University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE
CHESAPEAKE BIOLOGICAL LABORATORY

MOUNTAIN RIDGE MINERS

MARYLAND
DEPARTMENT OF NATURAL RESOURCES

Fracking in western Maryland

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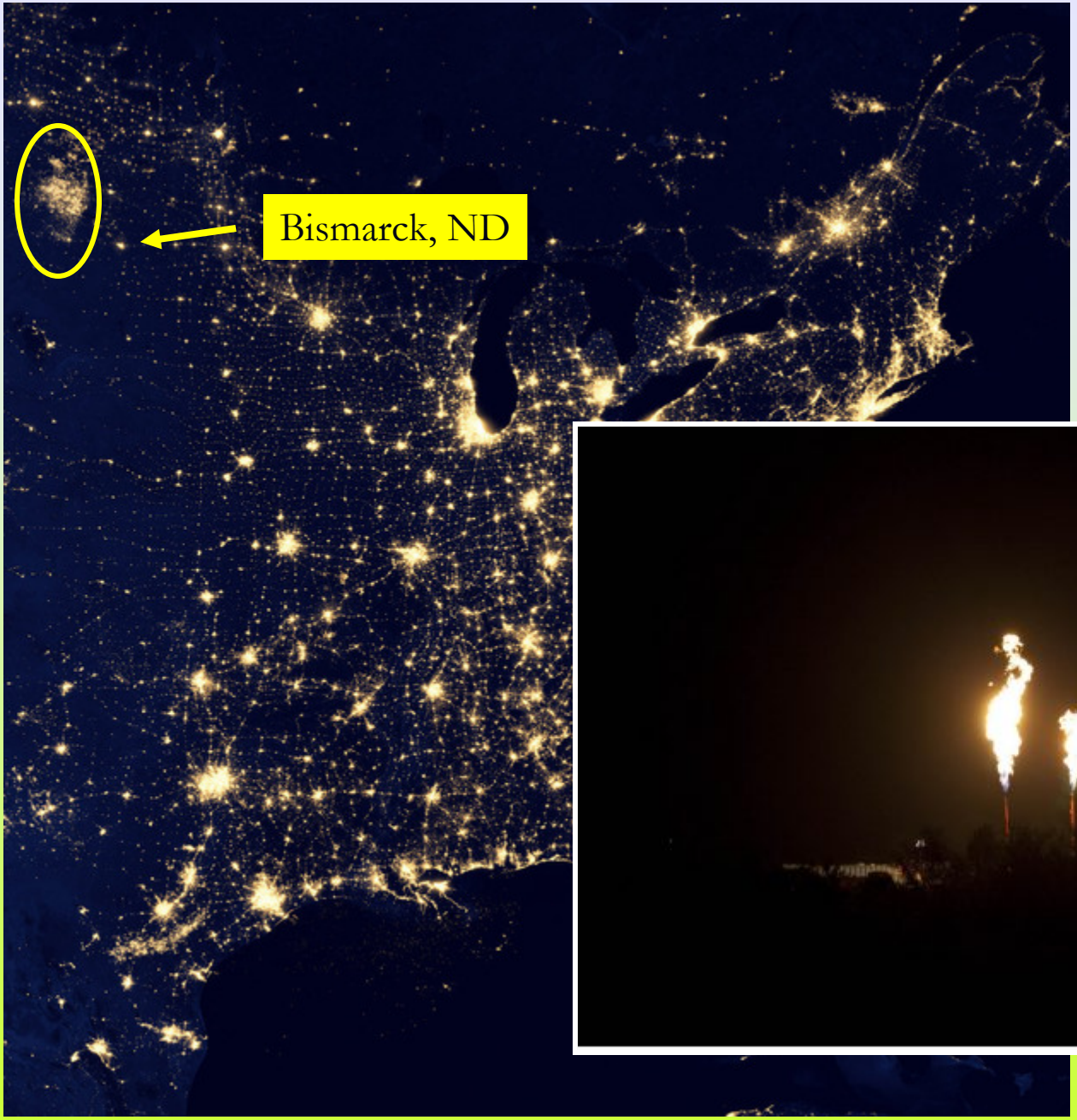
This seminar will consist of three parts:

I. What is fracking and why should we be concerned about it?
II. What is the situation in western Maryland?
III. What is CBL doing to address this issue?

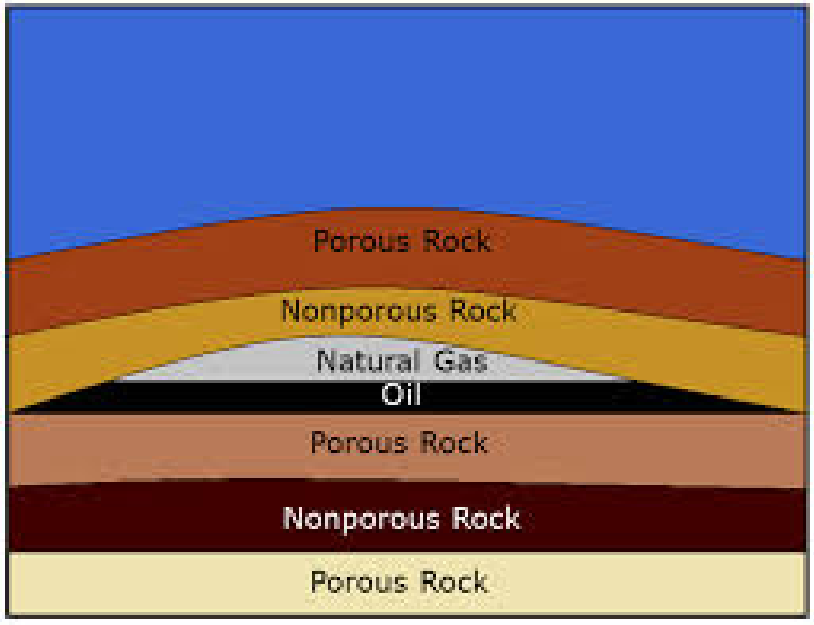

Bismarck, ND

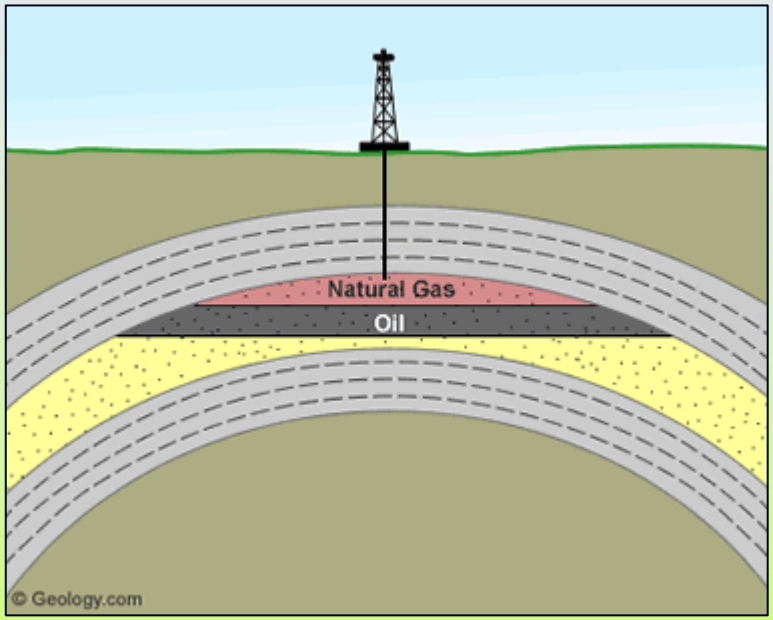
How are fossil fuels formed?

Coal (and gas)

Oil and **gas**

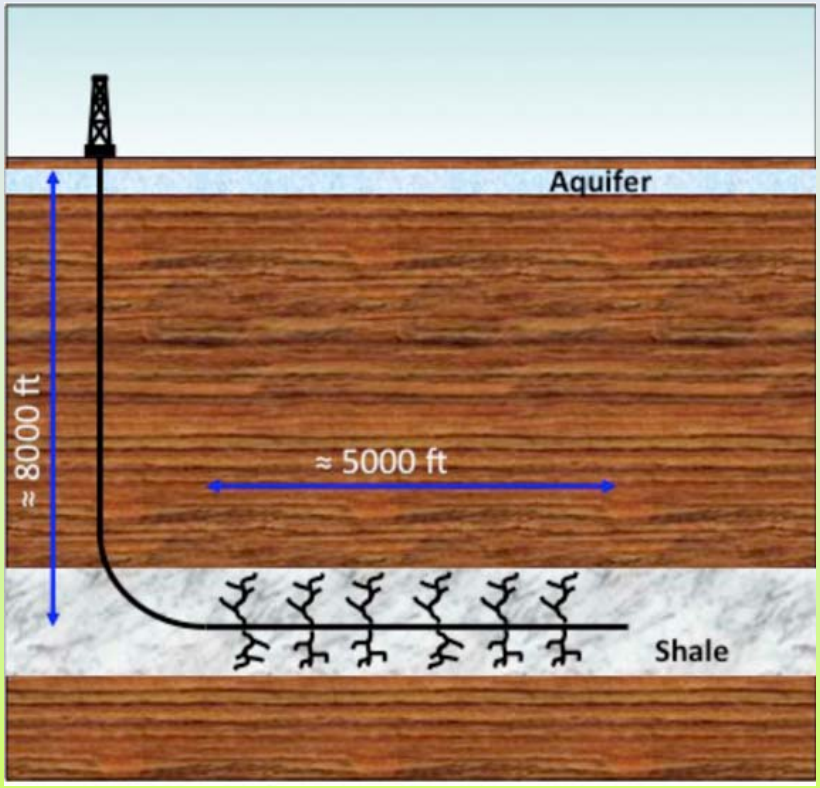
What is the difference between conventional gas drilling and fracking?





