meetabst/VMSG2000-MORs-Sedbergh.rtf Talk given at Geol Soc/Min Soc Volcanic & Magmatic Studies Group annual meeting, Sedbergh, 5-7 Jan 2000.

Construction of oceanic plates at MORs: a new model for the Earth's most active magmatic process

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The current model of the MOR process assumes (a) that hot-emplaced ophiolites (HEOs) are good examples, (b) that the seismic anisotropy is due to (divergent) mantle flow. But HEOs exhibit widely-ignored unre-equilibrated HP features (e.g. diamonds, garnet peridotite, picritic melt veins) that don't fit the MOR model. Moreover the model doesn't provide the young-plate buoyancy implied by 'flat-slab' subduction, nor explain many of the constructional features of MORs.

My (VMSG99) model for intraplate/OIB has an MOR counterpart, preliminarily outlined at IUGG95. Like the OIB model, it has a deep, narrow (20cm?) axial mantle crack, whose walls are sustained from collapse by magma diapiric pressure and the un-water-weakened LVZ wall-fabric rheology now recognized where low% interstitial melt is present. Crack opening ('spreading') is balanced by wall accretion of cumulate plus restite, crystallizing columnar olivine with a-axes (the seismically fast one) perpendicular to the walls. Heat-induced solid-state phase-change dilatation (e.g. spinel- to plag-peridotite), within the walls, locally and intermittently closes the crack and pushes the plates apart*, opening the crack along-strike and inducing flow up it. Cooling of the closed crack, due to magma shut-off, reverses the dilatation and completes the cycle.

I will show how the model explains some aspects of the MORB geochemical signature and variable fractionation, also most of the well-known constructional features (straight axes, orthogonal segmentation, OSCs, axis curvature at RTIs, oblique axes between closely-spaced transforms, fast uplift of fracture ridges, etc.), plus providing enough ridge push to support the Andes and Himalayas (the current model fails by a factor >5) and why slow spreading gives rift valleys (but not on Reykjanes/Iceland).

I will also present, very briefly, a stable-mate model for HEO genesis and emplacement which provides for the observed HP features, explains their frequent association with continental clastics and has nothing to do with subduction, even in the case of so-called SSZ HEOs.

* with greatly-increased ridge-push compared with the divergent flow model, and perhaps drive subduction without slab pull.