

Evidence supporting an intentional Neandertal burial at La Chapelle-aux-Saints

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The bouffia Bonneval at La Chapelle-aux-Saints is well known for the discovery of the first secure Neandertal burial in the early 20th century. However, the intentionality of the burial remains an issue of some debate. Here, we present the results of a 12-y fieldwork project, along with a taphonomic analysis of the human remains, designed to assess the funerary context of the La Chapelle-aux-Saints Neandertal. We have established the anthropogenic nature of the burial pit and underlined the taphonomic evidence of a rapid burial of the body. These multiple lines of evidence support the hypothesis of an intentional burial. Finally, the discovery of skeletal elements belonging to the original La Chapelle aux Saints 1 individual, two additional young individuals, and a second adult in the bouffia Bonneval highlights a more complex site-formation history than previously proposed.

Mousterian burial | Middle Paleolithic | symbolic behavior | taphonomy | archaeology

Since the discovery of the La Chapelle aux Saints skeleton in 1908 (LCS1) (refs. 1–4 and *SI Appendix*, Fig. S1), intentional primary Neandertal burials have often been considered as key evidence of behavioral modernity (5, 6). However, some scholars have remained skeptical (7), arguing that most of these special treatments of the dead were identified in the context of old and inadequate excavations. During the past decade, possible evidence of Neandertal symbolic behavior has been claimed, including the use of pigment (8) and decorative feathers (9), the collection of exogenous fossil shell (10), and a preference for colored shells in Middle Paleolithic layers (11). In light of this evidence, reassessment of the burial question is needed to better characterize the Neandertal cultural package. Here, we report on archaeological evidence from the La Chapelle-aux-Saints burial, derived from taphonomic analysis of the LCS1 skeleton, as well as the study of the geological context of the deposit. These data provide insights relevant to the archaeological context of the Paleolithic human occupations at La Chapelle-aux-Saints, and they support previous claims for the existence of intentional burial. By so doing, they buttress claims for complex symbolic behavior among Western European Neandertals.

The Bouyssonie Discovery and Ancient Evidence for Neandertal Burial

On August 3, 1908, the Bouyssonie brothers discovered a nearly complete Neandertal skeleton (LCS1) in a pit dug within the deposits of the bouffia Bonneval. For the first time, the hypothesis of the possible existence of intentional burials, and, therefore, symbolic capacities in an Upper Pleistocene human group other than anatomically modern humans, was clearly

raised (1). Consequently, our approach to understand prehistoric human groups was drastically modified and archaeologists began to look for Neandertal burial evidence. In the 5 y following the discovery at La Chapelle-aux-Saints, 9 more purported burials were discovered, and today nearly 40 possible cases have been reported (12), some of which (Kebara 2 and Shanidar 4/6/8/9) reflect complex funeral practices (13, 14). All of these discoveries have profoundly changed our perception of Neandertals.

However, in the last few decades, numerous criticisms and doubts have been raised regarding the reality of some of these burials, including questions as to whether Neandertals actually possessed the cognitive capability to bury their dead (7, 15). In terms of the bouffia Bonneval discovery, the lack of information regarding the Bouyssonie's excavation procedures has been used as support for reservations concerning the burial hypothesis (7). Because the site's formation processes remained relatively unknown, the agent responsible for the preservation of the skeletal remains was unclear, and the exact nature of the burial pit was still not firmly established. Similar questions have recently been proposed with regard to the Roc-de-Marsal 1 Neandertal child burial (15), where a reassessment of the sedimentation process and the archaeological context of the skeletal remains have cast doubts on its intentional nature.

Significance

For several decades, scholars have questioned the existence of burial in Western Europe prior to the arrival of Anatomically Modern Humans. Therefore, an approach combining a global field recovery and the reexamination of the previously discovered Neandertal remains has been undertaken in the site of La Chapelle-aux-Saints (France), where the hypothesis of a Neandertal burial was raised for the first time. This project has concluded that the Neandertal of La Chapelle-aux-Saints was deposit in a pit dug by other members of its group and protected by a rapid covering from any disturbance. These discoveries attest the existence of West European Neandertal burial and of the Neandertal cognitive capacity to produce it.

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Considering the controversy surrounding the issue of Neandertal burials and problems raised concerning La Chapelle-aux-Saints, we developed a twofold approach incorporating a field project combined with the taphonomic analysis of the LCS1 skeletal material.

