

Using Stable Isotopes to Understand Methane Origin, Migration and Mixing

Lindsay Bowman¹, Shikha Sharma, Michon Mulder, and Andrea Sack

¹WVU Stable Isotope Laboratory

Abstract

Dissolved and produced gas samples were collected from shallow groundwater aquifers, coal beds, and gas wells producing from shallow Devonian Sands and Marcellus Shale in North Central West Virginia and southern Pennsylvania. Our preliminary results indicate that stable isotopes are excellent tools to distinguish sources of methane and to test for hydrologic isolation of reservoirs during hydraulic fracturing. However, caution needs to be taken when applying these isotopic approaches to understand sources of dissolved methane (commonly referred to as stray gas) in groundwater aquifers. This is because the isotopic and molecular composition of dissolved gas can be significantly modified by changes in sampling methodologies, biological processes, redox conditions and physical processes such as migration and mixing. In addition, the complex structural regime of the Appalachian makes it difficult to decouple natural migration of stray gas along natural gas along faults/ fractures from new pathways that can potentially be created by hydraulic fracturing activities. The recommended approach to a stray gas investigation is complete integration of localized geology and structure with isotopic and geochemical data.