JURIJ ALEXANDROVICH ORLOV MEMORIAL NUMBER
JOURNAL OF THE PALAEONTOLOGICAL SOCIETY OF INDIA
VOL. 20, 1977 pp. 102—119 (*For* 1975).

THE STUDY OF DINOSAURS IN ASIA

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ABSTRACT

The earliest significant success achieved in the study of dinosaurs in Asia belonged to the Central Asiatic Expedition of the American Museum of Natural History (1918—1930), which discovered in Outer and Inner Mongolia a number of localities of Cretaceous dinosours: psittacosaurs, hadrosaurs, various theropods and arhaic ceratopsians represented by complete skeletal forms.

A new (recent) stage in the study of Asiatic dinosaurs is related to large special expeditions carried out in the post-war years. The earliest of them, the Mongolian Palaentological Expedition of the USSR Academy of Sciences—(1946-1949) made a search in the south of the Gobi desert, the area of deep depressions with extensive outcrops of Mesozoic sediments. The richest locality of various Late Cretaceous dinosaurs (theropods, sauropods, hadrosaurs and ankylosaurs) was discovered here in the Nemegetu basin. Other basins border this area on the south-west and north-west, which together with the Nemegetu basin contain many thousand skeletons of Late Cretaceous dinosaurs.

The latest palaentological expeditions : Soviet-Chinese (1959—1960), Polish-Mongolian (1963—1971) and Soviet-Mongolian (working from 1968 till now) expanded the area of observations and found first-rate qualified collections of iguanodonts. Valuable in situ findings of dinosaurs have also been recorded in the Soviet Union (Kuznetsk Basin, Kazakhstan and Fergana).

Dinosaurs are the largest and most diverse group of Mesozoic terrestrial vertebrates. They appeared in Middle Triassic and existed to the end of Cretaceous. Their remains are known from Mesozoic continental deposits of all the continents except for the Antarctic.

The history of the search for studies of dinosaurs is as long as one and a half century. It started in Great Britain where the first remains of dinosaurs were found in the twenties of the XIX century. However the European continent is not abundant in rich localities except for Bernissart in Belgium where an accumulation of 30 iguanodont skeletons was discovered. From the fifties of the last century the centre of the dinosaurs study has shifted to North America where a great number of large localities of dinosaurs of different geological age have been found.

The third continent where dinosaurs were discovered in the seventies of the XIX century was Asia. Later, towards the end of the same century, dinosaurs remains were found in Australia, though the latter is still rather poor in findings, and in Africa where one of the richest localities in the world, Tendaguru (Tansania), has been found.

In Asia the earliest dinosaur findings are known from India. The British palaeontologist R. Lydekker (1877) described a new genus and species of a sauropodous dinosaur, *Titanosaurus indicus*, by several tail vertebrae and an incompletely preserved thigh-bone which had been found in Jubbulpore district in the Lameta beds[1]. Later, in 1879, he attributed part of the found tail vertebrae to another species, *T. blanfordi*, which is unfortunately as invalid as the former. In 1885 R. Lydekker distinguished by these species a new family, Titanosauridae, which is still preserved including all late Cretaceous sauropods. Besides, R. Lydekker (1887, 1890) made a list of Indian fossil vertebrates including dinosaurs, and mentioned new localities of the latter in Trichinopoly and Nagpur districts.

Nearly simultaneously with the findings of dinosaurs remains in India, the Russian geologist G. D. Romanovsky (1882) discovered dinosaur tracks[2] in Middle Asia at the junction of the Gissar and Zeravshan Ridges on the right bank of the Yagnob river.

These two discoveries, in India and in Middle Asia, constitute the only dinosaur findings made in Asia in the XIX century.

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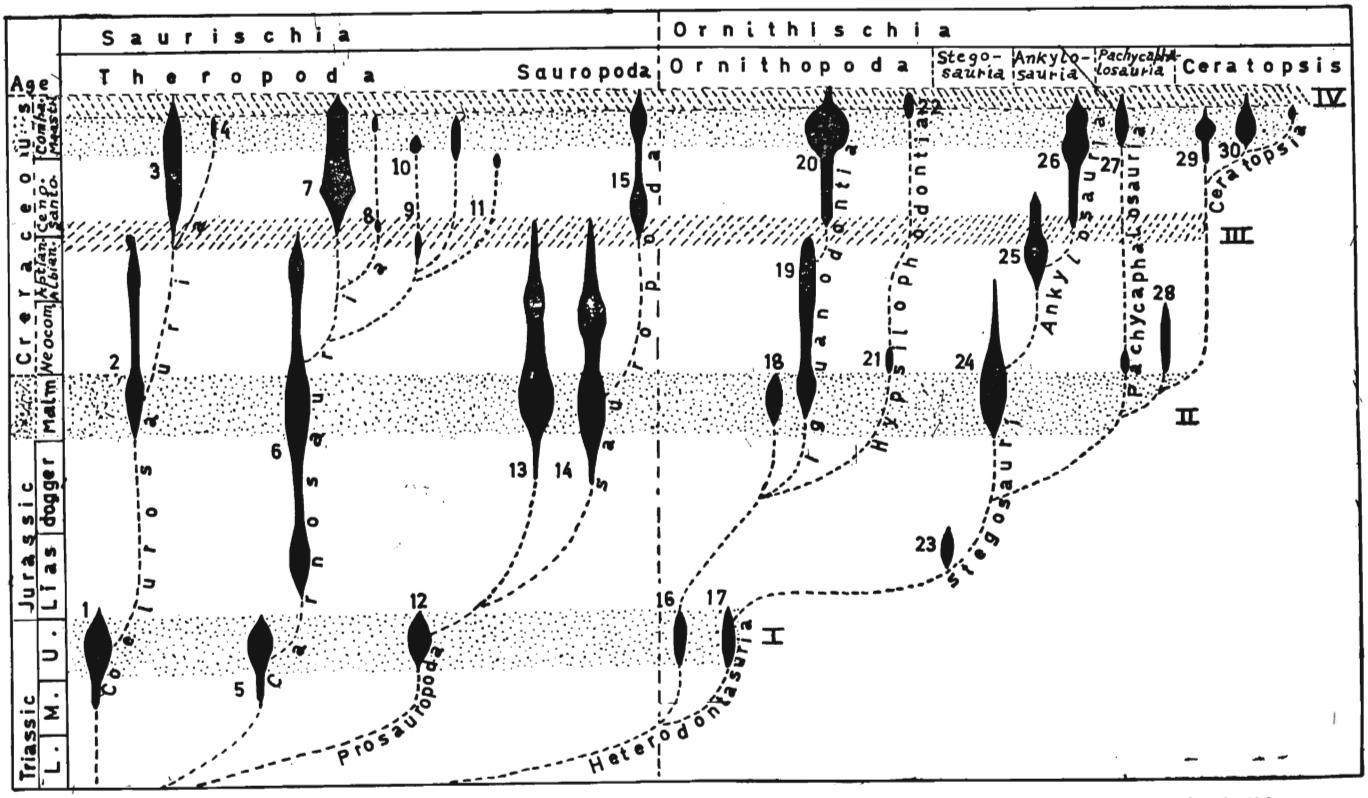
[1] The Lameta beds have been assigned the Turonian age (Krishnan, 1949).

[2] From the middle of the XX century dinosaur tracks have been discovered also in Mongolia, China, Transcaucasus and South-West Asia. These findings can be a subject of special consideration and, for reasons of limit, only the first discovery of the tracks is mentioned here.

