

消息

### THE 1988 FIELD PROGRAM OF THE DINOSAUR PROJECT

The Dinosaur Project (China-Canada-Alberta-Ex Terra) continued its fieldwork in northern China in 1988. The expedition was divided into two camps, one working in Xinjiang in the Junggar Basin, and the other in Nei Mongol. Between June and mid-September, staff of the Tyrrell Museum of Palaeontology joined their hosts from the Institute of Vertebrate Palaeontology and Paleoanthropology (Beijing) and the Nei Mongol Museum (Hohhot), concentrating their efforts at Bayan Manduhu and Erenhot, as well as working with the party in Xinjiang. Members of the National Museum of Natural Sciences (Ottawa) similarly contributed to the field programs in the Ordos and Alashan regions of Nei Mongol. During this time, the expeditions traversed nearly 12,000 km across the deserts of northern China, collecting a total of 51 cases (weighing 25 tons) of vertebrate fossils from sediments of Middle Jurassic to Late Cretaceous age.

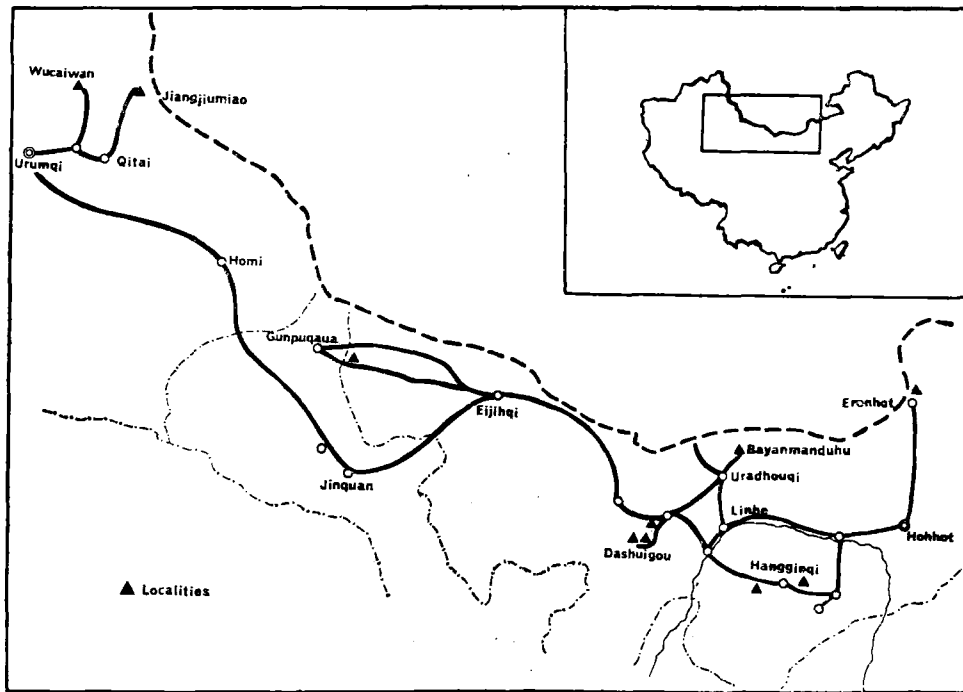


Fig. 1 The route of 1988 CCDP expeditions in China

#### NEI MONGOL

The largest camp of the summer was at Ba'an Manduhu (Pl. I, 1), close to Urad Houqi on the north side of the Lang Shan. The locality was discovered in 1978, by staff of the Nei

Mongol Museum, but little work had actually been done there. In 1987, a party of the Dinosaur Project led by Dong Zhiming visited the site and found it to be both rich enough and promising enough to merit a full expedition. From June 9 to July 6 of 1988, more than thirty people worked the extensive Upper Cretaceous exposures northeast of Bayan Manduhu. Although the beds have been referred to by some geologists as a western extension of the Iren Dabasu Formation, it quickly became apparent that they belong to the Djadokhta Formation, the type section of which is at Bayn Dzak (also known as the Flaming Cliffs and Shabarakh Usu) 300 kilometres to the northwest. Sedimentological features demonstrate that the depositional environment was in a semiarid basin with dunes, and intermittent streams and ponds in the interdunal areas.

*Protoceratops* is the most common vertebrate at Bayan Manduhu, and 66 specimens of all sizes (ranging from skull lengths of 2 cm to more than one metre) were recovered. At one site, five skeletons were collected in a group from the side of a fossil dune. Each of the five was lying on its belly with its head facing up the dune face, and it is possible that they were buried catastrophically.

Small theropods collected included isolated bones and teeth of *Velociraptor*, two partial skeletons of *Oviraptor*, and a well preserved hind limb of a juvenile *Saurornithoides*. Large theropods were rare, and are represented by isolated bones and teeth. The premaxillary teeth of one large theropod are not D-shaped in section, which suggests that it was not a tyrannosaurid.

*Pinacosaurus* is the ankylosaur at Bayan Manduhu. The skull from a mature individual was collected from one locality, and a group of six juveniles were found at a different site. It seems probable that the juveniles were siblings of the same age. Each is about 1.5 m in length with an 18 cm skull. Osteoderms loosely cover the skull and have fused into a pair of cervical rings, but most of the body was not protected by armour. None of the specimens have a tail club, but as in larger individuals, the tail is stiffened by ossified tendons. The juveniles were found on the side of a fossil dune, and five of the skeletons were found in a single pile. The individuals on top of the pile had been scavenged by *velociraptor*, as evidenced by some disarticulation and the presence of shed carnivore teeth. It seems probable that the juveniles had hatched from the same nest. Further analysis of this site will provide valuable information on the growth, variation, living habits and evolution of the armoured dinosaurs.

