CHAPTER 10
LE TROU MAGRITE

BACKGROUND

Location of site

The site of Le Trou Magrite is a large cave located in the Lower Carboniferous (Viséen) limestone cliffs on the north face of the Lesse river valley, a tributary of the Meuse (Figs. 10.1-10.4). It is found about 25 meters above the current valley floor and faces south-southwest (Straus 1995:23). The Lesse Valley contains a series of important Paleolithic cave sites (including La Naulette, Chaleux, Trou du Frontal, among others). It marks the effective southern limits of Paleolithic occupation in Belgium, due most likely to a lack of cave shelters in southernmost Belgium (except for Couvin) and extreme distance to sources of flint north of the Sambre-Meuse rivers. It should be noted, however, that systematic survey of southern Belgium has not been done for Paleolithic sites, which would have been in the open-air (but see Ziesaire 1994 for a synthesis of such survey and excavation in the Grand Duchy of Luxembourg). In the Province of Luxembourg (the southernmost province of Belgium), only more recent periods are represented in the archaeological record, due to their obviousness on the landscape (e.g., megaliths and Roman architectural features).

Raw material context

Of the sites studied, Le Trou Magrite is the most distant from sources of flint (although Couvin comes in a close second, with Spiennes flint being around 55 km north). Western sources (Obourg, Spiennes) are 70-75 km northwest while sources on the Hesbaye Plateau (Orp, Méhaigne river valley) are around 50 km north and sources in the Maastricht region are up to 80 km distant. Such distances place Le Trou Magrite in Zone 3. Local material includes chert and quartzite cobbles available on the Lesse river terrace and also on the plateau above the site (observed during geological survey), as well as abundant limestone, which was relatively hard, sometimes silicified.

The raw material context thus exerts a stronger influence on the nature of the lithic economy at Le Trou Magrite than for sites in Zones 1 and 2. The distances to flint sources are too great to make regular visits to provision the site, even if raw material procurement was embedded in subsistence activities. Additionally, and more importantly, flint present in an active tool kit would be diminished en route to Le Trou Magrite, arriving at the site in a much reduced, possibly nearly exhausted, state. Luckily for the occupants of Le Trou Magrite, the local limestone, while of relatively poorer quality than flint, was abundant and adequate for producing blanks, including blades.

Excavation history

Le Trou Magrite was first excavated in 1867 by E. Dupont as part of his systematic survey and excavation of cave sites in the Lesse Valley (Dupont 1868-69, 1872). He first visited the site in 1864, noting that the cave and terrace had already been partially cleared (some thirty years before) to prepare a touristic promenade for a nearby hotel (Dupont 1865; Otte 1995:11). His excavations in 1867 yielded a long sequence covering the Middle and Upper

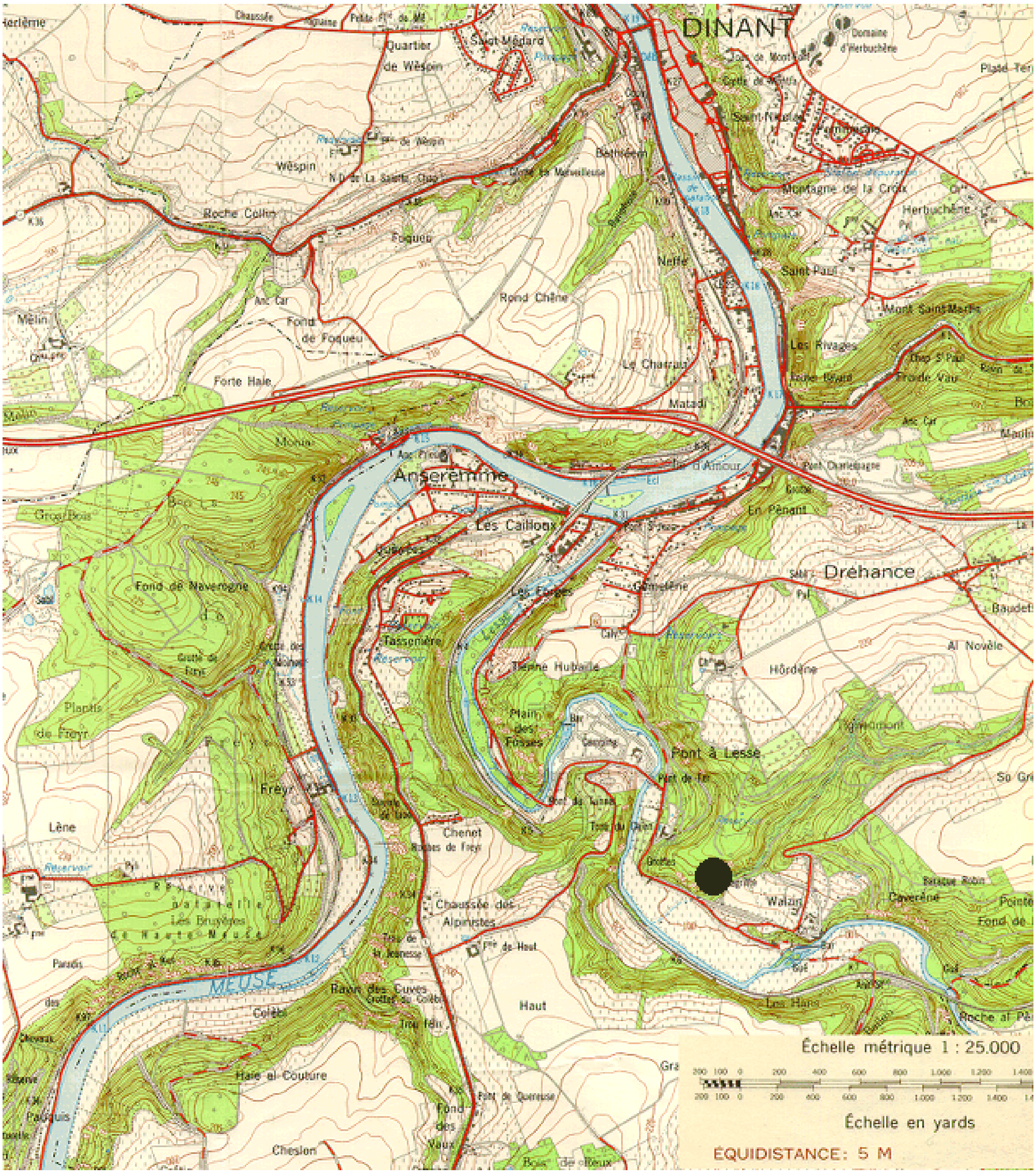

Figure 10.1. Le Trou Magrite. Location of site.
(after Institut Géographique National map 53/7-8, scale 1:25000)

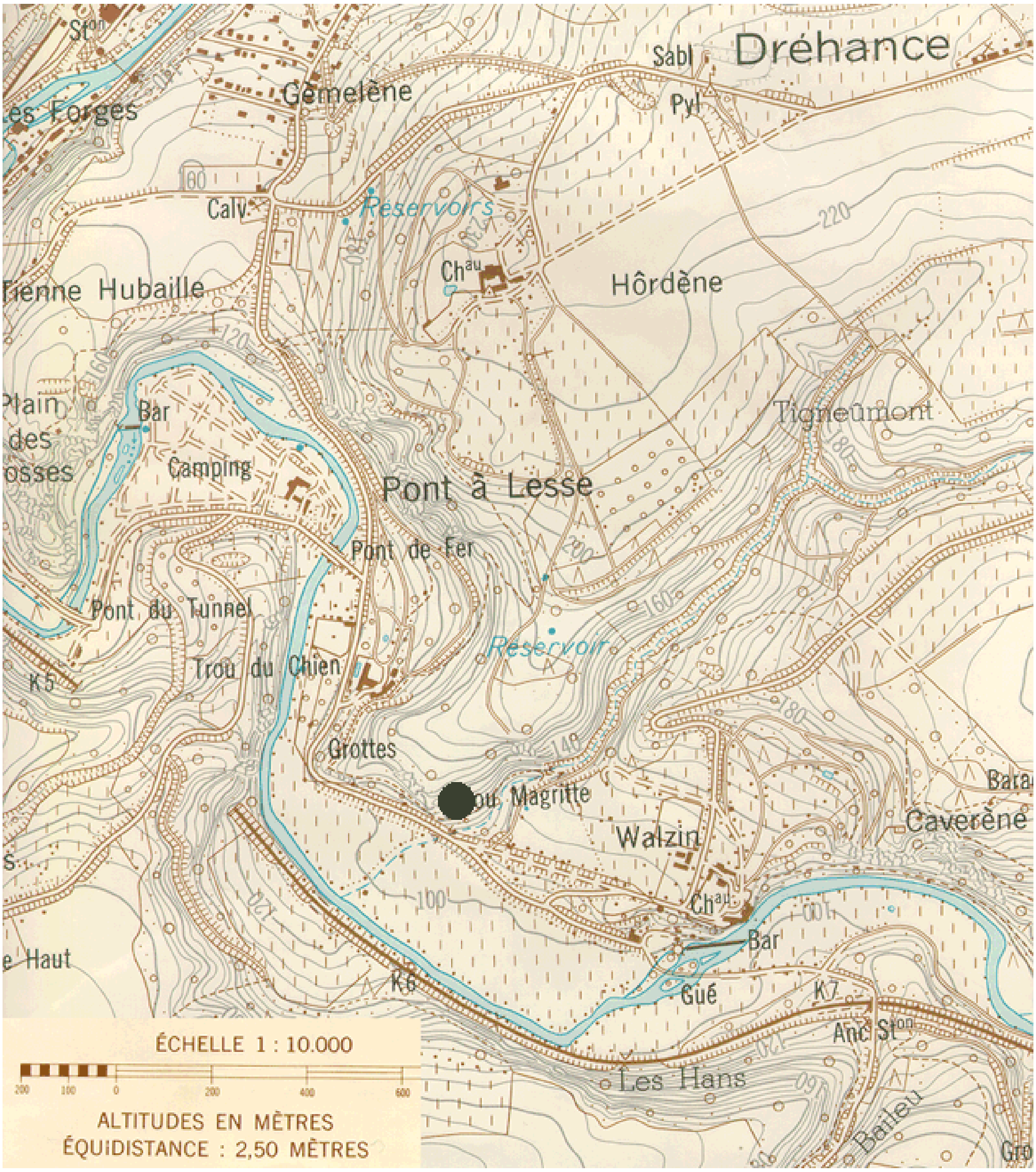

Figure 10.2. Le Trou Magrite. Location of site.
(after Institut Géographique National map 53/8, scale 1:10000)

