Comparison of Methodologies for Correcting Bottom-Hole Temperature Measurements: An Example from the East Cameron and West Cameron Federal Lease Areas in the Gulf of Mexico

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ABSTRACT

In many parts of the Texas-Louisiana continental shelf of the Gulf of Mexico, numerous bottom-hole temperatures (BHTs) have been reported from boreholes located within close proximity to one another. Availability of such datasets makes it possible to characterize in detail the geothermal setting of the continental shelf. However, a BHT as measured is not particularly useful for making geologic interpretation, because, prior to the measurement, formation temperature is artificially lowered by drilling fluid circulation in wells typically deeper than 600 m. In applying proper corrections to compensate for the circulation cooling effect, researchers have proposed two types of methodologies in the past. One is to add a temperature value as function of depth to the BHT, based on a previously found statistical correlation between BHTs and more reliable temperature measurements, (e.g., 'Harrison's' method). The other is based on theoretical models that describe how wellbore temperatures recover after the well has been shut-in (e.g., the 'Horner plot' method). Here, we perform a comparison of such methodologies and discuss approaches for characterizing geothermal gradients, using BHTs reported from ~270 boreholes in a 5,800-km2 area encompassing the East Cameron and West Cameron federal lease areas in the Gulf of Mexico. We find that Harrison's method yields a minimum of ~5° C higher estimates of the pre-drilling formation temperatures on the average and a five-percent higher geothermal gradient than the Horner plot method for this particular dataset. For regional representation of geothermal gradient, such difference may not be significant. However, if high-accuracy temperature estimates are required for particular geologic formations of interest, researchers should be aware of the difference among the correction methodologies.