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CHALCOLITHIC/EARLY BRONZE AGE AND ADDITIONAL MAGDALENIAN RADIOCARBON DATES FOR EL MIRÓN CAVE (RAMALES DE LA VICTORIA, CANTABRIA, SPAIN). DATE LIST VII

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ABSTRACT. There are now 101 radiocarbon dates from the long Paleolithic and post-Paleolithic culture-stratigraphic sequence in El Mirón Cave, Cantabrian Spain. Here we report on two dates on bone from two different humans whose remains were found in disturbed surface sediments in the cave vestibule rear and that confirm the existence of burials in addition to previously reported residential occupations in the vestibule front pertaining to the Chalcolithic and early Bronze Age periods (ca. 5500–3500 cal BP). In another attempt to resolve problems of stratigraphic incoherence of dates from the early Magdalenian periods in the vestibule rear, six new assays on faunal remains from Levels 119, 117, 114, 108, and 106 were run at Queen's University in Belfast. There continue to be date inversions in the Lower Magdalenian range of levels that may be explained by a combination of intensive anthropic and rodent activity, major rock fall, slope wash and gravity-caused object movements, as well as possible problems in following some thin levels during excavations over a large area and across many years of work in the cave vestibule interior, particularly in the absence of any layers that are culturally sterile or even poor. Nonetheless, the coherent age of the Initial Magdalenian is fully confirmed by a new date from Level 21 in the vestibule front at ca. 22,000–20,500 cal BP), as is the general age range of the Lower Magdalenian (ca. 20,500–18,000 cal BP).

KEYWORDS: Bronze Age, Cantabrian Spain, Chalcolithic, El Mirón Cave, Magdalenian, radiocarbon dates.

INTRODUCTION

Background

Archeological excavations in El Mirón Cave on the northern edge of the Cantabrian Cordillera and ca. 20 km from the present shore of the Bay of Biscay between Santander and Bilbao, Spain, have revealed a long series of cultural layers ranging from the late Middle Paleolithic to the Bronze Age. The cave is located at 43°14'44"N × 3°27' × 9"W × 260 m a.s.l., dominating an important river valley surrounded by mountain summits ≥ 1000 m a.s.l. A major aspect of the research directed by MRGM and LGS since 1996 has been systematic radiocarbon dating, with original publication in six articles in *Radiocarbon* (Straus and González Morales 2003, 2007a, 2010, 2016, 2018a; Straus et al. 2015a). Ninety-three dates also were recently summarized, systematically evaluated and analyzed in this journal (Hopkins et al. 2021). Here we report seven new dates. Two of these reveal a heretofore unsuspected aspect of the human use (namely for disposal of the dead) of this large, strategically located cave in post-Paleolithic prehistory. The other five help clarify both the age of the beginning of the Magdalenian cultural period and some significant stratigraphic disturbances during later phases of the Magdalenian in the cave vestibule rear.

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The stratigraphic sequence and characteristics of the site are monographically described in Straus and González Morales (2012a) and in numerous articles (e.g., Straus and González Morales 2020 for the Magdalenian). Excavations in the cave have been conducted mainly in the spacious, sunlit vestibule (16–8 m wide × 30 m deep × 20–13 m high), although small test pits and radiocarbon samplings were also done in the dark inner cave and in the steeply upsloping "Ramp" passageway that connects the vestibule and the inner cave. The vestibule excavation areas are: the Outer Vestibule ("Cabin") trench (9.25 m^2), the Mid-Vestibule Trench (9 m long × 0.5–1 m wide), the Vestibule Rear ("Corral") trench that includes a 2 m^2 deep sounding (11.5 m^2), and the Magdalenian human "Burial Area" in the SE corner of the vestibule rear (4 m^2) that is separated from the "Corral" by large (ca. 2×1×1 m) limestone ceiling-fall block. The names "Cabin" and "Corral" respectively refer to sub-modern structures (a stone cabin foundation and a wooden corral with feeding trough still in use for goats in 1996). The cultural sequences uncovered in the excavations are as follows: Cabin: Initial, Lower, Middle and Upper Magdalenian, Azilian, culturally nearly sterile Mesolithic, Neolithic, Chalcolithic and Early Bronze Age; Mid-Vestibule Trench: possible Solutrean or Initial Magdalenian, Lower, Middle and Upper Magdalenian, Azilian and, at the western end of the trench nearest to the Cabin and cave mouth, Neolithic; Corral: Mousterian, Early Upper Paleolithic ("Gravettian"), Solutrean, Initial, Lower, Middle and Upper Magdalenian, Azilian, culturally nearly sterile Mesolithic; Burial Area: Lower Magdalenian and disturbed Upper Magdalenian. While the levels in the Cabin are completely horizontal, those of the other areas eastwardly increasingly (albeit gently) slope up toward the vestibule rear, where the cultural strata are banked up at the foot of the "Ramp" against the eroded face of steeply sloping, water-worn cobble-rich, colluvial-alluvial clayey-silt fill of the inner cave, probably of early Pleistocene or even Mio-Pliocene age (Farrand 2012). Dated remnants of Lower and Middle Magdalenian and Azilian occupations were also found in a niche in the cave wall near the bottom of the Ramp, in a breccia adhering to the cave wall at the top of the Ramp and in a test-pit dug below the base of a 1950s trench dug across the middle of the inner cave in the fill of a fluvial channel cut into the ancient alluvium. Radiocarbon dates on chunks of charcoal from or near the surface in the Corral and inner cave indicate human activity (with use of torches?) in El Mirón during the Middle Ages and Renaissance.

