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Modern Turbidite System Depositional Patterns as Analogues for Subsurface Petroleum Plays in the Northern Gulf of Mexico*

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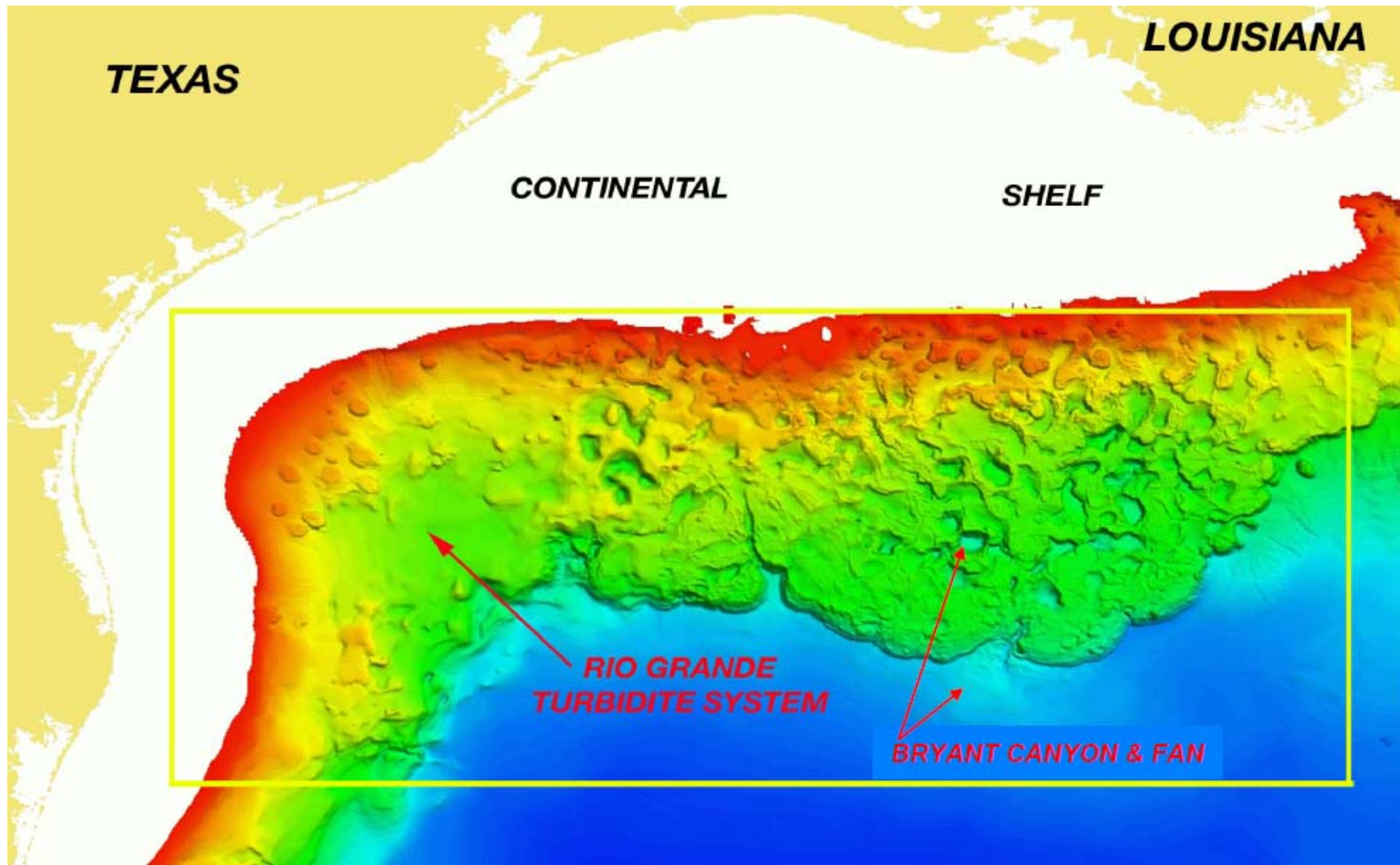
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Abstract

