Geophysical Research Abstracts, Vol. 7, 02377, 2005
SRef-ID: 1607-7962/gra/EGU05-A-02377

Crustal structure of the northern Ethiopian Rift from receiver function analysis.

G. Stuart (1), I. Bastow (1), S. Piladou (1), and C. Ebinger (2)

(1) School of Earth and Environment, University of Leeds, Leeds, UK;

(2) Department of Geology, Royal Holloway University of London, Egham, UK.

(g.stuart@earth.leeds.ac.uk / Fax: +44 113-3435259)

The crustal structure of the northern Ethiopian rift and the flanking plateaux have been determined by analysing receiver functions from teleseismic recordings of the EAGLE passive seismic experiment. The network was centred on the Boset magmatic segment, 75km SE of Addis Ababa, and covered an area 350km x 250 km. This part of the East African Rift system is thought to be transitional between continental rifting to the south and the sea floor spreading in Afar to the north. Extension rates are low (4mm/yr).

The Zhu and Kanamori technique has been used to measure Vp/Vs and crustal thickness from the Moho P-to-S conversions and their reverberations. Control of the assumed average crustal velocity, required for this method, came from both nearby wide angle refraction profiles and surface wave dispersion. The crust in the rift is more basic (Vp/Vs $\sim$1.93) compared to the flanks (Vp/Vs $\sim$1.83). In fact some stations associated with magmatic segments in the rift have such high Vp/Vs ratios ($>$1.95) that they can only be explained by the presence of partial melt. Crustal thickness varies both within the western plateau from $\sim$35km in the SW to $\sim$43km in the NW as well as between the flanks. In the NW, a recent interpretation of the EAGLE cross-rift wide-angle controlled source profile shows $\sim$10 km of underplate material (Vp $\sim$7.4km/s). The receiver function 'Moho' is at a similar depth as the top of this underplate, which is interpreted from the receiver functions to be the major velocity contrast.

There was sufficient station coverage within the rift (down to $\sim$10km spacing) to produce a migrated receiver function stack profile along the centre of the rift, through

a series of magmatic segments. This profile images a crustal thickness variation from $\sim$30km in the north, just south of Afar, to $\sim$36km, 350 km to the south. The crustal thickness thins most rapidly in a region around the Boset magmatic segment and a change of strike of the rift. Variations in crustal structure have been further studied by joint inversion of receiver functions and surface wave dispersion.