



**HAL**  
open science

## The Cro-Magnon Babies: Morphology and Mortuary Implications of the Cro-Magnon Immature Remains

Caroline Partiot, Erik Trinkaus, Christopher J Knüsel, Sébastien Villotte

► **To cite this version:**

Caroline Partiot, Erik Trinkaus, Christopher J Knüsel, Sébastien Villotte. The Cro-Magnon Babies: Morphology and Mortuary Implications of the Cro-Magnon Immature Remains. *Journal of Archaeological Science: Reports*, 2020, 30, pp.102257. 10.1016/j.jasrep.2020.102257 . hal-03004125

**HAL Id: hal-03004125**

**<https://hal.science/hal-03004125>**

Submitted on 13 Nov 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

1 **The Cro-Magnon Babies: Morphology and Mortuary Implications of the Cro-Magnon**  
2 **Immature Remains**

3 Caroline Partiot<sup>1\*</sup>, Erik Trinkaus<sup>2</sup>, Christopher J. Knusel<sup>1</sup>, Sébastien Villotte<sup>1</sup>

4

5 <sup>1</sup> University of Bordeaux, CNRS, PACEA, UMR 5199, F-33615, Pessac, France

6 <sup>2</sup> Department of Anthropology, Washington University, Saint Louis MO 63130, USA

7

8 e-mail addresses: caroline.partiot@gmail.com; trinkaus@wustl.edu; christopher.knusel@u-  
9 bordeaux.fr; sebastien.villotte@u-bordeaux.fr

10

11 \* Corresponding Author: Caroline Partiot (email: caroline.partiot@gmail.com; postal address:  
12 University of Bordeaux, CNRS, PACEA, UMR 5199, Bâtiment B8, Allée Geoffroy Saint  
13 Hilaire, CS 50023 33615 PESSAC CEDEX, France)

14

15 **Abstract**

16 Although the adult skeletons discovered in 1868 at the Cro-Magnon site (Dordogne,  
17 France) have been studied several times, the immature remains known as Cro-Magnon 5 and  
18 exhumed at the same time were only analyzed in detail once, some thirty years ago. Since  
19 then, doubts have persisted concerning, in particular, the minimum number of immature  
20 individuals present in the assemblage. A re-analysis of these immature remains (cranial  
21 fragments and long bone diaphyses) documents the presence of three neonates and one older  
22 infant in the sample. They are morphologically and metrically similar to recent and Late  
23 Pleistocene modern human infants, although the metaphyses of one femur are modestly  
24 unusual. They also document an unusual mortuary age profile at Cro-Magnon, with four  
25 infants, three older adults, and an additional adult, which raises questions about the manner of  
26 selection of individuals deposited in the Cro-Magnon rock-shelter.

27

28 **Keywords:** Gravettian; pair-matching; hunter-gatherers; funerary practices; Upper  
29 Paleolithic; demographic profile; baby burials

30

31 **Abbreviations**<sup>1</sup>

---

<sup>1</sup> 1: WA: weeks of amenorrhea

## 32 1. Introduction

33 Since its discovery in March 1868, the Cro-Magnon rock-shelter (Les Eyzies-de-  
34 Tayac-Sireuil, southwestern France), located on the banks of the Vézère river, acquired  
35 considerable celebrity with the discovery of human remains in association with extinct fauna  
36 and prehistoric artifacts (Lartet, 1868). These remains were long considered to date from the  
37 Aurignacian period (e.g. Broca, 1868; Lartet, 1868; Movius, 1969; Gambier, 1986). New  
38 considerations based on the dating of a pierced *Littorina* shell (Henry-Gambier, 2002), as well  
39 as the re-examination of the ornaments and the Gravettian sequence of the site of Abri Pataud,  
40 located 300 m downstream, indicate that the remains date to the early phase of the Gravettian,  
41 33–31,000 Cal. BP (Henry-Gambier et al., 2013a). This sample represents one of the largest  
42 and best-preserved assemblages of human remains of early modern humans in Europe, and  
43 thus an invaluable record of past human biology and funerary behavior.

44 In the original reports, the skeletal remains were identified as those of four adults and  
45 one neonate (Broca, 1868; Lartet, 1868). The ages and sexes of three of the adults have  
46 recently been re-evaluated: two males and one female, all of them being old or very old  
47 (Gambier et al., 2006; Thibeault and Villotte, 2018). A fragment of cranial vault (Broca,  
48 1868, Vallois and Billy 1965) and a few infra-cranial elements represent a fourth adult  
49 (Villotte et al., in prep).

50 With respect to the immature remains (cranial fragments and long bone diaphyses of  
51 very young individuals), they were long considered to belong to a single neonate (Broca,  
52 1868; Lartet, 1868; Vallois and Billy, 1965), known as Cro-Magnon 5 (CM5). In contrast,  
53 Gambier (1986) identified three or perhaps four immature individuals, two or three of whom  
54 had died during the perinatal period, and one just before the end of the first postnatal year.  
55 However, subsequent publications by the same author mention no more than a single  
56 immature individual (Henry-Gambier, 2008a; b; Henry-Gambier et al., 2013a).

57 In the context of new studies on the adult remains, a re-assessment of the Minimum  
58 Number of Individuals (MNI) and ages at death of these immature remains is now warranted,  
59 as it may have implications for the paleobiology and funerary behaviors of these early modern  
60 humans in Europe. The aim of this paper is therefore: 1) to review the biological  
61 characteristics of the remains of CM5 in order to re-assess the MNI and ages at death of these  
62 remains, 2) to re-associate the remains of individuals, 3) to evaluate their morphological  
63 characteristics, and 4) to highlight the funerary implications of old and very young individuals  
64 at the Abri de Cro-Magnon.

65

66        **2. Materials**

67        **2.1.        *The Cro-Magnon Sample***

68            The CM5 remains are curated at the Musée de l'Homme, Museum d'Histoire naturelle  
69 (MNHN) de Paris, France (inventory number 4252-1868-17-CM). They are represented by 12  
70 bones, including six complete diaphyses, three partial diaphyses and three cranial fragments.  
71 Since all have the same entry (4252-1868-17) in the MNHN database, a number was assigned  
72 to each according to their arrangement in the box (4252-1 to 4252-12). The alphabetic  
73 designations chosen for the some of the infra-cranial bones by Gambier (1986) are provided  
74 below under the designation (G:).

75

76        **2.2.        *Comparative samples***

77        **2.2.1.      *Recent humans***

78            For the metric analyses, the remains were compared to two pooled samples of recent  
79 human neonatal-infant remains, in addition to available Late Pleistocene remains of the very  
80 young.

81            The first recent human comparative sample consists of 116 neonates from three  
82 archaeological collections (Partiot, 2018). Ages at death were estimated between 26 and 48  
83 weeks of amenorrhea (WA) based on the maximum intermetaphyseal lengths of the long  
84 bones, with the method of Fazekas & Kósa (1978) revised by Sellier (cited in Schmitt &  
85 Georges, 2008). This sample includes 54 immature individuals from the 8B-51 Classic Kerma  
86 necropolis from the Nile island of Saï (3380 ± 25 – 3305 ± 30 BP) (Murail et al., 2004;  
87 Maureille et al., 2006), 27 from the medieval (10<sup>th</sup> to 12<sup>th</sup> centuries) French cemetery at  
88 Blandy-les-Tours (Delattre, 2008), and 35 individuals from a French medieval (13<sup>th</sup> to 18<sup>th</sup>  
89 centuries) parish cemetery from Provins (Guillon et al., 2002).

90            The second pooled sample includes remains between birth and approximately 1.5  
91 postnatal years, courtesy of L.W. Cowgill (N = 128) (Cowgill, 2008, 2010). The individual  
92 samples include Point Hope Inuit (Alaska, N = 7), Mistihalj (Serbia, N = 18), Kulubnarti  
93 (Sudan, N = 19), California Amerindians (N = 37), Indian Knoll (Kentucky, N = 19), and  
94 southern Africans (South Africa, N = 28). All except the last of these are archaeological  
95 samples from the earlier Holocene (Indian Knoll) to the Middle Ages (Mistihalj); the southern  
96 African sample is an ethnically mixed 20<sup>th</sup> century indigenous Transvaal sample from the Dart  
97 Collection, University of Witwatersrand with documented ages. Ages-at-death of the  
98 archaeological remains were primarily (ca. 80% overall) based on dental development; for  
99 those lacking associated dentitions, age-at-death assessments were made using within-sample

100 regressions of age on femur length for individuals <3 years of age ( $r^2$ : 0.479 – 0.918, mean:  
101 0.783; Cowgill, 2008, 2010). The concordance between the age-at-death assessments in  
102 Cowgill’s and Partiot’s samples, and in the present study of CM5, is provided by the existing  
103 high correlation between age and both dental mineralization and long bone growth processes  
104 in this age group (Sellier et al., 1997; Liversidge et al., 1998).

105 In addition, for the morphological study and, because the bones of CM5 cannot be  
106 removed from the museum to be compared directly with a large reference sample, two  
107 individuals from the first comparative sample were chosen to permit detailed comparisons  
108 with the remains of CM5. The first, S41, came from the 8B-51 necropolis, with an age-at-  
109 death estimated by the above methods at  $44.4 \pm 1.9$  WA, i.e., ca.1 month after the theoretical  
110 full gestation of 40 WA. The second comparative individual, P276, came from the Provins  
111 collection. Diaphyseal age-at-death was estimated at  $86.4 \pm 3.4$  WA, i.e., ca.11 post-partum  
112 months.

113

#### 114 2.2.2. *Late Pleistocene Remains*

115 In order to provide a Late Pleistocene comparative framework, long bone length and  
116 diaphyseal measurements were included (as available) for Late Pleistocene infant remains.  
117 The Neandertal sample includes remains from Amud, Dederiyeh, La Ferrassie, Kebara, Kiik-  
118 Koba, Mezmaiskaya, Le Moustier, Saint-Césaire, Sesselfelsgrötte, and Shanidar (metric data  
119 from Heim, 1982; Kondo and Dodo, 2002; Rathgeber, 2006; Cowgill et al., 2007; Cowgill,  
120 2008; Colombet, 2012; Trinkaus et al., 2016; Weaver et al., 2016). The Upper Paleolithic  
121 sample is based on pooled earlier and later remains in order to compensate for small sample  
122 sizes and includes remains from Fauroux, Grotte-des-Enfants, Kostenki, Mladeč, Ostuni, Abri  
123 Pataud, Romanelli, and Vado all’Arancio (data from: Gambier, 1986; Fabbri, 1987; Henry-  
124 Gambier, 2001; Trinkaus et al., 2006; Cowgill, 2008; Vacca et al., 2012).

125

### 126 3. Methods

#### 127 3.1. *Metric and Non-metric Data Acquisition*

128 The metric and non-metric studies follow those of Partiot (2018), partly based on the  
129 measurement protocols of Duday and colleagues (1995), Fazekas and Kósa (1978) and  
130 Schutkowksi (1987). Measurements were made with a digital plastic calipers ( $\pm 0.1$  mm), and  
131 with a tape measure for diaphyseal circumferences (Appendix A).

