Ancient and Modern Bone Artefacts from America to Russia

Cultural, technological and functional signature

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BAR International Series 2136
2010

Published by

Archaeopress
Publishers of British Archaeological Reports
Gordon House
276 Banbury Road
Oxford OX2 7ED
England
bar@archaeopress.com
www.archaeopress.com

BAR S2136

Ancient and Modern Bone Artefacts from America to Russia: Cultural, technological and functional signature

ISBN 978 1 4073 0677 3

Printed in England by Blenheim Colour Ltd

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Hadrian Books Ltd
122 Banbury Road
Oxford
OX2 7BP
England
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Pierced Metapodials from al-Ândalus: Some Observations Towards their Understanding

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Abstract

The Iberian Peninsula archaeological record contains metapodials, mainly of cattle, that feature a variable number of perforations on the posterior side of the diaphysis. They have been recovered singly or in small assemblages together with other faunal remains. So far they have never been studied from a contextual or functional point of view.
The observation of 40 examples from Portuguese and Spanish sites, all dated to the Islamic period, allowed us to characterize their typology. Traces from use (the position, number and differential external and internal wear of the holes) suggest that these bones were elements of a complex device in which spinning axes were involved.

Introduction

The use of bone as a raw material is widely recognised in the archaeological record. Throughout millennia people have used the hard parts of animals (*i.e.*, bone, horn, antler and ivory) to produce a wide variety of implements, from ornaments to tools (Choyke and Bartosiewicz 2001; Luik *et al*. 2005; MacGregor 1985). However, their study is often treated as an ancillary subject. Unfortunately, it is also still a common practice to exclude such finds from the zooarchaeologist's bench! As MacGregor (1985, 30) writes: "*for the most part, the species involved were identical with those generally exploited for food or motive power*".

As a result, many worked bone objects remain unpublished and stored for years (or even decades) in museum collections. Only the most stunning are exhibited but even then they fail to be correctly identified to taxon and part of skeleton or remain 'functionally' undetermined. In particular, there is a need to study bone artefacts from the more recent past, i.e., historical periods, with the same thoroughness and technological resources as those from earlier times. They not only attest to the extended use of such a raw material, but their analysis also allows us to recognize the origins of cultural traditions that are sometimes still practised.

Following our request to Portuguese archaeologists to let us know of any musical instruments fashioned from bone (Moreno-García and Pimenta 2004; 2006a; 2006b; 2007; Moreno-García *et al*. 2005a), we were presented with some cattle metapodials from Lisbon and Palmela (Figure 1) whose dorsal side displayed a variable number of perforations (Figures 2 and 3). Different stages of wear were clearly evident on the internal borders of some of them. This excludes their being interpreted as wind musical instruments. In a short period of time, we recorded 32 examples recovered from Portuguese sites and eight more from Spain in our database (Figure 1; Table 1), all of which were considered as scattered or isolated finds of unknown purpose. Thus, the aim of this paper is to bring to light these bone artefacts and to present the observations made on the positioning, morphology and wear of the holes located on the posterior side of the diaphysis. It is believed that these remarks are the only means to put forward some working hypotheses regarding their origin and consequently the use of these pierced long-bones.

Figure 1: Geographical distribution of pierced metapodials in the Iberian Peninsula. ***1.*** *Silves (Portugal);* ***2)*** *Aljezur (Portugal);* ***3)*** *Palmela (Portugal);* ***4)*** *Lisbon (Portugal);* ***5)*** *Mértola (Portugal);* ***6)*** *Seville (Spain). Squares indicate samples described in the literature or known by personal communication (Paderne and Alcoutim in Portugal; Calatayud, Alicante and Valencia in Spain).*

The archaeological context

All 40 finds are associated with the medieval Islamic culture in the Iberian Peninsula. The Portuguese examples (Moreno-García *et al.* 2006) were recovered from the following localities: Lisbon, Palmela, Mértola,

Alcoutim, Aljezur, Paderne and Silves (cf. Figure 1). They are dated to the period from the 10th to 13th-centuries AD. Also we had the opportunity to study 2 examples from Seville (Spain) dated to the 11th-12th-centuries AD and know of 6 more Spanish finds from Calatayud (Cebolla e*t al.* 1997), Paterna (Mesquida García 1989), Denia and Benipeixcar (Mª Dolores López Gila, *pers. comm*.) (cf. Figure 1).

In all cases they have been found isolated or in small numbers (with the exception of those recovered in the Silves *Arrabalde*; Table 1) together with other faunal materials identified as domestic and artisanal refuse.

