



# Bone implements from Chalcolithic Tepecik-Çiftlik: Traces of manufacture and wear on two classes of bone objects recovered from the 2013 excavation season

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## ABSTRACT

The site of Tepecik-Çiftlik in southern Cappadocia, Turkey, has provided a rich assemblage of worked bone objects from Pre-Pottery Neolithic (PPN) levels continuing into the extensively excavated Pottery Neolithic (PN) levels and the Early Chalcolithic period (6100–5800 cal BCE). This report presents an initial study of the worked bone objects recovered from the Chalcolithic levels during the 2013 excavation season. This paper examines the methods of manufacture, use-wear traces, and animal species used in the manufacture of two types of Chalcolithic bone tools at Tepecik. The most common tools are pointed implements, primarily made on caprine metapodia, many of which appear to have been used as perforators. Other objects include “idols” made from the first phalanges of equids, including both wild horses and hydruntines.

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## 1. Introduction and background

Between 2000 and 2017 archaeological excavations were carried out at the site of Tepecik-Çiftlik in the Niğde region of southern Cappadocia, Turkey, under the direction of Professor Erhan Bıçakçı of the University of Istanbul. These extensive excavations have revealed deposits dating to the Pre-Pottery Neolithic (PPN) extending into the Pottery Neolithic (PN) and the early Chalcolithic (ca. 6100–5800 cal BCE) periods. Tepecik-Çiftlik is a unique site in the Melendiz Valley region of Southern Cappadocia because it provides a complete archaeological sequence from the Pre-Pottery Neolithic through the Chalcolithic period. This report will present a preliminary study of some of the bone tools recovered from the 2013 excavation season which includes 128 Chalcolithic bone tool implements and a single bone tool from the later Neolithic period. Seven of the specimens were not available for detailed study because they were housed in the Niğde Museum.

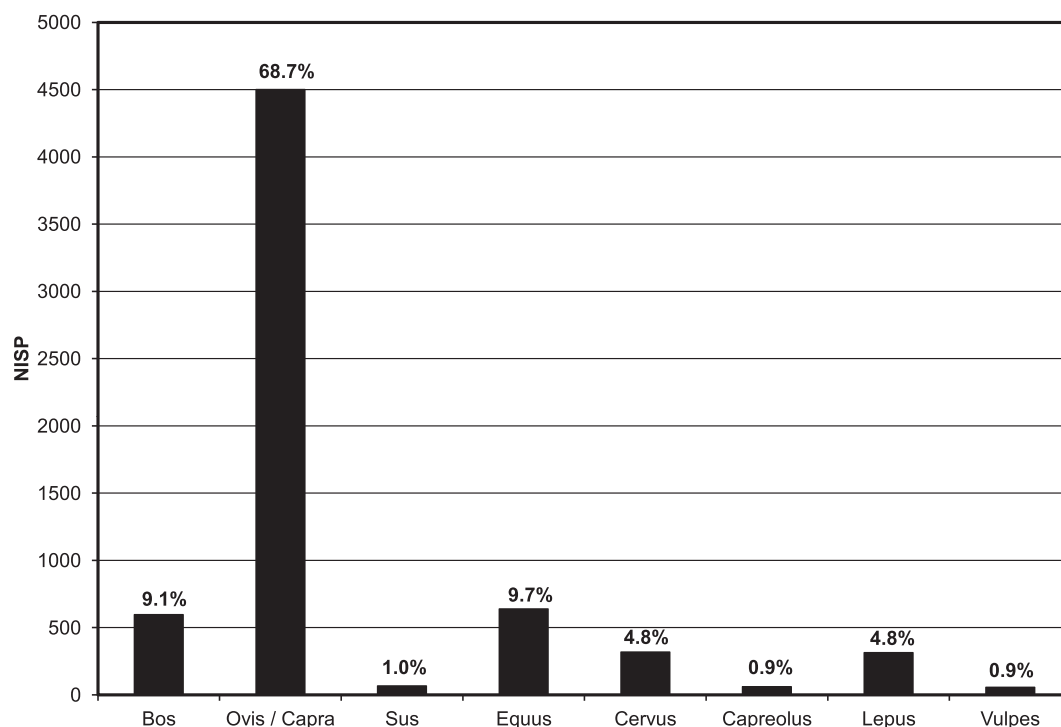
We were invited to join the Tepecik-Çiftlik excavation team in 2014, as the bone tool specialist (DVC) and the zooarchaeologist

(PJC). This provided a unique opportunity for collaboration since we were able to search the faunal collection for bone tools and debitage fragments that may have been missed by the excavators and to identify the faunal elements that were used in bone tool manufacture. We began our research with the Chalcolithic materials that has been recovered during the 2013 field season. This is a small portion of a much larger bone tool and animal bone assemblage accumulated over 15 seasons of fieldwork. Examination of the remainder of the bone tool collection and the faunal assemblage is ongoing but because of the field limitations will require several years to complete. Therefore, we believe an interim report is warranted. The conclusions drawn from it are necessarily preliminary.