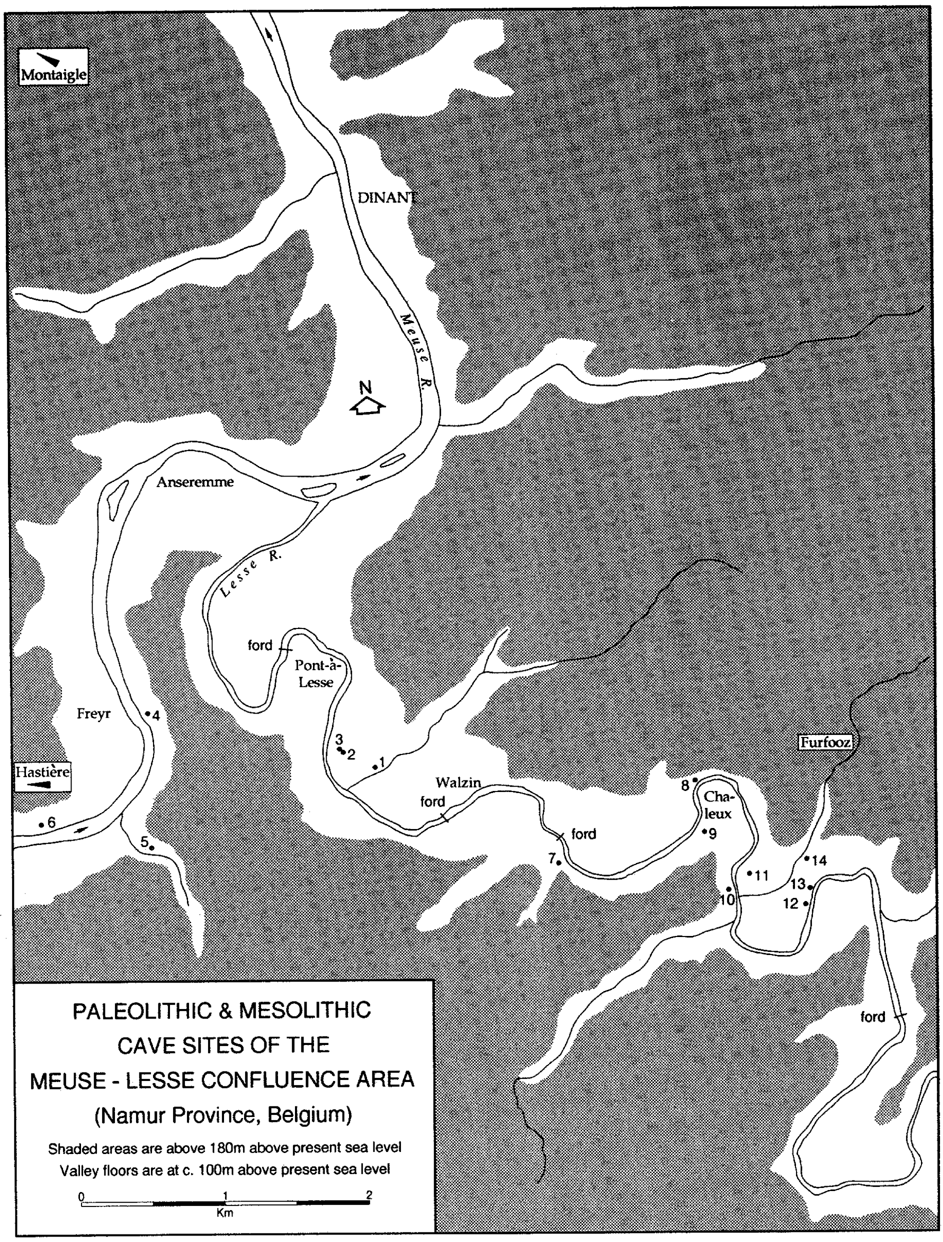

Figure 2.2 : Excavation of the terrace. 1. Trou Magrite; 2. Grotte Martina; 3. Trou Abri; 4. Abri du Pape; 5. Grotte Margaux; 6. Trou Da Somme; 7. La Naulette; 8. Trou de Chaleux; 9. Trou Balleux; 10. Abri de la Poterie; 11. Trou du Renard; 12. Trou du Frontal; 13. Trou des Nutons; 14. Trou Reuviau.

Figure 10.3. Le Trou Magrite. Paleolithic and Mesolithic cave sites of the Meuse-Lesse confluence area. (after Straus 1995:24, Fig. 2.2)

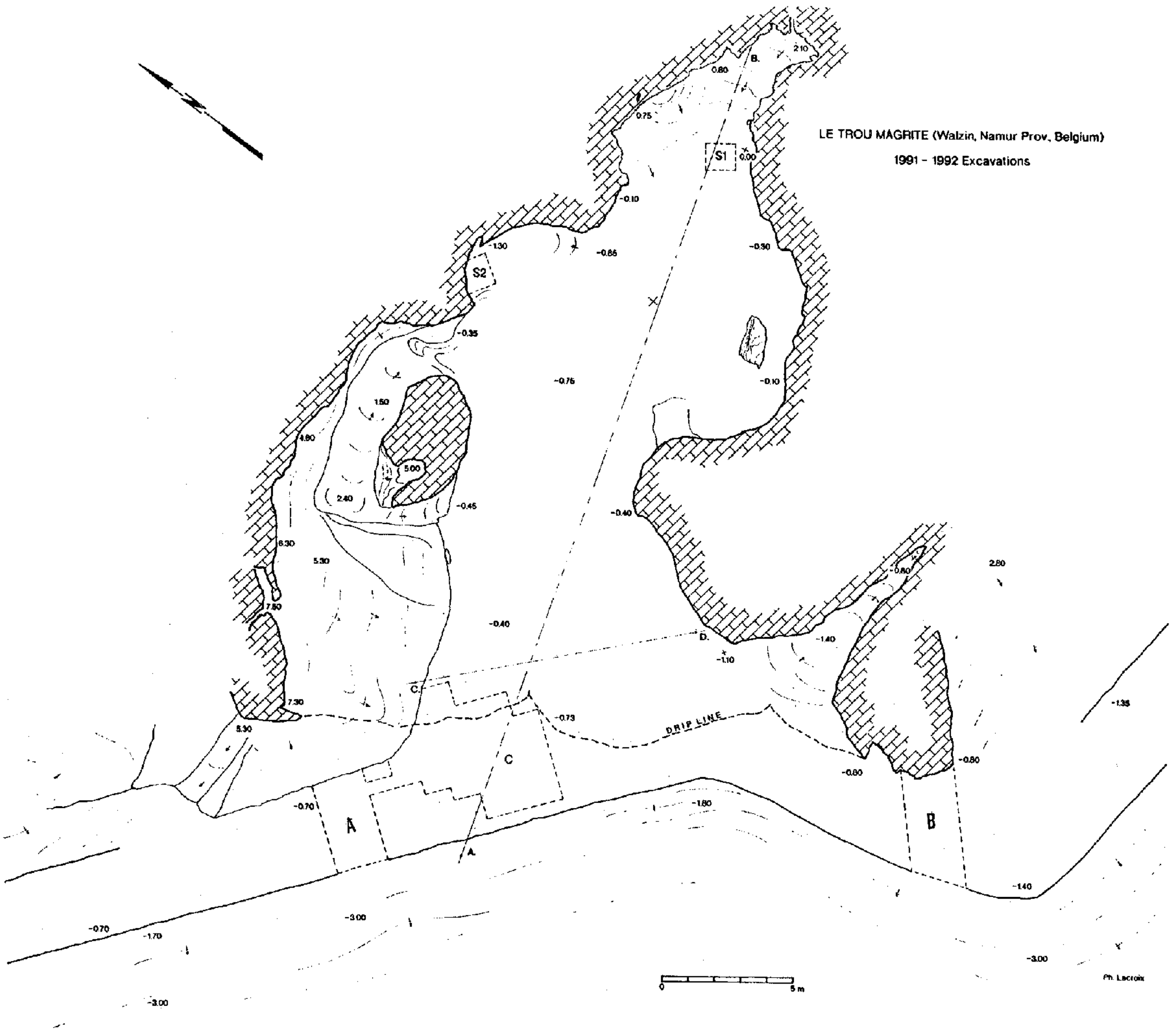

Figure 10.4. Le Trou Magrite. Plan of excavations. (after Straus 1995:27, Fig. 2.3)

Paleolithic, and included four identified archaeological levels which became a significant basis for his ordering of Paleolithic industries.

Subsequent excavations were undertaken by de Loë and Rahir (1908) and Rutot (1913-14) in remnants of intact sediments. More recently, L. Eloy (1960-62) and M. Toussaint (1976) excavated sondages in futile attempts to locate intact sediments.

The 1991-92 excavations directed by M. Otte and L. Straus uncovered an area on the terrace that had been in part protected by the supporting wall of the promenade. Thus, although the construction of the promenade destroyed the upper layers of the site, it protected the lower layers from further erosion down the talus slope.

Stratigraphy

The Dupont stratigraphy, due to its completeness, was extensively studied throughout the history of prehistoric chronological research and served as the basis for Breuil's chronological scheme for Paleolithic chronology (Dupont 1876b:131; Dupont 1868-69:33; Rutot 1906a; Breuil 1907:14; Rutot 1910; Peyrony 1948; Eloy 1956; de Sonneville-Bordes 1961; more recently by Ulrix-Closset 1975; Otte 1979; Dewez 1987). Otte (1995) recently summarized various interpretations of Dupont's stratigraphy and presented the currently accepted interpretation, due mainly to Dewez's (1985) detailed analysis. This interpretation is summarized below (Table 10.1) (after Otte 1995:13; Straus 1995c:101):

Appr. thickness	Geological formation	Archaeological level	Cultural attribution	Otte/Straus stratigraphy
1 m	clay with blocks	-	Magdalenian; Mesolithic or later	
2.5 m	clayey layer	A1	Upper Perigordian with Font-Robert points	
		A2	Evolved Aurignacian	Stratum 2
	stratified sandy layer	B3	Aurignacian	Stratum 3
		B4	Mousterian	Strata 4 and 5
	rolled Ardennes cobbles		sterile	

Table 10.1. Dupont stratigraphy, and correspondence with Otte/Straus stratigraphy.

For Dupont, the upper part of this sequence formed a major stage in his chronological ordering of Paleolithic industries (Montaigle = Aurignacian; Trou Magrite = Perigordian with Font-Robert points; Goyet = Perigordian with truncated pieces; Chaleux = Magdalenian) (Otte 1995:13-14).

The Otte/Straus stratigraphy on the terrace can be summarized as follows, from top to bottom (after Straus 1995a:36-45) (Figs. 10.5-10.8):

Stratum 1. blackish-brown humic topsoil and backdirt from earlier excavations (30-70 cm thick)
Stratum 1.1. light brown silt infilling a post-Paleolithic pit
Stratum 2. small, angular cryoclastic éboulis (25-40 cm thick)
Stratum 3. cryoclastic éboulis with larger blocks and slabs in a gravel matrix (generally 30-35 cm thick)

Stratum 4.	light (yellowish) brown clayey silt containing very large roof-fall boulders
Stratum 5.	waterlain deposits; upper: stony, light brown-beige silt; middle: owl regurgitation pellets; lower: pure yellowish beige-brown silt
Stratum 6.	crevice between or through bedrock and boulders.

Archaeological and cultural attributions of the above strata are summarized as follows (after Straus 1995b:55-86) (Fig. 10.9):

Stratum 1.	mixed modern, sub-modern and Paleolithic artifacts and faunal remains
Stratum 1.1.	large post-Paleolithic pit, probably mid-Holocene
Stratum 2.	richest archaeological layer, intact; Aurignacian, 30-27,000 yrs BP
Stratum 3.	Early Aurignacian, 32-34,000 yrs BP, 41,000 yrs BP
Stratum 4.	rare lithics and fauna, including five Upper Paleolithic and five Middle Paleolithic tools
Stratum 5.	rare lithics and fauna, with lens of rodent bones (owl regurgitation pellets); Mousterian but non-diagnostic.

Dating of the site

One of the major benefits of the Otte and Straus excavations is the series of dates obtained on Strata 2 and 3, summarized in Table 10.2 below (after Straus 1995b:65). Briefly (see Straus 1995b:55-86 for more detailed discussion), for Stratum 2, the first date is contaminated and for the second, bone apatite has proven to be unreliable for dating. The remaining three dates give the best estimate of Stratum 2, roughly 32/34-28,000 yrs BP. For Stratum 3, the first date, at 2 standard deviations, is similar to basal Stratum 2, and is supported by the second date. The third date of 41,300 ± 1690, while unexpectedly old, appears to be the only reliable date. According to Stafford, it is the only sample dated by AMS on aspartic acid that is not contaminated. Additionally, the date was obtained using an individual amino acid that could have only come from the bone (Straus 1995b:73; Straus, pers. comm.). Bone samples taken from Strata 4 and 5 were unsuccessful due to lack of protein remaining.

