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A small latest Villafranchian (late Early Pleistocene) rhinoceros from Pietrafitta (Perugia, Umbria, Central Italy), with notes on the Pirro and Westerhoven rhinoceroses

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KEY WORDS — *Rhinocerotidae, Perissodactyla, Mammalia, Pietrafitta (Perugia), late Early Pleistocene.*

ABSTRACT — *The lignite mine of Pietrafitta, which serves an ENEL thermoelectric power plant, has yielded an extremely rich collection of late Early Pleistocene rhinoceros remains. Cranial and dental remains, too few and badly preserved for confident specific attribution, sometimes have characters of both Stephanorhinus etruscus (Falconer, 1868) and S. hundsheimensis (Toula, 1902). A comparative analysis of the postcranial remains reveals greater similarity with the latter species. Despite its small size, the Pietrafitta rhinoceros is therefore referred to Stephanorhinus cf. hundsheimensis.*

The occurrence in Western Europe of rhinoceroses of about the same size and morphology as that of Pietrafitta and apparently of similar age, suggests a possible origin of S. hundsheimensis from S. etruscus through these small-sized intermediate representatives; however a possible derivation from some other species cannot be excluded.

RIASSUNTO — *Nella miniera di lignite di Pietrafitta, sfruttata da una centrale termoelettrica dell'ENEL, sono stati rinvenuti numerosi resti di rinoceronte di piccola taglia del tardo Pleistocene inferiore. I resti cranici e dentari, troppo scarsi e mal conservati per permettere una sicura attribuzione specifica, hanno talvolta qualche carattere proprio di Stephanorhinus etruscus (Falconer, 1868) e talaltra di S. hundsheimensis (Toula, 1902). Un confronto del materiale postcraniale ha evidenziato una maggiore corrispondenza con quest'ultima specie. Nonostante la piccola taglia, il rinoceronte di Pietrafitta viene riferito a S. cf. hundsheimensis.*

L'esistenza in Europa occidentale di rinoceronti simili per taglia e morfologia a quello di Pietrafitta e presumibilmente di un'età comparabile, suggerisce una possibile derivazione di S. hundsheimensis da S. etruscus attraverso queste piccole forme intermedie; non si esclude, però, un'origine da altre specie.

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M. Fortelius devoted himself to the study of the cranial and dental material; postcranials have been analyzed jointly by P. Mazza and B. Sala. The specimens from Pirro were studied by P. Mazza.

INTRODUCTION

In 1958, lignite mining at the small town of Pietrafitta, 30 km west of Perugia, began to supply the "Città di Roma" ENEL thermoelectric power plant. The excavations uncovered a very rich collection of fossil vertebrate remains. Mr. L. Boldrini, a worker at the plant, was the first to realise the importance of these remains. In the long period before his retirement, Mr. Boldrini spent much of his spare time looking for fossil vertebrates and recovered the specimens that now make up the body of the Pietrafitta collection.

The sample includes a large-sized southern elephant, *Archidiskodon meridionalis* (Ambrosetti *et al.*, 1987); the fallow deer, *Pseudodama cf. nestii* (Azzaroli, 1992); *Megaceroides boldrinii* (Azzaroli and Mazza, 1992; in press); a large-sized narrow-nosed ox, *Leptobos*; a rhinoceros; the beaver, *Castor*; the macaque monkey, *Macaca*; the etruscan bear, *Ursus etruscus*; two mustelids, one of which is

Pannonictis; some rodents, *Allophaiomys pliocaenicus* and the voles *Mimomys savini* and *Mimomys cf. pusillus* (Masini and Torre, 1987); a small-sized hare, *Lepus*; few birds; the European pond terrapin, *Emys orbicularis*; and some frogs and fish.

Allophaiomys and an advanced form of the narrow-nosed ox are characteristic elements of the end of the Early Pleistocene (Azzaroli *et al.*, 1988; Masini, 1989).

The rhinoceros remains are the subject of the present study. Other investigations on the Pietrafitta fauna are in progress. Preliminary notes on the site and its fauna have been presented by Ambrosetti *et al.* (1987), but Pantanelli in 1886 was he who made the first report on the Pietrafitta vertebrates.

THE PIETRAFITTA BASIN

The Pietrafitta lacustrine basin formed during

the Late Pliocene-Early Pleistocene interval as the result of extensional tectonics that affected the Northern-Central Apennine chain. The disruption caused an eastward tilting of the area, which inverted the original drainage network, so that the streams no longer reached the sea to the west, but discharged into the depressed Pietrafitta area (Ambrosetti *et al.*, 1987).

The change in the drainage pattern resulted in the formation of marshes, where plants, including *Pterocarya*, *Zelkova*, *Tsuga* and *Liquidambar* (Ricciardi, 1961), became established. Fine-grained sediments accumulated under oxygen-poor, acidic conditions that prevented the decay of plant remains and of the skeletons of bogged animals. The marshy environment persisted as the rate of sedimentation matched the rate of subsidence of the basin and of the plant remains turned to peat and lignite. An increase in the supply of sediments caused by later tectonic activity resulted in the infilling of the basin with sands and clays. Present day alluvial sediments of the Nestore river cap the sequence (Ambrosetti *et al.*, 1987).

MATERIAL

Several rhinoceroses were recovered from the lowest levels of the lignite sequence of Pietrafitta. Most are subadults, one of which is almost complete. One individual, excavated with traditional techniques, is relatively well preserved. The rest, accidentally recovered during lignite mining, are in very poor condition.

The bones, especially the largest ones, are generally flattened and fractured, because of recent tectonics movements, sediment load and desiccation. The material is so poorly preserved that consolidation and restauration were almost always necessary. The bones are dark brown and a ferromanganese veneer, commonly found on bones fossilized in lignite deposits, covers their outer surfaces.

The specimens (Table 1) found more recently have been well restored and are now preserved in the storerooms of the ENEL power plant. In the past, part of the material, that is now kept at Mr. Boldrini's home, was clumsily restored in a manner that obscured both the original state of the specimens and the alterations induced by fossilization. All the fossils found at Pietrafitta will be housed in a museum that will be constructed in the power plant.

The material presently kept at the ENEL power plant

The remains of at least five individuals found in different parts of the site, are preserved at the ENEL power plant, in addition to several other specimens that were found scattered throughout the mining area.

Individual 1 - it is represented by the following bones:

Mandible n° 820 - the specimen consists of both horizontal rami. It is deformed at the symphysis, with the two rami dorso-ventrally displaced. The ascending rami are fragmentary, but the angular

TABLE 1 - List of postcranial specimens studied

PIETRAFITTA

ENEL Power Plant Collection

1Pf - n. 833	8Pf - n. 539	15Pf - n. 826
2Pf - n. 825	9Pf - n. 540	16Pf - n. 501
3Pf - n. 835	10Pf - n. 505	17Pf - n. 819
4Pf - n. 821	11Pf - n. 515	18Pf - n. 502
5Pf - n. 541	12Pf - n. 827	19Pf - n. 790
6Pf - n. 542	13Pf - n. 503	20Pf - n. 849
7Pf - n. 543	14Pf - n. 504	

PIETRAFITTA

Boldrini Collection

21Pf - n. 525	35Pf - n. 527	49Pf - n. 518
22Pf - n. 832	36Pf - n. 854	50Pf - n. 519
23Pf - n. 514	37Pf - n. 533	51Pf - n. 521
24Pf - n. 524	38Pf - n. 534	52Pf - n. 520
25Pf - n. 750	39Pf - n. 839	53Pf - n. 522
26Pf - n. 528	40Pf - n. 512	54Pf - n. 523
27Pf - n. 529	41Pf - n. 508	55Pf - n. 530
28Pf - n. 837	42Pf - n. 840	56Pf - n. 535
29Pf - n. 536	43Pf - n. 516	57Pf - n. 848
30Pf - n. 537	44Pf - n. 544	58Pf - n. 510
31Pf - n. 838	45Pf - n. 545	59Pf - n. 511
32Pf - n. 531	46Pf - n. 517	60Pf - n. 513
33Pf - n. 532	47Pf - n. 515	61Pf - n. 509
34Pf - n. 526	48Pf - n. 507	

PIRRO

Museum of Geology and Paleontology of Florence

1Pr - IGF 2893 v	11Pr - IGF 2906 v
2Pr - IGF 2894 v	12Pr - IGF 2907 v
3Pr - IGF 2895 v	13Pr - IGF 2909 v
4Pr - IGF 2896 v	14Pr - IGF 2910 v
5Pr - IGF 2897 v	15Pr - IGF 2919 v
6Pr - IGF 2898 v	16Pr - IGF 2911 v
7Pr - IGF 2899 v	17Pr - IGF 2913 v
8Pr - IGF 2900 v	18Pr - IGF 2915 v
9Pr - IGF 2901 v	19Pr - IGF 2916 v
10Pr - IGF 2905 v	

VENOSA - LORETO

Museo Pigorini, Roma

1Ve - n. 250025
2Ve - n. 250039

WESTERHOVEN

Rijksmuseum van Geologie en Mineralogie, Leiden

1Wh - RGM 14194	8Wh - ST 14193
2Wh - RGM 18773	9Wh - RGM 18772
3Wh - RGM 18774	10Wh - RGM 18790
4Wh - RGM 18791	11Wh - RGM 18793
5Wh - RGM 14197	12Wh - RGM 14191
6Wh - RGM 14188	13Wh - RGM 18799
7Wh - RGM 14189	14Wh - RGM 14187

WISSEL

Dick Mol Collection

1Ws 176

region is preserved in both hemimandibles. Both tooththrows are complete. All teeth, including M/3, are worn.

Axis n° 822 - the bone is crushed and part of its right side is missing.

Cervical vertebra n° 823 - well preserved.

Left humerus n° 825 - the proximal half of the bone is crushed. The only rather well preserved part is the distal epiphysis, which bears an almost complete trochlea.

Proximal half of the left radius n° 820 - well preserved.

Proximal portion of the left cubitus n° 824 - so badly crushed that it could not even be measured.

The other individuals are considerably more incomplete.

Individual 2 (adult) - It is represented by only two rather well preserved bones, a right astragalus (n° 819) and the proximal fragment of a right second metatarsal (n° 818).

Individual 3 - Its occurrence is indicated by another right astragalus (n° 501), fractured but complete, and a right navicular (n° 502).

