



Ursus etruscus Cuvier, 1823 from the Early Pleistocene of Monte Argentario (Southern Tuscany, Central Italy)

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ABSTRACT - *Ursus etruscus* fossils have been recovered in the Monte Argentario site (late Villafranchian, Early Pleistocene, Tuscany). Teeth and bones show the typical morphology of the Etruscan bear. The occurrence of this species in the Early Pleistocene Monte Argentario faunal assemblage and other coeval sites (i.e. Pirro Nord) is very important in the framework of the Early Pleistocene biochronology. The occurrence of Etruscan bear at Monte Argentario and Pirro Nord confirms that *Ursus etruscus* persists in the Early Pleistocene assemblages, representing therefore an European carnivore coexisting with new taxa dispersing from Africa and Asia.

RIASSUNTO - [*Ursus etruscus* Cuvier, 1823 del Pleistocene Inferiore del Monte Argentario (Grosseto, Toscana Meridionale, Italia Centrale)] - Alcuni resti fossili di urside furono rinvenuti durante la metà del secolo scorso nel sito del Villafranchiano superiore (Pleistocene Inferiore) di Monte Argentario (Toscana). I reperti fossili sono conservati presso la sede dell'Istituto Italiano di Paleontologia Umana (IsIPU, Roma) e catalogati come *Ursus cf. Ursus etruscus*. L'intera collezione fossilifera dell'IsIPU è in corso di studio e di revisione, con il restauro e la preparazione del materiale in alcuni casi ancora inglobato nelle breccie fossilifere. Contemporaneamente, nuove attività di indagine sono pianificate per il 2009, in accordo con la Soprintendenza Archeologica per la Toscana.

Il confronto del campione di Monte Argentario con il materiale di *Ursus etruscus* proveniente da vari siti (Olivola, Valdarno superiore, Pietrafitta e Pirro Nord), ha consentito di attribuire a questa specie anche i resti di Monte Argentario. La presenza dell'orso etrusco in questo ed in altri siti coevi (Pirro Nord) è molto importante nel quadro biocronologico e in quello paleobiogeografico del Pleistocene Inferiore italiano ed europeo. Questa specie, che ha caratterizzato il Villafranchiano superiore europeo, perdura sino alla fine del Pleistocene Inferiore, ed era ancora presente quando sono avvenuti importanti eventi di dispersione faunistica che hanno portato in Europa taxa dai continenti africano e asiatico.

INTRODUCTION

Fossils referred to *Ursus etruscus* Cuvier, 1823 have been recovered, together with other vertebrate fossil bones, in karst fissures on Monte Argentario, a promontory located in the Grosseto district (South Tuscany, Central Italy; Fig. 1). Here outcrops a Permo-Triassic carbonatic and dolomitic succession affected by karst evolution during the Pleistocene (Decadia & Lazzarotto, 1980). The karst fissures were filled by residual sediments ("Terre Rosse") that include Early Pleistocene fossil vertebrate remains. The occurrence of bone breccias in the Monte Argentario area is known since late 1800 (D'Achiardi & Busatti, 1879; Forsyth Major & Busatti, 1882). During the 1950s, Prof. A.G. Segre extensively surveyed the region and reported the occurrence of bone breccias and archaeological deposits (Baschieri & Segre, 1958; Segre, 1959).

Baschieri & Segre (1958) collected fossil bones and breccias in the site called "Polveriera" and provided a short description of the discovery. Since then, the sample is stored in Roma, at the "Istituto Italiano di Paleontologia Umana" and recently became available to study as part of a new program of research on the Pleistocene site. The fossil bones are generally in a good state of preservation and some are partially articulated (Sardella et al., 2008). Together with a short description of the site, Baschieri & Segre (1958) provided the following faunal list for the

Monte Argentario deposits: *Castor* sp., *Lepus etruscus*, *Machairodus crenatidens* (Fabrini, 1890), *Panthera pardus* Linnaeus, 1758, *Lynx issiodorensis* (Croizet & Jobert, 1828), *Ursus etruscus* Cuvier, 1823, *Hyaena* sp., *Canis falconeri* Linnaeus, 1758, *Dicerorhinus etruscus* (Falconer, 1859), *Leptobos cf. etruscus* (Falconer, 1859), and *Tragulidae* indet.