Stratum	**Material dated**	**Method**	**Lab No.**	**Date BP**	**± 1 SD**	**Range @ 2 SD**
2 top	charcoal	AMS	Ox-A-4040	17,900	200	18,300-17,500
2	bone apatite	Conv	GX-17017A	22,700	1150	25,000-20,400
2	bone gelatin	Conv	GX-17017G	26,580	1310	29,200-23,960
2 base	bone gelatin	Conv	GX-18538G	30,100	2200	34,500-25,700
2 base	bone gelatin	Conv	GX-18537G	34,225	1925	38,075-30,075
3	bone gelatin	Conv	GX-18540G	27,900	3400	34,700-21,100
3	bone gelatin	Conv	GX-18539G	>33,800	-	-
3 mid	aspartic acid+	AMS	CAMS-10352	41,300	1690	44,680-37,920
4a	aspartic acid*	AMS	CAMS-10358	30,890	660	32,210-29,570
4a	aspartic acid*	AMS	CAMS-10362	21,550	190	21,930-21,170
5	aspartic acid*	AMS	CAMS-10356	12,450	250	12,950-11,950

Table 10.2. Radiocarbon dates obtained at Le Trou Magrite (Otte and Straus excavations).
+: very well preserved bone: % N = 1.74. *: very poorly preserved bone: protein leached out (according to T. Stafford).

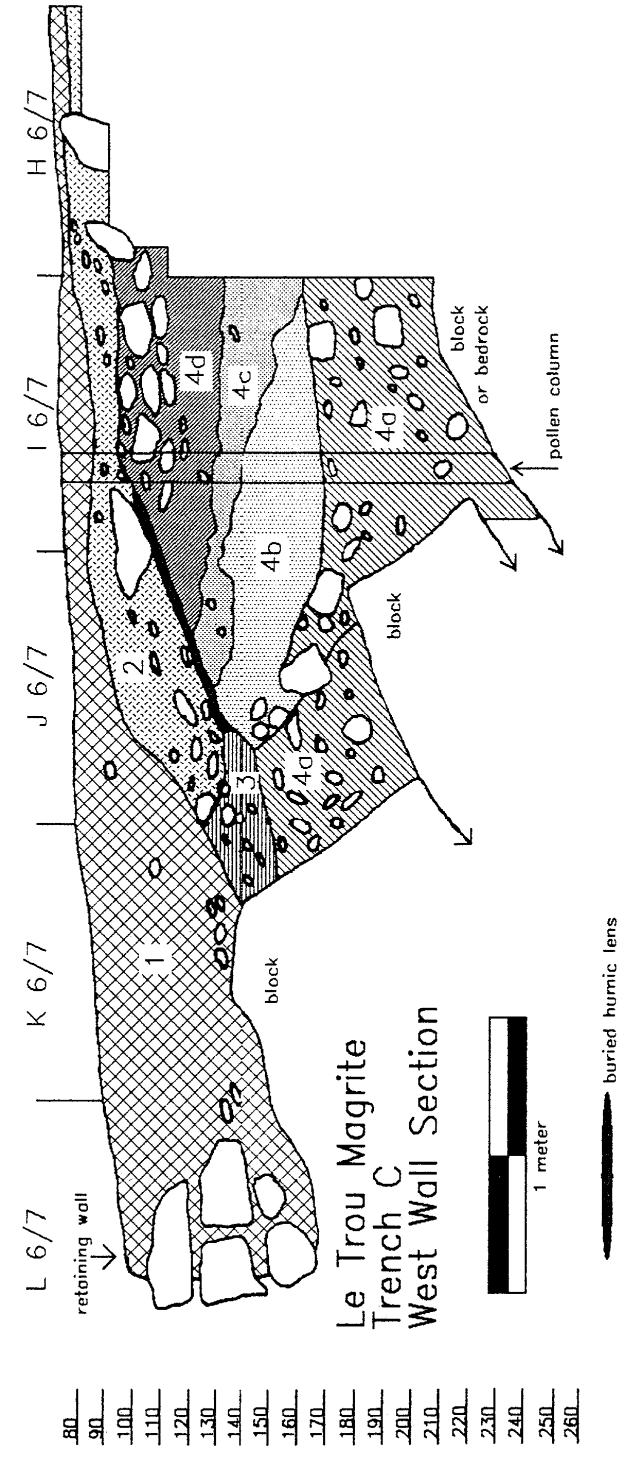

Figure 10.5. Le Trou Magrite. Trench C, West Section. (after Straus 1995:37, Fig. 2.10)

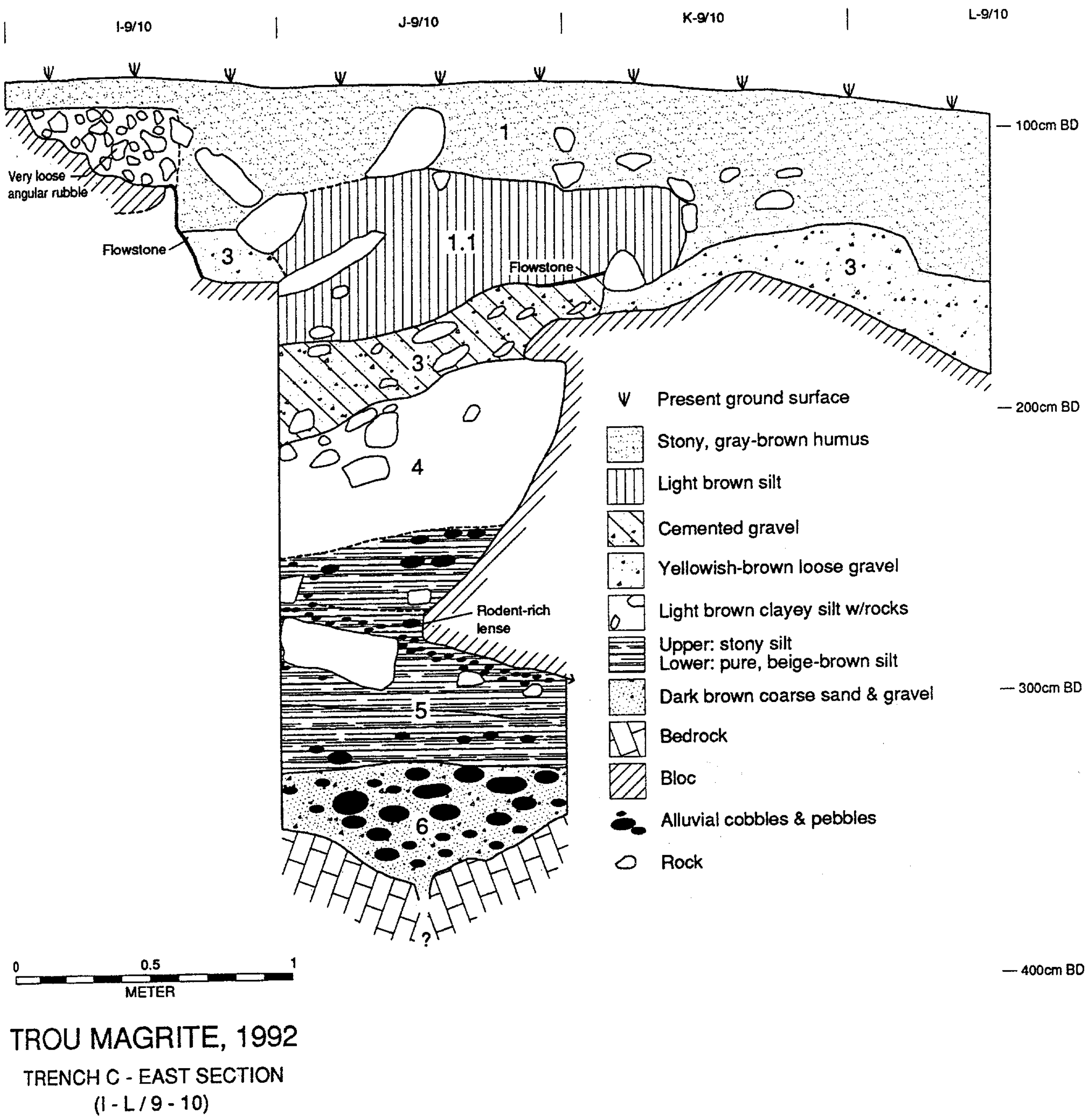

Figure 10.6. Le Trou Magrite. Trench C, East Section. (after Straus 1995:39, Fig. 2.12)

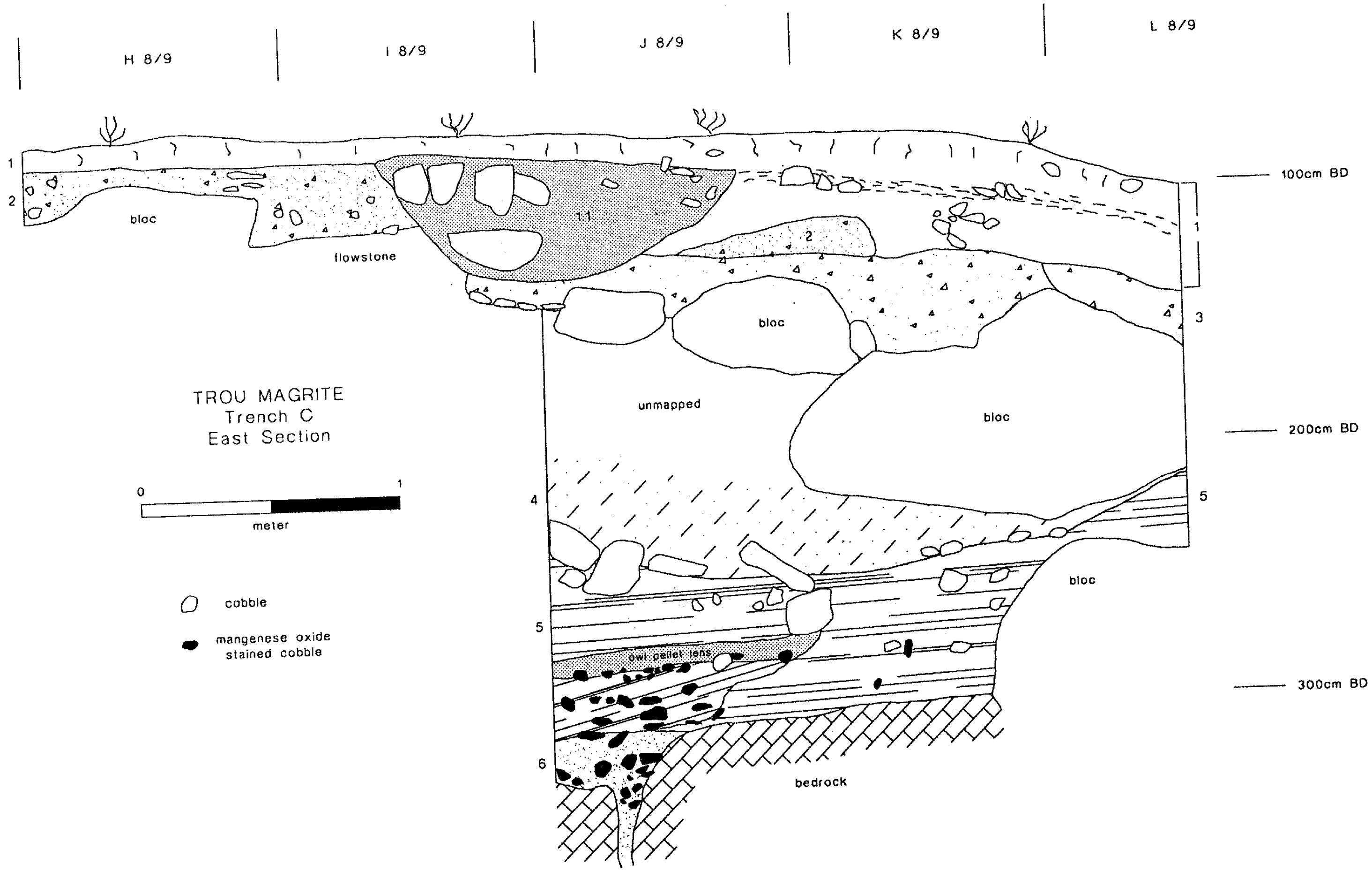

Figure 10.7. Le Trou Magrite. Trench C, East Section. (after Straus 1995:40, Fig. 2.13)

