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Pleistocene Artiodactyls from Vieste (Gargano, Italy)

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KEY WORDS – *Mammalia, Artiodactyls, Biochronology, Pleistocene, Vieste, Southern Italy.*

ABSTRACT – *Some bone remains in a fairly good state of preservation have been collected during a field work in the area of Vieste (Gargano promontory, Southern Italy). The remains have been found in a wide fissure inside the calcareous rocks of an old quarry. The studied bones can be attributed to four Artiodactyls species representing a local fauna referable to the late Middle Pleistocene. More particularly the presence of Dama dama tiberina and of an advanced form of Cervus elaphus allow to refer the remains from Vieste to the Vitinia Faunal Unit. The age showed by these remains is also important because they represent the first occurrence of a faunal association referable to the middle Aurelian in the Adriatic side of central-southern Italy.*

RIASSUNTO – [Gli Artiodattili pleistocenici di Vieste (Gargano, Italia) – *Durante una campagna di ricerca in superficie nell'area di Vieste (Gargano, Italia meridionale), in una cava attualmente abbandonata e adibita in passato ad attività estrattiva, sono stati rinvenuti, in una fessura nelle rocce calcaree, alcuni reperti ossei in discreto stato di conservazione. Tali resti, oggetto del presente lavoro, anche se riferibili solo a 4 specie di artiodattili, rappresentano una fauna locale attribuibile alle ultime fasi del Pleistocene medio. Più precisamente, la presenza di Dama dama tiberina e di una forma evoluta di Cervus elaphus permette di inquadrare i resti di Vieste nell'ambito dell'U. F. di Vitinia. L'importanza dei ritrovamenti risiede anche nel fatto che essi costituiscono la prima segnalazione di un'associazione faunistica riferibile dell'Aureliano medio nella fascia adriatica dell'Italia centro-meridionale.*

INTRODUCTION

The remains studied in this work were collected in 1988 during a field research, next to km 8.5 of Italian State Road 89 (Text-fig. 1). This road connects the towns of Mattinata and Vieste. The area of finding is an old quarry now closed, where many karst phenomena, mainly funnel-shaped hollows, can be observed. The bones were found inside one of these hollows, in the Lower Cretaceous pelagic limestone (the so-called Maiolica) of the Mattinata Formation.

From the lithostratigraphical point of view, the complete Cretaceous-Eocene succession can be subdivided into three main stratigraphical intervals on the basis of their physical-stratigraphical relationships, which correspond to three Sequences: the Mattinata Sequence, the Monte S. Angelo Sequence and the Monte Saraceno Sequence (Bosellini *et al.*, 1993). In particular, the Sequence of Mattinata extends from the basis of Neocomian to the Upper Albian (Luciani & Cobianchi, 1994) and is represented by the platform carbonates of the S. Giovanni Rotondo Formation and by the slope and pelagic deposits of the Mattinata Formation (Bosellini *et al.*, 1993).

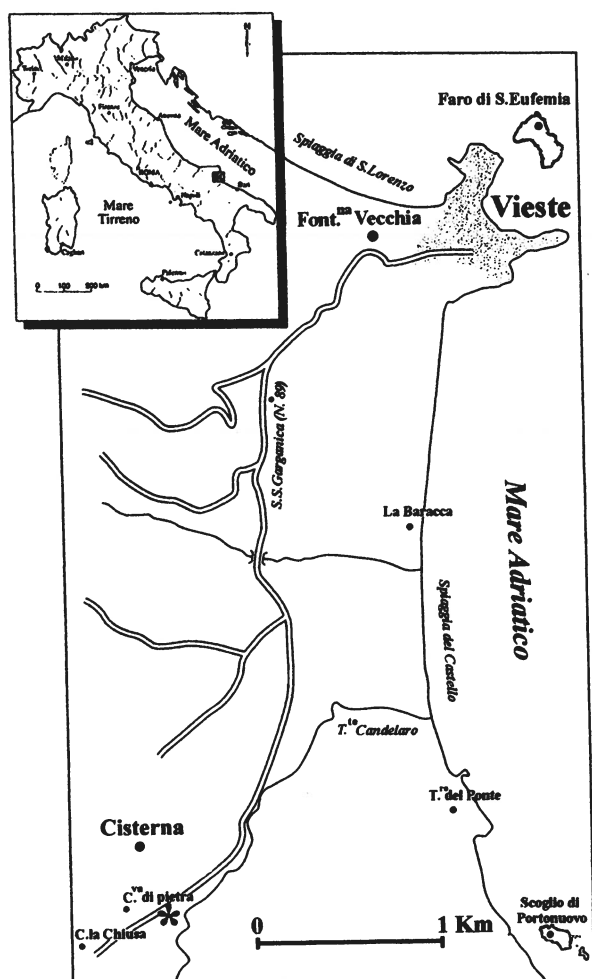
From the geomorphological point of view, the karst hollow where the bones were found is similar to those present in other areas of the Gargano promontory, like the Early Pliocene and Pleistocene ones in the calcareous rocks of Pirro Nord (De Giuli *et al.*, 1986; Abbazzi *et al.*, 1996). This particular hollow is filled with calcareous pebbles, clay-sandy material,

vertebrate bones and calcareous concretions. Evidence suggests that part of the calcareous concretions were present prior to the filling. The presence of skeletal parts in a partial anatomical connection indicates the absence of a long transportation even if some remains show different levels of transportation by water and/or fragmentation. However, the sedimentation might have been rather quick and perhaps affected only a small area, allowing the preservation of the bones.

