Middle Paleolithic Remains and Loess/Paleosol Sequences at Eguisheim (France)

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ABSTRACT

Archaeological excavations at Eguisheim have revealed a small quantity of Middle Paleolithic finds associated with periglacial mammal fragments. Given the scarcity of such occurrences in Alsace (eastern France) and important older Paleolithic discoveries around Eguisheim, close attention was paid to the chronostratigraphical framework of these remains. The investigated sequence starts with loessic Saalian deposits. A Bt horizon, attributed to the Eemian Interglacial, has revealed Middle Paleolithic finds in a primary position (one pseudo-Levallois point and fragmented faunal bones). It is covered by a dark and humic Early Glacial soil. The stratigraphical sequence continues with silty deposits from the Middle Pleniglacial. An erosive phase during the Middle/Upper Pleniglacial transition results in large gullies with sandy fills; these contain reworked lithic artifacts and fragmented mammal bones. A second episode of loess deposition occurs during the Upper Pleniglacial. Our results are consistent with the chronostratigraphical framework established for loess deposits in north-western Europe. The overall stratigraphy shows marked lateral discontinuity, which results from the topographical context, at the bottom of a loess-covered hill. This particular context allowed the preservation of ancient deposits, only 2-3 meters below the present surface.

RÉSUMÉ

Les fouilles archéologiques d'Eguisheim (Haut-Rhin, France) ont révélé une petite quantité de vestiges du Paléolithique moyen associés à des restes de faune périglaciaire. Etant donné la rareté de telles occurrences en Alsace et l'importance des découvertes paléolithiques plus anciennes réalisées autour d'Eguisheim, une attention particulière a été portée au cadre chronostratigraphique de ces vestiges. La séquence étudiée commence avec des dépôts lœssiques saaliens. Un horizon bt, attribué à l'Interglaciaire Eémien, a révélé des découvertes du Paléolithique moyen en position primaire (une pointe pseudo-Levallois ainsi que des ossements de faune fragmentés). Il est recouvert par un sol humifère datant du

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Début Glaciaire Weichselien, puis par des dépôts limoneux du Pléniglaciaire moyen. Une phase d'érosion lors de la transition entre le Pléniglaciaire moyen et le Pléniglaciaire supérieur a donné lieu à de grandes ravines dont le remplissage sableux contient des artefacts lithiques et des restes de faune remaniés. Un deuxième épisode de dépôt de lœss a enfin lieu durant le Pléniglaciaire supérieur. Nos résultats sont alors cohérents avec le cadre chronostratigraphique établi pour les dépôts de lœss dans le nord-ouest de l'Europe. La stratigraphie globale montre une discontinuité latérale marquée, qui résulte du contexte topographique, au pied d'une colline couverte de lœss. Ce contexte particulier a ainsi permis la préservation de dépôts anciens, à seulement 2-3 mètres sous la surface actuelle.

ZUSAMMENFASSUNG

Bei archäologischen Ausgrabungen in Eguisheim (Haut-Rhin, Frankreich) wurden einige mittelpaläolithische Befunde in Verbindung mit periglazialen Tierknochenresten ans Licht gebracht. Angesichts der Seltenheit solcher Befunde im Elsass sowie der Bedeutung der paläolithischen Funde aus älteren Grabungen aus der Umgebung von Eguisheim wurde dem chrono-stratigraphischen Rahmen dieser neuen Überreste besondere Aufmerksamkeit gewidmet. Die untersuchte Sequenz beginnt mit saalezeitlichen Lössablagerungen. Ein bt-Horizont, der dem Eem-Interglazial zugeordnet wird, enthielt Funde aus dem Mittelpaläolithikum in primärer Position (eine Pseudo-Levallois-Spitze sowie fragmentierte Tierknochen). Er wurde zunächst von einem humosen Boden aus dem Beginn der Weichsel-Eiszeit überlagert und später von Schluffablagerungen aus dem mittleren Pleniglazial bedeckt. Eine Erosionsphase während des Übergangs vom Mittel- zum Spätpleniglazial führte zu großen Einbuchtungen, deren sandige Verfüllung verrollte Steinartefakte und Tierknochenreste enthielt. Eine zweite Episode der Ablagerung von Löss findet schließlich während des Spätpleinglazials statt. Damit stimmen unsere Ergebnisse mit dem chrono-stratigraphischen Rahmen überein, der für die Lössablagerungen in Nordwesteuropa aufgestellt wurde. Die Gesamtstratigraphie zeigt eine deutliche laterale Diskontinuität, die aus dem topographischen Kontext am Fuße eines mit Löss bedeckten Hügels resultiert. Dieser besondere Kontext ermöglichte die Erhaltung alter Ablagerungen in nur 2-3 m Tiefe.

INTRODUCTION

In 2015, an archaeological excavation of a Gallo-Roman site at Eguisheim (Grand-Est region, France, Fig. 1), conducted by Antea Archéologie, revealed a small number of Middle and Upper Paleolithic remains associated with periglacial mammal fragments (Murer et al. 2016). During this excavation, the stratigraphical and paleoenvironmental contexts of these remains were closely examined. Prior to the excavation, an archaeological survey, carried out by INRAP (*Institut National de Recherches Archéologiques Préventives*), provided significant information regarding sedimentary accumulation during the Middle Pleistocene (Griselin 2014). Here, we present the preliminary results of these studies, which we relate to the long-known and rich prehistoric context of the Eguisheim area. The implications of our studies in a regional context, and on the other side of the Rhine, are also discussed.

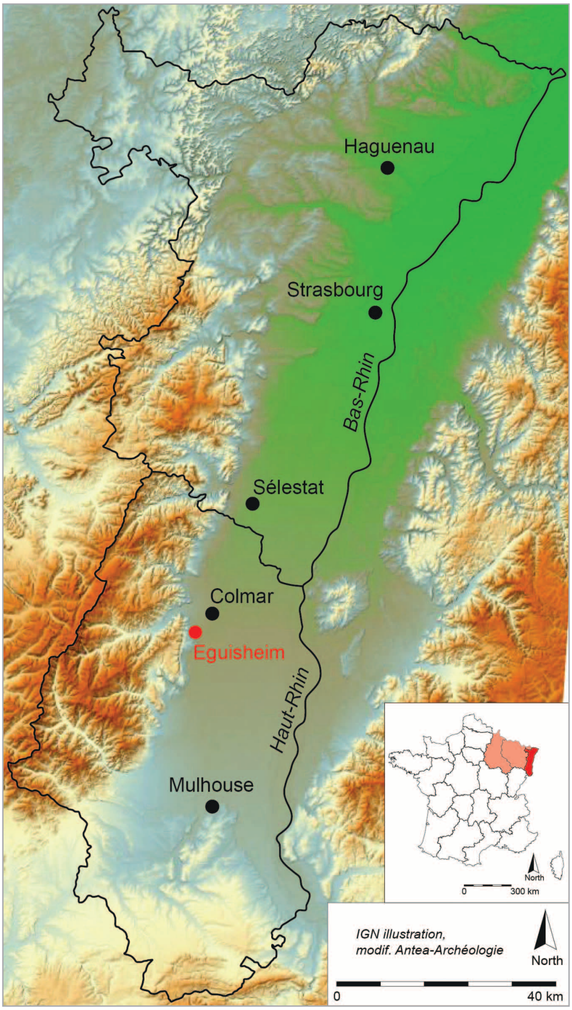


Fig. 1.
Localization of Eguisheim (*Institut Géographique National*, modified by Simon Goudissard).

