

FIRST DATA ON THE LATEST PLEISTOCENE MAMMALS FROM MORA CAVORSO CAVE (JENNE, LATIUM, CENTRAL ITALY)

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ABSTRACT: Salari L., Passacantando D. & Rolfo M.F., *First data on the latest Pleistocene Mammals from Mora Cavorso Cave (Jenne, Latium, Central Italy)*.

Since 2006 the Mora Cavorso Cave has been object of archaeological investigations, and archaeological and faunal finds have been recorded referable, with some discontinuities, to an interval of time lasting over 13,000 years. The most ancient testimonies till now investigated are referable to the terminal phases of the Late Pleistocene and are followed by various Holocene layers between the Mesolithic and the Middle Age. In this paper the preliminary data related to the large Mammals, together with the hare and the greats Rodents, attributed to the latest Pleistocene are described.

Nine taxa of fossil mammals in the "Dig B2" of the room 1 and ascribed to a late Upper Paleolithic cultural horizon (final Epigravettian) have been found: *Lepus* sp., *Marmota marmota*, *Vulpes vulpes*, *Mustela nivalis*, *Sus scrofa*, *Cervus elaphus*, *Capreolus capreolus*, *Rupicapra* sp. and *Capra ibex*. From other places of the cave (the perturbed ground of the room 1 and the "Sinkhole") the fossil remains of *Lepus* sp., *Lepus corsicanus*, *Castor fiber*, *M. marmota*, *Canis lupus*, *Ursus arctos*, *Equus ferus*, *E. hydruntinus*, *S. scrofa*, *C. elaphus*, *C. capreolus* and *C. ibex* have been also found and these too are referable to the latest Pleistocene. The marmot and the ibex are the most significant species, but is even important the red deer presence, and a particular attention deserves also European beaver, till now not signaled in lateglacial mammal assemblages of central Italy, and the sure evidence of the Italic hare. The ecological requirements of the present taxa allow reconstructing the environment of the Simbruini Mounts and the tall of the Aniene River valley during such period colder than today, outlining a composite landscape with forests and woods alternated with grasslands, rocky bands and scree slopes, and wetlands.

RIASSUNTO: Salari L., Passacantando D. & Rolfo M.F., *Primi dati sui Mammiferi tardopleistocenici della Grotta Mora Cavorso (Jenne, Lazio, Italia centrale)*.

La Grotta Mora Cavorso è oggetto d'indagine archeologiche dal 2006 ed ha restituito reperti archeologici e faunistici che coprono, con qualche discontinuità, un intervallo di tempo di oltre 13.000 anni. Le più antiche testimonianze finora indagate sono riferibili alle fasi terminali del Pleistocene Superiore e sono seguite da vari livelli olocenici compresi tra il Mesolitico e il Medio Evo. Nella presente nota sono esposti i dati preliminari relativi ai grandi Mammiferi, cui sono stati aggregati la lepre e i grossi Roditori, rinvenuti nel "Saggio B2" della sala 1 e attribuiti al tardo Pleistocene Superiore; altri resti di vertebrati tardopleistocenici sono stati recuperati in diversi luoghi della grotta (terreno rimaneggiato della sala 1 e "Inghiottitoio"). Le specie maggiormente significative sono marmotta e stambecco, ma è altresì importante la presenza del cervo e meritano una menzione particolare anche il castoreo, finora non segnalato tra le faune tardoglaciali dell'Italia centrale, e l'individuazione certa della lepre italiana. Le esigenze ecologiche dei taxa presenti permettono di ricostruire l'ambiente dei Monti Simbruini e dell'alta valle dell'Aniene durante tale periodo più freddo rispetto ad oggi, delineando un paesaggio composito, con foreste e boschi intervallati da praterie, fasce rocciose e aree a pietraia e zone umide.

Key Words: Vertebrates, Mammals, Late Pleistocene, Epigravettian, Palaeoecology.

Parole-chiave: Vertebrati, Mammiferi, Pleistocene Superiore, Epigravettiano, Paleoecologia.

1. INTRODUCTION

The cave locally called Mora Cavorso opens to 720 m a.s.l. in the locality Palo Montano near Jenne (Rome, Latium, Central Italy); it leans out on the right slope of the upper Aniene River valley inside the Simbruini Mounts Regional Natural Park (Fig. 1A).

This karst cavity is carved in the "Calclutiti e Calcareniti del Conaciano-Campaniano" formation (C9-11/38, Upper Cretaceous) (DAMIANI et al., 1998). The cave has a succession of rooms and ducts. The room 1 (medium dimensions, about 20 x 10 m) is closed towards outside by a recent stone wall and open directly

on the slope, on the bottom it is open a passage that leads to a natural duct with slight slope, partially filled by a recent Holocene deposit. At the end of the duct the room 2 opens, the first in the interior (about 6 x 4 m), it is paved by a stalagmite crust and below an archaeological deposit is present. On the north wall a second natural duct starts, horizontal, strongly concretioned, about 20 m length, at the end two paths (upper room and lower room) with anthropological remains open (ROLFO et al., 2009; 2010).

