Methodology for Generating Bottom Hole Temperature Gradients Using Published Correction Methods

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ABSTRACT

The U.S. Geological Survey (USGS) is mandated by Congress to conduct assessments of undiscovered oil and gas resources in priority U.S. basins. As part of this effort, resource assessments for the onshore and State waters portions of the U.S. Gulf Coast region are ongoing. A database containing bottom hole temperatures (BHTs) from wells has been compiled for the Gulf Coast region. Subsurface temperature gradients can be calculated from BHTs providing critical information for petroleum exploration and production, including evaluating source rock thermal maturity. BHT measurements are often unreliable because they are measured before drilling fluids are allowed to equilibrate. Because of this and other factors, numerous methodologies have been developed to correct measured data. This study illustrates the methodology developed by the USGS to compile this BHT database. It also describes how published correction methods have been applied to the data. The Gulf Coast database was compiled from a commercial database by collecting well records that contained BHTs, time since circulation, and depth. A smaller subset of the data was collected from well log headers and entered manually into the larger dataset. Approximately ten percent of the data were checked by randomly selecting wells and comparing them with the associated log header. Additionally, error checking was performed on records whose temperature gradients fell outside two standard deviations of the mean temperature gradient.

BHTs require correction because they are often artificially low due to the presence of relatively cool drilling fluid in the well bore. Many published correction factors exist; this study presents seven commonly used correction factors. Basin-scale maps for the Gulf Coast study area were created and show temperature gradients calculated using both uncorrected BHTs and BHTs corrected using the seven correction factors. The maps show that subsurface temperature gradients are higher along the Wilcox, Frio, and Vicksburg fault zones in southwestern Texas, and lower along the Gulf Coast coastal areas and southern Louisiana.

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