In many places natural gas is trapped in giant pockets that can be accessed by drilling straight down from the surface. The gas is under high pressure, so once the pocket is breached it flows up freely.

What is the difference between conventional gas drilling and fracking?



In other places natural gas is trapped in an oil/gas-rich but impermeable rock called shale. The gas is released by a combination of directional drilling and hydraulic fracturing (‘fracking’).

Fracking fluid contains:

1. Water.
2. Proppants (mostly sand).
3. Surfactants (laboratory of Dr. Michael Gonsior).
4. Anti-corrosives.
5. Hydrocarbons (laboratory of Dr. Andrew Heyes)
6. Bactericides.
7. etc. etc.

The mixture varies from company to company, is typically considered proprietary, and poorly regulated.

“Aye, there’s the rub”:

1. Fracking a *single* well requires 8-38 million liters of water.
2. At depth, the fracking fluid mixes with groundwater that contains high levels of salt.
3. After fracking, 10–40% (several million liters!) of this mixture returns to the surface as ‘produced water’.
4. This liquid waste can be (i) treated; (ii) stored; (iii) reused; (iv) dumped.

Potential problems:

1. Surface water contamination from produced water spills or disposal.
2. Methane leakage into groundwater and air.
3. Habitat destruction.
4. Golden algae.
5. Water demand.
6. Demand for increased infrastructure.
7. Increased truck traffic (exhaust, noise, vibration).
8. etc. etc.

In June 2011 governor O'Malley signed an executive order for the Marcellus Shale Safe Drilling Initiative (MSSDI).

It basically defers the processing of drilling permits for a period of 3 years, creating a window of time to collect baseline data and to establish Best Management Practices.

A MSSDI Advisory Committee was instated that will report back to the governor.

Chair: David Vanko

Dean of College of Science and Mathematics

Towson University

Heather Mizeur

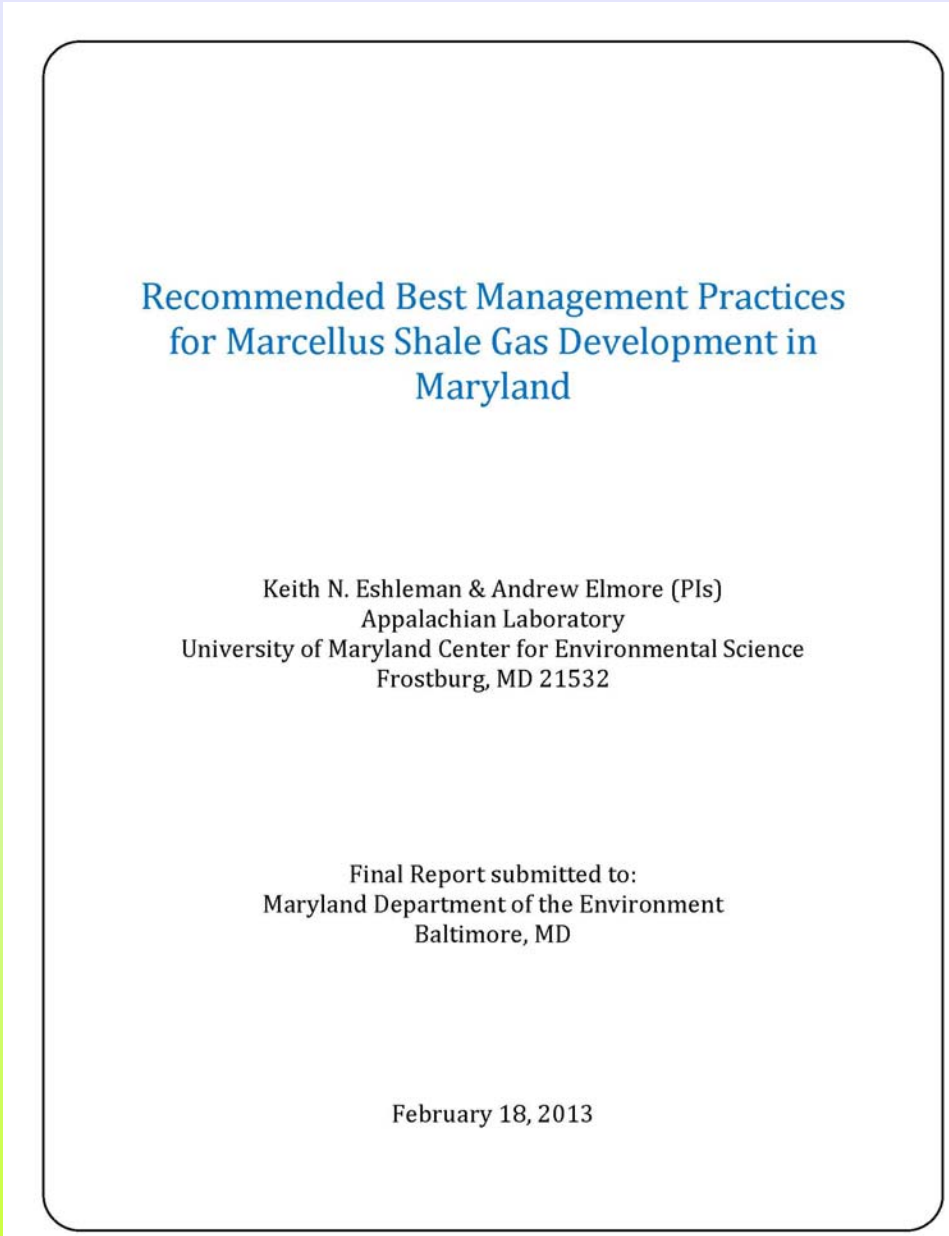
State Delegate (D)

Montgomery County

Also includes: county politicians, mayors, state agencies, local stakeholders, gas company rep, lawyer.

The primary focus of the MSSDI Advisory Committee is:

- Generation of revenue
- Liability for onsite and offsite impacts
  - Revenues and bonding
  - Surface Owners Protection Act (SOPA)
  - “Rebuttable presumption” (e.g., 3000 ft/1 year)