Chalcolithic and Bronze Age

While the ground surface of the cave vestibule was essentially flat when our excavations began in 1996 back to the base of the Ramp in the narrow passage leading up to the inner cave, it became apparent during the course of excavating the various vestibule trenches that increasingly more of the post-Pleistocene (post-Paleolithic) sequence present in the Cabin becomes missing in the direction of the vestibule rear, i.e., there are no Chalcolithic or Bronze Age levels in the Mid-Vestibule Trench, Corral or Burial areas; no Neolithic either in the eastern end of the Mid-Vestibule or at all in the Corral or Burial areas; no Mesolithic-age material in the Burial Area. There are hints of a remnant of an Azilian or Upper Magdalenian layer in a small, peripheral sector of the Burial Area at the SE end of the large, engraved and ochre-stained block that intimately borders (and may "mark") the Lower Magdalenian burial: a curved-backed "Azilian" point and three small, "thumbnail"-like endscrapers in Level 502 (square W6, east half, excavated in 2023). In 2013, Level 502 had yielded a curved antler harpoon barb fragment of Upper Magdalenian aspect (Straus et al. 2015). This level in W6 is stratigraphically contiguous with Level 102/103 in squares W-V7 immediately SW of the engraved block and that date to ca. 14–15 cal kya, consistent with an Upper Magdalenian or Early Aziian age.

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Recent goatherds had apparently leveled the area at the SE rear of the vestibule to construct their Corral, while looters had successively dug a large crater at the foot of the Ramp in the NE rear of the vestibule (which we emptied to allow us to excavate the sounding into the pre-Magdalenian levels). In 1996, we found that, while intact Bronze Age levels (2–3) lay immediately below goat excrement and the dirt floor of the Cabin, the vestibule rear Burial Area surface was characterized by masses of goat dung and more or less loose sediments containing mixtures of Upper Paleolithic and modern (e.g., bottle glass) artifacts. Human remains (probably including the child maxilla) were found by workmen while removing the loose, surficial goat dung and sediments along the south cave wall in the SE corner of the vestibule while the site was being cleaned in 1996 in preparation for the first season of excavation[1]. Further removal of mixed surface sediments in the same area of the vestibule rear yielded more remains in 1997. Human remains were also found in 2011 and 2013 in the more compact, underlying, but still mixed deposit (Levels 500–501) atop intact Lower Magdalenian deposits in the Burial Area (specifically in squares X5-6). All these human remains, among which stand out a mandible and a maxilla, were the object of thorough, multidisciplinary analyses by González Rabanal (2022). When trial excavation began in 2001 in the area (parts of squares X-Y7) that would later lead to the discovery of the Magdalenian burial between the large block and the cave vestibule bedrock wall, immediately upon removal of the last mixed fill (excrement, straw and loose sediments) it could be seen that intact layers rising up against the out-sloping cave wall had been truncated by "recent" digging to level this area of the Corral. One of the intact levels (504) that outcropped in this rising fashion was brightly stained red with ochre; it was this layer that would yield the "Red Lady" human burial in 2010 (Straus et al. 2015). Acting on his suspicion that these human remains from loose, mixed, surface deposits at the vestibule rear, based on the presence of major Chalcolithic and Bronze Age occupation layers with numerous large "silo" pits and hearths in the vestibule front, González Rabanal undertook to have the mandible and the maxilla directly AMS-dated.