Five types of fossilized eggs were collected at Bayan Manduhu, many of them in nests. The most common eggs appear to be too large to have been laid by *Protoceratops*, and Rozhdestvensky may well have been correct in referring these to the Ankylosauria. A smaller but similar type of egg is a better candidate for *Protoceratops*. Large round eggs are of a type generally referred to sauropods, but may have been laid by large theropods. Nests of small round eggs are possibly from small theropods, and the smallest eggs, which are never found in nests, are probably from lizards rather than dinosaurs. Although there were no embryos found within eggs, a number of skulls were collected that are small enough to have been from unhatched foetuses.

Teiid, varanid and bainguid lizards are well represented at Bayan Manduhu by skeletons, isolated skulls, and even one footprint. Four unidentified dermatemydid turtle shells were found, and one possible pterosaur bone. Nineteen multituberculate (mostly taeniolabidid) mammal skulls were collected, one of which has associated skeletons. Invertebrate trace fossils are similar to invertebrate traces found in the recent dunes at Bayan Manduhu.

In July, the expedition moved to Erenhot (also known as Erlien and Iren Dabasu), where the first dinosaurs from the Gobi Desert were discovered by staff of the American Museum of Natural History in 1922. The quarries of the American Museum and of the Sino-Soviet expeditions were relocated, and a hadrosaur quarry worked in 1976 and 1977 by the Beijing Museum of Natural History and the Nei Mongol Museum was reopened. Three nests of dinosaur (possibly ornithomimid) eggs were collected, and two other types of eggs were identified. A tibia and an *Astrodon*-like tooth show that sauropods lived in this region during Late Cretaceous times. A partial skeleton of *Alectrosaurus* was discovered too late to collect in 1988. Most of the work at Erenhot focused on collecting small vertebrates with the intent of increasing the faunal list of the Iren Dabasu Formation. Hybodont shark, *Myledaphus*, gar. amiid trionychid and other chelonian, lacertilian, crocodylian, pterosaur, sauropod, *Velociraptor*, *Archaeornithomimus*, *Aublysodon*, *Alectrosaurus*, hypsilophodont, *Gilmoresaurus*, *Bacrosaurus*, and ankylosaurid remains were identified. The discovery of seven pedal elements of *Avimimus* suggests that these beds may be younger than previously suspected, as this animal has only been reported previously from the Barun Goyot Formation, considered to be Campanian by most workers, of the Mongolian Peoples Republic. Although an intensive search was made for mammals, none were recovered.

South of the great northward bend of the Huang He, in the Ordos region of Nei Mongol, the expedition sampled sediments of Early Cretaceous age (Yijingholo Formation, which is several hundred meters thick) near the villages of Aluchaileng and Ahlingbola. In the lower part of the sequence, within micaceous sandstones of fluvial facies, were found nearly three dozen turtles, several *Psittacosaurus* specimens, and skeletal elements of champsosaurs, crocodylians, small theropods, stegosaurs and other dinosaurs. The upper part of the sequence, within a facies containing aeolian sands, yielded nearly two dozen *Psittacosaurus* skeletons, and turtle and pterosaur specimens. A fragmentary skeleton of a cow-sized armoured dinosaur was also collected, which, although osteologically very different from North American stegosaurs, appears to resemble *Wuerhosaurus* from the Early Cretaceous of the Junggar Basin.

Three hundred kilometres to the west, in the Alashan Desert (Pl. 1, 2) near the village of Tukemu, a sequence of banded lacustrine sediments over 400 meters thick (Bayin Gobi Formation) produced freshwater clams and gastropods, turtles (including trionychids), and skeletal parts of champsosaurs, small sauropods and two *Psittacosaurus* specimens. Clearly among the more interesting specimens were those of four medium-sized theropods, including one nearly complete skeleton. An evaluation of the relationships these carnivores will constitute a very interesting systematic and biogeographic problem.

Following the close of operations in the Alashan Desert, a small contingent from the expedition visited the Mazong Shan region 500 kilometres farther to the northwest in Gansu. Within a sequence of multicoloured sediments between 100 and 150 metres thick, the reconnaissance team was able to identify abundant skeletal remains of fossil vertebrates, including crocodyles, tyrannosaurids and hadrosaurids. The assemblage appears to be similar to that of the Upper Cretaceous Nemegt Formation.

### Xinjiang

The Xinjiang team continued the excavation of a large theropod (IVPP 87002) and a large sauropod (IVPP 87003) that were found in 1977. Specimens collected during the course of

the expedition included turtles, pterosaurs and small dinosaurs. At the end of July, this group drove east from Urumqi, through the Hexi Corridor of Gansu Province and along the Silk Road to the Ordos Basin, where they rejoined their colleagues at the mausoleum of Genghis Khan.

All of the materials collected in China are currently being prepared in Beijing, Drumheller and Ottawa. The 1989 field season is currently being planned, and again will include fieldwork in Xinjiang, Nei Mongol, Alberta and the Canadian arctic.

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1. Excavations in progress at Bayan Manduhu; 2 A strange new carnivorous dinosaur was exposed in the Alxa Desert of Nei Mongol