

Vol 179

March 2008

ISSN 1040-6182

QUATERNARY INTERNATIONAL

The Journal of the International Union for Quaternary Research

QUATERNARY OF BAIKALIA: STRATIGRAPHY, PALEONTOLOGY AND PALEOENVIRONMENTS OF THE PLIOCENE-PLEISTOCENE OF TRANSBAIKALIA AND INTERREGIONAL CORRELATIONS

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Revision of the fossil material attributed to *Stephanorhinus kirchbergensis* (Jäger 1839) (Mammalia, Rhinocerotidae) preserved in the museum collections of the Russian Federation

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Available online 26 September 2007

Abstract

The present work is devoted to the revision of the fossil remains ascribed to *Stephanorhinus kirchbergensis* (Jäger 1839), better known in Russia as “nosorog Merka”, found on Russian territory and preserved in the museum collections of the Russian Federation. A great amount of palaeontological material has been studied using morphological and non-metric characters. Unfortunately, a large part of the fossil material cited in the literature and ascribed to this taxon had not been traced. In any case, the rarity of this species, despite its being widely spread throughout the Eurasian continent, is apparent in Russian territory as well as in the European area. *S. kirchbergensis* is a rhinoceros still little investigated, and consequently, not well known yet. A brief history of *S. kirchbergensis* is also added.

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1. Introduction

According to the literature, within Russian territory *Stephanorhinus kirchbergensis* (Jäger, 1839), better known in Russia as “nosorog Merka” (literally, Merck’s rhinoceros), has been found in at least 21 localities, 18 in the Russian-European area and three in the Russian-Siberian area. A recent revision performed on the fossil material attributed to this species, preserved in the Russian museum collections, established that at present remains ascribed to *S. kirchbergensis* are available from six of these localities only: four in the Russian-European area (Samara, Saratov, Astrakhan’, and Volgograd regions) and two in the Siberian area (Irkutsk region and Sakha Republic [Yakutya]). Two other localities in European Russia (in the Republic of Tatarstan and in the Astrakhan’ region) have yielded remains, previously assigned to *S. kirchbergensis*, which have *ex novo* been attributed to other Pleistocene rhinoceros species by the author. Unfortunately, in the other 13 localities (12 in the Russian-European area and only one in Siberia), where remains ascribed to *S. kirchbergensis* have also been found, the material is not traceable.

Other rhinoceros fossil material, discovered in the museum collections during revision work, has *ex nihilo* been ascribed to *S. kirchbergensis* by the author. Remains came to light at three other localities in southeast Western Siberia (one in the Tomsk region and two in the Kemerovo region). Finally, in Russian museum collections, some other remains attributed to *S. kirchbergensis*, even if not discovered on Russian territory, are also available.

1.1. Abbreviations for museum collections

The following abbreviations are used in the text:

GIN RAS	Institute of Geology, Russian Academy of Science, Moscow
GMM KGU	Museum of Geology and Mineralogy, Kazan’ State University, Kazan’
KKM	Regional Ethnographic Museum, Kemerovo
OIGGM SB	Institute of Geology-Geophysics-Mineralogy, Russian Academy of Science (Siberian Branch), Novosibirsk
RAS	
PIN RAS	Palaeontological Institute, Russian Academy of Science, Moscow
PMK	Regional Ethnographic Museum, Pugachev
PM TGU	“V.A. Kakhlov” Palaeontological Museum, Tomsk State University, Tomsk

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RAS	Russian Academy of Science
SOIKM	“P.V. Alabin” Regional Historical-Ethnographic Museum, Samara
SB RAS	Siberian Branch of the Russian Academy of Science
TGU	Tomsk State University, Tomsk
ZIN RAS	Zoological Institute, Russian Academy of Science, St-Petersburg
ZMSU	Zoological Museum, Institute of Pedagogy, Smolensk State University, Smolensk

2. The species

2.1. Synonymy

The Pleistocene “tandem-horned” Eurasian interglacial rhinoceros *S. kirchbergensis* (Jäger, 1839) has been previously identified, during the last two centuries, 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

2.2. Taxonomical position

Its taxonomical position is the following:

Ordo	Perissodactyla	Owen 1848
Subordo	Ceratomorpha	Wood 1937
Superfamilia	Rhinoceroidea	Gill 1872
Familia	Rhinocerotidae	Owen, 1845
Subfamilia	Dicerorhininae	Simpson 1945 (= Dicerorhinae Osborn)
Tribus	Dicerorhinini	Loose 1975
Genus	<i>Stephanorhinus</i>	Kretzoi 1942
Species	<i>kirchbergensis</i>	Jäger 1839

2.3. *Stephanorhinus kirchbergensis* (Jäger, 1839): an account of the species

In monographs, the Plio-Pleistocene European rhinoceroses, *Coelodonta antiquitatis* (Blumenbach, 1799) and

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

S. kirchbergensis has very often diagnostically been confused, and the same situation survives *de facto* at present, with other rhinoceros species, particularly with *Stephanorhinus hemitoechus* (Falconer 1868) and *C. antiquitatis*. Apparently, there are some similarities with these two species, at least as regards some postcranial skeletal features. Again, many authors also misidentified *S. kirchbergensis* as *Stephanorhinus etruscus* (Falconer 1868), *Stephanorhinus hundsheimensis* (Toula 1902), *Stephanorhinus jeanvireti* (Guérin 1972) [= *Rhinoceros etruscus* Falc. var. *astensis* Sacco, 1895], *Stephanorhinus megarhinus* (de Christol, 1834), and others (Billia, 2005, in preparation). As well, many palaeontologists believed that *S. kirchbergensis* and *S. hemitoechus* represented a single species. In spite of the progress attained during the past decades, many nomenclatural and taxonomical problems incontestably still exist.

