AMS dating of a recently rediscovered juvenile human mandible from Solutré (Saône-et-Loire, France)

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Résumé

Nearly 150 years of excavation at the Upper Paleolithic type-site of Solutré has yielded substantial evidence for Late Pleistocene human occupation, food procurement, and tool manufacture in the Mâconnais. To date, however, no human skeletal material from the Solutrean phase of this eponymous site has been discovered. Among the finds curated by the Field Museum of Natural History resulting from a relatively obscure and poorly documented excavation conducted at the heart of the site in 1896 is, however, a human juvenile mandible which had, until quite recently, escaped both notice and study. While the scanty stratigraphic information available for the specimen indicates that it comes from a Solutrean level, recently conducted radiometric analysis (an AMS date of 1676 ± 36 BP, uncalibrated) suggests a much more recent origin.

Entrées d'index

Mots-clés : Solutréen, Solutré, radiocarbone, restes humains
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Texte intégral

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Introduction

The site of Solutré (46°18’N, 4°42’E), located in the department of Saône-et-Loire, approximately 10km west of Mâcon, is most widely known as the eponym for the Solutrean lithic industry and phase of the Upper Paleolithic (fig. 1). The majority of cultural materials recovered from excavations over nearly 150 years were excavated from a gentle slope located to the south-east of a nearly 500m tall limestone escarpment, the Roche de Solutré, in areas known respectively as the Crot-du-Charnier, Terre Communale, Terre Seve, and Terre Souchal (Combier 2002).

Figure 1 - Location of the Solutré site (drawing J. Seagard).

Figure 1 - Localisation du site de Solutré (dessin de J. Seagard).
The earliest excavations at Solutré began in 1866 under the direction of Adrien Arcelin and Henri Testot-Ferry, with efforts focused on the so-called “horse magma”, a layer of accreted horse bones, and several foyers du renne, hearths ostensibly of the l’age du renne, or the Solutrean (Combier 2002). Between 1873 and 1895, Arcelin, with the aid of Abbé Ducrost, conducted further excavations at the site, which identified three successive culturally distinct layers of occupation, Solutrean, Gravettian, and an unattributed basal stratum, which was subsequently defined in 1907 by Abbé Breuil as Aurignacian. Continued work in the 20th century by the University of Lyon and Jean Combier on behalf of the CNRS have combined to produce a fairly fine-grained understanding of the complex nature of over 20,000 years of occupation and activity at the site of Solutré (Combier 2002). What is lacking from the site, however, are definitively Solutrean period human remains, the discovery of which would allow useful and meaningful bio-cultural inferences about the lifeways of the ancient inhabitants of Solutré to be made. Numerous “pretenders”, human skeletal remains thought to be of Solutrean (or older) vintage, have been brought forward (e.g. Arcelin 1878), but, to date, none have withstood serious scientific scrutiny (Riquet 1955). The legitimacy of a recently re-discovered specimen of human skeletal material from Solutré is examined herein in the hopes that its verifiable antiquity might help to fill a gap in our knowledge base of life in Upper Paleolithic Southwestern Europe.
In 1896, at the same time as Arcelin and Ducrost were performing stratigraphically-oriented and rigorously documented work on the Crot-du-Charnier, the excavator of what would come to form the Field Museum’s collections, a M. Veillerot, working on behalf of the Union Parodiènne, was excavating in a more slapdash fashion just a few meters to the west (Combier 2002; Dalton 1968). To date, the almost total absence of documentation for Veillerot’s excavation has impeded interpretation of the resulting collection of material culture, a portion of which now resides at the Field Museum of Natural History in Chicago, Illinois. The only surviving account of the 1896 work is that of a Monsieur O. Vauvillé, a member of the Société d’Anthropologie de Paris, who visited the site for one day in May of 1896, and who recorded his observations in a report to the Société. From this report, however brief, several important aspects of the 1896 excavation can be reconstructed, thereby providing the resulting materials with some degree of archaeological context.

