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THE LOWER MAGDALENIAN OSSEOUS INDUSTRY FROM LEVEL 17 IN EL MIRÓN CAVE (RAMALES DE LA VICTORIA, CANTABRIA): A PRELIMINARY OVERVIEW

La industria ósea del Magdaleniense Inferior del Nivel 17 de la Cueva de El Mirón (Ramales de la Victoria, Cantabria): una revisión preliminar

Lawrence Guy Straus*, Jeanne-Marie Geiling** and Manuel R. González Morales**

** Dpt. of Anthropology. University of New Mexico. MSC01 1040, Albuquerque, NM 87131 (USA). E-mail: lstraus@unm.edu. ORCID ID: 0000-0003-0348-3338*
*** Instituto Internacional de Investigaciones Prehistóricas (IIIPC-UC). Edificio Interfacultativo. Avda. de los Castros, s/n. 39005 Santander. E-mail: jeanmarie.geiling@unican.es; manuelramon.gonzalez@unican.es. ORCID ID: 0000-0003-0147-3611; 0000-0001-7277-7837*

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Abstract: Level 17 is the principal Cantabrian Lower Magdalenian horizon in the outer vestibule area of El Mirón Cave, dating by radiocarbon to *c.* 15,500 uncal BP. It has yielded very rich faunal and artifactual collections associated with numerous hearths and abundant fire-cracked rocks. Among the many osseous artifacts are a striation-engraved red deer scapula and a spearthrower reported on elsewhere. This article presents a description and preliminary typological and metric analyses of the antler points, bone needles and other artifacts, as well as of the supports for the production of osseous items, namely antlers and bones with evidence of extractions. The *sagaies* include many that are characteristic of this period in this region –quadrangular sections, single-bevel bases, geometric engraved designs, including tectiforms–. Production, use –hunting- and domestic-related–, reuse and discard of osseous artifacts were major activities during the long period of repeated human occupation of El Mirón during Oldest Dryas.

Key words: Cantabrian Spain; Upper Paleolithic technology; bone and antler tools; sagaie; spearthrower.

Resumen: El Nivel 17 es el principal estrato del Magdaleniense Inferior Cantábrico en el área exterior del vestíbulo de la Cueva de El Mirón, datado por el radiocarbono en *c.* 15,500 uncal BP. Este nivel ha proporcionado colecciones ricas de materiales asociados con numerosos hogares y abundantes cantos rotos por el fuego. Entre los muchos instrumentos óseos hay una escápula con grabados estriados y un propulsor ya publicados anteriormente. Este artículo presenta una descripción y análisis tipológicos y métricos preliminares de puntas de asta, de agujas de hueso y otros objetos, y también de los soportes empleados para su producción, es decir, astas y huesos con huellas de extracciones. Las azagayas son numerosas, con características propias de este periodo –secciones cuadrangulares, bases de bisel simple, decoraciones grabadas geométricas, incluso tectiformes–. La producción, el uso –para fines cinegéticos o domésticos–, la reutilización y el abandono de los artefactos óseos fueron actividades importantes durante el largo periodo de reiterada ocupación humana de El Mirón durante el Dryas Inicial.

Palabras clave: España cantábrica; tecnología del Paleolítico Superior; utensilios de hueso y asta; azagaya; propulsor.

1. Introduction[1]

The purpose of this article is to describe preliminarily the osseous industry –principally the *sagaies* or antler projectile points– from Level 17, the most important Lower Cantabrian Magdalenian occupation horizon excavated between 1996-2011 in El Mirón Cave (Ramales de la Victoria, Cantabria) under the direction of Straus and González Morales (Fig. 1). Level 17 (Fig. 2) is a major cultural horizon very similar in cultural contents and density to coeval ones in several residential hub sites located on or at the edge of the Cantabrian coast such as El Castillo, Altamira and El Juyo as well as in Vizcaya and Asturias, but it is a montane site. El Mirón Level 17, excavated in the Outer Vestibule excavation area of the site, is at least roughly equivalent to similarly thick, artifactually and faunally rich strata of the same radiocarbon age and similar artifact contents in the middle and rear of the cave vestibule. It is treated here by itself, since there is not a continuous physical connection between it and Levels 312, 109-112 and 504-505 uncovered further into the interior of the El Mirón vestibule.

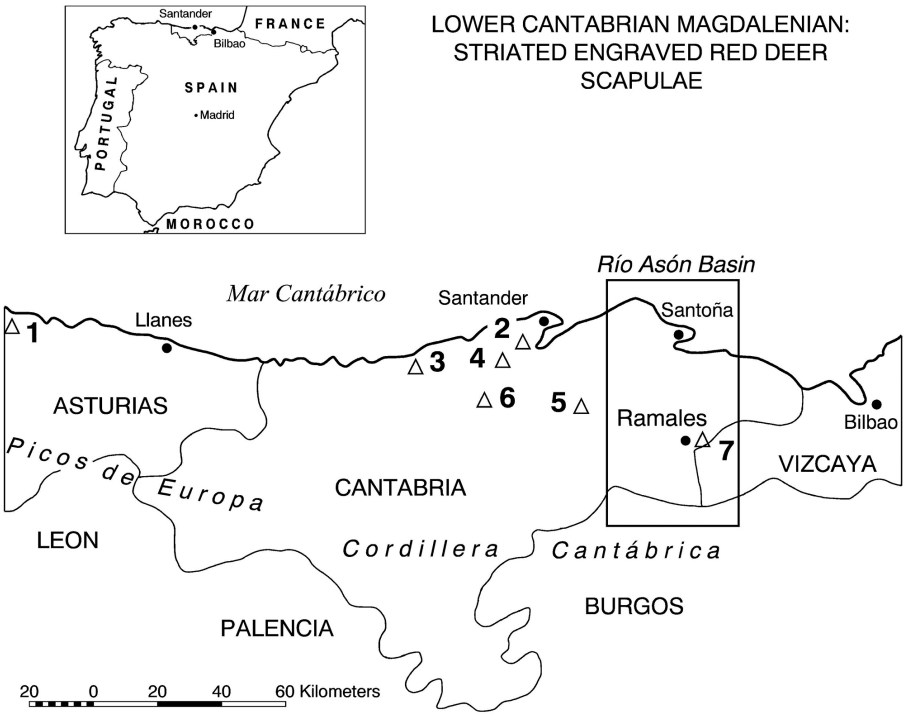

Fig. 1. *Map showing Lower Magdalenian sites in Cantabria: 1) El Cierro; 2) El Juyo; 3) Altamira; 4) El Pendo; 5) El Rascaño; 6) El Castillo; 7) El Mirón (L. G. Straus and R. Stauber).*

Level 17 was excavated in an area of 9.25 m² in the Outer Vestibule or 'Cabin' trench, meter squares H-J/2-4 plus partial square H1. This level is one of the richest, densest and thickest horizons defined during our 15 seasons of excavations in El Mirón Cave (1996-2013). Level 17 is a grey-brown to dark 'chocolate' brown silty clay with medium-small angular limestone rocks or ébouiis, but no large blocks (Farrand, 2012). It is underlain by a series of clayier levels attributed, basically by radiocarbon dating and by the lack of unambiguous Solutrean points, to the Initial Magdalenian, that are less dense in cultural and faunal remains. Level 17 is directly overlain by a pair of other Lower Magdalenian layers that are richer in angular gravel

[1] Excavations and analyses of El Mirón Cave, directed by LGS and MRGM, were authorized by the Gobierno de Cantabria and partly funded by it, the National Geographic Society, the Fund. Marcelino Botín, the Leakey Foundation, the Ministerio de Educación y Cultura, the NSF, the Univ. of New Mexico, and the Fund for Stone Age Research (J. and R. Auel, principal donors). Logistical support was provided by the town of Ramales de la Victoria and the IIIPC, Univ. de Cantabria. We warmly thank all the collaborating natural scientists and the scores of student excavators for their hard, intelligent work in the cave and in laboratories since 1996. R. Stauber drafted Figs. 1 and 2 after originals by LGS; A. Ruiz Redondo drew Figs. 4, 7 and 9 and L. Teira drew Figs. 5 and 12. Thanks go to the *Zephyrus* reviewers and editorial board for their suggestions and to M. C. Rapado Straus for correcting the Spanish abstract.