On the other hand, Loose (1975) seized the opportunity to emphasize that “... any publications in which the name *Rhinoceros* (or *Dicerorhinus*) *merckii* is used, should be read with the utmost caution.” Contemporary palaeontologists contribute to perpetuate this deprecable “tradition” from paper to paper, from handbook to handbook. One of the basic problems is represented by the fact that too often the diagnoses are based exclusively on postcranial remains, so that errors of identification among the species are frequently possible, whereas the attribution by means of teeth is unequivocal.

The author’s personal opinion is in favor of the wide agreement, as Heissig (1981) previously asserted, that the rhinoceroses are a highly stereotyped group with little morphological divergence. In other words, morphologically, substantial intraspecific differences and, conversely, interspecific likenesses may usually be found among them.

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 absolutely gigantic (“the biggest *Dicerorhinus* which had ever lived on the planet”), although Loose (1975) has vigorously rejected this thesis. However, anatomically, *S. kirchbergensis* has a very elongated half-high posture skull (as a browser, even if it also shows characteristics of a potential grazer) with an ossified *septum nasale* only in its anterior portion. The *mandibula* shows a long symphysis, and a horizontal high, heavy, and thick branch with a very brachyodont dentition. The graviportal postcranial skeleton, with big and long bones, morphologically suggests a demi-cursorial animal. Judging the reconstructions of the species, the one made by Flerov et al. (1955) (Fig. 1) seems to be very close to reality.

The range of *S. kirchbergensis* would include a large part of the Eurasian continent, in this context excluding the area situated at high latitudes, save only one case, in Siberia (Dubrovo, 1957), and the islands of the Mediterranean. In spite of the vastness of this area, at present, on the basis of the fossil evidence, *S. kirchbergensis*, unlike other Plio-Pleistocene rhinoceroses, “woolly rhino” included, which abound in Eurasia, seems to be decidedly rare on this territory. Recognized as a Middle Pleistocene species in Europe, it is reported from relatively few Italian, French, German, British, and East-European localities (Hinton, 1902; Schroeder, 1903, 1905, 1930; Toula, 1907; Wüst, 1909, 1911, 1914, 1922; Gorjanovich-Kramberger, 1913; Freudenberg, 1914; Rakovec, 1933, 1958; Simionescu, 1939–40; Staesche, 1941; Zeuner, 1945; Adam, 1958; Czyzewska, 1962; West et al., 1964; Malez, 1970, 1986; Samson and Nadisan, 1970; Mayer, 1971; Kahlke, 1977, 1978, 1984; David, 1980; Guérin, 1980; Groiss et al., 1981; Fortelius et al., 1993; Billia, 2005, in preparation).

As to the territories previously included in the ex-Soviet Union, *S. kirchbergensis* is certainly indicated by 12 isolated teeth coming from the village of Koshkurgan near Turkestan (Karatau Mountain, Chimkent region, South-Eastern Kazakhstan) (Khisarova, 1963). Some other remains possibly referable to the same species come from some other localities of Kazakhstan (Kozhamkulova, 1981; Kozhamkulova and Kostenko, 1984; Tleuberdina et al., 1990), from two localities of Tajikistan (Sharapov, 1980; Dmitreva and Nesmeyanov, 1982), and from Azerbaijan (Alev, 1969).

Reports from South-East Asia are also known. In Central Korea (Lee, 2001), the species is represented by a very-well preserved *mandibula* and some long bones. *S. kirchbergensis* is also attested from four Chinese provinces (Teilhard de Chardin and Pei, 1941; Wang, 1961; Xu, 1986; Fu, 2002).

Some authors also refer to the presence of *S. kirchbergensis* in the Middle-East: at Ksar’ Akil (Lebanon) and at Tabun-Mont Carmel (Israel) (Hooijer, 1961), at Jissr Banat Yakub (Bar-Yossef and Chernov, 1972). Nevertheless, these obviously will have to be attentively evaluated as there are possibilities of misidentifications with other local species.

Unfortunately, both cranial and postcranial easily datable remains are, *de facto*, very few.

3. *S. kirchbergensis* (Jäger, 1839) remains in Russian Museum collections: materials and localities

3.1. European Russia

Remains ascribed to *S. kirchbergensis* from European Russia are available in the following four localities:

- at Samara (ex-Kuybishev, Samara region; about 53°N–50°E) (Strizheva, 1991). The remains, a fourth upper premolar (SOIKM 5561/1) (Fig. 2(a)) and a second upper molar (SOIKM 5561/2), found in 1932 under the “uliza Pugachevskaya” (Pugachev street), in addition to five teeth of *C. antiquitatis*, are preserved at the Regional Ethnographic Museum “P.V. Alabin” at Samara. No stratigraphic data are available;
- from the right bank of the Bol’shoy Uzen’ river (about 50°40’N–48°05’E), about 4 km northwest of Kurilovka (Novouzen’ district, Saratov region) (Belyaeva, 1935; Gromova, 1935). The *mandibula* 110 (Fig. 2(b)) found in 1929, formerly at the Ethnographic museum of Pugachev (Saratov region), is at present preserved at the Palaeontological Museum of the Russian Academy of



Fig. 1. Reconstruction of *Rhinoceros mercki* Jäger, 1839 (= *S. kirchbergensis* [Jäger, 1839]) after Flerov (1955).

