Geophysical Research Abstracts, Vol. 9, 08268, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-08268

Quantifying temperature and seasonality changes at the end of the last interglacial by means of isotopically dated alpine speleothems

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We present a Th/U dated speleothem from Entrische Kirche cave (Salzburg, Austria) which grew continuously between 127 and 114 ka and intermittently during subsequent stadials and interstadials. The high-alpine catchment (mean elevation 2000 m a.s.l.) is highly sensitive to periglacial and glacial processes as well as to changes in temperature and precipitation which are ultimately recorded in the cave precipitates.

Peak interglacial conditions are characterized by high δ^{18}O values of -8 ‰ to -9 ‰ VPDB with relatively high growth rates between ca. 127 and 118 ka. The isotope values gradually increased over this ca. 10 ka period with a centennial-scale high frequency signal superimposed on this trend. An uninterrupted drop in δ^{18}O to -12 ‰ at 117-118 ka marks the end of the Last Interglacial at this site.

Given the present-day low temperature at this alpine cave we attribute the marked drop in δ^{18}O to atmospheric cooling, enhanced by a change in seasonality. Calculations suggest that summer temperatures decreased only slightly, whereas the winters were disproportionally colder by 6-8˚C and presumably also dryer as compared to the preceding Last Interglacial.

Speleothem growth terminated at ca. 114 ka but recommenced from ca. 90 to 86 ka and intermittently during marine isotope stage 3. Periglacial conditions prevailed during these times in the catchment area and seasonality was probably further enhanced with winter temperatures 10-12˚C lower than today keeping the catchment area very close to the glaciation threshold.