Geophysical Research Abstracts, Vol. 9, 05347, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05347

How does a lithospheric plate boundary adapt to changes in plate motion? An example from South Island of New Zealand

R. Malservisi (1), K.P. Furlong (2), R. Govers (3)

(1) LMU Munich, Germany, (2) PSU, University Park, PA, USA, (3) University of Utrecht, Netherland

Since ˜ 20 Ma the plate boundary along the Alpine Fault in South Island of New Zealand has undergone substantial changes. The combination of movement of the Eulerian pole describing the Pacific-Australian relative motion with the southern migration of the Hikurangi subduction zone has changed the conditions along the Alpine Fault to progressively more transpressive. On a crustal scale this change has been accommodated by crustal thickening and the creation of the Southern Alps, on the full lithospheric scale it is still not clear how these changes in plate motion are accommodated. At shallow to middle level where the lithosphere is predominantly brittle these changes of motion are normally accommodated through strain partitioning along preexisting weakness (faults) and/or through crustal thickening. Within the ductile regime,the plate boundary shear may reorient along a more favorable direction (a typical behavior for a linear viscous flow) or it may localize along a preexisting weak shear zone with lithospheric thickening (typical for power law rheology). Here we use a FEM to simulate the evolution of the Southern Alps and to analyze the effects of the coupling between ductile and brittle lithosphere (in particular the presence of a fault), the effects of boundary conditions (southern migration of the subduction) and of the rheology (linear vs. powerlaw) on the localization of the flow in the ductile part of the lithosphere and how the lithospheric scale plate boundary adapts to the new tectonic regime. We show that the location of the fault in the brittle layer that is better aligned with respect to plate motion controls the localization of deformations in the ductile regime. We also show that in the ductile region, the direction of maximum shear within the localized region of deformation tends to orient along the direction of the plate motion.