



RHINOCEROTIDS IN CHINA - SYSTEMATICS AND MATERIAL ANALYSIS

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ABSTRACT - Under the family Rhinocerotidae, seventeen genera, sixty-two species (including four subspecies and two variants) were recognized or originally named in China. *Chilotherium* is the most diversified genus, which contains eighteen species and two variants. *Rhinoceros sinensis*, *Coelodonta antiquitatis* and *Dicerorhinus mercki* are the three most frequently appearing species in geologic records, but 61% of the species have only one single locality and horizon. In material, *Coelodonta antiquitatis* is the best represented species. In geologic horizon, Miocene and Quaternary are the most productive rhino-bearing strata. In taxonomy, the Quaternary rhinos, especially *Rhinoceros sinensis* and *Dicerorhinus mercki*, are still in question. © 2001 Éditions scientifiques et médicales Elsevier SAS

KEYWORDS: RHINOCEROTIDAE, INVENTORY, GEOLOGICAL RANGE, CHINA.

RÉSUMÉ - Dix-sept genres et soixante-deux espèces (y compris quatre sous-espèces et trois variants) appartenant à la famille des Rhinocerotidae ont été signalés en Chine; un bon nombre des espèces y ont leur gisement-type. *Chilotheridium*, avec 18 espèces et deux variants, est le genre le plus diversifié. *Rhinoceros sinensis*, *Coelodonta antiquitatis* et *Dicerorhinus mercki* sont les taxons les plus fréquemment rencontrés alors que 61 % des espèces signalées ne le sont que d'un seul gisement et d'un seul niveau. *Coelodonta antiquitatis* est le rhinocéros le mieux représenté. Du point de vue stratigraphique, ce sont les niveaux miocènes et quaternaires qui sont les plus riches. Enfin, sur le plan taxonomique, les espèces quaternaires et particulièrement *Rhinoceros sinensis* et *Dicerorhinus mercki* posent encore des problèmes. © 2001 Éditions scientifiques et médicales Elsevier SAS

MOTS-CLÉS: RHINOCEROTIDAE, INVENTAIRE, EXTENSION STRATIGRAPHIQUE, CHINE.

GENERA UNDER THE FAMILY RHINOCEROTIDAE FOUND IN CHINA

- Subfamily DICERATHERIINAE Dollo, 1885
Diceratherium MARSH, 1875
- Subfamily ACERATHERINAE Dollo, 1885
* *Chilotherium* RINGSTRÖM, 1924
* *Plesiaceratherium* YOUNG, 1937
- Subfamily TELEOCERATINAE HAY, 1920
Brachypotherium ROGER, 1904
Diaceratherium DIETRICH, 1931
- Subfamily RHINOCEROTINAE Dollo, 1885
Gaindatherium COLBERT, 1934
* *Guixia* YOU, 1977
Rhinoceros LINNAEUS, 1758
- Subfamily DICERORHININAE Ringström, 1924
Coelodonta BRONN, 1831
Dicerorhinus GLOGER, 1841
- Subfamily ELASMOTHERIINAE Gill, 1872
Caementodon HEISSIG, 1972
Elasmotherium FISCHER, 1808
* *Huaqingtherium* HUANG & YAN, 1983
* *Shennongtherium* HUANG & YAN, 1983
* *Sinotherium* RINGSTRÖM, 1924
* *Tesselodon* YAN, 1979
- Subfamily IRANOTHERIINAE Kretzoi, 1942
* *Ninxiatherium* CHEN, 1977

Up to now seventeen genera under the family Rhinocerotidae were reported in China as listed above, eight of which were named originally in China (marked with *); six genera are known in China only; four genera, *Diceratherium*, *Brachypotherium*, *Diaceratherium* and *Gaindatherium* are not very well represented, because of the poor materials and limited locations. As to the genus *Guixia*, it's still open to question, because it is the earliest record of rhinocerotid in China, and its relationship with other rhinocerotines are not yet clear. The materials referred to the genus *Aceratherium* were included within *Acerorhinus*, and finally *Acerorhinus* was treated as a subgenus under *Chilotherium*; now *Chilotherium* is the largest genus which has two subgenera and twenty species and variants (see Fig. 1), this is also one of the most important genera both for paleontology and stratigraphy, other important genera being *Rhinoceros*, *Coelodonta*, *Dicerorhinus*. *Ninxiatherium* was originally put into Iranotheriinae, but subsequent scholars referred it to Elasmotheriinae (Guérin 1989; Heissig 1989). *Sinotherium* is a genus widely accepted, but some authors moved the species from under this genus to *Elasmotherium* without any comment, and didn't list the name of *Sinotherium* in the inventory of Elasmotheriines

