
Source and Evolution of the Fluids around the S. Liberty Salt Dome, SE Texas Gulf Coast

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ABSTRACT

Fluid-flow perturbation around the S. Liberty Salt Dome, Liberty County, Texas has been studied. Integration of the fluid-geochemistry (brine and oil) with the local stratigraphy, provides information on the fluid sources, and the nature of the fluid-rock interaction.

The local Frio reservoirs are slightly over-pressured (<0.55 psi/ft), while the Yegua and Cook Mountain sands are moderately over-pressured (<0.75 psi/ft). Whole-oil GC and GC-MS data indicate that the oils from these horizons belong to the same family, are of marginal marine origin with notable terrestrial inputs, and have similar source and maturation history (temperature of expulsion around 130°C). The most likely source-rock age is Late Cretaceous / Early Tertiary. While some samples (especially from the Frio reservoirs) are biodegraded, the possibility of a second charge into some reservoirs cannot be overruled.

The S. Liberty brines are products of mixing between the local meteoric water and geopressured brines, with mixing prevailing across formations. These Na-Cl type brines have undergone extensive halite and cap-rock dissolution (TDS: 68-254 g/L). Equilibrium reaction relationships indicate that these brines are buffered by carbonate and silicate phases present in the local strata. This equilibrium relationship, despite dilution by up to 50% of meteoric water, suggests a long residence time sufficient to re-equilibrate with the rocks after mixing. Thus, the chemical changes in the water are products of long circulation rather than geologically recent or localized phenomena.