Mice, Scats and Burials: unusual concentrations of microfauna found in human burials at the Neolithic site of Çatalhöyük, Central Anatolia

Three human burials were found at Çatalhöyük that contained large microfaunal assemblages. Taphonomic analysis demonstrated that many of these elements had passed through the digestive tract of a small carnivore, indicating that the microfauna entered the burials in carnivore scats rather than as carcasses. One of the burials in particular (F. 513) contained an enormous quantity of microfauna which was concentrated over the torso of the body. It is concluded that the scats were deliberately placed in the burials by the human inhabitants of the site as part of ritualistic practice. Furthermore, it is suggested that small carnivores were encouraged to enter Çatalhöyük in order to control house mice, and other small mammal, numbers.

Keywords

Microfauna; Çatalhöyük; Neolithic; taphonomy; carnivores; burials; scats; ritual

Introduction

Why should the scats of small carnivores be deliberately placed within a human burial? This appears to have been the practice for at least three burials at Çatalhöyük, providing further evidence of the diverse and complex ritual activity at this site. One of these burials was discovered during Mellaart's excavations in the 1960s; the other two were excavated by Hodder in the first phase of the recent ongoing excavations and provided the opportunity for a detailed taphonomic study.

This paper outlines the main results of the microfaunal analysis of these assemblages and discusses the possible explanations for their presence within human burials. I conclude that these deposits represent a previously unrecognized dimension of burial ritual and belief in the Neolithic of southwest Asia.

The Site

Çatalhöyük is one of the most intensively studied and yet still enigmatic prehistoric sites in the world and is dated to *c*.7400 to 6000 cal BC (Cessford 2001, 2005a). It consists of a dense cluster of rectilinear mud brick structures occupied by early Neolithic farmers on the Konya Plain of Turkey. It is estimated that between 3500 and 8000 people would have inhabited the site at any one time (Cessford 2005b). The majority of buildings have a similar layout, each containing ovens, storage bins, raised platforms and a ladder which provided the means of entering and exiting the building. The site is renowned for its Mother Goddess figurines, wall paintings, and reliefs and sculptures incorporating animal remains.

The dead were buried under the floors of occupied buildings, with some buildings yielding multiple burials. Skeletons with beads and ochre have been found and neonates are frequently buried in baskets. Burials are usually of a fully-fleshed, single individual placed in a flexed position. Sometimes the bodies are buried with grave goods but these are not common. Burials containing pottery have not been found (Andrews 2005).

Dramatic installations incorporating animal remains, and wall reliefs depicting animals, provide the most explicit testimony to the animal symbolism that appears to have pervaded every aspect of human life in this Neolithic settlement (Hodder 2006). The discovery of dense accumulations of microfauna within three human burials, suggests that even the scats of small carnivores may have been imbued with symbolic significance.

The burials

The three burials with high concentrations of microfauna were all excavated from Level VIII, in the South area of the site, which dates from c 6790 to 6460 Cal BC (Cessford et al 2005a). Furthermore, the two burials found in 1999 were both located in the same area, Space 163, Building 6 and were found beneath the floor level in the infilling deposits of the underlying Building, Building 17.

The burial with microfauna found during Mellaart's excavations was of a female and was excavated from a sealed context under a platform in, what was identified by Mellaart, as a shrine (Building VIII.31) (Mellaart 1966, 182; Brothwell 1981). The body was covered in ochre and fibre, leading Mellaart to suggest that the burial incorporated basketry or matting. The microfaunal remains were mixed up in these fibres. Two necklaces had been placed around the neck of the skeleton, one made of beads and perforated deer-teeth, and the other made of beads, with a mother of pearl pendant. Two bone rings and a limestone mace head had also been included in the burial. Mellaart suggests that the grave goods included in this burial imply that the woman may have had some authority or high social standing within the community (Mellaart 1966).

Burial 460 was cut through the floor of Space 63, Building 6 (see Figure 1) and was excavated in 1999. It was comprised of two spaces, the larger space to the East, Space 163, had previously been excavated by Mellaart in the 1960s and was known as Shrine E.-VIII.10, while the narrower ancillary room to the east, Space 173, remained untouched. Space 163 had been inconsistently excavated in the 1960s and although most of the room had been excavated to the infilling horizon of the previous building (Building 17) some features still remained along the north and south walls and the burials underlying the floor remained intact (Farid 2007).

Burial 460 contained the skeleton of a young male adult (4394) (Figure 2) and had a concentration of microfauna (4397) in the burial fill. The skeleton lay on its right side with the head to the south and both hands over the face. The microfauna were visible in the overlying fill deposit and around the skeleton and were described as being in ‘pockets’ rather than a continuous spread. This burial was in an unusually large grave cut and was located in the centre of the building. Some of the microfaunal elements were still articulated (Farid 2007).

Burial 513 was also found under the floor of Space 163, Building 6 during the 1999 excavation season and was a crouched burial of a mature adult female (Figure 2). A black carbon deposit was found within the upper ribs of the skeleton and red ochre was present underneath (Andrews et al 2005). The microfaunal concentration was excavated in four separate units, although it probably represents one depositional event: unit (4614) was the upper burial fill, (4615) was the sediment found within the skull of the skeleton, unit (4619) was the deposit overlying the torso of the skeleton which was orange/brown in colour making it distinct from the other units, and unit (4623) was the lower burial fill.

In addition to these three burials that had large microfaunal concentrations, two more burials were found with smaller microfaunal assemblages. Burial 492 was also found in Space 163, Building 6 in 1999 (Figures 1 and 2) and was a crouched burial of a young decapitated adult male. Lying over most of the skeleton was a large hackberry plank that was part carbonized, part mineralized. The fill of this burial, (4464), had a NISP of 80 and contained the remains of two rodents, one house mouse and one amphibian based on 59% of the total sample. One rodent incisor had a carnivore tooth puncture mark, which measured 0.24 mm.

The second burial with a smaller concentration of microfauna was found in Building 49, in the 4040 area of the site and was excavated in 2008. This contained a young woman and baby (F.4000) and produced a microfaunal assemblage with a NISP of 146 based on the analysis of 161 litres of soil out of 213 litres floated. Rodents are the dominant taxon with both mice (*Mus* sp). and voles (*Microtus guentheri*) remains being found, but snake, weasel (*Mustela nivalis*) and reptile/amphibian elements were also found. 4.8% of elements had tooth gnawing or tooth puncture marks and 0.7% of the bones had signs of digestion.

Digestion is the visible evidence in the form of corrosion and pitting that is found on the skeletal elements of prey as a result of passing through the digestive tract of a predator. The severity of the level of digestion varies according to the predator. Owls generally cause the least digestion to the remains of their prey, while carnivores such as foxes and mongooses cause high levels of digestion (Andrews 1990). The method of consumption of prey also varies according to the predator with owls and diurnal birds of prey regurgitating the undigested portions of their prey such as the bones, fur and feathers in what are known as pellets. In contrast carnivores do not regurgitate their prey but the remains pass completely through the digestive system and are defecated by the carnivore in their faeces or scats.

