PLUMES - The Strawman

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1. In hotspots, as in Island Arcs, the source of basalt, the source of heat or energy, and the source of "contamination" (trace elements, isotopes) can all be different.
2. The source of basalt must be relatively deep (greater say, than 300-400 km) to satisfy tomography and provide the kind of stability that plumes seem to have. The heat source must be deeper since plumes are probably mainly heated from below. The "contamination" may be shallow. The direct evidence for plume depths (gravity, bathymetry, heat flow, tomography) can be satisfied in the upper 200 or 300 km of the mantle.
3. The lower mantle (LM) has higher viscosity than the shallow mantle and by thermal effects and boundary topography can provide a stable reference frame (hot upper mantle plumes over hot patches of LM). Subducted slabs are high viscosity and can also provide a reference system more stable than continents or ridges.
4. Sediments and altered oceanic crust are hard to recycle below 200-300 km because of dehydration of the slab and mechanical effects. The slab is de-metasomatized upon subduction, hydrating and enriching the shallow mantle (non-uniformly). This shallow recycled material from the slab eventually acts as an enriched (but not necessarily fertile) source for hotspots. The plume signature is acquired at shallow depths, even if the basalt and the heat are based much deeper. The hydrous mantle wedge flows readily but stays shallow.
5. Small melt fractions are also trapped in the shallow mantle (sub-crust, sub-lithosphere) by buoyancy, viscous, strength, permeability and thermal considerations. These contribute a distinctly different enriched component to be later tapped by plumes.
6. The shallowness of the various enriched components is attested to by the initial (enriched) products of rifting, ridge jumps, abandoned ridges (final products in this case), new hotspots, fracture zones, propagating rifts, uplifted peridotites (St. Peter-Paul, St. John) and the perceived need for a shallow EM in models that involve widespread asthenospheric contamination, an enriched CL, streaks, tongues, channels, plume heads in a "depleted asthenosphere". Plume heads alone eliminate the "depleted asthenosphere" every 10^9 years and fill up the shallow near-ridge mantle more often.
7. The depleted fertile (MORB) reservoir is below the EM (which may be enriched yet refractory) and is underlain by a non-uniform heat source (plume-like upwellings require strong bottom heating). The CMB is not a strongly bottom heated region unless the lower mantle is depleted in radioactivities.
8. The characteristics of IAB and BABB suggest a shallow origin for EM (OIB-like).
9. The lower mantle is refractory, depleted and infertile and intrinsically denser than the upper mantle (mainly because of CaO, Al_2O_3, Na_2O, SiO - contents). It contributes heat but not material to the upper mantle.
10. Plumes and ridges share the same basalt reservoir (the fertile mesosphere).
11. Depleted and enriched basalts differ because of their interaction with the shallow namtle and lithosphere.
12. The purest uncontaminated MORB is found at mature, rapidly spreading, slowly migrating ridges but all MORBs are mixtures.
13. Shallow contamination by EM is most pronounced for slowly spreading, rapidly migrating, new ridges.
14. For dying ridges or aborted rifts, the shallow EM (perisphere) can creep back in, laterally.

15. Rift and plume-like upwellings can be initiated by lithospheric effects as well as by hydrodynamic instabilities.

16. At depth all upwellings are depleted. Plumes may be the primary convective upwellings (which would give MORB-like products if the enriched shallow mantle were not present which it, by and large, isn't near mature ridges). Plumes can be MORB-like; upwellings at ridges can be enriched.

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