

Distinguishing Recent Methane Migration into Groundwater From Natural Methane Sources in the Marcellus Gas Play

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Development of shale gas in the U.S.A has led to public concerns over environmental effects on water resources. Occasionally, methane and other hydrocarbons seep from gas wells and migrate into homeowner water wells. Methane migration is concerning due to its inherent explosion risk and the associated degradation of water quality (i.e., mobilization of metal elements).

Naturally high methane in groundwaters is not uncommon in areas with shale gas development. However, distinguishing waters rich in naturally-occurring methane from newly impacted waters has proven difficult even when pre-drill analysis is available. Previous research has characterized groundwaters with high naturally-occurring methane as rich in chloride, sodium and low in sulfate. In this study, we compare these “natural” high methane groundwaters to putatively impacted groundwaters from across Pennsylvania with the goal of understanding the geochemical differences. To accomplish this, we analyze one case study in Lycoming County, Pennsylvania (PA), where gas migration has been inferred to have begun 6 years ago. We also analyze published data for 9 water wells in Northeastern PA that were determined to have been impacted by gas migration from unconventional shale gas activity. A few methane and metal rich seeps along creeks in PA have also been investigated. Based on these analyses, we have identified geochemical parameters that semi-quantatively distinguish natural high-methane groundwaters from those affected more recently by onset of methane migration. These geochemical tools may be useful in differentiating newly introduced methane from natural methane that has been present over geologic time. These tools may be especially useful for homeowners and regulators in areas where pre-drill analysis was not performed.