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OCCURRENCES OF *STEPHANORHINUS KIRCHBERGENSIS* (JÄGER, 1839) (MAMMALIA, RHINOCEROTIDAE) IN EURASIA – AN ACCOUNT

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Abstract. A report on the presence of *Stephanorhinus kirchbergensis* (JÄGER 1839) in Eurasia is proposed here. As yet, *S. kirchbergensis* appears rarely recorded on this wide territory. As a whole, its occurrences are more frequent in Western than in Eastern Europe and in Asia. Unfortunately, well-dated both cranial and postcranial *S. kirchbergensis* remains are very few. Moreover – at least at present – the fossil material described in literature and assigned to this taxon is only partly available in Eurasian museum collections.
Among the Plio-Pleistocene rhinoceros, *S. kirchbergensis* is one of the most distinctive species being characterized by unique odonto-morphological traits. Furthermore, it is useless to deny when faced with facts that *S. kirchbergensis* seems to be a rhinoceros still little investigated, and consequently, not well-known yet.
History, general characters, anatomical and odontological features of *S. kirchbergensis* have been discussed in previous works by the author.

Keywords: *Stephanorhinus kirchbergensis,* Middle Pleistocene, Eurasia, "nosorog Merka".

Institutional abbreviations

AN ArmSSR - Akademya Nauk Armyanskoy SSR (= Academy of Sciences of Armenian SSR), Erevan.
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AN KazSSR - Akademya Nauk Kazakhskoy SSR (= Academy of Sciences of Kazakh SSR), Alma-Ata; at present, Academy of Sciences of Kazakhstan, Almaty.
AN MoldSSR - Akademya Nauk Moldavskoy SSR (= Academy of Sciences of Moldavian SSR, Kishinev); at present, Academy of Sciences of Moldova, Chisinau.
AN SSSR - Akademya Nauk SSSR (= USSR Academy of Sciences), Moskva/Leningrad; at present, Russian Academy of Sciences (RAN), Moskva/Skt-Peterburg.
AN UkrSSR - Akademya Nauk Ukrainskoy SSR or Akademia Nauk Ukrains'koï Radyans'koï Sozialistichnoï Respubliki (AN URSR) (= Academy of Sciences of Ukrainian SSR, Kiev); at present, Ukrainian Academy of Sciences, Kïv.
GIH - Geologischer Institut, Heidelberg.
HAZU - Hrvatska Akademija Znanosti i Umjetnosti (= Croatian Academy of Sciences and Arts), former Yugoslavian Academy of Sciences and Arts (JAZU), Zagreb.
IGUP- Istituto di Geologia, Università Statale, Padova.
IPE - Institut für Paläontologie, Erlangen.
IQW - Institut für Quartärpaläontologie (Senckenberg Forschungsinstitut), Weimar.
Izd-vo - Izdatel'stvo (= Publishing House).
IZiF - Institute of Zoology and Fisiology, Academy of Sciences of Moldova, Chisinau.
JAZU - Jugoslavenska Akademija Znanosti i Umjetnosti (Academia Scientiarum et Artium Slavorum Meridionalium = Yugoslavian Academy of Sciences and Arts); at present, Hrvatska Akademija Znanosti i Umjetnosti (= Croatian Academy of Sciences and Arts), Zagreb.
LNK - Landesmuseum für Naturkunde, Karlsruhe.
MCSN - Museo Civico di Storia Naturale, Vicenza.
MCSN-TS - Museo Civico di Storia Naturale, Trieste.
MNH - Museum of Natural History (ex British Museum of Natural History, BMNH), London.
MPP - Museo Paleontologico, Priabona near Monte di Malo (Vicenza).
MPUR - Museo di Paleontologia, "Sapienza" Università di Roma.
MZ - Muzeum Ziemi (= Museum of the Earth), Polska Akademia Nauk (= Polish Academy of Sciences), Warszawa.
NMM - Naturhistorisches Museum, Mainz.
OPS - Branch of Palaeontology and Stratigraphy, SSR Moldavian Academy of Sciences; at present, Academy of Sciences of Moldova, Chisinau.
PAN - Polska Akademia Nauk (= Polish Academy of Sciences), Kraków/Warszawa.
PM OGU - Palaeontological Museum, Odessa State University, Odessa.
PNHM - Prähistorische Abteilung des Naturhistorischen Museums, Wien.
RAN - Rossiyskaya Akademya Nauk (= Russian Academy of Sciences), Moskva/Skt-Peterburg.
SAN - Srpska Akademija Nauka (= Serbian Academy of Sciences), former Yugoslavian Academy of Sciences and Arts (JAZU), Beograd.
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SMN - Staatliches Museum für Naturkunde, Stuttgart.
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ZIN ANU - Zoological Institute, Branch of Palaeozoology, SSR Ukrainian Academy of Sciences, Kiev; at present, Ukrainian Academy of Sciences, Kïv.
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Other abbreviations

ESR - Electron Spin Resonance.
MIS - $\delta\ ^{18}O$ Stage (Marine Isotope Stage = OIS, Oxygen Isotope Stage).

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INTRODUCTION

Stephanorhinus kirchbergensis (JÄGER 1839) (= *Rhinoceros mercki* JÄGER 1839 = *Dicerorhinus kirchbergensis* [JÄGER 1839]) – better known in Russia and in all the former Soviet Union as "nosorog Merka" (literally, Merck's rhinoceros) – together with *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847) was one of the most characteristic members of the West-European late Middle Pleistocene interglacial fauna (Czyzewska, 1962), later called "*Palaeoloxodon antiquus* faunal assemblage". It also includes *Stephanorhinus hemitoechus* (FALCONER 1868), *Hippopotamus amphibius* L. 1758, *Bos primigenius* BOJANUS 1827, *Megaloceros giganteus* (BLUMENBACH 1803), *Capreolus capreolus* (L. 1758), *Dama dama* (L. 1758), *Sus scrofa* L. 1758, and *Bubalus murrensis* (BERCKHEMER 1927) (= *Buffelus murrensis* BERCKHEMER 1927) (Kahlke, 1986; Stuart, 1991; Koenigswald & Heinrich, 1999; Bradshaw & al., 2003, inter alios).

The *S. kirchbergensis* spreading areal would include a large part of the Eurasian landmass – from France up to China – in this context excluding the areas situated at both high and low latitudes, except for only one case close to 64° N in Siberia (Dubrovo, 1957) which represents the northernmost *S. kirchbergensis* Eurasian record.

Mostly frequenting forests, *S. kirchbergensis* supposedly inhabited Europe in the time span from MIS 15-13 up to the Eemian Interglacial (substage 5e). At present, on the basis of fossil evidence – unlike other Plio-Pleistocene rhinoceroses – the "tandem-horned" *S. kirchbergensis* seems to be barely represented within this enormous geographical extension. On the whole, its records are more frequent in Western than in Eastern Europe and in Asia. Remains ascribed to this taxon come from England, France, Germany, Austria, Italy, Slovenia, Croatia, Hungary, Czech Republic, Slovakia, Poland, Romania, Moldova, Russia, Kazakhstan, Korea, China, and possibly from Ukraine, Armenia, Azerbaijan, Tajikistan.

Furthermore, very few well-dated *S. kirchbergensis* cranial and postcranial remains are available. As a matter of fact, a great amount of such skeletal material found without macro-microfaunal and/or stratigraphic data does not allow inferring any chronological hypothesis.

Unfortunately – at least at present – the *S. kirchbergensis* material described in literature and taken here into consideration is only partly available in Eurasian museum collections.

Both Russian and Italian *S. kirchbergensis* material has been revised using morphological and non-metric characters (Billia, 2008a, 2008b; Billia & Petronio, 2009).

The reasons for *S. kirchbergensis'* rarity have not been unraveled yet. According to Loose (1975:21), the reasons are twofold: either its ecological niche was unfavourable for fossilisation, or it was really a rare animal.

Its rarity may also probably be due to the fact that *S. kirchbergensis* is usually found in interglacial faunal associations. As a general rule, during the interglacial periods the fluvial beds are characterized by erosion while within karst cavities sedimentation is very rare.

We must also consider another possible reason, which may justify the scarcity of the reports on *S. kirchbergensis:* very often, when the finds concern postcranial specimens only, these are frequently not taken into consideration because they are not recognised or because of their difficult specific determination.

De facto, *S. kirchbergensis* has very often been diagnostically misidentified with other rhinoceros species: *Stephanorhinus megarhinus* (DE CHRISTOL 1834), *Stephanorhinus elatus* (CROIZET & JOBERT 1828) (= *Rhinoceros etruscus* Falc. var. *astensis* SACCO 1895 = *Dicerorhinus jeanvireti* [GUÉRIN 1972]), *Stephanorhinus etruscus* (FALCONER 1868), *Stephanorhinus hundsheimensis* (TOULA 1902) (= *R. etruscus heidelbergensis* FREUDENBERG 1914 = *Dicerorhinus handzellensis* WANG 1928 = *Dicerorhinus hemitoechus intermedius* CIGALA-FULGOSI 1976 = *Dicerorhinus etruscus brachycephalus* GUÉRIN 1980), *S. hemitoechus* (FALCONER 1868), *Coelodonta antiquitatis* (BLUMENBACH 1799). Besides, for a long time too many palaeontologists believed that *S. kirchbergensis* and *S. hemitoechus* represented a sole species.

From the author's personal point of view, one of the basic problems is represented by the fact that too often the diagnoses are based exclusively on postcranial material so that errors of identification among the species are frequently possible, whereas the attribution by means of teeth is unequivocal.

In the author's opinion, in *S. kirchbergensis* – among postcranial elements – the third metacarpals, the astragali, and the calcanea may be liable to an exception presenting some unique morphological features which would make a difference from the other Pleistocene rhinoceros species (Billia, 2008b; Billia & Petronio, 2009).

As Heissig (1981) previously asserted, rhinoceroses (particularly, the Plio-Pleistocene ones) are a highly-stereotyped group with little morphological divergence. This means that, morphologically, substantial intraspecific differences and, conversely, interspecific likenesses may usually be found among them.

As it is well-known, some of the most prominent palaeontologists expressed their frustration on issues related to the identification of the rhinoceros species (vide, *e.g.*, Toula, 1902:92).

