M.Otte et L.G. Straus. *La grotte du Bois Laiterie*. Liège, E.R.A.U.L. 80, 1997.

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BOIS LAITERIE AND THE MAGDALENIAN OF BELGIUM: INTER-ASSEMBLAGE COMPARISONS

L.G. Straus and J. Orphal

Introduction

Leaving aside questions of sample-size effect and assuming reasonably tight chronological control by independent, radiometric means, there are two things that can conceivably be pursued by making inter-site comparisons of artifact assemblages: (1) the search for ethnic («cultural») similarities and differences and (2) the elucidation of inter-site functional (activity or role of «place») similarities and differences. The lithic inter-assemblage debate (initiated in its modern form by the «Bordes-Binford debate» over the Mousterian) is, in fact, a subset of the larger question of how to distinguish style and function in archeology.

Interpretations of the record traditionally assigned to «the Magdalenian» of Belgium and dated chronostratigraphically to the Bölling pollen zone and radiometrically to the period between c. 13,000-12,000 BP (uncalibrated) fall within the realm of this major debate within prehistoric archeology. Indeed, neither «explanation» is likely to be exclusively correct, but exploration of the possibilities for explanation can provide a valuable contribution to the discipline. We take the postion here that before *assuming* that the differences among the Magdalenian assemblages of the Low Countries are simply «ethnic» in nature, the possible «functional» significance of various aspects of the differences needs to be explored in light of logical, practical points of distinction: *e.g.*, physical type of site (cave or open-air), location, size, topographic and lithological setting. While not denying that self-identifying regional bands existed within the Magdalenian «community», it seems counterintuitive to automatically assume that all formal typological distinctions should have such meaning within the space of modern day eastern Belgium, an area that for mobile hunter-gatherers is small indeed, but whose contrasts of lithology and relief obviously suggest the existence of complementary (perhaps seasonal) activities at least as much as they might imply the existence of social boundaries. What follows will not resolve the debate over whether there were two Belgian Magdalenian «groups» (or «cultures») or just functionally different kinds of occupations by the same «people» in different places at different times for different purposes. It should, however, provide fuel for thought, as research into the Tardiglacial recolonization of NW Europe shifts into high gear, as evidenced by the recent work of P.Vermeersch (Vermeersch and Symens,1988, De Bie and Vermeersch,n.d.), M.Otte (1989), M.Dewez (1987, 1992), E.Rensink (1993), R.Charles (1994), E.Teheux (1994) and many others, including reseachers in Britain, northern France, Netherlands and Germany.

Cave and Open-Air Magdalenian Sites of the Lowlands: The Comparative Sample

As noted elsewhere in this volume, although there are now many known Upper Magdalenian sites from the eastern half of Belgium (and from adjacent regions of France, Netherlands and Germany) and although indeed there are now high-quality radiometric dates from 11 of these sites (AMS and/or conventional C14 from Chaleux, Bois Laiterie, Da Somme, Frontal, Nutons, Goyet, Coléoptère, Verlaine, Blaireaux and Walou; TL from Orp [Charles,1994; Gilot,1984; Vermeersch,1991]), there are fully published data on the artifact assemblages from modern-quality excavations at only three of these sites: Chaleux (Otte *et al.*,1994), Orp (East and West) (Vermeersch *et al.*,1987) and Kanne (Vermeersch *et al.*,1985) - the latter unfortunately not radiometrically dated.

Kanne is tentatively dated on geological grounds (by pedological study of its loess matrix) to the Bölling oscillation. Orp East is TL-dated on burnt flints to 11,800±1,200, 12,100±1,300 and 12,900±1,500 BP and Orp West is dated by the same method to 13,100±1,400 and 13,700±1,700 BP (Vermeersch,1991). Geologically dated to the pre-Alleröd Tardiglacial and because of the very large standard errors associated with these TL determinations, both Orp loci could pertain to Bölling (or Orp West to late Dryas I, given the fact that TL ages are presumably «older» than radiocarbon ages). The most acceptable dates for the Chaleux Magdalenian horizon (palynologically assigned to early Bölling [Noirel-Schutz,1994]) are five determinations (three AMS and two conventional C14) that range between 12,990±140 and 12,710±150, with one younger outlier of 12,370±170 BP (Charles,1994). At 12,650±120 BP, the three statistically identical AMS dates for the Magdalenian horizon at Bois Laiterie place it in the early-middle traditional Bölling.

Together with Bois Laiterie (and two recently excavated sites in Dutch Limburg near Maastricht: Mesch and Eyserheide [Rensink,1993]), these sites (Chaleux, Orp and Kanne) would seem intuitively to represent at least three different types of human occupations. (Other open-air sites from the northern part of the Dutch Limburg enclave [Sweikhuizen] and from the nearby Aachen district in Germany [Alsdorf] could have been added to the comparison, but the present sample is adequate to compare with the two Wallonian sites.)

Bois Laiterie and Chaleux are both caves: the former small, north-facing, uncomfortable, but strategically situated; the latter large, commodious and well-exposed both in terms of overlook and solar exposure. The habitable area of BL (including the narrow exterior terrace) is maximally c.50 m² and the cave faces due north. The habitable area of Chaleux (also including its large terrace) is c.110 m² and it faces southwest, overlooking a ford across the Lesse. Neither cave, however, is at all near proven, rich sources of high-quality flint, although Chaleux is quite far from both the Spiennes (70 air km) and the Orp (60 air km) sources, while Bois Laiterie is at least at only 2/3 the distance from Orp. Orp, Kanne and the Maastricht sites, in contrast, are all fairly exposed, open-air loci on the Hesbaye Plateau or on Meuse terraces, but situated *at* primary or secondary sources of excellent-quality Upper Cretaceous (Maastrichtian chalk) flint in the formation that runs east-west from Aachen to Eghezée (Namur Province). Orp actually consists of two different, adjacent and not strictly contemporaneous loci.

While Chaleux is «deep» within the Belgian uplands on the edge of the Ardennes *per se*, Bois Laiterie is at the very northern edge of those uplands, quite near to the low, loess-covered plateau (Hesbaye) of Middle Belgium, whose southern margin is the Sambre-Middle Meuse trench, only 12 air km north of the site. Chaleux is on the Lesse River, whose valley is a major avenue of access (even today by road and rail) between the upper Meuse (the confluence with which is c.7 km downstream of Chaleux) and the heart of the Ardennes. Bois Laiterie overlooks the confluence of the deeply entrenched Burnot stream with the lower stretch of the upper Meuse, c.15 km upstream of its confluence with the Sambre and its great turn to the east at Namur.

Bois Laiterie is 22 km downstream along the Lesse and Meuse from Chaleux; it is 39 km upstream along the Meuse and across the Hesbaye Plateau from Orp; and it is 85-90 km upstream along the Meuse from Kanne (and from Mesch, which is on the opposite [right] side of the Meuse in the Maastricht enclave, with Eyserheide being some 20 km further east therein). In terms of geographical (and potential actual human) relationships, Kanne, Mesch and Eyserheide are about the same distance from the Upper Magdalenian cave sites of the hill country just south of Liège (Walou, Coléoptère) - c.30-40 km - as Orp is from Bois Laiterie or Goyet. The chalk flint outcrops around Maastricht and Aachen are the logical sources for the cave sites of NE Liège Province, just as the Orp outcrop (and the Spiennes outcrop) make sense as sources for the cave sites of Namur Province.

The Orp, Kanne and Chaleux lithic tool assemblages were all classified according to the original de Sonneville-Bordes and Perrot typology, making comparison with Bois Laiterie straightforward. In the case of Chaleux, the additional category of «retouched flake» (Otte *et al.*,1994) was retabulated by us in the cumulative percentage graph as Type 77 (sidescraper). Because somewhat less detailed (or different) breakdowns of lithic debris were given by both Vermeersch *et al.* for Orp and Kanne and by Otte *et al.* for Chaleux than by us for Bois Laiterie and because their categories of bladelets were obviously longer than ours (though not explicitly defined in their publications), we have lumped our categories to be comparable with theirs, namely: cores, flakes, blades+bladelets, crested blades, microdebitage (our trimming flakes+shatter = their «esquilles»), and burin spalls.

