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Evidence for previously unknown mortuary practices in the Southwest of France (Fournol, Lot) during the Gravettian

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Abstract

European Mid Upper Paleolithic mortuary practices have been traditionally associated with primary burials, ochre, body ornaments and grave goods. Recently, evidence of the post-mortem treatment of skeletal remains, such as the displacement and removal of skeletal elements, has been reported for the Gravettian period in the Southwest of France. Here, we present the preliminary results of anthropological and taphonomic analyses of the human remains from the Gravettian site of Fournol (Soturac, Lot, France). We describe the first evidence of the scalping and disarticulation of human remains, a previously unknown post-mortem treatment in Gravettian contexts from the South West of France.

Keywords Mortuary practices; Mid Upper Paleolithic; post-mortem treatment, cut marks; Cannibalism.

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Highlights:

- Red ochre burials are characteristic of European Mid Upper Paleolithic (MUP)
- The situation seems different In the Southwest of France
- A site from this area with cut marks on MUP human remains is presented here

1 **Short Paper**

2 **TITLE:** Evidence for previously unknown mortuary practices in the Southwest of France (Fournol, Lot)
3 during the Gravettian.

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55 **1 Introduction**

56 The European Mid Upper Paleolithic (MUP, ca. 30-20 000 BP or 34-24 000 calBP) is well known for the
57 so-called "red ochre burials" across Europe and is mostly (but not only) associated with the Gravettian
58 culture (Mussi, 2001; Henry-Gambier, 2008; Riel-Salvatore and Gravel-Miguel, 2013; Trinkaus et al.,
59 2014; Reynolds et al., 2017). Until recently, all the securely dated MUP burials which were sufficiently
60 preserved to allow interpretations of the mortuary practices have been considered as primary deposits
61 (Henry-Gambier, 2008). Post-mortem manipulations of the body (apart from pierced teeth, see
62 Vercoûtère et al., 2008) were not known for this period. However, recent discoveries and reanalyses
63 significantly modified this paradigm.

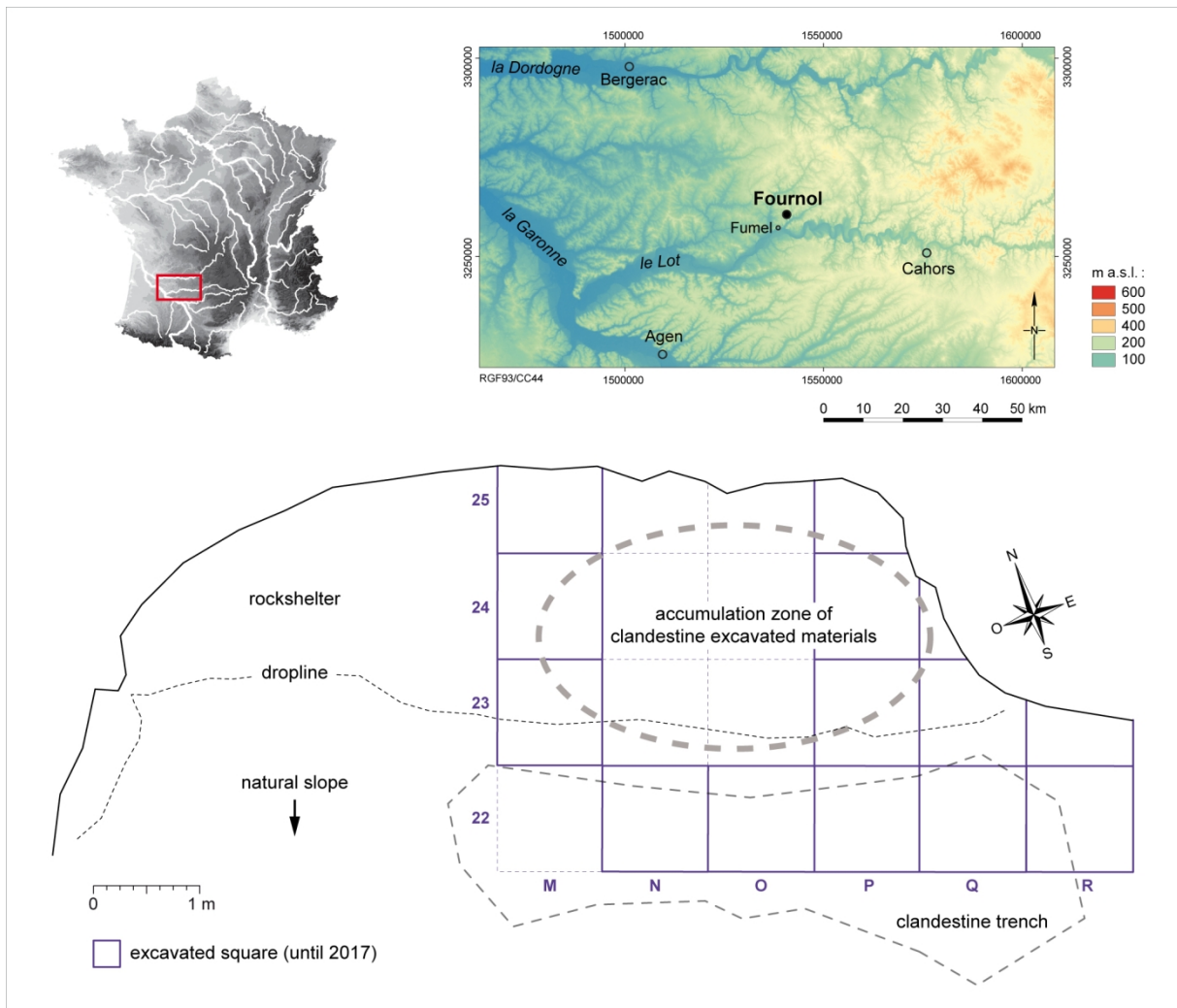
64 A recent reanalysis of the burial practices at Sunghir (Vladimir Oblast, Russia) indicated that an isolated
65 adult femur was intentionally placed within the grave of two immature individuals (Trinkaus et al.,
66 2014; Trinkaus and Buzhilova, 2018). The left forearm and hand of one of these individuals (Sunghir 2)
67 had been noted as missing during the excavation, implying a potential prehistoric human post-
68 depositional intervention (Trinkaus et al., 2014; Trinkaus and Buzhilova, 2018). At Paglicci (Apulia,
69 Italy), the left humerus of an adolescent buried with grave goods and ornaments (PAII) is missing
70 (Ronchitelli et al., 2015), suggesting a similar post-depositional intervention. At Pavlov I (Moravia,
71 Czech Republic), one pair of hands and two pairs of feet, disassociated from any distal long bones, have
72 been interpreted as indicators of cultural treatment of the individuals' remains (Trinkaus et al., 2010,
73 2017). At Buran-Kaya III (Crimea), fragmented human remains with cut marks were recently discovered
74 in several archeological layers associated with the Gravettian techno-complex (Prat et al., 2011;
75 Yanevich, 2014; Crépin et al. 2016). These were the first ever cut marks reported so far for MUP human
76 remains and have been interpreted as the result of a mortuary ritual (either specific mortuary practices
77 or a ritual cannibalism).

