



Stalagmites from Spannagel cave (Austria) and holocene climate

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The Spannagel cave is located around 2,500 m asl at the end of the Tux Valley in Tyrol (Austria) close to the Hintertux glacier. While the area above the cave is ice free at present, it was covered by ice during past glacials as well as during colder periods of Interglacials. Presently, the temperature inside the cave is between 1.8° and 2.0° C.

We used the $\delta^{18}\text{O}$ time-series of three stalagmites which grew in small distance from each other. This speleothem record is not influenced by effects of kinetic isotope fractionation due to the low temperatures in the cave. The stalagmites were precisely dated with the U/Th-method. The combined record (COMNISPA, Vollweiler et al. 2006) shows substantial variability within the last 9 kyr with features like the Holocene Climatic Optimum between 7.5 and 6.5 kyr, the Mediaeval Warm Period between 1.2 and 0.7 kyr and the Roman Warm Period between 2.25 and 1.7 kyr. In contrast, periods of lower temperatures are visible between 7.9 and 7.5, 5.9 and 5.1, 3.5 and 3 kyr, and during the LIA between 600 and 150 yr. The period between 5.9 and 5.1 kyr has equivalence in many records from various regions in both hemispheres corresponding to global cooling. It also includes the time of the Alpine Iceman at 5.3 kyr.

The timing of the climatic variations revealed by COMNISPA agrees approximately with that shown by other Alpine archives. Joerin et al. (2006) dated wood and peat samples which were released by melting Swiss Alpine glaciers located between Engadin and Valais. Both the $\delta^{18}\text{O}$ maxima and minima recorded in COMNISPA clearly have counterparts in the glacier recession record.

Comparisons of COMNISPA with other archives have shown that our stalagmite curve does not only record local climate but also the history of European climate. The extremely high correlation to the Hematite Stained Grain record of Bond et al. (2001) suggests that COMNISPA is a good archive for climate in the North Atlantic region (Mangini et al. 2007).

In addition we found that COMNISPA is also an archive for human activities such as rise and fall of cultures and settlement. For example archaeologists know from their excavations that there are several epochs of Troy culture. The reasons for the downfalls are still under consideration. We think that the absence of precipitation as shown in COMNISPA could be an important cause for the fall of the Trojan empire especially of the famous Homeric epoch Troy VI.