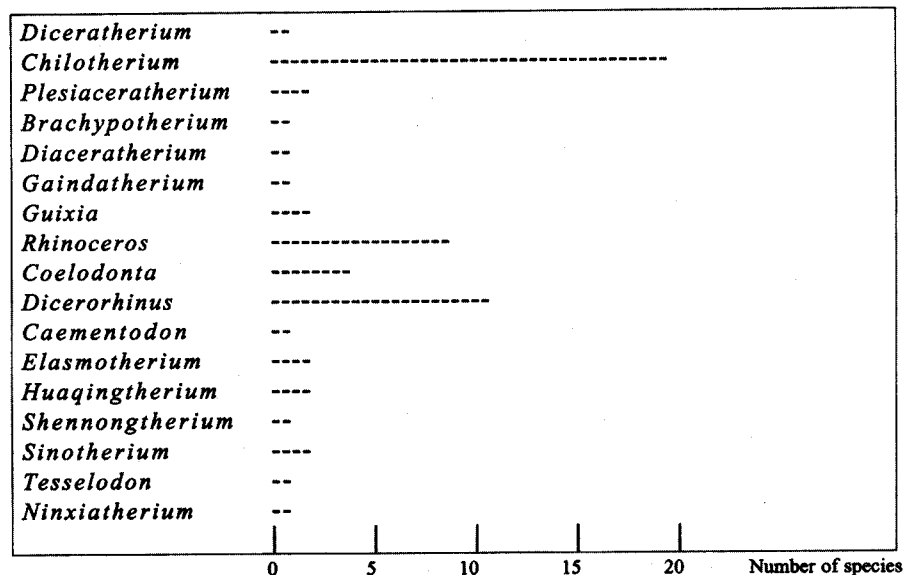


FIGURE 1 - Numbers of species (including subspecies and variants) named or recognized in each genus of rhinocerotids in China. *Nombre d'espèces (sous-espèces et variants inclus) définies ou reconnues en Chine dans chaque genre de Rhinocerotidae.*

(Huang & Yan, 1983); actually, there exists a large temporal gap between *Sinootherium* and *Elasmotherium*.

SPECIES (INCLUDING SUBSPECIES) OF RHINOCEROTIDS FOUND IN CHINA

- Diceratherium minus* (RINGSTRÖM, 1924) Bi et al., 1977 (M-L Mio.)
= *Diceratherium palaeosinense* var. *minus* RINGSTRÖM, 1924
- Chilotherium (Acerorhinus) blanfordi* LYDEKKER (1885) var. *hipparionum* (KOKEN, 1885)
= *Aceratherium blanfordi* var. *hipparionum* KOKEN, 1885 (?)
- Chilotherium (Acerorhinus) ceratorhinus* (SCHLOSSER, 1903) (?)
= *Aceratherium ceratorhinus* SCHLOSSER, 1903
- Chilotherium (Acerorhinus) cornutum* QIU & YAN, 1982 (E Pli.)
- Chilotherium (Acerorhinus) hezhengensis* (QIU & XIE, 1987) (L Mio.)
= *Acerorhinus hezhengensis* QIU & XIE, 1987
- Chilotherium (Acerorhinus) huadeensis* (QIU, 1979) (L Mio.)
= *Aceratherium huadeensis* QIU, 1979
- Chilotherium (Acerorhinus) palaeosinense* (RINGSTRÖM, 1924) Teilhard et al., 1942, Kretzoi, 1942 (L Mio.)
= *Diceratherium palaeosinense* RINGSTRÖM, 1924
- Chilotherium (Acerorhinus) tianzhuense* ZHENG, 1982 (L Mio.)
- Chilotherium (Acerorhinus) tsaidamense* (BOHLIN, 1937) Teilhard et al., 1942, Kretzoi, 1942 (L Mio.)
= *Diceratherium tsaidamense* BOHLIN, 1937
- Chilotherium (Chilotherium) anderssoni* RINGSTRÖM 1924 (L Mio.)
- Chilotherium (Chilotherium) gracile* RINGSTRÖM, 1924 (L Mio.)
- Chilotherium (Chilotherium) habereri* (SCHLOSSER, 1903) Teilhard et al., 1942 (L Mio-E Pli.)
= *Rhinoceros haberri* SCHLOSSER, 1903
- Chilotherium (Chilotherium) habereri* var. *laticeps* RINGSTRÖM, 1924 (L Mio.)
- Chilotherium (Chilotherium) planifrons* RINGSTRÖM, 1924 (L Mio.)
- Chilotherium (Chilotherium) wimani* RINGSTRÖM, 1924 (L Mio.)
- ? *Chilotherium brancoi* (SCHLOSSER, 1903) Teilhard et al., 1942 (L Mio-E Pli.)
= *Rhinoceros brancoi* SCHLOSSER, 1903
- Chilotherium fenhoensis* TUNG et al., 1975 (L Mio.)
- Chilotherium tanggulaense* ZHENG, 1980 (L Mio.)
- Chilotherium xizangensis* Ji et al., 1980 (L Mio.)
- Chilotherium yunnanensis* TANG et al., 1974 (L Pli.)
- Plesiaceratherium gracile* YOUNG, 1937 (M Mio.)
- Plesiaceratherium shanwangensis* WANG, 1965 (M Mio.)
- Diaceratherium cf. aurelianense* (NOUEL, 1866) (M Mio.)
- Brachypotherium pugnator* (MATSUMOTO, 1921) (E-M Mio.)
- Gaidatherium cf. browni* COLBERT, 1934 (E Pli.)
- Guixia youjiangensis* YOU, 1977 (L Eoc.)
- Guixia simplex* YOU, 1977 (L Eoc.)
- † *Rhinoceros chaii* LI, 1979 (unpublished) (invalid name)
- o *Rhinoceros oweni* RINGSTRÖM, 1927 (Synonym of *Rhinoceros sinensis* by OSBORN; Synonym of *Dicerorhinus mercki* by Teilhard, 1942) (*nomen nudum*)
- o *Rhinoceros plicidens* KOKEN, 1885 (Synonym of *Rhinoceros sinensis*) (*nomen nudum*)
- o *Rhinoceros pygmaeus* RINGSTRÖM, 1927 (materials referred to *Chilotherium*) (*nomen nudum*)
- o *Rhinoceros simplicidens* KOKEN, 1885 (Synonym of *Rhinoceros sinensis*) (*nomen nudum*)
- Rhinoceros sinensis* OWEN, 1870 (E-L Ple.)
- Rhinoceros sivalensis* FALCONER & CAUTLEY, 1868 (M Ple.)
- Rhinoceros sondaicus* DESMAREST, 1822 (Hol.)
- Rhinoceros unicornis* LINNAEUS, 1758 (E Ple.)
- Coelodonta antiquitatis* (BLUMENBACH, 1799, 1807) (M-L Ple.)
= *Rhinoceros tichorhinus* CUVIER, 1812
= *Rhinoceros manchuricus* ISHIJIMA, 1939, Teilhard et al., 1942