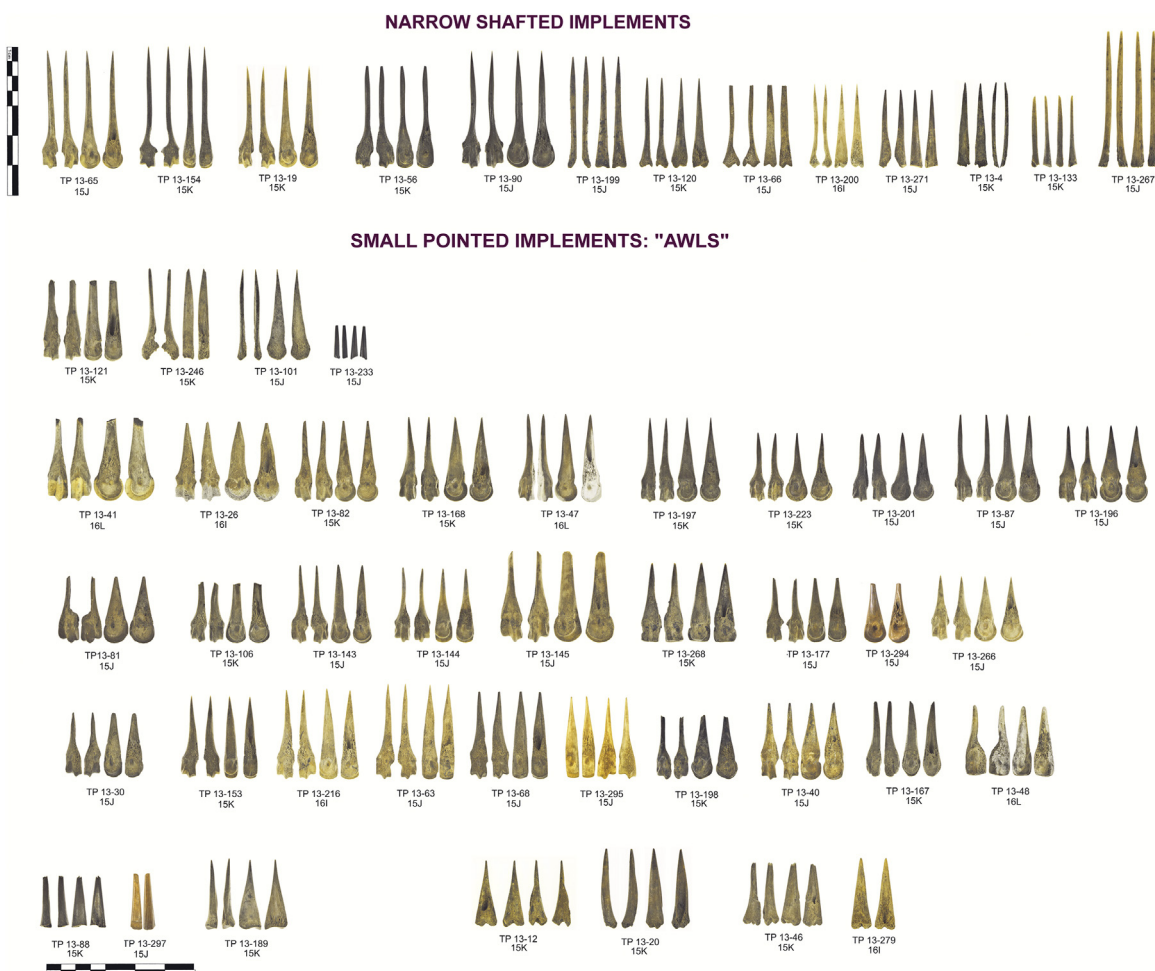
While early Neolithic faunal assemblages from Central Anatolia are generally made up of 80–90% sheep and goat bones (Steiner et al. 2014), caprines make up only about two-thirds (68.7%) of the Chalcolithic faunal assemblage from Tepecik-Çiftlik recovered during the 2013 and 2015 excavation seasons based on NISP. As can be seen in Fig. 1, cattle (including both domestic cattle, *Bos taurus*, and wild cattle, *Bos primigenius*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), wild pigs (*Sus scrofa*), hares (*Lepus europaeus*), and foxes (*Vulpes vulpes*) are also well represented in the Chalcolithic assemblage. The abundant equid remains include both wild horses (*Equus ferus*) and hydruntines (*Equus hemionus hydruntinus*). We have identified the larger equids as *Equus ferus* because there is no clear

