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Selected records of *Stephanorhinus kirchbergensis* (Jäger, 1839) (Mammalia, Rhinocerotidae) in Italy

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KEY WORDS - Stephanorhinus*, Pleistocene, Northern and Central Italy.*

ABSTRACT - Three upper jaws and some isolated teeth which may be attributed to Stephanorhinus kirchbergensis *(Jäger, 1839) have been discovered in the last two centuries at twelve localities of Northern and Central Italy. Unlike other Pleistocene rhinoceroses, which relatively abound in Italy as well as elsewhere in Eurasia,* S. kirchbergensis *has been reported only from few localities in this area. Almost all the material considered here, deposited in museum collections, has not been published so far. Odontological distinguishing characters using morphological and non-metric characters are discussed.*

RIASSUNTO - [Resti più significativi di *Stephanorhinus kirchbergensis* (Jäger, 1839) (Mammalia, Rhinocerotidae) in Italia] - *In questo lavoro sono prese in considerazione tre emiarcate dentarie superiori e numerosi molari e premolari isolati, attribuibili a* Stephanorhinus kirchbergensis *(Jäger, 1839) e rinvenuti, durante gli ultimi due secoli, in dodici località dell'Italia settentrionale e centrale: Vernasso (Udine), La Fornace di S. Ambrogio di Valpolicella (Verona), Ponte sul Farfa (Roma), Castel di Guido (Roma), Roma (lungo i terrazzi dell'Aniene, a Monte Sacro, a Tor di Quinto, lungo i terrazzi del Tevere, a Ponte Molle, alla "Sedia del Diavolo", oltre a tre suburbi oggi non più identificabili causa l'urbanizzazione), Madonna di Valle Radice (Sora, Frosinone).*

Stando alle evidenze fossili, al contrario di altre specie di rinoceronti pleistocenici che sono piuttosto frequenti sul territorio italiano - come del resto su quello eurasiatico - S. kirchbergensis *sembrerebbe essere alquanto raro sul territorio considerato. Dette considerazioni vengono operate sulla base della definizione soprattutto delle morfologie craniche e delle strutture dentarie che consentono una netta distinzione fra* S. kirchbergensis *e* Stephanorhinus hemitoechus *(Falconer, 1868), specie con cui nel Pleistocene medio è stato spesso confuso. Nel lavoro, oltre ai problemi tassonomici, di sinonimia e di diffusione nel continente eurasiatico, viene anche affrontato il problema dell'area di provenienza nella penisola italiana di questa specie.*

I resti fossili esaminati in questo lavoro, quasi tutti inediti, sono conservati in collezioni museali italiane.

INTRODUCTION

The occurrence of the Pleistocene "tandem-horned" Eurasian interglacial rhinoceros *Stephanorhinus kirchbergensis* (Jäger, 1839), a species still little known, has only been supposed (Gliozzi et al., 1997) in the Italian peninsula, in the Middle Galerian, possibly together with *Stephanorhinus hemitoechus* (Falconer, 1868) and, at first time, with *Stephanorhinus hundsheimensis* (Toula, 1902) which occurs in earlier faunal units. From a thorough investigation, the presence of *S. kirchbergensis,* in this time span, is nowhere attested. Actually, finds of *S. kirchbergensis* are rare during the Galerian Mammalian Age; later, they are more frequent in the Aurelian Faunal Units. The objective of the present paper - based on a systematic revision of some odontological remains collected in the last two centuries, coming from sites of Northern and Central Italy, and preserved in museum collections - is to investigate the biochronological boundaries of *S. kirchbergensis* in Italy and the fossil material which may confidently be referred to *S. kirchbergensis,* as distinct from *S. hemitoechus,* a species with which it has often been confused.

EURASIAN FINDS

Skeletal remains attributed to *S. kirchbergensis* - better known in Russia, and in the former Soviet Union, as "nosorog Merka" (Merck's rhinoceros) - were found in the Eurasian landmass in a relatively few localities only.

As yet, *S. kirchbergensis* has been rarely recorded from Eurasia. The reasons of this rarity have not been unraveled yet. According to Loose (1975), the reasons are twofold: its ecological niche was unfavourable for fossilisation or it was really a rare animal. Here, we favour the second hypothesis. In any case, the rarity of this species - despite of its being widespread in Eurasia - has been demonstrated on Russian territory (Billia, 2007) as well as in the European area.

Until today, *S. kirchbergensis* has very often been confused with other species particularly with *Stephanorhinus hemitoechus* (Falconer, 1868) and *Coelodonta antiquitatis* (Blumenbach, 1799). Actually, there are some similarities with these two species. In addition, many authors also misidentified *S. kirchbergensis* with *Stephanorhinus etruscus* (Falconer, 1868), *Stephanorhinus hundsheimensis* (Toula, 1902), *Stephanorhinus elatus* (Croizet & Jobert, 1828) (= *Stephanorhinus jeanvireti* (Guérin, 1972) = *Rhinoceros etruscus* Falc. var. *astensis* Sacco, 1895), *Stephanorhinus megarhinus* (de Christol, 1834), and others (Billia, 2007). Besides, for a long time it was believed that *S. kirchbergensis* and *S. hemitoechus* represented only one species. In spite of the progress attained during the last decades, we must accept that many taxonomic problems still exist.

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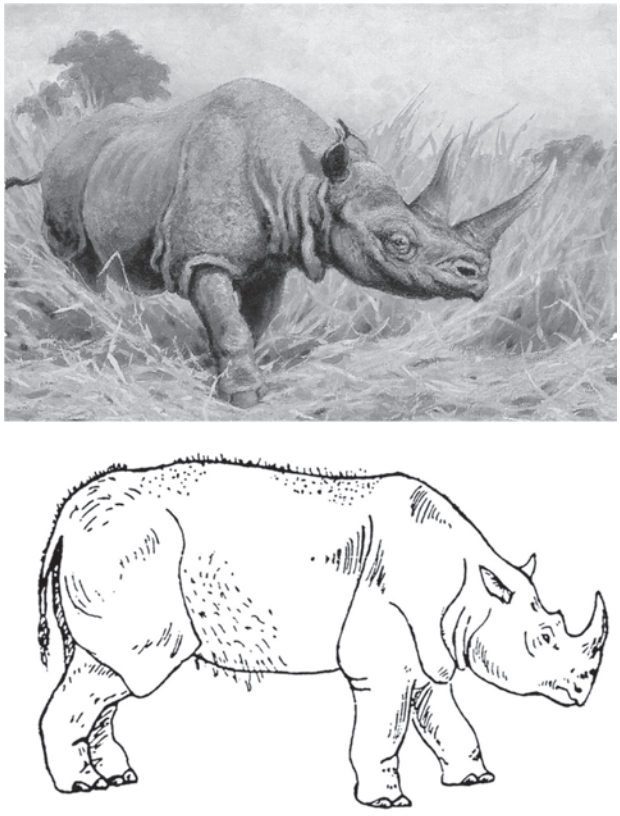


Fig. 1 - Reconstructions of *Rhinoceros mercki* Jäger, 1839 (= *Stephanorhinus kirchbergensis* (Jäger, 1839)) after K.K. Flerov (Flerov et al., 1955) and after Kozhamkulova (Kozhamkulova & Kostenko, 1984).

