Chapter 7

Pressure Seals—Interactions with Organic Matter, Experimental Observations, and Relation to a "Hydrocarbon Plugging" Hypothesis for Pressure Seal Formation

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ABSTRACT

Organic geochemical characteristics diagnostic of pressure seals have been determined for two wells in the Moore-Sams field of the Tuscaloosa trend, Louisiana Gulf Coast (Mix and Bizette wells) and one well penetrating a much weaker pressure transition zone of the Anadarko basin, Oklahoma (Weaver well). Preliminary data suggest these characteristics of organic matter in zones of pressure seals: a rapid increase in vitrinite reflectance near the top of the pressure seal; fractionation of bitumens through the pressure seal with a gradual change from lighter to heavier n-alkanes with increasing depth in the pressure seal; a buildup of hydrocarbons just beneath the pressure seal; and an enhancement of asphalt (or asphaltene) throughout the general zone of the pressure seal. For all three wells, very tight associations of carbonate cements, fine pyrite, asphaltenes, and micrinite (generally considered to be a residual product of hydrocarbon generation) were observed in the general zone of pressure seals, suggesting that interactions of organic and inorganic materials may be required for pressure seal formation and maintenance, even in fairly organic lean wells such as Weaver. A sharp jump in thermal maturity, as measured by vitrinite reflectance, occurs at the top of the Mix pressure transition zone. Maturity levels below the seal reach gas thermal window levels, suggesting that gas formation within and below the (seal) zone is contributing both to overpressuring and sealing of pressure seals investigated here. It is proposed that all these observations can be accommodated if the pressure drop across the seal pressure transition zone causes separation of oil and gas and deposition of asphalt from the upward-