132

#### 133 3.2. *Cro-Magnon Age-at-Death Assessment*

134 In the absence of dental remains, bone growth and maturation were considered to  
135 assess stature and age-at-death estimates. Data on chrono-geographical variation in stature at  
136 birth are rare (Leary et al., 2006), although the specimens <3 months of age from Cowgill  
137 (2008) are significantly different (Kruskal-Wallis  $p = 0.011$ ,  $n = 34$ ) in femur length across  
138 the six recent human samples. Yet, given maternal morphological constraints and the  
139 similarity of Gravettian and recent human female pelvic dimensions (Verneau, 1906;  
140 Matiegka, 1938; Vacca et al., 2012; Chevalier et al., 2016), it is unlikely, however, that the  
141 size of Gravettian newborns differed substantially from those of recent individuals. When  
142 preservation conditions permitted, age-at-death estimations were made in WA based on the  
143 estimated stature from the maximum length of long bones (mean age estimate and 95%  
144 confidence interval). The method of Fazekas and Kósa (1978) revised by Sellier (cited in  
145 Schmitt and Georges, 2008) was chosen for three reasons. First, the formulae were developed  
146 for various long bones, including those preserved for CM5. Second, they can be applied to  
147 individuals from the fetal stage up to four years of age (Sellier et al., 1997). Third, they  
148 provide confidence intervals. When the maximum length of a long bone was not preserved,  
149 age-at-death was estimated by comparing the general size and maturation stage of the element  
150 with data from the literature (Cunningham et al., 2016) and by comparison with the skeletal  
151 elements of the two comparative individuals, S41 and P276.

152 With regard to the live-birth of individuals, it is difficult to determine if an individual  
153 was stillborn without identifying the neonatal line (Rushton, 1933; Schour, 1936), or by  
154 identifying breastfeeding with isotopic analysis on children over three months of age  
155 (Herrscher, 2013), neither of which can be applied to the Cro-Magnon immature sample.  
156 Therefore, it is only possible to infer this information from the age-at-death and stature  
157 estimates.

158

### 159 ***3.3. Re-assessment of the Minimum Number of Individuals (MNI)***

160 Two types of bone re-associations (“liaisons ostéologiques de second ordre” of Duday,  
161 1987) were macroscopically investigated, the first being the association between bilateral  
162 pairs of bones from the same anatomical region (e.g. femur-tibia or left tibia-right tibia), and  
163 the second being between bones from different anatomical regions (e.g. vault fragment-lower  
164 limb diaphysis). However, this approach is limited by the stage of maturation of the bones and  
165 the absence of developed epiphyses, and it was thus not possible to rely on articular  
166 congruence, as would be possible for adults. Moreover, perinates may differ in their body  
167 proportions during fetal and postnatal life (for example, the lengths of the distal as compared

168 to the proximal limb bones), depending on age-at-death and chrono-geographical origins  
169 (Schultz, 1923; Warren, 1997; Cowgill, 2012). Although a variability of relative bone  
170 proportions could be a limitation to the re-association between the bones of Cro-Magnon 5,  
171 data on these variations are, however, rare, and could not be considered for this study.

172 Therefore, associations were based on two criteria: the first being the age-at-death  
173 estimation or overall dimensions of the remains, and, secondly, the morphological similarities  
174 between bilateral bones. Staining was not considered as a criterion, as all bones are more or  
175 less covered by red ochre. The probability of association between the bones were assessed  
176 two-by-two for each of these criteria according to the system of Thibeault and Villotte (2018),  
177 with modifications to adapt it to immature individuals:

- 178 1) Impossible association: overlap between bones or preserved zones of bones from the same  
179 side, or complete incompatibility of the estimated ages at death.
- 180 2) Unlikely association: doubtful association because, even if the individuals from whom the  
181 bones originated are from the same age group (e.g. children who died during the  
182 perinatal period), one is slightly older than the other based on the comparison of the  
183 remains with those of the two comparative individuals.
- 184 3) Possible association: bones are not overlapping, and the age-at-death estimations are  
185 compatible (the remains belong to individuals from the same age group, without it  
186 being possible to provide greater precision).
- 187- 4) Probable association: the dimensions of the bones are highly compatible.

188 The probability of association between the bones two-by-two was then evaluated through a  
189 synthesis of all criteria.

190

### 191 ***3.4. Anthropometric Analysis***

192 Metric comparisons with the comparative sample were limited by the preservation of  
193 the remains and, particularly, by taphonomic damage of the metaphyses. The metric  
194 comparisons therefore consist of assessments of diaphyseal hypertrophy (robustness) and  
195 midshaft proportions. The latter employs sub-periosteal diameters. The former comparisons  
196 plotted midshaft polar moment of area against intermetaphyseal length; the polar moments of  
197 area were computed by modeling the diaphyses as solid beams from the shaft diameters using  
198 standard ellipse formulae (O'Neill and Ruff, 2004).

199

### 200 ***3.5. Sex determination***

201           There are few reliable methods for the sex determination of infantile skeletons, and  
202 none of them can be applied to the CM5 remains owing to incompleteness of the required  
203 anatomical parts or the requirements for non-destructive sampling. The method of Braga and  
204 colleagues (2019) is based on cochlear shape and that of Stewart et al. (2017) on tooth enamel  
205 peptides. aDNA could not be considered due to the rarity of the remains and its destructive  
206 requirements (Thibeault and Villotte, 2018).

207

## 208       **4. Results**

### 209       **4.1.       *Preservation***

210           All of the Cro-Magnon immature bones are incomplete, with varying degrees of  
211 erosion and trabecular exposure (especially on the metaphyses) (Figs. 1 to 3). They all show  
212 visible traces of red ochre in varying quantities on the cortical surfaces and within trabeculae.  
213 As with the adult remains, and the evidence for their burial (Lartet, 1868), these infants were  
214 therefore likely to have been buried with or adjacent to the adults.

215

### 216       **4.2.       *Morphological Description***

217           The results are presented by anatomical region. The metric data, ages-at-death and  
218 stature estimates based on maximum length are in Appendices A and B.

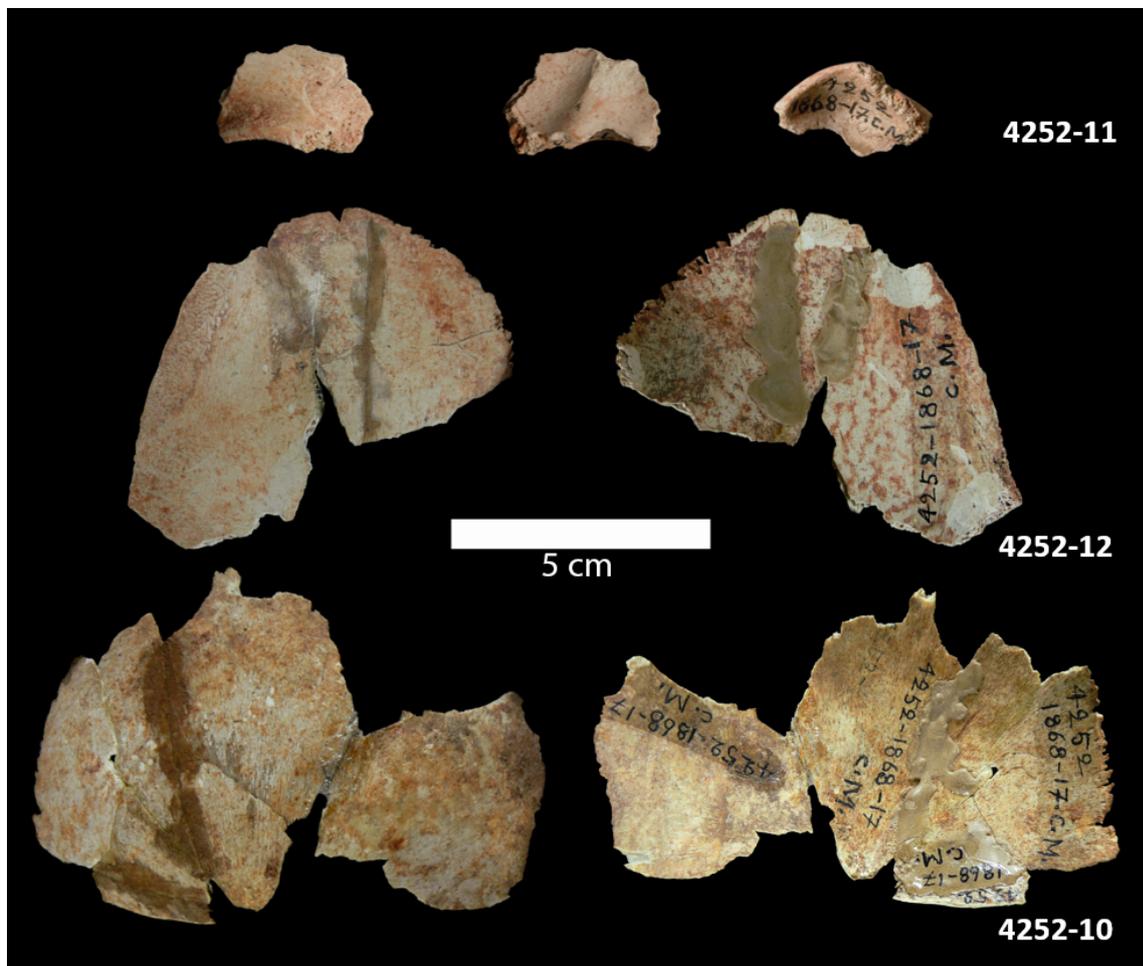
#### 219       **4.2.1.   *Cranial fragments***

220           Cro-Magnon 4252-11 is the infero-lateral part of a left hemi-frontal, including about  
221 half of the supraorbital margin, the zygomatico-frontal suture and part of the orbital roof  
222 (Fig. 1). The orbital roof shows very slight pitting, and there is a marked vascular groove on  
223 the ectocranial surface. Neither a foramen nor a supraorbital notch is visible, although it is  
224 possible that either of these features was located more medial than the preserved part. The  
225 orbital rim is rounded rather than sharply angled and is moderately thick for a very young  
226 child, minimally ca.3.5 mm laterally and 4.4 mm at the fronto-zygomatic suture. The overall  
227 dimensions of the fragment correspond to those of the hemi-frontal of comparative individual  
228 P276.

229           Cro-Magnon 4252-12 is a fragment of the supero-medial part of a left hemi-frontal  
230 (Fig. 1). The bone thickness is consistent with that of individual P276, with both the metopic  
231 and coronal sutures preserved. The endocranial surface preserves part of the sulcus for the  
232 superior sagittal sinus. The inferior portion of the metopic suture is fused and broken, while  
233 the superior part is unfused. The angle between the metopic and coronal sutures shows that  
234 the anterior fontanelle was present. The metopic suture normally fuses completely by 9

235 months of age post-partum (Vu et al., 2001), while the angulation of the superior medial edge  
236 of the hemi-frontal fuses in the first months of the second year of life. These observations  
237 support an age-at-death estimate of just before one post-partum year. The open bregmatic  
238 fontanelle is fully compatible with such an age-at-death estimate (Coqueugniot et al., 2004).  
239 The general dimensions of fragment 4252-12 are also compatible with those of 4252-11, and  
240 they could be portions of the same bone.

241 Cro-Magnon 4252-10 comes from a parietal bone, as indicated by the clear parietal  
242 eminence (Fig. 1). Several criteria indicate that the fragment is oriented antero-posteriorly  
243 (and not supero-inferiorly as Gambier, 1986 had considered). The preserved part of the  
244 slightly crenellated suture corresponds more to the lambdoidal suture than to the sagittal  
245 suture. Similarly, the angle formed by the opposite edge seems to correspond more to that  
246 observed at the coronal suture. The orientation of the growth centres on the ectocranial  
247 surface, as well as the groove of the middle meningeal artery on the endocranial surface,  
248 which is vertically oriented, indicate that the fragment comes from a right parietal. Its  
249 thickness is consistent with an attribution to an individual who died during the perinatal  
250 period.