Debris Comparisons

Tab.1 and Fig.1 provide summaries of the composition of the debris assemblages from Bois Laiterie, Chaleux (recent excavations), Orp East, Orp West and Kanne. The most striking contrast among these assemblages is the enormous relative and absolute frequencies of microdebitage at all three open-air sites (67-87%!) versus much more moderate quantities at the two cave sites (56-59%). There is also an interesting contrast between the two site types in terms of blades+bladelets: 19-23% at the cave sites versus 4-14% at the open-air loci. These facts suggest: (1) intensive flint smashing and knapping resulting in huge amounts of microdébitage at Orp and Kanne and (2) removal of the sought-after laminar blanks from Orp and Kanne (presumably *to* sites like Chaleux and Bois Laiterie where blades and bladelets are proportionally better represented, as a result of their deliberate transport from quarry-workshop loci).

TABLE 1

Comparison of Lumped Lithic Debris Categories
for Bois Laiterie, Chaleux, Orp Est, Orp Ouest, and Kanne*

Sites / Debris	Bois Laiterie			Chaleux			Orp Est			Orp Ouest			Kanne		
	N	%	cum %	N	%	cum %	N	%	cum %	N	%	cum %	N	%	cum %
cores	3	0.10	0.10	3	0.08	0.08	63	0.08	0.08	27	0.28	0.28	25	0.11	0.11
flakes	495	16.07	16.19	688	19.34	19.43	7068	8.59	8.67	1452	15.01	15.29	4082	18.29	18.40
blade / bladelets	713	23.15	39.38	683	19.20	38.63	2913	3.54	12.21	703	7.27	22.55	3103	13.90	32.30
crested blades	12	0.39	39.77	51	1.43	40.06	213	0.26	12.46	35	0.36	22.91	208	0.93	33.23
trimming flake / shatter	1820	59.09	98.96	1996	56.11	96.18	71200	86.53	98.99	7300	75.45	98.37	14833	66.46	99.69
burin spall	37	1.20	100	136	3.82	100	830	1.01	100	158	1.63	100	69	0.31	100
Total	3080	100		3557	100		82287	100		9675	100		22320	100	

* Table does not include chunks or platform renewal flakes.

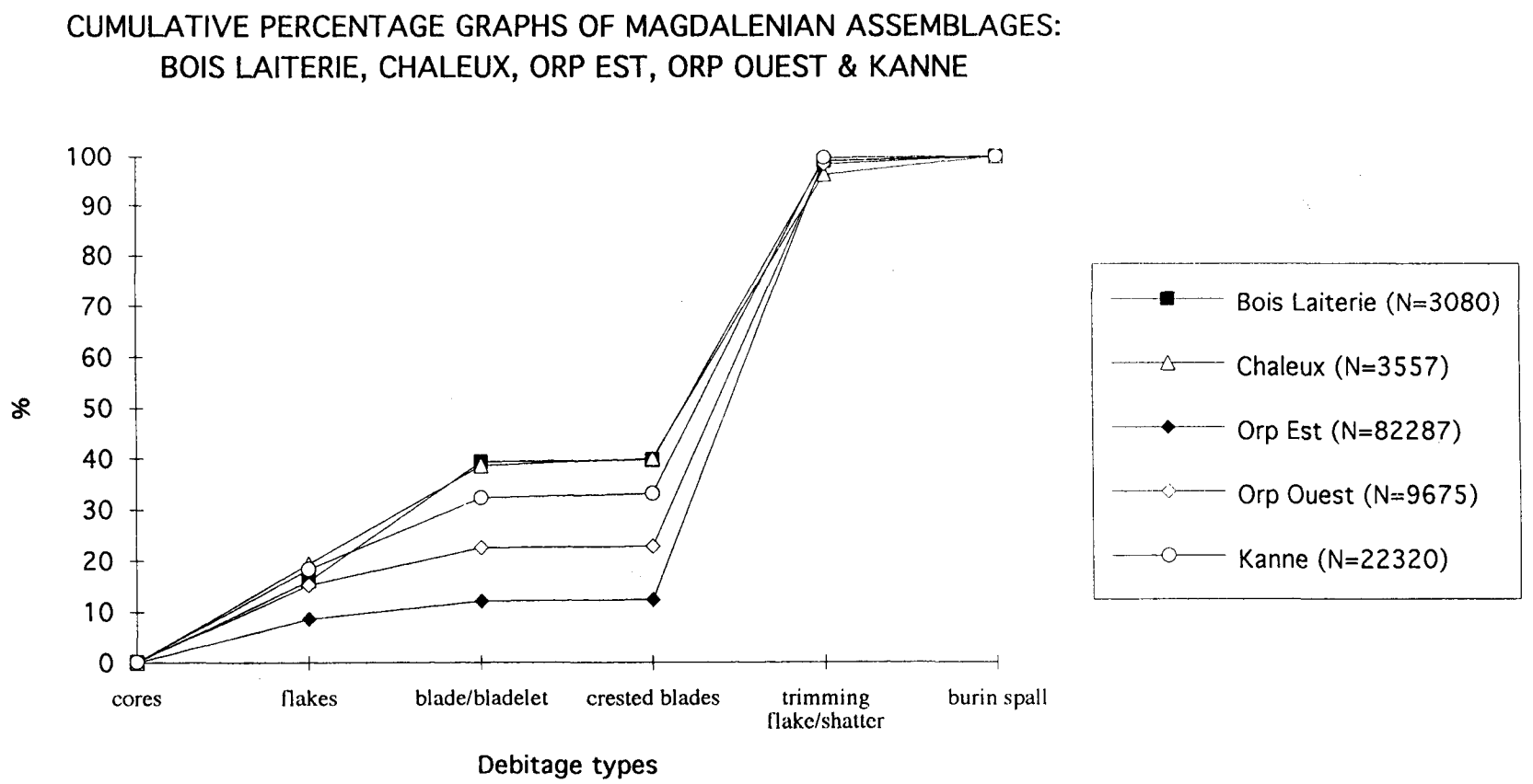

Fig.1 - Bois Laiterie, Chaleux, Orp and Kanne, cumulative percentage graphs of debris assemblages

It is unfortunate that the distinction between trimming flakes and shatter (small angular debris) was not made at the other sites, as the latter might be more indicative of initial reduction than of retouching/ resharpening - better represented by trimming flakes (small chips with Herzian morphology). It is also unfortunate that the other site reports do not all provide complete, consistent information on cortex, which would allow for distinction between early and late reduction stages. However, Orp is said to contain large numbers of often very big decortication flakes (Vermeersch *et al.*,1987:18) - items essentially absent at BL. Among 1371 items of larger debris (flakes, blades and bladelets) at Chaleux, 250 have some cortex - 18.2%. At Bois Laiterie the figure for the presence of cortex on the same three classes of larger débitage is 13.0%. It is unfortunate that we lack information on cortex for the Chaleux microdebitage. Significantly, many of the cortical pieces at Chaleux are actually on local, poor-quality Carboniferous chert - not so much on the imported chalk flint, according to Otte *et al.* (1994). At BL such cherts essentially do not exist.

Otherwise there is considerable variability among the percentages of the remaining debris classes at Orp, Kanne, BL and Chaleux that does not correlate with the simple binary categorization of open-air versus cave sites.

Statistical tests were conducted to compare the debris assemblage of Bois Laiterie with that of Chaleux (*i.e.*, between two cave sites far from flint sources), and also with those of Orp (East and West) and Kanne (*i.e.*, a cave site versus three open-air sites). To provide adequate per-category sample sizes, the debris assemblages from all five sites were lumped into the following 6 categories: cores, large flakes (>1 cm), blades+bladelets, crested blades, microdebitage (trimming flakes+shatter), and burin spalls (Tab.1). As illustrated in Tab.2, BL and Chaleux are statistically similar according to the Kolmogorov-Smirnov (K-S) two-sample test of homogeneity (Sokal and Rohlf,1981; Thomas,1986) at the 0.05 level. However, BL is statistically different from each of the 3 open-air sites.