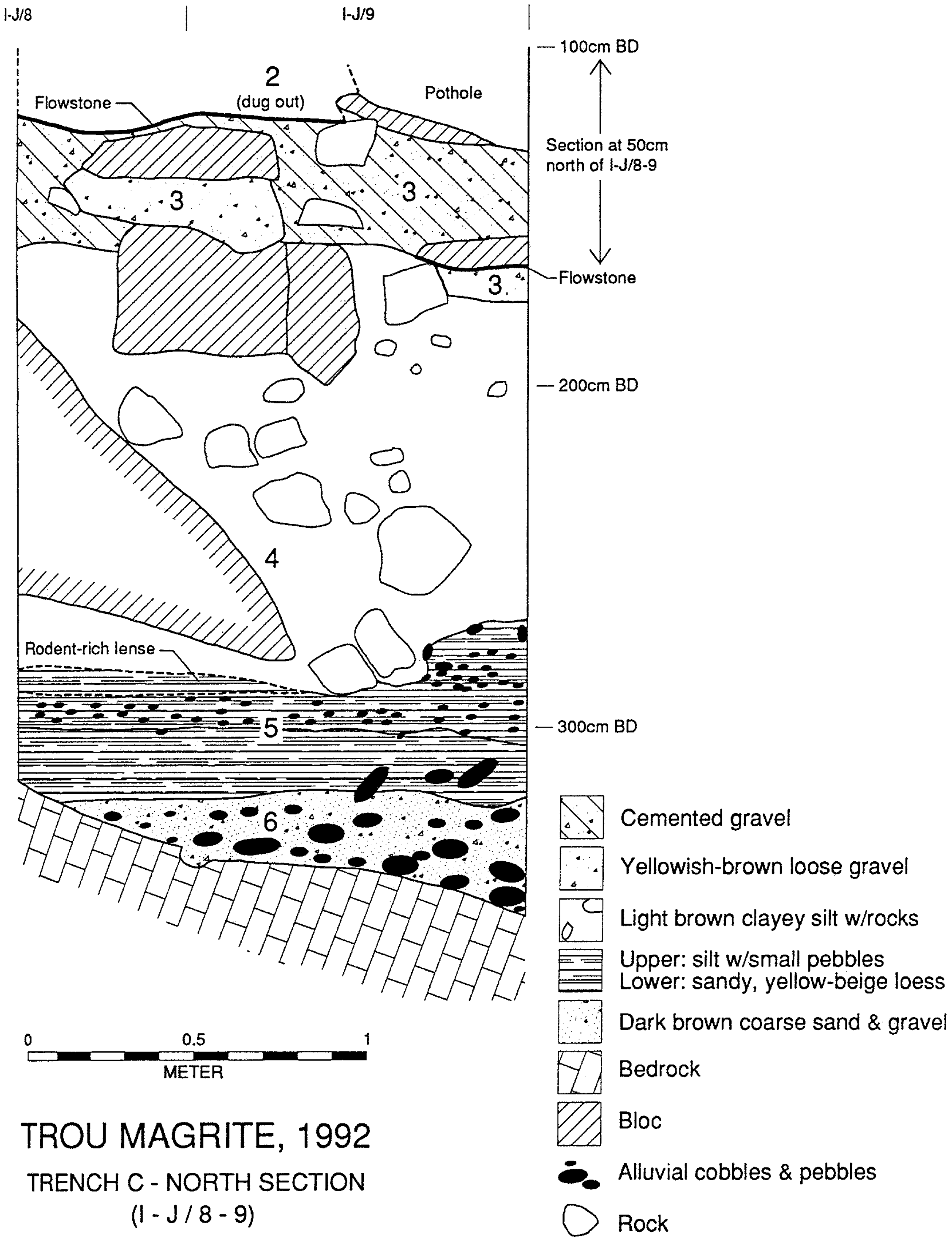

Figure 10.8. Le Trou Magrite. Trench C, North Section. (after Straus 1995::41, Fig. 2.14)

SUMMARY OF THE TROU MAGRITE CHRONOSTRATIGRAPHY

Stratum	Industry	Radiocarbon	Microfauna	Sedimentology
1.1 pit	Meso/Neolithic			
(Hiatus due to removal of Gravettian & Magdalenian in A.D. 1830)				
2 3	Aurignacian	34 ± 2 ka 41 ± 2 ka		Ox. isot.stage 3
(Hiatus/erosion in late Oxygen isotope stage 4 or early stage 3)				
4	Mousterian			Ox. isot. stage 4
5 up/mid	Owl/rodent lens		Ox. isot. stage 5b	
5	Mousterian			Ox. isot. stage 5
6	Sterile, fluviatile			Ox. isot. stage 5e

Figure 10.9. Le Trou Magrite. Summary of the Trou Magrite chronostratigraphy. (after Straus 1995::84, Table 4.5)

Climate and environment

From analyses of sediment and fauna, approximate climatic and environmental conditions have been reconstructed (Haesaerts 1995; Gautier 1995; Cordy 1995). Both Strata 3 and 2 were deposited under cold, somewhat humid conditions (late oxygen isotope stage 3), with evidence of freeze-thaw action. Stratum 3 appears to have been more humid. Stratum 4 contains loess deposited during alternating cold and dry conditions (4d-top and 4b-lower middle) and more humid conditions (4c-upper middle and 4a-base), by eolian and colluvial processes respectively. Based on the microfauna in the owl pellet lens, Stratum 5 was deposited in a cold climate; based on the presence of a sandy silt matrix deposited by water, there was "at least periodical high local humidity" (Straus 1995b:81; Haesaerts 1995). The microfauna shows similarities to Couche Vg/4 at Scladina Cave, located on the Meuse at Sclayn.

The macrofaunal faunal analysis by Gautier (1995) shows that the major game animals were, in decreasing order, reindeer, horse, and ibex, with similar percentages for Strata 3 and 2.

Seasonality studies by Stutz *et al.* (1995) on dental cementum revealed that winter kills were present, with most kills falling within fall and winter (October-April) and more commonly in winter and early spring (Stutz *et al.* 1995:181). An important point made was that "the simple presence of winter kills implies that during the Upper Pleistocene, in all but the most extreme arctic climatic oscillations, the Meuse River drainage and its adjoining tributary valleys provided adequate cold-season resources and shelter to support small groups of hominid foragers" (Stutz *et al.* 1995:180).

These results have important implications for the degree of seasonal mobility and access to lithic resources for hunter-gatherers in the Early Upper Paleolithic. First, in my view, winter-spring occupations of caves suggests a degree of seasonal sedentism, that caves such as Le Trou Magrite, Goyet and Spy served as residential camps over a period of months because they provided shelter. Short-term hunting camps may have been used in the vicinity but caves would have been a more permanent location to which to return. Rigorous climatic conditions would limit mobility during winters. Second, such a limit on mobility would limit access to distant flint resources at sites such as Le Trou Magrite, where the nearest flint sources were at least 40 km distant, because travelling during winter would have been too difficult. Stutz *et al.* (1995:181) raise the question of where hunter-gatherers settled from May to September, and suggest three possibilities: "occupation of open-air sites in the Mosan Basin as part of a year-round occupation of the river valleys, … seasonal movement out of the valleys to hunt reindeer, horse and other gregarious species that would have migrated to upland or open regions, such as the plains, … and summer kills were originally present at the Mosan Basin cave sites but have not yet been uncovered or by fluke have not survived."

Assemblage samples and problems

Only the assemblages recovered from the Otte/Straus excavations were selected for study, on the basis of the quality of data recovery with modern excavation techniques. The four assemblages come from Strata 5 and 4 (Mousterian) (Table 10.4 in Part B) and Strata 3 and 2 (Aurignacian) (Table 10.3). Although Dupont's excavation produced a long stratigraphic sequence, problems of correlating his stratigraphy with the Otte/Straus stratigraphy made it preferable to limit the sample to the modern excavation. First, Dupont's descriptions of the stratigraphic sequence (including geological and archaeological levels) were not always clear. Second, according to Straus, "surviving museum collections are unfortunately curated with only minimal provenience indications and are generally mixed" (Straus 1995a:21). Otte (1979) studied the Aurignacian and Gravettian components of the site, but found that, apart from certain diagnostic tool types, the majority of artifacts could not be attributed to one or the other of the components (Otte 1979; Straus 1995c:98).

	Stratum 2				Stratum 3			
	Count		Weight		Count		Weight	
Type	**n**	**%**	**wt in g**	**%**	**n**	**%**	**wt in g**	**%**
1 - Obourg	-	-	-	-	-	-	-	-
2 - Spiennes	-	-	-	-	1	-	12	0.12
3 - Hesbaye	3065	58.9	2580	16.9	830	31.7	1049	10.2
4 - phtanite	38	0.7	99	0.65	17	0.6	32	0.31
5 - Wommersom	-	-	-	-	-	-	-	-
6 - tan flints	-	-	-	-	-	-	-	-
7 - black flints	135	2.6	397	2.6	117	4.5	328	3.2
8 - gray flints	2	0	4	0.03	3	0.1	6	0.06
9 - brown flint	-	-	-	-	-	-	-	-
10 - cherts	131	2.5	561	3.7	123	4.7	1009	9.8
11 - quartzites	106	2.0	1341	8.8	55	2.1	535	5.2
12 - sandstone	3	0.1	19	0.12	12	0.5	35*	0.34
13 - black limestone	1698	32.6	10113	66.0	1440	55.0	6783	66.0
14 - quartz	24	0.5	96	0.63	17	0.6	129	1.3
missing	3	0.1	-	-	4	0.2	-	-
Total	**5205**	**100.0**	**15233 (n=1702)**		**2619**	**100.0**	**10259 (n=1252)****	**96.5**

* Two sandstone fire-cracked rocks weighing 235 g excluded.
** n=1252 but this includes records where count > 1 so actual n of artifacts =2619.
Table 10.3. Frequencies by count and weight for Strata 2 and 3 (Aurignacian levels).

PART A: STRATA 2 AND 3: AURIGNACIAN

RANKING OF MATERIALS BY FREQUENCY AND WEIGHT

Materials are ranked differently according to count or weight, which means that there is variability between material types in terms of size of artifacts. Flint is represented by numerous small and light artifacts (frequency % is greater than weight %), while limestone is represented by relatively fewer artifacts which are larger and heavier (weight % is greater than frequency %). The difference in ranking can also reflect differences in the raw materials itself: a kilogram of flint and a kilogram of limestone have different mass.