In the course of the last two centuries, *S. kirchbergensis* has been previously identified with at least thirty-one other synonyms:

Rhinoceros incisivus MERCK 1784
Rhinoceros tichorhinus BRONN 1831
Rhinoceros megarhinus DE CHRISTOL 1834
Rhinoceros minutus DE SERRES DUBREUIL & JEANJEAN, 1834
Rhinoceros leptorhinus CUVIER 1836
Rhinoceros kirchbergense JÄGER 1839
Rhinoceros mercki JÄGER 1839
Rhinoceros Schleiermacheri H. VON MEYER 1839
Rhinoceros Merckii (or *merckii, mercki, merki, Mercki*) KAUP 1841
Rhinoceros mercki KAUP 1841
Rhinoceros incisivus BLAINVILLE DE DUCROTAY 1846
Rhinoceros leptorhinus OWEN 1850
Rhinoceros lunellensis GERVAIS 1852
Atelodus leptorhinus POMEL 1853
Rhinoceros protichorhinus DUVERNOY 1853
Rhinoceros mesotropus et velaunus AYMARD 1853
Rhinoceros Aymardi POMEL 1854
Rhinoceros priscus FALCONER 1858
Rhinoceros mesotropus GERVAIS 1859
Rhinoceros leptorhinus BOYD DAWKINS 1867
Rhinoceros Merckii Jäger BRANDT 1877

Rhinoceros (*Atelodus*) *Mercki* WOLDRICH 1886
Rhinoceros sinensis OWEN 1870 (= *Rhinoceros sinensis* OSBORN 1898)
Rhinoceros Mercki (*Merckii*) var. *Brachycephala* SCHROEDER 1903
Rhinoceros Mercki Jäger var. *Vindobonensis* TOULA 1907
Rhinoceros Mercki var. *Krapinensis* GORJANOVICH-KRAMBERGER 1913
Coelodonta merckii ABEL 1919
Rhinoceros oweni RINGSTRÖM 1927
Rhinoceros choukoutiensis WANG 1931 (= *Dicerorhinus choukoutienensis* [WANG 1931])
Dicerorhinus kirchbergensis HOOIJER 1947
Dicerorhinus mercki (*kirchbergensis*) (JÄGER) var. *Brachycephalus* Schroeder vel *Dicerorhinus merckii* MAYER 1971

The *S. kirchbergensis* taxonomical position is as follows (in compliance with the criteria proposed by McKenna & Bell, 1997, except for the genus):

classis – **MAMMALIA** - LINNAEUS 1758;
subclassis – **THERIA** - PARKER & HASWELL 1897;
infraclassis – **EUTHERIA** - GILL 1872;
grandordo – **UNGULATA** - KAUP 1766;
mirordo – **ALTUNGULATA** - PROTHERO & SCHOCH 1989;
ordo – **PERISSODACTYLA** - OWEN 1848;
subordo – **CERATOMORPHA** - WOOD 1937;
infraordo – **TAPIROMORPHA** - HAECKEL 1866;
superfamilia – **RHINOCEROTOIDEA** - GRAY 1825;
familia – **Rhinocerotidae** - GRAY 1821;
subfamilia – **RHINOCEROTINAE** - GRAY 1821;
tribus – **RHINOCEROTINI** - GRAY 1821;
subtribus – **RHINOCEROTINA** - GRAY 1821;
infratribus – **RHINOCEROTI** - GRAY 1821;
genus – *STEPHANORHINUS* - KRETZOÏ 1942;
species – *S. KIRCHBERGENSIS* - JÄGER 1839.

History, general characters, anatomical and odontological distinguishing features of *S. kirchbergensis* have been extensively discussed in previous papers (Billia, 2008b; Billia & Petronio, 2009). In any case, there is no doubt that *S. kirchbergensis* is characterized by very suggestive odonto-morphological traits (fig. 1–a, b) and is therefore one of the most distinctive species among the other Plio-Pleistocene rhinoceros species.

The DF (dental formula) – similarly to other European Pleistocene rhinoceros species – is 0-0-3-3 in both upper and lower dentitions. Both occlusal model and occlusal mechanics of the molars of a rhinoceros such as *S. kirchbergensis* are well-represented by Fortelius (1982).

The attempts to reconstruct this species are extremely rare. In the author's opinion, the one made by Flerov (Flerov & al., 1955) (fig. 2–a) seems to be very close to reality. The Kojamkulova's reconstruction (Kojamkulova & Kostenko, 1984:56) (fig. 2–b) shows a too short skull. On the other hand, it appears very interesting because, in the light of the hypothesis advanced by this author, *S. kirchbergensis* had a derma covered by a sparse fuzz, *e.g.* as that of the living Sumatran "tandem-horned" *Dicerorhinus sumatrensis* (FISCHER V. WALDHEIM, 1814). However, we may consider both reconstructions as significant; this witnesses the current scarce knowledge of the anatomy of this species.

STEPHANORHINUS KIRCHBERGENSIS EURASIAN FINDS – LOCALITIES AND MATERIAL

1. Europe

S. kirchbergensis is represented in this area by five available skulls only – those from Daxlanden, Mosbach, Steinheim an der Murr (Germany, § 1.4), Husnjakovo Brdo at Krapina (Croatia, § 1.9), and Warsaw (Poland, § 1.13) – in addition to other dental and postcranial material. The vexata quaestio concerning the systematic positions of the three German skulls has been treated in Billia (2008a).

1.1. England

The first appearance of *S. kirchbergensis* in Britain seems to be represented by the remains coming from Barnfield Pit at Swanscombe (Kent) (Sutcliffe, 1964). The event was correlated with MIS 11 (ca 400 kys BP) (Schreve, 1996, 1997, 2001).

The rhinoceros remains collected in the following sites must unquestionably be assigned to *S. kirchbergensis*:

– Grays Thurrock (Essex); odontological remains as well as a third metacarpal (BMNH M 22024a) and a third metatarsal of large dimensions (BMNH M 23761g) (Morris, 1836; Hinton & Kennard, 1900; Hinton, 1901) (MNH collections). Proposed MIS: 9 (ca 300 kys BP) (Schreve, 1997, 2001);

– Clacton-on-Sea (Essex); odontological remains (West & al., 1964; Stuart, 1982) (MNH collections). Proposed MIS: 11 (ca 400 kys BP) (Schreve, 1997, 2001);

– Ilford (Essex); odontological remains found in the interglacial deposits along the Thames (Hinton, 1902) (MNH collections). According to some authors (Sutcliffe & Kowalski, 1976; Bridgland, 1994), the deposits represent the third post-Anglian formation and are correlated with MIS 7 (ca 200 kys BP).

Other *S. kirchbergensis* remains come from:

– Purfleet (west of Grays Thurrock, Essex) (Schreve & al., 2002); MIS 9 (ca 300 kys BP) (Schreve & Bridgland, 2002a);

– West Thurrock (Essex); the *S. kirchbergensis* remains reported by Abbott (1890) were rediscovered in the collections of the Wellcome Institute for the History of Medicine in London by Carreck (1976) and are now housed in the MNH collections. At present, MIS 7 (ca 200 kys BP) for these remains is only supposed;

– Stanton Harcourt (7 km west of Oxford, Oxfordshire) (Scott, 2001). MIS 7 (ca 200 kys BP) is suggested by both the stratigraphical position and the fossils (Buckingham & al., 1996); this is also supported by amino-acid racemisation data (Bowen & al., 1989).

For more details on ages of fossil remains from British interglacial sites, on the Pleistocene fluvial stratigraphy and palaeogeography of Essex, on the insularity and Pleistocene faunas in Britain, on mammalian biostratigraphy of the Lower Thames see also Szabo & Collins (1975), Bridgland (1988), Stuart (1995), Roe (2001), and respectively Bridgland & Schreve (2004).

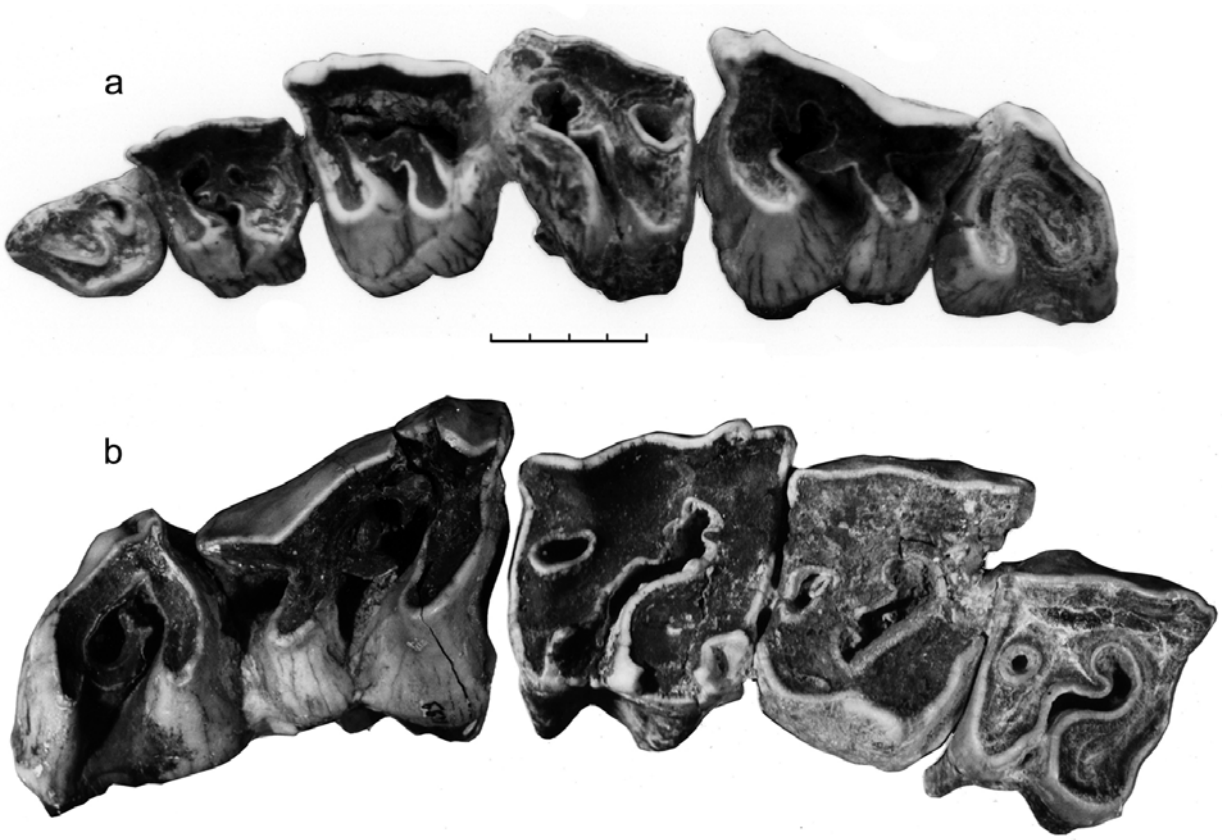

Figure 1 – *Stephanorhinus kirchbergensis* (JÄGER 1839); ? Middle Pleistocene; Latium, Central Italy. Suburbs of Rome (unknown localities); 1) upper half-jaw (M^3-P^2) (MPUR 1498), occlusal view; 2) upper half-jaw (M^3-P^3) (MPUR 1499), occlusal view (after Billia & Petronio, 2009) (coll.: Museo di Paleontologia, "Sapienza" Università di Roma).

1.2. The Netherlands

The report from Neede (Kolfschoten, 2001) does not appear to be reliable.

The presumed presence of *S. kirchbergensis* in the clay-pits of Tegelen (Limburg province) (Bernsen, 1927, 1932; Guérin, 1980; Hoek Ostende, 2003, 2004) is still object of debates. According to Loose (1975), the remains from Tegelen belong to *S. etruscus* (FALCONER 1868).

1.3. France

The localities where remains ascribed to *S. kirchbergensis* were found have, inter alios, diffusely been discussed by Guérin (1980) and Lacombat (2005).

