Proceedings of the First Zooarchaeology Conference in Portugal

Held at the Faculty of Letters, University of Lisbon, 8th–9th March 2012

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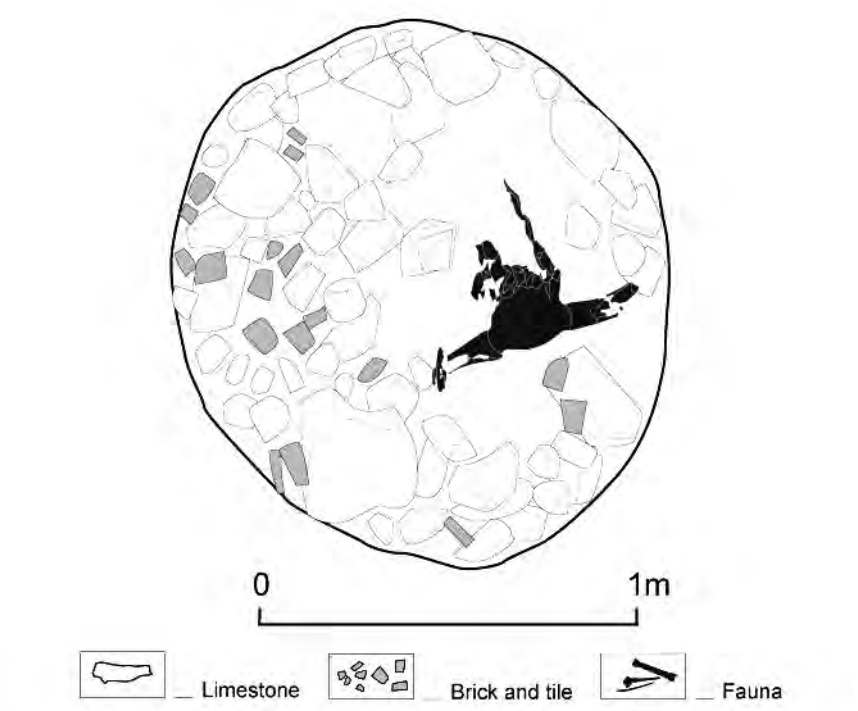

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The cover illustration by Joel Marteleira depicts a Roman pit containing faunal remains from Odrinhas (Sintra, Portugal). This find/context is described by Alexandre Gonçalves in this volume.

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Exploitation of bone and antler in the Upper Palaeolithic of Portugal

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Abstract
In the Upper Paleolithic contexts where organic remains were preserved, we see that the artisans of this period used all the hard animal materials that were available (bone, antler, tooth, ivory, tortoise-shell, shell, egg shell, horn, etc.) for the manufacture of utilitarian or / and symbolic objects.
The choice and the differentiated use for each of these materials appears to have been directly related with the cognitive capacity of these populations and their subsequent recognition of the different mechanical and aesthetic properties of each raw material.
The analysis of faunal collections, in addition to providing information about the means of subsistence of these communities, also enables us to infer about the procedures of exploitation of osseous materials and its use in the manufacture of tools. The production of the osseous artefacts may have had different procedures that, as will be seen, can be inferred by the characteristic marks left on the bone surface.
We present here the techniques of transformation and modification of the red deer antler and of mammal bones, since these were the raw materials used in the Upper Paleolithic in Portugal for the manufacture of tools like wedges, awls, bevelled tools, fishhooks or spear heads.

Keywords: Upper Paleolithic; osseous industry, processing, modification

Introduction

In Portugal, the Upper Paleolithic bone tools assemblages, that are known to date, came from 12 archaeological sites, maily located in Estremadura (Buraca Grande, Lagar Velho Rockshelter, Lapa do Picareiro, Lapa dos Coelhos, Caldeirão Cave, Casa da Moura Cave, Lapa Furada, Bocas Rockshelter, Lapa da Rainha and Salemas Cave), in Alto Alentejo (Escoural Cave), and in Western Algarve (Vale Boi) (Évora, 2008). The assemblage's composition is not homogenous, that is, the older assemblages have less quantities of artefacts, with no debris reported, then the more recent ones, with several categories of tools.

