Nature and Origins of a Cycle Boundary in Lower Permian Fluvial-Lacustrine Deposits in a Half Graben, Southern Bogda Mountains, NW China

Jeffrey, Brad M.[1]; Yang, Wan [1]; Feng, Qiao [3]; Liu, Yiqun [2] (1) Geology, Wichita State University, Wichita, KS. (2) Department of Geology, Northwestern University, Xi'an, China. (3) College of Geoinformatics, Shangdong University of Science and Technology, Qingdao, China.

A nonmarine stratigraphic boundary where major facies shifts occur indicates drastic changes in environmental conditions, but may have highly variable magnitude of facies shifts in different parts of a half graben due to rapid lateral facies changes, common autogenic processes, and irregular topography. This hypothesis is tested using the boundary separating Lower Permian Lucaogou and Hongyanchi low-order cycles in Tarlong-Taodonggou half graben, NW China, which covers 88 km^2. The boundary shows variable facies juxtapositions on 5 sections 0.2-5 km apart. Graben-wide at a km-scale, braided channels cut into lake-margin cycles in the NW; braided and meandering channels cut into profundal cycles in the NE, both suggesting a major regression and incision by a fluvial system from the north. In the SE, however, the boundary is a transgressive surface separating profundal cycles from overlying beach and deltaic deposits. In the SW, the boundary changes to a transgressive surface separating deltaic cycles from overlying marginal and profundal cycles. Thus, across the boundary, deltas shifted from SW to SE, and regression occurred in the north and transgression in the south. At a 100-m scale in NE, the fluvial erosional boundary changes into a transgressive surface separating profundal deposits from overlying marginal and fluvial cycles 500 m to the west, which, in turn, change into deltaic and profundal cycles 200 m farther to the west.

Several scenarios of paleogeographic and environmental changes across the boundary are possible. If the southern deltas were fed by the northern fluvial systems, the lake axis may be N-S in the eastern part of the half-graben. A lake-level drop followed by southward tilting at the boundary could have caused northern regression and southern transgression. Southward tilting may be caused by volcanic doming as indicated by rhyolitic flows above the boundary. Alternatively, the steep margin may be oriented E-W and located in the northern part, and the deepest part of the lake shifted from NE to SW across the boundary. The lack of Calcisols and the large clastic influx indicate increased river inflow in a wetter climate across the boundary. Complex facies relationships in the NE signify the control by local fluvial valley topography. Understanding autogenic and allogenic processes and basin topography is critical to correlating stratigraphic boundaries in nonmarine time-stratigraphic analysis.