

Identification of Microbial Communities Present in Late-Devonian Organic-Rich Shales in the Midcontinent Region, U.S.

By

Jennifer C. McIntosh

University of Michigan, Dept. of Geological Sciences, Ann Arbor, MI

(jmcintos@umich.edu)

The Antrim Shale in northern Michigan and the New Albany Shale, along the eastern margin of the Illinois Basin, contain copious biogenic gas deposits associated with relatively dilute formation waters. Higher gas production rates were found in wells with high alkalinity and $\delta^{13}\text{C}$ values for formation waters, indicative of microbial methanogenesis. The microbial gas was produced in-situ with the dilute waters, as shown by the δD values for methane and associated fluids. Formation water $\delta^{18}\text{O}$ and δD values indicate that freshwater recharged the shales, during/since Pleistocene glaciation.

Extensive research has been done on the hydrogeochemistry of the Antrim and New Albany shales, and on the geochemical indicators of microbial methanogenesis. However, the active microbial communities within the shales have yet to be identified. I propose to collect microbe samples from a subset of Antrim and New Albany shale wells in gas productive and gas poor areas along the Michigan and Illinois basin margins. Microbe samples will be collected anoxically in the field and preserved for polymerase chain reaction analysis, fluorescence in situ hybridization, scanning electron microscope analysis, and culturing experiments. These types of analyses will enable me to identify and image the active microbial communities present in the shale formation waters. Shale formation water and gas samples will also be collected simultaneously with microbe samples and analyzed for elemental and isotope geochemistry. Microbial assemblages for each well can be compared to analogous water, gas, and core chemistry to better constrain the microbial processes responsible for major unconventional gas resources.