and sand, but poorer in archeological finds. Above them, in turn, are Middle and Upper Magdalenian, Azilian, Mesolithic, Neolithic, Chalcolithic, Bronze Age and sub-modern levels (Straus and González Morales, 2012). Level 17 is dated by three radiocarbon assays on bone collagen and two on charcoal. The dates range between 15,700 ± 190 and 15,370 ± 80 uncal BP, but are not arranged in perfect stratigraphic order, suggesting that the level was formed quite quickly, despite its 30-40 cm thickness. Level 18 immediately below it dates to 16,080 ± 40 uncal BP and Level 16 immediately above –and with which Level 17 intergrades, such that the boundary between them is rather arbitrary– dates to 15,180 ± 100 uncal BP. Level 17 lies flat and thus was unproblematically excavated as a sedimentologically and culturally well-defined unit in 13-24 spits –average number of spits in which Level 17 was excavated among the 10 meter-squares excavated = 18–. These apparent living surfaces were densely covered with well-preserved faunal remains, mainly bones and teeth

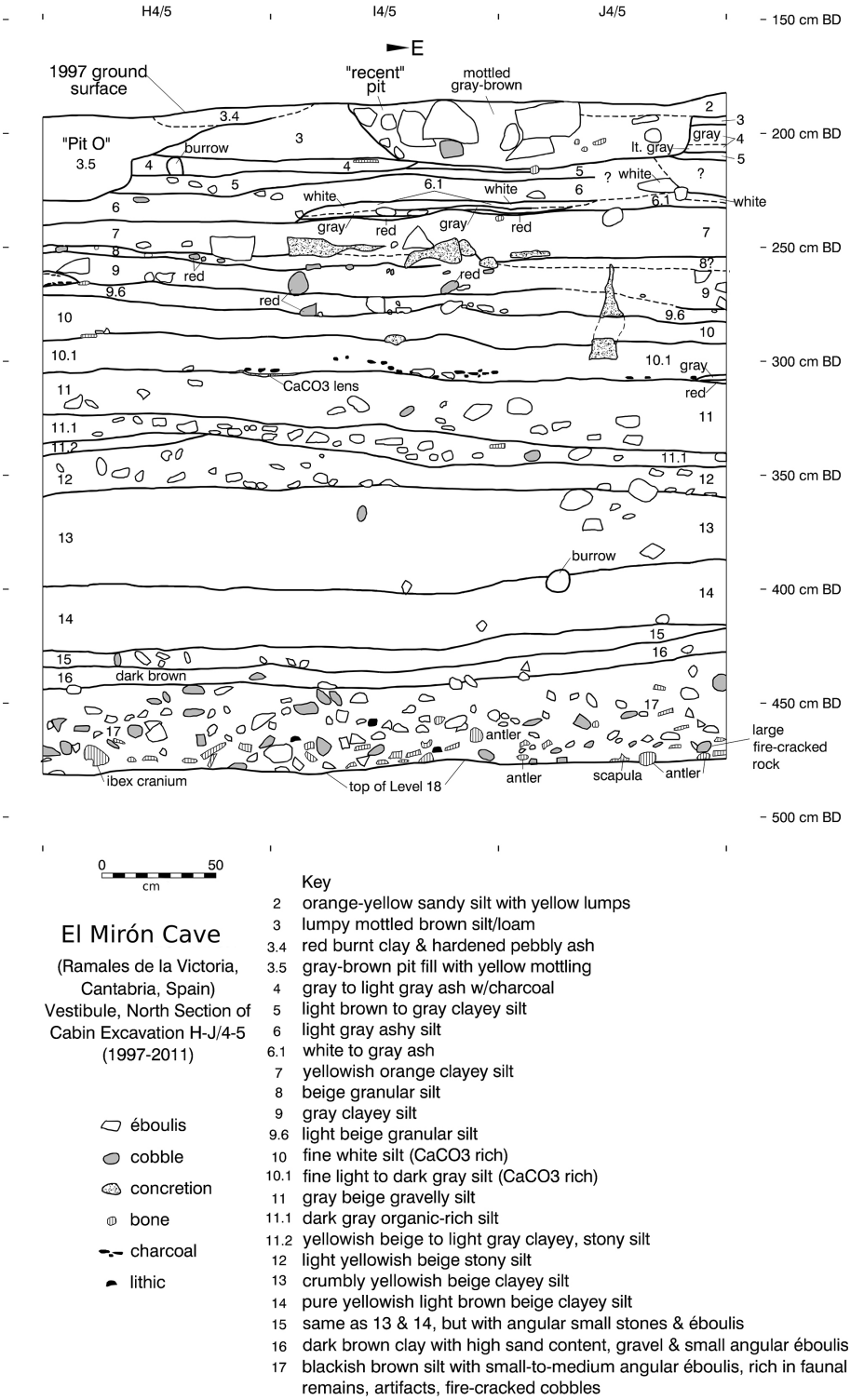

FIG. 2. *Stratigraphic section of El Mirón Cave outer vestibule excavation area showing Level 17 (L. G. Straus and R. Stauber).*

of ibex and red deer (Geiling *et al*., 2017), plus salmonid bones[2], lithic (Straus *et al*., 2016; Fontes *et al*., 2017) and osseous artifacts –debris and finished products–, manuports –cobbles, fire-cracked rocks including many that had first been used as hammerstones or anvils–, hearths or concentrations of charcoal and ash, some apparently used and reused over many years (Nakazawa *et al*., 2009). Level 17 yielded a large red deer stag scapula bearing the striation-'shaded' engraving of a red deer hind head and the outline engraving of a bovine head. This kind of artifact is absolutely typical and diagnostic of the Lower Magdalenian in Cantabria province –Altamira, El Castillo, El Juyo, El Pendo, El Rascaño– and El Cierro in eastern Asturias. This item is paralleled by similar striation engravings, mainly of hinds, in several caves of the same area, notably Altamira and El Castillo (González Morales *et al*., 2006; González Morales and Straus, 2009; De las Heras *et al*., 2012). During the course of excavation of Level 17 and in subsequent analyses, concentrations of different kinds of animal bones and of lithic artifacts became apparent, suggesting that activity spaces were organized and that the organization of space –at least in this small part of the cave– changed through time during the formation of this massive palimpsest horizon (Fontes *et al*., 2017; Geiling *et al*., 2017). The presence of a similar, culturally rich, 'chocolate' brown stratum in the Mid-Vestibule Trench –Level 312–, in the Corral area –Levels 110-116– and the Burial area –Levels 505-504– at the rear of the El Mirón vestibule, all with similar radiocarbon ages, suggests that the Lower Magdalenian occupations of this montane cave were frequent, extensive and intensive. They were reminiscent of major uses of several caves in the coastal zone as base camps during this part of Oldest Dryas, e.g., El Castillo, Altamira, El Juyo –all in Cantabria–.

[2] Consuegra, S. and García-Leaniz, C. (2001): *Análisis ecológico-genético de los salmónidos de la cueva de El Mirón (Alto Asón) a partir de restos fósiles.* Unpublished report, kept in Centro Ictiológico de Arredondo (Cantabria).

