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Neandertals from Belgium
Les Néandertaliens de Belgique

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Abstract

On at least six or seven occasions since 1830, the caves of the Mosan basin, in the southern part of Belgium, have provided Neandertal human remains. Some of these finds, like Engis, La Naulette or Spy, are famous; they have played a role of primary importance in the genesis and initial development of palaeoanthropology and prehistory (§ 2). Others, modest (Fonds de Forêt) or recent (Sclayn, Walou), should be better known. The different sites are first presented individually, from historical, geological, palaeoenvironmental, archaeological and palaeoanthropological points of view (§ 3). They are then integrated in analytical approaches successively developing the nature of the sites (§ 4.1), the archaeological material associated with the Neandertal remains (§ 4.2), the deposition processes of the bones (§ 4.3), anthropology (representativity of the bones, age, sex; § 4.4), pathology (§ 4.5), anthropic traces (§ 4.6), diet (§ 4.7) and DNA analyses (§ 4.8). Finally, we will present a proposition for Mosan Neandertal chronology (§ 4.9) as well as a discussion of future approaches to regional Neandertal research (§ 5).

Résumé

Les cavernes du bassin mosan, dans le Sud de la Belgique, ont, à six ou sept reprises au moins depuis 1830, livré des restes d'hommes de Néandertal. Certaines de ces trouvailles, comme Engis, La Naulette ou Spy, sont célèbres; elles ont joué un rôle de première importance dans la genèse et les premiers développements de la paléoanthropologie et de la préhistoire (§ 2). D'autres, modestes (Fonds de Forêt) ou récentes (Sclayn, Walou), gagnent à être connues. Les différents sites sont d'abord présentés individuellement, tant du point de vue historique que géologique, paléoenvironnemental, archéologique et paléoanthropologique (§ 3). Ils sont ensuite intégrés dans des approches analytiques abordant successivement la nature des sites (§ 4.1), le matériel archéologique associé aux ossements néandertaliens (§ 4.2), le mode d'introduction des ossements dans les sédiments (§ 4.3), l'anthropologie (représentativité des fossiles, âge, sexe; § 4.4), la pathologie (§ 4.5), les traces anthropiques (§ 4.6), le régime alimentaire (§ 4.7) et les analyses de l'ADN (§ 4.8). Enfin, une proposition de sériation chronologique des Néandertaliens mosans (§ 4.9) et une discussion des perspectives d'avenir de la recherche néandertalienne régionale (§ 5) sont présentées.

1. INTRODUCTION

On at least six or seven occasions since 1830, Belgium has provided Neandertal human remains, all from caves of the Mosan basin (fig. 1). Some of these finds, like La Naulette or Spy, are famous; they have played a role of primary importance in the genesis and initial developments of palaeoanthropology and prehistory. Others, modest or recent, should be better known. The quality of information available on the stratigraphic, archaeological and palaeoenvironmental contexts of these fossils varies greatly. Some human remains were found during recent multidisciplinary excavations. Others, brought to light during the 19th century, have only been placed in simplistic stratigraphic records, without exact distribution plans or contextual analyses. Whatever the case, in varying degrees, they have all made a significant contribution to knowledge of one of the most fascinating taxa in human history.

2. THE HISTORY AND IMPORTANCE OF MOSAN NEANDERTALS

Ph.-Ch. Schmerling, a doctor and non-conformist naturalist, was the first scientist to have clearly understood and demonstrated the contemporaneity of man and large extinct prehistoric mammals [2.97; 2.98]. During the winter of 1829–1830, in the second Engis cave, he discovered two skullcaps, notably associated with woolly rhinoceros and mammoth bones.

Even if this illustrious precursor did not affirm that this man was even morphologically slightly different from our contemporaries, scientific officialdom took more than a quarter of a century to admit Schmerling's ideas. This necessitated:

1. that prehistoric archaeology was more firmly established due to Jacques Boucher de Perthes' stubborn propagandizing;
2. that *The Origin of Species* (1859) by Charles Darwin had imposed the notion of transformism;
3. that the English geologist Charles Lyell, having visited the Liège sites in the company of C. Malaise, had come around to Schmerling's ideas.

As two of his 19th century biographers judiciously noted, Schmerling "was wrong because he was right too early" [2.16; 2.68].

Discovered in 1866 by the geologist Édouard Dupont in a Lesse valley cave, the famous La Naulette mandible also marks a date in the history of palaeoanthropology. The fossil's antiquity has been established by its stratigraphic context and its association with large extinct prehistoric mammals. Taking place in the maturity phase of the idea of the existence of a fossil man different from present forms—ten years after the eponymous Neandertal discoveries near Düsseldorf, which were out of context—, according to the illustrious Paul Broca [2.12 : 595] the La Naulette discovery represents "[...] the first fact providing Darwinists an anatomical argument, [...] the first link in the chain which, according to them, should reach from man to the monkey".

Twenty years later, a more prepared scientific opinion had little trouble accepting the discovery of "The Man of Spy" remains, exhumed in June and July 1886 from the terrace of the 'Betche aux Rotches' cave, 20 km west of the city of Namur. Due to the multi-disciplinary character of research conducted by the geologist Max Lohest and the archaeologist Marcel De Puydt, working in conjunction with the palaeontologist Julien Fraipont, this discovery led to definitively admitting the existence of a human taxon anatomically slighltly different from modern man.

In 1895, the discovery of a femur by Doctor F. Tihon in the 'Fonds de Forêt' caves, in the Vesdre valley, brought to a close regional Neandertal discoveries in the 19th century. We should recall that at this period the "cradle of mankind" was sliding progressively towards Asia and then towards Africa, following older and older grades of discoveries in the evolution of Hominids: *Homo erectus* of Java and China on the one hand, and the Australopithecines from Africa on the other.

During most of the 20th century, regional Neandertal anthropology took place in the laboratory. The salient facts are the recognition of the Neandertal character of the Engis child, a century after its discovery [2.49] as well as the detailed study of the Fonds de Forêt femur [2.106] and the La Naulette remains [2.74; 2.99].

With the resumption of vast field research programmes during the last decades of the past century, two series of finds have allowed Walloon research to renew ties with the long tradition of such pioneers as Schmerling, Dupont, or Fraipont and Lohest. The first series comes from Scladina cave, at Sclayn, where some stratigraphic units have yielded Neandertal remains, notably the mandible and the maxillary fragment discovered in many parts, beginning on July 16, 1993 [2.101]. The second is a premolar found in a Mousterian context, in Walou cave, at Trooz [2.43].

3. MOSAN NEANDERTAL SITES

3.1. The Schmerling cave in Engis

A famous site in the history of human palaeontology, the Schmerling cave forms part of a group of openings facing north, in the flank of a cliff of Dinantian limestone, in the territory of the village of Les Awirs (commune of Flémalle, province of Liège), some 750 m north of the Meuse valley. A ravine, mostly hollowed out by an old quarry, isolates it from the surrounding countryside and lends it a spectacular aerial aspect. Known originally as the 'Trou Caheur', the cave was named the 'Deuxième grotte d'Engis' (Second Engis cave) by Schmerling before being renamed the 'Grotte Schmerling' in 1939.

The first excavations were carried out by Schmerling in the winter of 1829–1830 [2.90]. Among the discoveries were two human skullcaps. In 1868, Éd. Dupont excavated the cave and detailed its stratigraphy [2.46]. J. Fraipont [2.51] further explored the site in 1885, before being relayed by É. Doudou [2.39] from 1895 on, and then by J. Hamal-Nandrin [2.110] in 1904. Finally, over the course of the 20th century, the "Chercheurs de la Wallonie" excavated the cave on several occasions, notably in 1907 and 1956 [2.30]. Given the oldness of all this research, the stratigraphic information appears quite summary in comparison with the immense interest of the cave filling. This is why the palaeoenvironmental data, provided

uniquely by the macrofauna, is of little use [2.110 : 115]. Fig. 5 tries to synthesize the information provided by the principal excavators.

Correlations between the various stratigraphies are delicate. For example, Dupont does not establish a subdivision in his layer 2, in which he nonetheless documents lithic items of the Mousterian and Upper Palaeolithic [2.110 : 112]. Hence his layer 2 at least partly corresponds to Destexhe's layers A and B. The site's Middle Palaeolithic industry is typical Mousterian of Levallois facies [2.110 : 116].

Two skullcaps (Engis 1 and 2) and various cranial fragments, as well as some postcranial remains were discovered in the cave, most of them by Schmerling. Their stratigraphic position is uncertain. Schmerling notes that "it was a meter and a half down [...] hidden under an osseous breccia [...]" that he discovered the adult Engis 1 skullcap [2.90 : 60] whereas the juvenile Engis 2 cranium "[...] was on the bottom of this cave, near an elephant tooth [...]" [2.90 : 62]. Dupont situates the human remains in his first ossiferous level, an archaeological catch-all layer, and Destexhe in his layer B, right in the midst of the Mousterian industry.

