

Preliminary results from the joint Chinese-Russian Project on the Lopingian of the International Permian Standard and the Tatarian of the Regional East European Scale

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Sponsored bilaterally by the National Science Foundation of China (40711120374) and All Russian Fundamental Foundation (GREN # 06-05-39015 and RFFI # 09-05-01009), the joint Project of "Comparative investigation and correlation of the Late Permian (Lopingian and Tatarian) of China and Russia" has been executed since 2007. The main goal of the project was a comparative investigation and correlation of the uppermost deposits of the Upper Permian from South China and the Eastern European Region of Russia, as well as the detailed correlation of the Lopingian Series of the global scale elaborated for the normal-marine deposits of Equatorial climatic zone and the Tatarian Series of the East-European Regional Scale applicable for the dating and detailed partition of the deposits outside of the Tropical zone of sedimentation.

Participants from China are Drs. Shang Qinghua (vertebrates), Shen Shuzhong (brachiopods), Wang Wei (geochemistry) and Wang Xiangdong (corals). Participants from Russia include Drs. E. Leven (fusulinids), V. Golubev (tetrapods), A. Markov (dynam-

ics of diversity of Phanerozoic biota). The co-leaders of the project are Drs. Wang Yue (China) and T. Grunt (Russia). The major results are described as follows.

1. Marine biostratigraphy (fusulinids, brachiopods and corals)

Among the invertebrates, the main attention is dedicated to fusulinids and brachiopods. Fusulinids are the principal group acceptable for compilation of global and Tethyan stratigraphic scales. The resulting monograph dedicated to the Upper Carboniferous and Permian of Western Tethys (fusulinids, stratigraphy, biogeography) pays special attention to the characterization of the final (Midian – Changhsingian) stages of their historical development compiled by E.Ja. Leven (in press) and by E.La Leven together with M.N. Gorgij (2007).

The characteristic assemblages for each stage and mostly for substages are elaborated. Those traced all over the territory from the Pamirs in the east to Spain and North Africa in the west. Common consistent patterns in the development of fusulinids are established. Three main peaks of diversity and abundance through the Late Carboniferous – Permian are established; these are: Moscovian, the Asselian – Sakmarian boundary and Midian. At the Midian/Wuchiapingian boundary (*i.e.*, the Guadalupian/Lopingian boundary of the International Scale) brief impoverishment of fusulinid assemblages are noticed. This supports the point of view of Chinese specialists that the well known biotic crisis at the Permian/Triassic boundary becomes only the last phase of extinction, which started at the beginning of the Lopingian. Chinese specialists connect this event with the beginning of the regression that exposed parts of South China and adjacent territories at the end of the Guadalupian. The traces of this regression could be noticed in the series of sections in Afghanistan, North Pamirs and Transcaucasia. In some sections these traces are not visible, but the distinctive interchanging of the assemblages and their impoverishment are marked.

The phylogeny of the Late Permian bouldoniids has been further discussed by Wang and Ueno (2009). The evolutionary lineage of *Dunbarula-Nanlingella-Paralingella-Dilatofusulina* was established. The genus *Palaeofusulina*, the dominant fossil for the Changhsingian, possibly represents a different origin from *Nanlingella*. The newly identified genus *Dilatofusulina* has a paleogeographic distribution limited to the northern and southern margins of the Tethys Basin. Stratigraphically, it belongs to the *Palaeofusulina sinensis* Zone, which is well developed in the Paleo-Tethys.

The stratigraphic age of the genus *Palaeofusulina* has long been recognized as Changhsingian. Recent study discovered the earliest *Palaeofusulina* at the base of the Wuchiapingian at the Penglaitan section in South China, the GSSP section for the base-Wuchiapingian. Further studies will be applied to refine its taxonomy and stratigraphic range.

Based on two main orders of Permian Brachiopoda (Productida and Spiriferida), which are mostly characteristic in the basins of all climatic zones, 17 regional biostratigraphic zones were elaborated by T. Grunt (2007a). They have been traced all over the territory of Eastern Europe, and through the Barentz Shelf area.

