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REFIT ANALYSIS OF THE BOIS LAITERIE PLAQUETTES

R. Miller and I. López Bayón

Summary

A total of 788 psammite plaquettes, varying in size from very small fragments to large slabs, were found at Bois Laiterie. Of these, 316 were individually piece-plotted in the Magdalenian level, 272 were individually measured (length, width, thickness, weight) and another 425 were weighed only. From the measured plaquettes, a total of 68 pieces refit into 22 separate sets. The nature of the refits and their spatial distribution within the site have implications for the transport of psammite to the site, site use, and estimates of surface area potentially covered by plaquettes.

Description of the Refit Sets

There are different materials represented by the plaquettes, but primarily psammite and a greenish-yellow sandstone. Most of the plaquettes and all but one of the refit sets are psammite. However, analysis by Lejeune (this volume) shows possible cutmarks on some pieces of the sandstone. This material would tend to show traces of possible butchery activity because it is much softer than the psammite.

22 separate refit sets were found (Tab.1, see at the end of this chapter), varying in number of pieces (Tab.2) and in area. Breaks include simple corner breaks, breaks along natural bedding or fracture planes, and long perpendicular breaks of large slabs.

TABLE 2.

Number of pieces in set	Numbers of sets
2	10
3	6
4	3
5	2
8	1

TABLE 1. Inventory of refitted plaquettes.

Set	terrace	entrance	interior
1	V4.44 W3.11 W3.60		U6.252 V8.6 V8.63 V8.67A, V8.67B
2	T4.41B, T4.41C, T4.41D		
3	V4.27 V4.65A, V4.65B W3.23		V7.83
4	V4.46		V8.9
5	W3.123 W3.127A,W3.127B		
6	V2.27 V4.74		U6.233
7	R7.1 U4.36	S5-St. 1	U6.202
8	W2.65 W2.69		V7.94
9			V8.21 W11.12
10			V7.105 V8.38
11	V4.64A, V4.64B, V4.64C W2.15	U5.10	
12			U6.112 U6.156 U6.170 U6.172
13	V3.1 V3.2		
14	W3.137		U6.61
15			U7.24 U7.25
16	S3.1 S3.2 S3.3 T3.1		
17			U6.209 U6.210
18			T6.24 T6.37 T6.40
19		T5.27 T5.39	T6.30.2
20			U6.47 U6.62
21	U4A.10.63.1 (spit) U4A.10.63.2 (spit)		
22			V8.32 V8A.3.18.1 (spit)

Set 1. This set consists of eight pieces which refit in two ways: either on top of each other, resulting from breakage along natural bedding planes, or perpendicularly, resulting from a break perpendicular to these planes. Pieces are dispersed along the eastern wall of the cave (V8: 4 pieces; U6: 1) and on the terrace (V4: 1; W3: 2). The set likely originated at or near Square V8, with broken pieces moving downslope along the wall to the terrace. All pieces from V8 refit to each other, supporting *in situ* breakage here, followed by downslope movement of the other pieces which broke off from V8 pieces. All pieces belong to Stratum YSS except U6.252, which comes from Stratum BSC.

Set 2. This set consists of three pieces which were found in the same location and plotted together in Square T4 in YSS. This indicates the breakage occurred *in situ*, without subsequent movement of the broken pieces. Breaks are perpendicular and irregular and each piece shares an edge with the other two pieces.

Set 3. This set consists of five relatively thin pieces with irregular, perpendicular breaks. Only one piece comes from inside the cave, along the eastern wall (V7), and the other pieces were found on the terrace (V4: 3; W3: 1), distributed vertically within 64 cm within YSS, except for V4.65A and B, which were found in Stratum BSC. V7.83 refits only to V4.27, with other pieces refitting to each other or V4.27 as well. V4.27 likely broke off from V7.83, followed by downslope movement and subsequent breakage of the other pieces.

Set 4. Set 4 is a refit pair from Stratum YSS with a small piece (V4.46) breaking perpendicularly off a larger one (V8.9) and moving downslope from inside the cave to the terrace.