'Engis 1' has often been attributed to the Upper Palaeolithic, a period in which it would have been buried in a grave dug in the Mousterian level. Yet a recent AMS dating at 4,590 ± 80 B.P. (OxA-746) [2.69] supports those who, since de Mortillet [2.27], place this cranium in the Neolithic.

The 'Engis 2' child (fig. 2) is represented by a skullcap, maxilla and malar fragments as well as upper and lower teeth. Death occurred between 4 and 5 years of age [2.77 : 471–472], or even between 5 and 6 years of age [2.96 : 51]. These fossils were not attributed to Neandertal man until a century after their discovery [2.47]. The cranium is relatively elongated, its vault rather flat, with a receding forehead; there is bulging of the rear cranium. On the biometric level, the cranium is large, the maximum width is found lower, at the parietals. Its frontal bone is more extended than the parietal, like other Neandertal children and many adults. The interorbital width is well above the present mean. The sagittal convexity of the parietal is weak. The occipital presents strong convexity in relation to the stretch of the rear cranium. The biasteric width is clearly much greater than that of present-day children. The foramen magnum is large.

The fossil presents a combination of juvenile characteristics, plesiomorphic (primitive) traits and derived (acquired) Neandertal traits. Among the primitive characteristics figure notably the forehead receding towards the back, the effacement of the frontal bosses, the topography of the meningeal veins with predominance of the anterior branch, stretching of the rear cranium from a lateral view or, further, the anterior obliquity of the main axis of the external auditory meatus. The majority of the derived Neandertal characteristics, defined in the adult, are all recognizable in Engis 2 child, for example:

1. the large, rounded orbits;
2. the low position of the maximal width of the cranium at the parietals and the transversal convexity which, from a posterior view, gives the cranium its "bomb shape";
3. the convexity of the occipital plane which is, furthermore, separated from the rather flat nuchal plane by a supra-iniac fossa;
4. in norma lateralis, the juxta-mastoid process descends beyond the mastoid process, poorly distinguishable from the bony mass.

Due to the subject's youth, other traits were still in development on Engis 2, notably the supraorbital torus, which was in the process of differentiation.

3.2. La Naulette Cave

La Naulette cave is situated on the left side of the Lesse, less than 1 km southwest of the hamlet of Chaleux (commune of Houyet, province of Namur). This is a vast cave whose principal entrance opens towards the northwest, about 25 m above the river, in a Dinantian limestone massif. A second, smaller entrance opens northeast of the principal entrance, at approximately the same altitude.

It was early in the year 1866 that Dupont carried out the first excavations at La Naulette [2.44]. In March he unearthed a human mandible and an ulna, associated with extinct animal remains. The quality of the results and the importance of the stratigraphic sequence led him to complete the research, during the summer of the same year, essentially in hopes of finding other parts of the human skeleton [2.45 : 248]; only a canine enriched his find.

It was only since the summer of 1999 that new research at La Naulette was carried out by the "Direction de l'Archéologie du Ministère de la Région wallonne" (Directorate of Archeology

of the Walloon Region Ministry). The principal objectives are to study the site's stratigraphy and palaeoenvironment as well as to date the human remains [2.102; 2.86].

The stratigraphic sequence of the La Naulette cave is more than 11 m thick. In his initial description, Dupont [2.44] reported four or five "stalagmitic sheets" (= stalagmitic floors) and two "ossiferous levels". Over the course of the second operation, he identified a third "ossiferous level", located under the two preceding ones, and the stalagmitic floors were increased to seven in number [2.45]. The discrepancy between Dupont's two stratigraphic descriptions makes it difficult to compare them. The human remains belong to the second "ossiferous level" of the stratigraphy published in 1867, situated between stalagmitic floors 2 and 3.

No lithic material was associated with the human remains. Yet for Dupont, some animal bones bore "traces of the hand of man" [2.44 : 52], so that "[...] the hypothesis of man's placing [...]" the human and animal remains in the layer seemed to him "[...] the most satisfying; even the only admissible" [2.45 : 253]. However, Dupont's arguments are not always convincing.

The only known palaeoenvironmental information from La Naulette comes from the macrofauna. The remains were "relatively few in number but admirably conserved" [2.44 : 47]. The fauna associated with the anthropological remains is the best documented.

The La Naulette mandible involves only the left side of the body, the symphyseal region and the right side of the body extending to the P_3 and partially to the P_4 (fig. 3). It is generally—and rightly—attributed to a female subject; doubtlessly a young adult. The symphyseal region is slightly receding and the alveolar part of the fossil's buccal face presents an alveolar plane, two plesiomorphic characteristics. The chin does not present the 4 components characteristic of modern man; it is reduced to an incipient tuber symphyseos and incurvatio mandibularis anterior. The genial region is clearly near the lower edge like many Neandertals; it presents a substantial genioglossal fossa, of plesiomorphic nature, furrowed in by two little cupulae, replacing the upper genial processes [2.74 : 24]. The mental foramen is double, the principal one right over P_4, which is a modern characteristic. On the other side, some of the principal autapomorphies of the Neandertal mandibles such as the existence of a retromolar space, the backward position of the mental foramen and the flatness of the anterior face of the symphysis are missing but these are features generally observed only on adults.

La Naulette anthropic remains are not dated. Yet some indices allow us to assume that they are older than the "classical Neandertals". The first depend on the presence of five overlying stalagmitic floors. The second ones are of a palaeoanthropological order. As we have seen, the mandible presents archaic—or plesiomorphic—traits but not veritable "derived" characteristics typical of Neandertals. Moreover, the mandible falls within the biometric variability of Neandertals and their pre-Neandertal ancestors. On the contrary, the ulna and third metacarpal show modern type morphological and metric characteristics.

Hence two hypotheses can be advanced. In the first, Dupont wrongly associated an ancient mandible with modern postcranial remains by mixing the layers. The finesse of his stratigraphic observations and various other arguments would tend to eliminate this possibility. If, on the contrary, all the remains do indeed come from the same layer, or even from the same subject, the explanation might lie in the concerned individual's belonging to a very early Neandertal group. In fact, the characteristics proper to Neandertals were progressively acquired "in mosaic" to end up with "classical" kinds around the Eemian interglacial. In some of their anatomical details, rather early fossils may thus be morphologically closer to modern man than to classical Neandertals. In the context of this hypothesis, the "modern" traits of the La Naulette postcranial bones will have to be interpreted in terms of "plesiomorphy". New research undertaken at the site will doubtlessly let us test this interpretation. New dating by gamma spectrometry might also prove useful to test the contemporaneity of the mandible and postcranial bones.

3.3. Spy Cave

Spy cave (commune of Jemeppe-sur-Sambre, province of Namur) is situated on the left bank of the Orneau river. Its principal entrance, preceded by a terrace, opens south-southwest, some fifteen meters above the stream, in a Dinantian limestone massif. The cave is relatively small and has a principal zone leading onto little narrow galleries.

The first Spy excavations were carried out in 1879 by A. Rucquoy [2.87]. M. De Puydt and M. Lohest [2.28] began research in August 1885, which, during the second operation, in June and July 1886, were "crowned with undreamed of success" [2.29 : 208]: human remains were unearthed in their stratigraphic context and in association with remains of extinct animals and archaeological material. Studying of the bones, animal as well as human, was entrusted to J. Fraipont. Other excavations were then undertaken at Spy: the Royal Museums of Art and History between 1903 and 1909 [2.26]; University of Liège from 1927 to 1933 [2.65; 2.66]; F. Twiesselmann and the Royal Belgian Institute of Natural Sciences from 1948 to 1956 [2.37]; "S.O.S. Fouilles" from 1979 to 1981 [2.31; 2.32].

We shall concentrate our attention on excavations of the terrace, which led to the discovery of Neandertals in 1886 (fig. 6). Subsequent excavations did not provide supplementary information on the context of human fossils.

Unfortunately, the excavation methods of De Puydt and Lohest were far from exemplary, even for the period, as the team geologist was to recognize later [2.76 : 146]. The timbered gallery excavations used from 1885 on [2.76] were certainly responsible for mixing up various archaeological occupations brought to light by recent typological studies [2.110; 2.33; 2.80], as well as, furthermore, the lack of spatial plans for Neandertal remains.

In fact, if today we admit the existence of at least seven Palaeolithic occupations, only three "ossiferous levels" were noted then. The notion of an "ossiferous level" is actually rather fluid. Although it seemed synonymous, to the excavators, with archaeological occupations, they nonetheless wrote that only "[...] the upper part of this ossiferous level included a thin bed of knapped flints [...]" [2.54 : 666].

To the lack of finesse in observation of sediments is added a certain confusion between the excavators' various descriptions [2.53 : 767–769; 2.54 : 663–665; 2.29 : 209, 236 & pl. I; 2.52 : 36–37]; for example, the number of layers yielding knapped flints varies from three to five depending on the article. Furthermore, the palaeoenvironment of the Spy deposits is poorly understood. The only data available concern the macrofauna, but the lacunae mentioned above limit the interpretation.

