Journal of Anthropological Archaeology 36 (2014) 1–11

Contents lists available at ScienceDirect

Journal of Anthropological Archaeology

journal homepage: www.elsevier.com/locate/jaa

Review

The smells of Neolithic Çatalhöyük, Turkey: Time and space of human activity

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ARTICLE INFO

Article history:
Received 21 March 2014
Revision received 3 July 2014

Keywords:
Smell
Zooarchaeology
Animal by-products
Human activity
Neolithic
Çatalhöyük
Turkey

ABSTRACT

All current and past human societies are based on specific places, and one way of describing these locations is by smell. Smell may be transmitted through specific human acts linked to daily activities, and especially by human–animal relations. The results obtained from Çatalhöyük (Turkey), which are both zooarchaeological and archaeological and have ethnographic and sociological applications, offer the possibility of considering the smell of this Neolithic settlement. Smell, as a potential factor in social life, can be reconstructed indirectly in the context of various human activities. Butchery, processing, consumption, and use of animal products are discussed, as well as the disposal of food waste in middens and the influence of architecture and spatial structure of the settlement on the human activity. All of these could affect the smell. Evaluations were performed on both the microscale (house) and macroscale (settlement). Despite the fact that the type of smell cannot be clearly determined, as it results from subjective human evaluation, multiple lines of evidence suggest that it is likely that what we would consider rather bad smells dominated at Neolithic Çatalhöyük.

Contents

1. Introduction

The Çatalhöyük site, located in central Anatolia in Turkey, is usually presented from the perspective of Mellaart's findings (1962a, 1962b, 1963, 1964, 1966), as a place associated with the cult worship of the mother goddess, spectacular paintings, and bucrania or ox-skull carvings. Since 1993, the continuation of research at Çatalhöyük has provided information about (among others) the spatial organization of the settlement, about the meaning of animals in the Neolithic, and about the processes of animal domestication (Hodder, 1996, 2000, 2005a, 2005b, 2005c, 2007a, 2013a, 2013b). This paper is intended to present a different approach to research the Neolithic settlement at Çatalhöyük from the point of view of the analysis of smell.

There are different kinds of odor, such as natural odors (e.g., from the body), manufactured odors (as pollution), and symbolic odors (olfactory metaphors), and they are conceptually distinct (Synnott, 1993, p. 182).

A smell is a pleasant, neutral, or unpleasant odor that humans or animals perceive through the sense of olfaction. Although the smell of flowers, coffee, and cut grass is pleasant for a majority

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http://dx.doi.org/10.1016/j.jaa.2014.07.001
0278-4165/

of individuals, while the smell of manure tends to be unpleasant, personal preference, and cultural influence in the reception of odor should be taken into account. Generally, a cultural consensus on judging odors such as body odors, the smell of decomposing biological materials, or fecal odors as unpleasant has been reported in studies involving different cultures from several continents (Chrea et al., 2004, p. 670; with further references).

It might seem that the reception of smell is transient, but at the same time, memories of odors can last very long (Porteous, 1990 in Tringham, 2012, p. 548). In this, smell is similar to the sense of touch: a touch, though brief, can be long remembered, and a new touch does not erase the memory of previous touches from the working memory (Spitzer and Blankenburg, 2011). Both old and new tactile memories can persist independently of each another. Croy et al. (2014, p. 1) examined the relation between smell and touch. It turned out that odors alter the perception of pleasant touch—in particular, unpleasant odors tend to reduce the pleasantness of touch, presumably through a disgust-related mechanism.

Smell evokes memories, and the same smell for different people evokes different memories. Studies of long-term memory, in contrast to short-term memory, have shown that successfully encoded odors show relatively slow to be forgotten (Schab and Cain, 1991, p. 226). Odor, memory, and meaning are therefore intimately linked, and reach deep into personal lives (Synnott, 1993).

The basic aspects of olfactory processing—including detection thresholds, adaptation rates, and intensity judgments—are strongly modulated by visual, perceptual, and cognitive factors (Gottfried and Dolan, 2003, p. 375; with further references). Smell is not only a biological and psychological phenomenon—it is a cultural, and hence social and historical, phenomenon (Classen et al., 1994, p. 3). And the moral nature of a phenomenon is often displayed in its evaluation as a good or bad smell (Synnott, 1993, p. 190).

Shepherd (2004, pp. 0573–0575) placed the sense of smell within an evolutionary framework, and suggested that it plays an important role in the evolution of the human diet, habitat, and social behavior, in conjunction with the advent of fire, and much later with the transition to agricultural and urban cultures through diversification of diet and complex flavors.

Ethnographic research has revealed that, among various ethnic communities, odors are invested with cultural values and are employed by societies as a means of and model for defining and interacting with the world (Classen et al., 1994, p. 3). In the case of the culture of the Colombian Desana, odors are the basis of an extensive system of classification of foods, and the odor of a food determines how it should be processed. Meat from animals with less potent odors is boiled, in contrast to game and fish, which must be smoked before boiling. Burning fat produces the most harmful food odors. On the other hand, among the Batek Negrito ethnic group of the Malay Peninsula, animals with different odors should not be cooked over the same fire (to give an example of just one of the odor-based rules). Classen et al. (1994, p. 3) highlight that the study of the cultural history of smell is, therefore, in a very real sense, an investigation into the essence of human culture.

In many cultures, the good or bad smell of food is the basis for a simplified classification as edible or inedible. According to Classen et al. (1994, p. 108), this does not hold among the Kapsiki of Cameroon and Nigeria, for whom distinctions regarding the edibility of food are made between social classes (farmers and traders). Edibility is only one issue—besides familiarity, pleasantness, and intensity—that can be used to examine the effect of culture on the knowledge of everyday odors in crosscultural studies (Chrea et al., 2004, p. 669; with further references). A separate issue is the cultural acceptability of eating specific species: in the case of Neolithic Çatalhöyük, Russell (2010) suggests the existence of three distinct kinds of taboo with respect to killing and consuming of some wild carnivores, deer and boar, many birds, and stillborn lambs.

