My ref. meetabst/IGCRioC1.rtf   Accepted 16/Dec 1999

31st Intl Geol Congr, Rio de Janeiro. August 2000.
General Symp. 4.1, Geologic Processes in Mid-Ocean Ridges.

What goes on beneath MORs? A reassessment

OSMASTON, MILES F. The White Cottage, Sendmarsh, Ripley, Woking, Surrey GU23 6JT, UK.   miles@osmaston.demon.co.uk

The divergent mantle flow model of MORs (mid-ocean ridges), fails >5-fold to provide enough ridge push to support the Andes or Himalayas. Also the plate thus constructed consists of slab/lithosphere only, so has not the thermal buoyancy needed for development of 'flat-slab' young-plate subduction zones. This requires that some LVZ (low-velocity zone) material be an integral part of the plate, made possible because interstitial melt removes the water-weakening of the mineral fabric. It also lowers LVZ thermal conductivity.

I present a new MOR model, developed from my earlier proposal (IUGG95), invoking a deep, narrow (<<1m?) mantle crack below the axis, maintained in width by wall accretion of restite and cumulate. Columnar olivine forms with a-axes perpendicular to the walls and builds-in magmatically the seismic anisotropy formerly thought to imply divergent mantle flow. Any asymmetry of lateral cooling results in asymmetrical wall accretion ('spreading') and can explain the straightness of MOR segments, axial curvature at transform intersections and occurrence of propagating offsets. Heat from the crack induces local phase-change dilatation of the adjacent mantle, temporarily closing the crack and wedging the plates apart, thus providing very large ridge push. Under slow MORs this mantle wedging can explain crustal rift valleys.

Hot-emplaced ophiolites (HEOs) show flow structures in the mantle tectonite directly below a disrupted crustal contact. But the presence of (widely overlooked) unre-equilibrated high pressure features (garnet lherzolite, garnet pyroxenite pods, picritic melt veins and even diamonds) in the tectonites sadly imply that HEOs cannot relate directly to the MOR process.