On the other hand, Loose (1975) emphasized that "... *any publications in which the name* Rhinoceros (*or* Dicerorhinus) merckii *is used, should be read with the utmost caution".*

One of the basic problems is that too often identification is based exclusively on postcranial remains (osteological basis) so that errors of identification among the species are frequent, whereas the attribution by means of cranial morphology and teeth is unequivocal. In *S. kirchbergensis,* only the third metacarpals, the astragali, and the calcanea may present some distinctive morphological features in respect to the other Pleistocene rhinoceros species.

We agree with Heissig (1981) that the rhinoceroses are a highly stereotyped group with little morphological divergence; in other words, this means that, morphologically, substantial intraspecific differences and, conversely, interspecific likenesses may usually be found among them.

As regards the dimensions, according to Wüst (1922), Bernsen (1927), Guérin (1980), Kurtén (1968), and other prominent palaeontologists, *S. kirchbergensis* was depicted as a large-sized rhinoceros, in some cases gigantic ("the biggest *Dicerorhinus* which had ever lived on the planet") even if Loose (1975) has always vigorously rejected this thesis. Among the reconstructions of the species, that by Flerov (Flerov et al., 1955) (Fig. 1) seems the most likely.

The distribution range of *S. kirchbergensis* includes a large part of the Eurasian continent: in Siberia, at least up to 110° E (Billia, 2007), generally at lower latitudes, except for only one case at about 64° N (Dubrovo, 1957). At present, on the basis of the fossil evidence, *S. kirchbergensis* - unlike *C. antiquitatis* (Blum.), which abounds in Eurasia, as well as other Plio-Pleistocene rhinoceroses - seems to be a rare species. Recognized as a Middle Pleistocene species in Europe, it is reported from few Italian, French, German, British, Austrian, and East-European localities only (Morris, 1836; Meyer, 1863-64; Lartet, 1867; Brandt, 1877; Abbott, 1890; Hinton & Kennard, 1900; Schroeder, 1903; Toula, 1902, 1907; Wüst, 1909, 1911, 1914, 1922; Gorjanovich-Kramberger, 1913; Freudenberg, 1914; Lubicz-Niezabitowski, 1926; Rakovec, 1933, 1958; Gromova, 1935; Simionescu, 1939-40; Stäsche, 1941; Zeuner, 1945; Thenius, 1956-59; Adam, 1958; Kowalski, 1959; Czyzewska, 1962; West et al., 1964; Radulescu et al., 1965; Malez, 1970, 1986; Samson & Nadisan, 1970; Borsuk-Bialynicka & Jakubowski, 1972; Mayer, 1971; Kahlke, 1975, 1977, 1978, 1984; Loose 1975; Guérin, 1980; Groiss et al., 1981; Jánossy, 1986; Fortelius et al., 1993; Döppes & Rabeder, 1997; Lacombat, 2005, inter alios).

On Russian territory, besides the skull from the "Irkutsk region" (Chersky, 1874; Brandt, 1877; Billia, 2007), other *S. kirchbergensis* remains (from levels referable to the Middle or Middle Late Pleistocene) are recorded at least from nine other localities (Gromova, 1932, 1935; Belyaeva, 1935; Dubrovo, 1957; Alekseeva, 1980; Strizheva, 1991; Billia, 2007). For the other Russian-European localities in which remains ascribed to *S. kirchbergensis* have been recorded (Gromova, 1932, 1935; Belyaeva, 1935, 1939, 1940; Gromov, 1948; Salov, 1957) unfortunately, at present, no material is available (Billia, 2007).

As regards the territories of the former Soviet Union, *S. kirchbergensis* is certainly testified by twelve isolated teeth coming from Koshkurgan (Turkestan district, Karatau Mountain, Chimkent region, South-Eastern Kazakhstan) (Khisarova, 1963) collected in Early Pleistocene levels. Some other remains possibly referable to the same species come from Southern Kazakhstan (Kozhamkulova, 1981; Kozhamkulova & Kostenko, 1984; Tleuberdina et al., 1990), Tajikistan (Sharapov, 1980; Dmitreva & Nesmeyanov, 1982), Azerbaijan (Vereshchagin, 1959; Alev, 1969), from Moldova (David & Vereshchagin, 1967; Belyaeva & David, 1971; David, 1980, 1983, 1995), and Ukraine (Gromova, 1935; Gromov, 1948; David et al., 1990).

For the Middle East there are three records very probably due to misidentifications: Ksar' Akil (Lebanon), Tabun-Mont Carmel (Israel) (Hooijer, 1961) and Jissr Banat Yakub (Israel) (Bar-Yossef & Chernov, 1972).

Records from South-East Asia are also known: at Sae-kul (Central Korea) (Lee Yu-Jo, 2001), the species is represented by a very well-preserved mandibula and some long bones recovered in Middle Pleistocene levels. *S. kirchbergensis* has also been recorded from four Chinese provinces (Teilhard de Chardin & Pei W.C., 1941; Wang T., 1961; Xu X., 1986; Fu Zh., 2002). According to Fu

Zh. (2002), on Dunbey territory *S. kirchbergensis* remains have been found in Middle Pleistocene levels.

In conclusion, there are very few well dated cranial and poscranial remains.

STEPHANORHINUS KIRCHBERGENSIS (Jäger, 1839)

Taxonomy and synonymy - Except for *C. antiquitatis* (Blum.) and *Elasmotherium*, the Plio-Pleistocene European rhinoceroses have traditionally been assigned to the genus *Dicerorhinus* (Gloger, 1841). Fortelius et al. (1993) substituted the name *Dicerorhinus* following the nomenclature previously introduced by Kretzoi (1942) with *Stephanorhinus,* as *nomen conservandum,* for all the Plio-Pleistocene European rhinoceros species.

