

Sino-German Cooperation on Stratigraphy, Vegetation and Climatic Development



Established in Dec. 2000, a Sino-German Station of Geosciences in Xinjiang has served as an important logistic base for field work. The photos show its three Co-Directors: Prof. Dr. V. Mosbrugger of Tübingen U. (first from left in the left photo), Prof. Zuo Xueyi of Geol. Surv. No 1 (standing in the left photo), and Prof. Dr. Sun Ge of NIGPAS/Jilin U. (second from left in the right photo) at a station meeting in 2001.

Xinjiang-Tübingen

The research project between the Nanjing Institute of Geology and Paleontology, CAS (NIGPAS), the Research Center of Paleontology, Jilin University, the Geological Survey No.1, Xinjiang and the Institute of Geology, University of Tübingen deals with the Mesozoic biota and stratigraphy of the Junggar Basin, located in the Xinjiang Autonomous Uygur Region in Northwest China.

Reported by Project leader Volker Mosbrugger

The Junggar Basin, one of the three large sedimentary basins of Xinjiang, contains more than 6000m of mostly fluvial or lacustrine Mesozoic sediments and is of particular interest to geoscientists for a number of reasons. Firstly, the basin plays a central role in the geotectonic evolution of Central Asia. Secondly, it yields an exceptionally complete and well-preserved fossil record of Mesozoic plants and vertebrates. Thirdly, the climatic changes observed there are eventually less affected by plate-tectonic movements, but rather primarily reflect global climatic changes. Furthermore, it has an enormous economic importance because of its abundant coal, oil and gas reservoirs.

Vegetation and Climatic Development of the Upper Triassic and Jurassic

The primary goal of the research project is to establish a solid, high-resolution palynostratigraphy for the Upper Triassic and Jurassic. In addition, to reconstruct the vegetation and climate development in the Junggar Basin during the Upper Triassic and Jurassic based on palynoflora and megafllora data. Particular emphasis is laid on the changes across the Triassic/Jurassic boundary for which a mass extinction is documented in the marine realm, the extent of which is debated for the continental record. The project is linked to other research projects which analyze the vertebrate fauna and the organic petrology of the Triassic-Jurassic sediments. Using this interdisciplinary approach, we aim at an integrated model-like reconstruction of the environmental evolution of the Mesozoic Junggar Basin.

Vertebrate Paleontology

The investigations in vertebrate paleontology concentrated on the Permo-Triassic boundary of the vicinity of Jimusar where numerous well preserved skulls and skeletons, mainly of mammal-like reptiles, were discovered, and on the Jurassic and Cretaceous of the western area of Urumqi. There, the Middle Jurassic Toutunhe Formation yielded a rich fauna fossils, including bony fish, sharks,

amphibians, turtles, crocodiles, pterosaurs, dinosaurs and mammals. The Upper Jurassic Qigu Formation yielded amphibians, turtles, crocodiles, fish and dinosaurs. Excellently preserved turtles and pterosaur remains were recovered from the Lower Cretaceous Tugulu Group. Most of the taxa are completely new in paleontological classification. The Jurassic vertebrates are paleobiogeographically closer to coeval faunas from the Fergana Basin of Kirghisia than to those from other parts of the Junggar Basin. A biogeographical comparison to other Central Asian occurrences is also important for biostratigraphic correlation, as the vertebrate-bearing beds yield few other fossils and no or very rare palynomorphs. A large number of taxa is endemic on a high taxonomic level. This supports the paleogeographic hypothesis of an isolated Central Asia from the Middle Jurassic to Lower Cretaceous times. The changes in the vertebrate faunas of the Upper Jurassic indicate a certain trend towards more arid climate.

Organic Petrography Investigation

During the field campaign 15 seams were investigated and sampled, including the under- and overlying sediments in the lower part of the Haojiagou Formation. Over 300 samples were collected. Besides a profile was taken up and exactly documented photographically.



Skeleton of a juvenile *Lystrosaurus hedini* Young, 1935 (a mammal-like reptile) from the Lower Triassic of Dalongkou near Jimusar, discovered in 2002.

These macropetrographical investigations show that most of the coal has a very low heterogeneity (very fine clarain coal). Homogenous, very hard, fat and non-iridescent coal is present in several seams. This could be sapropelic coal which are generally esteemed for their high oil and natural gas potential. Apart of these coal lithotypes both Vitrain and Durain is present in most of the seams. Fusain (charcoal) is particularly common. Microscopic analyses of a part of the samples resulted in that some coals of the Upper Triassic, in the Junggar Basin, consist mainly of cork tissues, very similar to what is known for the coal of the Upper Permian of the Changguang, Leping and Shuicheng basins in southern China. Beyond that, numerous coal are characterized by an enrichment of oxidized leaf-tissue, which could have developed during frosty periods. These results are significant as regards the reconstruction of the coal-forming plant community and the climate.

Sedimentologic Study

In the context of a sedimentologic study (2002) of the profile in the valley by Haojiagou in the Huangshanjie and Haojiagou Formations, a quantitative lithofacies and architectural element analysis was performed. The pattern of sedimentation cycles was

Info

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examined. In addition, a sequence of circa 450 m was assessed in detail sedimentologically. A complete logging was made using 4000 gamma ray measurements.

Over 140 samples were taken for porosity and permeability measurements, as well as for thin sections and REM investigations. The cycle and architectural element analysis were accomplished at a two and partly three-dimensional scale and documented a profile of approximately 600 m width. Sedimentary cycles on three yardstick levels could be proven. Within the sediment cycles, the lithofacies combination, the volume and the relative size, geometry, as well as the frequency and pattern of stratification of the lacustrine delta and fluvial architectural elements differed fundamentally. This is the rational behind interpreting the observed cycles as stratigraphic base-level cycles.

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