

Determining gas hydrate distribution in sands using integrated analysis of well log and seismic data in the Terrebonne Basin, Gulf of Mexico.

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The Terrebonne Basin is a salt bounded mini-basin in the northeast section of the Walker Ridge protraction area in the Gulf of Mexico, and the main site for an upcoming gas-hydrate focused International Ocean Discovery Program (IODP) cruise. The basin is infilled by an increasingly mud rich sedimentary sequence with several 5-15 meter gas-hydrate filled sand units of Miocene to Pliocene age overlying the up-domed salt. These gas-hydrate filled sand units can be identified in logging while drilling data from two existing wells in the Terrebonne Basin, drilled in 2009 by the Gas Hydrate Joint Industry Project (JIP) Leg 2. The sand units are cross cut by a distinct bottom-simulating reflector (BSR), and are clearly characterized by a polarity reversal in the sand units. The polarity reversal is caused by a positive gas-hydrate filled sand within the stability zone changing to negative gas-bearing sand.

Using well data and calculated synthetic seismogram well ties we are able to identify several additional 1-4 meter gas-hydrate and water-saturated sand units associated with thick (100-200 m-thick), fine grained, hydrate bearing fractured units in the upper sedimentary sequence on the seismic data. Following on previous work, we propose that microbial generation of methane occurring within the fine-grained, fractured units acts as a source for gas hydrate formation in the thin sands. In contrast, it has been proposed that the gas hydrate in the 5-15 m-thick sands first discovered by the JIP was originates from a deeper thermogenic source.

Through correlating hydrate occurrence in sands from well data, to amplitudes derived from the seismic data, we can estimate possible distribution of hydrate across the basin. Overall, we find the Terrebonne basin to be a complex gas hydrate system with multiple mechanisms of methane generation and migration.