Category	Frequency of occurrence	Species number	Ordinal numbers of species as in the text
category I	>60	2	33, 37
category II	40~60	0	
category III	20~39	1	47
category IV	5~19	0	
category V	2~4	18	1, 2, 7, 9, 10, 12, 15, 16, 21, 22, 24, 35, 40, 41, 48, 49, 50
category VI	1	33	3, 4, 5, 6, 8, 13, 14, 17, 18, 19, 20, 23, 25, 26, 27, 34, 36, 38, 39, 43, 44, 46, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62

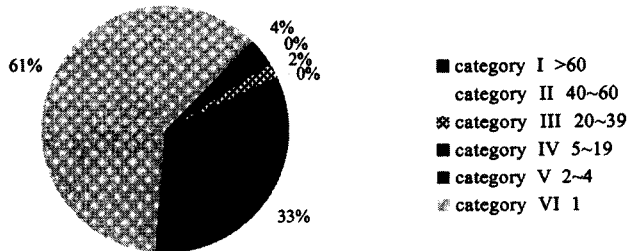


TABLE 1 - Categories of species according to the frequency of occurrence. *Catégorisation des espèces en fonction de la fréquence de leur découverte.*

FIGURE 2 - Percentage of different categories of species according to the frequency of occurrence, the pattern shows the majority (61 %) of the species were reported only by once. *Pourcentage des différentes catégories d'espèces en fonction de la fréquence de leur découverte: 61 % n'ont été trouvées qu'une seule fois.*

Category	Materials found for each group	Total numbers in each category	Species numbered as in previous text
Category I	Species represented by complete skeletons	2	37, 38
Category II	Species with complete skull and some limb bones	8	6, 7, 9, 10, 11, 17, 33, 47
Category III	Species with complete or almost complete skull	15	4, 5, 12, 13, 14, 19, 35, 39, 44, 46, 48, 50, 52, 56, 62
Category IV	Species represented by complete or partial maxilla or/and mandible	18	3, 8, 15, 16, 18, 20, 21, 22, 26, 27, 34(?), 40, 41, 43, 55, 58, 60, 61
Category V	Species represented by isolated teeth only	7	1, 2, 23, 24, 49, 53, 57
Category VI	Species represented by one single tooth only	4	25, 36, 54, 59

TABLE 2 - Category of species according to fossil materials. *Catégorisation des espèces en fonction de leurs restes.*

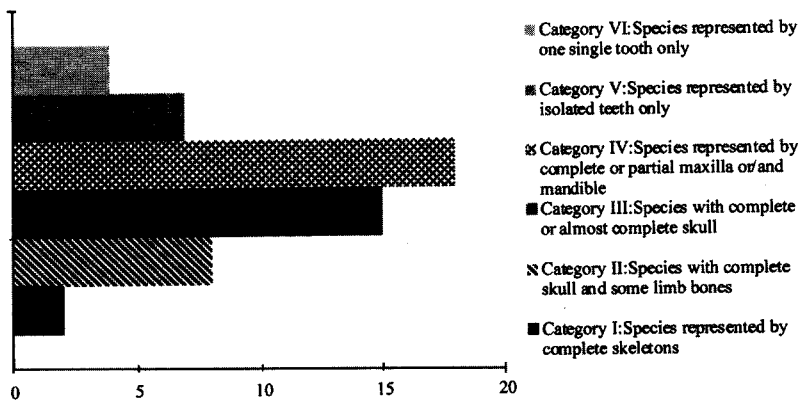


FIGURE 3 - Species numbers of each group according to fossil materials ever found, the bar-plot shows that the majority of the species were represented either by skulls, or by mandibles and/or maxilla; and quite a lot only by teeth. *Nombre des espèces de chaque groupe selon le matériel découvert.*

