Bull. Inst. r. Sci. nat. Belg. Bull. K. Belg. Inst. Nat. Wet.	Bruxelles Brussel	31-XII-1984

55	SCIENCES DE LA TERRE - AARDWETENSCHAPPEN	5

AN EARLY MIDDLE PALAEOLITHIC SITE AT MESVIN IV (MONS, BELGIUM). ITS SIGNIFICANCE FOR STRATIGRAPHY AND PALAEONTOLOGY

BY

Daniel CAHEN, Paul HAESAERTS, Barney J. SZABO (*), Wim VAN NEER and Patrick WANET (**)

(With 7 figures in the text)

SUMMARY

Recent research at the Mesvin IV site (Scheldt Basin) has established the existence of a characteristic Middle Palaeolithic industry associated with *Mammuthus* cf. *primigenius* and attributed to the begin of the Saalian. Uranium-series dates give a result of about 0.30 and 0.25 Myr. In its stratigraphical context, this site indicates an early appearence of industry and fauna which were more classically attributed to the Weichselian.

RESUME

Les fouilles effectuées à Mesvin IV (bassin de l'Escaut), ont révélé l'existence d'une industrie du Paléolithique moyen associée à une faune à *Mammuthus* cf. *primigenius*; l'ensemble est attribuable au début du Saalien et fut daté par la méthode des dérivés de l'Uranium entre 300.000 et 250.000 ans. De par son contexte stratigraphique ce site témoigne de l'apparition relativement précoce d'une industrie lithique et d'une faune généralement attribuées au Weichsélien.

(*) Geological Survey, Branch of Isotope Geology, Denver Federal Center, Box 25046, M.S. 963, Denver, Colorado 80225, U.S.A.

(**) Institut Interuniversitaire des Sciences Nucléaires, rue d'Egmont, 5-7, B-1050 Bruxelles.

I. INTRODUCTION

The chronological position of the Middle Pleistocene industries and palaeontological assemblages of Western Europe is usually established within local stratigraphic sequences which are difficult to correlate with other such sequences on a regional scale. The sedimentary sequences are more discontinuous than those of the Upper Pleistocene, radiocarbon dates are not available and chronological trends in the archaeological record are difficult to discern. Major events such as the Holsteinian interglacial are poorly defined and assessments of their geochronological position vary from author to author as it has been demonstrated by G. J. KUKLA (1977). Perhaps, because of the relative uncertainty of the stratigraphic data, arguments from archaeological and palaeontological data have often guided chronostratigraphic interpretation. This amounts to circular reasoning since these different lines of arguments are not independant.

This article presents the results of recent research on the southern slope of the Haine river, a tributary of the Scheldt, to the southeast of Mons (Belgium). There, between altitudes of 90 m and 25 m a.s.l., are found fluviatile deposits representing various stages in the incision of the hydrographic net (Fig. 1). The stratigraphic correlations between these deposits, some established since the nineteenth century by A. BRIART et al. (1868), were originally based on similarities in their archaeological contents. The archaeological stratigraphy rested on a supposed typological sequence and a principle, established by H. BREUIL and L. KOSLOWSKI (1934), that the degree of rolling (i.e. water abrasion) of an artifact was proportional to its age.

Recently, P. HAESAERTS (1978, 1980) has established the stratigraphy of the fluviatile deposits of the Haine basin and has allowed the sequening of the different archaeological assemblages within a relative chronology. This succession of assemblages spans a large part of the Middle Pleistocene, especially the period corresponding to the transition between the Lower and Middle Palaeolithic.

II. MESVIN IV

The site of Mesvin IV is situated at the altitude of 59 m, 20 m above the present alluvial plain, at the edge of a narrow plateau covered by fluviatile gravel deposits, named « Mesvin terrace », resting on Landenian sand (Paleocene). At the site, excavations have revealed at shallow depth the presence of a wide, keel-chaped channel cut in the Landenian sand. At the base lies a layer of frost-fractured flint nodules above which rests a gravel of chalky granules and small flint fragments. Ploughing has disturbed the top of the latter layer which is also affected by a recent pedogenesis.

