SEISMIC "NO-DATA ZONE", OFFSHORE MISSISSIPPI DELTA: DEPOSITIONAL CONTROLS ON GEOTECHNICAL PROPERTIES, VELOCITY STRUCTURE, AND SEISMIC ATTENUATION

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ABSTRACT

Seismic-acquisition problems plague exploration and production offshore the Mississippi Delta. Geologic and geotechnical analyses of 300-ft borings and 20-ft piston cores, combined with subbottom acoustic measurements, help identify and predict the locations, types, and magnitudes of anomalous seismic zones. This knowledge is used to design acquisition and processing techniques to circumvent the seismic problems.

Acoustic problems begin within the upper 5-10' of the Holocene delta-front deposits. The cause of these problems is the rapid input of fine-grained, organic-rich sediment, which produces beds with excess pore fluids and biogenic-gas buildup. These overpressured, underconsolidated units fail, producing collapse depressions, mudflow gullies, and mudflow lobes. Within these delta-front features, the physical agitation and release of overburden pressure during mass flow apparently liberates interstitial gas into bubble phase, producing extremely low interval velocities (less than 1000 ft/sec) and maximum seismic attenuation. The thickest measured acoustically anomalous zone is as much as 185' in front of one distributary-channel mouth.

In contrast, "typical" subbottom velocities (more than 5000 ft/sec) and least attenuation occur away from distributary-channel mouths. Bioturbated and laminated sediments indicate slower deposition and little biogenic-gas entrapment.

Erratic acoustic profiles are present in two other areas:

1. Highs between the mudflow gullies—the intergully platforms—have not failed. Irregularly alternating low- and high-velocity layers within the platforms correspond to homogenous vs. laminated muds, respectively, indicating differing depositional rates and gas production.

2. Mudflow lobes, the end products of mass flow located at the termini of mudflow gullies, also contain irregular velocity profiles. High-velocity layers have been completely degassed during downslope flow. Low-velocity intervals denote discrete, undisturbed blocks of gassy sediment as well as post-flow biogenic-gas buildup.

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