CHAPTER 8
LES GROTTES DE GOYET: THIRD CAVE, STRATUM 3

BACKGROUND

Location of site

Les Grottes de Goyet (Figs. 8.1 and 8.2) are located within the limestone massif at the confluence of the Samson River, a tributary of the middle Belgian Meuse (3 ½ km distant), and the Strud, a small stream, both of which drain the Condroz Plateau. The site includes three separate areas which are of archaeological interest (Toussaint *et al.* 1997:33-34): 1) a group of four, large interconnected cavities opening onto a common terrace (Dupont 1872; Tihon 1895-96; Rahir 1908, 1910; Ulrix-Closset 1975; Otte 1979; Dewez 1987; Germonpré 1997), 2) Trou du Moulin, another cave around 120 meters from the main terrace (Danthine 1952), and 3) *abri supérieur* (upper rock shelter), located between the two, 50 meters northwest of the main terrace and about a dozen meters higher (Eloy and Otte 1995).

A fifth cave, called Trou du Moulin (Danthine 1952), is also included in the Grottes de Goyet designation, but does not form a part of the interconnected karstic cluster and is not included in this study.

Raw material context

From the Samson and the Strud, river cobbles of quartzite, chert, and sandstone would have been available locally, directly in front of the cave complex. The nearest flint sources were on the Hesbaye Plateau, in the Mehaigne River region approximately 20 km to the northeast. The Meuse itself is only 5 km downstream, via the valley of the Samson. Flint sources to the west (Obourg and Spiennes in the Hainaut Valley) are approximately 70 km away. Phtanite and Wommersom quartzite, highly localized sources on the Brabant Plateau, are approximately 40 km to the north. Flint sources in the Maastricht region (eastern part of the Hesbaye Plateau, the Pays de Herve, and the southern Dutch Limburg enclave of Maastricht) are at least 60 km to the northeast, but do not appear to have been exploited.

Flint sources are thus not local, but rather exist within the Zone 2, a 40 km radius that, as will be seen, was exploited to provision the site.

To summarize the raw material context at Goyet, then, local material would be rare and of poorer quality, consisting primarily of cherts and quartzites. The nearest source of good quality material is the Plateau de Hesbaye, north of the Meuse. Other known sources, such as Spiennes and Obourg, also used, are much more distant. Therefore, at Goyet, quality and distance to sources both exert pressure on the lithic economy, and distances from Goyet to various sources would have affected the nature in which each material was utilized.

Excavation history

The Grottes de Goyet were discovered and first excavated by Edouard Dupont in 1869 (Dupont 1869a, 1872). Dupont excavated in all four of the caves (numbered 2-5, with the Grotte du Moulin being identified as Number 1). In 1891, Tihon excavated the large terrace as well as intact remnants within the caves (Tihon 1895-96). From 1907-1909, de Loë and Rahir, for the Musées Royaux d'Art et d'Histoire (Cinquantenaire), excavated the third and fourth

Figure 8.1. Les Grottes de Goyet. Location of site.
(from Institut Géographique National map 48/5-6, scale 1:25000)

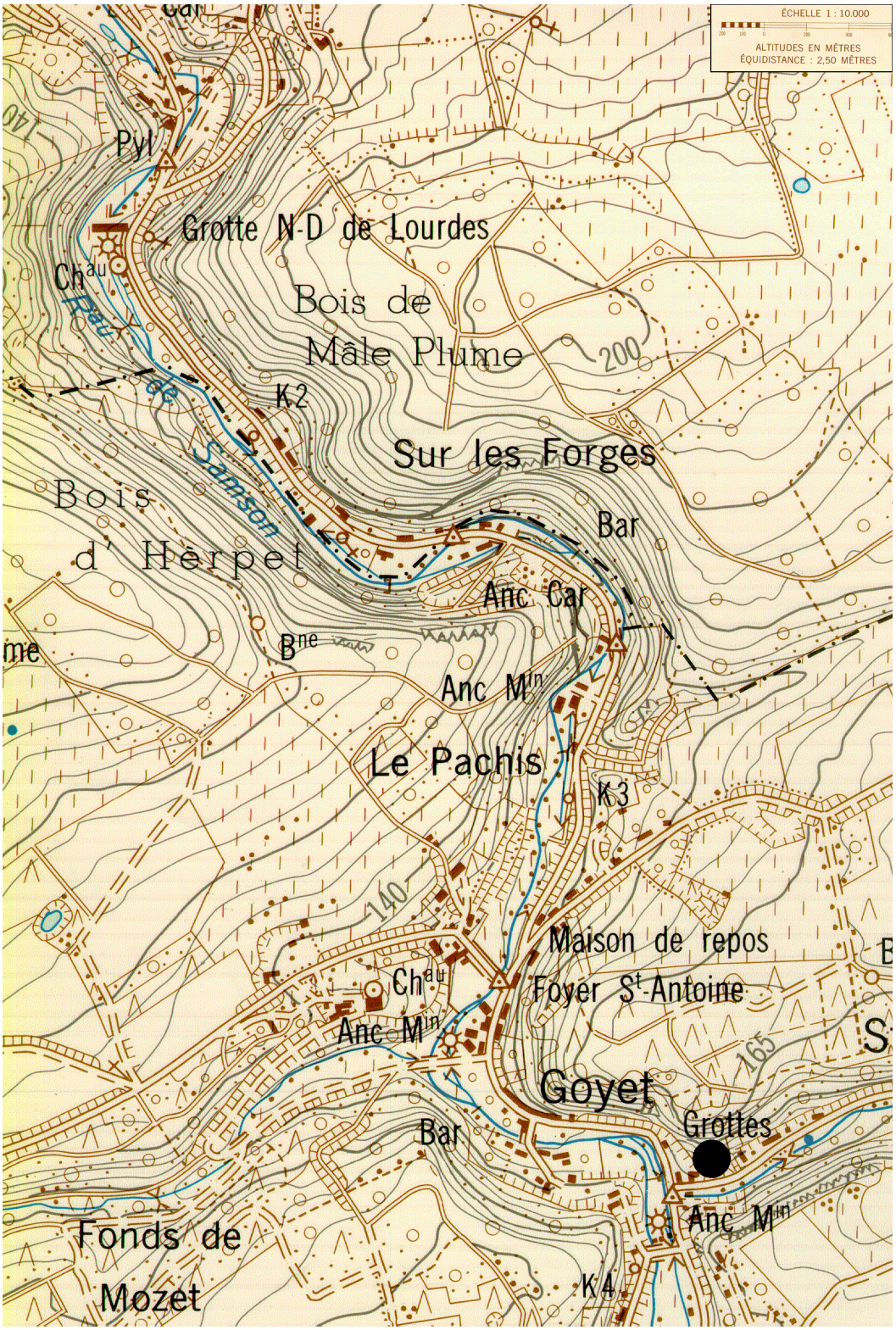


Figure 8.2. Les Grottes de Goyet. Location of site.
(from Institut Géographique National map 48/5, scale 1:10000)

caves (according to *their* numbering, which are equivalent to Dupont's Caves 2 and 3) as well as in the backdirt from previous excavations and a Neolithic burial (Rahir 1928). In the two caves, they found mainly mixed backfill, but also some Upper Paleolithic material in sediments somewhat perturbed by natural processes.