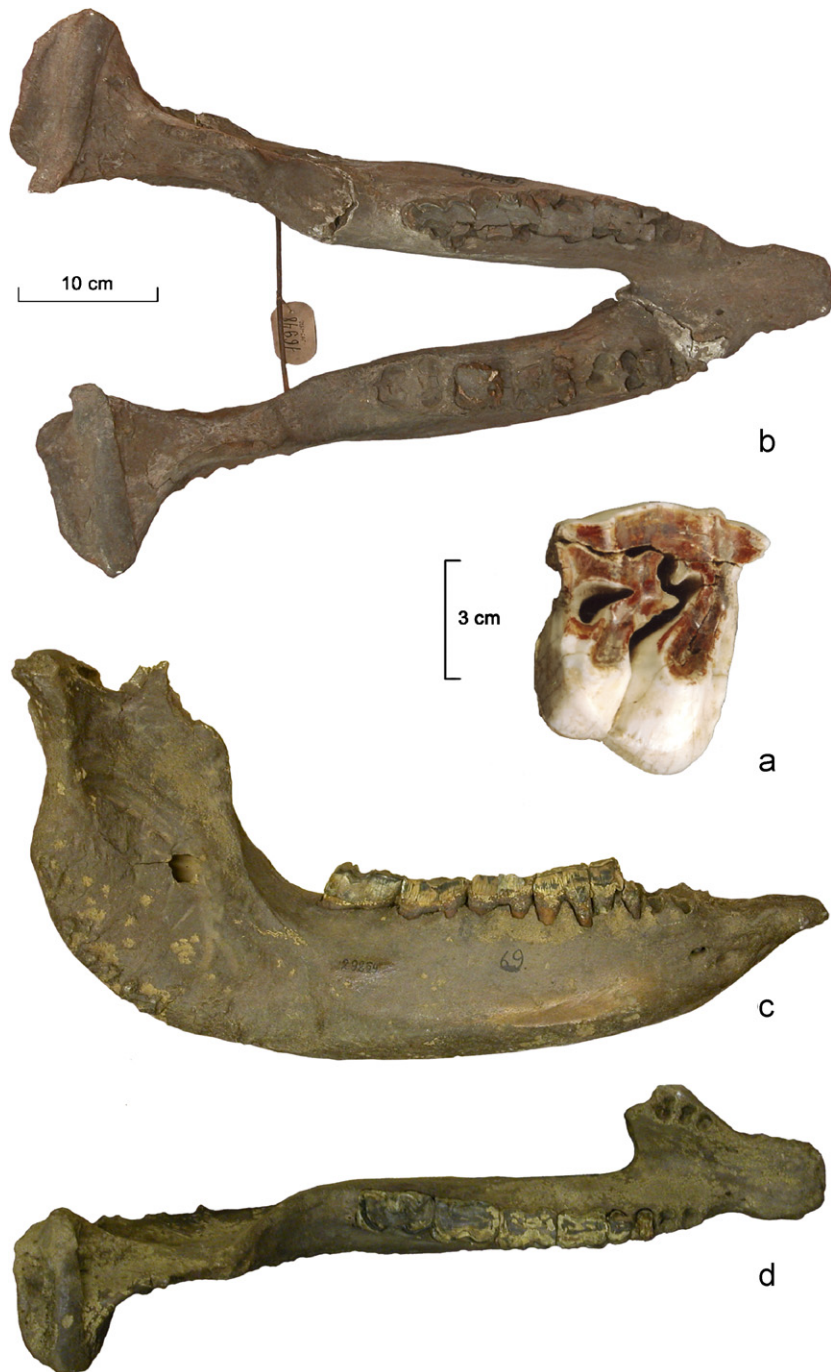


Fig. 2. *Stephanorhinus kirchbergensis* (Jäger, 1839). Samara (ex Kuybishev, Samara region, European Russia), uliza Pugachevskaya (Pugachev street): (a) fourth upper premolar [SOIKM 5561/1], occlusal view—Volga, between Cherny Yar and Nizhnee Zaymishche (Astrakhan' region, European Russia); (b) *mandibula* [ZIN RAN 16948], occlusal view; *hemimandibula* [ZIN RAN 29854], (c) lateral view and (d) occlusal view.

Science (PIN RAN) in Moscow. Stratigraphic data are uncertain (Likhvinsky gorizont? [Eastern European stratigraphy] = Mindel-Riss?; OIS 11?);

- from the right bank of the Volga, between the villages of Cherny Yar and Nizhnee Zaymishche (Astrakhan' region; about 48°05'N–46°10'E) (Gromova, 1935). Two remains found in 1929: the full *mandibula*, correctly reported by Gromova as ZIN 16948 (Fig. 2(c)), which in the literature is often erroneously cited as GIN 16948,

and the *hemimandibula* (ZIN 29854; without number in Gromova, 1935) (Fig. 2(d)), formerly in the Astrakhan' Ethnographic museum collections. Both of the rather damaged remains, previously attributed by Gromova (1935) to *R. mercki* Jaeger, are now at the Zoological Museum of the Russian Academy of Science (ZIN RAN) in St-Petersburg. Stratigraphically, the author suggested the Likhvinsky gorizont (Eastern European stratigraphy = Mindel-Riss; OIS 11) for both the

remains. *S. kirchbergensis* is included here in the so-called “Khazarskaya Fauna”;

- near the Podosinik village (Volgograd region), a fragmentary horizontal branch of a mandible (GIN 839-3) (unpublished material), was found by a farmer (Aleksandr Krotkov) in 1939; no more data are available. The remains are preserved at the Geological Institute of the Russian Academy of Science (GIN RAN) in Moscow.