Individual 4 - It is represented by an incomplete, fractured and partly crushed femur (n° 827), of which the caput, part of the diaphysis with the third trochanter and the distal epiphysis are preserved, and a tibia (n° 826) lacking the lateral half of its distal epiphysis.

Individual 5 - It is represented by a right femur (n° 505), lacking part of its trochanter major, with the diaphysis particularly crushed and fractured and the distal epiphysis crushed and twisted, the right patella (n° 503), fractured but complete, a fragment of the distal part of the right tibia (n° 504), in which no sealing with the fibula seems to have developed, a fragment of the first phalanx of the third toe of the right pes (n° 828), two first phalanges of the lateral toes of the right pes (n° 829 and 830) and a second phalanx of a lateral toe of the right pes (n° 831).

The following remains may belong to one of these five individuals, though there was no way to prove it.

Skull n° 518 - the specimen is strongly crushed, the nasal bones are missing. The right tooththrow consists of P4/ - M3/, the left of the three molars. The neurocranial part of the skull is flattened and three cervical vertebrae are crushed in it.

A segment of vertebral column n° 519 - this specimen, which is still embedded in part of the plaster case with which it was recovered, consists of the last nine thoracic and first three lumbar vertebrae. The transverse processes of the thoracic vertebrae are complete, whereas those of the lumbar vertebrae are all fractured. The spinal processes are all rather well preserved.

Two femora, one right (n° 515) and one left (n° 514) - the former, which was fractured in several parts, was completely restored. The left femur, though partly fractured as well, is somewhat better preserved.

A left IV Metatarsal (n° 510 bis) - complete but very damaged, faulted all along its length.

A fragmentary right first cuneiform (n° 790).

Two first phalanges of lateral toes (n° 774 and 788).

A fragmentary second phalanx of a third toe (n° 789).

An almost complete third phalanx of lateral toe (n° 772).

A fragment of third phalanx (n° 791).

The rhinoceros material stored in the ENEL power plant seems to be mostly from adult individuals, though the tibia (n° 504) in which there is no trace of sealing with the fibula could instead be from a sub-adult.

The rhinoceros material of the Boldrini Collection

These specimens were all found in the part of the Pietrafitta mine that was exploited first.

The most important specimen is an almost complete skeleton of an adult rhinoceros, represented by the skull, several vertebrae and the four limbs.

Unfortunately when the limb bones were mounted, some were glued together, making both detailed observations from all points of view and measurements impossible.

The skull, though crushed, has both mandibles (n° 585). Its neural portion is strongly flattened; the foramen magnum is twisted about 90° to the left. The tooththrows are complete and rather well preserved, but the left ones can be observed only buccally and the right ones only lingually. The degree of wear clearly indicates that the animal was rather aged. These are the only mandibles from Pietrafitta to have both ascending rami preserved. The specimen is still embedded in half of the plaster case used for its recovery.

The vertebrae are very fragmentary; in most cases they are represented only by the bodies.

Only the right scapula (n° 833) is present. Most of its supraspinous fossa is not preserved. The right humerus is fractured, while the proximal epiphysis of the left one is damaged; both have lost the proximal portion of the diaphysis. Both radii are complete, but the left one is fractured at the middle of its diaphysis. Only the epiphyses of the right cubitus are preserved; the left one, though fractured, lacks a small part of its diaphysis. Of the carpal bones, which are mostly well preserved, only the left pisiform and both trapeziums are missing. All the metacarpals are present and rather well preserved; in the left manus there is even a rudimentary fifth metacarpal. The digits of both hands are complete.

The caudal portion of right os coxae (n° 749), represented only by the ischium, pubis and acetabulum, is all that remains of the pelvis. The acetabulum is badly fractured. Both femurs are complete, but strongly fractured and faulted. The patellae are missing. The right tibia is fractured and deformed at the level of the diaphysis, while the left one is fractured in its proximal epiphysis and in the proximal portion of its diaphysis. Both fibulae are missing. The tarsal bones, of which only the left first cuneiform is missing, are rather well preserved. The metatarsals of both feet are present, but the second and fourth of each pes are fractured at mid diaphysis. The toes of both feet are complete.

The remains of at least other six individuals, two

of which are calves or subadults, also make part of Mr. Boldrini's Collection.

The following specimens are present:

two hemimandibles, one right (n° 583) and one left (n° 584), presumably from the same individual. The right one lacks P/2. The symphysis region, the ascending ramus and the angular region are lacking in both specimens. Several fractures, mostly longitudinal, are present; both hemimandibles are crushed latero-medially. The outer faces of the horizontal rami are concave, the inner faces convex.

A left upper toothrow (n° 582), likely from the same individual as the hemimandibles described above, as far as may be inferred from the degree of wear and the mode of fossilization. P3/ and M3/ are fractured, whereas the other teeth are well preserved. All the teeth are rather worn.

A left upper premolar-row (n° 572, 573, 574), deeply worn but well preserved.

The postcranials listed below can be divided into two groups, on the basis of their size, proportions, fossilization and degree of ossification, one including 528, 529, 536, 531, 541, 542, 539, 538, 534, 535, and the other 537, 532, 543, and 540. The two groups give the impression to having belonged to two distinct individuals, the former a smaller-sized adult, and the latter a larger-sized sub-adult, in that

the bones of the second group, though larger than those of the first group, are ossified to a lesser degree.

A fragment of the distal portion of a right radius (n° 524) and a left radius and cubitus (n° 790), presumably from the same individual. Most of the olecranon is lacking in the cubitus. The articular surfaces are well preserved in all these specimens.

Two complete scaphoids, one right (n° 528) and one left (n° 529), with well modelled articular surfaces outlined by distinct borders, probably from the same individual.

Two left semilunars, one smaller and complete (n° 536) and one larger and more fragmentary (n° 537).

Two complete left pyramidals (n° 531 and 532).

Three complete trapezoids, one right (n° 541) and two left (n° 542 and 543).

Three complete magnums, two left (n° 540 and 539) and one right (n° 538). The right one is so fragmentary as to be unmeasurable.

Two complete uncinates, one right (n° 534) and one left (n° 533), with very well modelled articular surfaces, bounded by sharply outlined borders.

Two right patellae, one complete (n° 544), with well modelled articular surface, the other badly fractured (n° 545).

TABLE 2 - Measurements of teeth from Pietrafitta

Upper dentitions				lower dentitions				
No		a	b	18		c	d	
P2	BBL	30.4	31.0	—	P2	BBL	28.7	31.1
	BLL	23	23.6	—		BLL	27.1	26.8
	MBB	37.6	36.1	—		MBB	16.9	15.8
	DBB	39.5	39.7	—		DBB	18.4	18.9
P3	BBL	37.0	35.6	—	P3	BBL	34.7	38.3
	BLL	—	32.4	—		BLL	34.3	32.9
	MBB	—	50.3	—		MBB	22.5	23.1
	DBB	—	45.9	—		DBB	25.3	25.9
P4	BBL	40.2	—	41.5	P4	BBL	36.8	36
	BLL	29.8	35.7	—		BLL	35.9	35.9
	MBB	57.0	56.8	—		MBB	26.0	26.3
	DBB	50.4	50.8	—		DBB	27.4	27.3
M1	BBL	40.9	—	49	M1	BBL	40.4	41.2
	BLL	—	—	38+		BLL	39.0	40.7
	MBB	56.0	—	62.4		MBB	28.3	29.1
	DBB	51.8	—	58.2		DBB	28.9	29.1
M2	BBL	45.8	—	48	M2	BBL	41.4	43.6
	BLL	40.4	—	42.6		BLL	41.7	42.5
	MBB	58.9	—	62.6		MBB	29.0	29.1
	DBB	52.1	—	55.2		DBB	27.8	27
M3	BBL	—	—	53.3	M3	BBL	42.7	41
	BLL	—	—	47.2		BLL	45.3	45.1
	MBB	—	—	52.9		MBB	27.72	7.9
					DBB	25.4	26.9	

Dimensions: BBL = basal buccal length, BLL = basal lingual length, MBB = basal mesial width, DBB = basal distal width (see Fortelius *et al.*, on this volume, for precise description).

A right tibia (n° 517), fractured longitudinally and slightly crushed dorso-plantarly.

A fragmentary left first cuneiform (n° 535).

There is a right pes of a rhinoceros in the collection that is represented by the astragalus (n° 507), calcaneum (n° 519), navicular (n° 521), cuboid (n° 520), third cuneiform (n° 522), and second (n° 510) and third metatarsals (n° 509). The calcaneum has lost its sustentaculum tali.

The Boldrini Collection also contains two pisi-forms, one right (n° 526) and one left (n° 527), a proximal fragment of a left metacarpal (n° 508), a proximal fragment of a left fourth metacarpal (n° 506), a right calcaneum (n° 518) with its sustentaculum tali partially missing, a right third cuneiform (n° 523), a proximal fragment of a left second metatarsal (uncatalogued), one first phalanx of a third toe (n° 546), four first phalanges of lateral toes (n° 550, 551, 552, 553, 556), three second phalanges of third toes (n° 547, 548, 549), three second phalanges of lateral toes (n° 554, 555, 572) six third phalanges of lateral toes (n° 564, 565, 566, 568, 570, 571) and two fragments of third phalanges (n° 567, 569).

DESCRIPTION

Skull, mandible and dental material

Not enough is preserved of the skull to allow measurements or even a meaningful morphological comparison. The mandibles are fortunately better preserved, and show that the horizontal ramus tapers rostrally, in a way more reminiscent of *S. etruscus* than *S. hundsheimensis*.

The teeth were compared with those of *etruscus* and *S. hundsheimensis*, by means of ratio diagrams and analysis of variance, as described in Fortelius *et al.* (present volume). Measurements are given in Table 2.

The dental remains from Pietrafitta have a rather nondescript *S. etruscus*-like appearance (Fortelius *et al.*, this volume). Both upper and lower dentitions have proportions more similar to *S. etruscus* than to *S. hundsheimensis* (figs. 1-2). An analysis of variance revealed no significant differences from either *S. etruscus* or *S. hundsheimensis*, however. The dental remains are simply too few for statistical analysis to be of much use. The main distinguishing character of the Pietrafitta teeth is the relatively very large M/1, which may well be a small-sample effect of no consequence (N=2).