The bones are often fragmented and sometimes compressed and deformed (see the fallow deer skull in the Plate 1, fig. 1 for example) by the sediment weight. The fractures seem all of natural origin and neither slaughtering nor predatory signs have been observed. As it usually happens in similar sedimentary situations (for example Pirro Nord or the so-called "ventarole" of Salento), the presence of fossil remains within the karst fissures is variable; in fact the other hollows in the area of the quarry of Vieste do not present remains. It is impossible to detect a stratigraphical level in the sediments of the hollow; the sediments are in fact very homogeneous.

THE FAUNAL REMAINS

As already mentioned, the remains collected from the fissure filling in the quarry of Vieste can be referred only to four herbivore species, all belonging to Artiodactyls. These remains are preserved in the Paleontological Museum of the Dipartimento di



Text-fig. 1 - Geographical localization of the site.

Scienze della Terra of the "La Sapienza" University of Rome.

CERVUS ELAPHUS Linnaeus, 1758 (advanced form)

Materials (the number of specimens for each bone is indicated in the brackets) – Antler fragment (2); upper M2 (1); mandibular fragments with P4-M3/P4-M2 (2); lower M2 (1); atlas (2); epistropheus (1); cervical vertebra (1); dorsal vertebra (3); lumbar vertebra (2); sacral bone fragment (1); complete humerus (1); humerus fragment (1); complete radius (1); radius fragments (2); complete metacarpus (1);

metacarpus fragments (2); pelvis fragments (3) complete femur (1); femur fragments (5); tibia fragments (4); calcaneum fragment (2); scapoid bone (2); complete metatarsus (1); metatarsus fragments (6); complete first phalanx (1); first phalanx fragments (3); complete second phalanx (1); second phalanx fragments (3); third phalanx (3).

Measurements of the upper molar (in mm)

Length M2	Breadth M2
25.20	20.00

Measurements of lower teeth (in mm)

Length P4-M3	Length M1-M3	Length P4	Length M1	Length M2
97.20	77.10	20.00	23.15	26.20

Length M3	Breadth P4	Breadth M1	Breadth M2	Breadth M3
32.00	12.50	13.00	13.50	14.00

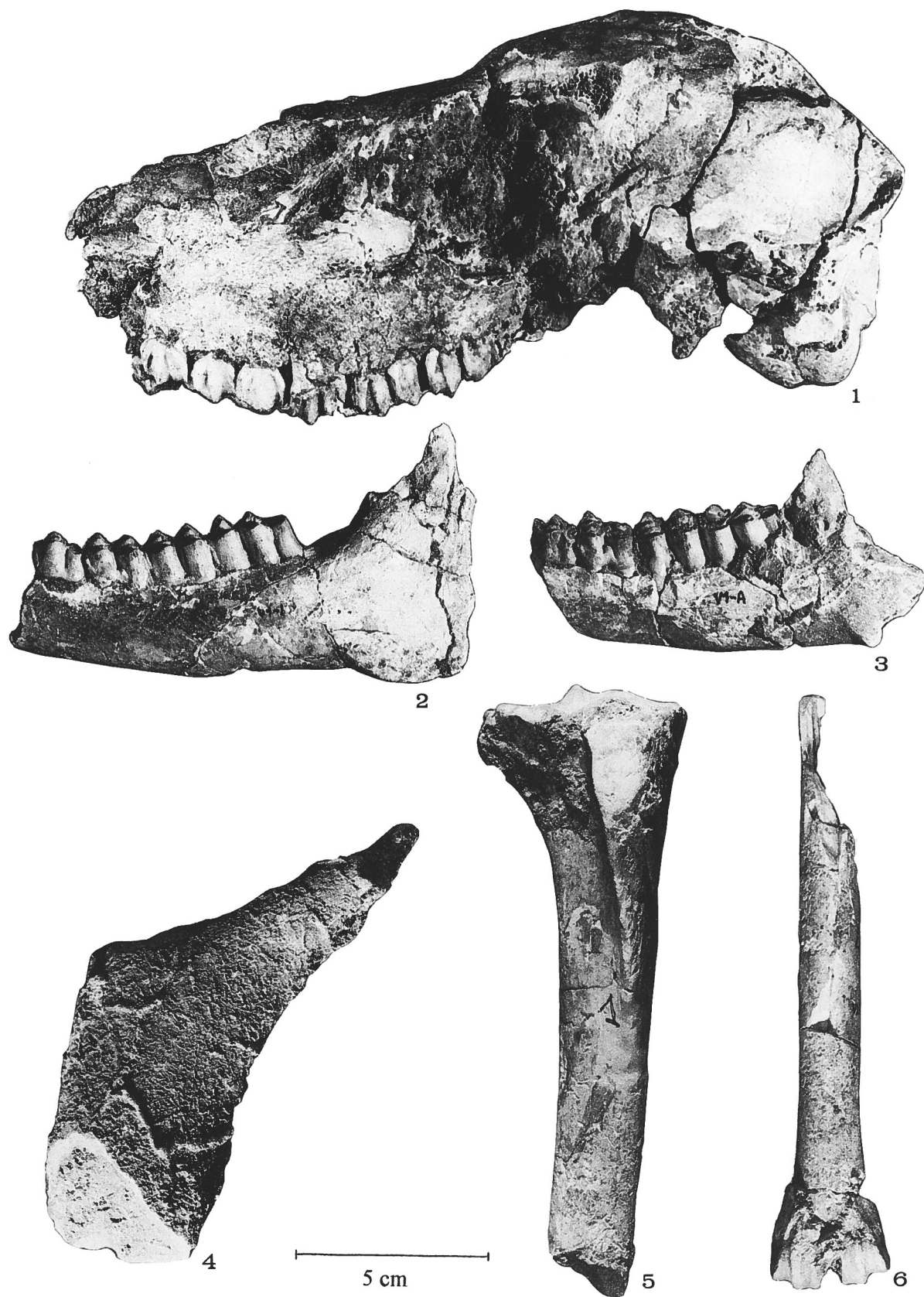
Length P4	Length M1	Length M2	Breadth P4	Breadth M1	Breadth M2	Length M2	Breadth M2
18.50	24.00	29.00	11.00	12.00	13.00	25.00	14.20