With respect to animals, tanning should be mentioned as the smelliest process that is known in the archaeological record (Albarella, 2003; Bartosiewicz, 2009; Ervynck et al., 2003).

Smells help to identify unpleasant or dangerous places, as well as familiar places, and therefore give a strong sense of belonging, linking environmental stimuli with autobiographical memories and a sense of self (Synnott, 1993, 183; Zeitlyn, 2014, p. 178). Low (2006, p. 607, 612) considers smell a 'social intermediary' with regard to the body, presentation of the self, and social and moral order. This means that smells possesses social meanings (Low, 2009) in respect of social identity (Corbett, 2006) and social interaction, such as eating or drinking (Synnott, 1993).

The determination of smell, in the sense of answering the question of "what is that smell?" allows the source of a smell to be determined. On the other hand, limitations on odor identification do exist, and hence there are limitations on semantic memory for odors (Schab and Cain, 1991, p. 232). The influence of age and differences between sexes are known to have an effect on odor identification. The studies of Ship et al. (1996) have demonstrated that smell identification deteriorates progressively with increasing age, even in the absence of overt medical problems, and may impact on the safety and quality of life of older persons. Women evaluate the pleasantness of perceived odors in a more extreme manner than men, and without significant differences in hedonic polarity (pleasantness/unpleasantness) (Thuerauf et al., 2009, p. 76). Doty et al. (1985) suggest that sex differences in odor identification ability are probably not due to ethnic or cultural factors, per se.

Given all of the above, and taking into account that smell is the only human sense that cannot be switched off (Low, 2009, p. 3), the olfactory sense should not be ignored when attempting to understand the conditions of life in the past. However, the reconstitution of smells from the past is largely overlooked as a topic of archaeological study, presumably because it is not an easy issue, if it is at all possible. Bartosiewicz (2003) has studied bad smells in antiquity in the light of prevailing wind directions, based on the organic remains of animal exploitation at various sites (prehistoric, classic, and medieval). He has also shown culturally varying attitudes to "bad" smells.

No direct evidence of smells in the past exists, but we can attempt to consider the cultural and natural factors that could affect their generation, and thus imagine or visualize smells in a recreated past. Research from Çatalhöyük in Turkey (37°40′03″N 32°49′42″E) offers the possibility to consider the smell of this Neolithic settlement, reconstructed indirectly in the context of various human activities. Slaughtering, butchery, processing (including cooking and burning), consumption, and use of animal products will be therefore discussed here, as will the disposal of food waste and feces in middens—one of the types of deposits found at the site. The influence of architecture and the spatial structure of the settlement on human activity will also be considered.

In this paper, the identification of a smell is considered on two levels. The first level is associated with small scale smells emitted and detected locally—for example, within a building or outside it. This will be more associated with daily activities, and can therefore be defined as an everyday smell. The second level of smell identification concerns a broader context: a smell over a settlement as a whole, which may related to larger-scale human activities or to a set of different activity on the small scale.

Smell as a means of communication in the animal world, such as the role of pheromones (Wyatt, 2003), will not be dealt with here.

2. Çatalhöyük site

Çatalhöyük is one of the recognized Neolithic settlements on the Konya Plain, Anatolia (Fig. 1), where animal bone research

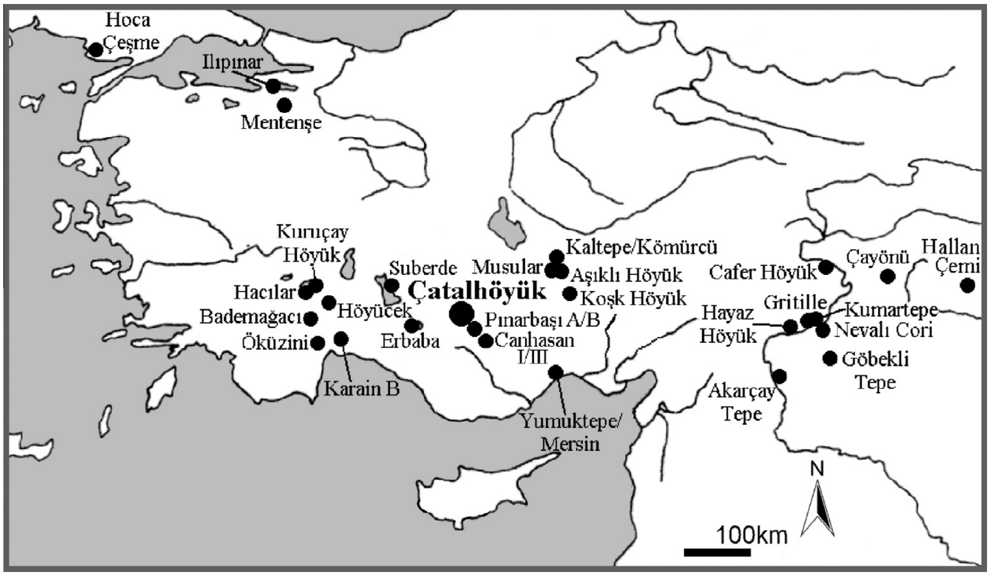

Fig. 1. Location of Çatalhöyük and other archaeological sites. *Source:* Çatalhöyük Research Project.

focuses on issues including herd management, the processes of domestication, and the use of animals. The site is one of the largest settlement mounds in the Near East, covering 13 ha and standing more than 18 m high. It included a wide range of people, animals, and activities—and was thus a site with a broad and complex smellscape.