In the last century, the archaeologists who reported the presence of bone tools in the archaeological record of Upper Paleolithic sites presented their analysis always based on typological descriptions and giving importance to the technological analysis of lithic assemblages (Cardoso e Gomes, 1994; Gomes, Cardoso and Santos,1990; Salvado, 2004). The exceptions were Aubry and Moura (1994), and Chauviere (2002) when publishing the bone tools assemblages from Buraca Grande and Caldeirão Cave, respectively.

One of the reasons for that to happen could be the bad preservation of some faunal assemblages, making necessary to deal with the preservation of a few bone tools and debitage debris or even with the total absence of them. This low frequency of bone tools in the UP faunal record could be due to taphonomic alterations or, most likely, with the excavations techniques, housing and selection of bone fragments still in the field and later in the laboratory (Évora, 2008; Marks et al, 1994).

To undertake the technological analysis of the bone tools assemblages it is necessary to collect all bone fragments, even the smallest ones, for it can hold specific *stigmata* that permit to identify a specific fracturing or shaping technique.

Exploitation of bone and antler

Mechanical properties

In Upper Paleolithic (UP) of Portugal, the hard animal materials, known until now, used in the production of bone tools were mammal bone and Red deer antler. These raw materials were known by their mechanical properties, in the sense that, by using the two raw materials Paleolithic artisans, in their dairy life, would accumulate the knowledge concerning the utility of the two in a diversity of purposes (Knecht, 1991). Red deer antler is composed by 60% of minerals and 40% of organic compounds. Its mechanical properties vary for fresh antler (which is obtained with the hunted animal) or shed antler (which has fallen off the stag naturally) and depends also on the animal's age, on the environmental and living conditions to which the animal was exposed and the conditions the antler suffered after it was shed (Goutas, 2004). Also, antler has larger dimensions than some types of mammal bones, but has limits on manufacturing methods due to its curvature. Due to its large elasticity, has greater resistance to fracture and impact than mammal bone (Otte, 1974), because it absorbs the energy from direct impacts and thereby becomes more resistant to fractures

Figure 1. Fracturing mammal long bone by direct percussion (experimental work, photo TECHNOS 2010).

Figure 2. Sectioning antler by direct percussion (experimental work, photo TECHNOS 2010).

(Goutas, 2005). Antler's acquisition may have been dependent on Red deer hunting or on seasonality, as they are cast and regenerated annually (Knecht 1991).

On the other hand, mammal bone combines approximately 1/3 of organic matter (collagen) and 2/3 of inorganic matter in its composition giving it hardness, stiffness, elasticity and resilience (Brothwell 1981; Davis 1987, Évora, in press). For this reason it would be a preferred raw material in the production of several kinds of tools and its *compacta* was most exploited by hunter-gatherer groups to manufacture their hunting and fishing toolkits (Évora, 2008). The mammal long bone is strong, has elasticity and is harder than antler, but it more easily fractures (Knecht, 1991) because it has a higher degree of mineralization than antler. It has a fibrous structure due to the presence of collagen which gives it great strength facing tractions and pushups, but it also causes naturally pointed fractures. Its hardness is due to the presence of minerals in its composition. The diversity of forms offered by bone anatomy of the hunted animals allows a wide choice of materials of different sizes and shapes (Otte, 1974). Bone would be easy to acquire since hunter-gatherers could choose to collect certain kinds of bone fragments after the animal carcasses were butchered. The fractured bone flakes could be transformed into a variety of shapes and sizes, until the desired tool was produced.