Reevaluation of La Chapelle-aux-Saints

Excavations carried out along the cliff and at the entrance of the bouffia Bonneval were designed to gather new information for establishing a more general understanding of the prehistoric occupation. Seven additional shallow north facing eroded cavities (SI Appendix, Fig. S2 and ref. 16), formed at the interface of the Upper Hettangian limestone of the cliff and the Lower Hettangian marl, were explored. In terms of morphology, these closed cavities appear as small rock shelters rather than well-developed karstic conduits. Features related to evolved karst drainage system (i.e., water circulation) are absent on the walls or the roof of the cavities, and the multiple test pits produced only limited traces of endokarstic sediments. Therefore, shelter formation appears mainly connected to (i) the opening of the limestone/marl interface of the Jurassic cliff (17), (ii) the retreat of the cliff by regressive erosion, (iii) the erosion and reworking of autochthonous weathered sediments at the lithological interface in the cliff, and (iv) the trapping of allochthonous sediments transiting along the slope.

Each of the rock shelters yielded Late Middle Paleolithic and Upper Paleolithic materials. A Quina Mousterian industry was identified in bouffia Bonneval and bouffia 102, Levalloisian Mousterian was identified in bouffia Bonneval and bouffia 118, and Mousterian of Acheulean Tradition (MTA) was identified only in bouffia 118. Additionally, Châtelperronian artifacts were recognized in bouffias 102, 129, and 137–140, whereas several Upper Paleolithic artifacts (Aurignacian or Magdalenian ones) were found in bouffias 102 and 129 (SI Appendix, Fig. S2). The archaeological sequence for the Middle-to-Upper Paleolithic transition in southwestern France is therefore represented at La Chapelle-aux-Saints (18).

Major taphonomic processes affected the integrity of the stratigraphic and archaeological units. Periglacial features (especially cryoturbation) were observed during excavation of all of the bouffias. Furthermore, mixed deposits from hyena dens and human occupations were also recognized at the Grotte du Noyer, as well as at bouffias 102, 131–133, and 137–140 (SI Appendix, Fig. S2). Finally, because the cliff limestone was eroded and consequently retreated, parts of the cavities' deposits were probably affected and remobilized along the slope.

Only bouffia 118 produced preserved archaeological strata: the lower level (C2) is clearly dominated by reindeer and is associated with a Denticulate Levallois Mousterian, whereas the upper layer (Alpha) is rich in bovines and is linked to a MTA industry (SI Appendix, Text S1 and Table S1). These two occupations have been attributed, respectively, to marine isotopic stage (MIS) 4 and MIS 3 based on biochronological data (SI Appendix, Text S1 and Fig. S3). Moreover, the taphonomic analysis demonstrates clear differences in the preservation of the faunal material. Whereas the C2 remains are systematically stained by Fe-Mn oxide deposits, those from layer Alpha, although free of these modifications, are heavily weathered (SI Appendix, Table S2). This information provides important contextual insights for the Mousterian occupations at the bouffia Bonneval.

Excavations in the bouffia Bonneval took place in 2011 and 2012. Multiple test pits were placed in a 23.5-m² area of the cave, as well as on the slope at the cave's entrance (Fig. 1). The sediments were backfill of the Bouyssonies' excavations both inside and outside, except for small areas where in situ deposits were identified inside the cave.

The marl substratum was reached 10 cm below the surface layer in the cave, and 40 cm on the slope outside under the