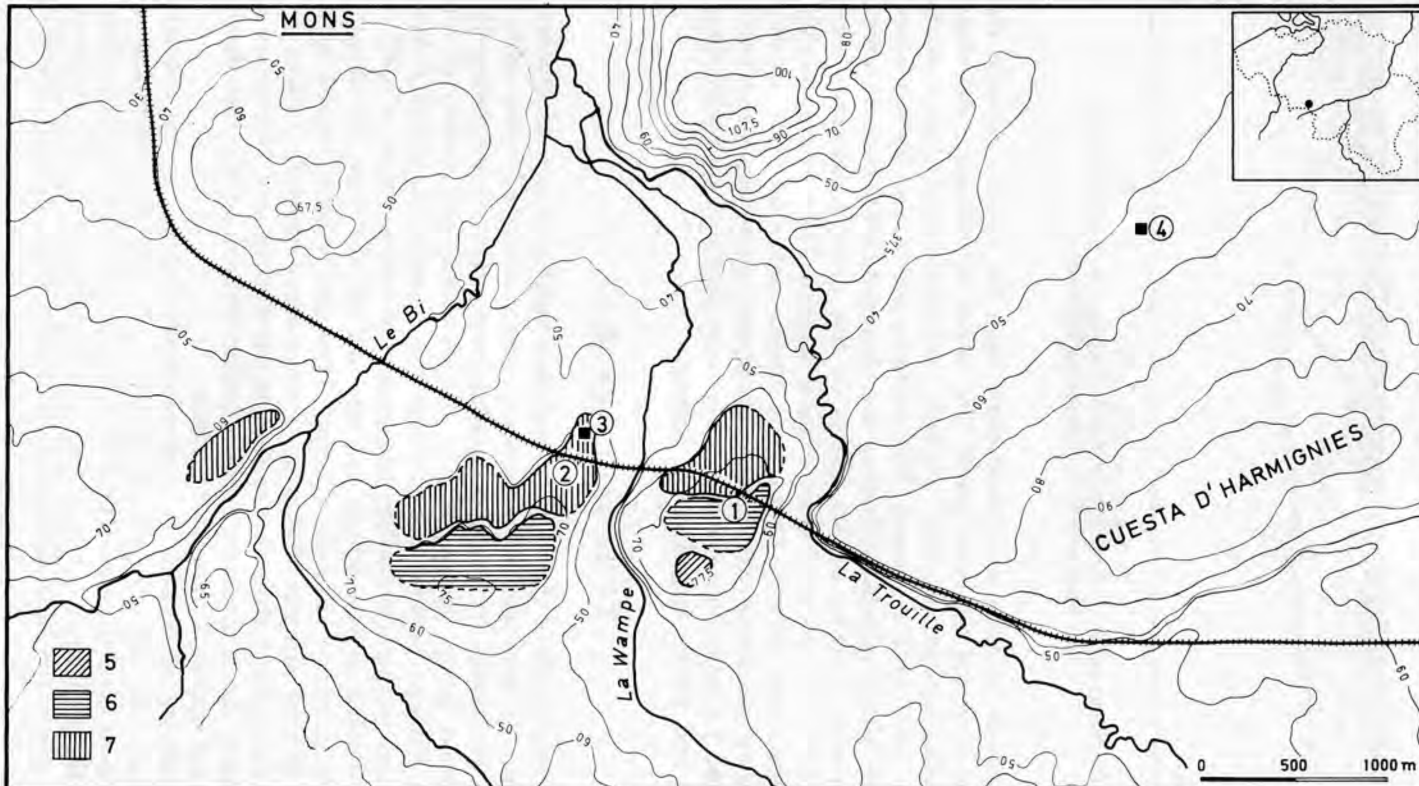


Fig. 1. — Locality map.
1 : Railway trench of Petit-Spiennes; 2 : Railway trench of Mesvin; 3 : Site of Mesvin IV;
4 : Hélin quarry; 5 : Pa d'la l'iau terrace; 6 : Petit-Spiennes terrace; 7 : Mesvin terrace.

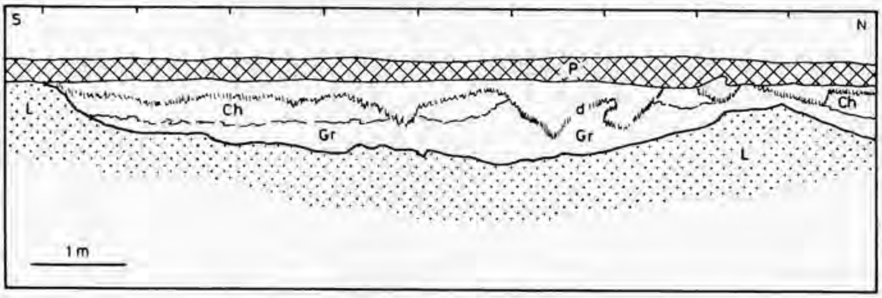


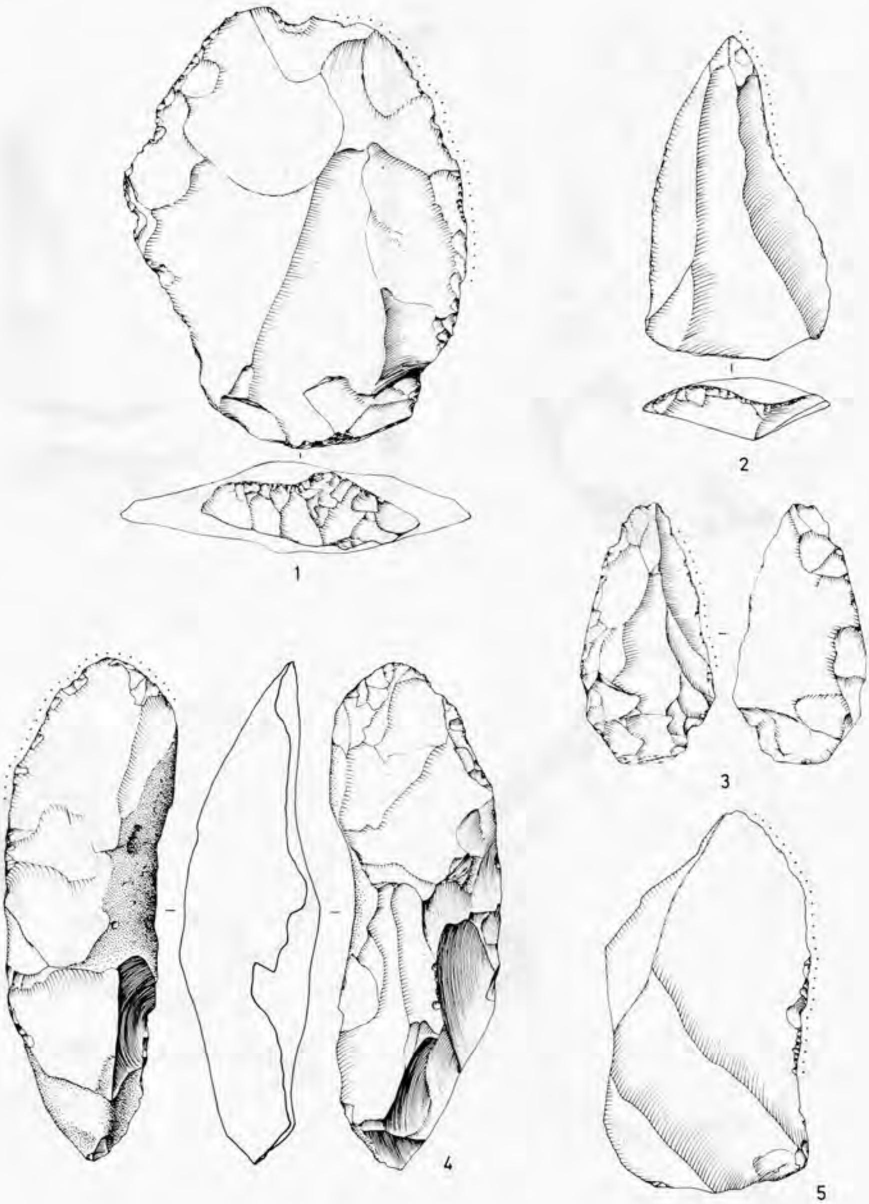
Fig. 2. — Mesvin IV.
P : Plough layer; d : Boundary of decalcification; Ch : Chalky gravel; Gr : Basal gravel; L : Landenian (Paleocene).

Most of the artifacts and bones come from the contact between the Paleocene sand and the basal gravel. The bones are not worn and show only post-depositional alteration. Similarly, over three fourth of the artifacts are fresh and unrolled. Several flint artifacts and a few broken bones have been refitted together indicating that they had hardly been disturbed or transported. Finally, several blocks of fine grained sediments were found which had preserved their original texture. These were probably eroded from the channel banks in a frozen state and were quickly incorporated into the gravels. These observations suggest that the archaeological and palaeontological material was only displaced over very short distances and swiftly buried in the channel.

Flint industry (D. C.)

About one fourth of the flint artifacts show varying degrees of abrasion and most of these probably represent pieces reworked from earlier deposits. However, the fresh, unabraded pieces form a technologically homogeneous group characterised by the abundance and quality of the Levallois flaking. Typologically, besides the abundant Levallois flakes, the industry is characterised by sidescrapers of various types as well as naturally-backed knives. Bifaces are rare and do not show the characteristic Acheulian « handaxe » shape. They are roughly shaped tools such as bifacial scrapers or knives. Preliminary microwear analysis of some artifacts shows that meat cutting, wood working and hide scraping were among the activities performed within the side. Only one denticulated tool may have been used on bone.

