DEER ANTLER OBJECTS PRODUCTION DURING BRONZE AGE IN SOUTHEAST OF THE IBERIAN PENINSULA. CABEZO REDONDO (VILLENA, ALICANTE, SPAIN)

La producción de objetos de asta de ciervo en la Edad del Bronce en el sureste de la península Ibérica. El Cabezo Redondo (Villena, Alicante, España)

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ABSTRACT Antler is a profusely used raw material throughout Late Prehistory. From1700/1600 cal BC, social and economic transformations that took place in the Southeast of Iberian Peninsula led to the period known as the Late Bronze Age. During this time, an extraordinary increase in the exploitation of antler raw material can be observed,to create varied objects, most of them involved in productive activities. This change took place in the general context of arise in the production of handicrafts. This includes the improvement of metallic tools made in real bronze and working techniques which allowed for the development of new and diverse implements made from different raw materials with a wide range of functions. The archaeological site with the most well-documented record of this process is Cabezo Redondo: a settlement characterized by a proto-urban organization on a hillside with a chronology which span along almost the entire 2nd millennium cal BC.

Keywords: Antler Artifacts, Antler Working, Late Bronze Age, Iberian Peninsula, Mediterranean.

RESUMEN El asta de ciervo es un material profusamente utilizado durante la Prehistoria Reciente. A partir de 1700/1600 cal BC., con las transformaciones económicas y sociales que en el Sureste de la península Ibérica darán paso al período conocido como Bronce Tardío, se produce un incremento extraordinario en la explotación del asta de ciervo como materia prima para realizar una amplia variedad de objetos, la mayoría de ellos involucrados

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Fecha de recepción: 05/04/2019. Fecha de aceptación: 22/06/2019.
http://dx.doi.org/10.30827/CPAG.v29i0.9771

en actividades productivas. Todo ello en un contexto ligado al auge de las actividades artesanales, con una mejora de las herramientas metálicas —de auténtico bronce— y de las técnicas, que permitió obtener soportes variados y, a partir de ahí, útiles de amplia variabilidad funcional. El yacimiento que mejor permite documentar este proceso es el enclave de Cabezo Redondo. Un poblado caracterizado por una organización protourbana en ladera, con una cronología que abarca buena parte del II milenio cal BC.

Palabras clave: Utillaje de asta de ciervo, Trabajo del asta de ciervo, Bronce Tardío, Península Ibérica, Mediterráneo.

ANTLER AS RAW MATERIAL. FROM THE END OF THE COPPER AGE TO EARLY BRONZE AGE IN THE EASTERN IBERIAN PENINSULA

Deer antler is used profusely as a raw material in the eastern area of the Iberian Peninsula since the Palaeolithic, appearing frequently in Neolithic and inoverall Chalcolithic archaeological contexts. Greater firmness, resistance, and a longer lifespan in comparison with bone, made antlera more appropriate for making tools to beat or perforate harder materials. In addition, antler has the advantage that it can be collected during the cervid's shedding season and storedfor a relatively long timeunder suitable temperature and humidity conditions.

In some Chalcolithic sites in this area, such as Ereta del Pedregal, there was a wide use of antler for the production of a considerable number of osseous artifacts. This settlement, which was inhabited from the 4th to at least the middle of the 3rd millennium BC, was excavated several times over the past century (Juan-Cabanilles, 1994). According to published data (Pascual, 1998:256, IV.6), there are nearly a hundred objects made from deer antler, which account for approximately 18% of the total registered osseous artifacts. This data concurs with evidence obtained from most of the Neolithic and Chalcolithic sites in this area, in which the percentage of deer antler objects, in relation to the total number of osseous objects, normally holds values above 15% (López Padilla, in press).

However, from c. 2200 BC the selection process of raw material for bone working shows a very clear change via a notable decrease in deer antler use over time. Thus, in the well-documented Bronze Age sites occupied between 2200-1500 B.C. -such as Cabezo Pardo, Lloma de Betxí and Muntanya Assolada, among others, the proportion of deer antler objects invariably remains below 10% in relation to the total number of osseous objects.

With the exception of Ereta del Predregal, in the Late Neolithic and Copper Age sites of 4th and 3rd millennia BC a greater percentage of antler objects is observed in relation to the deer bones found among the faunal remains, while in the sites of the first half of the 2nd millennium BC the opposite occurs. However, there is a marked difference between these and chronologically later settlements (approximately 1700-1200 cal BC), such as Cabezo Redondo, La Horna, or La Peña Sax. At these late sites, the percentage of antler objects not only reaches values of 20% or higher, but the ratio between red deer and other faunal remains (9'7:0'3) is extremely low relative to earlier site (fig. 1).