TABLE 3 - Measurements of the scapulae

Characters	AL	DB	CS	LG	BG
1Pf	432	110	87	70	(57)
1Pr	—	108	—	73	—
2Pr	—	104	87	67	51

- AL - anterior (cranial) length
- DB - distal breadth
- CS - breadth of the collum scapulae
- LG - length of the glenoid cavity
- BG - breadth of the glenoid cavity

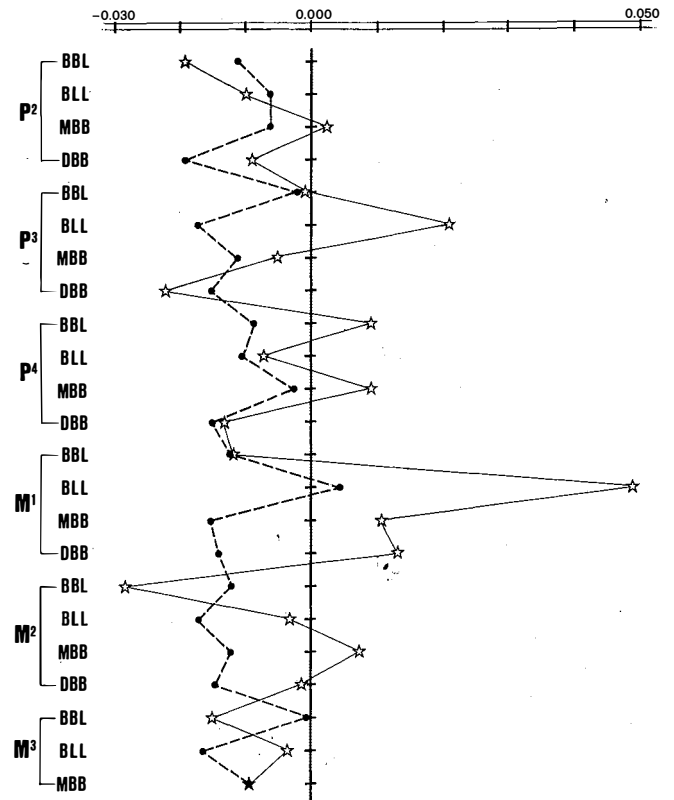


Fig. 1. Ratio diagram comparing the upper teeth from Pietrafitta with the dentitions of *S. etruscus* (Falconer) (standard) and *S. hundsheimensis* (Toula). Data and abbreviations as in Table 2. Comparative data from Fortelius *et al.* (in press).

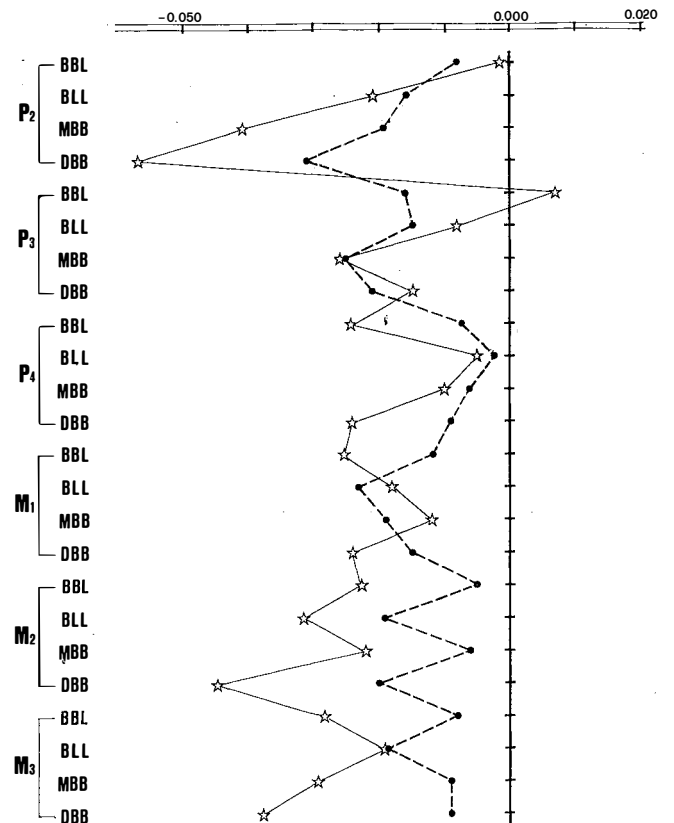


Fig. 2. Ratio diagram comparing the lower teeth from Pietrafitta with the dentitions of *S. etruscus* (Falconer) (standard) and *S. hundsheimensis* (Toula). Data and abbreviations as in Table 1. Comparative data from Fortelius *et al.* (in press).

TABLE 4 - Measurements of the humeri

Charac- ters	L	LL	PL	BP	DP1	DP2	DP min	DAP CH	DT CH	Bd	BS	DS	BD	BT	Ht ant	Ht post	Dt	Lml	Bo
Speci- mens																			
2Pf	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41.9	40.3	44	—	—
3Pf	—	—	—	—	—	—	—	89	82.2	—	53.8	52	124.5	83	39	32	40	55.6	41
3Pr	—	—	(345)	—	(165)	—	—	(85)	82	116	54	51.5	118	81.5	43.2	41	44.5	81	33.6
4Pr	—	—	(367)	—	(160.2)	—	—	82.7	83	—	(54)	(55.5)	—	—	—	—	—	82	—
1Wh	363	337	313	—	150	—	123	80.5	—	—	56.5	49	116	77	36	34	41	73	48.2
2Wh	362	343	318.7	130	—	126	(123)	80	82.5	—	57	47.5	110	81	37	33.5	41	73	48.5

L	- greatest length	Bd	- greatest breadth at the deltoid tuberosity
LL	- lateral length	BS	- smallest breadth of the shaft
PL	- physiologic length	DS	- smallest depth of the depth
BP	- proximal breadth	BD	- distal breadth
DP1	- proximal depth, from the caput humeri to the greater tubercle	BT	- breadth of the trochlea
DP2	- proximal depth, from the caput humeri to the lesser tubercle	Ht ant	- anterior height of the trochlear trough
DPmin	- smallest proximal depth in the intertuberal fossa	Ht post	- posterior height of the trochlear trough
DAP CH	- antero-posterior diameter of the caput humeri	Dt	- depth of the trochlear trough
DT CH	- transverse diameter of the caput humeri	Lml	- length of the medial lip of the trochlea
		Bo	- breadth of the olecranic fossa

TABLE 5 - Measurements of the radii/ulnae

Characters	Lr	PL	BPr	BPar	DPr	DPar	DPsi	BDr	BDar	DDr	DDar	BSr	DSr	Lu	Hsiu	BPau	BDu	BDau	DDau	BDaru
Specimens																				
23Pf	(342)	—	—	—	—	—	—	—	—	—	—	—	—	420	—	—	—	—	—	—
24Pf	—	—	—	—	—	—	—	92	76	61	45	—	—	—	—	—	—	—	—	—
25Pf	(359)	340	—	74.5	—	51	—	—	71	68	51	(45)	39.5	—	58	75	57	48	32	99
26Pf	—	—	85.2	83	54	—	41.5	—	—	—	—	49.2	34	—	—	—	—	—	—	—
5Pr	—	—	86	82.2	57	38.7	50.2	—	—	—	—	48	35	—	—	—	—	—	—	—
6Pr	—	—	—	—	—	—	—	78.2	65	53.9	37	—	32	—	—	—	—	—	—	—
7Pr	—	—	—	—	—	—	—	—	—	—	—	47.8	34.2	—	—	—	—	—	—	—
8Pr	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	58	32.2	55.8	—
9Pr	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	62.7	31.2	58	—
3Wh	(336.5)	(318)	82	81.5	52.7	37	50	81.3	66.5	57	49	44	32	—	—	—	—	—	—	—

Lr	- greatest length of the radius	DDar	- depth of the distal articular surface of the radius
PL	- physiologic length of the radius	BSr	- smallest breadth of the shaft of the radius
BPr	- proximal breadth of the radius	DSr	- smallest depth of the shaft of the radius
BPar	- breadth of the proximal articular surface	Lu	- greatest length of the ulna
DPr	- proximal depth of the radius	Hsiu	- height of the sygmoidal incisure of the ulna
DPar	- depth of the proximal articular surface	BPau	- breadth of the proximal articular surface of the ulna
DPsi	- depth of the proximal articular surface along the sygmoidal crest	BDu	- distal breadth of the ulna
BDr	- distal breadth of the radius	BDau	- breadth of the distal articular surface of the ulna
BDar	- breadth of the distal articular surface of the radius	DDau	- depth of the distal articular surface of the ulna
DDr	- distal depth of the radius	BDaru	- breadth of the distal articular surfaces of radius + ulna

TABLE 6 - Measurements of the scaphoide

Characters	L	l	H	L art prox	l art prox	L art dist	l art dist
Specimens							
26Pf	74.8	50	57.2	38	47.5	55	28.7
27Pf	73.5	48.8	56.8	39.5	48.4	58.5	32
28Pf	72	47	57.2	—	—	—	—
10Pr	—	52	62	36.3	47	—	27.2

L	- greatest length	l art prox	- breadth of the proximal articular surface
l	- greatest breadth	L art dist	- length of the distal articular surface
H	- height	l art dist	- breadth of the distal articular surface
L art prox	- length of the proximal articular surface		

TABLE 7 - Measurements of the semilunars

Characters	L	l	H	H ant
Specimens				
29Pf	60	41	42.7	44.2
30Pf	—	46.7	42	4.5
31Pf	57.2	48	49.2	—

L - length
l - greatest breadth
H - height
H ant - anterior height

TABLE 8 - Measurements of the pyramidals

Characters	L	l	H max	H phys	H face ant
Specimens					
32Pf	31.2	48.5	43.5	—	—
33Pf	37.2	53	51	33	44.5

L - greatest length
l - greatest breadth
H max - greatest height
H phys - physiologic height
H face ant - height of the anterior face

TABLE 9 - Measurements of the pisiforms

Characters	L	l	H
Specimens			
34Pf	56	41	24.2
35Pf	57	41.2	25
36Pf	57	36.5	28

L - greatest length
l - greatest breadth
H - height

Postcranial material (Tables 3-27)

The postcranial material from Pietrafitta actually shows much stronger affinities, in morphological characters and proportions, but not in dimensions, with *S. hundsheimensis* (Toula) than with *S. etruscus* Falconer. Differences from *S. etruscus* and similarities with *S. hundsheimensis* are especially clear in some basipodial bones and the femur, but most of all in the metapodials. The semilunars appear somewhat more compressed latero-medially and more stretched antero-posteriorly than they do in *S. etruscus*. The lateral portion of the distal articulation for the uncinates is somewhat more expanded than it is in Falconer's species.

