

Sr^{87/86} SIMS microanalysis of diagenetic carbonates and sulfates: preliminary results and perspectives

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Sr^{87/86} isotope ratios are commonly used in sedimentary carbonates and evaporites to infer 1) marine vs non marine origin, 2) stratigraphical age (preserved fossils) or 3) type of diagenetic waters. Sr^{87/86} ratios are generally measured on the bulk carbonate/sulfate fraction or on microdrilled samples. However, in many instances several generations may be present in a single sample, in particular in petroleum reservoirs that suffered complex diagenesis. In such situations, the high resolution (10 µm) provided by SIMS microanalysis on thin sections is the only way to determine the isotopic composition of each individual cementing phase in a diagenetic sequence. SIMS microanalysis is increasingly used for acquiring δ¹⁸O-δ¹³C values of carbonates in diagenetic studies. The work reported here aims at developing the same capability for Sr^{87/86} isotopes.

First, an appropriate analytical procedure was worked out in order to correct measured Sr^{87/86} ratios for instrumental mass fractionation and contribution of any Rb⁸⁷. The analytical procedure was validated on reference minerals of known Sr^{87/86} ratio (TIMS data).

Application tests were conducted on a selection of carbonate, sulfate and halite samples, of variable complexity, for which bulk Sr^{87/86} data were available. The results lead to the following observations. For samples showing high Sr and low Rb content, Sr^{87/86} ratios are determined with an error of ca. ±0.0007. The error however increases significantly with increasing Rb content, up to ±0.001 or poorer. When Rb content is similar or greater than Sr, the Sr^{87/86} determination is not possible. SIMS Sr^{87/86} microanalyses performed on samples of diagenetized carbonate reservoirs are generally consistent with the results of bulk analyses when considering the mean value of many SIMS determinations. However, the variability individual Sr^{87/86} ratios can be much larger than the analytical error (up to 0.01). The extent to which this variation is related to sample heterogeneity or analytical procedure remains unset.

Our preliminary tests show that it is possible to measure Sr^{87/86} ratios of carbonates/sulfates by SIMS microanalysis. At this stage, accuracy is not proper for stratigraphic age determinations, but it is sufficient for distinguishing marine from non marine Sr isotope signatures.