Following the discovery of human bones inside the cave, by the members of "Shaka Zulu" Speleological Club of Subiaco, the archaeological investigations in the

cave in 2006 started. The digs initially focused the areas of the Neolithic human remains outcrop and subsequently in more stratigraphical digs in the most external rooms to the purpose of investigating the stratigraphical sequence of the deposit (Fig. 1B). In particular, in the dig B2 (a trench about 4 x 3 m behind the stone wall, in the eastern sector of the front of room 1), just below a perturbed surface layer, the Stratigraphic Units 109, 110, 120, 135, 254 and 255 (= "Dig B2") are characterized by a compact reddish-brown silty ground with limestone clasts with sharp edges, where a moderate quantity of lithic artifacts referable to a late Upper Paleolithic cultural horizon (final Epigravettian) and numerous fossil remains of vertebrate animals have been recovered. The calcareous floor of the cave has not yet been reached.

In this paper the first data on the large Mammals, together with the hare and the greats Rodents, recorded in "Dig B2" and attributed to the latest Pleistocene are presented. Other mammal remains referable to the latest Pleistocene and that have been also found from the filling of an sinkhole that partially opens on the right side of the entry of the cave (= "Sinkhole") and from the perturbed ground of the room 1 are also described.

2. STRATIGRAPHIC NOTES

The synthetic stratigraphy of the various areas of the cave shows a variously articulated deposit (Fig. 2) that develops from the deepest layer till now investigated, referred to the latest Pleistocene, up to the superficial level of historical age (ROLFO *et al.*, 2010).

The "Dig B2" is the most ancient layer investigated with stratigraphical methodology and it has been intercepted in the room 1, below the altered surface layer with micromammal and bird remains and several fossil bones of great wild mammals together with numerous finds of prehistoric and recent domestic mammals. The "Dig B2" is a compact reddish-brown silty ground with limestone clasts with sharp edges that vary in diameter from few millimeters to the centimeter, and with a thickness of about 20-30 cm. In this layer many fossil remains of vertebrate have been found together with a moderate number of lithic artifacts referable to final Epigravettian, such as a frontal scraper on a retouched blade of jaspered flint, three fragments of backed blade lets, a fragment of backed point and a multiple burin. A radiometric dating¹ performed on a marmot mandible from this layer, has

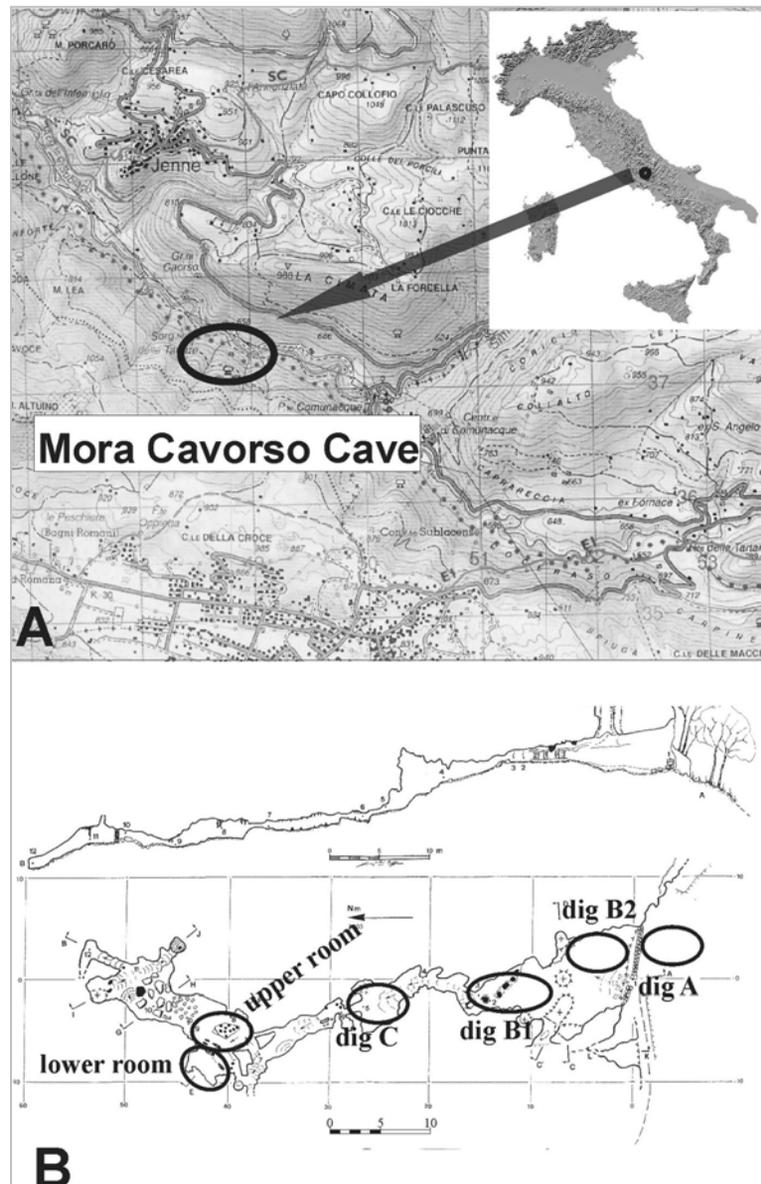


Fig. 1 - Mora Cavorso Cave: A) location of the site; B) longitudinal section (up) and plan (down) of the cave.