Also, the magnums are more squeezed latero-medially, more stretched antero-posteriorly and

TABLE 10 - Measurements of the trapezoids

Characters	L	l	H
Specimens			
5Pf	37.5	26.1	32
6Pf	38.1	25.5	30
7Pf	35.8	25.2	33.4

L - greatest length
l - greatest breadth
H - height

TABLE 11 - Measurements of the magnums

Characters	L	L art dist	l	H	H art
Specimens					
8Pf	—	—	43.5	—	53.5
9Pf	—	—	38	—	(53)
11Pr	—	42.9	47	—	63.5
4Wh	80	41	35	56	53.2
5Wh	89	46.2	38	—	58.5

L - greatest length
L art dist - greatest length
l - greatest breadth
H - height
H art - physiologic height

TABLE 12 - Measurements of the uncinates

Characters	L abs	L anat	l	H
Specimens				
37Pf	79.2	58	58	47.5
38Pf	79	(51)	59.2	48.4
12Pr	—	—	58.5	47

L abs - absolute length
L anat - anatomical length
l - greatest breadth
H - height

higher proximo-ventrally than are those of *S. etruscus*. Placed next to the latter, the magnums from Pietrafitta look much more slender.

The femurs from Pietrafitta, in proximal view, have much broader capita, shorter necks and more powerful trochanters major than those of *S. etruscus*. Also, their diaphyses appear somewhat stronger than those of Falconer's species.

In the calcaneums from Pietrafitta the apex of the tuber extends somewhat plantarly and the sustentaculum tali is short and strong; in the Upper Valdarno and Olivola *S. etruscus*, the apex of the tuber is more confined and the sustentaculum tali is decidedly more slender.

The cuboids from Pietrafitta, compared with those of *S. etruscus*, appear more compressed proximo-ventrally in dorsal view and more stretched dorso-plantarly in proximal view.

TABLE 13 - Measurements of the second metacarpals

Characters	L	BP	DP	BPa	DPa	BS	DS	BD	DD	BDa
Specimens										
39Pf	159.5	41	34.9	40	—	31	17.7	40.5	34.5	35
6Wh	159	35	42.2	23.4	36	30.5	19.2	40	34.7	32

TABLE 14 - Measurements of the third metacarpals

Characters	L	BP	DP	BS	DS	BD	DD	BDa
Specimens								
40Pf	182	49.5	43.2	43.6	16.6	51.8	40.3	—
41Pf	196	51	46.2	45.3	19	55	42	47.7
13Pr	—	52	45.7	49	20.4	—	—	—
14Pr	—	—	—	46.3	20.8	—	—	—

TABLE 15 - Measurements of the fourth metacarpals

Characters	L	BP	DP	BS	DS	BD	DD	BDa
Specimens								
42Pf	150	38	35.2	29	16	37	35.3	33
15Pr	—	—	—	32.6	19	36.1	37.8	34
7Wh	147	38.8	31.7	27.2	15.5	36	33.6	31.5

L	- greatest length	BS	- smallest breadth of the shaft
BP	- proximal breadth	DS	- smallest depth of the shaft
DP	- proximal depth	BD	- distal breadth
BPa	- breadth of the proximal articular surface	DD	- distal depth
DPa	- depth of the proximal articular surface	BDa	- breadth of the distal articular surface

TABLE 16 - Measurements of the femurs

Characters	L	PL	BP	DC	LC	BSoT	DSoT	BT	HT	HT max	BS	DS	BD	LLl	Lml	DDl	DDm	Lt	Btr	Bcon
Specimens																				
10Pf	465	467	—	—	—	86	—	141	69.5	—	(87)	—	116	—	—	112	—	—	—	—
11Pf	440	440	(161)	67.5	75.5	73.5	—	—	56.5	—	67	41.5	(128)	—	—	—	138.5	61	65	110
23Pf	439	439	(163)	71	74	70.5	—	—	56.5	—	65	45	123	—	—	—	(135)	60	69.7	—
43Pf	(436)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12Pf	—	—	—	—	—	—	—	—	56.2	69	—	—	121.5	76	89	118	122	62	—	—
16Pr	—	—	—	—	—	—	—	—	—	—	49	45	114.7	75	93	111.2	132	53.5	76	93.6
8Wh	—	—	152	72.5	74.3	(86)	(40)	—	—	—	—	—	—	—	—	—	—	—	—	—

L	- greatest length	DS	- smallest depth of the shaft
PL	- physiologic length	BD	- distal breadth
BP	- proximal breadth	Ll	- length of the lateral lip of the trochlea
DC	- depth of the caput femoris	Lml	- length of the medial lip of the trochlea
LC	- length of the caput femoris	DDl	- greatest depth of the lateral portion of the distal epiphysis
BSoT	- breadth of the shaft over the third trochanter	DDm	- greatest depth of the medial portion of the distal epiphysis
DSoT	- depth of the shaft over the third trochanter	Lt	- length of the trochlear trough
BT	- breadth of the shaft at the third trochanter	Btr	- breadth of the trochlea
HT	- smallest height of the third trochanter	Bcon	- breadth across the condyles
HT max	- depth of the shaft at the third trochanter		
BS	- smallest breadth of the shaft		

TABLE 17 - Measurements of the patellae

Characters	L	L art face	DT	DAP
Specimens				
44Pf	91	63	77.8	—
45Pf	—	(64)	85	62
13Pf	100	65	> 85	44

L - greatest length
 L art face - greatest length of the articular surface
 DT - transversal diameter
 DAP - antero-posterior diameter

Pietrafitta specimens than it is in those of *S. etruscus* and *S. hundsheimensis*.

In the third metacarpals from Pietrafitta the edge that separates the proximal articular surface from the facet that articulates with the uncinata is more salient and somewhat sharper than it is in the third metacarpals of *S. etruscus*. The distal articular surface is broader.

By comparison with *S. etruscus*, the proximal articular facet of the fourth metacarpal, in the form from Pietrafitta, is more compressed dorsally and more elongated medially and the distal articulation is wider. The diaphysis is more curved than it is in *S. etruscus* and much more so than it is in *S. hundsheimensis*; however these differences are probably allometric, because the curvature seems to increase with size.

TABLE 18 - Measurements of the tibiae

Characters	Lt	PL	BP	DP	BS	DS	BD	DD	BDA	DDa
Specimens										
46Pf	363	323	(111)	(110)	(56)	42	105	—	88	—
47Pf	(344)	(310)	(103)	(110)	50.3	35.3	87.8	57	67	36
14Pf	—	—	—	—	—	—	(91)	—	69	(48)
15Pf	—	—	111	116	55.5	48	—	—	—	—
17Pr	—	—	100.6	103.2	—	—	—	—	—	—
9Wh	327	293	101	101	53.5	40.9	84	62	59.5	48

Lt - greatest length of the tibia
 PL - physiologic length of the tibia
 BP - proximal breadth of the tibia
 DP - proximal depth of the tibia
 BS - smallest breadth of the tibia
 DS - smallest depth of the trochlea
 BD - distal breadth of the tibia
 DD - distal depth of the tibia
 BDA - breadth of the distal articular surface of the tibia
 DDa - depth of the distal articular surface of the tibia
 Lf - greatest length of the fibula

TABLE 19 - Measurements of the astragali

Characters	LL	ML	B	BD	DD	BDA	Lmt	Dmt	Llt	Htt	DL
Specimens											
16Pf	73	72	80	72	45	70	60	53	—	—	54
48Pf	68	70	77	69	43	68	63	51	—	—	54
17Pf	71	68.8	77	62.3	33.4	58.5	60.1	49	60.9	44	59.2
10Wh	65.5	60	70	63	45	61	52	43.5	59	38.4	50.7

LL - lateral length
 ML - medial length
 B - greatest breadth
 BD - distal breadth
 DD - distal depth
 BDA - breadth of the distal articular surface
 Lmt - length of the medial lip of the trochlea
 Dmt - depth of the medial lip of the trochlea
 Llt - length of the lateral lip of the trochlea
 Htt - height of the trochlear trough
 DL - distance of the trochlear lips

In the second metacarpals from Pietrafitta the proximal articular surface is broader than it is in those of *S. etruscus*. In lateral and medial view, the diaphysis appears flatter than in the second metacarpals of *S. etruscus*. The distal articular surface is wider and somewhat more asymmetrical in the

In the second metatarsals the only significant difference that is worth mentioning is that the distal articulations in the specimens from Pietrafitta are asymmetrical as in *S. hundsheimensis* and more than in *S. etruscus*.

In the third metatarsals from Pietrafitta, on the

TABLE 20 - Measurements of the calcanei

Characters	H	DAP somm	DT somm	DAP beak	DT sust	DT min post
Specimens						
49Pf	118	66.5	44	60.8	—	37
50Pf	112	67	48	61	—	36
11Wh	107.5	62.5	44	59	67	37.7
12Wh	105	62.7	41	56.2	69.5	37.5
H	- height					
DAP somm	- antero-posterior diameter of the tuberosity summit					
DT somm	- transverse diameter of the tuberosity summit					
DAP beak	- antero-posterior diameter at the beak					
DT sust	- transverse diameter at the sustentaculum tali					
DT min post	- smallest plantar transverse diameter					

TABLE 21 - Measurements of the naviculars

Characters	L	l	H	H min phys
Specimens				
51Pf	54	43.5	27.6	19.7
18Pf	57.5	46	29.2	19
L	- greatest length			
l	- greatest breadth			
H	- height			
H min phys	- smallest physiologic height			

TABLE 22 - Measurements of the cuboids

Characters	L	l	H	DAP art prox	DT art prox	H face ant
Specimens						
52Pf	64.5	43.9	50.8	40.6	44.2	39.6
L	- greatest length					
l	- greatest breadth					
H	- height					
DAP art prox	- antero-posterior diameter of the proximal articular surface					
DT art prox	- transverse diameter of the proximal articular surface					
H face ant	- height of the dorsal face of the bone					

TABLE 23 - Measurements of the third cuneiforms

Characters	L	l	H	H min phys
Specimens				
53Pf	43.2	38.2	25	19
54Pf	44.7	37.2	23.9	19.2
L	- greatest length			
l	- greatest breadth			
H	- height			
H min phys	- smallest physiologic height			

TABLE 24 - Measurements of the first cuneiforms

Characters	L	DT	DAP	DAP art	DT art
Specimens					
55Pf	60.5	29	20	15.7	16.2
56Pf	—	—	—	16	18
19Pf	(69.5)	(30)	>19.2	16	18
L	- greatest length				
DT	- transverse diameter				
DAP	- antero-posterior diameter				
DT art	- transverse diameter of the proximal articulation				
DAP art	- antero-posterior diameter of the proximal articulation				

third metatarsals of *S. etruscus* the diaphysis is always parallel-sided, maintaining a constant breadth all along its length. This sort of enlargement in the diaphysis can be observed in young individuals of *S. etruscus*. Thus, the rhinoceroses from Pietrafitta appear to be pedomorphic in this character.