The order of ranking between count and weight measures changes more radically in Stratum 2 than in Stratum 3 (Tables 10.5 and 10.6. In Stratum 3, the top three materials are in the same order but limestone and chert are heavier per artifact and Hesbaye flint lighter. Ranks 4 and 5 reverse, where quartzites are heavier than black flints but black flints are more numerous than quartzites. Quartz remains in Rank 6. Ranks 7-8 and 9-10 are substantially identical.

In Stratum 2, the top two materials reverse positions, where limestone is much heavier than Hesbaye, but Hesbaye flint artifacts are much more numerous. Ranks 3-5 are similar in frequency for black flint, cherts, and quartzites, but vary in weight and are in reverse order. Ranks 6-9 do not vary in rank between frequency and weight.

Rank	**Type**	**Count %**		**Rank**	**Type**	**Weight %**
1	13 - limestone	55.0		1	13 - limestone	66.0
2	3 - Hesbaye	31.7		2	3 - Hesbaye	10.2
3	10 - cherts	4.7		3	10 - cherts	9.8
4	7 - black	4.5		4	11 - quartzites	5.2
5	11 - quartzites	2.1		5	7 - black	3.2
6	14 - quartz	0.6		6	14 - quartz	1.3
7	4 - phtanite	0.6		7	12 - sandstone	0.34
8	12 -sandstone	0.5		8	4 - phtanite	0.31
9	8 - gray flints	0.1		9	2 - Spiennes	0.12
10	2 - Spiennes	0		10	8 - gray flints	0.06

Table 10.5. Le Trou Magrite. Stratum 3. Ranking of material types by frequency and weight.

Rank	**Type**	**Count %**		**Rank**	**Type**	**Weight %**
1	3 - Hesbaye	58.9		1	13 - limestone	66.0
2	13 - limestone	32.6		2	3 - Hesbaye	16.9
3	7 - black	2.6		3	11 - quartzites	8.8
4	10 - cherts	2.5		4	10 - cherts	3.7
5	11 - quartzites	2.0		5	7 - black	2.6
6	4 - phtanite	0.7		6	4 - phtanite	0.65
7	14 - quartz	0.5		7	14 - quartz	0.63
8	12 -sandstone	0.1		8	12 - sandstone	0.12
9	8 - gray flints	0		9	8 - gray flints	0.03

Table 10.6. Le Trou Magrite. Stratum 2. Ranking of material types by frequency and weight.

When the ranking is collapsed (Tables 10.7 and 10.8), four ranks can be observed, although Ranks 3 and 4 can be combined, here being separated to show the extreme rarity of certain material types. Comparing Stratum 3 with Stratum 2, the collapsed ranking shows a clear and important reversal between Ranks 1 and 2, reflecting a reversal in the importance of the local limestone and the non-local Hesbaye flint. By count, the local limestone was dominant in Stratum 3, Hesbaye flint in Stratum 2. However, by weight, both strata would have similar rankings for the two materials, indicating that the artifacts on Hesbaye flint used in Stratum 2 were much smaller and in greater quantity than those in Stratum 3. This may be the result of the transport of an already greatly diminished supply of flint and an extreme increase in intensity of utilization of flint to maximize the small supply remaining.

Rank 3 (and 4) materials are nearly all local, apart from the very rare presence of Spiennes flint in Stratum 3 and gray flints in Stratum 2, both of which, it should be said, may represent variants of Hesbaye flint.

Rank	No(s).	Type(s)	Count %	Weight %
1	13	black limestone	55	66.0
2	3	Hesbaye flint	31.7	10.2
3	10, 7, 11	cherts, black flint, quartzites	2.1-4.7	3-10
4	14, 4, 12, 2	quartz, phtanite, sandstone, Spiennes	< 1.0	< 2.0

Table 10.7. Le Trou Magrite. Stratum 3. Collapsed ranking of material types.

Rank	No(s).	Type(s)	Count %	Weight %
1	3	Hesbaye flint	58.9	16.9
2	13	black limestone	32.6	66.0
3	7, 10, 11	black flint, cherts, quartzites	2.0-2.6	2.6-8.8
4	4, 14, 12, 8	phtanite, quartz, sandstone, gray flints	< 1.0	< 1.0

Table 10.8. Le Trou Magrite. Stratum 2. Collapsed ranking of material types.

SOURCES OF MATERIAL UTILIZED

Rank 1

Hesbaye flints (Type 3), likely comprising a variety of possible proveniences which patinate similarly, come from the nearest flint source region (Fig. 10.10). However, the Hesbaye plateau itself is at minimum 40 km distant (following the Meuse to the western part of the Hesbaye Plateau north of Andenne) and sources in the Méhaigne valley are at least 50 km distant, with a maximum around 80 km for sources between Liège and Maastricht.

Rank 2

Black limestone (Type 13) is local and abundant (Fig. 10.11).

Rank 3

Black flint (Type 7) is of unknown provenience, but is not found locally, and matches neither Obourg nor Lanaye samples in lithic reference collections. It could be Tertiary black flint from the Brabant Plateau near Ottignies approximately 55 km distant (based on a sample provided by Eric Teheux).

Cherts (Type 10) are local and similar samples have been found (through survey) in the plateau up and behind Trou Magrite (near Dréhance).

Quartzites (Type 11) could have come from local secondary deposits (banks, terrace) from the Lesse River which passes in front of Trou Magrite.

Rank 4

Phtanite (Type 4) of the type found here (and the type commonly found archaeologically) comes from a highly localized known provenience on the Brabant Plateau near Ottignies-Mousty, about 55 km distant.

Quartz (Type 14) was likely obtained in the form of quartz cobbles found, like quartzite, in local secondary deposits of the Meuse.

Sandstone (Type 12) does not include any examples of Brussels sandstone.

Gray flints (Type 8) have unknown provenience, but probably come from one of the Hesbaye sources.

TRANSPORT OF MATERIAL

Cortex attributes and debitage analysis to identify stages of the chaîne opératoire were used to make inferences of transport form of material to the site. Assemblage structure for Strata 3 and 2 are summarized in Tables 10.9 and 10.10.

Stratum 3

Rank 1 material		
Type	**Assemblage structure**	**Brought to site as...**
13 - limestone	3 cores, 37 tools, 1066 blanks, 334 debris (including 75 chunks*)	unprepared blocks of material
Rank 2 material		
Type	**Assemblage structure**	**Brought to site as...**
3 - Hesbaye flint	1 core, 45 tools, 382 blanks, 402 debris (including 25 chunks)	prepared cores or cores already in use
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
10 - cherts	4 cores, 11 tools, 80 blanks, 28 debris (including 17 chunks)	prepared cores
7 - black flint	6 tools, 77 blanks, 34 debris (including 7 chunks)	nearly exhausted core(s), blanks
11 - quartzites	1 core, 3 tools, 44 blanks, 7 debris (including 3 chunks)	prepared core(s)
Rank 4 materials		
Type	**Assemblage structure**	**Brought to site as...**
14 - quartz	12 blanks, 5 debris (including 2 chunks)	blanks, possible chunk/core
4 - phtanite	10 blanks, 7 debris (including 3 chunks)	blanks
12 - sandstone	2 tools, 8 blanks	blanks and finished tools
2 - Spiennes flint	unretouched crested blade	crested blade

* Chunks are probably core remnants.

Table 10.9. Le Trou Magrite. Stratum 3. Transport form of raw materials (plus general assemblage structure).

The dominant material (Rank 1) in Stratum 3 is local black limestone, which is abundant and readily available although of poorer quality than flint. Transport costs are low. All stages of the reduction sequence are represented. Cortex attributes could not be used because cortex is not present on this material. Additionally, primary reduction or cortex removal from cores would not have been necessary. It is likely that many or most of the chunks are core fragments. The three recognizable cores are all flake cores.

The Rank 2 material, Hesbaye flint, comes from the nearest flint source region, but this source region is too far to regularly exploit to provision the site after arrival. This material would have been brought to the site as material already in use and conserved. Cortex is rare and cores reflect increased intensity of blank production to maximize the remaining material since new stock of flint could not be procured. Material came to the site as active cores, blanks, and finished tools. When it was exhausted, it was most likely replaced by black limestone.

Rank 3 material includes both local and non-local material which reflect a much more minor degree of reduction. The non-local material, black flint, lacks cores although there are seven chunks which could have been core fragments. Material would have been transported as nearly exhausted cores, blanks, and finished tools. As discussed in chapter 12, I argue that this material was procured prior to Hesbaye flint, both at previously occupied sites, and represents the last stages of an already dwindled supply. For the local materials, certain suitable chunks or cobbles could have been easily found and reduced, with cortex or cobble surface removed before transport, but were not extensively exploited. Chert and quartzite may have been more suitable for certain kinds of tools than the softer limestone.

Rank 4 materials are present only in very low percentages and were transported to the site as blanks and finished tools. No reduction occurred.

Stratum 2

Rank 1 material		
Type	**Assemblage structure**	**Brought to site as...**
3 - Hesbaye flint	3 cores, 76 tools, 1331 blanks, 1655 debris (including 137 chunks)	prepared, active cores
Rank 2 material		
Type	**Assemblage structure**	**Brought to site as...**
13 - limestone	11 cores, 24 tools, 1394 blanks, 269 debris (including 123 chunks)	unprepared blocks or shaped blocks
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
7 - black flint	13 cores, 2 tools, 83 blanks, 37 debris (including 17 chunks*)	active cores close to the last stages of reduction
10 - cherts	3 tools, 90 blanks, 38 debris (including 16 chunks)	chunks
11 - quartzites	4 cores, 2 tools, 95 blanks, 5 debris (including 3 chunks)	prepared cores (= decorticated esp. if cobbles)
Rank 4 materials		
Type	**Assemblage structure**	**Brought to site as...**
4 - phtanite	2 tools, 32 blanks, 4 debris (including 2 chunks)	blanks and finished tools, possible exhausted core
14 - quartz	15 blanks, 9 debris (including 5 chunks)	blanks
12 - sandstone	3 blanks	blanks
8 - gray flints	2 blanks	blanks

* Chunks are probably core remnants.

Table 10.10. Le Trou Magrite. Stratum 2. Transport form of raw materials (plus general assemblage structure).

In Stratum 2, the dominant material is Hesbaye flint. Hesbaye flint is nearly twice as common as black limestone (by count) in Stratum 2 but has the same weight percentage as in Stratum 3. This is due to the much higher frequency of debris (trimming flakes and shatter): 1655 artifacts for Hesbaye flint versus 269 for limestone. Blanks and tools together are in similar frequency although there are more tools on Hesbaye flint than on limestone. There are only three recognizable cores (as opposed to one in Stratum 3), but there are 137 chunks (versus 25 in Stratum 3). More material was brought to the site during the Stratum 2 occupation than Stratum 3 (2580 g vs. 1049 g.). It is unlikely that this increase in quantity reflects logistical trips, while the site was occupied, to obtain flint, because the quantity of flint present is still low and inadequate to completely provision the site. The absence of recognizable cores makes it more likely that all of the material was transported as an active tool kit from a previous occupation closer to the Hesbaye Plateau. This could have been in preparation for an occupation of longer duration than that represented in Stratum 3 or could reflect some sort of change in transport technology which permitted the transport of more material.

Black limestone falls to Rank 2 by count in Stratum 2, roughly reversing percentages with Hesbaye flint, but has the same weight percentage as in Stratum 3. While more Hesbaye flint was available as compared to Stratum 3, it was still limited with no possibility of obtaining fresh flint when it was exhausted. Limestone continues to replace or supplement the flint supply. There are 11 recognizable cores (6 flake, 1 prismatic blade, 1 pyramidal bladelet, and 3 mixed cores) and 123 chunks as opposed to 3 cores and 75 chunks in Stratum 3. This increase in use of local material supports an interpretation of longer duration of occupation during the Stratum 3 occupation.

