The underground of the Western Alps

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This study is an attempt at a multi-disciplinary approach towards a better understanding of the deep structures of the Western Alps. Although mainly based on deep seismic reflection data, this study has accorded equal importance to data provided by other geophysical methods (refraction seismology, gravimetry, tomography, etc.) and by surface geology (tectonics, stratigraphy, metamorphism, geochronology, etc.). A vital lead in this study is geodynamics: any interpretation of the present deep structures of the Western Alps must find an explanation in a geodynamic evolutionary context compatible with geological surface observations and actualistic geodynamic models. Thus the approach used here was to start from the well-known (i.e. surface geology) and to go progressively down to greater depths, first at a crustal- and then lithospheric-scale.

Detailed interpretation of seismic profiles in the Internal Alps reveals the importance of ductile deformation and in particular the role of backfolding in the present configuration of the nappe system. The crustal- and lithospheric-scale interpretation of five deep seismic profiles distributed through the Western Alps revealed striking similarities, such as the importance of the subduction of the European continental plate, reaching a depth of around 150 km below the Po plain. These interpretations also show some differences which appear progressively along the Alpine strike, such as the geometry and the composition of the Adriatic indenter. These differences can be coherently explained by a geodynamic evolutionary scenario which highlights the inheritance of structures due to the Tethyan rifting relative to the present deep structures resulting from the continental collision of the European and Adriatic plates.