The cross sections of the diaphyses of the fourth metatarsals from Pietrafitta are circular, as are those of *S. hundsheimensis*, while they are elliptical in *S. etruscus*. The proximal articular surface is sub-circular in the Pietrafitta specimens and sub-triangular in *S. etruscus*. The lateral condyles of the distal articulations of the Pietrafitta rhinoceroses are stronger and less concave than those of *S. etruscus*.

DISCUSSION

Apart from the relatively larger dimensions of M/1, a feature characteristic of *S. hundsheimensis*, the proportions and size of the dentitions of the Pietrafitta rhinoceros are more similar to *S. etruscus*.

On the other hand, the postcranial skeleton of the small-sized Pietrafitta rhinoceros shows many similarities with that of *S. hundsheimensis*. The Pietrafitta rhinoceroses differ in characters affected by size, such as, for instance, the degree of curvature of the diaphysis of the fourth metacarpal quoted above.

Among the other small-sized rhinoceroses with *S. etruscus* and *S. hundsheimensis* characters there are those from Pirro (Gargano, Southern Italy) and Westerhoven (Brabant, The Netherlands) described in appendix, which are chronologically close to the Pietrafitta rhinoceros, a form from Colle Curti (Colfiorito Basin, Macerata, Central Italy) (Borselli *et al.*, 1988; Ficcarelli *et al.*, 1990; Ficcarelli and Mazza, 1990) and another rhinoceros from Loreto (Venosa, Southern Italy) (Bonifay, 1977; Caloi & Palombo, 1980), represented by a third (Loreto 247) and a fourth (Loreto 492) metatarsal (see tables 26, 27), which are dimensionally and morphologically comparable with the ones from Pietrafitta.

Another specimen, a left third metatarsal found in the gravel pit of the Wissel power plant (Kalkar,

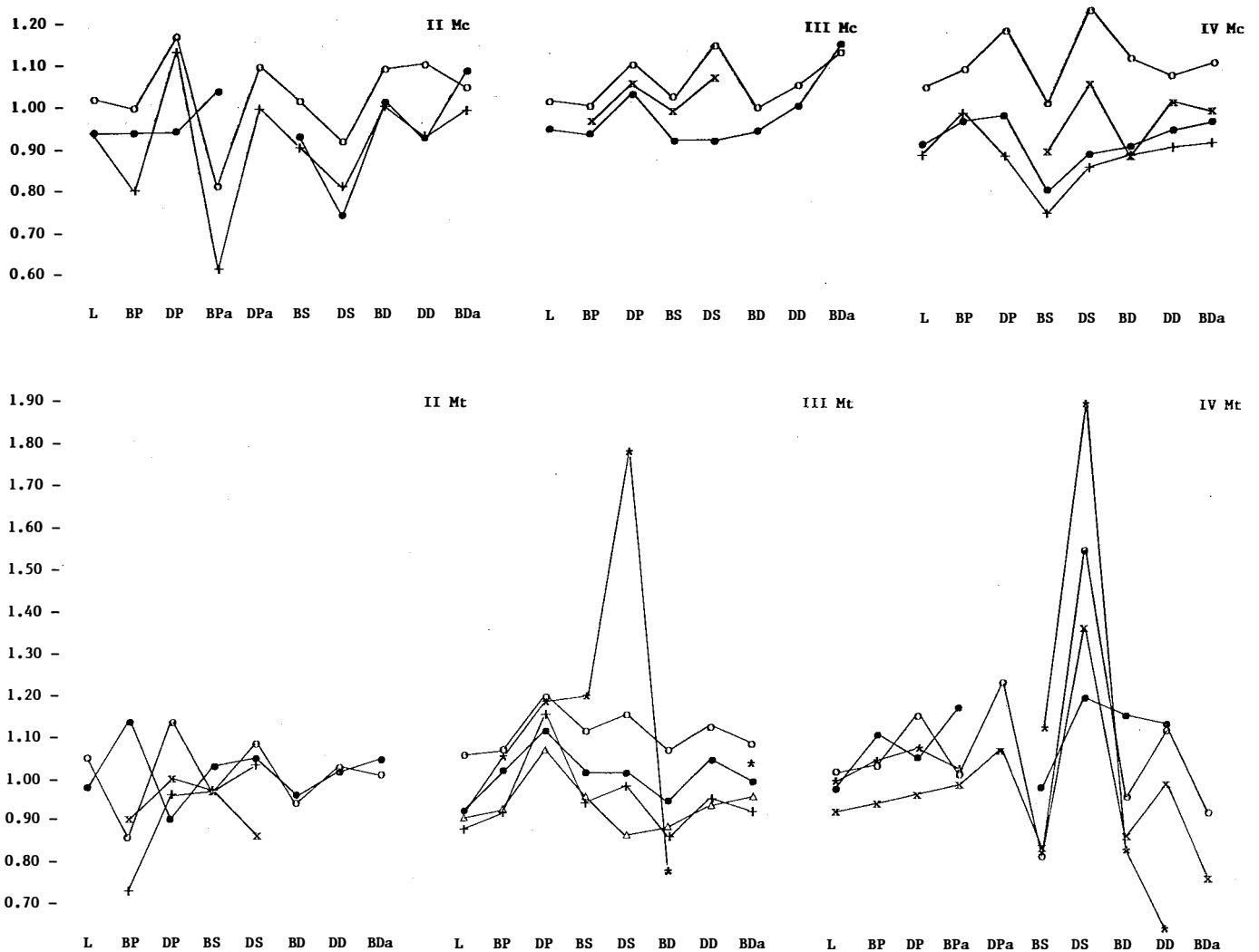


Fig. 3. Ratio diagram comparing the metapodials of *S. etruscus* (Falconer) (standard) and *S. hundsheimensis* (Toula) with those from Pietrafitta, Pirro, Venosa, Wissel and Westerhoven.

Germany), which is now specimen 176 in Dick Mol's Collection at 's-Heerenberg, The Netherlands, is quite small as well and is probably a further example of these small-sized rhinoceroses. Unfortunately the stratigraphic level that yielded the material from Wissel, which has produced other fossil remains in the past, is unknown. This specimen should therefore not be overvaluated.

The common features shared by the forms under discussion here are: 1) their close relationship with *S. etruscus* and *S. hundsheimensis* group of rhinoceroses; 2) their reduced body size, which is even smaller than that of *S. etruscus*; 3) their geological age. All these rhinoceroses belong to faunal assemblages characteristic of the younger part of the Late Villafranchian (*sensu* Azzaroli, 1977; Azzaroli *et al.*, 1988) (see appendix). The postcranial skeletons of these rhinoceroses are highly variable. As mentioned above, the skeletons of the rhinoceroses from Pietrafitta resemble that of *S. hundsheimensis* in morphological characters and proportions, but not in size, for they are smaller than Toula's species.

The ratio diagrams of the postcranial bones of these small rhinoceroses evidence a closer agreement with *S. hundsheimensis* than with *S. etruscus*, which was used as a reference. Although the small numbers of the samples certainly affect the heights of the peaks of the diagrams, the best accordance with *S. hundsheimensis* was obtained in the third metapodials, while lateral ones, especially second and fourth metatarsal bones, show some difference. Although morphologically similar to the limb bones of *S. etruscus*, the scanty specimens from Pirro seem to be closer to the postcranials of *S. hundsheimensis* in terms of proportions, as also results from the ratio diagrams.

The morphological affinities of the badly preserved material from Westerhoven cannot be readily established with respect to the one or the other species, but the proportions of the specimens are rather close to those of the skeletal elements of *S. hundsheimensis*, as is apparent in the ratio-diagrams. On the whole, the impression is that these rhinoceroses probably were members of populations in which modifications in the postcranial ske

TABLE 25 - Measurements of the second metatarsals

Characters	L	BP	DP	BS	DS	BD	DD	BDA
Specimens								
57Pf	150.5	28	36.5	25.5	24	36.8	37.2	34.2
58Pf	—	38	29	—	—	—	—	—
59Pf	—	41	31.8	—	—	—	—	—
18Pr	—	28	36	24	20	—	—	—
13Wh	—	23	34.5	24	23.5	—	—	—

TABLE 26 - Measurements of the third metatarsals

Characters	L	BP	DP	BS	DS	BD	DD	BDA
Specimens								
60Pf	171.5	52	39	44.8	21.3	50.2	38	43
61Pf	162	46	40	37	21	48	38.8	39
1Ve	165	51	42	48	37	41	—	43
14Wh	159.5	44.4	41	38	20.5	44.5	35	38.2
1Ws	167	45	38	38.5	18.2	45.8	34.5	39.5

TABLE 27 - Measurements of the fourth metatarsals

Characters	L	BP	DP	BPa	DPa	BS	DS	BD	DD	BDA
Specimens										
58Pf	(150)	(43)	—	(41)	—	—	—	45	40	—
20Pf	153	43.3	35.8	40	—	28	22.4	35.5	40	—
19Pr	143	37	33.2	33.7	31	24	25.6	30	35	27
2Ve	154	41	37	35	—	32	35	29	23	—

L - greatest length
 BP - proximal breadth
 DP - proximal depth
 BPa - breadth of the proximal articular surface
 DPa - depth of the proximal articular surface

BS - smallest breadth of the shaft
 DS - smallest depth of the shaft
 BD - distal breadth
 DD - distal depth
 BDA - breadth of the distal articular surface

leton were in progress. A somewhat different picture is given by the cheek teeth: on the basis of the numerous dental remains of the rhinoceros from Pietrafitta, the dentition still shows *etruscus*-like characters.