Measurements (in mm) of some postcranial bones (L: maximum length, TPD: transversal proximal diameter, APPD: antero-posterior proximal diameter, TMD: transversal medial diameter, APMD: antero-posterior medial diameter, TDD: transversal distal diameter, APDD: antero-posterior distal diameter).

	L	TPD	APPD	TMD	APMD	TDD	APDD
Metatarsus	290.00	37.00	42.00	25.00	30.50	43.80	29.80
Metatarsus		35.90	40.00			45.50	30.00
Metatarsus		36.50	42.00				
Humerus				32.00	42.00	62.00	59.80
Tibia		71.50					
Radius	305.00	55.00	32.00	36.80	23.20	51.20	36.70
Radius				34.00	27.00	52.00	44.00
Femur	326.00	86.00		30.00	32.00	75.00	98.00
Femur							
Metacarpus	264.50	42.00	31.20	27.00	26.00	45.00	29.00
Phalanx	57.50	22.00	24.80			20.00	19.80
Phalanx	43.50	21.00	27.00			20.00	26.00
Phalanx	38.50	20.50	31.00				
Phalanx	49.80	19.00	31.00				
Phalanx	46.00	17.50	29.50				
Phalanx						19.00	26.00
Ulna							

EXPLANATION OF PLATE 1

Figs 1-6 - *Dama dama tiberina* from Vieste. 1) Female skull; 2-3) left mandible in lingual view; 4) antler fragment; 5) left tibia in frontal view; 6) left metatarsus distal fragment in frontal view.



The remains referred to the red deer represent most of the bones collected in the karst hollow. In fact they constitute more than 60% of the remains and they can be referred at least to three individuals (Pl. 2, figs 1-4).

The cranial remains are scarce and the teeth do not show peculiar features which allow to identify one of the various red deer subspecies diffused during the late Middle and Late Pleistocene of Italy. The large size and the presence of evident interlobar styles can be observed in the molars but these features are not very important in the taxonomy of red deer. The limb bones are also large sized and can be compared with both the European archaic populations of red deer (*Cervus elaphus acoronatus*) and with the more advanced forms diffused in the late Middle and Late Pleistocene. The humerus shows a massive trochlea externally directed, with an angle more than 20° as typical of the red deer (Di Stefano, 1996). The proximal epiphysis of the radius shows a sinuial fossa that is scarcely deep if compared with the typical Galerian red deer populations (*C. e. acoronatus* and the early "crowned" forms). The proximal epiphysis of both metapodials shows a massive aspect with few projecting crests and wide but not very defined articular surfaces.

The proposed biometrical analysis cannot give definitive evidences on the taxonomy of the remains but it can offer more hints or indications to sustain the considerations described in the morphological analysis.

Some scattergrams on radius, metacarpus and metatarsus ratios are proposed (Text-figs 2-7). The measurements of the various red deer populations in the scattergrams have been taken from the remains stored in numerous European Museums and they have been published in previous papers (Di Stefano & Petronio, 1992, 1993).

The scattergrams on the radius (Text-fig. 2 and 3) show medium-large size, comparable with those of the most archaic populations and those present previously than the Late Pleistocene. The bone however is rather slender, particularly in the proximal epiphysis, close to the remains referred to *C. e. aretinus*.

The metapodials are large too (Text-figs 4-5). However, the metapodials are not as slender as the radii; on the contrary, in the metatarsus scattergrams, the remains seem rather massive, above all the distal epiphysis (Text-fig. 7). In the epiphysis scattergram the closest populations are the late Middle Pleistocene ones, like *C. e. rianensis* and *C. e. aretinus* but this similarity is less evident in other ratios.