In the four cases, no accompanying faunal complexes are mentioned.

3.2. Siberia

As far as Siberia is concerned, remains ascribed to *S. kirchbergensis* are available from the following five localities (specimens *ex nihilo* assigned to *S. kirchbergensis* by the author included):

- along the right bank of the Ob', at Krasny Yar village (about 57°05'N–84°30'E), in front of the Sargulin island (Krivosheino district, Tomsk region, southeast Western Siberia), about 110 km north of Tomsk (Billia and Shpansky, 2005). Here, during recent excavations in the brown quartz-arkose medium-grained Tobol'sky gorizont level sands (Siberian stratigraphy = Likhvinsky gorizont, in the Eastern-European stratigraphy = Holstein, in the Western-European stratigraphy; OIS 11), relatively abundant material has been unearthed: a second upper molar (PM TGU 5/1251), a fourth upper premolar (PM TGU 5/2878), a first and a second lower molar (PM TGU 5/1087 and PM TGU 5/1067), a fourth upper deciduous molar (PM TGU 5/2883), and a third metacarpal (PM TGU 5/2723) (Fig. 3(a–g)), together with other faunal skeletal remains found in the same level and referred to *Mammuthus* ex gr. *trogontherii-chosaricus*, *Bison priscus* Boj. 1827, and *Equus* ex gr. *mosbachensis-germanicus*. All of the material is preserved at the Palaeontological museum “V.A. Khakhlov” of the Tomsk State University;
- along the right bank of the Inya River, near an industrial railway station (“Promyshlennaya Stanzya”) (about 54°50'N–85°30'E), 58 km south–west of Kemerovo and 45 km north–west of Leninsk-Kuznetsky (Kuznetsk basin, Kemerovo region, southeast Western Siberia) (Billia, this volume). Here, in an outcrop, only one well-preserved, large, and remarkably brachyodont isolated third upper molar (KKM-PU 82) showing a lingual bulb of uncommon dimensions (max diameter 37.5 mm) (Fig. 3(h)) was discovered in 1964. Unfortunately, no stratigraphic data are available. The remains are preserved at the Kemerovo Regional Ethnographic museum;
- at Mokhovo (about 54°30'N–86°10'E), in the Meret' river Valley, about 20 km east of Leninsk-Kuznetsky (Kuznetsk basin, Kemerovo region, southeast Western Siberia) (Billia, this volume). Excavations in the lower part of one (thickness about 5.5 m) of the nine formations, the Berezovskaya Formation (Berezovskaya svita, in the local stratigraphy = Shirtinsky gorizont, in the Western-Siberian stratigraphy = Odinzovsky gorizont, in the Eastern-European stratigraphy = Holstein, in the Western-European stratigraphy; OIS 7), have yielded a great number of fossil skeletal remains (Foronova, 2001) ascribed to *Panthera spelaea* (Goldf., 1810), *Cervus elaphus* L. 1758, *Megaloceros giganteus* (Blum., 1803), *B. priscus* Boj. 1827, *Rangifer tarandus* L. 1758, *Equus* sp., *Ursus* cf. *U. arctos* L. 1758, *Mammuthus* cf. *M. intermedius* (Jourdan, 1861) (a transitional form with morphological features between *M. chosaricus* Dubrovo 1966 and primitive forms of *M. primigenius* [Blum., 1799]); among them, two *S. kirchbergensis* isolated upper molars (a third [OIGGM 9226] and a second [OIGGM 9242]) (Fig. 3(i)) have also been unearthed. All these taxa are included in the so-called “Tatarskaya Fauna”. On the basis of the faunal composition, the formation of the unit may be placed between the Shirta interglacial and the second half of the Saalian glacial (Foronova, 2001). The remains are in the collections of the Institute of Geology, Geophysics and Mineralogy of the Russian Academy of Science (Siberian Branch) in Novosibirsk;
- along the left bank of the Vilyuy river (about 63°47'N–120°55'E), close to its confluence with the Chebydy river, between the Verkhne-Vilyuysk and Vilyuysk villages (Yakutya region [Sakha Republic], northeast Eastern Siberia), a fourth upper premolar [PIN RAN 750/139] and a second upper molar [PIN RAN 750/140] (Fig. 3(l, m)) have been discovered, in 1951, by Dubrovo (1957), together with a fragmentary molar of *Parelephas wuesti* (Pavlova, 1914). As to the stratigraphy, the same author (personal communication) recently suggested the Shaytansky gorizont (Western-Siberian stratigraphy = Oksky gorizont, in the Eastern-European stratigraphy = Elster, in the Western-European stratigraphy; OIS 13); again, the rather well-preserved teeth (collections of the Palaeontological Institute of the Russian Academy of Science [PIN RAN] in Moscow) may be referred to the “Tiraspol'sky Faunistichesky Kompleks” (Tiraspol' Faunal Complex). In any case, because of its extraordinary latitude (close to 64°N), this currently represents the farthest find of *S. kirchbergensis*.
- from an unknown locality in the Irkutsk region (southwest Eastern Siberia) (Chersky, 1874; Brandt, 1877; Billia, this volume) comes a skull (ZIN 10718) (Fig. 4(a–c)), unfortunately, without upper teeth and mandible. Previously summarily described by Chersky (1874), and later by Brandt (1877), as “*R. Merckii* Jaeger 1839” (*sic*), it represents the only skull which has come to light and existing on Russian territory and is one of the five assigned to this species discovered at present in the whole of Eurasia. At first, it was placed in the collections (no. 26) of the Irkutsk Regional Ethnographic museum. Later, for a long time, it has