Fracturation techniques

Until now there are few fracturing and shaping techniques recognized on the archeological record of the UP in Portugal and all were used along this time period. These techniques could have been combine between them, and also may have been with other fracturing techniques that we don't have record of, because the shaping process that took place after fracturing erased those *stigmata*.

a) Fracturing

By fracturing we mean the anthropic action of breaking a bone or antler, by opposition to fragmentation which is a consequence of animals, sediments weight, ice… This technique is the most elementary and ancient one, but is also the most uncontrollable one because it is not possible to predict the size of the blanks in the case of mammal bones. And it poses the problem of recognizing if the fracturing of the bones is due to marrow extraction only or if it is to manufacture tools too. In the case of antler, the fracturing is a debitage technique, because antlers were not consumed, they were only used to produce tools (fig.1).

b) Sectioning

By sectioning we mean a way to obtain a support with its full section in which part of its morphology is intact, this technique can be applied transversally to the long axis of the bone or antler, to separate the antler tines and creating a support. In mammal bones it can be used to separate the epiphyses from the diaphyses, thus creating a support. This technique can be applied by direct percussion, by sawing and flexion or by combining them (figs.2, 3, 4, and 5).

c) Longitudinal grooving and bipartition

By this we mean creating a longitudinal groove parallel to the long axis of the bone with a lithic tool, making a uni / bidirectional movement leaving a cross-section in U or V, depending on the active edge of the lithic tool, when the groove is deep enough an intermediate tool (made of bone or antler with a bevel as an active part (fig.6) or a lithic splintered piece) is used to help separate both parts of the bone or antler (figs.7 and 8).

Shaping

a) Scraping

By scraping we mean the action of using of a lithic tool, which can be retouched or nonretouched, in the surface of

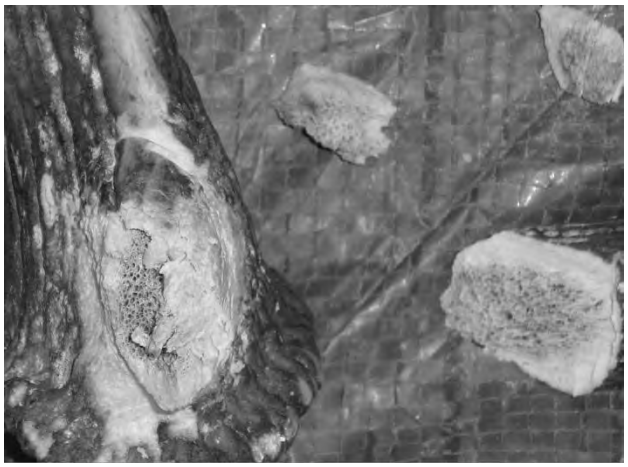

Figure 3. Antler debris and stigmata resulted from sectioning by direct percussion (experimental work, photo TECHNOS 2010).

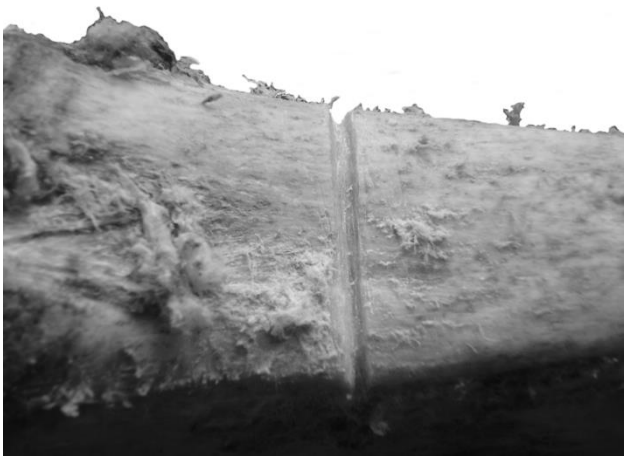

Figure 4. Sectioning mammal long bone by sawing (experimental work, photo TECHNOS 2010).

Figure 5. Antler tine sectioned by sawing and flexion (Vale Boi gravettian artefact).

Figure 6. Distal unibevel made on antler tine sectioned by direct percussion (Lapa do Picareiro magdalenian artefact).

