Hayashibara Museum of Natural Sciences Research Bulletin 1, p.13-16(2000)

PHILIP J. CURRIE

Report on the Preliminary Joint Field Excursion to the Gobi desert, 1992*

Suzuki, Shigeru; Watabe, Mahito

1. Introduction

Watabe and Suzuki, members of Hayashibara Museum of Natural Sciences carried out a short excursion in the central region of Gobi desert in order to evaluate prospects of fossil discovery at the major fossil localities in the desert. They also collected as much information as possible on the logistics for fieldwork in the Gobi desert and the necessary materials for it. They also collected several research papers on Gobi geology and paleontology published by the Soviet - Mongolian Joint Paleontological Expedition.

The Japanese side discussed with the Mongolian side (Dr. Barsbold, director of Geological Institute; presently called as Mongolian Paleontological Center) about the further plans of the joint research project in the Gobi desert.

They purchased necessary materials and foods for their short excursion in Ulan Bator. The exchange rate between US dollars and Mongolian Tuguruk was 1:80.

2. Members of the preliminary expedition team in 1992

Watabe, Muhito (researcher)
Suzuki, Shigeru (researcher)
Badamgarav, D. (researcher)
Chimiddorji (field assistant)
Boldbaatar (driver)
Boldbaatar (driver)

3. Schedule of the preliminary expedition

May 30: Trip from Okayama to Osaka
May 31: Trip from Osaka to Beijing
June 1: Arrived at Ulan Bator from Beijing
June 2-6: Preparation work for excursion and discussion with Mongolian side in Ulan Bator
June 7-15: Excursion in central region of Gobi desert
June 16: Discussion in Ulan Bator with Mongolian side for performance of joint expedition
June 17: Trip from Ulan Bator to Beijing
June 18-19: Stay in Beijing, visiting IVPP (Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica), Beijing Natural History Museum, and Zhoukoutian site of fossil hominid.
June 20: Coming back to Okayama via Osaka from Beijing

4. Localities visited in the excursion

Algui Ulan Tsav (Lower Cretaceous?)
Bayn Dzak (Upper Cretaceous, Djadokhta Formation)
Tugrikin Shire (Upper Cretaceous, Djadokhta Formation)
Osh Nuru (Basalt lava capping the Lower Cretaceous beds)

5. Narrative story of the preliminary expedition activities in 1992

July 2 - 6: Preparation works for the field excursion.

Japanese side and Mongolian side discussed the arrangement the schedule of field excursion, such as localities to be visited; participants from Mongolian side; provision of foods and gasoline; preparation of vehicles and maps. Two vehicles with drivers and one helper for the excursion were arranged by Mr. Chimidtseren who was a president of a company. The Japanese side discussed with Mongolian side to make clear the content of agreement for joint expedition from 1993, and logistic methodology for fieldwork in Gobi desert. The necessary instruments and materials for the work were listed by their cooperation. The skills and number of participants in the fieldwork were also consulted.

During this time, permission for field excursion was obtained from the Mongolian authorities.

June 7 - 15: Field Excursion.

On June 7, the excursion group consisting of two Japanese and four Mongolian left Ulan Bator with two UAZ 469 vehicles. One vehicle was prepared for transportation of foods and living materials such as tents and cooking instruments. Another vehicle brought people.

The UAZ 469 for materials had some troubles especially with its radiator. The group went southward and set camp at point 70 km north of Mandal Gobi. The GPS coordinate date taken on the road are as follows:

Figure 1. Route and localities visited in preliminary expedition of 1992.
1: Algui Ulan Tsav; 2: Bayn Dzak; 3: Tugrikin Shire; 4: Osh Nuru.

*This is contribution no. 10 of the Hayashibara Museum of Natural Sciences-Mongolian Paleontological Center Joint Paleontological Expedition.

On June 10, the group arrived at Algui Ulan Tsav. After searching for fossils, the group moved to Bayn Dzak. The GPS coordinate data on the road are as follows:

10:20 Arrived at southern part of main outcrop of Algui Ulan Tsav, 55.8 km from Tsogt Oboo. N: 44-31-51.2; E: 104-37-05.9; A: 1223 m

The group searched for fossil eggs in western part of the outcrop where the lower part of geological section was exposed, and, according to Mongolian researcher, eggs were richly found.

12:47 Searching fossil eggs in western area. There was no clear discovery of egg fossils in this area. N: 44-32-09.9; E: 104-36-09.3; A: 1208 m

13:30 The group decided to moved to Bayn Dzak.

14:30 Visited a gher in Algui Ulan Tsav to ask the road to Bayn Dzak, 61.8 km from Tsogt Oboo. The gher is a dwelling tent of

coordinate date on the road are as follows:

13:21 Visited a gher, 55 km from Tugrikin Shire. N: 44-41-52.8; E: 103-02-57.9; A: 1076 m

15:21 Visited the outcrop of basal lava in Osh, close to the road to north. It is 78.4 km from Tugrikin Shire. The group collected samples for K/Ar dating from the lava, overlying the Lower Cretaceous Osh Formation. N: 44-51-59.0; E: 102-51-09.2; A: 1145 m

16:27 Stopped on road, 102.9 km from Tugrikin Shire. N: 45-06-08.5; E: 102-50-36.1; A: 1145 m

18:12 Arrived at Tugurik, 146.9 km from Tugrikin Shire. N: 45-32-18.1; E: 102-59-37.2; A: 1145 m

00:30 Arrived at Arvaykheer, 82.6 km from Tugruk town. N: 46-15-55.1; E: 102-46-15.3; A: 1145 m

On June 14, the group obtained gasoline in Arvaykheer and continued a trip to Ulan Bator

11:29 On the road to south. N: 47-43-41.8; E: 106-41-45.2

17:05 On the road to south. N: 46-51-40.5; E: 106-37-43.6

20:27 On the road to south. N: 46-22-49.1; E: 106-30-08.7

Camping site. N: 46-23-49.8; E: 106-28-44.2

On June 8, the group moved to south, visiting Mandal Gobi to refuel cars. The GPS coordinate date on the road are as follows:

6:40 Camping site

10:40 On the road to Mandal Gobi. N: 45-56-23; E: 106-20-30.6

12:40 Arrived at Mandal Gobi gasoline station. Although the gasoline station hesitated to give gasoline to the cars that was not registered in Central Gobi Aimak, the excursion group could get gasoline after negotiation. N: 45-46-00.9; E: 106-16-22.4

14:38 South of Mandal Gobi. N: 45-32-38.2; E: 105-58-44.2

16:01 Point 64.4 km south of Mandal Gobi. N: 45-19-02.1; E: 105-45-05.7; A: 1313 m

16:53 Point 78.6 km south of Mandal Gobi. N: 45-12-04.5; E: 105-40-08.4; A: 1279 m

17:20 Rest at a well. There, the group tried to fix the trouble with the car that brought materials.

18:40 Lunch site, 107 km from Mandal Gobi. N: 44-58-11.5; E: 105-30-47.4; A: 1154 m

22:38 Camping site, 150 km from Mandal Gobi, one hour by car to Tsogt Oboo. It was hard to repair radiator of the car. N: 44-34-37.1; E: 105-20-41.9; A: 1210 m

On June 9, the group arrived at gasoline station in Tsogt Oboo. In Tsogt Oboo, the group could not get gasoline until 18:00 due to a power failure in the town. The GPS coordinate data are as follows:

10:10 Arrived at Tsogt Oboo, 166.7 km from Mandal Gobi. N: 44-25-33.4; E: 105-19-27.6; A: 1210 m

Waiting for power supply, the group fixed the trouble with the radiator, and observed outcrops of Lower Cretaceous (red beds of conglomerate, sandstone and mudstone).

18:25 Power supply was recovered. Water and gasoline were obtained by electric pump.

18:40 On the road to west going through saksaul field. N: 44-34-32.6; E: 104-43-16.1; A: 1210 m

21:00 Camping site, 52.3 km from Tsogt Oboo. N: 44-35-40.0; E: 104-41-10.2; A: 1087 m

On June 10, the group arrived at Algui Ulan Tsav. After searching for fossils, the group moved to Bayn Dzak. The GPS coordinate data on the road are as follows:

10:20 Arrived at southern part of main outcrop of Algui Ulan Tsav, 55.8 km from Tsogt Oboo. N: 44-31-51.2; E: 104-37-05.9; A: 1223 m

The group searched for fossil eggs in western part of the outcrop where the lower part of geological section was exposed, and, according to Mongolian researcher, eggs were richly found.

12:47 Searching fossil eggs in western area. There was no clear discovery of egg fossils in this area. N: 44-32-09.9; E: 104-36-09.3; A: 1208 m

13:30 The group decided to moved to Bayn Dzak.