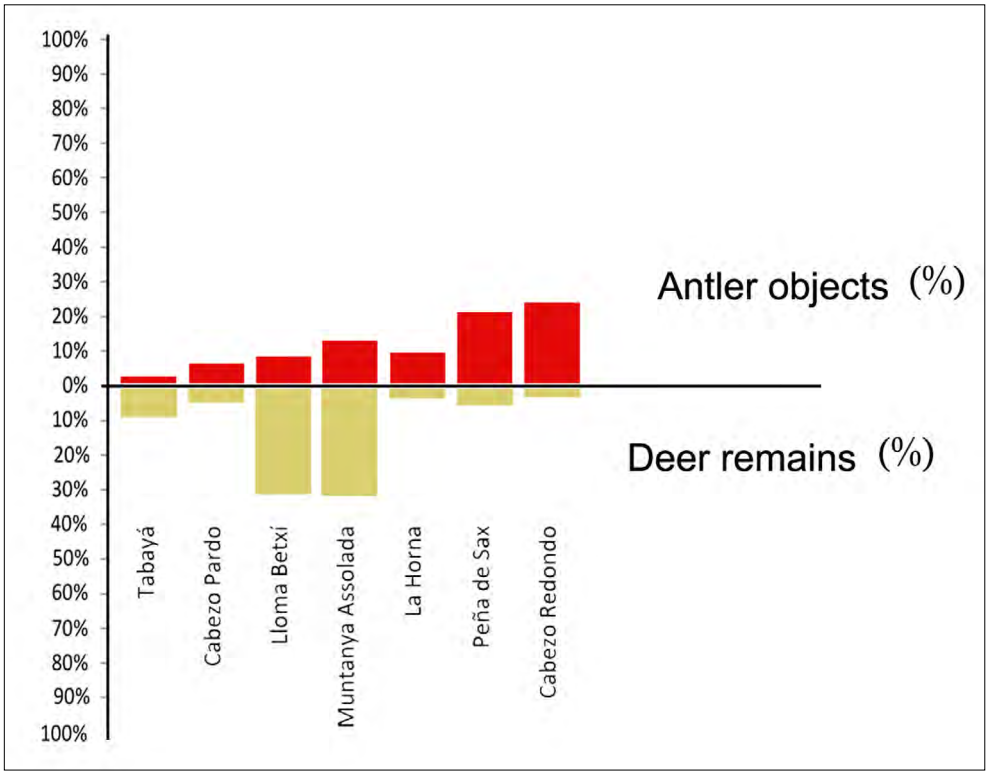

Fig. 1.—Percentage of antler objects compared to deer osseous remains in Bronze Age sites.

This shift can also be detected along the stratigraphic sequence of some intensively investigated Bronze Age sites, such as Terlinques, located just a few kilometers south of Cabezo Redondo (Jover and López, 2004, 2016). In Terlinques, of which almost two-thirds of its surface has been archaeologically documented, three successive occupation phases have been recognized. The first phase starts around 2200 cal BC and the last phase ends around 1500-1450 cal BC (Jover *et al.*, 2014). Although antler objects found at Terlinques only accounts for 15% of the total osseous material, almost all of them were found in the phase III strata, which dates to approximately 1600 BC. In this late phase, 26% of the artifacts and osseous worked remains found were of antler, while in the two previous phases, the antler objects hardly accounted for 1%. It can therefore be concluded that the value of antler as a raw material increased significantly from ca. 1700-1600 BC in Terlinques (López Padilla, in press).

This data is added to the finding of an antler working activity area in Habitational Unit 7 of Terlinques, dating of this same chronology. A large number of fragments of a nearly whole antler, mixed with production waste, were found

next to a flint-working area in a house of about 15 m². Among these worked antler pieces there were a small rectangular plate and two fragments of distal antler tines with carving and cut marks, made with metallic tools (López Padilla, 2011:344).

Terlinques is a settlement of just 0.25 ha, located a short distance from the Cabezo Redondo, ten times larger. Stratigraphy and radiocarbon dating have shown that both were contemporary, at least during the last phase of occupation at Terlinques, which was abandoned around 1500 BC. (Jover *et al.,* 2014). As the chronological sequence of Cabezo Redondo extends until around 1200 B.C. (Hernandez *et al.,* 2016) it is not surprising that there are considerable evidences of antler processing in the site, inclouding diverse working areas in some of the excavated houses.