A preliminary reconsideration of the fossil collection yields the following updated faunal list: *Ursus cf. U. etruscus* Cuvier, 1823, *Canis* sp., *Pachycrocuta brevirostris* (Aymard, 1846), *Lynx issiodorensis* (Croizet & Jobert, 1828), *Panthera* ex gr. *toscana-gombaszoegensis*, *Homotherium* sp., *Megantereon whitei* Broom, 1937, ***Stephanorhinus cf. hundsheimensis* (Toula, 1902)**, *Leptobos* sp., Bovidae indet. The Monte Argentario faunal assemblage is referred to late Villafranchian in the Farneta or Pirro Faunal Unit (FU), supported also by a preliminary analysis of a sample with microtheriofauna (Gliozzi et al., 1997; Sardella, 2006; Angelone et al., 2008).

The entire Monte Argentario faunal remains collection is at present under revision, and a number of taxa have been re-described (Sardella, 2006; Sardella et al., 2008). The larger breccia blocks are being restored and prepared. In addition, new field activities to re-locate the fossil deposits are planned for 2009 in agreement with the local officers from the "Soprintendenza Archeologica per la Toscana".



Fig. 1 - Location of the Monte Argentario site.

MATERIALS AND METHODS

The material from Monte Argentario has been compared to fossils stored in the following institutions: Museum of Geology and Palaeontology of the University of Florence, Earth Science Department of the University of Florence, Earth Science Department of Sapienza-University of Rome, Earth Science Department of Turin University, "Senckenberg Forschungstation für Quartärpaläontologie" (Weimar), "Museo De Prehistoria Y Paleontología" of Orce (Granada), Naturhistorisches Museum (Basel).

Standard measurements of craniodental and postcranial anatomical (Tab. 1) elements have been taken with digital calliper, following standards suggested by von den Driesch (1976).

THE ETRUSCAN BEAR

Ursus etruscus characterized the Eurasian Early Pleistocene-late Villafranchian faunal assemblages. Its earliest occurrence is recorded in the Olivola FU (Mazza & Rustioni, 1992; Gliozzi et al., 1997) and the latest one can be considered Pietrafitta (Rustioni & Mazza, 1993).

Etruscan bear was recognized for the first time by Cuvier (1812) in the Upper Valdarno, but it was described in detail successively by Ristori (1897). During the 20th century, this species was recovered in different Italian and European middle-late Villafranchian assemblages: Crostolo-Modolena (Mazza & Rustioni, 1992), Pirro Nord (Petrucci, 2008) and, possibly, in the latest Early Pleistocene site of Colle Curti (Mazza & Rustioni, 1992). In Europe, *Ursus etruscus* has been recorded in the late Villafranchian site of Senèze, in France (Bout, 1960; Maul, 2004), Venta Micena, in Spain (Torres, 1992), in the middle Villafranchian sites of St. Vallier in France (Argant, 2004), Tegelen, in the Netherlands (Erdbrink, 1953), and Kuruksay, in Tadjikistan (Sotnikova, 1989).

Mazza and Rustioni (1994) in their review of the material referred to *Ursus etruscus* considered this bear as a low polymorphic, very specialized species. In their opinion it was derived from the Late Pliocene *Ursus* aff. *U. etruscus* from St. Vallier. On the contrary, Argant (2004) suggested that the St. Vallier material was conspecific with material from the other localities, and that the Late Pliocene bear and Early Pliocene typical form of Etruscan bear would be better considered under the same specific name: *Ursus etruscus*.

