

The Neolithic worked bone assemblage from Ulucak Höyük, Western Anatolia

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ABSTRACT – *In this investigation we detail the results of a systematic analysis of worked animal bone from Ulucak, one of the earliest Neolithic sites in western Anatolia. The collection exhibits a wide range of types, including points, needles, spatulas, bevelled tools, perforated objects, and other unique objects. A study of the raw material shows a preference for sheep and goat long bones, while large-sized animal rib bones were also utilized. Manufacturing techniques employed included splitting, grooving, and abrasion, while a contextual analysis of the material underscores an intricate connection with other objects made from stone and clay. Items found in buildings relate to textile, leather, and ceramic production, while personal ornaments may have played a part in abandonment rituals. Examination of this assemblage is understood as a common set of regional tool types with some localized variations.*

KEY WORDS – *Early Neolithic; Western Anatolia; animal bone artefacts*

Neolitski zbir koščenih izdelkov iz Ulucak Höyüka, zahodna Anatolija

IZVLEČEK – *V razpravi predstavljamo rezultate sistematične analize obdelanih živalskih kosti iz Ulucaka, enega najzgodnejših neolitskih najdišč v zahodni Anatoliji. Zbir predstavlja široko paleto orodij, konic, igel, lopatic, prirezanih orodij, prebodenih predmetov in drugih unikatnih izdelkov. Analiza surovin kaže, da prevladujejo ovčje in kozje dolge kosti. Uporabljali so tudi rebra velikih živali. Tehnike izdelave vključujejo razcepljanje, žlebljenje in brušenje. Kontekstualna analiza je pokazala na povezave z drugimi predmeti, narejenimi iz kamna in gline. Koščeni predmeti, ki so bili najdeni v zgradbah, so povezani s tkanjem, izdelavo usjenih izdelkov in lončenine. Koščen osebni nakit je bil morda uporabljen v obredih opuščanja bivališča. Predmete razumemo kot regionalen zbir orodij, ki vključujejo tudi lokalne različice.*

KLJUČNE BESEDE – *zgodnji neolitik; zahodna Anatolija; izdelki iz živalskih kosti*

Introduction

The systematic study of worked animal bones at Neolithic and Chalcolithic sites in Anatolia has increased in the last two decades (Russell 2016). No longer a neglected sub-discipline, studies have shown how new avenues of scientific testing (Bradfield et al. 2019), use-wear analysis (Campana, Crabtree 2018)

and spatial analysis (Samei, Alizadeh 2020) can add to our understanding of sedentary communities. However, some long-standing excavations from Anatolia are yet to undergo the first element of systematic analysis: the establishment of a typology, raw material identification, and technological, contextual,

and comparative investigations of their collections to establish a foundation for these further studies.

One of these sites is Ulucak, located 25km east of Izmir. Continuous archaeological excavations since 1995 have uncovered a vast amount of material culture (Çevik, Erdoğan 2020; Çevik 2019; Çilingiroğlu et al. 2004; 2012). Uninterrupted occupation at the site occurred between Level VI (6850/6830–6500 cal BC), Level V (6500–6000 cal BC) and Level IV (6000–5700 cal BC), with habitation in Level III (5600–5460 cal BC) occurring after a brief cultural break. Later levels belong to the Early Bronze Age (Level II) and Middle Bronze Age (Level I), with evidence of Late Roman/Byzantine remains on the surface.