78 Apart from these examples from Central and Eastern Europe, most of the evidence for MUP post-
79 mortem manipulations comes from one region: the Southwest of France. At Pataud (Dordogne), the
80 Late Gravettian human remains from layer 2 (minimum number of individuals (MNI) of 6) had a
81 complex post-mortem history involving secondary deposits, displacement of cranial remains, and
82 removal of some long bones (Chiotti et al., 2013; Henry-Gambier et al., 2013a). At Cro-Magnon
83 (Dordogne), now securely dated to the Early Gravettian, the human remains (MNI=5) were likely not
84 buried, but instead deposited in the back of the shelter (Henry-Gambier, 2002; Henry-Gambier et al.,
85 2013a, 2013b). At Cussac (Dordogne), a Middle Gravettian decorated cave, human remains (MNI=6)
86 were not buried in the ground, but deposited in bear nests and some bones (including five crania) are
87 apparently missing (Henry-Gambier et al., 2013c; Jaubert et al., 2017; Peignaux et al., 2019). At Gargas
88 (Hautes-Pyrénées), several human remains, including an isolated juvenile mandible and adult femur
89 (both directly dated to ca. 25,000 ¹⁴C years BP) were recovered from the Gravettian layers close to

90 decorated walls (Foucher et al., 2019). In addition to this, some of the human remains from Gargas
91 were covered with a thin calcite layer, suggesting they were also deposited on the surface (Foucher et
92 al., 2019). Finally, at Vilhonneur (Charente), human remains (cranium, ribs, vertebrae, sacrum, left and
93 right os coxae, left and right femora and tibiae) of a young adult (directly dated to ca. 27,000 ¹⁴C years
94 BP) were found scattered on the floor of a decorated cave (Henry-Gambier et al., 2007).

95 To summarize, the Gravettian human remains from the Southwest of France seem to be associated to
96 mortuary practices that contrast greatly with the general idea of MUP primary burials where one, two
97 or three individuals were buried with ochre, body ornaments and grave goods (Mussi, 2001; Henry-
98 Gambier, 2008). Here we present the preliminary results of the anthropological study of Fournol
99 (Soturac, Lot, France) (Fig. 1). We provide evidence for a previously unknown Gravettian post-mortem
100 treatment in the Southwest of France.

101



102

103 Figure 1. Location of the site and schematic illustration of the excavation area. Data source of the
104 colored digital elevation model: SRTM, 1 Arc-Second Global. Authors: MR and JBC.

105

106 **2 The Fournol rock shelter**

107 Fournol is a relatively small rock shelter (ca. 10 meters long and 3 meters depth), open to the south
108 (Fig. 1) and developed into Coniacian limestone 162 m a.s.l. (above seal level). This prehistoric site was
109 likely known at the beginning of the last century, as in 1908, the Museum of Toulouse received a
110 number of excavated prehistoric remains from this site (Morala, pers. obs.). After World War II, the
111 site was occasionally excavated again, but the nature and location of the recovered material are
112 unknown (Morala, 1979, 1984, 2017). One of us (AM) did surface prospecting at Fournol in the 70's
113 and 80's. Typological and technological analyses of the lithic material found at the site identified two
114 chronocultures of the Upper Paleolithic: the Middle Gravettian and the Early Solutrean (Morala, 1979,
115 1984). An isolated human tooth was also discovered during this surface prospecting.

116 Between 2000 and 2005, clandestine excavations were carried out at the site. In 2012, at least a part
117 of the illegally excavated material was seized by the Gendarmerie of Villeneuve-sur-Lot. The
118 confiscated material (lithic artifacts and human and faunal remains) was then acquired by the *Musée*
119 *nationale de Préhistoire*. The lithic material can be typologically assigned to the Middle Gravettian
120 (Morala, 2015). A direct date was obtained from a frontal bone fragment displaying anthropic marks
121 (i.e. cut marks). The result of $24\,820 \pm 220$ BP (Lyon-9985 SacA 32610) (Morala, 2015) falls within the
122 age range for the Middle Gravettian in the Southwest of France (e.g. Klaric, 2007).

123 From 2015 onwards, several excavation seasons took place, led by one of us (AM) and funded by the
124 Ministry of Culture and Communication. The degree of deterioration caused by the last clandestine
125 excavations was evaluated (Fig. 1). At the front of the shelter, a large trench (nearly 5m long to a depth
126 of 50-80 cm) had been dug by the looter(s) with the excavated sediment (including archaeological
127 material) thrown inside the shelter and retained by a dry stone wall (Morala, 2017).

128

129 Three main geoarcheological units have been identified so far within and in front of the rock shelter,
130 with a 15° to 5° slope to the outside. Unit 1 is formed by a dark brown, carbonated sandy loam matrix
131 with limestone clasts (gravels to blocks). This unit is several decimeters thick (possibly close to one
132 meter in some areas), and was highly disturbed, both by bioturbation and by the previous illicit
133 excavations. Faunal and human remains, as well as lithic material characteristic of the Middle
134 Gravettian, were found in this unit (Morala, 2017). The artifact assemblage seemed homogenous,
135 apart from a few modern artifacts (some glass shards and small metallic fragments) likely related to
136 the previous excavations, and no evidence of intermixture between archeological layers from different
137 cultures was found. Unit 2, below Unit 1, is composed of limestone clasts in a yellowish loamy sand
138 carbonated matrix, and was much thinner than Unit 1 (0 to 20 cm). Less archeological material (and

139 no human remains) were found in this unit. The analysis of the lithic material points toward one or
140 several Late Aurignacian occupation(s). Unit 3 corresponds to limestone clasts in a yellowish loamy
141 sand cemented matrix (breccia). This phase of calcitic cementation had affected different deposits
142 including a residual coating preserved against the wall of the shelter with Early Solutrean artifacts.

143

144 **3 Material and methods**

145 The human remains from the looter's collection and from the recent excavation campaigns were first
146 studied by Dominique Henry-Gambier, and then by four of us (SV, LC, EB, MLL). Here, we present the
147 results of the anthropological and taphonomical analyses of the human remains from the looter
148 collection and those discovered during the archeological field seasons of 2015, 2016 and 2017.

149 A total of 127 skeletal remains were identified as probably or certainly human (table 1). One was
150 discovered in 1986, 45 are from the looter's collection and the other remains were excavated during
151 the three campaigns from 2015 to 2017 (respectively 32, 29 and 20 skeletal remains). All of the remains
152 discovered during the excavations were found in the Unit 1, spread over 24m² (but 73% of them derive
153 from 9m²).

154 The majority of the human remains (110, 86.6%) are fragmented, while only 17 remains are complete
155 (including 15 teeth). The maximum preserved length is very small on average (26 mm) and inferior to
156 40 mm for 90% of the assemblage. Teeth are the most common elements (28.3%), followed by bones
157 from the hand (23.6%) and neurocranial fragments (18.9%) (Table 1).

158 A part of the human remains (21.3%, mostly teeth) was clearly identified as juvenile. The remaining
159 skeletal and dental elements (78.7%) were considered adult. However, it is worthwhile mentioning
160 that, considering the high degree of fragmentation of the bones, the skeletal maturity cannot be
161 ascertained with complete confidence for a significant part of the remains. It is thus possible that the
162 percentage of adult remains is actually inflated.

163 Because of the small size of the fragments, systematic refitting, probable re-association and exclusion
164 was attempted only for the teeth. At least six individuals were identified from the dental remains,
165 including three juveniles and three adults. Individuals were identified based on the presence of
166 duplicate elements, dental morphology, dental developmental stages and wear patterns.

167 We did not attempt to assess the sex of the individuals or the age at death of the adult bone fragments
168 due to the very important degree of fragmentation. We did not attempt to estimate the age-at-death
169 of the adults based on the degree of tooth wear due to the many factors that can influence this
170 phenomenon. The age-at-death of the three identified juveniles were estimated to be 4-8, 6-10 and 8-
171 12 years, based on dental developmental stages (AlQahtani et al. 2010).

