ERAUL 80

LA GROTTE DU BOIS LAITERIE

Sous la direction de

M. OTTE et L.G. STRAUS

ETUDES ET RECHERCHES ARCHEOLOGIQUES DE
L'UNIVERSITE DE LIEGE

LA GROTTE DU BOIS LAITERIE

Recolonisation Magdalénienne de la Belgique

Magdalenian Resettlement of Belgium

Sous la direction de

MARCEL OTTE ET LAWRENCE GUY STRAUS

avec l'aide de la Direction des Fouilles de la Région Wallonne
(Subvention n° 96 / 12789)

ERAUL 80
LIEGE, 1997

Publié avec l'aide de la Direction des Fouilles, Division du Patrimoine,
Direction Générale de l'Aménagement du Territoire, du Logement et du Patrimoine de la Région Wallonne
(Subvention Fouilles en Grottes n° 96 / 12789)

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Couverture : Photo Y. HANLET

ERAUL
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Dépôt légal: D / 1997 / 0480 / 2

TABLE DES MATIERES / TABLE OF CONTENTS

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

PREFACE

HISTORIQUE DE LA DECOUVERTE.

J.-M. Léotard et Ph. Lacroix.

Les grottes de la basse vallée du Burnot.

En 1989 et 1990, dans le cadre d'un nouvel examen des cavités de la vallée du Burnot, la Grotte du Bois Laiterie fut réinventée par Ph. Lacroix. Cette analyse ne se fit pas sans atiser la polémique des appellations de ces grottes. En effet, au fil des publications, des inventaires, des relevés topographiques, une certaine confusion dans leur localisation et leur dénomination se développa, notamment par la présence dans chacune d'entre elles d'ossements humains. Cette publication est l'occasion d'une mise au point.

Bien que parfois dans la tradition orale, la dénomination « Burnot » ait été appliquée à l'une ou l'autre des cavités suivantes, la grotte éponyme est située à l'Est du collège du Sacré-Coeur (cfr. Fig.1 et Fig.2). Cette appelation est présente sous forme d'*unicum* dans la thèse inédite de Marie Gevers (1973). Par ailleurs, la grotte se dénomme depuis 1970 au moins, Trou du Juvenat (Delbrouck R., 1970, p.16; Delbrouck R., 1975, Pl.4; S.S.W., 1982, p.223; S.S.N., 1986, p.17). Pour faire court, Trou du Juvenat ou Grotte de Burnot seront assimilés à la cavité ayant fourni dès 1966, à Joseph Dries, Michel Fromont et Arnaud Thyes la belle série anthropologique étudiée par Marie Gevers.

Quelque soixante mètres en aval de cette cavité, approximativement à la même hauteur, se trouve le Trou du Pionnier (cfr. Fig.1). Il fut, dans la plupart des cas, confondu avec le Trou du Curé (Gevers M., 1973; Delbrouck R., 1975, Pl. 4; Delbrouck R., 1980, Pl.5; S.S.W., 1982, p.313-314; S.S.N., 1986, p.18-20). Lors de prospections récentes, menées en octobre 1990, Ph. Lacroix établit la jonction entre les deux conduits: Trou de Burnot ou du Juvenat et Trou du Pionnier forment un seul ensemble (cfr. Fig.2)

Descendant la route de la vallée, quelques mètres après avoir croisé la chaussée conduisant à droite vers le plateau du Bois Laiterie, se trouve le Trou du Curé (cfr. Fig.1). De nombreux auteurs l'ont confondu avec le Trou du Pionnier (*ibidem*).

Nous arrêtons le débat sur base de la note du Père F. Anciaux (1950, p.229) situant la cavité au bord de la route. La grotte est un long boyau (cfr. Fig.3) s'ouvrant au contact avec la chaussée. Son porche fut probablement tronqué, notamment lors des aménagements routiers. Le Trou du Curé a été vidé de ses sédiments comme en témoignent les reliquats de sols et de planchers stalagmitiques sur les parois. Quelques fragments d'ossements humains englobés dans la brèche indiquent la présence d'un ossuaire.

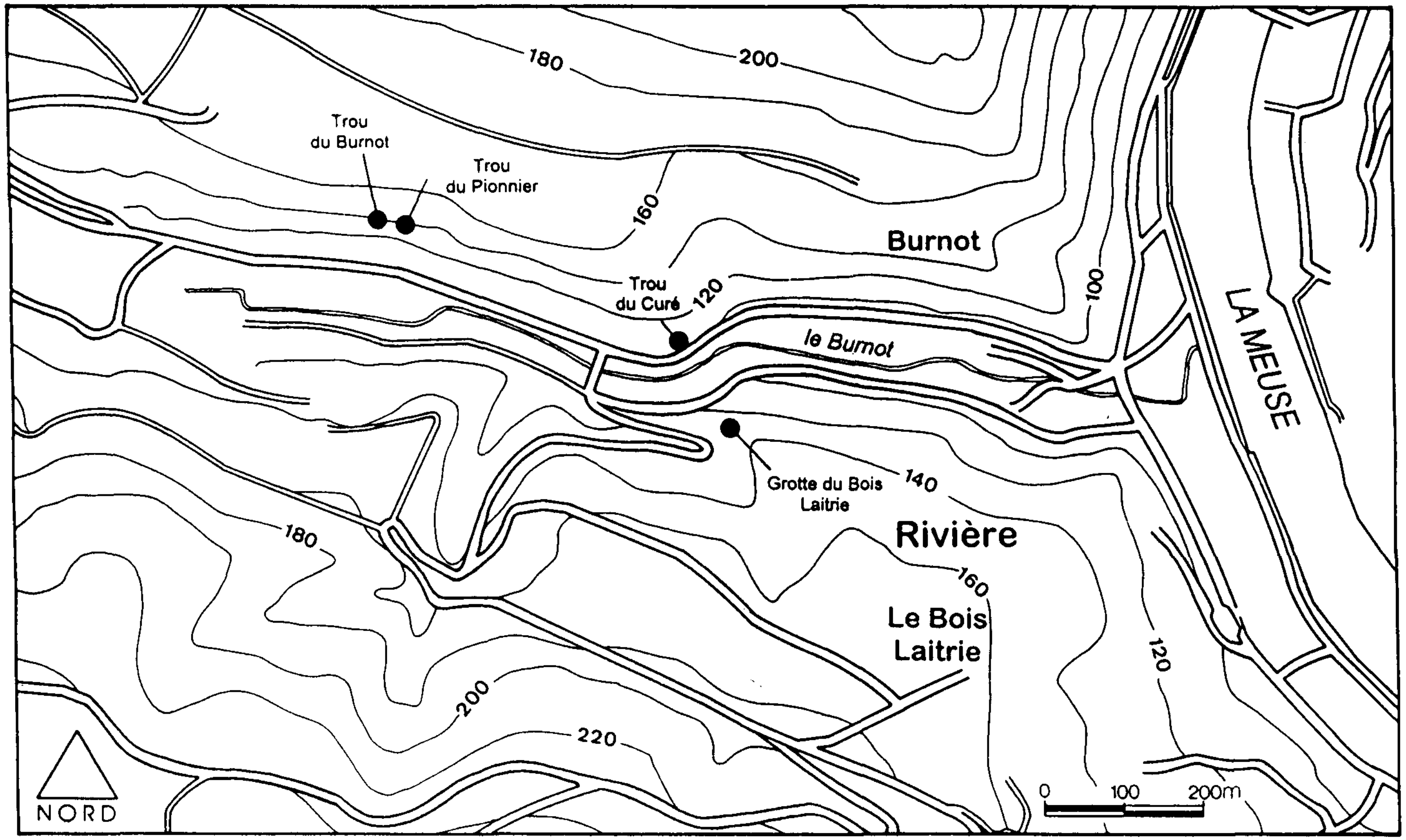

Fig. 1 - Situation des cavités de la basse vallée du Burnot.

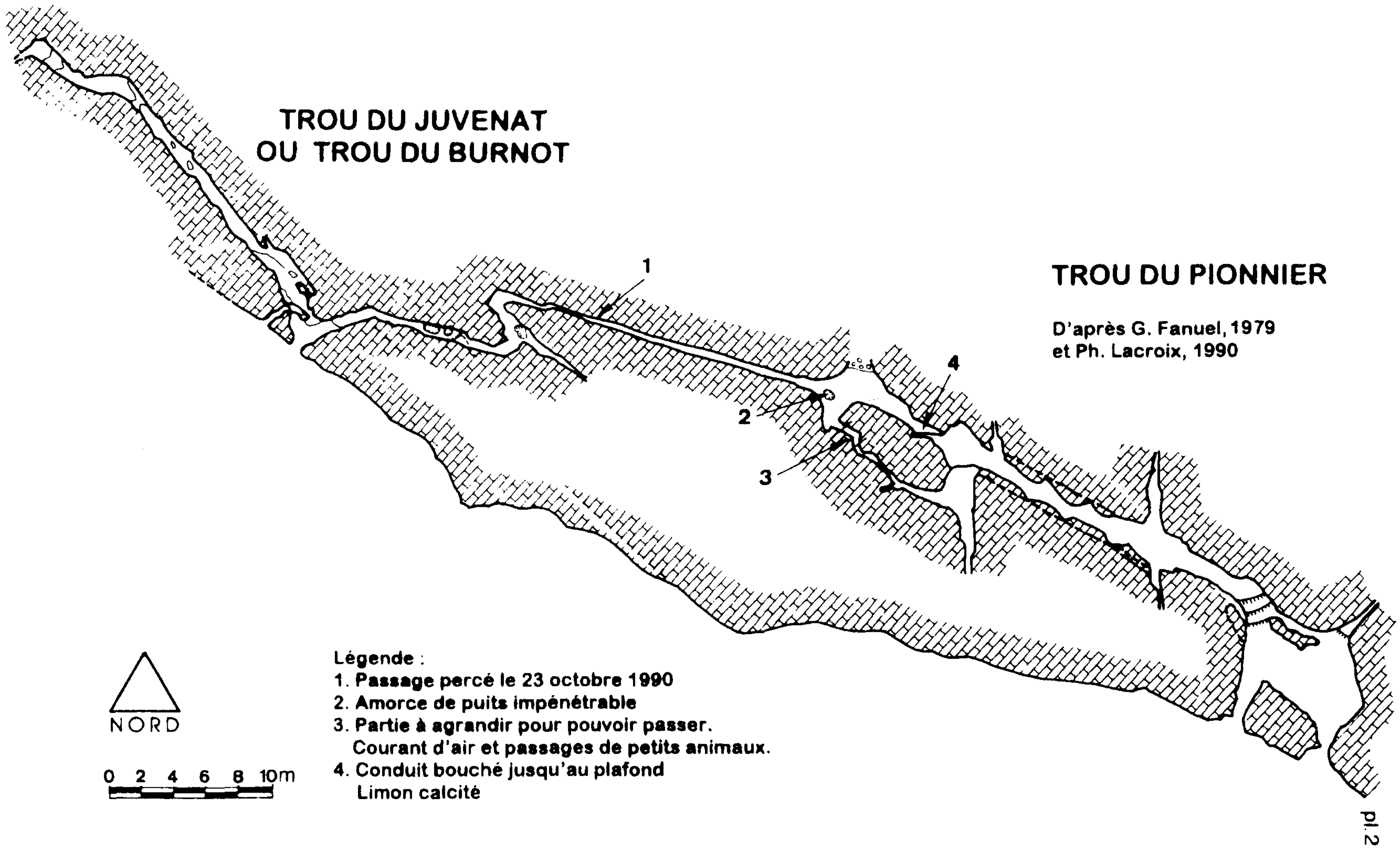

Fig.2 - Plan du Trou de Burnot ou Trou de Juvenat et du Trou du Pionnier.

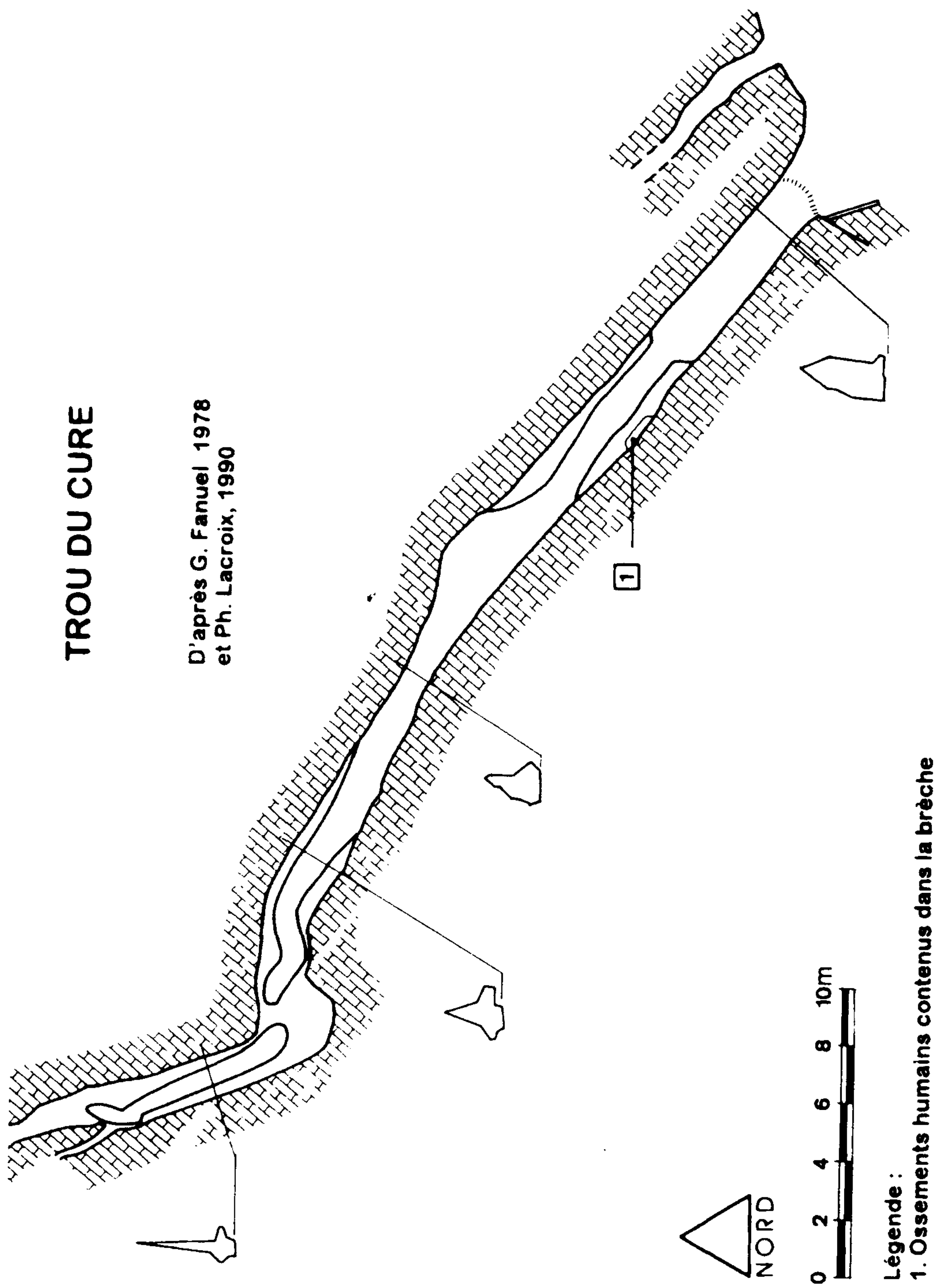

Fig.3 - Plan du Trou du Curé.

A l'inverse des grottes précédentes situées sur le versant septentrionnal de la vallée et appartenant à la commune de Profondeville, le Bois Laiterie se trouve sur le versant opposé appartenant au territoire du village de Rivière (cfr. Fig.1). Dans une courte note, nous l'avons personnellement confondue avec le Trou du Burnot (Chronique de l'Archéologie Wallonne, 1993, p.102). Cette cavité est peut être la Grotte en Face de Lustin de F. Anciaux (1950, p.230) et peut-être également le Trou de l'Usine à Bêches (S.S.W., 1982, p.406). Si nous avons désormais pour habitude de la dénommer Bois Laiterie (carte IGN de 1980), il est certainement plus correct et étymologiquement plus convenable d'utiliser Bois Laitrie (carte IGN de 1968; S.S.N., 1986, p.21 et 23).

La re-découverte.

Au printemps de l'année 1989, Ph. Lacroix entreprit un examen minutieux des cavités de la vallée du Burnot; il reconnut, comme nous l'évoquions ci-dessus, la présence d'ossements humains dans chacune d'entre elles, associés à quelques fragments de poterie et de silex. Dans la Grotte du Bois Laiterie, il découvrit un front de grattoir convexe aménagé sur l'extrémité distale d'une lame en silex à grains fins patinée en blanc indiquant une occupation durant le Tardiglaciaire. En juillet 1989, une première visite du site en compagnie de Ph.Lacroix nous permit de constater l'ampleur des déprédations récentes consécutives à des pillages. Dans la salle principale, sur son côté oriental,on pouvait observer au dessus du pinçage entre les sédiments et le plafond et collés à ce dernier, des placages de brèche contenant ossements humains et fragments de céramique. C'est à cette époque qu'un contact avec Joseph Dries, fouilleur du Trou de Burnot ou Trou du Juvénat, aboutit à la confusion commentée plus haut.

Comme à son habitude, Ph. Lacroix ne se laissa pas décourager. Malgrè l'importance des dégats et bien que le rocher apparut en maints endroits, il entreprit en décembre 1990 et janvier 1991, de sonder la zone de contact entre les rares sédiments encore en place et le plafond. Les six sondages, de S.1 à S.6, sont localisés sur la planche 4. Dès l'effleurement de la surface du sol et dans un contexte remanié, le premier sondage (carré S,T 14) permit la mise au jour du grattoir cité plus haut et de la pointe en os publiée par ailleurs (pointe «F»; López-Bayón *et al.*,1996).

Dans son deuxième sondage, partiellement sous la brèche, Ph. Lacroix attint les sédiments en place (l'horizon YSS du présent ouvrage). Ce sondage 2, situé dans le carré U 13, produisit quelques éclats de silex pulvérulents, très altérés. La richesse s'accrut dans le sondage 3. Ph. Lacroix en conclut que seule la sépulture dont les fragments apparaissaient dans la brèche, avait été fouillée et que les chercheurs, ne poussant pas plus loin leurs investigations, s'étaient arrêté au sommet des dépôts pléistocènes.

Le sondage 3, partagé entre les carrés V 11 et V 12, permit la découverte des sagaies «B» et «C» publiée par ailleurs (López Bayón *et al.*, *ibidem*).

Le sondage 5 (carré U 9, U 10) se révéla très riche; les artéfacts apparurent dès la surface et se répartissaient sur un quinzaine de centimètres d'épaisseur. Outre les plaquettes de psammite, les ossements, les fragments de silex (dont deux lamelles à dos), on y découvrit la

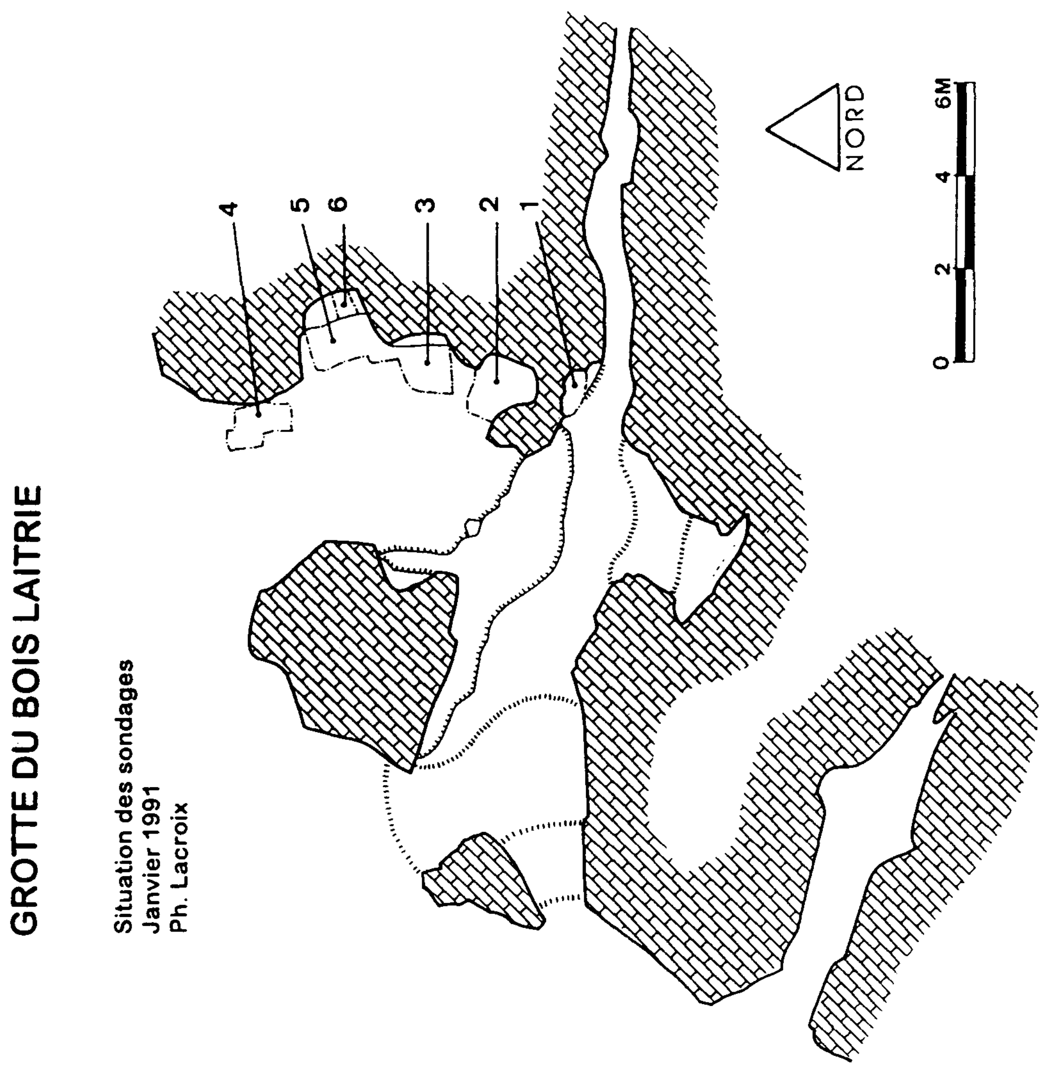

Fig.4- Grotte du Bois Laitrie ou Laiterie. Situation des sondages réalisés par Ph. Lacroix.

sagaie «A», l'os incisé «G» et deux coquilles perforées (*Bayania Lactea*) (López Bayón *et al.*, *ibidem*).

Le sondage 6 (carré W 10) consista en un début de démantèlement de la brèche. Dès l'apparition d'ossements et de tessons capturés dans le plancher stalagmitique, Ph. Lacroix interrompit ses investigations dans ce secteur.

Dans le sondage 4 (carré U 8), Ph. Lacroix démontra l'ouverture de la séquence stratigraphique vers le porche et l'enfouissement progressif des niveaux magdaléniens sous une cinquantaine de centimètres de sédiments. Il y récolta quelques éclats de silex et les fragments d'un os d'oiseau incisé présenté plus loin (López Bayón *et al.*, dans ce même volume). Le sondage fut arrêté sur la roche et, devant le potentiel du site, l'inventeur décida d'arrêter là ses prospections.

Dans l'attente de recherches plus importantes, les sondages furent comblés ou recouverts. L'attribution au Magdalénien fut complétée d'une datation AMS publiée par Ruth Charles (1994) (12.660 ± 140 BP, OXA 4.198) effectuée sur un fragment de la sagaie «B».

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Photo 1 - Grotte du Bois Laiterie. Vue du système karstique et de la double entrée de la cavité.

Photo 2 - Grotte du Bois Laiterie. Entrée principale en 1993 avant de commencer la fouille "sensu stricto".

INTRODUCTION

M. Otte et L.G. Straus

Différente de tout autre site magdalénien en Belgique, la Grotte du Bois Laiterie fut découverte récemment, en 1990, par Philippe Lacroix. Les travaux furent commencés en 1991 sous la direction du Service de Préhistoire de l'Université de Liège. De petits sondages préliminaires (voir Préface, Fig.4, dans ce même volume) montraient une richesse extraordinaire d'artefacts magdaléniens, notamment des sagaies en bois de renne, des coquilles fossiles perforées et des os d'oiseau incisés (Léotard, 1993). Une des sagaies fut datée de 12.600 B.P. par la technique d'accélérateur de particules au laboratoire d'Oxford (R.Charles, 1994). En 1993, M. Otte, Ph. Lacroix et le reste de l'équipe liégeoise attirent l'attention de leurs collaborateurs américains de l'Université de Nouveau Mexique (équipe dirigée par L.G. Straus) sur la signification et l'intérêt du site, en vue d'une fouille systématique.

J.-M. Léotard (Service de Fouilles de la Région Wallonne), M. Otte (Université de Liège) et L.G. Straus (Université de Nouveau Mexique) en commun accord décidèrent d'entreprendre la fouille du site. Le but était d'obtenir informations de qualité sur l'environnement et la chronologie du Tardiglaciaire en profitant des techniques modernes d'analyse et de fouilles. En outre, l'obtention de données sur les aptitudes d'adaptation des populations magdaléniennes dans des petits stations en grotte qui contrastent avec les occupations à plus longue durée des sites voisins de Chaleux et Goyet (fouillés jadis par Ed. Dupont au cours du XIXème siècle), ainsi qu'avec les sites de plein air d'Orp et Kanne récemment mis au jour en Moyenne Belgique par P. Vermeersch et l'équipe de l'Universiteit Katholieke de Leuven.

Initialement, il y eu une certaine confusion concernant la dénomination de la cavité. Le nom de Grotte du Bois Laiterie dérive du bois dans lequel la grotte est située et du hameau au-dessus la grotte; il sera donné au site par Ph. Lacroix lors de sa découverte. Le site avait déjà été pillé partiellement avant la découverte; on pensa dès lors qu'il s'agissait de la Grotte du Burnot (connue aussi comme Grotte du Juvénat), celle-ci étant déjà connue par son ossuaire néolithique (Brabant, 1974) et possèdant une datation radiocarbone d'environ 4,100 B.P. (Toussaint et Becker, 1992). La Grotte du Burnot se situe en fait au sud, de l'autre côté de la gorge du Burnot. La confusion fut encore facilitée parce que les clandestins avaient creusé dans les couches superficielles au Bois Laiterie (dénommé à partir d'ici «BL») et détruit un dépôt contenant des restes humains et des tessons de céramique. De restes du pillage étaient encore visibles sur la paroi est de la cavité au fond de la grotte, adhérant au conglomérat (brèche), lors de la découverte scientifique de Lacroix; celui-ci supposa alors qu'il s'agissait de la grotte du Burnot, laquelle fut également testée dans le passé par des amateurs (les trouvailles furent à l'époque analysées par des anthropologues physiques). Néanmoins, les deux grottes sont clairement séparées et bien distinctes. Ainsi, il n'y a pas eu de publication préalable sur le Bois Laiterie avant les travaux dont il est question dans ce volume. Lors de conversations avec des habitants locaux, nous avons appris que le pillage de cette grotte eut lieu dans les années 70, et furent le fait d'un professeur d'école locale et de ses élèves.

Fouilles antérieures

Heureusement, une fois le fond du dépôt supérieur atteint, les pillards s'arrêtaient aux niveaux sableux ou sablo-limoneux culturellement stérile qui séparait l'occupation néolithique de l'horizon magdalénien. Ainsi, malgré l'impressionnant nombre de «fosses», les pillards (par inadvertance) épargnaient le dépôt magdalénien. Donc, involontairement, ils nous ont facilité la tâche pour la fouille méthodique des niveaux magdaléniens auxquels nous avons pù nous attaquer directement sans évacuation préalable des dépôts néolithiques et/ou de l'ossuaire mésolithique. Certes, malgré notre tamisage d'une partie substantielle des sédiments ayant été remblayés par les anciens fouilleurs pour combler leurs tranchées, nous avons trouvé seulement 18 artefacts qui, par leur type de matière première, leur typologie et leur technologie, sont sans doute attribuables à la période magdalénienne. Dans la pente qui existe à l'est de la grotte se sont accumulés la majorité des restes magdaléniens, le dépôt étant particulièrement bien conservé. En plus, là, nous n'avons pas trouvé de traces de creusements de la part des clandestins, ni aucun hiatus à l'intérieur de l'horizon magdalénien. Des artefacts d'origine moderne ou des intrusions (mésolithiques ou néolithiques) n'ont pas été découvertes. A l'ouest, dans la partie supérieure de la pente, et à l'intérieur de la grotte, les pillards étaient arrivés à creuser jusqu'au contact avec la roche mère; néanmoins, nous y avons retrouvé quelques fragments de psammite semblables à ceux du dépôt magdalénien et quelques rares artefacts en silex (mais de nouveau pas d'intrusions), en contact avec le plancher ou dans de petites fentes. Souvent, ces objets étaient cimentés à la roche mère par une croûte carbonatée (strate TS: «tuffaceous silt»), confirmant ainsi le caractère *in situ* des trouvailles. Cette formation carbonatée était probablement la même que celle à l'origine de la brèche située au mur est de la cavité. Apparemment, une partie du dépôt magdalénien aurait subsisté en liaison avec le plancher dans la surface en contre-pente; une partie du dépôt aurait pu ne pas glisser ou bien l'avoir fait dans une faible mesure et sur une courte distance (environ de 1 à 4 m, vers le mur est de la grotte par gravité naturelle ou bien suite à un dérangement moderne des pillards).

Malgré les nombreux dommages causés par l'activité des clandestins sur la terrasse de la grotte, il n'y a pas de preuve claire que les pillards aient atteint ou non le dépôt magdalénien. Ni notre tranchée d'essai (O-P / 3-4) à l'extérieur de l'entrée de la grotte (ouest), ni notre fouille systématique sur la pente et la surface de la terrasse (est), ni encore notre fouille à l'intérieur de la grotte, ne montre des indices de perturbation des restes magdaléniens. En fait, notre tranchée d'essai extérieure (O-P / 3-4) a atteint la base du plancher sans aucun trace d'un niveau intact magdalénien, mais elle a montré des évidences de remplissage d'au moins deux épisodes de creusements récents. Le fait d'avoir le plancher dans la partie supérieure (en contre-pente) à l'intérieur et en dehors la grotte, joint à la découverte d'un niveau de sable stérile dans la zone tout au long du mur est de la grotte, mena les clandestins à arrêter leur «fouille», ayant seulement creusé très peu dans le niveau magdalénien (vraisemblablement en ne rencontrant qu'un petit groupe de pièces cimentées à la brèche à l'intérieur de la grotte, dont certaines que nous avons redécouvertes dans le sédiment du remblayage de leurs tranchées).

La fouille du Magdalénien de Bois Laiterie

Comme nous l'avons vu, par cette série de circonstances heureuses, le Magdalénien de la grotte du Bois Laiterie, trouvé par Ph. Lacroix en 1990, avait survécu. Les perturbations naturelles du dépôt survenues pendant la phase finale du Pléistocène, seront traitées ailleurs (Straus and Martinez, Miller and López Bayón, Cordy et Lacroix, López Bayón *et al.*, dans ce même volume). Malgré tout, cette grotte a fourni un nouvel échantillon valable d'informations à ajouter, par leur quantité et diversité, à la base de données que l'on construit sur les environnements, ressources et adaptations humaines pendant la phase Bölling et la ré-colonisation magdalénienne de la Belgique et du N-O de l'Europe. Quoique petite et inconfortable, la grotte du Bois Laiterie donne un type de « vue » très différent sur les activités magdaléniennes que, par exemple, une grotte comme Chaleux, récemment ré-fouillée par le premier auteur et ses étudiants. En outre, Bois Laiterie possède l'avantage de présenter une très bonne préservation taphonomique de la faune (point de contraste avec les carrières de plein air de Orp et Kanne). Avec seulement une composante magdalénienne (et aucune autre évidence Paléolithique), l'interprétation fonctionnelle de cette grotte, dans le contexte le plus large de réoccupation humaine de la Belgique il y a 12.900-12.300 ans, nous semble relativement nette. Ainsi, en association avec les fouilles dans des sites de plein air en Belgique et dans les pays voisins comme la France et les Pays-Bas, et les récentes ré-analyses et synthèses des collections provenant d'anciennes fouilles, Bois Laiterie peut apporter une lumière significative sur certains aspects spécifiques du mode de vie dans la frontière N-O de l'Europe pendant cette période relativement courte, mais clairement délimitée.

Remerciements

Le permis de fouille de la grotte du Bois Laiterie fut accordé par la Ville de Profondeville (propriétaire) et par le Gouvernement Régional Wallon. Le soutien matériel et financier pour la fouille et les analyses fut fourni par le Gouvernement de la Région Wallonne, la National Geographic Society (USA), le Service de Préhistoire de l'Université de Liège et le Research Allocations Committee de l'Université du Nouveau Mexique. Le parking, l'accès au site et l'approvisionnement en eau pour le tamisage furent gracieusement fournis par les propriétaires du camping des Sept Meuses, Mr et Mme Boessen. Le logement d'une bonne partie de l'équipe et une infrastructure de laboratoire furent, très généreusement, fournis par le capitaine Pierre François dans sa maison à Beez (Namur), lors de la campagne de 1995, au moment où la maison fournie par la Ville de Dinant les saisons précédentes (depuis 1991) devenait indisponible.

Les fouilles et analyses préliminaires furent conduites du 5 juillet au 3 août 1994 et du 15 juin au 1er août 1995, sous la direction de Straus et Otte assistés par Lacroix. L'équipe

était formée d'étudiants en Archéologie et Préhistoire, principalement des Universités du Nouveau Mexique et de Liège, ainsi que de l'Université du Michigan et de la St.John's College (Santa Fé, NM). Les dessins des pièces furent réalisés par M.Guilbaud, I. López Bayón, J. McClean, J.Orphal et J. Summers; dans beaucoup de cas, les dessins originaux au crayon furent mis à l'encre par Y. Paquay et A. Warnotte. Les profils et plans du site, esquissés par Ph.Lacroix, R.Miller et Straus, furent ré-dessinés par R.Stauber. Les plans de distribution spatiale et de remontages furent réalisés par A.Martínez, R.Miller et I.López Bayón. La saisie des données et les analyses statistiques furent essentiellement faites par J.Orphal, assisté de R.Miller, J.Summers, A.Martinez et A.Steffen. Les problèmes logistiques furent résolus par V.Ancion, qui a réalisé aussi - dirigé par E. Teheux - une étude des matières premières et une récolte de surface aux environs de la cavité. Ph.Lacroix, de sa propre initiative, a recueilli, traité et trié de grandes quantités de sédiment pour les analyses malacologiques et de microvertébrés, réalisée ultérieurement par I. López Bayón (qui prendra les responsabilités de coordination de la publication) et J-M.Cordy. Les échantillons de sédiments pour analyses micromorphologiques recueillis par L.Lang furent traités par M-A.Courty. Achilles Gautier était responsable non seulement de l'analyse des macromammifères, mais aussi de la coordination de la plupart des autres études paléontologiques.

Des remerciements particuliers doivent aller à notre ami Philippe Lacroix (dit «Bibiche»). Sans lui, la fouille du Bois Laiterie n'aurait pas eu lieu !

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INTRODUCTION

L.G. Straus and M. Otte

Discovery and Identity of Bois Laiterie Cave

Unlike all the other Magdalenian cave sites of Belgium, la Grotte du Bois Laiterie was discovered *recently*: in 1990 by Philippe Lacroix, who tested it in 1991 under the aegis of the Université de Liège, Service de Préhistoire (Léotard,1993). These small test pits (see Fig.4 in Preface) yielded an extraordinary wealth of Magdalenian artifacts, notably antler sagaies, perforated fossils and an engraved bird bone. One of the sagaies was accelerator radiocarbon dated at Oxford University to 12,600 years ago as part of R.Charles' (1994) dissertation research on the Tardiglacial resettlement of Belgium. Lacroix brought the site to the attention of Straus in 1993, stressing its significance and the need for its systematic excavation, given its serious vulnerability to looting. J-M.Léotard (Service de Fouilles), M.Otte (Université de Liège) and L.G. Straus (University of New Mexico) decided to excavate the site in collaboration with Ph. Lacroix. This was done in order to obtain modern-quality information on Tardiglacial chronostratigraphy and environments, and Magdalenian activities at a small cave site, that would obviously contrast with such large nearby caves as Chaleux and Goyet (excavated by E.Dupont in the late 19th century), as well as with the recently excavated open-air sites of Orp and Kanne in Middle Belgium (directed by P.Vermeersch of the Universiteit Leuven).

Initially there was some confusion concerning the identification of the cave in question. Because Bois Laiterie Cave (a name, derived from that of the wood and the hamlet on the hillside above the cave, that was eventually given to the cave by Lacroix) had already been partly looted at the time of Lacroix's initial visit, it was assumed that it was la Grotte du Burnot (also known as Grotte Juvénat). The latter site (which it turns out is probably one on the *south*-facing side of the Burnot gorge) is known for its Neolithic ossuary (Brabant,1974), radiocarbon dated to 4,100 BP (Toussaint and Becker,1992). The confusion was facilitated by the fact that the pothunters who had dug out the surficial layers in Bois Laiterie (hereafter referred to as «BL») removed a deposit containing human remains and ceramic sherds. These were still visible in a massive breccia remnant adhering to the rear and east walls of the cave when it was scientifically discovered by Lacroix, who then assumed that this was la Grotte du Burnot, which had also been dug out by amateurs, but whose finds had been analyzed by physical anthropologists. The two caves are however clearly separate and distinct. There is thus no known prior publication on Bois Laiterie and it is only through conversation with local inhabitants that we learned that the looting of this cave had possibly been conducted in the 1970's by a local school teacher with his pupils.

Previous «Excavation»

Fortunately, once they reached the bottom of the sherd-producing upper deposit, the pothunters stopped atop a generally culturally sterile sand or sandy silt that separated the Neolithic from the Magdalenian horizon. Thus, despite the impressive volume of their diggings, the looters (inadvertently) spared the Magdalenian deposit, while making it easy for us to carefully excavate the latter without having to first excavate the Neolithic and/or Mesolithic ossuary that once had existed in BL. Indeed, despite our screening of a substantial portion of the looters' backdirt, we found only 18 artifacts which, by their flint types, technological and typological attributes, are almost certainly of Magdalenian age. In the downslope (eastern) part of the cave - the main area where Magdalenian deposits were preserved - we found NO evidence of pothunter diggings having cut into the Magdalenian horizon. Nor did we find any modern artifacts or other intrusive objects (such as Mesolithic or Neolithic items). In the upslope (western) part of the cave, however, the pothunters had dug down to contact with the bedrock floor, where, nonetheless, we found a few psammite slabs (exactly like those of the Magdalenian deposit) and a few flint artifacts (but again no intrusive objects) right atop the bedrock or in small cracks and faults therein. Often these objects were cemented to the bedrock by a flowstone crust (Stratum TS: «tuffaceous silt»), insuring that they were *in situ*. This calcium carbonate precipitate formation was probably the same one that created the breccia adhering to the eastern cave wall. Apparently a remnant of the Magdalenian deposit had subsisted in contact with the bedrock in the upslope area, although much of it may have slid a short distance (c.1-4 m) down toward the eastern cave wall *in antiquity* (*i.e.*, not as a result of modern disturbance).

Despite massive amounts of clandestine digging on the cave terrace as well, there is no evidence there either, that the looters had cut into the Magdalenian deposit. Neither our test trench (O-P/3-4) at the upslope (W) end of the cave mouth exterior, nor our complete excavation of the downslope (E) terrace area (continuous with our excavation on the cave interior) uncovered any indication that the remnant Magdalenian material had been intersected by the pothunters. In fact (in complete consonance with the situation in the upslope part of the cave itself) our western exterior test trench (O-P/3-4) reached steeply sloping bedrock without attaining any trace of an intact Magdalenian level, but did cut through obvious fill from at least a couple of episodes of recent diggings. Having hit bedrock in the higher, upslope area both inside and immediately outside the cave, and having encountered sterile sand in the downslope zone along the eastern cave wall, the pothunters stopped, having only dug up a very few Magdalenian artifacts (presumably from the small group lying atop and sometimes cemented to bedrock in the upslope cave area), some of which we in turn re-discovered in their backdirt.

Perspectives and Rationale for the Excavation of the Magdalenian of Bois Laiterie

As we have seen, through this series of fortunate circumstances, the Magdalenian component of la Grotte du Bois Laiterie had survived to be found by Ph.Lacroix in 1990. Possible natural disturbances it had suffered during terminal Pleistocene times are dealt with elsewhere (Straus and Martinez, this volume). But despite them, this cave provides a valuable new sample of materials of many kinds to add both quantity and diversity to the data base on the environments, resources and human adaptations of the Bölling phase and hence of the Magdalenian recolonization of Belgium and, by extension, of NW Europe. Though small and uncomfortable (and thus providing a very different kind of «view» of Magdalenian activities than a large, convenient cave such as Chaleux - recently re-excavated by Otte and his students), Bois Laiterie has the advantage of having excellent faunal preservation (and thus another point of contrast with the open-air quarry-workshop sites of Orp and Kanne). With only one Magdalenian component (and no other Paleolithic evidence), functional interpretation of this cave, within the broader context of the human settlement of Belgium during the half-millennium between 12,900-12,300 years ago, seems relatively straightforward. Thus, in association with other new (re-)excavations of both cave and open-air sites in Belgium and adjacent regions of France and Netherlands, and with recent re-analyses and syntheses of collections from old excavations, Bois Laiterie can shed significant light on certain detailed aspects of life on the NW European frontier during this relatively short, but well-defined slice of time.

Acknowledgements

Permission to excavate la Grotte du Bois Laiterie was granted by the Town of Profondeville (the landowner) and by the Regional Government of Wallonia. Financial and material support for the excavations and analysis was provided by the Gouvernement de la Région Wallonne, the National Geographic Society (USA), the Service de Préhistoire de l'Université de Liège, and the Research Allocations Committee of the University of New Mexico. Parking and access to the site and to water for screening were graciously provided by the owners of the Sept Meuses Campground, Mr. and Mrs. Boessen. Crew lodging and lab space for the 1995 excavation season were very generously provided in Namur by Captain Pierre François, when the house provided during previous field seasons (since 1991) by the City of Dinant became unavailable.

Excavations and preliminary analyses were conducted between July 5-August 3, 1994 and between June 15-August 1, 1995, under the on-site direction of Straus assisted by Lacroix. The very hard-working, capable field crews consisted of students principally from the Universities of New Mexico and Liège, as well as from the University of Michigan and St.John's College (Santa Fé, NM). Artifact drafting was done by M.Guilbaud, I.López Bayón, J.McClean, J.Orphal and J. Summers, and in many cases the original pencil drawings were put into final form by Y.Balle and A.Warnotte. Site plans and sections, drafted by Ph.Lacroix, R.Miller and Straus, were redrafted by R.Stauber. A.Martinez produced the horizontal and vertical distribution and refit plans. Data-entry and statistical analyses were mainly done by J.Orphal, assisted by R.Miller, J.Summers, A.Martinez and A.Steffen. Some of the logistics were provided by V.Ancion, who also assisted E.Teheux in a lithic raw material survey of the area around Bois Laiterie. Ph.Lacroix, on his own initiative, collected, fine-screened, processed and sorted large quantities of sediment samples for malacological and micromammalian analyses, in turn carried out (with his assistance) by I.López-Bayón (who took on a great many coordination responsibilities for this book in Liège) and J.-M. Cordy, respectively. Sediment samples for micromorphological analyses by M-A.Courty were collected by L.Lang. Achilles Gautier was responsible not only for his excellent macromammalian analysis, but also for coordinating most of the other paleontological studies.

To one and all - and especially to Philippe Lacroix («Bibiche») - we extend our profound thanks! Without Bibiche, the excavation of Bois Laiterie would not have happened. Sans Bibiche, la fouille du Bois Laiterie n'aurait pas eu lieu!

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1

LA GROTTE DU BOIS LAITERIE: THE SITE, STRATIGRAPHY, CHRONOLOGY AND EXCAVATION

L.G. Straus

Site Location

La Grotte du Bois Laiterie is one of a number of karstic caves developed in a small steeply tilted outcrop of Carboniferous limestone on the northern flank of the Sept Meuses hill in the Rivière village of Profondeville Township (Namur Province, Wallonia, Belgium). The Sept Meuses hill is part of a highly complex succession of convoluted geological synclines and anticlines in the Ardennes Piedmont, between the cities of Namur and Dinant. This region of (for Belgium) relatively high relief, with alternating Devonian metamorphics and Carboniferous limestones, is transected by the Meuse River, whose valley becomes increasingly entrenched and eventually canyon-like as one moves upstream from its great southward bend and confluence with the Sambre River at Namur. The Sept Meuses hill (from which, on a clear day, one is said to be able to see seven meanders of the Meuse) is, at 260 m a.s.l., one of the highest elevations in this region of north-central Wallonia, 25 km from the French border at Givet (Photo 1). (By comparison, the highest elevations in the Ardennes Plateau itself are generally no greater than 500-600 m a.s.l. and the level of the Meuse adjacent to Bois Laiterie is only 85 m a.s.l., which gives an idea of the steepness of the local relief around Bois Laiterie.) The Meuse is the principal avenue of communication between the eastern Low Countries and north-central France, a fact for which the region's inhabitants have had to pay dearly during the two world wars (and many times before, during the bloody history of this part of Europe - and for which reason Namur, Dinant and Givet are all fortress cities) (Fig.1).

The Sept Meuses hill lies within 15 km of the end of the south-north stretch of the Belgian Meuse, which flanks the western edge of the Ardennes and which at Namur is joined by the Sambre to flow eastward along the Sambre-Meuse trench, the northern limit of the Belgian uplands. The southern face of the Sept Meuses hill has been eroded into a 150 m vertical cliff by a major meander of the Meuse. Bois Laiterie is on the northern, more gradually sloping flank of the Sept Meuses hill, which is abruptly cut by the gorge of the Burnot stream (Fig.2; Photo 2). This west-east running stream descends from the 240-250 m-high Sambre-Meuse interfluve plateau and, over the course of its last 3 km, has dug a very narrow, steep-sided canyon as it cuts down to the Meuse. The Burnot is one of relatively few streams upstream of Namur City that affords relatively easy access to the plateau of western Namur Province and on toward Hainaut from the upper Meuse valley. The road which runs along the Burnot valley floor from Rivière to Charleroi is surprisingly busy despite its small size.

La Grotte du Bois Laiterie is at an elevation of c. 120 m a.s.l. and about 35 m. above the present (artificially high) level of the Meuse at its confluence with the Burnot, 500 m from the site. The lower cave mouth, which is the location of the Magdalenian site, faces due North

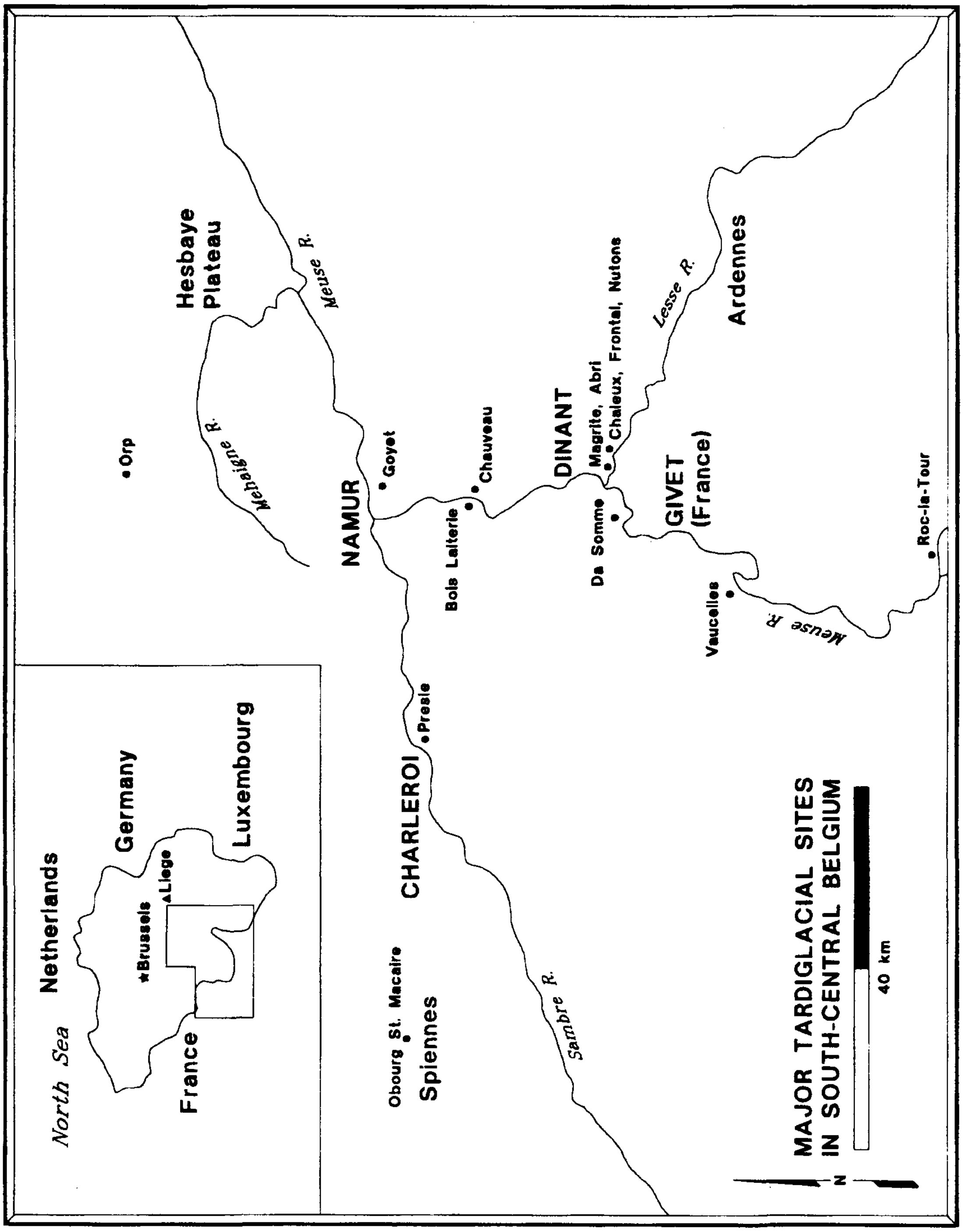

Fig.1 - Major Tardiglacial Sites in South-Central Belgium

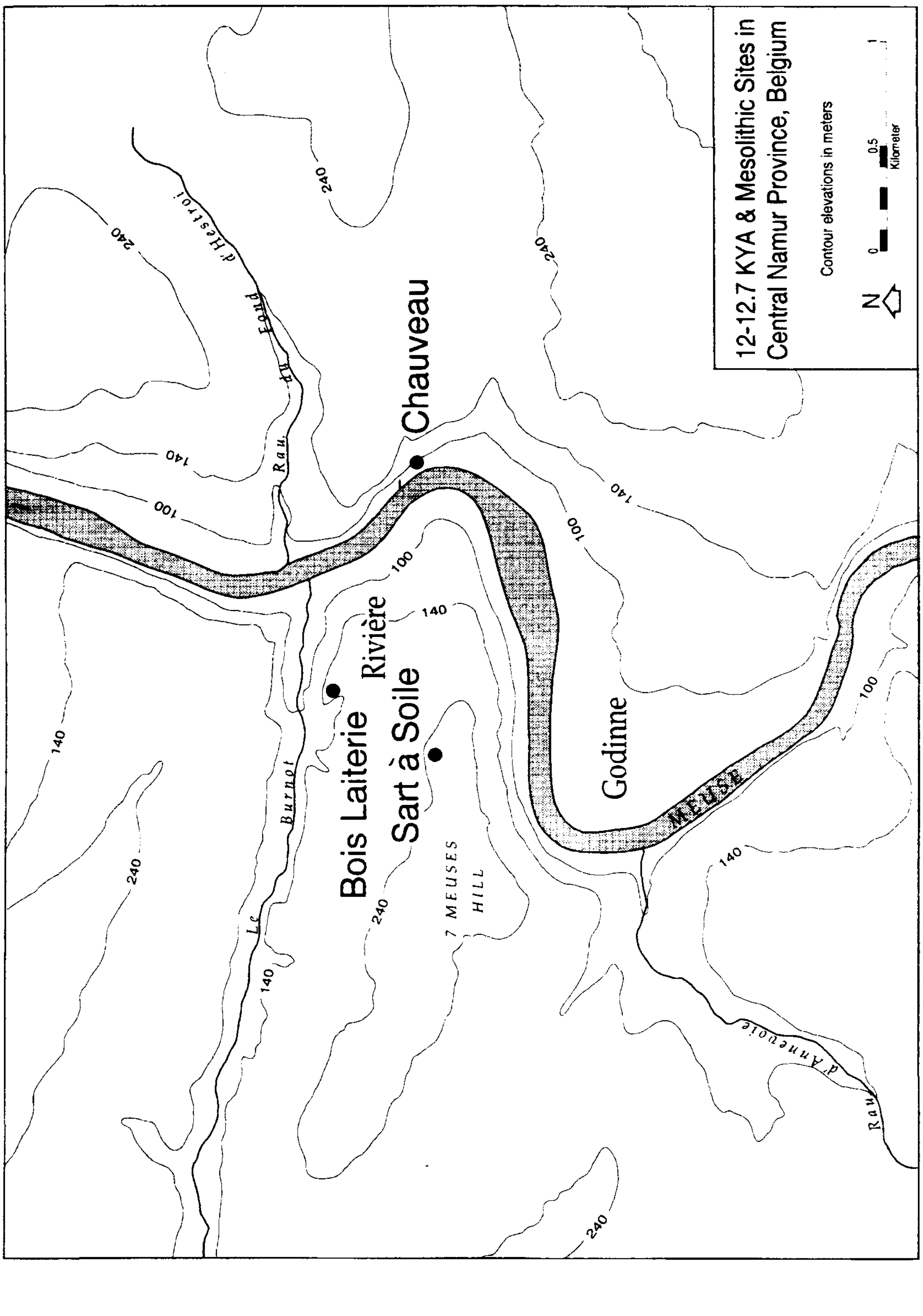

Fig.2 - Location of Bois Laiterie and Chauveau Caves

and dominates the Burnot gorge at its narrowest point, right above the confluence. Although not so readily apparent under today's densely wooded conditions, the cave would have had a dominant, commanding view of the Burnot gorge, the floor of which is a steep, but quick scramble from the site (and a rigorous, but short climb back up).

Exactly opposite the Sept Meuses hill, on the right (east) bank of the Meuse, 1,250 m ESE of Bois Laiterie, is the Grotte de Chauveau, which faces due west and is situated only a few meters above the river. This small cave recently yielded a small lithic assemblage radiocarbon dated to 12,000 ± 130 BP and attributed to the Magdalenian or Creswellian (Toussaint *et al.*,1993). A Chaleux-type double micro-perforator is present. Chauveau also has a microlithic trapeze-dominated Mesolithic component (with triangles and other microlithic weapon elements) dated to 7,350 ± 75 BP (uncalibrated). Via the Burnot valley and over the Meuse-Sambre interfluve, en route to the flint sources in eastern Hainaut, the cave sites of Presles are located in the Sambre valley, c. 22 km west of Bois Laiterie. One of the two radiocarbon dates from the cultural deposit in Trou de l'Ossuaire is 12,140 ± 160 BP. The associated cultural materials have been called «Creswellian» (Léotard and Otte,1988), but it is likely that there is a mixture of materials here (including typical late Magdalenian artifacts such as Lacan burins). There is also a radiocarbon date of 10,950 ± 200 BP whose association is unclear (Charles,1994). Another such site with problematical cultural attribution («Creswellian» or Magdalenian), Obourg-St.Macaire, is located near the Spiennes flint source, 42 km further west beyond Presles (Létocart,1970). It is undated, but has some truncation burins with a Magdalenian «aspect». Finally, Bois Laiterie Cave is very near the little-known, but very rich Mesolithic open-air site of Sarts-à-Soile, which is located near the summit of the Sept Meuses hill. Said to have produced large numbers of circle segment microliths, some trapezes and invasively retouched arrowheads, this site is attributed by Rozoy (1978 and pers.comm.) to the Late Mesolithic.

Site Characteristics

As noted above, the eastern face of the Bois Laiterie ridge which extends northward from the Sept Meuses hill is heavily faulted and caves form along the diaclases all of which seem to tilt down toward the North at about 30 degrees. Such is the case of Bois Laiterie cave *per se*. It opens out onto a small cliff-face and actually has two mouths (Photo 3). The upper mouth, some 4-5 m higher up on the slope near the top of the little cliff and about 7-10 m further west, is a jagged-edged crevice filled with a number of large blocs which, since they are still in place (not yet having rolled down the steep talus slope) and unweathered, may be indicators of a relatively recent opening of this upper mouth. At any rate, there are no sediments - only bare and extremely steeply sloping bedrock - in this upper cave, which is separated from the lower cave by a «bench» in the bedrock floor (no doubt following a joint in the limestone). Thus, what concerns us here is only the lower cave. It is highly unlikely that there could have been significant (if any) human occupation of the upper mouth for lack of any flat space.

The lower cave (hereafter simply referred to as «the cave» or «BL») is at the base of the little cliff. It has a mouth which at its inner, most restricted point is at most 4 m wide, opening up to 7 m wide at its outermost part along the cliffline. The top of the cave mouth is

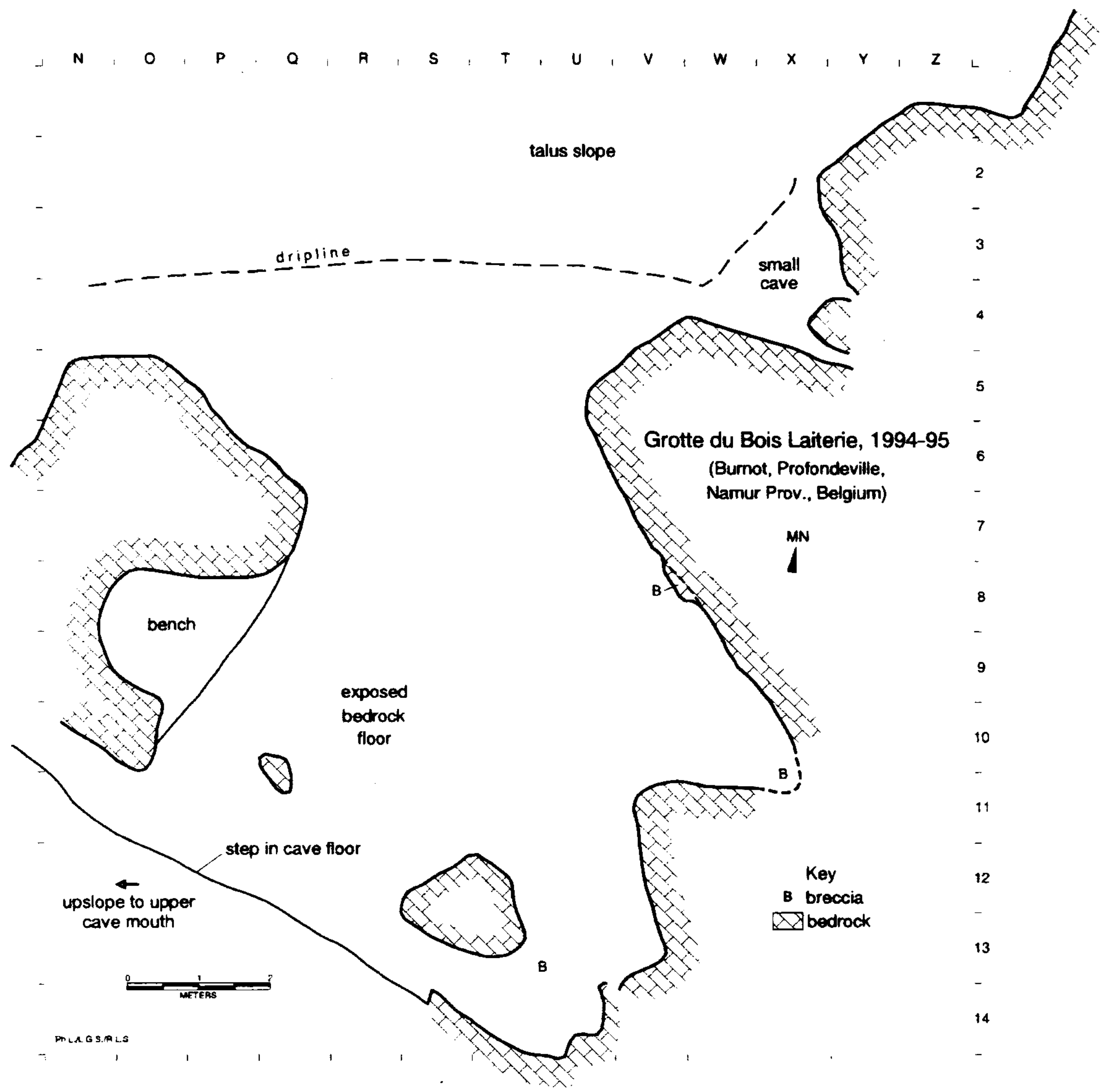

Fig.3 - Plan of Bois Laiterie, Lower Cave

smoothly, symmetrically curved; both it and the sides of the mouth are heavily weathered (Photo 4). Height of the cave mouth above the top of the Magdalenian horizon would have been c. 2,5 m. The lower cave area is maximally c.45 m^2, some of which is very high up the bedrock slope toward the upper cave (west). In addition there are some 13 m^2 of area in front of the cave mouth but under the present overhang and another c. 3 m^2 of useable space at the front of a small parallel cave entrance to the East of the lower mouth (Fig.3). So, altogether the sheltered site area (lower cave, small cave and area under the cliff overhang) totals about 60 m^2. However it is unlikely that c. 10 m^2 of the lower cave area furthest upslope toward the upper cave would or could have been used for habitation, due to the steepness of the bedrock floor, leaving a total area of about 50 m^2 (we found no artifacts stuck to or in cracks in the bedrock floor to the west of the «R» row of squares). On the other hand, it is likely that the overhang may have extended somewhat further northward at 12,600 years ago than today, and that there was a somewhat wider useable terrace during Bölling times than now. In any event, this is and always was a very small site.

In addition, it is a distinctly uncomfortable site. Besides the steep bedrock slope and the due north orientation (which at 50° 22' N latitude means that this is a cave with very little sunlight), BL is draughty. A continuous breeze descends from the upper mouth to the lower mouth. Even if the upper mouth did not exist in its present form during Bölling times, certainly its beginnings (a crack or small opening in the cliff-face) must have already existed and the draught with it. The cumulative effect of the northern exposure and the draught is to make BL a very cold, rather unpleasant cave - except during the hottest days of summer, when it is a cool spot in which to be excavating. It is hard to conceive of spending much if any time in this cave during the long Belgian winters - especially before Belgium had a North Sea coast with its moderating climatic effects.

Furthermore, the microtopography of the lower cave, with its steep bedrock floor, is such that a strip of only about 2-3 m wide, paralleling the eastern (downslope) wall, would really have been fairly flat by the end of the deposition of the Magdalenian-age sediments - and less at its inception (Figs.4-13). When Magdalenian people first used BL they would have found a narrow band of reddish clay or sand filling the bottom of an asymmetrical V-shaped «gully» in the bedrock formed by the eastern wall and the cave floor. They would have set up camp atop this «gully» fill and the lowest, adjacent area of bedrock floor, using psammite plaquettes to deal with the puddles and muddy spots along this band of wet basal sediments, such that, between the paved area and the bedrock, they had at least some more-or-less dry surface on which to live. But it was far from extensive and the only decently lit area would have been the front of the cave and overhang-covered terrace area.

The only advantageous aspect of this cave for Paleolithic hunter-gatherers - and it must have been a significant one - is its location dominating the confluence of the Burnot gorge with the Meuse valley. In short, BL is at a strategic location controlling a key passageway for game moving between the Meuse valley and the Meuse-Sambre interfluve plateau. In addition, under Bölling conditions, this north-facing slope was probably still treeless, though the south-facing slope opposite BL may have been covered with trees and shrubs. So, in order to have a view, a north-facing slope (despite the cold) would have been important. Humans did not go to Bois Laiterie Cave for comfort or commodity. They must have gone their for a purpose and this is what we must explore and elucidate.

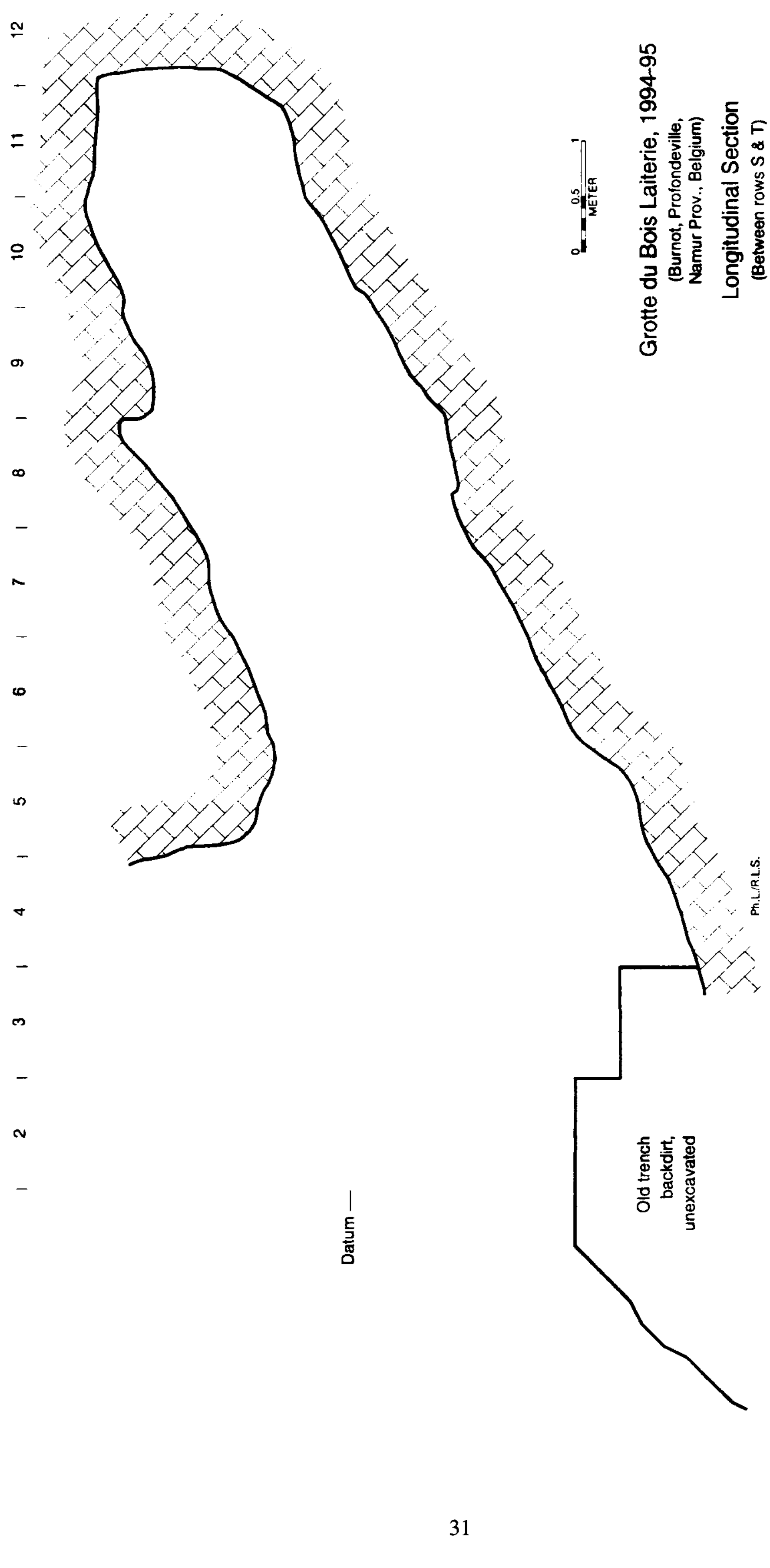

Fig. 4 - Bois Laiterie Cave, Longitudinal (N-S) section, S / T rows.

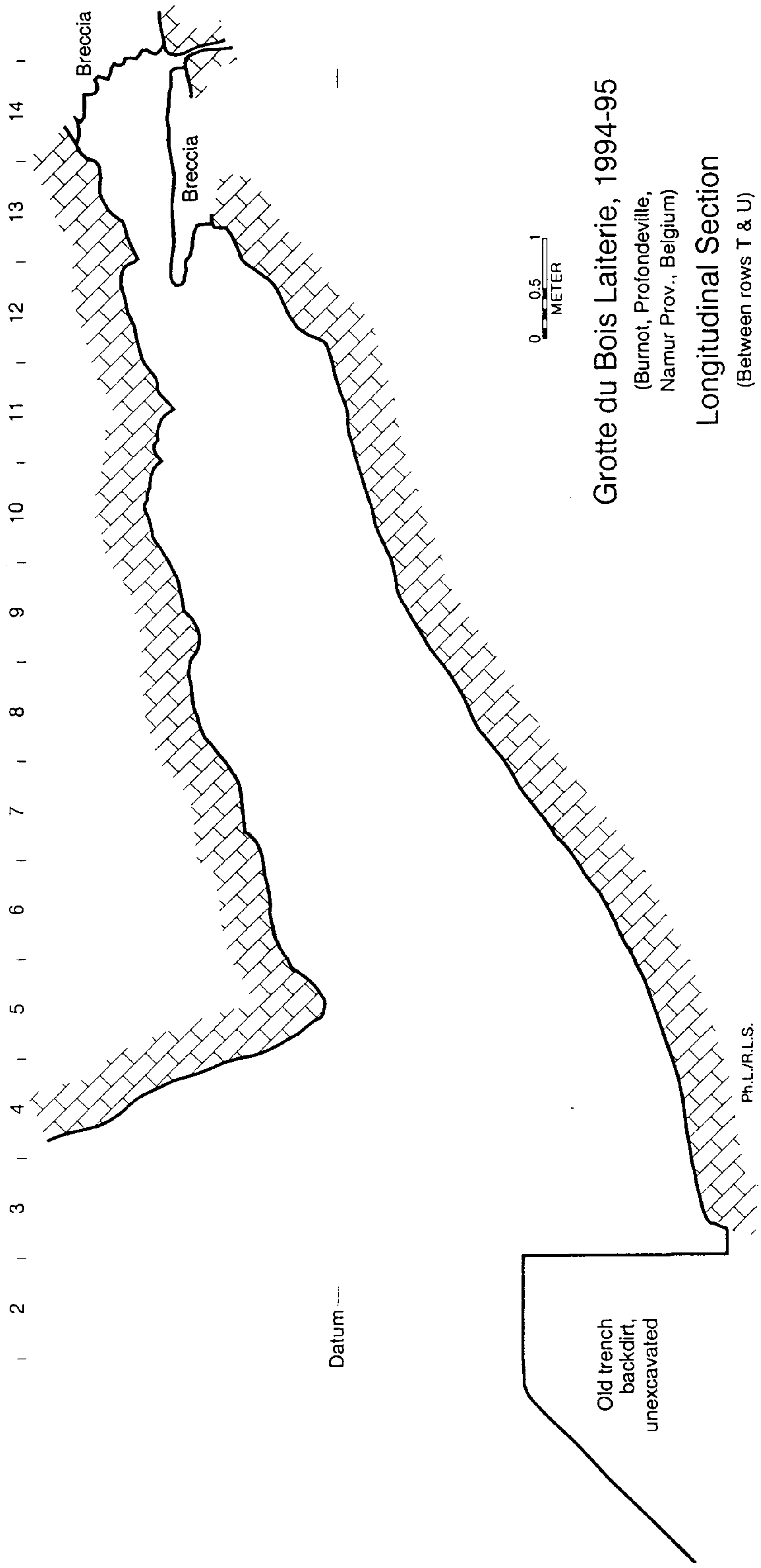

Fig.5 - Bois Laiterie Cave, Longitudinal (N-S) section, T / U rows.

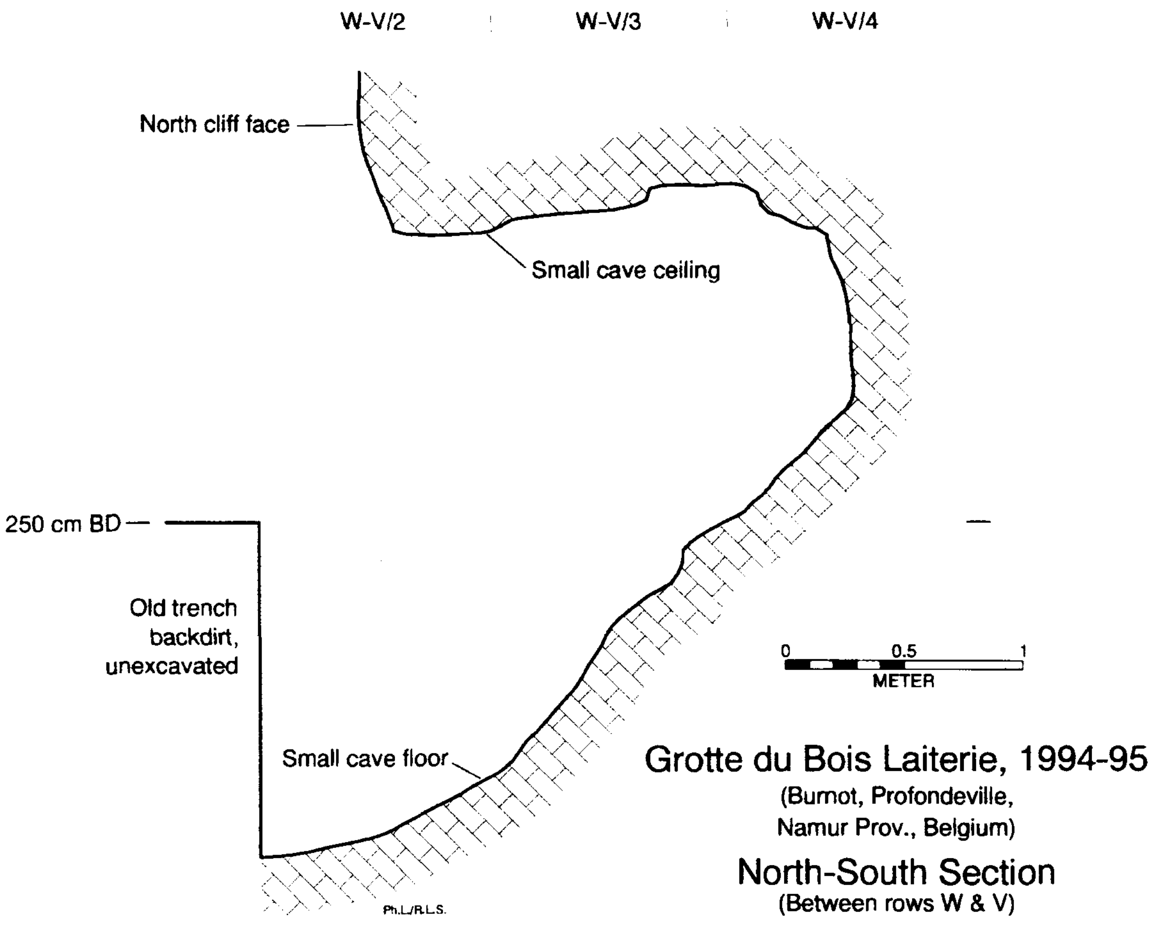

Fig. 6 - Bois Laiterie Cave, N-S section inside small cave, W-V / 2-4

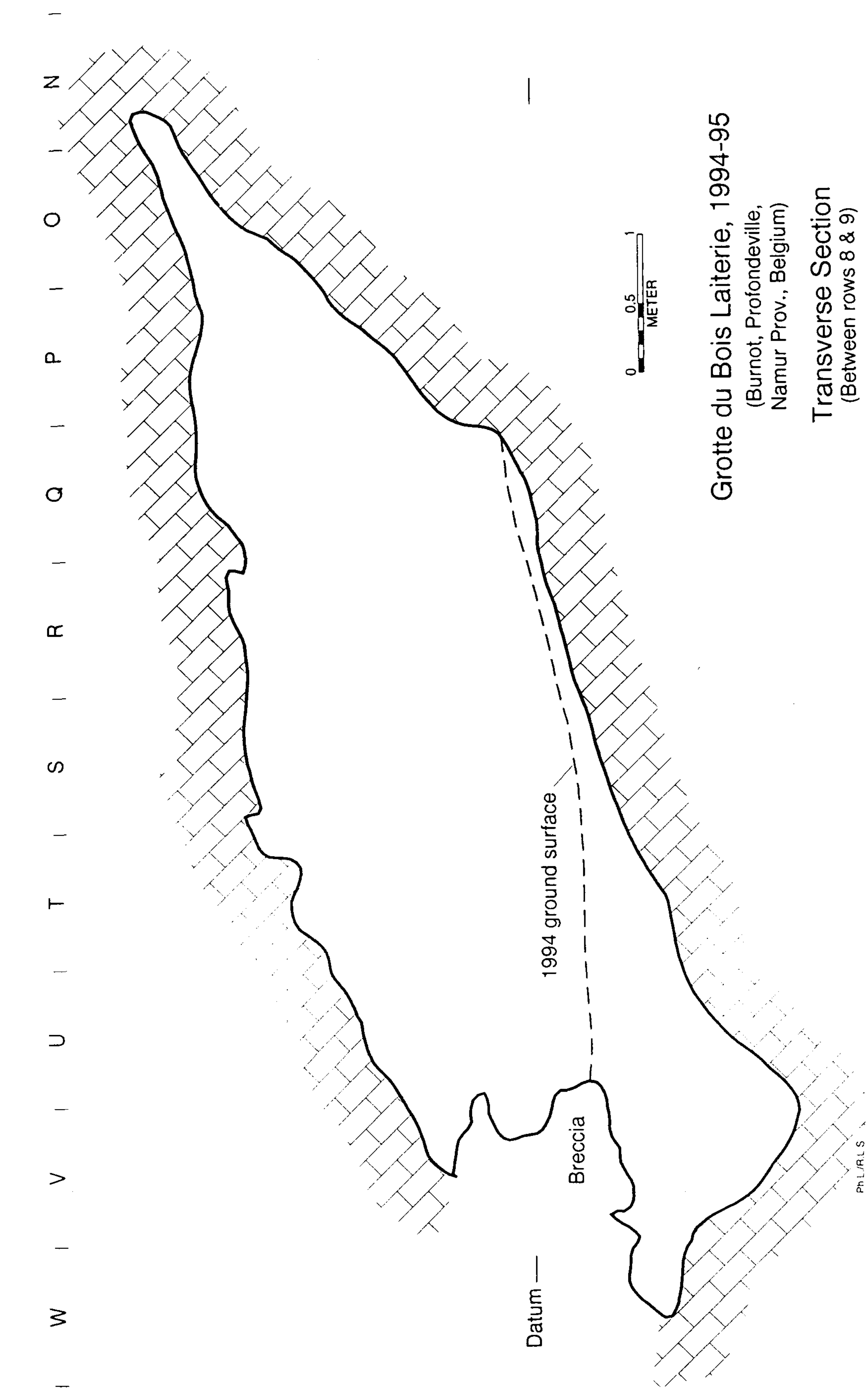

Fig. 7 - Bois Laiterie Cave, Transverse (E-W) section, 8 / 9 rows.

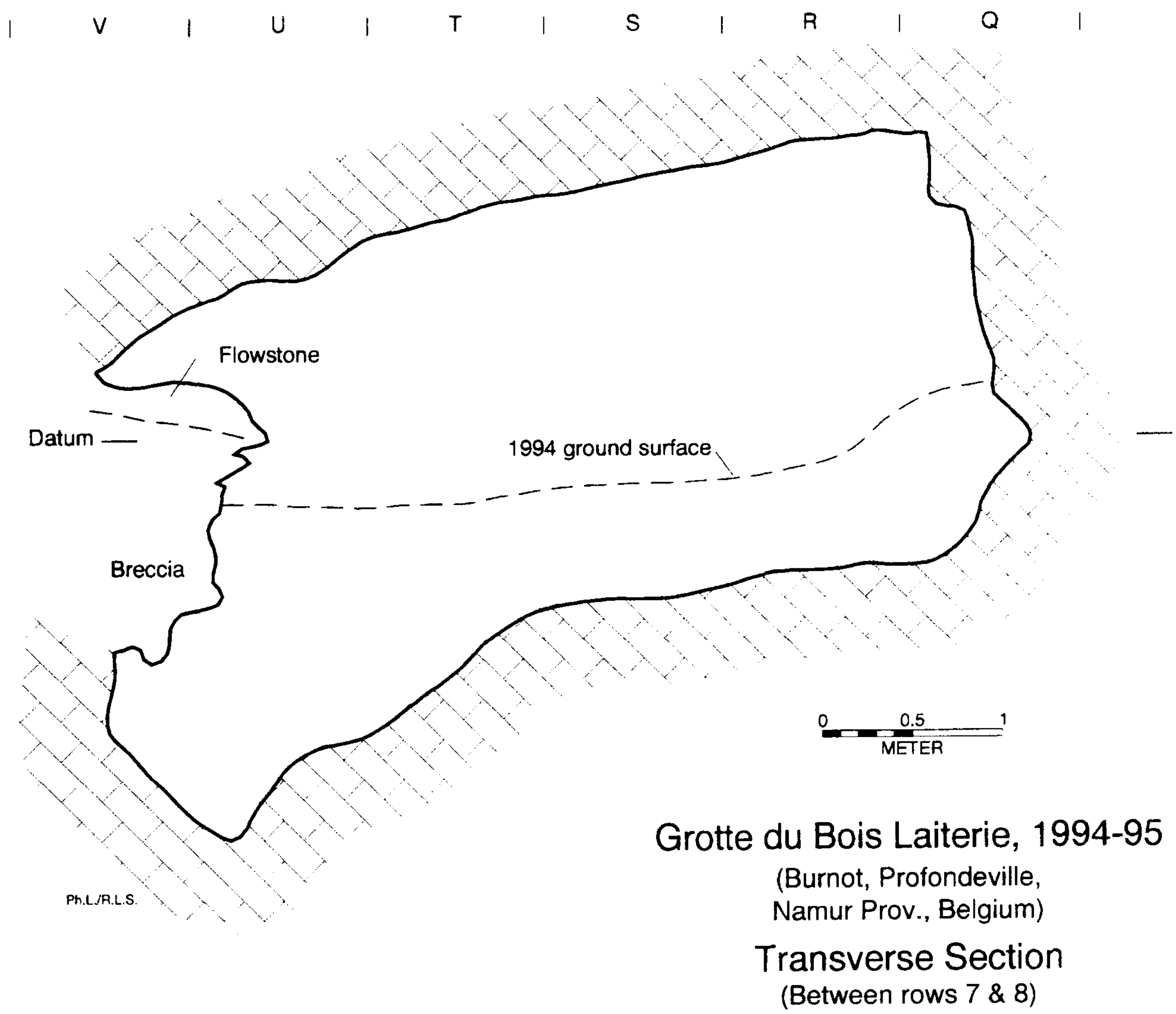

Fig. 8 - Bois Laiterie Cave, Transverse (E-W) section, 7 / 8 rows.

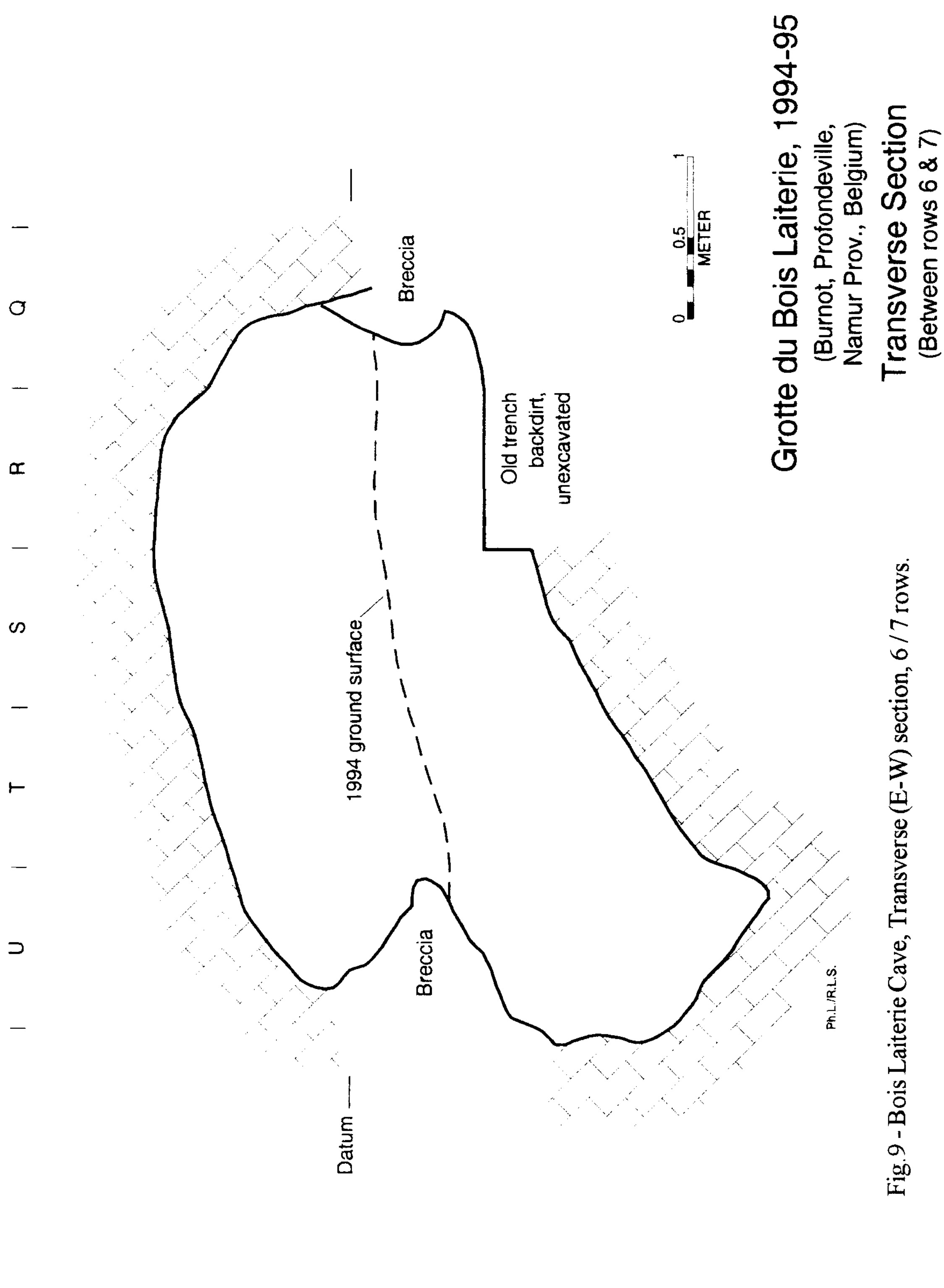

Fig. 9 - Bois Laiterie Cave, Transverse (E-W) section, 6 / 7 rows.

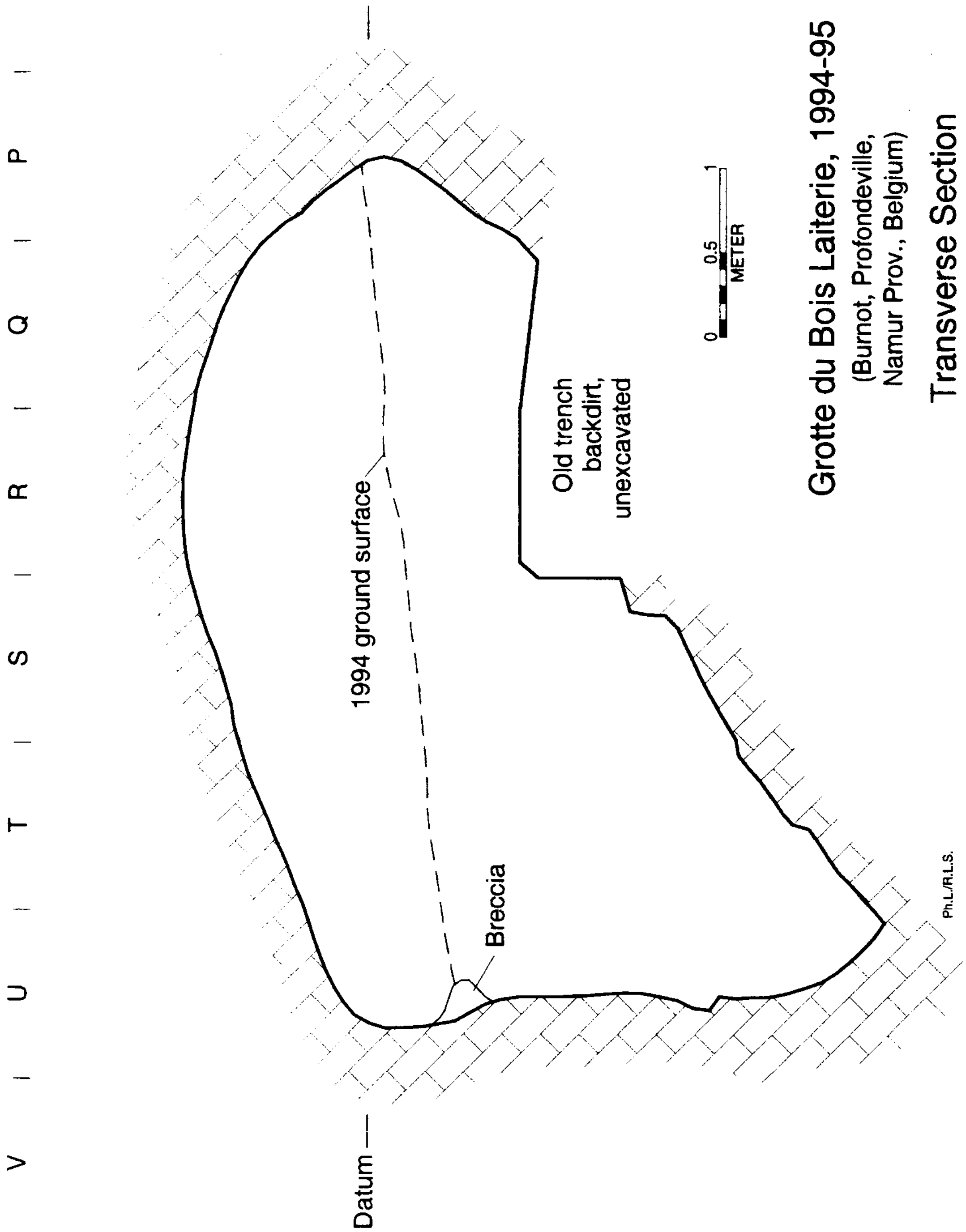

Fig.10 - Bois Laiterie Cave, Transverse (E-W) section, 5/6 rows.

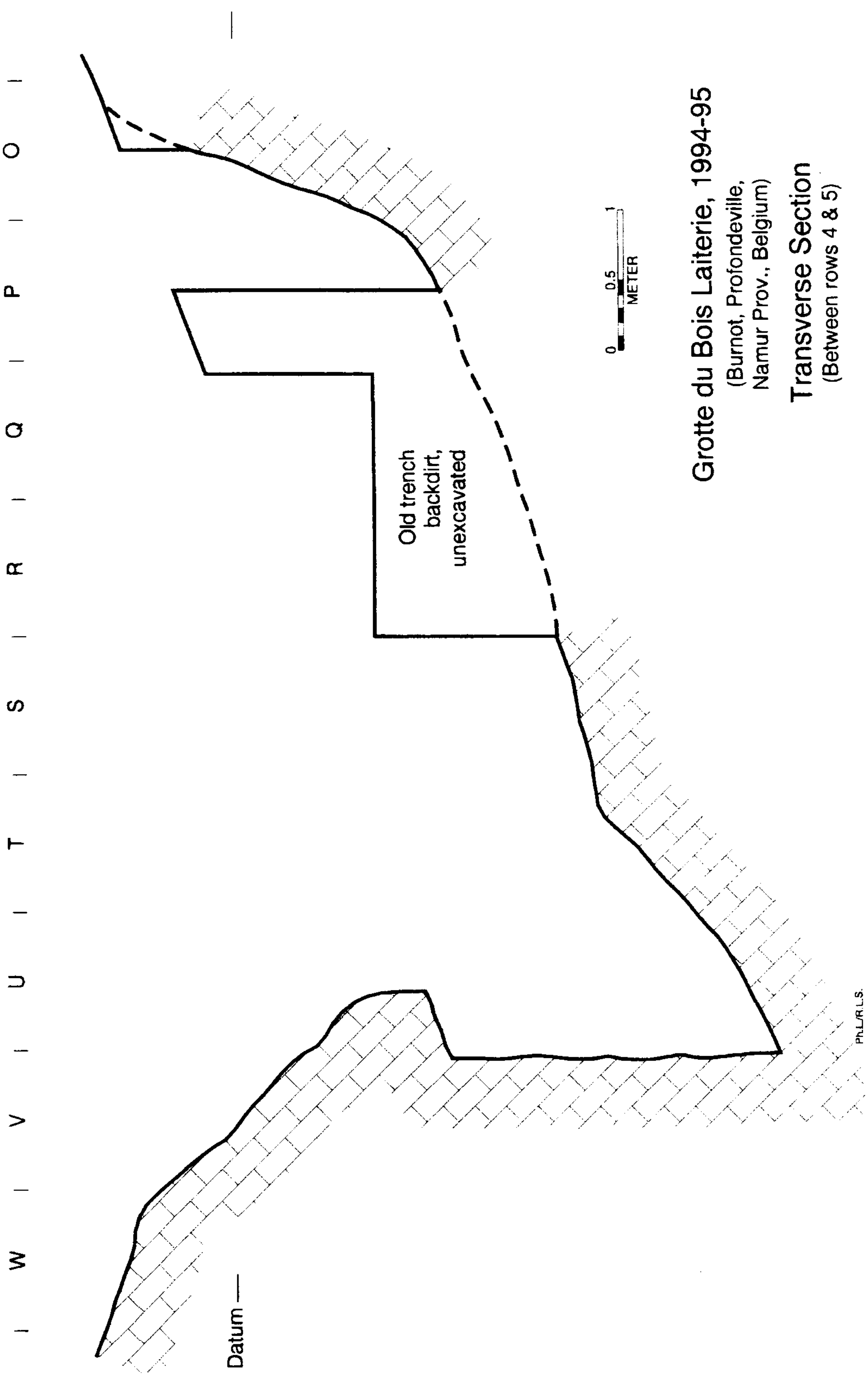

Fig.11 - Bois Laiterie Cave, Transverse (E-W) section, 4/5 rows.

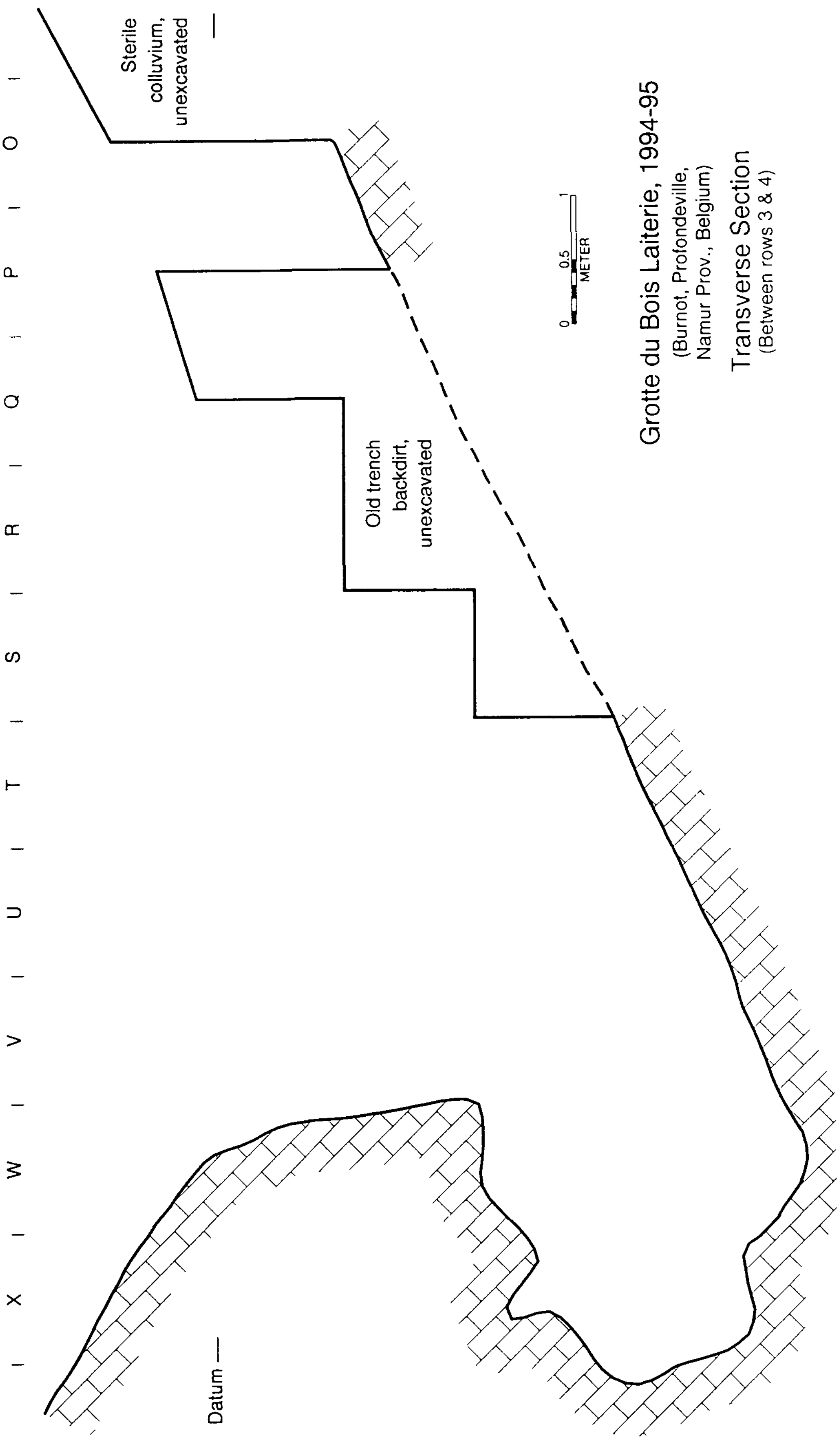

Fig. 12 - Bois Laiterie Cave, Transverse (E-W) section, 3/4 rows.

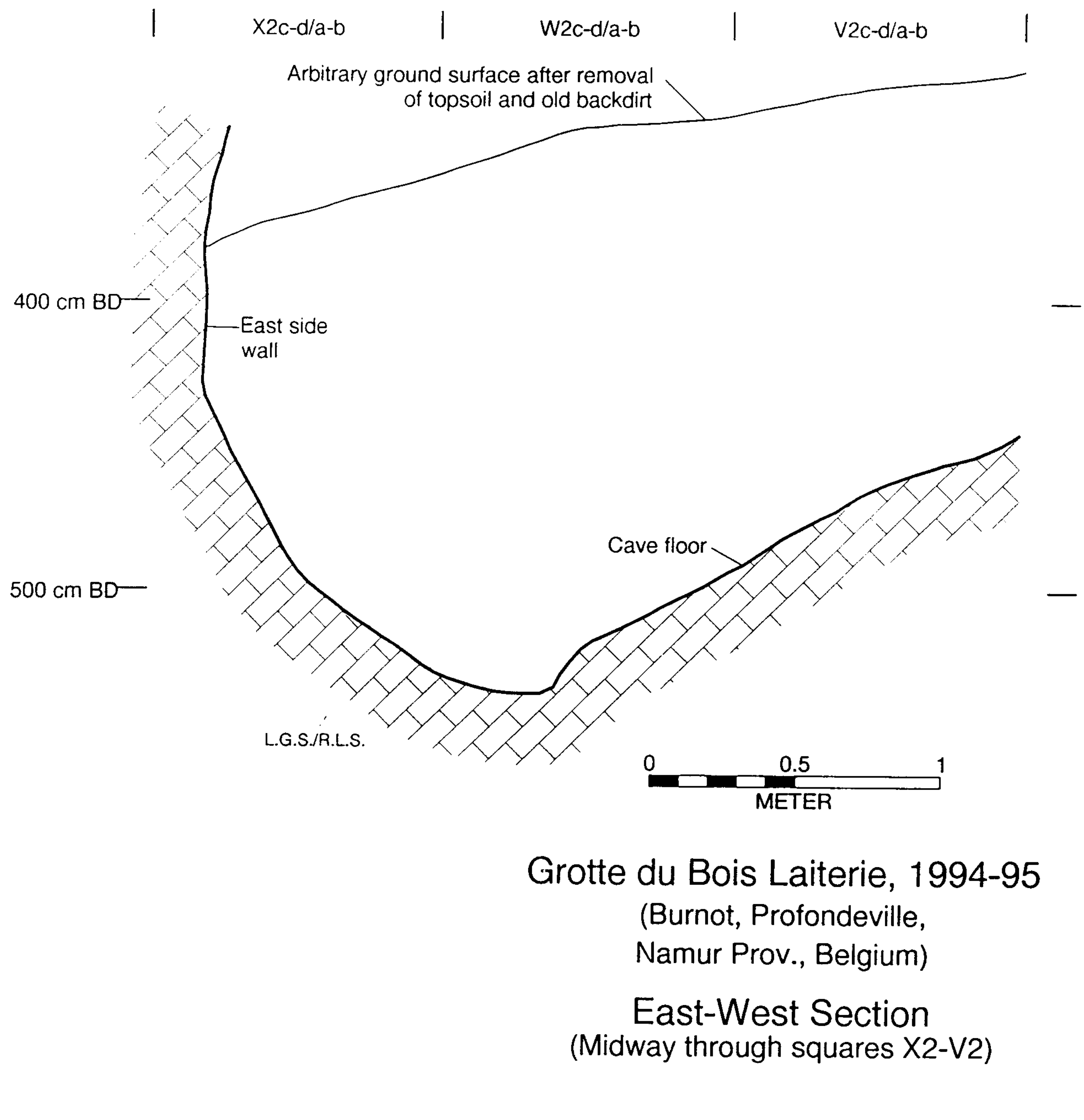

Fig. 13 - Bois Laiterie Cave, E-W section outside small cave, X-V / 2.

Stratigraphy: General Observations

As with any cave site, the stratigraphy of even the infilling of the small BL cave is relatively complex, due mainly to lateral variations and probably hiati. Fortunately, however, it is a short sequence and there is only one (remaining) principal cultural horizon that is so marked and continuous as to serve as a good «marker bed»in and of itself. The stratigraphy was first tentatively established by Ph.Lacroix in *sondages* at the rear of the lower cave, principally in the area that corresponds approximately to our squares U8-9 (his other shallower test pits were in the areas approximately corresponding to parts of V10 and U13). Since our first step was to establish a stratigraphy by extending northward from Lacroix's U8 pit parallel to the east wall of the cave, I will first characterize the sequence of levels from bottom to top in the area of U7-9, about mid-way toward the rear of the lower cave and roughly in the central axis of the «gully» formed by the bedrock of the cave wall and sloping floor. This is the most complete stratigraphy in the site; several of the levels defined at the cave mouth and on the terrace seem to be lateral variants (facies) of the basic units defined in U7-9. In general, the strata are far less clear in terms of texture and color in the terrace/small cave area of the site than toward the cave rear, where the alternation between levels is fairly distinct. Also in general, the exterior stratigraphy is simpler and the cultural horizon much thicker than the stratigraphy in the cave interior. The largest number of clearly distinct levels actually exist about mid-way back along the eastern side of the cave (U-V/8). Further toward the rear, the Magdalenian Stratum YSS lies directly in contact with bedrock. The strata which underlie YSS further toward the cave center may have been eliminated by erosion (?). Finally, in general, the sediments become less sandy toward the cave exterior - often with a higher clay content. The distinction between StrataYSS and BSC (see below) was often quite arbitrary, locally variable and subject to individual excavator interpretation. This is because it is a gradational distinction: from more «sandy silt» to more «clayey silt». Inside the cave, the sedimentary deposits fill the «gully» between the eastern cave wall and the steeply sloping bedrock floor. The non-cemented strata are fairly level on the west-east axis, but they all slope down relatively uniformly 10-20 degrees from the cave rear toward the cave mouth (south-north axis).

Stratigraphy in U9-U7 (U-V/7-9 Section: Figure 14)

Bedrock.

BGS: basal grey sand (not present in U9), 7-15 cm thick. Archeologically and paleontologically sterile.

RS: reddish (to bright red) clayey sand (mainly present in U8; possibly merges with BSC in U7, although this is unclear due to abundance of éboulis in that area), 10-20 cm thick. RS becomes a mere trace (1-2 cm thick) directly atop bedrock in U9 (U9-10 Section: Fig.15). Almost sterile archeologically (the few finds in RS may have migrated down from above in U7 or have been incorrectly labelled due to the difficulty of YSS-BSC-RS distinction in that square).

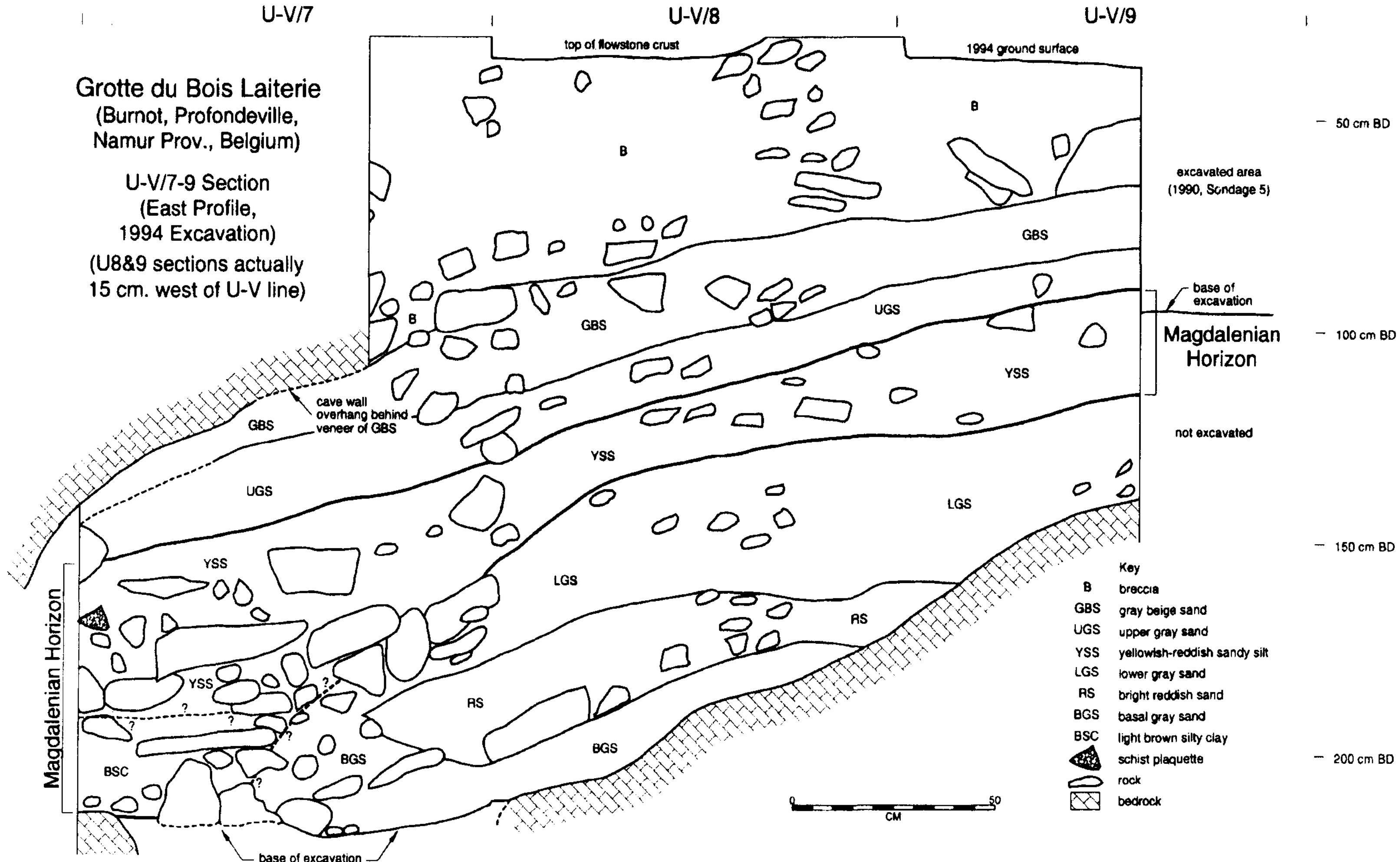

Fig. 14 - Bois Laiterie Cave, Stratigraphic section, U-V / 7-9

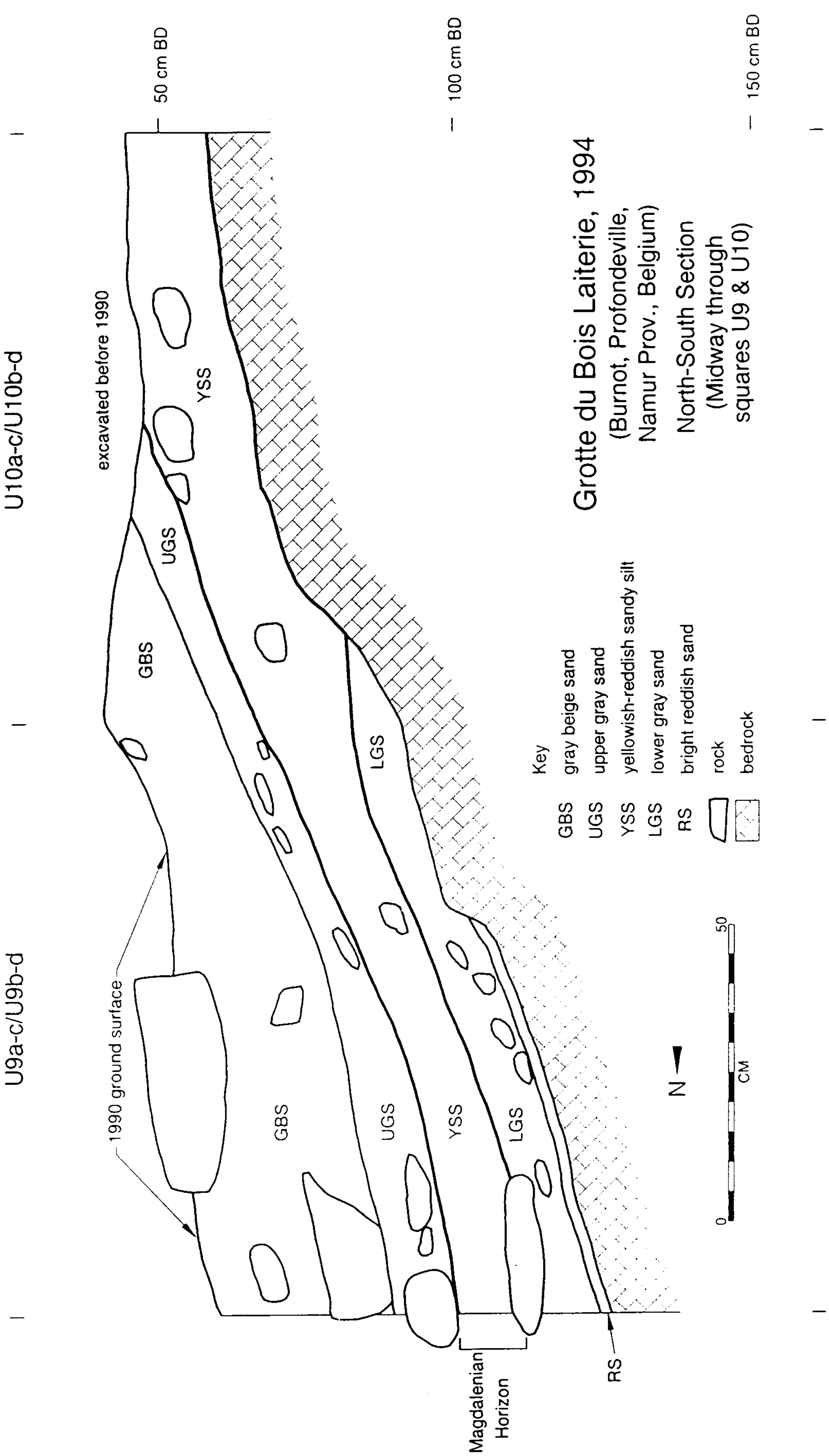

Fig.15 - Bois Laiterie Cave, Stratigraphic section, U/9-10

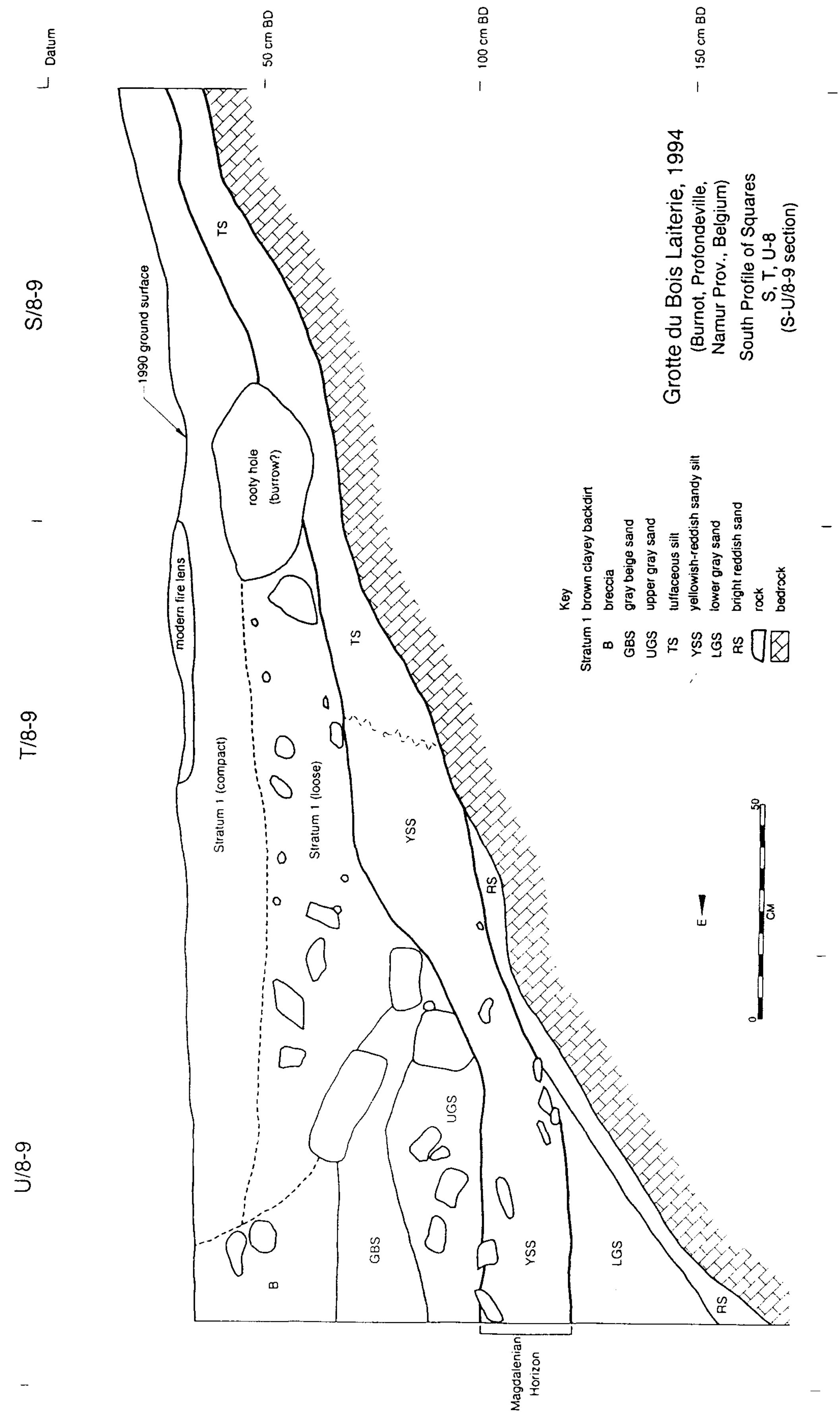

Fig.16 - Bois Laiterie Cave, Stratigraphic section, S-U / 8-9, showing pothunter trench fill («Stratum 1»).

BSC: basal silty clay (see below). Southern end of unit extends into U7 and apparently merges with RS in a mass of éboulis. Contains artifacts.

LGS: lower grey sand (coarse sand); archeologically sterile; present in U8-9 but absent toward front of cave in areas where BSC is present. 20-40 cm thick.

YSS: yellowish-red or orange brown sandy silt (with a dark olive greenish hue in the cave interior); color and clay content are locally and vertically variable; very high anthropogenic content (psammite plaquettes, lithic artifacts, faunal remains). 15-40 cm thick. Directly in contact with bedrock cave floor in U10 and beyond toward cave rear. Further to the west, in the T8-10 area, where no overlying sediments (except recent pothunter backdirt) subsided at time of our arrival), there is a tuffaceous silt («TS») which contains a few Magdalenian type artifacts and psammite slabs and which is cemented to the surface of the bedrock cave floor. It is continuous with and probably is a lateral (calcium carbonate-rich) facies of YSS (S-U/8-9 Section, Fig.16). Together, YSS+BSC make up the Magdalenian horizon at Bois Laiterie. There no break in vertical distribution of artifacts, manuports or faunal remains between these two lithostratigraphic units, and, as noted above, BSC seems to be a localized phenomenon: a pocket of clayier sediment below YSS at the mouth of the cave only.

UGS: upper grey sand (present inside the cave, including U7-9, but merges with GBS and base of Breccia further east in V and W rows); base of unit often has large to medium-size angular roof-fall blocks which lie directly atop YSS. Almost sterile archeologically; with some artifacts which may have been thrown up from YSS as a result of the rockfall episode(s). 10-20 cm thick.