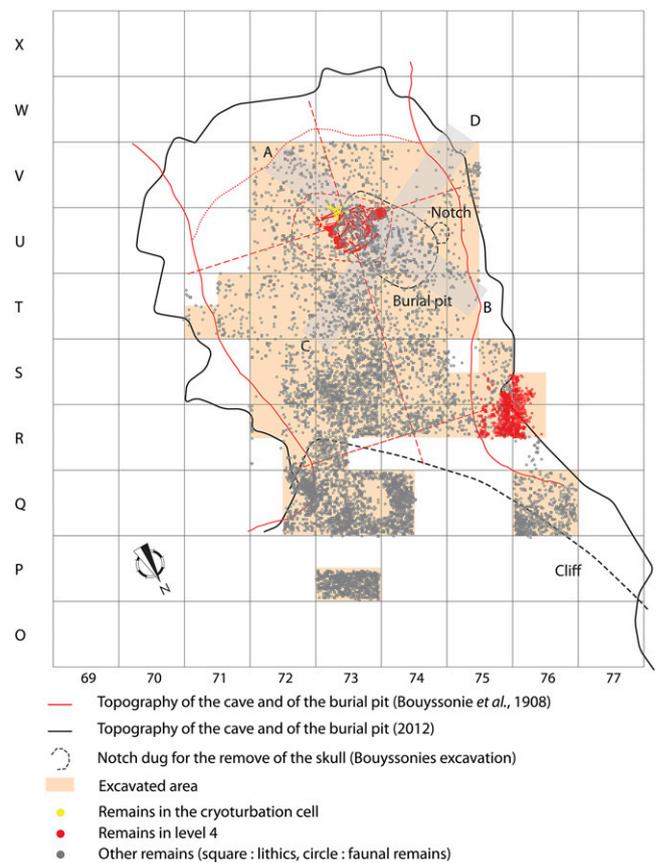


Fig. 1. Bouffia Bonneval excavation map and burial pit position. Here, differences in the cavity topography and in the localization of the burial pit are linked to imprecision in the Bouyssonies' drawing.

backfill deposits from the older excavations. The excavated sediments were rich in Middle Paleolithic artifacts similar to those previously recovered by the Bouyssonies. The assemblage is composed of numerous Levallois flakes and Quina scrapers made from quartz, as well as from both local and nonlocal flint. Bifacial shaping technology is also occasionally documented and suggests the presence of at least two Mousterian components (Quina and MTA). In the entire archaeological record of southwestern France, these two different chaînes opératoires are never found in association and appear not to be contemporaneous (18–20).

The faunal spectrum is dominated by reindeer, followed by bovine, with carnivores being represented by wolf, fox, and badger (SI Appendix, Table S3). Reindeer and bovine remains exhibit two different preservation patterns; natural oxide coloration is significantly more frequent on the reindeer elements than on bovine material, which in turn exhibits a higher frequency of weathering modifications. These features strongly suggest two different taphonomic histories for the two faunal components. The combined results of the lithic and faunal analyses support the hypothesis of two distinct Mousterian levels, one dominated by reindeer and the second mostly composed of bovine. As documented in the bouffia 118, the reindeer episode would be the earlier one.

Therefore, the recovering of several preserved (i.e., unexcavated by previous archaeologists) areas is of prime interest. In a sector of a square meter surface, located in the west part of the entrance under a limestone collapse, an in situ deposit was identified. Laying directly on the marl substratum, this deposit corresponds therefore to the first recorded occupation of the

cavity (stratigraphic unit C4). It is characterized by homogenous archaeological material composed of Quina Mousterian and a bone assemblage dominated by reindeer remains. The recurrent preferential orientation of the elongated remains and the very low frequency of recent fracture on the bone splinters attest that this area was not disturbed by the early 20th century excavation. Moreover, in at least two distinct areas within the cavity, materials were identified trapped in the first centimeters of the substratum (stratigraphic unit C2sup).

As a consequence, considering the local (in situ deposit and the bouffia 118) and the regional biochronological contexts (18), a stratigraphy can be inferred from the backfill analysis. The Quina Mousterian assemblage, associated with a reindeer exploitation, would have been followed by at least one other layer related to MTA Mousterian in association with a bovine exploitation. An attribution of the two theoretical assemblages to MIS 4 and MIS 3, respectively, can be proposed. The reindeer/Quina Mousterian occupation would therefore have been reworked by cryogenic processes that affected the marls (e.g., injection features).

In addition to the artifacts, a total of 13 human elements were unearthed during the recent excavations. Four elements belong to the LCS1 skeleton; the root of an upper second premolar, a fragment of a scapula, the distal extremity of an ulna, and a complete pollical proximal phalanx (*SI Appendix, Text S2 and Figs. S4 and S5*). These remains complement the previous discovery in the 1920s of an isolated upper right third molar (*SI Appendix, Text S2 and Fig. S4*) in the bouffia Bonneval (21).

Moreover, three additional individuals have been recognized, based on a left upper second premolar, a distal root of a lower permanent molar, a right upper central deciduous incisor, a right upper deciduous second molar, and a right lower deciduous first molar. These remains attest to the presence of two children and another mature individual (*SI Appendix, Text S2*).

All of these remains fall within the morphological variability of the Neandertals.

The Burial Pit

Excavations within the bouffia Bonneval exposed a 39-cm-deep subrectangular depression cut into the substrate marl. The upper part of the pit is damaged; the lower part is 140 cm long and 85 cm wide (*SI Appendix, Figs. S6–S8*). The interface of the backfill and the substratum is clear and regularly concave in this area. Its position is identical to the location of the burial pit indicated in the Bouyssonies' figures (Figs. 2 and 3). This is also supported by the relative position of the pit in relation to the relief of the roof (*SI Appendix, Fig. S7*) observable in the excavation pictures from the early 20th century.

