
PP41C-1669 Tristan-Gough-Walvis Ridge Plume System, testing plume-ridge interaction at IODP Expedition 391 Site U1577 on the eastern Flank of Valdivia Bank



Thursday, 14 December 2023



11:30 - 15:50



Poster Hall A-C - South (Exhibition Level, South, MC)

Abstract

The Tristan-Gough plume system forms age-progressive volcanism on the African plate over ~130 Ma, extending to the active islands of Gough and Tristan-Inaccessible. Walvis Ridge forms massive ridges and plateaus that split into three narrower ridges of the Guyot Province. International Ocean Discovery Program (IODP) Expedition 391 Site U1577 sampled the extreme eastern flank of Valdivia Bank, an oceanic plateau within the Walvis Ridge.

Here we report major and trace element data as well as Sr-Nd-Hf-Pb isotopic compositions of IODP 391 Site U1577. Three massive basalt flow subunits were drilled, separated only by thin chilled margins. The lack of any sediment or significant alteration at the contacts, and their consistent paleomagnetic inclination, all suggest that these flows were erupted in relatively quick succession. Accordingly, geochemical variations are minimal. Samples from Site U1577 form tight clusters that overlap in major and trace elements with previous dredge and Deep Sea Drilling Project (DSDP) drill site samples from the Walvis Ridge. All are less enriched in incompatible trace elements, i.e., Ti, K, P, Sr and Zr, relative to samples from Tristan and Gough islands and the Guyot province, consistent with Walvis Ridge samples formed by higher degrees of partial melting. In contrast to Walvis Ridge dredge samples, Site U1577 samples are shifted slightly towards higher $^{176}\text{Hf}/^{177}\text{Hf}$ and lower $^{208}\text{Pb}/^{204}\text{Pb}$ isotopic compositions, while overlapping in $^{207}\text{Pb}/^{204}\text{Pb}$ vs. $^{206}\text{Pb}/^{204}\text{Pb}$ as well as Sr-Nd isotopic compositions. Such elevated $^{176}\text{Hf}/^{177}\text{Hf}$ combined with lower $^{208}\text{Pb}/^{204}\text{Pb}$ isotopic compositions have otherwise only been reported from the Eastern

Rio Grande Rise formed in near-/on-ridge position. Magnetic lineations imply formation of Valdivia Bank by seafloor spreading as well. Site U1577 samples provide geochemical support for this hypothesis whereas dredge samples lack signatures of plume-ridge interaction. Also, with Site U1577 on the eastern flank, it is farthest from the mid-Atlantic Ridge at the time of formation compared to the location of near-by dredge samples. With major and trace element data integrated on the same samples as isotopic compositions, we will address the contrasting possibilities of an integral depleted plume component versus evidence for plume-ridge interaction.

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