Fingerprinting Formation Waters Using Stable Isotopes: Applications To Petroleum Exploration And Production

By Ass. Professor Ben J. Rostron, Dept of Earth and Atmospheric Sciences, University of Alberta, Edmonton, Alberta, Canada, a visiting scientist at CSIRO Petroleum

(WA Branch Meeting on April 11th, 2002)

During petroleum exploration and production operations the question often arises as to wether the fluid recovered during well-testing is pure formation-water or contaminated with drilling fluid? 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. A new fingerprinting technique using stable isotopes of hydrogen, oxygen and strontium in formation-waters has been developed that overcomes many of the problems with previous methods.

Our on-going sampling program has collected more than 900 samples from producing wells and drill-stem-tests in the Williston Basin (Canada-USA). These data have allowed us to create an isotopic database of formation-waters in the basin. This database has enabled the use of isotopic fingerprinting techniques in a variety of exploration and production operations, including:

1) During drill-stem-testing and swabbing operations to determine if the recovered fluid is formation water;
2) As a production monitoring tool, to determine if produced fluids are originating in the perforated zone (versus leaking into the wellbore from other formations);
3) As an aid to exploration, by enhancing understanding of reservoir continuity.

These techniques are relatively fast and inexpensive, and have proven very useful to the petroleum industry.

PESA News No. 57 (2002)