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ORIGINAL ARTICLE

Lithic Economy and Specialized Activities Among the Iberomaurusian Populations of Tamar Hat Rockshelter (Northeastern Algeria)

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Abstract Tamar Hat rockshelter (Béjaïa, northeastern Algeria) has yielded a lithic assemblage showing general characteristics of an Iberomaurusian Early Late Stone Age nature. Specific "becs," which we shall call "becs of Tamar Hat," appear as an important component of the assemblage in the upper occupations, which occurred at the end of Late Glacial Maximum. These becs, from a technological point of view and especially by their shaping processes, constitute a reliable reference collection, though showing morphological variability resulting in part to the reduction process. The use-wear analysis conducted, based on a microscopic examination validated by experimentation, testifies the becs would have functioned for engraving hard bone, such as those of deer. Other scars observed on the sharp edge and lower face near the active portion of the tool are caused by hafting. Hence, the results of the technological and functional analyses of the becs from Tamar Hat reveal the presence of specialized activities in the upper occupations, related to the animal bone processing. These results are supported by the archaeozoological study, which confirms that the site functioned as a seasonal habitat, where Megacerin deer was exploited in the upper occupations for utilitarian, non-food purposes. The emergence of the use of the becs of Tamar Hat is synchronous with the end of the Upper Paleolithic, prior to the expansion of bec use in the Upper Magdalenian of Europe, where technical and stylistic convergences were observed. This raises the question of the emergence of these lithic implements in North Africa and the possible spread of similar industries elsewhere.

Résumé Le gisement de Tamar Hat (Bejaia, Algérie nord-occidentale) a livré une industrie développant les caractères généraux d'un Ibéromaurusien du LSA ancien. Des becs particuliers que nous appellerons "becs de Tamar Hat" apparaissent comme une composante importante des occupations supérieures de ce site à la fin du Dernier Maximum Glaciaire Ces becs d'un point de vue technologique et dans les procédés de mise en forme du rostre, constituent un ensemble homogène susceptible toutefois d'une certaine variabilité morphologique, résultant en partie de processus de réductions. L'analyse fonctionnelle qui s'est basée sur l'examen microscopique des microtraces observées sur ces becs et validée par l'expérimentation a indiqué que ces derniers auraient fonctionné pour le rainurage de matières dures animales comme le bois de cerf. D'autres traces visibles sur le fil du trenchant et sur la face inférieure à proximité de la partie active seraient plutôt provoquées par l'emmanchement. Les résultats de l'analyse techno-fonctionnelle des becs de Tamar Hat concluent donc, à la présence d'activités spécialisées dans les occupations supérieures de ce site

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en rapport avec le travail de la matière dure animale. Ces résultats sont corroborés par ceux de l'analyse archéozoologique des restes fauniques qui attestent que le site a fonctionné comme un habitat préhistorique saisonnier et confirment la présence et l'exploitation du cerf mégacérin dans les niveaux supérieurs dans des buts utilitaires autres qu'alimentaires. Il est intéressant de noter que l'apparition et l'intensification de l'usage des becs de Tamar Hat se sont effectuées au cours d'une période synchrone de la fin du Paléolithique supérieur, antérieurement à leur expansion au sein du Magdalénien supérieur du Nord de l'Europe où des convergences techniques et stylistiques ont été observées. Ceci soulève la question de l'émergence de ces artéfacts lithiques en Afrique du Nord et leur probable expansion ailleurs.

Keywords Becs · Iberomaurusian · LSA · Tamar Hat · Use-wear analysis · Lithic technology

Introduction

Over the past few years, the term Later Stone Age (LSA), which emphasizes sub-Saharan African links, has been increasingly used by Anglophone researchers working on North African archaeology to describe Late Pleistocene microlithic industries of North Africa, traditionally designated by Eurasian terminology as Upper/Late Paleolithic and Epipaleolithic (e.g., Barich et al. 2006; Barton et al. 2013, 2015). In the following, we suggest the use of the term Iberomaurusian LSA (Barton et al. 2015) to designate the general time period of the Iberomaurusian culture in the Maghreb region, from approximately ~ 25–12 ka cal BP (~ 20,000–10,000 BP), while the classification of Iberomaurusian is necessary to distinguish this temporal period and region of the LSA.

Tremendous advances have been made over the last decade in the systematic application of multidisciplinary methods to answer questions about the origin and spread of the LSA (e.g., Barton et al. 2005, 2013; Barich and Garcea 2008; Bouzouggar et al. 2008; Barker et al. 2012; Linstadter et al. 2012; Douka et al. 2014). Moreover, recent technological analyses carried out on lithic industries provide a more accurate picture of the technical behavior of the Iberomaurusian populations and on the main role that climate change played in behavioral changes, territorial occupations, and dispersals of these populations (e.g., Sari 2012, 2014; Hogue and Barton 2016; Lucarini and Mutri 2014).

Here, we present data from the application of techno-morphological and use-wear analyses, carried out on both archaeological and experimental becs, from the Iberomaurusian lithic assemblage of Tamar Hat rockshelter. The overall high degree of preservation of these tools allowed a detailed analysis of the use-wear patterns on three sampled pieces representing three main techno-morphological varieties.

The becs have not been assigned to a specific typological category in the "typological list of the Epipaleolithic of the Maghreb" elaborated by Tixier (1963), nor were they reported in the subsequent published works on North African lithic assemblages. This might be due to heuristic data related to standard typology applied to discrete typological categories such as those related to becs. The pointedness of these lithic implements could have certainly led some researchers to type them as perforators/borers, points (in *varia* category), or even nosed endscrapers. The outcome of such arbitrary classifications relates back to the traditional debate about a dialectical approach to artifact classification. As Adams and Adams (1991, p. 282) have correctly stressed, "classification into types is a process of discovery of combinations of attributes favored by the makers of the artifacts, not an arbitrary procedure of the classifier." Consequently, current understanding of the becs in North African lithic assemblages remains patchy and subject to a confusing array of typological classification that masks underlying variability of these specific lithic tools.