The Konya Plain, one of several plains in the central part of the Great Konya Basin, lies at an elevation of ca. 1000 m asl (above sea level) and is a mosaic of diverse microenvironments. The modern climate is semiarid continental (Köppen classification), with cold moist winters (−25 °C) and hot dry summers (35 °C), with average temperatures at about 0 °C and 22 °C, respectively (De Meester, 1970, p. 23). De Meester (1970, p. 28) has observed local variations in the wind, with northerly winds in winter—as witnessed by the orientation of the numerous sheep shelters (Turkish: *yayla*), whose open sides face south—and southerly winds in spring and summer. The climate immediately prior to, and probably also during, the Neolithic occupation of Çatalhöyük was significantly wetter than at present (Rosen and Roberts, 2005, p. 43) and, together with these seasonal variations in weather conditions, if they also occurred then, must have affected the intensity and transmission of smells.

The site is made up of two mounds: Çatalhöyük East and Çatalhöyük West, divided by the Carşamba River during the Neolithic period. Excavations have focused on the north and south eminences of the East Mound, in the areas of BACH and 4040 (recently renamed as North), TP, TPC, Istanbul, and South. The off-site KOPAL Area is located to the north of the East Mound.

In addition, there are excavations focusing on the West Mound, but they will not be discussed here because they postdate the data under consideration here.

The main occupational sequence at Çatalhöyük East begins at 7400–7100 cal BC, and ends between 6200 and 5900 cal BC (i.a. Cessford, 2001; Hodder et al., 2007). The most recent results suggest that Neolithic occupation of the mound finally ended at 5975–5865 cal BC (end East Mound occupation; 95% probability), probably in 5965–5915 cal BC (68% probability) (Marciniak et al., in press). This sequence includes the levels from pre-XII.D to O (Mellaart levels) and from South.G to South.T and from 4040.F to 4040.J (Hodder levels). The earliest levels (Pre-XII) of the site are in the KOPAL and South Areas, and the uppermost levels (III–0) are in TP Area, labeled TP.M-TP.R. The correlation of Mellaart's and Hodder's levels (Farid, 2008), as well as Çatalhöyük's chronology in a broader context with respect to both Central Anatolian and Levantine periodization, has been recently summarized by Wright (2014, Table 1, p. 5; with further references).

The results of animal bone analysis from the pre-III levels have been extensively published (e.g. Russell and Martin, 2005; Russell and Twiss, in press; Russell et al., 2009, 2013). Therefore, in this paper, most references concerning animal bones are derived from the author's unpublished results of studies on the TP Area and from the current project.

3. Settlement and architecture

The settlement at Çatalhöyük had a compact spatial organization. The degree of packing of houses, located one next to the other, is remarkable. Movement from house to house within the neighborhood or residential 'zone' may very well have been across rooftops and through ground-level alleyways that run between at least some of the buildings, e.g. Space 271 (4040 Area; Hodder Level 4040.G), as suggested by Tringham (2012, pp. 540–541). Hodder (2006, p. 92), however, suggests that the material in these 'streets' indicates that they were not walked or trampled on.

Cessford (2005) calculated the population range as being between 3500 and 8000 people, with a minimum of permanent residents ranging between 1500 and 2700. The households, thought by Cessford to be associated with the buildings, had about 4–9 people associated with each of them.

It is likely that in Neolithic Çatalhöyük, rodents were quite numerous. Among these were *Mus* spp., which are by far the most abundant taxon, making up 93.5% of rodent specimens. The synanthropic species *Mus musculus* in particular comprises 2.7% of the total taxa among the microfauna examined (Jenkins, 2005). According Jenkins, rodents may have lived in the narrow spaces between buildings. The peculiar smell of the mouse seems to be well known, although no studies have demonstrated this. The origin of the biological interaction between mice and humans was proposed by Tchernov (1968, 1984). He showed that the shift from hunter-gatherer to sedentary societies created a new ecological niche attractive to preadapted populations of mice, as a barrier against predators, and as a buffer against temperature variation and food shortage in their natural habitat (Cucchi et al., 2012, p.

67). The factors acting against rodents were likely to include the thick floors in the storage contexts that are mentioned by Hodder (2005d, p. 14) and Matthews (2005b).

The spaces inside each building were organized similarly, with a main room and a side room associated with storage and food preparation. In main room, the northern part is different from the southern: the former often has a higher platform, more painting, whiter plaster floors, and more burials (Hodder, 2007b, pp. 28–29). The smell of any corpses under the floor could in this way be limited. The southern part of the main room is associated with at least one obsidian cache below the floors, but also with ovens and hearths, whose use generated smells inside the building. The buildings are of small size, were windowless, and had their only hole in the roof, which served as an entrance and exit with the use of ladders. Thus, the rooms in the houses were certainly smoky, which is also clear from the layers of soot found on the plaster walls (Hodder, 2006, p. 128). Cooking and food preparation may have occurred in the interior of the houses, and/ or on the roof, and may also have been seasonal in nature. Variation in the presence and number of soot-coated layers and/or plaster washes within each possible 'annual' cycle of plastering may correspond with variation in the intensity of use of fire in ovens or lighting and/or activities within buildings in any one year, perhaps seasonally (Matthews, 2005a, p. 368).

The situation, however, differs on the upper levels in the occupation sequence, for example in the TP Area. These buildings vary in size (Building 81 in level TP.M being the largest) and have different internal organization of space. Moreover, a new system of burial practices in the form of tomb chamber construction (Space 327; TP Area; Level TP.O) can be recognized (Hodder, 2008; Marciniak and Czerniak, 2008).

Both the spatial organization of the settlement, as well as the internal division of space in the buildings, could influence human activities such as butchery, disposal practices, and social behavior. They could thus have effects on the generation of smells.

4. Human activity and smell

Numerous activities carried out by the inhabitants of Çatalhöyük have been identified. Among these, food preparation, the processing of cereals, storage, burial, the obtaining of various types of raw material (e.g. obsidian, speleothems, clay), and various productive activities that took place on the site—such as grease processing, bead manufacture, obsidian knapping, and woodworking (Hodder, 2005d, p. 15; Hodder et al., 2007).