Grotta Mora Cavorso: A) ubicazione del sito; B) sezione (in alto) e pianta (in basso) della grotta

provided the age of 13,460±50 years BP (calibrated 14,175 - 13,910 BC 1σ) and agrees well with the attribution of the "Dig B2" lithic artifacts to a final Epigravettian cultural horizon. The "Sinkhole" instead is the filling of a sinkhole that partially opens on the right side of the entry of the cave. This include a pinkish-gray silty sand ground with coarse limestone breccias with sharp edges, and a small level with reddish slimy soil, and there some bone remains of vertebrate referable to the latest Pleistocene have been also found.

¹ All the radiometric dating have been performed by the "Centre de Datation par le Radiocarbonate - CNRS", Lyon (France), except that on a mesolithic red deer tooth, performed by the "Beta Analytic Inc.", Miami (U.S.A.).

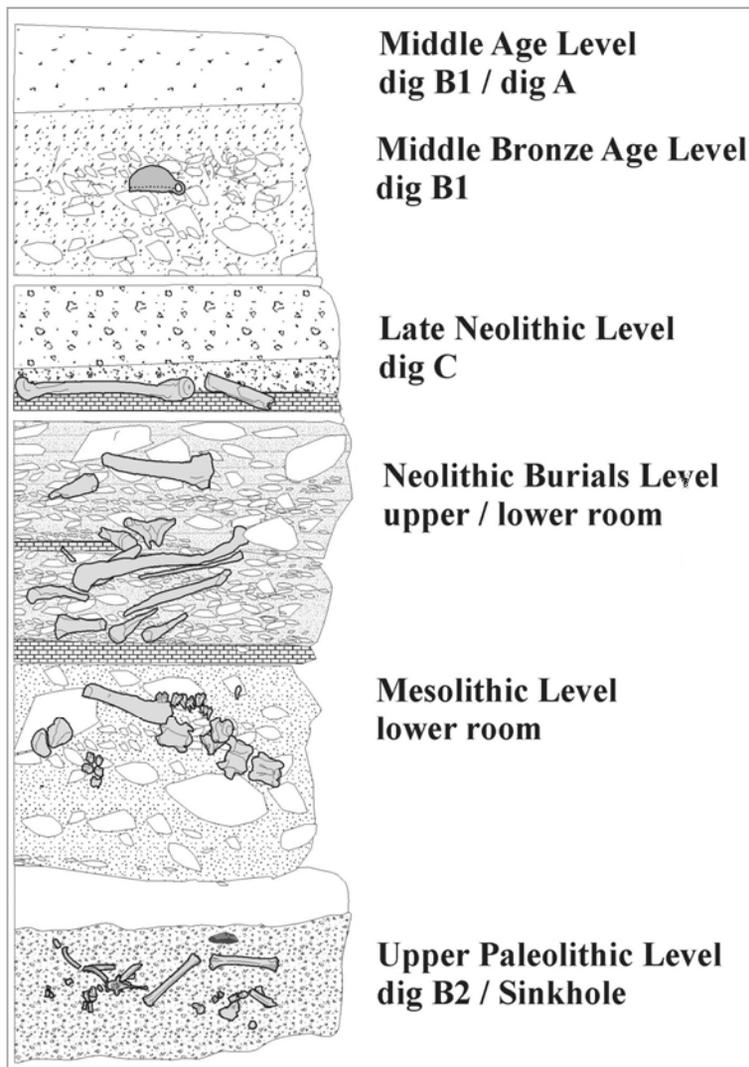


Fig. 2 - Mora Cavorso Cave: Stratigraphic synthesis.
Grotta Mora Cavorso: Stratigrafia sintetica.

A layer from the inferior room which can be attributed to early Holocene (Mesolithic cultural phase) follows; it is rich of *Cervus elaphus* bones in partially articulated (SALARI *et al.*, 2009; ROLFO *et al.*, 2010). Also for this level have been made two radiometric dating, one on a red deer tooth ($8,770 \pm 60$ years BP, calibrated 7,950 - 7,790 BC 1σ), and the other on a charcoal fragment ($8,805 \pm 45$ years BP, calibrated 8,197 - 7,729 BC 1σ). In this layer, except a moderate number of charcoal fragments and various ashes spots, no other evidence of human presence has been discovered. This level underlies a layer dated to the ancient Neolithic characterized by the noticeable presence of abundant human remains referable to at least 21 individuals (PASSACANTANDO, 2009), concerning partly disturbed burials (in the upper and lower room). Archaeological finds have also been recovered and are pertinent to the various funeral outfits (ROLFO *et al.*, 2009; 2010), together with bones and teeth primarily of domestic fauna, above all *Ovis* *vel* *Capra* (SALARI *et al.*, 2009). As well in this case two radiometric dating are been performed, the first one on human bone ($6,405 \pm 35$ years BP, calibrated 5,472 -

5,314 BC 1σ), the second on a charcoal fragment ($6,275 \pm 45$ years BP, calibrated 5,322 - 5,084 BC 1σ). A layer from the room 2 (dig C) has to be referred to the Neolithic final phase; it is characterized by a level rich of charcoal and ashes. In the deeper part of the room 1 (dig B1) the archaeological sequence is superficially covered by a layer very rich of pottery (fragments and a whole bowl) shed anywhere, and human bones, referable to disturbed burials dated to the middle Bronze age (first half of II millennium BC). Rare but noticeable it is the pottery referable to the historical age (VIII-X century AD) recovered in the dig A, in the external dig, and on the ground of the upper level of the dig B1 of the room 1 (ROLFO *et al.*, 2010).

