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Switching deformation mode and mechanisms during subduction of continental crust: a case study from Alpine Corsica

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The switching in deformation mode (from distributed to localized) and mechanism (viscous versus frictional) represent a relevant issue in the frame of processes of crustal deformation in turn connected with the concept of the brittle-“ductile” transition and seismogenesis. On the other hand the role of brittle precursors in nucleating crystal-plastic shear zones has received more and more consideration being now recognized as having a fundamental role in the localization of deformation and shear zone development, thus representing a case in which switching deformation mode and mechanisms interact and relate to each other. This contribution analyses an example of a crystal plastic shear zone localized by brittle precursor formed within a host granitic-mylonite during deformation in subduction-related environment.

The studied sample come from the external Corsican continental crust units involved in alpine age subduction and characterized by a low grade blueschist facies peak assemblages. The blueschist facies host rock is cut by a thin (< 1 cm thick) brittle-viscous shear zone that preserves domains with a cataclastic microstructure overprinted by mylonitic deformation. Blue amphibole is stable in the shear zone foliation, which therefore formed under HP/LT metamorphic conditions in a subduction environment. Quartz microstructure in the damage zone flanking the brittle-viscous shear zone shows evidence of both microcracking and dislocation glide, with limited recrystallization localized in intracrystalline bands. In the mylonite portion of the shear zone, quartz forms polycrystalline ribbons of dynamically recrystallized grains with a crossed-girdle c-axis CPO. Extrapolation of laboratory-derived flow laws indicates strain rate of ca. 3.5 * 10-12 s-1 during viscous flow in the shear zone.

The studied structures, possibly formed by transient instability related to episodic stress/strain rate variations, may be considered as a small scale example of fault behaviour associated with a cycle of interseismic creep with coseismic rupture and then a fossil example of stick-slip strain accommodation in subduction environment of continental crust.