38. *Coelodonta antiquitatis chilinensis* JIANG, 1977 (L Ple.)
39. *Coelodonta antiquitatis shansius* CHIA & WANG, 1978 (E Ple.)
40. *Coelodonta antiquitatis yenshanensis* CHOW, 1979 (M Ple.)
41. *Coelodonta nihowanensis* CHOW, 1978 (E Ple.)
42. Δ *Dicerorhinus choukoutienensis* (WANG, 1931) Teilhard et al., 1942 (No conspicuous differences from *Dicerorhinus mercki*) (*nomen dubium*)
- = *Rhinoceros choukoutienensis* WANG, 1931
- = *Dicerorhinus mercki* (JÄGER, 1839)
43. *Dicerorhinus choukoutienensis eurymylus* LIU et al., 1982 (M Ple.)
44. *Dicerorhinus cixianensis* CHEN & WU, 1976 (M Mio.)
45. # *Dicerorhinus kirchbergensis* (JÄGER, 1839) (*nomen oblitum*)
- = *Dicerorhinus mercki* (JÄGER, 1839)
46. *Dicerorhinus lantianensis* HU & QI, 1978 (E Ple.)

47. *Dicerorhinus mercki* (JÄGER, 1839) (E-L Ple.)
48. *Dicerorhinus orientalis* (SCHLOSSER, 1921) Ringström, 1924, 1927 (L Mio.)
49. *Dicerorhinus ringstroemi* (ARAMBOURG, 1959) (L Mio.)
50. *Dicerorhinus sumatrensis* (FISCHER, 1814) (Hol.)
= *Didermocerus sumatrensis* FISCHER, 1814
51. † *Dicerorhinus tianshuiensis* XIE, 1984 (unpublished)
(Invalid name)
52. *Dicerorhinus yunchuchenensis* CHOW, 1963 (E Ple.)
53. *Caementodon tongxinensis* GUAN, 1988, 1993 (M Mio.)
54. *Elasmotherium inexpectatum* CHOW, 1958 (E Ple.)
55. *Elasmotherium peii* CHOW, 1958 (M Ple.)
56. *Huaqingtherium lintungensis* (ZHAI, 1978) Huang & Yan, 1983 (M Mio.)
= *Hispanotherium lintungensis* ZHAI, 1978
57. *Huaqingtherium qiui* GUAN & ZHANG, 1993 (M Mio.)
58. *Shennongtherium hyposodontus* HUANG & YAN, 1983 (M Mio.)
59. *Sinotherium simplum* CHOW, 1958 (L Mio.)
60. *Sinotherium lagrelii* RINGSTRÖM, 1923 (L Mio.)
61. *Tesselodon fangxianensis* YAN, 1979 (M Mio.)
62. *Ninxiatherium longirhinus* CHEN, 1977 (E Pli.)

Totally, sixty-two species (including four subspecies and two variants) under the family Rhinocerotidae have been named or reported in China, fifty-two of which were originally defined on materials from China; one is regarded as forgotten name (*nomen oblitum*, marked with #); two are invalid names (marked with †), because of unpublication; one was considered as a *nomen dubium* (marked with Δ), because there is no conspicuous difference from a previously established form; four were regarded as *nomen nudum* (marked with o), because the materials under them were transferred to other species. *Chilotherium brancoi* is a species in question, because this species was originally erected under the genus *Rhinoceros*; most of the materials once

included in it was referred to *Chilotherium* (Teilhard et al. 1942), but the species name was not rejected; actually, both in morphology and geological occurrence, this species is more related to *Chilotherium* than to *Rhinoceros*. As to the species *Dicerorhinus ringstroemi*, in the papers by Hooijer (1966) and Heissig (1989), it seems that this species was erected by Arambourg in 1959, but up to now, the author did not found the original descriptions in Arambourg's paper of 1959; on the other hand, in Yan's paper of 1978, it looks like *D. ringstroemi* was erected by Schlosser in 1921, and the present author didn't find the original descriptions in Schlosser's paper either.

FREQUENCY OF OCCURRENCE OF SPECIES

Among all the rhino species, more than the half (thirty-three species) of them were reported only once, that means that most of the species were from one single locality and one single horizon. Too many species have only one single locality and occurrence, it seems necessary to have a good check on the taxonomic work. The most frequently appearing are *Rhinoceros sinensis*, *Coelodonta antiquitatis* and *Dicerorhinus mercki*, so these three are the most popular species, but it doesn't mean that they are the best known, especially for *Rhinoceros sinensis*, which has the highest frequency of occurrence, but whose skull is still imperfectly known up to now; on the other hand, to a great extent, its high frequency of appearance can be attributed to taxonomic work, this species has become a 'wastebasket', almost all the Quaternary rhino fossils from south China being put into it.

