Role of Organo-Clay Interactions on Sedimentary Molecular Biomarkers and Isotopic Compositions

Jonathan Smolen[1]
[1]University of Connecticut, Petroleum, Storrs, CT USA
Jonathan.Smolen@uconn.edu

ABSTRACT

Clay minerals are highly abundant, natural catalysts that are essential in petroleum and hydrocarbon production, however the role of clays in alteration of primary hydrogen isotope signatures of organic biomarkers is poorly constrained. The unique surface charge distribution of clays coupled with small particle sizes drives their ability to adsorb a range of organic molecules and serve as a template for cracking reactions during diagenesis. While the catalytic action of clays is commonly believed to result from acidic sites within the crystal structure, a range of volatiles and/or condensates are also released by the clay minerals upon heating. Some of these components, carried in the interlayer water and released at high pressures, have the potential to migrate in the subsurface, catalyzing cracking and isotopic fractionation far from the source clays. Different cracking mechanisms and decompositions kinetics could give rise to different magnitudes of isotopic fractionation (C/H) between parent and product molecules. The proposed research is focused on examining the effect of clay-organic interactions and clay-derived volatiles on hydrogen and carbon isotope alteration of organic biomarkers. This will be achieved through a series of controlled heating experiments using a suite of clay mineral standards and sedimentary organic matter. To assess these effects, clay-derived volatiles will be analyzed and we will measure the distributional and isotopic changes to organic biomarkers that were heated in the presence/absence of clay standards as well as clays that have had volatiles removed. Results of this work will shed light on processes of clay-organic interactions and implications for petroleum generation and isotopic alteration of molecular biomarkers.

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