1.4. Germany

The following material must certainly be assigned to *S. kirchbergensis:*

– the uncommonly well-preserved, relatively short skull (LNK Op/650) found at Daxlanden (Karlsruhe, Baden-Württemberg) in 1802. It represents the only complete skull existing in Germany. In the course of two centuries, it has been identified as *R. Merckii* by MEYER (1863-64; Pls. XXXV, XXXVI, XXXVII, XXXVIII, XXXIX), as *R. etruscus* FALCONER by Lartet (1867:180-181), as *R. Mercki* (*Merckii*) var. *Brachycephala* by SCHROEDER (1903, Pl. 2-fig. 2, Pl. 3-fig. 1, and 1930), as *R. hemitoechus* FALCONER by Toula (1906), as *R. merckii* JÄGER by Wüst (1922), as *D. mercki* JÄGER by Staesche (1941), as *D. mercki* (*kirchbergensis*) (JÄGER) var. *Brachycephalus* Schroeder by MAYER (1971), or as *D. kirchbergensis* JÄGER by Loose (1975, Pl. 5-fig. 1, Pl. 6-fig. 1, Pl. 8-fig. 3, Pl. 10-fig. 5, Pl. 13-fig. 1). Erroneously, Guérin (1980:623, 628) introduced for this skull the subspecies *D. etruscus brachycephalus* (= *S. hundsheimensis* [TOULA 1902] = *R. etruscus heidelbergensis* [FREUDENBERG 1914] = *D. handzellensis* WANG 1928 = *D. hemitoechus intermedius* [CIGALA-FULGOSI 1976]);

– the skull (NMM 1956/962) from the Rhine at Mosbach ("Mosbach–II", the main assemblage) (Heilbronn, Baden-Württemberg), the oldest *S. kirchbergensis* skull found in W-Europe. Seriously damaged in its splanchnocranium, it has been treated – among others – by Schroeder (1903, 1930), Freudenberg (1914), Wüst (1909, 1911, 1914), Loose (1975, 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 & al. (1993).

Isolated teeth and a third metacarpal (NMM 1956/520) were also recovered at Mosbach–II.

On the basis of the lithostratigraphy and the "*Palaeoloxodon* mammalian fauna" (Brüning, 1978; Igel, 1985; Koenigswald & Tobien, 1987) an interglacial age related to the second half of the "Cromerian Complex" (in this region assigned to MIS 15-13) is suggested (Koenigswald & Heinrich, 1999; Stuart & Lister, 2001). Consequently, MIS 13 (ca 500 kys BP) has been proposed for Mosbach–II by the above mentioned authors. An updated Mosbach-II faunal list is given in Hemmer & al. (2008).

– the SMN 16275 skull found along the Murr river (a small Neckar tributary) at Steinheim an der Murr (about 50 km north of Stuttgart, Baden-Württemberg).

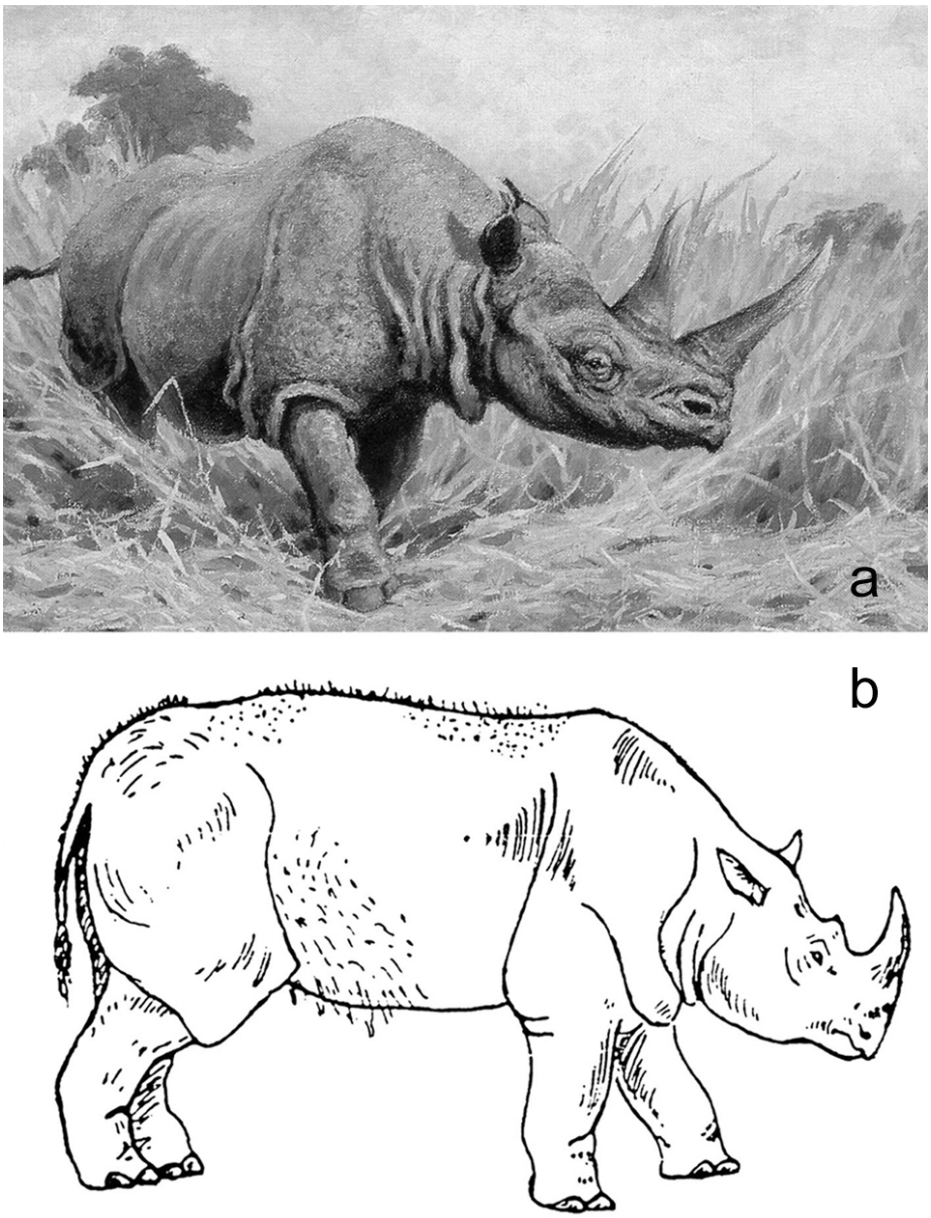

Figure 2 – Reconstructions of *Rhinoceros mercki* JÄGER, 1839 (recte *Stephanorhinus kirchbergensis* [JÄGER, 1839]); (a) after Flerov (in Flerov & al., 1955) and (b) after Kojamkulova (in Kojamkulova & Kostenko, 1984).

Used by Staesche (1941, Pl. 11-figs 1, 3) – in addition to the second one (SMN 16938), identified as *S. hemitoechus* and also coming from Steinheim – for his well-known comparative study, it has extensively been restored taking as a model (understandable, at least from my point of view) the one attributed to *S. hemitoechus.* Evidently, any comment seems here superfluous. In any case, Guérin (1980) agreed with Staesche in considering the SMN 16275 skull as *D. mercki.* According to Fortelius & al. (1993), both crania have to be ascribed to *S. hemitoechus.*

Three distinct layers may be recognised in this site indicating a glacial-interglacial-glacial transition (Koenigswald & Heinrich, 1999). A Holsteinian Interglacial (MIS 11, ca 400 kys BP) has been proposed for the "*Palaeoloxodon antiquus* horizon" including *S. kirchbergensis* (Adam & al., 1995). Schreve & Bridgland (2002a) correlated this horizon at Steinheim with the one at Swanscombe (Kent, England) referred to MIS 11 (ca 400 kys BP);

– the teeth from the Lower Travertines along the Ilm river (a Saale–Elbe tributary) at Weimar-Ehringsdorf (Thüringen) (Kahlke, 1974, 1975; Kahlke & al., 2002) (IQW collections).

The sequence – originally attributed by Kahlke (1974) to the Eemian (MIS 5e, ca 120 kys BP) – was later correlated with the pre-Eemian Interglacial (intra-Saale Interstadial; MIS 7, ca 200 kys BP) (Koenigswald & Heinrich, 1999) on the basis of small mammals. According to some authors (Schreve, 2002; Schreve & Bridgland 2002a; Bridgland & al., 2004), in comparison with the British sequence the large mammal assemblage

(*S. kirchbergensis* included) indicates MIS 7 rather than MIS 5e. This is also supported by Uranium-series dating which gave an age of 225 ± 28 kys BP (Blackwell & Schwarcz, 1986; Mallik & al., 2000).

Furthermore, U-series (Schwarcz, 1980; Schwarcz & al., 1988; Schüler, 1994) and ESR (Schüler, 1994) datings from the Lower travertines suggested that the Lower and Upper travertines represent successive parts of MIS 7 interglacial;

– the odontological and postcranial remains discovered at Taubach (a travertine site, 3.5 km southeast of Weimar, Thüringen) (IQW 1968/10610, Taubach 1207; IQW 1969/12075, Taubach 12788; IQW 1968/10692, Taubach 2632-2634-2639, etc.) (Kahlke, 1977a, figs 1, 4, 5, 6, 7, 8, 10, 12, 13, 14, 17, 20, 21, …. 41).

The deposit was correlated with the Eemian Interglacial (MIS 5e, ca 120 kys BP) (Kahlke, 1977b; Heinrich, 1994). Later, when radiometrically dated, it provided an absolute age of 116 ± 19 kys BP (Brunnacker & al., 1983).

At Taubach, 1224 *Stephanorhinus* sp. specimens were found. Most of them were ascribed to *S. kirchbergensis.* The assemblage, including at least 76 individuals, was characterized by a very high percentage of young or sub-adult animals (Bratlund, 2000). On the basis of this remarkable high percentage of mortality, Bratlund (2000) argued that such a copious accumulation has to be explained by selective hominid deliberate hunting activities (numerous cut-marks appear, especially on the *S. kirchbergensis* bones). Evidence from Taubach indicates that the megafauna exploitation (*S. kirchbergensis* included) constituted an important element of subsistence strategies during the Eemian Interglacial (Bratlund, 1999).

The faunal assemblage collected over several years at Taubach (*S. kirchbergensis* included) is represented by *Castor fiber* L. 1758, *Canis lupus* L. 1758, *Ursus arctos* L. 1758, *Ursus spelaeus* ROSENMÜLLER & HEINROTH 1793, *Meles meles* L. 1758, *Lutra lutra* L. 1758, *Crocuta crocuta* (ERXLEBEN 1777), *Lynx lynx* (L. 1758), *Panthera pardus* ssp., *Panthera leo spelaea* or cf. *spelaea* (recte *Panthera spelaea* or *P.* sp. cf. *spelaea* [GOLDFUSS 1810]), *Elephas antiquus* (FALCONER & CAUTLEY 1845), *Equus taubachensis* FREUDENBERG 1914, *Sus scrofa* L. 1758, *Megaloceros giganteus* (BLUMENBACH, 1803), *Dama dama* (L., 1758), *Cervus elaphus* L. 1758, *Alces latifrons* (JOHNSON 1874), *Capreolus capreolus* (L. 1758), *Bison priscus* BOJANUS 1827, *Bos primigenius* BOJANUS 1827, and *S. hemitoechus* (FALCONER 1868) (Bratlund, 2000);

– the dental elements found at Burgtonna (about 50 km west of Weimar, Erfurt, Thüringen) (Kahlke, 1978, figs 1, 2, 3; Kolfschoten, 2000) (IQW collections). The deposit was correlated with the Eemian Interglacial (MIS 5e, ca 120 kys BP); radiometrically dated, it provided an absolute age of 104-111 ± 7 kys BP (Brunnacker & al., 1983);

– the odonto-osteological remains from Weimar ("Travertine im Stadtgebiet") (Thüringen) (Kahlke, 1984, figs 1, 2, 3) (IQW collections);

– the mandible found in the Middle Pleistocene levels of a cave at Hunas (Pommelsbrunn, Bavaria) (Groiss & al., 1981, Pl. 3-figs 2, 4, 6) (IPE collections);

– the nine isolated teeth from Braunschweig (Niedersachsen) (? unpublished material);

According to literature, other *S. kirchbergensis* remains also come from:

