Sr-Nd-Pb-Hf isotopes reveal the nature and evolution of mantle upwelling at Ross Island, Antarctica

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Ross Island, Antarctica, is home to Erebus, the world's southernmost active volcano. Mt. Terror, Mt. Bird, and Hut Point Peninsula are older (~0.3 to 4 Ma), mainly basanitic volcanic centers that surround Erebus on the periphery of Ross Island. The geochemical compositions and the HIMU isotopic signatures of the phonolitic Erebus lavas are well characterized [1]. Many questions nevertheless remain about the nature of mantle upwelling, including whether Ross Island is the manifestation of a small mantle plume.

The peripheral volcanic centers provide a means to investigate these questions. We collected lavas and tephras from Mt. Terror, Mt. Bird, and Hut Point Peninsula and analyzed their Sr, Nd, Pb, and Hf isotope compositions and major and trace element concentrations. Fifty-eight samples have $^{87}Sr/^{86}Sr$, ε_{Nd}, $^{206}Pb/^{204}Pb$, and ε_{Hf} between 0.702907 and 0.703147, +4.28 and +6.28, 19.2820 and 20.2406, and +5.63 and +8.55, respectively. All of these ranges are wider than those of Erebus (excluding an Erebus trachyte, which shows clear signs of crustal assimilation [1]) and display distinct differences between the three peripheral volcanic groups. Many Mt. Bird samples deviate from other Ross Island samples in ε_{Nd}-ε_{Hf} (and Pb-Pb) space, revealing a shallower slope potentially indicative of the involvement of pelagic sediments in their source [2].

The radial symmetry of Ross Island's peripheral volcanic centers and high eruptive volumes suggest a plume origin for Ross Island magmatism. $^{206}Pb/^{204}Pb$ for samples from Mt. Terror and Mt. Bird decreases with increasing distance from Erebus, which could indicate dilution of the HIMU signature and increased mixing with surrounding lithosphere and asthenosphere with increasing distance from the center of the plume. The presence of kaersutite in peripheral lavas and its absence in Erebus lavas supports the presence of a plume with a hotter, drier core and a cooler, wetter periphery [3].

[1] Sims et al. (2008) *J Volcanol Geoth Res* **177**, 606-618, and references therein. [2] Blichert-Toft et al. (1999) *Science* **285**, 879-882. [3] Kyle et al. (1992) *J Petrol* **33**, 849-875.