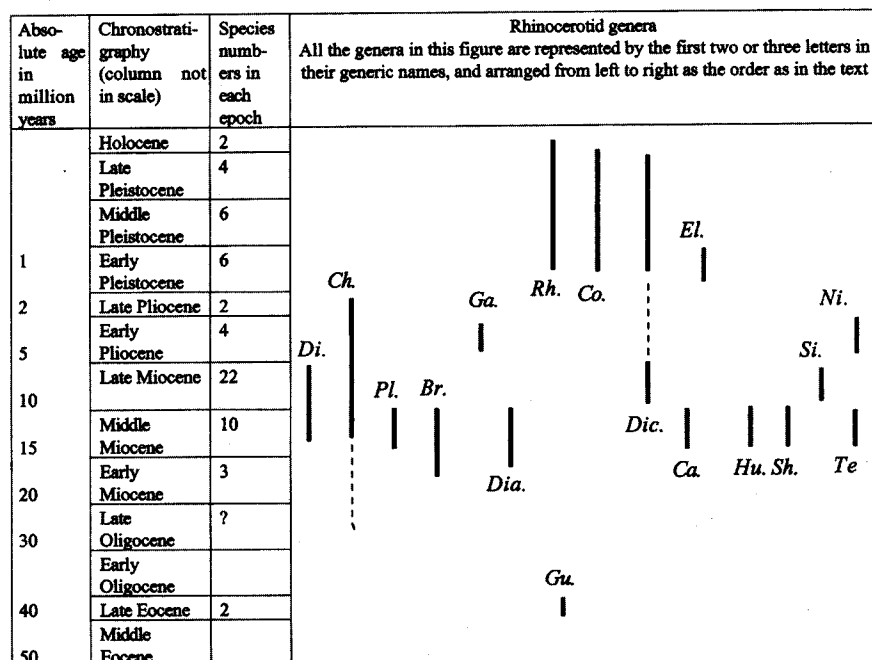


FIGURE 4 - Temporal ranges of Rhinocerotid genera in China. Extension temporelle des genres de Rhinocerotidae en Chine.

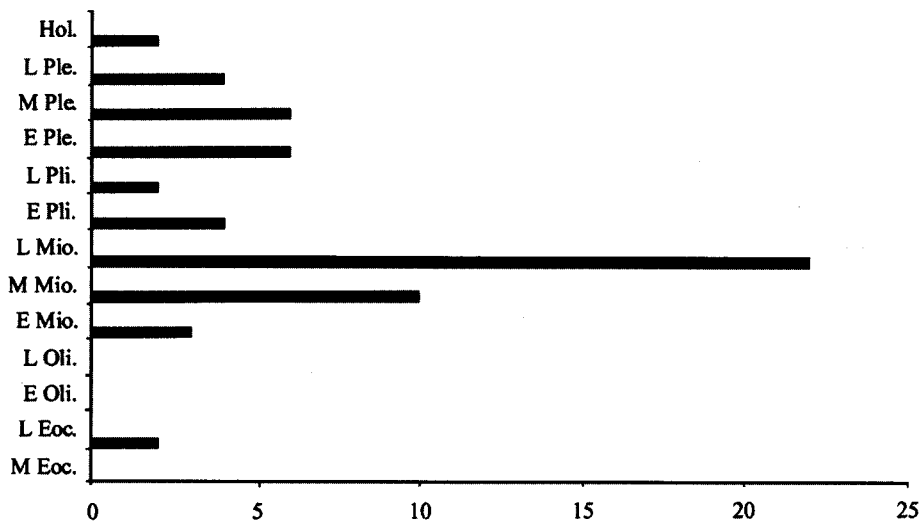


FIGURE 5 - Rhinocerotid species numbers through geologic time in China. Nombre des espèces de Rhinocerotidae en Chine, selon le niveau stratigraphique.

MATERIAL ANALYSIS

Among all the rhino species, only one was represented by complete skeletons, that's *Ceolodonta antiquitatis* and its subspecies, this species not only has a popular occurrence, but also has very well preserved materials; but most of the rhino species represented by partial skulls, mandibles and maxillae as well as partial tooth rows. It is necessary to indicate that seven of the species were known only by isolated teeth, and another four, *E. inexpectatum*, *S. simplum*, *G. browni* and *R. unicornis*, were all originally defined on one single tooth only, and without new finds ever since.

