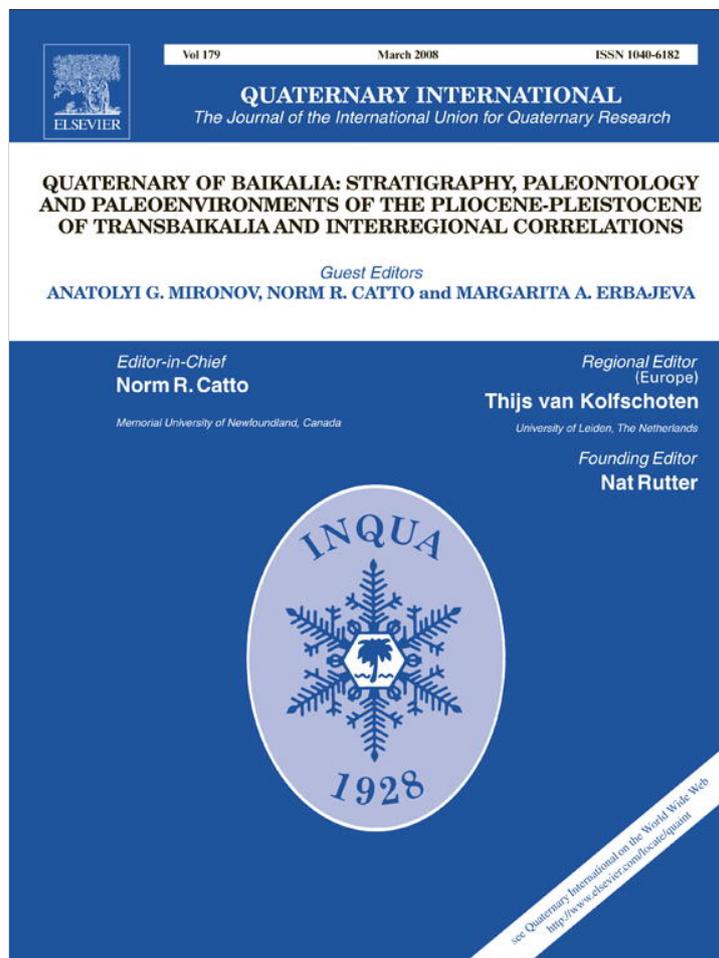


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The skull of *Stephanorhinus kirchbergensis* (Jäger 1839) (Mammalia, Rhinocerotidae) from the Irkutsk region (Southwest Eastern Siberia)

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Abstract

The skull discovered in the Irkutsk region (Southwest Eastern Siberia), previously attributed to “*Rhinoceros Merckii* Jäger 1839” (*sic*) (= *Stephanorhinus kirchbergensis* [Jäger 1839]) and preserved in the collections of the Zoological Institute of the Russian Academy of Science in St. Petersburg, is described here. It represents one of the five skulls ascribed to this taxon discovered until now in Eurasia and the only one recovered and existing on Russian territory. Some notes on three other skulls (from Daxlanden, Mosbach, and Steinheim an der Murr) ascribed to the same species are also included. Unlike other Plio-Pleistocene rhinoceroses (the “woolly rhino” included) which abound in the Eurasian continent, *S. kirchbergensis*, better known in Russia, and in the ex Soviet Union, as “nosorog Merka”, seems to be rather rare on this wide territory, being reported from a relatively limited number of localities only. This is the case of one of the two records of this species from Eastern Siberia, and one of the very few from Russia.

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1. Introduction

The ZIN RAN 10718 skull comes from an unknown locality in the Irkutsk region. It has previously summarily been cited (but not illustrated) by Chersky (1874), and later by Brandt (1877), as “*Rhinoceros Merckii* Jaeger 1839” (*sic*) (= *Rhinoceros mercki* Jäger 1839 = *Dicerorhinus mercki* [Jäger 1839] = *Dicerorhinus kirchbergensis* [Jäger 1839] = *Stephanorhinus kirchbergensis* [Jäger 1839]). Even if *sine dentibus et sine mandibula*, it represents the sole skull that has come to light and existing on Russian territory, and is one of the five assigned to this species discovered until today in the whole of Eurasia. At first, it was placed in the collections (nr. 26) of the Irkutsk Regional Ethnographic museum. Later, for a long time, it had 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 RAN 10817”.