Figure 2: Pierced cattle (Bos taurus) metacarpals recovered from excavations at Fundação Ricardo Espírito Santo (Lisbon, Portugal). In the complete example, on the left, three perforations are visible on the posterior surface. While that in the centre appears oval-shaped, those at the top and bottom show that the original round perforation suffered progressive wear towards opposite sides, towards the lateral and medial surfaces of the diaphysis.

Figure 3: Right cattle (Bos taurus) metacarpal recovered from Castle of Palmela (Portugal). The perforations on the posterior face of the diaphysis meet one another and the anterior side has also been perforated.

Osteological and taxonomical identification

The metapodials of ungulates have traditionally been favoured as a raw material to be worked into a diversity of objects (i.e., skates (MacGregor 1975), bone anvils (Benco *et al*. 2002; Esteban Nadal and Carbonell Roure 2004; Moreno-García *et al*. 2005b; Moreno-García *et al*. 2007), beads (Spitzers 1997) and so on) due probably to the fact that they are robust, present thick walls and have a hollow medullar cavity. They do not represent a meat value, although their medullary content is of some nutritive appeal.

Once the animal is slaughtered, the skinning process begins from these bones. Thus, they are usually associated with primary butchery waste.

As shown in table 1 there seems to have been a preference for metacarpals rather than metatarsals (28 of the former and 8 of the latter). It seems likely that the semi-circular section of the metacarpal shaft (flat posterior surface and convex anterior surface) made them easier to use than the metatarsals with their square shaft section. Most are derived from cattle (*Bos taurus*), two from donkey (*Equus asinus*) and one from sheep (*Ovis aries*). Curiously, these latter ones were recovered from two different places, an Almohad *Arrabalde* and castle, both in the city of Silves, Algarve.

Observations

No previous preparation of the bones is evident. Only some cut and chop marks related to the skinning of the animal and from the process of disarticulation from the upper limb bones are visible in some examples. The perforations are always located on the dorsal, flat side of the bone. This shows a clear preference for the use of this surface. Of those that are complete, it is possible to recognize specimens with one (Figure 4), two (Figure 5) or three holes (Figure 2). Although the number of perforations varies, there is always one placed at the midpoint of the diaphysis. Apparently this is the area initially chosen to make the object work. Such central perforation and any of the others present at the top and bottom were originally circular (Figure 5). It seems that in the course of their use, the borders of the holes tended to wear away towards one or both (medial and lateral) sides. This progressive wear provoked a shape change in the perforations making the central one oval. Thus, in the most advanced stages, the loss of cortical bone resulted in the breakage of the bone across its shaft and consequently, the end of its use life (Figures 6 and 7). The example from Palmela shows an extreme situation in which several of the perforations meet one another (cf. Figure 3). Perhaps the most interesting example is the complete metacarpal from Lisbon that was pierced three times. As figures 2 and 8 show, the hole closest to the proximal articulation area is deviated towards the lateral side while the third one, placed near the distal end, is worn oppositely, towards the medial side. The same pattern might have been exhibited in those examples

	Cattle (*Bos taurus*)		**Donkey (*Equus asinus*)**	**Sheep (*Ovis aries*)**	**Unknown***	**Total**
PORTUGAL	Metacarpal	Metatarsal	Metacarpal	Metacarpal		
Silves (Moreno-García *et al*. 2006) Arrabalde	12	4	2	-	-	18
Teatro Gregório Mascarenhas	-	1	-	-	-	1
Castelo	-	-	-	1	-	1
Alcoutim (Catarino 1997/8) * Castelo Velho	1	-	-	-	1	2
Aljezur Ribat da Arrifana	-	1	-	-	-	1
Paderne (Catarino 1997/8) * Castelo	1	-	-	-	1	2
Mértola (Moreno-García *et al*. 2006) Alcáçova	3	-	-	-	-	3
Palmela (Fernandes 2004) Castelo	1	-	-	-	-	1
Lisboa (Moreno-García *et al*. 2006) Fundação Ricardo Espírito Santo	3	-	-	-	-	3
Total Portuguese finds	**21**	**6**	**2**	**1**	**2**	**32**
SPAIN						
Calatayud (Zaragoza) (Cebolla *et al*. 1997)* Rua de Dato-C/San Miguel	-	1	-	-	-	1
Alicante * Fortí de Denia	1	-	-	-	-	1
Valencia * Alqueria de Benipeixcar	1	1	-	-	-	2
Paterna (Mesquida García 1989)	-	-	-	-	2	2
Seville C/San Luís nº93	2	-	-	-	-	2
Total Spanish finds	**4**	**2**	**-**	**-**	**2**	**8**
Total Iberian finds	**25**	**8**	**2**	**1**	**4**	**40**

*Table 1: Bone and species identification of pierced metapodials recovered from Portuguese and Spanish sites dated to the Islamic period. *Examples that have not been observed by us.*

Figure 4: Three cattle (Bos taurus) metacarpals recovered from Alcáçova de Mértola (Portugal). They all present a single oval perforation on the posterior side of the diaphysis.

