

## EXPLORATION IN INNER MONGOLIA

### —A PRELIMINARY ACCOUNT OF THE 1959 FIELD WORK OF THE SINO-SOVIET PALEONTOLOGICAL EXPEDITION (SPE)

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The Sino-Soviet Paleontological Expedition successfully closed its 1959 field season\*. During a period of about four and half months from the beginning of June to the middle of October, 1959, the Expedition traversed across a reconnaissance route of about 15,000 km. in the vast territories of Inner Mongolian Autonomous Region with the purpose of studying the geological history and collecting vertebrate fossils in the Mesozoic and Tertiary continental sedimentary basins of this region. As the result of the Expedition work more than twenty localities with rich vertebrate remains were investigated and a considerable amount of fossils was collected.

While the preparation of the materials collected during the season is still in progress and before the results of the systematic study of the fossils become available, a preliminary account of the work of the Expedition in general is given here.

### I. Aim and Organization

The Expedition is organized jointly by the Academy of Sciences, USSR, and Academia Sinica, and carried into execution under the direction of the Paleontological Institute and Institute of Vertebrate Paleontology and Paleoanthropology. The Aim of the Expedition is to investigate systematically the gobis and deserts of Central Asia in order to reveal the history of vertebrate life in this region during the long ages of its geologic past. The field work of the Expedition will continue for five successive years or more, beginning in 1959 from the central and western parts of Inner Mongolia and moving westward to end up in Soviet Central Asia.

The 1959 field party of the Expedition consisted of about seventy five persons, including 4 senior scientists (Drs. Bulchak-Abromovich, A. K. Trofimov, Rozdestvensky and Chow), 12 junior scientists (Chudinov, Dubrovo, Ailing Sun, C. K. Hu, Y. H. Hsu and the others), and photographer (Mr. Prozolovsky), medical doctor, two me-

\* A news note about the 1959 field work of the Expedition with some photographs has been published in *Vertebrata Palasiatica*, Vol. III, No. 4, 1959.

chanical engineers, 6 veteran collectors (Y. M. Egron, M. Lukjanova, C. Y. Wang and the others), excavators, administrators, drivers, etc. Prof. C. C. Young and Dr. E. A. Maleev paid short visit to the camp at Ula Usu (Shara Murun District) before the end of the season. The Expedition is equipped with in total 12 cars, 2 medium and 6 heavy (2-tons) jeeps, 4 trucks (4-tons) for transportation, and a heavy bulldozer for excavation.

## II. Methods and Expedition Work in General

The expedition work is carried out with reconnaissance and large-scale excavation operating in parallel. One or two reconnaissance groups of five to ten persons and equipped with lighter cars were sent out from the main camping bases in the radii of 50 to 200 km. in general. But they may go as far as more than 1,000 km. away from the base for long distance route reconnaissance. Their chief task is to locate new fossil localities, to evaluate the localities and make arrangements for excavations as well as to make general geological and physical geographical survey of the districts traversed during the reconnaissance trips.

The task of the excavation group is to carry out large-scale excavation and make more detail stratigraphical investigation of the fossil localities. They work with a central camping base from which several small groups are sent out to the localities in the district generally not more than fifty kilometers away from the center. The bulldozer is by all means the most powerful excavator of the whole party. It performs the amount of labour done by 100 or more workers by removing the overlying sediments, digging trenches for prospecting the bone-concentrating quarries, and removing large and heavy blocks ("monolites"), of which some weigh as much as more than two metric tons, from the surrounding rocks and lifting them directly on to the trucks.

This year the Expedition collected about two hundred and eighty boxes of fossils from more than twenty localities. Among these there are about two hundred single large blocks or "monolites". The reconnaissance work began on June 10th from the Iren Dabasu Lake and terminated at the Edsin Gol district in late September. The field season closed around the middle of October.

While the general physical conditions of the Inner Mongolian Gobi have not altered much since Roy Chapmen Andrews and his party bid good-bye to this region at the beginning of the nineteen thirties, the material conditions of the Gobi have undergone great and fundamental changes. The gobis and steppes have become more populous and more accessible to the explorers. With respect to communication in the gobis and deserts, there are a number of roads good enough for automobile transportation throughout the long stretches of the territories. And, in addition to the lamaseries there are many small villages, or even large towns, farms, geological and meteorological stations scattering all over the region that make field life in the gobis much less difficult than in the former days.