Magdalenian

For the second group of dates reported here, the goal was to yet again to attempt to clarify the ages of the Magdalenian layers in the Vestibule Rear (Corral), which, over the years, have shown themselves to be very complex, with numerous, serious date inversions. In addition, clarification was required in the meter square J2 test pit in the SE corner of the Outer Vestibule (Cabin) excavation area, because the sole original date for the lowest excavated layer (Level 21) was younger than the stratigraphically coherent pair of dates from overlying Levels 19 and18. Lacking diagnostic artifacts such as Solutrean points, it was necessary to ascertain whether Level 21 could pertain to the Initial Magdalenian like Levels 119.2–117 above the sequence of Solutrean layers in the Vestibule Rear.

The situation in the Corral, with slight, but double (downward east to west and south to north) slopes, is different from the stratigraphy of the Cabin area, where the layers lie flat and whose radiocarbon dates are essentially coherent. Up until now, a total of 31 assays had been run for the Magdalenian (and Azilian) levels in the vestibule rear (Levels 119.2–102.1). The problems arising from these dates have been summarized most recently by Hopkins et al. (2021:836–838). Because one possible source of incoherence could be errors in following thin, individual levels across the large excavation area of the Corral, particularly because of the slopes, the lack of

[1]Straus' excavation journal notes for June 13, 1996 state: "... found several human bones including skull parts with sherds, flints and animal bones (including an antler tine). ... The dead human was buried between the cave wall and a big block. Possibly Bronze Age." This observation probably pertains to the juvenile maxilla fragment dated here.

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culturally sterile or (in most cases) even artifact-poor layers separating rich ones, the great sedimentological and archeological similarities among most of the levels, the existence of large limestone blocks separating the eastern and western parts of the excavation in Levels 115–113 (Straus and González Morales 2018b), and the facts that the levels were excavated over many campaigns and by many different student diggers with varying amounts of experience, we decided to re-date levels from the SE corner of the Corral area (from stratigraphic sections in or adjacent to square V8, which was the initial test pit), where the levels were first defined. The worst problems affect Levels 116–104: Lower and Middle Magdalenian.

MATERIALS AND METHODS

The human bones that were dated belong to two individuals and include an adult left hemimandible with M_1, M_2 and M_3 that is apparently associated with three loose teeth and 31 postcranial human remains, all indicative of a person >22 years old (Individual 1). The other item is a child left maxilla with deciduous M^1 and M^2, permanent M^1, and unerupted I^1, I^2, C and M^2. The upper jaw seems to have been associated with left upper deciduous C and 10 unfused bones compatible with this child, ca. 6 years old (Individual 2) (González Rabanal 2022:289–291). The mandible was AMS-C14 dated by the International Chemical Analysis (ICA, Sunland, Florida) and the maxilla by the 14CHRONO Centre at Queen's University, Belfast (UBA)

Relatively large long-bone fragments were taken by MRGM and LGS from Levels 106, 108, 112, 114, 116, 117, 118, and 119 in the stratigraphic section between squares V8 and W8, which closely corresponds to the western face of the very large limestone block that separates the Corral from the Burial area at the rear of the vestibule. The bones were inspected with a stereomicroscope in EvoAdapta Laboratory, thanks to its Director, Ana Belen Marín-Arroyo, who also identified them as pertaining either to ibex or middle-size ungulate (ibex [*Capra pyrenaica*] or red deer [*Cervus elaphus*]—the overwhelmingly dominant game species in all the El Mirón Magdalenian levels). All the bones display cut, scrape and/or hammer marks. Dating was done at Queen's University, Belfast. The assays on the bones from Levels 112 and 118 failed for lack of sufficient collagen. Levels 114–118 were formed before the block fell atop squares W8 and W7 from the cave ceiling, while Levels 108 and 106 were deposited after the block-fall and are banked up against its smooth, flat, sloping west face. The latter two levels plus 104, 105, and 107 covered fine, linear and schematic, human-made engravings on that rock face, which corresponds to the bedding plane that had detached from the ceiling.

New (2022) excavation in Level 21 in test pit J2 yielded few faunal remains, so the bone chosen for re-dating this layer is a humerus or femur diaphysis fragment. This bone from a medium-size mammal (probably either ibex or red deer) has neither gnaw, cut, nor percussion marks and lacks any trace of burning. However, it displays green bone breaks indicating human agency.