The description of the late Middle Pleistocene subspecies of red deer (as *C. e. aretinus*, *C. e. rianensis*, *C. e. angulatus* and many others) is based above all on the antler and skull morphologies (Beninde, 1937; Azzaroli, 1962; Leonardi & Petronio, 1974) even if subsequent studies revealed some biometrical features also in the limb bones of some forms (Di Stefano & Petronio, 1992). The red deer remains from Vieste show morphological and biometrical features which do not allow to attribute them to a precise *C. elaphus* subspecies; however, the same features allow to exclude the presence of any Galerian red deer population and therefore to attribute the red deer remains from Vieste to an Aurelian advanced *C. elaphus*. More particularly, even if some analogies with the remains referred to *C. e. aretinus* and *C. e. rianensis* have been observed, the number and the features of the red deer remains from Vieste do not allow any sure attribution to these or other late Middle Pleistocene subspecies of the Italian peninsula.

DAMA DAMA TIBERINA Di Stefano & Petronio, 1997

Materials (the number of specimens for each bone is indicated in the brackets) – Female skull (1); mandible with P4-M3 (2); antler fragment (3); cervical vertebra fragment (1); dorsal vertebra (1); lumbar vertebra (2); sacral bone fragment (1); sternal segment (1); scapula fragment (2); humerus fragment (2); radius fragment (7) ulna fragment (1); metacarpus fragment (2); femur fragment (5); tibia fragment (3); calcaneum fragment (1); complete calcaneum (1); complete astragalus (2); metatarsus fragment (4); first phalanx (1); second phalanx (1); second phalanx fragment (1).

Measurements of upper teeth (in mm)

Length P2-M3	Length P2-P4	Length M1-M3	Length P2	Length P3	Length P4	Length M1
89.50	38.20	52.50	12.90	11.40	13.00	17.50

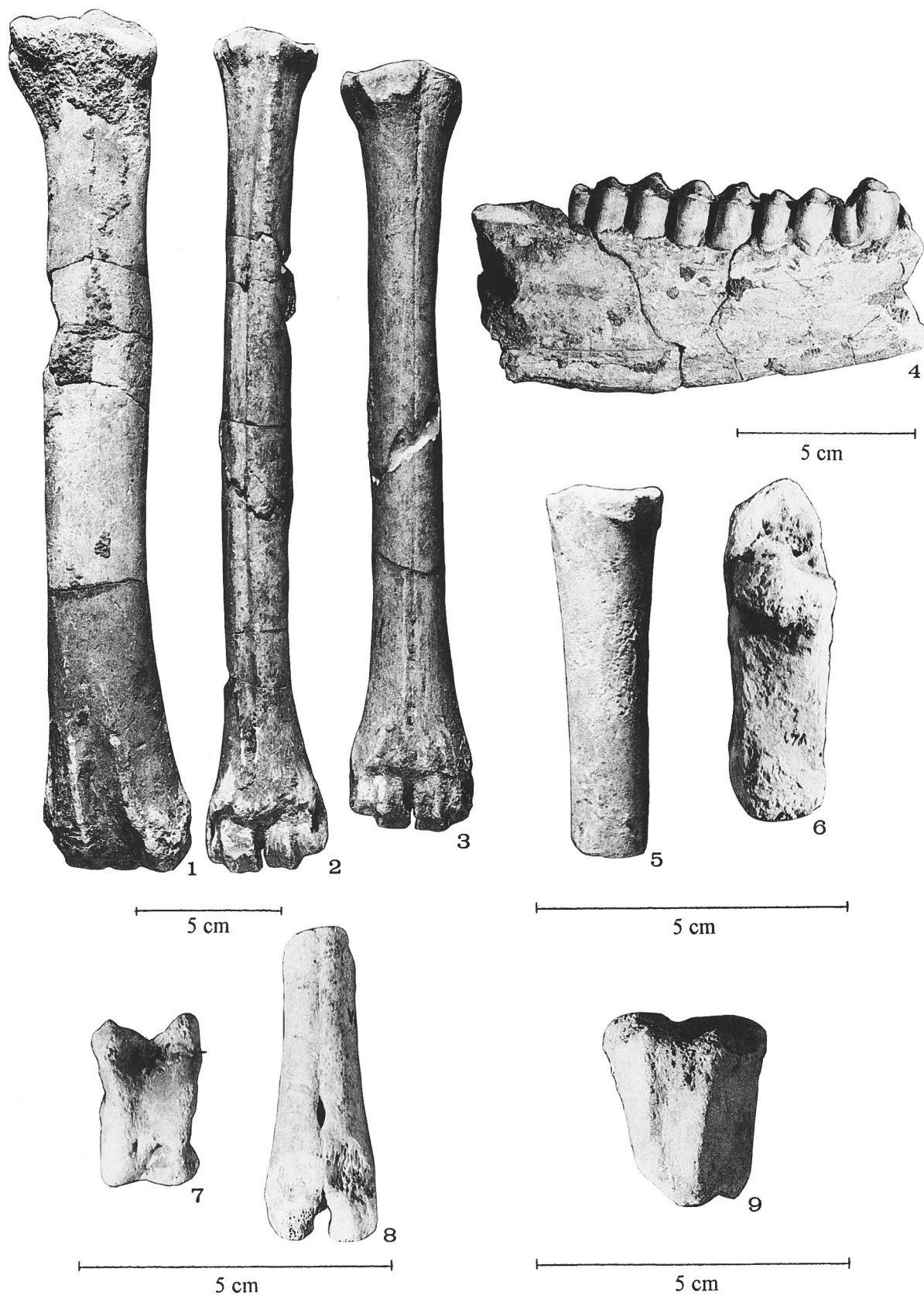
Length M2	Length M3	Breadth P2	Breadth P3	Breadth P4	Breadth M1	Breadth M2
19.20	20.50	12.20	14.20	16	17.50	18.50

