SILICICLASTIC STRATIGRAPHY IN AN EXPERIMENTAL TANK

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The correct deciphering of (continuous) time in a (discontinuous) stratigraphic reocrd has been one of the fundamental issues of stratigraphy. It is exemplified by the accommodation space equation T + E = S + W, where T is the rate of tectonic subsidence, E is the rate of eustatic sea-level rise, S is the rate of sedimentation, and W is the rate of water depth increase (or deepening). Conveying the complex interplay of these factors as theory to students in the classroom, in particular when loaded with the terminology of sequence-stratigraphic concepts, has traditionally been problematic. The design of appropriate exercises, usually practising the proper reconstruction of past events from industry 2-D seismic reflection lines, has also been challenging.

We constructed a simple portable experimental tank to better communicate concepts and common geometries of lithostratigraphic units at passive continental margins to undergraduate geology students. This tank allows to vary eustatic sea level, sediment supply and tectonic subsidence through base level change in two dimensions. The tank measures 1m (width) x 0,50 m (height) x 0,02 m (thickness) and uses a transparent plexiglas frontboard, adjustable water inflow and outflow taps, a gravity-fed adjustable sediment supply of fine-grained sand, and a number of freely moveable magnets supporting a flexible rubber strip. The latter make adjustments to basement geometry during the experiments possible. Coloured sands, injected at the right time, accentuate the geometry of individual key units (such as incised valley fills, lowstand deltas, lowstand basin floor fans, highstand deepwater condensed sections) and key horizons (such as sequence boundaries, maximum flooding surfaces, and shelf-slope seals).

This experimental setup enables the modelling of the principal stacking pattern geometries along passive margins, consisting of several generations of successive Highstand (HST) and Lowstand System Tracts (LST) while plainly illustrating the dependency of the generated progradational or regressive geometries on the interplay of the above-mentioned variables. As a consequence, students are more likely to recognize unconformities and missing geologic time in seismic sections and correlate correctly the equivalent sedimentary bodies along sequence-stratigraphic surfaces when later exposed to large-scale seismic sections. Digital movies in lecture classes and student-directed experiments in exercise sections using this tank will facilitate the communication of concepts requiring advanced stratigraphic understanding, such as regional stratigraphic syntheses, seismic interpretation, and petroleum geology.