From an archaeological point of view, the Spy deposits contain at least 3 Mousterian occupations and 4 from the Upper Palaeolithic (fig. 6). The "Men of Spy" were probably associated with Quina type Charentian [2.10 : 157; 2.110 : 65], which would assign them to a relatively recent chronological position [2.14 : 38]. The excavators observed the abundance of knapped flints near the human remains [2.29 : 233]; thus, "two Mousterian points, a glossy sandstone blade and many odd flakes [...]" accompanied the remains [2.54 : 665].

Dozens of human remains discovered in the Spy terrace were initially related to two adults, Spy 1 and 2 (fig. 4). In fact, some additional remains come from a young child (Spy 3) [2.105 : 99; 2.107 : 12] and two, or even three, more adults [2.103]. Spy 1 and Spy 2 are each represented by a skullcap, maxillar and mandible elements as well as by a series of postcranial remains, often incomplete, but belonging as much to upper as to lower members. According to Thoma [2.93; 2.94], Spy 1 seems to be a woman whose cranial capacity is in the order of 1,300 cm^3 and Spy 2 a rather young man with around 1,500 cm^3 of cranial volume.

The various Spy remains present numerous plesiomorphic characteristics, as well as derived characteristics, some shared with modern men (synapomorphic), the others specific to Neandertals (autapomorphic). All these remains are clearly Neandertal [2.93; 2.94] and cannot, contrary to the view defended earlier by Hrdlička [2.71], be considered as representing the phyletic transition between this taxon and modern men.

Among the plesiomorphic characteristics of the Spy crania figure, for example, the low and elongated cranial vault of the two skullcaps and the receding character of the mandibular symphysis as well as the planum alveolare of Spy 1. Numerous derived characteristics proper to Neandertals are observable on the two skulls: for example the "bomb shape" from a rear view, particularly clear on Spy 2, the effacement of the parietal lobes or, further, the retromolar space (1 cm for Spy 1 and 0.5 cm for Spy 2).

The postcranial bones from Spy, like those of other Neandertals, have robust epiphyses compared to modern man. Among the numerous traits characteristic of Neandertals, we shall mention for example:

1. the large sigmoid cavities of the Spy 2 ulnae tend to face anteriorly and not upward like recent humans;
2. seen laterally, the ulna's anterior face forms an angle under the coronoid process;

3. platolenian index of the ulnae is "eurolene";
4. shaft of the Spy 1 radius strongly curved;
5. shaft of the Spy 2 femurs slightly curved forward;
6. weak femoral pilaster;
7. left tibia of Spy 2 short and robust.

3.4. Fonds de Forêt Cave

On the left side of the Magne stream, a tributary of the Vesdre, are found the two Fonds de Forêt caves or Bay Bonnet caves (commune of Trooz, province of Liège). These cavities are situated in Dinantian limestone, about one hundred meters from the stream, around 20 m above it. They have a common artificial terrace. The upstream cave, or 'first cave', is larger. Oriented westward, an elbowed gallery around 30 meters long leads into a vast chamber. This was the gallery yielding Neandertal remains.

All the research work at Fonds de Forêt is old. Schmerling [2.90] excavated there around 1830, probably in the main chamber [2.95 : 147]. In 1895, Dr F. Tihon opened two trenches in the terrace before becoming interested in the cave interior, where he unearthed a human femur and upper left molar [2.95 : 165]. In 1906, Hamal-Nandrin also excavated in the cave [2.64; 2.67], before the *Musée royal d'Histoire naturelle de Bruxelles*, under the direction of A. Rutot, took up the torch in 1907 [2.89]. The same year, M. Exsteens [2.48] explored a portion of sediment left by Rutot on the right side of the gallery, in the middle part of the cave. In 1914, Hamal-Nandrin carried out a small excavation on the terrace of the two caves, near the principal entrance, with few results. Then, between 1931 to 1933, he opened a large trench in the slope leading down to the stream [2.67; 2.55; 2.50]. Among the other excavations, we mention Lequeux's works in 1916 [2.75].

Excavations by Tihon, Exsteens and Rutot provide the principal information on the stratigraphy of the cave interior, where the Neandertal remains were exhumed. The differences observed between these various stratigraphies might be partly explainable by their location in apparently different zones of the cave, yet there is a certain coherence between the various descriptions. Many propositions for correlation between the different stratigraphies have been proposed. That of Twiesselmann seems to us the most relevant.

Upper Palaeolithic and Middle Palaeolithic industries have frequently been mixed together, notably by Tihon [2.110 : 130]. Furthermore, the hypothesis of intrakarstic reworking due to water circulation cannot be totally ruled out [2.110 : 138–139]. Because of mixed layers, the study of the fauna gathered hardly permits palaeoenvironmental interpretation. The Middle Palaeolithic material seems homogenous. It is Quina type Charentian [2.110]. The human bones are probably related to this. The site's Upper Palaeolithic material corresponds to numerous occupations: Aurignacian, Gravettian and, on the terrace, Arhensbourgian, and maybe "Creswellian" [2.110 : 132; 2.80; 2.34].

The exact location of the molar and femur discoveries is unknown. Study of the latter (fig. 8) only dates back to 1961 [2.106]. It is a robust left bone, reduced to the lower four fifths. It comes from an adult subject. Its shaft shows an anteroposterior curvature and is rounded in cross section, characteristics found in classical Neandertals. The biometric study too shows that the femur of Fonds de Forêt resembles those of Spy and Neandertal, notably for the trochlear dimensions, the sub-trochanteric diameters and the mid body dimension.

3.5. Scladina Cave

Discovered in 1971, Scladina cave, at Sclayn (commune of Andenne, province of Namur), opens in Dinantian limestone, on the west side of the Fond des Vaux, a stream tributary of the Meuse. Oriented east-south-east, some twenty meters above the stream, the cave forms part of a karstic complex of at least three caves linked to each other by a network of galleries and shafts. It begins with a long passage 5 to 6 meters wide and roughly 6 meters high, extending more than 30 m. The excavation of this site has been carried on since 1977–78 by the "Service de Préhistoire" of the University of Liège and the "Archéologie Andennaise" association. Since 1993, it numbers among the rare sites of the Meuse basin to have provided Neandertal remains [2.100; 2.101].

The Scladina stratigraphy (fig. 7) shows, from bottom up [2.8], a cryoclastic phase (layers 7A and 7B), a runoff phase (layer 6), then a second cryoclastic sequence (layer 5) with the principal archaeological occupation, a Middle Palaeolithic of interglacial age *sensu lato* (Saint-Germain 1B), attributable to a Quina type Mousterian [2.78]. After a runoff deposit (layer 4B), is a layer of homogenous ochre-coloured silt (layer 4A), corresponding to rapid colluvial

sedimentation. The 9 juvenile Neandertal remains discovered in the past few years are contained in this level, which may well date back to the Saint-Germain 1C interglacial [2.9]. A stalagmitic floor (CC4) seals the sediments of layer 4. The karstic filling then presents an alternance of deposits, sometimes full of limestone blocks of all sizes, sometimes more silty. Layer 3 has yielded three human teeth and one first metatarsal; yet, since the limit of layers 3 and 4A was not always precisely identified at the beginning of the excavations, these remains might well come from layer 4A [2.8 : 18]. Layer 1A contains the second level of Mousterian habitat, with Charentian affinities in the large sense [2.79]. Finally, a Holocene stalagmitic floor (CC1), partly fused to the cave dome, surmounts all the deposits.

At one moment it seemed that certain squares of layer 1B had yielded Neandertal remains, based on the position of this layer under the level of Mousterian occupation of layer 1A. These pieces must be declassified from the inventory of Scladina Neandertals. In fact, some other bones, exhumed at the beginning of the excavations in the same sector and rediscovered recently, exhibit modern anatomic characteristics, notably on the level of the condyle of the mandible and on a radius. Moreover, perturbations observed along the wall suggest that these bones come from superficial deposits in the cave.

A number of contextual studies were done: stratigraphy and sedimentology [2.62; 2.59; 2.4], palynology [2.1], palaeontology [2.21; 2.91] and geochronology [2.9]. They are synthesised in fig. 7.

The layer 4A palaeoanthropological fossils are all from a child's mandible and right maxilla (fig. 9). Based on age criteria related to cutting teeth and the formation of molar roots in modern men, the child would be 12 or 13 years old. Yet the persistence of deciduous molars might suggest a younger age, doubtless not over ten or eleven. The Sclayn maxillary fragment is too incomplete to let us determine exactly whether it corresponds to the morphology in flexion or extension. The mandible's symphyseal region presents a slightly recessed sagittal profile. The upper part of the posterior face has a planum alveolare overlying a slight torus transversus superior. The fovea genioglossa is traversed by three vertical crests with the median descending in between the digastric fossae. The anterior face of the symphyseal region shows a very slight depression under the alveolar process suggesting the presence of an incipient incurvatio mandibulae anterior. There are no lateral tubercles, but only an incipient tuber symphyseos. The condylar process of Neandertal mandibles projects partly outside the branch, materialised by the upper edge of the mandibular incisor, whereas this structure is situated almost uniquely on the mesial side in modern men; at Sclayn, the condylar process shows the Neandertal arrangement. The width of the branch is elevated (35 mm) in relation to other Neandertals of more or less the same age, notably Teshik-Tash [2.109] or Fate II [2.56]. The mandibular foramen does not present the "horizontal-oval" form which appears on around half the Neandertals. The body depth decreases and thickens progressively from front to back, a characteristic often considered "modern" but which has no real taxonomic value in the child. Neither side has a retromolar space but this derived trait, characteristic of the majority of adult Neandertal fossils, is absent in most children. The mental foramen is double: the principal one situated under P_4 and the accessory under the septum separating this tooth from M_1.