During the last two centuries *S. kirchbergensis* has been identified also as:

Rhinoceros incisivus Merck, 1784; *Rhinoceros megarhinus* de Christol, 1834; *Rhinoceros leptorhinus* Cuvier, 1836; *Rhinoceros kirchbergense* Jäger, 1839; *Rhinoceros Merckii* (or *merckii, mercki, merki, Mercki*) Kaup, 1841; *Dicerorhinus mercki* (Kaup, 1841); *Rhinoceros leptorhinus* Owen, 1850; *Rhinoceros (Tichorhinus) Merckii* Brandt, 1877; *Rhinoceros Mercki (Merckii)* var. *brachycephala* Schroeder, 1903; *Coelodonta merckii* Abel, 1919; *Dicerorhinus kirchbergensis* Hooijer, 1947; *Dicerorhinus mercki (kirchbergensis)* (Jäger) var. *brachycephalus* Schroeder vel *Dicerorhinus merckii* Mayer, 1971.

Anatomically, *S. kirchbergensis* has a very elongated half-high posture skull with a septum nasalis ossified only in its anterior portion. The mandibula shows a long synphysis, and a horizontal high, heavy, thick branch. The graviportal postcranial skeleton, with large, long, and massive bones, morphologically suggests a demi-cursorial animal.

Odontological distinguishing characters - The odontological charaters are listed together since the same patterns may be observed on all of the material.

Odontologically, *S. kirchbergensis* has a very brachyodont dentition with high crowns; nevertheless, in both the upper and lower jaws, the premolars (much molarized, as in other rhinoceros species), by comparison, appear rather less brachyodont than the molars; this feature is more evident in the upper dentition.

In both the upper and lower teeth, the enamel is very thick, often smooth and bright; as a general rule, the coronal cement is absent; rarely, if present, it is very thin. In most cases, the buccal (vestibular) sides of the teeth are characterized by the presence of sub-vertical bluish lines. Sometimes, also some styli may be present. Metrically, at a glance, it is evident that there is a great variability among the dimensions of the same tooth typology with wide superpositions in comparison with those of other species. For this reason, in our opinion, biometry has to be considered (and used) very cautiously.

Upper dentition - The upper teeth (particularly the molars) are much higher buccally then lingually. From the occlusal view, the ectoloph of both first and second molar is rather similar to that of *S. hemitoechus*. Neverthless, in *S. kirchbergensis* its folds are shallow; in particular, the fold between paracone and mesostyle in *S. kirchbergensis* appears less emphasized than in *S. hemitoechus*, so that, on the whole, the undulation of the ectoloph in *S. kirchbergensis* appears to be "softer". In comparison with other species, the premolars are mesially considerably broad (and, by comparison, lingually relatively short); the folds of the ectoloph are shallow, the anterior valleys are very narrow; the ectoloph, mesially - and, often, also distally - curves strongly towards the inside of the tooth. In both molars and premolars, the protolophs and the metalophs show a remarkable bulbousity which, particularly on the second molar, may be of considerable dimensions (see MPUR 1432/40, 1454/118, 1498-5). However, these dimensions are unrelated to those of the tooth.

Lower dentition - In contrast with the upper jaw, no significant differences between molars and premolars can be observed in the lower dentition, the lower premolars being much more molarized than the upper ones, therefore isolated molars and premolars may often be difficult to distinguish from each other.

MATERIAL

Among a great amount of fossil material belonging to rhinoceroses and available in palaeontological museum collections, some odontological remains (isolated teeth and jaws) from two localities of North-Eastern Italy (Fig. 2), two localities in the surroundings of Rome, four sites in the Rome urban area, and three unknown suburbs of

Fig. 2 - Index maps of the geographical localization of the sites: (1) Cava Italcementi (Vernasso, Cividale del Friuli, Udine); (2) La Fornace di S. Ambrogio di Valpolicella (Verona); (3) Farfa river at Ponte sul Farfa (Roma); (4) Castel di Guido (Roma); (5) Roma, Aniene river at Monte Sacro; (6) Roma, Tor di Quinto; (7) Roma, Tiber at Ponte Molle (or Ponte Mollo, now called Ponte Milvio); 8) Roma, Sedia del Diavolo; 9) Roma, three unknown suburbs; (10) Cava Bernardo & Vincenzo Di Pede (Madonna di Valle Radice, Sora, Frosinone).

Rome have been excerpted. Until to-day, the material described here is still unpublished, except for the remains from "Cava Italcementi" (Pellarini, 1999).

1) "Cava Italcementi" (Vernasso, Cividale del Friuli, Udine, Friuli Venezia Giulia, North-Eastern Italy)

A travertine quarry opens in the village of Vernasso at the border between the towns of Cividale del Friuli and San Pietro al Natisone, along the SS 54 highway (Udine-Kobarid (Slovenia) axis). Here, in some natural cavities within limestone blocks and in rock fractures of karst origin, filled with red sands, two second upper molars, as well as one fourth upper premolar and one second lower molar have been recovered. The odontological remains formerly described by Pellarini (1999) are preserved at the Museo Friulano di Storia Naturale in Udine.

The teeth, uncommonly well-preserved (with the exception of a second upper molar) and very large sized teeth show demi-bright and smooth enamel. The two second upper molars (one of them damaged in its mesial portion) (MFSNU 220297 and MFSNU 220298; Figs. 3a, d) are very brachyodont with remarkably bulbous protocones and metacones. Mesial cingula are also present. The fourth upper premolar (MFSNU 220299; Fig. 3b) appears less brachyodont than the molars. The ectoloph, mesially, curves strongly towards the inside of the tooth. The tooth presents narrow interior valley, mesial and lingual *cingula*. The second lower molar (MFSNU 220300; Fig. 3c) shows strongly reduced mesial and distal valleys, mesial and distal cingula.

2) La Fornace di S. Ambrogio di Valpolicella (Verona, Venetia, North-Eastern Italy)

Three upper molars, three upper premolars, three lower molars, and two lower premolars (some of them, MCSN-V 9637, MCSN-V 9638, MCSN-V 9641, MCSN-V 9646, MCSN-V 9647; Figs. 3e-i) have been found in La Fornace di S. Ambrogio di Valpolicella (Verona) in the first half of the 20th century. Even if isolated, the remains form two semiarches, an upper and a lower-one respectively, belonging to one individual. Another second upper molar is also present. No additional information on this discovery is available (collections of the Museo Civico di Storia Naturale in Verona).

Well-preserved, large-sized teeth with rather polish and smooth enamel.

The upper molars (Figs. 3 e-g) are remarkably brachyodont, their protocones and metacones appear remarkably bulbous. Some styli are present at the entrance of the interior valley. The third and the fourth upper premolars (Figs. 3h-i) are less brachyodont than the upper molars. The ectoloph, mesially, curve strongly towards the inside of the tooth. Their lingual cones are also bulbous, the interior valleys are narrow. In both cases, the mesial cingula are also present.

