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NALPS: Last Glacial climate changes recorded in the northern Alps

Ronny Boch^{1,2*}, H. Cheng^{2,3}, C. Spötl¹, R. L. Edwards², X. Wang^{2,4} and Ph. Häuselmann⁵

¹ University of Innsbruck, Institute of Geology, Innsbruck, Austria

² University of Minnesota, Department of Earth Sciences, Minneapolis, USA

³ Xi'an Jiaotong University, Institute of Global Environmental Change, Xi'an, China

⁴ Columbia University, Lamont-Doherty Earth Observatory, Palisades, NY, USA

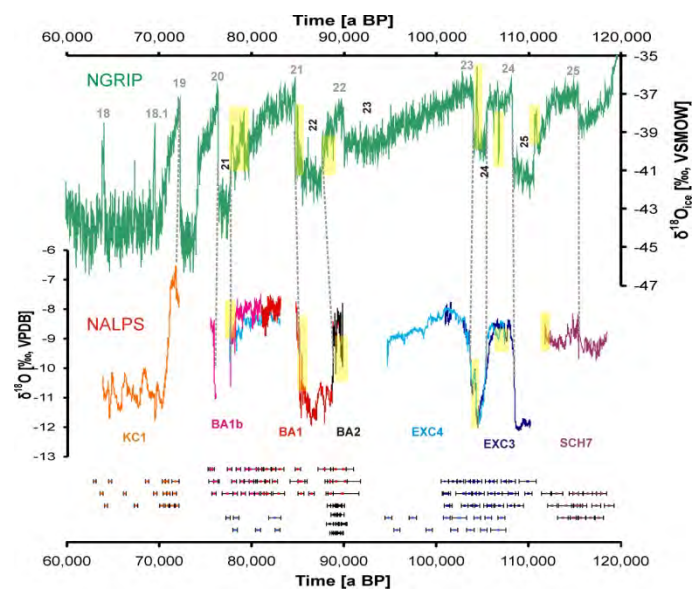
⁵ Swiss Institute of Speleology and Karst Sciences (SISKA), La Chaux-de-Fonds, Switzerland

*New address: Graz University of Technology, Institute of Applied Geosciences, Graz, Austria

In Greenland ice-cores drastic climate changes are documented during the Last Glacial period. Rapid and recurrent variations – known as Dansgaard-Oeschger (D-O) events – are expressed as relatively warm and humid Greenland Interstadials (GI) and cold and dry Greenland Stadials (GS). These successions had a global effect on climate, i.e. large air temperature changes, greenhouse gases and global sea-level. Accurate and precise chronologies are essential for interpreting climate signals from ice-core records and to study global teleconnections. Radiometric U-Th-based speleothem chronologies are promising in reducing these uncertainties substantially.

The NALPS stack consists of seven stalagmites from carefully selected Swiss and Austrian caves. All caves are located at the northern rim of the Alps and are exposed to a dominant Atlantic moisture advection, favouring a comparison of the speleothem- and ice-core oxygen isotope signals. Moreover, the caves developed in the same carbonate host rock providing stalagmites with excellent geochemical conditions for U-Th dating. NALPS covers most of the time interval from 120-60 thousand years (ka) ago and is temporally constrained by 154 U-Th ages (20-30/stalagmite). Typical 2σ -age-uncertainties range from 200-500 years (0.2-0.6 %). The stable isotope curves consist of ca. 8200 individual analyses and the temporal resolution ranges from 2-22 years.

The alpine speleothem O isotopic signal is highly reminiscent of Greenland. Interstadials dominate the record reflecting favourable conditions with regard to speleothem growth. Oxygen isotope values primarily reflect the isotopic composition of regional meteoric precipitation and in the Alps this variable is strongly correlated with air temperature. Rapid and large isotope shifts of 1-4.5 ‰ occurred within decades to centuries. Compared to an updated ice-core timescale (GI17.5-18.1) NALPS confirms the timing of rapid warming and cooling transitions between 118 and 106 ka, but suggests younger ages for D-O events between 106 and 60 ka. There is a discrepancy in the duration of the stadial following GI 22 between the ice-core and the stalagmite chronology (2900 vs. 3650 years). The short-lived D-O events 18 and 18.1 are not recorded in NALPS, provoking questions with regard to the nature and the regional expression of these events. NALPS further resolves recurrent short-lived climate changes superimposed on the stadial and interstadial successions that have not been documented outside Greenland before.



Oxygen isotope and age data available at: <http://www.clim-past.net/7/1247/2011/cp-7-1247-2011.html>