GBS: grey-beige silt; loose, light-color, fine silt (less compact than underlying levels); in direct contact with base of Breccia, this level may, in part, be the sort of sediment that was brecciated by calcium carbonate precipitation above. Almost sterile archeologically. Variable thickness, due to local differences in depth of brecciation; in direct contact with overhanging cave wall in U7, 15-25 cm thick.

Breccia: very hard, calcium carbonate indurated silts, éboulis, bones (including human bones), ceramic sherds. Adheres to eastern and rear walls of cave and merges with flowstone atop upslope bedrock cave floor toward the west. At least 75-100 cm thick in U8-9; merges with overhanging cave wall.

Stratigraphy in U6-T6 (U6-U7 Section, just inside cave mouth, Fig.17)

Bedrock.

RS (trace atop bedrock).

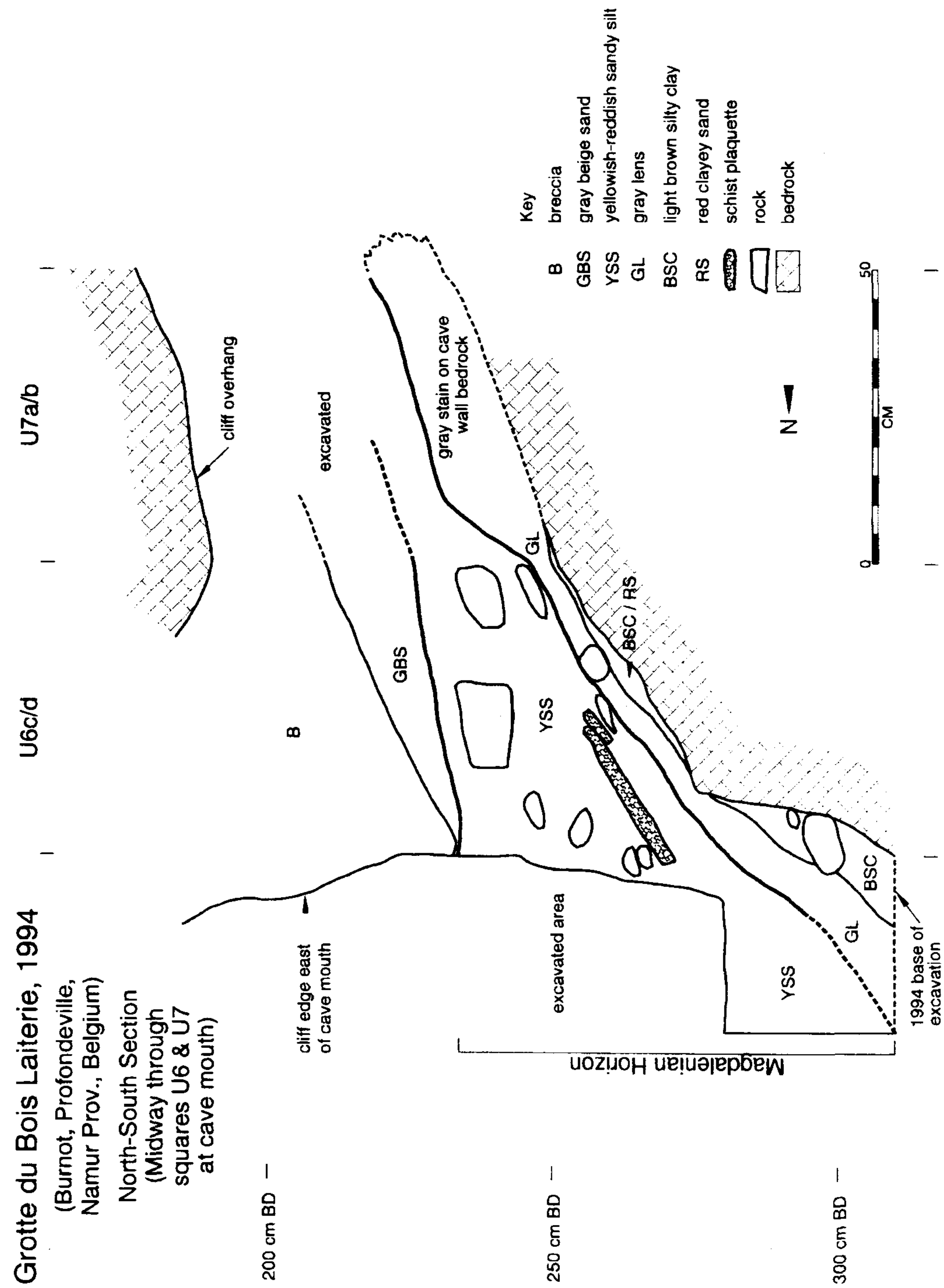

Fig.17 - Bois Laiterie Cave, Stratigraphic section at eastern edge of the cave mouth, U / 5-7

GL or «Pseudo LGS»:
localized zone of distintegrating, decalcified éboulis forming a grey sandy lens. Contains some artifacts.

BSC: basal silty clay. Reddish brown; grades to moist, plastic clay, but with silt content and more sand toward cave interior. Intergrades in color and clay content with overlying YSS. 20-25 cm thick. Rich in cultural remains.

YSS (see above). Extremely rich in cultural remains.

Breccia (see above): small remnant adhering to cave wall in U6.

Stratigraphy in U5,T5-4

Bedrock.

Hint of RS atop bedrock in T4.

«Pseudo-LGS», otherwise known as «YSS-grey lens»(or GL):
lens of grey silty sand near/at base of YSS and BSC. Possibly a result of intensive burning, as among the cultural remains are relatively many burnt flints and bones (see Straus and Martinez, this volume). «Grey lens» contains psammite slabs, some of which cut across YSS/BSC and the grey lens. Artifacts are abundant, especially in T5 and U5. Generally 10-15 cm. thick. «Grey lens» is localized around eastern edge of cave mouth and at base of cliff between there and and the small cave.

YSS: not quite like the prototypical YSS in the cave center and rear, since it is less compact. But here it does contain lenses of fine clay similar in texture to BSC, which, however, does not seem to be present as a more widespread unit as in U6-7.

LBS : light brown silt. Loose with evidence of disturbance (animal burrows).

Stratigraphy in U-X/3:
Terrace outside Cave (U-X/3-2 and W3-4 Sections, Figs.18 and 19)

Bedrock.

BSC: somewhat clayier zone at base of YSS in U and V3, but absent in W and X3.

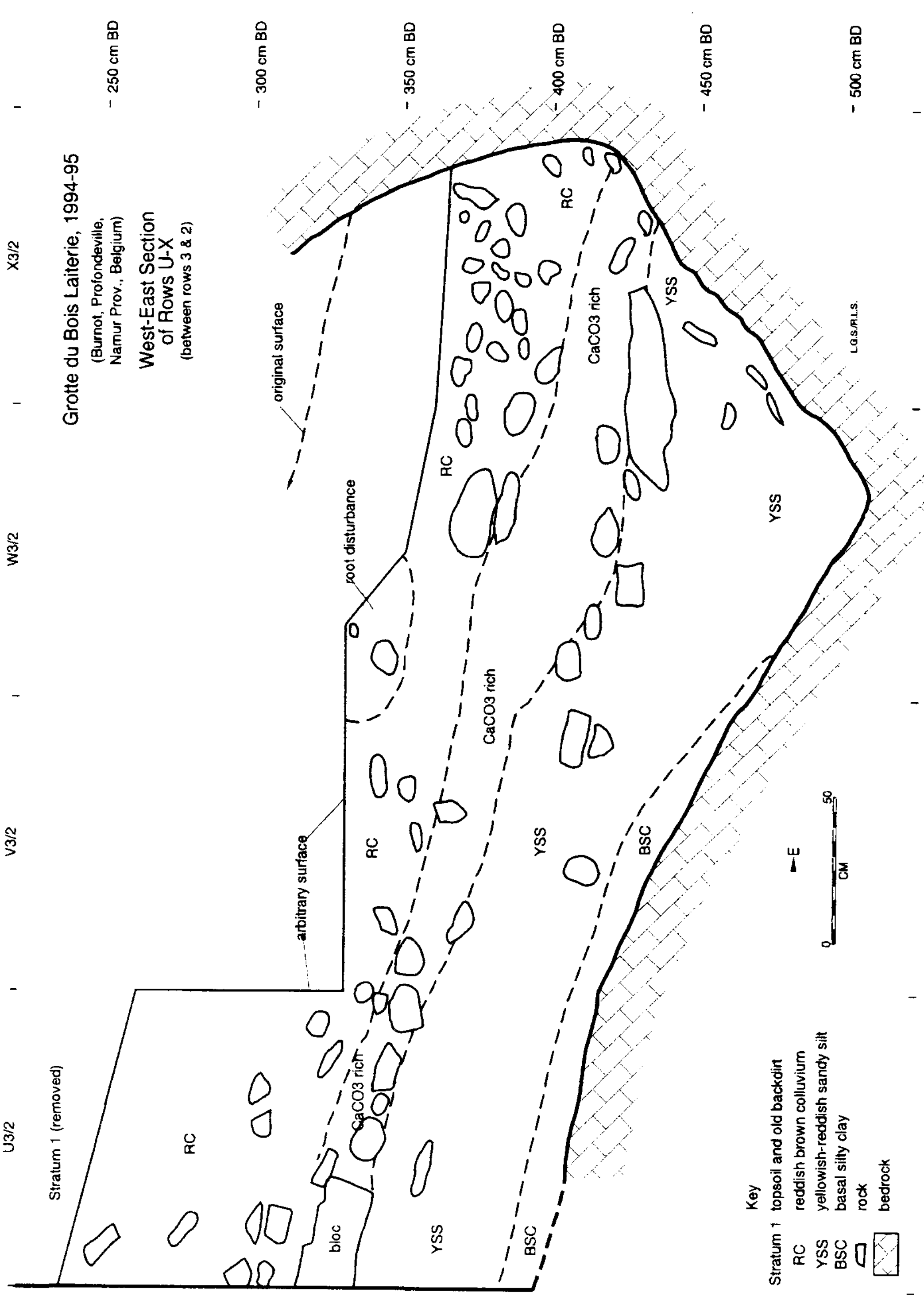

Fig.18 - Bois Laiterie Cave, W-E Stratigraphic section on the terrace, U-X / 3-2

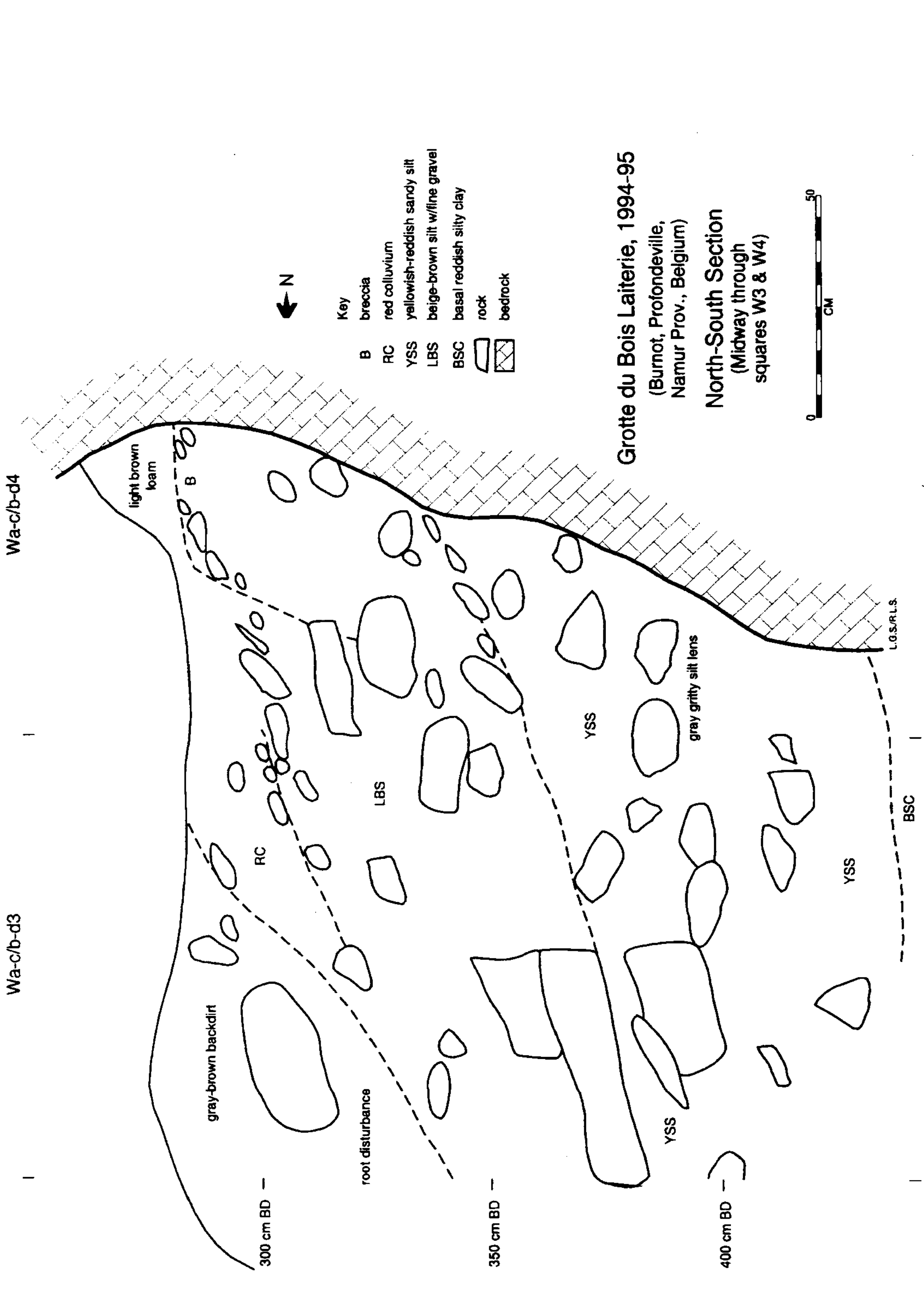

Fig. 19 - Bois Laiterie Cave, N-S Stratigraphic section on the terrace, W 3-4.

Contains artifacts down to bedrock. 5-15 cm.

YSS: Much redder, siltier (loamier) and thicker than in cave interior. Artifact and faunal distribution is continuous with that of YSS inside cave, but much more dispersed here both vertically and horizontally. 35-70 cm.

RC: reddish-brown colluvium; rich in éboulis, especially large angular blocks at base at contact with YSS, with which RC intergrades in color (YSS being somewhat more yellowish). Basal 15-35 cm of RC are heavily enriched in calcium carbonate precipitated from water percolated from above long after deposition of this loamy silt. The calcium carbonate-rich zone is possibly the same phenomenon as the Breccia and Tuffaceous Silt (TS) inside the cave and caused by the same climatic regimen. RC is disturbed by roots and is overlain by a surficial layer of humus and old backdirt («Stratum 1"). In some areas, RC intergrades with LBS (beige-brown silt, locally with fine «pea» gravel).

Further to the west on the narrow (2-3 m) terrace outside the cave mouth, there is considerable evidence of clandestine trenching exposed both by our main excavation extending out from the cave along its South-North axis (R-S/8-2 Section, Fig.20) and in our test trench (O-P/3-4) at the upslope edge of the terrace just west of the lower cave mouth. In this upslope area of the cave mouth (as inside the cave), the pothunters fortunately «ran out» of ceramic artifacts and human remains before hitting the Magdalenian component which mainly lay below the sterile Red Colluvium layer to the east. Having struck bedrock upslope, they gave up digging deeper in the downslope area before reaching the bottom of RC, hence never hitting YSS in the area to the east of the cave mouth and at the small cave. Thus, although there was massive disturbance (at least two cycles of trenching, backfilling, re-trenching and re-backfilling) in the P-S rows, hardly any Magdalenian had been present there and the Magdalenian horizon was spared in the T-X rows.

Chronostratigraphy and Chronology

Although more details are given below in micromorphological analysis (Courty, this volume), some preliminary chronostratigraphic hypotheses can be suggested here concerning the short stratigraphic sequence.

First of all, it seems likely that when Magdalenian people first used this cave, much of its floor was exposed, bare bedrock, since artifacts and psammite slab manuports were found in direct contact with the bedrock in parts of the R-T rows inside the cave (embedded in «Tuffaceous Silt») and right to the base of YSS/BSC in front and to the east of the cave mouth and in the front sector of the cave interior along the eastern wall. In these areas YSS/BSC either directly touched bedrock or was separated from it by a mere trace of Red Sand («RS»). Thus we can deduce that some erosive process had washed out any previously existing sedimentary infilling, the existence of which is testified to be the remnant deposits of «LGS»

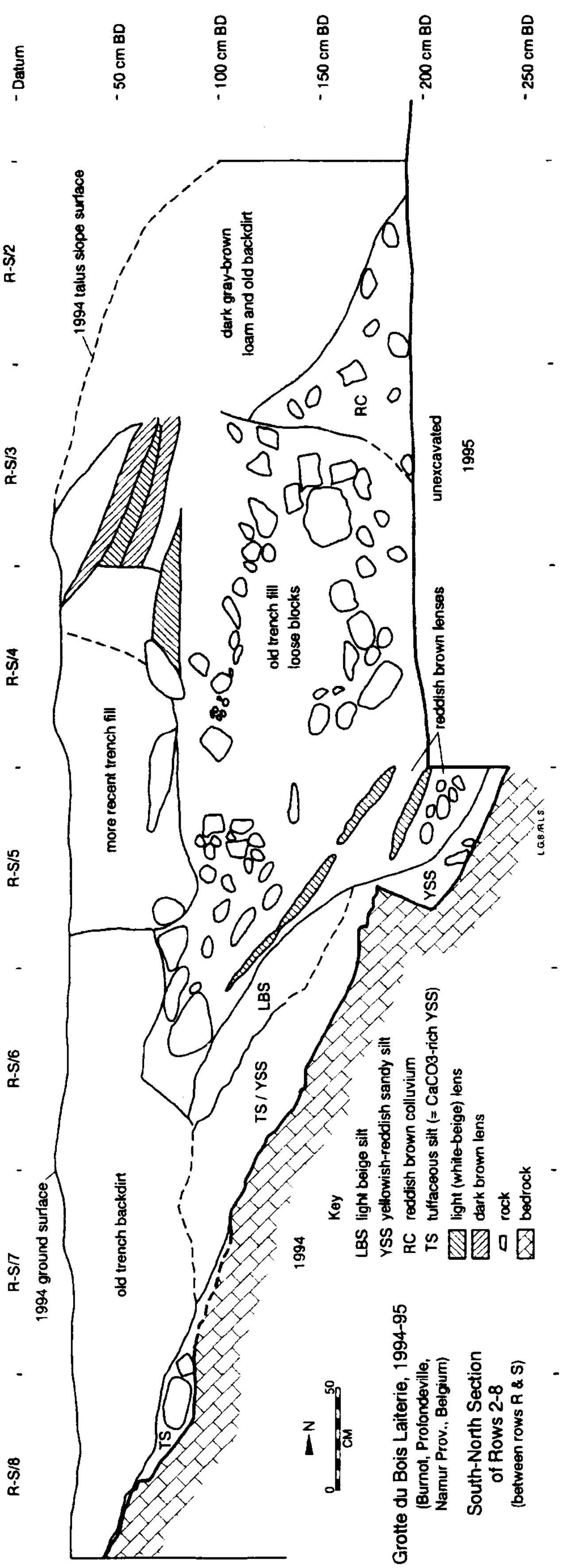

Fig.20 - Bois Laiterie Cave, S-N Stratigraphic section , R-S / 8-2, showing pothunter trench fill.

(lower grey sand), «RS» and «BGS» which underlie «YSS» in the deepest (best sediment trap) part of the «gully» in the bedrock between the eastern cave wall and the cave floor. Since we know that «YSS» (and presumbly also «BSC») probably dates to Bölling (see below), the coarse sand and blocks of LGS could have been deposited by freeze-thaw processes during some part of Dryas I. «RS» might be indicative of some oxidation (weathering) and could conceivably represent one of the more moderate climatic, humid pulses within Dryas I (*e.g.*, Pre-Bölling, Angles?), whereas the basal grey sand («BGS») could represent rigorous conditions of either early Dryas I or the Last Glacial Maximum.

The clayier content of «BSC» might be indicative of very humid conditions, perhaps at the tail end of the very wet episode that eroded the cave perhaps in early Bölling. The cave may have been quite wet, with muddy puddles along the eastern wall (the only area made flat by sedimentary infilling in the bedrock «gully») at the time of Magdalenian human arrival. One can perhaps suggest decantation of clay minerals in ponded water. Higher up in the stratigraphic sequence, somewhat drier conditions in Bölling led to the deposition of siltier (loess) sediments (YSS) - sandier inside the cave and siltier toward the front and in the exterior.

Inside the cave, the Upper Grey Sand («UGS») once again suggests freeze-thaw processes leading to deposition of coarse sand and the large angular roof-fall blocks that fell directly atop YSS. The Bölling amelioriation seems to have come to an abrupt, dramatic (albeit ultimately transitory) end with a major cold but fluctuating and relatively humid pulse, characterized by intense freeze-thaw activity. This could have been Dryas II (or Dryas III, in which case there would be a depositional hiatus in place of Dryas II and especially Alleröd, for which we have no certain indicators). «GBS» in the cave interior and «LBS» on the terrace *might* be lateral equivalents, but they are not physically continuous - being interrupted either by cave wall or floor bedrock or by the pothunter diggings. These loose, light brown/beige silt/silty clay deposits lack modern artifacts or other intrusives (despite disturbance of «LBS»). One or the other or both could either have been formed during the early Holocene (Preboreal?) or, more likely, at least for LBS during Alleröd. The only evidence possibly suggestive of the latter hypothesis (*i.e.*, LBS = Alleröd), aside from stratigraphic position, is the fact that «LBS» is characterized by mixtures of *both* cold, dry, open-habitat taxa and more temperate, humid, wooded taxa of micromammals and malacofauna, according to López Bayón *et al.* and Cordy and Lacroix (both in this volume). These data would seem to square poorly with Preboreal conditions in Belgium (densely wooded and very humid). LBS lacks either Mesolithic or Magdalenian artifacts, save for a very few probably brought up by minor disturbance agents (*e.g.*, burrowing animals).

The base of the Breccia yielded human bones, including a foot one of whose bones has been dated to 9,200 BP (uncalibrated): Preboreal/Early Mesolithic (see Krueger and Vandenbruaene and Gautier, this volume). In close association with these remains, however, there are ceramic sherds, suggesting reuse of the cave as a (Neolithic?) ossuary (of unknown age). The sediments (silts and limestone blocks) that were later cemented to form the Breccia were thus laid down during Preboreal, Boreal and at least early Atlantic. The calcium carbonate precititation must have taken place during the mid-late Atlantic period - or even more recently.

Radiocarbon Dates

The first radiocarbon date obtained from Bois Laiterie was a direct AMS (accelerator mass spectometry) determination on one of the antler sagaies discovered in the level that would later be named «YSS» in the cave rear (probably in V10) in 1991 by Lacroix. The date was procured by R.Charles as part of her dissertation research (1994); it was done on collagen by the Oxford University Research Laboratory for Archaeology and the History of Art. Two other accelerator dates were done on individual animal bones from our 1994 excavation. These samples were processed and the collagen samples were extracted by Geochron Laboratory in Cambridge, Massachusetts, but were also actually dated by the Oxford Accelerator. Both bones came from square U6 at the front of the cave: one from the top of «YSS» and the other from the bottom of «YSS». The three determinations are statistically identical at 12,650 BP.

Collagen from a human foot bone retrieved from the base of the Breccia in square V9 during the 1995 excavation was also extracted by Geochron and accelerator-dated by Oxford. It provided unexpected evidence for the existence of an early Mesolithic ossuary use of the cave - just as in several other caves in west-central Wallonia, all dated between c. 9,600-9,000 BP (see below). The BL radiocarbon dates (uncalibrated) are listed in Tab.1.

TABLE 1: BOIS LAITERIE RADIOCARBON DATES

Stratum	Square	Material	Lab.No	Date and 1 Standard Deviation
YSS	V-10	Antler sagaie	OxA-4198	12,660 ± 140 BP
YSS top	U6	Bone	GX-20433	12,625 ± 117 BP
YSS base	U6	Bone	GX-20434	12,665 ± 96 BP
Breccia base	V9	Human bone	GX-21380	9,235 ± 85 BP

The YSS/Magdalenian dates fall squarely in the middle of the traditional (uncalibrated) age range for the Bölling phase or pollen zone. As demonstrated by Charles (1994), all the credible dates for Magdalenian in Belgium fall within this period, denying the reliability of dates in excess of 13,000 BP. However, Street et al. (1994), using experimental calibration curves, suggest that the recolonization of NW Europe (notably the German Rhineland) may actually have begun as early as late Dryas I. This may be suggested by the recently obtained dates from the Magdelenian level at Trou Walou in the hill country of Liège Province (Gilot,1993), which may have fewer problems than the «old» dates from the lower, artifact-poor (or devoid) levels at Trou des Blaireaux in the upper Meuse basin. Radiocarbon-dated Bölling-age Magdalenian sites (c.12,900-12,200 years ago, uncalibrated) in Belgium now include the following: Sy Verlaine, Chaleux, Frontal, Nutons, Bois Laiterie, Blaireaux (Couche II), Coléoptère and Trou Da Somme. These sites are dated by a total of 18 acceptable determinations (mostly AMS). In addition, there are two C-14 dates of c.13,000 BP from the Magdalenian level at Trou Walou, which, given their single standard deviations of 140 and 190 years could either suggest an early traditional Bölling age or a late Dryas I occupation. But Charles (1994) questions their reliability due to the use of bulk bone samples for conventional (not accelerator) radiocarbon dating. Finally, the TL dates from one or both loci at Orp could be interpreted as dating to Bölling (as also suggested by geological / pedological evidence)

(Vermeersch,1991), since the standard deviations are very large and since C-14 dates are systematically «too young» in this time range.

With regard to the human foot dated to 9,200 BP, but apparently unassociated with any Mesolithic artifacts (none were found in our fine-screening of the pothunter backdirt or in our removal of the bones from and inspection of the Breccia base), there are a number of comparable data from the upper Meuse and Sambre valleys above Namur. In recent years no fewer than five other caves in this small region have yielded individual or multiple human burials, with few or no associated artifacts, but attributable to the early Mesolithic on the basis of 12 coherent radiocarbon dates (mostly AMS) ranging from 9,600 to 9,000 BP (Cauwe,1995; Toussaint *et al.*,1996). Bois Laiterie is thus part of a distinctive regional tradition involving use of certain caves for burial but not for residence during the Preboreal. On the other hand, other sites, such as the Abri du Pape, a shallow rockshelter upstream of Dinant whose lowest Mesolithic level dates to c. 9,000 BP, were used as campsites in roughly this same time period (see Straus *et al.*,n.d.).

The Excavation

The objectives of the two seasons of fieldwork in Bois Laiterie Cave were to extract the maximum possible amounts of information relative to Magdalenian environments and adaptations, and to completely excavate the limited remnant intact deposits to salvage this unprotected site's data before its almost inevitable final destruction by looters. This involved the removal of large quantities of old backdirt from within the cave and especially from the terrace, followed by careful, controlled excavation and screening of the remnant intact deposits. Actual excavation was done in an area totalling about 23 m², but in addition we cleared old backdirt down to bedrock and recovered artifacts and psammite slabs resting atop or cemented to the bedrock floor in an additional upslope area of about 7 m². Thus our sample covers a total of 30 m² and essentially no intact deposits remained after the close of the 1995 excavation (except small areas along the eastern and rear walls that are virtually inaccessible due to the overhanging breccia ledge). In addition, we excavated a 1x1.5 m test trench in the upslope area of the terrace (O-P/ 3-4), which reached the very steeply sloping bedrock and cut through the western end of at least two generations of clandestine trenches and a small area of intact sediments (on the upslope site) with no trace of Magdalenian deposits. Thus it is possible that we may have excavated (or, atop exposed bedrock floor, at least sampled) a total of as much as about 3/5 of the habitable area of the Magdalenian site in the lower cave + terrace (Fig.21).

In 1994 we cleaned the upper part of the south-north stratigraphy created along the U-V line by the pothunter diggings (which stopped along that axis because the capping breccia deposit had become too hard and too thick) and by Lacroix's *sondage* in U8 (Fig.14). Then we excavated the infilling of the «gully» in the bedrock along that axis, principally in squares U9-10, U7-5 and T7-4, while also recuperating Magdalenian materials from the exposed bedrock mainly in the «S» row. All this work was inside the cave.

In 1995 we finished excavating remnant deposits at the rear of the cave mainly in V7-9, V11-13, W9-10, X10, S14 (or portions thereof), often having to «tunnel» under the breccia in

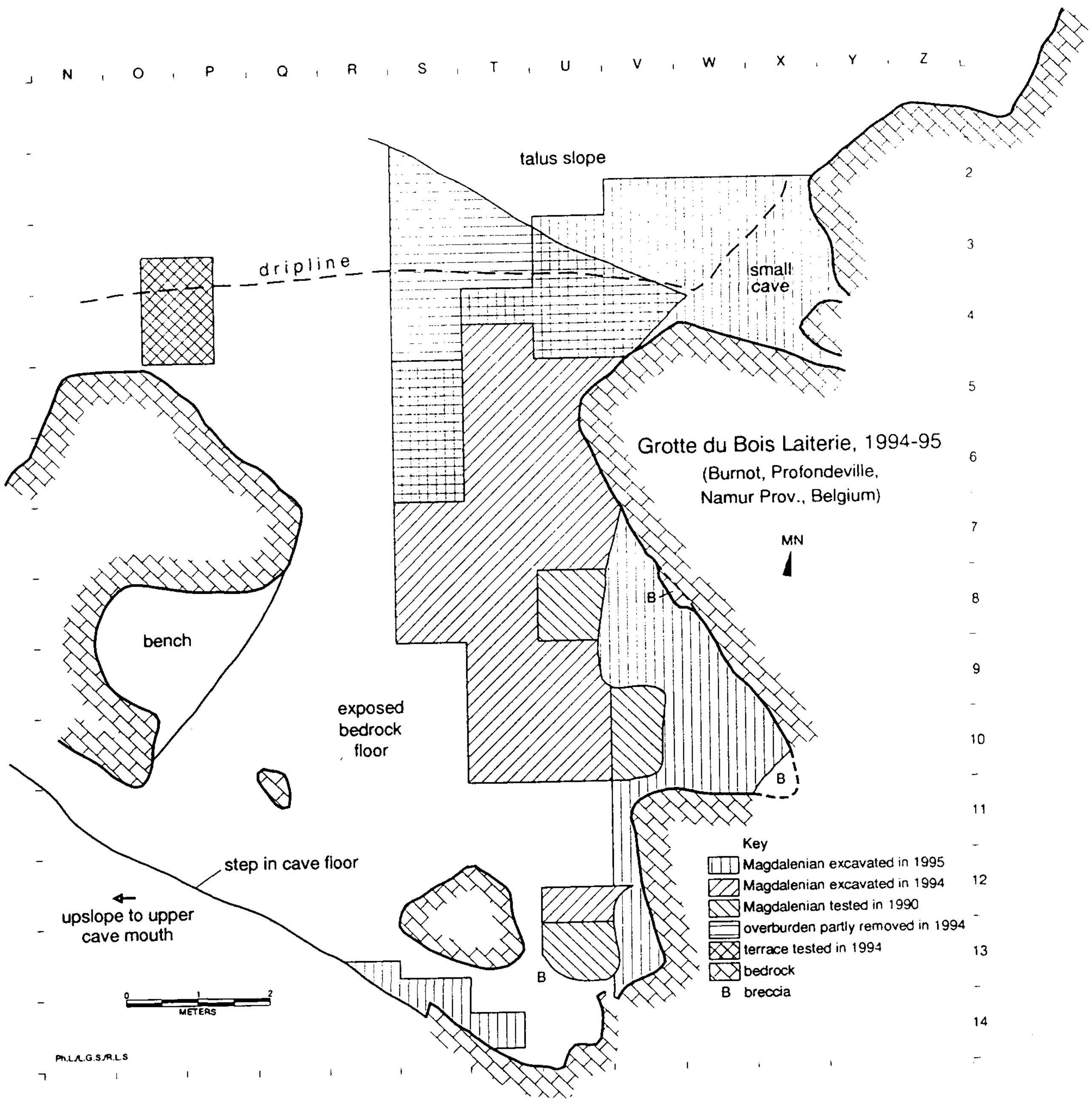

Fig.21 - Bois Laiterie Cave. Excavation areas.

order to be able to remove the Magdalenian deposit back to the cave walls where ever possible. We also excavated most of the area between U-X and between 2-4 in front of the eastern part of the cave mouth on the terrace and in the entrance of the small cave. *All* these areas were dug down to bedrock and the terrace area was excavated out to the edge of the bedrock ledge in front of the cave, at which point an earlier cliff-line, now buried in colluvial talus sediments, seems to plunge vertically down toward the Burnot stream.

The procedure of digging outward from and thereby vertically and horizontally extending existing stratigraphic sections, allowed us to maintain good stratigraphic control. However, as noted above, there was considerable lateral variation in texture and color of the strata and there was considerable complexity of levels and lenses in the east-central part of the cave, and a high degree of deposit homogeneity in the terrace area, which made our job difficult at times. Most fortunately in this essentially single-component site (leaving aside for all practical purposes the existence of apparently partially mixed early Mesolithic and Neolithic components in the Breccia), the distribution of Magdalenian artifacts, manuports and faunal remains was continuous and relatively (though variably) dense from the 13 row at the cave rear all the way to the 2 row on the terrace. Thus we were able to follow, document and recuperate this (palimpsest) «living surface» from one end of the site to the other without much uncertainly, despite the variations in its sedimentary matrix.

Excavation and Analysis Methods

The site was mapped in detail and, once the excavation was finished and bedrock exposed throughout, both longitudinal and transversal sections were drawn (mainly by Ph.Lacroix).

The entire lower cave was gridded into 1 m² units, using weighted strings hanging from screws driven into the ceiling. The terrace area grid units were marked by elastic strings attached to iron rods driven into the ground and screws driven into the cliff-face. The North-South axis was designated by numbers (numbers 2-14 were used) and the West-East axis by letters (letters O-X were used). For actual excavation and screening purposes, each meter square was subdivided into four quadrants labelled «A» (NW quarter square), «B» (NE), «C» (SW) and «D» (SE). A datum plane was established and permanently marked by screws driven into cave wall and upslope areas of the bedrock floor at an elevation higher than most of the extant deposits. Most «z» coordinates (depth measurements) are thus negative, but there are some finds from the very rear of the cave (11-14 rows) that were above the datum plane, thus giving positive depth measurements. At the beginning and end of the excavation of each «spit» (excavation level = «décapage») we would measure and record the 9 depths corresponding to the corners of all the quarter squares making up the meter square. Each spit in each square is thus a uniquely defined unit.

Except when backdirt had to be removed (by pick and shovel - although then coarse, dry-screened on site) or blocks broken (by wedge and sledge hammer), excavation was done by small pointing trowel, dental pick, wooden spatula and brush.

All tools, all artifacts of 1 cm or greater in length, and all faunal remains and plaquettes of more than about 4-5 cm in length were normally piece-plotted in three dimensions (cm from the southern and western edges of the square and cm below [or above]the datum plane). Depth measurements were taken with line levels on strings that were frequently double-checked. To study possible natural disturbance processes (*e.g.*, solifluxion, running water), we recorded the orientation of all elongated objects found *in situ* by compass and the inclination by clinometer. We also weighed all piece-plotted finds. Piece-plotted finds and bags of screen finds from subsquares and spits are given numbers that run in one single sequence from 1 to infinity for each meter square. A sample label would read: «BL-U6-107». Finds found in the screen or otherwise not individually piece-plotted, but otherwise «deserving» individualization (*i.e.*, retouched tools, identifiable bones or teeth) are given decimal numbers based on the field sample numbers assigned to their respective spit bags: *e.g.*, «BL-U6-108.3». Other analytically non-individualized screen finds (mainly microdebitage and bone splinters) are identified only by square, subsquare, stratum, spit and collective field sample number.

Excavation was carried out following the natural «lay-of-the-land», *i.e.*, following the presumed local angle(s) of the strata. In practice we would dig «spits» (excavation levels within natural strata) of generally no more than 5-8 cm in thickness (sometimes less in areas with extreme densities of finds; sometimes more in sterile layers such as the strata above YSS). All sediments were screened by units combining spits and quarter squares, so that even objects found in the screen (mostly microdebitage, bladelet fragments, small bone splinters, rodent remains) have a fairly precise provenience consisting of square, quarter-square, stratum, spit and depth range. Of course, piece-plotted objects have an additional degree of provenience precision: their three-dimensional coordinates. In 1994 all intact sediments were dry-screened on site through 2.5-3 mm mesh and samples of the residues were taken to Namur by Lacroix for finer wet screening for recovery of malacofaunal and micromammalian remains. In 1995 arrangements were made (*i.e.*, 280 m of hose run from the Sept Meuses campground on the ridgetop above the site) to water-screen on site, again through 2.5-3 mm mesh - after dry-screening through 5 mm mesh. Columns of samples for malaco- and microfauna were taken for later fine-screening, sorting and study by Lacroix in Namur (with further identification to be done by or in association with I.López Bayón and Professors Gautier, Peuchot and Cordy).

Micromorphological samples were taken by L.Lang from the stratigraphic sections before their final removal near the end of the 1995 season. Radiocarbon bone samples and dental cementum samples were selected after paleontological identification by Prof.A.Gautier. Flint artifacts (mainly retouched tools, but also some larger debris) that appeared relatively unpatinated, were selected for lithic microwear analysis (or residue analysis) in the field, minimally handled and put immediately into individual sealed plastic bags, unwashed and unlabelled. All other finds were washed in water, dried and labelled in the field laboratory (in Dinant in 1994 and in Namur in 1995). Faunal remains were separated for study by Gautier and his present and former students at the Universiteit Gent. Plaquettes were weighed, measured and inspected for engravings, cutmarks, ochre stains and for possible refits (several of which were found). Those bearing possible artificial modifications were set aside for study by M.Lejeune.

All flaked lithics were classified according to a uniform debris (core + debitage / blank) typology developed by Straus and students (Table 2). This classification, plus the weighing of all lithics (either individually in the case of piece-plotted items or other individualized objects, especially tools found in the screen), provide the basis for technological analysis. Piece-plotted

TABLE 2. BLANK OR DEBRIS (CORES+DEBITAGE) TYPES

ID	NAME	ATTRIBUTES
1	Non-cortical Trimming Flake	≤1cm with Hertzian morphology, no cortex
2	Non-cortical Shatter (small angular debris)	≤ 1cm without Hertzian morphology, without cortex
3	Plain Flake	> 1cm, no cortex
4	Primary Decortication Flake	cortex covers dorsal surface
5	Secondary Decortication Flake	some dorsal cortex
6	Plain, whole or proximal Blade	> 2cm twice as long as wide-whole or proximal fragment (with definite butt), no cortex
7	Primary, whole or proximal Decortication Blade	Length=2x Width & Length>2cm, cortex covers dorsal surface
8	Secondary, whole or proximal Decortication Blade	Length= 2x Width & Length>2cm, some dorsal cortex
9	Plain, whole or proximal Bladelet	≤ 2cm long, narrow, & thin - whole or proximal fragment, no cortex
10	Burin Spall	thick blade(let) with tri- or quadrangular section
11	Unidirectional Crested Blade	crest formed by flake scars perpendicular to blade axis in one direction
12	Bidirectional Crested Blade	same, but in two directions
13	Flake Core	core with only flake removals
14	Prismatic Blade Core	cylindrical core with only blade removals
15	Pyramidal Blade Core	pyramidal core with onlyblade removals
16	Prismatic Bladelet Core	cylindrical core with only bladelet removals
17	Pyramidal Bladelet Core	pyramidal core with only bladelet removals
18	Mixed Core	both flake and blade / bladelet removals
19	Non-cortical Chunk	> 1cm, without flake (large angular debris) morphology (i.e., no bulbs), includes core remnants and fragments of exhausted cores, no cortex
20	Platform Renewal Flake	has lip of platform, with nibbling from core preparation
21	Pièce Esquillée (splintered)	bipolar flake or core remnant
22	Cortical Trimming Flake	like No. 1, with some cortex on dorsal surface
23	Cortical Shatter	like No. 2, with some cortex
24	Broken Plain Blade	mesial or distal blade fragment, no cortex
25	Broken, Plain Bladelet	mesial or distal fragment like No. 9, but without cortex
26	Cortical Chunk	like No. 19, but with some cortex
27	Mesial/Distal Cortical Blade	like No. 24, but with some cortex
28	Medial/Distal Cortical Bladelet	like No. 25, with some cortex
29	Whole/Proximal Cortical Bladelet	like No. 9, but with some cortex
30	Fire-Cracked Rock	angular fractures, reddened and/or blackened
31	Pebble or Cobble	smooth, water worn stone
32	Hammerstone	
33	Plaquette	

items were individually measured and weighed. All lithics were also classified according to our *ad hoc* typology (Table 3) of lithic raw material types encountered archeologically in our work in Wallonia, a list developed in association with Prof.Otte, J-M.Léotard and E.Teheux. In addition, formal, retouched tools were all classified according to the original Upper Paleolithic type list of D.de Sonneville-Bordes and J.Perrot (1954-56) and retouched edge angles were measured. Multiple tool types on individual blanks, that are not covered by the established «Composite Tool» types (N° 17-22), are counted as separate tools (but they are not counted as multiple blanks in technological or raw material analysis). There are a dozen cases of such multiple-count tools (mostly doubles). All data (provenience and analytical) were entered into an SPSS computer database on a PC at the University of New Mexico for statistical analysis. Refitting of lithics and slabs was carried on both during initial artifact processing and later on, mainly by A.Martinez and R.Miller, but also by several other students (I.López Bayón, J.Orphal, R.Schwendler, J.Summers).

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TABLE 3. SOUTH BELGIUM LITHIC RAW MATERIAL LIST

Prepared by: J-M.Leotard, A.Martinez, R.Miller, L.G.Straus and E.Teheux.
(Used for le Trou Magrite, Huccorgne, Bois Laiterie and Abri du Pape, 1991-95)

ID	Description
9	Very fine grain, highly homogeneous, flint, white to gray with tiny black flecks, smooth uniform surface, opaque, crystalline inclusions, conchoidal fracture, pattern shiny. Source Tertiary deposits near Doisch Agimont (South Belgium) or Charleville (North France).
10.	Fine-grain flint: fine grain; shiny, smooth surface; opaque to slightly translucent; light brown or blue-gray original color; patinates white; chalk cortex; some white, ovoid inclusions ; conchoidal fracture pattern. Source: Cretaceous of Hesbaye and/or Spiennes. Intergrades with 11 and 12.
11	Fine-grain flint: fine grain; shiny, smooth surface; opaque to slightly translucent; brown-yellow color; patinates white; chalk cortex; occasional inclusions; conchoidal fracture pattern. Source Cretaceous of North Belgium. Intergrades with 10 and 12.
12	Medium-grain flint: medium grain; matte, slightly rough surface; opaque; occasional inclusions; gray color, patinates white; water-worn cortex; conchoidal fracture pattern. Source: Cretaceous, occurs in river beds. Intergrades with 10 and 11.
13	Fine-grain flint: fine grain; shiny, smooth surface; opaque; dark brown color with occasional yellow bands; does not patinate; water worn cortex; inclusions rare; conchoidal fracture pattern. Source: Tertiary of North Belgium.
14	"Pseudo" flint: fine grain; shiny, orthogonal surface; translucent to slightly opaque; light brown to dark gray, mottled; does not patinate; water worn cortex; inclusions rare conchoidal fracture pattern. Age and source unknown.
15	Black flint: like 12, except very matte; with some rare inclusions. Source: in local limestone.
16	Black flint: very fine grain; opaque; homogeneous; no inclusions; conchoidal fracture; orangeish chalk cortex, smooth and shiny. Source: possibly Obourg or, at Huccorgne, a local (Hesbaye) Cenomanian flint (like "Brandon" flint).
17	Light gray flint: fine grain; good quality; opaque; matte; grayish-white inclusions; chalk cortex, not water-worn; generally homogeneous; conchoidal fracture; (Cretaceous?). Source unknown.
18	Patinated "Hesbaye" yellow, medium-grain.
19	Other flint.
20	Chert - general, non-cortical: fine to medium grain; matte or shiny, smooth surface; opaque to slightly translucent; wide color range; does not patinate; cortex absent; inclusions rare; mainly orthogonal fracture pattern. Cretaceous. Source unknown.
20	Chert with unworn cortex: Same as above, but with unworn cortex. Occurs in Cretaceous geological beds.
20	Chert with water-worn cortex: Same as above, but with water-worn cortex. Cretaceous. Found in river beds.
30	Phtanite: medium-grain; matter or shiny surface; opaque; jet black to grayish black; does not patinate; gray cortex with occasional metal adhesions; no inclusions; conchoidal fracture pattern. Cretaceous. Occurs in geological bed at Ottignies, Central Belgium.
40	Medium-grain limestone; medium grain; soft, matte surface; opaque; gray-black;

	patinates gray; cortex impossible to distinguish; inclusions rare; conchoidal fracture pattern; violent reaction with acid.
41	Fine-grain limestone: fine grain; hard, matte surface; opaque; black with white-yellow flecks; light tray patina; cortex impossible to distinguish; inclusions rare; conchoidal fracture pattern; mild reaction with acid. Silicified limestone. Cretaceous. Intergrades with 15.
42	Crystallized limestone: fine to medium grain; hard, matter surface; opaque; gray-white mottled; does not patinate; cortex impossible to distinguish; occasional inclusions; mainly conchoidal fracture pattern; mild reaction with acid ("limy chert"). Cretaceous.
50	Medium-grain quartzite (includes quartzitic sandstone): medium grain; matte to shiny surface; opaque; wide color range; does not patinate; cortex water worn; no inclusions; conchoidal fracture pattern. Occurs as cobbles in river beds.
51	Fine-grain quartzite/siltstone: fine grain; matte surface; opaque; tan-brown color with occasional bands; does not patinate; cortex water worn; manganese inclusions; conchoidal fracture pattern. Possible source: Paris Basin; occurs as river cobbles.
52	Quartz crystal: fine to medium grain; shiny surface; translucent to opaque ("Milk quartz") milky-white to yellow; does not patinate; cortex unworn; no inclusions; orthoconchoidal to planar fracture pattern. Occurs in geological beds (incl. in the local limestone).
53	Sandstone.
54	Brussels sandstone.
55	Psammite: light brown with manganese oxide stains; medium-course grain (looks like quartzite); opaque; occurs in Meuse valley at Rivière and Lesse river valley at Gendron railroad. station in form of tabular plaquettes. Sandstone with quartz grains and mica inclusions.
56	Calcite.
57	Light olive green-gray micaceous schist; psammite-like (w/o manganese oxide specks) Badly eroded surfaces. Exfoliates in sheets along bedding planes with raised lumps; lamellar structure.
58	Red-brown (iron color) micaceous schist; dense, uniform, tabular, uneroded surface. Like 57, but denser, heavier and less eroded. (58 and 57 may be variants of 55).
90	Ochre/hematite.
99	Other stones.

Photo 1 - View from Sept Meuses Hill looking up (southward) the Meuse valley.

Photo 2 - Confluence of the Burnot Stream gorge with the Meuse at Rivière. The site is behind the hill at left. View is oriented c. NNW.

Photo 3 - Upper and lower mouths of Bois Laiterie Cave. Site is in lower mouth at left.

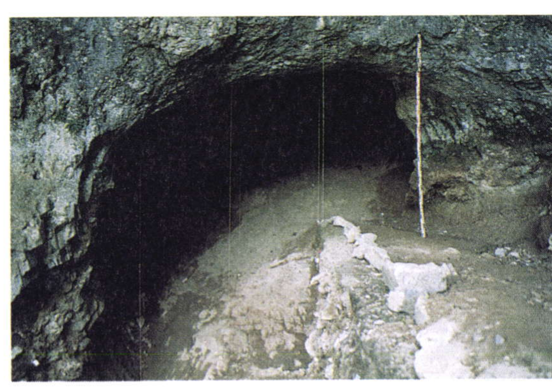

Photo 3 - Upper and lower mouths of Bois Laiterie Cave. Site is in lower mouth at left.

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

2

SITE FORMATION / DISTURBANCE PROCESSES, SPATIAL DISTRIBUTIONS, SITE STRUCTURE AND ACTIVITY AREAS

L. G. Straus and A. Martinez

Introduction

Each archeological site lies somewhere along a continuum of intactness from a pristine, Pompeii-like state to a condition of complete redeposition. We are wont to call these extremes «primary» and «secondary» context. In reality, most recognized «sites» can be characterized as being «decimals». Both organic (human and animal) and geological processes have affected almost all sites, especially those which date back to the Pleistocene, in such a manner that the distributions of cultural residues are not found in exactly the *location* or position where they were abandoned by the humans who had originally created or manipulated them. The complexity of the archeological record has been the subject of numerous theoretical and applied works, especially over the past two decades (see Schiffer, 1987; Nash and Petraglia, 1987; Goldberg, Nash and Petraglia, 1993, all with references). The upshot of this research is that archeologists have learned how not to despair of recovering behavioral data (admittedly at varying levels of specificity - ranging from coarse to fine grain in resolution), as methods (some in existence since the turn of the century, such as G.W. Smith's early experiments in lithic refitting at Caddington, England) are available to assess the condition of and interpret the distributions of finds from a variety of types of sites, including caves and rockshelters (*e.g.*, Straus, 1990).

The main thing to keep in mind is that one should never automatically interpret all patterns within a site (especially a very old one in a cave) as if they could *only* be due to the actions of the original human inhabitants. A program of site formation / disturbance analyses is necessary before making any qualified behavioral interpretation.

Two recent examples of such a procedure concerning Paleolithic rockshelter/talus slope sites are the cases of l'Abri Dufaure (Magdalenian and Azilian) (Straus, 1995) and Combe-Capelle Bas (Mousterian) (Dibble and Lenoir, 1995) both in SW France.

It is the purpose of this chapter (and of the micromorphology chapter: see Courty, this volume) to explore the state of the Magdalenian deposits in Bois Laiterie Cave and then to analyze the distributions of artifacts, manuports, faunal remains, burned objects and refitted lithics. Taking natural processes into account, we argue that it is nonetheless possible to extract information on the human organization of space within this small site, and thereby to help interpret its functions and role or place within the cultural and economic landscape of the Belgian Magdalenian.

The Bois Laiterie «Problem»

As described earlier, Bois Laiterie has a very steeply sloping bedrock, with the principal grade descending West-East at an angle of c.20-30° down from the upper mouth to the lower chamber where the site was located. The secondary gradient of the bedrock floor of the lower cave slopes at an angle of c. 20-25° down from the cave rear to the mouth and exterior ledge, before plunging vertically down the lower cliff-face, which is covered by the talus slope of the Burnot gorge. Gradients in the «gully» in the bedrock paralleling the eastern wall of the lower cave can be even steeper, making for a veritable «chute». Intuitively it would seem hard to imagine how archeological materials and sediments could have remained more-or-less in place in such a setting, especially given the presence of the upper cave mouth from which water could flow downward - and fast! The sloping bedrock would also be an ideal surface for the occurrence of solifluction, especially when sediments on a precarious angle of repose were to become lubricated with water.

Fears of substantial disturbance within the archeological deposit were promoted by the discovery of psammite slabs that lay at steep angles and even vertically, with five refit sets that cross-cut strata (see Miller and López Bayón, this volume). Other elongated objects were also often found lying akilter or on end. Yet at the same time, we continuously found fragile faunal remains and lithics in excellent condition throughout the whole site. Bones are neither rolled nor battered. The faunal assemblage is not dominated by only the most solid elements (teeth, foot bones, etc.) as would be the case in an assemblage that had suffered heavy mechanical disturbance. The antler sagaies are very well preserved. Most flints (including the smallest, most delicate chips and bladelets) are «fresh», although generally patinated. Edges are usually razor sharp with little or no edge damage that could be attributed to movement within the deposit. There are only a very few pieces that are in fact heavily battered or blunted («pièces émousées») - and these look like artifacts that had been picked up elsewhere and brought to BL for re-use. There are virtually no pieces with «ragged» edges due to abrasion.

So we were faced by an apparent contradiction: a site where one would predict massive disturbance and erosion and where there were many steeply angled manuports and artifacts, but one which also had excellent preservation that would seem to belie the possibility that the deposit had undergone significant movement or churning. The first question, then, is «How intact is the Magdalenian deposit in Bois Laiterie Cave?», or, to the contrary, «How disturbed is the deposit?»

Once this question is at least tentatively answered, one might be able to ask and address the second question: «What indications might there be for the site structure, for the organization of activities or of residue disposal in space, and what might we be able to learn from any patterned distributions of objects not attributable to natural (*i.e.*, non-human) processes?»

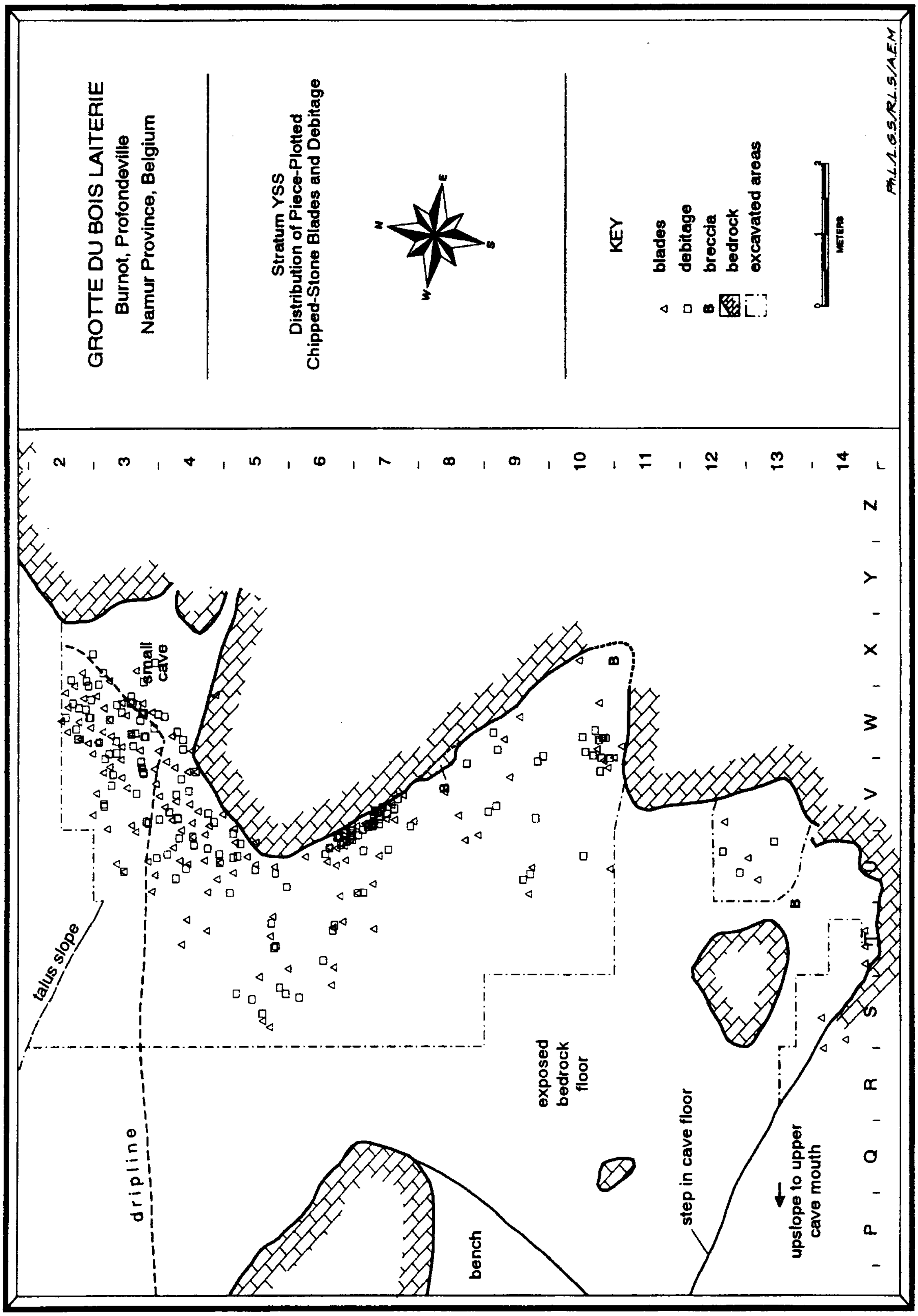

Fig.1 - YSS, Distribution of piece-plotted blades and other large debitage.

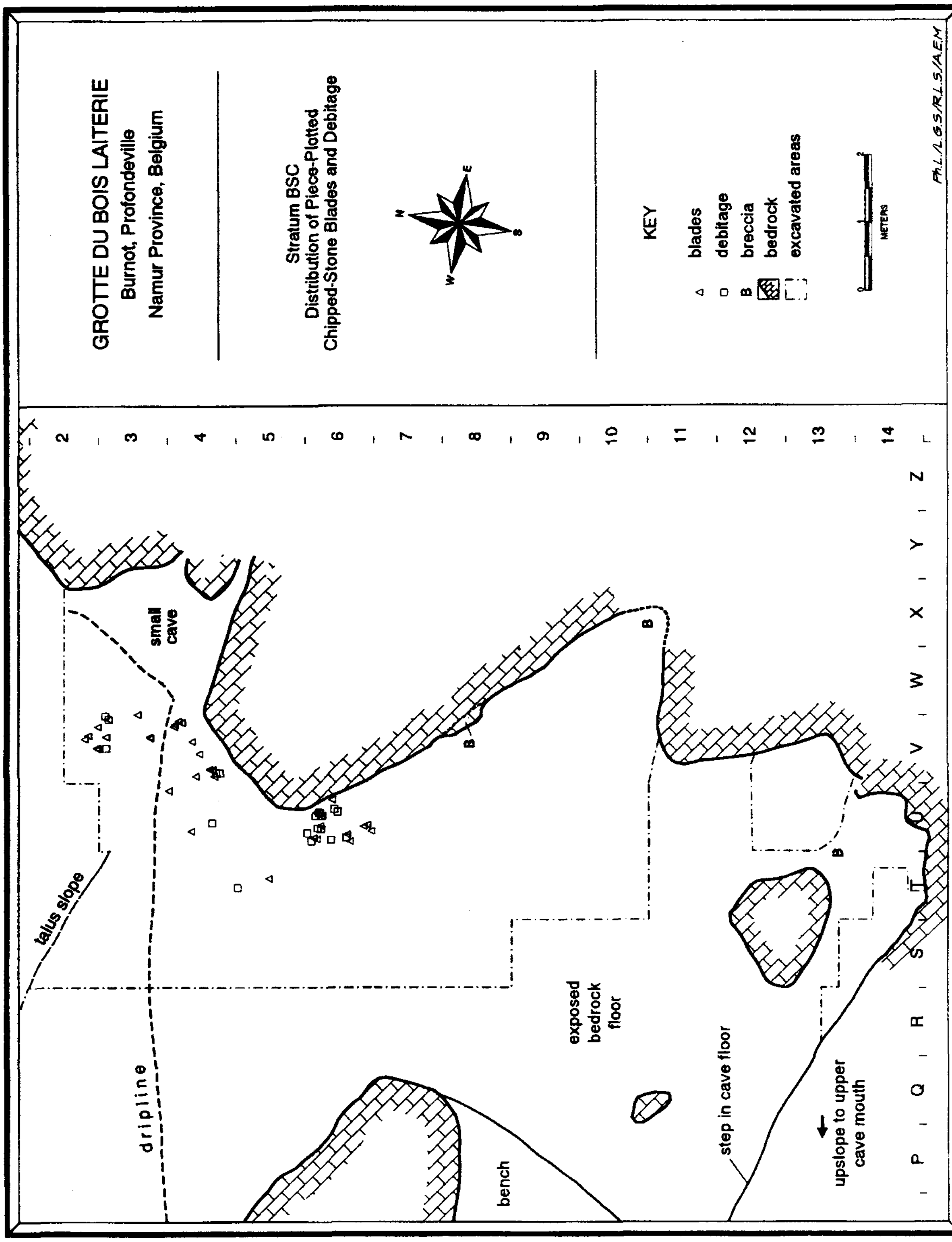

Fig.2- BSC, Distribution of piece-plotted blades and other large debitage.

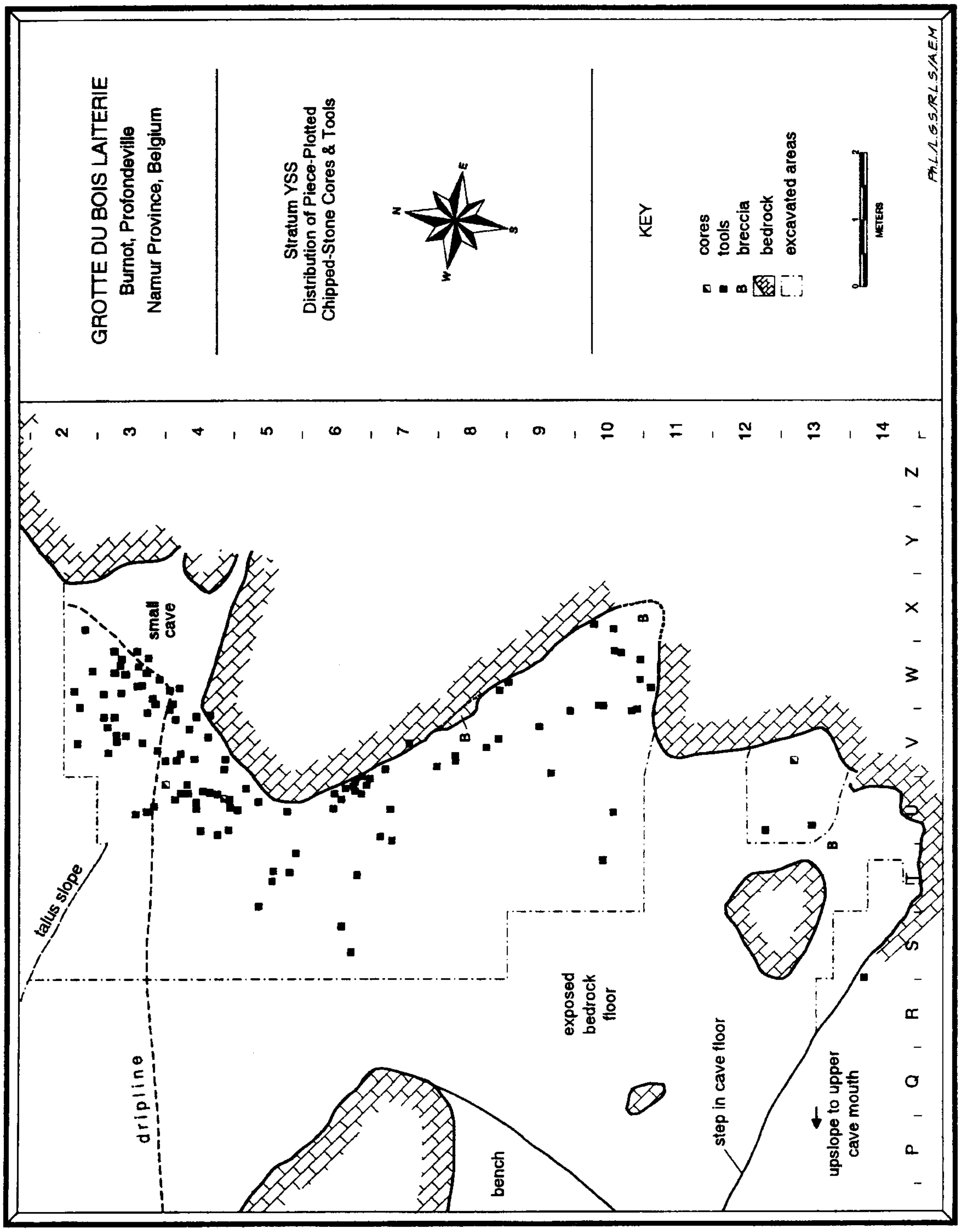

Fig.3- YSS, Distribution of piece-plotted cores and tools.

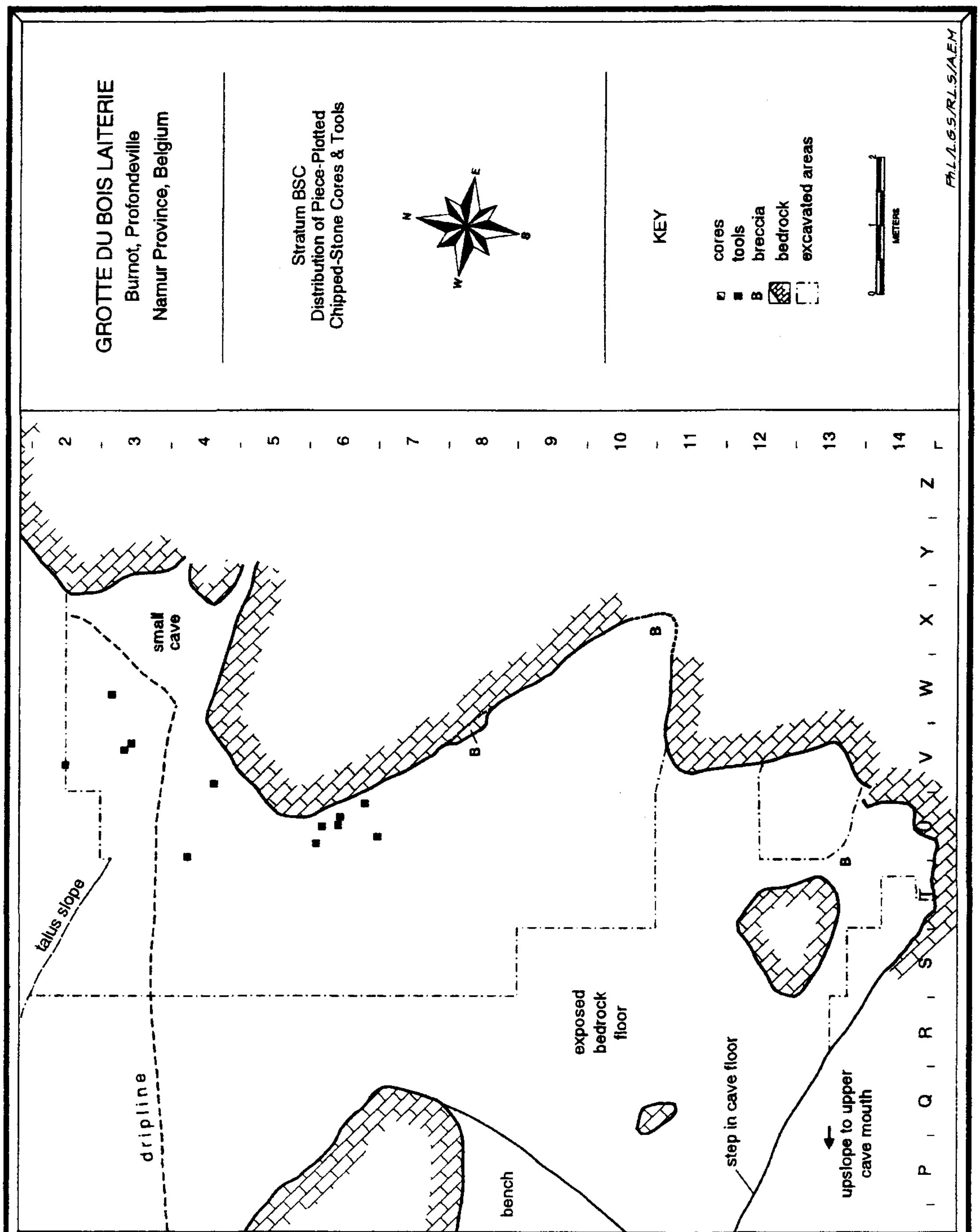

Fig.4- BSC, Distribution of piece-plotted cores and tools.

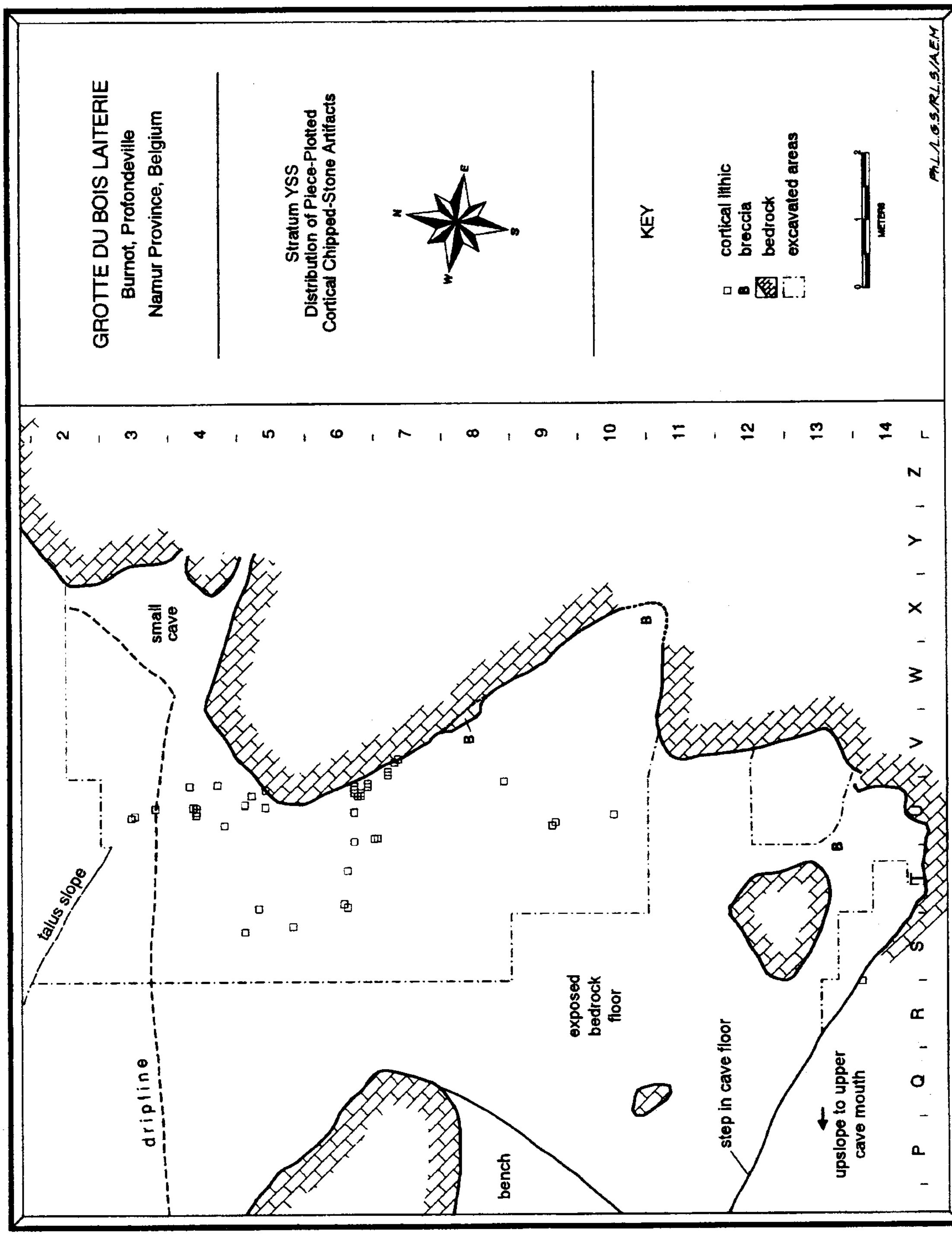

Fig.5- YSS, Distribution of piece-plotted cortical artifacts.

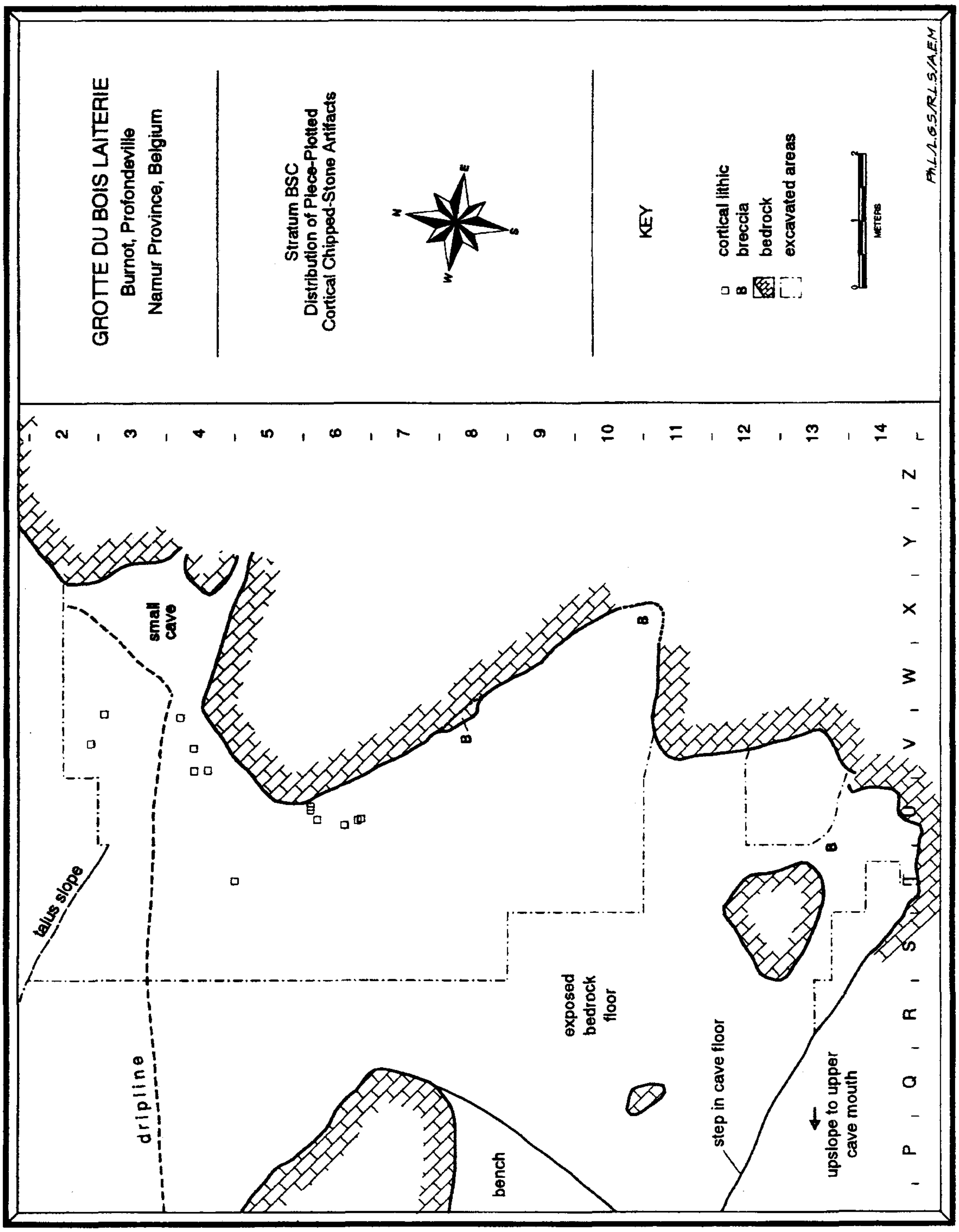

Fig.6- BSC, Distribution of piece-plotted cortical artifacts.

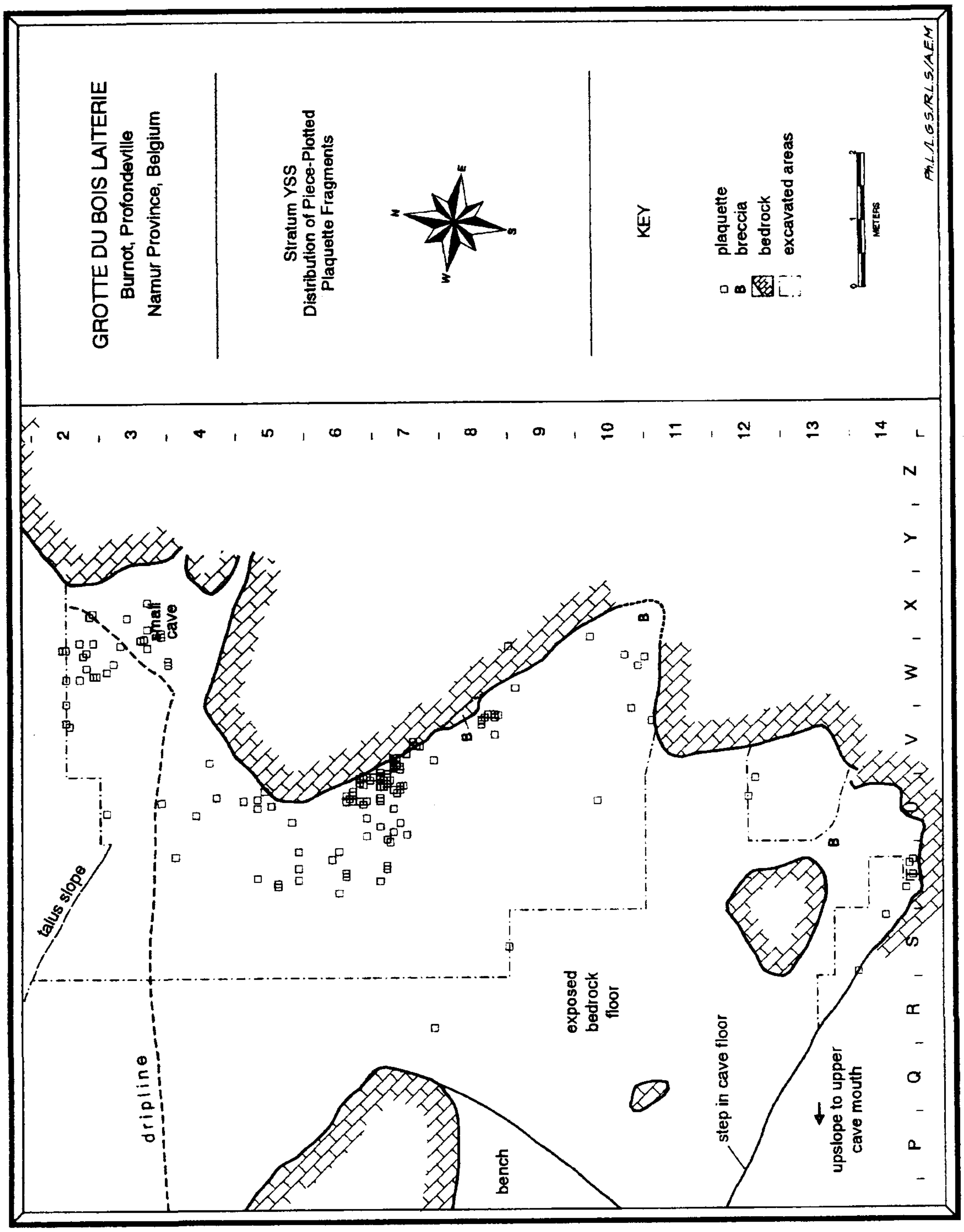

Fig.7- YSS, Distribution of piece-plotted plaquettes.

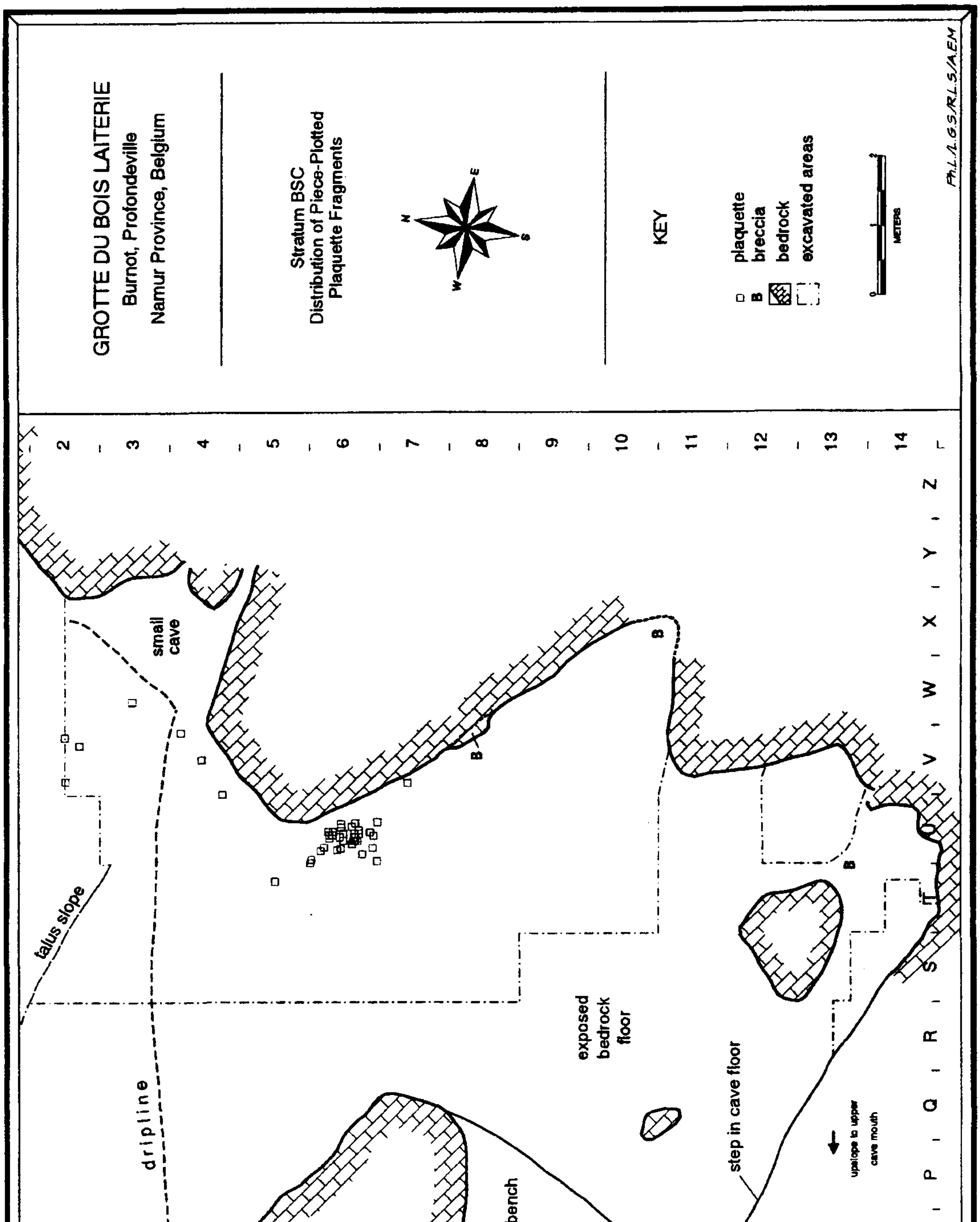

Fig. 8- BSC, Distribution of piece-plotted plaquettes.

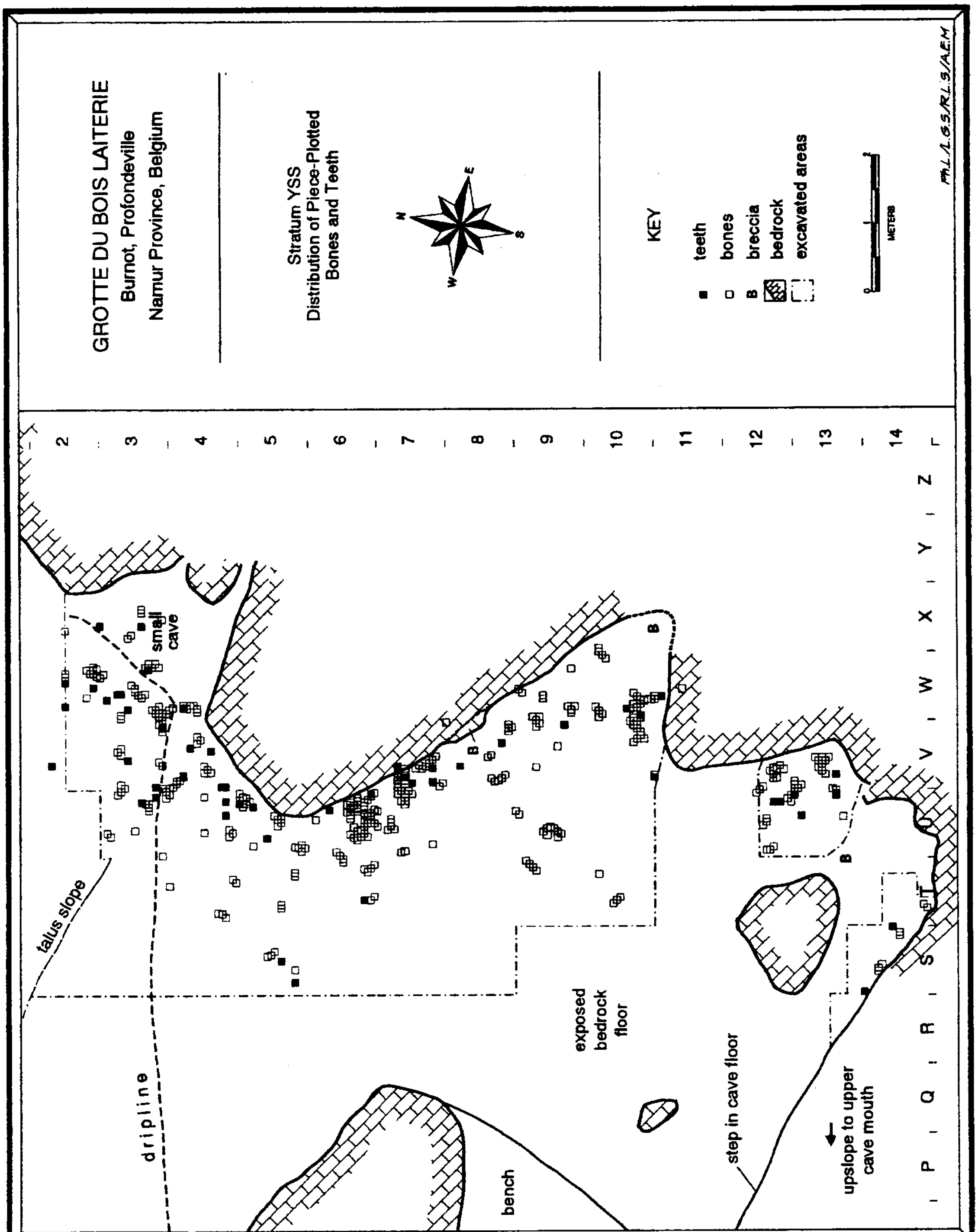

Fig.9- Bois Laiterie, YSS, distribution of piece-plotted faunal remains.

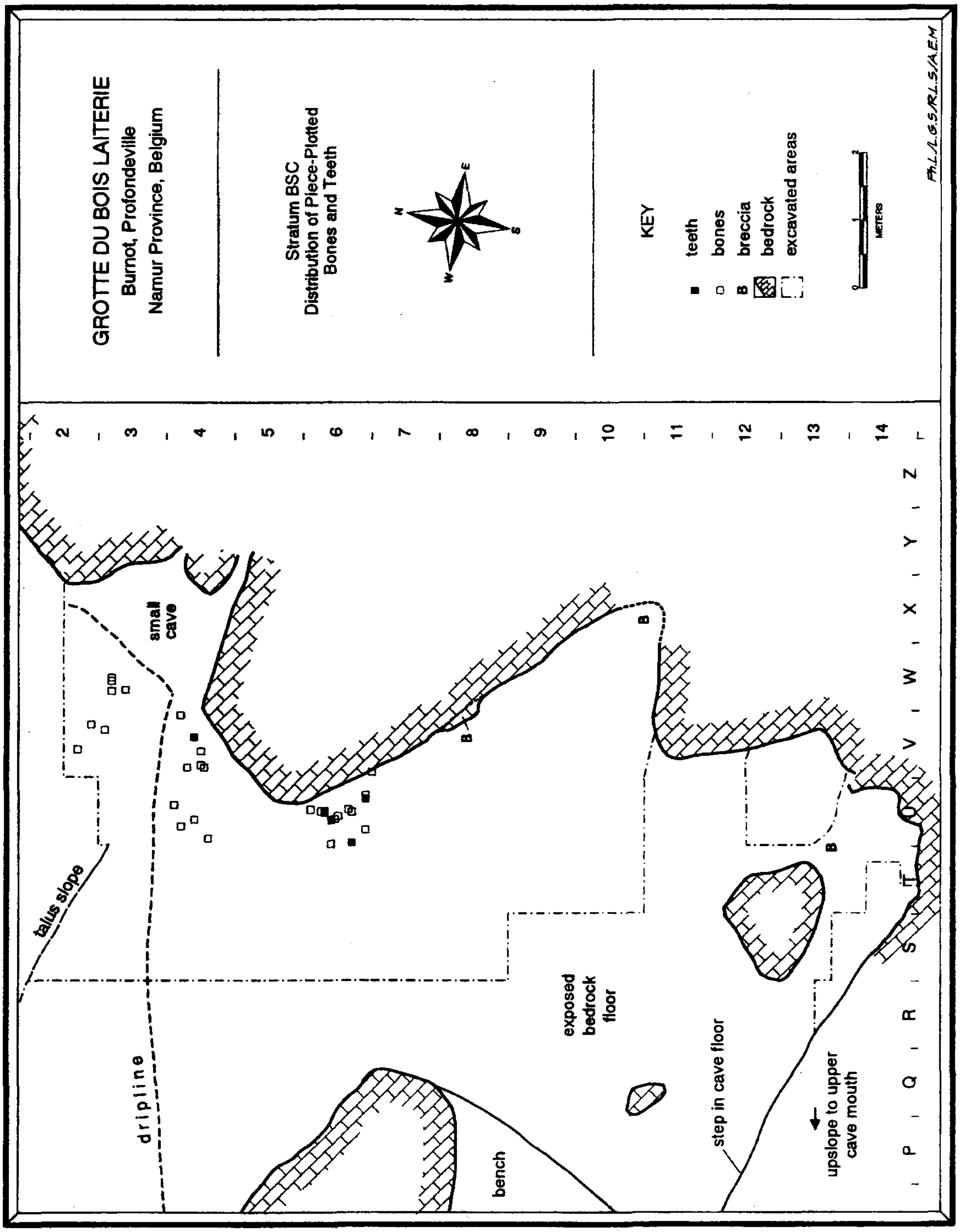

Fig.10- BSC, Distribution of piece-plotted faunal remains.

The Unity of the Magdalenian Horizon: YSS+BSC

In sedimentological terms there is a distinction (albeit vertically gradational and horizontally variable) between the two stratigraphic units which yielded abundant Magdalenian artifacts and associated faunal remains: YSS (yellowish-red sandy silt) and BSC (reddish-brown basal silty clay) - as well as between these and the grey gritty lens near/at the base of YSS at the cave mouth and *vis à vis* RS (red sand). Because the sedimentological difference between YSS and BSC is subtle, variable and gradational, and because artifacts, manuports and faunal remains (essentially not found in the overlying or underlying levels) of the same general kinds are distributed continuously between the two lithostratigraphic units (identified and hence «created», after all, by us), one can pose the question as to whether their distinction has any meaning or validity in an *archeological* sense. Do YSS and BSC in any respect represent distinct occupations of the site at different times, insofar as we can discern and measure them? Can we really make such a distinction?

First of all, about 21% of the Magdalenian debris and about 13% of the Magdalenian tools were found in BSC. Similar, significant portions of the psammite plaquettes (slabs) and faunal remains also came from BSC. Indeed, some individual large, tilted or vertical slabs cross-cut the two strata and some slab fragments refit across them (Miller and López Bayón, this volume), lending weight to skepticism over the existence of any break between these units, whose formation might, to the contrary, be seen as continuous. Figs.1-10 show the respective distributions for YSS and BSC of (Figs.1-2) piece-plotted blades + large debitage, (Figs.3-4) piece-plotted cores and retouched tools, (Figs.5-6) piece-plotted cortical artifacts, (7-8) piece-plotted plaquettes, and (Figs.9-10) piece-plotted faunal remains. The only notable differences between these paired distributions are that BSC has far fewer of all object classes than YSS and that BSC finds are limited to the front of the cave and the adjacent terrace area. BSC simply did not exist as a discernable unit to the south of the «6» row. Otherwise the YSS and BSC distributions coincide quite substantially, generally showing major concentrations of most types of finds in area of square U6 and, more diffusely, in the area of squares U-V/3-4. There is particularly a great mass of plaquettes in and immediately around U6 in *both* stratigraphic units and the distribution is absolutely continuous vertically as well as horizontally.

Figs.11 and 12 show the lumped horizontal distributions of piece-plotted lithic artifacts and faunal remains for both strata together and they also show the vertical distributions of these artifacts and bones + teeth by two «cuts» (rows S-U combined and rows V-X combined). (Gaps or low-density areas exist in the vertical distributions in part due to the existence of areas that had already been dug out [Lacroix's *sondages*] or that are occupied by bedrock of the eastern cave wall or the western bedrock floor slope.) The vertical distributions show no discernible lenses within YSS (although very locally, such distinctions were occasionally suspected, notably in square V8). They do show a few «high» outliers, but these are objects that were found atop or in crevices in the bedrock floor in the upslope «S» row. Most significantly, there is no indication of a break between items labelled as coming from YSS and those labelled as coming from BSC. The distributions are completely continuous both horizontally and vertically.

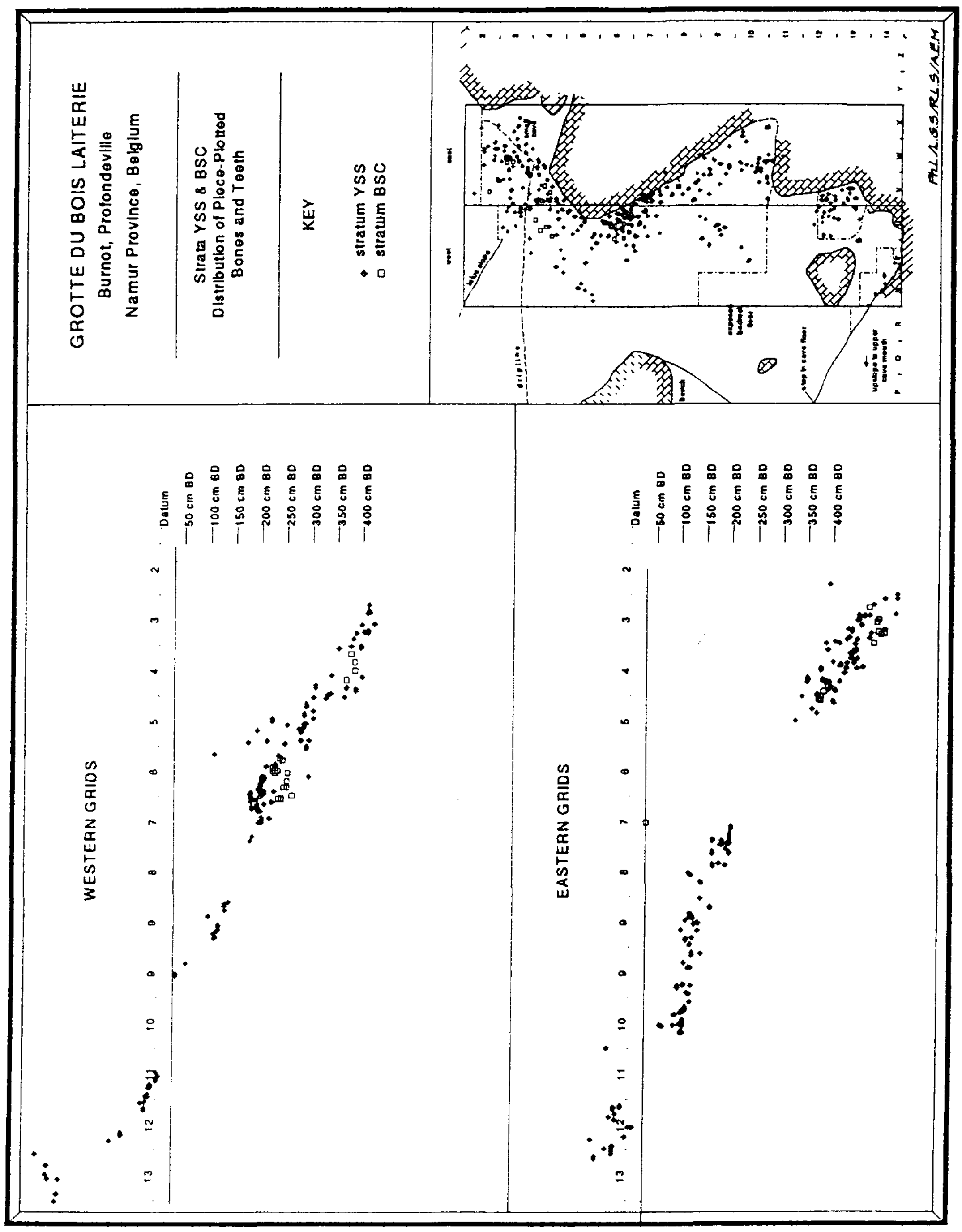

Fig.11- Vertical distribution of faunal remains in BSC + YSS.

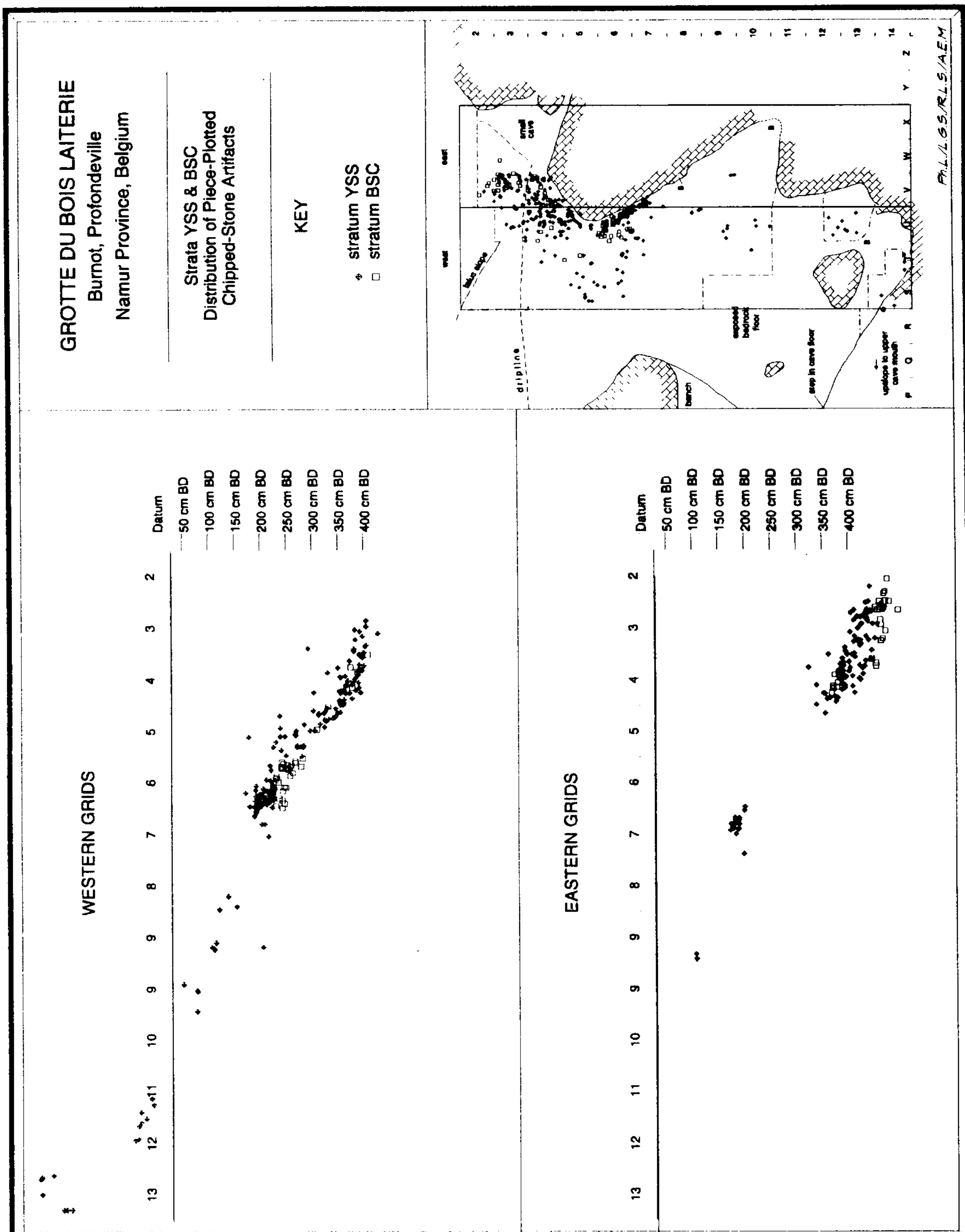

Fig.12 - Vertical distribution of lithic artifacts in BSC + YSS.

There are detailed differences in terms of the composition of the debris assemblages from YSS and BSC. In YSS, 9.5% are unretouched bladelets and only 5% in BSC; yet 43% of the tools from BSC are backed bladelets while there are only 19% in YSS. In YSS, 16% of the debris are blades, but only 8% in BSC. In YSS, 56% of the debris is composed of microdebitage (trimming flakes and shatter, both <1 cm), yet in BSC the relative frequency of these smallest lithics is 76%. In contrast, all three cores that were found *in situ* are from YSS. Overall, there is a statistically significant difference between the debris assemblages of YSS and BSC, but it is hard to interpret. It is possible that larger objects were prevented from migrating downward into BSC from YSS by their greater area, leading to a degree of size-sorting between the two units (or, in reality, *within* the stratigraphic horizon that contains Magdalenian artifacts).

Finally, lithic refits (dealt with in more detail below) also show the intimate archeological relationship (or identity) between YSS and BSC (Fig.13). Of the 32 sets of refits, fully 10 (nearly one-third) have elements from both strata that conjoin. This clearly suggests that the *archeological* subdivision of YSS and BSC is illegitimate, either because the assemblages come from one human occupation of the cave or, more likely, from several, closely-spaced epsiodes of use of the cave that became amalgamated by prehistoric human trampling and/or digging, by animal burrowing, by minor solifluction and/or cryoturbation, by rockfall and by the weight of overburden on the fairly plastic sediments of YSS and especially BSC (for comparisons, see, for example, P.Villa, 1977 and 1982; Villa and Courtin, 1983). Since no legitimate subdivision is possible, in all our typological and technological (and faunal) analyses, we lump data from YSS and BSC as «the Magdalenian horizon», even though it is likely to represent a palimpsest of more than one (but not many) occupation of the cave. In addition, there is a case of a lithic conjoin between YSS and the Grey Lens at its base, and several intra-YSS conjoins are separated by substantial vertical distances within the same square (the longest such cases being separations of 40, 45 and 46cm). Fully 23% of plaquette refits also cross-cut YSS-BSC. All this shows that the Magdalenian horizon cannot be analytically subdivided and therefore must be treated as one unit.

Orientations and Inclinations

In order to see whether there may have been natural processes that systematically rearranged the cultural materials in the Magdalenian deposit of Bois Laiterie, compass orientations and inclinations were measured and analyzed for elongated artifacts (mainly blades and plaquettes) and long bones. Were running water involved in deposition or disturbance of the Magdalenian, there should be alignments paralleling the direction of the flow. If soil creep or flow (solifluction) were operative, there should be alignments perpendicular to the axis of the slope and inclinations should be parallel to the angle of the slope. On the other hand, in the microenvironment of a cave, all kinds of confounding factors (cave walls, niches, anfractuosities, ledges, columns, etc.) can make the interpretation of results difficult or unclear.

The overall distribution of elongated object orientations for YSS is presented in a rose diagram (Fig.14). In these diagrams, compass orientation is based on the direction of the

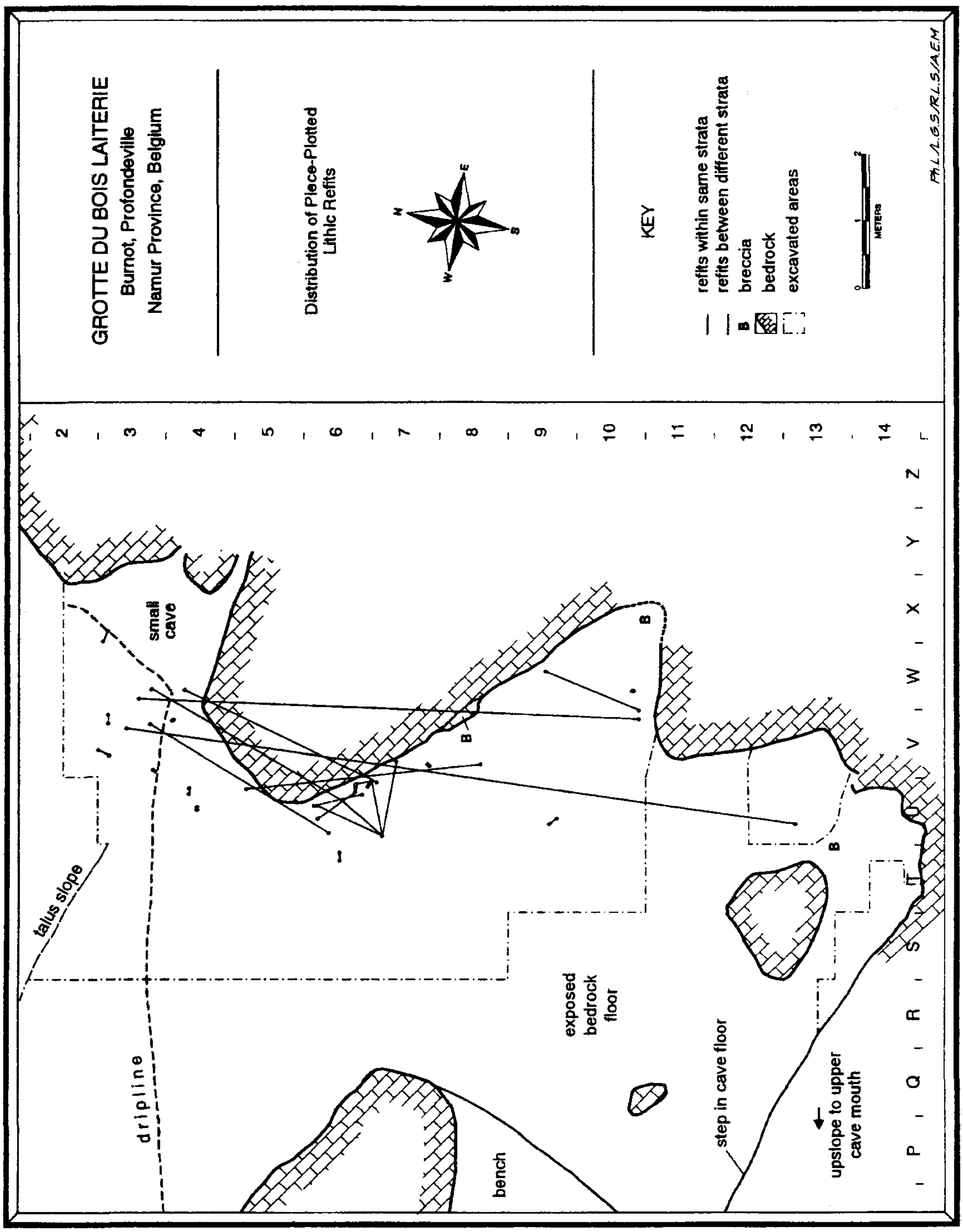

Fig.13- Plan of piece-plotted lithic refits, including inter-strata sets (YSS+BSC).

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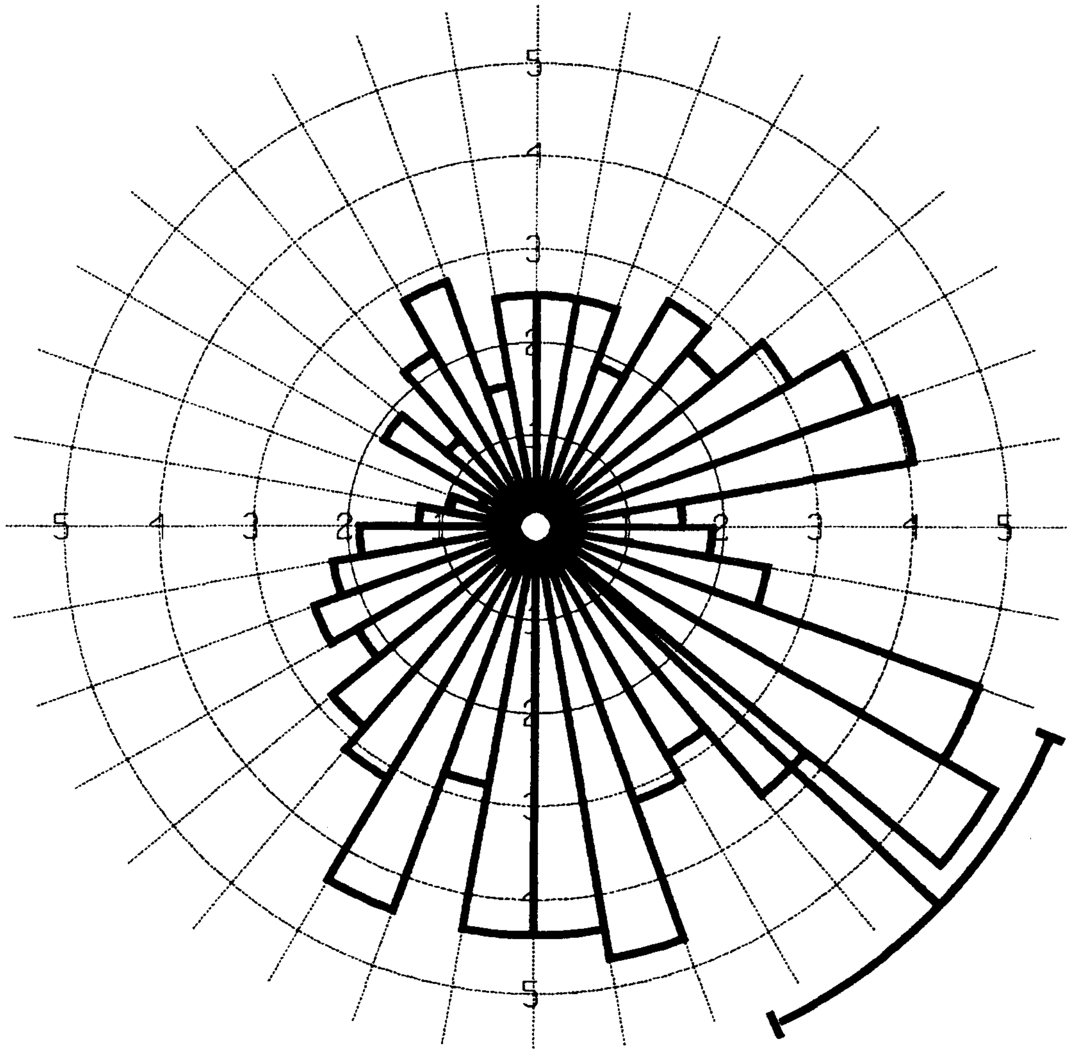
STRATUM YSS
Rose Diagram of General Orientation Information

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Calculation Method ... Frequency
Class Interval ....... 10 Degrees
Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 320
Maximum Percentage ... 5.6 Percent
Mean Percentage ...... 2.8 Percent
Standard Deviation ... 1.18 Percent
Vector Mean .......... 133.23 Degrees
Confidence Interval .. 20.98 Degrees
R-mag ................ 0.21
```

Fig. 14- YSS general - slab, artifact and bone orientations.

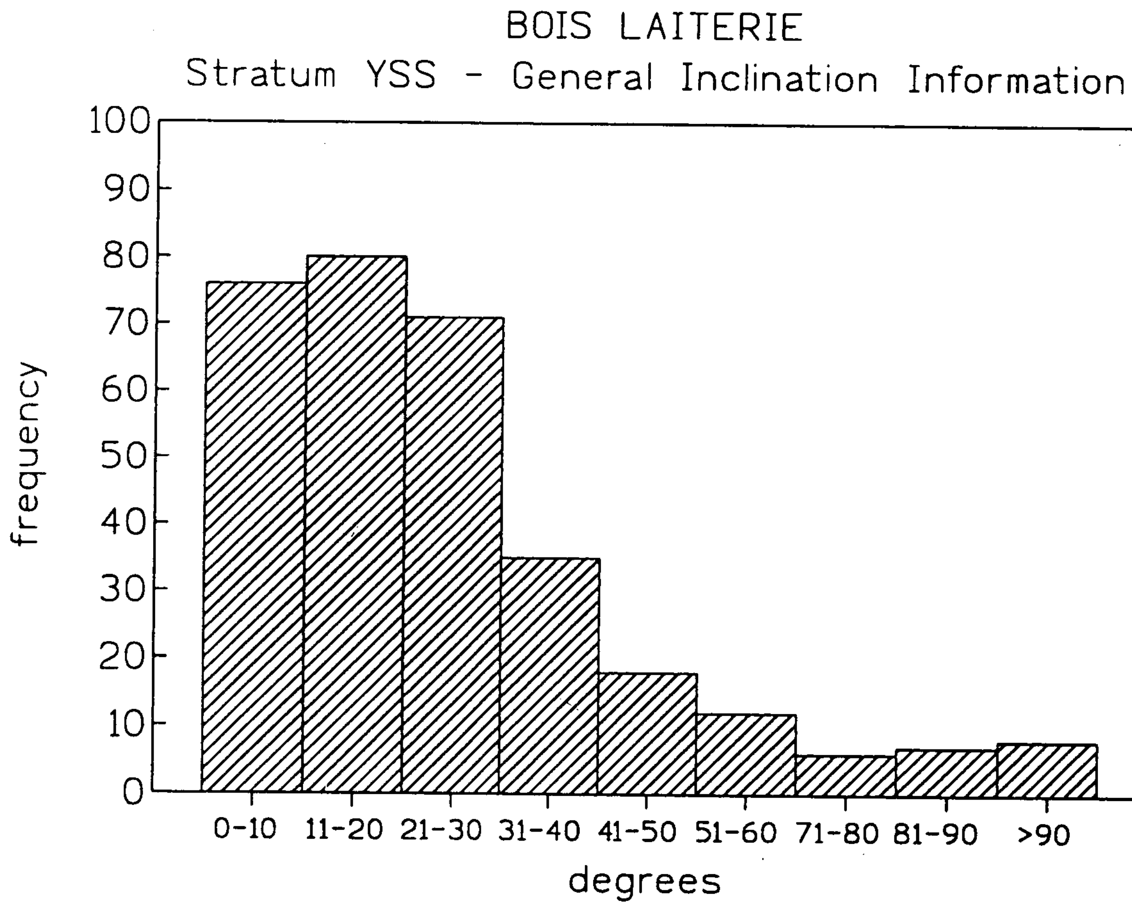

Fig.15- YSS general - slab, artifact and bone orientations.

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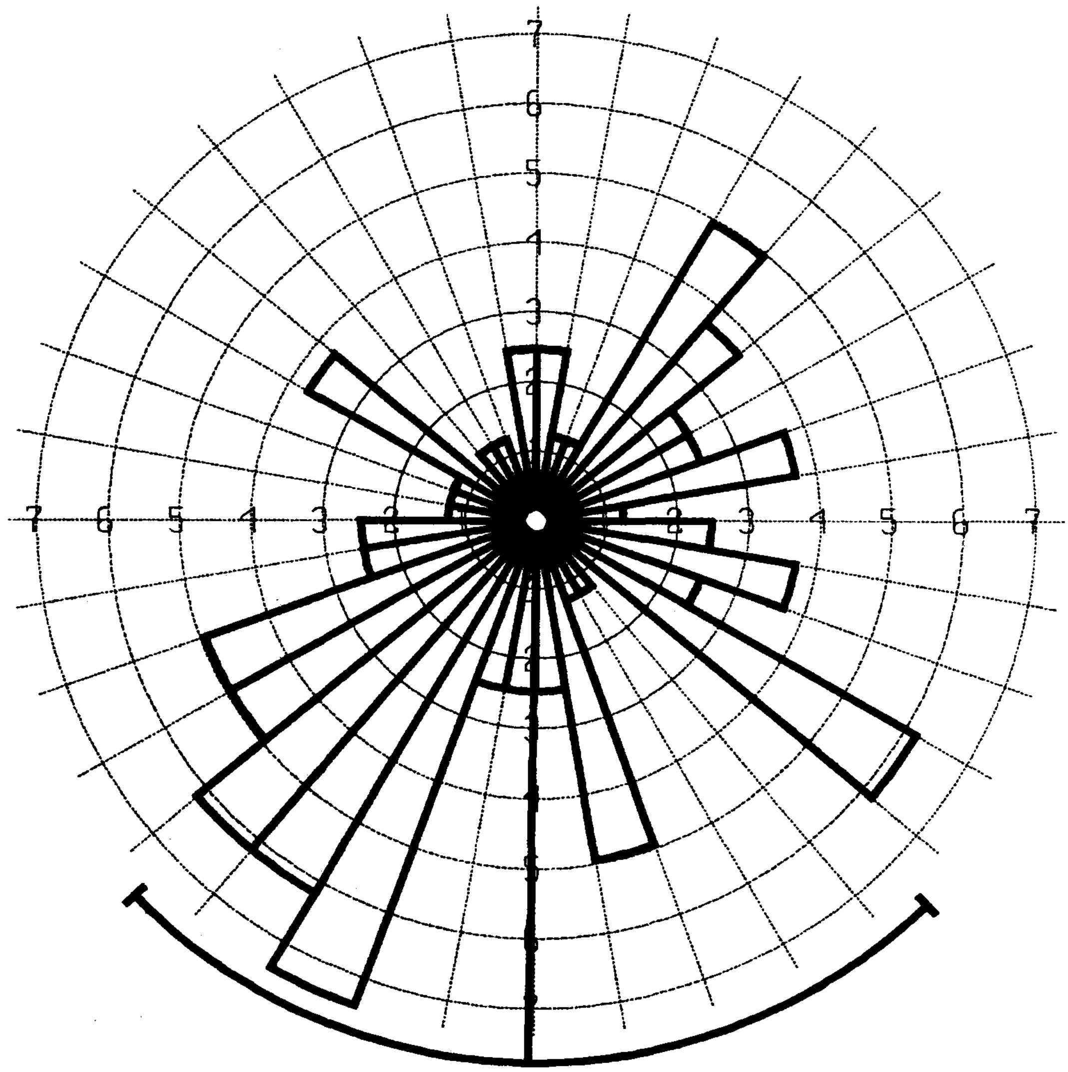
STRATUM YSS
Rose Diagram of Orientation Information for Cave Talus

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Calculation Method ... Frequency
Class Interval ....... 10 Degrees
Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 81
Maximum Percentage ... 7.4 Percent
Mean Percentage ...... 3 Percent
Standard Deviation ... 1.78 Percent
Vector Mean .......... 180.59 Degrees
Confidence Interval .. 45.64 Degrees
R-mag ................ 0.19
```

Fig. 16- YSS terrace - slab, artifact and bone inclinations.

higher end of each object (the upper end, as detemined by clinometer). Each concentric circle equals 1% of the total number of meansured items. Magnetic North (essentially the cave mouth) is at the top of the rose diagram. The heavy curved bar at the circumference describes 2 standard deviations around the mean orientation. The overall preferred orientation for all of YSS lies in the ESE direction, but with a second mode at essentially due South. The histogram of inclinations (Fig.15) of elongated objects from all of YSS (n = c.340 items) shows that over two-thirds lay between 0° and 30° (between flat and following the dominant slope angle of the cave bedrock floor).