CONCLUSIONS

One can hypothesise that these small rhinoceroses, which are peculiar of the latest Villafranchian or earliest Galerian faunas, represent a population transitional between *S. etruscus* and *S. hundsheimensis*, characterised by high variability in detail between local populations. Alternatively, they can be imagined as new incomers that gave rise to *S. hundsheimensis* through an increase in size, or even a taxon unrelated to either species. Morphological arguments against the derivation of *S. hundsheimensis* from *S. etruscus* were given by Fortelius *et*

al. (this volume). Anyhow, these rhinoceroses are readily identifiable because of their generally small body size, and for this reason they could be rightfully grouped up into a chronologically well defined subspecies.

Because of postcranial similarity and dental uncertainty here, we therefore provisionally refer the Pietrafitta rhinoceros to *Stephanorhinus* cf. *hundsheimensis*.

Appendix: The rhinoceros remains from Pirro, Apricena (Gargano Peninsula), and Westerhoven (Brabant, The Netherlands)

Wealthy collections of fossil mammalian remains were collected in the 1970s and '80s from karst fissure fillings of the Gargano Peninsula, Southern Italy. Excavations, detailed surveys and field studies were conducted in the area by the University of Florence during the first half of the 1980s. The efforts proved particularly rewarding, as

many new finds were added to the record. With increases in knowledge it has been possible to establish a framework of events to which further research can reliably be related (De Giuli and Torre, 1984; De Giuli *et al.*, 1987).

A fossil mammalian assemblage with clear late Villafranchian characters was found in karst fissure infillings in a relatively small area between Apricena and Poggio Imperiale, more precisely at Pirro, in the outskirts of Apricena (De Giuli *et al.*, 1987). *Ursus etruscus*, *Canis arnensis*, *C. falconeri*, *Pachycrocuta brevirostris*, *Homotherium crenatidens*, *Megantereon cf. cultridens*, *Archidiskodon meridionalis* are but a few of the Villafranchian forms that make up this fauna. In addition to these taxons De Giuli *et al.* (1987) report the occurrence of a few elements which presage the faunal turnover of the early Middle Pleistocene, such as *Eobison* sp., *Equus cf. altidens*, and two cervids, one large-sized and one small-sized. On these grounds it is reasonable to suppose that this fauna is late Early Pleistocene in age. The reader is referred to De Giuli *et al.*, 1987, for the complete faunal list and detailed information.

The present note discusses the rhinoceros remains from site P 80 of Pirro. Despite the incompleteness of the record and the fragmentary state of the specimens, the rhinoceros from Pirro shows similarities to both *S. etruscus* and *S. hundsheimensis*.

Material

The remains of three or four individuals, one of which is a subadult and one a calf, are present in the sample. The bones are very fragmentary but fairly well fossilized.

The sizes generally overlap the lower dimensional classes of the Upper Valdarno rhinoceroses.

— Teeth. The cranial material, which is part of the Pieri Collection, was kindly lent by the University of Bari, while the postcranial elements were found during the Florence University excavations in the early '80s and are now preserved in the Museo di Geologia e Paleontologia of Florence.

The only cranial remains found in site P 80 are two maxillary fragments, one right and one left, each bearing only a complete deciduous toothrow, an incomplete, slightly worn right first upper molar, an unerupted left first lower molar and fragments of at least three other unerupted upper teeth. All these cranial parts appear to have belonged to the same calf.

The deciduous teeth are quite worn and bear small cusps at the outlets of the U-shaped valleys between the protocones and the hypocones. These cusps are also present in the deciduous teeth of *S. etruscus*, at least in the rhinoceros from the Upper Valdarno. Traces of a cement-like veneer can be observed on the buccal wall of the ectolophe.

— Scapula. The distal portions of two right scapulae were found in the site P 80. One is from an adult, the other one from a younger individual. The glenoid cavity is elliptical and rather shallow. The supraglenoid tubercle and the coracoid process are strong, but do not protrude far.

— Humerus. The bone is represented by three

specimens: two belong to adult individuals, one is a little more complete than the other; the third is a fragment of the medial lip of a distal trochlea. The more complete of these specimens lacks parts of its proximal epiphysis. Specimens are more stocky than the humeri from the Upper Valdarno; the deltoid tuberosities are shifted to a more proximal position and their trochlear troughs are deeper and slightly more V-shaped. The olecranon fossae are also narrower.

— Radius/ulna. The Pirro sample includes the distal portions of a right radius and of two right ulnae, the proximal half of a left radius, the almost complete left radius of a calf, whose unsealed distal epiphysis is missing, and a diaphysis and an olecranon presumably from the same left ulna.

We have evidence here of at least three individuals, two adults and a calf. These specimens do not differ significantly from the radii/ulnae of *S. etruscus*.

— Carpal bones. The sample includes one fragmental right scaphoid, one incomplete right magnum and one incomplete right uncinat. The scaphoid is more compressed latero-medially and more extended proximo-ventrally than that of *S. etruscus* from the Upper Valdarno. The ventral articular surface, in palmar view, has a wavy dorsal margin; its medial portion is much broader and more extended dorso-ventrally than are those of the Upper Valdarno forms. In ventral view the middle portion of the ventral articular surface is more compressed latero-medially and more extended dorso-palmarly than it is in the Upper Valdarno specimens. The magnum appears just slightly more stretched proximo-ventrally than those from the Upper Valdarno. The uncinat does not differ significantly from the *S. etruscus* uncinates from the Upper Valdarno.

— Metacarpal bones. These bones are represented by two right third metacarpals, presumably of adult individuals, both distally incomplete, and by the distal half of a left fourth metacarpal. These specimens are morphologically similar to the metacarpals of *S. etruscus* from the Upper Valdarno. However, apart from some slight differences, the metacarpals from Pirro resemble those of *S. hundsheimensis* rather closely in their general proportions.

— Femur. The distal half of a left femur and the distal lateral condyle of another left femur were the only proximal rear limb segments found. As compared to the Upper Valdarno specimens, the trochlear trough appears much deeper and broader and has a steeper lateral wall which makes the lateral lip of the trochlea more prominent.

— Tibia. The sample includes the proximal half of a left tibia and the fragments of the proximal articular surfaces of one left and one right tibia. The specimens do not differ significantly from those from the Upper Valdarno.

— Metatarsal bones. These bones are represented only by the proximal half of a right second metatarsal of a rather young individual and by a complete, rather well preserved left fourth metatarsal, presumably of adult individual. The fragmentary second metatarsal resembles those of *S. etruscus*; the only difference is that, in lateral view, the

proximal margins of the two articular surfaces for the third metatarsal and the great cuneiform are not levelled with the proximal articular facet of the small cuneiform, but are shifted somewhat more distally. The fourth metatarsal differs from those of *S. etruscus* by having a diaphysis more circular in cross section.

Other specimens of a small-sized rhinoceros from Westerhoven (Brabant, The Netherlands), which have been assigned to *S. etruscus*, have repeatedly been described and illustrated both in the past (Stromer von Reichenbach, 1899; Rutten, 1909) and recently (Kolfshoten, 1989). The specimens are at the Rijksmuseum van Geologie en Mineralogie of Leiden, The Netherlands. The material is from three or four individuals, one or two of which were rather young.

The sample includes the following specimens:

left humerus (RGM 14194)
 right humerus (RGM 18773)
 right radius (RGM 18774)
 right magnum (RGM 18791)
 right magnum (RGM 14197)
 right II metacarpal (RGM 14188)
 right IV metacarpal (RGM 14189)
 right femur (ST 14192)
 left tibia (RGM 18772)
 left tibia (ST 14193)
 left astragalus (RGM 18790)
 right calcaneum (RGM 14191)
 left calcaneum (RGM 18793)
 left II metatarsal (RGM 18799)
 right III metatarsal (ST 14187)

This site also yielded remains of the southern elephant *Archidiskodon meridionalis* (Swelme & Rutten, 1923) as well as other rhinoceros remains that are however more readily attributable to *S. hundsheimensis* (right radius - RGM 14198, left

ulna - RGM 14195, right ulna - RGM 14199). The Westerhoven site is the type locality of the Interglacial II of the "Cromerian" of the Dutch continental stages (Kolfshoten, 1989). We do not know whether all these specimens come from the same stratigraphic levels, nor if these levels are the ones of the type locality.

The small-sized rhinoceros from Westerhoven has characters which are similar to those from Pietrafitta and Pirro.

Despite the presence of some young individuals, the Pirro rhinoceros appears to belong to the group of small-sized forms with *S. etruscus* - *S. hundsheimensis* affinities, which includes individuals from the localities of Pietrafitta, Loreto (Venosa) and Westerhoven (Brabant), and which lived in a fairly restricted period that straddled the Early - Middle Pleistocene boundary.