THE PRODUCTION OF ANTLER OBJECTS AT CABEZO REDONDO DURING THE LATE BRONZE AGE (C. 1550-1200 BC)

Cabezo Redondo. The archaeological context

Cabezo Redondo is located about two kilometers West from the town of Villena (Alicante, Spain) on a rounded hill with a summit of about 40 m above the surrounding land and 579 m above sea level. It is in the center of the so-called "Villena Basin", where several natural corridors converge to connect the Central Plateau of the Iberian Peninsula and the northern part of the Baetic mountain ranges with the Mediterranean Sea. Those lands configure an environment with an abundance of water, fertile lands, mineral salt, as well as many vegetal and hunting resources (fig. 2).

In 1950, J. M.ª Soler García carried out the first excavations at Cabezo Redondo, though the site had been known since the 19th century. It was a stage of discontinuous archaeological work, during which some extraordinary discoveries were made in Cabezo Redondo and the surrounding areas. One of the most outstanding took place in 1963 when a set of gold pieces —the *Tesorillo de Cabezo Redondo*— was found on the eastern slope of the hill, which would be surpassed in importance by the discovery, that same year, of the so-called *Tesoro de Villena*. It is a hoard of gold, silver and some iron objects, that was found at 2 km far from the Cabezo Redondo site, but most probably linked to its abandonment. These discoveries, and subsequent research on them, were published in several works, including a monograph about the 1950s excavations (Soler, 1987). A new stage in the field works and archaeological reserach of the site began, years later, leaded by J. M. Soler García and M. S. Hernández Pérez. Currently, a University of Alicante team continues to excavating Cabezo Redondo under the supervision of the authors of this paper (M. Hernández, G. García and V. Barciela) (Hernández *et al.,* 2016).

Until now, there are 50 radiocarbon dates available from both domestic and funerary contexts. These and the stratigraphic sequence define two main archaeological phases in the occupation of the site. The first one has been recorded at the top of the hill,

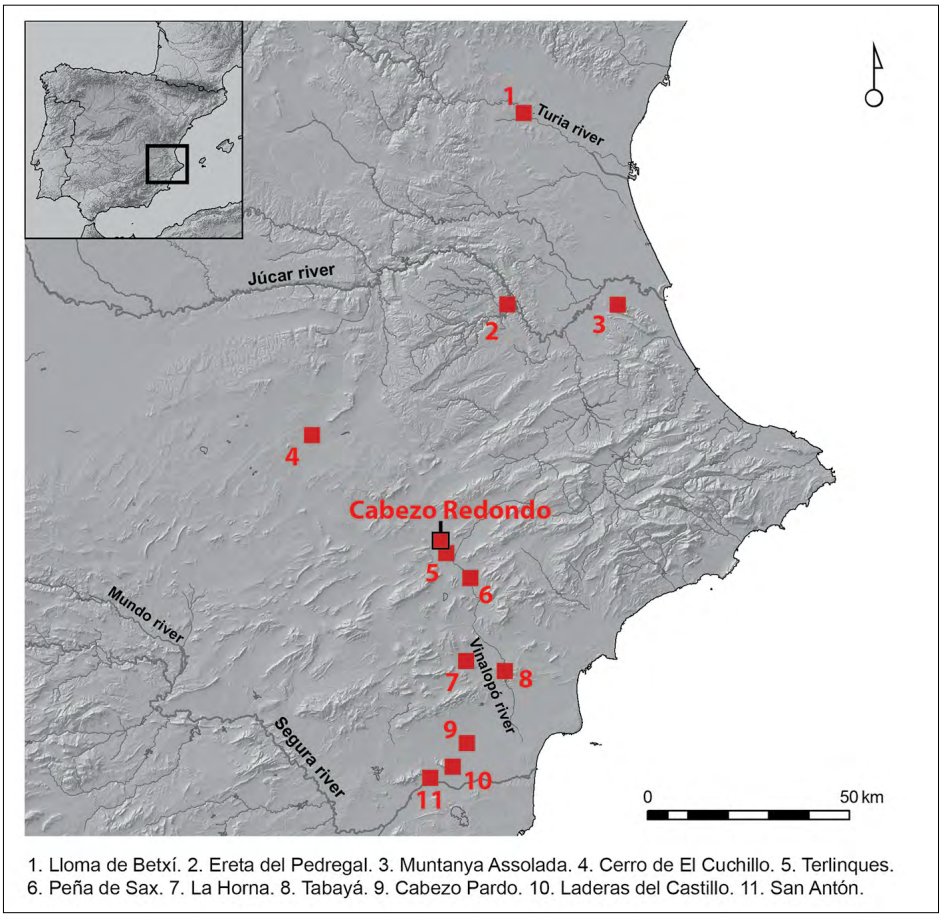

Fig. 2.—Location of Cabezo Redondo and the archaeological sites mentioned in the text.

where the earliest occupation dates back to around 2100 cal. BC. This phase lasted until 1700 cal BC when this sector of the settlement was rearranged and new houses were built, some of which have tombs beneath the floors. Many of the rock crevices and small caves of the hill were also used as burial places at that same time[1].