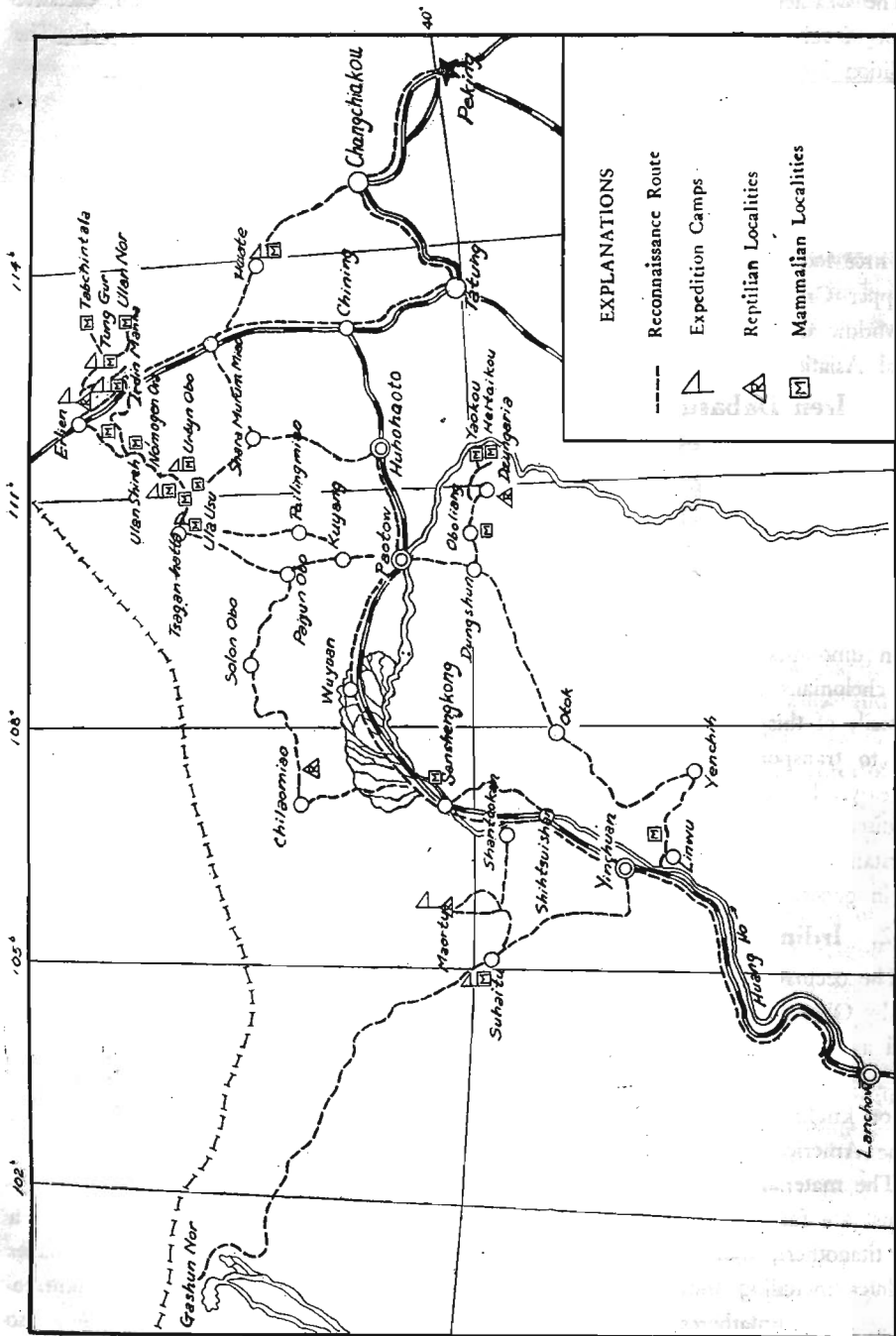


Fig. 1 Sketch Route Map of the Sino-Soviet Paleontological Expedition in 1959.

The weather of Inner Mongolia in 1959 was somewhat unusual with an excessive amount of rainfall which caused a great deal of unexpected troubles to our work. The Expedition lost no less than three weeks of working days on this account.

### III. Fossil Localities Investigated in 1959

#### A. Erlien (or Iren Dabasu) District

Three localities or groups of localities were investigated in this district. These are the upper Cretaceous localities of the Iren Dabasu Lake area, upper Eocene Irдин Manha, and Middle Oligocene Houldjin, all of which were known and first excavated by the Central Asiatic Expeditions of American Museum of Natural History.