Measurements of lower teeth (in mm)

M1-M3	Length P4	Length M1	Length M2	Length M3	Breadth P4	Breadth M1	Breadth M2	Breadth M3
58.00	14.00	15.60	17.90	24.50	9.00	10.40	11.80	11.40
56.50	12.60	15.40	18.90	23.20	8.70	10.60	11.10	11.40

EXPLANATION OF PLATE 2

- Figs 1-4 - *Cervus elaphus* ssp., 1) right radius in frontal view; 2) left metatarsus in frontal view; 3) left metacarpus in frontal view; 4) left mandible in lingual view.
 Figs 5-8 - *Capreolus capreolus*, 5) right metacarpus proximal fragment in frontal view; 6) right calcaneum in medial view; 7) right astragalus in plantar view; 8) right metacarpus distal fragment in frontal view.
 Fig. 9 - *Bos* sp. from Vieste, right metatarsus proximal fragment.

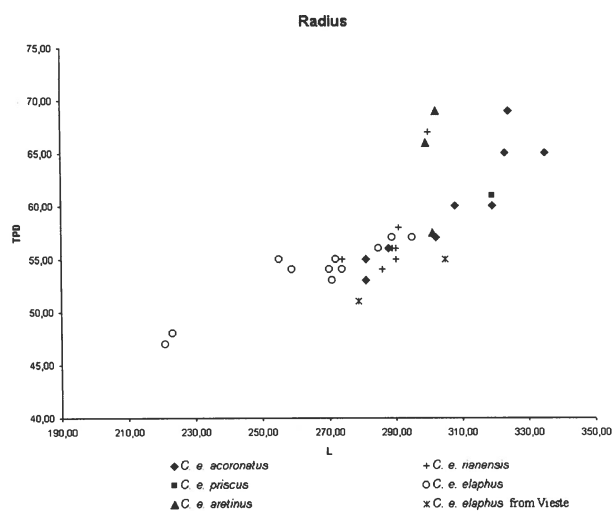


Measurements (in mm) of some postcranial bones (L: maximum length, TPD: transversal proximal diameter, APPD: antero-posterior proximal diameter, TMD: transversal medial diameter, APMD: antero-posterior medial diameter, TDD: transversal distal diameter, APDD: antero-posterior distal diameter).

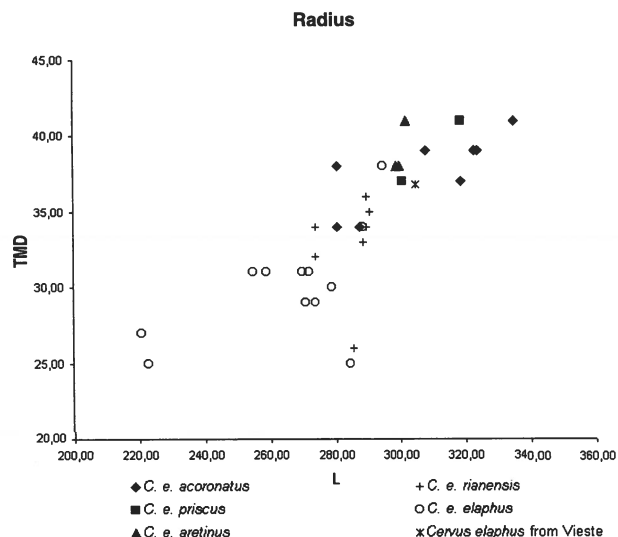
	L	TPD	APPD	TMD	APMD	TDD	APDD
Tibia		55.90	51.00	21.50	18.50		
Humerus						40.50	36.50
Tibia						33.50	24.50
Metatarsus						32.00	21.00
Metatarsus		28.00	30.00				
Femur							
Femur							
Femur						47.00	78.50
Femur						54.90	71.00
Radius				20.50	16.50	33.50	23.50
Radius						32.00	23.00
Phalanx	45.00	16.30	20.00			14.90	14.00
Phalanx	33.00	14.70	20.00			12.00	17.00

The fallow deer is the second species in number of collected remains. In fact, all the skeleton elements have been found but, on the contrary as observed for the red deer, the fallow deer remains are more fragmented and do not allow a biometrical analysis.