Human activity is here considered only on the basis of human–animal relations and animal-related activities, in the context of the analysis of potential smells. Animals (and humans themselves) may be considered as major sources of smell, owing to the fact that the most characteristic smells are emitted by a range of organic materials in various stages of decay (Bartosiewicz, 2003, p. 176).

The manner of sourcing the animals is indirectly shown by some of the paintings on the site (Fig. 2). It is worth noting that trapping may be another form of animal acquisition, although perhaps not symbolically important enough to be depicted. It is also known through direct evidence of the hunting process in the form of pieces of obsidian blades embedded in an aurochs shoulder (Fig. 3). However, the apparent bone regeneration around the obsidian demonstrates the lack of efficacy of this treatment (Best et al., 2012).

The distribution of animal body parts through time indicates that only the skins of bear, wild cat, small mustelids (most of which are probably martens, *Martes* sp., with some presumable polecats, *Vormela peregusna*), deer (after Level Pre-XII.B), and pigs (after Level Pre-XII.A) were brought back to the site; whole cattle,

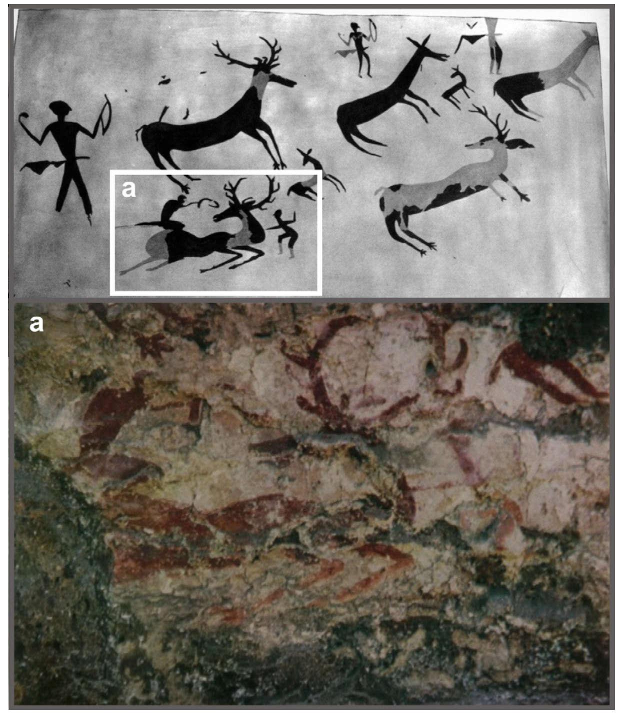

Fig. 2. Wall painting depicting animals and hunting scenes (Building III.1, Mellaart's phase III). Visible are five men, among whom three are wearing pieces of skin around their waist and two are holding bows, attacking group of animals (probably deer) (Mellaart, 1962b). (a) One of the animals seems to have been captured. *Source:* Mellaart (1962b).

Fig. 3. Auroch scapula with embedded obsidian pieces (17383.F143, Space 134, Building 79, South Area, Çatalhöyük East). (Photo by K. Pawłowska.)

equids, badgers, hares, deer, and pigs (until Level Pre-XII.B) were brought back to the settlement. Wolves arrived on site largely as skins, and fox skins also were brought there, in addition to some whole fox carcasses (Russell and Martin, 2005; Russell et al., 2013). Generally, this is also true in the later levels (TP Area, TP.M–TP.R–Pawłowska, forthcoming).

When only the skins of animals were taken to the settlement, the quality of the skin leaves open the issue of smell. It would seem that only the hides of leopards were returned to the site fully processed (with heads and paws removed) (Russell and Martin, 2005, p. 97); at least some were probably used as clothing/costuming, as seen in paintings (Fig. 4). It seems possible that taboos developed about bringing certain animals and animal parts onto the site, as

Fig. 4. Wall painting showing what appears to be leopard skin used as clothing or costuming. *Source:* Çatalhöyük Research Project.

in the case of the leopard (Hodder, 2006, p. 183). Tringham (2012, p. 548) has suggested the possibility of drying animal skins on the roofs of the buildings, as they would have been windier than other places, such as inside enclosed buildings.

The skins were used inside the houses. An example of this is a bin from Building 52 (4040 Area, approximately Mellaart Level VI – Twiss et al., 2008, Hodder Level 4040.G). It seems likely that this bin was lined with or contained a hare skin at the time of the building conflagration (Russell et al., 2013, p. 241).

High proportions of sheep's foot bones (and in two cases goat) were found in Space 187 of Building 1 (North Area), and they are best interpreted as the remains of skin containers, where the feet were still attached to the skins (presumably used as handles), although they could have had other uses (e.g., stored for broth making, or the metapodials could be raw material for bone tools) (Russell and Martin, 2005, p. 77). It is also possible that skin containers were used in cooking techniques, such as boiling using, for example, clay balls, as the quality of pots does not seem appropriate for this (Russell and Martin, 2005). The skin could also be used to store plants, as exemplified by storage containers for legumes made of what appears to be the remnants of gazelle skins at Ain Ghazal (Rollefson, 2001; von den Driesch and Wodtke, 1997 in Twiss (2007)). The paw of a bear (*Ursus arctos*), given the evidence of plaster among the first phalanges, seems to have been attached as a single paw, with the claws sticking out of the wall (Russell and Martin, 2005, p. 62). All of these examples would have contributed to the overall smell in the houses.

Slaughter and primary butchery usually left some odors. At Çatalhöyük, the body part distribution suggests that throughout the occupation the caprine bones deposited on site were slaughtered nearby, and the whole body (with the possible exception of some feet) was brought into the settlement (Russell et al., 2013, pp. 235–236). The KOPAL Area might have been such a slaughter site on the margins of the tell; however, it should be kept in mind that it represents a specific kind of off-site activity that seems to be different from activities on the tell, and which is possibly ceremonial in nature, as suggested by the cattle bones (Russell and Martin, 2005, p. 39, 90). Moreover, the paucity of open spaces on the tell with its closely packed houses also argues for this (Russell and Martin, 2005, pp. 88–89).