Skeletal element	Adult		Juvenile		Total		
	N	N with cut marks	N	N with cut marks	N	N with cut marks	% with cut marks
Skull (without mandible)	23	12	2	1	25	13	52.0%
Mandible	2	2	0	0	2	2	100.0%
Isolated tooth	16	1	20	1	36	2	5.6%
Vertebra	7	0	0	0	7	0	0.0%
Rib	5	0	0	0	5	0	0.0%
Clavicle	5	3	2	1	7	4	57.1%
Scapula	2	2	0	0	2	2	100.0%
Radius	0	0	1	1	1	1	100.0%
Ulna	2	0	0	0	2	0	0.0%
Metacarpal	6	2	0	0	6	2	33.3%
Hand phalanx	23	3	1	0	24	3	12.5%
Femur	4	1	0	0	4	1	25.0%
Tibia	3	0	0	0	3	0	0.0%
Fibula	1	0	1	0	2	0	0.0%
Pedal phalanx	1	0	0	0	1	0	0.0%
Total	100	26	27	4	127	30	23.6%

173 Table 1. Summary of human remains from Fournol and number of modified elements. N: Number of
174 fragments.

175

176 The taphonomic analysis of the anthropological sample was carried out visually, using a magnifying
177 glass and a light microscope (x10 - x60). Taphonomic modifications were recorded and tentatively
178 linked to specific taphonomic processes and agents following Binford, (1981), Potts and Shipman
179 (1981), Behrensmeyer et al. (1986), Reitz and Wing (1999), and Fernández-Jalvo and Andrews (2016).
180 In this article, we focus on the peri-mortem anthropic modifications such as cut marks or bone
181 breakage. Fracture morphologies (fracture outline, angle, edge and the extent of survivorship of the
182 shaft circumference of long bones) were recorded following Villa and Mahieu (1991). Fractures with
183 smooth textures, an oblique fracture angle and a curved or spiral outline usually occur on green bone
184 (e.g. Binford, 1981; Villa and Mahieu, 1991; Fernández-Jalvo and Andrews, 2016). The morphological
185 properties of the linear marks (trajectory of the groove, its orientation relative to the axis of the bone,
186 its position, and the section profile, symmetry, length and depth of the groove), as well as the presence
187 or absence of structural features inside (internal microstriations) or close to (shoulder effect) the
188 grooves were recorded following Bello and Soligo (2008), Domínguez-Rodrigo et al. (2009) and
189 Fernández-Jalvo and Andrews (2016). Many organic and inorganic processes can produce linear marks
190 on bones, the main problem being the possible confusion between superficial traces on bone produced
191 by trampling and those made during butchering. Some trampling marks can show similarities to
192 butchery marks (e.g. Andrews and Cook, 1985; Behrensmeyer et al., 1986), but they can usually be

193 differentiated when the following discriminating variables are applied jointly (e.g. Olsen and Shipman,
194 1988; Domínguez-Rodrigo et al., 2009):

195 - cut marks are usually deeper and longer than trampling marks;

196 - cut marks tend to have more frequently than trampling marks an asymmetrical V-shaped cross
197 section;

198 - the groove trajectory of cut marks is straight most of the time whereas trampling marks tend to be
199 sinuous;

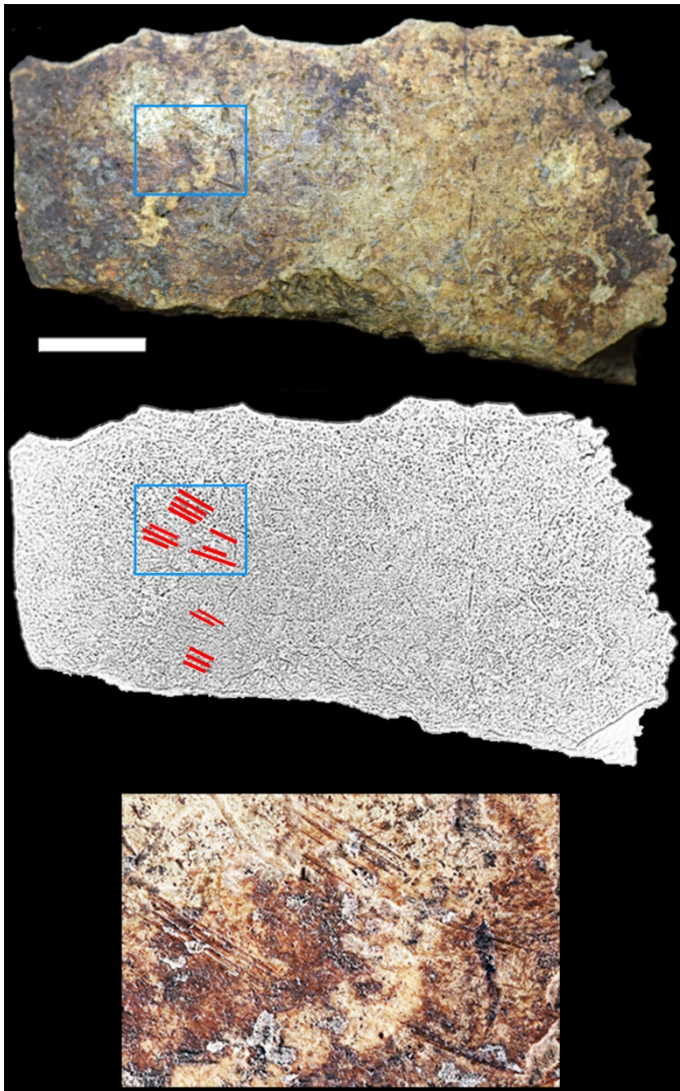
200 - the shoulder effect tends to be more common in cut marks than in trampling marks.

201 Trampling marks also tend to be randomly placed whereas cut marks occur preferentially in
202 anatomically meaningful locations (e.g. Binford, 1981; Andrews and Cook, 1985; Olsen and Shipman,
203 1988; Lyman, 1994; Reitz and Wing, 1999; Fernández-Jalvo and Andrews, 2016). The superimposition
204 and succession of marks caused by different post-depositional processes and agents (humans, plant
205 roots, trampling, calcitic concretion, etc.) were taken into account in order to attest the antiquity of
206 the anthropic marks analyzed here. Only unequivocal ancient evidence of human-induced linear marks
207 were considered for the present study.

208 **4 Results**

209 At least 30 skeletal elements (23.6 % of the assemblage) displayed striations very likely made with lithic
210 tools (Table 1). When isolated teeth are excluded, this percentage increases to 30.8% of the
211 assemblage (28/91). Interestingly, no clear evidence of other human induced modifications, such as
212 peri-mortem breakage, were observed on the human remains.

213 Cut marks were recorded on 26 adult skeletal remains (26.0% of the adult assemblage), the vast
214 majority of these were found on the cranial remains, the bones of the pectoral girdle and the hand.
215 Half of the adult neurocranial fragments exhibit cut marks. For example, the frontal remains (RH-084)
216 showed several groups of parallel marks with microstriations and shoulder effects (Fig. 2). They are
217 quite short (7-10 mm) and superficial, presenting the same patina as the bone and mostly covered by
218 calcite concretion. A right temporal bone fragment (RH-004), showed several very fine and short (1-3
219 mm) and longer (5-9 mm) cut marks in three different directions around the mandibular fossa.