TABLE 2

Kolmogorov-Smirnov Two-Sample Test of Homogeneity
Comparing Debris between Sites (.05 level).

Site comparison	D-value	D-critical	Statistical Result
BL vs. Chaleux	0.0324	0.0334	similar
BL vs. Orp Est	0.2731	0.0249	different
BL vs. Orp Ouest	0.1686	0.0281	different
BL vs. Kanne	0.0708	0.0261	different

In contrast, chi-square tests of homogeneity (Everitt,1979) using these same six categories show BL and Chaleux to be statistically *different* at the 0.05 level (χ^2 value=87.2, df=5, $p<0.001$). Nonetheless, BL, Orp E and W, and Kanne are still shown to be statistically different at the 0.05 level (χ^2 value=7618.6, df=15, $p<0.001$).

Although these two tests produce conflicting results when BL and Chaleux are compared, the K-S tests seem to be more informative. The D-value of 0.0324 (3.24%) is the *maximum* difference in cumulative percentages between debris categories; all other differences are less than 3%. This relatively small, albeit statistically significant difference (visually apparent in the cumulative percentage graphs of BL and Chaleux (Fig.2) suggests that the debris assemblages of BL and Chaleux are fundamentally quite similar. The open-air sites, however, are really very different in terms of their lithic debris.

An illuminating set of comparative data are the dimensions of whole laminar blanks (blades + bladelets) at Bois Laiterie, Chaleux, Orp East and West, and Kanne. Histograms of length are presented in Figs.3a-e. The distributions for BL and Chaleux are similar: both are dominated by short blade(let)s (<20-40 mm). This contrasts especially with both Orp loci, dominated by longer blade(let)s: 41-80 mm. Kanne is intermediate, with very few of the shortest bladelets, but many laminar blanks in the range between 21-50 mm, as well as a substantial quantity between 51-70 mm. (Unfortunately, formal statistical tests could not be conducted to compare these distributions, since standard deviations were not reported for Chaleux, Orp or Kanne. However, the qualitative similarities and differences seem substantial enough to lead to further interpretation.) The size classes of bladelets and small blades that are missing or rare at the open-air, flint source sites are precisely the ones that are best represented at the two cave sites. It is the long blades, so abundant at Orp and Kanne that are all but missing from the distant cave sites of Bois Laiterie and Chaleux.

In terms of some specific, technologically indicative categories, if one looks at absolute frequencies only, there are some obvious differences that are masked among the percentages because of the enormous disparities in terms of microdebitage amounts. This is most glaringly true of the cores; because the total debris assemblage are relatively small (due to the fact that there are not the huge masses of microdebitage in the cave sites, despite careful fine-screening), the three cores each at both Chaleux and Bois Laiterie translate to percentages that are no lower than the core percentages for Orp East and Kanne (and not much lower than that of Orp West). Yet *there are 8 to 21 times more cores at the open-air sites* - and they are substantially larger. Whereas the Bois Laiterie cores average 44 mm in length and have an average weight of 24.5 gm and the cores from the recent excavations at Chaleux have an average length of 36 mm and average weight of 25.7 gm, the 63 (!) cores from Orp East have an average length of 107 mm and average weight of 600 gm (ranging from 110-3410 gm). The averages for the 29 cores at Orp West are 96 mm and 511 gm (weight range: 64-2080 gm); for the 25 cores from Kanne the averages are 140 mm and 1155 gm (weight range:290-2655 gm). At both Orp and Kanne, almost all the cores are bladelet and/or (especially) blade cores. At Orp, in addition to the large numbers of more or less intact (*i.e.*, far-from-exhausted) cores, there are 16 and 10 nucleus fragments at the Orp East and West loci respectively.

Also of note are the large absolute numbers of crested blades at Orp East (213), Orp West (35) and Kanne (208), versus 12 at BL and 51 at Chaleux. Platform rejuvenation flakes (including «sausage slice» tablettes) are also very abundant at the open-air sites: 48 at Orp East, 24 at Orp West and 137 (!) at Kanne. In contrast, at Bois Laiterie there are only 13 and 25 at Chaleux. Kanne produced 11 hammerstones and Orp 5. None are listed for Chaleux, although one quartzitic sandstone cobble which is illustrated (Otte *et al.*,1994: Fig.35.2) seems

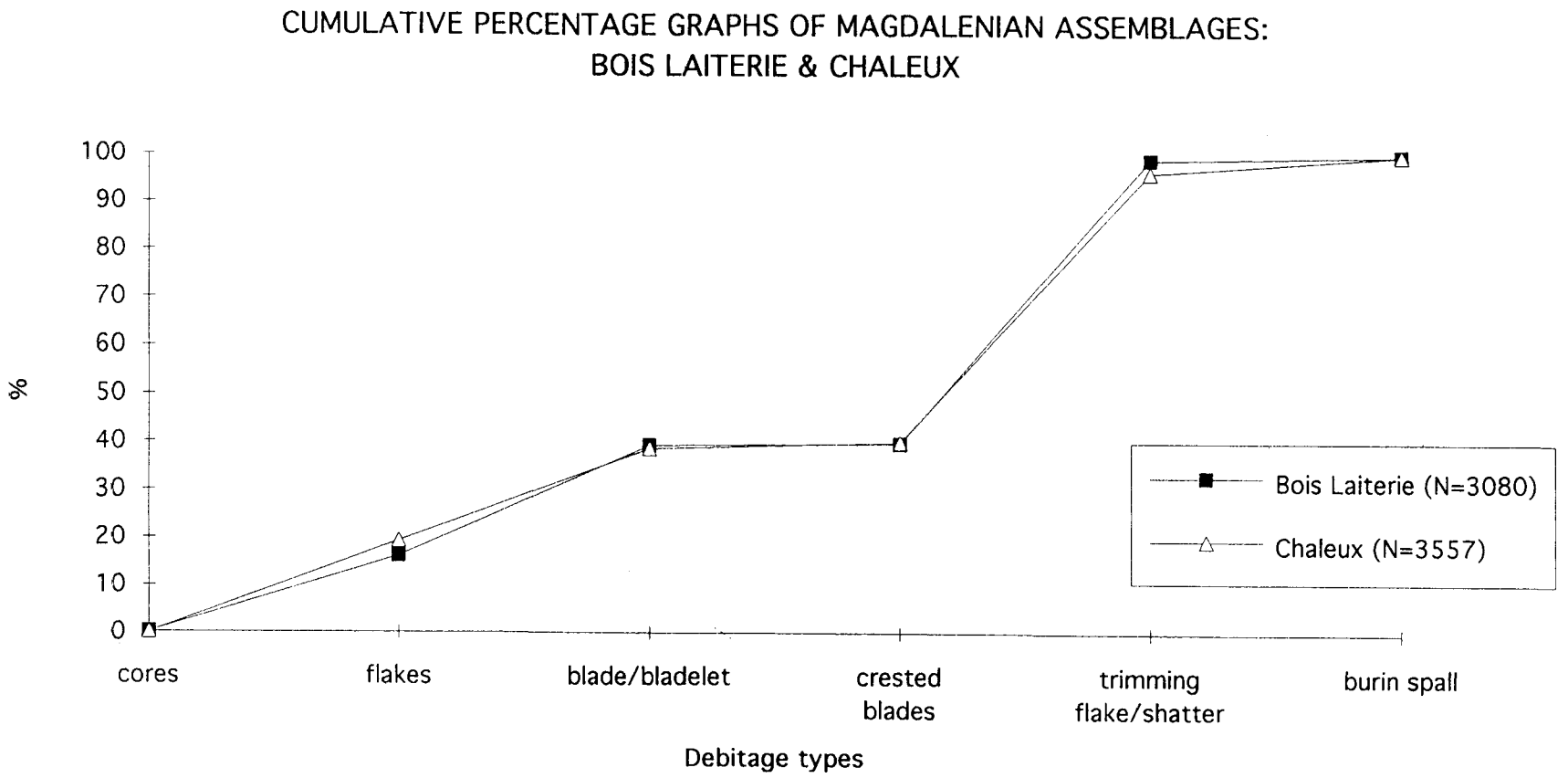

Fig.2 - Bois Laiterie and Chaleux, cumulative percentage graphs of debris assemblages.

to be battered and might have been a hammer. No hammers were found at Bois Laiterie, none of whose cobbles show evidence of battering. Unknapped flint nodules are present at Orp and Kanne, but, of course, not at the cave sites.