In conclusion, the mandible does not present "typical" derived Neandertal characteristics, such as, notably, the retromolar space and the anterior flatness of the incisive region. Yet the lateral development of the condylar process, the extreme width of the branch and the double mental foramen figure among characteristics that the Sclayn mandible shares with other European Neandertals, which association distinguishes it somewhat from modern men. Plesiomorphic traits are also well represented on the Sclayn mandible, for example, the absence of a chin and the presence of a fovea genioglossa and a planum alveolare.

3.6. Walou Cave

Walou cave (commune of Trooz, province of Liège) is in a Dinantian limestone massif, about 30 meters above the Magne, on the left bank of this affluent of the Vesdre. The site was discovered on various occasions by amateur spelaeologists and archaeologists, before becoming the object of two series of multi-disciplinary excavations, from 1985 to 1990 [2.38], then from 1996 to present [2.41; 2.43]. The excavations

principally involve the terrace extending in front of the cave.

Four major sedimentary members were distinguished [2.17]. Member A corresponds to the Holocene and has yielded some remains from Neolithic and Mesolithic industries [2.38]. The first four layers of member B, that is B1 to B4, have yielded Creswello-Tjongerian and Magdalenian material; they correspond to the Late Glacial. An important hiatus separates them from layer B5, where a Gravettian industry has been discovered. In member C, layers C4A to C10 correspond to a humid and cold part of the Weichselian glaciation. Layer C6C, dating back to around 29,000 B.P., has yielded Aurignacian material. Layer C8, the last to be ^{14}C dated, to more than 42,000 B.P., contained Mousterian material [2.42]. According to Collcutt [2.17:14], as to layers C1 to C4, they rather curiously seem to correspond to displacement from members A and B. Member D, where research has just begun, may correspond to the Saalian or even predate it [2.43]. The stratigraphic connections between Collcutt's reference sequence and ongoing excavations not yet having been established, a provisional nomenclature (C sup., C2, C3 and Da to Dc; *sensu* Draily) has been used for the probable equivalents of layers C8 to D2 [2.114].

Many palaeoenvironmental studies have been done at Walou. Generally speaking, we observe an excellent correlation between sedimentology [2.17], microfauna [2.23; 2.104], archaeology [2.35; 2.40; 2.41] and geochronology [2.41; 2.57]. Only palynology [2.70] poses some problems on the level of members B and C. Regarding the macrofauna, only layers C6C [2.92], C sup. to C3 and Da to Dc [2.114] have been studied. The sequences of Walou, as well those of Scladina and Trou Al'Wesse (Modave, province of Liège) [2.83], are keys for the palaeoenvironnemental data they have yielded.

The site's only hominid fossil, a tooth (fig. 10), comes from layer C sup., which might well be only a lateral variant of Collcutt's layer C8. It was found in 1997 but only identified in 1999 [2.43]. The diversity of fauna found in C sup. suggests [2.43] the existence of a mosaic of biotopes with grassy steppes, steppes with some trees and perhaps timbered zones, humid prairies, swampy milieux and rupestral milieux. The climate must have been of a continental type with very cold and wet winters and cool, sunny summers, recalling the characteristics of a mountainous climate and explaining the simultaneous presence of ibex, chamois and marmot. These observations do not correspond to a rigourous glacial period like a full ice age but rather to a phase of climatic improvement of the Weichselian interglacial which may correspond to an interstadial stage preceding that of Arcy. The layer C8 microfauna data are compatible with this interpretation [2.20].

The lithic industry associated with the human tooth corresponds to a Mousterian centred on the production of flakes, very much like that of layer C8 [2.42]. Among the tools discovered figure, notably, pseudo-Levallois points, various types of scrapers, backed knives and rare Mousterian points.

The tooth is a lower left premolar, probably a P_3. It presents the same state of conservation and fossilisation as the rest of the palaeontological remains gathered in layer C sup. The tooth presents a single root, with a relatively flattened profile in the mesial-distal direction. The crown is robust. Its maximal vestibular-lingual and maximal mesial-distal diameters are close to Neandertal means, an interesting observation but not enough to situate the fossil taxonomically. On the contrary, given the present state of research, it is the find's archaeological context, coupled with its stratigraphic position in a complex sedimentary sequence and, accessorily, the faunal examination, which advances our reflection. The lithic material of layer C sup.—like, for that matter, that of C8—has undergone no pollution coming from the archaeological occupations of the upper layers. Nor is the fauna gathered in this stratum disturbed by more recent fossils. Besides, from a stratigraphic viewpoint, layer C sup. is situated towards the middle of Member C, under layers of Early Upper Palaeolithic occupations. If the still somewhat hypothetical rapprochement between C sup. and C8 is confirmed during upcoming excavations, the ^{14}C dating to "over 42,000 B.P." (Lv-1838) obtained from bony splinters from layer C8 fauna also applies to the human premolar. Hence, to the extent that no observation indicates that a man of modern morphology might have appeared so early in north-western Europe in a Mousterian cultural milieu, it seems reasonable now to propose, certainly still as a testable hypothesis, attributing the recently discovered premolar to Neandertal man.

3.7. Other Neandertals?

Excavated on numerous occasions since the end of the 19th century, the 'Trou de l'Abîme' (the Abyss Hole) at Couvin (province of Namur), has yielded an original lithic industry corresponding to the transition between the Middle and Upper Palaeolithic techno-complexes, the "Couvin facies" [2.80; 2.112]. In 1984, on the occasion of a probe carried out on the terrace, the archaeological layer yielded the crown of a decidual lower right second molar. The fossil comes from the transitional zone between layers Ia and II, at around 2 meters below the present surface. The macrofauna and microfauna from the same layer testify to a temperate climate which has been related to the Cottés interstadial, around 35,000 years ago [2.18 : 72; 2.19 : 59–60]. On the contrary, the radiometric macrofauna dating suggests an older age: 46,820 ± 3,290 B.P. (Lv 1559).

The tooth's occlusal face is subrectangular and presents five principal cuspids whose order of decreasing size is: entoconid > hypoconid > metaconid > protoconid > hypoconulid. The vestibular face presents no tuberculum molare. The lingual face is smooth and without a Carabelli tubercule. The presence of a wear facet on the distal face implies that the eruption of M_1 was achieved, corresponding to a minimal age of 6 to 7 years if the schema of modern man is applicable to Palaeolithic children, whereas the maximal age is either 11 or 12 years, a period when the dm_2 is replaced by the P_4. The roots' destruction prevents our refining the range.

Taxonomic attribution of the Couvin tooth is delicate. If the ^{14}C dating proves to be correlated to the fossil, it would clearly be Neandertal inasmuch as no other taxon is known in western Europe 45,000 to 50,000 years ago. On the contrary, if the interpretation founded on the microfauna holds up, the attribution would be less clear, although, further south the Châtelperronian, another transitional industry between the Mousterian and the Upper Palaeolithic, has only yielded Neandertal remains, at Arcy-sur-Cure and Saint-Césaire.

Other poorly known fossils, a femur fragment and three metacarpals, were discovered in 1889 in the 'Rotches de D'Gennly' cave, at Montignies-le-Tilleul, in the Sambre valley [2.3]. Their probable association with a Mousterian industry [2.81] is not uninteresting but the absence of radiocarbon dating and detailed anthropological study prevents us from making further interpretations.

4. Analysis

4.1. The sites

Some forty Mousterian sites, fifteen of which are of primary importance, were found in the caves and rock shelters of the Mosan basin. Six of them, seven or maybe even eight, have yielded Neandertal remains, so one out of six or seven. Retaining only the important archaeological sites, this proportion climbs to a third.

In certain cases, the anthropological fossils come either from the terraces in front of the caves, or inside the cave, close to the cave entrance (Spy, Walou, Couvin). In others cases, they come from the caves themselves (Engis, Fonds de Forêt), sometimes in almost total darkness (La Naulette, Sclayn).

None of the numerous outdoor Mousterian sites of the Meuse and Haine basins as well as the plains of the Hesbaye and Flanders have so far yielded human bones, whereas the fossil fauna is sometimes conserved, among others at Mesvin IV, near Mons [2.13; 2.15] or at Veldwezelt-Hezerwater, in Limbourg (WFL Site) [2.11].

