Factors Controlling Modern Abyssal Fan Architecture in the Gulf of Mexico and Implications for Paleogene to Miocene Petroleum Plays in the Gulf of Mexico

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Modern submarine fans of the northern Gulf of Mexico (GOM) display various architectures that can serve as modern analogues for hydrocarbon reservoirs. Bryant Fan has been fed by relatively sand-rich, shelf-margin deltas and narrow canyons through a chain of 15 mini-basins (2-15 km diameter). Approximately 50% of seismic facies in the mini-basins consist of mass-transport deposits (MTDs) composed of wedges of chaotic mud and sheets of chaotic mud and sand. The Bryant mini-basin pathway apparently traps these MTDs, which produces a Bryant Fan architecture with few MTDs, compensation cycles of stacked channel-levee complexes, and non-bifurcated aggrading channels that extend >200 km to feed single, distal sand-rich depositional lobes of ~30 km in length. The Bryant Canyon/Fan architecture provides an analogue for the Miocene systems in the Mississippi Canyon area. In contrast, the mud-rich Mississippi Delta and present-day 20-km wide gullied canyon sediment source of MTDs controls an architecture of multiple mid-fan channel bifurcations and outer fan channel splays in the 200 km long distal lobes of the mud-rich Mississippi Fan. Extensive MTDs are deposited during lowering and rising sea level episodes and are intermixed at all scales (~400 km debris sheets to 10-cm thick MTD beds) with the channel and lobe turbidite facies. Possible analogues to Mississippi Fan, with intermixing of extensive MTD's, may be found in some subsurface turbidite systems of the GOM margin. The most sand-rich architecture is found in the Rio Grande Fan, where multiple canyons provide a line source of coarse-grained sediment from adjacent mountain sources to the fan, which is located on a continental-slope plateau. Factors such as the relatively steep fan gradient (1:250), incised rather than leveed channels, architecture of numerous channels throughout the surface and subsurface, seismic facies and sediment cores indicate that the Rio Grande Fan is a braided, sand-rich system. Rio Grande Fan provides an analogue for some Paleogene subsurface petroleum plays in the northwestern GOM such as the Wilcox and Frio.