In European literature, this skull is rarely mentioned: Schroeder (1903), Azzaroli (1962), Loose (1975), and Guérin (1980) apart, none of the other specialists referred

to the famous sample. It is also interesting to note that Chersky's name is never cited anywhere. Schroeder (1903) compared the Irkutsk skull with two other skulls, that from Daxlanden (see below) and another one from Ilford (Essex) ascribed by Woodward (1874) to *Rhinoceros leptorhinus* Owen (= *Rhinoceros hemitoechus* Falconer 1868 = *Dicerorhinus hemitoechus* [Falconer 1868] = *Stephanorhinus hemitoechus* [Falconer 1868]). According to Loose (1975, p. 20), the skull from Irkutsk belongs to *D. hemitoechus* (Falc.). Guérin (1980, p. 628, 631), who, like other European specialists, who had never seen the *cranium* from Irkutsk, considered it as *D. mercki* (Jäger). *De facto*, the skull from Husnjakovo Brdo at Krapina (Croatia), extensively previously described by Gorjanovich-Kramberger (1913; pl. I-fig. 1–3) as *Rhinoceros Mercki* var. *Krapinensis*, apart, there are some complex problems which involved heated debates regarding the skull from Irkutsk, as well as some other skulls, the attribution of which has been, and still is, decidedly controversial. Though the subject of several systematic studies since some time, no agreement has been reached by palaeontologists as to their systematic positions. There is sufficient motive to briefly discuss here the situation concerning at least three well-known *crania*: those from

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Daxlanden, Mosbach, and Steinheim an der Murr (all the localities are in Germany).

1.1. Daxlanden skull

Found in 1802, the uncommonly well-preserved skull from Daxlanden (Karlsruhe) (Landesmuseum f. Naturkunde, Karlsruhe; Op/650), which has to be considered as *S. kirchbergensis*, has been identified, in the course of two centuries, as *Rh. Merckii* by Meyer (1863–64), as *Rhinoceros etruscus* Falconer by Lartet (1867, pp. 180–181), by Schroeder (1903, 1930) as *Rh. Mercki* (*Merckii*) var. *Brachycephala*, as *Rh. hemitoechus* Falconer by Toula (1906), as *Rh. merckii* Jäger by Wüst (1922), as *D. mercki* (Jäger) by Staesche (1941), by Mayer (1971) as *D. mercki* (*kirchbergensis*) (Jäger) var. *brachycephalus* Schroeder, and as *D. kirchbergensis* (Jäger) by Loose (1975). In his account, Azzaroli (1962) was uncertain about the systematic position of the Daxlanden *cranium*, but he recognized in it some affinities with *S. kirchbergensis*. Finally, Guérin (1980, p. 623, 628) erroneously erected, for this skull, the subspecies *Dicerorhinus etruscus brachycephalus* (= *Stephanorhinus hundsheimensis* [Toula 1902] = *Rhinoceros etruscus heidelbergensis* [Freudenberg 1914] = *Dicerorhinus hemitoechus intermedius* [Cigala-Fulgosi 1976]). Illustrations of the *cranium* from Daxlanden may be found in Meyer (1863–64; pl. XXXV, XXXVI, XXXVII, XXXVIII, and XXXIX), in Schroeder (1903; pl. 2-fig. 2, pl. 3-fig. 1), in Mayer (1971), and in Loose (1975; pl. 5-fig. 1, pl. 6-fig. 1, pl. 8-fig. 3, pl. 10-fig. 5, pl. 13-fig. 1).

1.2. Mosbach skull

The skull from Mosbach (Wiesbaden) (Naturhistorisches Museum, Mainz; 1956/962), seriously damaged in the *splanchnocranium*, has been treated, among others, by Schroeder (1903, 1930), Freudenberg (1914), Wüst (1909, 1911, 1914), Loose (1975; illustrations are found in pl. 3-fig. 3, pl. 4-fig. 3, pl. 8-fig. 2, pl. 10-fig. 4, pl. 13-fig. 2), and Guérin (1980). Incidentally, the skull from Mosbach was not mentioned by Fortelius et al. (1993).

1.3. Steinheim an der Murr skull

Two skulls come from Steinheim a. d. Murr (Stuttgart) (Staatliche Museum f. Naturkunde, Stuttgart), one identified as *S. hemitoechus* (SMN 16938), and the second-one as *S. kirchbergensis* (SMN 16275). Both of them have been used by Staesche (1941) for his well-known comparative study. The skull belonging to *S. kirchbergensis* (Staesche, 1941; pl. 11, figs. 1–3) has extensively been restored taking as a model the one attributed to *S. hemitoechus*; any comment here seems superfluous. In any case, Guérin (1980) agreed with Staesche in considering the second *cranium* (SMN 16275) as *D. mercki*. According to Fortelius et al. (1993), both *crania* have to be ascribed to *S. hemitoechus*.