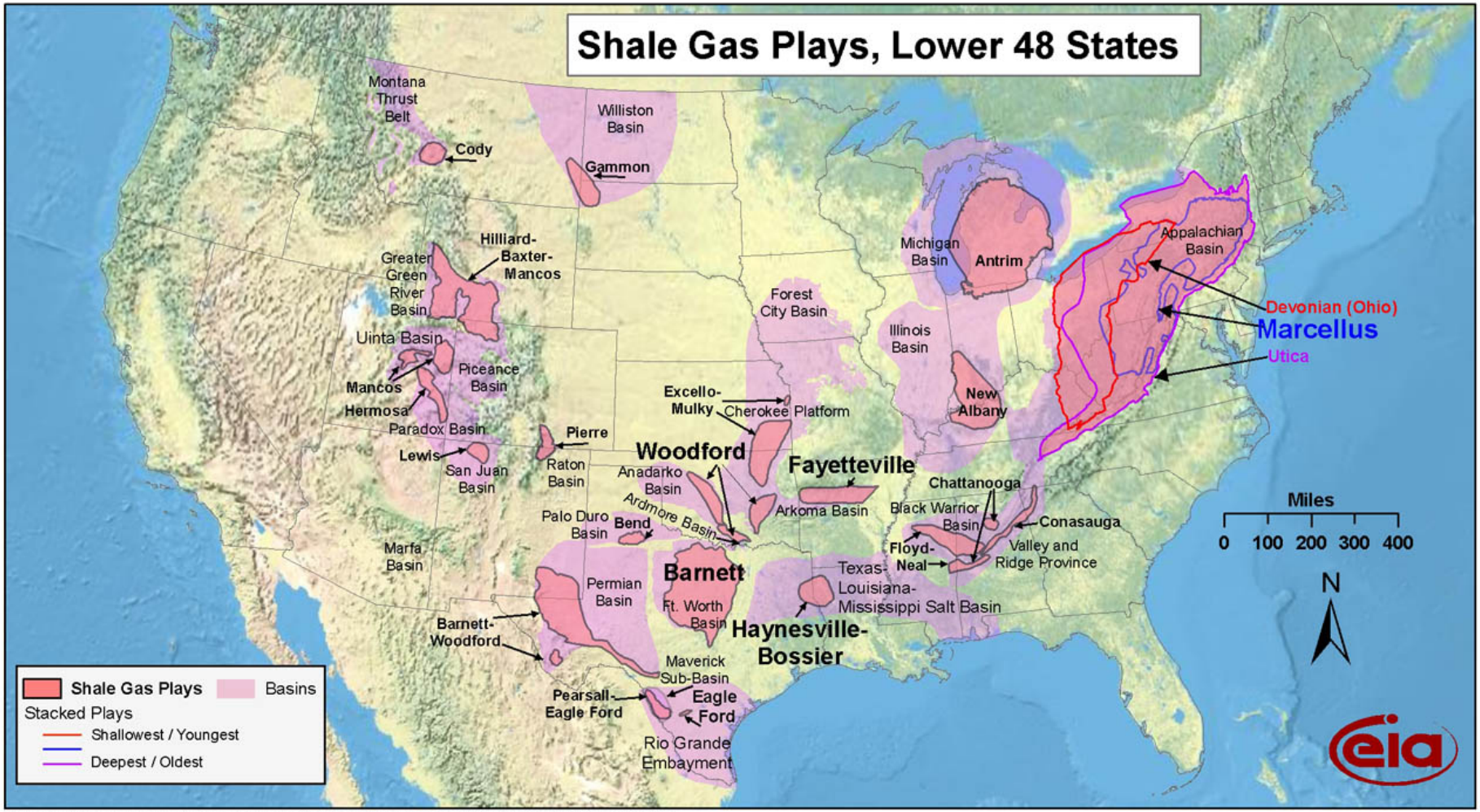


In the mean time UMCES has not been sitting still:

Dr. Keith Eshleman and Dr. Andrew Elmore of AL have issued their own report.

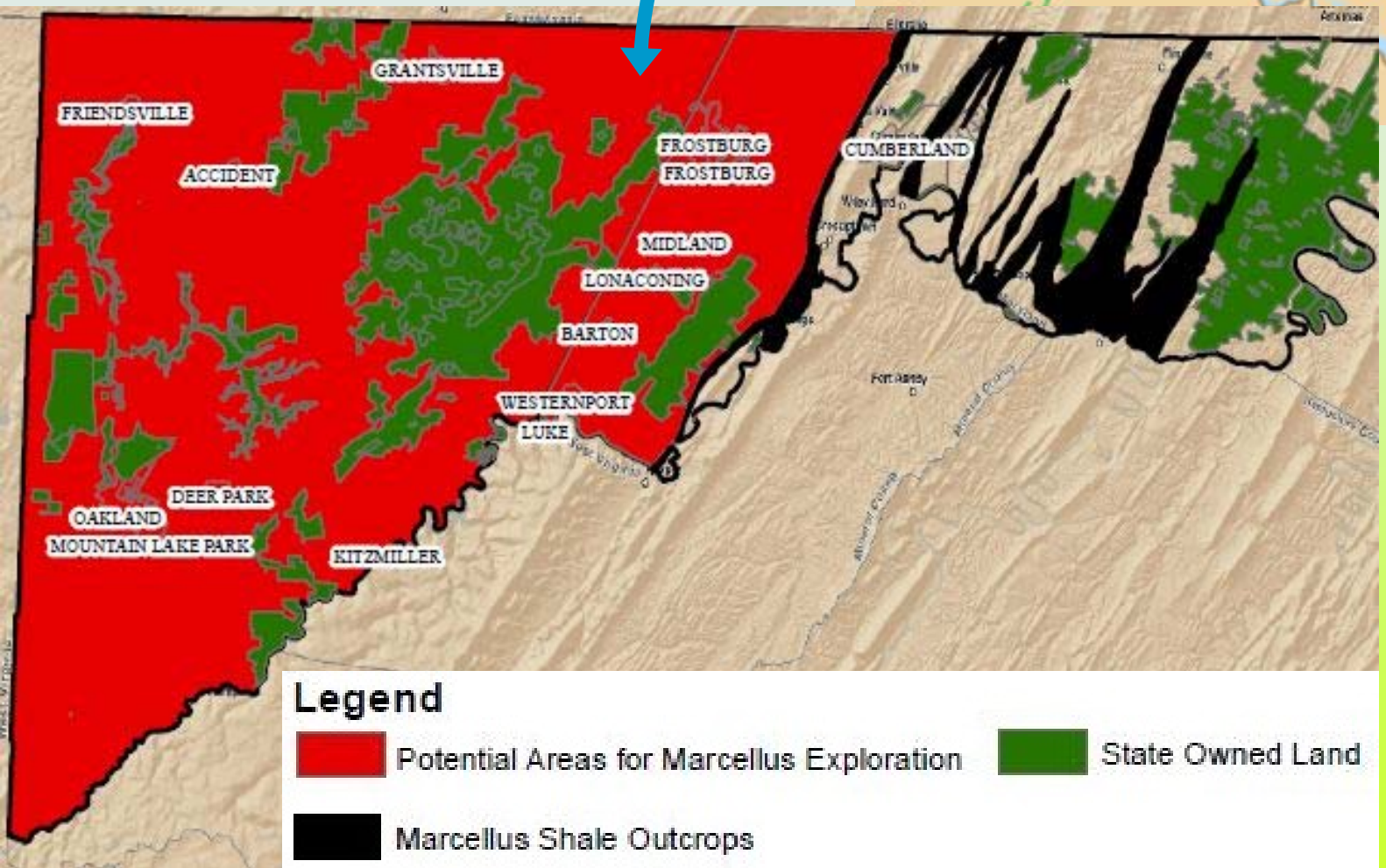
For this effort they recently independently won the USM Regents' Award.

What is going on in Maryland?

