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# PLEISTOCENE CARNIVORES IN THE MÂCONNAIS. FIELD TRIP OF THE 16<sup>TH</sup> INTERNATIONAL CAVE BEAR AND LION SYMPOSIUM (AZÉ, 2010)



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## ABSTRACT

The excursion day of the 16th ICBLs provided participants with the opportunity to visit three major palaeontological sites of the Mâconnais: the Azé and Blanot Caves, and the Breccia site of Château, especially rich in big Carnivores, mainly Ursids and Felids.

**Key-words:** Mâconnais, caves, Azé, Blanot, Château, Carnivores.

## RÉSUMÉ

CARNIVORES PLÉISTOCÈNES EN MÂCONNAIS. EXCURSION DU 16<sup>e</sup> SYMPOSIUM INTERNATIONAL DE L'OURS ET DU LION DES CAVERNES (AZÉ, 2011)

L'excursion organisée pendant le 16<sup>e</sup> ICBLs a permis aux participants de découvrir trois sites paléontologiques majeurs du Mâconnais et leur environnement géologique: Azé, Blanot et Château, particulièrement riches en restes de grands Carnivores, Ursidés et Félidés principalement.

**Mots-clés:** Mâconnais, grottes, Azé, Blanot, Château, Carnivores.

## 1 - INTRODUCTION

The Mâconnais alternates calcareous areas of the Middle and Upper Jurassic and granitic zones with sandy, possibly Triassic covering layers. This structure results from many fault displacements, a consequence of the alpine folding and of the subsidence of the Bressan rift. In the calcareous areas these faults largely contributed to the formation of relatively common karstic networks, a complex inheritance of the Cretaceous, the Tertiary and the Quaternary. They are usually small by comparison with those of some areas but they have often kept Middle Pleistocene fillings because of an erosion perhaps less strong than elsewhere. On the Symposium's excursion day, three major paleontological sites in the Mâconnais were visited: the Azé Caves, the Blanot Caves and the Château Breccia (fig.1). These three sites are particularly important for the paleontology of Carnivores.

## 2 - AZÉ CAVES

The Azé Caves are made up of a set of large and small cavities in the massif of Rochebin (fig.2). They range between 250 and 275 meters asl, in the valley of the Mouge not far from the village of Azé (Saône-et-Loire). They have developed in limestone of the Mesozoic era, more precisely in the Middle Bajocian, in the link of Azé-Bissy-la-Mâconnaise.

Since 1961, in order to attract tourists, the two largest cavities have been developed by the Association des Grottes d'Azé, directed by Maurice Bonnefoy.

As a result of this work, a very old prehistoric site dating from the Early Paleolithic (Azé1-1) was discovered in the upper cave, Azé 1, which is also called the Prehistoric Cave (275 m asl), excavated by J. Combier 1968-1970.

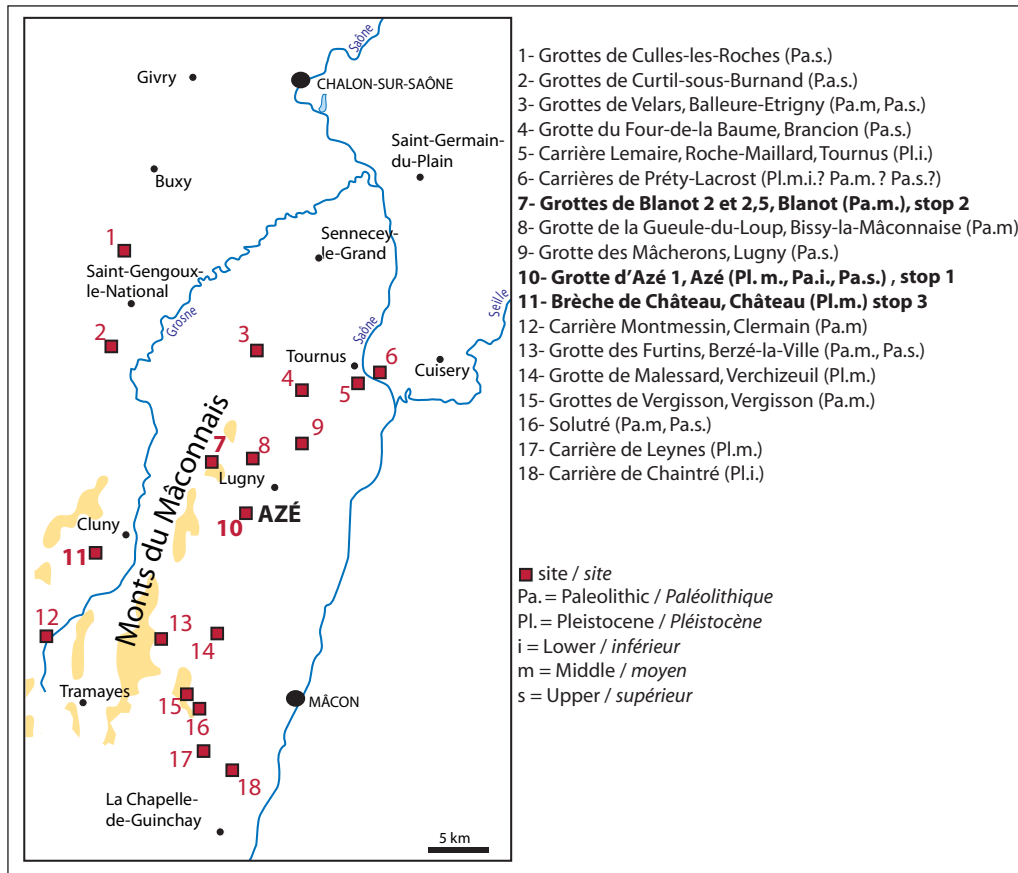
Clearing away many obstructions also led to the discovery of numerous paleontological remains, espe-

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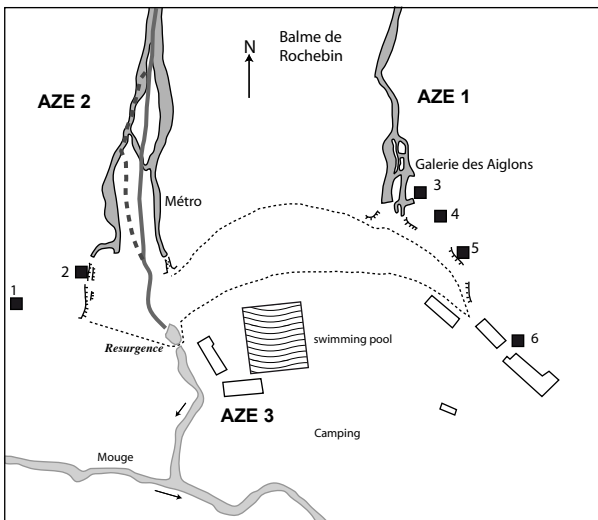
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**Fig. 1: Map of the Pleistocene paleontological and archaeological sites of the Mâconnais.**