The most representative remain is surely the female skull (Pl. 1, figs 1-6); it is rather fragmented and often covered with strong concretions from the sediments of the hollow. The splancnocranium is fragmented both in the nasal and in the palatal parts where however the two complete dental rows are present. The neurocranium is rather complete even if it



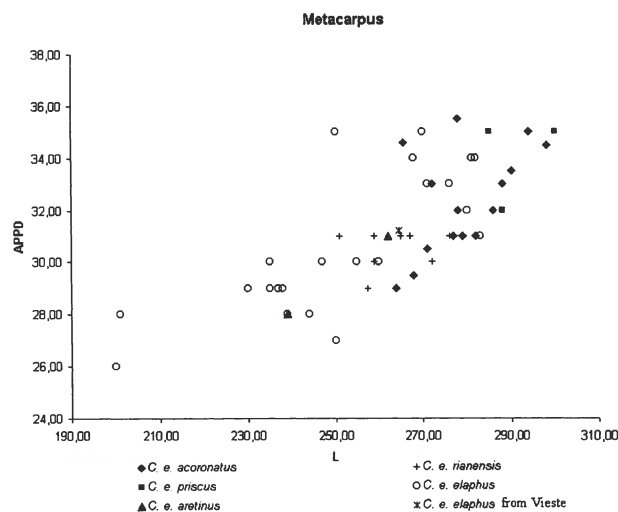
Text-fig. 2 - Scattergram on the maximum length (L) and the transversal proximal diameter (TPD) of radius.



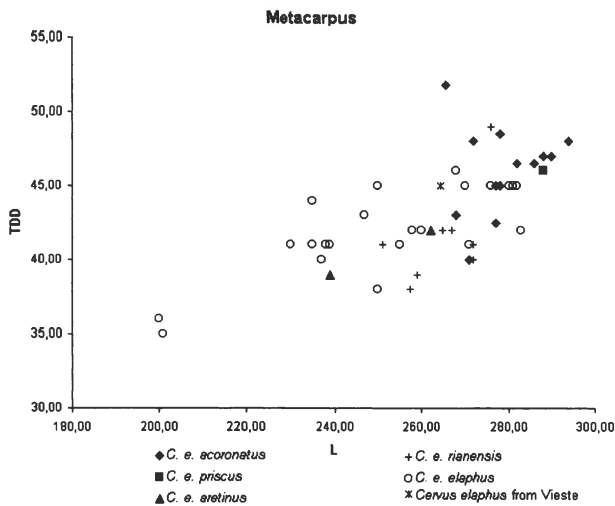
Text-fig. 3 - Scattergram on the maximum length (L) and the transversal medial diameter (TMD) of radius.

is laterally compressed and it lacks of part of the parietal bone so that the endocranial cast can be partially observed; the occipital part is also fragmented and does not show peculiar features, the occipital condyles are rather massive if compared with the living fallow deer. The conditions of the specimen do not allow a detailed morphological analysis and moreover it is a female skull whose features are usually not considered in paleontological studies.

The two mandibular fragments and the teeth in the female skull show morphological features which allow a good taxonomical reference. The upper teeth are medium-large sized and rather little worn; the molars show strong anterior and posterior cingula and the presence of well developed entostyles.



Text-fig. 4 - Scattergram on the maximum length (L) and the antero-posterior proximal diameter (APPD) of metacarpus.



Text-fig. 5 - Scattergram on the maximum length (L) and the transversal distal diameter (TDD) of metacarpus.

In the lower teeth the strong molarization of the fourth premolar can be observed, the same tooth also shows the presence of an anterior cingulum; the molars show an evident anterior cingulum and, above all in the first molar, the presence of a well developed entostylid. Finally the strong thickness of the enamel can be generally observed.

The limb bones are variable sized but surely less than the Clacton fallow deer and comparable with those of the largest sized living fallow deer. From the morphological point of view, any detailed analysis is not allowed because of the fragmentation of the remains. Generally speaking, the limb bones show

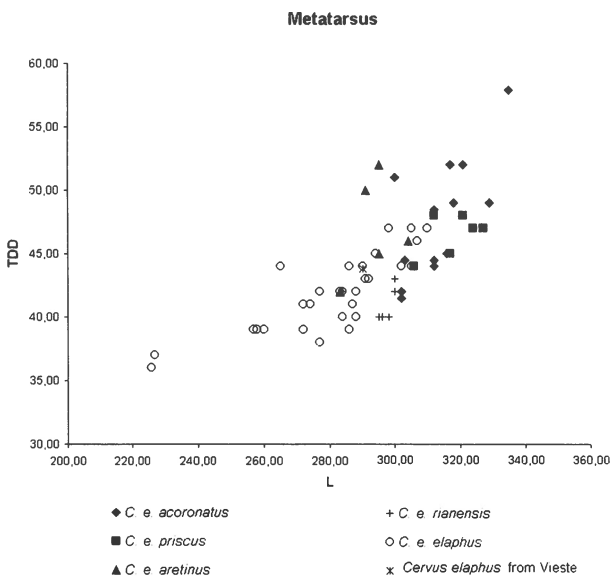
well defined articular surfaces as it usually happens in all the representatives of the genus *Dama*. The proximal epiphysis of the tibia shows the spinal tubercles at the same height (Lister, 1990; Di Stefano, 1996), while the distal portion of the metatarsus shows a slightly lengthened profile.