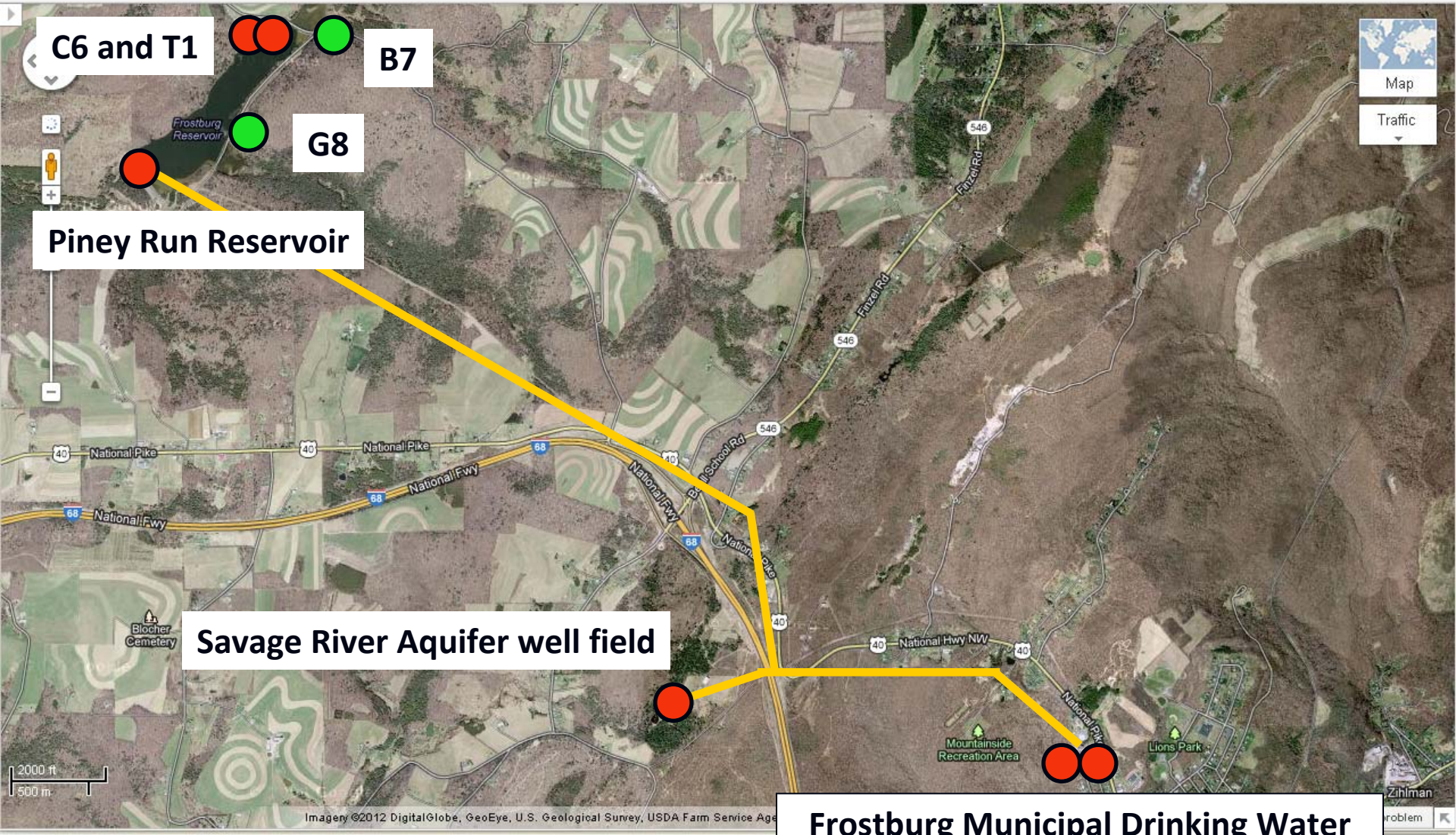


Source: Energy Information Administration based on data from various published studies.
Updated: March 10, 2010

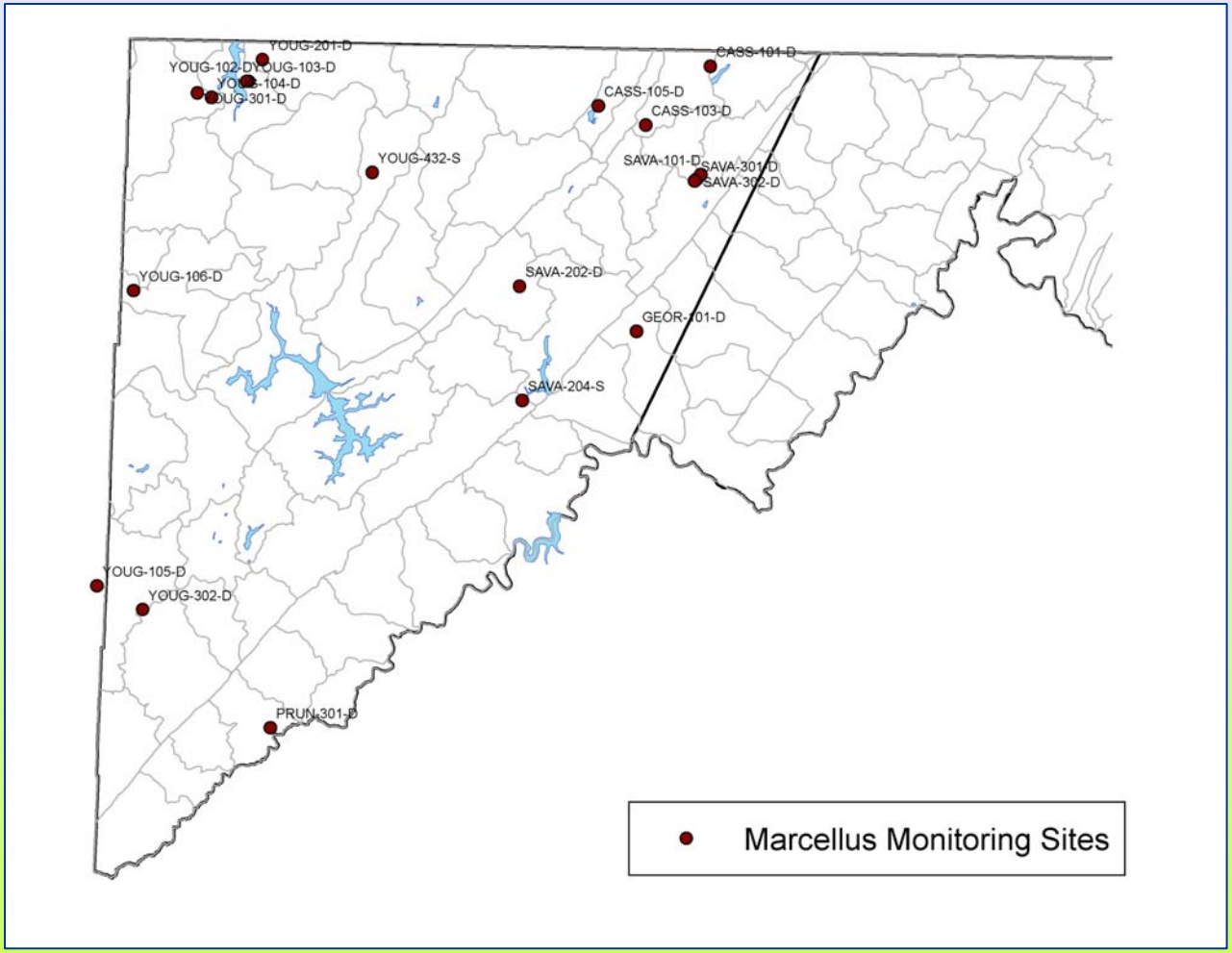
The Marcellus Shale in western Maryland



2012 sampling (Feb–Feb, monthly)

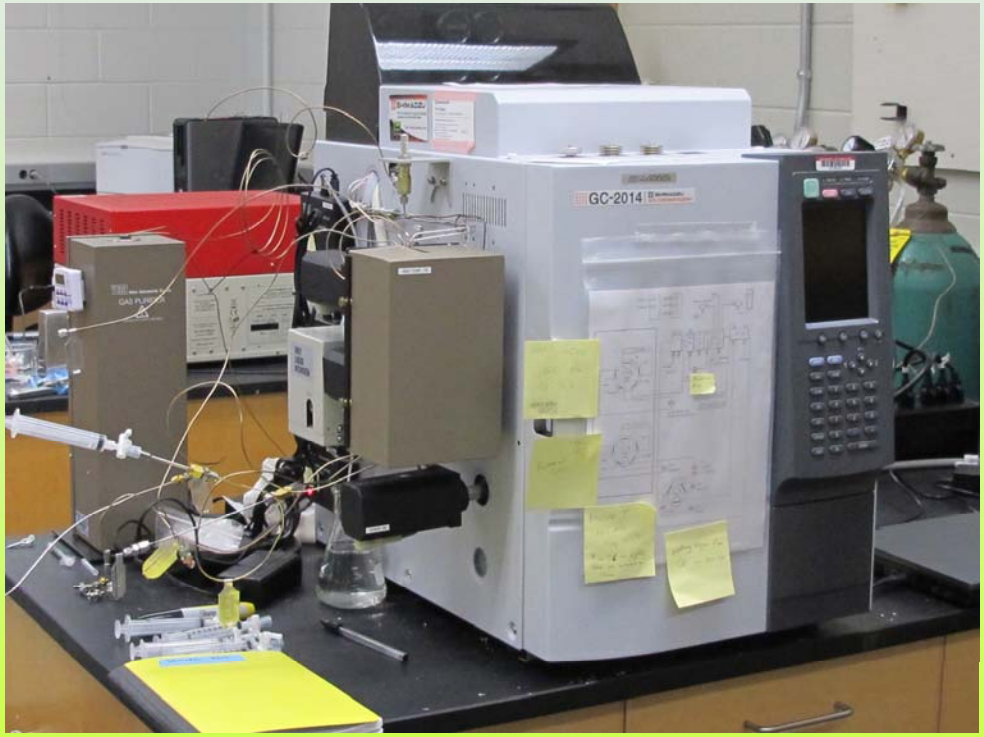


2013 sampling (Apr–Apr, bimonthly)