The microfauna from these assemblages are not included in the main analysis in this paper because the concentrations were not as high as the assemblages from the other three burials.

Method

The microfauna from the recent excavations were recovered in the heavy residue as part of the flotation process, which is undertaken using a SMAP (shell mound archaeological project) flotation machine. The extent to which a unit is sampled during heavy residue sorting varies from 6.25% to 100% depending on the amount of residue produced. Larger excavation units were also sampled again during microfaunal analysis. The percentage of sample for each unit analysed is shown in Table 1. The only unit not machine floated was unit (4619) which was hand floated using a 300 µm mesh.

Taxonomic identifications were made using the comparative collection at the Harrison Institute, Kent. The house mouse (*Mus musculus*) was distinguished from the Macedonian mouse (*Mus macedonicus*) using the methodology of Harrison and Bates (1991); the methodology for taphonomy followed Andrews (1990); and the methodology for identifying incisor and microtine molar digestion followed Fernandez-Jalvo and Andrews (1992). New digestion categories were created for murid molars (Figure 5).

MNI (the Minimum Number of Individuals present in a sample) counts were based on the most abundant cranial element per taxon for micromammals and post-cranial element for amphibians and reptiles. As the fill from Burial 513 was excavated in four separate units, it is possible that some individuals were scattered across multiple units and could have contributed to the MNI of more than one unit, thereby inflating the total.

The relative proportion of elements (RPE) in each concentration was calculated by taking the total number of each element in the sample and dividing it by the number in the skeleton. For example, if there were 48 humeri in a sample the RPE would be 24 (48/2). Symmetry was not taken into account when identifying post-crania. The portions of each element present were accounted for: for example, a distal end of a humerus and a proximal end of humerus would equal one humerus. Only the cranial elements and major limb bones were included in the RPE analysis.

Results

Brothwell (1981) states that the MNI for the Mellaart burial was 76, which was comprised of 75 house mice and a single shrew. MNI results for the two burials with large concentrations of microfauna excavated in 1999 are shown in Table 1 and demonstrates that Burial 460 has a MNI of 71 (unit 4397) while the units from Burial 513 have a combined MNI of 421, which also largely consisted of house mice. Taphonomic analysis produced unusual results with low levels of element breakage and digestive corrosion (e.g. 9% incisor digestion for Burial 460 and a mean of 15% for the units from Burial 513) but with evidence of carnivore gnawing and tooth puncture marks (Figure 3 and Tables 2-4).

Figure 6 shows the RPE of the three assemblages including those from Brothwell's analysis (Brothwell 1981). It is unclear from Brothwell's results whether his tooth analysis included isolated and *in situ* teeth or just isolated teeth. It is also not stated if sediments were routinely sieved for microfaunal remains (Brothwell 1981). Despite these uncertainties, similarities can be seen between the RPE from this burial and from Burials 460 and 513 with cranial elements being better represented than post-cranial ones and lower limb bones more abundant than upper elements.

Discussion

Which predator was responsible for the production of these microfaunal assemblages?

Such large concentrations of microfauna rarely build up accidentally and are usually accumulated by a predator such as an owl, diurnal bird of prey or small mammalian carnivore (Andrews 1990). This hypothesis is supported by the presence of digestion, gnawing and puncture marks on many of the elements found in these assemblages. Usually the species, or general identity of the predator, can be analogously identified by comparing the species composition and taphonomic patterns of the archaeological assemblage with those from known modern predator assemblages (Andrews 1990). In this instance, however, identifying the predator is problematic because it does not compare well with the taphonomic patterns for any known predator.

The digestion and breakage levels are typical of a predator that causes little modification to the remains of its prey, such as a barn owl, but this does not account for the gnawing and tooth puncture marks, which indicate that a carnivore played a role in the taphonomic history of, at least, the microfauna from the burials found in 1999 (Andrews and Nesbit Evans 1983; Andrews 1990).

If the agent of accumulation is assumed to be a carnivore then what possibilities are there based on the carnivores found in the macrofaunal assemblage? Dogs, foxes, wildcats, polecats, badgers, weasels, reptiles and snakes are all found at Çatalhöyük, although it would appear that the wildcats are brought in as skins (Russell and Martin 2005). All of the puncture marks found on the microfaunal elements are small, with a mean width of 0.48 mm (*N*=196, see Table 3). This suggests that a small-toothed predator caused these puncture marks and is a finding that is consistent throughout the whole of the Çatalhöyük microfaunal assemblage and is not just typical of the burial assemblages.

The potential predator with the smallest teeth would be a reptile but it has been demonstrated that reptilian predators cause very high levels of breakage and digestion to the bones of their prey. Some species of snake can swallow their prey whole, but analysis shows that their scats are largely devoid of bone, presumably because of the severity of their digestive systems (Blain and Campbell 1942; Fitch and Twining 1946).

Similarly, mustelids cause higher levels of digestion and breakage than are found in the Çatalhöyük assemblages. Andrews and Nesbit Evans (1983) analysed scat assemblages from three different types of mustelid, the weasel

(Mustela nivalis), the stoat *(Mustela erminea)* and the polecat *(Mustela putorius)*. They found that all of the elements showed signs of digestion and that most of the bones were broken to such an extent that identification to element was impossible. This research is supported by the work of Day (1968) who analysed the contents of the stomach and intestinal content of a number of weasels and stoats and found that only the hair and feathers of the prey were recovered. Larger species of mammalian carnivores such as felids and canids also cause much higher levels of digestion and breakage than is found in the assemblages from these three burials and would be expected to cause larger puncture marks (Andrews and Nesbit-Evans 1983; Andrews 1990).

Another possible predator is of course humans. Human coprolites have been found at the site (Shillito et al 2011) and there are archaeological instances where microfauna have been hunted and consumed by humans. For example, at Blombos Cave, South Africa, the remains of mole-rats (*Bathyergus suillus)* were found that have a distinctive charring pattern, similar to that observed on the remains of modern day mole-rats processed for human consumption (Henshilwood 1997). In addition, Weissbrod *et al* (2005) suggest that the Natufian inhabitants of el-Wad Terrace, Mount Carmel, ate mole-rats. This is based on evidence of age distributions, charring, rodent gnaw marks (presumably scavenged after human consummation and discard), completeness of tooth representation and breakage patterns (Weissbrod *et al* 2005).

Modern examples of small mammal bones being pulverised for soup have been found amongst native American Indians. This activity results in a high concentration of small unidentifiable fragments, which may be recovered in the flotation process (Kroeber 1925, 814). Small mammals are an important part of the diet of hunters in Malawi who will frequently trap small mammals and even dig them out of their burrows, an activity that can often be labour intensive and time consuming (Morris 2000).

