Tiny tracers tell old tales: Noble gases delineate the source and transport mechanisnm of hydrocarbons in shallow aquifers

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The potential for drinking-water contamination is central to the debate about the environmental impacts of hydraulic fracturing in unconventional hydrocarbon reservoirs. The environmental implications for the presence of elevated methane and aliphatic hydrocarbons (ethane, propane, etc.) in drinking-water remain highly controversial and require geochemical methods that can distinguish between naturally occurring and anthropogenic sources. Our recent work in the Marcellus and Barnett gas fields [1] developed noble gas techniques for distinguishing natural and anthropogenic natural gas sources by distinguishing isotopic fingerprints characteristic of the transport mechanisms through which natural gas migrated through the water-saturated crust. Here, we provide additional noble gas data in a broad and diverse set of geographic locations that validate our initial study and develop a standard model for the presence of naturally occurring thermogenic methane in shallow aquifers. When integrated with hydrocarbon isotope analyses, these methods provide a means to differentiate anthropogenic sources and the mechanism by which stray gas contamination occurs.

[1] Darrah et al., (2014)