251 **Figure 1: Cranial fragments of Cro-Magnon 5.** 4252-11: hemi-frontal fragment,  
252 ectocranial, endocranial and orbital views; 4252.12: hemi-frontal fragment, ectocranial and  
253 endocranial views; 4252.10: right parietal fragment, ectocranial and endocranial views.

254

#### 255 4.2.2. *Upper limb remains*

256 The upper limb is represented by two humeral sections, 4252-1 and 4252-8 (Fig. 2).  
257 CM 4252-1 is a largely complete bone lacking the epiphyses and the proximal metaphysis.  
258 The lateral part of the distal metaphysis is broken. In posterior view the right pillar is wider  
259 than the left one, and the right proximal margin is straighter than the slope of the left one,  
260 indicating that it is a right humerus. The distal metaphyseal surface is partially preserved. The  
261 piece does not have any particular characteristics, except for a very marked vascular imprint  
262 on the distal third of the diaphysis anteriorly, supero-lateral to the coronoid fossa. The general  
263 dimensions of the bone are similar to, or very slightly smaller than, those of the right humerus  
264 of comparative individual P276. Therefore, bone 4252-1 belongs to an individual who died  
265 shortly before the end of the first year of post-natal life.

266 The presence of the inter-tubercular sulcus and the slight antero-posterior flattening of  
267 the inferior part of 4252-8 indicates that it is the proximal third of a right humeral diaphysis  
268 (Fig. 2). It shows a nutrient foramen anteriorly, whereas this foramen is usually present on the  
269 medial side, as is the case for comparative individual S41. Based on its general dimensions,  
270 this fragment appears to belong to an individual who died during the perinatal period, but was  
271 slightly older than comparative individual S41.



272  
 273 **Figure 2: Upper limb remains of Cro-Magnon 5, anterior and posterior views. 4252.1:**  
 274 **diaphyseal and distal portion of a right humeral diaphysis; 4252.8: proximal fragment of the**  
 275 **right humeral diaphysis.**

276  
 277 *4.2.3. Lower limb remains*

278 Three femoral diaphyses, Cro-Magnon 4252-9 (G: c), 4252-2 (G: b) and 4252-5 (G:  
 279 d), are present (Fig. 3). CM 4252-9 is the proximal third of a left femoral diaphysis of an  
 280 individual who died during the perinatal period based on its general dimensions, at the same  
 281 age or slightly after the age-at-death estimate of comparative individual S41. The metaphyseal  
 282 region is heavily eroded, although a small part of the surface of the lesser trochanter can still  
 283 be identified. The *linea aspera* is well defined.

284 4252-2 is an almost entirely preserved left femoral diaphysis with slight taphonomic  
 285 alterations of its proximal and distal ends. The *linea aspera* is well defined on the posterior  
 286 surface. The diaphysis has a normal antero-posterior curvature. Based on its maximum length,  
 287 diaphysis 4252-2 derives from an individual who died around  $42.6 \pm 1.8$  WA.

288 The morphology of femur 4252-5 raises more questions, as Gambier (1986) queried its  
 289 identification as a human bone. In agreement with Gambier (1986), there is no non-human  
 290 faunal species to which bone 4252-5 corresponds. The shape of the proximal and distal ends,  
 291 the very partial preservation of the lesser trochanter metaphysis and especially the marked

292 presence of the *linea aspera* indicate that it is indeed a human left femoral diaphysis. It shows  
293 proximal and distal erosion, to which is added alteration of the postero-medial portion of the  
294 distal metaphysis. However, both the proximal and distal ends appear slightly antero-  
295 posteriorly flattened and flared compared to the estimated maximum length, even if this is  
296 difficult to assess metrically due to erosion. The antero-posterior curvature is reduced, but the  
297 distal curvature of the lateral margin is marked. This diaphysis also appears to be slightly  
298 thicker compared to its maximum length. The lesser trochanter is also in a slightly more  
299 lateral position compared to the comparative individual S41. Even if the distal and proximal  
300 alterations prevent a reliable age-at-death estimate from the diaphyseal length, this femoral  
301 diaphysis comes from an individual who died during the perinatal period.

302 Four tibial diaphyses, Cro-Magnon 4252-3 (G: g), 4252-6 (G: e), 4252-4 (G: f) and  
303 4252-7 (G: h), are present (Fig. 3). Two of them, 4252-3 and 4252-6, are left tibiae and two,  
304 4252-4 and 4252-7, are right tibiae. Their antero-posterior curvatures are normal and the  
305 anterior borders are well marked. All belong to individuals who died during the perinatal  
306 period based on size. They have pronounced erosion of their proximal and distal ends. All  
307 diaphyseal age-at-death assessments are therefore low estimations, with the exception of tibia  
308 4252-4, for which a few square millimetres of the proximal metaphyseal surface are  
309 preserved. This makes it possible to assess its age-at-death at  $46.3 \pm 1.9$  WA. The overall  
310 dimensions of tibiae 4252-3 and 4252-4 are slightly larger than those of comparative  
311 individual S41, while those of diaphyses 4252-6 and 4252-7 appear slightly smaller.



312 **Figure 3: Lower limb remains of Cro-Magnon 5 in anterior and posterior views. 4252-9:**  
 313 **proximal fragment of the left femoral diaphysis; 4252-2 and 4252.5: left femoral diaphyses;**

314 4252-3 and 4252-6: left tibial diaphyses; 4252-4 and 4252-7: right tibial diaphyses.

315

316 **4.3. Minimum Number of Individuals (MNI) and Suggested Re-associations**

317 The presence of three left femora belonging to individuals who died during the  
 318 perinatal period, as well as the humeral diaphysis and cranial fragments belonging to at least  
 319 one individual who died late in the first post-natal year, produces an MNI of four.

320 Following the protocol for assessing the probability of bone associations, 32 two-by-two  
 321 associations were considered “impossible”, 14 as “unlikely”, 11 as “possible” and 9 as  
 322 “probable” (Table 1). The association of each bone to one of these individuals is presented in  
 323 Table 2 and the probable associations in Figure 4.

324

325

	2	3	4	5	6	7	8	9	10	11	12
1	I	I	I	I	I	I	I	I	I	PR	PR
2		U	U	I	PR	PR	U	I	PO	I	I
3			PR	U	I	U	PR	PR	PO	I	I
4				U	U	I	PO	PO	PO	I	I
5					U	U	U	I	PO	I	I
6						PR	U	U	PO	I	I
7							U	U	PO	I	I
8								PO	PO	I	I
9									PO	I	I
10										I	I
11											PR

326 Table 1: Re-association probabilities between the remains of Cro-Magnon 5, I: impossible, U:  
 327 unlikely, PO: possible, PR: probable.

328

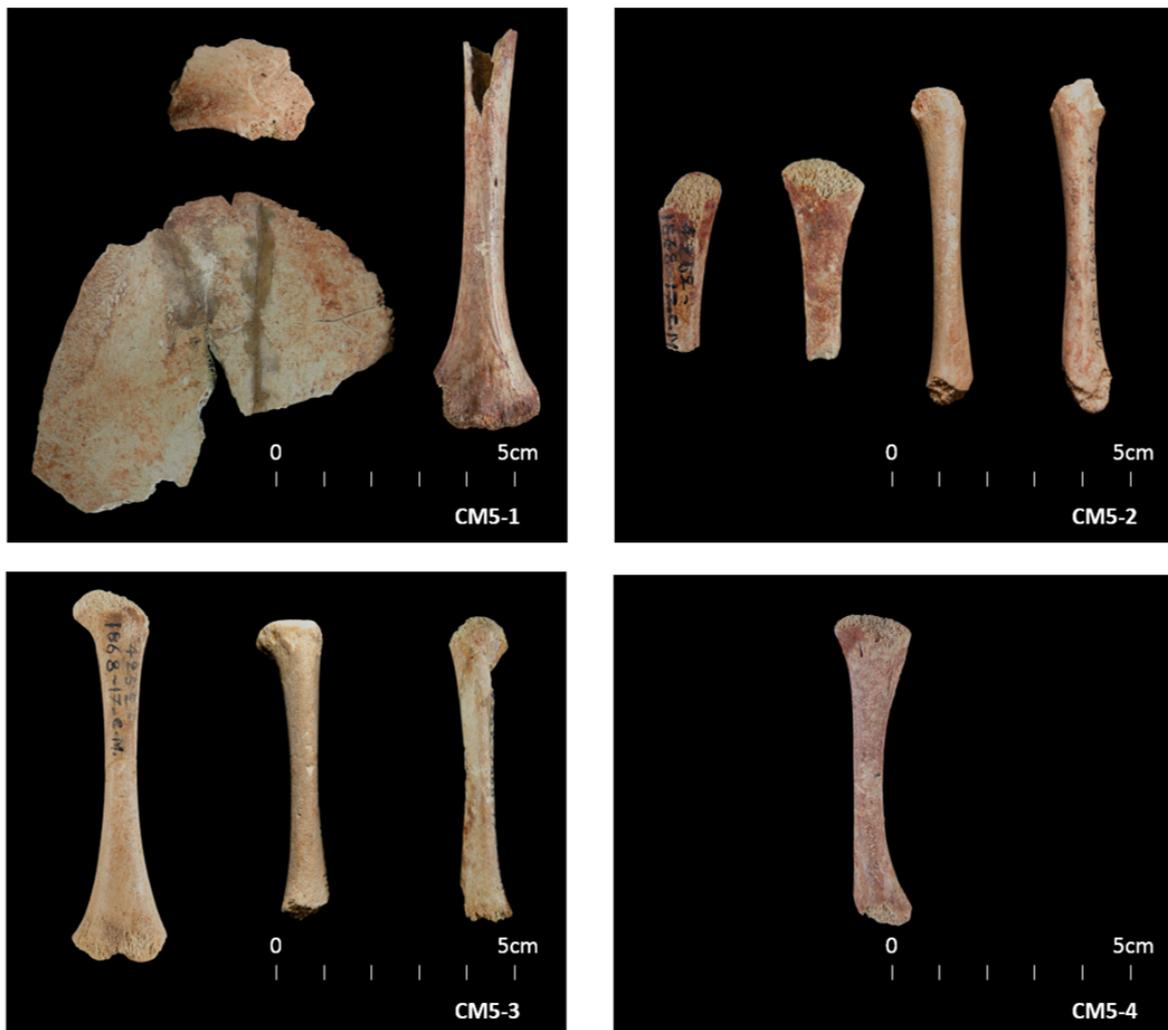
329

Individual	Number	Gambier (1986)	Element	Age at death
Cro-Magnon 5-1	4252-1	/	Right humeral fragment	just under one-year old
	4252-11	/	Hemi-frontal fragment	
	4252-12	/	Hemi-frontal fragment	
Cro-Magnon 5-2	4252-3	g	Left tibial diaphysis	46.3 WA (44.4-48.2 WA)
	4252-4	f	Right tibial diaphysis	

	4252-8	b	Right humeral diaphysis	
	4252-9	c	Left femoral diaphysis	
<b>Cro-Magnon 5-3</b>	4252-6	e	Left tibial diaphysis	42.6 WA (40.8-44.4 WA)
	4252-7	h	Right tibial diaphysis	
	4252-2	b	Left femoral diaphysis	
<b>Cro-Magnon 5-4</b>	4252-5	d	Left femoral diaphysis	Neonate

330 Table 2: Suggested associations between the remains of Cro-Magnon 5 and estimated ages-at-  
331 death with confidence intervals. WA: weeks of amenorrhea (mean; 95% CI).

332



333

334 **Figure 4: Suggested re-associations of the Cro-Magnon immature remains. CM5-1:**

335 4252-1, -11 and -12; CM5-2: 4252-3, -4, -8 and -9; CM5-3: 4252-2, -6 and -7; CM5-4: 4252-

336 5.