4.2. Archaeological material associated with human remains

The child from Sclayn comes from a stratigraphic unit (layer 4A) lacking any lithic vestige. The same goes for La Naulette fossils. Quina type Charentian is associated with the Neandertal bones of Spy and Fonds de Forêt and possibly Walou. The cranium of the 'Engis 2' child was apparently found in a typical Levallois Mousterian context, although its uncertain stratigraphic position leaves doubts. A transitional industry between Middle Palaeolithic and Early Upper Palaeolithic accompanies the Couvin tooth.

4.3. Modes of introduction of bones

Far too inaccurate methods used in many of the old excavations exclude any well developed hypothesis on the introduction of many of the fossil hominid bones into the sediments. This is the case at Engis, Fonds de Forêt and La Naulette.

From all appearances, the 'Spy 1' skeleton was the object of an intentional burial, even if the excavators deny it [2.53 : 768; 2.52 : 37]. In fact, the skeleton was "[...] lying on its side, its hand laid against its lower jaw" [2.54 : 662], an arrangement resembling what has since often been observed in Neandertal burials. Unfortunately, many lacunae remain due to the poor quality of the excavations, especially on the position of the lower members, on which hand was laid on the face, or, further, on the possibility of the grave being in a shallow pit or in another structure. Information relative to Spy 2 permits no sure deduction, although the hypothesis of a second burial cannot be excluded.

Fragments of the Sclayn child from layer 4A were scattered over nearly 6.5 meters, in a layer of rapid colluvial sedimentation [2.4]. At the present stage of research, it would be premature to explain their mode of introduction into the sediments, as for the Walou adult tooth. Concerning the Couvin deciduous tooth, it was probably lost on the spot due to the natural dental evolution.

The hypothesis of the introduction of human bones into the sediments by carnivores, occasionally forwarded, even recently [2.36], is baseless in the cases seen here.

4.4. Anthropology: representativity, age and sex

In most Walloon sites, like the whole area of Neandertal distribution, the osseous remains discovered represent only reduced parts of the skeleton: an incomplete skullcap at Engis, a femur fragment and a tooth from Fonds de Forêt, an isolated tooth at Walou, some teeth in Sclayn layer 3. The child from Sclayn layer 4A is hardly better represented: a mandible and a maxillary fragment.

If Dupont's stratigraphic observations are right, the four fragments conserved at La Naulette, coming from the head and upper member, may have belonged to the same person. The two principal Spy skeletons are the best represented, with elements of cranium, trunk, and upper and lower members. At Spy, some supernumerary human bones prove the existence of more than two individuals.

Taken together, the sampling of Mosan Neandertals is mostly composed of children and young adults. The Engis child died at around 4–6 years of age [2.77; 2.96]. The one from Sclayn was hardly over ten [2.101]. The Spy 3 child's age is harder to determine exactly. The Couvin deciduous tooth fell out during normal dental evolution.

The La Naulette mandible seems to be a young woman [2.99; 2.74]. The Spy 2 bones too, a partial skeleton, seem to be a young man (cranium with quite open sutures; epiphyseal lines on the right femur and left tibia). On the contrary, Spy 1 can be considered an adult female [2.93; 2.94] (35 years old, according to Twiesselmann) [2.105; 2.107]. The Fonds de Forêt femur and the Walou tooth also come from adults.

4.5. Pathology

The available Mosan Neandertals present hardly any clear pathological stigmas. Yet the left maxilla of the Spy 2 skull shows a little formation 2.5 by 3.5 mm, visible only by X-ray, in the left sinus basal wall. It is a minor anomaly resembling a dwarfed and deformed fourth molar; it could be an odontoma [2.108].

4.6. Anthropic traces on the bones?

Scratches found on the Engis 2 skullcap, principally on the frontal bone sagittal zone and around the fossil's broken edges, were interpreted as probable indications of scalping [2.88]. A more thorough re-examination has shown that these marks do not testify to the behaviour of prehistoric man but are modern in origin. They were made during one of the skullcap's restorations, successive casting of the fossil and taking craniogram profiles [2.113].

A long cutmark can be observed on the internal face of the Sclayn mandible body, especially by electron microscopic analyses. Yet many other marks observed on various Mosan Neandertal bones are probably of taphonomic origin.

4.7. Contribution of isotopic bio-geochemistry to reconstructing the Mosan Neandertal diet

Samples for studying the Mosan Neandertal diet by isotopic dosage of carbon and nitrogen were extracted from the child of Sclayn layer 4A, from the Engis 2 skull and one of the Spy scapulas. Collagen extractions were carried out through a variant on classical methods [2.6]. In order to verify the biochemical purity of these collagens, the carbon/nitrogen (C/N) ratio was

calculated. These ratios are all found in the variability of fresh collagen, indicating good preservation. Many bones of herbivores (horse, fallow deer, rhinoceros, bovine, mammoth), omnivores (cave bear, brown bear, fox) and carnivores (lion, hyena, wolf) from Sclayn, from both layers 1A and 1B, as well as layers 3 and 4A, have also been analysed in order to have a frame of faunal reference at our disposal for isotopically calibrating the Mosan basin ecosystem, in glacial, interglacial and interstadial contexts. The results of analyses of the Neandertal samples suggest protein sources isotopically quite similar to carnivores' [2.6; 2.7]. Isotopic composition of the Spy specimen approaches that of Marillac (Charente, France) with, apparently, in both cases, consumption of proteins from large herbivores. The Engis 2 child also consumed essentially the meat of herbivores, with perhaps also mother's milk, whereas the child of Sclayn layer 4A mainly consumed meat of herbivores living in open country, prairie rather than forest, despite the wooded landscape of the period [2.5].

4.8. DNA

Trial analyses of Mosan Neandertals' DNA have been attempted by M. Krings and S. Pääbo, based on a fragment from the mandible of Sclayn layer 4A, one of the Spy scapulas and the Engis 2 skullcap, using the technique which has already proved itself in studying eponymous skeletons [2.72; 2.73]. No result was obtained at Sclayn, where the DNA is not conserved well enough, while the other two samples are still being studied.

4.9. Chronology of Mosan Neandertals

4.9.1. Reinterpretation of older excavations

As we have seen, interpretation of old excavations is problematic. Stratigraphies are overly brief; there are no plans. The only palaeoenvironmental data concern the macrofauna, although too often (Engis, Spy and Fonds de Forêt) the mixing of layers and the difficulty of correlating stratigraphies of different excavators limit the utilization of lists available. Despite these problems, some information has nonetheless been obtained on the chronological position of Mosan Neandertal fossils discovered in the 19th century; this is based on palaeontological, archaeological, stratigraphic and anthropological criteria.

Re-examination of the regional Middle Palaeolithic sites' fauna has led Cordy [2.19 : 60] to hypothetically place the La Naulette mandible in a Mousterian "first wave", corresponding to the Eemien interglacial *lato sensu*. For their part, the Neandertals from Engis, Spy and Fonds de Forêt may belong to a "second wave", dating back to Hengelo-Les Cottés interstadial complex, between 40,000 and 35,000 B.P. [2.18 : 72; 2.19 : 60; 2.22 : 84]. According to Cordy [2.18; 2.19; 2.22], there would thus be a period without human occupation of Belgium of around 30,000 years, between 70,000 and 40,000 B.P., for climatic reasons; this absence would be comparable to the abandonment of northern Europe by the Solutreans and the first Magdalenians, between 20,000 and 15,000 B.P. Like Haesaerts [2.60] and Cahen [2.13], we think that this lacuna was shorter: it only affected the last ten millennia of the Lower Pleniglacial. In fact, some occupations are attributed to the beginning of the Weichselian (Franquenies, Harmignies) and to the beginning of the Middle Pleniglacial (l'Hermitage at Huccorgne). This unoccupied period corresponds to the first major climatic degradation of the Upper Pleistocene. A continual permafrost developed in north-western Europe at the time, followed by the deposit of a first allochtonous loessic cover. These rigourous conditions are certainly responsible for the migration of human populations southward.

Another indication related to the chronological position of the Neandertal fossils involves the nature of the industry associated with some of them (Spy and Fonds de Forêt): Quina type Charentian. In our regions, it seems to date from around 35,000 to 50,000 B.P. [2.14 : 38; 2.13 : 154; 2.60 : 35; 2.19 : 59]. Moreover, in the old excavations, the frequent telescoping of Mousterian and Early Upper Palaeolithic occupations has often been cited as an argument favouring a certain chronological nearness between the later Neandertals and Early Upper Palaeolithic men [2.110 : 163; 2.111]. So the fossils from Spy, Fonds de Forêt and Engis could be relatively recent.

Finally, the stratigraphic and anthropological criteria evoked in § 3.2 seem to indicate that La Naulette remains are very likely the oldest known in Belgium up to now.

4.9.2. Modern excavations

At Couvin, examination of the fauna associated with the tooth suggested to Cordy [2.18] a temperate period marking the end

of the Hengelo-Les Cottés complex, around 35,000–40,000 B.P. The characteristics of the associated industry, attributable to the Middle/Upper Palaeolithic transition period, accord with this interpretation, although ^{14}C dating indicates an older period (46,820 ± 3,290 B.P.; Lv 1559).

