16th Emile Argand Conference
Alpine Workshop
16-18 September 2024 - Siena, Italy

alpshop2024-54, updated on 17 Apr 2025
https://doi.org/10.5194/egusphere-alpshop2024-54
16th Emile Argand Conference on Alpine Geological Studies

The partitioning of present-day deformation in the W-Alps controlled by mantle indentation

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Recent ambient noise Vs tomography data at the scale of the Western Alps (Nouibat et al., 2022) highlight the deep structure of the chain. In the European foreland, the seismological model shows a crust of normal thickness, with slow velocities (<3.6 km.s^{-1}) in the lower part of the crust and the presence of Moho jumps localized below the External Crystalline Massifs (ECMs). In the inner zones to the east of the Pennine Front, crustal geometry is more complex, with the presence of a European continental slab that subducts locally more than 80 km beneath the Adria plate in the SW part of the Alpine arc, and detached beneath the Swiss Alps. This slab is surmounted by a metamorphic orogenic wedge whose lower part shows serpentinized mantle seismic signatures (Vs between 3.8 and 4.3 km.s^{-1}). Its roof is located at a depth of 10 km below the Dora Maira massif. These data allow to understand the role of crustal geometry in the development of the observed deformation field. Moho morphology is controlled by numerous pre-existing major faults reactivated during the Alpine orogeny. Two mantle indenters located above the subducted European plate at different depths appear to control the locus of active deformation. The rigid nature of Adria mantle explains the localization of brittle deformation that is transferred towards the upper crust. In this context, the strain-field partitioning results in a combination of strike-slip with either shortening or extension controlled by the the displacements imposed by the current NW/SE convergence associated with the anticlockwise rotation of Adria.

REF: Nouibat, A. et al. (2022) Lithospheric transdimensional ambient-noise tomography of W-Europe: implications for crustal-scale geometry of the W-Alps. Geophys. J. Intern. 229(2), 862–879.