The teeth features are on the whole rather archaic and comparable with those of *D. d. tiberina* from numerous localities of central Italy (Di Stefano & Petronio, 1997). In fact, the presence of both entostylids and anterior cingula in the lower molars can be recognized only in *D. clactoniana* and in *D. d. tiberina*; however the strong molarization of P_4 and the enamel thickness is typical of the archaic population of *Dama dama*. These considerations, also considering the size of the remains, allow to attribute the fallow deer bones from Vieste to *D. d. tiberina*.

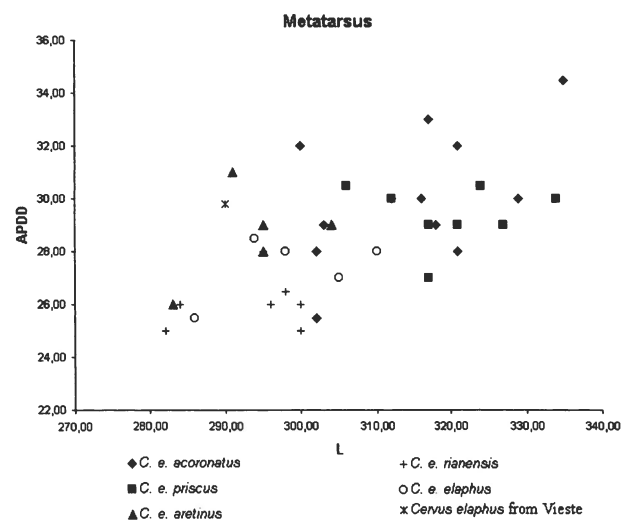
CAPREOLUS CAPREOLUS (Frisch, 1775)

Materials (the number of specimens for each bone is indicated in the brackets) – Scapula fragment (1); humerus fragment (6); radius fragment (4); ulna fragment (1); metacarpus fragment (6); femur fragment (6); tibia fragment (4); complete calcaneum (1); complete astragalus (1); metatarsus fragment (5); first phalanx fragment (4).

The roe deer remains are rather scarce and they are represented only by postcranial fragments (Pl. 2, figs 5-8). The size is small also considering that probably all the remains of this species collected from Vieste belong to a single subadult individual. Even if the remains do not show diagnostic and peculiar features, the size allows to exclude the attribution of the roe deer remains from Vieste to the Middle Pleistocene



Text-fig. 6 - Scattergram on the maximum length (L) and the transversal distal diameter (TDD) of metatarsus.



Text-fig. 7 - Scattergram on the maximum length (L) and the antero-posterior distal diameter (APDD) of metatarsus.

species *Capreolus suessenbornensis*, which was characterized by a rather large size (about 25% more than the living species) (Pfeiffer, 1998; Di Stefano & Petronio, in press).

BOS sp.

Materials – Dorsal vertebra fragment; right metatarsus proximal fragment.

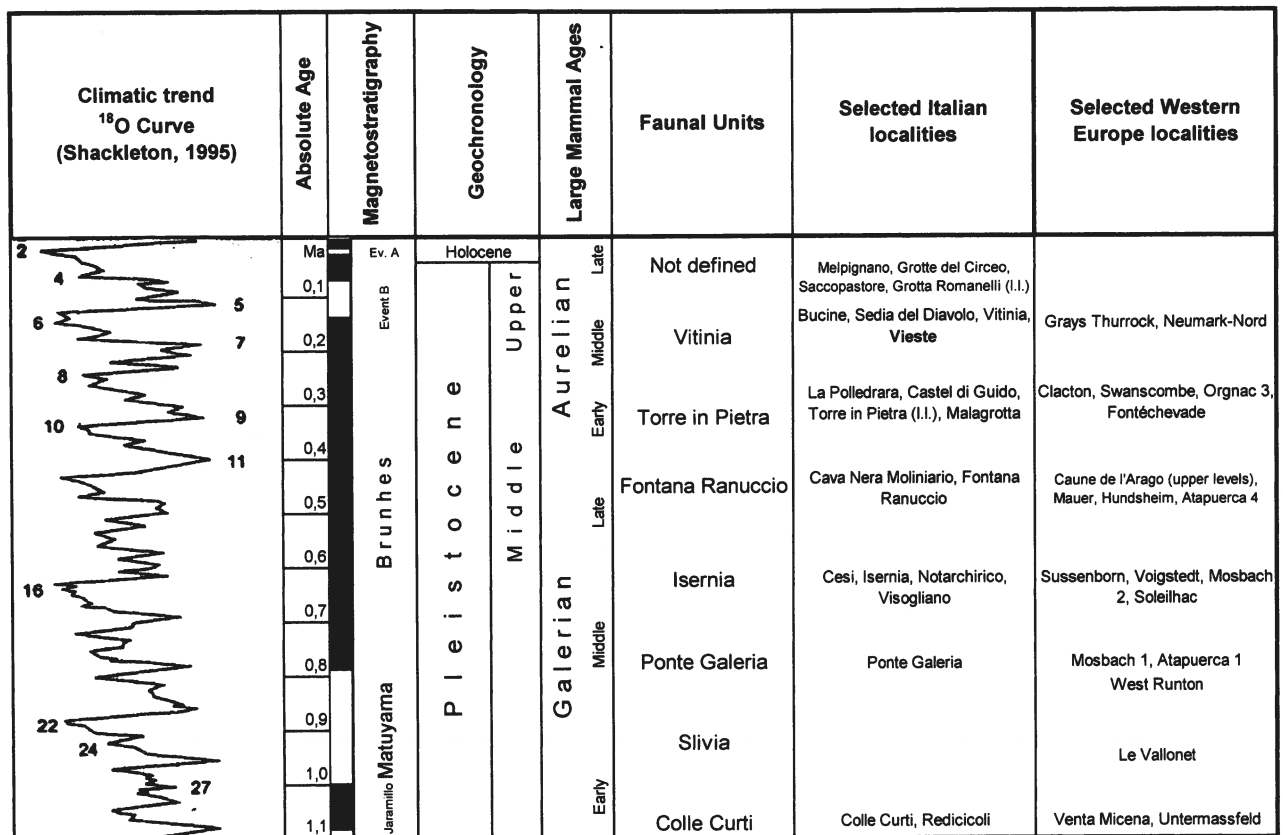
The bovid remains are represented only by two sure specimens. The small sized metatarsus fragment is referable to a young individual (Pl. 2, fig. 9). The morphological features of the proximal epiphysis, even if covered by sediment concretions, allow to exclude the attribution of this specimen to the genus *Bison* (Sala, 1986).

