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Mechanisms leading to overpressure and slope instability in the Gulf of Mexico continental slope

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Seismic and multibeam data have shown the occurrence of fossil large-scale Mass Transport Deposits (MTD) and Recent failure events in connection with fluid escape structures in Ursa Basin at $\sim$1000 m depth in the eastern levee of the Mississippi Canyon, northeastern Gulf of Mexico. Duirng IODP Expedition 308 three Sites (U1322, U1323 and U1324) were drilled adjacent to the Recent failures and through several MTD of Holocene and Pleistocene age. At these sites a complete suite of logging data and direct measurements of moisture and density and geotechnical data were acquired that will allow to illuminate the factors controlling initiation of past sediment failures and to characterize the hazard from future slope instabilities. Results indicate that Ursa Basin has very high sedimentation rates, at least 10m/ky with peaks up to 25 m/ky, which resulted in a particular porosity profile, with relatively high values compared to overburden stress. Fluid overpressure estimated from a variety of direct and indirect methods indicates that the vertical effective stress is 50 to 70 % lower than if hydrostatic conditions existed. The trends in density and undrained shear strength are relatively smoother at Site U1324 compared to Site U1322. At Site U1322 density and strength measurements show significant increases (up to 0.1 g/cm^3 and 50 kPa respectively) associated with MTDs. This may indicate higher consolidation of MTD, which probably results from shearing and dewatering of the sediments during the landslide process. High sedimentation rates are a crucial factor leading to overpressure and slope instability at Ursa. The location, depth, thickness and amount of shearing in MTDs will further influence slope stability.

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