14:30 Visited a gher in Algui Ulan Tsav to ask the road to Bayn Dzak, 61.8 km from Tsogt Oboo. The gher is a dwelling tent of Mongolian nomadic people, which is also called as Yurta. N: 44-32-42.8; E: 104-32-41.0; A: 1255 m

16:50 On the road to Mandal Oboo. Before this point, the group visited two ghers to ask the way. 29.7 km from the gher visited (14:30). N: 44-37-37.1; E: 104-11-15.3; A: 953 m

17:22 Arrived at Mandal Oboo gasoline station. Water was also supplied. N: 44-39-01.3; E: 104-03-13.2; A: 1043 m

18:30 On the road to southwest in sandy desert, 29.5 km from Mandal Oboo. N: 44-25-48.2; E: 103-49-44.4; A: 1029 m

19:33 Arrived at north of Bayn Dzak, 48.8 km from Mandal Oboo. N: 44-15-40.9; E: 103-44-33.2; A: 1029 m

20:44 Camp at the Ruin area near the main cliff of Bayn Dzak. The group shortly searched for fossils and found ankylosaur teeth, *Protoceratops* skeletons, and eggshells. N: 44-09-23.5; E: 103-41-53.9; A: 1327 m

On June 11, fossils were searched for in Bayn Dzak. Theropod bones, protoceratopsid teeth and its jaw were found. After searching fossils, moved to Tugrikin Shire. The GPS coordinate date taken on the road are as follows.

12:48 Top of the pediment in Bayn Dzak, 2.3 km from the camp. N: 44-08-33.1; E: 103-43-21.6

15:20 Arrived at Bulgan. The group obtained water and oil for engine of cars. N: 44-05-16.9; E: 103-32-55.1; A: 1327 m

17:30 On the road from Bulgan to Tugrikin Shire. Two volcanic cones were seen in north. There was a gher near the point. 22.4 km from Bulgan. N: 44-12-48.9; E: 103-19-42.3; A: 1130 m

18:20 Arrived at isolated sand dune east of Tugrikin Shire.

19:00 Arrived at Tugrikin Shire. The group set the camp on the top of pediment, 26.2 km from Bulgan. N: 44-13-58.3; E: 103-17-19.5; A: 1085 m

By short searching, *Protoceratops* skeletons and isolated skulls were found. This area rich in fossils was named as Tugrikin Shire - II (TS-II) in 1993.

On June 12, the group searched for fossils in Tugrikin Shire. Abundant fossil bones were found from yellowish white fine sandstone. Two skulls of *Protoceratops* and a theropod upper jaw were again buried, because the group had not any instruments and materials for making a jacket of plaster of Paris.

On June 13, the group moved northward to Arvaykheer. The GPS coordinate date on the road are as follows:

13:21 Visited a gher, 55 km from Tugrikin Shire. N: 44-41-52.8; E: 103-02-57.9; A: 1076 m

15:21 Visited the outcrop of basal lava in Osh, close to the road to north. It is 78.4 km from Tugrikin Shire. The group collected samples for K/Ar dating from the lava, overlying the Lower Cretaceous Osh Formation. N: 44-51-59.0; E: 102-51-09.2; A: 1145 m

16:27 Stopped on road, 102.9 km from Tugrikin Shire. N: 45-06-08.5; E: 102-50-36.1; A: 1145 m

18:12 Arrived at Tugurik, 146.9 km from Tugrikin Shire. N: 45-32-18.1; E: 102-59-37.2; A: 1145 m

00:30 Arrived at Arvaykheer, 82.6 km from Tugruk town. N: 46-15-55.1; E: 102-46-15.3; A: 1145 m

On June 14, the group obtained gasoline in Arvaykheer and continued a trip to Ulan Bator.

17:30 After refueling the vehicles, left Arvaykheer to Ulan Bator.

18:18 Point on the road to Ulan Bator, 34.2 km from Arvaykheer. N: 46-32-01.3; E: 102-59-20.0; A: 1145 m

19:20 Point on the road to Ulan Bator, 64 km from Arvaykheer. N: 46-42-36.8; E: 103-18-02.7; A: 1494 m

20:00 Stayed in Erdenesant, 176.9 km from Arvaykheer. N: 47-19-53.7; E: 104-29-34.8; A: 1382 m

On June 15, the group came back to Ulan Bator. The GPS coordinate data taken on the road are as follows:

11:25 Visited Lun town to present documents to local government on our trip. N: 47-52-06.2; E: 105-15-21.4; A: 1359 m

13:06 Repair of broken vehicle, 160.7 km from Erdenesant. N: 47-53-59.7; E: 106-27-35.6; A: 1426 m

13:42 Arrived at western traffic gate of Ulan Bator city.

On June 16, all materials and instruments were stored. The collected specimens during the excursion were sorted out. Japanese side and Mongolian side (Dr. Barsbold, Khand, and Badamgarav) together discussed the schedule of preparation works for expedition in the next year.

On June 17 and 18, Suzuki and Watabe left Ulan Bator to Beijing. They visited IVPP (Institute of Vertebrate Paleontology and Paleoanthropology) for consultation with Chinese vertebrate paleontologists for further joint projects on exhibition. They also visited Beijing Natural History Museum. It was hard to start joint research work with Chinese researchers, because of schedule of Chinese side.

On June 19, they visited Zhoukoutian, *Homo erectus* fossil and archeological site.

On June 20, they returned to Japan.

6. Result of reconnaissance excursion in 1992

Although the excursion group wasted time in their trip by unpredictable machine trouble in their vehicles and shortage of gasoline in local gasoline station of Gobi desert, they got very positive prospects for further expedition projects in the Gobi desert. The fossil localities visited in the excursion, Tugrikin Shire and Algui Ulan Tsav, were very rich in fossil contents.

The fossil localities in the Gobi desert appeared to be very promising places for paleontological and geological studies.

For successful fieldwork in the Gobi desert, it is necessary to manage the details of an operation of the work, such as supply of life materials and transportation of them. Tools and materials for excavation of discovered fossil specimens are also crucially needed, including carpenter tools, digging tools, plaster of Paris, screws nails, screws, hardener, glue, and electric device such as winch and generator. Well-maintained heavy trucks will transport them.

Several localities and areas were nominated for joint expedition work by discussion with Mongolian side. The localities are:

(1) Tugrikin Shire, central part of Gobi desert

This locality is famous for the discovery of the fighting dinosaurs (combined skeletons of *Velociraptor* and *Protoceratops*), many nearly complete skeletons of *Protoceratops*, and bones of small vertebrates such as Mesozoic mammals and lizards.

(2) Khuren Dukh in eastern part of the Gobi desert

Although this locality is small in scale of outcrops, it has yielded rich well-preserved specimens of vertebrates of Early Cretaceous age such as iguanodontids, ornithomimids, psittacosaurids, champsosaurids, pterosaurids, turtles, and fishes.

(3) Nemegt basin in the western part of the Gobi desert (localities such as Nemegt, Altan Ula, Bugin Tsav)

Nemegt basin, extremely rich in vertebrate fossils from the Late Cretaceous, was found by Russian expeditions in 1940s and had been searched by Polish and Russian workers after that. As the localities in the basin had not been searched in detail for a decade, it is possible to find many new dinosaur and other vertebrate specimens from these localities.

There are many other localities that are very prospective for fossil findings in whole areas of the Gobi desert. They are, in the eastern part of the desert, Tel Ulan Chaltsai, Baga Tariachi, Khongil Tsav, Bayn Shire, Burkhant, Shine Us Khuduk, and Bayshin Tsav; in the central part, Alag Teg, Udyn Sayr, and Dzamin Khond; in the western part, Gurilin Tsav, Shireegin Gashun, Nogon Tsav, and Khermeen Tsav. Those localities should also be considered as possible targets for fossil searching and geological study by our joint expedition.

7. Future plan for joint expedition

In 1993, the joint expedition in the Gobi desert will be carried out for nearly three months as reconnaissance searching for rich localities. The expedition party will visit fossil localities widely distributed in whole areas of the Gobi desert from east to west.

Before the field work in the summer time, the preparation works will be done in Ulan Bator in cooperation between Japanese and Mongolian members of the expedition.

The final agreement for the joint research project including the expedition will be concluded between the Japanese and Mongolian sides in spring of 1993.

8. Acknowledgments

The field excursion in 1992 became possible by the enthusiastic support of Mr. Ken Hayashibara, president of Hayashibara Company Limited. Dedicated support by staffs of the Mongolian Paleontological Center (Geological Institute, in 1992) of Academy of Sciences of Mongolia greatly made possible the successful field trip in the Gobi desert. Mongolian support staffs such as the helper and drivers are indispensable for the successful trip.

This manuscript was very much improved by Mr. Kh. Tsogtbaatar of the Mongolian Paleontological Center.

Hayashibara Museum of Natural Sciences Research Bulletin 1, p.17-29(2000)

Report on the Japan - Mongolia Joint Paleontological Expedition to the Gobi desert, 1993*

Watabe, Mahito; Suzuki, Shigeru; Hayashibara Museum of Natural Sciences - Mongolian Paleontological Center Joint Paleontological Expedition

1. Introduction

The first joint paleontological expedition between the Hayashibara Museum of Natural Sciences (abbreviated as HMNS) and the Mongolian Paleontological Center (abbreviated as MPC, this research organization was called as Geological Institute in 1993) was initiated in 1993. As the first year, the expedition team visited as many dinosaur fossil localities as possible, widely distributed in the Gobi, moving from east to west. The first fieldwork carried out a function of reconnaissance of the fossil abundance in the localities.

