


Mesolithic Miscellany

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CONTENTS

Editorial	2
<i>Nicky Milner</i>	
Maritime hunter-gatherers of the Atlantic Mesolithic: current archaeological excavations in the shell levels of Beg-er-Vil (Quiberon, Morbihan, France)	3
<i>Grégor Marchand and Catherine Dupont</i>	
Radiocarbon dating of Mesolithic human remains in Belgium and Luxembourg	10
<i>Christopher Meiklejohn, Rebecca Miller and Michel Toussaint</i>	
Redating a Mesolithic skeleton from Cabeço da Arruda, Muge, Portugal	40
<i>M.K. Jackes and D. Lubell and M.J. Cunha</i>	
Between appearance and reality: the excavation of Bergumermeer S-64B (Province of Friesland) as a milestone of Stone Age research in the Netherlands	45
<i>Marcel J.L.Th. Niekus</i>	
William Galloway and the Caisteal nan Gillean shell midden on Oronsay, western Scotland	56
<i>Alan Saville</i>	
A response to Meiklejohn and Woodman, 'Radiocarbon dating of Mesolithic human remains in Ireland'	70
<i>Alison Sheridan</i>	
International conference: "Mesolithic Burials – Rites, symbols and social organisation of early postglacial communities"	73
<i>Judith M. Grünberg</i>	
UISPP Commission for the Final Palaeolithic of Northern Eurasia	74
<i>Berit V. Eriksen and Susan K. Harris</i>	
Book news	76

Radiocarbon dating of Mesolithic human remains in Belgium and Luxembourg

Christopher Meiklejohn

University of Winnipeg, Winnipeg, MB Canada, R3B 2E9

c.meiklejohn@uwinnipeg.ca

Rebecca Miller

Université de Liège, BE-4000 Liège, Belgium

rmiller@ulg.ac.be

Michel Toussaint

Direction de l'Archéologie, Service public de Wallonie, BE-5100 Namur, Belgium

mtoussaint1866@hotmail.com

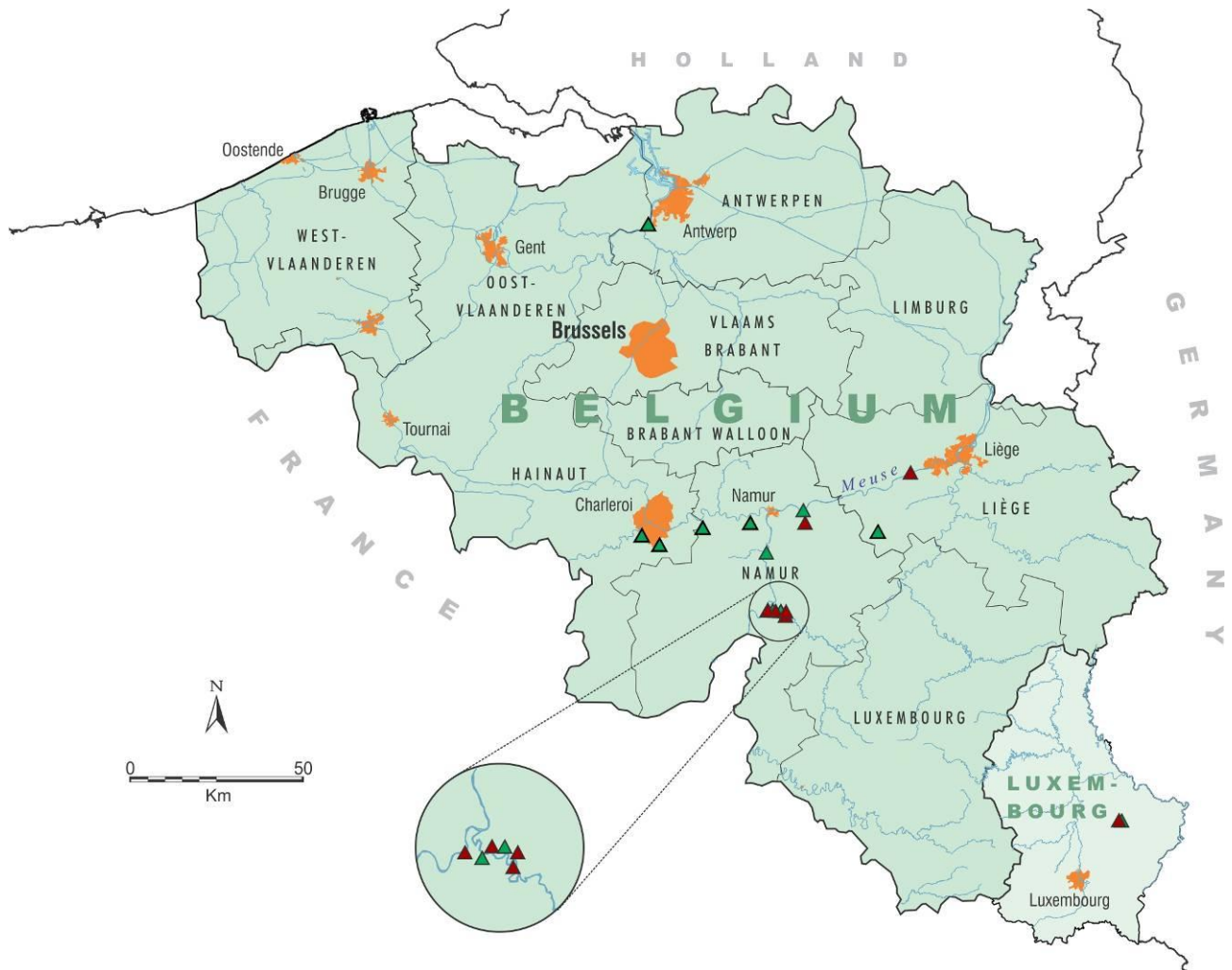


Figure 1: map of Belgium and Luxembourg

Introduction

This, the sixth of a series on the chronology of Mesolithic human remains, uses, with one exception, identical methods to the previous paper in the series (Meiklejohn and Woodman 2012). Date calibration employs CALIB version 6.1 with dates reported at a 1σ range. The exception to previous use is that no marine correction is applied to any finds, based on two considerations. Critical is that “(a) dietary protein source based mainly on terrestrial mammals, with the possible addition of some freshwater components, is ... supported by the isotopic composition of ... Mesolithic human collagen from (Belgium and Luxembourg), with few differences occurring between individuals” (Bocherens *et al.* 2007, 18). The second is that ^{13}C levels range from -19.4 to -24.8, in clear support of this conclusion. The one exception, Atsebach in Luxembourg ($^{13}\text{C} = -17.3$), is dated to the Neolithic (see section 2.3). Absence of a marine dietary component is also consistent with the distance of all sites from an ocean source, though Van Neer (1997; Van Neer *et al.* 2007) reports evidence for fishing in Magdalenian deposits from the Meuse Basin at Bois Laiterie and Chaleux, both discussed below. As previously, we stress the importance of reporting raw ^{14}C laboratory values. Calibrations are a function of calibration engine, reservoir correction value, and marine and terrestrial isotopic limits used. Calibrated dates published alone are very difficult to interpret.

For the first time in this series no sites discussed were noted *within a Mesolithic context* by Oakley *et al.* (1971; see Twiesselmann 1971a, 1971b). Newell *et al.* (1979) discussed no Belgian sites, though one Luxembourg find was seen as demonstrably Mesolithic, a second as “date not clear” (both discussed below). Twiesselmann (1971a) listed eight sites excavated in the nineteenth century, all as Upper or Middle Palaeolithic except one “not of great antiquity” (*ibid.*, 9). Direct dates are now available for six, one (Chaleux) of Mesolithic age (section 1.1), five Neolithic or later (section 2.1), stressing the need to re-evaluate find provenance when discussing burial chronology or using data from early sources. For Luxembourg Twiesselmann (1971b) lists one site, Oetrange (not discussed here), considered then as now as Upper Palaeolithic.

A brief introduction to the Mesolithic in these two countries is required, if only to clarify the earlier observation that, in 1979 (Newell *et al.* 1979), only one site was discussed with demonstrably Mesolithic human remains (Loschbour). Some thirty years later this number has risen to 13. What lies behind the change?

The answer is clearest for Belgium. Firstly, until very recently, sites with Mesolithic remains were geographically limited to the extended valley system of the Meuse in the provinces of Liège, Hainaut and Namur. Prior to 2011 no human remains were known from western (“Sandy Flanders”) and northern Belgium (“Campine”), with the earliest recovered human remains of Late Neolithic (Bell Beaker) age (Philippe Crombé, *pers. comm.*). As implied this situation has recently changed. Secondly, the presence of Mesolithic human remains was long hidden by the presumption that recovered material was either earlier or later in age (though see section 2.1). The material that *apparently* predated the Mesolithic was largely discovered or worked by two individuals, Philippe-Charles Schmerling (1790-1836) and Édouard Dupont (1841-1911). Of less interest is Schmerling as the key remains attributed to him, from Engis, are Neanderthal (though see section 2.1). Dupont, on the other hand, excavated at seven and the idea that there are Upper Palaeolithic burial caves in the Meuse Valley (broadly defined) is largely based on his work, though direct dating shows that most are later intrusions. For a current understanding of the late Upper Palaeolithic Meuse Valley see Miller and Noiret (2009).

The presence of Neolithic cave burials was also noted in the nineteenth century. A large number are known; many now directly dated. In a European Neolithic context this skeletal series stands out for its quality of chronological control. Bocherens *et al.* (2007) indicate that over 200 have been excavated, while Toussaint (2007) lists 94 radiocarbon dates (see also Toussaint 2002a, Toussaint and Ramon 1997) (over 20 further dates, still unpublished, are now in hand).

Within this context the initial reaction to sites now identified as having at least some Mesolithic human remains assumed them to be either older or younger, most obviously Magrite (see section 1.1). Magrite, excavated from 1864 to at least 1867, had human remains described as Aurignacian by Dupont (1867a), a conclusion apparently accepted by Twiesselmann (1971a, 10) though stating that “(a)dmixture of pottery throws doubt on the context ...”.

The presence of Mesolithic burials in the Meuse valley was only proven in 1984 (Cauwe and Toussaint 1993). Toussaint and Ramon (1997, 160; free translation) indicate that “(i)n 1984, dating of human bones in the diachron of Loverval D5 ... showed that the graves in the karst area (of Belgium) were not only from the Late Neolithic but also went back to the Mesolithic, as previously suspected though without real evidence”. A sense of this suspicion is as follows; in 1968 one of us (CM) was shown material from Malonne by François Twiesselmann, within the context that it might be Mesolithic. However, a decade later there was insufficient information for Newell *et al.* (1979) to write an entry.

