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New age constraints for the Last Interglacial from Italian speleothems

R. Drysdale (1), G. Zanchetta (2), J. Hellstrom (3) and A. Fallick (4)

(1) School of Environmental and Life Sciences, The University of Newcastle, Australia, Russell.Drysdale@newcastle.edu.au, (2) Department of Earth Sciences, The University of Pisa, Italy, (3) School of Earth Sciences, The University of Melbourne, Australia, (4) Scottish Universities Environmental Research Centre, East Kilbride, United Kingdom

Long-standing, unresolved issues in studies of the Last Interglacial include the timing of its onset, the nature of the preceding glacial-interglacial transition (G-IG), and the duration and timing of cooling events around the time of its cessation. Whilst deep-ocean cores preserve the sequence of events through this period, the difficulty of obtaining precise ages on marine sediments has precluded the development of a detailed chronology of events. This is a major setback, given that many long pollen and other terrestrial sequences from Europe are tied to marine-core records.

Speleothems are ideally suited to resolving chronological issues because they can be dated precisely and they are sensitive to climate change. We present high-resolution stable-isotope time series from four stalagmites from Antro del Corchia (Tuscany, Italy) which together encompass the MIS 6-5e transition and the MIS 5e-5d transition. Our results show that the onset of optimum conditions of the Last Interglacial occurred at $\sim$129 ka, an age estimate that (within analytical error) is consistent for isotope time series from three individual stalagmites. Prior to the optimum, a brief interruption during the transition to warmer and wetter conditions, inferred from prominent steps or reversals in the stable oxygen and carbon isotope data, can be correlated with the Termination II 'pause' recorded in IRD data and SST reconstructions from North Atlantic and western Mediterranean marine cores. We place the age of this event, which has been used as a marker for the base of the Eemian, at $\sim$130 ka. A high-resolution isotope time series from a fourth stalagmite (CC28), which grew between 118 and 96 ka, covers the late MIS 5e – late MIS 5c period, and is in good agreement with a recently published record (of stalagmite CC5) from Corchia covering the same period.

However, CC28 contains a higher level of detail than that currently available for CC5, and better preserves two major cooling events that are recorded by marked increases in both oxygen and carbon. Their timing coincides with cold stadials recorded in the NGRIP ice core, which in turn correlate with ice-rafting events C24 and C23 from the North Atlantic. A preliminary age model for these events ('preliminary' in lieu of results from further samples) based on top and basal ages and tuning to the CC5 record allows us to interpolate radiometric ages for C24 (112-110 ka) and C23 (105.5-103 ka). Given that the end of the Eemian is correlated with event C24 (Mélisey I), this allows us to estimate the length of the Eemian at ca. 18,000 years. We believe these age constraints, whose uncertainties will be significantly improved over the next month by further U/Th dating, will provide important chronological markers for regional marine and terrestrial records through the first half of MIS 5.