The lower molars are very brachyodont; the first and the third one are slightly damaged in their distal portions, whereas the second molar is slightly damaged in the mesial one. The lower premolars are more hypsodont than the lower molars. Molars and premolars show both the mesial and distal valleys strongly reduced. Mesial and distal cingula are always present. In some cases, the roots are still present.

3) Ponte sul Farfa (Fara Sabina, Roma, Latium, Central Italy)

In the second half of the 19th century, near Fara Sabina (about 40 km north-east of Rome) along the left bank of the Farfa river (an affluent of the Tiber) one isolated second upper molar has been discovered; no further information on this discovery is available (collections of the Museo di Paleontologia of the "Sapienza" Università in Rome).

The second upper molar (MPUR 1432/40; Fig. 4a), damaged in its mesial portion, is remarkably brachyodont and shows a thick, smooth and bright enamel with sub-vertical bluish lines. The anterior lingual cone presents an exceptional bulbousity. Roots are still present.

4) Castel di Guido (Roma, Latium, Central Italy)

In the second half of the 19th century, along the Aurelia highroad, Roma-Civitavecchia axis near Castel di Guido (about 20 km north-west of Rome) one isolated first upper molar has been recovered. Here too, no information on the discovery is available (collections of the Museo di Paleontologia of the "Sapienza" Università in Rome).

Very worn, damaged and brachyodont tooth (MPUR, unnumered; Fig. 4b) showing a rather thick, smooth and bright enamel with presence of sub-vertical bluish lines. The protocone is remarkably bulbous.

5) Aniene river at Monte Sacro, Roma (Latium, Central Italy)

In February 1906, along the right bank of the Aniene river at Monte Sacro (at that time, a suburb of Rome) two isolated third upper molars came to light. No more information on the discovery is available (collections of the Museo di Paleontologia of the "Sapienza" Università in Rome).

Very worn and rather brachyodont teeth (MPUR 1428/24; Fig. 4c1-c2 and MPUR 1476/105) with thick, smooth and rather bright enamel and sub-vertical bluish lines. Both the anterior lingual cones appear remarkably bulbous. In both cases, the roots are still present.

6) Tor di Quinto, Roma (Latium, Central Italy)

In 1894, in Tor di Quinto (at that time, a suburb of Rome), three isolated teeth - second, third, and fourth lower premolars - have been recovered in tufaceous conglomerates. No more information on this discovery is available (collections of the Museo di Paleontologia of the "Sapienza" Università in Rome).

The well-preserved second lower premolar (MPUR 1458/54; Fig. 4d1-d2) presents a thick, very smooth and bright enamel with sub-vertical bluish lines. The valley is reduced. The third lower premolar slightly damaged in its mesial portion (MPUR 1455/87; Fig. 4e) and the well preserved fourth lower premolar (MPUR 1455/86) show rather thick, smooth and bright enamel with sub-vertical bluish lines. Their valleys are reduced.

7) Tiber at Ponte Molle, Roma (Latium, Central Italy)

In the second half of the 19th century, in an outcrop on the right bank of the Tiber at Ponte Molle (or Ponte Mollo, now called Ponte Milvio; at that time, a suburb of Rome), five isolated teeth (fourth upper premolar, first or second lower molar, second upper molar, first upper molar, and two third upper molars) have been discovered. These remains, associated with evidence of piroclastic deposits, have been recovered on a Tiber terrace together