Most of our current knowledge of Mesolithic burials in the Meuse basin comes from three individuals or groups, sometimes in collaboration. In 1983 Georges Dubuis, an amateur archaeologist, excavated a small cave at Loverval, south of Charleroi in the province of Hainaut, and found human bones. He asked one of us (MT) to study this material and in this context 14C dates were obtained on human bones, one from Louvain-la-Neuve (Lv), the other at Gif-sur-Yvette (Gif). Both proved to be Early Mesolithic (see section 1.2).

Within the next few years Nicolas Cauwe excavated Grotte Margaux (1988) and Abri des Autours (1992-1993) providing a clear sense of Mesolithic burial practice in the region (Cauwe 1998, 2001). Parallel to this were cooperative Belgian/American excavations by Marcel Otte and Lawrence Guy Straus at Bois Laiterie, Trou Magrite and Abri du Pape from 1990 to 1995 (Otte and Straus 1995, 1997; Léotard *et al.* 1999a). Finally, beginning in 1984, much work on the skeletal material from Mesolithic sites in the Meuse Basin was by Michel Toussaint (2002a, 2010) and Caroline Polet (Polet and Cauwe 2002, 2007). These papers, and others deriving from them, are central to the understanding below. Finally, a very brief comment is necessary on the newest skeletal find reported here, from Bazel-Sluis in northwest Belgian “Sandy Flanders” (see section 1.2). Though minimal information is yet available this probable loose bone find expands our geographical coverage.

One other situation requires comment, related here to material from two sites, Trou Al’Wesse (section 1.1) and Bazel-Sluis (section 1.2), but of considerably broader interest in Belgian archaeology, the question of a late ceramic Mesolithic. One of these is La Hoguette, identified in Normandy in the 1980s (Jeunesse 1987). At Trou Al’Wesse several sherds have been found in an apparent Mesolithic context, although the hypothesis of a pre-LBK Neolithic occupation with La Hoguette pottery cannot yet be excluded (the human mandible is not in the same stratum, see below). This ceramic style parallels the earliest LBK (Linear Ceramic), associated with early farming in the Central European Plain. Whether it predates LBK is debated. Stylistically distinct, La Hoguette ceramics are often found on LBK sites though the distribution is generally west of the earliest LBK zone and west and southwest of the classic LBK area (see e.g. Bogucki 1999; Crombé 2009). Associated lithics are often seen as Mesolithic in type and an extended and ongoing debate concerns both the origin and relationships of the style. Crombé (*ibid*) argues that the current consensus is that late Mesolithic groups are manufacturing the pottery. However, whether they are fully independent of the LBK is less easy to discern (see also Amkreutz *et al.* 2010; Constantin *et al.* 2010).

The second ceramic tradition is Swifterbant, associated with sites first discovered on the floor of the reclaimed Swifterbant Polder in the Netherlands in the 1960s (de Roever 2004; Raemaekers and de Roever 2010). It is known from sites distributed from the valley of the Scheldt in northern Belgium easterly to the valley of the Elbe in Germany. The date obtained from the recently discovered human bone at the site of Bazel-Sluis does not exclude a link with this tradition though the link is not yet fully established (Crombé, *pers. comm.*). Originally published as associated with the earliest Neolithic population in the Netherlands, there is now an understanding that, culturally, Swifterbant is associated with populations that are, at the beginning, late Mesolithic foragers, while later transforming into early Neolithic food producers. As outlined by Peeters (2010, 151), “phases 1 and 2 belong to the Mesolithic, ... phases 3 and 4 to the Early Neolithic.” Though with possible roots in the LBK and/or Rössen it is not found on LBK/Rössen sites and has long been seen as having stylistic parallels to the late Mesolithic Ertebølle ceramic tradition in Denmark and northern Germany (de Roever 1979).

The situation in Luxembourg is far less complex with only two sites under discussion, within a kilometre of each other in the same valley and discovered within a two-year period by the same archaeologist. The Mesolithic nature of one has been clear since 1950, the other now excluded by direct dating. No other specific issues need to be raised here.

Finally, for distribution of the sites discussed in this paper and their time of initial discovery see table 1. In this paper we have divided the table into four groups, two for Belgium and two for Luxembourg. For each country there is division into sites discussed with human material shown to be Mesolithic, and for those sites where the material is shown not to be Mesolithic. This table differs from those in previous papers in this series in adding the second category (in all previous papers the two were considered together). As previously, the table shows site discovery by time period, with colour indicating the period of maximum discovery. For Belgian sites with remains dated to the Mesolithic there is a bimodal pattern, with sites discovered either prior to 1900 or after 1960. Of Belgian sites discussed below where remains are shown to be not Mesolithic, all but one was discovered prior to 1900. In Luxembourg the two sites discussed were both discovered between 1900 and 1960, with one shown to be Mesolithic, the other not Mesolithic. Of the total number of sites, 40 percent (8/20) were discovered before 1900, 50 percent (10/20) since 1960 (only one since 1995). We would finally stress that the non-Mesolithic sites reported here are a tiny fraction of sites with human remains available. The current list of sites with Neolithic or later remains in Belgium and Luxembourg exceeds 150.

Region	1829-1899	1900-1959	1960-1979	1980-1999	2000-2012
BELGIUM - MESOLITHIC	3	0	1	7	1
BELGIUM - NOT MESOLITHIC	5	0	0	1	0
LUXEMBOURG - MESOLITHIC	0	1	0	0	0
LUXEMBOURG - NOT MESOLITHIC	0	1	0	0	0
TOTAL	8	2	1	8	1

Table 1: Distribution of sites by region and time of first excavation

The Sites

For historical reasons (see above) the division below differs slightly from earlier papers. The primary division of the paper is chronological with two sections, 1) sites with material directly dated to the Mesolithic, and 2) those shown to be Neolithic or later. For the first time in this series there are no sites with material indirectly dated to the Mesolithic or of unclear age. Within each of the chronological sections there are three historic/geographic divisions: 1) Belgian sites discovered in the nineteenth century, 2) Belgian sites discovered since 1960, and 3) sites in Luxembourg. In Figure 1, sites shown to be Mesolithic are in green, those younger than Mesolithic in red. Before proceeding some topographic comments are in order.

Belgium is divided into Low, Middle and High regions, with all but one of the sites discussed here within the last. Low Belgium, a generally flat lowland, includes the lands along the North Sea coast and northern border with the Netherlands. The major river system, the Scheldt, rises to the southwest in France (where it is called l'Escaut), flowing northeast until it empties into its large estuary north of Antwerp. As discussed below, the newly discovered site of Bazel-Sluis lies in the lower Scheldt valley just south of Antwerp. To the south is the central plateau of Middle Belgium, including the low plateaus of Hesbaye, Brabant and Hainaut. Finally, High Belgium lies south of the northeast/southwest line of the valleys of the River Meuse and its tributary, the Sambre, which joins from the west at Namur. This last area, sometimes referred as the Ardennes, corresponds to the Belgian Mosan basin, a term used by some sources cited here. It includes three roughly southwest/northeast sub-regions, each with a different geological substrate, from north to south Condroz, Fagne-Famenne, and Ardenne (without "s") with Belgian Lorraine in the extreme southeast. The Ardenne is a higher wooded plateau with altitudes over 400 metres and a peak at ~700 metres. The Meuse Valley and its steep-walled tributaries cut through the Condroz and Fagne-Famenne and it is in these valleys that the cave sites that contain almost all the archaeological sites listed here are located. This is also the middle section of the Meuse river system. To the south the upper section rises in the French Département of Haute-Marne, flowing north-north-west to the French-Belgian border where it already lies in the French sector of the Ardenne. After passing into Belgium it runs north to Namur, a distance of ~40 km, before turning east-northeast towards Liège. North of Liège the lower section flows north into south-eastern Holland before heading west, in parallel with the Rhine, to a joint estuary south of Rotterdam.

Luxembourg lies to the immediate southeast of Belgium, with the northern third an eastern extension of the Ardenne Plateau. Both sites discussed are south of this in the area known as the Gutland. The Ernz-Noire, the river on which both sites lie, is within this zone and flows north into the Sûre, itself a tributary of the Moselle

separating Luxembourg from Germany. The Ernz-Noire valley lies in the limestone zone known as the Grès du Luxembourg (Le Brun-Ricalens and Vallotteau 2005) an area with a strong archaeological presence.

1. Sites with directly dated Mesolithic human remains

This section is divided into three groups as defined above. Within each the sites are listed in alphabetical order. As in previous articles the latitude and longitude locations are provided in metric terms rather than the classical degrees, minutes and seconds.

1.1 Belgian sites discovered in the Nineteenth Century

This section discusses three sites discovered and excavated by Édouard Dupont in the mid to late 1860s, two in the valley of the Lesse, a tributary entering the Meuse at Anseremme, ~3 km south of Dinant. These are among the 27 sites discovered by Dupont (1872) in the Lesse Valley. The third site, Trou Al'Wesse, is ~35 km to the northeast. Of interest is that the direct dates obtained from all three sites are later than those discussed in section 1.2.



Figure 2: excavations on the terrace Trou Al'Wesse (copyright Rebecca Miller)

Al'Wesse (Trou Al'Wesse), Liège (Province)

- **Nature and location of site:** Cave site and terrace on the right bank of the Hoyoux, a minor tributary of the Meuse, in the municipality of and ~2 km south of the village of Modave and ~10 km south-southeast of Huy on the Meuse; 50.43 N, 5.29 E, Figure 2.
- **First excavated:** By Édouard Dupont, who dug a trench in front of the cave entrance in the mid-1860s, briefly describing the stratigraphic sequence in his 1872 publication (Dupont 1872, 131-132). His work showed the presence of six levels. No human remains were recovered at this time.
- **Later excavations:** Between 1885 and 1887 Ivan Braconnier, Max Lohest and Julien Fraipont uncovered Mousterian and Upper Palaeolithic materials (Toussaint and Pirson 2006a; see also Masy 1993) using a tunnelling technique to open a gallery and expose multiple levels (Miller *et al.* 2004, 2006, 2012a). Fraipont

discovered a Neolithic collective burial (with recent/late Neolithic ceramics) in the vertical chimney at the back of the cave system. No deposits from the chimney remain today (Masy 1993).

A number of unpublished excavations occurred from 1912 to 1970 and both Neolithic finds and isolated human remains were recovered on the terrace and the alluvial plain. More formal excavations by the Université de Liège and the “Chercheurs de la Wallonie” occurred between 1988 and 2001, directed by Fernand Collin and Marcel Otte. Seventeen levels ranged from Mousterian to historical times, with the Mesolithic recovered in levels 7, 6a and 4b.

