Drilling and storage effects on biogenic carbonate mineralogy: Implications for isotope fractionation

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Since the introduction of corals and sclerosponges for paleoclimatology research, many scientists have noted an apparent shift in the stable oxygen and carbon isotopic values of specimens sampled via drilling/milling [1-4]. This is suspected to result from the inversion of aragonite to calcite within the skeleton by heat and pressure associated with the sampling process, or subsequent storage conditions [5], and the related exchange of CO_2. Despite the significant implications of this transformation the issue is extremely difficult to test, as skeletons are not isotopically homogenous, and it remains relatively unaddressed in the literature.

Recent X-ray diffraction analysis of micro-drilled/milled sclerosponge samples within our lab reveals skeletal compositions of low-Mg calcite between 8 and 20%, as opposed to samples ground by hand which retain their 100% aragonitic signature. Additionally, coral drilled/milled with a dremel hand drill also show up to 4% conversion to calcite. It is believed that the high temperature and pressure associated with, in particular, the micro-mill technology is the primary cause for these observations; however, its absolute effects on the isotopic composition of the skeletons remain unclear. Preliminary findings suggest a weakly negative relationship between the % calcite of the skeletal samples and the $\delta^{18}O$ values with no reproducible relationship between the % calcite and $\delta^{13}C$. Continued analysis will generate a more statistically significant data set and hopefully better elucidate the effects of sampling procedures on stable isotopic composition, as well as what implications this holds for associated paleoclimatological research.

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Chemical and chronologic complexity in the oceanic mantle: Evidence from the Taitao ophiolite

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Exposure of the *ca.* 6 Ma Taitao ophiolite, Chile, allows detailed chemical and isotopic study of upper mantle ultramafic and mafic rocks that were recently extracted from the depleted MORB mantle source (DMM). Sampled ultramafic and mafic rocks were examined for isotopic (Os, Sr, Nd, O), and major and trace element compositions, including the highly siderophile elements (HSE). The relative abundances of the HSE and enrichments in certain other elements, such as Ba, indicate that metasomatism via melt infiltration modified some of the peridotitic rocks. Peridotites have initial $^{187}Os/^{188}Os$ that range widely from 0.1168 to 0.1282. Mafic rocks have initial ratios ranging from 0.139 to 0.786 that do not overlap with the range for the peridotites. This is generally similar to the isotopic relation between abyssal peridotites and MORB. Oxygen in olivine and Nd and Sr isotopic compositions of most Taitao rocks are consistent with estimates for the DMM.

A negative correlation between the $Mg^{\#}$ of primary olivine grains and Os isotopic compositions of whole rock peridotites suggests that the Os isotopic compositions reflect primary mantle Re/Os fractionation at some time in the past. The isotopic variability is likely the result of variable extents of partial melting of these rocks at approximately 1.5 Ga. As is common in abyssal peridotites, all Taitao peridotites are depleted in Al_2O_3. Processes leading to alumina depletion must have been more recent, but somehow did not overprint the ancient Re/Os established in these rocks. The mafic rocks with highest $^{187}Os/^{188}Os$ have Os model ages of *ca.* 1.5 Ga that roughly match model ages for the most depleted peridotitic samples. The complementary model ages indicate that this several-cubic-km-scale block of the mantle remained isolated and unmixed within the convecting DMM for >1 Ga.