DATA REPOSITORY: ANALYTICAL METHODS

U-Th-Pb Chemistry

Chips of coral interiors (aragonite; X-ray diffraction) were cut with a steel blade and a Dremel microdrill, washed four times in water in an ultrasonic bath, and then dried, weighed, dissolved, and spiked (U-Pb, $^{235}$U-$^{236}$U-$^{205}$Pb; U-series, $^{229}$Th-$^{233}$U-$^{236}$U). U and Pb were separated on 250 µL columns by HBr methods (AG1x8 resin in Br$^-$ form; see also Strelow and Toerien, 1966), and then Pb was purified of Ca traces on 100 µL columns. U, Th, and Pb were run on a Micro Mass sector 54 mass spectrometer, with Pb signals (~$10^{-12}$ A for $^{208}$Pb) measured in Faraday cups in static mode. Fractionation corrections for Pb were 0.12% ± 0.04%/amu, and the correction for full procedural Pb blanks was 50±13 pg.

Corals for U-series analysis and U fractions from the U-Pb separation were prepared by iron coprecipitation and run by standard mass-spectrometric methods (Chen et al., 1986; Edwards et al., 1987). Spike calibration, chemical separation, and analytical protocols were confirmed by interlaboratory calibration with the University of Minnesota radioisotope lab and by U-series dating of known corals from Barbados (kindly provided by Larry Edwards).

Data Treatment

In corals, the initial coral ($^{230}$Th/$^{238}$U) is typically near zero, which generates a deficit in $^{206}$Pb$^*$ produced from $^{238}$U. The same holds for an initial coral ($^{231}$Pa/$^{235}$U) near zero, giving a slight deficit in $^{207}$Pb$^*$ from $^{235}$U. Modern and late Pleistocene oceans have a $^{234}$U excess of about 15% (e.g., Chen et al., 1986; Edwards et al., 1987), which ultimately yields an excess of $^{206}$Pb$^*$. Combined, these effects yield a time lag of ~60 k.y. for growth in $^{206}$Pb/$^{208}$Pb ratios after ~1 m.y..

U-Pb isochron ages and uncertainties were calculated at the 95% confidence level with Isoplot/Ex (Ludwig, 1999); the most precise ages were obtained with 3-D linear, concordia-constrained $^{238}$U/$^{206}$Pb-$^{207}$Pb/$^{206}$Pb-$^{208}$Pb/$^{206}$Pb isochrons. Coral CCD-6058 has a $^{206}$Pb/$^{208}$Pb intercept of 0.4906±0.007 (MSWD=0.33), and a $^{206}$Pb/$^{207}$Pb intercept of 1.217±0.024
(MSWD=0.33). The low MSWD results from the estimate of uncertainty in blank level. Coral CCD-878 has a $^{206}\text{Pb}/^{208}\text{Pb}$ intercept of $0.513\pm0.014$ (MSWD=3.1), and a $^{206}\text{Pb}/^{207}\text{Pb}$ intercept of $1.28\pm0.1$ (MSWD=4.3). Because coral growth may occur over decades and in different seasons, the MSWD greater than 1.0 may stem from small variations of initial Pb acquired from the ambient marine setting.