Work was finally reopened in 2003, continuing to the present, directed by one of us (RM) and Marcel Otte, Université de Liège, with a focus on “the chronostratigraphy of the Holocene human occupations” (Miller *et al.* 2009b, 280). Pirson and Collin (2005; see also Miller *et al.* 2012a) provide the fullest discussion of the stratigraphy of the recent excavations, with level 4b further divided into four facies (“lentilles”) identified as alpha through delta (4b- α , 4b- β , 4b- γ and 4b- δ), of which alpha through gamma are dated to the Early Mesolithic and delta to the Late/Final Mesolithic. 4b-delta has also been recently sub-divided into 4b-delta (Late Mesolithic) and 4b-LaH (Final Mesolithic).

• **Number of individuals:** *Mesolithic*: at least three; in 1997 several teeth and fragments of human bone were recovered from the site terrace (Toussaint 2002a). The piece dated from 1997 (OxA-10561; see below) is a fragment of maxilla (“fragment crânien” of Toussaint 2002a, table 1) (Miller *et al.* 2012a; see also Miller *et al.* 2009b). It is unclear if the maxilla and teeth were associated. In 2005 a deciduous (milk) incisor was recovered from level 4b- γ , the level dated by Beta-224153 on charred hazelnut shell (see below), two to three millennia earlier than the dated maxilla. The location indicates that it is not related to the 1997 material. In 2010 three refit fragments of a right mandible and two molar teeth (right mandibular M1 and M2) were recovered in level ACOF, underlying level AC directly below level 4b- δ , possibly eroded from level 7a (Miller *et al.* 2010).

Neolithic: ~10; Fraipont (1897, 342; free translation) mentioned the discovery “of at least ten human skeletons”. Collin *et al.* (1994; see also Masy 1993) indicate nine mandibles or mandibular fragments, two maxillae and additional cranial fragments in the collections in Liège. Masy (1993) also provides information on postcrania and gives a total of 156 bones, congruent with Fraipont (1897). More recently (spring 2011), further remains from this work were recovered in the departmental archives at Liège including postcranial material.

• **Primary description of human remains:** *Mesolithic*: beyond brief mention (see above) the 1997 and 2005 material is not described. The 2010 material is pictured and partially described by Miller *et al.* (2010). The material is currently under study.

Neolithic: Fraipont (1897) described the collective burial, Masy (1993) the material known prior to recent work, providing an inventory, partial analysis, and full description of the mandibular material. A Master's thesis (Ernotte 2012) examines this material (including the 2011 finds) as well as some other Neolithic burials excavated by Fraipont in the nineteenth century.

• **Direct dates on human bone:** *Mesolithic*: One; a date for material recovered in 1997 (Toussaint 2002a; Miller *et al.* 2008, 2009b, 2012a); from level 4, though not more closely assigned. An attempt to date the mandibular fragment from level ACOF (Miller *et al.* 2010) has been unsuccessful. It is as yet unclear whether it is associated with level 4b or 7a.

Neolithic: Two; dates recently obtained on two individuals (possibly male and female) from the collective chimney burial indicate an age at the end of the Late Neolithic (Miller *et al.* 2012b).

• **Other dates known:** *Mesolithic*: The Mesolithic sequence is seen in dates on charred hazelnut shell and mammal bone (Miller *et al.* 2008, 2009b, 2010, 2012a). Early Mesolithic dates in level 4b range from 9000 ± 40 (Beta-209871) in facies α to 9240 ± 40 BP (Beta-224152) in facies γ , followed by an occupational hiatus of over two millennia (Miller *et al.* 2009b). Above this, dates on bone and burnt bone for the later Mesolithic in levels 4b and 4a (Collin 1989; Otte *et al.* 1998; Miller *et al.* 2009a, 2010), range from 6650 ± 70 (Lv-1751) to 6910 ± 40 BP (Beta-251057), both in level 4b, facies δ . The dated human bone is from this level. Above this a date on bone is level 5a, 5950 ± 70 (Lv-1752), is consistent with the late Mesolithic/early Neolithic border (Collin 1989; Miller *et al.* 2012a).

Neolithic and later: A Middle Neolithic presence in level 4a is seen in two dates on bone and tooth, 4810 ± 40 (Beta-224151) and 5045 ± 45 BP (OxA-7633/Lyon-592) (Otte *et al.* 1998; Miller *et al.* 2009b, 2012a). A further two dates show recent disturbance; the most recent may indicate the presence of a medieval layer inside the cave (absent on the terrace).

Middle and Upper Palaeolithic: Seven dates on bone, ivory and mammal bone from basal levels are from Mousterian, Aurignacian and late Upper Palaeolithic levels (Otte *et al.* 1998, 2001; Miller *et al.* 2007, 2012a) and beyond the context of this paper.

• **Diagnosis and Discussion:** The site contains dated Mesolithic and Neolithic material. It is seen as unique in Belgium in its stratified sequence with multiple early and late Mesolithic occupations in levels 4b and 5a (Miller *et al.* 2009b, 2012a). Mesolithic human remains from 1997 lack stratigraphic context, their age determined by direct 14C dating. The 2005 and 2010 material is in clear stratigraphic context between levels 4b- δ and 7a, the former dated, the latter not. By extrapolation a direct date of ~7000 BP is probable. Of interest is whether the remains, especially from 2010, represent disturbed material from an as yet undiscovered burial, presumably in level 7a, or whether they fall into the general area of loose human bones (see Meiklejohn and Babb 2009).

Ongoing debate concerns the placement of La Hoguette ceramic sherds in level 4b- δ , associated with Beta-251057 (6910 \pm 40 BP; 5740-5840 calBC at 1 sigma). We see the interpretation of the chronostratigraphy of the La Hoguette sherds as still open to debate with further analyses in progress (more dates, geological interpretation of the stratigraphic context, etc.). If the ~6900 BP date is reliable, then the sherds are unrelated to the Early Neolithic material in stratum 4a, although we now think that it is more likely to be a reworked sample. Stratigraphic analysis so far shows the possibility of a layer between 4a (Early Neolithic) and 4b- δ (Late Neolithic) that would contain the La Hoguette sherds. This may be an occupation separate from both the underlying Late Mesolithic and overlying Early Neolithic. Work is underway (paper for Antiquity) to present new dates and geological results, and proposes an interpretation of the La Hoguette presence at Trou Al'Wesse.

Date (BP)	Number	Bone (if known)	δ 13C	δ 15N	cal. BP	cal. BC
4450 \pm 30	Beta-319270	5 th left metatarsal	---	---	4980-5260	3030-3310
4560 \pm 30	Beta-319269	5 th left metatarsal	---	---	5080-5310	3130-3360
6540 \pm 45	OxA-10561	Cranial fragment	---	---	7420-7490	5470-5540

Chaleux (Trou de Chaleux), Namur (Province)

• **Nature and location of site:** Cave site on the right bank of the Lesse in the municipality of Houyet, ~1 km west-southwest of the village of Furfooz, ~5 km southeast of Dinant, and ~3 km southeast of where the Lesse enters the Meuse; 50.22 N, 4.94 E.

• **First excavated:** By Édouard Dupont in 1865.

• **Later excavations:** Reviews of the stratigraphy were made by Edouard Rahir (1900 to 1902) and François Twiesselmann (from 1945 onwards). The most recent work is by Marcel Otte from 1985 to 1988 (Otte 1994; Otte and Teheux 1986; Teheux 1985).

• **Number of individuals:** *Upper Palaeolithic and/or Mesolithic:* Twiesselmann (1971a) refers to material from two adults, represented by a fragmentary parietal and postcranial remains, including four scapulae. Though Twiesselmann referred the material to the Magdalenian further work makes this less clear (see below).

Neolithic: not known.

• **Primary description of human remains:** Otte (1994, 21; free translation) refers to the discovery of human remains as follows: “some were discovered at the base of the site, where the Magdalenian level was not sealed by the second rubble level. The other bones were found in one of the widenings of the main room. In the same crevice, in 1902, E. Rahir discovered Neolithic material”. The material referred to as Magdalenian by Twiesselmann (1971a) was mentioned by Beneden *et al.* (1865) and described by Dupont (1867b). None of it has been restudied. Aside from mention by Otte the Neolithic material has not apparently been described.

• **Direct dates on human bone:** One, element not stated, shows that at least some of Dupont's material is Mesolithic (Bronk Ramsey *et al.* 2002).

• **Other dates known:** Nine, from Oxford and Louvain on faunal material, confirm the homogeneity of the Late Magdalenian occupation, spanning ~650 years from 12370 \pm 170 (Lv-1568) to 12990 \pm 140 BP (Lv-1569) (all the OxA dates fit within this period). The Louvain dates are on bone splinters from the Dupont and Otte excavations (Otte and Teheux 1986; see also Gilot 1994; Charles 1996; Lanting and van der Plicht 1995/96; Stevens *et al.* 2009). The Oxford dates, on pig, horse and musk ox bone, all show cutmarks and presence of humans at the time of deposition (Hedges *et al.* 1993, 1994; see also Charles and Baden-Powell 1994; Charles 1996; Housley *et al.* 1997; Sano *et al.* 2011; Stevens *et al.* 2009). A date on pig bone,

designed to see if pigs were present in the late glacial, shows the find to be intrusive (3060 ± 85 BP; OxA-4193).

• **Diagnosis and Discussion:** Originally thought to be from Magdalenian levels of this site, recent dating shows that at least some human material is of Mesolithic age. Otte (1994) clearly indicates that material assumed to be Magdalenian was recovered from two locations, but also notes (*ibid*, 21; free translation) that “their attribution to the Magdalenian is uncertain”. The relationship of the date to the age of this part of the skeletal collection is unclear, and Toussaint (2010) indicates that the context, including stratigraphic placement, is unknown. The dating to the Mesolithic of material excavated by Dupont in the 1860s provides the context for the discussion of the majority of the sites in section 2.1 (below; all except La Martina).

Date (BP)	Number	Bone (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
8730 ± 80	OxA-5679	not known	-19.9	---	9560-9880	7610-7930

Magrite (Trou Magrite), Namur (Province)

• **Nature and location of site:** Cave site on the right bank of the Lesse in the municipality of Dinant, ~2 km south-southeast of the town of Anseremme and 4 km south of Dinant; 50.22 N, 4.91 E.

• **First excavated:** By Édouard Dupont from 1864 to 1867, at which time human remains were recovered (Dupont 1867a; Twiesselmann 1971a; Di Modica 2009a).

• **Later excavations:** In 1991 and 1992 by Marcel Otte and Lawrence Straus (Otte and Straus 1995).

• **Number of individuals:** *Total:* Six; Dupont collected bones identified as from three adults, an adolescent and two children (Twiesselmann 1971a). Twiesselmann’s inventory differs slightly from that present at the Institut royal des Sciences naturelles de Belgique (Leguebe and Orban 1984).

Mesolithic: One or more; from the nineteenth century excavations (Toussaint 2002a). Only the dated piece is securely assigned at this time since the relationship to the remaining collection is unclear (Toussaint 2002a), especially since Twiesselmann (1971a) lists no clavicle, the bone used to obtain an AMS date (see below).

