**Impacts of Geochemical Rock-Fluid Interactions on Production and Carbon Storage in Caney Shale of Southern Oklahoma**

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**Abstract**

Shale reservoirs are an important unconventional hydrocarbon resource and can provide volume for CO2 storage when depleted. During production, hydraulic fracturing is employed to enhance permeability of shales, but this enhanced permeability is mostly short-lived. This trend, though unfavorable for hydrocarbon production, may favor CO2 storage due to the loss of permeability.

In this study, rock powders are reacted with produced fluids to simulate post-fracturing geochemical reactions in unconventional reservoirs. The aim is to evaluate geochemical reactions as they affect hydrocarbon production and subsequent use of reservoir for CO2 storage. Sample properties are evaluated before and after reactions using X-ray diffraction (XRD), scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), and inductively coupled plasma mass spectroscopy (ICP-MS). The results from these techniques are then integrated to characterize the geochemical changes due to the reactions. Finally, experiments are modeled to help forecast the trajectory of the reactions, the potential reactions products, and their impacts on the permeability of the formation.

Preliminary results show elemental and mineralogical transformations in both effluents and rock-powders after reactions. Dissolution of pyrite, feldspar, and carbonate minerals from rock powders was observed though carbonate dissolution lagged the other two. In contrast, illite composition increased after the reactions whiles elemental concentrations in effluents revealed considerable differences from initial fluid composition. Results from modeling of the experiment aligned with the changes identified in the laboratory assessments.

This study provides an insight on post-fracturing rock-fluid geochemical reactions and their impacts on permeability evolution. The study also highlights how initially brittle reservoirs are transformed into ductile formations due to rock-fluid reactions in the subsurface. This has implications for both hydrocarbon production and the use of depleted shale reservoirs for carbon storage.

A chart of different colors of bricks

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