During the second phase (1650-1300 cal BC; Late Bronze), the settlement reached a proto-urban organization, with blocks of houses distributed on artificial terraces, separated by narrow corridors and, exceptionally, stone-paved ramps, through which access to dwellings was gained. The dwellings are large, some of them as much as 100 square meters, and domestic mud structures of great complexity were built

1. A detailed analysis of Cabezo Redondo dates in Hernández *et al*., 2016:114.

inside. Individual burials —both adults and childs— were found under the floor of some of the houses.

Due to its size and characteristics, Cabezo Redondo can be considered one of the most outstanding Bronze Age settlements ineast and southeast of the Iberian Peninsula (Hernández *et al*., 2016) (fig. 3). Evidences of using high social prestige products are abundant and associated both with habitational and funerary contexts. Gold ornaments found in some adult burials and, especially, in a few child burials, points social differences among the inhabitants of the site, as well as the existence of hereditary privileges. Some exotic materials as gold, glass paste, ivory, as well as some fine decorated ceramic vessels connect Cabezo Redondo with the hinterland of the Iberian peninsula and with the Mediterranean and European trade routes of the middle of the 2nd millennium BC. Some adornments are exceptional because of something more than the material they are made of. The shape of particular pieces, such as the gold and silver truncated cones and ear expanders, as well as the ivory combs and the glass paste beads, is indicative of more than the existence of exchange networks with the Argaric culture (López, 2011; Barciela, 2015; Hernández *et al.,* 2016).

The site was probably abandoned along the 13th century cal BC, before the down of the Final Bronze Age (ca. 1000 BC). The hiding of the extraordinary hoard, Tesoro de Villena, probably occured during this time, linked with the social changes involved in the decline of the political power of this prominent Late Bronze Age site (Hernández *et al*., 2014).

Antler tools in Cabezo Redondo. Raw material, typological and functional evidence

Many osseous objects have been documented at Cabezo Redondo —worked bone, antler, and ivory tools and ornaments— reaching half a thousand pieces (López Padilla, 2011; Barciela, 2015). The importance of bone production in the settlement can also be measured from the considerable presence of production waste.

Antler raw material in Cabezo Redondo comes from the hunting of *Cervus elaphus,* commonly known as red deer, and, above all, from the selective gathering of their sheded antlers. A great number of finished and partially worked antler objects, and production waste has been documented (fig. 4). For the most part, these are antler tools made to transform other raw materials and performa variety of different functions. There are long and short chisels, straight and curved picks with different handle fastening systems, awls, rods, thread separators, hammers, circular spindle whorls or spindles for bow drills, tri-bladed projectile points, bi-pointed tools, arrowheads with peduncle and barbs, and handles for metallic tools (López Padilla, 2011) (fig. 5).

Among the tools made of deer antlers, one of the most numerous in the settlement are the so-called “peaks” (fig. 5b). These pieces were the active, distal part of a more complex artifact. In most cases they were attached to the end of a wooden handle, which has never been preserved until now. In Cabezo Redondo, different types of these peaks have been recognised, among which the ones made

Fig. 3.—Topographical map of Cabezo Redondo (a) with a plan of the excavated areas and of the documented houses and structures (b).