• **Primary description of human remains:** Mentioned by Dupont (1867a) and tabulated by Dupont (1872) but not described other than in inventory form (Twiesselmann 1971a; Leguebe and Orban 1984).

• **Direct dates on human bone:** One, showing that the single piece is Mesolithic (Bronk Ramsey *et al.* 2002).

• **Other dates known:** *Mesolithic:* None.

Upper Palaeolithic: Fifteen dates from Aurignacian levels show a wide range and highlight issues of contamination in early samples (Noiret *et al.* 1994; Otte and Straus 1995; Otte *et al.* 2001; Bronk Ramsey *et al.* 2002; Charles *et al.* 2003; Di Modica 2009a).

• **Diagnosis and Discussion:** The new date shows that some of Dupont’s human material is Mesolithic in age. However, Toussaint (2010) indicates that the context of the dated find, including stratigraphy, is unknown. As a result it is premature to state that the date applies to the full collection.

Date (BP)	Number	Bone (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
8645 ± 70	OxA-5841	IG 2426 – clavicle	-20.5	---	9540-9680	7590-7730

1.2 Belgian sites discovered since 1960

Eight of nine sites in this section result from work begun in 1962 at Malonne. The first clear demonstration of a Mesolithic age for a Meuse burial site occurred in 1984 with the dating of Loverval (published in 1995). The other Meuse sites were then sequentially dated between 1984 and 2002. Léotard *et al.* (1999b) point out that much of the Meuse work was due to the efforts of the rock climber and speleologist Philippe Lacroix (employed as professional technician at the “Direction de l’Archéologie” of the Walloon Region), known as “Bibiche”. In general there were very few associated artefacts with the burials. Of these sites, as of mid 2014, the only ones with detailed anthropological analyses are Malonne and Autours. The ninth site is the recently discovered Bazel-Sluis, with a loose human bone recovered in 2011.

Autours (Abri des Autours), Namur (Province)

• **Nature and location of site:** Cave site near top of limestone cliff on the right (east) bank of the Meuse in the Rochers de Freyr massif in the municipality of Dinant, ~2 km south-west of Anseremme and ~4 km south-southwest of the city of Dinant; 50.22 N, 4.89 E.

• **First excavated:** By Nicolas Cauwe in 1992 and 1993. Unpublished excavations had occurred earlier

(Cauwe 1993; Cauwe *et al.* 1992).

• **Later excavations:** None known.

• **Number of individuals:** At least 22 in three burial features, two Mesolithic, the third Neolithic.

Mesolithic: 13; a collective burial (AA2) with at least six adults and six children, a primary burial in a pit with enclosing walls and minimal grave goods. One of the six adults is cremated. A further single burial (AA3) lacks grave goods (Cauwe 2001; Polet and Cauwe 2002, 2007).

Neolithic: 9+; a Middle Neolithic (Michelsberg) collective burial (AA1) with grave goods and at least three adults and six children (one female individual accounts for ~70 percent of the remains).

• **Primary description of human remains:** Polet and Cauwe (2007) provide descriptions and inventory, with Polet *et al.* (2004) and Polet and Dutour (2007) describing the palaeopathology. Summaries of the collection include reviews by Cauwe (2001) and Polet and Cauwe (2002).

• **Direct dates on human bone:** Three; one from each of the features (Bronk Ramsey *et al.* 2002; Cauwe 1995; Lanting and van der Plicht 1997/98, 1999/2000). Bocherens *et al.* (2007) provide a further eight stable carbon and nitrogen isotope values, including the $\delta^{15}\text{N}$ figures given below.

• **Other dates known:** None.

• **Diagnosis and Discussion:** This site is only ~800 metres north of Margaux (see below). With multiple individuals from two Mesolithic features (the Neolithic feature is not discussed further), Cauwe (2001) stresses the incompleteness of the remains, not in anatomical connection, and taphonomic issues (see also Jones 2011; Straus and Otte 1999). Associated material was limited to a small number of flint blades and a considerable amount of burnt animal bone. The cremated individual in collective burial AA2 is the earliest dated Mesolithic example (Meiklejohn and Babb 2009).

Date (BP)	Number	Burial (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
5300 ± 55	OxA-5837	AA1	-21.0	10.1	6000-6180	4050-4230
9090 ± 140	OxA-5838	AA2/2	-19.5	9.5	9940-10480	7990-8540
9500 ± 75	OxA-4917	AA3	-20.2	9.2	10660-11070	8710-9120



Figure 3: Dinant Rochers Frey (image courtesy of Marc Ryckaert)

Bazel-Sluis (Kruibeke), Oost-Vlaanderen (Province)

• **Nature and location of site:** Open air wetland site on the west bank of the River Scheldt just below the mouth of the Rupel, ~2 km southeast of the village of Bazel and ~10-15 km south of Antwerp; 51.14 N, 4.32 E.

- **First excavated:** In 2011 and 2012 by the Archaeological Heritage Agency (Onroerend Erfgoed) and Ghent University, Department of Archaeology, following the construction of a lock and adjacent levees along the river Scheldt.
- **Later excavations:** None.
- **Number of individuals:** One; an isolated adult clavicle recovered in 2011.
- **Primary description of human remains:** The material has not been described.
- **Direct dates on human bone:** One; personal communication from the excavators.
- **Other dates known:** Twenty-seven dates on animal bone and antler (25) and carbonized plant remains (2) are available; the total range lies between ~6200 and ~3700 calBC. Initial dates were published by Perdaen *et al.* (2011).
- **Diagnosis and Discussion:** The full context of this find, beyond the direct date, has not yet been published. Philippe Crombé (*pers. comm.*) indicates that “(i)t is not yet established whether the human bone is related to the Swifterbant Culture. The site ... is a large palimpsest of occupations starting in the Middle Mesolithic and ending probably in the Middle Neolithic (4th mill calBC). However the 14C age of the human bone does not exclude a link with the Swifterbant Culture.”

Date (BP)	Number	Bone (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
5790±35	KIA-47328	Clavicle	-22.0	9.9	6550-6650	4600-4700



Figure 4: Excavations at Bazel-Sluis (image courtesy of Philippe Crombé)



Figure 5: Excavations at Bois Laiterie (image courtesy of Philippe Lacroix) and human bones from the site (image courtesy of Lawrence Straus). The talus was dated.

Bois Laiterie, Namur (Province)

- **Nature and location of site:** Cave in karst topography on the Sept Meuses Hill and left bank of the Meuse, overlooking the Burnot, a minor tributary (ruisseau) in the municipality of Profondeville, <1 km northwest of the village of Rivière and 1.5 km south of Profondeville; 50.36 N, 4.87 E.
- **First excavated:** Discovered by Philippe Lacroix in 1989, who dug six small trenches in 1990-91 (the site had previously been illegally dug). In 1994 and 1995 Marcel Otte, Université de Liège, and Lawrence Straus, University of New Mexico directed a full excavation.
- **Later excavations:** None known.
- **Number of individuals:** Six; four adults, a juvenile and a child (Toussaint 2002a, 2010; Vandenbrouaene and Gautier 1997; see also Toussaint *et al.* 1998b); there are four overlapping but slightly disparate summaries of the material, lifted *en bloc* and excavated in the laboratory; finds were scattered and identification of individuals problematic. The preliminary inventory is extremely incomplete (no crania are mentioned), because the material was still *en bloc* (Vandenbrouaene and Gautier 1997; see also discussion in López Bayón *et al.* 1996) prior to its excavation in the laboratory (Toussaint *et al.* 1998b); the final inventory has not been published.
- **Primary description of human remains:** None; Vandenbrouaene and Gautier (1997) provide a brief but incomplete inventory plus details of context (see comment above). Toussaint (2002a; Toussaint *et al.* 1998b) provides context but neither description nor inventory.
- **Direct dates on human bone:** Four from the early Mesolithic (Krueger 1997; Toussaint 2002a; Bocherens *et al.* 2007). Bocherens *et al.* (2007) provide alternate isotope values for the bones dated by Oxford but do not tie them to the individual dates ($\delta^{13}\text{C}$ ranges from -20.3 to -20.6; $\delta^{15}\text{N}$ from 8.9 to 9.4).
- **Other dates known:** *Mesolithic:* none.

Upper Palaeolithic: Three from the primary Magdalenian occupation range from 12625 ± 117 (GX-20433) to 12665 ± 96 BP (GX-20434) (Otte *et al.* 2001; Sano *et al.* 2011).

- **Diagnosis and Discussion:** Use of the site as a Mesolithic burial cave follows a lower Magdalenian occupation; the excavation was directed at the Magdalenian of Belgium and recolonization of northern Europe after the late glacial maximum (Straus and Otte 1998; see Montet-White 1999; Straus 2006; Sano *et al.* 2011). Site use for human burial overlying a primary occupation also occurs at other sites, including Abri du Pape (Straus 2006; see also Straus and Otte 1999) (section 2.2). Initially the human remains, in a breccia including ceramics and lacking Mesolithic artifacts, were viewed as Neolithic. A Mesolithic age was later demonstrated by direct dating. Homogeneity of the ^{14}C dates precludes the possibility that some skeletal material is of Neolithic age, as had been suggested by Otte and Straus (1997). The remains of this collective burial are roughly coeval with those at Autours and Malonne (it is not technically an ossuary since some bones were in anatomical connection; López Bayón *et al.* 1996).

Date (BP)	Number	Bone (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9235 ± 85	GX-21380G	talus (square V9)	-20.5	8.3	10280-10500	8340-8550
9420 ± 65	OxA-8911	left humerus	-19.7	---	10560-10720	8610-8770
9445 ± 60	OxA-8878	left humerus	-19.9	---	10580-10740	8630-8790
9515 ± 65	OxA-8910	left humerus	-19.4	---	10600-11060	8650-9110

Burin (Faille du Burin), Namur (Province)

- **Nature and location of site:** Small cave site at the base of cliffs beneath the medieval Château de Samson at Samson on the Meuse in the municipality of Andenne, ~5 km west-southwest of Andenne itself and ~8 km east of Namur; 50.47 N, 5.00 E.
- **First excavated:** In 1989 by Philippe Lacroix; speleologists from Namur had previously explored the site.
- **Later excavations:** None known.
- **Number of individuals:** Six+?; at least four adults and two children (Toussaint 2002a).
- **Primary description of human remains:** None.
- **Direct dates on human bone:** Four, published by Toussaint (2002a; Toussaint and Lacroix 2002). Bocherens *et al.* (2007) provide additional $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values though not linked to the ^{14}C dates ($\delta^{13}\text{C}$ ranges from -20.1 to -21.0, $\delta^{15}\text{N}$ from 9.4 to 10.4). While all of the dated elements are left naviculars, the Bocherens stable isotope values are from right metatarsal V.
- **Other dates known:** None.
- **Diagnosis and Discussion:** This collective burial contains only one cultural element, a backed bladelet (Toussaint 2011).