The age of the Late Permian deposits in the basins of the

Laba and Belaja rivers in the North Caucasus was discussed. The presence of diverse and abundant marine fauna represented by brachiopods, fusulinids, small foraminifers and others typical for the northern shelves of Paleotethys points are Wuchiapingian (=Dzhulfian) rather than Changhsingian in age. The normal-marine fauna from the North Caucasus hardly could be Changhsingian because of the intensive general extinction of marine biota finalized in the context of the significant reduction of the Permian shelves at the beginning of the Changhsingian. However, the diversity of brachiopods within the Late Permian North Caucasian sections reaches more than 240 species belonging to various Orders, and the dimensions of populations were significant (Grunt, 2007b).

The evolution of articulate brachiopods belonging to the order Athyridida through the Guadalupian – Lopingian are discussed by T. Grunt and Shuzhong Shen (2007).

The rugose corals, specifically the systematic revision of *Waagenophyllum* and *Ipciphyllum* of the Upper Permian from southern Tibet have been made by Wang Xiangdong and others. With the constraints of the biostratigraphy of fusulinids as well as the conodonts, the coral reefs at the Gyanyima section might represent the latest Permian rugose coral reefs.

2. Terrestrial biostratigraphy

A new itemized tetrapod regional biostratigraphic scale composed of 10 zones as elaborated by Golubev (2007a) for the post-Kungurian deposits of East Europe, which is significant for regional correlation. In global aspect only two superzones corresponding to the Guadalupian (~Biarmanian) and Lopingian (~Tatarian) are traced. The recent discovery of the new Vjaznikovian Regional Stage (Lozovsky, Kukhtinov, 2007) and faunistic assemblage (Golubev and Sennikov, 2007a; 2007b; Kukhtinov *et al.*, 2008;) in the uppermost part of Vjatskian Stage demonstrate that this rich and diverse assemblage contains floristic remains, bivalves, chonchostraca, ostracods, insects and tetrapods. It is characterized by “transitional” features between Permian and Triassic biota.

It was determined previously that there was a significant “break” at the Permian/Triassic boundary. The discovery of the Vjaznikovian demonstrates a gradual character of the Permian-Triassic boundary in the territory of the Russian Platform.

According to Chinese and Russian participants, continental deposits containing Pareasaurian Dicinocephalic tetrapod assemblage are present in the territory of Northwest China. V. Golubev suggested that in ecological and phylogenetic aspects, the Chinese fauna corresponds to the theriodontic fauna of the European Russia, which is characteristic for the Lopingian Series (*Scutosaurus* superzone). But, the composition of Chinese tetrapod fauna and the history of its development differ in some details from that of the Russian theriodontic fauna. In particular: *Lystrosaurus* and Dinocephalic tetrapods existed contemporary within the Chinese tetrapod communities at the end of the Permian; the lystrosaurids briefly replace dicynodontids over the Permian/Triassic boundary in Eastern Europe. This turnover represents the significant crisis within the terrestrial tetrapod communities. The singularity of Chinese tetrapod fauna is probably related with, on one hand, the considerable geographic isolation, and on the other hand, the

difference of climatic environments between the regions. In both regions, climate was warm, but it was seasonal in the European Russia. By contrast, it was humid in the territory of China (at least at the territory of Inner Mongolia). The Biotic crisis was gradual and stepwise both in the communities of China and South Africa. But, the same groups (pareiasaurids, gorgonopids, therocephalids, dicynodontids, lystrosaurids, tecodontids) arise and disappear in different regions at different stratigraphic levels. Endemic features and differentiation along this change in the different continents are gradual, continuous and mosaic, which gives evidence of some inner synecological reasons for this process (Golubev and Sennikov, 2007).

V. Golubev participated the geological excursion in Inner Mongolia in 2007 of the Permian – Carboniferous Congress.

Dr. Shang Qinghua has been working on the marine reptile in the Triassic. She demonstrated that the marine reptile appeared in the late Early Triassic in Anhui province may represent the earliest recovery of marine vertebrates after the end Permian extinction, and it was greatly developed in the Olenekian.

