

*Magdalenian chrono-stratigraphic correlations and cultural connections
between Cantabrian Spain and Southwest France...and beyond.*
*Corrélations chrono-stratigraphiques et interactions culturelles au cours du Magdalénien
entre l'Espagne cantabrique et le Sud-Ouest de la France... et au-delà.*
*Correlaciones y Conexiones Crono-Culturales del Magdaleniense
entre la Región Cantábrica Española y el Sur-Oeste de Francia...y más allá*
Textes publiés sous la direction de Lawrence Guy STRAUS et Mathieu LANGLAIS
Paris, Société préhistorique française, 2020
www.prehistoire.org
ISSN : 2263-3847 – ISBN : 2-913745-81-4

The Magdalenian sequence of El Mirón Cave (Ramales de la Victoria, Cantabria) in the context of Northern Spain and the broader Franco-Cantabrian Region

La séquence magdalénienne de la grotte d'El Mirón (Ramales de la Victoria, Cantabrie) dans le contexte de l'Espagne septentrionale et plus largement dans l'espace franco-cantabrique

Lawrence Guy STRAUS et Manuel R. GONZÁLEZ MORALES

Abstract: In excavations of El Mirón Cave directed by the authors between 1996-2013, one of the longest and most complete (albeit unevenly rich) Magdalenian sequences in the Cantabrian region was uncovered and dated by 60 assays to between c. 17-11 uncal. ky BP (c. 20-13 cal. ky BP). This contribution summarizes the characteristics of many of the lithic and osseous artifact assemblages found in four excavation trenches within the large vestibule of this cave on the northern flank of the Cantabrian Cordillera, some 25 km from the glacial-age shore of the Bay of Biscay. Variations among these assemblages are the result of functional differences in the use of the cave or areas within it both through time and contemporaneously, differences in (local vs. non-local) lithic raw material utilization, and changes reflecting developments ('fads') within the wider Magdalenian culture that spread via inter-group contacts/trade between the Cantabrian and Aquitanian "wings" of the southwest European culture area. Evidence of such contacts include flints from Chalosse and Labourd, an incised reindeer (a species otherwise as yet unknown in El Mirón Cave) tooth identical to ones from Roc de Marcamps in Gironde, a spear-thrower very similar to ones from that site and Le Placard in Charente, and one or two Lussac-Angles projectile points in the El Mirón Cantabrian Lower Magdalenian horizon. The red ochre human burial in the Lower Magdalenian of El Mirón Cave is unique on the Iberian Peninsula and bears many similarities to Magdalenian burials in France and Germany, with genetic relationships now proven by ancient DNA analyses. At least part of this horizon was chronometrically contemporaneous with the early Middle Magdalenian recently defined in Aquitaine. Nonetheless, El Mirón Cave joins several other sites in Cantabria and eastern Asturias to have yielded striation-engraved scapulae with images of ungulate heads (especially red deer hinds), a style of portable art object that typifies or defines the distinctive regional culture of the Cantabrian Lower Magdalenian. On the other hand, at least the excavated areas of El Mirón levels that are chronometrically contemporaneous with the classic Pyrenean Middle Magdalenian have not produced any artifacts diagnostic of that distinctive culture: proto-harpoons, flat bone cut-out and perforated circles and animal head images (which otherwise have been found in small numbers in several sites throughout the Cantabrian region).

Keywords: El Mirón Cave, Magdalenian, Cantabrian Spain, lithic artifacts, osseous artifacts, chronology.

Résumé : Depuis un siècle, en commençant par les fouilles de H. Obermaier et ses collègues espagnols (H. Alcalde del Río et L. Sierra) et français (H. Breuil, J. Bouyssonie et P. Wernert) dans les grottes de El Castillo et El Valle (Cantabrie), les registres archéologiques magdaléniens cantabriques (y compris l'Azilien) ont été étroitement liés. En regard de la prédominance de la préhistoire française vis-à-vis de la recherche en Espagne – relativement peu développée –, non seulement au début du XX^e siècle, mais aussi pendant les terribles années 1930 et les quatre longues décennies du régime franquiste, il est logique que la plupart des préhistoriens cantabriques s'efforcèrent à classer leurs séries archéologiques magdaléniennes (comme toutes les autres périodes du Paléolithique supérieur) dans les phases du système français actuel, soit d'abord celui de H. Breuil, soit plus tard celui de D. Peyrony et de D. de Sonneville-Bordes.

La prééminence de la séquence magdalénienne française (c'est-à-dire, essentiellement celle de l'Aquitaine) donna souvent l'impression que « tout » venait de France, du Nord au Sud (ou, autrement dit, dans le cas de la région franco-cantabrique, du NE au SO). Néanmoins, le « franco-centrisme », dans l'interprétation du registre magdalénien cantabrique, commença à perdre sa suprématie avec l'arrivée de l'archéologie anthropologique américaine et de la préhistoire économique britannique des années 1960 et 1970, avec la formation d'une nouvelle génération de préhistoriens espagnols. Les fouilles modernes des grottes de Tito Bustillo, La Riera, Las Cالدas, La Viña et Llonín aux Asturies, Cueva Morín, El Rascaño, El Juyo et Altamira en Cantabrie (ex-province de Santander), Ekain, Erralla, Amalda et Santimamiñe en Euskadi (Pays Basque méridional) et autres ont considérablement enrichi le registre magdalénien cantabrique et lui ont donné « une personnalité » propre – hypothèse soupçonnée dès la fin des années cinquante par Joaquín González Echegaray et Francisco Jordá avec la création du « Magdaleniense inferior cantábrico ». Désormais, grâce aux découvertes de contours découpés et de rondelles caractéristiques du Magdalénien moyen pyrénéen dans plusieurs sites des Asturies et de Cantabrie au cours des trois dernières décennies et à l'identification de silex provenant du Pays Basque français et de la Chalosse, l'intérêt des préhistoriens des deux côtés de la Bidasoa s'est orienté vers la recherche et la compréhension des relations indirectes et directes entre les groupes humains contemporains des deux « ailes » de la région franco-cantabrique, au sein de l'Europe occidentale. L'étude socio-économique et culturelle détaillée du Magdalénien exige la construction chrono-stratigraphique et archéologique de comparaisons entre les registres de qualité moderne des deux régions voisines, si semblables en artefacts, mais écologiquement différentes, surtout en ce qui concerne ses gibiers principaux respectifs : le renne en Aquitaine et le cerf dans les Cantabres. C'est dans l'intention d'établir des comparaisons et de comprendre les relations humaines dans la macro-région franco-cantabrique que nous présentons la séquence magdalénienne de la grotte d'El Mirón, à Ramales, à proximité de la frontière entre la Cantabrie et le Pays Basque espagnol.

Les fouilles de la grotte d'El Mirón, dirigées par les auteurs entre 1996 et 2013, livrent l'une des séquences les plus longues et complètes du Magdalénien de la région cantabrique, datée par 60 datations radiocarbone entre environ 17 et 11 ky uncal. BP (soit entre 20 et 13 cal. ky BP). Cette contribution résume les caractères principaux de plusieurs assemblages d'artefacts lithiques et osseux, mis au jour au sein de quatre tranchées réalisées dans l'énorme vestibule de cette grotte creusée dans le flanc nord de la cordillère cantabrique durant l'époque glaciaire, à quelque 25 km de la côte de la baie de Biscaye. Les variations parmi ces assemblages sont le résultat, soit de différences fonctionnelles dans l'occupation de la grotte ou des secteurs de celle-ci – tant à travers le temps que de façon contemporaine –, soit de différences dans l'utilisation des matières lithiques (locales ou non locales), ou encore d'évolutions au sein de la culture magdalénienne au sens large, laquelle s'étendra par contacts et échanges entre les aires cantabrique et aquitaine de la région culturelle du Sud-Ouest européen. L'évidence de tels contacts comprend des silex venus de la Chalosse et du Labourd, une incisive de renne sciée (espèce autrement inconnue jusqu'à présent à El Mirón) identique à celles reconnues au Roc de Marcamps, en Gironde, un propulseur semblable à ceux des sites de Gironde (Roc de Marcamps) et de Charente (Le Placard) et une (ou deux) pointes de sagaie du type Lussac-Angles. Ces objets proviennent de l'horizon du *Magdaleniense inferior cantábrico* d'El Mirón. La sépulture d'un individu ocré dans cette strate – unique dans la péninsule Ibérique – est très similaire à plusieurs exemples en France et Allemagne. Récemment, la relation génétique entre « la Dame Rouge » d'El Mirón et les Magdaléniens de France, Belgique et Allemagne a été prouvée par des analyses d'ADN ancien. La partie supérieure au moins de cet horizon est contemporaine du « Magdalénien moyen ancien » d'Aquitaine. Néanmoins, El Mirón rejoint plusieurs sites de la Cantabrie et de l'Est des Asturies ayant livré des omoplates avec des gravures striées représentant des têtes d'ongulés (surtout des biches). Ils définissent ou symbolisent une culture régionale distincte du *Magdaleniense inferior cantábrico*. En revanche, les niveaux fouillés d'El Mirón, correspondant chronologiquement au Magdalénien moyen récent pyrénéen, ne livrent pas les fossiles directs classiques de cette période (contours découpés, rondelles, proto-harpons), pourtant présents dans d'autres sites de la région cantabrique.

Mots-clés : El Mirón, Magdalénien, Espagne cantabrique, industries lithiques, industries osseuses, chronologie.

Resumen: Las excavaciones de la Cueva del Mirón, dirigidas por los autores entre 1996 y 2013, han revelado una de las secuencias más largas y completas (aunque desigualmente rica) del Magdaleniense de la Región Cantábrica, datada por 60 fechas de radiocarbono entre 17-11 ka BP (c. 20-13 ka cal. BP). Esta contribución resume las características de muchos de los conjuntos de artefactos líticos y óseos hallados en cuatro áreas de excavación dentro del gran vestíbulo de esta cueva, situada en la ladera norte de la Cordillera Cantábrica, a unos 25 km de la costa del Mar Cantábrico durante la era glaciaria. Las variaciones entre estos conjuntos arqueológicos son el resultado de diferencias funcionales en el empleo de la cueva y sus diferentes áreas a través del tiempo; o de manera contemporánea, de diferencias en la utilización de las materias primas líticas (locales o no locales), así como cambios que reflejan acontecimientos ('modas') dentro de la cultura magdaleniense sensu lato, que se extendieron por medio de contactos o intercambios entre grupos humanos de las "ramas" cantábrica y aquitana del área cultural distintiva del Suroeste de Europa. La evidencia de tales contactos o intercambios en el horizonte del Magdaleniense inferior cantábrico de El Mirón incluye silex de Chalosse y Labourd, un incisivo escotado de reno (una especie de otra manera ausente en El Mirón hasta el momento actual) idéntico a otros del sitio de Roc de Marcamps (Gironde), un propulsor muy similar a otros de ese mismo yacimiento y de Le Placard (Charente), y una o dos azagayas del tipo Lussac-Angles. El enterramiento humano con ocre rojo en el Magdaleniense inferior del Mirón es único en la península Ibérica, pero se asemeja a varios enterramientos en Francia y Alemania, con relaciones genéticas ahora probadas por los análisis de ADN antiguo. Al menos una parte de este horizonte es contemporánea con el Magdaleniense medio antiguo recién definido en Aquitania. Sin embargo, El Mirón se conecta a varios otros yacimientos de la provincia de Cantabria y el oriente de Asturias al haberse hallado omóplatos con grabados estriados de cabezas de ungulados (especialmente ciervas), un estilo de arte mueble que caracteriza o define la cultura regional propia del Magdaleniense inferior cantábrico. Sin embargo, en los niveles del Mirón (en las zonas excavadas hasta la fecha) que son cronológicamente contemporáneos al clásico Magdaleniense medio pirenaico no se ha encontrado ninguno de los artefactos diagnósticos de esta cultura: proto-arpones, rodets y contornos recortados; objetos que, sin embargo, sí han sido hallados en pequeñas proporciones en otros yacimientos de la Región Cantábrica.

Palabras clave: Cueva de El Mirón, Magdaleniense, región cantábrica española, industria lítica, industria ósea, cronología.

INTRODUCTION

El Mirón Cave (Ramales de la Victoria, easternmost Cantabria Province) provides a new, fairly complete sequence of Magdalenian (and Azilian) assemblages, dated by sixty ^{14}C assays between ca 17-11 ky uncal. BP, that adds much detail and clarification to the regional record for the Late Glacial based on such classic sites as El Castillo, Altamira, El Valle, La Chora, El Otero, Cueto de la Mina, La Paloma and Urtiaga, in addition to more modern excavations in Erralla, Ekain, Santimamiñe, El Juyo, El Rascaño, Cualventi, Llonín, La Riera, Tito Bustillo, Las Caldas, La Viña, *etc.* El Mirón cave is located in the west face of Pando Mountain in the second foothill

range of the Cantabrian Cordillera at 260 m a.s.l. some 20 km from the mouth of the Río Asón, a broad interior, 100 m a.s.l. stretch of which the cave dominates (fig. 1). The cave consists of a large vestibule (30 x 8-16 x 13 m) and a 100 m inner section, connected by a narrow passage containing an ancient, eroded alluvial-colluvial sedimentary slope (fig. 2).