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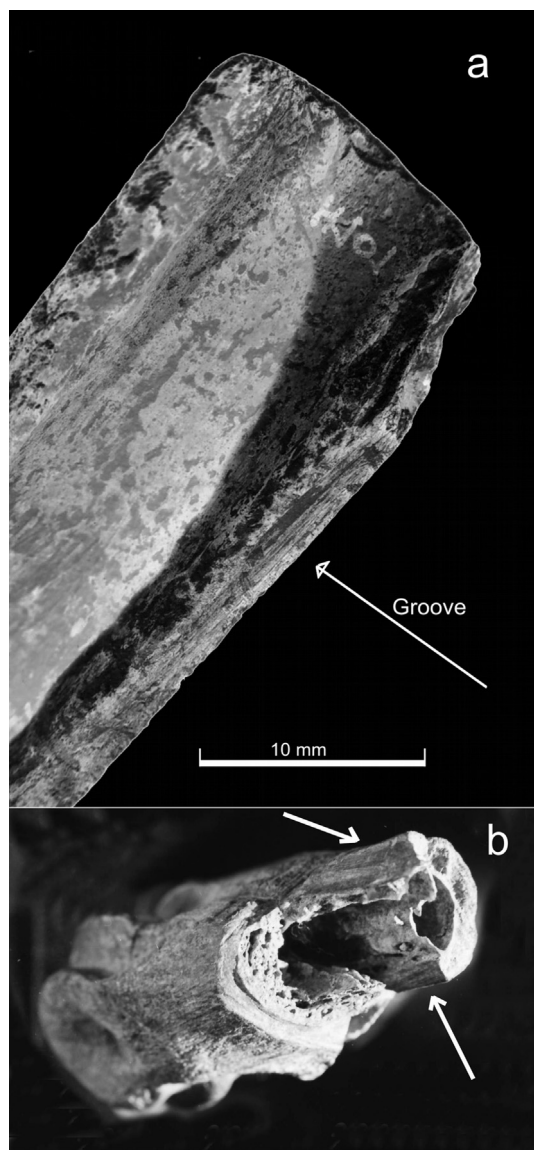
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**Fig. 1.** Taxonomic ratios based on NISP for the most common mammals recovered from the 2013 and 2015 excavations at Tepecik-Çiftlik. The equid category includes 182 bones that were identified as wild horse (*Equus ferus*) and 173 bones that were identified as hydruntines (*Equus hemionus hydruntinus*).



**Fig. 2.** The 2013 assemblage of small pointed implements. The top row may be fasteners, while the remaining tools appear to be fine perforators. The tools in the bottom row are missing their epiphyses.



**Fig. 3.** An example from the Natufian period (Israel) of the splitting of a metapodial by longitudinal grooving. 3a shows the characteristic manufacture traces left by this process. 3b shows a characteristic waste product after the desired blanks are removed.

evidence from morphology, demography, or paleopathology to suggest that they are early domesticates. Wild horses survived in central Anatolia until the Middle Holocene. Future studies of these horses are planned using aDNA. The diversity seen in the faunal assemblage is reflected in the bone tool assemblage as well.

## 2. Procedures for the study of the bone tool assemblage

Turkish government regulations require that the archaeological materials be studied on-site during the excavation season. The methods used in this study were designed to recover maximum information about the bone implements under field conditions. Notes were made on each artifact including species and anatomical identifications. Overall photographs of the objects were provided by the Tepecik-Çiftlik excavation staff. A digital microscope and 18-megapixel camera were used to photograph the tools in greater



**Fig. 4.** A rare example from Tepecik of a metapodial tool split by longitudinal grooving. The arrow points to the characteristic straight burin groove.

detail. In addition, a set of high resolution molds were prepared, primarily of the functional portions of the tools. These molds were used to examine the tools at higher magnifications later in the United States. The completed molds were subsequently examined with a stereo microscope and photographed at various magnifications, using point source lighting at a low angle to reveal surface markings. From 20 to 40 exposures of each view were made at a range of focal points and then focus-stacked to provide overall sharp images of the surface features. In addition, positive transparent replicas were made from the molds and similarly photographed using transmitted light; these revealed additional surface features. A full description of the procedure is provided in the interim report (Campana n.d.).