Set 5. This set consists of three pieces which all come from the same square (W3) and are separated vertically by only 4 cm. W3.127A and W3.123 are fairly large pieces (18-25 cm in length and 13-16 cm in width) while W3.127B is a small triangular corner snap from 127A. Breakage occurred *in situ* without subsequent movement. All pieces come from Stratum YSS (according to location within the malacofauna stratigraphy).

Set 6. This set consists of three pieces, two very large ones and a smaller piece (V2.27) breaking along a natural plane from V4.74. U6.233 and V4.74 are large (30-37 cm in length and 19-21 cm in width) and have a long perpendicular break. U6.233 comes from the grey lens within YSS and the other two pieces comes from BSC. Given the close proximity of V4 and U6, it is more likely that the break resulted from human action rather than natural processes since sliding or falling from U6 to V4 would not have the necessary force to break the larger piece in two. The smaller piece could have exfoliated naturally and moved further downslope.

Set 7. This set consists of four chunky pieces with multiple planes and a thick crystallized vein. Breakage occurred both along fracture planes and this vein. One piece comes from disturbed context (S5-Str.1) and was found in Stratum 1, backfill from earlier amateur excavations. Another piece comes from R7, a sondage along the cliff face between the two cave entrances. The other two pieces come from intact sediments in U4 and U6. Except for the piece in S5, all are found within YSS.

Set 8. This sets consists of three pieces from YSS with the larger piece located in Square V7 and the smaller pieces on the terrace, in W2. W2.65 and W2.69 moved downslope

to the terrace and then broke, leaving V7.94 inside the cave. The breaks are perpendicular snaps. The raw material is not psammite, but a softer, possibly clayey sandstone, yellowish-green with oval depressions on one surface.

Set 9. Set 9 is also a refit pair from YSS located well within the cave. One piece comes from W11 and the other from V8. The break is perpendicular. The material has an irregular surface with oval-shaped, smoothed spots and is a variant of psammite.

Set 10. Set 10 is a refit pair broken perpendicularly with pieces from V7 and V8, found along the eastern wall of the cave with only slight movement after breakage.

Set 11. This set consists of five pieces and has the largest area of all the refit sets. Three pieces, plotted together, come from the terrace (V4), and include one very large slab (V4.64A) and two very small corner snap fragments (V4.64B and C). The other two pieces are also large slabs and come from the terrace (W2) and just inside the cave entrance (U5). Like Set 6, this set crosscuts YSS and BSC and is more likely that the perpendicular breaks of the three large slabs is a result of human action rather than natural processes.

Set 12. This set consists of four pieces from the same square (U6). U6.112 comes from YSS at a depth of 197 cm below datum. The other three pieces comes from the underlying Stratum BSC at depths from 203-207 cm below datum, only six cm below U6.112. Interestingly, these three pieces each refit onto an edge of U6.112, with another edge shared between U6.172 and U6.156, which occurred after the break from U6.112. Horizontally, all four pieces are in close proximity. Breaks are all perpendicular and occurred *in situ*.

Set 13. Set 13 is a refit pair from YSS on the terrace (V3). V3.2 is a small protrusion which snapped from V3.1 and moved some cm downslope.

Set 14. Set 14 is a refit pair from YSS with a piece just inside the cave (U6) and another piece on the terrace (W3).

Set 15[1]. Set 15 is a refit pair with a perpendicular break, from YSS in Square U7. The pieces were found next to each other and were separated vertically by only one cm.

Set 16. This set consists of four pieces found in disturbed context in Squares S3 and T3, Stratum 1.

Set 17. Set 17 is a refit pair with a perpendicular break, from Stratum BSC in Square U6. The pieces were found next to each other and were separated vertically by three cm.

Set 18. This set consists of three pieces from Square T6. They are distributed vertically within 25 cm of YSS. The refit set is long and narrow, with very straight sides. Perpendicular breaks occur across the width of the original piece.

Set 19. This set consists of three pieces, two from T6 and one from T5, all from YSS. Breaks are perpendicular.

[1] Sets 15-20 were refit in 1994 by R. Miller, A. Martinez and others. Refitting of Sets 7 and 12 was started in 1994, but additional pieces were found during the 1996 refitting analysis.

