



Combined underthrusting and mantle dripping - lateral dragging controlling the lithosphere structure of the NW-Moroccan margin and the Atlas Mountains

I. Jiménez-Munt (1), M Fernandez (1), and S. Zlotnik (2)

(1) Inst. Earth Sciences 'J. Almera', ICTJA-CSIC, Barcelona, Spain (ivone@ictja.csic.es, +34 93 4095410), (2) LACAN, UPC, Barcelona, Spain

Recent studies carried out in NW-Africa indicate prominent variations of the lithosphere-asthenosphere boundary (LAB) depth. The studies integrate gravity, geoid, surface heat flow, elevation and seismic data along a profile running from the Tagus Abyssal Plain to the Sahara Platform and crossing the Gorringe Bank, the NW Moroccan Margin and the Atlas Mountains. The resulting mantle density anomalies show a prominent lithospheric mantle thickening beneath the margin (LAB >200 km-depth) followed by thinning beneath the Atlas Mountains (LAB ~90 km-depth). A combination of mantle underthrusting due to oblique convergence together with a viscous dripping fed by lateral mantle dragging can explain the imaged lithospheric structure. The model is consistent with a strong decoupled crustal-mantle mechanical response to the Africa-Eurasia convergence and results in positive/negative dynamic topography in regions with thickened/thinned crust.

In the present work we go a step further analysing the role of the lithospheric mantle structure on the resulting dynamic topography and the dynamic conditions suitable to produce the inferred mantle density anomalies. Therefore, we calculate the dynamic topography rising from mantle thickness variations along the profile and those related to possible lateral variations of mantle composition. In addition, we study the key factors controlling the deformation of the lithospheric mantle when submitted to convergence by means the fully dynamic software UNDERWORLD. Chief among these factors are the mantle viscosity and its temperature dependence, the characteristic time of the process, and the resulting topography variation of the free upper surface. These results allow us to speculate on the past and future evolution of the NW-Moroccan margin which could show the appropriated conditions for subduction initiation.