3. Geochemistry research

The geochemistry near the Guadalupian/Lopingian boundary has been studied in the upper Yangtze Region by Wang Wei and his colleagues (Wang *et al.*, 2004). The carbon isotopic result shows a negative shift near the boundary, which is largely consistent with the ‘pre-Lopingian benthos crisis’.

4. Statistical analysis on the Late Permian diversity

The dynamics of diversity of Phanerozoic marine and continental biota at the level of species, genera and families was established. It demonstrated that the hyperbolic growth of diversity could be explained by non-linear positive second-order feedback between the diversity growth and community structure complexity just prior to the end-Permian mass extinction and that the Permian/Triassic crisis became critical in the development of marine Phanerozoic communities leading to acceleration of the rates of community evolution (Grinin *et al.*, 2008).

Further investigations

Future work will include tracing the boundaries, including precise tracing of the lower boundary of the Lopingian within East-European sections (the possibility of determination of the Kiama/Illawara boundary within sections of South China) as well as determination of the lower boundary of the Lopingian within the “mixed” magnetostratigraphic zone of East European and Northern Germany sections.

Future work will also include precisely tracing the upper boundary of the Lopingian within East European sections. Correspondence of the Changhsingian International Stage to the Vjaznikovian Regional Stage (or Vjaznikovian Horizon) of the East European Regional Scale. The latter is characterized by “mixed” Permian/Triassic taxa within tetrapods, fishes, ostracods, flora and palynomorphs.

References

- E.Ja. Leven, M.N. Gorgij, 2007. Fusulinids of the Khan Formation (Kalmard region, Eastern Iran) and some problems of their paleogeography. Russian Journal of Earth Sciences. 10 pp.
Golubev, V.K. 2007. The Permian tetrapod zonation of European

- Russia. Journal of stratigraphy. Abstracts. XVI International Congress on the Carboniferous and Permian. June 21-24, 2007. Nanjing, China. Yue Wang, Hua Zhang and Xiaojuan Wang, Editors. Journal of Stratigraphy, vol. 1, Supplement 1, p. 219.
- Golubev, V.K., Sennikov, A.G. 2007a. Permian-Triassic boundary in eastern Europe. Journal of stratigraphy. Abstracts. XVI International Congress on the Carboniferous and Permian. June 21-24, 2007. Nanjing, China. Yue Wang, Hua Zhang and Xiaojuan Wang, Editors. Journal of Stratigraphy, vol. 1, Supplement 1, p. 181.
- Golubev, V.K., Sennikov, A.G. 2007b. New data of the Permian-Triassic transition on the Russian platform. Fossile Okosysteme: 77 Jahrestagung der Palaontologischen Gesellschaft (Freiberg, 17-19.9.2007). Freiberg. (Wissenschaftliche Mitteilungen des Institutes für Geologie der TU Bergakademie Freiberg, 36.) c. 46-47.
- Grinin L.E., Markov A.V., Korotaev A.V., 2008. Macroevolution in the alive Nature and Society. Moscow: LKI. 248 pp.
- Grunt T. and Shen Shuzhong, 2007. Diversity pattern and evolution of Atiridida (Brachiopoda) from Middle Permian to Early Triassic, Abstracts. XVI International Congress on the Carboniferous and Permian. June 21-24, 2007. Nanjing, China. Yue Wang, Hua Zhang and Xiaojuan Wang, Editors. Journal of Stratigraphy, vol. 1, Supplement 1, 2007. p. 174.
- Grunt T., 2007. Cisuralian/Guadalupian and Guadalupian/Lopingian boundaries of the Permian GSS in the East European and Tethyan RSSs Abstracts. Joint Meeting PTG – DGG GEO – POMERANIA. “Geology cross-bordering the Western and Eastern European Platform”. Szczecin. 21 – 26 September 2007. University of Szczecin, Poland p. 112.
- Grunt T., 2007a. Permian brachiopoda within the European Basins: evolution, biogeography, stratigraphic assemblages. Late Palaeozoic of Russia: stratigraphy and palaeogeography. Kazan: Kazanian State University. p. 284 – 290 (in Russian.).
- Grunt T., 2007b. Upper Permian (Lopingian) Series of the North Caucasus, Abstracts. XVI International Congress on the Carboniferous and Permian. June 21-24, Nanjing, China. Yue Wang, Hua Zhang and Xiaojuan Wang, Editors. Journal of Stratigraphy, vol. 1, Supplement 1, p. 54.
- Kukhtinov D.A., Lozovsky V.P., Afonin S.A. *et al.*, 2008. Non-marine ostracods of the Permian – Triassic transition from sections of the East European platform // Boll. Soc. Geol. It. (Ital. J. Geosci.). Vol. 127, No. 3. pp. 717 – 726.
- Leven E. Ja. (in press). Late Carboniferous (Pennsylvanian) and Permian of the West Texas (fusulinids, stratigraphy, biogeography). Moscow: GEOS 350 p. (in Russian).
- Lozovsky V.P., Kukhtinov D.A. Vjaznikovian, 2007. Stage – the youngest element of the Upper Permian from Russia. Bull. of Association of Moscow investigators of Nature. Ser. Geol. Vol. 82. #6. 2007. p. 17 – 26. (in Russian).
- Sennikov, A.G., Golubev, V.K., 2007. Permo-Triassic transition in Russia, South Africa and China // Biosphere Origin and Evolution. Abstracts of the 2nd International Conference (Loutraki, Greece, October 28 - November 2, 2007). Novosibirsk: Borekov Institute Of Catalysis. p. 171.
- Yue Wang and Katsumi Ueno, 2009. A New Fusulinoidean Genus *Dilatofusulina* from the Lopingian (Upper Permian) of Southern Tibet, China. Journal of Foraminiferal Research, 39(1): p. 56-65.
- Yue Wang, Peter Sadler, Shuzhong Shen, James Crowley, Charles Henderson, Xiangdong WANG, Wei Wang, Changqun Cao, Samuel Bowring, 2007. Quantifying the abruptness of the end-Permian mass extinction. Abstracts. XVI International Congress on the Carboniferous and Permian. June 21-24, 2007b. Nanjing, China. Yue Wang, Hua Zhang and Xiaojuan Wang, Editors. Journal of Stratigraphy, vol. 1, Supplement 1, 2007. p. 175.