BIOCHRONOLOGICAL CONSIDERATIONS

As already mentioned, the stratigraphical and sedimentological characteristics of the site in the Vieste area where the remains studied in this work were collected, do not allow any chronological consideration.

However, the numerous biochronological studies of the last years, generally referred to Pleistocene Mammals and particularly to Artiodactyls (Di Stefano & Petronio, 1992, 1993, 1998, in press; Gliozzi *et al.*, 1997; Petronio & Sardella, 1998) allow to draw a model of reference for the Italian peninsula from the early Villafranchian faunas up to present day ones. More particularly, the following considerations apply for the species found in the fissure filling of Vieste.

The red deer occurs in Italy from the Slivia F. U. with a crownless primitive form (Di Stefano & Petronio, 1992), but the first modern crowned populations with other advanced features occur in the late Galerian faunal assemblages (Fontana Ranuccio F. U.). During the Aurelian Mammal age the evolution of numerous subspecies occurs in all Europe: these populations show variable features that are mostly linked with local factors, and some plesiomorphic morphological elements (i.e. *Cervus elaphus rianensis* in Italy, *C. e. angulatus* in Germany, *C. e. binegadenensis* in France) (Beninde, 1937, Leonardi & Petronio, 1974, Guerin *et al.*, 1983, Di Stefano & Petronio, 1992). During the latest Middle Pleistocene some large size populations lived in Italy: one of these



Text-fig. 8 - Biochronological sketch of the Artiodactyls from Vieste.

forms is *Cervus elaphus aretinus*, also characterized by large antlers cup-shaped in the terminal part. The morphological features of these subspecies can be generally considered into the more advanced red deer populations which occurred in Italy from the late Middle Pleistocene. Therefore, the presence of a not well defined but advanced red deer allows to draw a lower biochronological limit to the remains from Vieste.

The presence of *Dama dama tiberina* is a stronger element for the attribution of the remains from Vieste to a more precise phase of Pleistocene. This fallow deer is in fact the first one with modern features and different from the archaic species *Dama clactoniana* with whom it lived together for a short time (Di Stefano & Petronio, 1997). The Tiber fallow deer still shows archaic features in the teeth but the antlers and the limb bones are already very similar to those of the living fallow deer. From the biochronological point of view *D. d. tiberina* occurs in central and southern Italy just during the latest Middle Pleistocene (corresponding to the Vitinia F. U.) (Di Stefano & Petronio, 1997; Abbazzi *et al.*, 2001), and therefore it represents a sort of biochronological "marker".

The presence of *Capreolus capreolus* is pointed out in Italy from the early Aurelian faunas (Torre in Pietra F. U.) and it does not allow detailed biochronological analysis because it occurs until today. The same consideration can be done for the presence of *Bos*: in fact, also excluding the attribution of the remain to the primitive form *B. galerianus*, the temporal distribution of the subsequent species (*B. primigenius*) is too wide for any biochronological analysis (Gliozzi *et al.*, 1997; Petronio & Sardella, 1998).

The biochronological considerations on the Artiodactyls from Vieste allow therefore to refer the remains to the Vitinia F. U. (Text-fig. 8). They also represent the first occurrence of a faunal assemblage referable to the late Middle Pleistocene in the Adriatic area of central-southern Italy. In fact the numerous faunal assemblages collected in this zone are referred to different Pleistocene phases (i.e., the late Villafranchian fauna from Pirro Nord, the Galerian fauna from Isernia and the late Aurelian faunas from the "ventarole" and the ossiferous breccias of Salento) (De Giuli *et al.*, 1986; Sala, 1986; Di Stefano *et al.*, 1992; Bologna *et al.*, 1994; Abbazzi *et al.*, 1996) but no certain occurrences of Middle Aurelian faunas have been pointed out until today.

The faunal remains from Vieste allow therefore to fill the temporal gap for this area of the Italian peninsula but also allow to extend our knowledge on the distribution of some Mammal species during an important phase of Pleistocene.

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