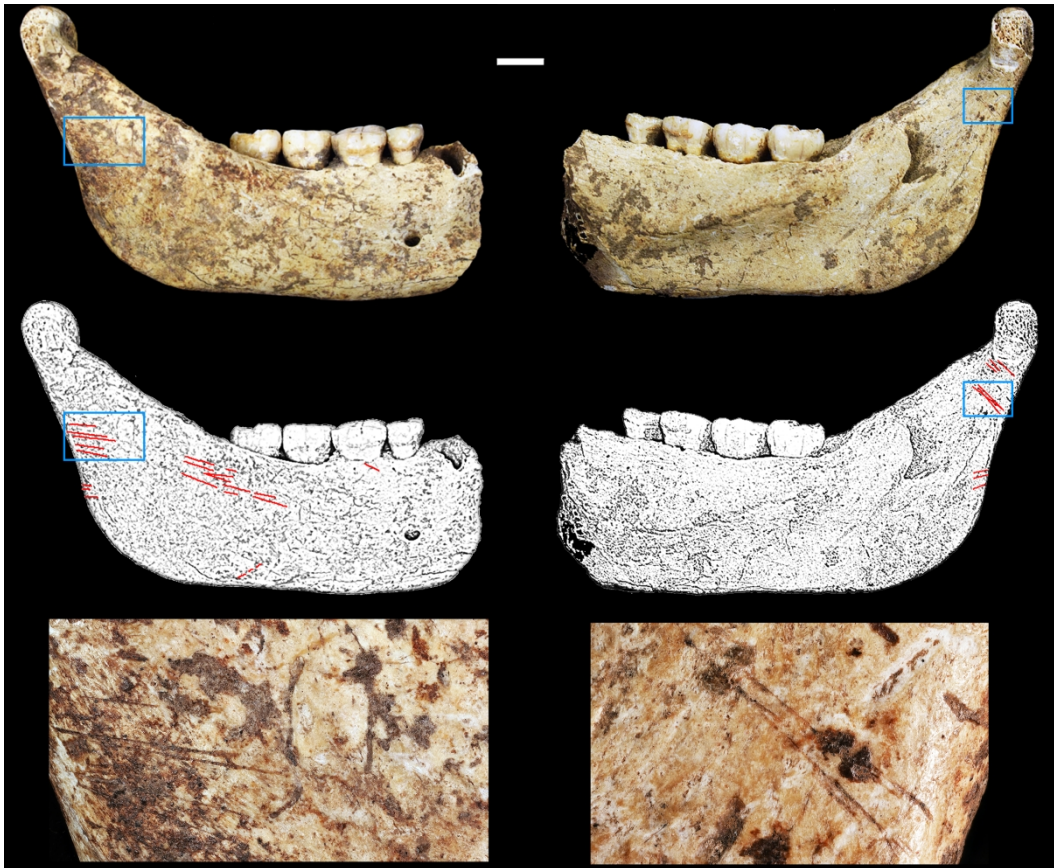
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221 Figure 2. Cut marks on the external surface of a human frontal fragment (RH-084) from Fournol (scale:
222 10 mm). From top to bottom: picture of the external surface of the fragment, sketch with cut marks
223 highlighted in red, and close-up view (not to scale) of the framed area. Photographs: AM and Maryelle
224 Bessou, sketch: LC.

225

226 One of the best preserved bones in the sample is a right corpus and ramus of an adult mandible (RH-
227 001) with more than twenty cut marks, located on both surfaces and ranging from 2 to 15 mm (Fig. 3).
228 The majority of these cuts are on the ramus, but some are also present on the external surface of the
229 body. They are almost all parallel, continuous, more or less deep and clear, and arranged in small
230 groups. Most of the marks seem to be located on the attachment sites of the lateral pterygoid muscle,
231 the capsule, and the associated ligaments.

232



233

234 Figure 3. Cut marks on the external (left) and internal (right) surface of a human hemi-mandible (RH-
 235 001) from Fournol (scale: 10 mm). From top to bottom: pictures of the fragment, sketches with cut
 236 marks highlighted in red, and close-up views (not to scale) of the framed areas. Photographs: AM and
 237 Maryelle Bessou, sketches: LC and SV.

238

239 One of the two teeth displaying cut marks, the first right premolar (RH-002), refits with the mandible
 240 RH-001. The oblique linear marks are visible on the vestibular surface of the crown in two locations
 241 (Fig. 4).

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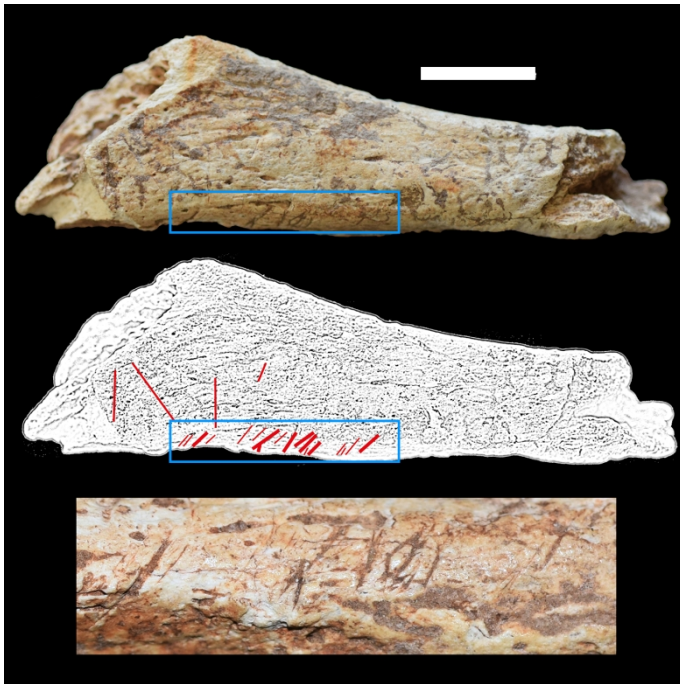
246 Figure 4. Cut marks on the vestibular aspect of a human premolar (RH-002) from Fournol (scale: 10
247 mm). Top: picture of the tooth and sketch with cut marks highlighted in red. Bottom: close-up view
248 (not to scale) of the framed area. Photographs: Maryelle Bessou, sketch: VL.

249

250 Three adult clavicular fragments display cut marks on their diaphyses. For instance, RH-012 (left
251 clavicle) shows four fine, short and oblique cut marks on its inferior surface. Its anterior surface
252 presents many more anthropic marks with ca. 16 very short (3-4 mm), deep and parallel marks (with
253 shoulder effects and microstriations) along the diaphysis (Fig. 5). They are covered by reddish and/or
254 calcified sediment. These incisions are located at the attachment site of the deltoid muscle. Cut marks
255 on the other adult clavicular fragments are also short and parallel, done transversally or obliquely to
256 the long axis of the bones on one or two directions maximum.

257

258



259

260 Figure 5. Cut marks on the inferior and anterior surfaces of a human left clavicle (RH-012) from Fournol
261 (scale: 10 mm). From top to bottom: picture of the inferior surface of the fragment, sketch with cut
262 marks highlighted in red, and close-up view (not to scale) of the framed area. Photographs: AM, sketch:
263 LC.

264 Human modifications are also visible on three hand phalanges and two metacarpal fragments. Cut
265 marks are principally located on the palmar surface except for one intermediate phalanx (RH-017),
266 where they were found on one side (Fig. 6). These marks are short, deep and parallel, grouped by two
267 or three at maximum, and appear transversally to the long axis of the bone.

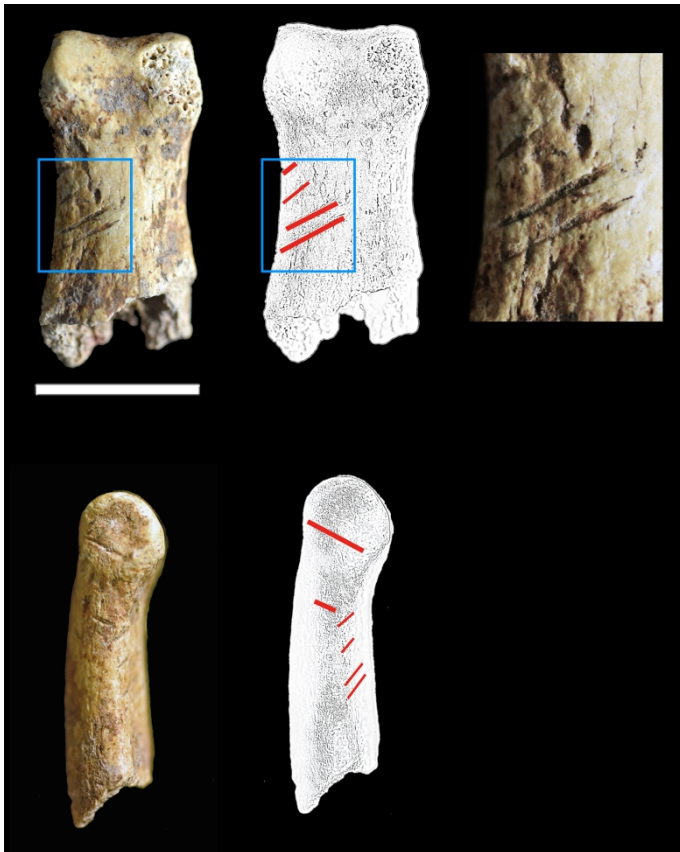
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274 Figure 6. Cut marks on the palmar and lateral surfaces of a human phalanx (RH-017) from Fournol
 275 (scale: 10 mm). Top: palmar view, bottom: lateral view. From right to left: picture of the surface of the
 276 fragment, sketch with cut marks highlighted in red, and close-up view (not to scale) of the framed area.
 277 Photographs: AM, sketch: LC.