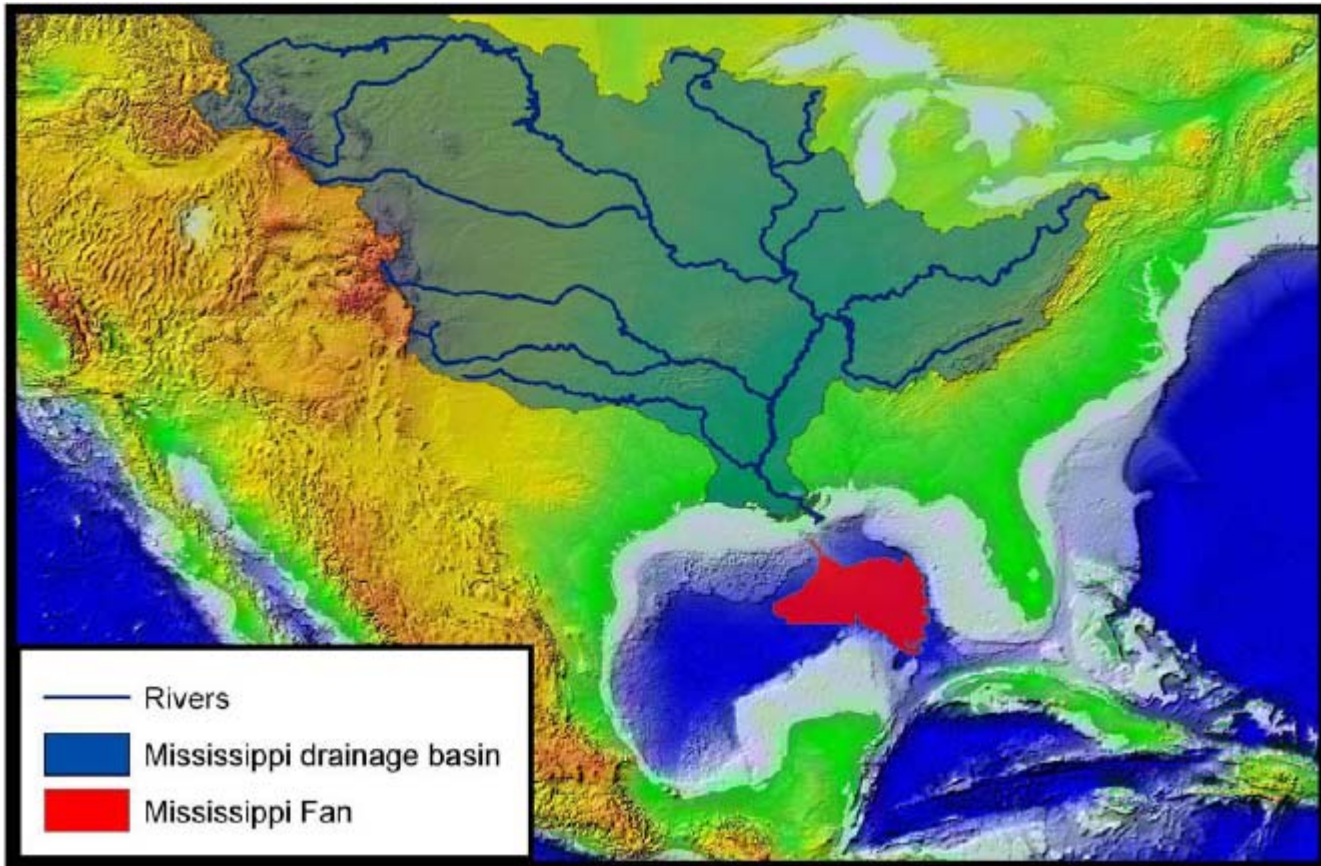
Several analogue depositional patterns are observed in modern turbidite systems of the northern Gulf of Mexico (GOM). Bryant Canyon/Fan feeds through a chain of mini-basins (2-15 km diameter) that exhibit seismic facies of: 1) Mass Transport Deposit (MTD) wedges of chaotic mud and sheets of chaotic mud and sand, 2) incised, ponded and perched turbidites, and 3) bypass channelized facies.