The rose diagram (Fig.16) of orientations for the terrace area of the site (here labelled «talus» and corresponding to the 4-2 rows) displays a very wide dispersion of values, with none being truly predominant. This would seem to preclude any systematic rearrangement by running water, despite the exposed location at the edge of the precipitous talus in front of the lower and small cave mouths. Similarly, the inclination values (Fig.17) include relatively many items that are flat or sloping no more than 30°. This would suggest that, despite the exposed location, once buried (presumably very quickly) the artifacts and bones on the terrace atop the narrow ledge of bedrock were immune from movement. Artifacts and bones were, in fact, found down to contact with bedrock in YSS/ BSC all the way to the edge of the ledge midway north across the «2» row, at which point the bedrock plunges straight down and obviously the archeological material stops. The stability of the buried Magdalenian «surface» on this ledge is remarkable, particularly since it is also at the foot of a very steep exterior slope descending along the exposed upper cliff-face from the upper cave mouth to the West, as well as at the end of the internal South-North bedrock slope descending from the cave rear.

Distributions of values for orientation and inclination for the cave front area (7-5 rows) are very different from those of the terrace. Fig.18 shows a very strongly preferred orientation of due south, with a secondary mode at due north (*i.e.*, objects lined up along the axis of the cave, its eastern wall (where most of the finds are from) and the bedrock «gully». The objects are mainly following the lay-of-the-land, with their high ends toward the cave rear, although there are some (those of the North mode) whose tilt is diametrically opposite to that of the bedrock slope along the N-S axis. There is another secondary mode of orientations toward the ESE. Fig.19 shows that there are fewer flat-lying objects relative to ones lying between 11-30°, and there is quite a respectable number of steeply tilted items (10 lying between 51-90° or more). It is quite likely that in this zone of the site (especially the extremely rich square U6) there was a «wall effect»: items aligning themselves along the wall and therefore naturally taking on a N-S orientation. Trampling in this intensively used (sheltered by still relatively well-lit part of the cave, combined with moist sediments, may have been the cause of the extreme angle of many of the cultural items. It is precisely in this sector that the base of the Magdalenian horizon consists of the most plastic, most purely clayey area of BSC, first defined, in fact, in U6. It is also here, probably not coincidentally, that we found by far the densest concentration of plaquettes. Probably people were obliged to make a bit of paving investment here in order that the best part of the cave not be excessively muddy, slippery and unpleasant underfoot. But the very moisture in the U6 area contributed to extensive *in situ* movement due to trampling and overburden weight. This means that things got rearranged within the clayey matrix without actually travelling significant distances laterally.

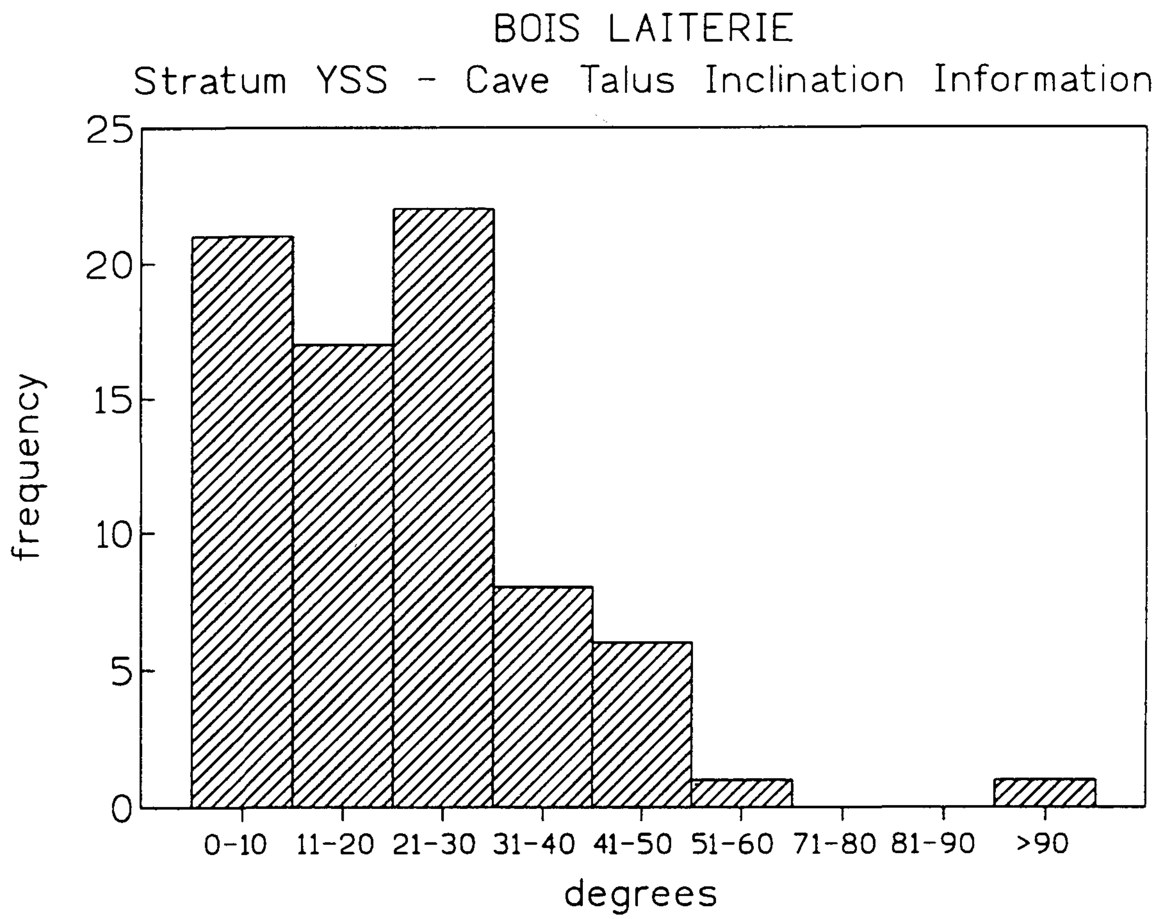

Fig.17- YSS terrace - slab, artifact and bone inclinations.

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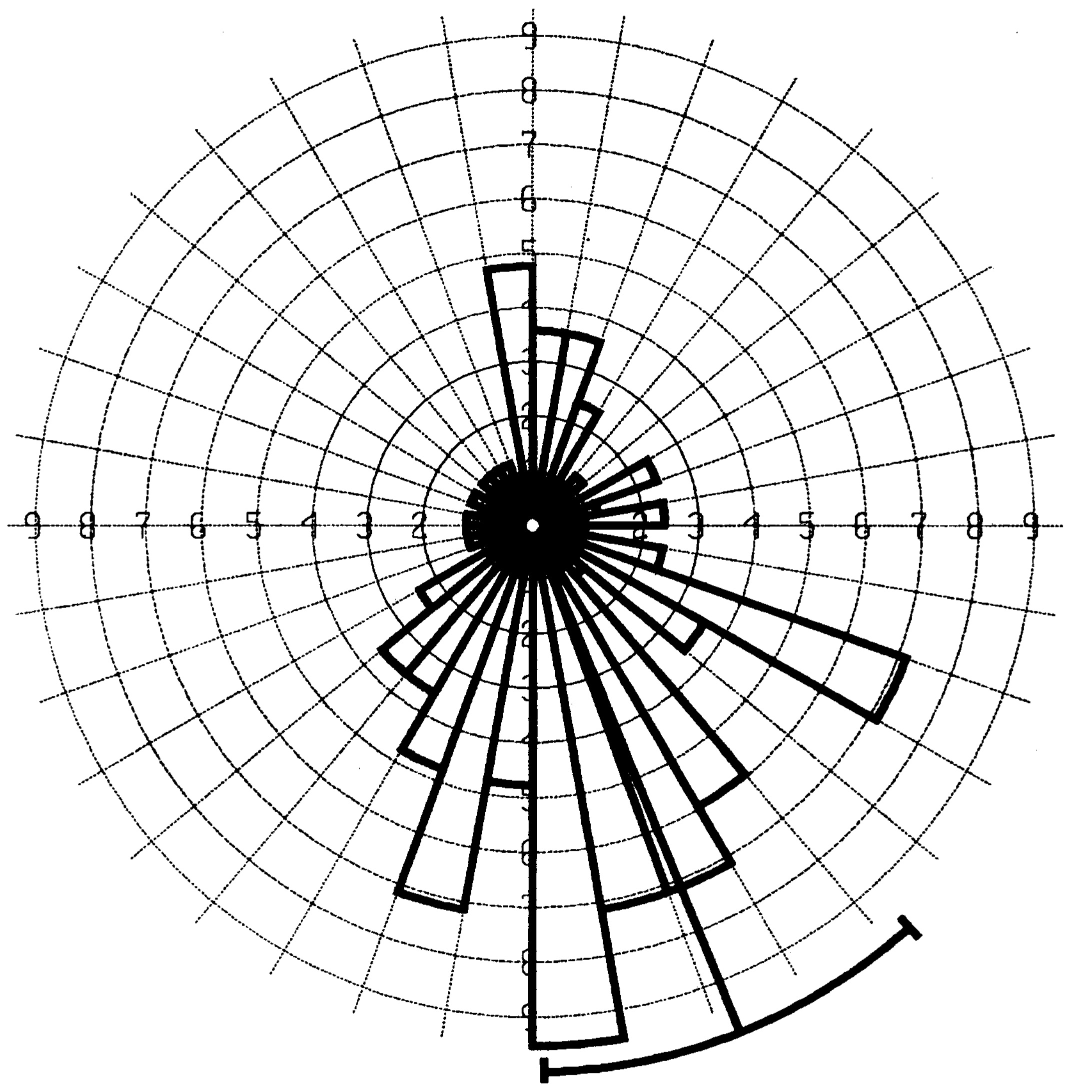
STRATUM YSS
Rose Diagram of Orientation Information for Cave Front



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Calculation Method ... Frequency
Class Interval ....... 10 Degrees
Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 84
Maximum Percentage ... 9.5 Percent
Mean Percentage ...... 3.4 Percent
Standard Deviation ... 2.39 Percent
Vector Mean .......... 158.06 Degrees
Confidence Interval .. 20.69 Degrees
R-mag ................ 0.4
```

Fig.18- YSS cave front - slab, artifact and bone orientation.

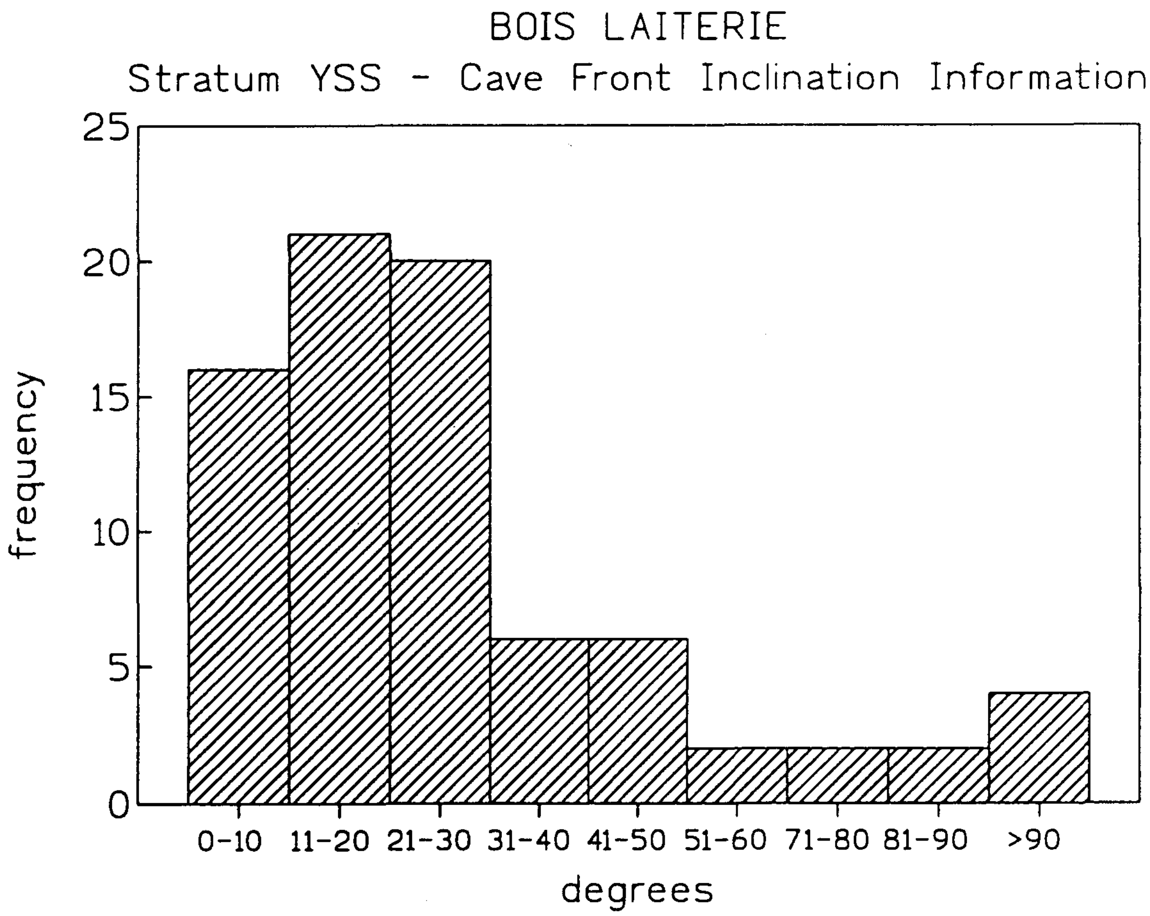

Fig.19- YSS cave front - slab, artifact and one orientations.

Orientation values are not so clearly dominated by one axis in the center of the cave (rows 8-10) (Fig.20); objects seem to be scattered across a wide variety of orientations, although there are modes at ENE, SE, and, secondarily at due south and at WNW. There are more items lying flat or close to it (0-2°) than at the cave front, and fewer lying at very steep or even vertical angles (Fig.21).

Sample size of elongated objects is more limited in the cave rear (rows 11-14), since much less was excavated there. Again, however, there is a very wide scatter of orientations (Fig.22), which would seem to preclude a significant role for running water. The histogram of inclination values is unlike any of the others, however (Fig.23), with two modes: a major one centered on values around 20° (but with very few items lying really flat) and a secondary mode of items lying vertically (or just under, or just over 90°). At the cave rear, YSS was in direct contact with the steeply sloping bedrock floor. Here, unlike in the cave center and front, humans found no strip of more or less level basal sands filling a bedrock «gully» when they first occupied the site. It is probable that they mainly used the dark cave rear as a «toss zone», since there is little artifactual, combustion or micromorphological evidence for actual intensive habitation of this zone (see below and Courty, this volume).

The sample being limited both quantitatively and spatially (cave front and part of the terrace only), we just give global figures (Figs.24 and 25) for orientations and inclinations in BSC. The former are quite scattered, but (as with YSS in the cave front) there is a preferred orientation at SSE, with objects tilted parallel to the long axis of the cave's bedrock floor. The diagram may be confounded somewhat by the inclusion of items from the terrace, where a more «random» scatter of orientations may be expected. Inclinations include many flat or nearly flat items, as in YSS on the terrace, but with a number of items more steeply tillted, especially between 30-70°. Overall, however, the histogram resembles that of YSS for the cave center. There is nothing in these rose diagrams or histograms that cannot be explained by local «wall effect», «lay-of-the-land effect», trampling without extensive lateral movement, or random scatter that may indicate areas of relatively intact deposits of cultural residues. The distribution maps tend to support this view and the good state of preservation of the bones and lithics militates against any catastrophic or even forceful movement by running water, solifluction, cryoturbation, etc., although it is undeniable that some local movement has occured, probably mostly after the items had been buried at least to some extent in the sedimentary matrix.

Distributions and «Latent Structures».

Inspection of the distribution maps of piece-plotted artifacts, plaquettes and faunal remains (Figs.1-10) show a fairly small, linear and very dense concentration of items along the easten cave wall toward the front of the cave, especially in and around U6. There is a broader, somewhat less dense concentration of especially artifacts and fauna on the terrace in front of the lower cave mouth and under the overhang of the small cave. The distribution of plaquettes is much less continuous between these two areas than are the distributions of artifacts and fauna; there is also a secondary cluster of piece-plotted plaquettes in the small cave area.

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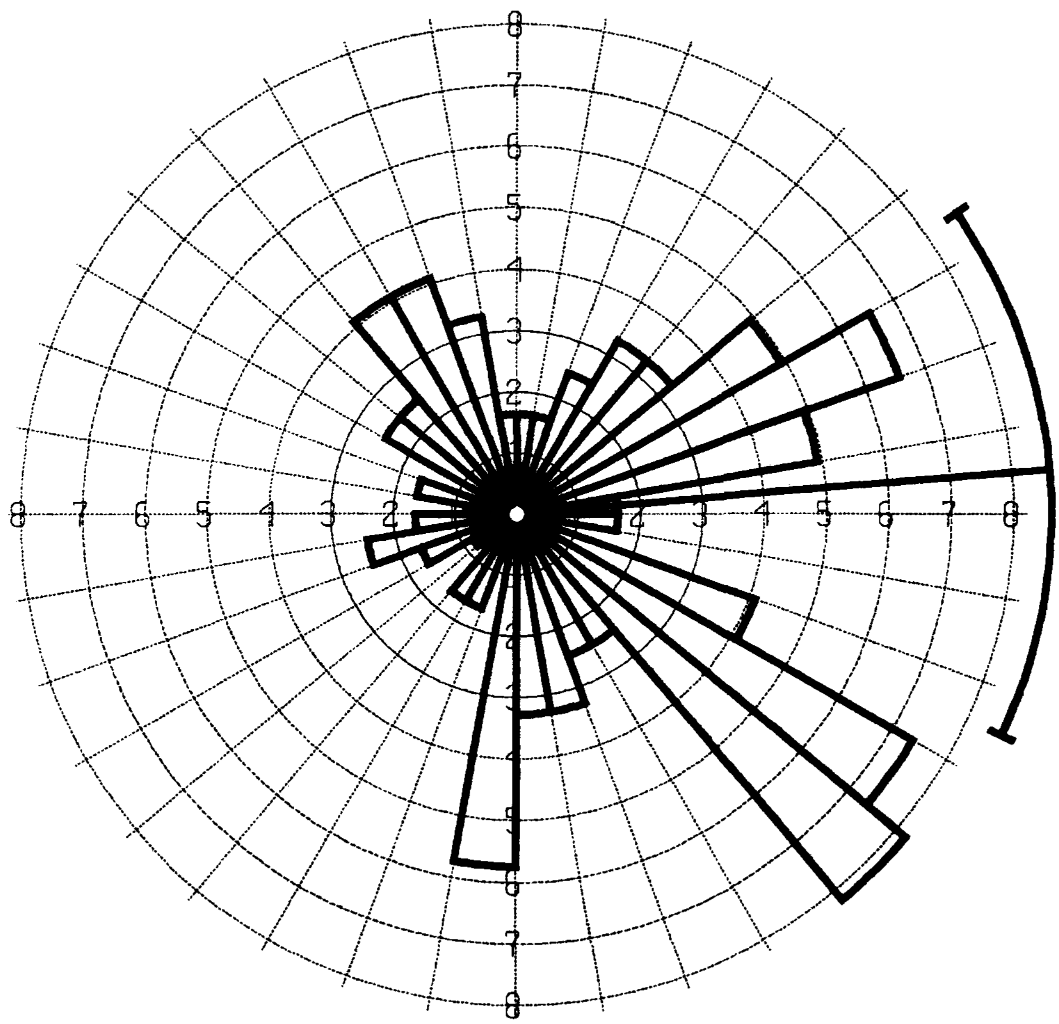
STRATUM YSS
Rose Diagram of Orientation Information for Cave Center



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Calculation Method ... Frequency
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Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 122
Maximum Percentage ... 8.2 Percent
Mean Percentage ...... 3.1 Percent
Standard Deviation ... 1.86 Percent
Vector Mean .......... 85.03 Degrees
Confidence Interval .. 29.78 Degrees
R-mag ................ 0.24
```

Fig.20- Bois Laiterie, YSS cave center - slab, artifact and bone inclinations.

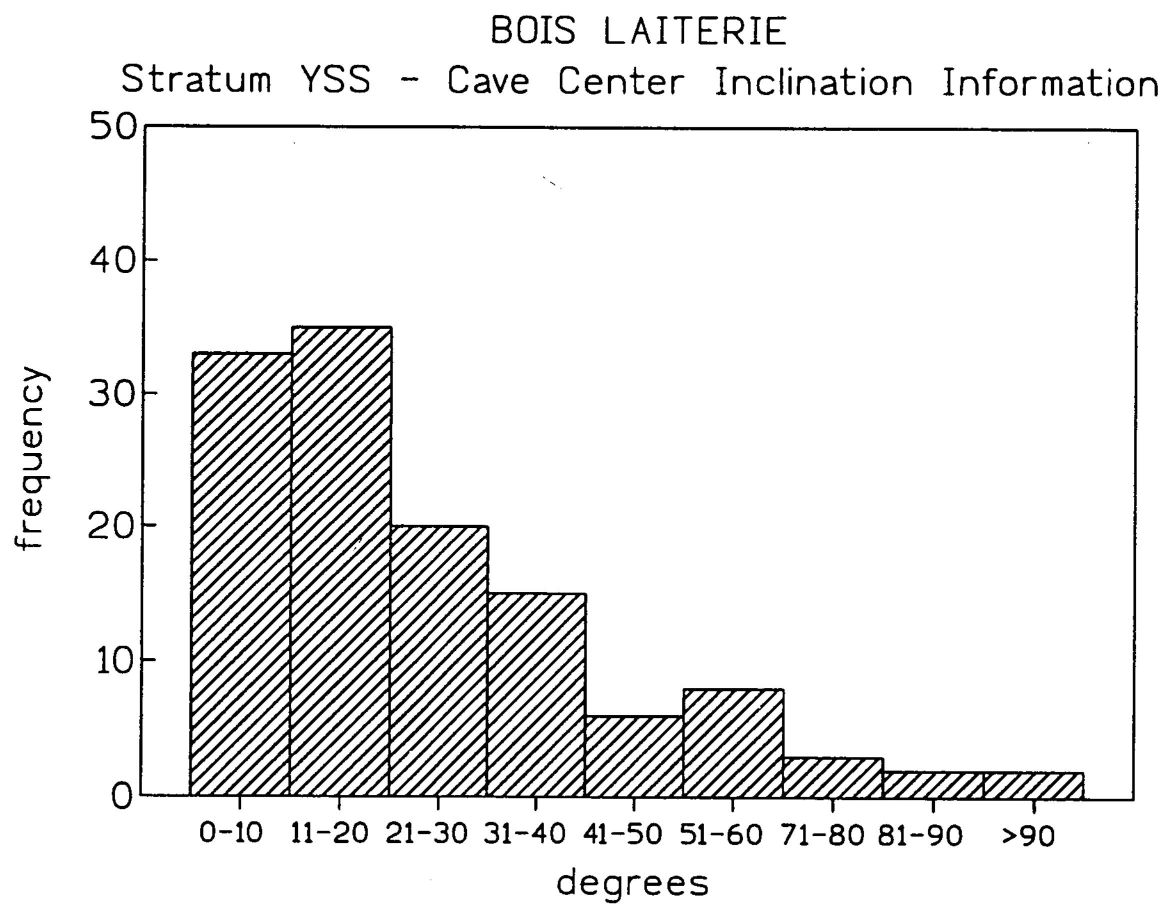

Fig.21 - Bois Laiterie, YSS cave center - slab, artifact and bone inclinations

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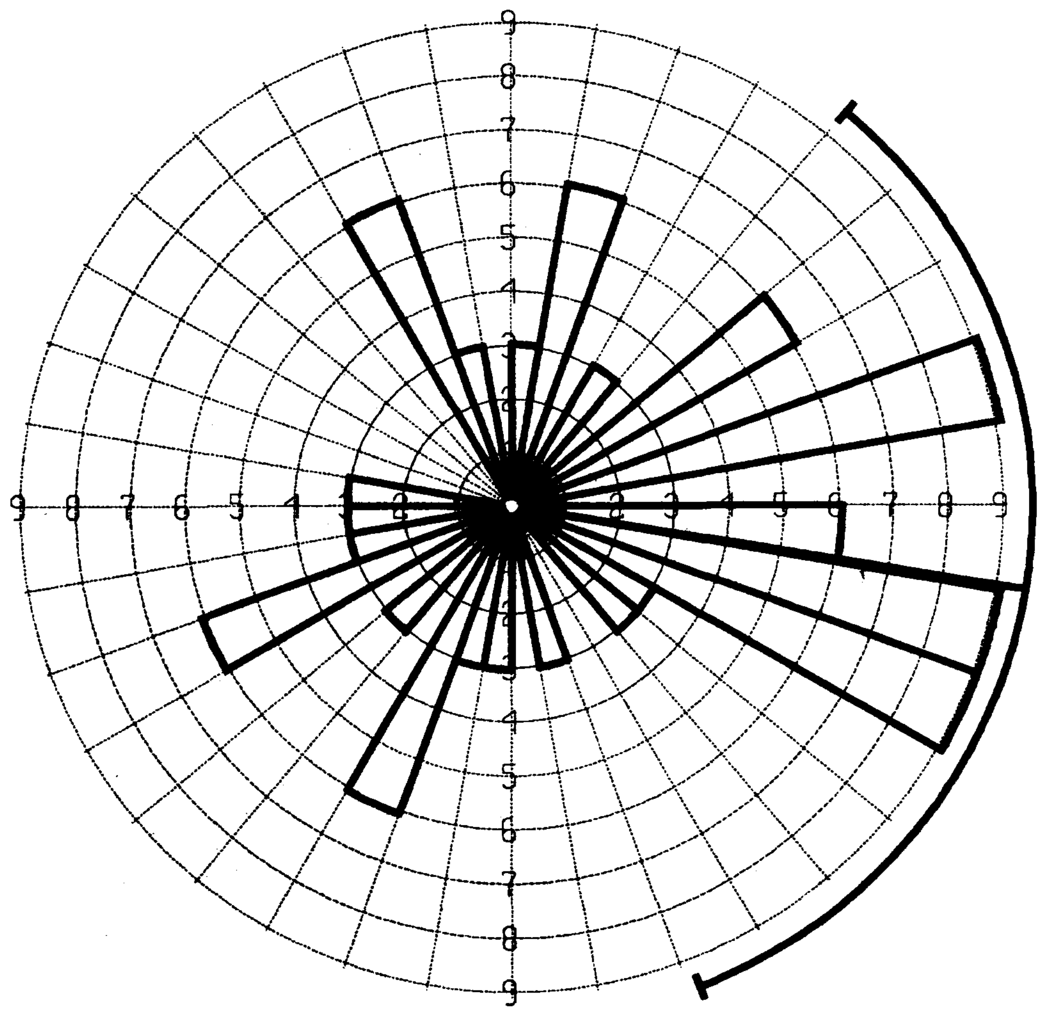
STRATUM YSS
Rose Diagram of Orientation Information for Cave Rear

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Calculation Method ... Frequency
Class Interval ....... 10 Degrees
Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 33
Maximum Percentage ... 9.1 Percent
Mean Percentage ...... 4.8 Percent
Standard Deviation ... 2.26 Percent
Vector Mean .......... 99.41 Degrees
Confidence Interval .. 59.34 Degrees
R-mag ................ 0.23
```

Fig.22 - Bois Laiterie, YSS cave rear - slab, artifact and bone orientations.

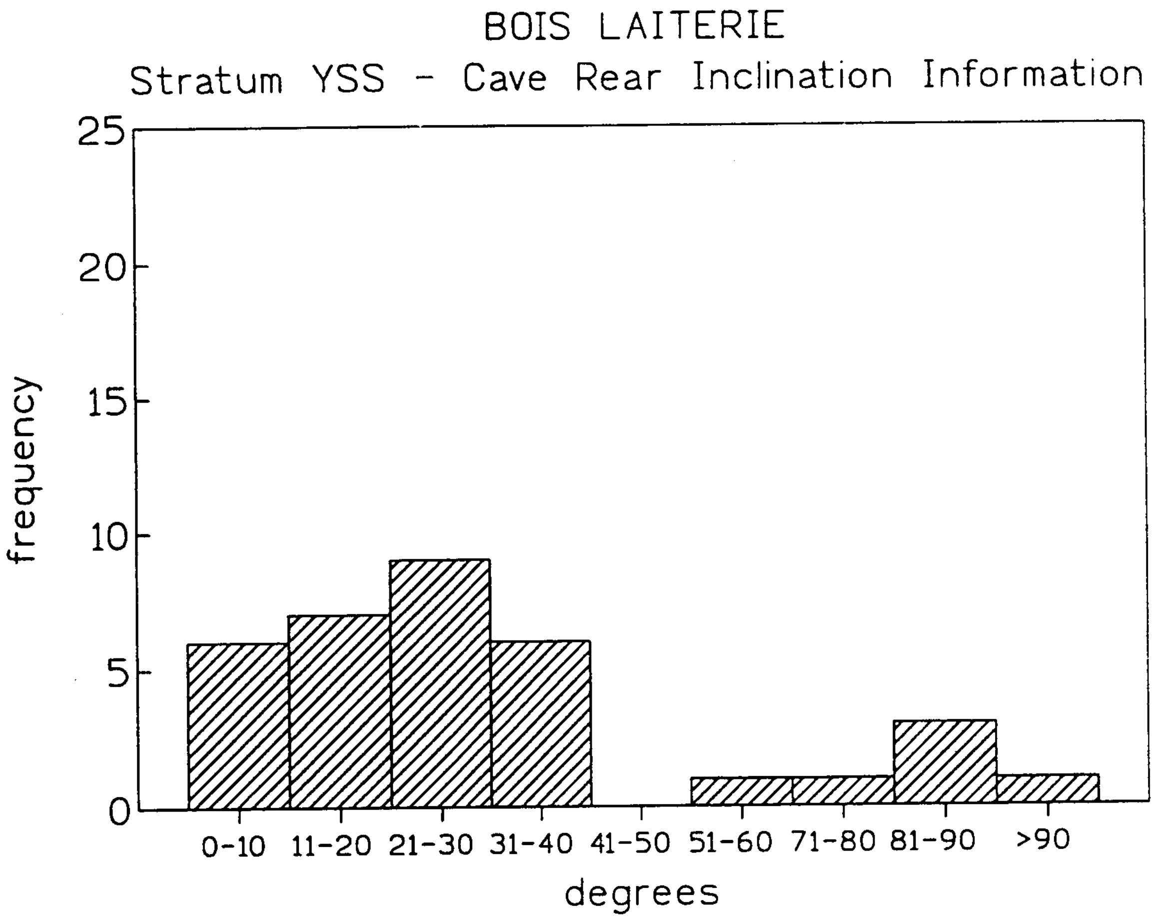

Fig.23 - Bois Laiterie, YSS cave rear - slab, artifact and bone inclinations.

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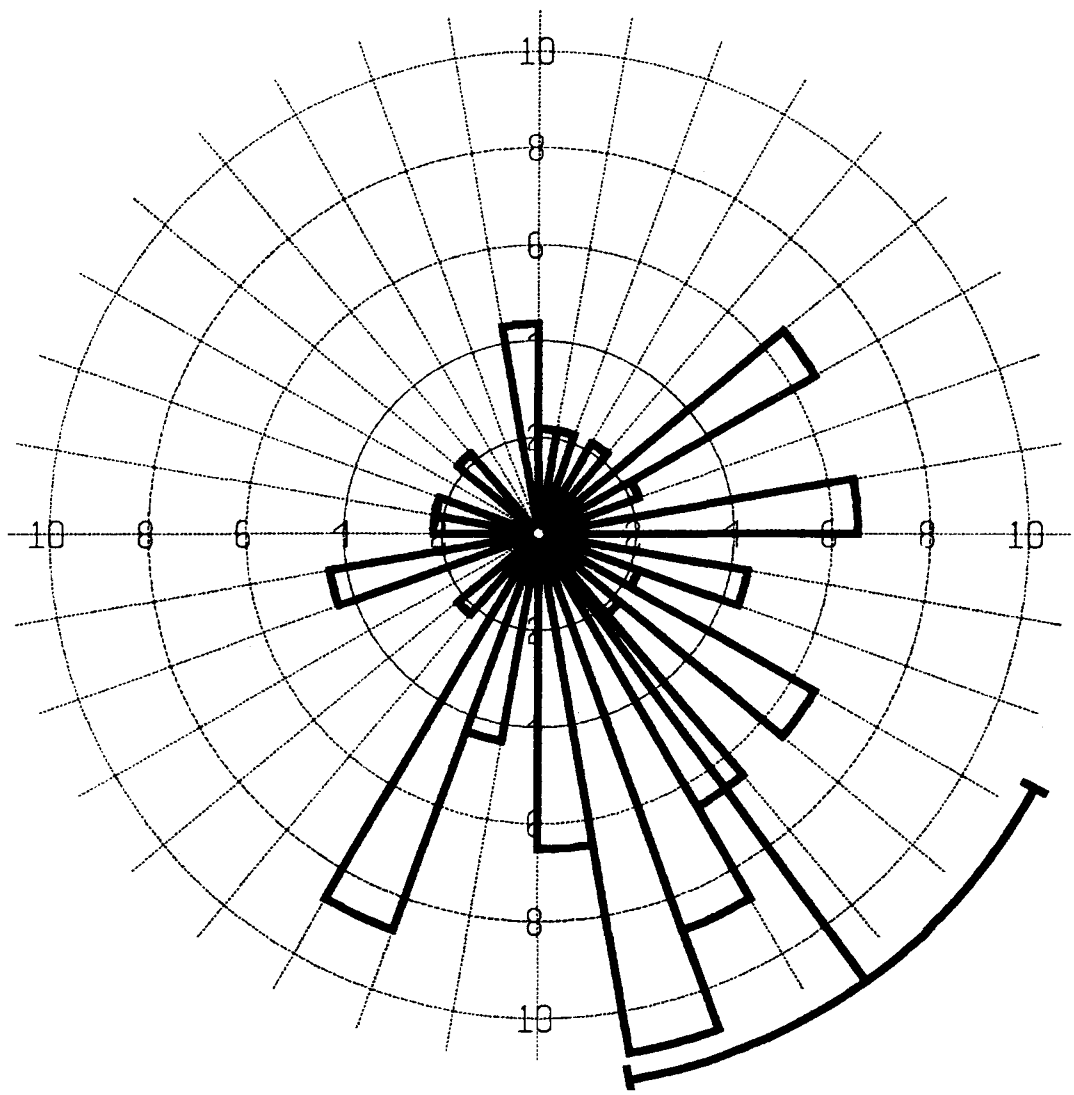
Namur Province, Belgium

STRATUM BSC
Rose Diagram of General Orientation Information