This paper aims at minimizing the effects of heuristic biases on data interpretation, by considering the archaeologically recovered becs from Tamar Hat rockshelter in terms of their variability, combining lithic technology and use-wear analyses. This will lead to a better understanding of site function, as well as adaptations the Iberomaurusian populations made to paleoclimatic and paleoenvironmental changes during the Late Pleistocene. Ultimately, the results will provide new and relevant data related to the understanding of LSA industries in the Maghreb region.

Site Setting and Archaeological Background

Tamar Hat rockshelter is located on the coast of the Mediterranean Sea, about 30 km east of the provincial capital Bejaïa and about 2 km east of the Wadi Agrioun (Fig. 1). The site opens on the sea in a northwest direction

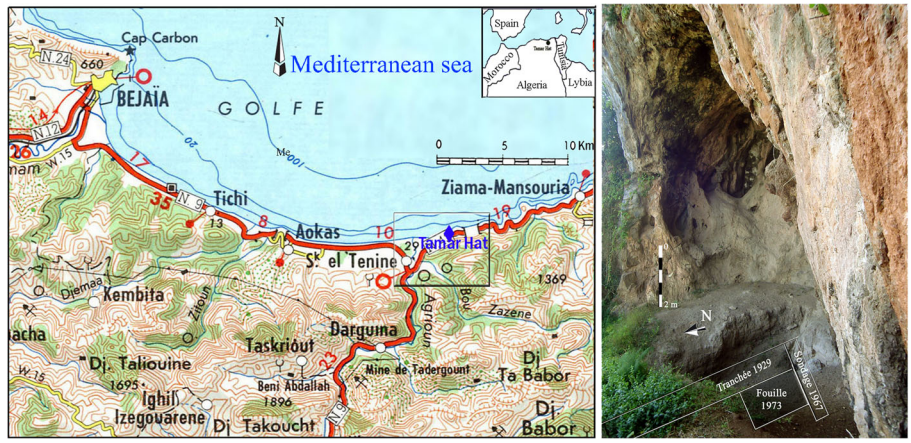

Fig. 1 Location of Tamar Hat rockshelter and the previous fieldwork investigations (photo: L. Sari)

at 15 m altitude above mean sea level, in a mixed landscape of mountain, forest, and coastal plains. The rockshelter measures 6 m wide by 8 m deep and is located at Djebel Babor Mountain which contains several coastal rock cavities such as Afalou bou Rhummel, which yielded numerous burials of Mechta Afalou populations (Arambourg et al. 1934; Hachi 1987, 1996). First noted by Ehrmann in 1920, Tamar Hat site has been excavated by several researchers: Arambourg et al. (1934), Balout (1955), Brahimi (1969) and Saxon et al. (1974).

This paper considers the 1973 excavations carried out by Saxon who used conventional survey methods (Saxon et al. 1974; Saxon 1975). Although the excavated surface from the western sector towards the front of the rockshelter was only 4.50 m^2, the recovered archaeological material stored at the Centre national de recherches préhistoriques, anthropologiques et historiques or CNRPAH (formerly CRAPE) in Algiers was abundant and rich in faunal and lithic remains. The stratigraphy included 85 layers belonging to six stratigraphic zones entirely assigned to the Iberomaurusian culture, and dated on bulked charcoal between 25,194–22,723 cal BP (20,600 ± 500 BP) and 20,337–18,689 cal BP (16,100 ± 360 BP) (Table 1). The reassessment of the radiocarbon dating which yielded new AMS dates from a single bone (Hogue and Barton 2016) supports a much earlier emergence of the LSA in the Maghreb before the Last Glacial Maximum, from at least ~ 25 ka cal BP (Table 1).

Tamar Hat rockshelter is a butchering and consumption site and provided meaningful evidence testifying to the presence of a repeatedly occupied residential camp in late autumn and early winter (Merzoug 2005; Merzoug and Sari 2008). The populations practiced selective hunting directed primarily towards Barbary sheep (Merzoug and Sari 2008), though more orientation to the fishery resources is attested from the end of the Last Glacial Maximum (Saxon et al. 1974; Saxon 1975). Little reliable information on dwelling structures is available as Saxon has already noted the presence of several holes in layer 34 (upper occupations: zone III) suggesting the use of small tent-like structures, which enhance the status of a residential base camp (Saxon et al. 1974). Moreover, hide working may have taken place given the existence of a large number of endscrapers, many with traces of ochre, while the presence of pestle-grinders and grinding stones, as well as wild plants and pigments, suggests the site occupants may have found the natural sources useful for their daily activities (Saxon et al. 1974; Sari 2012).

