УДК 903.3 599.6/73

GROTTA PAGLICCI, (RIGNANO GARGANICO, FOGGIA, SOUTHERN ITALY), AN OVERVIEW ON THE BONE AND ANTLER PRODUCTION

© 2017 г. V. Borgia, Fr. Boschin, A. Ronchitelli

The evidence of the bone and antler exploitation at Paglicci Cave (Rignano Garganico, Foggia, Southern Italy) are presented in the article. The analysis of the 104 osseous artefacts found in the Upper Palaeolithic sequence of the cave has allowed the authors to reconstruct the choices made by the prehistoric hunters both in terms of hunting and exploitation of hard animal materials for tool fabrication. Only some hunted animals bones were chosen for making the tools: deer, horse, aurochs and wild boar. A noteworthy observation concerns the lack of an interconnection between the kinds of species represented in the faunal assemblages and those used for the production of bone (and antler) tools. Even though the small number of pieces in each individual layer did not allow for statistical inferences, the authors could draw some interesting conclusions on the morpho-technological features of the artifacts, finding that some tool types appear to be linked to particular periods.

Keywords: archaeology, archaeozoology, Upper Palaeolithic, Paglicci Cave, osseous artefacts, bone technology.

Introduction

Grotta Paglicci is a Palaeolithic site located on the western slope of the Gargano promontory (Rignano Garganico, Apulia, Southern Italy) at about 143 m above sea level (fig. 1: 2).

The Upper Palaeolithic sequence excavated in the atrium of the cave (12 metres thick) is one of the most complete in Europe. Above the deepest levels, relating to the Late Middle Pleistocene, layers from 24A1 to 3A embrace indeed a period that includes, without significant interruption, the Aurignacian with marginal backed bladelets (layer 24), the Gravettian (Ancient: layers 23-22; Evolved: layers 21-19B, Final: layer 19A-18B), and the Epigravettian (Ancient: layers 18A-12A, Evolved: layers 11D-8A, Final: layers 7C-3A (Palma di Cesnola, 2001, 2006, 2007, 2007-2008; Lami, Palma di Cesnola, 2005; Wierer, 2013; Ricci *et al.*, 2016) (fig. 1: 1).

Intensity of human occupation is testified by the large quantity of stone tools and by abundant fauna remains, as well as plans of bones and hearts, sometimes structured. Two Gravettian burials and an incomplete Epigravettian one were also brought to light as well as numerous isolated human remains (Mezzena and Palma di Cesnola, 1972, 1989-90; Condemi *et al*., 2014; Ronchitelli *et al*., 2015; Posth *et al.,* 2016; Fu *et al.,* in press).

The personal ornaments and mobiliary art objects are frequent too (Palma di Cesnola, 1999, 2001; Arrighi *et al*., 2008, 2012a, 2012b).

Grotta Paglicci is also the only site in Italy where evidences of Upper Palaeolithic parietal paintings were discovered so far: the subjects of the paintings are some horses and hands located in an internal hall. These are dated back to the final Gravettian or the beginning of the Epigravettian (24/19ka cal. BP) (Zorzi, 1963; Mezzena, Palma di Cesnola, 1992; Ricci, Boscato, Ronchitelli, 2017; Palma di Cesnola, 2000; Ricci and Ronchitelli, 2016).

There are also clear evidences of plant collection and processing for dietary purposes among Gravettian hunter-gatherer populations (Revedin *et al.,* 2015; Mariotti Lippi *et al.*, 2015).

The analysis of the osseous artefacts found in the Upper Palaeolithic sequence of the cave, as well as recent studies on faunal remains, have allowed us to reconstruct the choices made by the prehistoric hunters both in terms of hunting and exploitation of hard animal materials for tool fabrication.

Materials and methods

This study comprises those specimens found at the site showing manufacturing traces or use traces, on their active or/and proximal ends (as handling traces), that have enabled them to be identified as tools or as

the *débitage*/processing waste arising from their production.

The bone and antler artefacts (n=104) were found throughout the whole of the cave's Upper Palaeolithic sequence and have been recently published (Borgia *et al.,* 2016). From the present study have been excluded 17 Gravettian pieces (layers 22–18; Mezzena, 1975) as well as those Epigravettian pieces (n=24) found during the first excavation of the site (directed by Zorzi in 1962-63) (Mezzena, Palma di Cesnola, 1967).

Bone/antler tools were found in all of the cultural phases (table 1), albeit in small numbers. Processing waste was mostly absent (n=2).

Only 45 of the specimens were taxonomically identified. Among the latter most of the pieces (n=38) were obtained from the processing of horse and red deer bones, although 7 were produced on aurochs, roe deer, wild boar and caprines (ibex or chamois) elements (table 2).

The following parameters were registered for every piece: anatomical origin

Table 1. Distribution of the bone/antler tools described in this paper, along the stratigraphic sequence of Grotta Paglicci. Abbreviation: Grav.= Gravettian; Epigr. = Epigravettian; Rew.=reworked; A=ancient; E=evolved; F=final.

Layer	Cultural Phase	TOT
1	Reworked	**1**
4	Final Epigravettian	**2**
5		**4**
6		**3**
7		**4**
8	Evolved Epigravettian	**4**
9		**5**
10		**8**
11		**3**
12	Ancient Epigravettian	**7**
13		**2**
14		**6**
15		**1**
16		**5**
17		**9**
6-10	Epigravettian reworked	**2**
10?		**3**
12?		**2**
15-17		**1**
18	Final Gravettian	**6**
19A		**1**
19B	Evolved Gravettian	**6**
20		**2**
21		**2**
burial		**1**
22	Ancient Gravettian	**3**
23		**3**
24	Aurignacian	**1**
reworked		**7**
TOT		**104**

of the blank, *débitage* and manufacturing technique, presence of markings, typology of fractures, presence of burnt areas, position of use-wear.

The registered morphometric data were maximum length, width and thickness.

For the typological analysis of the artefatcs we have used the main bibliographical references (Averbouh, 2000; Camps-Fabrer, 1988, 1990, 1991; Molari, 1994; Choyke, Schibler, 2007).

Every specimen has been examined with a Hirox KH-7700 digital microscope with the aim to identify both manufacture and use-wear (Arrighi, Borgia, 2009; Arrighi *et al.,* 2016). A very good state of conservation of the bone tools, as of most the finds of the cave, allows to deal with a functional study.

The differentiation between anthropic and natural wear, as well as the evaluation criteria of the manufactural and use wear trace are based on a large reference literature (in particular: Knecht, 1997; Averbouh, 2000; Villa, d'Errico, 2001; d'Errico, Backwell, 2003; Tartar, 2003; Goutas, 2004; Sidéra, Legrand, 2006; Cristiani, 2008; Tejero *et al*., 2012; Pétillon, Averbouh, 2013).