The lack of evolved karstic morphologies and sedimentation connected to groundwater action in the bouffia Bonneval and in the adjacent La Chapelle-aux-Saints loci reject the hypothesis (7) of an endokarstic origin for the depression. Furthermore, the pit does not have the same morphology as the cryoturbation cells, ruling out a periglacial origin. The pit is also unlikely to derive from a brown or cave bear hibernation nest. It does not have the same morphology of such nests (refs. 22 and 23 and Fig. 2), ursid remains are quasi absent from the faunal spectrum (*SI Appendix, Table S4*) and its origin (natural or carnivore accumulation) is largely unclear, and the shallow depth and relatively large opening of the bouffia Bonneval make it unlikely to have served for bear hibernation (Figs. 1 and 3).

It is not clear whether the hollow into the marl was excavated by the resident Neandertals, a natural feature or a natural depression enlarged by them. No tool marks into the marl were detected. However, the pit cut partially through a cryoturbated fissure (stratigraphic unit C5) that contained Quina artifacts (Fig. 4). The last aspect demonstrates that the area of the depression was at least partially modified for the burial of LCS1, removing

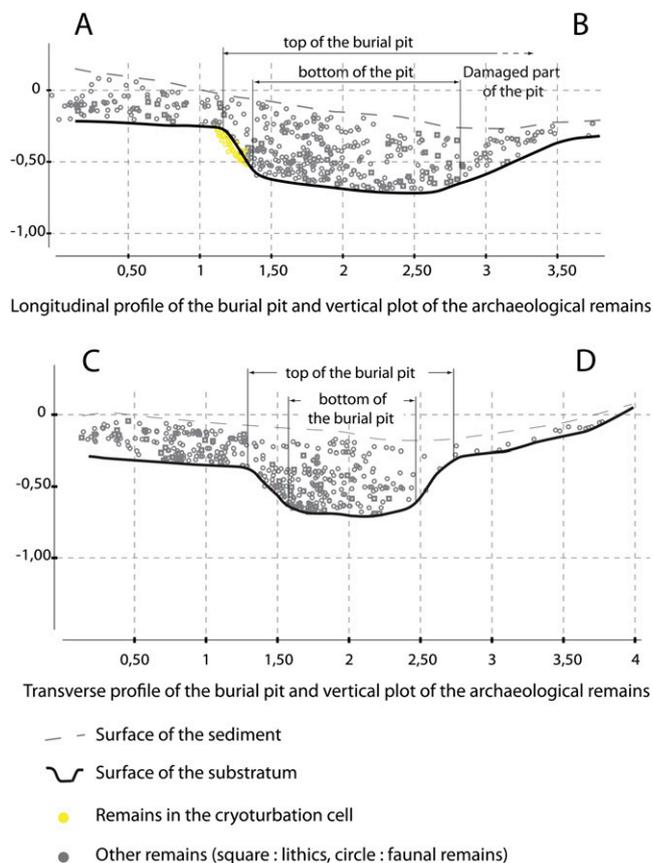


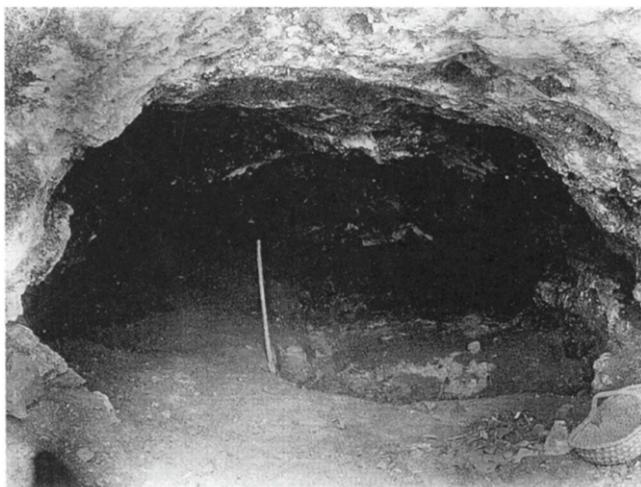
Fig. 2. Pit profile. The letters refer to Fig. 1. The in situ remains, found in the cryoturbated cell and observable in the A–B profile are in yellow. All other remains were found in the backfill.

accumulated cultural debris and sediment. This modification would have happened after the formation of the cryoturbated fissure, thus after the Quina deposit. Therefore, based on the excavations along the La Chapelle-aux-Saints cliff, an anthropogenic origin for the depression that contained the articulated remains of LCS1 at the bouffia Bonneval is the most parsimonious explanation.