2. Morphological analysis of the ZIN RAN 10718 skull from the Irkutsk region

A morphological description of the ZIN RAN 10718 *cranium* from the Irkutsk region is given below. Unfortunately, the upper teeth and the mandible have not been recovered.

2.1. Norma lateralis

Even if, from this view (Fig. 1a), the general profile shows affinities with other Pleistocene rhinoceros species, some distinctions may be made. The *os nasale* is high and massive, the inclination (the distance from the *rhinion* and the surface of the nasal horn base) is less prominent than that in *C. antiquitatis*. As regards this last species, the *septum nasalis* is open; the nasal aperture is higher and narrower, the distance from the posterior rim of the nasal

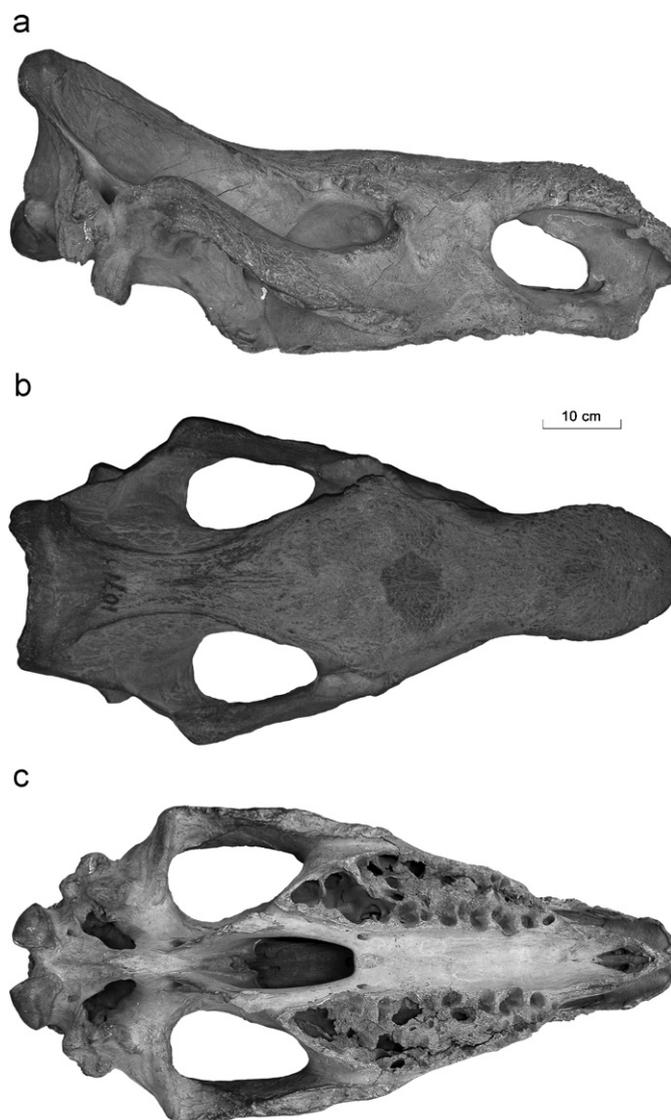


Fig. 1. *S. kirchbergensis* (Jäger 1839); Irkutsk region (South-West Eastern Siberia); *cranium*, (a) lateral view, (b) vertical view, and (c) basal view.

aperture and the anterior rim of the *orbita ocularis* is shorter; the *arcus zygomatici* appear more massive; the plane formed by the *planum parietali*+*interparietale* is shorter and its inclination is less pronounced; and the *processus postglenoideus* and the *processus paroccipitalis* show a much more massive character.

2.2. Norma verticalis

From this view (Fig. 1b), *versus* the woolly rhino, the skull appears somewhat less slight; the *os nasale* is much enlarged; the surface of the nasal horn base is wider and rather rugose, whereas that of the frontal horn is much less evident; the *orbitae oculares* appear massive and rather pronounced, and their base is much extended. Compared to *Coelodonta*, the *arcus zygomatici* are more massive and noticeably enlarge towards the outside and then converging, almost *ex-abrupto* (angle $\pm 90^\circ$), towards the *temporalia*; these form a very wide oval, as a general rule wider than in *Coelodonta*. The *occipitalis*, which represents the shorter base of the trapezium formed by the *facies occipitalis*, shows a mild concavity (which is more evident when observing the *cranium* occipitally) and is bent towards the inside. The two *apices* of the *crista occipitalis* are much pronounced, much more than in *Coelodonta* (in some skulls attributed to this species, these are even not discernable).