Crandall and Stahl (1995) conducted an experiment whereby a skinned, eviscerated, and segmented insectivore (*Blarina brevicauda*) was swallowed, without mastication, by an adult male. Their results showed that despite the lack of mastication the level of damage to the insectivore skeleton was high (Crandall & Sthall 1995). Generally, the level of modification caused by humans to an unmasticated insectivore exceeded the level of modification caused by small mammalian carnivores and this is without taking into account the additional effects that processing and mastication may have on the remains (Crandall & Stahl 1995).

It would seem unlikely that the microfauna found in the burials were from human coprolites. This is because one might expect to see evidence of processing on the bones. For example, there may be cut marks, charring and the assemblage may be dominated by certain meat-rich elements. In addition, the puncture marks found on the bones were smaller than one would expect to be made by human teeth.

It is clear from the above discussion that further research is needed to identify potential variables that could have caused such differences in the taphonomy of the Çatalhöyük assemblages to known predator scat assemblages. It is possible that the Çatalhöyük elements are less fragmented than those from modern small carnivore assemblages because the elements in these samples are from small microfaunal species, such as mice, rather than large microfaunal species such as voles. As a result, it may not have been necessary for the small carnivores to chew these remains thoroughly before consumption. In addition, the majority of the teeth in the Çatalhöyük assemblages are murid (rats, mice, and gerbils), and, due to their morphology, murid molars are less susceptible to digestion than are microtine (vole) molars (Williams 2001; 2005). Finally, there may have been an abundance of mice in and around the site. It is difficult to assess if this was the case because while the concentrations discussed here are large, the overall level of microfauna found in most units is low. If there was an abundance of suitable prey for small carnivores to predate, the level of digestion on the microfauna is likely to be lowered because the rate of digestion is directly proportional to the amount of time spent in the predator's stomach (Andrews and Nesbit Evans 1983).

How did the microfauna become incorporated into the burials?

There are a number of possibilities for the incorporation of microfauna within these burials, some of which do not take into account the theory that the microfauna came from carnivore scats rather than being incorporated into the burial fills as carcasses. All possible scenarios, along with their level of likelihood will be discussed in this section:

1) An owl roosted above the burials and deposited scats within them.

All evidence suggests that the burial cuts were dug, the bodies deposited, and the burials immediately backfilled using the same material that was originally removed to create the cuts. This is evident by a comparison of the composition and make-up of the burial fill and the underlying room fill, which found that the lithics, the clay ball assemblages, and the botanical remains in the two deposits were identical. There are no visible signs that the burials were left open, for example in the form of slumping of the cuts (Farid 2007).

Barn owls (the species most likely to live in close proximity to humans) consume on average 94g of prey per day and regurgitate about 1.4 pellets per day (Mikkola 1992). An adult house mouse weights approximately 15.2g (MacDonald and Barrett 1993). Therefore, a barn owl would have to eat approximately 6 house mice per day to fulfil its dietary requirements. The total MNI for the assemblages found in Burial 513 is 421 based on an average of 73% of the available sample. If one multiplies this up to represent the MNI expected if 100% of the sample had been analysed a figure of 577 is reached. Obviously this is a very crude calculation but does provide some idea of the approximate total MNI. Therefore, if a barn owl eats six mice per day the assemblage found in Burial 513 represents an accumulation of a size that would be expected for a period of 96 days.

It is impossible to determine if a burial left open within a building for approximately three months would show signs of slumping in the cut because we do not know all the variables, for example the condition the roof was in, the time of year in which the supposed abandonment occurred, and the levels of precipitation and temperature.

However, even if slumping were not visible, owl predation would not account for the presence of gnawing and tooth puncture marks on some of the bones found in the assemblage, which indicates that a carnivore had a role in the taphonomic history of these assemblages.

Furthermore, it is archaeologically quite clear when buildings at Çatalhöyük are left open or abandoned prior to infilling. Experience of fifteen years of excavation has shown that the house closure / abandonment sequence is planned and managed and nothing is accidental. Houses are closed and infilled with crushed rubble from the upper portion of the house. This is a continuous event, often mapping the ground plan of the new building whilst closing the old. Buildings that are abandoned show signatures of slow collapse and falling into ruin before being transformed into midden areas (Farid Pers Comm. 2012). Building 6 did show any sign of being abandoned.

2) The burials acted as pit fall traps for microfauna whose remains were subsequently scavenged upon by small carnivores. If these burials had acted as pit fall traps they would have had to have been left open for a considerable amount of time. It is difficult to estimate how long it would take for this number of small mammals to have fallen into the burial because the variables differ from one situation to the next. However, they would probably have had to have been left open for months if not years for this number of individuals to have accumulated. This probably would have been long enough for slumping of the burial cut to have occurred even within the building and for archaeological evidence of building abandonment t to be visible, which, as stated above, was not visible found during excavation.

Furthermore, there were no signs of disturbance, gnawing or weathering on the human remains. If mice were trapped within the burials one would expect them to take advantage of the human flesh if the bodies were not skeletonised. If, however, the bodies were skeletonised disturbance of the skeletal elements, particularly smaller ones such as the phalanges, would be expected. In neither burial was there any sign of gnawing on the bones or extensive disturbance of the elements.

In addition, the small carnivores, and probably even the mice, would have been capable of jumping or climbing out of these burials; the cut for Burial 460, is believed to have been in excess of 80 cm but it was gently sloping on the east side and stepped and uneven on the west side while Burial 513 was only 0.35 m deep (Farid 2007).

3) The burials may have been used as latrinal areas by small carnivores. In this way it is possible for accumulations of microfauna that were present in the scats to build up (MacDonald & Barrett 1993). This would, however, mean that Building 6 would have had to have been abandoned for some time for this density of microfauna to accumulate, which, based on all other forms of archaeological evidence described above, does not appear to have occurred, nor, as stated above, do the bodies appear to have been extensively disturbed (Andrews 2005; Farid 2007).

4) The burials may have been used as dens by small carnivores. It is documented that large numbers of scats can build up in mustelid den sites (Sleeman 1989). Weasels and wildcats do not excavate their own dens but take over those of other creatures while foxes and polecats will dig their own den if nothing else is available (Harris & White 1994; MacDonald & Barrett 1993; Sleeman 1989). The main arguments against this is that there were no signs of disturbance or burrowing in the burial cuts, which were specifically looked for by the archaeologist during excavation and are often found at Çatalhöyük, nor, as stated above, were there any signs of gnawing on or disturbance to the skeletons themselves. Also, as previously discussed, the burials do not appear to have been left open and archaeological evidence suggests that the building was not abandoned (Farid 2007).