The industry of Mesvin IV technologically belongs to the Middle Palaeolithic. The scarcity and morphology of the bifaces precludes an attribution to the Acheulian. The flake-tools are much more standardized than in the Acheulian but less than in the Mousterian. This industry most ressembles the Levalloisian as defined by H. BREUIL and LANTIER (1951).



Fg. 3. — Mesvin IV industry.
1 : Levallois flake; 2 : Levallois point; 3 : knive with retouched back;
4 : handaxe of « Prondnick » type; 5 : naturally backed knive (all meat-working tools).

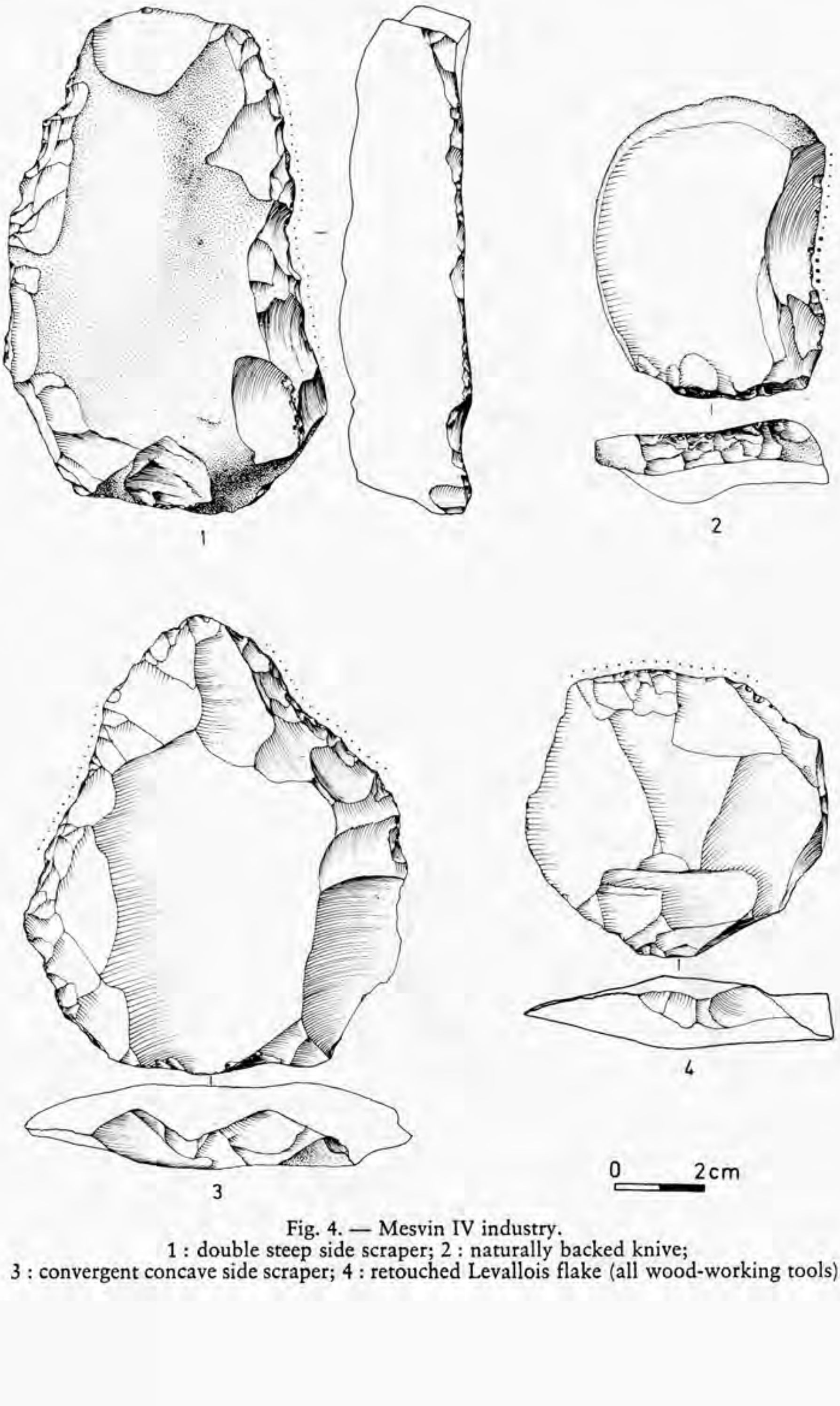


Fig. 4. — Mesvin IV industry.
1 : double steep side scraper; 2 : naturally backed knive;
3 : convergent concave side scraper; 4 : retouched Levallois flake (all wood-working tools).

Fauna (W. V. N.)

The majority of the faunal remains are well preserved and are, in decreasing frequency ascribable to the following mammals.

— *Equus* cf. *remagensis* (NEHRING, 1884).
— *Mammuthus* cf. *primigenius* (BLUMENBACH, 1799).
— *Coelodonta antiquitatis* (BLUMENBACH, 1807).
— *Bison priscus* (BOJANUS, 1827).
— *Megaceros giganteus* BLUMENBACH, 1799.
— *Cervidae* undeterminated.
— *Rangifer tarandus* (LINNAEUS, 1758).
— *Sus scrofa* LINNAEUS, 1758.
— *Alopex lagopus* LINNAEUS, 1758.

In the same manner as the flint artifacts, some small bone fragments are fairly abraded and probably derive from earlier deposits. The lack of small mammals is probably due to a hydraulic selection by the river as well as to a differential destruction in the deposit. This incompleteness of the sample renders palaeoenvironmental as palaeoeconomic interpretaton difficult as only the large animals are present.

The assemblage points toward a predominantly open and rather cold environment; although, the presence of species like *Megaceros giganteus* and *Sus scrofa*, seems to be indicative of a rather mild and wooded environment. Probably the area was only forested along the rivers.

The excavations yielded several bones showing striae or polished edges which were considered as butchering marks or bone artifacts. Closer examination however shows that these traces must be the result of a postdepositional process as they are clearly posterior to the weathering craks and breakages on the bones.

Dating the site by means of his large mammal fauna is difficult, due to the small number of comparable well-dated sites. The mammoth molars are of *primigenius* type which traditionally should be typical for the Weichselian. However, this fossil has recently been found in older deposits; it has been described by J. C. DESTOMBES (1982) in the Lower terrace of the Seine near Rouen (France) and by J. VAN KOLFSCHOTEN (1981) in the Ice-pushed ridge near Rhenen (The Netherlands). The large mammals assemblage of the latter site include *Mammuthus primigenius*, *Equus spec.*, *Coelodonta antiquitatis*, *Sus scrofa*, *Megaceros giganteus*, and other species, and has been placed in the upper part of the Middle Pleistocene, at the Holsteinian-Saalian transition or at the end of an interstadial of the Saalian.

