Reservoir Pressure and Sea Floor Venting: Predicting trap integrity in a Gulf of Mexico deepwater turbidite minibasin

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ABSTRACT

Pore pressures equal the least-principal stress at the crest of two sands in the Popeye/Genesis deepwater Gulf of Mexico minibasin (GC72/GC205). We interpret that sand pressures, elevated by flow focusing, are dilating fractures in the cap rock, inducing fluid migration from the crest. These 'leak points' limit the sand pressure to the least-principal stress at its crest and ultimately ensure the integrity of the hydrocarbon traps at the offset Genesis and Popeye fields. An active fault, adjacent to the leak-point, provides a potential migration pathway to overlying seafloor expulsion features. Gas hydrate deposits and fluid venting from mud volcanoes are present at the expulsion features. In overpressured basins with significant structural relief, we infer that pore pressures converge on the least-principal stress at the structural crests. This makes it is possible to predict the effective-stress state throughout, which allows for the estimation of trap integrity, potential column heights, and the design of safe and economic drilling programs.