The fieldwork was carried out in the Gobi desert from the end of July to the end of September for 2 months. The stay of Japanese member of the expedition team in Mongolia reached about 5 months from beginning of July to the end of November.

Preparation for the fieldwork in the Gobi desert was begun in the autumn of the previous year (1992), after the successful performance of the preliminary excursion in the Gobi desert in 1992.

Based on the information collected by interviews with the participants who were engaged with the Soviet - Mongolia Joint Expedition, Poland - Mongolia Joint Expedition, Sino-Canadian Dinosaur Project to Inner Mongolia, and AMNH-Mongolia Joint Expedition begun in 1991, we prepared the necessary materials for the expedition in Japan. Experience in the preliminary excursion in 1992 was also useful for the work.

All materials except some fresh foods, some spare parts and fuel (gasoline) for the cars, and large trucks were brought from Japan to Mongolia by two containers. The materials brought from Japan include: foods, research instruments (GPS machine, geological survey tools, mapping tools, photographic equipment and films, etc.); life materials (tents, water tanks, cooking tools, etc.); excavation instruments and chemicals (hammer, picks, iron bars, plywood boards, ...er of Paris, acetone, hardener, glues, needles, etc.); and four-wheel-drive vehicles for the expedition.

The experience in the Gobi desert by the Russian and Polish Expedition teams were also utilized for the management of the base camp of our expedition in the desert.

The two members of the Japanese side (HMNS) of the joint expedition, Watabe and Matsumoto arrived at Ulan Bator at the beginning of July as an advance party of the expedition. They did preparatory works for the fieldwork such as getting administrative permission for ...ieldwork from the Mongolian government; purchasing the additional foods, fuel, and other materials in Ulan Bator; and maintenance and repair of the vehicles with Mongolian drivers.

The fresh foods such as meat, bread, and vegetable were obtained in Ulan Bator, just before leaving for the Gobi desert. Additional foods were supplied from nomads and farmers locally in the Gobi desert.

The permission for the fieldwork in the Gobi desert had to be obtained from the Ministry of Geology, Ministry of Protection of Natural Environment, and the local government of the South Gobi Aimak.

Special difficulties existed for the performance of the fieldwork in Mongolia for the year (1993). The expedition team had to confront those unpredictable difficulties. The difficulties are: 1) shortage and unstable supply of fuel (gasoline) in Mongolia; and 2) confusion of administrative organs in their given power. These difficulties annoyed the expedition team during the whole term of the expedition in the year.

Also, there were more difficulties in Mongolia, namely: very poor communication condition between Japan and Mongolia, and a very limited possibility of medical treatment in Ulan Bator. In the Gobi desert, we could hardly communicate with Japan even using telephone lines. This problem urged us to introduce satellite telephone system for communication in 1994.

Shortage of gasoline (fuel) in Mongolia in 1993 was a critical social problem, and we had to obtain ration tickets for it. This shortage of fuel continued in 1994 and 1995.

Food was also scarce even in Ulan Bator. Acquisition of large amount of foods for expedition work was extremely difficult in the summer of 1993.

The confusion of the administrative organs in their given power was the hardest problem of the year. The administrative organ who gave permission for the fieldwork and for borrowing specimen to Japan for research was not clearly defined in law at that time. Therefore, many organs insisted that we got their permission, and we had to make superfluous application for their groundless permission. This procedure took a long time. This condition was also seen in 1994 and 1995, but was improved in 1996.

Purposes of the joint fieldwork in 1993 are as follows:

1) Preliminary investigation of dinosaur fossil localities in the Gobi desert to evaluate their prospects in fossil richness;

2) Geological investigations on the dinosaur fossil localities, especially to make clear their sedimentary environmental context;

3) Finding vertebrate fossils in those localities;

*This is contribution no. 11 of the Hayashibara Museum of Natural Sciences-Mongolian Paleontological Center Joint Paleontological Expedition.

4) Accumulation of experience of expedition works to make up rules and manuals for performance of the most efficient and sound international and multi-cultural expedition works.

2. Members of the Joint Expedition Team in 1993 and their Term

Fieldwork: July 28 - October 5, 1993

Japanese side:

Researchers:

Ishii, Ken-ichi (HMNS, director)

Yokobayashi, Koji (HMNS)

Watabe, Mahito (HMNS)

Suzuki, Shigeru (HMNS)

Matsumoto, Yukihide (HMNS)

Ishimoto, Hideki (Osaka City Univ., Dept. Geoscience)

Fastovsky, David E. (Univ. Rhode Island, Dept. Geology)

Weishampel, David B. (Johns Hopkins Univ., School of Medicine, Dept. Cell Biology and Anatomy)

Assistant staffs:

Hashimoto, Ryo (HMNS)

Amamiya, Chika (HMNS)

Mongolian side:

Researchers:

Barsbold, Rinchen (Geological Institute, present Mongolian Paleontological Center: MPC, director)

Narmandakh, Pagam (vertebrate paleontology)

Badamgarav, Demchig (sedimentology)

Khand, Yondon (invertebrate paleontology)

Sodov, Janchiv (paleobotany)

Tsogtbaatar, Khishigjav (vertebrate paleontology)

Ariunchimeg, Yarinpel (invertebrate paleontology)

Nyamsuren, Gombosuren (invertebrate paleontology)

Preparators:

Lkhagvasuren, Yondon

Enkhbat, Jamsran

Otgonjargal, Chultem

Assistant staffs (drivers and cook):

Magsarjav, Munkh-Ochir

Bayar, Osorjamaa

Mashbat, Damdindorj

Munkhzaya, Ganbaatar

Tsetsegmaa, Ognoon (cook)

3. Schedule of the fieldwork

Summarized schedule of the filed work in 1993 in the Gobi desert is as follows.

July 2 - July 27: preparation works in Ulan Bator for fieldwork

July 28: from Ulan Bator to Khuren Dukh

July 29 - August 9: fossil searching, geological survey, and excavation in Khuren Dukh

August 9 - 12: fossil searching and excavation works in Tel Ulan Chaltsai and Baga Tariachi

August 13: short visit to Khongil Tsav

August 14 - 15: fossil searching and excavation in Shine Us Khuduk

August 16 - 17: move to Bayshin Tsav, to west

August 18 - 21: fossil searching and excavation in Bayshin Tsav and Amtgai

August 22 - 23: move to Tugrikin Shire in central region of Gobi desert

August 24 - September 2: fossil searching, geological survey and excavation in Tugrikin Shire and Alag Teg

September 3: move to Dzamin Khond and excavation work there

September 4: move to Bugin Tsav

September 5 - 7: fossil searching in Bugin Tsav and Bugin Tsav-II

September 8 - 13: excursion team visited Nogon Tsav, Khermeen Tsav, Naran Bulak, and Altan Ula-IV. The rest of the main team continued fossil searching in Bugin Tsav.

September 14 - 16: fossil searching and excavation in Bugin Tsav, Bugin Tsav-II, and Gurilin Tsav

September 17: move to Naran Bulak

September 18: fossil searching in Tsagan Khushu

September 19: fossil searching in Altan Ula-II

September 20 -21: excursion and fossil excavation in Khermeen Tsav

September 22: fossil searching in Ulan Khushu

September 23: move from Naran Bulak to Nemegt

September 24 - 29: fossil searching and excavation in Nemegt

September 30 - October 5: trip coming back to Ulan Bator from Nemegt

October 6 - November 29: post-expedition works in Ulan Bator

4. List of the Localities visited and surveyed

The distribution of the localities visited and route of the expedition in 1993 are shown in Fig. 1.

Eastern region of the Gobi desert (geological formation on each locality shown in parentheses):

Khuren Dukh	(Apt-Albian, Early Cretaceous)
Tel Ulan Chaltsai	(Late Cretaceous?)
Baga Tariachi	(Bayn Shire Formation, Late Cretaceous)
Khongil Tsav	(Bayn Shire Formation, Late Cretaceous)
Bayn Shire	(Bayn Shire Formation, Late Cretaceous)
Burkhant	(Bayn Shire Formation?, Late Cretaceous)
Shine Us Khuduk (I and II)	(Bayn Shire Formation, Late Cretaceous)
Suikhent	(Jurassic petrified wood locality)
Bayshin Tsav	(Bayn Shire Formation, Late Cretaceous)
Amtgai	(Bayn Shire Formation, Late Cretaceous)

Central region of the Gobi desert:

Tugrikin Shire	(Djadokhta Formation, Late Cretaceous)
Alag Teg	(Djadokhta Formation, Late Cretaceous)
Bayn Dzak	(Djadokhta Formation, Late Cretaceous)
Dzamin Khond	(Djadokhta Formation, Late Cretaceous)

