Solubility of fish-produced high magnesium calcite

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It has been suggested that the fish produced high 10 to 48% magnesium calcite can contribute to the input of calcite to the oceans. Fish produce this material as part of the physiological mechanisms for maintaining salt and water balance. In this paper, we report on the first measurements of the solubility of this high magnesium calcite in seawater. The solubility ($pK^*_{sp} = 5.89 \pm 0.09$) of this material is approximately two times higher than aragonite ($pK^*_{sp} = pK^*_{sp} = 6.18$) and similar to the high magnesium calcite generated on the Bahamas Banks ($pK^*_{sp} = 5.90$). The dissolution of this fish-produced $CaCO_3$ input to the oceans will be discussed. The higher solubility of this fish-produced carbonate to surface ocean waters may partially explain the increase in total alkalinity above the aragonite saturation horizon in the oceans. More recent work has shown that the production of this high-magnesium calcite may affect the total alkalinity of coral reefs.

Ultra-high precision Fe isotope analysis of eucrites and diogenites - Fe stable isotope fractionation during planetary differentiation?

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The redox state of mantle sources, fractional crystallization of minerals with varying Fe^{3+}/Fe^{2+} ratios, diffusion processes and high pressure silicate-metal segregation have been identified as the main causes of Fe stable isotope variations in terrestrial magmatic rocks [1-4]. However, samples from smaller reduced planetary bodies show limited Fe stable isotope variations similar to chondritic values, which may indicate that Fe isotopes are not fractionated by any other processes during planetary formation and differentiation [1,5]. However, the limited number of samples measured and the precision of the available data preclude this as a definitive interpretation.

Diogenites and eucrites originate from the HED parent body, thought to be the asteroid 4-Vesta, and may have been generated during the crystallization of a nearly complete magma ocean within a few millions years of Solar System formation [6]. As such, they offer a unique opportunity to investigate the fractionation of Fe stable isotopes during planetary formation and differentiation, provided suitable analytical precision can be attained.

Here we present ultra-high precision Fe stable isotope measurements on a suite of diogenites and eucrites obtained by high-resolution MC-ICP-MS using a ^{57}Fe-^{58}Fe double spike to correct for instrumental mass bias (2 sd = 0.02‰, [7]) along with major and trace element concentrations and $\mu^{26}Mg^*$ values (for diogenites only, [6]). This dataset will allow us to investigate in detail the processes occuring during the development of planetary embryos and if Fe stable isotope fractionation occurred during differentiation of the HED parent body.

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