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Evidence of a Quaternary vertebrate fauna from fluvial-lacustrine sediments of the River Secchia, Emilian northern Apennine foothills (Italy)

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ABSTRACT – Fossil remains of Cervidae, Rhinocerotidae, Bovidae and Mustelidae, recovered in the Secchia riverbed between 1999 and March 2003 are described. The findings are from mid-Pleistocene fluvial-lacustrine sediments belonging to the so-called "Lower Emiliano-Romagnola Alloformation" sharply erosional overlapping deep-sea sediments. The fauna is characterised by: *Stephanorhinus etruscus* (Falconer), *S. hundsheimensis* (Falconer), *Leptobos* sp., *Cervus elaphus* Beninde, and *Martes martes* cf. *latinorum* (Barrett-Hamilton). *Cervus perrieri* (Croizet & Jobert) is reported for the first time in Italy. Sedimentological data are in contrast with possible fossil reworking, therefore a true co-existence of the recovered fauna is not rejected.

RIASSUNTO – [Segnalazione di una fauna quaternaria a vertebrati nei depositi fluvio-lacustri del fiume Secchia in località Veggia (RE)] - Vengono descritti reperti fossili di vertebrati appartenenti a Cervidi, Rinocerotidi, Bovidi e Mustelidi, recuperati nell'alveo del fiume Secchia tra il 1999 e Marzo 2003 in località Veggia (RE). I ritrovamenti sono stati effettuati entro sedimenti medio pleistocenici fluvio lacustri, appartenenti alla Alloformazione Emiliano-Romagnola inferiore, poggianti con contatto erosivo netto su facies di mare profondo. La fauna è caratterizzata da: *Stephanorhinus etruscus* (Falconer), *S. hundsheimensis* (Falconer), *Leptobos* sp., *Cervus elaphus* Beninde e *Martes martes* cf. *latinorum* (Barrett-Hamilton). Si segnala inoltre, per la prima volta in Italia, la presenza di *Cervus perrieri* (Croizet & Jobert). I dati sedimentologici sono in netto contrasto con la possibilità di rimaneggiamento dei fossili, quindi, non viene scartata l'ipotesi di una reale coesistenza delle specie ritrovate.

INTRODUCTION

Between 1999 and March 2003 scattered vertebrate fossil remains were recovered by a member of our team (A. Badodi) from strongly oxidised silty beds of the River Secchia near the village of Veggia (Province of Reggio Emilia, northern Italy) (Text-fig. 1).

During the past decade intense erosion of the riverbed caused extensive exposure of fluvial-lacustrine deposits overlapping deep-sea sediments (Bonazzi, 1996). The continental beds yielded antler and postcranial bone fragments of artiodactyls, the distal epiphysis of a right humerus and right femur belonging to Rhinocerotidae besides the right hemimandible of a mustelid. These bones are described in the following systematic section.

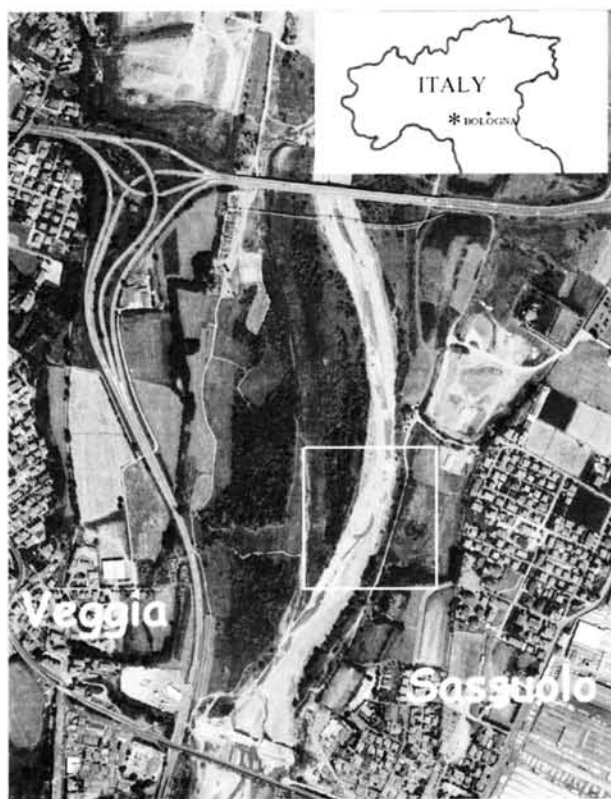
GEOLOGICAL SETTING

The stratigraphic section studied crops out in the Secchia riverbed just downstream of the village of Veggia (Province of Reggio Emilia) check dam and develops for about 1 km towards N-NE as far as the bridge of national road no. 467 (Text-fig. 1).

The first 30 m of the section (Text-fig. 2) stretch along the left bank of the river with a peculiar lithologic alternation, the first tract of which is made up

mainly of a well-exposed thick bed (about 30 m) of light blue to grey fossiliferous silty claystones corresponding to the "Light-blue silty Claystones Formation", early Pliocene to early Pleistocene in age (Gasperi *et al.*, in press). Between the rivers Panaro and Secchia, the above-reported formation crops out continuously as a belt 20 km long and about 10 km wide. In this first stretch and in the immediately following one the direction of the beds dips strongly towards NE, probably due to an Apennine foot margin tectonic alignment or to the River Crostolo Front (Gasperi *et al.*, 1989; Bonazzi, 1996; Barbacini *et al.*, 2002), the recently represented hinge line between the rising Apennine chain and the subsiding plain.