The relative importance of retouched tools at these sites is also of interest in distinguishing among them in terms of their functions as places on the human economic landscape of the Low Countries. At both Chaleux and Bois Laiterie there are only 12 items of debris (almost all debitage) for every tool, whereas at the open-air, flint source sites the ratio ranges from 62 to 1 for the Orp mixed assemblage, 68 to 1 at Orp West, 189 to 1 at Orp East, and 222 to 1 at Kanne. These figures eloquently speak to the manufacturing function of the open-air sites - places *from* which tools and/or blanks were taken to moderately distant, flintless sites like Chaleux and Bois Laiterie. All stages of the operatory chain (from nodule procurement and testing to «premature» abandonment of large, potentially much reuseable tools) are present at Orp and Kanne. In contrast (given the minimal representation of cores, scarcity of cortical items, platform rejuvenation flakes, and crested blades), essentially only the last stages of the operatory chain are represented at Bois Laiterie and (at least for the imported chalk flint) at Chaleux: blank preparation, retouching, resharpening, recycling and abandonment of small tools and weapon elements.

Some brief observations on the other two open-air sites that are situated on or near excellent flint sources (Mesch and Eyserheide) provide further contrasts with the caves that are distant from the chalk flint. The data come from E.Rensink's dissertation (1993), which reprints his earlier articles on these sites. At Mesch, among the total of 6,100 lithic artifacts (of which only 72 are tools: 1.2%; ratio of 84 debris for each tool), there are 66 cores (1.1% of the total artifacts) (plus three that were completely reconstructed from refitted flakes and blades). Maximum core length is c. 200 mm and the minimum is somewhat less than 100 mm. Maximum core weight is over 1,500 gm and the smallest cores are said to weigh 200-600 gm - still very large and heavy compared to those of Bois Laiterie and Chaleux. At Mesch there are 56 crested blades (0.92%). Of the 2196 flakes >2 cm, fully 41% have some cortex.

Eyserheide yielded 17 cores (0.5% of the 3414 total artifacts) plus 85 core fragments. The 91 tools represent 2.7% of the total artifact assemblage (ratio of 37 debris items per tool). Although not quantified, the description leaves it clear that cortical items are present, but that intial nodule testing and much decortication took place off-site, but probably not very far away. Blades make up 19.9% of the debris assemblage and «chips» (presumably equivalent to our trimming flakes + shatter) make up 44.5%.

It is apparent that the Orp loci, Kanne, Mesch and Eyserheide, although probably the scenes of other activities (Rensink proposes that Mesch also served as a hunting lookout.), were fundamentally places where, repeatedly, people came to obtain abundant large nodules of excellent-quality flint, to prepare laminar cores, to produce blades and bladelets, some of which were then removed to other sites - sites such as the caves of nearby, but flint-poor eastern Wallonia. Among these might have been Chaleux and Bois Laiterie, whose lithic debris assemblages in many respects are diametric opposites of those of the Hesbaye-Maastricht chalk formation. But what of the retouched tool assemblages from these different kinds of sites?.

TABLE 3

Comparison of Combined Tool Categories between Bois Laiterie and Chaleux Caves (Recent Excavations)*

Tool Category	Bois Laiterie			Chaleux		
	N	Assemblage %	Assemblage cum %	N	Assemblage %	Assemblage cum %
backed blade(let)s	91	34.21	34.21	136	45.95	45.95
perforators - becs	21	7.89	42.11	37	12.50	58.45
notches - denticulates	18	6.77	48.87	14	4.73	63.18
truncated pieces	24	9.02	57.89	4	1.35	64.53
endscrapers	22	8.27	66.17	21	7.09	71.62
burins	35	13.16	79.32	21	7.09	78.72
composite tools	2	0.75	80.08	8	2.70	81.42
retouched blades	43	16.17	96.24	27	9.12	90.54
pièces esquillées	2	0.75	96.99	21	7.09	97.64
pièces émoussées	-	0.00	96.99	7	2.36	100
ASSEMBLAGE TOTAL	258	96.99	96.99	296	100	100

* For Bois Laiterie, tool blanks (N=254) with multiple typological classifications are counted more than once.

Table does not include the categories of lithic point, raclette, denticulated bladelet, and other.

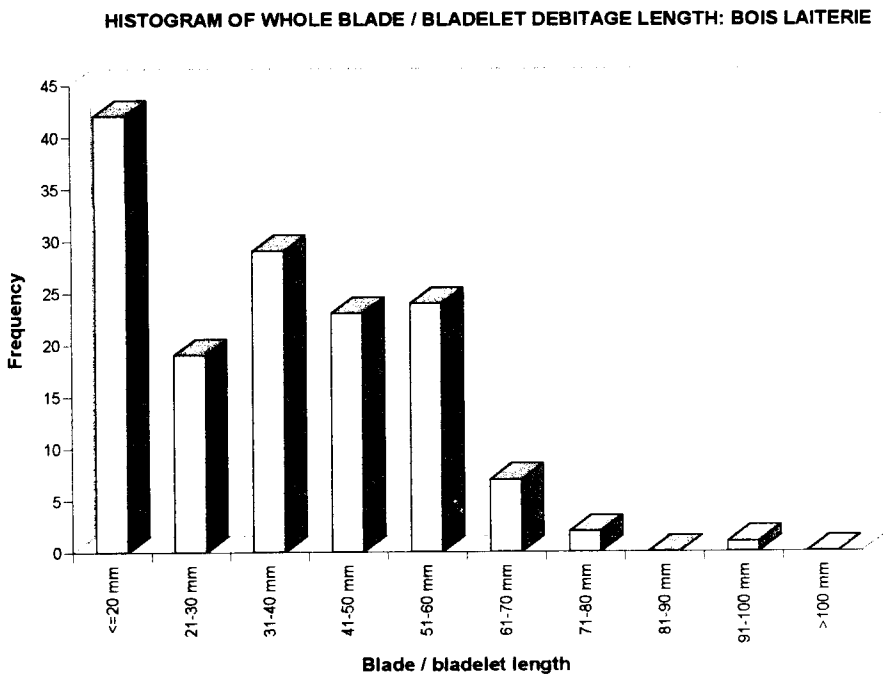

Fig.3a- Bois Laiterie, histogram of whole blade(let) lengths.

