Normalization of Gamma-Ray Logs Using Python for Enhanced Data Consistency in the Uinta Basin, Utah

Kate M. Jurney[1] and Joshua T. Sigler[2]

[1]XCL Resources
[2]XCL Resources LLC

Abstract

Normalization of well log data is crucial for correcting a variety of variations such as changes in borehole environment, borehole size, tool calibration, and differing vintages from well to well. In the Altamont-Bluebell Complex of the Uinta Basin, commonly encountered elevated pore pressure in the Lower Green River and Wasatch Formations resulting in multiple measurement-while-drilling (MWD) and wireline logging runs and numerous different calibrations for each run. Publicly reported gamma ray logs may or may not have these calibrations reported and legacy logging suites may simply be digitized from old paper logs with no logging parameters reported at all. Well-by-well normalization of gamma ray logs is common and corrects most discrepancy in gamma ray calibration but still allows for significant errors in normalization, particularly when open-hole and cased-hole gamma ray logs have been combined. This study leverages Python to automate the process of preprocessing gamma ray log data, conducting statistical analyses of the log data, normalizing processed gamma-ray logs and export the results for use in geological interpretation software from over 3,000 wells in the Uinta Basin. Given the significant impact of borehole size on log normalization, log depths were matched with their corresponding hole sizes and gamma-ray logs were then segmented by hole size to conduct normalization based on these hole sizes. The implementation of Python into the normalization process allows for the execution of numerous statistical measurements to compare numerous normalization schemes that are not available in typical geological interpretation systems. This presentation will discuss the Python-based methodology and data flow used in the analysis, accompanied by examples illustrating the data before and after normalization.