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A multi-proxy reconstruction of Holocene climate change from Blessberg Cave, Germany

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Although Holocene climate dynamics were relatively stable compared to glacial conditions, climatic changes had significant impact on ecosystems and human society on various timescales (Mayewski et al. 2004, Donges et al. 2015, Tan et al. 2015). Precious few high-resolution records on Holocene temperature and precipitation conditions in Central Europe are available (e.g., von Grafenstein et al. 1999, Fohlmeister et al. 2012).
Here we present a speleothem-based reconstruction of past climate dynamics from Blessberg Cave, Thuringia, central Germany. Three calcitic stalagmites were recovered when the cave was discovered during tunneling operations in 2008. Samples BB-1, -2 and -3 were precisely dated by the ^{230}Th/U-method, with errors between 10 and 160 years (2σ). The combined record covers large parts of the Holocene (10 – 0.4 ka BP). δ^{13}C and δ^{18}O were analysed at 100 μm resolution. To gain additional insights in infiltration conditions, Sr/Ca and S/Ca were measured on BB-1 and BB-3 using an Röntgenanalytik Eagle XXL μXRF scanner.
Differences to other central European records (e.g., von Grafenstein et al. 1999, Fohlmeister et al. 2012) suggest complex interaction between multiple factors influencing speleothem δ^{18}O in Blessberg Cave. Furthermore, no clear influence of the North Atlantic Oscillation on our proxies is found. However, a link across the N Atlantic realm is indicated by a centennial-scale correlation between Blessberg δ^{18}O values and minerogenic input into lake SS1220 in Greenland over the last 5 ka (Olsen et al. 2012). In addition, recurrence analysis indicates an imprint of Atlantic Bond events on Blessberg δ^{18}O values (Marwan et al. 2014), corroborating the suggested link with high northern latitudes. Larger runoff into the Greenland lake seems to be associated with lower δ^{18}O, higher δ^{13}C and S/Ca ratios, as well as lower Sr/Ca ratios in Blessberg Cave speleothems. This might be linked to lower local temperature and/or changes in precipitation seasonality. Opposing millennial scale trends with lowering S/Ca ratios and δ^{13}C values but increasing Sr/Ca ratios calls for more than one controlling factor. Most likely, δ^{13}C decreased through the Holocene due to afforestation, which in turn might have increased sulphate retention in the thickening soil cover (Frisia et al. 2005) and limited sulphur flux into the cave. Alternatively, marine sulfur flux could have diminished with winter wind intensities. However, additional data is required to clarify this hypothesis. A positive Sr/Ca trend through the Holocene might result from increasing prior calcite precipitation induced by a negative moisture balance in summer.

References

Breitenbach et al. (2012) Climate of the Past 8, 1765-1779
Donges et al. (2015) Climate of the Past 11, 709-741
Fohlmeister et al. (2012) Climate of the Past 8, 1751-1764
Frisia et al. (2005) EPSL 235, 729-740
Marwan et al. (2014) Geophysical Research Abstracts 16, EGU2014-8893
Mayewski et al. (2004) Quaternary Research 62, 243-255
Olsen et al. (2012) Nature Geoscience 5, 808-812
Tan et al. (2015) Scientific Reports 5:12284
von Grafenstein et al. (1999) Science 284, 1654-1657