The butchered remains were returned to the site for further processing and consumption, evidence of which include marks of skinning, dismemberment, filleting, tendon removal, consumption, as well as the nature of fragmentation and of burning patterns. A smell would also have been present, although for a small time, in the locations of each of these activities. Filleting is the only *in situ* human activity that can be established in the TP Area (Pawłowska, forthcoming). It is there associated with the occupation floor in Buildings 72 (Level TP.O), 73 (TP.P), and 34 (TP.R), where sheep-size bones with filleting cut-marks occur. However, it is difficult to imagine that this would have significance in the context of smell, even within the building. The situation is different in the case of cooking techniques.

Cooking techniques in Çatalhöyük related to the preparation of meat, including bone grease processing and roasting.

The rendering down of grease, usually from the spongy bone inside the articular ends, may be considered a smelly activity. Bone grease processing involves breaking up these articulations, boiling or simmering them to extract the grease, cooling the broth, and skimming the grease from the top (Russell and Martin, 2005, p. 93). Along with this occurs the release of smells. From Mellaart Level IX or Hodder Level South.K (Space 170, Building 17, South Area), there is a deposit of floor sweepings which are a good example of this domestic activity: concentrations of mostly sheep-size long bones show evidence that articulations were deliberately broken, consequently causing them to fragment into small pieces (Russell and Martin, 2005, p. 92). This deposit was not affected by taphonomic factors, such as gnawing or postdepositional reworking, and the bones have fresh surfaces.

Baking and roasting are also expected to produce different scales of smell on the local level. Roasting, that is burning (usually at low temperatures), is visible by patterns on the articular ends of the bones, as on the shafts-lengths the bone is protected by the meat (Fig. 5). However, taking into account that roasting seems to have been very rare, the scale of smell could not have been significant (there are a few specimens in earlier levels: Russell and Martin, 2005; and no specimens in the assemblage studied so far from TP Area; later levels: Pawłowska, forthcoming).

4.1. Animal by-products

Animals kept in herds or pens (as in the case of caprinae at Çatalhöyük) could themselves give off a smell. Odors would also derive from the dung produced by the animals in the place they

Fig. 5. Archaeologically visible roasting features, on caprine bones (unit 11544, post-Neolithic context, TP Area, Çatalhöyük East). (Photo by K. Pawłowska.)

Fig. 6. Cattle kept in the ruins at Güzelyurt in Cappadocia. (Photo by J. Pyzel.)

were kept. Henton et al. (2010, p. 447) and Henton (2012, p. 3264) suggest that herding was probably carried out on dedicated pastures on the arable fringes, which means off-site provenancing of some of the stock. Birthing ewes, however, might have remained nearer the settlement. The fairly even distribution of body-parts of caprines and cattle on the later levels of the sequence (TP Area, TP.M – TP.R) also suggests that these animals were kept close to the settlement and that all parts of their carcasses were thus brought back there (Pawłowska, forthcoming). This could provide for the possibility of collecting herbivore dung, but indications also exist that dung could be collected at the edge of the site, and more centrally within the site. This may be related to animals being penned in abandoned buildings, as indicated by Russell and Martin (2005) on the basis of the complete fetal/perinatal sheep/goat found in Building 2 (South Area, Mellaart Level IX). This is further supported by micromorphological evidence of compacted herbivore dung from different contexts, such as Spaces 199 and 198 on Levels XII–XI, and courtyard deposits from Level VIII (Matthews, 2005a). This practice of locating animals in abandoned spaces is also evident today in the region (Fig. 6). Besides, the existence of covered animal pens next to houses suggests domestic ownership of livestock (sheep) (Russell and Martin, 2005, p. 80). The penning area was most likely off-limits to dogs, as indicated by the lack of evidence for the presence of carnivore fecal matter in the form of digested bones and gnawed pieces in these areas (Russell and Twiss, in press). Consequently, animal dung offers indirect evidence of husbandry techniques (Reitz et al., 2008, p. 7) and animal management, including penning both within and close to the site, for at least some periods of the year (Matthews, 2005a, p. 378)—at least in relation to sheep and goats at Çatalhöyük.

It was certainly easier to collect the dung of animals that were herded or penned, but it is also possible that dung of wild animals could have been retrieved (Russell et al., 2013, p. 223). Dung was

Fig. 7. The drying and storage of dung in the Southeastern Anatolia Region, near Göbekli Tepe. (Photo by K. Pawłowska.)

collected as fuel (e.g., the *in situ* hearth deposit from Space 105, South Area, Mellaart Level VII; Fairbairn et al., 2005). The storage of dung as a fuel source may be reflected by the concentration of sheep/goat dung pellets on the floor of the bin (Building 52, 4040 Area, Hodder Level 4040.G) (Bogaard et al., 2013, p. 117).

The use of dung as a fuel requires its drying, which is also practiced today in Küçükköy, a village about 2 km away from Çatalhöyük, as well as in the Southeastern Anatolia Region (Fig. 7). On the basis of another example of a village in the Çumra Plain, in Türkmencamili, the ethnoarchaeological research of Yalman (2005) shows that dung cakes are made and dried outside of the building complex from mixed cow and sheep dung. In turn, ethnographic observations made of agropastoralist communities in northern Morocco by Moreno-García and Pimenta (2011) show the practice of drying dung cakes on rooftops in late spring or during the summer, before the pottery season begins. The practice of collecting and drying dung for use as fuel is also known from other regions of the world, such as Kenya and India. The dung cakes are various in shape and are placed in different ways, whether as a whole surface or as a tangent plane. It is difficult to confirm this process in Neolithic Çatalhöyük, but if it was similar, then some kind of smell was produced by it.

