

Annual-resolution carbon and oxygen isotope time series from three stalagmites from Zoolithencave (southern Germany) and their potential for climate reconstruction

Dana F.C. Riechelmann (1), Bernd R. Schöne (1), Detlev K. Richter (2), and Denis Scholz (1)

(1) Johannes Gutenberg-Universität Mainz, Institute of Geosciences, Mainz, Germany (d.riechelmann@geo.uni-mainz.de), (2) Ruhr-University Bochum, Institute for Geology, Mineralogy and Geophysics, Univeritätsstrasse 150, D-44801 Bochum, Germany

d13C and d18O values were analysed at annual resolution in an arrangement of three stalagmites from Zoolithencave (southern Germany) growing between AD 1800 to 1970. The speleothems show visible laminae (consisting of a pair of a clear and a brownish, pigmented layer, Riechelmann et al., in review), which provide the basis for annual sampling for stable isotopes using a Micro Mill.

The correlation coefficients between the individual d18O series of the three stalagmites are between 0.31 and 0.59 ($p < 0.001$). For the d13C series the correlation coefficients between the three individual series are insignificant. The correlations between d18O and d13C values for each stalagmite were significant. For both d18O and d13C, an annual mean time series was calculated and tested for their climate signal by correlating to monthly and annual precipitation and temperature data from the nearby meteorological station Bamberg. The d18O time series shows a correlation of 0.31 ($p < 0.001$) with mean annual temperature. Smoothing the mean annual temperature time series with a 5-year running mean results in an increase of the correlation to 0.53 ($p < 0.001$). Furthermore, the d18O series show a correlation coefficient of 0.51 ($p < 0.001$) with the Atlantic Multidecadal Oscillation (AMO). For the d13C values, no significant correlation with precipitation or temperature is observed.

The lamina thickness shows a significant correlation with the amount of winter to spring precipitation (Riechelmann et al., in review). A principal component analysis (PCA) of the lamina thickness and the d18O data results in two different components, which clearly show that one represents the precipitation and the other temperature. These results show that stalagmites from Zoolithencave have strong potential for reconstruction of winter to spring precipitation from laminae thickness and mean annual temperature as well as the AMO from the d18O series.

Riechelmann, D.F.C, Fohlmeister, J., Kluge, T., Jochum, K.P., Tjallingii, R., Richter, D.K., Scholz, D., in review. Detection and origin of different types of annual laminae in recent stalagmites from Zoolithencave, southern Germany, and their potential for high-resolution climate studies. *Palaeogeography, Palaeoclimatology, Palaeoecology*.