The application of the techno-functional method to bone industries takes advantage mostly of low power observation (up to 100x) in order to investigate the process of manufacturing and use of the tools, as well as the post-depositional traces (patina, planking traces, carnivores actions, etc.).

As regards microwear, not all scholars agree on the fact they have a unique diagnostic value: polish on bone tools are, in general, poorly documented (Maigrot, 2003; Christidou, 2008; Cristiani, 2008).

Manufacturing techniques

Excluding the 60 expedient tools, pointed fragments such as shaft fragments obtained during carcass-processing activities (fig. 2), the manufacturing techniques we have identified are the following:

a) Regularization of naturally-pointed skeletal elements (n=18)

This method, used mostly exclusively on horse rudimental metapodial (fig. 3: 3, 4, 7-10), has been documented at Paglicci from the Ancient Gravettian through to the Final Epigravettian, and only entails light scraping. The tool obtained employing this technique is a ready-to-use 'fortune' awl (*poinçon d'économie* in French), a very common find at prehistoric sites from transition complexes onwards (d'Errico *et al*., 2003, 2012).

b) Tools produced by breaking or grooving limb long bones (n=21).

This method was used to produce all the awls and some smoothers found at Paglicci. The two fractured waste products found from the Evolved Epigravettian (layers 11A and 10 E4 – fig. 1: 3-4) clearly illustrate how the working of red deer metapodials may have taken place. To begin with, four longitudinal grooves were carved onto the bone with the aid of a lithic tool (on the ventral and dorsal sides the tendons grooves were exploited). The shaft walls were incised across most of their depth and, in some cases, up to the marrow cavity. In the following opening phase it is not clear whether a wedge was used, although a number of impacts are clearly visible. Traces linked to impacts are also present on two finished awls produced on red deer metatarsals (fig. 4: 2). It is therefore possible that the percussion blow struck to the opening of the shaft was part of the *chaîne opératoire*.

This first stage, also known as *débitage*, is followed by the *façonnage*, that is to say, the shaping of the piece by means of scraping in order to obtain the desired shape.

c) Antler working (n=6).

The majority of worked antler remains found in the cave are attributed to the Ancient Epigravettian (fig. 7). We only have photographic evidence of an antler spearpoint from layer 18B (Final Gravettian) (Mezzena, 1975. P. 226. Fig. 1 – to the left). No antler-processing waste has been found at the site and it is therefore difficult to speculate on manufacturing methods. The spongy structure of antler do not permit to distinguish the shaping techniques used (scraping, abrasion).

Typological and functional analysis

The material was subdivided according to the nature of the active parts of the pieces (Molari, 1994). This classification, which can be defined as "morpho-typological", has

enabled to group most of Grotta Paglicci's material into a small number of 'type' categories. However such a classification is provided as a guide only, as some of the finds, especially those that are fragmented, can be classed under several of the categories.

The following categories were identified:

a) Blunted tools (n=9).

These are tools of diverse morphologies that have been used as smoothers (fig. 3: 1, 2, 5). In many of the pieces there is little evidence of working, but their use is nonetheless clear. In a case, a break margin of a flat bone (scapula or innominate), was regularized giving it a shape similar to that of a flint end-scraper common in the Gravettian/ Epigravettian layers. This tool's ventral side shows numerous streaks produced by a lithic tool on its surface. The tool active margin is very blunt and polished (fig. 3: 1).

b) Perforating tools (n=81, table 3).

Bone tools with pointed ends likely used as awls or needles have been included in this category, as well as the tools on which the pointed distal end is missing, but which cannot be confused with spearpoints because of the preserved articular hafting.

Awls made from horse splint bones are found in all occupation phases at Paglicci (excluding the Aurignacian) with no technological differences through time (fig. 3: 3, 4, 6, 8-10). This is a type of "fortune" awl represented by shaft fragments worked only on one of their ends in order to obtain a point, or even by pieces completely devoid

Table 2. Anatomic and taxonomic origin of the blanks. Abbreviations: A=ancient; E=evolved; F=final; L-M Ungulate = Large-Medium sized Ungulate (auroch, equidand red deer); S Ungulate = Small sized ungulate (roe deer, caprines and wild boar).

Taxon	Element	Aurignacian	Gravettian			Epigravettian				Rew.	TOT	TOT (per taxon)
			A	E	F	Rew.	A	E	F			
Horse	Fibula	-	-	-	1	-	-	-	-	-	1	20
	Rudimental Metapodial	-	1	6	1	-	2	5	2	1	18	
	Humerus	-	-	-	-	-	-	1	-	-	1	
Wild boar	Fibula	-	-	-	-	2	1	-	-	-	3	3
Red deer	Antler	-	-	-	-	-	5	-	-	1	6	18
	Metatarsal	-	-	1	-	2	3	3	-	1	10	
	Tibia	-	-	-	-	-	-	1	-	-	1	
	Ulna	-	-	-	-	-	-	-	1	-	1	
Roe deer	Metatarsal	-	-	-	-	1	-	-	-	-	1	1
Caprine	Metatarsal						1				1	1
Auroch	Metatarsal	-	-	-	1	-	1	-	-	-	2	2
Ungulate	Tibia	-	-	-	-	-		1	-	-	1	1
L-M Ungulate	Humerus (Diaphysis)	-	-	-	-	-	1	-	-	-	1	7
	Unid. (Diaphysis)	1	-	-	-	-	-	2	2	1	6	
S Ungulate	Metacarpal	-	-	-	-	-	1	-	-	-	1	1
Unidentified	Rib		-	-	-	-	1	-	-	-	1	50
	Diaphysis	-	-	-	-	-		-	1	-	1	
	Flat bone	-	-	-	-	-		-	-	1	1	
	Unidentified	-	5	4	4	3	15	7	7	2	47	
TOT		**1**	**6**	**11**	**7**	**8**	**31**	**20**	**13**	**7**	**104**	

of processing traces, but showing use-wear (fig. 2: 1- 7).

In all probability, all the awls described as 'tools with articular hafting' should have had pointed tips. These are blanks obtained from the bones of a number of species, with a preserved epiphysis as their shared feature. The presence of the epiphysis would have made holding the object easier. The working of the bone is always very accurate. In the majority of these artefacts apices have not been preserved (fig. 4: 1-12).

Amongst the perforating tools there are a number of objects characterized by their high degree of polish, which renders them very smooth and smaller in diameter than other artefacts found at the site c - 6 mm (fig. 6: 1-5). The only complete piece (fig. 6: 3) has the shape of a needle.

Around one third (32%) of the awls present traces of use-wear. These traces consist of a marked rounding of the apex or circular fractures, slightly deep, always located between 5 and 10 mm from the apex (fig. 3: 4a; 5: 2a, 12b, 13b).

c) Spearpoints (n=7).

The spearpoints were produced on both bone and antler.