First, Vauvillé states that the single trench was located “…au-dessous et contigu, du bout Est, au mur de clôture qui est vers l’Ouest du lien dit le Crot-du-Charnier, et à l’Ouest du chemin montant de Solutré au gisement” (Vauvillé 1896). We associate the enclosure wall and path Vauvillé describes with the mur and chemin depicted in the A-B section drawing of the Crot-du-Charnier published in Arcelin 1890 (fig. 2). In turn, transposing these features, and the distance between them, onto the A-B line of the plan drawing of Arcelin 1890 (fig. 3), allows us to surmise that Veillerot’s trench may have been located in the shaded area of fig. 3, to the west of the Crot-du-Charnier (note 1). In 1896, this area would have been, as Vauvillé described the trench’s location, a relatively undisturbed portion of the site. Finally, from Vauvillé we know the size of the trench (approximately 45m²) and that it included the remains of at least one well-stratified hearth (Vauvillé 1896). Beyond this fleeting reference, little is known of the stratigraphy of the 1896 trench.
Much of the material in the Field Museum’s collection is ascribed to one of four “foyers du renne”, hearths ostensibly of the Solutrean phase. As with much surrounding the early excavations at Solutré, the designation of these hearths as Solutrean remains suspect. Some of these foyers are further divided into levels, “couches”, which may represent either artificial spits imposed by the excavators or true archaeological levels, reflecting soil, use, or depositional changes. Combier has suggested (e.g. Combier 2002), based on later excavations, that much of the material in these hearths may be Magdalenian or later, although analysis of lithics from these hearths held by the Field Museum did not identify any Magdalenian inclusions, finding only tools of the Solutrean industry (Dalton 1968). Additional catalog lots at the Field Museum are designated as belonging to a particular “foyer/couche du cheval”, which, with a few exceptions, seem to describe the “horse magma” and accompanying hearths below the Solutrean occupation levels. Arcelin described these levels as Mousterian, Combier calls the hearths instead Perigordian or Aurignacian and the magma Gravettian, but suffice to say that they appear to be pre-Solutrean. The wrinkle, both literally and figuratively, is that in at least two different lots...
Osteological analysis

The specimen is comprised of approximately 60% of a juvenile mandible, broken post-mortem into two fragments (fig. 4). The larger posterior fragment includes a substantial portion of the right ascending ramus (although the most superior portions of both the coronoid and condylar processes are absent) and the majority of the right mandibular corpus through a break that bisects the socket of the right I₂ and the crypt of the right Cₓ. The smaller anterior fragment abuts the mesial end of this break and includes the entirety of the mental trigone and the beginning of the proper left portion of the dental arch through a break that passes through the thin section of bone remaining between the crypts of the left Cₓ and left P₁, between the left I₂ and left dCX.

Due to the limited nature of this specimen, dental development was the sole means by which biological age could be assessed. Given the lack of precision of dental ageing techniques based solely on the timing of tooth eruption, the biological age of this specimen was assessed instead by means of a radiographic examination of the state of deciduous and permanent dental mineralization, development, and resorption using the techniques of Moorrees, Fanning, and Hunt 1963a (as reworked in Smith 1991) and Moorrees, Fanning, and Hunt 1963b (fig. 5). The developmental stages of two deciduous (dm₁ and dm₂) and four permanent (P₁, P₂, M₁, and M₂) mandibular teeth were assessed, yielding the stage assessments and accompanying male and female mean ages detailed in Table 1. For the present purposes, the assessed developmental states and resultant ages derived from the individual roots of multi-root teeth have been averaged. The resulting age range for this individual is 6.7-9.4 years, with an average of 8.3 years. An age at the upper end of this range (in excess of 8 years) is independently supported both by the mild wear on the mesio-buccal cusp of the M₁, the presence of which
suggests that that tooth must have been in occlusion for some significant period of time following its eruption around age 6, and also by the first possible hint of onset of mineralization in the crypt of the $M_3$, which occurs, on average, just after 9 years of age (Smith 1991).

Figure 4 - Superior view, FM no. 215505 (photograph W. Pestle, drawing J. Seagard).

Figure 4 - Vue de dessus, FM n o 215505 (photo W. Pestle, dessin de J. Seagard).

Figure 5 - Medio-lateral radiograph, FM no. 215505 (photograph W. Pestle).

Figure 5 - Radiographie medio-latérale, FM n° 215505 (photo W. Pestle).