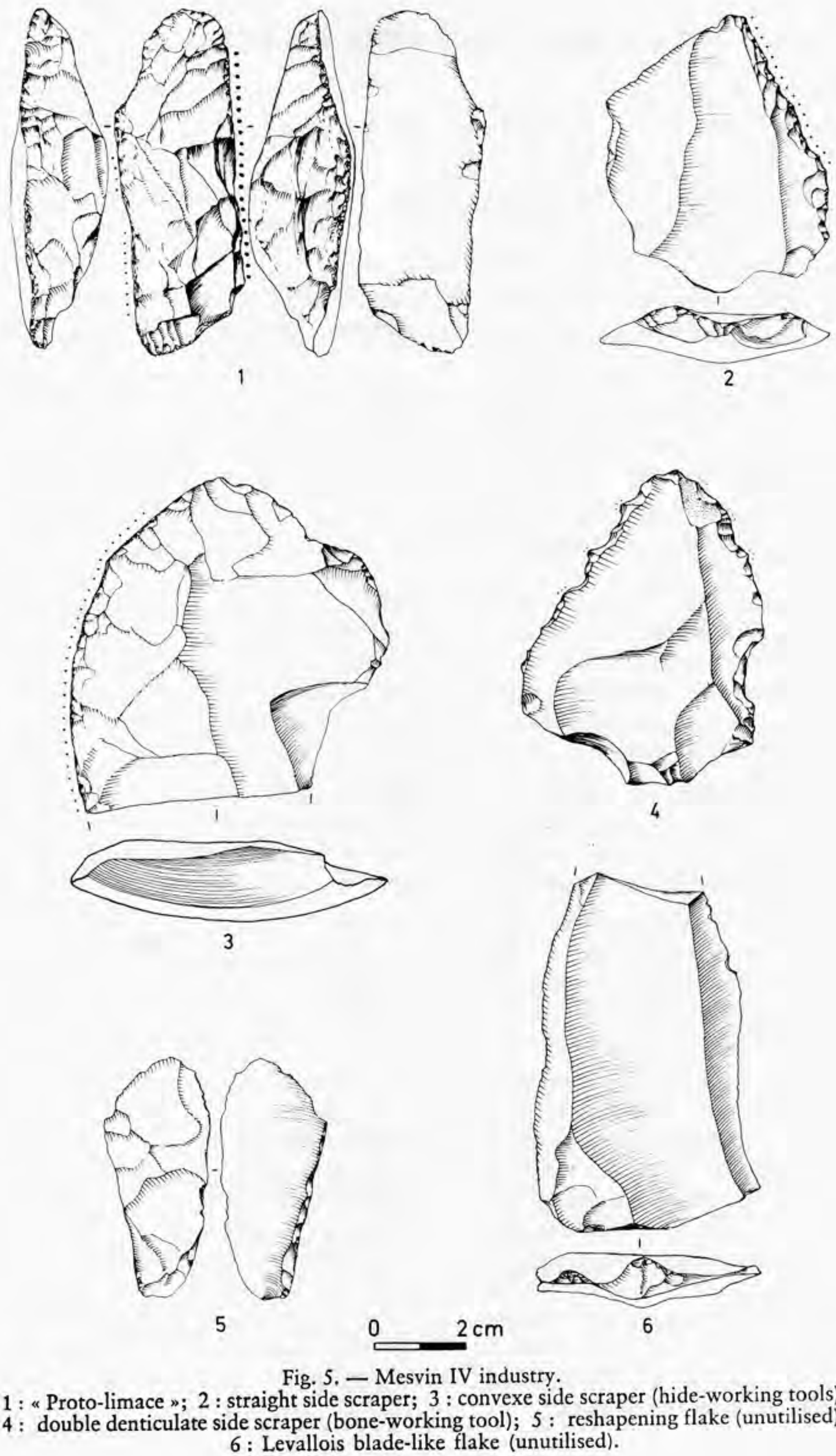


Fig. 5. — Mesvin IV industry.
1 : « Proto-limace »; 2 : straight side scraper; 3 : convexe side scraper (hide-working tools);
4 : double denticulate side scraper (bone-working tool); 5 : reshapening flake (unutilised);
6 : Levallois blade-like flake (unutilised).