A preliminary description of the lithic assemblage from the 1973 excavations was given by Saxon et al. (1974), and more details were published by Close (1977, 1978, 1981), who focused on stylistic variation of backed bladelets and concluded that "the entire sequence represents re-occupation of the site by a single, diachronic, social group" (Close 1981, p. 101), yet this author has noted typological variations between the upper and lower occupations. The results of the reanalysis of the same collection by Sari (2012, 2014) reached similar conclusions on a typological level but cast deeper insight into knapping schemes by focusing for the first time on the *chaîne opératoire*. Her study has demonstrated that the lithic production was primarily geared towards obtaining relatively standardized lamellar blanks according to different knapping schemes varying from lower to upper occupations. The prime agents contributing to this variability were the weapons

Table 1 AMS radiocarbon determinations and published radiocarbon dates on bulked material from Saxon excavation (modified, after Hogue and Barton, 2016)

Lab No	14C	d13C‰	cal BP (95.4%)	Material	Layer	Zone	Reference
OxA-27500	16,490 ± 80	− 19.59	20,122–19,632	Bone	5	I	Hogue and Barton 2016
OxA-27501	16,790 ± 90	− 19.76	20,511–20,006	Bone	8	I	Hogue and Barton 2016
MC-817	16,100 ± 360		20,337–18,689	Charcoal	9	I	Saxon et al. (1974)
MC-812	17,040 ± 400		21,665–19,623	Charcoal	15	I	Saxon et al. (1974)
OxA-27502	18,470 ± 100	− 19.33	22,547–22,019	Bone	43	IV	Hogue and Barton 2016
MC-818	18,750 ± 500		23,914–21,538	Charcoal	44	IV	Saxon et al. 1974
OxA-27503	18,440 ± 110	− 19.39	22,525–21,190	Bone	48	IV	Hogue and Barton 2016
MC-820	19,800 ± 500		25,194–22,723	Charcoal	50	IV	Saxon et al. (1974)
OxA-27505	18,990 ± 100	− 19.59	23,164–22,537	Bone	63	V	Hogue and Barton 2016
OxA-27504	19,060 ± 100	− 19.31	23,320–22,625	Bone	63	V	Hogue and Barton 2016
MC-822	20,600 ± 500		25,194–22,723	Charcoal	84/5	VI	Saxon et al. (1974)
OxA-27506	21,240 ± 130	− 19,81	25,845–25,270	Bone	85	VI	Hogue and Barton 2016

design systems and hunting strategies (Sari 2012, 2014). The initial phases of roughing out the lithic raw material are present and imply that this took place in situ. Moreover, the manufacturing of blanks also took place on the spot as suggested by the presence of microburins and burin spalls (Close 1981; Sari 2012, 2014). The lithic raw material is almost completely dominated by two local siliceous rocks (Eocene and Liassic flint), and this abundance reflects a low-cost process of raw material procurement combined with a reduced mobility of the occupants of the site who repeatedly frequented the area (Sari 2012, 2014). Table 2 reports our inventory of the Iberomaurusian lithic industry which shows a techno-typological pattern typical of the LSA of North Africa as suggested by the most evident characteristics, mainly the high index of microlithic backed bladelets, while other classes (endscrapers, truncations, notches, borers/perforators, burins, and splintered pieces) include only a few pieces.

The Becs of Tamar Hat: Occurrence and Morphological Features

Close (1981, p. 99) attributed 33 lithic pieces from the 1973 excavations of Tamar Hat rockshelter to a variety of "points" that she classified into *varia* category and distinguished from the group of perforators. This author found these "points" in the upper occupations between layers 9 and 32 where partially backed acute bladelets using the microburin blow technique were numerous. She noticed that the blanks were mostly "on short blades with two obverse, oblique truncations at one end, converging to form a rather wide but quite sharp point" (Fig. 2).

The description and the illustration given to these pieces by Close (1981) rather correspond to the typological definition of becs in the Upper Paleolithic context of Europe. In fact, our preliminary description given to the becs from the same collection in an unpublished thesis (Sari 2012) allowed us to record 34 pieces, which correspond to the description of becs dated between 20,337–18,689 cal BP (16,100 ± 360 BP) and 21,665–19,623 cal BP (17,040 ± 400 BP). These pieces are missing from the lower occupations (zones IV to VI), synchronous with the Late Glacial Maximum (Table 2).

Becs and borers on flint are known in typology as part of toolkits which occur in different forms and various proportions, particularly during the terminal Upper Paleolithic of Europe such as the Upper Magdalenian and Hamburgian (Leroi-Gourhan 1997, pp. 602, 1145). They are grouped into two main types for which we use the German nomenclature *Langbohrer* and *Zinken*, depending on whether the rostral part is or is not located on the blank axis (Schmider 1988). There is an important point to be made here. De Sonneville-Bordes and Perrot (1955) define perforators/borers of the Upper Paleolithic of Europe as tools which have an acute tip, achieved by using a bilateral retouch forming a simple or double shoulder. The term becs (thick perforators), meanwhile, should be assigned to tools showing

Table 2 Distribution of tool groups

Tool groups/zones	Zone VI		Zone V		Zone IV		Zone III		Zone II		Zone I	
	Lower occupations						Upper occupations					
	NB	%	NB	%	NB	%	NB	%	NB	%	NB	%
End scrapers	12	1.48	82	8.66	92	8.09	7	2.27	68	8.76	97	13.32
Perforators	3	0.37	2	0.22	–	–	–	–	3	0.38	2	0.27
Becs	–	–	–	–	3	0.26	4	1.29	14	1.81	13	1.78
Burins	5	0.61	14	1.47	1	0.08	1	0.33	1	0.13	2	0.27
Backed flakes/blades	9	1.11	5	0.53	6	0.53	–	–	2	0.26	4	0.55
Backed bladelets	717	88.51	749	79.09	950	83.63	284	91.91	629	81.05	559	76.79
Notches and denticulates	10	1.24	21	2.22	35	3.09	2	0.64	12	1.55	14	1.93
Troncatures	16	1.99	33	3.48	23	2.03	4	1.29	19	2.44	14	1.93
Geometric microliths	1	0.13	3	0.31	3	0.26	–	–	–	–	5	0.68
Trihedral points	1	0.12	2	0.22	4	0.36	–	–	2	0.26	2	0.27
Scaled pieces	15	1.85	13	1.37	3	0.26	–	–	3	0.38	–	
Marginal retouch	16	1.98	19	2.01	11	0.96	3	0.98	15	1.94	15	2.07
Varia	5	0.61	4	0.42	5	0.45	4	1.29	8	1.04	1	0.14
Total	810		947		1136		309		776		728	

a thickly rounded point called the rostral part, formed by frontal small lamellar retouch (Schmider 1982). These associated attributes have been sought on all becs studied from Tamar Hat and were found regularly occurring together on the same piece. Hence, the existence of a thickly rounded point formed by frontal small lamellar retouch is a fundamental characteristic in the typological determination of the becs, which allows differentiating them from perforators which have rather fine, developed points (Schmider 1982; Keeley 1988).