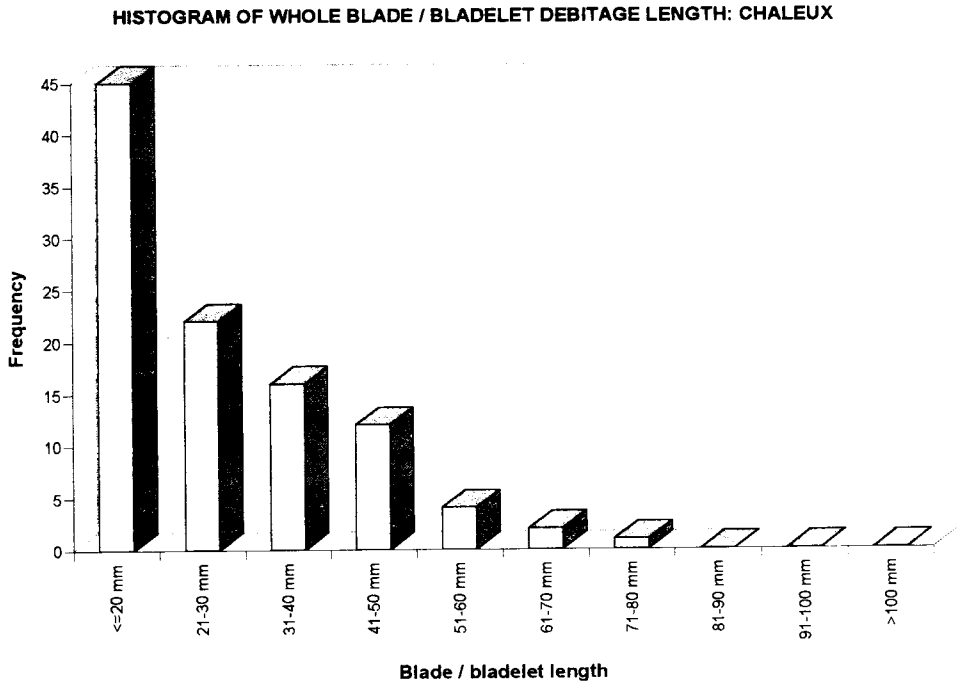

Fig.3b- Chaleux, histogram of whole blade(let) lengths.

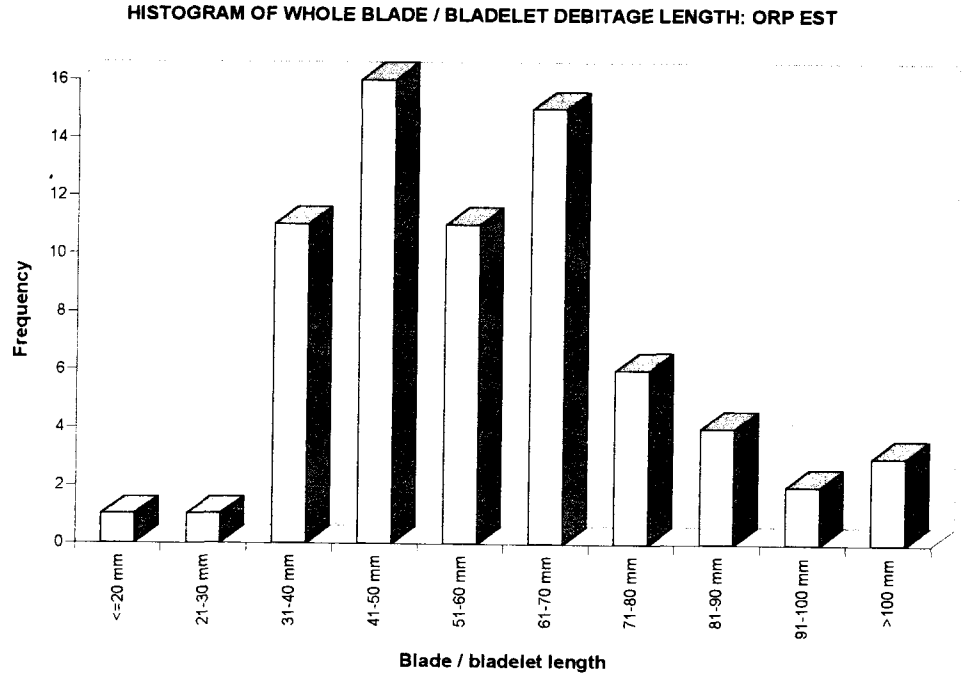

Fig.3c- Orp East, histogram of whole blade(let) lengths.

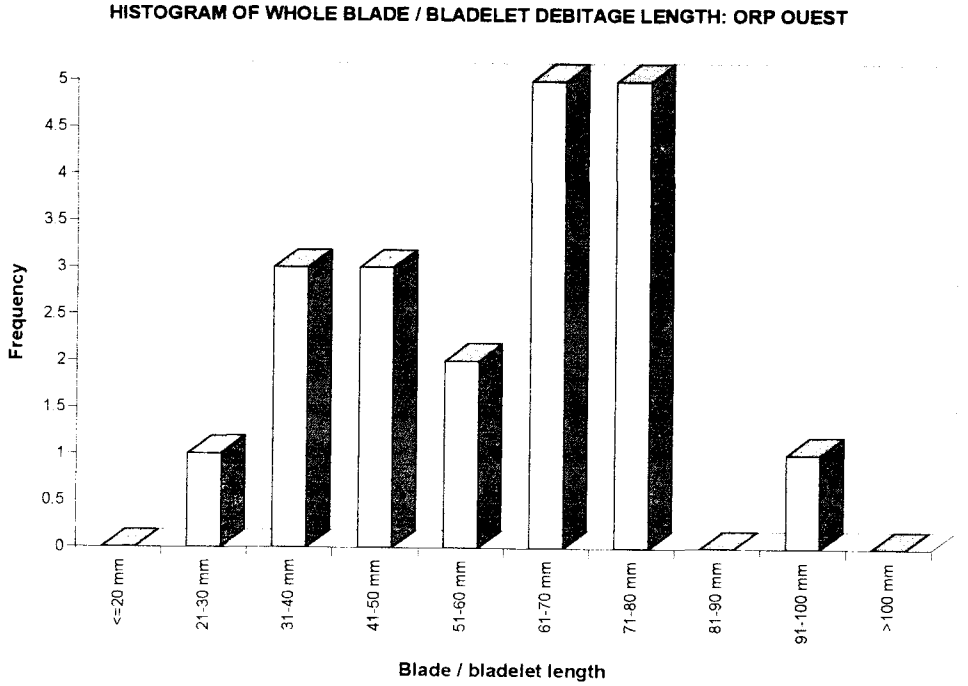

Fig.3d- Orp West, histogram of whole blade(let) lengths.

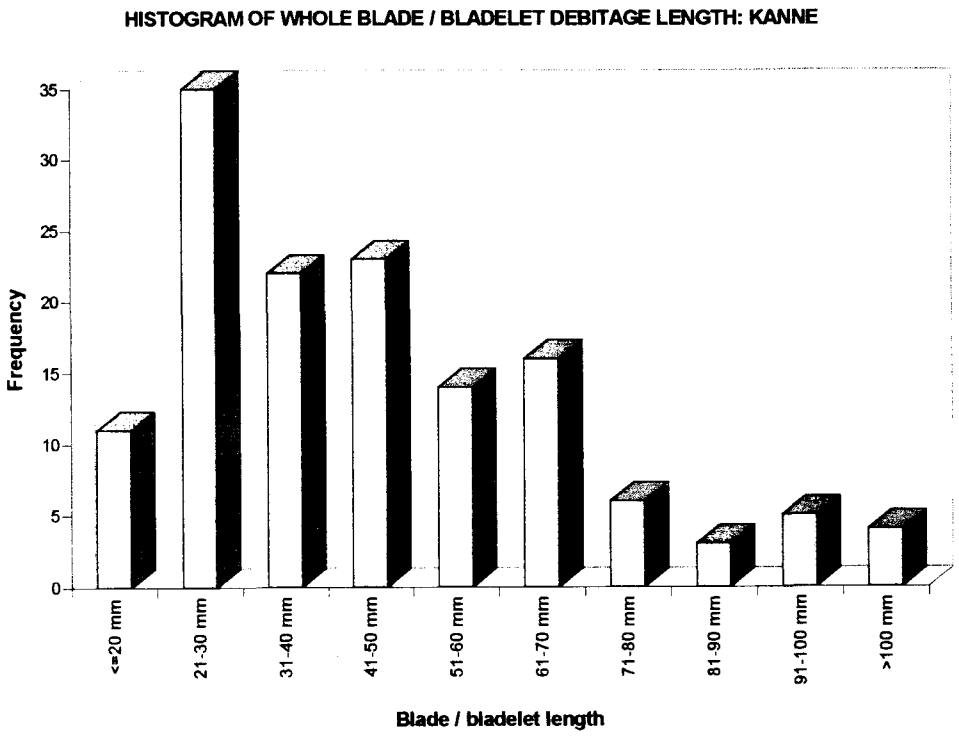

Fig.3e- Kanne, histogram of whole blade(let) lengths.