Date (BP)	Number	Bone (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9315 \pm 50	OxA-10564	Left navicular	-20.0	---	10430-10580	8480-8640
9335 \pm 75	OxA-10595	Left navicular	-19.6	---	10410-10650	8460-8700
9345 \pm 75	OxA-8938	Left navicular	-19.6	---	10420-10650	8470-8700
9520 \pm 75	OxA-10585	Left navicular	-19.6	---	10660-11070	8710-9120

Claminforge (Sambreville), Namur (Province)

- **Nature and location of site:** Small cave site on the right bank of the Bième, a tributary of the Sambre in the municipality of Sambreville, ~1 km south of the village of Falisolle and ~4 km south of Sambreville itself; 50.41 N, 4.62 E.
- **First excavated:** In 1988 by the Centre Spéléologique de la Basse Sambre, directed by Pierre Bodart and André-Marie Lacour; the site had been partially disturbed by a quarry.
- **Later excavations:** By one of us (MT) in 1995.
- **Number of individuals:** Five; three adults and two children discovered in 1988.
- **Primary description of human remains:** None; Toussaint *et al.* (1996) provide a brief but precise inventory (see also Toussaint *et al.* 2002a).
- **Direct dates on human bone:** Two, provided by Toussaint *et al.* (1996; Toussaint 2002a; Lanting and van der Plicht 1997/98; Bocherens *et al.* 2007 incorrectly cite the older date as OxA-1055).
- **Other dates known:** None.
- **Diagnosis and Discussion:** The individuals in this burial cave lacked associated artefacts and were assumed to be Neolithic. Direct dating shows them to be contemporaneous with Autours, Bois Laiterie, Lombeau and Malonne.

Date (BP)	Number	Bone (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9320 \pm 75	OxA-5451	Cervical vertebra	-19.4	10.5	10410-10650	8460-8700
9525 \pm 60	OxA-10552	3 rd metacarpal	-19.4	---	10710-11070	8760-9120

Lombeau (Grotte Lombeau), Hainaut (Province)

- **Nature and location of site:** Cave site on right bank of the Eau d'Heure, a tributary of the Sambre, at Mont-sur-Marchienne, a suburb of the City of Charleroi; ~3 km south-southwest of the centre of Charleroi; 50.38 N, 4.39 E.
- **First excavated:** By amateur archaeologist Georges Dubuis in the 1990s.
- **Later excavations:** None known.
- **Number of individuals:** *Mesolithic:* At least five?; Toussaint (1999a; 2002a) indicates recovery of several hundred bones, largely from an area of 1m² at the back of the cave.
Neolithic: At least one; recovered from the anterior of the deposit in the area impacted by construction.
- **Primary description of human remains:** None.
- **Direct dates on human bone:** *Mesolithic:* Three (Toussaint and Ramon 1997; Lanting and van der Plicht 1997/98; Toussaint 1999a, 2002a); the $\delta^{13}\text{C}$ values are from the same individuals but on different bones, L1 and L2 on adult crania, L3 on a juvenile mandible (Bocherens *et al.* 2007).
Neolithic: One; (Toussaint 2002a).
- **Other dates known:** One; a date of 15190 \pm 110 (OxA-6443) on reindeer bone indicates Upper Palaeolithic use of the site (Toussaint 1999a, 2002a).
- **Diagnosis and Discussion:** Identified as a burial cave (Toussaint 1999a; see also Straus and Otte 1999). Toussaint (2002a) notes presence of ochre on the Mesolithic burials (also seen at Bois Laiterie and Margaux). The Mesolithic remains are equivalent in age to finds at Autours, Bois Laiterie and Malonne.

Date (BP)	Number	Bone (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
4500 \pm 60	OxA-6446	3 rd metatarsal	---	---	5060-5290	3110-3340
9015 \pm 80	OxA-6445	L3/5 th metatarsal	-20.6	10.1	9940-10250	7990-8300
9360 \pm 75	OxA-6440	L2/5 th metatarsal	-20.9	9.8	10490-10700	8540-8750
9410 \pm 70	OxA-6441	L1/5 th metatarsal	-20.6	9.7	10560-10730	8610-8780

Loverval D5, Hainaut (Province)

- **Nature and location of site:** A cave or “diacalse” (fissure) in the rock on the right side of the stream, the Fond des Haies, ~2 km south-southwest of Loverval in the municipality of Gerpinnes and ~5 km south-southeast of Charleroi (close to the Sarrasins cave); 50.36 N, 4.46 W.
- **First excavated:** In 1983 by amateur archaeologists Georges and Jacqueline Dubuis (Toussaint 1997, 2002a).
- **Later excavations:** None known.
- **Number of individuals:** Two; both apparently female (Toussaint 1997, 2002a).
- **Primary description of human remains:** None.
- **Direct dates on human bone:** Two; Toussaint (1995) (see also Cauwe 1995; Toussaint and Ramon 1997; Lanting and van der Plicht 1997/98; Toussaint 2002a; Bocherens *et al.* 2007). Stable isotope values published by Bocherens *et al.* (2007) are not explicitly tied to the ¹⁴C dates.
- **Other dates known:** None known.
- **Diagnosis and Discussion:** In 1984 this was the first burial cave in the Meuse Basin dated to the Mesolithic (see also above) (Toussaint 1995, 1997; Toussaint and Ramon 1997; Straus and Otte 1999; see also Toussaint 2002a).

Some sources have incorrectly referred to this site as the Grotte de Sarrasins (Cauwe 1996; Jadin and Carpentier 1994; Miller *et al.* 2011; 2012a), a name referring to a nearby site without Mesolithic human remains.

Date (BP)	Number	Burial (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9090 ± 100	Lv-1506	Not stated	-20.5	9.3	10170-10410	8220-8460
9640 ± 100	GifA-94536	Not stated	-20.5	9.3	10790-11180	8840-9230

Malonne (Petit Ri), Namur (Province)

- **Nature and location of site:** Remains of cave site in an abandoned quarry in the valley of the Landoir, a small tributary of the Sambre, within the municipal boundary of the city of Namur, ~1.5 km south of the village of Malonne and ~5 km southwest of the centre of Namur. 50.43 N; 4.80 E.
- **First excavated:** Discovered by Michel Carpentier in 1962; a human skull and postcranial bones were recovered. The site was further examined by the amateur archaeologists Louis Éloy, Pierre Renier and Guy Bastin, the remains transferred to the Royal Belgian Institute of Natural Sciences where they have been studied since 1965. Eloy and Jean-Marie Cordy did further laboratory analyses of the archaeological and faunal materials but no excavation.
- **Later excavations:** None known.
- **Number of individuals:** Four; a cranium and postcranial remains of four individuals (MNI based on number of fibulae) (Twisselmann and Orban 1994). The site may have contained more individuals; when discovered it was partly destroyed by quarrying (Jadin and Carpentier 1994).
- **Primary description of human remains:** By Twisselmann and Orban (1994): there is brief mention of the finds in Twisselmann (1979).
- **Direct dates on human bone:** One; from a femur (Jadin and Carpentier 1994; Hedges *et al.* 1996). An attempt to date the cranium was not successful. The stable isotope results are from Bocherens *et al.* (2007) (a $\delta^{13}\text{C}$ result of -19.5 was published by Hedges *et al.* 1996).
- **Other dates known:** None.
- **Diagnosis and Discussion:** Prior to work published in 1994 (Cordy 1994; Éloy and Jadin 1994; Jadin and Carpentier 1994; Twisselmann and Orban 1994) the material had only been mentioned three times (Meiklejohn 1974; Twisselmann 1979; Awoust and Thiry 1984), the first of these based on information that the material was probably Mesolithic (F. Twisselmann, *pers. comm.* to CM, 1969). However, Twisselmann (1971a) did not include the site and, with no further details available, it was not mentioned by Newell *et al.* (1979). Prior to direct dating an accurate age assessment was not possible from the limited archaeological material (Éloy and Jadin 1994) and sparse fauna (Cordy 1994).

Date (BP)	Number	Bone (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9270 ± 90	OxA-5042	Femur	-20.4	9.5	10300-10560	8350-8620

Margaux (Grotte Margaux), Namur (Province)

- **Nature and location of site:** Deep limestone cave at the top of the dry Ravin du Colébi on the Meuse right (east) bank, ~800 metres south of Autours within the municipality of Dinant, ~3 km south of Anseremme, and ~5 km south-southwest of Dinant. 50.22 N; 4.89 E.
- **First excavated:** Discovered in 1988 by Philippe Lacroix and Jean-Marc Léotard, Service de l'Archéologie du Ministère de la Région Wallonne; excavated in 1988 and 1989 by Nicolas Cauwe and the Université de Liège (Cauwe 1989) with one of us (MT) as palaeoanthropologist.
- **Later excavations:** Not known.
- **Number of individuals:** *Mesolithic*: Seven to ten (MNI: for technique see Toussaint 1998); fragmentation makes diagnosis problematic. Toussaint (2011) provides a total bone number of 667; earlier sources provided varying and overlapping numbers (Lanting and van der Plicht 1997/98; Toussaint 1998; Cauwe 2001; Bocherens *et al.* 2007). The degree of fragmentation is seen in both the overall bone scatter (Cauwe 1998; fig 39) and individual scatter plots of different bone groups (*ibid*; figs 41-50).
- Post-Mesolithic (?)*: one (see diagnosis and discussion).
- **Primary description of human remains:** Not fully described, though considerable attention has been paid to burial taphonomy (Cauwe 2001). Toussaint's (1998) initial study includes age and sex assessment (all apparently adult female), stature, palaeopathology and cut-marks on cranium CR3 (see also Cauwe 2001; Toussaint 2011).
- **Direct dates on human bone:** Six; from three laboratories (Hedges *et al.* 1995, 1996; see also Cauwe 1988, 1989, 1995, 1998, 2001; Cauwe and Toussaint 1993; Gilot 1993, 1997; Lanting and van der Plicht 1997/98; Straus *et al.* 1993; Verhart 2008). The youngest date, from Louvain-la-Neuve (Lv) on rib fragments from several individuals, is possibly too young given the Gif and Oxford results. The two $\delta^{13}\text{C}$ values are from the Oxford laboratory and differ in average from those provided by Bocherens *et al.* (2007), who also give $\delta^{15}\text{N}$ values. Values from the latter source are linked to neither 14C dates nor individuals.
- **Other dates known:** None known.
- **Diagnosis and Discussion:** Discovered as part of work designed to locate late Upper Palaeolithic sites (Cauwe 1998), it was identified as a Mesolithic burial cave. It is ~50 metres deep, the burials placed at the deepest part of the cave in an apparently homogeneous deposit on top of a stalagmitic layer dated to the early Würm and before (Cauwe 1998, 2001). The remains are almost definitely secondary and associated with red ochre, the only recovered artifact a backed bladelet (lamelle à dos) from the top of the burial. On discovery comparisons were with Neolithic (Michelsberg) cairn burials (*ibid*) as no material of this type was known to be Mesolithic. Though the 14C dates could suggest a burial deposit conducted in phases, this was not detected archaeologically (Cauwe 2001). The burial is a "small pit partly surrounded by a dry-stone wall and pavement" (*ibid*, 149) with the cairn apparently of human construction rather than natural (Cauwe 1998, 46-7).