N° Catalogue	Anatomic element	Side	Measurements						
			P4EL	P4GB	P4LP _r	P4LP _a	P4LMe	LM1	BM1
ARG 13	Maxillar portion with P4 and M1	DX	15,51	11,89	8,71	9,01	6,52	22,4	17,33
				m1L	m1B	m2L	m2B		
ARG 14	Mandibular portion with m1, m2 and m3	DX		22	9,9	20,98	13,53		
ARG 15	Mandibular portion with m2	SX							
				cL	CB				
ARG 16	canine			17,1	12,07				
ARG 17	canine			16,68	12,05				
ARG 18	canine			16,53	11,05				
				BMD	DMD	BD	DD		
ARG 19	MT III	DX		10,84	10,11	15,72	14,05		
ARG 20	Metapodial indet			11,46	10				
				BP	DP	BMD	DMD		
ARG 28	Humerus	SX		63,5	78,04				
ARG 29	Humerus	DX							

Tab. 1 - Measurements (in mm) of *Ursus etruscus* remains from Monte Argentario. P4EL, upper carnassial external length; P4GB, upper carnassial breadth; P4LP_r, upper carnassial protocone length; P4LP_a, upper carnassial paracone length; P4LMe, upper carnassial metastyle length; M1L, upper first molar length; M1B, upper first molar breadth; m1L, lower first molar length; m1B, lower first molar breadth; CL, canine length; CB, canine breadth; BP, Proximal epiphysis breadth; DP, Proximal epiphysis depth; BSD, Diaphysis breadth; DSD, Diaphysis depth; BD, Distal epiphysis breadth; DD, Distal epiphysis depth.

THE ETRUSCAN BEAR FROM MONTE ARGENTARIO

The fossil remains considered in this paper are stored at the "Istituto Italiano di Paleontologia Umana" (Rome) and marked with the code Arg (for Argentario) followed by a progressive number. This sample includes:

Arg 13: a right portion of a maxilla with P4 and M1;

Arg 14: a right portion of mandible ramus with m1, m2 and m3;

Arg 15: a left portion of mandible ramus with m1 and m2;

Arg 16, 17: two upper canines;

Arg 18: a lower canine;

Arg 19: a third right metatarsal;

Arg 20: an indeterminate metapodial;

Arg 28, 29: respectively a proximal epiphyses of a right humerus and a proximal portion of a left humerus.

Not all remains are in the same good state of preservation; some are fractured or damaged owing to incrustations on the osteological surface.

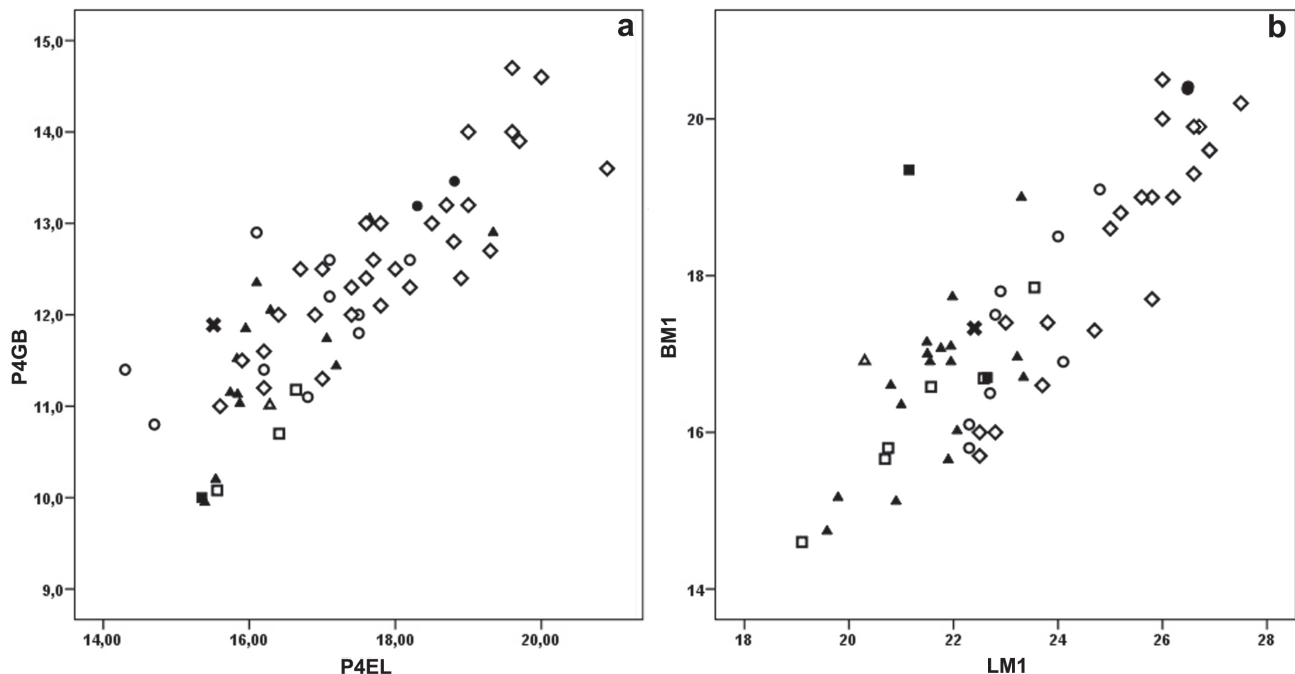
The right maxillary bone Arg 13 is well preserved, and P4 and M1 are present (Pl. 1, fig. 1). The upper carnassial tooth is triangular and is wider anteriorly than posteriorly. The paracone is the largest cusp, conic in shape, with an antero-posteriorly very developed crest on the occlusal surface. The metacone is smaller and conical. The crest of the occlusal surface is strongly developed and at its posterior edge presents a very small cusplet. A sturdy cingulum is present around the entire crown basis. The protocone is the lowest cusp, compressed laterally, with two cusps, the posterior cusplet being smaller than the anterior one. It is separated from paracone and metacone