278

279 Only four elements (one neurocranial fragment, one molar, one radial fragment and one clavicular
 280 fragment) displaying cut marks are from immature individual(s). On the radial (RH-020) and right
 281 clavicular (RH-015) fragments, the cut marks seem to correspond to one single event characterized by
 282 two to four short (2 to 5 mm long), fine and parallel striations appearing transversally to the long axis
 283 of the bone. The cut marks on the molar (RH-119) are short, sub-horizontal, and located close to the
 284 cervix on the mesio-vestibular aspect of the crown.

285 5 Discussions and conclusions

286 Isolated human remains are known from a variety of Gravettian sites, both with and without formal
 287 burials (e.g. Mallegni and Palma di Cesnola, 1994; Trinkaus et al. 2010, 2014; Foucher et al., 2019). The
 288 taphonomic histories of most of these remains are unclear, but their presence at sites with ritual
 289 burials (e.g. Paglicci, Dolní Věstonice, Sunghir) has raised questions as to why the remains of some but

290 not all people were formally buried. In the Southwest of France, the situation is quite different: formal
291 Gravettian burials are unknown and there is substantial evidence for the depositing of the body on
292 rather than in the ground as well as the displacement of body parts and the removal of long bones and
293 crania (Henry-Gambier et al., 2013a, 2013c; Foucher et al. 2019). Cut marks on human remains have
294 not been described previously for this time period in this region.

295 The anthropogenic nature of the marks seen at Fournol is attested by the frequency of surfaces
296 displaying several parallel incisions as well as the morphology and the anatomically meaningful
297 location of the marks. One of the remains with anthropogenic marks has been directly dated to the
298 Middle Gravettian, which is consistent with the typotechnological characterization of the lithic
299 material both from the looters' collection and Unit 1. Thus, despite disturbances, there are strong
300 arguments to consider all the human remains discovered so far as a chronologically homogenous
301 assemblage dated to the Middle Gravettian. Future work will involve obtaining more direct 14C dates
302 for the individuals represented in the assemblage.

303 The interpretation of the anthropic marks recorded on the human skeletal assemblage is hindered by
304 the small size of the fragments and the difficulty in attributing the bones to separate individuals.
305 However, it is likely that most of the marks on the neurocranial fragments are associated with skinning,
306 because this would involve repeated strokes, resulting in a series of striations. It is likely that the right
307 temporal bone RH-004 and the condylar process of the mandible RH-001 belong to the same individual
308 and the marks on these elements can be tentatively interpreted as the result of the disarticulation of
309 the temporomandibular joint. Labial cut marks on teeth are relatively frequent in the fossil record and
310 have been associated to the so-called "stuff and cut" behavior. However, these marks are
311 overwhelmingly found on in very large quantities on anterior teeth and spread throughout the labial
312 aspect of the crown (e.g. Fox and Pérez-Pérez, 1994; Volpato et al., 2012), whereas at Fournol, the cut
313 marks are visible on the vestibular aspect of a premolar and a molar, on a small surface relatively close
314 to the cervix. By analogy with zooarcheological studies (e.g. Soulier and Mallye, 2012; Mallye et al.,
315 2013), these marks can be tentatively associated with the skinning of the head. Finally, the cut marks
316 on the pectoral girdle and the phalanges of the hand seem to be mainly related to disarticulation of
317 joints.

318 There are at least two (not mutually exclusive, see for instance Belcastro et al., 2010) scenarios to
319 account for the human bone assemblage discovered so far at Fournol: cannibalism, or/and specific
320 mortuary rites. The frequency of human remains with cut marks, which is relatively high (ca. 24%) at
321 Fournol, is in the range of variation of what is seen in assemblages for which cannibalism has been
322 considered as probable (Table 2). However, cannibalism was also inferred from other anthropic

323 modifications identified in these sites, including scrape marks, tooth marks, destruction of vertebral
 324 bodies and long bone extremities, etc. for which evidence is currently lacking at Fournol. To infer the
 325 practice of cannibalism solely based on the relative high frequency of cut marks seen in this assemblage
 326 is therefore highly problematic. Moreover, the presence of residual red pigment on some human
 327 bones displaying cut marks (e.g. Fig. 3 and 5) may indicate a complex post-mortem treatment of the
 328 bodies involving dismemberment, skinning and defleshing of the cadaver, as well as the use of
 329 pigments. The (limited) skeletal representation of the current assemblage from Fournol is likely
 330 related, at least in part, to previous looting practices, as part of the looted material may have been
 331 sold or kept in personal collections. However, it might also be possible that the very partial skeletal
 332 representation (a minimum number of individuals of six) and the overrepresentation of metacarpals
 333 and manual phalanges indicates a specific focus on some parts of the body, namely the head and the
 334 hands. Interestingly, most of the hand prints and stencils in European cave art, some characterized by
 335 missing or partial fingers, are thought to be Gravettian (e.g. Jaubert 2008; Lorblanchet, 2010; but see
 336 Pettitt et al., 2015). The importance of hands and fingers during the MUP is also illustrated by the
 337 isolated pair of hands at Pavlov I (Trinkaus et al., 2010, 2017) and the discovery of two isolated manual
 338 phalanges close to a boomerang at Obłazowa Cave (Valde-Nowak, 2009).

Site	Country	Period	Frequency of bones with cut marks	Main other types of marks						Reference	
				Scr.	Fr.	Per.	Peel.	Bur.	Tooth		
Les Pradelles	France	Late Middle Paleolithic	38%	X	X	X				X	Mussini 2011
Goyet	Belgium	Late Middle Paleolithic	32%		X	X	X?			X?	Rougier et al. 2016
Gough's Cave	England	Late Upper Paleolithic	65%	X	X	X	X			X	Bello et al., 2015
La grotte des Perrats	France	Mesolithic	42%	X	X	X	X			X	Boulestin, 1998
Herxheim	Germany	Neolithic	22%		X	X	X			X	Boulestin et al., 2009
Mancos 5MTUMR-2346	U.S.A.	Pueblo III	12%	X	X	X	X	X		X	White, 1992

339 Table 2. Examples of archeological sites where cannibalism has been considered as probable. Scr.:
 340 Scrape-marks; Fr.: Fractures on fresh bones; Per.: Percussion marks; Peel.: Peeling; Bur.: Burning
 341 damage; Tooth: Human tooth marks.

342 Further analyses, as well as increasing the sample size of the assemblage through continued
343 excavation, are required in order to identify the most likely scenario resulting in the observed cut
344 marks. Microscopic studies will be carried out in order to better characterize the direction and the
345 movement of the marks, and will help to get a better understanding of the practices resulting in these
346 marks. The systematic study of ochre distribution on the skeletal remains will allow a discussion as to
347 whether the coloration was carried out on disarticulated and defleshed bones. Finally, comparative
348 taphonomic analysis of the faunal and human remains (e.g. Mussini, 2011; Prat et al., 2011; Rougier et
349 al., 2016) may allow the identification of a specific mortuary treatment of the human cadavers at this
350 site. To conclude, the evidence from Fournol, although limited in scope, suggests that the treatment
351 of human bodies during the MUP was much more diversified than previously thought, and that
352 Gravettian mortuary practices in the Southwest of France clearly deviate from the main pattern
353 observed elsewhere, i.e. the primary burials associating one or several individuals, ochre, body
354 ornaments and grave goods.

