3.1.P06

Formation mechanism of hydrocarbon reservoirs related to igneous rocks in Meso-Cenozoic basins of eastern China

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There are a number of petroleum-producing Mesozoic-Cenozoic basins in the coastal areas of eastern China. In these basins, voluminous volcanic and sub-volcanic intrusive rocks dominantly basaltic and trachytic in composition are intercalated in the sedimentary sequences including hydrocarbon sources. These igneous rocks serve as caprocks as well as trapping beds for reservoir forming. Oil and gas reservoirs related to volcanic rocks [1] can be classified into the volcanite-trapping type 1 and volcanite-sealing type 2, whereas those related to sub-volcanic intrusions include the roof fracture zone type 3, crypto-explosive breccia type 4 [2], primary fracture type 5, Contact metamorphic zone type 6, alteration-fractured zone type 7 and lateral sealing type 8. A generalized model (Fig. 1) for formation of hydrocarbon reservoirs linked to igneous rocks is proposed. More attention should be paid to igneous rock reservoirs during exploration for hydrocarbons in these basins in the future.

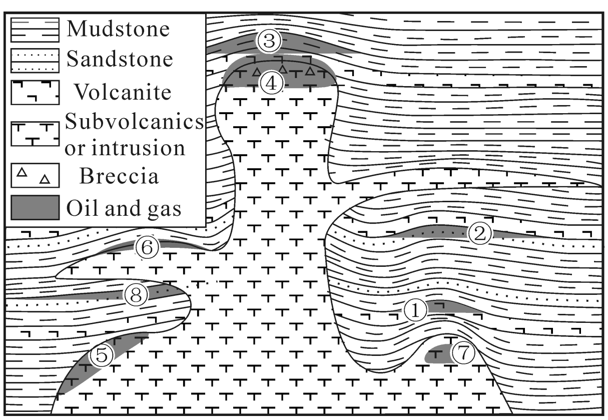

Figure 1. Generalized model for formation of hydrocarbon reservoirs related to igneous rocks

References

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3.1.P07

Mixing of meteoric water and deep brine, and fluid-isolation around salt domes, SE Texas, USA

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Many models of fluid mixing around salt domes have been proposed. However, geochemical confirmation using high resolution sampling and brine-geochemistry has been lacking. Thirty-four brine samples collected from normally pressured to slightly geopressured sediments of Lower Miocene to Upper Eocene ages around three salt domes (South Liberty, High Island and Spindletop) all in SE Texas were used to chemically characterize the local fluids and establish flow patterns. Samples were analyzed for Na, K, Ca, Mg, Li, Al, SiO_2, Br, I, Ba, Fe, CO_3, HCO_3, F, Cl, SO_4, acetate, δD and $\delta^{18}O$ and by whole oil gas chromatography.

δD and $\delta^{18}O$ isotopic values of these brines plot between local meteoric water and geopressured brines [1,2]. Depthwise mixing between local geopressured brines and these fluids is also evident from a plot of depth vs. $\delta^{18}O$. The mixing trend prevails across formations, with the percentage of meteoric-sourced water decreasing with increased depth. These brines are Na-Cl type, and have high TDS (68-254 g/L). Chemical cross-plots indicate that the compositions of these brines also have been influenced by dissolution of halite present in the local salt bodies. Four brine samples from South Liberty oil field contain high SO_4 (>500 mg/L), and indicate local gypsum caprock dissolution. Use of SOLMINEQ.88 [3] indicates that these brines are buffered by calcite and disordered-dolomite equilibrium and quartz dissolution reactions consistent with the local geopressured brines [2] found away from the domes.

In South Liberty, closely spaced samples from similar depths separated by faults (based on stratigraphic analyses) produce waters of strikingly different compositions, suggesting recent hydrologic isolation. Coincidence of faults with greater influx of meteoric water and reaction with cap rock suggests the faults may act as conduits for vertical flow.

Whole oil gas chromatography and cross plots (2,4 DMP vs. 2,3 DMP ratios, and Pr/nC17 vs. Ph/nC18) of two oil samples from South Liberty indicate a mixed organic source, and approximately 130ºC as the expulsion temperature. However, a plot of nC7/MCH vs. Toluene/nC7 suggests different degrees of evaporative fractionation and migration histories, thereby pointing at the complex nature of fluid flow around the domes studied.

References

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