Geophysical Research Abstracts,
Vol. 10, EGU2008-A-05803, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-05803
EGU General Assembly 2008

The role of brittle deformation during fast-to-superfast seafloor spreading inferred from tectonic windows into East Pacific Rise-spread crust

Hayman, N.W. (1), and Karson, J.A. (2)

(1) Institute for Geophysics, University of Texas (hayman@ig.utexas.edu), Austin, TX 78758, USA (2) Department of Earth Sciences, Syracuse University, Syracuse, NY 13244, USA

Magmatic and volcanic processes accommodate much of the extension across fast-spreading mid-ocean ridges. Yet, mechanical deformation likely accompanies subsidence of the axial magma chamber and thickening of the lavas. Faults and fractures also provide pathways for hydrothermal fluids. Such fault zones are buried beneath lavas along mid-ocean ridges, and are only intersected locally in drill cores. Escarpments in the Hess and Pito Deep rifts thus provide a unique opportunity to evaluate the distribution and dimensions of fault zones that developed in the subaxial East Pacific Rise (EPR). The faults comprise localized, sub-meter shear zones that nucleated along dike margins and propagated upward into the lavas, in places along multiple splays that offset dikes and lava-flow boundaries. Hydrothermal fluids passed through the shear zones altering the geochemical and mineralogical composition of the fault rocks. Fault-gouge and secondary minerals sealed some parts of the shear zones, whereas other parts were long-lived conduits that underwent multiple increments of veining and cataclasis. Damage zones surround the faults and are characterized by their 'deformation intensity'; deformation intensity is proportional to fracture spacing. Individual damage-zone outcrops contain meter-wide zones of breccias between less deformed dikes and lavas. The result is a quantifiable variation in fracture-spacing and permeability at the outcrop scale. At a regional scale deformation intensity ranges from 'high' where fractures completely overprint the igneous structure of the rock, to 'low' where only the cooling-joints of the lavas and dikes are prominent. Relatively high deformation intensities extend for tens-to-hundreds of meters and, in places, co-

incide with changes in the position of the lava-dike transition and/or thickness of the sheeted dike complex. Systematic variations in fault-zone structure and composition suggest that there are characteristic scales of hydrothermal, magmatic, and mechanical behavior of the EPR in both space and time.