Set 20. Set 20 is a refit pair with a perpendicular break, from YSS in Square U6. The pieces are in close proximity and separated vertically by six cm.

Set 21. Set 21 is a refit pair which is the result of exfoliation of a small fragment from the top of a slightly larger fragment. Neither piece was piece-plotted, but both came from Spit 10, YSS, in square U4.

Set 22. Set 22 is a refit pair with a triangular corner break. Both pieces come from Square V8, Stratum YSS.

Descriptive Statistics

Tabs.3-5 below summarize the size dimensions for the refit sets, the sample of refitted plaquettes, and all plaquettes. They show that there is a wide range in each of the size dimensions, but the histograms in Fig.1 show that most plaquettes cluster around a certain size range, with several large plaquettes skewing the distribution and increasing the range between minimum and maximum. The histograms for dimension classes for refitted and unrefitted plaquettes (Fig.1) show that length and width are skewed to the right, with most between 41-120 mm. Thickness is also slightly skewed to the right with the majority between 6-20 mm. Weight is highly skewed to the right as a result of several very large plaquettes while the majority of plaquettes weigh between 0.1-50 g. Comparing refitted and unrefitted plaquettes, it can be observed that refitted plaquettes come from the longer, wider, thicker, and heavier classes.

The dimensions of the refit sets show that although most plaquettes are small to medium sized, they can refit to form relatively few, but fairly large plaquettes which were transported to the site instead of arriving at the site in smaller form.

TABLE 3. Dimensions of Refit Sets

Variable	n	Mean	Std Dev	Minimum	Maximum
length (mm)	20	271.50	129.61	70	580
width (mm)	20	184.50	101.07	50	450
thickness (mm)	20	17.0	12.07	5	60
weight (g)	22	1943.59	2409.91	48	9404

TABLE 4. Dimensions of Refitted Plaquettes

Variable	n	Mean	Std Dev	Minimum	Maximum
length (mm)	59	168.46	80.86	43	388
width (mm)	59	113.98	55.89	31	238
thickness (mm)	59	18.12	6.85	9	46
weight (g)	63	779.59	940.97	31	4000

