

## China's fabulous land of palaeontology

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Probably the biggest fossil bonanza in the world is Western "Liaoning" and its neighbouring area in northeast China, where a string of spectacular discoveries in the past decade, including complete and exquisitely preserved vertebrate fossils, has transformed our knowledge of dinosaur-bird relation. "John Ostrom", the past American vertebrate palaeontologist who first in 1960's proposed a possible dinosaur-bird connection, after visiting this area declared that "fossils from this area held a century worth of work". In the last summer, as a part of the pre-conference excursion program of the second International Palaeontological Congress (IPC 2006), I had the opportunity of visiting some of these unique Chinese palaeontological treasures. Here I take you along the itinerary of this 5 day excursion.

In early Cretaceous (around 125 Million years ago) a distinct biogeographical region in east Asia including most of north China, south Mongolia,

Trans-Baikalia (Russis), Korea and Japan existed, which is characterized by its rich and various kinds of terrestrial and fresh water animals and plants. This distinct Mesozoic terrestrial fauna and flora are called the "Jehol Biota". The history of research on this biota goes back to the 1920's however; they only become famous during the last decade by the discovery of several legendary specimens. These areas, 125 million years ago, were covered by forests and quite fresh water lakes. Nearby volcanoes erupted periodically, producing thick layers of ash that killed and preserved many animals in great detail such as dinosaurs, birds, mammals, lizards, fish, turtles, insects and plants. Birds may have been killed by fumes from eruptions and fallen into the lake. Dinosaurs may have been suffocated while swimming and sunk to the bottom or washed to the lake by streams from the surrounding lands. Thus, these fossil bearing strata known as "Yixian Formation" include alternation

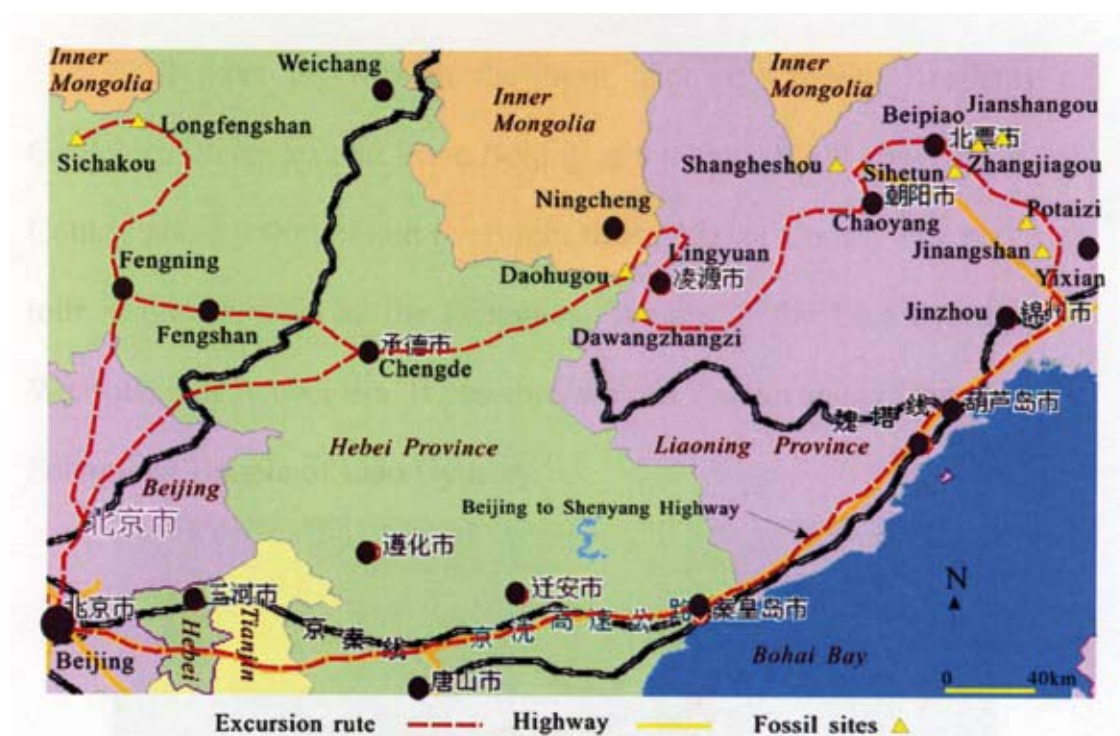


Figure 1. A sketch map showing the route of excursion and the visited fossil sites in the "Liaoning" and "Hebei" provinces in northeast China (from IPC 2006 Excursion A5 guide book).

of volcanic ash and lake bed sediments which are one thousand meters thick in some areas.