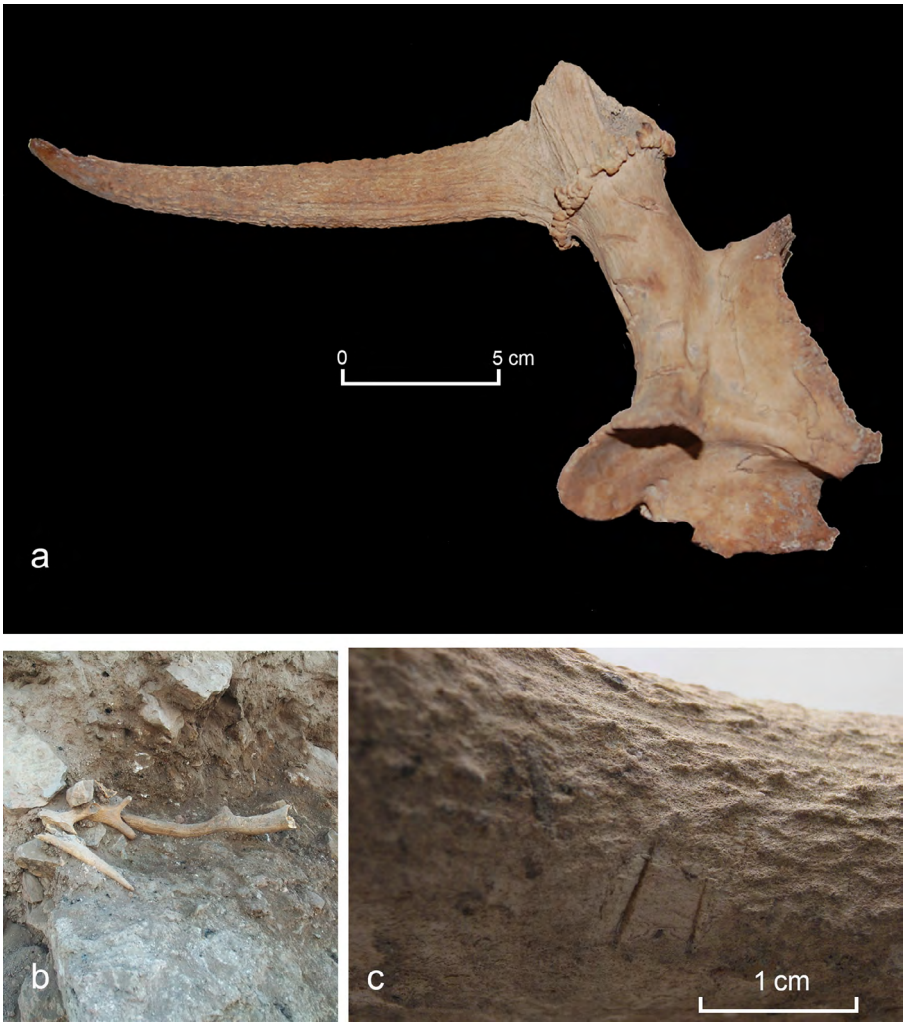

Fig. 4.—Antler raw material from Cabezo Redondo. Cut marks in deer skull (a). Complete deer antler found in House XXVIII (close to deer molars and skull fragments, which indicate that the raw material was obtained from hunting) (b) and detail of some cut-marks on it (c).

from the antler tines stand out for their relative abundance. In these peaks the natural morphology of the tines was taking in advantage to obtain the desired shape for the tool. Only in a few cases has an added work of carving been observed to provide the object with a rectangular cross-section.

Some of these artefacts, provided with a transverse perforation, have sometimes been interpreted as horse bits, similar to those found in Central Europe and Mycenaean sites (Schubart and Arteaga, 1980:273). However, none of the observed macroscopic traces on them seem compatible with that use. On the other hand, some

Fig. 5.—Some antler tools from Cabezo Redondo: straight pick interpreted as an awl (a), curved picks (b), discoid spindle whorls (c), bi-pointed tools (d), arrowheads with peduncles and barbs (e).

of these peaks show breakages, cracks and unequivocal signs of having received strong impacts in their pointed ends. From this it can be deduced that they were used to work materials of great hardness (López Padilla, 2011:391).

It should also be noted that, regardless of the shape, some of these pieces have one or two perforations aligned longitudinally in the mesial-proximal end which may be related to the handle fastening system. Of particular interest is a burned piece where the perforation contour was not affected by fire. This observation allows us to infer that the unburnt surface area was likely covered by this fastening system and may suggest these tools potentially had two active parts. However, other types of picks could have been used directly by hand.

Antler chisels would have also been useful in the working of hard materials by percussion, though the flattened and beveled active end of a chisel indicates specialised and well-defined uses. Other objects classified as picks, with rectilinear shape and a very thin active part, of which we only have one complete piece, seems to have been used like a big point (fig. 5a). Their blunted edges are likely due to the morphology of the active part and rubbing against various materials.

Arrowheads are also abundant, andare clearly related with the importance of hunting as subsistence activity at this site (fig. 5e). Other elements, such as the perforated discoid pieces made from the burr or coronet of the antler, are intended as spindle whorls, involved in textile production, but have also been interpreted as counterweights for bow drills. (fig. 5c). The function of the two bi-pointed pieces

found in Cabezo Redondo is more difficult to determine (fig. 5d). These are unique objects in the archaeological record of the Iberian Bronze Age. In fact, the broken condition of the first of the two pieces initially found suggested that there were two different objects and they were classified as arrowheads (López Padilla, 2011:401). The second entire piece was found few years later near the House XXX (Hernández *et al.,* 2016:70, fig. 6) and allowed us to correct this assumption and led us to think that some similarly broken pieces found in other sites, such as Torrelló de Onda, in Castellón, may also belong to double-pointed objects too.

A morphological similarity to modern loom shuttles does not seem enough to infer a similar use for these objects. In fact, neither its shape nor macroscopically observed wear traces bear any resemblance to the bone textile shuttles found thus far in Mediterranean Bronze Age sites (Cristiani, 2008). However, its function could be related to another kind of work with textile and vegetable fibers, which would make use of its double active part for making bi-directional gestures.