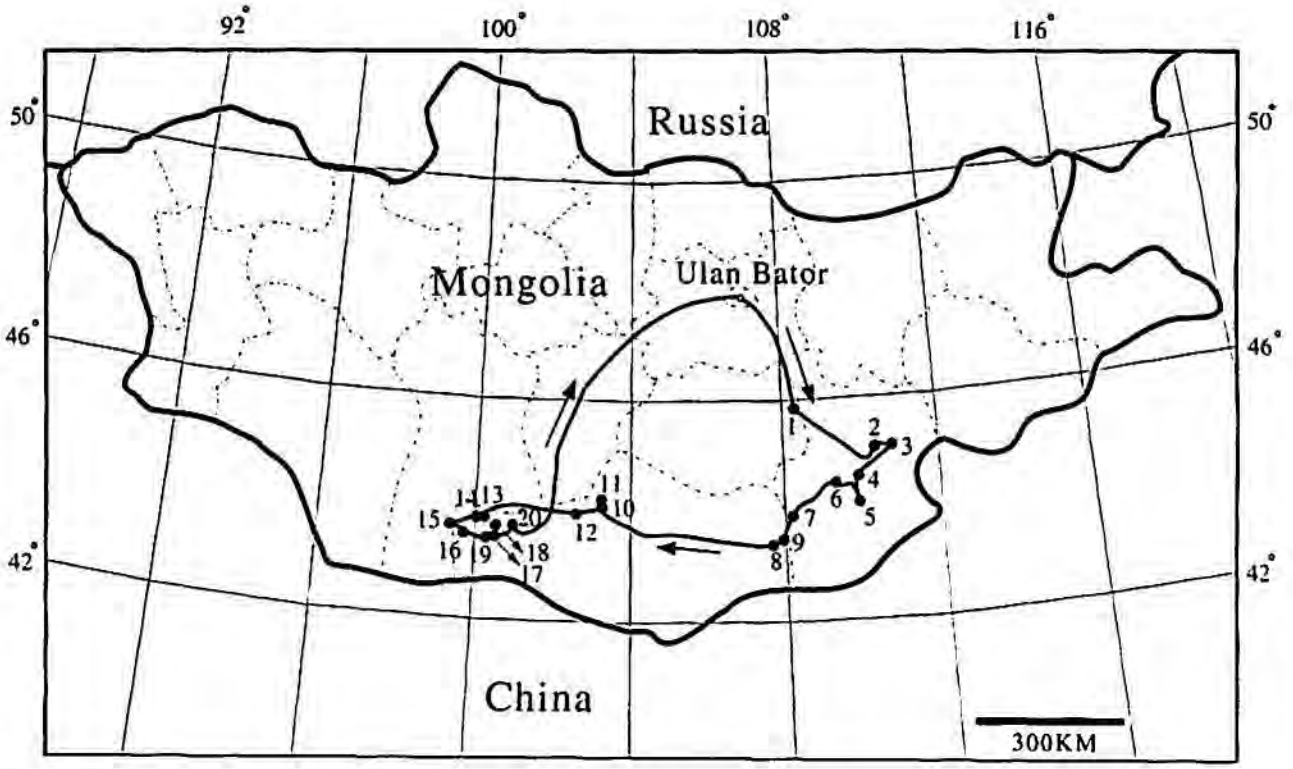

Figure 1. Route and localities visited in the joint expedition of 1993.
1: Khuren Dukh; 2: Tel Ulan Chaltsai; 3: Baga Tariachi; 4: Khongil Tsav; 5: Bayn Shire; 6: Shine Us Khuduk; 7: Suikhent; 8: Bayshin Tsav; 9: Amtgai; 10: Tugrikin Shire; 11: Alag Teg; 12: Dzamin Khond; 13: Gurilin Tsav; 14: Bugin Tsav; 15: Nogon Tsav; 16: Khermeen Tsav; 17: Naran Bulak and Ulan Khushu; 18: Altan Ula-II, III, and IV; 19: Tsagan Khushu; 20: Nemegt

Western region of the Gobi desert:

Bugin Tsav	(I and II)(Nemegt Formation, Late Cretaceous)
Gurilin Tsav	(Nemegt Formation, Late Cretaceous)
Nogon Tsav	(Nemegt Formation, Late Cretaceous)

Khermeen Tsav (Bayn Shire, Barun Goyot, and Nemegt Formation, Late Cretaceous)

Tsagan Khushu	(Nemegt Formation, Late Cretaceous; Paleocene and Eocene, Cenozoic)
Naran Bulak	(Nemegt Formation, Late Cretaceous; Paleocene and Eocene, Cenozoic)
Altan Ula - II, III, IV	(Nemegt Formation, Late Cretaceous)
Ulan Khushu	(Nemegt Formation, Late Cretaceous)
Nemegt	(Barun Goyot and Nemegt Formation, Late Cretaceous)

5. List of the collected specimens

The list of the specimens collected by the joint expedition team during the fieldwork is shown in Table 1.

6. Narrative story of the expedition activities in 1993 and results of fieldwork at each locality

The fieldwork was performed for the purpose of gaining an insight into the productivity of the fossil localities in the overall Gobi region, and finding prospective fossil localities among them.

The expedition team visited the localities moving from east to west in the Gobi desert in the summer season from August to September.

July 2 - 11: Preparation in Ulan Bator for fieldwork

On July 2, two members of the Japanese side (Watabe and Matsumoto) arrived at Ulan Bator as an advance party, and began works for customs clearance of the containers with materials for the expedition sent from Japan. Although the Mongolian Customs alleged to impose customs duties on the materials, we negotiated with the Customs to obtain them without duties.

Getting a certificate for gratis aid to the scientific activities of Mongolia from the Ministry of Trade and Industry of Mongolia, we could obtain customs clearance without duties.

The containers were brought to the yard of the Paleontological Laboratory of the MPC, near the Natural History Museum of Mongolia. The work of sorting out, checking, and maintenance of the arrived materials and vehicles began. Japanese members were registered as foreigners working in Mongolia at the police station of the district.

From July 11 to 13, the national holiday of Mongolia, Naadam, was held in Ulan Bator and the works were suspended.

During two weeks from July 13 to 27, before leaving for the Gobi desert, works for getting permission of fieldwork, registration of vehicles, acquisition of gasoline, purchase of additional foods and packing

of materials for expedition were done. On July 24, Dr. Ishii, director of HMNS and other two members (Ishimoto and Amamiya) arrived at Ulan Bator. On July 26, the Japanese side led by Dr. Ishii discussed with Mongolian side (Dr. Barsbold) about the further schedule of the expedition and additional cooperation projects.

On July 27, we loaded the materials used for the expedition into the vehicles, namely, one ZIL 130 truck, two GAZ 66 trucks, and two 4WD cars brought from Japan.

On July 28, the expedition team left the MPC for the first locality, Khuren Dukh (Eastern and Central Gobi Aimak border). The team went along the rail road line to the southeast, to town Choyr.

The GPS coordinates of each point in the route are as follows (N: latitude, E: longitude, and A: altitude of the points):

13:41 Point on road. N: 47-41-47.3; E: 106-56-36.2

14:24 Point. N: 47-33-09.2; E: 106-59-59.4; A: 1580 m

15:57 Lunch point. N: 47-14-22.1; E: 107-03-50.8; A: 1595 m

18:30 Arrived at Bayan Tsagan

20:21 Arrived at Tsagan Delger. N: 46-24-42.9; E: 107-38-33.4; A: 1584 m

00:00 Camp on the road to Khuren Dukh. N: 46-15-59.6; E: 107-49-59; A: 1351 m

July 29 - August 9: The expedition team worked in Khuren Dukh (late Early Cretaceous, Apt-Albian age). On July 29, the team arrived at Khuren Dukh. The base camp was set in the northern part of the main outcrops, near the granite mountain.

The coordinate data of the points on the road to Khuren Dukh in July 29 are as follows:

12:05 Point. N: 46-06-42.9; E: 108-28-49.9; A: 1351 m

13:10 Point. N: 45-52-28; E: 108-24-54.5; A: 1218 m

The locality was divided into fossiliferous sub-area as Khuren Dukh (abbreviated as KD) - I, II, and III.

In the southernmost outcrop, called KD-I, many vertebrate fossils such as turtle, fish, champsosaur, iguanodonts, theropod claw and upper jaw, were found. The lithology of fossiliferous beds of the site is alternation of bluish white fine to coarse sandstone and black lignite and lignitic mudstone (paper shale in some horizons).

In the KD-II, two iguanodon skeletons, partial skeletons and isolated bones of *Psittacosaurus*, pterosaur, and champsosaur were found.

GPS coordinate of the KD-II site is: N: 45-49-48.6; E: 108-26-47.7; A: 1041 m.

GPS coordinate of pterosaur site is: N: 45-50-44.6; E: 108-26-41.5; A: 880 m.

The GPS coordinate of the second iguanodon skeleton is: N: 45-51-07.7; E: 108-26-44.7; A: 1099 m.

The coordinate of the site where the molluscan fossils and petrified woods were found is: N: 45-52-00.6; E: 108-27-51.6; A: 1311 m.

In the site 15km south of KD-II, rich plant mega-fossils were found. The coordinate data of the site is: N: 44-44-03; E: 108-30-34.8; A: 1149 m.

In the KD-III (south of the base camp), Dr. Ishii found turtle fossil, and its coordinate is: N: 45-51-00.5; E: 108-26-47.6; A: 1080 m.

From KD-III, isolated bones of *Psittacosaurus* were also found. Its coordinate is: N: 45-51-38.3; E: 108-26-40.9; A: 890 m.