Fig. 3. *Stephanorhinus kirchbergensis* (Jäger, 1839). Ob' at Krasny Yar (Tomsk region, southeast Western Siberia): (a) second upper molar [PM TGU 5/1251], (b) second lower molar [PM TGU 5/1067], (c) fourth upper premolar [PM TGU 5/2878], (d) first lower molar [PM TGU 5/1087], (e) fourth upper deciduous molar [PM TGU 5/2883], occlusal views; third metacarpal [PM TGU 5/2723], (f) cranial view and (g) medial view—Inya river (Kuznetsk Basin, Kemerovo region, southeast Western Siberia); (h) third upper molar [KKM-PU 82], occlusal view—Mokhovo (Kuznetsk Basin, Kemerovo region, southeast Western Siberia); (i) third [OIGGM 9226] and second [OIGGM 9242] upper molars, occlusal views—Vilyuy river, close to its confluence with the Chebydy river, between Verkhne-Vilyuysk and Vilyuysk (Yakutya region [Sakha Republic], northeast Eastern Siberia); (l) fourth upper premolar [PIN RAN 750/139] and (m) second upper molar [PIN RAN 750/140], occlusal views.

not been traceable. Recently, the author found it in a vault of the Zoological Institute of the Russian Academy of Science in St-Petersburg, provided with the wrong label “ZIN 10817”.

Fig. 5 shows the geographic localization of the nine sites on Russian territory where the available remains of *S. kirchbergensis* have been found. A detailed list of the specimens, their measurements, and localities is given in Tables 1–4.

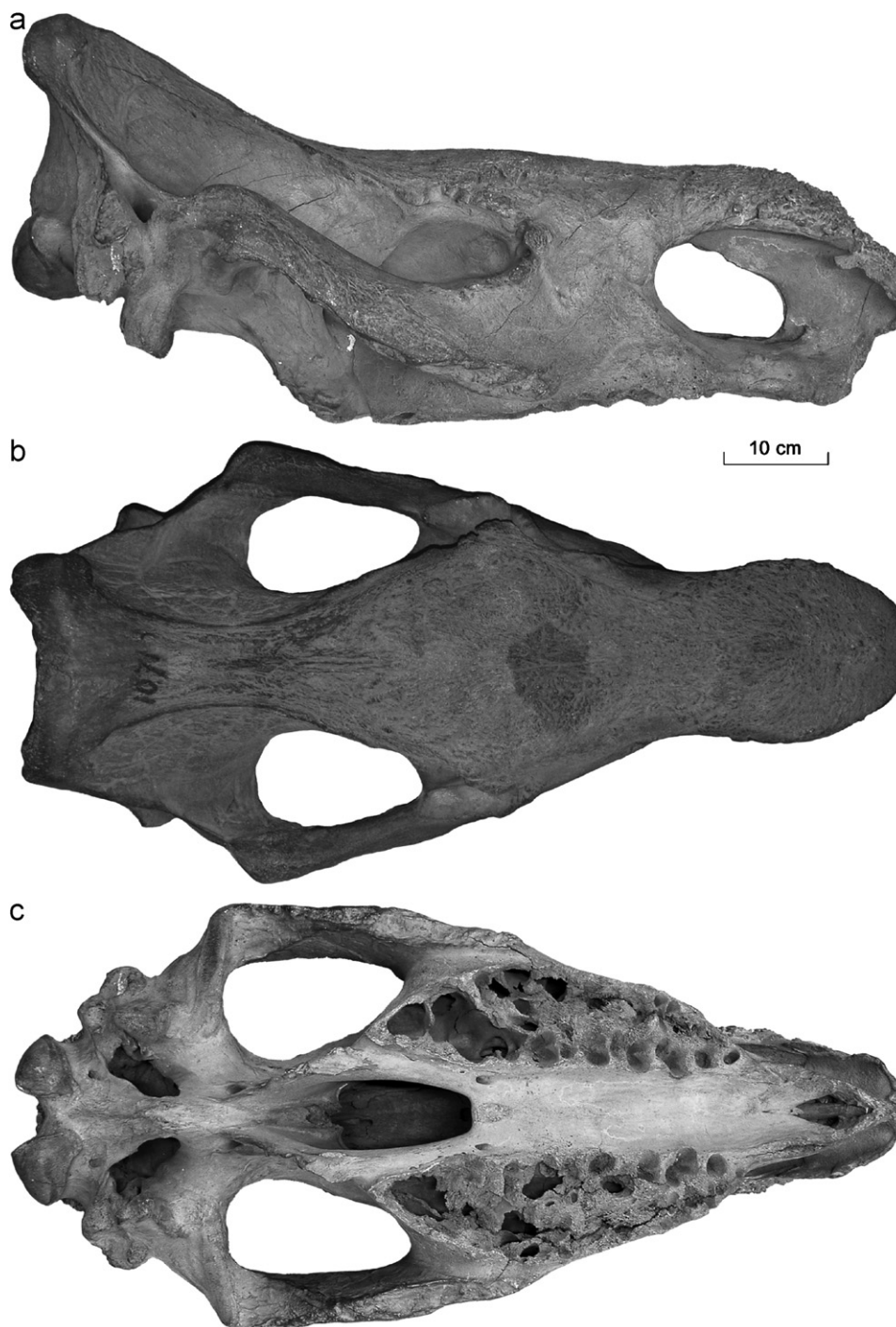


Fig. 4. *Stephanorhinus kirchbergensis* (Jäger, 1839). Irkutsk region (southwest Eastern Siberia); skull [ZIN 10718]: (a) lateral view, (b) vertical view and (c) basal view.

