# Application of the U-Th chronometer to modern dating: U metal CRM 112-A and marine carbonates

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We present new high-precision U-Th data for U metal CRM 112-A, and give examples of application of the U-Th chronometer to modern marine carbonates. All measurements were carried out on a ThermoScientific Neptune Plus MC-ICPMS equipped with a jet interface and a DSN-100 desolvation system yielding an overall ion effiency of 2-3%. U samples and bracketing std CRM 112-A were spiked with reference material IRMM-3636a to correct for mass bias and yield drift of the SEM. Additional corrections were applied for tailing and hydride generation. For Th determinations, 229Th-spiked samples were bracketed against IRMM-3636a, and special attention was given to maximise washout of 230Th between samples. [230Th]/[238U] and [234U]/[238U] data were calculated using decay constants and reference values given in (1), i.e., [230Th]/[238U] = 1.00458 for Harwell Uraninite HU-1; and δ234U = -38.5‰ for CRM112-A (2). Analytical uncertainty for δ234U was ~0.6‰; whereas errors on [230Th]/[238U] were mostly derived from 230Th counting statistics and blank/washout corrections. Final ages were then calculated using Isoplot 4.15 (2).

Our previous determination of CRM112-A in 2005 yielded a production (Th separation) age of 1938±3 years (3). We remeasured the age more precisely at UWA in May 2014 as 1937±0.4; and again in Dec 2015 as 1937±0.4. Notably, the calculated time difference between our last two determinations is accurate to within 15 days. These measurements are significantly more precise than previously reported and indicate its utility as a modern dating standard.

The above protocol has also been utilised to date 'modern' coral and sclerosponge samples. Following (3,4), we determine [230Th]/[232Th]init by analysing either layer-counted annual bands from *Porites* coral cores, or an outer rim sclerosponge sample of known collection age. This leads to estimations of [230Th]/[232Th]init ranging between 1 and 2.5, well within the range of typical seawater values. We find that calculated vs stratigraphic age for the 'modern' corals agree to within several years whereas sclerosponge uncertainties can be signifcantly larger (10-20 years) due to higher indigenous 232Th, indicating that the major uncertainty remains the determination of initial [230Th]/[232Th].

(1) Cheng H. et al., *EPSL* **371-372**, 82-91 (2013). (2) Ludwig K., *USGS open file report* (1991). (3) McCulloch M.T. et al., *Austral. J. Earth Sci.* **55**, 955 (2008). (4) Rosenheim B.E. et al., *GCA* **71** (2007).