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Reservoir Pressure and Sea Floor Venting: Predicting Trap Integrity in a Gulf of Mexico Deepwater Turbidite Minibasin

Fluid pressures within the F and G-sand reservoirs in the Green Canyon 72 (GC72) field (offshore Gulf of Mexico) are controlled by venting at a sea floor expulsion feature, 13 km to the south. Given pore pressure measurements at GC72, and the assumption that the sands are permeable (fluid pressures follow the hydrostatic gradient), pore pressures at the crest of the reservoir converge on the overburden stress at the expulsion vent. At the intersection with the expulsion vent, the G-sand pressures equal 50.4 MPa (7310 psi), and the overburden stress equals 54 MPa (7825 psi). The shallower F-sand pressures are 48.1 MPa (6976 psi), which is greater than the overburden stress of 47.7 MPa (6920 psi. We interpret that overpressuring at the crest of these turbidite minibasin sandstones breached the trap integrity. Fluids leaked out of this crest, resulting in shallow gas washout and seafloor expulsion above the crest. The seafloor vent is expressed as a series of conical features up to 900 meters (2953 feet) in diameter and with a relief of up to 60 meters (197 feet). The observation that sandstone pressures equal the overburden stress at expulsion vents can be used to predict the pore pressure in any reservoir that is hydraulically connected with this expulsion event. This methodology can be used to predict trap integrity in an exploration setting and to design safe and economic drilling programs within geopressured basins.