Figure 7. Bipartition on a Red deer metacarpus, stigmata left by a wedge (Vale Boi gravettian artefact).

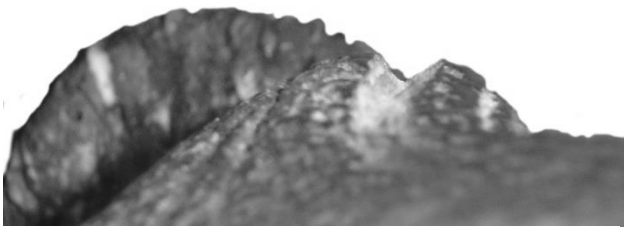

Figure 8. Longitudinal grooving (experimental work).

Figure 9. Stria made by scraping with an unretouched lithic tool (Buraca Grande gravettian artefact, 20x).

Figure 11. Stria left by an abrasive (Lapa dos Coelhos gravettian artefact, 20x).

the bone tool to remove portions of the material until obtaining the desired shape. Depending on the active part of the lithic tool, different pattern of *strias* will be left on the bone surface (figs.9 and 10).

b) Abrasion

By abrasion we mean the action of eliminate small particles of material by rubbing it on an abrasive, which can be a soft stone, leather, sand, sand and water or sand and leather, and according to the abrasive that was used different *stria* will be left on the bone surface. This technique was usually applied after scraping and overlaps on to it (fig.11).

c) Incision

By incision we mean a line that is rectilinear, transversal or diagonal to the longitudinal axis of the artifact, made on the bone surface by a lithic tool, usually its cross-section is V or |/ and it's not as deep as a groove (fig.12). They are present in several types of tools, like spear heads (decorated or not), appearing in sets of lines that have been interpreted as having a functional or decorative role, or both, depending on the tool.

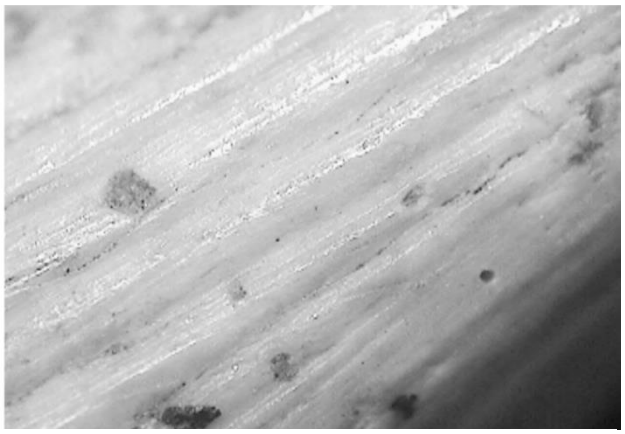

Figure 10. Stria made by scraping with a retouched lithic tool (Buraca Grande gravettian artefact, 20x).

Figure 12. Diagonal incisions (Buraca Grande magdalenian artefact, 20x).

Conclusion

In the Upper Palaeolithic archaeological sites of Portugal where bone tools were recovered, we find that, until now, the main raw materials used were Red deer antler and mammal bones. This fact is related to food activities where mammal bones were available to use after the butchering of the animal carcasses and their fracturing to extract bone marrow, and antler could be gathered in the wild or obtained when hunting Red deer. Both were used to manufacture several utensils, but their mechanical properties were somehow known by the artisans to produce specific tools, as projectile points and wedges were preferably made of antler which is more suitable to resist to direct impacts, and awls were made of mammal bone that is harder than antler. Both antler and bone were suitable to manufacture spear heads and that is seen on the Portuguese UP record.

These techniques of fracturing and shaping were continuous along the UP in Portugal, all of them leaving specific *stigmata* and *stria* on the bone and antler artefacts surfaces. These can be recognized in the faunal record, which is why all bone fragments should be recovered during excavation, some are small fragments but can still preserve the identification marks.

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