Geophysical Research Abstracts,
Vol. 11, EGU2009-2516-2, 2009
EGU General Assembly 2009

Asymmetric ocean basins

G.F. Panza (1), C. Doglioni (2), and A. Levshin (3)

(1) Dipartimento di Scienze della Terra, Università di Trieste, Via E. Weiss 4, 34127 Trieste, and ICTP Trieste Italy, (2) Universita La Sapienza, Dipartimento Scienze Terra, Rome, Italy (carlo.doglioni@uniroma1.it), (3) Department of Physics, Campus Box 390, University of Colorado, Boulder, CO 80309, USA

While the superficial expression of oceanic ridges manifests a general symmetry, the deep nature may rather present a relevant asymmetry. Based on a recent surface-wave tomographic 3D model of the upper Earth's 300 km (Shapiro and Ritzwoller, 2002), we constructed a cross-section parallel to the so-called tectonic equator. The shear wave velocity indicates a systematic difference between the western and eastern flanks of the three major oceanic rift basins (Pacific, Atlantic and Indian ridges). They have a faster velocity and thicker lithosphere in the western limb with respect to the eastern or northeastern one, whereas the upper asthenosphere is faster in the eastern side with respect to the western limb. Perpendicular cross-sections confirm the persistence of the asymmetry moving along the strike of the rifts. The upper asthenosphere (LVZ) is a quite general feature at global level and can be reconciled with a decoupling surface between lithosphere and mantle. It is also well defined by the distribution of the radial anisotropy that reaches minimum values close to the rifts, but with an eastward offset. The data are coherent with the notion of the "westward" drift of the lithosphere relative to the underlying mantle (first order flow) and the occurrence of asthenospheric oblique upraise along rifts (second order mantle flow).

Shapiro, N.M. and Ritzwoller, M.H., 2002. Monte-Carlo inversion for a global shear velocity model of the crust and upper mantle, Geophys. J. Int., 151, 88-105.