Belfast's pretreatment and measurement methods are described in the report accompanying their dates as follows:

Collagen Pretreatment

Collagen is extracted from the bone samples based on the method of Brown et al. 1988 using a Vivaspin® filter cleaning method introduced by Bronk Ramsey et al. (2004). An alkali step has been added since 2014 following Brock et al. (2010).

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Table 1 Radiocarbon dates from human bones in surface sediments and from ungulate bones in intact Magdalenian levels in El Miron Cave.

Level	Period	Lab no.	^{14}C age BP	±	δ^{13}C	δ^{15}N	C:N	Yield	cal BP (2σ)
Surface	CL	UBA-46795	3860	29	–21.2	9.5	3.19	13.90	4408–4156
500	BA	ICA-14C5551	3420	50	–21.5	9.1	3.20	8.50	3832–3497
106	MM	UBA-46787	14,675	60	–20.4	4.3	3.24	5.20	18193–17,813
108	MM	UBA-46788	16,756	71	–20.2	2.0	3.25	1.40	20,466–20,052
114	LM	UBA-46790	18,986	88	–20.4	2.6	3.26	1.00	23,065–22,591
117	LM	UBA-46792	17,538	86	–20.1	2.6	3.28	1.70	21,419–20,920
119	IM	UBA-46794	17,847	88	–20.1	2.7	3.90	3.90	21,979–21,400
21	IM	UBA-49891	16,949	95	–20.4	2.6	3.14	2.20	20,777–20,251

CL=Chalcolithic; BA=Bronze Age; MM=Middle Magdalenian; LM=Lower Magdalenian; I=Initial Magdalenian

Stable Isotopes

Analyses on bone collagen are routinely undertaken on samples submitted for carbon dating provided there is adequate material remaining following ^{14}C processing. The EA-IRMS is also used to produce a %Nitrogen content value on raw bone samples at the initial stages of bone processing. This value helps to decide if pre-treatment is viable by indicating how likely the sample is to yield sufficient collagen suitable for ^{14}C dating.

Protocol and Standards

Three blank (empty) capsules are measured at the start of the sequence and any C or N contribution from the tin is automatically deducted from the results.

The sample gas is compared against a relevant reference gas of known isotopic composition and the relative differences computed by the software to calculate an isotopic number for the sample gas. Samples are measured in duplicate with standards of certified isotopic composition typically bracketing every 10–12 samples. These standards are selected to encompass the result range normally observed for the material type being measured. They are used to monitor machine performance, reproducibility and to correct sample data using a two-point regression line based on the offset between observed (measured) v [versus] expected results of the standards".

Calibrations were done according to IntCal20 (Reimer et al. 2020), using the OxCal v4.4 software (Bronk Ramsey 2009).

Information on the methodology of the sole ICA AMS assay was not made available by the lab other than that AAA (acid-alkali-acid) pretreatment was applied to the bone sample. The stable isotope values for the mandible and maxilla were obtained by González Rabanal.

RESULTS

Chalcolithic and Bronze Age

The eight new dates from El Mirón are presented in Table 1. The mandible yielded a date of 3832–3497 cal BP (1883–1548 cal BC), while the human maxilla provided a date of 4408–4156 cal BP (2459–2207 cal BC). The inverted order of the human jaws from the top of the sequence (Table 1) is not surprising, given the loose, mixed nature of the surficial deposits in the vestibule rear. The temporal boundary (and artifactual distinction) between the Chalcolithic and the

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Bronze Age in the Cantabrian region is rather imprecise and there is some overlap, but according to González Rabanal (2022) the former dated between ca. 4650–4050 cal BP and the latter between ca. 4250–2650 cal BP. This would place the mandible squarely in the Bronze Age and the maxilla late in the Chalcolithic.

Magdalenian

Four of the five new Magdalenian dates from the Vestibule Rear (Corral area) are in stratigraphic order; the strikingly out-of-order date from Level 114 poses yet another problem for understanding the chronological situation in the vestibule rear. The Initial Magdalenian Levels 118 and 117 together show an unproblematic age range between 22,029–20,973 cal BP. Level 114—in the middle of the Lower Magdalenian series of layers in the Corral—inexplicably yielded an age range (23,112–22,644 cal BP) putatively older than the dates from the stratigraphically much deeper Initial Magdalenian. While El Mirón (perhaps by mere accident of where we dug our trenches that represent a very small fraction of the total surface area of the vestibule) has not yielded any classic temporally diagnostic Middle Magdalenian artifacts (bone *contours découpés* and engraved/perforated disks, spiral/meander-motif antler wands, proto-harpoons), by their stratigraphic position and age, newly re-dated Levels 108 and 106 probably pertain to this period. However, the former is especially problematic at 20,515–20,102 cal BP, while Level 106 makes more sense at 18,243–17,864 cal BP.

