

Strategies for the treatment of coral age data in the reconstruction of sea-level change

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The reconstruction of sea-level history is a primary goal of paleoclimate research, and shallow-water corals, which can be dated by U-Th, represent the principal archive of sea level history. Recent advances in mass spectrometry have dramatically reduced measurement uncertainty: a 122, 000-year-old coral from the Last Interglacial can now be dated with an analytical precision of about 100 years. It is clear that isotope ratio measurement precision is no longer the limiting factor in U-Th coral dating. The major challenge facing coral geochronology is open-system behavior of the isotopes used for dating, which degrades age accuracy. This problem has long been recognized, and two fundamental approaches have been employed to improve age accuracy. In the first method, screening criteria are used in an effort to select those samples that have behaved as an ideal closed system. The second method attempts to correct the ages for open-system artifacts. Both approaches have their advantages, but neither provides accurate ages in every case. In such a circumstance, what is the best framework for interpreting coral ages in a meaningful way? We suggest a simple and effective approach for quantifying and reducing the age errors associated with open-system effects by measuring discrete sub-samples of individual corals. Considering age data in a detailed stratigraphic content is also crucial. Several examples will serve to illustrate these strategies and their implications for sea-level reconstruction. The results suggest that the duration of sea-level highstands are routinely overestimated with existing treatments of coral age data.

The lithium isotope composition of the Maoniuping complex, Sichuan

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The Maoniuping carbonatite complex occurs in the eastern Indo-Asian collision zone. Main phases of the complex are pink calcite carbonatite and white coarse-grained calcite carbonatite with ~90% modal calcite. Associated syenites are grey-white, fine-grained, consisting of K-feldspar, albite and quartz. Overlapping emplacement ages, Sr-Nd isotopic compositions and mantle-normalized trace element patterns, which are similar to those of the associated syenites, suggest that the carbonatites formed as a result of liquid immiscibility.

In four samples of carbonatite, one sample of syenite and one sample of feldspar in syenite, Li contents vary from 1.1 to 49 ppm and $\delta^7\text{Li}$ values vary from +0.5 to +3.9. A sample of arfvedsonite in a sample of white carbonatite has about nine times as much Li (460 ppm) as the same carbonatite sample, but both samples have similar $\delta^7\text{Li}$ value of +3.1. The Li isotope compositions of the carbonatites mostly overlap with those reported for MORB and OIB, suggesting that the carbonatites and syenites reflect the Li isotopic composition of their mantle source. However, one syenite sample with 34.5 ppm Li, one white carbonatite sample with 28.9 ppm Li, and one arfvedsonite sample (in the same carbonatite sample) with 360 ppm Li, have lighter $\delta^7\text{Li}$ compositions (-1.1, -0.4 and -0.2, respectively), which may reflect assimilation of isotopically light lower crustal mafic granulites. In addition, one feldspar sample separated from a syenite and one arfvedsonite sample in a carbonatite have different Li concentrations (2.1 and 360 ppm) and have higher $\delta^7\text{Li}$ values (-0.4 and 1.6) compared to the $\delta^7\text{Li}$ values of their respective whole-rock samples (-1.1 and -0.2). The $\Delta\delta^7\text{Li}_{\text{mineral-whole-rock}}$ differences of 0.7 and 1.8 are interpreted to reflect diffusion-driven isotopic fractionation.

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