Utility of Archived Rock Materials in Determining Organic Matter Properties and Establishing a Correlation Between Pyrolysis and Vitrinite Reflectance Data in the Delaware Basin

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Abstract

The Permian Basin of West Texas, comprised of the Midland Basin, Central Basin Platform, and the Delaware Basin, has proven to be one of the most prolific oil and gas producing regions in North America over the last 70 years. Production originally peaked during the 1970s, with operators primarily focused on conventional targets in the Midland Basin and on the Central Basin Platform. Recent activity over the last 10-20 years has shifted toward exploring Permian age unconventional targets across the entire basin, with Wolfcampian and Leonardian targets in the Delaware Basin receiving most of the current attention. As the basin has matured, operators have moved from exploration style drilling, to systematic field development plans founded on consistent and accurate rock properties data to better model well performance. Determination of organic matter type, quantity, quality and maturity within Permian Basin source rocks and reservoirs proves to be fundamental in productivity prediction. However, lab techniques, instrumentation, and sample quality are often not standard across the industry and often lead to an added layer of analytical uncertainty that is independent of geologic character. In order to address lab and sample inconsistencies, and demonstrate the value of archived rock materials for organic geochemical applications, this study will draw upon a subset of wells across Winkler and Loving Counties to create a consistent geochemical dataset (XRD, XRF, TOC,

pyrolysis, vitrinite reflectance, and stable carbon isotope) that details the dominant organic matter properties across the Paleozoic (Mississippian, Pennsylvanian, and Permian) source rocks of the Delaware Basin. The main objectives of the study are, 1) compare rock material of various vintages to test and quantify any potential organic matter degradation over time, 2) understand how potential degradation impacts organic properties (i.e. thermal maturity), 3) establish a linkage between various thermal maturity techniques (i.e. pyrolysis, stable carbon isotopes, and vitrinite reflectance) for Delaware Basin specific samples and formations. Previous studies have detailed these relationships in other basins, yet few have focused on a comprehensive Delaware Basin model.