Limits and applications of high precision coral ^{230}Th dating techniques

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AB: Faithful interpretation of coral-inferred environmental and climatic records relies on accurate dating. Our newly-developed ^{230}Th dating technique offers a precision better than 1 year. To approach this objective, chemistry has been refined and only brings about an equivalent age uncertainty of 1-2 months. The most important factor limiting the precision and accuracy is the initial ^{230}Th content, incorporated into the growing matrix during crystallization. The initial ^{230}Th can be constrained by building a ^{230}Th/^{232}Th vs. ^{234}U/^{232}Th isochron plot. The initial ^{230}Th/^{232}Th ratio for modern *Porites* corals, collected from Nanwan, southern Taiwan, is 5.2 (± 1.1) x 10^{-6} (atomic ratio, hereafter), consistent with a value of 4.0 (± 0.5) x 10^{-6} in the dissolved fraction of seawater and higher than that of 3.0 (± 0.7) x 10^{-6} in the suspended particulate matter. The results indicate that the initial ^{230}Th content is attributable mainly to the dissolved phase of seawater. Isochron plots for modern and fossil corals, sampled from Nanwan and Sumatran Islands, display little temporal and spatial variations of initial ^{230}Th/^{232}Th ratio. Applications of the technique given in this study include determining the occurrence of earthquakes in the Sumatran Islands and the variability of ENSO system in the equatorial Western Pacific Ocean.