PHYLOGENETIC SCHEME OF DINOSAURS



1. Podokesauridae ;
2. Compsognathidae ;
3. Ornithomimidae ;
4. Deinocheiridae ;
5. Teratosauridae ;
6. Megalosauridae ;
7. Tyrannosauridae ;
8. Therizinosauridae ;
9. Dromaeosauridae ;
10. Saurornithoididae ;
11. Oviraptoridae ;
12. Thecodontosauridae ;
13. Camerasauridae ;
14. Cetiosauridae ;
15. Titanosauridae ;
16. Heterodontosauridae;
17. Fabrosauridae ;
18. Laosauridae ;
19. Iguanodontidae ;
20. Hadrosauridae ;
21. Hypsilcphodontidae ;
22. Thescolosauridae ;
23. Scolidosauridae ;
24. Stegosauridae ;
25. Acanthopholidae ;
26. Ancylosauridae ;
27. Pachycaphalosauridae ;
28. Psittacosauridae ;
29. Protocerotopsidae ;
30. Ceratopsidae ;
31. Pachyrhinosauridae.

The Horizontal strips (I-IV) accord to periods of appearance, development and exchange (extinction) of dinosaur's families.

The second stage in the studies of Asian dinosaurs is related to the progress of geological investigations in Asiatic Russia at the beginning of the XX century (Yurjev, 1954a ; Rozhdestvensky, 1959, 1973a, 1974a). In the course of these investigations, in the second decade of the XX century, Russian geologists discovered remains of Cretaceous dinosaurs in Kyzyl Kum, in the Transbaikal region and at the Amur river. Palaeontological excavations made at the right-hand bank of the Amur river and in South Kazakhstan yielded abundant but odd materials of dinosaurs predominantly duckbilled (Hadrosauridae) and some of carnivorous (Theropoda).

All the collections of dinosaur remains including those added later from other areas, mainly from Kazakhstan, were studied by A. N. Riabinin (1915, 1925, 1930 a, b, 1931 a, b, 1937, 1938, 1939) who tragically died in blockaded Leningrad during the war. He described several new genera and species the most important of which is *Mandschurosaurus amurensis* (1925, 1930 a), a hadrosaur from the Amur river, whose skeleton was restored from the odd bones of several specimens and is now exhibited in Central Geological Museum in Leningrad. The restoration was an extremely hard task owing to lack of remains and absence of comparative forms. The skeleton was restored essentially after the North American genus, *Anatosaurus* (*Trachodon*), though the Amur dinosaur seems to be closer to *Nipponosaurus sachalinensis* (Nagao, 1936, 1938), an incomplete skeleton of which was excavated in the Southern Sakhalin near Sinegorsk town a few years later and is now kept in Japan. The two species appear to be of the same age (Maastrichtian). Another, possibly more valuable, finding is a rear part of the skull of a domelike headed hadrosaur, *Jaxartosaurus aralensis* (Riabinin, 1939) taken from the Upper Cretaceous (Cognacian) deposits of South Kyzyl Kum.

Intensive reconnaissance palaeontological investigations of vertebrates began in the twenties in Central Asia. The first to be successful was the Central Asiatic Expedition of the American Museum of Natural History

(1918—1930), headed by the well known zoologist R. Ch. Andrews (1932). The expedition carried out various investigations a large amount of which was devoted to palaeontology. In 1922-1925 in Inner Mongolia (China) and in Outer Mongolia (Mongolian People's Republic) the expedition discovered localities of predominantly small dinosaurs of Early Cretaceous and first half of Late Cretaceous. The fossils found were studied by famous American palaeontologists.

Very interesting among the Early Cretaceous dinosaurs are skeletons of small ornithischian dinosaurs, psittacosaurs, found in the localities of Oshih-Nuru and Anda-Khuduk[1] and tentatively described by Osborn (1923, 1924 a) as two different genera and species, *Psittacosaurus mongoliensis* and *Protiguanodon mongoliense*, though Osborn himself admitted their possible identity as it appears to be the case (Rozhdestvensky, 1955, 1964 d).

An incomplete skeleton of primitive hadrosaur, *Bactrosaurus johnsoni* (Gilmore, 1933 a) have been found in the beds which are now dated as Cenomanian (Rozhdestvensky, 1966) in the locality Iran-Nor[2] situated at the border between Inner and Outer Mongolia. In the same locality, using the odd remains, Gilmore described another hadrosaur, *Mandschurosaurus mongoliensis*, which appears to be an evident synonym of the former (Rozhdestvensky, 1964 d), a peculiar carnivorous dinosaur, *Alectrosaurus olseni*, with very large ungual phalanges of the fore limbs, and a coelurosaur, *Ornithomimus asiaticus*, which was later attributed to the new genus *Archaeornithomimus* (Russel, 1972).

The richest locality proved to be Bayn-Deak (by American investigators designated as Shabarakh-Usu) situated 90 km north-west of Dalan-Dzadagad. A great number of skeletons and skulls of archaic horned dinosaurs, *Protoceratops andrewsi*, have been excavated here (Granger and Gregory, 1923 ; Brown and Schlaikjer, 1940). Other new dinosaurs have also been described from Bayn-Dzak, predominantly by skulls. These are small theropods, *Velociraptor mongoliensis*, *Oviraptor philoceratops* and *Saurornithoides mongoliensis* (Osborn, 1924 b) and ankylosaur, *Pinacosaurus grangeri* (Gilmore, 1933 b). The locality has also become famous owing to the earliest in the world discovery of dinosaur eggs which at first were attributed to protoceratopsians and which are likely to be those of ankylosaurs (Rozhdestvensky, 1969). Also very interesting was the discovery in Bayn-Dzak of the remains of the oldest mammals contemporary with dinosaurs. Finally, remains of crocodiles and turtles have been found in Bayn-Dzak. On the whole, the Bayn-Dzak fossils represent well characterized dinosaur fauna, the earliest known in Asia, the age of which may be dated as the middle of Late Cretaceous (Rozhdestvensky, 1972 b, 1974 b).

In addition to the above mentioned dinosaurs, fragmentary remains (predominantly separate teeth) of Early Cretaceous carnosaurs and sauropods have been collected and described from Mongolia and China.

In fact, the Central Asiatic Expedition revealed great perspectives for further investigations in Gobi (Osborn, 1930). The continental deposits of the desert proved to be rich in remains of Mesocenozoic vertebrates and accessible to study. The expedition attracted the attention of many investigators to searches for fossil vertebrates, primarily dinosaurs, in other areas of Asia.

In India appear reports on new findings of dinosaurs remains (theropods, sauropods and ankylosaurs) from the Lameta beds of central provinces and also from Trichinopoly district and Bengal (Matley, 1921, 1929, 1931 ; Rao and Seshachar, 1927 ; Rama, 1932). The fossil collections were studied by Indian palaeontologists (Matley, 1923 ; Das-Gupta, 1929, 1931 ; Chakravarti, 1934). However the collected fossils were odd and generally fragmentary, and the species described by them were invalid.[3] The result of the dinosaur studies in India was the publication of a small monograph (Huene and Matley, 1933), in which some other doubtful genera and species of carnivorous dinosaurs and sauropods were established. In addition, F. von Huene (1940, 1942 a, b) published the information on the Late Triassic tetrapod fauna, including dinosaurs, from the Maleri area and on the fauna of Panchet age from Benglal.

In the USSR the territory from the Aral Sea to Lake Issyk-Kul, where new findings had been made, which are mentioned above, was investigated by I. A. Efremov (1932, 1933, 1944) who gave the palaeontological evaluation of the Middle-Asian dinosaur localities with their taphonomic characteristics. He came to a conclusion that the bone-bearing beds had been intensely washed up in a huge area north of the Tien-Shan. As a result of the secondary redeposition, the bones turned out to be separated and rolled. The dinosaurs, whose remains had been identified by A. N. Riabinin, seemed to Efremov to be of different age, and he supposed that washing up had occurred after Cretaceous, i.e. in Paleogene. This concept was adopted and existed for a long time. As a result, the interest to the dinosaurs of Middle Asia greatly decreased.

