



Horizontal asthenosphere flow beneath the lithosphere

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An east-west line (the Pocos de Calda - Cabo Frio Alignment) of ~20 alkalic igneous intrusions occurs just inland of the Brazilian coast near Rio de Janeiro. This trend is about 500 km long and progresses in age from ~80 Ma in the west to ~50 Ma in the east. The Trindade/Martin Vaz hotspot track comes ashore the Brazilian coast at about 50 Ma. In the time range 80 to 50 Ma, Trindade's projected track is parallel to but displaced ~300 km north of this line of intrusions. We propose this is evidence that the mantle plume stops rising when it meets the base of the thick continental lithosphere (beneath the Sao Francisco Craton) and begins to spread out horizontally beneath the lithosphere. It spreads out most easily toward the south, in the direction of the thin-lithosphere Atlantic Ocean, and undergoes some pressure-release melting as the moving asthenosphere ascends where the lithosphere begins to thin as it changes from cratonic to oceanic thickness. The Brazil case is an exact analog of an example in Eastern Australia where in the interior there is a straight-line hotspot track marked with four leucitite intrusions while several hundred kilometers east following the coastline there are numerous basaltic fields with measured ages progressing exactly the same as the interior line. (Asthenosphere blocked by the Australian lithosphere spreads to the east; pressure-release melting occurs where asthenosphere rises as it approaches the thinner oceanic lithosphere.)

We think the Cameroon volcanics are also an example of horizontal asthenosphere flow; asthenosphere brought up by plumes in interior of Africa (Al Hoggar and Tibesti) moves in a lithosphere channel (marked by the Benue Trough) with eruptions occurring as it approaches the thinner-lithosphere ocean. The ~90 Ma volcanics of the Mississippi Embayment appear to be yet another example of this process. [These volcanic progressions which we consider to be evidence of upslope-moving-asthenosphere have been studied by several others, notably McDougall and Duncan (Australia), Thomaz-Filho (Brazil), and Perez-Gussinye (Cameroon).]