##### 1. Iren Dabasu

This locality, consisting of nine sets of badlands, are situated some thirty kilometers northeast of the railway station of Erlien (Iren Dabasu), now a frontier town with more than two thousand inhabitants, and on the northern side of the Iren Dabasu Lake. Extensive excavations working with the bulldozer were carried out in this area from 14th of June to 17th of July. The materials collected include two partially complete skeletons (one with skull) of *Bactrosaurus*, three partially complete skeletons of some small carnosaurian dinosaurs and small ornithopods (of *Struthiomimus* type), some remains of sauropods, chelonians and crocodiles. Though quite abundant in dinosaurian bones as a whole, the fossils of this place are generally rather scattering and had more or less been subjected to transportation. Therefore, to secure well articulated complete skeletons is not quite easy. The collections of 1959 are rather good and comparatively well represented. The discovery and systematic studying of these material are of importance towards an understanding of this interesting late Mesozoic dinosaurian fauna and those of the eastern Asia in general.

##### 2. Irдин Manha

The occurrence of mammalian fossils in this area was first reported as early as in 1892 by Obruchev, one of the most well known earliest explorers of the Central Asia who found a fragmentary titanotheres molar here. The upper Eocene bone bearing beds extend for a north-south distance of about 10 kilometers with outcrops along a series of low hills or knolls lying east of the railroad. The fauna had been extensively investigated by the American paleontologists. The locality was excavated this year from July 19 to 29. The materials procured, though without much novelties and comparatively miscellaneous, are fairly representative. The better ones of them include partial skeleton of a large titanotheres, more than sixty upper and lower jaws of different groups of smaller ungulates including those of small titanotheres, lophiodonts, chalicotheres, "anthracotheres, and uinatheres, together with those of creodonts, rodents, and so forth, in addition to numerous isolated teeth and foot bones. Of particular abun-

dance are the teeth and jaw fragments of the small perrisodactyls (lophiodonts etc.). Besides, some avian, chelonian, and piscian bones were also collected. The locality as a whole is abundant in late Eocene mammalian fossils and has good perspective for future investigation.

### 3. Houldjin

The locality is situated some thirty five kilometers southwest to the railway station of Erlien. Fossils occur in the upper coarse-grained sandstone and gravel beds of the formation. They are comparatively few, fragmentary and much rolled as is characteristic of the case with the coarse detrital sediments. A few jaw fragments, teeth and limb bones of titanotheres, indricotheres, carnivores and small perrisodactyls were picked up there.

## B. Tung Gur District

Three localities known in this district are all of Neogene age. Two of them, i.e. Tung Gur and Tairum Nor (=Ulan Usu) respectively of Miocene (late Miocene or slightly earlier) and Mio-Pliocene ages, were first discovered by the Central Asiatic Expeditions. The other one, Tabchintala, is new.

The Tung Gur locality, about 50 kilometers southwest of Irдин Manha, was excavated in 1959 with the bulldozer from July 26 to August 17 while a group was camping near the "Wolf Camp" at the northern part of the Tung Gur Tableland. The material collected include two partial skeletons and several incomplete skulls and jaws of mastodonts, four skulls and about 10 lower jaws of rhinocerotids, and jaws of antelopes, cervids, carnivores, costorids, etc. Some antlers of the cervids, horn cores of antelopes and chelonian shells were also collected. Of interest are the skull and lower jaws of the shovel-tusked proboscidiens. The excavation of this locality is certainly far from exhaustive and further exploration will no doubt yield important results.

The Tairum Nor or Ulan Nor locality, situated fifty kilometers southwest of Tung Gur, is of somewhat higher stratigraphical horizon. The better finds are a mastodontoid skull, a skull and some cervical vertebrae of a new meline mustelid, and remains of the cervids. Many of the fossils are preserved in the concretions.

Tabchintala is a new locality some twenty kilometers from the Tung Gur and probably of the same horizon but less abundant in fossils than the latter. The fossils collected here are mostly very fragmentary, including teeth and bones of rhinocerotids, mastodonts, carnivores and artiodactyls.

## C. Hwate District

The district lies in the far south some 150 kilometers north of Kalgan. Two localities with abundant remains of Neogene mammals are spotted there. Reconnaissance work was done during the first period of the season while the Expedition was doing ex-

cavation at Erlien. Excavation of the localities was carried out from September 29 to October 13 but soon closed due to the unexpected early arrival of the severe winter weather.

### 1. Tuchtentse

The locality lies twenty five kilometers to the southeast of the town of Hwate and yields abundant remains of *Hipparion* fauna preserved in the red clays. The fossils collected included three large rhinocerotid skulls, a skull of *Hipparion*, and more than thirty pieces of upper and lower jaws of rhinoceroses, hipparions, giraffids, cervids and other small ruminants, carnivores and rodents. The fauna represents most probably an eastern extension of the early Pliocene *Hipparion* fauna of North China. The locality has good perspective and it is necessary to make arrangements for further excavation.

