

# CORRESPONDENCE

## Fascination of the South China Sections

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In March 1999, we joined an international group led Shen Shuzhong and Bruce Wardlaw for a visit to the Permian sections of Laibin-Heshan area, South China. We were fascinated by surrealist karst landscapes, the bustling cities, the tranquillity of the riverside rural life, the marvelous hospitality of Laibin officials, but most of all by the quality of the sections and the work done by our Chinese colleagues and their international associates. On the banks of Hongshui River we could see one of the world's most complete, continuously exposed Permian section with the Sakmarian - Artinskian Maping bioclastic limestones at the base and topped conformably by the Triassic Louluo turbidites (Jin et al., 1998; Shen et al., 1999). The facies range from hemipelagic carbonates and cherts with black shale interbeds to sponge-algal reefs to paralic coals and volcanoclastics. The distinctive lithologies of recurrent sea-level sequences, as well as the extraordinary diversity of organic remains provide for recognition of stratigraphic levels that reflect major events of geological history.

Thus, the proposed stratotype of the Guadalupian - Lopingian boundary on the Penglai Tan of Hongshui River corresponds to the megasequence boundary between the shoaling Maokou and transgressive Heshan formation, a supposedly pan-Tethyan sea-level event. The conodont zonation over the boundary is closely paralleled by the fusulinid, brachiopod and ammonoid successions. With the advance of paleontological research, evolutionary events in cyclolobids, a phylogenetically well understood ammonoid group may add significantly to the conspicuousness of the boundary.

From a chronostratigraphic point of view facial diversity is often seen as a disadvantage, but it opens opportunities of correlation over different facies domains, which presents a major problem of the Permian stratigraphy. Our attention was naturally focused on the features of potential importance for correlation with the Boreal realm. Incidentally, the shelf carbonates of Chihhsia Formation contain spectacular ikaites (calcitic pseudomorphs of celestine aggregates) indicating a cold water environment. At this level a mild anoxia owing to upwellings is suggested by the frequent black shale interbeds, while the brachiopod diversity, considerable below and above, is reduced to a single species *Tyloplecta nankingensis* Muir-Wood et Cooper. But where did the cold deep water come from? One potential source might be the Ufimian cold-water transgression of the Boreal realm. The ikaites horizon of Chihhsia then corresponds to the Ufimian of Cisuralian area, but more work on brachiopods is needed to support this suggestion.

As is well known, the classical Tatarian equivalents of the Lopingian are non-marine redbeds. Their correlation with marine sequences is based on magnetostratigraphic data alone (Jin et al., 1998). Some findings in the Penglai Tan Section seem relevant to

this problem. Terrestrial plant remains were found at two levels in the Heshan and Talung formations. We added two more levels in the lower and upper Talung members. Notably, in both the mid-Wuchiapingian sapropelite horizon and in the lower Changhsingian black shale bed the ammonoids are crowded on the bedding planes suggesting mass mortality. The associated plant fossils indicate an influx of fresh water with terrestrial organic material that might cause eutrophication and algal blooms. The mid-Wuchiapingian plant assemblage includes the last appearance of the Cordaites morphotype. In the Volga Basin, European Russia, this morphotype, dominant over most of the Permian, disappeared at the boundary of Severodvinian and Vyatkian horizons, the upper Tatarian sub-stage.

In the lower Changhsingian, we collected conifer shoots of *Quadroclaus* morphology that is common in the Vyatkian Horizon. Upsection, the Talung Formation consists of Milankovitch-scale cyclothems, with conifers preserved as impressions of leafy branching systems in tuffaceous shales with ripple marks. This conifer assemblage of a late Zechsteinian aspect has no exact equivalents in the type Tatarian. The Zechsteinian flora penetrated the Northern Cathaysian Province in the latest Permian apparently reaching to the southern Cathaysia at the peak of Changhsingian regression.

The lowest stand of Talung basin is marked by a thin coal bed overlain by shales with *Gigantonoclea - Gigantotheca* assemblage about 50 m below the Permian - Triassic boundary. The assemblage also contains a few conifer remains comparable to *Ullmannia* of the European uppermost Permian, but an admixture of Mesozoic forms, such as the osmundaceous genus *Todites*, suggests correlation with the lowermost Buntsandstein of Central Europe and the basal Vetlugian of the Volga Basin. These preliminary correlations are yet to be confirmed by detailed plant morphological studies.

## References

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## Letter from Tatjana A. Grunt

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I would like to present my personal impressions concerning the International Symposium "Upper Permian Stratotypes in Volga Region" hosted in Kazan in July 28-August 3, 1998. The main purpose of the Symposium was the introduction of the newest data on biostratigraphy, paleontology, litho- and magnetostratigraphy from stratotypes and key-sections of the Upper Permian of Volga-