Amongst the antler points, the only complete tool found (fig. 7: 1 – layer 17D) is diamond-fusiform in shape, mostly perfectly symmetrical, and sub-oval in section. On this tool (80×13×10 mm), on which working and use-wear traces are not very clear, we determined the mostly rounded part to be the base of the piece (fig. 7: 1b), characterized by the presence of dark residues and deep oblique notches, as well as numerous streaks. The apex appears to be fractured and slightly smoothed/rounded (fig. 7: 1a). These intentional markings are very common on the proximal end of bone points (Goutas, 2002; Straus, Gonzales Morales, 2009), and across the whole length of harpoons (Julien, 1999).

Another point (fig. 7: 2, layer 17D), oval in section and greater in diameter than the above piece (92×16×11 mm), was likely originally a *pointe à base biseautée,* although it is not known whether a single or double one. This *biseau* does not appear to have been obtained through scraping, but rather by means of a trenchant blow.

There is a unusually long antler *baguette* (fig. 7: 8) from layer 17E (196×11×10 mm). This piece has one end flattened and rounded, and another fractured. If this artefact was related to hunting activities, it may have been used as an intermediate element, or *préhampe* (Pétillon, 2006). The curvature of the piece is likely the result of tissue decay (Yurgenson *et. al.*, 2012).

The rest of the antler artefacts are pointed fragments, almost all from layer 17.

As far as bone is concerned, the only complete bone point (fig. 7: 5) does not appear to be particularly well-finished. Because of concretions, it is not possible to observe working or use-wear traces, which may be able to provide us with clues as to the orientation of the piece.

Some pointed fragments could also be re-classed into this category (e.g. fig. 4: 11).

Markings (n=6; table 4). Six pieces from Grotta Paglicci show markings to their surfaces, the purpose of which (purely decorative or additionally functional in some way) remains unknown (fig. 3: 6; 4: 1, 2, 8, 1 0; 5: 9). In three of the cases the markings are very close to each other, and in two of these they are found on both sides of the tool. In the case of the horse splint bone from layer 18B (fig. 3: 6), two pairs of notches are located on one side of the tool and these are accompanied by other fainter streaks.

The fact that all the pieces are fragmented prevents us from observing the complex structure of the marking motifs.

A fragmented pointed piece (fig. 5: 9) presents an interesting peculiarity: a cracking of the bone surface, probably due to the passing of time, has affected the series of markings; these, however, have been 'reclaimed', undoubtedly after the cracking, although with a more subtle stroke (fig. 5: 9b).

Conclusions

The main conclusions drawn from this study of Grotta Paglicci's worked bone industry can be summarized as follows:

1) The number of bone and antler artefacts is small, especially considering the high level of occupation noted at the site highlighted not only by the thousands

of stone tools and faunal remains recovered from its long sequence, but also by other evidence, such as the burials, art objects and paintings, representing the symbolic and spiritual sphere of those who made use of Paglicci. The relative scarcity of bone and antler tools, besides, is common in most of the Mediterranean Europe sites.

2) There is a lack of an interconnection between the kinds of species represented in the faunal assemblages and the species used for the production of bone (and antler) tools. This is the case with red deer remains, which are rare within Paglicci's faunal collections, but were preferentially used for the production of artefacts. The working of red deer antler or post-cranial elements is noted throughout the Epigravettian sequence, even during periods when the presence of this taxon is extremely rare. The most striking case concerns layer 17 (Ancient Epigravettian, c. 20,000 cal. BP), from which five antler spearpoints were recovered (layers 17C, 17D, 17E and 17G) (fig. 7: 1, 2, 3, 4, 6, 7) as well as the point described by Mezzena and Palma di Cesnola (1967). In this layer the frequency of red deer remains in terms of the total ungulate fauna recovered does not exceed 5% in layers 17A–D1 and 2.5% in 17D2-H (Crezzini, 2007; Boschin, 2013). This choice of raw material is therefore neither random nor simply linked to the general availability of prey, but rather shows a profound understanding of the properties of the skeletal elements, which can be linked to the presence of technological choices that were maintained throughout the Upper Palaeolithic.

Some kind of tool types appear to be linked to particular periods. In terms of the typological and functional characteristics of the tools, those used for domestic activities (smoothers/spatulae, awls) appear, all in all similar in terms of their characteristics, throughout the whole sequence. The oldest tool at Paglicci is an awl made from the shaft of a medium-to-large-sized ungulate from Aurignacian layer 24A1 (fig. 3: 7). From the Ancient Gravettian to the Final Epigravettian there is a kind of tool produced on horse rudimental metapodial (there are 6 in the Evolved Gravettian layer 19, all completely identical (fig. 3: 8). This kind of object was already present in the Uluzzian (d'Errico *et al*., 2012) and is a sturdy type of awl, the production of which is very fast.

The spread of the thinnest and carefully-polished tools (perhaps needles – fig. 6), seems to be present exclusively during the Gravettian.

In the Ancient Epigravettian layer 17, the correlation between antler spearpoints, shouldered stone points and the faunal assemblages predominated by ibex remains, offers a unique and interesting glimpse on a specific moment in time at the site when a change in tool productions and in hunting strategies took place as result of the arrival of a new population or new ideas.

V. Borgia carried out the analysis of the osseous artefacts, F. Boschin conducted the taxonomic identification and carried out analysis on some osseous artefacts and A. Ronchitelli is responsible for the researches at Paglicci and coordinated this work. The conclusions were elaborated jointly by all Authors.

Acknowledgements

We thank the Soprintendenza Archeologia, Belle Artie Paesaggio per le provincie di Barletta - Andrea - Trani e Foggia for authorizing and supporting the excavations at Grotta Paglicci, Arturo Palma di Cesnola for his fieldwork and studies over the years and Paolo Boscato (Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, Università degli Studi di Siena) for his stimulating advice.

REFERENCES

Arrighi S., Borgia V. Surface Modifications of Flint Tools and Their Functional Meaning. *In:* Materials and Manufacturing Processes. 2009. Vol. 24. P. 922–927.

Arrighi S., Borgia V., D'Errico F., Ronchitelli A. I ciottoli decorati di Paglicci: raffigurazioni e utilizzo. *In:* Rivista di Scienze Preistoriche. 2008. Vol. 58. P. 39–58.

Arrighi S., Borgia V., D'Errico F., Ricci S., Ronchitelli A. Manifestazioni d'arte inedite e analisi tecnologica dell'arte mobiliare di Grotta Paglicci (Rignano Garganico – Foggia). *In:* Preistoria Alpina. 2012a. 46. P. 49–58.

Arrighi S., Borgia V., Guasparri G., Ricci, S., Scala A., Ronchitelli A. Grotta Paglicci (Rignano Garganico, Foggia): analisi sulle materie coloranti. *In:* Preistoria Alpina. 2012b. Vol. 46. P. 91–92.