– Lehringen (about 35 km southeast of Bremen, northwestern German plain), found with the following accompanying fauna: *Castor fiber* L. 1758, *Canis lupus* L. 1758, *Ursus* sp., *Equus* sp., *Equus hydruntinus* REGALIA 1904, *Cervus elaphus* L. 1758, *Dama dama* (L. 1758), *Capreolus capreolus* (L. 1758), *Megaloceros giganteus* (BLUMENBACH 1803), and *Bos primigenius* BOJANUS 1827. The site was originally excavated in 1948 (Adam, 1951; Deibel-Rosenbrock, 1960; Sickenberg, 1969, inter alios);

– the upper "Mauerer Sande" on the banks of the Elsenz river (a small Neckar tributary) at Mauer an der Elsenz (south of Heidelberg). The deposit yielded a relatively great number of fossil rhinoceros remains. Even if they were mainly assigned to *S. hundsheimensis* (TOULA 1902), in the case of some specimens (a radius, a second metacarpal, an astragalus, and a third metatarsal; GIH collections) *S. kirchbergensis* seems also to be attested (Koenigswald & Heinrich, 1999; Schreiber, 2002). For all rhinoceros remains, MIS 15 (ca 600 kys BP) is supposed only;

– Neumark-Nord (Halle, Sachsen-Anhalt), collected with an Eemian Interglacial faunal assemblage (Mania & al., 1990; Mania, 1992; Koenigswald, 1997). The age of this deposit is still object of debates;

– the right bank of Rhine at Reilingen (west of Heidelberg) (Ziegler & Dean, 1998);

– the open cast lignite mine at Schöningen (near Magdeburg, Niedersachsen), about 150 km north of Weimar-Ehringsdorf (Thüringen) (Kolfschoten, 1993, 1995; Koenigswald & Heinrich, 1999). Two different isotope stages have been proposed for this site: MIS 9 (ca 300 kys BP) (Urban, 1995; Urban & al., 1995) or MIS 11 (ca 400 kys BP) (Mania, 1996);

– Rabutz (Sachsen-Anhalt) where an upper dentition was found (Fritsch, 1880). An Eemian age has only been advanced by Eissmann (1990), but the age of this deposit is still object of debate.

A part of the rhinoceros odonto-osteological remains from the Wipper river (a Saale–Elbe tributary) at Bilzingsleben ("Bilzingsleben–I") (northern margin of the Thuringian basin) referred to the post-Elsterian (MIS 11c, ca 430 kys BP) (Schreve, 2001; Schreve & Bridgland, 2002b) was formerly assigned to *S. kirchbergensis* by Mania (1983). Later, Made (2000) ascribed it to *Stephanorhinus* sp. aff. *S. kirchbergensis* (IQW collections).

On the reconstruction of the palaeoenvironment of Northwestern Europe based on fossil mammals, on the Eemian climate, on the Eemian Interglacial in Northern Europe, on the Eemian mammal fauna of Central Europe, respectively on the Eemian Interglacial in general see also Kolfschoten (1995), Zagwijn (1996), Turner (2000) and Gaudzinski (2004), Kolfschoten (2000, 2002), Gibbard (2000).

1.5. Austria

S. kirchbergensis remains come from two sites only: Nordwestbahn bei Wien-Heiligenstadt (Toula, 1907) and from Willendorf–I (about 4 km south of Spitz an der Donau, Niederösterreich) (Woldrich, 1893; Thenius, 1956-59; Frank & Rabeder, 1997:69).

From Wien-Heiligenstadt comes a hemimaxilla with six teeth found in 1870 by H. Wolf, described as *Rhinoceros Mercki Jäger* var. *Vindobonensis* TOULA 1907 (Toula, 1907:449-454, Pl. XI-figs 1, 2).

The three teeth from Willendorf–I (Thenius, 1956-59:160-162, figs 116-117-118) were recovered in 1893

by Woldrich who erroneously assigned the specimens to *C. antiquitatis* (BLUM. 1799) (Woldrich, 1893) (PNHM collections).

The Willendorf–I accompanying fauna (revised by Thenius in 1956) consists of: *Aquila chrysaëtos* (L. 1758), *Ochotona pusilla* PALLAS 1768, *Arvicola terrestris* (L. 1758), *Lepus* sp., *Canis lupus* L. 1758, *Vulpes vulpes* (L. 1758), *Alopex lagopus* (L. 1758), *Gulo gulo* (L. 1758), *Ursus* sp. cf. *U. arctos* L. 1758, *Panthera spelaea* (GOLDFUSS 1810), *Lynx lynx* (L. 1758), *Cervus elaphus* ssp., *Rangifer* sp., *Alces alces* (L. 1758), *Capra ibex prisca* WOLDRICH 1893, *Bison priscus* BOJANUS 1827, *Mammuthus primigenius* (BLUMENBACH 1799), and *Equus* sp.

In both cases, no stratigraphical data are available.

1.6. Spain and Portugal

In the older Spanish literature, rhinoceros material has often been referred to "*Dicerorhinus mercki*" (Obermaier, 1925, 1937; Meléndez, 1955; Fuentes Vidarte, 1979, inter alios). Altuna Echave (1972) reported on some remains of *D. kirchbergensis* from Lezetxiki (Guipúzcoa), while Pérez Ripoll (1977) referred to the presence of the same species at Cova Negra (Valencia).

At present, we may exclude that *S. kirchbergensis* lived in Spain, as well as in Portugal (Barandarian & Veiga Ferreira, 1971; Veiga Ferreira, 1975). On the other hand, as to the Spanish area, Cerdeño (1990) revised the "*Dicerorhinus mercki*" material concluding that it would have to be referred to *S. hemitoechus* (FALCONER 1868).

1.7. Italy

The twelve localities and the specimens (with their illustrations and measurements) have been discussed – using morphological and non-metric characters – in a previous paper (Billia & Petronio, 2009).

Afterwards, some additional *S. kirchbergensis* reports have been found in literature. The material was originally collected in the following seven other localities:

– along the Trieste-Venezia railway near Aurisina (Carso Triestino, Trieste, Venezia Giulia, Northeastern Italy): two upper molars (Leonardi, 1945-47, Pl. V-fig. 4, Pl. VI-fig. 2) (MCSN-TS collections);

– at Preluca (Venezia, Venezia Euganea, Northeastern Italy): one first upper molar referred to the Mindel-Riss by Fabiani (1919, Pl. XVII-figs 8, 8a) (Valle private collection, Trieste);

– at Cava "Calcara" (Monte di Malo, Vicenza, Venezia Euganea, Northeastern Italy): only one fourth upper premolar. It was recovered in 1955 in a rock crack of this quarry in which some other rhinoceros osteological remains (untraceable, at present) were contained (MPP collections);

– at Monte Zoppega (= Grotta di San Lorenzo di Soave, Soave, Verona, Venezia Euganea, Northeastern Italy) (Scortegagna, 1844; Molon, 1875; Fabiani, 1919, Pl. XVII): two mandibular branches (with P^2–M^3 and P^4–M^3), a few isolated upper teeth, and some skeletal remains belonging to only one individual. The remains were referred by Fabiani (1919) to the Mindel-Riss (odontological material – MCSN di Vicenza collections; skeletal remains – IGUP "A. de Zigno" collections);

– Grotta Valdemino (Borgio Verezzi, Savona, Liguria, Northwestern Italy): a fragmentary metapodial of large dimensions ascribed to *Stephanorhinus* cf. *S. kirchbergensis* (Sala, 1992). It was found together with a well-represented accompanying interglacial faunal complex: *Testudo hermanni* GMELIN 1789, *Oryctolagus burgi* NOCCHI & SALA 1997, *Mammuthus armaeniacus* (FALCONER 1857) (= *M. trogontherii* [POHLIG 1885]), *Sus scrofa* L. 1758, *Bos primigenius* BOJANUS 1827, *Macaca sylvanus* (L. 1758), *Canis mosbachensis* (SOERGEL 1925), *Panthera pardus* (L. 1758), *Felis* (*Lynx*) gr. *spelaea, Homotherium* sp., *Ursus* sp., *Microtus* (*Iberomys*) *brecciensis* (GIEBEL 1847), *Sorex* sp., *Talpa* sp., *Allocricetus bursae* SCHAUB 1930 (*Allocricetus* = *Cricetulus*), *Pliomys episcopalis* MÉHELY 1914, *Apodemus* sp., *Clethrionomys* sp., and *Microtus* (*Terricola*) sp. (Nocchi & Sala, 1998; Sala & Masini, 2007) (collections: Museo Civico, Chiostri di S. Caterina, Finale Ligure, Savona).

Excavated at the end of the 1980s, Grotta Valdemino was correlated with the Middle Galerian. It represents one of the few Italian cave sites provided with a well-known chronology (Sala, 1992);

– Caverna degli Orsi (San Dorligo della Valle – Dolina, Trieste, Northeastern Italy). From this cave comes a dental gemma of a fourth lower deciduous molar referable to *S.* sp. cf. *S. kirchbergensis* (Berto & Rubinato, 2010) supposedly correlated with the Eemian (MIS 5e);

– Roma, Tiber at Ponte Molle (or Ponte Mollo, now called Ponte Milvio; at that time a suburb of Rome). The odontological material described in Billia & Petronio (2009) apart, a fouth upper premolar and a third upper molar were collected from the same site (the right Tiber bank) in the second half of the XIX century (Leonardi, 1947, Pl. II-figs 4, 9; IGUP collections). No more information is available.

Unfortunately, except for Grotta Valdemino, the other Italian *S. kirchbergensis* remains found without macro-microfaunal and/or stratigraphical data do not allow inferring any chronological hypothesis.

Toula (1907:447) reports on "ein Zahn aus einer Höhle nächst Matteria bei Cosina (zwei Meilen von Triest; *Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt,* Jhrg 1860, p. 114)" attributed to *S. kirchbergensis.* Unfortunately, no further information on this report is available.

At least a dozen of other reports on *S. kirchbergensis* in Italy (from north to south) may be found in literature, but they are related to nomenclatural misidentifications with other Pleistocene rhinoceros species (? *S. hemitoechus,* ? *S. hundsheimensis*). These rhinoceros remains – formerly attributed to *S. kirchbergensis* – come from Zandobbio (Trescore Balneario, Bergamo, Lombardia) (Vialli, 1957), from the lacustrine basin of Piànico-Sèllere (Bergamo, Lombardia) (Casati, 1968), from the Po near Portalbera (Pavia, Lombardia) (Cadeo, 1958), from Monte Giogo (Piacenza, Lombardia) (Simonelli, 1897-98), from the Grotta di Madonna dell'Arma near Bussana (San Remo, Liguria) (Isetti et al., 1962), from Monte Tignoso (Livorno, Toscana) (Del Campana, 1909), from Lecce Sole (Falciano Selice, Caserta) (Sorbini & Durante Pasa, 1974), from Cagnano Varano (Foggia, Gargano, Apulia) (Sorbini & Durante Pasa, 1974), from the "ventarole" karst cavities at Melpignano (Otranto, Lecce, Apulia) (Mirigliano, 1941; Barbera et al., 2006), from Torre Talao (Scalea, Cosenza, Calabria) (Bulgarelli, 1972; Mangano, 2007), or from S. Francesco-Contrada Corvo (Archi, Reggio Calabria, Calabria) (de Stefano, 1899, 1901; Flores,

1900; Bonfiglio & Berdar, 1986; Mangano, 2007).

1.8. Slovenia

In Slovenia, *S. kirchbergensis* was recognised at Dolarjeva jama near Logatec (about 25 km southwest of Ljubljana) (Rakovec, 1933) and at Kamnitnik (Skofija Loka, about 20 km northwest of Ljubljana) (Rakovec, 1942).