## 3. Bone artifacts

### 3.1. Pointed implements

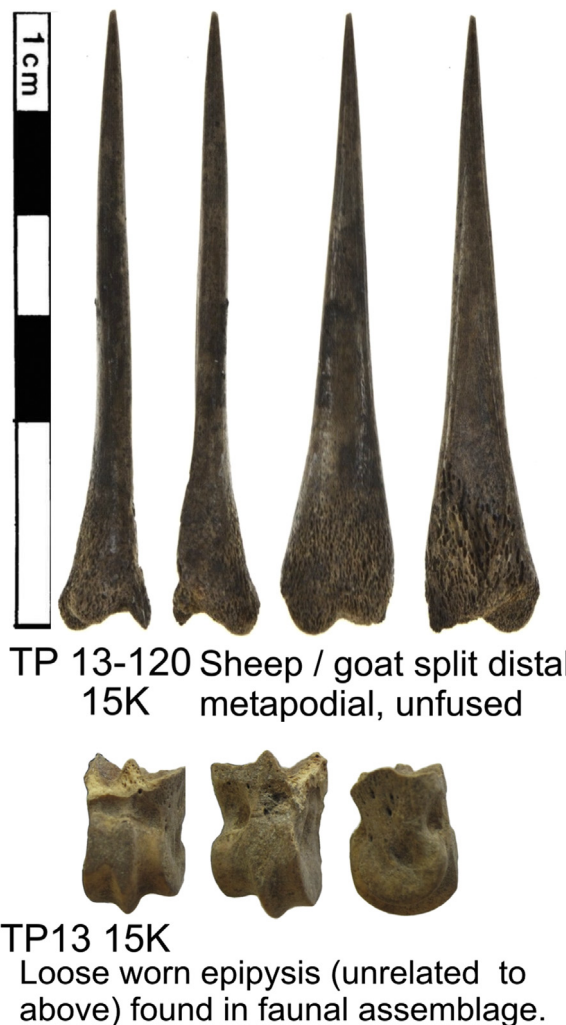
By far, the most common artifacts in this assemblage are small



**Fig. 5.** Tool from the 2015 season assemblage made by abrasion that was resharpended by shaving with a lithic edge.

pointed implements, usually designated as “awls.” Fig. 2 illustrates 53 of these implements, 36 of which are made from sheep or goat metapodia with fused distal epiphyses that have been split lengthwise along the suture that joins the two sides of the metapodial. Even though roe deer is present in the faunal assemblage, none of the tools examined to date appear to have been made on split roe deer metapodia, and none were made on the metapodia of large artiodactyls such as cattle and red deer. Most of these bone implements are complete or nearly complete; only 7 are partial. Ungulate metapodia from other sites and periods are commonly split by cutting a groove between the two fused halves with a chipped stone burin. Fig. 3a shows an example of a long-bone from a Natufian assemblage (Hayonim Cave, Israel) and Fig. 3b shows an example of a waste fragment from the same assemblage left from splitting a metapodial by longitudinal grooving (Campana, 1989: 38). No unambiguous evidence of burin grooves was found in this assemblage, nor have any similar waste fragments yet been found in the bone assemblage. Given the absence of clear burin traces on any of the 2013 specimens, it is possible that they were split by inserting a wedge between the distal condyles, although positive trace evidence for this is lacking. A preliminary examination of the 2012 assemblage, not yet fully studied, reveals a few specimens split by grooving (Fig. 4). Very similar bone points appear in the Neolithic assemblage from Çatalhöyük (Russell, 2016), where they are reported as possible perforators and/or basketry tools.

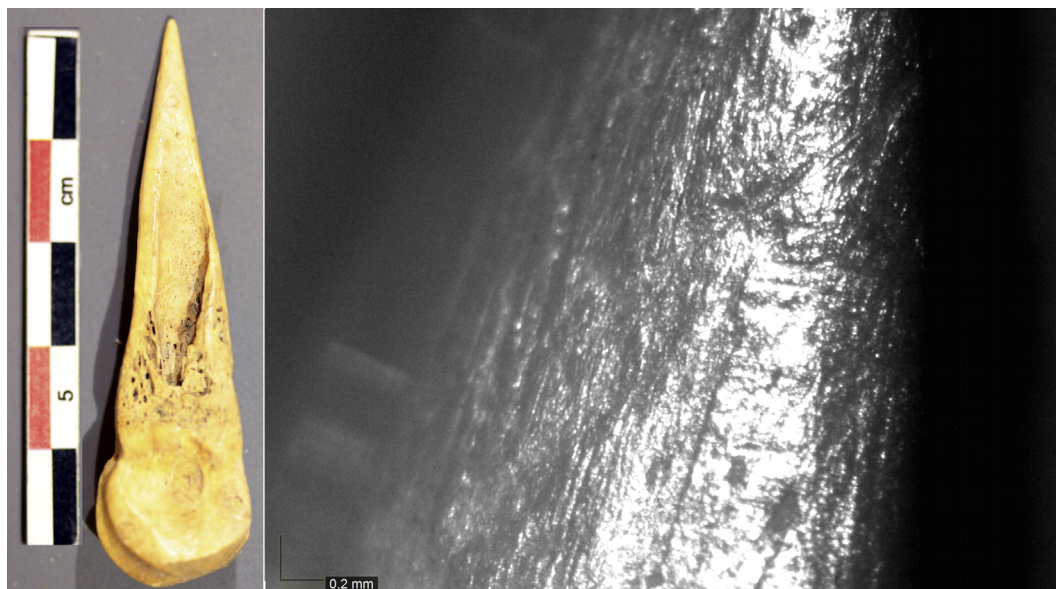
Referring to the center three rows in Fig. 2, all these similar tools are small, averaging about 5 cm in length. Most of these tools