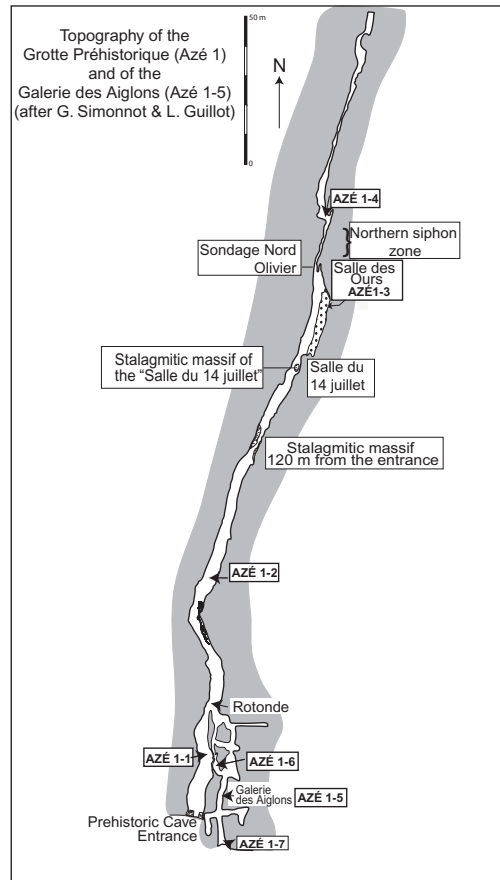
*Fig. 1: Carte des sites paléontologiques et archéologiques du Pléistocène en Mâconnais.*



**Fig. 2: Location of the different caves of Azé (after Simonnot, 2003).**

*Fig. 2: Localisation des différentes grottes d'Azé (d'après Simonnot, 2003).*

cially of cave bears. About 400 m of Azé 1 have been developed, including 220 m which is open to tourists. Several collections of bones were scientifically excavated along the galleries (fig.3): Azé 1-2 (A. and J. Argant, 1978), Azé 1-3 (A. and J. Argant, from 1982 to 1985), Azé 1-5 and Azé 1-6 (R. Villeneuve from 1990 to 1997, L. and J. Barriquand from 1998 to 2001). There are still fossils of cave bears in Azé 1-4.



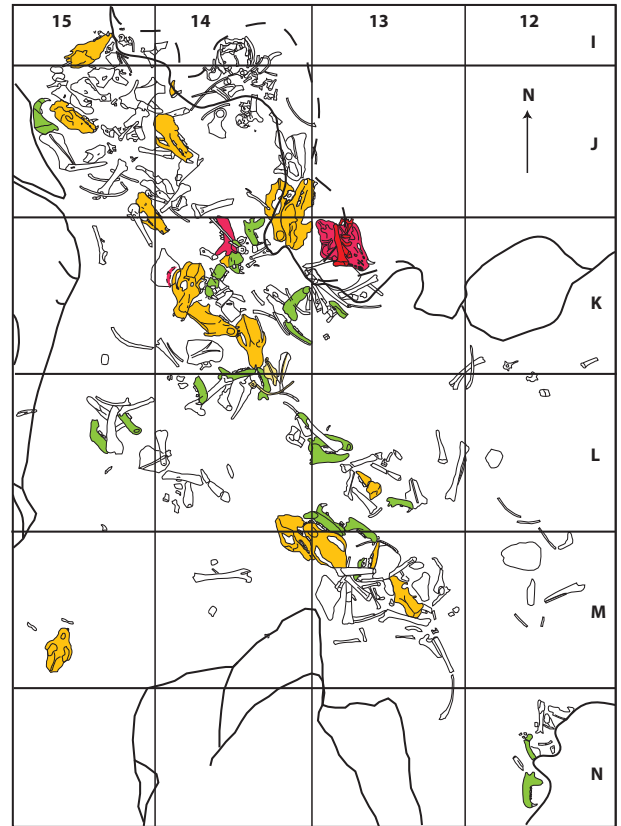
**Fig. 3: Map of Azé 1 with its different loci.**

*Fig. 3: Plan d'Azé 1 avec ses différents loci.*

In fact, there are fossil bones everywhere in Azé 1. The collections indicated here (studied or being studied) correspond to concentrations of bones in places where overflows of water and probably of sediments drained away, when the galleries were blocked by physical constraints: concretions and breccias as in Azé 1-3; stalagmitic floors at 60 m as in Azé 1-2; slope deposits blocking entrances as in Azé 1-1 and Azé 1-5; or total filling up of an inferior network by sediments as in Azé 1-6. Most of the material was more or less transported. Except in some rare cases (Azé 1-5 and the “bear in the roof” of Azé 1-3) there are no complete skeletons and the anatomical connection of bones of a single individual are uncommon (lion skull, mandible and upper canine of the same individual in Azé 1-3) (fig. 4 and 5)

The Azé 1 cave has been known for a long time and has been excavated since the 19th century. Briefly, let us note the visits of Adrien Arcelin, the discoverer of Solutré, who undertook some excavations in the terrace, of H. Testot-Ferry, of J. Bouvet, of M. Touzot and of J. Mazenot. In 1946, the famous Professor André Leroi-Gourhan began some investigations in the “remarkably sterile” entrance chamber. From 1946 to 1964, in the “Salle de la Rotonde”, André Jeannet discovered a large number of ceramics from the “Champs d’Urnes” epoch under soil dating from the Iron Age -LaTène III. For more details see the article “Le site des Grottes d’Azé au Pléistocène” (Barriquand *et al.*, this issue).

From a paleontological as well as an archaeological point of view, these caves represent a particularly rich set. Since the Middle Quaternary (more than 300,000 years



**Fig.4: Azé 1-3: Map of the digging. *Ursus spelaeus deningeroides*: skulls (in yellow), mandibles (in green). *Panthera spelaea* (in red): canine, left hemimandible, skull.**

*Fig. 4: Azé 1-3: Plan de la fouille. *Ursus spelaeus deningeroides*: crânes (en jaune), mandibules (en vert). *Panthera spelaea* (en rouge): canine, hémimandibule gauche, crâne.*



**Fig. 5: Azé 1-3. Skull of *Panthera spelaea* in situ (photo A.J. Argant).**

*Fig. 5: Azé 1-3. Crâne de *Panthera spelaea* in situ (photo A.J. Argant).*

ago) all periods are represented in the Azé site which continuously offered to Man and animals an exceptional situation, water, a favourable orientation to the south and the shelter of caves (tab.1). These shelters were especially invaluable to the bears which had to winter somewhere and didn't hesitate to go far inside the cavities. Besides, it was there that the cubs were born in winter.