Information obtained at the two sites where Neandertal remains were discovered over the course of the last decade of the 20th century are more complete. The mandible of the child from Scladina layer 4A has been "directly" dated by gamma spectrometry to 127,000 +46,000/−32,000 B.P. [2.101 : 740]. The stalagmitic floor CC4, which caps layer 4A, has been the object of thermoluminescence dating at 117,200 ± 11,200 B.P. [2.25 : 41] and out of some twenty U/Th dates, two thirds of the results are between 90,000 and 120,000 B.P. [2.9 : 52–53]. The date by thermoluminescence of stalagmitic floor CC14, situated under the human bones, is 122,000 ± 11,700 B.P. [2.25 : 41]. Based on this, the Scladina child may be situated in the Saint-Germain 1C interglacial period, around a hundred thousand years ago. Palaeoenvironmental studies confirm, moreover, the temperate character of layer 4A, while proposing a slightly more recent chronostratigraphic interpretation [2.2].

As for the Walou tooth, if the equivalence between layers C sup. and C8 is confirmed (*cf.* § 3.6), it might also belong to the first part of the Middle Pleniglacial or even to the Lower Pleniglacial, given the date older than 42,000 B.P. obtained in C8 and the absence of interglacial indices for C sup.

4.9.3. Synthesis

By combining the elements mentioned above, the following chronology may be proposed (fig. 11). La Naulette might be the regional site to have yielded the oldest human remains, during or before the Eemian interglacial *lato sensu*. The child from layer 4A of the Scladina cave may go back to the 5c marine isotopic stage (Saint-Germain 1C). The other Neandertal remains, Spy, Engis, Fonds de Forêt and Walou, seem to be relatively recent, between 35,000 and 50,000 years, so in the first part of the Middle Pleniglacial. Finally, if its taxonomical attribution to Neandertals is confirmed, the Couvin deciduous tooth would mark one of the last phases of "non modern" occupation of the Walloon Mosan basin.

5. PERSPECTIVES

The future is promising for regional Neandertal palaeoanthropology in the field. Based on the first results obtained, ongoing excavations of Scladina and Walou caves should yield additional fossils. The resumption of research at La Naulette cave will at least supply useful information on the palaeoenvironment and on dating the bones discovered by Dupont in 1866 [2.102; 2.86]. Knowing that one important Middle Palaeolithic cave site out of three in the Meuse basin has yielded remains of Neandertal man, all hopes for new discoveries are also permissible for sites undergoing excavations, like Trou Al'Wesse and Goyet. The same goes for open-air sites to the extent that some of them conserve bones more or less correctly.

Results so far obtained in key sites with developed stratigraphies such as Scladina, Walou and Trou Al'Wesse [2.85; 2.83; 2.84] should further encourage the pursuit of palaeoenvironmental studies as well as systematization of stratigraphic and sedimentological studies. This approach will, at last, give reference sequences indispensable for developing a canvas of Belgian prehistory in the karstic context and hence better knowledge of the contexts in which these Neandertals evolved. Such a canvas is uniquely available now for the open-air sites [2.60; 2.61; 2.63]. In this connection, it is worth insisting on the necessity of multi-disciplinarity in this research work, beginning with the field phase. Too many specialists—palaeontologists, sedimentologists, anthropologists...—still end up intervening *a posteriori* in Mosan cave excavations and thus writing "annexed reports", whereas their intervention would have been precious from the first phases of excavation on. For example, it seems fundamentally important that the stratigraphy of sites be established in concert with archaeologists and geologists, since a good understanding of deposits' succession is dependent on the quality of observations of all the other disciplines, including prehistory and palaeoanthropology.

In the laboratory, AMS dates directly on Mosan Neandertal bone fragments have been attempted for the Spy and Engis fossils, with rather unsatisfactory results—because they are measured as too young, probably due to varnish applied in the 19th century. New attempts should be made using only the inner parts of the bones. Continuing the analyses related to diet, already undertaken at Sclayn, Engis and on

some Spy fragments, is equally fundamental for better understanding the variability of Neandertals' dietary behaviour. As to attempts at DNA study of the Sclayn child, they have proved negative, perhaps because the fossils are too old. New results are expected on the Engis child's skullcap and on one of the Spy scapulas.

Finally, precise description of the documents gathered in modern excavations at Sclayn, Walou and Couvin need to be completed, too, notably in the fields of taphonomic analysis, dental micro-wear or, further, their morphological and biometric comparison with other European Neandertal remains.

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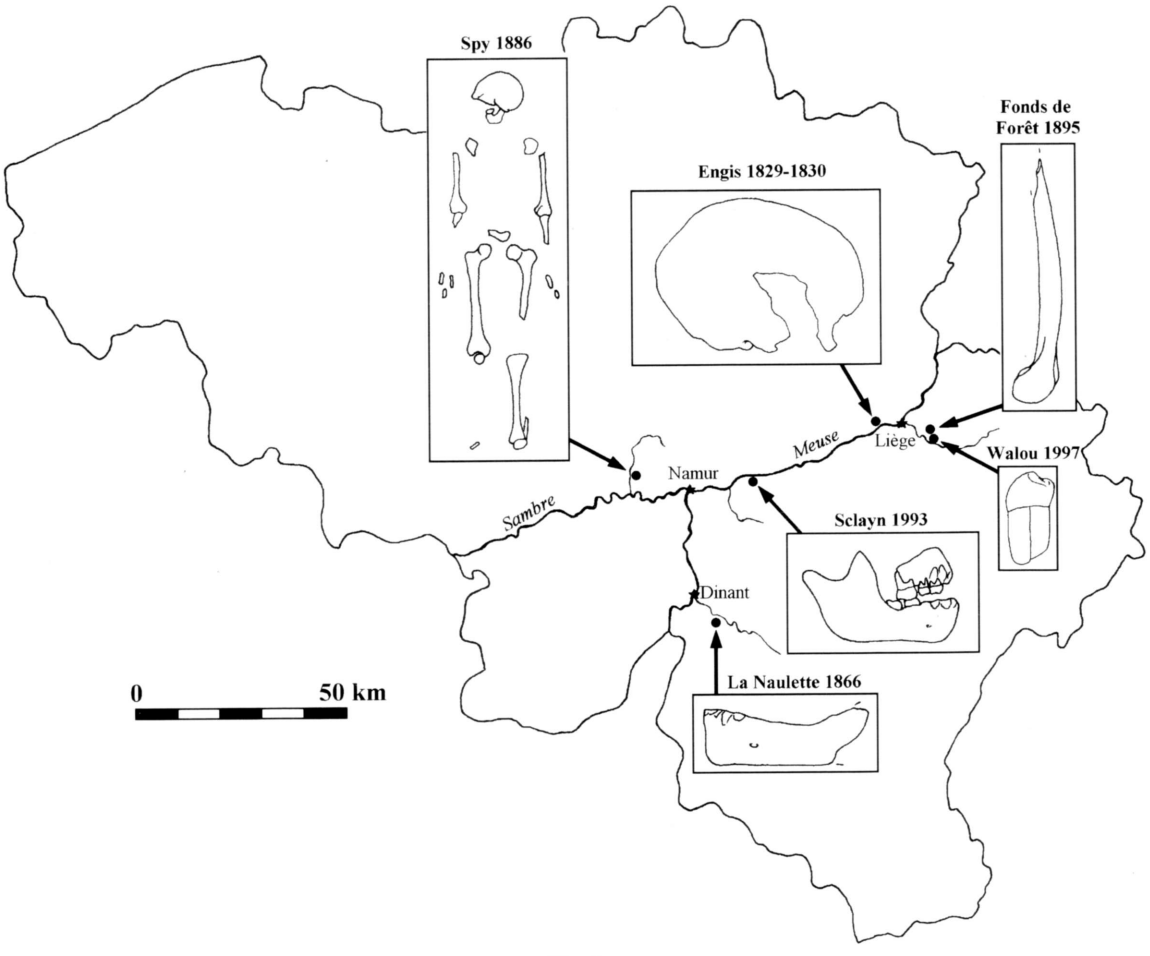

Fig. 1.
Incontestable Neandertal sites of the Meuse Valley
Sites de la vallée de la Meuse ayant livré des restes néandertaliens incontestables

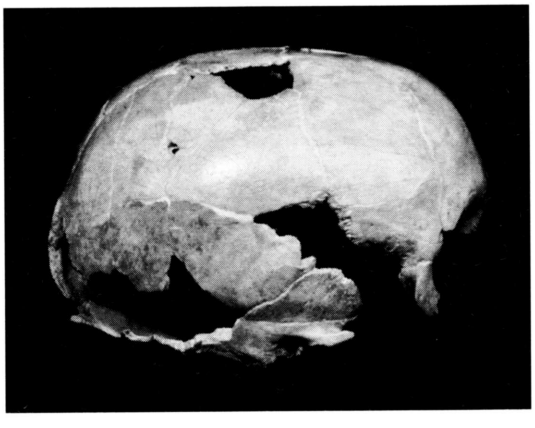

Fig. 2.
'Engis 2' Neandertal skullcap, found by Schmerling in the second cave during the winter of 1829–1830.
Calotte crânienne néandertalienne d'« Engis 2 », trouvée par Schmerling dans la seconde grotte au cours de l'hiver 1829–1830.