Recent studies of human activity related to dung indicate that people burned dung much more intensively outdoors (in external spaces, such as fire spots and midden deposits) than inside, and these 'events' often did not involve the kinds of plant processing activities that took place indoors (Bogaard et al., 2013, pp. 127–128). Moreover, the extensive use of dung fuels in the lime-burning process can be seen from the large number of spherulites in 'lime-burning deposits' in the South Area (Rosen, 2005, p. 208). In this way, regardless of the context of its use, a great deal of smoke was produced all around, affecting the smell.

Fossilized dung (coprolites) forms the second category among the animal by-products that can be recognized on site, and could have influenced the smell at a local level (Fig. 8). Both human and animal coprolites are known from two contexts—middens and infills. Human coprolites can be distinguished from animals' by the presence of bile acid biomarkers (Shillito et al., 2011). Apart from the obvious matter of sickness or disease, defecation and the associated process of removing or not removing the feces raises the issue of smell. Presumably the fecal material in the houses was swept up, taken up the stairs onto the roof, and discarded on a nearby midden (Hodder, 2006, p. 212), where it is usually found. According to Hodder, such practices draw attention to the physical boundaries of self. There is another aspect of this in the form of the

Fig. 8. Animal coprolite (a) outer view (b) inner view (from midden deposit, unit 20449, Space 490, North Area, Çatalhöyük East). (Photo by K. Pawłowska.)

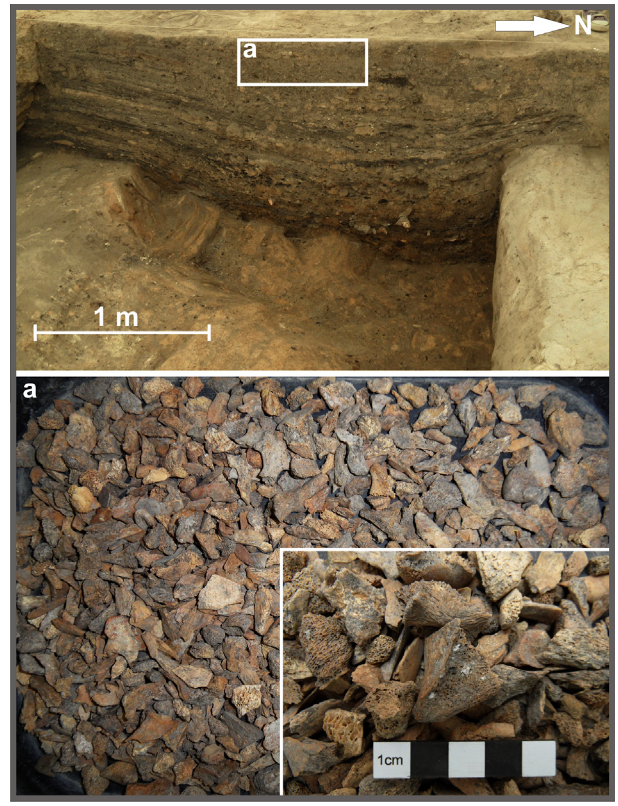

Fig. 9. Midden deposit in Space 490 (North Area, Çatalhöyük East) with (a) concentration of digested bones (unit 20449). (Photo by K. Pawłowska.)

sustained smell inside the houses, given that the smell of fresh feces is characteristic, especially in warm and humid climates. However, in the case of Building 1, there is a possibility that the northeast corner room of the building was used as a latrine, perhaps laid with straw and periodically cleaned out (Hodder, 2011, p. 61). Large amounts of carnivore scat, which according to Jenkins (2012, p. 380) is known only in three human burials, where they appear to have been deliberately placed there as part of a ritualistic practice, is out of the question here, as it does not seem that humans can decode this scent source.

Bones also appear in infills and middens, as do vomited and digested bones. These last usually appear as an admixture (7.5% of the East Mound mammalian assemblage – Russell and Twiss, in press), though in the case of a recently excavated midden from the North Area (formerly 4040 Area; unit number 20449, Hodder level 4040.G- Tung, 2012; Fig. 9), they have been found in considerable quantities (ca. 40%). It is likely that some of these result from the presence and activity of animals, particularly dogs—indicating that dogs had access to this midden. Dogs may act to convert some of the smellier parts of middens, including eating feces. The distribution of gnawed and digested bones within the site (with more digested bone than gnawed) confirms the presence of dogs in the midden areas among the houses, as well as on the edge of the site (Russell and Martin, 2005; Russell and Twiss, in press). Hence, their access to food remains. Another possibility, suggested by Russell and Twiss (in press), in the study of dogs as taphonomic agents at Çatalhöyük and which may be applicable here, is that dog feces were gathered and dumped in a particular area, placing them in a tertiary context. The latter scenario is more plausible due to the putative singular infill event recorded in the upper part of this midden, the heterogeneous nature of all animal assemblages (Best et al., 2012), the mixed nature of archaeobotanical residues (Bogaard et al., 2012), and the activity of dogs on the East Mound over time. In general trends, many of the pre-XII level midden deposits have been worked over extensively by dogs, in contrast to many of the Level V middens that show particularly rapid burial and excellent preservation, while the Level III-I (TP Area) middens are more slowly accumulated and slightly degraded (Russell et al., 2006, p. 145). However, regardless of the intensity of their activity, the excretion and urine must have left a smell, at least for some time.

4.2. Human practices

In terms of smell, human practices of note include the disposal of waste, some kinds of outdoor activities, and the abandonment practice.

