Geophysical Research Abstracts, Vol. 9, 05164, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05164

Magmatism and extension at LIP-related volcanic rifts and volcanic margins

L. Geoffroy (1), M. Leroy (1), S. Gac (2) and J.P. Callot (3)

(1) LGRMP, Université du Maine, Le Mans, France, (2) University of Bergen, Norway, (3) IFP, Rueil Malmaison, France (laurent.geoffroy@univ-lemans.fr)

In LIPs (Large Igneous Provinces) the melting mantle exerts a first-order control on the rheology of the lithosphere and, therefore, on the location and pattern of extension. We present arguments suggesting that the decompressive adiabatic melting mantle is not homogeneously distributed at depth. We argue that these melting anomalies are consecutive to a thermal or regional stress enhancement of the small-scale convection in the gravitational unstable mantle located beneath the mechanical lithosphere. This hypothesis better explains (1) the spacing between the localized melting areas, (2) their setting at the earliest stage of LIPs emplacement, (3) the frequent independence of localized melting areas from former (i.e. ante-LIP) extensional areas. We formerly described the consequences of lowering thermally (and locally) the lithosphere viscosity above the top of small-scale convection cells (the so-called 'soft-point model' for lithosphere extension). However, accumulation of melt products in both the lower and upper crust also plays a role in the mechanical behaviour of the lithosphere. Understanding this role is not straightforward: magma reservoirs act as regional stress concentrators in the crust, promoting its hydraulic-type fracturing. In the other hand, progressive magma plumbing of the lower-crust has an overall hardening effect by increasing its intrinsic viscosity. Finally, focused magma accumulation increases locally the lithosphere gravitational energy, promoting its collapse. We discuss the geometry of volcanic rifts (asymmetry, segmentation, time and space partitioning between magma dilatation and tectonic extension...) integrating previous considerations, field examples and a range of numerical, analytical and analogical modelling.