5) The microfauna burrowed into the burials. Burrowing activity has been identified in some units at Çatalhöyük, but, as already discussed, the excavators did not see any signs of burrowing in these cuts, as should have been evident if a creature the size of a small carnivore burrowed into them (Farid 2007). The presence of digestion and tooth puncture marks on the remains of some elements also makes this explanation improbable. These marks demonstrate that the microfauna did not enter the burial as live animals but had already been through the digestive tract of a predator.

6) The burials were used by a small carnivore to cache food. Small carnivores frequently store food to eat at a later time. This behaviour has been observed with red fox, and various species of mustelid who will cache between 30 and 50 small mammals when they are in abundance. There is one account of a stoat in New York that hunted tagged voles that were part of a study. It took over a vole nest, lined it with fur, killed over half the tagged voles in the study and took them back to its nest (Madison 1984). There is another report of a stoat who cached 150 lemmings under a rock and there are even records of polecats caching live toads and frogs and storing them in underground chambers (King & Powell 2007; MacDonald & Barrett 1993; Sleeman 1989).

For this to have been the method of accumulation in the burials, they would either have had to have been left open, or the small carnivore would have had to have burrowed in and for the reasons outlined above this seems improbable. Furthermore, this does not account for the presence of digestion on the microfaunal elements.

7) The microfaunal assemblages were incorporated into the material used to backfill the burial. As stated above a comparison of the underlying room fill for Space 163 (the space in which Burial 460 and Burial 513 were found) and for the fills in Burials 460 and 513 was conducted, which showed that the lithics, the clay ball assemblages, and the botanical remains found in the two deposits were identical, indicating that the burial fills were excavated from the under-lying room deposit rather than being floor surface debris. The only difference between the burial fills and the under-lying room deposit were the microfaunal concentrations (Farid 2007).

8) These burials could have been used as a deliberate dumping location for the scats. This is possible but does not fit with the typical pattern of behaviour encountered at Çatalhöyük. Burials are not used as rubbish dumps, there are specific midden areas for this purpose. Also, it would seem unlikely that people would take the trouble to adorn the bodies with jewellery and incorporate other grave goods such as matting if the burials were going to be used to dump rubbish.

9) Carnivore scats incorporating microfauna were deliberately placed in the burials. This hypothesis is offered largely because of the inability of the other theories to account for these assemblages, particularly, the dense concentration of microfauna, unit (4619), over the torso of Burial 513.
A comparison of the MNI per litre of sediment excavated for all of the units from this burial demonstrates that the assemblage from unit (4619) had the greatest density of microfauna with a MNI per litre of 61.9 (Table 1). This is consistent with the excavator's observation that the concentration of microfauna found over the torso of the skeleton was exceptional. If the MNI for all of the units from Burial 513 are combined the total MNI is 421 based on a mean of 73% of the total sample. As stated above, when one combines MNIs it is likely that the total is inflated based on the premise that some individuals may have been counted over more than one unit. However, if this calculation is taken as a rough estimate it can be concluded that a great number of small vertebrates were

incorporated into Burial 513, 190 of which were restricted to the torso of the skeleton. Such a density of scats over the torso is difficult to explain using accidental deposition and suggests deliberate placement by humans. An artist's reconstruction of this burial event can be seen in Figure 4.

Mellaart does not note any burials, other than the one described, with microfauna being uncovered during his excavations (Mellaart 1962; 1963; 1964 and 1966). Nor do any of the other 420 burials found to date during the Hodder excavations, have concentrations of microfauna within them. Mellaart believes that these small mammal remains did not become incorporated into the burial by accident but were deliberately placed there. He goes as far as to suggest that due to the lack of certain elements such as vertebrae, ribs, scapulae and pes that these mice may have been used as a personal adornment and puts forward the theory that the mice may have been turned inside-out and used as small purses that were attached to the body with a belt (Mellaart 1966; Brothwell 1981).

Why put scats in human burials?

The presence of digestion and gnawing, as well as the orange tinge to the sediment that is indicative of organic matter, is a further indication that the microfauna were in scat rather than carcass form. The two most convincing explanations for the microfauna in the burials is either that all three burials were used as den sites by small carnivores or that the scats were deliberately placed there by humans.

There are, however, four main arguments against the burials being used as den sites: 1) there are no evident burrow marks in the burial cuts, which are found in other units at Çatalhöyük; 2) the burials were relatively undisturbed; 3) it is coincidental that the three burials are the only carnivore den sites found at the site; 4) this does not account for the exceptional density of microfauna over the torso in Burial 513. Therefore, I suggest that the scats were placed there by humans.

The scats may have served a functional purpose and could have been used as a type of preservative for the bodies. In the Medieval and post-Medieval periods, faeces were often mixed with urine and used as tanning solutions and the scats in these three burials may reflect a similar practice (Denison 1998). It could have been that these three individuals were highly regarded in their society and their descendants wished to preserve their bodies for as long as possible or that the scats were used as markers of skills that the dead had shown as tanners while living. If this was the case one would imagine that scats or dung from larger animals species such as cattle or sheep would have been selected for this purpose.

Scats may also have been used in the past for medicinal use. In Medieval times it was believed that all parts of the cat, excluding the brains but including their scats, could be used in this way (Bobis 2000). Similarly, there is modern evidence from Mozambique that elephant scats are used as a medicine for many illnesses (De Boer & Baquete 1998).

Another interpretation is that the placement of scats could have been motivated by a feeling of dislike or hatred of the dead. Other indicators however, such as the incorporation of grave goods, suggests that this was unlikely and that contrary to this, the individuals buried were held in high regard.

An alternative theory is that the inhabitants of Çatalhöyük may have practised pest control and encouraged small carnivores to enter the site to predate upon rodents in an attempt to limit populations. The individuals found in these burials may have been responsible for monitoring this activity. These concentrations of microfauna demonstrate that house mice, and other small mammals, were to be found in or around Çatalhöyük, though it is hard to establish how dense these populations were because the majority of units at the site have low but consistent levels of microfauna.

Evidence from Building 52, which was a burnt building found in the 4040 area of the site, suggest that small mammals did scavenge on stored food at Çatalhöyük. As a result of the burning, this building had remarkable organic preservation and allowed an in depth analysis of three storage bins that were found in the north-east part of the building. Botanical evidence indicates that the bins were used to store cereal grains, almonds, peas, wild mustard and a variety of wild seeds (see Bogaard 2009; Twiss 2009), while the pea concentration and the surrounding deposits contained charred mouse pellets (Twiss et al. 2009).

The majority of microfaunal elements analysed were found in these storage bins and displayed no signs of digestion or gnawing suggesting that these individuals died natural deaths or were burnt by the fire. This discovery of *in situ* dead rodents and pellets in the bins in Building 52 provides the first direct evidence of rodents infesting food storage areas at Çatalhöyük. This highlights the challenge of storing food in an early agricultural community where a food surplus would have been essential insurance against crop failure.