Quaternary loess deposits in the vicinity of Eguisheim

Between the Vosges Mountains and the Ill floodplain, the Eguisheim landscape is composed of tertiary hills, which were raised by tectonic activity during the formation of the Upper Rhine Graben (Fig. 2). These hills are mainly made up of Oligocene marl and conglomerates, which came from a granitic and sandstone catchment basin (Théobald et al. 1976). Fine and carbonate aeolian dusts (loess) blanketed these hills during the Quaternary glaciations. These deposits can reach a thickness of 10 meters (e.g., at Eguisheim quarry; Théobald et al. 1976). The ongoing Quaternary climate variations have resulted to loess and paleosol sequences, but these climatic records are not yet fully characterized in the area around Eguisheim (Blanck and Wacquant 1971). Our excavation is located at the foot of one

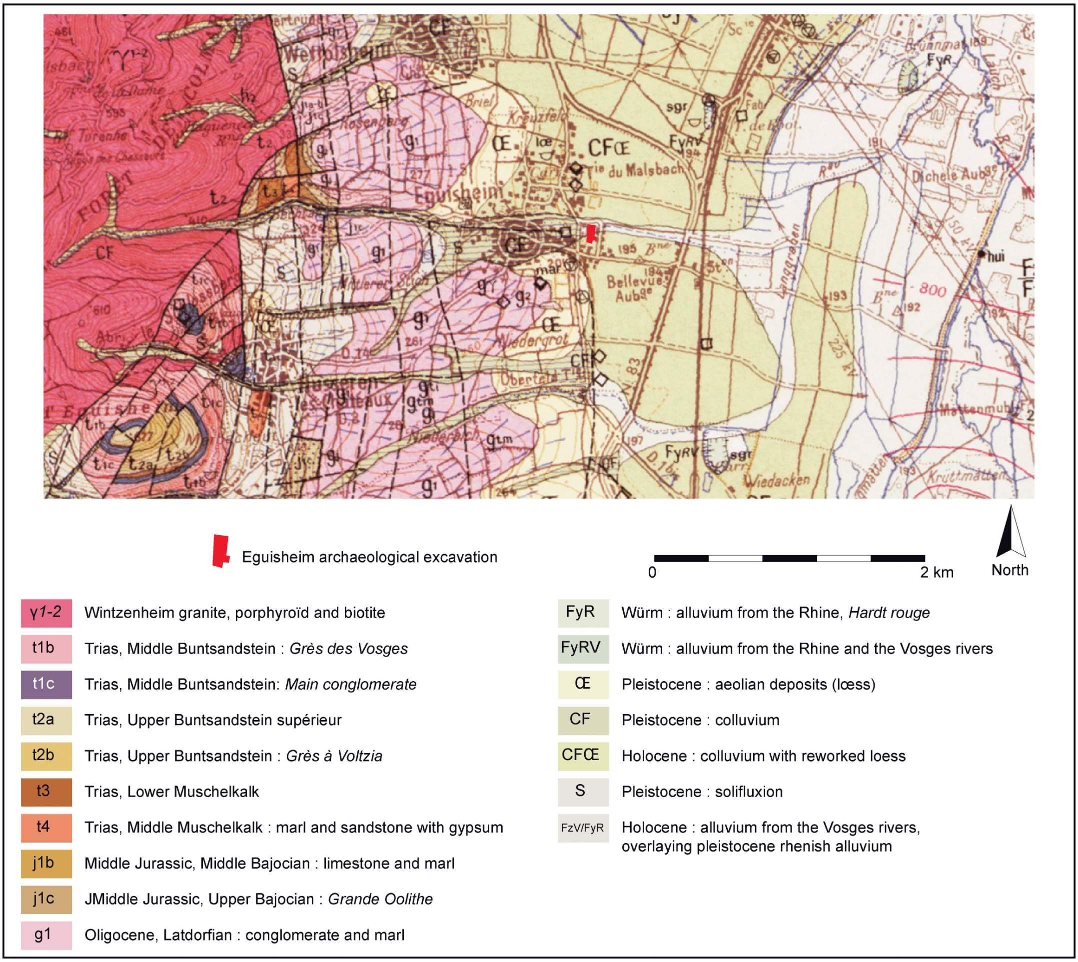


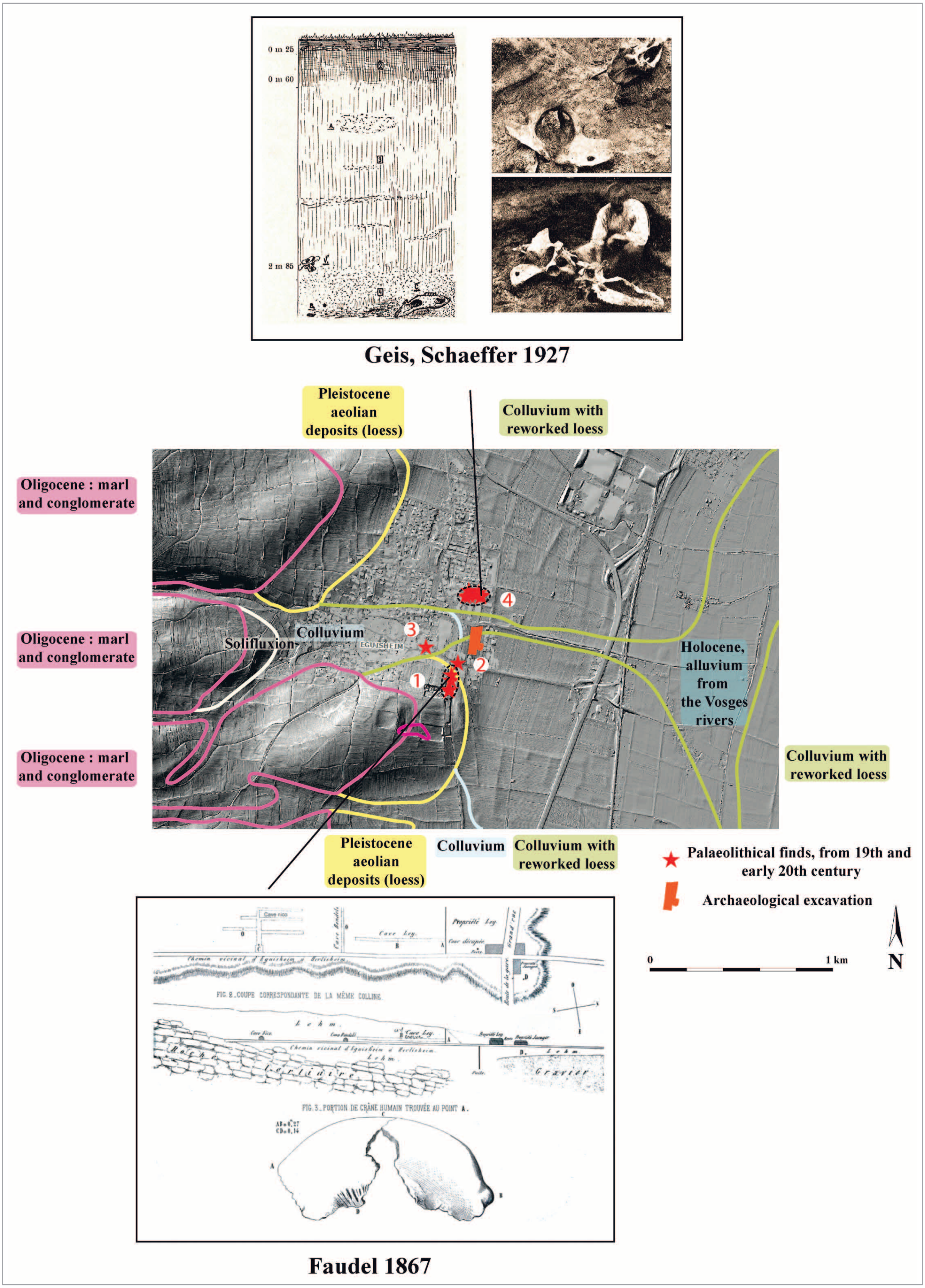
Fig. 2. above
Geological map around Eguisheim (*Bureau de Recherches Géologiques et Minières*, modified by Simon Goudissard).

Fig. 3. right
Paleolithic finds around Eguisheim (Lidar topography by *Conseil Départemental du Haut-Rhin*, modified by F. Bachellerie and S. Goudissard).

of the loess-covered hills (Bühl Hill), where a Quaternary accumulation of loess colluvium and sandstone alluvium, carried from the Vosges by a nearby stream (the Marlsbach), have merged together to form a smooth slope towards the east, extending to the nearby floodplain of the Ill River (Fig. 3). The excavation area is at a height of 199 to 196 m asl, lower than the nearby "Bühl hill," who reaches a height of 220 m asl, and slightly higher than the Ill floodplain, at 195 m asl.