The site plan in Cauwe (1998) suggests that there was also an undated individual burial in the porch, under the rock overhang. Cauwe (2001, 149) provides the same diagram but does not discuss the burial. Cauwe (1998, 24-25) indicates that although identifiable as a child or young adolescent the remains were in very poor condition, with only ~200 grams of material recovered and much of the apparent skeleton a "phantom". Overlying deposits were disturbed and material recovered, including proto-historic pottery, cannot be associated with the burial. Without a direct date the age is unknown.

Date (BP)	Number	Bone(s) (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
9190 ± 100	Lv-1709	Rib fragments	---	---	10240-10490	8300-8540
9260 ± 120	GifA-92362	Right humerus/HM8	---	---	10280-10570	8330-8620
9350 ± 120	OxA-3534	2 metacarpals/MC115 & 117	-19.4	---	10310-10730	8360-8780
9530 ± 120	OxA-3533	Right humerus/HM10	-19.5	---	10690-11090	8740-9140
9530 ± 110	GifA-92355	Right humerus/HM12	---	---	10690-11090	8740-9140
9590 ± 100	GifA-92354	Right humerus/HM9	---	---	10770-11100	8820-9150



Figure 6: Grotte Margaux (image courtesy of Lawrence Straus)

1.3 Luxembourg sites

This section discusses a single site discovered in 1935, one of four found within 2.5 km of the valley of the Ernз-Noire (see also section 2.3), which flows into the Sûre (Sauer), in turn a tributary of the Mosel separating Luxembourg from Germany in its lower course. Not discussed in “Oakley” (Twisselmann 1971b) it was included by Newell *et al.* (1979), though misplaced (identical coordinates were provided for both Loschbour and Atsebach, section 2.3, with the latitude given only ~3 km south of the correct location, but with a longitude of 11.9 E, ~350 km to the east near the Czech-German border).

(Abri de) Loschbour (Heffingen-Loschbour), Reuland Commune (Luxembourg)

- **Nature and location of site:** Rock shelter at the foot of cliffs lining the Müllerthal in the valley of the Ernз Noire, ~3 km southeast of Heffingen and 15 km north-northeast of the City of Luxembourg; 49.76 N, 6.28 E.
- **First excavated:** By Nicolas Thill and Charles Weber in 1935, assisted by Marcel Heuertz, when both burials were recovered. Further work was done the following year “in the talus at the foot of the cliff-face” (Heuertz 1950, 411; free translation) (see also Gob 1982).
- **Later excavations:** In 1981 André Gob, the Université de Liège and the Société Préhistorique Luxembourgeoise checked the site stratigraphy, with palaeoenvironmental work conducted in 2003 (Brou 2006; Gob 1982; Toussaint *et al.* 2009). No remains survived of the 1935 archaeological levels (Gob 1982; Brou 2006).

- **Number of individuals:** Two; a largely complete skeleton and a cremation grave. The skeleton has received considerable attention. Heuertz (1950) and Rozoy (1978) briefly mentioned the cremation (“a fireplace (‘foyer’) with remains of calcined and indeterminate human and animal bones”; Heuertz 1950, 413; free translation) but it was otherwise unknown until reworking of the site after 1998 (Brou 2006; Brou *et al.* 2008; Toussaint *et al.* 2009).
- **Primary description of human remains:** *Inhumation:* described by Heuertz (1950). Delsate *et al.* (2009, 2011) report new work, including aDNA haplotyping (see also Le Brun-Ricalens *et al.* 2005). *Cremation:* described by Toussaint *et al.* (2009, 2011a), associated perforated shells of the Eocene genus *Bayania* by Brou *et al.* (2008) (see also Le Brun-Ricalens *et al.* 2005; Brou 2006).
- **Direct dates on human bone:** Two; one from the inhumation (Higham *et al.* 2007), one from the cremation (Toussaint *et al.* 2009). The date from the inhumation (OxA-7338) is in general agreement with GrN-7177 (see next section). Toussaint *et al.* (2009) incorrectly cite the date from the inhumation as OxA-7738 in their figure 13.2, though correctly in the text.
- **Other dates known:** Two (Gilot 1984, 1997; see also Gob 1982, Brou 2006); one on bone (aurochs) possibly associated with the inhumation (7115 ± 45 BP; GrN-7177) the other on charcoal from travertine below the archaeological levels (9400 ± 280 BP; Lv-1293).
- **Diagnosis and Discussion:** Named for the small stream (‘ruisseau’) immediately northeast of the rock face backing the site. Heuertz (1950) described the original excavation and provided the section given by Newell *et al.* (1979; see also Heuertz 1969). Other than for the skeletal material little archival evidence survives for the 1935 work (Brou 2006). Direct dating shows the inhumation to be ~750 years younger than the cremation, associated with a pure Late Mesolithic industry. The cremation is attributed to the RMS (Rhine-Meuse-Schelde) “culture” (Gob 1984; see also Brou *et al.* 2008; Toussaint *et al.* 2009). Association of the cremation with both the RMS and the Eocene (Lutetian) fossil shell *Bayania lactea* links the find with cremations at Oirschot (Netherlands) and La Chaussée-Tirancourt (northern France) (Brou *et al.* 2008).

Date (BP)	Number	Burial (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
7205 ± 50	OxA-7338	Skull (MNHN-1943-2065)	-20.0	---	7960-8140	6010-6190
7960 ± 40	Beta-132067	Patella from cremation	-24.8	---	8750-8980	6800-7030



Figure 7: the rockshelter at Loschbour (images courtesy of Domi Delsate)

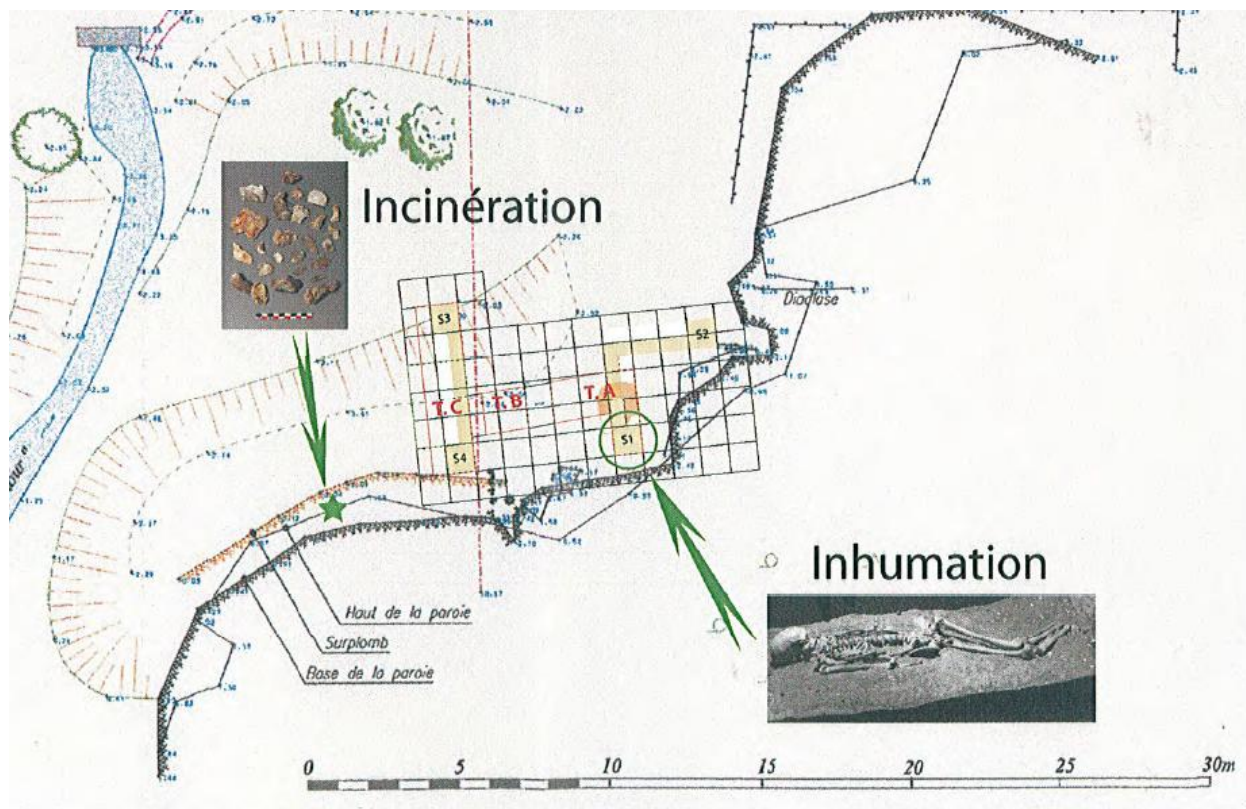


Figure 8: Loschbour site plan (image courtesy of Laurent Brou)

2. Sites with human remains excluded from the Mesolithic by direct dating

This section looks at sites with human remains now excluded from consideration as Mesolithic, with similar division as in section 1.

2.1 Belgian sites discovered in the Nineteenth Century

This section is divided into two parts. The shorter initial part has a single site; one that was once suggested to have Mesolithic human remains. The second includes four sites not referred to previously as Mesolithic but with a key relationship to Chaleux (section 1.1), their excavation and publication by Édouard Dupont (see also introduction to 2.1.2 below).

2.1.1 Nineteenth Century site with material initially referred to the Mesolithic

Martina (Grotte de la Martina), Namur (Province)

- **Nature and location of site:** Cave site above the flood plain on the right bank of the Lesse between the villages of Walzin and Pont-à-Lesse in the municipality of Dinant, 2-3 km southeast of Anseremme and 1-2 km south of where the Lesse joins the Meuse; 50.22 N, 4.92 E.
- **First excavated:** By Édouard Dupont in 1867; human and faunal material was recovered without cultural association (Toussaint and Ramon 1997; see also Dupont 1872).
- **Later excavations:** By Maria Gilbert-Louis and M.A. Gilbert in 1949, who also recovered human and faunal material without cultural association (Toussaint and Ramon 1997) other than a single pottery sherd (Dewez *et al.* 1995). Minimal records exist prior to donation of the collection to the Université Catholique de Louvain in 1991 (Dewez *et al.* 1995; Toussaint and Ramon 1997).
- **Number of individuals:** Five?; at least three adults and two children. Dupont recovered two adult mandibles and two partial humeri. A further 23 pieces were recovered in 1949 (Dewez *et al.* 1995). The two collections are contemporaneous, suggested by the very close resemblance between humerus fragments from 1949 and 1867. Based on clavicles at least four individuals are present, two adults and two children. In addition neither mandible from 1867 belongs to calvarium CR1 from 1949, indicating presence of at least three adults.