by a medial depressed area, medially located. A less pronounced crest is present on the occlusal surface.

The upper first molar is rectangular in shape, with rounded corners. On the labial side, the paracone is developed, conical shaped, and characterized by an evident longitudinal pointed crest. The metacone is slender and is comparable in height to the paracone, it is also characterized by a longitudinal crest, although less marked than in the metacone. The parastyle is just weakly pronounced, as a protuberance on the cingulum. On the contrary, the metastyle is evident, pointed and not much laterally depressed. On the lingual side, the protocone is less pronounced than the labial cusps. It is damaged on the occlusal surface and shows an ellipsoidal shape. Centrally, the metaconule is small, slightly worn, laterally depressed. The hypocone is rounded, with a posterior protuberance, without evident worn surfaces. The paracone, metacone and metaconule surround a flat central basin. A cingulum runs along the tooth base, very pronounced on the labial and lingual sides, slightly evident anteriorly and posteriorly.

The portion of mandible ramus Arg 14 (Pl. 1, figs. 2a-b) is better preserved than the mandibular fragment Arg 15 (Pl. 1, fig. 3). In Arg 14 the inferior border of the mandible is straight. The teeth are compressed laterally, worn and partially damaged. The trigonid of the lower carnassial is narrower than the talonid. The first molar is rectangular in shape, very worn and fractured on the lingual side. The crown of the third molar is much damaged and it is impossible to recognize any feature on the occlusal surface.

Two isolated upper canines (Arg 16 and Arg 17) are damaged, missing part of the root (Pl. 1, figs. 4-5).



Explanation: * Mt. Argentario; ○ Atapuerca TD; □ Pirro Nord; ▲ St. Vallier; ● Untermassfeld; ▲ Upper Valdarno; ◇ Le Vallonnet; ■ Venta Micena.

Fig. 2 - a) Scatter diagrams comparing P4 length versus P4 greatest breadth in European Late Pliocene-Early Pleistocene ursids. b) Scatter diagrams comparing M1 length versus M1 breadth in European Late Pliocene-Early Pleistocene ursids.

The lower canine (Arg 18; Pl. 1, fig. 6), shows a quite worn crown, but it is better preserved than the upper ones. The crown is relatively weak compared to the root.