Excavations were conducted in four areas of the vestibule (plus small tests on the slope and in the inner cave - both with evidence of Magdalenian-age cultural deposits and the former with Azilian materials in a remnant breccia). In the outer vestibule, within the ruins of a stone structure ("the Cabin") a 9.25 m² area was dug, yielding a sequence of levels dating to the Cantabrian Initial (Levels 21-18), Lower (17-15), Middle (14-13) and

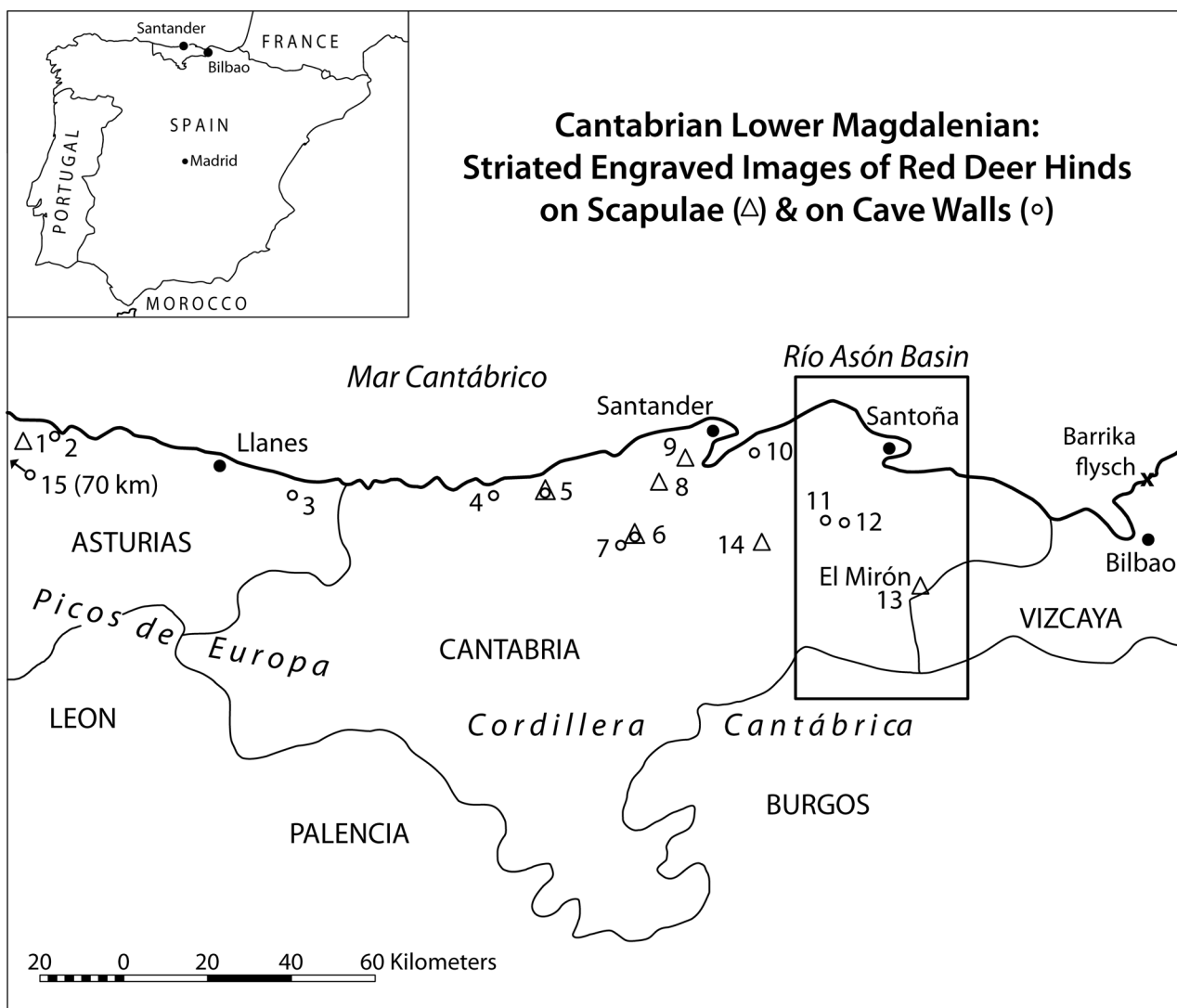


Fig. 1 – Location of El Mirón Cave in Cantabria (Spain) among sites with striation-engraved images of red deer hinds on scapulae (triangles) of proven or likely Lower Magdalenian age and on cave walls (circles). 1. El Cierro; 2. Tito Bustillo; 3. Llonín; 4. Las Aguas; 5. Altamira; 6. El Castillo; 7. La Pasiega; 8. El Pendo; 9. El Juyo; 10. La Garma; 11. Emboscados; 12. Cobrante; 13. El Mirón; 14. El Rascaño (image on scapula is of a bison); 15. Peña de Candamo (image on wall is of a stag).

Fig. 1 – Localisation de la grotte d'El Mirón dans les Cantabres (Espagne) parmi les sites ayant livré des gravures de biches striées sur scapula (triangles) et pariétales (cercles), certaines ou probables du Magdaleniense inférieur cantabrique. 1. El Cierro ; 2. Tito Bustillo ; 3. Llonín ; 4. Las Aguas ; 5. Altamira ; 6. El Castillo ; 7. La Pasiega ; 8. El Pendo ; 9. El Juyo ; 10. La Garma ; 11. Emboscados ; 12. Cobrante ; 13. El Mirón ; 14. El Rascaño (scapula gravée d'un bison) ; 15. Peña de Candamo (représentation pariétale de cerf).

Upper (12) Magdalenian, with Level 11.2 being either Final Magdalenian or Azilian and Levels 11-11.1 Azilian. In a 0.5-1.0-m wide “Mid-Vestibule Trench” spanning the 9 m between the outer and inner vestibule excavation areas, the following sequence was revealed (mainly in meter square P6): Level 313, Solutrean (without lithic points) or Initial Magdalenian; 312, Lower Magdalenian; 308, Upper Magdalenian; 306, Final Magdalenian or Azilian, and 305, Azilian.

The inner vestibule excavation area, located inside a formerly fenced area (“the Corral”) (8.5 m²) produced a sequence of Initial Magdalenian levels (119.3-117) – atop a series of Mousterian, Gravettian and Solutrean layers – Lower Magdalenian levels (116-110), possible Middle Magdalenian levels (109-104) and Final Magdalenian/Azilian (102.1-102). Level 119.3 rests directly atop 122 or 121 in squares U9-10 (120 being a compact backdirt layer at the base of the looters’ hole in squares V-W-X10). Level 121 is a thin, localized lens found in only a half square, with only 10 retouched tools; it yielded no Solutrean points, perhaps as an accident of sampling). There may have been an hiatus (or a lacuna) in occupation between Levels 121 and 119.3 that may have corresponded to several centuries (perhaps between *ca* 21.8 cal. ky BP – Level 122 – and *> ca* 20.6 cal. ky BP – Level 119.2 cal. ky BP) and there is a sedimentary unconformity between the light-color, organic- and culturally-poor, clayey silts of the Solutrean (and earlier layers) and the overlying dark brown, organic – and culturally – rich Initial and Lower Magdalenian ones. The apparent hiatus in occupation between the Solutrean and Ini-

tial Magdalenian in at least the vestibule rear of El Mirón Cave, is regionally filled by final, Solutrean-point-bearing deposits dated between *ca* 17.5-17 ky uncal. BP in Las Caldas [Levels XIVc and 4], La Riera [17], Cueto de la Mina [F-AMS], El Ruso [III], Altamira [6], Amalda [IV], Urutiaga [F-base] and Antoliñako [Lmb]. And it is true that isolated Solutrean point fragments do sometimes appear in later, but clearly Magdalenian levels, as in some El Mirón Cave layers, while it is also true that there are cultural levels convincingly dated within the accepted Solutrean age-range but lacking Solutrean points, possibly as accidents of archeological trench location vis à vis prehistoric activity/discard areas within occupations [e.g., Aitzbitarte III mouth – Level II and III inner – Level IV]).

Adjacent to the inner vestibule excavation area, but separated from it by a large block that had fallen from the ceiling during the Lower Magdalenian, is the 4 m² area in the SE corner of the vestibule in which was excavated a 18.8 cal. ky BP human female burial in Level 504. The “Burial Area” produced a series of Lower Magdalenian levels (505-503.1) and evidence (an antler harpoon barb) in an overlying disturbed layer (502). The 60 radiocarbon dates for all these Magdalenian/Azilian sequences are presented in table 1. While the dates in the outer and mid-vestibule and burial areas are stratigraphically coherent within their standard deviations, there are numerous inconsistencies in the inner vestibule “Corral” area. These could be due to problems of disturbance by Magdalenian pit digging and other activities, animal burrowing, runoff from the inner cave, and/or errors in accurately following the double slope during broad area excavation. Repeated

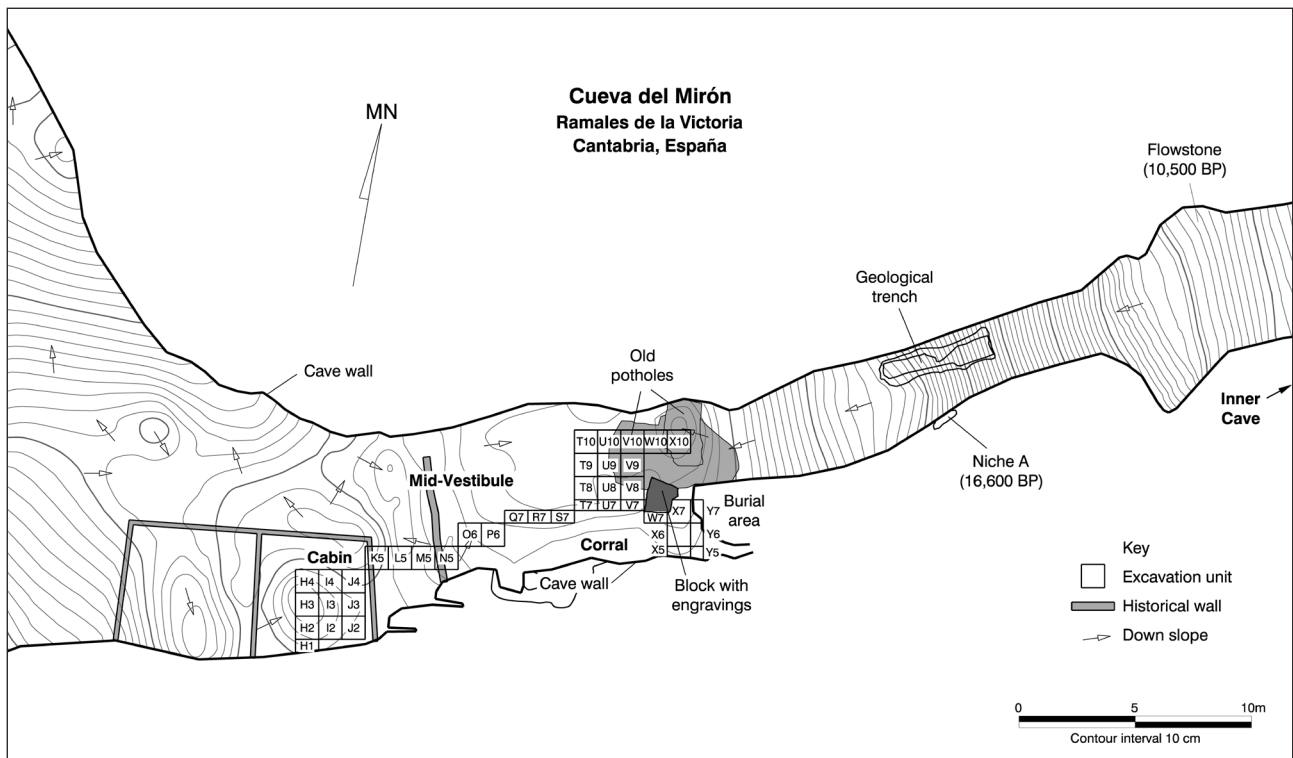


Fig. 2 – Plan of El Mirón Cave showing excavation areas.
 Fig. 2 – Plan de la grotte d’El Mirón avec les zones de fouilles.