Eguisheim: A hotspot for prehistoric research in Alsace

Revealed through investigations carried out by erudite scholars during the second half of the 19th century and the first half of the 20th century, several archaeological discoveries testify to scattered Paleolithic occupation around Eguisheim (Fig. 3). In 1867, during the construction of a beer cel-



Geis, Schaeffer 1927
Pleistocene aeolian deposits (loess)
Colluvium with reworked loess
Oligocene : marl and conglomerate
Oligocene : marl and conglomerate
Oligocene : marl and conglomerate
Solifluxion
Colluvium
EGUISHEIM
1
2
3
4
Holocene, alluvium from the Vosges rivers
Colluvium with reworked loess
Pleistocene aeolian deposits (loess)
Colluvium
Colluvium with reworked loess
Palaeolithical finds, from 19th and early 20th century
Archaeological excavation
0
1 km
N
FIG. 2. COUPE CORRESPONDANTE DE LA MÊME COLLINE
FIG. 3. PORTION DE CRÂNE HUMAIN TROUVÉE AU POINT A.
Faudel 1867

lar, Dr. Faudel discovered two fragments of human skulls (a frontal and a parietal bone) at a depth of 2.5 meters within loess deposits (Faudel 1867; Fig. 3: 1). Now identified with certainty as belonging to *Homo sapiens*, for several decades these skulls were wrongly identified as *H. neandertalensis* (Boës 2005). Close to the skulls, Dr. Faudel unearthed several fragmented deer and bovine bones. Dr. Faudel also makes reference to the discovery in 1867 of mammal bones on a property owned by Mr. Jaenger, which is adjacent to our excavation area (around 50 meters from the southern limit of our trenches; Faudel 1867). The remains, a mammoth molar and a bovine metacarpal, were uncovered at the bottom of a loess sequence, in granitic gravels (Fig. 3: 2). In 1902, K. S. Gutmann describes the discovery, 1 m below the surface, of several mammoth bones which had been disturbed from deeper horizons by Neolithic digging (Gutmann 1902; Fig. 3: 3). Finally, in 1927, A. Geis and F. A. Schaeffer describe their discoveries in a clay pit near our own excavation (Geis and Schaeffer 1927; Fig. 3: 4). At a depth of between 3 and 4.5 m they found several fragmented deer antler, an ibex skull, scattered horses bones, a mammoth tusk and an anatomically connected rhinoceros skeleton. These numerous remains lay within quartz sands, below a 2-m thick clay sequence, which had a brown to yellow hue, and sandy layers.

Methodology

Our investigations concerned unexpected Paleolithic finds which were uncovered during the excavation of a rich Gallo-Roman site but which had initially gone unnoticed for several reasons (profusion of antique remains, shallow depth of the contemporary layout). Despite the failure of the subsequent archaeological survey to reveal Paleolithic finds, the quaternary substrate was sampled anyway. Thus, fieldwork carried out as part of the excavation program consists of logging and sampling cross-sections in selected areas (Fig. 4). Samples were taken during the archaeological survey and the excavation in order to perform sedimentological, micromorphological and malacological analyses. Furthermore, seven optical stimulated luminescence (OSL) dates were obtained for the stratigraphical sequence. In this paper, we will present preliminary results from the sedimentological analyses, OSL dating, identification of faunal remains, and typo-technological studies of lithic artifacts. Sedimentological analyses were carried out by M. Trautmann, at Strasbourg University (Laboratoire d'Analyses des Sols, France), and consisted of laser granulometry (Beckman-Coulter, LS230), calcimetry, and organic matter concentration which was measured by loss on ignition at 375° C. OSL samples taken during the INRAP archeological survey were dated by Alexander Fülling at the Humboldt Universität in Berlin. OSL samples taken from the Antea archaeological excavation were dated by Armel Bouvier at CIRAM-Art (Bordeaux, France). Faunal bones were examined by Cedric Beauval (Archéosphère society).

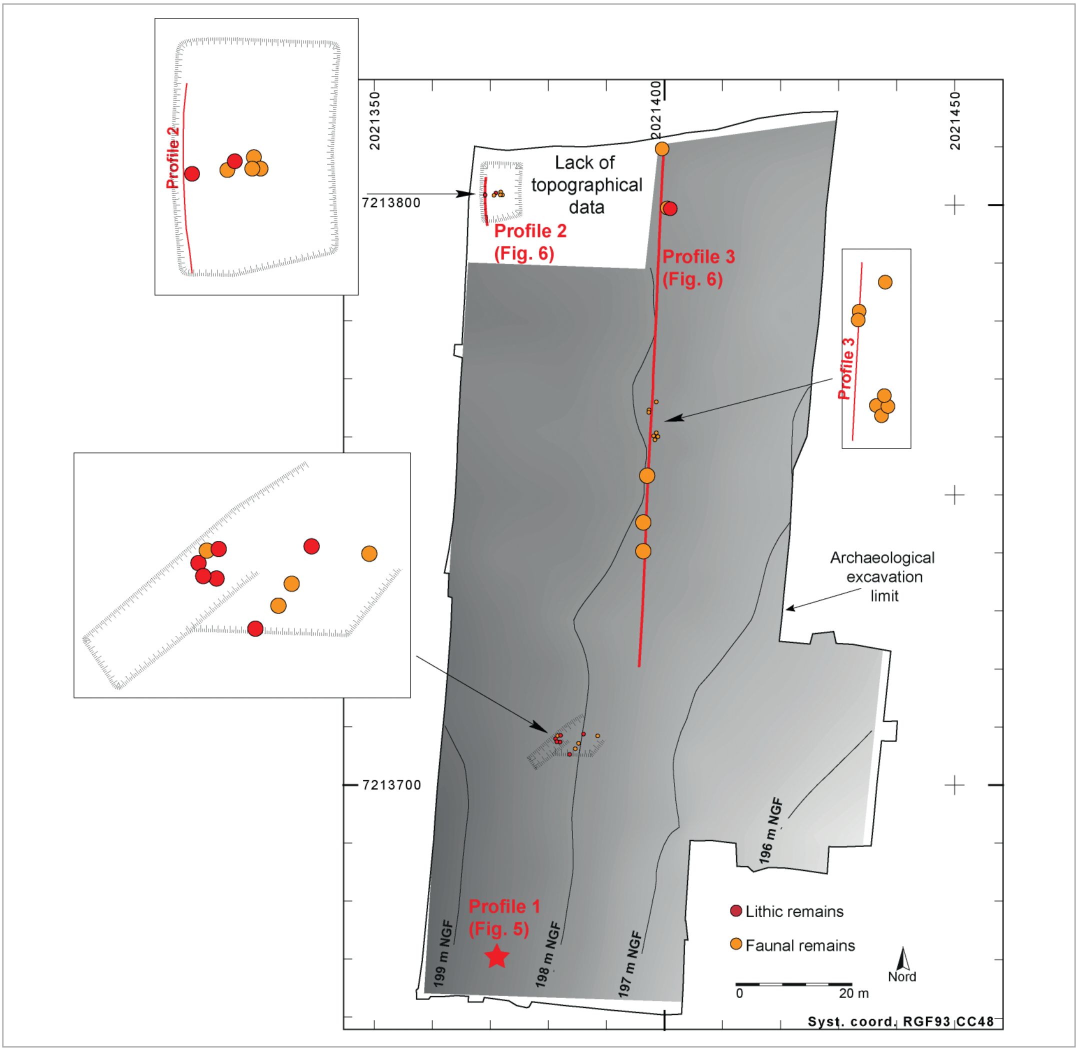


Fig. 4.
Sedimentary profiles localization (S. Goudissard, F. Bachellerie and S. Goepfert).

RESULTS

Pedosedimentary framework

Several sedimentary units and soil horizons were distinguished and were grouped together within 8 main pedostratigraphic sequences (I to VIII), according to their depositional and alteration processes (Figs. 5, 6 and 7). They are described below, from the oldest one to the most recent.

Sequence I (Fig. 5): The oldest sequence was recorded at the south of our excavation, around 60 meters away from Dr. Faudel's discoveries on a

Sample	Lab. No.	Uranium (U-238) [ppm] (a)	Thorium (Th-232) [ppm] (a)	Potassium (K-40) [ppm] (a)	Cosmic dose rate [Gy/ka] (b)
EGU 14, Log 2, OSL 1	HUB-0596	2.66 ± 0.14	9.24 ± 0.43	1.2 ± 0.03	0.20 ± 0.02
EGU 14, Log 2, OSL 2	HUB-0597	2.75 ± 0.11	10.33 ± 0.57	1.51 ± 0.03	0.18 ± 0.02

Table 1. above and right
Dosimetry data and OSL ages (F. Preusser).