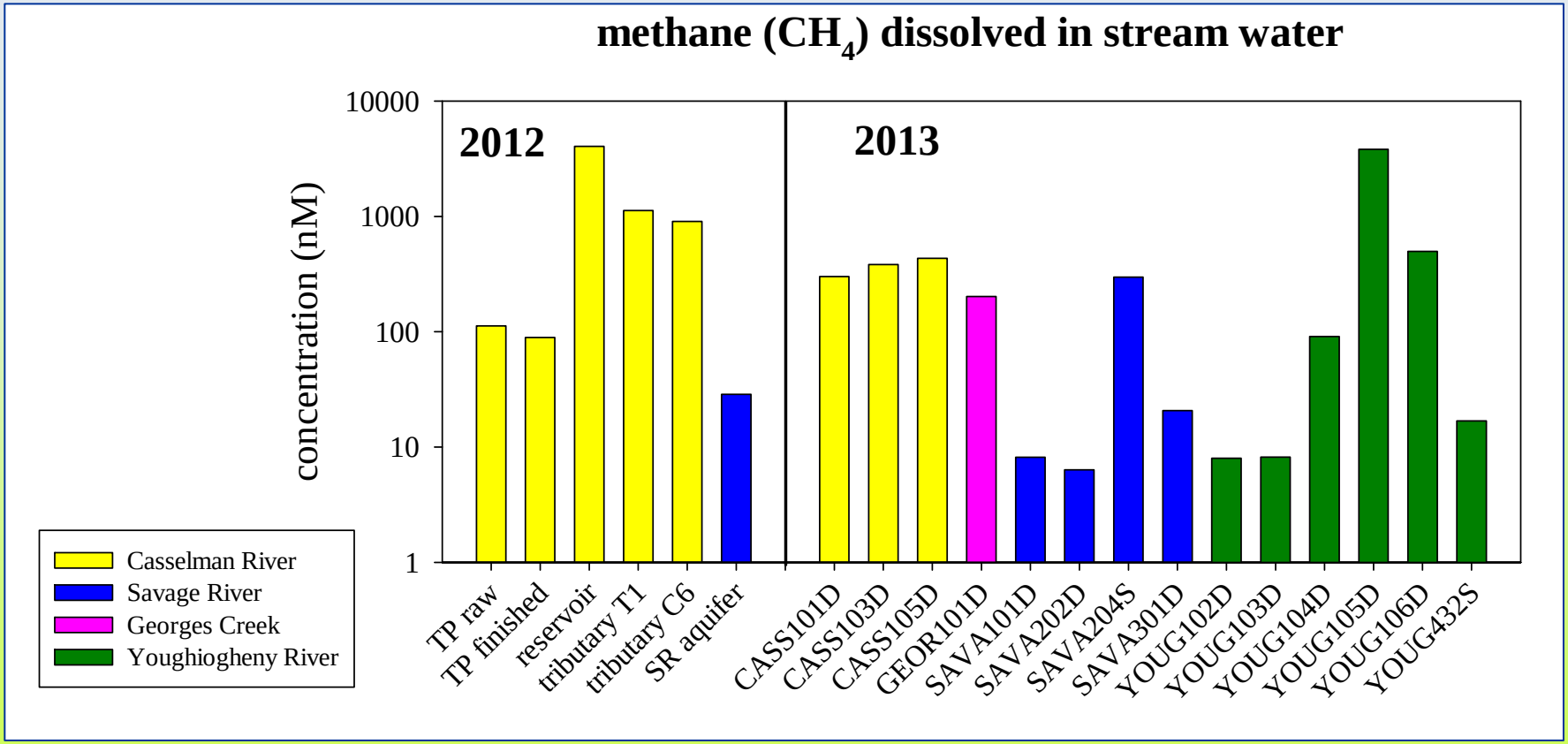


Four watersheds: Casselman, Savage, Georges Creek, Youghiogheny

Methane is measured by gas chromatography (concentration) and cavity ring-down laser spectroscopy (carbon isotope ratios)



Variation in space (data for October)



YOUG105D

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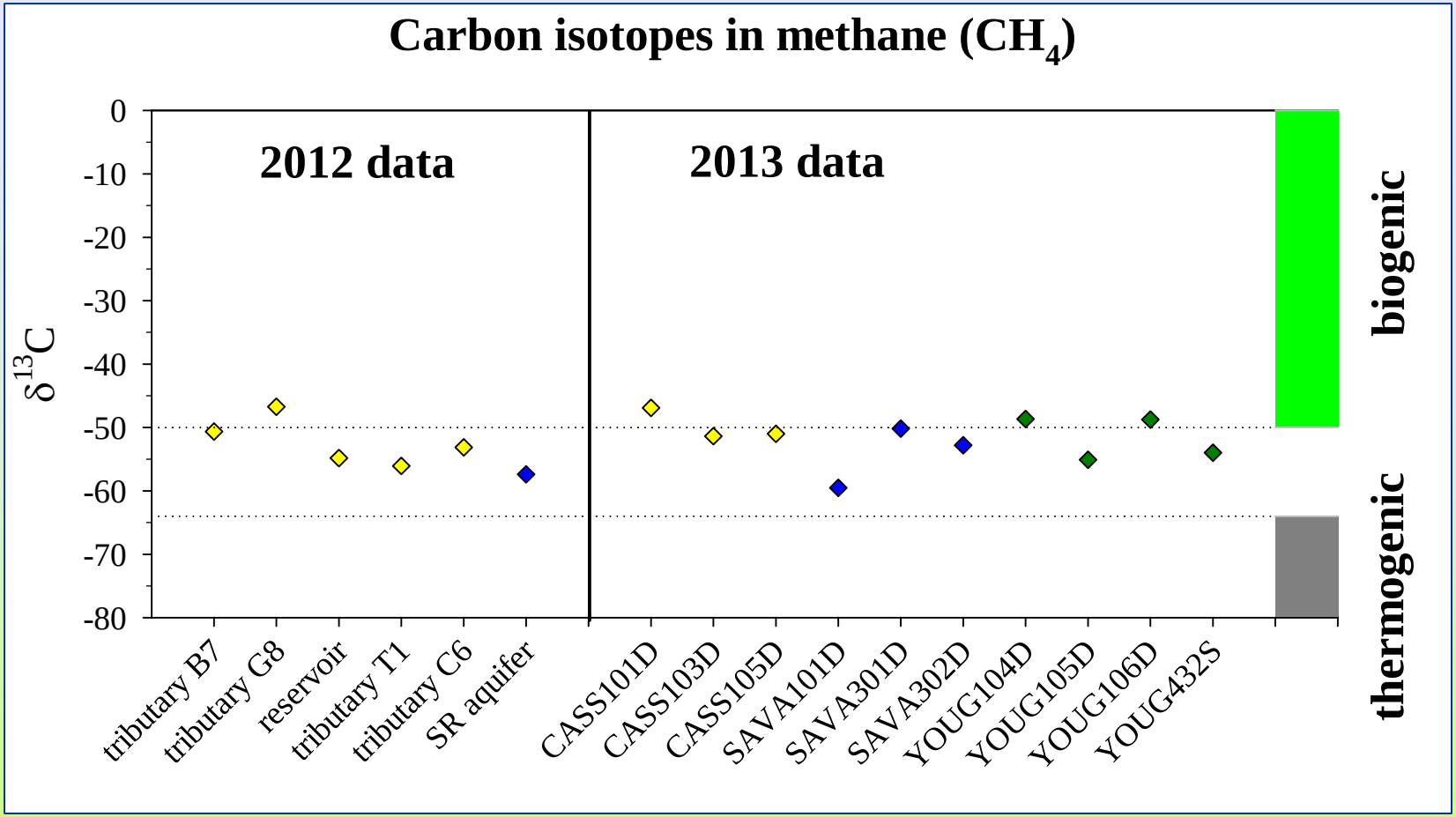
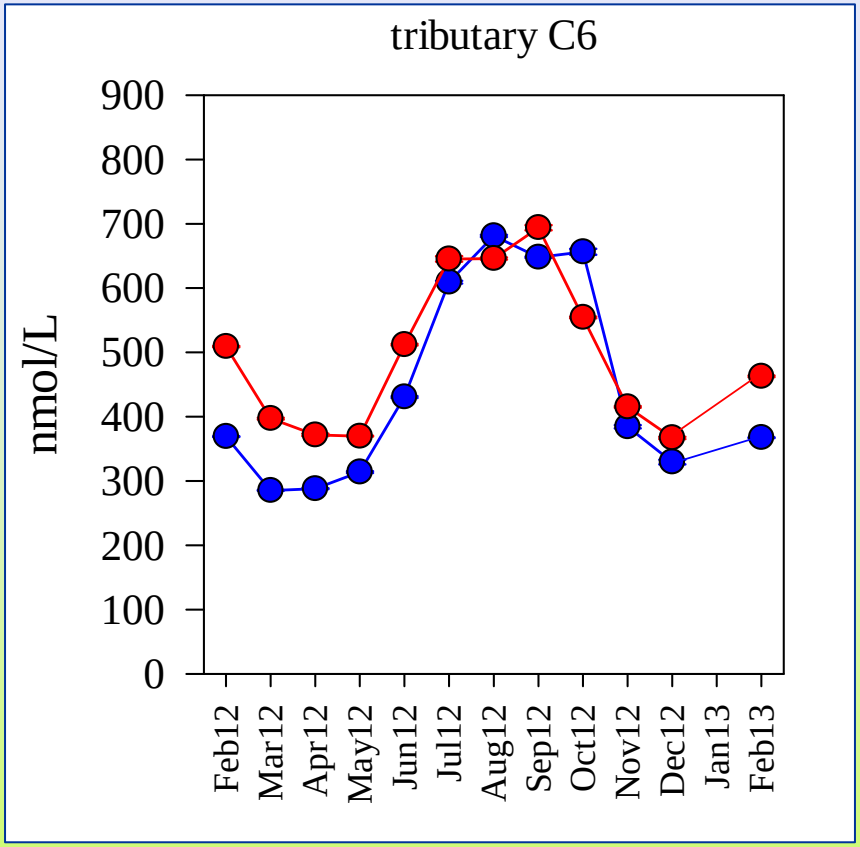
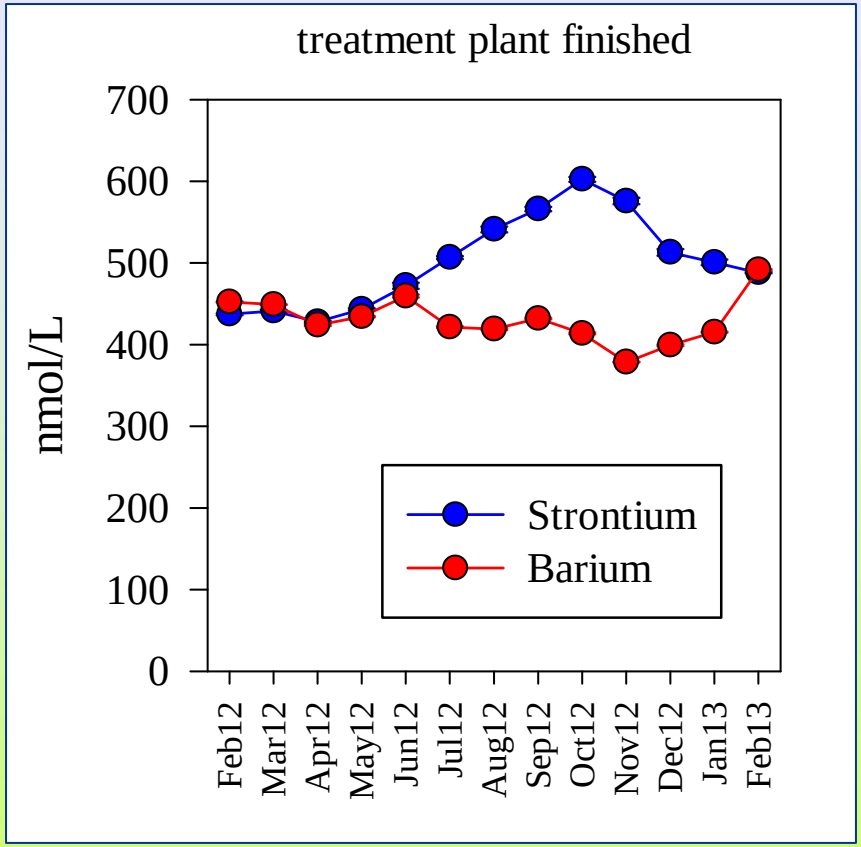