Subsequently, excavations were undertaken by various amateurs, as well as by Kaiser (de Bournonville 1955a) for the Institut des Sciences Naturelles de Belgique, who prepared the caves for touristic exploitation in the mid-1930s. In 1952, Louis Eloy excavated a nearby abri, the results of which have been only recently published (Eloy and Otte 1995).

The latest excavations directed by M. Toussaint and A. Becker (Toussaint *et al.* 1997; Toussaint *et al.* 1998; *Carnets de Patrimoine* 26, 1999) began in 1997 on the terrace, in remnant sediment deposits in Dupont's Cave 3, and in chambers newly discovered by Philippe Lacroix. The terrace was revealed to be an artificial accumulation of sediment consisting of backdirt from 19th century excavations and redeposition in the 1930s in preparation of the site for tourism. The intact Pleistocene sedimentary deposit is currently being analyzed (pollen and microfauna) to reconstruct the climatic sequence. The skeleton of a Late Neolithic child was found in the newly discovered chamber and anthropological analyses are in progress by Toussaint.

Stratigraphy

Because only the Dupont collection from Cave No. 3 has been analyzed for this study, only the stratigraphy from this cave will be discussed, based on Dupont's admittedly general and sometimes inaccurate description (Dupont 1872:106-119).

From bottom to top, Dupont identified five geological strata, three of which contained archaeological materials (Figs. 8.3 and 8.4). Stratum 5 contained a carnivore occupation, primarily cave lion and cave bear. Stratum 4 also contained a carnivore occupation, hyena and cave bear. Stratum 3 contained an archaeological assemblage that Dupont considered to be analogous to the industry at Montaigle. Analyses of this assemblage (e.g., Otte 1979, as well as my own study) show that the surviving assemblage at the IRSNB contains a mixture of Mousterian and Aurignacian materials, although it is not clear whether the material had already been mixed by natural processes before excavation or if Dupont's excavation techniques caused the lumping of multiple archaeological layers into one "stratum". Stratum 2 contained an archaeological assemblage analogous to those observed by Dupont at Montaigle and Trou Magrite, and is today considered to be Gravettian. Stratum 1 contained an assemblage analogous to Chaleux and Furfooz, and is attributable to the Magdalenian (Germonpré 1997).

Dating of the site

The two levels studied have not been dated, although recent dates have been produced for Dupont's Stratum 1 in the third cave (Germonpré 1997), which contains Magdalenian material. These dates are presented in Table 8.1. While the Magdalenian level does not form a part of this research, these recently obtained dates conform well to dates obtained at other Magdalenian sites in Belgium (Chaleux, Bois Laiterie, Trou Da Somme) and thus add to our understanding of the Magdalenian occupation of Belgium. The anomalous date (GrA-3239), as Toussaint points out (Toussaint *et al.* 1997:37), demonstrates once again the heterogeneity of the "strata" identified by Dupont.

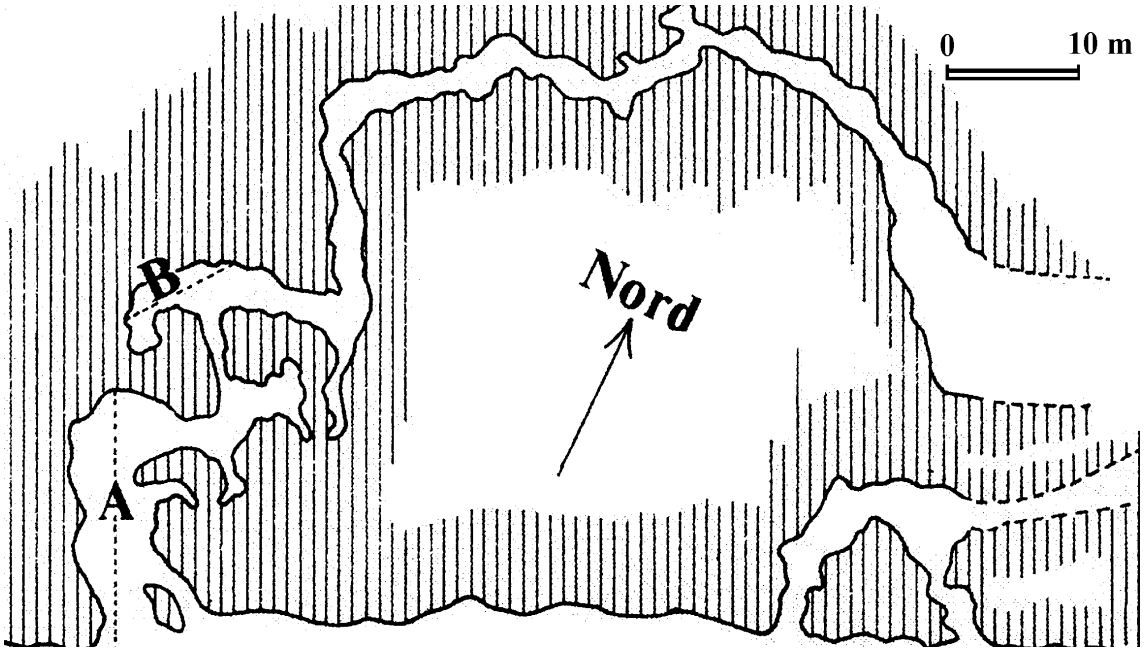


Figure 8.3. Les Grottes de Goyet. Plan of Cave no. 3 (after Dupont 1872:106, Fig. 12).

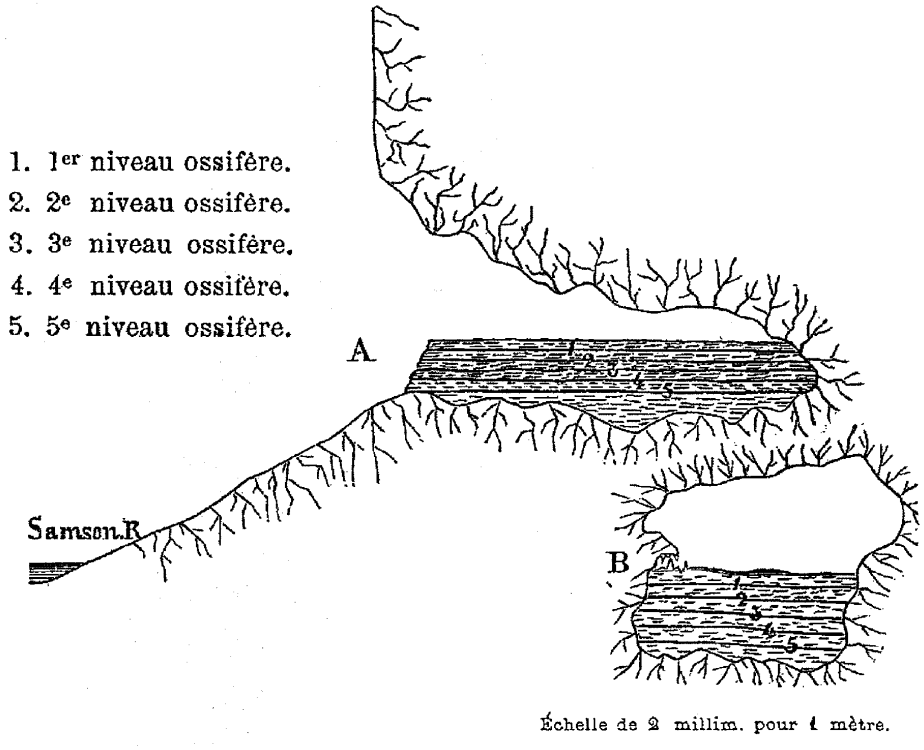


Figure 8.4. Les Grottes de Goyet. Dupont's stratigraphy of Cave no. 3 (after Dupont 1872:107, Fig. 13).