337 According to Gambier (1986), one individual is represented by tibiae 4252-4 (G: f)  
338 and 4252-6 (G: e) and femur 4252-2 (G: b), the second by tibiae 4252-3 (G: g) and 4252-7  
339 (G: h) and femur 4252-9 (G: c). These associations appear unlikely because tibia 4252-4 (G:  
340 f) is slightly larger than tibia 4252-6 (G: e), and because tibia 4252-3 (G: g) seems slightly  
341 larger than tibia 4252-7 (G: h). Similarly, femur 4252-9 (G: c) and tibia 4252-4 (G: f) appear  
342 to be slightly larger than the femur and the tibia of the comparative individual S41, whereas  
343 tibia 4252-7 (G: h) and femur 4252-2 (G: b) appear slightly smaller than the ones of S41,  
344 which makes the respective associations between femur 4252-9 (G: c) and tibia 4252-7 (G: h),  
345 and tibia 4252-4 (G: f) and femur 4252-2 (G: b) unlikely.

346 Although relative bone proportions may sometimes vary among populations (Schultz, 1923),  
347 the matching of bones between the upper and the lower limbs, as well as of the proximal and  
348 distal lower limb bones of Cro-Magnon 5, is compatible with the currently available data.

349 Brachial and crural indices are, for example, largely similar for infants across Cowgill's  
350 (2012) samples, except for the low Inuit crural indices, and humero-femoral, brachial, inter-  
351 membral and crural indices do not exhibit population-based differences across Partiot's  
352 (2018) sample. Considering the age-at-death assessments, there is no doubt that the oldest  
353 individual, CM5-1, survived at least several months after birth. There are no available data on  
354 variations in size at birth of Gravettian children by which to assess the three perinatal  
355 individuals. Nevertheless, according to WHO data (2006), the birth length of babies in current  
356 global populations at the 97th percentile ranges between 46.5 and 53 cm for boys, and 45.5  
357 and 52.5 cm for girls. As the length of CM5-2 is estimated at around  $55.5 \pm 1.6$  cm based on  
358 right tibia 4252-4 (cf. Appendix B), it is probable that this individual survived a few days,  
359 maybe even a few weeks after birth, although the large statures for Mid Upper Paleolithic  
360 adults (Trinkaus et al., 2014), including those from Cro-Magnon (Thibeault and Villotte,  
361 2018), may imply that neonates were longer than their modern counterparts. As the length at  
362 birth of CM5-3 is estimated at around  $52.4 \pm 1.6$  cm based on left femur 4252-2 (cf. Appendix  
363 B), it is also possible that this individual survived at least a few days after birth. No  
364 conclusion can be made for CM5-4 because s/he may have been stillborn or died shortly after  
365 birth, even if born prematurely.

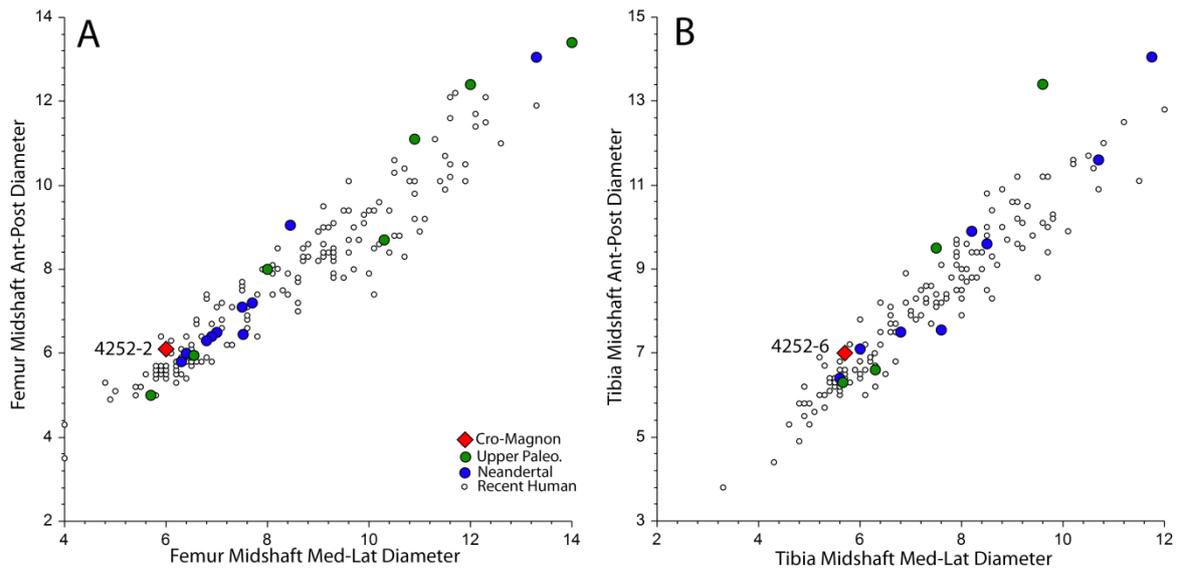
366

#### 367 **4.4. Diaphyseal Comparisons**

368 The comparisons of the midshaft perpendicular diameters for the femora and tibiae  
369 (Fig. 5), place the two most complete Cro-Magnon long bones well within the ranges of  
370 variation of the recent human and Late Pleistocene infant remains. They have relatively large

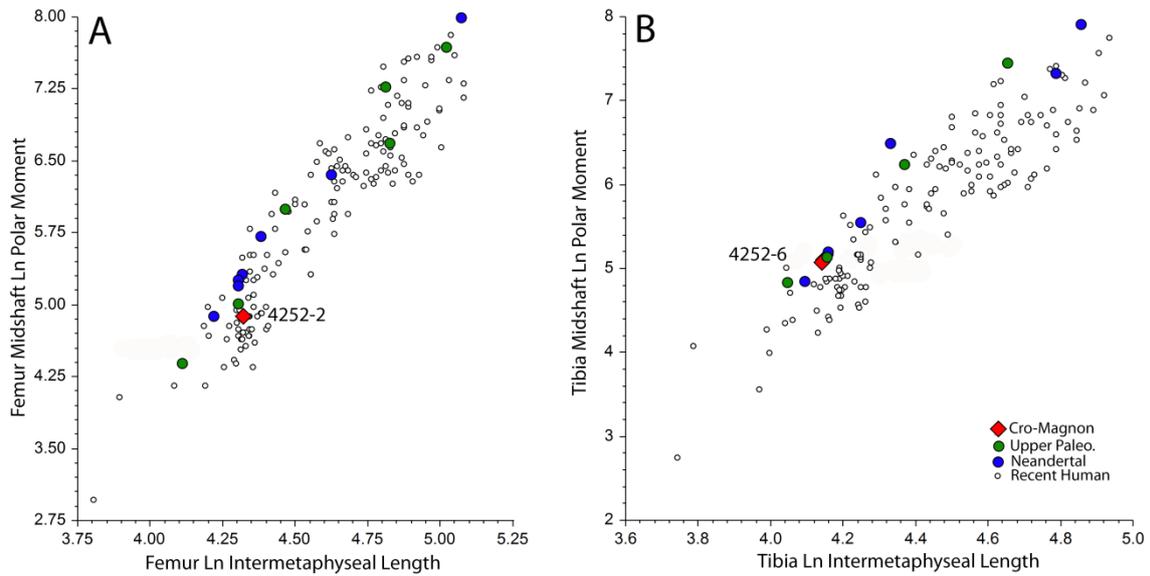
371 antero-posterior diameters but remain unexceptional relative to both those of Late Pleistocene  
372 and recent human infants.

373 The comparison of femoral midshaft polar moments of area versus lengths (Fig. 6)  
374 places all of the Late Pleistocene infant femora (including CM 4252-2) solidly within the  
375 recent human variation. The same pattern holds for the tibiae, although the Late Pleistocene  
376 remains (including CM 4252-6) cluster along the more robust side of the recent human  
377 distribution (Fig. 6).



378  
379

380 **Figure 5. Bivariate plots of perpendicular midshaft sub-periosteal diameters for the**  
381 **femur (A) and tibia (B).** The recent human and Late Pleistocene samples include infants  
382 from late fetal age to ca. 1.5 years postnatal.



383

384 **Figure 6. Bivariate plots of the ln midshaft polar moment of area versus ln**  
 385 **intermetaphyseal length for the femur (A) and tibia (B).**

386

## 387 5. Discussion

### 388 5.1. Morphological considerations

#### 389 5.1.1. Morphometric characteristics

390 The morphological features of all of the Cro-Magnon infantile remains (except 4252-5  
 391 – see below) place them comfortably within the ranges of variation of recent human infants,  
 392 in terms of discrete features and (for the cranial remains) patterns of maturation. Only the  
 393 lateral orbital rim thickness of 4252-11 implies a modestly more robust cranium. The long  
 394 bone midshaft proportions are unexceptional for a Late Pleistocene or recent human infant  
 395 (Fig. 5; Appendix I). The midshaft rigidities of these Cro-Magnon femora and tibiae, relative  
 396 to their intermetaphyseal lengths, are similar to those of both recent humans and other Late  
 397 Pleistocene archaic and early modern humans. As previously noted by Cowgill (2010; see  
 398 also Trinkaus et al., 2016), and *contra* Vlček (1973) and Weaver et al. (2016), there are no  
 399 meaningful differences between these remains with respect to perinatal or infantile femoral or  
 400 tibial hypertrophy.

401

#### 402 5.1.2. The case of the CM 4252-5 femur

403 Although the CM 4252-5 femur is similar to other Late Pleistocene and recent human  
 404 infantile femora in its metric proportions (Appendix I), the alterations of the metaphyses make  
 405 it difficult to draw conclusions about the rest of its characteristics. Features such as the robust

406 appearance and the apparent slight widening of the proximal and distal ends raise questions  
407 regarding its deviation from the normal variability of this age group, or even the existence of  
408 a discrete bone dysplasia.

409 A thicker and shorter diaphysis can be a sign of achondroplastic dwarfism, one of the  
410 most common types of skeletal dysplasia identified in neonates (Lewis, 2017). Its skeletal  
411 manifestations, as in an archaeological case from Brownslade, Wales, UK (Sables, 2008), are  
412 clearly discernible (Harris, 1933; Lewis, 2017). Similarly, the skeletal features of  
413 thanatophoric dwarfism, which usually results in death *in utero*, show an extreme shortening  
414 and broadening of the long bones (Lewis, 2017). Hence, neither of these etiologies is  
415 consistent with the appearance of the CM 4252-5 femur. A flattened femoral head and a more  
416 lateral position of the lesser trochanter are also features of congenital hip dysplasia in children  
417 (Mitchell and Redfern, 2008). However, these criteria are not compatible with the age group  
418 to which CM 4252-5 belongs, as they appear progressively during fusion of the elements  
419 (Lewis, 2017). The youngest archaeological individual for whom this diagnosis has been  
420 proposed has an estimated age-at-death of 6 months post-partum (Mays, 2007). Therefore,  
421 none of the etiologies mentioned appears to be compatible with the morphology of femur  
422 CM4252-5.

423 However, this question remains of interest considering the abundance of  
424 developmental anomalies in the Pleistocene fossil record (Trinkaus, 2018), to the point that  
425 they may indicate a high level of inbreeding (Wu et al., 2013; Ríos et al., 2015; Sparacello et  
426 al., 2018; Trinkaus, 2018). If the individual to whom CM 4252-5 belonged had abnormalities  
427 evident to the social group, as was the case for Cro-Magnon 1 whose skeletal lesions indicate  
428 a systemic and rare disease (Dastugue, 1967; Thillaud, 1985; Charlier et al., 2018; Ruggieri et  
429 al., 2018; Thibeault and Villotte, 2018), this condition may have played an important role in  
430 group behavior towards him/her, and particularly after his/her death. As previously noted  
431 (Oliva, 1996; Formicola 2007; Trinkaus et al., 2014), Gravettian burials contain an unusually  
432 high number of individuals with both developmental and degenerative conditions.