Magdalenian Tool Assemblages

Tab.3 and Fig.4 present a detailed comparison of the tool assemblages from BL and Chaleux. For the sake of this comparison, our BL backed bladelets have been redefined upward in length to 5 mm in order to be more closely comparable with the definition used at Chaleux and the other sites. Although there are statistically significant differences between these two tool assemblages at the 0.05 level (both by Kolmogorov-Smirnov two-sample test [Tab.4] and by Chi-square test [χ^2-value=161.5, df=49, $p<0.001$]), the cumulative percentage graphs are clearly very similar in general. The few specific discrepancies (which cause the graphs to be *statistically* different) are among the truncated blades and retouched pieces (more frequent at BL) and splintered pieces (more frequent at Chaleux). The difference in terms of «retouched pieces» may be more an artifact of classification than a real distinction, since at Chaleux, Otte *et al.* (1994) counted «retouched flakes» as sidescrapers rather than as «retouched pieces» (blades + flakes in our application of the standard typology).

However, as would be expected, there are statistically significant differences in tool assemblages of BL and the open-air sites of Orp E and W and Kanne at the 0.05 level (both by Kolmogorov-Smirnov two-sample test (Tab.4) and by Chi-square test (χ^2=464.2, df=150, $p<0.001$). As will be discussed in more detail below, these differences may be due to differences in relationship to flint sources and hence in site function between BL on the one hand and Orp and Kanne on the other.

TABLE 4

Kolmogorov-Smirnov Two-Sample Test of Homogeneity
Comparing Tools between Sites (.05 level).

Site comparison	D-value	D-critical	Statistical Result
BL vs. Chaleux	0.3265	0.1147	different
BL vs. Orp Est	0.3292	0.1040	different
BL vs. Orp Ouest	0.4075	0.1396	different
BL vs. Kanne	0.2355	0.1593	different

Tab.5 and Fig.5 illustrate the differences among BL, Chaleux, Orp East and West, and Kanne. The differences between the cave sites on one hand and the open-air sites on the other is striking. All three open-air tool assemblages are dominated by burins (36-46%), especially truncation burins. They are 3-4 times more abundant than at BL or Chaleux. The open-air sites are surprisingly similar not only in terms of overall burin percentages, but also in the representatation of dihedral and truncation burins. Endscrapers are also more abundant at the open-air sites (10-15%), but by much smaller margins. Perforators, in contrast, are less abundant at all three open-air sites (3-5%) than in the two caves (8-12%). Percentages of truncated pieces at Orp East and West and Kanne lie between BL and Chaleux. BL really stands out in terms of its high percentage of truncated blades (9%). *Vis à vis* Chaleux (which is

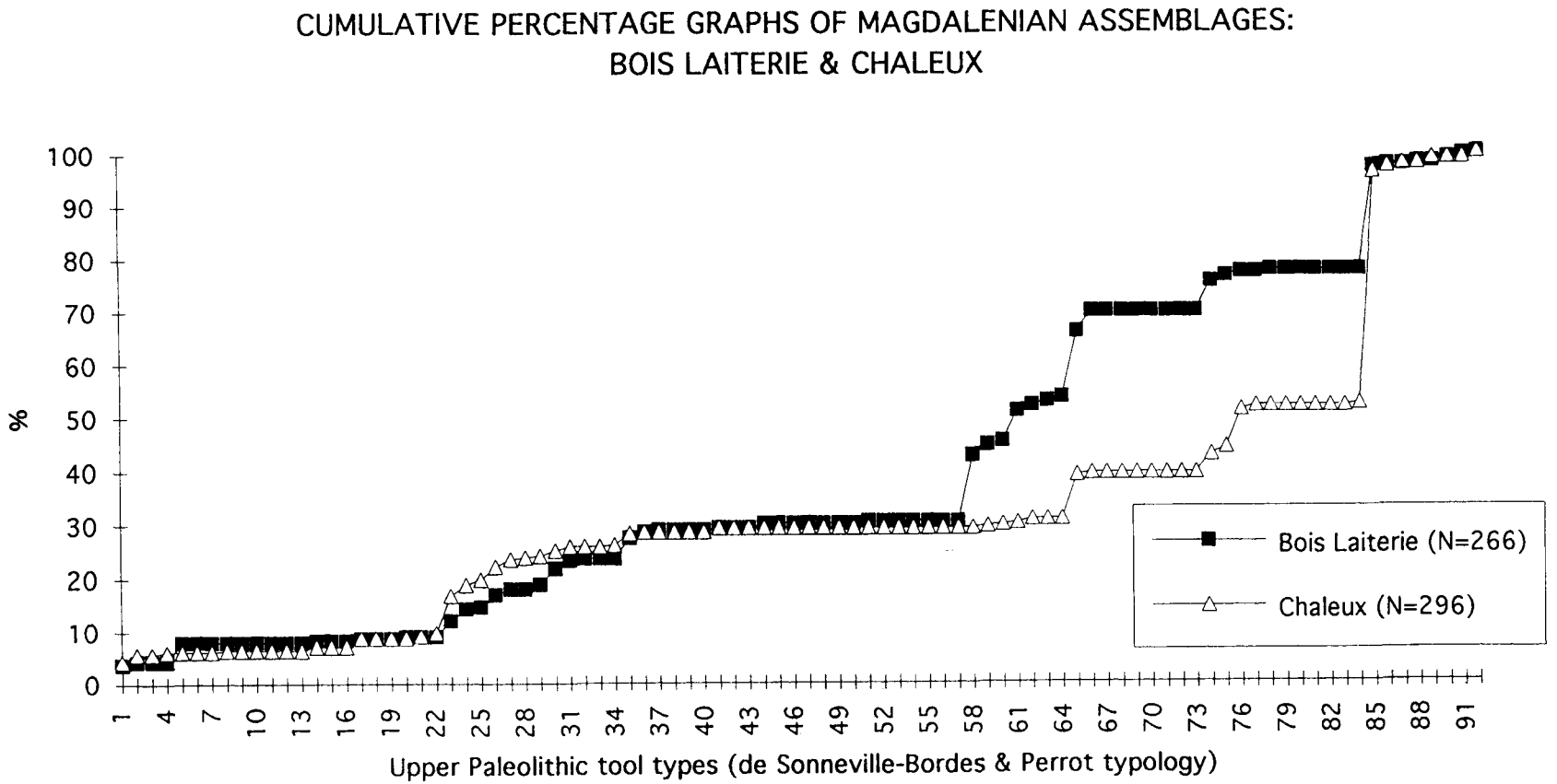

Fig.4 - Bois Laiterie and Chaleux, cumulative percentage graphs of tools assemblages.

