Refining terrestrial palaeoclimate chronologies: new tools for old speleothems

J. WOODHEAD[1,] J.HELLSTROM[1] AND R. MAAS[1]

[1] School of Earth Sciences, The University of Melbourne, VIC 3010, Australia; jdwood@unimelb.edu.au

Speleothems are widely used archives of palaeoclimate variation and have yielded some remarkable insights into climatic conditions during the late Quaternary. Compared to other proxy methods, they offer the possibility of furnishing palaeoprecipitation as well as palaeotemperature records and are eminently suited to dating by U-series analysis, a technique which is highly robust for carbonate materials up to ~550 ka in age. Unfortunately, beyond this time their value has been limited by a lack of appropriate chronometers.

Building upon the work of Richards et al. [1], we have developed a method for precise dating of speleothems beyond the range of the U-Th technique using the U-Pb decay scheme. By coupling low-blank sample preparation procedures and MC-ICPMS analytical methodologies, we find that, under ideal circumstances, U-Pb dating of speleothems is not only possible but also produces excellent age resolution—often comparable to or better than U-series studies. Corrections for initial isotopic disequilibrium, however, remain necessary in most analytical situations and exert a strong control on the achievable age uncertainty.

This technique will be of immediate benefit in extending speleothem-based climate proxy records beyond ~550 ka and will also find other uses, such as the dating of associated sub-fossil remains, and providing constraints on rates of landscape evolution and neo-tectonic processes.

Now that detailed chonologies can be established for older spoeleothems, our next goal is to document how well such materals preserve proxy records. Here we demonstrate the potential of innovative elemental imaging techniques (by LA-ICPMS) to help distinguish true palaeoclimate signals from alteration and grain-scale effects (see below).

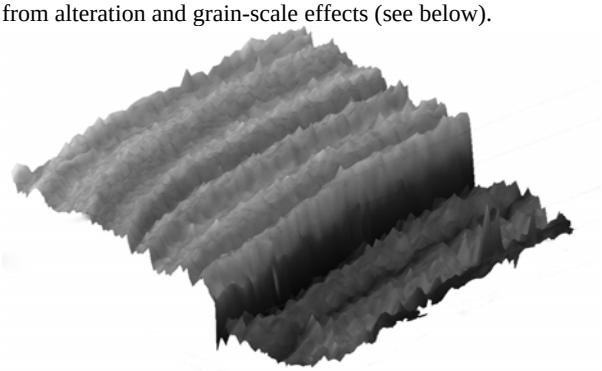

Figure shows a ~5mm section of Nullarbor speleothem contoured in U, Sr, and I content.

[1] Richards, D.A., et al. (1985) *GCA* **62,** 3683-3688.