The earliest occupation at Ulucak, Level VI, has been exposed in trenches L13 and partly L12 and K13. This period is known from two adjacent buildings (Buildings 42 and 43), which has a possible communal function, lime plastered and red painted floors and open spaces with fire installations around the buildings (Fig. 1). Level V has five sub-phases (Va-e) and is exposed in trenches L13, L12 and K13. This level consists of rectangular single-roomed domestic buildings with either mud-slab or post-framed walls. After 6000 cal BC, in Level IV, distinctive changes occurred both in the construction technique and size

of the buildings. Of the 10 sub-phases of Level IV, only IVb has been exposed in a wider area of about 1000m². In Level IVb one- or two-roomed substantial domestic buildings with sun dried mudbrick walls on stone foundations were divided by narrow streets. Level IVc is known from a specialized ceramic workshop with six rooms built of post-framed walls (Çevik 2016). The inventory of the workshop consists of several clay loaves, hematite lumps, unfinished vessels, bone tools and grinding stones possibly used for powdering hematite, which indicates the whole sequence of pottery manufacturing (Fig. 2).

Pottery has been attested starting from Level V onwards, while the earliest occupation at Ulucak is devoid of pottery and any other clay objects. Ceramics of the earliest periods include cream, brown and grey burnished wares, with an increase in red-slipped burnished wares in Level IV (Çilingiroğlu 2012; Çevik, Vuruşkan 2020). Other items recovered at the site include stone tools (with obsidian mostly originating from Melos), figurines, stamp seals, spindle whorls and loom weights (Sevindik 2018). The faunal assemblage (Pilaar Birch et al. 2019; Çakırlar 2012) consists mainly of domestic sheep and goat, with cattle and pig frequently recorded. Deer (most commonly fallow), small mammal (such as hare, fox, and tortoise), bird and fish remains are documented in lower numbers.



Fig. 1. Architectural remains Levels VI, V, and IV.



Fig. 2. Level IVc ceramic workshop.

The worked animal bone collection constitutes a sizeable part of the small finds at the site. Analysis of this material has been limited in previously published accounts (Çilingiroğlu A. et al. 2004:50; Çilingiroğlu Ç. 2012:21), with reports outlining common types such as awls, spatulas, and perforated items. Subsequent systematic analysis of the material has been conducted in more recent unpublished studies (Paul 2016; Sivil 2017).

An initial assessment of the worked animal bone was made by Jarrad W. Paul during the 2014 and 2015 excavation seasons. The objects analysed were recovered from the 1997–2015 excavation seasons. An emphasis during the initial assessment was on recording all items stored onsite, establishing a typology, and identifying raw material. A study based on this initial recording of items, which number 268 from Levels VI–III, is included in a comparative analysis of worked animal bone from sites in the north Aegean (Paul *forthcoming*). Coşkun Sivil has further conducted a contextual analysis of the material, a vital step in placing the material within its setting. Sivil's research was based solely on worked bone items from the Neolithic, Levels VI–IV. In his assessment 549 items were recorded, including those stored in the local museum. In this paper, Neolithic material will again be the focus of investigation from

the uninterrupted Levels VI–IV, uniting the work of both Paul and Sivil to illustrate a complete picture of the Neolithic worked bone assemblage from Ulucak.

The typology below is informed by Paul's initial analysis combined with Sivil's typological categorization, with a description accompanying each type and subtype. Identification of manufacturing techniques was conducted on-site by Paul using both macro (viewing distinct markers on the object or tool, for instance colouration and breakage patterns) and micro (using a x3 magnifying eye-piece to detect striations left on the object or tool) techniques. The analysis of raw material was also conducted on-site by Paul, with the assistance of Evangelia Pişkin. The contextual analysis is based on research conducted by Sivil. Discussion and interpretation in the present study is conducted by Paul, Sivil, and Çevik. Items are inclusive of those uncovered from 1995–2017.

Typology

A total of 554 worked animal bone items have been placed in Levels VI–IV. The typology created for this assessment was informed by previous research in the region, especially the work of Nerissa Russell (2016), Alexandra Legrand and Isabelle Sidera (2007) and Marcella Marinelli (1995). Objects have been sepa-

rated based on their surmised functional attributes (for example, tools used for piercing). Raw material was then used to further separate objects within types (referred here as sub-types) when necessary. The 554 items identified within this typology do not include any preforms, items too fragmentary to identify, or manufacturing waste as a by-product of worked animal bone manufacture found at the site. Although these items are found on site and mentioned later in this paper (see Context) they are not included in this assessment as the typology only includes items that have been positively identified. The typology includes six types and 23 sub-types (see Tab. 1).

