eichrom

Expertise in Sample Preparation

Application Note: 503

SrRSA: Strontium Isotope Residual Salt Analysis

Introduction:

The isotopic geochemistry of carbon and hydrogen in gases has been extensively used in oil & gas exploration for several decades. It provides information on the origin of the gaseous hydrocarbons, on reservoir compartmentalization and on the efficiency of the cap rock. The isotopic composition of strontium in residual salts offers a means of determining vertical and lateral connectivity in reservoir units and the chronology of hydrocarbon filling of the structures. The Total SA, Fluids and Organic Geochemistry laboratory has developed a set of sampling and analysis techniques for increasing the vertical resolution and precision of the measurements while reducing the time and cost of analyses. It has thus become possible to conduct precise isotopic screening of the zones to be characterized and thereby provide new keys to interpretation.

One component of this characterization approach is Strontium isotope Residual Salt Analysis (SrRSA). The residual salts are extracted from the cores by washing in an ultrasonic bath with distilled water. Another possibility is to collect formation and/or reservoir waters to determine their origin (paleo-aquifer or present-day aquifer).

Historically, very accurate measurements of the strontium isotope ratios by ICP-MS or TIMS have been hindered by isobaric interferences between ^{87}Sr and ^{87}Rb. To overcome this issue, the Total approach utilizes a sample preparation system to purify the strontium isotopes from interfering rubidium.

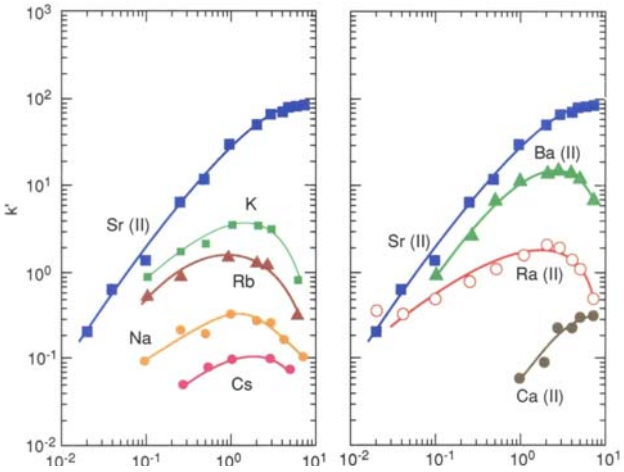

Figure 1. Uptake of Various Metal Ions by Sr Resin

Sample Preparation:

Figure 2. ASPEC-XL automated sample preparation system

The technique uses Eichrom's Sr Resin, an extraction chromatographic material which shows very strong and specific affinity for strontium over rubidium, calcium and barium, among others elements. (See Figure 1 above.) The strontium is separated out on a solid phase extraction system (ASPEC-XL) into which Sr Resin cartridges are incorporated. Beside the selectivity of this resin for Sr over Rb, another advantage is that it can operate under pressure, which considerably reduces elution time. This automatic system can process **200 samples a week**.

Isotopic Measurement:

The isotopic analysis of the strontium is undertaken using an ICP-MS-MC (AXIOM). Over 200 samples can be analyzed per week, with a precision better than 10ppm. This methodology can be applied to samples with ppb levels of strontium content.

Figure 3. Axiom ICP-MS-MC System

Results:

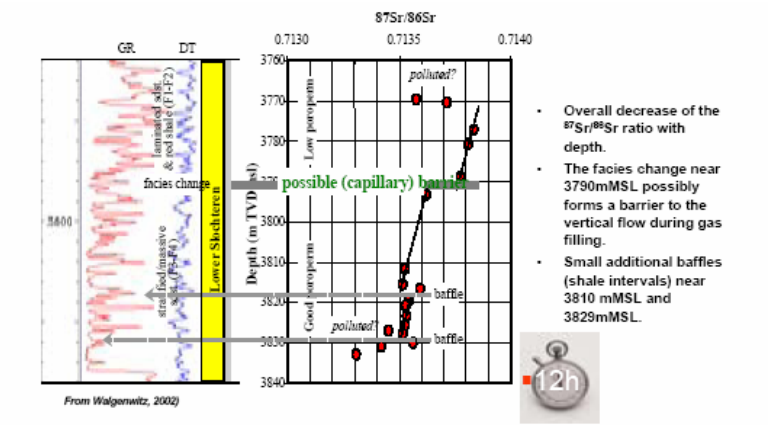

Figure 4. $^{87}Sr/^{86}Sr$ ratio vs. sample depth

Figure 4 is an example of the type of results that this technique can achieve. The isotopic ratio of $^{87}Sr/^{86}Sr$ can be plotted vs. sample depth. Overall the ratio changes slightly with depth. Deviations from this line indicate geological formations which may be significant in the characterization of the petroleum field.

Reference:

Isotope geochemistry in the oil & gas exploration context: progress towards a high vertical resolution screening tool; Y. Poirier, et al., Total SA, Fluids and Organic Geochemistry, Pau, France; Poster presented at: *Applied Isotope Geochemistry-5***,** Heron Island,. Australia May 26-30 2003

www.eichrom.com

Eichrom Technologies, Inc.
8205 S. Cass Ave.
Suite 106
Darien, Illinois
60561 USA
+1-630-963-0320 (tel)
info@eichrom.com

Eichrom Europe
Campus de Ker Lann
Parc de Lormandière – Bât. C
rue Maryse Bastié
35170 Bruz – FRANCE
+33 (0)2 23 50 13 80 (tel)
EichromEurope@eichrom.com