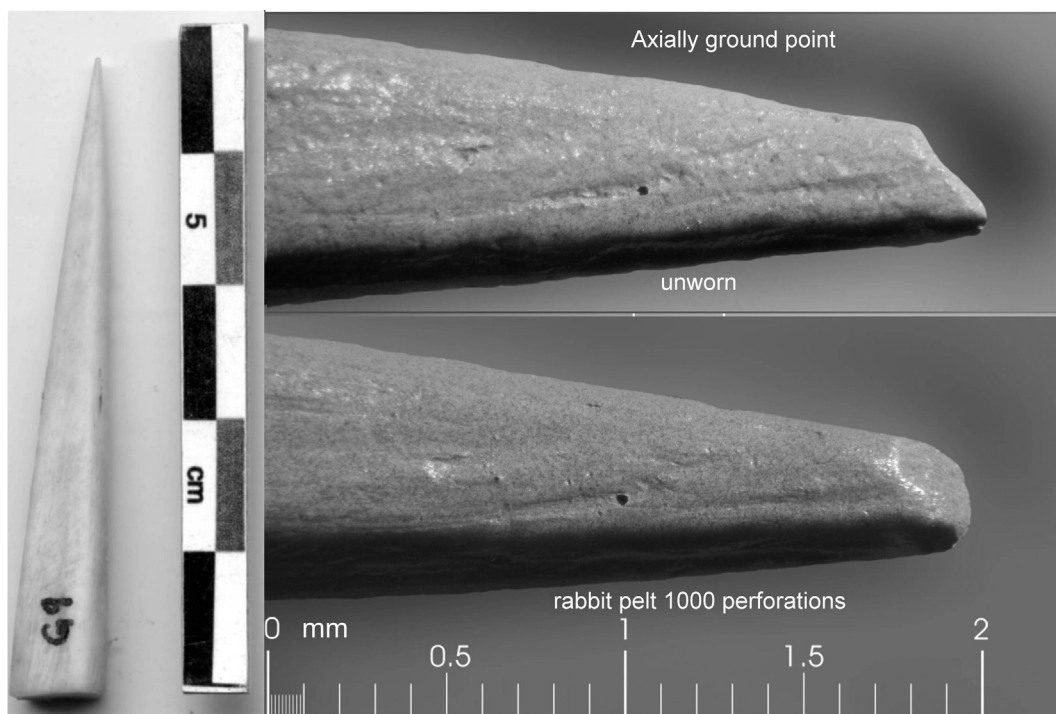
**Fig. 6.** An example of an unfused metapodial tool. While tools with fused epiphyses are usually polished from prolonged handling, the unfused distal end shows no polish. Several worn detached distal epiphyses suggest that some tools lost their epiphyses only after use.

were then ground to a point, usually by abrading them axially against a large, flat grindstone. This is evidenced by the long, straight sides seen in the profiles of many of the tools. A detailed discussion of the criteria used to distinguish the surface markings left by the various manufacture methods appears in an earlier publication (Campana, 1989: 26–34). A few objects were further shaped by shaving with a stone edge, presumably obsidian. Although distinguishing shaving with a flint tool from shaving with obsidian can be difficult, Tepecik is located near a major source of obsidian that was exploited throughout the Neolithic and Early Chalcolithic periods. The vast majority of the stone tools from Tepecik are made of obsidian rather than flint which is very rare. With one exception seen in a preliminary examination of a sample of the 2015 assemblage (Fig. 5), there is no clear evidence of regular resharpening of the bone implements. The tools show different degrees of flattening of the distal epiphysis, ranging from none through very slight, to complete flattening along the entire shaft. The illustrations of the tools in Fig. 2 are ordered to show this continuous range. Rather than being intentional, the flattening of the epiphysis appears to be a consequence of grinding the tool to a





**Fig. 7.** A sharp pointed tool from the 2015 excavation season (this analysis not yet complete) showing fine scratches due to tool rotation surrounding the tip. Such scratches are rare.