A *S. kirchbergensis* second deciduous molar (Ck 210) was recovered at Crni Kal (southeast of the Osp village, Koper Municipality, Northern Istria, Southwestern Slovenia) (Adam, 1958; Rakovec, 1958; Malez, 1986) (collections: Geological-Palaeontological Institute, Ljubljana University).

1.9. Croatia

Apart from the skull from Husnjakovo Brdo at Krapina (about 40 km north of Zagreb) – one of the five *S. kirchbergensis* skulls found until now in Europe – damaged at the right zygomatic arch and in illo tempore described as *Rhinoceros Mercki* var. *Krapinensis* by GORJANOVICH-KRAMBERGER (1913) (v. autem in Billia, 2010), mandibles and isolated teeth were also collected from the same site (Gorjanovich-Kramberger, 1913; Malez, 1970, 1986).

S. kirchbergensis is also represented by the dental elements discovered at Varazdinske Toplice (about 13 km southeast of Varazdin and about 45 km east of Krapina) (Gorjanovich-Kramberger, 1913) and by a fragmentary second lower molar and two phalanges from the Veternica cave (Medvednica Mountain, 9 km west of Zagreb). Malez (1963) dubiously correlated these remains with the Riss-Würm Interglacial.

The material coming from Husnjakovo Brdo and from Varazdinske Toplice is preserved at the Quaternary Institute of HAZU (Zagreb) and at the Museum of Geology and Palaeontology of SAN (Belgrade). Numerous illustrations of these remains may be found in Gorjanovich-Kramberger (1913; Pls. III, IV, V, VI, XI, XIII).

The two rhinoceros upper molars (MCSN-TS n.n.) from Volosko (Lussino island – at present, Losinj, Dalmatia) (Leonardi, 1945-47, Pl. VI-fig. 1) must be also assigned to *S. kirchbergensis*.

The two mandibular fragments (IGUP n.n. and MCSN-TS n.n.) – with two molars on both specimens – coming from the island of Lesina (at present, Hvar, Dalmatia) (Woldrich, 1882:455-456, Pl. X-figs 26, 27; Woldrich, 1886:178; Leonardi, 1945-47, Pl. IV-figs 2, 3; Leonardi, 1947, Pl. III-fig. 8) may tentatively be attributed to *S. kirchbergensis* (just as in Woldrich, 1882, 1886 and in Leonardi, 1945-47, 1947).

1.10. Hungary

Two *S. kirchbergensis* fragments of mandible and some postcranial remains of late Middle Pleistocene age – found together with *Bison* (*Urus*) *hungaricus* KRETZOÏ 1942 skeletal remains – come from the top of the strata at the "entrance N° 1" of the Ördöglyuk cave (about 1 km west of the Solymár village, eastern slope of the Zsíros Hill, northwestern border of Budapest, left side of the 10 highway, Budapest-Dorog axis, western side of the Danube; about 300 m a.s.l.) (Jánossy, 1986:111, 113–Pl. II-figs 2, 3, p. 188) (collections: Department of Palaeontology, Hungarian Museum of Natural History, Budapest).

Jánossy (1986) chronologically correlated the above mentioned strata with Steinheim (Baden-Württemberg) and Swanscombe (Kent).

Further data on the Ördöglyuk cave at Solymár are also available in Fostowicz-Frelik & Gasparik (2006).

M. Gasparik (2007, personal communication) does not exclude the existence of some other *S. kirchbergensis* remains found in Hungary but no data are available at present.

1.11. Czech Republic

S. kirchbergensis finds are very rare. This fact may be due to the arid continental climate (R. Musil, 2007, personal communication). In any case, the remains consist of small fragments of teeth only.

1.12. Slovakia

Only one *S. kirchbergensis* record is attested (P. Holec & M. Sabol, 2007, personal communications). The remains (skull fragments and some limb bones) come from a travertine mound at Gánovce-Hrádok (about 3 km southeast of Poprad, Poprad district, Presov region, Northeastern Slovakia) together with a cast of *Homo sapiens aniensis* (recte *Homo sapiens* var. *aniensis* SERGI 1929) (unpublished material). Presumed age: Eemian Interglacial (M. Sabol, 2007, personal communication).

1.13. Poland

The earliest occurrence of *S. kirchbergensis* in this area is represented by a mandible (ZIN 10743) of large dimensions with massive features (at present, de facto only a hemimandible) (Pusch, 1836; Brandt, 1875-76:81, Pl. XXI; Brandt, 1877:97, Pl. III-figs 2, 3, 4; Chersky, 1891:519-520; Pavlova, 1892-93; Gromova, 1935:95 and 102, Pl. I-fig. 3, Pl. II-fig. 7, Pl. III-fig. 10). In 1811, it was unearthed near the confluence of the Liur river with the Bug river not far from the town of Kamienczyk (or Kamieniec-Mazowiecki; in Brandt, 1877:97, Kamenetz-Mazowski) (Wyszków region, Central-Eastern Poland). "Poluchena iz Varshavy v 1832 g." (literally, "[remains] received from Warsaw in 1832"), as I found in an old ZIN Museum catalogue.

The present hemimandible (max lenght = about 590 mm) appears frontally and occipitally seriously damaged. Moreover, only four very worn dental elements were preserved.

The most significant *S. kirchbergensis* Polish record (Borsuk-Bialynicka & Jakubowski, 1972, Pls. I-V) concerns the almost complete skull (MZ VIII Vm-450) recovered in 1970 – with mandibular fragments – at the dept of 6-7 m in alluvial deposits of the Wisla (= Vistula) river bed, in the Siekierki district of Warsaw. Exhaustively described by the above mentioned authors, it represents one of the five *S. kirchbergensis* skulls found until to day on European territory. Some other skeletal remains assigned to *Equus caballus* L. 1758 (recte *Equus ferus* BODDEART 1785), *Bos primigenius* BOJANUS 1827, *Rangifer tarandus* (L. 1758), and *Cervus elaphus* L. 1758 were also found.

Between 1880 and 1882, at Szczesliwice near Warsaw, *S. kirchbergensis* odonto-osteological remains were collected by Slósarski (1882, 1884) together with remains of *Bison priscus* BOJANUS 1827, *Cervus elaphus* L. 1758, *Capreolus capreolus* (L. 1758), and *Elephas antiquus* FALCONER & CATLEY 1845. At first, the *S. kirchbergensis* remains were mistakenly assigned by Slósarski to *C. antiquitatis* (BLUM. 1799). Later, in 1935,

L. Sawicki revised this material ascribing it to *S. kirchbergensis.*

From a brickyard at the same locality (Szczesliwice) comes a well-preserved maxilla with nine teeth collected by Sawicki in interglacial deposits in 1935 (Czyzewska, 1962).

According to some authors, other *S. kirchbergensis* remains were allegedly found in Poland:

– along the Wisla (= Vistula) near Grudziadz; some teeth (Jentsch, 1901; Hermann, 1911; Schroeder, 1930);

– at Minieta (Sztum province); some teeth (Hermann, 1911; Schroeder, 1930);

– at Grupa (Swiecie province); a fourth lower premolar (Hermann, 1911; Schroeder, 1930);

– at Obornikach near Poznan; a mandible (Lubicz-Niezabitowski, 1926, Pl. 4-figs 11, 12);

– at Imbramowice (Swidnica province, Lower Silesia); a mandible (Gürich, 1908; Pax, 1921);

For more detailed data on these records, vide autem in Kowalski (1959:153-154), Czyzewska (1962), Jakubowski & al. (1968).

1.14. Romania

S. kirchbergensis is reported from five localities:

– Reci-Comolău (Târgu Secuiesc Basin, Southeastern Transylvania); in "andesitic detrital deposit above the middle level A" with *Cervus elaphus* L. 1758, and *Bubalus murrensis* (BERCKHEMER 1927) (= *Buffelus murrensis* BERCKHEMER 1927) some not-specified *S. kirchbergensis* remains were collected (Kovács, 1981). The A level of Mindel-Riss/Holstein age is correlated with the Steinheim a.d. Murr "*antiquus*-Schotter" fauna (Rădulescu & Samson, 1985:91);

– Borsec (Borsec Basin, Harghita district, Eastern Transylvania); from travertines a *S. kirchbergensis* isolated upper molar was recovered (Samson & Rădulescu, 1969). From the same travertines also comes a *S. kirchbergensis* upper maxillary fragment provided with the fourth premolar, the first and second molars found together with an isolated fourth upper premolar belonging to the same individual (Samson & Nadisan, 1970; an illustration of the maxillary fragment is given in fig. 1, p. 247). According to Samson & Rădulescu (1969), a Mindel-Riss or Riss-Würm age may only be supposed. The isolated fourth upper premolar is housed in the Miercurea-Ciuc Museum collections;

– a Danube terrace deposit south of Plenița (Dolj district, Southwestern Oltenia, Southwestern Romania); here, an isolated fourth upper premolar of Mindel-Riss age was recovered (Ghenea & al., 1963:50, Pl. I). No descriptions of the specimen are available;

– "Peştera Cioarei" (Cioarei Cave) at Boroşteni (or Broşteni, Gorj district, Oltenia, Southwestern Romania); the *S. kirchbergensis* fragmentary remains were collected from bed IV as part of a mammalian assemblage including *Canis lupus* L. 1758, *Ursus arctos* L. 1758, *Putorius putorius* L. 1758 (recte *Mustela putorius* L. 1758), *Cervus elaphus* L. 1758, *Equus* sp., Bovidae indet. (Terzea, 1987). Unfortunately, this paper mentions a species list only, neither descriptions nor images of the remains are available;

– Grojdibodu (Olt district, Oltenia, Southwestern Romania); only one *S. kirchbergensis* isolated molar was found in this site (Bandrabur & al., 1963:122). Other data are not available.

In the author's opinion, the well-known rhinoceros "skull from Bessarabia" – without upper dentition and mandible – referred by Simionescu (1939-40) to *S. kirchbergensis* ("Nach den oben angeführter Einzelangaben glaube ich, dass der beschriebene Schädel mehr an *Rh. mercki* erinnert", Simionescu, 1939-40:430), on the basis of some of its morphological characters (vide in Simionescu, 1939-40:433, Pl. I) would seem to belong to *C. antiquitatis* (BLUM. 1799). In any case, the specimen – found in an unknown locality in Bucovina (at present, in Ukraine) – previously preserved in the collections of the Palaeontological Institute of the University of Bucharest is unfortunately unavailable at present (no information is available about the collection in which it is housed; probably, in ? Cernauti [Chernivtsi], Southeastern Ukraine; V.A. Codrea, 2009, personal communication).

As regards hydrological details on Plenița and/or on the Danube terrace vide autem in Ghenea & al. (1963). For analogous details on Grojdibodu vide in Bandrabur & al. (1963).

1.15. Moldova

From the alluvial deposits ("tiraspol'skaya gravya" = "Tiraspol' gravel") of Kolkotova balka (near Tiraspol', southeast of Chişinău (= Kishinev) (Pavlova, 1925; Gromov, 1948; David & Vereshchagin, 1967; Belyaeva & David, 1971; David, 1963, 1966, 1969, 1980, 1983, 1995; David & al., 1990; Eremeyko, 2002), originated several *S. kirchbergensis* remains:

– a right hemimandible (OPS 1640) (Belyaeva & David, 1971, Pl. XV-fig. 2; David, 1980, fig. 3; David, 1983, fig. 16) provided with P_3–M_3 showing traumatological consequences at the level of M_2–M_3 (collections: previously, OPS – at present, IZiF);

– a right hemimandible (OPS 1-128, non OPS 1-218 as in Belyaeva & David, 1971:131) with M_2 and M_3 only (both teeth are seriously damaged) (collections: previously, OPS – at present, IZiF);

– a mandible (ZIN ANU 19-159) with seven teeth on the whole, without the left vertical branch (David & al., 1990, fig. 25) (ZIN ANU collections);

– a fragment of a right horizontal mandibular branch without teeth (ZIN ANU collections);

– two fragments (a proximal and a distal one) of humerus (inv. nrs. 1/221 and 1/224);

– a tibia fragment of great dimensions (ZIN ANU collections).