Taphonomic Patterns of the LCS1 Neandertal

The taphonomic analysis of the human [number of identified specimens (NISP), 77] and faunal (NISP, 1,533) remains recovered in the early 20th century has included the systematic recording of climatic, mechanical, and carnivore modifications visible on the bone surfaces. The preservation of the human bones is significantly different from the pattern observed for the faunal material. The cortical surfaces of the Neandertal bones are significantly less deteriorated than the reindeer (χ^2 : 307.3; $P < 0.001$) or bovine (χ^2 : 212.7; $P < 0.001$) material. Only longitudinal cracks are observable on the LCS1 remains and smoothing and exfoliation are absent, whereas such modifications are frequent on the faunal elements (*SI Appendix, Tables S5 and S6*). No carnivore marks are observable on the human bones, although their occurrence on the faunal material (carnivore marks: 4.2% NISP) indicates that carnivores had access to the discarded carcasses.

These data highlight two different taphonomic histories for the human and faunal material, lending considerable support to the hypothesis that the Neandertal corpse was covered rapidly. Furthermore, all major anatomical regions are represented by



La Chapelle aux Saints, 1909



La Chapelle aux Saints, septembre 2012

Fig. 3. The bouffia Bonneval in 1909 and September 2012. The 1909 picture comes from the Fonds Bouyssonie-Ecole Bossuet.

the human skeletal remains (*SI Appendix, Fig. S9*), despite the absence of many of the smaller skeletal elements.

The recurrent modern fractures on all of the long bones of the LCS1 reflect the speed at which the Bouyssonies conducted their excavations and not preexcavation processes.

Discussion

Recent excavations at La Chapelle-aux-Saints have revealed Middle Paleolithic and carnivore occupations in numerous cavities along the cliff (17). Thousands of lithic artifacts and bone fragments attest to long-term occupations during MIS 4-3. The taphonomic recovery and our excavations in the bouffia Bonneval argue in favor of the existence of at least two distinct archaeological assemblages. After the deposition of the Quina Mousterian layer during the MIS 4, some cryoturbation occurred, injecting part of the material within the substratum. At some stage in the MIS 3, a group of bovine hunters, related to the MTA complex, occupied the cavity. Throughout these, at least two, occupations, Neandertals introduced a large number of medium and large ungulates, namely bovine and reindeer, which were processed on-site. Moreover, the excavations reported here have identified the exact position of the LCS1 burial pit.

The results of the comparative taphonomic analysis of the human and faunal materials demonstrate that the LCS1 Neandertal

corpse was rapidly interred and protected from the post-depositional modifications experienced by the faunal remains. The existence of an artificially modified pit and the rapid burial of the body constitute convincing criteria for establishing purposeful burial during the Middle Paleolithic of Western Europe.

Whether the origin of the pit is natural or anthropogenic is not considered here as a discriminatory factor because the opportunistic use of natural depressions in funeral practices has already been demonstrated in Upper Paleolithic contexts (24) and therefore cannot be ruled out as a possibility. The lack of information about the original stratigraphy and excavations makes it impossible to address the dynamic sedimentary processes involved in the filling of a pit. However, three arguments support the rapid burial of the corpse: the completeness of the cranial and infracranial elements, the existence of anatomical connections, and the preservation patterns seen on the cortical surfaces of the bones.

In Western Europe, 20 primary or secondary burials (25) have been proposed (*SI Appendix, Table S7*) for Neandertals. In each case, the burial hypothesis is based on at least one of these two criteria: the presence of a pit and the rapid burial of the remains. However, only 8 cases exhibit the two criteria in conjunction, and for the 12 other potential burials, the available information is insufficient for the burial context to be properly evaluated.

It should be highlighted that in every case where sufficient data are available, the burial is associated with an occupation characteristic of a residential camp (26, 27). Therefore, no task-specific location (28) in the European Middle Paleolithic can be linked exclusively to funerary activities (29). It thus seems that symbolic manifestations and economic patterns are both firmly embedded within European Neandertal territories.



— Limit of the cryoclastic feature cut by the pit

Fig. 4. Cryoclastic figure cut by the pit (stratigraphic unit C5).