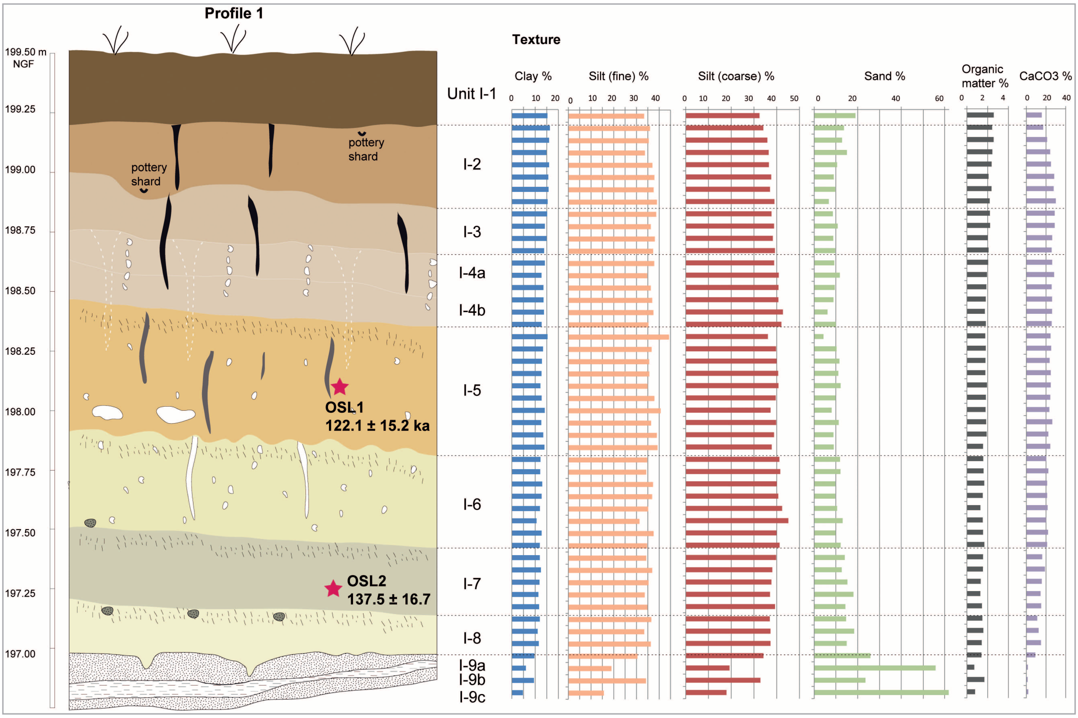


Fig. 5.
Sedimentary log in loess sequence (N. Schneider).

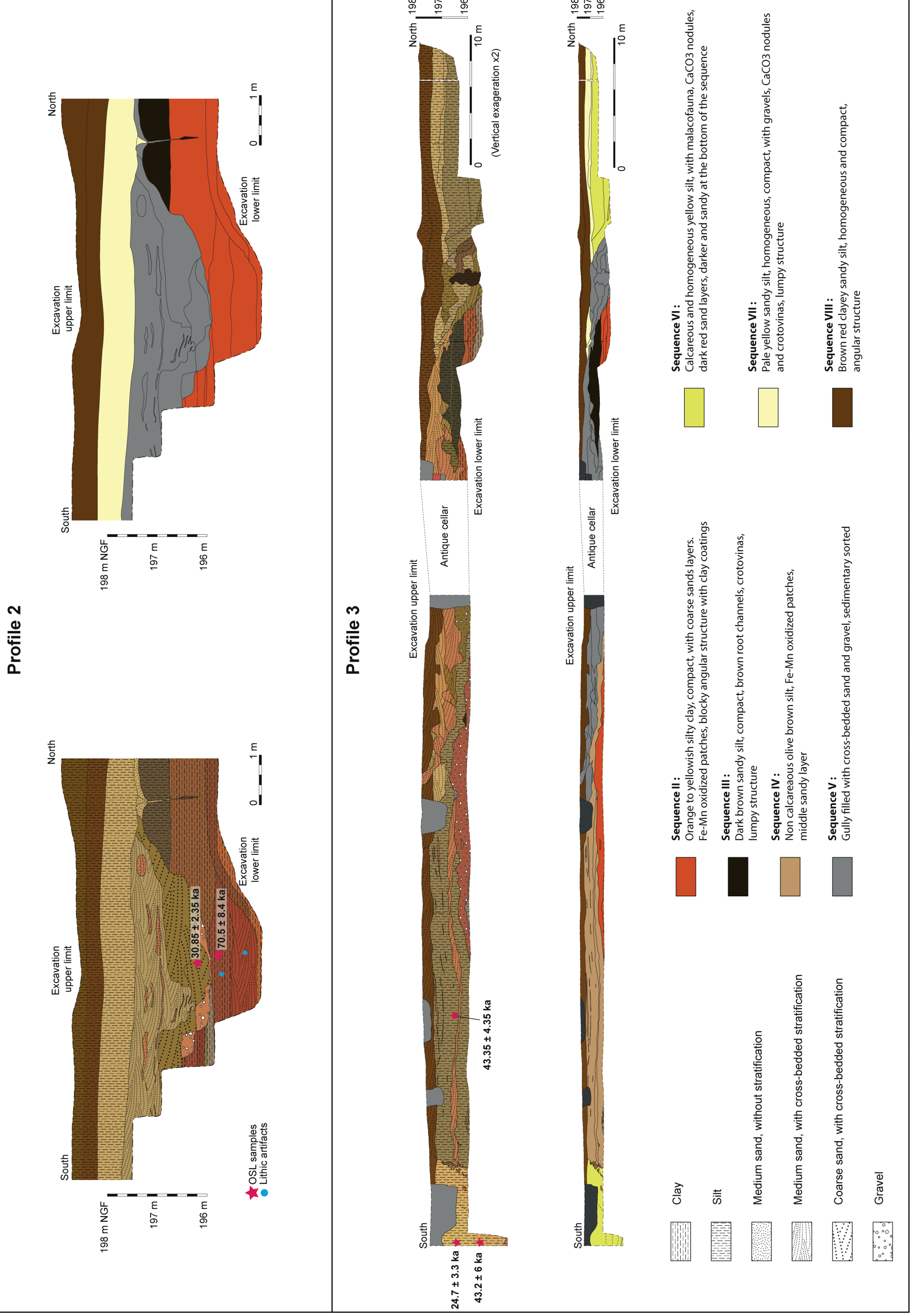
property owned by Mr. Jaenger (see above). This sequence is 2.5 meters thick, and is an accumulation of calcareous loess layers, without clear sedimentary ruptures. The bottom of the sequence is made up of fine sorted layers of medium to coarse sands, with altered granitic clasts (Unit I-9). Above these sands lay beige grey clayey silts, with a few granitic pebbles and less sands for the upper part of these units (Units I-8 and I-7). They are covered by a dark yellow loess, which is powdery and contains numerous carbonated nodules and malacofauna (Unit I-6). This loess displays vertical tongues of greyish color, which could attest to soil leaching. This unit is overlaid by an orange yellow loess, of platy structure, with some

Water cont. measured [%] (c)	Water cont. estimated [%] (d)	Dose rate (Do) [Gy/ka] (e)	Equivalent dose (De) [Gy]	Age Model (f)	OSL age [ka] (g)
13.5 (14.4)	15 ± 5	Q: 2.31 ± 0.17	309.9 ± 9.1	CAM, OD = 3.5%	133.9 ± 10.3
		FG: 3.37 ± 0.41	411.0 ± 10.5	CAM, OD = 0%	122.1 ± 15.2
12.1 (16.2)	15 ± 5	Q: 2.65 ± 0.18	340.1 ± 12.1	CAM, OD = 4.5%	128.6 ± 10.1
		FG: 3.78 ± 0.45	520.3 ± 15.0	CAM, OD = 0%	137.5 ± 16.7

(a) Uranium, thorium, and potassium contents were determined via high resolution gamma ray spectrometry (HPGe detector).
U-238: U-234 (53.2 keV), Th-234 (63.3 keV), Ra-226 (186.1 keV), Pb-214 (295.2 keV, 351.9 keV), Bi-214 (609.3 keV, 1120.3 keV, 1764.5 keV), Pb-210 (46.5 keV).
Th-232: Ac-228 (338.3 keV, 911.2 keV, 969.0 keV), Pb-212 (238.6 keV), Bi-212 (727.3 keV), Tl-208 (583.2 keV).
K-40: 1461.0 keV.
U-238 and Th-232: The weighted means of the activities of the above mentioned natural daughter products were used.
(b) Cosmic dose rates were estimated regarding geographic position (Eguisheim: 48.0°N, 7.3°E), altitude (Eguisheim: 199.5 m a.s.l.) and sampling depth.
(c) Water content of sediment samples in % of dry mass (values in brackets were measured on sediment from the OSL tubes in the Luminescence Lab at Berlin after oven drying for 3 days at 50°C).
(d) Water content used for dose rate calculation.
(e) Q = Quartz, FG = polymineral fine grain. For dose rate calculation of polymineral fine grain samples an a-value of 0.08 ± 0.02 (Rees-Jones 1995) was assumed.
(f) Equivalent doses of the quartz samples (± standard error) were calculated according the Central Age Model (CAM, Galbraith et al. 1999). OD = overdispersion: relative error of the central age, which arises in addition to the expected error. The expected error results from the random error and from the systematic error of all aliquots. Aliquots measured per sample: HUB-0596 and HUB-0597: 10 (quartz), 3 (polymineral fine grain).