2. The osseous artifact assemblage of Level 17

One of the hallmarks of the Cantabrian Lower Magdalenian, along with the presence of the striation-engraved scapulae, is the abundance of antler points or *sagaies* –*azagayas* in Spanish– often of quadrangular cross-section and sometimes decorated with complex, incised, geometric or 'tectiform' motifs (Barandiarán, 1967; Utrilla, 1981; Corchón, 1985). Level 17 in El Mirón is no exception, with a large collection of *sagaies*, including many with engraved decorations, some quite spectacular. The preliminary description of this collection is the objective of this article, as a significant contribution to the corpus of Lower Magdalenian osseous artifacts from Cantabrian Spain. The osseous artifacts from the penecontemporaneous deposits associated with the Lower Magdalenian human burial at the rear of the El Mirón vestibule have been published by Fontes *et al.* (2015) and those of the underlying Initial Magdalenian by Straus *et al.* (2014); see also González Morales and Straus (2005) for other Magdalenian *sagaies*. It must be stated at the outset that almost all the osseous artifacts from Level 17 –and other levels in El Mirón– are fragmentary and many of the fragments are quite small and often eroded/weathered. In quite a few cases it is difficult to distinguish small fragments of antler tines from undecorated *sagaie* mesial fragments. Included here, along with all items individually piece-plotted during excavation and those recognized during the field screening and sorting process from all excavation units, are objects not recognized in the field that were identified during the archeozoological analysis of a *c*. 50% sample of the faunal remains from Level 17 by J-MG. Thus, more osseous artifacts undoubtedly exist in the other 50% of the fauna that has not been studied, although most of these will certainly be small *sagaie* and needle fragments and antler blanks.

We use a simple classification of antler/bone implements that includes *sagaies*, fine points or *puntas finas*, needles and awls. These are all listed in Fig. 3 with information on provenience, type, portion, cross-section, base configuration, decoration

Item No.	Type	Portion	Section	Base	Decoration	Length	Width	Thickness
Square H2								
2666	S	D	OV				6.6	3.1
2076 + 2077	S	D + M	R		E		7.8	6.7
2326	S	M	Q				8.1	6.3
1534	N /S	D	SC				2.0	1.5
1675	PF / N	D	R				3.3	2.2
2266	N	M	OV				1.7	1.5
3007	N	M	R				2.4	2.2
Square H3								
1861	S	D + M	R				6.4	6.1
2033	S	P + M	Q	SB	E		8.7	7.0
2285	S	P	Q	SB	E		12.2	6.4
2314	S	P + M	Q	DB		(47.0)	4.4	4.1
2711	S	D	R		E		9.4	8.5
2935	S	W	FL	DB	E	38.3	9.1	5.3
2938	S	D	Q		E		8.2	7.4
4346	S	D + M	SC				8.3	5.0
2710	S / PF	M	OV				6.5	5.2
4777a	N	M	R				1.5	1.5
4777B	N	M	R				1.0	1.0
1699	A	D	Q		G		3.5	3.5
2875	A	D	OV				8.6	3.2
Square H4								
1905	S	M	Q		E		5.5	5.0
2072	S	D	Q		E		8.5	6.5
2725	S	M	OV				5.2	2.9
2785	S	D	OV				5.4	3.3
4725	S	P	Q	SB	E		9.5	8.0
4801	S	M	Q				6.2	5.1
4848	S	P	Q	DB	E		5.7	4.1
5135a	S	M	FL				7.7	2.7
5135b	S	P	Q	SB			5.8	4.9
5333	S	P	Q	DB	E		10.5	8.2
5431	S	P	SC	SB			6.1	4.2
2880	PF	M	TR				5.1	3.5
2882	PF	D	OQ				5.2	2.9
5226	PF	M + P	Q	SB	E		4.0	3.5
1614	N	P	FL	eye			2.5	1.5
2722	N	M	FL				2.3	1.3
2926	N	M + D	R				1.7	1.4
Square I2								
580	S	D	R				5.0	4.5
1476	S	M	Q				7.8	4.8
1727	S	D + M	OV	SB			8.0	7.0
2060	PF	P	SC	SB	E		3.5	2.5
2215	N	M	TR				3.0	3.0
Square I3								
1128b	S	P	Q	DB			9.4	7.2
1129a	S	M	R				4.0	3.5
1574	S	P	Q	DB	E		6.0	5.0
1686	S	D	CF		E		9.0	7.5
1819b	S	D	FL				4.0	2.0

Types: S = *sagaie*; PF = *punta fina*; N = needle; A = awl; SP = spatula.
Portion: W = whole; P = proximal; M = mesial; D = distal.
Section: CF = centrally flattened; FL = flat; OQ = oval-quadrangular; OV = oval; Q = quadrangular; R = round; SC = semi-circular; TR = triangular.
Base: CN = conical; DB = double bevel; SB = single bevel.
Decoration: E = engraved lines; G = groove; (n): nearly whole length.

Fig. 3. *Osseous artifacts from El Mirón Level 17.*

–engraved lines and grooves–, length –only in the rare instances where the items are whole or nearly so–, width and thickness in mm. There are also at least 51 unfinished antler artifact blanks, some –one for sure– of which could be called wands *varillas* and others are merely splinters. The *bona fide* wand is a mesial fragment of a plano-convex section item, 14 mm wide x 8 mm thick with many oblique engraved marks on both edges. There are also three antler 'cores' or pieces of antler from which blanks had been extracted by the groove-and-splinter technique, one of which is a large red deer shed antler base with one 'failed' groove and a complete blank removal scar –see below. In addition, the studied collection contains a split metapodial; a partly split rib –J2, no. 639– with masses of engraved lines on one face (Fig. 4, no. 1); another split rib with several irregular engraved lines –possibly not cut-marks?– at one end of the cortical surface –H3, no. 4811–; a heavily engraved split bird long bone; a heavily burnished antler spatula –J3, no. 1034–; three grooved bones –probably needle 'cores'– and worked bone fragments. Some of these materials are further detailed below. Not included here are red deer antler tines that seem to be completely unworked.

The fragmentary nature and heavily *sagaie*-dominated assemblage from Level 17 precludes formal application of the osseous artifact typology of I. Barandiarán

Item No.	Type	Portion	Section	Base	Decoration	Length	Width	Thickness
1824	S	M	Q				8.6	8.1
3665	S	D	R				6.5	5.5
3907	S	M	R				9.7	8.8
4151	S	M	Q				12.9	11.6
4152	S	P	Q	DB	E		4.8	3.8
5360	S	P	Q	DB	E		10.0	8.5
1128a	S/ PF	D	TR				4.1	3.2
1129b	S / PF	D	Q				4.2	3.4
1819a	PF	D + M	OV				3.5	2.0
4578	PF	P	R	SB			3.5	3.0
3090	N	D + M	R				2.9	2.6
3300	N / PF	M	OV				4.2	2.9
1524	N / A	D	OV				3.5	3.0
1753	A	D	TR				8.0	4.0
2840	A	M	Q				8.5	6.4
Square I4								
1221	S	P	R	SB	G,E		6.0	5.0
2235.31	S	M	R				4.0	3.5
2235.32	S	P	FL	DB			7.0	3.5
2283	S	M	R		G,E		5.0	5.0
3784	S	M	OV				7.0	6.0
3933	S	D + M	O/ Q		E		10.4	7.7
4241	S	M	Q				7.1	7.1
4243	S	M	Q				7.8	5.2
4939	S	M	R				7.9	7.1
6237	S	P	SC	SB			9.8	6.6
6719	S	P	FL	DB			8.8	6.1
7424	S	P	OQ	SB	G		10.9	8.3
2600	PF	M	R				2.4	2.3
3221	PF	M	R				4.1	3.7
3510	PF	M	R				2.6	2.6
5061	PF	M	Q				4.0	4.5
5101	PF	D	R				3.5	3.5
5941	PF	D	SC				4.5	2.5
6772	PF	P	SC	SB			3.5	3.0
7014	PF	D + M	Q				4.0	4.0
7092	PF	W	R			87.5	6.2	5.9
3611	PF / S	M					4.0	3.7
2235.33	N	D	OV				3.5	2.5
2424	N	M	R				2.0	2.0
3480	N	M	R				2.5	2.4
5349	N	M	R				2.0	2.0
Square J2								
638b	S	M	TR				7.0	5.0
861	S	W	Q	SB		(49.6)	6.4	5.3
862b	S	P	Q	DB	E		8.5	6.0
940	S	M	OV				8.5	6.0
973	S	P	OV	CN	E		9.0	7.0
1302	S	M	Q		E		6.2	5.0
1381	S	D	OQ				4.1	3.9
1515	S	D	OV				5.8	4.4
1811	S	M	OV				8.8	6.5

Types: S = *sagaie*; PF = *punta fina*; N = needle; A = awl; SP = spatula.
Portion: W = whole; P = proximal; M = mesial; D = distal.
Section: CF = centrally flattened; FL = flat; OQ = oval-quadrangular; OV = oval; Q = quadrangular; R = round; SC = semi-circular; TR = triangular.
Base: CN = conical; DB = double bevel; SB = single bevel.
Decoration: E = engraved lines; G = groove; (n): nearly whole length.