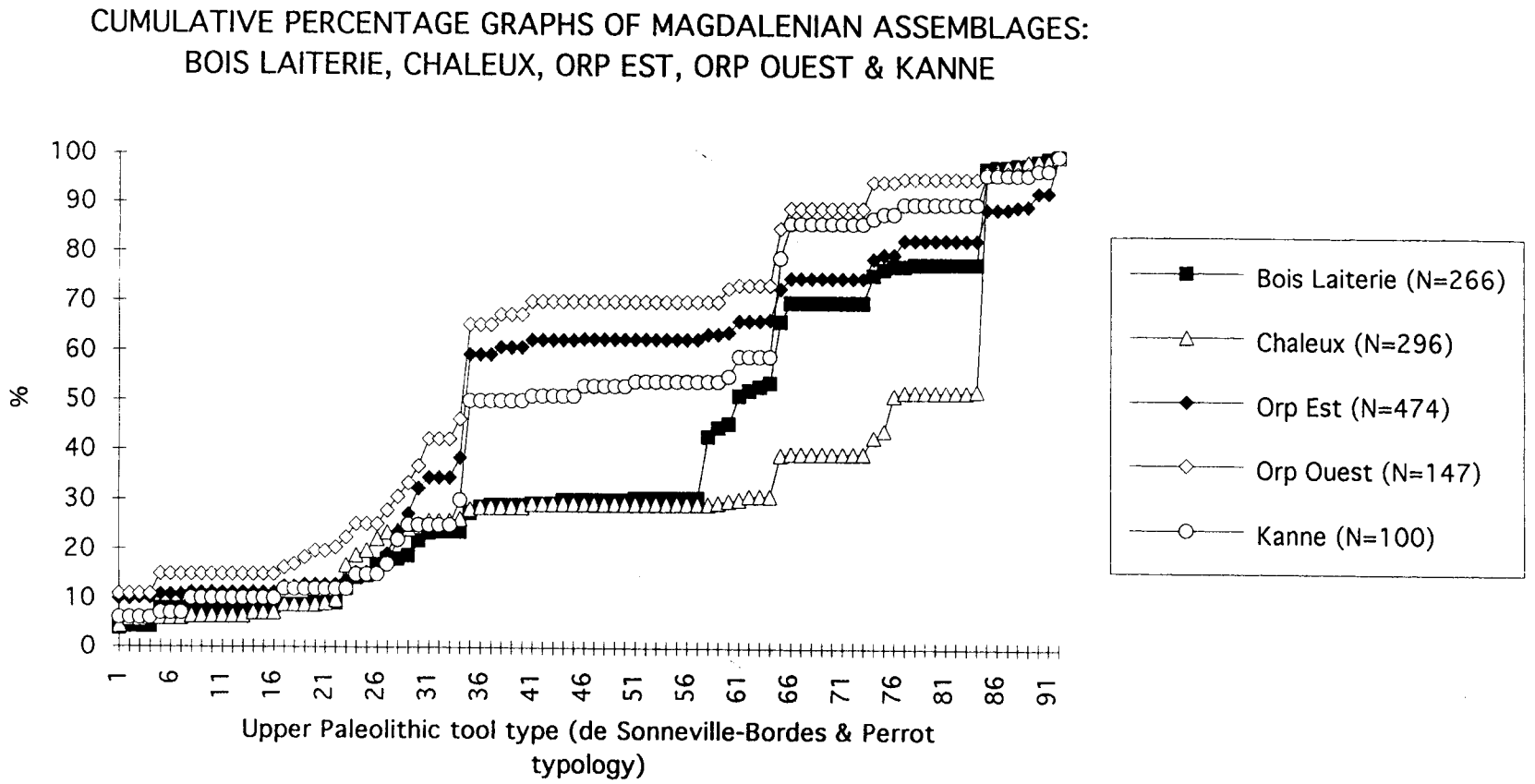

Fig.5 - Bois Laiterie, Chaleux, Orp and Kanne, cumulative percentage graphs of tools assemblages.

poor in burins - 7%), BL, with its intermediate value of 13.2%, also stands out in terms of its relative abundance of burins (especially dihedral ones - in contrast to the open-air sites, where truncation burins are dominant). BL is also somewhat more richly endowed in denticulates and especially notches (total=7%) relative not only to the open-air sites (2-5%), but also to Chaleux (5%).

However, the most significant difference is among the backed bladelets: only 1.4-7.0% at the open-air sites versus 34.2-46.0% at the cave sites. Whatever activities were conducted with the use of backed bladelets (presumably hunting) were virtually absent at Orp and Kanne. At Mesch, with a very small total tool assemblage (n=67), there are only 9 backed bladelets (13.4%). Unfortunately, bad organic preservation conditions mean that faunal remains and bone/antler artifacts (even if any of the latter had originally been present) are absent from the open-air loess sites, so we cannot be sure as to whether much hunting was actually conducted at or near them. What is sure is that both fauna and antler sagaies, as well as backed bladelets, are abundant not only at BL and Chaleux, but also at the other cave sites in Wallonia (where even antler harpoons have been found at Goyet and Coléoptère). The open-air sites were fundamentally concerned with lithic blank production, but the *abundance* of burins in particular must mean that other activities were conducted - possibly involving bone/antler working (?). The significant presence of endscrapers must imply that some hidescraping was also done at these open-air locations.

The small tool assemblage from Mesch (n=67) is richer in backed bladelets than the other open-air sites (13.4%), but still far poorer than the cave sites. Endscrapers (14.9%) barely outnumber burins (13.4%) - again differentiating this site from Orp and Kanne. Likewise there is a very high 22.4% of perforators+becs. Truncated blades amount to 6.0% and retouched pieces total 29.9% (Rensink,1993). Lacan burins, so characteristic of the other Magdalenian sites of the region (both caves and open-air) are absent; perhaps their function was replaced by the relatively numerous becs (?). At any rate, the Mesch collection is so small that these percentages may be subject to a considerable sampling effect. The 91 tools from Eyserheide include 22% burins (mostly dihedral), 11% endscrapers, 6% perforators, 6% retouched blades and only 4% backed blades (presumably including bladelets?) - a percentage completely in line with Orp and Kanne (as are the other percentages, although the burin index, while still much higher than those of the cave sites, is rather low *vis à vis* Orp and Kanne).

One final comparison of the tools from Orp, Kanne, Chaleux and BL involves their size. Although typologically all these assemblages are classifiable within the late Magdalenian of NW Europe with absolutely no definitional problems, there are «small» and «large» varieties of the same standard tool types. Average lengths of retouched tools (excluding backed bladelets) are given as follows:

TABLE 5

Principal Tool Group Indices
for Bois Laiterie, Chaleux, Orp Est, Orp Ouest, and Kanne*

Sites / Tool category	Bois Laiterie		Chaleux		Orp Est		Orp Ouest		Kanne	
	N	Assemblage %	N	Assemblage %	N	Assemblage %	N	Assemblage %	N	Assemblage %
endscrapers	22	8.27	21	7.09	53	11.18	22	14.97	10	10.00
burins:	35	13.16	21	7.09	220	46.41	66	44.90	36	36.00
dihedral burins	18	6.77	11	3.72	88	18.57	25	17.01	10	10.00
truncated burins	14	5.26	8	2.70	125	26.37	37	25.17	25	25.00
perforators - becs	21	7.89	37	12.50	14	2.95	7	4.76	3	3.00
backed bladelets	91	34.21	136	45.95	13	6.33	2	1.36	7	7.00
notches-denticulates	18	6.77	14	4.73	23	4.85	8	5.44	2	2.00
truncated pieces	24	9.02	4	1.35	14	2.95	5	3.40	5	5.00
ASSEMBLAGE TOTAL	266	79.32	296	78.72	474	74.68	147	74.83	100	63.00

* For Bois Laiterie, tool blanks (N=254) with multiple typological classifications are counted more than once.

TABLE 6

Cave and open-air sites, average tool lengths compared.

SITES	AVERAGE TOOL LENGTH (mm)	N
BL	35.43	160
Chaleux (Otte)	37.18	108
Chaleux (Dupont)	46.31	86
Orp East	72.05	65
Orp West	56.93	29
Kanne	60.51	57

The difference is stark. The tools produced and abandoned at the flint sources are huge - like the débitage and, of course, the cores. The tools brought to, probably often resharpened and then abandoned at the cave sites are consistently very small. This is a glaring piece of evidence for the «transportation effect». Small, light lithic objects were transported to, probably made lighter by reworking in some cases (due probably to a need to economize good lithic raw material), and finally abandoned at the sites far from the quarry-workshop locations where their blanks (or decorticated cores) may originally have been produced.