2.3. Norma basalis

The *os incisivum*, laterally rounded, shows a pronounced middle concavity (Fig. 1c), even if its thickness is not remarkable. Frontally, the *cavitas palatalis* ends as an “arrow tip”. The dental alveoli testify a dentition of uncommon exceptional dimensions. Also from this view, the massive character of the zygomatic arches is very evident.

2.4. Norma occipitalis

The occipital face traditionally shows a trapezium where the *crista occipitalis* represents the upper base with a mild middle concavity and very rounded angles. The large occipital *crista* is undoubtedly much more massive than in *Coelodonta*. The *foramen occipitalis* is quite rounded; above it, there is a very pronounced relief formed by the *tuberculus nuchalis*.

Some dimensions of the ZIN RAN 10718 *cranium* from the Irkutsk region are given in Table 1.

3. Results

In contrast to those from Daxlanden (LNK Op/650), from Mosbach (NMM 1956/962), and from Krapina (n.n.), the ZIN RAN 10718 skull from the Irkutsk region is completely toothless. However, when compared with the other three, it shows remarkable morphological affinities

Table 1

Dimensions (in mm) of the ZIN RAN 10718 *cranium* from the Irkutsk region (Southwest Eastern Siberia)

1	Max length (= max length <i>occipito-nasale</i>) ^a	832
2	Max length <i>condilus occipitalis-rhinion</i>	798
3	Max length of the nasal aperture (dx \cong sx)	260
4	Min length nasal aperture/ <i>orbita ocularis</i>	135
5	Min transversal diameter at the <i>costritio post-orbitaria</i>	119
6	Length of the space occupied by the dental alveoli (dx \cong sx)	310
7	Max width of the <i>arcus zygomatici</i>	390
8	Min width of the <i>facies occipitalis</i> ^b	204
9	Medial height of the <i>facies occipitalis</i>	251
10	Ext. max transversal diameter of the <i>condili occipitales</i>	154
11	Max transversal diameter of the <i>foramen magnum</i>	49
12	Max width of the <i>facies occipitalis</i> ^c	273

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

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

^cMeasured outwardly at the mastoid apophyses.

and significant analogies, particularly *versus* that from Mosbach and that from Krapina.

In detail:

- from the lateral view, the nasal bone is high and robust; the length and the slope of the *planum parietali* is very similar; besides the open *septum nasalis*, the peculiar morphology of the nasal aperture; the massive characters of the *processus postglenoideus* and the *processus paroccipitalis*;
- from the vertical view, just as in the Daxlanden, Mosbach, and Krapina specimens, the Irkutsk skull appears to be less slight and much enlarged in the zygomatic arches which are strikingly massive and end abruptly at a right angle towards the *temporalia*. As in the three mentioned skulls, the nasal bone is very large, the orbits massive and very “chiselled” with a much pronounced anterior rim; the two rounded extremities of the occipital crest are much marked;
- from the basal view, the morphology of the *os incisivum* and of the *cavitas palatalis*; the conspicuous space occupied by the dental alveoli;
- from the occipital view, the peculiar trapezium shape; the very massive *crista occipitalis*; the considerably pronounced of the *tuberculus nuchalis*, not found in any other species.

The characters expounded above are undoubtedly traits suggestive of *S. kirchbergensis* (Jäger, 1839).

4. Discussion

At present, on the basis of the fossil evidence, *S. kirchbergensis*, unlike other Plio-Pleistocene rhinoceroses which abound in Eurasia, seems to be decidedly rare on this wide territory. In Eastern Siberia, besides the *cranium* from the Irkutsk region, *S. kirchbergensis* is present only along the left bank of the Vilyuy river, close to

its confluence with the Chebydy river, between the villages of Verkhne-Vilyuysk and Vilyuysk (Yakutya region [Sakha republic]) (Dubrovo, 1957). Until today, because its extraordinary latitude (close to 64°N), this represents the most distant *S. kirchbergensis* find in the whole of Eurasia.

