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Os Isotopic Signature of Backarc Abyssal Peridotites from the Godzilla Megamullion
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Backarc seafloor spreading is a unique form of extension intimately tied to subduction zone dynamics. Unlike volcanism at mid-ocean ridges, backarc volcanism evolves from arc-like to MORB-like compositions over the short lifespan (˜15 Ma) of the backarc. Our understanding of the evolution of oceanic mantle during backarc extension is limited to exposures of abyssal peridotite and ophiolites. While some ophiolites are thought to have formed in a backarc environment, few direct comparisons of ophiolite and backarc peridotite have been made due to the small number of documented exposures and limited in situ samples from backarc settings. As a consequence, isotopic investigations have thus far been limited to ophiolite and mid-ocean ridge settings, limiting our understanding of the backarc oceanic mantle.

Here we report Re-Os isotopic data for backarc abyssal peridotites from the Godzilla Megamullion, a massive ˜9000 km^2 oceanic core complex located in the Parece Vela Basin (Philippine Sea). In this region, Izu-Bonin-Mariana subduction zone is responsible for creating the Parece Vella and Shikoku backarc basins as well as the Mariana Trough. In the last decade, five expeditions have collectively sampled the length of the Godzilla Megamullion. The distal end records early, magmatically productive extension marked by moderately depleted spinel peridotites. This transitions into a less melt-productive medial region characterized by more fertile peridotite. The proximal region represents the most recently exhumed portion of the megamullion and was the focus of the latest (October 2011) mapping and sampling expedition. Ultramafic samples from the proximal region are dominantly spinel lherzolite +/- plagioclase. Whole rock $^{187}Os/^{188}Os$ (0.1208-0.1301) ranges from mildly subchondritic to primitive mantle values, consistent with abyssal peridotites from mid-ocean ridge settings. Samples from distal, medial, and proximal regions are isotopically indistinguishable. Spinel grains in proximal samples record high TiO_2 and Cr# produced by melt stagnating and interacting with the mantle. Re concentrations are positively correlated with TiO_2 abundances in spinel, suggesting that Re is also influenced by melt-rock interaction. However, $^{187}Os/^{188}Os$ ratios are not correlated with Re concentration, demonstrating that modest Re addition occurred recently. A few samples record mildly radiogenic values (0.1321-0.1414), the most radiogenic of which has experienced approximately 5 wt. % MgO loss. Therefore, the radiogenic $^{187}Os/^{188}Os$ signature may be the result of seafloor weathering. As a whole, the $^{187}Os/^{188}Os$ data suggest that the backarc oceanic mantle in this region did not experience significant ancient melt depletion, and radiogenic $^{187}Os/^{188}Os$ ratios were likely generated during secondary processes.

キーワード: oceanic core complex, abyssal peridotite, osmium, Godzilla Megamullion
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