Mantle Flow from beneath Antarctica toward the Southeast Indian Ridge

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New geochemical data on glassy basalts from ~37 localities along the Zone A spreading axis of the Southeast Indian Ridge (SEIR) between 126°-140°E map a geochemical and negative axial depth anomaly centered on two overlapping ridge segments at ~135°E. The anomaly has distinct radiogenic Pb and He isotopes, relative to adjacent segments west and east. Pb-Pb isotopic co-variations for all 5 Zone A segments define two linear arrays, a western trend and an eastern trend intersecting at the composition of the 135°E anomaly with $^{206}Pb/^{204}Pb$ ~ 19. In contrast to Pacific MORB the Zone A lavas have negative $\Delta^{207,208}Pb/^{204}Pb$ suggesting Mesozoic source U-enrichment. Recent tomographic studies [1]show slabs in the upper mantle subducted and positioned along the 140 Ma edge of Gondwana in the Mesozoic era, prior to breakup, that could be the source of the U-enrichment. Overall, $^{206,207,208}Pb/^{204}Pb$ and $^{4}He/^{3}He$ of the anomaly define trends that vector toward the fields for Cenozoic lavas from West Antarctica (Marie Byrd Land and Balleny Islands). West Antarctica has a history of mantle plume underplating and lithosphere modification by subduction [1-3]. Surface wave tomography indicates hot sublithosphere mantle (slow) and relatively thin lithosphere beneath Marie Byrd Land and the Ross Embayment, in sharp contrast to the thick cool (fast) lithosphere beneath East Antarctica [4]. The fast/slow contact runs under the Transantarctic Mountains and seismically slow material (plume material?) extends along the George V and Balleny TF region across the SEIR to near Tasmania [4]. The geochemical anomaly beneath Zone A is potentially explained by the presence of this residual plume/mobilized lithospheric material in the subridge mantle of the SEIR.

[1] Simmons et al. 2015, GRL; [2] Hart et al., 1997, Chem Geol; [3] Aviado et al. 2015, G3; [4] Morelli and Danesi, 2004, GPC

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