**The geodynamics of plume-ridge interaction**

**at fast spreading rates**

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Interaction between actively upwelling deep mantle plumes and mid-ocean ridges usually results in excess melting, thickened oceanic crust and unusually shallow ridge depths. The Foundation plume, in contrast, is geophysically characterized by a supposedly only weak excess temperature (<20K) and a small plume volume flux (~1.0 km3 a-1) but these geophysically derived constraints may be biased by the high volume flux through the melting zone of the fast-spreading Pacific-Antarctic Ridge (PAR). However, the Foundation plume delivers material compositionally distinct to the PAR, thus opening up the unique opportunity to geochemically map and infer on the dynamics of plume-ridge interaction at fast-spreading ridges.

Plume dispersal along the PAR can be mapped using geochemistry but draws a heterogeneous picture depending on the tracer used. Radiogenic isotopes (e.g., 206Pb/204Pb) may indicate a symmetric geochemical anomaly along the PAR whereas the signal carried in incompatible trace elements (e.g., Ba/Nd, Nb/Zr) indicates a strong asymmetry. Assuming that melts, following segregation, are extracted to the ridge axis in almost no time, this mismatch may be explained by the time-integrated relative motions between plume conduit, convecting plume mantle and the axial melting zone. However, a southward sub-lithospheric mantle flow is required to explain the observed patterns in geochemical composition and excess volume observed at the PAR axis. Further evidence for the existence of a southward mantle flow is derived from the following observations. The overlapping spreading center in the north of the Foundation-PAR intersection acts as a barrier for the dispersal of plume material and is migrating south. This is in contrast to the expected migration direction away from where the maximum flow of material from the plume to the ridge is observed (i.e., where both intersect). The volume of intraplate volcanism linked to excess melting and increased magma supply along the axis (as also reflected in shallowing of the axis and crustal thickening) is greatest exclusively at and south of the plume-ridge intersection.

This provides evidence that a strong uni-directional flow must exist at sub-lithospheric depths that effectively drags the plume material southwards. The trajectory of this induced flow is resulting from the relative motions between the migrating PAR, the separating plates and the residual mantle, emphasizing the strong tectonic control of fast-spreading ridges on plume-ridge interaction.