The postcranial skeleton is represented by two proximal parts of two humerus and two metapodials. The humerus (Arg 28, Pl. 1, figs. 9a-b) is slender, with the diameter of diaphysis smaller than that of the epiphysis. The *trochitere* is developed laterally, but it is not higher than the head. The head is rounded on the posterior side, and anteriorly is supported by a protuberance. The distal epiphysis (Arg 29) is damaged, but shows a slender morphology.

The third metatarsal (Arg 19; Pl. 1, fig. 7) is relatively slender, broadening towards the distal portion of the diaphysis. The bone is partially damaged, especially in the proximal epiphysis. The other metapodial (Arg 20; possibly a fourth right metacarpal) lacks the proximal epiphysis and the distal one is very damaged (Pl. 1, fig. 8). In both metapodials the distal epiphyses are relatively larger than diaphyses.

The Monte Argentario specimens share similar features of teeth and postcrania with the bears of Olivola, Upper Valdarno, Pietrafitta and Pirro Nord. In fact, the simplified morphology of the upper teeth cusps, laterally compressed jugal teeth, both in maxilla and in mandible, the smaller size of the canines and the slender structure of the postcranial bones, can be considered features typical of *Ursus etruscus*, suggesting a more primitive condition than that seen in the European bears of the latest Early Pleistocene.

In the Etruscan bear, these features, together with the low number of cusps and cusplets in P4 and in the molar teeth, show a primitive condition, described by Mazza & Rustioni (1992) and García & Arsuaga (2001). In fact, the European bears of the latest Early Pleistocene and in the Middle Pleistocene have more complicated tooth morphology, with an increased number of cusps (Moullé, 1992; Mazza & Rustioni, 1994; García & Arsuaga, 2001; Musil, 2001). Similar change occurred in the postcranial bones, i.e. in the metapodials, increasing their size and, moreover, their sturdiness.

The relationship between the Monte Argentario material and the Etruscan bear group can be seen in Fig. 2, in which the datum of the Monte Argentario fall within

the range of *Ursus etruscus* from Valdarno and Venta Micena, including in this group *Ursus* aff. *etruscus* from St. Vallier.

The Italian Etruscan bears clearly represent a definite group closer to St. Vallier and Venta Micena *Ursus etruscus*, and are morphologically and morphometrically distinguished from *Ursus dolinensis* García & Arsuaga, 2001 from Atapuerca, *U. deningeri* Linnaeus, 1758 from Vallonnet and *U. rodei* Musil, 2001 from Untermassfeld. In fact, features of the upper teeth of *Ursus dolinensis*, such as the M1, include approximately squarer angles and quite laterally compressed lingual cusps. *Ursus rodei* shares with *U. dolinensis* very similar cranio-dental morphological features, thus it has been considered synonymous (Kahlke, 2006). The teeth of *U. deningeri*, in particular the maxillary teeth, show a more complicated cusp structure, with additional cusps in the protocone of P4 and in the lingual cusps of M1 (Moullé, 1992).

CONCLUSIONS

The taxonomy of the European latest Villafranchian bears (Epivillafranchian, *sensu* Kahlke, 2006 and references therein) is still matter of debate. Two new species have been described, one at Trincheria Dolina of Atapuerca (Spain), *Ursus dolinensis* (García & Arsuaga, 2001), and another one at Untermassfeld (Germany), *Ursus rodei* (Musil, 2001). In addition, some late Early Pleistocene deposits of Europe (e.g. Vallonnet) are characterized by the occurrence of early forms of *Ursus deningeri* (Moullé et al., 2006).