The certainly marine massive claystones are intercalated with a couple of levels 2 m thick made up of an alternation of centimetre to decimetre thick very fine silty sandstones and pelites. A third alternation level of silty sandstones and pelites with fossil lags is at the top of the pelitic horizon and represents the boundary with a new layer completely different from the previous one. It consists of a sub-vertical conglomerate bed of heterogeneous chaotic pebbles 1.50 m thick, generally clast-supported, and has coarse sandy discontinuous levels in its lower part are present. Some pebbles of the conglomerate show perforations by lithophagous molluscs confirming that



Text-fig. 1 - Location of the studied area with aerial photograph of the River Secchia between Sassuolo and Veggia. The square indicates the fossiliferous riverbed (courtesy of Technical Office, Municipality of Sassuolo, 2003).

these elements must have been part of a littoral environment.

At the top of the conglomerate horizon we find 50 cm thick pelites with little lenses of sandstone preceding a new 5 m thick horizon mainly composed of massive pelites with abundant malacofauna and vegetal remains that indicate the beginning of relatively deep, low-energy, marine environment sedimentation, probably in a transgression facies linked to a sudden movement or stasis in the rising of the chain behind it (forced regression).

The boundary between marine claystones and continental conglomerates is sharp, of erosional type, geometrically irregular and characterised by loan pockets. Such boundary features clearly indicate stratigraphic discontinuity, supported by the lack of transitional facies, which were evidently eroded before the fluvial conglomerate deposition. Tectonic events are more likely to have raised marine sediments to erosional levels and the gradual succession between marine environment deposits and continental ones have been eroded throughout the littoral. This gap could represent the "Imola Sandstones" (Amorosi *et al.*, 1998), correlable to the "Yellow Sands" Formation

(Gasperi *et al.*, in press). The presence-absence of these littoral sands is a fundamental key event in the time correlation of the various units of this sequence. At present, all Pleistocene conglomerate-sandy deposits overlapping the Light blue Claystone Formation belong to this "unit" (Yellow Sands). In the Emilia-Romagna Region, these deposits crop out mostly continuously at the margin of the Apennine chain, showing different features in the various places where they crop out. The following development of the stratigraphic column maintains a continental environmental condition. The latter horizon is also assembled by clast-supported conglomerate whose elements show imbrications by current (from S-SW).

In the exposed section one can see various sedimentary cycles overlapping each other and incomplete as far as regards the bottom channel and bars. It seems they consist of river braided channels and bars.

The conglomerate represents the beginning of the "Lower Emiliano-Romagnola Alloformation" (Barbascini *et al.*, 2002) (AEI of Text-fig. 2).

At 160 m from the above reported check dam, the conglomerate horizon attitude is close to 4° and 23 m thick and, after a further 360 m, disappears under the present erosional river surface.

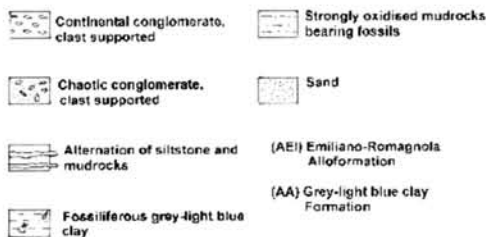
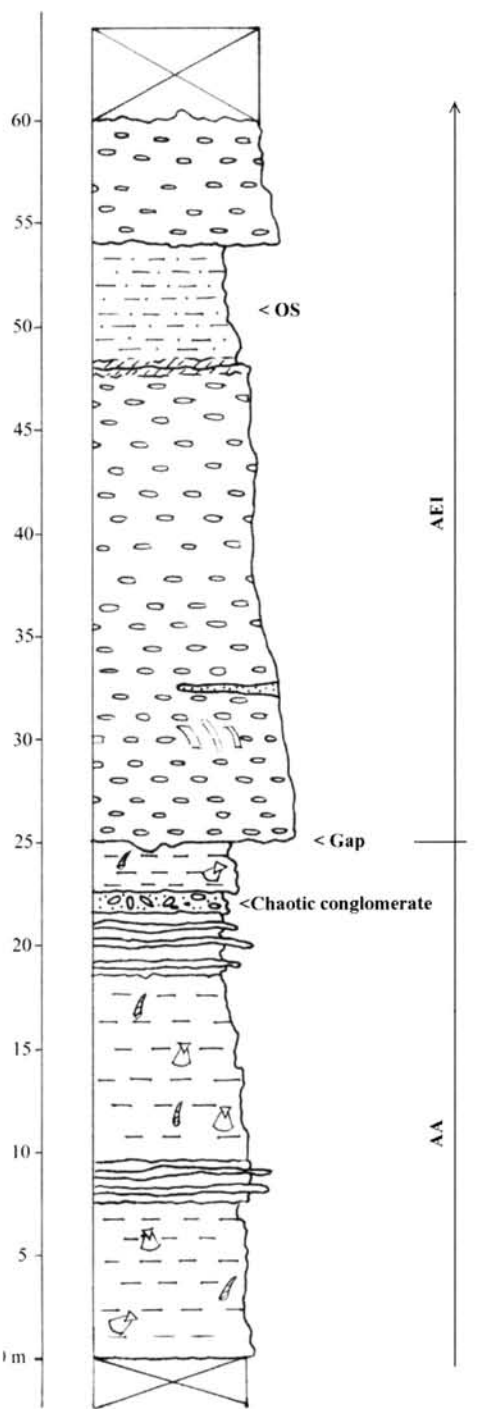
"Modal analysis" was carried out on some sand samples from the base and the top of this continental conglomerate level (Boni, 2004), and after comparison with data published by Amorosi *et al.* (1998), a close similarity with the Imola Sandstone emerged. On the contrary, if the same data are compared with sands deposited by the River Secchia today, the data completely disagree. This means the reported similarity does not coincide with the non-contemporaneous settlement of the two formations. Furthermore, the so-called "Yellow Sands" formerly present in the River Secchia, have been in part eroded, reworked, and then resettled in the continental conglomerate. This fact underlines the above-reported theory on the lack of littoral facies deposits.

A bed of reddish-yellowish plane parallel sandstone 1.5 m thick overlies the conglomerate and pelites without sedimentary structures follow immediately afterwards. The pelites are strongly oxidised and are being pedogenised. The depositional environment is of low energy type and probably represents an inter-channel fluvial area if not a true alluvial plain.