The deliberate disposal of cultural material created midden deposits at Çatalhöyük, both between houses and in abandoned houses. Upon excavation, these show a dense buildup of a variety of materials, mainly animal bones, but also human bone, mollusks, eggshell, figurines, beads, obsidian, baskets, clay balls, pottery, carbonized seeds, small flecks of plaster, fecal material, phytoliths and charcoal (see, among others, Hodder, 2006). However, at the time of deposition stage, the midden would have been a kind of reservoir of biomass, likely to generate odor. Obviously, to be certain about such an opinion regarding middens, an analysis of the degree of processing of animals carcasses is needed. Both the degree of fragmentation of animal bones and the presence of articulated bones are good starting points.

Generally, animal bones from middens are less processed than the bones of other recognized deposits (infill, floor). They include

Fig. 10. Cattle mandibles as a part of abandonment deposit (15261.X11 and .X12, Space 325, Building 74, TP Area, Çatalhöyük East). (Photo by TP Team.)

an almost complete or half-complete bones, as well as long bone cylinders, rather than the shaft splinters from the floor. Abandonment and feasting deposits are not taken into account here, because these, being special deposits, contain selected bones (Fig. 10). For example, feasting deposits consist of concentrations of less heavily processed bones (broken for marrow, but not processed for bone grease), with higher proportions of the larger animals, especially cattle (Russell et al., 2009, p. 106). Also, other kind of special deposits of animal remains (e.g., installations, ritual trash, grave goods) and commemorative deposits, such as collections of items buried in subfloor pits or incorporated into remodeled features during the occupation of the house—which seem to select a few items from an event to bury in the house (Russell et al., 2009, p. 106)—are not taken into account here.

The articulated bones of caprines, cattle, and equids, which can be observed in the middens in the example of the TP Area (Tables 1–3), indicate the practice of discarding carcass parts outside of buildings. They were thus located together with the soft tissues, and the smelly process of decomposition occurred in middens. Furthermore, containing fecal and rotting organic material in a densely occupied agglomeration of buildings, these deposits must have been a health hazard, attracted lots of flies, and must at times have had a strong odor, although senses of smell vary very much from one cultural context to another (Hodder, 2006, pp. 95–96).

Moreover, there occurred in middens a range of human activities related to smell in the form of smoke. Activities that produced smoke included the burning of rubbish—indicated by postdepositionally burnt bones with no particular patterning on their surface—lighting fires, charring plants, burning lime, and firing pottery (Biehl et al., 2012; with further references). Further, the middens were made up of many small acts including individual fire spots and numerous spreads of material containing house sweepings, and material discarded from the hearth and oven area visible as fine lenses in these deposits (Hodder, 2006, p. 53, 96).

Another source of smoke, and thus smell, in Neolithic Çatalhöyük was fire from of the deliberate or accidental burning of buildings, as occurred in the case of buildings B.1 (North Area),

Table 2
Çatalhöyük East, TP middens. The articulated bones of cattle (*Bos/Bison*). *Abbreviations:* GID – General Identification Number; NISP – Number of Identified Specimens.

TP levels	Building	Space	GID	Element	NISP
TP.R		412	7867.F8	Central tarsal	1
			7867.F7	Metatarsal III + IV	4
TP.P		406	15849.F5	Os malleolare	1
			15849.F6	Astragalus	1
			15849.F7	Astragalus	1
			15849.F8	Calcaneus	1
TP.O	72	428	15217.F48	Metacarpal III + IV	1
			15217.F49	Anterior first phalanx	1
TP.M		420	17637.F6	First phalanx	1
			17637.F5	Second phalanx	1

Table 1
Çatalhöyük East, TP middens. The articulated bones of caprines. *Abbreviations:* GID – General Identification Number; NISP – Number of Identified Specimens.

TP levels	Building	Space	GID	Taxon	Element	NISP
TP.R		412	7814.F115	Caprine	Radial carpal	1
			7814.F116	Caprine	Intermediate carpal	1
			7814.F177	Caprine	Second phalanx	1
			7814.F178	Caprine	Second phalanx	1
			7867.F4	Caprine	Intermediate carpal	1
			7867.F5	Caprine	Second + third carpal	1
			7864.F12	Caprine	Central + fourth tarsal	1
			7864.F11	Caprine	Second + third tarsal	1
			7864.F10	Caprine	Metatarsal III + IV	1
TP.O	72	428	13570.F441	Caprine	Radius	1
			13570.F442	Caprine	Ulna	1
	72	435	15847.F2	Caprine	Radial carpal	1
			15847.F1	Caprine	Second + third carpal	1
			17630.F2	Ovis	Humerus	1
			17630.F3	Ovis	Radius	1
TP.N		439	17804.F5	Caprine	Radius	1
			17804.F8	Caprine	Radial carpal	1
			17804.F7	Caprine	Intermediate carpal	1
			17804.F6	Caprine	Second + third carpal	1
			17804.F1	Ovis	Tibia	1
			17804.F2	Ovis	Astragalus	1
			17804.F3	Ovis	Humerus	1
			17804.F4	Ovis	Radius	1
TP.M		420	17637.F3	Ovis	Tibia	1
			17637.F4	Ovis	Astragalus	1
			17637.F2	Caprine	First phalanx	1
			17637.F1	Caprine	Second phalanx	1

Table 3
Çatalhöyük East, TP middens. The articulated bones of a large equid (*E. ferus*) and a small-medium equid (*E. hydruntinus/hemionus*). *Abbreviations:* GID – General Identification Number; NISP – Number of Identified Specimens.

TP levels	Space	GID	Large equid (NISP)	Small-medium equid (NISP)	Element
TP.P	406	15849.F1	1		Radius
		15849.F13	1		Radial carpal
		15849.F14	1		Intermediate carpal
TP.N	439	17804.F82		2	Metacarpal III
		17804.F83		1	Metacarpal IV
TP.M	420	17697.F8		1	Astragalus
		17697.F9		1	Calcaneus

B.52 and B.77 (4040 Area), B.76, B.79, and B.80 (South Area). Deliberate burning was related to the abandonment process. However, the burnt nature of buildings B.76, B.79, and B.80, as well as their mutual proximity, raises the possibility, according to Regan (2010, p. 16), of a general conflagration in this neighborhood. In this case, it is easy to imagine the smell that occurred on the scale of the settlement.

