Walvis Ridge-Tristan-Gough, South Atlantic – triple-zonation of a plume over 60 Ma and the role of LLSVP

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Synchronous, sub-parallel and long-lived volcanism along the South Atlantic hotspot tracks (Tristan-Gough, Discovery, Shona) as well as their alignment at the projected edge of the African Large Low Shear wave Velocity Province (LLSVP) supports their origin from plumes rising from the lower mantle [1]. The Walvis Ridge-Tristan/Gough seamount province in the South Atlantic represents 130 Myr of continuous intra-plate volcanism that can be connected to the once conjunct Parana-Etendeka flood basalt province. With this it represents one of the few primary hotspots consistent with the thermal plume model. In addition, the Tristan-Gough plume has been shown to represent the longest-lived, bi-laterally zoned mantle plume (>70 Myr) yet observed [2].

The detailed dredge sampling of cruise MV1203 using the R/V Melville complements previous sampling, achieving a dense coverage of seamounts <70 Ma. Samples free of seawater alteration from 26 previously unsampled seamounts reveal in Pb isotope space a third compositional zone. This zone persists for at least 60 Myr and is sampled by seamounts between the two previously identified zones. However, in Pb isotope space the three zones can be described as a set of binary mixing arrays between only four mixing endmembers, each well defined as intersections of 2 or 3 arrays. The Tristan-endmember only contributes to the northern zone, the Gough-endmember to the southern zone. The fact that all three zones have contributions from the DSDP-525 and high-$^{206}Pb/^{204}Pb$ endmembers as well as the lack of ternary or quaternary mixtures has important dynamic implications. The shared DUPAL character and contributions in space and time of the Tristan and Gough endmembers suggest sources linked to the LLSVP. Here all plume-zones relate to the LLSVP, thus the explanation of LLSVP vs. non-LLSVP sources as the cause of plume zonation does not apply. The origin of the well-defined mixing endmembers is modelled in the context of DUPAL and global variations of oceanic basalts.

[1] O'Connor et al., 2013, *Nature Geoscience* **5**, *735-738*; [2] Rohde et al., 2013, *Geology* **41** *335-338*.