Conclusion

More than a century after the discovery of the La Chapelle-aux-Saints skeleton, we have corroborated the information provided in the original excavation reports concerning the finding of an articulated, complete human skeleton within a depression in the bedrock. Microstratigraphic observation of the edges of the depression indicates that it postdates both the accumulation of Quina Mousterian deposits and their postdepositional cryoturbation and, therefore, that, originally, it cut through sediment fill, first, and then the bedrock itself. The anthropic origin of the excavation of this feature is the parsimonious reading of the evidence; a geogenic origin can be excluded, and there is no evidence that cave bears used the site for hibernation (and the site is too shallow for that to be possible in the first place). The taphonomy of the human remains sets them clearly apart from the site's fauna, because no carnivore modification is apparent, indicating rapid burial, as one would expect in a funerary context. No reason exists to question the interpretation of the LCS1 burial.

The results include the identification of three further Neandertal individuals, additional elements attributed to the first individual, as well as several other shelters occupied by Middle and Upper Paleolithic human groups.

In the light of our work at La Chapelle-aux-Saints and following the recent revision of the Roc-de-Marsal child burial, it now appears that a general reassessment of European Mousterian burials needs to be undertaken with the aim of furnishing new scientific arguments and evidence relevant to the ongoing debate surrounding Neandertal symbolic behavior.

Whatever the status may be of other purported Neandertal burials, the evidence from the bouffia Bonneval at La Chapelle-aux-Saints serves to establish the existence of intentional Neandertal inhumation in the European Middle Paleolithic. Therefore, this work contributes to the current redefinition of the general picture of Neandertal cultural behavior.

Materials and Methods

Excavation Method. From 1999 to 2010, we excavated seven cavities at La Chapelle-aux-Saints. One of them, bouffia 118, provided a significant series of lithic and animal remains (17). From 2011 to 2012, the excavations were centered in the Bouffia Bonneval. During 2011 excavations, only backfill deposits were identified in the cavities. In 2012, several in situ deposits were identified and excavated. At the end of the field project, more than 80% of the surface of the cavity was excavated. The excavations followed the same protocol during all of the process, whatever the nature of the excavated sediment (backfill or in situ deposit). All lithic artifacts larger than 25 mm and fauna larger than 30 mm were given 3D coordinates with a total station. Identifiable bones and every macrofaunal tooth fragment smaller than 30 mm were systematically collected. All natural stones larger than 10 mm were recorded with a single coordinate, and all natural stones larger than 150 mm were measured with multiple coordinates to describe their volume. A first anatomical and taxonomical identification was undertaken on the field for each faunal remain to identify in situ the potential human remains.

Sediment was collected by stratigraphic units and by quarter of square meter surfaces every 5-cm depth and was water-screened through fine mesh (1.8 and 2.2 mm). The coarse fraction was sorted to separate lithics, fauna, and any other archaeological items. Human remains were methodically looked for in the coarse fraction in a laboratory by a human paleontologist expert. Every cavity, locus and stratigraphic unit is described in detail in the excavation report that was presented to the Department of Archaeology of the Limousin Region (Service Régional de l'Archéologie du Limousin) on February 8, 2012*.

Taphonomic Analysis. The analysis concerned the faunal remains excavated in bouffia 118 and in bouffia Bonneval during the recent field project (more than 8,500 remains), the faunal material excavated during the early 20th century [Number of Remains (NR), 1,841], and the totality of the Neandertal remains discovered by the Bouyssonies (NR, 77) and located in the Musée de l'Homme in Paris (France). Every piece from the different faunal assemblages was analyzed by physical paleoanthropologist to recover all possible human remains. Pieces were identified at the most precise level, and, when it was not possible to propose a specific attribution, unguulate size classes were used (following ref. 30 modified from ref. 31). With regard to the skeletal part profiles, all identifiable specimens (including shaft fragments) collected were taken into account and recorded following the "element, portion, segment" coding format established by Gifford and Crader (32). Analysis of the bone surfaces for the faunal and human remains excavated by the Bouyssonies was performed by the same analyst (C.B.) to avoid interobserver variability. Weathering, root etching, anthropogenic, and carnivore modifications were systematically looked for using the criteria listed by Blumenschine et al. (33) and others (34–37). Moreover, oxide colorations of the bone cortical surfaces were carefully recorded. The stage of preservation of the cortical surfaces was estimated (following refs. 38 and 39). When unclear modifications were detected, specimens were subjected to more thorough evaluation with a 10–40× microscope. Percentage values were calculated on the basis of the total number of remains, bones with unobservable surfaces having been excluded (following ref. 40).

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