433

## 434 **5.2. Mortuary considerations**

### 435 **5.2.1. Baby burials**

436 In 1986, Gambier concluded that at least three very young individuals were buried at  
437 Cro-Magnon. Her article received little attention and, interestingly, she mentioned only one  
438 immature individual at Cro-Magnon in later publications (Henry-Gambier, 2008a; b; Henry-  
439 Gambier et al., 2013b). The present study confirms that the CM 4252-5 femur cannot be

440 attributed to a non-human faunal species, and that four individuals are present (CM5-1 to  
 441 CM5-4, Fig. 4). CM5-1 died at the end of the first year of life, whereas the others died during  
 442 the perinatal period *sensu lato*.

443 Several of the criteria normally used to confirm intentional deposition of human  
 444 remains permits the identification of the Cro-Magnon rock-shelter as a funerary site (Henry-  
 445 Gambier, 2008a, b). It is nonetheless not possible to know - due to the lack of detailed  
 446 recording during the 1868 excavations (Lartet, 1968) - if the burials were deposited  
 447 simultaneously or successively (Henry-Gambier, 2008a, b).

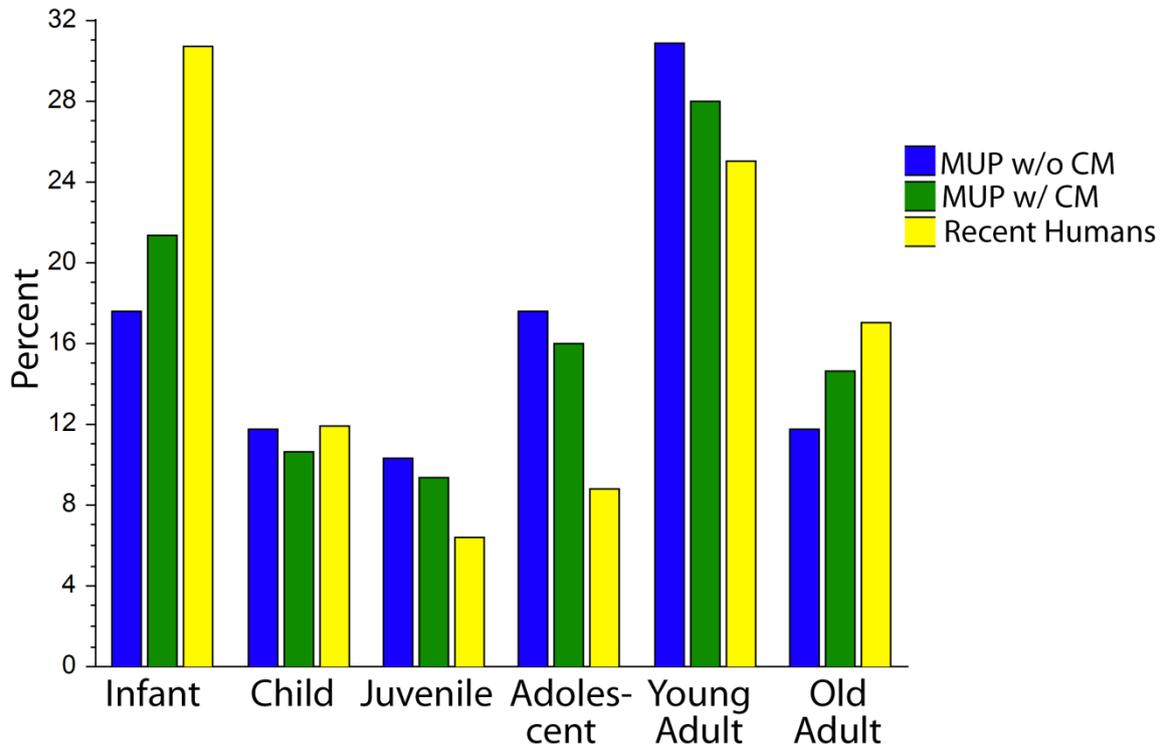
448 Burials of young immature individuals are not unusual in the MUP funerary landscape  
 449 (Table 3, Fig. 7). For instance, two elaborate Gravettian burials, one containing two allegedly  
 450 twin neonates who died between 9 and 10 lunar months, embedded in red ochre and overlaid  
 451 with a mammoth scapula, and one of an infant who died around 3 post-partum months, were  
 452 found at Krems-Wachtberg (Einwögerer et al., 2006), and further east at Mal'ta a young  
 453 infant and a modestly older child were buried with extensive grave goods (Gerasimov, 1935).

454

455

Reference	Country	Site	N	Age-at-death
Henry-Gambier et al., 2013b; Villotte et al., 2015	France	Abri Pataud	3	Two infants who died around 4.5 and 7.5 postnatal months, one child who died between 4 and 7 years of age
Onoratini et al., 1996; Henry-Gambier, 2008b	France	Le Figuier 1	1	One child who died between 2 and 4 years of age
Zilhão and Trinkaus, 2002	Portugal	Lagar Velho	1	An individual who died between 4 and 5 years of age
Einwögerer et al 2006	Austria	Krems-Wachtberg	3	2 neonates and one infant who died around 3 postnatal months
Wilczyński et al., 2016	Poland	Borsuka	1	One child who died between 1 and 2 years of age
Velemínská et al., 2008	Czech Republic	Předmostí	5	Three individuals who died before the age of one year, one between 2 and 3 years of age and one around 4 years of age
Svoboda, 2016; Trinkaus et al., 2000	Czech Republic	Dolní Věstonice	2	Child (DV 4) burial, and possible burial (DV 36) of an infant ≈1 year old
Sinitsyn, 2004; Henry-Gambier, 2008b	Russia	Kostenski	3	One neonate, one child who died between 6-7 years of age and one who died between 9-10 years of age
Gerasimov, 1935; Alexeev, 1998	Russia	Malt'a 1	2	One child who died between 3 and 4 years of age and one infant
Trinkaus et al., 2014	Russia	Sunghir	1	One male ≈10 years old, buried with an early adolescent

456 Table 3: Burials of pre-adolescent immature individuals in the Mid Upper Paleolithic (MUP)  
 457 funerary landscape.



458  
 459 **Figure 7. Percentage age distributions for Gravettian (Mid Upper Paleolithic; MUP)**  
 460 **burials.** MUP sample without the Cro-Magnon remains (n = 68), MUP sample with the Cro-  
 461 Magnon remains (n = 75), and pooled recent human archaeological sample (data from  
 462 Trinkaus, 1995). See Appendices C and D.

463  
 464 As with Krems-Wachtberg and other Gravettian burials of immature individuals  
 465 (Henry-Gambier, 2008b), all of the immature bones from Cro-Magnon exhibit red ochre of  
 466 variable thicknesses on the cortical surface or within the trabeculae. This is true for many  
 467 Cro-Magnon adult bones as well (Henry-Gambier, 2008a; Thibeault and Villotte, 2018). In  
 468 any case, it is evident that the children in Cro-Magnon were treated in a similar way to the  
 469 adults, which is consistent with other Paleolithic sites. These infants therefore had a social  
 470 existence, even if they did not have the same capacity to aid the survival of the group as did  
 471 older children.

472  
 473 *5.2.2. MUP burial age distribution and age selection at Cro-Magnon*

474 In the broader context of Gravettian burials, the burials from Cro-Magnon fill out an  
475 overall mortuary age profile that is unusual, primarily for its dearth of infants and older adults  
476 and its abundance of adolescents and younger adults (Fig. 7). The addition of the four infants  
477 and three older adults from Cro-Magnon to the Gravettian sample reduces the differences  
478 with the expected pattern. The relatively small percentage of infants can be attributed in part  
479 to poor preservation of fragile bones, but the abundance of buried adolescents remains an  
480 anomaly for the Gravettian mortuary age distribution.

481 At the same time, the association of immature and adult individuals in the same  
482 archaeological layers or even in the same burials is not uncommon (i.e., Formicola and  
483 Buzhilova, 2004; Henry-Gambier, 2008b). However, in these cases, the immature individuals  
484 are usually adolescents of more than ten years of age at death (e.g., Barma Grande, Paglicci  
485 and Sunghir (Mezzena and Cesnola, 1989; Formicola, 1990; Trinkaus and Buzhilova, 2018)).  
486 At only three Gravettian sites (Abri Pataud, Dolní Věstonice II and Předmostí) are both adults  
487 and infants known, in each case found with older immature individuals and, for the latter two  
488 cases, with both young and older adults (Svoboda, 2016; Velemínská et al, 2008; Henry-  
489 Gambier et al., 2013b). The demographic profile observed at the Cro-Magnon rock-shelter,  
490 with the association of elderly adults and very young children (under one year of age) thus  
491 appears unusual for the Gravettian, and suggests selective funerary practices, perhaps related  
492 to perceptions of similar levels of vulnerability.

493 The presence of at least one adult, and possibly one infant, displaying visible signs of  
494 disease (Charlier et al., 2018), reinforces this hypothesis, as has been suggested for the burial  
495 of other Gravettian impaired individuals (Oliva, 1996; Formicola, 2007). An additional  
496 intriguing aspect, which could be coincidental, is that the number of children is of the same  
497 order as the number of adults at Cro-Magnon. This aspect, added to the perception of  
498 vulnerability, may provide insight into funerary practices, the full extent of which remains to  
499 be fully understood. Some of the practices documented in the hunter-gatherer ethnographic  
500 record indicate special care given to infants who have not yet acquired autonomy. For  
501 example, in some Native Australian groups, the corpses of deceased infants and very young  
502 children were preserved and carried by the mother until an adult male died and the child could  
503 be buried beside him (Littleton and Allen, 2007). Although it is currently not possible to  
504 substantiate practices of this kind, the hypothesis of a delay between infant death and burial in  
505 MUP populations remains intriguing.

506

## 507 **6. Conclusion**

508 The re-analysis of Cro-Magnon 5 remains confirms Gambier's (1986) conclusions  
509 regarding the MNI of these immature individuals: they include at least four immature  
510 individuals who died before one year of age. The results of the present study place the  
511 remains within the morphological variability of the comparative age group, and most of the  
512 bones fit comfortably within the expected variation of the comparative archaeological  
513 samples. Only the CM 4252-5 femur appears modestly unusual in its metaphyses. Moreover,  
514 this study highlights the unusual nature of the demographic profile of the site in its Gravettian  
515 context. The burial of newborns and infants with adults, most of whom were elderly, adds to  
516 the mortuary variability of the Mid Upper Paleolithic. Whatever the specific interpretations of  
517 this evidence, this study confirms the important contribution of the immature human remains  
518 from the Cro-Magnon rock-shelter, which remains a key site for the study of the paleobiology  
519 and funerary practices of the Upper Paleolithic.