CHRONOLOGICAL DISTRIBUTION

Regarding to the geological distributions of rhinocerotids in China, firstly it should be indicated that the geological ages have been recalibrated and revised for each species by subsequent researchers, maybe they are completely different from the original publications; in this paper, the ages were determined according to the papers by Li et al. (1984), Qiu & Qiu (1990) and Tong et al. (1995). Unfortunately the sequence of fossil rhinoceros is not very clear, so few people use them as zone fossils. Concerning the earliest record of *Chilotherium*, according Qiu & Qiu (1990), this genus appeared in Tunggurian (middle Miocene), but in Huang's paper of 1982, the earliest *Chilotherium* record is from late Oligocene in Nei Mengol; from the latest stratigraphic data, most of the rhinocerotid genera and species were from middle and late Miocene in China, and most of the rhinocerotid localities are concentrated in Miocene and Quaternary. What should be stressed hereby is that the Pliocene genera didn't survive into Quaternary, all the Quaternary genera, except *Dicerorhinus*, appeared in China at the beginning of Quaternary period; as to the relationships between Miocene and Quaternary *Dicerorhinus*, is still not clear; there exist a very large gap between the Miocene *Dicerorhinus* and the Quaternary ones, there were no records of this

genus for a long time between late Miocene and early Pleistocene; on the contrary, it was very frequent in Europe during this time span; so whether the Chinese Quaternary *Dicerorhinus* is a relict of Miocene *Dicerorhinus* or a newcomer from Europe is still open to question.

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REFERENCES

- Bi Zhiguo, Yu Zhengjiang, Qiu Zhanxiang, 1977. First discovery of mammal remains from Upper Tertiary deposits near Nanking. *Vertebrata Palasiatica* 15, (2), 126-142 [in Chinese with English summary].
- Bohlin, B., 1937. Eine tertiäre Säugetier-Fauna aus Tsaidam. (Reports from the Scientific Expedition to the NW Provinces of China under leadership of Dr. Sven Heden. VI, Vertebrate Palaeontology). *Palaeontologia Sinica* 14, 1, 60-98.
- Chen Guanfang, Wu Wenyu, 1976. Miocene mammalian fossils of Jiulongkou, Cixian district, Hebei. *Vertebrata Palasiatica* 14, (1), 8-10 [in Chinese with English summary].
- Chen Guanfang, 1977. A new genus of Iranotheriinae of Ningxia. *Vertebrata Palasiatica* 15, (2), 143-147 [in Chinese with English summary].
- Chow Ben-shun, 1963. On the skull of *Dicerorhinus choukoutiensis* WANG from Choukoutien Locality 20. *Vertebrata Palasiatica* 7, (1), 62-70 [in Chinese with English summary].
- Chow Benschun, 1978. The distribution of the woolly rhinoceros and woolly mammoth. *Vertebrata Palasiatica* 16, (1), 47-59 [in Chinese with English abstract].
- Chow Benschun, 1979. The fossil Rhinocerotids of locality 1, Choukoutien. *Vertebrata Palasiatica* 17, (3), 236-258 [in Chinese with English summary].
- Chow Minchen, 1958. New Elasmotherine rhinoceros from Shansi. *Vertebrata Palasiatica* 2, (2-3), 131-142 [in Chinese with English summary].
- Chow Minchen, Wang Banyue, 1964. Fossil vertebrates from the Miocene of Northern Kiangsu. *Vertebrata Palasiatica* 8, (4), 341-351 [in Chinese with English summary].
- Colbert, E.H., Hooijer, D.A., 1953. Pleistocene mammals from the limestone fissures of Szechuan, China. *Bulletin of the American Museum of Natural History* 102, (1), 90-102.
- Falconer, H., 1868. On the fossil Rhinoceros of central Tibet and its relation to the recent upheaval of the Himalayahs. *Palaeontologia Sinica* 14, 1, 60-98.