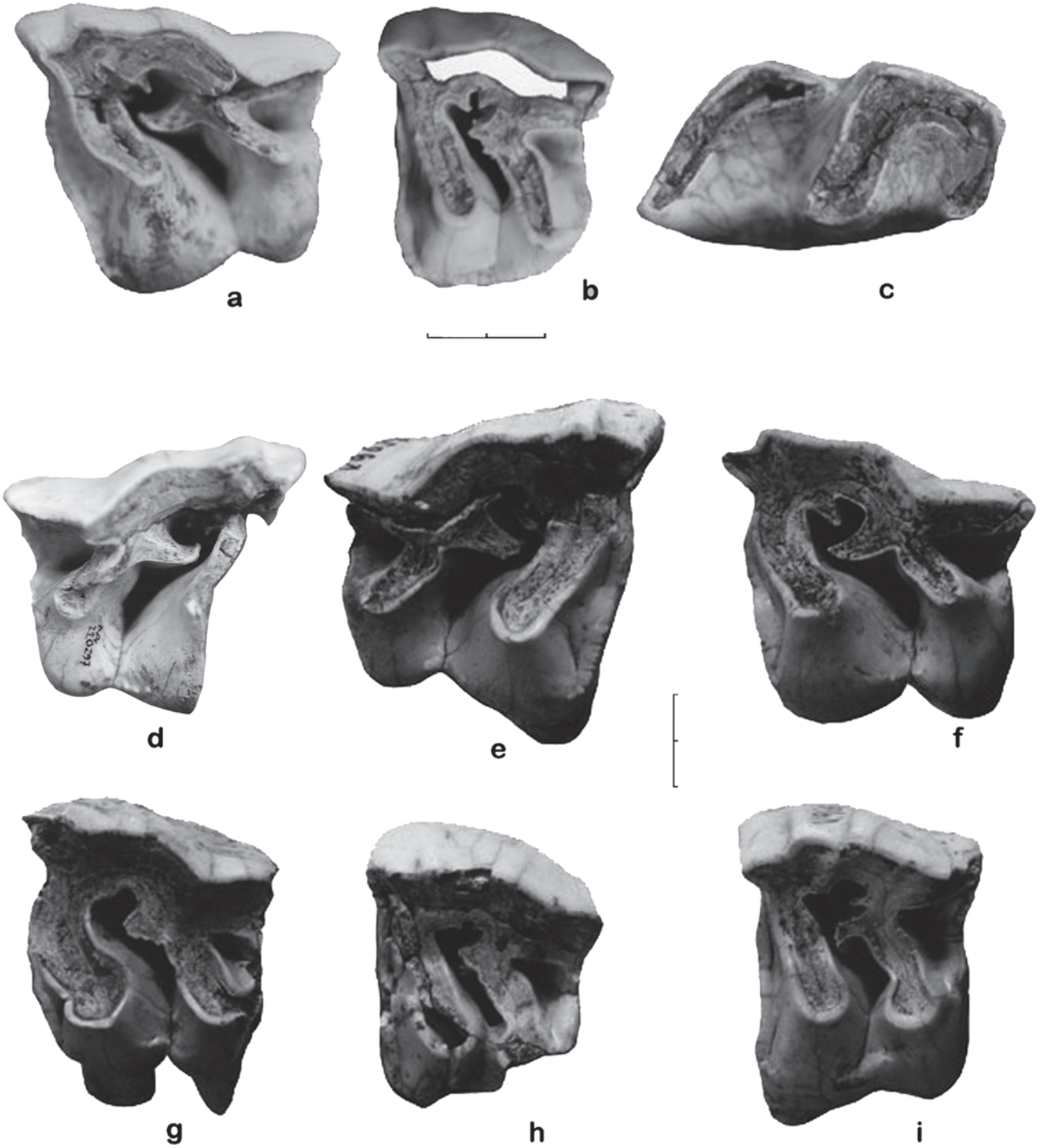
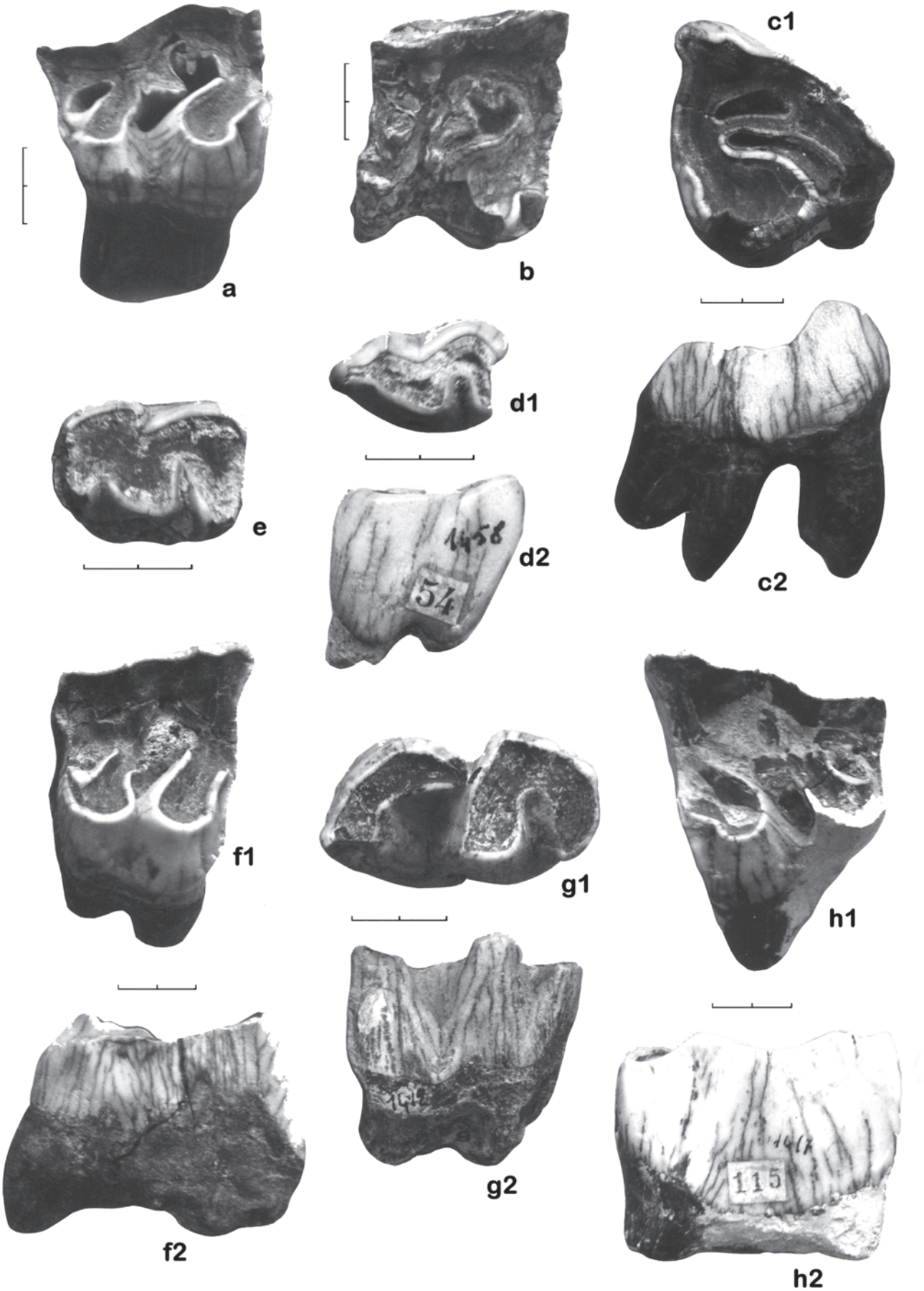


Fig. 3 - *Stephanorhinus kirchbergensis* (Jäger, 1839); Middle Late - Late Pleistocene; North-Eastern Italy. Cava Italcementi (Vernasso, Cividale del Friuli, Udine, Friuli Venezia Giulia): a) second upper molar (MFSNU 220298), occlusal view; b) fourth upper premolar (MFSNU 220299), occlusal view; c) second lower molar (MFSNU 220300), occlusal view; d) second upper molar (MFSNU 220297), occlusal view. La Fornace di S. Ambrogio di Valpolicella (Verona, Venezia Euganea): e) second upper molar (MCSN-V 9637), occlusal view; f) second upper molar (MCSN-V 9646), occlusal view; g) first upper molar (MCSN-V 9641), occlusal view; h) third upper premolar (MCSN-V 9638), occlusal view; i) fourth upper premolar (MCSN-V 9647), occlusal view. The bar is approximately 2 cm.

with skeletal remains belonging to *Cervus elaphus acoronatus* Beninde, 1937, *Axis eurygonos* (Azzaroli, 1967), *Bison schoetensacki* Freudenberg, 1914, and *Megaceroides solilhacus* (Robert, 1827) and are attributed to the faunal association called "Ponte Molle 1" (Di Stefano et al., 1998). All these remains are preserved in the collections of the Museo di Paleontologia of the "Sapienza" Università in Rome.