### 2. Heishatou

This point is located about seventy kilometers in the northeastern direction of Hwate. The fauna which contains anchitherine equids, chalicotheres, and the other, represents probably a faunal stage slightly earlier than that of Tuchtentse. On account of the shortage of time no systematic excavation was carried out there in this season, but these localities are certainly of considerable interest, because they seem to be among the most perspective localities for yielding abundant remains of *Hipparion* faunas (*s.l.*) in Inner Mongolia, and an understanding of their relationship with those of Tung Gur and the *Hipparion* fauna of North China to the west is important from the paleozoogeographical viewpoint.

## D. Shara Murum District

This includes a group of localities ranging in geological age from late Eocene to late Oligocene and with fossiliferous beds cropped out as badlands along the borders of several tablelands. Nearly all of these localities had been excavated by the various Expeditions of American Museum and large quantities of important fossils were collected. In 1959 this district was again extensively investigated by the members of the Sino-Soviet Expedition and excavations were made in the course of August and September and a great deal of material were unearthed therefrom.

### 1. Ula Usu

This is the type locality of the upper Eocene Shara Murum formation. The Expedition had its field centre there while working in the district. The fossiliferous beds, which consists of light greyish sands and clays in the upper part and light brown clays in the lower, are exposed as lower hillocks on the northern flanks of the tableland extending way south to immerse near the Baron-Sog-in-Sumu. While both the upper and lower parts are fossiliferous, the overwhelming majorities of the material were derived from the lower part of the formation exposed near the Well of Ula Usu ("Mountain Water" in Mongolian language). Fossils are amazingly rich in this place and their pre-

ervation is excellent. The most interesting and abundant finds are those of titanotheres and *Archaeomeryx*. Of the former three skeletons and more than a dozen skulls and lower jaws and many limb bones in articulated position were discovered. As to the fossils of *Archaeomeryx*, more than thirty mostly complete skeletons of individuals of varying ages in addition to numerous upper and lower jaw fragments were enearthed. Of special interest is the finding of the nearly complete skeleton of a rhinocerotid with unusually long limbs and skull and dentition primitive in appearance. It resembles in many respects a small indricothere of primitive type.

Furthermore, fairly good specimens including many skulls and lower jaws of amynodonts, helaletids, chalicotheres, carnivores, rodents and chelonians and avian bones were also collected. The excavation of this important locality, though carried out on large scale, is far from being exhaustive. Much is still left for future investigations.

## 2. Baron Sog

The locality is twenty kilometers from the monastery Baron-Sog-in-Sumu and fifteen kilometers east of Ula Usu. The fauna is also of late Eocene age but the fossils are not so rich as in the latter. At some distance to the south is a locality where Oligocene mammals were discovered by the American explorers, but it was not surely located by us this year.

## 3. Teng Nor

This is on the western side of the Lake Teng Nor and twenty kilometers from Ula Usu to the west. The locality was unknown before. The fauna is the same as that of Ula Usu, but the fossils are not rich. Some titanotherian teeth and chelonian fossils were gathered there.

## 4. Urtyn Obo

This locates on the east side of the river Shara Murum, the valleys of which cut through the original continuous tablelands of Urtyn Obo and Baron Sog and divide it into two sections. Lithologically, the sediments here is an eastward extension of those of Ula Usu and Baron Sog. From the lower part of it mammalian faunas of late Eocene and early Oligocene age are known. Fossils of embolotherine titanotheres including two well preserved skulls and several lower jaws were collected from the higher horizon of the lower part; and from the upper part we collected remains of large indricotheres (=baluchitheres) and advanced forms of entelodonts, suggesting the fauna being more typical of a higher Oligocene level.

## 5. Nomogen Ora

This is the locality named as Nom Khong Shireh by Andrews' party. It is about fifty kilometers from Urtyn Obo and essentially a replica of the latter in the nature of sediments and faunas. From the lower part of the section in the badlands skulls and lower jaws of titanotheres, amynodonts, small lophiodonts and other perrisodactyls and

small artiodactyls were collected and in the upper part large bones and teeth of indricotheres were discovered.

## 6. Ulan Shireh

It is a locality north of Tukum Sumu and about thirty kilometers from the Ula Usu. Its geological conditions are similar to those of the last mentioned locality except the uppermost part of which is probably missing here. Fossils collected here include several skulls and many lower jaws of helaeletids, titanotheres and carnivores. Besides, chelonians are found in great abundance, one well preserved trionychid turtle being of very large size. Most of these fossils are from the upper Eocene horizon in the lower parts of the formations.