Arrighi S., Bazzanella M., Boschin F., Wierer U. How to make and use a bone spatula. An experimental program based on the Mesolithic osseous assemblage of Galgenbühel / Dos de la Forca (Salurn/Salorno, BZ, Italy). *In:* Quaternary International. 2016. Vol. 423. P. 143–165.

Averbouh A. Technologie de la matière osseuse travaillée et implications palethnologiques, Mémoire de doctorat de l'Université Paris I. Paris, 2000.

Borgia V., Boschin F., Ronchitelli A. Bone and antler working at Grotta Paglicci (Rignano Garganico, Foggia, southern Italy). *In:* Quaternary International. 2016. Vol. 403. P. 23–39

Boscato P., Palma di Cesnola A. Nuovi ritrovamenti di Epigravettiano antico “iniziale” a Grotta Paglicci (Rignano Garganico, Foggia). *In:* P. Biagi (ed). Studi sul Paleolitico, Mesolitico e Neolitico del bacino dell'Adriatico in ricordo di Antonio M. Radmilli. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia. Quaderno. 2000. Vol. 8. P. 45–60.

Boschin F. I macromammiferi epigravettiani di Grotta Paglicci: dati paleoecologici, tafonomici e paleoeconomici inseriti nel contesto Tardoglaciale dell’Italia meridionale. PhD Thesis, Università degli Studi di Siena, Italy. 2013.

Camps-Fabrer H. (dir.). Fiches typologiques de l’industrie osseuse préhistorique. Cahier I, Sagaies. Aix-en Provence: l’Université de Provence, 1988.

Camps-Fabrer H. (dir.). Fiches typologiques de l’industrie osseuse préhistorique. Cahier III, Poinçons, pointes, poignards, aiguilles. Aix-en Provence: l’Université de Provence, 1990.

Camps-Fabrer H. (dir.). Fiches typologiques de l’industrie osseuse préhistorique. Cahier IV, Objets de Parure. Aix-en Provence: l’Université de Provence, 1991.

Choyke A.M., Schibler J. Prehistoric bone tools and the archaeozoological perspective: research in Central Europe. *In:* C. Gates St.-Pierre, R.B. Walker (eds). Bones as Tools: Current methods and interpretations in Worked Bone Studies. BAR International Series; 1622. Oxford: Archaeopress, 2007. (BAR International Series; 1622). P. 51–65.

Christidou R. An application of micro-wear analysis to bone experimentally worked using bronze tools. *In:* Journal of Archaeological Science. 2008. Vol. 35. № 3. P. 733–751.

Condemi S., Capecchi G., Monti L., Voisin J. L., Mounier A., Ricci S., Ronchitelli A. I resti umani rinvenuti a Paglicci (Rignano Garganico – FG): nota preliminare. *In:* C. Peretto, M. Arzarello, J. Arnaud (eds.). Annali dell'Universita' di Ferrara – Museologia Scientifica e Naturalistica. 2014. Vol. 10/2. P. 233–238.

Crezzini J. Lo sfruttamento degli ungulati nel Paleolitico medio e superiore della Puglia: cinque siti a confronto. PhD Thesis, Università degli Studi di Siena, Italy. 2007.

Cristiani E. Analisi funzionale dei manufatti in materia dura animale del Riparo Dalmeri (Altopiano della Marcesina, Trento).In: Preistoria Alpina. 2008. Vol. 40. P. 259–287.

D'Errico F., Backwell, L R. Possible evidence of bone tool shaping by Swartkrans early hominids. *In:* Journal of Archaeological Science. 2003. Vol. 30 (12). P. 1559–1576.

D’Errico F., Julien M., Liolios D., Vanhaeren M., Baffier D. Many awls in our argument. Bone tool manufacture and use in the Châtelerronian and Aurignacian levels of the Grotte du renne at Arcy-sur-Cure. *In:* J. Zilhão, F. d’Errico (eds.). The Chronology of the Aurignacian and the Transitional Technocomplexes. Dating, Stratigraphies, Cultural Implications. Trabalhos de Arqueologia. 2003. Vol. 33. P. 247–270.

D'Errico F., Borgia V., Ronchitelli A. Uluzzian bone technology and its implications for the origin of behavioural modernity. *In:* Quaternary International. 2012. Vol. 259. P. 59–71.

Fu Q. et al. The genetic history of Ice Age Europe. *In:* Nature. 2016. Vol. 534. P. 200–205.

Goutas N. L’exploitation des bois de cervidés dans les niveaux gravettiens de la Grotte d’Isturitz (Pyrénées-Atlantiques): le procédé d’extraction de baguette par double rainurage longitudinal. *In:* M. Patou-Mathis, P. Cattelain, D. Ramseyer (eds.). L’industrie osseuse pré- et protohistorique en Europe. Approches technologiques et fonctionnelles. Actes du Colloque 1.6, XIV Congrès de l’UISPP, Liège. Bullettin du Cercle archéologique Hesbaye-Condroz. Vol. 26. Liège, 2002. P. 19–28.

Goutas N. Caractérisation et évolution du Gravettien en France par l'approche techno-économique des industries en matières dures animales (étude de six gisements du Sud-ouest), PhD thesis, Paris 1 University, France. Paris, 2004.

Julien M. Une tendance créatrice au Magdalénien, à propos de stries d'adhérence sur quelque s harpons. *In:* M. Julien, A. Averbouh, D. Ramseyer. Préhistoire d'os, Recueil d'études sur l'industrie osseuse préhistorique offer à Henriette Camps-Fabrer. Aix-en-Provence: Publications de l'Université de Provence, 1999. P. 133–142.

Knecht H. Design Strategies of Early Upper Paleolithic Bone and Antler Projectile Technologies. *In:* Anthropologie et Préhistoire. 1997. Vol. 111. P. 28–36.

Lami S., Palma di Cesnola A. Le industrie degli strati 10-12 della Grotta Paglicci (Promontorio del Gargano). Primo approccio allo studio, Askategi – Miscellanea in onore di Georges Laplace. *In:* Rivista di Scienze Preistoriche. 2005. Suppl. 1. P. 177–199.

Maigrot Y. Etude technologique et fonctionnelle de l'outillage en matière dures animales. La station 4 di Chalain, Mémoire de Doctorat de l'Universitè de Paris I. Paris, 2003.

Mariotti Lippi M., Foggia B., Aranguren B., Ronchitelli A., Revedin A. Multistep food plant processing at Grotta Paglicci (Southern Italy) around 32 600 cal. BP. *In:* Proceedings of the National Academy of Science. 2015. Vol. 112/39. P. 12075–12080.

Mezzena F. Il Gravettiano della Grotta Paglicci nel Gargano. III: Industria dell'osso, oggetti di ornamento e vari. *In:* Rivista di Scienze Preistoriche. 1975. Vol. 30 (1–2). P. 225–236.

