

Using Stable Isotopes to Identify Formation-waters in the Williston Basin

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During exploration and production operations the question often arises “Is a fluid sample recovered from a flow-test pure formation-water or contaminated with drilling mud?” A variety of water chemical techniques (e.g., “stiff” diagrams) have historically been used to answer this question. However, standard chemical fingerprinting techniques can be problematic or ambiguous, especially when working in environments with evaporites (hence brine formation water), or in shallow (fresh formation water) settings. Both settings are found in the Williston Basin. A new technique using stable isotopes of hydrogen, oxygen and strontium in formation waters has been developed that overcomes many of the problems with previous fingerprinting methods.

Previously demonstrated examples using stable isotopes have been based on well-characterized isotopic “profiles” obtained in selected areas with extensive data coverage (such as the Midale area, SK). However, isotopic methods can work even in cases when an isotopic profile has not been established. Examples of such applications include:

- Identifying anomalous water production from the Winnipegosis Formation in the Steelman Field, based only on samples collected from Winnipegosis producers;
- identifying the presence of formation-fluid in Drill-Stem-Test recoveries in wells in the “fresh water zone” in southwestern Saskatchewan;
- a potential tool for monitoring waterfloods.

Isotopic fingerprinting techniques are relatively fast and inexpensive. They have proven useful in a wide variety of exploration and production settings, even in areas without well-defined isotopic profiles.