The two iguanodon skeletons and other fossils of turtle, fish, and a small iguanodont were excavated as monolith and jacket of plaster of Paris. The large monolith of two iguanodon skeletons were left at the locality, because it is difficult to bring them with us and go through whole further route. The monoliths were picked up and brought back to Ulan Bator by second transportation team visiting there again, when the whole fieldwork was finished.

On August 9, two members of the Japanese side (Dr. Ishii and Amamiya) went back to Ulan Bator. The party went to the south, to the second locality, Tel Ulan Chaltsai, through Sainshand (central town of the Eastern Gobi Aimak).

13:40 Point. N: 45-48-53.2; E: 108-35-38.7; A: 932 m

15:05 Point. N: 45-32-14.6; E: 108-50-30.9; A: 1155 m

16:51 Point. N: 45-13-11.1; E: 109-28-41.2; A: 963 m

19:00 Arrived at Sainshand gasoline station. There was no gasoline. Additional foods were purchased.

Sainshand gasoline station coordinate: N: 44-54-40.1; E: 110-09-56.5; A: 870 m.

21:00 Arrived at Tel Ulan Chaltsai (abbreviated as TUC, Late Cretaceous?) and set the base camp. Its coordinate is: N: 45-02-39.0; E: 110-18-32.4; A: 923 m.

On August 10, fossil search in Tel Ulan Chaltsai was done for one day.

TUC-I site. N: 45-06-03; E: 110-19-08.3; A: 945 m

TUC-II site. N: 45-05-57; E: 110-19-11.6; A: 955 m

TUC-III site. N: 45-06-06.3; E: 110-21-42.7; A: 1000 m

In TUC-III, many egg fragments of dinosaur were found.

On August 11, the team moved to Baga Tariachi (BTR, Bayn Shire age, Late Cretaceous) locality for fossil searching.

9:04 Point on the road to Baga Tariachi. N: 45-07-12.9; E: 110-27-23.5; A: 924 m

10:24 Point. N: 45-17-29.4; E: 110-46-39.3; A: 924 m

11:25 Point. N: 45-06-23.0; E: 110-58-50.3; A: 1029 m

11:57 Point with gher. N: 45-15-33.0; E: 111-06-09.5; A: 938 m

13:00 Arrived at Baga Tariachi and set up the base camp. N: 45-07-46.0; E: 110-50-10.2; A: 877 m

On August 12, the second members of the Japanese side came to Sainshand to join the main team. Dr. Weishampel, Dr. Fastovsky, Suzuki, and Hashimoto from Japanese side, Ariunchimeg from Mongolian side came. Theropod egg nest was collected in TUC-III in the afternoon of the day.

On August 13, the team moved to Sainshand and get water and additional foods there. From this point, the team was divided into two groups: truck group and search group. The truck group went directly to the locality Shine Us Khuduk and waited for the search group there. The search group will visit several localities in southwestern area of Sainshand, and join the truck group in Shine Us Khuduk in the evening.

The search group visited Khongil Tsav (Bayn Shire age, late Cretaceous) 15km southwest of Dzun Bayan.

The coordinate of the locality is: N: 44-26-11.1; E: 109-51-19.2; A: 763 m.

Here, short fossil search was done. The specimens found are: turtle, theropod-digits, teeth, molluscs, hadrosaur femur, sauropod femur, theropod skull, crocodilian scutes, etc.

The expedition team moved to Burkhant (BK, Bayn Shire age?) and searched fossils shortly. Its coordinate is: N: 44-20-22.1; E: 109-51-34.5; A: 763 m. The discovered fossils are dromaeosaur claw, theropod digits, vertebrae, turtles, sauropod skeletons, and molluscs.

After Burkhant, the team visited Bayn Shire. Although there is no bone fossil there, rich molluscan fossils were found. Its coordinate is: N 44-16-25.0; E: 109-53-57.8; A: 793 m.

From Bayn Shire, the searching group went to northwest and joined the truck group in Shine Us Khuduk. The coordinate of base camp of Shine Us Khuduk is: N: 44-19-26.1; E: 109-18-42.9; A: 864 m.

August 14 - 16: Fossil searching and excavation of discovered fossils in Shine Us Khuduk (SUK). The locality was divided into two sub-area with rich fossils: SUK-I and SUK-II. The coordinate of SUK-I is: N: 44-19-45.4; E: 109-19-20.4; A: 835 m.

The coordinate of SUK-II is: N: 44-21-29.5; E: 109-20-55.5; A: [illegible]

The discovered fossils in SUK-I are: hadrosaur and theropod femur, vertebrae, hadrosaur digits, theropod claw, and crocodilian teeth; and those from SUK-II are: theropod claw, ornithomimid tibia, theropod teeth with serration, hadrosaur digits, hadrosaur tibia, pelvic part (unknown taxon), vertebrae, and turtle.

On August 16, the team moved to Bayshin Tsav locality through Tsagan Tsav and Suikhent. In Tsagan Tsav, the additional foods especially vegetable were obtained. The coordinate of Tsagan Tsav is: N: 43-38-13.9; E: 108-55-05.4; A: 734 m.

[illegible]:00 ZIL truck was stuck near ephemeral lake. The trouble in wheels of 4WD truck (flat tire) often happened. The stuck site coordinate is: N: 43-46-19.5; E: 108-43-38.9; A: 620 m

The team was lost in field and set up the camp near well.

Location of the camping site is: N: 43-39-11.8; E: 108-31-36.3; A: 685 m

On August 17 the team went west. They visited shortly monastery of Ulgii Khiid. The crossing point of river is located at: N: 43-37-[illegible]; E: 108-10-36.5; A: 852 m.

[illegible]:45 The team arrived at Suikhent with rich petrified wood buried in volcaniclastic sediments of Late Jurassic age. Here, trace of road disappeared. The coordinate of the petrified wood site is: N: 43-39-22.6; E: 108-07-12.1; A: 931 m.

16:11 Point. N: 43-39-11.6; E: 108-05-54.4; A: 979 m

17:00 Point, western edge of Suikhent Mountain. N: 43-39-51.7; E: 108-04-29.3; A: 961 m

18:49 Close to Bayshin Tsav. Passing Amtgai, the team visited a gher to ask the road to Bayshin Tsav. The location of the gher is: N: 43-31-01.7; E: 107-53-11.6; A: 1069 m.

20:10 Hill top point. N: 43-27-54.5; E: 107-51-12.6; A: 634 m

20:30 Arrived at Bayshin Tsav. The coordinate of the base camp in Bayshin Tsav is: N: 43-30-02.4; E: 107-45-54.1; A: 828 m.

August 18 - 22: Fossil searching and geological survey in Bayshin Tsav and Amtgai were carried out. The Bayshin Tsav (abbreviated as BTs, Bayn Shire age, late Cretaceous) is divided into 4 fossiliferous sub-localities, namely: BTs-I, II, III, and IV. In BTs-I, II, and IV, there were traces of wide area disturbed by bulldozer of Russian [illegible]edition team in 1980s. From the pile of the sediment raked up by the bulldozer, many isolated dinosaur bones were found.

In BTs-I and II, isolated bones of hadrosaur and segnosaur were found. Additional specimens, partial skeleton of hadrosaur and its isolated bones were also discovered in BTs-IV. In BTs-I, D. Fastovsky made detailed topographic map.

The specimens discovered from BTs-IV are: theropod femur, hadrosaur tibia, metatarsals, articulated vertebrae, and 2 carnivorous dinosaur incomplete skeletons including pubis - ilium - caudal vertebrae - femur.

Short search of fossils in Amtgai was done and the specimens are found as follows: sauropod teeth, femur, vertebrae; theropod claw, theropod caudal; ankylosaur braincase, hadrosaur digits; ankylosaur scute, ribs, vertebrae, and neurocranial.

The GPS coordinate of Amtgai is: N: 43-33-30.7; E: 107-54-37.1; A: 650 m.

On August 22, the expedition team left for Tugrikin Shire (central part of the Gobi desert) through Dalanzadgad (central town of the South Gobi Aimak).

The coordinate data of points on the route to Dalanzadgad are as follows:

14:14 Oboo. N: 43-22-50.4; E: 107-14-38.9; A: 638 m

15:14 Road junction. N: 43-27-28.1; E: 106-51-36.3; A: 1168 m

16:09 River with water. N: 43-44-17.2; E: 106-46-38.6; A: 1162 m

16:42 Road junction. N: 43-48-43.6; E: 106-41-27.1; A: 1216 m

17:25 Gher. N: 43-41-48.7; E: 106-33-34.7; A: 1216 m

18:19 Lunch point. N: 43-40-42.8; E: 106-15-07.6; A: 1216 m

19:48 Road junction in mountain. N: 43-37-01.3; E: 106-00-05.3.

20:53 Crossing point of large river with water. N: 43-45-07.1; E: 105-39-15.1; A: 1718 m

The team set camp on the road.

On August 23, the expedition team arrived at Dalanzadgad and obtained permission for fieldwork from the local government.

In Bulgan with spring, the team obtained foods and water for further expedition work.