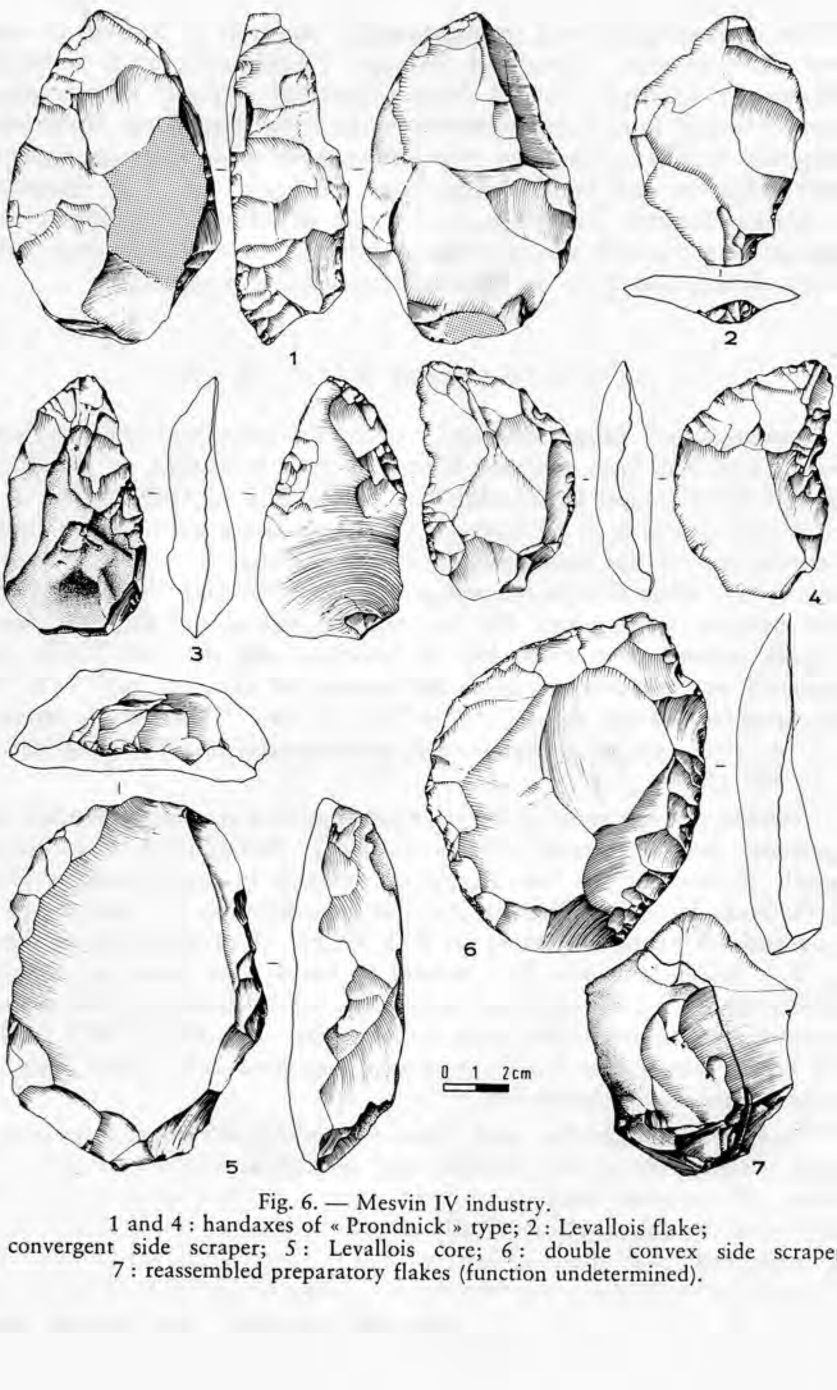


Fig. 6. — Mesvin IV industry.
1 and 4 : handaxes of « Prondnick » type; 2 : Levallois flake;
3 : convergent side scraper; 5 : Levallois core; 6 : double convex side scraper;
7 : reassembled preparatory flakes (function undetermined).

Datation

The archaeological and palaeontological material of Mesvin IV offer thus little evidence concerning its age. Traditionally, such a Middle Palaeolithic industry, had it been discovered without stratigraphical context, would have been attributed to the early part of the Weichselian especially since it is associated with *Mammuthus* cf. *primigenius*. However such industries and faunal assemblages are beginning to be discovered in Saalian context. Therefore, in the case of Mesvin IV, only its placement in a regional stratigraphical framework and independent radiometric dating can solve the chronostratigraphical problem.

Uranium-series dates (B. J. S.)

Uranium-series dating of fossil vertebrates associated with archaeological sites has been reported before by F.C. HOWELL et al. (1972), M. SAKANOUE and M. YOSHIOKA (1974), B. J. SZABO and D. COLLINS (1975) and B. J. SZABO (1979). These dates are obtained by the measurement of the amount of ^{230}Th nuclide that is produced through time by its radioactive parent and grandparent ^{234}U and ^{238}U, respectively. The primary assumptions for this type of dating are that the fossils initially assimilate uranium but no thorium and that the fossils subsequently neither loses nor gains the isotopes of uranium and ^{230}Th. The measurements of the activity ratios $^{234}U/^{238}U$ and $^{230}Th/^{234}U$ are required for the calculation using the standart mathematical relations proposed by T. L. KU (1976).

Uranium emplacement in fossil vertebrates is a secondary process that continues until all active organic matter is decomposed. The average length of time for the assimilation of uranium in fossil bones is about 2,700 years but for a few samples this time lag may be several tens of thousands of years depending on their degree of preservation as shown by B. J. SZABO (1980). The enamel of fossil teeth takes up uranium rapidly (about 1,000 years) and appears to yield reliable ages for samples younger than about 30,000 years as shown by C. R. McKINNEY (1978). We report here dating results on both fossil bone and enamel from the terrace deposits at Mesvin IV.

The fossils used in this study were cleaned by ultrasonic scrubbing in water, crushed to a fine powder, and ignited at 800 °C for about six hours. The enamel samples of teeth were separated from dentine and cementum, scrubbed ultrasonically in water, crushed to a fine powder, homogenized, and then ignited at 800 °C for about six hours. The uranium concentration, and the activity ratios $^{230}Th/^{232}Th$, $^{234}U/^{238}U$ and $^{230}Th/^{234}U$ were determined by alpha spectrometry using standart spike solutions of ^{236}U, ^{229}Th and ^{228}Th.

TABLE 1

Analytical data and calculated ages of vertebrate fossils from deposit at Mesvin IV

Sample No.	Sample depth (cm)	Material	Uranium (ppm)	^{230}Th/^{232}Th	^{234}U/^{238}U (activity ratios)	^{230}Th/^{234}U	^{230}Th Age (years)
			Upper gravel				
M-4	50	Bone fragment	17.8 ± 0.4	98 ± 10	1.216 ± 0.018	0.988 ± 0.030	298,000 + 50,000 − 35,000
			Basal gravel				
M-2	85	Enamel from molar of *Mammuthus*	0.887 ± 0.018	72 ± 20	1.270 ± 0.019	0.886 ± 0.053	201,000 + 37,000 − 28,000
M-1	90	Bone fragment	15.7 ± 0.3	140 ± 14	1.235 ± 0.018	0.973 ± 0.029	275,000 + 38,000 − 29,000
M-3	110	Enamel from molar of *Equus*	2.86 ± 0.06	127 ± 25	1.247 ± 0.019	0.699 0.028	> 123,000 (1)

(1) The apparent ^{230}Th age is considered a minimum age. See discussion in text.

The results of the analyses and calculated ^{230}Th ages for each sample are shown in Table 1. The $^{230}Th/^{232}Th$ activity ratios of the dated samples vary between 72 and 140 indicating that no significant amount of common thorium (^{232}Th) from the environment had been incorporated with the fossil samples. Usually, a $^{230}Th/^{232}Th$ ratio of greater than about 20 is considered sign that there has been no contamination. The uranium concentrations and $^{234}U/^{238}U$ activity ratios are similar in both fossil bone samples (M-1 and M-4). The calculated ^{230}Th ages of both bone specimen agree within limits of experimental error indicating that there is no measurable age difference between the upper and basal gravels at Mesvin IV. The average ^{230}Th age of the two bone samples is 287,000 $\pm$ 12,000 years B. P.

The uranium concentration of the enamel M-2 is low (0.89 ppm) relative to the bone samples (Table 1) and a similar relationship has been observed previously; in fact, clean enamel samples are in most instances low in uranium concentration relative to coexisting bones by factor of about 10 to 50. The calculted ^{230}Th age of this enamel sample is 201,000 $+$ 37,000, $-$ 28,000 years B. P. The uranium concentration of enamel sample M-3 is about three fold higher than the uranium in the enamel M-2, or 2.9 ppm. It appears that the thin enamel plates of simple M-3 (0.5 mm) have not been completely separated from the enclosing dentine which has normal uranium concentrations similar or higher than that of fossil bones. Because of the probable uranium contamination we interpret the calculated ^{230}Th age of sample M-3 (123,000 years B. P.) as being a minimum age only. Considering the apparently acceptable dating of the two bones and the enamel sample M-2, the age of the deposition of the sediment containing the fossils and artifacts at Mesvin IV may be estimated as between 200,000 and 300,000 years old, and most probably between 250,000 and 300,000 years.