Fig. 3. *Osseous artifacts from El Mirón Level 17 (cont.).*

(1967), which is comprised of many very specific types of implements. It is difficult to distinguish what we call small *sagaies* from fine points or fine points from large needle fragments without eyes. Given the highly fragmentary nature of many of the artifacts and given the fact that cross-sections may be very different near the tip, in the mid-section and at the base –especially with bevel bases–, classification of *sagaie* cross-sections for small fragments can be problematic. In particular, there is intergradation between round and oval sections, between quadrangular and flat –the latter being quadrangular, but with thicknesses much less than the widths–, and between quadrangular and semi-quadrangular sections, the latter often having two opposing flat surfaces and two opposing slightly convex surfaces, here called 'oval-quadrangular'. Centrally flattened *sagaies* can be round in section toward their distal and/or proximal ends.

2.1. Sagaies

Sagaies were subdivided by cross-section: quadrangular, semi-quadrangular –oval-quadrangular–, round, oval, plano-convex –semi-circular–, triangular, flat, and centrally flattened. Given the caveats mentioned above, we have defined 113 *sagaies* from Level 17, all but five of which are fragments. Some were classified as '*sagaie/punta fina*' or '*sagaie*/needle' and are thus not included in the calculation of

Item No.	Type	Portion	Section	Base	Decoration	Length	Width	Thickness
510	PF/S	D	R				4.5	4.0
1040	N	M	OQ				4.0	2.5
1136	N	P	FL	(no eye)			2.5	1.5
1192	N	D	FL				2.0	1.5
Square J3								
796	S	M	SC				7.0	3.0
1221	S	M + D	R	SB	E		6.0	5.0
1251a	S	D	OV				5.0	3.5
1258	S	M	Q		E,G		8.0	5.5
1614	S	D	R				7.5	7.0
2266c	S	M + D	OV				7.5	5.0
2380a	S	M+ D	Q				6.0	6.0
2380b	S	(W)	Q	SB		(58.5)	6.5	5.5
2489	S	W	R		E	60.0	5.0	4.0
2764	S	D	OQ				7.5	5.7
2792	S	M			E		6.0	3.9
3292	S	M	SC		E		7.8	6.2
4494	S	D	SC		E		7.2	4.9
4503	S	M	TR				9.2	5.6
4733	S	P	Q	DB	E		5.5	5.0
5145	S	P	FL	DB			8.6	3.4
5506	S	D	R				9.2	(2.8 split)
2484	PF	W	R		E		5.0	4.0
4734	PF	M+ D	Q				4.5	4.0
4766	PF	M+ D	OQ				3.5	2.5
5144	PF	P	SC	SB	E		4.5	2.5
5195	PF	M+ D	Q		E		4.5	4.0
5196	PF	(W)	OV			(56.2)	5.8	4.1
1034	SP	D					22.5	10.
2266a	N	M	OV				3.5	2.5
2266b	N	M	OV				2.5	2.0
2474	N	D	R				3.0	2.5
2734	N	M	R				2.4	2.1
2789	N	M	R				1.9	1.8
4071	N	D	R				2.5	2.0
4493	N	D	OV				3.0	2.0
5612	N	M	R				2.0	2.0
5813	N	D	OV				2.0	1.8
Square J4								
1326	S	D	OV				11.5	9.5
1922b	S	D	Q				4.0	3.0
1924	S	D	TR				3.0	3.0
2161a	S	D	FL		E		5.0	2.0
2161c	S	M	Q		G		7.5	5.0
2161d	S	M	OV				6.0	4.0
2162	S	P	OQ	SB			9.0	4.5
2169	S	P	Q	SB	E		5.0	3.0
2344	S	P	FL	SB			3.8	2.2
2611	S	M	Q				8.3	6.4
2828	S	M	Q				7.2	5.6
3127	S	M	Q				4.2	3.5
3507b	S	M	OV				7.1	5.6

Types: S = *sagaie*; PF = *punta fina*; N = needle; A = awl; SP = spatula.
Portion: W = whole; P = proximal; M = mesial; D = distal.
Section: CF = centrally flattened; FL = flat; OQ = oval-quadrangular; OV = oval; Q = quadrangular; R = round; SC = semi-circular; TR = triangular.
Base: CN = conical; DB = double bevel; SB = single bevel.
Decoration: E = engraved lines; G = groove; (n): nearly whole length.

Fig. 3. *Osseous artifacts from El Mirón Level 17 (cont.).*

dimension statistics. The *sagaies* include 22 small antler *sagaie* fragments found among the faunal remains during archeozoological analysis of a *c.* 50% sample of the Level 17 large mammal assemblage by JMG and measured by LGS. More osseous artifacts undoubtedly exist among the other unstudied 50%. Three of the five 'whole' *sagaies* are not totally complete, but apparently almost lacking only small bits of their tips/bases. Bases, which are rare in this assemblage, were classified as single-bevel, double-bevel or conical. 'Decorations' were classified as 'engraved decorations' with no apparent practical function, longitudinal grooves, sometime overlapping with engraved lines, and engraved 'bevel marks' usually diagonal that were probably made to aid in secure hafting as anti-slip features.

Four of the five 'whole' *sagaies* have quadrangular or flattened sections; the five range from 38-60 mm in length, with an average of 51 mm. Two have a double-bevel base and another single-bevel base. One whole point has a round section. Altogether, forty-six –41%– of the 113 *sagaies* and fragments thereof are quadrangular in section –a hallmark of the Cantabrian Lower Magdalenian–; 18 *sagaies* –17%– are round-section; 20 –18%– are oval-section; 10 –8%– are semi-circular, some of which are, however, basal bevel fragments; 9 –8%– are semi-quadrangular-section; the remaining 4 fragments are triangular, 3 flat-section and 2 centrally flattened. The combined quadrangular, semi-quadrangular and flat

Item No.	Type	Portion	Section	Base	Decoration	Length	Width	Thickness
3893	S	M + D	Q		E,G		9.9	9.6
3968	S	M	Q/TR				6.1	4.5
3970	S	P	OQ	CN	E		12.3	9.6
4069	S	D	R				4.4	4.2
4305	S	D	R		E, ochre		6.9	6.3
5835	S	D	Q		E		5.6	5.2
6298	S	P	SC	SB			7.6	3.8
7074	S	D	SC		E		8.1	6.6
7160	S	D	CF		E		6.9	3.7
7779	S	D	OV				5.1	3.4
7811	S	M	Q				8.1	7.9
2342b	PF	M	Q				4.0	3.8
2709a	PF	M	R				3.7	3.3
3160a	PF	M + D	R				3.0	3.0
2709b	PF/N	P	OV				3.0	2.0
2160	PF/N	M	R				3.5	3.0
1922a	N	M	R				1.5	1.0
1926	N	M	R				2.5	2.0
2159	N	M	R				2.0	2.0
2160b	N	M	R				2.0	1.5
2161b	N	M	OV				4.0	2.0
2342a	N	M	R				1.4	1.3
2708	N	M	R				1.9	1.9
3507a	N	D	OV				2.3	1.5
6523	N	W	OV	eye		42.5	3.0	2.0
7161	N	M	R				2.3	2.2
7162	N	M	OV				2.5	2.1

Types: S = *sagaie*; PF = *punta fina*; N = needle; A = awl; SP = spatula.
Portion: W = whole; P = proximal; M = mesial; D = distal.
Section: CF = centrally flattened; FL = flat; OQ = oval-quadrangular; OV = oval; Q = quadrangular; R = round; SC = semi-circular; TR = triangular.
Base: CN = conical; DB = double bevel; SB = single bevel.
Decoration: E = engraved lines; G = groove; (n): nearly whole length.