In China excellent findings were made in the Shantung peninsula. They were a skeleton of the Early Cretaceous sauropod, *Helopus*[4] *zdanskyi*, and a skeleton

[1] Ondai-Sair in American transcription.

[2] Same as Iren-Dabasu in American transcription and Erlan in Chinese.

[3] The total list of all the species of Asian dinosaurs is given in Table 1.

[4] Since this name turned out to be preoccupied, A. S. Romer (1966) substituted it by the term *Eohelopus*

of the Late Cretaceous hadrosaur, *Tanius sinensis*, described in the monograph by K. Wiman (1929).

In the late twenties and early thirties a Sino-Swedish expedition was working in China under the leadership of the well known Swedish traveller Sven Gedin. However the dinosaur fossils collected mainly in the Upper Cretaceous deposits of Kansu and Inner Mongolia were very scarce. They were examined and identified by the Swedish palaeontologist B. Bohlin (1953), who described several new genera and species of ankylosaurs resembling *Pinacosaurus grangeri* from Bayn-Dzak and an archaic horned dinosaur similar to *Protoceratops andrewsi* also from Bayn-Dzak. In addition, using fragmentary remains, B. Bohlin described a Late Cretaceous sauropodous dinosaur and an Early Cretaceous armoured dinosaur.

It is worth noting that one of the members of the Sino-Swedish expedition was the young Chinese palaeontologist C. C. Young who later became an organizer and director of the Laboratory and then of the Institute of Vertebrate Palaeontology. This scientist made a great contribution to the study of dinosaurs in China and Asia on the whole by his personal research and organization work.

The earliest works of C. C. Young (1931, 1935 a, b, c, d, 1937 a, b, 1939 a) were devoted to new findings and description of dinosaurs remains from Inner Mongolia, Ninghsia and Szechuan provinces, from the Shantung peninsula and Sinkiang. By fragmentary remains he described the doubtful species *Psittacosaurus* and *Pinacosaurus*, and by incomplete postcranial skeletons he identified two new genera and species of sauropods, *Tienschanosaurus chitaensis*, from the lower beds of the Cretaceous in Sinkiang (Young, 1937 b) and *Omeisaurus junghsiensis* from the Upper Jurassic of Szechuan (Young, 1939 a). Later Young currently reported about new findings of dinosaurs in the above mentioned and adjacent areas (Young, 1948 c, d, 1958 c ; Young and Sun, 1957). Yet most of his works are devoted to the Late Jurassic dinosaurs of Szechuan (Young, 1942 b, 1944 a, 1954 a, 1958 a, 1959 a ; Young and Chow, 1953) from where he described other new forms of sauropods, theropods and other dinosaurs. They were identified by extremely incomplete remains (the skulls always lacking), which resulted in many inevitable inaccuracies. For instance, "coelurosaur" *Sinocoelurus fragilis* identified by four teeth proved to be a crocodile. "Iguanodont" *Sanpasaurus yaoi* identified from Szechuan by a part of a postcranial skeleton (Young, 1944) is undoubtedly a young sauropod (Rozhdestvensky, 1964 c, 1966), just as, evidently, *Chialingosaurus kuani* identified by several vertebrae, limb bones and girdles as a "stegosaur".

The subsequent works of C. C. Young (1939 b, 1941 a, b, 1942 a, 1946, 1947, 1948 a, b, 1951 a, 1966) were devoted to the description of the Late Triassic dinosaur fauna from province Yunnan. Having studied the nearly complete skeletons collected from this province, he reported several new genera and species of prosauropods, *Lufengosaurus huenei*, *Gyposaurus sinensis*, *Yunnanosaurus huangi*, *L. magnus* and *Y. robustus*. However, the differences between them virtually fall within an individual (growth) variability, and consequently, they must be regarded as synonyms (Rozhdestvensky, 1964 b, 1965), though the author himself does not agree with this interpretation (Young, 1966). A postcranial skeleton "*Sinosaurus triassicus*" (Young, 1951 a) should also be attributed to prosauropods. It was undoubtedly wrong to identify the skeleton as *S. triassicus*, a carnivorous dinosaur previously described by jaw fragments (Young, 1948 a) together with the other carnivorous dinosaur *Lucousaurus yini* identified by a part of a skull. The systematic position of these dinosaurs in the theropod group is disputable. They may be most probably attributed to archaic carnosaurs, Teratosauridae. From the same Lufeng locality in Yunnan the archaic ornithischian dinosaur, *Tatisaurus oehleri*, was identified by a lower jaw (Simmons, 1965) which belongs to heterodontosaurs.

The third group of C. C. Young's papers (1954 b, 1958 b, d, 1959 b) is devoted to the description of dinosaur remains from the Cretaceous deposits of the Shantung peninsula, including the eggs previously reported by M. Chow (1951, 1954). A new species, *Psittacosaurus sinensis*, is reported from the Lower Cretaceous identified by a complete skeleton of excellent preservation. A new genus and species of a hadrosaur, *Tsintaosaurus spinorhinus*, also identified by a skeleton is reported from the Upper Cretaceous (Wangshih formation)[1]. The latter can hardly represent a separate genus (Rozhdestvensky, 1964d ; Romer, 1966), if it is not a complete synonym of *Tanius sinensis* (Wiman, 1929).

In addition to the principal (descriptive) papers, C. C. Young also published some articles concerning dinosaur studies in China (Young, 1951b ; Young and Chow, 1956), as well as various information of new latest findings (Young, 1965 ; Young and Chow, 1962).

Another important stage in the studies of Asiatic dinosaurs is related to the work of post-war large specialized palaeontological expeditions in most promising areas. The earliest of them was the Mongolian Palaeontological Expedition of the USSR Academy of Science (1946—1949). The expedition concentrated the search mainly in the south of Gobi, the area of deep depressions with extensive outcrops of Mesozoic sediments. The general information about the expedition and its scientific results is given in the papers by I. A. Efremov, Head of the expedition, and other members (Efremov,

[1]This formation apparently corresponds to the Cognacian stage.

1949, 1954a, 1956 ; Orlov, 1952, 1961 ; Rozhdestvensky, 1952a, 1957a, d, 1958, 1960a, 1969, 1974c).

The greatest success achieved by the expedition in the dinosaur studies[1] was the discovery of the worlds richest locality of various Late Cretaceous dinosaurs, primarily gigantic ones, carnosaurs, hadrosaurs, ankylosaurs and sauropods, in the Nemegetu basin. Other basins also with extensive badlands border Nemegetu on the south- and north-west, which together with Nemegetu contain many thousand skeletons of Late Cretaceous dinosaurs which have been successfully excavated by the subsequent expeditions during the last 20 years. In addition to Nemegetu, the Mongolian Palaeontological Expedition discovered other localities of Cretaceous dinosaurs in the Gobi, though not so rich. The series of skeleton remains collected by the expedition commenced the systematic study of dinosaurs in the USSR, which was entrusted to the two young scientists of the Palaeontological Institute of the USSR Academy of Science, E. A. Maleev (ankylosaurs and carnosaurs) and A. K. Rozhdestvensky (ornithopods).