### 3 - BLANOT

In the small dell of La Mangette located to the west of Mont Saint-Romain, there is an alignment of six cavities

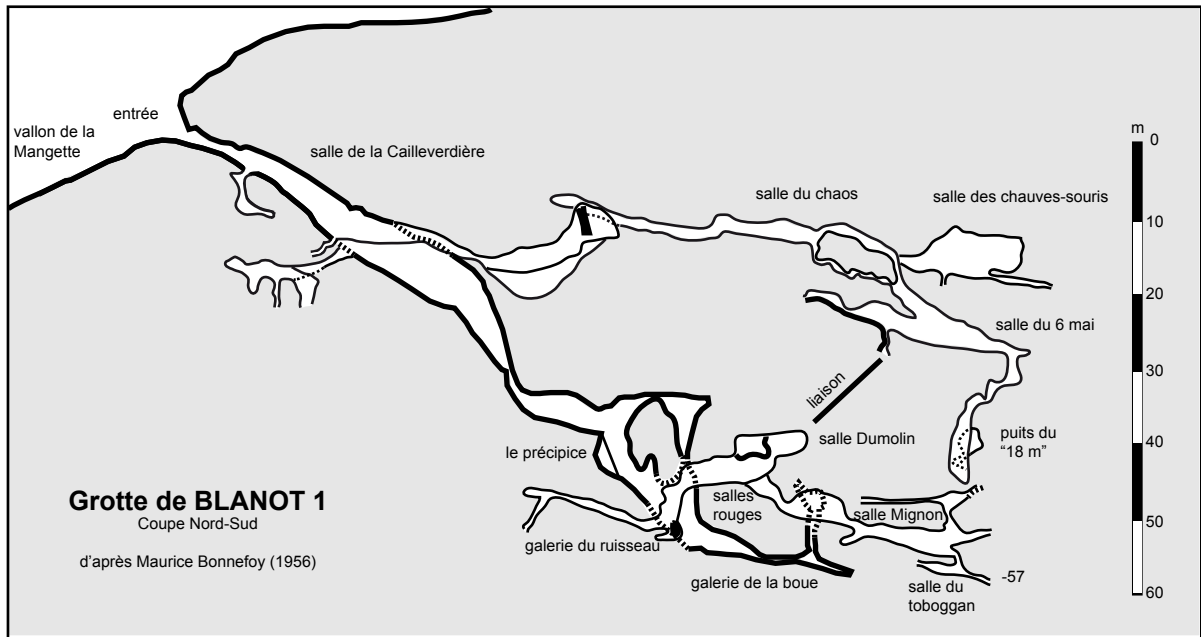
(Blanot 1, Blanot 2, Blanot 2 ½, Blanot 3, Blanot 4 and Blanot 5).

The main cave, open to tourists, is Blanot 1 (fig.6) which corresponds to a sink hole more than 700 m long and 57 m deep. Blanot 1 is also called Cave de la Caille-verdière (which in its Latin origin means "green coloured cave") because the entrance oriented to the north is covered with mosses and ferns which gives locally a green colour to the rocks. The others are much smaller and the maximum length is 35 m at Blanot 2.

The structure of the Mâconnais is on the whole monoclinical with an average dip of 20 to 30° E. This zone is split by a network of principal faults oriented N20°. These normal faults have led to the formation of a series

AZÉ	Référence	Fouilleur	Carnivores	Autre faune
<b>AZÉ 1 Grotte préhistorique</b>	<b>AZÉ 1</b> Fouilles anciennes (avant 60 m)	Dravet R. et Morel R.	<i>Ursus spelaeus</i> <i>Crocuta spelaea</i>	<i>Cervus elaphus</i> (C.G.) <i>Rangifer tarandus</i> (C.G.)
	<b>AZÉ 1-1</b> (salle d'entrée)	Combier J.	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Felis silvestris</i> <i>Vulpes vulpes</i>	<i>Dicerorhinus hemitoechus</i> (C.G.) <i>Equus</i> sp. (grande taille) (A.A.)
	<b>AZÉ 1-2</b>	Argant A. & J.	<i>Ursus spelaeus</i> <i>Vulpes vulpes</i> <i>Cuon alpinus</i> ? <i>Mustela putorius</i>	
	<b>AZÉ 1-3</b> Salle des ours	Argant A. & J.	<i>Ursus spelaeus</i> <i>Panthera spelaea</i> <i>Vulpes vulpes</i>	<i>Equus</i> sp. (grande taille)(A.A.)
	<b>AZÉ 1-4</b> Baïonnette	Spéléos d'Azé Barriquand L. & J. Spéléos les Argilons	<i>Ursus deningeri</i> <i>Ursus arctos</i>	
	<b>AZÉ 1-5</b> Galerie des Aiglons	Villeneuve R. Barriquand L. & J.	<i>Canis lupus</i> <i>Vulpes vulpes</i> <i>Ursus deningeri</i> <i>Ursus spelaeus</i> <i>Ursus arctos</i> <i>Panthera spelaea</i>	<i>Bos ou Bison</i> (A.A.) <i>Capra ibex?</i> (A.A.) <i>Cervus elaphus</i> (A.A.) <i>Magaceros</i> (ou très gros <i>C. elaphus</i> ?) (A.A.) <i>Capreolus</i> sp. (A.A.) <i>Dicerorhinus mercki</i> (C.G.)
	<b>AZÉ 1-6</b> Galerie de liaison	Villeneuve R. Barriquand L. & J. Argant T.	<i>Panthera pardus</i> <i>Crocuta spelaea</i> <i>Hyaena prisca</i> ? <i>Felis silvestris</i> <i>Meles meles</i>	<i>Equus</i> sp. (A.A.) <i>Sus scrofa</i> (A.A.) <i>Lepus</i> sp (A.A.) <i>Aves</i> indet (A.A.) Microfaune (M.J.) : 26 espèces
	<b>AZÉ 1-7</b> Porche d'entrée des Aiglons	Barriquand L. & J.	<i>Canis lupus</i> (M.J.) <i>Vulpes vulpes</i> (M.J.) <i>Meles meles</i> (M.J.) <i>Mustela nivalis</i> (M.J.) <i>Mustela erminea</i> (MJ)	Microfaune (M.J.) : 41 espèces
<b>AZÉ 2 Rivière souterraine</b>	<b>AZÉ 2-1</b> Abri du rhinocéros	Béru M. Jeannet A.		<i>Coelondonta antiquitatis</i> (C.G.)
	<b>AZÉ 2-2</b> Site moustérien de plein air	Spéléos d'Azé Combier J.	<i>Ursus</i> sp (J.C.) <i>Canis lupus</i> (J.C.)	<i>Elephantidae</i> indéterminé, <i>M. primigenius</i> possible (C.G.) <i>Bison priscus cf mediator</i> (C.G.) <i>Equus germanicus</i> (C.G.) <i>Rangifer tarandus</i> (J.C.) <i>Marmota marmota</i> (J.C.) <i>Castor fiber</i> (J.C.) <i>Citellus citellus</i> (J.C.)
	<b>AZÉ 2-3</b> Abri du Chevreuil	Spéléos d'Azé		<i>Capreolus capreolus</i> (Spéléos d'Azé)

Tab.1: List of fauna of Azé.  
Tab.1: Liste de faune d'Azé.



