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Cockade-textured cataclasite and silica gel from damage zone in carbonated ultramafics: markers of cycles of seismic activity?

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Shallow crustal processes occurring during seismic slips and generating fracture networks are of great interest due to their complex interplay with a spectrum of other geological processes .

Our study focuses on faults with peculiar core textures, similar to those of "cockade breccia" (Genna et al., 1996) and "clast cortex grains" (Rempe et al., 2014), and on their relation with syntectonic hydrothermal alteration linked with Au bearing-quartz and chalcedony veins.

Our work aims to study the enviromental conditions for the formation of such peculiar texture, their relation with the hydrothermal vein system and their potential as shallow seismic indicators.

We present field, microstructural and petrochemical data of a peculiar damage zone of fault rocks located in carbonated peridotites and serpentinites of the Ligurian Alps (Voltri Massif, Italy). These are mainly reverse faults, which are coeval with syntectonic Au-bearing quartz veins and chalcedony veins (Giorza et al., 2010), in which lherzolites occupy the hangingwall of the faults and serpentinites the footwall. The fault rocks show evidence for carbonation, as olivine and serpentine are clearly transformed into an assemblage made of magnesite, dolomite and minor ankerite. The damage zones of the faults are serpentinite-rich and about 10 m in thickness, while the cataclasite cores are carbonate-rich and ca. 1 m thick. The top of the fault core shows the occurrence of a chalcedony shear veins with chatter marks and slikenlines on the surface. The "cockade breccia" is made of spherical aggregates of Fe-Mg carbonates and are 1 mm to 3 cm in size. These aggregates show cores of microcrystalline Fe-Mg carbonates, and concentric outer layers of relatively coarser Fe-Mg carbonates with radial or laminated texture. In some cases, these aggregates show evidence for rotation along secondary slip zones.

We interpret all these features as the products of chemical interaction between the olivine and serpentine initially present within the fault rocks and the hydrothermal fluid that flowed within these faults. These interactions were probably similar to those occurring within the coeval Au- and chalcedony veins.

Field evidence and theoretical considerations indicate that the reverse faults could have experienced stages of fault-valve behaviour (Sibson et al., 1998), which consisted in cycles of fluid pressure build-ups, fault opening, fluid flushing, and mineral precipitation during the seismic failure of the faults. These cycles varied transiently fault permeabilities. During the fluid pressure build up stage the radial coarse grains developed, while during the fluid flushing stage the clast cortex grains developed their laminated texture. The Au-quartz and chalcedony veins could have formed during the stages of fluid pressure drops following fault slip (Sibson et al., 1998, 2004).

References

Capponi G. & Crispini L., 1997, Progressive shear deformation in the metasediments of the Voltri Group (Ligurian Alps, Italy): occurence of structure recording extension parallel to the regional foliation, Boll. Soc. Geol. It., 116, 267-277.

Genna A., Jébrack M., Marcoux E., Milési J.P., 1996, Genesis of cockade breccias in the tectonic evolution of the Cirotan epithermal gold system, West Java, Can. Journ. of Earth Sci., 33, 93-102.

Giorza A., 2010, Late to post-metamorphic hydrotermalism in the Voltri Unit (Lavagnina Lakes Area, NW Alps). Structural-Petrological-Geochemical approach, PhD Thesis, University of Turin.

Rempe M., Smith S. A. F., Ferri F., Mitchell T. M., 2014, Clast-cortex aggregates in experimental and natural calcite-bearing fault zones, Journ. Of Struct. Geol., 68, 142-157.

Sibson R. H., 2004, Controls of maximum fluid overpressure defining conditions for mesozonal mineralization, Journ. of Struct. Geol., 26, 6-7, 1127-1136.

Sibson R. H., Robert F., Poulsen H., 1998, High-angle reverse faults, fluid-pressure cycling, and mesothermal gold-quartz deposits, Geology, 16, 551-555.

Spagnolo C., 2006, Late orogenic tectonics in the eastern sector of the Ligurian Alps, PhD Thesis, Univesity of Genoa.