A piece interpreted as a thread separator could be also linked to the working of these materials, given their morphological affinity with similar wooden objects preserved in other hinterland Bronze Age sites (López Padilla, 2011:430, figs V.2.76-77). However, other possibilities should not be ruled out, including the use of this object as a necklace spacer.

At present, these artifacts are being subjected to a traceological and experimental study that will allow us to approach functionality and other technological aspects, as well as the possible hafting systems.

Contexts and workshop areas

Regarding the original contexts of antler objects, the most detailed data continue to be those published by J. M. Soler García (1987), having already been analysed by one of the authors (López Padilla, 2011:204). Only 40% of this material can be related to a specific context, although new distribution and consumption patterns are being defined in recent unpublished research.

These data therefore cautiously led us to infer that there was an equitable distribution of antler objects among the different excavated sectors at Cabezo Redondo. Two of the most numerous osseous objects in particular —theawls made from ovicaprine tibiae and antler tine picks— are widely distributed throughout the settlement. The widespread use of these objects was likely related to the most common activities within the framework of a substantially peasant economy.

On the other hand, the data show some half-finished product concentration and production waste in certain areas. In XI, XV, and XXVIII Houses, among others,deer antler raw material and processing waste were found. The best-preserved workshop area is House XVIII, excavated during the former fieldworks of the 1950s (Soler, 1987:86-94). Here, a high concentration of chopped-off points was discovered, as well as antler waste of different anatomical origins (López Padilla, 2011:404) (fig. 6). There were also several metallic tools, such as a poorly-preserved medium

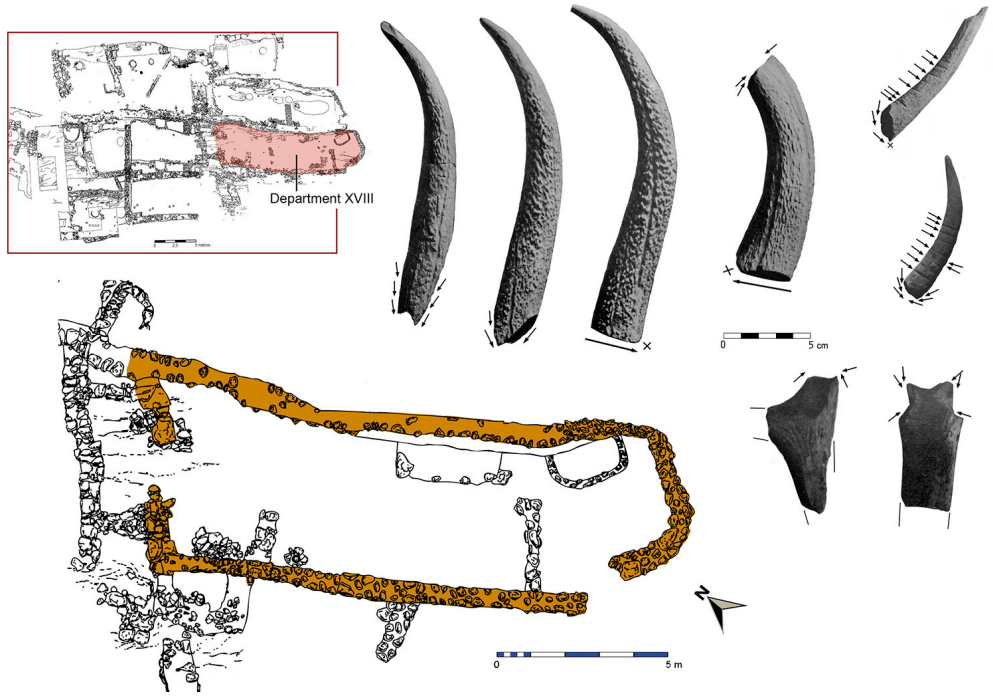

Fig. 6.—Chopped-off points and antler blocks from workshop area in House XVIII.

knife, a chisel, and a square cross section awl. There was also a considerable number of sandstone plates and sharpeners, which were remarkable in comparison with those registered in other houses from the site. A particularly relevant fragmented piece of about 17 cm in length stood out among these (Soler, 1987).

In an adjoining space, west of House XVIII, a collection of small half-finished arrowheads, mixed with the remains of a destroyed mud bench, was recorded in 1995. They were made from longitudinally sectioned deer antler plates, two of which were approximately of rectangular shape, and were presumably stored and prepared to be used for making new arrowheads of the same type (fig. 7). There were also several pottery vessels and other objects around the collapsed bench, which were probably disposed when the house was destroyed.