**Fig. 6: Longitudinal section of the Blanot 1 Cave (after M. Bonnefoy).**  
 Fig. 6: Coupe longitudinale de la grotte de Blanot 1 (d'après M. Bonnefoy).

of five blocks which descend to the rift of the river Saône valley.

The Blanot Caves are located in the most western of the five blocks of the Mâconnais. On its eastern edge, the faulting caused the series of jurassic limestone to come in contact with the microgranite massif of the Mont Saint-Romain (579 m asl) in the second link. The cavities open at 395 m asl on the north face of the dell of La Mangette where a small brook emerges north-east of the caves on the slopes of the neighbouring paleozoic massif. After running down for about a hundred meters on the slopes of the hercynian massif, the water disappears into a swampy area in contact with the microgranite and the limestones 200 m uphill from Blanot.

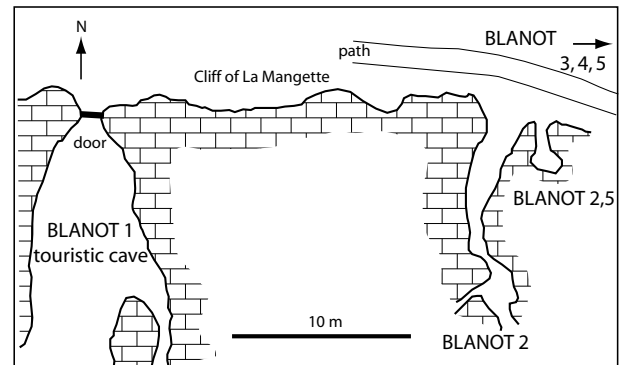
The lower part of the network of Blanot 1 is always active with a brook that sometimes floods the bottom parts when there is a lot of rain. Dyes added to the water at the point where it disappears at La Mangette, and at the bottom of Blanot 1, emerged the Vivier spring and the spring of the river Grison, both situated 1 km to the west of the caves, in the axis of the dry dell. Thus, the La Mangette brook supplies water to a part of the active system of Blanot 1.

The caves developed in the cherty limestone of the upper Aalenian and in the encrinitic and coral limestone of the Bajocian. In places, selective erosion has led to the protrusion of cherts and fossils. Deeper, the formations are impermeable because of the marls of the Lias lying on the hercynian bedrock.

Two main structural factors are responsible for the general aspect of the caves: the dip of the limestone layers and the faults. The sink-hole of Blanot and its chambers developed according to the 22°E dip of the layers. Collapses have also determined the overall aspect of the site as can be seen in the large entrance chamber (or Cave de la Cailleverdière) where we find a huge block – called

“the ship” – which is estimated to weigh nearly 1200 tons. The faults also play a notable role in the morphology of the karst. The cavities are lined up on the general direction 20°N of the great regional faults. The rooms are linked to each other by pits or galleries which are all joints enlarged by erosion.

Several of them were excavated from 1959 to 1962 by Maurice Bonnefoy when he developed the Blanot Cave (fig. 7).



**Fig. 7: Location of Blanot 1, Blanot 2 and Blanot 2,5 (after Argant, 1990).**

Fig. 7: Location of Blanot 1, Blanot 2 and Blanot 2,5 (after Argant, 1990).

Blanot 2 or The Cave of the Bear (or Cave of the Fox) yielded a large number of bones associated with some silex flakes (fig. 8) and a beautiful mousterian blade. The fauna is very varied and is attributed to a temperate episode of the Eemian interglacial period or of the beginning of the last glacial period, i.e. Isotopic Stages 5 or 4 (Argant, 1990) (tab.2).

Among this fauna we notice the presence of three species of bear, the cave bear (*Ursus spelaeus*), the brown

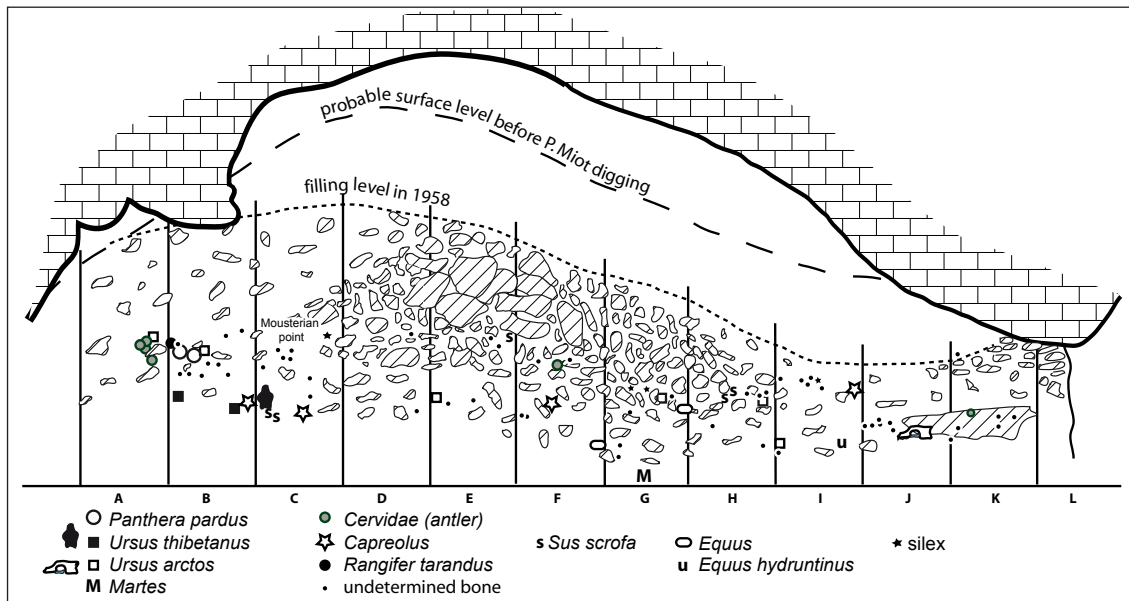


Fig.8: Longitudinal section NS of Blanot 2 (after M. Bonnefoy).  
Fig. 8 : Coupe longitudinale NS de Blanot 2 (d'après M. Bonnefoy).