3. METHODOLOGY

The proceeding of the analyses of the "Dig B2" faunal remains, referable to a final Epigravettian horizon, were carried on at the same time to archaeological investigations progress. Other mammal remains referable to the latest Pleistocene have been recovered from the "Sinkhole" and from a disturbed level of the room 1.

The examined finds have been compared to the osteological material stored in the Department of Earth Sciences of the University of Rome "Sapienza". The bone remains are very fragmentary and generally their state of preservation does not allow the individualization of the anatomical portion, neither the taxonomic determination. Among the determined remains, nevertheless, there are also some intact skeletal elements like metapodials, carpal and tarsal bones, phalanges, isolated teeth and some mandibles.

This material has been recovered in different places of the cave, so its description will be carried on taking into account the origin place of the remains. The mammal bones recovered in the "Dig B2" originate from a level investigated with stratigraphical methodology, it is well dated both radiometrically and according to the cultural chronology and it is therefore possible to effect a numerical analysis. Every taxon is quantified both in number of remains (NR) and in the minimum number of individuals (MNI), calculated according BÖKÖNYI (1970); the fragments of ribs and vertebrae of difficult taxonomical attribution have been counted apart. For the material remainder, instead are listed out the recognized taxa and valued their relative frequency (Tab. 1).

4. FAUNAL DESCRIPTION

4.1. The Mammals remains from the "Dig B2"

From the "Dig B2" over 1000 mammal remains have been recorded, 171 of which (17.05%) have been anatomically and taxonomically determined. From the

Tab. 1, in which the percentages of each taxon are calculated on the total of the determined fragments, while the percentages related to the ribs, to the vertebrae, to the undetermined and to the total determined remains are calculated on the general total, the most abundant taxon is *Marmota marmota* (LINNAEUS, 1758), with more than the half of the determined remains and a third of the individuals. *Cervus elaphus* LINNAEUS, 1758, *Capra ibex* LINNAEUS, 1758, *Rupicapra* sp. and *Lepus* sp. are present with a certain number of fragments, *Sus scrofa*.

LINNAEUS, 1758, *Capreolus capreolus* (LINNAEUS, 1758) and *Vulpes vulpes* (LINNAEUS, 1758) with few finds, and *Mustela nivalis* LINNAEUS, 1766 has present only a single fragment of mandible (Fig. 3, n). These finds are accompanied by several Birds bones, few Amphibious bones and abundant micromammal remains above all

Rodents, particularly *Arvicola amphibius* (LINNAEUS, 1758), *Apodemus* sp. and small arvicolid, and scarce bats, *Rhinolophus ferrumequinum* (SCHREBER, 1774) and *Myotis bechsteinii* (KUHLE, 1817).

The marmot is represented by bones of the whole skeleton (Fig. 3, b-d), primarily mandible mainly fragmentary, isolated teeth, phalanges, metapodials and tarsal bones intact, while the skull and the other postcranial skeleton elements are fragmented. This fossil material is referable to at least 7 individuals; some deciduous teeth, a tibia with epiphysis not fused and a very small astragalus point out that among these at least one is a cub. The hare is present with some isolated teeth, metapodials and phalanges than at least two individuals; the scarcity of diagnostic morphological characters (see PALACIOS, 1996) does not allowed a sure attribution of such finds to *Lepus europaeus* PALLAS, 1778 or *Lepus corsicanus* DE WINTON, 1808. The fox is present with some metapodials and calcaneum (Fig. 3, l) of an adult. The wild boar is present with an inferior molar, a third metacarpus (Fig. 4, d), a metapodial with distal epiphysis not fused, a carpal bone and a first lateral phalanx concerning a fully grown and a young individual. The red deer is represented by isolated teeth, humerus, femur, tibia (Fig. 4, i), carpal and tarsal bones, phalanges (some with the proximal epiphysis not fused) and sesamoids belonging a fully grown and a young individual. The roe deer is present with a mandibular branch fragment, some isolated teeth, two of which deciduous, and a phalanx referable to a young individual and an adult. The ibex is represented by isolated teeth, some of which deciduous, radius, coxal, femur, metapodials with distal epiphysis not fused (Fig. 4, f-g), tarsal bones and phalanges referable to a young individual and an adult. The chamois is present with isolated teeth, some of which deciduous, radius (Fig. 4, m), ulna and phalanges concerning a fully grown and a young individual;

Taxon	"Dig B2"				"Sinkhole" freq.	Perturbed freq.
	NR		MNI			
	n.	%	n.	%		
<i>Lepus</i> sp. - hare	11	6.43	2	9.52	R	R
<i>Lepus corsicanus</i> - Italic hare						RR
<i>Castor fiber</i> - European beaver					RR	
<i>Marmota marmota</i> - marmot	94	54.97	7	33.33	A	CA
<i>Canis lupus</i> - wolf						C
<i>Vulpes vulpes</i> - fox	4	2.34	1	4.76		
<i>Ursus arctos</i> - brown bear					CR	
<i>Mustela nivalis</i> - weasel	1	0.58	1	4.76		
<i>Equus ferus</i>					RR	
<i>Equus hydruntinus</i>					C	
<i>Sus scrofa</i> - wild boar	5	2.92	2	9.52	RR	
<i>Cervus elaphus</i> - red deer	25	14.62	2	9.52	R	CA
<i>Capreolus capreolus</i> - roe deer	4	2.34	2	9.52		R
<i>Capra ibex</i> - ibex	16	9.36	2	9.52	C	C
<i>Rupicapra</i> sp. - chamois	11	6.43	2	9.52		
total determined	171	17.05	21			
ribs	136	13.56				
vertebrae	36	3.59				
undetermined	660	65.80				
Total	1003					

Tab. 1 - Mora Cavorso Cave, Late Pleistocene: number of remains (NR), minimum number of individuals (MNI) and percentages (%) from the "Dig B2", and mammal remains frequency (freq.) from the other archaeological contexts ("Sinkhole" and the perturbed ground of the room 1); RR: very rare; R: rare; CR: common-rare; C: common; CA: common-abundant; A: abundant.