During the excursion to the west “Liaoning” we visited 6 different localities (Fig.1) each of them famous for a particular discovery in the recent years. After travelling from Beijing to the “Yixian County”, on the second day we visited the “Jingangshan section”. At this site, located 20 Km southwest of the “Yizhou” town, a set of volcanic rocks intercalated with tuffaceous sandstones, siltstones and shales represented the upper parts of “Yixian Fm.” (Jingangshan member). Numerous fossils of the “Jehol biota” have been found in the sedimentary parts of this section. The most significant discoveries here were the Pterosaur (*Beipiaopterus*) eggs (preserving the first pterosaur fossil embryos ever found) and *Eomaia*, the oldest placental mammal. Later, a few kilometres northwest of “Yizhou” town we visited the “Baitaigou” fossil site, an active fossil quarry, several meters deep (Fig. 2). At this site middle parts of “Jiufo-tang Fm.” (Overlying the “Yixian Fm.”) exposed in a series of light gray and white tuffs and tuffaceous mudstones. Important discoveries such as *Microraptor* (the four winged theropod dinosaur) and the eggs of the marine reptile *Hyphalosaur* preserved with embryos were found at this locality. The next site was visited on the way from “Yixian County” to the “Beipiao” city. This section called “Zhangjiang” (quite close to other fossil quarries in “Sihetun” area) yielded lots of feathered dinosaurs and primitive birds such as *Caudipteryx* and *Confuciusornis*. Here fossils were discovered from the so called “Jianshangou beds” representing middle parts of the “Yixian Fm.”

The famous “Sihetun” fossil site and the recently built paleontological museum and palaeo-park there, was on the next day schedule. This section is probably the most famous site containing fossils of “Jehol biota”. It yielded lots of feathered dinosaurs, pterosaurs, mammals, birds and etc. Fossils of feathered dinosaurs such as *Sinosauropteryx*, *Protarchaeopteryx*, *Sinornithosaurus* and *Archaeofructus* (a basal angiosperm and the oldest known flower) were discovered in this site. Fossils in this locality occur in the lower parts of the “Yixian Fm.” As an ambitious plan, a large building has been constructed in this site (Fig. 3), capping parts of the original fossiliferous strata and displaying all the splendid fossils of the Jehol biota (23 kinds) as well as hundreds of other impressive specimens. Leaving “Beipiao” city to “Lingyuan” we visited the naturally camouflaged



Figure 2. The “Baitaigou” fossil quarry



Figure 3. The “Beipiao” city Palaeontological museum built on the place of famous discoveries in “Sihetun” fossil site.



Figure 4. The path toward the “Longfengshan” site near the top of the hills (white outcrops).



Figure 5.  
A fossil shop in  
“Beipiao” city  
selling common!  
fossils of “Jehol  
Biota”.

“Dawangzhangzi” section. Here, under the cover of trees, the lower mainly volcanic parts of the “Yixian Fm.” were well exposed. From the middle parts of this section important mammal fossils like *Eomaia* (earliest ancestor of placental mammals) and *Sinodelphis* (oldest marsupial fossil) and *Sinobattar* together with several feathered dinosaurs and birds were discovered.

On the last day, the “Longfengshan” site, situated in the “Fengning County”, was visited. This abandoned site was accessible through a rather long walk toward the top of the hills in the area which has the exposures of the early Cretaceous “Qiaotou Fm.” (Fig. 4). The most important and recent fossil discovery at this site was the new Avialian bird *Jinfengopteryx elegans* which was described in 2005 and is supposed to have relationships with *Archaeopteryx*.

After all, it should be mentioned that latest discoveries from north east China comes from “Lujiatun” fossil site (the so called “dinosaur Pompeii” 11 km east of “Sihetun” section) which is famous for its 3D preservation of fossils such as *Mei long* and *Dilong paradoxus* and the mammal *Repenomamus*. This site as some people suggest, can not be correlated with the “Yixian Fm.” and forms a sep-

arate biota. That is mainly because ubiquitous elements of Jehol biota such as *Lycoperia* (fish) and *Ephemeropsis* (insect) has not been found in this site and the fossils from this site are unknown in the original “Jehol biota”. Nevertheless, Liaoning fossils are our best window into the vanished world of feathered dinosaurs, primitive birds, early mammals, and basal flowering plants. Hopefully this rare treasury is still productive and new surprises will continue to be delivered from this astonishing land of palaeontology.

#### Further readings:

- Hecht, J. 2005. Dinosaur special: Welcome to Dinotopia. *New Scientist* 2500:40–46.  
Qiang, J., Young-Qing, L. and Shu-An, J., 2006. The Early Cretaceous Jehol Biota of Northern China: Feathered dinosaurs, basal birds, mammals and angiosperms. IPC 2006 Pre-Conference Excursion A5 guide book, 55 p.

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