

Comparison of new temperature proxies in stalagmites - A step towards quantitative climate reconstruction

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Stalagmites are increasingly used to reconstruct past climate variations, as they can be precisely dated and occur globally in various climatic settings. Low latitude stalagmites are typically used to infer variations in precipitation in a qualitative way through changes in the oxygen isotopic composition ($\delta^{18}\text{O}$) of the calcite. The goal of this study is to take a step further and obtain quantitative climate information by reconstructing past temperatures and using them to calculate the isotopic composition of the rainwater.

Several new tools to reconstruct past temperatures in stalagmites have recently emerged, which are compared here for the first time in the framework of the SNF-Sinergia project StalClim. Temperatures are inferred from 1) the difference in fluid inclusion and calcite $\delta^{18}\text{O}$ [1], 2) the density of fluid inclusion water determined by liquid-vapor homogenization [2], 3) noble gas concentrations in fluid inclusions [3], and 4) the carbonate isotopologue (or ‘clumped isotope’) composition [4].

The stalagmite used for this study was obtained from a cave in Borneo (4.1°N, 114.9°E) and covers 2 glacial-interglacial cycles, from Marine Isotope Stage 12 to the beginning of Marine Isotope Stage 9 (460-330 ka). The sample has previously been used for inferring past changes in precipitation [5]. The temperature reconstructions show clear and consistent temperature differences between glacials and interglacials. However, discrepancies between different methods are also apparent, which will be used to better understand biases and complicating factors of the individual methods.

References: [1] Dublyansky and Spötl (2009), *Rapid Comm. Mass Spectrom.*, 23, 2605-2613. [2] Krüger et al. (2011), *Chemical Geology*, 289, 39-47. [3] Vogel et al. (in press), *G-cubed*. [4] Eiler (2011), *Quaternary Science Reviews*, 30, 3575-3588. [5] Meckler et al. (2012), *Science*, 336, 1301-1304