The new date from Level 21 in the Outer Vestibule (Cabin area), 20,777–20,251 cal BP, is stratigraphically coherent with AMS dates from overlying levels 19 (20,210–19,900 cal BP) and 18 (19,550–19,240 cal BP). These dates fit well with the Initial Magdalenian dates from Levels 119.2–117 in the Vestibule Rear (Corral area). Unfortunately, Levels 21–18 have not yielded culturally/temporally diagnostic artifacts, either lithic or osseous. In fact, antler projectile points ("sagaies") that could have given a clue as to whether these levels pertain to the classic Cantabrian Lower Magdalenian (CLM) or the Initial Magdalenian (see Straus et al. 2014) are absent, but so are any lithic "fossil directors" of the Badegoulian techno-complex (save for one *raclette* in upper Level 18, which, however, also yielded a geometric microlith, more characteristic of the CLM). Single nucleiform endscraper (cores), usually common in the CLM, have been found in upper and lower Level 18 and Levels 19 and 21. Tables 2–4 respectively present the heretofore unpublished basic data on lithic debris, retouched stone tools and the simplified lithic raw material composition of the tool groups from Levels 18–21. Although "archaic" flake tools (notches, denticulates and sidescrapers) are well represented in the Initial Magdalenian of the Corral area, they are also commonly found in Lower Magdalenian assemblages. Indeed, in the small lithic assemblages from square J2 these "Mousterian-looking" implements make up 30.0% of the 50 tools in Level 18, 33.3% of the 18 in Level 19, 53.1% of the 13 retouched tools in Level 20, and 42.8% of the 14 tools in Level 21. On the other hand, while backed and retouched bladelets are very abundant in most of the Lower Magdalenian levels, they are fewer, but still well represented in the Initial Magdalenian levels of the Corral. In Level 18 in the Cabin, they make up 32.0% of the tools, in Level 19 22.2%, in Level 20 15.4% and in Level 21 21.4%. Non-flint lithic raw materials are quite abundant in the Initial Magdalenian levels of the Corral, although they are found throughout the whole sequence of Magdalenian levels. The great majority of retouched tools from Levels 18–21 are made on flints (many from non-local sources), but several of the "archaic" types of tools are indeed mudstone or quartzite. Cores of quartzite are almost as numerous as flint cores in Level 18 and there are a few non-flint cores along with flint cores among the other levels. The only

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Table 2 Lithic debris from the earliest Magdalenian levels of El Mirón Vestibule front area, Square J2.

Debris[0] types/levels	18 top[1]	18 base[2]	19	20	21
1 Non-cortical trimming flake	555	111	494	508	395
2 Cortical trimming flake	3	5	9	1	19
3 Non-cortical shatter	251	6	81	25	51
4 Cortical shatter	67	34	157	27	8
5 Plain flake	102	4	40	38	51
6 Primary decortication flake	11	18	7	2	7
7 Secondary decortication flake	40	3	27	22	30
8 Whole or proximal blade	6	1	2	2	1
9 Mesial or distal blade	2		2	3	1
10 Whole or proximal Primary decortication blade	1		2		
11 Secondary decortication blade	1		2		
12 Medial or distal decortication blade	1				
13 Whole bladelet	26	3	1	2	18
14 Bladelet fragment	10	2	11		4
15 Whole cortical bladelet	1	5		1	
16 Cortical bladelet fragment				1	
17 Burin spall		1		1	1
20 Flake core	17	4	4	6	9
21 Prismatic blade core					4
23 Prismatic bladelet core	1				
24 Pyramidal bladelet core	1				
25 Mixed core	15	2	2	6	12
26 Non-cortical chunk	33	15	20	14	6
27 Cortical chunk	15	3	7	3	5
28 Platform renewal flake	1			2	1
Totals:	1160	217	868	664	623
Manuports & non-flaked Lithics:					
Fire-cracked rock	60	6	10	12	10
Hammerstone				2	3
Plaquette		1			1

[0]Cores+Débitage; [1]Spits 33–34; [2]Spit 35.

osseous artifact from these levels is a very small fragment of flat bone from Level 18 that bears two parallel lines that could be either cut marks from butchery or deliberate engravings.

