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Multi-Order Tectonic and Climatic Signals in Permian-Lower Triassic Terrestrial Sedimentary Successions in Bogda Mountains, NW China

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Superbly-exposed fluvial-lacustrine deposits in Bogda Mountains, NW China, record Permian-Early Triassic terrestrial environmental, tectonic, climatic, and biological evolutions in the mid-high paleolatitude of NE Pangea[1,2]. Six major sections in Tarlong-Taodonggou, Zaobishan, and Dalongkou areas in southern and northern Bogda are 1000-2100 m thick, deposited in half grabens on the Upper Carboniferous back-arc basement of the greater Turpan-Junggar intracontinental rift basin[2,3]. Three orders of sedimentary cycles are defined. High-order cycles (HCs) are 0.1-1s m thick, composed of siliciclastics, carbonates, and paleosols, indicating repetitive lake expansion and contraction or fluvial erosion and deposition. Intermediate-order cycles are 1-10s m thick of stacked HCs forming systems tracts of depositional sequences. Low-order cycles (LCs) are 10-100s m thick and bound by regional unconformities and conformities and have persistent tectonic and/or climatic conditions. Ten LCs are identified; their ages are constrained by 10 U/Pb zircon ID-TIMS dates and biostratigraphy.

The upper Gzhelian to mid-Sakmarian lower, middle, and upper Daheyan LCs are 150-300 m thick, containing fluvial, alluvial, and minor lacustrine deposits. Abundant Calcisols in the upper LC indicate an arid climate. It is absent in Zaobishan. The upper Sakmarian Lucaogou LC is 80-180 m thick and contains profundal and deltaic deposits in the basin and fluvial-deltaic deposits in the margin. Sedimentary evidence indicates a highly-variable arid-humid climate. The Artinskian Hongyanchi LC is 51-117 m thick and has similar lithology and climatic conditions to the Lucaogou. A major unconformity caps the Hongyanchi and may span up to 14 Ma. The Wordian to basal Capitanian lower Quanzijie LC is 2-95 m thick and contains fluvial deposits and Calcisols and Vertisols, indicating an arid climate[4]. The Capitanian upper Quanzijie LC is 60-220 m thick and contains fluvial and loess deposits, which change to thick Gleysols at the top, indicating a dramatic arid-to-humid climate change[1,5]. The Wuchiapingian-basal Induan Wutonggou LC is 330-829 m thick and contains fluvial, deltaic, and littoral deposits, Argillisol, Gleysol, Histosol, and minor Calcisol, indicating humid-subhumid climate with a short arid episode in the upper part[6]. The P-T boundary is confined in a 90-m interval. The Induan Jiucaiyuan LC is 98-183 m thick and contain fluvial and lake-margin deposits, Calcisols, and Vertisols, indicating arid-semiarid climate. The Olenekian Shaofanggou LC is 112-2.5 m thick and contains fluvial-littoral deposits and Calcisols, indicating an arid climate.

The succession comprises one overall and several LC-scale fluvial-lacustrine tripartite sequences typical of rift-basin fills. The Sakmarian-Artinskian, Capitanian, and mid-Induan-Olenekian intervals of arid-semiarid conditions are in conflict with modern mid-latitude east-coast humid climate. Extreme continentality, orography, or abnormal Paleo-Tethys circulation may be the causes. The stable humid-

subhumid condition across P-T boundary implies that climate may not be a major cause of end-Permian terrestrial mass extinction. The pace and timing of the extinction need to be explored.

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