Geophysical Research Abstracts
Vol. 13, EGU2011-8388, 2011
EGU General Assembly 2011

3D geodynamic evolution of a section between Grenoble and St Jean de Maurienne (External Western Alps)

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From rifting to continental collision, the Alps are the result of a succession of tectonic events whose impact is variable both in space and time. Particularly, the respective contributions of N-S and E-W shortening events to the present-day structure are difficult to unravel without a quantitative 3D model of the belt. This project aims at constructing a 3D model of key areas of the French-Italian Alps in order to decipher the amount of shortening due to both stages of shortening and relate to them geodynamics of the Alps-Apennine junction.
Areas that have been chosen offer several opportunities such as: (1) the steep topographic gradients that permit a structural analysis in 3 dimensions. (2) the ante-rift Triassic deposits that are supposed to have been deposited over a peneplain. Attached to the basement through most of the tectonic evolution, this level is a good marker of the metric to kilometric deformations after the rifting. (3) The metapelitic in the Liassic sediments that allows to estimate Pressure-Temperature-time-deformation (P-T-t-d) conditions, essential for geodynamics reconstructions.
With the perspective to constrain the multiphased character of the shortening proposed in the litterature – namely a N-S ante- to syn Priabonian followed by an E-W phase post-Priabonian- and to quantify the respective contributions of these two phases, an identification of structures was carried out in the field. The analysis of basement-cover interface and ductile deformation above and below shows that the intense deformation of the overlying Lias is accommodated in the basement by a limited number of reverse shear zones who reactivates only very partially the normal faults inherited from the rifting and lead to an apparent 'folding' of the basement. The kinematics of these shear zones is mainly East to West. P-T estimates (multi-equilibrium methods and RSCM) suggests that deformation occured in the greenschist facies conditions (3-4 kbar and 300-370°C). In addition, the 3D model allows the visualization of structures in their entirety. A point of interest is to avoid bias of quantification during restauration caused by the orientation of cross-sections. It is then possible to quantify the amount of shortening of each phase (N-S and E-W) in space.