DISCUSSION AND CONCLUSIONS

Chalcolithic and Bronze Age

The topmost intact levels (1 base, 2 and possibly 3) in the Cabin area are classified on the basis of ceramic vessel shapes and decorations as Early Bronze Age (Vega 2012), although there uncertainly concerning the transition from the Chalcolithic. One interesting difference between the two periods is the increasing size of storage jars. The presence on the surface of the vestibule of sherds from "a truncated, conical, high-keeled form" and "a small, keeled body sherd with *boquique* (chevron) decoration", along with a date of 3560–3360 cal BP on a torch fragment from

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Table 3 Lithic tools from the earliest Magdalenian levels of El Mirón Vestibule front area, Square J2*.

Tool types/levels	18 top	18 base	19	20	21
1 Simple endscraper		1			
2 Atypical endscraper			1	1	1
8 Endscraper on flake		2	1	1	
13 Thick nosed endscraper		1			
15 Nucleiform endscraper (or core)	1	1	1		1
22 Burin-Endscraper		1			
23 Perforator		1			
24 Atypical perforator/bec	3	1			
30 Angle burin on break	1		1		
37 Burin on convex retouched truncation			1		
41 Multiple mixed burin	1				
58 Completely backed blade		1			
60 Piece with straight truncation			1		
61 Piece with oblique truncation		2			
65 Piece with one continuously retouched edge	1	1	1	2	1
66 Piece with two continuously retouched edges	1				
74 Notched piece	6	1	2	3	1
75 Denticulated piece	6	1	4	4	4
76 Splintered piece (or bipolar core)	4	2	1		2
77 Sidescraper	2				1
78 Raclette	1				
83 Circle segment	1				
85 Backed bladelet	7	3	3	1	3
86 Truncated backed bladelet	1				
88 Denticulated bladelet	2	1			
89 Notched bladelet			1		
90 Retouched bladelet	1	1		1	
Totals	39	21	18	13	14

*Typology of D.de Sonneville-Bordes & J. Perrot.

the test trench in the inner cave suggest that the cave was also visited during the Middle-Late Bronze Age (Vega 2012:387, 392). Level 1/2 yielded a possibly unifacial lithic point fragment and Level 3 a foliate point fragment. Level 3 also produced a bi-pointed copper awl of a type common in both Chalcolithic and Early Bronze Age cave and dolmen sites in and around the Spanish and French Basque Country (Straus et al. 2012). The sole date from Level 3—4160–3900 cal BP (GX-25851) is only slightly older than the date on the human mandible reported here and attributed to the Early Bronze Age. This makes sense, as Level 3 is believed to have been deposited right around the time of the transition from the Chalcolithic. The modeled age for Level 3 is 4250–3720 cal BP (Hopkins et al. 2021: Table 4).

Levels 4–7 in the vestibule are attributed to the Chalcolithic ("Eneolithic") on the basis of ceramic types—mainly small jars and bowls, with little, simple [incised or cord] or no decoration—(Vega 2012) and the presence of foliate and stemmed lithic arrowheads (Straus et al. 2012). The three dates from the rich occupation layers (5, 5.1, and 7) in the vestibule are

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Table 4 Lithic raw materials of tools from the earliest Magdalenian levels of El Mirón vestibule front area, Square J2.

Lithic types:	Flints				Mudstone				Limestone				Quartzite				Quartz				Sandstone			
Levels:	18	19	20	21	18	19	20	21	18	19	20	21	18	19	20	21	18	19	20	21	18	19	20	21
Endscraper	5	3	2	1												1								
Burin-Borer	1																							
Perforator	3																							
Burin	4	2																						
Backed piece	1																							
Truncated pc.	1	1																						
Continuously ret.pc.[1]	1	2	1																					
Notched pc.	3	2					1	1						2		1							1	
Denticulate	3	3	1			1		1						2		1								
Splintered pc.	5	1		1								1												
Sidescraper								1					1											
Raclette	1																							
Circle segment	1																							
Backed bladelet	10	3	1	3																				
D/N bldelet[2]	3	1																						
Ret.bladelet	1		1																					
Ret.tool totals	43	18	4	5	1		1	3				1	5		3								1	
Core	15	2	5	7	2	2		4			1	2	13	2	4	3	1		1	9		2	1	
Hammer		1						1														1	3	
Plaquette																					1			

[1]Continuously retouched piece.
[2]Denticulated or notched bladelet.