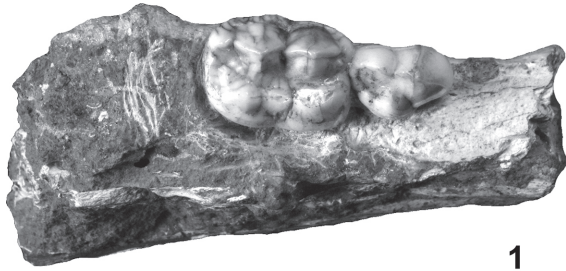
In the late Villafranchian faunal assemblages of the Italian Peninsula, the occurrence of *Ursus etruscus* has been recognized at Olivola, Upper Valdarno and in the latest Villafranchian site of Pietrafitta (Mazza & Rustioni, 1994). At Pirro Nord, Mazza & Rustioni (1992) suggested the occurrence of an arctoid form. Such opinion has not been confirmed by a recent revision of material integrated by new findings from the site; the Pirro Nord bear is better considered as an occurrence of *Ursus etruscus* (Petrucci, 2008). This interpretation of the Pirro Nord bear sample provides evidence that Etruscan bears continued to characterize the latest Villafranchian mammal faunal assemblages of Italy. The

EXPLANATION OF PLATE 1

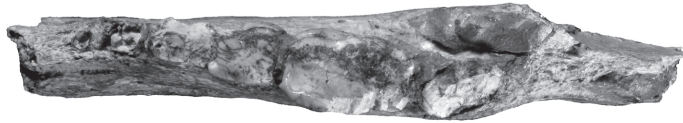
figs. 1-9 - *Ursus etruscus* Cuvier, 1823 from Monte Argentario (Central Italy).

- 1 - Arg 13, right maxillar with P4 and M1, occlusal view.
- 2 - Arg 14, right mandible ramus with m1, m2 and m3; 2a: occlusal view; 2b, external view.
- 3 - Arg 15, left mandible ramus.
- 4 - Arg 16, right upper canine.
- 5 - Arg 17, left upper canine.
- 6 - Arg 18, lower canine.
- 7 - Arg 19, third right metatarsal.
- 8 - Arg 20, indeterminate metapodial.
- 9 - Arg 28, left humerus; 9a, proximal view; 9b, caudal view.

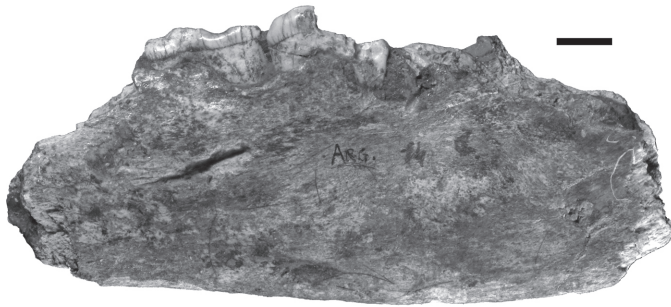
Scale bar = 1 cm.



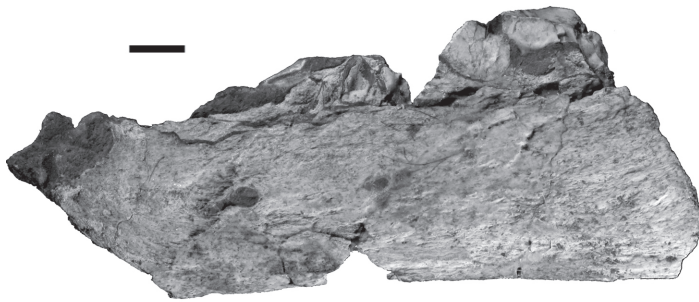
1



2a



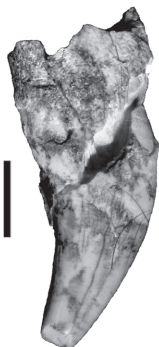
2b



3



4



5



6



7



8



9a



9b

revision of the fossils from the Monte Argentario site is also included in this scenario. The probable occurrence of *U. etruscus* at Colle Curti (Mazza & Rustioni, 1992) could represent the last appearance datum of this species in the Italian Peninsula, but the scantiness of the material prevents a definite identification to species.

The occurrence of Etruscan bear at Monte Argentario and Pirro Nord testifies that *Ursus etruscus* is still present in the Early Pleistocene, when mammal assemblages of Europe were renewed by different dispersal events from Africa and Asia (Martínez-Navarro, 2004; O'Regan et al., 2006; Sardella et al., 2008).

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