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Seismic Geomorphology and Stratigraphy of Submarine Canyons—Insights Regarding Genesis, Evolution, and Fill, Based on 3-D Seismic Data

Submarine canyons commonly serve as conduits for sediment supplied to deep-water turbidite systems. Detailed morphology of canyons can be observed using 3-D seismic data, which reveals that most canyons are characterized by high-sinuosity channels at their base. This high-sinuosity pattern characterizes these canyons from canyon head to canyon mouth. No evidence of mass transport processes such as slide, slump or debris flow, commonly is observed. Based on these analyses, it is inferred that turbulent flow likely was the dominant flow attribute right from the shelf edge. It follows that these flows probably originated at river mouths from rivers in flood as a quasi-continuous process of hyperpycnal flow rather than flows originating as mass failure of deposits temporarily stored in the shelf-edge staging area.

Canyons evolve initially by channel entrenchment as a result of erosion by successive turbidity flows. Canyon widening concurrently occurs as a result of mass wasting of canyon walls. These sediments are delivered to the axial channels, which incorporate these laterally-sourced contributions into the turbidity flows. These flows act as a conveyer belt transporting a mix of shelf-edge and canyon-slope derived sediment to the deep basin down system. Late in a deep-water lowstand episode, when river mouths decouple from canyon heads due to shoreline transgression, turbidity flows largely cease, or at least decline significantly in volume, and continued mass wasting from canyon walls results in delivery of sediment to canyon axes. With the sediment conveyer belt (i.e., the axial channel) now dormant, the canyon progressively fills, largely with mass wasting deposits.