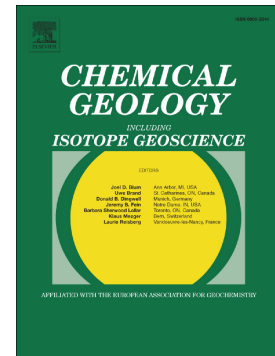


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Quantification of paleo-aquifer changes using clumped isotopes in subaqueous carbonate speleothems

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Abstract

Here we track the water-table position and temperature of the Mount San Giovanni aquifer (Iglesiente-Sulcis mining district, SW Sardinia, Italy) during the past 600 ka by determining the ages (U-Th dating) and stable isotope compositions ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$ and Δ_{47}) of a variety of subaqueous carbonate speleothems (e.g. calcite spars, dogtooth calcite crystals and calcite coatings). Clumped isotopes (Δ_{47}) provide quantitative estimates of carbonate formation temperatures (and thus water temperatures) that are independent of the oxygen isotope composition of water ($\delta^{18}\text{O}_w$). Then, the $\delta^{18}\text{O}_w$ of the paleo-water has been reconstructed from the clumped isotope temperature ($T_{\Delta_{47}}$) and the $\delta^{18}\text{O}$ of the carbonate ($\delta^{18}\text{O}_c$). We find that high-temperature calcite spars formed already before 600 ka at temperatures above ~ 120 °C. Lower-temperature

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