COMPARISON OF DIMENSIONS OF REFITTED AND UNREFITTED PLAQUETTES

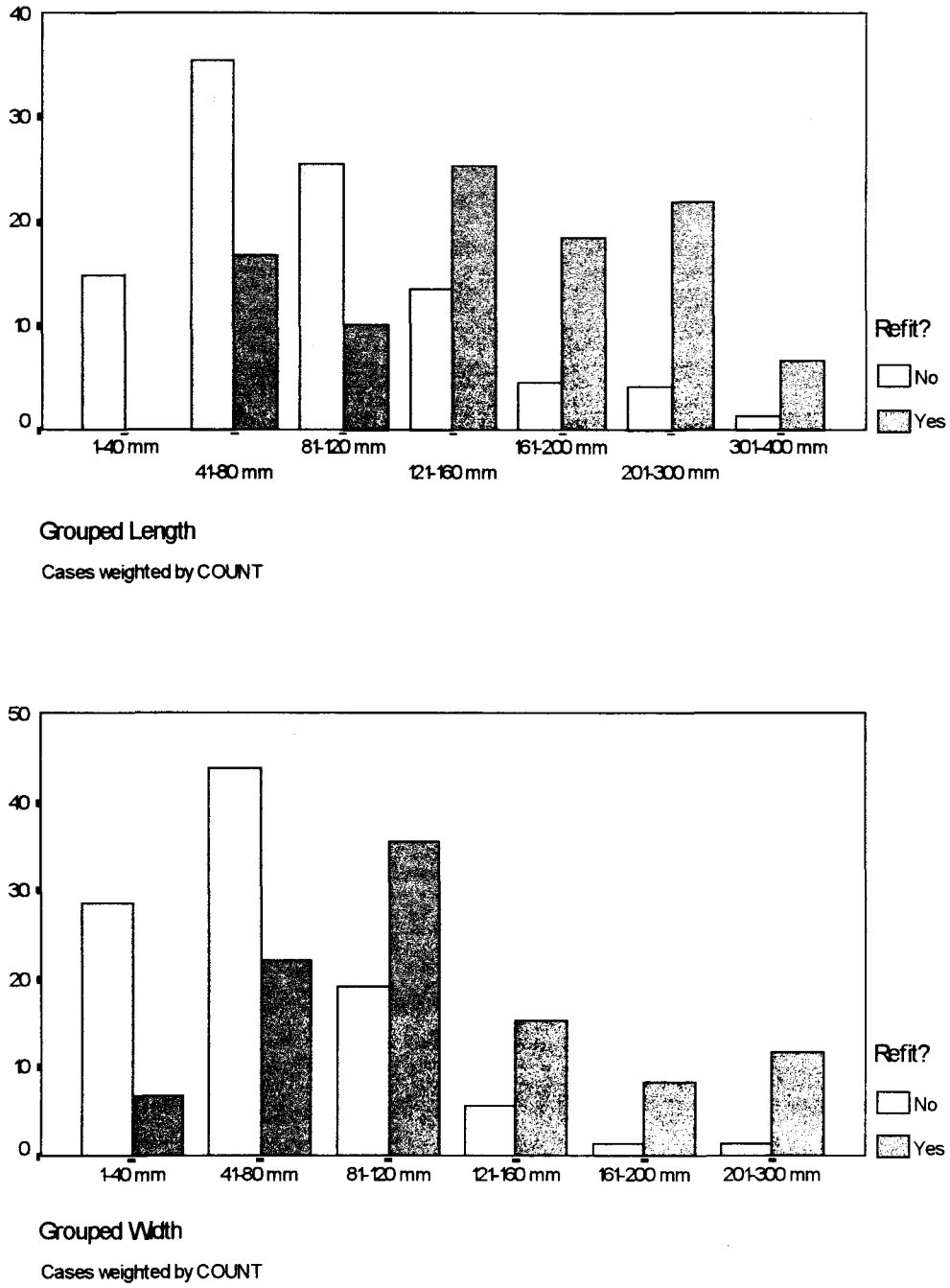

Fig. 1- Histograms for Dimension Classes for Refitted versus Unrefitted Plaquettes

TABLE 5. Dimensions of All Plaquettes.

Variable	n	Mean	Std Dev	Minimum	Maximum
length (mm)	273	110.90	72.25	17	400
width (mm)	273	76.34	48.79	9	292
thickness (mm)	272	14.45	12.10	2	166
weight (g)	697	175.77	493.38	1	6355

Spatial Distribution of Plaquettes

In fact, 95.2% (n=746) of all plaquettes come from the Magdalenian layer, with 19 plaquettes found in the old backdirt and 19 plaquettes below the Magdalenian layer. Fig.2 (all piece-plotted plaquettes) shows that plaquettes are concentrated along the eastern wall of the cave and on the terrace, with some found in the back of the cave. Fig.3 shows the spatial distribution of refitted plaquettes. Fig.4 showing the spatial distribution by size (small, medium, and large), indicates that the larger plaquettes are found on the terrace and at the entrance of the cave. Fig.5, showing the spatial distribution of material (psammite, limestone, and sandstone), shows that the majority of sandstone slabs are found on the terrace.

Size distribution (small, medium, large) in three sections of the site (terrace, entrance, inside the cave) was examined to see if plaquettes were distributed differentially by size in these areas. Terrace area includes rows 2-4, entrance includes row 5, and cave interior as rows 6+. The table below (Tab.6) shows that more large and medium sized plaquettes are on the terrace and entrance than expected and fewer inside. The percentages of small plaquettes in each area corresponds to the expected distribution. From this, we can infer that the larger plaquettes were deliberately placed on the terrace and at the entrance to the cave.

TABLE 6.

	% of all plaquettes	large (>= 1000 g)	medium (200-999 g)	small (<200 g)
terrace	40%	43%	49%	39%
entrance	22%	26%	24%	22%
cave interior	37%	30%	27%	39%

Discussion

Transport

Plaquettes were transported to the site and, with a combined weight of more than 122.5 kg (combined weight of the 697 weighed plaquettes), represent the highest labor investment in the site (after carcass transport), compared to 3.14 kg of lithic tools and debris.