520

## 521 **7. Acknowledgements**

522 The authors thank Veronique Laborde, Aurélie Fort (curators at the Musée de  
523 l'Homme) and Dominique Grimaud-Hervé (in charge of the collection) for granting access to  
524 the remains of CM5. We are grateful to Dominique Henry-Gambier for sharing her  
525 knowledge about the Cro-Magnon site and human remains, to Libby Cowgill for her recent  
526 human comparative metric data, and to Bruno Maureille, Mark Guillon and Valérie Delattre  
527 for granting access to the comparison collections of Saï, Provins and Blandy-les-Tours. We  
528 would also particularly like to thank those who helped us rule out the possibility that any of  
529 the remains of CM5 were, in fact, faunal remains: Cédric Beauval, David Cochard, Bruno  
530 Maureille, Jean-Christophe Castel and Sylvain Renou. We thank Mary Lewis for sharing her  
531 expertise on morphological abnormalities, and we also thank particularly the anonymous  
532 reviewers for providing useful comments on the first draft of the paper. CP also thanks  
533 Alexandre Petel and Vitale Sparacello for their support in the writing of this manuscript, and  
534 Grégory Gay for his support in carrying out the analysis of the comparative sample.

535

## 536 **8. Funding sources**

537 The research is a part of the project Gravett'Os funded by the Agence Nationale de la  
538 Recherche (Grant number: ANR-15-CE33-0004). The collection of recent comparative data  
539 was supported by a doctoral research grant from the Ministère de l'Enseignement et de la  
540 Recherche to the CNRS UMR 5199 PACEA (Pessac, France).

541

542 **9. Declarations of interest**

543 None.

544

545 **10. Data Availability Statements**

546 The recent remains of the comparative sample are preserved at the CNRS UMR 5199 PACEA  
547 (Allée Geoffroy Saint Hilaire, CS 50023 33615 PESSAC CEDEX France). The CM5 remains  
548 are available with authorization of the Museum d'Histoire naturelle de Paris (Musée de  
549 l'Homme, France).

550

551 **11. References**

552 Alekseev, V.P., 1998. The physical specificities of Paleolithic hominids in Siberia. In:  
553 Derev'anko, A.P., Shimkin, D.B., Powers, W.R. (Eds.), *The Paleolithic of Siberia:*  
554 *New Discoveries and Interpretations.*: Institute of Archaeology and Ethnography,  
555 Siberian Division, Russian Academy of Sciences, University of Illinois Press:  
556 Novosibirsk, Urbana, pp. 329–335.

557 Braga, J., Samir, C., Risser, L., Dumoncel, J., Descouens, D., Thackeray, J.F., Balaesque, P.,  
558 Oettlé, A., Loubes, J.M, Fradi, A., 2019. Cochlear shape reveals that the human organ  
559 of hearing is sex-typed from birth. *Sci. Rep.* 9, 10889.

560 Broca, P., 1868. Sur les crânes et ossements des Eyzies. *Bull. Mém. Soc. Anthropol. Paris* 3,  
561 350–392.

562 Charlier, P., Benmoussa, N., Froesch, P., Huynh-Charlier, I., Balzeau, A., 2018. Did Cro-  
563 Magnon 1 have neurofibromatosis type 1? *The Lancet* 391, 1259.

564 Chevalier, T., Mafart, B., Stalens, H., 2016. La ceinture pelvienne de “La Dame de Cavillon”.  
565 In: de Lumley, H. (Ed.), *La Grotte du Cavillon sous la Falaise des Baousse Rousse,*  
566 *Grimaldi, Vintimille, Italie III: Étude Anatomique du Squelette de “la Dame de*  
567 *Cavillon”.* C.N.R.S., Paris. pp. 1159-1171.

568 Coqueugnot, H., Hublin, J.J., Veillon, F., Houët, F., Jacob, T., 2004. Early brain growth in  
569 *Homo erectus* and implications for cognitive ability. *Nature* 431, 299–302.

570 Colombet, P., 2012. Analyse morphologique et métrique des restes des nouveau-nés inédits  
571 du Paléolithique moyen de Saint-Césaire (Charente-Maritime). Unpublished Mémoire de  
572 Master 2, Université de Bordeaux 1.

- 573 Cowgill, L.W., 2008. The ontogeny of Recent and Late Pleistocene human postcranial  
574 robusticity. Ph.D. Thesis, Washington University, Saint Louis, ProQuest Dissertations  
575 Publishing, 2008. 3332080.
- 576 Cowgill, L.W., 2010. The ontogeny of Holocene and Late Pleistocene human postcranial  
577 strength. *Am J Phys Anthropol.* 141, 16–37.
- 578 Cowgill, L.W., 2012. Developmental variation in ecogeographic body proportions. *Am J Phys*  
579 *Anthropol.* 148, 557-570.
- 580 Cowgill, L.W., Trinkaus, E., Zeder, M.A., 2007. Shanidar 10: A Middle Paleolithic immature  
581 distal lower limb from Shanidar Cave, Iraqi Kurdistan. *J. Hum. Evol.* 53, 213–223.
- 582 Cunningham, C., Scheuer, L., Black, S., 2016. *Developmental Juvenile Osteology*, 2nd  
583 edition. Academic Press, San Diego.
- 584 Dastugue, J., 1967. Pathologie des hommes fossiles de l'abri de Cro-Magnon. *L'anthropologie*  
585 71, 479–492.
- 586 Delattre, V., 2008. Les sépultures de nouveau-nés au Moyen-Âge : l'hypothèse d'un  
587 sanctuaire à répit précoce à Blandy-les-Tours (France, Seine-et-Marne). In: Gusi, F.,  
588 Olaria, D.C., Muriel, L.S. (Eds.), *La muerte en la infancia*, Servicio de Investigaciones  
589 Arqueológicas y Prehistoricas de la Diputacion de Castellon y el Laboratorio de  
590 Arqueologia Prehistorica de la Universidad "Jaume I" de Castellon, Castelló, 183–  
591 210.
- 592 Duday, H., 1987. Contribution des observations ostéologiques à la chronologie interne des  
593 sépultures collectives. In: Duday, H., Masset, C., (Eds.) *Anthropologie Physique et*  
594 *Archéologie, Méthodes d'Etude des Sépultures*, pp. 51–61, CNRS, Paris.
- 595 Duday, H., Laubenheimer, F., Tillier, A.M., 1995. Sallèles d'Aude - Nouveau-nés et  
596 nourrissons gallo-romains. Presses Universitaires de Franche-Comté, vol. 144, les  
597 Belles Lettres, Paris.
- 598 Einwögerer, T., Friesinger, H., Händel, M., Neugebauer-Maresch, C., Simon, U., Teschler-  
599 Nicola, M., 2006. Upper Palaeolithic infant burials. *Nature* 444, 285–285.
- 600 Fabbri, F., 1987. Restes humains retrouvés dans la grotte Romanelli (Lecce, Italie): Étude  
601 anthropologique. *Bull. Mém. Soc. Anthropol. Paris* 14, 219–247
- 602 Fazekas, I. G., Kósa, F., 1978. *Forensic Foetal Osteology*. Akadémiai Kiadó, Budapest.
- 603 Formicola, V., 1990. The triplex burial of Barma Grande (Grimaldi, Italy). *Homo* 39, 130–  
604 143.
- 605 Formicola, V., 2007. From the Sunghir children to the Romito Dwarf: Aspects of the Upper  
606 Paleolithic funerary landscape. *Curr. Anthropol.* 48, 446–453.

- 607 Formicola, V., Buzhilova, A.P. 2004. Double child burial from Sunghir (Russia): Pathology  
608 and inferences for upper paleolithic funerary practices. *Am. J. Phys. Anthropol.* 124,  
609 189–198.
- 610 Gambier, D., 1986. Étude des os d'enfants du gisement aurignacien de Cro-Magnon, Les  
611 Eyzies (Dordogne). *Bull. Mém. Soc. Anthropol. Paris* 3, 13–25.
- 612 Gambier, D., Bruzek, J., Schmitt, A., Houët, F., Murail, P., 2006. Révision du sexe et de l'âge  
613 au décès des fossiles de Cro-Magnon (Dordogne, France) à partir de l'os coxal. *C.R.*  
614 *Palevol* 5, 735–741.
- 615 Gerasimov, M.M., 1935. Excavations at the Paleolithic site of Mal'ta, Paleolit SSSR (in  
616 Russian). *Izvestiya Gosudarstvennoy Akademii Material'noy Kul'tury* 118, 78–124.
- 617 Guillon, M., Portat, E., Sellier P., 2002. Provins : une fouille programmée (Seine et Marne).  
618 *Archéopages* 6, 14–26.
- 619 Harris, H.A., 1933. *Bone Growth in Health and Disease: The biological principles underlying*  
620 *the clinical, radiological, and histological diagnosis of perversions of growth and*  
621 *disease in the skeleton.* Oxford University Press, London.
- 622 Heim, J.L., 1982. *Les enfants Néandertaliens de La Ferrassie.* Masson et Cie, Paris.
- 623 Henry-Gambier, D., 2001. *Le Sépulture des Enfants de Grimaldi (Baoussé-Roussé, Italie).*  
624 *Anthropologie et paléthnologie funéraire des populations de la fin du Paléolithique*  
625 *Supérieur.* Éditions du Comité des travaux historiques et scientifiques. Réunion des  
626 *Musées Nationaux, Paris.*
- 627 Henry-Gambier, D., 2002. Les fossiles de Cro-Magnon (Les Eyzies-de-Tayac, Dordogne):  
628 nouvelles données sur leur position chronologique et leur attribution culturelle. *Bull.*  
629 *Mém. Soc. Anthropol. Paris* 14. pp. 89–112.
- 630 Henry-Gambier, D., 2008a. Comportement des populations d'Europe au Gravettien :  
631 pratiques funéraires et interprétations. *Paléo* 20, 399–438.
- 632 Henry-Gambier, D., 2008b. Les sujets juvéniles du Paléolithique supérieur d'Europe à travers  
633 l'analyse des sépultures primaires : L'exemple de la culture gravettienne. In: Gusi, F.,  
634 Olaria, D.C., Muriel, L.S. (Eds.), *La muerte en la infancia, Servicio de Investigaciones*  
635 *Arqueológicas y Prehistoricas de la Diputacion de Castellon y el Laboratorio de*  
636 *Arqueologia Prehistorica de la Universidad "Jaume I" de Castellon, Castelló,* pp. 331–  
637 364.
- 638 Henry-Gambier, D., Nespoulet, R., Chiotti, L., 2013a. An Early Gravettian cultural attribution  
639 for the human fossils from the Cro-Magnon rock sheleter (Les Eyzies-de-Tayac,  
640 Dordogne). *Paléo* 24, 121–138.

