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The Magdalenian human remains from El Mirón Cave, Cantabria (Spain)

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ABSTRACT

In 2001 and between 2010 and 2013 El Mirón cave in northern Spain yielded a partial human skeleton in a Cantabrian Lower Magdalenian deposit. The skeleton has been directly radiocarbon dated to 15,460 ± 40 BP. The archaeological context suggests that the human remains were deposited at the site as a result of a deliberate burial. Here we present a complete inventory and anthropological study of this individual. The remains belong to a single, middle-aged, robust female individual of ca. 160 cm in height and weighing ca. 60 kg, with good health status. The individual is represented by the mandible, numerous teeth and many postcranial bones, including significant portions of the vertebral column, costal skeleton, hands and feet. The Magdalenian context of El Mirón cave provides additional data on the otherwise poorly known Upper Paleolithic populations of Southwestern Europe.

1. Introduction

The Iberian Peninsula of Southwest (SW) Europe is an important region for the study of the Upper Paleolithic due to the abundance of sites with long and well-dated sequences (Straus, 1995). Despite the abundant archaeological record comprised mainly of cave sites, with many expressions of cave-art, human remains for this cultural period are far rarer (Arsuaga et al., 2001; Straus et al., 2011; Trinkaus et al., 2001, 2011; Zilhão and Trinkaus, 2002) especially when compared to the relative plethora of Upper Paleolithic skeletons found in France, Italy and Central Europe (Holt and Formicola, 2008; Trinkaus and Svoboda, 2006; Trinkaus et al., 2014).

El Mirón cave has revealed a long sequence of Magdalenian plus Azilian (Epimagdalenian) levels that, with its 54 radiocarbon dates, is one of the most complete and thoroughly dated in Iberia (González-Morales and Straus, 2005; Straus and González-Morales, 2012). In the 2001, 2010, 2011 and 2013 excavation seasons, a partial human skeleton was recovered in a highly ritualized context at the southeastern corner of the cave vestibule. The burial was placed in a narrow space between the engraved cave wall and a large block that had fallen from the ceiling soon before the burial and that was subsequently also engraved and stained with red ochre (Straus et al., 2011). A direct radiocarbon assay of the human fibula yielded a date of 15,460 ± 40 BP, placing the interment of this individual in the Lower Cantabrian Magdalenian. The archaeological and zooarchaeological details of this burial are explained at length in Fontes et al. (2015), Geiling and Marín-Arroyo (2015), Marin-Arroyo and Geiling (2015), González-Morales and Straus (2015) and Straus et al. (2015).

The skeleton from El Mirón Cave has been labeled "El Miron 1", there being several unrelated isolated human teeth from other levels – especially Magdalenian ones – in the cave- It takes on

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great significance and interest because it is the only human burial of Magdalenian age yet to be found in the Iberian Peninsula and because it was found in a reliable stratigraphic context and has been directly dated. The only reported Upper Paleolithic burials from Iberia (both Portuguese) are the Gravettian skeleton from Lagar Velho (Zilhão and Trinkaus, 2002) and the Magdalenian human remains from Galeria da Cisterna whose archeological context (including a set of perforated shell beads) suggest that the human remains entered the site as a result of burial practices (Trinkaus et al., 2011).

In this study, we present a complete inventory of the skeletal elements together with a thorough anthropological study, including measurements and comparisons with other skeletons, age at death estimation and sexual determination, stature and body mass estimations and some phylogenetic considerations.

2. Materials and methods

The El Mirón human remains are described using standard paleontological approaches and measurements. The dental crown morphology is scored in part using the Arizona State University Dental Anthropology System (ASUDAS) (Turner et al., 1991). In order to assess the size and proportions of the remains, the dental and postcranial remains are compared, when possible, to European Upper Paleolithic and recent human remains. The fossil sample is divided into "Early Upper Paleolithic" (EUP; mostly Gravettian) and "Late Upper Paleolithic" (LUP; principally Magdalenian) samples, with the division between them being the Last Glacial Maximum at ca. 20 uncal. kya. The comparative data derive from bibliographic sources or the authors' own studies of the original material (Table S1). Since the remains we present here are Magdalenian in age, they fall within the LUP time span. Recent European (or Euroamerican) data are included for the dental and phalangeal metrics; the permanent dental metrics are from Manzi et al. (1997) and the postcranial metrics derive from different sources mentioned in the captions to the tables.

