

Pore fluid chemical compositions and $\delta^{37}\text{Cl}$ reveal salt precipitation and dissolution mechanism in the Late Quaternary Dead Sea

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A Dead Sea Deep Drilling Project (DSDDP) core drilled at the abyssal floor of the Dead Sea under the umbrella of the ICDP exposed a near complete sedimentary record spanning ca. 200 ka. The pore fluids from the ICDP core had recorded the chemical composition of the deep lake. Here, pore fluids and salt (halite) sampled from the core, as well as salt from units that are exposed at the adjacent Mt. Sedom salt diapir, were used to understand the long term dynamics of salt precipitation and dissolution in the Dead Sea over the last interglacial and glacial periods. During the last interglacial (ca. 132 to 117 ka) when lake levels dropped and halite layers had precipitated, the pore fluid conservative ion concentrations increased (Mg^{2+} and Br^-) and the Na/Cl ratio decreased, a process which was also accompanied by a decrease in $\delta^{37}\text{Cl}$. The changes in $\delta^{37}\text{Cl}$ of the pore fluids were the result of salt precipitation, and values from both pore fluid and accompanying halite layers fit a Rayleigh distillation curve, inferring that external sources of Cl^- into the lake were relatively negligible over that time. On the contrary, during the last glacial (ca. 116 to 14 ka) pore fluid conservative ion concentrations became diluted and the Na/Cl ratio increased, inferring lake dilution and significant dissolution of the salt. This process recharged the lakes Na^+ and Cl^- inventory and salinity, and caused an increase of the $\delta^{37}\text{Cl}$ in the brine. Chemical and $\delta^{37}\text{Cl}$ isotope mass balance calculations from the glacial period point to dissolution of salt at the marginal terraces which had precipitated during the preceding last interglacial along with dissolution of seawater derived salt found at the uplifting Mt. Sedom salt diapir.