4. Material *ex novo* attributed to other Pleistocene rhinoceros species

The following material has *ex novo* been attributed to other Pleistocene rhinoceros species by the author:

- the mandible (GMM KGU 1930) from the right bank of the Kama river near Mysy Layshevsky (Republic of Tatarstan, European Russia), erroneously referred to *R. mercki* Jaeger by Gromova (1932, 1965) and Alekseeva (1977), must be attributed to *C. antiquitatis*;
- the hemimandibula (ZIN RAN 16290, in the literature often erroneously cited as GIN 16290 or GIN 16948) from the right bank of the Volga near Nikol'skoe (Astrakhan' region, European Russia), previously referred to *R. mercki* Jaeger by Gromova (1932, 1965), must be attributed to *S. etruscus* (Falc. 1868).



Fig. 5. Geographic localization of the nine sites on Russian territory where available remains of *S. kirchbergensis* have been found: 1. Samara; 2. Bol'shoy Uzen' river near Kurilovka; 3. Volga near Cherny Yar, Podosinik near the Volga; 4. Ob' at Krasny Yar; 5. Inya river and Mokhovo (Kuznetsk Basin); 6. Irkutsk region; 7. Vilyuy river.

Table 1
Dimensions (in mm) of the *S. kirchbergensis* (Jäger) available teeth from five Russian localities

N	Specimen	Collection	BL	LL	MW	DW	Locality	Preservation site	References	T.F.
1	IV upper premolar	SOIKM 5561/1	52	43.5	65	56.5	Samara, Pugachev street, Samara region	"P.V. Alabin" museum, Samara	Strizheva, 1991	2-a
2	II upper molar	SOIKM 5561/2	66	52.5	74.5	70.5	Samara, Pugachev street, Samara region	"P.V. Alabin" museum, Samara	Strizheva, 1991	–
3	II upper molar	PM TGU 5/1251	=	63.2	=	=	Ob' at Krasny Yar, Tomsk region	"V.A. Khakhlov" museum, Tomsk	Billia & Shpansky, 2005	3-a
4	IV upper premolar	PM TGU 5/2878	46.1	41.2	64.5	40.4	Ob' at Krasny Yar, Tomsk region	"V.A. Khakhlov" museum, Tomsk	Billia & Shpansky, 2005	3-b
5	I lower molar	PM TGU 5/1087	>54	=	36.5	38.7	Ob' at Krasny Yar, Tomsk region	"V.A. Khakhlov" museum, Tomsk	Billia & Shpansky, 2005	3-c
6	II lower molar	PM TGU 5/1067	=	60.6	41.2	42.4	Ob' at Krasny Yar, Tomsk region	"V.A. Khakhlov" museum, Tomsk	Billia & Shpansky, 2005	3-d
7	IV upper d. molar	PM TGU 5/2883	61.2	=	=	44.1	Ob' at Krasny Yar, Tomsk region	"V.A. Khakhlov" museum, Tomsk	Billia & Shpansky, 2005	3-e
8	III upper molar	KKM-PU 82	71.2	69.4	=	62.5	Inya river, Kuznetsk basin, Kemerovo region	Kemerovo Reg. Ethnogr. museum	Billia, this volume	3-h
9	III upper molar	OIGGM 9226	72.6	73.1	=	67.3	Mokhovo, Kuznetsk basin, Kemerovo region	OIGGM SB RAS, Novosibirsk	Billia, this volume	3-i
10	II upper molar	OIGGM 9242	66.2	=	=	69.8	Mokhovo, Kuznetsk basin, Kemerovo region	OIGGM SB RAS, Novosibirsk	Billia, this volume	3-i
11	IV upper premolar	PIN 750/139	45.1	32.5	56.2	52	Vilyuy river, Verkhne-Vilyuysk-Vilyuysk, Yakutya	PIN RAS, Moscow	Dubrovo, 1957	3-l
12	II upper molar	PIN 750/140	59.2	36.1	66.4	64.2	Vilyuy river, Verkhne-Vilyuysk-Vilyuysk, Yakutya	PIN RAS, Moscow	Dubrovo, 1957	3-m

BL: buccal length; LL: lingual length; MW: mesial width; DW = distal width; T.F.: text figure.

Table 2
Dimensions (in mm) of the *S. kirchbergensis* (Jäger) available odonto-osteological material from three Russian localities

N	Specimen	Collection	ML	MW	MH	Locality	Preservation site	References	T.F.
13	Mandibula	110	> 520	341	219	Bol'shoy Uzen' river near Kurilovka, Saratov region	PIN RAS, Moscow	Belyaeva, 1935; Gromova, 1935	–
14	Mandibula	ZIN 16948	603	418	332	Volga (Ch. Yar–Nizhnee Zaym.), Astrakhan' region	ZIN RAS, St-Petersburg	Gromova, 1935	2-b
15	Hemimandibula	ZIN 29854	581	=	=	Volga (Ch. Yar–Nizhnee Zaym.), Astrakhan' region	ZIN RAS, St-Petersburg	Gromova, 1935	2-c, d
16	Fr. hemimandibula	GIN 839-3	389	=	=	Podosinik village, Volgograd region	GIN RAS, Moscow	unpublished	–

ML: max length (in sagittal plane); MW: max width; MH: max height; T.F.: text figure.

