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# Feedback between fluid flow and rheology during the evolution of the East Tenda Shear Zone (Haute Corse, France).

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The East Tenda Shear Zone (ETSZ) is the major Alpine tectonic boundary marking the overthrusting of the oceanic-derived Schistes Lustrés nappe onto the Hercynian crystalline basement of western Corsica. In this work we present new structural and geochemical investigations along a transect ranging from the undeformed protolith (PR) to the contact with the Schistes Lustrés. The results are used to construct a rheological model for the ETSZ.

Shear deformation within the ETSZ is heterogeneously distributed with high-strain domains (shear zones, SZ) wrapping sigmoid shaped low-strain domains (massive lenses, ML). Locally, mica-rich mylonites occur (phyllonites). The main foliation is concordant with that in the overlying Schistes Lustrés, strikes NW-SE, and is dominantly shallow-dipping to NE. The ML mineralogy consists of an assemblage made of quartz, phengite and (relict) feldspar (epidote, Fe-oxides, zircon and allanite as accessory phases). The SZ mineralogy is invariably dominated by highly celadonitic ($Si^{4+}$= 3.5-3.7 a.p.f.u.) phengite (40 $\pm$ 10 vol%) and modally abundant quartz (35 $\pm$ 5 vol%), albite (15 $\pm$ 5 vol%) epidote (<5 vol%) and microcline (10 $\pm$ 5 vol%). Locally, Na-amphibole (10-20 vol%) also occurs in the SZ assemblage to form thin (up to 1 m thick) dark mylonitic levels. Stretching lineations strike WSW-ENE to E-W and consist of quartz-phengite-albite in ML and of Na-amphibole-quartz-albite-phengite in SZ. Deformation is progressive and evolves from ductile-to-semibrittle conditions. Sense of shear is predominantly top-to-the-SW and is locally reworked in the phyllonites with top-to-the-NE sense of shear.

Whole rock geochemistry suggests an increasing chemical alteration moving from the undeformed rocks to ML and SZ. In particular, $Ca^{++}$ is progressively leached while $Na^{+}$ and $K^{+}$ contents systematically increase as deformation proceeds. Destabilization of Ca-bearing phases, such as plagioclase and epidote, and neoblastesis of feldspars (albite and microcline) is consistently observed in the more evolved shear zones. These observations indicate that progressive shear deformation was governed by intensive fluid-rock interaction characterized by increasingly higher fluid/rock ratios.

The effect of chemical alteration of the host rock by fluids on the rheology of the ETSZ has been estimated taking into account the modal composition and the fabric of the main lithotypes (PR, ML, SZ, phyllonites). Flow laws are obtained using an averaging procedure based on weighted averages of single-phase rheology. These flow laws are used to infer strain rates, construct deformation maps, and estimate the depth of the brittle-ductile transition for each lithotype during progressive deformation. The combined effects of the feldspar-to-mica reaction and the development of a strong planar fabric induce weakening and strain localization along the shear zones. Fluid channelling along these shear zones enhances dominance of Na and K over Ca and, particularly, albite and microcline neoblastesis. The latter, in turn, generates strain hardening. Among the possible consequences of such feedback processes between strain localization and fluid-rock interaction are episodes of transient rheology.

The main result of our observations and rheological estimates is that reworking during top-to-the-E regional extension occurred only in the uppermost part of the deforming crustal section and localized within the weaker phyllonite levels.