Mezzena F., Palma di Cesnola A. L'Epigravettiano della Grotta Paglicci nel Gargano (scavi F. Zorzi 1961–63). *In:* Rivista di Scienze Preistoriche. 1967. Vol. 22 (1). P. 23–156.

Mezzena F., Palma di Cesnola A. Scoperta di una sepoltura gravettiana nella Grotta Paglicci (Rignano Garganico). *In:* Rivista di Scienze Preistoriche. 1972. Vol. 27 (1). P. 27–50.

Mezzena F., Palma di Cesnola A. Nuova sepoltura gravettiana nella Grotta Paglicci (Promontorio del Gargano). *In:* Rivista di Scienze Preistoriche. 1989–90. Vol. 42. P. 3–29.

Mezzena F., Palma di Cesnola A. Nuove manifestazioni d'arte parietale e mobiliare della Grotta Paglicci nel Gargano. *In:* Atti della XXVIII Riunione Scientifica IIPP. Firenze, 1992. P. 277–292.

Molari C. The industry on bone of the Pleisocene layers from the Arene Candide Cave (Savona, Italy). *In:* Quaternaria Nova. 1994. Vol. 4. P. 297–340.

Palma di Cesnola A. 1999. La séquence de la grotte Paglicci (Mont Gargano) dans le cadre du Leptolithique de l'Italie méridionale. *In:* Proceedings of the XXIV Congrès Préhistorique de France, Carcassonne. Paris: Societé Préhistorique Française, 1999. P. 185–193.

Palma di Cesnola A. Le Paléolithique supérieur en Italie. Éd. J. Millon, collection «L'Homme des origines», série «Préhistoire d'Europe» 9. Grenoble, 2001. 482 p.

Palma di Cesnola A. L'Aurignacien et le Gravettien ancien de la grotte Paglicci au Mont Gargano. *In:* L'Anthropologie. 2006. Vol. 110. Issue 3. P. 355–370.

Palma di Cesnola A. L'Epigravettiano tra 15.000 e 10.000 anni da oggi in Puglia. In: F. Martini (ed.). L'Italia tra 15.000 e 10.000 anni fa. Cosmopolitismo e Regionalità nel Tardoglaciale. Studi di Archeologia Preistor ica. 5; Millenni, Museo Fiorentino di Preistoria "Paolo Graziosi". Firenze, 2007. P. 135–156.

Palma di Cesnola A. Le industrie di Grotta Paglicci (Rignano Garganico-FG): strati 9-8 (scavi A. Palma di Cesnola 1973-75. *In:* Rassegna di Archeologia. 2007–2008. Vol. 23. P. 11–54.

Pétillon J. M. Des Magdaléniens en armes. Technologie des armatures de projectile en bois de Cervidé du Magdalénien supérieur de la grotte d'Isturitz (Pyrénées-Atlantiques). Treignes: CEDARC, 2006. 302 p.

Pétillon J. M., Averbouh A. L'industrie osseuse du Solutréen au Magdalénien moyen dans le Bassin parisien. *In:* B. Pierre, L. Chehmana, L. Klaric, L. Mevel, Ludovic, S. Soriano, N. Teyssandier (eds.). Le Paléolithique supérieur ancien de l'Europe du Nord-Ouest. Mémoires de la Société préhistorique française. Vol. 56. Paris: Société Préhistorique Française, 2013. P. 143–158.

Posth C., Renaud G., Mittnik A. et al. Pleistocene Mitochondrial Genomes Suggest a Single Major Dispersal of Non-Africans and a Late Glacial Population Turnover in Europe. *In:* Current Biology. 2016. Vol. 26. Issue 4. P. 557–561.

Revedin A., Longo, L., Mariotti Lippi M., Marconi E., Ronchitelli A., Svoboda J., Anichini E., Gennai M., Aranguren B. New technologies for plant food processing in the Gravettian. *In:* Quaternary International. 2015. Vol. 359-360. P. 77–88.

Ricci S., Capecchi G., Boschin F., Arrighi S., Ronchitelli A., Condemi S. Toothpick use Among Epigravettian Humans from Grotta Paglicci (Italy). *In:* International Journal of Osteoarchaeology. 2016. Vol. 26. P. 281–289.

Ricci S., Ronchitelli A. L'arte parietale di Grotta Paglicci (Rignano Garganico-FG): nuovi rilievi sul pannello dei cavalli. *In:* F. Radina (ed.) Preistoria e Protostoria. 2017 Vol. 4 P. 635–640.

Ronchitelli A., Mugnaini S., Arrighi S., Atrei A., Capecchi G., Giamello M., Longo L., Marchettini N., Viti C., Moroni A. When technology joins symbolic behaviour: the Gravettian burials at Grotta Paglicci (Rignano Garganico – Foggia – Southern Italy). *In:* Quaternary International. 2015. Vol. 359–360. P. 423–441.

Sidéra I., Legrand A. Tracéologie fonctionnelle des matières osseuses: une méthode. *In:* Bullettin de Société Préhistorique Française. 2006. Vol. 103. № 2. P. 291–304.

Straus L., Gonzales Morales M. A preliminary description of Solutrean occupations in El Mirón cave (Ramales de la Victoria, Cantabria). *In:* Munibe (Antropologia-Arkeologia). 2009. Vol. 60. P. 117–137.

Tartar É. L'analyse techno-fonctionnelle de l'industrie en matière osseuse dite «peu élaborée». L'exemple des pièces intermédiaires en os de l'Aurignacien ancien de la grotte des Hyènes (Brassempouy, Landes). *In:* Préhistoires Méditerranéennes. 2003. Vol. 12. P. 139–146.

Tejero J. M., Christensen M., Bodu P. Red deer antler technology and early modern humans in Southeast Europe: an experimental study. *In:* Journal of Archaeological Science. 2012. Vol.39. № 2. P. 332–346.

Villa P., D'Errico F. Bone and ivory points in the Lower and Middle Paleolithic of Europe. *In:* Journal of Human Evolution. 2001. Vol. 41. P. 69–112.

Wierer U. Variability and standardization: the early Gravettian lithic complex of Grotta Paglicci, Southern Italy». In: Quaternary International. 2013. Vol. 288. P. 215–238.

Yurgenson G. A., Girya E. Y., Moroz P. V. Flint Raw Materials of Kostenki and Flints of the Russian Plain (an attempt of comparison)". *In:* M. E. Tkachuk (ed.). Stratum plus. Vol. 1. In the Beginning of Beginnings. St. Petersburg; Kishinev; Odessa; Bucharest: Stratum Publishing House, 2012. P. 179–191.

Zorzi F. Pitture parietali e oggetti d'arte mobiliare del Paleolitico scoperti nella grotta Paglicci presso Rignano Garganico. *In:* Rivista di Scienze Preistoriche. 1963. Vol. 17. P. 123–137.