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PLATE 1

Stephanorhinus cf. *hundsheimensis* - Pietrafitta mine

Fig. 1 - left upper toothrow, occlusal view;

Fig. 2 - incomplete left upper toothrow, buccal view;

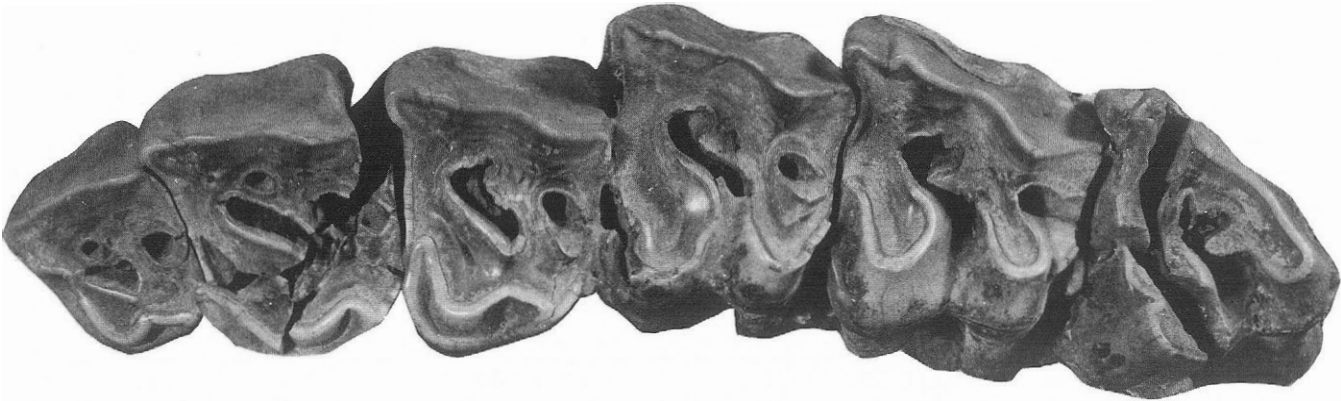
Fig. 3 - right upper molar row, occlusal view;

Fig. 4 - left lower toothrow, occlusal view;

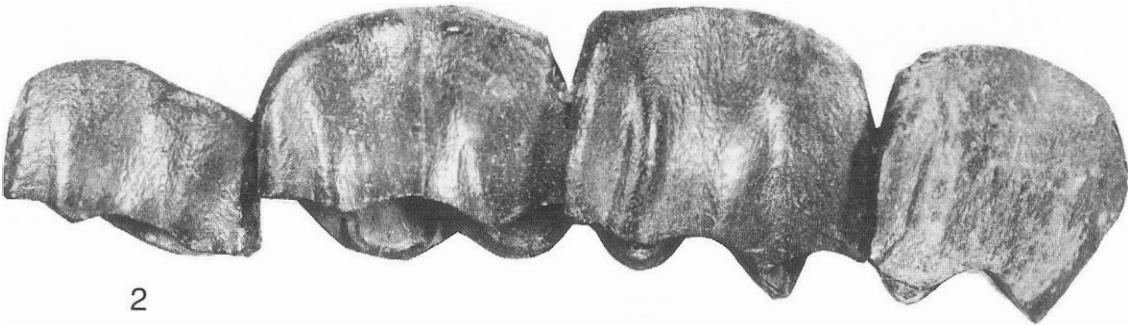
Fig. 5 - left lower toothrow, lingual view;

Fig. 6 - left lower toothrow, occlusal view.

All figures about 3/4 nat. size



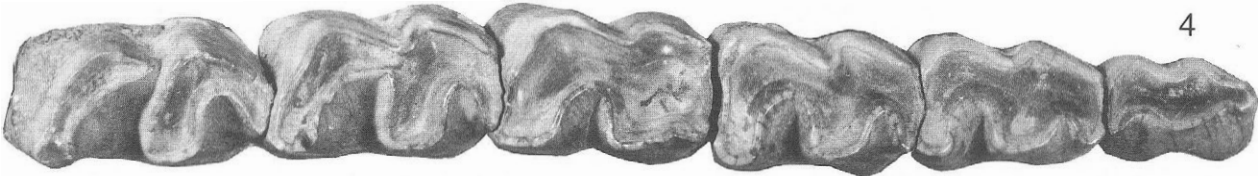
1



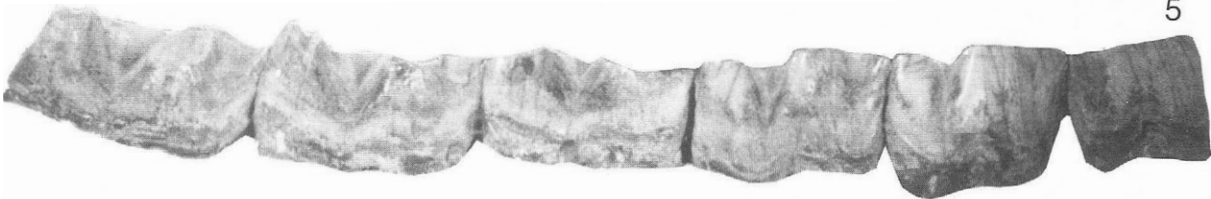
2



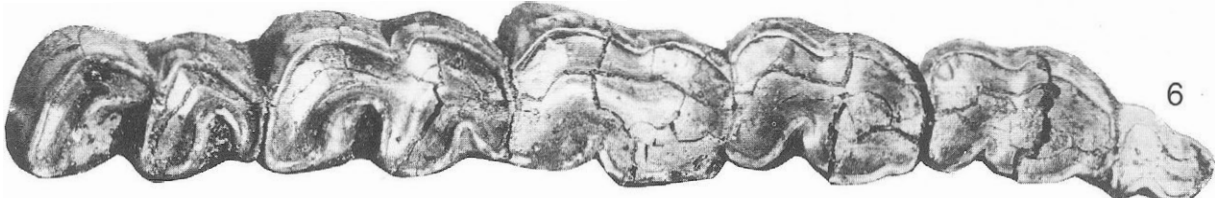
3



4



5



6

PLATE 2

Stephanorhinus cf. *hundsheimensis* - Pietrafitta mine

- Fig. 1 - skull, about nat. size;
- Fig. 2 - distal end of left humerus, cranial view, about nat. size;
- Fig. 3 - left radius, dorsal view, about nat. size;
- Fig. 4 - right femur, cranial view, about nat. size;
- Fig. 5 - right femur, proximal view, about nat. size;
- Fig. 6 - right femur, distal view, about nat. size;
- Fig. 7 - left femur, cranial view, about nat. size;
- Fig. 8 - left femur, proximal view, about nat. size;
- Fig. 9 - left femur, distal view, about nat. size;
- Fig. 10 - right tibia, dorsal view, about nat. size;
- Fig. 11 - right tibia, proximal view, about nat. size.

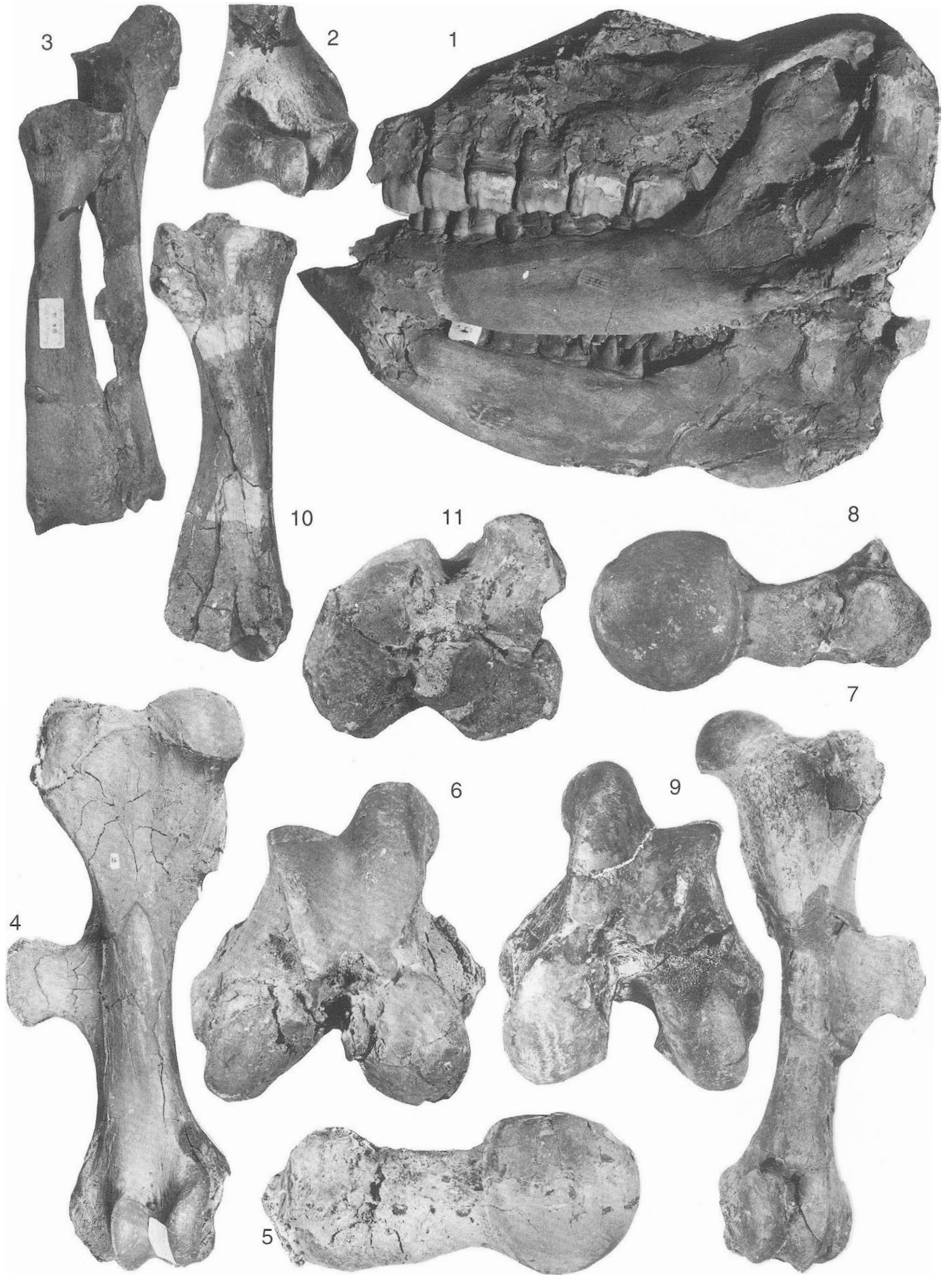


PLATE 2

PLATE 3

Stephanorhinus cf. *hundsheimensis* - Pietrafitta mine

Fig. 1 - right second metacarpal, dorsal view;

Fig. 2 - right third metacarpal, dorsal view;

Fig. 3 - right fourth metacarpal, dorsal view;

Fig. 4 - right scaphoid, proximal view;

Fig. 5 - right scaphoid, dorsal view;

Fig. 6 - right semilunar, dorsal view;

Fig. 7 - left pyramidal, dorsal view;

Fig. 8 - left pyramidal, palmar view;

Fig. 9 - left pyramidal, proximal view;

Fig. 10 - right pisiform, medial view;

Fig. 11 - right pisiform, distal view;

Fig. 12 - right magnum, dorsal view.