International Field Workshop and Symposium Report: An approach to the Carboniferous-Early Permian Stratigraphy, Paleontology, Paleogeography and Paleoclimatology of the Calingasta-Uspallata Subbasin (western Argentina) and Tepuel-Genoa Basin (Patagonia), Argentina, February 16 - March 2, 2009.

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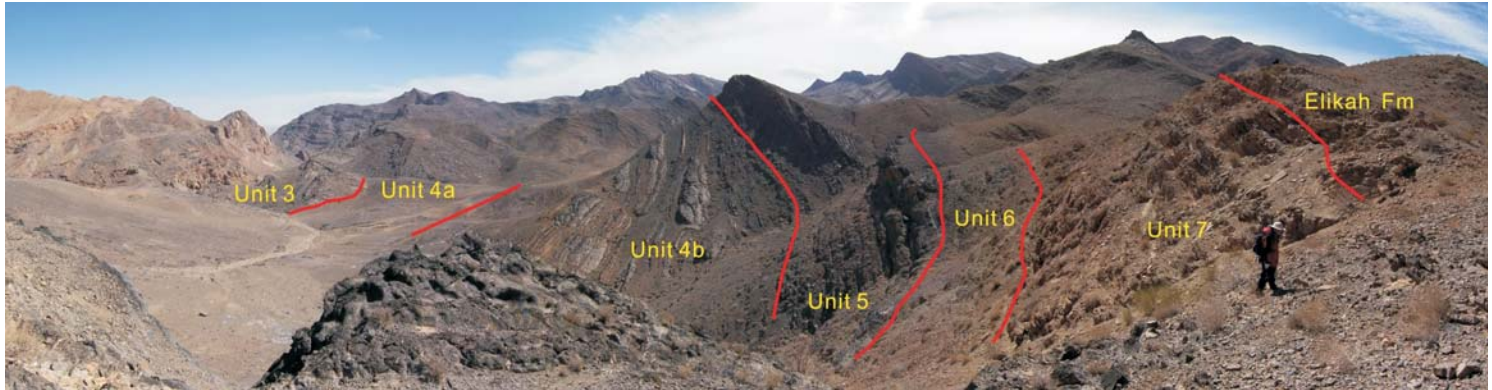
The Second International Symposium and Field Workshop of Gondwana was held in Argentina; it was organized as a second step, following the first International meeting held at Deakin University in Melbourne, Australia, in January 2008, inspired by Prof. Guang Shi (see report by Charles Henderson, Guang Shi and Roger Pierson in Permophiles 50, p. 9). On this occasion the Symposium was organized by Alejandra Pagani, Arturo Taboada and Pablo Puerta (in charge of the logistic organization of the fieldtrip), and colleagues from Australia, Canada, New Zealand and Russia were invited. Participants experienced the richly fossiliferous Upper Paleozoic outcrops and the beautiful Argentinean landscapes.