Grotta Mora Cavorso, Pleistocene Superiore: numero dei resti faunistici (NR), numero minimo degli individui (MNI) e relative percentuali (%) del "Saggio B2", e frequenze dei resti faunistici (freq.) relative agli altri contesti archeologici ("Inghiotto" e terreno rimaneggiato della sala 1); RR: rarissimo; R: raro; CR: comune-raro; C: comune; CA: comune-abbondante; A: abbondante

the fragmentary of the finds and particularly the absence of cranial parts with horn cores, useful to the distinction between *Rupicapra rupicapra* (LINNAEUS, 1758) and *Rupicapra pyrenaica* BONAPARTE, 1845 (see MASINI & LOVARI, 1988), allow to identifying the chamois only to the genus level.

The presence of the lithic artifacts and the same mammal assemblage, characterized essentially by ungulate and marmot, would suggest an anthropic contribution of the bone accumulation, but till now only an undetermined fragment with a lithic tool incision has been observed. Some bones show traces of gnawing of rodents, while neither signs of carnivores or further traces of human activity are present. Considering also the large number of small animals and young individuals among the ungulate ones, it cannot be excluded that, over the humans, also the raptor birds and/or the other factors have contributed to the accumulation of the "Dig B2" bones.

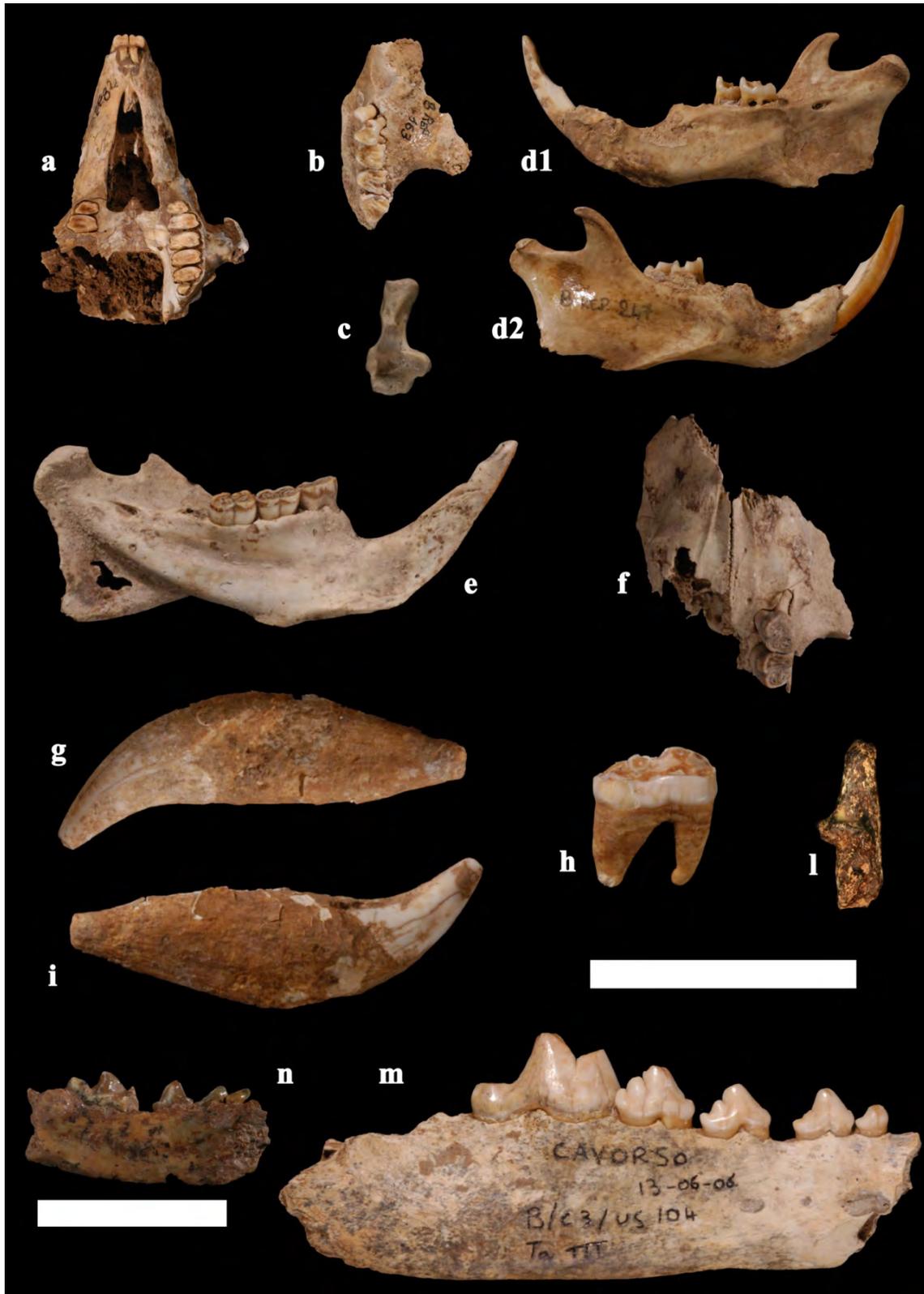


Fig. 3 - Mora Cavorso Cave, Late Pleistocene: *Lepus corsicanus*, a) skull; *Marmota marmota*, b) maxilla, c) calcaneum; d1) mandible, lingual view, d2) mandible, labial view; *Castor fiber*, e) mandible, f) skull fragment; *Ursus arctos*, g) upper canine, h) lower canine, i) second lower molar; *Vulpes vulpes*, l) calcaneum; *Canis lupus*, m) mandible; (scale bar: 5 cm); *Mustela nivalis*, n) mandible (scale bar: 2 cm).

Grotta Mora Cavorso, Pleistocene Superiore: *Lepus corsicanus*, a) cranio; *Marmota marmota*, b) mascellare, c) calcagno; d1) mandibola, norma linguale, d2) mandibola, norma labiale; *Castor fiber*, e) mandibola, f) frammento di cranio; *Ursus arctos*, g) canino superiore, h) canino inferiore, i) secondo molare inferiore; *Vulpes vulpes*, l) calcagno; *Canis lupus*, m) mandibola; (riferimento metrico: 5 cm); *Mustela nivalis*, n) mandibola (riferimento metrico: 2 cm).



Fig. 4 - Mora Cavorso Cave, Late Pleistocene: *Equus ferus*, a) first phalanx; *Equus hydruntinus*, b) first phalanx, c) astragalus; *Sus scrofa*, d) third metacarpus; *Capra ibex*, e) metacarpus, f) metacarpus (juvenis); g) metatarsus (juvenis); *Cervus elaphus*, h) metatarsus, i) tibia; *Capreolus capreolus*, l) metatarsus; *Rupicapra* sp., m) radius; (scale bar: 5 cm).

Grotta Mora Cavorso, Pleistocene Superiore: *Equus ferus*, a) prima falange; *Equus hydruntinus*, b) prima falange, c) astragalo; *Sus scrofa*, d) terzo metacarpo; *Capra ibex*, e) metacarpo, f) metacarpo giovanile; g) metatarso giovanile; *Cervus elaphus*, h) metatarso, i) tibia; *Capreolus capreolus*, l) metatarso; *Rupicapra* sp., m) radio; (riferimento metrico: 5 cm).

4.2. The Mammals remains from the other archaeological contexts