```
Calculation Method ... Frequency
Class Interval ....... 10 Degrees
Filtering ............ Deactivated
Data Type ............ Unidirectional
Rotation Amount ...... 0 Degrees
Population ........... 46
Maximum Percentage ... 10.9 Percent
Mean Percentage ...... 4.5 Percent
Standard Deviation ... 2.68 Percent
Vector Mean .......... 143.98 Degrees
Confidence Interval .. 26.54 Degrees
R-mag ................ 0.42
```

Fig.24 - Bois Laiterie, BSC general - slab, artifact and bone orientations.

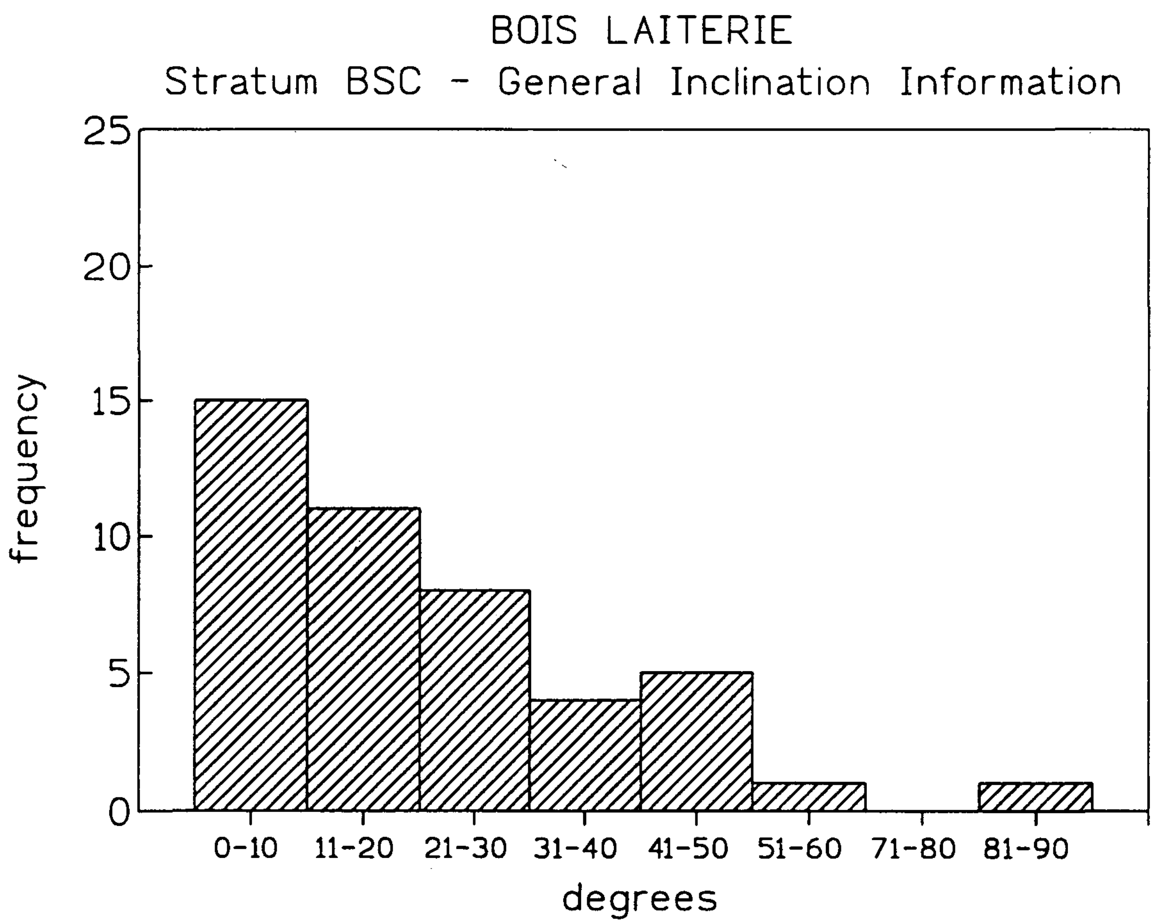


Fig.25 - Bois Laiterie, BSC general - slab, artifact and bone inclinations.

Although artifacts and faunal remains are scattered throughout the central and rear areas that we excavated (note, again, that there are gaps in the distribution plans that correspond to areas tested by Lacroix in 1990-91), there are no distinct clusters, except perhaps bones and teeth in and around W11 and in U-V/13. In general, artifacts are very scarce in the cave rear and plaquettes are virtually absent to the south of the «8» row. In general, these conclusions are supported by the plans that show distributions of non-piece-plotted («grid-collected») large debitage (Fig.26), microdebitage (Fig.27) and faunal remains (Fig.28) that were recovered in the screens. These plans and the piece-plot distributions not only show denser concentrations of artifacts at the east-front of the cave and on the terrace, but also hint at the nature of the activities that may have caused them. There seems to have been a paved area around U6-7 (no doubt including squares immediately upslope, some of whose plaquettes slid down and piled up against the eastern wall). This same area shows the only (albeit scanty) cluster of cortical lithics, a definite concentration of blades and large debitage of all sorts and an extraordinary concentration of microdebitage. The implication is that this area, sheltered, relatively well-lit and whose surface was made dry, flat and solid by limited slab paving, was a (the) principal locus for flint-knapping (probably tool + weapon production and reworking). This area is also rich in both piece-plotted and grid-collected faunal remains.

Formal, retouched tools are abundant both on the terrace and in the east-front area of the cave, but become progressively rarer toward the cave rear, south of the «7» row. It is as if tools were not used (or discarded) in the darkest areas of the cave, which makes eminent sense. On the other hand, the large sagaie fragments were found by Lacroix at the cave rear. But these are, after all, broken discards (and with traces of possible animal gnawing). One of the three cores was found at the very back of the cave in V13, as if it had been thrown back there once exhausted. It is likely that most activities producing lithic debris and tool abandonment (except in the cases of active «tossing» - either down the talus in front of the terrace and toward the cave rear) would have taken place in on the terrace under the rockshelter overhang and in the immediate (sunlit) front zone of the cave. This localization would really be obligatory, due to the north-facing and draughty nature of Bois Laiterie, with the cave center and rear being poor places to be or to try to do any craft activity for any length of time. The concentrations of manuports, debris, tools and (to a lesser exent) faunal remains tend to bear out this logical hypothesis.

One more distribution plan (Fig.29) lends further evidence to the notion that «latent structures» are perceivable even in this limited, slightly reworked spatial record: burnt items (bones and, especially, flints). There are virtually no burnt objects inside the cave. There is essentially one concentration of burnt objects: right outside the cave mouth on the terrace. This concentration corresponds to the area of the «grey lens» within/at the base of YSS, and probably represents an area of bonfire building. There was no evidence of firepit construction nor any concentration of fire-cracked rock. Fires may simply have been built on the surface of the rockshelter area and material from them eroded toward the talus. This burning area is *surrounded* by plaquettes. On the other hand the cluster of burnt objects corresponds to (overlaps with) significant concentrations of lithic debris (including two cores and cortical items), tools and faunal remains. In contrast to the «U6» concentration of artifacts, plaquettes and faunal remains, which has essentially no burning evidence, this terrace «bonefire» zone (centered on V-W/4-W3) suggests the existence of a second activity area. A rather *ad hoc* paved area around a fire was used to make (or rework) blanks, tools and weapons, to butcher, process and/or consume animal carcasses.

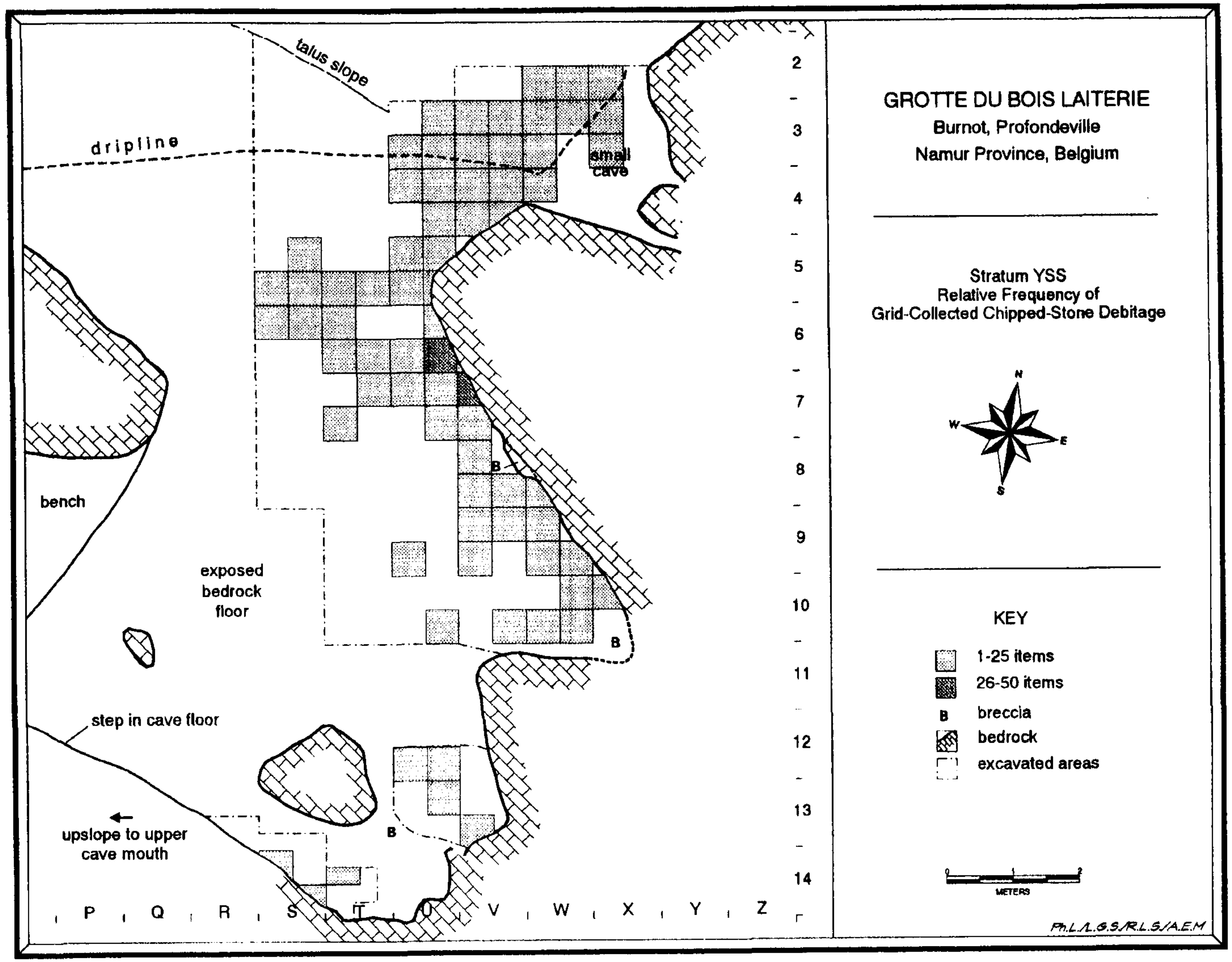


Fig.26 - Bois Laiterie, YSS, distribution of non-piece-plotted large debitage.

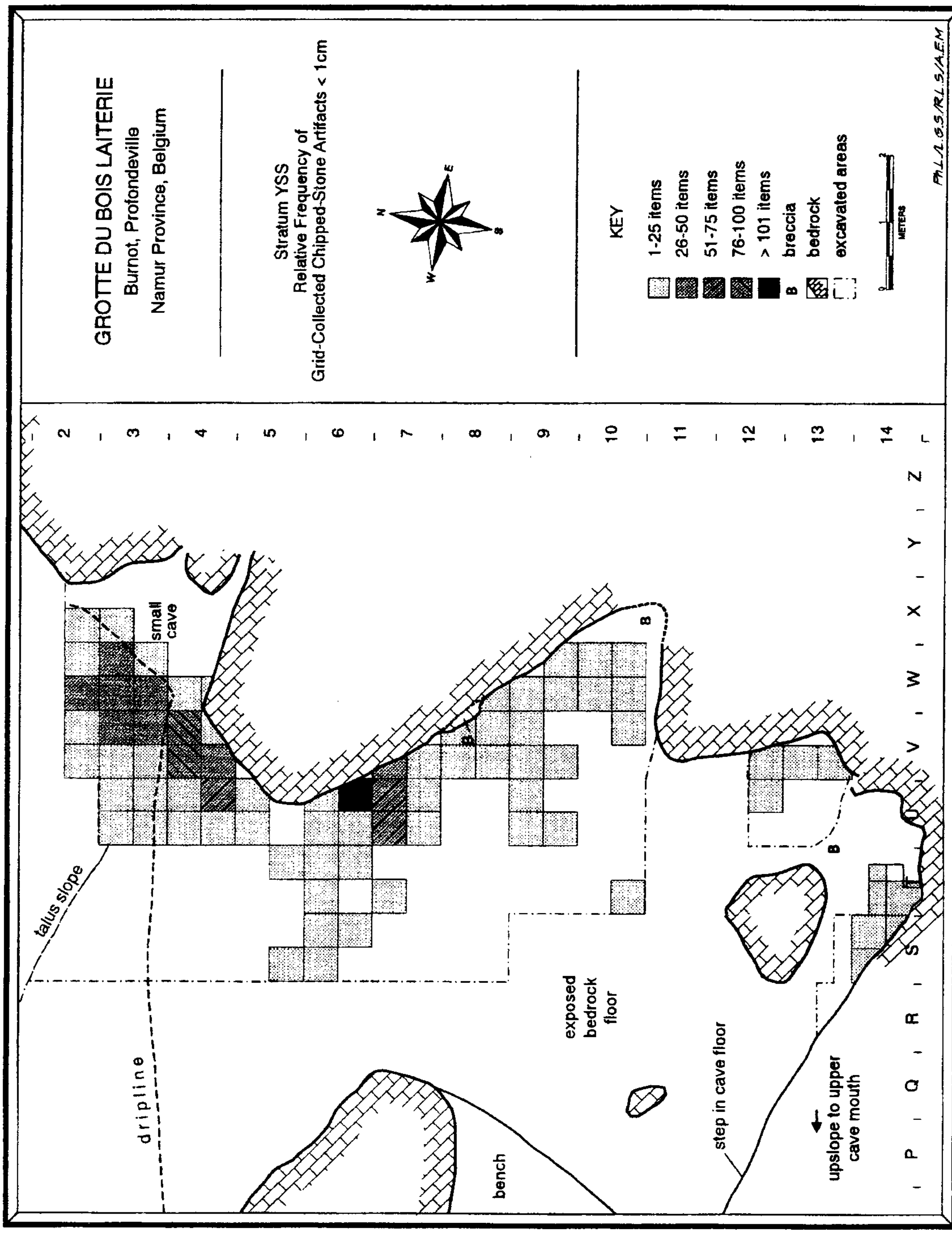


Fig.27- Bois Laiterie, YSS, distribution of non-pieced-plotted microdebitage.

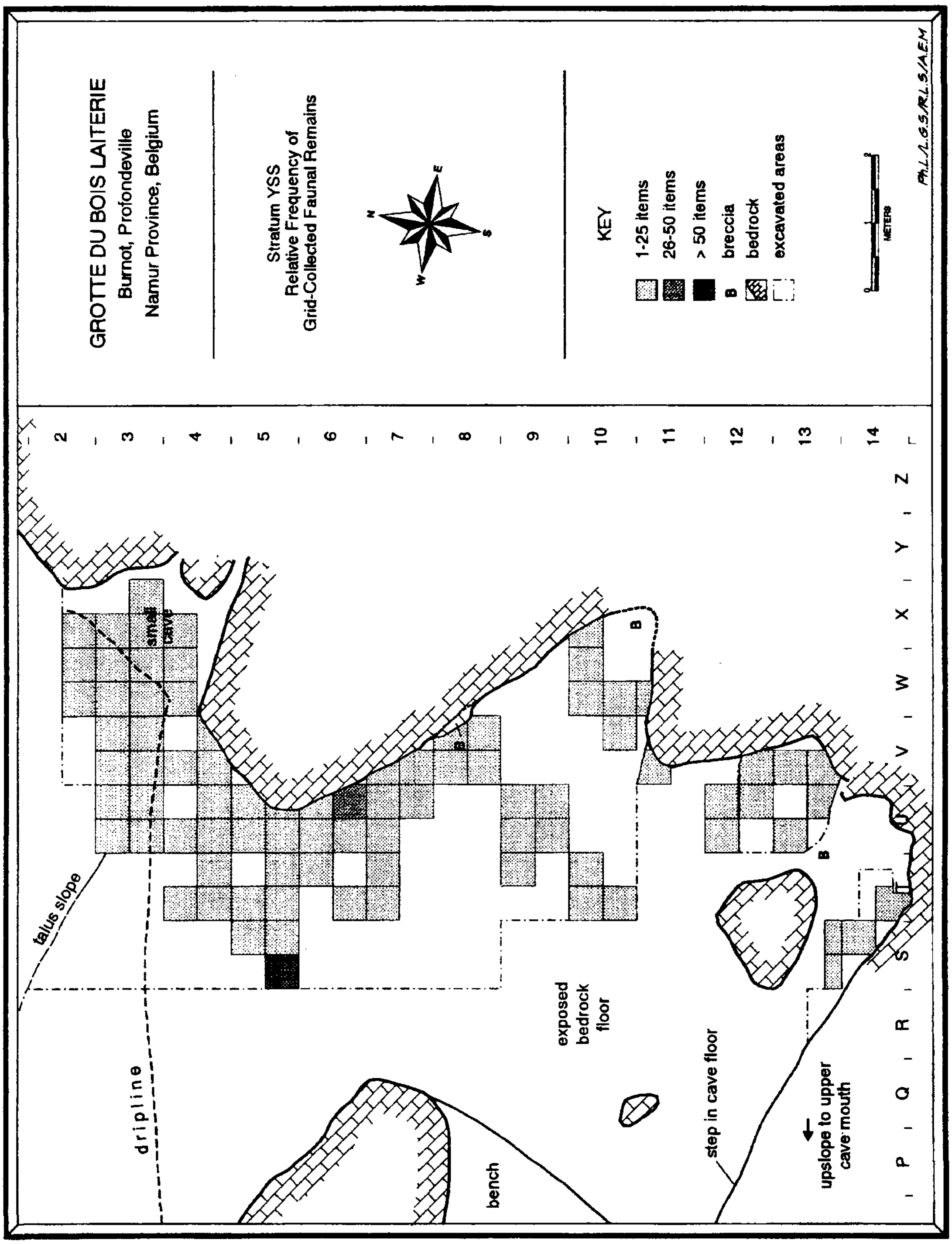


Fig.28- Bois Laiterie, YSS, distribution of non-piece-plotted faunal remains.

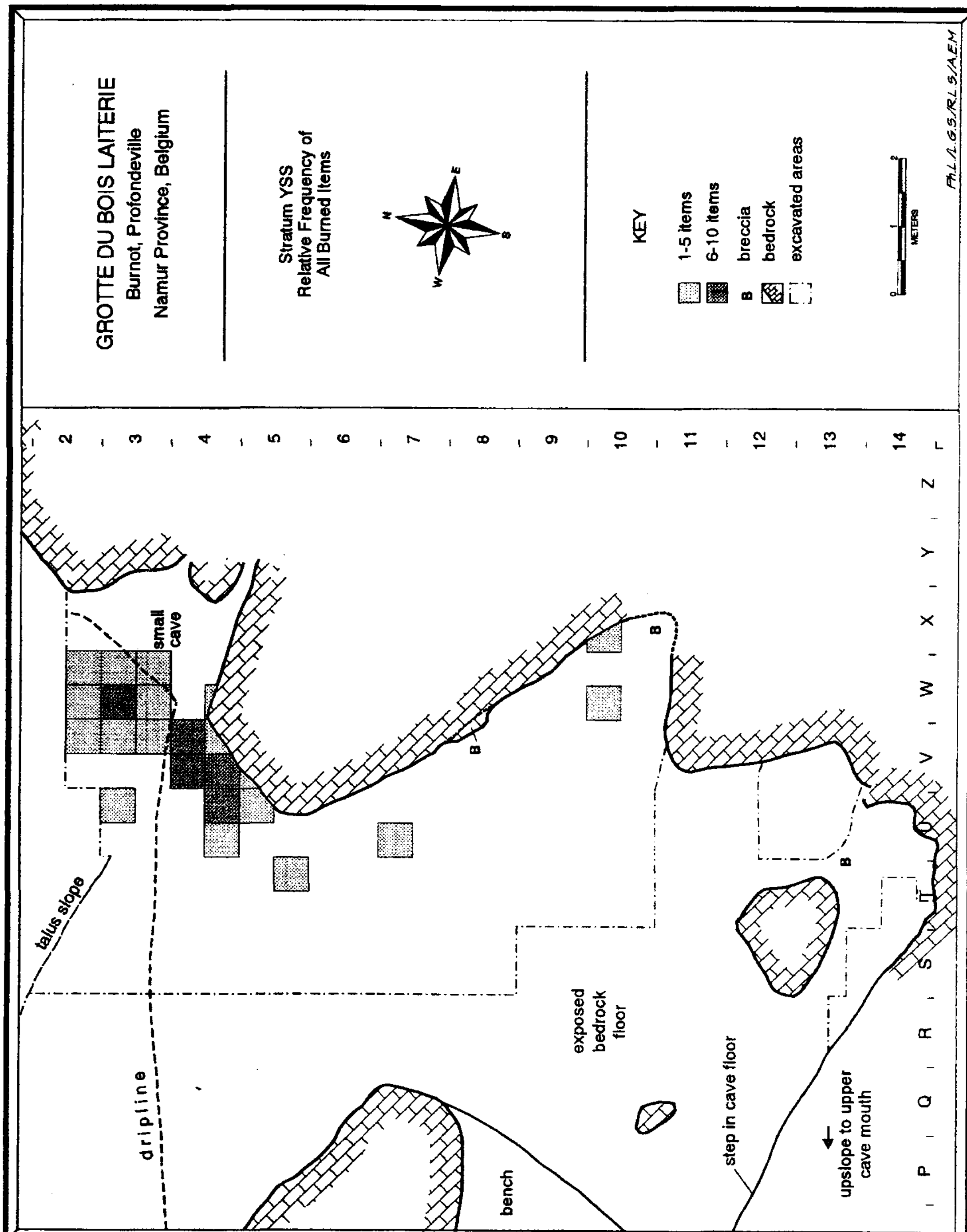


Fig.29 - Bois Laiterie, YSS, distribution of burned items.

Interestingly, the exotic Miocene and Eocene fossils shells show no real concentrated distribution within the site. The original two discoveries of perforated fossils were made by Lacroix near the cave rear. However our six discoveries (four perforated and two non-perforated) came from both the terrace and from the cave center. Other «oddities» that may have been collected more locally by Magdalenian humans (fossil sponge, corals, urchin spines, pyrite) were also widely distributed throughout the site (cave rear, center and terrace). The one worked «pendant» (unilaterally bored circular sandstone object) was found near the cave rear in a nook next to the eastern wall in W11. Its location might be suggestive of caching behavior.

The loci for actual activities (besides caching and toss-discard) at this site were thus mainly at the front of and immediately outside the cave on the sheltered terrace. This evidence of far more intensive human activity at and outside the front of the cave than in the deeper interior, is confirmed by the interpretation of micromorphological analyses (see Courty, this volume). Just as for us, the cave interior would not have been a pleasant (or even tenable) place for Magdalenian humans to stay very long - even in summer - because of its darkness, draughtiness, and humidity. In addition, the ceiling is very low at the cave rear, which we had to excavate on hands-and-knees. Light and the ability to keep dry from the rain and warm, away from the drafts of the cave interior, with the use of simple fires, were the chief locational criteria for the apparent activity areas at the front of the cave and on the terrace. A modicum of preparation was involved, namely the collection of psammite slabs in the immediate vicinity of the cave to provide dry, stable surfaces on which to stand, sit and squat atop the muddy, slippery clayey-silt ground (we needed to do the same kind of *ad hoc* preparation of the ground surface with flat stones in the areas of the talus where we screened and ate lunch). This leads us, finally, to a discussion of the psammite plaquettes (so characteristic not only of BL, but also of the other Magdalenian cave sites of the upper Belgian Meuse basin).

«Plaquettes» (Psammite and Sandstone Slabs)

We piece-plotted a total of 316 plaquettes and larger fragments (generally those more than about 5 cm in length). Another 427 small plaquette fragments were found among all the strata (including the old backdirt), collected by subsquare and spit, and weighed.

Most plaquettes are from YSS, but with a significant number from BSC, especially in the massive, thick, stratigraphically transgressive plaquette concentration centered on square U6 (Figs.30-32). As noted above, the «bonfire» area against the cliffbase on the terrace is «ringed» by plaquettes, mainly pertaining to YSS. There are virtually none in the cave interior, except for a small concentration of plaquettes (often «stacked up» against the eastern cave wall and generally quite tilted) in V8-9 at or near the top of YSS (as if they had slid downslope and come to rest in this spot). The presence of a few slabs (including some notably large ones) cemented to the bedrock cave floor in the T, S and R rows points to the source of some of the plaquettes that had moved down to the eastern edge of the cave and suggests that paved areas of the site were originally somewhat less localized along that eastern wall. Nevertheless, the presence of underlying sediments filling the bedrock «gully» (including the very clayey, plastic BSC in precisely the area with the greatest numbers of plaquettes in the cave front) at the time

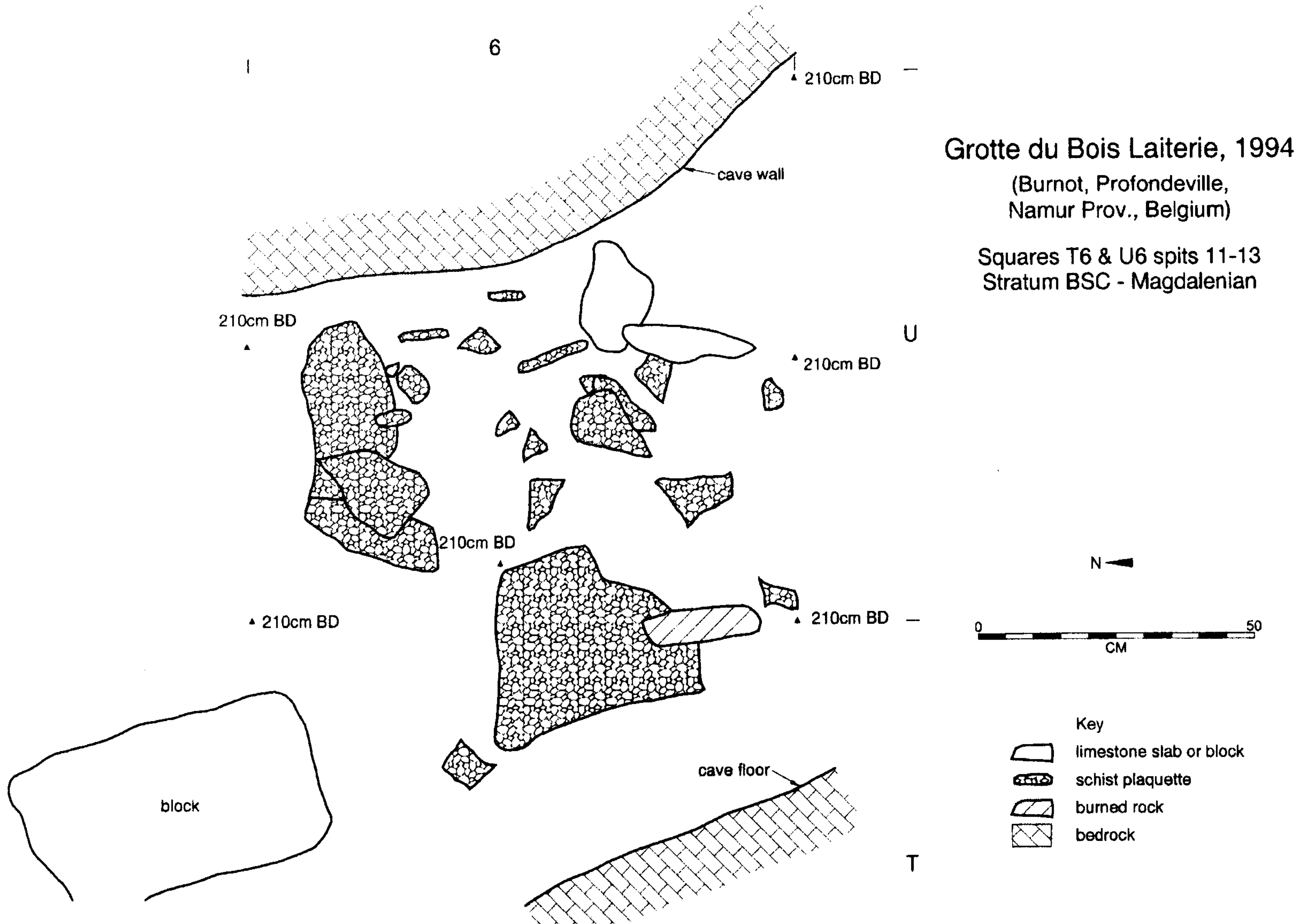


Fig.30 - Bois Laiterie, BSC, squares T-U / 6, plan of psammite slabs.

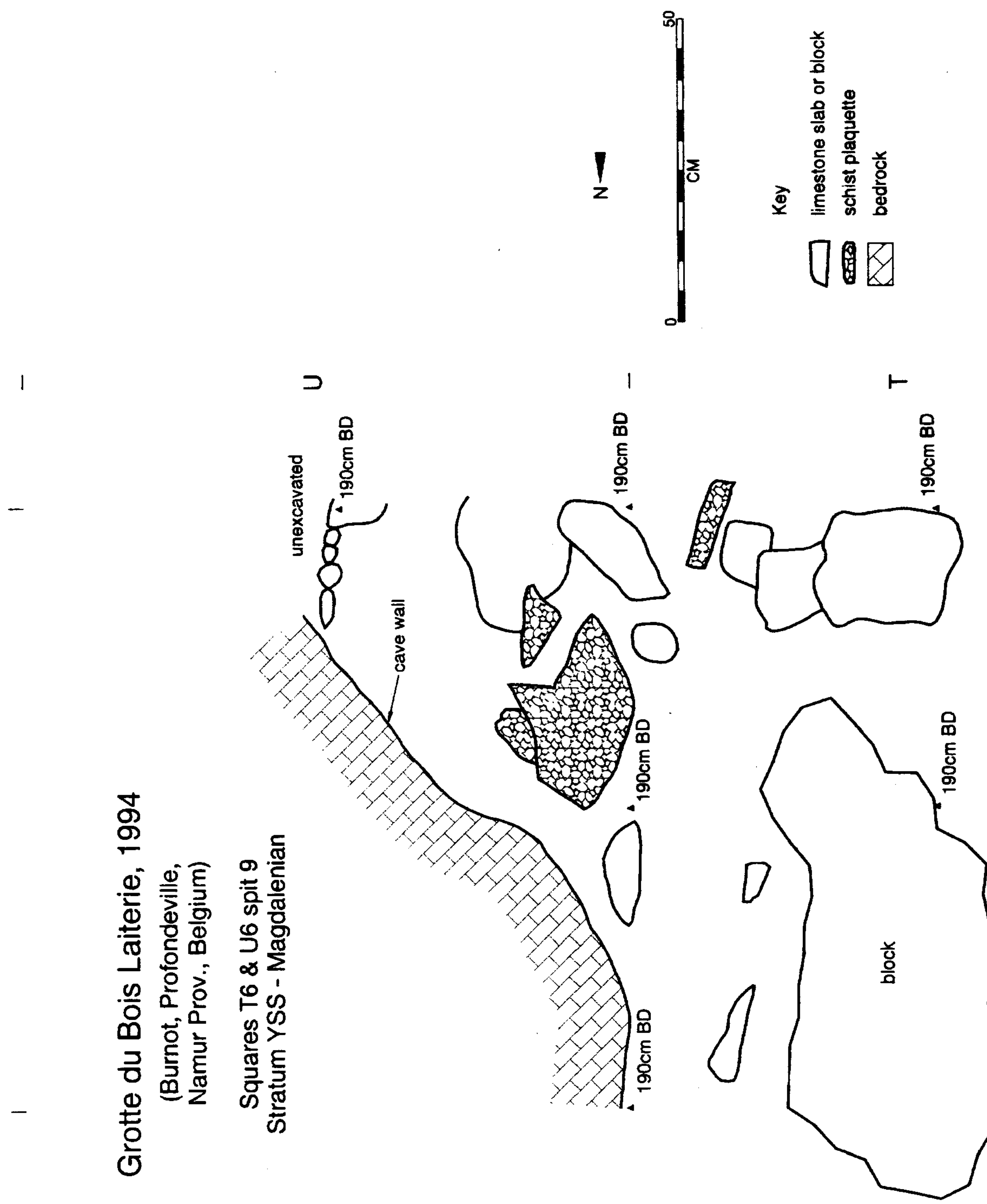


Fig.31 - Bois Laiterie, YSS, squares T-U / 6, plan of psammite slabs.

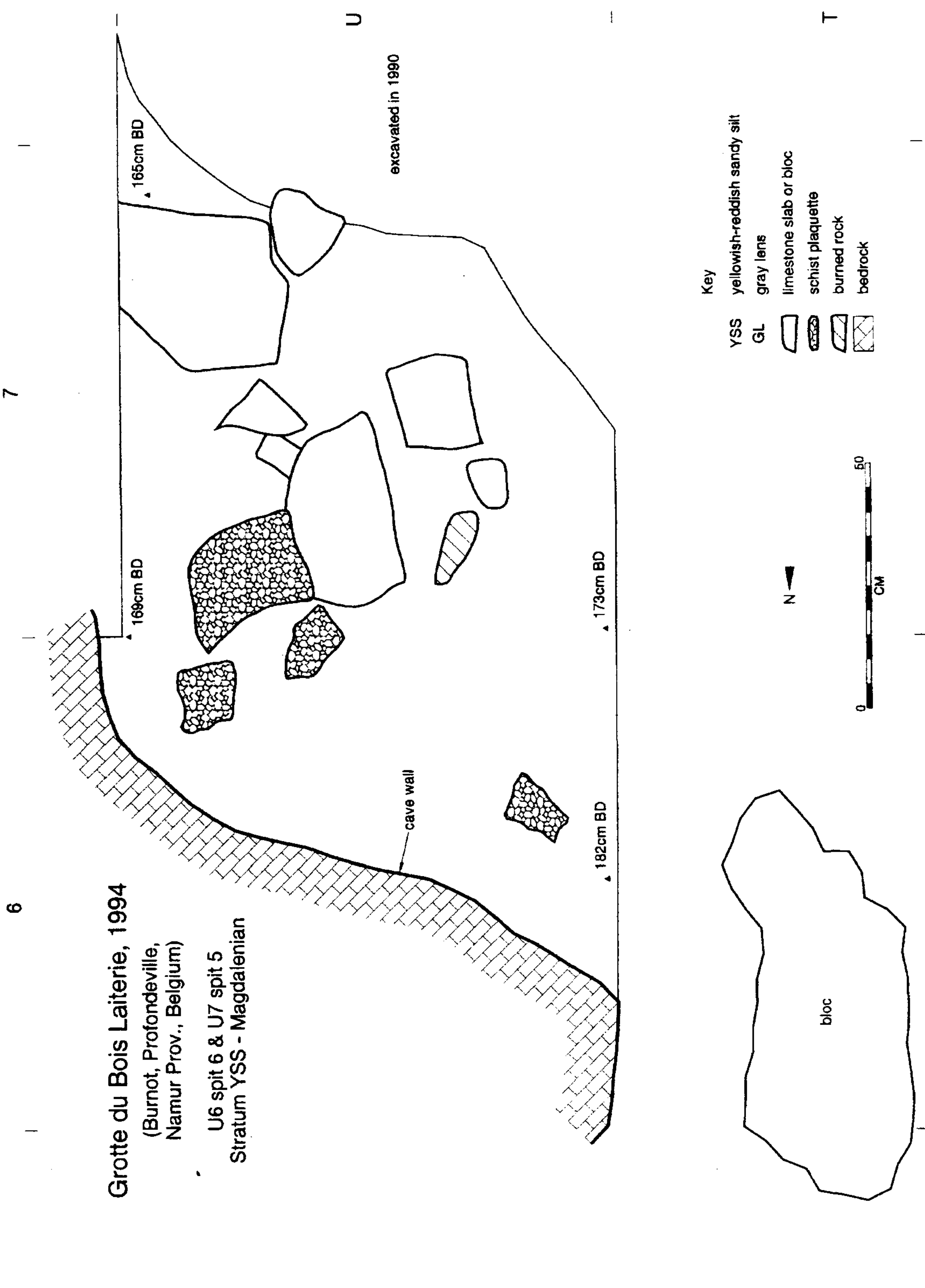


Fig.32 - Bois Laiterie, YSS, squares U / 6-7, plan of psammites slabs.

of Magdalenian arrival, would have necessitated particular emphasis on the paving of that potentially muddy, slippery, but relatively level strip, especially *vis à vis* the exposed bedrock areas upslope of the infilled gully.

Average length of piece-plotted plaquettes and fragments is 108.8 mm; average width is 75.4 mm; average thickness is 14.8 mm. Average area is 114 sq.cm and average weight is 243 gm. The largest slabs we found range between 30-40 cm long. and weigh about 1-1,5 kg. (or slightly more), but generally the surviving fragments are relatively small. Total weight of all piece-plotted plaquettes amounts to 82.5 kg, but when all the small, non-piece-plotted fragments (originally parts of large slabs) are added in, the total weight of all tabular psammite and sand-stone recovered from the site reaches 122 kg. The total area of the piece-plotted (and hence measured) plaquettes is 2,67 m^2, but a maximal estimate of the area all the slabs and fragments together could have paved would be c.3 sq.m. (but see Miller and López Bayón, this volume). So, even counting all the tiny fragments of what were once larger slabs, the amount of strictly local flag-stones brought to the cave for paving did not amount to a very large area. This suggests the *ad hoc* nature of this activity, and, probably, the relatively ephemeral, short-term nature of the human visits to the cave. They simply did not invest in much infrastructure at this site. It was not used for long-term residence, nor (because of its small size and uncomfortable nature) by many people.

In 1994, a preliminary effort was made to refit plaquette fragments. Eight sets involving 20 fragments were found. None crosscut intact strata, although one set links a piece from YSS in U6 with another from possibly disturbed surface fill atop bedrock in S5. This weakly supports the hypothesis that some of the slabs along the eastern cave wall (U-V rows) had slid downslope from the R-T rows. All the other refits are from the same stratum (either BSC or YSS) and from the same or adjacent squares. However, further information on plaquette refits and distribution is provided by Miller and López (this volume) who conducted more extensive refitting.

A few psammite plaquettes bear some cut marks, possibly suggesting their use as «cutting boards». Others have some reddish-brown stains (ochre?). But there are no signs of artwork on these objects - in distinct contrast to the zoomorphologically engraved slabs of Chaleux, Da Somme, Goyet and Roc-la-Tour. The modified BL plaquettes are described elsewhere by M.Lejeune (this volume).

Faunal Distributions

The macro-mammalian faunal remains (mainly of ungulate game species that were human prey) are also discussed at length elsewhere (Gautier, this volume), but a few additional remarks on the distribution of certain remains are in order here. This discussion was motivated by the observation that faunal remains seemed to be somewhat more evenly distributed throughout the cave than artifacts and especially lithic manuports (Figs.9 and 28). In particular, there seem to be relatively more faunal remains than artifacts and manuports at the rear of the cave. This observation was coupled with the anecdotal finding of a whole wolf ulna in YSS at the rear of the cave in U13, an area rich in faunal remains. And it was also coupled with puzzlement over the surprisingly large number of fox bones and teeth found during our excavations (and in Lacroix's test pits). Could at least part of the accumulation and distribution of ungulate remains be due to the activity of carnivores? Could the rear of BL have served as a carnivore den in times (the majority of time) when humans were not using the cave?

Fig.33 shows the distribution of all identified fox (*Vulpes vulpes* and *Alopex lagopus*) remains (n = 68) for combined strata YSS+BSC. There are three distinct concentrations: on the terrace (W3), in the front of the cave (U5-6) and at the cave rear (U12). However the distribution is continuous (especially if one were to add in the areas of Lacroix's *sondages*). Although none of the fox bones have cut marks and none of the many canines are perforated (truly unusual, as fox canines were usually favorite pendant material for Upper Paleolithic people), it is highly unlikely that fox could have been responsible for much or any of the large-medium size ungulates brought to the cave; it is simply too small for that. And the hypothesis of fox denning at the rear of the cave is at least partly belied by the general nature of the distribution of fox remains - especially the large quantities on the terrace and at the front of the cave, in intimate association with the great mass of tools, weapons, lithic debris, plaquettes and other faunal remains. Therefore, the nature of the relationship between humans and foxes at this site remains enigmatic. Possibly the foxes were winter residents of BL when humans were absent.

As for the other, larger, carnivores (ones capable of being agents of accumulation of ungulate remains), they are very few (see Gautier, this volume). There are a couple of wolf remains (the complete ulna from U13 and a phalange from mixed deposits in the exterior test trench in the western terrace area: O-P/3-4). A lynx tooth also came from that test trench, while an ulna fragment was found in stratum LBS of square T4 (hence, post-Magdalenian) and some teeth were found in YSS, square U4. Bear is also represented by a phalange from the test trench and another from the «4» row in YSS. There is only one identifiable hyena part: a tooth from YSS in square X3 at the mouth of the small cave. Hyena coprolites were not found. No case for carnivore denning can be made on the basis of these few, scattered remains, especially when some are from intact deposits *outside* the cave. Evidence for carnivore gnawing on ungulate bones is scarce and is discussed elsewhere. The main conclusion would seem to be that carnivores played little or no role in the distribution of ungulate remains in BL. Humans, who probably butchered, processed and consumed at least parts of ungulate carcasses on the terrace and in the front zone of the cave, may have disposed of some faunal remains in the rear of the cave, using it as a «toss-zone». Such (noxious) behavior could be an additional indicator of the fact that humans did not intend to spend much time at the cave during their visits.

Lithic Refits: Site Formation Processes, Activity Areas and Reduction Sequences

Besides being useful in demonstrating the illegitimacy of separately analyzing collections from «strata» YSS and BSC by showing the existence of conjoins between the two units, lithic refitting is important in showing the horizontal integrity of the Magdalenian horizon

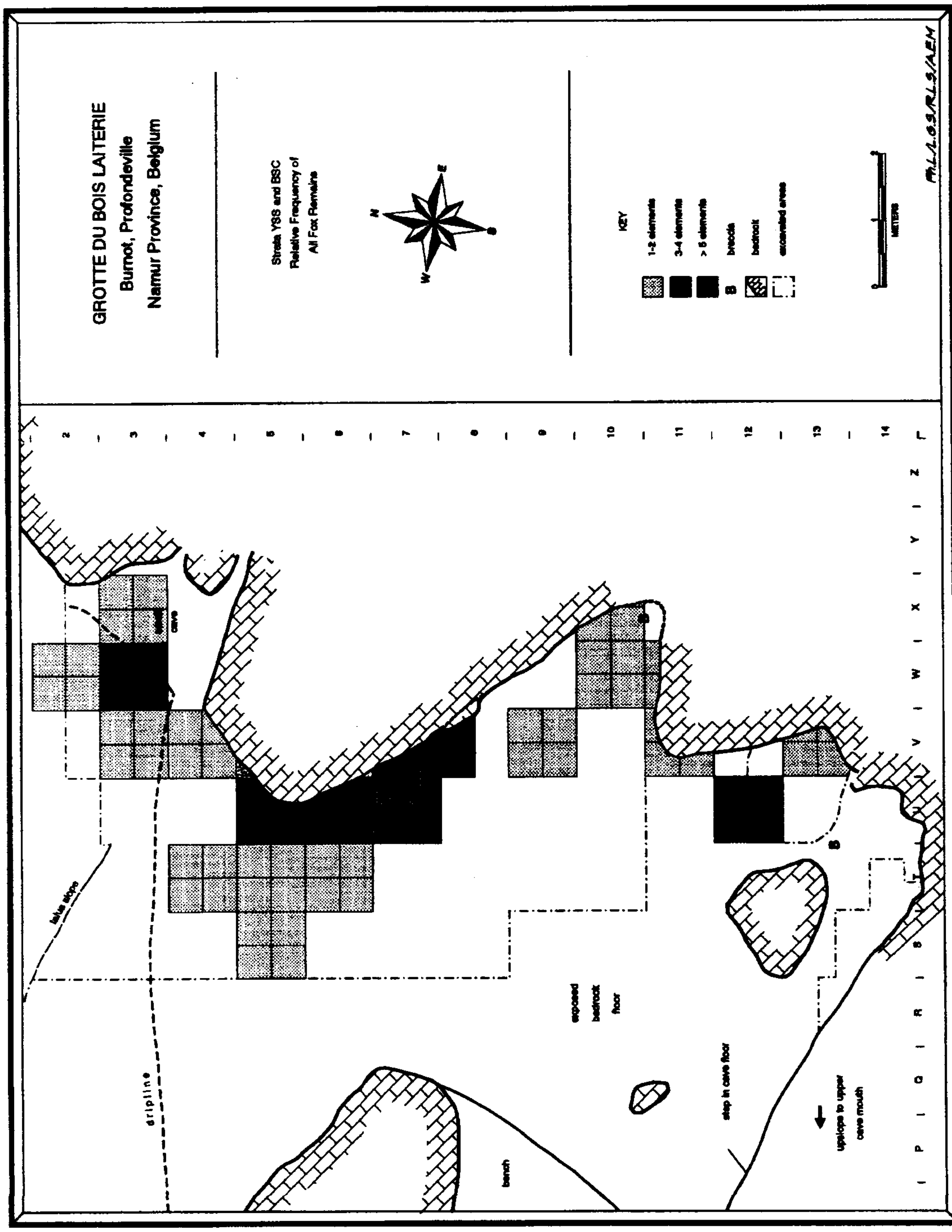


Fig.33 - Bois Laiterie, YSS + BSC distribution of fox remains.

(*i.e.*, by linking the cave rear, center, front and exterior). It is also useful to demonstrate that many other conjoin sets are made up, on the other hand, of pieces that have hardly moved at all since deposition (thereby eliminating the hypothesis of ubiquitous mass movements by solifluction or water erosion). Refitting can more or less confirm the homogeneity of the lithic assemblage, even if small-scale disturbances are almost certain to have occured within the deposit (if only by trampling, rockfall, short-distance downslope sliding and because of the weight of overburden on fairly plastic sediments). Finally, refitting can help us to understand some of the aspects of flint knapping that took place at the site (technological interpretation of the reduction sequence insofar as it is very partially represented here).

The methodology used in refit analysis involved the systematic inspection of all 1,297 large debris (*i.e.*, excluding trimming flakes and shatter) and all 254 tool blanks (excluding 128 debris and tools selected for microwear analysis), hence a total of 1,423 pieces. The flints were inspected for similar properties of (1) color and banding, (2) patination, (3) cortical surface, (4) grain size, and (5) distinctive inclusions. Pieces were conjoined to one another on the basis of any attributes of Hertzian morphology that might indicate a direct correspondence. Distribution plots detailing the location of all piece-plotted lithics were then prepared to assist in the evaluation of site formation processes in both horizontal and vertical dimensions (see Fig.13).

Of the 1,423 artifacts, 77 were found to refit into 32 separate conjoin sets (Tab.1; Fig.34). The majority (26) of these sets are simple two-element conjoins (including many snapped blades or flakes). The rest of the sets are composed of three or more elements. There are four triple conjoins, 1 quadruple and one set with 9 conjoined pieces. There are 5 sets which link the exterior with the front of the cave, 3 which link the front of the cave with the center, 3 which link the exterior with the cave rear, and 1 triple set which links the front, center and rear. The other refits either come from within the same square or nearby/adjacent squares. Twenty-eight of the sets include one or more blade(let). No cores are involved. Twenty-five of the refitted items have at least some cortex. One item each classified as a unidirectional and birectional crested blade and a platform renewal flake are included among the refits. Six of the sets include a total of 7 tools (one set is composed of 2 backed blades). One of the tools is a burin, one a notch, one a denticulate, and two are truncations. (In addition to actual physical refits, there are several groups of flint that by their color, texture, cortex, inclusions and general morphology, almost certainly came from the same block. Although some of these potential conjoin sets are quite interesting, as they sometimes contain widely distributed elements, they are not f urther considered here, owing to lack of absolute proof of refitting).

The greatest number of real refits in a single set is nine. The refits in this set come from both YSS and BSC; 6 of them are from square U6, 1 each is from adjacent squares U7 and V7 - all near the east-front of the cave - but the 9th flake is from W3 on the far eastern part of the terrace. This set amounts to a series of successive flake removals (see Fig.35). Analysis of the reduction strategy involved in production of these 9 conjoins (done in association with Michel Guilbaud) suggests that a multi-directional, hard-hammer percussion technique was used, most likely in an attempt to produce elongated blades. Primary cortex removal occurred before these artifacts (8 flakes + 1 blade fragment) were removed, though 4 bear at least a little cortex and 1 flake is classified as a possible platform renewal flake. None of this seems to have resulted in

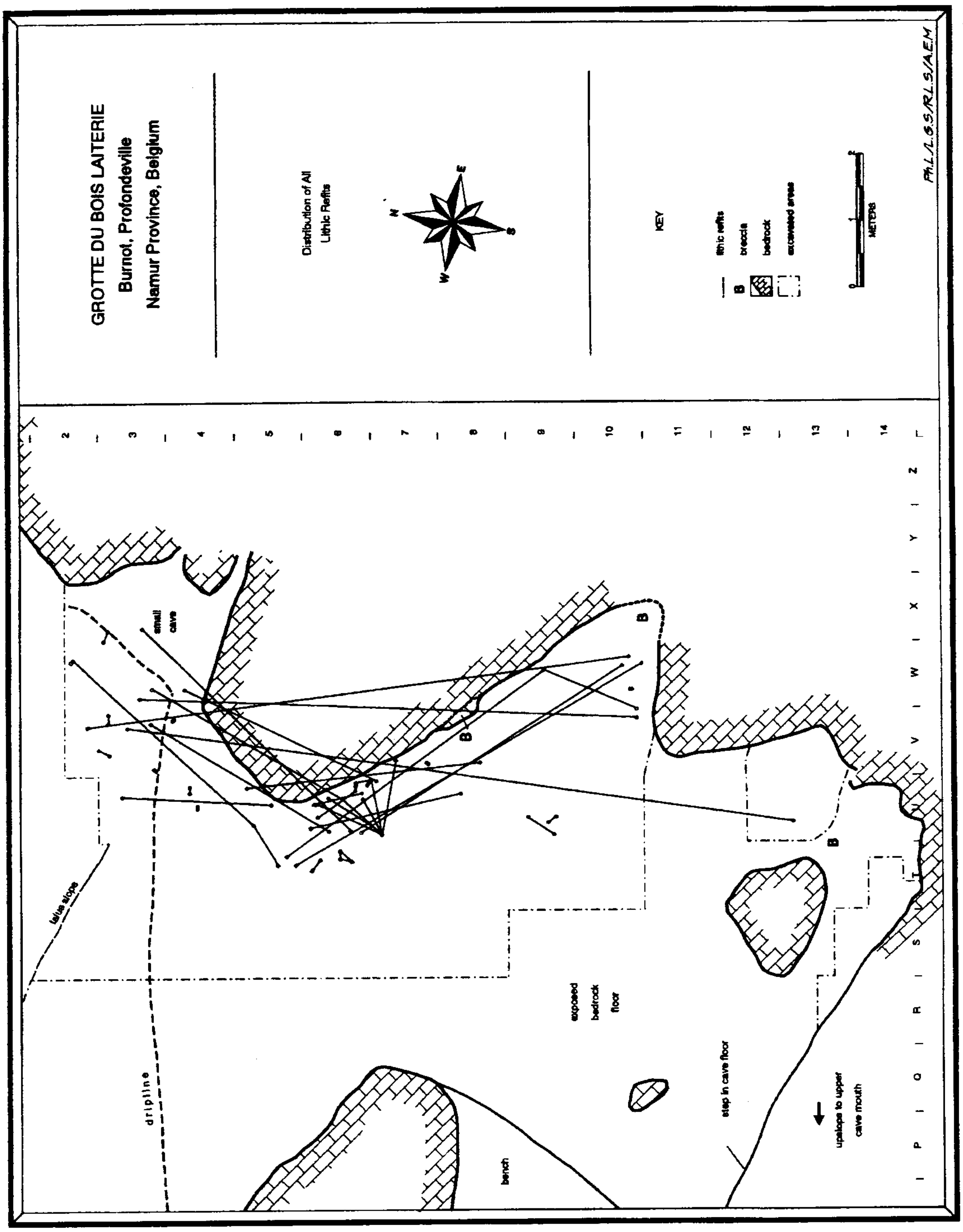


Fig.34 - Bois Laiterie. All lithic refits (piece-plotted and subsquares-provenienced items from both YSS + BSC).

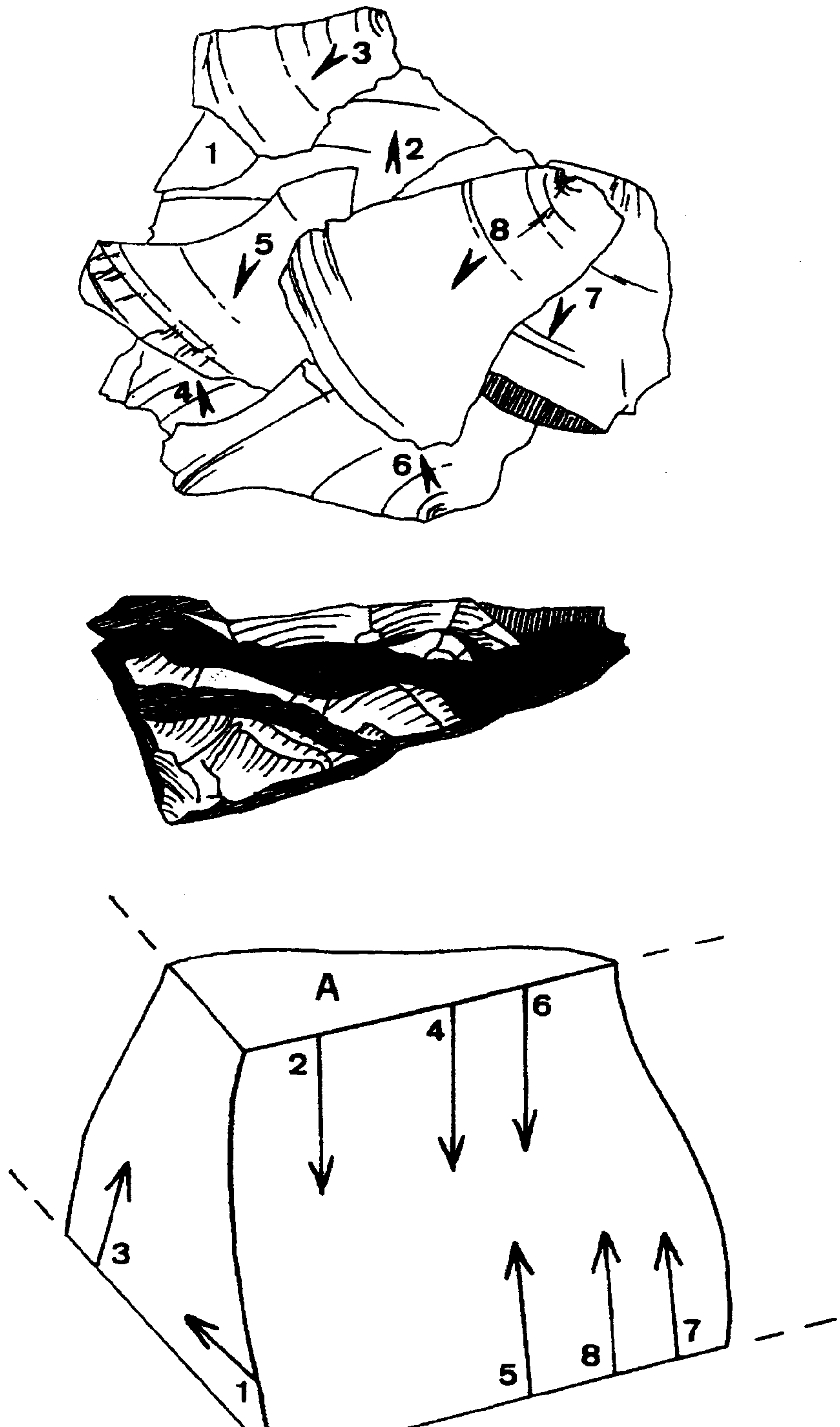


Fig.35 - Bois Laiterie.
Drawing and technological reconstruction of removal sequence of 9-item refit set.

the successful production of a complete, useful blade. The blade fragment was, however, later retouched into a notch (type 74). Ironically, although 8 of these refitted items are classified as type 10 chalk flint, one is classified as type 12, confirming what we have suspected, namely that flint types 10-12 intergrade and are often the same thing.

There are three other cases of refits of flint types 10+12 (one of which also includes an item of type 19 flint - also confirming our suspicion that type 19 is a chalk flint from the same source as 10-12). Another set conjoins a flint type 10 with a type 17.

The BL lithic assemblage exhibits several technological reduction strategies which are exemplified among the refit sets. First, the large number of non-cortical artifacts (94% of the total) indicates that earlier stages of lithic reduction occurred off-site. The refits do not involve primary reduction. Second, the small size of the lithic artifacts (see chapter on lithic assemblages by Straus and Orphal, this volume) suggest that lithic reduction at BL most likely consisted of tool maintenance and limited blade blank production using cores whose dimensions when introduced to the site were already small and from which most or all cortex had already been removed. Third, the total number of cores found at the site is very small (only 4), and they are reduced down to mere stubs. And there may never have been many cores. Based on examination of (1) raw material types, (2) patination types and states, (3) grain size, and (4) technological aspects of reduction strategy; it is estimated that the number of cores used as sources for generating the lithic assemblage may have been quite small, most of which probably were never actually brought to the cave, since many of the blade blanks may have been produced at the distant quarry/workshop sites. The reduction of the cores which were transported to BL was highly intensive. It involved the exhaustion of these valued materials through the repeated hammering of the cores, resulting in numerous step fractures on all the few cores which were recovered.

These factors, combined with the lithic refitting analysis, suggest several points concerning site formation processes. As the artifact distribution plans (see above) demonstrate that the BL artifacts were concentrated on the terrace, at the front of the cave and, to a lesser extent, at the cave rear. The distribution of refits mirrors this general pattern, with blade snap refits being found in all three of these areas. However, two very long-distance refits between the cave rear and terrace were found. In addition, numerous refits between the cave front and terrace were also found, as noted above.

As the micromorphological analysis of BL sediments from stratum YSS suggests (Courty, this volume), a fair degree of site integrity had subsisted. The explanation between the cave rear and terrace must be human transport. Although knapping seems to mainly have been conducted at the front of the cave and on the terrace, objects were taken to the back of the cave for purposes which remain unclear. The refits between the cave front and terrace are also curious, though less difficult to explain than the long-distance conjoins. The cave front and the terrace areas both contain virtually all categories of secondary lithic debris, while the space *between* the elements of these inter-area conjoins is virtually devoid of artifacts, suggesting that these were two separate (albeit nearby) activity areas (as also indicated by other facts mentioned above). Fully 19 of the refit items from 8 sets are from the concentration of artifacts in square U6 alone (plus several more from adjacent squares). Another substantial group of refits (16 items from 10 sets) comes from the 2-3 rows on the terrace. There are 4 refits between these groups, suggesting that the two activity areas were contemporaneous or that flint from one was scavenged not much later for use in the other. Thus, the refits contribute to showing that even a small cave site such as Bois Laiterie can yield latent structural evidence indicative of a rudimentary organization of space.

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3

ETUDE MICRO-STRATIGRAPHIQUE DE LA GROTTE DU BOIS LAITERIE (Province de Namur, Belgique)

M-A. Courty

(Prélévements réalisés par Laurent LANG)

Objectifs de l'étude

Lors de la campagne de fouille 1995 de la grotte du Bois Laiterie, 14 échantillons non perturbés ont été prélevés dans les différentes unités stratigraphiques du remplissage en vue d'une étude micro-stratigraphique. L'étude a porté sur les coupes suivantes:

- en V8, échantillonnage concernant les différentes couches du remplissage;

- en V13b, échantillonnage au fond de la grotte dans le niveau magdalénien YSS;

- en V5, échantillonnage à l'entrée de la grotte concernant le contact du niveau magdalénien YSS avec le substratum rocheux et la partie sommittale d ce niveau.

L'objectif de l'étude était d'apporter des éléments de réponse aux questions suivantes:

- modes de mise en place des différentes unités stratigraphiques;

- évolution des conditions environnementales et des ambiances climatiques au cours de la mise en place des dépôts;

- nature et intensité des remaniements ayant pu affecter la distribution spatiale des artéfacts lithiques et faunistiques mis au jour au cours de la fouille.

14 lames minces de grandes dimensions (13,9 x 7 cm) ont été réalisées au laboratoire de Science des sols et hydrologie de l'INA P-G, et ont fait l'objet d'une étude au microscope pétrographique.

Après une présentation générale des caractères du remplissage de la grotte du Bois Laiterie, la dynamique de mise en place, l'histoire post-dépositionnelle et la nature des manifestations anthropiques sont discutées pour chaque unité stratigraphique.

Caractères généraux du remplissage

La comparison des différentes unités stratigraphiques a permis d'identifier deux populations de matériaux:

- \- une population calcaire (P1) constituée de sables grossiers calcitiques, subanguleux à anguleux, mal triés, faiblement altérés, associés à des fragments calcaires hétérométriques (décimétriques à millimétriques), anguleux à subarrondis, faiblement altérés, fréquemment fissurés;

- \- une population quartzitique (P2) constituée de limons grossiers, riches en esquilles anguleuses, mélangés à une fraction fine limono-argileuse brune, faiblement à non carbonatée, riche en paillettes micacés et à des sables fins minéralogiquement semblables aux limons grossiers.

La similitude pétrographique entre les fragments calcaires et les sables grossiers permet d'interpréter la population P1 comme résultant de la désagrégation *in situ* de la paroi constituée de calcaires durs à bioclastes, partiellement dolomitisés et métamorphisés. Les fissures de la roche calcaire sont fréquemment remplies par un ciment ferrugineux. L'hétérognéité texturale de cette roche explique la nature des produits de désagrégation: la fragmentation se développe préférentiellement dans les zones les plus dolomitisées, libérant des sables anguleux hétérométriques; les plages à bioclastes et à large cristaux calcitiques sont moins affectées par la désagrégation, et donnent des fragments grossiers peu gélifs.

Les caractères pétrographiques et texturaux de la population P2 indiquent qu'il s'agit d'un matériau loessique érodé de dépôts alluviaux non carbonatés. La proportion variable de constituants fins suggère que ces loess ont subi une pédogenèse modérée, préalablement à leur piégegage dans la grotte (sols steppiques peu développés).

La proportion relative des populations P1 et P2 apporte ainsi des informations sur les conditions climatiques synchrones de la mise en place des différentes unités stratigraphiques:

- population P1 dominante: prédominance de phénomènes gélifs, entraînant une forte fragmentation de la paroi calcaire, sous des conditions froides et humides;

- population P2 dominante: forte influence d'apports loessiques synchrones de vents de poussières et faible contribution des phénomènes gélifs locaux, caractéristiques de conditions froides et sèches;

- matériau mixte constitué d'un mélange des populations P1 et P2: conditions dans l'ensemble froides, marquées par des alternances du degré d'humidité, soit de nature saisonnière, ou correspondant à des cycles plus longs.

Dans l'ensemble, le remplissage étudié est affecté par des transformations pédologiques peu développées. Il s'agit surtout:

- d'une bioturbation caractérisée par le développement d'une structure micro-agrégée qui entraîne une homogénéisation partielle des sédiments;

- d'une structuration par le gel caractérisée par le développement d'une microstructure fissurale de type "lentilles de glace"; du fait de l'hétérométrie texturale des sédiments, cette fissuration n'apparaît nettement développée que dans les zones les plus fines entre les fragments grossiers; l'absence d'une macro-organisation en «lentilles de glace» suggère qu'il s'agit surtout d'un gel superficiel, insuffisant pour façonner les couches dans leur ensemble; l'absence de signes de cryoturbation témoigne du maintien de bonnes conditions de drainage au cours de la mise en place du dépôt;

- d'une calcitisation exprimée surtout par la présence de revêtements micritiques sur les parois des cavités d'entassement et des chenaux biologiques et, dans une moindre mesure, par des plages micritiques diffuses; ces plages calcitiques témoignent de circulations d'eaux chargées en carbonates dissous, synchrones des périodes de dégel, et d'une précipitation contrôlée par l'évapotranspiration lors du desséchement estival; l'absence de précipitations de carbonates secondaires contrôlé par les gels saisonniers indique que l'humidité est faible au début de l'hiver;

- de revêtements d'argiles limoneuses brunes sur les parois des cavités d'entassement et des chenaux; ils sont généralement peu développés et témoignent de faibles percolations verticales.

Un meilleur développement des transformations pédologiques dans les couches les plus riches en matériaux loessiques confirme que les conditions synchrones des épisodes d'accumulation de loess sont globalement moins froides que lors de la mise en place des couches les plus grossières. La faible altération des fragments calcaires dans les couches les plus grossières atteste que leur mise en place s'est produite sous des conditions très froides, peu favorables à la pédogenèse.

Les différentes unités stratigraphiques sont caractérisées par une forte variabilité spatiale du mélange des deux populations de sédiments et du degré de structuration. Dans de nombreux cas, cette variabilité est liée à l'hétérogénité texturale des sédiments, chaque fragment grossier créant à sa proximité un micro-environnement surtout marqué par des phénomènes de désagrégation. Dans les couches fines, texturalement plus homogènes, la brutalité du contact entre des plages pédologiquement bien structurées et d'autres seulement constituées de produits de désagrégation indique que des remaniements ont perturbé l'organisation originale des sédiments. Il ne peut s'agir d'un colluvionnement d'origine naturelle qui aurait entraîné une homogénéisation des sédiments. L'hypothèse de remaniements mécaniques liés à une intervention humaine apparaît comme la plus vraisemblable.

La présence anthropique est attestée dans les différentes couches, et plus spécifiquement dans le niveau magdalénien YSS, par la présence de fragments osseux, souvent calcinés, de résidus charbonneux, de rares micro-débris lithiques, d'agrégats de sols bruns apportés des proches environs par le piétinement ("terre à godasse"). Dans l'ensemble le degré d'anthropisation reste faible et la masse fine des différents niveaux est surtout constituée de matériaux d'origine naturelle. L'abondance et la distribution spatiale des constituants anthropiques conduit à distinguer trois types de situations:

1. - constituants localement abondants, distribués sub-horizontalement qui marquent des surfaces d'occupation relictuelles;
2. - constituants répartis de manière aléatoire et en tout sens dans des matériaux à structure ouverte qui correspondent à des surfaces d'occupation relictuelles perturbées par des remaniements mécaniques;
3. - constituants répartis de manière aléatoire et en tout sens dans des matériaux denses qui correspondent plus à des aires de rejets.

Interprétation des différentes unités stratigraphiques

1 - Niveau BGS (Fig.1a)

Il s'agit ici d'un cailloutis fortement cimenté qui correspond à la désagrégation en place de la roche calcaire. L'argile brune ferruginisée présente dans les fissures de la roche semble surtout provenir de l'altération en place du ciment ferrugineux.

2 - Niveau RS (Fig.1b)

Ce niveau est constitué de sables calcitiques anguleux provenant de la désagrégation de la roche calcaire. La masse argileuse brun rouge qui cimente partiellement ces sables se présente localement sous la forme de revêtements fragmentés. Ce caractère témoigne d'une origine allochtone, vraisemblablement liée à des percolations d'eaux boueuses provenant de ruissellement le long de la paroi de la cavité. La faible altération des matériaux calcaires indique que cette mise en place n'est pas synchrone d'une phase de pédogenèse prolongée. Il s'agit vraisemblablement d'un épisode marqué par la formation d'un profil d'équilibre du talus, synchrone d'un cryoclastisme important et de ruissellements.

3 - Niveau LGS

Ce niveau est constitué du mélange d'un sédiment calcaire riche en sables calcitiques anguleux et en fragments grossiers d'origine allochotone (P1) et de limons argileux bruns loessiques (P2). Sa mise en place résulte d'une désagrégation de la paroi, vraisemblablement par le gel, et d'apports éoliens fins. La micro-agrégation d'origine biologique bien exprimée peut être mise en relation avec une pédogenèse liée au développement d'une couverture végétale à enracinement profond, avec des racines de petite taille de type graminées. La présence de cavités sub-horizontales qui évoluent localement vers un réseau de fissures, associée à une forte densité des agrégats biologiques (Fig.1c), évoque localement une modification structurale liée au développement de lentilles de glace, en relation avec un gel superficiel.

Les fragments anthropiques abondants (os, résidus carbonisés) sont fréquemment concentrés dans des niveaux centimétriques où ils présentent une distribution sub-horizontale. Ces caractères peuvent être interprétés comme des reliques de surface d'activité qui caractérisent des épisodes marqués par une occupation plus intense de la grotte. La faible anthropisation de la masse fine du sol suggère cependant que les témoins d'occupation, intégrés par le piétinement, proviennent de zones d'activité situées hors de la cavité, peut-être sur le porche. Il s'agit donc de témoins d'anthropisation en position tertaire. Entre ces surfaces d'activité résiduelles, la distribution alélatoire des témoins d'anthropisation suggère plutôt une intégration liée à des rejets de déchets d'activité qui se sont déroulées dans une autre zone.

4 - Niveau YSS (Fig.1d, Figs.2a à 2d, Fig.3, Figs. 4a et 4b)

Dans l'ensemble, le niveau YSS diffère du niveau LGS sous-jacent par une proportion plus élevée de la composante loessique, à l'origine de la texture plus fine et de la couleur brun jaune (Fig.1d; tab.1). Ce niveau est, néanmoins, toujours marqué par l'abondance de plages plus sableuses et de fragments calcaires grossiers qui attestent de la contemporanéité des apports éoliens et de la fragmentation de la paroi calcaire par le cryoclastisme (Fig.2c). Comme précédemment, la micro-agrégation d'origine biologique bien exprimée traduit une pédogenèse liée au développement d'une couverture végétale à enracinement profond, avec des racines de petite taille de type graminées. La différence réside ici dans la présence de calcitisations liées à la porosité biologique (Figs.2a et 2b). Ces caractères peuvent être mis en relation avec des maxima thermiques plus élevés, synchrones d'une forte activité biogénique. La présence d'une structuration fissurale sub-horizontale peu développée atteste, cependant, de l'influence de gels saisonniers superficiels (Fig.3b). L'évolution du niveau YSS semble donc s'être déroulée sous des conditions marquées par un contraste saisonnier plus marqué que pour le niveau sous-jacent, qui peut être interprété comme la conséquence d'un réchauffement global. Localement, la présence de plages denses de limons loessiques (Figs.3a et 7c) indique que la sédimentation loessique résulterait d'aports discontinus, synchrones d'épisodes marqués par un gel superficiel plus intense. La mise en place du niveau YSS se serait donc produite au cours d'une période caractérisée par des alternances rapides de l'humidité et de l'action des vents, les épisodes loessiques marquant des phases plus sèches et plus ventées.

La partie supérieure du niveau YSS en V8 est marquée par une augmentation de la composante détritique locale et un développement plus net de la structuration en lentilles de glace (Figs.4d et 5a). Ces caractères suggèrent une intensification des conditions froides et humides qui entraîne une reprise de la désagrégation de la paroi.

L'originalité du niveau YSS réside dans la juxtaposition de plages caractérisées par une structuration biologique bien préservée et de plages plus ouvertes caractérisées par une plus grande abondance de la composante calcaire locale (Figs.2c et 2d), ou encore de zones montrant un fin mélange de plages loessiques et de plages sableuses (Fig.3a). La brutalité des contacts entre ces différentes plages traduit un mélange mécanique qui ne peut être imputé à un mélange par colluvionnement. Il pourrait s'agir là des indices de remaniements anthropiques

BOIS LAITERIE - DESCRIPTION MICROMORPHOLOGIQUE

COUPE EN V8

Unité	Ech.	Description de terrain	Texture	Structure	Caractères pédologiques	Caractères anthropiques	Mode de mise en place
UGS 106-116	B.L. 4	Sables brun gris à cailloutis grossier (>1 cm)	30% limons oessiques 70% sables calcitiques et fragments calcaires	cavitaire ouverte	agrégats subarrondis à coiffes, distribués en tout sens	abondants fragments osseux dispersés	(1) sédimentation loessique et structuration par le gel (2) désagrégation physique de la paroi calcaire (3) mélange mécanique, d'origine anthropique.
YSS	B.L. 5	Sables limoneux brun jaune à cailloutis Niveau magdalénien	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire fermée à tendance fissurale	fine homogénéistation d'origine biologique	abondants fragments osseux dispersés	sédimentation loessique contemporaine d'une désagrégation in situ des fragments grossiers; forte influence d'un gel saisonnier
YSS 136-143	B.L. 6	Sables l imoneux brun jaune à cailloutis Niveau magdalénien	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire à canalicu-laire fine	structuration biologique bien développée; fissuration en lentilles de glace rares calcitisations le long des chenaux	concentrations de fragments osseux	sédimentation loessique contemporaine d'une désagrégation in situ des fragments grossiers; influence modérée d'un gel saisonnier; développement d'une couverture végétale

YSS 119-131	B.L. 12	variation latérale de 5/6	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire à canalicu-laire fine	structuration biologique bien développée; abondantes calcitisations le long des chenaux	concentrations de fragments osseux	sédimentation loessique contemporaine d'une désagrégation in situ des fragments grossiers; influence modérée d'un gel saisonnier; développement d'une couverture végétale
YSS 140-147	B.L. 7	Sables limoneux brun jaune à cailloutis Niveau magdalénien	50% limons loessiques 50% sables calcitiques et fragments calcaires	cavitaire ouverte	structuration biologique bien développée rares calcitisations le long des chenaux	fragments osseux dispersés	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers; influence modérée d'un gel saisonnier; mélange mécanique
YSS 135-146	B.L. 8	Sables limoneux brun jaune à cailloutis Niveau magdalénien	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire fermée à canalicu-laire	structuration biologique bien développée calcitisations le long des chenaux localement bien développées	fragments osseux dispersés	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers; influence modérée d'un gel saisonnier; développement d'une couverture végétale; mélange mécanique
LGS 158-170	B.L. 9	Sables limoneux gris mélangés à un cailloutis calcaire	50% limons loessiques 50% sables calcitiques et fragments calcaires	cavitaire ouverte à tendance fissurale	structuration biologique bien développée	abondants fragments osseux et résidus carbonisés, distribués sub-horizon-talement	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers; influence modérée d'un gel saisonnier; développement d'une couverture végétale

RS 175-184	B.L. 10	Sables brun rouge mélangés à un cailloutis calcaire	80% sables calcitiques et fragments calcaires, 20% argiles limoneuses	cavitaire ouverte	agrégation biologique bien développée; revêtements argileux, poussiéreux, fragmentés	absents	relique de sol peu développé, faiblement remanié
BGS 195-207	B.L. 11	Partie suppérieure du substratum: cailloutis désagrégé dans matrice sableuse grise	sables et fragments millimétriques calcaires, anguleux faible composante argileuse ferruginisée	fissurale	faible dissolution des fragments calcaires	absents	désagrégation in situ du substratum; pas de composante loessique; percolations faibles

destinés à aménager la cavité, par exemple lors de la formation de surfaces planes avant la mise en place de dallage.

Le niveau YSS présente une grande variabilité dans la distribution des constituants anthropiques, qui sont dans l'ensemble abondants. On observe localement la présence de concentrations de fragments osseux, avec une distribution sub-horizontale qui peuvent être interprétés comme des reliques de surface d'activité (Figs.3c et 3d). D'autres zones sont plutôt caractérisées par une distribution aléatoire des constituants anthropiques liée soit à la perturbation de surfaces d'activité lors des remainements mécaniques, ou à l'intégration de rejets.

Le degré d'anthropisation est nettement plus élevé dans le prélévement provenant du fond de la cavité (Figs.4b et 4c, et Figs.8a et 8b). Il s'agit ici non seulement de fragments osseux millimétriques mais également de fragments infra-millimétriques finement mélangés à la masse fine du sol qui peuvent être liés à une intégration plus importante de rejets provenant d'aires d'activité. Le fond de la grotte est également marqué par la présence de revêtements argileux grossiers dans la partie supérieure du niveau YSS (Fig.4c) qui traduisent des percolations plus importantes le long de la paroi de la cavité. L'originalité des conditions régnant au fond de la cavité est également exprimée par le plus grand développement des calcitisations qui affectent localement l'ensemble de la masse basale (Fig.8c) et les chenaux biologiques (Fig.8d). Le fait que les imprégnations carbonatées se surperposent aux organisations pré-existantes suggèrent qu'il pourrait s'agir d'une transformation postérieure à la mise en place du niveau YSS, synchrone de l'installation de conditions plus tempérées.

Les prélévements étudiés vers l'avant de la grotte en V5 montrent des caractères similaires du niveau YSS dans cette zone par rapport à ceux de l'intérieur de la grotte. On constate, néanmoins, une plus grande hétérogénéité (Figs.6a et 7) qui traduit des remaiements mécaniques, liés soit à l'instabilité du talus ou à des aménagements anthropiques. On observe, corrélativement, une plus grande abondance des constituants anthropiques, et plus particulièrement des résidus carboniés (Figs.6a et b). Cette évolution semble confirmer que les zones d'activité seraient plutôt situées vers l'extérieur de la cavité.

5 - Niveau UGS

Ce niveau est caractérisé par une nette diminution de la composante loessique, synchrone d'une plus faible structuration biologique et de l'abondance de la composante calcaire hétérométrique (Figs.5b, c et d). Ces caractères traduisent une évolution vers des conditions plus froides et plus humides, favorisant la désagrégation par le cryoclastimse de la paroi de la cavité.

Les constituants anthropiques restent abondants et distribués en tout sens (Figs.5b et c). Cette répartition, associée à la juxtaposition de plages riches en fractions fines mais désorganisées (Fig.5d) témoignent de perturbations mécaniques qui semblent plutôt de nature anthropique.

BOIS LAITERIE - DESCRIPTION MICROMORPHOLOGIQUE

COUPE EN U13b (au fond de la grotte)

Unité	Echan.	Description de terrain	Texture	Structure	Caractères pédologiques	Caractères anthropiques	Mode de mise en place
YSS 64-54	B.L. 13	Sables jaunes à cailloutis Niveau magdalénien	50% limons loessiques 50% sables calcitiques et fragments calcaires	cavitaire fermée	fins revêtements argileux poussiéreux le long des cavités; structuration biologique bien développée	concentrations d'esquilles osseuses et de petits fragements osseux intégrés à la msse basale	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers; développement d'une couverture végétale; percolations importantes

BOIS LAITERIE - DESCRIPTION MICROMORPHOLOGIQUE

COUPE EN V5

Unité	Echan.	Description de terrain	Texture	Structure	Caractères pédologiques	Caractères anthropiques	Mode de mise en place
YSS 309-326	B.L.2	Contact de la paroi bréchifiée; artéfacts en quantité moins importante que le niveau gris sous-jacent	50% limons loessiques 50% sables calcitiques et fragments calcaires	canalicu-laire	abondantes calcitisations le long des chenaux et imprégnations micritiques de la masse bassale	abondants fragments osseux dispersés	sédimentation loessique et désagrégation de la paroi de la grotte; fortes percolations d'eaux chargées en carbonates
YSS inf. 323-336	B.L.1 B.L. 14	Lentille grisâtre sables limoneux et cailloutis calcaire grossier (>10 cm). Artéfacts aen position aléatoire	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire fermée à tendance fissurale	agrégation biologique bien développée; calcitisations le long des cavités peu développées	abondants fragments osseux et agrégats de sols	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers
base de YSS 374-384	B.L. 3	Sables limoneux brun rouge à cailloutis; sous le niveau archéologique dans la diaclase; contient très peu d'artéfacts.	60% limons loessiques 40% sables calcitiques et fragments calcaires	cavitaire ouverte à fermée	agrégation biologique bien développée;	abondants fragments osseux, résidus charbonneux et agrégats de sols	sédimentation loessique contemporaine d'une forte désagrégation in situ des fragments grossiers; mélange mécanique

Planche 1

a) Niveau BGS (V8) : transformation en place du substratum calcaire montrant un entassement dense de sables calcitiques anguleux, mal triés, de fragments calcitiques millimétriques, anguleux, fissurés, sertis dans une masse fine brune d'argile ferruginisée (BL 11. LN. N 1,6. Largeur de la photo: 5 mm).

b) Niveau RS (V8) : sables calcitiques anguleux, mal triés, sertis dans une masse argileuse brun rouge localement présente sous forme de revêtements fissurés et fragmentés. La faible altération des sables calcaires suggère que la fraction argileuse résulte de percolations d'eaux boueuses (BL 10, LN. N 1,6. Largeur de la photo 5 mm).

c) Niveau LGS (V8) : mélange finement homogénéisé d'une fraction sableuse calcitique mal triée (composante allochtone) et d'une fraction limono-argileuse loessique. Abondants fragments anthropiques dispersés: os altérés, os carbonisés, fragments charbonneux. La microstructure cavitaire à tendance fissurale et la distribution des fragments anthropiques soulignent une organisation sub-horizontale faiblement exprimée (BL 9, LN. N 1,6. Largeur de la photo 5 mm).

d) Base du niveau YSS (V8) : zone à larges cavités montrant le mélange d'unefraction sableuse calcitique mal triée (composante allochtone) et d'une fraction limono-argileuse loessique. Abondants fragments osseux distribués en tout sens (BL 8, LN. N 1,6. Largeur de la photo: 5 mm).

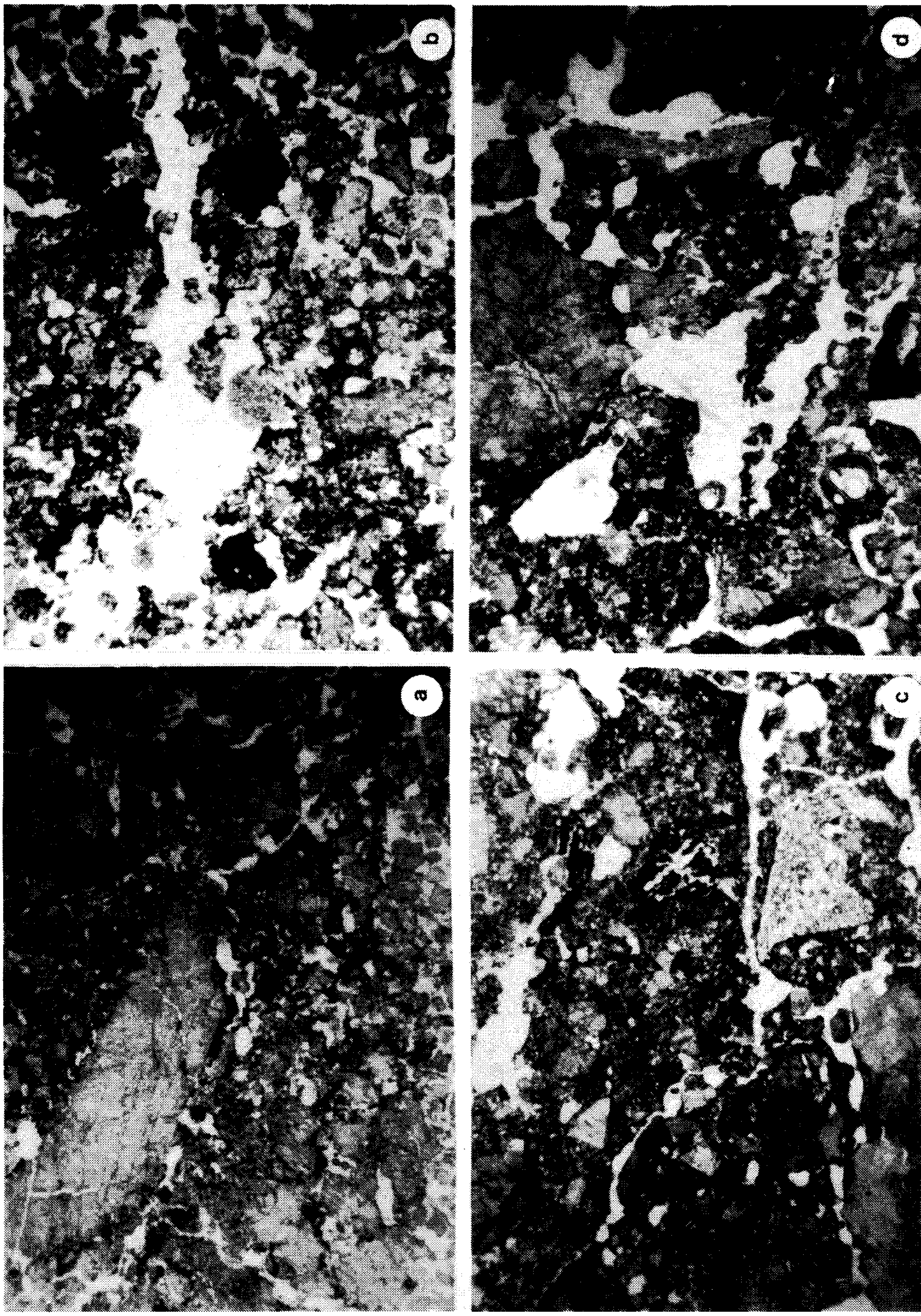

Planche 1

Planche 2

a) Base du niveau YSS (V8) : zone dense constituée principalement de limons argileux loessiques mélangés à une composante allochtone calcitique, mal triée. La masse fine est imprégnée de carbonates micritiques qui s'individualisent en fins revêtements dans les pores racinaires (BL 8, LN. N 1,6. Largeur de la photo 5 mm).

b) *id.* a (BL 8, LP. N 1,6)

c) Base du niveau YSS (V8) : zone sableuse à forte porosité présente au-dessus de la zone dense de 2a; fragments osseux distribués en tout sens (BL 8, LN. N 1.6. Largeur de la photo: 5 mm).

d) Base du niveau YSS (V8) : zone à larges chenaux constituée d'un mélange de sables calcitiques, mal triés, et de limons argileux loessiques; présence de revêtements calcitiques le long des chenaux; fragments osseux distribués en tout sens (BL 7, LN. N 1,6. Largeur de la photo 5 mm).

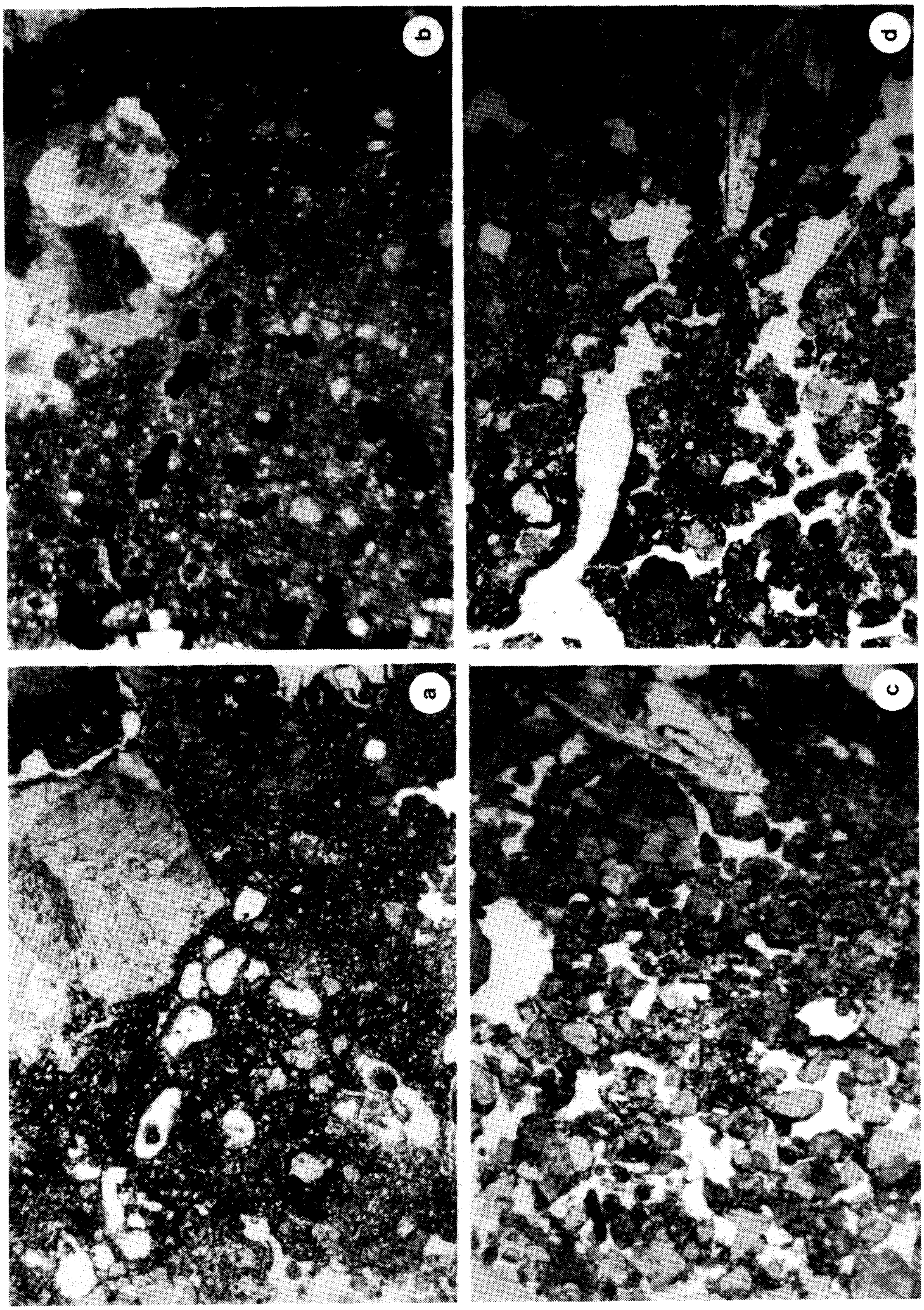

Planche 2

Planche 3

a) Base du niveau YSS (V8) : juxtaposition d'une plage limono-argileuse loessique et de sables calcitiques mal triés provenant de la dé sagrégation des fragments de roches calcaires (BL 7, LN. N 1,6. Largeur de la photo: 5 mm).

b) Milieu du niveau YSS (V8) : limons argilo-sableux résultant d'une fine homogénéisation d'une composante loessique et d'une composante sableuse allochtone, faiblement altérée; microstructure cavitaire, dense, résultant de la formation de lentilles de glace; calcitisations diffuses le long des parois des cavités (BL 6, LN. N 1,6. Largeur de la photo: 5 mm).

c) Milieu du niveau YSS (V8) : limons argilo-sableux résultant d'une fine homogénéisation d'une composante loessique et d'une composante sableuse allochtone, failement altérée; microstructure cavitaire, ouverte; calcitisations diffuses le long des parois des cavités; concentration de fragments osseux (BL 6, LN. N 1,6. Largeur de la photo: 5 mm).

d) Partie supérieure du niveau YSS (V8) : limons argilo-sableux résultant d'une fine homogénéisation d'une composante sableuse allochtone, faiblement altérée; microstructure cavitaire, ouverte; concentration de fragments osseux distribués horizontalement (BL 12, LN. N 1,6. Largeur de la photo: 5 mm).

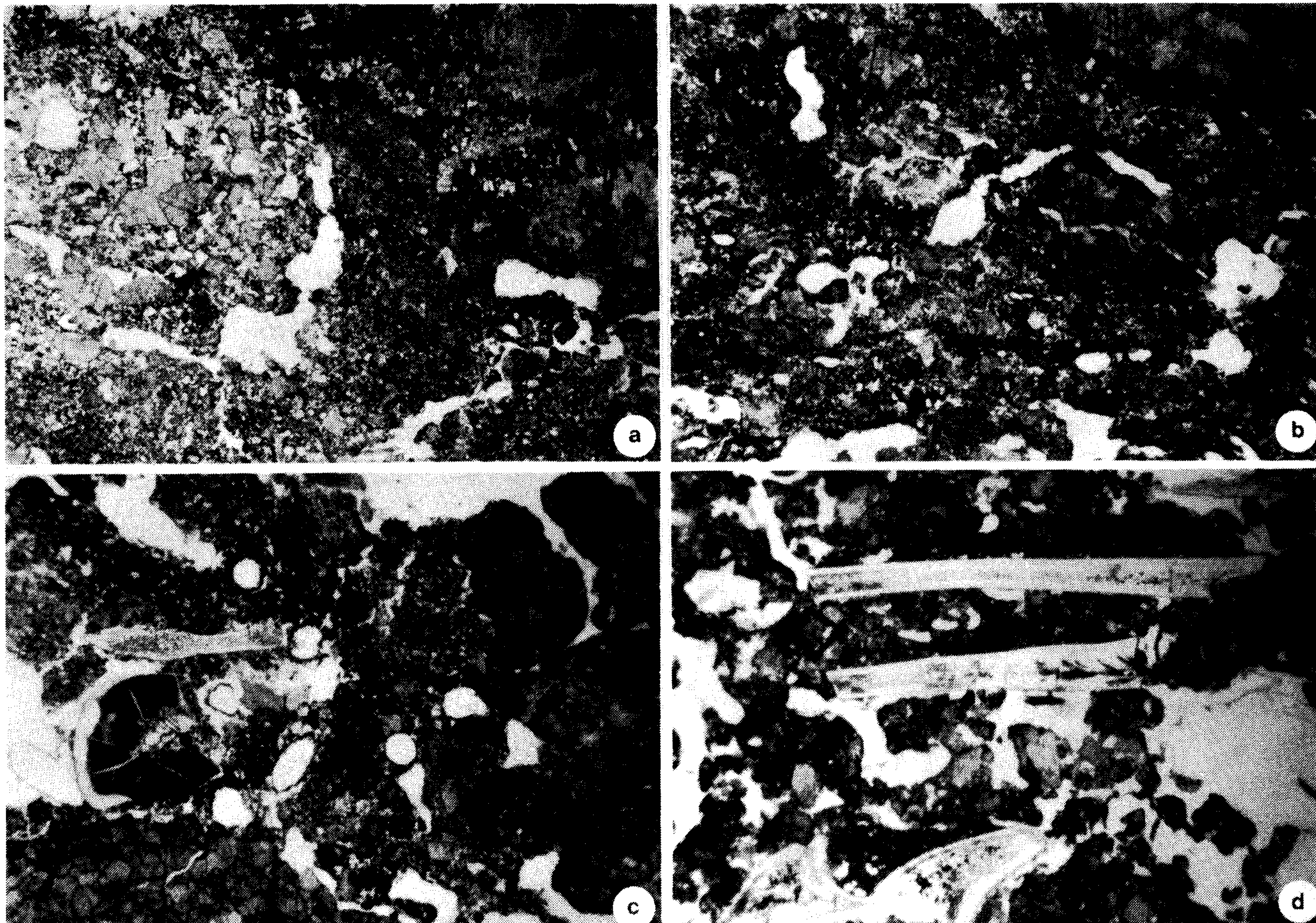

Planche 3

Planche 4

a) Partie supérieure du niveau YSS (V8) : limons sablo-argileux résultant d'une fine homogénéisation d'une composante loessique et d'une composante sableuse allochtone, faiblement altérée, abondante; microstructure cavitaire, fermée; agrégat brun de sol argileux introduit par le piétinement (BL 12, LN. N 1,6. Largeur de la photo: 5 mm).

b) Niveau YSS, au fond de la grotte: limons argilo-sableux résultant d'une fine homogénéisation d'une composante loessique et d'une composante sableuse allochtone, faiblement altérée, abondante; microstructure cavitaire fermée; agrégats bruns de sols argileux introduits par le piétinement et abondants fragments osseux dispersés (BL 13, LN. N 1,6. Largeur de la photo: 5 mm).

c) Niveau YS, au fond de la grotte, détail de 4b montrant des revêtements argileux grossiers et de petits fragments osseux finement intégrés à la masse du sol (BL 13, LN. N 10. Largeur de la photo: 0.85 mm).

d) Partie supérieure du niveau YSS (V8) : sables limono-argileux résultant d'une fine homogénéisation d'une composante loessique et d'une composante sableuse allochtone, faiblement altérée, abondante; microstructure fissurale à cavitaire, fermée (BL 5, LN. N 1,6. Largeur de la photo: 5 mm).

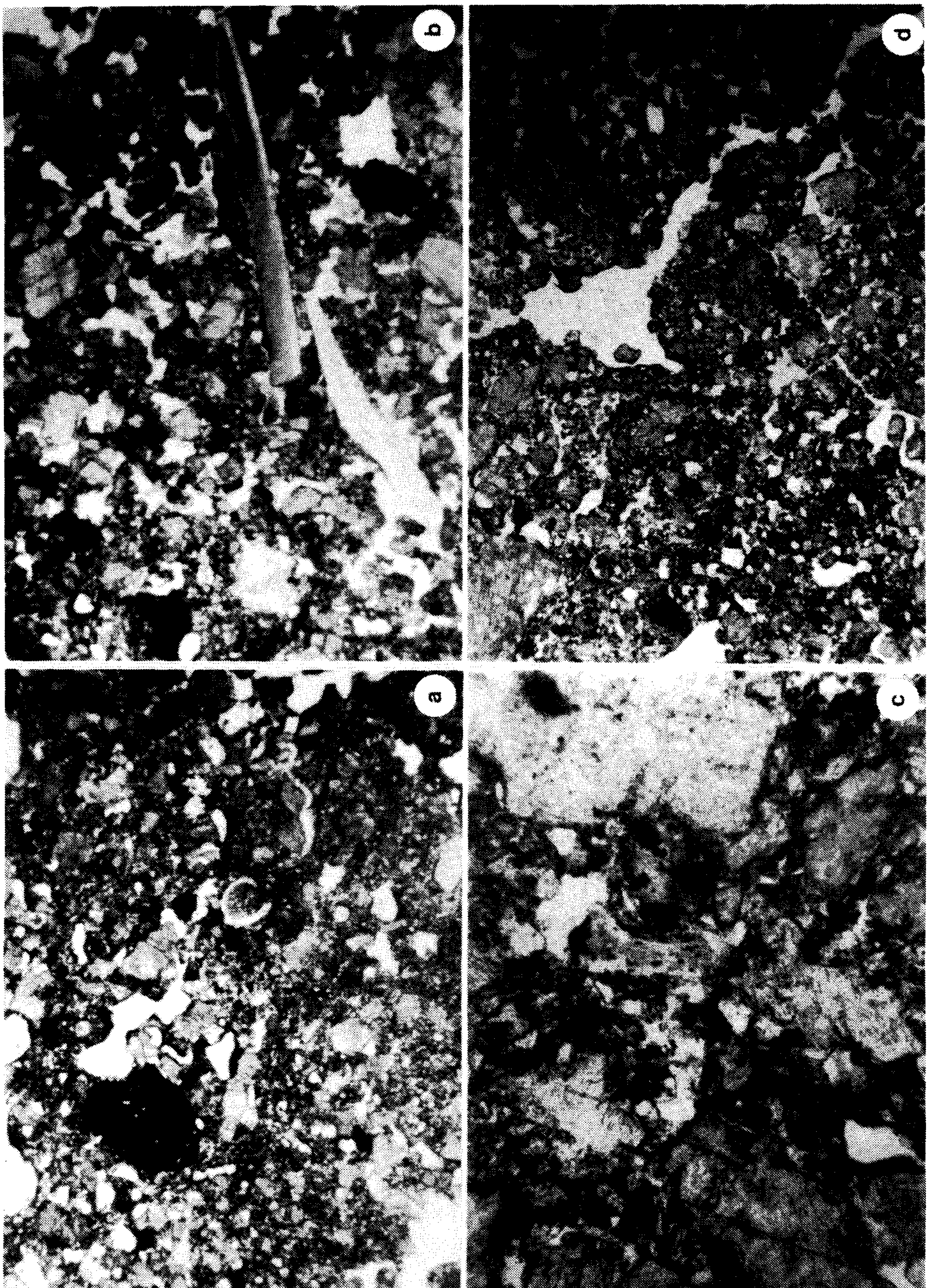

Planche 4

Planche 5

a) Partie supérieure du niveau YSS (V8) : même vue que 4d en lumière polarisée.

b et c) Niveau UGS (V8) : Sables limoneux ouverts, essentiellement constitués de produits de désagrégation de la roche calcaire, et dans une moindre proportion de limons loessiques présents en agrégats résiduels; fragments osseux dispersés; le mélange de ces différents matériaux suggère un remaniement d'origine mécanique (BL 4, LN. N 1,6. Largeur de la photo: 5 mm).

d) Niveau UGS (V8) : fragments grossiers à coiffes limono-argileuses mélangés à des sables calcitiques mal triés; le mélange de ces différents matériaux suggère un remaniement d'origine mécanique (BL 4, LN. N 1,6. Largeur de la photo: 5 mm).

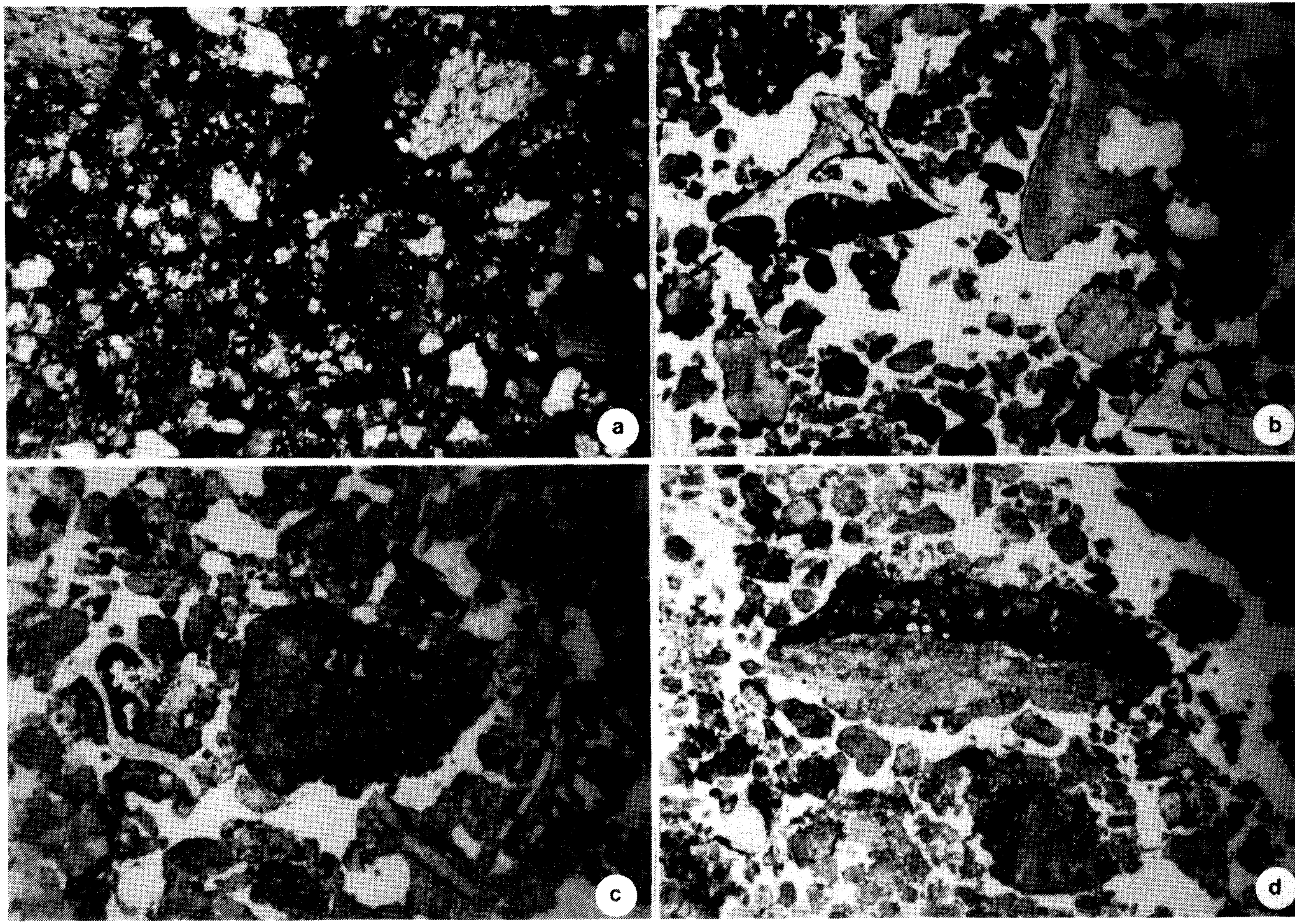

Planche 5

Planche 6

a) Partie inférieure du niveau YSS (V5), dans les fissures de la roche mère: limons argilo-sableux montrant une forte composante loessiaue; microstructure cavitaire ouverte traduisant un léger remaniement mécanique; abondants fragments charbonneux intégrés à la masse fine du sol (BL 3, LN. N 1,6. Largeur de la photo: 5 mm).

b) Détail de 6a montrant les plages charbonneuses finement intégrées à la masse fine du sol (BL 3, LN. N 10. Largeur de la photo: 0.85 mm).

c) Détail de 6a montrant la composante loessique constituée de limons argileux bruns, riches en micro-particules contrastées, résidus charbonneux et fragments organiques humifiés (BL 3, LN. N 10. Largeur de la photo: 0.85 mm).

d) Détail de 6a, vue en lumière polarisée de 6c montrant la faible quantité de limons calcitiques dans la masse fine du loess.

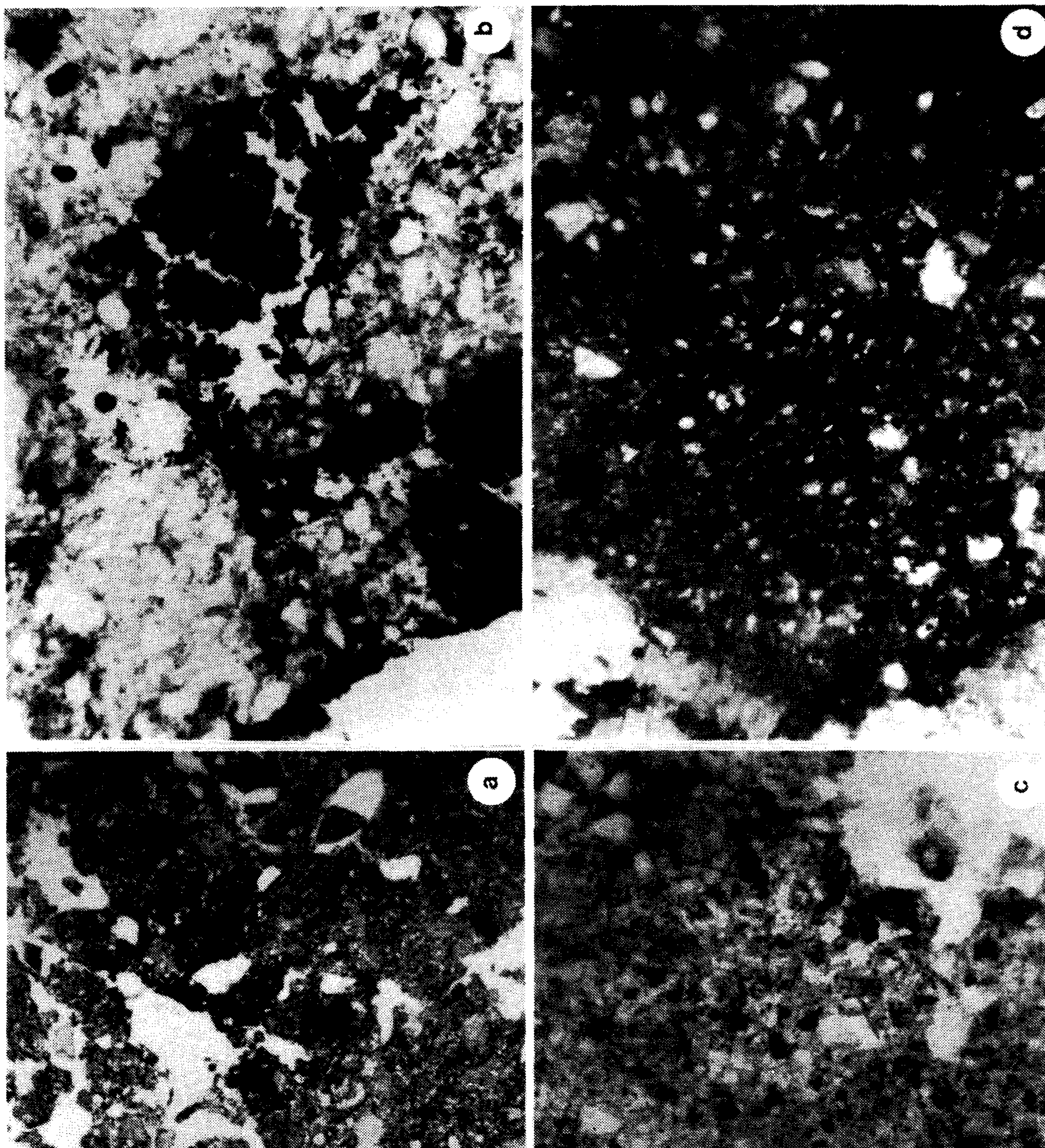

Planche 6

Planche 7

a) Partie inférieure de YSS (V5) : limons argileux d'origine loessique finement mélangés à une composante sableuse provenant de la désagrégation de la roche mère calcaire; microstructure cavitaire fermée produite par des lentilles de glace; calcitisations micritiques diffuses le long des chenaux racinaires (BL 1, LN. N 1,6. Largeur de la photo: 5 mm).

b) Même vue que 7b en lumière polarisée montrant le fin mélange de la composante loessique non carbonatée et de la composant autochtone calcaire.

c) Partie inférieure de YSS (V5): relique d'accumulation de loess limono-argileux bruns, à la base d'un fragment calcaire (BL 1, LN. N 1,6. Largeur de la photo: 5 mm).

d) Partie inférieure du niveau YSS (V5), dans les fissures de la roche mère: limons argilo-sableux bruns montrant une forte composante loessique microstructure cavitaire fermée; fragment osseux présentant un enduit organique brun noir, bitumineux (?) (BL 3, LN. N 1,6. Largeur de la photo: 5 mm).

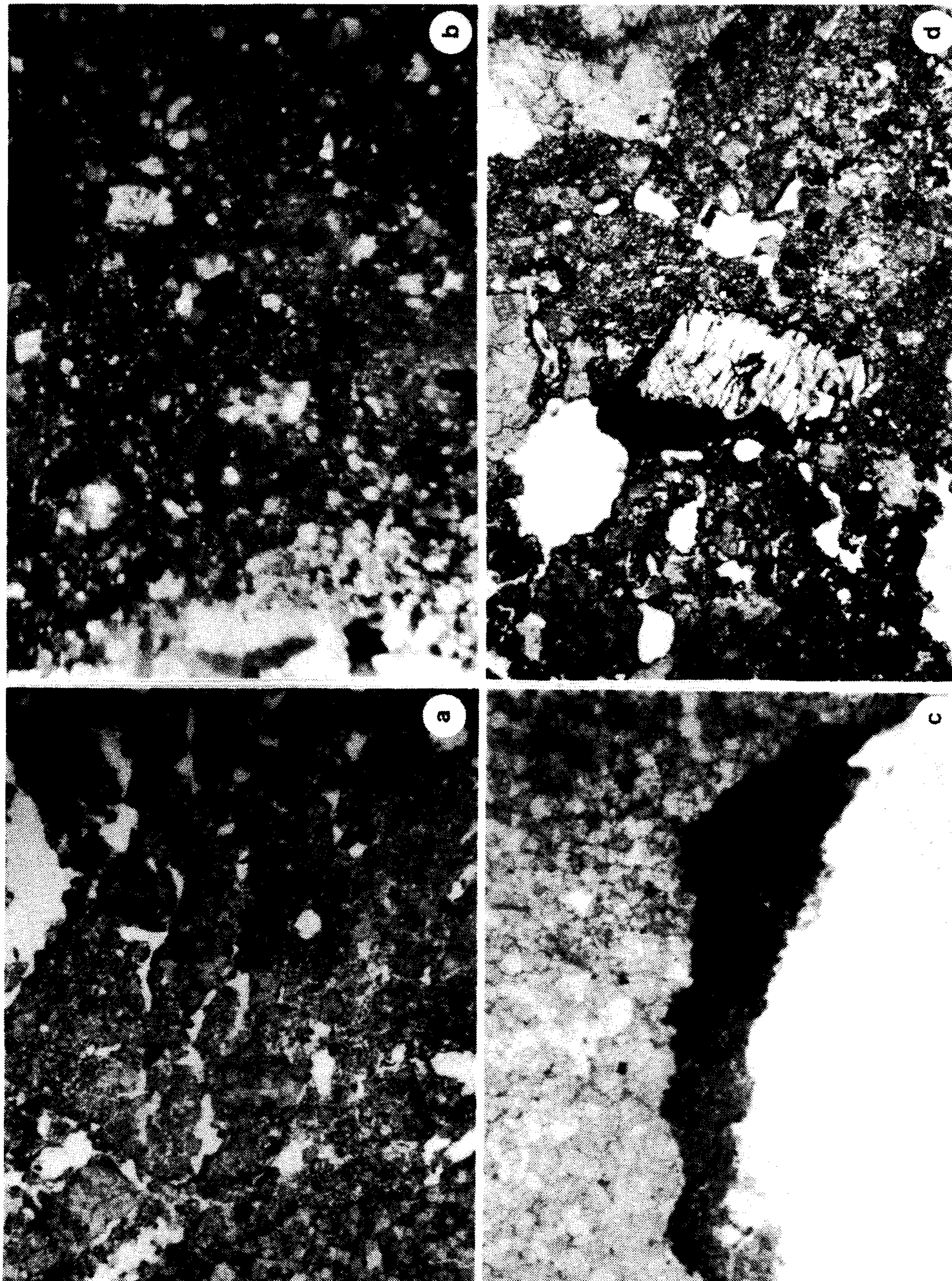

Planche 7

Planche 8

a) Niveau YSS, au fond de la grotte: limons argilo-sableux à forte composante loessique, fragments osseux et agrégats de sols bruns introduits par le piétinement; microstructure cavitaire fermée (BL 14, LN. N 1,6. Largeur de la photo: 5 mm).

b) Niveau YSS, au fond de la grotte: concentration de limons argilo-sableux à forte composante loessique entre des fragments grossiers calcaires; fragments osseux et agrégats de sols bruns introduits par le piétinement; microstructure cavitaire fermée (BL 14, LN. N 1,6. Largeur de la photo: 5 mm).

c) Partie supérieure du niveau YSS, au fond de la grotte : limons argilo-sableux, bruns, très carbonatés, à microstructure très dense; abondants fragments osseux dispersés (BL 2, LN. N 1,6. Largeur de la photo: 5 mm).

d) Partie supérieure du niveau YSS, au fond de la grotte: fragment grossier calcaire à barbe calcitique provenant de la désagrégation de la paroi de la grotte, serti dans une masse fine de limons argilo-sableux, bruns, très carbonatés; calcitisations abondantes le long des chenaux racinaires (BL 2, LN. N 1,6. Largeur de la photo: 5 mm).

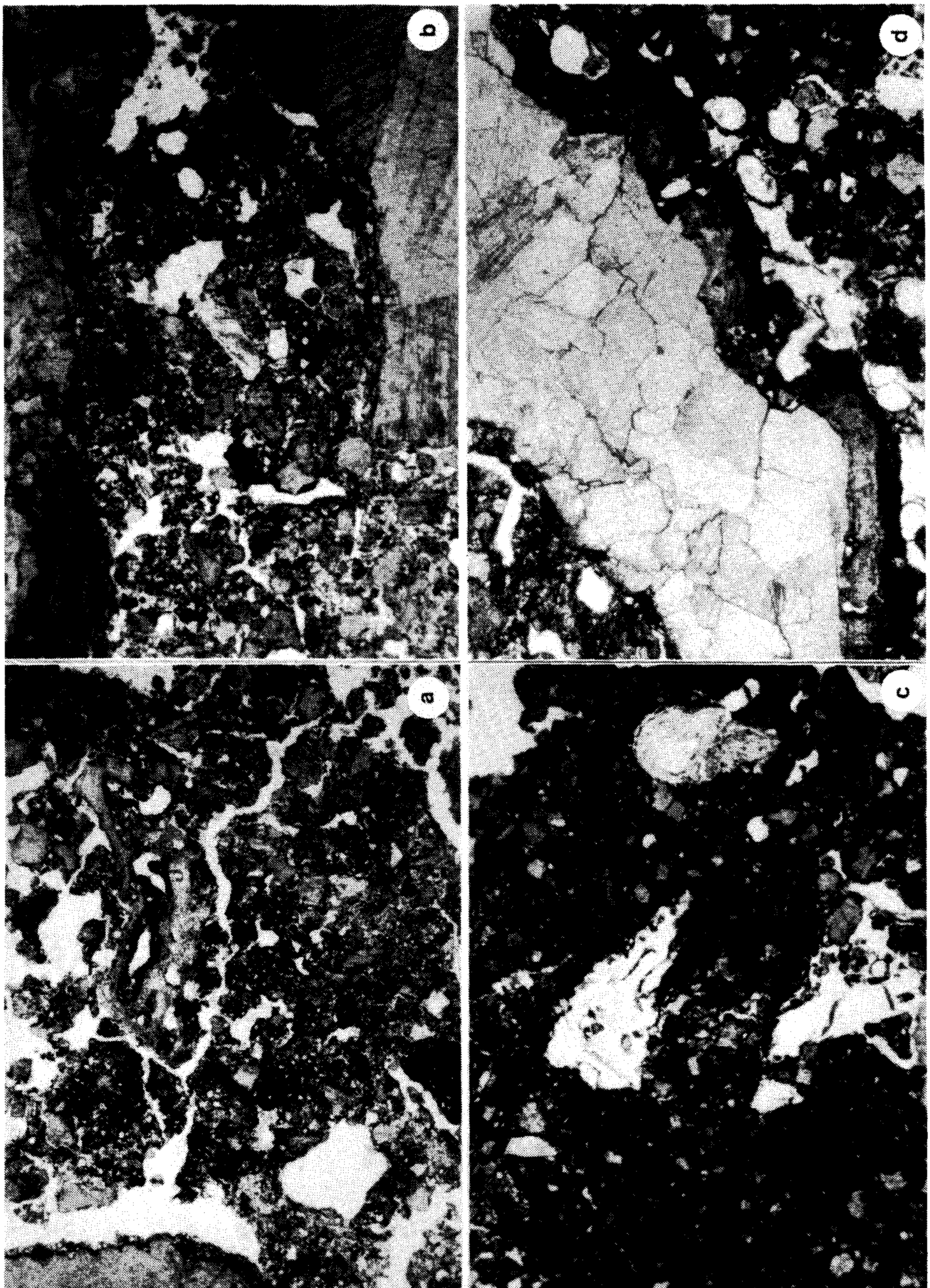

Planche 8

Conclusions

L'étude effectuée met en évidence une nette évolution des conditions climatiques synchrones des différents épisodes de mise en place des dépôts.

La mise en place des niveaux LGS et UGS s'est produite sous les conditions les plus froides marquées par un forte activité cryoclastique et une faible contribution des apports loessiques. A titre d'hypothèse, cette ambiance peut être respectivement corrélée avec l'épisode froid du Dryas I pour le niveau LGS et du Dyras II pour le niveau UGS.

La mise en place du niveau YSS s'est produite sous des conditions globalement moins froides, surtout caractérisées par un réchauffement estival plus marqué. La diversité des organisations pédologiques traduit une forte variabilité des ambiances peut-être liée à une instabilité climatique. Les caractères pédo-sédimentaires du niveau YSS sont donc cohérents avec les datations absolues qui permettent de corréler l'occupation magdalénienne avec la phase de réchauffement du Bölling (*ca.* 12,600 B.P.). Le fait que cet épisode apparaisse globalement synchrone de la mise en place de loess primaires, alors que les épisodes les plus froids ne sont pas associés à des apports éoliens suggère que une la sédimentation loessique ne serait pas caractéristique des conditions les plus rigoureuses. Une étude régionale permettrait de déterminer s'il s'agit là d'une spécificité locale ou d'une tendance plus globale.

Les processus de sédimentation et de pédogenèse n'apparaissent pas comme les facteurs responsables des perturbations locales du niveau YSS qui semblent plutôt être d'origine anthropique. L'intérieur de la cavité de la grotte ne semble pas avoir été le lieu principal des activités qui ont pu se dérouler dans une zone située plus vers l'extérieur. La présence de plusieurs surfaces d'activité résiduelles montre, néanmoins, clairement que les niveaux archéologiques sont stratigraphiquement en place.

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

4

ANALYSE PALYNOLOGIQUE DE LA GROTTE DU BOIS LAITERIE

A. Emery-Barbier

Plusieurs échantillons, parmi les séries prélevées en colonnes par L.G.Straus au Bois Laiterie, furent traités par les méthodes employées habituellement dans ce laboratoire pour des sédiments de grotte. Malheureusement tous les échantillons provenant de la partie située sur le devant de la grotte (carrés T-U6) s'avérèrent stériles.

Néanmoins, deux échantillons pris vers le fond de la cavité (carré U9) dans la couche magdalénienne («YSS», datée de 12.600 BP par trois déterminations C-14) ont donné quelques pollens:

ECHANTILLON C3 (sommet de la Couche YSS)

1 Alnus
2 Corylus
3 Juniperus
1 Pinus
1 Graminée
2 Spores Trilètes

ECHANTILLON C4 (base de la Couche YSS)

2 Corylus
1 Juglans
3 Juniperus
1 Pinus
1 Rosacée
2 Spores Monolètes
1 Equisetum

TOTAL: 21

Bien qu'il soit impossible de donner des précisions quelconque en vue de l'extrême faiblesse numérique de ces échantillons, nous remarquons non seulement la présence sinon aussi la prédominance de pollens d'arbres dans les deux. Ces arbres comprennent des essences mésophiles (*Alnus*, *Corylus* et surtout *Juglans*). La présence de fougères indique l'existence d'humidité au moins locale. Ces indices suggèrent que l'occupation magdalénienne ait eu lieu lors d'une amélioration climatique, qui, en vue des datations C-14, serait logiquement le Bölling.

A titre de comparaison, au sein de la couche magdalénienne (12.900-12.700 B.P.) de la Grotte de Chaleux (21 km au sud en bordure de l'Ardenne) ont été retrouvées des pollens de toutes ces mêmes essences (parmi bien d'autres arbres et arbustes) par Cl. Noirel-Schutz (1990) au cours d'analyses réalisées dans ce même laboratoire. Ces travaux montrent l'existence d'un environnement en mosaïque dans les reliefs marqués de la Wallonie vers la fin du Tardiglaciaire. Cette tentative de conclusion tend à appuyer les résultats paléontologiques non seulement au Bois Laiterie, mais aussi à Chaleux et Goyet, qui ont tous des «mélanges» d'animaux (grands et petits) de steppe/toundra arctique et de bois plutôt tempéré au moment de l'occupation magdalénienne de cette région située à 50° de latitude. Elle également la découverte de charbons de bois d'arbres et d'arbustes franchement tempérés dans la couche magdalénienne de Chaleux (Schoch 1994).

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5

LE SITE DU BOIS-LAITERIE (PROVINCE DE NAMUR, BELGIQUE) RAPPORT DE L'ANALYSE ANTHRACOLOGIQUE DES NIVEAUX DU MAGDALENIEN SUPERIEUR (12,600 B.P.)

J-M. Pernaud

Matériel et méthode

Les charbons de bois ont été récoltés par tamisage puis observés en microscopie optique à réflexion, fond clair-fond noir, selon les trois plans anatomiques du bois.

Résultats (tab. 1):

Les prélèvements effectués (plusieurs par niveau) ont livré très peu de charbons de bois et consécutivement peu de taxons.

En tout, deux essences ont été clairement individualisées : le Bouleau *(Betula sp.)* et le Noisetier *(Corylus avellana)*. Un fragment n'a pu être déterminé au-delà de la famille. Il appartient à la famille des Betulacées *(Betulaceae)*. Il peut correspondre à l'un ou l'autre des deux taxons identifiés. Il peut aussi s'agir d'Aulne, de Charme.

	STRATUM LBS	STRATUM YSS	STRATUM BSC
Betula sp.	-	1	-
Corylus avellana	1	4	1
Betulaceae	-	1	-
Total (déterminés)	1	6	1
Indéterminables	-	6	-

TABLEAU 1 - Resultats de l'analyse anthracologique dans la grotte du Bois Laiterie.

Sur le plan quantitatif, l'échantillon est trop restreint pour autoriser l'établissement de pourcentages.

Interprétation

Les résultats obtenus sont assez fragmentaires et, de ce fait, limitent considérablement l'interprétation. Notons que le Noisetier et le Bouleau sont des essences héliophiles et pionnières témoignant donc d'un environnement boisé clairsemé. Le Bouleau a une connotation climatique plus froide que le Noisetier qui, malgré tout, peut tolérer des températures assez basses. Les résultats obtenus ici s'intègrent assez bien aux données enregistrées par la palynologie du site, réalisée par A. Emery-Barbier, et plus largement à celles acquises jusqu'ici en Belgique (Munaut, 1968). En effet, durant le Bölling, les premiers boqueteaux se développent dans un paysage jusque là essentiellement steppique (pelouse à *Artemisia*). Ils regroupent le Saule, le Bouleaux, tous deux majoritaires dans les pollens, le Pin puis quelques autres taxons mésophiles encore très discrets comme l'Aulne, le Noisetier, l'Orme et le Tilleul.

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6

ETUDE DES RESTES MALACOLOGIQUES DE LA GROTTE DU BOIS LAITERIE

I. López Bayón, Ph. Lacroix et J-M. Léotard.

Introduction

La grotte du Bois Laiterie se trouve dans une falaise calcaire au-dessus du village Rivière, dans la commune de Profondeville; elle est exposée plein nord et se situe à quelques 130 m. au-dessus du niveau de la mer. Elle est caractérisée par la présence d'un assemblage magdalénien hautement spécialisé et vraisemblablement apporté pour une activité spécifique, telle la chasse en embuscade. L'occupation magdalénienne (couche YSS), fouillée sous la direction de M. Otte et L.G. Straus, fut datée de 12.660 ± 140 B.P. (OxA-4198), 12665 ± 96 B.P. (GX-20434 AMS) et 12625 ± 117 B.P. (GX-20433 AMS). Ces datations correspondent parfaitement à l'oscillation de Bölling, comme celles obtenues pour d'autres sites: Chaleux, Trou de Frontal, Trou des Nutons, Trou da Somme, Coléoptère, Verlaine et plausiblement à Walou et au Trou des Blaireaux (Vaucelles). Le but de l'étude malacologique était de contrôler les variations environnementales et climatologiques lors de l'occupation magdalénienne et des périodes immédiatement postérieures à celle-ci.

Methodologie

Les dégâts successifs produits par des groupes de fouilleurs clandestins ont engagé à l'équipe de fouille à échantillonner avec promptitude. Etant donné la surface réduite de la cavité et le remaniement produit par les clandestins et afin de ne pas gêner la fouille, nous avons opté pour la réalisation de plusieurs sondages en bordure de la fouille principale. Parmi ceux-ci, seules deux colonnes semblaient aptes pour les analyses.

La colonne W 3, située sur la terrasse, fut prélevée par le deuxième auteur; les niveaux étaient faiblement perturbés, comme en témoignent la position verticale de certaines plaquettes et l'abondance du matériel. Le niveau YSS (voir Courty, dans ce même volume) constituait la matrice principale de l'horizon culturel magdalénien. L'activité des groupes humains a sans doute biaisé l'échantillonnage, qui s'avère moins riche en malacofaune dans cet horizon que dans les horizons sus-jacents. L'exposition, la manque de luminosité et l'exiguïté de la grotte ont obligé les occupants à s'installer près du porche, sur la terrasse, pour y réaliser les activités principales; de ce fait, les sédiments ont souffert d'un piétinement continu qui s'est ajouté à des remaniements anthropiques produits lors de la construction d'un dallage en psammite (voir Miller et López Bayón, dans ce même volume). En outre, nous avons constaté la présence de petits glissements qui ont provoqué un remaniement naturel de la base de la colonne d'échantillonnage W3, dont certains éléments provenant de l'intérieur de la cavité ont été piégés et mélangés dans les échantillons W3-12 à W3-17. Parmi eux se trouvaient quelques esquilles de silex et de petits fragments de psammite. Cette partie inférieure de la colonne est composée de seulement 188 éléments identifiables, donc 31,3 documents par échantillon (2.36 % du total de la colonne). Du fait de cette perturbation, la conservation est très mauvaise et la lecture malacologique est donc profondément biaisée. Sur la fig.1, la partie supérieure de la séquence est représentée d'une manière harmonieuse et cohérente, pendant que la partie inférieure a une image illogique en dents de scie avec de très profonds bouleversements sans cause apparente.

La colonne S 6 fut récoltée sous l'auvent juste à l'intérieur de la grotte; elle correspond à l'horizon magdalénien. La puissance sédimentaire de cette colonne est manifestement moindre qu'en W3. Cependant, nous avons réalisé une analyse en ce lieu pour y contrôler les possibles défaillances de la colonne principale et les variations entre le comportement malacologique à l'intérieur et l'extérieur de la cavité, ainsi que les possibles variantes dues à l'activité humaine lors de la phase d'occupation. Les problèmes de piétinement et de remaniement semblent minimisés parce que cette aire s'avere être une zone de rejet (voir, Miller and López Bayón, López Bayón *et al.*, et Straus and Martínez, dans ce même volume).

Le tamisage fut entièrement réalisé en laboratoire et la récolte de spécimens par flottation à maille de 0,5 mm. Les identifications furent réalisées à l'aide de collections de comparaison et de plusieurs atlas malacologiques. Les déterminations spécifiques furent réalisées seulement sur spécimens adultes, complets ou non. La collection est actuellement conservée au Service de Préhistoire de l'Université de Liège. Les conclusions malacologiques furent contrastées avec les résultats microfauniques (voir Cordy, dans ce même volume) afin de contrôler les problèmes internes propres à l'échantillonnage.

Presentation de la collection

Colonne W3

- *Phase II (échantillons W3-17 à W3-12)*

Dans cette deuxième phase, on a constaté la présence d'une seule espèce à caractère strictement forestier, *Discus ruderatus*, qui est spécifique des forêts de conifères; la présence de 19 éléments en W3-16 est un peu extravagante, si l'on tient compte des taux des échantillons W3-13, W3-14, W3-15 et W3-17, qui sont plus uniformes.

Les espèces avec de larges possibilités d'adaptation, comme les espèces mésophiles, sont représentées par plusieurs taxons. *Trichia hispida* est la plus présente; elle exprime un environnement caractérisé par un fort taux d'humidité. Il est intéressant de constater la disparition de *Milax* dans cette phase, indiquant un milieu sédimentaire très troublé.

Parmi les espèces qui habitent les stations découvertes, *Vallonia costata*, la plus adaptable, est capable de s'installer dans des stations peu humides et de subsister sous des pierres et parmi des feuilles mortes. *Vallonia pulchella* semble s'adapter plus facilement à des conditions plus humides, et à la fin de cette phase semble cohabiter avec *Vallonia costata*. *Vertigo pigmaea* est toujours représentée faiblement: ceci est un caractère inhérent à l'espèce, elle ne s'associe pas à d'autres héliophiles, sauf *Vallonia costata*; sa présence s'avère plus importante à mesure que l'habitat se stabilise; paradoxalement son taux de représentation dans cette phase est très élevé; cette discordance nous informe de nouveau d'un problème interne à l'échantillon, vraisemblablement lié à la mise en place du dépôt. Les espèces de plus petite taille, ayant moins souffert lors de la formation du dépôt, présentent des taux d'identification plus importants.

La présence d'espèces semi-forestières, comme *Discus rotundatus* et *Retinella hamonis*, soulignerait un paysage boisé, mais ces espèces sont capables de s'adapter aussi à des stations de buissons et taillis; soulignons que nous n'avons ni des taux vraiment importants ni des taxons boisés vraiment diversifiés. Les deux espèces sont très prolifiques, donc les pourcentages montrent une surabondance par rapport à d'autres espèces, surabondance qu'il faut nuancer.

Les comportements de *Vallonia costata* et *Trichia hispida* nous font penser à une augmentation progressive du taux d'humidité; l'apparition (lors de la phase finale de l'occupation) de *Carychium sp.* et l'évolution de *Succinea oblonga* nous confirment cette conjoncture.

La présence de *Carychium* associée à *Discus rotundatus* est typique des zones de formation de «tufas» (Evans 1972, p.301) et de petits sols humifères de faible épaisseur. Cette caractéristique semble correspondre aux couches LGS et UGS qui entourent la phase d'occupation magdalénienne (YSS et BSC). Les échantillons W3-12 et W3-13 pourraient correspondre à une phase de stabilisation à la fin du Dryas II.

- *Phase III (échantillons W3-9 à W3-11)*

La phase postérieure se caractérise par la restriction importante qui se produit à l'intérieur du groupe des espèces exclusivement forestières. *Acanthinula aculeata* va apparaître associée à *Discus ruderatus*, mais le pourcentage de celui-ci s'est fortement dégradé: le taux de représentativité ne dépasse pas 2.5 %.

Le groupe des espèces semi-forestières semble garder les mêmes pourcentages que dans la phase antérieure; *Retinella hamonis* a pris le dessus sur *Discus rotundatus*. De nouvelles espèces telles que l'ubiquiste *Punctum pygmaeum*, *Ena obscura* et *Columella edentula* font maintenant partie du cortège malacologique.

Le caractère humide est souligné par la présence d'*Azeca menkeana*, espèce forestière mais réclamant beaucoup d'humidité.

Les espèces de stations découvertes vont atteindre des proportions oscillant entre 20 et 30 %. L'éclosion se produit dans les «moments» 10 et 11; en 12, on constate une régression (taux inférieur à 2.5 %) qui continuera jusqu'à la disparition progressive des taxons de milieu ouvert. Il est intéressant de souligner l'opposition entre le développement de *Pupilla sp.* et la diminution de *Discus rotundatus* lors de la phase initiale de cette séquence. *Pupilla* est une espèce qui s'éclipse lors du développement de la fôret; elle ne supporte pas des taux d'humidité relative supérieurs à 40-50 %. Dans la phase finale de la séquence, les rapports entre les deux espèces s'inversent: *Pupilla* passe de 3.7% du total à 0.3%, *Discus rotundatus* évolue de 3.1% à 9.6 %. *Discus rotundatus* semble raffoler d'ambiances plus humides avec des taux d'humidité relative proches de 70%. Cette tendance est marquée aussi pour l'ensemble des espèces semi-forestières qui vont passer de 14% à 25.9%, alors que les espèces de milieu découvert passeront de 28.7% à 12.6%, pour ensuite presque disparaître (3.7%, 2.1%, etc.).

Lors de cette phase, on constate aussi l'évolution des taxons xérophiles, surtout le développement de *Clausilia parvula* et de l'héliophile *Abida secale*. D'autres espèces telles *Vitrea sp.* et *Vertigo pusilla* se développent également. C'est surtout dans la phase initiale que *Abida secale* s'installe; elle est caractéristique des milieux secs et ouverts. L'éclosion de *Vertigo*, *Vitrea* et *Clausilia* semble nous indiquer, de nouveau, une évolution vers une phase plus humide et légèrement plus boisée. Ces résultats sont en parfaite symbiose avec les données obtenues pour les espèces de stations découvertes.

En ce qui concerne les espèces mésophiles, *Trichia hispida*, les agrégations de *Cochlicopa* et la présence d'*Euconulus* et *Vitrina* semblent souligner ce passage vers une période plus humide et boisée.

Dans cette phase, l'espèce palustre *Succinea* et les aquatiques *Ancylus sp.* et *Valvata sp.* ont une présence occasionnelle et accidentelle.

- *Phase IV (échantillons W3-6 à W3-8)*

Les espèces exclusivement forestières vont maintenir leur niveau de présence. *Acanthinula* se confirme comme chef de file. *Discus ruderatus* va disparaître de façon progressive; sa place sera prise par des nouvelles espèces à caractère plus tempéré et humide, comme *Cochlodina laminata*, *Helicigona lapicida* et vraisemblablement *Orcula dolium* et *Ena montana* (qui ne supporte pas les étés froids ou rigoureux). *Helicigona* est très rupicole, elle se cache pendant le temps sec et sort seulement quand il y a de la pluie. *Ena montana* est plus forestière, elle s'installe sur les mousses et les feuilles mortes au pied des arbres.

Les espèces semi-forestières vont devenir le groupe capital lors de cette phase; leur épanouissement est constant et progressif. D'un taux de 14% à la fin de la phase précédente, elles vont passer à des valeurs tournant autour de 35 et 40%, pour finir à 43.1%. Pendant que *Retinella hamonis* reste à des niveaux constants, *Discus rotundatus* évoluera de façon progressive. Il est possible que la propre éthologie de l'espèce soit responsable de cet effet, *Discus rotundatus* étant très prolifique.

Les espèces de paysages ouverts vont progressivement diminuer, jusqu'à leur disparition; seule *Vertigo pigmaea* semble tenir le coup. *Vallonia pulchella* et *Pupilla* vont s'éclipser, certainement à cause d'un taux d'humidité relative et d'un boisement plus accrus. Les taux pour ce groupe évoluent de 28.7% à la fin de la phase précédente vers 12.6% au début de celle-ci, pour progressivement atteindre des valeurs situées autour de 2 ou 2.5%.

BOIS LAITERIE / W3	X3b	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Espèces exclusivement forestières																		
Acanthinula aculeata		7	9	6	14	5	15	8	8	11	7							
Discus ruderatus								1	2	5	13	13		1	1	4	19	1
Cochlodina laminata		x		2	2	1	5	4	3	4								
Helicigona lapicida	12	2	x	4	4	2	4	x	2									
Helicodonta obvoluta	45	3	2	2	2													
Orcula doliolum	2	5	x	3	x	x		x										
Clausilia rolphii	2				1													
Ena montana							x											
Espèces semi-forestières																		
Discus rotundatus	75	63	76	137	125	228	273	231	142	101	27		6	2				1
Retinella hamonis	111	53	57	34	120	118	150	157	131	158	86	46	11			1	3	
Punctum pygmaeum		7	14	14	5		7	9	7	6	4	4						
Columella edentula				1	2	4	3	5	3	6	3	3						
Ena obscura			x	1	x	x	1	2		1	1							
Espèces forestières reclamant humidité																		
Azeca menkeana		9		4						1	1							
Zénobiella incarnata	2	1																
Espèces de stations découvertes																		
Pupilla sp.										3	32	17	12		1			
Vallonia pulchella										23	58	48	1					
Vallonia costata					4	5	10	11	22	89	159	109	2		1	1	6	4
Vertigo pygmaea		7	3	8	13	3	14	10	8	17	3	3	1	1	1			
						3												
Espèces xérophiles																		
Abida secale + Chondrina avenacea	3	9		3	2	5	3	4	10	30	34	18	1					
Clausilia parvula	12	35	26	28	56	35	233	242	181	172	79	21	4					1
Vitrea sp.	110	29	31	28	17	14	27	30	32	59	18	4	3	1				
Vertigo pusilla	1		3	2	6	1	19	34	27	26	17	11						
Pomatias élégans	18	2	2	x	x													
Espèces mésophiles																		
Cochlicopa lubrica		1	2		3	8	18	103	54	87	90	104	2	1		1	1	
Oxychilus sp.	32	4	7	16	19	14	27	19	24	21	8	4						1
Vitrina sp.	1	2	1	1						3	3	3	1					1
Milax sp.		1		2	4	2	5	3	15	11	12	5	2	2			1	12
Euconulus fulvus	1	4	1	1	3	3	8	4	8	1	4	5						1
Trichia hispida	1	4		1	3	13	97	48	73	143	158	114	15	3	2	3	4	
Cepaea sp.	22		1	5	6	6	14	5	2	3	2	1	1	1	1	1	1	1
Fruticicola fruticum				1	2	x												
Espèces aimant l'humidité																		
Carychium sp.	29	52	73	89	59	25	61	49	47	60	26	10	7	1				
Acme lineata	14	5	19	11	5	3												
Espèces palustres																		
Succinea sp.										6	15	39	25	3	1		1	
Lymnaea truncatula											1							
Espèces aquatiques																		
Ancylus sp.										1								
Pisidium sp.			1															
Valvata sp.								1		1	1							

Tab.1- Nombre de spécimens identifiés (colonne W3). Ils sont classés en fonction de leur niche écologique. Attributions environnementales d'après les groupes établis par R. Peuchot de l'Université Libre de Bruxelles (comm. personnelle).

Les espèces xérophiles profiteront de l'adversité pour atteindre des valeurs autour de 30%. *Clausilia parvula* sera l'espèce qui bénéficiera principalement de cette transformation, pendant que les autres xérophiles garderont des taux similaires à ceux de la phase antérieure. Les taxons mésophiles s'amoindrissent en douceur, en faveur des espèces semi-forestières et xérophiles, *Discus rotundatus* et *Clausilia parvula* principalement.

La hausse, lente mais progressive, de la représentation de *Carychium* et son association avec *Discus rotundatus* sont à souligner. La disparition de *Succinea oblonga* et *Discus ruderatus,* ainsi que l'éclosion de *Discus rotundatus,* expriment l'installation progressive d'un climat tempéré et un bouleversement important de l'environnement.

- *Phase V (échantillons W3-1 à W3-5)*

La malacofaune forestière s'enrichit; de nouvelles espèces comme *Clausilia rolphi, Orcula doliolum* et *Helicodonta obvoluta,* figurent à présent dans le cortège. *Acanthinula, Helicigona* et *Cochlodina* sont aussi représentées. Leur taux de présence va s'installer autour de 4,5 % en moyenne.

Les espèces semi-forestières vont jouer le rôle principal, avec *Discus rotundatus* comme chef de file. Ces taxons vont s'installer autour de 45% de l'échantillon, bien que dans le début de cette phase on enregistre un taux de 70%.

Des espèces forestières (réclamant d'importants taux d'humidité) étaient déjà représentées par *Azeka menkeana* lors de la période de transition de la phase II à la phase III. Dans la phase IV, *Azeka* confirme sa présence. Le caractère humide et boisé de la période est souligné par l'apparition d'un nouveau taxon, *Zenobiella incarnata.*

Les espèces de stations découvertes poursuivent leur déclin; seule *Vertigo pigmaea* semble tenir le coup face au boisement.

Les taxons xérophiles et mésophiles vont subir une réduction, plus accentuée chez les mésophiles. Cette réduction est plus claire si l'on suit les courbes comparées de *Trichia hispida* (avec une évolution négative depuis la fin de la phase III) et de *Clausilia parvula* (avec une évolution positive depuis la phase III jusqu'à la fin de la phase IV). Lors de la phase V, *Clausilia parvula* arrivera à se maintenir en raison de la hausse du taux d'humidité, mais perdra du terrain en faveur des espèces à caractère forestier et humide comme *Carychium* et la nouvelle venue *Acme lineata.*

- *Phase I (échantillons S6-3 à S6-8)*

Les espèces exclusivement forestières sont fondamentalement représentées par *Discus ruderatus*: au début de la séquence les taux de représentation oscillent entre 34.29% et 42.11%; la phase moyenne montre le déclin et même la disparition de cette espèce; à la fin de la séquence, *Discus ruderatus* va réapparaître en s'associant à *Acanthinula aculeata,* mais leurs valeurs ne dépasseront pas 1,46%.

BOIS LAITERIE / W3	X3b	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Espèces exclusivement forestières																		
Acanthinula aculeata		2.3	2.7	1.5	2.9	1	1.5	0.8	1	1	0.8							
Discus ruderatus								0.1	0.2	0.5	1.5	2.2		6.25	13	36	53	4.3
Cochlodina laminata		x		0.5	0.4	0.2	0.5	0.4	0.4	0.4								
Helicigona lapicida	2.4	0.7	x	1	0.8	0.4	0.4	x	0.2									
Helicodonta obvoluta	9.1	1	0.6	0.5	0.4													
Orcula doliolum	0.4	1.6	x	0.7	x	x		x										
Clausilia rolphii	0.4				0.2													
Ena montana							x											
Espèces semi-forestières																		
Discus rotundatus	15	21	23	34	26	46	27	24	18	9.6	3.1		6.4	12.5				4.3
Retinella hamonis	23	17	17	8.4	25	24	15	16	16	15	10	7.9	12			9.1	8.3	
Punctum pygmaeum		2.3	4.3	3.5	1		0.7	0.9	0.9	0.6	0.5	0.7						
Columella edentula				0.2	0.4	0.8	0.3	0.5	0.4	0.6	0.3	0.5						
Ena obscura			x	0.2	x	x	0.1	0.2		0.1	0.1							
Espèces forestières reclamant humidité																		
Azeca menkeana		3		1						0.1	0.1							
Zénobiella incarnata	0.4	0.3																
Espèces de stations découvertes																		
Pupilla sp.										0.3	3.7	2.9	13		13			
Vallonia pulchella										2.2	6.7	8.2	1.1					
Vallonia costata					0.8	1	1	1.1	2.7	8.5	18	19	2.1		13	9.1	17	17
Vertigo pygmaea		2.3	0.9	2	2.7	0.6	1.4	1	1	1.6	0.3	0.5	1.1	6.25	13			
						0.6												