Table 3
Dimensions (in mm) of the *S. kirchbergensis* (Jäger) postcranial material from Ob' at Krasny Yar, Tomsk region (Western Siberia)

N	Specimen	Collection	ML	APD	TD	APDde	TDde	TDdj	mTDd	Locality	Preservation site	References	T.F.
17	third metacarpal	PM TGU 5/2723	229	56	62	55.6	80.3	64.2	61.4	Ob' at Krasny Yar, Tomsk region	“V.A. Khakhlov” museum, Tomsk	Billia and Shpansky, 2005	3-f, g

ML: max length (in sagittal plane); APD: antero-posterior diameter of the proximal epiphysis; TD: transverse diameter of the proximal epiphysis; APDde: antero-posterior diameter of the distal epiphysis; TDde: transverse diameter of the distal epiphysis; TDdj: transverse diameter of the distal joint; mTDd: min transverse diameter of the diaphysis; T.F.: text figure.

Table 4
Dimensions (in mm) of the *S. kirchbergensis* (Jäger) ZIN 10718 skull from the Irkutsk region (Eastern Siberia)

A	Max length (= max length <i>occipito-nasale</i>) ^a	832
B	Max length <i>condilus occipitalis-rhinion</i>	798
C	Max length of the nasal aperture (dx ≅ sx)	260
D	Min length nasal aperture/ <i>orbita ocularis</i>	135
E	Min transversal diameter at the <i>costritio post-orbitaria</i>	119
F	Length of the space occupied by the dental alveoli (dx ≅ sx)	310
G	Max width of the <i>arcus zygomatici</i>	390
H	Min width of the <i>faces occipitalis</i> ^b	204
I	Medial height of the <i>faces occipitalis</i>	251
L	Ext. max transversal diameter of the <i>condili occipitales</i>	154
M	Max transversal diameter of the <i>foramen magnum</i>	49
N	Max width of the <i>faces occipitalis</i> ^c	273

ZIN RAS, St-Petersburg (Chersky, 1874; Brandt, 1877; Billia, this volume) (Fig. 4(a–c)).

^aHorizontally measured, along the sagittale plane (*rhinion/crista occipitalis*).

^bMeasured at the exterior rims of the *crista occipitalis*.

^cMeasured outwardly at the mastoid apophyses.

5. *S. kirchbergensis* (Jäger, 1839) untraceable remains: material and localities

In the literature, 13 other Russian localities in which remains ascribed to *S. kirchbergensis* have been found are also mentioned, but unfortunately, at least at present, the

material is not traceable. Twelve of these are situated in European Russia and one in Siberia.

5.1. European Russia

In this area, no *S. kirchbergensis* remains are available in the 12 localities specified in the following list:

- on the right bank of the Dnepr near Vysokoe (about 54°42'N–32°15'E), 15 km south–east of Smolensk (Smolensk region), odonto-osteological material (n.n.) was found. Preserved at the Zoological museum of the Smolensk State University (ZMSU), it has *in toto* irremediably been lost during the Nazi occupation in 1941 (Salov, 1957);
- along the right bank of the Sheksna river, near the brick kiln “Trudovik” (about 58°05'N–38°50'E), 12 km from Rybinsk (Yaroslavl' region), a forearm (PIN 113a) was recovered in anatomical connection (Belyaeva, 1940);
- along the Moscow-Volga canal (about 56°25'N–37°30'E), about 70 km north of the Moscow centre (Dmitrov district, Moscow region), a mandible (n.n.) was discovered (Belyaeva, 1939; Gromova, 1965);
- from Podol'sk (about 55°30'N–37°30'E), about 40 km south of the Moscow centre (Moscow region), came a mandible fragment (PIN 326) (Belyaeva, 1940);
- near the village of Shchigry (about 51°50'N–36°50'E), 55 km north-east of Kursk (Kursk region), an isolated

first upper molar (PIN 725) has been discovered (Belyaeva, 1940);

- on the right bank of the Volga (about 53°30'N–49°05'E), 11 km south–west of the village of Khryashchevka and 2 km west of the mouth of the Bol'shoy Cheremshan river (Tungus peninsula, Samara region), a *radius* (PIN 131/293) and an *os carpale* (PIN 131/27–28) have been recovered (Gromova, 1932, 1935; Belyaeva, 1939);
- on the bank of the Volga, in front of the village of Alekseevka (about 52°15'N–48°10'E), 23 km south of Khvalynsk and about 50 km north–east of Volzhsk (Khvalynsk district, Khoroshevsky island, Saratov region), an isolated tooth (PIN 2212) was found (Belyaeva, 1935);
- from the Bol'shoy Igriz river, 2 km from the Klevenka village (about 52°10'N–49°05'E) (Ivanteevo district, Saratov region), come a distal epiphysis of *radius* (n.n.) and a proximal epiphysis of *ulna* (n.n.), found together with remains referred to *Mammuthus* sp., *C. antiquitatis* (Blum. 1799), *B. priscus* Boj. 1827, and *Ursus spelaeus rossicus* Borisiak 1930 (Belyaeva, 1935);
- from the left bank of the Kamelik river (about 51°55'N–49°15'E), 2 km from Rozhmanovka, at the border between the districts of Pugachev and Perelyub (Saratov region), come a *magnum* (n.n.), a second metacarpal (n.n.), and a third metatarsal (n.n.) found, in 1928, by Zhuralev together with remains assigned to *B. priscus longicornis* Gromova 1935 and *M. giganteus* (Blum.). Formerly, the remains were at the Ethnografic museum in Pugachev (Belyaeva, 1935);
- from the right bank of the Kamelik river (about 52°05'N–49°20'E), 3 km north of Tarasovka (Pugachev district, Saratov region), come a *magnum* (n.n.), a trapezoid (n.n.), and an unciforme (n.n.) found together with remains of *Mammuthus* sp. and *Vulpes* sp. Formerly, the fossil material was at the Ethnografic museum in Pugachev (Belyaeva, 1935);
- along the right bank of the Sestra river (about 52°05'N–49°30'E), very close to the village of Cheremukhova Krucha (Perelyub district, Saratov region), a fourth metacarpal (n.n.) has been found, in the years 1925–1930, by Zhuralev together with remains attributed to *Elasmotherium sibiricum* Fischer v. Waldheim 1808. Formerly, the remains, which are included in the so-called “Khazarskaya Fauna”, were in the collections of the Ethnografic museum in Pugachev (Belyaeva, 1935);
- from the Girey quarry (about 45°05'N–38°30'E), in the Kuban' river basin (Krasnodar region, Northern Caucasus), an isolated lower molar (n.n.) was recovered together with remains of *Mammuthus primigenius* (Blum.), *Mammuthus* aff. *M. trogontherii* (Pohlig), *C. antiquitatis* (Blum.), *Megaloceros* sp., *B. priscus deminutus* Gromova, *B. priscus* cf. *B. p. longicornis* Gromova, and *Elephas wuesti* M. Pavlova (= *Elephas trogontherii meridionalis*) (Kolbutov, 1935–36; Gromov, 1948).

