Methodology for Correcting Bottomhole Temperatures Acquired from Wireline Logging Measurements in the Onshore U.S. Gulf of Mexico Basin to Characterize the Thermal Regime of Total Petroleum Systems

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ABSTRACT

Characterization of the subsurface thermal regime is critical for understanding many facets of the petroleum system, from thermal maturation of organic-rich source rocks to thermal preservation and non-degradation of hydrocarbon accumulations. On a broad scale, paleo-heatflow has been mapped for the North American continent (Blackwell and Richards, 2004) as well as the contiguous United States (Blackwell et al., 2011). However, in situ reservoir temperature is a fundamental property (Cooper and Jones, 1959) that is difficult to accurately measure in the subsurface (Deming, 1989). Previous work has described the thermal regime of the offshore U.S. Gulf of Mexico Basin (Waples et al., 2004; Forrest et al., 2005; Nagihara and Jones, 2005; Husson et al., 2008); however, due to the lack of an applicable bottomhole temperature (BHT) correction method, virgin rock temperatures of the onshore portion of the basin remains largely uncharacterized in a regional or subregional context.

The abundance of BHT measurements offers a useful way to characterize the subsurface thermal environment, provided that they are corrected to reflect the reservoir temperature. This study develops BHT correction methods that are specifically calibrated for the onshore U.S. Gulf of Mexico Basin. These BHT corrections are empirically derived and are based on a newly compiled database of temperatures obtained from BHT wireline measurements and, to a lesser extent, from drill stem test (DST) data. The results of this investigation provide a unified BHT correction methodology for the onshore U.S. Gulf of Mexico Basin as well as provide 12 distinct BHT correction equations for each of the 12 physiographic provinces within the onshore Gulf Coast region. This study also characterizes the geothermal gradient regime across the onshore U.S. Gulf Coast, which ranges from 1.89ºF/100 ft in Sabine Uplift area to 1.39ºF/100 ft in the Southern Louisiana Salt Basin.

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