The vertebrate remains studied in this paper were recovered precisely in the above last reported pelitic beds (Text-fig. 2, marked as OS).

The lithology continues to be sub-horizontal for about 400 m towards N-NE and about 5 m thick along the present riverbed.

Palinomorph searches have been carried out in order to date the above-described continental sediments, but unfortunately, they were fruitless, perhaps because of the high degree of oxidation affecting the sediments.



Text-fig. 2 - Schematic geological section of the Secchia river-bed outcrop studied (after Boni, 2004).

According to Amorosi *et al.* (1998), the last littoral facies were deposited in the Emilia-Romagna area during the mid-Pleistocene. Taking into account sedimentological data, if we consider oxidised pelites bearing vertebrate remains as following stratigraphically the Imola Sandstones, it is possible to date them as very probably Middle Pleistocene in age.

SYSTEMATICS

The described fossils are part of the paleontological collection stored in the Museum of the Dipartimento del Museo di Paleobiologia e dell'Orto Botanico under the Collection Numbers IPUM 31143-31155. The terminology proposed by Lister (1987) is adopted here to describe antlers.

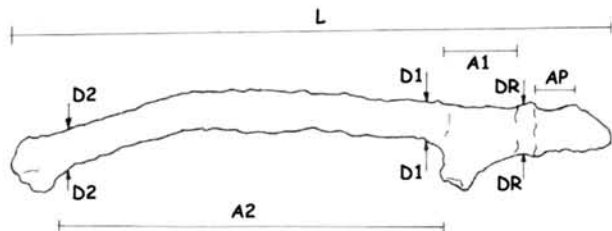
Family CERVIDAE Gray, 1820
Subfamily CERVINAE Baird, 1857
Tribe CERVINI Viret, 1961
Genus CERVUS Linnaeus, 1758

CERVUS PERRIERI Croizet & Jobert, 1828
(Text-fig. 3, Pl. 1, figs 1a-6)

Material - Right antler (No. 31149)

Description - Fragment of antler anatomically connected to the pedicle; after the burr and the first tine (with unpreserved tip) the beam develops for a length of about 360 mm till the second tine again with unpreserved tip. Main features and measurements are reported in Text-fig. 3 and Tab. 1.

Remarks - The presence of the pedicle implies that the animal lost the antler after its death, whereas dur-



Text-fig. 3 - Antler fragment No. 31149 sketch.

Length of antler fragment (L)	535
Pedicule length (PL)	34
Pedicule diameter	32
Burr diameter (BD)	55
Length (A1)	76
Length (A2)	360
Diameter 2 nd tine (D2)	35
Diameter 1 st tine (D1)	32

Tab. 1 - Antler fragment No. 31149 (measurements in mm)

ing seasonal replacement the antler is detached at burr level. The linear, straight shape of the tine, the position of the first tine and the very long pedicle do not coincide with the morphology of the two most widespread Pliocene-Early Pleistocene genera of cervids from Italy: e.g. *Pseudodama* and *Eucladoceros*. The unusual pedicle length indicates a young specimen. The antler is considerably abraded by weathering so measurements were made difficult by this situation, although relative proportions and the morphology of the studied antler indicate a typical Early Villafranchian Spanish and French form like *Cervus perrieri* Croizet & Jobert 1828 (Heintz, 1970). The antler of this specimen and the diameter of each beam suggest that the whole antler could reach a value of 800 mm, which fits in well with the variability range of *C. perrieri* (Heintz, 1970). The pedicle length and slightly flattened shape also fit in with the above reported species. The finding of this species confirms *C. perrieri* is not exclusive to the early Villafranchian, but survives until the end of this unit as indicated also by its occurrence at Dmanisi and Alkalkalaki [Georgia, Russia (Vekua, 1986, 1995)].

Material - Left calcaneum (No. 31145)

Description - It consists of a deer calcaneum 90 mm in length, which lacks tuberosity and is not yet hardened because it belongs to a young specimen. In Tab. 3, our material is biometrically compared with those of two typical Pliocene-Early Pleistocene genera, e.g. *Eucladoceros* and *Pseudodama*.

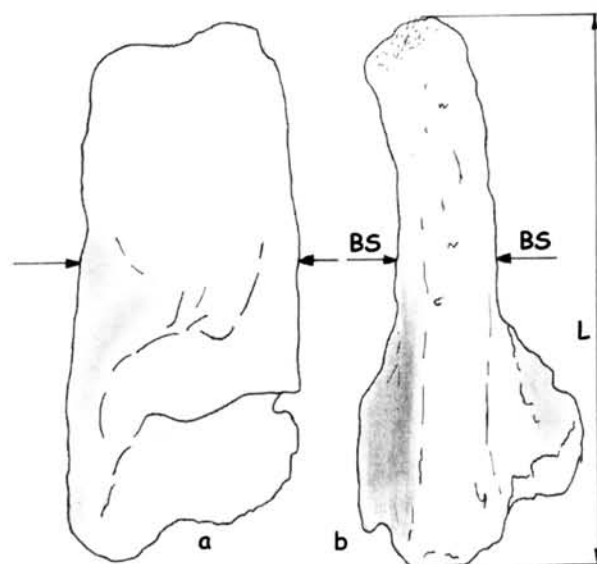
Remarks - It is evident the studied specimen does not fit in with any variability range of the above reported genera. The calcaneum minimum thickness of *Eucladoceros* appears similar but is not really comparable because of the lower value of its breadth. After direct comparison with several specimens belonging to the above reported genera, stored at the Natural History Museum (Geological and Palaeontological Section) of Florence University, our material seems to belong to a middle sized specimen between the reported two. Even if it is not so different from that of *Eucladoceros*, on comparison the calcaneum studied is more flattened and shorter.