- ontological Memoirs and Notes of the Late Hugh Falconer edited by Charles Murchison, vol. 1, Robert Hardwicke (Ed.) London, pp. 173-185.
- Guan Jian, 1988. The Miocene strata and mammals from Tongxin, Ningxia and Guanghe, Gansu. *Memoirs Beijing Natural History Museum* 42, 1-21 [in Chinese with English abstract].
- Guan Jian, 1993. Primitives Elasmotherines from the Middle Miocene, Ningxia (northwest China). *Memoirs Beijing Natural History Museum* 53, 200-207.
- Guan Jian, Zhang Xing, 1993 - Miocene mammal fossils from Guanghe, Gansu. *Memoirs Beijing Natural History Museum* 53, 237-251.
- Guérin, C., 1980. Les rhinocéros (Mammalia, Perissodactyla) du Miocène terminal au Pléistocène supérieur en Europe occidentale. *Documents des Laboratoires de Géologie de Lyon* 79, 1-1185.
- Guérin, C., 1989. La famille des Rhinocerotidae (Mammalia, Perissodactyla): Systématique, histoire, évolution, paléocologie. *Cranium* 6 (2), 3-14.
- Heissig, K., 1989. The Rhinocerotidae. In : Prothero, D.R., Schoch, R.M. (Eds.) *The evolution of Perissodactyls*. Clarendon Press, New York, pp. 399-417.
- Hu Changkang, Qi Tao, 1978. Gongwangling Pleistocene mammalian fauna of Lantian, Shaanxi. *Palaeontologia Sinica C*, 21, 36-39 [in Chinese with English summary].
- Huang Wanpo, Yan Defa, 1983. New material of elasmotherini from Shennongjia, Hubei. *Vertebrata Palasiatica* 21 (3), 223-229 [in Chinese with English abstract].
- Ishijima, W., 1939. On fossil Rhinoceros from Ku-Hsiang-Tung, near Harbin. *Jub. Public. prof. H. Yabe's*, 321-331.
- Ji Hongxiang, Xu Qinqi, Huang Wanbo, 1980. The *Hipparion* fauna from Guizhong Basin, Xizang, in *Palaeontology of Xizang*, vol. 1, Science Press (Ed.), Beijing, pp. 18-32 [in Chinese].
- Jiang Peng, 1977. A new subspecies of *Ceolodonta antiquitatis*. *Vertebrata Palasiatica* 15 (3), 207-210 [in Chinese].
- Jia Lanpo, Wang Chien, 1978. Hsihoutu A culture site of early Pleistocene in Shansi Province. *Cultural Relics Publishing House* (Ed.) Beijing, pp. 28-35 [in Chinese, English summary].
- Koken, E., 1885. Ueber fossile Säugethiere aus China. *Paläontologische Abhandlungen* 3 (2), 31-114.
- Kretzoi, M., 1942. Bemerkungen zum System der nachmiozänen Nashorn-Gattungen. *Földtany Közlöny* 72, 309-318.
- Li Chuankuei, Wu Wenyu, Qiu Zhanxiang, 1984. Chinese Neogene: Subdivision and correlation. *Vertebrata Palasiatica* 22 (3), 163-178 [in Chinese with English summary].
- Li Youheng, 1961. A Pleistocene mammalian locality in the Likiang Basin, Yunnan. *Vertebrata Palasiatica* 5 (2), 143-149 [in Chinese with English summary].
- Liu Guanbang, Zhang Chenghua, 1986 - Two late Cenozoic stratigraphical sections containing vertebrate fossils in northern Sihong County, Jiangsu Province. *Vertebrata Palasiatica* 24 (3), 222-228 [in Chinese with English summary].
- Liu Jialong et al. 1982. New species of Middle Pleistocene mammals from Chaoxian, Anhui. *Memoirs Beijing Natural History Museum* 19, 8-13 [in Chinese with English summary].
- Liu Tungsun, Li Chuankui, Zhai Renjie, 1978. Pliocene vertebrates of Lantian, Shensi. *Professional Papers on Stratigraphy and Palaeontology* 7, 149-200 [in Chinese with English summary].
- Matsumoto, H., 1921. On some fossil mammals from Honan, China. *Science Reports Tohoku Imperial University Sandai* 2, (Geol.), 3 (1), 1-28.
- Matthew, W.D., Granger, W., 1923. New fossil mammals from the Pliocene of Szechuan, China. *Bulletin of the American Museum of Natural History* 43 (48), 563-598.
- Owen, R., 1870. On fossil remains of mammals found in China. *Quarterly Journal of the Geological Society of London* 26, 417-434.
- Prothero, D.R., Guérin, C., Manning, E., 1989. The history of the Rhinocerotidae. In : Prothero, D., Schoch, R.M. (Eds.) *The evolution of Perissodactyls*, Clarendon Press, New York, pp. 322-340.
- Qiu Zhanxiang, Yan Defa, 1982. A horned *Chilotherium* skull from Yushe, Shansi. *Vertebrata Palasiatica* 20 (2), 122-132 [in Chinese with English summary].
- Qiu Zhanxiang, Xie Junyi, Yan Defa, 1988. A new *Chilotherium* skull from Hezheng, Gansu, China, with special reference to the Chinese *Diceratherium*. *Scientia Sinica B*, 31 (4), 494-502.
- Qiu Zhanxiang, Qiu Zhuding, 1990. Neogene local mammalian faunas: succession and ages. *Journal of Stratigraphy* 14 (4), 241-260 [in Chinese with English summary].
- Qiu Zhuding, 1979. Some mammalian fossils from the Pliocene of Inner Mongolia and Gansu (Kansu). *Vertebrata Palasiatica* 17 (3), 223-224 [in Chinese with English abstract].
- Ringström, T., 1924. Nashörner des *Hipparion*-Fauna Nord-Chinas. *Palaeontologia Sinica C*, 1 (4), 156.
