Geophysical Research Abstracts, Vol. 9, 07500, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-07500

Spatial and temporal evolution of the magmatism in the Asal-Ghoubbet rift, Afar depression

P. Pinzuti (1), H. Humler (2), I. Manighetti (3), Y. Gaudemer (1)

(1) Laboratoire de Tectonique, IPGP, (UMR) 7578, CNRS, 75252 Paris Cedex 05, France. (pinzuti@ipgp.jussieu.fr,gaudemer@ipgp.jussieu.fr), (2) Laboratoire de Planétologie et Géodynamique, UMR CNRS 6112, Université de Nantes, Nantes, 44100, France. (Eric.Humler@univ-nantes.fr), (3) Laboratoire de Géophysique Interne et Tectonophysique de Grenoble, Grenoble, France. (isabelle.manighetti@obs.ujf-grenoble.fr)

We investigate the relationships between magmatic and tectonic activities during the process of rifting, taking the example of Asal, one of the most recent and active rifts of Afar. We sampled 65 surface basalt flows across the rift; previous dating suggests that they emplaced from ∼800 ka. The major and trace element composition of the samples preserve a signal of mantle melting depth variations. FeO, $Fe_{8.0}$ and $(Sm/Yb)_N$, $(Hf/Lu)_N$ decreases and $Na_{8.0}$ is constant across the rift. These variations are consistent with shallower melting beneath the axis than from the shoulders of the rift. The quantification of the depth range and percent of decompression melting from $Fe_{8.0}$ and $Na_{8.0}$, suggests that the Asal-Ghoubbet rift is the surface expression of a lithospheric mega-dyke of ∼10 km width and of ∼60 km depth. This result implies a rate of thinning of 6.25 cm/yr over a period of ∼800 ka. The magmatic filling of the rift results from a shallow magmatic chamber (∼4 km). Combined geochemical (major and trace elements) and paleomagnetic analyses of the successive basaltic lava flows (total: 48) exposed in three of the highest (30-80 m) normal fault escarpments, show that the magmatic chamber gives pulses of activities between 300 and 66 ka. The magmatic filling of the rift corresponds to a total volume of lava of about 20 km^3 in 230 ka, giving a mean rate of 10^5 m^3yr^{-1}. Filling occurred in pulses lasting from a few hundred years to about 5 ka with recurrence times of several hundred years to ∼30 ka. The Asal rift thus opened primarily by dyking (since ∼800 ka), the activity in normal faults started late (40 to 70 ka; although some faults existed at 900 ka) and played a minor role in the opening process.