	BLANOT 2 1959-1962	BLANOT 2,5 1985
LAGOMORPHES	<i>Lepus europeus</i>	
CARVIVORES	<i>Vulpes vulpes</i> <i>Ursus thibetanus</i> <i>Ursus arctos</i> <i>Ursus spelaeus</i> <i>Martes martes</i> <i>Crocota crocuta spelaea</i> <i>Felis minuta</i> <i>Felis silvestris</i> <i>Panthera pardus</i>	<i>Ursus spelaeus</i> <i>Crocota crocuta spelaea</i>
PERISSODACTYLES	<i>Equus caballus</i> <i>Equus hydruntinus</i>	
ARTIODACTYLES	<i>Cervus elaphus</i> <i>Capreolus capreolus</i> <i>Rangifer tarandus</i> <i>Bison schoetensacki</i> <i>Sus scrofa</i>	<i>Cervus elaphus</i> <i>Bison schoetensacki</i> <i>Sus scrofa</i>

Tab.2: List of fauna of Blanot 2 and Blanot 2,5.  
Tab.2: Liste de faune de Blanot 2 et Blanot 2,5.

bear (*Ursus arctos*) and the Tibet bear (*Ursus thibetanus*) which is much rarer and is mentioned here in Burgundy for the first time (Argant, 1991). It is represented by a complete skull, the first to be discovered in France but unfortunately it has suffered many vicissitudes (fig. 9). It is exhibited in the Museum of the Azé Caves.

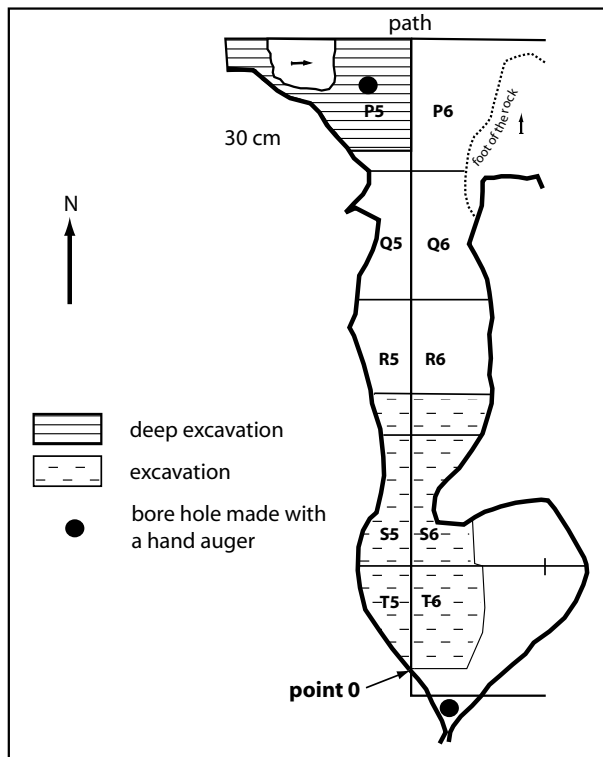
Very close to Blanot 2 (3 m eastwards) a fissure opens in the same karstic system. It is Blanot 2,5 (between Blanot 2 and Blanot 3) (fig.10). Because of illegal excavations, the regional Director of Cultural Affairs of Burgundy authorized a rescue excavation (Argant - Verjux) in 1985. Although the fauna was less abundant than in the former case, there were the same species (material exhibited inside the touristic cave Blanot 1). A pollen analysis by J. Argant (Argant, 1990) indicates very clearly temperate conditions that confirm the dating given for Blanot 2 (tab. 3).

Arboreal pollen		Non arboreal pollen		Spores (Pteridophyta)
Taxa	%	Taxa	%	%
<i>Quercus</i>	41,7	Poaceae	10,1	4,9
<i>Carpinus</i>	16,5	Ranunculaceae	2,0	
<i>Corylus</i>	3,1	<i>Plantago</i>	1,0	
<i>Pinus</i>	2,8	Apiaceae	0,7	
<i>Betula</i>	1,4	<i>Artemisia</i>	0,3	
<i>Tilia</i>	1,0	Campanulaceae	0,3	
<i>Alnus</i>	0,7	Oenotheraceae	0,3	
<i>Acer</i>	0,3	Rosaceae	0,3	
<i>Fagus</i>	0,3	Scrophulariaceae	0,3	
<i>Salix</i>	0,3	Ambrosiaceae	0,3	
<i>Fraxinus</i>	0,3	Rubiaceae	0,3	
<i>Juglans</i>	0,3	Caryophyllaceae	0,3	
		<i>Typha</i>	0,3	
		Asteraceae	0,3	
Undetermined	5,9			

Tab.3: Results of pollen analysis of the sample BLANOT. 2,5 - S6-24.  
Tab.3: Résultats de l'analyse pollinique de l'échantillon BLANOT. 2,5 - S6-24.



**Fig.9: Blanot 2. Skull of *Ursus thibetanus* (photo A.J.Argant).**  
*Fig.9: Blanot 2. Crâne d'*Ursus thibetanus* (photo A.J.Argant).*



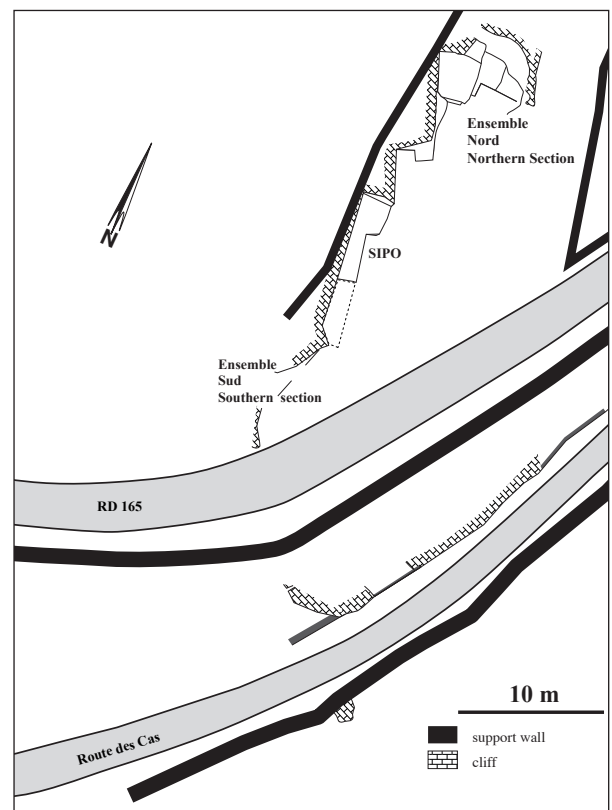
**Fig. 10: Plan of Blanot 2,5.**  
*Fig. 10: Plan of Blanot 2,5.*

The other small cavities of the dell (Blanot 3, Blanot 4 and Blanot 5) have also yielded some bones. These were collected by M. Bonnefoy, and are essentially fox, badger and some pieces of sub-current fauna such as a mandible of domestic dog. They don't look very old.

