PP43B-03 Chemical Stratigraphy of IODP Expedition 391 Site U1578, Guyot Province, Tristan-Gough-Walvis Ridge Hotspot Track with Links to Physical Properties Measurements

Thursday, 14 December 2023

17:32 - 17:42

3020 - West (Level 3, West, MC)

Abstract

Walvis Ridge, a time-transgressive series of ridges, oceanic plateau, seamounts, guyots, and two active volcanic islands extending SW from the coast of Namibia, records the evolution of the Tristan-Gough-Walvis Ridge (TGW) hotspot and the opening of the South Atlantic since ~135 Ma. However, much of our current understanding of the interplay between geodynamic cycles, tectonism, and mantle plume generation along the TGW hotspot track is based upon a limited number of dredged rock samples. Here, we present preliminary whole rock major and trace element geochemistry and shipboard physical properties data from Site U1578, located on a Center track guyot in the Guyot Province. The 302 m of igneous section recovered from Site U1578 provides an extraordinary, > 1 Myr record of plume magmatism, submarine volcanism, and geochemical evolution.

The chemical stratigraphy of core from Site U1578 provides important new perspectives on submarine volcanism, magma flux, and the transition between continental tholeiitic basalts of the Etendeka flood basalt province and alkaline lavas of the Guyot Province. Core from U1578 records the longest sequence of pillow, sheet, and massive lava flows in the TGW system. Eleven (of 12 total) lithologic flow units record shifts in major and trace element geochemistry and episodic cycles of recharge and fractional crystallization. Preliminary XRF and ICP-MS analyses indicate a dominantly

pyroxenite source and document the shift between high TiO_2 (>3.5 wt. %) to low TiO_2 (<3.5 wt. %) alkaline basalts. Site U1578 core samples from the Guyot Province have lower Nb/Y and Zr/Nb compared to Walvis Ridge sites drilled closer to the African continent (Frio Ridge at Site U1575 and Valdivia Bank at Sites U1576 and U1577), coincident with a transition from plume-ridge interaction to intraplate magmatism with time. This shift resulted in a thicker lithospheric lid and thus deeper and lower degrees of melting, preferentially sampling the enriched plume component.

Additionally, shipboard natural gamma radiation (NGR) and magnetic susceptibility (MS) measurements correlate well with observed lithologic characteristics and new ICP-MS and XRF analyses. A 100 m zone of high NGR values neatly overlaps high K_2O, and olivine cumulate layers correlate to higher MS and higher concentrations of Cr and Ni.

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