Period	Vestibule Front		Mid-Vestibule		Vestibule Rear		Burial, Slope & Inner Cave	
	Level	Date	Level	Date	Level	Date	Level	Date
AZ			305	10270±50			Breccia	10390±50
							Breccia	10740±40
TM/AZ	11	11785±55						
	11,1	11205±55						
	11,1	11720±140	306	11650±50	102,1	11950±70		
					104	14120±35		
					105	13490±40		
UM					105	14720±40		
	12	12970±70	308	12350±190	106	12460±180		
L-MM	13	14930±70						
	14	14600±190			108	13660±70	VIII	14620±80
	15	15010±260			108	13710±70		
	15	15220±300			108	14710±160		
	16	15180±100			108	14850±60#		
					110	14760±70	503,1	15120±40
					110	14795±75		
					110	15660±80		
					110	16130±25		
	17	15470±240			110	16520±40		
	17	15450±160			111	16370±190		
	17	15700±190			111	15530±230	504(b)	15460±40
	17	15610±90			112	15430±75	504	15740±40
	17	15370±80	312	15850±170	114	16460±50	505	15670±40
					114	16760±90		
				115	(13800±840)			
				115	16750±45			
IM	18	16080±40			116	15220±100		
	19	16600±40			116	15510±90		
					116	17400±80		
	21	16050±40			117	17050±60		
					117	17240±70		
					118	15460±190		
					119	16960±80	Niche	16600±90
					119	17230±40		
					119,2	16320±160		
Sol			313	17400±270	121	18390±300		
					122	17990±50		
					125	18980±360		
					126	18950±350		
					127	19230±50		
					127	20440±50		

Table 1 – El Mirón Cave Azilian, Magdalenian and Solutrean radiocarbon chronology (AZ=Azilian; TM/AZ=Terminal Magdalenian or Azilian; UM=Upper Magdalenian; L-M=Lower and Middle Magdalenian; IM=Initial Magdalenian; Sol=Solutrean). Dates are uncalibrated BP. Details of all dates and calibrated ages are given in *Radiocarbon* 45:41-58; 49:1205-1214; 52: 33-39; 57: 183-188; 58: 943-945; 60); 17,400 ± 80: sample is from a hearth pit; 17,400 ± 270: Level 313 in P6 test pit might be Solutrean, but without Solutrean points; Niche=fill of niche in south cave wall above mid-slope between vestibule and inner cave; Breccia=concretion at base of flowstone remnant adhering to north cave wall at top of slope between vestibule and inner cave; b=human buried at vestibule south rear (500-numbered levels=the burial area).

Tabl. 1 – Liste des dates radiocarbones (non-calibrées) des niveaux magdaléniens et aziliens de la grotte d'El Mirón.

re-datings (including some with application of ultra-filtration methods) have not entirely resolved these problems, making some correlations with levels in the other areas tentative. We propose the following correlations based on ^{14}C dates, sediment color and texture, and archeological contents among the Magdalenian (and Azilian) levels of the four excavation areas:

- Cabin Levels 21-18=Mid-Vestibule 313(?)=Corral 119.3-117=Slope Niche: Initial Magdalenian
- Cabin Levels 17-15=Mid-Vestibule 312=Corral 116-110=Burial 505-503.1: Cantabrian Lower Magdalenian
- Cabin Levels 14-13=Mid-Vestibule 311-309(?)=Corral 109-104(?)=Inner Cave Trench VIII: Middle Magdalenian (?)
- Cabin Levels 12=Mid-Vestibule 308-307(?)=part of Burial Area 502: Upper Magdalenian
- Cabin Levels 11.2=Mid-Vestibule 306=Corral 103-102: Final Magdalenian/Azilian
- Cabin Level 11.1-11=Mid-Vestibule 305=Slope Cap-ping Breccia: Azilian

For the regional subdivisions of the Magdalenian, we generally follow the systematization of González Sainz and Utrilla (2005) and divide the Early Magdalenian into two phases: Initial (a.k.a. “Archaic”) and Lower.

Very summarily, it is clear that all Magdalenian occupations of El Mirón Cave involved hunting of and subsistence dependence on mainly two ungulate species: red deer and ibex. This is in line with the Late Upper Paleolithic of Cantabrian Spain in general, but in most sites either one or the other of these two game species is patently dominant: *Cervus* at sites on the coastal plain or in major valleys; *Capra* in montane sites. In contrast, El Mirón Cave, while located on a steep, rocky mountain-side whose summit is nearly 1000 m above sea level – ibex habitat – is only about 150 m above the low, broad valley floor of the Río Asón at its confluence with the Calera and Gandara – excellent red deer habitat. Cave occupants had easy access to both species. Mammalian faunal analyses of the Azilian, Upper, Middle, Lower and Initial Magdalenian assemblages from Levels 11-14, 305-308, 102-108 (Marín, 2009), 15-17 (J. M. Geiling, personal communication, October 2017), 504 (Marín and Geiling, 2015); 115 (E. L. Jones, personal communication, November 2018) and 119 (M. Carvalho, personal communication, November, 2018) all found approximate parity between the two species in terms of minimum numbers of individuals in most cases, although the amounts of meat provided by *Cervus elaphus* would often have outweighed *Capra pyrenaica*. Other game species are usually represented by small or negligible quantities of bones from chamois, roe deer, and occasionally horse, bovines and boar. Fish remains (including those of large salmon) are also common in Magdalenian levels (Centro Ictiológico de Arredondo, 2001). A mix of terrestrial and aquatic animal foods, as well as plants in the diet of the buried Lower Magdalenian human is indicated by dental microstriation and stable isotope analyses (García-

González *et al.*, 2015). Analysis of dental calculus from the human mandible indicates that seeds and mushrooms also contributed to subsistence at El Mirón Cave at least around 19,000 cal. BP (Power *et al.*, 2015)

THE MAGDALENIAN DIAGNOSTICS AND ARTIFACT ASSEMBLAGES

Several of the levels have very small artifact assemblages and others are yet unanalyzed, so this article concentrates on both summarizing previously published levels and presenting new data for certain others. Details on cultural materials (not subsistence, climatic and other faunal evidence) from published Magdalenian (and Azilian) levels can be found in the following articles: Levels 11-12 (González Morales and Straus, 2012); Level 17 (Straus *et al.*, 2016 ; Fontes, 2016 ; Fontes *et al.*, 2017 ; Straus *et al.*, 2018); Levels 18-21 (Straus and González Morales, 2010); Levels 312-313 (Straus *et al.*, 2008); Level 115 (Straus and González Morales, 2018); Levels 503-505 (Fontes *et al.*, 2015 et 2016); Levels 117-119.3 (Straus *et al.*, 2014); Lower Magdalenian hearths (Straus and González Morales, 2007 ; Nakazawa *et al.*, 2009); General El Mirón Magdalenian information (González Morales and Straus, 2000 et 2005 ; Straus and González Morales, 2012a ; Straus *et al.*, 2015); El Mirón background, including stratigraphy and sedimentology (Straus and González Morales, 2012b).

New data on the stone and bone artifacts from Levels 108 (chronologically Middle Magdalenian) and Levels 111,112,113,114 and 116 (Cantabrian Lower Magdalenian, but the latter two with Lussac-Angles points) are presented in tables 2 to 9. Notable are the general similarities between the lithic tool assemblages from the richest of these levels (108,111 and 116) – separated by roughly a millennium – in terms of most major groups. The older Lower Magdalenian Level (116) does have nearly thrice as many “archaic” types (20.2%) than the later one (111-6.5%) and the Middle Magdalenian one (108-7.7%), while Level 108 has 50% and Level 111 has 47% backed/retouched versus 37% in Level 116 – part of the kind of variability that characterizes differences among El Mirón assemblages, possibly due to functional and/or excavation sampling causes (i.e., where the trenches may have happened to coincide with different presumed activity areas with thus different kinds and proportions of artifacts in the various levels within the cave vestibule). The inverse relationship between worked bladelets and flake tools is a well-known phenomenon in the Cantabrian Upper Paleolithic, as discussed in the La Riera Cave monograph (Straus and Clark, 1986). It could conceivably have its root cause in the difference between occupations (or activity areas) dominated by hunting-related activities (arming and re-arming) versus those more involved in butchering, processing, manufacturing and maintenance activities (i.e., the working of carcasses, hides, antler, wood, other vegetal materials).

S-B/P Tool Types	N	S-B/P Tool Types	N
1. Simple endscraper on blade	4	53. Arched backed piece	1
2. Atypical endscraper	7	56. Atypical shouldered point	1
4. Ogival endscraper	2	57. Shouldered piece	1
5. Endscraper on retouched blade	2	58. Totally backed blade	19
8. Endscraper on flake	9	59. Partially backed blade	6
10. Thumbnail endscraper	3	60. Piece with straight retouched truncation	6
11. Keeled endscraper	8	61. Piece with oblique retouched truncation	4
12. Atypical endscraper	8	64. Bi-truncated piece	1
13. Nosed endscraper	6	65. Continuously retouched piece-1 edge	37
14. Flat nosed endscraper	3	66. Continuously retouched piece-2 edges	12
15. Nucleiform endscraper	26	74. Notch	24
16. Plane	1	75. Denticulate	18
17. Endscraper-burin	1	76. Splintered piece	18
20. Perforator-truncated blade	1	77. Sidescraper	8
22. Perforator-burin	1	79. Triangle	5
23. Perforator	5	83 Circle segment	3
24. Bec/atypical perforator	18	85. Backed bladelet	305
25. Multiple perforator	1	86. Truncated backed bladelet	2
26. Microperforator	1	87. Denticulated backed bladelet	1
27. Straight dihedral burin	4	88. Denticulated bladelet	3
28. Canted dihedral burin	3	89. Notched bladelet	3
29. Angle dihedral burin	4	90. Nibbled bladelet	9
30. Angle burin on break	20	92. Others	5
31. Multiple dihedral burin	1	Total	652
34. Burin on straight truncation	3	TOOL GROUP	%
35. Burin on oblique truncation	6	Endscrapers without type 15	7.9
36. Burin on concave truncation	1	Perforators	3,8
37. Burin on convex truncation	1	Burins	7,1
38. Transversal burin on truncation	2	Truncated pieces	1,7
41. Multiple mixed burin	1	Denticulates + notches	6,5
48. Gravette point	1	Sidescrapers	1,2
50. Vachons point	3	Geometric microliths	0,1
51. Microgravette	3	All retouched & backed bladelets/points	49.8

Table 2 – El Mirón Cave (Level 108). Lithic retouched tools (S-B/P: Sonneville-Bordes et Perrot list).

Tabl. 2 – Inventaire typologique (selon la liste type de Sonneville-Bordes et Perrot) des outils lithiques d'El Mirón (niveau 108).

In terms of diagnostic artifacts, there are few among the Upper Paleolithic levels in El Mirón: Levels 12 and disturbed Level 502: round-section harpoons; Levels 17, 115 (fig. 3), 116: Altamira/El Castillo-style striation engraved scapulae (González Morales *et al.*, 2006); Levels 114, 116 (?) Lussac-Angles points; Levels 122-127: Solutrean points. Less “absolute” temporal diagnostics among flaked lithics include so-called “nucleiform endscrapers” (type 15 in the de Sonneville-Bordes/Perrot list) and microlithic triangles, “commonly” found in Cantabrian Lower Magdalenian assemblages. *Raclettes* are the defining lithic hallmark of the Badegoulian (ex. Magdalenian 0) industry in France. Short, round-section, single-bevel base, uni- or bilaterally

grooved Lussac-Angles points (Pinçon, 1988) are hallmarks of the so-called Early Middle Magdalenian in SW France (Langlais *et al.*, 2017 with references), but whether such objects were only made at one “moment” in time and how long that “moment” might have been remain to be seen. The striation engraved scapulae are found in the territory of the modern province of Cantabria and eastern Asturias – from El Mirón to El Cierro. Rupestral striated engravings, also mainly of red deer hinds identical to the ones on the scapulae, are found in caves in the same territory, and indeed in some of the same sites (Altamira, El Castillo; Breuil and Obermaier, 1935; Almagro, 1976; González Morales and Straus, 2009; Heras *et al.*, 2010) (fig. 1),.