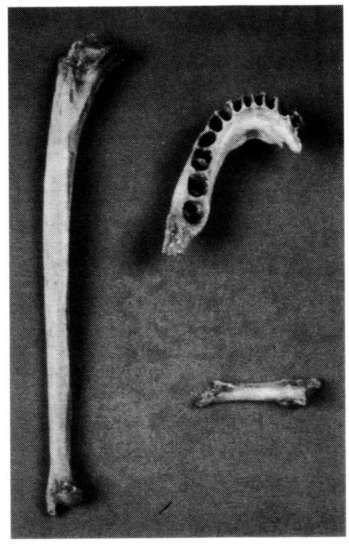

Fig. 3.
La Naulette: mandible, ulna and third metacarpal.
La Naulette : mandibule, cubitus et troisième métacarpien.

Fig. 4.
Spy: most representative Neandertal bones.
Spy : ossements néandertaliens les plus représentatifs.

EXCAVATORS ' STRATIGRAPHIC DESCRIPTIONS					PRESENT DAY POINT OF VIEW	
SCHMERLING	DUPONT		DESTEXHE-JAMOTTE		ARCHAEOLOGY	ANTHR.
"Osseous breccia"	1	Silt and "osseous breccia"			History	
Generally very dry earth with, from bottom to top, bones and rounded or angular stones. 2.5 m thick. **SKULLCAPS (ENGIS 1 & 2)**	2	**First "ossiferous level"** Angular or little rounded stones and yellowish earth, both of them bound by clacareous infiltrations. Pottery fragments and knapped flints. **HUMAN ULNA** Fauna : Ursus spelaeus, Rhinoceros, Sus scrofa, Equus caballus, Cervus tarandus, Cervus elaphus, Bos primigenius. "Mammoth Age"	A	Very compact "osseous breccia" with Upper Paleolithic (flints) and Neolithic (pottery fragments). 5 to 25 cm thick. Fauna : horse, ox, reindeer, bat, shrew.	Neolithic Mesolithic ? Late Upper Paleo. ? Gravettian	Engis 1*
			?	?		
			B	Little or not stratified brown clayey layer with rounded stones and large amount of limestone fragments; at places over 1m thick. Mousterian **HUMAN SKULL FRAGMENT** Fauna : mammoth, rhinoceros, boar, horse, reindeer, deer, badger, polecat, wolf, bear, beaver, etc.	Typical Mousterian of Levallois facies	Engis 2
	3	Traces of a more clayey sheet				
	4	**"Second ossiferous level"**. No knapped flint. Fauna : rhino. tooth, gnawed bones (hyena lair). "Mammoth Age"	C	Yellow sandy silt (max. 20cm). Dupont : bones gnawed by hyena.		
More or less compact clayey earth	5	Clayey sand	D	Yellow sand sheets with clay pockets (max. 30cm).		
Bedrock	Bedrock		E	Bedrock		

* According to Schmerling, 'Engis 1' was found at a depth of 1.5 m [see text], but the ^{14}C date [§ 3.1] suggests a Neolithic grave dug in older layers.
* *Selon Schmerling, « Engis 1 » a été trouvé à une profondeur de 1,5 m [voir texte], mais une date ^{14}C [§ 3.1] suggère qu'il s'agit d'une sépulture néolithique, creusée dans des niveaux plus anciens.*

Fig. 5.

Schmerling cave (Engis): correlation between the stratigraphic descriptions of Schmerling [2.90 : 31–32], Dupont [2.46 : 506–507; 2.47 : 132] and Destexhe-Jamotte [2.30 : 115–117] compared with the present day point of view of the archaeological [according to 2.30; 2.110; 2.80] and anthropological material's position.

Grotte Schmerling (Engis) : corrélation entre les descriptions stratigraphiques de Schmerling [2.90 : 31–32], Dupont [2.46 : 506–507; 2.47 : 132] et Destexhe-Jamotte [2.30 : 115–117] confrontées au point de vue actuel sur la position du matériel archéologique [selon 2.30; 2.110; 2.80] et anthropologique.

OLD EXCAVATIONS						PRESENT DAY POINT OF VIEW	
1886 EXCAVATORS ' STRATIGRAPHY				FAUNA	INDUSTRY	ARCHAEOLOGY	ANTHROPO.
A	Brown clay sometimes mixed with very large limestone blocks (scree).	25cm to 3m		*No mentionned fauna*		History Neolithic Mesolithic	Neolithic ?
B	Very clacareous yellow clay locally changing into tufa (breccia) and containing angular limestone blocks. Ossiferous level in the upper part	80cm to 1m	1st OSSIFEROUS LEVEL	Mammoth, woolly rhinoceros, reindeer, deer, cave bear, cave hyena, hare, wolf, fox.	Knapped flints (1)	Creswellian/Magdalenian Gravettian	
C	Almost totally red-coloured area, formed by a tufa (breccia) containing numerous mammoth ivory fragments, charcoal, knapped flints and limestone fragments.	5 to 30cm	2nd OSSIFEROUS LEVEL	Mammoth, woolly rhinoceros, reindeer, deer, megacerin deer, aurochs, bison, horse, cave bear, cave hyena, roe-deer, cave lion, fox, boar.	Knapped flints (2)	Aurignacian Foliate points industry Late Mousterian	
D	Yellow clay with limestone blocks, locally changing into a tufa similar to B (breccia). There was a thin charcoal bed at the bottom.	15cm	3rd OSSIFEROUS LEVEL	Mammoth, woolly rhinoceros, reindeer, deer, megacerin deer, aurochs, horse, cave bear, cave hyena, cave lion, wolf, glutton, badger.	Knapped flints (3)	Charentian	
E	Human bones	?			Knapped flints (4)		SPY NEAND.
F	Very dark brown clay, locally blackish, with small limestone elements.	?			Knapped flints (5)	? ? Moust. of Acheulean tradition	

Fig. 6.

Spy: stratigraphy recorded by geologist Lohest in 1886 [2.54; 2.29]; fauna list for each "ossiferous level" (compiled in 2.14, based upon all the excavations); position of knapped flints according to 1886 excavators; present day point of view concerning archaeology [2.110; 2.80; 2.33] and anthropology.

Spy : stratigraphie relevée par le géologue Lohest en 1886 [2.54 ; 2.29] ; liste faunique de chaque « niveau ossifère » (compilation dans 2.14, basée sur l'ensemble des fouilles) ; position des silex taillés selon les fouilleurs de 1886 ; point de vue actuel sur l'archéologie [2.110 ; 2.80 ; 2.33] et l'anthropologie.

(Knapped flints' position is mentioned in / *La position des silex taillés est mentionnée dans*: **1.** [2.53 : 768; 2.54 : 664; 2.29 : 209-213]; **2.** [2.53 : 768; 2.54 : 664; 2.29 : 213-219; 2.52 : 37]; **3.** [2.52 : 37]; **4.** [2.54 : 663]; **5.** [2.52 : 37; 2.53 : 769; 2.54 : 663]).

Fig. 7. (right/*à droite*)

Scladina cave: lithostratigraphy [2.8; 2.59; 2.4; 2.62]; archaeological occupations ("archaeo."; [2.8]; the rare Upper Palaeolithic artifacts are not mentioned because of doubts about their exact position [2.82]) and human fossils position ("anthropo."); synthesis of palaeoenvironmental studies (Sed = Sedimentology [2.62]; Pal = Palynology [2.1; 2.24]; µf = Microfauna [2.21; 2.24]; Mf = Macrofauna [2.91; 2.24]; CD = cold dry; CH = cold humid; CVH = cold very humid; MH = medium humid; RA = rigourous arid; T = temperate; TC = temperate cold; TCH = temperate cold and humid; TD = temperate dry; VC = very cold); dates (for dates and the sigma, see 2.9 and 2.25); chronostratigraphical context [2.9.].

Grotte Scladina : lithostratigraphie [2.8 ; 2.59 ; 2.4 ; 2.62] ; occupations archéologiques (« archaeo. » ; [2.8] ; les rares artefacts paléolithiques supérieurs ne sont pas mentionnés à cause des doutes concernant leur position exacte [2.82]) et position des fossiles humains (« anthropo. ») ; synthèse des études paléoenvironnementales (Sed = Sédimentologie [2.62] ; Pal = Palynologie [2.1 ; 2.24] ; µf = Microfaune [2.21 ; 2.24] ; Mf = Macrofaune [2.91 ; 2.24] ; CD = froid sec ; CH = froid humide ; CVH = froid très humide ; MH = moyennement humide ; RA = rigoureux et aride ; T = tempéré ; TC = tempéré froid ; TCH = tempéré froid et humide ; TD = tempéré sec ; VC = très froid) ; dates (pour les dates et l'écart-type, voir 2.9 et 2.25) ; contexte chronostratigraphique [2.9].