Referring to the typological classification of European Upper Paleolithic becs (Schmider 1982, 1988), those of Tamar Hat can be grouped into three categories: (1) axial becs (Longbohrer) with free-standing long rostral part formed by shoulders and terminated by a narrow extremity of triangular section (Fig. 3, no. 7); (2) off-center becs with shorter rostral part formed by the meeting of a truncation and a retouched edge, closely related to the Hamburgian "zinken" (Fig. 3, nos. 1–4); and (3) artifacts with ogival extremities, formed by two abrupt, convergent retouches, straight or slightly convex (Fig. 3, no. 5). Off-center becs with wide and well exposed rostral parts are well represented, followed by ogival and then axial becs (Table 3).

As already assumed for some Magdalenian lithic assemblages (Schmider 1982, p. 267), off-center becs could be a form derived from resharpening big axial becs. This is all the more likely given that the axial and off-center becs occur in the same layers and near hearths at the upper occupations of Tamar Hat, which would suggest the possible existence of a spatial arrangement assigned to specialized activities related to these specific

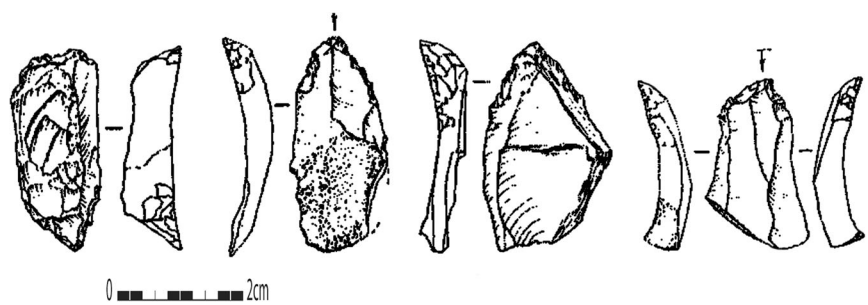

Fig. 2 Becs classified by A.E. Close into Varia group (after Close 1980–1981, Fig. 9, p. 96)

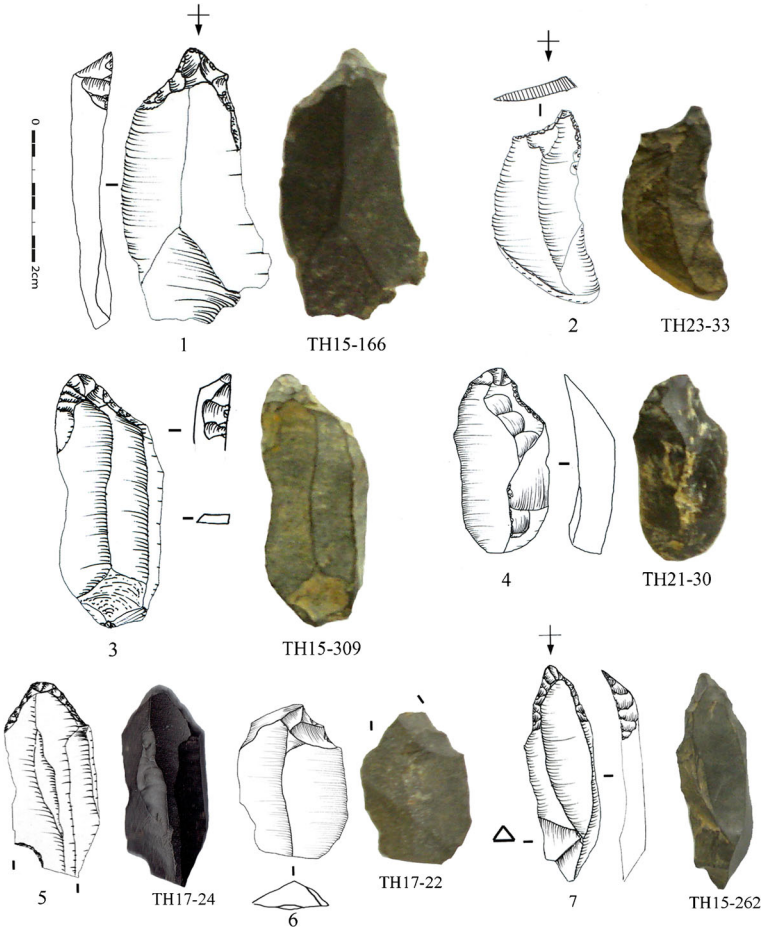

Fig. 3 Principal bec categories at the upper occupations of Tamar Hat '(photos and drawings: L. Sari)

tools. Three pieces were heavily stained with ochre (two from layer 23 and one from layer 18) and have been found near hearths.

Although refitting of debitage waste material was not possible and the degree of resharpening of these tools is difficult to understand, we can state that these pieces were produced on site as suggested by the presence of waste debitage reflecting an expedient strategy. Their local production is also evidenced by the presence of one piece which broke during the manufacture of the rostral part (Fig. 3, no. 6).