The earliest papers of E. A. Maleev (1952a, b, 1954 a, 1956) were devoted to the description of ankylosaurs. He attributed a postcranial skeleton from Bayn-Dzak to a new genus and species, *Syrmosaurus viminicaudis*, being hesitant to identify it with a skull of *Pinacosaurus grangeri* (Gilmore, 1933 b). A complete skeleton later found here by Polish palaeontologists served to unite the American and Soviet findings into one species, *P. grangeri* (Maryanska, 1971). Another species of the same genus, *S. disparoserratus*, was identified by jaws from the Shiregin-Gashun basin adjacent to Nemegetu. A new species of the genus previously known from North America as *Dyoplosaurus giganteus*[2] was identified by a part of a postcranial skeleton from Nemegetu. Another new genus and species, *Talarurus plicatospineus*, was reported by E. A. Maleev from several skeletons, also "headless" except one having a preserved occipital part of a skull, collected in the Eastern Gobi (locality Bayn-Shireh). This form seems to be the oldest representative of the Ankylosauridae family.

Unfortunately, E. A. Maleev did not complete his studies of carnivorous dinosaurs, a remarkable series of skeletons and skulls from the Nemegetu basin (Maleev, 1955a, b, 1965, 1968, 1974)[3]. At first he described a new species of carnosaur, *Tyrannosaurus bataar*, by a skull attributing the Mongolian species to the American genus. Then he reported three more species, *Tarbosaurus efremovi*, *Gorgosaurus lancinator* and *G. novojilovi*, represented by skeletons or skulls. One of them, *Tarbosaurus*, is a new genus, while the other genus *Gorgosaurus*, is also American. Later it was proved (Rozhdestvensky, 1965) that the differences between the three Mongolian genera are much more minor than those between the Mongolian and American species of the same genus, and that they fall within individual (growth) variations. For this reason, the Mongolian species were combined into one which was named *Tarbosaurus bataar* in accordance with the code of nomenclature[4].

Apart from ankylosaurs and carnosaurs, E. A. Maleev (1954b) described another peculiar reptile by gigantic claws from Nemegetu. He named it a chelonianlike "saurus", *Therizinosaurus cheloniformis*, distinguishing it into a separate family. V. B. Sukhanov (1964) placed it into the group of turtles. However, using the fossils that have become available since then, the problem was re-examined, and *Th. cheloniformis* was attributed to carnivorous dinosaurs (Rozhdestvensky, 1970a). This position has been finally proved by the recent findings in Nemegetu.

Mongolian ornithopods consist of two families, Iguanodontidae and Hadrosauridae. The former is represented by a new species identified as *I. orientalis* (Rozhdestvensky, 1952b), which belongs to the *Iguanodon* genus well known from Europe. It was identified by a lower jaw and odd remains of a postcranial skeleton collected by the Soviet geologists in the Lower Cretaceous locality Khamarin-Khural, near Sayn-Shanda. This species is the earliest undisputable finding of iguanodonts in Asia. The series fossils collected by the Mongolian Palaeontological Expedition from the Nemegetu basin provided the material for reporting a new hadrosaur species, *Saurolophus angustirostris* (Rozhdestvensky, 1952c, 1957c), which belongs to a previously known American genus. The study of the morphogenetic relationships between the Mongolian and American *Saurolophus* species allowed assignment of the Maastrichtian age to the Nemegetu bone-bearing deposits, which was later confirmed by all subsequent investigations. This dating commenced the stratigraphic allocation of the Mesozoic continental deposits of Mongolia within the universal geological scale with an accuracy of a stage.

The study of Psittacosauridae (Rozhdestvensky, 1955) which were previously attributed to ornithopods, has shown that all the specimens derived from Mongolia (Oshih-Nuru, Anda-Khuduk, Ulan-Osh) and from Siberia (Shestakovo in Kuzbass) where they have been discovered in situ, belong to one species, *Psittacosaurus mongoliensis*, the age of which, as evidenced by the accompanying fauna in Siberia, must be Neocomian. At the same time

[1]The expedition also discovered and excavated several new and very rich localities of Tertiary mammals.

[2]The fossils collected recently suggest that this species belongs to a new genus.

[3]E. A. Maleev died in 1966.

[4]The unfinished paper of E. A. Maleev (1974) contains the old names used by the author in the manuscript interrupted in 1965. The paper is supplied with proper comments.

the author came to a conclusion that psittacosaurs bearing the features of various suborders, such as ornithopods, ankylosaurs and ceratopsians, should be separated into an individual suborder, even though later (1964d) he still placed them into a group of ornithopods. And only recently it has been proved that by the structure of teeth psittacosaurs are much closer to ankylosaurs (Rozhdestvensky, 1973b) or even to ceratopsians (Galton, 1974 ; also see the phylogenetic scheme).

In addition to the palaeontological study of the fossils collected by the Mongolian expedition, extensive taphonomic observations were made in the field in places of dinosaurs burials, which were comprehensively described by I. A. Efremov (1950, 1955, 1957). In particular, he reported that very large localities of dinosaurs (as other terrestrial vertebrates) had been formed in delta areas. As an example, he mentioned Nemegetu, though some geologists disagree with him (Gradzinski, 1970). However, the analysis of the dinosaur localities of the whole world proves that I. A. Efremov was right. The study of representative collections on dinosaurs laid the basis for the stratigraphic differentiation of the continental Mesozoic of Mongolia (Efremov, 1954a; Rozhdestvensky, 1957d, 1971a) adopted by geologists for practical use (Marinov, 1957 and others). It has also become possible to make the first judgement of the biology and evolution of dinosaurs (Efremov, 1953, 1954b ; Rozhdestvensky, 1957b ; Strelnikov, 1959). Finally, all the evidence available on Mongolian dinosaurs was naturally used in the preparation of the appropriate sections (written by Maleev and Rozhdestvensky) of the volume on reptiles in the reference manual "Fundamentals of Palaeontology" (Rozhdestvensky and Tatarinov, 1964).

A direct continuation of the large-scale palaeontological investigations in Mongolia and of the dinosaur studies in China was a new, larger, Soviet Chinese Palaeontological Expedition of the USSR and China Academies of Science (1959-1960), which predominantly worked in Inner Mongolia. The general information about the expedition and its scientific results is given in a series of papers written by the two leaders of the work from the Chinese and Soviet sides (Chow and Rozhdestvensky, 1960 ; Rozhdestvensky and Chow, 1960 ; Rozhdestvensky, 1961a, b, 1969). The expedition applied bulldozers at excavations, which naturally made the work very effective. A great number of series fossils of dinosaurs (and also of mammals) were collected for a short time. The most valuable collections of dinosaurs were series of skeletons of late iguanodonts at the newly discovered Lower Cretaceous locality Maortu in Alashan (Klebanova, 1963). In the same locality were found remains of carnivorous dinosaurs and sauropods. A skeleton of a gigantic ankylosaur was dug out in the vicinity, at the locality Tashuikou (Upper Cretaceous) which was also discovered by the expedition. A complete skeleton of the hadrosaur *Bactrosaurus* was excavated at the locality Iren-Nor previously discovered by the American expedition. Abundant skeleton remains of carnivorous dinosaurs were also collected in this locality.

Among the carnivorous dinosaurs, the young Chinese palaeontologist Hu Shou-yung (1964) distinguished a new genus, *Chilantaisaurus*[1] consisting of two species *Ch. maortuensis* and *Ch. tashuikouensis*, derived respectively from Maortu and Tashuikou. Both species are represented by separate elements of a skull and of postcranial skeleton which are hardly comparable. It is possible that the latter species is more related to the genus *Alectrosaurus* from Iren-Nor, and should be placed into a different group, namely therizinosaurs (Rozhdestvensky, 1970a). Iguanodonts from Maortu are attributed to the new genus, *Probactrosaurus*, (Rozhdestvensky, 1966), including two species *Pb. gobiensis* and *Pb. alashanicus*, derived from different bone-bearing horizons. This genus closely resembles *Bactrosaurus*, apparently being the ancestor of the latter. Accordingly, Iguanodontidae are the ancestors of the Hadrosauridae family. The time interval when iguanodonts were replaced by hadrosaurs was suggested to be considered the boundary between the Lower and Upper Cretaceous in the continental deposits.