Because of issues with our Picarro instrument, isotopes were measured by IRMS at Florida State University. **Biogenic** means naturally produced by bacteria; **thermogenic** means fossil methane coming from deep underground.

Strontium and barium are measured by inductively coupled plasma mass spectrometry

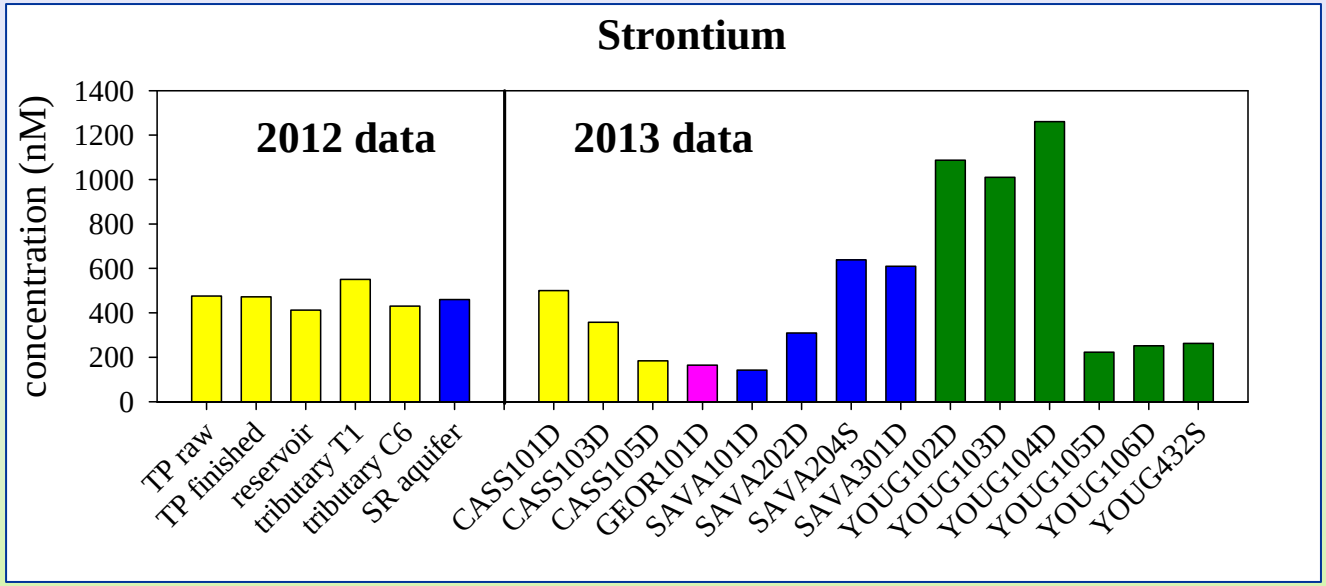
Variation in time (2012 data)