Method	Lab code	Date	Material
AMS	GrA-3237	12,770 ± 90 BP	worked bone
AMS	GrA-3238	12,620 ± 90 BP	worked bone
AMS	GrA-3239	27,230 ± 260 BP	unworked bone

Table 8.1. Goyet. AMS dates for Cave No. 3, Stratum 1 (Magdalenian) (Germonpré 1997).

Description of assemblages and industry attributions

The assemblage from Stratum 3 has been analyzed for this research. This stratum, as described above, contains a mixture of Mousterian and Aurignacian materials. In the holdings of the IRSNB, Stratum 3 was sorted at some point in the past, most likely at the beginning of the century, and material is stored in drawers labeled "Couche 3 - Aurignacien" and "Couche 3 - Moustérien". It is not clear what criteria were used to make this separation. However, the separation has been provisionally used in this research to identify possible differences between the so-called Mousterian and Aurignacian components, but it is more prudent to ultimately consider the Goyet "Couche 3" assemblage as a whole, assuming that Stratum 3 is a vast palimpsest of multiple occupations spanning both Mousterian and Aurignacian periods.

Assemblage samples

Although many collections exist (in varying degrees of quality and availability) from the multiple excavations at Goyet, they come from different caves in the system, from the terrace, and from backdirt of preceding excavations. Dupont's assemblage from Cave No. 3 was selected for analysis for three principal reasons, although problems still exist with this collection (see below). First, Dupont was the first to excavate at Goyet; thus there is no possibility of mixture with backdirt coming from other areas of the cave complex. We can therefore say with reasonable confidence that the collection comes only from Cave No. 3. Second, the material recovered from the third cave was the most abundant and most important for interpreting the local Paleolithic cultural sequence. Third, considering the level of archaeological expertise in the 19th century and the less than scientific quality of most of the subsequent excavations by amateurs, it would be impossible to correlate the variously identified "strata" in order to study a complete archaeological level. The selection of a single collection, then, from the most important part of the site, controls for problems associated with the nature of excavations at Goyet. Frequencies by count and weight for the "Aurignacian" and "Mousterian" components of Stratum 3 are summarized in Tables 8.2 and 8.3 below.

Problems with assemblage and resolution of problems/justification for analyses

Several problems with this collection had to be addressed. First, as discussed above, the 19th century excavations were done by thick, artificial, composite layers that crosscut different occupation levels and even different industries. Recent analysis of the Dupont stratigraphy (Otte 1979) shows that the observed mixing of different industries was likely due to natural, post-depositional disturbance, as well as to the quality of excavations. If one accepts that an archaeological level represents multiple occupations and is time-averaged (or time-collapsed), analysis of raw material and assemblage structure may be able to untangle some of this mixing.

Second, there was clearly a bias against collection or saving of small debitage (almost a complete lack of any material less than one cm in length) by the early excavators. This problem prevents detailed assessment of the degree of *in situ* tool production and/or tool resharpening

	Count		Weight	
Type	**n**	**%**	**wt in g**	**%**
1	118	6.9	693	6.30%
2	30	1.8	287	2.61%
3	1149	67.5	6682	60.71%
4	3	0.2	2	0.02%
5	1	0.2	11	0.10%
6	157	9.2	1222	11.10%
7	67	3.9	363	3.30%
8	133	7.8	1182	10.74%
9	3	0.2	91	0.83%
10	7	0.4	187	1.70%
11	7	0.4	79	0.72%
12	1	0.1	4	0.04%
missing	26	1.5	204	1.85%
Total	1702	100.00%	11007	100.00%

Table 8.2. Stratum 3: “Aurignacian”. Frequency of raw material types by count and weight.

	Count		Weight	
Type	**n**	**%**	**wt in g**	**%**
1	39	5.2	435	2.9
2	28	3.8	541	3.6
3	392	52.5	7324	48.7
4	6	0.8	78	0.5
5	18	2.4	403	2.7
6	93	12.5	2007	13.3
7	17	2.3	376	2.5
8	73	9.8	973	6.5
9	14	1.9	401	2.7
10	51	6.8	1757	11.7
11	6	0.8	105	0.7
12	1	0.1	5	0.03
missing	8	1.1	624	4.2
Total	746	100.0	15029	100.0

Table 8.3. Stratum 3: “Mousterian”. Frequency of raw material types by count and weight.

Rank	No.	Type	Count %
1	3	Hesbaye flint	67.5
2	6	tan flints	9.2
3	8	gray flints	7.8
4	1	Obourg flint	6.9
5	7	black flints	3.9
6	2	Spiennes flint	1.8
7	10	cherts	0.4
7	11	quartzites	0.4
8	4	phtanite	0.2
8	9	brown flint	0.2
9	5	Wommersom quartzite	0.1
9	12	sandstone	0.1

Table 8.4. Stratum 3. “Aurignacian”. Ranking of material types by frequency and weight.

Rank	No.	Type	Count %
1	3	Hesbaye flint	52.5
2	6	tan flints	12.5
3	8	gray flints	9.8
4	10	cherts	6.8
5	1	Obourg flint	5.2
6	2	Spiennes flint	3.8
7	5	Wommersom quartzite	2.4
8	7	black flints	2.3
9	9	brown flint	1.9
10	4	phtanite	0.8
10	11	quartzites	0.8
11	12	sandstone	0.1

Table 8.5. Stratum 3. “Mousterian”. Ranking of material types by frequency and weight.

Rank	No(s).	Type(s)	Count %
1	3	Hesbaye	67.5%
2	6, 8, 1	tan, gray, Obourg	6-10%
3	7, 2, 10, 11, 4, 9, 5, 12	all others	0.1-4%

Table 8.6. Stratum 3. “Aurignacian”. Collapsed ranking of material types.

Rank	No(s).	Type(s)	Count %	Weight %
1	3	Hesbaye	52.5%	48.7%
2	6, 8, 10	tan, gray, cherts	6.1-10%	6-13%
3	1, 2, 5, 7, 9, 4, 11, 12	all others	0.1-6%	< 5%

Table 8.7. Stratum 3. “Mousterian”. Collapsed ranking of material types.

which would produce trimming flakes. However, the proportion of tools in relation to unretouched flake and blade blanks can attest to the relative intensity of tool production.