The investigations of the Mongolian (1946—1949) and Soviet-Chinese (1959-1960) palaeontological expeditions did not only prove high prospects of the dinosaur studies in Central Asia (Efremov, 1963 ; Colbert, 1968 ; Russell, 1970), but also stimulated new searches of dinosaur remains in various areas of Asia, including the Asiatic part of the USSR (Rozhdestvensky, 1969) and India.

While only odd and fragmentary fossils of dinosaurs were continued to be found in the Far East (Rozhdestvensky, 1957e) and in the Trans-Baikal region (Dmitriev, Rozhdestvensky, 1968), in 1953 the first dinosaur skeleton was at last found in Kuzbass (Shestakovo) in situ in the Lower Cretaceous deposits (Rozhdestvensky, 1955, 1960b). In 1957 the expedition of the Palaeontological Institute of the USSR Academy of Science discovered a hadrosaur skull in situ in the Beleutin formation (Turonian) north of the Aral Sea (locality Shakh-Shakh)[2]. In 1961, near the Syuk-Syuk water well in the vicinity of Tashkent, an almost complete hadrosaur skeleton with a skull was found in the Upper Cretaceous deposits, also in situ (Belenky and Rozhdestvensky, 1963). These findings, particularly the latter, taken from the beds overlying the "dinosaur" horizon proved that the washing up of the bone-bearing deposits north of the Tien-Shan had been more local than it was believed earlier

[1]The term not accurately transcribed from the Mongolian name of Lake Jilantai.

[2]This locality was later examined by Kazakh palaeontologists who collected additional materials on dinosaurs (Nurumov, 1964).

(Efremov, 1932, 1933, 1944) and that it occurred in the first half of Late Cretaceous rather than in Paleogene.

Dinosaurian egg shells were found in Eastern Kazakhstan (Zaisan basin) in the same deposits as in Bayn-Dzak in Mongolia (Bazhanov, 1961). The egg shells were similar to those of Bayn-Dzak. In the sixties the expeditions of the Palaeontological Institute of the USSR Academy of Science examined the Fergana area and discovered a promising Upper Cretaceous locality, Kansai. The excavations resulted in abundant, though odd remains of dinosaurs (theropods and hadrosaurs), crocodiles and turtles (Rozhdestvensky, 1964f).

The faunal complexes with dinosaurs of the first half of Late Cretaceous[1] discovered in Kazakhstan and Central Asia effectively filled in the gap in the history of dinosaurs of Asia and the whole world (Rozhdestvensky and Khozatsky, 1967 ; Rozhdestvensky, 1970b).

The most interesting fossils from Kazakhstan were those of hadrosaurs which were studied by A. K. Rozhdestvensky (1968a). The skull from Shakh-Shakh was attributed to the new genus and species, *Aralosaurus tuberiferus*, by the example of which the hadrosaur teeth were proved to be of an asymmetric structure, typical for ornithischians in general. The teeth in the lower and upper jaws were found to be quite different, which is very important for identification, particularly when isolated teeth are found. The skeleton from the vicinity of Tashkent was identified as a new species of the American genus *Procheneosaurus—P. convincens*, which made it necessary to change the age of the deposits, in which it had been found, from Turonian to Santonian, and which evidenced that in the middle of Late Cretaceous Middle Asia and North America were having an exchange of elements of dinosaur fauna.

A good finding was made by a team of the Leningrad geologist N. N. Verzilin in Eastern Fergana near Tashkumyr town where a postcranial sauropod skeleton was discovered apparently of Late Jurassic age (Rozhdestvensky, 1968b, 1969). Within the USSR territory that was the first good finding of the oldest and largest dinosaur which may prove to be related to *Apatosaurus* after the material is fully studied and identified.

For the last two decades dinosaur remains have been collected and studied in India (Lapparent, 1957 ; Jain, Robinson and Roy-Chowdhury, 1964 ; Prasad, Verma, 1967). The most interesting finding is the remains of early sauropods from the Kota formation (Lower Jurassic) of the Decan (Jain, Kutty, Roy-Chowdhury and Chatterjee, 1975).

As far as we know, no large expeditions have been working in China for the last fifteen years, though some work on the collection and study of dinosaur remains have been reported (Young and Chow, 1962 ; Young, 1965, 1966 ; Chao, 1962 ; Chao and Chiang, 1974 and others)[2].

A further great contribution to the study of Central Asiatic dinosaurs was made by the Polish-Mongolian Expedition which worked on the territory of Mongolian People's Republic from 1963 to 1971. From the Polish side the expedition was headed first by J. Kulczitsky and K. Kowalski and later (most of the period) by Z. Kielan-Jaworowska, from the Mongolian side first by N. Dovchin and then by R. Barsbold. The results of the work have been widely reported in literature (Kielan-Jaworowska and Kowalski, 1965 ; Kielan-Jaworowska, 1966, 1967, 1968, 1969; Kielan-Jaworowska and Dovchin, 1968 ; Kielan-Jaworowska and Barsbold, 1972).

The operations of the expedition were concentrated in the most promising areas, Bayn-Dzak, Nemegetu basin and the area west of the latter, where the expedition was able to reach having at the disposal cross-country vehicles capable of moving across the sands. Having operated for many years, the expedition succeeded to collect a series of complete skeletons of *Tarbosaurus*, coelurosaurs, armoured dinosaurs and pachycephalosaurs. The latter were found for the first time, their doubtful remains having been earlier mentioned only from Inner Mongolia (Bohlin, 1953). Also the first almost complete skeleton of a Late Cretaceous sauropod was found. In the eastern part of the Nemegetu basin, in the red beds underlying the bone-bearing horizon which had been previously regarded unfossiliferous, the expedition succeeded to collect the remains of protoceratopsians and associated Cretaceous mammals, like in Bayn-Dzak. In both localities the expedition found a great number of the remains of lizards, crocodiles and turtles only single specimens of which had been previously reported. The palaeontological work of the expedition was accompanied by thorough stratigraphic investigations (Gradzinski, 1970 ; Gradzinski and Jerzykiewicz, 1974).

The study of the dinosaur fossils collected by the Polish-Mongolian expedition resulted in the substantial addition of the newly identified representatives to the existing dinosaur list. Among the carnivorous dinosaurs a peculiar *Deinocheirus mirificus* was reported (Osmolska and Roniewicz, 1970) identified by the gigantic fore limbs (about 3 m long) and pectoral girdle from Nemegetu (Maastrichtian). The dinosaur was distinguished to represent the new family, Deinocheiridae, and was classified as carnosaur, though it is not improbable that it is a special type of coelurosaur (Rozhdestvensky, 1970a). The new genus and species, *Gallimimus bullatus*, was reported (Osmolska, Roniewicz and Barsbold, 1972) identi-

[1]The reports about the findings of the remains of large Cretaceous dinosaurs from the upper Tobol river basin (Bazhanov, 1947 ; Novokhatsky, 1954) were erroneous. Actually the remains belong to marine reptiles, mosasaurs (Rozhdestvensky, 1973a).

[2]All the papers are predominantly published in Chinese.

fied by several skeletons (with skulls) of ornithomimids also from the Maastrichtian bone-bearing horizon of the Nemegetu basin, which had been previously found without skulls. Unlike the other known representatives of this family (Ornithomimidae), *G. bullatus* is characterized by a long snout with a flattened and broadened end, which would point to the swamp life of the animals (Rozhdestvensky, 1964f), rather than the land one, as was traditionally suggested by the authors. The new species *Saurornithoides junior*, was reported from the same Nemegetu deposits (Barsbold, 1974a), which is geologically younger than *S. mongoliensis* previously known from Bain-Dzak (Osborn, 1924c). Combining the mongolian genus with one or two American genera, R. Barsbold distinguished them as a separate family.