Table 1 - Dental development age assessment using the techniques of Moorrees, Fanning and Hunt 1963, and Smith 1991.

Areas of periodontal disease, visible in the osteological record as alveolar resorption, were observed at both the dm₁ and in the area of the incisors, with the most pronounced appearance at the level of the right I₁. While some of the observed bone loss is, no doubt, the result of taphonomic processes, the moth eaten appearance of alveolar bone is consistent with either periodontal disease, an ankylosed frenum, or both (Mintz et al. 2005). The latter etiology, commonly resulting in a “lip tied” condition which promotes the retention of food residues and the proliferation of bacteria, would also be consistent with the extremely robust appearance of the chin of this specimen (American Academy of Pediatric Dentistry 2005). Several carious lesions were observed on this specimen, one on the occlusal surface of the right M₁, between the mesio-buccal and mesio-lingual cusps, and three additional small buccal pit caries on the right dm₁, dm₂, and M₁. The presence of these carious lesions is suggestive of a recent origin for this specimen, as one would not expect this number of dental caries in an individual who had consumed the typically low-carbohydrate, low-sugar diet of the Upper Paleolithic (Hillson 1996).

Several aspects of the pathological presentation of this specimen stem from a possible case of malocclusion. This diagnosis is supported by the heavier than expected wear on the mesio-buccal cusp of the M₁, which appears markedly different from the other cusps of the same tooth. While this wear could be the result of a high grit diet (in which case, an accelerated, but non-pathological, wear progression would begin, as normal, with the mesiobuccal cusp of M₁ (Hillson 1996), a possibility supported by the wear found on the dm₁ and dm₂, it could also stem from malocclusion with the corresponding maxillary teeth (dm₂ or M₁). Either etiology (facial dysplasia, prognathism, or malocclusion) could explain the presence of heavy wear on both central incisors resulting in the exposure of dentin and the production of a knife-edged appearance of their occlusal surfaces (Garcia Pola et al. 2002).

Finally, this specimen possesses a notable, albeit non-pathological, non-metric variation in the form of a small (approx. 1 mm) fenestration on the lingual aspect of the mandibular ramus at the apex of the distal root of M₁. This aperture would have, in life, provided the opening by which a branch of the lingual nerve would have individually innervated the first molar. This trait, present in approximately 2% of modern human adults, has only infrequently been recognized in the paleopathological record (Kay 1974).

Direct AMS radiocarbon dating

The sediment that made up the soil sample in which this specimen was re-discovered
was notably red in color, which we took as a preliminary indicator of the post-Glacial date eventually ascribed to this specimen (Jayet 1951, Dalton 1968). AMS dating of a sample (OxA-13424) from this specimen was performed in late 2003/early 2004 by the Oxford University Radiocarbon Accelerator Unit. Chemical pretreatment, target preparation, and AMS measurement were performed following procedures detailed in Hedges et al. 1989, Ramsey et al. 2000a, Ramsey et al. 2000b, and Hedges et al. 1992. The uncalibrated result in radiocarbon years BP (Before Present-AD1950) is as follows: OxA-13424, human bone, \[ \Delta \varepsilon = -18.7 \% \text{, } 1676 \pm 36 \text{ BP.} \]

When calibrated using Oxcal v3.10 of C. Bronk Ramsey and the atmospheric data of INTCAL04 (Reimer et al. 2004), the sample is found to date to the period between 240 AD and 540 AD (3-sigma). For the purpose of comparison, faunal specimens in the Field Museum’s collection from several of the foyer du renne of Veillerot’s excavation were also dated by AMS. One of these faunal specimens (OxA-13298), the calcaneus of a Cervus elaphus, from a foyer du Renne, yielded a definitive date of the Solutrean phase, between 22200 cal BC and 20900 cal BC. Another sample, the maxilla of an Equus sp. (OxA-13299), from the 4e foyer du Renne, 6e Couche, dated to between 16100 cal BC and 14800 cal BC, the heart of the Magdalenian phase.