At the upper levels in House XXVIII, a large,complete antler was documented next to deer molars and cranial fragments. This may indicate at least some of the raw material was obtained from hunting (fig. 4b-4c). In the same level, a curved antler pick was also found. Additional concentrations of raw antler and artifacts were found in House XXII, next to a big open area around which evidence for crafting of other osseous raw materials (e.g. ivory), as well asand metallurgical production have been documented.

Fig. 7.—Rectangular plate blanks and arrowheads found near House XVIII in Cabezo Redondo.

Antler technology in Cabezo Redondo

Preservation allowing, the morphology of these objects could indicate which anatomical part of the deer antler was used in their manufacture (fig. 8a). In some cases, the natural shape of the tines was integrated almost completely into the final shape of the artifact. Thus, the tines (primarily brown tines)were used to manufacture picks which were generally robust and sometimes had transverse perforations in the mesial part or in one end (López Padilla, 2011:398). Within these perforations,some wood or bone pins would be inserted, muchlike those still preserved in similar objects found at Fuente Álamo in the 19th century (Siret and Siret, 1890:fig. 65, 124-125), which would make hafting at the end of a handle possible.

The circular spindle whorls are a similar care. They are made with the burr of the basal section of the antler, which is cut off transversally from the beam. Some of these objects demonstrate high surface transformation —some times through usage—,while others hardly offer any further transformation beyond a central perforation of variable diameters (López and Basso, in this same volume).

However, most deer antler artifacts located in Cabezo Redondo were made from plates or rods of variable lengths and widths cut off from the beam. Although the typology of these objects obtained from rods is very diverse, the most well-documented process to date is related to arrowhead production (fig. 9). During

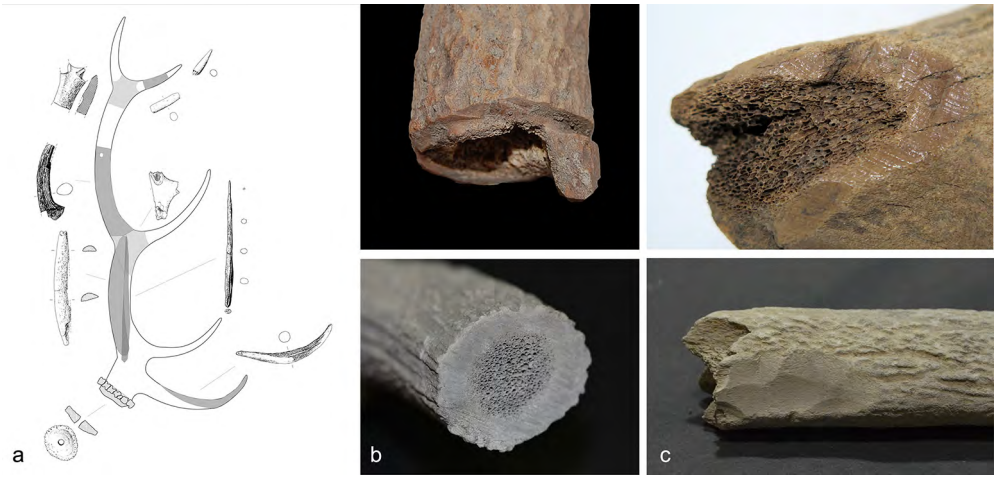

Fig. 8.—Antler anatomical parts used in Cabezo Redondo for making diverse antler objects (a). Different types of cutting marks documented in a macroscopic analysis: antler fragments obtained by sawing and bending (b) and direct percussion using a Bronze axe (c).