The GPS coordinate data on the road are as follows:

9:18 Waiting point for other cars. N: 43-39-38.9; E: 105-10-44.7; A: 2967 m

11:00 Dalanzadgad gasoline station. N: 43-34-48.4; E: 104-27-39.5; A: 2967 m

17:02 West of Dalanzadgad, lunch site. N: 43-42-04.9; E: 104-11-49.3; A: 2967 m

18:49 Waiting point for other cars. N: 43-46-51.4; E: 103-55-00.0; A: 1560 m

19:42 Waiting point for other cars. N: 44-03-34.0; E: 103-33-40.7; A: 1582 m

20:30 Arrived at Bulgan, obtained water and foods:

22:30 Arrived at Tugrikin Shire

In Tugrikin Shire, we met the expedition team from Austria, with Dr. Barsbold, Badamgarav, Khand, Lhagvasuren, 1 driver, and 2 Austrian researchers.

August 24 - September 3: The team worked in Tugrikin Shire (TS as abbreviation, Djadokhta age, late Cretaceous) and Alag Teg. An excursion team visited Bayn Dzak in one day.

The coordinate of the base camp in Tugrikin Shire is: N: 44-13-56.8; E: 103-16-30.1; A: 1113 m.

The ZIL truck with collected specimens went back to Ulan Bator to bring them. Its crew is: Bayar, Munkhzaya and Enkhbat.

Tugrikin Shire was divided into five sub-localities (area) with rich fossil occurrence as TS-III, IV, I, II, and V from west to east. From whole areas, well-preserved skeletons of *Protoceratops* (Ceratopsia) were found and excavated. Especially, in TS-II, many skeletons of them were unearthed.

Sedimentologist members of the team (Fastovsky, Badamgarav, Ishimoto, Khand, and Ariunchimeg) made geological research on thick sandstone beds with rich vertebrate fossils in Tugrikin Shire and also the fluvial beds in Alag Teg that is located 3 km north of TS. They also visited Bayn Dzak and Khashaat (Djadokhta age, late Cretaceous, about 11 km east of TS). In Alag Teg, several fossils such as fragments of skull of theropod were found.

On August 30, ZIL truck with additional supplies came back from Ulan Bator. Tsogtbaatar and Watabe visited the local government of Bulgan to explain our expedition activities in the area and to get understanding from them.

After the intensive excavation of discovered skeletons of *Protoceratops*, it became clear that available amount of plaster of Paris and acetone was insufficient for further works. Mongolian side and Japanese side discussed the further expedition schedule considering this problem.

On September 3, the sub-group led by Dr. Barsbold left for Bugin Tsav (western Gobi area) prior to the main expedition team. The monoliths made in Tugrikin Shire were left in Alag Teg for transportation to Ulan Bator by the second transportation team after the expedition, because it was difficult to bring them with the team during the rest of the expedition term. The main expedition team left for the next locality, Dzamin Khond (Djadokhta age, late Cretaceous: DK).

The GPS coordinate of points on the road to DK are as follows:

20:45 Khoyer Khudak well. N: 44-00-31.9; E: 102-51-26.0; A: 1567 m

21:00 Dzamin Khond camp. N: 44-02-52.6; E: 102-49-24.4; A: 1317 m

In September 3 and 4, the team made short search work for fossils in DK to find an egg-nest, ankylosaur scute, and its postcranial bones.

On September 4, the team moved to Bugin Tsav locality (western Gobi area). The coordinate data on the route to Bugin Tsav are as follows:

11:44 Well. N: 44-01-01.9; E: 102-48-08.1; A: 1296 m

12:15 Waiting point for other cars, southern skirt of basalt mountain range. N: 43-57-18.1; E: 102-35-59.7; A: 1474 m

13:44 Waiting point for other cars. N: 43-57-19.5; E: 102-27-27.8; A: 1525 m

14:22 Lunch point. N: 43-57-05.9; E: 102-15-36.8; A: 1216 m

16:08 Waiting point for other cars. N: 44-01-10.9; E: 102-02-35.3; A: 1211 m

16:58 Waiting point for other cars. N: 44-02-34.6; E: 101-52-00.9; A: 1110 m

17:27 Waiting point for other cars, in mid of desert area. N: 44-05-02.3; E: 101-46-31.9; A: 944 m

18:05 Waiting point for other cars. N: 44-12-18.4; E: 101-34-43.4; A: 1021 m

18:37 Lost in swampy area. N: 44-08-20.5; E: 101-30-22.5; A: 1082 m

21:09 Camping point on the road, route was changed to south, because of very bad road condition for heavily loaded trucks. N: 43-48-02.1; E: 101-22-11.6; A: 1037 m

On September 5, the team arrived at Bugin Tsav and set up the base camp. The coordinate data of points on the road are as follows:

10:48 Point. N: 43-52-31.3; E: 101-12-47.2; A: 1037 m

11:05 Crossing dried river channel. N: 43-50-05.5; E: 101-10-26.6; A: 1037 m

11:57 Point. N: 43-51-18.4; E: 100-54-56.8; A: 879 m

13:34 Top of the badlands. N: 43-52-35.0; E: 100-31-54.5; A: 1100 m

15:21 Lunch point. N: 43-50-48.5; E: 100-14-27.8; A: 873 m

17:12 Arrived at Gurilin Tsav. We visited site of *Tarbosaurus* skeleton previously discovered. N: 43-51-14.9; E: 100-08-30.3; A: 914 m

18:12 Waiting point for the other cars. N: 43-49-12.1; E: 99-59-15.6; A: 947 m

18:46 Arrived at Bugin Tsav (Nemegt age, late Cretaceous, as BgT). We met the group of Dr. Barsbold who had already arrived at the locality. The team set up the base camp and obtained water from well located west of the locality.

September 5 - 7: All members of the expedition team carried out fossil searching and geological survey in Bugin Tsav. The dinosaur egg fossils with embryos were found in northern area of Bugin Tsav. Egg fragments were found from the upper white sandstone bed.

On September 6, the team visited the southern outcrops, called Bugin Tsav-II for search. There, we found the fossils such as: *Tarbosaurus* skeleton, sauropod claw, pachychephalosaur skull, crocodile skeleton, *Trionyx* (3 individuals), and *Mongolochelys* skeleton with skull.

On September 8, some members of the team (Tsogtbaatar, Hashimoto, and Suzuki) left for Ulan Bator.

A part of the team left for the reconnaissance excursion to the western area of the Ingeni Khobur basin and Nemegt basin (localities: Nogon Tsav, Khermeen Tsav, Tsagan Khushu, and Naran Bulak). The rest of the team stayed in Bugin Tsav and continued the fossil searching there. Members of the reconnaissance team are: Barsbold, Khand, Nyamsuren, Sodov, Badamgarav, Ariunchimeg, Watabe, Matsumoto, Fastovsky, Weishampel, and Lkhagvasuren.

The GPS coordinate data of points on the route in reconnaissance excursion are as follows:

13:30 Point. N: 43-52-56.4; E: 99-39-49.6; A: - m

15:30 Point. N: 43-47-21.9; E: 99-22-48.7; A: 948 m

The team went to Nogon Tsav through Dushi Ula (Lower Cretaceous fossil locality) westward and then southward.

17:21 Arrived at Nogon Tsav (Nemegt age, late Cretaceous), near the ultramafic rock mountain. N: 43-38-52.4; E: 99-09-42.8; A: 708 m

The team stayed in the locality and made short fossil searching there. Turtle fossils were found from the lower mudstone layers.

In September 9: In northeastern area of Nogon Tsav, along the large sayr (river), the team found the eggshell and nests. Two differ-

ent kind of eggs were discovered. The geological age of the egg nest site is not yet clear. Strong wind destroyed the base camp in Nogon Tsav in this afternoon. We encountered another expedition team, namely, Poland-Russia-Mongolia geographical joint expedition team in Nogon Tsav, and exchanged information on field condition of the Gobi desert.

September 10, after the excavation of the egg nests, the team left for the locality, Khermeen Tsav southward. The GAZ 66 truck was stuck in the wet streambed in dried channel. It took 2 hours to escape from the mud trap there.

The party approached Khermeen Tsav from southwest, taking a roundabout route to the west and south of Ongon Ulan Ula mountain.

GPS data of the route are:

17:55 Point. N: 43-22-52.5; E: 99-45-09.5; A: 1040 m

18:50 Point. N: 43-27-52.0; E: 99-45-54.0; A: - m

18 Arrived at Khermeen Tsav. N: 43-28-58; E: 99-48-04.8; A: 896 m

The base camp was set up on left bank of the main valley near the entrance of the valley.

On September 11: Fossil searching was done in the entrance area of the valley, called the Gate Area. Many fossils such as *Mononykus*-like skeleton, *Gobipteryx*-type eggs, and skeleton of protoceratopsid were discovered.

On September 12, the team moved eastward to Naran Bulak gene fossil locality in western part of the Nemegt basin).

GPS data of the locality are: N: 43-27-53.0; E: 100-26-55.5; A: 1435 m.

There is a spring in Naran Bulak, with very rich amount of water and superb quality.