From a partially perturbed layer of the room 1 a thousand of vertebrate remains has been recovered in an advanced state of fossilization together with prehistoric and recent domestic mammals. Small and medium-sized Birds are present, micromammals (*A. amphibus*, *Apodemus* sp. and small arvicolids), and bones and teeth attributed to hare, marmot, wolf (Fig. 3, m), red deer (Fig. 4, h), roe deer (Fig. 4, l) and ibex (Fig. 4, e) (ROLFO *et al.*, 2009; SALARI *et al.*, 2009). Some morphological features of a sub-intact skull of hare (Fig. 3, a), particularly the occlusal surface contour of P2 with the postcone protrudes further than the lagicone (see PALACIOS, 1996), allow attributing this find to *L. corsicanus*.

In the "Sinkhole" a hundred of vertebrate fossil remains chaotically assembled has been recovered, partly from a level characterized by a reddish slimy soil. The bones accumulation seems of reasonable natural contribution (water energy), nevertheless the emptying has not been completed yet, but till now lithic artifacts has not been recovered yet. The mandibles and the skull fragments of *M. marmota* are abundant and are accompanied by carpal and tarsal bones and phalanges of *Equus hydruntinus* REGALIA, 1907 (Fig. 4, b-c), isolated teeth, metatarsus and phalanges of *C. ibex* and isolated teeth of *Ursus arctos* LINNAEUS, 1758 (Fig. 3, g-i). There are also rare fragments of Birds bones, micromammals and *Lepus* sp., a few isolated teeth of *C. elaphus*, a skull portion and a mandible² of *Castor fiber* LINNAEUS, 1758 (Fig. 3, e-f), and a first phalanx of *Equus ferus* BODAERT, 1785 (Fig. 4, a) and a skull fragment of *S. scrofa*.

5. CHRONOLOGICAL AND PALAEOECOLOGICAL CONSIDERATIONS

The radiometric dating of 13,460±50 years BP (calibrated 14,175 - 13,910 BC 1σ) agrees well with the attribution of the "Dig B2" lithic industry to a final Epigravettian cultural horizon, and permit to attribute this mammal assemblage to the last glacial episode final phases, or rather to the first part of the Lateglacial preceding the Bølling - Allerød temperate oscillation (see RAVAZZI *et al.*, 2007). The lateglacial climatic oscillations recorded in central-western Europe also occur in Italy, although with less intensity, especially in the Mediterranean regions. In the piedmont Alpine area, associations with ibex, chamois and marmot during the colder moments are frequent, together with elk, bison and alpine hare, that alternate to red deer and roe deer associations, sometimes accompanied to the wild boar during the temperate moments (PETRONIO *et al.*, 2007; SALA, 2007). In Mediterranean environment the lateglacial mammal assemblages seem to be conditioned by the geographical location and by the territory morphology at least how the climatic oscillations did. In fact the Adriatic slope of the peninsula shows a harder climate than the Tyrrhenian one, more temperate and humid. In the Adriatic slope prevail associations with *E. ferus*, *E. hy-*

druntinus, chamois and ibex, typical of prevailing opened environments like steppe, prairie and arid mountain; in the Tyrrhenian slope, instead, associations with red deer, wild boar and roe deer are present, together with ibex and sometimes to equids, and mark a wider presence of woodland and forest environments (PETRONIO *et al.*, 2007; SALA, 2007).