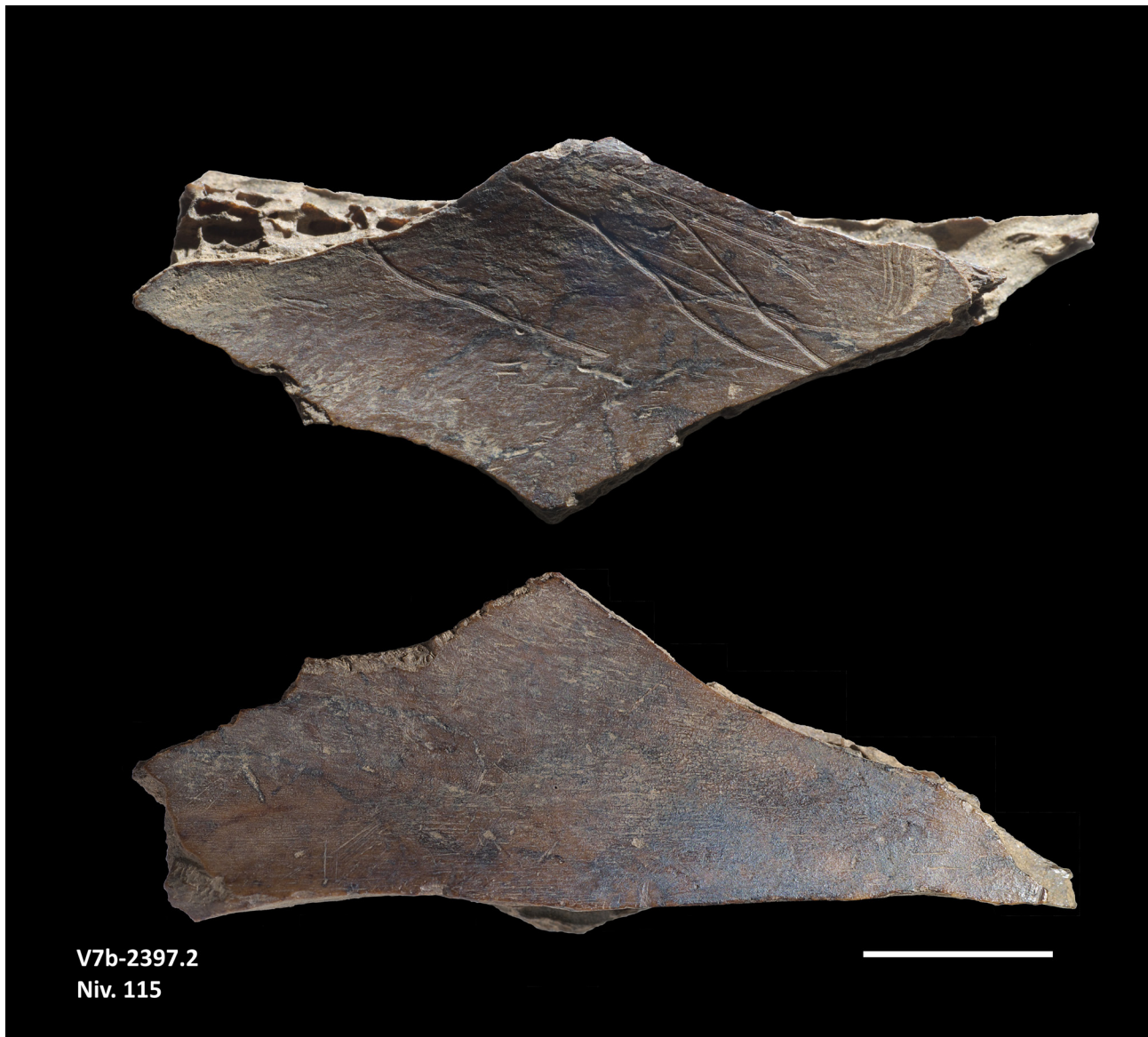


Fig. 3 – Photograph of ungulate scapula fragment with engravings probably representing deer ears from El Mirón Level 115 (photo M. R. González Morales).

Fig. 3 – Photographie d'un fragment de scapula d'ongulé avec des gravures représentant probablement des oreilles de cervidé du niveau 115 d'El Mirón (photo M. R. González Morales).

Finally, the discovery in El Mirón of the first human burial of Magdalenian age (18,8 cal. ky BP) ever to be found on the Iberian Peninsula also indicates cultural relations with the world of the French and German Magdalenian, which has yielded numerous highly ritualized burials (Straus and González Morales, 2015; Pettitt, 2011). This manipulated burial of a healthy, robust, middle-aged woman, stained with specially prepared, non-local red hematite ochre and with a possible grave marker in the form of a large engraved and red-stained limestone block (Seva *et al.*, 2019), fits squarely within (and perhaps was an origin point for) the pene-contemporaneous burial traditions of Aquitaine and beyond in the expanding *oikmene* of Magdalenian Western Europe, while there is nothing like it (at least to date) in the Mediterranean ecozone that makes up almost all of the rest of Iberian south of the Cantabrian Cordillera and Pyrenees. The

existence of actual genetic relations between the “Red Lady of El Mirón” and recolonizing Magdalenian populations in France, Belgium and Germany has recently been demonstrated by ancient (mt and n) DNA (Fu *et al.*, 2016). It is interesting to observe that among the small number of Magdalenian burials in France and now Spain, half the sexed individuals were adult females and some of these interments were among the “richest” in terms of evidence for ritualization, including red ochre, grave goods, and/or other special treatment or marking.

Lithic artifacts

Details on the lithic knapping debris (cores and *débitage*) from many El Mirón levels can be found in the publications referenced above (or in this article for Levels 108 and 116, table 3 and 8). Summaries of the relative

Type	N
0. Microburin	3
1. Non-cortical trimming flake	19 186
2. Cortical trimming flake	1 306
3. Non-cortical shatter	2 716
4. Cortical shatter	321
5. Plain flake	2 762
6. Primary decortication flake	148
7. Secondary decortication flake	1 118
8. Whole or proximal plain blade	300
9. Broken medial or distal blade	323
10. Whole/proximal primary decortication blade	12
11. Whole/proximal secondary decortication blade	107
12. Medial/distal cortical blade	29
13. Whole or proximal plain bladelet	1 967
14. Mesial/distal plain bladelet	1 718
15. Whole or proximal cortical bladelet	108
16. Mesial/distal cortical bladelet	53
17. Burin spall	139
18. Unidirectional crested blade	36
19. Bidirectional crested blade	8
20. Flake core	13
21. Prismatic blade core	26
22. Pyramidal blade core	27
23. Prismatic bladelet care	16
24. Pyramidal bladelet core	37
25. Mixed core (flake+blade/bladelet removals)	44
26. Non-cortical chunk	557
27. Cortical chunk	386
28. Platform renewal flake	94
29. Splintered piece	19
TOTAL	33 579

Table 3 – El Mirón Cave (Level 108). Lithic debris (cores & debitage).

Tabl. 3 – Inventaire des débris (nucléus et produits de débitage) en silex d'El Mirón (niveau 108).

frequencies of large products (potential tool blanks) – flakes, bladelets and blades – are presented in table 10. Our definition of bladelets is laminar products ≤ 2 cm in length – with widths generally < 0.5 cm. Blades are usually not much bigger; large blades and blade cores are very rare throughout the Magdalenian sequence. Lithic artifacts were made on a wide variety of flints, mudstone, quartzite, quartz and limestone. Bladelets (including backed and retouched ones) and many other classic Upper Paleolithic tool types were very often made on high-quality, Upper Cretaceous flysch flint from outcrops along the coast of eastern Cantabria and Vizcaya at distances of c. 40-70 km from the site, while many “Middle Paleolithic” tool types were made on non-flint materials that are available locally (such as in the beds of rivers

Type	N	Sagaie	N
Sagaies	40	<i>cross-section</i>	
Needles	5	Plano-Convex	13
Antler Blanks	5	Oval	10
Spatulas	3	Quadrangular	8
Bone Awls	3	Round	5
Antler Retoucher	1	Triangular	3
Antler Wand	1	Irregular	1
TOTAL	58	<i>bases</i>	
		1-bevel	7
		2-bevel	1
		Conical	1

Table 4 – El Mirón Cave (Level 108). Osseous industry; three nearly whole *sagaies* (lengths: 82.5, 79.5, 62.5 mm); all needles are fragmentary (one is proximal with eye; average width: 2.92 mm); two of the bone awls are whole (lengths: 69.0, 57.5 mm.)

Tabl. 4 – Inventaire des éléments de l'industrie osseuse d'El Mirón (niveau 108).

below the site). Among the flints in Lower Magdalenian Level 17, however, are items from known outcrops south of the Cantabrian Cordillera in Navarra, Alava and Treviño, as well as in the extreme Southwest of France (Bidache in Labourd and the sources in the valley of the Adour in Chalosse: Fontes, 2016; Fontes *et al.*, 2017). Other evidences of El Mirón Magdalenian human contact (seasonal or more frequent) with the Atlantic coast are numerous marine mollusks – some perforated for ornamentation – and ochre from a source on Monte Buciero at the mouth of the Asón River (Seva *et al.*, 2015 and 2018). That at least some of the Magdalenian occupants (and other regional bands) were indirectly (and no doubt loosely) tied to the Mediterranean world is attested by the presence of the marine mollusks *Homalopoma sanguineum* and *Cyclope* sp. (Alvarez, 2006; Gutiérrez-Zugasti and Cuenca-Solana, 2015).

There do not appear to be any trends through time in terms of the percentages of bladelets (range: 13-39% of the products > 1 cm in length), flakes (range: 33-54%) or blades (range: 7-10%). Most of the highest percentages of bladelets are from Initial Magdalenian levels and the highest percentages of flakes are from Lower Magdalenian ones, seemingly defying the notion that the earliest Magdalenian should be dominantly a flake-based industry. Blades are always rare, except in Lower Magdalenian Level 115. The variations among levels are probably due to functional and/or locational differences among occupations/activity areas as (accidentally) sampled by our trenches and pits.

Summaries of the percentages of selected retouched tool types and groups from major levels organized in chronological order, as determined within each trench by stratigraphy and among trenches by position and radiocarbon ages, are presented in table 11 and fig. 4. At El Mirón, nucleiform endscrapers (mainly bladelet cores

S-B/P Type / Level	111	112	113	114
1. Atypical endscraper	3			
5. Endscraper on retouched blade/flake	1			
8. Endscraper on flake	1		2	1
10.. Thumbnail endscraper	2	1		
11. Keeled endscraper	3			
12. Atypical keeled endscraper	1			
13. Thick nosed endscraper	3			
15. Nucleiform endscraper	13			
17. Endscraper-burin				1
21. Perforator-endscraper	1			
23. Perforator	1			1
24. Atypical perforator/bec		2	1	
30. Angle burin on break	6	1		
31 Multiple dihedral burin		1		
35. Burin on oblique retouched truncation	3			
37. Burin on convex retouched truncation	1	1		
43. Nucleiform burin	1			
50. Vachons point	2			
51. Microgravette		1		
58. Completely backed blade	1			
59. Partially backed blade	2			
61. Obliquely truncated piece		1		
65. Piece continuously retouched on one edge	14	2	2	1
66. Piece continuously retouched on 2 edges	2			
74. Notch	6	2		
75. Denticulate	5	1		
76. Splintered piece (or bipolar core)	8			
77. Sidescraper	3			
79. Triangle	3		1	
83. Circle segment	1	2		
85. Backed bladelet	77	6		
86. Truncated backed bladelet		1		
88. Denticulated bladelet	1			
90. Nibbled bladelet	1	5		
92. Other	2			
TOTAL	168	27	6	4
Hammerstone	1	1		

Table 5 – El Mirón Cave (Levels 111, 112, 113 and 114).

Retouched lithic tools (S-B/P: Sonneville-Bordes et Perrot list). Level 111: Endscrapers [without type 15=8.3%; with type 15=16.1%]; Burins [without type 43=6.0%; with type 43=6.5%]; Notches+Denticulates=4.5%; Sidescrapers=1.8%; Geometric microliths=2.4%; Backed/retouched bladelets=47%. Among the “archaic” tool types (notches, denticulates and sidescrapers on flakes) from both levels, only 4 are made of quartzite or limestone, while the rest are flint.

Tabl. 5 – Inventaire typologique (selon la liste type de Sonneville-Bordes et Perrot) des outils lithiques d'El Mirón (niveaux 111, 112, 113 et 114).

Types / Level	111	112	113	114
1. Plain trimming flake	8337	1258	400	550
2. Cortical trimming flake	318	14		
3. Plain shatter	905	394	217	339
4. Cortical shatter	134	18		
5. Plain flake	833	136	44	10
6. Primary decortication flake	44	19	2	
7. Secondary decortication flake	271	39	26	4
8. Plain blade (whole/proximal)	71	10	4	1
9. Plain blade (mesial/distal)	37	12	1	2
10. Primary decort.blade (whole/prox.)	2	1		
11. Secondary decort. blade(whole/prox.)	28	3	1	1
12. Mesial/distal cortical blade	13		1	
13. Plain bladelet (whole/proximal)	523	55	6	3
14. Plain bladelet (mesial/distal)	296	25	2	1
15. Cortical bladelet (whole/proximal)	14	4		
16. Cortical bladelet (mesial/distal)	24	1		
17. Burin spall	19	4		
18. Unidirectional crested blade	78	2		
19. Bidirectional crested blade		1		
20. Flake core	8	5	2	
21. Prismatic blade core	2		1	
22. Pyramidal blade core	1			
23. Prismatic bladelet core	4	1		
24. Pyramidal bladelet core	9	3		
25. Mixed core (flake+blade/bladelet)	18	4	1	
26. Non-cortical chunk	174	43	21	8
27. Cortical chunk	117	18	14	5
28. Platform renewal flake	10	2	1	
29. Splintered piece (bipolar core)	1			
Total	12 291	2072	744	924
Debris Group	%			
Microdebitage	78,90	81,30	82,90	96,20
Flakes	9,40	9,50	12,40	1,50
Blades	1,90	1,40	0,90	0,04
Bladelets	7,10	4,30	0,10	0,04
Cores	0,30	0,60	0,50	0,00
Chunks	2,40	2,90	4,70	1,40

Table 6 – El Mirón Cave (Levels 111, 112, 113 and 114).

