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Sub-seismic Scale Architecture of a Sinuous Submarine Channel Complex, Lewis Shale, southern Wyoming

Sinuous, fine-grained, slope channels are of interest from a variety of perspectives including the insight they provide on sediment gravity-flow processes and forcing mechanisms for sinuosity, and their importance as hydrocarbon reservoirs. Our study of fine-grained, slope channel-fill outcrops of the Lewis Shale, Wyoming provides insights into these processes and offers explanations for some of the complex behavior associated with this common deepwater reservoir type.

The slope channel outcrops comprise a few hundred feet of multistory, lenticular, channel-fill sandstones, vertically separated (compartmentalized) by thin-bedded sandstones and laminated to structureless mudstones. Channel-fills exhibit asymmetric internal stratigraphy consisting of sandy turbidites, muddy debrites, and slump deposits on one side of the fill, and low-angle, cross-bedded turbidite sandstones on the stratigraphically equivalent opposite side. Ground penetrating radar images document asymmetric channel geometry, a complex boundary between the channel-fill sandstones and adjacent fine-grained strata, and possible lateral accretion surfaces.

The complex nature of channel margins suggests a significant time interval between channel formation and channel filling. The asymmetric geometry and stratigraphy are to be expected from a sinuous channel-fill, where one channel wall periodically slumped and the opposite side received sediment by cross-channel traction transport and deposition. Also, the occurrence of debrites and slump deposits only on one side of the channel thalweg might result in progressive diversion of post-slump, sediment-gravity flows, leading to erosion of the opposite channel wall and the initiation/enhancement of channel sinuosity. Most significantly, in an analog reservoir, the above features will result in horizontally and vertically compartmentalized strata, and possible complex fluid/pressure distributions and production performance.