reworked characteristics (Unit I-5). It contains numerous carbonated nodules and less malacofauna than the underlying unit. Organic-filled tongues appear at the top of the unit. The upper unit is a dark yellow loess, with fossilized vertical root channels (Unit I-4). The topsoil units consist of dark yellow calcareous loess, with numerous tongues and root channels (Unit I-3), overlaid by silty horizons from the surface Luvisol (Units I-2 and I-1). Granulometric data reveal a high degree of homogeneity for this sequence: Apart from the sandy samples at the bottom of the profile and those from the topsoil layers, the samples are made up of about 70-80% silts with a constant clay content of between 10 and 12%. Organic matter is present in low and decreasing proportions: 2.5% in the upper layers and 1% within the basal sands. Carbonate content is also homogeneous: apart from the lower sandy samples, all layers are highly carbonated with contents exceeding 20%, and with a peak of between 28 and 29% for units I-3 and I-4. Sedimentary sorting is pronounced; the particle sizes vary from around 2 to 50 µm, which attests to their aeolian origin. This data highlights the absence of paleo-pedogenesis in the sequence. The two OSL dates (Table 1) performed on polymineral fine grains provide dates of 137.5 ± 16.7 ka (unit I-7) and 122.1 ± 15.2 ka (Unit I-5), which correspond to the Upper Saalian Glaciation (Marine Isotope Stage 6, according to Lisiecki and Raymo 2005). These results are consistent with the Upper Saalian sequences known for north-western Europe, characterized by

Fig. 6.
Sedimentary profiles (S. Goudissard).



loessic deposits during a Pleniglacial phase, prior the Eemian Interglacial (Hérisson et al. 2016). Furthermore, these results provide a new chronological context for the adjacent discoveries made by Dr. Faudel in Jaenger's cellar, where mammal remains were unearthed in sandy layers, covered by similar loess deposits (Faudel 1867).

Sequence II (Fig. 6): The sequence was identified to the north of our excavation area, and lacks a stratigraphical connection with the previous one. It is composed of a thick clay deposit (2 m in thickness), subdivided between 3 main clayey units with reddish colored variations. Over the clayey matrix, many patches and nodules of oxidized Fe-Mn indicate the intensity of the alteration processes. These units have a blocky angular pedological structure, with clay coatings on aggregates. This matrix encompasses several layers of coarse sands, sorted and stratified by stream water deposition, along with undulated fine silt layers. These deposits are interpreted as multiple superimposed Bt horizons (Baize and Girard 2009), over sandstone alluviums. They correspond to the lower illuvial portion of interglacial Luvisols that developed during a succession of interglacial phases. In fact, the sequence is probably too thick (2-m thick) to have resulted from a single interglacial phase. At the middle of this sequence, the OSL sample provides a date of 70.5 ± 8.4 ka (Bouvier in Murer et al. 2016). Given the interglacial characteristics of the sequence, and the Lower Pleniglacial attribution of the upper sequence (see below), we consider this date to be underestimated; this is a frequently encountered problem in such clayey altered deposits (Antoine et al. 2001). Therefore, we propose an Eemian date within MIS substage 5e, between ca. -130 and -110 ka, for the last Luvisol development in the sequence. Two lithic artifacts were uncovered from these clayey units, along with 4 heavily fragmented faunal bones. We assume that these remains were in a primary position since their edges are still sharp and they are within a thin clayey matrix, without gravels or coarse sediments. This sequence appears similar to the clayey layer described by A. Geis and F. A. Schaeffer, around 200 meters from the north of our excavation (see above).

Sequence III (Fig. 6): The sequence lies directly above the previous one and the sedimentary transition is progressive. This is a dark brown compact sandy silt, with numerous topsoil features: brown root channels, abundant crotovines and a lumpy structure. The dark hue reveals a humic composition. The thickness of the horizon reaches up to 1 m. Carbonated nodules are concentrated at the bottom of the layer. At the upper limit of this dark silt, narrow cryodessication cracks, 1 m in depth, are filled with gravels within a carbonated silty matrix. A Weichselian Early Glacial age (MIS 5d to 5a) is proposed for this topsoil horizon (Saint-Sauflieu soil complex; Antoine et al. 1994). In north-western Europe, these humic soils indicate a moderately-cold forested environment, gradually evolving into a colder steppic one following the global warming of the Eemian Interglacial (Antoine et al. 2001). The upper part of this soil is eroded by pronounced stream activity, which is synchronous with the opening of cryodessication cracks.

Sequence IV (Fig. 6): The sequence lies in the middle part of our excavation area. It is composed of two similar layers of non-calcareous olive brown silt, both having a thickness of 0.5 m and separated from each other by sorted coarse sands, 0.1 to 0.3 m in thickness. The silt levels are homogeneous, non-calcareous, with a massive structure and containing numerous Fe-Mn oxidized nodules. Sands are abundant within the silts; clusters of sorted and stratified sands are also present. OSL dating of the upper silt level gives an age of 43.35 ± 4.35 ka (Bouvier in Murer et al. 2016), which corresponds to the second half of the Middle Pleniglacial (SIM 3, ca. -55/50 and -35/30 ka). This time period is characterized in north-western Europe by soil formation under an interstadial warming regime (Saint-Acheul/Villiers-Adam and Havrincourt soil complex, Antoine et al. 2014). At Eguisheim, this pedogenesis is somehow limited, ending with silt deposition, decarbonation and Fe-Mn oxidization, but these processes did not result in the development of a cambisol. It is worth noting that these silts and sorted sand layers came from a reworked interstadial soil in an upstream location. Furthermore, fragmented mammal bones are sometimes associated with the sandy clusters.

Sequence V (Fig. 6): The sequence begins with the opening of two large gullies (around 7 and 24 m width) at the north and in the middle part of our excavation; these features eroded preceding depositional sequences (II, III and IV). Filling of the gullies was initiated by deposits of poorly sorted pebbles and gravels of granite, quartz and sandstone which are embedded within a reddish sandy matrix. They are overlain by well-sorted coarse sands featuring cross-bedded stratification. Spots of oxidized Fe-Mn are also present in these porous sands. The upper part of these gullies is filled with pale grey silt, with oxidized patches and reddish sand layers. The grey hue of the silts results from a waterlogged environment. OSL dating of the sands gives an age of 30.85 ± 2.35 ka, which corresponds to the Middle / Upper Pleniglacial transition (Bouvier in Murer et al. 2016). These erosion processes seem to have occurred during a major climatic shift, which is known in several north European loess sequences (Lautridou and Antoine 2003). This rapid global climate cooling led to networks of ice-wedges and thermokarst activity, and preceded large-scale loess deposition in Europe. At Eguisheim, the slope context and the proximity of hills composed of low-cohesive rocks (Tertiary conglomerates) resulted in these large gullies which were then filled with waterborne sands and gravels: they may have been superimposed on a pre-existing ice-wedge network. These coarse deposits yielded several blunted stone artifacts and fragmented mammal bones, which are therefore in a secondary position (see below).

