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Slope Channel Morphology and Depositional Controls: The Pleistocene-Holocene Niger Delta Slope as an Analog for Ancient Slope Systems

The present day Niger Delta slope is characterized by multiple Pleistocene-Holocene channel complex systems, covering a range of depositional styles, and dimensions. Extensive 3-D seismic data coverage provides an exceptional resource for collection of geomorphic observations from multiple channel systems and quantification of their dimensions. These observations provide insight into a) scales of variability within channels and b) the origin of channel systems in the slope environment.

Systematic collection and analysis of channel measurements yields an understanding of the spatial variability within individual channels and documents basin-wide channel morphology trends and the smaller scale features that comprise them. Close inspection reveals that analysis of individual meander bends permits the quantification of changes in channel morphology (e.g. down channel gradient, cross channel gradient, cross-sectional area). Comparison of numerous bends confirms that changes in channel dimension are spatially consistent and predictable. This analysis documents changes in channel cross-sectional area, and how the volume of its fill changes spatially and temporally.

Geomorphic observations reveal that slope channels are not strictly erosional or depositional in origin. Rather, channels may originate as chains of slump scars forming bathymetric lows. The position of these lows is controlled by differential compaction of/around older, buried channel-fills. Deformation of the pre-existing complex margin creates an instability that propagates upward and results in depressions later exploited by sediment gravity flows. Individual scars are not always connected to one another initially. They are later linked by erosion to form an integrated sediment pathway.