All figures about nat. size.

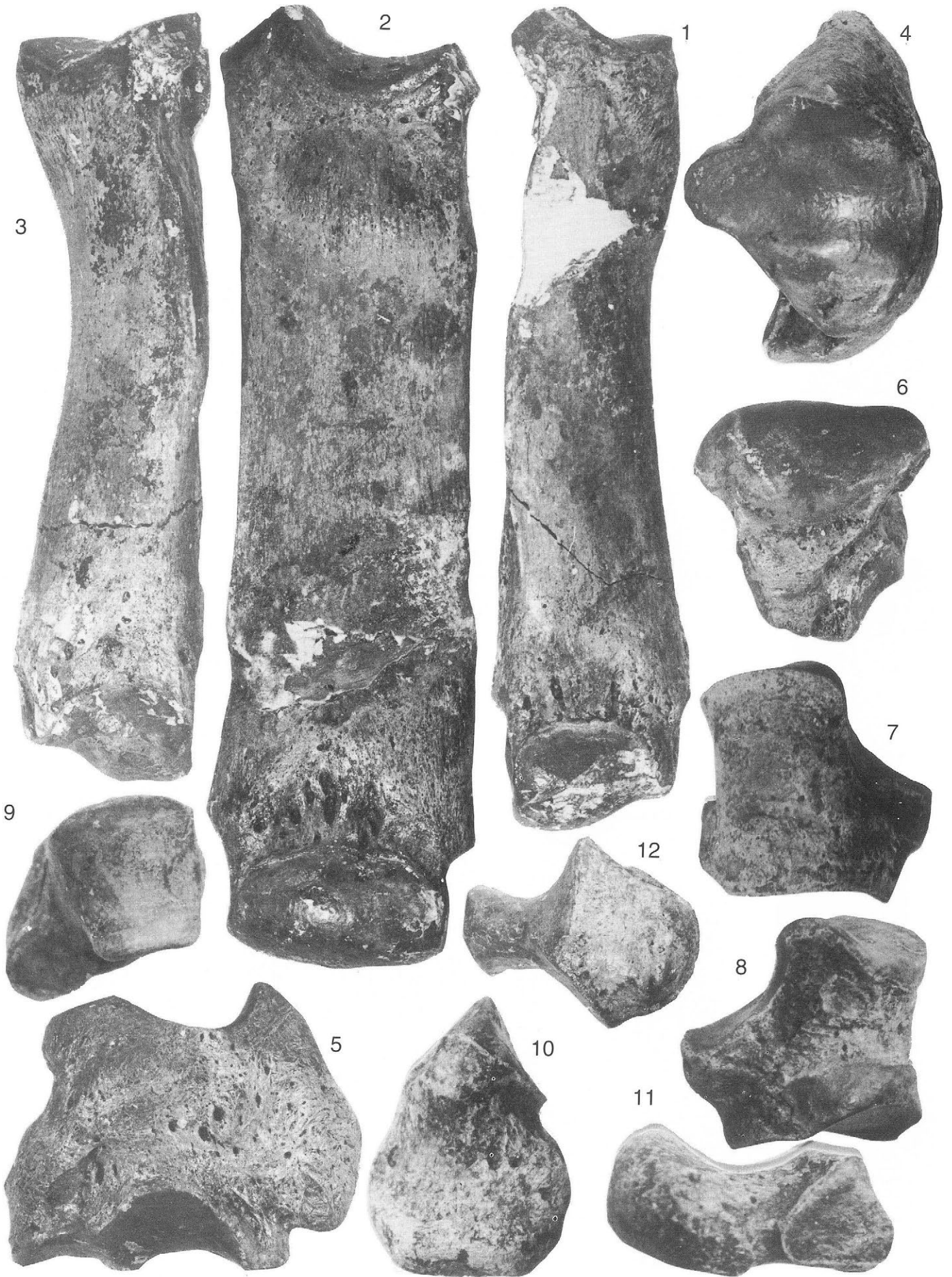


PLATE 3

PLATE 4

Stephanorhinus cf. *hundsheimensis* - Pietrafitta mine

- Fig. 1 - left uncinata, dorsal view;
 - Fig. 2 - left uncinata, distal view;
 - Fig. 3 - right patella, articular view;
 - Fig. 4 - right navicular, dorsal view;
 - Fig. 5 - right navicular, medial view;
 - Fig. 6 - right navicular, dorsal view;
 - Fig. 7 - right second metatarsal, dorsal view;
 - Fig. 8 - right second metatarsal, proximal view;
 - Fig. 9 - right third metatarsal, dorsal view;
 - Fig. 10 - right third metatarsal, proximal view;
 - Fig. 11 - right fourth metacarpal, dorsal view.
- All figures about nat. size.



PLATE 4

PLATE 5

Stephanorhinus cf. hundsheimensis - Pietrafitta mine

- Fig. 1 - right astragalus, dorsal view;
 - Fig. 2 - right astragalus, plantar view;
 - Fig. 3 - right astragalus, distal view;
 - Fig. 4 - right calcaneum, dorsal view;
 - Fig. 5 - right calcaneum, distal view;
 - Fig. 6 - right calcaneum, lateral view;
 - Fig. 7 - right cuboid, dorsal view;
 - Fig. 8 - right cuboid, lateral view;
 - Fig. 9 - left third cuneiform, proximal view;
 - Fig. 10 - left second cuneiform, dorsal view;
 - Fig. 11 - left second cuneiform, proximal view.
- All figures about nat. size.



PLATE 5

PLATE 6

Stephanorhinus cf. hundsheimensis - Pirro

Fig. 1 - palate, ventral view;

Fig. 2 - right cheek teeth, lingual view;

Fig. 3 - right cheek teeth, buccal view;

Fig. 4 - right scapula, lateral view;

Fig. 5 - right scapula, distal view;

Fig. 6 - left radius, proximal view;

Fig. 7 - right scaphoid, dorsal view;

Fig. 8 - right magnum, lateral view;

Fig. 9 - left third metacarpal, dorsal view;

Fig. 10 - left femur, cranial view;

Fig. 11 - left femur, distal view;

Fig. 12 - left tibia, dorsal view.

Fig. 13 - left tibia, proximal view;

Fig. 14 - right second metatarsal, dorso-medial view;

Fig. 15 - left fourth metatarsal, lateral view.

All figures about nat. size.

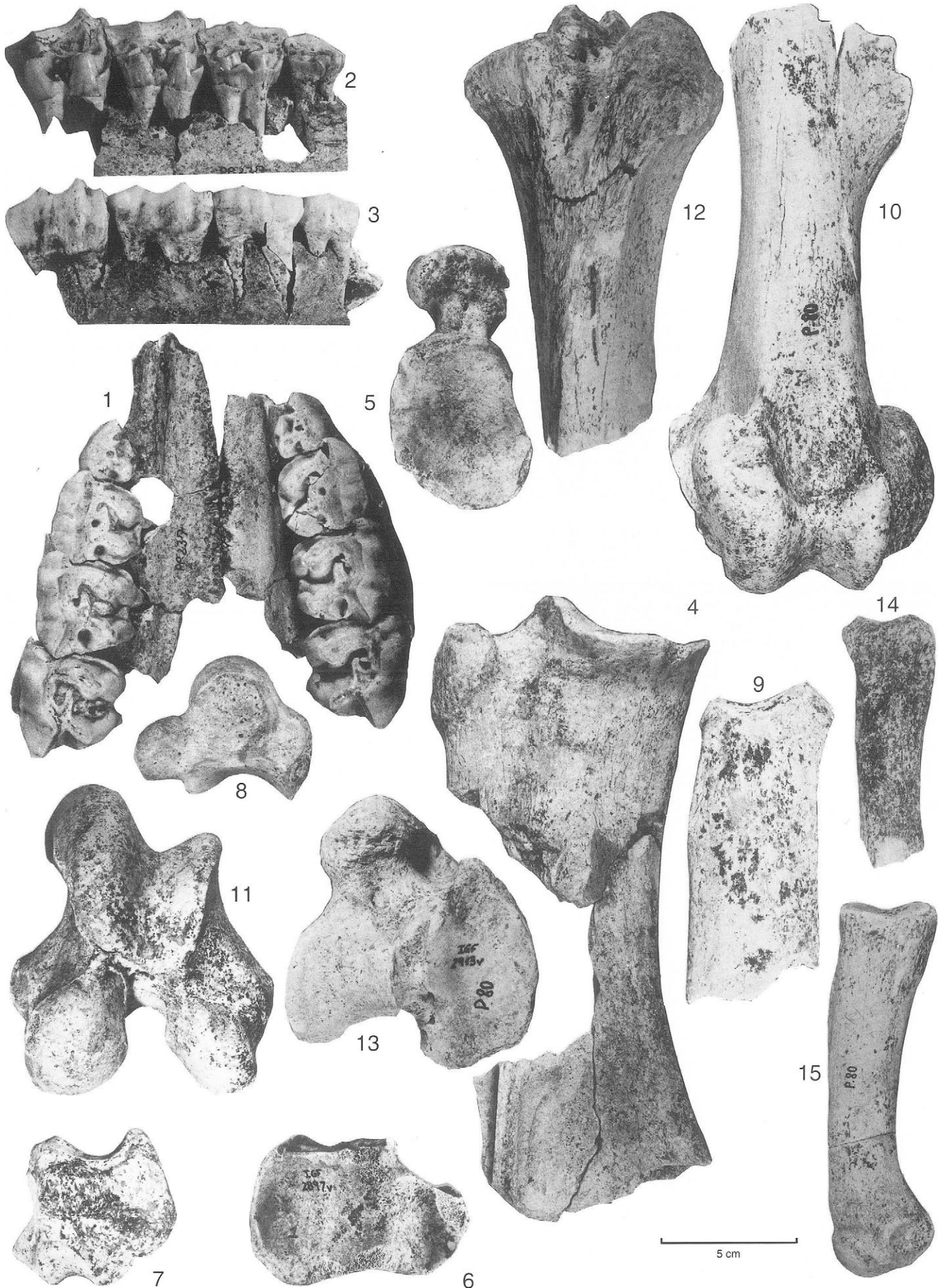


PLATE 6

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