1. Points

The most common type in the assemblage are points (n=319). Points are characterized by their pointed tips (Fig. 3). Their primary function was as a piercing tool. They are likely to have been used in textile manufacture, sewing animal hide, scraping ceramic surfaces and in basket weaving. They are separated into seven subtypes.

1A. Metapodial points

These points are made from metapodial (metacarpal and metatarsus) bones and have mostly polished surfaces. Manufactured by splitting along a whole



Fig. 3. Type 1. Points.

Type	Subtype	Number
1. Point	1A. Metapodial points	115
	1B. Ulna points	7
	1C. Other long bone points	62
	1D. Oval-bodied points	35
	1E. Square-bodied points	54
	1F. Fragments	40
	1G. Flat bone points	6
2. Needle	2A. Perforated needle	24
	2B. Notched needle	2
3. Spatula	3A. Flat spatula	92
	3B. Spatula-spoon	15
4. Bevelled tool	4A. Smoother	26
	4B. Chisel	39
5. Perforated object	5A. Flat bone perforated objects	2
	5B. Long bone perforated objects	6
6. Other	6A. Comb	6
	6B. Bipoint	2
	6C. Bone handle	10
	6D. Antler handle	5
	6E. Worked antler	3
	6F. Fastener	1
	6G. Hook	1
	6H. Arrow/spearhead	1
Total		554

Tab. 1. Ulucak Höyük animal worked bone and antler object typology from Levels VI-IV.

bone, the base of these objects is often left intact. They are the most numerous subtype point (n=115) in the collection.

1B. Ulna points

Points made from ulna bones are uncommon, with only seven examples recorded. Their natural form lends itself to use as a perforator, with an area to grip to the tool at its base. They would have been a suitable tool for processing soft material.

1C. Other long bone points

These points are made from undetermined long bones. The base of these tools is often rounded and smoothed, making further identification difficult. They are the second most frequent subtype (n=62).

1D. Oval-bodied points

Points in this subtype have their base missing and are defined by the form of their shaft, in this case oval-shaped (n=35). They are made of long bone fragments.

1E. Square-bodied points

As with subtype 1D, square-bodied points have their base missing and are defined

by the shape of their shaft (n=54). They are also made of long bone fragments.

1F. Fragments

Points in this subtype were made hastily, most with asymmetrical shafts, with little polishing on their surface (n=40). The construction of these points included minor morphological changes to the natural structure of the bone fragment. Based on their manufacturing techniques and less elaborated shapes, they may have met immediate needs.

1G. Flat bone points

Flat bone points are made from rib bones. They are the least common subtype, with only six examples, and were used intensively, as indicated by their bur-nished surfaces. They may have been better suited to working on soft materials, such as hide and tex-tiles, due to their form. They share similar prop-erties with spatulas and may be in fact more akin to the pointed spatula type used for ceramic shaping (Märgärit 2017).

2. Needles

Needles are made from both long and flat bones and include two subtypes: those that are perforated (2A) and those that are notched (2B) (Fig. 4). Perforated needles were drilled either on one side or both and are the preferred subtype, with 24 examples rec-orded. They are mostly made from rib bones. Notched examples are less frequent, with only two objects noted. The notches for these objects appear at the base. Needles would have been used to com-bine materials together, with wider and flatter examples associated with basket weaving.

3. Spatulas

Spatulas are also separated into two subtypes: those made from flat bones (3A) and those with a handle (3B) (Fig. 5). Those made from flat bones, rib bones in this case, are the second most frequent subtype in the collection (n=92). They would have been used



Fig. 4. Type 2. Needles.

for pottery moulding, stripping any excess materi-al. Less frequent are spatulas with a handle (n=15), also known as spatula-spoons (Paul, Erdoğru 2017). They are made on long bones. All subtype 3B spat-ulas at Ulucak were located within domestic struc-tures and open spaces. Further use-wear and trace analysis needs to be conducted to determine the function of these tools.