On September 13, the reconnaissance team visited the locality Altan Ula-IV (Nemegt age) for searching, and found the fossils such as: theropod digits, hadrosaur digits, ankylosaur scutes, skull roof, theropod claws, turtles, and many pelecypods.

part of the reconnaissance team (Narmandakh, Watabe, and Matsumoto) went back to Bugin Tsav. They came back to Bugin Tsav on the same day. The rest continued its reconnaissance trip to the locality Nemegt.

A member (Yokobayashi) of the expedition team arrived at Bugin Tsav from Ulan Bator together with Tsogtbaatar.

September 14 - 17: Fossil searching and excavation were done by the main expedition team in BgT and BgT-II. From BgT-I, additional fossils such as large femur of hadrosaur, pachycephalosaur skull with mandible, small hadrosaur caudal (articulated) in northern mountain area, small hadrosaur skeleton in central area, and molluscan fossil bed (pelecypods and gastropods).

From BgT-II, two partial skeletons (Hadrosaur-I and Hadrosaur-II) of *Saurolophus* (Hadrosauridae) were found. In one of the skeleton (Hadrosaur-II), well preserved skin impression was recognized.

From the same horizon in Bugin Tsav-II, these specimens were discovered: *Saurolophus* (1 individual); *Tarbosaurus* (1); *Trionyx* (3); crocodile (1) and *Mongolochelys* (1).

In Bugin Tsav, very strong wind attacked the base camp in day and night time, and gave damages to it. Windiest weather we had there in the season of 1993.

On September 16, the team visited Gurilin Tsav for searching. We collected *Mongolochelys* skeleton preserved in hard sandstone block and ornithomimid pelvic part (pubis-ilium).

On September 17, after the packing work of collected fossils, the team moved to Tsagan Khushu. After short fossil searching, the team moved to Naran Bulak and set up the base camp there.

The GPS coordinate data of Tsagan Khushu are: N: 43-29-18.1; E: 100-21-33.5; A: 1367 m.

At this time of expedition term, the zippers of individual tents used by expedition members began to be break due to the sand particles between them.

On September 18, the team visited Tsagan Khushu for fossil searching, and found the fossils: *Tarbosaurus* maxilla, crocodile scute, *Gallimimus* femur, turtles (many), dinosaur eggs and digits, scapula of Paleogene mammal, and *Saurolophus* bones.

On September 19, the team visited Altan Ula-II for searching. The GPS data of the locality are: N: 43-35-53.2; E: 100-30-14.3; A: 1573 m.

The discovered fossils at the locality are: turtle, *Tarbosaurus* skeletal elements, claw, small theropod tibia and ribs, and dinosaur egg shells. The lower horizon of the section was not productive in fossils, but its upper part was rich. The members visited Altan Ula-III on foot. There, in the lower horizon, turtle and petrified woods were found in gray blue silt - fine-grained sandstone beds. The locality was poor in fossil.

September 20 - 21; Reconnaissance team visited Khermeen Tsav. The team consisted of Tsogtbaatar, Otgonjargal, Enkhbat, Ariunchimeg, Watabe, Matsumoto, and Yokobayashi.

In western Khermeen Tsav (Gate area and southern bank of the valley), protoceratopsid skeleton and egg nest were excavated.

On September 22, Ulan Khushu, located east of Naran Bulak was shortly visited and searched by Watabe, Ariunchimeg, Ishimoto, Matsumoto, Narmandakh, Bayar, and Mashbat. The fossil egg shells were collected there. The geological age of the locality is referred to the Nemegt age. The coordinate data of the locality are: N: 43-29-01.6; E: 100-27-41.7; A: 1253 m.

On September 23, the whole expedition team moved from Naran Bulak to Nemegt. The base camp was set in the Viper Sayr (named by Polish expedition team). This was the last locality for 1993 fieldwork.

The GPS coordinate data of the base camp are: N: 43-30-43.2; E: 101-03-46.9; A: 1279 m.

September 24 - 29: Fossil searching and collection works in Nemegt were done.

It became clear that in the Western Sayr (named by the Polish expedition team), the articulated postcranial skeleton of *Tarbosaurus* with skin impression that had been discovered and left in field in 1992 had been destroyed by someone.

Although the two formations, namely Barun Goyot Formation as lower bed, and overlying Nemegt Formation were both equally fossiliferous, the latter of typical fluvial origin was richer in vertebrate fossils.

In the Northern Sayr (named by the Polish team), the fossils were found as follows: pachycephalosaur skull, sauropod limb bones, ornithomimid bones: ribs, distal end of tibia, digits, and scapula frag-

ments. In the southern end of the Northern Sayr, the egg nest, egg fragments and mammalian skull were discovered in the red sandstone beds of the Barun Goyot Formation. On this day, the summer time in Mongolia of the year ended.

In the Central Sayr (named by the Polish team), the fossils were searched and found as: pachycephalosaur skull, digits, bone fragments, *Gallimimus* and hadrosaur skeletons, and *Tarbosaurus* skeleton (badly weathered). The many molluscan fossils were also found in deepest area of the Sayr. At the area where the Polish team set their base camp in 1964 and 1965 was searched intensively. In hard coarse-grained sandstone layer, *Tarbosaurus* partial skeleton with hindlimbs - caudals articulated was found at the site near the Reconnaissance Hill that had been named by the Polish team in 1964.

Air temperature in the area fell, and the water for life was frozen in the morning.

On September 27, Tsogtbaatar and Watabe visited Gurvantes, central town of Gurvantes Somon, and reported the activities of destruction of fossils in Nemegt.

On September 29, after picking up of jacket of plaster of Paris, and monoliths made in field, the fieldwork in 1993 was closed.

On September 30, we broke down the base camp and went northward crossing the Nemegt mountain range. The GPS coordinate data of points on the road are as follows:

14:04 Crossing saksaur field. N: 43-27-24.6; E: 101-08-17.3; A: 1279 m

14:52 Southern skirt of the Nemegt mountain range. N: 43-34-14.4; E: 101-09-55.2; A: 1279 m

15:15 Passing the Goyotin Brigade, choosing road to east. N: 43-36-08.2; E: 101-11-07.4; A: 1543 m

15:43 Crossing the pass of the mountain range. N: 43-38-22.0; E: 101-11-37.7; A: 1645 m

19:46 Camping on the road. N: 44-19-07.5; E: 100-47-37.6; A: 1613 m

October 1 - 5: The expedition team traveled to Ulan Bator. The coordinate data of the route in the day (October 1) are as follows:

10:54 Arrived at Bayan Lig:

12:28 North skirt of the Mongol Altai mountain range. N: 44-44-45.1; E: 101-00-12.5; A: 1613 m

13:16 On plain in the northern slope of the mountain range. N: 44-57-15.1; E: 101-02-32.7; A: 1534 m

14:30 Middle of the plain (Lake Valley region). N: 45-17-56.5; E: 101-11-29.5; A: 1226 m

15:30 Crossing the Taatsyn Gol river, at the point near the brigade. N: 45-24-08.9; E: 101-16-01.9; A: 1371 m

17:05 Southern skirt of mountain. N: 45-23-44.4; E: 101-29-39.1; A: 1434 m

17:21 Southern skirt of mountain. N: 45-22-17.8; E: 101-32-50; A: 1434 m

18:52 Northern skirt of mountain. N: 45-32-30.2; E: 101-42-39.6; A: 1835 m

On October 2, the team continued travel to Ulan Bator.

12:02 Waiting point for other cars. N: 45-37-30.5; E: 101-58-57.9; A: 1604 m

12:30 Crossing a river. N: 45-39-45.8; E: 102-04-56.8; A: 1427 m

13:06 Visiting a gher. N: 45-42-28.8; E: 102-23-04.7; A: 1452 m

17:00 Arrived at Arvaykheer:

The team stopped in east of the town. N: 46-24-56.9; E: 102-48-30.9; A: 1684 m

On October 3, the team visited Khar Khorin through Khuzhirt. The coordinate data are:

10:27 Waiting point in pass for other cars, east of Dzun Bayan Ulan. N: 46-31-41.2; E: 102-41-06.2; A: 1701 m

12:44 North of the pass, waiting point. N: 46-45-39.4; E: 102-45-46.8; A: 1698 m

13:15 Arrived at Khuzhirt

15:07 Lunch site. N: 46-55-59.9; E: 102-54-47.8; A: 1710 m

17:30 Crossing a bridge. N: 47-05-01.6; E: 102-58-23.5; A: 1535 m

18:30 Arrived at Khar Khorin. N: 47-13-06.3; E: 102-47-56.7; A: 1474 m

The party camped in Khar Khorin.

On October 4, after short visit to Erdene Zuu temple, the team went eastward to Ulan Bator. The coordinate data of the route are:

14:45 On the road to Ulan Bator. N: 47-16-03.4; E: 103-11-20.9; A: 1503 m

15:40 Pass. N: 47-19-56.9; E: 103-36-40.7; A: 1503 m

16:10 Camping near the Mongol Els sand dune.

On October 5, the team arrived at Ulan Bator. The coordinate of the route are:

11:05 Waiting point. N: 47-25-50.4; E: 104-32-32.5; A: 1264 m

12:24 Arrived at Lun town. N: 47-52-34.1; E: 105-17-46.9; A: 1362 m

14:02 waiting point. N: 47-53-57.9; E: 106-28-09.7; A: 1362 m

15:05 Arrived at the Paleontological Laboratory, and the team unloaded the materials from the cars and stored them in containers.