• **Primary description of human remains:** Toussaint and Ramon (1997) provide an inventory from both excavations. Dupont's material, assumed to be Neolithic, was included in Hué's bibliographic study (1937; see Toussaint and Ramon 1997, Dewez *et al.* 1995). Dewez *et al.* (1995) briefly describe the 1949 material, still in process of being removed from stalagmitic encrustation.

• **Direct dates on human bone:** *Mesolithic:* When the 1949 material was inventoried a direct date suggested a Mesolithic age (Gilot 1997), though later than Loverval and Margaux (see further below) (Dewez *et al.* 1995; see also Toussaint 2002a who suggests possible carbonate contamination).

Neolithic: Work on the Gilbert-Louis collection noted that differing elements in the faunal material suggested a complex site taphonomy. Despite the fact that the human material was not accurately associated with any faunal subsamples a Mesolithic age was suggested (Dewez *et al.* 1995). In re-examining the full collection Toussaint and Ramon (1997) dated the four clavicles, and thereby four different individuals, plus a tibia, all suggesting a Late Neolithic age. The samples also covered material of differing preservation, equivalent to the earlier noted faunal differences. Toussaint (2002a) also sees femur FM6, apparently Mesolithic in age, as from the same individual as calvarium CR1, dated to the Neolithic.

• **Other dates known:** None.

• **Diagnosis and Discussion:** Examination of all sources suggests that this is a Late Neolithic burial cave, consistent with Hué's (1937) conclusion that Dupont's material was Neolithic. Diagnosis as Mesolithic, in the absence of associated cultural material, is based solely on the Louvain radiocarbon date (Dewez *et al.* 1995; see also Jadin and Carpentier 1994). Toussaint and Ramon (1997) suggest that Lv-2001 may have been contaminated with older carbonates, the piece being encrusted in calcite. Cauwe's (1998) comment about the unclear relationship of the 1867 and 1949 pieces was written prior to the work of Toussaint and Ramon (1997; see also Toussaint 2002a). In conclusion, Toussaint (2010, 75; free translation) argues that "allocation to the late Mesolithic of a small series of bones collected in 1949 at the Grotte de la Martina, suggested on the basis of a single date (Dewez *et al.* 1995), is undermined with six other dates from two different laboratories (Toussaint and Ramon 1997)".

Date (BP)	Number	Bone (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
3940 ± 50	Beta-110769	Tibia Lma TB1	---	---	4300-4500	2350-2550
4330 ± 55	OxA-6560	Clavicle Lma CLV2	---	---	4850-4960	2900-3010
4340 ± 55	OxA-6590	Calvarium Lma CR1	---	---	4850-4960	2900-3010
4350 ± 55	OxA-6559	Clavicle Lma CLV1	---	---	4850-4970	2900-3020
4370 ± 55	OxA-6578	Clavicle Lma CLV4	---	---	4860-5030	2910-3080
4460 ± 55	OxA-6562	Clavicle Lma CLV3	---	---	4980-5280	3030-3330
7440 ± 110	Lv-2001	Femur Lma FM6	---	---	8170-8380	6220-6430

2.1.2 Nineteenth Century sites excavated by Dupont

Discussion of the following four sites may be seen as marginal since none have been referred to in the literature as Mesolithic (Twisselmann 1971a; Newell *et al.* 1979). However, we feel that a discussion is advisable for two reasons.

The first relates to the dating of bone from Chaleux to the Mesolithic (see section 1.1). This was unexpected and raised several lines of enquiry. Chaleux, and other sites excavated by Édouard Dupont between 1864 and 1872, and Schmerling in the 1830s, had material accepted as possibly of Upper Palaeolithic age by Twisselmann (1971a). Demonstration that material from one of the sites was Mesolithic raised the question of the age of material from the other sites. Subsequent dating has, in fact, failed to verify that any of the material is from the Upper Palaeolithic.

The second reason arises from the first. If none of the material is Upper Palaeolithic, what is its age? Does the dating at Chaleux raise the possibility that there is other Mesolithic material from the sites excavated by Dupont? Though not demonstrated to date, this base suggests that the Dupont material is of interest for further dating. We also note that the unexpected discovery of Mesolithic burial caves in the Meuse Valley opens the possibility that Mesolithic material exists in those sites not excavated by Dupont but listed elsewhere (Toussaint 2007; see also Toussaint 2002a, Bocherens *et al.* 2007). To list and discuss all of these sites at this point is beyond the possible scope of this article or journal, but is obviously an area that deserves exploration.

This discussion is limited to the material referred to as Upper Palaeolithic by Twiesselmann (1971a). As a result one further early site with material now dated in part to the Neolithic is excluded, Spy (Bêche-aux-Rotches). In this case the age of material from the Middle Palaeolithic, identified as Neanderthal, has been confirmed by direct dating (Toussaint and Pirson 2006b, Semal *et al.* 2009, Pirson *et al.* 2012; see also Jungels 2009). However, the material dated as Neolithic, Spy 4, was excavated by Twiesselmann in the 1950s. Other material dated as late is from what appears to be a Late Neolithic/Early Bronze Age collective tomb (Semal *et al.* 2009). We also do not discuss the other sites inventoried by Twiesselmann (1971a) where the material is confirmed as Neanderthal (Fond-de-Forêt, La Naulette). Discussions in the section below are more limited than those in section 1.

Engis (Second Cave/Trou Caheur/Grotte de Schmerling), Liège (Province)

- **Nature and location of site:** One of four caves on a small tributary of the Meuse Valley, ~1 km northeast of the Pont d'Engis in the municipality of Flémalle, ~1 km south of the village of Awirs and ~11 km west-southwest of Liège; 50.58 N, 5.40 E.
- **First excavated:** By Schmerling in 1829 and 1830.
- **Later excavations:** By Dupont in 1872, Julien Fraipont in 1885, and several in the 20th century, including the Chercheurs de la Wallonie (Toussaint and Pirson 2006b).
- **Number of individuals:** Four?; a child and two adults recovered in 1829 or 1830, an additional ulna in 1872.
- **Primary description of human remains:** Engis 1 (adult calotte) and 2 (child's calvarium, maxilla and teeth) initially described by Schmerling (1833; numbering as in Twiesselmann 1971a). Restudy by Fraipont (1936) emphasized Engis 2. There is also a study of Engis 1 by Gabriel de Mortillet (1882), and a review by Twiesselmann (1947).
- **Direct dates on human bone:** *Neolithic:* two; both from the same fragment of Engis 1, showing that the calotte is Neolithic (Hedges *et al.* 1996; Toussaint 2001, 2002a; Bocherens *et al.* 2007).

Middle Palaeolithic: two; both from the Engis 2 calvarium (identified as Neanderthal), 26820 ± 340 (OxA-8827) and 30460 ± 210 (GrA-21545) (Toussaint and Pirson 2006b; Toussaint *et al.* 2011b).

- **Other dates known:** None.

• **Diagnosis and Discussion:** Twiesselmann (1971a, 6) described Engis 1, Engis 3 (adult cranial and postcranial fragments) and Engis 4 (isolated ulna) together as a unit, as “Aurignacian burial into Mousterian level. C. Fraipont 1936”, using the singular tense for burial. Whether this means that he thought that the three belonged to a single individual, the literal meaning of the phrase, or as all attributed to the Aurignacian, is unclear. After discovery of the three pieces de Mortillet (1882) had called them Robenhausien (Neolithic). Prior to direct dating the materials were seen as Gravettian in age, following Otte (Spencer 1997; Leguebe and Orban 1984). If Engis 1, 3 and 4 are in fact linked then all three are probably of Neolithic age. Note that Twiesselmann's comment (1971a, 6) that the cave is “now destroyed” is incorrect. The destroyed cave is the “First Cave”.

Engis 2 (child's skeleton) was identified as Neanderthal by Fraipont (1936; confirmed by Tillier 1983 and verified by mtDNA analysis; Serre *et al.* 2004). Its dating is clearly too young, probably because it was varnished in the nineteenth century.

Date (BP)	Number	Burial (if known)	δ13C	δ15N	cal. BP	cal. BC
4590 ± 80	OxA-746	Engis 1 – frag calotte	---	---	5060-5460	3110-3510
4920 ± 50	Beta-154814	Engis 1 – frag calotte	-21.2	---	5600-5700	3650-3750

Frontal (Trou de Frontal/Furfooz), Namur (Province)

- **Nature and location of site:** Cave site on the right bank of the Lesse, ~1 km south-southeast of the Chaleux site in the municipality of Dinant, ~1.5 km south of Furfooz and ~6 km southeast of the confluence of the Lesse and the Meuse in Anseremme; 50.21 N, 4.96 E.
- **First excavated:** By Édouard Dupont in 1864 and 1865 (Beneden and Dupont 1865; see Charles 1996).
- **Later excavations:** By Edouard Rahir from around 1900 to 1902 and Jean-Marc Léotard and Nicolas Cauwe in 1986 (Léotard and Cauwe 1986).
- **Number of individuals:** Sixteen? (see below); recovered by Dupont.
- **Primary description of human remains:** Reported by Beneden *et al.* (1865) and Dupont (1867b, 1872). There is no full publication of the remains.
- **Direct dates on human bone:** Two; from the Neolithic (Hedges *et al.* 1994; Charles 1996; Toussaint and

Becker 1994; Toussaint and Ramon 1997).

- **Other dates known:** three; on fauna confirming Upper Palaeolithic use of the site (Gilot 1984; Léotard 1993; Hedges *et al.* 1994; Charles 1996), ranging from 10720 ± 120 (Lv-1135) to 13130 ± 170 BP (Lv-1750).
- **Diagnosis and Discussion:** This well-known Magdalenian site (de Sonneville-Bordes 1961; Dewez 1987) contains a late glacial fauna (Germonpré *et al.* 2009; van Neer *et al.* 2007). The human bones from this and other sites in the Lesse Valley led to identification of “Furfooz Man”, an Upper Palaeolithic “race” parallel to Cro-Magnon and Grimaldi, among others (e.g. John Lubbock, Arthur Keith, Armand de Quatrefages). The number of finds is unclear. Twiesselmann (1971a, 8-9) lists “two well preserved crania with mandibles in yellow clays”, but it is also clear that more material was recovered. Boyd Dawkins (1874, 236) mentions “sixteen human skeletons”; also stating that there were two skulls, but that “(t)he human remains were mixed pêle mêle with stones and yellow clay within the chamber” (*ibid.*, 238). For Dupont, Trou de Frontal was a Magdalenian burial. However, some nineteenth century workers, including de Mortillet (1882) disagreed and thought that they were Neolithic (see also Engis above). In this context Twiesselmann (1971a; 9) reported a largely recent nitrogen level (4.98%; analysis apparently by K.P. Oakley), indicating that the finds were “not of great antiquity”. From this base the two 14C dates clarify that the human bones from Trou de Frontal are Neolithic.