4860–3580, 4830–4450, and 4310–3720 cal BP (GX-22127, 22130, 24460). The fact that they are not in strict stratigraphic order is not surprising given the many large pits that dot the Chalcolithic (as well as the Neolithic and Bronze Age) levels (Straus and González Morales 2012b). The range of modeled ages for Chalcolithic Levels 4–7 is 5200–4020 cal BP (Hopkins et al. 2021).

Despite the mixed character of the sediments where these human remains were recovered (and possibly their anatomical disconnection during the course of removal of the surficial fill), the skeletal profile representation of both individuals suggests that they were primarily buried at the rear of the vestibule and later disturbed in modern times (González-Rabanal 2022). The upshot of the dating of human remains from mixed, surficial deposits at the rear of the El Mirón Cave vestibule is that, while the ample, sunlit outer area was used for intensive human habitation and livestock stabling, the darker rear area was apparently used for primary human burials during the same Chalcolithic and Early Bronze Age periods. Whether the vestibule interior was also used for other purposes cannot be determined because those gently up-sloping topmost layers seem to have been removed to create the recent goat corral in that area and the surficial sediments thoroughly mixed to contain artifacts ranging from modern to the Upper Magdalenian. The combination of funerary and occupational use of a cave in these periods is relatively uncommon, as caves, especially narrow ones, seem to have mostly been used for burial in this region. However, burials have been also identified in a few larger caves used mainly as habitation sites, such as Kobaederra in Vizcaya (Armendáriz 1990).

Pre-Harpoon Magdalenian

There is little reason to question the new date for Level 106, as the only other (very recent) date for this level was discounted by Hopkins et al. (2021) because it was run on bulk carbonized bone samples taken from several squares in the U and V rows. It seems likely to be of Middle Magdalenian age at around 18,000 cal BP.

Leaving aside dates not from square V8 and its immediately adjacent squares (i.e., the place where the Corral levels were originally defined and are very clearly stratified) and discounting a relatively old conventional date on a bulk bone sample from V8 (per Hopkins et al. 2021), the new date from Level 108 is around 4000 years older than the only other technically credible AMS date from V8 which has a 2-sigma range of 16,800–16,280 cal BP (GX-22703). All told, the five dates for this level from all parts of the Corral excavation area range between 20,515-16,280 cal BP, suggesting significant disturbances—geological, animal and/or anthropogenic. Similar (but far less egregious) dispersion of dates characterizes the 5 assays from underlying Level 110, the 2 from Level 111, the 3 from Level 114 and the 2 from Level 115. Level 116 is more coherently dated, particularly if one excludes the oldest of three AMS results (GX-29439: 21,330–20,820 cal BP), not for any technical reasons, but rather because the dated bone may have actually pertained to underlying Level 117, as it was taken from a pit dug into Level 116. The new date from Level 117 (Initial Magdalenian) coincides well with the other AMS dates: 20,810–20,450 and 20,930–20,620 (GX-25857 and UG-15180), giving an age for the end of this heretofore poorly know cultural period in Cantabrian Spain of around 21–20,000 cal BP. Underlying Level 119 now has 3 AMS dates, all coinciding around the same age (ca. 22–20,500 cal BP). Intervening Level 118 has an extended count conventional ^{14}C date with a large standard deviation that is somewhat younger (19,120–18,280 cal BP). Level 119.2, which is in reality the base of Level 119, has one significantly younger conventional ^{14}C date that was

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discounted by Hopkins et al. (2021) and one AMS date very similar to all the other Level 119 dates (21,440–21,040 cal BP: UG-15181). The deepest layer reached so far in the Cabin area, Level 21, is now convincingly dated to 20,577–20,251 cal BP, a millennium older than the previous, stratigraphically incoherent date from this layer: 19,520–19,200 cal BP (UG-3364r). The new date for Level 21 is very close to the most recent dates for the Solutrean in the Cantabrian region (Straus 2015; Schmidt 2015), in El Mirón itself (Hopkins et al. 2021), and, for example, at the key site of La Riera Cave (Asturias), where a new date places one of the uppermost Solutrean point-bearing layers (Level 14) at 17,300 ± 50 BP (21,011–20,725 cal BP: MAMS-51979) (Posth et al. 2023).

