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# Microstructural analysis of the fault rocks in Mesozoic platform carbonates (Campolongo fault, Asiago Plateau, Venetian Prealps)

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Fault zones cutting carbonatic sedimentary sequences in the shallow crust often represent seismogenic sources worldwide. The majority of faults in carbonates of the Southalpine domain are Mesozoic structures, reactivated during Alpine orogeny.

Here we study the architecture of the Campolongo Fault (FC) by means of microcrack distribution and microstructural investigations of fault rocks. The FC is located in the core of Spitz-Campolongo Anticline (ASC), a major alpine structure in the Venetian Prealps, Italy. This fault cuts the whole sedimentary sequence from the Dolomia Principale dolostone (Norian) to the Formazione di Monte Zugna limestone (Hettangian-Sinemurian).

We identified three structural domains, based upon fracture density and the type of fault rocks, namely protocataclasites, cataclasites and ultracataclasites. Optical and electron microscope observations show textural differences among different samples: proto-cataclasites (embryonic fabric) are strongly segmented fault rocks, which are composed of coarse grains (< 2 mm) isolated by microcrack arrays. Cataclasites (intermediate fabric) and ultracataclasites (mature fabric) are produced by chipping processes allowing for rotation and shearing of the matrix.

To better describe the cataclastic process, cumulative grading curves were built for each fault rock type using image analysis from acquired SEM images to estimate fractal dimension D that is a fundamental parameter to compare the grain distribution of fault rocks and estimate the grain comminution degree (cataclasis): elevated D values indicate high presence of fine grain clasts rather than coarse ones.

In order to infer the kinematic evolution of FC, the microcrack distribution was analyzed. A high density of fractures in the 15°-75° sector indicates reverse kinematic of FC. We did not find kinematic indicators or other evidence suggesting a previous normal dip-slip activity. Also energy-dispersive X-ray spectroscopy results show thin layers of brucite and accessory Mg-olivine adjacent to the slip surface. This layer could be the result of either decarbonation reaction through seismic slip or could be related to the presence of ultramafic dikes cross by the FC.

From grain distribution analysis we found increasing D values moving from the protocataclastites in the damage zone – fault core transition, to ultracataclasite adjacent to the slip surface. Moreover sudden changes of the D value suggest that different grain-comminution mechanism were dominant: grinding for cataclasites ($D \sim 1,6$) and attrition for ultracataclasite ($D \sim 2$)

From the acquired data, we conclude that this structure is a thrust hosted in the hanging wall of the major blind fault, which caused the ASC formation during alpine shortening. This contradicts kinematic reconstructions based on listric geometry and position of the fault, where the FC is suggested to be an inherited extensional liassic structure, reactivated as a thrust during Neogene contraction.