About the authors:

Borgia Valentina. PhD. McDonald Institute for Archaeological Research, University of Cambridge. CB2 3ER, Downing Street, Cambridge, United Kigdom; vb330@cam.ac.uk

Boschin Francesco. PhD. Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, U.R. Preistoria e Antropologia, Università degli Studi di Siena. 8 Laterina St., Siena, 53100, Italy; fboschin@hotmail.com

Ronchitelli Annamaria. Dr. (Prof.). Dipartimento di Scienze Fisiche, della Terra e dell'Ambiente, U.R. Preistoria e Antropologia, Università degli Studi di Siena. 8 Laterina St., Siena, 53100, Italy; annamaria.ronchitelli@unisi.it

ПЕЩЕРА ПАГЛИЧЧИ, (RIGNANO GARGANICO, FOGGIA, ЮЖНАЯ ИТАЛИЯ), ОБЗОР ОБРАБОТКИ КОСТИ И РОГА

В. Борджиа, Ф. Босшин, А. Рончителли

В данной статье приведены доказательства обработки костей и рогов в пещере Пагличчи (Rignano Garganico, Foggia, Южная Италия). Анализ 104 костных артефактов, найденных в верхнепалеолитическом слое пещеры, позволил авторам реконструировать стратегию выбора первобытных охотников, как с точки зрения объектов охоты, так и точки зрения использования твердых животных материалов для изготовления орудий. Для изготовления орудий были выбраны кости только тех животных, на которых охотились: оленя, лошади, зубра и кабана. Интересное наблюдение касается отсутствия взаимосвязи между видами, представленными в фаунистических комплексах, и теми видами, которые используются для производства костяных (и роговых) орудий. Несмотря на то, что небольшое количество фрагментов в каждом отдельном слое не допускает статистических выводов, авторами сделаны представляющие интерес выводы о морфо-технологических особенностях артефактов, на основании того, что некоторые типы инструментов, по-видимому, относились к конкретным периодам.

Ключевые слова: археология, археозоология, верхний палеолит, пещера Пагличчи, костные артефакты, технология обработки кости.

Информация об авторах:

Борджиа Валентина, доктор, Институт археологических исследований Мак-Дональда Кембриджского университета (г. Лондон, Великобритания); vb330@cam.ac.uk

Босшин Франческо, доктор, отделение физических наук, наук о земле и окружающей среде, факультет предыстории и антропологии университета Сиены (г. Сиена, Италия); fboschin@hotmail.com

Рончителли Аннамария, доктор, профессор, отделение физических наук, наук о земле и окружающей среде, факультет предыстории и антропологии университета Сиены (г. Сиена, Италия); annamaria.ronchitelli@unisi.it

Table 3. Perforating tools. Specimens are divided according to tipology, cultural context, origin of the blank, and method of production. Abbreviations: Unid. = Unidentified. L-M Ung. = Large-Medium sized Ungulate; S Ung. = Small sized ungulate.

Tool type	Phase	Taxon	Element	N	Method		
					Fracturing	Scraping	Abrasion
Thin awls	Final Gravettian	Horse	Fibula	1	-	yes	-
		Unid.	Unid.	1	-	-	yes
	Evolved Gravettian	Unid.	Unid.	1	-	-	yes
	Ancient Gravettian	Unid.	Unid.	3	yes	yes	yes
Awls with epyphisis	Final Epigravettian	Unid.	Unid.	1	-	yes	-
	Evolved Epigravettian	Horse	Rudimental metapodial	1	yes	yes	-
		Red deer	Metatarsal	1	-	-	yes
	Ancient Epigravettian	Wild boar	Fibula	1	yes	yes	-
		Red deer	Metatarsal	1	-	-	yes
		Cervid	Metatarsal	1	yes	yes	yes
		Caprine	Metatarsal	1	yes	yes	-
		S Ung.	Unid.	1	-	-	yes
	Epigravettian (reworked)	Wild boar	Fibula	2	-	-	yes
		Red deer	Metatarsal	1	yes	yes	yes
	Evolved Gravettian	Red deer	Metatarsal	1	yes	yes	yes
Awls	Final Epigravettian	Horse	Rudimental Metapodial	2	yes	yes	-
		L-M Ung.	Diaphysis	1	yes	yes	-
		Unid.	Diaphysis	1	yes	yes	-
		Unid.	Unid.	5	yes	yes	-
	Evolved Epigravettian	Horse	Rudimental Metapodial	3	yes	yes	-
			Rudimental Metapodial	1	-	-	-
		Ungulate	Tibia	1	yes	yes	-
		L-M Ung.	Diaphysis	1	yes	yes	-
		Unid.	Unid.	2	yes	yes	-
				2	yes	yes	yes
	Ancient Epigravettian	Horse	Rudimental Metapodial	1	yes	yes	-
			Metatarsal	1	yes	yes	-
		Red deer	Metatarsal	2	yes	yes	-
		Unid.	Unid.	3	yes	yes	yes
				5	yes	yes	-
	Epigravettian (reworked)	Red deer	Metatarsal	1	yes	yes	-
		Roe deer	Metatarsal	1	yes	yes	yes
		Unid.	Unid,	1	yes	yes	yes
		Unid.	Unid,	1	-	-	-
	Final Gravettian	Horse	Rudimental Metapodial	1	-	yes	-
		Unid.	Unid.	2	yes	yes	-
				1	yes	yes	yes
	Evolved Gravettian	Horse	Rudimental Metapodial	6	yes	yes	-
		Red reed	Metatarsal	1	yes	yes	yes
		Unid.	Unid.	3	yes	yes	-
	Ancient Gravettian	Horse	Rudimental Metapodial	1	-	yes	-
		Unid.	Unid.	1	-	-	yes
	Aurignacian	L-M Ung.	Diaphysis	1	-	yes	-
	Reworked	Horse	Rudimental Metapodial	1	yes	yes	-
		Unid.	Unid.	1	-	yes	-

Expedient awls	Final Epigravettian	Red deer	Ulna	1	yes	yes	yes
	Evolved Epigravettian	Red deer	Tibia	1	yes	yes	-
		Unid.	Unid.	1	-	yes	-
		L-M Ung.	Diaphysis	1	yes	yes	-
	Ancient Epigravettian	Auroch	Metatarsal	1	yes	-	-
		Unid.	Unid.	1	-	-	yes
				1	-	yes	-
	Epigravettian	Unid.	Unid.	1	-	yes	-
	Reworked	Red deer	Metatarsal	1	-	-	yes
TOT				**81**			

Table 4. Tools on which are visible markings, decorations, nonfunctional modifications.