LITHOSTRATIGRAPHY		ARCHAEO. ANTHROP.	PALAEOENVIRONMENT				DATE BP cal. (ky)	CHRONO-STRATI.		
			Sed	Pal	µf	Mf				
C1	Stalagmitic floor	Neolithic burial ?	-	-	-	-	0,68 to 7,05 (^{14}C)	MIS 1	HOLOCENE	
36	Set of silty beds, locally very disturbed by burrows and separated from each other by stalagmitic floors.		-	-	-	-	*No data*			
37	Dark brown silt containing lots of cryoclastic deposits.		-	-	-	-		MIS 2 ? ?		
38	Silt lighter in colour than in layer 37. Lower cryoclastic deposit content.		-	-	-	TC		MIS 3	Middle pleniglacial	WEISCHSELIAN
39	Stony deposit composed of small limestone elements in a grey-brown Matrix. Some coarser elements at the bottom.		-	*NAP 90%*	-	TC				
40	Thin yellow silt layer with some limestone elements and containing two superposed thin lenses of grumous calcite.		CD							
1A	Stony deposit composed of small limestone elements with large blocks at the bottom.	Mousterian	CH	Pleniglacial	CH	TCH	± 36 to 45 (U/Th, ^{14}C and TL)			
1B	Yellowish silt with low coarse element content. Numerous reworked rounded Stones. The bottom is reddish leading outside the cave to a collapse, receiding porch.		CD	Interstadial	Interst.	TC	*No data*			
				Interstadial	RA	-				
2A	Stony deposit composed of rather fine limestone elements in a greyish to brownish silty matrix. Presence of small quartz pebbles.		-	Worsening climate	Interst. ?	CD		MIS 4	Lower pleniglacial	
2B	Stony deposit composed of small limestone elements in a dark brown silty matrix rich in organic matter and iron (Small soil on top of layer 3).		TC	Worsening climate	CA ?	CD				
3	Stony deposit composed of small limestone elements in an homogeneous yellowish silty matrix. At the bottom are a few large blocks, more numerous near the cave entrance.	**Neandertalian bones ?**	CH	T *(forest)*	MH	TC	59 to 106 (U/Th)	MIS 5a	St Germ. 2	EEMIAN
				-						
CC4	Stalagmitic floor. Towards the cave entrance, the top of layer 4 is weathered (pedogenesis).		-	Interglacial	-	-	90 to 120*(U/Th) 117 (TL)	MIS 5c	St Germain 1C	
4A	Homogeneous ocherish yellow silt ; numerous stalagmite and platy limestone fragments. Few larger blocks. In the second cave room, intermittent calcitic floor inside the layer, supporting a few large stalagmites (CC14).	**Neandertalian bones**	TCH	Interglacial	TD	T	99 to 104 (TL) 127 (spectro γ) 144 (U/Th) CC14 : 75 (U/Th) and 132,5 to 112,8 (TL)			
CC14										
4A										
4B	Very thin bedded pure yellowish silt with black spots, containing rare small limestone elements.		?	*NAP 90%*	RA	VC	*No data*		St Germain 1B (Montaigu)	
5	Dense stony deposit of small angular limestone blocks ; greyish grumous loose matrix. Outside the cave, changing into a Coarse block deposit (porch collapse).	Mousterian	?	*Strong ↓ AP*	RA	TC	130± 20 (TL)			
				Low ↓ AP	TD					
6	Yellowish silt with weak coarse fraction (limestone rather altered, mixed with a few small terrace pebbles).		?	Climatic optimum	TD	T	*No data*		St Germ. 1A	
7A	Stony deposit composed of angular limestone elements with a grey-brown grumous silty matrix. At the bottom, large limestone blocks.		?	*↑ AP*	CH	marked cooling		MIS 5d	Melissey 1	
				marked cooling	CVH					
7B	Stony deposit composed of pebbles (especially quartz and quartzite) and rounded limestone elements. Brown yellow clayey silt matrix with many black spots.		-	-	-	-				
Bedrock										

* ⅔ of the dates range between 90 and 120 ka, but the extremes are 21.7 and 157 ka.

* *⅔ des dates se situent entre 90 et 120 ka, mais les extrêmes sont 21,7 et 157 ka.*

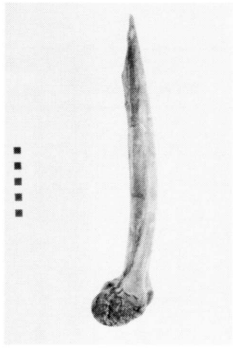

Fig. 8.
Fonds de Forêt: the Neandertal femur.
Fonds de Forêt : le fémur néandertalien.

Fig. 9.
Scladina cave: Neandertal child mandible and maxillary from layer 4A.
Grotte Scladina : mandibule et maxillaire d'enfant néandertalien, trouvés dans le niveau 4A.

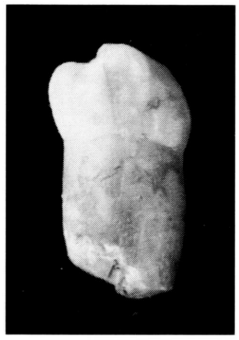

Fig. 10.
Walou cave: premolar from layer C sup.
Grotte Walou : prémolaire du niveau C supérieur.

CHRONO-STRATIGRAPHY		AGE (ky)	MIS	ARCHAEOLOGY			PALAEOANTHROPOLOGY	
					OUTDOOR	KARST	BELGIAN FOSSILS	REFERENCE FOSSILS
				UPPER PALAEOLITHIC			MODERN MAN	
WEICHSELIAN	Middle pleniglacial	25-50	3	MIDDLE PALAEOLITHIC	Mais Huc	Egh 3 / Eng / FdF / Taw Scla 1A / Spy b / TdD / Wal	**Couvin** **Engis / Fonds de Forêt** **Spy / Walou**	Saint Césaire Chapelle-aux-S[ts] / Ferrassie
	Lower pleniglacial	50-75	4		*ABSENCE OF HUMAN OCCUPATION IN BELGIUM*			Amud Shanidar / Kebara
					Har / Fra	-		
EEMIAN lato sensu	St Germain II	75-85	5a		Roc Rem Hel / Har Hez Oma / Cly	Che Egh 1-2 Erm / San Scla 5 Spy a		
	Melissey II	85-95	5b					Krapina / Bañolas
	St Germain I	95-105	5c				**Sclayn 4A**	Cova Negra
	Melissey I	105-115	5d					
	Eemian s.s.	115-128	5e				? **La Naulette** ?	Font / Ehring / Sacc / Tabun La Chaise Petralona Atapuerca SLH / Steinheim Montmaurin
SAALIAN and older		128-190	6		Ris / Hez Hel Mes PS Pdl			
		190-240	7					
		240-290	8					
		290-330	9	?				
		330-380	10	?				
		380-450	11					Azych Tautavel
		450-480	12					

Fig. 11.
Attempt at chronostratigraphical positioning of the Belgian Neandertals ("Belgian fossils"). Comparison with the main Belgian Middle Palaeolithic sites ("Archaeology") and with the main non-Belgian Neandertal fossils ("Reference fossils") [vertical arrows define the supposed chronological interval of the mentioned fossils or sites].
Essai de classification chronostratigraphique des Néandertaliens de Belgique (« Belgian fossils »). Comparaison avec les principaux gisements du Paléolithique moyen belge (« Archaeology ») et les principaux fossiles néandertaliens non-belges (« Reference fossils ») [les flèches verticales indiquent l'espace chronologique supposé des fossiles ou des sites mentionnés).

Archaeology/*Archéologie* [2.8; 2.11; 2.13; 2.18; 2.19; 2.60; 2.83]; **outdoor/*sites de plein air***: Cly = Clypot; Fra = Franquenies; Har = Harmignies; Hel = carrière Hélin; Hez = Hezerwater; Huc = Huccorgne; Mais = Maisière; Mes = Mesvin; Oma = sablière Kinart (Omal); Pdl = Pa d'la l'iau; PS = Petit-Spiennes; Rem = Remicourt; Ris = Rissori; Roc = Rocourt; **karst (caves and rock-shelters)/*grottes et abris naturels***: Che = Trou du Chena; Egh = Engihoul; Eng = Engis; Erm = Grotte de l'Ermitage; FdF = Fonds de Forêt; San = Abri Sandron; Scla = Sclayn; Spy a = MTA, Spy b = Charentien; Taw = Trou Al'Wesse; TdD = Trou du Diable; Wal = grotte Walou. **Palaeoanthropology – Reference fossils/*Paléoanthropologie – fossiles de référence*** [2.58]: Font = Fontéchevade; Ehring = Ehringsdorf; Sacc = Saccopastore; Atapuerca SLH = Sima de los Huesos.