#### 4 - CHÂTEAU BRECCIA

In 1863 during the construction of route D165 at Château (Saône-et-Loire), the palaeontological site of the Château Breccia was discovered and "an enormous amount of bear and lion bones was exposed" (Monnier,

1869). A. et J. Argant rediscovered the site in 1968 and started an excavation which continued from 1997 to 2008. The quarries demolished the karstic system and enabled us to discover a network of cavities filled with sediments most of them embedding fossil bones and bound together with breccia. Phases alternate between breccias, consisting of material deriving from limestones and sometimes sandstone or granite, erosive episodes (solifluction flows). There are two distinct sectors (North and South) non contemporaneous, ranging from Early Middle Pleistocene to Late Middle Pleistocene (fig. 11).



**Fig. 11: Château Breccia. Location and map of the different sectors.**  
*Fig. 11: Brèche de Château. Localisation et plan des différents secteurs.*



Thus, globally, this site, especially rich in Carnivores remains, spans a long chronological period of the Middle Pleistocene, which enables us to follow a very long term evolution of the fauna, which is not so frequent (fig. 12). Bear remains largely dominated the fossil assemblage, but the characteristic feature of this site was the abundance of big cats.

– The Northern Section (EN), the older, yields three fossiliferous units datable by biochronology (Ursids, Felids, and especially *Arvicola cantianus*) of Early Middle Pleistocene (Breccia 4) and above all Median Middle Pleistocene (Breccias 3 and 2, about 600,000 years ago).

– The Southern Section (ES) stratigraphy is 7 m thick, with, at middle height in the breccia, a remainder of a 14 cm thick stalagmitic floor the top part of which has been dated by U/Th-TIMS method (GEOTOP-Montréal, Canada) at 176,795 + 9,337 - 8,540 years. The ES covers a chronological span from at least Median Middle Pleistocene (Isotopic Stage 8) to Late Middle Pleistocene (isotopic stage 6) at the top.

Pollen analysis of samples of breccia and of stalagmitic floor in both sections indicates a mosaic landscape, with grassy areas, conifers on the plateau and scattered broadleaved woodland areas in the shelter of the valley. The climatic conditions seem to be rather temperate but cooler

than today, even with some cold episodes also indicated by the microfauna.

The interest of the Château Breccia is the abundant palaeontological material, especially rich in big cats, first the european jaguar (*Panthera gombaszoegensis*), and then the ancient form of the cave lion (*Panthera spelaea fossilis*). In spite of erosive episodes the evolution of their association with wolf (*Canis lupus mosbachensis*) and above all bear (*Ursus deningeri*), ever abundant, can be followed over a long time span, the former looking for food, the latter for a hibernation place (plate 1).

Although climatic variations necessarily played a major role, the fact that the associations of big Carnivores remained unchanged and was associated with big herbivores only in the South Section, is evidence of the determining role of the karstic trap in the origin of this fossil assemblage. After all, lions and jaguars of the North Section necessarily fed on large herbivores, even if we don't find any remains of their prey there. It is really the opening in the karstic system of the South Section that created a trap for herbivores, and led to the important changes in the more recent associations of fauna.

The plateau of la Garenne is a faulted block (Y fault) of the Bajocian limestones which came to rest against the

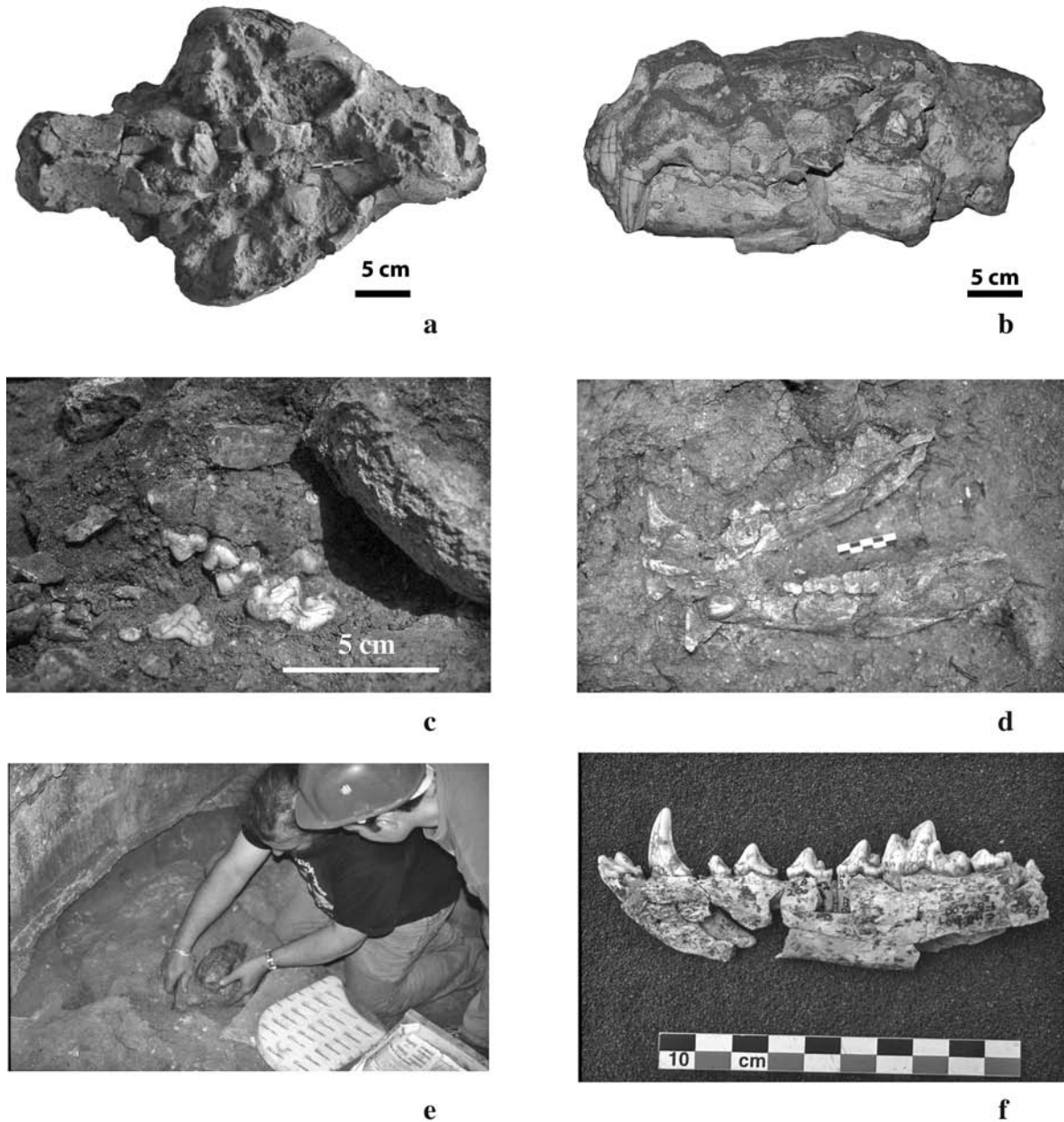
STRATIGRAPHY		FAUNA
Brown soil	US 101	Sterile
BRECCIA 1 yellow ocher, with gravels and blocks	US 102	Sterile
thin stalagmitic floor		
BRECCIA 2 yellow ocher, pinkish, with gravels and blocks	US 103	<i>Ursus deningeri</i> <i>Panthera spelaea fossilis</i> <i>Canis lupus mosbachensis</i> <i>Felis silvestris</i> <i>Sus scrofa</i> Microfauna
id. beige	US 104	
BROWN CLAY from deep karst	US 105	Sterile
BRECCIA 3 yellow ocher with many pebbles (charts) + yellowish clayish fine sand	US 106	<i>Ursus deningeri</i> <i>Panthera spelaea fossilis</i> <i>Panthera gombaszoegensis</i> Microfauna
	US 107	<i>Ursus deningeri</i> (moins évolué) <i>Panthera gombaszoegensis</i> <i>Canis etruscus</i> <i>Ursus arctos</i> Microfauna
BRECCIA 4 yellow ocher with thin flatstones and small blocks	US 115	<i>Oryctolagus cf. lacosti</i> <i>Mimomys hintoni</i> (2 to 4 Myrs)
Reworked		

