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Eclogitic breccia from the Monviso ophiolite complex: new field and petrographic data

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The Monviso meta-ophiolite complex (Northern Italy, Western Alps) represents a coherent portion of oceanic lithosphere metamorphosed under eclogite facies conditions during the Alpine orogeny (2.6 GPa - 550°C, Lago Superiore Unit, Angiboust et al., 2011), and exhibits from bottom to top a thick serpentinite sole locally capped by metasediments, Mg-Al-rich metagabbros, then Fe-Ti-metagabbros capped by metabasalts. This section is disrupted by three main shear zones. Our study focusses on the Lower Shear Zone (LSZ), situated between the serpentinite sole (to the East) and the Mg-metagabbro bodies (to the West), and composed of blocks of both Fe-Ti and Mg-Al metagabbros embedded in a talc and tremolite-rich serpentinite matrix. Among these blocks, some were described as eclogitic breccias and interpreted as the result of a seismic rupture plane (Angiboust et al., 2012). These breccias correspond to blocks of Fe-Ti-metagabbros that were brecciated in eclogitic facies conditions (as attested by the omphacite + garnet $\pm$ lawsonite cement of the breccia) in a fluid-rich environment, as suggested by the abundance of lawsonite in the cement. Here we present new field data on the distribution and petrographic characterization of these eclogitic blocks in the LSZ.

The aim of this work is twofold: (I) detailed mapping of the eclogitic block distribution along the LSZ, in order to determine precisely the extent and representativity of the breccias and (II) characterization of the brecciated blocks, at the outcrop scale, to explore the brecciation processes and structures.
Between Pian del Re and Colle di Luca localities, the occurrence of eclogite blocks is uniform along the strike of the shear-zone, resulting in a 16 km-long belt of outcropping eclogitic bodies embedded in serpentinite matrix. The shear-zone width, by contrast, varies from 1.3 km to 0.8 km. Three types of eclogitic blocks can be distinguished: (1) intact (i.e. not brecciated) blocks of Fe-Ti-metagabbros restricted to the lower part of the shear zone, close to the serpentinite sole; (2) numerous brecciated Fe-Ti-metagabbros scattered in the intermediate to upper levels of the LSZ; (3) blocks showing compositional variations and complex structures, with boudins of intact Fe-Ti-metagabbros embedded in highly foliated and folded Mg-rich rocks bounded on one side by Fe-Ti-breccia planes.
In some cases the full transition from intact to highly brecciated rock is recorded in the same block. Here, the contacts between intact metagabbros and breccia are characterized by about 1m-wide zones of non rotated clasts with diameter up to 80 cm, almost matrix-absent. The amount of matrix vs clast increases, associated with a reduction in the clast size and increasing clast rotation, over a few meters up to the end of the bodies. These particular blocks give us a unique opportunity to better characterize the brecciation processes.
Different kinds of measurements were realized on the brecciated blocks: (1) block size, (2) clasts vs. matrix relative volumetric abundances, (3) dimension and shape ratio of clasts, and angle of misorientation between their elongation axis or internal foliations (for five selected blocks). Preliminary results show that the majority (82%) of mapped blocks have a diameter of less than 10 meters, with only 8% being larger than 20 meters. In the brecciated Fe-Ti gabbros the average content of matrix is 28%, while for blocks showing compositional variation it varies from zero to 30%. The angle of misorientation between clasts' foliation shows, instead, a chaotic distribution.
Preliminary field data thus demonstrate that breccia blocks have to be considered as a constant feature along the LSZ rather than as an exception, and that further work is needed to determine whether they formed through pervasive brecciation (and potentially multiple events) or through a localized event and were later disrupted by ductile deformation along the LSZ.