Some problems were encountered when comparing measurements of No. 31145 with those available of *C. perrieri* because post cranial elements of this

species are reported in Heintz (1970, Etouaires locality) with those of another similar cervid (*Arvenoceros ardei*) and nobody has attempted to distinguish between the bones of the latter and those of *C. perrieri*, in turn very close to those of *C. elaphus* (pers. comm. by Dr. L. Abbazzi, letter of May, 28th, 2004). It is obvious that this situation does not permit any profitable comparison.

Material - Upper cheek-teeth (No. 31159a, b, c, d)

Description - They represent upper left cheek-teeth not anatomically linked to maxillary bone but recovered in anatomical order each one lying next to the other on the riverbed surface. Four selenodont type teeth lacking root apparatus were found. A M3 (31153a, the most complete) preserves its anterior



Text-fig. 4 - Left calcaneum (No. 31145) sketch - a) lateral view - b) back view.

Breadth of the diaphysis (BS)	17
Thickness of the diaphysis (TS)	35
Length of calcaneum (L)	90

Tab. 2 - Calcaneum measurements (in mm).

EXPLANATION OF PLATE 1

Figs 1-6 - *Cervus perrieri* (Croizet & Jobert, 1828).

- 1) a) Antler of a young specimen in lateral internal view; b) the same in outer lateral view (scale bar = 20 cm);
- 2) a) Calcaneum (No. 31145) in frontal view; b) the same in rear view; c) the same in lateral view (scale bar = 2 cm);
- 3-6) Upper right cheek teeth in cheek view (scale bar = 1 cm).



Genera	Breadth in mm	Thickness in mm	Mean Breadth	Mean Thickn.
<i>Eucladoceros</i>	min. 31.8 max. 45.0	min. 17.7 max. 25.9	38.4	21.8
<i>Pseudodama</i>	min. 18.5 max. 24.1	min. 9.5 max. 12.8	21.3	11.15
Specimen No. 31145	35	17		

Tab. 3 - Comparison among *Eucladoceros*, *Pseudodama*, and the calcaneum No. 31145.

part and partly the cheek and labial ones; the M2 (31153b) element is almost fragmentary; however the labial part, a portion of the enamel and dentine are preserved. Only a few fragments remain of the probably deciduous D4 among which fragments of the labial part plus a small piece of its lateral side are preserved. Compared with M2 and M3 it is smaller in size. The strongly abraded chewing surface indicates that it was probably at the end of its working life. The last cheek element consists of a P3. The sole possible measurement is that of the M3 base length that is 23.5 mm.

Remarks - All ruminants bear selenodont type structure in cheek teeth, furthermore those belonging to deer are rather uniform and lack useful distinctive taxonomic features. The lack of the root parts perhaps implies that they remain attached to the maxillary bone or perhaps that they were detached by the river stream. In our material, the two molar occlusion surfaces appear to be poorly abraded suggesting they had just started to be used. The comparison between M3 measurements and those of the variability range of the genus *Pseudodama* allows the latter to be excluded from the studied fauna. The possible presence of a P3 element is only due to its position in the ordinate sequence of the recovered cheek teeth.

Distribution - Early Villafranchian of France, Spain (Heintz, 1970), and mid Pleistocene of Italy (Northern Apennine foothill, this paper). Middle Pleistocene of Alkalkalaki and Dmanisi [Georgia, Russia, (Vekua, 1986, 1995)].

CERVUS ELAPHUS Beninde, 1937
(Text-fig. 5, Pl. 2, figs 1a-b)

Material - Right replacement antler fragment of a presumably fully-grown animal (No. 31155).

Description - It consists of a basal well-preserved shed beam complete with two closely spaced tines. In addition, unconnected with the previous one, there is a terminal part with tines. The latter is slightly squashed in its lower part, while two terminal tines are well preserved. All antler elements bear some irregular longitudinal furrows as ornamentation. The main features and measurements are reported in Text-fig. 5 and Tab. 4.

Remarks - The antler's morphology showing two staggered frontal tines (brow and bez tines) is peculiar to *Cervus elaphus*. From a stratigraphic point of view, this fossil should be the youngest of the recovered fauna; nevertheless, it was found in the base of the pelitic bed, stratigraphically below the oldest remains, like the *C. perrieri* antler.