- 641 Henry-Gambier, D., Villotte, S., Beauval, C., Brůžek, J., Grimaud-Hervé, D., 2013b. Les  
642 vestiges humains: un assemblage original. In: Nespoulet, R., Chiotti, L., Henry-  
643 Gambier, D. (Eds.), *Le Gravettien final de l'abri Pataud (Dordogne, France). Fouilles*  
644 *et études 2005–2009*, Archaeopress. BAR International Series, Oxford, pp. 135–177  
645 2458.
- 646 Herrscher, E., 2013. Détection isotopique des modalités d'allaitement et de sevrage à partir  
647 des ossements archéologiques. *Cahiers de Nutrition Diététique* 48, 75–85.
- 648 Kondo, O., Dodo, Y., Muhesen, S., Akazawa, T. 2002. The postcranial bones of the  
649 Neanderthal child of burial No. 1. In: Akazawa, T., Muhesan, S. (Eds.), *Neanderthal*  
650 *burials. Excavations of the Dederiyeh Cave, Afrin, Syria*. International Research  
651 Center for Japanese Studies, Kyoto. pp. 139–214.
- 652 Lartet, L., 1868. Une sépulture des troglodytes du Périgord (crânes des Eyzies). *Bull. Mém.*  
653 *Soc. Anthropol. Paris* 3, 335–349.
- 654 Leary, S., Fall, C., Osmond, C., Lovel, H., Campbell, D., Eriksson, J., Forrester, T., Godfrey,  
655 K., Hill, J., Jie, M., Law, C., Newby, R., Robinson, S., Yajnik C., 2006. Geographical  
656 variation in neonatal phenotype. *Acta Obstet. Gynecol. Scand.* 85, 1080–1089.
- 657 Lewis, M.E., 2017. *Paleopathology of children: identification of pathological conditions in*  
658 *the human skeletal remains of non-adults*. Academic Press, London, San Diego,  
659 Cambridge, Oxford.
- 660 Littleton, J., Allen, H., 2007. Hunter-gatherer burials and the creation of persistent places in  
661 southeastern Australia. *J. Anthropol. Archaeol.* 26, 283–298.
- 662 Liversidge, H.M, Herdeg, B., Rösing, F.W., 1998. Dental age estimation of non-adults. a  
663 review of methods and principles. In: Alt K.W., Rösing F.W., Teschler-Nicola M.  
664 (Eds.) *Dental Anthropology*. Springer, Vienna, p. 419–442.
- 665 Lovejoy, C., Meindl, R.S., Pryzbeck, T.R., Barton, T.S., Heiple, K.G., Kottling, D., 1977.  
666 *Paleodemography of the Libben Site, Ottawa County, Ohio*. *Science* 198, 291–293.
- 667 Matiegka J. 1938. *Homo předmostensis. Fossilní člověk z Předmostí na Moravě II. Ostatní*  
668 *Části Kostrové*. Prague: Česká Akademie Věd a Umění.
- 669 Maureille, B., Peressinotto, D., Murail, P., Geus, F., 2006. La nécropole 8B51 de l'île de Saï  
670 (Province du Nord, Soudan). *Archéologie du Nil Moyen* 10, 181–202.
- 671 Mays, S.A., 2007. Spondylolysis in non-adult skeletons excavated from a medieval rural  
672 archaeological site in England. *Int. J. Osteoarchaeol.* 17, 504–513.
- 673 Mezzena, F., Cesnola, A.P.D., 1989. Nuova sepoltura gravettiana nella Grotta Paglicci  
674 (Promontorio del Gargano). *Rivista di Scienze Preistoriche* 42, 3–29.

- 675 Mitchell, P.D., Redfern, R.C., 2008. Diagnostic criteria for developmental dislocation of the  
676 hip in human skeletal remains. *Int. J. Osteoarchaeol.* 18, 61–71.
- 677 Movius, H.L., 1969. The abri of Cro-Magnon, Les Eyzies (Dordogne) and the  
678 probable age of the contained burials on the basis of the evidence of the nearby abri  
679 Pataud, *Anuario Estudios Atlanticos* 15, 323–344.
- 680 Murail, P., Maureille, B., Peressinotto, D., Geus, F., 2004. An infant cemetery of the Classic  
681 Kerma Period (1750-1500 Bc, Island of Saï, Sudan). *Antiquity* 78, 267–277.
- 682 Oliva, M., 1996. Mladopaleolitický hrob Brno II jako příspěvek k počátkům šamanismu.  
683 *Archeologické rozhledy* 48, 537–542.
- 684 O'Neill, M.C, Ruff, C.B., 2004. Estimating human long bone cross-sectional geometric  
685 properties: a comparison of noninvasive methods. *J. Hum. Evol.* 47, 221–235.
- 686 Onoratini, G., Defleur, A., Joris, C., 1996. Mise en évidence du Magdalénien ancien II dans  
687 les gorges de l'Ardèche. *Bull. Soc. Préhis. Fr.* 93, 25–32.
- 688 Owsley, D.W., Bass, W.M., 1979. A demographic analysis of skeletons from the Larson Site  
689 (39WW2). Walworth County, South Dakota: vital statistics. *J. Phys. Anthropol* 51,  
690 145–154.
- 691 Palkovich, A.M., (1981). Demography and disease patterns in a protohistoric Plains group: a  
692 study of the Mobridge Site (39WW1). In: Jantz R.L., Ubelaker, D.H. (Eds.), *Progress*  
693 *in skeletal biology of plains populations. Plains Anthropologist Memoir* 17, 71–84.
- 694 Partiot, C., 2018, Diversité biologique des enfants décédés en période périnatale et traitements  
695 funéraires au Kerma classique - Les exemples de la nécropole 8B-51 (Kerma  
696 classique, Nord Soudan) et des cimetières de Blandy-les Tours (Xe-XIIe siècle,  
697 France) et de Provins (XIIe-XVIIIe siècle, France). Ph.D. Thesis, Université de  
698 Bordeaux, Pessac, {tel-02157918v2}.
- 699 Rathgeber, T., 2006. Fossile Menschenreste aus der Sesselfelsgrötte im unteren Altmühltal  
700 (Bayern, Bundesrepublik Deutschland). *Quärtar* 53, 33–59.
- 701 Ríos, L., Rosas, A., Estalrich, A., García-Taberero, A., Bastir, M., Huguet, R., Pastor, F.,  
702 Sanchís-Gimeno, J.A., de la Rasilla, M., 2015. Possible further evidence of low  
703 genetic diversity in the El Sidrón (Asturias, Spain) Neandertal group: Congenital clefts  
704 of the atlas. *PLoS One.* 10(9), e0136550.
- 705 Rose, J. C., Santeford, L.G., 1985. Burial descriptions. In: Rose, J.C. (Ed.) *Gone to a better*  
706 *land. Arkansas Archeological Survey Research Series* 25, 39–129.
- 707 Ruggieri, M., Praticò, A.D., Catanzaro, S., Palmucci, S., Polizzi, A., 2018. Did Cro-Magnon 1  
708 have neurofibromatosis type 2? *The Lancet* 392, 632–633.

- 709 Rushton, M.A., 1933. On the fine contour lines of the enamel of milk teeth. *Dent. Rec.* 53,  
710 170–171.
- 711 Sables, A., 2008. Rare example of an early medieval dwarf infant from Brownslade, Wales.  
712 *Int. J. Osteoarchaeol.* 20, 47–53.
- 713 Schmitt, A., Georges, P., 2008. Quelle démarche suivre pour estimer l'âge au décès à partir du  
714 squelette? In: Charlier, P. (Dir.), *Pour un manuel pratique de paleopathologie*  
715 humaine, De Boccard, Paris, p. 269–280.
- 716 Schour, I., 1936. The neonatal line in the enamel and dentin of the human deciduous teeth and  
717 first permanent molar. *J. Am. Dent. Assoc.* 23, 1946–1955.
- 718 Schutkowski, H., 1987. Sex determination of fetal neonate skeletons by means of discriminant  
719 analysis. *Int. J. Anthropol.* 2, 347–352.
- 720 Schultz, A.H., 1923. Fetal growth in Man. *Am. J. Phys. Anthropol.* 6, 389–399.
- 721 Sellier, P., Tillier, A.M., Bruzek, J., 1997. À la recherche d'une référence pour l'estimation de  
722 l'âge des fœtus, nouveau-nés et nourrissons. *Anthropologie et Préhistoire* 108, 75–87.
- 723 Sinitsyn, A., 2004. Les sépultures de Kostenki: chronologie, attribution culturelle, rite  
724 funéraire. *Etud. Rech. Archéol. Univ. Liège* 106, 237–244.
- 725 Sparacello, V.S., Rossi, S., Pettitt, P., Roberts, C., Riel-Salvator, J., Formicola, V., 2018. New  
726 insights on Final Epigravettian funerary behavior at Arene Candide Cave (Western  
727 Liguria, Italy). *J. Anthropol. Sci.* 96, 161–184.
- 728 Stewart, N.A., Gerlach, R.F., Gowland, R.L., Gron, K.J., Montgomery, J., 2017. Sex  
729 determination of human remains from peptides in tooth enamel. *Proc. Natl. Acad. Sci.*  
730 114, 13649–13654.
- 731 Storey, R., 1992. *Life and death in the ancient city of Teotihuacan*. University of Alabama  
732 Press, Tuscaloosa, AL.
- 733 Svoboda, J.A., 2016. *Dolní Věstonice-Pavlov*. Academia, Praha.
- 734 Thibeault, A., Villotte, S., 2018. Disentangling Cro-Magnon: A multiproxy approach to  
735 reassociate lower limb skeletal remains and to determine the biological profiles of the  
736 adult individuals. *J. Archaeol. Sci. Rep.* 21, 76–86.
- 737 Thillaud, P.L., 1985. L'Homme de Cro-Magnon et ses maladies. *Dossiers d'Histoire et*  
738 *d'Archéologie Ancienne, Les Dossiers d'Archéologie de Dijon* 97, 67–73.
- 739 Trinkaus, E., 1995. Neanderthal mortality patterns. *J. Archaeol. Sci.* 22, 121–142.
- 740 Trinkaus, E., 2018. An abundance of developmental anomalies and abnormalities in  
741 Pleistocene people. *Proc. Natl. Acad. Sci.* 115, 11941–11946.

- 742 Trinkaus, E., Svoboda, J., West, D.L., Sládek, V., Hillson, S.W., Drozdová, E., Fišáková, M.,  
743 2000. Human remains from the Moravian Gravettian: Morphology and taphonomy of  
744 isolated elements from the Dolní Věstonice II site. *J. Archaeol. Sci.* 27, 1115–1132.
- 745 Trinkaus, E., Smith, F.H., Stockton, T.C., Shackelford, L.L., 2006. The human postcranial  
746 remains from Mladeč. In: Teschler-Nicola, M. (Ed.), *Early Modern Humans at the*  
747 *Moravian Gate: The Mladeč Caves and their Remains.* Springer Verlag, Vienna. pp.  
748 385–445.
- 749 Trinkaus, E., Buzhilova, A.P., Mednikova, M.B., Dobrovolskaya, M.V., 2014. *The People of*  
750 *Sunghir: Burials, Bodies, and Behavior in the Earlier Upper Paleolithic.* Oxford  
751 University Press, New York.
- 752 Trinkaus, E., Mednikova, M.B., Cowgill, L.W., 2016. The appendicular remains of the Kiik-  
753 Koba 2 Neandertal infant. *PaleoAnthropology* 2016, 185–210.
- 754 Trinkaus, E., Buzhilova, A.P., 2018. Diversity and differential disposal of the dead at Sunghir.  
755 *Antiquity* 92, 7–21.
- 756 Ubelaker, D.H., 1980. Human skeletal remains from Site OGSESO. A preceramic site on the  
757 Sta. Elena Peninsula, coastal Ecuador. *J Wash Acad Sci* 70, 3–24.
- 758 Ubelaker, D.H., 1981. The Ayalán Cemetery. A late integration period burial site on the south  
759 coast of Ecuador. *Smithsonian Contributions to Anthropology* 29. Smithsonian  
760 Institution Press, Washington, D.C.
- 761 Vacca, E., Formicola, V., Pesce Delfino, V., Coppola, D., 2012. I resti scheletrici umani delle  
762 sepolture paleolitiche di Grotta Santa Maria d’Agnano – Ostuni (BR). In: Coppola, D.  
763 (Ed.) *Il Riparo di Agnano nel Paleolitico superiore. La sepoltura Ostuni 1 ed I suoi*  
764 *simboli.* Rome: Università di Roma Tor Vergata. pp. 205–364.
- 765 Vallois, H.V., Billy, G., 1965. Nouvelles recherches sur les hommes fossiles de l’Abri de Cro-  
766 Magnon. *L’Anthropologie* 69, 249–272.
- 767 Velemínská, J, Brůžek, J, Velemínský, P., 2008. The Human Finds from Předmostí:  
768 Documentation and Catalogue of the Glass Plate Negative. In: Velemínská J, Brůžek  
769 J, editors. *Early Modern Humans from Predmosti near Prerov, Czech Republic: A new*  
770 *reading of old documentation.* Academia, Prague. p 45–58.
- 771 Verneau R. 1906. *Les Grottes de Grimaldi (Baoussé-Roussé), Tome II – Fascicule I.*  
772 *Anthropologie.* Monaco: Imprimerie de Monaco.
- 773 Villotte, S., Chiotti, L., Nespoulet, R., Henry-Gambier, D., 2015. Étude anthropologique des  
774 vestiges humains récemment découverts issus de la couche 2 de l’abri Pataud (Les  
775 Eyzies-de-Tayac-Sireuil, Dordogne, France). *Bull. Mém. Soc. Anthropol. Paris* 27,  
776 158–188.