4. Bevelled tools

Tools in this type are sturdy and recovered mostly intact. They are grouped together here for their scraping function and are further separated into two subtypes. The first (4A) are smoothers made from tibia bones (n=26). They have a bevelled tip, un-worked base, and a hollow shaft. They are associ-ated with leather manufacture; in particular, the pre-paration of animal hide. The second subtype (4B) are chisels made from long bones (n=39). They are strong and robust tools, with a thick cortex and be-velled tip (Fig. 6). These tools are associated with wood working activities, ideal for carving and chip-ping.

5. Perforated bone objects

This type includes any object of worked bone that has been perforated and not considered a needle. They are not common in the collection, with only eight examples (Fig. 7). They are separated into two subtypes based on their raw material: those made



Fig. 5. Type 3. Spatulas.

from flat bones (5A) and those made from long bones (5B). For those made from flat bones (n=2), they may be considered a type of pendant, but due to their fragmented condition it is difficult to assign function. Perforations are drilled from either side of the object. For the long bone examples, they may have been related to weaving activities due to their size (n=6). Further use-wear analysis is needed to determine function.

6. Other

Included in this type are eight subtypes that do not fit into the categories above. They are often unique tools or objects for specific purposes.

6A. Comb

Six objects contain serrated edges, giving the appearance of a comb (Fig. 8). All are recovered from open areas in Late V and IV levels. They are made from long bone fragments and may have been used in textile manufacture to separate fibres, or possibly in pottery decoration, to incise ceramics. However, incised ceramics from the site have deeper and wider lines and dots than bone comb tips. Additionally, the teeth of these combs are often squared and flattened at their ends. Their use in textile production is thus more plausible.

6B. Bipoint

There are two items defined by their flat surface and double active tips. They are found in levels VI and V (Fig. 9).

6C. Bone handle

Also known as a shaft/sheath, these items were used to protect the user's hand during use. Inside the handle would fit an additional tool, such as a sharp stone tool. They are made from long bones (n=10) (Fig. 9).

6D. Antler handle

Similar to the objects above, antler handles, or shafts/sheaths, were made from antler and used to hold an additional tool, most likely a stone tool (n=5) (Fig. 9).



Fig. 7. Type 5. Perforated objects.



Fig. 6. Type 4. Scrapers.

6E. Antler tools

Three additional tools were manufactured from deer antler. Further use-wear analysis is needed to ascertain the function of these variously shaped tools (Fig. 9).

6F. Fastener

This object was recovered on the floor of Building 43 in Level VI. This object has been expertly constructed, delicate, and is fragmented at one end. Its suggested use is as a clothes fastener due to its size and shape. This bone object may have been deliberately placed to the building's floor together with a scapula as part of closing ritual since the building appears to have been left clean (Fig. 9).

6G. Hook

This item was uncovered in Level Vc and could have been used as a hook, owing to its shape and dimensions. It has a perforated tip which curves into a wide and flat shank, akin to fishhooks found in similar Neolithic contexts in the region (Powell 1996). However, its functional status is not entirely certain, as a similar item found at Çatalhöyük has been interpreted as a belt hook (Russell, Griffiths 2013) (Fig. 9).

6H. Arrow/spearhead

A single arrow or spearhead belongs to Level IVb. It has an oval-bodied shaft, with a pointed and flat tip (Fig. 9).

Not included in this assessment are an additional nine decorated

worked animal bones, which contain several patterned incisions, including zigzags, dots, and chevrons. These items are currently being examined in detail in a separate study.

Raw material

Analysis of the Ulucak raw material occurred on site. It is often difficult to identify species of worked bone items, especially if the objects are extensively worked. As a result, the number of positively identified species is substantially less than the overall number of worked bone items. Moreover, the number of species identified can then be limited when conducting an initial identification in the field. In this case, 95 items were positively attributed to a species from Levels VI-IV (Tab. 2). The results below are summarised from this sample.