Family BOVIDAE Gray, 1821
Genus LEPTOBOS Rütimeyer, 1877-78

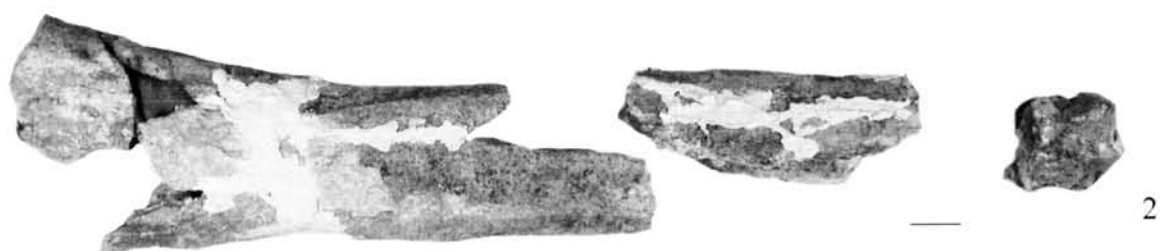
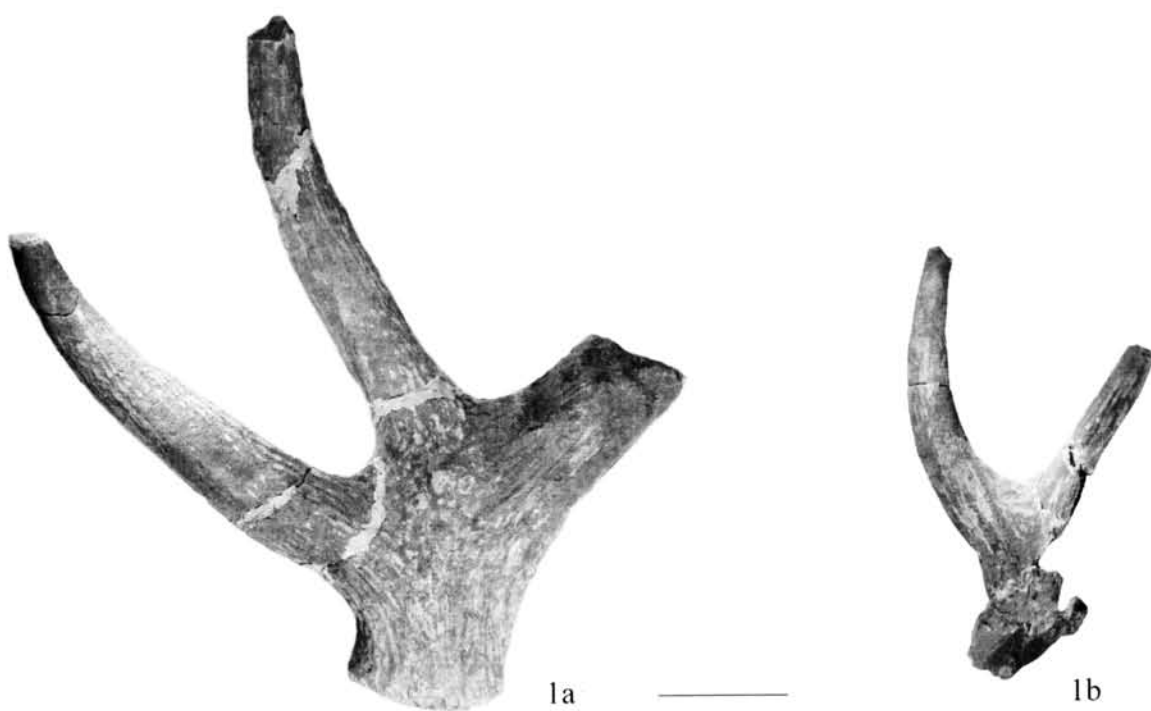
LEPTOBOS sp.
(Pl. 2, fig. 2)

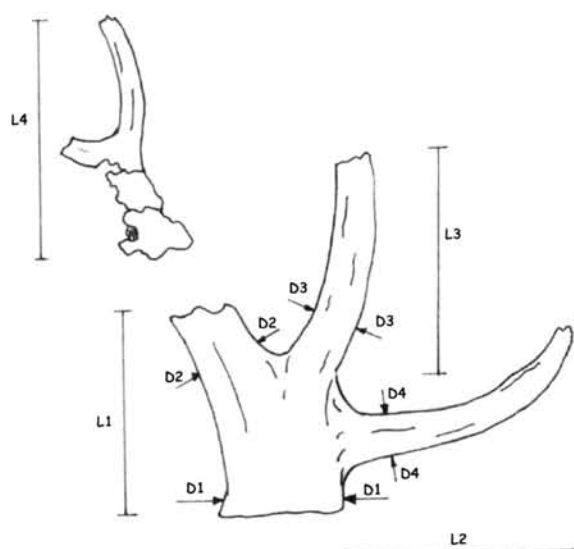
Material - Right Radius (No. 31154)

Description - The wide incomplete ox diaphysis shows a length of 260 mm and a maximum diameter of 50 mm. Two fragmentary epiphysis in their anatomical setting are also available. The proximal one shows only its last 30 mm with an articular area 28 mm wide.

EXPLANATION OF PLATE 2

- Figs 1-2 - *Cervus elaphus* cf. *C. e. acoronatus* (Beninde, 1937).
a) Antler basal part of a fully-grown individual in lateral internal view; b) upper terminal part of the same antler in lateral internal view (scale bar = 10 cm);
Right radius in frontal view (scale bar = 5 cm).
- Fig. 3 - *Martes m. cf. latinorum* (Barrett-Hamilton, 1904).
a) Right hemi-mandible in lingual view;
b) The same in cheek view;
c) The same in occlusal view (scale bar = 1 cm).





Text-fig. 5 - Antler No. 31155 sketch. Basal and terminal element.

Remarks - By direct comparison with specimens stored in the Paleontological Museum of Florence University, our material fit in well with those of *Leptobos* from the Tuscany Pleistocene. These fossil remains were recovered at the top of the pelitic sediments, in strong contrast with its systematic position. Unfortunately, its extremely fragmentary condition does not permit further taxonomical investigations.

Family RHINOCEROTIDAE Owen, 1845
Genus STEPHANORHINUS Kretzoi, 1942

STEPHANORHINUS ETRUSCUS (Falconer, 1868)
(Text-fig. 6; Pl. 3, figs 1a-2b)

Material - Complete right femur (No. 31144) recovered by the late Prof. A. Sirotti in 1994, who classified it as *Stephanorhinus hundsheimensis*, and a right humerus (No. 31143).

Description - Frontally the trochanter major is short in comparison to the femur head and well rounded. The inter-trochanter line is only slightly distinguishable. The trochanter minor is well developed and shows a rough outline. Another evident feature is the sagittal suture line where the great middle muscle fits in. The third trochanter is strong and well developed halfway along the diaphysis.

Remarks - The good state of preservation of our material, despite several micro-fractures probably due to long weather exposure before definitive burial, permits a useful biometric comparison with other Pliocene-Early Pleistocene species (see Tab. 5). We report also some average dimensions related to this species (after Mazza, 1988). They are: (BP) 171.33; (L) and (PL) 460.50; (BS) 82.00.

Without doubt, *S. hundsheimensis* seems larger than *S. etruscus*, even if the latter is slightly longer; in particular, the *S. hundsheimensis* femur is wider but shorter and consequently stockier.