III. REGIONAL STRATIGRAPHY

Fluviatile terraces (P. H.)

Near Mesvin IV, several stages of the incision of the hydrographic net have been preserved. Between the top of the « Cuesta d'Harmignies » (+ 90 m) and the bottom of the present talwegs (+ 25 m), the following formations of fluviatile gravels can be observed.

— Pa d'la l'iau terrace: at approximately + 77 m a.s.l., about 38 m above the alluvial plain. These gravels, of limited lateral exposure, have as yet furnished some artifacts *in situ* and a few hand-axes found on the surface.

— Petit-Spiennes terrace: between + 70 and + 68 m; consisting of gravels of flint nodules and chalky granules, associated

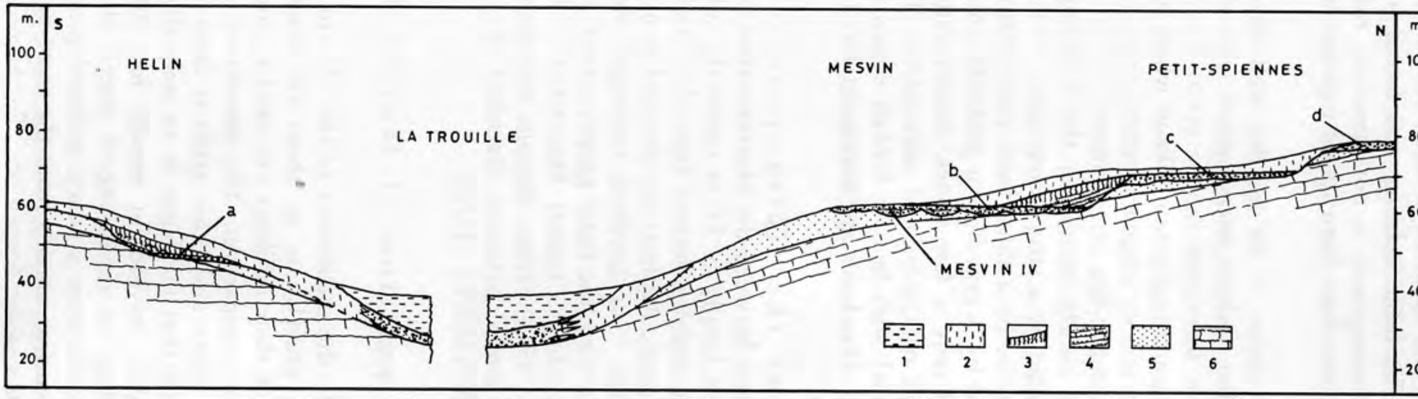


Fig. 7. — Composite section across the Trouille valley.
a : Lowest gravel of the Hélin quarry; b : Mesvin terrace; c : Petit-Spiennes terrace; d : Pa d'la l'iau terrace;
1 : Holocene alluvial deposits; 2 : Weichselian loess; 3 : Interglacial soil (Eemian);
4 : Saalian loess; 5 : Landenian sand (Paleocene); 6 : Chalk (Cretaceous).

with lenses of cross bedded sand. Until now, this terrace has yielded no identifiable bone. The lithic industry was found in a variety of conditions so that its homogeneity is not apparent; rather numerous Middle Acheulian handaxes have been found together with unevolved Levallois flaking.

— Mesvin terrace: about + 60 m; this well developed terrace consists of gravels of flint nodules interstratified with sand and layers of chalky granules. This formation can be up to 2 m thick; toward the top, these deposits grade into a sandy loam which locally contains molluscan fossils, from mainly stagnant waters with some terrestrial forms, which evoke a steppe-like environment.
The Mesvin terrace is clearly incised in the Petit-Spiennes terrace, from which it is separated by a steep ramp some 10 m high (Fig. 7). Together these are covered by a thick loam representing two generations of loess separated by a gray-brown podzolic soil. Recent excavations have produced only a few bones, mainly reduced to rolled fragments, and a tooth of *Coelodonta antiquitatis*. The lithic artifacts are usually abraded with heavily broken edges, however some artifacts are quite fresh. Handaxes are infrequent but Levallois flakes and cores are common.

— Lowest gravel of the Hélin quarry: + 47 m; this gravel is intermediary between the Mesvin terrace and the gravels of the river beds which locally ly 15 m under the alluvial plain. It consists mainly of flint nodules derived from the basal gravel of the Landenian sand (Paleocene). Artifacts are abraded to a varying degree and are of " Clactonian " or Levallois technique. From the sandy and loamy deposits overlying the basal gravel, several Middle Palaeolithic assemblages, including « typical Mousterian », have been described by J. MICHEL (1978). These deposits also display a complex stratigraphy including several paleosols described by J. de HEINZELIN (1959) and P. HAESAERTS (1978).

Stratigraphical position of Mesvin IV (P. H.)

Several arguments justify the attribution of the Mesvin IV channel to the Mesvin terrace. Both gravels are at about the same altitude; the stratigraphical succession of their infillings are similar, both with respect to lithology and degree of compaction. The abundance as well as the good preservation of the fauna and lithic artifacts from Mesvin IV are easily explained by the fact that the latter is an only slightly reworked archaeological site, whereas the Mesvin terrace has suffered a more complicated history including the reworking of several channels like the Mesvin IV one. It contains therefore a mixed archaeological and palaeontological material, incorporating remains from the same age as the gravel and remains reworked from older formations. Furthermore, test pits in various outcrops of the Mesvin terrace have confirmed the presence of an industry similar to that of Mesvin IV.

The gravels of the Mesvin terrace and those from Mesvin IV suggest the existence of a grid of channels formed under cold climatic conditions, mainly active after the spring snow melting. This situation started between 0.3 and 0.2 Myr. according to the uranium-series dates of Mesvin IV and lasted several 10,000 years according to the results of the racemization of the bones from the Mesvin terrace given hereafter. These channels were spread from the northern edge of the Petit-Spiennes terrace to near the « Bois-la-Haut » hill. Most of the gravel, flint and chalk was derived from the Cretaceous formations outcropping immediately upstream.

Amino acid racemization analysis (P. W.)

The possibility of an age determination by the yield of racemization of amino acids has been the object of a large number of papers and review articles, mainly by J. L. BADA and E. H. MAN (1980), G. DUNGWORTH (1976), A. SCHROEDER and J. L. BADA (1976) and K. L. WILLIAMS and G. G. SMITH (1977). The amino acid dating method is based on the fact that the L-amino acids which are solely produced in living organism tend to be slowly converted into D-amino acids in dead material. This process, which takes place in fossils is called *racemization.*

The racemization reaction can be written as follows :

$$\text{L-amino acid} \overset{k}{\rightleftharpoons} \text{D-amino acid},$$

where k is the rate constant. For most cases and particularly in bones, the racemization reaction is believed to proceed via first order kinetics. The following reaction is then obtained :

$$\ln \frac{1 + R}{1 - R\,t} - \ln \frac{1 + R}{1 - R\,(t = 0)} = 2\,k\,t \qquad (1)$$

R is the ratio $\frac{D}{L}$, in which D and L stand for the concentration of the optically active species.

