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Drought histories from active stalagmites, Wombeyan Caves, SE Australia

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The geochemistry of drip waters from shallow caves in drought-prone southeastern Australia record palaeohydrology at sub-annual time scales (McDonald et al. 2004; McDonald et al. *in review*) via the climatically-driven process of prior calcite precipitation. Three actively forming stalagmites have been collected for high-resolution geochemical analysis (Mg/Ca; Sr/Ca; Ba/Ca; P/Ca; organic fluorescence; δ^{18}O and δ^{13}C) in order to reconstruct late Holocene rainfall trends in the region.

Two stalagmites (WM4 and WM6) have undergone preliminary laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) analyses where continuous scans are performed along pre-ablated tracks parallel to the growth axis. The results reveal that both stalagmites show significant trace element variability, particularly in Mg/Ca, Sr/Ca and Ba/Ca. Whilst there are some subtle differences between adjacent scan lines, significant commonalities indicate the potential for a robust and reproducible record of palaeorainfall. Both Sr/Ca and Ba/Ca are highly correlated, whilst Mg/Ca deviates sporadically from expected ratios based on trace element relationships in their respective drip waters. Frequent elevated Sr/Ca and Ba/Ca support the recur-

rence of multiple drought episodes during the past 200 years, although lack of a rigid chronology at this stage precludes direct comparison with the instrumental record and reconstruction of a precise drought-frequency history. Multiple LA-ICP-MS scans on the third stalagmite (WM7) also show significant structure in trace element/calcium ratios, suggesting oscillations between wet and dry periods.

Work is currently underway to obtain robust chronologies of the stalagmites. Establishing a chronology for each stalagmite is particularly difficult due to their young ages and low uranium content ($\sim$ 15 ppb). Preliminary dating by high-resolution MC-ICP-MS U/Th indicates that WM4 and WM6 have basal ages of $\sim$ 200 years. WM4 (9 cm) is a much faster growing stalagmite than WM6 (2.6 cm). Stalagmite (WM7) has an age of $\sim$ 1,000 years at a distance of 3.5 cm from the tip. Accelerator mass spectrometry (AMS) ^{14}C measurements on small sub-samples of WM4 are being carried out to locate and characterise the atmospheric bomb pulse ^{14}C peak and use it as a chronostratigraphic marker.

Following collection, the stalagmites were replaced with “Stalagmates” (data loggers that continuously record drip discharge). All three drips feeding the stalagmites are responding to recharge events and thus recording the site hydrology. The feeding drip waters are also being collected regularly for geochemical analyses.