The well-preserved, uncommonly large-sized fourth upper premolar (MPUR 1421/107; Fig. 4f1-f2) presents thick, smooth and bright enamel with sub-vertical bluish lines, protocone and metacones rather bulbous, narrow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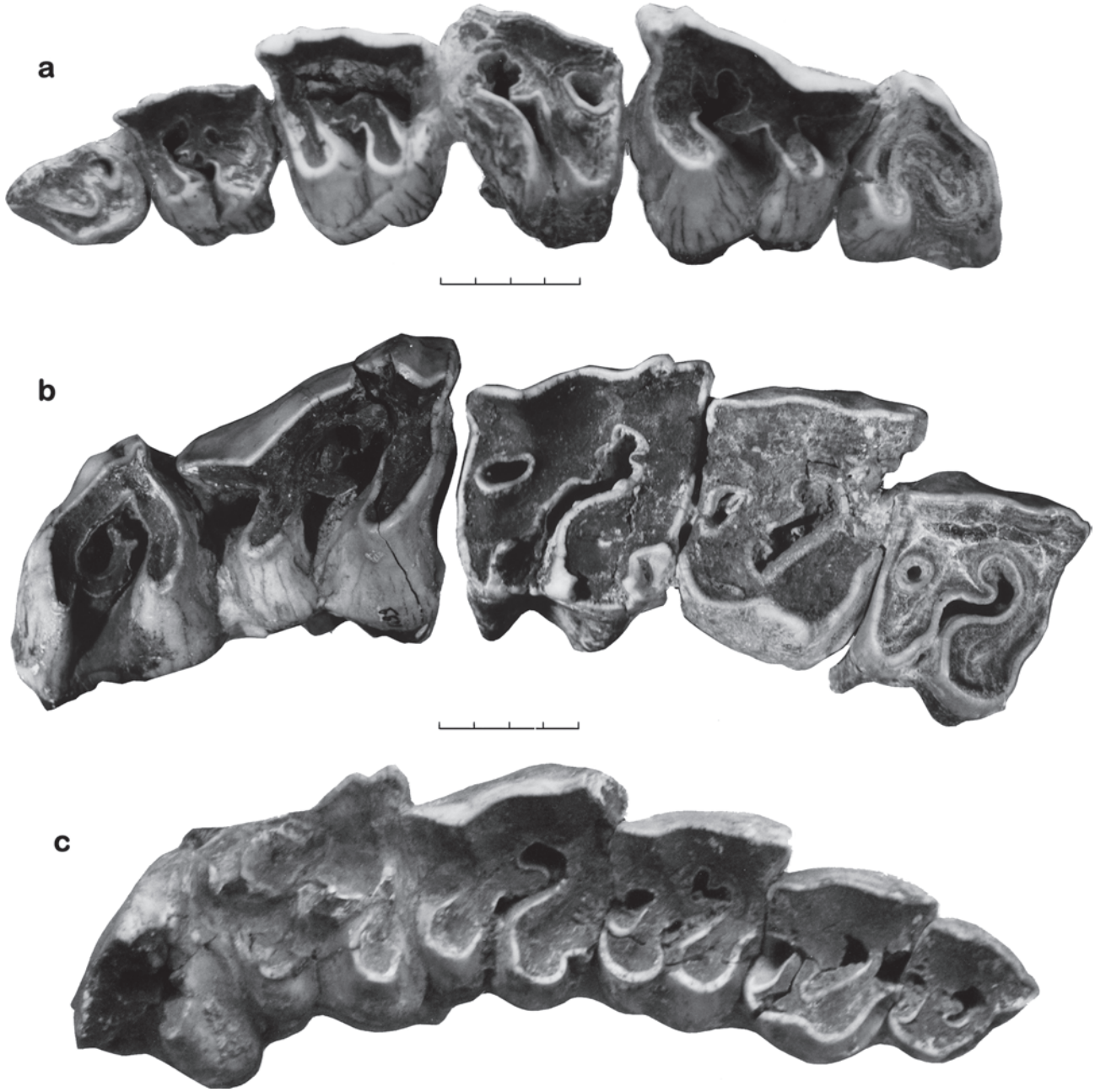

Fig. 5 - *Stephanorhinus kirchbergensis* (Jäger, 1839); Middle Pleistocene?; Latium, Central Italy. Suburbs of Roma (unknown localities); a) full upper jaw (MPUR 1498)), occlusal view; b) upper jaw (M^3-P^3) (MPUR 1499), occlusal view; c) full upper jaw (M^3-P^2) (MPUR 1518), occlusal view. The bar is approximately 2 cm.

interior valley, mesial and lingual cingula. The ectoloph, mesially, curves strongly towards the inside of the tooth. Roots are still present.

The also well-preserved first (or second) lower molar (MPUR 1412/8; Fig. 4g1-g2) shows thick, smooth and bright enamel with sub-vertical bluish lines, and reduced valleys.

The remarkable large-sized, very brachyodont second upper molar (MPUR 1417/115; Fig. 4h1-h2), restored in its distal portion, has rather thick, smooth and bright

Fig. 4 - *Stephanorhinus kirchbergensis* (Jäger, 1839); Middle Late Pleistocene; Latium, Central Italy. Farfa river at Ponte sul Farfa (Roma); a) second upper molar (MPUR 1432/40), occlusal-lingual view - Castel di Guido (Roma); b) first upper molar (MPUR s.n.), occlusal view - Roma, Aniene river at Monte Sacro; third upper molar (MPUR 1428/24), c1) occlusal view and c2) buccal view - Roma, Tor di Quinto; second lower premolar (MPUR 1458/54), d1) occlusal view and d2) vestibular view; e) third lower premolar (MPUR 1455/87), occlusal view - Roma, Tiber at Ponte Molle (or Ponte Mollo, now called Ponte Milvio); fourth upper premolar (MPUR 1421/107), f1) occlusal-lingual view and f2) mesial view; first (or second) lower molar (MPUR 1412/8), g1) occlusal view and g2) lingual view; second upper molar (MPUR 1417/115), h1) occlusal-lingual view and h2) buccal view. The bar is approximately 2 cm.

