that the pit was dug through the layers sampled from the eastern portion of the room. The sloping of the eastern stratigraphy towards the pit also further supports the evidence that the pit was dug through these occupation layers at a later date, rather than being contemporaneous with the lower levels.

The eastern portion of the section revealed at least two distinct, whitish layers that were originally identified during excavation as 'living floors'. These layers were in an orangey-brown matrix, giving the impression of floor and fill levels at the macroscopic level. The whitish layers were not completely continuous, and sloped slightly to the west towards the pit (Figure 2). These levels correspond to a number of light grey, phytolith-rich layers uncovered during excavation of the room. Similar field observations were made during excavations at Tel Dor, with the whitish 'floor' levels later being associated with accumulated fills from likely continuous stabling activity (Shahack-Gross *et al.* 2005; Albert *et al.* 2008). As at Tel Dor, the apparent 'floors' were not plaster, as originally presumed.

The micromorphology of the lower portion of the section revealed layers of reed stems embedded in clusters of dung spherulites, suggesting that the structure housed animals rather than humans (Figure 4). Calcareous dung spherulites form on the intestinal tracks of animals and an association of their presence with intensive animal activity has been established at historic and archaeological sites (Courty *et al.* 1991; Brochier *et al.* 1992; Matthews & Postgate 1994; Canti 1997, 1998, 1999). There is no microscopic evidence of constructed floor levels, the section instead consisting of the organic laminate with interspersed fill

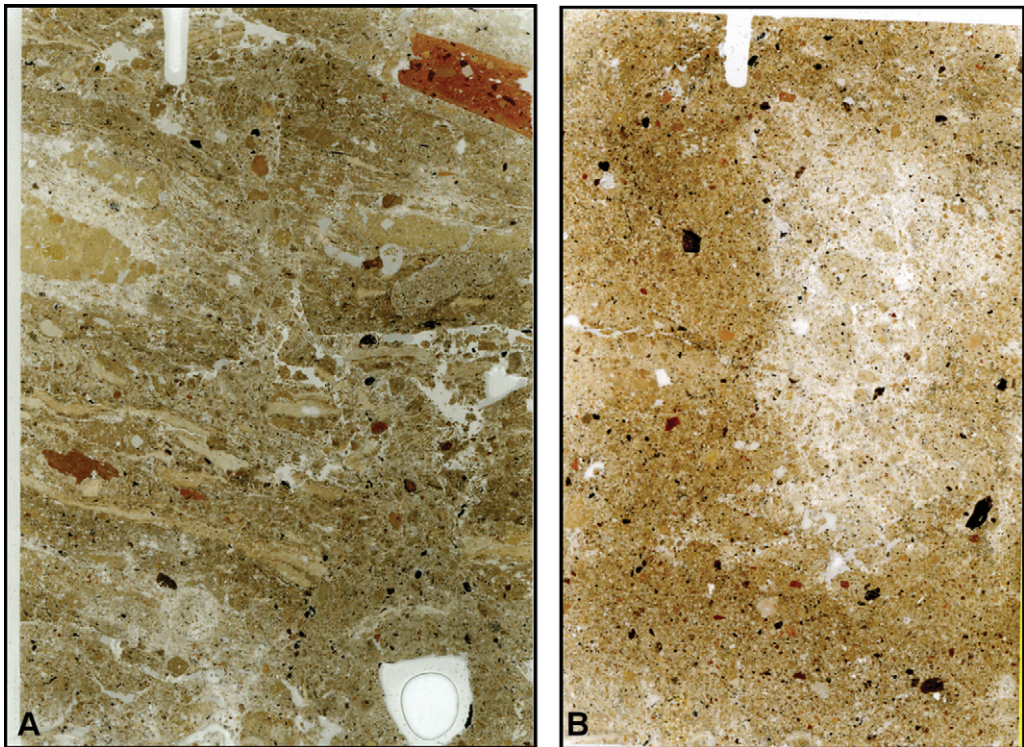


Figure 3. Flatbed scans of the micromorphology slides created from samples A (left) and B (right). Sample A clearly shows the vertically compressed layers visible in the section beside the pit, while sample B highlights the lack of visible layers above the pit (actual slide size: 5×7 cm).

material. The material is *in situ* and vertically compressed with limited post-depositional disturbance and strongly suggests that this area was occupied by animals for a continuous period. It is unclear whether this was the primary or secondary use of this building. It is possible the building was originally constructed with another purpose in mind and later re-used as a pen. However, given the distinctive circular architecture and accumulation of material, the author suggests that room 230 was built to house animals.