Further comparison with biometric data of *Stephanorhinus etruscus* (Tab. 5) shows that the studied material coincides well with the variability range of *S. etruscus*, despite its slightly greater maximum length. The slender shape of this bone suggests that this animal was very active. Defined as "cursory" this rhino will have been reduced in size but an excellent runner (Mazza, 1988).

Also, in comparison with data regarding some specimens of *S. emitoechus* (Tab. 6) the latter seems to be bigger and more massive than our specimen. In other terms, *S. emitoechus* could have been a grazing animal like today's rhinos and larger in size than *S. hundsheimensis*. Lastly, *S. etruscus* (Falconer) probably lived during a span of time from the late Pliocene to the early Pleistocene.

STEPHANORHINUS HUNDSHEIMENSIS
(Falconer, 1868)
(Text-fig. 7; Pl. 3, figs 1a-2b)

Material - Very fragmented humerus distal epiphysis (No. 31143)

Description - At a first check this bone seems to belong to a stocky animal of large size. In Tab. 8 biometric data are reported. Owing to the lack of its upper part (proximal epiphysis) and the impossibility of measuring its real features, we must proceed to a comparison by using extrapolated data.

Remarks - By comparison with humerus bones of *S. etruscus* from Alto Valdarno and Olivola localities (Tab. 6) the studied humerus clearly does not fit in with the biometric data reported above, even if it could belong to a big specimen of *S. etruscus*.

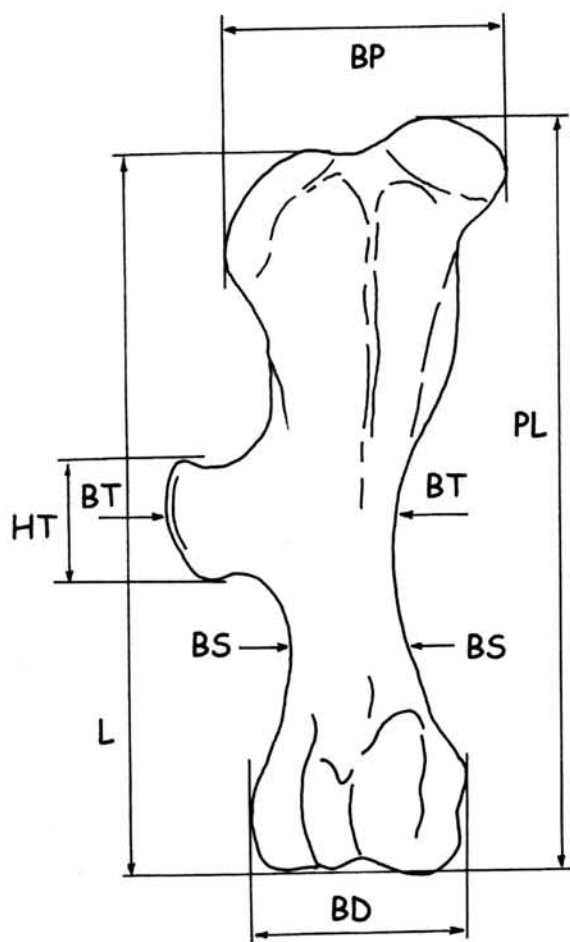
By comparison with *S. hundsheimensis* humeral bones, typical of the early half of the mid-Pleistocene, it is evident that the biometric data of the studied material fit in well with those of the latter species.

EXPLANATION OF PLATE 3

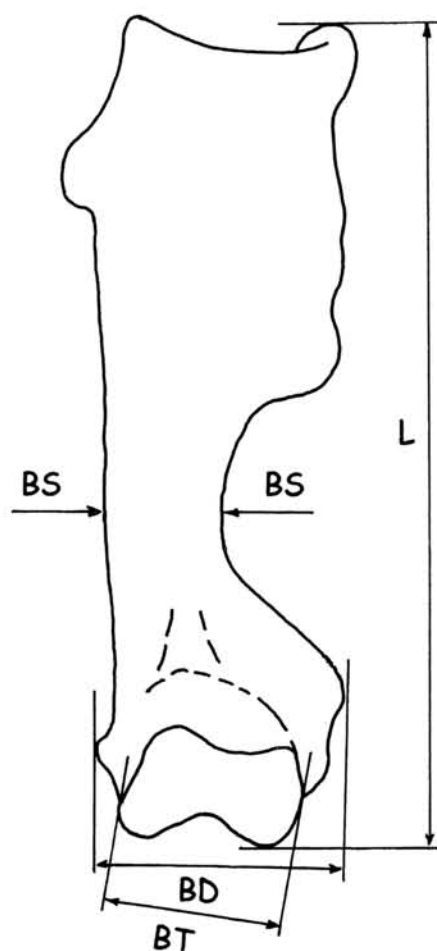
Figs 1, 2 - *Stephanorhinus etruscus* (Falconer, 1868).

- 1) Right femur in frontal view; b) Rear view of the same specimen (scale bar = 20 cm);
- 2) Right humerus of a fully-grown specimen in frontal view; b) The same in rear view (scale bar = 10 cm).





Text-fig. 6 - Right femur (No. 31144) sketch (frontal view).



Text-fig. 7 - Humerus No. 31143 sketch (frontal view).

From a phyletic point of view, *S. hundsheimensis* seems to be closer to *S. etruscus* but is not necessarily a descendant. However, Rhinocerotidae phylogeny is still being debated.

Because of the forelimbs' slender features, *S. hundsheimensis*, such as *S. etruscus*, must be regarded as a cursorial animal. However, *S. hundsheimensis* was larger and stockier than *S. etruscus*. Unfortunately, the incompleteness of studied material does not permit further investigation into biometric and proportional analyses.

Although the dimensions of this fossil coincide with the dimensional range of *S. hundsheimensis* we cannot exclude that it is from a big specimen of *S. etruscus*, moreover found in the same place.

Distribution - Early mid-Pleistocene of Europe (Fortelius *et al.*, 1993).