- 777 Vlček, E., 1973. Postcranial skeleton of a Neandertal child from Kiik-Koba, U.S.S.R. *J. Hum.*  
778 *Evol.* 2, 537–544.
- 779 Vu, H.L., Panchal, J., Parker, E.E., Levine, N.S., Francel, P., 2001. The timing of physiologic  
780 closure of the metopic suture: A review of 159 patients using reconstructed 3D CT  
781 Scans of the craniofacial region: *J. Craniofac. Surg.* 12, 527–532.
- 782 Warren, M.W., 1997. Prenatal limb growth in Humans: linear growth, allometry, locomotion,  
783 and skeletal age (gestational age, growth and development, radiography. PhD thesis,  
784 University of Florida, Gainesville. . <https://ufdc.ufl.edu/AA00022858/00001/1j>.
- 785 Weaver, T.D., Coqueugniot, H., Golovanova, L.V., Doronichev, V.B., Maureille, B., Hublin,  
786 J.J., 2016. Neonatal postcrania from Mezmaiskaya, Russia, and Le Moustier, France,  
787 and the development of Neandertal body form. *Proc.Natl. Acad. Sci.* 113, 6472–6477.
- 788 WHO. 2006. Multicentre Growth Reference Study Group. WHO Child Growth Standards:  
789 Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body  
790 mass index-for-age: Methods and development. Geneva, World Health Organization.
- 791 Wilczyński, J., Szczepanek, A., Wojtal, P., Diakowski, M., Wojenka, M., Sobieraj D., 2016.  
792 A Mid Upper Palaeolithic child burial from Borsuka Cave (Southern Poland). *Int. J.*  
793 *Osteoarchaeol* 26, 151-162.
- 794 Wu, X.-J., Xing, S., Trinkaus, E., 2013. An enlarged parietal foramen in the late archaic  
795 Xujiayao 11 neurocranium from Northern China, and rare anomalies among  
796 Pleistocene Homo. *PLoS One* 8, e59587.
- 797 Zilhão, J., Trinkaus, E., 2002. Portrait of the Artist as a Child. The Gravettian Human  
798 Skeleton from the Abrigo do Lagar Velho and its Archeological Context. *Trabalhos de*  
799 *Arqueologia* 22. Lisboa, Instituto Português de Arqueologia.
- 800

801 **Appendix A.** Metric data of the remains of Cro-Magnon 5 (CM5) and of the comparative  
 802 individuals (CI) P276 and S41. no: not observable; (x): data acquired on a slightly eroded  
 803 bone. For each element, the probable Cro-Magnon 5 associated “individual” is provided (see  
 804 Table 2).

805

Measurements of humeri	Bones of CM5		CI	
	4252-1	4252-8	P276	S41
Probable CM5 individual	5-1 Rt	5-2 Rt		
Maximum diameter at midshaft	(8.9)	(6.7)	10.7	5.2
Minimum diameter at midshaft	(8.1)	(5.5)	9.4	4.2
Width of the olecranon fossa	(14.8)	no	13.7	9.5

806

Measurements of femora	Bones of CM5			CI
	4252-9	4252-2	4252-5	S41
Probable CM5 individual	5-2 Lt	5-3 Lt	5-4 Lt	
Maximum intermetaphyseal length	no	(75.3)	(62.5)	77.8
Perimeter at midshaft	no	21.0	(18.0)	17.0
Antero-posterior diameter at midshaft	(6.3)	6.1	5.1	5.2
Transverse diameter at midshaft	(7.0)	6.6	6.0	5.4
Maximum proximal diameter	(17.1)	(17.1)	15.3)	17.7
Proximal diameter perpendicular to the maximum proximal diameter	(10.8)	(12.5)	(8.6)	11.9
Transverse distal diameter	no	(19.6)	(12.2)	21.2
Antero-posterior distal diameter	no	(9.4)	(8.7)	12.3
Length between proximal end and nutrient foramen	no	(33.0)	no	38.7

807

Measurements of tibiae	Bones of CM5				CI
	4252-3	4252-6	4252-4	4252-7	S41
Probable CM5 individual	5-2 Lt	5-3 Lt	5-2 Rt	5-3 Rt	
Maximum intermetaphyseal length	(67.8)	(62.9)	(71.2)	(63.2)	68.8
Perimeter at midshaft	(19.5)	(20.0)	(20.5)	(21.0)	19.0
Antero-posterior diameter at midshaft	7.0	(7.0)	(6.9)	(6.9)	6.7
Transverse diameter at midshaft	5.8	(5.7)	(6.4)	(5.9)	5.3
Antero-posterior diameter at nutrient foramen	8.2	8.2	(8.3)	no	7.3
Transverse diameter at nutrient foramen	7.2	6.7	7.3	no	6.0
Maximum proximal diameter	no	(13.9)	no	no	14.8
Sagittal proximal diameter	no	(11.3)	no	no	11.8
Length between the proximal end and the nutrient foramen	(20.0)	(19.4)	(22.0)	no	22.5

808

809

810

811 **Appendix B.** Ages-at-death and stature assessments with confidence intervals of the  
 812 individuals of Cro-Magnon 5 and of the comparative individuals S41 and P276 based on the  
 813 method of Fazekas and Kosa (1978) revised by Sellier (Schmitt and Georges, 2008). R: right  
 814 side; L: left side.

	N	Bone	Side	Probable association	Reliability of the assessment	Length (mm)	Stature at death (cm)	Age at death (lunar months)	Age at death (weeks of amenorrhea)
Cro-Magnon 5	4252-2	Femoral diaphysis	L	CM5-3	Reliable assessment	75.3	52.4 (50.8-53.9)	10.6 (10.2-11.1)	42.6 (40.8-44.4)
	4252-4	Tibial diaphysis	R	CM5-2	Reliable assessment	71.1	55.5 (54-57.1)	11.6 (11.1-12.1)	46.3 (44.4-48.2)
	4252-3	Tibial diaphysis	L	CM5-2	Underestimated assessment	68	53.4 (51.8-54.9)	10.9 (10.5-11.4)	43.7 (41.9-45.5)
	4252-5	Femoral diaphysis	L	CM5-4	Very underestimated assessment	62.5	44.4 (42.8-46)	8.6 (8.3-9)	34.5 (33.1-36)
	4252-6	Tibial diaphysis	L	CM5-3	Very low assessment	62.9	49.8 (48.2-51.3)	9.9 (9.5-10.4)	39.7 (38.1-41.4)
comparative individuals	S41	Femoral diaphysis	L	/	Reliable assessment	77.8	53.9 (52.4-55.5)	11.1 (10.6-11.6)	44.4 (42.5-46.2)
	P276	Humeral diaphysis	R	/	Reliable assessment	105.2	80.8 (79.3-82.3)	21.6 (20.8-22.5)	86.4 (83.1-89.8)

815

816

817

818

819

820

821

822 **Appendix C.** The distribution of Gravettian/Mid Upper Paleolithic burials by age interval.

823

	<b>Infant</b>	<b>Child</b>	<b>Juvenile</b>	<b>Adolescent</b>	<b>Young Adult</b>	<b>Older Adult</b>
<b>Age range (yrs)</b>	0-1	2-5	6-11	12-18	20-40	40+
<i>Cro-Magnon</i>	<b>4</b>					<b>3</b>
<b>Arene Candide</b>				1		
<b>Baouso da Torre</b>				1	2	
<b>Barma Grande</b>				2	2	
<b>Borsuka</b>	1					
<b>Brno-Francoušká</b>						1
<b>Caviglione</b>					1	
<b>Dolní Věstonice</b>	1	1		1	3	1
<b>Le Figuiér</b>		1				
<b>Grotte des Enfants</b>				1	1	1
<b>Kostenki</b>	1		2	1		
<b>Krems-Wachtburg</b>	3					
<b>Lagar Velho</b>		1				
<b>Mal'ta</b>	1	1				
<b>Mittlere Klause</b>					1	
<b>Ostuni<sup>1</sup></b>				1	1	
<b>Paglicci</b>		1		2	2	
<b>Pataud</b>	2	1			1	
<b>Paviland</b>					1	
<b>Pavlov</b>					1	
<b>Předmostí</b>	3	2	4	1	5	1
<b>Sunghir</b>			1	1		2
<b>Veneri-Parabita</b>						2
<b>Totals</b>	<b>12</b>	<b>8</b>	<b>7</b>	<b>12</b>	<b>21</b>	<b>8</b>
<b>Totals w/ Cro-Magnon</b>	<b>16</b>	<b>8</b>	<b>7</b>	<b>12</b>	<b>21</b>	<b>11</b>

824

825 <sup>1</sup> Not included is the Ostuni 1b third trimester fetus, found within the abdominal area of Ostuni 1.

826

827

828 **Appendix 4.** The recent human comparative paleodemographic data. The recent human  
 829 distribution is the average of the age interval percentages for eight archaeological samples,  
 830 aged by the same general techniques as the Gravettian remains. They provide a general  
 831 reference for the Gravettian distribution. Details are tabulated in Trinkaus (1995). The  
 832 percentages are:

833

	<b>Infant</b>	<b>Child</b>	<b>Juven- ile</b>	<b>Adoles -cent</b>	<b>Young Adult</b>	<b>Older Adult</b>	<b>n</b>	<b>reference</b>
<b>Libben</b>	17.5	13.2	9.1	14.4	31.8	14.0	1289	Lovejoy et al., 1977
<b>MO-1</b>	50.8	12.4	5.6	4.0	15.3	11.9	177	Palkovich, 1981
<b>MO-2</b>	29.7	12.0	6.4	12.4	20.9	18.5	249	Owsley and Bass, 1979
<b>Larson</b>	40.9	15.1	7.7	7.2	19.5	9.5	621	Owsley and Bass, 1979
<b>Ayalán</b>	25.0	13.3	4.7	6.5	26.0	24.5	384	Ubelaker, 1981
<b>OGSE-80</b>	14.6	9.9	6.8	5.2	39.1	24.5	192	Ubelaker, 1980
<b>Teotihuaca n</b>	39.3	5.3	4.9	12.1	23.8	14.6	206	Storey, 1992
<b>Cedar Grove</b>	27.8	13.9	6.3	8.9	24.1	19.0	79	Rose and Santeford, 1985

834

835

836

837

## **Credit Author Statement**

**Caroline Partiot:** Conceptualization; Methodology, Formal analysis; Investigation; Data Curation; Writing - Original Draft; Writing - Review & Editing; Visualization

**Erik Trinkaus:** Conceptualization; Methodology, Formal analysis; Investigation; Data Curation; Writing - Original Draft; Writing - Review & Editing; Visualization

**Christopher J. Knüsel:** Conceptualization; Writing - Original Draft; Writing - Review & Editing

**Sébastien Villotte:** Conceptualization; Methodology; Writing - Original Draft; Writing - Review & Editing; Project administration; Funding acquisition