AAPG Datapages/Search and Discovery Article #90285 © 2016 AAPG Gulf Coast Association Geological Society, Corpus Christi, Texas, September 18-20, 2016

Measurement of Rare Earth Element Concentrations in Produced Water from the Eagle Ford Shale

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ABSTRACT

This project is evaluating the concentrations of rare earth elements (REEs) and other strategic elements in produced water from high-temperature hydrocarbon-producing wells, particularly in the Eagle Ford Shale where thousands of wells are available for strategic minerals recovery from 'low value' produced brine. Geothermal fluids dissolve REEs as they flow through shale formations, and extracting strategic elements from such geothermal fluids is effectively 'solution mining by nature.' Geochemical analyses of the Marcellus Shale have indicated that geothermal brines contain relatively high concentrations of REEs and other strategic elements. One of the major challenges associated with recovering REEs from geothermal brines is the difficulty of extracting the target elements from the extremely complex matrix. Geothermal brines from shale formations typically have total dissolved solids (TDS) concentrations several times greater than seawater (e.g., >100,000 mg/L) and competing ions such as sodium and chloride interfere with the extraction processes (e.g., ion exchange). Current separation technologies based on solvent extraction provides unsatisfactory performance when applied to high-salinity fluids like geothermal brines. As an initial step towards assessing the feasibility of developing an economic strategic element recovery process, the study will: (1) develop an accurate and reliable analytical method to determine concentrations of strategic elements in complex brine matrices, and (2) measure the concentrations of target strategic elements in produced water from the oil and gas operations in the Eagle Ford Shale region in Texas.