



A speleothem record of the Penultimate Interglacial from the Alps

C. SPÖTL (1) and A. MANGINI (2)

(1) Institut für Geologie und Paläontologie, Leopold-Franzens-Universität Innsbruck, Innrain 52, 6020 Innsbruck, Austria (christoph.spoetl@uibk.ac.at)

(2) Forschungsstelle Radiometrie, Heidelberger Akademie der Wissenschaften, Im Neuenheimer Feld 229, 69120 Heidelberg, Germany

Speleothems from Spannagel Cave in the Central Alps of Austria provide the only currently available precisely dated chronology on the timing and structure of the Penultimate Interglacial (MIS 7) in Europe. We use oxygen isotope data obtained at high resolution along the growth axis of speleothems as a proxy for changes in atmospheric temperature above the cave. A key aspect of speleothems from this cave is the exceptionally high uranium content, which, coupled with very low initial thorium, gives rise to precise TIMS U/Th ages.

Here we present a new stalagmite, SPA121, which grew nearly continuously during the Penultimate Interglacial and hence permits to improve the chronology previously obtained from flowstones (Holzkämper et al., EPSL 2005). The age uncertainties are mostly between 1 and 2 percent (2 sigma). Oxygen isotope data show three periods of high values and two intervening intervals of low values, which strongly resemble the tripartite structure of the Penultimate Interglacial known from orbitally tuned deep-sea records. Warming of MIS 7.5 commenced ca. 240 kyr ago (as indicated by increasing oxygen isotope values) and ended after ca. 234 kyr. The second warm period, MIS 7.3, started ca. 213 kyr ago (midpoint) and ended ca. 205 kyr ago, and MIS 7.1 commenced ca. 198 kyr ago (midpoint) and came to an end ca. 190-192 kyr ago.

The timing of the three warm phases in the Alps is generally consistent with orbitally forced insolation changes, which occurred 248, 226 and 204 kyr ago (midpoints, 65°N). We note, however, that MIS 7.3 appears significantly delayed with respect to the insolation, whereas the onsets of MIS 7.5 and 7.1 agree more closely with the inso-

lation changes. Our data are consistent within the uncertainties of the U/Th data with high sea-level during MIS 7.1 as reconstructed from submerged stalagmites on the Tyrrhenian coast (ca. 202-190 kyr; Bard et al., EPSL 2002) and from Barbados corals (ca. 201-194 kyr; Gallup et al., 1994). U/Th-dated Bahamas slope sediments suggest an onset of MIS 7.3 ca. 215 kyr ago and a duration of the MIS 7.5 highstand from ca. 237 to ca. 228 kyr (Robinson et al., EPSL 2002); both data sets are compatible with the new Spannagel cave record.

Based on oxygen and carbon stable isotope data we infer that none of the three MIS 7 warm phases reached the same level of warmth as during MIS 5.5 or during the Holocene in the Alps.