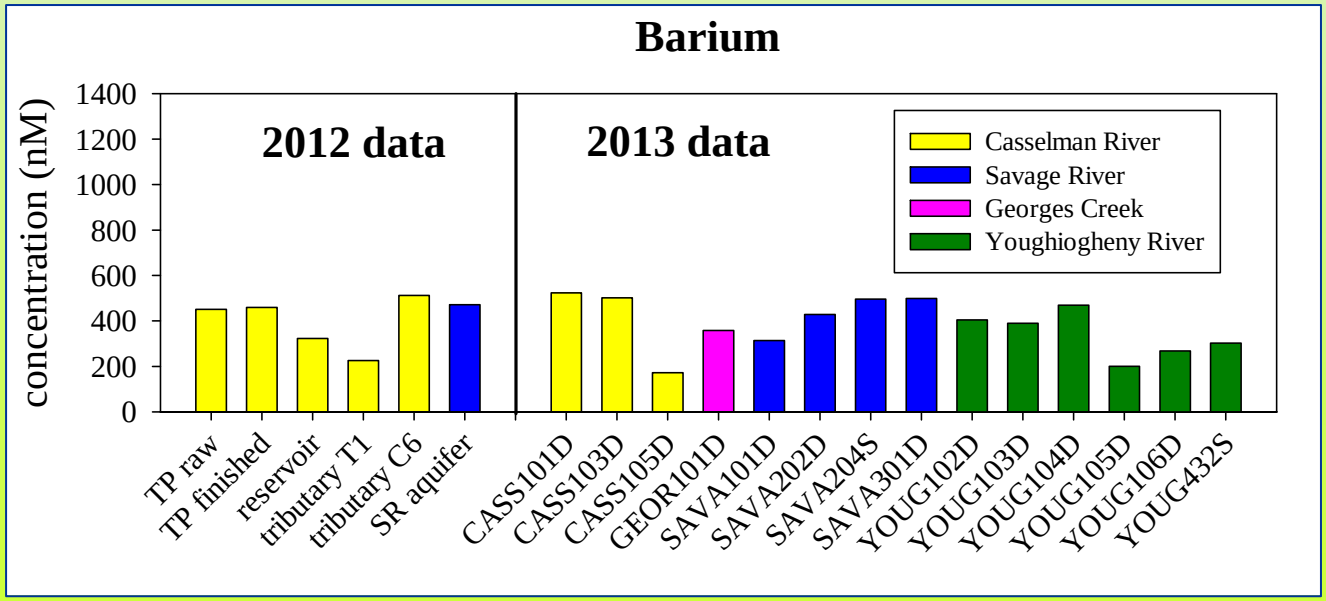




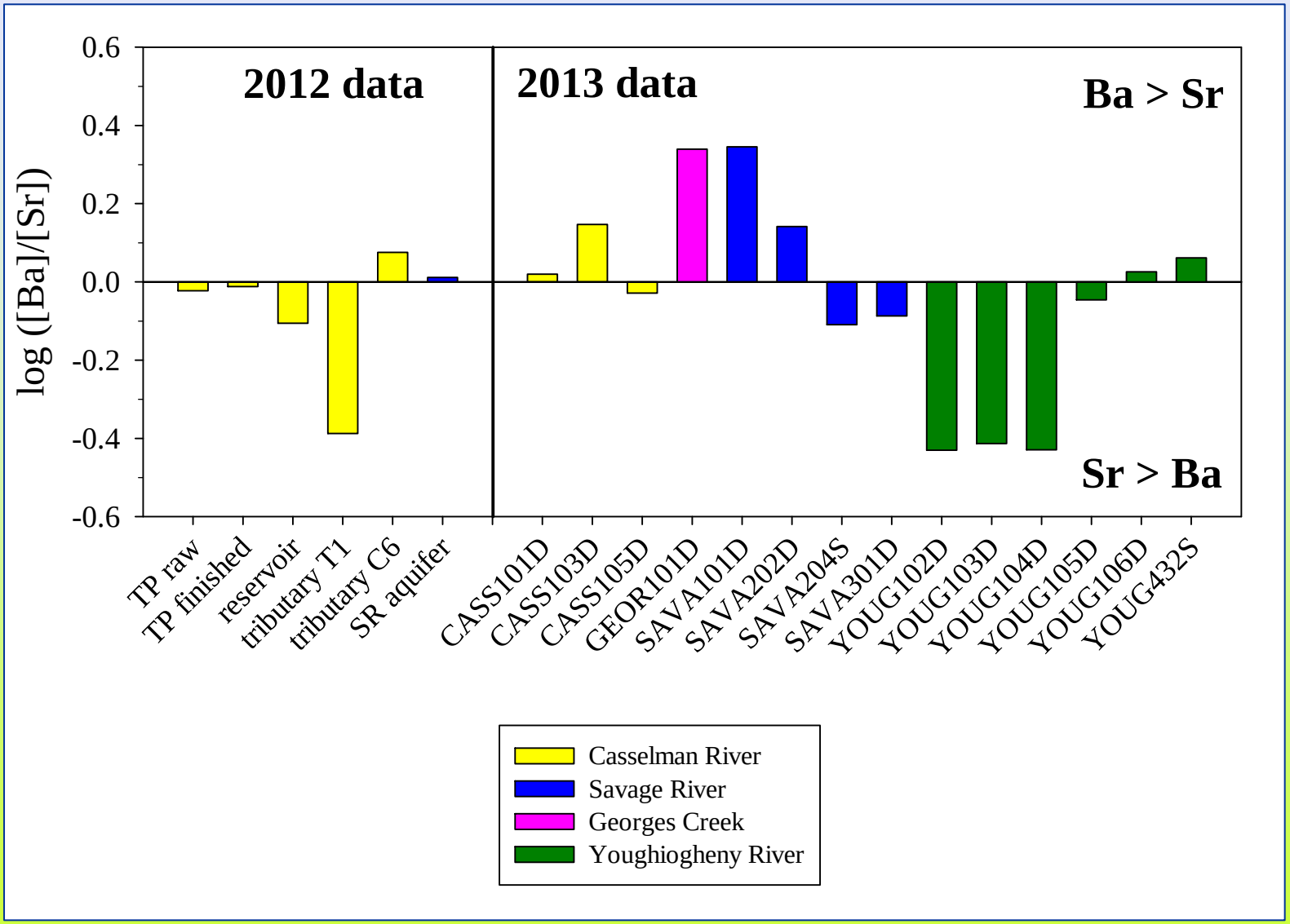
These elements derive from deep groundwater and are very enriched in the produced water, but their natural concentrations are low. They may therefore be a good indicator of spills.

Variation in space (data for June)



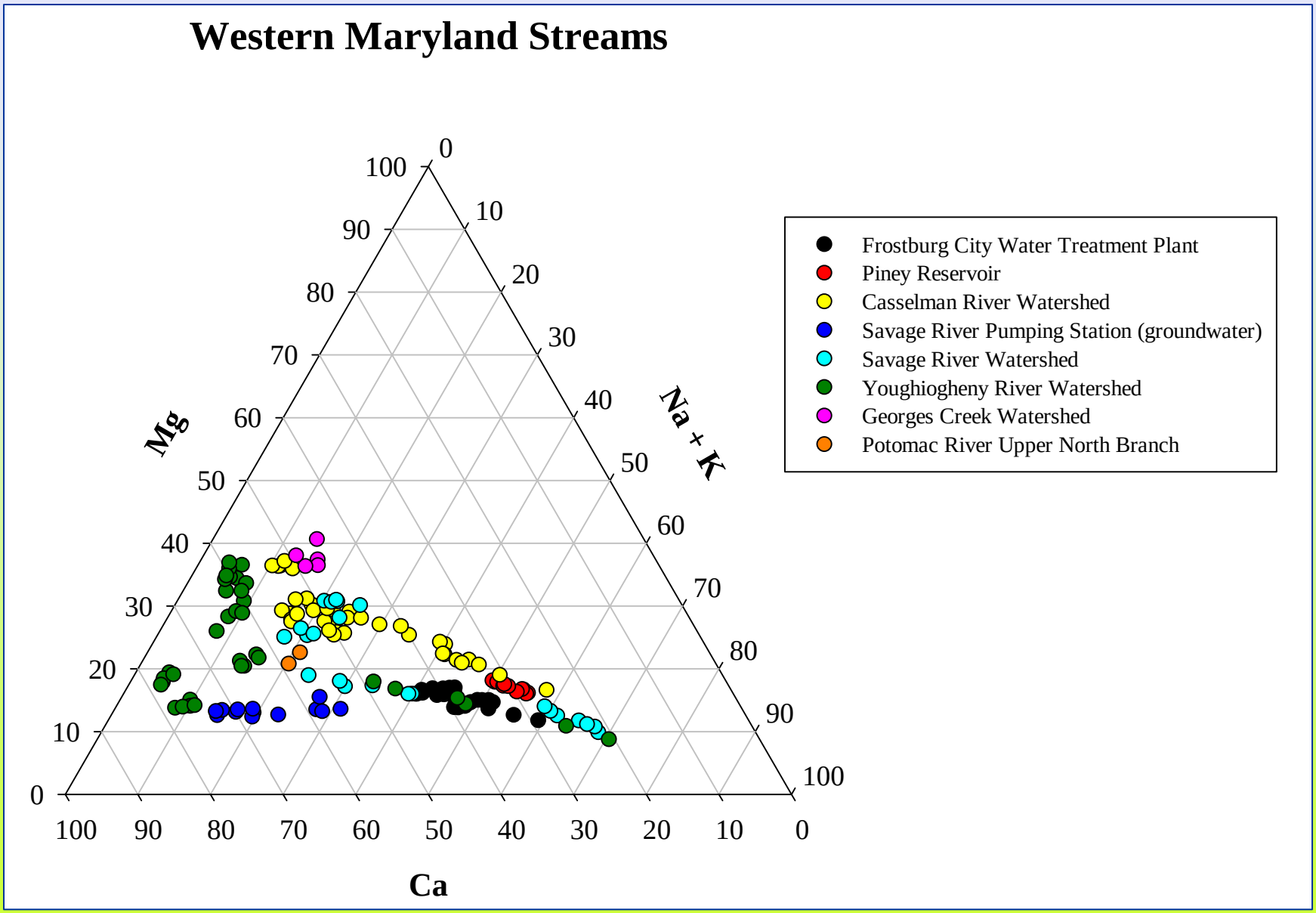


Comparison of Sr and Ba (data for June)

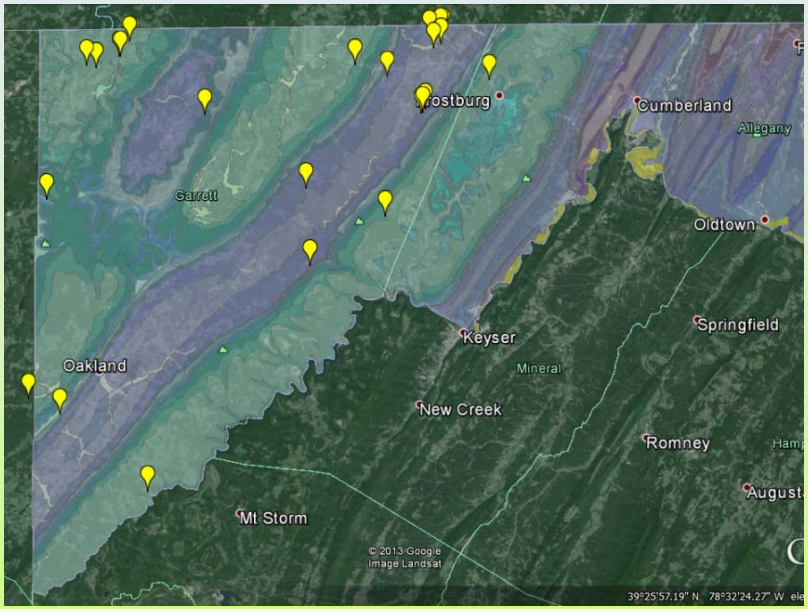


Major ions are measured by inductively coupled plasma atomic emission spectrometry