The k-value can be determined by a calibration method: a sample of known age (dated by C^{14} or U/Th) from a given site is analyzed. Substitution of age and D/L ratio in equation (1) yields the rate constant k. The other samples coming from the same site or the same area are supposed to have the same temperature history as the calibrated sample.

Three bone samples originating from the Mesvin terrace (sample A), from Mesvin IV (sample B) and from the Petit-Spiennes terrace (sample C), were analyzed after submitance to the following treatment.

— Washing and dissolution : the samples were repeatedly washed under ultra-sound action. The surface layer has been dissolved in diluted acid and the rest completely dissolved in 6 N hydrogen chloride.

— Separation of the amino acids : the 6 N HCl solution has been heated for 22 hours at 110 °C; hydrogen chloride was then distilled off until a pH of 3 was reached. The amino acids were fixed on a strongly acidic resin (DOWEX 50 W 8) at pH = 3 to 4, and desorbed by NH_4 OH 0,75 M eluent. In this way they were totally demineralized.

— Esterification and acetylation : the amino acids were dissolved in dry methanol, 2 N in HCl. The solution was heated for three hours at 90 °C for the esterification to occur. After evaporation of the solvant, the esters were acetylized by trifluoroacetic or pentafluoropropionic anhydride.

The analysis was performed on an optically active (Chirasil-Val) column in a Hewlett-Packard chromatography (type 5880); racemization yields are given in table 2. Reliable data could only be obtained for aspartic acid, because for other amino acids the conversion has not reached a measurable value. For aspartic acid, equation (1) becomes

$$\ln \frac{1 + R}{1 - R} - 0{,}14 = 2\ k\ t.$$

The values of kt are reported in Table 2.

TABLE 2

Sample	(D/L) aspartic acid	kt	Age
A : Mesvin terrace	0.35	0.29	157,000
B : Mesvin IV	0.49	0.46	250,000
C : Petit-Spiennes terrace	0.72	0.83	450,000

If it is arbitrarily assumed that the three considered samples have been submitted to the same mean conservation temperature and that sample B (Mesvin IV) is 250,000 yr. old (U/Th dating), ages of 157,000 yr. and 450,000 yr. are obtained for samples A and C respectively. On the other hand, if the three analyzed samples do not have the same temperature history, it is however certain that sample C is much older than sample B which is older than sample A.

IV. CHRONOSTRATIGRAPHY (P.H.)

In the limited context of the Upper Haine basin, the chronostratigraphical interpretation of the alluvial terraces rests principally on their relative positions and on their connexions with the cover deposits and their paleosols. The insertion of this data in a wider geographic frame, the Scheldt basin, can also be considered.

The Lowest gravel of the Hélin quarry is older than at least one interglacial-type pedological complex which most probably represents the Last Interglacial (Eemian). In view of its position, 8 m above the present alluvial plain, the afforsaid gravel may be considered as a « Lower terrace ». It is therefore analoguous to the Lower terrace of the Scarpe river at Biache-Saint-Vaast in Northern France, described by J. SOMME (1978), which carries an important succession of Middle Palaeolithic occupations excavated by A. TUFFREAU (1978). The two sites are symmetrically located in respect of the Scheldt valley.

The Mesvin terrace, 20 m above the alluvial plain, is obviously older than the Lowest gravel of the Hélin quarry. In the general scheme of the Quaternary evolution of the Scheldt basin established by R. TAVERNIER and R. DE MOOR (1975), the Mesvin terrace occupies a position similar to that of the Zoetendale terrace in the Scheldt valley, which should be younger than the Melle terrace attributed to the Holsteinian Interglacial on a palynological basis. The exact relationship between the Mesvin gravel and this interglacial remains however unknown.

The Petit-Spiennes terrace, 28 m above the alluvial plain, must be considered as a lateral equivalent of the Ressaix terrace in the Upper Haine valley. The latter gravel has been correlated by R. TAVERNIER and R. DE MOOR (1975) with the Meulebeke terrace in the Scheldt valley, which is certainly older than the Holsteinian deposits of Melle.

V. CONCLUSION

The fluviatile deposits studied in this paper all belong to the Middle Pleistocene, ranging from a Pre-Holsteinian age to a Pre-Eemian age. In this succession, the age of the Mesvin terrace and of the Mesvin IV channel is close to the Holsteinian, probably slightly younger. The Uranium-series dates are in good agreement with this view. The prehistoric industries found in these deposits show a sequence from a not yet identified industry, possibly Lower Acheulian in the Pa d'la l'Iau terrace, through a Middle Acheulian in the Petit-Spiennes terrace and a Middle Palaeolithic industry with an evolved Levallois flaking in the Mesvin terrace to a rough and atypical industry, associating " clactonian " and Levallois techniques, in the Lowest gravel of the Hélin quarry.

The various approaches united to assign the Mesvin IV site to an old phase of the Saalian. Without such a context, the archaeological and palaeontological assemblages of this site would have probably been attributed to more recent periods.

A general evaluation of these results is hindered by the scarcity of comparable sites. The fact that chronological scales vary from author to author (« short » or « long » chronologies, « Alpine » or « Nordic » systems) complicates the usual imprecision of the chronostratigraphical interpretation. In such conditions, preconceived schemes may mislead both the comparisons and the conclusions.

The chronostratigraphical interpretation (begin of the Saalian) and the radiometric dates of the Mesvin IV site are in good agreement with some results achieved for sites attributed to the same period, such as Rhenen (The Netherlands), Biache-Saint-Vaast (Northern France) and Tourville-la-Rivière (Normandy, France), where comparable rather old faunal assemblages, including a mixture of « cold » and « temperate » species, were mentioned.

Concerning the lithic industry of Mesvin IV, comparisons are biased by the fact that the raw material, its nature, quality and abundance may exert a very strong influence both on the technology and on the typology of a prehistoric assemblage. In areas of Northwestern Europe where a large supply of good quality flint was available, the existence of industries anterior to the Weichselian devoid of handaxes but very rich in Levallois flakes is now a well established fact, as shown by A. TUFFREAU (1979), but the exact relationship between such industries and the Acheulian remains unknown, both chronologicaly or genetically. It is not impossible that these industries represent only a specialised facies of the Acheulian but it seems more likely that they are part of distinct industrial complex which prefigurates the Mousterian complex of the Weichselian.

REFERENCES

BADA, J. L.