As a whole, the remains were generically assigned to the (? Russian) Middle Pleistocene (Eremeyko, 2002:8).

The rhinoceros remains from the "Tiraspol' gravel" were previously described by Pavlova (1925) – just as indicated by Gromov (1948:449) – as *Rhinoceros* aff. *hemitoechus* FALCONER (actually *S. etruscus* [Falconer 1868]).

Not less than 24 palaeontological sites are know on the Moldovian territory where Plio-Pleistocene rhinoceros remains were found, *S. etruscus* (FALCONER 1868), *Elasmotherium peii* CHOW MINCHEN 1958, and *Elasmotherium* sp. included (Eremeyko, 2001).

1.16. Ukraine

In the literature (Rogovich, 1875; Pidoplitschko, 1932; Gromova, 1935:96-97; Gromov, 1948:449), *S. kirchbergensis* – described by Rogovich (1875) as *Rhinoceros leptorhinus* CUVIER 1836 – would be attested

in five localities: near Kiev, at Kaniv (also Kanev, Cherkasy region, Central Ukraine) (? "*Rhinoceros Mercki,* skull"), at Tripol', at Pekarya, and at Ol'viopol'. According to Gromova (1935:97), in the 1930s the material was housed by the Geological Museum collections of the UkrAN.

According to David & al. (1990:101-102 and 2008, personal communication), fourteen *S. kirchbergensis* fragments of teeth and bones were recovered from Sinyakovo–1 (collections: Palaeontological Museum, UkrAN) while a *S. kirchbergensis* mandibular fragment with four teeth (inv. nr. 3675) (David & al., 1990:102, fig. 26) was found at Belyaevka ([Biliaivka], Odessa region) (PM OGU collections).

Logvynenko (2004) reported on some other poorly-characterised *S. kirchbergensis* skeletal remains from Morozivka (about 5 km south of Brusyliv, Brusyliv district, Zhytomyr region), Shutnovzi, and Tikhonivka (Zaporozhye province). No additional data are available.

Stepanchuk & Rekovetz (2008) referred to a discovery of "*Dicerorhinus*" cf. *kirchbergensis* JÄGER remains from the alluvial deposits of Medjibozh ([Medzhibizh], Lower Bug basin, Khmel'nits'ky region, Western Ukraine). Further information is not available.

1.17. Russian Federation (European area)

As far as the Russian-European area is concerned, the author recently revised all the *S. kirchbergensis* available material using morphological and non-metric characters.

Unfortunately – at least at present – *S. kirchbergensis* available remains come from some Russian European localities only. With reference to other localities mentioned in the literature where *S. kirchbergensis* remains were also allegedly found, the respective material is untraceable. However, all the localities and the available specimens (with their illustrations and measurements) have been discussed in a previous paper (Billia, 2008b).

2. Asia

As to the territories previously included in the ex Soviet Union, the most noteworthy *S. kirchbergensis* reports concern the skull from the Irkutsk region (Eastern Siberia) (Chersky, 1874; Brandt, 1877; Billia, 2008a, 2010), the only skull recovered until now on the whole Russian territory which has been re-identified by the author in a vault of the ZIN RAN Museum in St-Petersburg in 2004.

2.1. Russian Federation (Asian area)

Recently, a revision – using morphological and non-metric characters – has been performed on the Siberian *S. kirchbergensis* material by the author. Differently from the *S. kirchbergensis* remains recovered in the Russian European area, here the specimens – except for only one site – are available in museum collections. Moreover, other rhinoceros fossil material – discovered in the museum collections during revision works – has been ascribed to *S. kirchbergensis.* The six Siberian localities of the finds and the material (the famous "Irkutsk skull" included) – with their illustrations and measurements – have been treated in previous works (Billia, 2008a, 2008b).

2.2. Armenia

In the author's opinion, the horizontal left branch of a mandible (inv. nr. 29) described as "*Rhinoceros mercki* Jäg." (recte *S. kirchbergensis*) belonging to a sub-adult individual – found in 1928 at Kazach' (southern environs of Leninakan, Northwestern Armenia) besides remains of *Equus stenonis* COCCHI 1867, *Camelus knoblocki* NEHRING 1901, *Cervus* sp., and *Elephas* sp. (Avakyan, 1948, 1955, 1959:31-34, Pl. VIII-figs 18, 19, 20, 1961:389-390, Pl. 2-figs 1, 2, 3; Avakyan & Burchak-Abramovich, 1945:101; Vereshchagin, 1959:74), should only cautiosly be assigned to *S. kirchbergensis.* All the remains were collected by Bogachev (collections: Kapetyan Museum, Institute of Geology, Armenian Academy of Sciences, Erevan).

2.3. Azerbaijan

According to Vereshchagin (1959:129), "skull fragments and teeth of a juvenile rhinoceros – *Rhinoceros* cf. *mercki* (recte *Stephanorhinus* sp. cf. *S. kirchbergensis*) – found together with skeletal material assigned to *Equus* sp. and *Crocuta* sp. were allegedly found at Kishla (north of Baku, Apsheron peninsula)". Other *S. kirchbergensis* material probably originated from the Azikh cave (Alev, 1969; Mamedov & Aleskerov, 1988:106-107), also known as Azykh, Azokh or Azix magarasi (about 3 km northeast of the Tugh village, Fizuli district, Southern Karabakh). No further information is available for any of the finds.

2.4. Tajikistan

The following *S. kirchbergensis* remains were reported from two localities (Sharapov, 1980; Dmitreva & Nesmeyanov, 1982):

– from the left bank of the Obigarm river near the village of Obigarm (Obigarm basin, Roghun district, Central-western Tajikistan). On the basis of Khisarova's data, Kojamkulova (1969) assigned the remains to the (? Russian) Early Pleistocene;

– from both the right and the left banks of the dry bed of the Kuruksay river (? Dashtigulo or ? Shalash point; ? Kuruksay–3; ? 0.97 Mys BP), northeast of the Bal'djuan village (Eastern Tajik depression, Southern Tajikistan) with remains of *Equus stenonis* COCCHI 1867 and *Equus* sp. cf. *E. hydruntinus* REGALIA 1904 (attributions by Kojamkulova, 1969).

Even if the stratigraphy of Southern Tajikistan (within the Tajik depression, an intermontane basin) – based on data obtained by biostratigraphical, climatostratigraphical, geological-geomorphological, and physical methods (Dodonov, 1980, inter alios) – would seem to be well-known in the interval Late Pliocene/Late Pleistocene, we consider that in the second case (Kuruksay), the chronology for *S. kirchbergensis* is currently questionable.

2.5. Kazakhstan

S. kirchbergensis was certainly testified by twelve isolated teeth (eight of which – after Khisarova, 1963 – are figured in fig. 3, in this paper) coming from the village of Koshkurgan (14.5 km northeast of Turkestan,

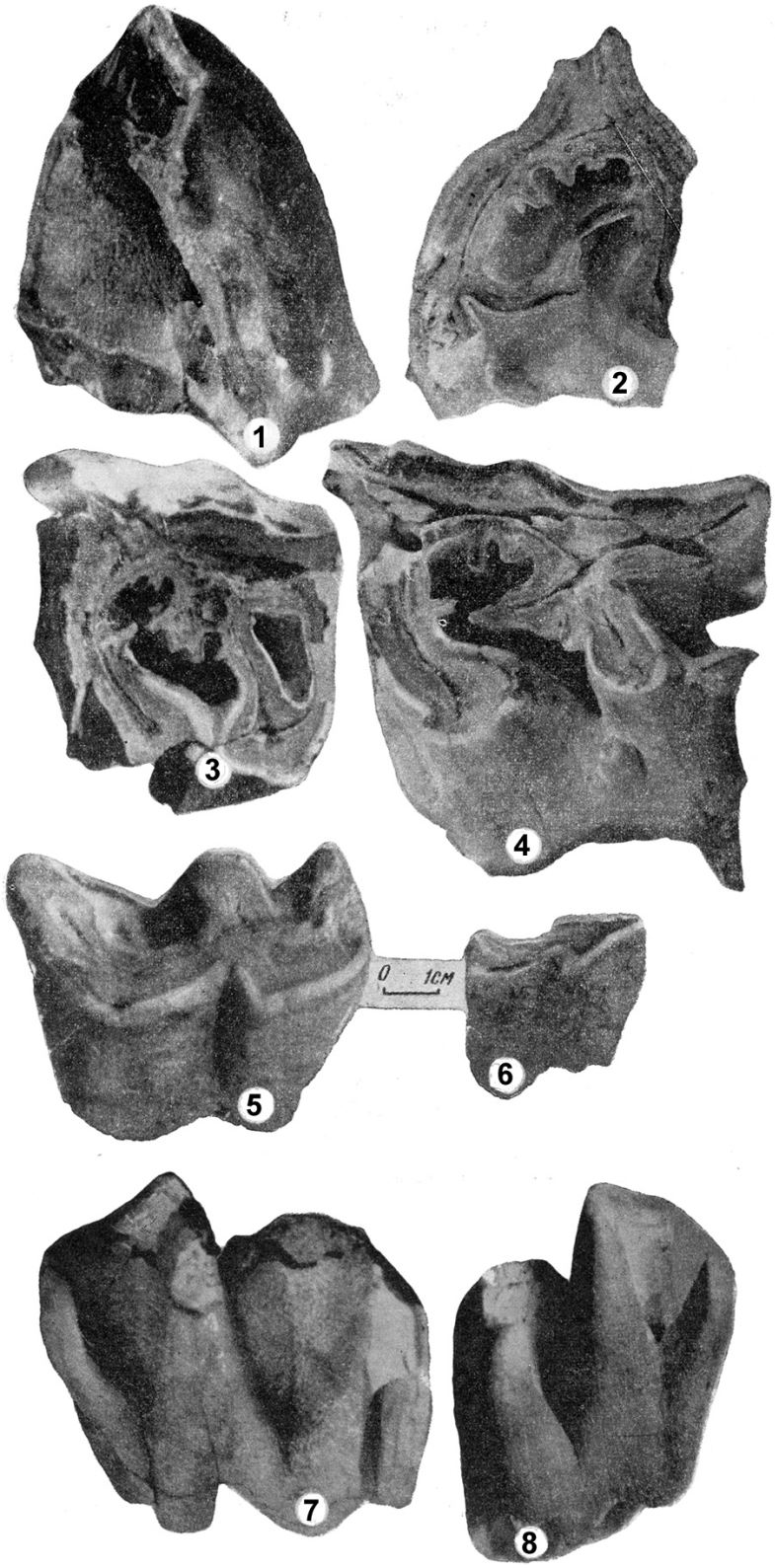

Figure 3 – *Stephanorhinus kirchbergensis* (JÄGER, 1839); Koshkurgan village (Turkestan, Turkestan district, Kara Tau Mountains, Chimkent region, Southeastern Kazakhstan); eight isolated upper and lower teeth; (1-2) third upper molars [729-14/55-K and 2/55-K]; (3) first upper molar [760-33/55-K]; (4) second upper molar [5/55-K]; (5) second lower molar [756-32/55-K]; (6) second lower premolar [758-32/55-K]; (7-8) third lower molars [754-30/55-K and 17/56-K] (scale bar for all the specimens = 1 cm) (after Khisarova, 1963, modified) (coll.: "G.V. Plekhanov" Gorny Institut [= Institute of Mines], St-Petersburg).