Results from this sample show that medium-sized animals (n=61) are favoured for bone tool construction, with large-sized animals also often utilised (n=32). Bones from small-sized animals (n=2) are seldom used. Sheep/goat and sheep-sized animals are most prominent for their use in constructing points, the most frequent tool type. Bones of cattle were also used repeatedly (n=32), while pig, hare, bird, and dog/wolf bones are rare. For the deer (n=14), roe deer are most common, with possible fallow and red deer examples in the collection. In terms of element selection, from the sample (n=95) of tibia bones were used most frequently for bone tool and object creation. Metapodials, including both metatarsal and metacarpal bones, were also used often, along with antler and rib bones. The use of ribs was also not constrained to a certain type; used to construct points, spatulas, and perforated objects. Deer



Fig. 8. Type 6. Other. Subtype 6A combs.

antler was also used in far greater numbers than deer bones.

Animal species selection for bone tool and object construction are similar when viewing the zooarchaeological record for Levels VI through IV (see *Pilaar Birch et al. 2019*). That is, the most common species in the zooarchaeological record, sheep/goat, is also favoured for tool manufacture. Cattle is also frequent, although to a lesser extent, in both the worked and unworked bone groups. Suzanne E. Pilaar Birch and colleagues also note an increase in deer bone frequency over time at Ulucak, which mirrors species selected tool manufacture. From the n=14 items made from deer antler and bone investigated in this sample, n=12 are contextually placed in Level IV, with one in Level V, and one in Level VI.



Fig. 9. Type 6. Other. Subtypes 6B-H, bipoint, bone handle, antler handle, worked antler, fastener, fish related item, arrow/spearhead.

Manufacturing techniques

Craftspeople at Ulucak used a range of manufacturing techniques to construct individual tool types. The most common technique for point manufacture was the splitting and grooving of metapodial bones, before shaping the tip into a point (subtype 1A). Separation of the bone was via bipartition as a result of percussion followed by grooving. The creation of ulna points (subtype 1B) was less labour

intensive with abrasion of the tip to create a point with the base left unworked. Other bone points in the assemblage (1C, 1D, 1E) were created by splitting a bone into irregular splinters and then through the process of grooving and abrasion creating a pointed object. The practice of splitting was also used to create flat spatulas (3A), where a rib bone was split in two and the inner spongy bone was smoothed via abrasion. Tibia bones were used for smoother (4A) items, with the base and shaft of the bone left unworked, while the tip was fractured via percussion then bevelled through abrasion. Objects that were perforated are also mostly drilled from both sides of the tool, evident in the slanted areas around the drill hole, although this may also be an indicator of extensive use-wear.

While most tools contain the usual amounts of soil staining, some show evidence of intense burning, turning some objects black, grey, white, and blue. Bone colour can be an indicator of the degree of burning, with white and blue colouration suggestive of intense heating (Gilchrist, Mytum 1986:32). Tools with traces of burning are associated with contextual units that were destroyed by fire, also evident on damaged clay objects. One example, a pointed tool, shows evidence of controlled burning at the tip of the object, a technique used by the Ulucak craftspeople to strengthen the bone. This procedure requires specialized knowledge, as too much exposure to heat will result in damage.

For use-wear, due to time constraints liner striations were only observed under x3 magnification, and

this produced limited results. Due to this, we focus here on two subtypes: metapodial points (1A) and smoothers (4A). For metapodial points, the direction of the striations (when positioning the object with the base at the bottom) ran transversely across the body in 21 examples. Nine points showed evidence of longitudinal striations, with less occurrences of diagonal striations (n=6) and no discernible direction (n=5). The remaining points contained no evidence of striation pattern or direction under x3 magnification. For smoothers, most had a collection of random directional striations (n=10) with some exhibiting either longitudinal (n=2) or transverse patterns (n=2). The remaining smoothers showed no evidence of striation pattern or direction under x3 magnification. Further microscopic analysis is needed to ascertain whether striations were the result of use or manufacture wear, and the types of techniques involved in the process, such as scraping or abrasion.

