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2006 EPA Graduate Fellowship Conference

From Discovery to Solutions: Generation X Scientists Lead The Way

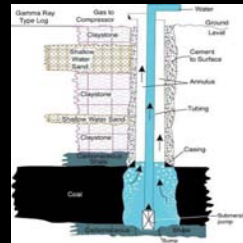
Water & Soil Quality Issues Associated With Coal Bed Natural Gas Development Using Strontium Isotopes as an Environmental Tracer

Coal Bed Natural Gas Development

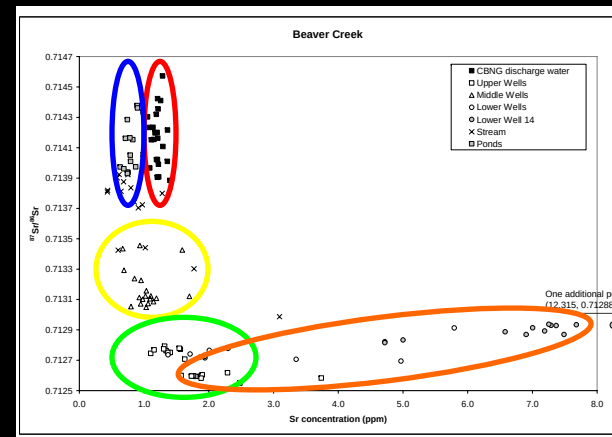
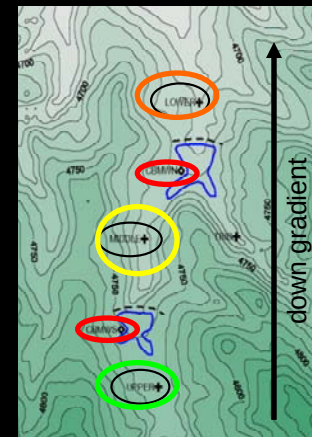
- Extraction of Coal Bed Natural Gas (CBNG) involves pumping large amounts of Na-rich water—an environmental concern.
- Water is disposed of primarily in three ways:
 - Off-channel ponds
 - In-channel ponds
 - Irrigation



WYOMING

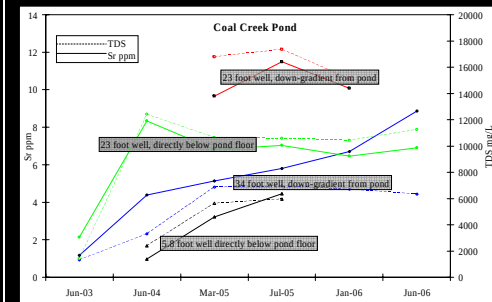


In-Channel Impoundments



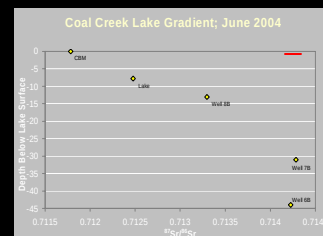
- Strontium isotopic composition easily distinguishes **CBNG water** from **local groundwater**.
- The intermediate $^{87}\text{Sr}/^{86}\text{Sr}$ ratio at the **middle well site** indicates mixing between CBNG and local groundwater.
- Precipitation of calcium bearing minerals is shown by the decrease in strontium concentration from the atmospherically isolated **CBNG water** source to the **in-channel impoundment**.
- Dissolution of local calcium bearing salts is implied by the increase in strontium concentration at the slightly off-channel **lower wells**.

Off-Channel Impoundments



Degradation of groundwater below off-channel ponds has been characterized by increased TDS levels. This study shows that Sr concentration is also an indicator of this degradation in groundwater below Coal Creek Pond.

The strontium isotope ratio of the introduced CBNG water is quickly swamped by dissolution of local salts.



Irrigation



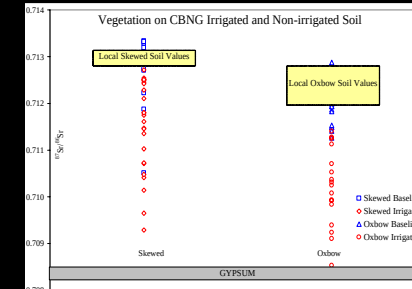
Oxbow Field

- Irrigated for 3 years
- Gypsum and Sulfur amendments

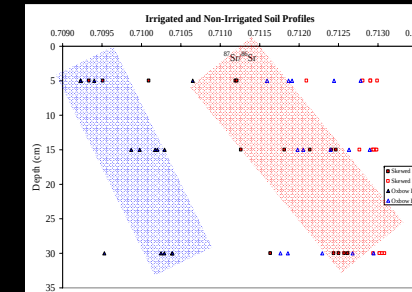


Skewed Field

- Irrigated for 1 year
- Gypsum and Sulfur amendments



The vegetation on the irrigated fields (in red) take up a gypsum source of calcium. Skewed, which has only been irrigated for one year, shows more variation in calcium source.



The irrigated fields exhibit $^{87}\text{Sr}/^{86}\text{Sr}$ ratios that vary with depth due to the influence of the gypsum, which is applied to the surface. The steeper gradient of the irrigated Oxbow profile results from a longer equilibration time.

Conclusions

This study demonstrates that:

- Strontium isotopic composition can be used to trace the infiltration and impacts of some CBNG water.
- Strontium concentration changes may indicate degradation of groundwater.
- Strontium isotopes are effective tracers of the calcium cycle in environmental studies.

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