**Fig. 8.** The rounded tip resulting from pressing an experimental tool through a rabbit pelt 1000 times.

point against a large, flat, grinder. [Sidéra \(2012: 57\)](#) notes that flat-sided pointed tools have a very wide geographic distribution throughout the Neolithic of Europe and the Near East. In Tepecik-Çiftlik, such tools form one end of a continuous distribution. The exceptions are the few tools at the end of the distribution where the epiphysis is further rounded.

Nearly all the tools show a distribution of polish that includes most of the shaft and includes the distal epiphysis. This polish must

have resulted from extensive handling and indicates these tools were not further hafted. A small number of similar tools (bottom row, [Fig. 2](#)) have an unfused distal epiphysis ([Fig. 6](#)). This area is commonly lacking in any polish from handling. The most likely explanation for this disparity is that these tools had an epiphysis that was attached during use but which later became detached, either at the end of the tools' use life or post-depositionally. This interpretation is supported by the later recovery of several



Fig. 9. Narrow shafted tool with overall polish that may have served as a garment fastener or possibly a hairpin.

detached, polished epiphyses in the faunal sample. (These epiphyses were recovered from the same grid square as the unfused tools in most cases.).

The tips of these tools, where complete, are quite small and sharp, averaging about 0.5 mm measured 0.5 mm back from the very tip. Slightly more than half of the tool tips are broken off near the tip. Complete tips are usually rounded from use. A concerted effort failed to find evidence for patterned use scratches at the tips in this sample, but a few specimens from an additional sample, not yet fully studied, were found to show very fine scratches near the tip resulting from tool rotation (Fig. 7). The rounding of the tips is consistent with the use of these tools as perforators for thin pelts, similar to that seen on experimental points used to pierce rabbit skin 1000 times (Fig. 8). The Tepecik-Çiftlik faunal assemblage includes many hares (Fig. 1), as well as other fur-bearing small mammals such as pine martens and foxes. Breakage of the tool tip can occur if too much pressure is applied. Angled scratches on similar tools from the 2015 assemblage (also seen on a re-examination of the 2013 assemblage) suggest that some of these tools may have been used as manipulators for an activity such as basketry.

A sub-group of the awl-like tools has most of the characteristics of the group as a whole, but differs from the main group in that the shaft is intentionally made quite narrow along its entire length. Such narrowing would weaken the tool and serve little purpose as a perforator. The example shown is highly polished from handling overall (Fig. 9). These objects are suitably shaped to serve as garment pins and may have served as fasteners.

One tool from the 2013 assemblage has been identified as Late Neolithic in age. It is markedly different from the other

tools in this assemblage (Fig. 10). It is a large pointed implement made on a complete sheep distal tibia. The proximal end is broken off, and ground crosswise to a point. The very tip of the tool is missing. There are many clear scratches resulting from tool rotation around the tip to about 5 mm from the tip; the diameter of the tool at the farthest scratch mark is about 4 mm. This tool was likely used as a heavy-duty perforator, probably used for working thick hides, although it may have been used in basketry.