Espèces xérophiles																		
Abida secale + Chondrina avenacea	0.6	3		0.7	0.4	1	0.3	0.4	1.2	2.9	3.9	3.1	1.1					
Clausilia parvula	2.4	11	7.9	6.9	12	7	23	25	23	16	9.2	3.6	4.3					4.3
Vitrea sp.	22	9.5	9.5	6.9	3.6	2.8	2.7	3.1	4	5.6	2.1	0.7	3.2	6.25				
Vertigo pusilla	0.2		0.9	0.5	1.3	0.2	1.9	3.5	3.4	2.5	2	1.9						
Pomatias élégans	3.7	0.7	0.6	x	x													
Espèces mésophiles																		
Cochlicopa lubrica		0.3	0.6		0.6	1.6	1.8	11	6.7	8.3	10	18	2.1	6.25		9.1	2.8	
Oxychilus sp.	6.5	1.3	2.1	4	4	2.8	2.7	1.9	3	2	0.9	0.7						4.3
Vitrina sp.	0.2	0.7	0.3	0.2						0.3	0.3	0.5	1.1					4.3
Milax sp.		0.3		0.5	0.8	0.4	0.5	0.3	1.9	1	1.4	0.9	2.1	12.5			2.8	52
Euconulus fulvus	0.2	1.3	0.3	0.2	0.6	0.6	0.8	0.4	1	0.1	0.5	0.9						4.3
Trichia hispida	0.2	1.3		0.2	0.6	2.6	9.8	4.9	9.1	14	18	20	16	18.8	25	27	11	
Cepaea sp.	4.5		0.3	1.2	1.3	1.2	1.4	0.5	0.2	0.3	0.2	0.2	1.1	6.25	13	9.1	2.8	4.3
Fruticicola fruticum				0.2	0.4	x												
Espèces aimant l'humidité																		
Carychium sp.	5.9	17	22	22	12	5	6.1	5	5.9	5.7	3	1.7	7.4	6.25				
Acme lineata	2.8	1.6	5.8	2.7	1	0.6												
Espèces palustres																		
Succinea sp.										0.6	1.7	6.7	27	18.8	13		2.8	
Lymnaea truncatula											0.1							
Espèces aquatiques																		
Ancylus sp.										0.1								
Pisidium sp.			0.3															
Valvata sp.								0.1		0.1	0.1							

Tab.2- Pourcentages de représentation des différentes espèces malacologiques présentes à la Grotte du Bois Laiterie (colonne W3). Les espèces sont classées en fonction de leur niche écologique. Attributions environnementales d'après les groupes établis par R. Peuchot de l'Université Libre de Bruxelles (comm. personnelle).

Les taxons semi-forestiers sont représentés par *Retinella hamonis* et, à la fin du cycle, par *Discus rotundatus*. L'accroissement léger qui se produit dans les valeurs de *Retinella* semble indiquer une tendance vers une plus forte humidité à la fin de cette phase.

Le groupe des stations découvertes est constitué par la triade *Pupilla sp.*, *Vallonia pulchella* et *Vallonia costata*, cette dernière agissant comme chef de file. Leur évolution va de 5,7% pour la phase initiale, en passant pour un taux d'environ 15% pour la phase moyenne, pour finir autour de 8.73%. Leur importance relative lors de la phase finale est évidente et ne doit pas être séparée du déclin des espèces semi-forestières et principalement de celui des taxons forestiers.

Colonne S6

Les espèces xérophiles vont passer de taux très bas (2.63%) à des taux moyens d'environ 10%, en passant pour un pic de 30% dû au comportement de l'héliophile *Abida secale* et à l'évolution de *Clausilia parvula*. Ce bouleversement important se produit très rapidement et sans avoir un parallèle dans l'étude microfaunique (voir Cordy, dans ce même volume). Nous pensons que certaines transformations de type très local sont à l'origine de cette métamorphose. Néanmoins étant donné qu'aucune pièce archéologique (*sensu stricto*) ne fut récoltée en S6, nous n'excluons pas une possible contamination à partir des milieux holocéniques. La représentativité de l'échantillon macrofaunique pour la phase holocène est limitée; donc tout type de contamination holocène aura tendance à se «diluer» dans l'ensemble pléistocène et sera par là difficilement discernable. D'ailleurs, aucun taxon exclusivement holocène ne fut mis au jour.

Les espèces mésophiles vont osciller autour de 40% au début de la séquence; dans la phase moyenne, elles atteignent 60.85 et 50.94% et - pendant la phase finale - 33.58%. *Milax* se trouve plus à l'aise que dans la colonne W3; il est possible que la forte activité anthropique sous le porche et/ou le bouleversement lors de la mise en place du dépôt, par rapport au type d'activités qui semblent avoir eu lieu en S6 (zone de rejet), ait pu favoriser l'implantation de l'espèce à l'intérieur de la cavité.

Les espèces palustres comme *Succinea oblonga* et *Lymnaea truncatula* sont bien représentées, surtout lors de la première phase où elles possèdent des valeurs supérieures à celles des espèces semi-forestières, xérophiles et de stations découvertes confondues.

Les espèces aquatiques sont fondamentalement représentées par *Pisidium sp.*; nous pensons qu'elles pourraient correspondre à des intrusions pénécontemporaines causées par des activités anthropiques (pêche, ramassage de flore de rivière, etc.).

Evolution

- *Phase I (échantillons S6-3 à S6-8)*

Cette phase a été identifiée à l'intérieur de la cavité; du point de vue sédimentologique (voir Courty, dans ce même volume), elle est uniforme et a été attribuée au Bölling. Du point de vue malacologique, nous avons constaté la présence à l'intérieur de cette phase de deux moments bien différenciés: *Phase Ia* et *Phase Ib.*

La *Phase Ia* est représentée par les échantillons S6-7 et S6-8 et montre la présence à l'entrée de la cavité d'un paysage boisé, mais suffisamment ouvert, pour y permettre la présence de *Pupilla*, *Vallonia pulchella* et *Vallonia costata*. Les espèces mésophiles sont bien représentées et diversifiées; *Trichia hispida* est le taxon le mieux représenté. Si l'on fait exclusion du taux élevé de boisement qui correspondrait vraisemblablement à une image très locale de l'environnement proche de la grotte, l'analyse des microvertébrés de la *Phase Ia* a présenté des résultats similaires.

La *Phase Ib* (échantillons S6-6 à S6-3) est, du point de vue des microvertébrés, très uniforme, ainsi que la suite de la *Phase Ia*, étant donné la taille de l'échantillon microfaunique (voir Cordy, dans ce même volume). Les profondes variations observées lors de l'analyse malacologique auraient pu, soit être la réponse à des conditions très locales (peut-être d'origine anthropique), soit être dues à la «possible» contamination citée auparavant.

L'ensemble de la *Phase I* a pu être biaisé par des activités anthropiques qui auraient perturbé les conditions d'enfouissement, en facilitant la conservation préférentielle de certains taxons. Evidemment, cette détérioration était plus importante lors des phases d'occupation anthropique plus intenses. L'étude taphonomique des restes nous signale un enfouissement rapide et non destructif. En outre, certaines espèces avec des coquilles très fragiles comme *Vitrina* ou *Vitrea*, qui auraient plus facilement souffert de ce dérangement, se sont très bien conservées. A priori, l'installation d'un dallage en psammite (voir Miller et López Bayón, dans ce même volume) et le piétinement lors de l'occupation, ont pu provoquer certaines destructions. Néanmoins, étant donné que la zone où l'échantillon fut récolté (S6) s'est avérée être une zone de rejet (voir López Bayón *et al.*, dans ce même volume), les activités ayant pu perturber la collection ont du être moindres. Cette restriction ou perte taphonomique est vraisemblablement moins appréciable sur la collection de microvertébrés. En résumé, si les profondes différences existant entre les phases *Ia* et *Ib* ne répondent pas à des problèmes taphonomiques, d'échantillonnage, ou de contamination, et s'il n'existe pas de rupture, érosion ou arrêt sédimentaire, la seule réponse a cette divergence est la présence de changements à un niveau très local, changements produits par des causes non naturelles, donc par une activité humaine. Ces changements, non visibles dans l'enregistrement microfaunique, sont discernables uniquement par l'analyse malacologique, où les pulsions locales sont mieux représentées. D'ailleurs, une contamination importante d'origine holocène aurait provoqué une hausse très marquée chez les taxons forestiers et semi-forestiers. Nous concluons que si la contamination est *a priori* possible, néanmoins elle reste faible. Ainsi, les profondes variations chez les espèces forestières et semi-forestières doivent correspondre à des activités d'origine anthropique.

BOIS LAITERIE / S6	**3**	**4**	**6**	**7**	**8**	**% 3**	**% 4**	**% 6**	**% 7**	**% 8**
Espèces exclusivement forestières										
Acanthinula aculeata	1					0.73				
Discus ruderatus	1		2	16	12	0.73		4.35	42.11	34.29
Espèces semi-forestières										
Discus rotundatus	3					2.19				
Retinella hamonis	10	3	1	1	2	7.30	2.83	2.17	2.63	5.71
Espèces de stations découvertes										
Pupilla sp.	1		1		2	0.73		2.17		5.71
Vallonia pulchella	1			1		0.73			2.63	
Vallonia costata	10	16	5	1		7.30	15.09	10.87	2.63	
Espèces xérophiles										
Abida secale + Chondrina avenacea	2	6	1			1.46	5.66	2.17		
Clausilia parvula	11	25	5	1		8.03	23.58	10.87	2.63	
Vitrea sp.	1	1				0.73	0.94			
Espèces mésophiles										
Cochlicopa lubrica	4	4	1	3		2.92	3.77	2.17	7.89	
Oxychilus sp.	1		1			0.73		2.17		
Vitrina sp.	4	2	1	1		2.92	1.89	2.17	2.63	
Milax sp.	4	4	4	2	4	2.92	3.77	8.70	5.26	11.43
Euconulus fulvus	2	1	1	1	1	1.46	0.94	2.17	2.63	2.86
Trichia hispida	30	40	19	7	9	21.90	37.74	41.30	18.42	25.71
Cepaea sp.	1	3	1	1	1	0.73	2.83	2.17	2.63	2.86
Espèces palustres										
Succinea sp.	1		1	1	4	0.73		2.17	2.63	11.43
Lymnaea truncatula	1	1		1		0.73	0.94		2.63	
Espèces aquatiques										
Bithynia tentaculata	1					0.73				
Ancylus sp.	1					0.73				
Pisidium sp.	5		2	1		3.65		4.35	2.63	

Tab.3- Nombre d'éléments identifiés et pourcentages de représentation des différentes espèces malacologiques présentes à la Grotte du Bois Laiterie (colonne S6). Les espèces sont classées en fonction de leur niche écologique. Attributions environnementales d'après les groupes établis par R. Peuchot de l'Université Libre de Bruxelles (comm. personnelle)

Le défrichement à l'entrée de la cavité d'une surface arborée assez grande aurait pu engendrer un milieu profitable et assez favorable pour le développement de *Vallonia costata.* Ceci expliquerait la chute violente des taxons exclusivement forestiers.

La présence de taxons aquatiques est aussi associée à des activités anthropiques; certains spécimens auraient pu arriver à la grotte comme intrusions pénécontemporaines, piégés dans des nasses lors des activités de pêche (voir Van Neer, dans ce même volume). Bien qu'il ne faille pas exclure la possibilité des occupations dans les premiers moments du Bölling, les occupations semblent néanmoins s'intensifier pendant la phase finale.

- *Phase II (échantillons W3-17 à W3-12)*

L'échantillon microfaunique étant beaucoup plus riche pour cette phase II (voir Cordy, dans ce même volume), il exprime plus fidèlement l'environnement entourant le gisement dans un large rayon. Les données malacologiques étant biaisées par des problèmes taphonomiques, elles expriment une situation plus complexe caractérisée par une courbe de représentativité en dents de scie.

Les échantillons malacalogiques de la phase II sont caractérisés par le développement des taxons mésophiles, qui sont les plus diversifiés. Au début de cette phase, l'échantillon W3/17 est caractéristique d'un climat froid associé à un paysage de type steppe-toundra; les espèces mésophiles et les taxons de stations découvertes sont les mieux représentés. En W3-16, *Discus ruderatus*, caractéristique de forêts de conifères, est le taxon plus représentatif avec un taux de 53 %. Cette tendance n'est pas confirmée par l'étude microfaunique; nous pensons qu'il s'agit d'un développement très local à proximité de l'entrée de la cavité d'un paysage de forêts claires, très ouvertes, qui permettent la présence de certaines espèces métayères de stations découvertes comme *Vallonia costata*. Au fur et mesure que l'on avance à l'intérieur de cette phase, les taxons de stations découvertes vont se multiplier suite à la régression des espèces exclusivement forestières et la disparition des espèces semi-forestières; ainsi nous avons constaté l'apparition de *Pupilla* et *Vertigo*.

L'association de *Pupilla* et *Succinea* souligne la présence d'un environnement redevenu plus steppique et nettement plus froid, expliquant ainsi la présence dans le registre archéozoologique (voir Gautier, dans ce même volume) de taxons très froids comme *Ovibos moschatus*, déjà signalé dans d'autres sites de la région comme Chaleux (Van Beneden *et al.*, 1865; Patou-Mathis, 1994).

A la fin de cette séquence, *Vallonia pulchella* va apparaître, soulignant une tendance progressive vers un milieu plus humide qui se confirme avec *Succinea* laquelle arrivera à une valeur proche de 18.8%, et le développement de *Trichia hispida* parmi les espèces mésophiles. Le caractère plus humide est encore indiqué par la présence de *Carychium*, espèce forestière réclamant une grande humidité. Les échantillons W3-12 et W3-13 indiquent une amélioration courte et peu intense, caractérisée par une reprise dans les taux des espèces semi-forestières et une forte réduction des valeurs chez les taxons de stations ouvertes.

Les échantillons W3-12 et W3-13 extériorisent donc plusieurs caractéristiques qui nous font penser à un processus de transformation vers une phase plus tempérée et humide, qui n'est pas représentée suite à des processus d'érosion et/ou d'arrêt sédimentaire.

- *Phase III (échantillons W3-11 à W3-9)*

Les exemplaires de cette phase ont bénéficié d'un milieu taphonomique beaucoup plus stable et propice. L'humidité semble augmenter, vu l'apparition d'*Azeka menkeana*, bien qu'on puisse constater une tendance dégressive chez *Carychium*. Les valeurs chez les espèces semi-forestières vont augmenter progressivement, et, de plus, les espèces se multiplient (surtout dans la phase finale): *Ena obscura, Columella edentula, Punctum pygmaeum, Discus rotundatus* et *Retinella hamonis*.

Un nouveau bouleversement est exprimé par la substitution en douceur de *Vallonia pulchella* (jusqu'à sa disparition à la fin de la séquence), la disparition de *Pupilla* et l'importante dégradation chez *Vallonia costata* (qui dès ce moment sera progressive jusqu'à son retrait).

Les espèces xérophiles devanceront progressivement les taxons mésophiles. *Clausilia parvula* en viendra à se substituer d'une certaine façon à *Trichia hispida*. On se trouve à l'intérieur de la première phase de reboisement, dans une forêt tempérée, mais encore assez ouverte pour y permettre la présence des *Vallonia*. On se trouve au Préboréal.

- *Phase IV (échantillons W3-6 à W3-8)*

Les taxons récoltés dans cette phase correspondent à la phase Boréal, dans laquelle se confirme la tendance antérieure. L'association de *Discus rotundatus* et de *Carychium* annonce la formation de «tufas». La forêt devient plus dense. Les taxons exclusivement forestiers se consolident et diversifient; *Discus ruderatus* va disparaître et les espèces semi-forestières se développeront en raison de la pulsion de *Discus rotundatus*. On commence à retrouver des espèces thermophiles forestières comme *Helicigona lapicida* et la présence d'*Ena montana* souligne la réduction des différences thermiques saisonnières.

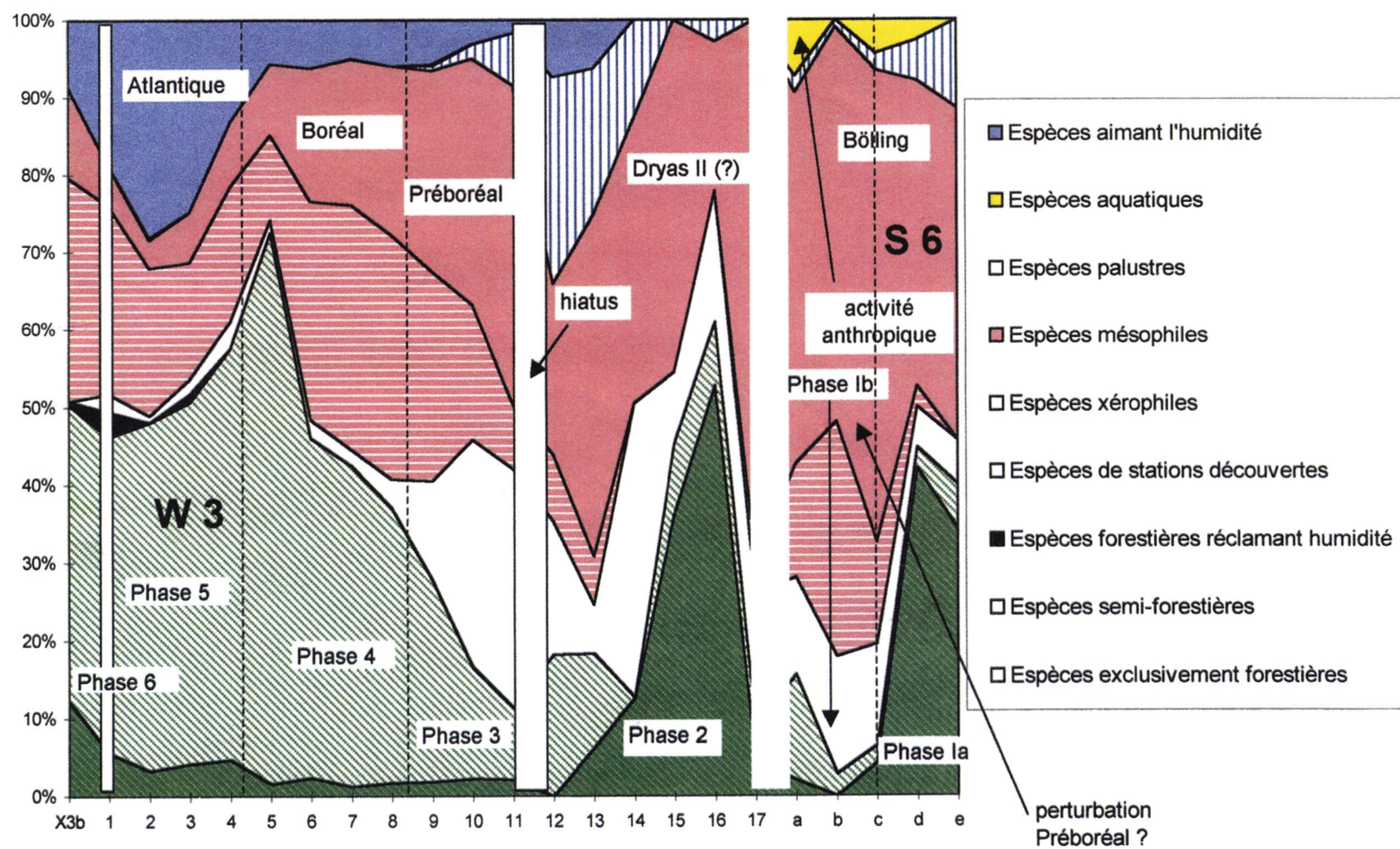
- *Phase V (échantillons W3-5 à W3-1)*

Les échantillons W3-5 à W3-1 représentent la phase Atlantique, pendant laquelle les taxons plus humides se développent et les espèces se diversifient. La forêt est dense, *Vallonia* disparaît et les espèces mésophiles se font rares. La présence d'*Acme lineata* souligne bien le caractère moins continental et plus humide de la période.

- *Phase VI (échantillon X3b)*

L'échantillon annexe X3b correspond à la phase actuelle; il se différencie des échantillons antérieurs par la disparition de *Vertigo pygmaea*, donc l'absence totale de taxons de milieu ouvert. Chez les espèces semi-forestières, *Retinella hamonis* a pris l'avantage face à *Discus rotundatus*, et parmi les taxons forestiers, *Helicodonta obvoluta* et *Helicigona lapicida*, espèces qui jusqu'à présent étaient faiblement représentées, deviendront chefs de file.

Fig.1- Evolution de gastéropodes à la grotte de Bois Laiterie en fonction de leur niche écologique. Echantillons S6, W3 et X3b.



La phase Bölling est caractérisée par une courbe en dents de scie fruit d'actions anthropiques. La phase Dryas II montre une courbe en dent de scie fruit d'un échantillon alteré par de processus taphonomiques et de mis en place des sédiments.

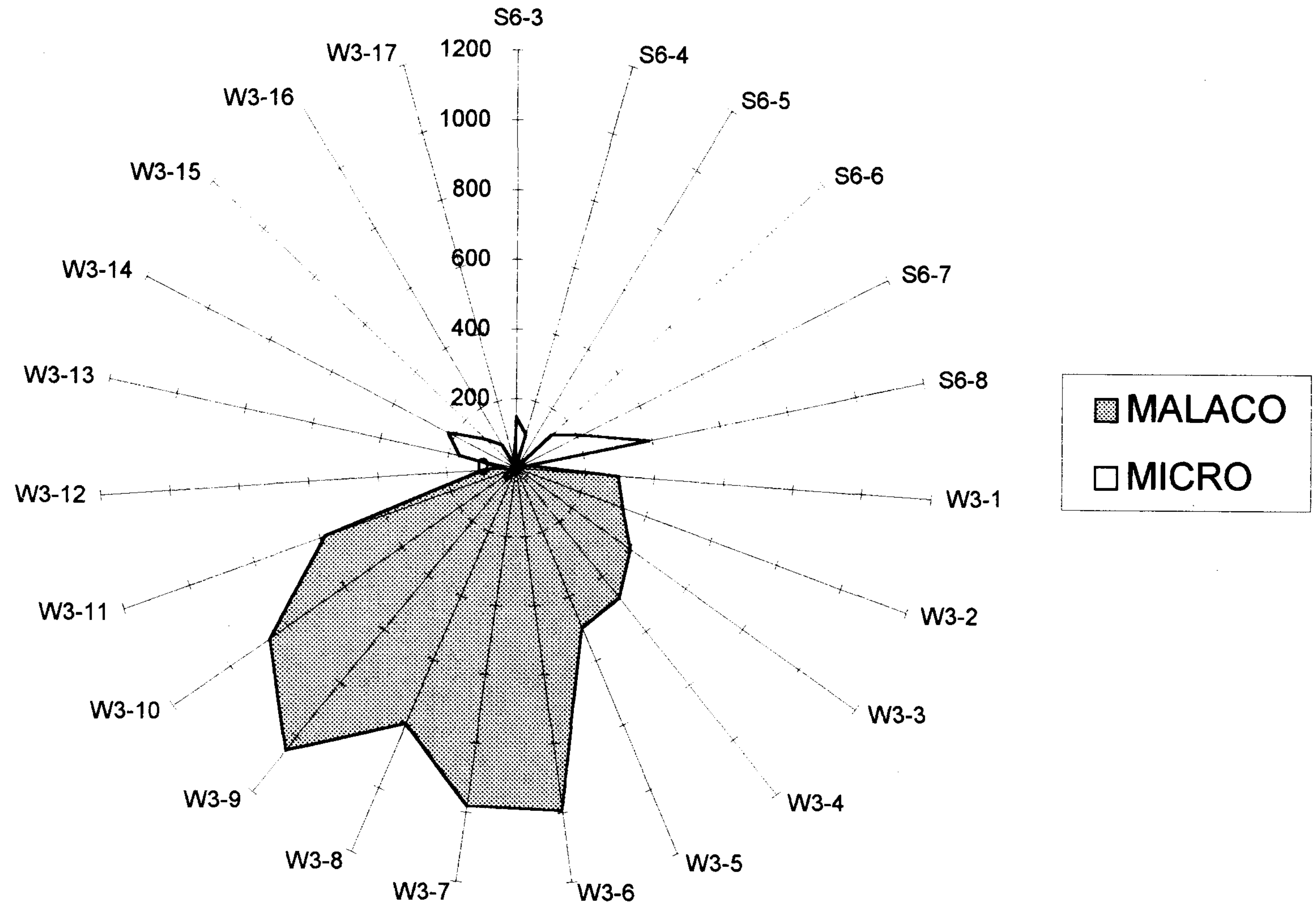


Fig. 2 - Densité de population des échantillons malacologiques et microfauniques.

Conclusions

L'étude malacologique dans la grotte du Bois Laiterie montre l'existence d'occupations humaines dès le début du Bölling. Ces occupations vont s'intensifier *a posteriori* et, du fait de l'intensification des activités humaines (utilisation de fibres, écorce, pour la construction de nasses de pêche; coupe de bois et récolte de branchages pour le feu; défrichement d'une surface pour l'installation de tendeurs appropriés au traitement des peaux ou pour la construction de fumoirs pour le poisson; abattage des arbres localisés entre la cavité et la source de plaquettes, utilisation de troncs d'arbres pour le transport de grosses dalles de psammite, etc.), une clairière s'installera à l'entrée de la cavité.

Lors de la phase suivante, certains processus de solifluxion et/où des faibles glissements ont faiblement érodé les couches sous-jacentes à l'intérieur de la cavité, certaines esquilles lithiques étant piégées avec des sédiments attribués au Dryas II, paradoxalement à ce moment à l'entrée de la cavité et de façon très locale on assiste à une petite pulsion forestière (comme témoigne la présence importante et curieuse de *Discus ruderatus* en W3-16). Malgré la faiblesse de l'échantillon malacologique, taphonomiquement biaisé, les résultats de l'analyse de microvertèbrés ont permis de confirmer la tendance. La fin de cette phase atteste déjà une tendance vers un climat plus tempéré.

Postérieurement on assiste à une phase d'érosion o bien d'arrêt sédimentaire. La reprise commence avec le développement des taxons semi-forestiérs et l'augmentation progressive des espèces xérophiles, des taxons de stations découvertes vont encore subsister. C'est la phase Préboréal. Ensuite on assiste à une augmentation de l'humidité jusqu'à des taux proches au 60% d'humidité relative. Les espèces semi-forestières et forestières vont se développer et multiplier, les taxons xérophiles de même. *Pupilla* et *Vallonia pulchella* disparaissent.

Pendant la dernière phase on assiste à une augmentation de l'humidité et une perte de continentalité qui se traduit en l'équilibre et la stabilisation des températures saisonnières.

Remerciements

Nous tenons à remercier R. Peuchot de l'ULB pour son aide inestimable lors de l'élaboration de cette étude.

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7

BIO- ET CHRONOSTRATIGRAPHIE DE LA GROTTE DU BOIS LAITERIE (PROFONDEVILLE, NAMUR) A PARTIR DES MICROVERTEBRES

J.-M. Cordy et Ph. Lacroix

1. Introduction

La grotte du Bois Laiterie se situe dans la vallée du Burnot, près du village de Rivière (commune de Profondeville, province de Namur). La fouille de cette petite grotte en 1994 et 1995 a été réalisée sous la conduite de L.G. Straus et M. Otte. Elle a permis de recueillir un assemblage magdalénien spécialisé, qui a été daté par accélérateur d'environ 12.650 ans B.P. (Straus *et al.*, 1994; Otte *et al.*, 1994 et 1995). Sur cette base, l'occupation préhistorique, qui se trouve dans les niveaux stratigraphiques dénommés YSS et BSC, a été rapportée au Bölling.

L'étude des restes de microvertébrés devait permettre de reconstituer le paléoclimat et le paléoenvironnement liés à cette occupation magdalénienne. La méthodologie est celle qui est classiquement employée dans cette discipline (par exemple: Cordy, 1992b). Au tableau habituel du décompte des dents déterminées, nous avons ajouté ici un décompte des humérus de tous les microvertébrés afin de quantifier l'importance relative des batraciens au sein des microfaunes. Enfin, notons l'emploi du terme générique *Clethrionomys* sp. en rapport avec l'imprécision de la détermination spécifique; dans le cas de l'Holocène, ce terme devrait correspondre logiquement au campagnol roussâtre, *Clethrionomys glareolus*, mais, dans le cas du Tardiglaciaire, ce terme pourrait également correspondre à des espèces propres aux milieux boisés scandinaves, tels que *Clethrionomys rutilus* et *Cl. rufocanus*. Notons encore que, pour homogénéiser autant que possible les décomptes, les calculs ont été réalisés sur la base des molaires inférieures et supérieures à l'exclusion des autres dents; toutefois, compte tenu de la très petite dimension de certaines molaires, nous avons choisi de décompter la P4/ supérieure au lieu de la M3/ supérieure dans le cas des Soricidés, et la P/4 inférieure au lieu de la M/3 inférieure dans le cas d'*Ochotona*.

Les matériaux étudiés proviennent, d'une part, directement de la fouille et, d'autre part, du tamisage de deux colonnes stratigraphiques, l'une dans le carré W3 sur la terrasse, l'autre dans le carré S6 à l'intérieur de la grotte (Fig. 1). Les prélèvements ont été effectués chacun sur une épaisseur d'une dizaine de centimètres et en continu. Le tamisage a été entièrement réalisé en laboratoire, sous eau et avec une maille minimale de 0,5 mm. L'un des auteurs (Ph.L.) a assuré les prélèvements, le lavage-tamisage des sédiments, le tri des refus de tamis et un première séparation des grands groupes zoologiques. Le premier auteur (J.-M.C.) a réalisé toutes les déterminations spécifiques, les interprétations et la rédaction de cet article.

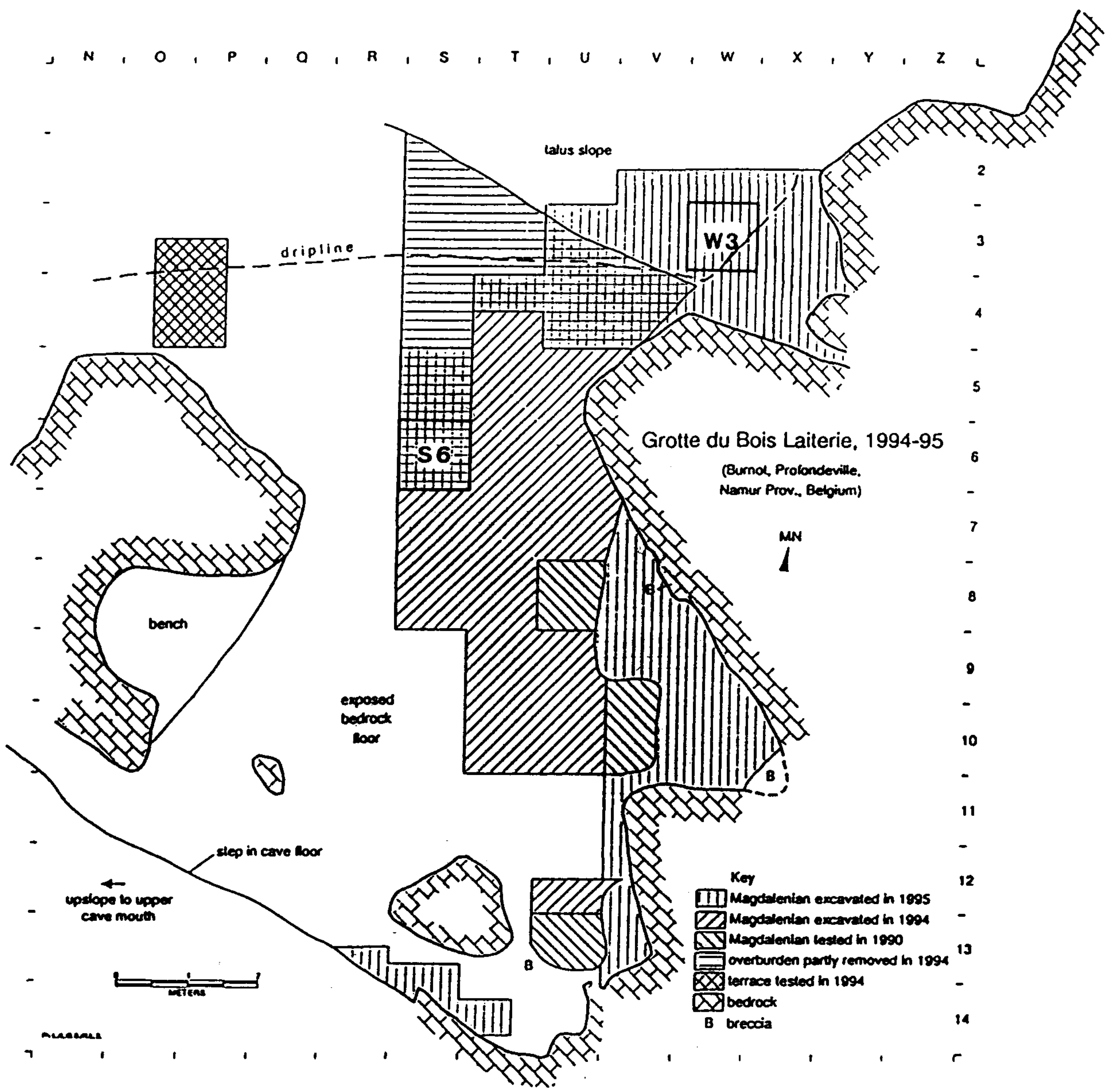

Fig. 1 - Plan de la grotte du Bois Laiterie et du carroyage (d'après Straus *et al.*, 1992). Emplacement des colonnes biostratigraphiques.

Nous remercions MM. L.G. Straus et M. Otte, responsables de la fouille de la grotte du Bois Laiterie, de nous avoir permis de réaliser cette recherche. Nous exprimons également notre gratitude à Mme A. Taverna et F. Giraldo (Projet PRIME n° 30170) pour leur aide technique (dactylographie et dessins).

2. La colonne biostratigraphique en W3

Dix-sept niveaux (numérotés de 1 à 17, du haut vers le bas) ont été prélevés dans la couche magdalénienne YSS/BSC et dans la couche supérieure LBS. D'une épaisseur d'environ 10 cm chacun, ces échantillons s'étalent de - 280 cm à - 450 cm (Tableau 1 et 2). Seul, l'échantillon 17 est manquant; comme nous le verrons, il a probablement été confondu et mélangé avec l'échantillon 7. Les effectifs sont relativement faibles, voire très petits dans les deux tiers supérieurs, mais deviennent heureusement tout à fait significatifs à la base de la colonne (Tableau 1 et 2).

A la vue du tableau des décomptes et du diagramme microfaunique (Fig. 2), il est aisé de discerner deux ensembles microfauniques bien distincts. Dans le bas de la colonne (échantillons 16 à 12, de - 440 cm à - 390 cm), les associations de micromammifères sont caractérisées, dans leur ensemble, par la domination absolue des rongeurs allochtones froids (70 à 80 % de la microfaune). Parmi ceux-ci, le campagnol des hauteurs, *Microtus gregalis*, est généralement l'élément prépondérant et le lemming à collier, *Dicrostonyx gulielmi*, représente environ le quart des rongeurs déterminés. Corrélativement, les rongeurs sylvicoles (*Clethrionomys* et *Apodemus*) sont très faiblement représentés, les chiroptères semblent absents et les batraciens sont quasi inexistants. En revanche, l'ensemble supérieur (échantillons 11 à 1, de - 390 à - 280 cm) n'a livré aucun reste d'espèces allochtones à l'exception de l'échantillon 7. De plus, ce sont cette fois les rongeurs sylvicoles (*Clethrionomys* et *Apodemus*) qui dominent d'une manière absolue les microfaunes (50 à 70 %). Enfin, généralement, la présence des chiroptères est attestée et les ossements de batraciens sont prédominants. Le seul échantillon qui dénote totalement est l'échantillon 7 qui réunit les caractéristiques des deux ensembles d'une manière contradictoire; cette microfaune ambiguë pourrait très bien être le résultat d'un mélange de deux échantillons, en l'occurrence le 7 et le 17 qui est précisément absent.

Soulignons encore que le passage de l'ensemble inférieur à l'ensemble supérieur, qui se situe entre les échantillons 11 et 12, est net et discontinu. Il doit sans doute correspondre à la limite lithostratigraphique des couches YSS et LBS et témoigne certainement de l'existence d'une lacune biostratigraphique et donc chronostratigraphique.

Les caractéristiques microfauniques définies ci-dessus pour les échantillons de la séquence inférieure démontrent incontestablement le caractère stadiaire du climat. Les pourcentages de représentativité du lemming à collier, qui sont d'environ de 20 à 30 %, sont tout à fait compatibles avec les données connues en Belgique pour les Dryas. Compte tenu de la relative augmentation de la représentativité du lemming à collier au long de cette séquence et de la disparition des rongeurs sylvicoles (*Clethrionomys* et *Apodemus*), nous observons probablement la progression d'un stade glaciaire. Notons que le dernier échantillon n° 12, qui est à la limite sommitale de la série inférieure, est peut-être légèrement [2]pollués[2] par des apports de la couche supérieure. Ceci expliquerait l'apparente contradiction de la simultanéité de l'augmentation des pourcentages de *Dicrostonyx* et de *Clethrionomys*; les deux molaires de

Echantillons W3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Taxons / Prof. en cm	280-290	290-300	300-310	310-320	320-330	330-340	340-350	350-360	360-370	370-380	380-390	390-400	400-410	410-420	420-430	430-440	440-450
Rongeurs																	
Dicrostonyx gulielmi							3					9	40	54	32	17	
Lemmus lemmus																	
Microtus gregalis							1 *					1 *	21 *	25 *	16 *	7 *	
Microtus nivalis																	
Microtus oeconomus							1 *					2 *	2 *	1 *		3 *	
Microtus arvalis-agrestis	2	1 *					1 *		3 *	5 *		1 *	12 *	8 *	4 *	4 *	
Microtus sp.	1			5			7	3	10	13	2	12	84	122	63	42	
Arvicola terrestris				1		3		1	2	1	5	2	4	2	4	1	
Clethrionomys sp.		8	8	3	6	2	5	7	20	17	8	2		4	3	2	
Apodemus sylvaticus-flavicollis	1	1	1		1	+	3	3	6	3	2			1			
Eliomys quercinus							+		1								
Lagomorphes																	
Ochotona pusilla														1			
TOTAL Rongeurs et Lagomorphes	4	10	9	9	7	5	21	14	42	39	17	29	163	218	122	76	?
Insectivores																	
Talpa europaea		1	+		+	+	+	1	+			3	+	+	+	1	
Sorex araneus-coronatus					+	+							3	2			
Sorex minutus																	
Neomys anomalus																	
Chiroptères			+	+				1									
Eptesicus serotinus					2												
TOTAL Insectivores et Chiroptères	0	1	0	0	2	0	0	2	0	0	0	3	3	2	0	1	?
TOTAL MICROMAMMIFERES	4	11	9	9	9	5	21	16	42	39	17	32	166	220	122	77	?
Humérus Batraciens/Micromammifères	5/0	10/0	16/3	18/2	12/0	16/1	6/1	3/3	+/1	0	0/1	0	+/7	+/8	+/8	0/2	?

Tab.1- Décomptes des molaires ou des dents jugales principales des micromammifères de la colonne stratigraphique en W3 de la grotte du Bois Laiterie.
+ = présence attestée par d'autres dents ou par des os; * = décompte réalisé uniquement sur les M/1.

Echantillons **W3**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Taxons / Prof. en cm	280-290	290-300	300-310	310-320	320-330	330-340	340-350	350-360	360-370	370-380	380-390	390-400	400-410	410-420	420-430	430-440	440-450
Rongeurs																	
Dicrostonyx gulielmi							(14.2)					31.0	24.5	24.8	26.2	22.4	
Lemmus lemmus																	
Microtus gregalis							(15.9)					13.8	43.8	52.6	54.4	36.8	
Microtus nivalis																	
Microtus oeconomus							(15.9)					27.6	4.2	2.1		15.8	
Microtus arvalis-agrestis	(75.0)	(10.0)					(15.9)		30.9	46.1		13.8	25.0	16.8	13.6	21.1	
Microtus sp.				(55.6)				(21.4)			(11.8)						
Arvicola terrestris				(11.1)		(60.0)		(7.1)	4.8	2.6	(29.3)	6.9	2.5	0.9	3.3	1.3	
Clethrionomys sp.		(80.0)	(88.9)	(33.3)	(85.7)	(40.0)	(23.8)	(50.1)	47.6	43.6	(47.1)	6.9		1.8	2.5	2.6	
Apodemus sylvaticus-flavicollis	(25.0)	(10.0)	(11.1)		(14.3)	+	(14.3)	(21.4)	14.3	7.7	(11.8)			0.5			
Eliomys quercinus							+		2.4								
Lagomorphes																	
Ochotona pusilla														0.5			
TOTAL Rongeurs+Lagomorphes/Microm.	(100.0)	(90.9)	(100.0)	(100.0)	(77.8)	(100.0)	(100.0)	(87.5)	100.0	100.0	(100.0)	90.6	98.2	99.1	100.0	98.7	?
TOTAL des M/1 du genre *Microtus*	0	1	0	0	0	0	3	0	3	5	0	4	35	34	20	14	
TOTAL des dents déterminées	4	10	9	9	7	5	21	14	42	39	17	29	163	218	122	76	
Insectivores																	
Talpa europaea		(100.0)	+		+	+	+	(50.0)	+			(100.0)	+	+	+	(100.0)	
Sorex araneus-coronatus					+	+							(100.0)	(100.0)			
Sorex minutus																	
Neomys anomalus																	
Chiroptères			+	+				(50.0)									
Eptesicus serotinus					(100.0)												
TOTAL Insectivores+Chiroptères/Microm.	(0.0)	(9.1)	(0.0)	(0.0)	(22.2)	(0.0)	(0.0)	(12.5)	0.0	0.0	(0.0)	9.4	1.8	0.9	0.0	1.3	?
TOTAL des dents déterminées	0	1	0	0	2	0	0	2	0	0	0	3	3	2	0	1	
Humérus Batraciens/Micromammifères	100.0	100.0	84.2	90.0	100.0	94.1	85.7	50.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	?

Tab.2- Pourcentages des micromammifères de la colonne stratigraphique en W3 de la grotte du Bois Laiterie sur la base des décomptes des molaires ou des dents jugales principales.
+ = présence attestée par d'autres dents ou par des os;
( ) = pourcentages peu significatifs en fonction de l'effectif réduit.

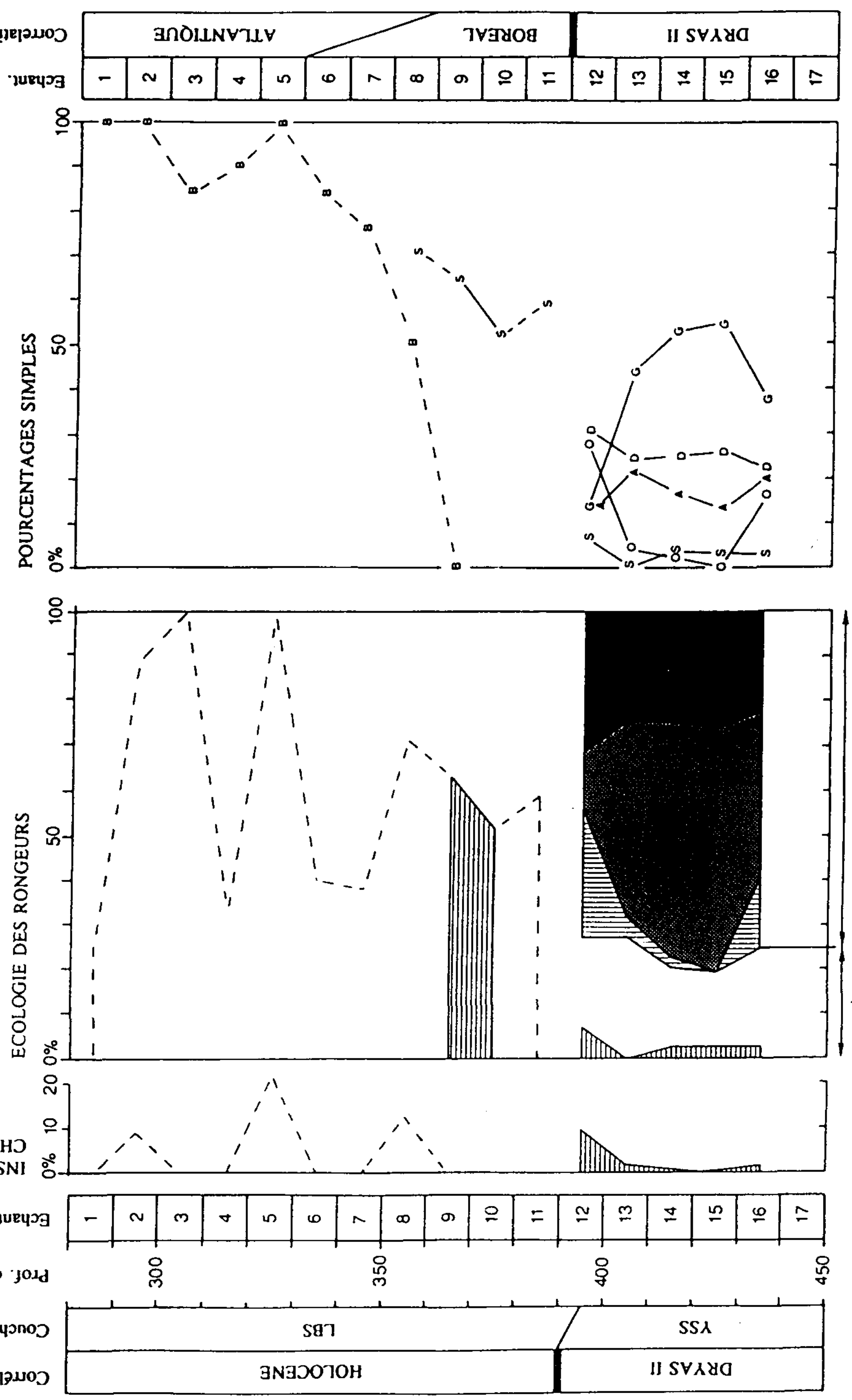

Fig.2- Diagramme microfaunique de la colonne biostratigraphique en W3 de la grotte du Bois Laiterie. Le tracé est fonction de la profondeur moyenne de chacun des prélèvements. Symboles utilisés, voir Fig.3; en complément: B = batraciens; D = *Dicrostonyx*; S = rongeurs sylvicoles.

ce dernier qui ont été observées en 12 pourraient provenir du niveau 11. Sur la base des datations de l'occupation magdalénienne, cette séquence stadiaire ne peut être rapportée qu'à la première partie du Dryas II, qui suit logiquement le Bölling. Les spectres fauniques sont d'ailleurs tout à fait compatibles avec les données déjà publiées pour la grotte du Coléoptère et la grotte de Presles (Cordy, 1975 et 1985). De plus, les pourcentages de représentativité du Lemming à collier sont loin d'atteindre les valeurs qui caractérisent la microfaune du Dryas I à la grotte des Blaireaux à Vaucelles (couche III) (Cordy et Peuchot, 1983).

Dans le détail, il semble que le début de cette séquence est un peu moins sec au vu de la représentativité du campagnol nordique, *Microtus oeconomus*; la présence du gastéropode *Succinea* sp. renforce cette impression (López Bayón *et al.*, 1996). C'est peut-être le cas également de la fin de cette période, bien qu'il faille rester très prudent avec la petitesse de l'échantillon (4 M/1); toutefois, ici aussi, l'analyse malacofaunique renforce cette hypothèse non seulement par le développement relatif de *Succinea*, mais aussi par l'apparition non négligeable du genre *Carychium* (López Bayón *et al.*, *ibidem*). Toutefois, le caractère continental aride de l'essentiel de cette séquence climatique est bien attesté par la domination du *Microtus gregalis* et par la présence du petit lièvre des steppes, *Ochotona pusilla*, au niveau 14; cet environnement steppique est encore bien confirmé pour le niveau 14 par les pourcentages élevés de trois espèces de gastéropodes typiques de stations découvertes (*Pupilla*, *Vallonia* et *Vertigo*) (López Bayón *et al.*, *ibidem*). La progression de la rigueur du climat est probablement la cause de la dégradation finale des milieux boisés qui s'étaient développés au cours de l'interstade précédent, c'est-à-dire au cours du Bölling.

Quant à la séquence supérieure, toutes les caractéristiques microfauniques décrites précédemment correspondent parfaitement à celles d'un épisode interglaciaire, en l'occurrence l'Holocène. Le climat est tout à fait tempéré comme l'indiquent l'absence d'espèces allochtones froides et la prédominance des milieux boisés.

Les échantillons de l'ensemble supérieur ont des effectifs trop faibles pour montrer des modifications significatives des associations de micromammifères. Toutefois, l'augmentation rapide des populations de batraciens dans les échantillons 8 à 6 pourrait très bien correspondre au passage du Boréal à l'Atlantique, tel que cela a été observé dans l'étude des microfaunes holocènes de la grotte Walou (Cordy et Turmes, à paraître). Cette interprétation concorde avec l'étude de la malacofaune de Bois Laiterie qui montre bien l'apogée climatique et l'humidité de l'Atlantique dans les niveaux 5 à 1 (López Bayón *et al.*, *ibidem*). La prédominance des ossements de batraciens dans ces niveaux est en parfait accord avec cette attribution chronologique; l'apparition des Chiroptères à partir du niveau 8 et la détermination d'une mandibule de Sérotine, *Eptesicus serotinus*, confirme tout à fait le caractère nettement tempéré du climat. D'un autre côté, les valeurs élevées de représentativité des rongeurs sylvicoles (*Clethrionomys*, *Apodemus*, *Eliomys*) dès le début de la séquence supérieure indiquent que le reboisement était déjà fort avancé. En fonction de cela et par comparaison avec les microfaunes du Préboréal des couches A6 et A5 de la grotte Walou (Cordy, 1991a et b; Cordy et Turmes, à paraître), il semble exclu que la base de la séquence corresponde au Préboréal. Les niveaux 11 à 8 pourraient donc être corrélés au Boréal ancien, voire durant la transition du Préboréal au Boréal si l'on tient compte des interprétations issues de l'analyse malacofaunique (López Bayón *et al.*, *ibidem*). Au cours de cette période, il paraît évident que des espaces ouverts persistaient encore et diminuaient progressivement au profit des milieux forestiers. La persistance de biotopes ouverts aux alentours immédiats de la grotte est d'ailleurs bien démontrée par l'étude de la malacofaune (López Bayón *et al.*, *ibidem*).

3. La colonne biostratigraphique en S6

Huit niveaux (numérotés de 1 à 8, du haut vers le bas) ont été prélevés dans des sédiments attribués avec incertitude à YSS. Parmi ceux-ci, cinq niveaux ont pu être étudiés sur le plan des micromammifères, soient les niveaux 3 à 8 de - 135 cm à - 183 cm, à l'exception du niveau 5. Notons que ces niveaux sont d'épaisseur variable (Tableau 3). Soulignons encore que les effectifs des microfaunes sont nettement significatifs puisqu'ils sont tous supérieurs à 100 et peuvent même atteindre presque 400 dents déterminées dans le cas du niveau 8 (Tableau 3).

Les différents échantillons microfauniques provenant de cette colonne présentent une homogénéité incontestable (Fig. 3). Les lemmings (*Dicrostonyx* et *Lemmus*) sont bien présents, sans toutefois atteindre des pourcentages élevés. Les espèces de biotopes ouverts (prairies, steppes) sont dominantes avec comme chef de file le groupe du *Microtus arvalis-agrestis*. Tout à la fois, les rongeurs sylvicoles (*Clethrionomys* et *Apodemus*) sont non seulement présents, mais ils affichent un pourcentage élevé d'environ 10 à plus de 20 %. L'importance des espèces allochtones froides, qui oscillent entre 30 et 60 %, et la présence des lemmings correspondent parfaitement à l'ambiance climatique du Tardiglaciaire. Toutefois, la faiblesse relative des effectifs des lemmings, l'importance des campagnols des champs et agreste et surtout le développement marqué des rongeurs sylvicoles démontrent sans conteste le caractère interstadiaire du climat.

Plusieurs caractéristiques séparent nettement cet ensemble d'échantillons de la série inférieure de W3. En particulier, notons la réduction tout à fait significative de la représentativité du Lemming à collier, la présence discrète mais non moins significative du grand lemming (*Lemmus lemmus*), la prédominance du groupe du *Microtus arvalis-agrestis* et l'augmentation considérable des populations du genre *Clethrionomys*. Avec de telles différences, il n'est pas possible de corréler directement les deux ensembles S6 et W3; au contraire, il faut considérer que ces deux séries biostratigraphiques représentent sans doute deux épisodes distincts de l'histoire climatique du Tardiglaciaire. En l'occurrence, la série en S6 représenterait l'interstade du Bölling ou d'Alleröd et la série inférieure en W3 la première partie d'un stade glaciaire, vraisemblablement le Dryas II.

Dans le détail, plusieurs modifications fauniques semblent se dessiner dans les échantillons 8 à 4. D'une part, le lemming à collier et le campagnol des steppes régressent, alors que *Lemmus* semble s'accroître légèrement; ceci pourrait témoigner d'une diminution relative du caractère continental et sec du climat. D'ailleurs, le grand campagnol, *Arvicola terrestris*, qui fréquente les prairies humides, augmentent légèrement sa représentativité et le campagnol nordique (*Microtus oeconomus*) atteint un pic de représentativité au niveau 6 avec plus de 20 %, ce qui atteste d'une ambiance plus humide. Le dernier niveau, quant à lui, semble correspondre à une modification plus importante du climat. En effet, *Microtus gregalis* devient majoritaire aux dépens de *Microtus arvalis-agrestis*, le Lièvre des steppes, *Ochotona pusilla*, s'installe dans nos régions et, enfin, *Clethrionomys* régresse considérablement. Tout semble indiquer une aridification du climat continental avec développement de prairies sèches ou de steppes; ceci paraît être confirmé par la présence simultanée de trois espèces de gastéropodes typiques des stations découvertes et appartenant aux genres *Pupilla* et *Vallonia* (López Bayón *et al.*, *ibidem*), Ces données paléoécologiques ne sont pas sans rappeler l'écozone définie dans la couche I de la grotte de Presles (Cordy, 1985) qui annonce, à la fin du Bölling, la reprise du climat glaciaire du Dryas II.

Echantillons **S6**	**3**		**4**		**5**		**6**		**7**		**8**	
Prof. en cm	135 - 139		139 - 142		142 - 152		152 - 164		164 - 175		175 - 183	
Taxons	N	%	N	%	N	%	N	%	N	%	N	%
Rongeurs												
Dicrostonyx gulielmi	6	*4.5*	9	*9.4*			16	*11.5*	26	*12.9*	55	*14.2*
Lemmus lemmus	4	*3.0*	1	*1.0*			3	*2.2*	3	*1.5*	7	*1.8*
Microtus gregalis	12 *	*37.4*	2 *	*8.3*			2 *	*7.8*	7 *	*15.4*	12 *	*13.1*
Microtus nivalis	1 *	*3.1*									2 *	*2.2*
Microtus oeconomus	3 *	*9.3*	2 *	*8.3*			6 *	*23.3*	4 *	*8.8*	10 *	*11.0*
Microtus arvalis-agrestis	7 *	*21.8*	11 *	*45.8*			10 *	*38.8*	18 *	*39.6*	36 *	*39.4*
Microtus sp.	73		45				79		100		195	
Arvicola terrestris	13	*9.7*	5	*5.2*			5	*3.6*	2	*1.0*	8	*2.1*
Clethrionomys sp.	14	*10.4*	21	*21.9*			16	*11.5*	42	*20.8*	61	*15.7*
Apodemus sylvaticus-flavicollis							2	*1.4*			2	*0.5*
Lagomorphes												
Ochotona pusilla	1	*0.7*										
TOTAL Rongeurs et Lagomorphes	134	*91.8*	96	*96*	0	*0.0*	139	*99.3*	202	*96.2*	388	*99.2*
Insectivores												
Talpa europaea	+		4				+		3		2	
Sorex araneus-coronatus	10		+				+		3		1	
Sorex minutus							+					
Neomys anomalus	2		+						2			
Chiroptères							1					
TOTAL Insectivores et Chiroptères	12	*8.2*	4	*4.0*	0	*0.0*	1	*0.7*	8	*3.8*	3	*0.8*
TOTAL MICROMAMMIFERES	146		100		0		140		210		391	
Humérus Batraciens/Micromammifères	1/11	*9.1*	0/7	*0.0*	0	*0.0*	0/7	*0.0*	0/2	*0.0*	0/8	*0.0*

Tab.3 - Décomptes et pourcentages des micromammifères de la colonne stratigraphique en S6 de la grotte du Bois Laiterie sur base des molaires ou des dents jugales principales.
+ = présence attestée par d'autres dents ou par des os;
* = décompte réalisé uniquement sur les M/1

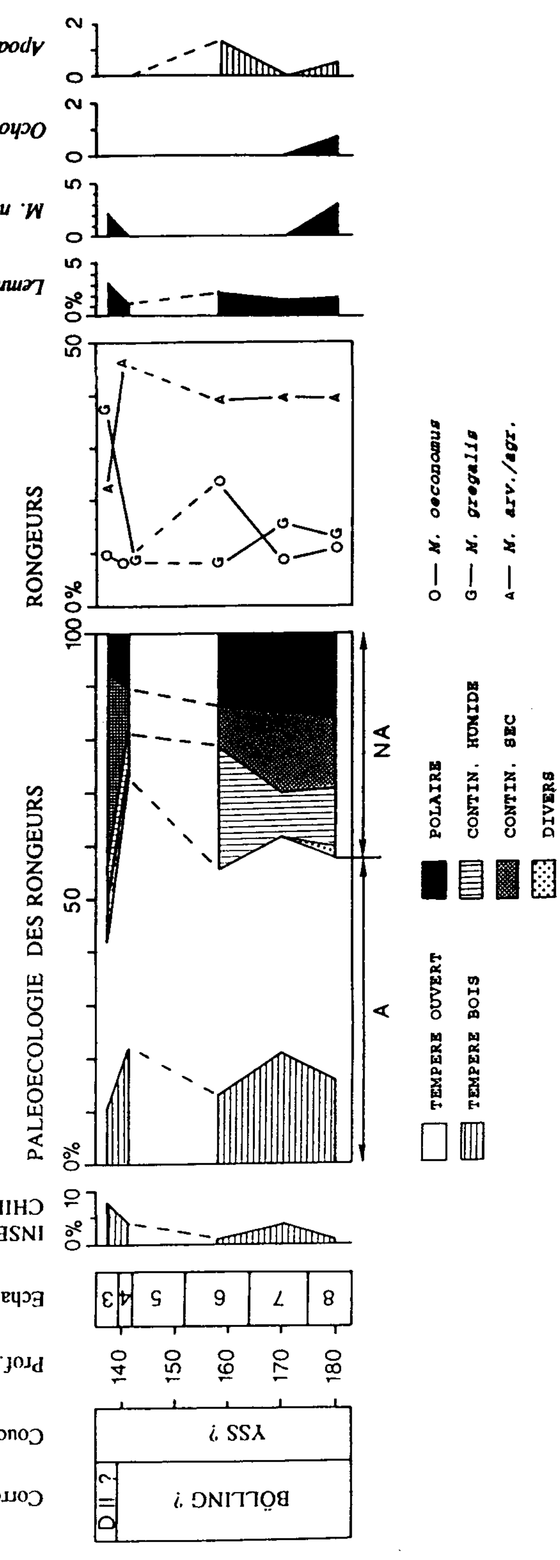

Fig.3- Diagramme macrofaunique de la colonne biostratigraphique en S6 de la grotte du Bois Laiterie. Le tracé est fonction de la profondeur moyenne de chacun des prélèvements.

L'interprétation chronostratigraphique de cet interstade est délicate, car la séquence étudiée est courte et l'interprétation stratigraphique des sédiments est incertaine. Selon L.G. Straus (communication personnelle), la couche correspondant aux échantillons microfauniques ne contenait pas d'artefacts et serait plus récente que l'occupation magdalénienne. Ainsi, l'attribution à l'interstade de Bölling, qui semblait logique en raison des dates ^{14}C, a dû être remise en question, la seule autre alternative possible étant l'attribution à l'Alleröd. Cette dernière hypothèse est défendable, d'autant que plusieurs analogies existent entre les spectres microfauniques du Bois Laiterie et ceux qui caractérisent l'Alleröd du Trou Jadot (Cordy et Toussaint, 1993) : les pourcentages élevés de rongeurs sylvicoles, la présence d'*Apodemus* et de *Microtus nivalis* et la prédominance du groupe du *Microtus arvalis-agrestis*. Toutefois, à l'inverse de ce qui a été observé dans l'Alleröd, d'une part, la séquence se termine par un pic de *Microtus gregalis*, d'autre part, *Dicrostonyx* est toujours présent avec des pourcentages relativement élevés et il domine toujours le genre *Lemmus*. Or, ces deux caractéristiques correspondent à ce qui a déjà été décrit pour le Bölling à la grotte de Presles et à la grotte Walou (Cordy 1985 et 1991b). Dès lors, l'hypothèse de l'attribution au Bölling n'est pas à exclure. Les quelques différences observées pourraient très bien rentrer dans le cadre de variations aléatoires dues à l'échantillonnage ou de variations géographiques des biocénoses : présence marquée des rongeurs sylvicoles, rongeurs allochtones dominant mais généralement pas d'une manière absolue, dominance du groupe du *Microtus arvalis-agrestis*. D'autre part, la présence d'*Apodemus* et du *Microtus nivalis* qui n'avait jamais été observée dans les microfaunes du Bölling en Belgique n'est pas nécessairement contradictoire : en effet, ces rongeurs n'ont peut-être pas été observé jusqu'à présent en raison de leur faible représentativité et de leur répartition sans doute discontinue dans le paysage. En conclusion, l'interstade décelé en S6 pourrait être attribué soit au Bölling, soit à l'Alleröd, avec peut-être un peu plus de chance pour le Bölling si l'on s'en tient aux seules particularités des spectres microfauniques.

4. Les échantillons de fouille

Le Tab.4 reprend les décomptes effectués sur des échantillons récoltés au cours de la fouille dans différentes couches; ils sont constitués essentiellement par des mandibules. Ces résultats doivent être interprétés avec prudence car une couche homogène sur le plan lithostratigraphique ne l'est pas nécessairement sur le plan bio- et chronostratigraphique. D'autre part, la récolte des restes de microvertébrés au cours de la fouille est aléatoire et privilégie bien évidemment les grandes formes.

L'échantillon correspondant à la couche magdalénienne est significatif. Les grandes espèces sont surévaluées, comme le lemming à collier avec 45,5 % et le grand campagnol, *Arvicola terrestris*, avec 18,2 %. Néanmoins, le haut pourcentage du lemming à collier fait songer immanquablement à un épisode glaciaire, en l'occurrence à un Dryas. D'ailleurs, parmi les *Microtus*, qui se ressemblent par la taille, c'est le Campagnol des hauteurs, *Microtus gregalis*, qui domine et qui souligne encore le caractère rigoureux et continental du climat. Enfin, dans l'échantillon TT (Trench Test) qui provient essentiellement de la couche magdalénienne, les pourcentages se répètent avec le *Dicrostonyx* dominant et le *Microtus gregalis* en second. Ces données inclinent à penser que l'essentiel de la couche magdalénienne correspond en fait au Dryas II plutôt qu'au Bölling. Enfin, l'échantillon YSS permet d'ajouter

Taxons / Couches	YSS		TT		RS		BSC		UGS		LBS		Brèche	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Rongeurs														
Dicrostonyx gulielmi	20	*45.5*	52	*55.3*	1		4		1		1		1	
Lemmus lemmus			2	*2.1*										
Microtus gregalis	8	*18.2*	16	*17.0*									1	
Microtus nivalis	1	*2.3*												
Microtus oeconomus	1	*2.3*	9	*9.6*					1		1			
Microtus arvalis-agrestis	2	*4.5*	7	*7.4*							2			
Microtus sp.														
Arvicola terrestris	8	*18.2*	4	*4.3*										
Clethrionomys sp.	1	*2.3*	4	*4.3*							1			
Apodemus sylvaticus-flavicollis									1					
Cricetus cricetus	1	*2.3*												
Lagomorphes														
Ochotona pusilla	2	*4.5*									1			
TOTAL Rongeurs et Lagomorphes	44	*93.6*	94	*97.9*	1		4		3		6		2	
Insectivores														
Talpa europaea	3		2											
Sorex araneus-coronatus														
Sorex minutus														
Neomys anomalus														
Chiroptères														
TOTAL Insectivores et Chiroptères	3	*6.4*	2	*2.1*	0		0		0		0		0	
TOTAL MICROMAMMIFERES	47		96		1		4		3		6		2	

Tab.4- Décomptes et pourcentages des micromammifères de diverses couches de la grotte du Bois Laiterie sur base des mandibules.

à la liste des espèces le hamster, *Cricetus cricetus*, espèce rare qui avait déjà été repérée à la fin du Bölling à la grotte de Presles (couche I) (Cordy, 1985).

Les autres échantillons sont très pauvres et donc peu significatifs. Chacun d'eux conserve des restes du lemming à collier ce qui permet de rapporter les couches (au moins en partie) RS, BSC, UGS et LBS au Tardiglaciaire, ce qui n'a rien d'illogique. Plus étonnant est la présence du lemming à collier et du campagnol des hauteurs dans la brèche qui, en principe, devrait correspondre au début de l'Holocène (ossuaire mésolithique daté d'environ 9 250 ans B.P.); les inhumations ont sans doute été faites dans un dépôt du Tardiglaciaire ou ont atteint en profondeur un tel dépôt.

5. Interprétations stratigraphiques

Les résultats obtenus par l'analyse microfaunique pourraient indiquer que les niveaux magdaléniens YSS/BSC ne sont pas homogènes d'un point de vue chronologique. En effet, ces couches se sont déposées durant l'interstade de Bölling si l'on se réfère aux dates ^{14}C, mais aussi durant le début du stade du Dryas II en W3. En outre, ces résultats impliquent également que les dépôts ne sont continus dans l'espace puisque seul l'interstade de Bölling ou d'Alleröd est représenté dans la grotte ou du moins en S6; il se peut que la sédimentation elle-même n'ait pas été continue sur l'ensemble du gisement ou que des phénomènes d'érosion ou de glissement de terrain aient provoqué des lacunes stratigraphiques locales. Du point de vue archéologique, ces résultats pourraient également indiquer que l'occupation magdalénienne est plurielle et qu'elle s'est produite au moins à deux époques différentes et dans des ambiances écologiques bien différentes. Toutefois, l'échantillon de microfaune récolté lors de la fouille de YSS semble indiquer que la plus grande part des occupations se serait peut-être produite au début du Dryas II.

Notons encore à propos des niveaux YSS/BSC que la sédimentation semble assez rapide puisque l'interstade de Bölling, peut-être partiel, s'étale sur une épaisseur d'environ 50 cm en S6 et que la moitié (?) du Dryas II s'étale aussi sur une épaisseur d'environ 50 cm en W3. La sédimentation est également discontinue comme nous l'avons vu pour la couche magdalénienne et comme nous pouvons encore le constater avec la lacune stratigraphique entre les dépôts inférieurs du Dryas II et les dépôts supérieurs de l'Holocène en W3.

Enfin, l'interprétation des associations de microvertébrés dans la couche LBS semble indiquer qu'elle s'est formée au Boréal et à l'Atlantique avec, à nouveau, une sédimentation rapide puisque ces prélèvements s'étalent sur un peu plus d'un mètre. La situation de la grotte sur une pente escarpée est probablement à l'origine de cette sédimentation rapide et de cette stratigraphie lacunaire.

6. Essai de reconstitution de l'environnement magdalénien

L'occupation magdalénienne semble être associée à au moins deux types d'environnement, l'un interstadiaire, l'autre stadiaire.

Si l'on admet l'attribution hypothétique au Bölling de l'ensemble prélevé au S6, nous pouvons esquisser les grands traits d'un paléoenvironnement marqué par un net adoucissement du climat glaciaire. Le groupe du campagnol des champs et du campagnol agreste est dominant et témoigne de la prépondérance des biotopes ouverts de type prairies. Les insectivores sont bien diversifiés (Taupe, Musaraigne carrelet, Musaraigne pygmée, Musaraigne de Miller) et leur présence est bien attestée. Toutefois, le trait le plus marquant est le développement des rongeurs sylvicoles et, en particulier, du *Clethrionomys* qui peut atteindre jusqu'à 20 % de représentativité. Ces chiffres sont particulièrement élevés et témoignent d'un reboisement appréciable de la région. C'est la première fois que nous obtenons de telles valeurs pour un interstade en Belgique et, en définitive, la séquence du Bois Laiterie en S6 pourrait nous fournir la première image correcte du Bölling dans nos régions, qui viendrait se placer entre les écozones de Walou B4 et de Presles I (Cordy, 1991a et 1992a). Assez curieusement, dans ce contexte de réchauffement, les lemmings gardent une représentativité non négligeable; visiblement, des milieux très découverts d'aspect toundroïde, probablement sur les plateaux, devaient leur permettre de subsister avec le campagnol des hauteurs. Dans les vallées, des zones humides abritaient les populations de campagnol nordique et *d'Arvicola terrestris* et les rochers bien exposés au soleil abritaient une petite colonie de campagnol des neiges, *Microtus nivalis*. Ainsi, l'environnement apparaît en mosaïque avec des biotopes variés et une faune un peu hétérogène. Le climat se rapprochait sans doute d'un climat de type montagnard, avec toutefois un caractère un peu continental.

Dans le second cas, le climat est nettement plus rigoureux, plus continental et plus sec comme l'attestent les pourcentages élevés du lemming à collier et du campagnol des hauteurs. Dans ce contexte climatique, le paysage était tout à fait ouvert avec prédominance des biotopes steppiques et toundroïdes sur tous les plateaux; corrélativement, les milieux boisés étaient quasi inexistants. Les fonds de vallée gardaient des espaces humides profitables à de petites populations du campagnol nordique et du grand campagnol. Enfin, la persistance de la taupe, probablement dans les vallées humides, indique que le climat n'était pas encore assez rigoureux pour la formation d'un pergélisol continu.

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8

THE MACROMAMMAL REMAINS OF LA GROTTE DU BOIS LAITERIE

A. Gautier

Introduction

The Grotte du Bois Laiterie is located in the Frasnian cliffs above the Burnot hamlet of the Rivière village in the Profondeville township, about 14 km upstream of Namur on the left or west bank of the Meuse River. The site lies about 30 m above the floor of the Burnot gorge and about 500 m from the confluence of this small river with the wide, entrenched Meuse. The Burnot valley provides easy and direct access to the plateau between Sambre and Meuse. From the mouth of Bois Laiterie, Paleolithic man had a commanding view of the Burnot gorge, while from the hilltop above the cave, he had panoramic views of both up- and downstream stretches of the Meuse. The slope from the cave to the Burnot river is very steep and the habitable area of the cave is restricted; also the cave faces almost due north. Because of the foregoing, Bois Laiterie was no doubt not a site that invited regular occupation by larger groups of people, but rather a strategically located place for spotting game in the valleys. Uncalibrated accelerator radiocarbon dates on an antler sagaie and on bones found in the site are 12,625 ± 140 B.P. (GX-20433), 12,660 ± 140 B.P. (OXA-4198) and 12,665 ± 96 B.P. (GX-20434). Already published notes on the BL fauna (Gautier, 1994; Straus *et al.*, 1994 and 1995) are preliminary and incomplete, and have been revised considerably in the following assessment of the fauna. For detailed information on the site and its non-organic, floral and small animal contents the reader is referred to other texts in this publication. In earlier, preliminary publications, the site was incorrectly referred to as Grotte de Burnot. This is actually a site on the other slope of the Burnot river, which is known for its Neolithic ossuary; later this site was renamed Grotte de Juvénat.

Faunal remains were collected in various contexts, of which a short description follows.

BD : backdirt resulting from clandestine excavations containing modern artefacts, a potsherd of possible Medieval age and a few Magdalenian artefacts.

STR1 : stratum 1, topsoil and old backdirt.

RC : reddish brown colluvium.

BR : breccia, containing remains of both Mesolithic burials and ceramics.

GBS : grey beige silt, 15-25 cm, archeologically sterile.

UGS : upper grey sand, 10-15 cm, archeologically sterile.

YSS : yellow-reddish sandy silt, 20-75 cm, Magdalenian artefacts and faunal remains; grading into the underlying deposit BSC.

BSC : light brown silty clay, 10-25 cm; Magdalenian artefacts and faunal remains.

LGS : lower grey sand, 20-35 cm, archeologically sterile, but containing some faunal remains.

RS : sandy clay, 1-25 cm; archeologically sterile, but containing some faunal remains.

BGS : basal grey sand, 7-15 cm, archeologically sterile.

Inter-level lithic refits indicate that, archeologically, levels YSS and BSC cannot be distinguished. Thus, their faunal contents may be lumped in discussion of the Magdalenian use of the cave. Remains from the backdirt BD were collected selectively for comparative purposes, but all the other contexts were sampled during the excavation itself, by handpicking or by sieving (mesh size : 2,5-3 mm).

In 1990, Ph. Lacroix excavated several test trenches in BL. I have combined the samples from these tests into one assemblage TT (test trenches) of which the contents indicate that most of the finds originate from YSS. For purposes of comparison, assemblage TT has been listed before YSS in the tabulations presented in this paper. As for LBS (light brown sandy silt), it consists of a partially disturbed layer overlying YSS near the mouth of the cave. Its faunal remains seem to be derived mainly, if not completely, from the underlying Magdalenian deposit. For purposes of comparison, I have also included LBS before YSS in Tab.1.

Inventory and systematics

Tab.1 summarizes the distribution of faunal remains in the various contexts. The analysis was carried out in the same manner as that of the fauna collected during the recent excavations of Trou Magrite (Aurignacian; Gautier, 1995). As in the case of the latter site, the remains consist mainly of smaller fragments of bone and teeth, resulting from human activity (marrow extraction) and other degrading processes such as fragmentation due to animal activity, depletion of bone components, overburden compaction, rockfall, etc. As Tab.1 shows, about 1,000 specimens were identified out of some 3,800 remains (micromammals not included), and the identification rate is much higher than that computable for Trou Magrite (about 28% versus 4%), although the degree of fragmentation seems to be comparable in both sites. In BL, however, birds, hare and fox are by far the main constituents of the assemblages and even small bone fragments of these animals still exhibit diagnostic features. If we leave out the remains of these animals, the identification rate decreases markedly (12%), but is still much higher than for Trou Magrite. Perhaps the remaining difference is due to the facts that the Trou Magrite material was buried under deeper sediments, including many huge blocks, than the BL fauna and was washed by the excavators in the field, and hence suffered some secondary fragmentation. The BL material was studied after minimal cleaning in the paleontology laboratory at Ghent. The notes that follow give some brief comments on the identified taxa or animal groups.

Tab.1 : General composition of the vertebrate fauna of the Grotte de Bois Laiterie (specimen counts).

ANIMAL GROUP / ASSEMBLAGE	BD	STR 1	BR	GBS	UGS	LBS	TT	YSS	BSC	LGS	RS	Totals(a)
fish (Pisces)(b)	-	-	-	-	-	7	1	66	-	-	-	74
frogs (Anura)(e)	-	-	-	-	-	-	4	5	-	-	-	9
birds (Aves)(b)	3	-	7	3	9	9	54	79	7	-	3	174
mole (*Talpa europaea*) (postcranial)(d)	-	-	-	(4)	(1)	-	(19)	(28)	(2)	-	-	R
micromammals (postcranial)(e)	-	(1)	-	(1)	(6)	(2)	(F)	(F)	(12)	1	1	F
rabbit (*Oryctolagus cuniculus*)	4	-	-	-	-	-	-	1	-	1	2	8
snow/common hare (*Lepus timidus/capensis*)	3	-	1	1	5	4	35	130	13	1	1	194(7)
common/arctic fox (*Vulpes vulpes/Alopex lagopus*)	-	-	-	2	5	4	22	163	21	1	1	219(12)
wolf (*Canis lupus*)	-	-	-	-	-	-	1	1	-	-	-	2(1)
wild cat (*Felis silvestris*)	1	-	1(?)	-	-	-	5	-	-	-	-	7(1)
lynx (*Lynx lynx*)	-	-	-	-	-	1	1	5	-	-	-	7(1)
weasel (*Mustela nivalis*)	-	-	-	-	-	1	2	1	-	-	-	4(1)
stoat (*Mustela erminea*)	-	-	-	-	-	-	2	4	2	-	-	8(2)
polecat (*Mustela putorius*)	-	-	-	-	-	-	-	1	-	-	-	1(1)
badger (*Meles meles*)	12	4	-	-	-	3	1	10	-	-	-	30(6)
cave bear? (*Ursus spelaeus*)	-	-	-	-	-	-	1	1	-	-	-	2(1)
cave hyena (*Crocuta crocuta spelaea*)	-	-	-	-	-	-	-	1	-	-	-	1(1)
horse (*Equus* cf. *germanicus*)	-	-	-	-	-	3	4	46	8	-	-	61(3)
Equus hydruntinus	-	-	-	-	-	-	-	1	-	-	-	1(1)
wild boar (*Sus scrofa*)	5	1	1	-	-	-	-	-	-	-	-	7(3)
reindeer (*Rangifer tarandus*)	1	1	4	4	1?	5	9	40	4	1	-	70(4)
red deer (*Cervus elaphus*)	-	1	-	-	-	-	2	3	-	-	-	6(1)
elk (*Alces alces*)	-	-	1	-	-	-	-	3	2	-	-	6(1)
chamois (*Rupicapra rupicapra*)	-	-	-	-	-	-	-	10	1	-	-	11(1)
ibex (*Capra ibex*)	1	1	-	1(?)	2	-	3	24	4	1	1(?)	38(2)
small ruminants (Ruminantia)	1	-	2	-	-	2	1	7	1	-	-	14(1)
muskox (*Ovibos moschatus*)	1	-	-	-	-	-	3	11	-	-	-	15(2)
steppe wisent (*Bison priscus*)	-	-	-	-	-	1(?)	-	2	1	-	-	4(1)
domestic cat (*Felis silvestris* f. domestica)	2	-	-	-	-	-	-	-	-	-	-	2(1)
cattle (*Bos primigenius* f. taurus)	3	4	-	1	-	-	-	-	-	-	-	8(1)
Total identified bones(f)	37	12	17	17	29	42	170	643	78	6	9	1060
not identified bones(g)	-	5	25	124	102	69	100	1975	327	8	40	2775
Total bones(g)	37	17	42	141	131	111	270	2618	405	14	49	3835

(a) between brackets MNI, see text concerning Table 2; (b) see VAN NEER (this volume); (c) see DEVILLE and GAUTIER (this volume); (d) for the cranial elements, see CORDY (this volume); (e) mainly small rodents, see CORDY (this volume); (f) mole and micromammals not included; (g) approximate numbers.

Tab.1 does not include invertebrate finds, but non-marine mollusks, mainly terrestrial, occur throughout the deposits in varying number. Two columns were sampled separately and the results of the malacological analysis of strata LBS and YSS in these columns are presented elsewhere in this publication (López Bayón and Lacroix, this volume). As to the fish remains, consisting mainly of small vertebrae, they were analyzed by W. Van Neer (this volume).

In TT and YSS, some postcranial remains of anurans occur. They include three iliums with comparable morphology, which can be ascribed to *Rana temporaria* on the basis of the well individualized tuber on the vexillium (Böhme, 1977). The other remains are not diagnostic or are difficult to assign, but may represent the same frog species. The named frog is widely distributed in Europe and can live in subarctic conditions, as long as the soil is not frozen (Arnold *et al.*, 1978).

A detailed analysis of the birds is presented also separately by Deville and Gautier (this volume). Micromammalian remains were found in the two columns sampled for malacological purposes. These and the cranial remains found in the excavation samples are dealt with also in a separate paper (Cordy and Lacroix, this volume). The postcranial remains of micromammals in the excavation are listed in the table, but no precise numbers are given. These remains are mostly derived from small rodents, but some insectivores, bats and small mustelids may also be present. Most postcranial remains of mole (*Talpa europaea*), which are very typical, were taken out of the micromammal samples and are listed separately.

Lagomorphs are well represented and could easily be separated into two size groups, corresponding to rabbit and hare. Among the latter remains, five incisors (TT:1; YSS:4) are present, which all have a squarish cross section as in the snowhare. These finds may indicate that most of the hare remains derive from this lagomorph.

As Tab.1 shows, about a dozen carnivores are represented in the cave, but none are frequent except the foxes and, to a much lesser degree, the badger. I write «foxes», because the variation in size of the remains is quite marked, indicating that both common and arctic fox are present. Three metapodials (YSS) and a lower M2 (TT) measuring only 5.5 mm are distinctly smaller than the smallest red fox specimen in the quite extensive comparative sample of that species in the Ghent laboratory. They can thus be assigned to arctic fox. Much of the other material agrees in size with the red fox comparative sample. It has been said that the Upper Pleistocene common foxes were larger than their extant descendants, but that the arctic fox was generally smaller than its Holocene descendants (Toepfer, 1963). If so, most of our material may belong to the common fox.

The felids have been separated on the basis of size. The same applies for the smaller mustelids, of which, as already noted, some postcranial remains may have been left in the micromammal residue category. A first and second phalanx represent an ursid : either brown bear or cave bear. The fossil record of the second species is very impressive and the BL bear is tentatively attributed to this species. Cave hyena is only represented by one lower premolar.

Horse is quite frequent (Pl.1, Figs.5 and 6), but most of the remains are fragments of teeth (Tab.3). Measurements could be taken on only a few specimens:

lower M2, L. occlusal :	29.3 mm (not very worn)
humerus, min. TR.D. shaft :	36.0
trapezoid, TR.D. :	± 46
Ph.3, TR.D. art. surface :	± 45.7

These measurements and visual comparisons suggest horses of medium size. According to Eisenmann (1991), the dominant horse of the Upper Pleistocene is *Equus germanicus*. In southern France, a smaller, and somewhat different form, *E. arcelini*, would replace it at about 15,000 B.P. or somewhat later; there is also evidence of a size decrease among horses in the later Pleistocene elsewhere (see for example Weniger, 1987, p. 93). As far as I could ascertain, the BL equid seems to correspond to the larger *E. germanicus* and I labelled it tentatively as *E.* cf. *germanicus.*

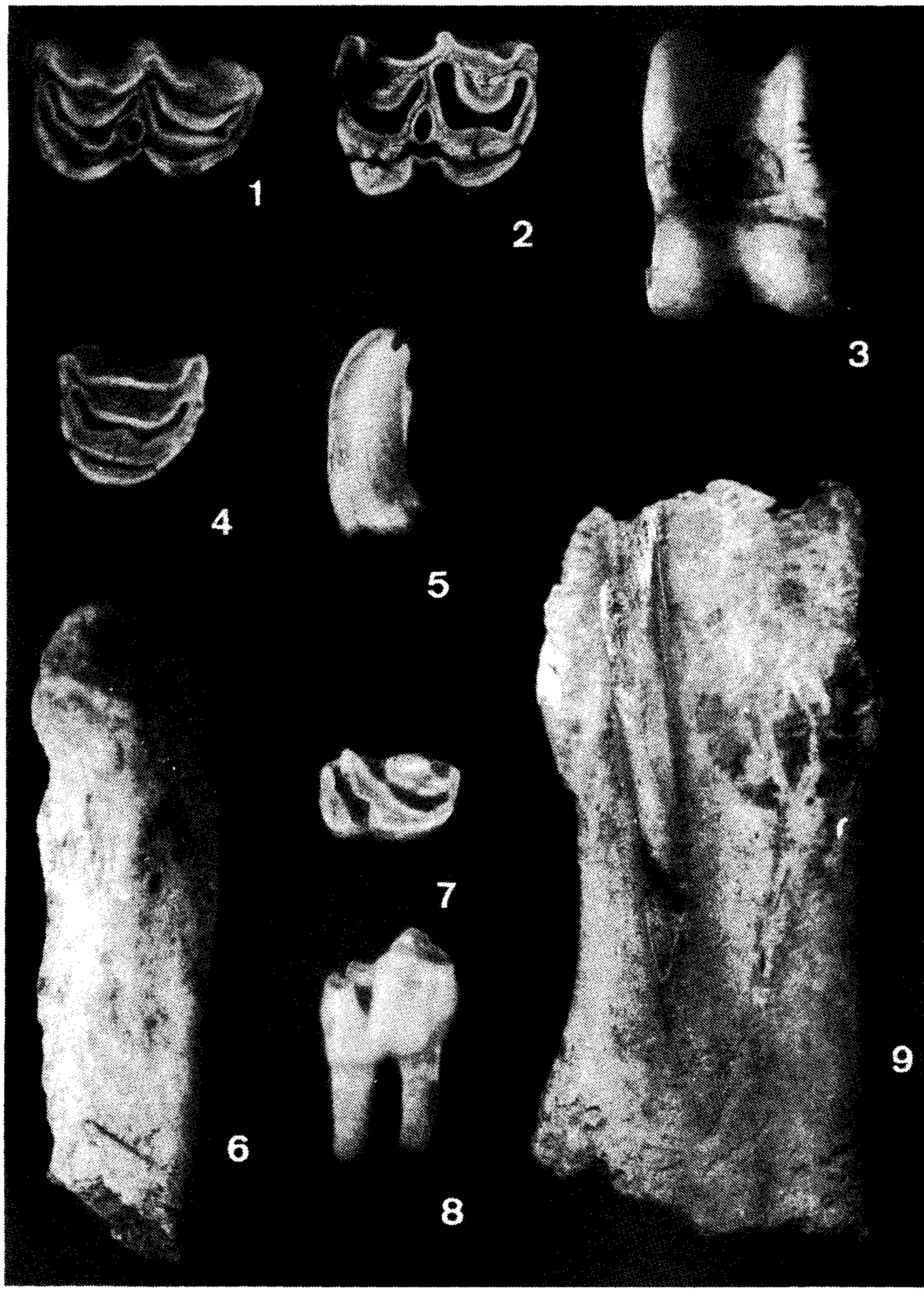
One scapula fragment from YSS presented an identification problem. It is clearly derived from a small equid, but the articular end is missing and carries extensive carnivore gnaw marks (Pl.1, Fig.9). My experience suggests that carnivores will readily attack not yet (completely) fused articular ends of bones. As to the bone itself, it is well ossified. Therefore I think the specimen is derived from a subadult; but even if subadult, it decidedly derives from an equid much smaller than that represented by the other equid remains. The minimum breadth of the neck is 43 mm. Comparisons with small equid scapulae in the Ghent laboratory and some simple computations indicate that the dimensions of this specimen fall in or near the lower range of the so-called European ass - *Equus hydruntinus* (see Bonifay, 1991 for measurements).

The distinction between reindeer (Pl.1, Fig.3) and larger cervids did not pose any problems. Red deer and elk (moose) were separated on the basis of size (see Chaix and Desse, 1981) and the diagnostic dental features provided by Desbrosse and Prat (1974). A lower molar (YSS: M1/2) appears too large for even large red deer; furthermore, the oblique position of its conids and stylids and the presence of a small ectostylid without basal cingulum all permit us to attribute this specimen to elk (*Alces*). A large incisor (from TT) has a oval transverse outline as in elk. A lower P3 from BSC is quite small (L: 19.6 mm; Pl.1, Figs.7 and 8), but the metaconid is well individualized and clearly oblique, again as expected in elk; perhaps the tooth originates from a female.

Most of the smaller ruminant remains can be assigned to ibex, but some teeth and phalanges (see Bosold, 1966) definitely represent chamois. To this second caprid, some other less diagnostic and fragmentary remains were assigned mainly on the basis of size. The category of «small ruminants» groups remains which I hesitate to attribute to ibex, chamois or, less likely, other smaller ruminants such as saiga (see further) or roe deer. Possibly too many remains were assigned to the chamois category.

Muskox is represented by nine quite distinctive teeth (Pl.1, Figs.1, 2 and 4) and some tooth fragments in BD, TT and YSS. A few postcranial fragments were added after comparison with recent muskox skeletons in the Institut Royal des Sciences Naturelles de Belgique, Brussels (see also Vanlerberghe, 1979).

Larger bovids are represented by a large, fragmented radius, of which the distal epiphysis (LBS) is not fused, and by a massive scaphoid (YSS; *os carpi radiale*). The proximal articular surface of the radius shows only a shallow notch to fit the ulna and the scaphoid is rather high and narrow with a straight and almost horizontal dorsal side; the mentioned features are diagnostic for *Bison* (Stampfli, 1963). The other remains originate from smaller bovids and are concentrated in the upper deposits and BD; among them is a subadult ulna undistinguishable from its analog in (domestic) cattle. On the basis of the foregoing I identified this second group of larger bovid remains as derived from domestic cattle.



Pl.1- (1) Upper last molar of muskox (*Ovibos moschatus*);YSS. (2) First or second upper molar of muskox; TT. (3) Astragalus of reindeer (*Rangifer tarandus*) with cutmarks; YSS. (4) Upper second or third premolar of muskox; YSS. (5) Canine of horse (*Equus* cf. *germanicus*); YSS. (6) Fragment of posterior mandible of horse with cutmarks; YSS. (7 and 8) Lower third premolar of elk (*Alces alces*); BSC. (9) Subadult (?) scapula of European ass (*Equus hydruntinus*) with carnivore gnaw marks on articular and opposite, fragmented ends; YSS.

Bone modification

Since the remains are generally rather fragmentary, the search for fossil traces of animal or human activity on the bones produced but limited results. Moreover, several non-biological agents can produce traces which mimic real ichnofossils (trace fossils) and I personally find it often very difficult to attribute less distinct modifications of bone surfaces. Therefore, in what follows only the very distinct trace fossils are inventorized.

Clear carnivore traces occur on a proximal ulna attributed to domestic cattle (STR 1), on the distal epiphysis of a humerus of horse (YSS), on a subadult first phalanx of the same species (TT), on an innominate bone fragment attributed tentatively to horse (YYS), on the already mentioned equid scapula fragment identified as *Equus hydruntinus* (YSS; Pl.1, Fig.9), and on a tibial shaft fragment of reindeer (YSS). Very clear etching due to passage through the digestive system of a carnivore seems to be quite evident on a flake derived from a large long bone (YSS), on two phalanges of ibex (YSS) and a cubo-navicular of the same species (YSS). The gnawing marks could have been produced by cave hyena, wolf or foxes, but the etched pieces point to the larger species among this trio. However, neither hyena and wolf are frequent in our sample and hyena coprolites do not occur. This virtual absence and the low incidence of carnivore traces suggest that neither hyena or wolf frequented the cave regularly, as did most other carnivores.

Quite a few bone fragments show breakage and fragmentation patterns one normally finds in archaeological sites and implicitly associates with human activity. Specific evidence of such activity left on bones, however, consists of only two fragments with butchering marks. The first concerns reindeer, of which the medial upper surface of an astragalus carries several clear transverse cutmarks (Pl.1, Fig.3). Such marks are frequently found on this tarsal element (see for example, Guilday *et al.*, 1962; von den Driesch and Boessneck, 1975). They obviously serve to disarticulate the lower leg at the hock joint. Two cutmarks also occur on a horse mandible fragment (Pl.1, Fig.6). They are located at the outer aboral border of the vertical ramus, somewhat higher than midway along this border; they slope downwards aborally. Traces on the vertical ramus of the mandibula can be connected with the removal of the mandible from the skull, generally to obtain access to the tongue (von den Driesch and Boessneck, *ibid.*). A cutmark is also visible midshaft on a humerus fragment of wild boar from the selective backdirt sample (BD), but the remains of wild boar are thought to be post-Magdalenian (see Taphonomy).

Some small fragments from YSS and BSC show blackish, greyish and white discolorations due to exposure to fire, which may have been accidental. Diffuse traces of ochre occur midshaft on the already mentioned, almost complete horse humerus carrying carnivore gnawing traces; they may also be accidental. Coloration by ochre has also been noted on bone remains from the upper Magdalenian horizon at Goyet (M. Germonpré, pers. comm.).

Taphonomy

In what follows the attention will focus on the Magdalenian assemblage from YSS and BSC, to which one can add most of the remains from the other assemblages (notably TT and LBS). What is left, then, forms the post-Magdalenian assemblage. Remains of wild boar are found only in

BD and the uppermost deposits. My first impression was that these finds belong to the post-Magdalenian assemblage, but a perforator from the Magdalenian deposits could have been in contact with suid proteins (Newman, this volume), indicating that the BL-Magdalenians might also have included wild boar in their hunting bag, although no bones of wild boar have been recognised in the lower deposits. The fact that the wild boar finds, representing some three individuals, one of which is a juvenile, cluster all in the upper sequence and that boar is a typical Holocene game animal made me decide to keep the wild boar finds in the post-Paleolithic assemblage. The preservation of some of the remains (for example, the humerus with a cutmark) also suggests a recent origin. For reasons discussed below, some badger remains should also be put into the post-Magdalenian assemblage. Summing up, this Holocene assemblage would then comprise : rabbit, badger, wild boar, domestic cat and domestic cattle. In age, these remains could range from Mesolithic to recent.

On the basis of the nature of the Magdalenian remains, the life habits of the animals encountered, those of Late Paleolithic people as inferred from previous studies and the modifications on the bones, we can puzzle together the most plausible taphonomic history of this assemblage. It would comprise three taphonomic groups *sensu* Gautier (1987).

The cutmarks attest to the fact that the Magdalenians butchered horse and reindeer, most probably after having killed these animals. To this group of hunted animals, we may no doubt add most of the other herbivores, since larger carnivores, such as wolf or hyena, occur but sporadically in the samples.

The group of the late intrusives includes the rabbit, which probably arrived during the Middle Ages in the Burnot area, if not later, since this lagomorph prefers open biotopes (*cf.* Van Damme and Ervynck, 1988). Rabbits may have dug their holes in suitable places within the cave fill and thus have reached layer YSS and perhaps even lower deposits (LGS, RS). More likely, badgers digging their set contributed to the mixing of recent intrusives in the lower deposits. This would mean that some of the badger remains found are derived from recent intrusives, while others may be much older. The badger remains can be combined into some six individuals; one of them is represented in TT by a pair of mandibles, the preservation of which compares with that of the domestic cat and rabbit remains. As is known, badgers may live for 10,000 years at the same site (Peters *et al.*, 1972).

The remainder of the fauna seems to form the group of penecontemporaneous intrusives. No doubt, the reader will not quarrel over the inclusion of the frogs, the mole and the small rodents in this category. As to the fish remains Van Neer (this volume) argues that they represent leftovers of fish caught by people and brought to the cave. However, the bird bones do not show any evidence of butchering and the geese, grouse and whimbrel can be explained as prey of foxes or some other carnivore capable of catching them. Accidental death would have provided the remains of winged visitors to the cave such as the swallow and the owls. The latter are responsible for most of the already mentioned micromammal remains by way of their regurgitation pellets (Deville and Gautier, this volume).

Among the remains of foxes, combining into a dozen individuals and again showing no butchering traces, some are derived from juveniles, as one would expect if this carnivore denned in the cave. As stated above, the foxes may have brought in many of the birds as prey. Probably the same can be assumed for most of the hare remains, which combine into some seven individuals; again I saw no clear evidence of butchering on these remains. Carnivores visiting the cave much more sporadically than the foxes, include the small mustelid trio (weasel, stoat and polecat) and the badger, as well as wolf, hyena and bear. For the wolf or the bear a more fanciful taphonomic fate can be imagined (see further).

Paleoecology and ecostratigraphy

Generally speaking, the composition of the BL fauna is comparable with that of other Upper Paleolithic assemblages in the Ardennes and adjacent regions. One such assemblage was excavated recently in the Aurignacian levels of Trou Magrite and studied by the author according to the same procedure as used for the Grotte du Bois Laiterie (Gautier, 1995). Aurignacians occupied Trou Magrite during the late part of the Middle Weichselian (around 38-30,000 B.P.) (Otte and Straus, 1995), before the onset of the Upper Pleniglacial harsh conditions, during which Paleolithic people were no longer present in the Ardennes. Rough estimates for temperatures and precipitation during the Aurignacian occupation of Trou Magrite (Gautier *ibid.*) are as follows : -10 to -20°C (January); up to 16°C (July); 300-500 mm. The techniques used for translating faunal spectra into climatic parameters (Hokr, 1951; Bonifay, 1982) do not reveal any major climatic differences between the Aurignacian of Trou Magrite and the BL Magdalenian, because these techniques are frustratingly incomplete and imprecise.

Another problem concerns the function of the sites being compared. In both the Trou Magrite and the BL assemblages, the same major game species occur, but their relative importance differs appreciably. In the Grotte du Bois Laiterie, ibex is more important with respect to horse and reindeer : 22,0% versus 18,3% for the combined layers 2 and 3 of Trou Magrite (Gautier, 1995: p.146, Tab.7.3). In fact the difference may be greater than the numbers suggest, because quite a few medium-sized ruminants were left unidentified and most if not all of these could be ibex. Assuming that all of them are indeed ibex, the percentage of this caprid goes up to about 28,0%. Such a difference, if real, might reflect the specific functions of the sites, Trou Magrite being a base camp, while the Grotte du Bois Laiterie would be a hunters' stop or short-term camp, where people bagged more readily available resident game in the vicinity. The relative importance of horse is also higher with respect to reindeer (46,6% versus 30,6% at Trou Magrite). Because of its seasonal migratory behaviour, reindeer may not have been so readily available during the periods when people came to the Grotte du Bois Laiterie, the herds being dispersed either on their summer or winter pastures. However, general climatic conditions may also have been drier than during the Aurignacian at Trou Magrite. Horses prefer no doubt a drier climate with less snow than reindeer.

A third problem concerns the possible telescoping of faunal elements of successive short climatic phases into one assemblage. Three species at the Grotte du Bois Laiterie might be involved in such telescoping : *Equus hydruntinus*, elk and muskox. The combined presence of *E. hydruntinus*, saiga and muskox in the Magdalenian of Chaleux (Rutot, 1910; Patou-Mathis, 1994; Germonpré, in press) is reminiscent of the odd trio at Bois Laiterie. The following paragraphs discuss the record and significance of the four species mentioned.

Records of *E. hydruntinus* in Belgium are rare. As far as I know, they include only a doubtful metatarsal from Trou du Sureau (Montaigle; Upper Paleolithic; see Otte, 1979) and several finds from Ixelles (Brussels) described by Stehlin and Graziosi (1935), from Trou de l'Abîme (early Upper Paleolithic; Cordy, 1988), Sclayn (Eemian and Pleniglacial; Simonet, 1992) and, as already noted, from Chaleux (Rutot, 1910; Patou-Mathis, 1994). The biostratigraphical and paleoecological significance of this small equid, now considered to be related to the extant zebras, is far from clear (Groves, 1986; Bonifay, 1991; Forsten, 1990; Forsten and Dimitrijevic, 1995). No doubt, the European ass was a stenotypic equid which could coexist with the larger, true horses under specific conditions. The records indicate that it did not tolerate the severe cold acceptable to horses, and according to Bonifay (1992), it signals cold- temperate and dry climates. The same author refers to the complementary distributions of European ass and saiga, already noted by previous authors, but offers no explanation. Attention has also been drawn to the substrate type as a limiting factor for the distribution of European ass (Groves, 1986), but what the precise substrate requirements of *E. hydruntinus* would be is not clear to me. The slenderness of the legs suggest that the European ass preferred hard substrates, while its narrow snout may have made browsing easier than for true caballoids (Forsten, 1990).

The record of elk (moose) in the Belgian Quaternary is also quite restricted; a comparable situation exists in adjacent countries (Gautier *et al.*, 1986). No doubt, this meagre record reflects the ecological requirements of this large species as well as its non-gregarious nature. Elk prefers lightly wooded terrain, where in summer one finds it in marshy areas near water; in winter it moves to higher ground. Its diet consists mainly of leaves, bark and herbs, but almost no grasses. Thus one has come to regard it as an indicator of interglacial and interstadial conditions, or reforestation. However, do the few BL finds warrant a conclusion in that sense? As indicated, elks live mostly by themselves, forming pairs in the mating seasons or small bands in winter. The gallery forest in the Meuse Valley and on its slopes may have sufficed for a restricted number of elks living under otherwise still rather harsh conditions and which became victims of opportunistic hunting.

Up to now only seven Belgian sites have yielded muskox remains (Van Lerberghe and Gautier, 1981). Four of the occurrences are located in the so-called Flemish Valley or its tributaries and would date from the Early or Middle Weichselian (*cf.* Germonpré, 1993). The other records come from the Magdalenian at Goyet and Chaleux and from Trou Reuviau (Furfooz). In the latter cave, a small and mixed assemblage of Mousterian, Aurignacian and Upper Perigordian or Magdalenian artefacts and a diverse mammalian fauna have been recorded (Otte, 1979). Since we know now at least three Magdalenian sites with muskox, the finds in Trou Reuviau can perhaps be attributed to the Magdalenian also. According to Crégut-Bonnoure (1984 and 1992), *Ovibos* made several incursions into Western Europe, but it would seem that most records date from the later Weichselian. At the end of Wurm III (*i.e.*, the end of the Upper Pleniglacial), the species apparently crossed the Pyrenees, as indicated by a find from the Catalonian cave of Arbreda near Serinya. Extant muskoxen are typical tundra inhabitants. In summer one finds them near rivers and lakes, while in winter they move to higher ground deflated of snow by the wind. Their diet consists mainly of sedges, creeping willow and similar stunted vegetation; herbs, mosses and lichens are minor dietary components (Weniger, 1982: p.89). Muskox is generally regarded as a indicator of cold and dry climate with reduced precipitation. At the end of the Pleniglacial, conditions for the expansion of muskox in Western Europe apparently became optimal and therefore this ruminant became, in my opinion, a quite regular prey of the Magdalenians in the Belgian Ardennes. In the early phase of the BL analysis, it occurred to the writer that perhaps the Magdalenians had acquired new hunting techniques as a result of which they could include muskox in their game bag; thus the animal might have become much more visible in the archaeozoological record. However, muskox herds form a ring formation when attacked and are then easily dispatched with lances and arrows (Münzel, 1987: p.211); no doubt spears or other projectiles can do the job also. Most probably the sudden appearance of muskox in the Ardennes Magdalenian would hence not result from some new invention in cynegetics.