A similar baulk was left in the southern portion of room 263 at the beginning of the 2007 excavation season in the hope of finding further evidence to support the correlation between architectural form and function. Two micromorphology slides present features similar to those in room 230, but they are much more disturbed. The slides show greater bioturbation and redeposition of material and no clear stratigraphy was evident in the baulk. The micromorphology did highlight further evidence of redeposited animal dung through the presence of dense concentrations of dung spherulites and some scattered reed phytoliths, in addition to greyish ash with high biofringence, which may indicate melted dung. The slide suggests that room 263 was either intentionally filled with material that included dung and reeds or that it was used as a pen but suffered from greater post-depositional disturbance

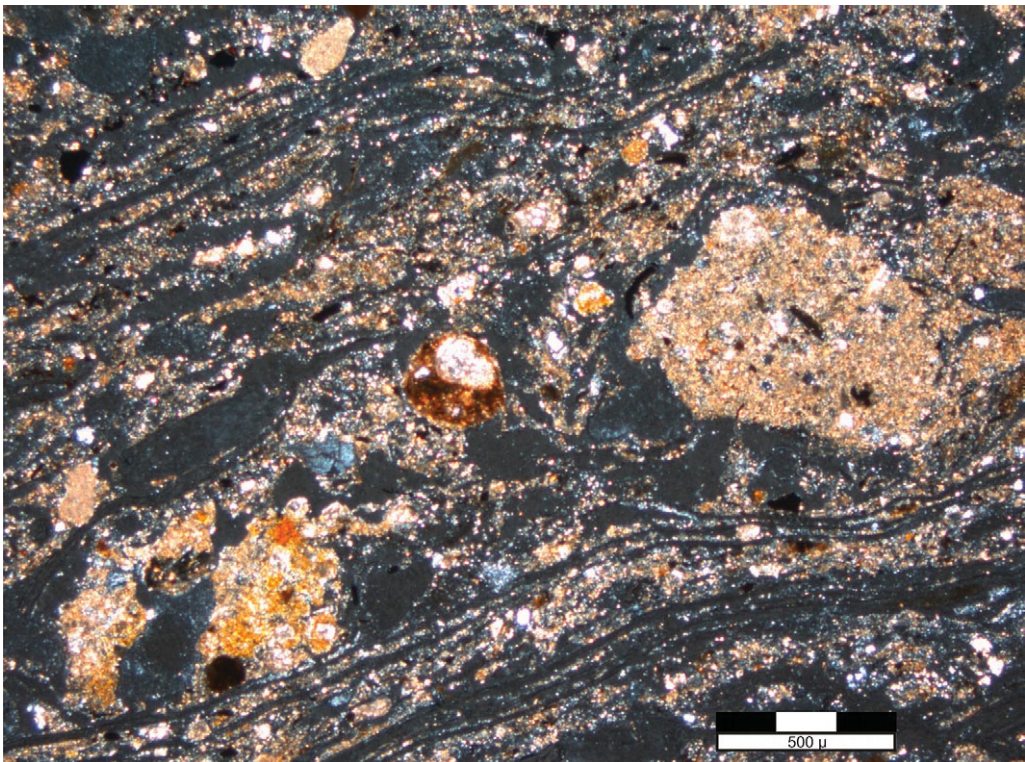


Figure 4. Microscopic view of Building II, room 230. The dark, striated voids represent the reed stem phytoliths. These are embedded in organic material, and while they are not clearly visible at this resolution, there are dung spherulites present. There are few mineral aggregates, and no evidence of a constructed floor surface ($40\times$ XPL).

than room 230. While the evidence is not as conclusive as for room 230, the slides from room 263 do show some indicators of likely animal penning.

In contrast, micromorphology samples from Building I produce completely different evidence, suggesting human use and occupation of the area. Excavations produced a baulk in rectangular room 70 after the 2005 season. The section clearly shows at least three plastered floor levels. Micromorphological data reveals that these levels were constructed of mud rather than lime plaster, but there are clearly oriented plant voids from organic material used as chaff within the floors and evidence of replastering on at least one of the surfaces (Figure 5). They are well-constructed surfaces and indicate that room 70 was likely used for human occupation.