Psammite is available locally, in an outcrop just above the cave as well as in outcrops in the surrounding area.

The dimensions of the refit sets show that at least some of the plaquettes (*e.g.*, sets 6 and 11) were transported to the site as very large slabs which were then broken (either by human action or natural processes) at the site.

Surface Area

An earlier estimate of potential surface area covered by plaquettes (Straus and Orphal, n.d.) has been revised downward somewhat (Straus and Martinez, this volume). The estimate was originally calculated by multiplying maximum length by maximum width of each measured plaquette. Several refits are the result of fracture along horizontal bedding planes. Estimates of surface area needs to take into account that many pieces are on top of each other and not contiguous.

Breakage and Movement

There are two patterns of natural breakage: (1) *in situ* breakage creating small- to medium-size pieces without subsequent movement (Sets 2, 5, 10, 12, 13, 15, 17, 18, 19, 20, 21, 22), and (2) breakage inside the cave along the eastern wall with subsequent movement of smaller pieces to the terrace or cave entrance (e.g, Sets 1, 3, 4, 8, 14). Human action can account for the breakage of very large, thick slabs which were then placed just inside the cave and on the terrace (*e.g.*, sets 6 and 11).

Nearly all of the plaquettes found are located along the eastern wall inside the cave or on the terrace and two possible hypotheses can be put forth. First, the area along the eastern wall is the only area *inside* the cave where the slope levels out to form a floor which can be used while the terrace is also level enough for use. Psammite plaquettes were placed in these two areas as paving, to provide protection from mud and to make useable work surfaces. The deliberate placement of very large slabs just inside the entrance and on the terrace (within the drip line) coincides with the "best" places within the site, i.e., the area with a level floor, light, and shelter. Smaller plaquettes were placed inside the cave along the east wall to pave over mud and slippery bedrock, for ease of human movement inside the cave rather than for actual activities. Breakage of the smaller pieces inside the cave could have been caused by trampling by people as well as by post-depositional breakage and movement, as water and mud drain through the cave, causing the smaller broken pieces to slip downslope to come to rest on the terrace. Other small pieces may have continued to move down the slope in front of the cave.

An alternative scenario, which seems unlikely, is that psammite paving was placed in the upper part of the cave and that plaquettes were moved by water and slid down the steep bedrock slope, coming to rest naturally at the eastern wall, with smaller pieces continuing on to the terrace where the slope levels off. If plaquettes originated in the upper part of the cave, this would be the expected scenario, with natural processes of movement. However, the extremely steep slope of the bedrock, which is quite slippery when wet, would not have permitted the placement of plaquettes there. Additionally, the *in situ* breakage of 12 of 22 refit sets indicates a high level of site integrity, with a smaller degree of site disturbance. If plaquettes had broken