S. kirchbergensis remains have also been discovered in four other localities in the Western Siberian area: along the Ob' near the Krasny Yar village (Krivosheino district, Tomsk region) (Aleksееva, 1980); along the right bank of the Ob' at Krasny Yar, in front of the Sargulin island (Krivosheino district, Tomsk region) (Billia and Shpansky, 2005), in the Tobol'sky gorizont levels (Western-Siberian stratigraphy = Likhvinsky gorizont in the Eastern-European stratigraphy = Holstein, in the Western-European stratigraphy; OIS 11); along the right bank of the Inya river, 58 km south-west of Kemerovo (Kuznetsk Basin, Kemerovo region) (Billia, in press); and at Mokhovo, about 20 km east of Leninsk-Kuznetsky (Kuznetsk Basin, Kemerovo region) (Billia, in press).

The relatively limited number of the discoveries of the *kirchbergensis* rhinoceros on Russian territory (where it is better known as “nosorog Merka” [literally, Merck's rhinoceros]) (Billia, in preparation), as well as in the European area, testify the rarity of this species, the reasons of which have not been unraveled yet. Unfortunately, both cranial and postcranial easily datable remains are everywhere, *de facto*, very few.

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References

- Alekseeva, E.V., 1980. Mlekopitayushchie Pleystozena Yugo-Vostoka Zapadnoy Sibiri (Khishchnye, Khobotnye, Kopytnye) [Pleistocene Mammals from South-East of Western Siberia]. Akademya Nauk SSSR, Dal'nevostoch. Nauch Zentr Biologii (Pochva Institut), Nauka, 187pp, Moskva [in Russian].
- Azzaroli, A., 1962. Validità della specie *Rhinoceros hemitoechus* Falconer. Paleontographia italica LVII, 21–34 Pisa.
- Billia E.M.E., in press. First records of *Stephanorhinus kirchbergensis* (Jäger, 1839) (Mammalia, Rhinocerotidae) from the Kuznetsk Basin (Kemerovo region, Kuzbass area, South-East of Western Siberia). Bollettino della Società Paleontologica Italiana, Modena.
- Billia, E.M.E., in preparation. Catalogue of the Fossil Material ascribed to *Stephanorhinus kirchbergensis* (Jäger 1839) (Mammalia, Rhinocerotidae) Preserved in the Museum Collections of the Russian Federation (with a list of bibliographic references on the Rhinocerotidae family).
- Billia, E.M.E., Shpansky, A.V., 2005. *Stephanorhinus kirchbergensis* (Jäger 1839) (Mammalia, Rhinocerotidae) from the Middle Pleistocene levels of the Ob' River at Krasny Yar (Tomsk region, Western Siberia). DEINSEA 11, 75–82 Rotterdam.
- Brandt, J.F., 1877. Versuch einer Monographie der Tichorhinen Nashörner nebst Bemerkungen über *Rhinoceros leptorhinus* Cuvier. Academie Impériale des Sciences St-Petersbourg, s 7 24 (4), 1–135 (Zapiski Imperatorskoy Akademii Nauk, s. 2, 26:49, Sanktpeterburg').
- Chersky, I.D., 1874. Opisanie cherepa nosoroga, razlichnago ot' *Rhinoceros tichorhinus* [description of a rhinoceros skull different from *Rhinoceros tichorhinus*]. Zapiski Imperatorskoy Akademii Nauk' 25, 65–75 Sanktpeterburg' [in Russian].
- Dubrovo, I.A., 1957. Ob ostatkakh *Parelephas wüsti* (M. Pavl.) i *Rhinoceros mercki* Jaeger iz Yakutii [On remains of *Parelephas wüsti* (M. Pavl.) and *Rhinoceros mercki* Jaeger from Yakutya]. B'ulletin Komissii Izuch Chetvertich Perioda 21, 97–104 (Akademya Nauk SSR, Moskva/Leningrad [in Russian]).
- Fortelius, M., Mazza, P., Sala, B., 1993. *Stephanorhinus* (Mammalia: Rhinocerotidae) of the Western European Pleistocene, with a revision of *S. etruscus* (Falconer 1868). Paleontographia italica 80, 63–155 Pisa.