The mini-basin pathway of Bryant Canyon, which traps mud, has resulted in non-bifurcated aggrading channels that extend 200 km across the sand-rich Bryant Fan to feed single distal depositional lobes of ~ 30 km in length. The Bryant mini-basin and fan patterns provide analogues for the Miocene systems in the Mississippi Canyon area. In contrast, the mud-rich Mississippi Delta and 20 km-wide gullied canyon sediment source has resulted in multiple mid-fan channel bifurcations and outer fan channel splays in 200 km-long lobes of the mud-rich Mississippi Fan. Extensive MTD's were deposited during lowering and rising sea level episodes and are intermixed at all scales (~400 km debris sheets to 10 cm MTD beds) with the channel and lobe turbidite deposits. Similar to Bryant Canyon and Mississippi Fan, intermixing of turbidites and extensive MTD's is found in some subsurface turbidite systems of the GOM margin.

The Rio Grande Fan is a contrasting braided-fan analogue for some Paleogene subsurface petroleum plays in the northwestern GOM. Multiple canyons provide coarse-grained sediment from adjacent mountain sources to deposit the fan on a continental-slope plateau. The seismic facies, relatively steep fan gradient (1:250), and incised rather than leveed, channels throughout the surface and subsurface show that the Rio Grande Fan is a braided sand-rich fan.

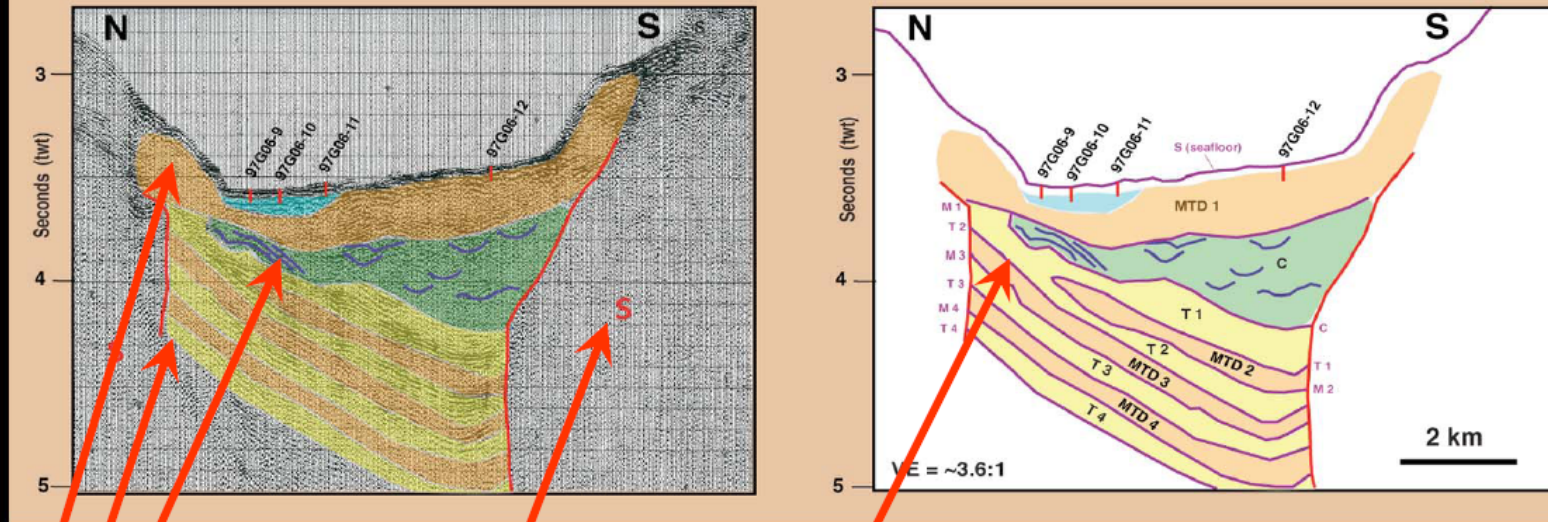


Location map of Bryant and Rio Grande turbidite systems (Seafloor Relief Map by Lui and Bryant, Texas Sea Grant College Program).



