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Influence of Slope Gradient on the Distribution and Architecture of Deep Water Channels and Fans Inferred from Near Surface 3-D Seismic Data, Niger Delta Slope, Nigeria

A near surface 3-D seismic dataset from offshore Niger Delta was interpreted in order to study the controls on channel and fan development in a slope setting. Interpretation is based solely on seismic stratigraphy; event geometry, bounding surface relationships, amplitude continuity, and seismic geomorphology.

Four channel systems were identified, two of which are long enough within the data cube to study. Four fans are described, derived from three of the channel systems. Geomorphic features of interest include incised channels with knick-points, and fans with plunge-pools and basal scours. Observed seismic facies and stacking patterns are similar to those described in other slope settings in which seismic facies have been calibrated to core and log data. These include Mass Transport Complexes, Distributary Channel/Lobe Complexes, Incised Channel Complexes, and Hemipelagic Drape Complexes. Channel-Levee Complexes are absent in the study area.

Extensional faulting and mud diapirism influence slope gradient and profoundly affect fan development and channel incision. Adjustment of the equilibrium profile to changing slope gradient causes fan aggradation in areas of slope reduction such as the proximal flank of mud diapirs or the hanging-wall block of active normal faults. Areas of increased slope gradient, such as the distal flank of mud diapirs or fault scarps, cause channel incision through the headward propagation of knick points.

Fans that show evidence of through-going incised channels are termed transient while those that show no or minor channel incision are termed terminal. This has implications for sand distribution and compartmentalization, important in exploration and reservoir management.