Reworking of felsic rocks in ductile shar zones: an example from the Curinga-Girifalco line

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In the northern Serre Massif, Alpine tectonics juxtaposed the Castagna unit orthogneisses (below), representative of the Hercynian intermediate crust, to mafic and felsic granulites and granulite facies migmatitic paragneisses of the Hercynian lower crust (above), along the Curinga-Girifalco ductile shear zone.

The detailed microstructural study of progressively sampled ductilely sheared orthogneisses from their host, highlighted mineral assemblage variations from i) Kfs + Pl + Qz + Bt + Mu + Ep + Tnt ± Ilm in weakly deformed orthogneisses to ii) Kfs + Ab + Qz + Phe + Czo + Tnt + (Grs-rich) Grt ± Ep ± Chl ± Bt and iii) Kfs + Ab + Qz + Phe + Czo + Tnt ± (Grs-rich) Grt ± Chl in mylonitic orthogneisses.

Phase diagram calculations in the MnNCKFMASHTO model system highlight that the progressive replacement of pre-Alpine mineral phases (e.g., plagioclase, biotite and ilmenite) by new Alpine ones (i.e., garnet, albite, titanite, epidote and clinozoisite) is related to different amount of external fluid infiltration, promoting partial to total renovation of the pre-Alpine mineral assemblage. On the basis of the garnet $XGrs_{(0.47-0.54)}$ and $XSps_{(0.08-0.22)}$ isopleth intersections, the reworked Castagna orthogneisses record a prograde, stepwise, Alpine P – T evolution in the amphibolite facies, with peak metamorphic conditions at ca. 0.9 GPa. Further, the subsequent exhumation stage, characterized by decompression and cooling, occurred in the stability field of sin-kinematic clinozoisite, accounting for an overall anticlockwise P – T path.

The results of this work clearly show that continental crustal rocks from the intermediate nappe underwent hydration when underthrusted during the Alpine subduction in Calabria, recording the highest P – T conditions with respect to the juxtaposed other lithologies due to complete mineral assemblage reworking. Therefore, the Curinga-Girifalco shear zone developed during Eocene nappe stacking and prolonged its activity during Oligocene extensional tectonics.