Context

Level VI (6850/6830–6500 cal BC)

Worked bone objects from this period are found in Buildings 42 and 43 and in open areas surrounded by hearths. Low numbers of worked animal bone objects are attributed to Buildings 42 and 43, both of which have red painted lime floors and walls. The buildings are believed to have been deliberately emptied during an abandonment ritual (Çevik 2019). This ritual act is supported through evidence of object placement, particularly grinding stones, positioned directly above the location in the previously built structure. As a result, any worked animal bone objects found after cleaning may have been associated with this abandonment ritual. In Building 42 these objects include two points (1A, 1D), and a spatula (3A), while in Building 43 a bone fastener (6F) was found with a scapula. Due to its find context, the bone fastener may therefore be considered an important personal ornament, and due to its connection with the burial of the building, possibly a communal building, may have played a part in wider burial traditions.

Far more worked animal bones are attributed to open areas in this level, found in connection with several hearths and ovens. Points are most frequently found here, with spatulas and

Elements	Species							Total
	Large-sized	Medium-sized			Small-sized			
	cattle	deer	sheep/ goat	dog/ wolf	pig	hare		
antler		12						12
tooth				1	1			2
rib	15							15
mandible	1							1
scapula	1							1
vertebrae	1							1
long bone	5						1	6
radius			2					2
ulna			1					1
tibia		1	21					22
metapodial		1	6					7
metacarpus			4					4
metatarsus			5					5
undetermined	9		6			1		16
Total	32	14	45	1	1	1	1	95

Tab. 2. Positive species and element identification of worked animal bone objects from Levels VI–IV at Ulucak.

bevelled tools also numerous (Fig. 10). The level of skill used to produce spatulas and bevelled tools is lower when compared to examples in later levels. Similarly, their used surfaces have less abrasion and deformation. The types of tools suggest a mixed production area of leather and textile manufacture. The presence of a high number of animal bones around fire installations may suggest the processing of animals (butchering and hide processing) also took place in the same area. As such, an immediate need for an item may have been met with these opportunistically made tools.

Level V (6500–6000 cal BC)

Ten buildings from this period (22, 23, 27, 30, 33, 40, 47, 51, 54 and 59) contain evidence of worked animal bone tools.

Buildings 40 and 59 represent the earliest buildings from this period (Level Ve). Both buildings contained a low number of processed bone items, following the trend in Level VI. Three items were recovered from Building 40: points of subtypes 1A, 1C and 1E. Associated with Building 59, to its south, is a shallow lime-covered pit, that is believed to be another deposit connected to ritual abandonment. A single bone point (subtype 1G) was found in the pit alongside chipped stone tools, animal bones, and a ceramic sherd. Use-wear on the point suggests its function as a possible scraper involved in ceramic production. Building 54 (Level Vd) shows an increase in worked bone, and material more generally, with the inclusion of four metapodial points (1A), one oval-bodied point (1D), one perforated needle (2A) and one spatula (3A). Among the finds in this building was a higher than usual collection of spindle whorls (a total of 20). The appearance of the needle and spindle whorls together suggests textile production was one important activity carried out in Building 54.

