Isotope systematics of ocean island basalts in the Central Group islands of the Azores Archipelago

H. YU* AND E. WIDOM

Dept. of Geology, Miami University, Oxford, OH 45056, USA
(*correspondence: huiminy@muohio.edu)

Ocean island basalts of the Azores archipelago were produced by hotspot-ridge interaction [1], and exhibit large chemical and isotopic variations from depleted mantle to HIMU and EM-type signatures. It is still unclear whether these variations can be attributed to a heterogeneous mantle plume, or instead reflect shallow lithospheric processes. We have analyzed Sr-Nd-Pb-Hf-Os isotopes in a suite of young, fresh, MgO-rich basalts from four Central Group islands of the Azores archipelago to help constrain the origins of the heterogeneity. No correlations between radiogenic isotope signatures and MgO are found, suggesting that the isotopic compositions may reflect mantle source heterogeneity. Basalts from Terceira and most from São Jorge are radiogenic and vary widely in ^{206}Pb/^{204}Pb, with negative Δ7/4Pb and $\Delta\varepsilon_{Hf}\approx0$, indicative of a young HIMU component [2]. Sub-chondritic ^{187}Os/^{188}Os in these samples is not easily reconciled with a significant recycled oceanic crust component, but could represent young metasomatized oceanic lithospheric mantle. Terceira basalts have higher ^{3}He/^{4}He than MORB [3, 4], indicating that their mantle source also contains plume material, possibly from the lower mantle. Faial basalts have lower ^{206}Pb/^{204}Pb and higher ^{87}Sr/^{86}Sr ratios than São Jorge and Terceira samples, with EM-type signatures. Sub-chondritic^{187}Os/^{188}Os ratios and slightly negative $\Delta\varepsilon_{Hf}$ indicate limited contribution to their source of recycled oceanic crust and pelagic sediment, but their source could contain recycled subduction-modified mantle wedge, consistent with their slightly heavy Li isotopic signatures [5]. Faial basalts have MORB-like ^{3}He/^{4}He ratios [3, 4], indicating that their mantle source does not contain a deeply derived plume component, but rather the local mantle plume may contribute heat that resulted in melting of heterogeneous upper mantle, mixed with 'plums' of recycled mantle wedge. Pico basalts show a mixing trend between the Faial end-member and the Terceira HIMU end-member, with MORB-like to slightly elevated ^{3}He/^{4}He ratios [3, 4], indicating a limited contribution of plume material.

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Emerging global deep ocean carbonate ion concentrations since the last glacial age

JIMIN YU[1]*, WALLY S. BROECKER[1]
AND HARRY ELDERFIELD[2]

[1]Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY, USA
(*correspondence: jiminyu@ldeo.columbia.edu)
[2]Department of Earth Sciences, University of Cambridge, CB2 3EQ, UK

The history of deep ocean carbonate ion concentration, [CO$_3^{2-}$], can provide important constraints on possible mechanisms causing past atmospheric CO$_2$ changes. However, available deep ocean [CO$_3^{2-}$] reconstructed using different proxies conflict and no quantitative, continuous record exists for global deep oceans, highlighting the need to improve reconstructions. Here, we present seawater [CO$_3^{2-}$] for a suite of cores back to the last glacial period for the Atlantic, Indian, and Pacific Oceans quantitatively reconstructed using benthic foraminiferal boron/calcium ratios [1]. Our deep Indian [CO$_3^{2-}$] record shows an elevated value by 5 μmol/kg at the Last Glacial Maximum relative to today, a rise of 10 μmol/kg during the Mystery Interval, and a sharp decline of 15 μmol/kg since 10 thousand years ago (kyr), producing a deglacial peak at 14 kyr to 10 kyr. This pattern is similar to the 'Indo-Pacific' carbonate content variations. Circulation changes affected variations of [CO$_3^{2-}$] in the deep North Atlantic [2] and 2.3-3.4 km water depth in the western equatorial Pacific [3]. Combined with benthic foraminiferal carbon isotopes, our results offers some constraints on processes influencing carbon reorganizations in oceans and the atmospheric CO$_2$ rise during the last deglacial transition.

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