Date (BP)	Number	Bone(s) (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
4430 ± 80	OxA-4196	Tibia – number not known	-20.1	---	4880-5270	2930-3320
4430 ± 30	GrN-10179	Rib frags – number not known	---	---	4900-5220	2960-3270

Goyet, Namur (Province)

- **Nature and location of site:** Cave complex in the valley of the Samson, a Meuse tributary in the municipality of Gesves, ~3 km south of the confluence of the Samson and the Meuse, and ~10 km east-southeast of Namur; 50.44 N, 5.01 E.

- **First excavated:** By Dupont from *ca* 1868 to 1870 (Germonpré 2001; Di Modica 2009b).

- **Later excavations:** Numerous (see Toussaint 2002a, 2005b; Toussaint *et al.* 1998a; Di Modica 2009b); “amateurs” between 1914 and 1953, plus work by professionals such as A. de Loë (1907 to 1909), F. Twiesselmann (1937-1938) and, most recently, Michel Toussaint (1997 to 2004).

- **Number of individuals:** *Nineteenth century:* Unknown; three adult mandibles, a fragment of parietal and two isolated teeth by Dupont in 1868 (Twiesselmann 1971a). However, other bones found by Dupont were not recognized as human during his excavation; some are Neanderthal and not discussed here further (Rougier *et al.* 2009).

Twentieth century: Many, NMI not yet clear; amongst the bones found are a human radius modified into a point recovered during construction work between 1935 and 1945 (Toussaint 2005a) and a Neolithic child’s burial discovered in 1998 (Toussaint *et al.* 2004; Toussaint 2005b).

- **Primary description of human remains:** *Nineteenth century:* By Hamy (1873; see also Dupont 1872 and Walkhoff 1903).

Twentieth century: The human radius is described by Toussaint (2005a), the child’s burial by Toussaint *et al.* (2004; Toussaint 2005b).

- **Direct dates on human bone:** Four; two each for the Iron Age and Neolithic. The youngest Iron Age date is on material excavated by Dupont (Bronk Ramsey *et al.* 2002; see also Warmenbol 2007), the older on the modified radius. The Neolithic dates are for the child discovered in 1998 (Toussaint *et al.* 2004; Toussaint 2005b), and from the Abri supérieur, date given by Toussaint (2002b) but not discussed.

- **Other dates known:** Eighteen dates from four laboratories confirm the Upper Palaeolithic nature of much of the deposit, though with mixture between levels and Holocene admixture in upper levels (Toussaint *et al.* 1998a; Bronk Ramsey *et al.* 2002; Stevens *et al.* 2009 see also Germonpré 1997, 2001, Germonpré and Hämäläinen 2007, Dalén *et al.* 2007; Sano *et al.* 2011). The full date range is from 10640 ± 50 (KIA-13550) to 38770 ± 1180 BP (GrA-9605).

Diagnosis and Discussion: Though Twiesselmann (1971a) attributed Dupont’s material to the Middle Magdalenian, direct dating suggests that most of it is from the Neolithic, Iron Age or Roman Iron Age, though some Neanderthal bones and teeth excavated by E. Dupont around 1870 have recently been found in the storerooms of the Belgian Royal Institute of Natural Sciences (Rougier *et al.* 2009). Neither human material nor lithics have been identified from the Mesolithic.

Date (BP)	Number	Burial (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
1985 \pm 70	OxA-5678	Roman Iron Age	-19.1	---	1860-2030	AD 90-80 BC
2420 \pm 40	OxA-8875	Iron Age radius	-19.1	---	2360-2670	410-720
4410 \pm 50	Beta-124825	Neolithic child	---	---	4870-5210	2920-3260
5345 \pm 50	OxA-10534	Neolithic	---	---	6010-6200	4060-4250

Reuviau, Namur (Province)

- **Nature and location of site:** Cave site on right bank of the Lesse in the municipality of the city of Dinant, ~1 km south-southwest of Furfooz and ~6 km from the confluence of the Lesse and the Meuse; 50.22 N, 4.96 E.
- **First excavated:** By Dupont in 1865.
- **Later excavations:** None known.
- **Number of individuals:** Two; cranial and postcranial material, mostly fragmentary.
- **Primary description of human remains:** Twiesselmann (1971a) lists cranial and postcranial material. Dupont (1867b) provided a partial inventory, a humerus and a parietal (see also Leguebe and Orban 1984). There has been no apparent restudy.
- **Direct dates on human bone:** One; see Bronk Ramsey *et al.* (2002).
- **Other dates known:** None
- **Diagnosis and Discussion:** Identified as Magdalenian by Twiesselmann (1971a), a Middle Neolithic (Michelsberg) intrusion is confirmed by direct dating, suggested earlier by Rahir (1920).

Date (BP)	Number	Burial (if known)	$\delta^{13}\text{C}$	$\delta^{15}\text{N}$	cal. BP	cal. BC
5025 \pm 65	OxA-5677	Burial 2 – I.G.2585-14	-20.2	---	5670-5690	3720-3940

2.2 Belgian sites discovered since 1960

The single site discussed here is included due to its study parallel to the sites discussed in section 1.2. It was introduced within the umbrella of both Mesolithic and Neolithic sites, and discussed within this context (see e.g. Straus and Otte 1999).

Pape (Abri du Pape), Namur (Province)

- **Nature and location of site:** Small rock shelter at the base of the Rochers de Freyr, bordering the right bank of the Meuse south of Autours and north of Margaux in the municipality of Dinant, ~2 km south of the confluence of the Lesse and the Meuse in Anseremme and ~4 km south-southwest of Dinant; 50.22 N, 4.89 E.
- **First excavated:** Discovered in 1988 by Philippe Lacroix who dug a test-pit (Léotard 1989). In 1989 and 1990 Jean-Marc Léotard and Marcel Otte dug upper levels for the Service de Préhistoire, Université de Liège and S.O.S. Fouilles, extended in 1992 by Lacroix. The initial work excavated Neolithic and younger levels.
- **Later excavations:** In 1993 and 1994 Lawrence Straus, in a combined excavation by the Université de Liège and the University of New Mexico (Léotard *et al.* 1999a), excavated the remnant of the upper Neolithic levels along with the Mesolithic below. Stratigraphically, levels 20 to 23 at the base were Mesolithic, above sterile layers 24 to 26. Level 18 was the base of the Neolithic system (Straus 1999).
- **Number of individuals:** Six?; Toussaint (1999b) provides an MNI of three adults and three children but notes that the remains are fragmentary and scattered in the stratigraphy.
- **Primary description of human remains:** By Toussaint (1999b) as a single unit (refitting was possible of bones recovered from different “units” of the excavation), including a full inventory (286 bones and teeth were recovered including 43 isolated teeth). Masy and Toussaint (1999; Toussaint and Masy 1998) discuss the palaeopathology.
- **Direct dates on human bone:** One, a conventional date showing a Neolithic age (Léotard 1989; Gilot 1997; Cauwe *et al.* 2000; Toussaint 2002a).
- **Other dates known:** Six (Noiret *et al.* 1994; Straus 1999; Toussaint 1999b); charcoal from the lowest apparent level with human remains, dated to 4450 \pm 360 (GX-20206), is associated with Michelsberg-associated ceramics and lithics. Four further dates on charcoal from Mesolithic levels 20 through 22 range from 7843 \pm 85 (GX-19365) to 8817 \pm 85 BP (GX-19366).
- **Diagnosis and Discussion:** Straus *et al.* (1993) initially indicated that a “few human remains” were found in Mesolithic level 20, though probably from the directly dated Neolithic intrusion in level 18 (Léotard 1989). The material recovered in 1988 was from levels V through VII, while that recovered in later work was from

equivalent levels 11 to 15. Level 18, in which the majority of the material appears to have been found was later shown to be from disturbed higher levels (Toussaint 1999b). Disturbance in this level is also seen in the presence of intrusive faunal material, including rabbit.

Date (BP)	Number	Bone (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
4190 \pm 60	Lv-1747	Not known	---	---	4630-4840	2680-2890

2.3 Luxembourg sites

A single site is discussed here. As with Loschbour (section 1.3) it is not included in Twiesselmann (1971b), but listed by Newell *et al.* (1979) as “age and affinities” not demonstrated.

Atsebach, Reuland Commune (Luxembourg)

- **Nature and location of site:** Series of four rock-shelters in the valley of the Ernzt-Noire, <1 km southwest of Loschbour (see above), northeast of the village of Reuland and 15 km north-northeast of the City of Luxembourg; 49.76 N, 6.27 E.
- **First excavated:** By Nicolas Thill in 1936 who recovered the skeletal remains.
- **Later excavations:** None known.
- **Number of individuals:** Four+?; Heuertz (1969) is cryptic on numbering and location of the finds with more explicit information provided by Spier (1993). An adult cranium, Ats1, was recovered from the terrace in front of shelter A1 and interpreted as Mesolithic (Heuertz *et al.* 1959), while an adult skeleton, Ats2, is from where shelters 2 and 3 intersect. Heuertz also indicates recovery of two subadult calvaria, an 11 year old and a 13 year old, together with “fragments of long bones” (Heuertz 1969, 194; free translation). Spier (1993) mentions only the fragmented material. Neither mentions the source of the latter material.
- **Primary description of human remains:** The material was partially described by Heuertz (1969); in more detail by Heuertz *et al.* (1959).
- **Direct dates on human bone:** One; on Ats1, published by Spier (1993; see also Hedges *et al.* 1995). The calibration does not include a marine correction offset (see introduction). Correction, using a Delta R of -46 \pm 60, produces a 1-sigma calibration of 5570-5740 calBP, approximately a century later than the figure below. An attempt to date Ats2 was not successful (*ibid*).
- **Other dates known:** None
- **Diagnosis and Discussion:** Newell *et al.* (1979) concluded that the mixture of Mesolithic and Neolithic materials in a uniform gravel deposit made clear association of skeletal material and archaeological levels impossible. For Spier (1993) Ats1 is clearly Neolithic, Ats2 and the remaining material Ats2 and the remaining materials are undated.

Date (BP)	Number	Burial (if known)	$\delta^{13}C$	$\delta^{15}N$	cal. BP	cal. BC
5010 \pm 80	OxA-3579	Cranial fragment A1, 1945-1	-17.3	---	5660-5890	3710-3940

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