The ecological requirements of the taxa from the cave mammal assemblage may therefore provide some useful indications to reconstruct the environmental landscape of the Simbruini Mounts and of the upper Aniene River valley in the Late Pleistocene final phases and to individualize, if possible, the chronology of the mammal remains recovered from the archaeological contexts others than the "Dig B2".

The Italic hare is a species adapted to live in different environments, but seems to prefer shrubby dry areas and prairie alternated with hardwood forest with large grassy open clearings; the European hare instead seems to be more connected to the open environments like prairie and steppe, and it is adapted to the traditional agricultural environments, characterized by mixed farming; today the marmot is present in the Alps, Pyrenees, Carpathian and Tatra Mountains and, recently, has been reintroduced in some areas of the northern Apennine and it lives in mountain places characterized by large alpine prairie with stony zone or scattered rock near high stem woods (AMORI *et al.*, 2008). The European beaver is no longer present in Italy since XVI-XVII century (PETRONIO *et al.*, 2007) and today it is present in damp and woodland environments, with streams and stretches of water between France and Russia, and the northern Balkans and the Scandinavian peninsula (HALLEY & ROSELL, 2002). Among the carnivores, both the wolf and the fox are animals adapted to a variety of environments, but generally settle the lair in woodlands with gorges and stony zone; the brown bear is a forest species especially and it prefers environments rich of water; the weasel too prefers open woodland near water (BOITANI *et al.*, 2003). Among artiodactyls the wild boar prefers woods and wetlands, the red deer is particularly common in open woods with large grassy clearings, and the roe deer is a typically woody species and prefer hardwood forests rich of brushwood and clearings; the ibex actually lives on the Alps frequenting rocky ledges and alpine prairie, and the chamois frequent coniferous and hardwood woody areas rich of brushwood spaced by rocky walls and stony zones, prairies, bare patches and grassy ledges (BOITANI *et al.*, 2003). Finally *E. ferus* and *E. hydruntinus*, were quite commons in the Late Pleistocene, preferring open environments like steppes and prairies, and their last occurrences in Italy are in the early Holocene (PETRONIO *et al.*, 2007; CONTI *et al.*, 2010).

The ecological requirements of the taxa discovered in the "Dig B2" suggest the presence of woods and forests spaced by prairies, rocky bands and stony zones and wetlands near the site. Evidently the faunal finds are been accumulated during a climatic period colder than today, like the presence of species as *M. marmota*

2 For mere material error, this mandible has been referred to the marmot in the Fig. 2 caption of the Abstract Volume of "Convegno in memoria di Alberto Malatesta (1915-2007) Geologo e Paleontologo. Roma 4-5 febbraio 2010". We apologize for the mistake.

and *C. ibex* shows. Both the species were in the lateglacial faunal complex of the central-southern Italy, in locality near the sea too, but now they are living in high mountain areas of the alpine arch. However the two species are not considered "cold" stenotherm, but euritherm species (CAPASSO BARBATO *et al.*, 1991), and nor even the ibex is considered a typical high mountain animal (MASSETI *et al.*, 1995; PHOCA COSMETATOU 2004). The last palaeontological evidence of *M. marmota* and *C. ibex* in central-southern Italy, however, are referred to the early Holocene (PETRONIO *et al.*, 2007), with the rapid climatic warming that characterized the early stages of this epoch, the consequent going up of the tree limit at higher altitude and a considerable reduction of the congenial alpine grasslands type. The distribution of these two species in the peninsula during the last millennia of the Late Pleistocene was been somewhat unequal. In the Adriatic slope the marmot reached Salento (southern Apulia) (TAGLIA-COZZO, 2003), while in the Tyrrhenian slope there would not be evidence of its presence at south of the Latium. The ibex, frequently with the chamois, instead, is present in the Tyrrhenian slope also in southern Campania and northern Calabria, while there would not be evidence of its presence at south of the Gargano promontory (northern Apulia) in the Adriatic slope (PHOCA COSMETATOU 2004; SALA, 2007). The others "Dig B2" taxa are currently in central Italy and, except the chamois, also in the Simbruini Mounts area (AMORI *et al.*, 2009).

The faunal remains with an advanced fossilization status recovered in the room 1 together with the prehistoric and recent domestic fauna likely came from the dismantling of "Dig B2", probably because of clandestine excavate or of the arrangement of the cavern as a refuge during the Second World War. The faunal assemblage is almost the same to that of the "Dig B2" (Tab. 1) and may be referred to the same final Epigravettian horizon.

