Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03827, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03827
EGU General Assembly 2008

Effect of the inherited structures on continental break-up: a multi-scale modelling approach

M.C. Knoll(1,3), A. Tommasi(1), J.W. Signorelli (2), R.E. Logé(3)

(1) Géosciences Montpellier, Université de Montpellier II, France (knoll@gm.univ-montp2.fr), (2) IFIR, Rosario, Argentina, (3) CEMEF, Ecole des Mines de Paris, Sophia-Antipolis, France

A strong parallelism is generally observed between rift and ancient orogenic belts, such as the East African, North and South Atlantic rifts. During this process, ancient lithospheric faults are systematically reactivated which suggests that the preexisting structuration of the lithosphere influences the formation and propagation of continental rifts. Besides, the initiation of this process is generally temporally and spatially linked to plume-related magmatism. Nevertheless, there is a paradox between the thermal perturbation and axisymmetric stress field due to the upwelling plume and the planar geometry of rift. Furthermore, data from seismic and electrical anisotropy as well as observations on xenoliths shows that a strong lattice preferred orientation (LPO) of mineral exists in the lithospheric mantle. As a matter of fact, this LPO, developed and frozen from past events, seems to be the main parameter that controls the lithosphere deformation.

In order to study the effect of an inherited LPO and its evolution in response to a tensional stress field leading to continental break-up, we use a multi-scale model in which a viscoplastic simulation of the evolution of olivine LPO is coupled with a 3D finite element mechanical model. We perform extension simulations on a continental lithosphere composed by domains displaying different initial olivine LPO. The later are defined using a multi-domain meshing tool. Results show that a heterogeneous deformation, characterized by strain localisation, appears in the plate. The initial texture acts as a pilot for both initiation and propagation of the strain and the resulting mechanical anisotropy leads to development of a significant simple shear component parallel to the inherited structures.