Subfamily MUSTELINAE Gill, 1872
Tribe ICTONYCHINI Pollock, 1921
Genus MARTES (Kurtén, 1968)

MARTES MARTES cf. LATINORUM
(Barrett-Hamilton, 1904)
(Text-fig. 8, Pl. 2, figs 3a-c)

Material - Right hemi-mandible bearing 4 teeth (No. 31150)

Description - It consists of a fragment of the right part of a mandible for a length of 45 mm in which four little teeth are inserted. Among the teeth, M1 shows typical tribosphenic features where a trigonid formed by three main cusps; the paraconid, protoconid, and metaconid are recognizable. As reported below, the difference in shape of the tribosphenic molar talonid basin hypoconid cusp does not permit sure specific determination, and so it is left in open nomenclature. The anterior part of the hemi-mandible with incisors and canine is not preserved. On the cheek side, two deep fractures from the back part converge towards the anterior-lower part. The lingual side is well preserved as shown in Text-fig. 8 and Pl. 2, fig. 3a.

Features	L	PL	BP	HT	BS	BT	BD
No. 31144	468	470	175	70	63	132	120
Specimens of <i>hundsheimensis</i>							
75 hu	464	464	182	--	68	--	131
76 hu	457	457	167	--	65	138	130
77 hu	--	--	165	64	--	126	--
79 hu	--	--	--	--	67	>137	--
Specimens of <i>etruscus</i>							
IGF 716	440	450	161	70	61	120	122
IGF 487v	442	447	160	--	58	--	121
IGF 2234	--	--	155	--	56	120?	--
IGF 2235	--	--	--	--	59?	--	--
IGF 722	407	442	150	59	51	109	115
IGF 710	--	--	169	71	63	136	--
IGF 1868	--	--	--	--	70?	--	--
IGF 1872	--	--	--	52	60	--	--
IGF 4326	--	--	--	--	58	--	--
IGF 1878	--	--	--	--	71?	--	--
IGF 1870	--	--	--	--	50	--	--
IGF 1873	--	--	--	50?	61	--	--
IGF 162v	--	--	161	--	60	--	--
Specimens of <i>emitoechus</i>							
Botro maspino	--	503	--	--	73	--	143
Stirone	--	--	--	--	63.5	--	134
Voigtstedt	--	462.5	--	--	66.7	--	136.2
Ilford	--	478	--	--	70	--	--

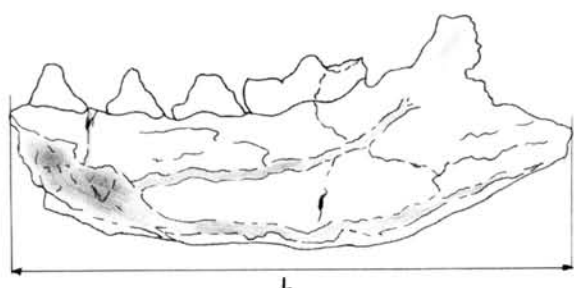
Tab. 5 - Comparison among femur No 31144 and different specimens of *S. hundsheimensis* (after Fortelius *et al.*, 1993), *S. etruscus* (after Mazza, 1988), and *S. emitoechus* (after Cigala Fulgosi, 1976). BD: breadth of the distal epiphysis; L: length 2nd trochanter; PL: Physiologic length; HT: height of the 3rd trochanter; BT: breadth across 3rd trochanter; BP: breadth of the proximal epiphysis; BS: breadth of the diaphysis. All measurements are in mm.

Remarks - A direct comparison with mustelid specimens stored in the Museum of Palaeontology of Florence University allows the studied specimen to be classified as *Martes* sp. In the attempt to give a specific determination we follow the «key to the European forms of *Martes*» reported by Miller (1912, pp. 356-381), who, using data based mainly on dentition, allows a choice among various species spanning between *M. martes* Linnaeus, *Martes martes martes* Linnaeus, *Martes martes latinorum* (Barrett-Hamilton), *Martes foina* Erxleben, *Martes foina foina* Erxleben, *Martes foina mediterranea* (Barrett-

Hamilton), to *Martes bunites* (Bate). Comparing our specimen with those described in this book, the main difference is to be found in the tribosphenic M1 and talonid basin hypoconid cusp, which clearly bends to the left side in the studied specimen. For this reason, we prefer to leave it in open nomenclature. However, we point out the difficulties in finding comparable material, probably due either to the living tree-density environmental conditions or to small animal dimensions. Both are not ideal conditions for fossilisation.

Features	BS	BD	BT
No. 31143	67	142	100
Specimens of <i>etruscus</i>			
IGF 716	56	128	87
IGF 488v	45	121	79
IGF 2209v	--	130	86
IGF 2210v	55	116	77
IGF 14840	59	122	78
IGF 712	58	126	86
IGF 730	55	153?	86?
IGF 717	53	125	79
IGF 732	--	128	89
Specimens of <i>hundsheimensis</i>			
Average values	63.425	145	96.00

Tab. 6 - Comparison among humerus No 31143, different specimens of *S. etruscus* (after Mazza, 1988) and average values for *S. hundsheimensis* (after Fortelius *et al.*, 1993). BS: Breadth of the shaft; BD: Breadth of the distal epiphysis; BT: Breadth across the deltoid tuberosity. All measurements are in mm.



Text-fig. 8 - Right *Martes m. cf. latinorum* hemi-mandible (No. 31150) sketch.

Distribution - *Martes martes* cf. *latinorum* according to Miller, 1912, represents the sole species with *M. f. foina* recovered in Italy: the first near Milan (northern Italy) and the second near Rome (central Italy). Our finding allows the presence of this species in northern Italy to be confirmed.

Sardinia, the Balearic Islands and Mediterranean region in general are the main distribution areas of this species.