The mammal remains recovered in the "Sinkhole" have some affinities, but also differences compared to the "Dig B2" fauna (Tab. 1). Some taxa (hare, marmot, wild boar, red deer and ibex) are the same and the relatively abundance of *M. marmota* is also a common element. Remains of beaver, brown bear, *E. ferus* and *E. hydruntinus* are only in the "Sinkhole". Although these are few fossil remains, the presence of the equids, in particular, together to the rare remains of red deer and wild boar, suggest a more opened environment with a less woody covering and perhaps referable to a moment probably cooler than that shown by the "Dig B2" mammal fauna.

The environments frequented by the total recovered taxa show a composite landscape, in some points not so different to the present, but during moments of climate colder than today. The Simbruini Mounts slopes were probably covered by deep forests and sparse woods (cervids, carnivores, chamois), spaced by rocky bands and stony ground (ibex, chamois, marmot), while the upper bottom valley were covered by prairies that may evolved in steppe (marmot, hare, equids, ibex) and the river offered banks rich of vegetations, sometimes marshy (wild boars, beaver).

6. COMPARISON WITH OTHER SITES AND CONCLUSIONS

In central Italy different sites with lateglacial mammal faunas are known, generally associated to Epigravet-

tian lithic industry. Leaving out the northern Tuscany, these sites are placed along the Tyrrhenian coast of Tuscany and Latium (CASSOLI, 1977; ALESSIO *et al.*, 1993; BOSCATO, 1996; ALHAIQUE & Di CAMILLO, 2007), along the Abruzzi and Marche Apennine (RADMILLI, 1977; WILKENS, 1991; ALHAIQUE & RECCHI, 2001; 2003; ALHAIQUE, 2003; 2005; ESU *et al.*, 2006), and the Latium inland (RADMILLI, 1974; PENNACCHIONI & TOZZI, 1985; CERILLI & BROCATO, 1998; UCELLI GNESUTTA *et al.*, 2006). Among these, some affinities can be noticed with several mammal faunas of the Fucino basin in the Abruzzi Apennine, rather to the Latium sites, included the near Polesini Cave, but this may be attributed to the geographical location and/or to the altimetric position, than to the eventual chronological correlation with Mora Cavorso Cave.

At Polesini Cave (RADMILLI, 1974) near Tivoli, about 26 Km NNE of Rome, in the lower Aniene River valley, the fauna of a sequence that include the recent Lateglacial is largely dominated by the red deer, always about 70% among ungulates, followed by wild boar, roe deer and equids with lower rates, while aurochs, chamois and ibex are just present, the marmot and the wolverine sporadically appear. At Riparo Salvini (ALESSIO *et al.*, 1993; ALHAIQUE & Di CAMILLO, 2007) near Terracina, on the Latium Tyrrhenian coast, an Epigravettian sequence referred to Bølling temperate oscillation and that has provided radiometric dating between 12.400 ± 170 and 13.365 ± 190 years BP (^{14}C not-calibrated dating), close to Mora Cavorso Cave dating, the red deer is the more abundant specie with rate superior of 50%, followed by equids (about 10%) and other ungulates like roe deer, chamois, wild boar and ibex and with hare, aurochs and carnivores sporadic presence.

In the lateglacial stratigraphic sequences of Ortucchio Cave, La Punta Cave, Maritza Cave (ALHAIQUE & RECCHI, 2001; ALHAIQUE, 2003; 2005), located at about 700 m a.s.l. on the hills surrounding the Fucino basin, there is a large presence of small animals (especially at Ortucchio, less at Maritza), in particular hare, but marmot and stoat are also present; among the ungulates chamois and red deer prevail, followed by ibex, wild boar, roe deer and aurochs, with sporadic presence of equids, in particular *E. hydruntinus*. In the oldest sites of the area, Tronci Cave, Maurizio Shelter, Ciccio Felice Cave (ALHAIQUE & RECCHI, 2003), with sequences referable in part to the Last Glacial Maximum, the faunas are quite the same, but there is a clear prevalence of ungulates, among them equids are more abundant, marking a colder and drier climate compared to the subsequent periods.

The preliminary analyses of the faunal remains from the "Dig B2" and other archaeological contexts of Mora Cavorso Cave have permit to define 15 taxa, divided into 5 orders, 10 families and 13 different genera of mammals. *M. marmota* and *C. ibex* are the most significant species both from the "Sinkhole" and from the "Dig B2" mammal assemblages, but is even important the *C. elaphus* presence, and a particular attention deserves also *C. fiber*, till now not signaled in lateglacial mammal assemblages of central Italy, and the sure evidence of the Italic hare.

The "Dig B2" mammal assemblage with marmot followed by red deer, ibex, chamois, wild boar and roe deer is referable to a moment less hard and humid of

the last glacial episode final phases (probably the first part of the Lateglacial preceding the Bølling - Allerød temperate oscillation), according to the cultural chronology and the radiometric dating. The "Sinkhole" mammal assemblage with marmot and ibex, followed by the equids more abundant than red deer and wild boar, perhaps has to be referred to a different moment, more cold and arid. At least part of the animals from the "Dig B2" has been introduced in the cave by Epigravettian human groups frequenting the upper Aniene River valley and the Simbruini Mounts during the latest Pleistocene.

These data on the latest Pleistocene mammal faunas from Mora Cavorso Cave, suggest some chronological, climatic and environmental indications that will be adequately investigated and better outlined during the prosecution of the archaeological and palaeontological searches.

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