- Ringström, T., 1927. Über quartäre und jungtertiäre Rhinocerotiden aus China und der Mongolei. *Palaeontologia Sinica C*, 4 (3), 24.
- Schlosser, M., 1903. Die fossilen Säugethiere Chinas nebst einer Odontographie der recenten Antilopen. *Abhandlungen Bayerische Akademie der Wissenschaften* 22 (1), 49-72.
- Tang Yingjun et al. 1974. New materials of Pliocene mammals from Banguo Basin of Yuanmou, Yunnan and their stratigraphical significance. *Vertebrata Palasiatica* 12 (1), 60-67 [in Chinese with English summary].
- Tang Yingjun, Zong Guanfu, 1987. Mammalian remains from the Pliocene of the Hanshui River Basin, Shaanxi. *Vertebrata Palasiatica* 25 (3), 222-235 [in Chinese with English summary].
- Tang Yingjun et al. 1988. The Late Cenozoic and its mammalian fossils from Hanzhong Basin, Shaanxi. *Beijing Scientific and Technological Publishing House*, 1-47 [in Chinese with English summary].
- Teilhard, P., Piveteau, J., 1930. Les mammifères fossiles de Nihowan (Chine). *Annales de Paléontologie*, 1-134.
- Teilhard, P., Leroy, P., 1942. Chinese fossil mammals. A complete bibliography, analysed, tabulated, annotated and indexed. *Inst. Geo-Biol.* 8, 1-142.
- Tong Haowen, 2000. Les Rhinocéros des sites à fossiles humains de Chine. *L'Anthropologie* 104 (2000), 523-529.
- Tong Haowen, 2000. Quaternary Rhinoceros of China. *Acta Anthropologica Sinica*, Suppl. vol. 19, 257-263.
- Tong Haowen, 2001. Age profiles of rhino fauna from the Middle Pleistocene Nanjing Man Site, South China. Explained by the rhino specimens of living species. *Int. J. Osteoarchaeol.* 11, 231-237.
- Tong Haowen, 2001. Fossil materials of rhinoceros (*Dicerorhinus mercki*) from the Middle Pleistocene Nanjing Man Site (in press).
- Tong Yongsheng, Zheng Shaohua, Qiu Zhuding, 1995. Cenozoic mammal ages of China. *Vertebrata Palasiatica* 33 (4), 290-314 [in Chinese with English summary].
- Tung Yongsheng, Huang Wanpo, Qiu Zhuding, 1975. *Hipparion* fauna in Anlo, Hohsien, Shansi. *Vertebrata Palasiatica* 13 (1), 34-47 [in Chinese with English summary].
- Wang Banyue, 1965. A new Miocene aceratherine rhinoceros of Shanwang, Shantung. *Vertebrata Palasiatica* 9 (1), 109-112 [in Chinese with English summary].
- Wang, K.M., 1931. Die Fossilen Rhinocerotiden von Choukoutien. *Contr. Nat. Research Inst. Geol. (Nanking)* 1 (3), 69-84.
- Wu Weitang, 1983. On the two rhinoceros subfossils from Hemudu Neolithic Site. *Vertebrata Palasiatica* 21 (2), 160-165 [in Chinese with English summary].
- Xie Wanming, 1982. New discovery on Aceratherine rhinoceros from Shanwang in Linchu, Shandong. *Vertebrata Palasiatica* 20 (2), 133-137 [in Chinese with English abstract].
- Xu Xiaofeng, 1986. *Dicerorhinus kirchbergensis* (JÄGER, 1839) from the late Middle Pleistocene mammalian fauna of Anping, Liaoning. *Vertebrata Palasiatica* 24 (3), 229-241 [in Chinese with English summary].
- Yan Defa, 1978. On the geological age of Duodaoshi Formation, Jingxiang Region, Hubei. *Vertebrata Palasiatica* 16 (1), 30-32 [in Chinese].
- Yan Defa, 1979. Einige der Fossilen Miozänen Säugetiere der Kreis von Fangxian in der Provinz Hupei. *Vertebrata Palasiatica* 17 (3), 189-199 [in Chinese with German summary].
- Yan Defa, 1983. On classification and morphology of rhinocerotid genus *Plesiaceratherium*. *Vertebrata Palasiatica* 21 (2), 134-143 [in Chinese with English summary].
- Yan Defa, Heissig, K., 1986. Revision and autopodial morphology of Chinese-European rhinocerotid genus *Plesiaceratherium* YOUNG, 1937. *Zitteliana* 14, 81-109.

- You Yuzhu, 1977. Note on the new genus of Early Tertiary Rhinocerotidae from Bose, Guangxi. *Vertebrata Palasiatica* 15 (1), 46-53 [in Chinese].
- Young Chungchien, 1937. On a Miocene mammalian fauna from Shantung. *Bulletin of the Geological Society of China* 17 (2), 209-238.
- Zhai Renjie, 1978. A primitive elasmothere from the Miocene of Lintung, Shensi. *Professional Papers in Stratigraphy and Palaeontology* 7, 122-126 [in Chinese with English abstract].
- Zheng Shaohua, 1980. The *Hipparion* fauna of Bulong Basin, Biru, Xizang, 33-47, in *Palaeontology of Xizang*, vol. I, Science Press (Ed.) Beijing [in Chinese with English abstract].
- Zheng Shaohua, 1982. Some Pliocene mammalian fossils from Songshan- 2 and - 3 (Tianzhu, Gansu) and the Songshan Fauna. *Vertebrata Palasiatica* 20 (3), 216-227 [in Chinese with English abstract].
- Zong Guanfu et al. 1996. Cenozoic mammals in Hengduanshan Area and their paleo-environments. Ocean Press (Ed.) Beijing, 244 pp. [in Chinese with English summary].

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