This occurrence of rodents, particularly mice, within the units associated with food storage is unsurprising. One would imagine that Çatalhöyük would have been a haven for small mammals, particularly the commensal house mouse; it would have presented them with excellent scavenging opportunities in the form of stored food and refuse, it would also have provided shelter (the walls and roofs of the houses would have been ideal hideaways), and it would have minimised competition with other small mammal taxa.

Mice populations can increase in number very quickly. Mice by evolution are r-selecting, which means that they breed frequently and have lots of offspring. Litters typically contain five to ten young and one breeding pair of mice and their offspring have the potential to produce 500 mice in just 21 weeks (MacDonald & Fenn 1994). Such an infestation would have been disastrous for an agricultural community, who would have had to store food reserves in order to sustain them through the winter, and it seems probable that some form of pest control would have been necessary.

Indeed, there is evidence that ancient Egyptians kept weasels before they had domesticated cats, in order to control the number of rodents in their settlements.

In some parts of modern Egypt, weasels are encouraged to occupy houses to such an extent that they have been described as "almost completely commensal" (Osborn & Helmy 1980, 409).

Weasels were found in the faunal assemblage from Pompeii and Powell (forthcoming) argues that due to the urban nature of the site, it would have been an unlikely habitat for wild weasels and suggests that weasels were kept by the inhabitants and used for pest control. This interpretation is supported by the presence of house mouse and other rodent bones in the assemblage and the discovery of a house mouse pelvis with puncture marks (Powell forthcoming).

In more recent times, the first professional rodent exterminator in New York city, Walter "sure Pop" Isaacsen, used ferrets (a domesticated Mustelid) that he bred himself on a farm in the countryside to help catch rodents (Sullivan 2005, 97). Further evidence of relationships between humans and weasels can be found in reports of fur trappers from North America who sometimes shared their camps with weasels (King & Powell 2007, 6). Not only would weasels have been useful for pest control but they would have been a good source of fur after death.

The encouragement of predators into settlements during the Neolithic period is not without precedent. A cat (*Felis silvestris*) burial was found in close proximity to a human at the Neolithic site of Shillourokambos, Cyprus, which dates to 9500 to 9200 BP. The excavators argue that cats may have had special status in Neolithic societies in southwest Asia and that the burial may provide evidence for the taming of cats, which were used to control the mice attracted by grain storage (Vigne et al. 2004).

Animals in ritual at Çatalhöyük

We know from reliefs, sculptures and mobiliary art that animals played an important role in the ritual life at Çatalhöyük and scats may have been viewed in a positive rather than a negative way. Although it is frequently 'wild' animals that were depicted in the reliefs and sculptures at Çatalhöyük, the only human burial found with an animal was from Level VII and was of a human with a lamb (Russell & Düring 2006). This demonstrates that although the inhabitants of Çatalhöyük may have had great respect for wild animals they had the most intimate relationships with the tamer, less threatening animals, which were common in and around the site. In this way, the burial of the three individuals with scats could demonstrate that the individuals in question may have had a special relationship with the producer of the scats that protected the inhabitants from the unwanted nuisance of house mice infestation.

Weasel and fox skulls were found plastered into the walls of Shrine VII, 21 during the Mellaart excavations. The fox skull was placed above the weasel skull and both had been covered in plaster. Mellaart believed that these 'protuberances' represented breasts (Mellaart 1964). This interpretation is debatable but it is significant that other forms of evidence suggest that small carnivores appeared to have a symbolic or ritual role at Çatalhöyük.

Examples of other burials with remains of scats/pellets and animal remains

This is not an isolated example of small mammal bones being found in human burials. A burial containing a female skeleton that became known as 'Cille Phedair Kate' was found on South Uist, Hebrides and was dated to *c*700 AD. This burial was found in a cairn and was devoid of grave goods except for a small pebble that had been placed over the groin and mice bones with digestion were found in the burial fill. The excavators attribute the digestion to owls and suggest that the grave was left open for some time, possibly with "a loose arrangement of slabs on top" and that an owl had roosted on these slabs (Parker-Pearson *et al* 2004: 117-119).

Another example of pellets being found in burials is a Beaker period burial found at Bredon Hill in Worcestershire. A central pit was found beneath a barrow that contained the remains of two individuals, a male and a female. Within the skull of the female a single pellet was found which was identified as being either from a buzzard or a kite. The excavator suggests that the corpse was exposed for a short time prior to burial and that the pellet had become incorporated into the fill. They further propose that the body had been decapitated, the brain removed and the pellet had worked its way into the skull through the foramen magnum (Thomas 1965).

In addition, an unusual human burial of an elderly female containing much faunal material, including the skulls of two stone martens (*Martes foina*), which appear to have been buried with the fur in place, was found at the Natufian site of Hilazon Tachtit. Found within the burial fill were: over fifty complete tortoise shells and tortoise limb bones from the Mediterranean spurthighed tortoise (*Testudo graeca*); wing bones from a golden eagle (*Aquila chrysaetos*); articulated vertebrae from the tail of an aurochs (*Bos primigenius*), the pelvis of a leopard (*Panthera pardus*), the radius and ulna of a wild boar (*Sus scrofa*) and finally a male gazelle horn core (*Gazella gazella*). In addition to the faunal material the burial contained a complete human foot, which did not belong to the buried individual (Grosman *et al* 2008). The presence of the two marten skulls in this burial demonstrates that in the Natufian of the Levant mustelids held some specific ritual significance. Such an unusual burial has led (Grosman *et al* 2008) to suggest that this may be the burial of a shaman.

Conclusion

The discovery of concentrations of microfauna deriving from carnivore scats, which appear to have been deliberately placed in human burials, gives us a unique insight into a previously unknown burial practice at Çatalhöyük, adding a new dimension to our understanding of human/animal relations at the site.

Past research on this topic has been focused on the symbolism of the animals represented in the wall art and installations, and art objects. The wall art and installations frequently consist of wild/dangerous animals such as cattle and leopards, while wild boar tusks are used to make necklaces (Russell & Meece 2005; Hodder 2006). The discovery, however, of these unique burials demonstrates that it is not only the wild/threatening animals that hold symbolic significance for the inhabitants of Çatalhöyük but the less threatening animals may also have been imbued with symbolic significance, albeit in a more subtle and intimate way.

It has been proposed in this paper that house mice and other small mammals may have been a threat to stored food at the site and that carnivores could have been encouraged to enter the site in order to keep small mammal numbers under control. If this was the case the carnivores would have been viewed not as a nuisance, but as welcome intruders who were vital for helping protect stored food reserves from scavenging by small mammals. This theory is supported by the discovery of small mammal remains that appear to represent in situ deaths by burning in Building 52 as well as small mammal pellets. These were recovered from the fills of three food storage bins in Space 93 of the building and demonstrate that small mammals did take advantage of the scavenging opportunities presented by stored food at Çatalhöyük.

