Deepwater Gulf of Mexico—Using Seepage and Oils to Understand the Source and Charge Issues

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Abstract

Understanding the deepwater petroleum system of the Gulf of Mexico (GoM) requires use of piston coring seepage data, reservoired oils and shows, and a good understanding of the source rock system even though there are few penetrations of this interval. Tools are available to the geoscientists to address these issues such as 3D seismic survey. These 3D seismic surveys allow us to better locate possible seepage sites, and characterization of this seepage allows us to determine the source type or origin of the oils.

Geochemical correlation techniques between oils and seepage provides information on the underlying source system, and when tied to 2D fluid flow models, allows us to address oil and gas charge issues. For the deepwater GoM these correlations indicate the presence of a primary Upper Jurassic source unit centered on the Tithonian but includes the lower Neocomian. In the central deepwater area, this source is a marl to carbonate and expels heavier and more sour (higher sulfur and metals) oil, whereas in the southeast and eastern deepwater areas, this source becomes more siliciclastic and expels a lighter, less sulfur oil.

Correlating and inferring oil quality from seepage to a reservoir is possible in some cases, but generally seepage can be misleading in parts of the deepwater area because of migration and charge issues. In some parts of the GoM, stacked turbidite sand reservoirs are charged with oils that have different geochemical signatures, though the source type is the same. The deepest reservoirs usually contain a heavier (sometimes biodegraded) oil but the shallower reservoirs contain lighter, more mature and less biodegraded oils. The mechanism invoked is early charge from the Tithonian source of a heavy, less mature, more viscous oil, and these reservoirs cannot mix efficiently, therefore, the later oil charge bypasses or inefficiently mixes with the oils in the deeper reservoirs resulting in charge of a more mature and lighter oil in the shallower reservoirs. This is one mechanism observed, whereas in other parts of the deepwater GoM, the seepage may type to the same oil found in the reservoir sands. Seepage cannot determine levels of biodegradation, however.