Lithic Raw Material and Manufacturing Process

The becs of Tamar Hat rockshelter are preferentially made on Eocene flint, locally available in the form of cobbles not exceeding 8–9 cm in diameter and collected from the nearby Wadi Agrioun. Eocene flint is more homogeneous and vitreous than Liassic flint and allowed the manufacture of sufficiently regular blanks to create an efficient and thin point (Fig. 4). Despite the variability of the rostral part, becs have been made on fairly similar blanks which belong to the roughing-out operation of lamellar cores and were obtained by hard-hammer percussion (Sari 2012).Three pieces are on non-cortical blades while the rest of blanks are on elongated flakes of which four show residual cortex (Table 4). The metrical data on the unbroken blanks are variable. Many short pieces measure between 30 and 33 mm long, while the width is generally between 16 and 19 mm. However, the thickness is less variable, being between 5 and 6 mm probably for hafting constraints (Figs. 5 and 6). It appears that the robustness is one of the key criteria of the choice in blanks, which led the knappers to select less standardized blanks from the lamellar *chaîne opératoire.*

Table 3 Distribution of the different types of becs by layers

Layer	Age ka BP	Axial becs	Off-center becs	Ogival becs	Fragmented	Total
8	16,790 ± 90	–	–	2	–	2
9	16,100 ± 360	–	–	1	–	1
14	–	–	–	1	–	1
15	17,040 ± 400	1	5	3	–	9
17	–	–	–	1	1	2
21	–	–	1	–	–	1
23	–	3	4	–	–	7
24	–	–	1	–	–	1
25	–	1	–	1	–	2
26	–	–	1	–	–	1
27	–	–	–	2	–	2 (including 1 fragment)
28	–	1	–	–	–	1fragment
32	–	–	1	–	–	1 fragment
35	–	1	–	1	–	2
36	–	–	1	–	–	1 fragment
Total		7	14	12	1	34

The morphological variability of the rostral part of the becs results essentially from retouching. This effective part is usually sharpened by truncation, which allows several resharpening sequences to ensure prolonged use of the becs. The rostral part has a relatively constant polygonal section and strong ratios of width/thickness. The width is between 14 and 19 mm, while the thickness varies from 5 to 9 mm. The notable differences in length and thickness could be consistent with use-related constraints. The rostral part is located either on the distal end (n = 19) or the proximal end (n = 17) which means that the blanks have quite similar thickness at the distal and proximal ends. One composite tool has an axial bec at the proximal end and an endscraper at the distal end, which suggests that some becs might have been used for different tasks.

Functions of the Becs of Tamar Hat

Our functional analysis aimed to identify use-wear and residue traces on becs, to provide data on the worked material and the type of action of these tools. It was not possible to analyze the use-wear on all becs recovered from Tamar Hat rockshelter; thus, they were grouped into three main categories based on the morpho-technological variability of the rostral part, and a piece was selected from each category for conducting use-wear analysis. The results of this analysis will be used in further research on becs.

Experimentation

To analyze the function of lithic tools, experimental tools and archeological artifacts were examined

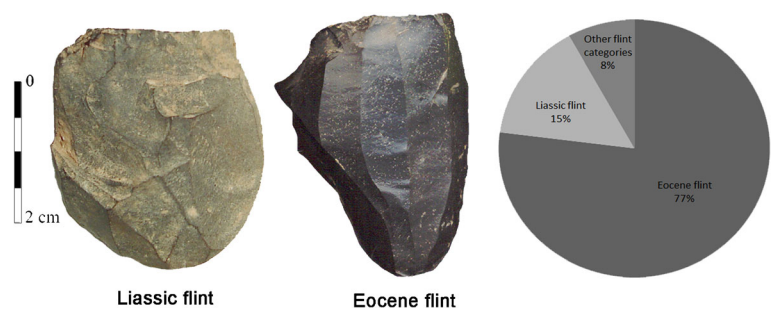

Fig. 4 Distribution of the lithic raw material categories (photo and circular chart: L. Sari)

Table 4 Categories of the becs according to blank nature

Blank type	Zone I	Zone II	Zone III	Zone IV	Total
Total flakes	12	13	4	2	31
First cortical	2	–	–	1	3
Rejuvenation	–	3	–	–	3
Semi cortical	1	3	1	1	6
Non-cortical	9	7	3	–	19
Total blades	1	1	–	1	3
First cortical	–	–	–	–	–
Rejuvenation	–	–	–	–	–
Semi cortical	–	–	–	–	–
Non-cortical	1	1	–	1	3
Total blanks	13	14	4	3	34

microscopically. The experimentation on the becs was carried out in the Laboratory of Prehistory and Technology (UMR 7055) in France. Dried, worked materials including hide, antler, bone, wood, and shell were selected for identifying various characteristics of use-wear on the tools. In accordance with types and conditions of worked materials, various kinds of use-wear, which include polish, edge-rounding, micro-chipping, and striations, were seen on the tool surfaces. Lithic tools used in this experimentation were made from Turonien flint and Bergeracois flint that have similar textural properties as Eocene flint collected from Tamar Hat rockshelter (Fig. 7, no. 6). In accordance with the types of worked material envisaged, boring and grooving experiments were conducted (Fig. 7, no. 7). Basically, each experiment lasted 30 min. A stereoscopic microscope (SMZ 168 T) of 10 and 50 magnifications and a metallurgical microscope (Nikon Labophot) of 100 and 200 magnifications were used for observing use-wear on the surface of lithic tools.