Sequence VI (Fig. 6): Identified in the southern and northern part of our excavation, these deposits consist of massive calcareous silts, which reach around 2.5 m in thickness. The stratigraphical contact with northern silts of sequence IV is formed by a thermokarst limit, of sub-vertical dip. At the north of our excavation, the contact with the sandy gully is lateral and progressive. The base of this sequence is composed of coarse

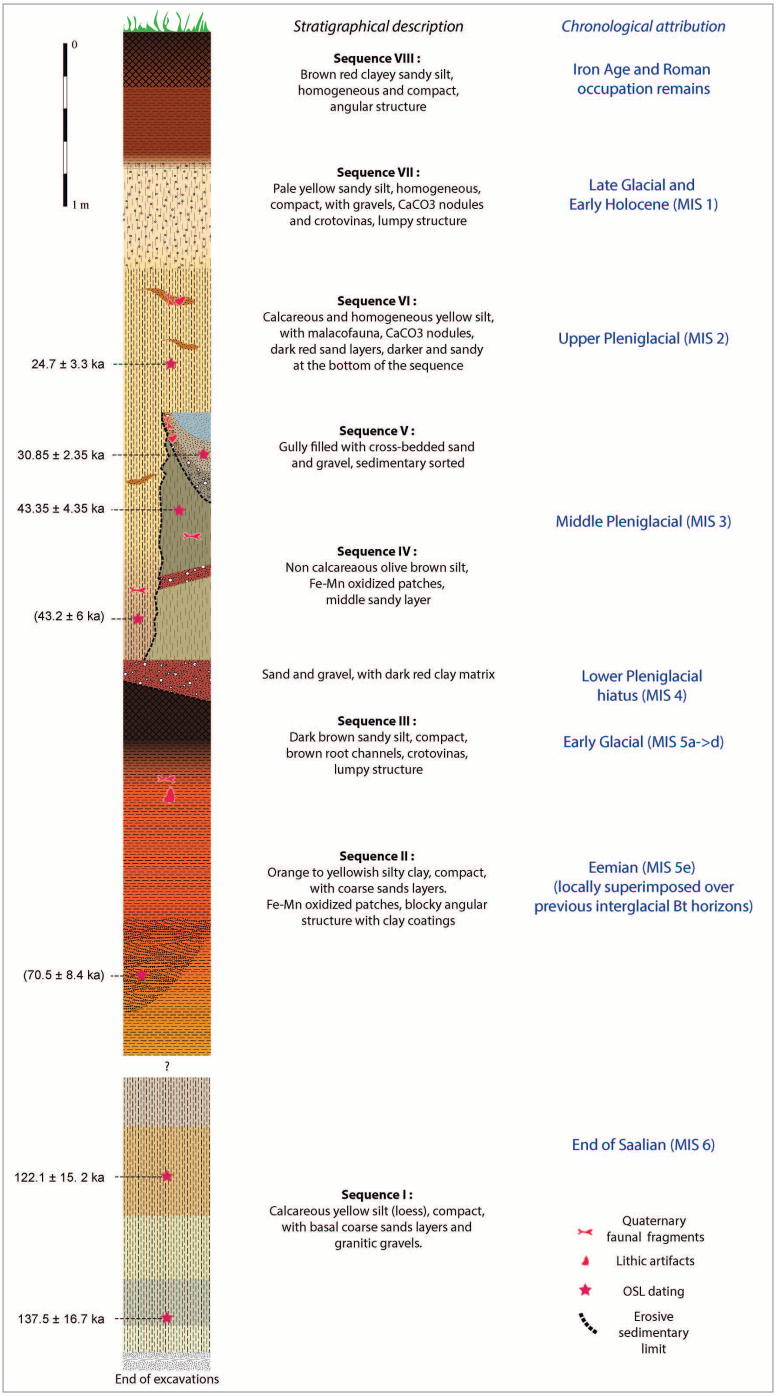


Fig. 7. Synthetic log with chronostratigraphic interpretations (S. Goudissard).

alluvial sands (sandstone materials), mixed with calcareous silts. The proportion of sand decreases progressively in the upper part of the sequence, which is composed of yellow and calcareous silts, with a massive structure and containing CaCO3 nodules. This sequence is interpreted as a loess deposit. The OSL dating of the lower part of the loess provides a Middle Pleniglacial date (43.2 ± 6 ka), the upper part dates to the Upper Pleniglacial (24.7 ± 3.3 ka). No sedimentary shortage was identified that might explain such a temporal gap between the two OSL samples. We presume that the older OSL date could be explained by reworked aggregates within the sample, provided by the near- and sub-contemporaneous silty deposits of sequence IV (see above). The younger date is coherent with the chrono-stratigraphical framework defined for north-western Europe; we thus propose a Weichselian Upper Pleniglacial age for these aeolian deposits.

Sequence VII (Fig. 6): All of the previous sequences (except Sequence I) are covered by this yellow sandy silt. This horizon lies below the actual Luvisol, and it attains a thickness of about 0.60 m. These silts contain numerous carbonated nodules and gravels concentrated at the bottom of the horizon. A loessic origin for the silts seems evident, but the lack of any stratification and the abundance of coarse elements suggest colluvial transportation of the sediments in a period after the disappearance of permafrost. These processes are likely to have occurred during a Late Glacial / Early Holocene timespan.

Sequence VIII (Fig. 6): The last sequence is an orange sandy silt, 0.60 m in thickness, with a blocky angular structure resulting from pedological illuviation (Bt horizon). Numerous vertical tongues underline the lower limit of the horizon. The latter is covered by the actual surface horizon, a dark grey silt, with a lumpy structure. The development of this Luvisol predates the protohistoric archaeological structures which are dug into the Bt horizon.

The Paleolithic remains

In line with previous discoveries made in the village, the recent excavation carried out on the site of Eguisheim “Lotissement Herrenweg” has brought to light several remains that are attributable to the Paleolithic. In total, twenty faunal remains, two small groups of bone fragments and nine lithic artifacts have been discovered (Figs. 8 and 9). These finds are divided into two stratigraphically distinct assemblages.

First, the Bt horizon attributed to the Eemian (Sequence I) has yielded four undetermined ungulate bones and one pseudo-Levallois quartzite point which features fine direct retouch on its distal edge (Fig. 9: 3). Perfectly integrated into a discoid system, this piece can be confidently assigned to the Middle Paleolithic. The surface of the object is in good condition which, combined with the survival of the faunal remains, albeit in poor condition, suggests that there was little disturbance or reworking of the material.

Most of the other Paleolithic remains from the site were found in the sandy-gravel fill of the channels that have cut into the nearby slopes (Sequence V). Thus, they are all likely to be in a secondary position. Moreover, the surface state of most of the artifacts suggests the same; the bone remains seem very worn, while many of the lithic remains display significant gloss and blunted ridges and edges.

Fig. 8.
Fragment mammal bones (image: F. Bachellerie).
1: mammoth, elongated bone;
2: mammoth, definitive molar;
3: horse, femur extremity distal;
4: horse, premolar.