DISTRIBUTION OF PIECE-PLOTTED PLAQUETTES

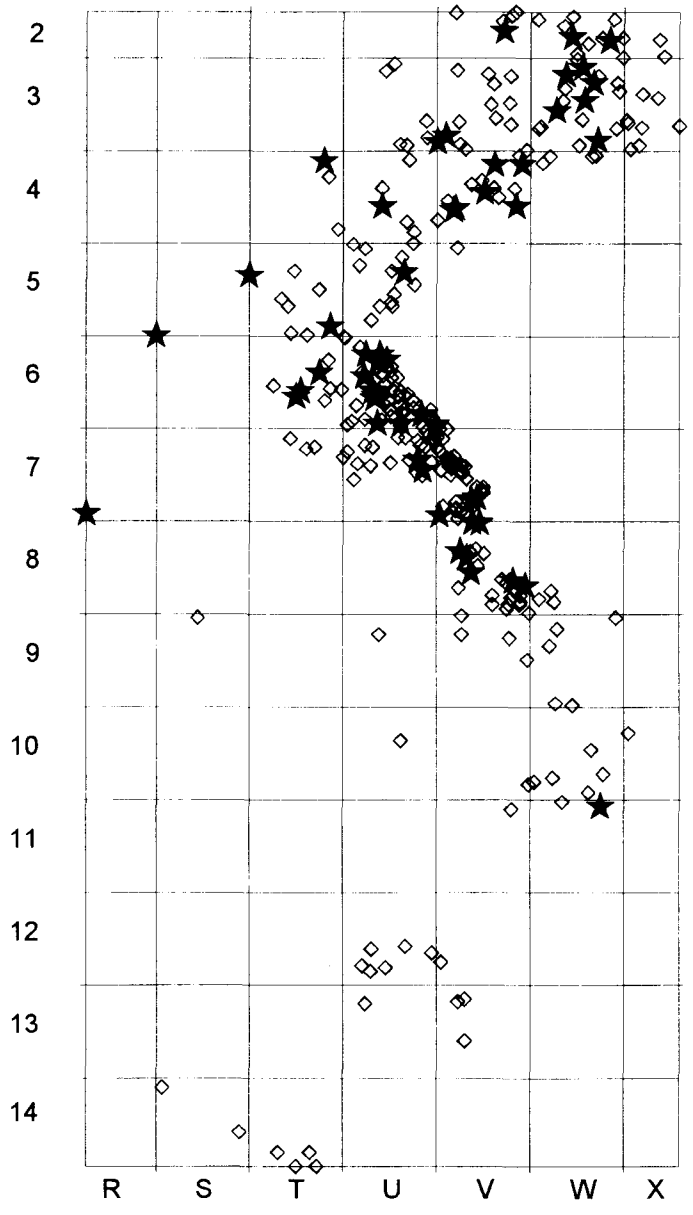

Fig.2- Distribution of all piece-plotted plaquettes in the Magdalenian level.
(Stars indicate refitted pieces.)

DISTRIBUTION OF REFITTED PLAQUETES

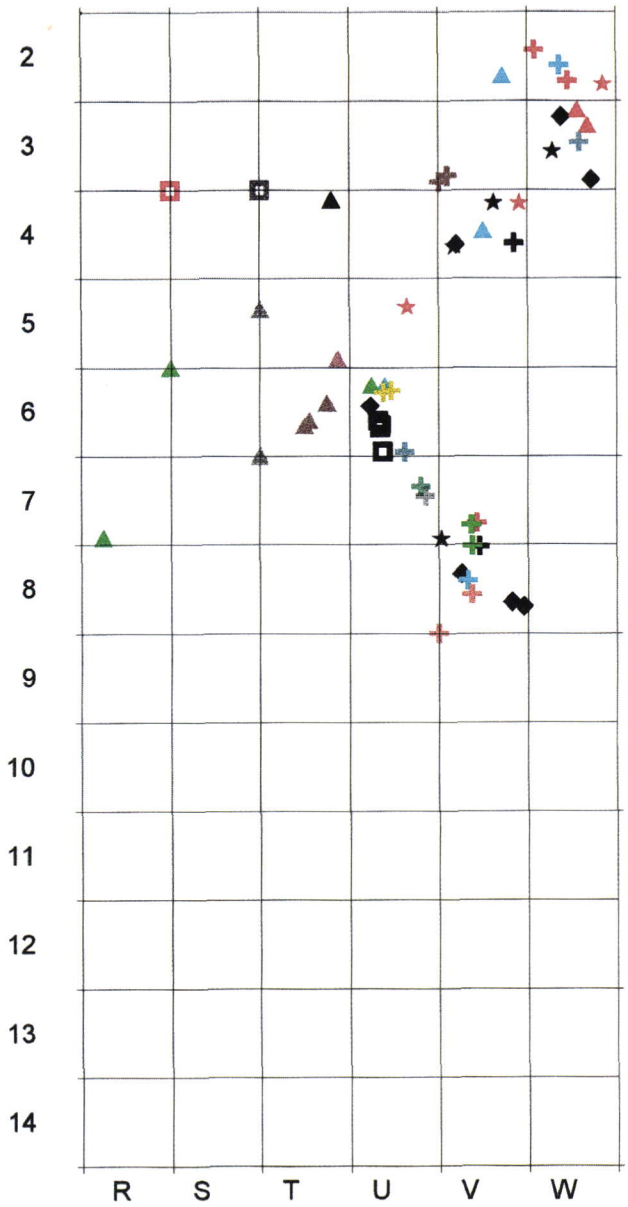

Fig. 3 - All refit sets.