Third, the third archaeological level was more or less artificially separated into "Aurignacian" and "Mousterian" components (as discussed above). The majority of the smaller debitage appears to have been primarily assigned to the Aurignacian component, with debris (length 10-30 mm) categories elevated in the Aurignacian component and rare or absent in the Mousterian component. This has implications for assessing the relative degree of core reduction/blank production, but, in general, analysis of the larger flakes, blades, bladelets and cores is sufficient to interpret the kinds of reduction techniques used for different materials. It should be noted that both components are still somewhat mixed. I have provisionally accepted this division, despite these problems, and have analyzed the two components separately, to elucidate potential similarities and differences.

Expectations

Given that the Grottes de Goyet are found in Zone 2, the time and energy expenditure to regularly procure flint from non-local sources is expected to affect reduction and tool production strategies to some degree. However, the distance to the nearest flint source is not so great as to require substantial economization.

RANKING OF MATERIALS BY FREQUENCY AND WEIGHT

Stratum 3, as discussed above, has been analyzed as two separate components – "Mousterian" and "Aurignacian", where the terms indicate only that one or the other industry is typologically dominant in a mixed assemblage. Results are presented here in parallel and similarities and differences discussed within the context of each analysis.

In both components (Tables 8.4 and 8.5), the Rank 1 material is Hesbaye flint, followed by the first two Rank 2 materials (Type 6 – tan flints, and Type 8 – gray flints). However, Type 10 (chert), negligible in the Aurignacian component, was more commonly used in the Mousterian component (6.8 versus 0.4%) and moves up to Rank 2. Rank 3 materials (each less than 6% of the assemblage) are equally represented in both components, varying slightly in their order.

This ranking can be reduced to three tiers (Tables 8.6 and 8.7), indicating that Hesbaye flints are by far the dominant material, followed by much smaller percentages of tan flint, gray flint, and Obourg flint, with insignificant percentages of the other types (except when the material is represented by curated tools). This ranking is used in subsequent discussion.

SOURCES OF MATERIAL UTILIZED

<u>Rank 1</u>

Hesbaye flints (Type 3) come from the Hesbaye Plateau, with primary sources found in the Mehaigne river valley, approximately 20 km from Goyet. It is 60 km northeast to the heart of the Maastrichtian region, where flint is available on the Meuse river terraces and eroding out of chalk cliffs. Flints on the Hesbaye Plateau would have been the closest non-local source of good quality flint. One difficulty in procuring Hesbaye flint is that it would have been necessary to cross the Meuse River, although fords may have formerly existed before the river was dammed.

Rank 1 materials		
Type	**Assemblage structure**	**Brought to site as...**
3	34 cores, 161 tools, 361 blanks, 593 debris	partially prepared cores
Rank 2 materials		
Type	**Assemblage structure**	**Brought to site as...**
6	11 cores, 28 tools, 61 blanks, 60 debris	prepared cores
8	10 cores, 29 tools, 13 blanks, 81 debris	partially prepared cores
1	4 cores, 26 tools, 32 blanks, 56 debris	prepared cores
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
7	1 core, 3 tools, 20 blanks, 43 debris	nearly exhausted core, blanks, curated tools
2	1 core, 8 tools, 14 blanks, 7 debris	nearly exhausted core, blanks, curated tools
10	1 core, 4 tools, 2 blanks	nearly exhausted core, curated tools
11	3 blanks, 4 debris	local
4	3 debris flakes	possibly intrusive from Stratum 2
9	3 tools	curated tools
5	1 tool	curated tool
12	1 debris flake	local

Table 8.8. Stratum 3. “Aurignacian”. Transport form of raw materials and general assemblage structure.

Rank 1 materials		
Type	**Assemblage structure**	**Brought to site as...**
3	11 cores, 182 tools, 166 blanks, 33 debris	partially prepared cores
Rank 2 materials		
Type	**Assemblage structure**	**Brought to site as...**
6	6 cores, 38 tools, 42 blanks, 7 debris	prepared cores and blanks
8	1 core, 24 tools, 43 blanks, 5 debris	prepared core and blanks
10	3 cores, 17 tools, 21 blanks, 10 debris	prepared cores (but with probable local primary reduction
Rank 3 materials		
Type	**Assemblage structure**	**Brought to site as...**
1	9 tools, 26 blanks, 4 debris	prepared blanks and tools
2	22 tools, 2 blanks, 4 debris	curated tools and blanks
5	15 tools, 3 blanks	curated tools and blanks
7	16 tools, 1 blank	curated tools and blanks
9	11 tools, 3 blanks	curated tools and blanks
4	4 tools, 2 blanks	curated tools and blanks
11	6 tools	curated tools
12	1 debris	local

Table 8.9. Stratum 3. “Mousterian”. Transport form of raw materials and general assemblage structure.

Rank 2

The geological source of the tan flints (Type 6) is unknown, but the lithic reference collection at Katholieke Universiteit (Leuven) has 11 samples from various proveniences in the Maastricht region (60 km NE) and 3 samples from the Hainaut region (74 km west). The tan flints are probably a subset of Hesbaye flints.

The geological source of the gray flints (Type 8) is also unknown. Observations of the lithic reference collection show that gray is the most common color of flints, and that gray flints are found in every region. Considering that Hesbaye flints are the most common and that clearly identifiable Obourg and Spiennes flints are rare or absent in the Goyet assemblages, it is reasonable to assume that the other gray flints were not procured in the Hainaut region, but on the Hesbaye Plateau.

The geological source of Obourg flint (Type 1) is located just north of Mons, in the Hainaut Valley, about 70 km west of Goyet. Spiennes flint is found south of Mons, also about 70 km west of Goyet. Both are non-local materials at Goyet and, of the known sources, are the most distant.

Rank 3

Of the other materials (each less than 4% of the assemblage), most can be regarded as insignificant, except for comments on the following:

Type 5, Wommersom quartzite, 1 tool, 40 km north (east of Tienen).
Type 9, which is a brown flint, represented by 3 tools.
Types 7 (black), 2 (Spiennes), and 10 (cherts): each has a single core and evidence of very minor reduction. The source of Type 7 is unknown, Type 2 is 74 km west, and chert was probably local.
Type 4 (phtanite) comes from the Ottignies-Mousty area, around 20-25 km to the north.

TRANSPORT OF MATERIAL

Using data from cortex and debitage attributes, presence/absence of stages of the chaîne opératoire was assessed (Tables 8.8 and 8.9).

The Rank 1 material in both components was transported to the site in the form of partially prepared cores and was then reduced *in situ* to provision the site with tools for various activities. Rank 2 materials, present in much lower percentages, evidence a minor degree of *in situ* reduction before being discarded and replaced by Rank 1 material. Rank 3 materials are represented by finished tools and blanks, and, in the Aurignacian component, three nearly exhausted cores.

The primary difference between Ranks 1/2 and Rank 3 materials for both components is that Ranks 1 and 2 show evidence of at least some blank production at the site, clearly present for Rank 1 and less intense for Rank 2, while Rank 3 materials consist of only curated tools and unused blanks which were not reduced at the site. (There are only 64 small debris items (8.6%) in the entire Stratum 3.1 assemblage, compared to 848 (50%) in Stratum 3.0. I would argue that this would not be representative of the original assemblages, due to at least two possible reasons. First, excavators finding many blade tools in Stratum 3.0 may have been more apt to collect blade-like debris and have a better eye for smaller debris. Second, the artificial division into Aurignacian and Mousterian components could have been biased to put more debris with the Aurignacian component.)