It is unfortunate that to date we have not been able to identify the carnivore responsible for the production of these scats using the microfaunal elements alone. This is because the patterns of digestion and breakage found on the assemblages do not match analysis conducted on modern carnivore scat assemblages. The size of the puncture marks, however, suggests that the carnivore in question was quite small, possibly a weasel. Recent advances in scientific analysis, such as the work of Shillito et al (2011) on the use of Gas chromatography–mass spectrometry (GC-MS) and thin section micromorphology to identify faecal material provides confidence that if further burials with microfauna are found this issue could potentially be resolved.

This problem, however, does not detract from the fact that these burials are not only interesting but unique, with nothing quite like them being reported from any other site in the world. It is now hoped that further burials with microfauna will be found which will help answer some of the remaining questions.

Word Count: 7101

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Captions

Figure 1 Plan of Building 6 showing the location of Burials 460, 492 and 513 (courtesy of the Çatalhöyük project)

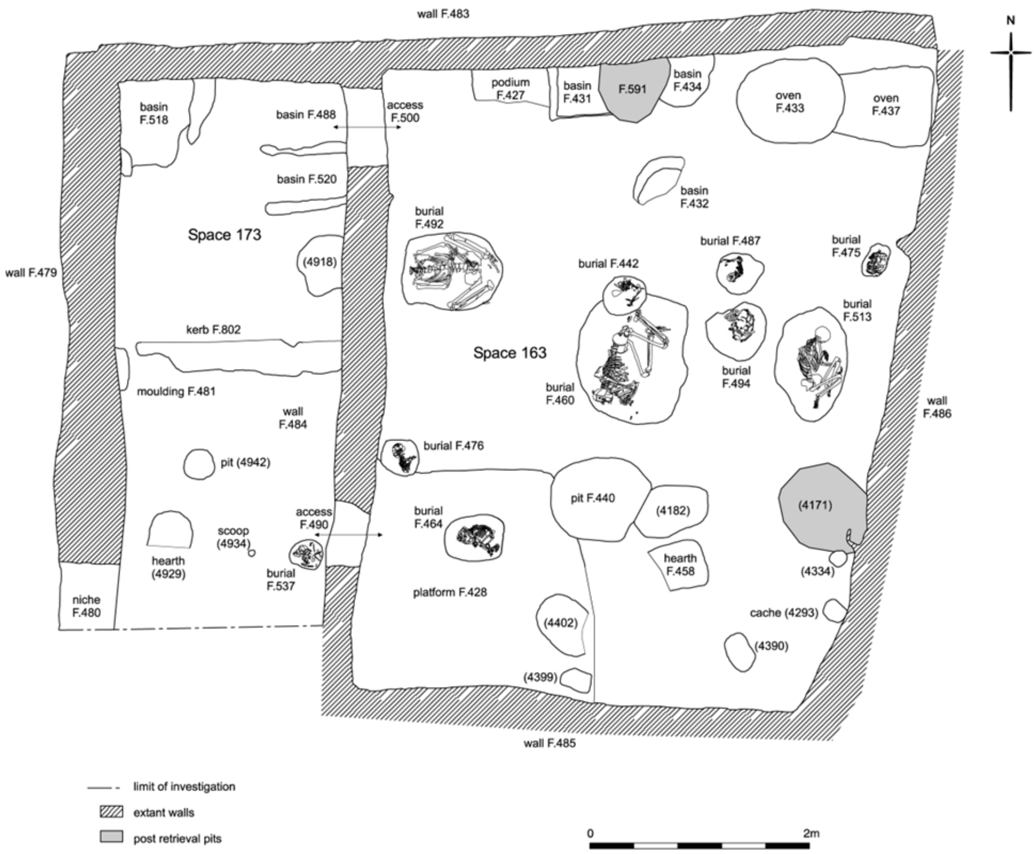
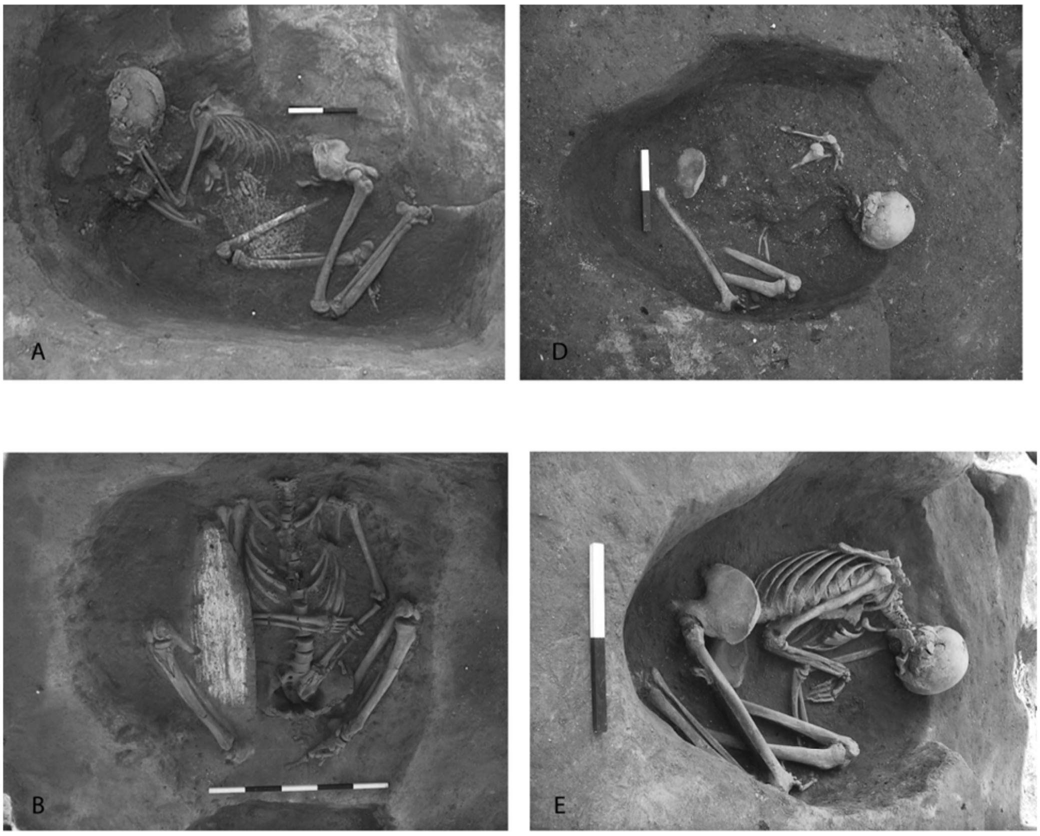


Figure 2. Images of the burials with microfauna (courtesy of the Çatalhöyük project)