Symbol, referring to number of pieces in a set: cross:
2; triangle; 3; square; 4; star; 5; diamond: 6+.
Plaquettes plotted together, as in Set 2, share a symbol. Colors indicate different sets.

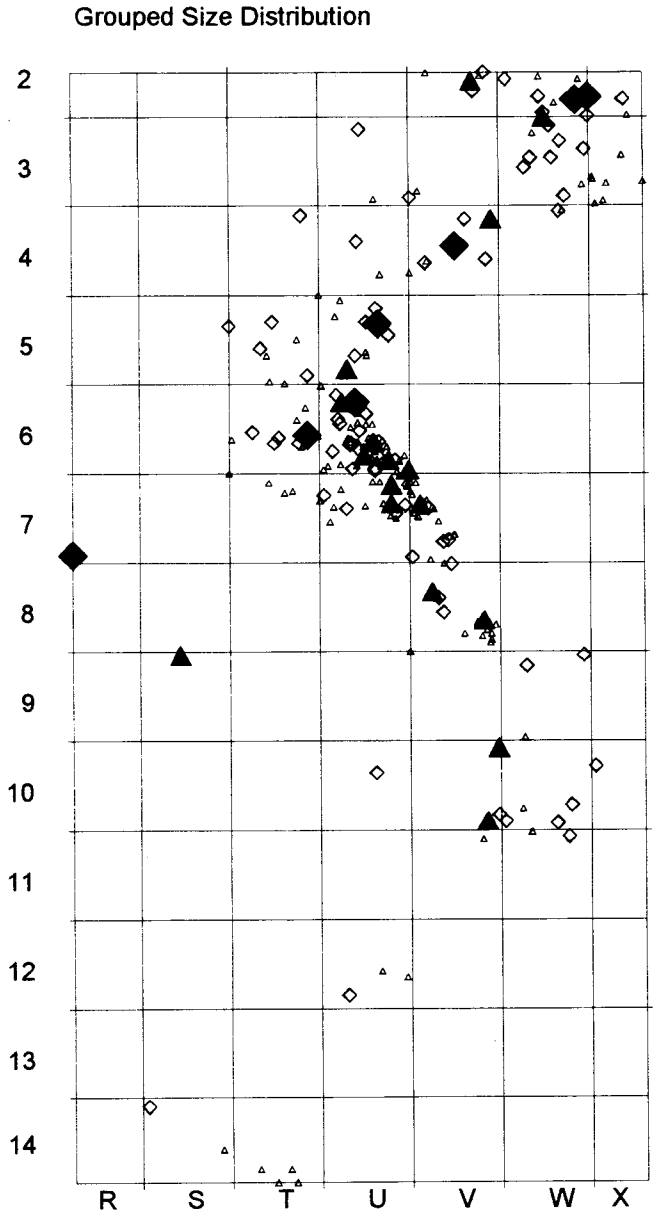

Fig.4- Distribution of refitted plaquettes by size.

small: small open triangles;
medium: small open diamonds;
large: filled triangles;
very large: filled diamonds.

