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The World Heritage Naracoorte Caves beyond 500 ka: U-Pb dating and charcoal analysis from speleothems with implications for Pleistocene vertebrate fossil deposits

Rieneke Weij[1], Jon Woodhead[1], Liz Reed[2], Kale Sniderman[1], John Hellstrom[1], and Russell Drysdale[3]
[1]School of Earth Sciences, The University of Melbourne, Melbourne, Australia (hweij@student.unimelb.edu.au)
[2]School of Physical Sciences, University of Adelaide, Adelaide, Australia
[3]School of Geography, The University of Melbourne, Melbourne, Australia

Under the current rapid global warming, studying how environments responded to past climate change becomes increasingly important to better understand what impact climate variability has on regional flora and fauna. Our new multi-proxy study to the World Heritage Naracoorte Caves in southern Australia provides a unique window into the past climate as they are heavily decorated with speleothems but also contain in-fill deposits rich in Pleistocene vertebrate fossils including the extinct Australian megafauna. Until now, these speleothems have been dated using U-Th series and the fossil-bearing sediments with Optical Stimulated Luminescence and Electro Spin Resonance techniques, but only up to ca. 500 ka. We have U-Pb dated speleothems from the Naracoorte Caves for the first time and extended the record beyond 500 ka. We combined precise chronology with analyses of pollen and charcoal within the speleothems which allows us to better understand how southern Australia's climate and its vegetation changed during the Quaternary. It also provides a unique insight into the timing and extent of cave opening with important potential for much older vertebrate fossil deposits than previously thought.