5.2. Siberia

As far as the Siberian area is concerned, the unavailable *kirchbergensis* remains consist of the 17 isolated upper teeth (8, 61, 63, 64, 65, 1788, 1789, 2952, etc.) found by Alekseeva (1980) on a small beach along the right bank of the Ob' (about 57°10'N–84°27'E) near Krasny Yar, about 120 km north of Tomsk (Krivosheino district, Tomsk region, southeast Western Siberia).

6. *S. kirchbergensis* (Jäger, 1839) remains in Russian Museum collections from localities outside Russia

In the Russian museum collections, material attributed to *S. kirchbergensis* found outside Russian territory is also available:

- an *hemimandibula*, of great dimensions (ZIN 10743), outcropping near the confluence of the Liur river with the Bug river, not far from the town of Kamieniec-Mazowiecki (Central-Eastern Poland), previously described by Brandt (1877) and preserved at the ZIN (Zoological Institute, Russian Academy of Science, St-Petersburg);
- twelve isolated teeth coming from the Koshkurgan village, 14.5 km north–east of Turkestan (Karatau Mountain, Chimkent region, South-Eastern Kazakhstan) (Khisarova, 1963); in detail: four upper molars (M¹, 760-33/55-K; M², 5/55-K; M³, 729-14/55-K; M³, 2/55-K), three lower premolars (P₂, 758-32/55-K; P₂, 757-33/55-K; P₃, 759-35/55-K), and five lower molars (M₁, 755-31/55-K; M₂, 756-32/55-K; M₂, 753-29/55-K; M₃, 754-30/55-K; M₃, 17/56-K) preserved at the Gorny Institut (Institute of Mines) in St-Petersburg.

7. Discussion

7.1. On the *S. kirchbergensis* dentition

Considering the fact that the material examined here essentially consists of odontological specimens, some remarks on the dental features of *S. kirchbergensis* are expedient. The odontological characters are listed together since the same patterns may be observed on all of the remains.

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

On 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. 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 teeth typology with wide superpositions in comparison with those of other rhinoceroses species. For this reason, biometry has to be considered (and used) very cautiously.

7.1.1. Upper dentition

The upper teeth (particularly the molars) are much higher buccally than lingually. From the occlusal view, the ectolophe of both the first and the second molar is rather similar to that of *S. hemitoechus*. Nevertheless, 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 ectolophe in *S. kirchbergensis* appears to be “softer”. In comparison with other rhinoceros species, the premolars are mesially considerably broad (and, by comparison, lingually relatively short). The folds of the ectolophe are shallow, the anterior valleys are very narrow; the ectolophe, mesially, and, often, also distally, curves strongly towards the inside of the tooth. In both the molars and the premolars, the protolophes and the metalophes show a remarkable bulbosity which, particularly on the second molar, may be of considerable dimensions. However, these dimensions are not related to those of the tooth.

7.1.2. Lower dentition

In contrast with the upper jaw, significant differences between molars and premolars cannot be observed in the lower dentition, the lower premolars being much more molarized than the upper ones. Thus, when molars and premolars are isolated, it may often be problematic to distinguish from each other. However, their valleys are always drastically reduced in comparison with those of other rhinoceros species.

7.2. Rarity of the *kirchbergensis* species

The material considered here may be assigned, on the whole, to the Middle Pleistocene. The rarity of *S. kirchbergensis*, though widely spread in Eurasia, has been witnessed on Russian territory as well as in the European area. The reasons of this rarity have not been unraveled yet. According to Loose (1975), it may probably be due to two reasons: its ecological niche was unfavorable for its fossilization or it was really a rare animal. The author inclines to the second hypothesis. At present, *S. kirchbergensis* is a rhinoceros still little investigated, and consequently, not well known as yet.

Acknowledgments

My long stay in Russia has partly been financed by NATO. I am greatly indebted to all the Directors, Staff, and Personalities of so many Russian Institutions and

Museums, which I have visited and where I was a very difficult and demanding guest.

I am very much indebted, and particularly grateful, to all my Russian Friends and Colleagues – who overwhelmed me with their typical Russian attentions, hospitality and availability – for having very kindly and generously dedicated their time in supporting my research in all possible ways, for allowing access to the rhinoceros collections, and for providing valuable comments and suggestions.

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