### 3.2. "Idols"

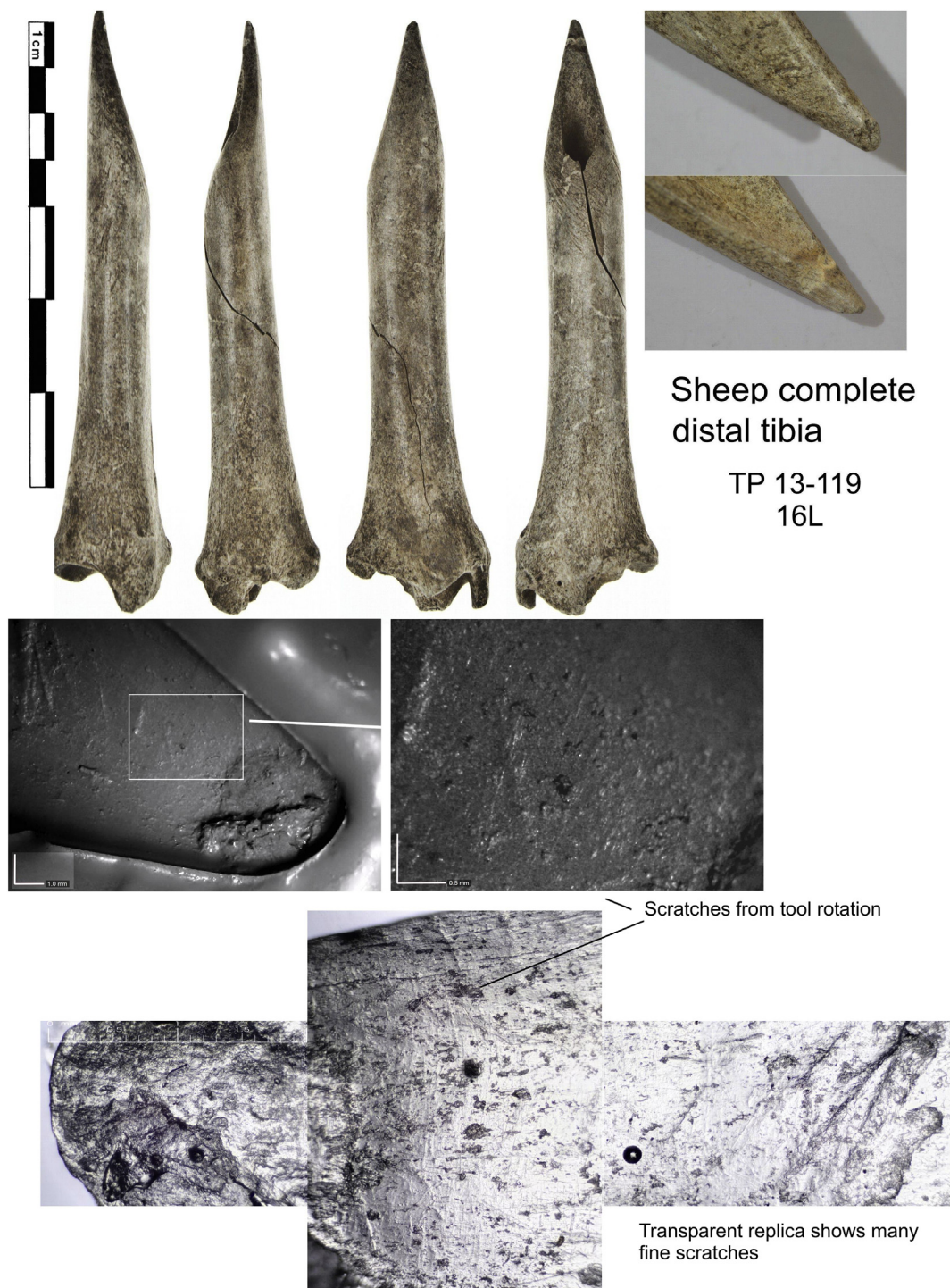
Of particular interest are twelve objects in the sample that have been identified as "idols" (Fig. 11). Numerous examples of such idols have been recovered from the site and are discussed in previous publications (Bıçakçı, 2001, 2012; Christidou, 2005, 2006; Christidou et al., 2009). One unusual specimen that was unavailable for close study because it was on display in the Niğde Museum appears to have been carved from red deer antler. The others were fashioned from the first phalanges of equids, including both wild horses (*Equus ferus*) and hydruntines (*Equus hemionus hydruntinus*). Analysis of the unmodified faunal remains from the site shows that equid remains make up just under 10% of the animal bone assemblage, and that wild horses and hydruntines are present in roughly equal numbers. In general, these phalanges have been modified by reducing the distal end of the bone and substantially thinning the both the dorsal and plantar/volar surfaces toward the distal end (Fig. 12). Other previously recovered examples are more distinctly modified into anthropomorphic shapes. One specimen from the 2013 season (Fig. 13) is strongly waisted and has a "neck" protrusion at the distal end.

It is particularly striking that all these phalanges all come from wild equids, even though domestic cattle phalanges which could have been used to make the "idols" were also available. Cattle first phalanges, however, are narrower than equid ones. In this assemblage three phalanges are from wild horse, while five are from hydruntines. One other fragmentary and heavily modified specimen may also be a hydruntine. Two partial specimens could not be identified to species.

An additional object might also have been an idol. This is a long, narrow, slightly curved stick-shaped artifact abrasively flattened on one side and then carved to shape from a segment of red deer (*Cervus elaphus*) antler. Red deer antler would have been readily available to the inhabitants of Tepecik since the mountains that surrounded Tepecik would have been forested in Neolithic and Chalcolithic times, and forest animals, including both red deer and roe deer, are well represented in the faunal assemblage. The wider end of this object is rounded and is surrounded by notches to resemble a head. There is no polish or clear wear on this protrusion, nor is there any wear within the notch that would suggest a suspension cord had been tied there. There is a slight polish along the central portion of the shaft, but there is marked rounding and substantial polish on the narrow end, which is darkened as well. This object may have served as a digging tool; alternatively it might have been stuck into the ground as an idol, but the degree of wear suggests repetitive action.