Figure 5: Twenty pierced metapodials recovered from excavations in the Arrabalde, Castle and Theatre Gregorio Mascarenhas in Silves (Portugal). From the left, the third complete example and the first proximal half are identified as metacarpals of donkey (Equus asinus). The last example on the upper row represents the only find fashioned from a sheep (Ovis aries) metacarpal.

broken at their mid-shaft that have one of these secondary perforations still visible (cf. Figure 5). Understanding how that happened may shed some light on how these bones were used.

The borders of the holes are rounded and looked polished. From broken examples it was possible to observe that the wear of bone tissue is not limited to that area. The internal side of the diaphysis, coincident with the hole, also contains a rounded and abraded depression (Figure 9). In some cases, the loss of cortical bone from inside the medullary cavity is such that the bone becomes very thin and small perforations are produced on the anterior face (Figure 9). Additionally, in some cases this internal depression appears covered by a thin black layer. Micro X-ray fluorescence spectrometry analysis of that dark deposit showed that iron was the principal component (Figure 10) (Lopes *et al*. 2007).

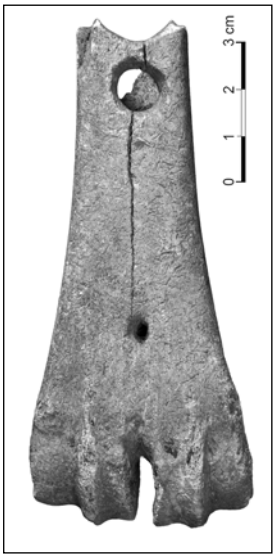

Figure 6: Distal half of pierced cattle (Bos taurus) right metatarsal recovered from excavations at Ribat da Arrifana (Aljezur, Portugal). The loss of cortical bone by the oval central perforation resulted in the breakage of the artefact at the mid-shaft.

Figure 7: Two distal halves of pierced cattle (Bos taurus) metacarpals recovered from excavations at C/ San Luis nº 93 (Seville, Spain).

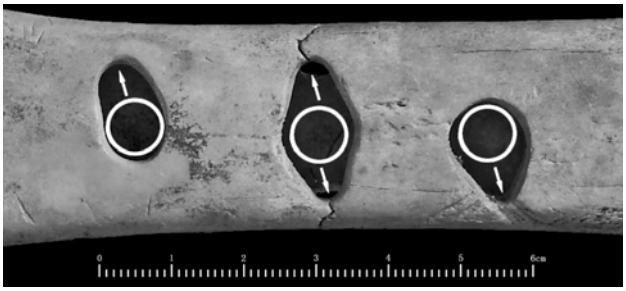

Figure 8: Detail of one of the cattle (Bos taurus) metacarpals recovered from excavations at Fundação Ricardo Espírito Santo (Lisbon, Portugal). Note how the lateral original round perforations suffered progressive wear towards opposite sides while that in the centre appears oval-shaped.

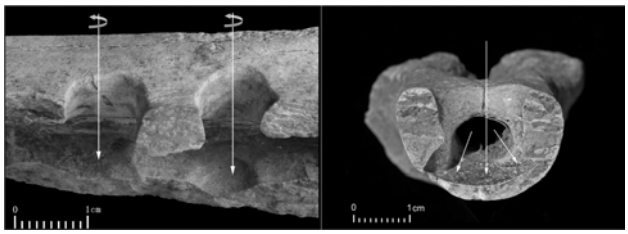

Figure 9: Internal view of two of the pierced metacarpals recovered from Silves Arrabalde (Portugal). Note that the wear of bone tissue is not limited to the border of the perforations. The internal side of the diaphysis, opposite the hole, presents a rounded and abraded depression which could have been caused by the continuous action of spinning axes, as suggested by the arrows.

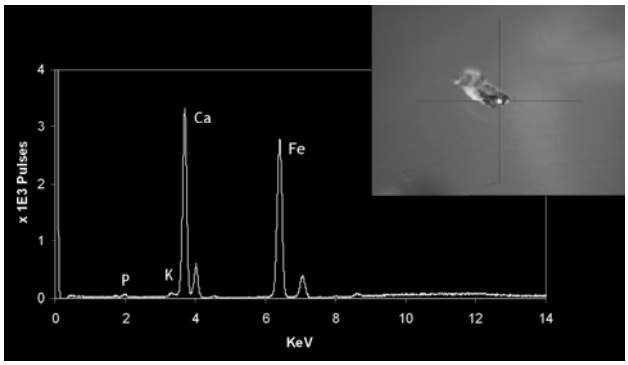

Figure 10: Results of the micro X-ray fluorescence spectrometry analysis of the black layer present inside the medullary cavity. Note that iron was the principal component.