Northern Unit / Ensemble Nord

STRATIGRAPHY		FAUNA
BRECCIA yellowish, with some angular stones from the wall	US 303	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Cervus elaphus</i>
BROWN CLAY with round stones and flints (pebbles)	US 304	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Cervus elaphus</i>
BRECCIA lower layer with rounded stones	US 305	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Felis silvestris</i> <i>Canis lupus</i> <i>Bos primigenius</i> <i>Cervus elaphus</i>
Stalagmitic floor	US 308	Sterile 176,795 + 9,337 - 8540 yrs U/Th-TIMS Geotop-Montréal
BRECCIA	US 309 to US 312	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Cervus elaphus</i>
LATERAL BRECCIA and, below, uncemented sediment, slipping under the wall at the bottom of the digging	US 313	<i>Ursus deningeri</i> <i>Panthera spelaea</i> <i>Felis silvestris</i> <i>Canis lupus</i> <i>Vulpes vulpes</i> <i>Cervus elaphus</i>
	US 314	

Southern Unit / Ensemble Sud

Fig. 12: Stratigraphy of the Château Breccia (Northern and Southern sectors).  
Fig. 12: Stratigraphie de la Brèche de Château (Ensembles nord et sud).



**Plate 1: Château Breccia.** a- Skull of *Panthera spelaea fossilis* (CHA1-06-C3-431), overview; b- Skull of *Panthera spelaea fossilis* (CHA1-98-C3-246); c- *Panthera gombaszogensis*: skull and right mandible in situ (CHA1-01-G8-171); d- *Ursus deningeri*: mandible in situ (CHA1-98-D5-75); e- Excavation of the skull of a bear cub (*Ursus deningeri*, SIPO, CHA1-02-AA25-23); f- Left hemimandible of *Canis lupus mosbachensis* (CHA1-01-F8-200). Photos A.J. Argant.

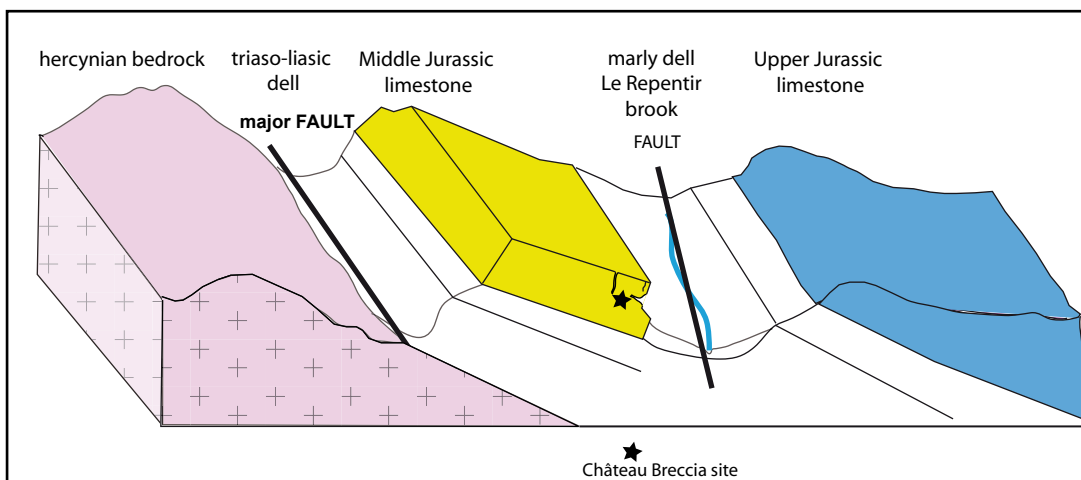
*Planche 1: Brèche de Château.* a- Crâne de *Panthera spelaea fossilis* (CHA1-06-C3-431) vu de dessus; b- Crâne de *Panthera spelaea fossilis* (CHA1-98-C3-246); c- *Panthera gombaszogensis*: crâne et mandibule droite in situ (CHA1-01-G8-171); d- *Ursus deningeri*: mandibule in situ (CHA1-98-D5-75); e- Dégagement d'un crâne d'ourson (*Ursus deningeri*): SIPO, CHA1-02-AA25-23; f- Hémimandibule gauche de *Canis lupus mosbachensis* (CHA1-01-F8-200). Photos A.J. Argant.

hercynian granitic bedrock of Mont Gremoi (555 m-asl) to the west. As typical in the Mâconnais, the dip of marls and limestones is 20-22° East. The western part of the Y of the fault corresponds to the valley of Le Nière, a triassic-liassic combe as often met in the Mâconnais. It developed by erosion of the marls of the Toarcian at the foot of much more resistant encrinitic limestones. To the East, we find the dell of Le Vernay where a small brook, a tributary of the river Grosne called Le Repentir, originates. It flows southwards along the “tail” of the Y fault and supplies the washhouse of Le Vernay with water all the year long. The eastern edge of the plateau

of la Garenne also corresponds to a fault and its encrinitic limestones are different from the white limestones which are found on the opposite side of the valley (fig. 13).