Saiga antelope is not present in the BL assemblage, but as already said, its presence in the Magdalenian of Chaleux invites comments. This record goes back to Dupont (1871) and was repeated by Charles (1993 and 1994) and by Patou-Mathis (1994). Dupont (1871) also records saiga from fluviatile deposits in Lower Belgium. Hasse (1931) discusses this find (Gent-Terneuzen channel) and adds one more (Hemiksem, Antwerp). No doubt, these occurrences originate from the so-called Flemish Valley or its tributaries; most of the fossils in these deposits are Lower or Middle Weichselian, but Late Glacial deposits also occur (Germonpré, 1993). Cordy (1976) records the saiga in the Aurignacian of the Trou du Renard, but does not provide an inventory. The occupation of Trou du Renard dates to about 22,600 B.C., and has been placed in the so-called Interstadial of Tursac (Otte, 1976 and 1979). According to Delpech (1983) and Kahlke (1992), saiga expanded into Western Europe during the late Saale Glaciation and also during the late Weichselian, more precisely during Dryas I and Dryas II, when dry continental climates prevailed with reduced snow cover. Historical records demonstrate that saiga has occupied the Eurasian continental steppic plains with a preference for its drier and semi-arid components, but the species has also been encountered in wooded steppe. Its food consists of grasses, herbs and small shrubby vegetation (Bannikow, 1963).

Germonpré (1997, in press) provides a critical appraisal of the ecostratigraphical subdivisions and chronometric boundaries of the Late Glacial. On the basis of geological and paleobotanical data, it would seem that the Pleniglacial waned around 15,000 B.P. and the lower boundary of the Oldest Dryas (Dryas I; Alteste Tundrenzeit of the Germans) can be placed there. The climatic amelioration of the Bølling period would follow about 14,700 B.P. by calibrated radiocarbon dates, and the return of the harsher conditions of the Older Dryas (Dryas II, Altere Tundrenzeit) would fall around 14.100 B.P. (calibrated). The Oldest Dryas is very generally characterised by an open tundra/steppe landscape. During the Bølling perod, this open landscape acquired a richer cover with more, and less stunted, trees, mainly birch. An increase of water discharge indicates precipitation rose and this caused an increase of erosion of the landscape not yet well protected by vegetation and a concomitant increase of fluviatile sedimentation. According to Germonpré (*ibid.*), the calibrated radiocarbon dates indicate that the Magdalenians might have visited the Belgian Ardennes already before these Late Glacial changes. Thus Chaleux may have been occupied from the end of the Pleniglacial to the early Dryas I, according to the AMS-dates, while the conventional dates prolong the occupation into the Bølling period. For the Grotte du Bois Laiterie only AMS-dates are available, they indicate occupation essentially during the terminal Pleniglacial and most of Dryas I. The occupation periods of other cave sites point in the same direction.

At Chaleux we encounter the rather odd combination of muskox with saiga and *Equus hydruntinus*, two species one associates with steppic conditions. Perhaps telescoping of late Pleniglacial to early Late Glacial elements has occurred in the deposits which may have formed in the course of iterative visits of Magdalenian people during a period of about half a millennium. A comparable scenario can be applied for the Grotte du Bois Laiterie, where muskox, *Equus hydruntinus* and elk (moose) form the odd trio. *E. hydruntinus* and eland may point respectively to occupation during Dryas I or Bølling, while muskox may be a late Pleniglacial (or early Dryas I?) component. Goyet would have been occupied mainly in the early Dryas as was the Grotte du Bois Laiterie, but here muskox could be an indicator of occupation in the very late Pleniglacial. At Chaleux, saiga may be regarded as a guide fossil, indicative of the presence of the Magdalenians at that site in Dryas I times.

The foregoing discussion assumes that the hunting bag of the Magdalenians in the Ardennes included the herbivores adduced as evidence for telescoping of faunal elements. In the case of Bois Laiterie, one could argue, for example, that perhaps the muskox remains do not result from hunting and that they pre-date the Magdalenian occupations. Similar doubts could be voiced for other sites. To me, they seem to flout the principle of most parsimonious explanations. As to constructs referring to mosaic landscapes and persistent remnant populations, I am not convinced they are applicable in the case of larger herbivores and at the time scale of the events under discussion.

Hunting near the Grotte du Bois Laiterie

The contents of the three groups established in the section on taphonomy cannot be given precisely. Thus people may have included a few birds in their hunting bag, as well as some hare, as indicated by an endscraper which tested positive to anti-rabbit serum (Newman, this volume). The immunological data suggest that wild boar was also on the menu, but the animal is not visible in the faunal samples. These same data confirm the hunting of some bovine, either muskox or steppe bison, both present in the faunal assemblage. The Magdalenians may also have killed some of the carnivores, while some herbivores may have been prey of wolf or hyaena. One can further imagine that the few remains of wolf or bear, being phalanges, derive from pelts used by people and presenting thus evidence of some hunting episode perhaps not directly related to the occupation of the cave.

For clearness' sake, Tab.2 summarizes the putative maximum composition of the bag of larger hunted game the excavation obtained. For those interested in minimum numbers of individuals (MNI), these numbers have been added in this table. They are based on the combination of dental and osteological elements into individuals and are given per sample or assemblage. Since it is assumed that all the material attributed to the Magdalenian represents the leftovers of one occupation period, albeit most likely interrupted and iterative, the last column gives the MNI's for the combined samples or assemblages. These same global MNI's can be found in Tab.1. Because of the restricted size of the samples and the quite fragmentary nature of the material, very small MNI's were obtained which are of little or no significance or use. The author has explained elsewhere his dislike of MNI's (Gautier, 1984).

On the basis of the osseous remains studied in this paper, not much more can be said about hunting at the Grotte du Bois Laiterie. One unworn canine of horse indicates the presence of a young stallion. In domestic horses deciduous canines are generally not present and the permanent ones erupt about the time the wisdom teeth erupt (see Silver, 1969; Brömmler, 1954; Muylle *et al.*,1996); the BL stallion may hence have reached the age of some four years. Observations of wild and feral horses (Monagan, 1982; Berger, 1983; Levine, 1983; Mohr and Volf, 1984) indicate that horses normally live in family and bachelor groups. Family groups are composed of a leading, mature stallion, his harem of three or four mares and their offspring. From the age of two on, males leave the family group and join bachelor groups. Normally, they live with such groups for some five years before they succeed in establishing their own reproductive unit. The BL hunters apparently attacked such bands. In my opinion, nursery herds are easier targets, because of the presence of colts and perhaps the more predictable behavior of these well organized aggregates. Or was this stallion handicapped and therefore an easy victim? Whatever is the case, the foregoing may be an indication of rather opportunistic hunting of whatever came into view.

Tab.2 : Larger game presumably hunted during the Magdalenian in Grotte du Bois Laiterie(a).

	TT	YSS	BSC	total	others	total	Global MNI
horse	4(2)	46(2)	8(2)	58(2)	3(1)	61	3
Eq. hydruntinus	-	1(1)	-	1(1)	-	1	1
reindeer	9(2)	40(3)	4(1)	53(3)	17(1)	70	4
red deer	2(1)	3(2)	-	5(1)	1(1)	6	1
elk (moose)	-	3(1)	2(1)	5(1)	1(1)	6	1
chamois	-	10(1)	1(1)	11(1)	-	11	1
ibex	3(1)	24(1)	4(1)	31(1)	6(1)	37	2
small ruminants	1(1)	7(1)	1(1)	9(1)	5(1)	14	1
muskox	3(1)	11(1)	-	14(1)	1(1)	15	2
bison	-	2(1)	1(1)	3(1)	1(1)	4	1
totals	22(8)	147(14)	21(8)	190(13)	35(8)	225	17

(a) The numbers between brackets in the columns for the separate layers, samples or combinations of these, give the MNI for these divisions.

The remains provide also scanty evidence of seasonal occupation. Assemblage YSS contains an incomplete, deciduous lower molar (dP3 / dP4) of reindeer which is but slightly worn. Present-day reindeer are said to calve from May to July (Weniger, 1982). Thus the fawn concerned would have died a few months after birth (see Bouchud, 1966: p.106, fig.4.1), *i.e.*, the Magdalenians might have dispatched it in the later warm season. Another fragmentary tooth (lower M1/2?) shows no wear. The first molar erupts after some three months, while the second molar would do so about a year later *(ibid.)*; perhaps this second young reindeer tooth represents another animal killed during the warm season.

The foregoing inference accords quite well with the data on seasonality provided by other studies. Van Neer (this volume) argues that people caught the fish found in BL at the end of the cold season or during the early warm season. As to the analysis of the cementum annuli provided by Stutz (this volume), two teeth of reindeer, both from the main Magdalenian deposits, suggest that the corresponding individuals met death in summer or fall. The analysis of the bird remains (Deville and Gautier, this volume) does not provide straightforward evidence for seasonal occupation. However, grey lag goose and whimbrel may have been summer guests in the Ardennes in the late Pleistocene. If such was the case, the Magdalenians had access to these waterbirds only in the warmer period of the year.

The three main large game species intraskeletal distributions are summarized in Tab.3. The small size of the samples and the fragmentary nature of the material make it impossible to extract much reliable information from these distributions. They suggest that the bodies of the three species often arrived more or less complete at the site. The virtual absence of vertebrae or ribs should not be taken as an indication that these were left at the kill site, because elements of the axial skeleton are easily fragmented and often end up in the category of the unidentified fragments. Indeed, some remains of rib and vertebrae occur in the samples of unidentified material. Moreover, costal cartilages of reindeer were identified. These characteristic elements would not be present if axial skeleton parts were not brought to the cave, since they are associated with the latter (Bouchud and Desbrosse, 1972). The Magdalenians had probably not much difficulty carrying whole or minimally butchered carcasses of reindeer, ibex or other game of comparable weights. Heavier game, such as horse or larger cervids, may have been cut up before transport. Thus the heads of horse, evidenced by loose teeth and mandible fragments, may have been brought to the cave. The Aurignacians of Trou Magrite also seem to have brought most parts of their prey to their shelter (Gautier, 1995).

Tab.3 : Intrasquelettal distributions of major game species in the Magdalenian of Grotte du Bois Laiterie.

skeletal element	horse	reindeer	ibex
antler	-	5	-
skull	-	-	-
mandible	4	1	-
teeth(a)	14	4	9
tooth fragments(b)	25	4	2
vertebrae	-	1	-
costal cartilages	-	5	-
humerus	1	2	2
radius	1	4	-
cubitus	-	1	2
innominate	-	1	-
femur	-	-	2
tibia	3	8	-
carpals/tarsals	2	7	4
metapodial	2	13	3
Phalanx 1	1	4	9
Phalanx 2	1	3	4
Phalanx 3	1	-	-
vestigal phalanges	-	6	-
sesamoid	6	1	-
totals	61	70	37

(a) complete or at least half of the tooth preserved;

(b) less than half of the tooth preserved.

Summary and conclusions

The faunal samples studied in this paper are restricted and fragmentary and it should be stressed that their analysis provides but incomplete and sometimes rather hypothetical results. Two major assemblages can be distinguished. The post-Magdalenian assemblage dating from the Mesolithic to the recent period, comprises rabbit, badger, wild boar, domestic cat and domestic cattle. The composition of the Magdalenian assemblage, mainly represented by samples from the test trenches (TT) and layers YSS and BSC can be found in Tab.1. This assemblage divides in a not very precise way into three taphonomic groups. Late intrusives related to the post-Magdalenian include rabbit and badger, while the penecontemporaneous intrusives include various microvertebrates (anurans, mole, rodents), probably most remains of hare, as well as most of the remains of foxes and the other much less frequent carnivores (wolf, hyena, bear and the mustelids). The main game animals hunted by the Magdalenians appear to be horse and reindeer, (each with one osseous element bearing cutmarks) and ibex. Other larger game probably hunted is much less frequent and includes *Equus hydruntinus*, elk *(Alces alces)* and muskox. The latter trio suggests that the shelter was occupied over a long period, from the end of the Pleniglacial (muskox) to the Bølling period *(E. hydruntinus*, elk?). Other Magdalenian cave sites in the Belgian Ardennes also seem to present evidence of the early colonization of the region by the Magdalenians, as well as of the telescoping of elements in their faunal assemblages. Among the horse remains, an unworn canine probably indicates the presence of a young bachelor no longer living in a nursery herd. Ibex, which lives in not very mobile herds, is quite well represented and may have been bagged in the immediate vicinity of the shelter. The bachelor stallion and the ibexes can be interpreted tentatively as indicating opportunistic hunting of whatever game was available in the immediate site catchment. One deciduous tooth of a reindeer fawn, with restricted wear, suggest occupation in the warmer period of the year, during the calving season of reindeer or shortly thereafter. A unworn fragmentary molar of reindeer may pertain to another warm season kill. Comparable results with regard to the nature of the occupation are provided by the fish and the cementum annuli analysis; the presence of migratory waterbirds can be interpreted accordingly, *i.e.*, occupation during the warmer season. The intraskeletal distributions of the major game species suggests transport of more or less complete carcases to the cave.

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9

SEASONALITY OF MAGDALENIAN CAVE OCCUPATIONS IN THE MOSAN BASIN: CEMENTUM INCREMENT DATA FROM BOIS LAITERIE, CHALEUX, AND THE TROU DA SOMME

A. J. Stutz

Introduction

In this chapter, we present results of cementum increment analysis of an ungulate tooth sample from the Magdalenian layers of the Grotte du Bois Laiterie. We also present the results of analysis of Magdalenian samples from three other Mosan Basin sites: the Trou de Chaleux, the Trou da Somme, and the Trou des Nutons à Furfooz[1]. Seasonality studies of late glacial Belgian archaeological assemblages have not been extensive; our samples provide the only cementum information available for the Mosan Basin Magdalenian[2]. While limited in scope, our results certainly complement information we have gained in the 1980's and 1990's from recent excavations and reanalysis of old collections (this volume; Charles, 1994a; Dewez, 1987; Otte, 1994).

In particular, the cementum increment data presented below can be combined with other faunal information in order to address the continuing debate about the seasonal nature Late Glacial occupation of Belgium. Sturdy (1975) and Gordon (1988) have suggested that Late Glacial hunting economies throughout Central and Western Europe were organized around the annual migrations of reindeer (*Rangifer tarandus*). This species does dominate the assemblages of a very large proportion of Late Glacial European sites, but there also appears to have been considerable variability across Europe and over the course of the Late Glacial in the diversity and proportions of ungulate species hunted. The Mosan Basin Magdalenian archaeofaunas deviate markedly from the reindeer-dominated pattern; therefore, their composition is not easily compatible with the «herd-following hypothesis». The assemblages from Mosan Basin Magdalenian sites exhibit a diverse range of ungulate species, and it is wild horse (*Equus ferus*) that is most common (see Charles, 1994a). Chaleux represents the largest assemblage and best-known example of this pattern (Charles, 1994a; Dupont, 1872; Patou-Mathis, 1994). Bois Laiterie and the Trou da Somme contain smaller archaeological accumulations, but the ungulate fauna are distributed similarly: wild horse is the most common taxon in assemblages that include large and medium cervids, large bovids, caprids, and sometimes wild boar (Gautier, 1994; Léotard, 1988a, 1988b). Nutons appears to have had only

1 The cementum increment data from these three sites was first presented in Stutz (1993).

2 To date, Gordon (1988) has published reindeer cementum increment data from the Ahrensburgian site of Rémouchamps.

a trace faunal component associated with its very small Magdalenian lithic assemblage (Charles, 1994a; Dewez, 1987), but an *Equus ferus* phalanx with cut marks has been directly dated by AMS ^{14}C assay to Magdalenian times (Charles, 1994a, 1994b).

Arguments for a specialized reindeer economy also require summer seasonality of Mosan Basin sites, since the Ardennes or the northwest European Plain would have provided calving grounds and rich summer forage for reindeer herds (Gordon, 1988; Sturdy, 1975). The cementum increment data from Bois Laiterie, Chaleux, and the Trou da Somme suggest a different scenario: while individual sites might have been preferentially utilized in one season, Magdalenian foragers resided in the Mosan Basin during winter as well as summer.

Cementum Increments and Season of Death in the Archaeological Samples

Cementum is a mineralized tissue that is deposited on the surface of the tooth root, and it functions to anchor the roots to the periodontal ligament. In most ungulate taxa, cementogenesis proceeds at a slow, but seasonally variable rate throughout the life of the tooth. The roughly semiannual change in cementum growth, which is most likely related to seasonal variation in diet[3], produces tree-ring-like increments. A ground thin section of a tooth, when viewed through a microscope in transmitted cross-polarized light, reveals cementum increments as alternating translucent and opaque bands.

At least in some environments, equids are an important exception to the ungulate pattern of cementum formation (Stutz, unpublished data; but see Burke, 1993, 1994; Burke and Castanet, 1995; O'Brien, 1994). Efforts to identify seasonal incremental structures in the cementum of horse teeth from Chaleux have been unsuccessful (Stutz, unpublished data). This obviously leaves a gap in our knowledge about residential mobility among Mosan Basin Magdalenian groups, because horse appears to have such an important focus of Magdalenian hunting in this region. However, the taxa we have included in our study sample give us a broad view of the hunting and butchery of those ungulate prey that supplemented horse for Mosan Basin Magdalenian groups. Our sample includes reindeer (*Rangifer tarandus*), elk (*Alces alces*), musk ox (*Ovibos moschatus*), and ibex (*Capra ibex*)[4].

3 Several sources of data suggest that bands in cementum form in response to regular seasonal shifts in diet. Controlled feeding experiments on domesticated nubian goats (*Capra hircus*) illustrate how changes in the physical and nutritional qualities of diet affect cementum increment formation (Lieberman 1993a, 1993b, 1994). Keeping in mind the results of the feeding experiments, we can examine ecological data on annual foraging cycles (and possibly endocrine-related physiological cycles, and periodicity in mating and birth events) to infer the parameters on the rate of cementum growth, its composition, and the orientation of the collagenous fibers that give cementum flexibility and a structural anchor to the periodontal ligament (cf. Lieberman 1993a; 1993b, 1994; Lieberman and Meadow 1992; Spiess 1990). Finally, we can utilize analyses of cementum increments in the teeth of modern wild ungulates of known age and season of death (Gordon 1988; Grue and Jensen 1979; Klevezal 1988; Klevezal and Kleinenberg 1969; Lieberman 1993b, 1993c; Pike-Tay 1991; Spiess 1976, 1990). These results reveal that the timing of formation of these semiannual cementum increments corresponds to the timing of seasonal changes in diet.

4 The ibex, reindeer, elk, and musk ox specimens from Bois Laiterie were excavated during the 1994 and 1995 campaigns. The Chaleux specimens were excavated by Otte et al. from the cave's terrace and entrance (cf. Otte 1994). The Trou da Somme material was recovered by Léotard (1988a, 1988b). The Magdalenian layers from these three sites included remains of stone-paved floors, antler sagaies with bevelled bases, and

Analysis of modern *Rangifer, Ovibos,* and *Alces* field specimens of known age and season of death demonstrates that populations of these taxa throughout North America and Europe - regardless of latitude, altitude, or microhabitat - exhibit growth of «translucent» cementum from spring (usually late spring) through late fall or the beginning of winter (November through January), and of «opaque» cementum through winter and perhaps early spring (Grue and Jensen, 1979:p.13-17 and references therein; see also Gordon, 1988; Pike-Tay, 1991; and Spiess, 1976, 1990). There is no comparably thorough documentation of the timing of growth of translucent and opaque cementum in modern ibex. However, other *Ovicapridae* inhabiting cool, continental regions exhibit a similar timing of translucent and opaque band growth (Grue and Jensen, 1979).

Determining Season of Death

Season of death is approximated from the optical nature of the tooth's youngest, outermost acellular cementum band, which can be seen most clearly at and just below the gum line (Fig.1). As discussed above - and this cycle characterizes only those ungulate populations occupying temperate and subarctic habitats - an opaque outer increment indicates that the animal died in winter or early spring; a translucent outer band demonstrates a death in late-spring, summer, or fall. It is also possible to infer season of death more precisely. Lieberman (1993b) and Spiess (1990) have shown that the growth rate of a seasonal increment is statistically predictable, so that one can maintain, for example, that a *Rangifer* molar with a very thick outermost translucent band (*e.g.*, >15 mm) died near the end of that growth phase, or, conservatively, between October and December.

It is stressed that variations in the rate of cementogenesis do occur. In order to err on the side of caution, we only make precise season of death determinations when the outermost band is either very thick or very thin. We estimate the width of the outermost band relative to that of the same band (translucent or opaque) from the previous year (*cf.* Spiess, 1990). Tab.1 shows the seasonal relationship between «thin», «medium», and «thick» outer bands and season of death. A medium band is approximately the same width as the previous year's band; a thin band exhibits <50% of the width of the previous year's band; and a thick increment is >150% of the previous year's band. The width assessments represent an increment's width relative to the thickness of the same band (translucent or opaque) from the previous year. We also caution that precise determinations of season of death in subadults (≤3 years)display relatively high error ranges, because young animals are most likely to undergo fluctuations in growth rates from year to year (Spiess, 1990).

lithic assemblages with high proportions of backed bladelets. The Nutons reindeer material is not positively associated with the small Magdalenian lithic and antler point assemblage from the site. Charles (1994a, 1994b) has demonstrated that Dupont made no stratigraphic separation between Late Glacial and Holocene deposits; she reports an AMS ^{14}C date on a Nutons red deer (*Cervus elaphus*) bone at ca. 2000 BP. The reindeer from Nutons are certainly Pleistocene in age, and consequently, they might reflect Magdalenian hunting and butchery.

Tab.1

CEMENTUM INCREMENTS AND SEASON OF DEATH		
Outermost Cementum Increment		
Appearance and Width *	Season of Death	Approximate Months**
Opaque	Winter - Early Spring	January - April
Thin Traslucent	Late Spring - Early Summer	May - July
Medium Translucent	Summer - Fall	June - December
Thick Translucent	Fall	October - December

* The «opaque» and «translucent» terminology refers here to cementum's analysis under transmitted cross polarized light.

** See Gordon 1988, Grue and Jensen 1979, Pike-Tay 1991, Spiess 1976 and 1990.

In order to «read» the cementum bands in an archaeological tooth the researcher requires a method of obtaining a cross-section view of the archaeological tooth and a means of observing and assessing the cementum itself. We follow the petrographic thin section procedure described in Lieberman *et al.* (1990). For most specimens we only prepared one section through the tooth from crown to apex in a mesio-distal plane. However, if the cementum appeared abraded, we prepared additional sections in order to increase the surface area analyzed. The polished thin sections were observed under cross-polarized transmitted light on an Olympus™ BH-2 bifocal microscope at magnifications of 40x, 100x, and 200x. The higher magnifications have proved essential in distinguishing cementum increments in poorly preserved archaeological teeth.

Materials, Results, and Conclusions

Nearly half of the thin sections reveal cementum too poorly preserved to convey season of death. Positive results, then, are indeed limited in scope. However, ibex teeth from Chaleux and Trou da Somme provide two independent indications that Magdalenians occupied the Mosan Basin during winter or early spring. One reindeer specimen from Nutons also reveals winter-early spring death; if the Nutons reindeer remains are associated with Magdalenian activity, then we have three separate instances of cold-season occupation of the Mosan Basin. These cementum increment data are consistent with the hypothesis that a «Magdalenian regional band» occupied the Meuse River valley year-round during the Bölling oscillation (Straus *et al.* n.d.). The reindeer teeth from Bois Laiterie provide two examples of summer or summer-fall kills. In part, this information provides additional confirmation for the year-round occupation hypothesis. It also hints that reindeer were hunted primarily in the summer or fall (two of three specimens from Nutons exhibit the same seasonality as the reindeer from Bois Laiterie). If future finds do support this trend, it would indicate that as Sturdy (1975) and Gordon (1988) have asserted, Late Glacial *Rangifer* populations utilized the Ardennes as a calving ground and for summer forage. During the Bölling oscillation, though, reindeer provided a significant but minor - and perhaps seasonal - supplement to a Magdalenian hunting economy that appears to have focussed largely on *Equus* (Charles, 1994a; Patou-Mathis, 1994). We contend that the results reported above help to illuminate the diversity of human social and economic adaptations that characterizes the end of the Pleistocene in Europe (Otte, 1992).

Tab.2

Results of Cementum Increment Analysis from Bois Laiterie (BL), Chaleux (CHA), Trou da Somme (TDS) and Trou des Nutons à Furfooz (FUR).

Section	Catalog	Species	Element	Outer Band	Est. Season of Death
BL 1	CBL U7-22	*R. tarandus*	r. mandible P4	med. translucent	summer-fall
BL 2	CBL T6-30.1	*O.moschatus*	r. mandible P2	n.a.	n.a.
BL 3	CBL U6-211	*Capra*	l. mandible M1 or M2	n.a.	n.a.
BL 4	CBL V9-3	*Capra*	l. mandible M2	n.a.	n.a.
BL 5-3	CBL V2-5	*R.tarandus*	l. mandible P4 M1 M2	 n.a. med.-thin translucent med. translucent	 n.a. summer summer-fall
BL 6-4	CBL W3-5	*Alces alces*	isolated r. lower M1	n.a.	n.a.
CHA 5	Cha R6 113	*Capra*	r. mandible M2	opaque	winter - early spring
CHA 6	Cha R6 128	*Capra*	r. mandible M1	n.a.	n.a.
TDS 1	TDS 88 P21-51	small ungulate*	l. maxilla M1	med. translucent	summer-fall
TDS 2	TDS 88 O21-137	*Capra*	r. mandible M2	med. translucent	summer-fall
FUR 1 **	E. Dupont 2533	*R.tarandus*	l. mandible P2, P3, M1 M3	med. translucent	summer-fall
FUR 1 **	E.Dupont 2533	*R.tarandus*	r. mandible M1-M3	med. translucent	summer-fall
FUR 1 **	E.Dupont 2533	*R.tarandus*	l. mandible dp3	opaque	winter - early spring

* unidentified small cervid or caprine, possibly chamois (*Rupicapra rupicapra*).

** The Trou des Nutons (Furfooz) specimens were recovered by E. Dupont's team in 1864. They are not definitely associated with the Magdalenian component of this site.

Acknowledgments

The author thanks Dan Fisher, Dan Lieberman, Ofer Bar-Yosef, Richard Meadow, Richard Redding, and John Gerry for providing laboratory facilities or technical support for this project. The Department of Anthropology and the American School of Prehistoric Research at Harvard University, and the Department of Anthropology and the Rackham School of Graduate Studies at the University of Michigan provided funding for laboratory resources.

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10

FISH REMAINS FROM THE UPPER MAGDALENIAN IN THE GROTTE DU BOIS LAITERIE

W. Van Neer

Introduction

A survey of the literature shows that fish remains have only seldom been reported from Paleolithic sites in Belgium. The Caverne Marie-Jeanne yielded some fish bones from Middle Paleolithic levels that were tentatively identified as 'percomorph' (Gautier and de Heinzelin, 1980), whereas six remains of 'freshwater fish' were found in a layer with a mixture of Aurignacian and Neolithic material from the Grotte de la Princesse at Marche-les-Dames (Gautier, 1981). Finally, a vertebra of the European catfish (*Silurus glanis*) has been reported from a Magdalenian level in a cave at Néviau, about 5 km south of Namur (Giltay, 1931). Because of the foregoing, the fish bone sample from Grotte du Bois Laiterie, although small in size, may help to understand better Paleolithic fishing in Belgium.

The Grotte du Bois Laiterie is situated on the north-facing side of the Burnot gorge at about 50 metres above the Burnot valley floor. Human inhabitants of the site had access not only to the Burnot affluent, but also to the Meuse located about 500 metres farther east. The former hydrological situation probably differed from present-day conditions, but the general geological setting was more or less similar. Temperatures were lower than today and this must have influenced the behaviour of the fish. As to the samples, fish remains were collected mostly in layer YSS, the main Magdalenian deposit. A few finds originate from LBS, the partially disturbed layer overlying YSS near the mouth of the cave, while the original test trenches (TT) dug into YSS yielded only one fish bone. More information on the site, its context and samples can be gleaned from the other contributions to this volume.

Material

The remains were identified with the aid of the comparative collections housed in the Royal Museum of Central Africa, Tervuren. Specimens were first brought to skeletal element and to species and then the corresponding fish length was estimated by direct comparison to modern specimens of known length. The estimates are given by classes of 10 cm length (Fig.1). Tab.1 summarizes the finds per level.

Salmo trutta fario (brown trout)

LBS: 2 precaudal and 2 caudal vertebrae;

YSS: 1 keratohyal, 1 quadrate, 1 articular, 14 precaudal vertebrae, 15 caudal vertebrae, 1 precaudal or caudal vertebra, 4 scales; total 37 specimens.

The morphological distinction of bones from the brown trout *Salmo trutta* and the Atlantic salmon *Salmo salar* is very subtle and in many cases impossible (Le Gall, 1984; Desse and Desse, 1976). Le Gall (*ibid.*) mentions small differences on the outer morphology of precaudal and caudal vertebrae, whereas Desse and Desse (*ibid.*) demonstrate a great deal of intraspecific variation and overlap between both species when frontal radiographs of vertebral centra are used. Lepiksaar and Heinrich (1977) report that the width-length ratio of the keratohyal is a good distinguishing character, as they found an index of 25.2 to 32.1% in salmon and of 17.2 to 22.2% in brown trout. For the comparative material at Tervuren, we computed an index of 35.7% for salmon and indices of 22.3 and 24.3% for two brown trout specimens. The keratohyal specimen found at Bois Laiterie Cave is slender as in the brown trout, with an index of 23.5%.

The reconstructed sizes (Fig.1) of the well preserved brown trout remains are between 30 and 50 cm SL (= standard length, *i.e.*, length from the tip of the snout to the base of the tail). Most of the vertebrae show growth bands which theoretically can be used for analyses such as ageing, calculation of the growth rate and establishment of the season of death (Casteel, 1976). However, a large number of the BL vertebral centra are poorly preserved, the margins especially being weathered. Reading of the growth zones and establishing the amount of marginal growth is hampered in many cases. Nevertheless, it is clear that most of the salmonids were caught in their fourth or fifth year (4+ and 5+ in ichthyological jargon). The archaeological relevance of this is minimal, but the ages obtained confirm the identification of the salmonid vertebrae as brown trout. Atlantic salmon of such ages are much larger. All the vertebral centra of which the margins seemed intact had a relatively wide outer growth zone. This indicates that the fish died at a moment when their last rapid growth season was over. The potential of this observation for seasonality will be discussed below.

Thymallus thymallus (grayling)

YSS: 1 frontal, 1 articular, 1 precaudal vertebra.

The very distinct morphology of the two cranial bones allows an unequivocal identification as grayling, whereas the damaged precaudal vertebra can be labelled only through the small anatomical details described by Le Gall (1984). All grayling bones belong to individuals of 30-40 cm SL.

Lota lota (burbot)

TT: 1 caudal vertebra;
LBS: 2 precaudal vertebrae;

YSS: 1 otolith, 1 premaxilla, 2 quadrates, 2 cleithra, 13 precaudal vertebrae, 1 caudal vertebra; total 20 specimens.

The distribution of the reconstructed fish lengths (Fig. 1) demonstrates that most of the burbot specimens measure between 40 and 60 cm SL. An attempt was made to use the incremental growth structures of the vertebral centra for the determination of the individual ages and the season of death, but several difficulties were encountered. Compared with the salmonids, the seasonal bands in burbot vertebrae are less clear. Moreover, the vertebral centra are more heavily weathered and the margins are most frequently affected. The specimens permitting a reasonably good reading indicate that the majority of the burbots were captured when 4 or 5 years old.

	TT	LBS	YSS
Salmo trutta fario (brown trout)	-	4	37
Thymallus thymallus (grayling)	-	-	3
Lota lota (burbot)	1	2	20
total identified	1	6	60
unidentified	-	1	6

Tab. 1 - Fish remains found in the different archaeological levels.
The numbers represent number of specimens

Taphonomy and Magdalenian Fishing

The mammalian fauna (Gautier, this volume) demonstrates that the cave has been visited by man and that several carnivores also temporarily inhabited the place during the considered period. The identified carnivore remains derive mainly from foxes, with only small numbers of badger, polecat, weasel, stoat, wolf, hyena and bear. Although some of those carnivores may contribute significantly to the deposition of bones, it is believed that the fish remains are mainly derived from fish that were brought to the cave by man. The large size of the fish (mainly between 30 and 60 cm SL) excludes the smaller mustelids (weasel, stoat and polecat) as possible taphonomic agents. The distance of the Burnot and Meuse to the cave, together with the difficult access to the site, seem to exclude the other carnivores also, as major accumulators of the fish bones. Fish do not belong to the usual food of badgers but these animals occasionally eat them as carrion. Salmon stranded as a result of disease along a river in the neighbourhood of a large badger set have been found in scavenged condition in the undergrowth back from the river bank. On two occasions, skeletal remains of salmon have been observed in a set at about 200 metres from the river, but there exists only one eye-witness account of a badger actively capturing fish from shallow water (Neal, 1986). Fish is usually not mentioned as a food item in foxes (Lloyd and Hewson, 1986; Broekhuizen *et al.*, 1992); however, since they are opportunistic feeders it is likely that they sometimes catch spawning fish in shallow water (Maitland and Campbell, 1992, p.126). Hyena and wolf also eat fish occasionally (Ewer, 1973), whereas bears are known to prey actively on migrating or spawning salmonids. Generally, all the aforementioned carnivores feed rarely on fish and the few existing observations on their ichthyophagous behaviour show that the catch is consumed in or near the water. The same is true for the otter, the only real fish eating carnivore in our region, but of which no remains have been found in the cave. Otters can be responsible for the accumulation of fish remains on archaeological sites as a result of the prolonged deposit of spraints. These droppings contain, however, mainly remains of small fish (Wise *et al.*, 1981) and are deposited along the shore.

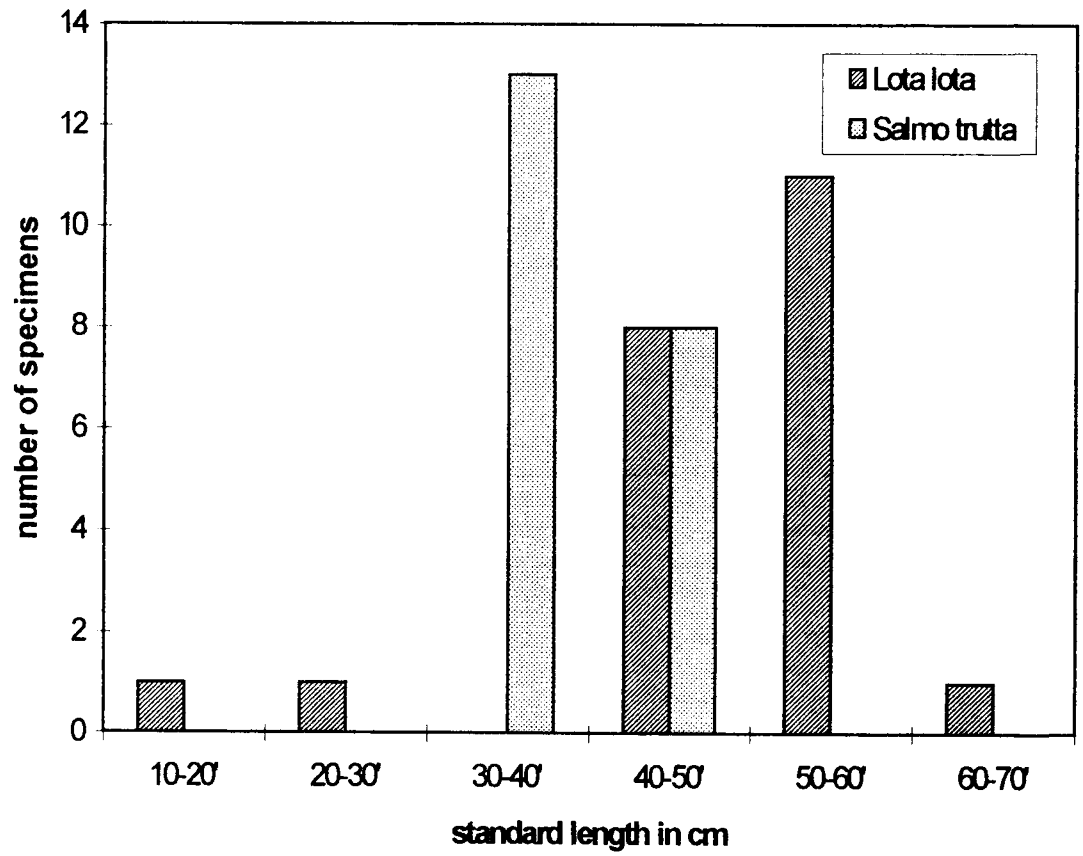

Fig.1 - Distribution of the reconstructed lengths of brown trout and burbot found in the Bois Laiterie Cave, all samples combined.

The intraskeletal distribution of the BL fish remains shows that there is a heavy preponderance of vertebrae, especially in the salmonids. Such patterns have been interpreted as an indication of decapitation of fish near the place of capture, possibly followed by conservation of fish bodies for later consumption (*e.g.*, Cleyet-Merle, 1990, p.95). Experiments have demonstrated, that differential preservation is a much more likely explanation for the underrepresentation of head bones (Butler, 1993; Butler and Chatters, 1994; Lubinksi, 1996).

The brown trout occurs in cool, oxygen-rich waters with gravelly bottoms, and shows a preference for irregularities in the bottom and the river bank. The members of this species are strictly confined to their territory, which they leave only for reproduction. Young fish prefer shallow waters, whereas the larger ones occur in deeper parts. This explains also why the larger specimens are not found in the trout zone *sensu* Huet (1954), but rather in the grayling or barbel zone (Seifert and Kölbing, 1989). The Meuse near the Bois Laiterie Cave belongs to the barbel zone. The growth rate of the brown trout near the site must have been high compared to that in small, fast streaming waters where food is scarce and where fish use up a lot of energy struggling against the strong currents. The reconstructed fish lengths and the number of growth rings observed on the BL material indicate indeed that we are dealing with a fast growing population.

The age at maturity of fishes depends on the feeding behaviour and growth rate which in turn depends on the habitat (Maitland and Campbell, 1992). Usually, the first spawning of brown trout occurs in the second or third year. Today, spawning takes place mainly from mid-October to mid-December. Earlier dates have been recorded, however, and spawning may be extended into late January or early February depending on the temperature (Maitland and Campbell *ibid.*). The average temperatures in Late Magdalenian times being lower than those of the present-day, it is likely that spawning occurred rather late. The best spawning grounds are usually not situated in the main river but in small tributaries with fast running water over gravelly bottoms. The Burnot tributary is likely to have been such a suitable spawning place, visited seasonally by trout from the Meuse. Reproduction of the brown trout usually occurs in 15-30 cm deep water. Mortality by predation is high at the spawning places but also at other shallow parts of the river where the migrating trout pass. Adult trout can also strand in small streams. In such places they are an easy prey to many predators, including several bird species, mammals such as otter and foxes (Maitland and Campbell *ibid.*,p.126). Prehistoric man may also have taken the opportunity to capture migrating or spawning fish.

Grayling prefers spawning grounds similar to those used by brown trout but their season of reproduction sets on later in spring when river temperatures start rising (Maitland and Campbell, 1992, p.161).

As to the burbot, its presence among the BL fish remains cannot be explained in terms of high vulnerability related to spawning behaviour. The species is a typical bottom dweller reproducing in running but usually deep water. The Meuse would seem a more suitable environment for reproduction of burbot than the Burnot. However, the species is vulnerable to predation during the spawning season of trout and grayling, as a result of its feeding behaviour. Burbot is reputed to search actively for the spawning grounds of salmonids where it predates on the eggs and fry (Seifert and Kölbing, 1989). The damage can be such that some of the fishery literature recommends to eradicate burbot in the nursery reaches of salmonid waters (Maitland and Campbell, 1992, p.264). In conclusion, it seems likely that both brown trout and grayling were captured by man in shallow parts of the Burnot river during the spawning period probably in late winter and early spring. Burbots visiting the salmonid spawning grounds for feeding could also be easily captured in the shallow waters.

The foregoing scenario is based on the behavior of the fish species and on the assumption that the Late Magdalenians were opportunistic fishers. An analysis of the growth increments on the fish vertebrae from Bois Laiterie Cave might support this hypothesis. The seasonal variations in temperature and food availabity result in a different growth rate of fishes within the year. The alternation of zones of rapid and slow growth on the vertebrae allows the reading of the age of the fishes, whereas the amount of the latest incremental growth permits the establishment of the season of death and hence the season of capture. Increment studies base seasonal inferences on the width of the last, external growth zone. The vertebrae from BL are mainly derived from 4 or 5 years old specimens. Complete growth zones formed during the fourth and fifth year are already relatively narrow and estimating the season of death from such specimens cannot be done with high precision. Also, the BL sample is too limited and the material too fragmentary to allow a detailed analysis of the growth increments as Monks and Johnston (1993) have proposed. The outer growth zones, apparently intact, that could be observed, give the impression of being already fully developed with respect to the growth zone of the preceding year. This suggests that the fish were captured towards the end of their fast growth season. A major methodological problem, however, is that, from the marginal part of outer growth zones of vertebrae (or other bone structures), it is difficult to distinguish animals having just ended their rapid growth season from individuals captured during the slow growth season (winter) and from those captured at the very beginning of the new rapid growth season (early spring). As a result of this there can be a tendency to overestimate the number of fish captured during the rapid growth season (Van Neer, 1993). The width of the observed outer growth zones in the BL vertebrae are compatible with the hypothesis that fish were captured in late winter and early spring but they provide no unequivocal proof.

As already mentioned in the introduction, only a few Paleolithic sites in Wallonia have yielded fish remains thus far, which excludes comparisons of the BL material with other faunas. The assemblage from the cave is small and comprises mainly brown trout, followed by burbot and grayling. Worth mentioning, with respect to the predominance of brown trout in the BL assemblage, is the find of a Magdalenian *bâton de commandement* at Goyet, about 5 km southeast of Namur. This artefact, made of reindeer antler, bears a very realistic carving of brown trout (Twiesselmann, 1951). Salmonids, both Atlantic salmon and brown trout, predominate among the numerous Upper Paleolithic representations of fish found in France (Cleyet-Merle, 1990). The importance of seasonal salmonid fishing is also illustrated by the preponderance of their remains in French sites. Ichthyofaunas studied in France and Germany demonstrate that besides the three species found in the Bois Laiterie cave, other fish were also regularly captured during the Late Magdalenian (Torke, 1981; Le Gall, 1992). A survey of some 30 Early, Middle and Late Magdalenian sites gives the impression that fishing became an important economic activity only in Late Magdalenian times. The changing climatic conditions resulted in the gradual disappearance of reindeer which was the favorite game animal of the Magdalenians. This and the fact that the site catchment became more forested may have seriously affected the mode of exploitation of the environment. Possibly this led to a more diversified and more intense fishing activity (Le Gall, 1992).

No precise reconstruction can be given of the fishing methods used near the Bois Laiterie Cave, but given the shallow, inshore waters in which the fish occurred, the methods did not have to be very elaborate. Grasping by hand as well as the use of any type of striking or wounding gear *sensu* von Brandt (1984) would have been successful. A wide variety of fishing gear made of wood (clubs, spears) or plant fiber (baskets, etc.) could be used but no such instruments are preserved in the Magdalenian archaeological record. It is not absolutely certain whether the harpoons made of bone or reindeer antler, regularly found in Magdalenian sites, were used for fishing and the same is true for the very elaborate «leister» elements (Cleyet-Merle, 1990). Fish gorges made of bone have been found at Late Magdalenian sites in France and possibly small bipointed stone tools made suitable gorges as well. Among the BL artifacts, none can be associated specifically with fishing, although harpoons have been found at Goyet and Coleoptère.

Conclusions

The fish assemblage found in the Bois Laiterie cave comprises, in decreasing order of importance, brown trout, burbot and grayling. This small assemblage is considered to be of anthropic origin. Fishing was probably a seasonal activity practised at the end of the winter, the beginning of spring, or during both periods. The occupants of the cave then had easy access to spawning brown trout and grayling and to burbot feeding on the eggs and fry of the first species in the Burnot river.

Acknowledgements

This text presents research results of the Belgian programme on Interuniversity Poles of Attraction initiated by the Belgian State, Prime Minister's Office, Federal Services.

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11

THE AVIFAUNA OF LA GROTTE DU BOIS LAITERIE

J. Deville and A. Gautier

Quite a few bird remains were collected during the archaeological excavations in the Grotte du Bois Laiterie. As Tab.1 shows, nine avifaunal assemblages have been distinguished. The reader can find the definition of these assemblages in the other papers dealing with faunal remains of the cave (Gautier,this volume; Cordy and Lacroix, this volume and López Bayón *et al.*, this volume). These papers and others in this same volume provide further information on the site and its context. Most of the remains derive from the Magdalenian Yellow Sandy Silt (YSS) and from the same horizon in test trenches (TT) as a result of which systematic excavations were undertaken. No doubt, the finds from LBS, BSC, RS are also Magdalenian. The same would apply for the upper sequence (UGS, GBS, BR) and the backdirt (BD), as suggested by the prevalence willow grouse, which is well represented in the lower sequence.

The finds are almost exclusively derived from the postcranial skeleton and their identification is based mainly on the morphology and the dimensions of long bones. For comparison we used the bird collection in the Laboratory of Paleontology, University of Ghent, as well as several German monographs given in the references and dealing with the diagnostic features of some of the major bird groups found in Europe. The remains are generally rather fragmentary and in several cases the number of specimens assignable to a particular bird type is very limited. As a result several identifications had to remain tentative and do not reach species level. Moreover, as we found out during previous work, the duck family shows marked variation even within single species; this led us to adopt a general, threefold division of the duck remains according to size.

Clear traces on the bones due to biological agents are extremely rare. Slight vermiculations caused by plant roots occur on some specimens. On three long bone fragments of willow grouse from YSS, we found slight pitting which may be due to etching by gastric acid, but we can also think of other possible causative factors such as leaching in the soil. In general, clear traces of modification due to predators, comparable with those illustrated by Andrews (1990), are lacking, except in the case of the proximal humerus of an intrusive domestic fowl found in YSS. The articular end of this bone carries distinct depressed fractures such as are made by small carnivores and which we have noted on chicken bones treated by domestic cat.

Butchering marks have not been noted on any of the remains, suggesting that most of them are the result of causes other than people. Indeed, most of the larger birds, especially the geese, ducks, galliforms (willow grouse etc.) and whimbrel may have been victims of such predators as fox, wolf, lynx or wild cat. The buzzard and the falcon like to nest in cliffs, may have done so at the cave entrance and may thus have contributed some remains of their small prey animals to the deposits. Moreover, buzzard may have been attracted by prey remains in the cave, as it is a carrion eater. The two owls probably roosted in the cave and left their regurgitation pellets which provided most of the micromammals (see Cordy and Lacroix, this volume) and perhaps some smaller bird remains. Other birds that may have visited the cave are the swallow and the jackdaw; both live often

Tab.1 - The avifauna of Bois Laiterie (specimen counts).

	BD	BR	GBS	UGS	LBS	TT	YSS	BSC	RS	TOTAL
grey lag goose *(Anser anser)*?	-	-	-	-	-	1	2	-	-	3
large duck(a)	-	1	-	1	-	-	5	-	-	7
medium sized duck(b)	-	-	-	-	-	1	-	-	-	1
small duck(c)	-	-	-	-	1	-	-	-	-	1
buzzard *(Buteo* sp.)	-	-	-	-	-	1	2	-	-	3
falcon *(Falco* sp.)	-	-	-	-	-	1	1	-	1	3
willow grouse *(Lagopus lagopus)*	1	3	3	1	3	10	23	-	1	45
black grouse *(Tetrao tetrix)*	-	1	-	-	2	2	-	-	-	5
partridge *(Perdix perdix)*	-	-	-	-	-	2	1	2	-	5
domestic fowl *(Gallus gallus* f. domestica)(d)	-	-	-	-	-	-	1	-	-	1
whimbrel *(Numenius phaeopus)*	-	-	-	-	-	1(?)	1	-	-	2
eagle owl *(Bubo bubo)*	-	-	-	-	-	2	1	-	-	3
long-eared owl *(Asio otus)?(e)*	-	-	-	-	-	-	-	1	-	1
swallow *(Hirundo rustica)*	-	-	-	-	1	1	-	1	-	3
jackdaw *(Corvus monedula)*	-	-	-	-	-	6	9	-	-	15
jay/magpie *(Pica pica/Garrulus glandarius)*	-	-	-	-	-	1	-	-	-	1
Turdus sized passerine(f)	1	-	-	4	-	-	-	-	-	5
small passerines(g)	-	-	-	-	-	13	6	1	1	21
not identified	1	2	-	3	2	12	27	2	-	49
Total	3	7	3	9	9	54	79	7	3	174

(a) size of *Anas platyrhynchos*; (b) size of *Aythya fuligula*; (c) size of *Anas crecca*; (d) late intrusive; e) long- or short-eared owl *(A. otus / flammeus)*; (f) thrushes etc.; (g) at least three species.

near cliffs and nest in them. The passerines may also have lived near the cave and its entrance. Some of them are perhaps prey animals, others met death accidentally near the cave. Something comparable applies no doubt for the magpie or jay.

Summing up, it would seem that basically the Bois Laiterie birds can be put into the category of penecontemporaneous intrusives with respect to the fauna caused by the Magdalenians. As to the domestic fowl in YSS, it is clearly a late intrusive due to the burrowing of badgers, which are also responsible for the presence of rabbit in the Magdalenian sequence (Gautier, this volume); the state of preservation of this bone also indicates a recent origin.

As already stated, most bird remains from the upper deposits may be derived from the Magdalenian, but we cannot exclude the possibility that some of these finds, especially among the passerines, are in fact associated with the post-Magdalenian history of the cave. In the same way, some finds in the Magdalenian sequence may be late intrusives with histories comparable with those of the domestic fowl and rabbit remains. The foregoing does not fundamentally affect the taphonomic partioning of the Magdalenian avifauna. Furthermore, it cannot be excluded that some of the game birds are leftovers of birds killed by the Magdalenians, who processed them without leaving telltale traces. Since most of the fox remains seem to derive from animals using the cave as a den (Gautier this volume), it remains more reasonable to regard the fox as the killer and accumulator of most of the many hare remains in the deposits, as well as of those of most game birds.

The appraisal of the avifauna in terms of landscape combines ecological notes found in Peterson *et al.* (1962), Bruun *et al.* (1986) and Jonsson (1994). The geese, ducks and whimbrel point to the river Meuse and perhaps its small tributary, the Burnot, while the grouse and partridge suggest quite open biotopes that may have prevailed on the plateau. Nearer to the cave, on the cliffs and in the woods on the slopes of the Burnot Valley lived the cliff-dwelling birds, the magpie or jay and the passerines. The eagle owl would have no particular habitat preferences, but the long-eared owl *(Asio otus)* seems to prefer wooded habitats, especially with conifers, while its relative, the short-eared owl *(A. flammeus)* would choose more open habitats. The foregoing suggests that the cave may have been occupied by the first *Asio* species rather than the second one.

Most of the bird groups identified are resident species or comprise such species. The grey lag goose and the whimbrel appear to be exceptions, as today these migratory birds visit Belgium only in the colder season. In the late Pleistocene, however, they may have nested in Belgium, migrating south for winter. The foregoing could indicate that the grey lag geese and whimbrel of Bois Laiterie met death in the warmer period of the year and provide a clue as to the seasonal use of the cave by people, if these were indeed involved in their killing. The Magdalenians would, in that case, have visited the Bois Laiterie shelter in the warmer season.

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12

THE BOIS LAITERIE MAGDALENIAN LITHIC INDUSTRY

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Introduction

The lithic assemblage from Bois Laiterie Cave contributes to the growing list of Magdalenian collections from the Meuse Basin of Belgium and adjacent areas of French Ardennes and Dutch Limburg that date to the traditional Bölling phase (plus late Dryas I at the earliest and early Dryas II at the latest), c.13,000-12,000 years ago (uncalibrated). Until recently, the technology of the period of Bölling recolonization of Belgium was known mainly from the 19th century excavations and publications by Edouard Dupont of such major cave sites as Chaleux and Goyet, located on tributaries of the upper Belgian Meuse, as well as from the early 20th century work of J.Hamal-Nandrin and J.Servais at Coléoptère on the Ourthe, a tributary of the lower Belgian Meuse (see Dewez,1987). While several collections from modern excavations of Upper Magdalenian deposits at such sites as Roc-la-Tour (near the Semois-Meuse confluence in France), Trou des Blaireaux (above the Meuse at Vaucelles near the French enclave of Givet), Trou Dasomme (near the Meuse-Lesse confluence upstream of Dinant) and Trou Walou (on the Vesdre, another tributary of the lower Belgian Meuse) are not yet fully published, the corpus of data has grown significantly with the publication of the new excavations of remnant cave deposits at Chaleux (Lesse valley) by Otte *et al.* (1994) and of the recently discovered open-air sites of Orp Est and West (Brabant) (Vermeersch *et al.*,1987; Vermeersch 1991), Kanne (Belgian Limburg) (Vermeersch *et al.*,1985), Mesch and Eyserheide (Dutch Limburg) (Rensink,1993). The purpose of this chapter is to describe the 12,600 BP Upper Magdalenian lithic assemblage from Bois Laiterie Cave, and to thereby add to the record a kind of occupational residue not yet well represented among the Magdalenian sites of the Meuse Basin: *i.e.*, materials from a small, uncomfortable cave with a poor solar orientation (north-facing), but with a strategic location dominating a critical gorge passageway between the Meuse canyon and the Meuse-Sambre interfluve plateau. Other small caves site, possibly analogous to Bois Laiterie, exist (*e.g.*, Trous Abris and Da Somme), but their materials are very scanty and are as yet only very summarily published (*e.g.*, Léotard, 1988 and 1993).

As argued earlier (see Straus and Martinez; Courty, this volume), there are no substantive reasons for stratigraphically subdividing the Magdalenian materials from Bois Laiterie Cave. The site can be considered to be single-component in nature. And while the artifacts in Strata YSS+BSC (plus a few outlier items of the same raw materials, technological and typological characteristics from right above and below this horizon) probably resulted from more than one actual episode of human use of the cave, they were probably deposited within a relatively short interval of time, perhaps by repeated, short-term, functionally-similar visits to the cave, as suggested by the three identical AMS-radiocarbon dates of 12,600 BP on materials from different parts of the cultural horizon within the cave. For this reason (and since any attempt at subdivision would reduce sample sizes to numbers that would make statistical analysis difficult or meaningless), we are treating the assemblages of lithic debris (cores+debitage) and tools as single entities, whose characteristics are believed to represent the «averaged» residues of essentially redundant human uses of a limited-function site. The totals given here include small numbers of artifacts recovered by Ph.Lacroix in several small test pits he dug at the rear of the lower cave when he discovered the Magdalenian site in 1990. These were clearly all from YSS.

Overview of the Assemblages

We recovered (both in the course of excavation and during fine screening) a total of 3,369 lithic artifacts (not including manuports [psammite slabs or «plaquettes», water-worn cobbles, fire-cracked rocks]) (Tabs.4 and 5). Of these objects, 2,577 (76.5%) were found in Stratum YSS (yellowish-red sandy silt), including the localized grey lens (possible diffuse burning area) at the front of the cave. Another 699 (20.8%) lithic artifacts of identical morphological and raw material characteristics were found in underlying «Stratum» BSC (basal silty clay) toward the cave mouth and in its lateral facies, RS (red sand) toward the cave rear. Only 68 (2.0%) artifacts of Magdalenian appearance were found above YSS in sandy deposits (UGS [upper grey sand], LBS [light beige sand]) locally in contact with the base of the breccia adhering to the south and especially east walls of the cave. These latter include only four formal tools: backed, truncated and retouched blades and a backed bladelet.

It should be noted that *no* obvious Mesolithic or Neolithic types of lithics (*e.g.*, no geometric microliths or Montbani blades, or any artifacts made of Wommersom quartzitic sandstone, so characteristic of the central Belgian Mesolithic) were found either in these *in situ* deposits above YSS or during the screening of large amounts of mixed backdirt from the pothunter diggings into the post-Magdalenian deposits of the cave. Nor were ceramics or any other modern artifacts found in any of the intact strata of our excavations (including LBS or UGS, which sealed YSS).

Of the 3,369 lithic artifacts, 266 (7.9%) are retouched tools that can be classified into the standard descriptive Upper Paleolithic typology of D.de Sonneville-Bordes and J.Perrot. (Tool blanks that have more than one typological classification, but do not conform to any of the «composite tool» categories defined by that typology are counted more than once when we refer to tool types - but *not* when we refer to blank characteristics, such as dimensions and weight. Thus, of the 254 tool blanks, 11 have two separately counted tool types and one has three types.) The 3,115 unretouched debris (3 cores - not including one from the old backdirt - and 3,112 items of debitage) have been classified according to a technologically-oriented type list developed by Straus and students over the course of many Upper Paleolithic excavations throughout Western Europe. The ratio of debris to tools is 12 to 1, which is relatively low, as compared with other assemblages - such as the Middle and Upper Magdalenian Strata 5 and 4 of the Abri Dufaure, located near good flint sources in SW France, with ratios of 18-19 to 1 (Straus 1995), or Upper Magdalenian Level 24 of La Riera Cave, also located near some lithic sources in northern Spain, with a ratio of 15 to 1 (Straus and Clark 1986) - both collected with similar screening procedures and meshes. This fact (together with the scarcity of cores) immediately suggests that *much less than the complete lithic reduction sequence is represented* at Bois Laiterie Cave.

Lithic Raw Materials

Lithic raw materials represented among the Bois Laiterie assemblages were classified according to an *ad hoc* typology developed during the course of the South Belgium Prehistoric Project by Straus, J-M.Léotard, A.Martinez, R.Miller, M.Otte, E.Teheux, *et al.* This typology is described in Tab.6. There is some disagreement and much uncertainly among us as to the exact, specific sources of many of the lithic types represented at Bois Laiterie and there is some degree of overlap among some of the categories, suggesting that some of the distinctions may be somewhat arbitrary. Such is the case of the predominant flint(s) represented at Bois Laiterie: «types» 10, 11 and 12, which are all excellent-quality, homogeneous, fine-grain, nodular chalk flint of probable Cretaceous origin that intergrade in color, grain, degree of translucence, inclusions, and cortex. Type 18 is probably just a heavily patinated variety of one or more of these flints. Type 19 consists of probable variants of these types. The only other flint of any quantitative significance at the site is type 9, which is highly distinctive by its extraordinarily fine grain, homogeneity, opacity, black crystalline inclusions, shininess and excellent flaking characteristics. Other lithic materials are of absolutely negligible importance at Bois Laiterie.

By count, 95.6% of the debris are of flint types 10,11,12, 18 and 19 combined; by weight (a measure which is more significant relative to human transport considerations), 90.9% of the debris are of these five flint types, whose total combined weight is 1,975 gms (only 2 kg, or 4.4 pounds) (Tab.7). Among the tools, by count 88.6% are on these 5 flint types, and by weight, 86.3% - totalling only 636 gms (0.64 kg or 1.5 pounds).

Type 9 flint is the only other lithic raw material of any consequence (albeit in reality minimal) at Bois Laiterie: 3.2% by count and 5.7% by weight among the debris and 8.2% by count and 11.4% by weight among the tools. The fact that the percentages by weight far exceed (almost by twice) the percentages by count for this distinctive raw material, is interesting in comparison with the five other combined flint types, for which percentages based on count and on weight are almost identical for both debris and tools. This means that type 9 artifacts are on average heavier than the artifacts made on the combined five-flint group. Indeed, average weight of the 120 artifacts (tools + debris) on type 9 flint is 1.7 gms, whereas average weight of the 3204 artifacts made on types 10-12 + 18-19 flint is only 0.8 gms.

Although not yet confirmed by petrographic analysis, the «common» flint types (especially types 10 and 12, but also 11, 18 and 19) probably come from Upper Cretaceous (Maastrichtian) chalk limestone sources, either on the Hesbaye Plateau (Brabant, northern Namur and northern Liège provinces) to the north and northeast of Bois Laiterie or in the Mons Basin of Hainaut Province to the west (Caspar 1984). The closest known specific sources of flints that are similar (by visual inspection with the naked eye or with a hand lens, and by touch) to the «common» Bois Laiterie flints are Orp (on the Brabant-Namur border) and Spiennes (nears Mons). Both of these flint sources have not only Neolithic flint mines, but also Magdalenian sites (Vermeersch *et al.*,1987) or at least «terminal Paleolithic» in the case of Obourg-St.Macaire near Spiennes (Létocart,1970). The Orp locality is 39 km from Bois Laiterie via a route down the Meuse to its confluence with the Sambre at Namur and then further north up onto the Hesbaye Plateau. Spiennes is 63 km to the west of Bois Laiterie via a route over the Meuse-Sambre interfluve, up the Sambre valley and then across the Sambre-Escaut (Scheldt) interfluve (following the route of the modern Canal du Centre). There are no Cretaceous chalk limestone outcrops between Orp (at the western end of the Hesbaye «formation») and Spiennes (the Hainaut «formation») and there are none in the upper Meuse region at all, which runs along the western edge of the Ardennes Plateau with its Devonian schists and narrow bands of Carboniferous limestone. That our flint types 10, 12 and 19 are at least sometimes the same thing, is demonstrated by inter-type refits at BL (see Straus and Martinez,this volume).

On the other hand, type 9 flint *may* be material of Secondary age redeposited in Tertiary deposits either in the area of Agimont-Doische (25-30 km upstream [south] along the Meuse) (E.Teheux,1994, and personal communication) or in the area of Charleville-Mézières (France) (c. 75 km up the Meuse from Bois Laiterie) (J-M.Léotard, personal communication). If the Agimont hypothesis is correct, then this flint would have been the marginally more «local» high-quality material - a possibility that squares with the heavier weight of the artifacts made of it. This hypothesis also would make sense in light of the presence of Magdalenian sites all the way up the Meuse from Goyet and Bois Laiterie to Roc-la-Tour in French Ardennes, via the Dinant-Lesse Valley site cluster (Chaleux, Frontal, Nutons, Abri, Magrite, Da Somme) and Trou des Blaireaux at Vaucelles near Doische. It is this southward axis that would lead eventually toward the Paris Basin, a major region of contemporaneous Upper Magdalenian settlement and the source of fossil shells found in several Belgian Magdalenian sites, including Bois Laiterie (Taborin,1994; see Lozouet and Gautier,this volume).

Nonetheless, the fact that the vast majority of flints at Bois Laiterie probably come from Cretaceous chalk sources suggests that the most significant, common contacts of Bois Laiterie human inhabitants were with the Hesbaye and/or Hainaut regions of Middle Belgium, at least during the times of the year when they were at Bois Laiterie or in the northern part of their annual range or territory and/or possibly coming from the chalk regions.

Lithic Debris: Cortical vs Non-cortical

The presence or absence of cortex on lithic artifacts is an important datum for the reconstruction of prehistoric operatory chains, including the significance of lithic transport and hence human mobility patterns. The Bois Laiterie assemblage is striking for its scarcity of cortical items - especially those with completely or mostly cortical dorsal surfaces.

There are 3,115 items of lithic debris (cores+debitage) attributable to the Magdalenian component at Bois Laiterie (Tab.8; Fig.1). Lithic debris weighs a total of 2,174 gm (2.2 kg), whereas retouched tools from the site total 737 gm (a high 34% of the debris weight). Among the debris, there are only three tiny cores (or perhaps mere core remnants; see below) and 23 chunks (angular debris >1 cm in length), of which only 8 have any cortex. Most chunks are very small.

In reality, the debris assemblage is essentially a light debitage assemblage, fully half of which is composed of trimming flakes (< 1 cm). Of the 1,555 trimming flakes, only 28 have cortical dorsal surfaces. Similarly, of the 265 small angular debris (shatter, < 1 cm), only 7 have any cortex. Fully 58.4% of the debris assemblage is composed of microdebitage (trimming flakes and shatter).

Of the 495 larger flakes (> 1 cm), only 80 have any cortex (and of these, only 9 have fully cortical dorsal surfaces). There are 387 non-cortical blades (> 2 cm) versus only 72 with any cortex and 259 non-cortical bladelets versus only 7 with any cortex. In total, only 6.5% of all the debris (and tool blanks) has any cortex (generally partial), versus 93.5% non-cortical. Among the microdebitage (trimming flakes and shatter, which is either produced at the locus of primary knapping or in the course of retouching/resharpening), only 1.9% have any cortex. Together with the

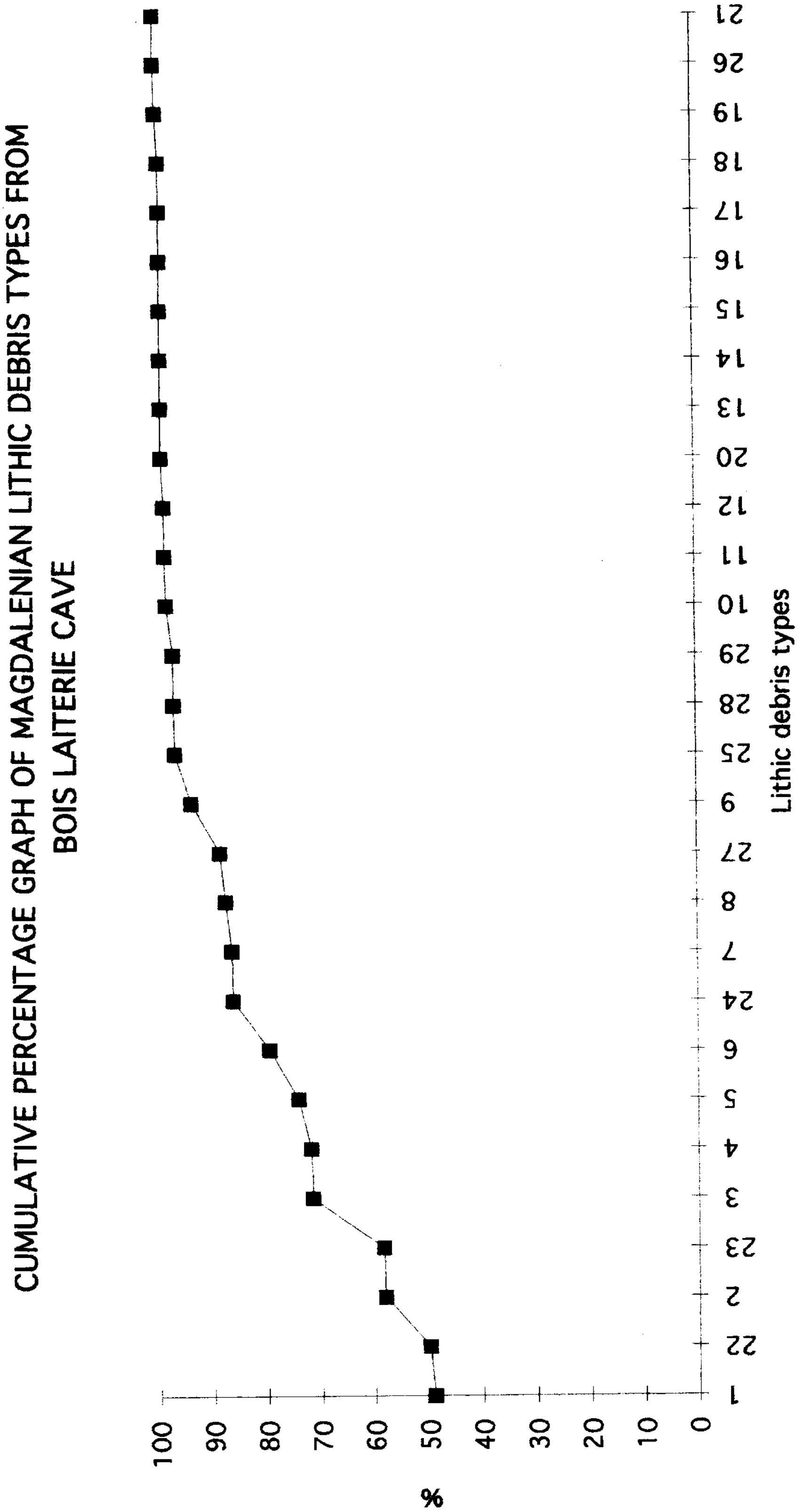

Fig.1- Cumulative percentage graph of combined Magdalenian lithic debris assemblage from Bois Laiterie Cave.

fact that trimming flakes outnumber shatter (small angular debris) by nearly 6 to 1, this would clearly point to final tool-shaping activities rather than to initial reduction at Bois Laiterie. (By contrast, in the Middle and Upper Magdalenian levels of l'Abri Dufaure, with much more evidence of complete reduction sequences, the ratios of trimming flakes to shatter are a much lower 4.3-4.6 to 1[Straus,1995].) Further indications of tool production from blanks (and/or resharpening of tools) at Bois Laiterie include the relatively high number of burin spalls (37, 1.2% of the debris total).

Not surprisingly (especially given the huge masses of non-cortical trimming flakes and small bladelets), the average weight of non-cortical debris is only 0.61 gm(!), while the average weight of the (few) cortical debris is more than three times as great, 2.0 gm. The average weight of all microdebitage (trimming flakes and shatter combined) is only 0.16 gm, a fact which gives a good idea of the diminutive size of much of the Bois Laiterie lithic assemblage.

Lithic Debris: Cores

As noted above, three small, exhausted cores were found in the Magdalenian horizon (all actually in Stratum YSS). In addition, one other core was found in backdirt from the pothunter diggings; it, by its morphological and raw material characteristics, is almost certainly from the Magdalenian - one of the very few lithics artifacts found by us in the old backdirt (n=18). All four cores are of excellent type 10 non-local chalk flint. Formally classified as 1 prismatic blade core, 1 prismatic blade core and 2 mixed cores, all were used for producing small laminar blanks and were reduced to the maximum (Fig.2). Length ranges between only 40-50 mm (average length=44.25 mm), width between 16-49 mm (average=33.0 mm), thickness between 11-20 mm (average=17.25 mm), and weight between 1 (!)-46 gm (average=24.5 gm). These really are the minimum expressions of the «nucleus» category - both quantitatively and in terms of size. Average weight of «chunks» is only 0.96 gm. - no larger than that of all flakes excluding trimming flakes (1.33 gm).

In addition to the scarcity of cores (and of «large» angular debris/chunks: 0.7 of the debris total), there are only 13 possible platform renewal flakes (0.4%) and only 12 crested blades (0.4%) - only 3 of which are bidirectional. Combined with the very low number of cortical debitage items and the light weight and small size of the artifacts in general, these facts clearly indicate that Bois Laiterie is far from the locus of primary reduction and that this is a transported assemblage. No hammerstones or antler billets were found. It is conceivable that light flaking and retouching could have been done with hardwood implements, since trees were present in the Bölling landscape of Wallonia.

Lithic Debris: Blades and Bladelets

The Bois Laiterie debris and tool assemblages are highly laminar. Here «blades» are defined as being at least twice as long as wide and > 2 cm long (and essentially parallel-sided); «bladelets» are 2 cm long or less. Most of our «blades» would be classified as «bladelets» by other researchers who use a cut-off value of 5 cm, for example.

Among the total debris at Bois Laiterie, 14.7% are blades by our definition and 8.6% are bladelets, for a total laminar index of 23.3%. If one eliminates microdebitage and cores from

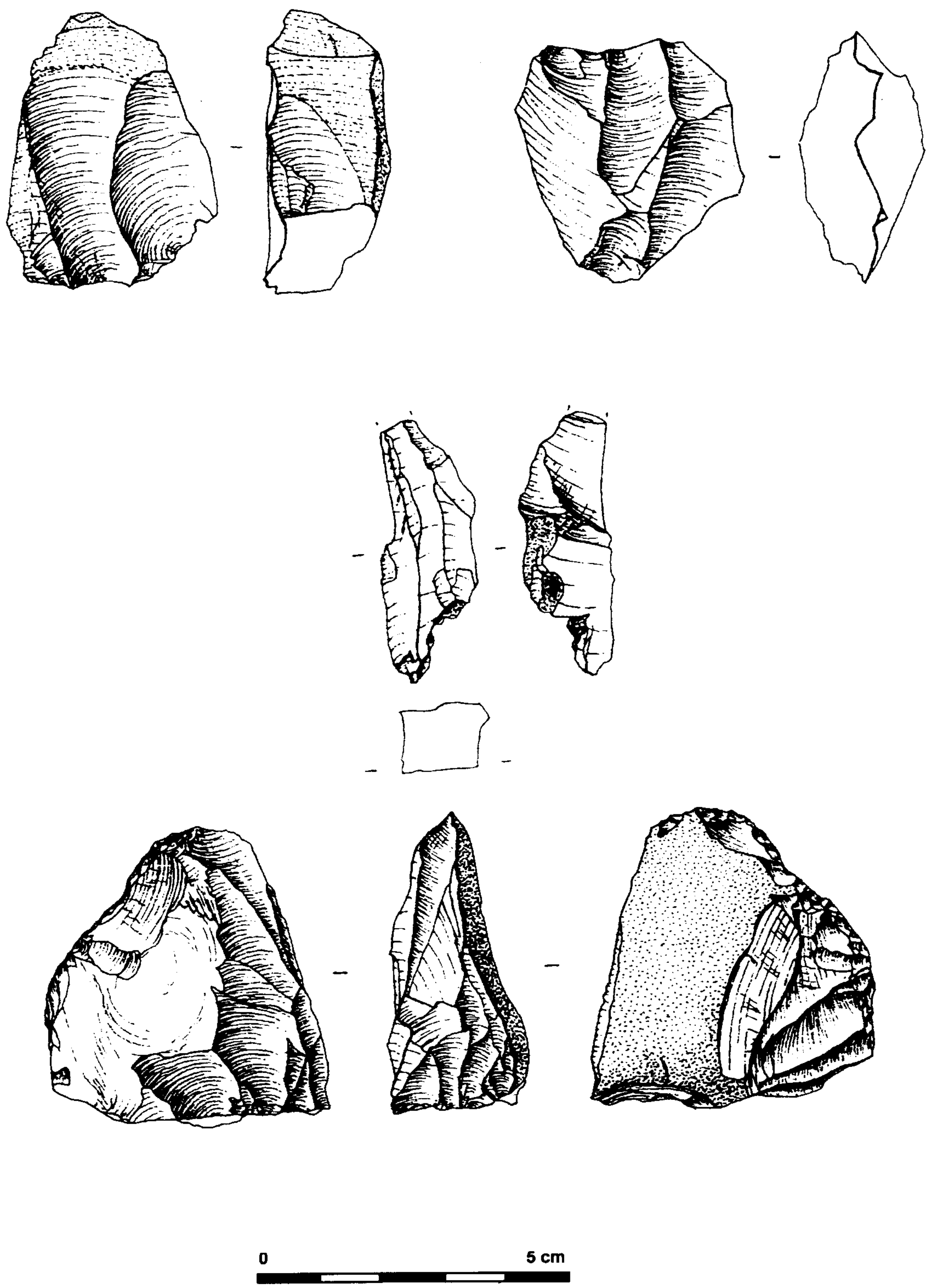

Fig. 2- Bois Laiterie (Magdalenian): cores.

consideration, leaving a total of 1,292 items of larger debitage, blades+bladelets make up 56.1%. Average weights of blades and bladelets are 1.95 gm and 0.54 gm, respectively; average weight of blades+bladelets combined is 1.43 gm.

In terms of the laminarity of the retouched tool assemblage, 68.1% of the tools are made on blades and 22.2% on bladelets, for a total of fully 90.3%. Nearly all the tools at Bois Laiterie were produced on small blades and bladelets - a leptolithic and laminar industry indeed. Flakes and chunks (8.7% of the assemblage) were simply not chosen to make formal tools and were just discarded with little if any (at least macroscopic) evidence of use.

Combined blade/bladelet size information is provided below (including both whole and fragementary items):

TABLE 1

Blades+Bladelets	N	Av. Length	Av. Width	Av. Thickness
Unretouched	405	27.57 mm	13.47 mm	3.64 mm
Used for Tools	219	30.79 mm	13.15 mm	4.24 mm

The difference in average lengths is statistically significant at the 0.05 level ($.01<p<.02$). The average length of *whole* unretouched blades+bladelets (n=95) is 37.82 mm and the average length of *tools* made on *whole* blades+bladelets (n=37) is 51.46 mm. The difference in average lengths of *whole* blades+bladelets is also statistically significant at the .05 level ($p<.001$). Clearly, longer blades/bladelets were selected for the manufacture of formal tools/weapon elements. Among unretouched whole blades+bladelets, in terms of length, 16.8% are <20 mm, 16.8% are 30-20 mm, 25.3% are 31-40 mm and 41.1% are >40 mm. But among the *tools* made on whole blades+ bladelets, fully 78.4% are >40 mm in length. The average length of *all* tools that are not backed blade(let)s (*e.g.*, endscrapers, burins, perforators, truncated and retouched pieces) is 35.43 mm.

The average width of whole unretouched blade(let)s (n=95) is 14.06 mm and that of tools on whole blade(let)s is 17.5 mm (statistically different at the .05 level [$.001<p<.01$]), whereas average thicknesses for the same same samples are 4.3 mm and 5.95 mm (statistically different at the .05 level [$.001<p<.01$]). Tools on whole blade(let)s are mainly in the single length mode of 51-60 mm, while the single length mode for unretouched whole blade(let)s is 31-40 mm, considerably smaller (Figs.3 and 4). In terms of width, tools on the sample of whole blade(let)s fall mostly in the two modes of 6-10 mm (our »backed bladelets») and 16-25 mm, whereas there is a single width mode of 11-15 mm for unretouched blade(let)s, precisely the group *not* much selected for tool manufacture (Figs.5 and 6). The thickness mode for tools on whole blade(let)s is 5-8 mm, but this mode for unretouched whole blade(let)s is < 4 mm (Figs.7 and 8). There seem to have been fairly standardized optimal blank sizes for the manufacture of tools/weapon elements on blade(let)s; other potential laminar blanks were often discarded unretouched.

Average weight of blades is 1.95 gm, while average weight of backed, truncated and retouched blades is 2.62 gm; but the average weight of bladelets is 0.54 gm, practically identical to the average weight of backed and retouched bladelets at 0.51 gm. This would seem to suggest selection for very small (light, narrow, but not too thin) blanks (in turn slightly further reduced in size by retouch) for the purpose of making microlithic weapon elements, whereas other retouched blades

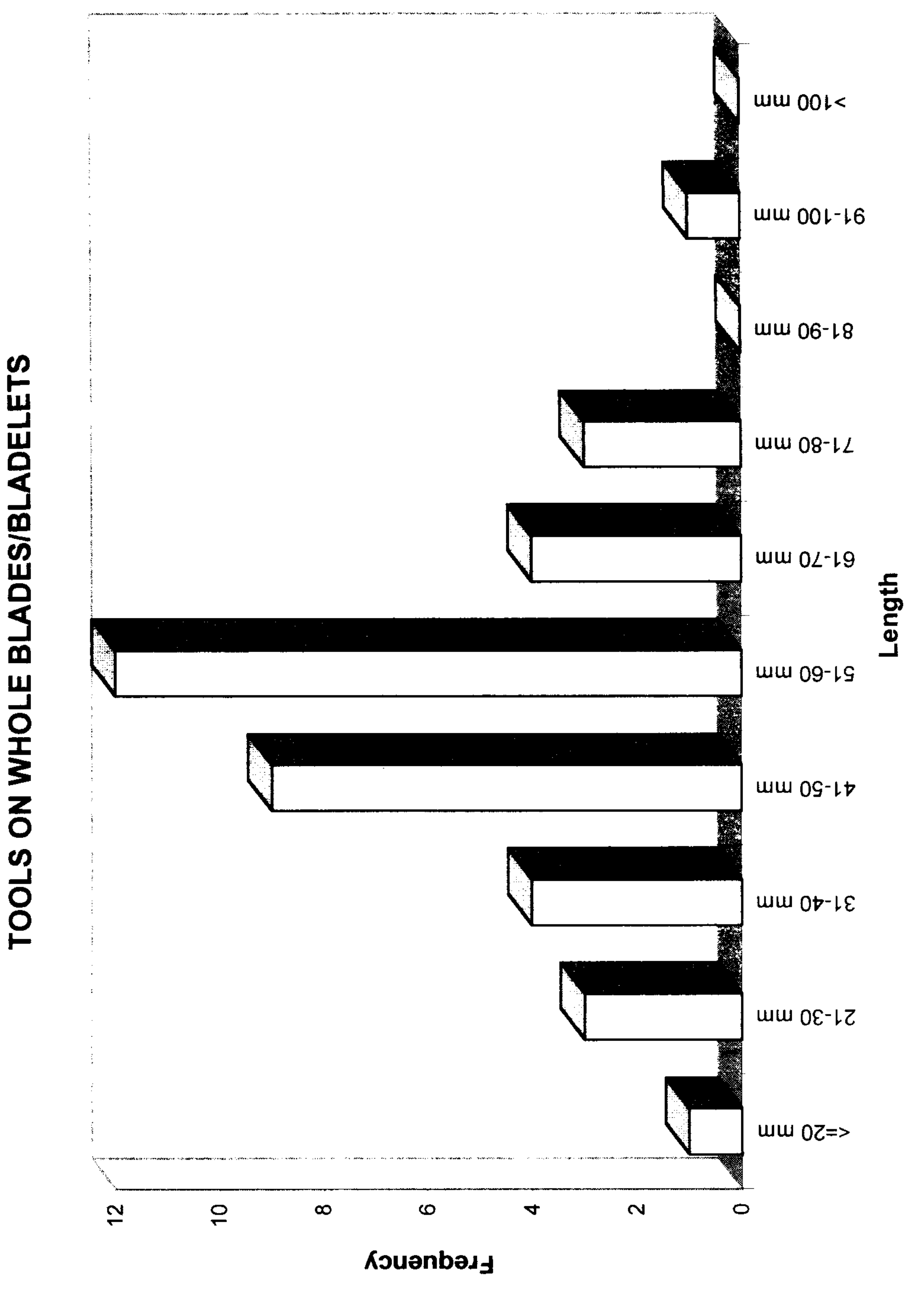

Fig.3- Histogram of lengths of tools made on whole blades and bladelets.

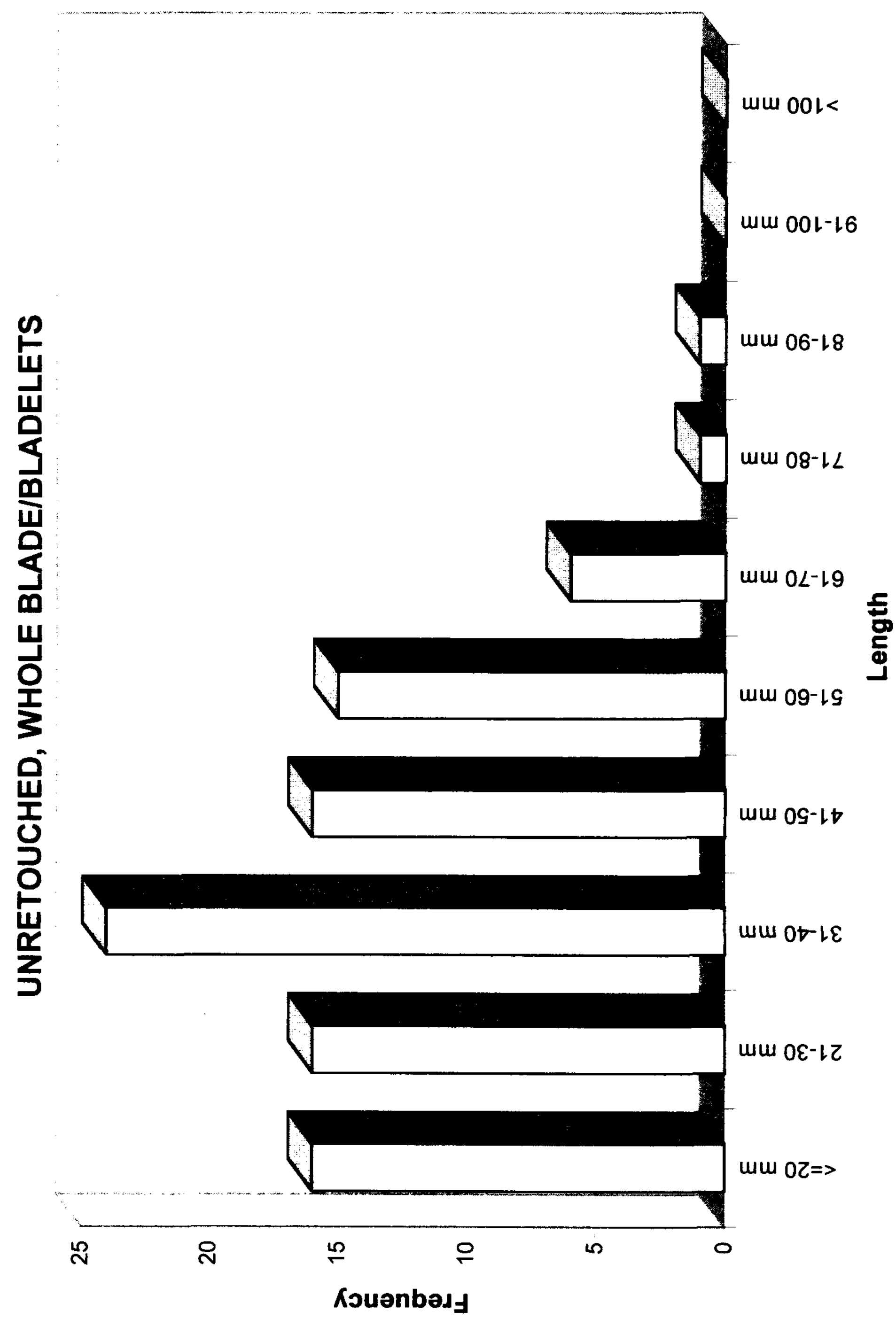

Fig.4- Histogram of lengths of unretouched whole blades and bladelets.

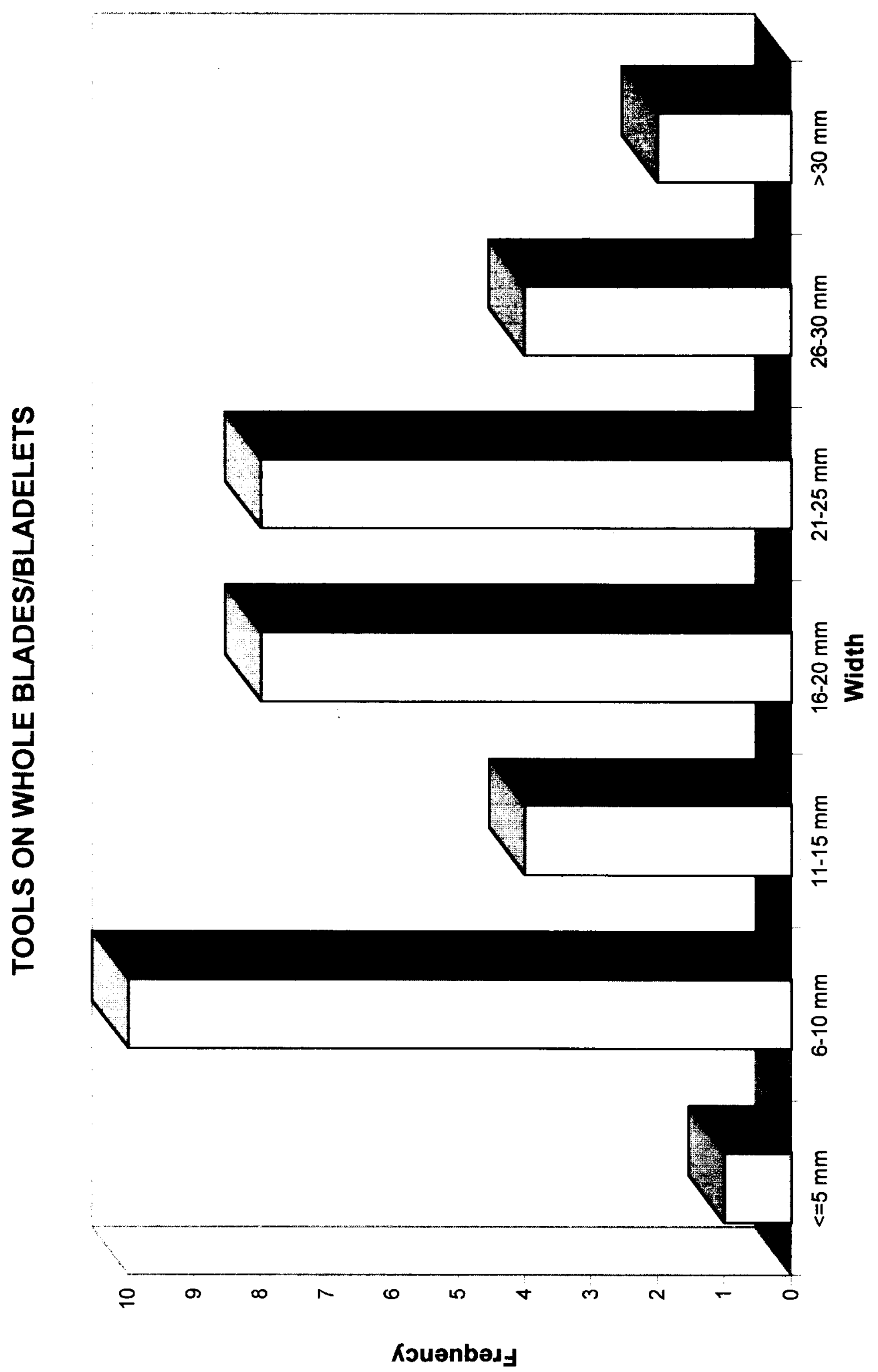

Fig.5- Histogram of widths of tools made on whole blades and bladelets.

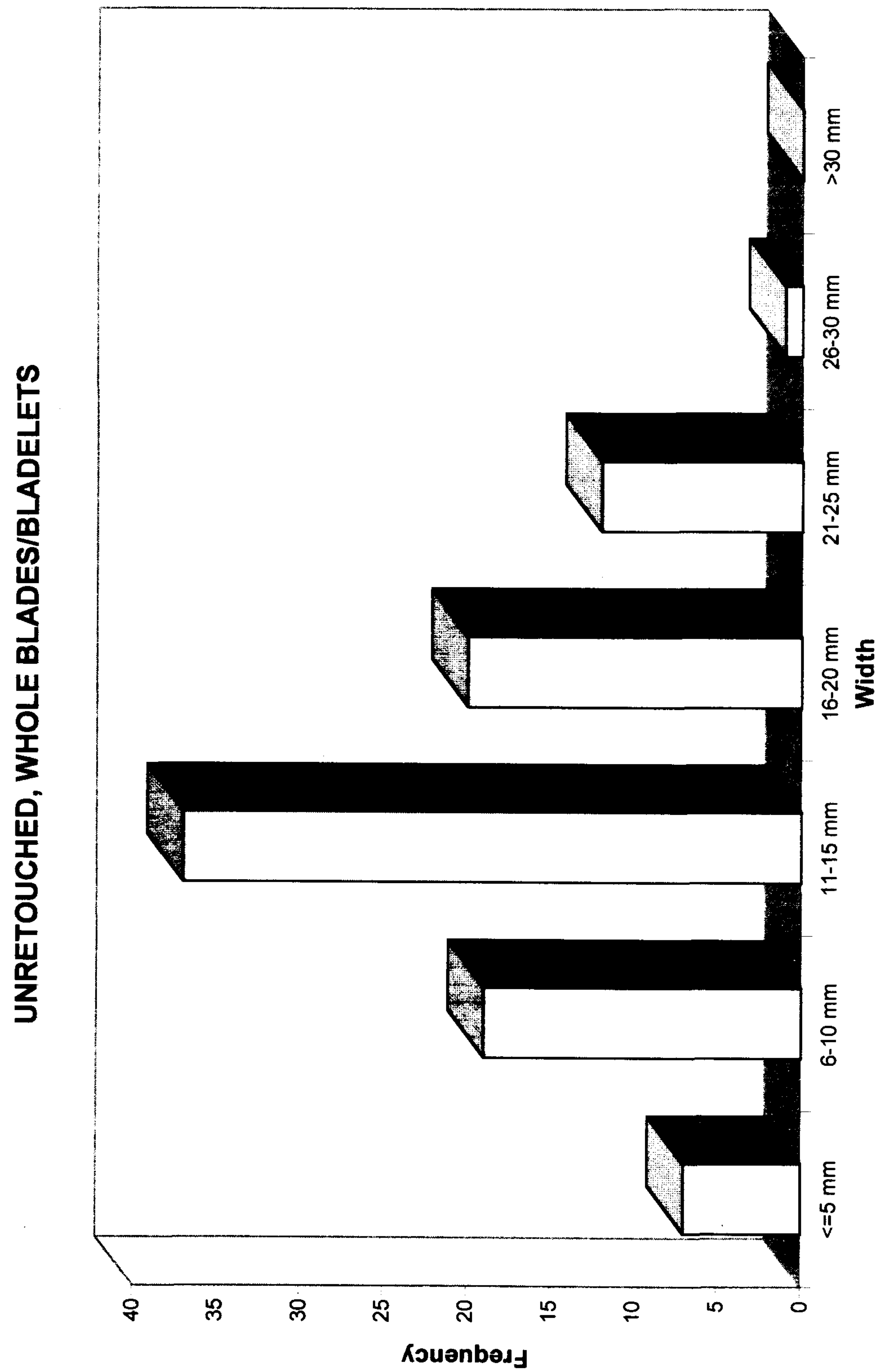

Fig.6- Histogram of widths of unretouched whole blades and bladelets.

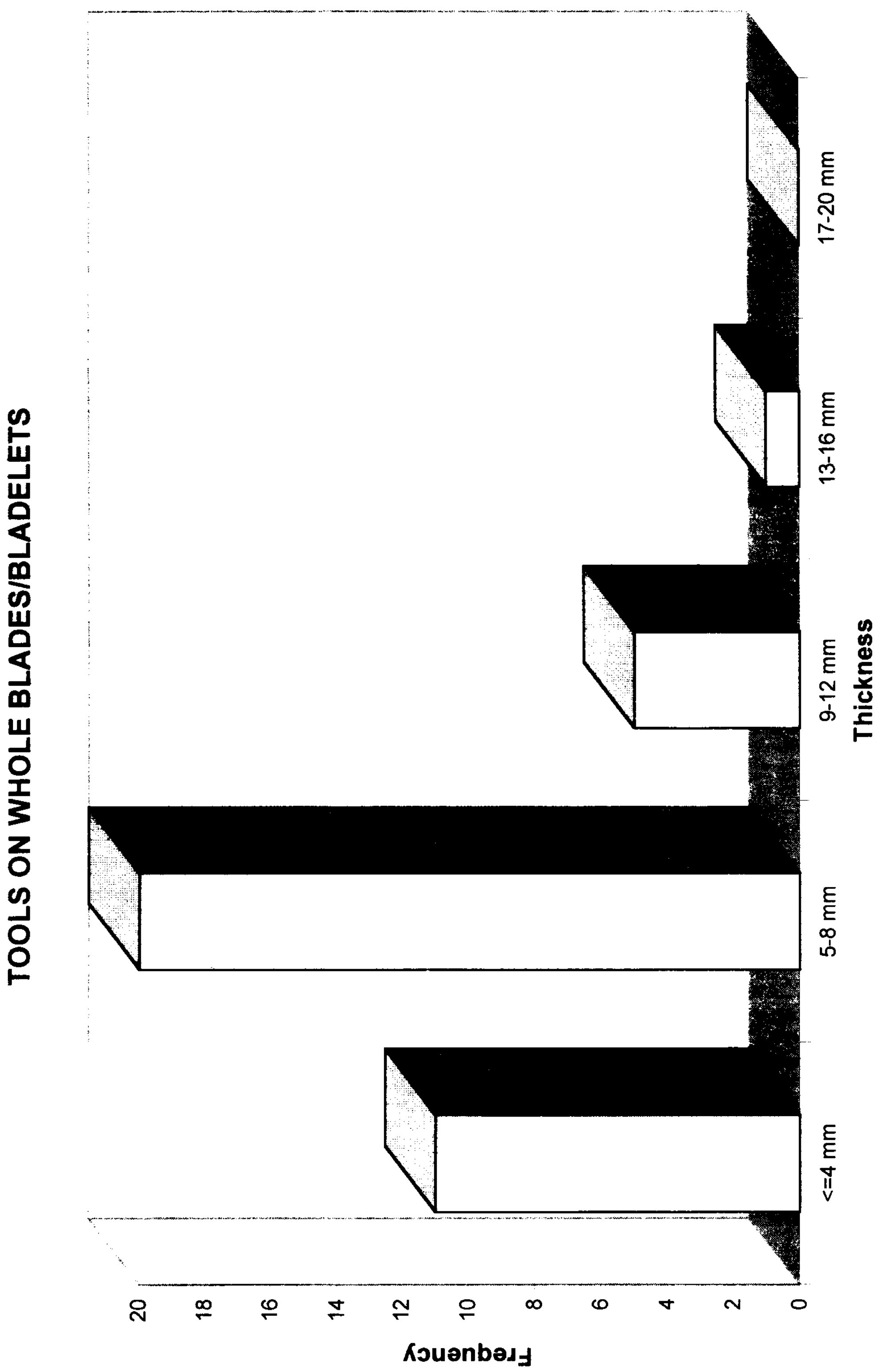

Fig.7- Histogram of thicknesses of tools on whole blades and bladelets.

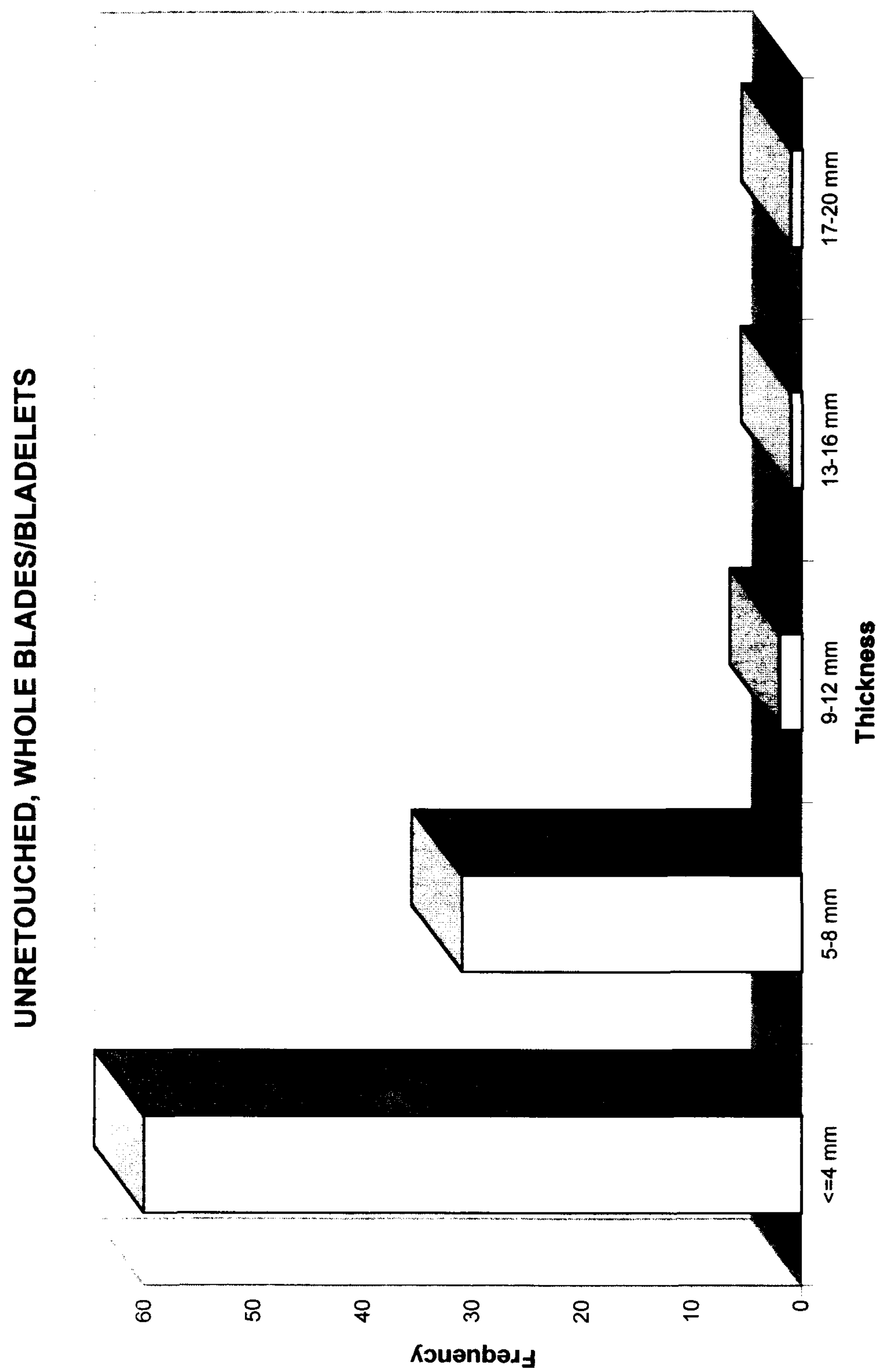

Fig.8- Histogram of thicknesses of unretouched whole blades and bladelets.

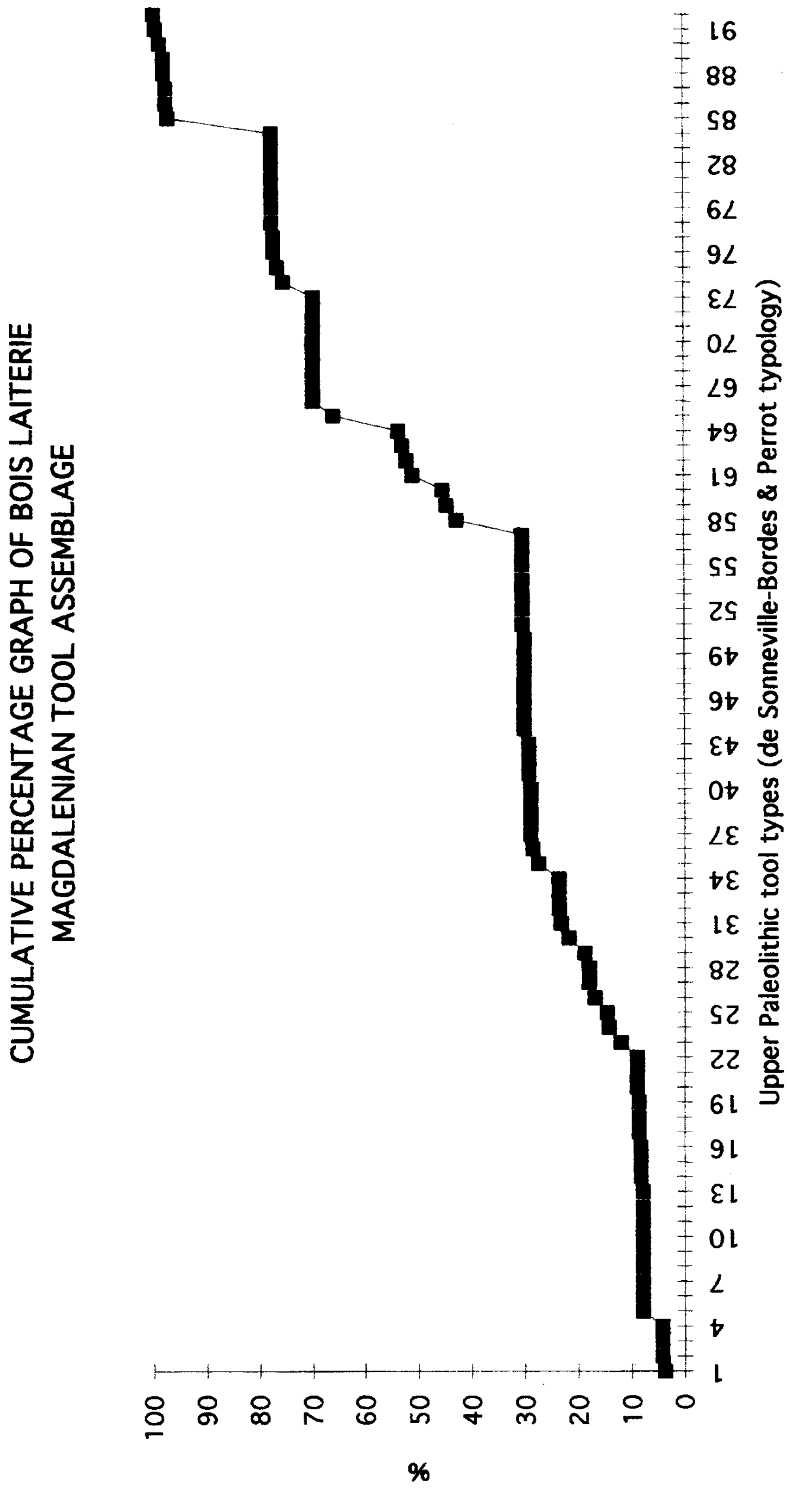

Fig.9- Cumulative percentage graph of the combined Bois Laiterie Magdalenian tool assemblage.

(possibly functionally used as knives, planes, etc.) were selectively made on larger (heavier, wider) blanks, as is suggested by the weight and dimensional data.

Overall, what the human users of Bois Laiterie wanted, sought and brought back to the cave (either themselves through direct or embedded procurement, or indirectly through exchanges with other groups) were small, laminar blanks, from which they selected a fairly narrow range of pieces for the fabrication of tools and especially weapons at the site. Neither cores nor large flakes or blades were often transported to Bois Laiterie, probably due to the long distances involved from the chalk flint source(s) in Hesbaye and/or Hainaut, and hence high transportation costs. Small blades, intergrading with our category of bladelets, were brought to the site (usually already fully decorticated) and then were transformed into tools/weapons. Hence the high amount and percentage of non-cortical trimming flakes (and burin spalls) - and very little primary debitage or cores. The fact that 6 of the 30 sets of lithic refits involve a total of 7 tools (2 truncations, 2 backed blades, a burin, a notch and a denticulate) is clearly indicative of this kind of on-site tool production from laminar blanks. All the refit sets which include a tool or two, are composed wholly or partly of blades. Fully 43 of all the 73 refitted items (59%) are blades+bladelets (most of the rest are plain and secondary decortication flakes).

Retouched Tools: Typology

The 266 formal, retouched tools and weapon elements (Tab.9; Fig.9) include items made on 254 blanks, since there are 11 that have two different tool types on the same blank and one that has three. The tools are distributed among the major groups as follows:

TABLE 2

Endscrapers (IG):	8.27%	Total Burins (IB):	13.16%
Dihedral Burins (IBd):	6.77%	Truncation Burins(IBt):	5.26%
Perforators (IP):	7.89%	Truncated Pieces (IT):	9.04%
Backed Bladelets(Ibb):	19.92%	Backed Pieces and Points*:	35.34%
Denticulates+Notches:	6.77%	Continuously Retouched Pieces:	16.17%

* types 51, 58, 59, 85, 86, 91 on the de Sonneville-Bordes and Perrot list (includes backed bladelets)

Representative lithic tools from the Magdalenian of Bois Laiterie are shown in Figs.10-17. In terms of supposedly temporal/regional diagnostics, it should be noted that the assemblage contains two Azilian (curved back) points (Photo 1), a microgravette point and several Lacan (oblique, concave truncation) burins. The high percentages of burins, truncations, perforators and backed pieces are completely normal in a Tardiglacial, Magdalenian context. The relatively low percentage of endscrapers (IG<IB) and the absence of sidescrapers (there is just one item classifiable as a «raclette») *might* be indicative of rather little (albeit some [see Jardón,this volume) hidescraping activity at the site. On the other hand, the high percentages of burins might be suggestive of relatively significant antler-working (as might be the high percentages of continuously retouched pieces [16.2%] and notches [5.6%], both of which might have been used for shaving or planing sagaie blanks removed by burin grooving from cervid antlers?) Some of the sturdier pieces classified as «perforators» might also have been used to groove out antler splinters (there are no true *zinken*).

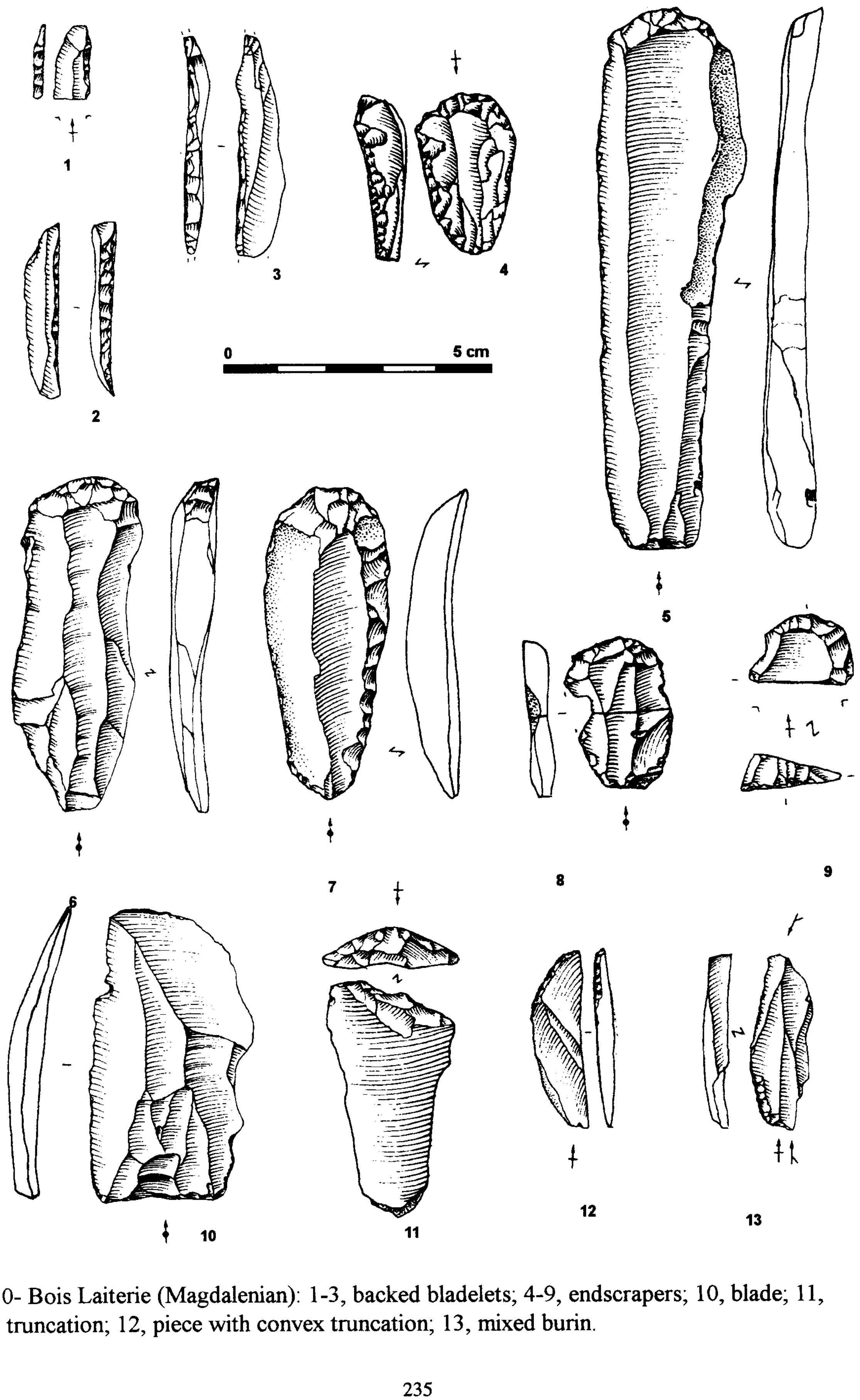

