



Evidences for weak crust during Alpine collision in external Western Alps

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In the external Western Alps, the collision started with the shortening of the proximal European (Dauphinois) margin. One peculiar feature is the crustal thickening that finally led to the exhumation of the basement External Crystalline Massifs (ECM) during the Neogene. In these massifs, various age of shortening, structural style and sequence of deformation have been proposed leading to different kinematics along the Alpine arc that in turn do not imply the same crustal/lithospheric strength.

In this contribution, we present new structural and microstructural data along with Ar/Ar ages from field studies in the Oisans-Grandes Rousses massifs, between Grenoble and Briançon).

From balanced cross-sections, we show that about half of the external zone crustal shortening is accommodated within the ECM with similar Ar/Ar ages in all massifs. Furthermore, the shear zones present very large thicknesses (several hundred meters) and do not reactivate either the inherited Liassic normal faults or the Variscan foliation. Finally, the main shortening structures are localized beneath inherited Liassic syn-rift basins.

These results suggest that the crust was weak during its shortening. Such behavior is most likely due to the combination of several factors: the crust burial (below the overthrusting internal units) down to about 10km, the presence of weak inherited syn-rift basins, and the strain softening in shear zones that evolve in mica-rich phyllonites. These results are consistent with the studies in the Aar massif and should most likely apply to the Mont Blanc massif, whose relationships with its cover are still debated.