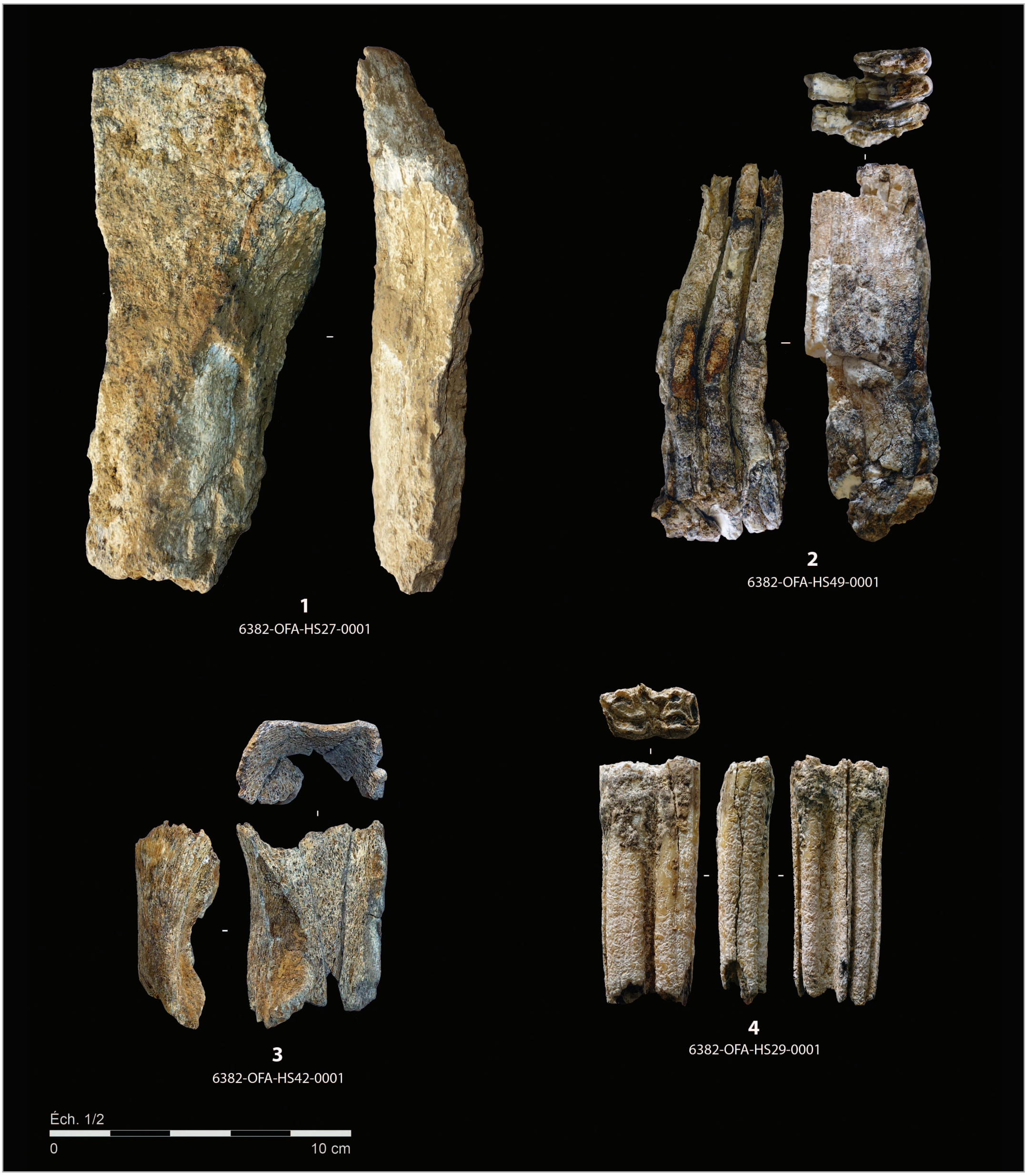
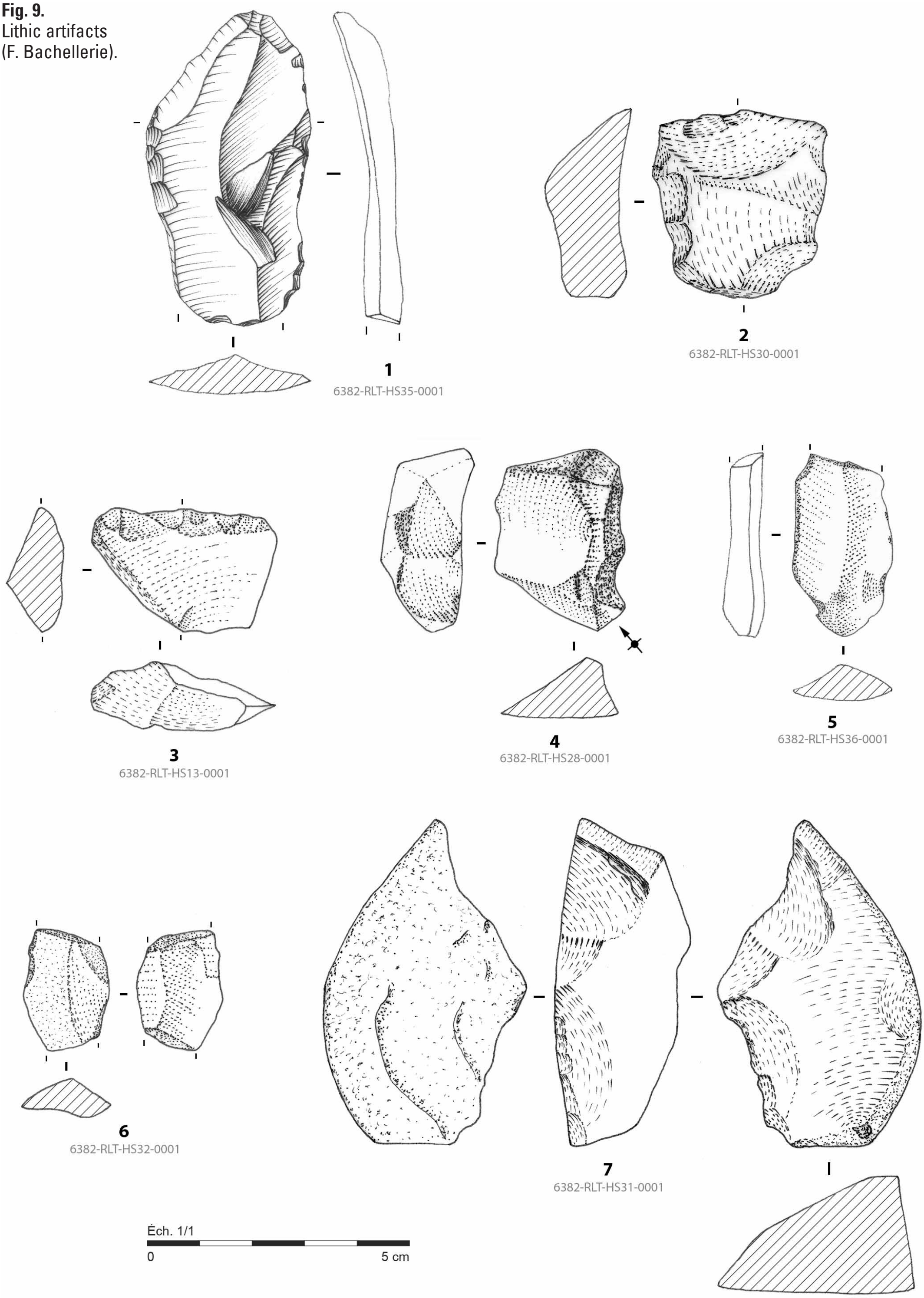


Fig. 9.
Lithic artifacts
(F. Bachellerie).



Given the small quantity of artifacts involved, the chronological attribution of the remains in this sector cannot be precise. While analysis of the faunal remains indicates the presence of species frequently encountered in the Paleolithic (i.e., mammoth, rhinoceros, large deer, horse, etc.; Table 2), the absence of direct dating evidence does not allow us to narrow down their chronological attribution. It should also be noted that traces of anthropic activity are completely absent from the bone; they bear no visible fracturing notches, and the degraded state of the surfaces prevents the identification of potential cut marks.

The scarcity of the lithic remains discovered in this area of the site (Table 3), along with the absence of clearly diagnostic elements, prevent us from identifying the specific chrono-cultural context of the pieces.

Inventory number	Determination	Weight (in gram)
HS 15	Ungulate 4/5, undeterminated splinters	<0.5
HS 27	Mammoth, fragment of long bone	287.7
HS 29	Horse, lower premolar	59.9
HS 34	Horse, fragment of lower molar	2.1
HS 37	Rhinoceros, dental crown	1.7
HS 39a	Large Cervidae, fragment of metatarsal	354.7
HS 40	Mammoth, fragment of rib	329.5
HS 42	Horse, distal extremity of femur	59.6
HS 43	Ungulate 4/5, undeterminated fragments	20
HS 44	Undeterminated splinters	0.7
HS 45	Ungulate 3/4, undeterminated fragments	19
HS 46	Ungulate 3/4/5, undeterminated splinters	122.3
HS 47	Ungulate 3/4/5, undeterminated splinter	44.5
HS 48	Ungulate 3/4/5, undeterminated splinter	8.6
HS 49	Mammoth, fragment of permanent molar	221.1
HS 50	Ungulate 5, fragment of flat bone	43.8
HS 51	Mammal, undeterminated	0.5
HS 52	Ungulate 3/4/5, undeterminated splinter	5.2
HS 53	Undeterminated splinters	<0.5
HS 54	Ungulate 3/4/5, undeterminated fragments	10.8
HS 55	Ungulate 3/4/5, undeterminated fragments	<0.5
HS 56	Ungulate 3/4/5, undeterminated fragments	9.1

Table 2.
Inventory of faunal remains.

Inventory number	Determination	Material	Measurements (mm.)			Weight (g.)
			length	width	thickness	
HS 13	Pseudo-Levallois point	Quartzite	25	36.2	15.6	9.2
HS 28	Debordant flake	Quartzite	35	26	13.6	12.4
HS 30	Flake	Quartz	36.6	33.5	15	21.6
HS 31	Flake, reverse shaping on right edge (notch?)	Quartzite	62.7	39	25.4	59.4
HS 32	Proximal fragment of a flake	Quartzite	24	17	7.1	3.1
HS 35	Elongated flake, partially shaped on left edge	Flint	60.3	32	7	14.6
HS 36	Proximal-mesial fragment of an elongated flake	Quartzite	35.6	19.2	7.2	5.5
HS 39b	Nucleus, for flakes	Flint (lacustrine Tertiary?)	71	81	54.4	354.7
HS 41	Fragment of a flake	Flint	13.7	8.75	4.5	0.7

Table 3.
Inventory of lithic artifacts.