Turkestan district, Kara Tau Mountains, Chimkent region, Southeastern Kazakhstan) (Khisarova, 1963, Pls II, III). They have been collected from Middle Early Pleistocene (*sic*) alluvial and proluvial pebble beds, conglomerates, sands, limestones, and clays together with other fossil skeletal remains assigned to *Paracamelus gigas* SCHLOSSER 1903, *Equus caballus* cf. *mosbachensis* REICHENAU 1914 (recte *Equus* sp. cf. *E. mosbachensis* [REICHENAU 1914]), *Asinus hydruntinus* REGALIA 1904 (recte *Equus hydruntinus* [REGALIA 1904]) and *Bison priscus* ssp. In detail, they consist of: four upper molars (M^1, 760-33/55-K; M^2, 5/55-K; M^3, 729-14/55-K; M^3, 2/55-K), three lower premolars (P_2, 758-32/55-K; P_2, 757-33/55-K; P_3, 759-35/55-K), and five lower molars (M_1, 755-31/55-K; M_2, 756-32/55-K; M_2, 753-29/55-K; M_3, 754-30/55-K; M_3, 17/56-K).

At present, the twelve teeth – previously preserved at the Palaeobiological Branch, Zoological Institute, AN KazSSR – are housed at the "G.V. Plekhanov" Gorny Institut (= "G.V. Plekhanov" Institute of Mines) in St-Petersburg.

Some other Early Middle Pleistocene (*sic*) remains possibly referable to the same species could come from four other localities of Kazakhstan:

– in a ZIN old card-index, under "*Rhinoceros merckii* Jaeg."(*sic*), I found remains (ZIN 21007; ledger n. 368-1939) "discovered along the Irtysh river, near the village of Chernoyarka" (Chernoyarka or Pavlodar; in toponymy, Chernoyarka and Pavlodar represent two different localities, whereas – in literature – they must be considered as synonyms indicating the same palaeontological site). The Chernoyarka village is situated about 18 km north of Pavlodar (Pavlodar region, Northeastern Kazakhstan). No other data are available;

– Kojamkulova (1981) and Kojamkulova & Kostenko (1984) shortly reported on "a discovery of indeterminate remains referable to *Dicerorhinus mercki* (recte *S. kirchbergensis* [JÄGER]) at Zyryanovsk" (about 49° 55' N – 84° 25' E), about 150 km north of the Zaysan lake and about 120 km east of Ust'-Kamenogorsk (Vostochno-Kazakhstanskaya oblast') (= Northeastern Kazakhstan), without any other appreciable remarks;

– reports on finds of "*Dicerorhinus mercki*" (recte *S. kirchbergensis* [JÄGER]) at Novoiliysk (Alma-Ata [Almaty] region, Southeastern Kazakhstan) may be found in three other works (Kojamkulova, 1981; Kojamkulova & Kostenko, 1984; Tleuberdina & al., 1990). No additional data are available;

– finally, from a bank of the Ili river near the Kapchagay village (Tyan'-Shan' Mountains, Alma-Ata [Almaty] region, Southeastern Kazakhstan), Kojamkulova (1974, 1981) referred to the recovery of typical "Koshkurganskaya Fauna" (= Koshkurgan Fauna) remains: *Dicerorhinus mercki* JÄGER (recte *S. kirchbergensis*), *Elasmotherium sibiricum* FISCHER 1808, *Asinus hydruntinus* REGALIA 1904 (recte *Equus hydruntinus* [REGALIA 1904]), and *Archidiskodon* cf. *wüsti* M. PAVLOVA 1914, identified in the Q_1 levels (Russian Middle-Early Pleistocene).

According to Tleuberdina & al. (1990), the *S. kirchbergensis* remains from Chernoyarka (or Pavlodar), Zyryanovsk, and Novoiliysk must be assigned to the Russian Middle Pleistocene.

The rhinoceros remains (mandibular fragment, ZIN 10742 and humerus, ZIN 3989) from Semipalatinsk (Semipalatinsk region, Northeastern Kazakhstan) discovered in 1869 by Gulyaev and erroneously assigned both by Brandt (1877:96) – "Mandibula speciminis juvenilis (pulli) Rhinocerotis Merckii Semipalatinsk 1864, Guliaew" (figured in Brandt, 1877; Pl. III-figs 5, 6) – and by Chersky (1891:608) to *Rhinoceros Merckii* JAEGER (recte *S. kirchbergensis* JÄGER) must be assigned to *C. antiquitatis* (BLUM. 1799).

Chernoyarka, Pavlodar, Semipalatinsk, and Zyryanovsk are located in the northeastern part of Kazakhstan, which geographically represents the extreme southern area of Western Siberia. Since 1992, Kazakhstan is an independent republic.

In the author's opinion, apart from the teeth from Koshkurgan, the other *S. kirchbergensis* skeletal material will have to be attentively evaluated as there are possibilities of misidentifications with other local rhinoceros species.

Differently from Siberia, during the Middle Pliocene very active tectonic movements affected Kazakhstan and the adjacent regions. Originally called the "Irtysh phase" (Kostenko, 1963), they later acquired the name "Irtysh-Tekes phase" implying the regional nature (Kostenko & Kojamkulova, 1980).

2.6. Korea

S. kirchbergensis is attested from two caves of the "Turubong Cave Complex" near Sinam village (8 km northeast of Cheongju, Chungbuk province, Central Korea, 36°30'31"N–127°31'21"E) by a very well-preserved mandible and some long bones collected between 1976 and 1983 in Middle Pleistocene levels (Lee, 2001:3-5, fig. 14–p. 16) (collections: Chungbuk National University Museum, Chungbuk).

2.7. China

Back in the past, a great part of the South Chinese Pleistocene rhinoceros material has been referred to *Rhinoceros sinensis* OWEN 1870 (= *Rhinoceros sinensis* OSBORN 1898). Furthermore, *Rhinoceros choukoutiensis* WANG 1931 (recte *Dicerorhinus choukoutienensis* [WANG 1931]) has been considered as a synonym of *S. kirchbergensis* by some authors (Teilhard de Chardin, 1933, 1936, 1941; Teilhard de Chardin & Leroy, 1942; Xu, 1986; Tong & Wu, 2010). Now, if one definitively assumes that *R. sinensis* and *D. choukoutienensis* must be considered as synonyms of *S. kirchbergensis,* four other skulls found on the Chinese territory must be ascribed to *S. kirchbergensis*. Two of them come from Choukoutien (= Zhoukoudjan), two others from Anping and respectively from Xiniudong.

According to Tong (2002), *S. kirchbergensis* is a common element of the North Chinese Fauna. Nevertheless, "although the studies on *S. kirchbergensis* have experienced more than one and a half centuries, the knowledge about this species is still not enough because of the lack of fossil material" (Tong & Wu, 2010:1165).

However, some reports regard *S. kirchbergensis* remains discovered in at least eight localities:

– Choukoutien (= Zhoukoudjan) locality 1 (CKT-1) (Beijing province). The first report concerning rhinoceros remains at CKT-1 (*Sinanthropus* deposits) is due to Zdansky (1928) who referred the material to *Rhinoceros* sp. Teilhard de Chardin & Young (1929) ascribed the same material to *R.* cf. *sinensis.* Wang (1931) erected for this material a new species, *R. choukoutiensis* (= *D.*

choukoutienensis WANG). Afterwards, other authors dealt with this material but pro parte only (Black & al., 1933; Teilhard de Chardin, 1936; Teilhard de Chardin & Pei, 1941; Teilhard de Chardin P. & Leroy, 1942; Pei, 1957; Chia L.P. & al., 1959; Chao & Li, 1960; Kahlke & Chow, 1961; Chow, 1963, 1978).

Chow (1979) was the first who examined all the rhinoceros material collected at CKT-1 from 1927 to 1959. In his work, he mentioned 271 specimens, 85% of which belonging to *D. choukoutienensis:* the damaged juvenile VM 555 skull (unavailable nowadays), several upper/lower jaws, isolated juvenile/permanent teeth, postcranial bones (some of them are figured in Pls I-II; measurements are given in pp. 238-239). These remains were recovered from the CKT-1 layers 4-1 and 12-6. For them, Chow (1979) proposed a late Mindel-early Mindel-Riss age. The rest of the material belongs to *Coelodonta antiquitatis yenshanensis,* the subspecies erected by Chow (1979);

– Choukoutien (= Zhoukoudjan) locality 20 (CKT-20) (Beijing province). From CKT-20 comes the very well-preserved V2682 skull (Chia & al., 1959; Chow, 1963) collected in 1951. Provided with complete upper cheek teeth, it represents the best rhinoceros skull found in the Choukoutien region (Chow, 1963, Pl. I; skull and teeth measurements on pp. 63-64). Chia & al. (1959) proposed a Middle Pleistocene age;

– Taiyuan (Shaanxi province). Remains were found in this locality (Wang, 1961);

– Xiaogushan, Haicheng (Liaoning province). Remains were discovered in the Late Pleistocene levels of this site (Zhang & al., 1985);

– Anping (Liaoning province). Xu (1986) reported on a damaged juvenile skull as well as several odontological and postcranial remains (LA7701-xxx; some of them – but not the skull – are figured in Pl I; some measurements are given in tabs 1, 2, 3);

– Tangshan (Nanjing province, Southern China). Remains were collected in this locality (Huang, 1996; Tong, 2001a, 2001b, 2001c, 2002);

– Dunbey territory (NE China). Unspecified remains come from Middle Pleistocene levels of the Dunbey territory (Fu, 2002:7, 9);

– Xiniudong (Shennongjia Forest District, Hubei Province, CS China). Very recent studies (Tong & Wu, 2010) attributed the Late Pleistocene rhino remains from the Paleolithic site of Xiniudong (or "Rhino Cave") (west of Hongping, Shennongjia Forest District, Hubei Province, Central-South China, 31°40'19.9"N–110°25'11.9"E) to *S. kirchbergensis.* Wu (1998) previously referred this material to *R. sinensis*.

The material consists of a fragmentary juvenile skull (H36), skull fragments belonging to an adult animal, four mandibles (the best *S. kirchbergensis* Chinese material), isolated upper and lower teeth, many other postcranial elements (atlas, axis and other cervical vertebrae, scapula, humerus, radius, ulna, carpals, metacarpals, basin bones, femur, patella, tibia, fibula, astragalus, calcaneum, metatarsal, phalanges, etc) (Tong & Wu, 2010, figs 1, 2).

Shennongjia represents the highest altitude locality (the cave entrance lies at 2102 m) of Pleistocene rhinoceros in Central-South China, being also the Chinese southernmost and the richest locality after Zhoukoudian in *S. kirchbergensis* remains (Wu, 1998). Furthermore, it is the first *S. kirchbergensis* find associated with the *Ailuropoda-Stegodon* fauna, the typical Pleistocene mammalian fauna in Southern China including *Ailuropoda melanoleuca*, *Stegodon*, *Hystrix*, *Atherurus*, *Rhizomys*, *Megatapirus*, *Cervus unicolor*, *Capricornis*, *Bubalus,* and others (Wu, 1998) (collections: Shennongjia Museum of Natural History and the Shennongjia local government office for cultural relics administration).