		Cortex		Proportion		Primary Context		Secondary Context	
Rank	**Type**	**n**	**%***	**n < 50%**	**n > 50%**	**n**	**%**	**n**	**%**
1	3 – Hesbaye flint	381	33.2	301	80	309	82.2	67	17.8
2	6 - tan flint	56	35.7	40	10	41	73.2	15	26.7
2	8 - gray flint	47	35.3	36	3	31	79.5	8	20.5
2	1 – Obourg flint	44	37.3		11	37	84.1	7	15.9
3	7 - black flint	26	38.8	20	5	21	84	4	16
3	2 – Spiennes flint	18	60	18		16	89	2	11
3	10 - chert	3	42.9	3		1	33	2	66
3	5 - Wommersom quartzite	1	100	1		1	100		

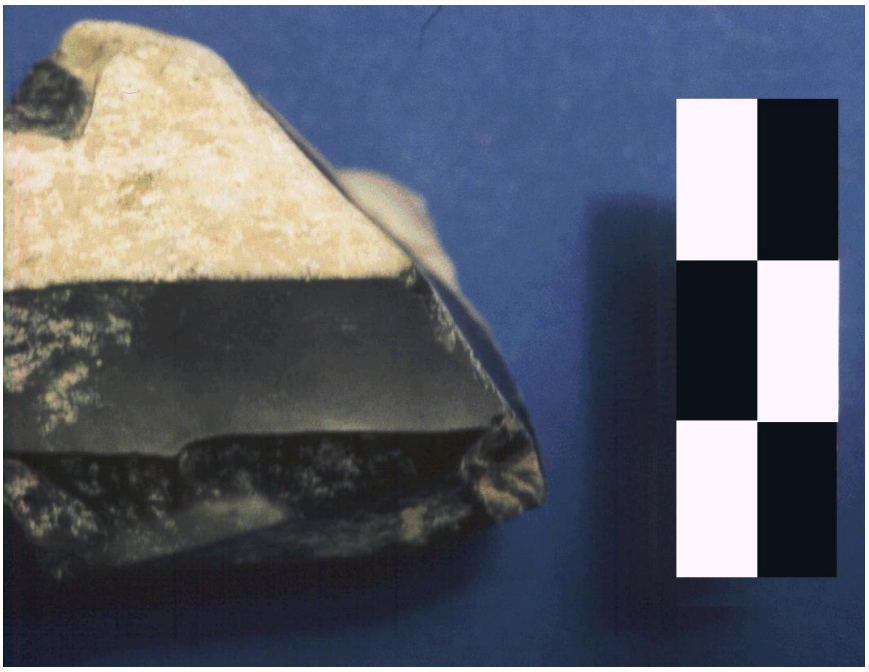
Table 8.10. Stratum 3. "Aurignacian". Procurement context: cortex data. * Percentage of cortical artifacts for material type.

Rank	Type	Cortex		Primary Context		Secondary Context	
		n	**%***	**n**	**%**	**n**	**%**
1	3 - Hesbaye flint	143	34.5	99	69.2%	44	30.8%
2	6 - tan flint	35	37.6	20	57.1	15	42.9
2	8 - gray flint	17	23.3	11	64.7	6	35.3
2	10 - cherts	18	35.3	7	38.9	11	61.1
3	7 - black flint	8	48.1	4	50	4	50
3	1 – Obourg flint	19	48.7	11	57.9	8	42.1
3	2 - Spiennes flint	6	21.4	2	33.3	4	66.6
3	5 - Wommersom quartzite	9	50.0	5	55.5	4	44.4
3	7 - black flints						
3	9 - brown flint	7	50.0	6	86	1	14
3	4 - phtanite	2	33.3			2	100
3	11 - quartzites	2	33.3			2	100

Table 8.11. Stratum 3. "Mousterian". Procurement context: cortex data. * Percentage of cortical artifacts for material type.

Stratum 3 Rank 3 Materials	**Mousterian component**		**Aurignacian component**	
cores	0	0.00	3	4.9
tools	83	69.1	19	32.7
blanks	37	30.8	38	63.9
TOTAL	120		60	

Table 8.12. Assemblage structure of Rank 3 materials, excluding debris.



a)

b)

Figure 8.5. Les Grottes de Goyet. Variability in cortex. a) Obourg flint with chalk cortex, b) local chert with waterworn cobble cortex.

The diversity of Rank 3 materials (seven material types, excluding the single sandstone debris flake) likely reflects the palimpsest nature of Stratum 3. It is argued in chapter 12 that Rank 3 materials most likely reflect the last vestiges of lithic materials obtained prior to occupation of the current site, although curation for non-technological purposes may have occurred (e.g., for the color, technical skill evidenced, etc.). Blanks and tools have been curated and transported from site to site, as the materials are reduced and move from Rank 1 (actively exploited sources to provision site), to Rank 2 (mobile toolkits), to Rank 3 (curated blanks and tools). The diversity of Rank 3 materials comes from sources in multiple directions from the site. This would suggest that each of the Rank 3 materials came with a different occupation of the site, not all at once.

Looking only at cortical artifacts, the kind of cortex and cortex wear indicate whether material was obtained from primary geological sources (fresh, unworn cortex) or secondary sources, such as river terraces (waterworn or cobble cortex) (Fig. 8.5). Tables 8.10 and 8.11 summarize cortical data for the two components, with non-cortical materials excluded. Primary procurement context dominates in both components but percentages for primary context are higher in the Aurignacian component. In addition, artifacts with greater than 50% cortex are rare in the Mousterian component while they are somewhat better represented in the Aurignacian component. In both cases, cores were prepared elsewhere, but Mousterian cores were either more exhausted or more intensely prepared (primary reduction) before arrival at the site.

Material in secondary context was largely ignored, possibly because primary sources were permanent locations on the landscape with good quality material that had not been affected by rolling, etc. The benefits of obtaining material in primary context are both a minimization of search time (because the location is known and material is abundant and readily available at the source) and maximization of quality (material has not been affected by rolling). The most suitable blocks can easily be selected from the available material at the source. In contrast, material may have been more difficult to find in secondary contexts because it was scattered across the landscape. In secondary contexts, material may be less abundant, smaller, and of poorer quality due to movement. The cost of obtaining material in non-local primary context is the time and energy spent in travel to and from the source, but this would have been a direct trip with little search time possibly embedded within subsistence activities on the Hesbaye Plateau. The cost of obtaining material in secondary context is an increase in search time, first to find a secondary source and then to evaluate the material.

EVIDENCE FOR REDUCTION OF MATERIALS AT THE SITE

Rank 3

The Rank 3 materials are represented only by finished tools and blanks, with three nearly exhausted cores in the Aurignacian component. Comparison of the Mousterian and Aurignacian components reveals a suggestive difference in the structure of Rank 3 artifacts: nearly all of the materials in the Mousterian component are tools with few blanks and no cores while tools are much less common in the Aurignacian component (Table 8.12). Excluding the debris, which appears to have been non-randomly included in the Aurignacian component, 32.7% (n=19) of the Aurignacian Rank 3 materials are tools in comparison with 69.1% (n=83) for the Mousterian component.