Fig.10- Bois Laiterie (Magdalenian): 1-3, backed bladelets; 4-9, endscrapers; 10, blade; 11, basal truncation; 12, piece with convex truncation; 13, mixed burin.

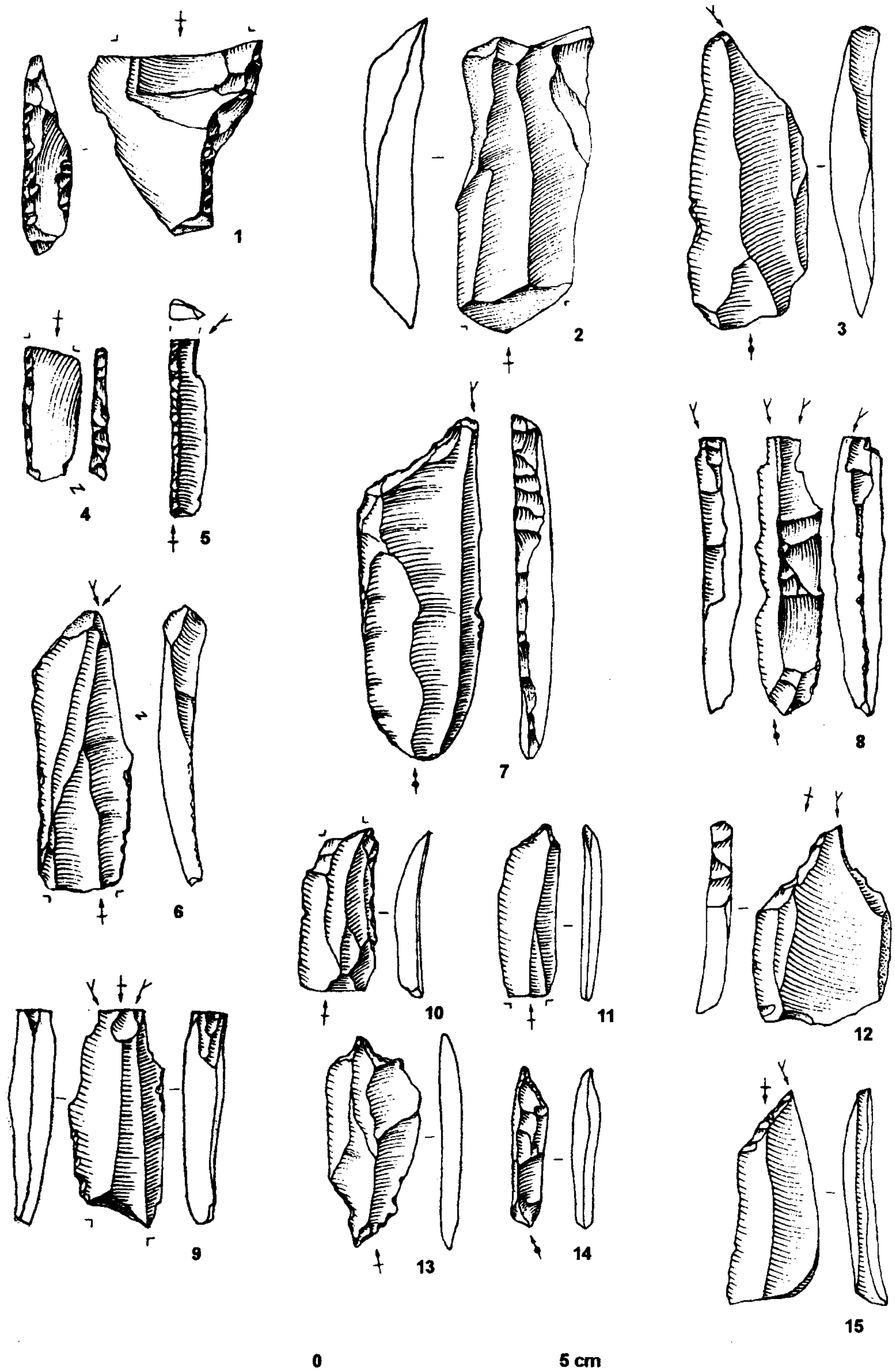

Fig. 11- Bois Laiterie (Magdalenian): 1, shouldered piece; 2, blade; 3, transverse burin; 4-5, backed bladelets; 6, dihedral burin; 7, 12, Lacan burins; 8-9, double burins on break; 10, 11, 13, 14, perforators; 15, burin on oblique truncation.

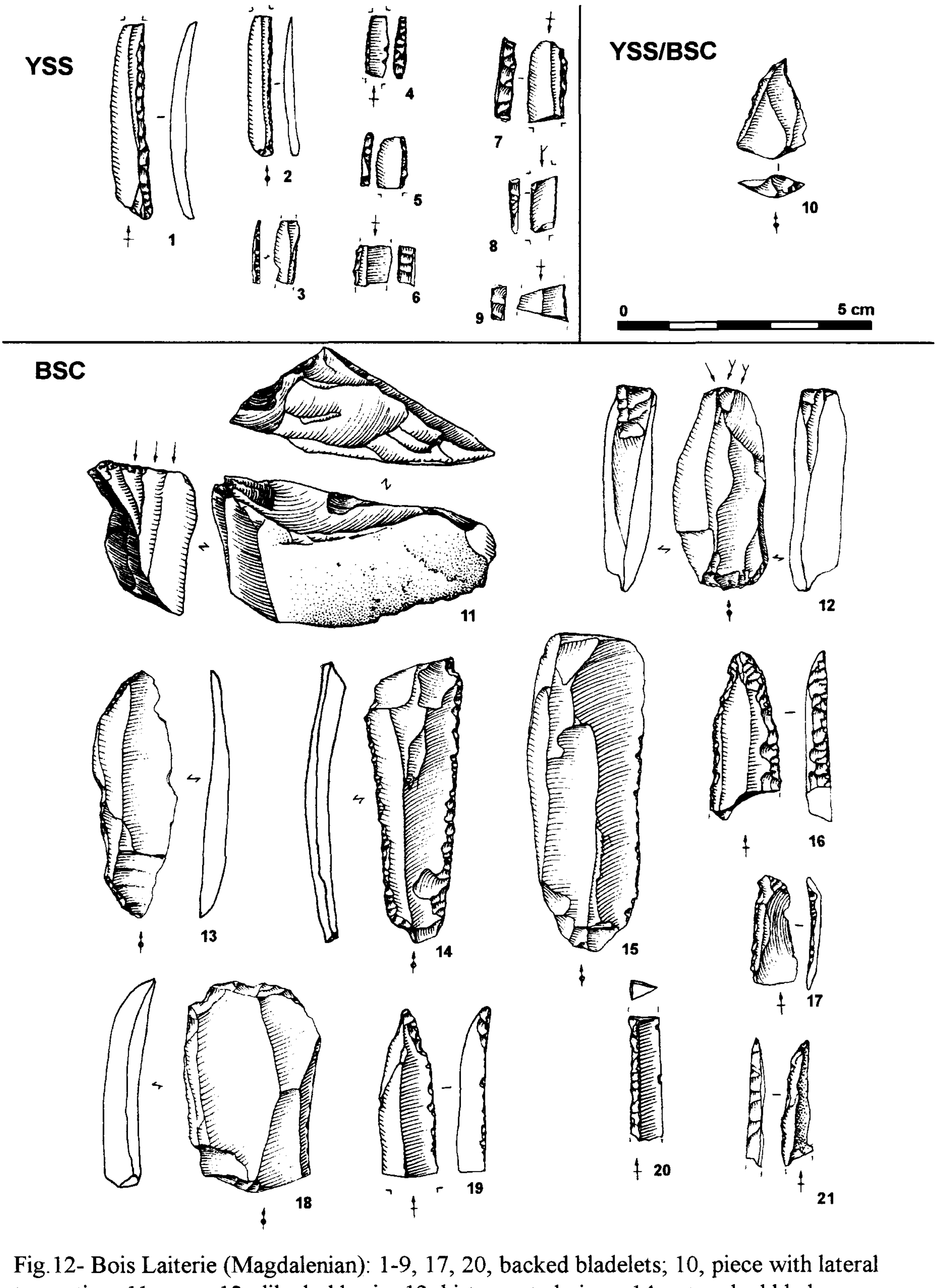

Fig.12- Bois Laiterie (Magdalenian): 1-9, 17, 20, backed bladelets; 10, piece with lateral truncation; 11, core; 12, dihedral burin; 13, bi-truncated piece, 14, retouched blade; 15, utilized blade, 16, pointed blade; 18, endscraper; 19, perforator; 21, microgravette point.

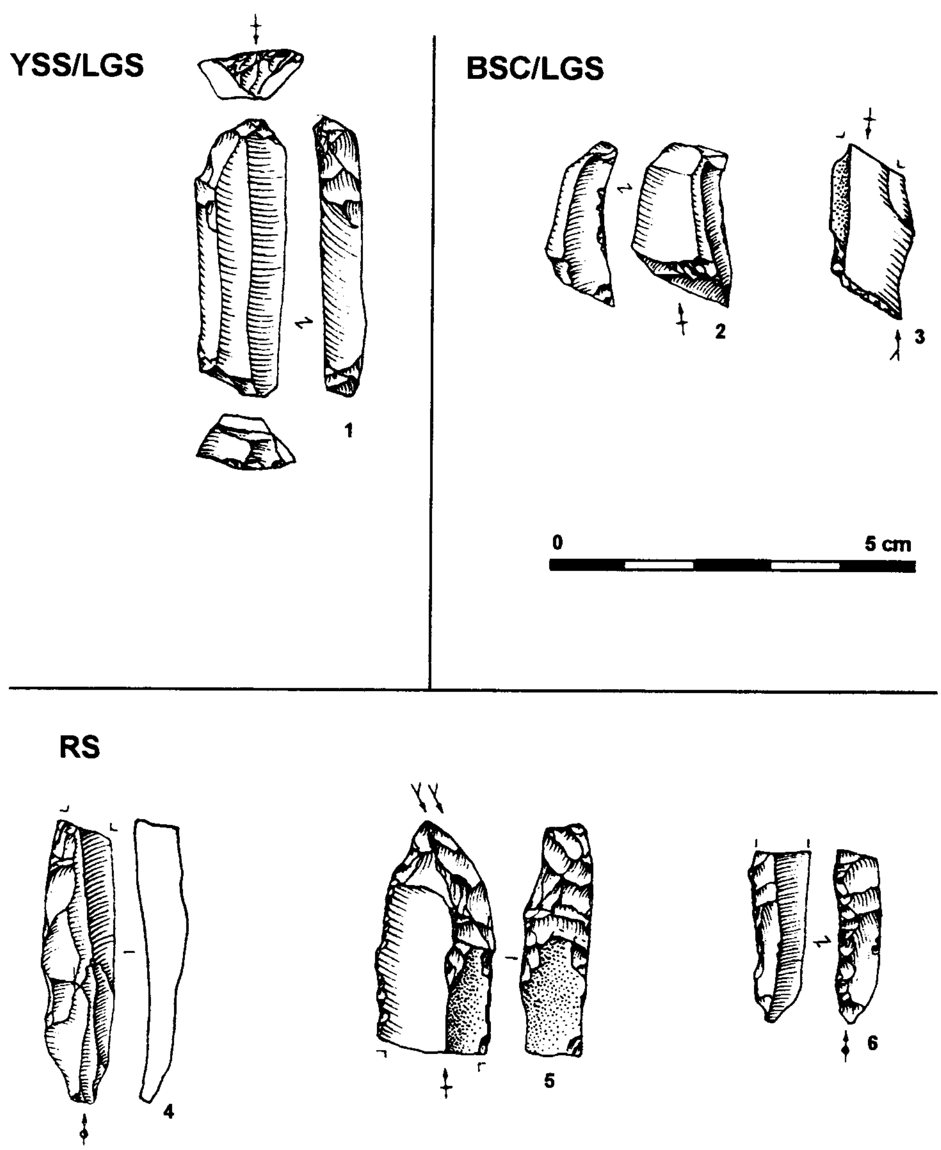

Fig. 13- Bois Laiterie (Magdalenian): 1-2, endscrapers; 3, burin on truncation; 4, blade; 5, bec; 6, backed blade.

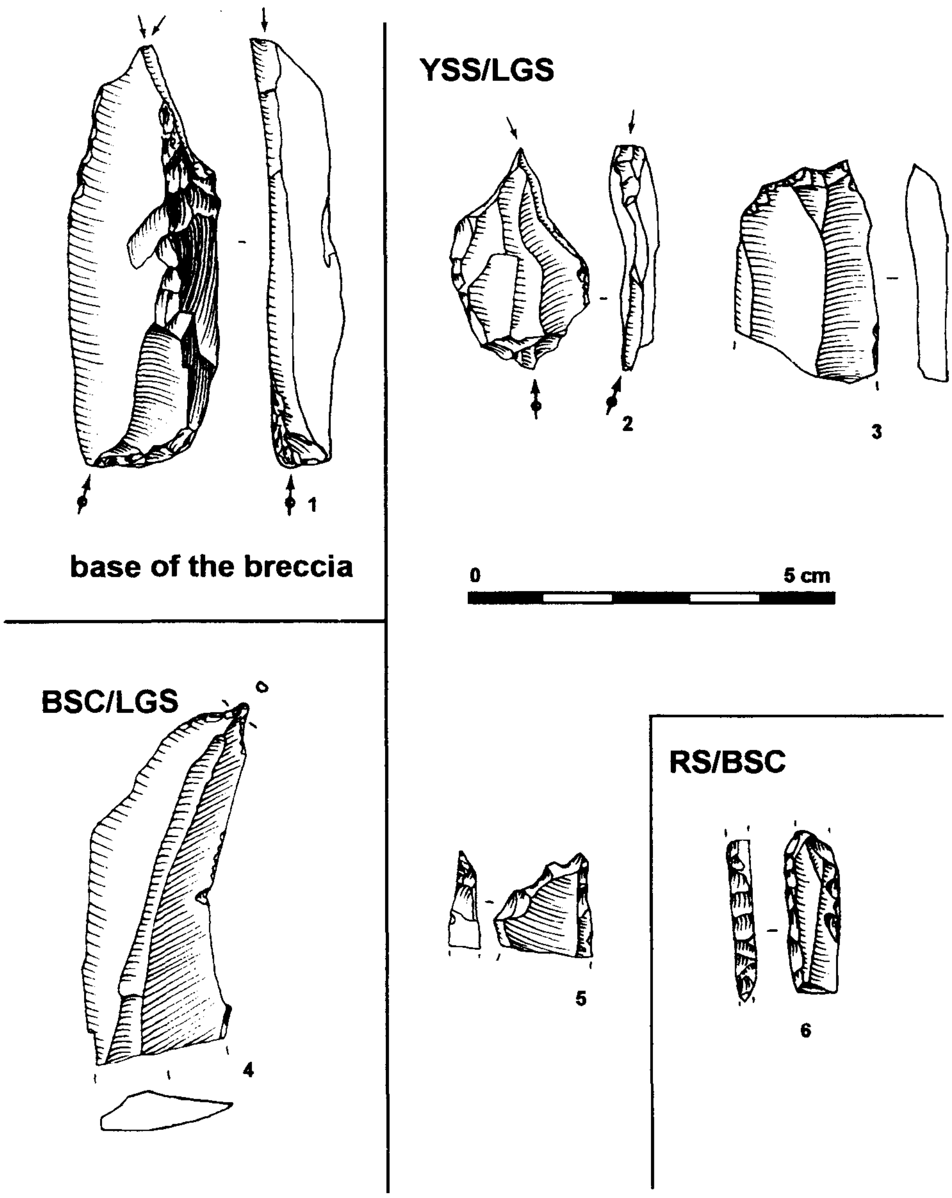

Fig. 14- Bois Laiterie (Magdalenian): 1, endscraper-burin; 2, burin on oblique retouched truncation; 3, perforator; 4, microperforator; 5, denticulated piece; 6, blade with abrupt retouch.

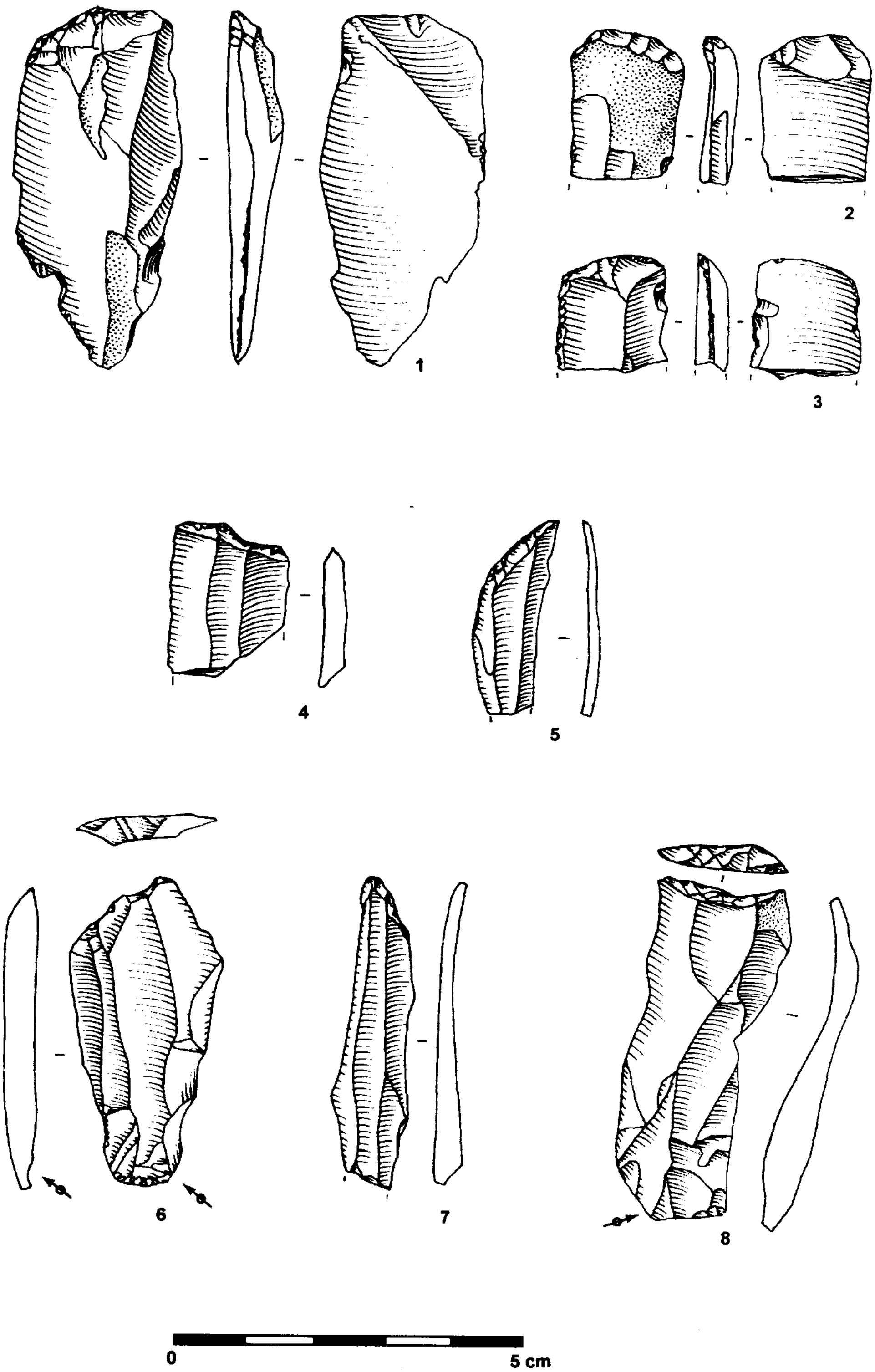

Fig.15- Bois Laiterie (Magdalenian): 1-3, endscrapers; 4-7, pieces with oblique truncations; 8, piece with concave truncation.

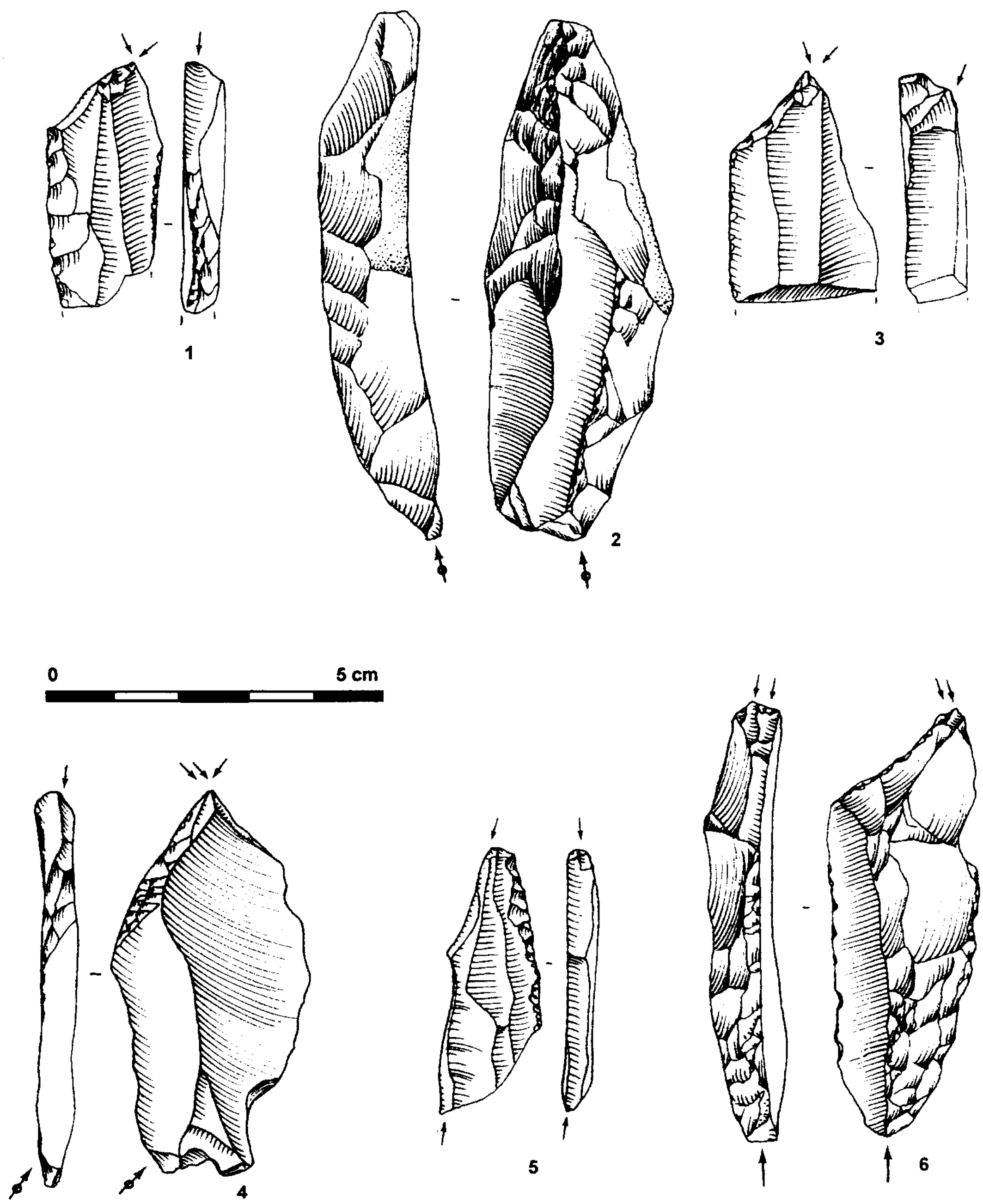

Fig.16- Bois Laiterie (Magdalenian): 1, 4, dihedral burin; 2, multiple dihedral burin; 3, Lacan burin; 5, multiple mixed burin; 6, burin on retouched truncation.

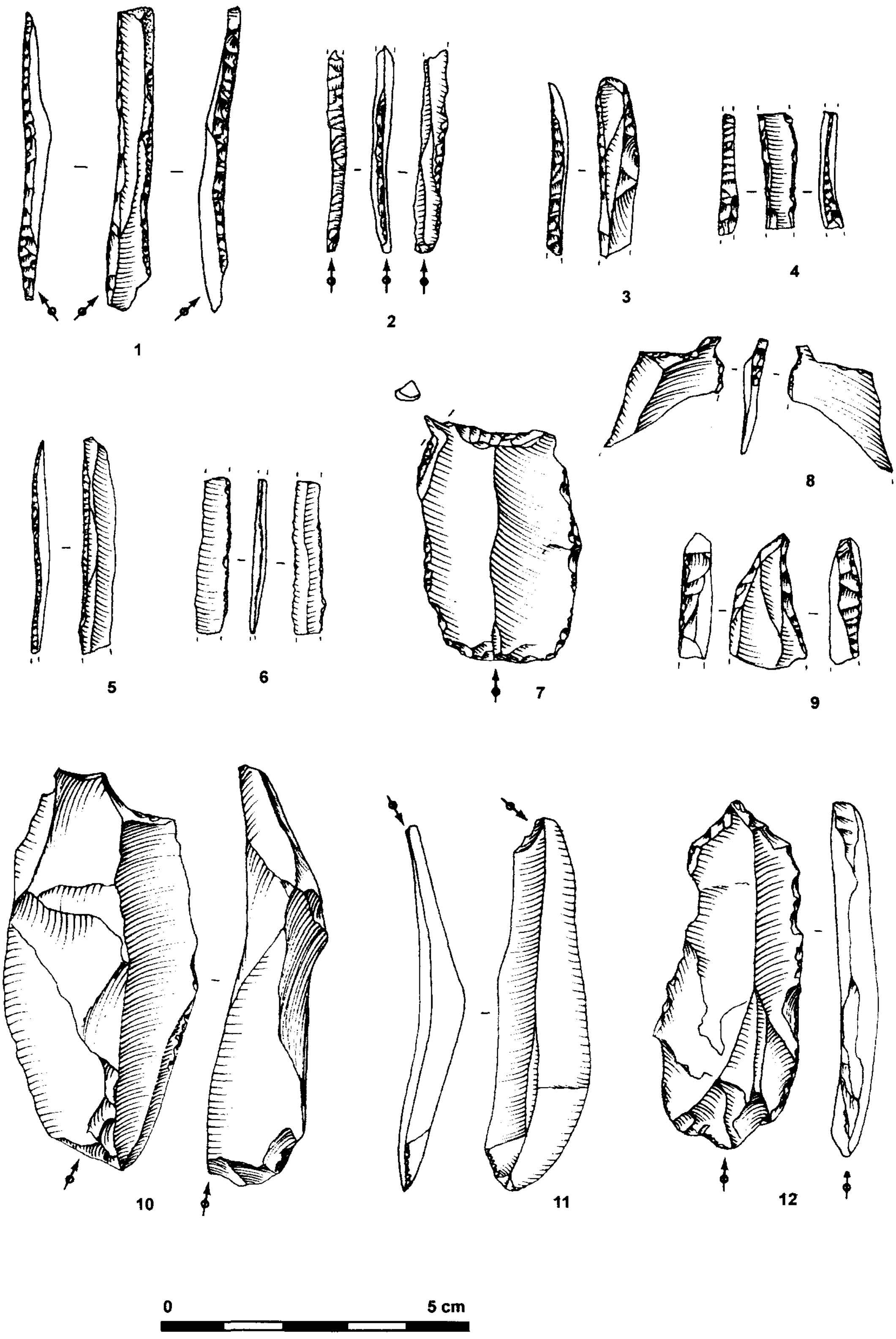

Fig.17- Bois Laiterie (Magdalenian): 1-5, backed bladelets; 6, Dufour bladelet; 10, atypical perforator; 7-9, 11-12, perforators.

Average backed blade(let) dulled edge angle is 76.8 deg. (n=75;SD=7.4;range=55-95°); average endscraper edge angle is 68.2 deg.(n=15; SD=12.6; range=48-95°). Only edges of heavily patinated pieces not selected for microwear analysis were measured. Both distributions are unimodal and normal, with modes at 73° and 63° respectively.

The Bois Laiterie tools are truly leptolithic (light-weight), both highly portable and indicative of intensive economization of the scarce, «expensive» flint resource. Weights of the main tool classes are given as follows:

TABLE 3

CLASS	AV.WEIGHT	N
Backed and retouched bladelets	0.51 gm	56
Backed, truncated and retouched blades	2.62	95
Burins and perforators	4.79	56
Endscrapers	6.17	22
Other tools	2.57	23
All tools(excluding backed and retouched blade[let]s)	4.56	101
All tools	3.93	252

These artifacts (with a few notable exceptions) are extraordinarily small and light, and testify to Bois Laiterie's geographical position far from sources of good flint. The blades of appropriate size that were brought to this cave (either directly or indirectly from the Hainaut or Hesbaye sources) were used to the maximum for the fabrication of classic but «microlithic» Magdalenian tool types. This would be expected of backed bladelets of course, but the «microlithization» is true as well especially of burins, endscrapers, truncated and retouched blades, with the only relative large, heavy tools being a few of the endscrapers that drive up the weight average for that particular (underrepresented) class.

It should be observed that there are no Hamburgian (shouldered), Ahrensburgian (tanged) or Creswellian (angled back) points at Bois Laiterie. There are, however, several micro-perforators and a multiple perforator, reminiscent of several such artifacts from Chaleux and other upper Belgian Meuse Magdalenian sites.

But the notable aspect of this assemblage - and one which makes it quite similar to Chaleux and many other Magdalenian sites in France and Spain - is the high number and percentage of backed bladelets and backed micro-points (56 items, 21.1%). In addition to these probable elements from multi-component weapons, Bois Laiterie has yielded several fragments of antler sagaies (see López-Bayón *et al.*,this volume). Four are large, proximal, single-bevel base fragments (two with diagonally striated bevels) and one is a possible distal (tip) fragment. There are also a grooved bone point (?) fragment and three bone needle fragments (one eyed and another grooved).

Other Items of Material Culture

In addition to the chipped stone lithics, there is one artifact of ground stone that was found at the left rear (southeast) corner of the cave: a small, circular, perforated piece of dark brown sandstone. The hole in the center of this well-smoothed, semi-symmetrical object is bored from one surface only and has a V-shaped profile. While a conventional interpretation of this object could be as a «pendant», alternative «practical» explanations could also be proferred, such as an implement for sharpening antler sagaie tips (analogous to a pencil sharpener) or as a (net or fishing line?) weight, etc. (see M. Lejeune,this volume).

In addition, and as at other Belgian Meuse Basin sites of penecontemporaneous Bölling age (Chaleux, Frontal, Da Somme, Goyet, Verlaine and Coléoptère [Rensink 1993, p.144]), Bois Laiterie has yielded eight non-local fossil shells, probably from the Paris Basin (see Lozouet and Gautier,this volume). Only four of these fossils are perforated, probably deliberately, but all are clearly manuports. Their presence at Bois Laiterie - especially that of a very large, possibly perforated specimen of *Campanile* - might argue for occupations of the site which were not strictly limited to hunting alone. The abandonment of these presumably prized fossils in this small site is frankly enigmatic. While small numbers (of the same order of magnitude as at Bois Laiterie) of non-local fossils were found (by E.Dupont and others) at most of the rest of the above-mentioned sites, Chaleux yielded 54 during Dupont's 19th century excavations (Dupont, 1873, p.158) and 7 more during the 1985-88 excavations (Otte *et al.*, 1994,p.152), clearly suggesting (along with many other indicators) that it was a very different kind of site: multifunctional, longer-term, larger-scale, etc. Chaleux seems to have been the «stockpile» for these imported,exotic items, from which they were «redistributed» out to several of the other Upper Magdalenian of the Belgian uplands. Thus, these fossils (among which *Campanile* is a prominent genus), which link the Belgian Magdalenian «territory» to the Paris Basin (and presumably to the contemporaneous human inhabitants and well-known sites of that region) by means of long-distance visits and/or exchanges across the apparently «empty marchlands» of Champagne, also link the Belgian sites to one another, probably through residential and logistical moves (seasonal and non-seasonal) and through short-distance visits. Curiously, all the Belgian shells come from *cave* sites; none have yet been found in the open-air sites of Middle Belgium or Dutch Limburg. This fact could be seen as support for the argument that the two groups of sites were not directly related or connected socially.

Other manuports at BL consist essentially of psammite slabs and fragments thereof: a total of 788. Altogether, they weigh more than 122 kg. These slabs (on average 14.8 mm thick) are of strictly local origin; small pieces can be picked up today all over the ground surface of the wooded hilltop directly above Bois Laiterie Cave. Directly opposite the confluence on the Burnot stream on the right bank of the Meuse there is an enormous exposure of bedded psammite of Devonian age that currently exfoliates in slabs along the exposed face of the same syncline that forms the Bois Laiterie hill on the left bank of the Meuse. Psammite is a kind of brown-reddish brown micaceous schist that often has manganese oxide stains or specks.

This material is also known to outcrop along the Lesse valley, whence it was procured closeby for paving purposes by the Magdalenian residents of Chaleux and the other sites around Furfooz. Psammite slabs were also engraved especially at Chaleux, but also at nearby Frontal, at Trou Da Somme near the Lesse-Meuse confluence, at Goyet not far from Bois Laiterie, and at Roc-la-Tour 70 km up the Meuse from the Lesse confluence (Lejeune,1987,1993; Rozoy,1990). (Schist or slate slabs were also engraved at Chaleux and at Roc-la-Tour, at which site Rozoy [1990] counted about 6,000 slab fragments of greater than 2 cm in size - clearly principally used for paving, but of which around 10% had engravings. This is a situation reminiscent of the pene-contemporaneous middle German Rhineland sites of Gönnersdorf and Andernach[Bosinski,1982]).

The distribution and limited paving function of the Bois Laiterie psammite slabs are discussed elsewhere (Miller and López Bayón; Straus and Martinez, this volume), as are the ochre stains and few possibly non-representational, utilitarian «engraved lines» or cutting marks (Lejeune, this volume).

In addition to the psammite slabs, the Bois Laiterie Magdalenian horizon yielded 33 unmodified cobbles and pebbles (which could have washed/rolled in from the hilltop above the site via the upper cave mouth) and one chunk of limestone with possible evidence of burning (plus a few other much less probable pieces of fire-cracked rock). There is simply little evidence for much preparation of the site by the bringing of non-organic materials into the site for construction purposes or by the digging of pits for hearths, storage, posts, etc. The plaquettes represent the paving of a relatively minor area even of this small cave, with no unequivocal evidence of their (secondary) use as media for artistic expression as in the other sites of the upper Meuse valley.

Conclusions

Altogether, the Bois Laiterie Magdalenian artifacts include 3 lithic points, 91 backed bladelets/small backed blades, 3 retouched/denticulated bladelets and 5-6 osseous points. Assuming, quite arbitrarily for the sake of argument, that a composite weapon tip might have 4-6 stone edge or barb segments and that all the recovered backed blade(let)s and retouched bladelets were indeed used as weapon elements, the 94 items could have come from 15-23 composite weapons. Added to the Azilian and Microgravette points and the sagaies, this could mean a complement of some 23-32 abandoned (or retooled) weapons at Bois Laiterie. While it cannot be said that «domestic» (manufacturing / maintenance / processing) activities were absent from Bois Laiterie (witness the abundance of burins and the presence of perforators, truncated and retouched blades, endscrapers, needles and «ornaments», as well as the evidence for limited slab paving of the site surface), the definite emphasis would seem to have been on hunting and on preparation of hunting weapons on imported lithic materials, as well as on antler. A fairly limited hunting focus for Bois Laiterie Cave would be altogether in keeping with the site's strategic location versus its small size and uncomfortable nature. This is simply not a cave that could accomodate large-scale or long-term human occupations, but it would be ideal for the interception of game moving between the Meuse valley and the Meuse-Sambre interfluve plateau via the narrow,deep, steep-sided Burnot tributary gorge. Everything in the lithic raw materials, in the composition of the lithic debris, in the characteristics of the lithic retouched tool assemblage and in the osseous artifact assemblage points in the direction of a fairly specialized site, principally focused on hunting and short-term activities closely related to hunting.

The stratigraphy, radiocarbon dates and refits suggest a relatively short occupation or closely spaced series of redundant occupations of Bois Laiterie Cave by small parties - presumably hunting parties. Nonetheless, humans used the cave long and/or often enough to make the minimal investment in infrastructure (a modicum of comfort on a plastic, presumably humid, clayey-silty substratum), namely the paving of a small area of the cave (especially along its eastern, downslope edge) with psammite slabs that were obtainable in the immediate surroundings of the site. No hint of pits or dug-out hearths was found, although there are clear «latent» traces of burning areas at the f ront of the cave and on the narrow terrace just outside the cave mouth.

In sum, the artifact assemblages, in conjunction with a variety of other classes of data and logical observations, all lead to the conclusion that Bois Laiterie served as a fairly specialized, limited-function, short-term site (perhaps a logistical «location» or «field camp» *in sensu* L.R. Binford [1983]). Its probable relationship to a major residential site or base camp such as Chaleux is not merely hypothetical because of the presence of the fossil shells. Here not only the mute stones, but also the silent shells truly speak to us across 13 millennia. If only we can learn to decode their speech correctly...

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TABLE 4

Frequencies and Percentages of Magdalenian Lithic Debris Types
from Bois Laiterie Cave,Belgium (1990, 1994-95)*

Strata Debris type	Breccia Base, LBS, UGS	YSS, grey lens	BSC, RC
1: non-cortical trimming flake	38	1049	437
2: non-cortical shatter	2	204	52
3: plain flake	7	346	62
4: primary decortication flake	1	8	
5: secondary decortication flake	4	55	10
6: plain/whole/ proximal blade	2	138	22
7: primary whole/ proximal bladelet		6	1
8: secondary whole/ proximal decortication blade	1	28	5
9: plain whole/ proximal bladelet	7	139	16
10: burin spall	1	32	4
11: unidirectional crested blade		9	
12: bidirectional crested blade		1	1
13: flake core			
14: prismatic blade core		1	
15: pyramidal blade core			
16: prismatic bladelet core		1	
17: pyramidal bladelet core			
18: mixed core		1	
19: non-cortical chunk	1	13	1
20: platform renewal flake		10	3
21: pièce esquillée			
22: cortical trimming flake		25	3
23: cortical shatter		6	1
24: broken plain blade	4	181	20
25: broken plain bladelet	2	76	17
26: cortical chunk		6	2
27: medial/ distal cortical blade		23	6
28: media/ distal cortical bladelet		4	
29: whole/ proximal cortical bladelet		3	
Total:	70	2365	663

*Table does not include 16 lithic debris from backdirt and one (1) from Stratum GBS.

TABLE 5
Frequencies of Upper Paleolithic Tool Types (de Sonneville-Bordes and Perrot Typology) from Bois Laiterie Cave, Belgium (1990, 1994-95)*

Strata / Tool types	Breccia Base, LBS, UGS	YSS, grey lens	BSC, RS
1: simple endscraper		10	
2: atypical endscraper			1
5: endscraper on retouched flake/ blade		10	
14: shouldered endscraper		1	
17: endscraper - burin		1	
20: perforator - truncated piece		1	
23: perforator		6	2
24: bec		5	1
25: multiple perforator/ bec		1	
26: miroperforator		6	
27: straight dihedral burin		3	
29: angle dihedral burin		2	
30: angle on break burin		8	
31: multiple dihedral burin		4	
32: busked burin		1	
35: burin on oblique retouched truncation		10	
36: burin on concave retouched truncation		3	
37: burin on convex retouched truncation		1	
41: multiple mixed burin		1	
44: flat-face burin		2	
51: microgravette			1
58: completely backed blade	1	25	7
59: partially backed blade		3	2
60: straight truncated pieces	1	1	
61: oblique truncated piece		14	1
62: concave truncated piece		3	
63: convex truncated piece		2	
64: bitruncated piece		2	
65: piece with continuous retouch / 1 side	1	27	3
66: piece with continuous retouch / 2 sides		9	1
74: notch		13	2
75: denticulate		3	
76: splintered piece		2	
78: raclette		1	
85: backed bladelet	1	59	11
86: truncated backed bladelet		1	
88: denticulated bladelet			1
90: retouched (Dufour) bladelet)		1	1
91: Azilian point		1	1
92: other		1	
Total:	4	224	36

* Tool blanks (N=254) with multiple typological classifications are counted more than once. Table does not include two (2) classified tools (2 pieces with continuous retouch / 1 side) from backdirt.

TABLE 6. SOUTH BELGIUM LITHIC RAW MATERIAL LIST

Prepared by: J-M.Leotard, A.Martinez, R.Miller, L.G.Straus and E.Teheux.
(Used for le Trou Magrite, Huccorgne, Bois Laiterie and Abri du Pape, 1991-95)

ID	Description
9	Very fine grain, highly homogeneous, flint, white to gray with tiny black flecks, smooth uniform surface, opaque, crystalline inclusions, conchoidal fracture, pattern shiny. Source Tertiary deposits near Doisch Agimont (South Belgium) or Charleville (North France).
10.	Fine-grain flint: fine grain; shiny, smooth surface; opaque to slightly translucent; light brown or blue-gray original color; patinates white; chalk cortex; some white, ovoid inclusions ; conchoidal fracture pattern. Source: Cretaceous of Hesbaye and/or Spiennes. Intergrades with 11 and 12.
11	Fine-grain flint: fine grain; shiny, smooth surface; opaque to slightly translucent; brown-yellow color; patinates white; chalk cortex; occasional inclusions; conchoidal fracture pattern. Source Cretaceous of North Belgium. Intergrades with 10 and 12.
12	Medium-grain flint: medium grain; matte, slightly rough surface; opaque; occasional inclusions; gray color, patinates white; water-worn cortex; conchoidal fracture pattern. Source: Cretaceous, occurs in river beds. Intergrades with 10 and 11.
13	Fine-grain flint: fine grain; shiny, smooth surface; opaque; dark brown color with occasional yellow bands; does not patinate; water worn cortex; inclusions rare; conchoidal fracture pattern. Source: Tertiary of North Belgium.
14	"Pseudo" flint: fine grain; shiny, orthogonal surface; translucent to slightly opaque; light brown to dark gray, mottled; does not patinate; water worn cortex; inclusions rare conchoidal fracture pattern. Age and source unknown.
15	Black flint: like 12, except very matte; with some rare inclusions. Source: in local limestone.
16	Black flint: very fine grain; opaque; homogeneous; no inclusions; conchoidal fracture; orangeish chalk cortex, smooth and shiny. Source: possibly Obourg or, at Huccorgne, a local (Hesbaye) Cenomanian flint (like "Brandon" flint).
17	Light gray flint: fine grain; good quality; opaque; matte; grayish-white inclusions; chalk cortex, not water-worn; generally homogeneous; conchoidal fracture; (Cretaceous?). Source unknown.
18	Patinated "Hesbaye" yellow, medium-grain.
19	Other flint.
20	Chert - general, non-cortical: fine to medium grain; matte or shiny, smooth surface; opaque to slightly translucent; wide color range; does not patinate; cortex absent; inclusions rare; mainly orthogonal fracture pattern. Cretaceous. Source unknown.
20	Chert with unworn cortex: Same as above, but with unworn cortex. Occurs in Cretaceous geological beds.
20	Chert with water-worn cortex: Same as above, but with water-worn cortex. Cretaceous. Found in river beds.
30	Phtanite: medium-grain; matter or shiny surface; opaque; jet black to grayish black; does not patinate; gray cortex with occasional metal adhesions; no inclusions; conchoidal fracture pattern. Cretaceous. Occurs in geological bed at Ottignies, Central Belgium.
40	Medium-grain limestone; medium grain; soft, matte surface; opaque; gray-black; patinates gray; cortex impossible to distinguish; inclusions rare; conchoidal fracture pattern; violent reaction with acid.

TABLE 6, continued

41	Fine-grain limestone: fine grain; hard, matte surface; opaque; black with white-yellow flecks; light tray patina; cortex impossible to distinguish; inclusions rare; conchoidal fracture pattern; mild reaction with acid. Silicified limestone. Cretaceous. Intergrades with 15.
42	Crystallized limestone: fine to medium grain; hard, matter surface; opaque; gray-white mottled; does not patinate; cortex impossible to distinguish; occasional inclusions; mainly conchoidal fracture pattern; mild reaction with acid ("limy chert"). Cretaceous.
50	Medium-grain quartzite (includes quartzitic sandstone): medium grain; matte to shiny surface; opaque; wide color range; does not patinate; cortex water worn; no inclusions; conchoidal fracture pattern. Occurs as cobbles in river beds.
51	Fine-grain quartzite/siltstone: fine grain; matte surface; opaque; tan-brown color with occasional bands; does not patinate; cortex water worn; manganese inclusions; conchoidal fracture pattern. Possible source: Paris Basin; occurs as river cobbles.
52	Quartz crystal: fine to medium grain; shiny surface; translucent to opaque ("Mild quartz") milky-white to yellow; does not patinate; cortex unworn; no inclusions; orthoconchoidal to planar fracture pattern. Occurs in geological beds (incl. in the local limestone).
53	Sandstone.
54	Brussels sandstone.
55	Psammite: light brown with manganese oxide stains; medium-course grain (looks like quartzite); opaque; occurs in Meuse valley at Rivière and Lesse river valley at Gendron railroad. station in form of tabular plaquettes. Sandstone with quartz grains and mica inclusions.
56	Calcite.
57	Light olive green-gray micaceous schist; psammite-like (w/o manganese oxide specks) Badly eroded surfaces. Exfoliates in sheets along bedding planes with raised lumps; lamellar structure.
58	Red-brown (iron color) micaceous schist; dense, uniform, tabular, uneroded surface. Like 57, but denser, heavier and less eroded. (58 and 57 may be variants of 55).
90	Ochre/hematite.
99	Other stones.

TABLE 7

Bois Laiterie Magdalenian Lithic Raw Materials (Artifacts)*

Raw material type	DEBRIS				TOOLS			
	N	%	weight	%	N	%	weight	%
3	1	0.03	1	0.05				
7					1	0.39	3	0.41
9	99	3.18	123	5.66	21	8.27	84	11.40
10	2476	79.44	1388	63.85	181	71.26	495	67.16
11	11	0.35	20	0.92	1	0.39	3	0.41
12	426	13.67	523	24.06	36	14.17	126	17.10
13	2	0.06	2	0.09				
14	1	0.03	1	0.05				
15	4	0.13	6	0.28				
17	13	0.42	25	1.15	3	1.18	3	0.41
18	4	0.13	4	0.18				
19	61	1.96	40	1.84	7	2.76	12	1.63
20	5	0.16	4	0.18	2	0.79	2	0.27
25	1	0.03	11	0.51				
41	1	0.03	3	0.14				
42	1	0.03	0.1	0.00				
50	2	0.06	10	0.46	2	0.79	9	1.22
55	1	0.03	9	0.41				
56	1	0.03	1	0.05				
90	3	0.10	2	0.09				
99	4	.013	1	0.05				
Total	3117	100	2174	100	254	100	737	100

* Tools with multiple typological classifications are only counted as one (1) blank.

TABLE 8

Magdalenian Lithic Debris
from Bois Laiterie Cave, Belgium (1990, 1994-95):

All Strata Combined

Debris type	N	%	Cum %
1: non-cortical trimming flake	1527	48.99	48.99
22: cortical trimming flake	28	0.90	49.89
2: non-cortical shatter	258	8.28	58.16
23: cortical shatter	7	0.22	58.39
3: plain flake	415	13.31	71.70
4: primary decortication flake	9	0.29	71.99
5: secondary decortication flake	71	2.28	74.27
6: plain/ whole proximal blade	166	5.33	79.60
24: broken plain blade	209	6.71	86.30
7: primary/ whole proximal decortication blade	7	0.22	86.53
8: secondary/ whole proximal decortication blade	35	1.12	87.65
27: medial / distal cortical blade	30	0.96	88.61
9: plain / whole proximal bladelet	164	5.26	93.87
25: broken plain bladelet	95	3.05	96.92
28: medial / distal cortical bladelet	4	0.13	97.05
29: whole / proximal cortical bladelet	3	0.10	97.14
10: burin spall	37	1.19	98.33
11: unidirectional crested blade	9	0.29	98.62
12: bidirectional crested blade	3	0.10	98.72
20: platform renewal flake	13	0.42	99.13
13: flake core	-	-	99.13
14: prismatic blade core	1	0.03	99.17
15: pyramidal blade core	-	-	99.17
16: prismatic blade core	1	0.03	99.20
17: pyramidal bladelet core	-	-	99.20
18: mixed core	2	0.06	99.26
19: non-cortical chunk	15	0.48	99.74
26: cortical chunk	8	0.26	100
21: pièce equillée	-	-	100
Total	3117	100	100

TABLE 9

Frequencies and Percentages of Upper Palaeolithic Tool Types (De Soneville-Bordes and Perrot Typology) from Combined Magdalenian Strata at Bois Laiterie Cave, Belgium (1990, 1994-95)*

Tool type	N	%	Cum %
1: simple endscraper	10	3.76	3.76
2: atypical enscraper	1	0.38	4.14
5: endscraper on retouched flake / blade	10	3.76	7.89
14: shouldered endscraper	1	0.38	8.27
17: endscraper - burin	1	0.38	8.65
20: perforator - truncated piece	1	0.38	9.02
23: perforator	8	3.01	12.03
24: bec	6	2.26	14.29
25:multiple perforator / bec	1	0.38	14.66
26: microperforator	6	2.26	16.92
27: straight duhedral burin	3	1.13	18.05
29: angle dihedral burin	2	0.75	18.80
30: angle on break burin	8	3.01	21.80
31: multiple dihedral burin	4	1.50	23.31
32: busked burin	1	0.38	23.68
35: burin on oblique retouched truncation	10	3.76	27.44
36: burin on concave retouched truncation	3	1.13	28.57
37: burin on convex retouched truncation	1	0.38	28.95
41: multiple mixed burin	1	0.38	29.32
44: flat-face burin	2	0.75	30.08
51: microgravette	1	0.38	30.45
58: completely backed blade	33	12.41	42.86
59: partially backed blade	5	1.88	44.74
60: straight truncated piece	2	0.75	45.49
61: oblique truncated piece	15	5.64	51.13
62: concave truncated piece	3	1.13	52.26
63: convex truncated piece	2	0.75	53.01
64: bitruncated piece	2	0.75	53.76
65: piece with continuous retouch / 1 side	33	12.41	66.17
66: piece with continuous retouch / 2 sides	10	3.76	69.92
74: notch	15	5.64	75.56
75: denticulate	3	1.13	76.69
76: splintered piece	2	0.75	77.44
78: raclette	1	0.38	77.82
85: backed bladelet	52	19.55	97.37
86: truncated backed bladelet	1	0.38	97.74
88: denticulated bladelet	1	0.38	98.12
90: retouched (Dufour) bladelet	2	0.75	98.87
91: Azilian point	2	0.75	99.62
92: others	1	0.38	100
Total	266	100	100

* Tool blanks (N=254) with multiple typological classifications are counted more than once.

Photo 1 - "Azilian" (curved back) point.

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

13

L'INDUSTRIE OSSEUSE DU MAGDALENIEN DU BOIS LAITERIE

I. López Bayón, L.G. Straus, J-M. Léotard, Ph. Lacroix et E. Teheux.

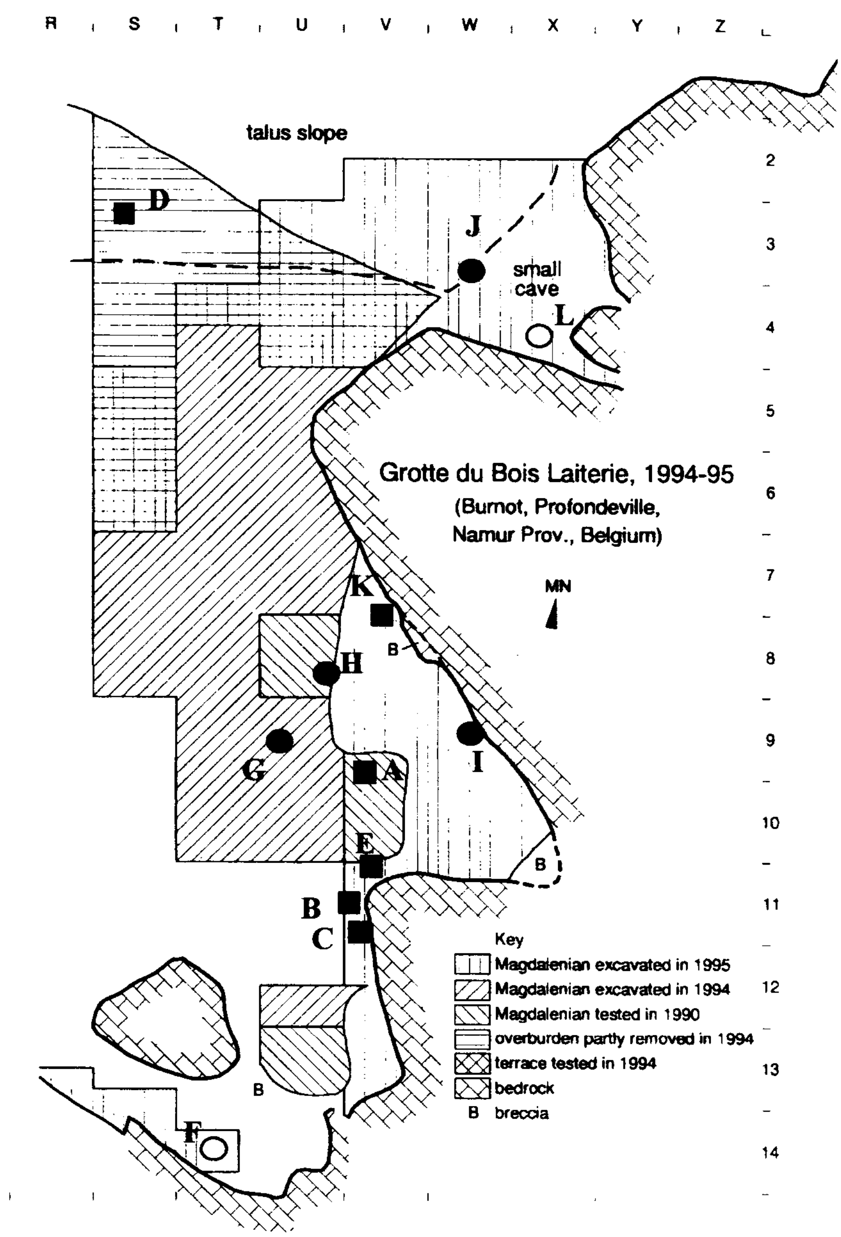
Description

Une petite collection de pièces travaillées en os et en bois de cervidé fut mise au jour lors du sondage de 1990 et les campagnes des fouilles de 1994 et 1995 dans la grotte du Bois Laiterie. Toutes les pièces proviennent du niveau magdalénien, à l'exception d'un fragment proximal de sagaie en bois de renne (pièce D) qui fut retrouvé dans les déblais.

Les pièces A et B (photos 1 et 2) sont des fragments de sagaies réalisées sur bois de renne par la technique du rainurage ("split and groove"). Sur la photo 8, illustrant à la pièce A, on constate la présence d'une profonde rainure qui témoigne de l'extraction d'une baguette pour donner accès au tissu spongieux, réduisant ainsi le travail de façonnage. Celui-ci fut travaillé surtout par grattage à l'aide d'outils en silex. La photo 9 montre les traces de ce grattage caractérisé par la présence de stries et de faibles sillons toujours parallèles à l'axe longitudinal de la pièce, ainsi que par l'existence de facettes et d'ondulations de raclage perpendiculaires aux stries (les fameux "chattermarks" ou "corrugations" en terminologie française). Ces ondulations sont dues à la difficulté de maintenir l'outil en contact avec la surface au cours du raclage. Le but primordial de ce façonnage est de donner un aspect approximativement cylindrique à la section. Ces deux pièces sont proximales à biseau simple et leur partie mésiale a subi un sciage et une fracture volontaires (photos 1 et 2).

La partie corticale (externe) du biseau présente, sur les deux pièces, une série d'incisions courbes et parallèles à l'axe longitudinal, vraisemblablement associées à la technique d'emmanchement (photos 10 et 11). Les deux sagaies ont subi *a posteriori* une fracture au niveau du début du biseau.

La première sagaie (pièce A, photo 1) fut retrouvée en 1990 dans le sondage 5 (carrés V 9-10, couche YSS); elle montre d'importantes traces de morsures dues à l'action de carnivores, surtout sur sa partie mésiale mais aussi au niveau du biseau où les entailles sont moins nombreuses et plus abruptes. L'approche archéozoologique semble désigner le renard comme auteur plausible de ce mâchonnage. En outre, cette pièce montre une différence de coloration au niveau de la fracture entre la partie mésiale de couleur blanchâtre et le biseau plutôt grisâtre. Cette particularité semble être due à la présence sur le biseau d'une sorte de résine ou de mastic destinée à faciliter l'emmanchement. Le mâchonnage étant présent sur les deux fragments, la proximité à laquelle les deux restes furent récoltés, ainsi que l'homogénéité



■ sagaies et fragments de bois de renne

○ os long

● os d'oiseaux et fragments d'aiguilles

Fig. 1 - Bois Laiterie, localisation des pièces (López Bayón et Straus)

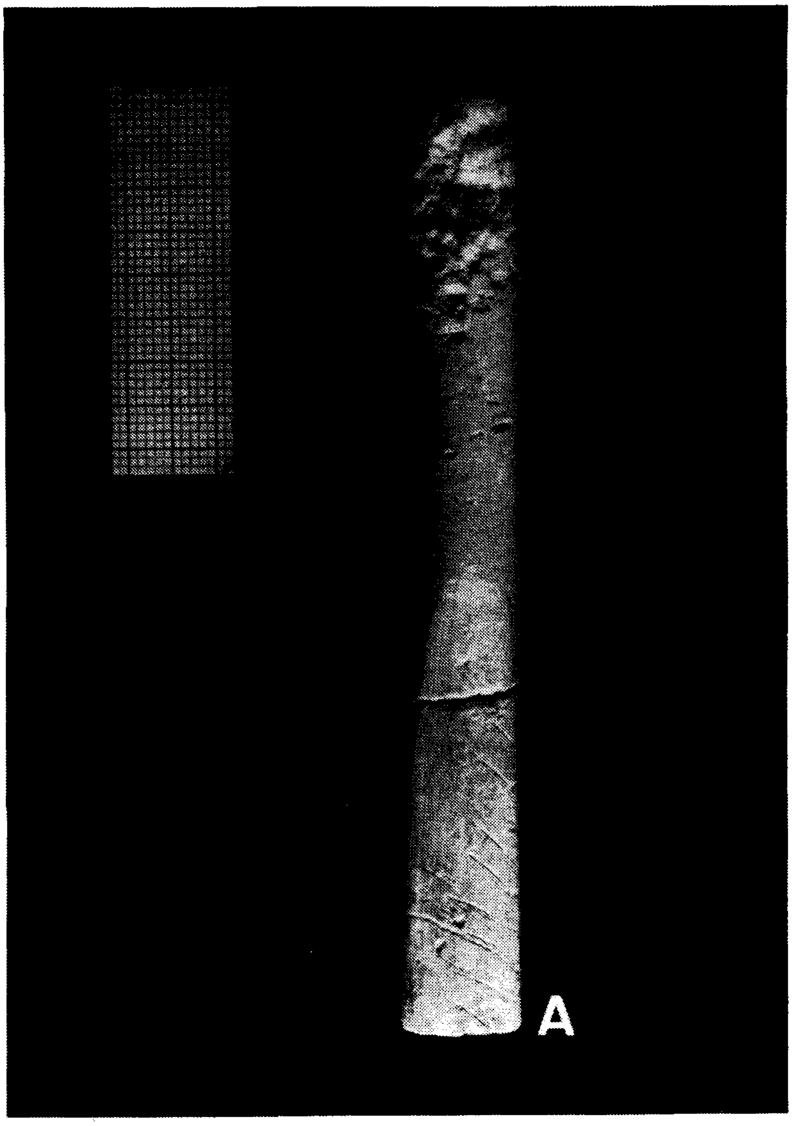


Photo 1 - Pièce A, fragment de sagaie en bois de renne.

sédimentologique de cette phase semblent exclure un séjour en deux milieux taphonomiques différents.

La deuxième sagaie (pièce B, photo 2) fut aussi retrouvée en 1990 dans le sondage 3 (carrés V 11-12, couche YSS); elle présente une coloration rougeâtre et des taches d'oxyde de fer d'origine taphonomique localisées tant dans la partie sciée qu'au biseau. D'autre part, au niveau de la fracture, on constate une certaine rugosité sans doute liée à l'écrasement pendant des opérations de redressement. Il n'est donc pas exclu que la fracture soit due à une faille techno-mécanique lors de cette opération.

La pièce C (photo 3), aussi en bois de renne, provient du sondage 3 réalisé en 1990 (horizon YSS); elle est débitée par la technique de sciage-fracturation; le façonnage est réalisé par grattage. Au niveau du sciage (photo 12), la pièce présente des traces d'écrasement liées au redressement, lesquelles se développent jusqu'au biseau. Ces traces se superposent à celles du grattage, mais sont sous-jacentes à celles du biseautage. La matrice devait être beaucoup plus longue au départ; elle aurait subi un grattage primaire suivi d'un redressement, cause d'une première fracture. On aurait ensuite procédé à un sciage, suivi d'un biseautage précaire - le biseau de section biconvexe n'aurait donc pas été fini. A ce moment, on aurait voulu réaliser un nouveau redressement qui a produit une deuxième fracturation (photo 13) et, par conséquent, l'abandon de la pièce. La coloration blanchâtre, le grattage peu marqué, le biseau biconvexe et l'absence d'incisions d'emmanchement habituelles confirment l'abandon de la pièce pendant le processus de façonnage.

Tab.1 Données métriques et indices des sagaies

	PIECE A	PIECE B	PIECE C
longueur	104.1	108.2	115.3
largeur	12.7	12.9	12.8
épaisseur	10.1	10.0	10.8
indice de massivité	128.27	129.0	138.24
indice d'aplatissement	1.25	1.29	1.18
angle de biseau	11.3°	10.75°	15.6°
poids en g	12.1	12.2	14.2

La pièce D (photo 4d) trouvée en 1994 dans les anciens déblais fut également réalisée en bois de renne. Elle porte un sciage et une fracture volontaires, comme les précédentes. Le débitage est réalisé par rainurage et le façonnage par raclage. Le biseau n'étant pas bien défini, il pourait s'agir d'une pièce abandonnée au cours du façonnage, comme pour la pièce C.

La pièce E (photo 4e) trouvée en 1994 dans la couche YSS est aussi en bois de renne; pour le débitage, la pièce semble avoir subi un rainurage, le façonnage étant réalisé par grattage. Dans ce cas-ci, il s'agit d'une partie distale de sagaie, quelques traces sur la pointe suggèrent des impacts ou des chocs violents. Il n'est pas exclu que la pièce ait été fracturée (à cause de ces impacts) probablement au cours de la chasse.

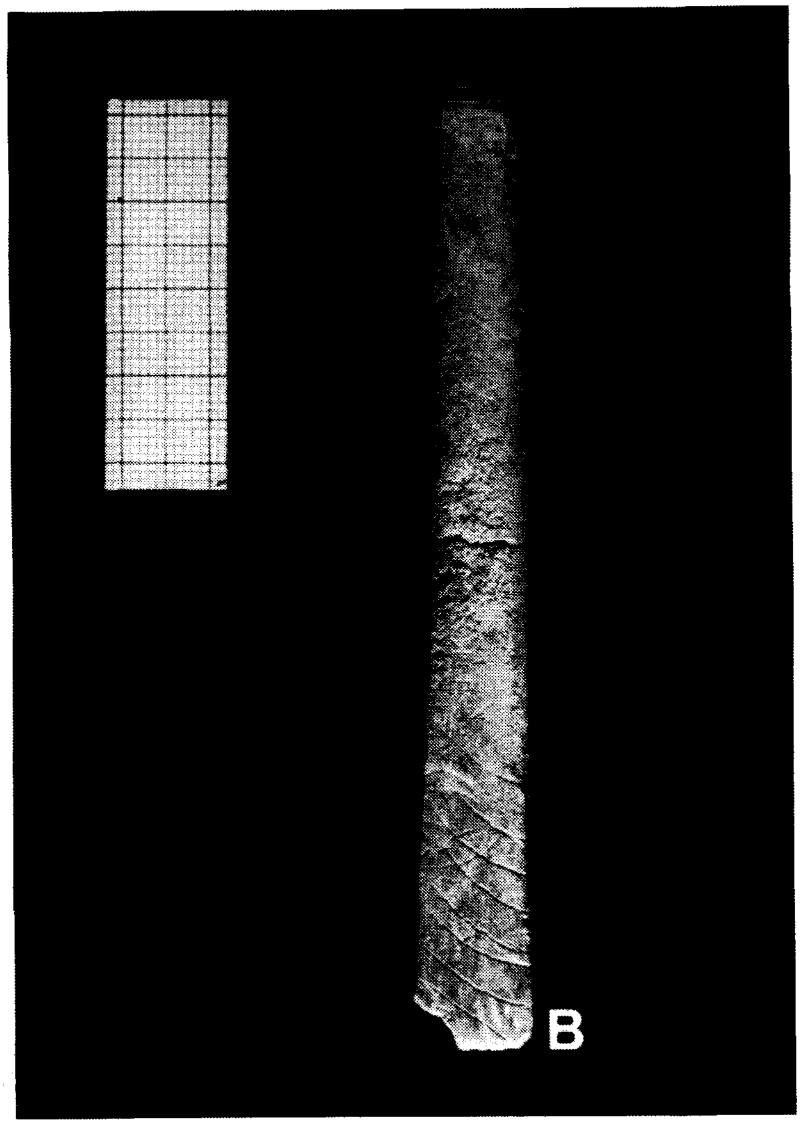


Photo 2 - Pièce B, fragment de sagaie en bois de renne.

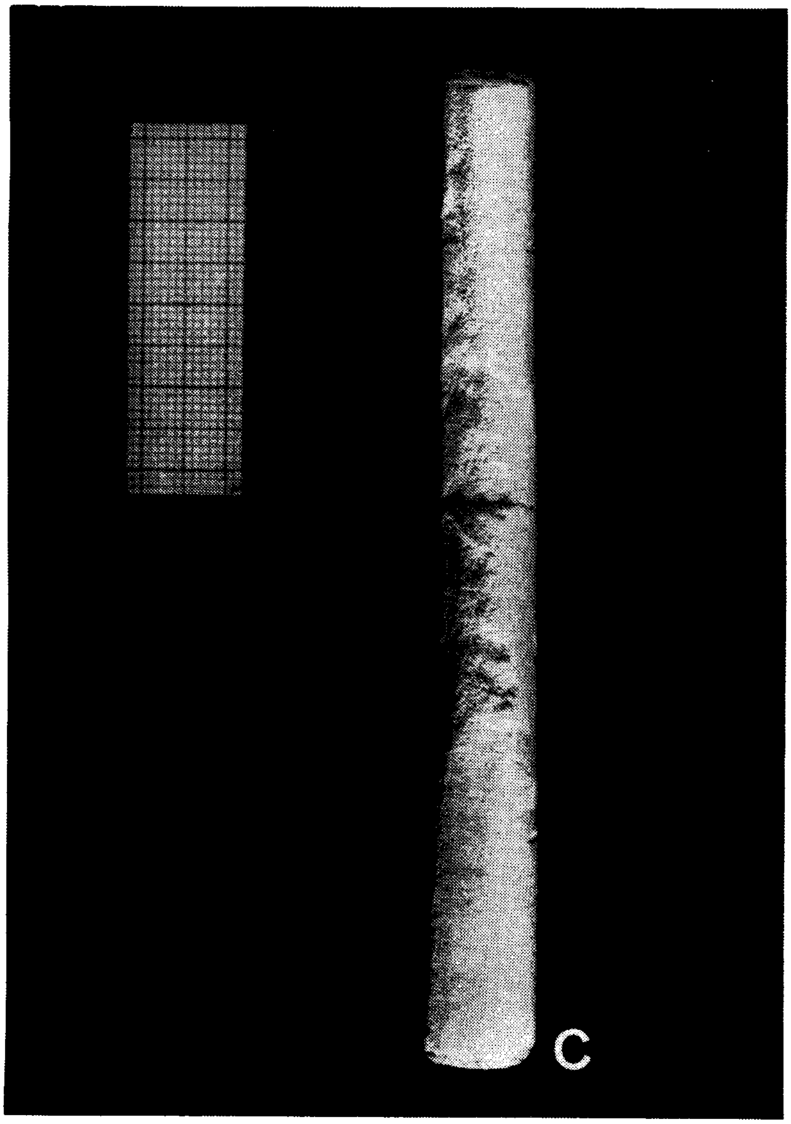


Photo 3 - Pièce C, fragment de sagaie en bois de renne.

On constate une adaptation des solutions techniques employées en fonction des activités aux sites; parmi les 67 pièces (fragments proximaux et sagaies complètes) mises au jour jusqu'à présent en Belgique, seules 4 possèdent des traces de sciage transversal. Toutes les 4 ont été découvertes au Bois Laiterie ! Le tableau suivant exprime schématiquement la morphologie des sagaies (complètes ou proximales) des principaux sites magdaléniens de Belgique.

Tab.2 Sagaies (fragments proximaux et pièces complètes des sites magdaléniens belges)

Sites / Types	Goyet	Verlaine	Coléoptère	Nutons	Frontal	Chaleux	Bois Laiterie
Entières à biseau simple	7	0	0	1	0	3	0
Entières à biseau double	3	0	0	0	3	7	0
Entières à biseau en gradins	1	0	0	0	0	2	0
Bases à biseau simple	5	0	0	1	0	11	4
Bases à biseau double	5	3	1	1	3	5	0
Bases à biseau en gradins	1	0	0	0	0	0	0
TOTAL	**22**	**3**	**1**	**3**	**6**	**28**	**4**

La particularité primordiale des sagaies du Bois Laiterie reste la présence de sciage transversal. La variabilité que l'on observe dans la finition des trois pièces principales (les pièces A et B ayant été emmanchées et la pièce C ayant été abandonnée lors de sa fabrication) n'empêche pas la présence de traces de sciage transversal; donc, une réponse technique similaire a été donnée pour certaines pièces au cours de leur façonnage, ainsi que pour d'autres pièces au cours de leur ré-aménagement. Nous signalons la présence d'une même réponse technique, mais celle-ci correpond à des mécanismes bien différents.

1) Après une action primaire de redressement réalisée sur un long andouiller, nous obtenons une matrice primaire; celle-ci permet le façonnage d'une ou plusieurs pièces en fonction de sa longueur. Si la pièce est assez longue et permet la fabrication de deux outils, on doit obtenir à partir de cette matrice primaire deux matrices secondaires. Le détachement par percussion, directe ou indirecte, a des resultats toujours plus aléatoires que si l'on réalise un sciage transversal suivi d'une fracturation par flexion. Deux notions économiques se dégagent de cette technique: (a) économie de matière première (maîtrise de la fracture), et (b) économie de l'effort (le travail de redressement sur la matrice d'origine n'étant pas perdu). Les deux «sous-matrices» subiront plusieurs processus préalables à l'affûtage: extraction de languettes (pièce K), biseautage, redressement, etc. La pièce C aurait été fracturée lors du deuxième redressage et donc abandonnée. La pièce D pourrait être le résultat d'un échec lors du biseautage.

2) Le deuxième mécanisme, plus complexe, est en rapport avec les pièces A et B; il serait lié aux stratégies de chasse et aux déplacements de chasseurs chargés d'approvisionner le

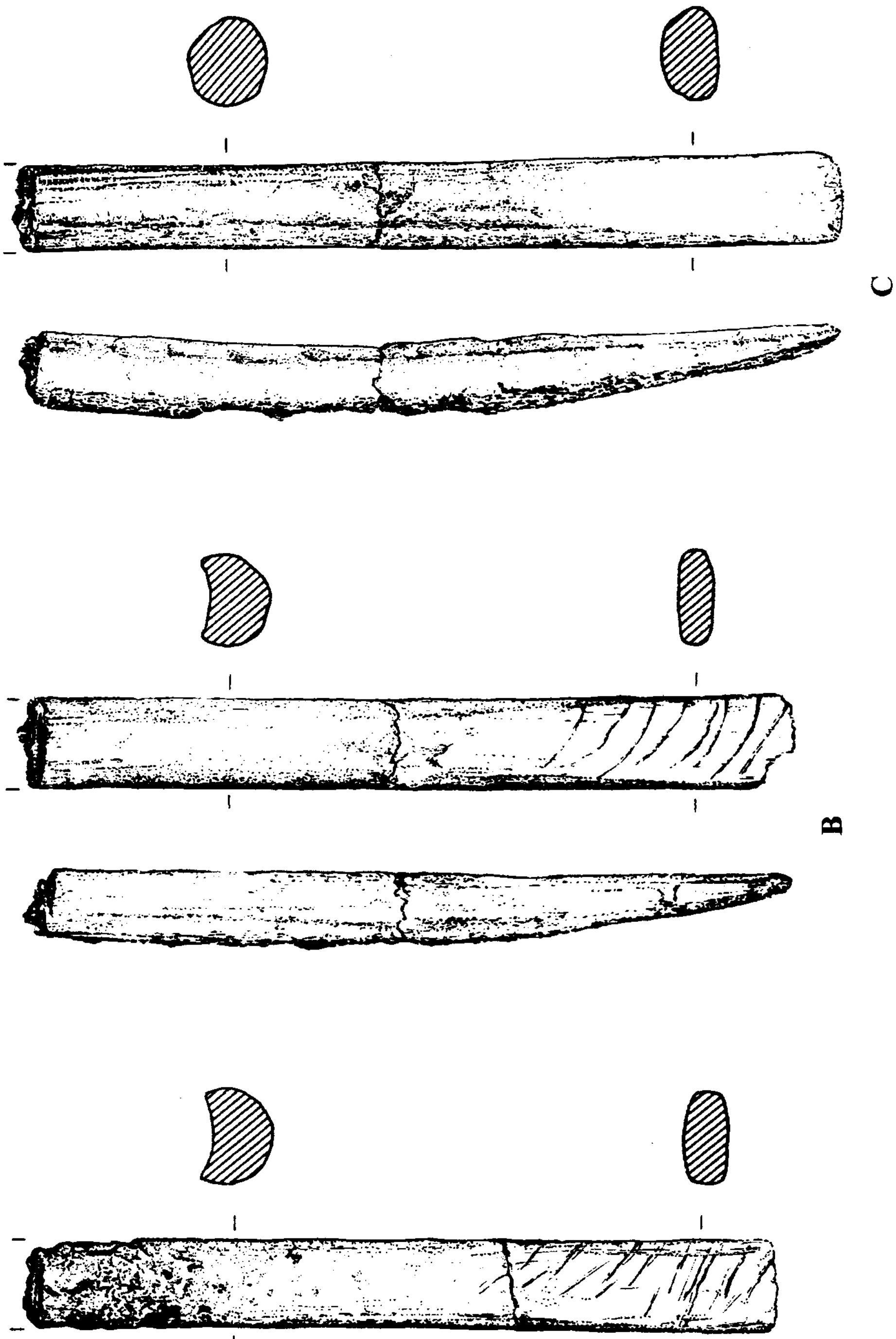


Fig. 2 - Pièces A, B et C. Dessins et sections des sagaies (bois de renne).

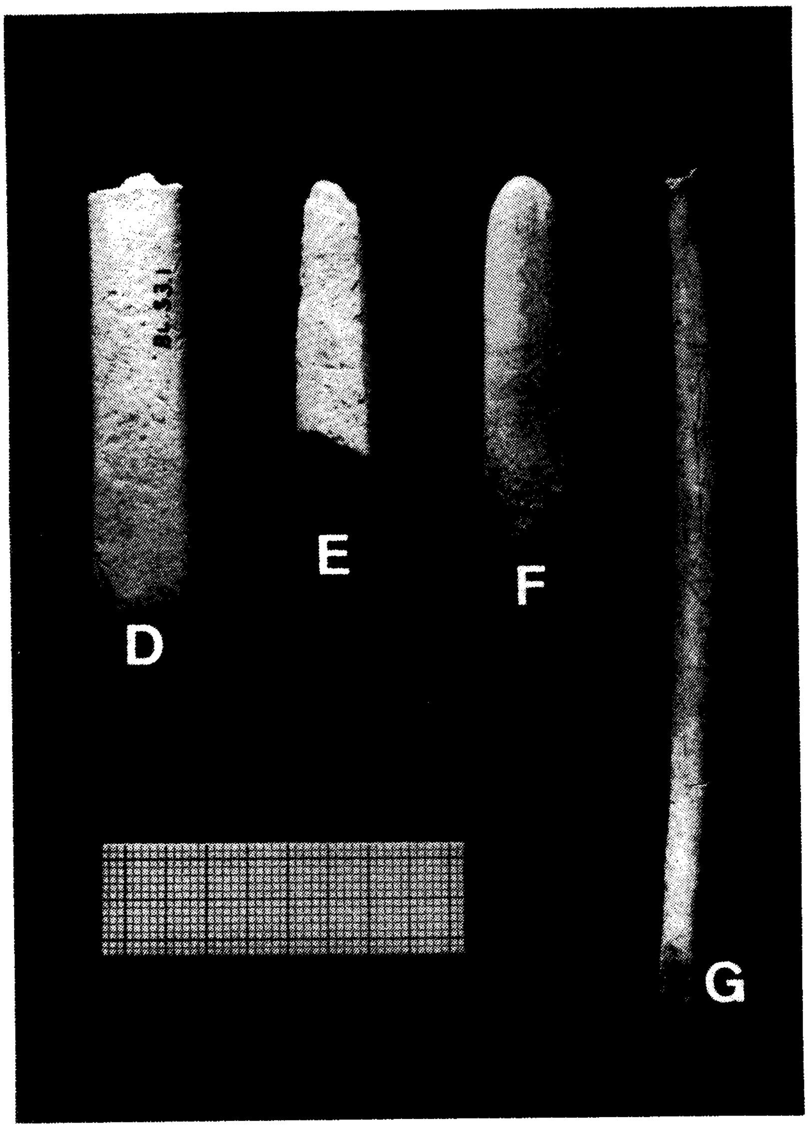


Photo 4 - Pièce D, fragment proximal de sagaie (bois de renne). Pièce E, fragment distal de sagaie (bois de renne). Pièce F, pointe en os. Pièce G, os long (radius d'oie cendrée?) encoché et biseauté.

groupe. Nous pensons que ces sagaies ont été intentionnellement sciées et que la fracturation s'est produite lors des activités cynégétiques. Les chasseurs semblent privilégier la conservation de la hampe. Il s'agit d'un autre exemple de souplesse et d'économie de l'effort; les chasseurs magdaléniens en s'éloignant de leur campement principal emportent un nombre limité de hampes, la longueur de ces outils empêchant des mouvements aisés lors de la prédation. Un animal non mortellement blessé peut fuir avec la hampe dans le corps, laquelle peut se casser lors de la chute de l'animal s'il est mortellement atteint, ou pendant qu'il se débat pour s'en défaire après avoir été blessé. Un tir manqué ou un impact sur un os dense peut aussi produire une fracture de la hampe. La recherche de bois appropriés pour l'élaboration des hampes est contraignante lors des parties de chasse. On privilégie la conservation de la hampe par un procédé simple: les chasseurs vont réaliser un sciage transversal sur la pointe du projectile. La fragilisation de la sagaie produit la cassure au moment de l'impact, la partie distale de la sagaie se dégageant du reste du projectile. Ainsi, non seulement on préserve la hampe, mais en même temps on récupère la sagaie qui pourra être, soit remplacée par une autre (élément moins encombrant qu'une deuxième hampe), soit ré-affûtée. Ce ré-affûtage implique à nouveau le traitement de la pièce, donc un nouveau redressage. Certaines sagaies ayant pu atteindre, par leur longueur, leur dernier stade de ré-utilisation seront abandonnées afin de récupérer la hampe. Etant donné la faible longueur de la pièce, la partie emmanchée qui a déjà souffert plusieurs impacts se fragilise et le biseau devient plus friable (pièce A). Après l'impact, la sagaie doit être redressée; certaines pièces peuvent se casser lors de cette opération et seront donc abandonnées (pièce B).

La pièce F (photo 4f) découverte dans le sondage 1 de 1990 (carrés S-T 14, couche YSS) fut réalisée sur os, vraisemblablement sur diaphyse d'os long d'herbivore de grande taille. On constate l'absence de corrugations et de striations. On observe donc la mise en oeuvre d'une technique de façonnage par polissage après un débitage probablement par percussion directe.

La pièce G (photo 4g) fut réalisée sur un fragment diaphysaire de radius d'oiseau de grand taille, probablement un ansériforme (voir Neville et Gautier dans ce même volume). La pièce a subi un raclage, suivant le sens longitudinal de l'os, ayant pour but le nettoyage et la préparation de la surface. Dans sa partie distale, on trouve deux profondes incisions parallèles entre elles et perpendiculaires à l'axe longitudinal de la pièce (photo 14). Dans la partie mésiale (photo 15), des encoches moins profondes se disposent tout au long de la surface (face ventrale et face dorsale), suivant toujours le même sens (mouvement dextrogyre), et de direction presque parallèle formant un angle de quelques 45° avec l'axe longitudinal de l'os (vraisemblablement en lien avec l'action du déplumage). Dans la partie proximale de la pièce, on observe une coupure intentionnelle en biseau (photo 16). Cette pièce fut retrouvée dans le sondage 5 de 1990 (carrés U9-U10).

La pièce H (photo 5) fut retrouvée dans le sondage 4 de 1990, carré U8, unité YSS. Elle fut confectionnée sur un fragment distal de cubitus d'un ansériforme, la détermination à l'intérieur du groupe n'étant pas possible, la perforation biaisant le diagnostique; néanmoins certains caractères biométriques rapprochent la pièce de l'oie cendrée. Une perforation intentionelle (photos 17 et 18) tres regulière fut réalisée sur la surface « plantaire » en suivant l'axe longitudinal de l'os; quelques stigmates nous font penser à la réalisation d'un travail de préparation de la surface articulaire préalable à la perforation. Celle ci a été réalisée sur l'os

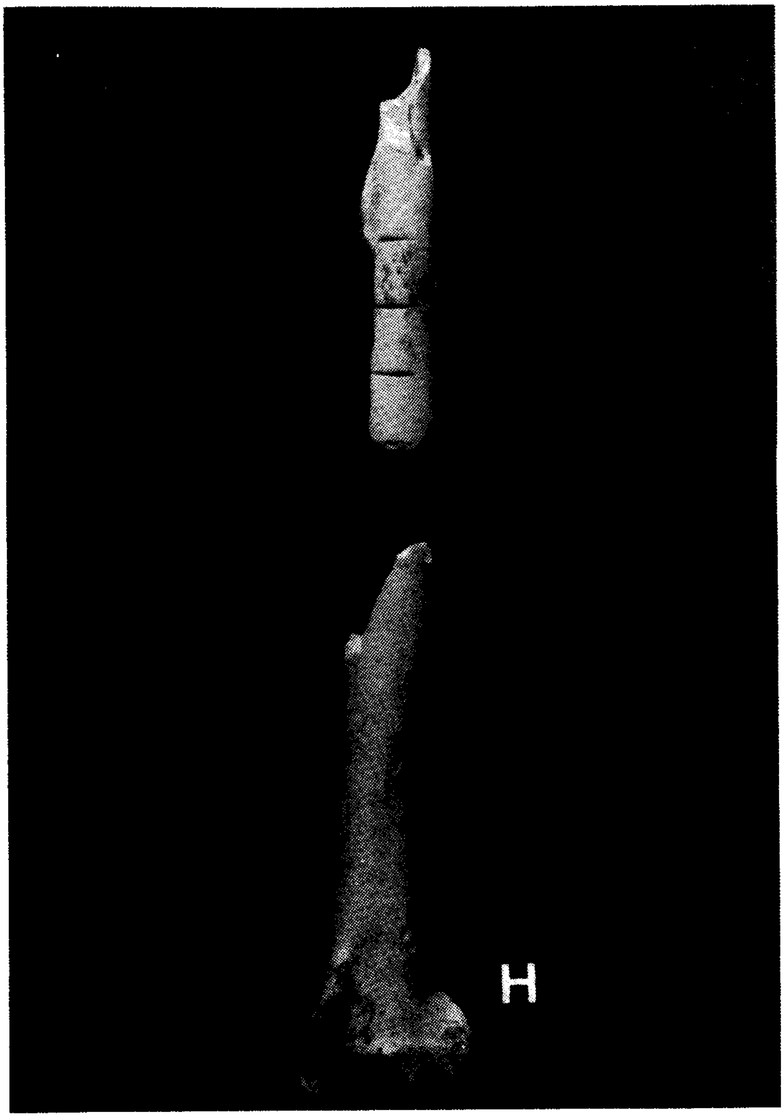


Photo 5 - Pièce H, fragment de cubitus distal d'oie cendrée avec perforation distale et encoches ocrés dans sa partie mésiale (étui à aiguilles).

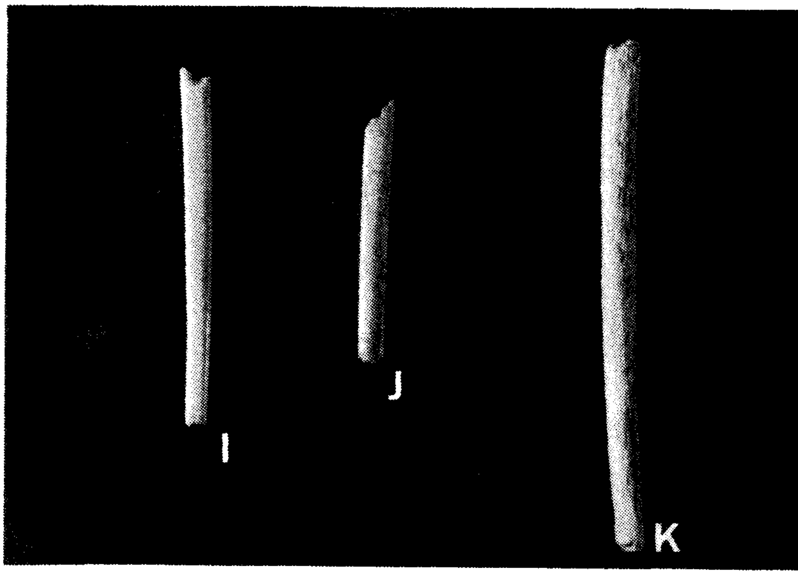


Photo 6 - Pièce I, aiguille à chas (os d'oiseau) . Pièce J, fragment d'aiguille à chas (os d'oiseau ?). Pièce K, fragment de baguette d'extraction (bois de renne).

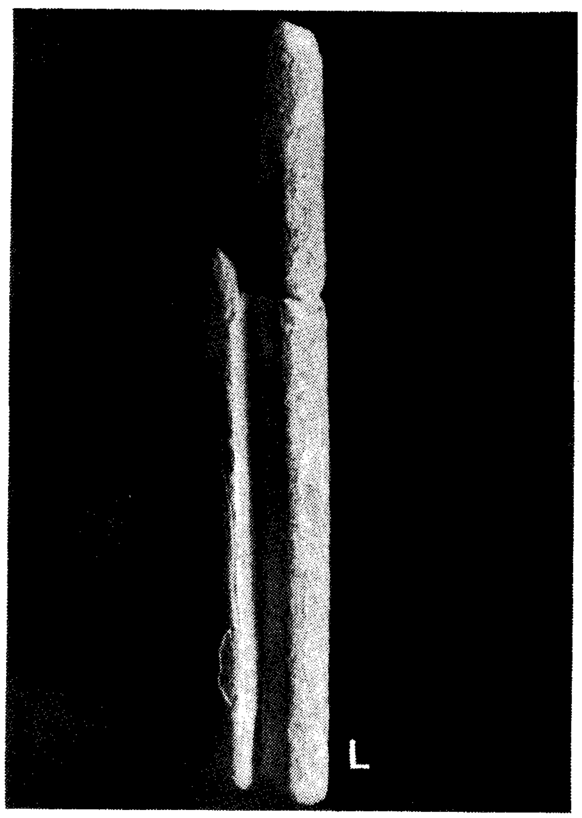


Photo 7 - Pièce L, fragment mésial de métatarse incisé (*Rangifer tarandus*).

encore frais. Associé à cette pièce, on a découvert un fragment de diaphyse (vraisemblablement appartenant au même os) portant quatre incisions perpendiculaires à l'axe longitudinal de l'os, les incisions contenant des incrustations rougeâtres non débordantes, c'est-à-dire sans depasser jamais la pente du clivage (photo 19). Donc, la presence d'ocre ne doit pas être mise en relation avec l'action d'entaillement de la pièce; elle est plutôt du à l'insertion d'un élément préalablement ochré à l'intérieur de la fente. Nous pensons que l'objet en question est une sorte de « kit » de couture, la perforation permettant l'insertion à l'intérieur du tube des aiguilles à chas, éléments très fragiles. Les incisions auraient pu avoir une triple fonction : (a) décorative, (b) personelle comme une sorte de signature permettant l'identification du propiètaire à l'intérieur d'un groupe et (c) fonctionelle, sillons facilitant l'installation du fil à coudre, ce dernier ayant pu être réalisé à partir de tendons ou de lanières végétales traités pour renforcer sa solidité avec certains types de degraissants dont l'ocre. Les incisions ayant vraisemblablement eu un caractère pluri-fonctionnel, une combinaison des differentes fonctions semblerait donc une réponse plus véritable que la prise en compte d'une seule aptitude.

La pièce I (photo 6i) fut retrouvée en 1995 à l'intérieur de l'unité YSS dans le carré W9d. Il s'agit d'un fragment d'aiguille à chas réalisée vraisemblablement sur un fragment d'os long d'oiseau (taille petite à moyenne); on peut encore discerner la cannelure correspondant au canal médullaire de l'os. La réalisation d'aiguilles sur os longs d'oiseaux n'est pas commune (Stordeur-Yedid, 1979), néanmoins il y en a deux exemplaires en Belgique, l'un dans le Magdalénien final de Goyet et l'autre du Trou du Frontal à Furfooz (Stordeur-Yedid, *ibid.*). L'aiguille est fragmentée dans sa partie mésiale et aussi au chas. Celui-ci fut obtenu par perforation double decalée (non symétrique) réalisée par pression amorcée sur les deux faces et poussée jusqu'à la rencontre des deux entailles (photos 20 et 21); la pente de forage étant moins abrupte et longue dans la partie correspondant à la zone médullaire. L'élargissement du trou fut réalisé par un travail de rotation circulaire à l'aide probablement de l'outillage lithique associé dans la couche (perçoirs et microperçoirs du type Chaleux); ainsi on a obtenu la régularisation de la forme et des parois internes du chas. Le fragment a une longueur de 32 mm. La section proximale est dissymétrique donc trapézoïdale (catégorie 1 de Stordeur-Yedid), la section mésiale est biconvexe à pans (catégorie 4b de Stordeur-Yedid). Le diamètre du chas est de 1,2 mm. Nous n'avons pas constaté la présence de traces de polissage intentionnel, donc nous envisageons plutôt un polissage produit lors de l'utilisation.

La pièce J (photo 6j) fut retrouvée lors des fouilles de 1995 dans la couche magdalénienne YSS (carré W3c), à l'extérieur de la cavité sur la terrasse. Il s'agit d'un fragment méso-distal d'aiguille à chas réalisée sur un fragment d'os long d'oiseau; elle mesure 24 mm, la section mésiale est biconvexe à pans (catégorie 4b), elle se transforme progressivement en section ronde (catégorie 5). On a constaté la présence de polissage d'usure.

La pièce K (photo 6k) fut également retrouvée en 1995 à l'intérieur de la couche YSS dans le carré V8a. Elle est en bois de renne; il s'agit d'une «languette d'extraction» obtenue par la technique de rainurage. La partie proximale présente une coupe en dents de scie, ceci impliquerait que la languette ait été obtenue à partir d'une matrice secondaire, la cicatrice d'extraction occupant toute la longueur du fragment (48 mm), la partie distale étant fracturée. La pièce, après extraction, a subi un travail d'arrondisement et dans sa partie distale d'amincissement. Nous envisageons trois possibilités: (a) la matrice secondaire pourrait avoir

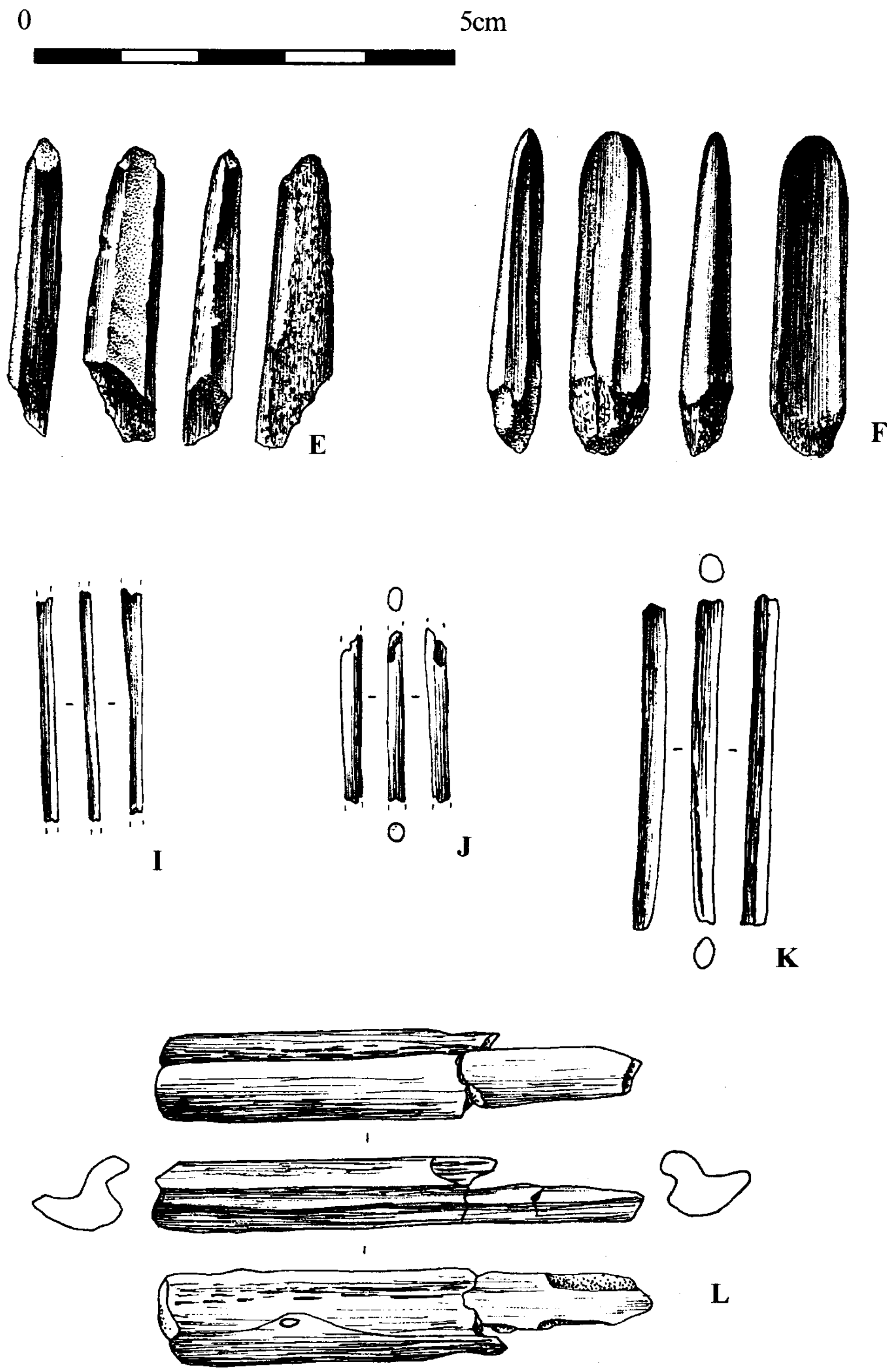


Fig.3 - Pièces E, F, I, J, K et L. Dessins et sections.

été un fragment de merrain ou d'andouiller obtenu par fracturation, (b) la matrice secondaire pourrait avoir été un fragment de sagaie, et (c) la matrice serait un fragment de bois destiné au façonnage d'une sagaie, l'extraction d'une baguette faisant partie du procédé habituel de confection.

La pièce L (photo 7) fut retrouvée en 1995 à l'intérieur de la couche magdalénienne YSS (carré X4a). Il s'agit d'un fragment diaphysaire de métatarse de *Rangifer tarandus*, intentionellement rainuré. La pièce fut probablement fracturée pour l'obtention de la moelle; en vue plantaire, des traces de fracturation intentionnnelle sont visibles. En vue dorsale, les lignes de rainurage s'installent tout au long du sillon médian dorsal (ligne de gouttière) en démarrant à partir du canal métatarsien distal. La pièce présente des bords très érodés et émoussés témoignant de processus post-dépositionnels.

Conclusions

Quelle est la motivation du façonnage et de la transformation de ces objets particuliers? Peut-on supposer que la présence de produits semblables réponde à des notions abstraites supplémentaires à celles du quotidien ?

Par l'uniformité des besoins, les réponses vont se standardiser. On se retrouve ainsi face à des productions normalisées. Cette normalisation, même au niveau des objets abandonnés, permet la constatation de l'acquis culturel, de la faculté d'abstraction artisanale et du développement des habitudes cognitives, lesquelles se manifestent dans le choix de la matière première, de la technique de façonnage, etc.

La grotte semble avoir servi comme repaire pour la chasse en embuscade. Les chasseurs lors de l'attente auraient réalisé des activités de préparation de l'outillage cynégétique: redressement, affûtage, façonnage, débitage, etc. Le sciage de certaines pièces semble répondre à une « économie de l'effort » ou à la réutilisation des objets pour une autre fin, par exemple la transformation des sagaies à biseaux simple brisées lors des parties de chasse en ciseaux (comme à Morin, voir Deffarge *et al.*, 1977). La matière première principale, le bois de renne, fut vraisemblablement stockée ailleurs pour son utilisation comme c'était le cas au Trou des Nutons (OxA 4.195 = 12.630 ± 140 B.P.; Charles 1993; López Bayón et Teheux, 1994) ou au Trou des Blaireaux (Lv 1.386 = 12.440 ± 180 B.P.; Bellier et Cattelain, 1986)

Dans la grotte du Bois Laiterie, une datation AMS (R. Charles,1993) sur un petit échantillon de la pièce B a donné le résultat suivant : OxA 4.198 = 12.660 ± 140 B.P.. D'autres dates disponibles sur la couche magdalénienne proviennent de deux échantillons récoltés lors des fouilles de 1994: GX 20.433 = 12.625 ± 117 B.P. (os) et GX 20.434 = 12.665 ± 96 B.P. (os), elles confirment à nouveau l'existence d'une importante occupation magdalénienne finale dans les Ardennes belges par des groupes de chasseurs-cueilleurs durant l'interstade de Bölling; celle-ci aurait continuée lors des premières phases du Dryas II d'après les donnés issues des études malacologiques (López Bayón *et al.*, dans ce même volume) et des microvertèbres (Cordy et Lacroix, dans ce même volume).

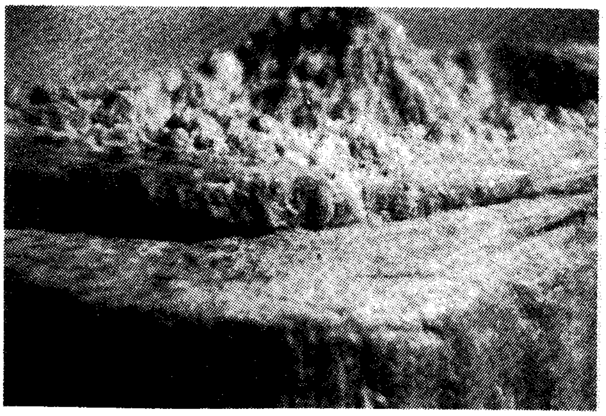


Photo 8 - Pièce A, détail sciage.

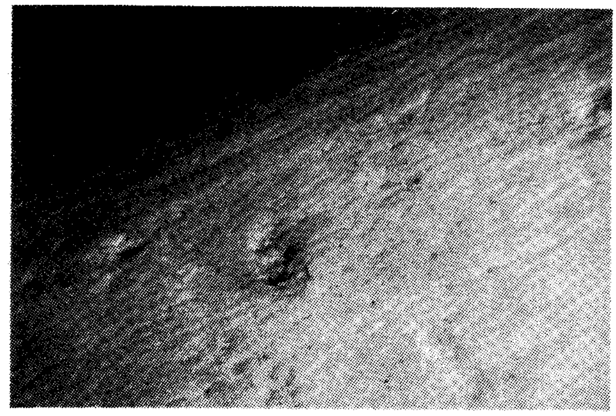


Photo 9 - Pièce A, détail raclage.

Photo 10 - Pièce A, détail du biseau présentent des incisions pour faciliter l'enmanchement et avec des traces de mâchonnement par des carnivores.

Photo 11 - Pièce B, détail du biseau présentent des incisions pour faciliter l'enmanchement.

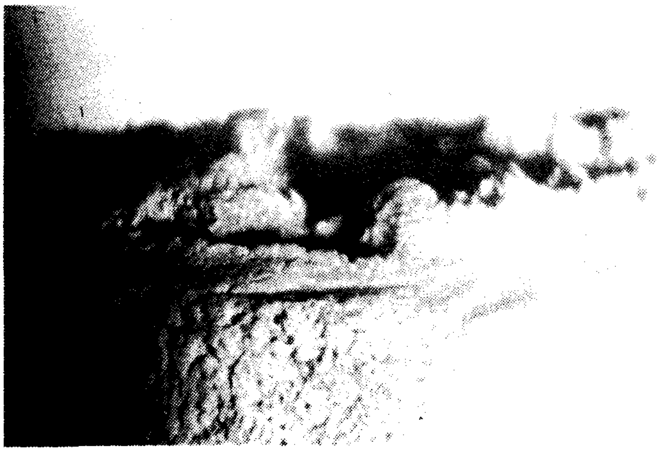


Photo 12 - Pièce C, détail du sciage et des plages de redressement.

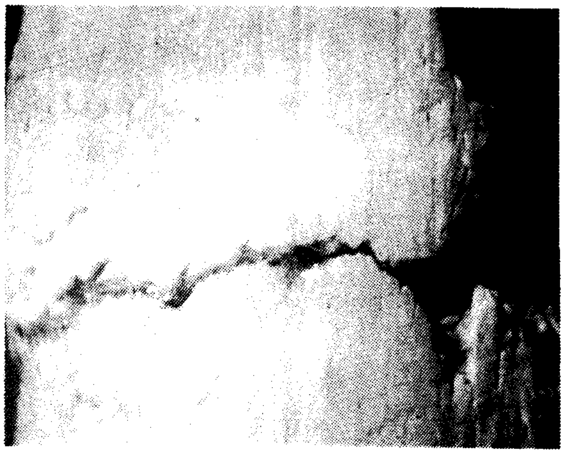


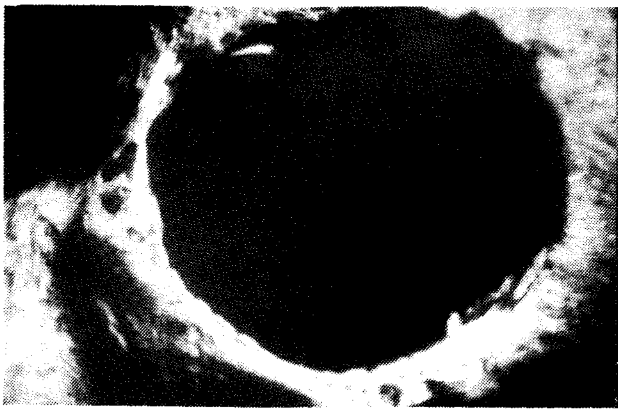
Photo 13 - Pièce C, détail du raclage, de la fracture et de la plage de redressement qui en est la cause.

Photo 14 - Pièce G, détail des encoches (anthropiques) et des lignes de fracture parallèles à l'axe longitudinal de l'os (dues au piétinnement ou au poids des sédiments).

Photo 15 - Pièce G, détails des incisions anthropiques liées à l'activité de déplumage.

Photo 16 - Pièce G, détail biseau.

Photo 17 - Pièce H, perforation distal.



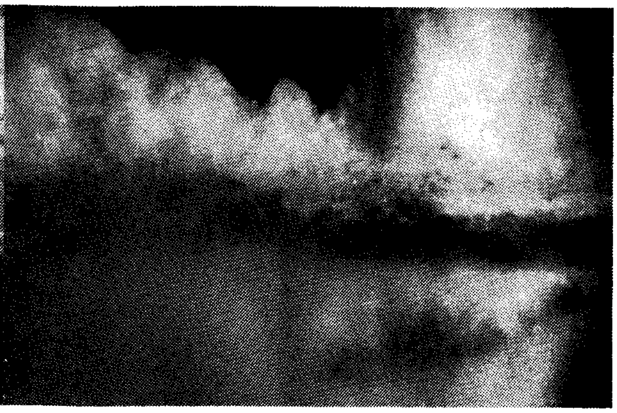


Photo 18 - Pièce H, vue en détail de la perforation distal et du travail préalable d'amennagement de la surface plantaire.

Photo 19 - Pièce H, détail des encoches avec disposition non débordante d'ocre.

Photos 20 et 21 - Pièce I, détail du chas, (vue externe et interne, respectivement).

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14

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.

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[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.

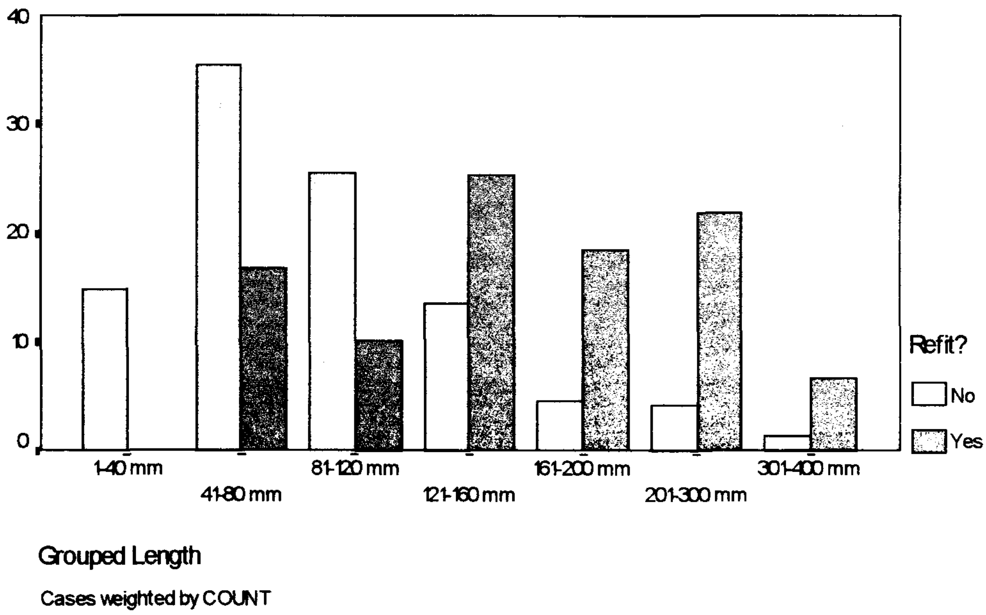
TABLE 3. Dimensions of Refit Sets

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



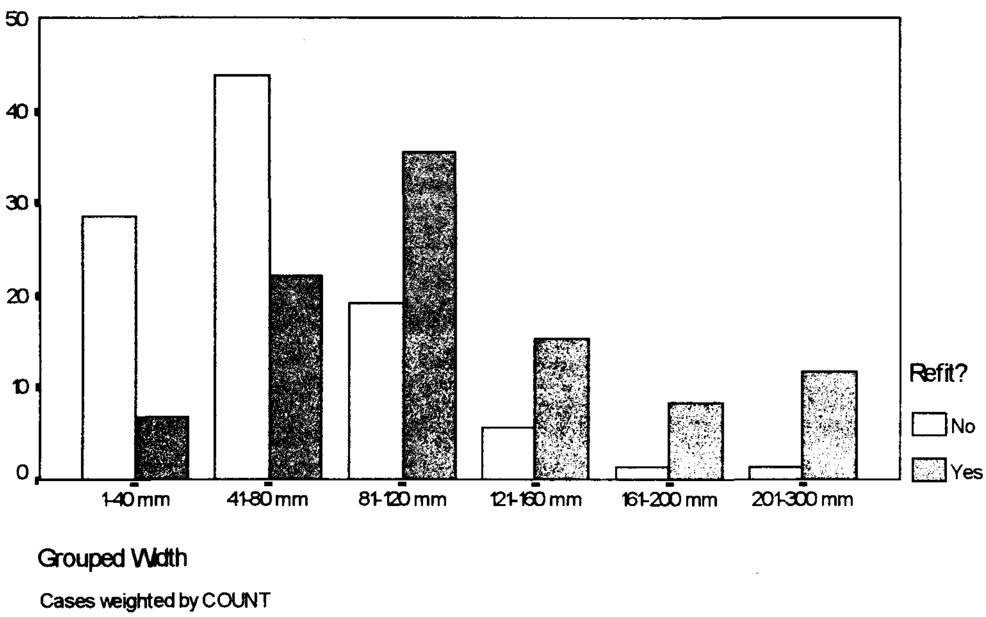


Fig. 1- Histograms for Dimension Classes for Refitted versus Unrefitted Plaquettes

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

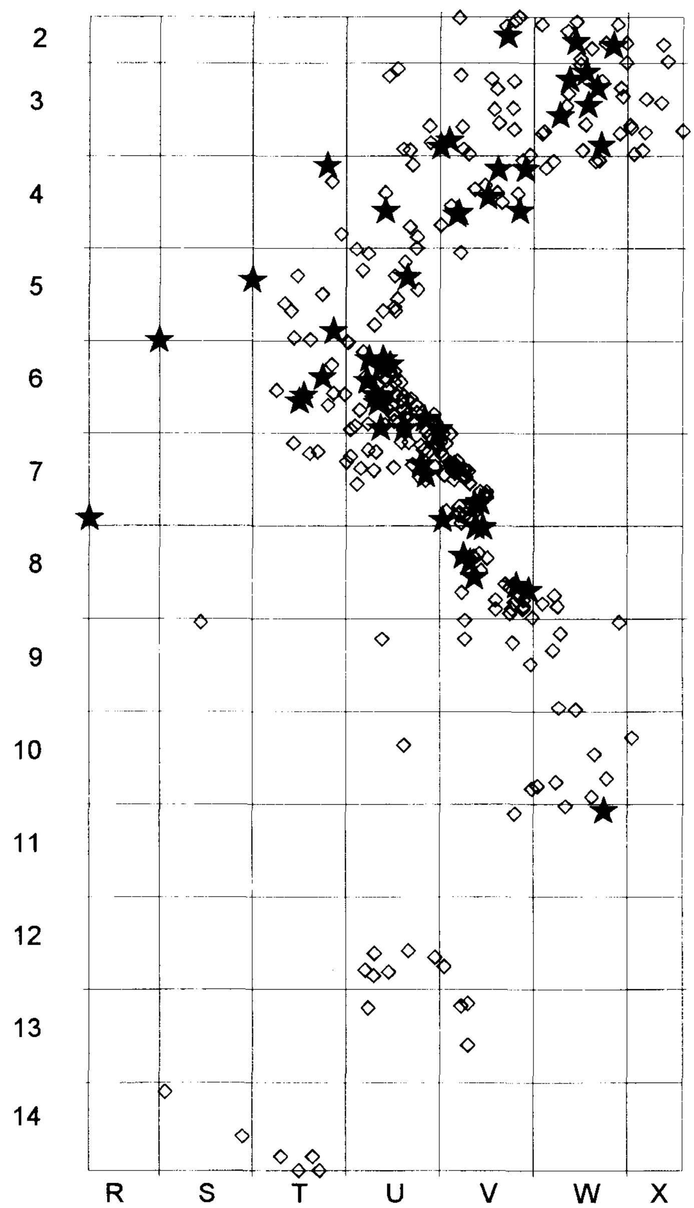


Fig.2- Distribution of all piece-plotted plaquettes in the Magdalenian level. (Stars indicate refitted pieces.)

DISTRIBUTION OF REFITTED PLAQUETES

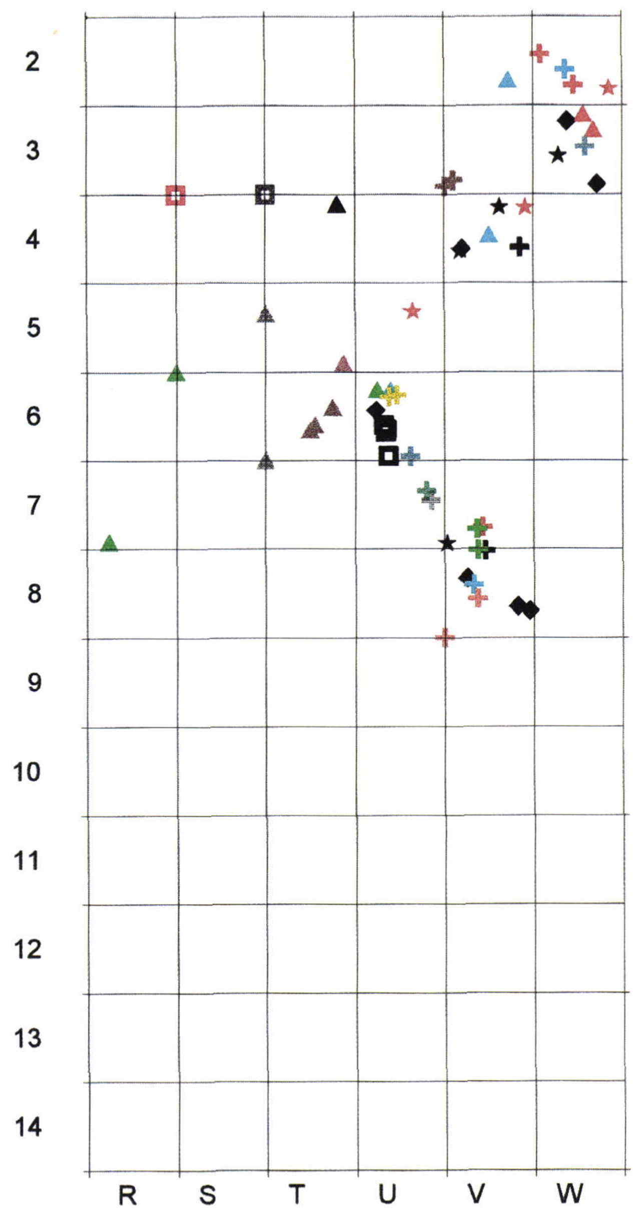


Fig. 3 - All refit sets.

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.

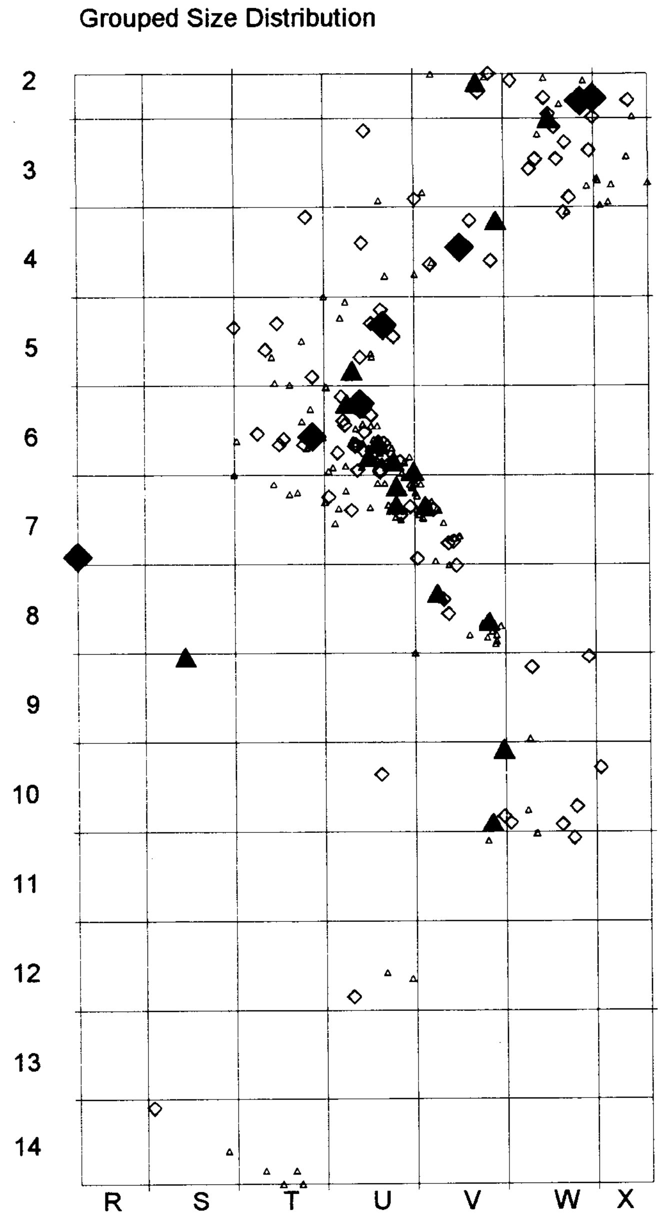


Fig.4- Distribution of refitted plaquettes by size.

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

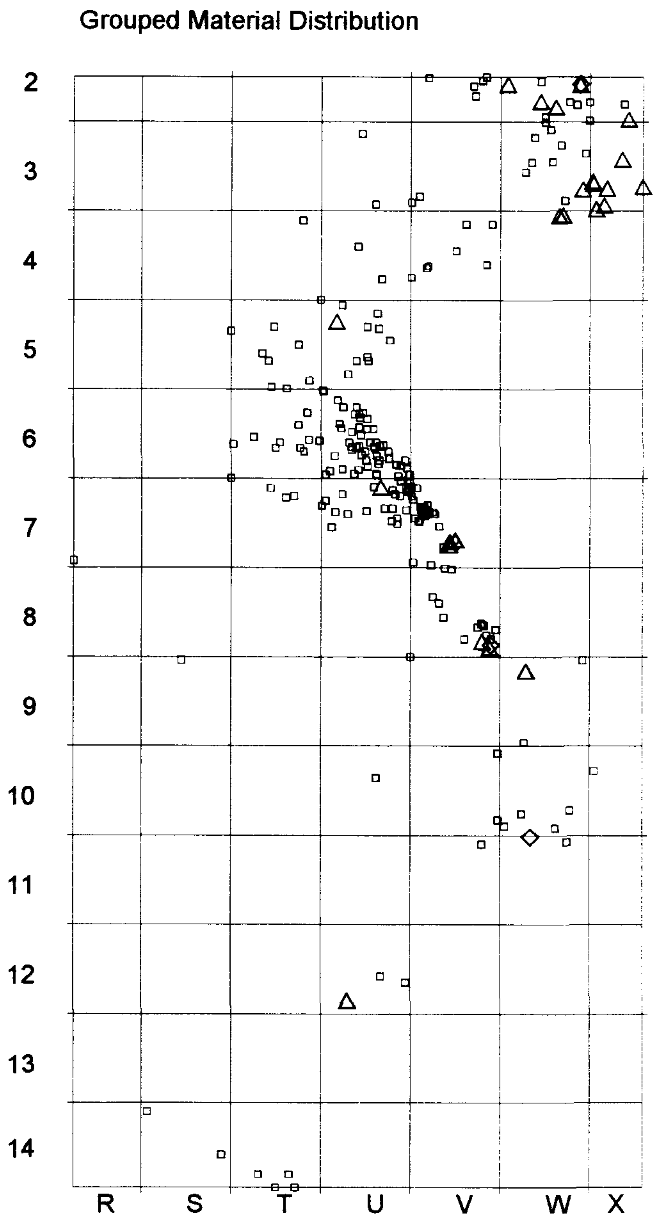


Fig.5- Distribution of refitted plaquettes by material type.
(limestone: triangle; diamond: sandstone; psammite: square)

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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15

L'ART MOBILIER MAGDALENIEN FINAL DE LA GROTTE DU BOIS LAITERIE

M. Lejeune

Introduction

Découverte en 1990 par Philippe Lacroix, la couche magdalénienne de la grotte du Bois Laiterie à Profondeville (Namur) fut fouillée par les universités de Liège et du Nouveau Mexique en 1994 et 1995.

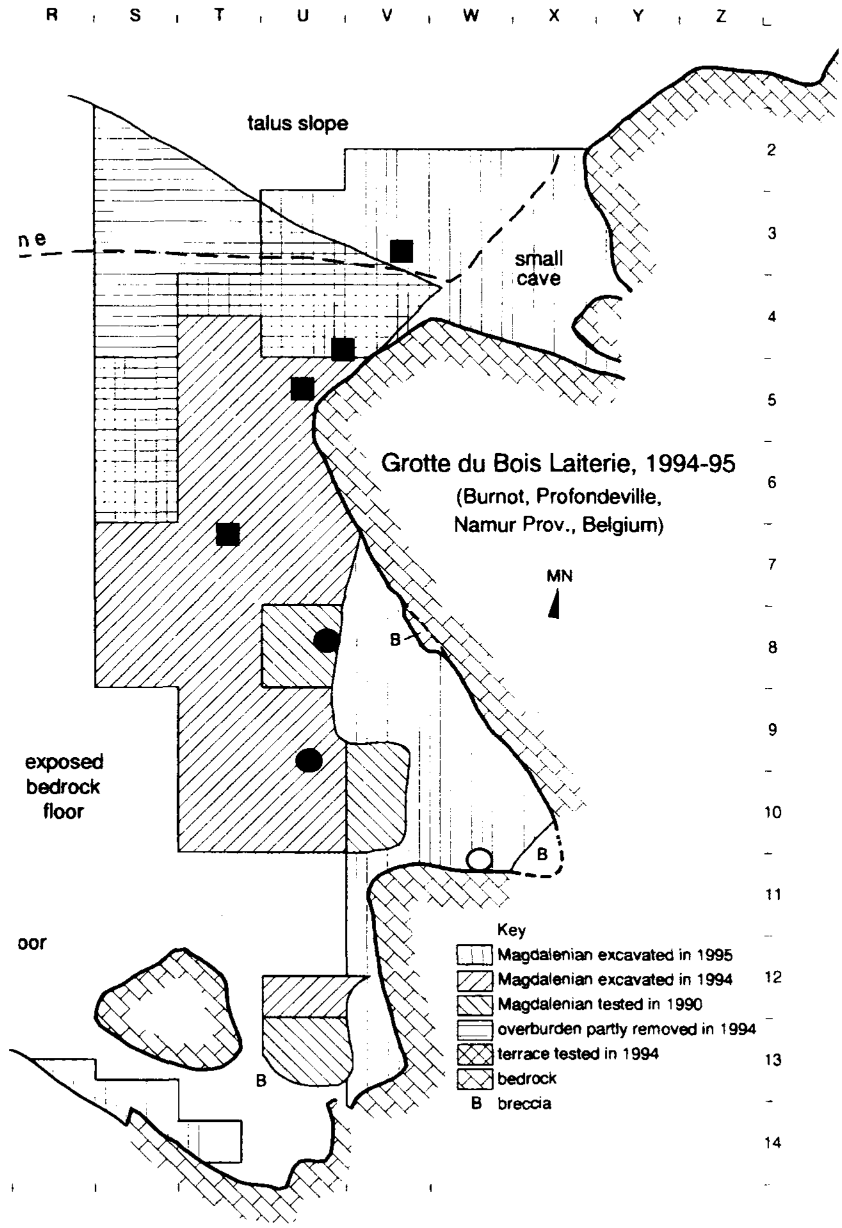
Outre un outillage lithique et osseux assez traditionnel, on y a également trouvé quelques témoins présentant des éléments caractéristiques de l'art mobilier. Il s'agit d'une « perle » en grès perforée, de quatre coquilles tertiaires perforées, de deux os longs d'oiseau encochés et de vingt-six plaquettes en pierre possédant des traits gravés non figuratifs et quelques traces colorées (rouges, noires, jaunes).

Ces pièces proviennent essentiellement de la terrasse et de l'entrée de la grotte (Fig.1).

Description des témoins

1. « Perle » en grès perforée.

Trouvée à l'intérieur de la cavité, cette perle en grès dont le diamètre extérieur varie de 27 à 28 mm, est épaisse de 11,2 mm au niveau de la perforation. Pratiquée au centre de la pièce, cette perforation présente un aspect biconique et asymétrique. Les diamètres extérieurs de la perforation sont de 8,5 et 4,9 mm. La jonction des troncs de cône, située à 9,1 mm du diamètre extérieur le plus large et à 2,1 mm du plus étroit, possède un diamètre de 3 mm. La perforation a dû être réalisée par abrasion circulaire ainsi qu'en témoignent des traces circulaires encore visibles à l'intérieur. Toutefois, quelques petits traits parallèles à l'axe de la perforation apparaissent à son point le plus étroit, c'est-à-dire à la jonction des deux cônes. Quatre petits traits finement gravés, longs d'environ 5 mm, sensiblement parallèles et distants d'environ 2 mm, sont également visibles entre le plus grand diamètre extérieur de la perforation et le bord de la pièce (Fig.2 et photo 1).



perle en grès ○ os travaillé ● coquilles perforées ■

Fig. 1 - Bois Laiterie, localisation des pièces.

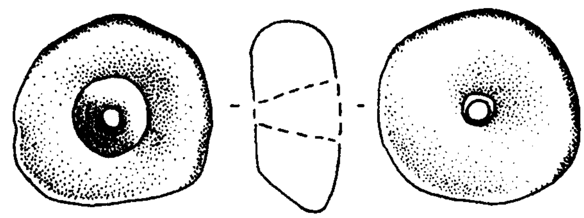


Fig. 2 - Bois Laiterie. Perle en grès perforée.

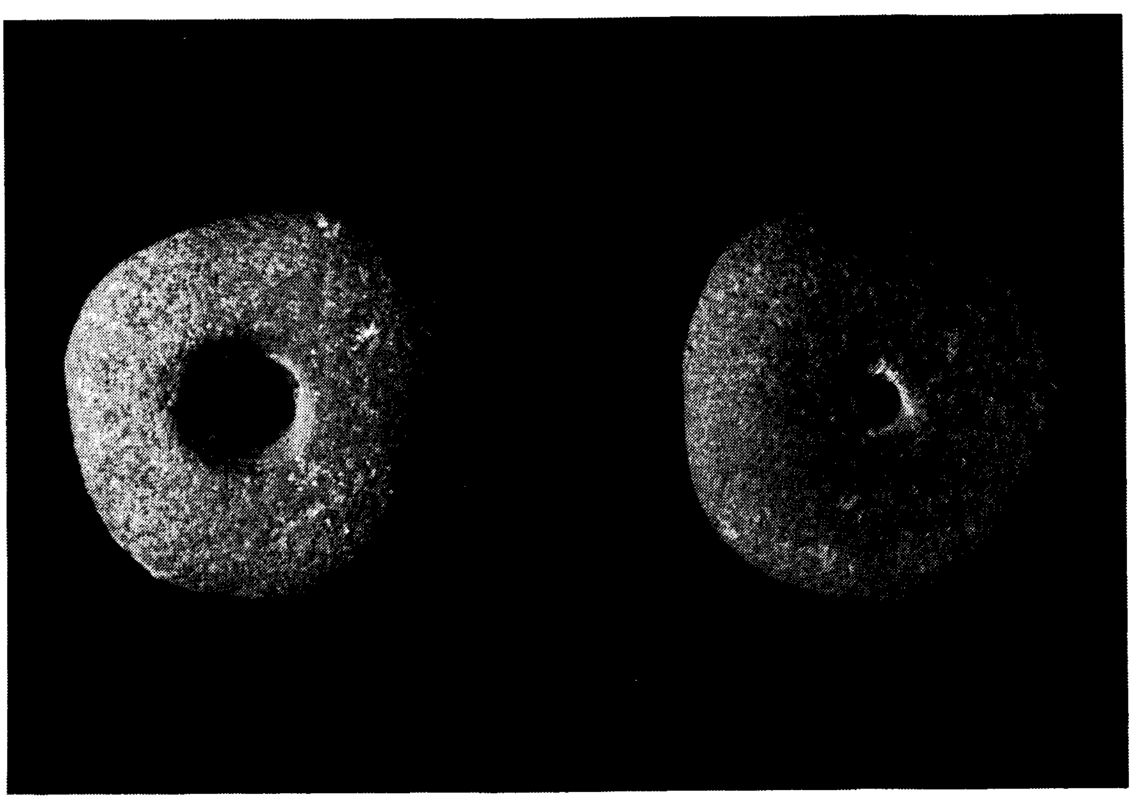


Photo 1 - Bois Laiterie. Perle en grès perforée (cliché Y. Hanlet)

2. Plaquettes en pierre.

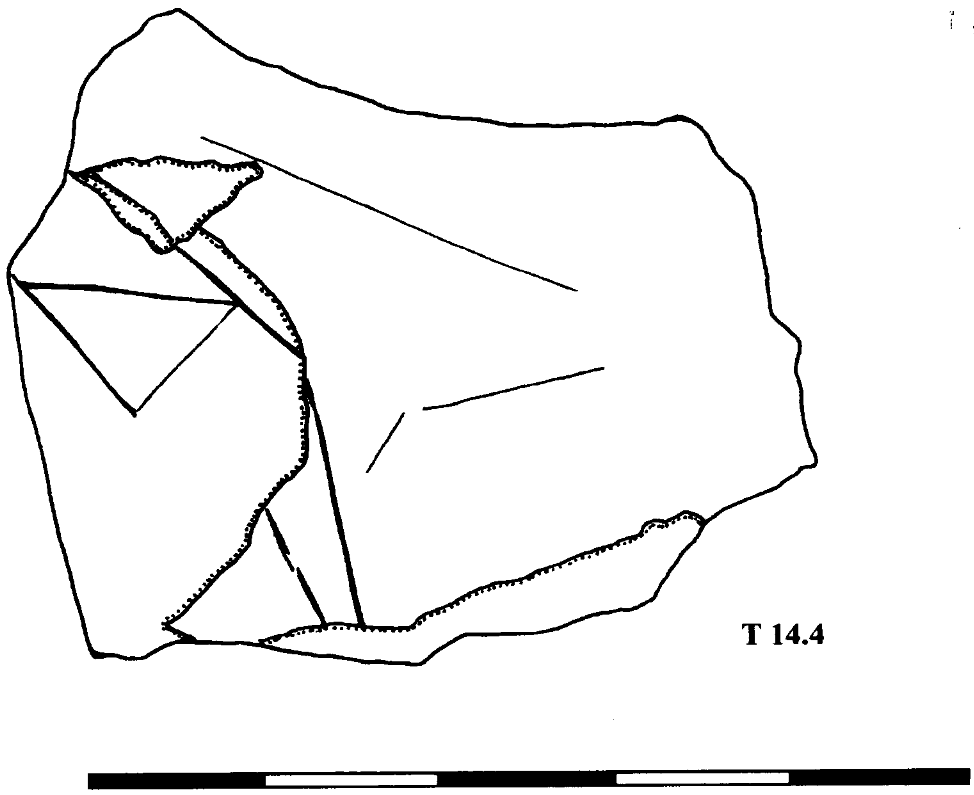
Sur les 788 plaquettes recueillies sur la terrasse, à l'entrée et à l'intérieur de la cavité, 26 présentent des traits gravés et des traces colorées assez diffuses. Qu'elles soient en grès, en psammite ou en schiste, toutes ces plaquettes sont d'origine locale et ont dû servir à aménager un dallage sur la terrasse et à l'entrée de la cavité.

Les gravures n'apparaissent que sur une face et des craquelures, vraisemblablement dues à l'action du feu, sont visibles sur certaines d'entre elles. Ces gravures consistent surtout en de nombreux petits traits isolés, généralement minces, rectilignes, à bords nets et à section en V. Ils sont non figuratifs, sans organisation apparente, à caractère vraisemblablement accidentel. D'autres traits plus larges, à bords irréguliers et section en U, présentent parfois une encoche de départ marquée et font songer à des traces de griffades animales.

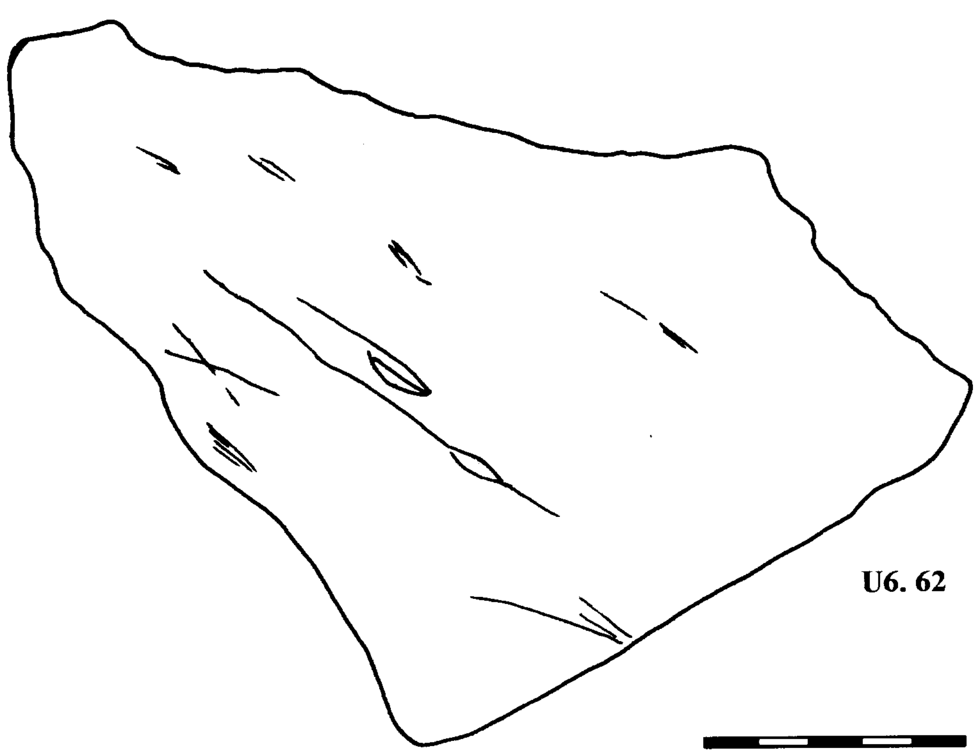
Quant aux traces colorées, il s'agit plutôt d'oxydations dues à la présence de fer et à l'action éventuelle du feu. Des traces d'ocre rouge, ne présentant aucun caractère figuratif, sont toutefois visibles sur une seule plaquette.

TABLE 1a. Plaquettes gravées (Fig. 3a à 3r)

Carré	N°	Nature matière
T14	4	grès
U6	62	grès
V3	spit 9	grès
V4	57	grès
V7	88	grès
V7	89	grès
V7	90	grès
V7	117	grès
V7	128	grès
V7	139	grès
V7	143	grès
V8	20	psammite
V8	75	grès
W2	72	grès
W2	75	psammite
W3	37	grès
W3	82	psammite
W9	23	grès

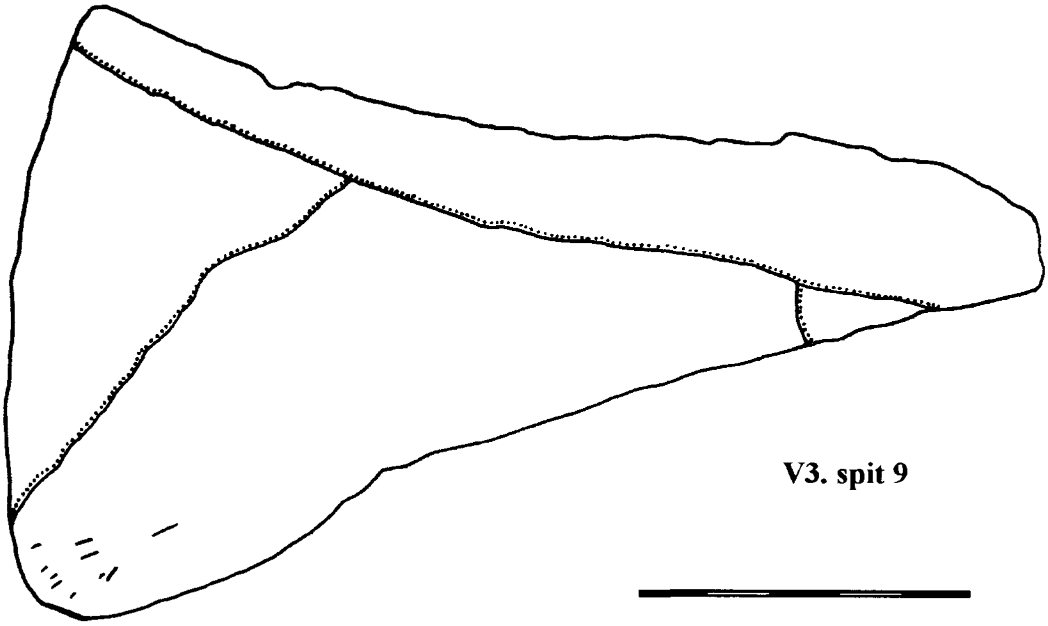


T 14.4

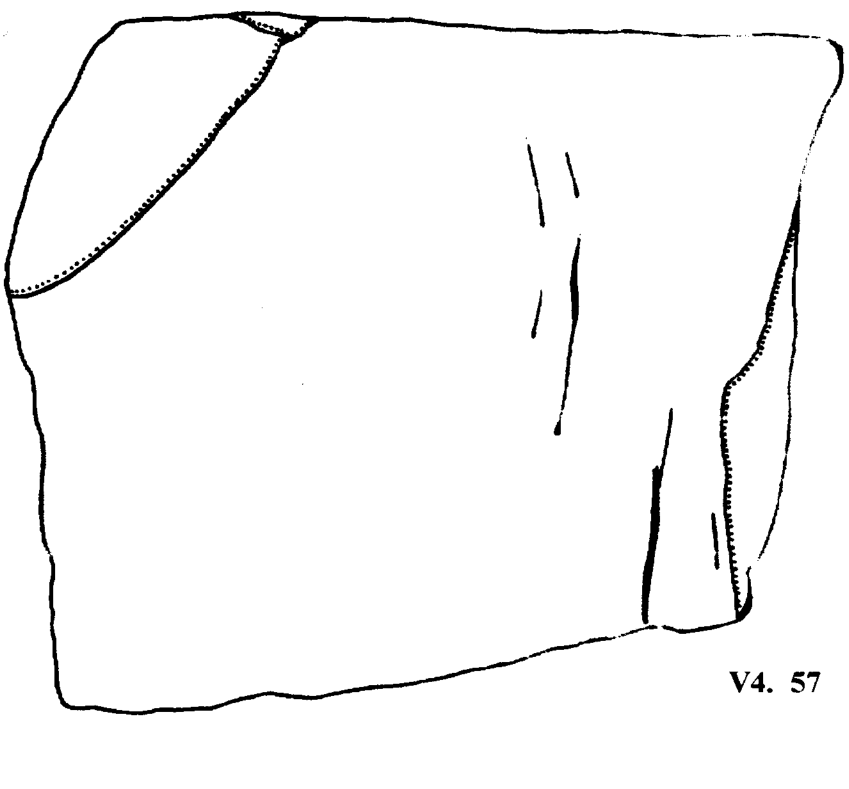


U6. 62

Fig.3a et 3b - Bois Laiterie. Plaquettes gravées.

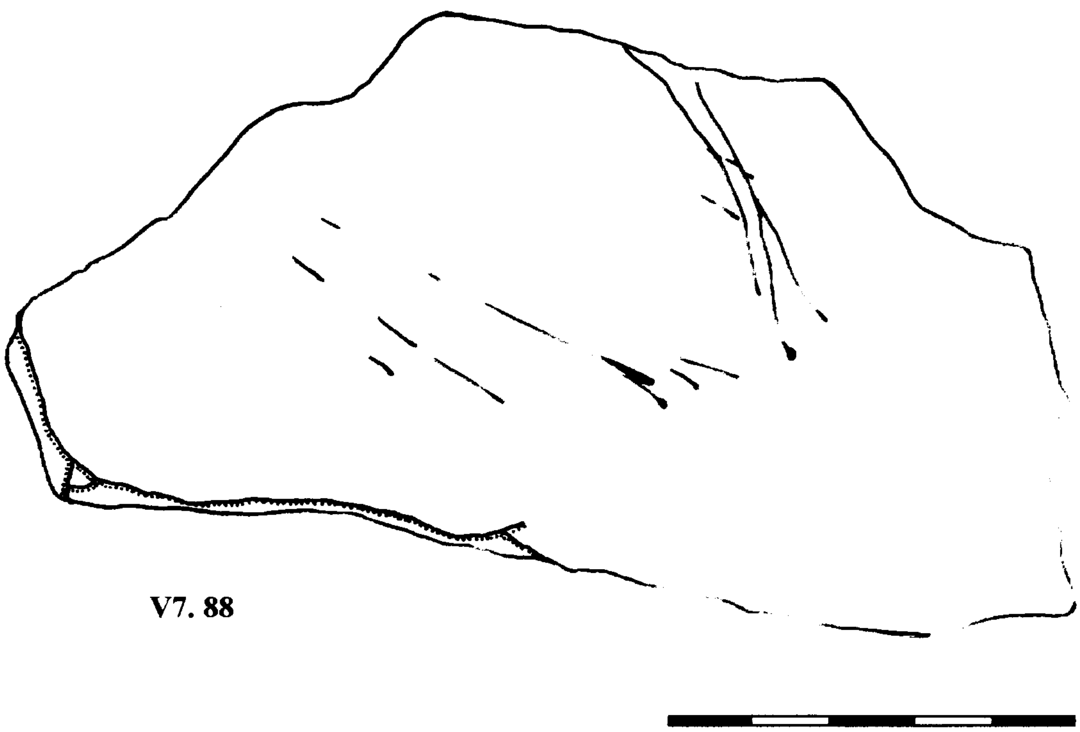


V3. spit 9

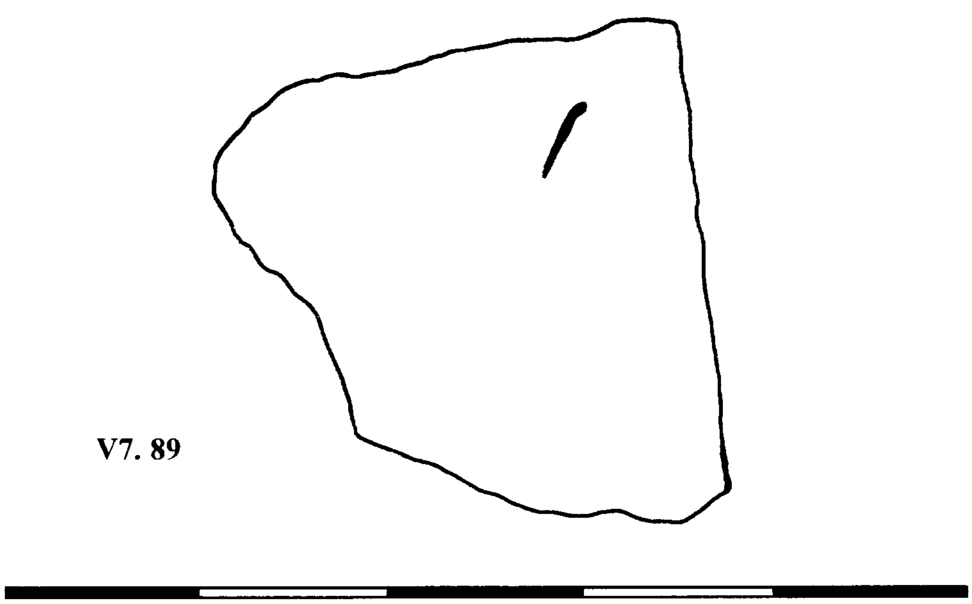


V4. 57

Fig.3c et 3d - Bois Laiterie. Plaquettes gravées.

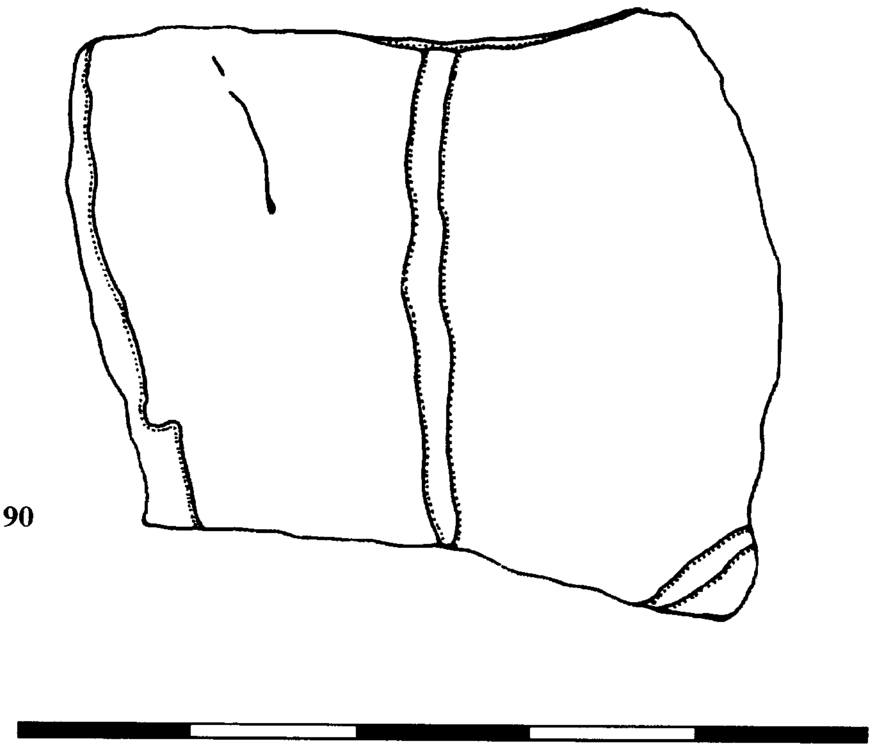


V7. 88

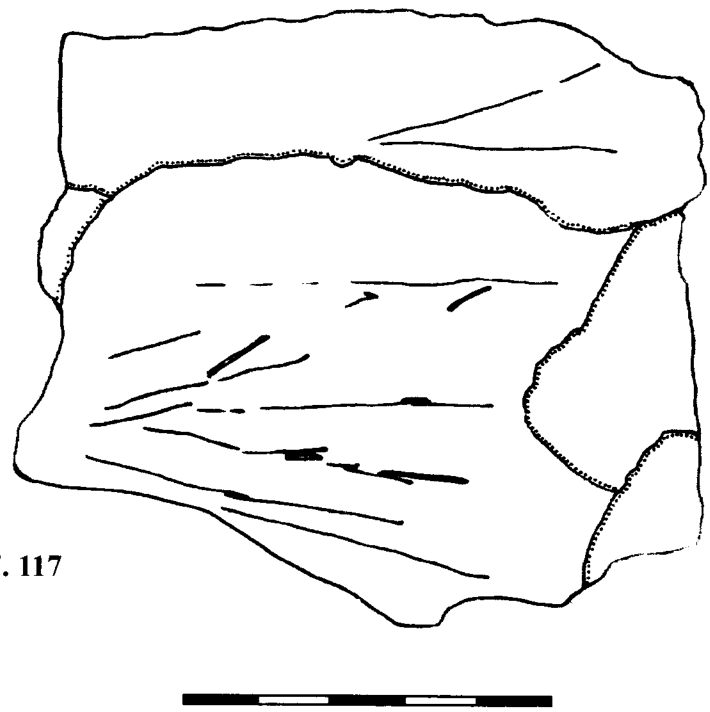


V7. 89

Fig.3e et 3f - Bois Laiterie. Plaquettes gravées.

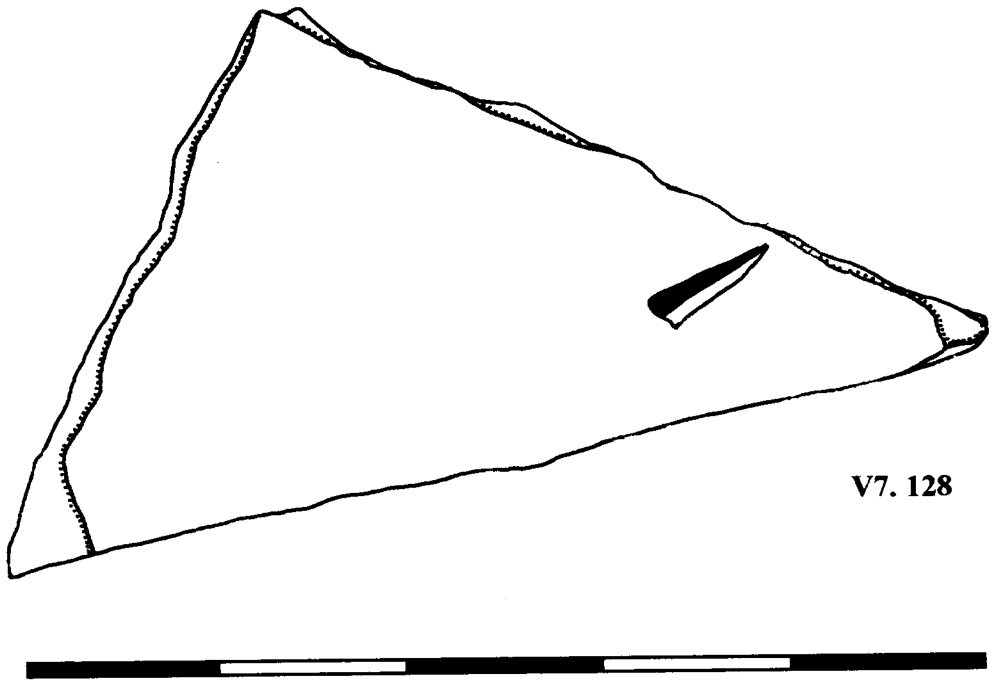


V7. 90



V7. 117

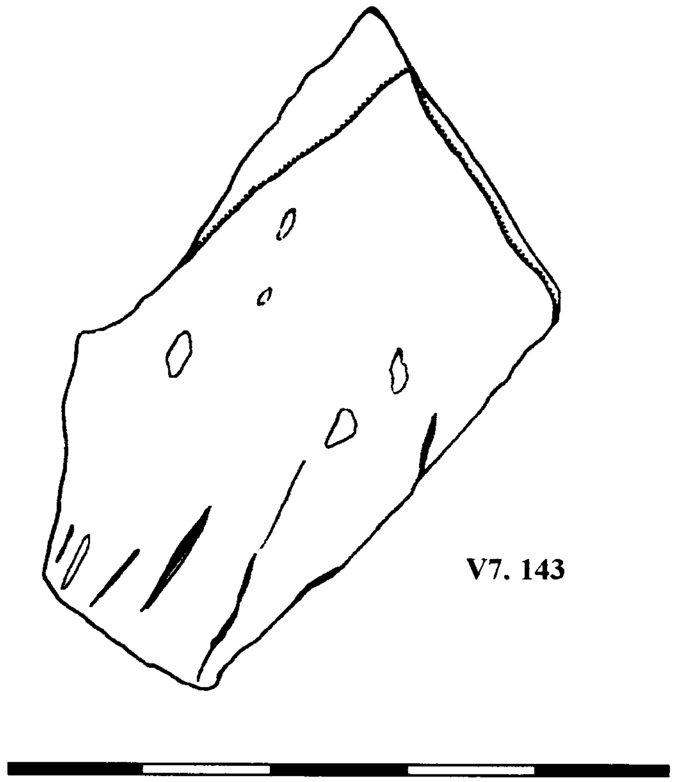
Fig.3g et 3h - Bois Laiterie. Plaquettes gravées.



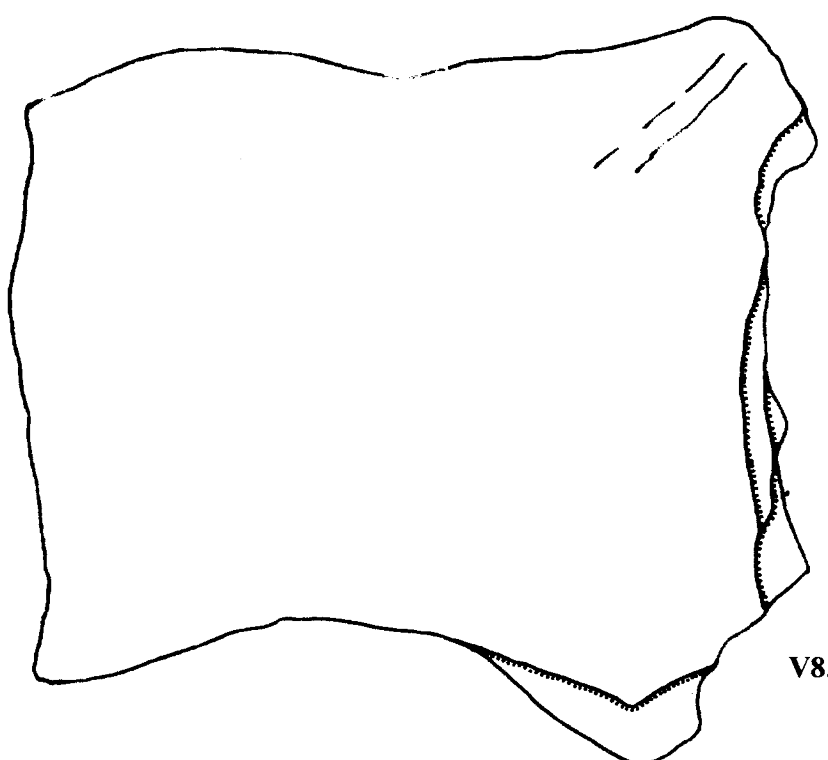
V7. 128

V7. 139

Fig.3i et 3j - Bois Laiterie. Plaquettes gravées.

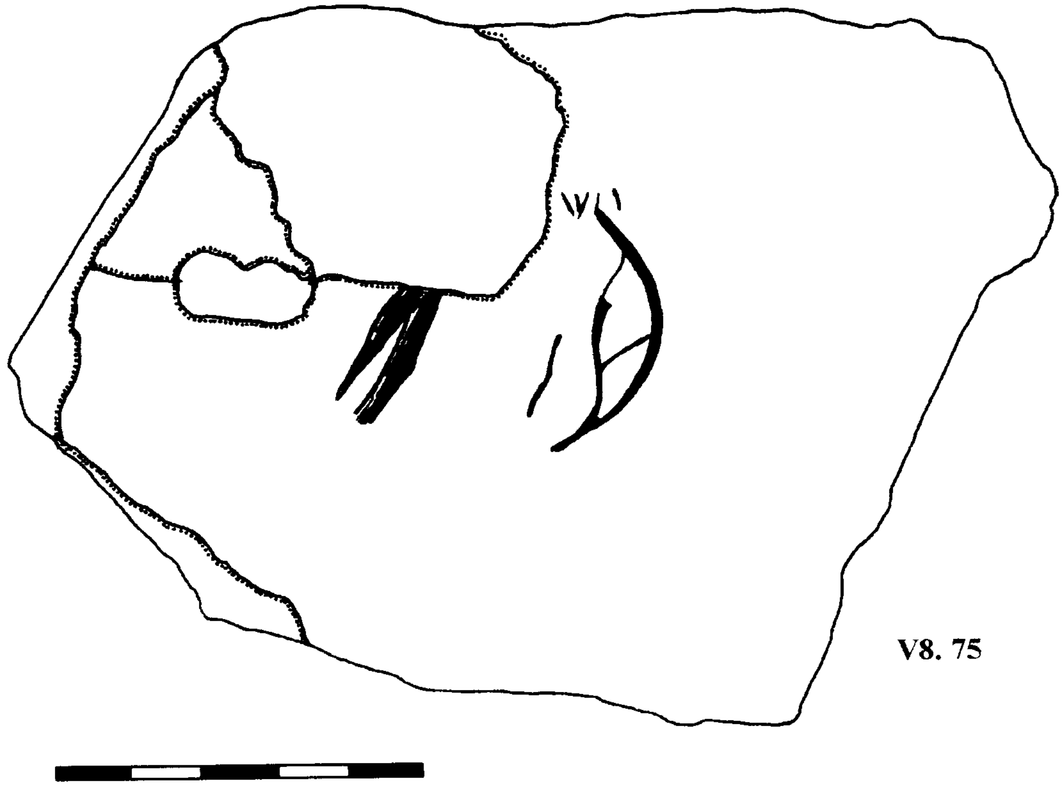


V7. 143



V8. 90

Fig.3k et 3l - Bois Laiterie. Plaquettes gravées.

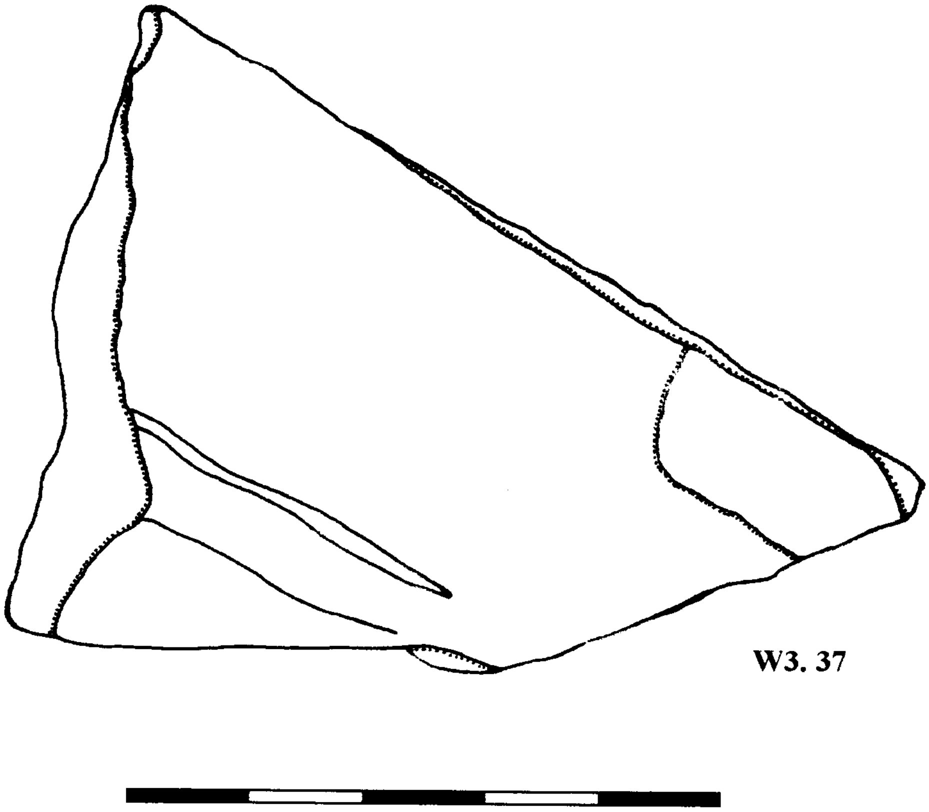


V8. 75

W2. 72

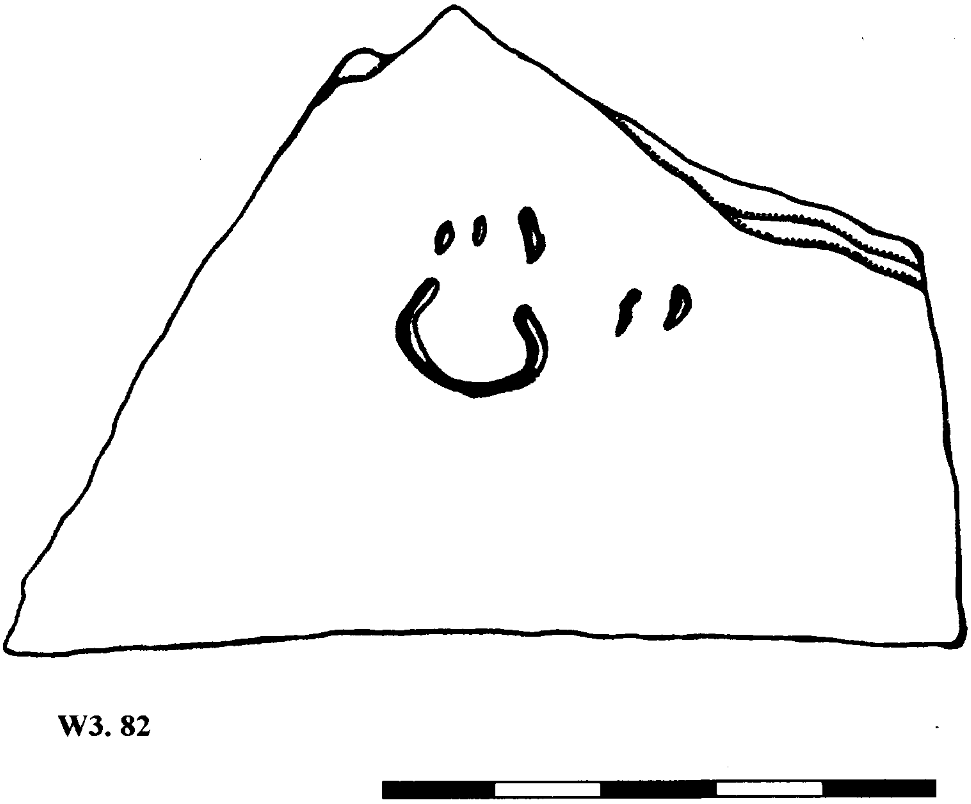
Fig.3m et 3n - Bois Laiterie. Plaquettes gravées.

W2. 75



W3. 37

Fig.3o et 3p - Bois Laiterie. Plaquettes gravées.



W3. 82

W9. 23

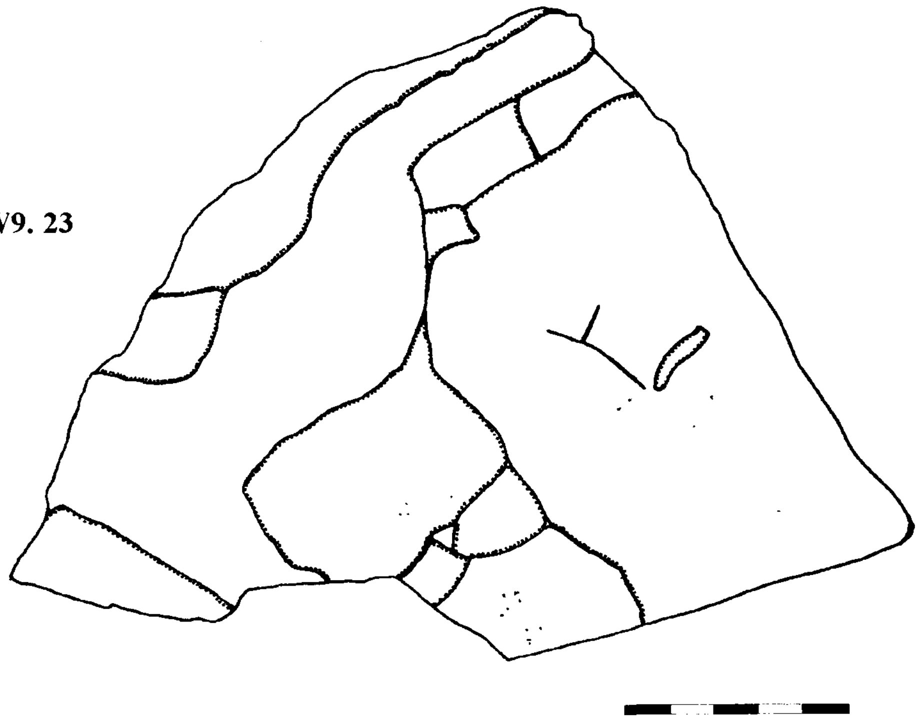


Fig.3q et 3r - Bois Laiterie. Plaquettes gravées.

TABLE 1b. Plaquettes gravées avec de légères traces colorées diffuses (Fig. 4a à 4c).

Carré	N°	Nature matière
U3	42	grès
U6	47	grès
V8	35	schiste

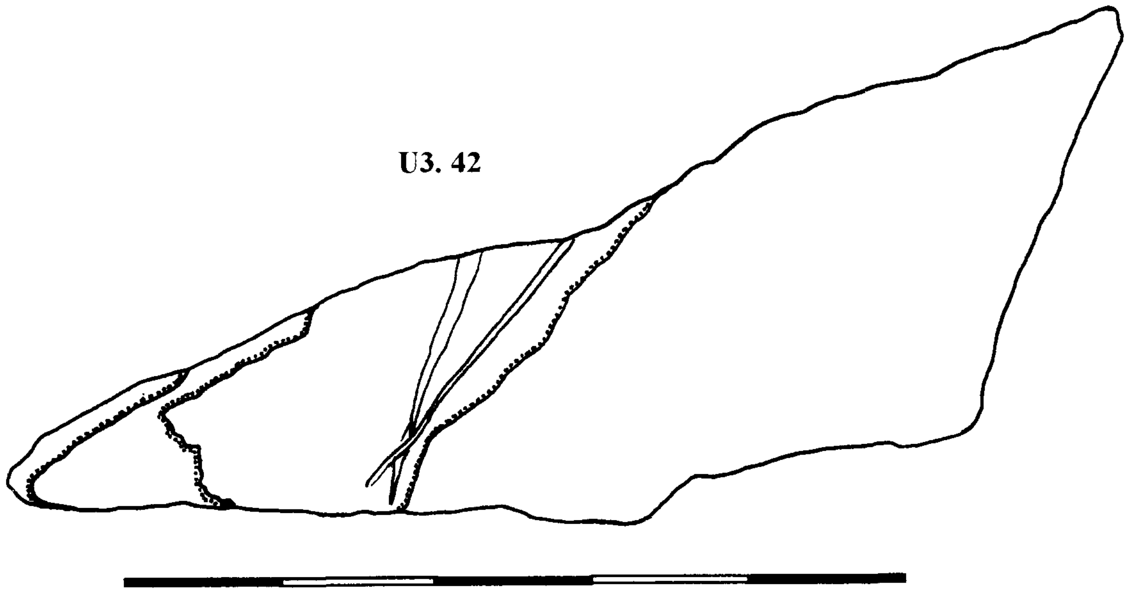
TABLE 1c. Plaquettes colorées (légères traces diffuses) (Fig. 5a à 5e).

Carré	N°	Nature matière	Description
S14	11	psammite	2 traces noire et rouille
S14	14	psammite	2 traces noires
V3	79	grès	traces rouges, brune, noire
W3	124	psammite	traces brune, noire, jaune
X10	3	psammite	oxyde de fer

3. Os longs d'oiseaux encochés

Le premier, trouvé dans le sondage 5 réalisé en 1990 (carrés U9-U10), consiste en un fragment mésial biseauté d'os long d'oiseau. Dans sa partie distale, on observe deux incisions parallèles et perpendiculaires à l'axe longitudinal de la pièce. Longues de 3,2 mm et large de 0,1 mm, ces incisions ont une profondeur de 0,1 mm et présentent une section en V à bords ébréchés. D'autres traits gravés sont également visibles sur la pièce mais il s'agit vraisemblablement de traces de désincarnation (Photo 2).

Quant au second, I. López Bayón (López Bayón *et al.*, 1997) considère qu'il s'agit d'un étui à aiguilles façonné sur un fragment de radius d'oie cendrée. Ce fragment d'os creux présente cinq encoches parallèles, perpendiculaires à l'axe longitudinal du tube et régulièrement espacées , bien que celle située à proximité de la fracture en double biseau soit un peu décalée par rapport à l'alignement des quatre autres. Ces traits dont la longueur varie de 3.1 à 3.7 mm, ont une largeur maximale de 0.2 mm et une profondeur d'environ 0.1 mm. Leur section, en V émoussé, a des bords nets. Les quatre encoches alignées sont incrustées d'ocre, ce qui fait dire à I. López Bayón qu'il pourrait s'agir d'encoches de blocage d'un fil ocré y ayant laissé une partie de son ocre, plutôt que d'un décor. En effet, la pièce ne possède pas d'autres traces ocrées (photo 3).



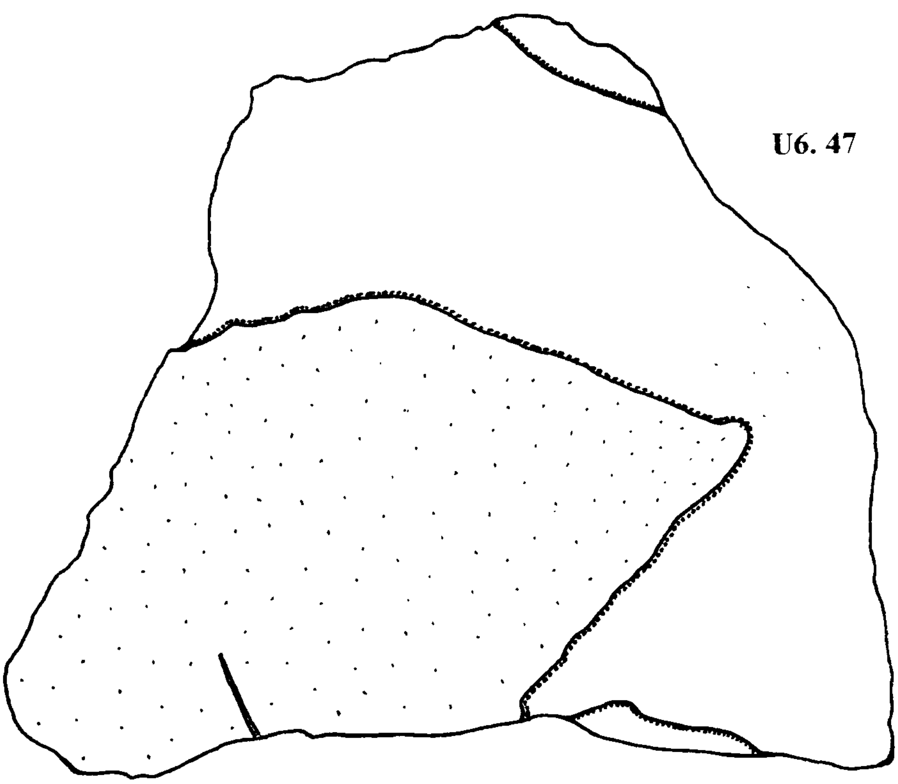
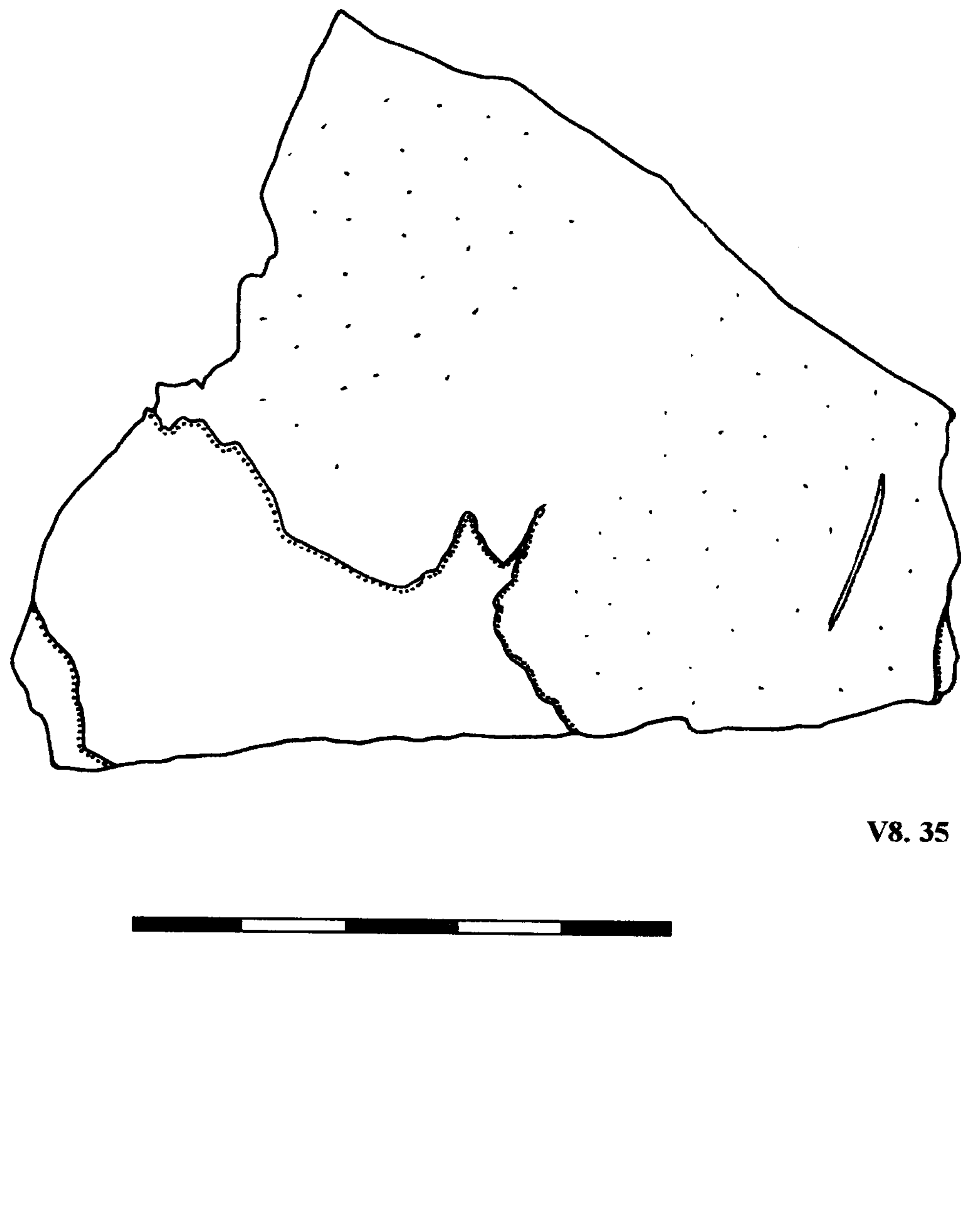
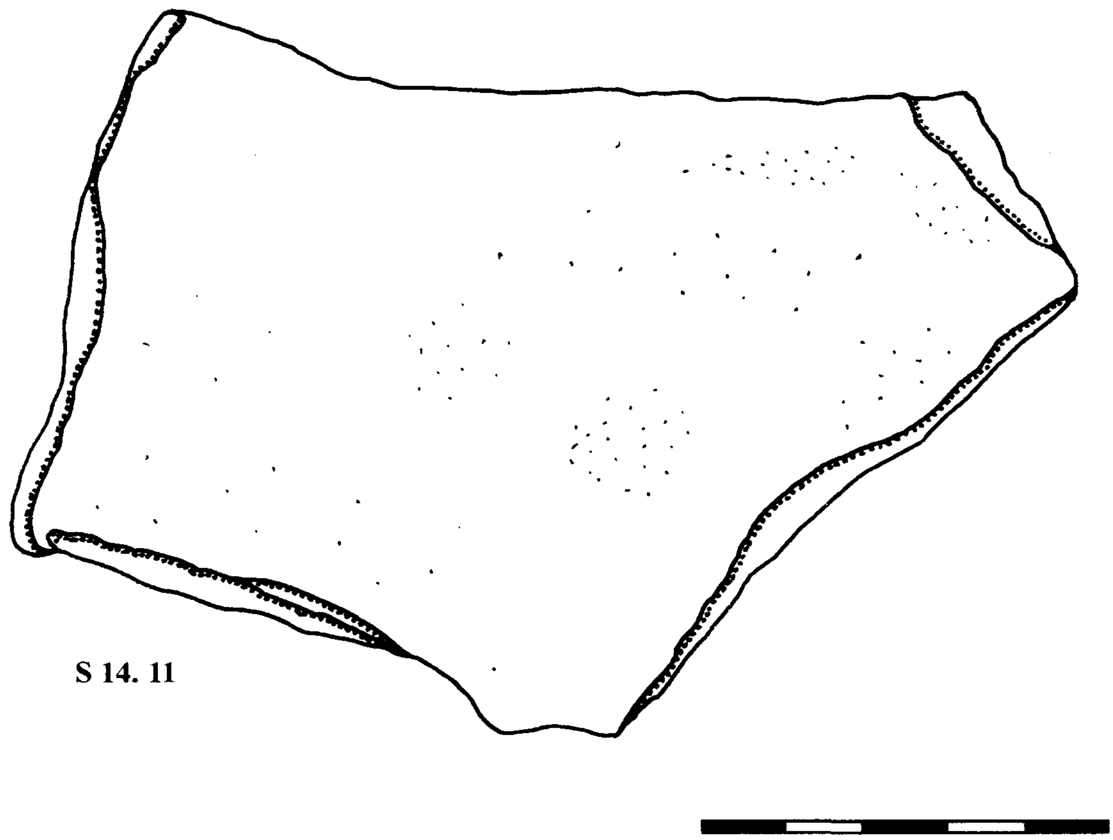


Fig.4a et 4b - Bois Laiterie, plaquettes gravées avec de légères traces colorées diffuses.

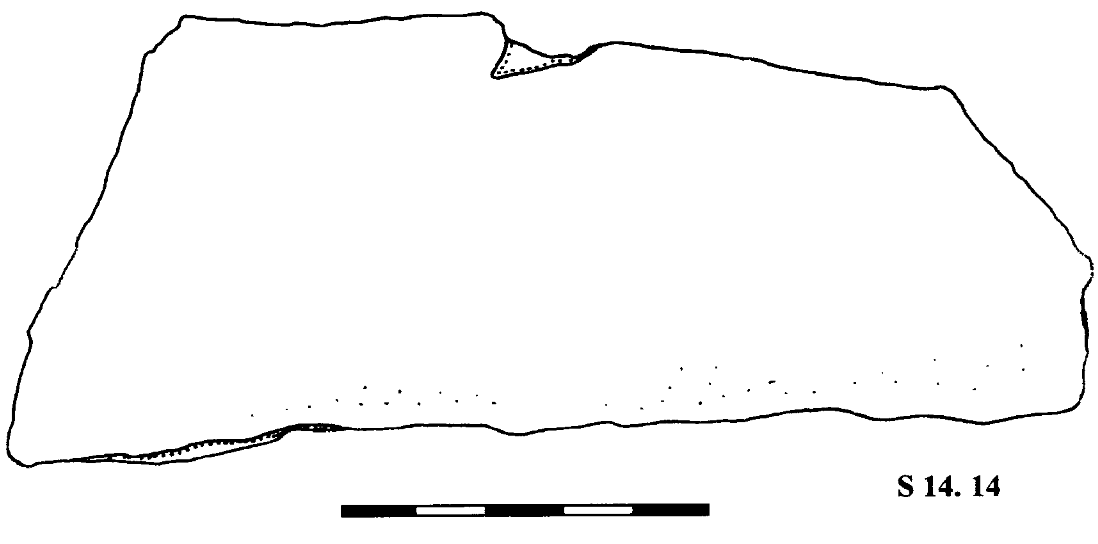


V8. 35

Fig.4c - Bois Laiterie, plaquette gravée avec de légères traces colorées diffuses.

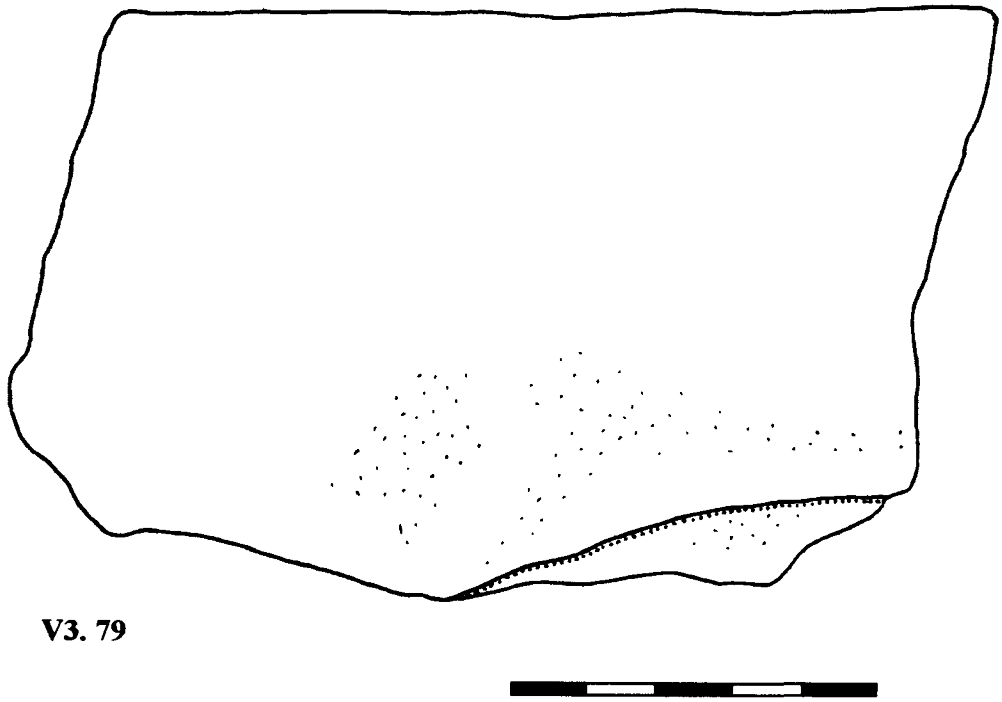


S 14. 11

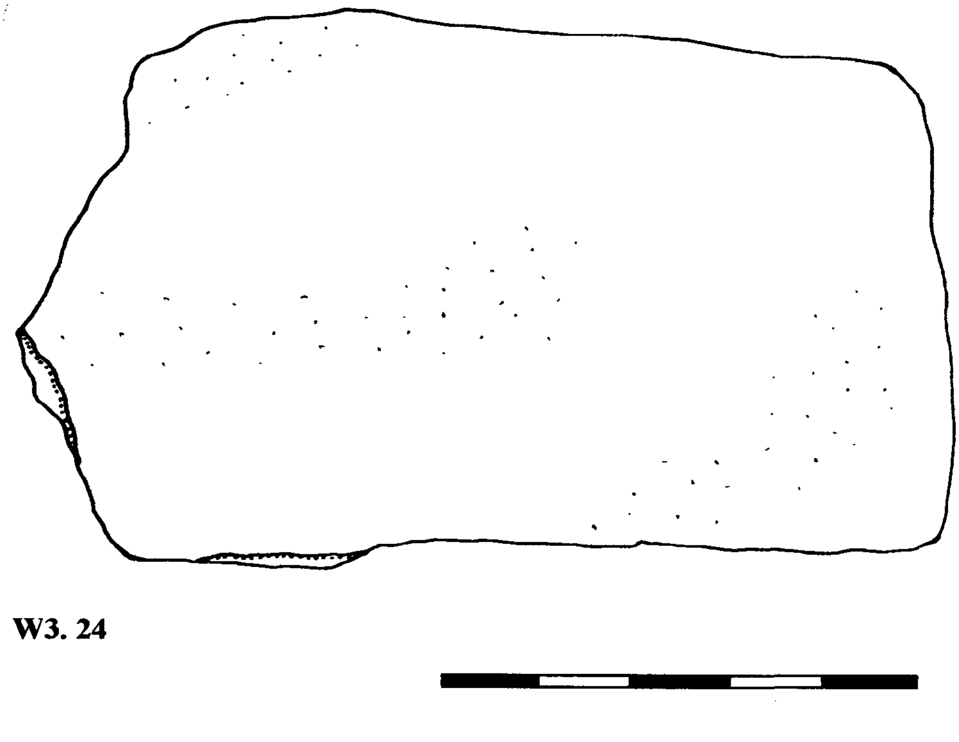


S 14. 14

Fig.5a et 5b - Bois Laiterie, plaquettes colorées (légères traces diffuses).

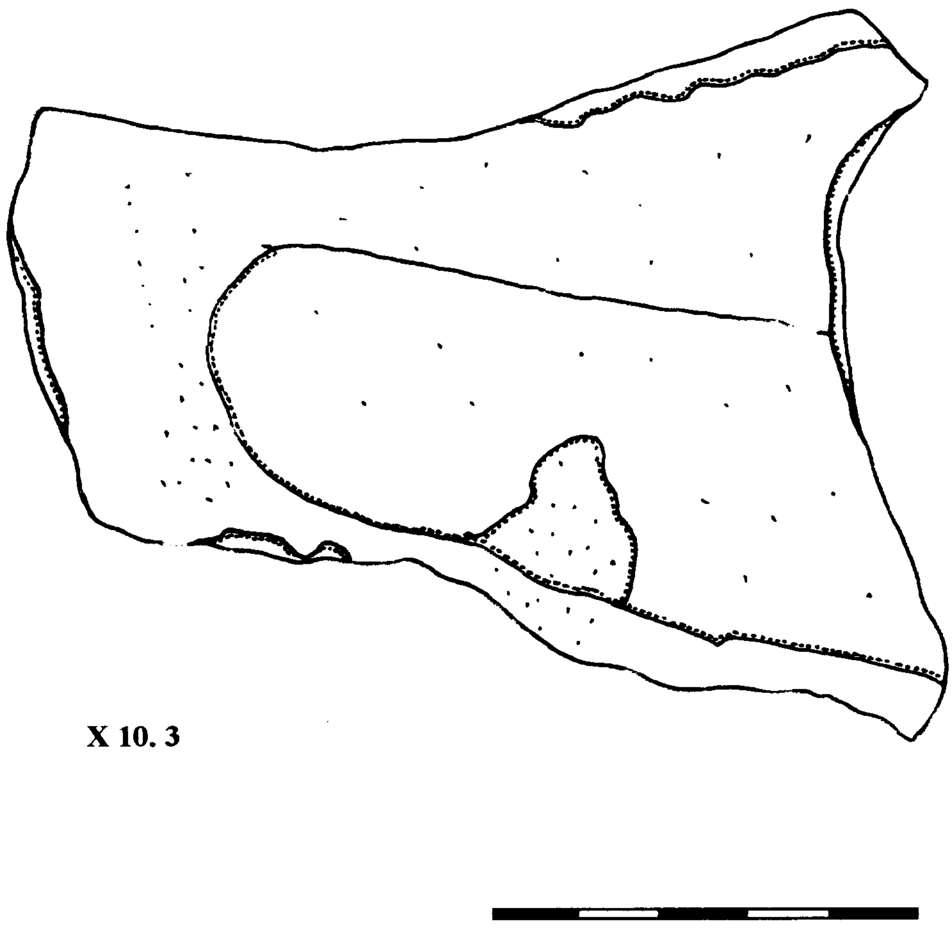


V3. 79



W3. 24

Fig.5c et 5d - Bois Laiterie, plaquettes colorées (légères traces diffuses).



X 10. 3

Fig.5e - Bois Laiterie, plaquette colorée (légères traces diffuses).

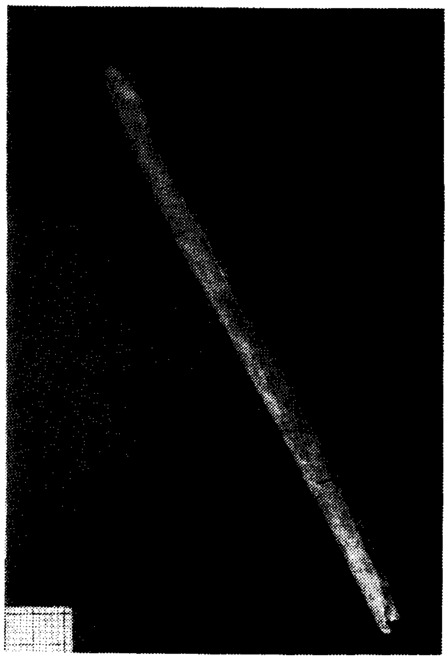


Photo 2 - Bois Laiterie. Os long d'oiseau incisé et biseauté (cliché Y. Hanlet)

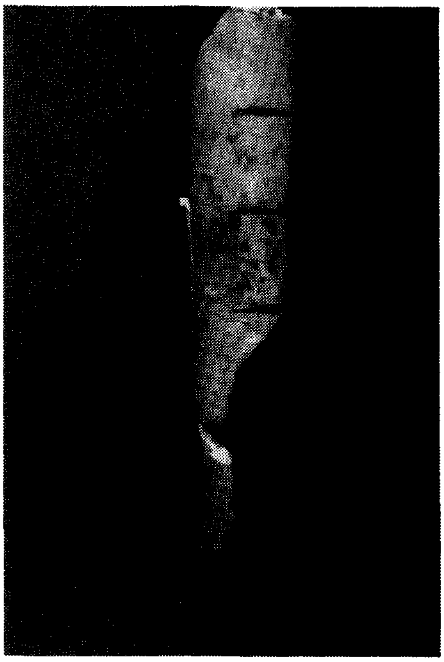


Photo 3 - Bois Laiterie. Fragment mésial d'os long d'oiseau encoché (cliché Y. Hanlet)

4. Les coquilles tertiaires perforées.

Parmi les huit coquilles fossiles provenant vraisemblablement de dépôts tertiaires du Bassin Parisien (Lozouet et Gautier, 1997), cinq possèdent une perforation d'origine anthropique, transformant ainsi la pièce en éventuel objet de parure à suspendre. Elles appartiennent aux espèces *Bayania lactea* (4) (photos 4 et 5), *Sigmesalia* sp. (1) (photos 6 et 7) et *Terebralia bidentata* (1) (photos 8 et 9). Les perforations, dont le diamètre varie de 1 à 2 mm, sont obtenues par polissage et entourées d'une plage polie due à l'abrasion (*Bayania lactea* et *Sigmesalia* sp.). Quant à la perforation de *Terebralia bidentata,* elle a été réalisée par pression.

Comparaisons

Si la couche magdalénienne de la grotte du Bois Laiterie nous a livré des plaquettes gravées, des os longs d'oiseaux encochés et des coquilles tertiaires perforées, d'autres sites belges en possèdent également (Trou de Chaleux, Trou du Frontal, Grotte du Coléoptère,...), de même que certains sites étrangers, relativement proches (Roc-la-Tour, Gönnersdorf). Quant aux « perles » en pierre, elles font plutôt figure d'exception. Nous en avons toutefois trouvé dans le site de Gönnersdorf (Magdalénien final).

Conclusion

L'examen des quelques témoins d'art mobilier trouvés dans la grotte du Bois Laiterie («perle» en grès perforée, os longs d'oiseaux encochés, coquilles tertiaires perforées et plaquettes en pierre gravées), montre qu'ils correspondent bien à ceux livrés par d'autres sites belges et étrangers possédant un contexte magdalénien final.

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Photo 4 - Bois Laiterie. Deux *Bayania lactea* perforées (cliché Y. Hanlet)

Photo 5 - Bois Laiterie. *Bayania lactea,* détail de la perforation (cliché I. López Bayón).

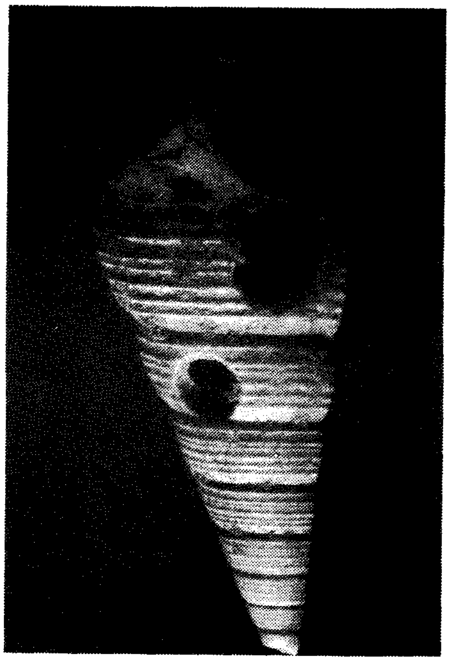

Photo 6 - Bois Laiterie. *Sigmesalia sp.*,
perforation naturelle et perforation anthropique.
(cliché Y. Hanlet)

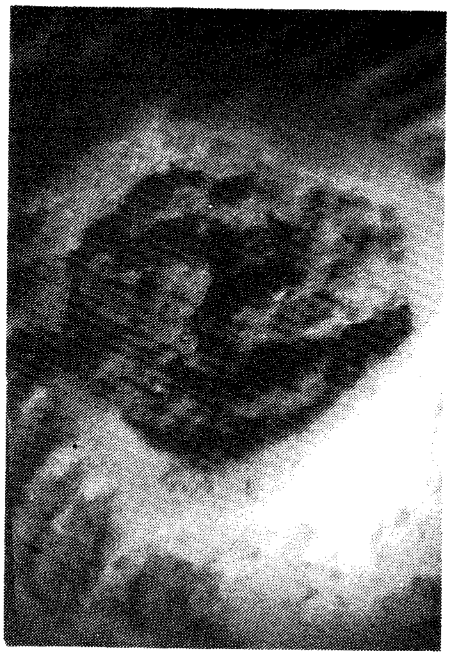

Photo 7 - Bois Laiterie. *Sigmesalia sp.*, détail de la perforation anthropique
(cliché I. López Bayón).

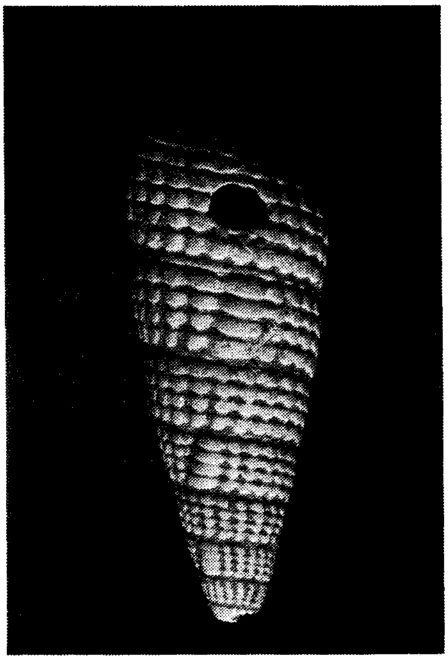

Photo 8 - Bois Laiterie. *Terebralia bidentata* avec perforation anthropique. (cliché Y. Hanlet)

Photo 9 - Bois Laiterie. *Terebralia bidentata,* détail de la perforation anthropique (cliché I. López Bayón).

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16

COQUILLAGES FOSSILES ET RESTES DE "BRIQUET" DANS LA GROTTE DU BOIS LAITERIE

P. Lozouet et A. Gautier

Le site a livré quelques mollusques marins cénozoïques se distribuant en cinq espèces dont quatre gastéropodes et un bivalve.

- *Bayania lactea* (Bruguière, 1789) (Eocène du Bassin de Paris, photo 1):

  couche BSC, U4a, N° 79 : un fragment des premiers tours de spire;
  couche BSC, V4c, N° 62.1 : un exemplaire perforé pour parure;
  sondages Lacroix (TT) : deux exemplaires perforés pour parure (López Bayón *et al.*, 1996).

- *Sigmesalia* sp. (Eocène du Bassin de Paris, photo 2):

  couche YSS, T7b : un exemplaire perforé de deux trous. L'un est naturel et a été effectué par un gastéropode perçeur (Naticidae ou Muricidae) l'autre est d'origine anthropique.

- *Terebralia bidentata* (Defrance, 1832) (Miocène, photo 3):

  couche YSS, V3b, N° 98 : un exemplaire perforé pour parure.

- *Glycymeris pulvinata* (Lamarck, 1805) (Eocène du Bassin de Paris, photo 4):

  contact « base de old backdirt et sommet de YSS », U10, N° 2.1 : une valve.

- *Campanile giganteum* (Lamarck, 1804) (Eocène du Bassin de Paris, photo 5):

  couche YSS, V8a, N° 27 : un gros fragment (longueur : 125 mm) d'un individu particulièrement usé, portant plusieurs perforations, sans doute naturelles. Il est toutefois probable que les perforations de la base aient été modifiées par l'homme.

La plupart des fossiles sont d'âge paléogène et ont été récoltés dans les niveaux de l'Eocène moyen du Bassin de Paris (étage lutétien?). La provenance précise de ces coquilles est impossible à établir car il s'agit de fossiles particulièrement communs. Les sites de récoltes se situent dans un rayon d'environ 100 kilomètres autour de Paris. A noter que *Bayania lactea* est signalée en région parisienne dans le site magdalénien supérieur de Verberie (Oise) tandis que *Campanile giganteum* est recensé dans le magdalénien d'Etiolles (Essonne) (Taborin, 1993). Ces coquillages de l'Eocène de la région parisienne étaient assez largement diffusés comme l'atteste leur présence dans différents abris ou grottes paléolithiques du quart est de la France (Yonne, Côte-d'Or, Doubs, Haute-Marne, etc.) (Taborin,1993).

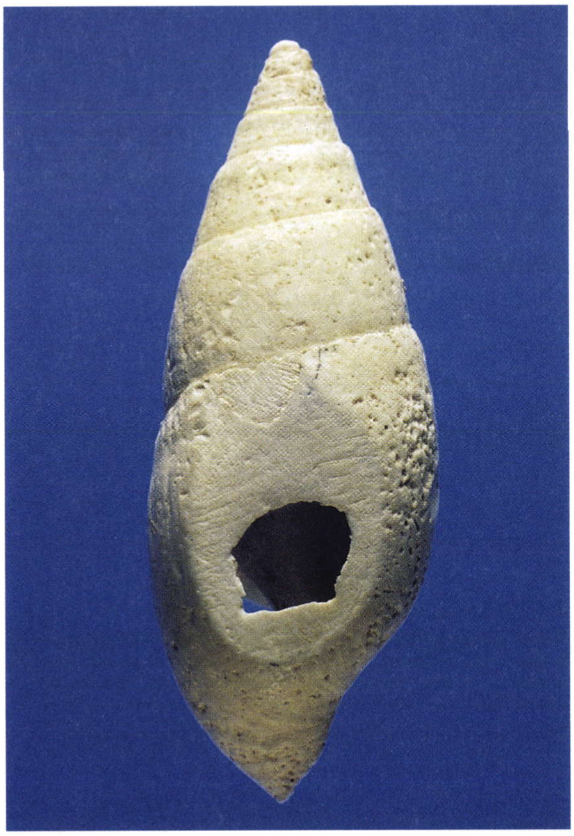
L'espèce *Terebralia bidentata* peut avoir plusieurs provenances depuis l'Europe centrale (domaine de la Paratéthys) jusqu'au Bassin d'Aquitaine. De Belgique, le premier point de récolte et le plus plausible est le Bassin de la Loire.

A ce lot nous avons ajouté trois coquillages fossiles recueillis sur le site de Goyet. Il s'agit de deux valves de *Polymesoda convexa*, dont une cassée, et un gastéropode *Granulolabium plicatum* (Bruguière, 1792). Ces deux espèces sont très communes dans les dépôts de l'Oligocène de la région de Tongres (Sables de Vieux-Joncs, Sables de Bautersen) dont ils proviennent vraisemblablement. Ces coquillages furent découverts à Goyet lors de fouilles en 1952 par Louis Eloy. L'industrie appartient au Gravettien et est datée d'environ 24,000 B.P. (M. Otte, comm. pers.). Ces trouvailles ont été inclues, parce qu'elles indiquent clairement que les paléolithiques occupant le territoire belge avaient accès à des gisements plus proches que ceux dont proviennent les coquillages de Bois Laiterie. Une analyse approfondie des mollusques étrangers, découverts dans les divers sites belges du Paléolithique supérieur, pourrait fournir des précisions sur les modalités de recolte et d'échange de ces objets.

Les fouilleurs ont aussi recueillis quelques fossiles paléozoïques. Il s'agit de six restes d'un stromatoporoïde, de coraux (*Rugosa*, *Tabulata*) et d'un gastéropode. Ces fossiles fragmentaires et peu "attrayants" sont dérivés des calcaires frasniens dans laquelle la grotte fut creusée. Ils n'ont aucun rapport direct avec l'occupation humaine et appartiennent à la catégorie taphonomique des intrusions remaniées (*sensu* Gautier, 1987).

Signalons encore quatre fragments provenant d'un nodule de pyrite (couche YSS, W10, N° 6.6), à structure fibro-radiée et dont la surface est fortement emoussée; le diamètre du nodule complet complet s'estime à quelque 4 cm.

Trois rognons comparables furent mis à jour dans le Magdalénien du Trou de Chaleux, dont un présente un sillon profond résultant de percussions répetées (Perles, 1977, p.32-34; Otte 1994, p.41-44). Un fragment de pyrite provenant de Laussel (Dordogne) présente des striés également attribuées à la percussion répetée. Dans quelques autres grottes, en France et en Allemagne, des fragments ont été découverts (Perles, *ibid.*), apparemment plus ou moins semblables à ceux de Bois de Laiterie. Tous ces restes sont considérés comme les premiers témoignages de l'utilisation de pyrite comme "briquet". Quant à leur provenance, on observe fréquemment des concrétions *in situ* dans les dépôts de craie du Crétacé d'Europe Occidentale; ils ont une surface hérissée de pointes en raison de leur structure interne fibro-radiée. L'érosion et l'abrasion sur la plage ou par le transport fluviatile les transforment en rognons à surface émoussée. Jusqu'à maintenant aucune étude a permis de retracer l'origine de ces "briquets" paléolithiques. Ceux de la Belgique pourraient provenir du Bassin de Mons, mais des provenances plus lointaines (le Boulonnais, par exemple) ne sont pas exclues (Ch. Dupuis, comm. pers.)



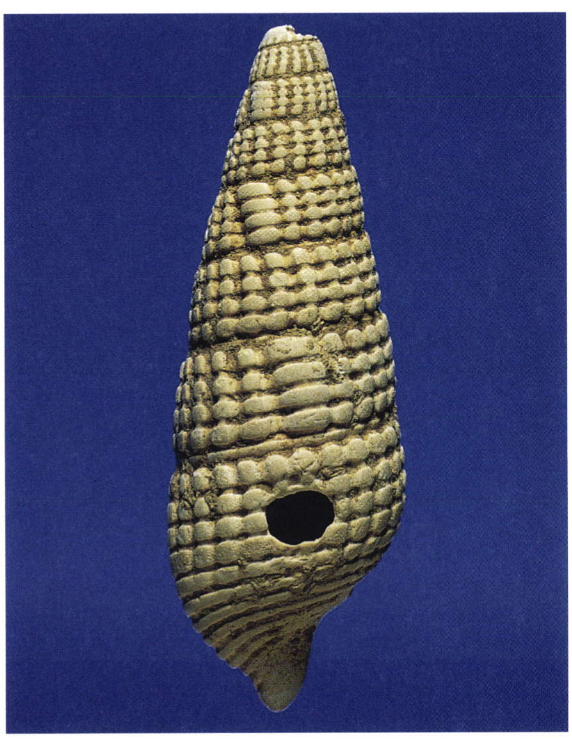


Photo 1 - *Bayania lactea* (Test trench, L: 21.0 mm). Photo 2 - *Sigmesalia* sp. (YSS, L: 18.5 mm). Photo 3 - *Terebralia bidentata* (YSS, l: 43.0). Photo 4 - *Glycymeris pulvinata* (contact de la base de l'ancien remblais et sommet de la couche YSS, L: 21.0, l:22.0).

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Photo 5 - *Campanile giganteum*, (YSS, L: 125.0 mm).

17

ANALYSE TRACEOLOGIQUE DU MATERIEL LITHIQUE DE LA GROTTE DU BOIS LAITERIE.

P. Jardón Giner.

Introduction

Cette étude concerne un échantillon du matériel lithique issu des campagnes de fouilles de 1994 et 1995 au Bois Laiterie. Il s'agit de 129 pièces, pami les «moins» visiblement patinées au moment de leur découverte. L'ensemble est composé de matériel informe de taille (36 éclats et restes de taille, 30 lames ou fragments de lame et 14 lamelles ou fragments lamellaires non retouchés), comme de matériel retouché (7 burins sur troncature retouchée, 2 burins dièdres, un burin double mixte, 1 chute de burin, 5 grattoirs simples, un grattoir double, 11 lamelles à dos, 16 pièces avec rétouches partiels, 1 perçoir, 3 pointes, un apex trièdre, un fragment de façonnage de lamelle à bord abattu et une troncature).

Etat de la collection

L'état général de cette industrie peut être classifié comme d'altération intense. Les pièces sont en grand partie patinées en blanc, et dans le cas où il y a absence de patine il existe une détérioration microscopique des bords et des arètes.

Etant donné cet situation d'altération générale, l'analyse microscopique des traces est déconseillé, parce que l'intensité de l'altération naturelle est plus extrême que les traces d'utilisation resultant de l'activité humaine. Cependant nous avons décidé de selectionner 24 pièces pour évaluer l'intensité de l'altération et bannir la possible existence de fractures ou encoches attribuables à des actions déterminées.

Résultats

On documente les activités suivantes (voir tab. 1):

a) - Coupe de matières tendres. Utilisation vraisemblablement déterminée par la concentration, la forme et la distribution des encoches sur le bord coupant. Certains éclats et lames. (références U4-60, V4-154, V3-101, V4-40, V4c-71, V4d-77 et V4-83).

REFERENCE	TYPOLOGIE	UTILISATION	ZONE D'USE	TYPE DE TRACES D'USURE	ACTION	MATERIAUX TRAV.	AUTRES TRACES	ALTERATION
W3c-64	burin sur troncature	oui	facette de burin	micro-enlévements	grattage	matière dure		patiné
W3c-41	burin sur troncature	non					stries de percussion	patiné
W2-59	burin sur troncature	oui	trièdre de burin	micro-enlévements et polie	rainurage	matière dure		patiné
U3-28	burin sur troncature	oui	trièdre de burin	usure importante	rainurage	matière dure abrassive		usure des arêtes
U4-102	burin sur troncature	?					stries de percussion	patiné
U5-80	burin sur troncature	?						patiné
U4-56	troncature	?						patiné
U13a-10	troncature	?					stries de percussion	patiné
V8d-45	burin dièdre	oui	facette de burin	micro-enlévements	grattage	matière dure		patiné
W8c-6	burin dièdre double	oui	facette de burin	micro-enlévements	grattage	matière dure		patiné
W4a-28	pointe	oui	pointe	micro-enlévements	impact ?			patiné
U5-65	pointe	oui	pointe	micro-enlévements	impact ?			patiné
S6c-26	grattoir	oui	front	usure intense	grattage	?		patiné
U5-77	grattoir double	oui	front (+ étroit)	usure légère	grattage	?		patiné
W2-60	grattoir	?						patiné
V9-4	grattoir	?						patiné
V3b-108	lamelle à bord abattu	oui	bord lat. gauche	micro-enlévements	impact ?			légerèment brillant
X2c-18	lame	?	bord lat. droit	micro-enlévements	?	?		légerèment brillant
V5-micromorf.	fragment de lame	?						usure des arêtes
V4-140	lamelle à retouches part.	?						patiné
U4-113	lame	?	bord lat. gauche	micro-enlévements	?			patiné
T4b-39	lame à crête part.	?	bord lat. gauche	micro-enlévements	?			usure des arêtes
V7-78	perçoir	oui	apex	micro-enlévements	perforation	?		patiné
U4-106	pointe	?						patiné

Tab.1- Bois Laiterie. Résultat de l'analyse tracéologique.

b) - Grattage de matière dure. (références W8c-6, W3c-64, V8a-45).

c) - Rainurage de matière dure abrassive (U3-28).

d) - Rainurage de matière dure (W2-59).

Parmi les grattoirs étudiés seul un des fronts (appartenant au grattoir double) possede de traces d'une usure plus intense. Ces exemplaires ont été utilisés pendant peu de temps après le dernier reavivage. L'un d'eux, par leur morphologie denticulée, n'était pas apte pour le travail de tannerie, regulièrement associé à cet type d'outil.

Les microtraces d'impact observées sur les pointes de projectile sont trop ténues et nous ne croyons pas qu'elles aient rendu ces outils inutilisables pour une application postérieure.

Ils n'existent pas de restes de taille à l'exception d'un fragment de nucléus (W9a-14), une crète (V3b-40), une tablette (U4-43), un flanc (W2-22) et trés probables éclats de réavivage du plan de frappe (V'-33, V4-19a, V4-116).

Il y a quelques fragments de lamelles à bord abattu en processus de faconnage (W3-77, U4-77, V3-92, V3-103).

L'information tracéologique que l'on obtient à partir des exceptionnelles traces conservées (micro-impacts et usure) est rare et peu représentative. Malgré tout, la composition de l'ensemble et son utilisation probable permettent détacher quelques considerations sur le comportement téchnologique qui peuvent être utiles pour la compréhension fonctionelle de l'occupation.

18

IMMUNOLOGICAL ANALYSIS OF LITHIC ARTIFACTS

M. Newman

In recent years there has been an increased use of molecular, biomolecular and biochemical techniques in the analysis of archaeological materials. Immunological methods have been used to identify plant and animal residues on flaked and groundstone lithic artifacts (Downs, 1985; Hyland *et al.*, 1990; Kooyman *et al.*, 1992; Newman, 1990; Newman and Julig, 1989; Yohe *et al.*, 1991). Plant and animal residues on ceramic artifacts have been identified by their amino acid sequences (Broderick, 1979) and by analysis of lipid and fatty acids (Fredericksen, 1988; Heron *et al.*,1991; Hill *et al.*, 1985) while serological methods have been used to determine blood groups in skeletal and soft tissue remains (Heglar, 1972; Lee *et al.*, 1989) and in the detection of hemoglobin from 4,500-year-old bones (Ascenzi *et al.*, 1985). Human leukocyte antigen (HLA) and deoxyribonucleic acid (DNA) determinations made on human and animal skeletal and soft tissue remains have demonstrated genetic relationships and molecular evolutionary distances (Hansen and Gurtler, 1983; Lowenstein, 1986; Pääbo, 1985, 1986, 1989; Pääbo *et al.*,1989). It has become evident that data obtained from these analyses can contribute valuable information to archaeologists - information that cannot be obtained by other means.

Several immunological methods have been utilized in the analysis of archaeological materials including Ouchterlony (Downs, 1985), cross-over immunoelectrophoresis (CIEP) (Barr, 1989; Newman, 1990), radioimmunoassay (Lowenstein, 1980, 1986) and enzyme immunoassay (Hyland and Anderson, 1990, Hyland *et al.*, 1990). These methods differ only in degrees of sensitivity with Ouchterlony being the least and RIA as the most sensitive. However the use of RIA is limited to a facility and person(s) licensed for nuclear medicine. Immunological techniques were first used in medico-legal work in the early 1900s and despite some dissenters at this time (Gaensslen, 1983, p.223) have continued to play an integral role in forensic medicine. Although the application of these techniques to archaeological materials has been questioned, literature reviews of forensic studies (Arquembourg, 1975; Haber, 1964; Gaensslen, 1983; Lee and DeForest, 1976; Macey, 1979; Sensabaugh *et al.*, 1971, among others), demonstrate that old and denatured bloodstains will still result in a positive precipitin test (Gaensslen, 1983, p.225). While these studies generally deal with relatively recent stains, at least in comparison to the age of most archaeological materials, it has been shown that various efforts to remove bloodstains from clothing or other materials, using solutions such as bleach, harsh detergents or boiling, are generally unsuccessful (Gaensslen, 1983, p.225; Lee and DeForest, 1976). Species identification has also been made on tissues recovered from a sewer (Milgrom and Campbell, 1970) and on body tissues (Bjorklund, 1952; Milgrom *et al.*, 1964). Chemicals present in soils such as tannic acid, aluminum chromate or organic solvents may result in non-specific precipitation of antiserum (*i.e.*, false positive). However, routine testing of site soils indicates the presence of substances that may interfere with artifact analysis, thus validating these tests.

One of the pioneers in the field of forensic medicine was George Nuttall. During the course of his studies he carried out the most extensive testing of antisera in order to determine the relatedness of animals (Nuttall, 1901a, 1901b, 1904). In this work, more than 16,000 precipitin tests were carried out on over 500 animal species, which included mammals, birds, reptiles, and fish. When one considers that these experiments were carried out nearly 90 years ago, it is a truly remarkable piece of work and, moreover, has been substantiated to a great extent by recent work in molecular evolution. It is interesting to note that many of the problems and sources of error experienced by Nuttall and other researchers are still applicable today. Such problems as the strength and reliability of anti-sera, the pH of the medium, bacterial contamination, the difficulty of re-solubilizing dried blood, and the fact that blood heated over 100°C will not give a positive reaction often occur today as they did in the past (Nuttall, 1904). However, he also noted : «The fact that dried bloods give reactions after the lapse of a considerable time, months, or even years has been fully established by Uhlenhuth and confirmed by others» (Nuttall, 1904, p.120).

Materials and Methods

The method of analysis used in this laboratory is cross-over electrophoresis (CIEP). Minor adaptations to the original method were made following procedures used by the Royal Canadian Mounted Police Serology Laboratory, Ottawa (1983) and the Centre of Forensic Sciences (Toronto). Although this test is not as sensitive as RIA, it has a long history of use in forensic laboratories, does not require expensive equipment, is reasonably rapid and lends itself to the processing of multiple samples (Culliford, 1964). In this test the antigen and antibody are driven together by an electrophoretic force instead of simple diffusion as in the Ouchterlony test. The test is performed in agarose gels with a pH of 8.5, by this the antigen is positively charged and the antibody is negatively charged. Paired wells, roughly 1.5 mm. in diameter are punched in the agarose gel approximately 5 mm. apart. The antigen (unknown extract) is placed in the cathodic well of the pair and the anti-serum in the anodic one. The gel is placed in an electrophoresis tank containing a barbital buffer, pH 8.6, and triple thicknesses of filter paper are used as wicks to connect the ends of the slides with the buffer. The application of an electrical current, set at a constant 100v, moves the two towards each other. If the unknown sample contains protein corresponding to the species antiserum against which it is being tested, an extended lattice forms as a result of cross-linking, and a precipitate forms where they reach equivalence concentrations. Weak positive reactions, common in archaeological samples, are more readily observed if the gel is dried and stained with a protein stain, such as Coomassie Blue. Appropriate positive and negative controls, prepared in 5% ammonia solution, are run with each gel. These are: (a) *positive* - blood of species being tested for *e.g.*, deer blood for deer antiserum and (b) *negative* - blood of species in which antiserum is raised *e.g.*, rabbit if raised in that animal. Duplicate testing is carried out on all positive results.

The specific substances that are tested for in CIEP are immunoglobulins, or antibodies, a group of glycoproteins present in the serum and tissue fluids of all mammals (Roitt *et al.*, 1985). There are five known immunoglobulin groups in normal human serum, IgG (70-75%), IgM (10%), IgA (15-20%), IgD (<1%) and IgE (in trace amounts). IgA is the predominant immunoglobulin in serosecretions such as saliva, tracheobronchial secretions, colostrum, milk, and genito-urinary secretions (Roitt *et al.*, *ibid.*). These are present in varying amounts in all vertebrates, but are absent in invertebrates (Roitt *et al.*, *ibid.*).

Twelve flaked lithic artifacts recovered from the Grotte de Bois Laiterie, Burnot, Belgium, were submitted for potential identification of animal residues by immunological analysis. A control soil sample from the site was also sent for analysis. Possible residues were removed from the artifacts using a 5% ammonium hydroxide solution. This has been shown to be the most effective extractant for old and denatured bloodstains and does not interfere with subsequent testing (Dorrill and Whitehead, 1979; Kind and Cleevely, 1969). Artifacts were placed in shallow plastic dishes and 0.5mL of the 5% ammonia solution applied directly to each. Initial disaggregation was carried out by floating the dish and contents in an ultrasonic cleaning bath for two to three minutes. Extraction was continued by placing the boat and contents on a rotating mixer for thirty minutes. The resulting ammonia solutions were removed with a pipette, placed in individual numbered plastic vials and refrigerated prior to further testing. One milliliter (1 mL) of Tris buffer (pH 8.0) was added to approximately 1g of soil, mixed well and allowed to extract for 24 hours at $4^{\circ}C$ to prevent bacterial contamination. The resulting supernatant fluid was removed and tested against pre-immune serum only. Initial testing of all samples was carried out against pre-immune serum (*i.e.*, serum from a non-immunized animal). A positive result against pre-immune serum could arise from non-specific protein interaction not based on the immunological specificity of the antibody (*i.e.*, nonspecific precipitation). No positive results were obtained and testing of artifacts was continued against the antisera shown in Tab.1.

TABLE 1: Antisera used in analysis.

ANTISERA	SOURCE
anti-bear	Organon Teknika
anti-bovine	"
anti-cat	"
anti-chicken	"
anti-deer	"
anti-dog	"
anti-guinea-pig	"
anti-horse	"
anti-human	"
anti-pig	"
anti-rabbit	"
anti-rat	"
anti-sheep	"
anti-elk	University of Calgary

Antisera obtained from commercial sources are developed specifically for use in forensic medicine and, when necessary, these sera are solid phase absorbed to eliminate species cross-reactivity. However, these antisera are polyclonal, that is they recognize epitopes shared by closely related species. The relationship of animal antisera used to potential prey species identified is shown in Tab.2. The antiserum to elk, raised against modern species (*Cervus canadensis*) is species-specific.

TABLE 2: Relationship of animals to antisera used in analysis.

ANTISERA	MOST PROBABLE SPECIES
Bear	Grizzly, brown or black bear
Bovine	Cow, bison, musk-ox.
Cat	Bobcat, lynx, mountain lion, cat.
Chicken	Chicken, turkey, quail, grouse, pheasant.
Deer	Deer (all species), elk, moose, caribou, pronghorn.
Dog	Coyote, wolf, fox, dog.
Guinea-pig	Porcupine, squirrel, beaver.
Horse	Equids
Pig	Pig
Rabbit	Rabbit, hare, pika.
Rat	Rat (all species), mouse (all species).
Sheep	Sheep, goat.

Results

The results of CIEP analysis are shown in Tab.3 and discussed below.

A positive result to bovine antiserum was obtained on one artifact, a simple endscraper (T5-55). As shown in Tab.2, a positive result to bovine antiserum is obtained with bison, cow and musk-ox of the family Bovidae. Cross-reactions with other members of the family Bovidae or other unrelated families do not occur with this antiserum.

One artifact, an endscraper, (U7-10), tested positive to rabbit antiserum. As shown in Tab.2, other members of the Order Lagomorpha (rabbits, hares and pikas) could be represented by this result.

A positive result to pig antiserum was obtained on one artifact, an atypical perforator (U7-29.1). This antiserum has not been tested against Old World members of the Suidea family so species identification is not possible at this time.

No other positive results were obtained in this analysis. The absence of identifiable proteins on artifacts may be due to poor preservation of protein or that they were used on species other than those encompassed by the antisera. It is also possible that the artifacts were not utilized.

TABLE 3: Results of CIEP analysis.

Artifact #	Artifact type	Result
T5-22	Burin	Negative
T5-30	Burin	Negative
T5-55	Endscraper	Negative
T7-16.1	Endscraper	Bovine
U6-127	Burin	Negative
U6-132	Perforator	Negative
U6-149	Burin	Negative
U6-179	Azilian point	Negative
U7-10	Endscraper	Rabbit
U7-29.1	Perforator	Pig
U7-68	Burin	Negative
U10-6	Endscraper	Negative

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19

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 m^2 and the cave faces due north. The habitable area of Chaleux (also including its large terrace) is c.110 m^2 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*