Lithic debris (cores & debitage); for blades just pieces ≥ 2 cm long; burin spalls are grouped with bladelets and splintered pieces with cores.

Tabl. 6 – Inventaire des débris (nucléus et produits de débitage) en silex d'El Mirón (niveaux 111, 112, 113 et 114).

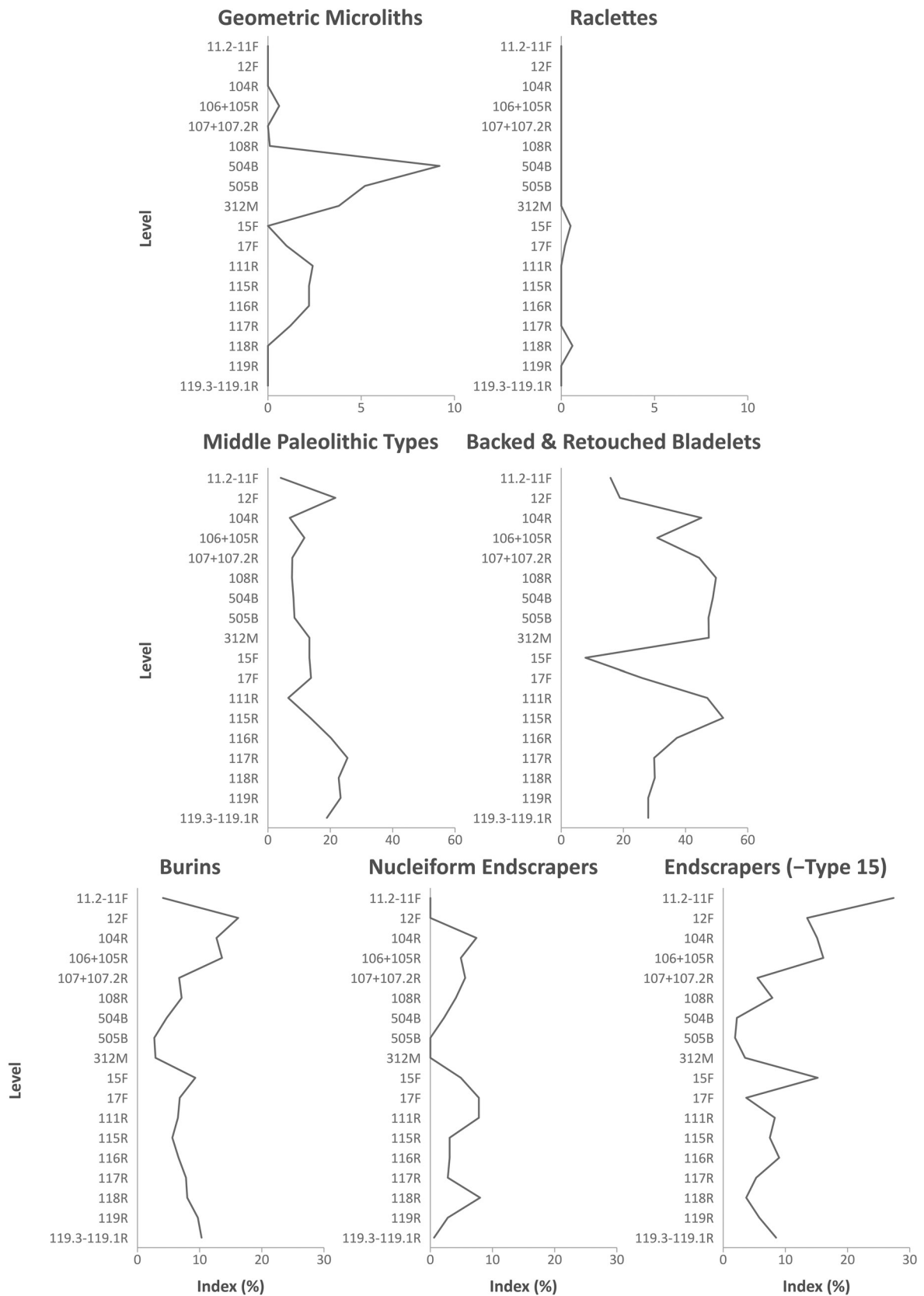


Fig. 4 – Graphs of selected tool group percentages in various El Mirón Magdalenian (and Azilian) levels arranged in approximate chronological/stratigraphic order (drafted by J. Dombrosky).

Fig. 4 – Pourcentages de certains types d'outils au sein des différents niveaux (Magdalénien et Azilien) rangés en ordre chrono-stratigraphique estimé d'El Mirón (CAO J. Dombrosky).

S-B/P Tool Type	N
1. Simple endscraper on blade	7
2. Atypical endscraper	18
3. Double endscraper	2
4. Ogival endscraper	1
5. Endscraper on retouched blade or flake	6
8. Endscraper on flake	38
9. Circular endscraper	1
10. Thumbnail endscraper	5
12. Atypical keeled endscraper	5
13. Thick nosed endscraper	3
14. Flat nosed endscraper	4
15. Nucleiform endscraper	31
17. Endscraper-burin	5
18. Endscraper-truncated blade	1
21. Perforated-endscraper	2
23. Perforator	23
24. Bec/atypical perforator	31
25. Multiple perforator	3
26. Microperforator	16
27. Straight dihedral burin	2
28. Canted dihedral burin	3
29. Angle dihedral burin	3
30. Angle burin on break	37
31. Multiple dihedral burin	8
34. Burin on straight retouched truncation	3
35. Burin on oblique retouched truncation	6
39. Transversal burin on notch	1
43. Nucleiform burin	3
48. Gravette point	1
53. Arched backed piece	4
58. Totally backed blade	4
59. Partially backed blade	6

60. Piece with straight retouched truncation	3
61. Piece with oblique retouched truncation	16
62. Piece with concave retouched truncation	1
63. Piece with convex retouched truncation	2
64. Bi-truncated piece	1
65. Continuously retouched piece-1 edge	52
66. Continuously retouched piece-2 edges	9
68. Aurignacian retouched blade	1
74. Notch	105
75. Denticulate	66
76. Splintered piece	34
77. Sidescraper	31
79. Triangle	12
80. Rectangle	1
83. Circle segment	9
84. Truncated bladelet	12
85. Backed bladelet	312
86. Truncated backed bladelet	18
87. Denticulated backed bladelet	2
88. Denticulated bladelet	11
89. Notched bladelet	6
90. Nibbled bladelet	12
92. Other	1
Total	1000
Tool Groups	%
Endscrapers without type 15	9.0
Perforators	7,2
Burins	6,6
Truncated pieces	2,3
Denticulates + notches	17,1
Sidescrapers	3,1
Geometric microliths	2,2
All retouched & backed bladelets	37.2

Table 7 – El Mirón Cave (Level 116). Retouched lithic tools (S-B/P: Sonneville-Bordes et Perrot list; endscrapers with type 15=12.1%; backed bladelets=33.1%).

Tabl. 7 – Inventaire typologique (selon la liste type de Sonneville-Bordes et Perrot) des outils lithiques d'El Mirón (niveau 116).

that may or may not have actually been used as endscrapers (Straus *et al.*, 2016) range from minima of 0 or 0.6% respectively in the Azilian and Upper Magdalenian (11.2-11, 12) and earliest Initial Magdalenian (119.3-119.1) assemblages to maxima of 8.0% in Initial Magdalenian Level 118, 7.7%, 8.8% and 7.8% in Lower Magdalenian Levels 111, 312 and 17 respectively and 7.4% in Upper Magdalenian Level 104. Other relative frequencies for type 15 tend to be in the 3-5% range – all far less than in such classic Cantabrian Lower Magdalenian sites as El Juyo, El Castillo, El Rascaño, Altamira, La Lloseta, El Cierro, Urtiaga, Santimamiñe (Utrilla, 1981). The variability in representation of type 15 core-scrappers within the Lower Magdalenian is also attested by Levels 18-20

in La Riera, with very low percentages (Straus and Clark, 1986). Geometric microliths – some classified as triangles, others as circle segments because the two types intergrade in outline form – are found in small numbers in a few El Mirón assemblages: 1.2% in Initial Magdalenian Level 117, 0.95%, 2.2%, 2.2%, 2.4%, 3.8% 5.2% and 9.2% Lower Magdalenian Levels 17, 115, 111, 116, 312, 505, and 504 (the human burial deposit) and 0.6% in combined possible Middle Magdalenian Levels 106-105. As at Las Caldas (Corchón, 2017), a very few *raclettes* are scattered among different levels in the El Mirón sequence – not exclusively in the Initial Magdalenian ones: 0.6% in only Initial Magdalenian Level 118, and 0.2% and 0.5% respectively in Lower Magdalenian Lev-

Type	N
1. Non-cortical trimming flake	37 164
2. Cortical trimming flake	1561
3. Non-cortical shatter	6439
4. Cortical shatter	652
5. Plain flake	4126
6. Primary decortication flake	328
7. Secondary decortication flake	1192
8. Plain whole or proximal blade	458
9. Broken plain blade	129
10. Primary whole/proximal decortication blade	44
11. Secondary whole/prox. decortication blade	106
12. Medial/distal cortical blade	30
13. Plain whole or proximal blade	4395
14. Broken plain bladelet	1645
15. Whole or proximal cortical bladelet	212
16. Medial/distal cortical bladelet	69
17. Burin spall	300
18. Unidirectional crested blade	23
19. Bidirectional crested blade	3
20. Flake core	47
21. Prismatic blade core	7
22. Pyramidal blade core	5
23. Prismataic bladelet core	39
24. Pyramidal bladelet core	33
25. Mixed core	110
26. Non-cortical chunk	904
27. Cortical chunk	434
28. Platform renewal flake	79
29. Splintered piece (=tool type 76)	39
Total	60 573

Table 8 – El Mirón Cave (Level 116).
Lithic debris (cores & debitage).

Tabl. 8 – Inventaire des débris (nucléus et produits de débitage) en silex d'El Mirón (niveau 116).

Type	Number	sagaie	Number
Sagaies	6	cross-section	
Spatula	1	Quadrangular	3
Bone Awls	2	Round	1
Needles	12	Plano-convex	2
Blank	1	base	
TOTAL	22	Single bevel	3

Table 9 – El Mirón Cave (Level 116). Osseous industry (total *sagaies* includes two *sagaies* blanks, *sagaie* width range=3.0-15.0 mm and average=9.83 mm, *sagaie* thickness range=2.5-7.5 mm and average=5.67, one whole *sagaie*, length: 61.5 mm; two whole awls, lengths: 48.0 and 59.5 mm, needles includes several possible fine points, 12 needle fragments, average width: 2.89 mm).

Tabl. 9 – Inventaire des éléments de l'industrie osseuse d'El Mirón (niveau 116).

els 17 and 15 – long after the age of the French Badegoulian (Note that the French Badegoulian seems to range in age between c. 23-21 cal. ky BP [Ducasse, 2012], while the basal Magdalenian levels of El Mirón date to around 20.6-20 cal. ky BP, albeit with several inconsistencies in stratigraphic order.)