Fig. 3. *Osseous artifacts from El Mirón Level 17 (cont.).*

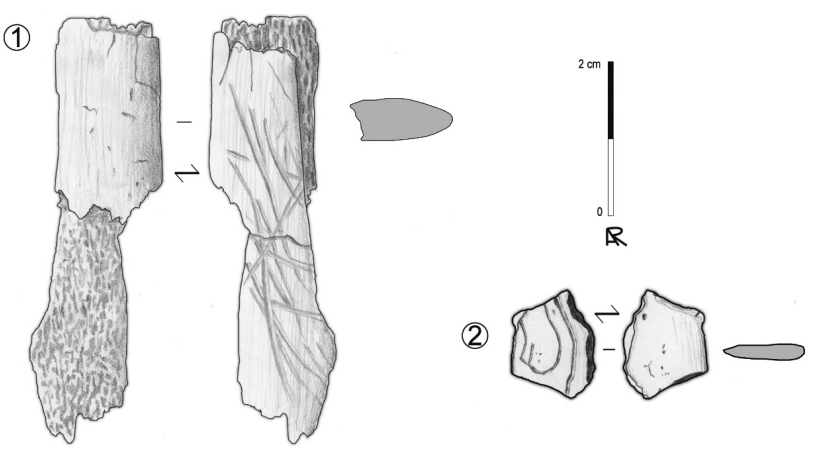

Fig. 4. *Engraved flat bones from El Mirón Level 17 (drawn by A. Ruiz Redondo).*

section items make up half of the entire assemblage of *sagaies.* Nineteen of the *sagaies* and fragments have single-bevel bases; 12 of which are on quadrangular-section pieces; 14 have double-bevel bases, 13 of which are on quadrangular pieces. The only other preserved bases are three conical ones –all on oval-section pieces–. Widths of *sagaies* range from 3.0-12.9 mm, with an average of 8.4 mm; thicknesses range from 2.0-11.6 mm, with an average of 5.95 mm. These values for all *sagaies* are generally somewhat smaller than the ones published recently by Tapia *et al.* (2017) for a group of only 50 quadrangular-section *sagaies* from a dozen mainly classic Cantabrian Lower Magdalenian sites –average width: 9.2 mm; average thickness: 8.2 mm–, although the ranges are similar. In fact, it is the case that quadrangular-section points are often larger than round or oval-section ones.

The significance of quadrangular-section antler points as characteristic 'markers' of the Cantabrian Lower Magdalenian is highlighted in the Tapia *et al.* (2017) study of such finished objects and related manufacturing waste products from El Cierro cave in eastern Asturias, one of the sites also known for the presence of a red deer scapula engraved with the striated image of a hind. El Mirón thus joins such sites in Cantabria, such as El Castillo, Altamira, El Juyo and El Rascaño; in Asturias such as La Paloma, Cueto de la Mina, La Riera and El Cierro; and in the Basque Country as Bolinkoba, Erralla and Urtiaga in yielding a significant collection of these temporally/culturally diagnostic quadrangular-section projectile points.

There are 29 items classified as fine points or possible ones, two of which are essentially whole. One of these is oval-section and measures 56 mm long; the second is round-section, 88 mm long. Only 3 fine points are quadrangular-section; 10 are round-section and 5 are oval-section, with 1-3 each of the other types of sections. Fine point widths range from 2.4-6.2 mm, with an average of 3.96 mm; thicknesses range from 2.0-5.9 mm, with an average of 3.4 mm. Clearly, the *sagaie* and fine point types overlap metrically in terms of width and thickness and undoubtedly some of them could have served the same functions, presumably as projectile tips. On the other hand, the smallest fine points overlap metrically with needles and the distinction in the absence of needle eyes can be quite arbitrary. Five fine points have single-bevel bases and one a double-bevel base. Needle widths range between 1.0/4.0 mm –average = 3.36 mm– and thicknesses range between 1.0/3.0 mm –average = 1.91 mm–.

A plot of *sagaie* widths indicates a rather tight distribution of values between 3/9 mm, with 13 outliers at the wide end of the range between 10/13 mm. There is a slight hint of bimodality in the width distribution, with peaks at 6 mm and at 8/9 mm. Addition of the widths of the so called fine points augments the numbers of items with widths between 3/5 mm. If all or most of these artifacts were weapon tips, it is conceivable that the smaller, lighter ones may have been used to tip atlatl-propelled darts or even bow-propelled arrows, while larger, heavier ones may have been deployed at the ends of thrusting spears. Note that Level 17 yielded a complete, antler spear-thrower similar to ones known from this approximate period in SW France (González Morales and Straus, 2009: 274-277).

2.2. *Other types of finished tools*

Items classified as needles or fragments, mostly very short, thereof total 42, one of which are essentially whole with an eye whose diameter is 1.5 mm (Fig. 5). There is also one proximal fragment of another needle with an eye. These items include 14 small needle fragments found among the faunal remains during archeozoological analysis by J-MG and then measured by LGS. The whole needle measures 43 mm long. Another whole needle 23 mm long with an eye was found in mixed surface fill. The relatively large range of needle sizes from the El Mirón Magdalenian levels in general, including the diameters of eyes, suggests that different kinds of 'threads' may have been used, e.g., tendons versus plant fibers. In Level 17 there are also four sharpened, polished long bone splinters that are classified as awls. One is whole –21 x 4 x 4 mm– and the other three are distal fragments: one very thin all around –3.5 x 3.5 mm– and two relatively wide, but thin –9 x 3 mm and 8 x 4 mm–. There is one piece –I3, no. 1524– could either be an awl or a large needle. Two other bone awl fragments were found among the faunal remains by J-MG, but are not included in Fig. 3.

FIG. 5. *Eyed needle from El Mirón Level 17.*

The collection includes a small flat bone fragment of 26.5 x 12.0 x 2.0 mm with a fine engraving of an ungulate hoof, presumably originally part of a larger animal figure (Fig. 4, no. 2). This work of art –J4, no. 3968– was identified by A. Ruiz Redondo and is a bit reminiscent of a hoof engraving on a bone fragment from the Middle Magdalenian of Isturitz (Rivero, 2015: figs. 9 and 101). Its presence in the same level as the striation-engraved scapula with hind and bovine images is significant.

3. *Sagaie* decorations/technological markings

We do not count as decorations or markings the myriad fine striae that cover many surfaces of most *sagaies* as a result of the fabrication and finishing processes, i.e., 'polishing striations'. Two whole and 29 fragmentary *sagaies* bear some sort of decorative or technological engravings on the shaft. Five fragments have marks on one or two basal bevels and one has both shaft decorations and marks on its single basal bevel. The 'bevel marks' are generally oblique lines engraved across the bevels, presumably to aid in securely fixing the *sagaies* to a similarly beveled foreshaft –antler or wood– or shaft –presumably wood–. Ten *sagaies* in this collection have longitudinal grooves, presumably most or all used for the mounting of microlithic elements, six of which also have more clearly decorative engravings. In addition, one quadrangular-section *sagaie* mesial fragment has a simple longitudinal line, which could be either 'decorative' or 'technological' in nature. Three of the objects classified as fine points have oblique lines on single-bevel bases, presumably anti-slip marks.

