

# Fluid flow analysis in fractured rock using structural geometry and geochemical tracers (noble gas isotopes and trace elements)

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Basic scientific research on fluid flow through low permeability rock formations, specifically on how fractures affect fluid flow, is increasingly important because of hydrocarbon exploration in shales and mudstones and because such “tight” formations are being utilized as seals for geologic carbon sequestration. Despite considerable research into fracture networks, there is still a lack of understanding about how fluids move through tight rock and it is difficult to predict the conduits that fluids will take while migrating in the subsurface. Our research characterizes the fracture network present in the middle Devonian rocks of the Appalachian plateau (southern tier of New York and northern Pennsylvania) and uses a variety of chemical tracers to determine the impact of this fracture network on past fluid flow. Notable outcomes from these studies include:

- Identification of up to 10 different sets of extension and shear fractures formed by a complex geologic history
- Determination of the relative timing of fracture formation and implications for the regional strain history
- Chemical evidence suggesting that multiple generations of fluids may have utilized certain fracture sets for flow

## Complex Fracture Array



## Trace Element Fracture Profile