Thus a superficial network developed and filled up with decalcification clay. Once it had opened up on the surface it could also absorb solifluction mudflows with detritic matter, blocks from the roofs or from the walls and, sometimes, bones of animals sheltering in upper cavities today decayed by erosion.

The “puits à cannelures” of the large quarry also provide evidence of strong withdrawing occurring from time to time and therefore of an important lower karstic



**Fig.13: Typical pattern of a link in Monts du Mâconnais (after Simonnot, 2003). The case of Château.**

*Fig.13 : Structure typique d'un chaînon des Monts du Mâconnais (d'après Simonnot, 2003). L'exemple de Château.*

network. This karst probably appeared just after the emergence of the Lower Cretaceous and before the Jurassic or Alpine periods of stress because the shafts observed in the quarry, probably originally vertical, are now oblique and they follow the general tilting of the Mâconnais towards the East.

The general evolution of this karst is to be placed at the end of the Tertiary era. The keyhole-shaped galleries of the Château Breccia site (Galerie Ouest, Galerie des Blaireaux), reflect several phases of development and indicate a formation in free water in a deep karst, probably in warm and humid conditions such as those prevailing during the Pliocene. The phases of intense erosion and of filling with abundant colluvium, bound together by breccia afterwards, can be dated from Early, Median and Late Middle Pleistocene, as indicated by fauna. A section 200 m northwards in the valley of Le Vernay, (foundations of the Dufour's house) is a good example of the complexity of these karstic fillings and it easily explains the chronological interval between the North and South sectors of the Château Breccia site which have no direct link with each other.

## 5 - PLEISTOCENE CARNIVORES OF THE MÂCONNAIS

A particular feature of the Mâconnais is its great wealth of prehistoric and palaeontological deposits (fig. 1), alas often prematurely exploited and excavated without sufficient care and expertise with the result that we now lack detailed and precise information about what was found. The Middle Pleistocene appears well-represented in an ancient karst filled with sediment but which escaped severe dismantlement during the course of the last glacial period. In this landscape paleontology and prehistory often coincide. The three sites visited by the Symposium give a clear picture of this richness and of the important contribution of the Mâconnais to the palaeontology of the Carnivores. It was not possible to include in the excursion

the Grotte de Verchizeuil (or Grotte de Malessard, 290 m asl) at Verzé (Argant, 2000) because of lack of time and its very difficult access. It is attributed to the Middle Pleistocene (Argant, 1991).

Cave bears and their ancestors have been encountered in numerous Mâconnais deposits. The most ancient, *Ursus deningeri*, is found in Brèche 4 in the Ensemble Nord at Château (Early Middle Pleistocene) where it probably coexisted with *Ursus arctos* (1 M/1 is characteristic and different to the small collection of these from *Ursus deningeri* found in this breccia). *Ursus deningeri* is encountered again in the Late Middle Pleistocene, in a more evolved form, in the upper layers of the Ensemble Sud of the Château Breccia (OIS 6 or 5). The same pattern occurs in finds from the Azé 1 cave, in the deposits of Azé 1-1 and Azé 1-4. The transitional form *Ursus spelaeus deningeroides*, so named because of its proximity to its very close but more speleean ancestral form, is encountered in the Azé 1-2 and Azé 1-3 deposits to the north of the stalagmitic obstruction 60 m from the cave's entrance. In the Blanot 2 cave (OIS 4?) we find *Ursus spelaeus*, typically associated with *Ursus arctos* and *Ursus thibetanus* (first complete skull found in France, fig. 9). *Ursus spelaeus* is also present in Azé 1-5 (Galerie des Aiglons) and Azé 1-6 (gallery joining Azé 1). Several other Mâconnais sites have also provided significant quantities of *Ursus spelaeus* remains, such as the Grotte des Furtins (Berzé-la-Ville) (Leroi-Gourhan, 1950), the Grotte des Mâcherons at Lugny, one of the caves at Préty-Lacrost (Argant, 1991), and quite a few others.

Large Felidae appear well-represented in the Mâconnais, less so than the bears because they don't hibernate, but they appear regularly in caves, no doubt because they came there to feed on bear or bear cub carcasses or even to prey on and carry off live bear cubs during winter when food was difficult to find. The remains of big cats are frequently found in Burgundy, particularly in the Mâconnais, at times in large quantities as in the Château Breccia. Firstly *Panthera gombaszogensis*, the European Jaguar, the only large Felidae found in Brèche 4, the most

ancient dating from the Early Middle Pleistocene, then in the Median Middle Pleistocene, associated with *Panthera spelaea fossilis* in Brèche 3, and lastly the presence of the only *Panthera spelaea fossilis* in Brèche 2. In the Late Middle Pleistocene the cave lion is clearly present in Azé 1-3 with a single individual well-represented by a complete skull, half a left mandible and 9 other items including the complete right humerus and radius, and an impression left by its right P4/ on the distal extremity of a bear tibia. The remains of cave lions, often very large ones, have been found in several other Mâconnais deposits, including Verzé, Préty-Lacrost and Les Mâcherons.

The wolf or its ancestors are often encountered in caves where bears hibernated. In the Château Breccia it is possible to follow the evolution of *Canis mosbachensis* throughout the Middle Pleistocene. The real wolf, *Canis lupus*, is present at Azé 1-5 in the Galerie des Aiglons, in the Late Pleistocene, and in several other Mâconnais deposits from this period, but it remains rarely represented.

Remains of the cave hyena, *Crocuta spelaea*, are rare in the Mâconnais and seem to appear only from Isotopic Stage 5. It occurs in Azé 1 (old excavations carried out by Dravet and Morel) in the front part of the cave before the stalagmitic obstruction 60 m from the entrance, and at Azé 1-5 and Azé 1-6, but only in the form of a few remains. There are indications that *Hyaena prisca* may also be present at the latter two sites but this is yet to be confirmed. Remains of cave hyenas have been found in several other Mâconnais deposits, but always in small numbers: Bissy-la-Mâconnaise (Argant & Argant, 1983); Les Mâcherons at Lugny; the Grotte de Germolles; Solutré 1 (prehistoric deposit); and Solutré 2 (karstic crack in the

valley opposite the prehistoric deposit), but always from the Late Pleistocene. No remains of Hyaenidae have been found in the Château Breccia deposit. However a few very characteristic coprolites (in which numerous grains of pollen were revealed by palynological analysis) were discovered in the Ensemble Sud (Late Middle Pleistocene), which proves that the absence of bones doesn't necessarily indicate absence of the species.

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