N	SPECIMEN	COLLECTION	BL	LL	MW	DW	LOCALITY
1	II upper molar	MFSNU 220297	70	=	70.3	55	Cava Italcementi, Vernasso (Cividale d. Friuli, Udine)
2	II upper molar	MFSNU 220298	70.5	50	71	55	Cava Italcementi, Vernasso (Cividale d. Friuli, Udine)
3	IV upper premolar	MFSNU 220299	46.5	38	60	52.5	Cava Italcementi, Vernasso (Cividale d. Friuli, Udine)
4	II lower molar	MFSNU 220300	55.5	49.5	33.5	35.8	Cava Italcementi, Vernasso (Cividale d. Friuli, Udine)
5	II upper molar	MCSN-V 9637	69	50.5	66	53.5	La Fornace di S. Ambrogio di Valpolicella (Verona)
6	III upper premolar	MCSN-V 9638	47	39	60	56	La Fornace di S. Ambrogio di Valpolicella (Verona)
7	I upper molar	MCSN-V 9641	59	47	65	54.5	La Fornace di S. Ambrogio di Valpolicella (Verona)
8	II upper molar	MCSN-V 9646	67	50	68	54	La Fornace di S. Ambrogio di Valpolicella (Verona)
9	IV upper premolar	MCSN-V 9647	51	45	67	58.5	La Fornace di S. Ambrogio di Valpolicella (Verona)
10	II upper premolar	MCSN-V s.n.	37.2	27	39.2	43.7	La Fornace di S. Ambrogio di Valpolicella (Verona)
11	III lower molar	MCSN-V s.n.	62.3	59	34.8	37	La Fornace di S. Ambrogio di Valpolicella (Verona)
12	IV lower premolar	MCSN-V s.n.	45.1	39	30.2	34.5	La Fornace di S. Ambrogio di Valpolicella (Verona)
13	III lower premolar	MCSN-V s.n.	38.5	36.3	24	30.7	La Fornace di S. Ambrogio di Valpolicella (Verona)
14	II upper molar	MPUR 1432/40	62.2	48	65.5	57.3	Farfa river at Ponte sul Farfa (Fara Sabina, Roma)
15	I upper molar	MPUR s.n.	48.8	47	57.2	47.1	Castel di Guido (Roma)
16	III upper molar	MPUR 1476/105	>52	=	>53	>46	Roma, Aniene river at Monte Sacro
17	III upper molar	MPUR 1428/24	62.8	=	58.6	52	Roma, Aniene river at Monte Sacro
18	I lower molar	MPUR/V 1469	46.3	45.7	26.6	27.4	Roma, Sedia del Diavolo
19	IV lower premolar	MPUR 1455/86	45.2	42.4	22.1	24	Roma, Tor di Quinto
20	III lower premolar	MPUR 1455/87	32.6	31.8	22	26.5	Roma, Tor di Quinto
21	II lower premolar	MPUR 1458/54	31.2	24	13.6	19.8	Roma, Tor di Quinto
22	I (or II) lower molar	MPUR 1412/8	49.5	40	27.8	30	Roma, Tiber at Ponte Molle (Ponte Milvio)
23	II upper molar	MPUR 1417/115	66.5	54.3	76	>50	Roma, Tiber at Ponte Molle (Ponte Milvio)
24	IV upper premolar	MPUR 1421/107	49.5	39.5	71.6	61	Roma, Tiber at Ponte Molle (Ponte Milvio)
25	I upper molar	MPUR 1445/27	51.3	37	50.9	44.6	Roma, Tiber at Ponte Molle (Ponte Milvio)
26	III upper molar	MPUR 1454/117	67.8	=	57.2	54.1	Roma, Tiber at Ponte Molle (Ponte Milvio)
27	III upper molar	MPUR 1454/118	58	=	56.8	52.1	Roma, Tiber at Ponte Molle (Ponte Milvio)
28	III upper premolar	Ist.It.PU s.n.	44	31	54	50	Cava Di Pede, Madonna di Valle Radice (Frosinone)
29	I upper molar	MNPEPR s.n.	62	40	64.5	51	Cava Di Pede, Madonna di Valle Radice (Frosinone)
30	II upper molar	MNPEPR s.n.	65.5	45	67	59	Cava Di Pede, Madonna di Valle Radice (Frosinone)

Tab. 1 - Dimensions (in mm) of the *S. kirchbergensis* (Jäger, 1839) teeth from nine Italian localities. BL=buccal length; LL = lingual length; MW = mesial width; DW = distal width.

enamel with sub-vertical bluish lines, bulbous protocone, mesial cingula.

The poorly preserved first upper molar (MPUR 1445/27) and two third upper molars (MPUR 1454/117, MPUR 1454/118) show a remarkable brachyodonty, thick, smooth, bright enamel with sub-vertical bluish lines, bulbous lingual cones, mesial and distal cingula.

8) "Sedia del Diavolo", Roma (Latium, Central Italy)

From the "upper gravels" of this quarry (at that time, a suburb of Rome), besides remains ascribed to *Homo neanderthalensis* King, 1864 (a second metatarsal) (Blanc, 1956), *Canis lupus* L., 1758, *Elephas antiquus* Falc. & Cautley, 1847, *Bos primigenius* Boj., 1827, *Equus caballus piveteaui* David & Pratt, 1962, *Equus hydruntinus* Reg., 1904, *Hippopotamus amphibius* L., 1758, *Cervus* cf. *Cervus elaphus eostephanoceros* Di Stefano & Petronio, 1993, *Dama* cf. *Dama clactoniana* (Falconer, 1868), come a second metacarpal (at present, not available) and an isolated first lower molar (MPUR/V1469, not figured here) previously identified as *Dicerorhinus* sp. by Caloi et al. (1980). As regards the tooth, the enamel is rather thick, smooth and bright; the mesial valley is reduced; the buccal side of the tooth presents sub-vertical bluish lines (collections of the Istituto Italiano di Paleontologia Umana in Rome).

9) Roma, three unknown suburbs (Latium, Central Italy)

In the second half of the 19th century, four upper jaws (one of them, very much damaged) were found in three unknown suburbs of Rome. Unfortunately, no additional information on these discoveries is available (collections of the Museo di Paleontologia of the "Sapienza" Università in Rome).

The MPUR 1498 upper half-jaw (Fig. 5a) presents thick, smooth, uncommonly bright enamel and conspicuous sub-vertical bluish lines. The molars (the first one is much damaged), very brachyodont, have remarkable bulbous lingual cones, whereas those of the premolars are less bulbous. The same premolars have narrow interior valleys, lingual cingula and the ectoloph of the fourth one, mesially, curves strongly towards the inside of the tooth.

The MPUR 1499 upper half-jaw (Fig. 5b) is showing a thick, smooth and very bright enamel with sub-vertical bluish lines, and mesial cingula. The molars are very brachyodont with remarkable bulbous lingual cones. The premolars have rather bulbous protocones and metacones and narrow interior valleys. The ectoloph of the fourth one, mesially, curves strongly towards the inside of the tooth.

The MPUR 1518 (Fig. 5c) and MPUR 1519 upper half-jaws (the second one is very much damaged and not figured here) unequivocally belong to the same individual. Both of them show thick, rather smooth, demi-bright enamel with sub-vertical bluish lines, and mesial cingula. The molars (the first one on MPUR 1518 is much damaged) are very brachyodont and have remarkable bulbous lingual cones; those of the premolars are also rather bulbous. The premolars have rather narrow interior valleys and their ectolophs (particularly that of the fourth one), mesially, curve strongly towards the inside of the tooth.