Provisionally accepting the division into two components as valid, this suggests that there were different behavioral patterns with respect to long-term curation of raw materials for Mousterian and Aurignacian groups occupying Goyet. Mousterian groups transported finished

Aurignacian component									
7 – black flint		2 – Spiennes flint		10 – chert		9 – brown flint		5 – Wommersom quartzite	
n=3		n=8		n=4		n=3		n=1	
UP	MP	UP	MP	UP	MP	UP	MP	UP	MP
8			**10**		**19-42**	8			**9**
77		11		13		**77-74**			
	8		**13-43**	**77**		**77**			
			19-42	**77**					
		5							
		5							
		65							
		65							
3 flakes		2 flakes 3 blades		3 flakes 1 blade		3 flakes		1 flake	

Table 8.13. Stratum 3. Aurignacian component. Tool types (de Sonneville-Bordes and Perrot and Bordes type lists) represented in Rank 3 materials. In bold: Mousterian types.

Aurignacian component						
	7-black flint	2-Spiennes flint	10-chert	11-quartzite	9-brown flint	5-Wommersom quartzite
flakes	11 (3)	6 (2)	5 (3)	2	3 (3)	1 (1)
blades	12	16 (6)	1 (1)			
cores	1	1	1			

Table 8.14. Stratum 3. “Aurignacian”. Kinds of blanks present. Parentheses indicate number of tools included in total blanks.

Aurignacian component	
Length	**n**
20-30 mm	2
31-40 mm	2
41-50 mm	3
51-60 mm	5
61-71 mm	6
71-80 mm	1

Table 8.15. Stratum 3. “Aurignacian”. Length of Rank 3 tools.

tools, curating such tools long after the core reduction phase for their materials had ended. Aurignacian groups, in contrast, transported blanks ready to be retouched into whatever tools were necessary. This in turn suggests differences in problem-solving strategies. One strategy was to have a series of tools always on hand, often composite (as will be seen below); the other strategy was more flexible, where blanks could be retouched into the appropriate tools as needed. Even if each component reflects a palimpsest of multiple occupation episodes (several Mousterian within the Mousterian component and several Aurignacian within the Aurignacian component), the interpretation still holds for the two periods.

If, however, one recognizes that the two components are artificially separated and come from Dupont's thick Stratum 3 (a single, mixed, unit), the two components can be seen to complement each other, one containing mainly tools and the other mainly blanks.

Because the issue involved here is curation of tools, it should be possible to use typology to verify that the Rank 3 materials in each component truly represent Mousterian and Aurignacian tools (regardless of whether or nor each component contains artifacts from multiple occupations). The Bordes and de Sonneville-Bordes type-lists were used to identify tools as Mousterian or Aurignacian.

In the Aurignacian component, 11 of 19 tools are actually "Mousterian" types, only three of which are made on blades (Table 8.13). Thus, the so-called Aurignacian component is probably quite mixed with Mousterian artifacts. Table 8.14 shows that the majority of blanks are blades, of which seven were tools.

Of the tools, only the two largest (lengths equal 69 and 81 mm) are whole, but most tools are greater than 40 mm (Table 8.15), and therefore were obviously larger when the blades were whole. They were probably curated due to their size (which gave them a longer use-life) and were apparently discarded when broken.

Table 8.16 shows that there are only 12 so-called Upper Paleolithic tool types (less than 10%) present in the Mousterian component, indicating that there is probably less mixing than in the Aurignacian component. All but one of the presumed "Aurignacian" tools were made on blades, and only three presumed "Mousterian" tools on blades. The blanks selected for tools are more diverse than in the Aurignacian component, with some tools made on chunks, a core, a crested blade, and a Levallois flake as well as ordinary flakes and blades.

Table 8.17 shows that the majority of "Mousterian" tools are between 31 and 60 mm in length. A relatively high frequency of whole tools is observed (39 of 83). These were discarded before being broken, either due to exhaustion or because they were replaced with new tools on higher ranked materials. Ten tools are composite tools, either due to reshaping of old tools or the production of multiple use tools. In either case, this indicates increased intensity of use.

The comparison of the Rank 3 materials typologically suggests that the Mousterian component is relatively less mixed than the Aurignacian component. Only 12 of 83 tools (around 15%) can be assigned to the Upper Paleolithic while 11 of 19 tools in the Aurignacian component are Mousterian types.

The Mousterian component also had many whole tools (39 of 83) as opposed to only 2 of 19 in the Aurignacian component. Such tools, discarded before being broken and often composite, would have been discarded either because they were exhausted or because they were replaced by tools made on Rank 1 materials.

The number of tools, whole tools and composite tools, along with the higher typological integrity of the Rank 3 Mousterian component, together suggest that Mousterian group(s) occupying Goyet transported finished tools, many reflecting long use, rather than blanks which could be shaped as needed.

The so-called Aurignacian component is more problematic. It is clearly more mixed. Of the blanks, 22 are unretouched blades and 16 are flakes. The simplest interpretation, excluding the 11 Mousterian tools and adding the 12 UP tools from the Mousterian component, is that

Mousterian component													
1 – Obourg flint		2 – Spiennes flint		5 – Wommersom quartzite		7 – black flint		9 – brown flint		4 – phtanite		11 - quartzite	
n=9		n=22		n=15		n=16		n=11		n=4		n=6	
UP	MP	UP	MP	UP	MP	UP	MP	UP	MP	UP	MP	UP	MP
	100	**27**			10		12		10-42		9		29
	13-42	**27**			13		100		13	**66**			35
	10-42	77			10		100		13	**58**			10
	9-42	77			18		19		26	**58**			16
	10		42-45		17		10		13				10
30			6		9		9		10				9
77			6		9		9	23-77					
	9-42		6		10		10	**27**					
27			100		9		9	77					
			100		17		7	74					
			11		9		10-42		13				
			10		12		10						
			17		26		100						
			10		10		30						
			9		100		9-42						
			10				17						
			10										
		29											
		44											
		23											
		1											
			100										
			100										
6 flakes 3 blades		16 flakes 4 blades 2 chunks		11 flakes 1 Lev. flake 1 blade 1 chunk 1 crested blade		14 flakes 1 chunk 1 blade		6 flakes 4 blades 1 core		1 flake 3 blades		5 flakes 1 chunk	

Table 8.16. Stratum 3. "Mousterian". Tool types represented in Rank 3 materials.
In bold: Upper Paleolithic types. 100 = throwing stone.

Mousterian component			
	Tools	**Whole tools**	**Composite tools**
Length	**n**	**n**	**n**
< 20 mm	1	1	1
20-30 mm	3	2	
31-40 mm	21	10	1
41-50 mm	25	7	3
51-60 mm	20	11	2
61-71 mm	10	6	3
71-80 mm	1	1	
81-90 mm	1	1	
91-100 mm			
101-110 mm	1		
TOTAL	**83**	**39**	**10**

Table 8.17. Stratum 3. "Mousterian". Length of Rank 3 tools, with breakdown of number of whole and composite tools.