Comparing major ion composition by watershed



Looking at the geology of the underlying bedrock



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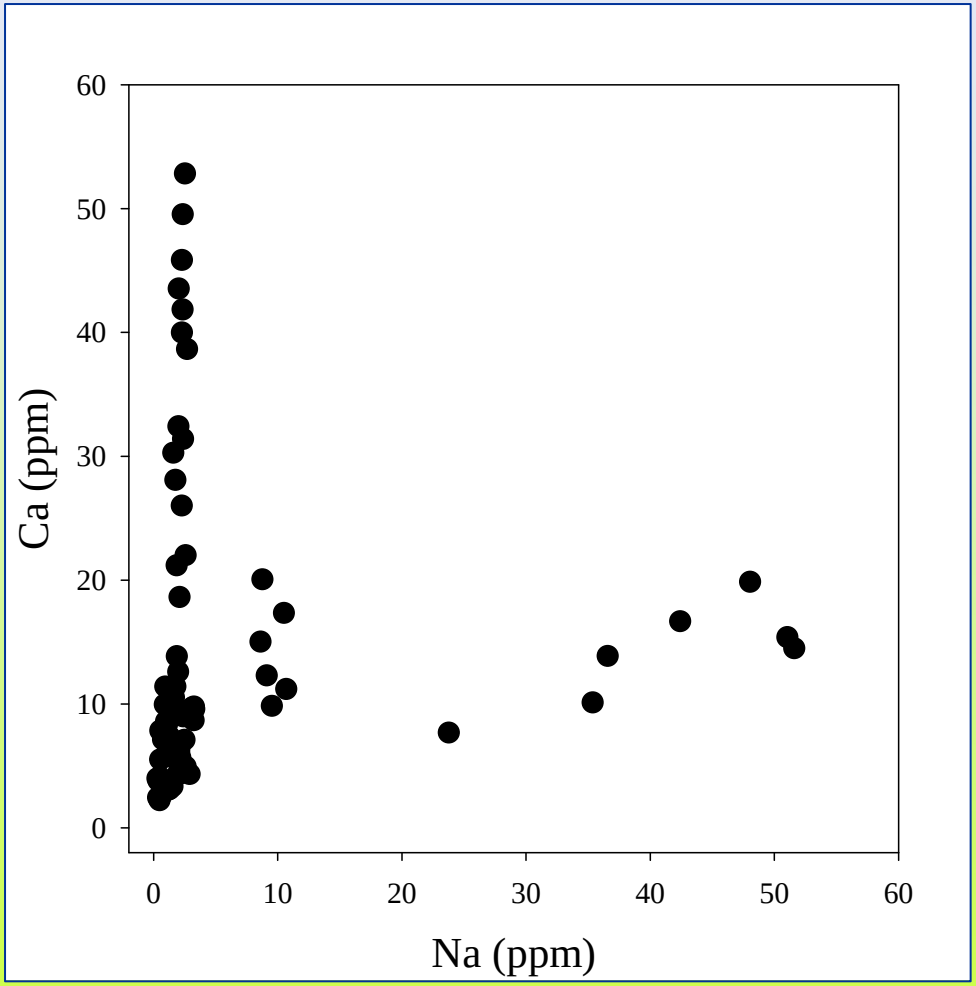
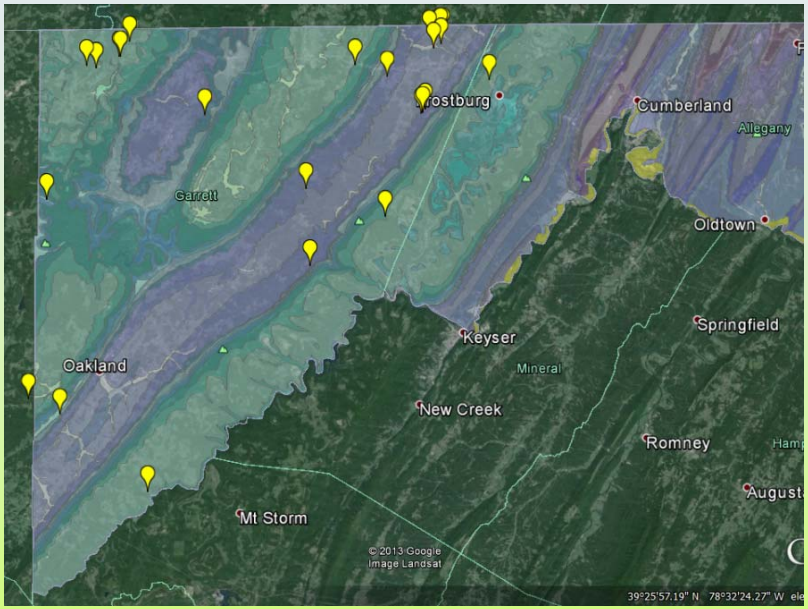


green = Devonian era
purple = Pennsylvanian era

Looking at the geology of the underlying bedrock



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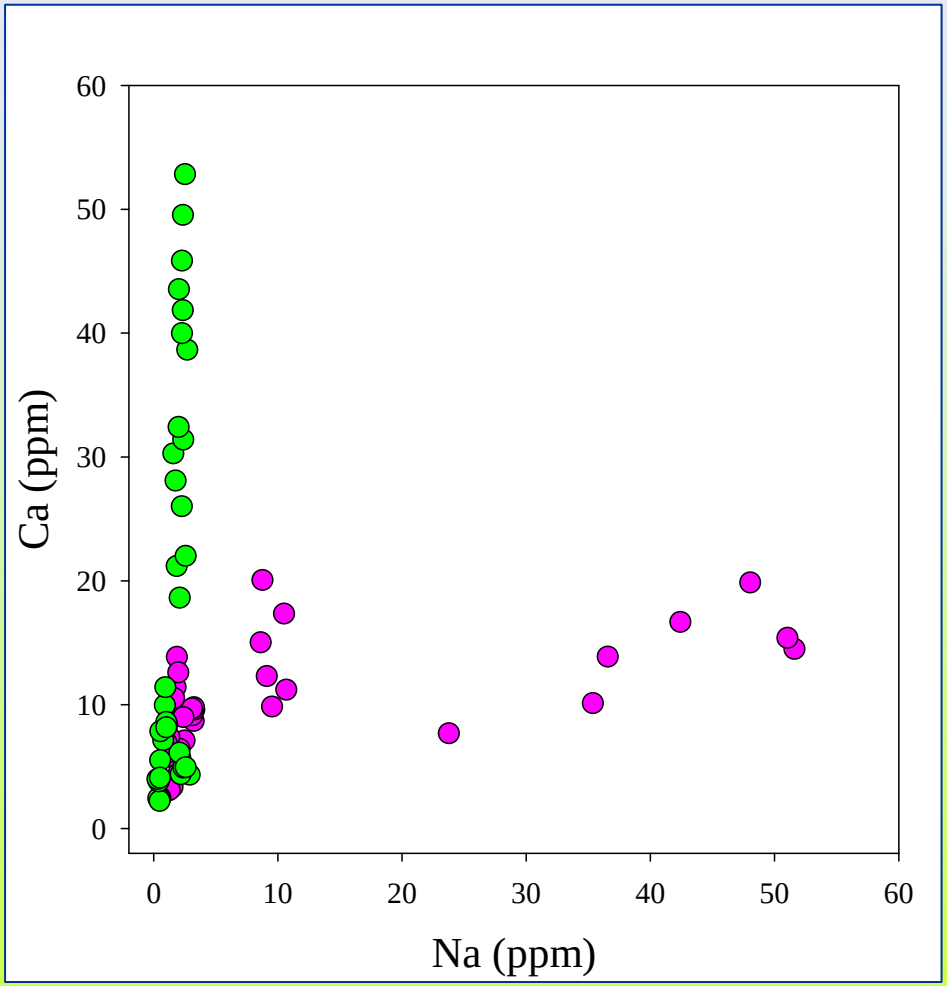

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Conclusions

1. The governor's Marcellus Shale Safe Drilling Initiative is providing us with a unique opportunity to generate essential pre-fracking baseline data on water and air quality.
2. Methane is currently found in western Maryland streams; although isotope data are somewhat inconclusive, it appears to be mainly of biogenic origin.
3. Background stream concentrations of strontium and barium are highly variable in space and time; this may greatly complicate their use as indicators of potential produced water spills.
4. Stream levels of major cations, like sodium and calcium, appear to be related to the highly intricate geochemistry of the underlying bedrock.

Acknowledgements

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