True endscrapers are of course ubiquitous, but their percentages fluctuate considerably. In particular they do seem to increase in the possible Middle and Upper Magdalenian levels and rise dramatically in the Azilian (as is typical). In contrast, burins (never very abundant in El Mirón and generally simple types such as burins on break) are nearly absent in the Azilian after reaching a peak in the Upper Magdalenian and fluctuate considerably, with c. 10-12% being a frequent relative frequency except in three Lower Magdalenian levels (505 – below the burial – 111 in the Corral area, and 312 in the Mid-Vestibule Trench. Transverse burins (another diagnostic artifact of the Badegoulian in France) are all but absent (n=2) in all of the El Mirón Initial Magdalenian levels. There is no apparent trend in the representation of perforators, which generally range between c. 2-7%, with only one statistically meaningful high value of 8.6% in the lowest Magdalenian layer. The most dramatic fluctuations characterize backed and retouched bladelets, no doubt related to variations in function and accidental excavation sampling of different activity areas within the cave vestibule (*i.e.*, weapon preparation/re-arming areas *vs.* areas not or less involved in hunting-related tasks). Percentages of backed/retouched bladelets are often as high as 40-45% of all retouched lithics but are as low as c. 20% in Levels 17 and 108 and plunge to \leq 10% in Lower Magdalenian Level 15, Upper Magdalenian Level 12 and Azilian Levels 11-11.2. Finally, although it is true that “Middle Paleolithic” types (denticulates, notches and sidescrapers, often but not always made on large flakes of local non-flint materials such as quartzite and mudstone) are common (c. 20%) in the Initial Magdalenian assemblages, this is also the case in Lower Magdalenian Level 116 and Upper Magdalenian Level 12, and such artifacts are otherwise always present (usually around 10%). We stress that such “archaic” tool types are common in many Magdalenian (and other Upper Paleolithic) assemblages in Cantabria and Asturias and are not at all necessarily exclusive markers of the earliest phases of the Magdalenian. The use of local, often non-flint materials is size-related, as high-quality, non-local or even exotic flints are usually quite small (because of transport costs) and were used to make classic “leptolithic” tools, especially ones on bladelets. In short, there are no clear-cut, absolute, diagnostic lithic hallmarks of any Magdalenian phase in El Mirón, and this more generally the case throughout the Cantabrian region.

Osseous Artifacts

Antler points types traditionally have also been used to supposedly distinguish among different Magdalenian phases. The classic Cantabrian Lower Magdalenian is

Products/Levels	119.3-119	118	117	116	115	111	112	505	504	312	17	108
Bladelets	32,40	47,30	38,70	13,10	39,00	33,70	22,90	21,50	12,70	24,60	27,80	38,30
Flakes	39,50	33,70	41,30	38,80	37,40	46,50	50,50	53,60	33,10	52,60	48,30	41,00
Blades	5,20	5,60	7,10	3,50	9,70	8,80	7,50	6,90	3,40	5,40	4,30	8,10
n (≥1 cm products)	13 194	2379	4372	14 757	5121	388	2597	4549	7095	11 145	33 718	10 047

Table 10 – Relative frequencies of unretouched lithic knapping products from selected El Mirón Cave Magdalenian levels; percentages based on total cores+debris ≥1 cm in length (i.e., not including microdebitage).

Tabl. 10 – Pourcentages des supports (éclats, lames, lamelles) parmi les supports bruts (≥ 1 cm) issus des principaux niveaux magdaléniens d'El Mirón.

Level	14C cal ky BP	EndS	EndS – type 15	Burins	Perforators	MP	Raclettes	Geometric	Backed bladelets	Total Tools
11.2-11F	14.0–13.1	27,4	27,4	4,1	2,1	4,1	–	–	15,8	146
12	15.9–15.3	13,5	13,5	16,2	10,8	21,6	–	–	18,9	37
104R	17.4–18.0 or <16.6	22,5	15,1	12,7	1,4	7,0	–	–	45,1	73
106+105R	15.5–14.2 or 18.0–16.6	21,0	16,1	13,6	3,7	11,7	–	0,6	30,9	162
107+107.2R		11,1	5,5	6,7	3,3	7,8	–	–	44,4	90
108R	18.0–17.3 or 16.7–16.2	17,8	12,7	11,9	6,8	17,4	–	–	17,4	236
504B	18.9–18.1	4,4	2,2	4,7	2,9	8,2	–	9,2	48,8	969
505B	18.9–18.8	2,7	1,9	2,7	1,4	8,5	–	5,2	47,4	365
312	19.3-18.6	12,3	3,5	2,9	2,1	13,3	–	3,8	47,5	579
15F	18.6–17.6	20,1	15,2	9,3	5,9	13,3	0,5	–	7,8	204
17F	19.1–18.1	11,5	3,7	6,8	5,3	13,8	0,2	1,0	26,0	5353
111R	19.9–19.2 or 18.9–18.2	16,1	8,3	6,5	0,1	6,5	–	2,4	47,0	168
115R	20.3–20.1 or 17.6–15.5	10,6	7,5	5,6	4,7	13,6	–	2,2	52,1	359
117R	20.0–20.7	10,3	5,3	7,8	5,3	25,5	–	1,2	29,9	321
118R	18.9–18.1	11,7	3,7	8,0	3,1	22,7	0,6	–	30,1	163
119R	20.5–19.9	8,6	5,8	9,7	4,7	23,3	–	–	28,0	464
119.3-119.1R	20.7–19.8	9,1	8,5	10,3	8,6	18,9	–	–	28,0	175

Table 11 – Key retouched stone tool indices from certain Magdalenian and Azilian levels in El Mirón Cave (¹⁴C cal. ky BP: maximum range of calibrated dates at ±1 standard deviation; B=Burial Area; R=Vestibule Rear (“Corral”); M=Mid-Vestibule; F=Vestibule Front (“Cabin”); EndS: endscrapers, type 15=nucleiform endscrapers, which are often/mainly bladelet cores; MP=Middle Paleolithic tool types: denticulates, notches and sidescrapers, geometric microliths (triangles, trapezes and circle segments); Backed bladelets=all edge-backed bladelets plus edge-nibbled bladelets; Backed bladelets from Level 11.2-11 F=15.6+8.2% backed micro-points).

Tabl. 11 – Pourcentages des types clé d'outils et groupes typologiques (selon la liste type de D. de Sonneville-Bordes et Perrot) issus des principaux assemblages magdaléniens et aziliens d'El Mirón.

characterized by quadrangular section points. This does seem to be partly true in the El Mirón Cave sequence (table 9 and 12); although such points are found nearly ubiquitously (except in the lowest Initial Magdalenian levels), it is the Lower Magdalenian levels (especially 505 and 17) that abound in quadrangular section pieces (some with geometric engravings bordering on the classic “tectiform” designs of Altamira and El Castillo. Round and oval section antler points are found throughout the sequence but are nearly exclusive in the Initial Magdalenian levels. Plano-convex sections lack in the Initial Magdalenian but are found throughout the

Lower and into the possible Middle Magdalenian of the site. Centrally flattened points, characteristic of the Solutrean and Lower Magdalenian of the Cantabrian region, are so represented in El Mirón Cave, but they continue almost to the possible Middle Magdalenian. There are several notably large, round-section points in the Initial Magdalenian levels; the Lower Magdalenian ones (particularly Level 17, but also as recently as Level 104) yielded several very similar large, square-section points often with elaborate geometric markings. The late Cantabrian Lower Magdalenian age levels contained numerous short, round-section points (one each in Levels 114 and

Level	Cross-section Types							Base Types			
	Round	Oval	Plano-convex	Centrally flattened	Flattened	Square	Triangular	Single-bevel	Double-bevel	Convex	Conical
104						2	1	2			
106	1	4	1			4	2	2			1
107			1			1		1			
108	5	10	13			7	3	7	1		1
109	1			1		2		1			1
110	2	3	1	1		11		3	4		1
111	3	7	3			5		4			1
112	5	2		1		5		2	1		1
113	1	2	1			2	1	1	1		
16+15		2	1		1	3		2			
17	18	20	10	2	3	55	4	19	14		3
312	1	6	2		1	5		6	1		1
504	7	7	6	2		9		3	2	1	
505	5	2	4			1					1
114	1		1			2		2			
115	5	4	4		1	2	2	6	1		
116	1		2			3		3			
117	6	5			1	1					1
118	4						1				
119	3	1		3							
119,2	2										

Table 12 – Antler points (*sagaies*) from Magdalenian levels in El Mirón Cave (square includes quadrangular-biconvex and rectangular sections; the latter can overlap with flattened sections).

Tabl. 12 – Décompte des caractéristiques principales des pointes en bois de cervidé issues des principaux niveaux magdaléniens d'El Mirón.

116 with longitudinal grooves [one trilateral, the other unilateral] more or less similar to the “Lussac-Angles” type of the Aquitaine early Middle Magdalenian; fig. 5). In terms of point bases, bevel bases are not found in the Initial Magdalenian levels, while double – and especially single-bevel bases are common in the Lower (and possible Middle) Magdalenian ones. Small numbers of conical-base points exist throughout the sequence. Longitudinal grooves (uni- or bi-lateral) are common and certainly served for the insertion of bladelet segments (perhaps using pine resin or other adhesives) as cutting elements to increase point lethality. In short, even the quadrangular section antler points are not exclusive Lower Magdalenian diagnostics, but they do start to appear only in that period after the Initial Magdalenian. Then they co-exist with round, oval, plano-convex and a few centrally-flattened and triangular section points throughout the rest of the sequence. The Upper Magdalenian and Azilian levels are devoid of antler points (save the two Magdalenian harpoons mentioned above). Several representative decorated antler points with round, quadrangular and centrally flattened sections from El Mirón Lower and Middle Magdalenian assemblages are shown in fig. 6, as well as in various of the articles cited above. In Magdalenian levels of El Mirón Cave there is no evidence of points blanks

that were made by flaking (as opposed to the groove-and-splinter technique) – another supposed hallmark of the French Badegoulian (Pétillon and Averbouh, 2012) that is missing from the Cantabrian site.

Needles (some eyed) are present in all the major osseous artifact assemblages and are in some levels quite abundant. Other, rarer, osseous tools include spatulae, burnishers and awls. Fine points (*puntas finas*) are generally included among the antler points in the counts given here, but they can overlap in width and thickness dimensions with large needles, making it hard to distinguish among these types when (as is usually the case) they are fragmentary. There are also perforated or incised teeth (ornaments), as well as perforated marine shells, both in varying numbers throughout the whole Magdalenian sequence. None of these objects seem to vary typologically through time so as to be in any way temporally diagnostic. An antler spear-thrower (one of very few known from Cantabrian Spain – the others being at El Castillo and Las Caldas) and a grooved reindeer incisor (to date the only item from this species to be found in El Mirón Cave – identified by J. M. Geiling) both from Level 17, are virtually identical to such objects (two atl-atls and four incisors) from the nearly identically (c. 18.8 cal. ky BP) dated Level 3 of Roc de Marcamps (Gironde) and, in

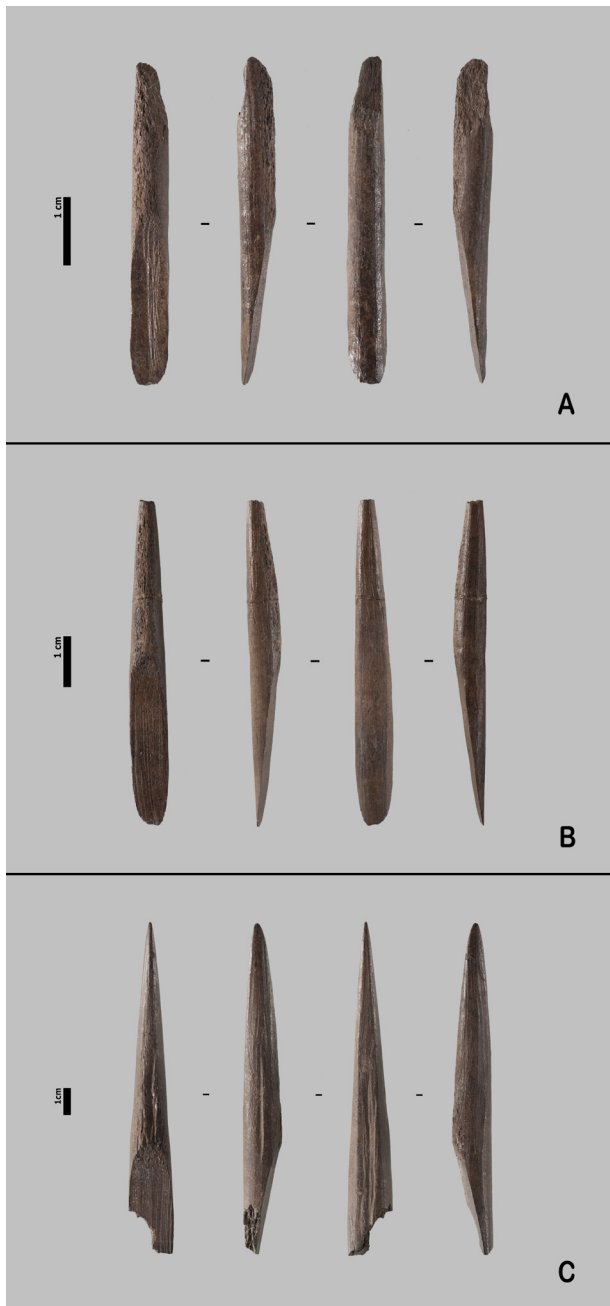


Fig. 5 – Photographs of short, round section *sagaies* from El Mirón Lower Magdalenian (Levels 111, 112 and 114) (L. Agudo Pérez).