Rank 3 materials include black flint, chert, and quartzite. These are identically ranked in Stratum 3 and reflect a similar minor degree of use in comparison with limestone and Hesbaye flint. Percentages decrease due to the increase in use of Hesbaye flint but remain similar to those in Stratum 3. One major difference is that black flint includes 13 cores and 17 chunks in Stratum 2, as opposed to no cores and 7 chunks in Stratum 3. A working hypothesis (see chapter 12) is that black flint was obtained prior to Hesbaye flint, as in Stratum 3, but with a shorter length of time between procurement and arrival at Trou Magrite. While it is still nearly exhausted, the assemblage structure is more complete than in Stratum 3, with a series of cores present rather than simply blanks and tools.

In contrast, local chert is much rarer in Stratum 2 than in Stratum 3. There no cores and 16 chunks versus 4 cores and 17 chunks in Stratum 3. Quartzite is used slightly more than in Stratum 3. There are 4 cores and 3 chunks versus 1 core and 3 chunks in Stratum 3. Perhaps with more flint available, local chert was rejected.

Rank 4 materials include the same range of materials as in Stratum 3 - phtanite, quartz, and sandstone - with the exception that Spiennes flint (n=1 in Stratum 3) is now absent and only two artifacts in gray flint are present in Stratum 2. No reduction occurred and material was transported as blanks and finished tools, although there are some chunks in phtanite and quartz. Again, these materials represent the very last stages in the history of the material - cores have been exhausted prior to arrival at Trou Magrite and only blanks and tools remain. Local quartz was probably again rejected as unsuitable.

Overall, each material tends to include a wider range of assemblage components than in Stratum 3 (materials lacking cores in Stratum 3 *are* represented by cores in Stratum 2) and a greater quantity (more cores, more blanks, more tools). These observations have two implications. First, there could be shorter intervals between sites so that material such as black flint, obtained prior to Hesbaye flint, still contains cores and is less exhausted. Alternatively, this could reflect an increase in stockpiling so that more material is being transported than in earlier times. Second, the greater quantity of material in weight and count reflects both an increase in the amount of material procured for the site and an increase in reduction activity. The still substantial use of local limestone when flint was exhausted reflects a longer duration of occupation. It should be noted that the observed differences between Strata 3 and 2 could simply reflect differences in the spatial distribution of site activities using different materials.

Given the rarity of cortex on any of the material, an assessment of procurement context is not possible. Tables 10.11 and 10.12 summarize the cortex information for Strata 3 and 2.

		Cortex		Proportion		Primary Context		Secondary Context	
Rank	Type	n	%	n < 50%	n > 50%	n	%	n	%
1	13-limestone	-	-	-	-	-	-	-	-
2	3 - Hesbaye	50	6.1	43	7	20	40.0	4	8.0
3	10-chert	10	8.1	8	2	4	40.0	-	-
3	7 - black flints	6	5.1	4	2	1	16.6	1	16.6
3	11 - quartzites	10	18.2	5	5	-	-	-	-
4	14 - quartz	-	-	-	-	-	-	-	-
4	4 - phtanite	-	-	-	-	-	-	-	-
4	12 - sandstone	-	-	-	-	-	-	-	-
4	2 - Spiennes	-	-	-	-	-	-	-	-

Table 10.11. Le Trou Magrite. Stratum 3. Procurement context: cortex data.

		Cortex		Proportion		Primary Context		Secondary Context	
Rank	Type	n	%	n < 50%	n > 50%	n	%	n	%
2	3 - Hesbaye	200	6.5		20	51		26	
1	13-limestone	-	-	-	-	-	-	-	-
3	7 - black flints	10	8.3	7	3	2		3	
3	10-chert	9	6.8	7	2	4		1	
3	11 - quartzites	25	23.6	14	11			1	
4	4 - phtanite	-	-	-	-	-	-	-	-
4	14 - quartz	-	-	-	-	-	-	-	-
4	12 - sandstone	-	-	-	-	-	-	-	-
4	8 - gray flints	1	50.0		1	1			

Table 10.12. Le Trou Magrite. Stratum 2. Procurement context: cortex data.

EVIDENCE FOR REDUCTION OF MATERIALS AT THE SITE

The assemblage structure for each material varies with rank, with decreasing inclusivity of stages of the reduction sequence as rank decreases. Rank 4 materials only appear as blanks or finished tools (with a few chunks), and reduction is absent at the site.

Ranks 3 and 4

For Strata 3 and 2, the Rank 3 and 4 materials are the same, with the exception of the presence of Spiennes flint in Stratum 3 (n=1) and gray flint in Stratum 2 (n=2). The general assemblage structure for the combined Rank 3 and 4 materials (Table 10.13) shows that Strata 3 and 2 are essentially identical, apart from a slight increase in cores and decrease in tools in Stratum 2. A more detailed breakdown, by raw material type (Table 10.14), supports this observation, with a substantially similar pattern of distribution of assemblage components in both strata.

Rank 3 and 4 Materials	**Stratum 3**		**Stratum 2**	
	n	%	n	%
cores	5	1.70	17	4.34%
chunks	35	11.90	43	10.97%
tools	22	7.48	9	2.30%
blanks	232	78.91	323	82.40%
	294	100.0%	392	100.0%

Table 10.13. Assemblage structure of Rank 3 and 4 materials, excluding debris.

Stratum 3						**Stratum 2**					
Type	**total n**	**cores**	**chunks**	**tools**	**blanks**	**Type**	**total n**	**cores**	**chunks**	**tools**	**blanks**
10- chert	123	4	17	11	80	7	135	13	17	2	83
7- black flint	117		7	6	77	10	131		16	3	90
11- quartzite	55	1	3	3	44	11	106	4	3	2	95
14- quartz	17		5		12	4	38		2	2	32
4 - phtanite	17		3		10	14	24		5		15
12 - sandstone	12			2	8	12	3				3
2 - Spiennes	1				1	8	2				2
TOTAL	**342**	**5**	**35**	**22**	**232**	**TOTAL**	**439**	**17**	**43**	**9**	**320**

Table 10.14. Le Trou Magrite. Strata 3 and 2. Assemblage structure for Rank 3 and 4 raw materials.

In Stratum 3, the majority of the tools are made on flakes, with a few pieces made on small debris and chunks, and two blades. On chert, 8 of the 11 tools have low shaping intensity (that is, edge retouch with little alteration of the blank perimeter) and include notches, denticulates, and pieces with one continuously retouched edge. The other three tools are an endscraper on flake, an atypical carinated endscraper and an angle on break burin. Black flint (Type 7) shows the same pattern: 5 of 6 tools have low shaping intensity, with a single multiple dihedral burin on a blade. Quartzite (Type 11) includes a double endscraper, a flat-nosed, shouldered endscraper and a piece with one continuously retouched edge, all on flakes. Sandstone (Type 12) includes an endscraper on a retouched flake and a denticulate, both flakes. Cores are rare, but there are several chunks which could have been discarded core fragments.

In Stratum 2, tools are much less common, although there are more cores and more blanks were produced and/or transported. All tools were made on flakes, except for two chunks. Tools again appear to have low shaping intensity, and include notches, denticulates and continuously retouched pieces on one or two edges. There are two endscrapers.

In both strata, most of the blanks are flakes (Stratum 3: n=221; Stratum 2: n=266), with an increase in blades in Stratum 2 (n=53 versus 22). Crested blades and bladelets are rare.

The size distribution of blanks and tools, using length as an estimate (Table 10.15), shows that most artifacts fall within a 21-40 mm range, with a few larger pieces. In both strata, roughly half of the measured artifacts are whole, including the larger artifacts which are rare and maximally 61-80 mm long. This, along with the relative lack of cores, suggests that at least some of the blanks, the larger ones, were transported to the site.

	Stratum 3		**Stratum 2**	
Length	n	n whole	n	n whole
0-20	37	12	31	8
21-30	36	17	23	8
31-40	21	15	19	15
41-50	5	4	9	6
51-60	1	1	2	0
61-70	4	4	5	4
71-80			1	1
TOTAL	**104**	**53**	**89**	**41**

Table 10.15. Le Trou Magrite. Size distribution of Ranks 3 and 4 materials for Strata 3 and 2.

In general, the overall pattern for Rank 3 and 4 materials, in both strata, suggests the limited use of local material and transported flint, with only Rank 4 materials being transported only as blanks and rare tools.

Ranks 1 and 2

The following sections discuss in more detail patterns of reductions for Ranks 1 and 2.

What blanks were produced?

For Stratum 3, Table 10.16 summarizes the kinds of blanks produced for each material type, removals which could have potentially been retouched into tools. Flakes are overwhelmingly dominant for all materials, with blades slightly more common on the two types of flint (Hesbaye and black).

There are two factors limiting blade production for both strata. First, the poorer quality of materials (limestone, chert, quartzite) made it difficult to control fractures and to prepare cores for blade removals. Second, the small, nearly exhausted state of the available flint cores, made it difficult to produce blades, although bladelets were still possible, perhaps reflecting maximization of small flint cores.

Material	**Total n (blank pool)**	**flakes**		**blades**		**bladelets***	
		n	%**	n	%	n	%
13 - limestone	1100	999	90.8	87	7.9	14	1.3
3 - Hesbaye flint	418	332	79.4	38	9.1	48	11.5
10-chert	87	78	89.6	7	8.0	2	2.3
7 - black flints	83	72	86.8	9	10.8	2	2.4
11 - quartzites	47	44	93.6	3	6.4	-	-

Table 10.16. Le Trou Magrite. Stratum 3. Blank production by material type.
*This category includes small flakes and blades >10 mm long, and bladelets, although for Stratum 3, only bladelets are present. It does not include trimming flakes and shatter.
**Percent of blank pool, not of assemblage of each material type.

For Stratum 2, Table 10.17 shows the kinds of blanks produced for each material type. As in Stratum 3, a low number of retouched tools were actually made (see next section), again possibly due to small size of the potential blanks or because they were used unretouched. Flakes are still dominant for all materials, but there is an overall increase in blades produced on all materials except black flint (6-11% in Stratum 3 versus 11-22% in Stratum 2). More bladelets were produced, but remain in percentages similar to Stratum 3, the increase in quantity paralleling the overall increase.

Blade production is still low, compared to other Aurignacian assemblages (see Straus and Otte 1996**)**, but has substantially increased from Stratum 3. The same factors are present to limit blade production - poorer quality of materials and small size of flint cores - but to a lesser degree. Limestone blades increase from 7.9% of the blank pool to 14.9%. Quartzites and cherts show the same increase: 6.4% to 22.7% for quartzites and 8.0% to 17.8% for cherts. Such increase in quantities of blades produced on relatively poorer quality materials may indicate improvement in blade producing techniques. Interestingly, blades do *not* increase substantially for flints (9.1% in Stratum 3 to 11.2% in Stratum 2, for Hesbaye flints). The second factor - small size of flint cores - appears to continue to limit blade production although the increase in number of cores increases the raw counts of blades (so that there is no substantial increase in percentage of flint blades).

Material	**Total n (blank pool)**	**flakes**		**blades**		**bladelets**	
		n	%*	n	%	n	%
3 - Hesbaye flint	1397	1128	80.7	156	11.2	113	8.1
13 - limestone	1418	1180	83.2	211	14.9	27	1.9
7 - black flints	86	79	91.9	5	5.8	2	2.3
10-chert	90	72	80.0	16	17.8	2	2.2
11 - quartzites	97	75	77.3	22	22.7	0	0

*Percent of blank pool, not of assemblage of each material type.
Table 10.17. Le Trou Magrite. Stratum 2. Blank production by material type.

