



Hyper-extended rifted margins in Alpine-type orogenic belts: evidences from the Valaisan Domain (Western Alps)

Gianluca Frasca (1,2), Marco Beltrando (1), Roberto Compagnoni (1), Alberto Vitale-Brovarone (1,3)

(1) Dipartimento di Scienze della Terra, Università di Torino, Via Valperga Caluso 35, 10125 Torino, Italy, (2) Géosciences Rennes, UMR 6118, Université de Rennes 1, Campus de Beaulieu, 35042 Rennes Cedex, France, (3) Géosciences Montpellier, UMR 5243, Université de Montpellier 2, place E. Bataillon, 34095 Montpellier Cedex 5, France

The Valaisan Domain, in the Petit St. Bernard Pass area (Punta Rossa unit, Western Alps), consists of largely serpentined sub-continental mantle juxtaposed with Paleozoic basement, meta-pillow lavas and Mesozoic to Tertiary meta-sediments. The complex lithostratigraphy was largely acquired during rift-related extensional tectonics, when mantle peridotites were exhumed at the bottom of the North Penninic basin. Extensional faulting resulted in widespread cataclasis of continental basement rocks, which rested above serpentined mantle as extensional allochthons. The serpentinite-Paleozoic basement pair was sealed by locally sourced polymictic breccias, prior to the deposition of radiolaria bearing gray micaschists, followed by other basinal meta-sediments, including calcschists. Despite subsequent Alpine deformation and metamorphism, resulting in multi-stage folding and high Pressure-low Temperature metamorphism, the rift-related relationships between the different rock types can still be observed or inferred in several localities.

The Punta Rossa unit preserves evidence of a multi-stage Alpine evolution. Post-high pressure isoclinal folding (Fctd) is associated with a pervasive axial planar cleavage (Sctd), defined by chloritoid and white mica. Following re-heating to ~ 400 °C, Sctd was statically overgrown by garnet and chloritoid, prior to large-scale recumbent folding at greenschist facies conditions (Frec). Interference between Fctd and Frec is responsible for the regional occurrence of basement rocks resting upon Mesozoic metasediments. Following Frec, shear zones with top-to-the-south kinematics dissected the tectonic pile, prior to the formation of upright folds with NNE-SSW trending fold axes.

Therefore, the Punta Rossa unit preserves evidence of complete crustal excision in the Valaisan basin, with exhumation of ultramafics and minor mafic magmatism. Multi-stage deformation and a laterally discontinuous pre-Alpine architecture, typical of hyper extended rifted margins, are responsible for the complex outcrop pattern observed in the field.

This study adds evidences indicating that a large part of the apparent complexity of Alpine-type orogens is related to inheritance from the rifting history, rather than to complex subduction dynamics.