The new genus and species, *Nemegtosaurus mongoliensis*, was reported (Nowinski, 1971) by a skull identified from a skeleton found in the Maastrichtian bone-bearing horizon of Altan-Ula also in the Nemegetu basin. Armoured dinosaurs from Bayn-Dzak and Nemegetu (Maryanska, 1970, 1971) represented by the skeletons from at least three bone-bearing horizons are still being studied. Remarkable findings are the skeleton and skulls of pachycephalosaurs found in two Upper Cretaceous beds in the Nemegetu Basin. They were reported by Maryanska and Osmolska (1974) who distinguished three new genera and species, *Tylocephale gilmorei* (Campanian), *Prenocephale prenes* and *Homalocephale calathocercos* (Maastrichtian). The latter two differ by the fact that the former has a strongly developed dome in the frontal-parietal area, which may be explained by sexual dimorphism (Galton, 1971), although the authors doubt it. The separation of pachycephalosaurs into a separate suborder by the authors appears to be adequately grounded. This had been suggested previously though with lesser certainty (Rozhdestvensky, 1964e).

A peculiar finding was made by the expedition not far from Bayn-Dzak, in the contemporaneous locality Tugrikin-Us, where two skeletons of *Protoceratops andrewsi* and *Velociraptor mongoliensis* were found to be in a posture looking like a deadly fight (Barsbold, 1974b). However, the strongly displaced bones of the skeletons, particularly those of the protoceratopsian, and other evidence suggest that the "fight" between the carnivorous and herbivorous dinosaurs did not occur when the animals were living but that the bodies were brought together postmortally in the course of their burial, yet, the case itself is undoubtedly very rare.

In 1964, during the work of the Polish-Mongolian expedition, the Soviet palaeontologists P. K. Chudinov and B. A. Trofimov were invited by the Mongolian Academy of Science to examine the locality Bugin-Tsab situated to the north-west of the Nemegetu basin, which had not been reached by the expedition of the USSR Academy of Science because it did not have cross-country vehicles (1946—1949). The locality proved to be as rich as Nemegetu, the dinosaur fossils and their age being the same as in the latter (Chudinov, 1966 ; Trofimov and Chudinov, 1970).

In 1968 the Soviet-Mongolian Palaeontological Expedition began its long-term investigations in Mongolia. The expedition was headed from the Soviet side at first by A. G. Vologdin, then by N. N. Kramarenko and at present by J. I. Voronin, and from the Mongolian side by R. Barsbold. The early results of the work have been published (Barsbold, Voronin, Zhegallo, 1971; Kramarenko, 1974). The reports have been also published on the faunal characteristics of the new Lower Cretaceous dinosaur localities (Kalandadze, Kurzanov, 1974) and on their taphonomy (Novodvorskaja, 1974; Tverdokhlebov, Tsybin, 1974).

Having been informed by the Soviet geologists of new sites with dinosaur bones in the Eastern Gobi, the expedition examined them and excavated most promising localities. The richest among them is the Lower Cretaceous locality Khuren-Dukh situated about 80 km south of the railway station Choiren. From this locality the expedition collected a series of several skeletons of *Iguanodon orientalis* (previously known by scarce isolated remains from Khamarin-Khural), skeletal materials of *Psittacosaurus mongoliensis* and a skull with a part of a postcranial skeleton of a crocodile-like lepidosaur. At the locality Baga-Tariachi (the base of the Upper Cretaceous), 70 km east of Sayn Shanda city, the expedition collected abundant but isolated bones of ankylosaurs possibly identical to *Talarurus plicatospineus*. At the locality Baishin-Tsab (about 50 km north-west of Ulugei-Hid) a skeleton of a young or small hadrosaur was recovered (not yet studied), and numerous remains of armoured and various carnivorous dinosaurs were found, which are being studied at present.

In the Southern (Trans-Altai) Gobi, south-west of Nemegetu, in the locality Khermin-Tsab, two skeletons of ankylosaurs were unearthed from different horizons of the Campanian-Maastrichtian, which are characterized by a very flat body. Similar materials have been recovered from this locality by the Polish-Mongolian expedition. Both findings are being studied. S. M. Kurzanov (in press) described a new carnosaur by a skull and isolated bones of a postcranial skeleton found at the locality Nogon-Tsab (Maastrichtian) not far from Khermin-Tsab.

In the vicinity of Bain-Dzak excavations were made at the above-mentioned locality Tugrikin-Us, which yielded excellent series material of protoceratopsians as well as skeletons of small carnivorous dinosaurs, *Velociraptor mongoliensis*, and abundant remains of ankylosaurs. And, finally, in the South-Khangai area, in the locality

Guchin-Us, where the earliest collections had been made by the well known Russian traveller P. K. Kozlov (1949), the expedition recovered a skeleton of *Psittacosaurus mongoliensis* and a part of a skeleton with an incomplete skull of a very archaic ankylosaur which is not yet studied. The remains of dinosaurs were found to be accompanied by abundant remains of lizards, turtles and mammals.

The expedition continues its work.

The foregoing review of the study of Asiatic dinosaurs shows that, although the study began a century ago, the fundamental and rapidly progressing investigations were made in the second half of the period concerned and particularly in the last quarter. As to the collections available, Asia is second to North America. This is not astonishing, for in the New World they have been intensively accumulated for more than a hundred years, the localities being extremely abundant and rich in dinosaur remains. The Asiatic genera and species constitute about a quarter of all the dinosaurs known in the world. As to the large taxons of a suborder rank, only stegosaurs were not found in Asia, the fact that has not yet found its explanation. Also lacking are real horned dinosaurs, Ceratopsidae, which were the endemic forms of North America having had probably no time to spread elsewhere for a very short period of their existence (Rozhdestvensky, 1972b, 1974b). The study of dinosaurs in Asia did not only greatly extend the list of the dinosaurs of the world but also contributed much to the solution of many general theoretical problems concerning dinosaurs.

As far as systematics is concerned, many important aspects have been elucidated, for instance, the importance of sexual dimorphism through the study of dinosaurs on the whole (Davitashvili, 1961) and of protoceratopsians in particular (Brown and Schlaikjer, 1940 ; Kurzanov, 1972), and growth variations in various groups of dinosaurs (Brown and Schlaikjer, 1940 ; Rozhdestvensky, 1957c, 1965). By the example of ornithopods (Rozhdestvensky, 1966, 1968a) it has been established that extremely important for diagnosis are the teeth of ornithischian dinosaurs, since they rapidly vary within closely related taxons and even in one and the same specimen their structure varies depending on the position in a jaw. An interesting prospect to systematics will evidently be made by histologic diagnostics, particularly, in view of the fact that complete skeletons and skulls constitute but a very small percentage of all the specimens found in the fossil cemeteries, which most frequently consist of single bones.

Dinosaur egg shells which were thoroughly analyzed histologically during the last years (Sadov, 1970 ; Sotchava, 1969, 1970, 1971 ; Kolesnikov and Sotchava, 1972) displayed a great variety of types which may be of great significance to systematics. In passing, it is worth noting that the beginner of these investigations A. V. Sotchava (1972) found remains of a dinosaur embryo in one of the eggs, which is by itself a sensational discovery. It is hoped that the histology of bone tissue (Yurjev, 1954b) will be of aid to systematics.

Accumulation of dinosaur materials allows one to advance from descriptive to functional morphology and further to ecology using an actual method of morphological analogies (Rozhdestvensky, 1970a, 1973b). Indeed, all morphological adaptations found in dinosaurs were repeated by mammals (and partially by birds), which occupied their ecologic niches in Cenozoic. For the first time in the dinosaur study this was brilliantly demonstrated by the prominent American palaeontologist G. F. Osborn (1917).