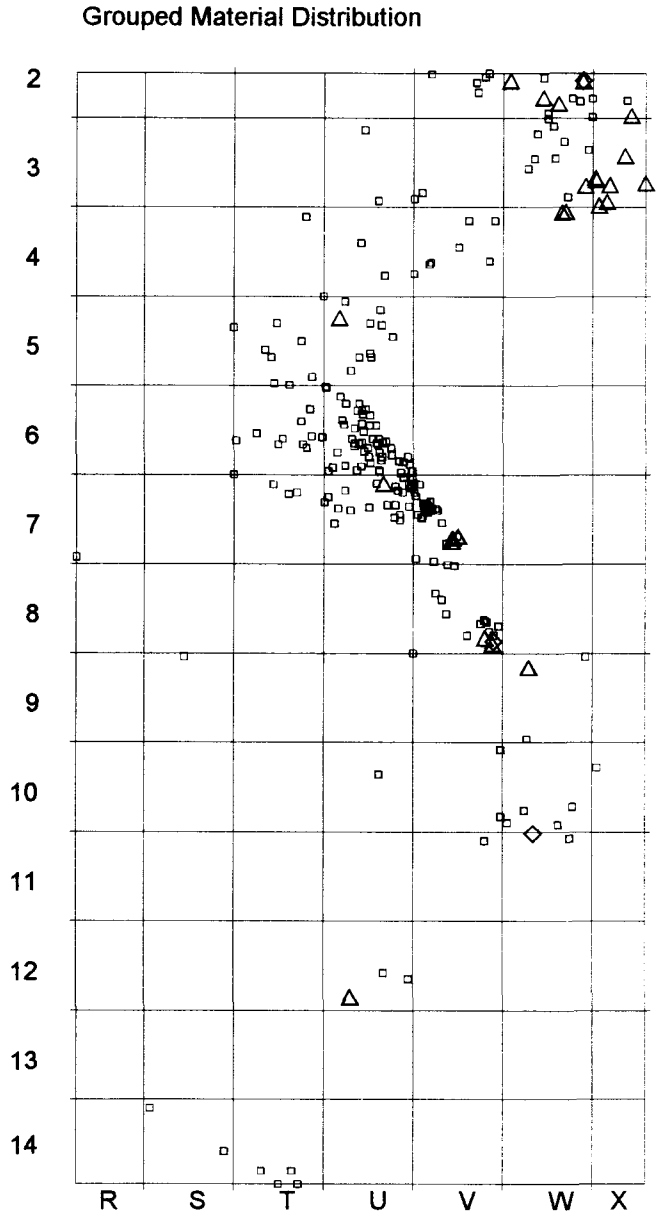

Fig.5- Distribution of refitted plaquettes by material type.
(limestone: triangle; diamond: sandstone; psammite: square)

after sliding from the upper part of the cave, the refitted pieces should not have been found so close together. Five sets of refits cross-cut Strata BSC and YSS, thereby helping to demonstrate (along with the lithic artifact refits) that the gradational sedimentological distinction between these two units has no *archaeological* significance (Straus and Martinez, this volume).

Conclusions

The combined weight of the plaquettes, along with the large size of some of the refit sets, indicates a more intensive use of the site than simply an overnight or short-term stay in the cave. The amount of labor invested in transporting plaquettes to the site, and their spatial distribution within the site, show that there was interest or need to make the site more habitable. A likely interpretation is that plaquettes accumulated at the site accretionally, where plaquettes are brought to the site during multiple visits rather than all at once.

The large number of sets (12 out of 22) which reflect *in situ* breakage support the argument that plaquettes were originally placed along the eastern wall, where the steep slope of the cave floor levels out, rather than being deposited there by natural processes of movement. The five sets which show movement of small pieces downslope to the terrace show that small pieces may have been affected by natural processes of disturbance, such as water. The orientation of the plaquettes (tilted and sometimes vertical) also shows some natural process of post-depositional disturbance.

Finally, the presence of plaquettes in such a small site points to its relative importance within the network of Magdalenian sites. The larger sites, including Chaleux, Gonnersdorf, Andernach (M. Street, pers. comm.) all show investment in paving the living areas. Smaller, logistical, sites, such as Trou des Nutons and Trou da Somme (Teheux 1994), have a few plaquettes but show no evidence for paving. At Bois Laiterie, the existence of a large number of plaquettes and the corresponding investment of time to transport material for paving indicates a possible intention of re-using the site, perhaps seasonally or yearly. Plaquettes were used to make the site more habitable, and if it had been used as a short-term, single use, camp, it is unlikely that much labor would have been invested in making it more habitable. The presence of plaquettes seems to indicate a degree of planning ahead, to prepare the site for repeated visits.

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