Hide

Polish and edge-rounding were detected on the working surface of experimental becs used for puncturing hides (Fig. 7, no. 4). Polishes were somewhat bright, but in some cases, they were matte. The contour of polishes was less bright. In accordance with hide types, polishes were somewhat differently formed. In the case of wet hide, polishes were more developed than those formed in dry hide. Striations and micro-chippings were rarely observed.

Wood

It could be observed that similar use-wear patterns formed on the surface of becs used for processing bones and antlers as on tools used for processing wooden materials (Fig. 7, no. 3). Becs used for carrying out this experimentation were characterized by a very smooth texture and very bright polishes. However, polishes were only detected on the high points of the microtopography; and their expansions were slow to develop. In addition, both broad and shallow striations were observed.

Bone and Antler

Short and deep striations and breaks along the edge were mainly found on the surface of tools used for processing hard animal materials, such as bone and antler. In some cases, very bright and no smoothed polishes or distinguishing contours of polishes were formed. The use-wear patterns formed by bone showed similar characteristics with those formed by antler; but the former was a little more distinctive and bright than the latter (Fig. 7, nos. 1, 2).

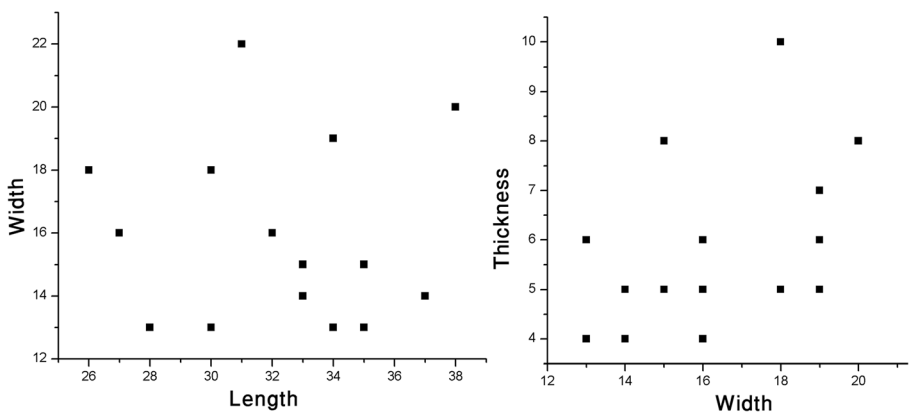

Fig. 5 Scatter plot of the metrical data (mm)

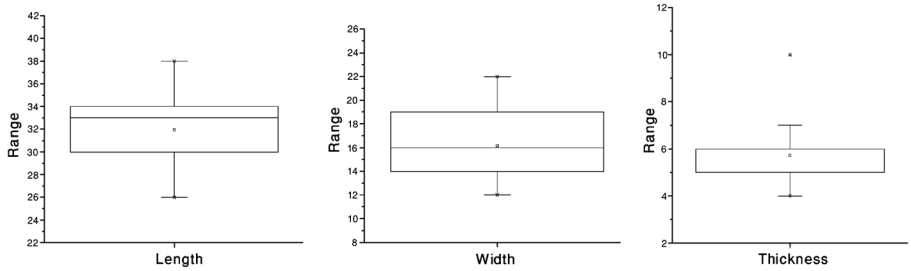

Fig. 6 Box chart distribution of the metrical data (mm)

Shell

Very narrow and clear striations were observed on the surface of becs used for boring and expanding holes in shell. In some cases, bright and less smooth polishes were also formed. Edges touching shells were easily damaged; thus, the break patterns were easily seen in the tools used in processing this material (Fig. 7, no. 5).

To conclude, the breaks and short strings of damage were mainly formed on the edge of the rostral part of

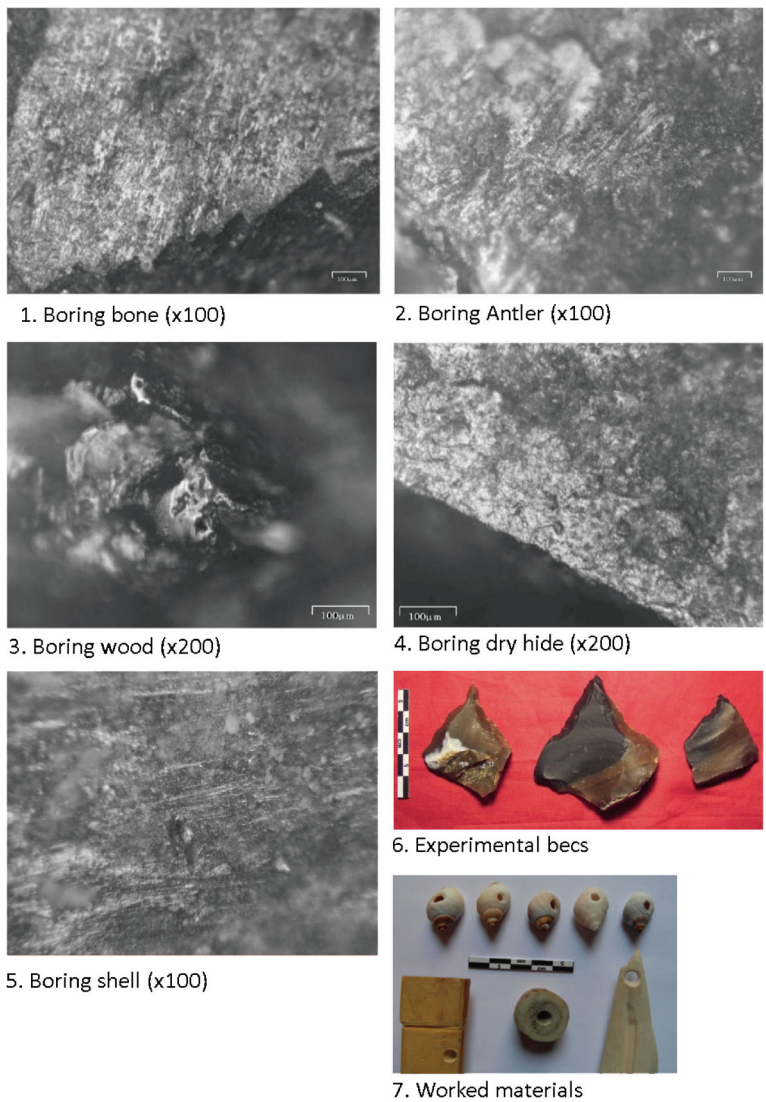

Fig. 7 Traces observed on the experimental pieces and worked materials (photos and photomicrographs: K.J. Kim)