Phylogenetic constructions are so far at the initial phase for in the history of various groups of dinosaurs there are virtually no uninterrupted sequences. This refers not only to the dinosaurs of Asia but also to those of the whole world (see phylogenetic scheme). Most fully represented are ornithopods (Rozhdestvensky, 1966, 1968a). Good prospects in this line are expected for ankylosaurs. The history of these groups in Asia may be traced throughout the Cretaceous, whereas in other regions of the world the record is interrupted.

Naturally, it is a long time since the problem of evolution and extinction of dinosaurs has attracted the universal attention. This also refers to the interests of the Soviet palaeontologists (Efremov, 1954b, Rozhdestvensky, 1957b, 1964a, 1969 ; Gabunia, 1969; Davitashvili, 1969), which to a great extent were favoured by the systematic study of dinosaurs, that began in the USSR after the second world war. Greatly helpful in this respect is the analysis of the world-wide dinosaur history with due allowance for the data available from Asia (Rozhdestvensky, 1972a, b, 1973b, 1974b). It has been, for example, proved that the extinction of dinosaurs had not been at one time and all over the world contrary to the belief of the majority of scientists who based their hypotheses on it.

The history of dinosaurs has been found to consist of several periods of flourishing and extinction of separate groups. In different continents these processes occurred in a different way but everywhere they are well correlated with the most significant geological events of a respective time. It has also been found that most of the known localities of dinosaurs (and, consequently, zones of their dwelling (in sensulato of the world) are confined to the border zone of the land and sea, which is most unstable in ecologic conditions. The periods of flourishing and extinction and the development of certain adaptations in dinosaurs very well agree with the similar phenomena among other groups of Mesozoic vertebrates, which implies that the regularities of historical development

were alike for all. Therefore, we should look for the common causes which determine them. Incidental, random factors which act occasionally must not be taken for universal causes, just as the supposed internal imperfection of the organisms themselves. This idea is not new, but the important thing is that it is proved by the documentary material on the whole history of dinosaurs including those of Asia.

More than ten dinosaur faunistic complexes have been established for the Mesozoic in Asia (Rozhdestvensky, 1957d, 1970b, 1971, 1972b, 1974b), which provide valuable information for paleofaunistics, evolution and paleogeography and constitute a good basis for the stratigraphy of Asia and for well grounded intercontinental stratigraphic correlations. Without studying the dinosaurs of Asia such correlations would have been virtually impossible, especially for the Upper Cretaceous deposits.

It should be reminded in this connection that dinosaurs (if they are present) are not only excellent index forms for the Mesozoic stratigraphy, particularly in Asia, where continental deposits are extremely widespread, but the disappearance of the last dinosaurs from the geological record is taken for the boundary between the Mesozoic and Cenozoic. At the present time there are only two sufficiently well studied and promising areas for the solution of this problem. They are North America and Central Asia.

To conclude, the study of Asiatic dinosaurs helps to reconstruct certain gaps in the history of this important and interesting group of Mesozoic terrestrial vertebrates. There is no doubt, that the joint efforts of palaeontologists of various countries will solve many problems facing the study of dinosaurs in Asia and in the whole world, the more so that in the last three decades many scientists have made the research of dinosaurs their speciality. The Asiatic continent opens up wide prospects in this respect.

Table 1 – Geological and Geographical Distribution of Dinosaurs in Asia and Validity of their species*

Validity	Systematic group / Geological age	Triassic	Jurassic		Cretaceous								Geographical distribution
					Lower				Upper				
		Upper	Lower	Upper	Neocomian	Aptian-Albian	Cenomanian	Turonian	Coniacian	Lower Santonian	Upper Santonian Campanian	Maastrichtian	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
	I. Theropoda												
	1. Ornithomimidae												
●	*Archaeornithomimus asiaticus*	..	..	..	..	..	×	..	..	..	..	..	Inner Mongolia,
~ synonyms?	*Compsosuchus solus*	..	..	..	..	..	..	×	..	..	..	..	India, Jubbulpore
~ synonyms?	*Coeluroides largus*	..	..	..	..	..	..	×	..	..	..	..	„
~ synonyms?	*Jubbulpuria tenuis*	..	..	..	..	..	..	×	..	..	..	..	„
~ synonyms?	*Laevisuchus indicus*	..	..	..	..	..	..	×	..	..	..	..	„
~ synonyms?	*Ornithomimoides mobilis*	..	..	..	..	..	..	×	..	..	..	..	„
~ synonyms?	*O. barasimlensis*	..	..	..	..	..	..	×	..	..	..	..	„
+	*Gallimimus bullatus*	..	..	..	..	..	..	..	..	..	..	×	MPR, Southern Gobi
	2. Deinocheiridae												
●	*Deinocherus mirificus*	..	..	..	..	..	..	..	..	..	..	..	MPR, Southern Gobi
	3. Teratosauridae												
~	*Teratosaurus (?) bengalensis*	×	..	..	..	..	..	..	..	..	..	..	Bengal
√ synonyms?	*Lukousaurus yini*	×	..	..	..	..	..	..	..	..	..	..	China, Yunnan
● synonyms?	*Sinosaurus triassicus*	×	..	..	..	..	..	..	..	..	..	..	„

Table 1—*Continued*

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	4. Megalosauridae												
~	synonyms? *Szechuanosaurus campi*	..	..	×	..	..	..	..	..	..	..	..	China, Szechuan
~	synonyms? *Chienkosaurus ceratosauroides*	..	..	×	..	..	..	..	..	..	..	..	..
~	*Antrodemus (?) sibiricus*	..	..	×	..	..	..	..	..	..	..	..	USSR, Trans-Baikal,
~	*Embasaurus minax*	..	..	..	×	..	..	..	..	..	..	..	Trans-Caspian areas
~	*Prodeinodon mongoliense*	..	..	..	×	..	..	..	..	..	..	..	MPR, West Gobi,
●	*Chilantaisaurus maortuensis*	..	..	..	..	×	..	..	..	..	..	..	North China, Alashan
	5. Tyrannosauridae												
~	synonyms? *Orthogoniosaurus matleyi*	..	..	..	..	..	..	×	..	..	..	..	India, Jubbulpore
~	synonyms? *Indosuchus raptorius*	..	..	..	..	..	..	×	..	..	..	..	„
~	synonyms? *Indosaurus matleyi*	..	..	..	..	..	..	×	..	..	..	..	„
~	synonyms? *Dryptosauroides grandis*	..	..	..	..	..	..	×	..	..	..	..	..
~	*Chinkankousaurus fragilis*	..	..	..	..	..	..	..	×	..	..	..	China, Shantung
~	*Albertosaurus periculosus*	..	..	..	..	..	..	..	..	..	..	×	Amur river
+	*Tarbosaurus bataar* (=*Gorgosaurus lancinator*; =*G. novojilovi*; =*Tyrannosaurus efremovi*)	..	..	..	..	..	..	..	..	..	..	×	.. MPR, South Gobi
	.6 Therizinosauridae												
●	*Alectrosaurus olseni* (?=*Chilantaisaurus tashuikowensis*)	..	..	..	..	..	×	..	..	..	..	..	China Inner Mangolia
●	*Therizinosaurus cheloniformis*	..	..	..	..	..	..	..	..	..	..	×	MPR, South Gobi
	7. Dromaeosauridae												
√	*Velociraptor mongoliensis*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
	8. Saurornithoididae												
√	*Saurornithoides mongoliensis*	..	..	..	..	..	..	..	..	..	×	..	„
√	*S. junior*	..	..	..	..	..	..	..	..	..	..	×	..
	9. Oviraptoridae												..
√	*Oviraptor philoceratops*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
	II. Prosauropoda												
	10. Thecodontosauridae												
+	*Lufengosaurus huenei* (=*L. magnus*; =*Gyposaurus sinensis*)	×	..	..	..	..	..	..	..	..	..	..	China, Yunnan
+	*L. huangi* (=*Yunnanosaurus robustus*; =*Sinosaurus triassicus*, *pars postcranial skeleton*)	×	..	..	..	..	..	..	..	..	..	..	„
	III. Sauropoda												
	11. Camarasauridae												
●	*Omeisaurus junghsiensis*	..	..	×	..	..	..	..	..	..	..	..	China, Szechuan
	(?=*Sanpasaurus yaoi*; ?= *Chialingosaurus kuani*)	..	..	×	..	..	..	..	..	..	..	..	„
~	*O. changshouensis*	..	..	..	×	..	..	..	..	..	..	..	China, Kansu
+	*Euhelopus* (=*Helopus*) *zdanskyi*	..	..	..	×	..	..	..	..	..	..	..	China, Shantung
●	*Tienschanosaurus chitaensis*	..	..	..	×	..	..	..	..	..	..	..	China, Sinkiang
~	*Asiatosaurus mongoliensis*	..	..	..	×	..	..	..	..	..	..	..	MPR, West Gobi