A Burial 460 after excavation of fill

B Burial 492 after removal of the uppermost part of the hackberry board

C Burial 492 before removal of hackberry board

D Burial 513 under excavation

E Burial 513 after excavation of fill

Figure 3 SEM micrographs showing elements with digestion from Burial 513: A) Upper *Mus* sp. molar with extreme digestion from unit (4623); B) *Mus* sp. mandible with extreme digestion on the M_1 and surface alteration on the bone surface from unit (4623); C) Isolated lower *Mus* sp. Molar with heavy digestion: D) Upper isolated rodent incisor with extreme digestion from unit (4619); E) Rodent maxilla with puncture marks from unit 4619; F) Isolated upper *Mus* sp. incisor with puncture mark; G) Rodent maxilla with puncture mark from unit (4619); H) Murine mandible with puncture marks from unit (4619)

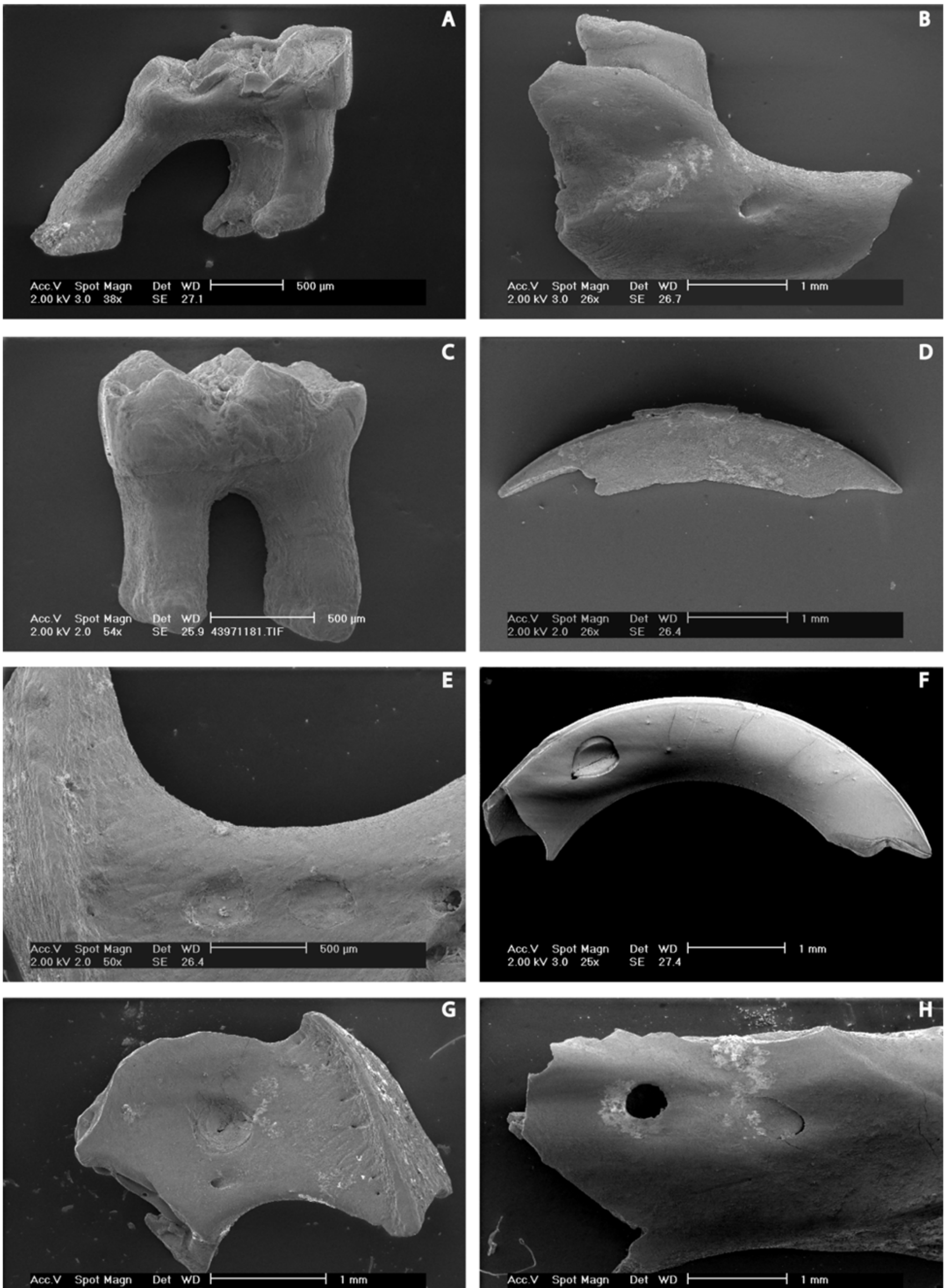


Figure 4 A Plan of Burial 513 showing unit (4619) overlying the torso (courtesy of the Çatalhöyük project)

