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Crustal shortening in the External French Alps

N. Bellahsen (1), S. Garcia (2), F. Mouthereau (1), L. Jolivet (1), O. Lacombe (1), C. Gumiaux (3), L. LePourhiet (1), and F. Negro (4)

(1) Univ. Paris 6, Laboratoire de Tectonique, France, (2) Freie Universität Berlin, FR Geologie, Germany, (3) Univ. Orleans, ISTO/DSTE, France, (4) Univ. Neuchatel, Institut de Géologie et d'Hydrogéologie, Suisse

In this contribution, we present a new complete and detailed cross-section of the external Alps from the Valence basin to the penninic frontal thrust (at the latitude of Bourg d'Oisans). From this data, several problems are addressed: (1) the estimated total shortening amount, (2) the restoration of this cross-section, the deformation sequence, and the basement-cover coupling and, (3) the kinematics and mechanics of crustal rocks deformation (especially basement rocks).
The cross-section has been built from field observations (and published other data) along a transect through the external cristalline massifs of South Belledonne, Grandes Rousses, and Pelvoux. Special attention was paid to the Triassic formations in order to have a proxy of the basement deformation. The shortening amount in the basement is estimated to about 15% though the external crystalline massifs. The sedimentary cover over the decollement (at the base of the cover) clearly accommodated more shortening and was probably deformed shortly before the basement. The shortening in the basement is accommodated along thrust faults or shear zones, that are not reactivated normal faults neither reactivated variscan foliation planes. Moreover, the basement-cover interface if folded. This implies a delocalized deformation at certain distance from the fault/shear zone. We show that in many places this delocalization is actually due to numerous and very thick shear zones, attaining few hundreds of meters. Detailed mapping, petrologic investigations and datations are in progress to better understand both the evolution of such shear bands under green schist to surface conditions and the evolution of the western Alps since the end of Eocene.