1976. Cf. SCHROEDER, A.

BADA, J. L. and MAN, E. H.

1980. Amino acid diagenesis in deep sea drilling project cores: cinetics and mechanisms of some reactions and their applications in geochronology and in paleotemperature and heat flow determination. — *Earth-Sc. Rev.*, v. 16, pp. 21-55.

BREUIL, H. and KOSLOWSKI, L.

1934. Etudes de stratigraphie paléolithique dans le Nord de la France, la Belgique et l'Angleterre. La Belgique. — *L'Anthropologie*, t. 34, pp. 249-290.

BREUIL, H. and LANTIER, R.

1951. Les hommes de la pierre ancienne. — Payot, Paris.

BRIART, A., CORNET, F. L. and HOUZEAU DE LEHAIE, A.

1868. Rapport sur les découvertes géologiques et archéologiques faites à Spiennes en 1867. — *Mémoires et Publications de la Société des Sciences, des Arts et des Lettres du Hainaut*, IIIe Série, t. II, pp. 355-392.

COLE, G. H.
1972. Cf. HOWELL, F. C.

COLLINS, D.
1975. Cf. SZABO, B. J.

CORNET, F. L.
1868. Cf. BRIART, A.

DE HEINZELIN, J.
1959. Stratigraphie de la carrière Hélin sur la base des résultats de la campagne de fouilles de 1958. — *Bull. Inst. Roy. Sc. Nat. Belg.*, t. XXXIV, n° 14, pp. 1-27.

DE MOOR, R.
1975. Cf. TAVERNIER, R.

DESTOMBES, J. C.
1982. Tourville-la-Rivière (Seine-Maritime, France) : le premier grand gisement de mammifères du Pléistocène moyen (Riss) dans la basse vallée de la Seine. — *C. R. Hebd. Séances Ac. Sc.*, t. 295, Sér. III, (Sc. de la Vie), n° 10, pp. 575-577.

DUNGWORTH, G.
1976. Optical configuration and the racemization of amino acids in sediments and in fossils : a review. — *Chemical Geol.*, v. 17, pp. 135-153.

HAESAERTS, P.
1978. Contexte stratigraphique de quelques gisements paléolithiques de plein air de Moyenne Belgique. — *Bull. Soc. Roy. Belg. Anthrop. Préhist.*, v. 89, pp. 115-133.
1980. Stratigraphie des dépôts limoneux du Pléistocène supérieur de Moyenne Belgique : essai de zonation paléoclimatique = pp. 165-173 *in* Problèmes stratigraphiques quaternaires en France et dans les pays limitrophes, edited by J. CHALINE. — *Suppl. Bull. Ass. Franç. Et. Quat.*, N. S., 1.

HOUZEAU DE LEHAIE, A.
1868. Cf. BRIART, A.

HOWELL, F. C., COLE, G. H., KLEINDIENST, M. R. SZABO, B. J. and OAKLEY, K. P.,
1972. Uranium-series dating of bone from the Ismila prehistoric site, Tanzania. — *Nature*, v. 237, pp. 51-52.

KLEINDIENST, M. R.
1972. Cf. HOWELL, F. C.

KOSLOWSKI, L.
1934. Cf. BREUIL, H.

KU, T. L.
1976. The Uranium-series method of age determination. — *Ann. Rev. Earth Planetary Sc.*, v. 4, pp. 347-379.

KUKLA, G. J.
1977. Pleistocene Land-Sea correlations, I, Europe. — *Earth-Sc. Rev.*, v .13, n° 4, pp. 307-374.

LANTIER, R.
1951. Cf. BREUIL, H.

MAN, E. H.
1980. Cf. BADA, J. L.

McKINNEY, C. R.
1978. An evaluation of Uranium-series disequilibrium dating of fossil teeth. — *Geol. Soc. Amer., Abstr. Progr.*, v. 10, p. 454.

MICHEL, J.
1978. Les industries paléolithiques de la carrière Hélin à Spiennes. — *Helinium*, v. 18, pp. 35-68.

OAKLEY, K. P.
1972. Cf. HOWELL, F. C.

SAKANOUE, M. and YOSHIKA, M.
1974. Uranium-series dating of bone samples from the Amid Cave site. — *The Quaternary Research* (Tokyo), v. 13, pp. 220-224.

SCHROEDER, A. and BADA, J. L.
1976. A review of the geochemical applications of the amino acid racemization reaction. — *Earth-Sc. Rev.*, v. 12, pp. 347-391.

SMITH, G. G.
1977. Cf. WILLIAMS, K. L.

SOMME, J.
1978. Le gisement paléolithique de Biache-Saint-Vaast (Pas-de-Calais). Géomorphologie et lithostratigraphie. — *Bull. Ass. Franç. Et. Quat.*, nº 1-2-3, pp. 27-37.

SZABO, B. J.
1972. Cf. HOWELL, F. C.
1979. Dating fossil bone from Cornelia, Orange Free State. — *J. Arch. Sc.*, v. 6, pp. 201-203.
1980. Results and assessment of Uranium-series dating of vertebrate fossils from Quaternary alluviums in Colorado. — *Arct. Alp. Res.*, v. 12, pp. 95-100.

SZABO, B. J. and COLLINS, D.
1975. Age of fossil bones from British interglacial sites. — *Nature*, v. 254-680.

TAVERNIER, R. and DE MOOR, R.
1975. L'évolution du bassin de l'Escaut, pp. 159-233 *in* Cent. Soc. Géol. Belg., L'évolution quaternaire des bassins fluviaux de la Mer du Nord méridionale, edited by P. MACAR, Liège.

TUFFREAU, A.
1978. Les fouilles du gisement paléolithique de Biache-Saint-Vaast (Pas-de-Calais) : années 1976 et 1977. Premiers résultats. — *Bull. Ass. Franç. Et. Quat.*, nº 15, pp. 46-55.
1979. Les débuts du Paléolithique moyen dans la France septentrionale. — *Bull. Soc. Préh. Franç.*, t. 76, pp. 140-142.

VAN KOLFSCHOTEN, T.
1981. On the Holsteinian ? and Saalian mammal fauna from the Ice-pushed Ridge near Rhenen (The Netherlands). — *Med. Rijks Geol. Dienst*, v. 35, nº 2/7, pp. 223-251.

WILLIAMS, K. L. and SMITH, G. G.
1977. A critical evaluation of the application of amino acid racemization to geochronology and geothermometry. — *Origins of life*, v. 8, pp. 91-141.

YOSHIKA, M.
1974. Cf. SAKANOUE, M.

Institut royal des Sciences naturelles de Belgique,
Département des Vertébrés récents,
Section Anthropologie et Préhistoire.

Koninklijk Belgisch Instituut voor Natuurwetenschappen,
Departement Paleontologie,
Afdeling Fossiele Vertebraten.