- Freudenberg, W., 1914. Die Säugetiere des Altern Quartärs von Mitteleuropa mit besonderes Berücksichtigung der Faunen von Hundsheim und Deutsch-Altenburg in Niederösterreich nebst Bemerkungen über verwandte Formen anderer Fundorte. Geologische und Paläontologische Abhandlungen, NF XII (4–5), 455–671 Jena.
- Gorjanovich-Kramberger, D., 1913. Fossilni rinocerotidi Hrvatske i Slavonije, s osobitim obzirom na *Rhinoceros mercki* iz Krapine (De rhinocerotidibus fossilibus Croatiae et Slavoniae, praecipua ratione habita *Rhinocerotis mercki* var. Krapinensis mihi). Djela Jugoslavia Akademija (JAZU), XXII (8), 1–70 Beograd [in Serbian].
- Guérin, C., 1980. Les Rhinocéros (Mammalia, Perissodactyla) du Miocène terminal au Pléistocène supérieur en Europe occidentale. Comparaison avec les espèces actuelles. Thèse Doctorat d'Etat et Sciences, Université Lyon I, Documents des Laboratoires de Géologie de la Faculté Sciences de Lyon, 79 (1–3), 1–1185, Lyon [in French, with English, German, and Russian summary].
- Loose, H.K., 1975. Pleistocene Rhinocerotidae of Western Europe with reference to the recent two-horned species of Africa and S.E. Asia. Scripta Geologica 33, 1–59 Leiden.
- Mayer, G., 1971. Beiträge zur Geschichte der Badischen Landessammlungen für Naturkunde in Karlsruhe. Der Schädel des *Dicerorhinus mercki* (kirchbergensis) (Jäger) var. Brachycephalus Schroeder von Daxlanden und seine Geschichte. Beiträge zur naturkunde Forschung Südwest-Deutschland 30 (2), 157–163 Karlsruhe.
- Meyer, H.V., 1863–64. Die diluvianen Rhinoceros-Arten. *Palaontographica*, Bd. 11, pp. 233–283, Kassel.
- Schroeder, H., 1903. Die Wirbelthier-Fauna des Mosbacher Sandes. 1. Gattung Rhinoceros. Abhandlungen Königlich Preussen Geologische Landesanstalt, NF XVIII, 1–143 Berlin.
- Schroeder, H., 1930. Über *Rhinoceros mercki* und seine nord- und mitteleuropäischen Fundstellen. Abhandlungen Königlich Preussen Geologische Landesanstalt, NF CXXIV, 1–114 Berlin.
- Staesche, K., 1941. Nashörner der Gattung *Dicerorhinus* aus Diluvium dem Württembergs. Abhandlungen der Reichsstelle für Bodenforschung 200, 1–148 Berlin.
- Toula, F., 1902. Das Nashorn von Hundsheim *Rhinoceros* (*Ceratorhinus* Osborn) *hundsheimensis* nov. form. mit Ausführungen über die Verhältnisse von elf Schädeln von *Rhinoceros* (*Ceratorhinus*) *sumatrensis*. Abhandlungen der kaiserlich-königlichen geologischen Reichsanstalt XIX (1), 1–92 Wien.
- Toula, F., 1906. Gebiss und Reste der Nasenbein von Rhinoceros (*Ceratorhinus* Osborn) *hundsheimensis*. Abhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt 20 (2), 1–38.
- Woodward, H.M., 1874. On the remains of *Rhinoceros leptorhinus* Owen (*R. hemitoechus* Falc.) in the collection of Sir Antonio Brady, FGS, from the Pleistocene Deposits of the Valley of the Thames at Ilford (Essex). Geologists Magazine XI, 398–403.
- Wüst, E., 1909. Das Vorkommen von *Rhinoceros merckii* Jäger in den oberen Travertinen von Ehringsdorf bei Weimar und seine Bedeutung für die Beurteilung der Klimaschwankungen das Eiszeitalters. Centralblatt für Mineralogie, Geologie und Paläontologie, Stuttgart, pp. 23–25.

Wüst, E., 1911. Zwei bemerkenswerte Rhinoceros-Schädel aus dem Pliozän Thüringens. *Palaeontographica* LVIII, 133–138 Stuttgart.

Wüst, E., 1914. Rhinoceroszähne aus dem Sande von Mauer bei Heidelberg (in Freudentberg W., Die Säugetiere des älteren Quartärs von Mitteleuropa mit besonder Berücksichtigung der Fauna von

Hundsheim und Deuschaltenburg in Nieder-Österreich). *Geologische und Paläontologische Abhandlungen*, NF 12 (4–5), 23–26, + 475–478.

Wüst, E., 1922. Beiträge zur Kenntnis der diluvianen Nashörner Europas. *Centralblatt für Mineralogie, Geologie und Paläontologie* XX, 641–656 XXI:680–688, Stuttgart.