Table 1—*Continued*

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	12. Cetiosauridae (?)												
●	*Barapasaurus tagorei*	..	×	..	..	..	..	..	..	..	..	..	India,
●	*Mamenchisaurus constructus*	..	..	×	..	..	..	..	..	..	..	..	China, Szechuan
●	*M. hochuanensis*	..	..	×	..	..	..	..	..	..	..	..	China Szechow
~	*Mongolosaurus haplodon*	..	..	..	×	..	..	..	..	..	..	..	North China
	13. Titanosauridae												
~	synenyms? *Titanosaurus indicus*	..	..	..	..	..	..	×	..	..	..	..	India, Jubbulpore
	(?=*T. blanfordi*)	..	..	..	..		..	×	..	..	..	..	„
~	*Laplatasaurus madagascariensis*	..	..		..	..	..	×	..	..	..	..	„
●	*Antarctosaurus septentrionalis*	..	..	..	..	..	..	×	..	..	..	..	..
O	*A. (?) jaxarticus*	..	..	..	..	..	..	..	×	..	..	..	USSR, Kyzyl-Kum
~	*Chiayüsaurus lacustris*	..	..	..	..	..	..	..	..	..	×	..	China, Kansu
√	*Nemegtosaurus mongoliensis*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
	IV. Heterodontosauria												
	14. Heterodontosauridae												
●	*Tatisaurus oehleri*	×	..	..	..	..	..	..	..	..	..	..	China, Yunnan
	V. Ornithopoda												
	15. Iguanodontidae												
●	*Iguanodon orientalis*	..	..	..	×	..	..	..	..	..	..	..	MPR, East Gobi
+	*Probactrosaurus gobiensis*	..	..	..	..	×	..	..	..	..	..	..	China, Alashan
+	*Pb. alashanicus*	..	..	..	..	×	..	..	..	..	..	..	„
	16. Hadrosauridae												
+	*Bactrosaurus johnsoni* (=*Mandschurosaurus mongoliensis*)	..	..	..	..	..	×	..	..	..	..	..	Inner Mongolia
√	*Aralosaurus tuberiferus*	..	..	..	..	..	..	×	..	..	..	..	USSR, Central Kazakhstan
√	*Jaxartosaurus aralensis* (=*Bactrosaurus prynadai*)	..	..	..	..	..	..	..	×	..	..	..	Southern Kazakhstan
~	*Thespesius* (=*Cionodon*) *kysylkumense*	..	..	..	..	..	..	×	..	..	..	..	USSR, Kyzyl-Kum
+	*Tanius sinensis* (?=*Tsintaosaurus spinorhinus* ; ?=*Ts. chinkankouensis*)	..	..	..	..	..	..	..	×	..	..	..	China, Shantung „
+	*Procheneosaurus convincens*	..	..	..	..	..	..	..	..	×	..	..	USSR, Southern Kazakhstan
●	*Nipponosaurus sachalinensis*	..	..	..	..	..	..	..	..	..	..	×	Southern Sakhalin ..
●	*Mandschurosaurus* (=*Trachodon*) *amurensis* (=*Saurolophus kryshtofovici*)	..	..	..	..	..	..	..	..	..	..	×	Amur river
+	*Saurolophus angustirostris*	..	..	..	..	..	..	..	..	..	..	×	MPR, South Gobi
	VI. Ankylosauria												
	17. Acanthopholidae												
~	*Sauroplites scutiger*	..	..	..	×	..	..	..	..	..	..	..	China, Kansu

Table 1—*Continued*

1	2	3	4	5	6	7	8	9	10	11	12	13	14
	18. Ankylosauridae												
●	*Talarurus plicatospineus*	..	..	..	..	..	×	..	..	..	..	..	MPR, East Gobi
~	*Lametasaurus indicus*	..	..	..	..	..	..	×	..	..	..	..	India, Jubbulpore
~	*Brachypodosaurus gravis*	..	..	..	..	..	..	×	..	..	..	..	„
●	*Syrmosaurus disparoserratus*	..	..	..	..	..	..	..	..	..	..	..	MPR, South Gobi
+	*Pinacosaurus grangeri*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
~	*P. ninghsiensis*	..	..	..	..	..	..	..	..	..	×	..	China, Ninghsia
●	*Heischansaurus pachycephalus*	..	..	..	..	..	..	..	..	..	×	..	China, Kansu
	(*?=Peishansaurus philemys ;*	..	..	..	..	..	..	..	..	..	×	..	„
	?=Stegosaurides scutiger)	..	..	..	..	..	..	..	..	..	×	..	„
~	*"Dyoplosaurus" giganteus*	..	..	..	..	..	..	..	..	..	..	×	MPR, South Gobi
	VII. Pachycephalosauria												
	19. Pachycephalosauridae												
~	*Stegoceras bexelli*	..	..	..	..	..	..	..	..	..	×	..	China, Alashan
√	*Tylocephale gilmorei*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
+	*Prenocephale prenes*	..	..	..	..	..	..	..	..	..	..	×	„
√	(*?=Homalocephale calathocercos*)	..	..	..	..	..	..	..	..	..	..	×	„
	VIII. Incertae subordinis												
	20.Psittacosauridae												
+	*Psittacosaurus mongoliensis*	..	..	..	..	..	..	..	..	..	..	..	MPR, West,
	(*=Ps. osborni ; =Ps. tingi ;*	..	..	..	..	..	..	..	..	..	..	..	North and
	=Protiguanodon mongoliense)	..	..	..	..	×	..	..	..	..	..	..	East Gobi; Kuzbass
+	*Ps. sinensis*	..	..	..	..	×	..	..	..	..	..	..	China Shantung
+	*Ps. youngi*	..	..	..	..	×	..	..	..	..	..	..	„
	IX. Ceratopsia												
	21. Protoceratopsidae												
+	*Protoceratops andrewsi*	..	..	..	..	..	..	..	..	..	×	..	MPR, South Gobi
●	*Microceratops gobiensis*	..	..	..	..	..	..	..	..	..	×	..	China, Kansu

+ Species with complete diagnosis (skeleton and skull) —
V Species with incomplete diagnosis (skull)
● Species with insufficient diagnosis (postcranial skeleton and its articulated parts, partial skull)
~ Doubtful species with diagnosis by single, separate fragments of skull or of postcranial skeleton
O Species without diagnosis (nomen nudum)

*The list includes many new data and corrections in the systematics which have become available since the time when Huene published his list of Asiatic dinosaurs (Huene, 1958).

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