10) "Cava Bernardo & Vincenzo Di Pede" (Madonna di Valle Radice, Sora, Frosinone, Latium, Central Italy)

In a crack of this travertine quarry, five isolated teeth have been recovered: a first and a second upper molars together with a second, a third, and a fourth upper premolars (two of them are much damaged). Even if isolated, the five teeth are associated and, consequently, belong to the same jaw. The first and the second upper molars (MNPEP unnumered; not figured here) are very brachyodont, with bulbous lingual cones (particularly those of the second one). The second molar is also characterized by some styli on the lingual side.

The second, the third, and the fourth upper premolars (Ist.It.PU unnumered; not figured here) show narrow valleys and their ectolophs, mesially, curve strongly (this peculiarity is more evident on the fourth premolar) towards the inside of the tooth. All the teeth present thick enamel which is covered by a thin layer of carbonate concretions.

The material is preserved in the collections of the Istituto Italiano di Paleontologia Umana and of the Museo Nazionale Preistorico Etnografico "Luigi Pigorini" in Rome.

A detailed list of the material, measurements, and localities is given in Tabs. 1 and 2.

JAW ($P^2 \div M^3$) MPUR 1498 - ROMA, unknown suburb

SPECIMEN	COLLECTION	BL	LL	MW	DW	∅ LB
II upper premolar	MPUR 1498-1	=	=	=	=	
III upper premolar	MPUR 1498-2	39	28	42	38.1	
IV upper premolar	MPUR 1498-3	47.3	37.3	58.2	48.1	
I upper molar	MPUR 1498-4	=	=	=	=	
II upper molar	MPUR 1498-5	65	47	67.4	50.7	33.2
III upper molar	MPUR 1498-6	57.8	=	51.7	48	

JAW ($P^3 \div M^3$) MPUR 1499 - ROMA, unknown suburb

SPECIMEN	COLLECTION	BL	LL	MW	DW	∅ LB
II upper premolar	MPUR 1499-1	ab	ab	ab	ab	
III upper premolar	MPUR 1499-2	39.5	30.8	48.2	42	
IV upper premolar	MPUR 1499-3	46	38	60	50.4	
I upper molar	MPUR 1499-4	48	42.8	55.5	47.5	
II upper molar	MPUR 1499-5	71	47.5	70.9	52.4	28.1
III upper molar	MPUR 1499-6	63.4	=	58.2	52	27.2

JAW ($P^2 \div M^3$) MPUR 1518 - ROMA, unknown suburb

SPECIMEN	COLLECTION	BL	LL	MW	DW	∅ LB
II upper premolar	MPUR 1518-1	35	21.7	39.2	36	
III upper premolar	MPUR 1518-2	44.2	34.5	57.6	44.8	
IV upper premolar	MPUR 1518-3	47.8	38	63.2	51.1	
I upper molar	MPUR 1518-4	>60	40	67.2	52.2	27.8
II upper molar	MPUR 1518-5	=	45	67.1	=	27.5
III upper molar	MPUR 1518-6	61.8	=	61.7	49.2	28.4

JAW ($P^2 \div M^3$) MPUR 1519 - ROMA, unknown suburb

SPECIMEN	COLLECTION	BL	LL	MW	DW	∅ LB
II upper premolar	MPUR 1519-1	ab	ab	ab	ab	
III upper premolar	MPUR 1519-2	44.5	35.8	58.1	45.2	
IV upper premolar	MPUR 1519-3	49.8	37.8	62.6	50.9	
I upper molar	MPUR 1519-4	=	=	=	=	
II upper molar	MPUR 1519-5	66.7	=	=	=	
III upper molar	MPUR 1519-6	61.4	=	66.4	47.5	27.2

Tab. 2 - Dimensions (in mm) of the *S. kirchbergensis* (Jäger, 1839) teeth from three Rome unknown suburbs. BL = buccal length; LL =l ingual length; MW = mesial width; DW = distal width; Ø LB = max diameter of the lingual bulbous; ab = absent element.

DISCUSSION

The aim of the present work, based on morphological observations of the main distinguishing characters of the dental apparatus of *S. kirchbergensis* examined on specimens from twelve Italian localities, is that of separating *S. kirchbergensis* from other species also in order to determine the first appearance of this taxon on the Italian peninsula as well as its extinction. Obviously, this paper does not pretend to sum up all the occurrences of this taxon in Italy. The present study was also partly motivated by the fact that *S. kirchbergensis* is a still poorly known species.

According to the evidence presented above, there is no doubt that *S. kirchbergensis,* among the Plio-Pleistocene rhinoceros species, is characterized by unique odonto-morphological traits and is, therefore, one of the most distinctive species. This means that there are systematical differences between the teeth of this species and those of others.

At present, on the basis of the fossil evidence, *S. kirchbergensis* is represented in Eurasia by six skulls only (Daxlanden; Mosbach; Steinheim a. d. Murr, Germany; Husnjakovo Brdo at Krapina, Croatia; Warsaw, Poland, and "Irkutsk region", Eastern Siberia), some upper and lower jaws, and some dozens of isolated teeth.

As regards the Italian territory, the biochronology of the species is still uncertain.

The oldest *S. kirchbergensis* remains examined here seem to be those found at Ponte Molle (Di Stefano et al., 1998; Capasso et al., 1998) which may confidently be ascribed to the Isernia Faunal Unit (Middle Galerian Mammal Age) at present dated about 0.55 My BP (Petronio & Sardella, 1999; Coltorti et al., 2003).

More recent finds (Tor di Quinto and Sedia del Diavolo, Roma) on the base of the accompanying fauna may be ascribed to the Fontana Ranuccio F.U. (Galerian Mammal Age; about 0.45 My BP).

The *S. kirchbergensis* remains from Castel di Guido and Monte Sacro may belong to the Torrimpietra F.U. (Aurelian Mammal Age; Gliozzi et al., 1997).

Other remains, for which additional macro-microfaunal and/or stratigraphical data are unavailable, do not allow to infer any chronological hypothesis.

Thus, the first appearance in Italy of *S. kirchbergensis* is sufficiently constrained, whereas its disappearance cannot be dated precisely, possibly during the Late-Early

Pleistocene; in the second part of the Late Pleistocene only *S. hemitoechus* and *C. antiquitatis* are attested (Petronio et al., 2007).

S. kirchbergensis has also been recorded from other localities in Italy (Flores, 1900; de Stefano, 1899; Del Campana, 1910; Vialli, 1957), but these remains actually belong to *S. hemitoechus*.

The problem concerning the phylogenic relationship between *S. kirchbergensis* and other ancestral rhinoceros species is still unresolved. *S. megarhinus* (de Christol, 1834) has been generally considered as a very close and possible ancestor of this species, but being confined to the Early Pliocene a wide ghost range has to be assumed. Conversely, it cannot be excluded that the two species belong to the same clade without direct ancestor-descendent relationship.

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