The frequency of worked bone items found in buildings increases towards to end of this period. In Level Vb, Building 30 includes five worked bone pieces (three subtype 3A spatulas and two subtype 4A bevelled tools) and may have been linked to ceramic production given the types of tools recorded and absence of other textile-related items such as bone points and spindle whorls. Building 33 contains three worked bone items (subtype 1A

point, subtype 1E point and subtype 3A spatula), while in Building 47 four points are found: one made from a metapodial bone and three from other long bones. Building 51 contained a high density of bone tools (n=17), a standout for this period due to its breadth of types: seven subtype 1A points, one subtype 1E point, a perforated needle (2A), five subtype 3A spatulas, two bone handles (6C) and one antler tool (6E). A stone chisel found in the building was able to be inserted into one of the bone handles, providing a direct link between the two material groups. In addition, an unworked metapodial bone and unworked rib bone were found at the south of the building, perhaps stored for future tool production. The end of Level V (Va) is seen in Buildings 23, 23 and 27. Building 23 contained a single perforated bone needle among 21 spindle whorls and 31 stone slingshots, while in Building 22, a metapodial point, two spatula-spoons, and an antler tool were uncovered. A single bone point was found in Building 27.

Level IV (6000–5700 cal BC)

Buildings in this period are placed in two categories: the specialized ceramic production of Level IVc and residential buildings of Level IVb.

Regarding structures in Level IVc, Building 55 contains the most evidence of worked animal bone. Eighteen items include: two metapodial points (1A), a point made from a long bone (1C), four square-bodied points (1E), a perforated needle (2B), six spatulas (3A), two chisels (4B), a perforated object (5B), and an antler tool (6E). Most items were made from the bones of large-sized animals. One of the points, made from a deer long bone, contained red pigment on its tip. This tool was therefore used for a different purpose than the other bone points in the assemblage, and suggests that at least some tools may have been used haphazardly for mixing/diluting

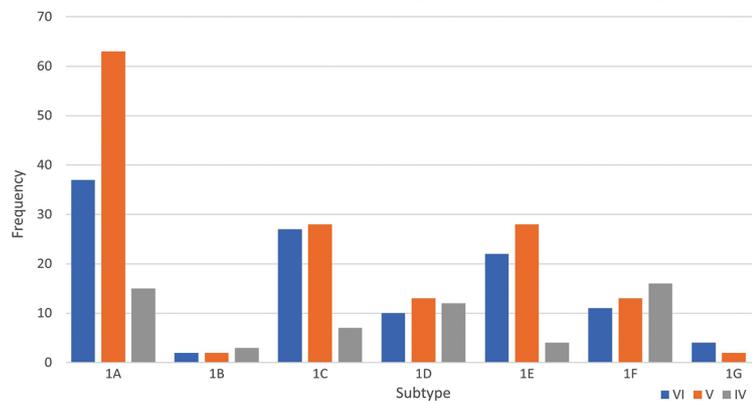


Fig. 10. Point distribution (subtypes 1A–1G) across Levels VI–IV at Ulucak.

paint, not necessarily its originally intended purpose. Worked bone preforms and manufacture waste in relation to wider on-site tool creation are the focus of an additional ongoing study, but it is worth mentioning that Building 55 contained a variety of preformed worked bone tools including a tibia that had been divided into equal parts by splitting but was discarded, and a split long bone with its epiphysis cut.

Other buildings in this category contain fewer worked bone objects. Building 56 contains a single point made from a rib bone (1G), while in Building 61 a metapodial point (1A), an oval-bodied point (1D), a square-bodied point (1E), and two spatulas (2A) were recorded. For Building 62 the types of tools are varied: two metapodial points (1A), a long bone point (1C), a fragmented point (1F), two perforated needles (2A), a spatula (3A), a chisel (4A), and a perforated object (5B).

The worked bone objects in the residential buildings of Level IVb offer an interesting insight into daily tool types. Building 6, for example, contains four worked bone tool objects (a metapodial point, two spatulas, and a perforated needle) among other small finds, such as figurines, pendants, and spindle whorls. Building 13 also records figurines and pendants with the inclusion of two metapodial points and a spatula. Points are the only type found in Building 12, with four made from long bones (1C) and two that are square-bodied (1E), with other objects including a stone tool, a pendant, and 13 beads. A figurine, stone tools, pestles, a grinding stone, and a spindle whorl are seen in Building 52, along with eight worked animal bone items: two metapodial points (1A), a square-bodied point (1E), a perforated needle (2A), two spatulas (3A), a chisel (4B), and a perforated bone object (5A). Four worked bone items were also found in the street between Building 52 and Building 12, although they are too fragmented to be identified.