What blanks were selected for retouch into tools?

The following table (Table 10.18) shows the number of tools made on the different kinds of blanks for strata 3 and 2. With flake production dominant in all materials, it is not surprising that most of the tools were made on flakes. However, there is a clear increase in the number of blades used for tools in Stratum 2, particularly for Hesbaye flint, where almost a third of the tools made on this material are made on blades.

Material	n tools	flakes	blades	bladelets	chunks	PRF
Stratum 3						
13 - limestone	37	33	3			1
3 - Hesbaye flint	45	33	5		6	1
10-chert	11	8	1		2	
7 - black flints	6	4	2			
11 - quartzites	3	3				
Stratum 2						
3 - Hesbaye flint	76	50	20	1	4	1
13 - limestone	24	20	4			
7 - black flints	2	2				
10-chert	3	2			1	
11 - quartzites	2	2				

Table 10.18. Le Trou Magrite. Aurignacian. Blank selection for tool production.

What is the intensity of blank selection?

The intensity of blank selection refers to the ratio between tools and unused blanks. For all materials, the ratio of tools to available blanks is extremely low. As discussed above in the context of flake versus blade production, there are several factors affecting the suitability of blanks for formal tool production. As the small size of flint cores limited blade production, it would also affect the ability to control fractures to obtain flakes or blanks of acceptable shape for tool production. In this way, only blanks of appropriate shape were retouched into identifiable tools. The small size of flint blanks produced may also have necessitated their use unretouched, for usability: instead of shaping them into a tool that was too small to handle.

It should be noted that more retouched tools were made on Hesbaye flint than on black limestone in either stratum although limestone removals were almost three times more common in stratum 3 and flint and limestone removals were similar in Stratum 2 (Table 10.19). Given the relatively softer quality of limestone and its abundance, it is possible that many of the blanks produced were used unretouched, discarded when dulled or retouched for resharpening, which would account for the number of continuously retouched pieces and denticulates found. Blanks here refers to deliberately flaked flakes and blades and excludes reduction debris and trimming flakes. Of the 1066 unretouched blanks in Stratum 3 and 1394 in Stratum 2, many may have been utilized, but, unfortunately, use-wear analysis is impossible, given the physical properties of limestone.

Larger retouched tools that were made could have been curated for use on the way back to regions with flint, traveling north across the flint-free Condroz Plateau or west toward the Hainaut Valley.

Type	n tools	n unused blanks	tools + blanks*	tool/blank ratio	% tools
Stratum 3					
13 - limestone	37	1066	1103	.03:1	3.35
3 - Hesbaye	45	382	427	.12:1	10.5
10 - cherts	11	80	91	.14:1	12.1
7 - black	6	77	83	.08:1	7.2
11 -quartzites	3	44	47	.07:1	6.4
14 - quartz	0	12	12	0:1	0
4 - phtanite	0	10	10	0:1	0
12 - sandstone	2	8	10	.25:1	20.0
2 - Spiennes	0	1	1	0:1	0
Stratum 2					
3 - Hesbaye	76	1331	1407	.06:1	5.4
13 - limestone	24	1394	1418	.02:1	1.7
7 - black	2	83	85	.02:1	2.4
10 - cherts	3	90	93	.03:1	3.2
11 -quartzites	2	95	97	.02:1	2.1
4 - phtanite	2	32	34	.06:1	5.9
14 - quartz	0	15	15	0:1	0
12 - sandstone	0	3	3	0:1	0
8 - gray flints	0	2	2	0:1	0

*Numbers vary from table calculating blank pool because some tools were made on chunks and other pieces.

Table 10.19. Le Trou Magrite. Strata 3 and 2. Intensity of blank selection for tool production.

EVALUATION OF LITHIC ECONOMY WITH RESPECT TO RAW MATERIAL CONTEXT

The ranking of materials reflects distance in space and time (recent past of the group occupying Trou Magrite). The "oldest" materials, the ones which they had transported the longest and furthest, have been completely exploited and all that remains are a few curated tools and blanks which are finally discarded. These are the Rank 4 materials: phtanite, sandstone and Spiennes flint. Quartz is also in Rank 4, but reflects an attempt to exploit local material without much success.

The next "oldest" transported material is black flint, included in Rank 3, which would have been procured more recently than Rank 4 materials, but still far enough in the past so that most of the active reduction and use of the material had occurred at previous sites. At Trou Magrite, black flint is almost exhausted, and the last session(s) of core reduction occur and the material is finished. Chert and quartzite, also in Rank 3, show the same pattern of minor reduction activity, but reflect only a slightly more successful attempt to exploit local materials other than limestone. A few (14) tools were produced from this reduction. Given the low shaping intensity of the tools and the availability of local sources for most of the Rank 3 materials, it is more likely that these reflect half-hearted attempts to exploit local materials in the absence of flint.

The most recently exploited flint source, in both strata, is Hesbaye flint. This material is Rank 2 in Stratum 3, Rank 1 in Stratum 2, based on the more significant quantity present in the latter. It would have been procured prior to human arrival at Trou Magrite, during occupation of a site closer to the Hesbaye Plateau with regular access to the flint sources there. It had been actively used and had probably been the Rank 1 material at the site occupied by the group before they reached Le Trou Magrite. At Trou Magrite, the supply was diminished, and more intense reduction activity occurred to maximize the remaining supply because there are no flint sources available to replace this source. The Hesbaye source(s) are here too distant to make special trips to obtain more flint. It is likely as well that subsistence resources were found in a range around le Trou Magrite that included the river valley and plateau, but did not extend as far as the Hesbaye Plateau, particularly in winter. When the Hesbaye flint was exhausted, the local black limestone had to replace it.

The dominant material in Stratum 3 is local black limestone. In other raw material contexts where flint sources were non-local, but not too distant, black limestone might have been rejected. At Trou Magrite, however, the distance to the nearest flint source is exerting strong pressure on the lithic economy and the transported flint supply is already greatly diminished in contrast to a slightly larger supply in Stratum 2. Quality has been compromised to benefit from low procurement costs. It is adequate for tasks occurring at the site, but not for transport elsewhere.

A recent synthesis on Neandertal acculturation (d'Errico *et al.* 1998) comments on the nature of the assemblages excavated by Otte and Straus. Regarding an ivory ring found at Trou Magrite, they note, concerning Stratum 3: "The layer in question was excavated recently (Otte and Straus 1995). Its radiocarbon dating indicated an age of ca. 40 kyr BP but it yielded a non-diagnostic lithic assemblage hardly classifiable as Aurignacian, dominated by Mousterian elements and corresponding, in all likelihood, to an OIS 3 mixed context identical to that from Spy." I would argue (see also Straus 1999) that the Mousterian-like character of the lithic assemblage in general is due to differential use of non-local and local materials and the lack of good quality raw material. There is a clear differentiation in tool types made on local, poorer quality, limestone and non-local, good quality, flint.

Limestone is dominant in Stratum 3, and on this material, 21 of 37 tools are Mousterian types (14 notches, 5 denticulates, 2 sidescrapers). However, the non-local Hesbaye flint yielded 45 tools, the majority of which are clear "Aurignacian" types (only eight are Mousterian types [6 notches, 1 denticulate, and 1 sidescraper]).

The "Mousterianization" is actually a technical response to a raw material context lacking good quality material. On the transported, good quality flint, Aurignacian tool types dominate. Straus (pers. comm.) commented that we may in general have been too pessimistic about mixture of industries in assemblages resulting from 19th century excavations: a significant proportion of tools in the Ardennes Aurignacian may have actually been what we would typologically identify as "Mousterian".

Based on the stratigraphy, there is no directly underlying Mousterian; rather, there is large boulder roof-fall separating Stratum 3 from Stratum 4. Thus, there is little chance of contamination from Mousterian Stratum 4.

Even in Stratum 2, dated to around 30,000 yrs BP, 13 of 24 limestone tools are typologically Mousterian. On flint, only 19 of 76 tools are Mousterian types (8 notches, 5 denticulates, and 6 sidescrapers). This is the same pattern as in Stratum 3, dated to 40,000 yrs BP.

In summary, then, I disagree with the comparison of Le Trou Magrite to the mixed assemblages at Spy, mixed in large part due to the quality of the 19th century excavations. At Le

Trou Magrite, the excavations were carefully controlled and assemblage variability can be explained in terms of responses to a raw material context which imposed constraints on the lithic economy.

PART B: STRATA 4 AND 5: MOUSTERIAN

Strata 4 and 5 of Le Trou Magrite yielded small Mousterian assemblages (Table 10.4). While the assemblages are not typologically diagnostic, analyses of assemblage and raw material structure and comparison with the Aurignacian levels permit one to address the possibility of changes in lithic economy through time in a stratified site, where distances to flint sources, regardless of climatic conditions or seasonal accessibility, remained constant. Part B presents the results of such analyses.

Stratum 4					**Stratum 5**				
	Count		**wt**			**Count**		**wt**	
Type	**n**	**%**	**wt in g**	**%**	**Type**	**n**	**%**	**wt in g**	**%**
1 - Obourg flint	0	0	0	0	1 - Obourg flint	0	0	0	0
2 - Spiennes flint	0	0	0	0	2 - Spiennes flint	0	0	0	0
3 - Hesbaye flint	28	18.5	37	3.4	3 - Hesbaye flint	16	14.0	57	4.7
4 - phtanite	1	0.7	1	0.09	4 - phtanite	1	0.9	70	5.8
5 - Wommersom	0	0	0	0	5 - Wommersom	0	0	0	0
6 - tan flints	0	0	0	0	6 - tan flints	0	0	0	0
7 - black flints	8	5.3	40	3.7	7 - black flints	10	8.8	53	4.4
8 - gray flints	1	0.7	6	0.56	8 - gray flints	0	0	0	0
9 - brown flint	0	0	0	0	9 - brown flint	0	0	0	0
10 - cherts	10	6.6	79	7.3	10 - cherts	22	19.3	185	15.4
11 - quartzites	4	2.6	38	3.5	11 - quartzites	1	0.9	17	1.4
12 - sandstone	1	0.7	28	2.6	12 - sandstone	3*	2.6	7	0.6
13 - black limestone	87	57.6	776	72.1	13 - black limestone	52	45.6	603	50.1
14 - quartz	10	6.6	71	6.6	14 - quartz	7	6.1	206	17.1
missing	1	0.7			missing	2	1.8		
Total	**151**	**100.0**	**1077 (n=108)**	**99.85**	**Total**	**114**	**100.0**	**1203 (n=93)**	**99.5**

*All three sandstone artifacts in Stratum 5 are fire-cracked rocks and are excluded from analysis.

Table 10.4. Frequencies by count and weight for Strata 4 and 5 (Mousterian levels).

RANKING OF MATERIALS BY FREQUENCY AND WEIGHT

In both strata (Tables 10.20 and 10.21), the top-ranked material by count and weight is black limestone. Hesbaye flint is ranked third by count in Stratum 5 and second in Stratum 2, but in both strata consists of very small, light pieces and is ranked sixth by weight (as opposed to second by weight in Strata 3 and 2). Certain material types present in Stratum 4 (sandstone and gray flints) are absent in Stratum 5.

Rank	Type	Count %		Rank	Type	Weight %
1	13 - limestone	45.6		1	13 - limestone	50.1
2	10 - cherts	19.3		2	14 - quartz	17.1
3	3 - Hesbaye flint	14.0		3	10 - cherts	15.4
4	7 - black flints	8.8		4	4 - phtanite	5.8
5	14 - quartz	6.1		5	3 - Hesbaye flint	4.7
6	11 - quartzites	0.9		6	7 - black flints	4.4
6	4 - phtanite	0.9		7	11 - quartzites	1.4

Table 10.20. Le Trou Magrite. Stratum 5. Ranking of material types by frequency and weight.