Fig. 5 – Photographies de pointes en bois de cervidé courtes et de section ronde du Magdaléniense inférieur cantabrique d'El Mirón (niveaux 111, 112, 114) (CAO L. Agudo Pérez).

the case of the atl-atl, also the one atl-atl from an undated early Magdalenian Level in the site of Le Placard, Charente (Cattelain, 2004; González Morales and Straus, 2005; Kunz *et al.*, 2015). These objects suggest at least indirect, down-the-line trade connections during the Cantabrian Lower Magdalenian (early Aquitaine Middle Magdalenian) between El Mirón Cave and sites in SW France – separated by c. 350–450 km. In similar fashion, the point from Level 116, typologically classifiable as a “Lussac-Angles” and indirectly (but closely) dated to c. 18.8 cal. ky BP

(Straus and González Morales, 2016) could conceivably be related via social contacts with similar objects in SW France (if it is not the product of independent local invention, i.e., technological convergence). On the other hand, unlike several sites in Cantabria [La Garma, Las Aguas, El Línar], Asturias [La Viña, Las Caldas, Tito Bustillo, Llonín] and Guipúzcoa [Ermittia, Ekain]), the levels in El Mirón Cave dated to the time of the Middle Magdalenian lack the proto-harpoons and portable art objects (*contours découpés* and, less exclusively, *rondelles*) characteristic of the Middle Magdalenian of the French Pyrenees and Greater Southwest. If the chronological attribution is correct, then either the inhabitants of El Mirón Cave did not obtain “Pyrenean” portable art objects, or the excavations did not happen to be in areas where such relatively rare items might have been deposited.

CONCLUSIONS

The unevenly rich Magdalenian/Azilian sequence in El Mirón Cave – one of the longest in the Cantabrian region – illustrates a variety of factors that govern inter-assemblage variability. Among these is the reality of “random” archeological sampling (serendipity): pits and trenches that represent a minimal percentage (< 10%) of the surface area of the large (c. 300 m²), eminently inhabitable cave vestibule and that accidentally uncovered different sorts of activity and discard areas throughout many layers. While it is true that the walls and mouth of the cave, its active drips, more or less sun-lit areas, large blocks fallen from its ceiling, and the steep slope in front of its mouth all conditioned the ways in which different spots within the vestibule could have been used, such that, for example, hearths were often repeatedly made in the same places during reiterated occupations, the limited archeological holes transected accumulations of faunal remains, osseous artifacts, lithic debris and retouched tools that could vary (maybe only slightly) in location throughout time. These variations could show up archeologically as inter-assemblage differences that had no temporal (“evolutionary”) or cultural significance, but yet could be misinterpreted as such. Other factors leading to inter-assemblage variations could also include genuine functional differences among whole occupations of the site, such as between minor, short (hours, days) visits by male hunting parties and major, long-term (weeks, months) stays by several families (older and younger men and women and children – a band), or even multi-band aggregations (possible in such a large, dry, well-lit, commodious, geographically prominent cave). Seasonal differences among occupations, band territorial changes affecting access (or not) to non-local flints, etc. could also be in play in causing the differences seen in artifact representations. And so, could contacts between Asón valley inhabitants with other bands and ultimately, down-the-line with distant territories and their resources (mates, flints, portable art objects and ideas).

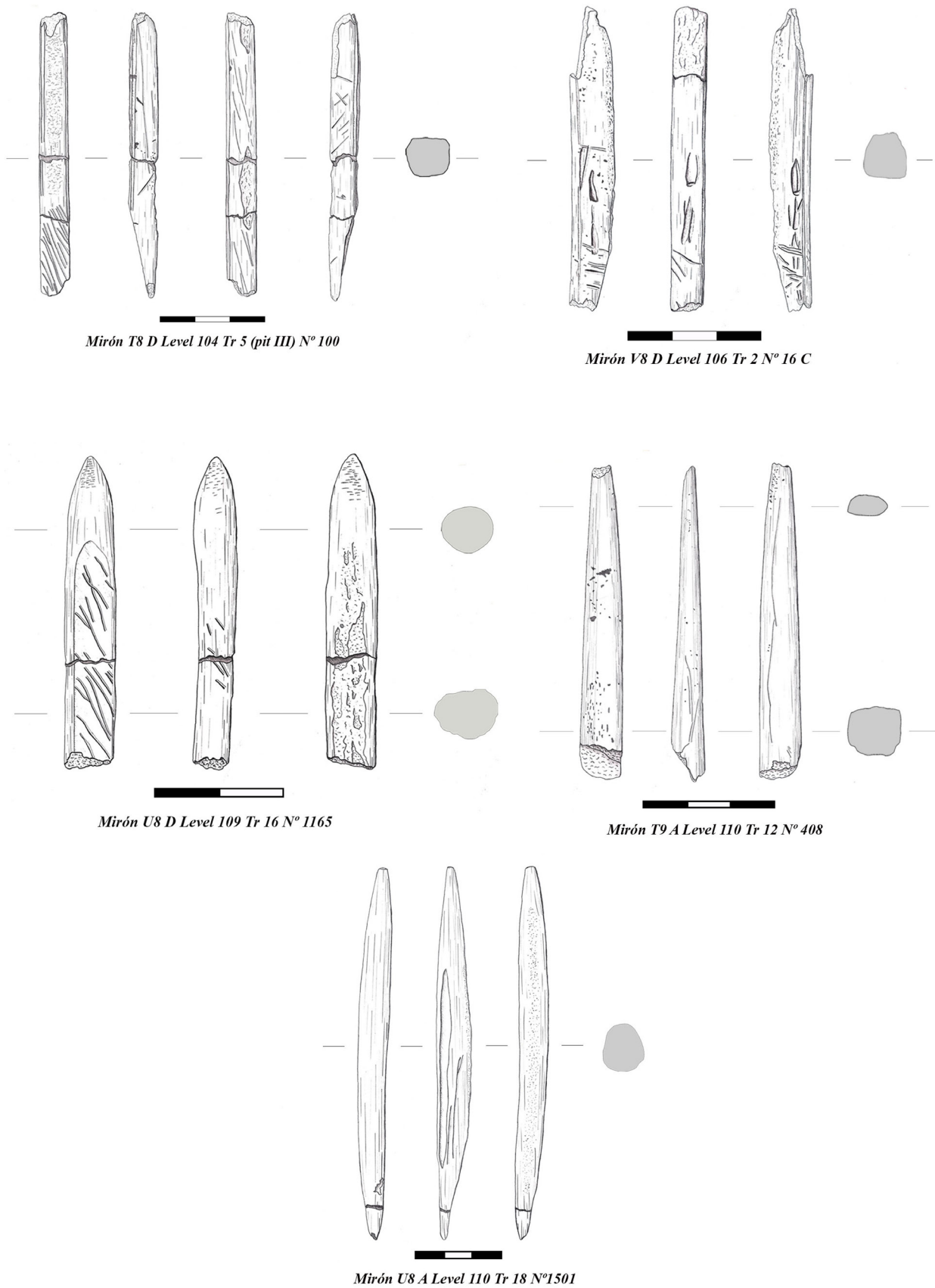


Fig. 6 - Drawings of sagaies from El Mirón Middle and Lower Magdalenian Levels 104, 106, 109 and 110 (S. Salazar).
Fig. 6 - Pointes en bois de cervidé du Magdalénien moyen et du Magdaléniense inférieur cantábrico d'El Mirón
 (niveaux 104, 106, 109 and 110) (dessins S. Salazar).

Among the facts that do seem apparent throughout the El Mirón Magdalenian-Azilian sequence are shifts in the popularity of different antler point types, but without absolute fossil directors with the possible exception of Lussac-Angles points and round-section harpoons. Among lithic artifacts, there may be a trend toward higher percentages of “true” endscrapers in the Middle and Upper Magdalenian and Azilian (but with an isolated high percentage also in Lower Magdalenian Level 15). Simple burins also seem to increase in Middle and Upper Magdalenian levels, but then decrease significantly in the Azilian (conceivably related to a decline in antler-working and the replacement of *sagaies* by wooden arrows in the terminal Pleistocene-early Holocene). Backed and retouched bladelets are relatively low in representation in the oldest and youngest levels (but also in a couple of Lower and Middle Magdalenian levels. There are no apparent trends among the other main lithic artifact groups. Quadrangular-section points are particularly common in Cantabrian Lower Magdalenian levels, while the Initial Magaleniian ones lack the otherwise common quadrangular-section and bevel-base points and are dominated by round-section points (also found throughout the sequence).

Regionally and temporally distinctive artifacts include striation – engraved scapulae – hallmarks of the Cantabrian Lower Magdalenian (along with technically, thematically and stylistically similar striation-engraved images of hinds and other ungulates on cave walls also in a territory extending east-west some 130 km from the Río Asón to the Río Sella. At the same time, direct and/or indirect social/trade contacts with the Basque Country and with SW France are manifested in small quantities of high-quality flints and two objects (an incised reindeer tooth and an antler spear-thrower) identical to ones from the region between Bordeaux and Angoulême. Even the culturally distinctive Cantabrian regional band during the Oldest Dryas was connected with other human groups in today’s Euskadi and Aquitaine. The markers of those

social relations – along with the increasingly accurate and precise radiocarbon record – also indicate chronological correlations among artifact assemblage groupings, thus serving the purposes of archeologists on both sides of the modern nation-state border and prehistoric ecological boundary of the Pyrenees. Separated by the Western Pyrenees and different subsistence bases (reindeer, horse and sometimes saiga hunting in the north and red deer and ibex hunting and marine mollusk gathering in the southwest) the Magdalenian regional bands of Aquitaine and Vasco-Cantabria were nonetheless connected by social contacts manifested by non-local flints, portable art and other objects, especially in the Cantabrian Lower/Middle and Upper phases. Along with material items, no doubt information and mates were exchanged – both essential for long – term human survival. People who made use of El Mirón Cave sometimes (especially c. 19-18 cal. ky BP) were more directly involved in inter-regional relations; at other times, not so much, at least insofar as our archeological sampling of this major site was able to reveal.

Acknowledgements: Excavations in El Mirón Cave were authorized and partly funded by the Gobierno de Cantabria. Other financial support was provided by the U.S. National Science Foundation, Fundación M. Botín, National Geographic Society, Spanish Ministerio de Educación y Ciencia, L.S.B. Leakey Foundation, University of New Mexico and UNM Foundation Stone Age Research Fund (J. and R. Auel, principal donors). Material support was provided by the Town of Ramales de la Victoria and the Instituto Internacional de Investigaciones Prehistóricas de Cantabria. The grooved reindeer incisor from Level 17 was identified by Jeanne-Marie Geiling. The small engraved scapula fragment from Level 115 was recognized by Emily Jones. We warmly thank all the many student excavators and collaborating specialists without whom the El Mirón Cave project and its many achievements would have been impossible. Mathieu Langlais kindly corrected the French abstract and we thank the anonymous reviewer of the whole paper.

RÉFÉRENCES

- ALMAGRO M. (1976) – Los omóplatos decorados de la Cueva de “El Castillo”, *Trabajos de Prehistoria*, 33, p. 9-99.
- ALVAREZ, E. (2006) – *Los objetos de adorno-colgantes del Paleolítico superior y del Mesolítico en la Cornisa Cantábrica y en el Valle del Ebro. Una visión europea*, doctoral dissertation, universidad de Salamanca, 1333 p.
- BREUIL H., OBERMAIER H. (1935) – *The Cave of Altamira at Santillana del Mar, Spain*, Madrid, Tipografía de Archivos, 223 p.
- CATTELLAIN P. (2004) – Le propulseur de la Grotte du Placard (Vilhonneur, Charente, France), *Notae Praehistoricae* 24, p. 61-67.
- CENTRO ICTIOLOGICO DE ARREDONDO (2001) – Análisis ecológico-genético de los salmónidos de la Cueva del Mirón (Alto Asón) a partir de restos fósiles, *Unpublished report in possession of the authors*.
- CORCHÓN M. S. (2017) – *La Cueva de Las Caldas (Priorio, Oviedo). Ocupaciones Magdalenieses en el Valle del Nalon*, Salamanca, Universidad de Salamanca, 820 p.
- DUCASSE S. (2012) – What is Left of the Badegoulian “interlude”? New Data on Cultural Evolution in Southern France between 23,500 and 20,500 cal. BP, *Quaternary International*, 272-273, p. 15-165.
- FONTES, L. (2016) – *Economies Set in Stone? Magdalenian Lithic Technological Organization and Adaptation in Vasco-Cantabrian Spain*, Ph.D. dissertation, university of New Mexico, Albuquerque, New Mexico, 294 p.
- FONTES L., STRAUS L. G., GONZÁLEZ MORALES M. (2015) – Lithic and Osseous Artifacts from the Lowe Magdalenian