Layer	Phase	Taxon	Element	Description	Location of markings
8A	Evolved Epigravettian	Horse	splint bone	Spiral working	
6/10	Evolved Epigravettian	Red deer	Metatarsal	Markings	1 side
Rew.	Epigravettian	Unidentified	Unidentified	Markings	2 sides
15B	Ancient Epigravettian	Red deer	Metatarsal	Markings	1 side
16B	Early Epigravettian	Small ungulate	Metacarpal	Markings	2 sides
18B	Final Gravettian	Horse	splint bone	Markings	1 side

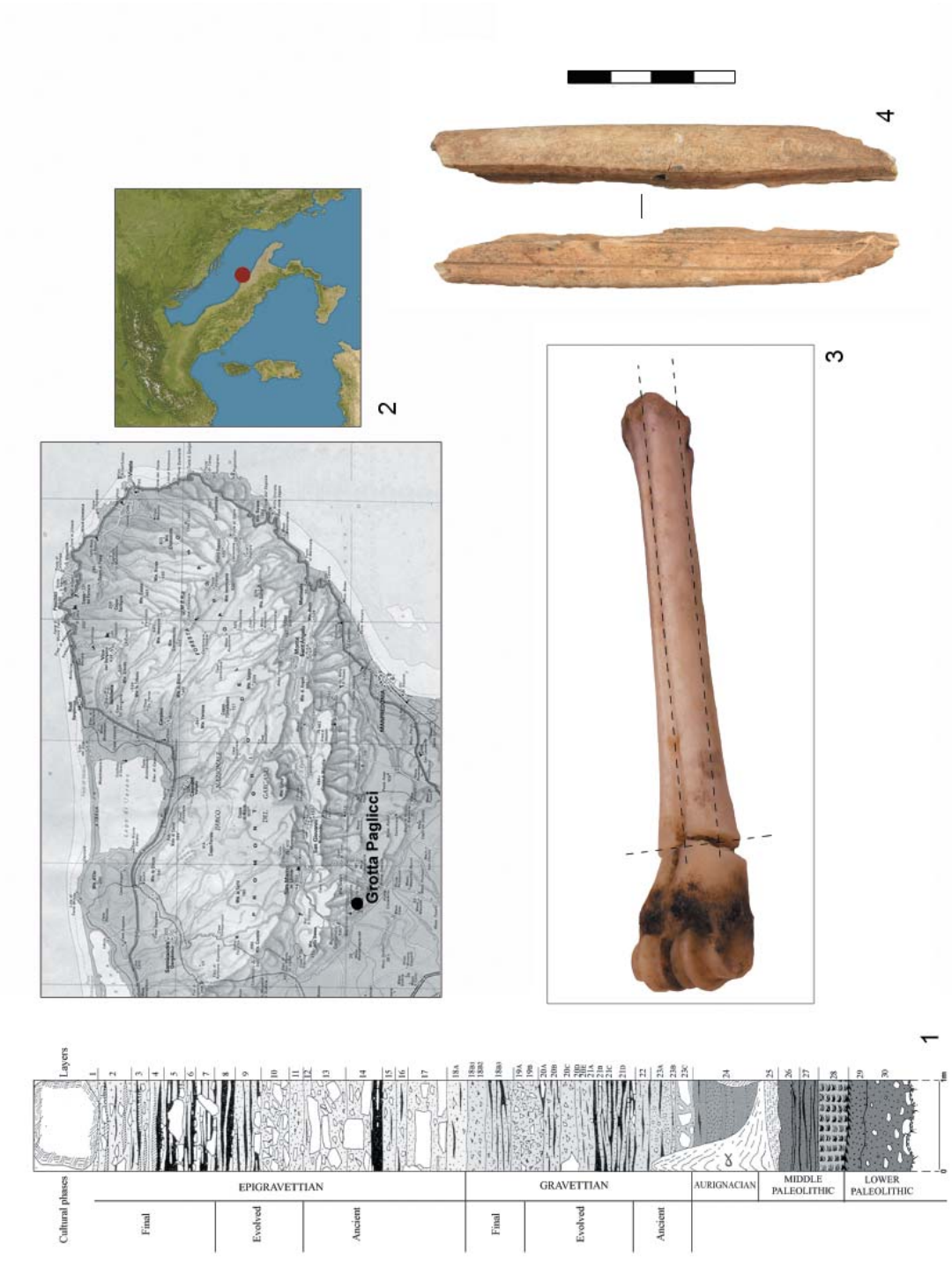

Fig. 1. Stratigraphic sequence of Grotta Paglicci and 2: location of the site; 3: Example of extraction of blanks by fracturing a red deer metatarsus; 4: Roughout found in Epigravettian layer 10.

Fig. 2. Perforating tools (expediency awls): 1 (n. 30, E. Grav.), 2 (n. 108, A. Epigr.), 3 (n. 103, A. Epigr.), 4 (n. 70, E. Epigr.), 5 (n. 116, E. Epigr.), 6 (n. 102, A. Epigr.), 7 (n. 109, F. Epigr.).

Fig. 3. Blunted tools (see Abbreviations Table 1): 1 (n. 97, Rew.), 2 (n. 107, A. Epigr.), 5 (n. 67, A. Epigr.); Awls and fragment of awls: 3 (n. 6, A. Grav.), 4 (n. 58, E. Epigr.), 6 (n. 31, F. Grav.), 7 (n. 0, Aurignacian), 8 (n. 81, E. Grav.), 9 (n. 75, A. Epigr.), 10 (n. 61, E. Epigr.), 11 (n. 11, E. Epigr.), 12 (n. 15, A. Epigr.), 13 (n. 114, E. Epigr.), 14 (n. 97, Rew.), 15 (n. 95, E. Epigr.).

Fig. 4. Perforating tools: 1 (n. 117, A. Epigr.), 2 (n. 21, A. Epigr.), 3 (n. 87, A. Epigr.), 4 (n. 92, A. Epigr.), 5 (n. 113, A. Grav.), 6 (n. 88, A. Epigr.), 7 (n. 59, E. Epigr.), 8 (n. 96, E. Epigr.), 9 (n. 66, F. Epigr.), 10 (n. 89, E. Epigr.), 11 (n. 53, F. Epigr.), 12 (burial).