3. Middle East and Africa

3.1. Lebanon and Israel

Two reports (Hooijer, 1961) refer to the presence of *S. kirchbergensis* at Ksar' Akil (Lebanon) and at Tabun-Mont Carmel (Israel). Woldstedt (1958) reported on *S. kirchbergensis* remains from Ras-el-Kelb (Beirut, Lebanon) and from Umm Quatala near Jerusalem (Israel).

The reports of both authors are very probably based on misidentifications with other rhinoceros species.

As to the *S. kirchbergensis* remains from Jissr Banat Yakub near 'Ubeidiya (Jordan Valley, Israel) (Bar-Yossef & Chernov, 1972), Guérin (1986) revised the material concluding that it must be assigned to *S. etruscus* (FALCONER 1868). On 'Ubeidiya site, vide autem in Chernov (1987) and in Belmaker (2004).

3.2. Algeria and Morocco

The report on *S. kirchbergensis* remains from Algiers (Arambourg, 1950) and other reports from Algerian and Moroccan localities (Arambourg, 1938; Neuville & Ruhlmann, 1941; Balout, 1955; Biberson, 1955; Vaufrey, 1955, inter alios) are probably based on misidentifications with other rhinoceros species.

REMARKS

The present study was partly motivated by the fact that *S. kirchbergensis* – when faced with evidence – is undeniably a rhinoceros still little investigated and consequently not well-known yet.

Though widely spread throughout Eurasia, *S. kirchbergensis* seems to be decidedly rare on this wide territory being reported from a relatively limited number of localities only.

On the other hand, Gromova (1932, 1935, 1965, 1967), Belyaeva (1935), Gromov (1948), Vangengeym & Zajigin (1965), Alekseeva (1980) also referred to the scarce presence of *S. kirchbergensis* in Russia and/or in Asia. Furthermore, according to N.V. Garutt (2004, personal communication), in Russia the rhinoceros remains ascribed to the genus "*Dicerorhinus*" are very rare.

As mentioned in the present paper, very often neither chrono- nor biostratigraphical data are available because of the lack of reliable data.

Currently, *S. kirchbergensis* represents a rhinoceros species which supposedly inhabited Europe from MIS 15-13 ("Mauerer Sande" and "Mosbach-II", in Germany, § 1.4) up to the Eemian Interglacial MIS 5e (Taubach and Burgtonna, in Germany § 1.4).

"Concentrations" of remains of this rhinoceros species are represented by the finds in England (§ 1.1), Germany (§ 1.4), Italy (Friuli-Venezia Giulia and Venetia Euganea, Latium, § 1.7), Slovenia and Croatia (§ 1.8, § 1.9], Poland (§ 1.13), and possibly Romania (§ 1.14), Moldova (§ 1.15), Ukraine (§ 1.16), Kazakhstan (§ 2.5), and China (§ 2.7).

As to the Russian distribution of *S. kirchbergensis* remains, the Middle-Lower Volga area (European Russia), as well as the southeast of Western Siberia represent other "concentration" areas of discoveries of material assigned to this species (Billia, 2008b).

At present, it seems that *S. kirchbengensis, C. antiquitatis, S. etruscus,* and – dubitatively – *Elasmotherium* constitute the Pleistocene rhinoceros group which is common to both European and Asian continents, even if the Asian occurrences of *S. etruscus* (Gromova, 1935, 1950; Gromov, 1939; Sokolovsky, 1958; Gabunya, 1959; Leybman, 1960; Babaev, 1962; Kahlke, 1966; Alekseeva, 1974, 1977; Liubin & Belyaeva, 2008; Nioradze & Nioradze, 2008, inter alios) seem to be very scarce.

According to Baryshnikov & Guérin (1986) and Baryshnikov & al. (1989), remains of *Dicerorhinus etruscus brachycephalus* GUÉRIN 1980 (recte *S. hundsheimensis* TOULA, 1902) were respectively found in the Acheulean layer of the Kudaro–1 cave (Georgia, Greater Caucasus) and in a Mousterian site in Erevan (Armenia).

Until to-day, the area of origin of *S. kirchbergensis* has not been identified yet, even if in the author's opinion the Central Asian area (? Kazakhstan, ? China) would seem fairly plausible.

The phylogenetic relationship between *S. kirchbergensis* and other ancestral rhinoceros species represents a problem still unresolved. On the other hand, there are some complex problems which lead to heated debates regarding the same relationship between *S. kirchbergensis, S. elatus, S. etruscus, S. hundsheimensis,* and *S. hemitoechus* whose position has been – and still is – decidedly controversial. Moreover, though subject of several systematic studies since some time, yet, no agreement has been reached so far by palaeontologists as to the relationship between the genus *Stephanorhinus* and the other Rhinocerotidae genera. For more detailed data on this theme, vide autem in Osborn (1900), Soergel (1914), Matthew (1931), Borissyak (1935, 1938), Gromova (1935:125, 1965:52, 1967:149), Wood (1941, 1949), Viret (1958), Thenius (1969), Heissig (1973, 1981), Rensberger & Koenigswald (1980), Guérin (1980, 1982), Groves (1983), Prothero & al. (1986, 1989), Fortelius & al. (1993), Cerdeño (1995, 1998, inter alios).

The Eurasian faunal and floral complexes reported by several authors do not seem to be very reliable because of the lack of certain stratigraphical and/or biochronological data. As a general rule, we may assume that *S. kirchbergensis* occupied palaeoenvironmental landscapes dominated by Conifera, but often also the open forest, as well as the extensive grasslands with sparse trees.

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A D D E N D A

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Thanking so much Dan Ziegler (Section Editor, Rhino Resource Center) as well as Martin Sabol (Comenius University, Bratislava) and Jan van der Made (Museo Nacional de Ciencias Naturales, Madrid), after the delivery of the manuscript to the publisher, further data have come to my knowledge as follows:

1.1. England

In January 1909, twenty-nine *S. kirchbergensis* teeth and tooth fragments – together with some other fossil remains – were found in a swallet on Worlebury Hill (Weston-super-Mare, Avon) in presumed Hoxnian levels (= Holsteinian; MIS 11, ca 400 kys BP) by the Reverend J.H.H. Doorbar (Davies, 1920:24; Savage & Richards, 1980). The remains belong to two individuals. Some *Bos primigenius* BOJANUS 1827 remains were also recognised. Two newspaper reports (Anon., 1914 and Anon., 1925) also referred to this discovery.

At Hoxne (Suffolk) (Bed E, pollen zones Ho I-II), *S. kirchbergensis* remains were recovered in addition to a remarkable large interglacial mammal fauna: *Dama dama clactoniana* (FALCONER 1868), *Bos primigenius* BOJANUS 1827, *Megaloceros giganteus* BLUMENBACH 1803, *Capreolus capreolus* L. 1758, *Cervus elaphus* L. 1758, *Sus scrofa* L. 1758, *S. hemitoechus* FALCONER 1868, and *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847).

Schreve (2004) and Ashton & al. (2008) correlated both Swanscombe (the Lower Gravel and the Lower Loam) and Hoxne with MIS 11c (ca 425-395 kys BP).

1.2. The Netherlands

The rhino material from Tegelen (a latest Pliocene locality, according to Freudenthal & al., 1976) has been assigned to *S. kirchbergensis* (*R. mercki* by Bernsen, 1927). Others suggested that the material belongs to *S. etruscus* (FALCONER 1868) (Loose, 1975; Kolfschoten, 1989). According to Made (2010a), "the rhinoceros from Tegelen resembles metrically *S. hundsheimensis,* though there are some specimens that differ morphologically".

1.4. Germany

Neumark-Nord (Sachsen-Anhalt, Germany) is a late Middle Pleistocene archaeo-palaeontological locality in sediments of a small interglacial lake which yielded a rich, typical interglacial mammalian fauna (deers, elephants, aurochs, rhinoceroses, and others) (Mania & al., 1990). On the whole, palaeontological data suggest MIS 7 (about 200 kys BP) (Mallik & al., 2000; Mania, 2000; Mania & al., 2003; Made, 2010a, 2010b). The geological situation of Neumark-Nord was described by Thomae (1990). From Neumark-Nord come the following *S. kirchbergensis* remains:

– a well-preserved skull (198) – lacking a fragment of the right zygomatic arch only – preserving both the right and the left P2–M3 (Made, 2010a, Pls 1, 3, 27; Made & Grube, 2010, figs 2, 3, 4, 5, 6);

– a second much damaged skull (193-NN 32) with both the right and the left P2–M3 coming from the "Untere Uferzone" (Made, 2010a, Pl 2);

– fragments of a large part of a third skull (200-E 24/241-243) (Made, 2010a, Pl 2);

– a fair number of dental elements (Made, 2010a, Pl 4) as well as postcranial bones (Made, 2010a, Pls 8, 10, 12).

The three skulls belong to adult animals. Exceptionally, the *S. kirchbergensis* dental fossette of the upper cheek teeth (as well as those of the two other rhinoceroses species found at Neumark-Nord, infra) were filled by plant remains such as: *Populus, Quercus, Crataegus, Pyracantha, Urtica, Nymphaea* as well as plants of the Betulaceae, Rosaceae, and Poaceae and others, suggesting that *S. kirchbergensis* from Neumark-Nord was a browser (Grube, 2003; Made & Grube, 2010:392).

Skull measurements are given in tab 1, those of the teeth in tabs 2, 3 (Made, 2010a).

Other noteworty rhinoceros remains (skulls included) found at Neumark-Nord belong to *S. hemitoechus* and *C. antiquitatis* (the last one is considered here as a peculiar presence; Made, 2010a, 2010b; Made & Grube, 2010). The whole material from Neumark-Nord is kept in the Landesmuseum für Vorgeschichte in Halle (LVH).

1.13. Poland

According to Król (unavailable date), in the collections of the National Museum of Natural History in Kielce (Central-southern Poland), three *S. kirchbergensis* remains are preserved: a humerus proximal epiphysis (MNKi/P/15) from Opatów (east of Tarnobrzeg, Podkarpacki), a radium (MNKi/A/631) from an unknown locality, and a tibia (MNKi/P/3423) found near Chmielnik (south of Kielce) in 1878.

0.0. Macedonia

S. kirchbergensis remains come from the Manastirec cave (Galerian in age), together with *Bison* sp., *Sus scrofa* L. 1758, *Pachycrocuta brevirostris* (AYMARD 1846), *and Ursus deningeri* V. REICHENAU 1906 remains (Kurtén & Garevski, 1989).

0.0. Greece

S. kirchbergensis remains come from the Megalopolis open site (Peloponnese) which also yielded *Bison priscus* BOJANUS 1827, *Bos primigenius* BOJANUS 1827, *Cervus elaphus* L. 1758, *Capreolus* sp., *Dama* sp., *Sus scrofa* L. 1758, *S. hemitoechus* FALCONER 1868, *Palaeoloxodon antiquus* (FALCONER & CAUTLEY 1847), *Hippopotamus* sp., and *Crocuta* sp.

This association is rather indicative of the late Galerian age in Southern Europe (Kahlke & al., 2010).

3.1. Lebanon and Israel

Two other reports (Martínez-Navarro, 2004; Rabinovich & al., 2007) would concern *S. kirchbergensis* remains from Gesher Benot Ya'aqov (Israel) (0.8-0.7 Ma BP, MIS 18).

3.2. Algeria and Morocco (and Lybia)

The remains from Algeria – as well as those from Haua Fteah (Libya), about 100 kys in age, described as *D. mercki* by Klein & Scott (1986) – "long referred to *S. mercki,* it is now believed to belong to *S. hemitoechus* …" (Geraads, 2010:672 and 677).

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