becs that was used for boring or expanding holes in hard materials, such as shell. However, use-wear patterns formed on these tools was easily lost with the chipping of edges; and in some cases, rostral parts were broken off. Use-wear patterns were detected on the surface of the rostral parts of becs used for grooving shells.

Use-Wear Analysis on Becs from Tamar Hat Rockshelter

Bec N° 1 (Fig. 8, no. 1)

Micro-chipping of the edge was detected on the distal part of the ventral face of this tool. Brightness was observed around edges, but less smooth polishes were also formed. In addition, clearly marked, thin striations were also found. All wear patterns were formed at right angles to edges. It seems that these patterns were formed by scraping or grooving hard animal materials. Long and thin striations were found in the middle of the ventral face; and wide polishing patterns were also observed in this part. These patterns can be interpreted as use-wears formed by hafting rather than by using as tools, based on experimental data (Kim 2010).

Bec N° 2 (Fig. 8, no. 2)

Less developed use-wear was identified on the distal end of this tool. Bright but less smooth polishes and very thin and short striations were observed on the left side. It can be assumed that it was used for scraping materials by using the left edge of the tool; but it is impossible to examine worked materials processed by this tool, because patterns showing clear characteristics were not identified.

Bec N° 3 (Fig. 8, no. 3)

Due to its poorly preserved condition, it was not easy to observe use-wear on the surface of this tool. Nevertheless, small patterns consisting of bright, unsmooth polishes with a clear contour, and deep and

Fig. 8 Traces observed on the becs of Tamar Hat rockshelter (photos and photomicrographs: K.J. Kim)

distinctive striations were identified on the end of its rostral part. These patterns suggest that it was a tool for processing hard animal materials. However, it is difficult to know its exact function, because only a small amount of use-wear was preserved on a small area of the bec.

Discussion and Concluding Remarks

Tamar Hat rockshelter presents a long-term, stratified Iberomaurusian sequence covering at least 5,000 years and is a key site for insights into Early Iberomaurusian lifeways in the Maghreb region. After the end of the Late Glacial Maximum, the occupants of the site manufactured some becs on local homogenous flint according to an expedient strategy, with the blanks selected from strong laminar flakes recovered from the lamellar *chaîne opératoire*. The nearly equal dimensions of these becs might depend upon hafting constraints, while the volumetric configuration of the rostral part could be related to use on similar materials. Moreover, the occurrence of axial and off-center becs in the same layers and near hearths of the upper occupations of Tamar Hat might be related to the use of these tools on similar contact materials but with different motions of use.

Interesting and relevant data on the nature of the worked material and the type of action of the studied experimental becs were acquired, while the results of the functional analysis conducted on archaeological becs were of uneven interest. Based on current data, the examination of microwear traces on the three archaeological samples testifies that use-wear was formed in two cases by processing hard animal materials, most likely for manufacturing bone artifacts. The retouched extremities of the becs were used for grooving and/or scraping bone or antler.

The bone assemblage from the Arambourg collection has no stratigraphic information with it, but includes a few punches, bone projectile points, and needles, plus an antler showing traces of use-wear (Camps-Fabrer 1966). Other bone tools were found in the more reliable 1973 excavations of Saxon carried out by Merzoug (2005), who did an archaeozoological study on the faunal remains. In addition, this author conducted a technological analysis of the *Megaceroïdes algericus* deer remains and concluded that shaping the antler was done on the spot (Merzoug 2012). This enhances the results of our technological analysis of the becs of Tamar Hat which assume that they were manufactured at the site.

It is noteworthy that the reexamination of the faunal remains showed that deer remains and antler were found only in the upper occupations (zones I, II, and III) of Tamar Hat (Merzoug 2005, 2012). This appearance coincides with the occurrence of the becs, which become numerous in zones I and II. While it is true that this could be affected by the restricted area of the 1973 excavations, both the deer antler and becs seem to demonstrate specialized activities which come late, after the last heavy snail deposits (layer 44 of zone IV dating back to 18,750 ± 500 BP: 23,914–21,538 cal BP) or the so-called "faunal break." This last was previously reported by Saxon et al. (1974) who associated it with a change in stratigraphy and a return to favorable climate conditions at the end of the Last Glacial Maximum. Moreover, the becs that were preferentially located around hearths undoubtedly represent specialized tools devoted to a seasonal task. This is in agreement with the archaeozoological analysis (Merzoug 2005), which concluded that the site was occupied in late autumn and early winter. Thus, we would suggest, despite the small number of analyzed archaeological samples considered for use-wear analysis, that the combination of the functional and technological analyses contribute significantly to the understanding of the site's function.