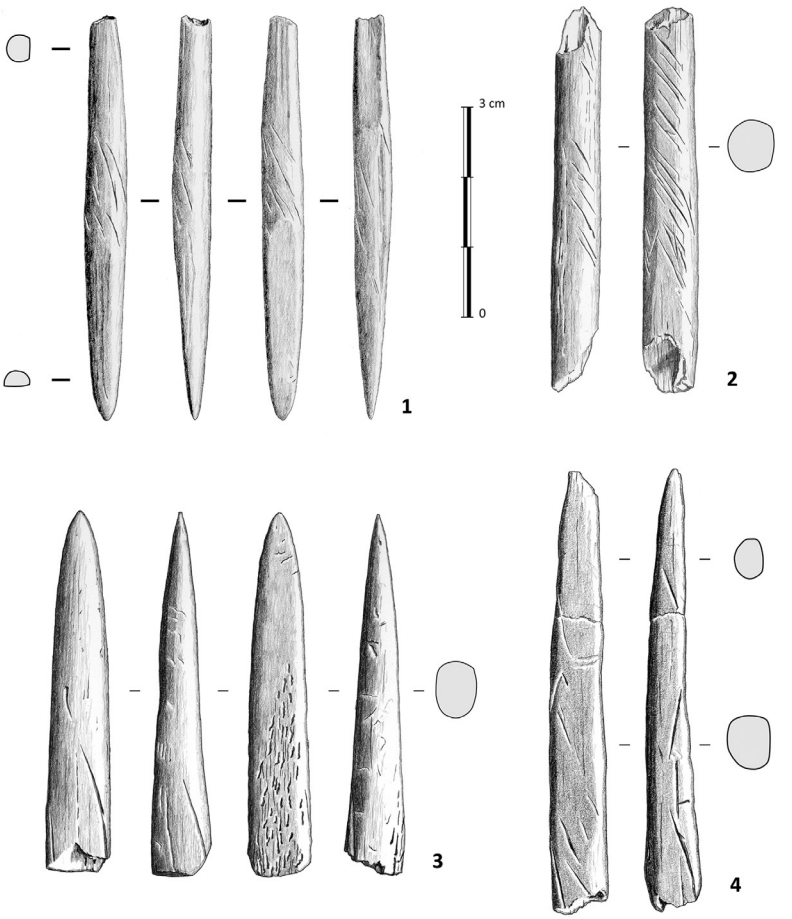

Fig. 6. Sagaies *from El Mirón Level 17 (drawn by L. Teira).*

Most of the decorations or markings are series of fine engraved lines that are oblique, perpendicular or parallel to the *sagaie* shaft axis, including haft-aiding, 'anti-slip' oblique lines across basal bevels. However, several *sagaies* bear far more complex engraved designs; they are among the ones upon which we comment in the following description of illustrated pieces.

3.1. Illustrated sagaies

Items are identified by meter square and field specimen number:

— H2, no. 2077: mesial + distal fragment of a round-section *sagaie* with many fine oblique marks. Dimensions: 72.5 x 8.0 x 6.5 mm (Fig. 4, no. 2).

— H3, no. 1861: distal + mesial fragment of an undecorated, oval-section *sagaie.* Dimensions: 79.0 x 8.4 x 6.1 mm (Fig. 8, no. 1).

— H3, no. 2033: a proximal + mesial fragment of a quadrangular-section *sagaie.* Dimensions: 9 mm wide x 7 mm thick with many perpendicular lines on two opposing faces. It is very similar in size, form and general types of decoration to H4, no. 2072 and I3, no. 5360. All three *sagaies* were found at very similar depths –*c.* 15.3-15.4 m above datum– in the NW quadrant of the 'Cabin' excavation area –H3, H4– and in association with

many ibex remains, including crania and horn cores (Fig. 7, no. 4).

— H3, no. 2710: mesial fragment of a partly split, oval-section *sagaie*. Dimensions: 30.0 x 6.5 x 5.0 mm (Fig. 6, no. 2).

— H3, no. 2711: distal fragment of a round-section *sagaie* with oblique marks resembling the 'tectiform' motif. Dimensions: 51.5 x 9.5 x 8.5 mm (Fig. 6, no. 4).

— H3, no. 2938: a distal+mesial fragment of a quadrangular-section *sagaie* 8 mm wide x 7 mm thick with 'tectiform' engraved marks (Fig. 6, no. 3).

— H4, no. 1906: mesial fragment of a semi-quadrangular-section *sagaie* with various "barbed wire" and oblique engraved decorations. Dimensions: 45.0 x 5.5 x 5.0 mm (Fig. 7, no. 3).

— H4, no. 2072: a distal + mesial fragment of a quadrangular-section of 89.5 mm long x 8.5 mm wide x 6.5 mm thick with both deep oblique and perpendicular engraved marks across one face and finer, shallower, less continuous marks on the other three surfaces. The piece has suffered a clear impact fracture on its proximal part, presumably from contact with a spear or javelin shaft. It is very similar in size, form and general type of decoration to H3, no. 2033; I3, no. 5360 and J4, no. 3893 (Fig. 6, nos. 1 and 8).

— H4, no. 2222: mesial + proximal? possible plano-convex-section basal bevel *sagaie* fragment with *c*. 6 oblique lines across flat surface. Dimensions: 32.4 x 6.0 x 5.0 mm (Fig. 8, no. 3).

— H4, no. 5333: A proximal fragment of a quadrangular-section *sagaie* 11 mm wide x 8 mm thick with an engraved 'IXIX' mark series on one face and many oblique lines on the other (Fig. 7, no. 2).

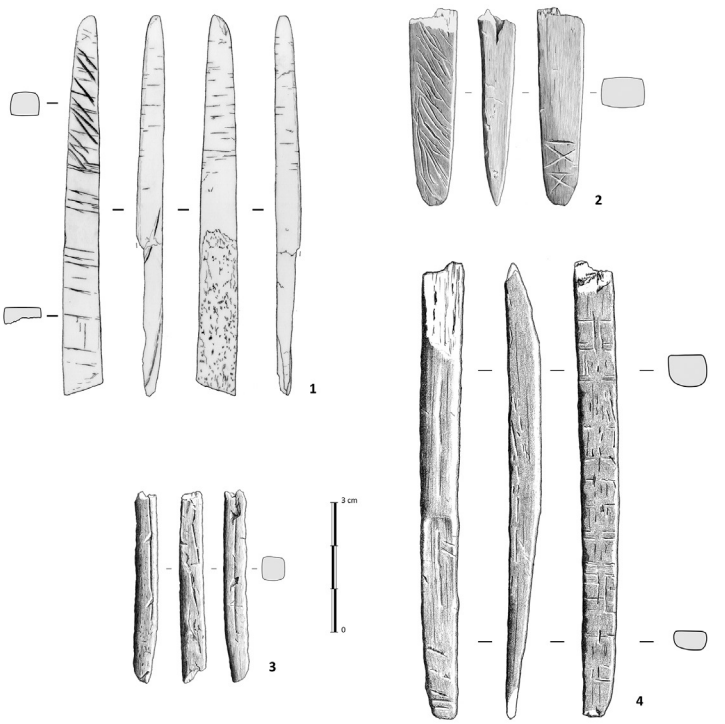

Fig. 7. Sagaies *from El Mirón Level 17 (drawn by L. Teira).*

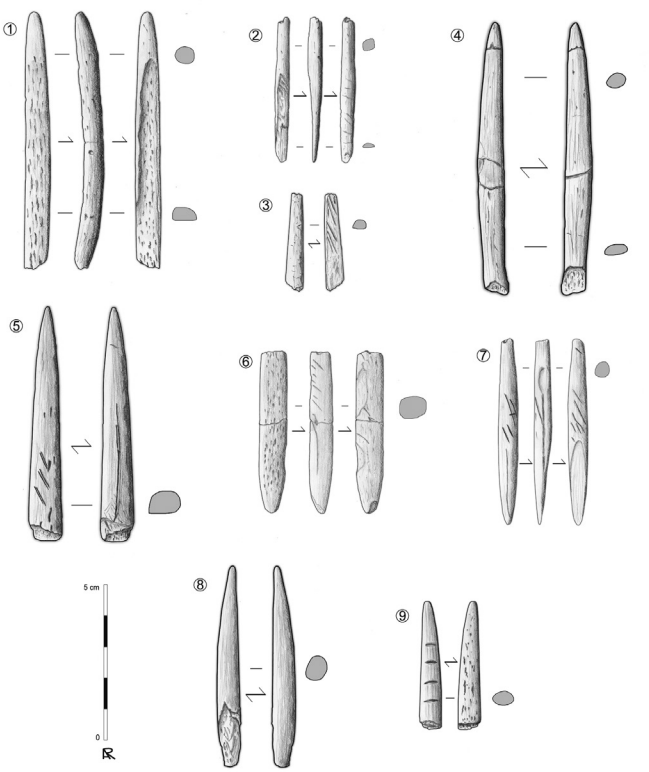

Fig. 8. Sagaies *from El Mirón Level 17 (drawn by A. Ruiz Redondo).*

— I2, no. 1727: distal + mesial fragment of an undecorated, oval-section *sagaie.* Dimensions: 67.0 x 8.0 x 7.0 mm (Fig. 8, no. 4).
— I3, no. 5360: a proximal + mesial fragment of a semi-quadrangular-section, double-bevel base *sagaie* 10.0 mm wide x 8.5 mm thick with transversal engraved lines on one face, longitudinal lines on a second face, and both oblique and transversal lines on a third face. It is very similar in form, size and general type of decoration to H4, no. 2072 and H3, no. 2033. (Fig. 10, no. 1).
— I4, no. 3933: distal + mesial fragment of a squared oval *sagaie* with three pairs of short oblique lines on one flat surface and a longitudinal engraved line on the other. Dimensions: 74.5 x 10.4 x 7.7 mm (Fig. 8, no. 5).
— J2, no. 973: proximal –rounded base– fragment of an oval-section *sagaie* with a half-dozen fine, oblique engraved lines along one edge of one surface and possibly one other on another surface. Dimensions: 53 x 9.0 x 7.0 mm (Fig. 7, no. 6).