5. Type of smell

The power of smell lies in its subjectivity. While the senses seem to indicate objective truth, the data from the senses are open to interpretation and influenced by individual and group preferences (Chiang, 2008, p. 405).

Therefore, whether a particular type of smell was considered pleasant or unpleasant cannot be clearly stated, as it results from subjective human evaluation. An unbearable smell for one person might seem indifferent to another. Also, the lack of a well-developed sense of smell is relevant, as shown by the example of the relation of Tringham (2012, p. 547): "*I am ashamed to say that my sense of smell is poorly developed. Although I am far from being anosmic, I am not aware of bad or dangerous smells until long after others in my company. I cannot put this down to evolution, since my mother had an incredibly sensitive nose to any new and potentially threatening smell: sour milk, burning toast*."

Hence, in the evaluation of smell, the threshold between weak, distinct, strong, and intolerable odors cannot be clearly specified.

We can say, however, that given the poorly ventilated and smoky spaces in which grease rendering was conducted at Çatalhöyük, and given the practices of penning animals in abandonment buildings, the disposal of waste within the settlement, the burning of rubbish, it was likely that what we would consider rather bad smells dominated. A suggested example of a human practice aimed at avoiding bad smells was given by Russell et al. (2013), who discussed how a partially decomposed dog was collected and put into an oven. This could have been intended simultaneously to remove the smelly animal remains and to backfill the oven in order to stabilize the foundation for the house above (Russell et al., 2013, p. 239). These authors, however, also gave an alternative explanation—that this deposit could have a symbolic significance, in that dog, just like the cattle, were meant to protect the house. Moreover, it is likely that dogs, which may have been owned by individual families, reduced the amount of smelly garbage to a much smaller and slightly safer amount of smelly dog feces (Russell and Twiss, in press).

Tringham (2012, p. 548) suggested the possibility of some kind of habituation on the part of the residents of Çatalhöyük (based on Building 3, BACH Area) to everyday smells. These smells originate from what the author calls "strong olfactory sources", including the smoke of dung-fueled fires, plaster, drying herbs, grasses, chaff, dried grain, sweat and other body odors embedded in clothing and bedding, wet reed baskets, wet clay, wet hair, the boiling of plant and animal foods, including boiled grease, fermenting plant foods, toasting nuts, seeds, or grains, blossoms and wildflowers, flowering fruit trees, human and general domestic waste, fresh and dry animal dung, drying animal skins, and rotting things from the midden. Habituation is the mind's ability to disregard a smell that is irrelevant to the mind's preoccupation of the moment (Almagor, 1990, p. 271). Human can habituate to various smells and, according to Bensafi et al. (2002, p. 162), odors are first categorized according to pleasantness. Exposure to a pleasant smell reduces its subsequent pleasantness, whereas exposure to an unpleasant smell decreases its subsequent unpleasantness, which is affective habituation (Cain and Johnson, 1978, p. 459). The human olfactory system habituates more readily to 'bad' smells than to 'good' smells, and it has a broader range of adaptation for bad smells (Jacob et al., 2003). The degree of adaptation, according to Jacob et al., is inversely proportional to stimulus strength.

6. Conclusions

Smell, as a potential factor in social life, was considered in the archaeological context using both zooarchaeological and ethnographic date and with sociological applications. As one of the human senses, olfaction is strongly associated with memory. It allows specific products to be recalled and to be correlated with the situations in which they were recognized through the sense of smell. Recognition of a smell as a pleasant, neutral, or unpleasant is not unambiguous to all people.

Smells as integral and idiosyncratic factors in human culture (Bartosiewicz, 2003, p. 175) were described on the basis of human activity and practices in Neolithic Çatalhöyük.

Smell could be present during the killing and processing of carcasses. On the other hand, it would also derive from piles of waste, from dung and feces, and could result from the structure of the buildings, with their nonventilated, windowless rooms. The use of a hearth in the house was a source of the smoke, and apart from this there were fires in the midden, related to disposal practices, and a range of activity as well as this, such as the deliberate or accidental burning of buildings.

All these forms of human activity, in relation to the structure of the settlement and the internal spatial organization of the buildings and the spaces between them could affect the smell on both the microscale and macroscale.

Defining the type of smell is difficult, due to the subjective evaluation of odors. We do not know exactly how distinctive smell was for the inhabitants of Çatalhöyük. Nevertheless, some human behaviors may indicate an attempt to reduce the smell, assuming that it was not considered a recognizable characteristic of the place by the inhabitants.

Acknowledgments

This paper was presented at the ASWA Conference in Haifa (Archaeozoology of Southwestern Asia and Adjacent Areas), organized by Guy Bar-Oz, Daniella Bar-Yosef Mayer and others, whom I thank for giving me the opportunity to present this issue. I would also like to thank Lech Czerniak, Ian Hodder, and Arkadiusz Marciniak for the possibility of participating in the Çatalhöyük Research Project, in the framework of which this research has been done, as well as all the members of the zooarchaeology team for their elaboration of the bone material, and especially Kathy Twiss for her several useful remarks on an earlier version of this manuscript. Special thanks go to two anonymous reviewers for their useful suggestions, and László Bartosiewicz, whose paper about bad smells in antiquity inspired me to look at the site of Çatalhöyük from this perspective. I am also grateful to Tomasz Kozłowski for a stimulating discussion during the excavation season of how life might look in Neolithic Çatalhöyük, Agata Czeszewska for providing images of the wall paintings, and Joanna Pyzel for her kind sharing of the photograph in Fig. 6. Last, but not least, special thanks are due to my husband, who was intrigued by the smell of my letters, until he realized that they are, in fact, perfumed.

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