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ALKALI-METASOMATISM AND PHYLLONITE DEVELOPMENT ALONG A MAJOR ALPINE SHEAR ZONE: THE EAST TENDA SHEAR ZONE (ALPINE CORSICA, FRANCE)

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Here we present results of an integrated study which combines structural geology, petrology and geochemistry addressed to assess modes and regimes of fluid-rock interaction during shear fabric development along the East Tenda Shear Zone (ETSZ), Haute Corse, France. This shear zone marks the overthrusting of the oceanic-derived Schistes Lustrés nappe onto the Hercynian granitic basement of the western Corsica. The granitic protolith (Casta Granodiorite) consists of K-feldspar, plagioclase, quartz and minor hornblende, and accessory apatite and zircon. A progressive, ductile-to-brittle top-to-the-W/SW shearing affects the Casta granodiorite, evolving from blueschist-facies (S-L tectonites) to upper crustal (brittle thrust faults) conditions. Apart the variably retrogressed mafic blueschist boudins, within the ETSZ two main rock types were recognised: weakly-foliated gneisses (hereafter referred as massive bodies) and phengite-dominated mylonites (hereafter referred as phyllonites). Both rock types consist of a high-variance mineral assemblage made up of feldspar (albite and K-feldspar) + quartz + phengite. Accessory minerals include relict zircons, and syn-kinematic andradite, epidote, monazite, leucoxene and titanite. At a regional scale, phyllonites envelop the massive bodies that, commonly, form sigma-shaped shear lenses wrapped within the mylonitic foliation. Phyllonites consist of alternating, micro-crystalline quartz-feldspar-phengite-bearing layers and by different generation of variably deformed quartz and composite quartz-feldspar (albite and microcline) vein segregations (up to 30 cm in thickness). Late-stage, laminated sub-horizontal quartz-feldspar vein arrays also occur, suggesting their origin as thrust-related shear veins. Microtextures are indicative of pseudomorphic growth of phengite after relict igneous K-feldspar. Nevertheless, new growth of microcline is ubiquitous along the rims of porphyroclastic K-feldspar grains. EMPA of phengite systematically revealed a high celadonitic substitution, ranging from 3.52 to 3.65 a.p.f.u. without any systematic core-rim zonation. $P--T$ pseudosections in the NKFMASHO (Na_2O-K_2O-FeO-MgO-Al_2O_3-SiO_2 -H_2O-O_2) for the $P--T$ range 250–600 ˚C and 1.5–9.5 kbar was computed using the Perple_X software (Connolly 2005; http://www.perplex.ethz.ch/) for phyllonite bulk rock compositions. These calculations indicate that the phyllonite assemblage (quartz-microcline-albite-phengite-epidote) is stable in the 3-7 kbar pressure interval for temperatures between 250 and 450 ˚C, indicating $P-T$ conditions compatible with the low-grade greenschist facies field. Activity diagrams in the NKFMASH (Na_2O-K_2O-FeO-MgO-Al_2O_3-SiO_2-H_2O) compositional system indicate that the phyllonite assemblage represents an invariant point, which argues for a rock-buffered fluid circulation system. Mass balance calculations comparing whole rock chemical composition of a progressively deformed rock sequence and assuming Al as immobile, documents a progressive gain in Si (up to 29%), Na and K (both up to 43%), a depletion in all other major elements, and a volume increase up to about 20%. This implies a strong alkaline metasomatism operated by the circulating fluids during phyllonite development. In this light, the matrix, highly substituted phengite compositions of phyllonites (i.e. not compatible with the overall greenschist-facies $P-T$ conditions) appear strongly influenced by the intense fluid-rock interaction during progress of shear deformation.