Map showing Mississippi drainage history and location of Mississippi Fan (Twichell et al., in press).

Beaumont Basin -- Bryant Canyon



MTD 1= YOUNGEST MTD

T4= OLDEST PONDED TURBIDITE DEPOSIT

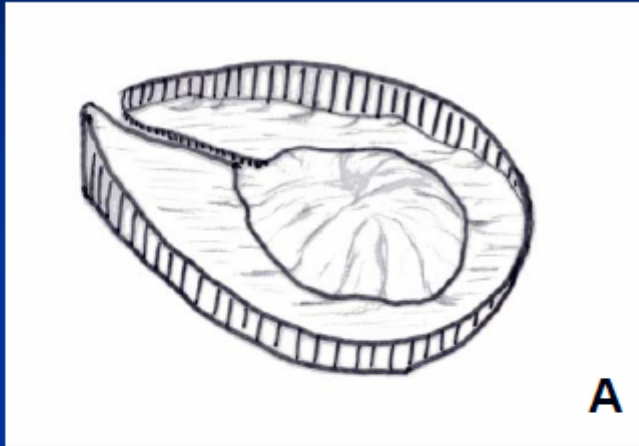
C= BYPASS CHANNEL DEPOSITS (NOTE INCISION INTO T1)

S= SALT DIAPIRS

NOTE SYNTECTONIC DEPOSITION SHOWN BY EROSION OF T1 INTO MTD 2 AND T2

Example of an interpreted seismic line across Beaumont Basin along the Bryant Channel pathway (from Damuth, Nelson, and Olson, 2006).

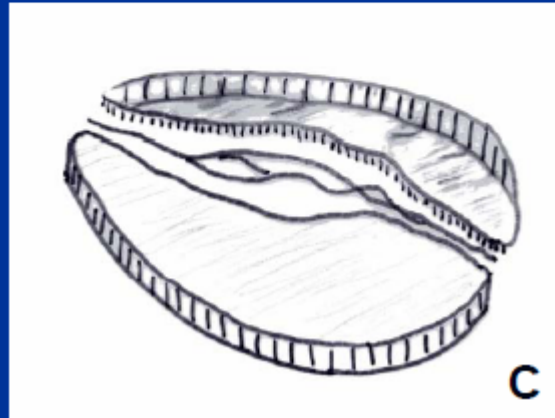
CHAOTIC MUD/SAND SHEETS



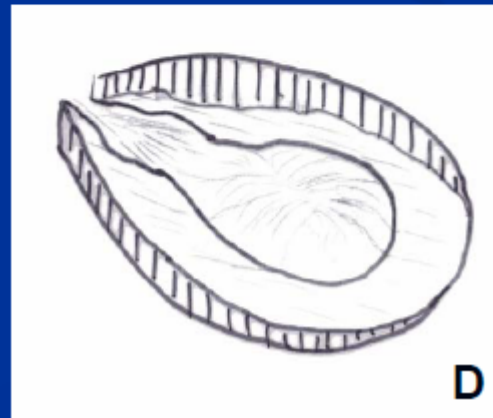
CHAOTIC MUD WEDGES



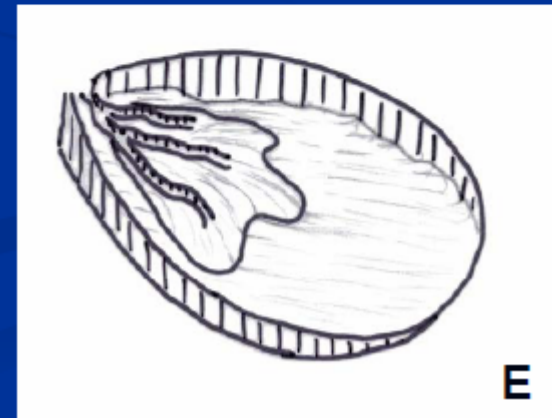
BYPASS CHANNEL FILL



PONDED



PERCHED



Mini-basin depositional patterns. A, B. mass transport deposits. C, D, and E. turbidite sand deposits.

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