

The development of two potential international carbonate standards: *Porites* Spp. Coral ANUp and *Tridacna* ANUt

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The chemical composition of marine carbonates, such as coral, and giant clams, provides an invaluable archive for reconstructing past changes in the global carbon cycle, ocean circulation patterns, climate events, and seawater physical and chemical conditions. A well-characterized reference material is crucial for ensuring accurate and consistent data quality in these marine carbonate studies. Due to high demand, the main international marine carbonate reference materials, JCp-1 (coral-based) and Jct-1 (tridacna-based), are no longer commercially available, hindering research progress in marine carbonate. This shortage underscores the urgent need for new, homogeneous and sufficient carbonate standards to facilitate consistent data quality control and reliable inter-laboratory comparisons.

In response, we developed two potential carbonate standards: the tridacna-based standard ANUt (~18kg) and the *porites* coral-based standard ANUp (~10kg). The consistency and reproducibility of our results underscore the suitability of ANUp and ANUt as reference materials for environmental reconstructions, specifically in coral and tridacna-based studies. These standards, in conjunction with minimal and controlled pre-treatment, offer a reliable framework for future research in marine geochemistry and paleoclimate reconstructions, where trace elements and isotope proxies are well developed.

We focused on the measurement of the Li, Mg, Mn, Cu, Sr, V, Cd, Ba, Pb and U element concentrations and the C and O isotopic compositions. These are a large suite of elements and isotopes that are of particular interest to the paleoclimate and paleoceanography community for the reconstruction of past environmental studies. Here we present the chemical composition of these two standards:

1. The measured concentrations of trace elements in ANUp and ANUt, have been determined to a precision < 10% RSD, with the exception of ultra-low abundances elements which include V and Cd.
2. The measured Sr/Ca molar ratio for ANUp is 8.989 ± 0.013 mmol/mol and for ANUt is 1.547 ± 0.007 mmol/mol and the estimated Mg/Ca molar ratio for ANUp is 3.960 ± 0.035 mmol/mol and for ANUt is 1.376 ± 0.014 mmol/mol.
3. The measured $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values for the stable isotopic composition of the ANUp are $-1.19\text{‰} \pm 0.09\text{‰}$ and $-4.69\text{‰} \pm 0.07\text{‰}$ and the ANUt are $1.77\text{‰} \pm 0.04\text{‰}$ and $-1.06\text{‰} \pm 0.05\text{‰}$.