A major shortcoming is that no accurate information about the occurrence of becs is yet available in other Iberomaurusian LSA sites in the Maghreb, and we could find no published accounts or artifact drawings of lithic pieces typed as becs, either because of heuristic biases on data, discussed above, or because they do not exist. Our own review of the Iberomaurusian lithic assemblages from Rassel and Columnata sites in Algeria indicates the absence of such becs (Sari 2012, 2014). We would suggest this could be explained by inter-site variability within the framework of group mobility and different functional specializations at these sites, which were occupied at different times and in different ecological niches. Also, we would speculate that the absence of becs from the Rassel and Columnata sites might be compensated for by the existence at both of substitutes, such as burins with a narrow cutting-edge, "*burins à biseau étroit*," which have good morpho-functional homology with becs as already suspected in some Upper Magdalenian lithic assemblages (Valentin 1995, p. 468). This is an interesting hypothesis which requires verification in further use-wear analysis, though it may not be

supportable given the scarcity of such burins and burins in general in Iberomaurusian sites.

One other main point is that the results presented in this paper corroborate other studies which suggest that the becs were used for expanding or grooving the hole in bones or antler. The use-wear analysis of lithic tools uncovered from Verberie, a Magdalenian open-air site in the Paris river-basin (France), that has been conducted by several researchers suggests that becs found in the upper layer of this site were used for boring or expanding holes on bone or antler (Keeley 1981, p. 139; Symens 1986, p. 216; Beyries et al. 2005, pp. 21–23). Of six becs unearthed from the lower layer, traces of utilization were identified on two pieces (Kim 2010). Becs there were used for processing hard animal materials, mainly grooving or scraping (Fig. 9). Technological and stylistic convergences between Iberomaurusian and Magdalenian becs can be observed in the significance of the technique of retouched truncation applied to the rostral part of the becs, as well as the existence of backed straight/curved and shouldered points (Schmider 1988).

Multiple processes could be interfering with similar forms of material such as cultural inheritance, cultural diffusion between populations, and independent reinvention (Groucutt et al. 2015). Bearing this in mind, a major research question for us is whether the morphological and functional convergences between Iberomaurusian and Magdalenian becs were the result of specialized tasks, invented independently as a result of similar environmental adaptation to long-term favorable environmental conditions, or whether they were the consequence of a cultural transmission according to a south/north corridor. This last suggestion is currently consistent with the fact that the first occurrence of the Magdalenian becs is around 16 ka BP (Schmider 1988, p. 193), which means that the emergence and the use of the becs of Tamar Hat occurred prior to their expansion in the Upper Magdalenian of Europe at the end of the Upper Paleolithic. However, there is a large spatial gap between the northern (Magdalenian) and southern (Iberomaurusian) occurrences of the becs. Besides, technical transmission should be distinguished based on the techniques and methods describing the *chaîne opératoire* and on the skills necessary for efficiently putting techniques, methods, and tools into action (Roux 2008, pp. 82–104). This involves establishing chronological controls for reliable samples as well as more detailed technological comparisons of entire lithic assemblages, as stressed by many scholars for other contexts (e.g., Shennan 2000; Groucutt et al. 2015; Will et al. 2015).

Currently, we can only assume that the combination of technological analysis with the microwear study carried out on both archaeological and experimental becs of the upper occupations of Tamat Hat rockshelter brings new insight into Early Iberomaurusian lifeways. Following the end of the Late Glacial Maximum, the lithic assemblages become further characterized by the abundance of partially backed bladelets, mostly obtained by the microburin blow technique, as well as axial/off-center becs that coexist with ogival becs, involved in

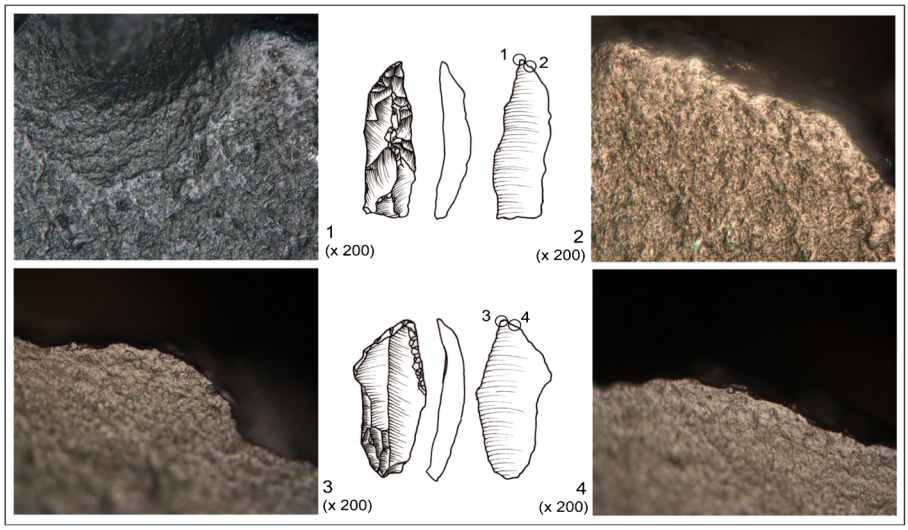

Fig. 9 Traces observed on the becs of the lower level of Verberie (Kim 2010)

hard animal-material processing. This could mark the originality of these lithic assemblages as a specific regional Iberomaurusian tradition. The study of site functions, fundamental to any reconstruction of prehistoric hunter-gatherer settlement systems, must be conducted in the context of a more general analysis of lithic economics (Keeley 1988). In further investigations we therefore intend to combine techno-typological and use-wear analyses on the remaining becs from Tamar Hat, as well as from other Iberomaurusian lithic assemblages. We encourage researchers working on other Iberomaurusian LSA assemblages to look for evidence of the existence of becs or the lack thereof, combining technological and use-wear analyses. This will contribute significantly to enhance overall knowledge about the inter-site variability of this period on a territorial scale.

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