Conclusions

Although the sites of Bois Laiterie and Chaleux are similar in many respects, they differ in others, so it is not surprising that there be some differences between their lithic artifact assemblages. Both sites are caves, but Chaleux is much larger and flatter, better exposed (hence warmer), less draughty, and generally more commodious and apt for larger-scale, longer-term human use than BL. Both BL and Chaleux are strategically situated for hunting purposes: the former on a gorge of a minor tributary of the Meuse that provides critical access to the plateau between the Meuse and the Sambre and hence westward to the flint source areas of Hainaut. Chaleux is at a ford on the Lesse, which is a major avenue of communication between the Ardennes uplands and the Meuse. Neither site is near a source of good flint, but Chaleux, which is farther than BL from both the Hainaut and especially the Hesbaye sources, at least has usable local chert. In general (perhaps of necessity and because of longer stays at the cave), the inhabitants of Chaleux used a substantially greater variety of lithic raw materials than the visitors to Bois Laiterie, who used essentially only the good, non-local flint they had come with when occupying that small site. Although there is evidence for the paving of a very limited area of BL, a much larger pavement area was uncovered by the successive excavations at Chaleux, which, unlike BL, yielded at least one constructed hearth. This feature was a large, dug-out, stone-lined, quartzite cobble and psammite slab-surrounded structure, described and illustrated in detail by Otte *et al.* (1994, p.56-89). This hearth may in reality have been a

roasting pit that was maintained repeatedly over a long period of time. At BL, there seem to only have been bonfires built on the surface of the cave mouth/terrace area, with no construction investment.

Chaleux is much richer in artifacts of most sorts (except cores!) than BL: the stone *tools* alone that survive in the old Dupont collections total 3,174 pieces (Dewez,1987), while Otte *et al.* (1994) found 296 more tools in their rescue excavation of the small remnant of intact deposits on the terrace at Chaleux. Dupont recovered large numbers of antler sagaies and other items of bone industry, ornamental objects, works of art, exotic fossils, pieces of jet and other non-local minerals, and a few other such items were found during the recent excavations. Finally, there is no comparison, quantitatively at least, between BL and Chaleux in terms of faunal assemblages: Dupont found tens of thousands of teeth and bone fragments, especially from many ungulate species - notably horse, of which Dupont (1873, p.169) calculated the presence of at least 56 individuals (!). Other ungulates included reindeer, saiga, red deer, roe deer, chamois, ibex, and boar, all of whose presence (except for boar and saiga) was confirmed by the new excavations, which produced an MNI of 10 horses (Otte *et al.*,1994). This is a very large faunal assemblage and clearly an aggregate of many hunting episodes - especially in comparison with the more modest assemblage from BL.

In sum, it is clear that Chaleux is a major, multi-function base camp type of site, frequently utilized, whereas BL is a much more ephemeral, limited-use kind of location - probably a specialized hunting camp. Chaleux is certain to have witnessed a much wider range of manufacturing, maintenance and processing activities of most kinds than BL, and it is likely to have been inhabited by larger groups with a more diverse composition of people in terms of ages and sexes than the small, uncomfortable Bois Laiterie cave. Thus, differences in the lithic assemblages - which clearly do exist - are to be expected. And yet, because of the non-negligible distances involved to sources of good-quality flint and because of the consequent transport effect, there are some fundamental structural, economic similarities between these two cave sites in the uplands of Wallonia, especially in contrast to the penecontemporaneous open-air quarry/ workshop sites of Middle Belgium and Dutch Limburg. At both cave sites, humans had to use small, easily transported blanks of the good chalk flint and probably had to economize due to the effort invested in obtaining this raw material from afar. Thus, although there are general *typological* similiarities to the open-air sites' assemblages (all of which are Upper Magdalenian in normative terms), there are clear and logical differences in debris assemblage composition, in artifact size and - due to the very different nature of open-air quarry/workshop sites on the one hand and cave sites both engaged at least in significant amounts of hunting on the other hand - in formal tool assemblage composition (few weapon elements at the former and many - including both lithic and antler ones - at the cave sites). Orp East and West and Kanne have NO Azilian (curved back), microgravette (straight back) or other lithic points and only a few backed blade(let)s in their inventories. Thus, fundamental technological and functional differences govern the differences between the assemblages of these two classes of sites, despite the other functional differences that undoubtedly existed between Chaleux and BL. There were undoubtedly also functional differences among the open-air sites (as hinted at in the differences in certain tool types - which particularly set Mesch apart from Orp and Kanne), but the lack of faunal preservation makes it difficult to suggest what these might have been.

On the other hand, it is true that the non-organic works of art so typical of Chaleux and many of the other upland cave sites (as well as at the Rhineland sites of Gönnersdorf and Andernach, and in the French Ardennes open-air site of Roc-la-Tour, for example), are absent from the open-air sites of Middle Belgium and Dutch Limburg - as they are also absent from the Paris Basin Magdalenian sites of Pincevent, Etiolles, Verberie, Tartarets, Marsangy and Ville-St.-Jacques (Taborin,1994). One might argue that this is because there are no psammite (or slate) slabs available lithologically in the loesslands of Middle Belgium. But such an argument cannot explain why the Paris Basin Tertiary fossils, so common (as ornaments?) in the Magdalenian sites of Wallonia - even at a small site like BL located within 40 km (a day's walk) of Orp - are apparently absent from the quarry-workshop open-air sites. This might be because fossil shells simply may not have been preserved in the loess matrix (P.Vermeersch, pers.comm.). Thus their absence *cannot* be used to support the «ethnic» interpretation, namely that the open-air sites were produced by a different cultural group than used the caves of adjacent Wallonia.

It is also true that the presence of Lacan (oblique concave truncation) burins at both the cave and open-air sites would not seem to be an adequately specific «stylistic / cultural / ethnic» marker to be able to assert that all these sites were made by the same self-identifying group of people. Lacan burins were, after all, first defined in southwestern France and are well-known there in sites of this same Tardiglacial age. They may be a good temporal marker, but not a stylistic one. And there are no other *specific* «fossil directors» that would seem to tie the two groups of sites together.

However, on balance, an explanation of the differences among these pene-contemporaneous Low Countries sites based on factors of lithic raw material procurement and manufacture, and on other functional differences derived from fundamental topographic facts, seems to deserve further consideration and detailed research. What is most lacking are specific petrographic analyses to determine the exact source(s) of the chalk flints used at Chaleux, BL and the other cave sites of Wallonia, as well as at Roc-la-Tour. Combined with more high-quality seasonality data from those sites, lithic sourcing analyses could clinch one or the other interpretation of the nature of the Magdalenian phenomenon (a) in Belgium: two cultural groups or one; an independent territory with social contacts to the «ancestral homeland» in the Paris Basis or a summer territory of hunting groups who wintered in the Paris Basin. Preliminary dental cementum analyses by A.Stutz (1993 and this volume) suggest that Magdalenian people were killing ungulates in the Belgian Meuse basin not only during summer-fall (2 reindeer at BL; 2 reindeer at Nutons), but *also* in winter-early spring (1 reindeer from Nutons; 1 small ungulate at Da Somme; 1 ibex from the Otte excavation at Chaleux). Reindeer dental eruption and wear evidence from two individuals seconds the indication of summer kills at BL (Gautier, this volume), while some of the fish are argued to have been caught in late winter/spring (Van Neer, this volume). All these indicators would seem to preclude group-scale human seasonal migrations back to the Paris Basin, a region which is separated from Roc-la-Tour (the southernmost Meuse Magdalenian site) across an inhospitable (even dangerous) «marchland» (the plains of Champagne) apparently devoid of Magdalenian sites (Rozoy,1989). The Paris Basin sites, on the other hand, have evidence of at least late summer-fall kills, but other lines of evidence suggest year-round human occupation, with a full gamut of activities represented among the various sites that are at least partly contemporaneous with those of Belgium (Audouze,1992; Taborin,1994; David,1994). Future research in Belgium and surroundings will hopefully resolve these critical issues, to which Bois Laiterie, Chaleux, Orp and Kanne have all contributed in significant but different ways.

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