The courtyard in Building I also shows indication of human activity. Micromorphology slides show evidence of roughly constructed surfaces and fill levels. The fill includes charred wood, ash and organic matter, in addition to a number of micro-flint fragments. This pattern of surface and fill repeats at least twice on one 7cm micromorphology slide, indicating that the courtyard was repeatedly used as an outdoor activity area. This is further supported by the presence of the roasting pits, and the lack of evidence of animal habitation such as dung spherulites, that were present in Building II.

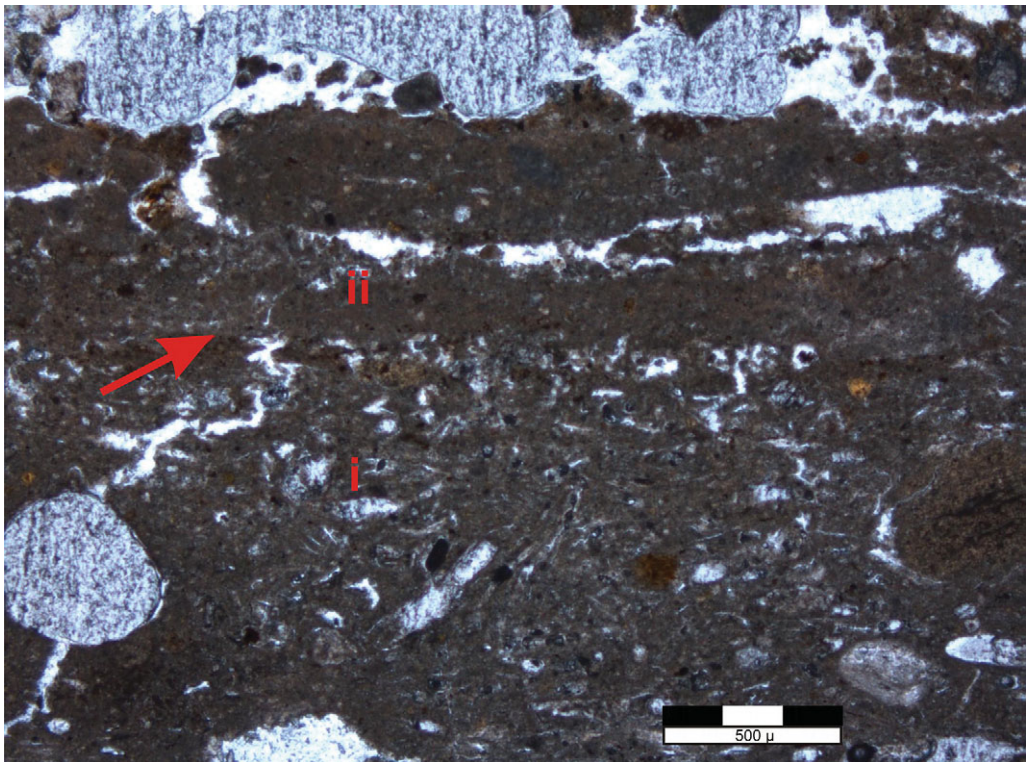


Figure 5. Microscopic view of the mud floor in Building I, room 70. (i) Mud render, plant voids visible, few mineral aggregates; (ii) upper layer of mud render, even finer, few plant voids visible – laid on top of (i). Arrow indicates the division between levels ($40 \times$ PPL).

Discussion

The micromorphological evidence discussed above presents new possibilities to account for the variation in architectural forms at Tel Tsaf. The appearance of both circular and rectangular rooms within discrete courtyards likely represents a separation of human and animal occupation at the site, which may indicate specialisation, but may not, in itself, directly indicate socio-economic stratification. The difference in size and shape of rooms between the courtyards appears to be directly linked to function rather than wealth or prestige. The limited excavation area prevents us from determining to which household or households the animal penning areas belonged, or how they related to the occupants of Building I. However, the evidence suggests that the circular architecture during phase 3 was directly related to animal penning and it is likely that the associated courtyard, bins and silos were associated also with this function.