Two weeks of an International Field Workshop visiting Carboniferous and Early Permian sequences of western Argentina (Calingasta-Uspallata Subbasin) and Patagonia (Tepuel-Genoa Basin), and a final day symposium held at the Paleontological Egidio Feruglio Museum (MEF) in Trelew city, brought together a group of biostratigraphers and paleontologic experts. The event had financial and logistical support from the National Research Council of Argentina (CONICET) and the MEF, as well as ALUAR S.A. The aim of the meeting was to show some key stratigraphic sections, as well as faunal and floral assemblages, that charac-



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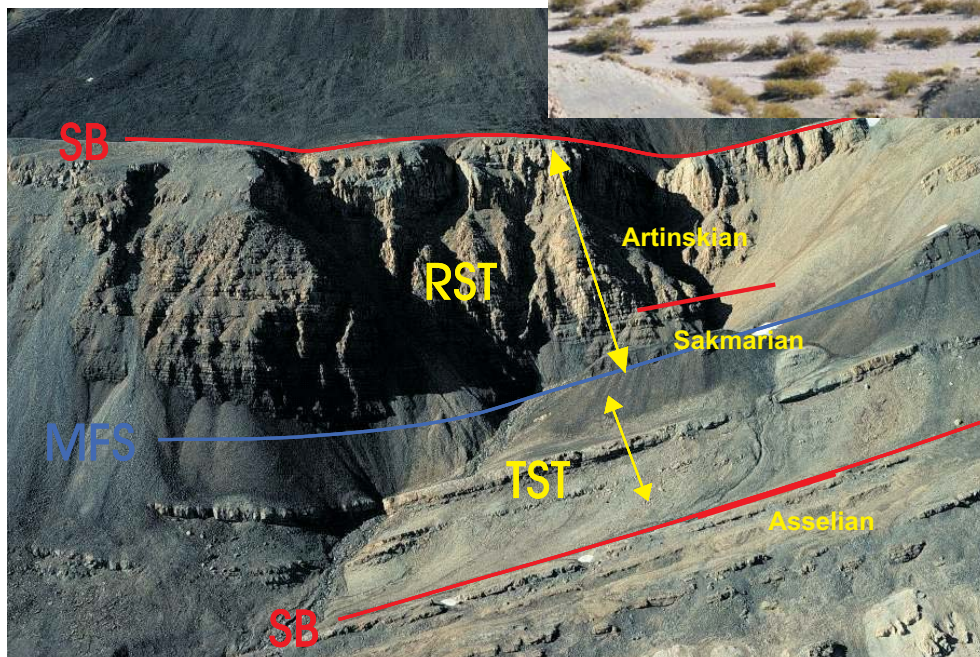


The Upper Permian and Lower Triassic of Iran (p. 2).
Photo by Shuzhong Shen.

Right: The Lower Permian of Uspallata Hills. The major transgression marks the end of major Gondwana glaciation although some minor glacial deposits occur above. Photo by Charles Henderson. See Taboada et al. (p. 13).



Below: Notice the similarity in sequence stratigraphic signature with high-frequency cycles in Asselian and earliest Sakmarian and major 3rd order sequence above. Photo by Benoit Beauchamp from Ellesmere Island, Sverdrup Basin, Canadian Arctic.



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