All these dates satisfactorily suggest that the Initial Magdalenian was a rather short cultural phenomenon, but with intensive occupation of El Mirón. The Initial Magdalenian (in the Corral) is distinguished from the Lower Magdalenian by the presence of large, circular-section antler points and the absence of more gracile, quadrangular-section, geometrically engraved antler points, scapulae engraved with striated images of red deer hinds, and (except in Level 117) geometric microliths. In truth, there is little upon which to base the Initial Magdalenian designation to any of the archeological poor layers below extraordinarily rich Level 17 in the Cabin area other than the radiocarbon dates; the lithic tool assemblages are small and lack definitive diagnostic types (and antler points are lacking from the 1 m^2 J2 test pit). There are however hints that at least ca. 19.4 cal ky-old Level 18 might be assignable to the Lower Magdalenian (relatively high percentage of backed and retouched bladelets, several nucleiform "endscrapers" and presence of a geometric microlith, albeit associated with a *raclette*. Underlying Levels 19–21, all older than ca. 20 cal kya, could well pertain to the Initial Magdalenian, but only an enlarged excavation area and bigger samples of artifacts might permit confirmation of this hypothesis. This work has begun in 2023.

Although there is no evidence of water channels, light flow (slope wash), which still occurs today on the eroded face of the colluvial-alluvial ramp after prolonged rains, is likely to have affected the doubly sloping Magdalenian levels in the Corral area at the vestibule rear. Intensive human activity such as pit digging, hearth construction, possible wall-building (see Straus and González Morales, 2007b, 2018b, trampling, scuffing and site cleaning, combined with rodent (*Arvicola* [G. Cuenca, personal communication[2]]) burrowing (labelled 107.1), notably within Level 107 and underlying Level 107.2 (whose sediments are indicative of water ponding), are all likely to have caused considerable disturbance and mixture of bones among the levels in the vestibule rear. None of these levels are separated by sterile layers that would have indicated long periods of non-occupation. The Lower (and Middle) Magdalenian layers constitute a massive palimpsest, so it is perhaps not surprising that there are so many inconsistencies in the radiocarbon record of Levels 116–106. Furthermore, the fall atop Level 110 of the ca. 2.5×1×1 m limestone block from the ceiling would have caused major disturbance to that and several underlying levels. Perhaps, given all these disturbance and mixing factors, the best that can be concluded is that the Lower Magdalenian in the Corral area developed between ca. 20.8–20.4 and ca. 18.8–18.0 k cal BP and that this coincides rather well with the age range for the same cultural period in the Cabin, as modeled by Hopkins et al. (2021: Table 5). There is basically one thick Lower Magdalenian horizon no doubt filling the cave vestibule that has been sampled archeologically in the Burial Area, Corral, Mid-Vestibule

[2]A good example of the effect of possible burrowing is the fact that a *Microtus* bone taken from Level 306 from the Mid-Vestibule Trench (Azilian or Final Magdalenian), stratigraphically coherently AMS-dated on an ungulate bone to 13,610–13,360 cal BP, yielded an AMS age of 16,001–15,736 cal BP—two and a half millennia older than the level in which the bone ended up (Baca et al. 2020).

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and Cabin trenches. While activity areas can be reconstructed around individual hearths within the horizon (see Nakazawa et al. 2009), the strict integrity, identifiable spatial extension, and indeed reality of levels within it may be questionable. In fact, in the Cabin area, without the apparent alternation of more and less quantities of angular limestone spall (*éboulis)* observed in Corral square V8 and to varying degrees to the west and north thereof, most of the Lower Magdalenian horizon was simply called Level 17 (ca. 30 cm thick) and was excavated by apparent "living floors" that were often associated with hearths and that had been formed relatively quickly. This Lower Magdalenian horizon throughout the vestibule is indicative of repeated, long-term, intensive human occupations of El Mirón at various seasons (Marín-Arroyo et al. 2023), probably by a multi-family band (or even several bands at times of socio-economic aggregation), during which many kinds of activities involving construction of hearths, pits, a possible wall and the burial in a pit of a "special" middle-age woman—the "Red Lady" around 18,750 years ago (Straus et al. 2015b). In many respects (age, massiveness, built features, industrial, artistic and faunal contents), it is very similar to the thick, culturally and faunally rich Lower Magdalenian horizons in the caves of El Castillo, Altamira and El Juyo in central Cantabria. The difference is that the El Mirón residential base camp of this period is located in the montane interior of the region—not on or near the Cantabrian coastal plain, which, however, was routinely visited by El Mirón occupants, as attested by marine molluscs, flint from outcrops along the present shore, and the distinctive specular hematite ochre used exclusively in the Magdalenian burial and demonstrated by mass spectrometric analysis to come from a specific source at near the present mouth of the Río Asón (Seva et al. 2019).

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