

## **The small, the bad and the ugly: U-Pb dating buried speleothems from archaeological cave sites**

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Wonderwerk Cave, in the Northern Cape, South Africa, contains a long and much studied sequence of archaeological sediments and stone tool industries and is particularly well known for its Earlier Stone Age (ESA) deposits. ESA sites are common within South Africa but paucity of well dated sites leaves many questions about the evolution of our early ancestors from this time period unanswered.

During excavations at Wonderwerk Cave a number of small stalagmites and soda-straw stalactites were recovered from various depths through the sediments. Uranium-Lead (U-Pb) dating of speleothems is a relatively new chronometer and ages for samples as small and fragmentary as the little buried stalagmites from Wonderwerk Cave would help establish it as an imminent dating technique for archaeological sites.

The key to successful U-Pb dating of these relatively young, buried speleothems is thorough pre-screening. The laser ablation scans proved invaluable in identifying layers within the speleothem suitable for U-Pb dating, as well as providing detailed trace element data, which excludes the possibility of diffusion-absorption of U in or out of the samples and confirms the integrity of the U-Pb ages.

The relationship between the small stalagmites and the sediments surrounding them is paramount to interpreting the ages. Given that stalagmites need a stable cave floor to form on, these samples will predate the sediments below them and are most likely coeval with the sediments surrounding them and as such, provide close to maximum ages for these deposits.

Three samples were successfully dated, providing ages ranging from ~500 to 800 ka. These ages are precise enough to become a powerful tool to be used in pinning palaeomagnetic sequences but a much larger data set is needed before this can be done with confidence.

Further work will be needed to constrain the chronology of the ESA deposits at Wonderwerk Cave but the addition of a new chronometer in the form of U-Pb dating adds an important new line of evidence for this complex task. As such this technique will have broad applications ESA cave sites older than 500 ka and beyond the limit of conventional Uranium-Thorium dating.