

# The Holocene Indian Summer Monsoon - a Story from Underground

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A stable isotope and grey scale record from a stalagmite from North-Eastern India covers the entire Holocene. This uninterrupted terrestrial high-resolution record from subtropical India has been dated with the <sup>238</sup>U-<sup>234</sup>U-<sup>230</sup>Th decay system. Grey scale layer counting provides an independent chronology for the past ~5 ka, in close agreement with the U-series ages.

The  $\delta^{18}\text{O}$  record reflects changes in rainfall, related to Indian Summer Monsoon (ISM) strength at (sub-) decadal-scale resolution, based on drip and rainwater  $\delta^{18}\text{O}$  monitoring at our site. On millennial time-scales, our  $\delta^{18}\text{O}$  time-series shows a strong dependence of the ISM on summer insolation, with a rainfall maximum during the Holocene Climate optimum (9.3 ka) and a gradual decrease during the late Holocene (since 6 ka). Superimposed are decadal to centennial-scale excursions of reduced ISM strength that can be related to hemispheric events, such as the 8.2 ka or 1.2 ka events. The grey scale data has been obtained at sub-decadal to sub-annual resolution. Sub-decadal scale variability could be related to regional and/or local factors. Lower grey values are interpreted as reflecting reduced stalagmite growth during drier conditions. The grey values are clearly related to the  $\delta^{18}\text{O}$  record, with depleted isotope values found parallel to lower grey values. Both,  $\delta^{18}\text{O}$  and grey scale data show evidence for an increase in ISM variability over the past 1.3 ka.  $\delta^{18}\text{O}$  values well above modern ones suggest that severe multi-annual droughts occurred during the late Holocene.

Current work is focussed on statistical analysis of the grey scale and its relation to other high-resolution records. Also, we work on further layer counting and laser ablation element profiling. Ongoing cave microclimate monitoring will eventually help calibrating our proxy record against meteorological data.