The circular structures are well constructed from mud-brick, which is the same material used to build the dividing walls, silos and rectangular structure. It appears that mud-brick was economically efficient and the standard building material on site. The use of the same material to build living areas and animal pens may indicate the importance of the animals or

animal products at Tel Tsaf. In addition, the micromorphology is consistent with long-term accumulation of dung rather than pens that were frequently cleaned. The possibility exists that the 'pens' were also used to store dung for fuel. Further analysis of bulk samples of soil from the roasting pits in Building I may provide further evidence of dung as fuel at Tel Tsaf.

The circular structures may also be related to the use of animals for other secondary products, such as milk, yogurt and cheese. Ethnographic evidence supports this hypothesis with numerous examples of small circular structures being associated with modern pastoralist communities and used to separate young animals from their mothers, especially when they wish to limit the suckling of infants (Cribb 1984; Banning & Köhler-Rollefson 1992: 191, 195; Shahack-Gross *et al.* 2003; Palmer *et al.* 2007). Alternatively, Brochier *et al.* (1992) describe pens from Sicily that are designed to confine sheep and goats to facilitate easier milking of the animals. The Sicilian pens are more elaborate, with a slab for supporting the milking bucket as well as vertical stones to protect the bucket. While the dimensions and layout at Tel Tsaf are not identical, the enclosed area, complete with step down, may have been used as a milking area, confining a limited number of animals and allowing easier containment during the process.

Recent evidence has demonstrated that pigs play a significant role in the faunal assemblage at Tel Tsaf (Ben-Shlomo *et al.* 2009). The 2004–2006 assemblage, representing phase 3, contains 28 per cent pig remains. That is significantly less than sheep/goat (45 per cent) but does demonstrate that pig was an important food source at Tel Tsaf (Ben-Shlomo *et al.* 2009). Given this evidence, it is also possible that Building II was used to house pigs, while the sheep and goat grazed off-site.

The rectangular room and associated courtyard in Building I appear to have been used to house human occupants and their domestic activities. This may suggest that livestock were not privately owned or that specialisation was beginning to appear, however, as neither building has been fully excavated, the possibility that animal pens are present in an unexcavated portion of Building I cannot yet be excluded. It is possible that the community practiced a combination of agriculture and seasonal pastoralism, but it is unclear whether Building II was used to house animals all year round, or only seasonally.

Conclusion

It is likely that the appearance of the two main architectural forms was a local phenomenon based on specific intended function related to the local economy. The evidence of a large area devoted to penning animals indicates the importance of livestock within the Tel Tsaf economy. As Garfinkel *et al.* (2009) discussed, the first stage in the accumulation of wealth is surplus. The silos at Tel Tsaf indicate that significant quantities of grain were stored, suggesting not only a surplus but advanced planning. Whether used for meat or secondary production, the animal pens represent similar evidence for surplus or specialisation.

The evidence also raises interesting questions regarding animal management at Tel Tsaf. Unfortunately, it cannot be determined which animals were being housed in Building II, but a few observations can be made. It is generally assumed that sheep and goat are herded and kept off-site. However, at Tel Tsaf it is possible that sheep and goat were kept on-site, perhaps seasonally. The appearance of circular structures similar to modern Bedouin milking

or kidding pens on-site, rather than at herding camps, also raises questions about ancient strategies.

The Chalcolithic period represents the transition from egalitarian villages to stratified towns and eventual cities. The presence of both silos and animal pens at Tel Tsaf offers evidence of this changing economy in the region. As Garfinkel *et al.* (2009) noted, surplus represents the accumulation of wealth, which in turn leads to full-time craft specialisation and socio-economic stratification. Tel Tsaf appears to offer a glimpse of when and how these changes began to take place in the Levant, or at the very least at one specific site. Only further investigation will demonstrate whether Tel Tsaf is typical for the region as a whole.

The micromorphological evidence challenges the assumption that variation in architecture should automatically indicate inequality or variation in wealth or status. While the variation at Tel Tsaf does represent economic functions which suggest specialisation, it is not the architectural forms themselves that provide the most data. In this research geoarchaeological techniques have been used to help strengthen previous suggestions, such as the use of Building I, whilst also presenting a new scenario for consideration. The application of these techniques is becoming increasingly important and beneficial to archaeological exploration. The data from Tel Tsaf highlights the ability of microscopic analysis to offer insights into the use of space by both humans and animals.

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Livestock and people in a Middle Chalcolithic settlement

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