Stratigraphic Signals of Autogenic Processes in a Bimodal Alluvial Fan: Laboratory Experiments

Haein Shin

Morphodynamics and Quantitative Stratigraphy Lab.

Dept. of Earth System Sciences, Yonsei University

Autogenic processes are intrinsic to the depositional system and occur naturally without changes in external forcing. It has been generally accepted that stratigraphic records could mainly reflect changes in allogenic forcing such as climate, sea level and tectonic movement. However, autogenic processes also record unique stratigraphic signatures. Understanding the relationship between autogenic processes and their associated sedimentary record is critical to correctly interpreting basin-filling history. This study used physical laboratory experiments of an alluvial fan evolution to investigate the short-term migration of a lithofacies boundary as an autogenic signature preserved in the deposit. A series of six experiments was conducted to test the effects of sediment discharge (Qs), water discharge (Qw), and the ratio of these discharges (i.e., Qs/Qw) on the autogenic process' timescale. The sediment mixture was composed of 50 % quartz sand and 50 % crushed walnut sediment in volume. Here, the experiments show a progradational fan-margin migration during the experiments. There is a transitional boundary between the quartz sand and walnut sediment served as the grain-size transition (GST) proxy in the alluvial fan. The GST in general progrades along with the fan margin but shows short-term fluctuations in the downstream migration rate. After each run, the resulting fan deposits were dried and then sectioned in the radial coordinates. The sliced cross sections were analyzed to capture the migration of GST and calculate associated autogenic timescale of the migration preserved in the deposits. The timescale that characterizes the GST migration has a strong negative correlation with Qs and Qs/Qw, whereas Qw is weakly correlated with the results. Also, the timescale of GST migration has a positive correlation with that of local fan-margin migration and global and local wet fraction changes. The current study will provide a new perspective in interpreting the paleoenvironment using the autogenic signatures recorded in alluvial-fan deposit.