Fig. 9. Sagaie *H4, no. 2072 from El Mirón Level 17.*

— J3, no. 1221: a proximal + mesial fragment of a round-section, single-bevel base *sagaie* 6.0 mm wide x 5.0 mm thick with oblique lines and a longitudinal groove. It is nearly complete, with a length of 57.5 mm (Figs. 5, no. 1 and 7).
— J3, no. 1250: mesial fragment of a rectangular-section *sagaie* with at least 9 oblique lines on one surface and a shallow longitudinal groove along the opposite surface. Dimensions: 34.0 x 8.0 x 5.5 mm (Fig. 9, no. 2).
— J3, no. 1614: distal + mesial fragment of an undecorated, round-section *sagaie.* Dimensions: 63.5 x 7.5 x 7.0 mm (Fig. 7, no. 8).
— J3, no. 4733: a proximal + mesial fragment of a quadrangular-section, double-bevel base *sagaie* –5.5 mm wide x 5.0 mm thick– with oblique lines on all four faces and a longitudinal groove on one (Fig. 9, no. 3).
— J3, no. 5195: a mesial + distal fragment a fine point –with missing tip– of quadrangular section –4.5 mm wide x 4.0 mm thick– with transversal and oblique lines on one face and longitudinal and oblique lines on another face with a longitudinal groove. It may possibly be nearly complete, with a length of 30.5 mm (Fig. 9, no. 4).
— J4, no. 2162: proximal, plano-convex-section, single-bevel base *sagaie* fragment with a mass of fine, oblique and longitudinal lines covering the bevel surface (Fig. 9, no. 5).
— J4, no. 2169: proximal, rectangular-section, single-bevel base *sagaie* fragment with many fine, oblique lines across bevel and a few on the opposite face and on one side of the piece. Dimensions: 25.5 x 5.0 x 3.0 mm (Fig. 9, no. 6).
— J4, no. 3893: a distal + mesial fragment of a quadrangular-section *sagaie*, 10 mm wide x 10 mm thick with both perpendicular and zigzag or 'tectiform' marks on one face and many short tick marks along two edges (Fig. 9, no. 7).
— J4, no. 4305: distal fragment of an oval-section *sagaie* with four, evenly spaced, engraved lines perpendicular to one surface. Red-ochre stains, 10.4 x 6.9 x 6.3 mm (Fig. 7, no. 9).

In addition to the engraved *sagaies*, there is a split bird long bone shaft from square J4, spit 80 covered

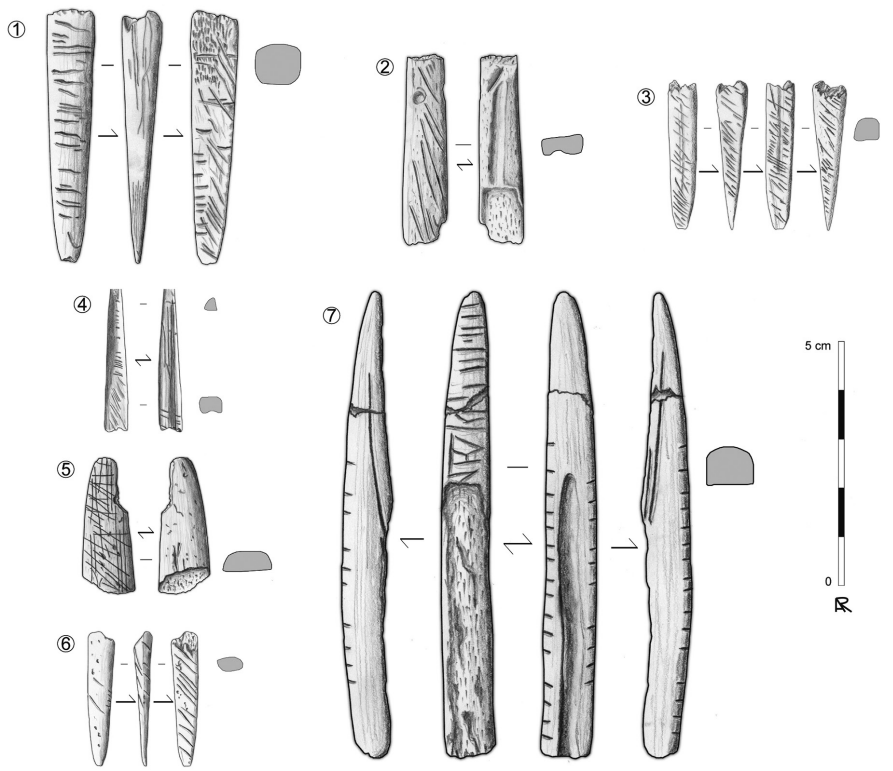

Fig. 10. Sagaies *from El Mirón Level 17 (drawn by A. Ruiz Redondo).*

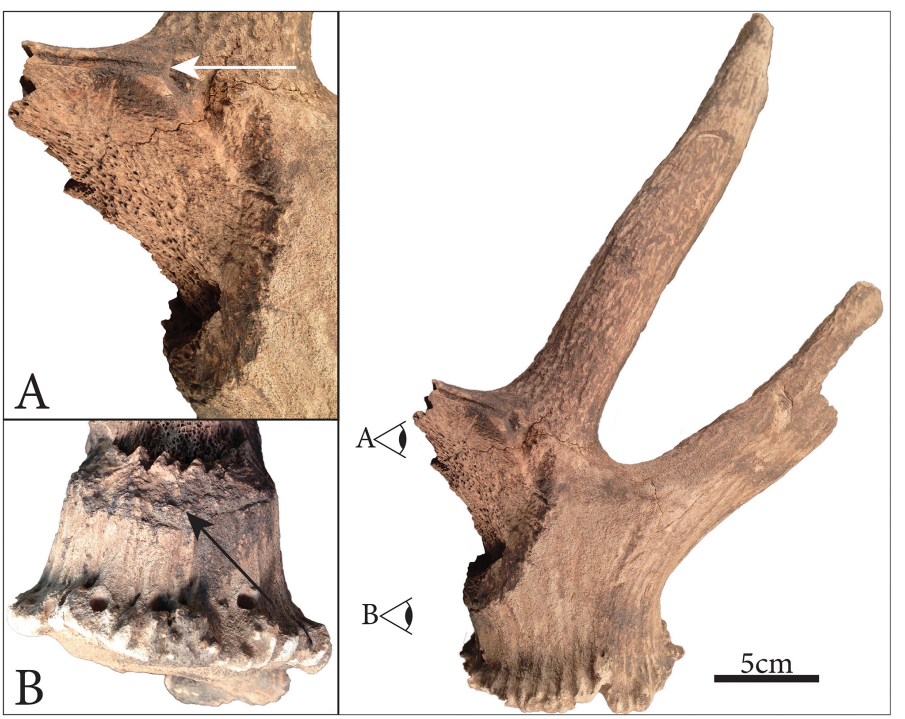

Fig. 11. *Antler base (H2, no. 3888) with blank removals.*

with series of many short lines perpendicular to the axis of the piece on two surfaces.

