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THE MACROMAMMAL REMAINS OF LA GROTTE DU BOIS LAITERIE

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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).

ASSEMBLAGE ANIMAL GROUP	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.*

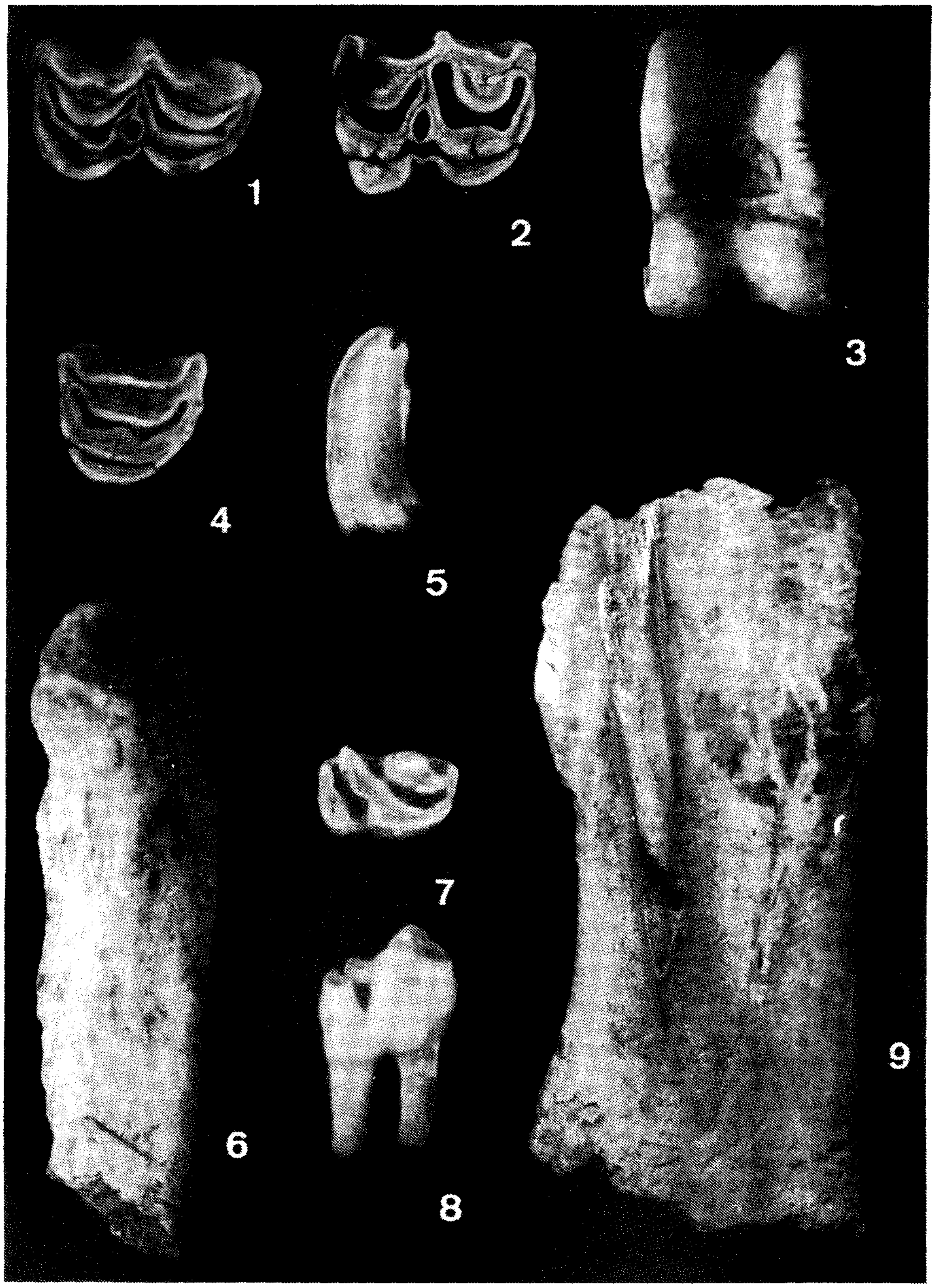
One scapula fragment from YSS presented an identification problem. It is clearly derived from a small equid, but the articular end is missing and carries extensive carnivore gnaw marks (Pl.1, Fig.9). My experience suggests that carnivores will readily attack not yet (completely) fused articular ends 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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