October 6 - 10: Works for arrangement and storage of the materials used in the fieldwork, and preparation for the second trip to the Gobi desert for the transportation of monoliths left in the field.

Two transportation teams were organized for picking up the monoliths. One team went to Khuren Dukh in Eastern Gobi and another to Alag Teg in Central Gobi region.

October 10 - 15: The two teams visited the Gobi desert to pick up the monoliths left there.

On October 15, two teams came back to Ulan Bator with monoliths from Khuren Dukh and Alag Teg.

October 16 - 29: Administrative works were done for transportation of the collected specimens to Japan, and making up the expedition plan for the next year. The storage, arrangement, and checking of the materials and tools used in the fieldwork were also done in October.

On October 18, expedition members, Yokobayashi and Ishimoto went back to Japan, and in October 25, Matsumoto went back to Japan.

Watabe continued his work for custom clearance and packing for the transportation of specimens to Japan, and discussion with Mongolian side for the expedition of the next year.

In October 27, he met heavy snow, and the work of loading of monolith to container became difficult. In the October, intensive works were made for getting permission for borrowing fossils to Japan, and custom clearance by Mongolian Customs Office.

Permission of the transportation was obtained from the Ministry of Education and Science; Ministry of Commerce and Industry; and Mongolian Custom.

On November 17, the minimum atmospheric temperature fell to -26 degree Celsius.

On November 29, Watabe left Ulan Bator to Beijing, and came back to Japan on the next day.

7. Summary

1) Early and Late Cretaceous dinosaur fossil-localities widely distributed in Gobi desert were visited by our joint expedition team. It became clear that those localities were very promising for fossil searching and geological works. During the fieldwork of this year, rich skeletal remains of dinosaurs such as iguanodonts, protoceratopsids, many theropods were found and excavated. More detailed and ...trated fieldwork in those localities will provide a rich collection of dinosaur and other vertebrate fossils, and also geological information on the fossil-bearing strata there.

2) Detailed geological survey on the visited localities made clear that the fluvial sedimentary environments were dominant compare to lacustrine ones once proposed. Especially, detailed sedimentological study by Dr. D. E. Fastovsky revealed that fossiliferous beds yielding many *Protoceratops* skeletons in Tugrikin Shire had been of large-scaled eolian dune origin. Recognition of the dominance of arid and ...environments in the Late Cretaceous period of the Gobi desert is a novelty for history of investigations on geology and paleontology of Central Asia.

3) Performance of the joint expedition in the Gobi desert of this year made possible acquisition of productive and practical data and information for the execution of more effective fieldwork in succeeding years. The experience of fieldwork in the Gobi desert for Japanese member brought new knowledge and experience never received before by them. The GPS coordinate data taken during the fieldwork will be a guide for field trips to the fossil localities. The data will be also utilized in formulation of policy for protection of the fossil localities.

8. Future perspectives

The following works will be necessary as further joint expedition works in the Gobi desert.

1) More detailed and long-termed fossil searching and geological survey on each fossil locality.

2) Sedimentological and geochronological (radiometric dating and magnetostratigraphy) studies on the fossil-bearing beds in the Gobi desert.

3) Preparation and study of discovered and excavated specimens of dinosaurs and other vertebrates under the cooperation between Japanese and Mongolian researchers.

9. Acknowledgments

The field expedition in 1993 became possible by the enthusiastic support of Mr. Ken Hayashibara, president of Hayashibara Company Limited, and the generous support by members of the Hayashibara Museum of Natural Sciences. Cooperation and understanding by the Mongolian Authorities such as the Ministry of Education and Sciences of Mongolia and the Mongolian Customs are also a factor for smooth performance of the expedition. Dedicated support by the Mongolian Paleontological Center (Geological Institute, in 1993) of the Academy of Sciences of Mongolia greatly made possible the successful fieldwork in the Gobi desert. Devoted and enthusiastic efforts of all members of the Japanese and Mongolian sides in the joint expedition were the basis for success of the fieldwork. For preparation of the draft of this report, Khishigjav Tsogtbaatar, Mongolian leader of the fieldwork, gave much contribution.

TABLE I

List of the specimens collected in the joint expedition, 1993

Abbreviation

Upper K: Upper Cretaceous (undifferentiated); Lower K: Lower Cretaceous (undifferentiated)

M: Monolith of specimen; PJ: Plaster of Paris Jacket of specimen; UJ: Polyurethane Jacket

Field No.	Name of Specimen	Locality	Formation	Remarks
930731 KD-I	Fish	Khuren Dukh	Lower K	PJ
930731 KD-I	Turtle	Khuren Dukh	Lower K	M
930801 KD-II	Iguanodon skeleton No. 1	Khuren Dukh	Lower K	M
930803 KD-II	Iguanodon skeleton No. 2	Khuren Dukh	Lower K	M
930804 KD-II	Small iguanodon skull and mandible (part)	Khuren Dukh	Lower K	UJ
930812 TUC-III	Nest of 5 eggs	Tel Ulan Chaltsai	Upper K?	M
930815 SUK-II-1	Hadrosaurid, fibula	Shine Us Khuduk II	Bayn Shire	PJ
930815 SUK-II-2	Pelvic part of dinosaur	Shine Us Khuduk II	Bayn Shire	PJ
930820 BTs-II-1	Hadrosaurid right femur	Bayshin Tsav	Bayn Shire	PJ, returned to Mongolia in 1996 after preparation
930820 BTs-II-2	Hadrosaurid? left tibia, right femur	Bayshin Tsav	Bayn Shire	PJ of tibia, returned to Mongolia in 1996
930820 BTs-II-3	Tyrannosaurid ilium, sacral vertebrae	Bayshin Tsav	Bayn Shire	PJ
930820 BTs-II-4	Segnosaurid left humerus	Bayshin Tsav	Bayn Shire	PJ
930820 BTs-II-6	Hadrosaurid femur	Bayshin Tsav	Bayn Shire	PJ, returned to Mongolia in 1996
930820 BTs-II-7	Hadrosaurid left femur, left tibia	Bayshin Tsav	Bayn Shire	UJ, returned to Mongolia in 1996
930820 BTs-II-8	Hadrosaurid 3 femora, 3 tibiae, ulna, caudal vert., segnosaur pubis	Bayshin Tsav	Bayn Shire	UJ, returned to Mongolia in 1996 except segnosaur
930820-21 BTs-II-5	Hadrosaurid 11 caudal vertebrae	Bayshin Tsav	Bayn Shire	PJ, Hadro-block, returned to Mongolia in 1996
930821 AMG	Skull (partial) of dinosaur?	Amtgai	Bayn Shire	PJ
930821 BTs-IV-1	Ornithomimosaur metatarsal II, pubis	Bayshin Tsav	Bayn Shire	PJ
930821 BTs-IV-2	Hadrosaurid right dentary	Bayshin Tsav	Bayn Shire	PJ, returned to Mongolia in 1996
930821 BTs-IV-3	Hadrosaurid 5 caudal vertebrae	Bayshin Tsav	Bayn Shire	PJ, returned to Mongolia in 1996
930821 BTs-IV-4	Hadrosaurid left tibia	Bayshin Tsav	Bayn Shire	PJ, returned to Mongolia in 1996
930828-1 TS-II	*Protoceratops* body parts	Tugrikin Shire-II	Djadokhta	M
930828-2 TS-II	*Protoceratops* body parts	Tugrikin Shire-II	Djadokhta	M
930828-29 TS-II-1	*Protoceratops* complete skeleton	Tugrikin Shire	Djadokhta	3Ms
930830 TS-II-2	*Protoceratops* posterior half skeleton	Tugrikin Shire	Djadokhta	2Ms
930902 TS-I-1	*Protoceratops* posterior half skeleton	Tugrikin Shire	Djadokhta	M
930902 TS-I-2	*Protoceratops* part of skull, lower jaw	Tugrikin Shire	Djadokhta	PJ
930902 TS-III	*Protoceratops* skull	Tugrikin Shire	Djadokhta	PJ
930916 BgT-II	Crocodile lower jaw and posteranial bones	Bugin Tsav-II	Nemegt	
930916-2 BgT-II T-2	*Mongolemys*	Bugin Tsav-II	Nemegt	PJ
930916 BgT-II ENK	*Mongolochelys* caudal vertebrae, skull, fragments	Bugin Tsav	Nemegt	PJ (of caudal vertebrae)
930918 TK	Pachycephalosaurid part of skull	Tsagan Khushu	Nemegt	
930921 KmT	*Mononykus* complete skeleton without skull	Khermeen Tsav	Barun Goyot	
930921 KmT	Egg nest of 9 eggs	Khermeen Tsav	Barun Goyot	PJ
930921 KmT-I	*Bagaceratops* complete skeleton	Khermeen Tsav	Barun Goyot	M
930927 NG MS	*Gallimimus*	Nemegt	Nemegt	M
930928 NG WTB	*Tarbosaurus* skull fragment	Nemegt Western Sayr	Nemegt	M
930929 NG	Eggshells	Nemegt	Nemegt	PJ