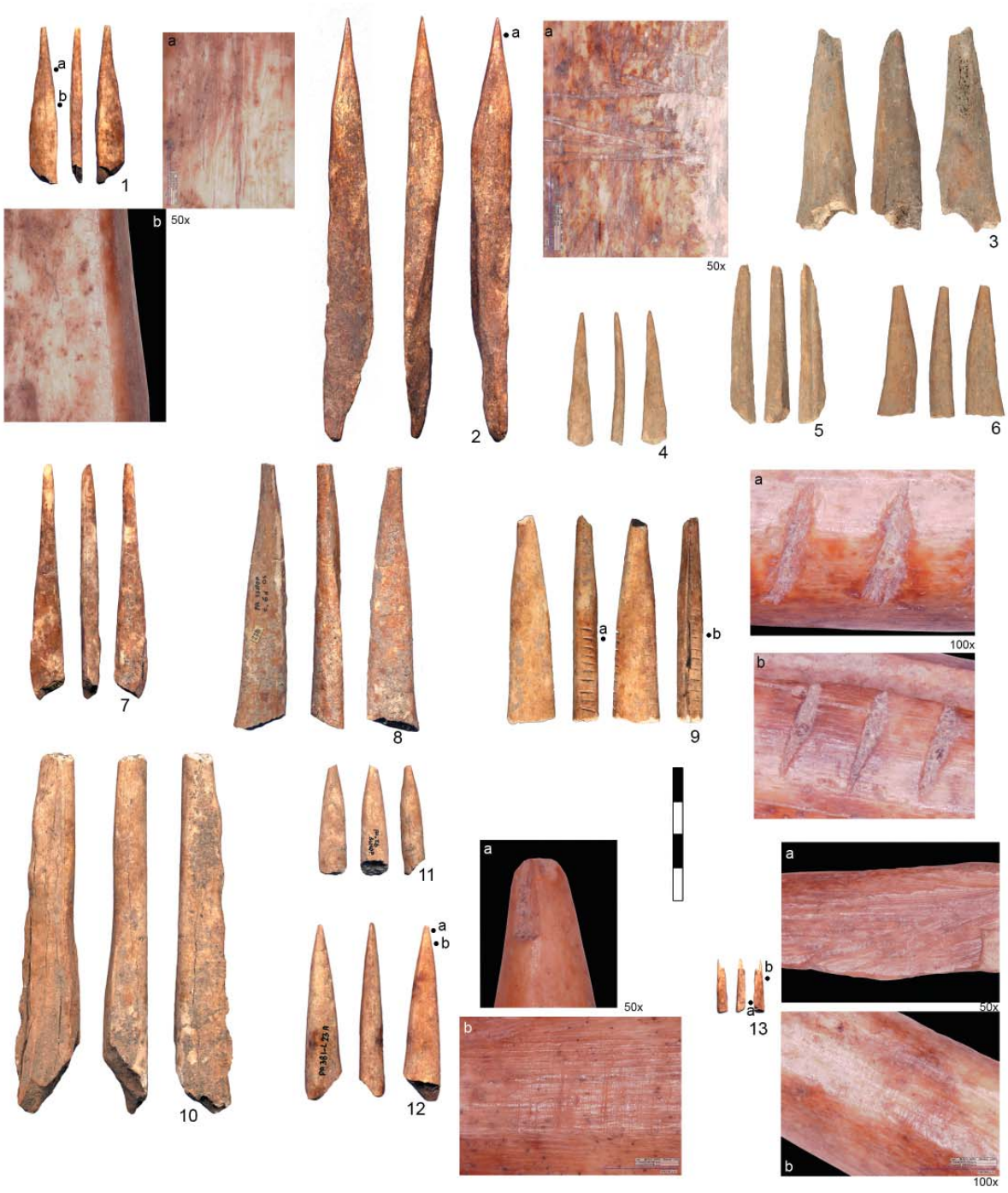

Fig. 5. Perforating tools: 1(n. 7, F. Grav.), 2 (n. 50, A. Epigr.), 3 (n. 68, A. Epigr.), 4 (n. 111, E. Epigr.), 5 (n. 86, E. Epigr.), 6 (n. 101, Rew.), 7 (n. 63, F. Epigr.), 8 (n. 64, F. Epigr.), 9 (n. 115, E. Epigr.), 10 (n. 93, E. Epigr.), 11 (n. 62, F. Epigr.), 12 (n.11, E. Epigr.), 13 (n. 2, A. Grav.).

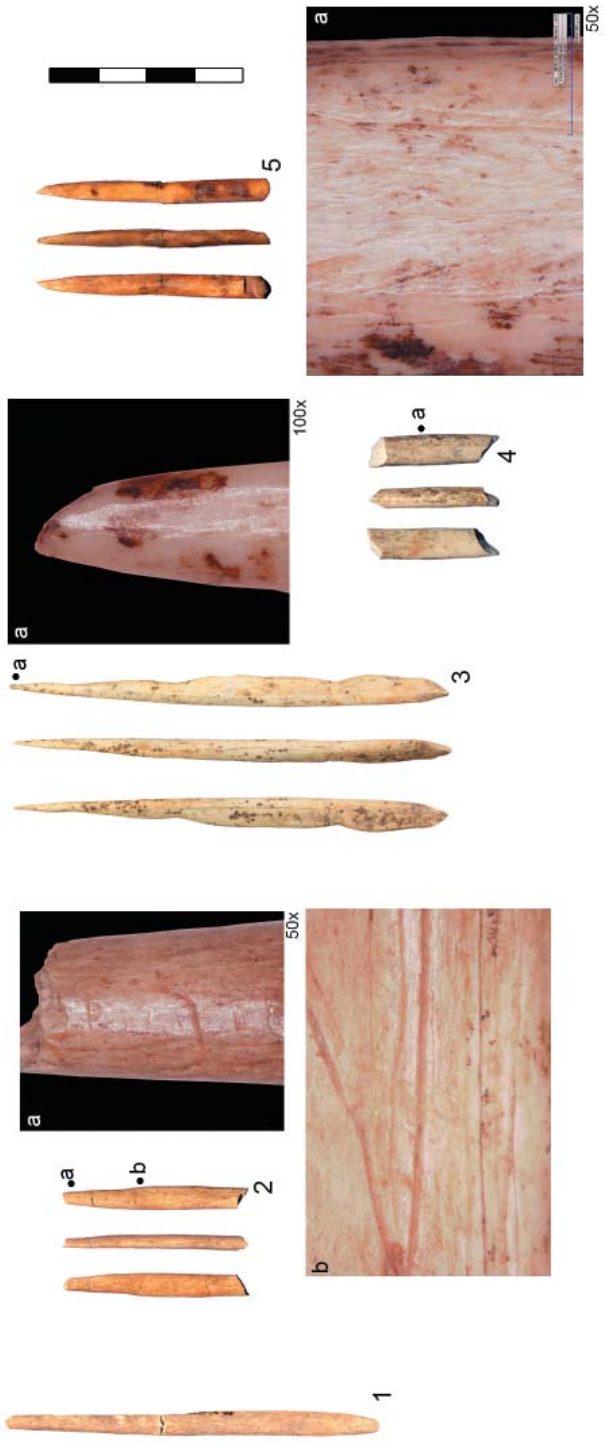

Fig. 6. Perforating tools (needles): 1 (n. 28, F. Grav.), 2 (n. 1, A. Grav.), 3 (n. 5, A. Grav.), 4 (n. 3, A. Grav.), 5 (n. 12, F. Grav.).

Fig. 7. Spearpoints: 1 (n. 10, A. Epigr.), 2 (n. 14, A. Epigr.), 3 (n. 18, A. Epigr.), 4 (n. 16, A. Epigr.), 5 (n. 57, F. Epigr.), 6 (n. 94, A. Epigr.), 7 (n. 200, A. Epigr.).