Furthermore, it is possible that we are looking at a mixture of industries given that the artifacts appear to be in a secondary position.

On the one hand, a debordant flake made from quartzite and featuring significant gloss seems to be attributable to the Middle Paleolithic (Fig. 9: 4). On the other hand, an elongated blade-like flake made from flint, which is a rarely found raw material in Alsace and therefore probably imported, and having a relatively fresh surface, can be tentatively attributed to the Upper Paleolithic (Fig. 9: 1).

The rescue excavation carried out in Eguisheim has thus brought to light two stratigraphically distinct Paleolithic assemblages. While the cross-relating of geomorphological and archaeological observations confirms the probable existence of an unaltered occupation level attributable to the Middle Paleolithic, other finds seem to be in a secondary position.

These elements confirm, however, the good recording potential of the archaeological and paleontological signal on Bühl Hill. The stratigraphic distribution of the lithic artifacts, and their typo-technological characteristics, seem to reflect a long history of human occupation in the area starting during the Eemian Interglacial.

DISCUSSION

Occurrences of Early Glacial soils are rare in Alsace. They are only identified on the Kochersberg Plateau, a series of loess-covered hills to the west of Strasbourg. Within this area, excavations at Achenheim (Loessière Hurst; Lautridou et al. 1986) have revealed an Early Glacial soil, subdivided into two horizons: the lower one developed under a pine forest, the upper one attests to steppic conditions where pine persisted. A recent archaeological survey carried out in the Kochersberg area has also revealed Early Glacial soils; again, they are subdivided into forest and steppic horizons (Croutsch et al. 2017). Otherwise, the nearest recorded occurrence of Early Glacial soil is at Nussloch (Germany), about 200 km to the north of Eguisheim (Antoine et al. 2001). At Schaffhouse-prés-Seltz, around 130 km to the north of Eguisheim, a loess-paleosol sequence also reveals a grey silty horizon, with abundant pine charcoal, dating to the Early Glacial (Wuscher et al. 2017).

At Eguisheim, such soil occurs at a depth of only 1.50 m below the present surface; in contrast, in the Kochersberg area and in Nussloch, it is buried under several meters of loess deposits. This unique feature of the Eguisheim sequence testifies to high lateral variability in the erosive processes. The overall stratigraphy shows a marked discontinuity, which requires cross-section profiles in order to be understood. Scattered sedimentary logs are inadequate in such a topographical context. In our excavation, the preservation of ancient deposits probably results from horizontal dispersal by successive erosive vectors. Thus, Saalian loess deposits lie at the same altitude as their Upper Weichselian counterpart, observable only 60 meters away. Global erosion events, which have previously been identified in north-western Europe, also seem to be recorded at Eguisheim, e.g., the Lower Pleniglacial hiatus and the Middle/Upper Pleniglacial transition.

There is still great potential for future study: micromorphology and malacology will hopefully provide us with interesting data regarding soil formation processes and paleoenvironments during phases of loess deposition. Finally, our results highlight the potential for fossilized Middle and Upper Paleolithic occupations in the Eguisheim area.

LITERATURE

Antoine, P., A.-V. Munaut, and J. Sommé. 1994. Réponse des environnements à l'évolution climatique du Début Glaciaire weichsélien : données de la France du Nord-Ouest. *Quaternaire* 5 (3-4): 151–56.

Antoine, P., D.-D. Rousseau, L. Zöller, A. Lang, A.-V. Munaut, C. Hatté, and M. Fontugne. 2001. High Resolution Record of the Last Interglacial-Glacial Cycle in the Nussolch Loess-Palaeosol Sequences, Upper Rhine Area Germany. *Quaternary International* 76/77: 211–29.

Antoine, P., E. Goval, G. Jamet, S. Coutard, O. Moine, D. Hérisson, P. Auguste, G. Guerin, F. Lagroix, E. Schmidt, V. Robert, N. Debenham, S. Meszner, and J.-J. Bahain. 2014. Les séquences loessiques pléistocène supérieur d'Havrincourt (Pas-de-Calais, France): Stratigraphie, paléoenvironnement, géochronologie et occupations paléolithiques. *Quaternaire* 25 (4): 321–68.

Baize, D., and M.-C. Girard. 2009. *Référentiel Pédologique 2008*. Versailles: Editions Quae.

Blanck, J.-P., and J.-P. Wacquant. 1971. Contribution à l'étude des formations loessiques d'Eguisheim (Sud-ouest de Colmar, Haut-Rhin, France). *Bulletin du Service de la Carte Géologique d'Alsace et de Lorraine* 24 (2-3): 57–91. Strasbourg.

Boës, E. 2005. Une pièce emblématique de la préhistoire régionale: le crâne d'Éguisheim. In *Histoires de squelettes: Archéologie, médecine et anthropologie en alsace*. Musées de la Ville de Strasbourg, Strasbourg: 201–208.

Croutsch, C., F. Bachellerie, and P. Wuscher. 2017. *Dingsheim, Griesheim-sur-Souffel, Pfulgriesheim, Stutzheim-Offenheim, Truchtersheim-Pfettisheim, A 35 - Contournement ouest de Strasbourg - Tronçon 4*. Rapport de diagnostic archéologique. Strasbourg: SRA Grand Est.

Faudel, F. 1867. Sur la découverte d'ossements fossiles humains dans le lehm de la vallée du Rhin à Éguisheim, près Colmar. *Bulletin de La Société Géologique de France* 24, deuxième série 1866-1867: 36–43.

Geis, A., and A. Schaeffer. 1927. Les récentes découvertes archéologiques faites à Éguisheim. *Cahiers d'Archéologie et d'Histoire d'Alsace* 69-72: 19–38.

Griselin, S., H. Cicutta, S. Humbert, F. Jodry, N. Schneider, and M. van Es. 2014. *Eguisheim (Haut-Rhin), Unterer Teil Vom Herrenweg - Lotissement Herrenweg: Des occupations gallo-romaines et protohistoriques*. Rapport de diagnostic archéologique. Strasbourg: Inrap Grand Est sud.

Gutmann, K. S. 1902. Funberichte Une Kleinere Notizen. Die Archäologischen Funde von Eguisheim (1888-1898). *B.S.C.M.H.A.* II (20): 1–87.

Hérisson, D., S. Coutard, E. Goval, J.-L. Locht, P. Antoine, Y. Chantreau, and N. Debenham. 2016. A New Key-Site for the End of Lower Palaeolithic and the Onset of Middle Palaeolithic at Etricourt-Manancourt (Somme, France). *Quaternary International* 409 (B): 73–91.

Lautridou, J.-P., J. Sommé, J. Heim, J. Maucorps, J.-J. Puisségur, D.-D. Rousseau, A. Thévenin, and B. Van Vliet Lanoë. 1986. Le cycle climatique du Pléistocène Supérieur dans les lœss d'Alsace à Achenheim. *Bulletin de l'Association Française Pour l'Etude Du Quaternaire* 23 (1-2): 97–104.

Lautridou, J.-P., and P. Antoine. 2003. La séquence du dernier cycle (Eemien-Weichselien) dans les lœss de la France Septentrionale. In *Données récentes sur les modalités de peuplement en Europe au Paléolithique inférieur et moyen*, pp. 22–25. Rennes: Université de Rennes 1.

Lisiecki, L. E., and M. E. Raymo. 2005. A Pliocene-Pleistocene Stack of 57 Globally Distributed Benthic d18O Records. *Paleoceanography* 20: 1–17.

Murer, A., F. Bachellerie, L. Boury, L. Daverat, S. Goepfert, S. Goudissard, L. Jammet-Reynal, A. Mauduit, and A. Tenud. 2016. *Éguisheim Lotissement Herrenweg, Alsace, Haut-Rhin (68)*. Rapport final d'archéologie préventive. Strasbourg: Antéa-Archéologie, SRA Grand Est.

Théobald, N., F. Menillet, J. Lougnon, and C. Bonnet. 1976. *Neuf-Brisach Obersaasheim. BRGM*. Carte Géologique de La France à 1/50 000.

Wuscher, P., H. Koehler, O. Moine, F. Bachellerie, S. Griselin, S. Goudissard, É. Boës, A. Pracht, N. Schneider, N. Sévêque, J. Detrey, and F. Basoge. 2017. *Le Paléolithique et le Mésolithique de la Plaine d'Alsace et des collines sous-vosgiennes. Reprises des données existantes, pistes pour détecter les sites et approches territoriales. Bilan de l'année 2016*. Rapport de Projet Collectif de Recherche. Strasbourg: SRA Grand Est.