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Ultra-High Resolution 3-D Characterization of Deep-Water Deposits: Approaching a Better Understanding of the Stratigraphic Evolution of Intra-Slope Depositional Systems

An ultra-high resolution 3-D survey was acquired to investigate the stratigraphic evolution and basin fill history of a Pleistocene intra-slope basin in the western Gulf of Mexico. The data have a peak frequency of 200 Hz, providing near outcrop scale resolution of basin fill deposits. This basin is the termination of a system of 4 basins connected by a network of channels (Basin 4). The basin fill history is marked by two distinct phases of sedimentation: ponded and perched. The ponded phase is characterized by sheet-like deposits (confined sheet complexes) interbedded with localized mass transport complexes, forming a relatively thick unit restricted to the deepest portion of the basin. The confined sheet complexes are marked by high-amplitude, continuous reflections and show limited seismic facies variations. In contrast, channelized deposits overlying an extra-basinal mass transport complex characterize the perched phase. The channelized deposits (upper fan) form a widespread distributary channel-lobe complex showing a fan pattern in map view. The upper fan is thick and channelized updip and relatively thin and lobate downdip. Strong seismic facies variations are associated with these transitions in geometry and internal architecture. The differences between the ponded and perched deposits are related to a sedimentary response to an evolving accommodation profile. Computational fluid dynamics modeling is being used to investigate to the interplay of flow mechanics and changing accommodation during basin filling. Preliminary results show that, for turbidity currents simulated for indentical input conditions, profound differences in sediment transport and deposition arise simply by changing the gradients and geometry of the depositional profile.