

Lake Kinneret as a natural laboratory to study the carbonate system using $^{88}\text{Sr}/^{86}\text{Sr}$ fractionation in authigenic inorganic calcite

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The precipitation rate of inorganic calcite (R_{cal}) is a function of the calcite degree of saturation (Ω_{cal}), which in turn is a function of the ionic composition and the ambient water temperature. It was found experimentally that the fractionation factor of the stable Sr isotopes between dissolved Sr and authigenic calcite (defined as $\Delta^{88/86}\text{Sr}_{\text{calcite-water}} = \delta^{88/86}\text{Sr}_{\text{calcite}} - \delta^{88/86}\text{Sr}_{\text{water}}$) is a function of R_{cal} [1], this however was never demonstrated in nature. In this study we use carbonate system parameters, CaCO_3 vertical flux and the Sr isotopic composition $\delta^{88/86}\text{Sr}_{\text{water}}$ and $\delta^{88/86}\text{Sr}_{\text{calcite}}$ in Lake Kinneret (Sea of Galilee) to evaluate the relationship between $\Delta^{88/86}\text{Sr}_{\text{calcite-water}}$ and R_{cal} . Lake Kinneret serves as a “natural laboratory” for this purpose, since its Ω_{cal} increases seasonally as a result of massive phytoplankton blooms, which causes calcite precipitation.

Our preliminary results of authigenic calcite that were collected in sediment traps deployed in the lake show a wide range of R_{cal} . The Sr isotopic composition of the dissolved Sr ($\delta^{88/86}\text{Sr}_{\text{water}}$) and the authigenic calcite ($\delta^{88/86}\text{Sr}_{\text{calcite}}$) show that $\Delta^{88/86}\text{Sr}_{\text{calcite-water}}$ depends on R_{cal} . It is concluded that after proper calibration it will be possible to use downcore $\delta^{88/86}\text{Sr}_{\text{calcite}}$ data that was measured on lacustrine (and marine) authigenic inorganic calcite for reconstructing variations in calcite deposition rates.

[1] Böhm F., Eisenhauer A., Tang J., Dietzel M., Krabbenhöft A., Kisakürek B. and Horn C. (2012). *Geochim. Cosmochim. Acta* **93**, 300–314.