355

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368

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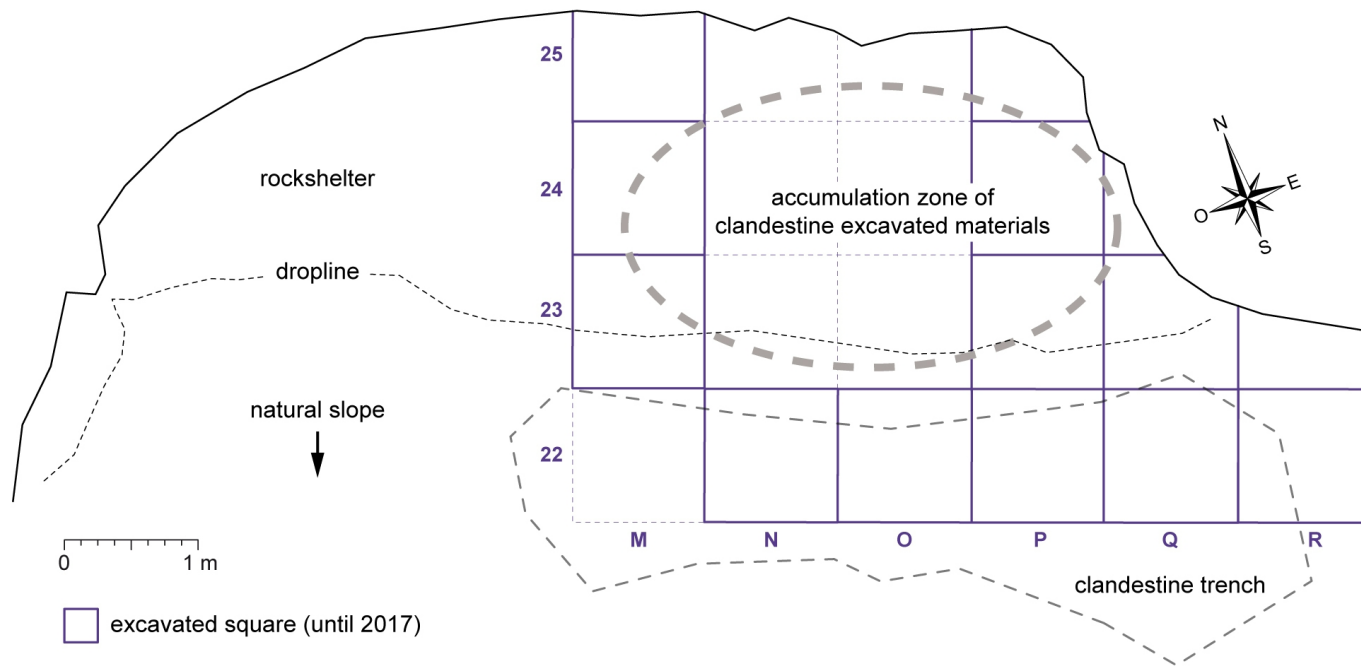
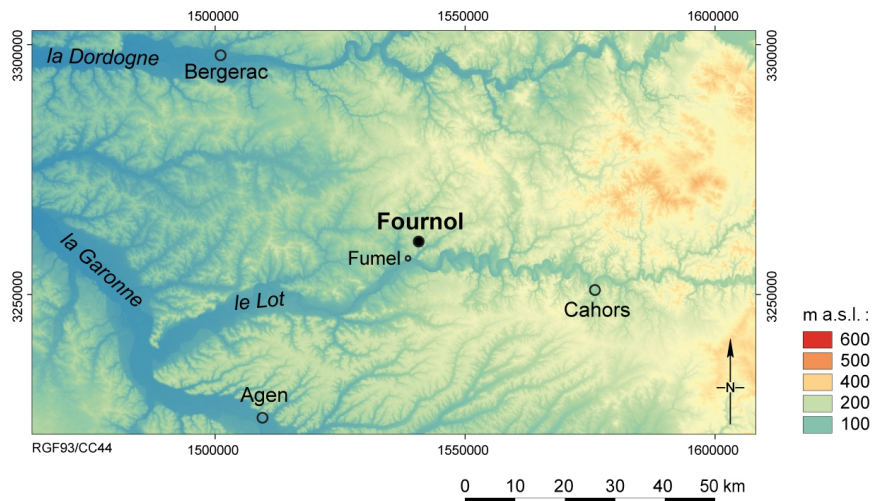
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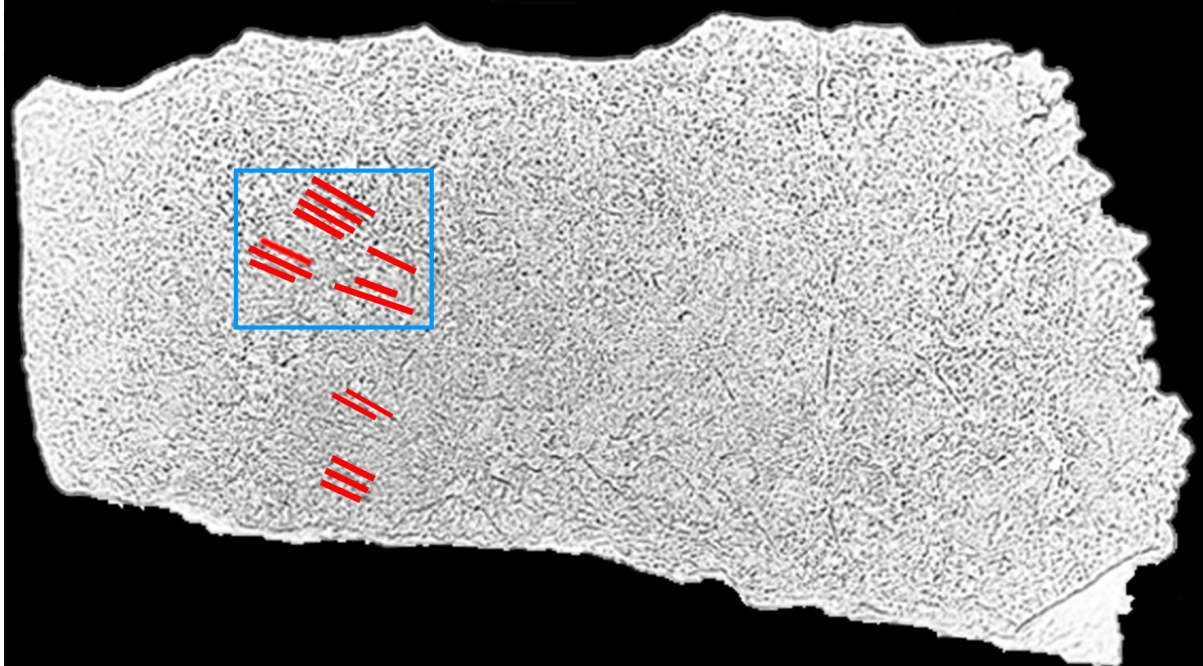
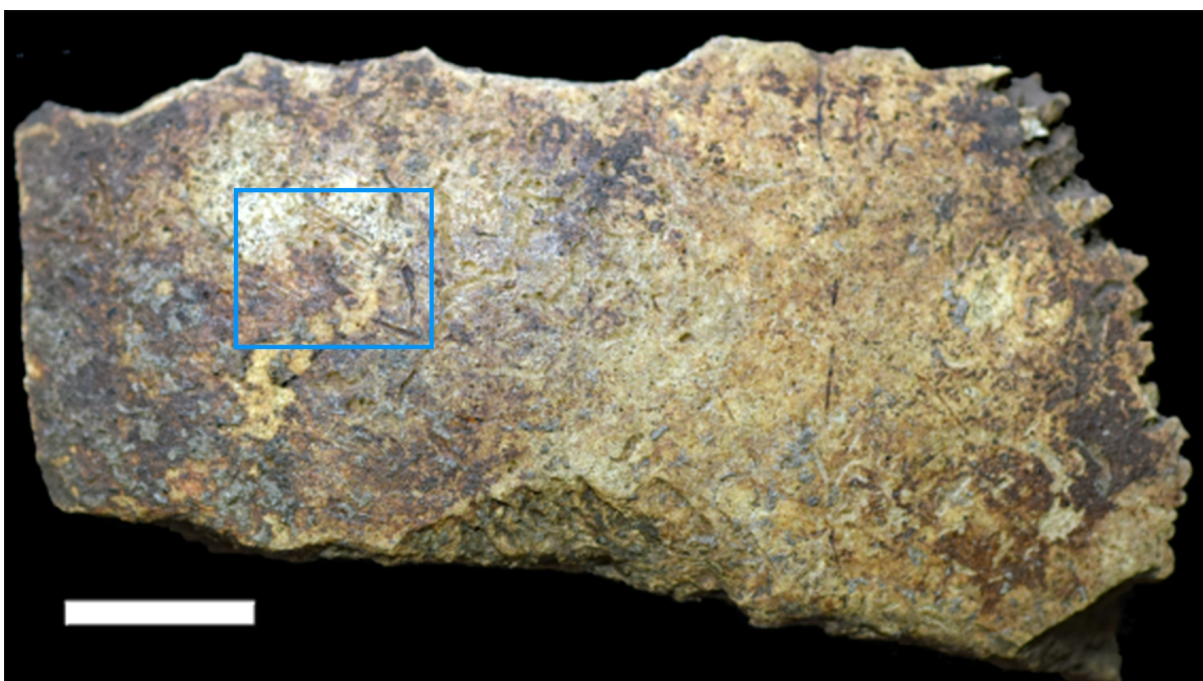