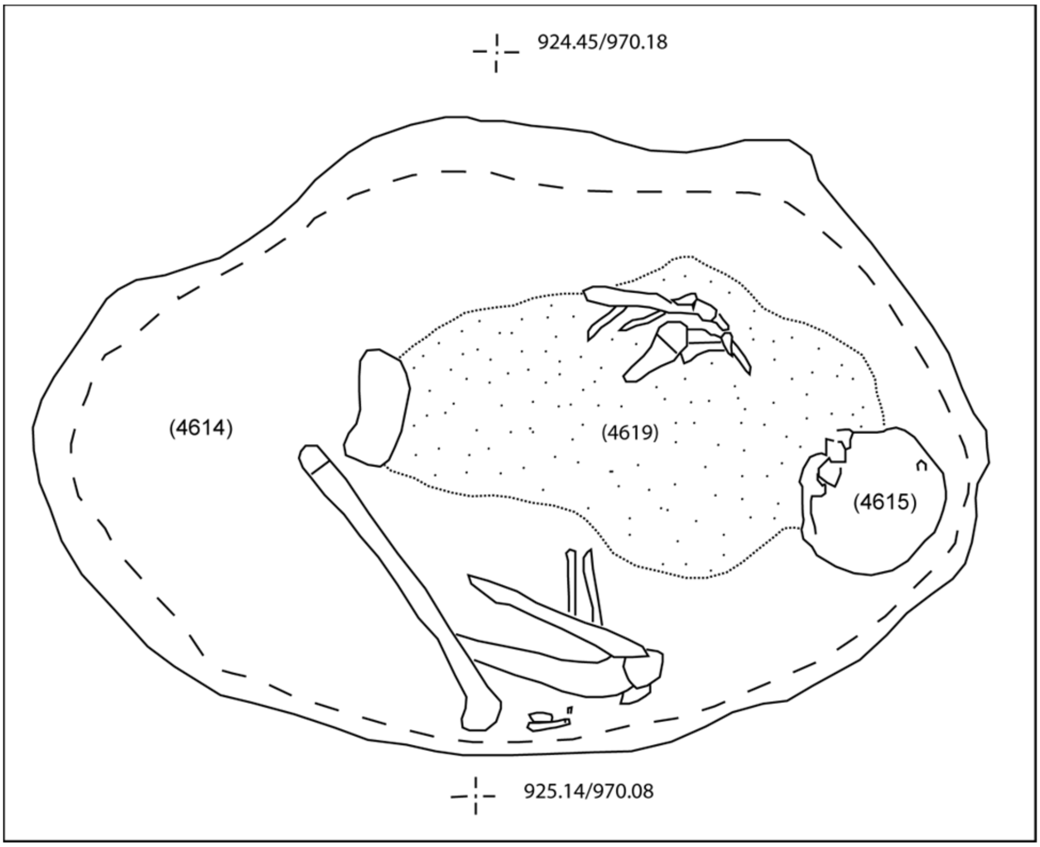


Figure 5 Digestion categories for murid molars: A) No digestion- enamel is shown in white, dentine in grey, B) Light digestion- the junction between enamel and dentine has a 'wavy' appearance and is, C) Moderate digestion- more of the enamel is digested and the enamel/dentine junction is found higher up the crown of the tooth, D) Heavy digestion-a limited amount of enamel remains on the occlusal surfaces, E) Extreme digestion-enamel is nearly completely absent from the tooth and in some instances corrosion of the dentine is visible

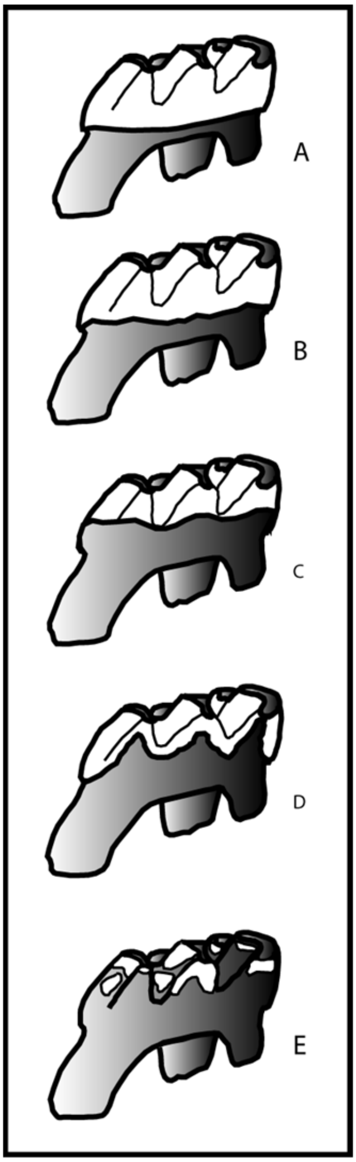


Figure 6 The relative proportion of elements for the burial fill assemblages

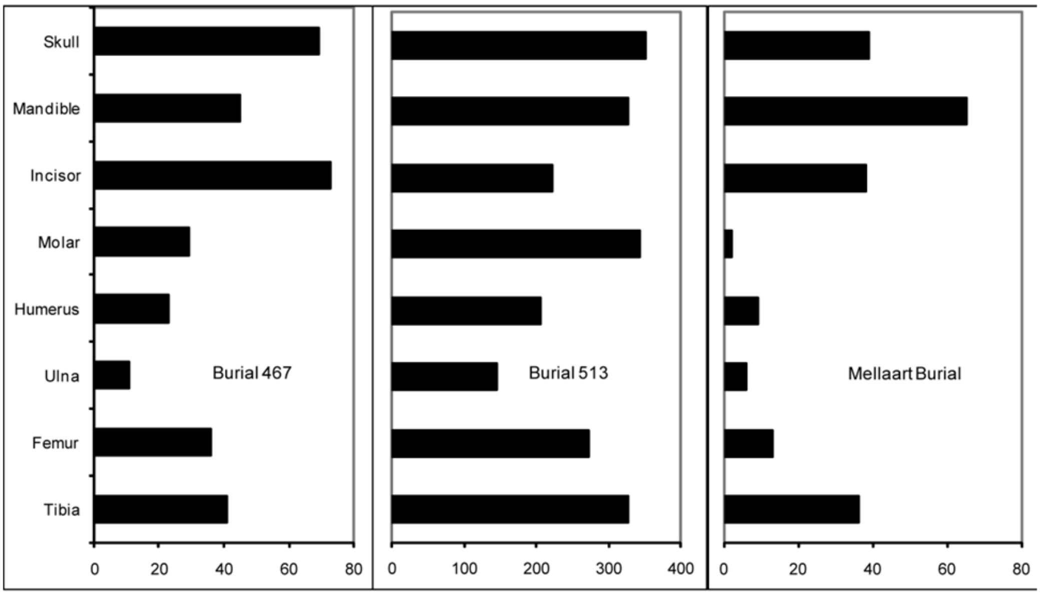


Table 1. MNI for the burial units (percent sample analysed is based on percent sampled for flotation and for analysis)

Unit	*4397*	*4614*	*4615*	*4619*	*4623*
% of sample analysed for crania	*67*	*47*	*100*	*100*	*44*
Large micromammal	0	1	0	0	0
Suncus etruscus	0	1	0	0	2
Crocidura suaveolens	2	1	0	2	0
Crocidua leucodon	3	1	0	1	0
Rodent	8	37	0	0	0
Arvicola terrestris	1	0	0	0	0
Mus sp.	43	99	6	184	50
Mus musculus	11	19	0	5	7
Microtus sp.	0	1	0	2	0
Small carnivore	1	0	0	0	0
Mustela nivalis	0	1	0	1	0
Amphibian	1	0	0	0	0
Snake	1	0	0	0	0
Total MNI	**71**	**161**	**6**	**195**	**59**
Total MNI/litre of sediment	**0.6**	**1.4**	**5.0**	**61.9**	**4.5**

Table 2. Percent digestion for incisors, molars, humeri and femora for each of the burial units

Unit	***Incisor***	***Molar***	***Humerus***	***Femur***
4397	9	4	13	4
4614	4	3	23	10
4615	17	23	0	0
4619	24	6	54	18
4623	15	8	73	0

Table 3. Percent of elements with puncture marks

Unit	***% of elements with puncture marks***	***No measured***	***Mean width (mm)***	***Standard deviation***
4397	3	35	0.43	0.17
4614	9	104	0.41	0.15
4615	5	2	0.65	0.07
4619	7	34	0.48	0.37
4623	13	21	0.43	0.26

Table 4. Percent element breakage for the burial units

Breakage	***Skull*** *(% of maxillae lacking the zygomatic process)*	***Mandible*** *(% with the ascending ramus missing and the inferior border broken)*	***Post-crania*** *(%) complete*
Unit 4397	100	83	5
Unit 4614	100	75	15
Unit 4615	100	55	10
Unit 4619	100	88	2
Unit 4623	100	67	3