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## **Terrestrial Permian-Triassic Transitional Sequence in North China: Implication for the correlation with the Marine Events in South China**

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The marine Permian-Triassic (P-Tr) sequences have been extensively studied in South China, where the global P-Tr boundary is defined and various aspects dealing with the P-Tr transitional events are further documented. However, the great P-Tr process that had profoundly affected the whole Earth's life and environments is known quite little from the terrestrial records on land because of the difficulty of the P-Tr stratigraphic correlation between the marine and terrestrial facies. Actually, the well-developed terrestrial P-Tr sequences are widespread in North China, which were deposited in a large inland lake near sea during the P-Tr transitional time. Recent studies indicate that the terrestrial P-Tr sequences in North China show a similar transition with the marine process in South China.

The strata that probably cover the P-Tr boundary are lithostratigraphically named the Shiqianfeng Group (Gr) in North China, which is a series of red clastic sedimentary rocks. The complete Shiqianfeng Gr is composed of two supercycles from sandstone- to mudstone-dominated rocks, and divided into three formations, i.e. Sunjiagou Formation (Fm), Liujiagou Fm, and Heshanggou Fm in ascending order. The Sunjiagou Fm includes the whole lower supercycle of the Shiqianfeng Gr, whereas the Liujiagou Fm is for the sandstone-dominated part and the Heshanggou Fm for the mudstone-dominated strata of the upper supercycle.

The Permian-type plant and vertebrate fossils and a few coal lines occur in the interbeds of the lower sandstone member of the Sunjiagou Fm and some Triassic vertebrate and plant forms in the Heshanggou Fm, but the upper member of the Sunjiagou Fm and the Liujiagou Fm contain quite few fossils for the identification of the age except for a small quantity of sporopollen. Recently, some microbial-induced sedimentary structures (MISS) are discovered in the upper member of the Sunjiagou Fm and Liujiagou Fm<sup>[1, 2]</sup>, and they are regarded as the result of the mass extinction like the anachronistic facies in the marine sediments of South China. Consequently, if the end-Permian mass extinction synchronously happened in marine and terrestrial facies, the P-Tr boundary would be within the Sunjiagou Fm in comparison with the marine P-Tr sequence of South China.

If fact, the Sunjiagou Fm shows an apparent color transition from grayish- to reddish-dominated variegated rocks, and the upper member of the Sunjiagou Fm and the overlying strata are obviously more reddish. Meanwhile, the indicators of paleosols such as the calcareous nodules become common in the strata from the upper part of the Sunjiagou Fm upwards. The Liujiagou Fm contains rich "sand balls" and the sedimentary structure of sand cracks is very common in the formation. The paleoclimate shows a clear change from humid to arid through the Sunjiagou Fm. The climate would be cool and humid during the deposition of the underlying Shihezi Formation and it became semi-humid when the lower member of the Sunjiagou Fm was deposited. A sharp climate change occurred in the middle part of the Sunjiagou Fm. The upper member of the Sunjiagou Fm was formed in a semi-arid to arid condition while the most arid sediments formed the Liujiagou Fm. However, the climate became semi-arid in the

Heshanggou Fm. This climate variation shows a considerable correlation with the temperature curve constructed through the P-Tr transition and Early Triassic time by the marine conodont materials<sup>[3]</sup>.

[1] Chu et al. (2014) *Scientific Reports* 5: 10109

[2] Tu et al. (2016) *Sedimentary Geology* 333: 50-69

[3] Sun et al. (2012) *Science* 388: 366-370