Rank	Type	Count %		Rank	Type	Weight %
1	13 - limestone	57.6		1	13 - limestone	72.1
2	3 - Hesbaye flint	18.5		2	10 - cherts	7.3
3	10 - cherts	6.6		3	14 - quartz	6.6
4	14 - quartz	6.6		4	7 - black flints	3.7
5	7 - black flints	4.3		5	11 - quartzites	3.5
6	11 - quartzites	2.6		6	3 - Hesbaye flint	3.4
7	4 - phtanite	0.7		7	12 - sandstone	2.6
8	8 - gray flints	0.7		8	8 - gray flints	0.56
9	12 - sandstone	0.7		9	4 - phtanite	0.09

Table 10.21. Le Trou Magrite. Stratum 4. Ranking of material types by frequency and weight.

The collapsed ranking results in three tiers for each stratum (Tables 10.22 and 10.23), with a similar order in both, with the exception of chert in Stratum 5, which shares Rank 2 with Hesbaye flint by count. By weight (4.7%), Hesbaye flint would actually be in Rank 3. Ranking by count will be used in lithic analyses to parallel the analyses done for the Aurignacian strata.

Rank	No(s).	Type(s)	Count %	Weight %
1	13	black limestone	45.6	50.1
2	10, 3	cherts, Hesbaye flint	14-19.3	4.7-15.4
3	7, 14, 11, 4	black flints, quartz, quartzites, phtanite	0.9-8.8	1.4-17.1

Table 10.22. Le Trou Magrite. Stratum 5. Collapsed ranking of material types.

Rank	No(s).	Type(s)	Count %	Weight %
1	13	black limestone	57.6	72.1
2	3	Hesbaye flint	18.5	3.4
3	10, 14, 7, 11, 4, 8, 12	cherts, quartz, black flints, quartzites, phtanite, gray flints, sandstone	0.7-6.6	0.09-7.3

Table 10.23. Le Trou Magrite. Stratum 4. Collapsed ranking of material types.

TRANSPORT OF MATERIAL

Debitage analysis was used to identify stages of the chaîne opératoire and infer transport form of material to the site.

Rank 1 material		
Type	**Assemblage structure**	**Brought to site as...**
13 - limestone	3 cores, 2 tools, 36 blanks, 11 debris (including 6 chunks*)	cores or small chunks
Rank 2 material		
Type	**Assemblage structure**	**Brought to site as...**
10 - cherts	14 blanks, 8 debris (including 5 chunks)	blanks
3 - Hesbaye flint	2 tools (on chunks), 11 blanks, 3 debris (all chunks)	exhausted cores (=chunks)
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
7 - black flint	1 tool, 3 blanks, 6 debris (all chunks)	exhausted cores (=chunks)
14 - quartz	1 core, 1 blank, 5 debris (all chunks)	exhausted cores
11 - quartzites	1 tool	finished tool
4 - phtanite	1 core	exhausted core

* Chunks are probably core remnants.

Table 10.24. Le Trou Magrite. Stratum 5. Transport form of raw materials (plus general assemblage structure).

In Stratum 5 (Table 10.24), the dominant material is local black limestone, but, unlike Strata 3 and 2, is not present in very substantive quantity. There are only three identifiable cores, along with 6 chunks which could be core remnants. Reduction activity was minor, much more similar to that on Rank 3 materials in Strata 3 and 2. Rank 2 materials include cherts and Hesbaye flint. This is the *only* stratum in which the top two materials (limestone and chert) are both local and of poorer quality than flint. Both chert and Hesbaye flint have similar assemblage structure: blanks and chunks, while there are two tools in Hesbaye flint. Any reduction activity occurred elsewhere, although chert could have been reduced nearby. Rank 3 materials include black flint, quartz, quartzite, and phtanite, all represented by exhausted cores and a few blanks or tools.

In contrast to later assemblages, the overall pattern of raw material assemblage variability in Stratum 5 is one of little reduction activity and near-complete exhaustion of non-local materials. None of the materials show much evidence of reduction: there are few cores, and low frequencies of each material type. This appears to indicate a short-term occupation, where transported (non-local) materials were nearly exhausted and represented only by blanks and tools. Even Hesbaye flint falls in this category, although there are five chunks (two retouched as tools). Local material (limestone, chert, quartz) dominates, but was not used to a great extent, which again supports interpretation of a short-term occupation(s).

Rank 1 material		
Type	**Assemblage structure**	**Brought to site as...**
13 - limestone	1 core, 4 tools, 53 blanks, 29 debris (including 14 chunks)	core(s)
Rank 2 material		
Type	**Assemblage structure**	**Brought to site as...**
3 - Hesbaye flint	15 blanks, 13 debris (including 1 chunk)	exhausted core (if chunk is core remnant)
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
10 - cherts	9 blanks, 1 tool	blanks and finished tool
14 - quartz	4 blanks, 6 debris (all chunks)	blanks
7 - black flint	4 blanks, 1 tool, 3 debris (all chunks)	blanks and finished tool
11 - quartzites	3 blanks	blanks
4 - phtanite	1 debris piece (shatter)	mixed? mis-identified?
8 - gray flints	1 tool	tool
12 - sandstone	1 tool	tool

* Chunks are probably core remnants.

Table 10.25. Le Trou Magrite. Stratum 4. Transport form of raw materials (plus general assemblage structure).

In Stratum 4 (Table 10.25), the dominant material is also local black limestone. There is only one identifiable core, along with 14 chunks which could be core remnants. As in Stratum 5, reduction activity was quite minor. Hesbaye flint is in Rank 2, and appears to have been transported as blanks and possibly an exhausted core. There is no reduction activity present (except for the presence of a PRF) and a very slight indication of resharpening (10 trimming flakes). Rank 3 materials include all other materials and are present as transported blanks and tools, even local chert and quartzites. It is possible that tools on local materials were made nearby and transported to the site for use. As in Stratum 5, the overall pattern of raw material assemblage variability in Stratum 4 is one of little reduction activity.

EVIDENCE FOR REDUCTION OF MATERIALS AT THE SITE

In both strata, the assemblage structure for each material varies with rank, with decreasing inclusivity of stages of the chaîne opératoire as rank decreases. However, unlike the Strata 3 and 2 assemblages, all materials show depletion in assemblage components, with only 1 core present. Rank 1 and 2 materials here are comparable to Ranks 3 and 4 in later assemblages. Reduction activity was slight.

What blanks were produced?

Tables 10.26 and 10.27 show the kinds of blanks produced on Rank 1 and 2 materials in Strata 5 and 4. Flakes are typical although there is a small series of blades in each stratum.

Material	Total n (blank pool)	flakes n	blades n	bladelets n
13 - limestone	38	34	4	0
10-chert	14	10	3	1
3 - Hesbaye flint	11	10	0	1

Table 10.26. Le Trou Magrite. Stratum 5. Blank production by material type.

Material	Total n (blank pool)	flakes n	blades n	bladelets n
13 - limestone	51	43	8	0
3 - Hesbaye flint	15	13	1	1
10-chert	10	7	3	0
7 - black flints	5	4	1	0

Table 10.27. Le Trou Magrite. Stratum 4. Blank production by material type.

What blanks were selected for retouch into tools?

Table 10.28 summarizes the breakdown of tools made on different kinds of blanks in the two strata. For Hesbaye flint, it is possible that only chunks were large enough to be suitable for tool retouch. This exhibits the maximization of a very scarce material by using exhausted cores as tools before discarding them.

Material	n tools	flakes	blades	chunks
Stratum 5				
13 - limestone	2	2		
10-chert	0			
3 - Hesbaye flint	2			2
7 - black flints	1		1	
14 - quartz	0			
11 - quartzite	1	1		
Stratum 4				
13 - limestone	4	3	1	
3 - Hesbaye flint	0			
10-chert	1		1	
7 - black flints	1		1	
8 - gray flint	1			1
12 - sandstone	1			1

Table 10.28. Le Trou Magrite. Blank selection for tool production.

EVALUATION OF LITHIC ECONOMY WITH RESPECT TO RAW MATERIAL CONTEXT

For both Strata 5 and 4, it appears that all non-local materials (Hesbaye flint, black flint, phtanite) were nearly exhausted when they arrived at Trou Magrite. Most were transported as blanks or finished tools. Reduction activity is minor for Ranks 1 and 2, similar to the Rank 3 pattern in the upper strata. This supports an inference of short-term occupation.

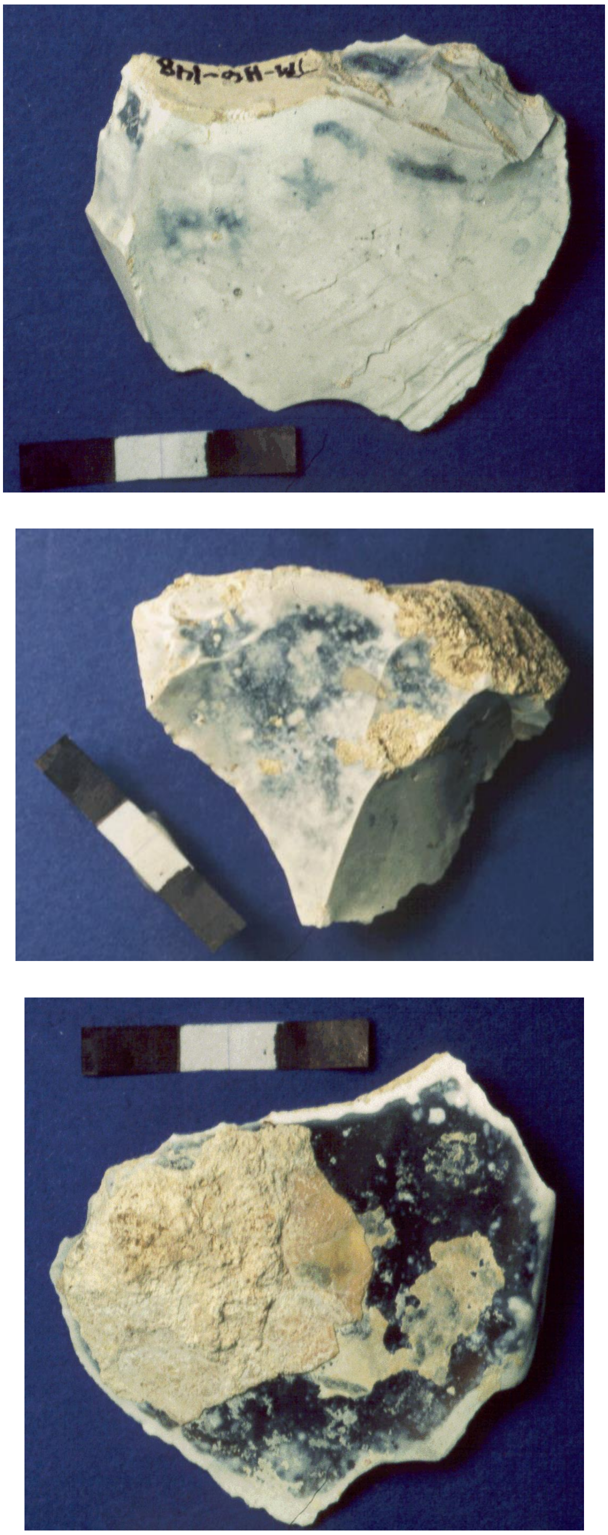

Figure 10.10. Le Trou Magrite. Non-local Hesbaye flint, showing different degrees of patination.

Figure 10.11. Le Trou Magrite. Local Viséen limestone.