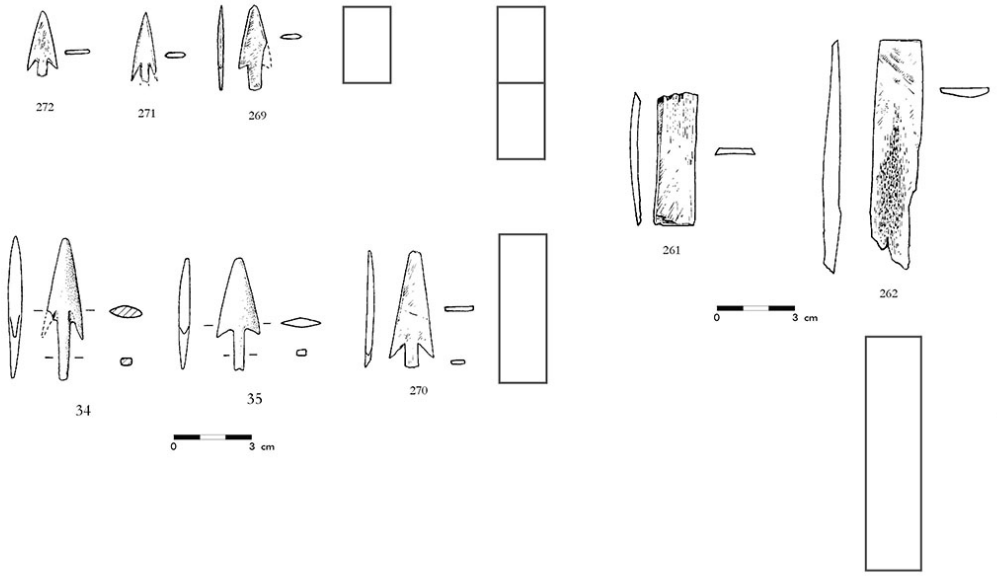

Fig. 9.—Arrowhead working process diagram.

excavation, numerous arrowheads of metal, bone, and deer antler were found, distributed throughout various houses of Cabezo Redondo. Some of them have a very complex morphology, which likens them to Middle and Late Bronze Age types common in Northern Italy and in other Central Mediterranean areas (Hernández and López, 2001). Even so, the majority correspond with the most common type of flat section arrowhead with peduncle and acute wings.

The collection of items found in the space adjacent to House XVIII, some of which werehalf-finished products, provided insight on the working process. Compared with the dimensions of the arrowheads with rectangular plates found in the same place, it could be observed that the size of both types of objects were held to the same size standards, adapted from the plate transformation process. That means that smaller arrowheads were about half the size of larger ones (López Padilla, 2011:402). Meanwhile, the maximum length of larger arrowheads corresponds, in turn, to the half the size of the longest plate (fig. 9).

This working procedure, based on the cutting of rectangular plates extracted from the antler beam, was used to produce other objects whose function is more difficult to determine, such as double-pointed pieces or multi-perforated plates.

A macro and microscopic analysis carried out on the material serves to identify the tools and techniques used in their manufacture. Although the complementary traceological studies are still at a preliminary stage, there is a strong evidence that metal tools as saws, knives, awls and chisels have been used in many cases (fig. 8b-c).

Objects such as curved and straight picks, discoid spindle whorls, or arrowheads are especially representative of a systematic selection process of different parts of the antler to be manufactured into specific preform and tool types. This standardized operational chain guarantees greater productivity and the best use of raw material, which consequently gave rise to different tools that present an equal sense of morphological standardization.

Therefore, the evidence obtained from the morphological study, as well as the first observations on the applied techniques, suggest a clear productivity improvement in antler working during Late Bronze Age. Although some types of objects are already present in previous periods, the Cabezo Redondo archaeological record not only shows an increase in use of antler objects, but also allows to know the beginnings of a greater standardization of the manufacturing processes thanks to the greater availability of metal tools.

CONCLUSION: SOME REMARKS ABOUT THE PRODUCTION OF DEER ANTLER OBJECTS IN THE LATE BRONZE AGE IN THE EAST AND SOUTHEAST OF IBERIA

An increase in the productivity of osseous object manufacture has been documented based on Cabezo Redondo evidence. This study of antler objects bases this statement on the following factors:

— Improvement in raw material quality used: with a notable increase in deer antler use —with greater firmness and elasticity than bone— for the elaboration of a wide variety of artifacts, primarily tools.
— Improvement in the means of production: with the widespread incorporation of metal tools —chisels, awls, saws, knives, and axes— in the production of artifacts (reserved, until now, for working maximum social value raw materials, such as ivory).
— Greater capacity for the best use of raw materials and improvements tomanufacturing processes: through a standardized operational chain to obtain a considerable number of objects, employing certain preforms, with varying morphologies or sizes.

All these elements place us, in our opinion, in the antechamber —if not already in the same threshold— of craft specialization, although no spaces are exclusively reserved for osseous material working. The activity areas are not located as of yet in restricted spaces, but rather inside domestic areas where other raw materials were also worked or other activities were developed, such as food storage and processing.

In any case, it is also evident that although the antler work was not developed exclusively in a specific area, it was far from being a generalized activity in all of the houses. Moreover, the information available supports the presence of certain spaces in some specific dwellings in which these antler working proceses appears to be allocated in a particularly prominent way.

A similar situation seems to be seen in other sites in the Southeast of Iberian peninsula, such as Cerro de la Encina or Castellón Alto, in Granada, even though there the data are more scarce. The diversification of the osseous material production and the increase of antler objects since 1700 cal BC, and especially from 1500 cal BC, could be prompted by proximity to Argaric territory and its surroundings, where there would be greater availability of metal tools. It therefore seems plausible to establish a direct relationship between the increase in the productivity of deer antler working processes and the widespread use of real tin-alloyed bronze, since both are shown to coincide in time and space.

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