**The Foundation-PAR plume-ridge interaction: constraints on competing forces and the structure of oceanic lithosphere**

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Actively upwelling deep mantle plumes can affect the physical and chemical properties of nearby mid-ocean ridges even over large distances by supplying additional material and heat to the axes. Strong plumes affecting several hundreds of kilometers of the ridges close to Iceland or Galápagos lead to large scale excess melting with the formation of oceanic plateaux or islands and long sections of thickened crust at the adjacent spreading centers. The Foundation plume – Pacific-Antarctic Ridge (PAR) interaction is different in that the fast-spreading ridge effectively masks most obvious geophysical signals of the melting anomaly. Here, we demonstrate that the well-preserved geochemical signature allows to set precise constraints on the geodynamics of plume-ridge interaction.

Compositionally, plume-ridge interaction leads to the enrichment of the axial magmas in radiogenic isotopes and incompatible elements. In order to qualitatively map out the spatial distribution of plume material underneath the PAR, we applied robust statistical fitting methods to geophysical and geochemical data of the axis. In agreement with the geophysical constraints on plume center location, the highest 206Pb/204Pb and La/Sm, Ba/Nb and Nb/Zr ratios occur in axial lavas near 37.5°N. From this point, the geochemical plume signature decreases north- and southwards along the axis. To the south, the geochemical plume signature is detectable for >250 km but to the north the plume signature is bound by the overlapping spreading centre (OSC) at 36.5°S, restricting the dispersal of plume material northwards to within ~100 km off the plume center.

Here, we show that the lithosphere structure of the PAR controls the dispersal of plume material along the axis, at least in its present state. The small but significant offset in lithosphere thickness at the retreating limb of the OSC prevents plume material to flow further north. This implies, that the plume material must be channeled into the ridge axis and dispersed along the axis at very shallow, sub-lithospheric, depth. Otherwise, plume material would be expected to be tapped also by lavas erupted on the PAR segment further north that is in parts closer to the plume center than much of the Foundation Segment. The preferred along-axis flow of plume material towards the south may be enhanced by the plate configuration that imposes a southward drag of material at sub-axial asthenospheric depths. This system, however, is not in a steady-state but responds to the competing forces between the ridge and plume with the Foundation plume showing evidence for increased activity at a periodicity of ~1.5 Ma.