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Fluid assisted shearing at the depth of the Brittle-Ductile Transition: an integrated structural, petrological, fluid inclusions study of the Erbalunga shear zone, Schistes Lustrés Nappe, Alpine Corsica (France).

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In this work we present structural, petrological and fluid inclusion studies performed in a major retrogressive shear zone (the Erbalunga shear zone), which occurs within the HP/LT domain of the Schistes Lustrés Nappe of eastern Alpine Corsica. This shear zone is part of the post-orogenic network of shear zones that favoured the exhumation of the HP core of Alpine Corsica (Daniel et al., 1996) during Late Oligocene/Early Miocene times (Brunet et al., 2000). The shear zone is characterised by a progressive ductile-to-brittle top-to-the-E shearing, starting at greenschist facies conditions (ca. 600 MPa, 400-450 °C). Evidence for vigorous fluid flow through the shear zone is documented by widespread quartz and quartz-calcite vein segregations, which accompanied the progressive evolution of shearing. Textural characteristics of three main generations of veins record the incremental evolution of the shear zone tracing the continuum transition from ductile- to brittle-dominated deformation environments. Regardless of the vein generation, fluid inclusions hosted in quartz grains hosted within the three different sets of veins document a low-salinity (<5% NaCl eq.) fluid circulation. Fluid trapping occurred under pore pressure conditions fluctuating from lithostatic to hydrostatic values, as also attested by the crack-sealing textures preserved in most of the veins. The findings of this study suggest that the main source of fluid was of meteoric origin and argue for fluid percolation and infiltration at the brittle-ductile depths. Such a fluid supply cause the availability of a higher amount of fluids in the deforming rock volume, working against ductile deformation and tendency to pore space reduction by recovery during progressive deformation. This impose definition of the (i) mechanism through which superficial fluids infiltrate the mid-lower crust; and (ii) the modes (fracturing vs. ductile creep) of creation and maintenance of the structural permeability moving from the brittle to the ductile crust. The cyclical release of seismic energy in the brittle crust (Sibson et al., 1975) is a feasible scenario to frame the downward fluid flow in the ductile crust along pathways maintained by large scale fault zones active in the extending upper crust.