Material	Total n (blank pool)	flakes		blades	
		n	%*	n	%
Aurignacian					
3 - Hesbaye	555	284	51	271	49
6 - tan flints	84	29	35	55	65
8 – gray flints	35	32	91	3	9
1 – Obourg flint	54	19	35	35	65
Mousterian					
3 - Hesbaye	340	209	61.5	131	38.5
6 - tan flints	80	65	81.2	15	18.8
8 - gray flints	65	61	93.8	4	6.2
10 - cherts	44	39	88.6	5	11.4

Table 8.18. Stratum 3. Blank production by material type. *Percent of blank pool, not of assemblage of each material type.

Material type	Blank type	% of preferred blanks
Aurignacian		% (n)
3 - Hesbaye	no difference (flake, blade, debris flake)	27-34% (54, 52, 44)
6 - tan flints	blade	44% (11)
8 - gray flints	debris flake 1-30 mm	45% (13)
1 - Obourg flint	blade	50% (13)
Mousterian		
3 - Hesbaye	flake, chunk, debris flake	63-89% (128, 11, 17)
6 - tan flints	flake	47% (27)
8 - gray flints	flake	75% (18)
10 - cherts	flake	94% (16)

Table 8.19. Stratum 3. Blank selection for tool production. Ranks 1 and 2.

Type	n tools	n unused blanks	tools + blanks	tool/blank ratio	% tools
Aurignacian					
3	161	361	522	.45:1	30.8%
6	28	61	89	.46:1	31.5%
8	29	13	42	2.23:1	69.0%
1	26	32	58	.81:1	44.8%
7	3	20	23	.15:1	13.0%
2	8	14	22	.57:1	36.4%
10	4	2	6	2:1	66.7%
11	0	3	3	0:1	0.0%
9	3	0	3		100.0%
5	1	0	1		100.0%
Mousterian					
3	182	166	348	1.1:1	52.3
6	38	42	80	.90:1	47.5
8	24	43	67	.56:1	35.8
10	17	21	38	.80:1	44.7
1	9	26	35	.35:1	25.7
2	22	2	24	11:1	91.7
5	15	3	18	5:1	83.3
7	16	1	17	16:1	94.1
9	11	3	14	3.7:1	78.6
4	4	2	6	2:1	66.6
11	6	0	6	-	100

Table 8.20. Stratum 3. Intensity of blank selection.

Aurignacian group(s) transported a few curated tools and a series of large blanks that could be shaped into whatever tools were needed, when needed.

If my hypothesis is correct that rank of raw materials reflects time (duration of possession of material), where material passes from material provisioning a site to an active toolkit to the last vestiges of the material in the form of blanks and tools, then the Rank 3 materials in the two components reflect different behavioral strategies – one geared to keeping a stock of finished tools and the other to keeping a stock of blanks ready to be shaped as needed, along with a few curated tools.

Ranks 1 and 2

What blanks were produced?

The following table (Table 8.18) shows the variability in the kinds of blanks produced during core reduction at the site, from which blanks were selected for retouch into tools. In the Aurignacian component, there is no significant difference in percentage of flakes and blades. Hesbaye flint was utilized to provision the site during occupation, and thus for various activities which may have had different blank form requirements. If different types of tools are made preferentially on different blank forms, it follows that different blank production techniques would also be used. As seen below, endscrapers were preferentially made on flakes, while blades were used for other types of tools. For tan flints and Obourg flint, blades are more common than flakes. For gray flints, flakes are much more common than blades. In the Mousterian component, flakes dominate for all material types.

What blanks were selected for retouch into tools?

The following table (Table 8.19), for the subset of tools in the assemblage, shows blank preference by material type for the two components. The pattern of blank selection reflects the kinds of blanks produced in the table above. For all materials, blanks selected for retouch come from the debitage category that is most common.

In the Aurignacian component, the dominant material (n=161), Hesbaye flint, shows almost no difference in percentage between flakes, blades, and debris flakes 10-30 mm. This is to be expected if Hesbaye flint is the most abundant and commonly used material in the assemblage: it would have been used for a wider range of tools for which flakes, blades, and debris flakes would have been appropriate. For tan flints (n=25) and Obourg flint (n=26), blades are the preferred blank type. This could possibly be explained as a technical strategy to maximize the number of tools obtained from rare, non-local flints. By employing blade-producing techniques, more blanks are produced from these materials. However, gray flint (n=29) differs from the others by primarily utilizing debris flakes 10-30 mm, possibly due to the kind of tools produced on this material (see below). In the Mousterian component, flakes dominate for all material types, regardless of material quality or distance to source.

What is the intensity of blank selection?

The intensity of blank selection refers to the ratio between tools and unused blanks. A high ratio, like those seen above, means that most blanks produced eventually became tools; few or relatively few were ignored. Intensity of blank selection is an index of how efficiently material was actually used. Local or abundant material may be used to produce many blanks, but only the “best” blanks need to be actually used, resulting in a low ratio of tool to unused

Aurignacian component, Rank 1, Type 3. Whole blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.298**
Blanks (unretouched)	19	62.6842	14.442	3.313
Tools (retouched)	7	56.4286	9.090	3.436
WIDTH Width (mm)				**p=.117**
Blanks (unretouched)	19	27.6316	11.026	2.530
Tools (retouched)	7	20.5714	4.685	1.771
THICK Thickness (mm)				**p=.549**
Blanks (unretouched)	19	8.6842	2.790	.640
Tools (retouched)	7	7.8571	3.805	1.438

Aurignacian component, Rank 1, Type 3. Whole flakes.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.564**
Blanks (unretouched)	4	55.2500	17.689	8.845
Tools (retouched)	9	49.4444	15.685	5.228
WIDTH Width (mm)				**p=.325**
Blanks (unretouched)	4	39.2500	14.080	7.040
Tools (retouched)	9	32.2222	10.121	3.374
THICK Thickness (mm)				**p=.360**
Blanks (unretouched)	4	9.2500	2.217	1.109
Tools (retouched)	9	11.1111	3.551	1.184

Aurignacian component, Rank 2: Types 6, 8, 1. Whole blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.444**
Blanks (unretouched)	18	61.1667	12.743	3.004
Tools (retouched)	4	56.0000	5.888	2.944
WIDTH Width (mm)				**p=.401**
Blanks (unretouched)	18	22.6111	5.761	1.358
Tools (retouched)	4	20.0000	3.742	1.871
THICK Thickness (mm)				**p=.356**
Blanks (unretouched)	18	6.7222	2.024	.477
Tools (retouched)	4	8.0000	4.082	2.041

Table 8.21. Size analyses. Stratum 3. “Aurignacian”.