A study of the overall assemblage of idols which includes several hundred specimens from the Pre-pottery Neolithic, Pottery Neolithic, and Chalcolithic levels is currently in progress (see Campana and Crabtree, 2017). Many of these objects are only minimally modified, and only a few show the addition of anatomical details such as eyes. Since many of these objects are only minimally modified, the question of whether they all served as





**Fig. 10.** Large tool made from a complete sheep distal tibia with many fine scratches due to rotation, probably for piercing a relatively thick pelt or possibly in basketry.

idols or whether some or all of them may have served a more prosaic purpose such as counters remains an open one.

### 3.3. Other bone implements and objects

The bone artifact assemblage includes a variety of objects including spatulate tools, antler hafts, possible rubbers, and numerous beads. These items will not be discussed here, but will be addressed in the future.

## 4. Future directions

This is a preliminary report on what will be a long-term study of the manufacture and use of bone objects at Tepecik-Çiftlik. Our research shows that a wide range of domestic and wild animals, including sheep, goats, wild horses, hydruntines, and red deer were used in the manufacture of bone objects and that this diversity is also reflected in the assemblage of unmodified faunal remains. In future seasons, our goal will be to study the later Neolithic bone



Fig. 11. So-called “idols” recovered in the 2013 season. Similar artifacts are plentiful from the Neolithic onward and will be the subject of further study.



Fig. 12. Horse first phalanx “idol” with narrowed distal end.



Fig. 13. Hydruntine first phalanx “idol” with narrowed “waist” and a “neck” protruding at the distal end, giving the object a more anthropomorphic appearance.



objects to see whether there are distinctive changes in bone tool manufacture and use between the later Neolithic and the Chalcolithic periods and whether these changes reflect changes in the overall faunal assemblage as well.

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## References

- Bıçakçı, E., 2001. Tepecik/ciftlik höyüğü (Nigde) kazisi ixiginda orta dogu tarihöncesi kültürleri ile ilgili yeni bir degerlendirme. *Tüba-ar. Turkish Acad. Sci. J. Archaeol.* 4, 25–41.
- Bıçakçı, E., Godon, M., Çakan, Y.G., 2012. Tepecik-çiftlik. In: Özdoğan, M., Başgelen, N., Kuniholm, P. (Eds.), *The Neolithic in Turkey*, vol. 3. Archaeology and Art Publications, Istanbul, pp. 89–134.
- Campana, D.V., 1989. Natufian and Protoneolithic Bone Tools: the Manufacture and Use of Bone Tools in the Zagros and the Levant. *British Archaeological Reports, International Series*, Oxford, 494.
- Campana, D. V., n.d. Tepecik Bone Tools Assemblage 2013 Season, Analyzed 2015–16. Interim report submitted May, 2016.
- Campana, D.V., Crabtree, P.J., 2017. Equid “idols” from Tepecik-Çiftlik, southern Cappadocia, Turkey. In: Poster Presented at the 12th Meeting of the Worked Bone Research Group (WRBG), University of Grenada, Spain. May 23–27, 2017.
- Christidou, R., 2005. Tepecik-Çiftlik—the Bone Artifacts. Unpublished Manuscript provided to the Authors by E. Bıçakçı.
- Christidou, R., 2006. Study Session August 28th–september 6th, 2006. Unpublished manuscript provided to the authors by E. Bıçakçı.
- Christidou, R., Coqueugniot, E., Gourichon, L., 2009. Neolithic figurines manufactured from phalanges of equids from Dja'de el Mughara, Syria. *J. Field Archaeol.* 34, 319–335.
- Russell, R., 2016. Anatolian neolithic bone tools. In: Yalçın, In Ü. (Ed.), *Anatolian Metal VII, Der Anschnitt*, pp. 125–134. Supplement 31.
- Sidéra, I., 2012. Nouveau regard sur la néolithisation L'industrie osseuse de l'Antolie au Bassin parisien via la Méditerranée. *Collection Travaux de la Maison René-Ginouvès*, No. 15, Paris.
- Steiner, M.C., Buitenhuis, H., Duru, G., Kuhn, S.L., Mentzer, S.M., Munro, N.D., Pöllanth, N., Quade, J., Tsartsidou, G., Özbaşaran, M., 2014. A forager–herder trade-off, from broad-spectrum hunting to sheep management at Aşıklı Höyük, Turkey. *Proc. Natl. Acad. Sci.* 111 (23), 8404–8409.