For age-at-death estimation we have mainly relied on dental formation stages as well as consideration of other postcranial parameters such as the fusion of the epiphyses (Krogman and Işcan, 1986; Cardoso and Ríos, 2011). The sexual diagnosis is based on articular dimensions, mainly in the acetabular vertical diameter and glenoid fossa size, plus the size of several bones (carpals, metacarpals, tarsals and metatarsals) and on the use of several formulae proposed by Marino (1995) for the C1 (atlas). Stature has been estimated using regression equations derived from foot bones (Pablos et al., 2013a), since these elements are complete, as well as from estimations of the tibial length. Body mass has been estimated using the acetabular size (Auerbach and Ruff, 2004).

The postcranial metric variables are mainly those defined by Martin and Saller (1957), complemented by a few additional measurements. CT-scanning of all the bones was done using a YXLON Compact (YXLON International X-Ray GmbH, Hamburg, Germany) industrial multi-slice computed-tomography (CT) scanner housed at the University of Burgos, Spain (see Text S1 for details).

3. Inventory

Straus et al. (2011) previously reported the discovery of a mandible (plus loose teeth) and some post-cranial bones found in the 2010 field season. The current, expanded inventory includes no duplicated elements, and the human remains represent a single individual. Although the remains were concentrated in a small space (ca. 2.5 m^2), none were in actual anatomical connection (although a degree of general order in bone position had been maintained; see Geiling and Marín-Arroyo, 2015) and cranial bones (except the mandible) are absent.

The individual is represented by a mandible with eleven *in situ* teeth, one maxillary tooth and fragments of 95 different identifiable postcranial bones (including three sesamoid hallucial bones), plus 13 undetermined fragments. Most of the elements are hand and foot bones, but fragments of vertebrae, ribs, scapula (glenoid fossa), pelvis (acetabulum) and lower leg (tibia, patellae and fibulae) were also found. Samples of three postcranial bones (fragment of fibula and two foot phalanges) and a tooth were taken by S. Pääbo (Max Planck Institute for Evolutionary Anthropology, Leipzig) for ancient DNA and stable isotope analyses and direct AMS ^{14}C dating. The recovered skeletal elements are listed grouped by anatomical region in Table 1 and presented graphically in Fig. 1 (and see also Table S2). The good preservation of hand and foot elements is noteworthy since these are often lost due to transport and/or scavenger activity. The spatial distribution of the remains is compatible with a primary *in situ* burial (see Geiling and Marin-Arroyo, 2015, for detailed discussion).

4. Age-at-death estimation and sex diagnosis

Age-at-death was estimated based on standard skeletal indicators in the dentition and postcranial skeleton. Regarding the dentition, the M_3 is fully erupted and most of the teeth show signs of wear on the occlusal surface. The incisors and lower canine show marked wear, with the incisal edge completely worn away and considerable dentine exposure. The first molar also shows pronounced dentine exposure in the buccal cusps, with most details of the crown surface erased. Wear is less pronounced in the M_2 and the P_4, with point dentine exposure on the buccal cusp tip in the latter. The M_3 shows little wear on any of the cusp tips. Compared with the prehistoric hunter–gatherer sample from the North American site of Libben (Lovejoy, 1985), the degree of dental attrition in the El Mirón individual does not match any of the defined wear stages precisely. Rather, the P_4 is most consistent with stage F (30–35 years), while the M_2 would appear to correspond to stage G (35–40 years) and the wear in the M_1 matches stage H (40–45 years) most closely. Given this wide range of ages, a mid-range estimate of 35–40 years seems to represent a reasonable age-at-death for the El Mirón individual.

Regarding the postcranial skeleton, the developmental status of all preserved bones also corresponds to a fully adult individual. All the secondary ossification centers of the hand and foot bones, scapula, coxal bone, ribs and the annular epiphyses of the L1 are fused which provides a minimum age-at-death of 18 years (Krogman and Işcan, 1986). Although the age of the union of the sternal end of the clavicle is quite variable in modern humans, fusion begins from the 18th to the 25th year and ends between the 27th and 30th years (Krogman and Işcan, 1986; Scheuer and Black, 2000; Webb and Suchey, 1985). In the El Mirón clavicle the sternal epiphysis was completely fused with the clavicular shaft, so this individual was probably above 30 years old, quite compatible with the dental evidence. The acromial end is completely ossified indicating an age over 18–20 years.

For sexual diagnosis we have relied on several bones. The diminutive size and relative gracility of the mandible seems more compatible with a female sex diagnosis. While the location of flexure of the posterior border of the ascending ramus has also been suggested to reflect sexual differences (Loth and Henneberg, 1996; but see Hill, 2000), this region is not preserved in the El Mirón specimen. However the degree of chin development is modest, corresponding to stage 3 in Buikstra and Ubelaker (1994), and is ambiguous for sex determination. Neither of the coxal bones is