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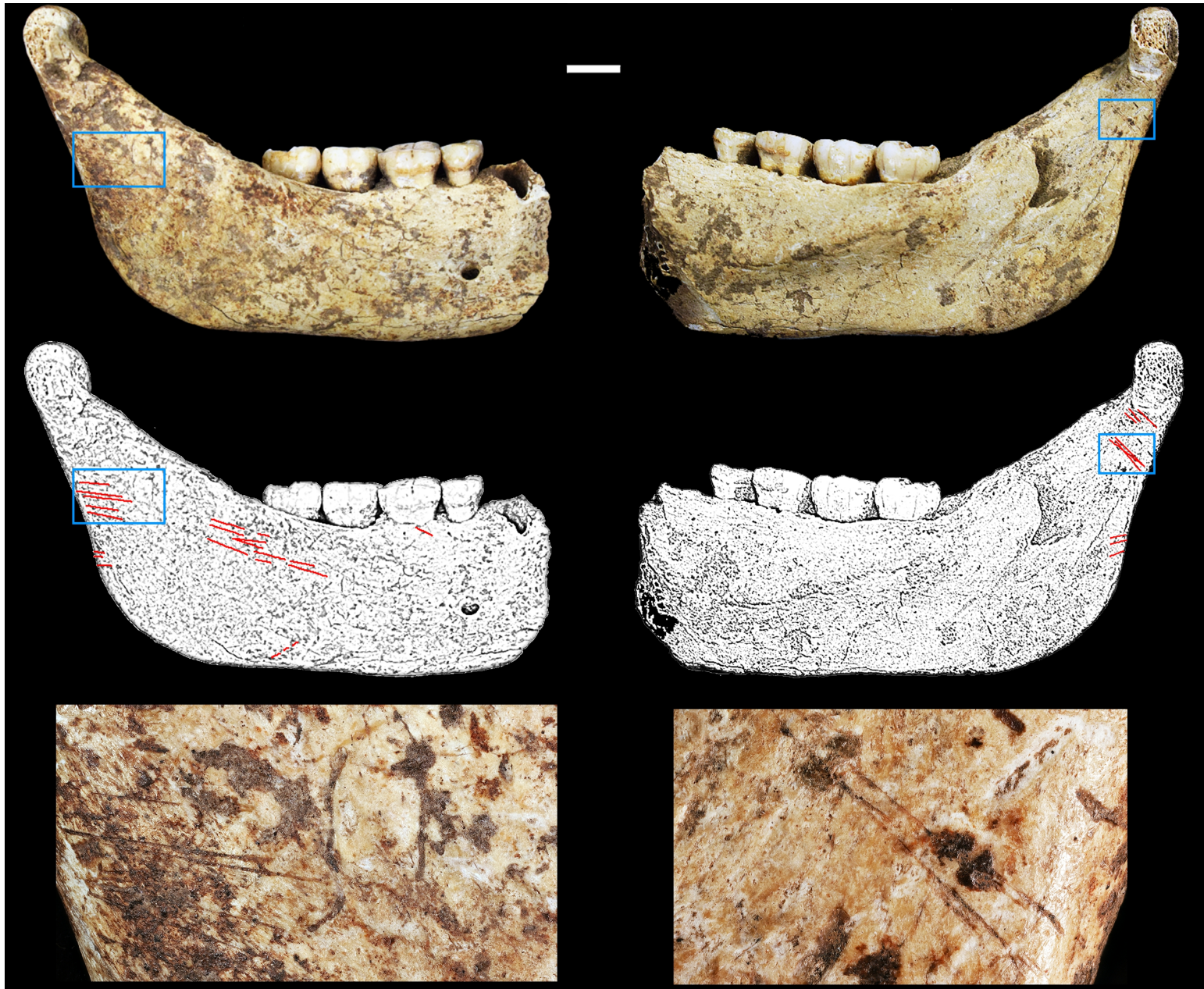
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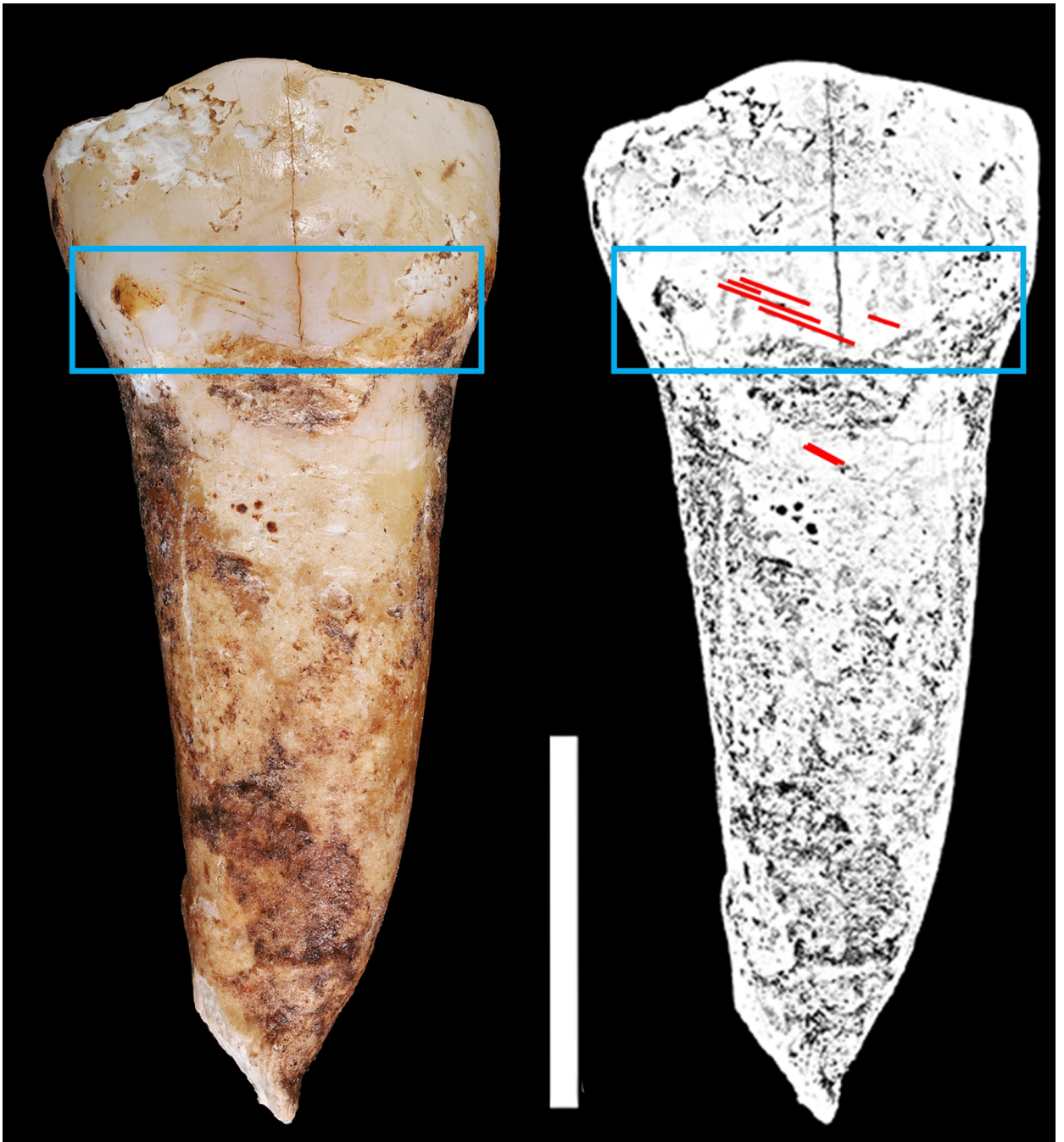
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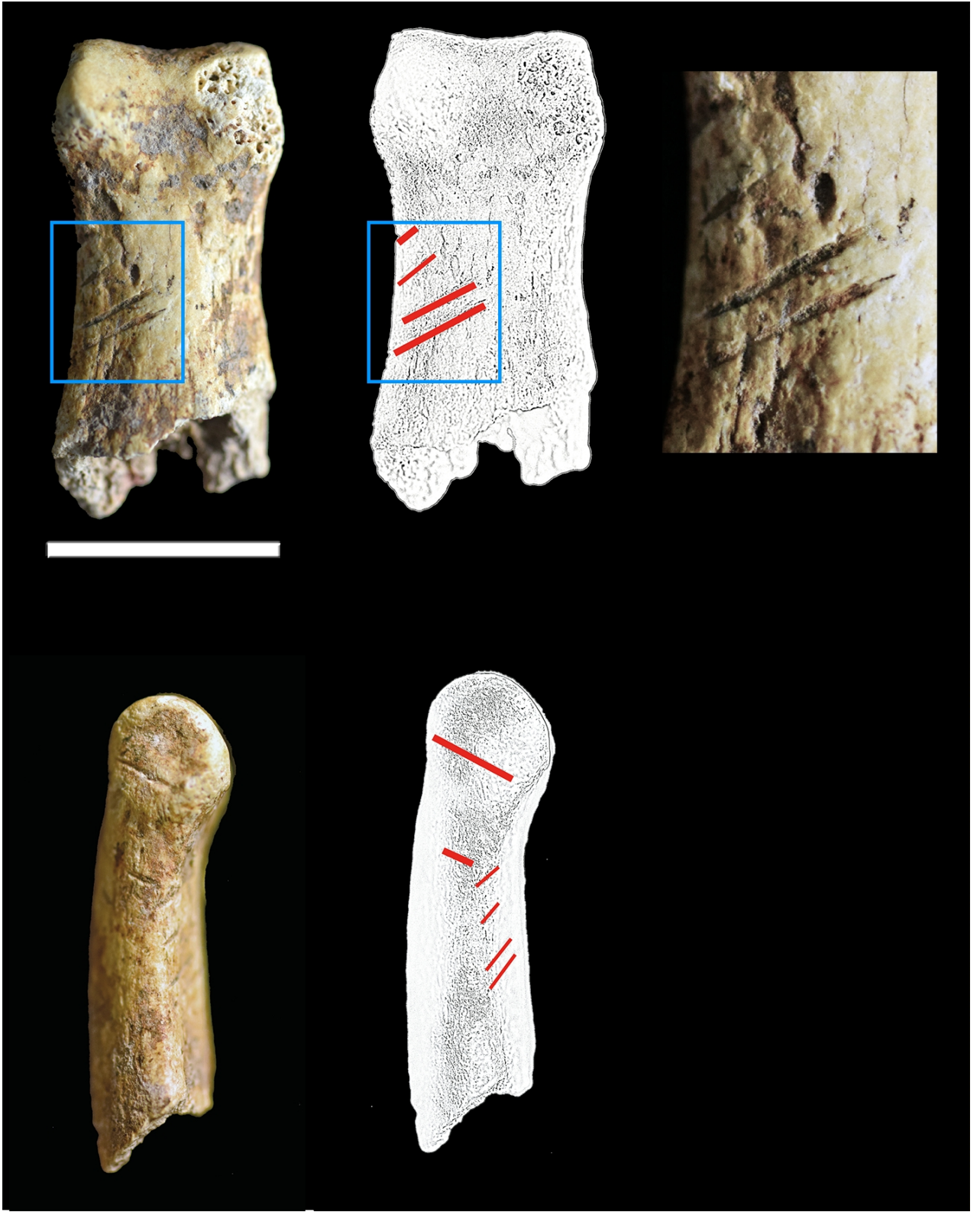