Debris / Sites	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.

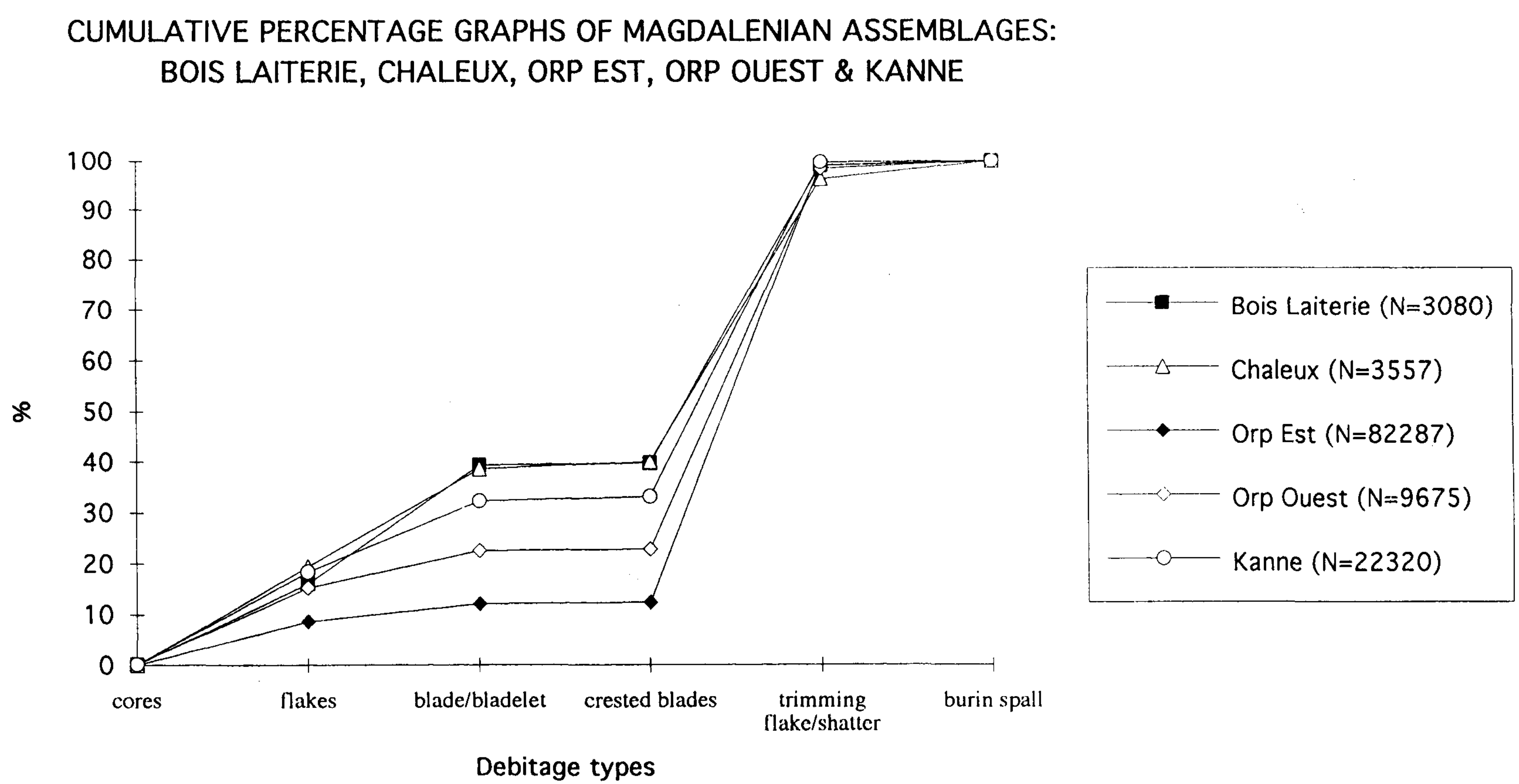

Fig.1 - Bois Laiterie, Chaleux, Orp and Kanne, cumulative percentage graphs of debris assemblages

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

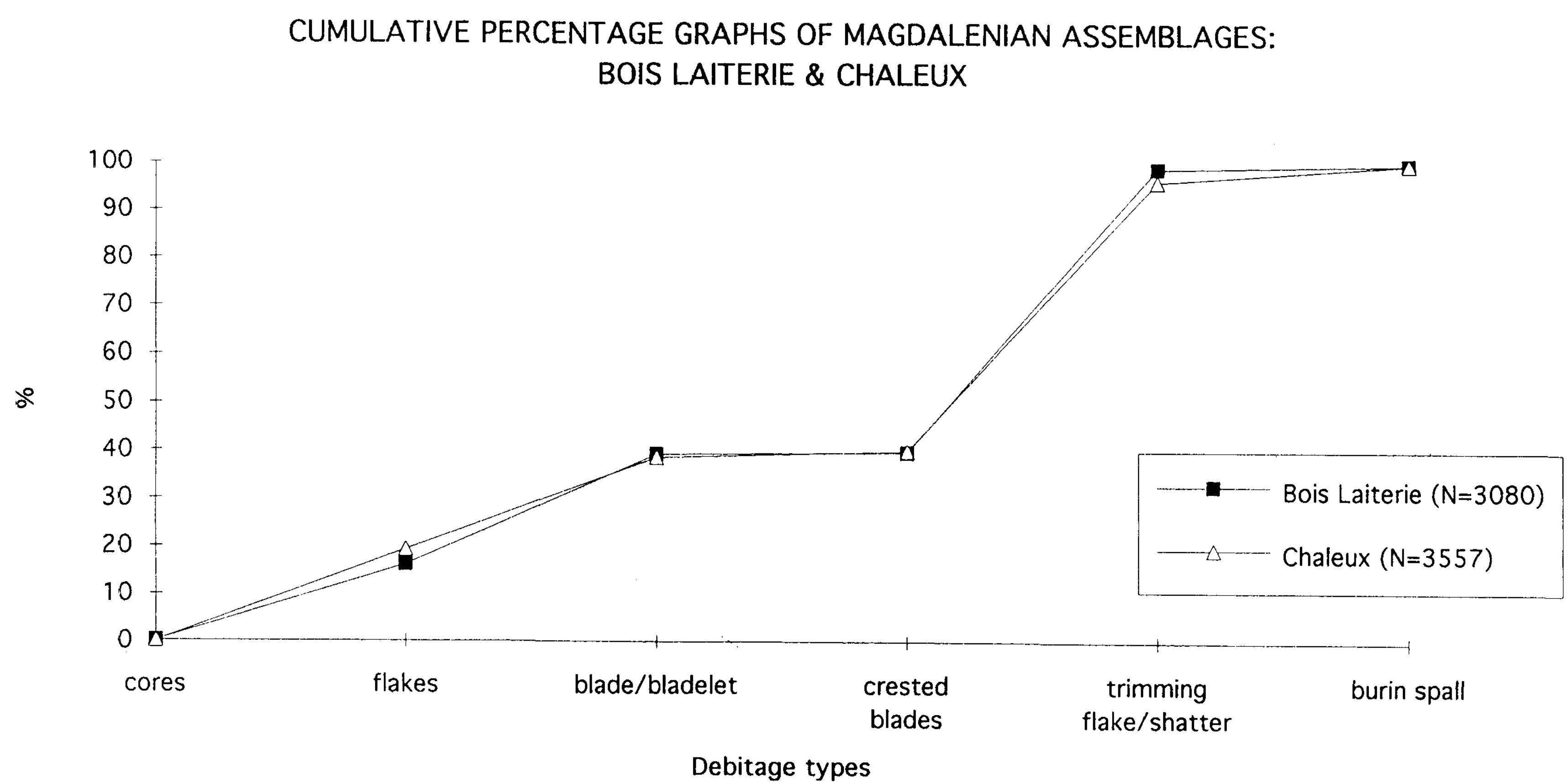

Fig.2 - Bois Laiterie and Chaleux, cumulative percentage graphs of debris assemblages.

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.

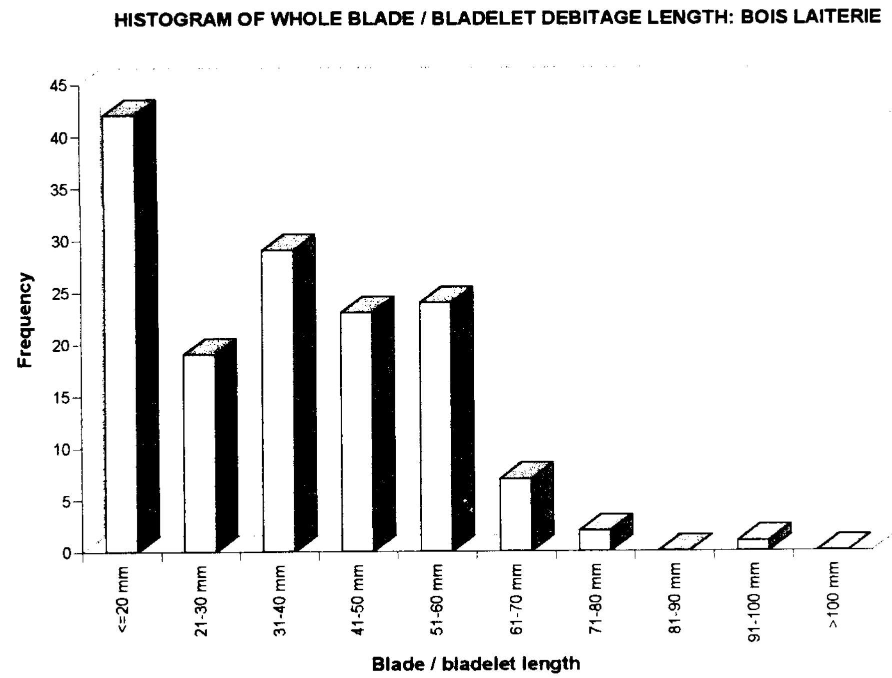

Fig.3a- Bois Laiterie, histogram of whole blade(let) lengths.

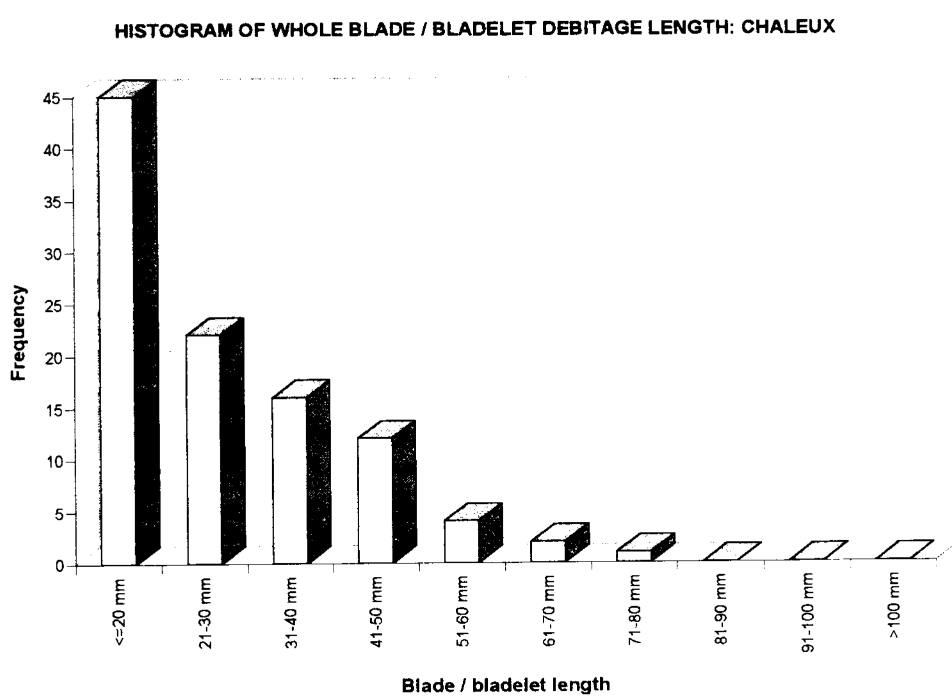

Fig.3b- Chaleux, histogram of whole blade(let) lengths.

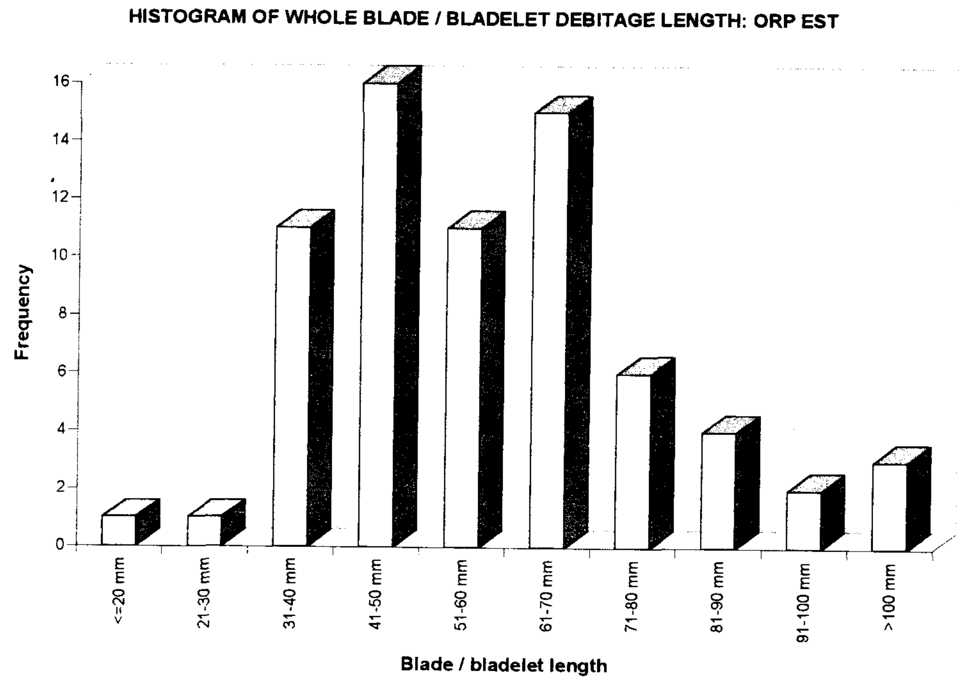

Fig.3c- Orp East, histogram of whole blade(let) lengths.

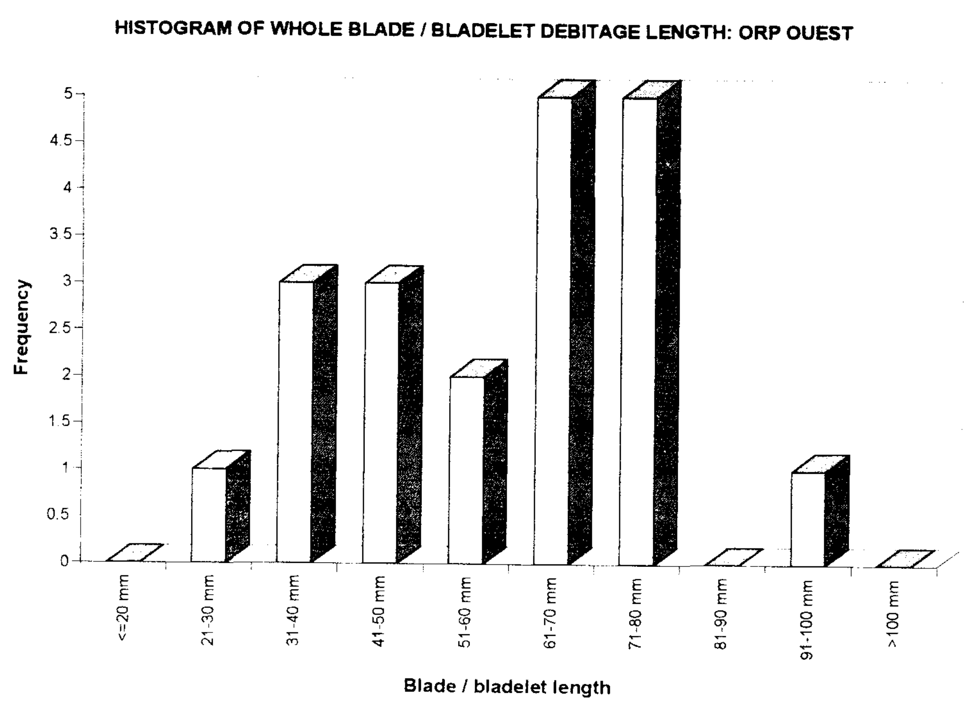

Fig.3d- Orp West, histogram of whole blade(let) lengths.

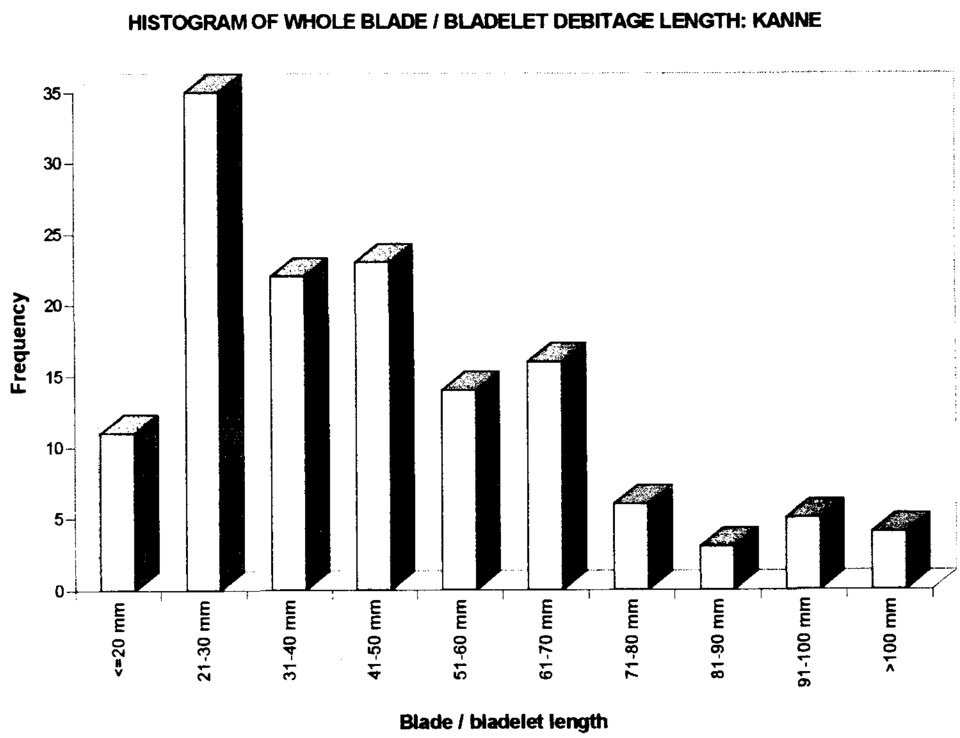

Fig.3e- Kanne, histogram of whole blade(let) lengths.

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

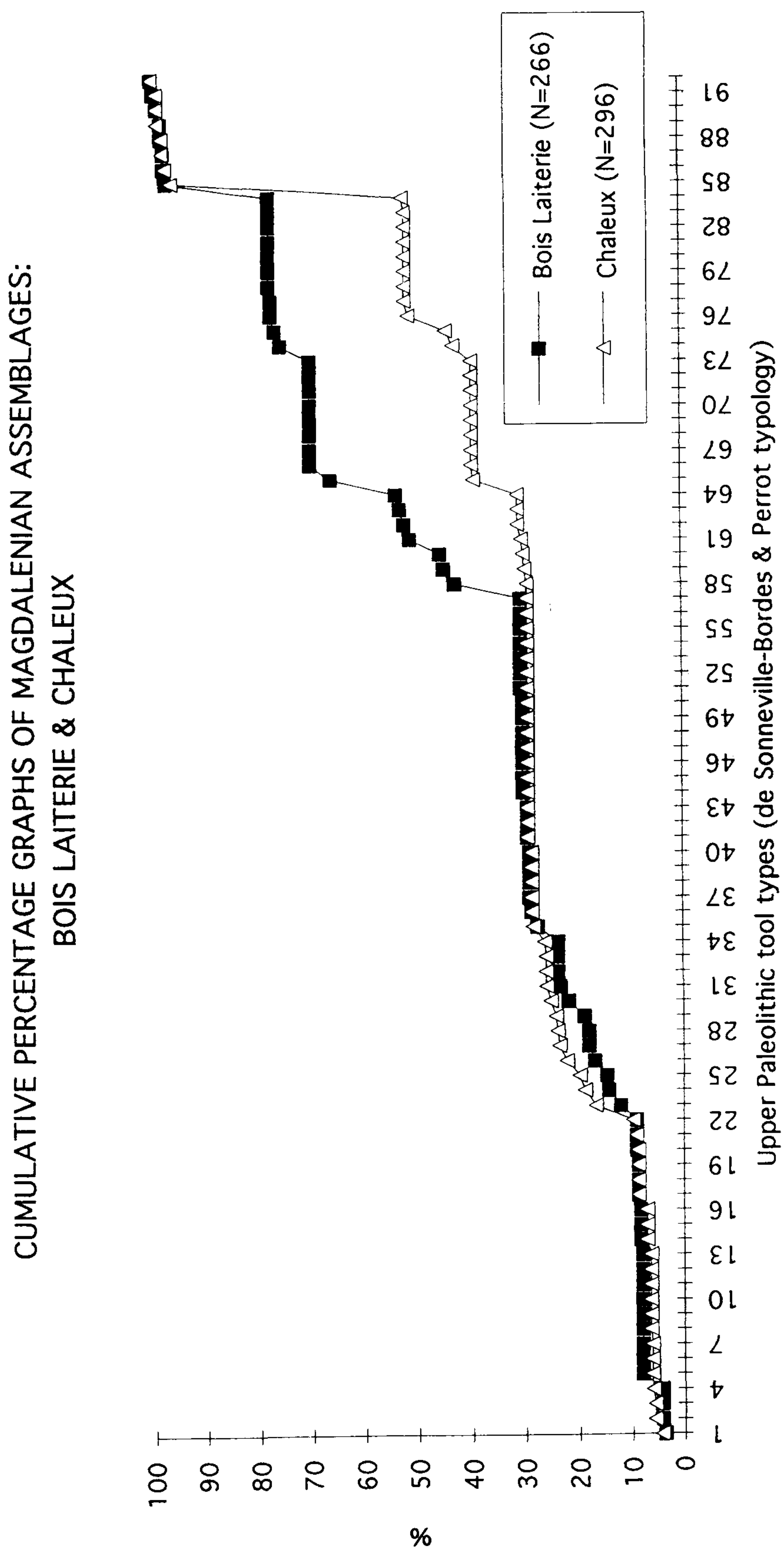

Fig.4 - Bois Laiterie and Chaleux, cumulative percentage graphs of tools assemblages.

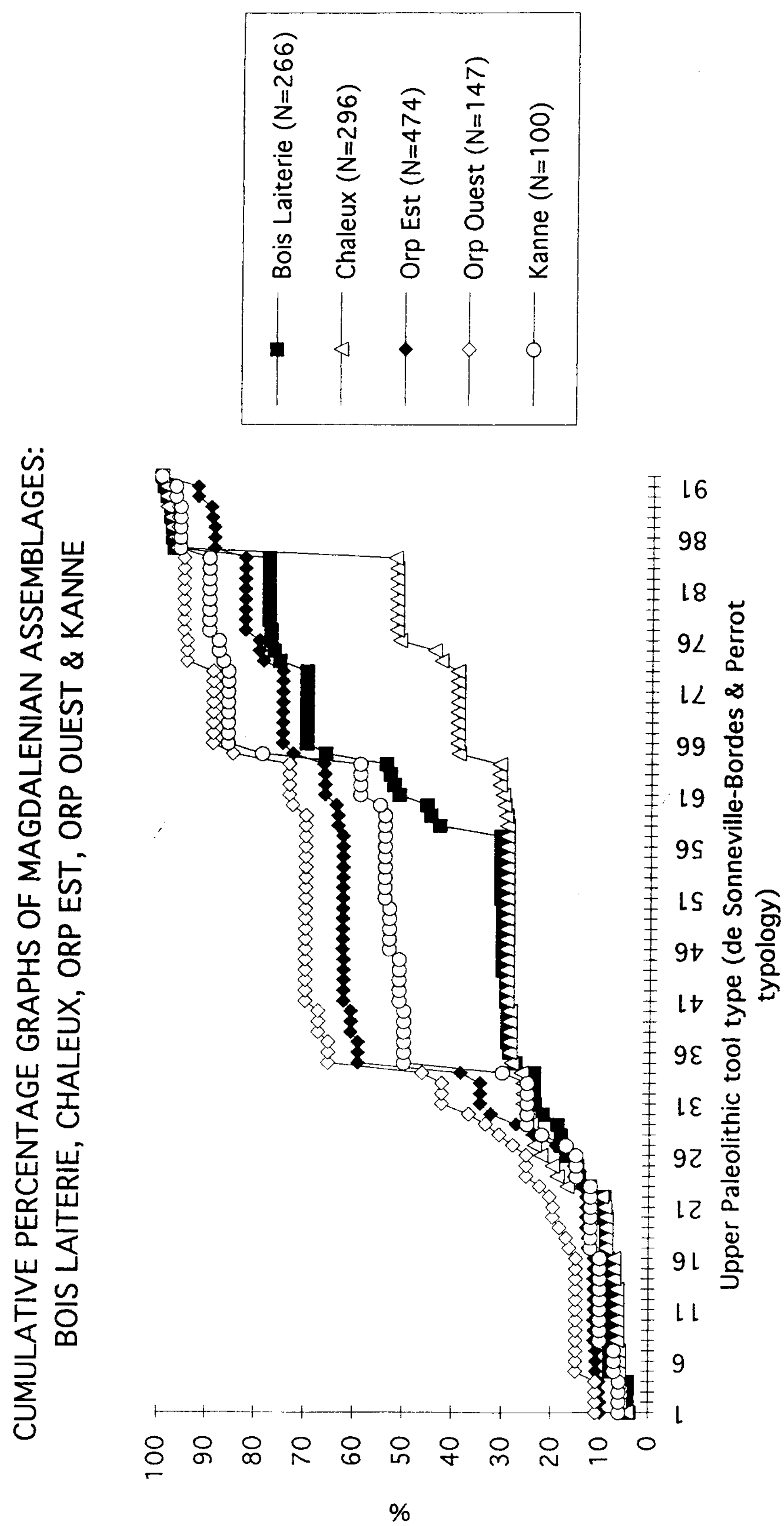

Fig.5 - Bois Laiterie, Chaleux, Orp and Kanne, cumulative percentage graphs of tools assemblages.

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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20

MESOLITHIC HUMAN REMAINS FROM LA GROTTE DU BOIS LAITERIE: A PRELIMINARY REPORT

M. Vandenbruaene and A. Gautier

Among the faunal remains from la Grotte du Bois Laiterie submitted for study to the second author (see Gautier, this volume), quite a few human remains were found. Most of these are associated with the Breccia, which was originally thought to contain a Neolithic "ossuary" because of the presence of potsherds. A talus (see inventory below; Square V9, base breccia, 45 cm BD) was AMS dated with the surprising result of 9,235 ± 85 BP (GX-21380, uncalibrated), *i.e.*, early Mesolithic, despite the total lack of any characteristic Mesolithic artefacts on the site. Thus BL joins the growing list of early Mesolithic funerary caves with few or no cultural remains in the Upper Meuse-Sambre Basin of Namur Province. Some of these are individual tombs, others represent more complex multiple or collective ones, testifying to the diversity of mortuary practices in the Mesolithic (see, *e.g.*, Cauwe, 1995). Material of the sample for AMS dating was also submitted to carbon and nitrogen stable isotope analyses (Krueger, this volume); these would indicate that Mesolithic hunters-and-gatherers hunted less than it is generally assumed. For details on the site and its context, the reader is referred to the other contributions in this volume.

An inventory of the human finds by square or subsquare and depth (BD : below datum) follows. The names of the skeletal elements etc. are those used by Anderson (1969). Measurements, not reproduced in this preliminary report, were taken following Martin (1928). Brothwell (1963), Bass (1971), Szilvassy (1977), Herrmann *et al.* (1990) and Knussman (1992) provided ageing criteria.

- Square Q2:

  Rib : a shaft fragment.
  Left upper limb : a clavicle, which on the basis of the morphology of the *facies articularis sternalis* would indicate an individual of 21-25 years.

- Square V8 (breccia # 69, 60 cm BD) :

  Right foot : a talus.

- Square V9b (base breccia, 35-45 cm BD) :

  Left hand : a hamate co-articulating with a triquetrum.
  Hand : a proximal, middle and distal phalanx of the second to fifth finger.

- Square V9b (base breccia, 45 cm BD) :

  Left foot : three co-articulating tarsal bones : talus, calcaneus and navicular; a proximal fragment of a second metatarsal. The talus accords morphologically and metrically with the talus of Square V8. The second metatarsal articulates with the co-articulating left foot bones W9a (#16).
  Right foot : four co-articulating metatarsals : second, third, proximal fragment of the fourth, and fifth.
  Foot : a proximal phalanx of the first toe.

- Square W8c (breccia, 60 cm BD) :

  Hand : a middle and a distal phalanx of the fifth finger, co-articulating.
  Left foot : a second metatarsal, which accords morpohologically with its right homologue in square V9b.
  Foot : a proximal phalanx of the first toe, two proximal phalanges of other toes, a distal fragment of a metatarsal and a sesamoid.

- Square W9a (base brecia, # 16) :

  Right hand : a third metacarpal.
  Hand : a proximal and a middle phalanx of the second to fifth finger. The proximal finger bone exhibits bony spurs or osteophytes ventrally.
  Sacrum : a fragment of the spinal part.
  Left knee : a patella.
  Left foot : three co-articulating bones : second and third cuneiforms, third metatarsal; a distal fragment of a metatarsal and a distal phalanx of the first toe.
  Foot : a proximal phalanx of the second to fifth toe; a proximal fragment of a middle phalanx and a sesamoid.

- Square W9a (base breccia, 60 cm BD) :

  Dentition : an upper right lateral incisor of which the crown has broken off *post mortem*, but with slight traces of calculus still visible on the lingual side.
  Left hand : a lunate and a proximal phalanx of the first finger.
  Hand : a proximal and a middle phalanx of the third finger, co-articulating.

- Square W9c (base breccia, 60 cm BD) :

  Dentition : an upper left third molar with inter-proximal neck caries and a medium calculus deposit on all sides; the degree of wear suggests an age of 17-25/25-35 years.

- Backdirt :

  Left arm : a proximal epiphysis of a juvenile radius.
  Right leg : a right femur shaft with a quite marked linea aspera (male?).

The size difference of the two left second metatarsals and two proximal phalanges found in squares V9b and W8c indicate clearly two adults of different stature. To these another smaller individual can be added, represented by the distal fragment of a metatarsal in Square W8c; this bone is decidedly smaller and apparently more gracile than all the other metatarsals. In our view, it might represent a juvenile. In squares V8/9 and W8/9, we would therefore be dealing with the remains of two adult individuals and a younger one. Most of the remains in the V-squares belong probably to the same adult who appears to be somewhat smaller and more gracile than the adult apparently represented by most of the remains in the W-squares, including the third molar of 17-25/25-35 years. Perhaps the observed morphological differences reflect sexual dimorphism. The femur shaft from the backdirt most probably represent a third adult (male?), while the radius fragment from the same context may represent a second juvenile individual, both having been reworked in the backdirt as a result of the clandestine excavations by pothunters. The isolated clavicle of square Q2, if also Mesolithic, might be added as a fourth adult, but the fill of the test pit Q2 is mixed, so the relationship to the *in situ* material in the breccia is unclear.

Summing up, the finds combine into minimally two Mesolithic adults, perhaps of different sex, and a juvenile(?), and possibly a child and another two adults whose provenances are less certain. Two of the definitely Mesolithic adults seem to be represented by clustered hand and foot bones, which co-articulate in some cases. The predominance of these smaller bones is probably mainly a taphonomic artefact, *i.e.*, degradation of other skeletal elements proceeded much further and poorly preserved fragments of these eventually ended up in the category of non-identifiable faunal remains. Whether the finds represent a multiple or a collective burial, disturbed by non-human or human agents is difficult to say. Excavation of remaining breccia with human remains, essentially in squares V8/9 and W8/9, has been carried out recently as a separate project. A detailed osteological and spatial analysis of all the human remains and the faunal remains (wild boar, red deer) which may be associated with them (I. López Bayón, pers. comm.), will be published separately and will no doubt shed more light on the nature of the Mesolithic «ossuary» of La Grotte du Bois Laiterie.

Acknowledgments

The first author thanks Prof. Dr. M. Otte and Prof. Dr. L. Straus, leaders of the La Grotte du Bois Laiterie project for providing the opportunity to acquaint herself with human remains entombed in a cave context. Her participation in the project is sponsored by the Belgian Programme of Interuniversity Poles of Attraction initiated by the Belgian State, Prime Minister's Office, Science Policy Programming.

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21

RADIOCARBON DATING AND ISOTOPIC ANALYSES OF THE HUMAN REMAINS

H.W. Krueger

Introduction

At the request of Dr. Lawrence Straus, I have examined a sample of human bone from the Bois Laiterie Cave and determined its radiocarbon age and stable isotope content. The sample analyzed was a portion of the foot bone recovered from square V9-B. The human remains are described elsewhere in this volume by Vandenbruaene and Gautier.

Methodology

The bone sample was heavily encrusted with secondary $CaCO_3$ and was found in a cemented breccia. It was presumed to be quite old (Neolithic) and its state of preservation was uncertain. We elected to try to obtain reliable isotopic information on bioapatite carbon, gelatin carbon, and gelatin nitrogen, while preparing the possible bone gelatin for C-14 dating by AMS.

Because of the heavy carbonate cementation, a small portion of the crushed bone was demineralized in dilute HCl without any pretreatment. The amount of carbon evolved as CO_2 was more than 10 times that expected from bioapatite in normal bone (0.9%, Ambrose, 1993; 0.5-0.7% with proper cleaning, our unpublished data). Mass balance calculation indicates that the untreated bone was about 50.7% $CaCO_3$ and the isotopic composition of the contaminant was about -4.8 ‰ (Table 1), characteristic of many limestones.

After pretreatment with 1N acetic acid for 24 hours with periodic evacuation, as developed in our lab, the residual bone yielded 0.79% carbon, with an isotopic composition of -10.6 o/oo, still too much carbon for fully cleaned bioapatite.

With fresh 1N acetic acid added, the pretreatment was continued for 5 more days with periodic pumping. The carbon content of the residual bioapatite was then 0.5% (normal for mammalian bone) with an isotopic composition of -11.3 (normal for a largely herbivorous C_3 diet, Krueger and Sullivan, 1984).

Results

All three experiments yielded a substantial amount of collagen after the demineralization. Each was refined to bone gelatin by standard procedures (Longin, 1971) and analyzed for carbon and nitrogen isotopes (results in Tab.1).

Carbon isotopes in gelatin gave essentially the same result in all three experiments, averaging -20.5 ‰ and indicating a 95 to 100% C_3 diet (Krueger and Sullivan, 1984). Nitrogen isotopes in gelatin gave similar results in all three experiments, averaging +8.3 ‰, and indicating some animal protein in the diet (Krueger, 1985). The difference between bioapatite carbon and gelatin carbon is 9.3 ‰ in the fully pretreated sample, indicating a low lipid diet and not enough animal protein to contribute much to energy metabolism (Krueger and Sullivan, 1984). Elemental C/N ranged from 3.1 to 3.2 in the three gelatins, all normal for uncontaminated bone gelatin.

One of the three gelatin preparations was analyzed for its C-14 age by AMS. The sample (GX-21380, Oxford AMS analysis) gave a C-13 corrected age of 9,235 ± 85 C-14 years BP, a result similar to reported results from the early Mesolithic sites at Grottes Margaux, Mallone, des Sarrasins, Autours, and Claminforge.

Conclusions

Three conclusions can be drawn from all these results:

1) The dated human bone from Bois Laiterie Cave is early Mesolithic, at about 9,235 C-14 years BP.
2) The dietary regimen of this individual was largely herbivorous (C_3 plants) with a small amount of animal protein and low lipid content.
3) Despite extreme contamination and/or alteration, reliable isotopic analyses and radiocarbon ages can be obtained with proper and careful preparation and analyses.

Tab.1. Isotopic Results on Bois Laiterie Bone

Pretreatment	None	24 hours	6 days
%C in residue	6.58	0.79	0.50
$\delta^{13}C$ in residue, ‰	- 5.3	- 10.6	- 11.3
% gelatin in residue	n.a.	16.5	35.0
$\delta^{13}C$ gelatin, ‰	- 20.5	- 20.4	- 20.6
$\delta^{15}N$ gelatin, ‰	+ 8.3	+ 8.1	+ 8.6
C/N, elemental (gelatin)	3.1	3.2	3.2

n.a. = not analyzed.

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22

SYNTHESIS: BOIS LAITERIE'S PLACE IN THE STONE AGE PREHISTORY OF BELGIUM

L.G. Straus

Introduction

The interest in conducting an excavation of the small site of Bois Laiterie Cave in the context of the Belgian Magdalenian lies precisely both in its size and in its chrono-cultural attribution. The study of the Belgian Magdalenian is in current ferment with the recent and/or ongoing work of Vermeersch and students at Orp and Kanne, Otte and students at Chaleux and other sites near the Lesse-Meuse confluence, with the theses by Teheux, Charles and Stutz, new excavations at Vaucelles (by Bellier and Cattelain) and at Walou (by Dewez) and re-analysis of Goyet (by Germonpré), as well as recent excavations in immediately adjacent regions of Netherlands (by the University of Leiden group in the Maastricht area, as summarized by Rensink) and France (Roc-la-Tour, excavated by Rozoy). More generally, the question of the Tardiglacial recolonization of northern Europe has stimulated much new research, including extensive (re-) excavation and dating of sites in England (work of Barton, Jacobi, Roberts, Tolan-Smith, *et al.*), NW France (Fagnart) and Germany (Bosinski, Street, Baales, Weniger). Just within the last few years, a large number of radiocarbon dates (many of them high-precision AMS determinations) have been produced on materials associated with Magdalenian artifacts in several cave sites on the edges of the Belgian Ardennes. Twenty dates from 9 sites place the Magdalenian occupation of Belgium within the traditional temporal range of Bölling; in fact the determinations fall between 13,000-12,200 BP (uncalibrated). If only AMS dates on artifacts or cut-marked bones are considered, the range is even narrower: 12,900-12,300 BP (Charles, 1994; Germonpré, 1997). We are, in short looking at a relatively short «moment» in time, perhaps no more than one climatic phase, some 600 years, during which humans, re-extending their range after the southward contraction imposed by the Last Glacial Maximum, re-found and re-learned how to use the environments and resources of the Meuse Basin. The nature and degree of permanency of their re-settlement in Magdalenian times have been the subjects of speculation and research since the phenomenon was first discovered and defined some 130 years ago by Edouard Dupont. Competing models of permanent occupation versus seasonal migration, major versus minor degrees of contact with and dependency on the Magdalenian territory of the Paris Basin, have been put forth since Dupont's day. We now possess a database that is adequate to *begin* to test some of these ideas.

Yet many of the cave sites that have been radiometrically dated recently were excavated long ago (mostly by Dupont in fact). Reexcavation of a few of those sites (notably Chaleux) has provided much valuable information of all sorts (especially paleoenvironmental and faunal), but often from very limited remnant deposits. The recent excavations at open-air sites in adjacent areas of Middle Belgium, Dutch Limburg and French Ardennes have provided a great wealth of information of lithic technology (and, at Roc-la-Tour, engraved stone slabs similar to those of the Belgian cave sites and the penecontemporaneous German Rhineland sites of Andernach and Gönnersdorf). Yet they are totally lacking in faunal remains and have poor chronological precision. Cave sites are still required, even if the range of activities conducted therein clearly differed from that of the open-air flint quarry-workshop sites of Brabant and Limburg. Among the recently (re-) excavated cave sites, Chaleux and, to a lesser extent, Vaucelles (Blaireaux) and Walou are all fairly large. Little was known about smaller cave sites, since Trou Abri and Trou da Somme had been mainly dug out in the past with little increase in our knowledge. In addition to the larger, possibly residential cave sites and the open-air flint workshop sites, we need smaller, possibly limited-activity cave sites. Bois Laiterie filled this bill.

In addition, small sites are advantageous in that they can be totally excavated, thus obviating the skewing effects of sampling that inevitably come with the partial excavation of large cave sites. With Bois Laiterie we were able to recover essentially the entire lithic and faunal contents of a «place» that had formed a part of the Magdalenian settlement system in Belgium. And because that place has some very definite physical characteristics of both positive and negative character, the nature of its human use could be hypothesized to have been limited. The location dominating a gorge that is a strategic avenue of communication between the Meuse and the Meuse-Sambre interfluve plateau, suggests the importance of game spotting and ambush hunting at Bois Laiterie. But with its north-facing exposure, small area, steeply sloping bedrock floor and draft-producing upper mouth, Bois Laiterie is a dark, cold, uncomfortable cave, suggesting the hypothesis of short-term, limited-function human visits. It is, theoretically, in such sites that archeologists are most likely to obtain a clear «reading» of site function, as contents should be fairly simple and unblurred by the accumulation of residues from many different kinds of occupations. In fact, even if an archeological horizon in such a site is the result of multiple visits, those visits were likely to have been similar in nature and scope and redundant in their basic residue contents. The archeological decipherment of such small, possibly limited-use sites should be more straightforward than that of large, complex sites with their massive palimpsest deposits.

And yet, even in the little cave of Bois Laiterie, with only one Paleolithic horizon, we must confront the problems of palimpsests, disturbance and mixing. All archeological sites lie some-where on a scale of intactness between (rare) Pompeii-like pristineness and total redeposition. We were immediately confronted at Bois Laiterie with slopes (down both west to east and south to north) so steep as to suggest the likelihood of at least local deposit movement of some kind(s).

Site Integrity

The study of site formation/disturbance processes in Bois Laiterie Cave reveals a series of rather perplexing apparent contradictions. Yet these must somehow be dealt with, not only to try to determine whether Bois Laiterie had one or many types and seasons of use, but also to try to understand its strange faunal assemblages that combine both arctic steppe/tundra taxa and more temperate or humid, woodland-dwelling animals, both large and small. The question is whether that «combination» is the result of mechanical mixture or of azonal Late Glacial ecological mosaic cohabitation (for a North American perspective on the reality of species-by-species «mixtures» of late Pleistocene faunas that defy presentday *community* patterns at continental scale, see FAUNMAP 1996).

On the one hand, most of the Magdalenian lithic artifacts (including very thin, fragile bladelets) have sharp, fresh edges without obvious crushing or rolling damage. Antler and bone artifacts (sagaies, needles) are very well preserved, despite some rodent gnawing on at least one of the sagaies. Large mammal bones are also in good condition and include some fragile elements. Bird and fish remains are also well preserved, indicating the absence of significant sediment movement. Spatial analyses detailed in this book show the existence of distinct activity areas involving at least fire and flint knapping. The fact that they had maintained their spatial integrity despite the cave floor's slopes, suggests the absence of catastrophic solifluction or erosion by running water. The micromorphological analyses by Courty (this volume) also argue against massive slope failure or runoff erosion, although localized movements caused by such processes as human trampling are not ruled out. Importantly, three accelerator radiocarbon determinations (one on an antler sagaie and two on individual bones) from YSS in different parts of the cave and at different depths, yielded statistically identical dates of 12,600 BP. This would suggest that the Magdalenian occupation was a short episode or series of closely-spaced episodes - not a massive palimpsest.

On the other hand, there are inescapable indicators of some disturbance in what at times may have been a rather wet, plastic sedimentary matrix (the sandy silt of Stratum YSS that locally grades into the silty clay of BSC in precisely the area where slab manuports are concentrated). Many of the stone slabs (presumably brought in from the surrounding hillside and top to alleviate the muddiness of the habitable area at the front of the cave) were found lying at steep angles or even vertically - and many of the fragments refit (see Miller and López Bayón, this volume). There are lithic refits across the thickness of YSS and even a few that connect pieces from both YSS and BSC - a combined horizon that reaches 50 cm in thickness at the front of the cave and even greater on the terrace, although much thinner at the rear (where BSC does not exist). This all suggests both movement both vertically within the deposit and some limited «sliding» from the rear toward the exterior terrace - all of which makes sense given the bedrock slopes of the cave floor. The existence of «preferred» orientations of elongated objects lining up against the eastern cave wall, especially at the front of the cave, is also an indicator of at least some movement, as are the steep inclinations of a few items besides stone slabs (*e.g.*, long bones, blades) (see Straus and Martinez, this volume).

Common sense and these facts require us to admit that the site is not «pristine». Nor however does it lie toward the totally redeposited, mixed end of the intactness spectrum. Astonishingly, the scatter of artifacts and faunal remains continues within YSS all the way to the rim of the bedrock ledge in front of the cave. Only where the bedrock plunges nearly vertically (in an old buried cliffline) down to the Burnot stream, does the cultural horizon stop. Although completely exposed to the elements (notably water running down the very steep slope from the hilltop - combined with gravity) outside the cave *per se*, even this sector of the cultural layer survived remarkably intact, with distinct evidence of burning and knapping areas on the terrace. There must have been very rapid but relatively gentle burial in silt. So the situation at Bois Laiterie cannot be characterized as one of major disturbance. Nor is there *archeological* evidence that the Magdalenian horizon represents a vast amount of time. To the contrary, the refits, the AMS dates, the lithic raw materials (all the same) and the typological characteristics of the assemblage from YSS+BSC all point to homogeneity and to a relatively short period of human use.

Paleoenvironments and Faunas

Bois Laiterie provided a half-dozen sources of information on the environments during, before and/or after Magdalenian occupation: micromorphology, palynology, anthracology, malacology and paleontology of macromammals and of microfauna. Unfortunately, due to the very small size of the site, due (nonetheless) to discordance among the stratigraphies of the cave rear, front and terrace, and due to the different times and locations of sampling for all these analyses (except macromammals, which, of course, came from the whole excavation and not localized samples), there are significant problems of compatibility among the different sources of paleoenvironmental information. The micromorphological analysis (Courty, this volume) tells of cold conditions with intense cryclastic activity during the formation of strata LGS (lower grey sand) and UGS (upper grey sand), which respectively underlie and overlie YSS (yellowish/reddish sandy silt) in the cave interior. These cold periods are tentatively attributed to Dryas I and II respectively. Loess was not being deposited very much at these times. Primary loess was however being deposited in YSS times under somewhat less cold conditions, with especially warmer summers (*i.e.*, more significant seasonality than in the immediately preceding or succeeding periods). YSS sedimentary characteristics are fully consonant with the Bölling age indicated by the three AMS dates. Given that the site is at 50 degrees north latitude, it is not surprising that conditions during Bölling were still relatively cold, albeit less so than those of Dryas I.

It was pollen and wood evidence from the recent re-excavation of the Magdalenian horizon at Chaleux that first (and with great surprise and some disbelief) suggested the relatively moderate nature of Bölling-age environments, with the presence of localized woods or thickets in at least favored microhabitats of the deep Ardennes valleys alongside the continued existence of open steppe-tundra landscapes presumably on the plateaux (Noirel-Schutz, 1994; Schoch, 1994; see also Léotard, 1993, in regard to wood charcoal from the Magdalenian at the nearby small site of Trou Abri). Unfortunately, neither palynology nor anthracology yielded quantitatively impressive results at Bois Laiterie, despite our concerted efforts. Nevertheless, the limited results of both analyses (Emery-Barbier and Pernaud, both in this volume) both show the presence of trees: alder, hazel, juniper, pine and walnut among the pollen; charcoal of birch and alder, plus another tree in the birch family that could be alder or hornbeam. Pollen from the rose family and grasses, as well as fern and horsetail spores, were also found in Stratum YSS. All these taxa are represented among the radiometrically penecontemporaneous pollen and charcoal spectra at Chaleux. The combination of the sedimentological and botanical data paints a very mixed picture for the Bölling, that is no doubt appropriate to the northerly (and still North Sea-less, continental) location of Belgium. It was still cold and loess was being deposited by the winds, but summers were relatively warm and there was enough local humidity in the valleys of Wallonia to permit the growth of a variety of both coniferous and deciduous trees, including some relatively warm-loving taxa probably confined to sheltered, south-facing slopes. Yet the woodlands had not spread to the plateaux of the Ardennes or Middle Belgium, which were still apparently covered with steppe-tundra vegetation. Because of the relief of Wallonia, the wooded microhabitats would have been adjacent to the open grasslands; humid areas were contiguous with dry expanses. And both types of environments and their respective resources (animal foods from both; fuel and vegetal foods from the gallery woods) were accessible from the Magdalenian sites.

It is in this context that one should not be incredulous at the apparently anomolous co-occurrence of of cold, dry, open steppe-tundra ungulates and others today associated with relatively temperate, often wooded environments. Gautier (this volume) documents the presence in Strata YSS+BSC of reindeer, musk oxen (also present in the radiometrically pene-contemporaneous Magdalenian assemblages found by E. Dupont at Chaleux and Goyet), bison, European wild ass and horse, along with red deer and moose. The first group (and most notably the musk ox) signify the presence of open vegetation and cold, dry conditions, whereas the second group (especially the moose) indicates locally much more humid conditions with woods or thickets. The presence of chamois (also sometimes a woodland-dweller) and especially ibex mainly indicates the existence of steep, rocky slopes. Both arctic and common fox are present in YSS+BSC. Such a faunal mosaic does not seem impossible given the local relief surrounding Bois Laiterie and the other cave sites of Wallonia. Although the glacial faunas were still present in Belgium during Bölling, it appears that the most favorable habitats of the region were being populated by taxa more at home in relatively temperate, humid woodlands. Humans, as part of this northward biotic displacement, preyed on all the ungulates available within a short radius of each site such as Bois Laiterie. Because it overlooks an obligatory passage between the 85 m a.s.l. Meuse canyon floor and the 250 m a.s.l. plateau, this cave was ideally situated for hunters to «sample» species that probably lived contiguously but ecologically separated by vegetation and terrain type in the complex mosaic situation of the Belgian Bölling.

The remaining sources of information on paleoenvironments are microfaunal (terrestrial molluscs, lagomorphs, rodents, insectivores, bats and batrachians). Like pollen, but unlike wood charcoal and large mammal bones, these remains are not primarily in the cave because of human action. Sampling and fine-screening for malaco- and microvertebrate faunas was conducted by Ph. Lacroix in 1995. Unfortunately there are no complete columnar samples from the cave interior, where the sequence of strata was more complete and intact. (However, rodent/ insectivore mandibles and bones were unsystematically collected during excavation of the main sequence within the cave in 1994-5.) The two columns of samples were taken in square W3 on the terrace at the exterior of the cave and in S6 just inside the cave mouth, but upslope of the area of dense Magdalenian deposit. The stratigraphic sequence in W3 starts at the bottom with a possible lens of BSC (reddish-brown silty clay) or RS (red sand) in contact with bedrock, followed by a 60-75 cm thick-Stratum YSS. This is overlain by LBS (light brown silt, rich in calcium carbonates and blocks in the contact zone atop YSS). The sequence in W3 is capped by RC (reddish colluvium). The latter two units gave the impression of slope wash deposits. Although UGS is absent in the cave exterior and its stratigraphic relationship to LBS is unclear, it is noteworthy that there are large blocks directly atop YSS at the base of

UGS within the cave and that there are also large blocks at the top of YSS in the cave exterior, suggesting a generalized roof-fall episode at the close of YSS deposition. Magdalenian artifacts were found in abundance immediately below these blocks in both areas. LBS was laid down later and often has a loose, possibly churned aspect. Such is the case in square S6, where the other malaco/microfaunal columnar samples were taken, and whose results should thus be interpreted with caution in the absence of dates.

Outside the area of main Magdalenian remains concentration at the threshold of the cave mouth atop a precipitous bedrock slope, S6 never yielded much archeological material. The excavators were never certain of stratum designation, labelling the entire sequence down to contact with bedrock «LBS/YSS?» (with the exception of the topmost spit which was called «LBS»). This deposit had the appearance of slopewash. Had the Magdalenian horizon once existed in this spot (the upslope part of the cave mouth), it may have slid downslope 1-2 m to compound the amount of cultural material piled up in T-U6 against the eastern cave wall. In short, the deposit sampled for malaco/microfauna in S6 may have been somewhat mixed (LBS+ YSS?), but probably essentially postdated the Magdalenian occupation (Alleröd?).

Thus the only malaco- and microfaunal samples that were unequivocably associated with the Magdalenian occupation at Bois Laiterie are those from YSS in square W3 (plus the rodent bones collected during archeological excavation by hand-picking from the screens). In terms of microvertebrates, this unit yielded the following information to Cordy and Lacroix (this volume): an abundance of *Dicrostonyx guliemi* and *Microtus gregalis* (both cold, open-vegetation rodents [a lemming and a vole]) and presence of *Ochotona pusilla* (pika: another cold, open-country dweller), together with *Clethrionomys glareolus* (or *C.rutilus*)(bank or ruddy vole: both today woodland dwellers) and *Apodemus sylvaticus-flavicollis* (yellow-necked field mouse: also a woodland taxon). *Microtus oeconomus* (root vole), *M.arvalis-agrestis* (common or short-tailed vole) and *Arvicola terrestris* (ground vole) are also represented in YSS, together with *Sorex areneus-coronatus* (common shrew). All these presently live in humid habitats, sometimes with considerable arboreal cover, the former being the «coldest» in its modern distribution in western Europe (Van den Brink,1971). In short, the YSS micromammals are a mix of open, arctic species and more temperate, humid woodland taxa - like the macromammal fauna from this stratum.

The malacofauna from square W3-Stratum YSS (López Bayón *et al.*, this volume) includes only one strictly woodland-dwelling species (*Discus ruderatus*) and two semi-woodland species (*D. rotundatus* and *Retinella hamonis*). There are also a very few individuals of taxa that prefer humid or even marshy environments, especially at the top of the stratum. On the other hand, there are also a few heliophiles (molluscs preferring open habitats) and (paradoxically also at the top of YSS) a few xerophiles. Mesophiles (taxa tolerant of a wider range of enviroments) are abundant and diverse throughout YSS. These facts again may suggest the existence of mosaic environments during the time of human occupation, with areas of woodland or thickets and local humidity, but close to drier, more open patches, perhaps on the north-facing slope where the cave is located. Indeed, one would expect the low-mobility landsnails to give the «coldest», most open vegetation picture of all the environmental indicators for this Tardiglacial location. Humans may also have denuded the area in front of the cave mouth, creating a more open microhabitat.

Even the bird bones in YSS (Deville and Gautier, this volume) are consonant with a mosaic environment. There are open country grouse and partridge (living on the plateau above the cave), water birds (geese and whimbrel, favoring the Meuse and Burnot stream below the cave), rocky cliff-dwellers around the cave (magpie, jay, passerines), and either a woodland-preferring owl (*Asio otus*) or (and?) an open vegetation one (*A.flammeus*).

In short, all these biological data (botanical and paleontological) paint of picture of very mixed ecological conditions in southern, upland Belgium c. 12,600 radiocarbon years ago. While loess was still being deposited and the plateaux were still vegetated by steppe-tundra plants and the north-facing slope around the cave may have been partly bare, partly covered with low grasses and shrubs, the valley floor and south- and west-facing slopes of the Meuse and Burnot probably harbored not only conifers, but also some deciduous trees and bushes - made possible by higher summer temperatures and local humidity. This set of conditions nonetheless represented a dramatic change vis à vis the much more uniformly open or even barren environments of Dryas I at 50 degrees North. And these conditions made possible the human recolonization of Belgium and NW Europe in general during Bölling in its traditional definition.

Nature of the Human Occupations

Bois Laiterie Cave seems to have seen only one period of actual human habitation: during the Upper Magdalenian. There is no evidence for use of the cave either before or immediately after the episode(s) centered fairly tightly around 12,600 years ago (uncalibrated). Extensive screening of backdirt from the clandestine diggings that had preceded our intervention, revealed only very few lithic and bone artifacts, and most of these can be (by typology and raw material) surely attributed to the Magdalenian. The pothunters had probably cut slightly into the Magdalenian horizon in upslope areas of the cave, where they dug all the way down to bedrock. But their backdirt produced no definite Mesolithic materials, although a variety of ceramics (sub-modern and prehistoric) was found in our screening operation. Sherds are also visible in the side and base of the breccia remnant that adheres to the south and east walls of the cave and that contains human remains. Since this deposit is almost in contact with the cave ceiling, it probably indicates an «ossuary» role for the cave during the Neolithic. This is a well-known regional phenomenon - including an ossuary in Burnot/Juvénat Cave on the slope opposite Bois Laiterie with two C14 dates 4,100 BP (uncalibrated) (Cauwe, 1993; Toussaint and Becker, 1992). The surprise came when a presumed «Neolithic» human foot bone from the base of the breccia (Vandenbruaene and Gautier, this volume) was radiocarbon dated. The result of 9,200 BP (uncalibrated) (see Krueger, this volume) indicates that people had already begun to use Bois Laiterie Cave as a burial site in the early Mesolithic. That such burials were apparently unassociated or unaccompanied by Mesolithic artifacts (be they banal or offeratory) is not surprising, since there are now five other cases of such burials with few or no artifacts dating to 9,100-9,600 BP (uncalibrated) in caves along the upper Meuse and lower Sambre valleys of Namur Province (Toussaint *et al.*, 1996; Cauwe, 1993, with references). The remaining Mesolithic burials from Bois Laiterie (excavated from the breccia after a large block sense. As outlined earlier (Straus and Orphal, this volume), almost all the chipped stone artifacts are of non-local flint. This high-quality material was probably brought to Bois Laiterie from one of the Upper Cretaceous chalk sources in Middle Belgium - either the Mons-Spiennes area of Hainaut to the west or the closer Orp area in Brabant to the north. The flint was mainly transported in the form of blade blanks; virtually no cores were abandoned at Bois Laiterie and probably very few had been brought there, as there is very little cortical debris either (and almost none of it primary). There are no hammerstones. The artifacts (debris and implements) are almost all very small - also an indicator of transport from a distance. The large number of tiny trimming flakes is an indication of *in situ* transformation of some blanks into tools and weapons - and of resharpening/recycling. The high tool/debris ratio is added evidence that far from the whole lithic reduction sequence took place at Bois Laiterie. To the contrary, this is a place where mainly tertiary reduction and abandonment happened. People arrived here with their light flint blanks and tools, and abandoned a minimum when they moved on to other places. Finally, the tools are a specialized lot: many backed bladelets/small blades, plus several burins and only a few endscrapers and perforators. Together with a few stone points, there are also four magnificent large antler sagaie fragments and other bits of possible sagaies. Since the backed blade(let)s have generally been shown by microwear analysis to have been used as weapon tips or barbs (and there is some support for this here too [see Jardon, this volume]), all these data together support the hypothesis that Bois Laiterie was fundamentally a hunting camp. There is little evidence for much in the way of maintenance activites (*e.g.*, hidescraping, wood-working), although the burins (with some microwear evidence for hard substratum scraping and grooving) may have been used in osseous weapon manufacture or reworking, just as the lithic assemblage composition suggests blank transformation and implement/armature resharpening. That animal carcasses were processed is suggested by the organic residue analyses of a few lithic artifacts (Newman, this volume).

Although spatial analyses (Straus and Martinez, this volume) show the existence of a rudimentary site structure (given the very small useable area of the cave), with burning and flint-knapping areas (in part corresponding to small slab-paved zones) at and in front of the cave mouth and a disposal area at the cave rear, there is no evidence for elaborate organization or substantial investment in infrastructure at Bois Laiterie. The stone slabs are not very numerous and paved only a small surface; they were available strictly locally on the Bois Laiterie hilltop and slopes. None are artistically engraved, as is otherwise the case at Chaleux, Trou du Frontal, Trou da Somme or Roc-la-Tour. There is no evidence (not even a hint) of constructed hearths (fires had simply been built on the ground surface) or other pits. Trash (bones, lithics and even broken sagaies) was simply tossed toward the dark, otherwise perhaps un- or little-used back of the cave (and presumably also down the steep talus in front of the cave). In short, there is no indication of major, long-term, multi-purpose residence at this site.

The macromammalian faunal assemblage (studied by Gautier, this volume) is small, and, unlike that of Chaleux (dominated by horse), is quite diverse: reindeer (MNI=4), horse (3), ibex and muskox (2 each), ass, red deer, moose, chamois and bison (1 MNI each) from combined Strata YSS+BSC. Such an assemblage probably speaks of opportunistic hunting of small numbers of animals during a few repeated visits to the cave, taking advantage of its strategic location on a cliff above the Burnot talweg connecting the Meuse and plateau. Humans not only took equids, bovines and cervids moving up and down that gorge, but also exploited the rocky slopes around the cave itself for caprines. Although none of the large mammals are represented by very large numbers of bones and teeth, the reindeer, horses and ibex (in contrast to the muskoxen and other animals) do have enough remains (including (bones, lithics and even broken sagaies) was simply tossed toward the dark, otherwise perhaps un- or little-used back of the cave (and presumably also down the steep talus in front of the cave). In short, there is no indication of major, long-term, multi-purpose residence at this site.

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Some of the larger water birds may have been prey to humans, also possibly during the warm season according to Deville and Gautier (this volume). Many or most of the smaller birds may have been prey to owls and foxes, both also present at Bois Laiterie. There is no evidence that humans had anything to do with the foxes, which probably used the cave as a den when humans were not there. If so, winter denning by foxes might have been a possibility. However, some of the fish evidence (Van Neer, this volume) suggests (through arguments about fish availability during spawning) that humans were responsible for catching some large fish (brown trout, burbot and grayling) in late winter or early spring. This finding either contradicts the reindeer data or extends the time when there were human visits back to the very end of the cold season or beginning of the warm season. Yet common sense still militates against the notion of humans spending very much, if any, time in Bois Laiterie Cave during winter.

In any event, Bois Laiterie was clearly a limited-use site, which saw one or a few short-term visits by humans during Bölling (and perhaps into the beginning of Dryas II?). Although such occupations were minor both in duration and in numbers of participants (the cave is, after all, tiny, especially in terms of its actually habitable area), some minimal investment was made in providing for a dry, solid living surface by paving a small area with locally available stone slabs. This paved area in the downslope strip at the front of the cave may have supplemented bare bedrock floor upslope (where a few Magdalenian artifacts were found lodged in cracks and cemented to the rock in travertine). But in no case, either in the small cave or on the narrow ledge in front of it, would there have been space for extensive occupations or activities.

The Place of Bois Laiterie Cave in the Belgian Magdalenian System

The Magdalenian of Belgium (and contiguous enclaves of Netherlands and France) is represented by two kinds of sites: 1.) radiocarbon-dated cave sites along the northern (Ourthe-Middle Meuse drainage) and western (Lesse-Upper Meuse drainage) fringes of the Ardennes and 2.) open-air sites on the low plateaux of Middle Belgium and on the high plateaux of the Ardennes. Only two of the open-air sites have been dated (imprecisely, by TL): Orp East (11,800-12,900 years ago) and West (13,100-13,700 years ago) - all with standard deviations between 1,200-1,700 years) (Vermeersch, 1991). (TL dates are likely to be older by nature than 14C dates from the same deposits, as shown at Pincevent and Etiolles, where both methods were used [Valladas, 1994]). The open-air sites fall into two general categories: loci at high-quality flint sources that seem to have been (probably among other things) quarry-workshops (Orp, Kanne, Mesch, Eyserheid, Schweikhuizen and possibly Obourg-Saint Macaire) and a site located at a strategic lookout location at the rim of a cliff dominating the Meuse-Semois confluence (Roc-la-Tour). Arguments (summarized by Rensink, 1993, with references) have been made that most (all?) of these sites were occupied during the traditional Bölling. (Cultural evidence could support either a penecontemporaneous Magdalenian or - less likely - slightly more recent «Creswellian» age for St.Macaire.)

The chronological information for the cave sites are most recently summarized by Charles (1994, with references). The Ourthe cave cluster south of Liège consists of Coléoptère, Sy Verlaine, Font-de-Forêt and Walou. The first site has two conventional and one accelerator radiocarbon date that place the Magdalenian occupation in Bölling (*i.e.*, 13,000-12,200 years ago). The most reliable date (AMS on a cut-marked horse bone) from Verlaine is of early Bölling age. Walou has two conventional dates that, with their standard deviations, straddle the traditional 13,000 years ago Dryas I/Bölling boundary. The Magdalenian cave sites of the Lesse-Meuse confluence area (Chaleux, Trou du Frontal, Trou des Nutons, Trou Magrite, Trou Abri, Trou da Somme and Vaucelles/Blaireaux) are probably all of traditional Bölling age, since all but Magrite and Abri have now produced radiocarbon dates that lie between about 12,900 and 12,300 years ago. (There also are equivocal [in Charles' estimation] indications of late Dryas I visits to Vaucelles - as in the case of Verlaine.) Germonpré (1997) has recently obtained AMS dates of 12,600 and 12,700 years ago on cut-marked musk ox and horse bones in the Dupont collection from Goyet on the Samson, a tributary of the Middle Meuse. The three AMS dates from Bois Laiterie (12,600 years ago) fall squarely within the traditional Bölling time period. The dates from the cave sites suggest a main (or sole) Magdalenian colonization of the Belgian Meuse basin during a period of no more than about 600 years. The problem we face is how to correlate the cave sites with the open-air sites that are *argued* to also be of traditional Bölling age. *Assuming* that the two groups of sites are at least penecontemporaneous (and pertained to the same set of environmental conditions), we may possess (admittedly incomplete) samples from different aspects of a regional settlement system. Even if the open-air sites are not *strictly* contemporaneous with the cave sites (and this could only be demonstrated - albeit within the margin of error imposed by the possibility of stone scavenging by later prehistoric human visitors - by intersite lithic refitting of the sort pioneered by A.Scheer [1993] among 3 Gravettian sites in the Ach Valley of SW Germany), it is easy to imagine that there are/were other such sites either waiting to be discovered or long ago destroyed. What follows is the sketch of a model for an Upper Magdalenian settlement-subsistence system based on the territory of what is today Belgium, but with contacts both to the south (Paris Basin) and east (Neuwied Basin).

Seasonality evidence from dental cementum analyses of specimens from modern, controlled excavations in Chaleux (ibex), Trou da Somme (ibex or chamois) and Bois Laiterie (reindeer, confirmed by dental eruption/wear sequence analyses) and reindeer (hence *not* Holocene intrusives) from Dupont's excavation in Trou des Nutons indicates (1) winter-early spring *and* summer-fall kills (hence, presumably, human presence) in the upland Lesse-Meuse confluence area along the Ardennes and (2) summer/summer-fall kills around Bois Laiterie at the very northern edge of the uplands near the Sambre-Meuse confluence and the plains of Middle Belgium (Stutz, this volume). Following the logic that people would naturally prefer to take advantage of available shelter (*i.e.*, caves) especially in winter, that game would seek shelter during winter in the protected, well-watered valleys of the Ardennes fringes (rather than on the open, windswept plains of Middle Belgium), and that flint nodules would be difficult or impossible to obtain under the snow or in frozen earth, it can be hypothesized that the open-air Magdalenian sites (both known and as yet undiscovered) of Limburg, Brabant and Hainaut were mainly occupied by people in the warm season (summer-early fall). These places would be repeatedly visited specifically for their abundant, high-quality flint. The aim of flint-knapping activities at such sites as Orp and Kanne was the specialized production of laminar blanks (*e.g.*, Vermeersch and Symens, 1988). Our analyses (Straus and Orphal, this volume) show that precisely those kinds of small blades/bladelets that predominate in the upland cave assemblages of Chaleux and Bois Laiterie are the ones that are underrepresented at Orp and Kanne. This might suggest the selective transport of lightweight blanks from the quarry-workshop sites to the caves. The absolute scarcity of cores, cortical debris, crested blades, hammerstones or other evidence for primary reduction in the cave sites (and, to the contrary, their abundance at the open-air sites) clearly supports an hypothesis of functional (and perhaps seasonal) complementarity between the two *classes* of sites. That flint transport was involved is indicated by the large average size of artifacts at the open-air sites and the very small average size thereof at Chaleux and BL. The general scarcity of backed blade(let)s and points (presumed weapon elements) at the open-air sites is in complementary opposition to their abundance at the cave sites - suggesting that, while some hunting must have been conducted around the open-air sites, it was not the principal activity at the quarry-workshops. In contrast, hunting was very important around the cave sites.

Given its geographic location and physical characteristics, Bois Laiterie might have been a transit camp *en route* between the open-air flint sources of Middle Belgium and the Ardennes. Though its lithic inventory is smaller and somewhat less diverse than that of Chaleux, there are strong similarities between their debris and tool assemblages - perhaps because BL was on the logistical supplyline between the flint sources and Chaleux (or sites like it in the uplands). Given the relatively short distances involved (maximally 63 km from Chaleux to Orp and 80 km from Chaleux to Obourg/Spiennes via the easiest routes - including the Lesse, Meuse, Burnot and Sambre valleys), humans could use the Ardennes caves at times even during the warm season and still go (or send logistical parties) to the flint sources also in summer. Logically, the stricter seasonal constraints would be imposed on human use of the open-air sites, for reasons mentioned above. Presumably better than no shelter at all, Bois Laiterie could have served both as an unspecialized hunting camp during the warm season *and*, if the fish were really caught by people, as a minor site at the very end of the cold season or beginning of the warm season.

Obviously we need seasonality information from Goyet (which is actually a major series of caves on the border between the hill country and the Hesbaye plateau along the Middle Meuse), from other upland sites in the Ourthe drainage (such as Trou Walou), and (ideally) from open-air loci - if any are eventually found that contain faunal remains. Likewise we need petrographic «fingerprinting» of the flints in order to be able to distinguish with certainty among the very similar Upper Cretaceous flints of the Mons, Hesbaye and Maastricht areas (see Caspar, 1984), a task that so far has defied several serious efforts (P.Vermeersch, pers.comm.). If this could be done, we would be able to determine *where* the people who used different cave sites procured their flints - presumably via either logistical trips and/or as a result of their annual residential moves (see discussion in Rensink, 1993 and 1995). The presumption of direct group visits to source areas is based on the relatively short distances involved. In the case of Bois Laiterie, the presence of pyrite, whose closest known source is in the Mons area (Lozouet and Gautier, this volume), is another indicator of contacts with that flint-rich area, but does not prove the *nature* of the contact. The presence of pieces of pyrite at Chaleux (Otte, 1994) could suggest that BL lay along the route between it and Mons. This brings us to the question of the fossil shells at BL and other pene-contemporaneous Magdalenian cave sites.

Although Dupont (1873) had thought that the Magdalenian inhabitants of the caves in the Upper Meuse and Lesse valleys procured their flints in north-central France, this has been shown to be highly unlikely in the face of much more feasible and parsimonious «Belgian» origins (Teheux 1994). Yet the fossil shells (64 in Chaleux, over a dozen at Frontal, 1 at Dasomme, and unspecified numbers at Goyet - as well as at Verlaine and Coléoptère in the Ourthe drainage [Rensink, 1993]), also important to Dupont's argument, are now joined by 8 at BL (5-6 artificially perforated). Most of these are probably from Eocene deposits in the Paris Basin, although one taxon's closest source is the Loire Basin, even further south. The fact that these shells - clear evidence of direct (visits/intermarriage) or indirect (exchange) contacts between the «Belgian» regional band (perhaps a «daughter» offshoot) and the Parisian area (the location of the pene-contemporaneous or slightly older sites of Pincevent, Verberie and Etiolles) - are only found in the cave sites and not in the open-air sites, is not an argument against possible contemporaneity of the two classes and hence their potential participation in the same settlement-subsistence system. According to P.Vermeersch (pers.comm.), such fossils would likely not have survived in the loess milieux of sites such as Orp and Kanne. On the other hand, the fact that they are found both in major «residential» cave sites such as Chaleux and Goyet and at minor cave sites such as Da Somme and Bois Laiterie, helps to tie these sites together in one territorial system, into which the fossils were introduced as a consequence of social relationships and movements that linked the Belgian and Parisian areas and groups. The *closest* possible geological sources of the Paris Basin fossils are believed to be *no less* than about 150 km from Chaleux. It is one thing to transport small numbers of mostly small fossils (either in long, point-to-point trips or in down-the-line, group-to-group exchanges); it is a different matter to transport significant amounts of lithic raw materials over distances of this magnitude.

On the other hand, there are now known to be Gravettian-age fossils at nearby Goyet (*Polymesoda convexa* and *Granulolabiugm plicatum*) that are probably from Oligocene beds near Tongres in Belgian Limburg (Lozouet and Gautier, this volume), suggesting connections, at least at that time, between the upland cave area and the flint-rich plains (also the location of the Gravettian site of Huccorgne between Goyet and Tongres). Such connections between caves of the northern Ardennes flanks and quarry-workshop sites in both Belgian and Dutch Limburg (the locations of Kanne, Mesch, Eyserheide and Schweikhuizen) no doubt also existed c.15-12 ky later, in the Magdalenian.

It has been convincingly argued (*e.g.*, Bosinski, 1988; Floss, 1991) that substantial proportions of the flints used in the open-air sites of Gönnersdorf and Andernach at the northern end of the Neuwied Basin of the Middle Rhine came from Upper Cretaceous sources in the region of Maastricht-Liège (eastern end of the Hesbaye), a distance of at least 80 km. The Neuwied sites are radiometrically penecontemporaneous with the Belgian cave sites and most of the Paris Basin sites (Street *et al.*, 1994). While there is no evidence (yet) of contacts between inhabitants of the Belgian cave sites and those of the Neuwied Basin sites, one can formulate the hypothesis that there existed in late Dryas I-Bölling-early Dryas II at least three regional bands in this part of western Europe: Paris Seine-Oise-Basin, Belgian Meuse Basin (perhaps with western and northern subterritories) and Neuwied Rhine Basin. (Other human territorial groups at this time in NW Europe may have included ones in southern and central England, NW and SW Germany, NE France and western Switzerland.) The Belgian group was clearly not an isolate, yet it was separated and distinct from the Paris Basin group (from which it may have split off as ameliorating environmental conditions and increasing food resources made settlement of the Meuse Basin possible). Unlike earlier visions thereof, it is clear that the Magdalenian of Belgium (and NW Europe in general) was not just dependent on specialized reindeer hunting. Although there is some tendency for horse to dominate the fauna of Chaleux, there was clearly a very wide diversity of game in the Bölling-age landscapes. The relief of southern Belgium (however undramatic) provided rich food, lithic and shelter resources. Physical separation of the Belgian territory was apparently «dictated» by the exposed, shelterless, flintless, and then food resource-poor plains of Champagne (Rozoy, 1988), which people must have crossed quickly *en route* to/from the Paris Basin (to maintain social contacts, seek mates, obtain possibly socially and/or symbolically important fossils, etc.).

Thus two types of «traffic» seem to have made up the human landscape of NW Europe.

These were:

I) procurement of non-local flints for tool manufacture either by means of

A) embedding in group movements governed by subsistence activities:

- seasonal or
- non-seasonal, or

B) essentially specialized logistical supply expeditions; and

II) long-distance contacts whereby fossil shells (and presumably other things such as mates) circulated either by

A) direct visits or

B) down-the-line exchange.

Bois Laiterie helps to prove that there was at least one essentially whole Magdalenian settlement-subsistence system on the territory of Belgium in Bölling times *and* that its group members maintained contacts with the Paris Basin. The Belgian system was apparently self-sufficient in terms of game, fuel, some vegetal food, lithic resources and natural shelters. But demographically this (or these) regional band(s) may have depended on the ability to acquire mates among «adjacent» bands, even if these were at some distance (see Wobst, 1976). They may also have needed an «insurance policy» (*i.e.*, kin or fictive kin to whom they might hope to turn in times of crisis such as a game crash, severe winter, etc., as was done in the ethnohistoric Arctic).

Bois Laiterie Cave, a small, uncomfortable, but usefully situated site, was part of this system. It was a good place to stop *en route* between the flint sources of the plains and the larger residential caves deeper in the hill country. It was a good place from which to hunt local caprines or a variety of other large game often likely to be moving between the Meuse and the inter-Meuse-Sambre plateau. It may have been a good place near which to fish in the Meuse or Burnot stream. Since its qualities were known and since it was at the intersection of two excellent (nearly obligatory) routes between Upper and Middle Belgium, Bois Laiterie may have been visited several times - enough to warrant at least minimal paving to slightly better its uncomfortable living conditions. Lightweight flint blanks were brought to the site; some were transformed into tools and weapons. Antler weapons may also have been fabricated or reworked at the site, possibly using burins. Spent weapons (including broken sagaie bases) were abandoned. But much of the flint may have been taken out by humans as they moved on to their next destination, although some that was left behind may have been reused/resharpened during possible later visits. Animal carcasses or parts thereof were also brought into the cave presumably from nearby killspots. Some may have been consumed *in situ*, but others may have been removed to other (residential) sites. The few endscrapers, perforators and needles testify to the fact that at least some other activities may have been conducted around the simple campfires in Bois Laiterie, such as clothes-making or repair. Meat or hides may have been cut against some of the stone slabs. Perhaps skins were scraped with ochre, traces of which were found on other slabs. And then there are the bored circular stone and the eight fossil shells, most of which are perforated. Why they were abandoned or forgotten at Bois Laiterie, we will never know. Yet they testify to the facts that there were other aspects to the activities conducted at this small cave and that it was in turn part of a wider world. Belgium was on the fringe of that Magdalenian world and community. But it was a vital, viable fringe, thanks to its peculiarly advantageous combination of resources.

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23

BOIS LAITERIE : LE MESSAGE D'UN SITE MAGDALENIEN

M. Otte

La grotte

Tapie au débouché d'un profond vallon, cette petite grotte a capté pour nous douze mille ans d'histoire.

Combinant l'attrait d'un point de vue à l'intérêt d'un piège pour dépôts naturels, elle s'est progressivement constituée en témoignage archéologique, discret mais intégral. Assurément, d'innombrables autres petites cavités du même ordre subsistent dans les paysages wallons, sortes de petites fenêtres sur notre passé. Ces archives fragiles devraient attendre, avant d'être consultées, qu'un respect équivalent à leur valeur leur soit accordé.

A mesure où elle se comblait, la grotte du Bois Laiterie fossilisa deux formes d'utilisation par l'homme. Encore largement ouverte, elle accueillit l'embuscade de chasseurs magdaléniens (12.600 ans avant aujourd'hui) et, presque comblée, elle reçut des défunts mésolithiques (il y a 9.200 ans).

Les circonstances

L'histoire de cette recherche commence mal : le site fut d'abord visité et pillé par un instituteur local au cours des années 1970. Paradoxalement, celui dont la fonction de transmettre le respect patrimonial, prodiguait, par son exemple, la leçon inverse. Ces dégâts furent cependant limités aux dépôts supérieurs, laissant intacte la couche magdalénienne.

L'étude présentée ici résulte en réalité d'une coïncidence. Philippe Lacroix (surnommé Bibiche), prospecteur intelligent et averti, transmit ses observations aux milieux scientifiques liégeois. Conscient de ses propres limites, il confia la découverte des premiers objets paléolithiques à une équipe qu'il jugeait plus compétente. Cette marque d'humilité et de clairvoyance mérite d'être saluée, voire de servir d'exemple.

L'autre terme de la coïncidence consista en une équipe belgo-américaine, tout aussi motivée que le découvreur, mais mieux "armée" quant à la maîtrise des méthodes scientifiques utilisées actuellement. A ce stade, il faut souligner l'amitié, fondée sur l'estime, qui s'est forgée entre les différentes personnalités, d'origines si variées. En l'absence de ce liant essentiel, la démarche générale n'aurait pas connu un tel fonctionnement harmonieux.

En toile de fond à cette aventure, se situe le paysage formé par le Bassin Mosan, particulièrement fertile en terrains de recherches de cette sorte. Il s'en trouva d'autant plus exploitable qu'un intérêt soutenu nous fut accordé par le Gouvernement de la Région Wallonne. Transcrite en une aide substantielle, cette sollicitude rencontra opportunément les préoccupations des représentants universitaires de l'Université de New Mexico et de l'Université de Liège.

L'abri

Presque vide à l'époque magdalénienne, la cavité rocheuse possédait une surface intérieure d'une trentaine de mètres carrés. Sa terrasse formait une extension appréciable et ensoleillée. Le sommet du versant, près de l'embouchure du vallon du Burnot vers la Meuse, offrait un panorama très large sur les plaines alluviales giboyeuses. Inversement, la grotte était invisible au loin et garantissait la discrétion du groupe qui l'occupait. Le saillant rocheux où se perce la cavité formait un point de repaire sur lequel on pouvait s'orienter afin de retrouver l'abri. Ainsi, cette situation, inscrite dans le paysage, favorisait-elle le maintien des liens au sein du groupe. Retrouvailles, partage, point de rendez-vous et d'échange se conciliaient ainsi avec les fonctions dispersées aux alentours : chasse, pêche, récoltes de matériaux, déplacements, transports. Les activités techniques menées sur place, telles les réparations d'armes, se trouvaient dès lors en équilibre fonctionnel avec la prédation alimentaire. Les déplacements, saisonniers ou quotidiens du gibier pouvaient y être observés, mémorisés, utilisés de ce simple poste d'observation privilégié.

Le décor

La série de datations au radiocarbone situent la phase d'occupation vers 12.650 ans avant aujourd'hui. Les reconstitutions paléo-climatiques utilisées habituellement en Europe septentrionale placent ces datations lors de l'oscillation tempérée du Bölling. Les informations indirectes sur le climat contemporain des chasseurs paléolithiques au Bois Laiterie confirment globalement cette attribution. Les pollens, les rongeurs, les mollusques et les bois brûlés furent utilisés à cet effet. Cependant, l'image générale finalement reconstituée reste ambigüe. Certaines espèces seraient aujourd'hui incompatibles entre elles. Il semble donc, qu'en dépit du refroidissement général, par rapport au climat actuel, l'ensoleillement et les latitudes considérées créaient un paysage en «mosaïque», d'aspect composite, probablement sans analogie stricte dans le monde contemporain. La diversité de ces biotopes a d'ailleurs pu favoriser les modes de vie des prédateurs mosans paléolithiques. Quoi qu'il en soit, on constate à la fois la présence d'espèces propres à la steppe et celle de plantes ou d'animaux forestiers.

En conséquence, on peut imaginer une couverture steppique étendue aux plateaux, où subsistaient les chevaux par exemple, assortie de forêts-galeries, installées le long des cours d'eau et où l'élan, également retrouvé à la grotte, pouvait être rencontré. Les restes de plantes (pollens et charbons) attestent en tous les cas d'une forêt claire, faite de bouleaux, de noisetiers et d'aulnes à proximité de l'habitat. La présence de tels arbres feuillus confirme l'existence de conditions relativement tempérées, au moins dans les aires abritées et ensoleillées.

La nourriture

Parmi les différents restes d'animaux consommés, on retrouve une dominance de chevaux et de rennes. L'orientation environnementale principale donnée par ces deux espèces était donc la steppe ou de vastes plaines alluviales où ces animaux pouvaient se déplacer. Leurs vestiges furent rapportés presque intégralement, ce qui démontre les pratiques de partage menées au site. Par contre, l'élan et le boeuf musqué ne sont représentés que par quelques fragments, comme si ils avaient fait l'objet de re-distribution extérieure (vers les sites de la Lesse, par exemple). Le bouquetin, également abattu, témoigne de prédation dans les zones rocheuses aux alentours du site.

Différentes espèces d'oiseaux furent reconnues parmi les ossements. Mais il est difficile de faire la part des espèces abattues par l'homme de celles apportées par les renards ou d'autres prédateurs, occasionnellement installés au même abri. En tous les cas, l'oie et le canard semblent avoir faits l'objet d'une chasse par les Magdaléniens. De plus, pourvus d'os creux, ces grands oiseaux furent aussi chassés pour le façonnement d'étuis à aiguilles (retrouvés au site). Leurs plumes destinées à l'empennage des sagaies, également présentes, ont constitué un autre motif à leur prédation.

Diverses espèces de poissons furent aussi reconnues parmi les ossements récoltés lors du tamisage : l'ombre, la truite, la lotte y furent ramenés. Les méthodes de pêche peuvent consister en un harponnage à la pointe barbelée en bois dans les basses eaux des méandres, ou à la nasse tressée de vannerie. L'une et l'autre méthode n'ont pas pu laisser de trace archéologique. L'abondance des vertèbres par rapport aux os crâniens montre peut-être la préparation de ces poissons, directement en bordure de rivière, afin d'en faciliter le transport (bien que les processus taphonomiques de conservation différentielle aient pu aussi être à l'origine de cet état de fait).

Les techniques

Les armes de chasse et leurs déchets de préparation dominent parmi les restes abandonnés à la grotte. Une petite série de pointes de sagaies étaient réalisées en bois de renne. Biseautées à la base pour l'emmanchement sur la hampe, elles étaient sciées à l'autre bout, peut-être pour une réfection ou pour faciliter le détachement de l'arme dans la proie.

De nombreuses lamelles et pointes à dos droit, faites en silex, étaient probablement destinées à armer latéralement des extrémités de sagaies en matières organiques (os ou bois végétal).

L'abondance des remontages des silex manifeste l'intensité de la taille sur place. Cependant, la très forte réduction, en termes de dimensions, de l'ensemble est dû à l'éloignement des sources de matière première et à l'économie qui a donc prévalu dans son traitement. Par ailleurs, le nombre relativement important d'outils finis et d'éclats de retouche témoignent de l'existence de phases opératoires précédentes, mises en oeuvre à l'extérieur de cet habitat, par exemple à proximité des sources d'approvisionnement. Il s'agit donc ici davantage de déchets liés à la mise en forme ou au ré-affûtage d'outils qu'à la préparation de la matière première. L'absence de pièce corticale répond à cette même tendance.

Les quelques aiguilles, retrouvées à l'état de fragments, indiquent des activités de peausserie (fabrication de vétements et/ou de sacs).

Les activités

Outre la chasse et les réparations techniques, le site témoigne de préparations culinaires par des traces de foyers dispersées et le stockage des ossements consommés au fond de la grotte.

Un dallage constitué d'un grand nombre de plaquettes en psammite et en schiste rendait probablement l'abri plus confortable, par l'assèchement du sol et sa régularisation. Au total, environ 122 kg de ces grandes plaques furent apportées au site (contre environ 3 kg de silex !). Ceci témoigne de l'effort déployé dans ce but, probablement plus important qu'il n'y paraît à première vue. Certaines de ces plaquettes sont striées, apparemment involontairement lors d'activités de découpage et de grattage. Certaines sont fracturées, soit par le piétinement, soit par des actions naturelles. Enfin, d'autres pièces portent des traces d'ocre rouge. On sait que ce minéral sert à tanner les peaux (corroyage, élimination des micro-organismes,...) et qu'il subsiste après la disparition de celles-ci. Les taches rouges laissées sur les plaquettes furent peut-être dues à l'imprégnation des peaux disposées sur ce dallage approximatif dans la grotte.

Outre les traces évidentes de foyer (charbons de bois, silex et os brûlés), un fragment d'un briquet naturel fut retrouvé. Il s'agit d'un bloc de pyrite percuté, analogue à ceux trouvés dans de rares sites magdaléniens contemporains, dont celui de Chaleux tout proche. Cet oxyde de fer, percuté sur un silex, provoque en effet l'incandescence d'un combustible léger, par le dégagement d'une paillette métallique rougie. L'origine de cette matière semble être la région de Mons.

Une gamme assez complète d'activités techniques étaient donc représentée au gisement, témoignant du mode de vie des chasseurs, y compris les réparations techniques nécessaires régulièrement. En outre, une série de huit fossiles tertiaires furent découverts, attestant d'activités non utilitaires. Certains d'entre eux furent peut-être portés en pendeloque, comme la perforation dont ils firent l'objet le montre. Sorte d'identifications personnelles ou sociales, ces coquilles ont pu être percées sur place par abrasion. Une perle de pierre (grès), également associée à ce lot, illustrait la variété du message symbolique véhiculé par de telles pendeloques.

Le moment

Les données relatives à la saisonnalité convergent pour situer l'occupation magdalénienne du Bois Laiterie au cours de la bonne saison. Ces indices sont tirés des rythmes de croissance observés sur l'émail dentaire de certains des herbivores abattus. Une installation saisonnière liée spécialement à la chasse semble aussi correspondre à l'étroitesse de la grotte où un grand groupe ne pourrait subsister longtemps. On peut donc imaginer l'installation d'un "raid de chasse" au Bois Laiterie, fonctionnellement orienté, mais dont l'existence a pu se répéter à plusieurs reprises, à la même saison, pendant plusieurs années, autour de 12.650 BP.

L'existence d'une telle occupation, de courte durée, dans un habitat de petites dimensions et relativement intact, permet d'éclairer le réseau d'installation magdalénienne auquel il était intégré régionalement. Par exemple, on connait les sites magdaléniens de la Lesse, Chaleux en premier lieu, approximativement contemporains du Bois Laiterie (entre 12.300 et 12.900 B.P.). On y retrouve à la fois une gamme d'activités très diversifiées, une grande extension de l'habitat et, surtout, des traces de présence humaine étalées sur plusieurs saisons. Des "camps de base" liés à la même ethnie et à la même tradition formaient une des composantes à cette emprise magdalénienne sur le territoire régional (Otte, 1989).

Le réseau

De l'autre côté de la Meuse, des sites de plein-air, également magdaléniens, témoignent d'activités liées à l'extraction des roches siliceuses propices à la taille. Bien qu'appartenant à la même tradition, ces ensembles sont probablement un peu plus anciens que celui du Bois Laiterie. Cependant, ce réseau culturel manifeste ainsi une possibilité d'extraction des roches, identiques à celles retrouvées au Bois Laiterie (silex crétacés). Ce modèle d'exploitation spécialisée convient donc parfaitement pour évoquer ce qu'ont pu réaliser les prospecteurs magdaléniens mosans. La variété des outillages retrouvés dans les divers emplacements confirme la répartition des tâches à travers l'espace : outillage de chasse au Bois Laiterie et déchets de taille et nucléus aux sites hesbignons. Ainsi, un modèle d'organisation spatiale peut être restitué liant les sites d'habitats et de chasse dans les grottes mosanes aux gisements d'exploitation de roches sur les plateaux de Hesbaye.

Dans cette perspective, l'apport des coquilles tertiaires nous paraît crucial. Leur origine géographique, située au minimum dans le Bassin Parisien (150 km), atteste d'échanges méridionaux jusqu'à cette région. Cependant, le mode de transport pour ces petits objets à usage prolongé fut manifestement d'une toute autre nature que celui relatif aux matériaux destinés à l'outillage. L'extension de ce réseau d'échange méridional a donc pu rester épisodique et s'organiser selon des relais ou des échanges. Quoiqu'il en soit, ces coquilles manifestent des relations avec les aires géographiques aux origines mêmes de la population magdalénienne (Otte, 1992).

Migrations

Si l'on considère les phases directement antérieures au site de Bois Laiterie, on constate une quasi absence d'occupation humaine dans la plupart des régions d'Europe du Nord. La forte dégradation climatique qui a affecté tout le continent de 20 à 15 mille ans environ fut probablement responsable d'un retrait provisoire des populations vers le Sud-Est (Balkans) et le Sud-Ouest européen. Au cours du Tardiglaciaire, différentes vagues progressives d'extension manifestent la recolonisation des plaines septentrionales à mesure du retrait glaciaire. Le Bassin Parisien fut naturellement ré-occupé avant les régions mosanes qui, elles-mêmes, le furent, par exemple, avant la Rhénanie ou la Grande-Bretagne. Notre pays a donc joué le rôle d'intermédiaire dans ce processus (ce qu'il n'a pas cessé de faire depuis lors...).

Il est donc naturel que les contacts furent maintenus avec l'aire d'origine, sous la forme par exemple des coquilles tertiaires du Bassin Parisien, dont la pratique s'est maintenue au fil de ces migrations. De la même manière, retrouve-t-on des silex mosans dans les sites de Rhénanie, illustrant de nouveau ce processus de "retour aux sources" avant que les possibilités d'exploitation locales ne soient découvertes ou systématiquement exploitées (Floss, 1991).

Filiations

Dans ce grand ensemble du Magdalénien nordique, il ne faudrait donc pas confondre les migrations saisonnières qui affectaient une partie du groupe au sein d'une même région (tel que le Bassin Mosan) et les mouvements exploratoires et pionniers, liant indirectement les différentes provinces entre elles par une filiation originelle. Par référence aux populations des chasseurs récolteurs actuels, on peut imaginer le maintien de relations épisodiques entre des groupes apparentés culturellement, par exemple pour des cérémonies, des mariages ou des fêtes durant lesquels les échanges d'information et d'idées pouvaient s'opérer au sein de la même tradition. C'est ainsi, par exemple, que l'on peut expliquer selon nous ces grandes similitudes dans les critères stylistiques de l'art sur plaquettes de Rhénanie et de Belgique.

Inversement, un mouvement migratoire, originaire de l'Europe orientale, recouvre progressivement les plaines dénudées par les glaciers, particulièrement à l'emplacement de l'actuelle Mer du Nord, alors exondée (Otte, 1990). Les extrémités britanniques et allemandes en témoignent abondamment. Curieusement, durant le même interstade du Bölling, ce courant septentrional s'est aussi étendu aux grottes mosanes. Celles de Presles près de Charleroi en constituent le plus brillant témoignage. Deux "traditions" aux affinités distinctes se partageaient donc alors le territoire de l'actuelle Belgique: l'une reliée aux plaines du Nord, l'autre répandue par les zones des collines, Moravie, Thuringe, Rhénanie (Kozlowski, 1985).

Le circuit

Ainsi, cette humble cavité rocheuse au creux du vallon du Burnot à Profondeville, s'inscrit-elle au sein d'un réseau d'installations humaines beaucoup plus vastes. Dans un premier niveau, on peut parler d'une entité ethnique régionale, liant les sites de la Lesse, à Goyet, au

Bois Laiterie et aux gisements en Hesbaye. La variabilité fonctionnelle de tous ces gisements désigne une emprise intime de ce groupe sur les ressources et le milieu mosan en général : par l'habitat, le gibier, la pêche, les matériaux et le micro-climat. Une forte symbiose entre un paysage et une population de chasseurs est attestée de toutes les manières par les nombreux ensembles inscrits dans les sites mosans. A un second niveau, cette tradition s'inscrit dans un vaste mouvement de recolonisation, venu du Sud-Ouest européen, vers le Nord-Est, à mesure du retrait glaciaire. Les liens ethniques ont pu subsister entre ces différentes provinces, tels que les plaquettes gravées, analogues aux décors pariétaux des grottes françaises, le suggèrent. Enfin, un mouvement opposé semble conquérir les Iles Britanniques à partir de l'Allemagne du Nord, puis toucher également les régions mosanes. Les affinités y sont alors de nature toute différente et, par exemple, l'art figuré y est inexistant.

Les interactions complexes entre ces différentes provinces territoriales et les mécanismes de migrations à long terme trouvent dès lors leur illustration dans le réseau de sites dont le Bois Laiterie fait partie. Par la qualité de la documentation exceptionnellement préservée, le site apporte un complément très clair à ce tableau général. D'autres emplacements, aussi miraculeusement préservés mais aussi potentiellement vulnérables, méritent une identique sollicitude. On peut espérer qu'ils en seront honorés désormais en cas de découverte fortuite car ils constituent les reliquaires du plus vieux patrimoine wallon.

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