The last three localities are really of great interest and very rich in mammalian fossils but only small scale excavations were made in 1959.

## E. Ordos Districts

Work carried out in 1959 in the districts of Ordos is mostly of reconnaissance nature. A number of localities ranging geographically from the extreme north to the southernmost part of the region in the district of Ninghsia were recorded. With the exception of sigintze locality where some fragmentary bones of Triassic age found at one place, the rest are all of Tertiary and Pleistocene ages. All the localities surveyed in 1959 are summarized as follows:

### 1. Heitakou, Northern Ordos—Pliocene and Pleistocene.

From Pliocene beds only isolated mammalian bones and struthio egg shells were found. More interesting findings are made in the Pleistocene loess deposits from the basal part of it, including rhinoceros skull and lower jaws.

### 2. Yaokou, Northern Ordos—Pliocene.

Many teeth, fragmentary lower jaws and skeletal bones of *Hipparion*, rhinoceroses, ruminants (antelopes, cervids, giraffids) and carnivores were collected from this locality.

### 3. Obo-liang, Northern Ordos—Pliocene and Pleistocene.

Remains of *Hipparion*, gazelles, and cervids from the Neogene beds and rhinoceros, equids, and bovids are known from the Pleistocene deposits.

### 4. Siyintse, Northeastern Ordos—Triassic and Pleistocene.

From the Triassic red beds some vertebrae of Archosaurian type reptile were found. This fossiliferous horizon is probably a westward extension of the horizon of *Kannemeyria* fauna of Shansi widely distributed on the eastern side of the Huangho. Besides, rhinoceros remains are found in the overlying loess deposits.

### 5. "St. Jaques", Northwestern Ordos—Oligocene and Pleistocene.

This is the locality first investigated and named by Teilhard de Chardin (1926). But the village of Toukoutang ("St. Jaques"), now a section of the city of Shanshenkon,



is on the western bank of the Huangho, and the fossil locality is on the eastern side of the river in the Ordos region. Remains of some Oligocene mammals including those of indricotheres, carnivores and rodents were found during one of our reconnaissance trip to the west. Many of these fossils were found redeposited in the overlying loess together with numerous struthiolithes.

## F. Alashan District

This district is comparatively less known before with regard to vertebrate paleontology and has not been thoroughly investigated by the Expedition in 1959. However, two important new localities, one of late Cretaceous and the other of early Oligocene, were located and preliminarily excavated this season.

### 1. Moartu

This locality lies about sixty kilometers north of the town Gilantai on the east side of the Gilantai Salt Lake in the eastern part of the great Alashan deserts. It is composed of two sets of badlands outcropped along the northern edge of a sedimentary basin six kilometers from the Maortu Obo. In the west section of the badland, from the lower greenish and reddish sandstones bones of large sauropods were discovered, and from the higher part of the same section remains of ornithopods and carnosaurian dinosaurs were found. Fossils are most abundant in the east section of the badlands where we found no less than three skeletons and jaws of some ornithopods, while the structure of the teeth resembling those of the hadrosaurids, but those of the skeleton are more like those of some iguanodonts. Several isolated maxillae and lower jaws appear to be many skeletal bones were also collected from this place. The locality is to be systematically excavated in the next season.

### 2. Suhaitu

This is a new Oligocene locality with rich mammalian fossils occurred in the basal part of a lenticular pocket. The bone bearing sediments are greenish and brownish clays. Some of the fossils are comparatively well preserved, but many are badly deformed by crushing. Skulls of large titanotheres and artiodactyls were collected during the preliminary excavation. Judging from the fossils available for observation in the field the fauna is probably of early or middle Oligocene characterized by the presence of the embolothereine titanotheres and entelodonts.

What is given above is but a brief summary of the work of the first season of the Sino-Soviet Paleontological Expedition and more can be learned when the materials collected have been thoroughly investigated.

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For decades the gobis and deserts of the Mongolian region have attracted the attention of the vertebrate paleontologists all over the world and had been repeatedly ex-

plored by several well known expeditions. All the previous works done in this region have given confidential proofs that this part of the Asiatic continent is one of the most important centers of evolution of many a reptilian and mammalian groups. Our work done in 1959 in the central and western parts of Inner Mongolia means a further verification of these hypotheses. The Mesozoic and Tertiary basins of Central Asia with their treasuries of vertebrate fossils are indeed a paradise for paleontological explorations. Much has been learned in the past, but, still more remains to be done. At present this is the task for the Sino-Soviet Paleontological Expedition to endeavour.