Insights into the Organic Geochemistry of Interactions among Reservoir Rocks, Formation Waters, and Hydraulic Fracturing Fluids in Unconventional Energy Systems: An Experimental Study

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ABSTRACT

Hydraulic fracturing of organic-rich shales has significantly increased the recoverable volume of hydrocarbons in the United States. Interactions among hydraulic fracturing fluids, rocks, and formation waters in the reservoir may affect long-term reservoir productivity and waste management needs by changing mineral composition and produced fluid chemistry. Preliminary, evaluations have shown interactions between hydraulic fracturing fluids and inorganic minerals dissolving feldspars and carbonates but our understanding of interactions between hydraulic fracturing fluids and organic matter resident in unconventional source rocks is incomplete. This is a problem because the water-organic-rock interactions affect production efficiency in a variety of ways. They can induce clay swelling or dissolution, precipitate/dissolve minerals, and dissolve kerogen/bitumen affecting porosity and permeability. All theories can be observed or refuted through an experimental study making this research important to unconventional reservoirs across North America and abroad. Additionally, an experimental approach allows specific problems to be tested that can't be done in the field due to many variables present. Results can help identify reservoir properties for shale lithofacies that cannot correlate with geophysical well logs and thus, are not identifiable in wells lacking core data. Different lithofacies can have similar reservoir properties but affect fluid flow units dissimilarly. Successful completion of the project will contribute to Wyoming's energy objectives by improving our understanding of the process of hydraulic fracturing in unconventional reservoirs of Wyoming and across the United States.

AAPG Search and Discovery Article #90321 2018 Grants-in-Aid Projects