Skeletal element	Adult		Juvenile		Total		% with cut marks
	N	N with cut marks	N	N with cut marks	N	N with cut marks	
Skull (without mandible)	23	12	2	1	25	13	52.0%
Mandible	2	2	0	0	2	2	100.0%
Isolated tooth	16	1	20	1	36	2	5.6%
Vertebra	7	0	0	0	7	0	0.0%
Rib	5	0	0	0	5	0	0.0%
Clavicle	5	3	2	1	7	4	57.1%
Scapula	2	2	0	0	2	2	100.0%
Radius	0	0	1	1	1	1	100.0%
Ulna	2	0	0	0	2	0	0.0%
Metacarpal	6	2	0	0	6	2	33.3%
Hand phalanx	23	3	1	0	24	3	12.5%
Femur	4	1	0	0	4	1	25.0%
Tibia	3	0	0	0	3	0	0.0%
Fibula	1	0	1	0	2	0	0.0%
Pedal phalanx	1	0	0	0	1	0	0.0%
Total	100	26	27	4	127	30	23.6%

Table 1. Summary of human remains from Fournol and number of modified elements. N: Number of fragments.

Site	Country	Period	Frequency of bones with cut marks	Main other types of marks						Reference
				Scr.	Fr.	Per.	Peel.	Bur.	Tooth	
Les Pradelles	France	Late Middle Paleolithic	38%	X	X	X			X	Mussini 2011
Goyet	Belgium	Late Middle Paleolithic	32%		X	X	X?		X?	Rougier et al. 2016
Gough's Cave	England	Late Upper Paleolithic	65%	X	X	X	X		X	Bello et al., 2015
La grotte des Perrats	France	Mesolithic	42%	X	X	X	X		X	Boulestin, 1998
Herxheim	Germany	Neolithic	22%		X	X	X		X	Boulestin et al., 2009
Mancos 5MTUMR-2346	U.S.A.	Pueblo III	12%	X	X	X	X	X	X	White, 1992

Table 2. Examples of archeological sites where cannibalism has been considered as probable. Scr.: Scrape-marks; Fr.: Fractures on fresh bones; Per.: Percussion marks; Peel.: Peeling; Bur.: Burning damage; Tooth: Human tooth marks