

## Triple oxygen isotope signatures in mid-latitude snowpack and ice

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Stable isotopes of oxygen are widely used for paleoclimatic applications in ice cores. Small variations in mass dependent fractionation of  $^{17}\text{O}/^{16}\text{O}$  and  $^{18}\text{O}/^{16}\text{O}$  ( $^{17}\text{O}$ -excess) provide a new, temperature-independent tool for humidity and moisture source reconstructions [1]. However, post-depositional effects on the  $^{17}\text{O}$ -excess signature in snow and ice still need to be examined.

We investigated triple oxygen isotope signatures in snow and atmospheric vapor samples from Zugspitze mountain in the German Alps. Our dataset is complemented by laboratory and field experiments and selected samples from the Scărișoara ice cave, Romania.

Samples were analysed as  $\text{O}_2$  by dual-inlet IRMS after fluorination with  $\text{CoF}_3$ . Average reproducibility of  $^{17}\text{O}$ -excess is  $\pm 8$  per meg (1 SD) [2].

Natural snow and vapor samples from Zugspitze mountain show elevated  $^{17}\text{O}$ -excess ranging from 41 to 61 per meg. Post-depositional isotopic alteration of surface snow can be observed for  $\delta^{18}\text{O}$  (up to +4 ‰) but does not affect  $^{17}\text{O}$ -excess significantly. Laboratory freezing experiments indicate no significant effect on  $^{17}\text{O}$ -excess for freezing rates between 0.05 and 0.2  $\text{mm min}^{-1}$ . Ice samples from the Scărișoara cave indicate a slight correlation of  $\delta^{18}\text{O}$  and d-excess with  $^{17}\text{O}$ -excess, the latter showing a variability from 15 to 30 per meg while d-excess ranges from 7.5 to 11.9 ‰.

Our results suggest that the  $^{17}\text{O}$ -excess parameter is broadly resistant to isotopic overprint (evaporation and refreezing) at snow surface, making it a useful tool for paleohumidity studies at mid-latitudes.

[1] Landais et al. (2012) *Geochim. Cosmochim. Acta* **77**, 304-316.

[2] Surma et al. (2015) *Geophys. Res. Lett.* **42**, 8456-8462.