Aurignacian component, Rank 3: Types 7, 2, 10, 11, 4, 9, 5, 12. All blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.353**
Blanks (unretouched)	7	48.7143	9.032	3.414
Tools (retouched)	7	54.7143	13.720	5.186
WIDTH Width (mm)				**p=.513**
Blanks (unretouched)	7	20.5714	6.051	2.287
Tools (retouched)	7	22.7143	5.851	2.212
THICK Thickness (mm)				**p=.628**
Blanks (unretouched)	7	7.4286	3.645	1.378
Tools (retouched)	7	8.4286	3.867	1.462

Aurignacian component, Rank 3. All flakes.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.920**
Blanks (unretouched)	3	54.6667	15.144	8.743
Tools (retouched)	10	55.5000	11.607	3.670
WIDTH Width (mm)				**p=.054**
Blanks (unretouched)	3	49.3333	15.948	9.207
Tools (retouched)	10	36.7000	6.378	2.017
THICK Thickness (mm)				**p=.364**
Blanks (unretouched)	3	11.6667	5.033	2.906
Tools (retouched)	10	14.7000	4.832	1.528

Table 8.21. Size analyses. Stratum 3. “Aurignacian”. (continued)

Mousterian component, Rank 1. Type 3. Whole blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.655**
Blanks (unretouched)	2	57.0000	9.899	7.000
Tools (retouched)	7	54.1429	7.198	2.721
WIDTH Width (mm)				**p=.526**
Blanks (unretouched)	2	25.0000	2.828	2.000
Tools (retouched)	7	22.4286	5.062	1.913
THICK Thickness (mm)				**p=.316**
Blanks (unretouched)	2	10.0000	.000	.000
Tools (retouched)	7	7.8571	2.673	1.010

Mousterian component, Rank 1. Type 3. Whole flakes.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.923**
Blanks (unretouched)	23	47.6696	13.591	2.834
Tools (retouched)	75	47.3840	12.045	1.391
WIDTH Width (mm)				**p=.096**
Blanks (unretouched)	23	41.1826	15.879	3.311
Tools (retouched)	75	35.0973	10.649	1.230
THICK Thickness (mm)				**p=.051**
Blanks (unretouched)	23	11.1348	4.003	.835
Tools (retouched)	75	13.1187	4.260	.492

Mousterian component, Rank 2: Types 6, 8, 10. Whole blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.111**
Blanks (unretouched)	4	56.5000	10.970	5.485
Tools (retouched)	1	84.0000	.	.
WIDTH Width (mm)				**p=.534**
Blanks (unretouched)	4	27.0000	3.830	1.915
Tools (retouched)	1	30.0000	.	.
THICK Thickness (mm)				**p=.664**
Blanks (unretouched)	4	10.5000	4.655	2.327
Tools (retouched)	1	8.0000	.	.

Table 8.22. Size analyses. Stratum 3. “Mousterian”.

Mousterian component, Rank 2. Whole flakes.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.666**
Blanks (unretouched)	13	42.5846	11.354	3.149
Tools (retouched)	41	44.0366	10.242	1.600
WIDTH Width (mm)				**p=.566**
Blanks (unretouched)	13	39.9462	13.029	3.614
Tools (retouched)	41	38.0024	9.715	1.517
THICK Thickness (mm)				**p=.168**
Blanks (unretouched)	13	11.2615	4.786	1.327
Tools (retouched)	41	13.3756	4.734	.739

Mousterian component, Rank 3: Types 1, 2, 5, 7, 9, 4, 11, 12. All blades.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.427**
Blanks (unretouched)	4	57.7500	24.295	12.148
Tools (retouched)	16	46.5625	7.330	1.833
WIDTH Width (mm)				**p=.216**
Blanks (unretouched)	4	18.5000	4.041	2.021
Tools (retouched)	16	22.5625	5.944	1.486
THICK Thickness (mm)				**p=.686**
Blanks (unretouched)	4	8.0000	1.414	.707
Tools (retouched)	16	8.5625	2.607	.652

Mousterian component, Rank 3. All flakes.

Variable	Number of Cases	Mean	SD	SE of Mean
LENGTH Length (mm)				**p=.072**
Blanks (unretouched)	9	40.9111	9.855	3.285
Tools (retouched)	55	48.5800	11.888	1.603
WIDTH Width (mm)				**p=.786**
Blanks (unretouched)	9	36.6000	6.400	2.133
Tools (retouched)	55	35.7473	8.966	1.209
THICK Thickness (mm)				**p=.023**
Blanks (unretouched)	9	10.6000	3.829	1.276
Tools (retouched)	55	13.5091	3.402	.459

Table 8.22. Size analyses. Stratum 3. “Mousterian”. (continued)

blanks. Non-local, good quality material would be expected to be maximized, using every possible blank produced, and therefore resulting in a higher ratio. In the following table, debris flakes and chunks are excluded from the category of potential blanks. Table 8.20 summarizes the number of tools and blanks, the tool to blank ratio, and the percentage of tools in the combined tool-blank pool.

In the Aurignacian component, for Ranks 1 and 2, roughly 30-45% of blanks were selected for retouch. Type 8 (gray flints) is an exception because it shows more intense blank selection (69%). For the Rank 3 materials, which are present only as blanks and tools, types 7, 2, and 10 show similar percentages to those in Ranks 1 and 2. Types 9 and 5 are present only as tools.

In the Mousterian component (as in the Aurignacian component), for Ranks 1 and 2, roughly 35-50% of blanks were selected for retouch. Type 1 (Obourg flint) is an anomaly because the majority of blanks were unused despite the transport distance. For the rest of the Rank 3 materials, each type consists of only tools and blanks, resulting in high percentages.

Is there a size differential between blanks and tools?

For Rank 1 and 2 materials, the sizes of whole blades and blade tools, and whole flake and flake tools. For Rank 3, all blanks and tools (whole or not), were compared to increase the sample size (Tables 8.21 and 8.22). Samples are small for whole artifacts in both components, but comparison of means shows that there is *no* statistically significant difference between blade and flake blanks and tools in either component.

EVALUATION OF LITHIC ECONOMY WITH RESPECT TO RAW MATERIAL CONTEXT

By sorting the materials by their distance from site to source (where it can be estimated), it can be seen that local materials were rarely used. The dominant material (Hesbaye flint) comes from the nearest known flint source region, although specific geological sources are not yet known. Rank 2 materials, substantially less common than Rank 1, come from the most distant source (Obourg) or are unknown. Rank 3 materials, apart from the local materials, come from at least 40 km away or are unknown. All Rank 3 materials came to the site as curated tools and blanks, except for black flint and Spiennes flint, which each included prepared cores.

The general pattern is that local materials were not used, while the dominant material comes from the nearest flint source region. Materials from greater distances came to the site as prepared cores and curated tools, and possibly represent the previous occupied region.

All cortical materials (except chert, with a sample too small to be meaningful) indicate that material was generally procured in primary context rather than secondary (70-80% of cortical pieces show primary context). As Demars (1982) and Geneste (1985) also argue, material in primary context is likely to be larger, more abundant, and less subject to damaging effects of transport, and therefore will be of better quality than material in secondary context.

The procurement range indicated by the ranking of materials shows that the Plateau de Hesbaye is dominant, while other materials were transported as prepared cores, blanks, and tools. That is, while the lesser-ranked materials were transported as curated materials, once at Goyet, material was obtained from a single source region either via logistical trips or embedded procurement.

Given the lack of good-quality local material as well as the distances to be covered to procure Hesbaye flint, it is unlikely that major export activities occurred at the site, as they

would have been at a site like Maisières-Canal, where a large proportion of reduction activity was for transport and not for use at the site. Certain items, primarily prepared cores and tools, would likely have been curated and transported to the next site, as were the Rank 3 materials at Goyet from the previous sites. However, these would be transported as part of the active toolkit, not as deliberately produced items for export/transport.