3D Seismic Stratigraphic Interpretation of the Upper Miocene to Lower Pleistocene Deepwater Sediments of the Thunder Horse–Mensa Area, Southern Mississippi Canyon, Northern Deep Gulf of Mexico

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ABSTRACT

A detailed 3D seismic stratigraphic analysis was done of the Mensa–Thunder Horse minibasins in the south-central Mississippi Canyon protraction area, northern deepwater Gulf of Mexico. The stratigraphic interval of interest lies between the 9.0 to 1.3 Ma (upper Miocene to lower Pleistocene). The analysis is based on the integration of a 979 km^2 (378 mi^2) 3D seismic dataset and wireline logs.

Eleven depositional sequences were identified and correlated. Depositional elements include channels (depositional and erosional), levee-overbank, depositional lobes (sheets), and mass-transport deposits. The mud-rich overbank deposits constitute about 90% of the sediments in the interval of study. Seismic attribute analyses and wireline logs indicate that the channel-fill sediments can be of variable grain size along the path of the channel. Levees usually had well developed bathymetric relief. They are dominantly mud with sands proximal to the main channel. Depositional lobes, interpreted to be sand-prone, developed within the 9.0-8.2 Ma, 7.0-6.2 Ma, 5.4-4.7 Ma, and 2.8-1.3 Ma sequences and occur at the terminal part of channels. Erosional channels developed within the 9.0-7.0 Ma interval, some of which are interpreted having a sand-rich fill. Mass-transport deposits are present in the upper intervals, the 4.1-3.6 Ma and the 2.8-1.3 Ma intervals. Well logs show that they are composed dominantly by mud with some interbedded sands.

The Mensa and Thunder Horse turtle structures, as well as the shallow allochthonous Thunder Horse, Bohr, Poseidon, and Devil's Tower salt features, created bathymetric highs at the time of deposition. All of these created a complex seafloor bathymetry that affected the distribution of the sediments. Two south-trending main sediment pathways, east and west of the Thunder Horse salt feature, were identified.

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