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Origin of Low Salinity Pore Water in the Seal Overlying the Geopressured Regime, Northeast Texas Gulf Coast: Implications for Fluid Flow and Sealing

The chemistry of water in the top seal of the Chocolate Bayou field, Brazoria, Texas was used to deduce the chemistry of the fluid present at the time of the seal formation and to constrain the timing of the seal formation. The composition of the water in the top seal is distinctly different from those of the underlying geopressured and overlying normally-pressured regimes, indicating a lack of hydraulic communication that has lasted since this interval became an active seal. High Cl/Br ratios (380-1210) but low salinities (32-64g/L) of the seal water indicate it has experienced halite dissolution and subsequent dilution. Shale water released from the smectite-to-illite conversion is the only diluted water source compatible with the stable isotope chemistry of the seal water. The smectite-to-illite conversion is observed only in the seal and below, suggesting it contributes to the sealing effect significantly. As it is a sealing mechanism as well as a diluted water source, the timing of smectite-to-illite conversion, 23.6 Ma (Morton, 1985), likely represents the minimum age of the seal formation. This age corresponds to a main period (L. Oligocene to E. Miocene) of deep fluid expulsion in the Texas Gulf Coast (Light et al., 1987; Sassen et al., 1994). The discharged hot brine, probably K-rich, might have triggered this diagenetic event (Morton, 1985) and be an original saline brine of the seal before dilution. Under-compaction of the seal sediments supports the early nature of the seal formation.
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