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On/Near Ridge Formation of the Eastern Rio Grande Rise, South Atlantic

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The barely studied Rio Grande Rise (RGR), South Atlantic, is a Large Igneous Province linked to the Parana-Etendeka flood basalt province and generally believed to have formed in conjunction with the Walvis Ridge when the Tristan-Gough-plume (TG-plume) was on or near the mid-Atlantic Ridge. Here we present the first comprehensive major, trace and Sr-Nd-Hf-Pb isotope study of cruise NBP1808 dredge samples with focus on the Eastern RGR (E-RGR). Ages by Davidson et al. [1, and this meeting] found no simple age progression. RGR lavas overlap in Pb isotopic compositions with other TG-plume lavas supporting a co-genetic origin. However, in detail RGR is very different. MORB-type signatures suggesting on-ridge eruptions with Nd-Hf-Pb isotopic and depleted trace element compositions overlapping South Atlantic MORB are found in the most northern and southern sections of E-RGR. Overall E-RGR lavas are dominated by depleted Sr-Nd-Hf isotopic compositions with higher Hf-Nd isotopes, yet their Pb isotopes fall on the $^{208}Pb/^{204}Pb$-$^{206}Pb/^{204}Pb$ array defined by other TG-plume samples. We interpret this to reflect a continuum of plume-ridge interactions and suggest that the E-RGR formed in a dominantly on- or near-ridge tectonic position. This is consistent with the microplate hypothesis by Sager et al. [2] with the MORB-type samples delineating its northern and southern limits, although the eastern and western limits are not captured by the limited sampling. Finally, a **lateral geochemical zonation over 70 Ma characterizes the Guyot Province with Tristan-type to the north and Gough-type to the south [3]. No such spatial zonation is observed for the E-RGR. To the contrary,** Gough-type signatures are only found in the north of the E-RGR intermingled with Tristan-type, which is difficult to reconcile with our present understanding of lateral plume zonation even in the presence of a microplate. It appears that the unique asymmetry of TG-plume volcanism at the time of E-RGR formation is mainly controlled by plate configuration and the presence of a microplate.

1. Davidson, P.C., et al. Fall AGU 2022.
2. Sager, W.W., et al., 2021. Geochemistry Geophysics Geosystems, 22(3).
3. Rohde, J.K., et al., 2013. Geology, 41, 335-338.