- Human Burial Deposit in El Mirón Cave, Cantabria, Spain, *Journal of Archaeological Science*, 60, p. 99-111.
- FONTES L., STRAUS L. G., GONZÁLEZ MORALES M. (2016) – Lithic Raw Material Conveyance and Hunter-Gatherer Mobility during the Lower Magdalenian in Cantabria, Spain, *Quaternary International*, 412, p. 66-81.
- FONTES L., STRAUS L. G., GONZÁLEZ MORALES M. (2017) – Lower Magdalenian Lithic Raw Material Provisioning: A Diachronic View from El Mirón Cave (Ramales de la Victoria, Cantabria, Spain), *Journal of Archaeological Science: Reports* [http://dx.doi.org/10.1016/j.jasrep.2017.0301].
- FU Q., POSTH C., HAJDINJAK M., PETR M., MALLICK S., FERNANDES D., FURTWÄNGLER A., HAAK W., MEYER M., MITTNIK A., NICKEL B., PELTZER A., ROHLAND N., SLON V., TALAMO S., LAZARIDIS L., LIPSON M., MATHIESON I., SCHIFFELS S., SKOGLUND P., DEREVIANKO A. P., DROZDOV N., SLAVINSKY V., TSYBANKOV A., GRIFONI CREMONESI R., MALLEGNI F., GÉLY B., VACCA E., GONZÁLEZ MORALES M. R., STRAUS L. G., NEUGEBAUER-MARESCH C., TESCHLER-NICOLA M., CONSTANTIN S., MOLDOVAN O.T., BENAZZI S., PERESANI M., COPPOLA D., LARI M., RICCI S., RONCHITELLI A., VALENTIN F., THEVENET C., WEHRBERGER K., GRIGORESCU D., ROUGIER H., CREVECOEUR I., FLAS D., SEMAL P., MANNINO M. A., CUPILLARD C., BOCHERENS H., CONARD N. J., HARVATI K., MOISEYEV V., DRUCKER D. G., SVOBODA J., RICHARDS M.P., CARAMELLI D., PINHASI R., KELSO J., PATTERSON N., KRAUSE J., PÄÄBO S., REICH D. (2016) – The Genetic History of Ice Age Europe, *Nature*, 534, p. 200-205 + Online supplementary information.
- GARCIA-GONZÁLEZ R., CARRETERO J., RICHARDS M., RODRIGUEZ L., QUAM R. (2015) – Dietary Inferences through Dental Microwear and Isotope Analyses of the Lower Magdalenian Individual from El Mirón Cave (Cantabria, Spain), *Journal of Archaeological Science*, 60, p. 28-38.
- GONZÁLEZ MORALES M., STRAUS L. G. (2000) – La Cueva del Mirón (Ramales de la Victoria): Excavaciones 1996-1999, *Trabajos de Prehistoria* 57, 1, p. 12-133.
- GONZÁLEZ MORALES M., STRAUS L. G. (2005) – The Magdalenian Sequence of El Mirón Cave (Cantabria, Spain), in V. Dujardin (dir.), *Industrie osseuse et parures du Solutrén au Magdalénien en Europe*, actes de la table ronde sur le Paléolithique supérieur récent (Angoulême, 28-30 mars 2003), Paris, Société préhistorique française (Mémoire, 39), p. 209-219.
- GONZÁLEZ MORALES M., STRAUS L. G. (2009) – Extraordinary Early Magdalenian Finds from El Mirón Cave, Cantabria (Spain), *Antiquity*, 3, p. 267-281.
- GONZÁLEZ MORALES M., STRAUS L. G. (2012) – Terminal Magdalenian/Azilian at El Mirón Cave (Ramales de la Victoria, Cantabria) and the Río Asón Valley, in J. Muñiz (dir.), *Ad Orientem. Del final del Paleolítico en el Norte de España a las primeras civilizaciones del Oriente Próximo: estudios en homenaje a Juan Antonio Fernández-Tresgüerras Velasco*, Oviedo, *Ménsula*, p. 189-215.
- GONZÁLEZ SAINZ C., UTRILLA P. (2005) – Problemas actuales en la organización y datación del Magdaleniense de la región cantábrica, in N. Bicho et M. Soledad Corchón Rodríguez (dir.), *O Paleolítico*, actas do 4e Congresso de Arqueología Peninsular, universidade do Algarve (Faro, 14-19 setembro), Centro de Estudos de Património, Departamento de História, Arqueologia e Património, p. 39-47.
- GUTIERREZ-ZUGASTI I., CUENCA-SOLANA D. (2015) – Ornaments from the Magdalenian Burial Area in El Mirón Cave (Cantabria, northern Spain). Were They Grave Goods? *Journal of Archaeological Science*, 60, p. 112-124.
- HERAS C. DE LAS, LASHERAS J.A., RASINES P., MONTES R., FATÁS P., PRADA A., MUÑOZ E. (2010) – Datation et contexte archéologique de la nouvelle omoplate gravée découverte à Altamira, in J. Clottes (dir.), *L'Art Pléistocène dans le Monde*, actes du Congrès IFRAO (Tarascon-sur-Ariège, septembre 2010), Tarascon-sur-Ariège, Société préhistorique Ariège-Pyrénées, p. 270-271 + CD 1571-1588.
- KUNZ D., SÉCHER A., COSTAMAGNO S., MALLYE J.-B., PÉTILLON J.-M., PESCHAUX C., PUBERT E., RENDU W., BOUADIF-MALIGNE M., LAROUANDIE V., BARSHAY-SZMIDT C., LANGLAIS M. (2015) – Le Roc de Marcamps 2 (Prignac-et-Marcamps, Gironde), *Bulletin de la Société préhistorique française* 112, 3, p. 475-516.
- LANGLAIS M., PÉTILLON J.-M., SÉCHER A. (2017) – Les débuts du Magdalénien moyen dans le Sud-Ouest français, in C. Bourdier, L. Chehmana, R. Malgarini et M. Połtowicz-Bobak (dir.), *L'essor du Magdalénien: aspects culturels, symboliques et techniques des faciès à navettes et à Lussac-Angles*, actes de la séance de la SPF (Besançon, 17-19 octobre 2013), Paris, Société préhistorique française, p. 209-234.
- MARÍN, A. B. (2009) – The Human Use of the Montane Zone of Cantabrian Spain during the Late Glacial: Faunal Evidence from El Mirón Cave, *Journal of Anthropological Research*, 65, p. 69-102.
- MARÍN, A. B., GEILING, J. M. (2015) – Archeozoological Study of the Macromammal Remains Stratigraphically Associated with the Magdalenian Human Burial in El Mirón Cave (Cantabria, Spain), *Journal of Archaeological Science*, 60, p. 5-83.
- NAKAZAWA Y., STRAUS L. G., GONZÁLEZ MORALES M., CUENCA D., CARO J. (2009) – On Stone-Boiling Technology in the Upper Paleolithic: Behavioral Implications from an Early Magdalenian Hearth in El Mirón Cave, Cantabria, Spain, *Journal of Archaeological Science*, 36, p. 684-693.
- PÉTILLON J.-M., AVERBOUH A. (2012) – Le travail du bois de renne dans les couches badegouliennes, in J. Clottes, J.-P. Giraud et P. Chalard (dir.), *Solutrén et Badegoulien au Cuzoul de Vers. Des chasseurs de rennes en Quercy*, Liège, Service de préhistoire, université de Liège (ERAUL, 131), p. 359-386.
- PETTIT P. (2011) – *The Palaeolithic Origins of Human Burial*, New-York, Routledge, 320 p.
- PINÇON G. (1988) – Sagaies de Lussac-Angles, in Camps-Fabrer H. (dir.), *Fiches typologiques de l'industrie osseuse préhistorique, Cahier I, Sagaies*, Commission de nomenclature sur l'industrie de l'os préhistorique, Union Internationale des Sciences Pré- et Protohistoriques, université de Provence, Unesco, fiche 3 bis, p. 1-7.
- POWER R., SALAZAR D., STRAUSS L. G., GONZÁLEZ MORALES M., HENRY A. (2015) – Microremains from El Mirón Cave Human Dental Calculus Suggest a Mixed Plant-Animal Subsistence

- Economy during the Magdalenian in Northern Iberia, *Journal of Archaeological Science*, 60, p. 39-46.
- SEVA R., BIETE C., LANDETE M. D. (2015) – Analysis of the Red Ochre of the El Mirón Burial, *Journal of Archaeological Science*, 60, p. 84-98.
- SEVA R., LANDETE M. D., JUAN J., BIETE C., STRAUS L. G., GONZÁLEZ MORALES M. (2019) Sources of the Ochres Associated with the Lower Magdalenian “Red Lady” Human Burial and Rock Art in El Mirón Cave (Cantabria, Spain), *Journal of Archaeological Science-Reports*, 23, p. 265-280.
- STRAUS L. G., CLARK G. A. (1986) – *La Riera Cave: Stone Age Hunter-Gatherer Adaptations in Northern Spain*, Tempe (AZ): Arizona State University Department of Anthropology (Anthropological Research Papers, 36), 498 p.
- STRAUS L. G., GONZÁLEZ MORALES M. (2007) – Early Tardiglacial Human Uses of El Mirón Cave (Cantabria, Spain), in M. Kornfeld, S. Vasil’ev et L. Miotti (dir.), *On Shelter’s Ledge: Histories, Theories and Methods of Rockshelter Research*, actes du 15e Congrès mondial de l’UISPP (Lisbonne, 4-9 septembre 2006), Oxford, Archaeopress (BAR, International Series 1655), p. 83-93.
- STRAUS L. G., GONZÁLEZ MORALES M. (2010) – The Radiocarbon Chronology of El Mirón Cave (Cantabria, Spain): New Dates for the Initial Magdalenian Occupations, *Radiocarbon*, 52, 1, p. 33-39.
- STRAUS L. G., GONZÁLEZ MORALES M. (2012a) – The Magdalenian Settlement of the Cantabrian Region (Northern Spain): A View of El Mirón Cave, *Quaternary International*, 272-273, p. 111-124.
- STRAUS L. G., GONZÁLEZ MORALES M. (2012b) – *El Mirón Cave, Cantabrian Spain: The Site and Its Holocene Archaeological Record*, Albuquerque, University of New Mexico Press, 368 p.
- STRAUS L. G., GONZÁLEZ MORALES M. (2015) – “The Red Lady of El Mirón Cave”: Lower Magdalenian Human Burial in Cantabrian Spain. Special issue, *Journal of Archaeological Science*, 60, p. 1-137.
- STRAUS L. G., GONZÁLEZ MORALES M. (2018) – A possible Structure in the Lower Magdalenian Horizon in El Mirón Cave (Cantabria, Spain), in P. Valde-Nowak, K. Sobczyk, M. Nowak et J. Żrałka (dir.), *Multas per Gentes et Multa per Saecula: Amici Magistro et Collegae suo Ioanni Christopho Kozłowski Dedicant, Krakow, Jagiellonian University/Alter Publishing*, p. 157-166.
- STRAUS L. G., GONZÁLEZ MORALES M., STEWART E. (2008) – Early Magdalenian Variability: New Evidence from El Mirón Cave, Cantabria, Spain, *Journal of Field Archaeology*, 33, 2, p. 197-218 ; 3, p. 367-369.
- STRAUS L. G., GONZÁLEZ MORALES M., FONTES L. (2014) – Initial Magdalenian Artifact Assemblages in El Mirón Cave (Ramales de la Victoria, Cantabria, Spain): A Preliminary Report, *Zephyrus*, 73, p. 45-65.
- STRAUS L. G., GONZÁLEZ MORALES M., MARIN-ARROYO A. B., FONTES L. M. (2015) – Magdalenian Settlement-Subsistence Systems in Cantabrian Spain: Contributions from El Mirón Cave, Studies in Honour of Professor Rodrigo de Balbín-Berhmann., in P. Bueno et P. Bahn (dir.), *Prehistoric Art as Prehistoric Culture*, Oxford, Archaeopress, p. 111-122.
- STRAUS L. G., FONTES L. M., DOMINGO R., GONZÁLEZ MORALES M. (2016) – Cores, Core-Scrapers, and Bladelet Production during the Lower Magdalenian Occupations of El Mirón Cave, Cantabrian Spain, *Lithic Technology*, 14, 3, p. 212-235.
- STRAUS L. G., GEILING J. M., GONZÁLEZ MORALES M. (2018) – The Lower Magdalenian Osseous Industry from Level 17 in El Mirón Cave (Ramales de la Victoria, Cantabria): A Preliminary Overview, *Zephyrus*, 81, p. 15-30.
- UTRILLA P. (1981) – *El Magdaleniense inferior y medio en la costa cantábrica.*, Santander, Centro de Investigación y Museo de Altamira. 4, 335 p.

Lawrence Guy STRAUS

Department of Anthropology MSC01 1040

University of New Mexico, Albuquerque

NM 87131-0001 USA

lstraus@unm.edu

Manuel R. GONZÁLEZ MORALES

Instituto Internacional de Investigaciones

Prehistóricas

Universidad de Cantabria,

Avda. de los Castros s/n

E-39005 Santander

moralessm@unican.es