**Conclusions and discussion**

Specimen no. 215505 represented the tantalizing possibility of the presence, in a legitimately Solutrean level from the site of Solutré, of human remains. The authenticity of similar specimens has been the subject of great debate in scholarly journals for over a century (Arcelin 1878, Riquet 1955). Perhaps not surprisingly, all available evidence in this instance appears to rule out the possibility of the specimen’s Solutrean antiquity. The apparently post-Glacial character of the sediments in which it was discovered and the presence of such a large number of carious lesions in the dentition of this individual are both indicative of a relatively recent origin for this specimen, a conclusion that is confirmed by the late antique provenance determined by AMS dating.

Given the stark contrast between the date of the human mandible in question and the much older dates of the faunal materials discovered in presumably close context, it is reasonable to assume that the human mandible, no. 215505, represents a much later burial which intruded into bona fide Upper Paleolithic strata. While this result lessens the significance of the individual specimen, it does begins to offer some insight into the nature and stratigraphy of the archaeological levels of Solutré as is represented in collections at the Field Museum of Natural History. Further research is presently being conducted on the mass of faunal materials at the Field Museum in an attempt to reconstruct fully the stratigraphy and absolute chronology of the materials recovered in such a slipshod manner over a century ago.

**Bibliographie**


ARCELIN A. 1878– Les sepultures de l’age du renne de Solutré. Revue des questions

http://paleo.revues.org/index772.html
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Annexe

Version française abrégée

Solutré est connu en tant que site éponyme de l'industrie lithique solutréenne correspondant à une période du Paléolithique supérieur. Près de 150 ans de fouilles à Solutré ont mis en évidence une occupation humaine datant du Pléistocène tardif, l'existence d'un approvisionnement en nourriture et de fabrication d'outils dans le Mâconnais. A ce jour, toutefois, aucun reste humain n'a été découvert dans les niveaux solutréens. Plusieurs « candidats » ont bien été proposés (Arcelin 1878) mais aucun n'a résisté à un sérieux examen scientifique (Riquet 1955). Des restes humains provenant de Solutré, récemment redécouverts, sont examinés ici dans l'espoir que leur ancien naïté puisse nous aider à combler les lacunes de nos connaissances sur la vie au Paléolithique supérieur dans le sud-ouest de l'Europe.

Le spécimen considéré dans le cadre de cette étude a été redécouvert à la fin de l’année 2002 au Field Museum of Natural History. Il est constitué de deux fragments contigus provenant d’une mandibule d’un être humain juvénile. Ce spécimen a été mis au jour lors de fouilles archéologiques effectuées en 1896 au Crot-du-Charnier par un certain M. Veillerot. En utilisant le seul document qui nous est parvenu au sujet de ces fouilles, une lettre de 1896 écrite par Monsieur O. Vauvillé, un membre de la Société d’Anthropologie de Paris, nous avons essayé de localiser l’endroit d’où proviendrait le spécimen. Il aurait été prélevé quelque part dans la zone sombre de la figure 3, à l’ouest de Crot-du-Charnier. S’appuyant sur une note trouvée avec le spécimen, décrivant le lieu de la découverte : « 4e foyer du Renne, 3e couche », nous sommes confrontés à la possibilité, somme toute assez mince, que le spécimen puisse provenir d’une couche solutréenne.

Un examen ostéologique approfondi a permis d’établir que le spécimen appartiendrait à un individu âgé de 6,7 à 9,4 ans. Il a également révélé l’existence de caries et de problèmes dentaires provoqués peut-être par un cas de malocclusion et de maladie parodontale. La présence des caries est un indicateur de l’âge géologique du spécimen. De telles caries ne sont pas compatibles avec le régime alimentaire faible en glucide et notamment en sucre, d’un individu du paléolithique supérieur.


Le spécimen n° 215505 représentait donc la possibilité très excitante d’avoir découvert la présence de restes humains dans une couche solutréenne du site de Solutré. Malheureusement, nos travaux n’ont pas permis d’établir une datation correspondant à la période solutréenne pour ce spécimen. Des éléments de faunes (dont un maxillaire d’Equus sp. (Oxa-13299) découverts dans le même contexte du 4e foyer du Renne, 6e couche, ont été datés entre 16 100 cal BC et 14 800 cal BC (période magdalénienne). La différence de datation entre la mandibule humaine n° 215505 et la faune laisse penser à une inhumation plus récente qui constituerait une intrusion dans une couche paléolithique supérieure.

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