DISCUSSION

Lacking a sure co-existence of the described faunal assemblage and being in presence of an apparently anomalous fauna, we take only in consideration some similar recoveries along the Emilian northern Apennine foothills belt. Twenty km far from Veggia locality (Reggio Emilia Province) along the middle valley of Crostolo River, inside fluvial-lacustrine deposits overlaying littoral yellow sands, a rich fossil fauna have been recovered. Such mammal fauna is represented by *S. etruscus*, (mostly fragmentary complete skull, mandible fragment, plus a cranial fragment with almost complete tooth series, part of the tibial diaphysis and a cervical vertebra), *Hippopotamus amphibius*, *Libralces gallicus*, *Elephas meridionalis*, *Equus* sp., *Cervus* (*Dama*) cf. *nesti*, *Sus* sp., *Hystrix* sp., *Ursus etruscus*, *Canis* cf. *etruscus* (Ambrosetti & Cremaschi, 1975). The presence of *Hippopotamus amphibius* and *Libralces gallicus* suggests a late Villafranchian age of the fauna.

The fauna reported above is not to take into consideration because it is impossible to correlate with the Secchia River's one (which has a completely different fossil assemblage with the only exception of *S. etruscus*).

Following the Amorosi *et al.* (1998) stratigraphic sketch (see geological setting here), the littoral yellow sands ended their depositional setting in the mid Pleistocene, so the overlaying sediment bearing *S. etruscus* (from late Pliocene to early Pleistocene, Gliozzi *et al.*, 1997) - both in Secchia and Crostolo rivers - must be considered younger.

Furthermore both faunal fossil assemblages seem to be in contrast both with geological (fossils bearing sediments) and paleontological (faunal assemblages) stratigraphy.

On the other hand, continental faunas seem to be characterized by discontinuity and punctuated distribution either in space or in time affecting so dating and correlations.

We could take into consideration mammal fossil localities fauna during late Villafranchian in Italy outside Emilia-Romagna Region. Even if it seems to us out of the main purpose of the present paper, we can refer to De Giuli & Masini (1986); De Giuli (1986); De Giuli *et al.* (1986), in which *Martes* sp., «*Leptobos*» *wallisarni*, *Dicerorhinus etruscus*, at Casa Frata (Upper Valdarno, Tuscany); *Leptobos* sp., *Eucladoceros* cf. *dicranios* (Nesti) at Selvella (southern Chiana Valley); *Dicerorhinus etruscus* at Apicena (Gargano) are reported. These scattered faunal elements show some affinities with those described in this paper.

CONCLUSION

The recovered faunal assemblage is represented by apparently contrasting elements that leave open some questions. The presence of two rhinoceros species, one (*S. etruscus*) characterising the Villafranchian and the second (*S. hundsheimensis*) widespread in the first part of the mid-Pleistocene seems improbable. Even stranger is the concurrent presence of *Cervus elaphus* and *Cervus perrieri*. *C. elaphus* was found for the first time in the Slivia bone breccia mid-Pleistocene in age (Ambrosetti *et al.*, 1979; Bon *et al.*, 1992), whereas *C. perrieri* characterises the Lower Villafranchian of Spain and France (Heintz, 1970). However, *C. perrieri* is reported inside two faunal assemblages of the mid Pleistocene at Alkalkalaki and at Dmanisi (Southern Georgia) (Vekua, 1986, 1995). Owing to the paucity of information concerning this deer, we cannot exclude that it reached the mid-Pleistocene. The writers would like to underline the fact that the antler, calcaneum and tooth series (perhaps of the same young specimen) of *C. perrieri* recovered in the River Secchia represents the sole report on the presence of this species in western Europe in mid Pleistocene sediments. The mustelid presence does not allow obtaining any time information. On the contrary, the recovered leptobovid represents another Villafranchian element.

At this point, it might be logical to think we are in possession of two different reworked faunal assemblages: one of the early Pleistocene and the other of the mid-Pleistocene. Partially supporting this statement are some fossil elements (e.g. *Leptobos* sp.) which have been recovered above the oxidised pelitic horizon, so it must be younger (e.g. *C. elaphus*).

However, after careful examination of both geological and sedimentological data (Boni, 2004) we believe that there are not enough assumptions to con-

firm the hypothesis of a reworked faunal assemblage, since the studied material was found inside alluvium plain deposits, rather than a very low energy environment. The complete lack of any evidence of sedimentological features (e.g. chaotic horizons, deformed stratification, and coarse elements inside fine sediments) could even suggest that the fossil remains had tumbled down from riverbank areas made up of coarse deposits and that the pelitic horizon was not an inter-channel area, but a wide abandoned channel filled by fine sediments. Again, the degree of fossilisation and the crushing of the remains (attributable to the same diagenetic episodes inside oxidised pelites), in particular of the two cervid antlers, is the same for the rest of the fossils. These considerations disagree once again with any reworking event. Furthermore, sedimentological evidence linked to meander structure (a probable area of fossil accumulation created by the transport reworking differently aged fossil remains) was not found.

At Dmanisi and Alkalkalaki (Vekua, 1986; 1995) inside Lower Pleistocene fossil assemblages was found the contemporaneous presence of *Cervus perrieri*, *Stephanorhinus etruscus* and *Martes* sp., the same faunal elements recovered in the River Secchia area.

S. etruscus is reported at the Crostolo River area in a fossil assemblage belonging to late Villafranchian (Ambrosetti & Cremaschi, 1975), but recovered in sediments that according to the stratigraphic sketch by Amorosi *et al.* (1998), must be probably younger than mid Pleistocene. This last remark could represent a further aid against reworking of the studied fossil assemblage.

In conclusion, even if it cannot completely exclude fauna reworking, a real contemporaneous presence is possible, as shown by the described fossil assemblage reported in Georgia. Unfortunately, lacking the direct dating of the horizon bearing studied vertebrate remains, we must use inference by means of geological succession.

If the contemporaneous presence of the studied species in continental sediments after the Middle Pleistocene littoral facies deposition could be confirmed, it would provide very important evolutionary data concerning the described species.

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