4. Antler and bone cores, blanks and manufacturing waste

4.1. Antler blank production for projectile points

Red deer antler was used as raw material, mostly in shed form (Figs. 11-12). The sequence of grooving-chopping-shaping-smoothing, seems to have been the *chaîne opératoire* for producing the *sagaies* of Lower Magdalenian Level 17, as leftovers of each of these production steps are frequently found among the faunal material and preliminarily studied as follows. Two large antler rosettes –bases– display blank extractions done by grooving. Both these antler 'cores' have basal dimensions of around 8 x 9 cm. The blank production waste count is 48 items, in addition to which there are 7 production failures, 4 antler flakes and 4 blanks. Grooves were made along the main beam, preferably close to the antler base, where its shape is generally straighter. Repeated,

uniform cuts aligned along the beam progressively removed the compact outer antler surface until the spongier inner tissue was reached. Two of these parallel grooves isolated the splinter in the middle and thus defined the maximum thickness of the extracted blank, thereby producing quite large sized blanks. Chopping and levering seem to have been the habitual ways to extract inter-groove antler splinters as blanks. Longitudinal striations on the entire blank surface, including the removal of the spongy interior are results of presumed scraping that successively reduced the blank's diameter, as evidenced by all the point fragments described here. Some antler items –N = 7– with fine striations and polish probably derive from surface smoothing, either intentional for artifact finishing or from use-wear.

4.2. *Bone blank production*

During the butchering of game carcasses, some long bones from the main prey animals, *Cervus elaphus* and *Capra pyrenaica*, seem to have been set aside as raw material sources, as indicated by various waste products of bone blank production –N = 18– in the studied sample from Level 17. Testing for the proper bone might be recorded by some superficial, but clearly visible cut-mark bundles or deeper, unfinished grooves that imply some kind of problem or failure at the early stage of blank extraction mainly from metapodial shafts –N = 3–.

4.3. *Bone awl production*

Due to the typical compact nature of the ungulate ulna, when used, this bone was only slightly modified into the desired shape, presumably as an awl. Another awl fragment found was made on a metapodial shaft. The longitudinal striation marks range from deep and individually visible cut marks to smoothed, polished surfaces on one piece, resembling the final state of production and possibly use.

4.4. *Bone needle production*

Needles were also produced from bone shafts; the 14 specimens in the faunal collection from Level 17 are mainly small mesial fragments. The production of needles seems to have followed the same schemata as described above for antler point blanks, only starting with narrower spaces between the grooves gouged out of the bones to produce splinters with smaller diameters.

4.5. *Broken point tips*

Among antler –N = 22–, *sagaie* and bone –N = 4– point fragments found among the faunal remains, there are several very short, broken point tips –N

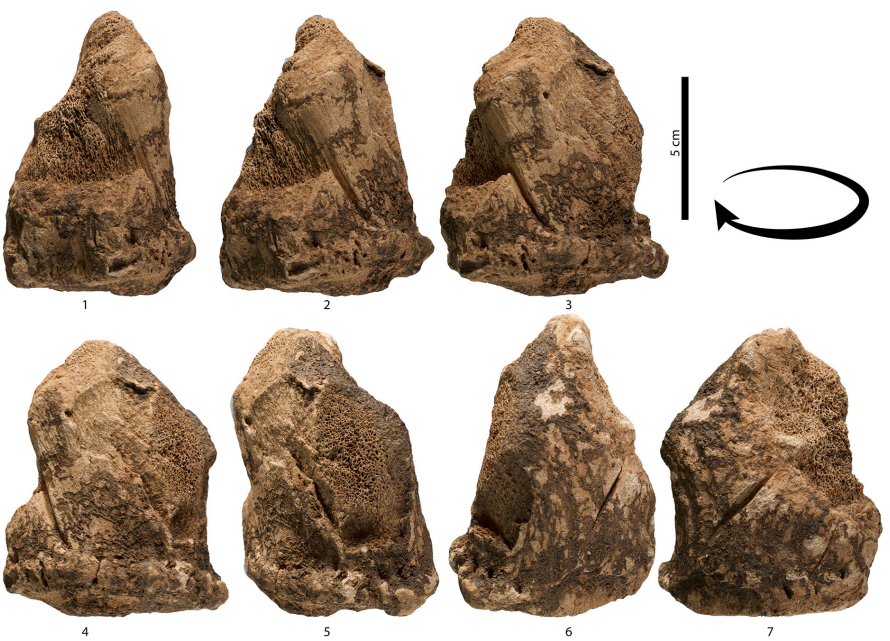

Fig. 12. *Antler base (H4, no. 3700) with blank removals.*

= 8– with impact marks, which resemble fractures caused by use, including the striking of intended game targets or other objects –the ground, rocks, etc. – in 'misses'.

4.6. Other possible bone tools

Certain other items found among the faunal remains have been preliminarily designated as bone tools. Some especially long bone shaft fragments seemed to have been appropriate media for use as wedges as indicated by unidirectional, often stepped, bifacial negative removals located at one or both shaft ends –N = 21–. These possible wedges might have been used for antler blank extraction by leverage. Another, rather loosely defined, tool category includes several bones –N = 37– that exhibit retouched or polished ends, which suggest some sort of, as yet unknown, usage. Five bones more clearly may have been used as retouchers or billets.

Further investigation is under way that will go beyond this very preliminary overview of antler and bone tool production behavior during the Lower Magdalenian in El Mirón cave, although the present study already provides some interesting insights into the manufacturing *chaînes opératoires* of osseous weapons and tools in this period.

5. Conclusions

One of the defining characteristics of the Magdalenian in general and the Cantabrian Lower Magdalenian in particular is the presence of abundant, diverse osseous artifacts. Most notable are antler points, *sagaies* or *azagayas* that are very often 'decorated'. They are engraved with lines, some of which on beveled bases were most likely functional or technomic (*sensu* Binford, 1963) in nature, i.e., they aided in the security of hafting. Others, on shafts except for longitudinal grooves in which were probably mounted microlithic cutting elements, may have served as collective or individual markers of ownership or identity –i.e., sociotechnic– or as symbols of higher-level meanings or beliefs –i.e., ideotechnic–, although the latter the latter could easily have been confounded with regional social identity markers. It is the complexity and patterning of the designs of the non-functional decorations that make them susceptible and appropriate for both traditional culture-historical methods of classification and social interpretation like those of M. Conkey (1980) in her interpretation of Lower Magdalenian aggregation sites such as Altamira.

At the level of function, the dramatic increase in antler points in the Lower (and Initial) Magdalenian associated with large numbers of backed bladelets signaled a replacement of large- or medium-size, mostly invasively retouched lithic Solutrean points with a new killing technology (Straus, 1993). In a general way this represented an as-yet-unexplained 'popularity'-driven, if not demonstrably efficiency- or efficacy-driven return to a dependence on osseous projectiles and bladelets that had originated in the European and Cantabrian Aurignacian *sensu lato*. This had never disappeared during the Gravettian and Solutrean, having surviving as a secondary weapon technology in parallel with the much more common single-element stone points in those intervening periods of the middle Upper Paleolithic. The focus on *sagaies* in the Magdalenian represented cyclical change, albeit with new forms and certainly the use of a new propulsion instrument, the spear-thrower or atlatl, invented in the French Solutrean, but increasingly popular in the early Magdalenian, as demonstrated in Spain by finds at El Mirón, El Castillo and Las Caldas (De las Heras *et al*., 2003; González Morales and Straus, 2009; Corchón, 2017: 264). Presumably, the combination of antler *sagaies* with backed bladelet inserts was more maintainable (*sensu* P. Bleed, 1986) and 'cheaper' than the reliably deadly, but fragile and 'expensive' Solutrean points –especially the large, invasively and bifacially retouched laurel, willow and concave base stone points–. In any event, the clear emphasis in both osseous and lithic –flint– technology of the Lower Magdalenian occupations of El Mirón Cave was the manufacture, use and recycling of projectile points, particularly but not exclusively, quadrangular-section *sagaies*.

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