Some interpretations of the use of these pierced metapodials

The above observations suggest that the wear of the borders of the perforations and the internal depression of the medullary cavity were caused simultaneously by the continuous and progressive attrition of an external element in contact with those surfaces. Such a situation is compatible with the action of one or several spinning axes inside the holes located on the dorsal face of the diaphysis (cf. Figure 9). Thus, these bones may not represent artefacts on their own but may have been elements of a sophisticated mechanism assembled into a complex piece of equipment.

Ethnographic records from different cultures reveal a wide number of devices that have single or multiple rotating axes as functional components – drills, lathes and many of the implements used in textile manufacturing (i.e., spindle, spinning wheel, and so on). Since the internal and external borders of the holes are rounded and polished and no sharp scratches are evident it appears the attrition was caused by an agent that was as soft as, or softer than, the bone itself. While processing fibres (i.e. wool, linen, cotton, silk) it is a common procedure to wind them around one or several axes. Hence, it could be argued that if the Iberian perforated metapodials from the Islamic period were related to textile manufacture there might not have been direct contact between the edge of the perforations and the spinning axis working inside them. Fibres wrapped around the rotating axes could have produced the kind of smooth wear observed. Equally, the deposition of fibre residues inside the holes could have worked as a velvety abrasive material responsible for the polished aspect of the inner medullary cavity.

Based on the wear pattern observed in the central perforation we suggest, as a working hypothesis, that these bones may have been used lying on one of their sides. Thus, the weight of the spinning axis would wear down the original round internal border of the perforation towards that side (cf. Figure 8). Once it was close to the edge of the diaphysis the bone was turned over and wear towards the opposite direction occurred, causing the perforation to change from circular to oval. Such a pattern appears to be confirmed by the metapodials that display more than one central perforation, as in the complete metacarpal from Lisbon (cf. Figure 2). In those cases, two parallel rotating axes – one in the central perforation and another in one of the additional holes – were probably working simultaneously. Once the borders were worn towards the side on which the bone was set, it was turned over and the axes were rearranged. Presumably, one was introduced again in the central hole and the other went into a new, third perforation that would begin to wear in the opposite direction to that shown by the second hole which had been previously employed. In conclusion, the top or bottom holes could have both been utilised with the central perforation, sequentially or in alternation.

Conclusion

The archaeological record has brought to light a whole range of bone artefacts used by our ancestors. However, in many occasions we are just dealing with isolated items or components of more complex mechanisms that are difficult to recognise as such. In this paper, we have presented an assemblage of bovine and equine metapodials from different regions of the Iberian Peninsula dated to a chronological period that extends from 10th to 13th-centuries AD, associated with the Islamic culture. After the observation of nearly all the Portuguese finds recovered up until now, and some of the Spanish specimens, we were able to note a series of characteristics common to all of them. Independently of the complexity of the actions responsible for the traces that we have tried to decipher, it seems that all these artefacts were related to similar uses probably associated to the processing of fibres. They represent a technological solution that was abandoned or was substituted by a new one once the Christian re-conquest happened.

The recovery of 18 examples from the Silves *Arrabalde*, a neighbourhood dedicated to artisanal activities, suggests that they were possibly related to one of the trades

practised there (Moreno-García *et al*. 2006). This craft could have also taken place in the domestic environment, perhaps on a smaller scale, as evidenced by some of the other finds. For this reason, one can expect that as more animal bone assemblages from the Islamic period are studied more examples will turn up.

Finally, in order to confirm the working hypothesis put forward here use-wear analyses of the perforations will be carried out in the near future.

Acknowledgements

We are very grateful to all the Portuguese and Spanish archaeologists who provided information on, or access to, the pierced metapodials presented in this paper: Mª J. Gonçalves and A. Medeiros Rodrigues (Silves), H. Catarino (Alcoutim and Paderne), M. Varela Gomes (Ribat da Arrifana and Silves), L. Rafael & S. Gómez (Mértola), A. Gomes and A. Gaspar (Lisbon), I.C. Fernandes (Palmela), P. López Aldana and A. Pajuelo (Seville), Mª D. López Gila (Valencia and Alicante), J. Ortega (Calatayud). Filipa Lopes is acknowledged for the micro X-ray fluorescence spectrometry analysis.

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