Regional parallels

From a typological standpoint, the collection at Ulucak is consistent with other collections found in western Anatolia from the Neolithic. For instance, pointed tools are also common at Yeşilova, where deer antler was also used to create tools, including antler handles (or sheaths) (*Derin 2012.180–182*). Points dominate the Ege Gübre collection (*Sağlamtimur 2012.200*), while similar types of objects are found at Çukuriçi Höyük, including points, spatu-

las, smoothers, and spoons, common after 6500 cal BC (*Horejs et al. 2015.304*). This trend – the dominance of pointed tools, usually made from the long bones of sheep/goats – is also present in collections in the northwest, at sites such as Uğurlu, Ilıpınar, Barcın, and Aktoprallık (*Paul, Erdoğan 2017*), and more broadly throughout Anatolia (*Russell 2016*).

However, there are variations in the Ulucak collection that are unique to the site. For instance, while medium-sized animals were favoured for making bone tools, large-sized animals were also utilized in greater numbers when compared to other sites in western and northwestern Anatolia (*Paul 2016*). Likewise, the under-representation of small-sized animal bones is regionally uncommon. The presence of unique items in the collection, such as the arrowhead/spear, comb, and the intricate fastener, are also rarely seen in the wider region. The number of items in the assemblage is also worth noting, as it is higher than the average for the region (*Paul forthcoming*).

Overall, the Ulucak worked bone assemblage is consistent with other collections in the region. However, when the typology is examined closely on a type-by-type basis and compared with other collections in the region, certain unique trends emerge that illustrate some localization within a regionally established toolkit.

Conclusion

Results of this systematic investigation (including a typology, raw material and contextual analysis) underscore the prevalence and significance of worked animal bone at Ulucak. In the earliest levels of the settlement (Level VI) low numbers and a restricted diversity of types characterize a largely utilitarian toolkit, with production occurring rapidly for short periods of use. As the settlement grew, so did the number and range of tools produced, peaking in Levels V and IV. These tools were also used in conjunction with an increasing number of items made from stone and clay. The tools at Ulucak were produced primarily from the metapodial and tibia bones of medium-sized animals (most commonly sheep/goat), with the rib bones of large-sized animals (such as cattle) also used. A variety of techniques were employed, most notably grooving and splitting of long bones, splitting of rib bones, and shaping via abrasion.

Contextual analysis also provides clues as to the function of these items. Textile manufacture is seen

as the primary role for many of the items in the assemblage. Bone points, needles, and combs in particular formed part of a wider textile toolkit at Ulucak. This is especially clear in Levels V-IV, with evidence of spindle whorls and loom weights (numbering more than 300) at the site being one for the largest collections in western Anatolia for this period (Sevindik 2018). However, tool types do not always seem to be restricted to set functions. For instance, the bone point with the painted tip in Level IVc is indicative of an item with an intended function (boring or sewing) that may have been haphazardly used for another purpose, in this case mixing/diluting paint. Leather processing is also suggested to have been conducted using scraping tools, while spatulas could have aided ceramic production. Evidence of preformed items also suggests on-site manufacture.

Tools in use during the Neolithic are also seen to be part of complex abandonment rituals at the site, with items repeatedly placed deliberately on cleaned flo-

ors. This may help in understanding the status of worked bone more generally at the site, with scarce evidence of tools found discarded in the streets between buildings after Level IV, perhaps indicative of a possible secondary symbolic importance.

Worked animal bone tools were therefore an important aspect of the social and economic life at Ulucak for over 1000 years of initial occupation. This study has laid the foundation for future worked bone research at the site, with additional analysis needed, such as detailed use-wear analysis, to confirm the results of current interpretations.

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