Textural variations during antigorite dehydration as markers for fluid release mechanisms in subduction zones: Constrains from the Cerro del Almirez ultramafic massif (Betic Cordillera, SE Spain)

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Subduction zones are dynamic convergent plate boundaries associated with arc volcanism and earthquakes, which are believed to be controlled by fluids released during devolatilization reactions from the downgoing slab. The high-pressure breakdown of antigorite serpentinite to prograde chlorite-harzburgite is considered to be the most significant source of water in subduction zones. The Cerro del Almirez ultramafic massif (Betic Cordillera, SE Spain) is a unique exhumed subduction terrane that preserves this dehydration reactions as a sharp front. Chl-harzburgite in this massif displays two differentiated textures–granofels and spinifex-like– indicating that antigorite dehydration occurred at different overstepping of the dehydration reaction. Detailed mapping of textural variations in chl-harzburgite unveils a network of granofels and spinifex-like lenses. These lenses have triaxial ellipsoid shapes with average axial ratios of 16:7:1 and 19:8:1, respectively, with the shorter axis nearly perpendicular to the serpentine-out isograd, and the longest axis ranging from 23 to 190 meters. We calculated the volume of water release per lens using the modal amount of olivine according to the model reaction 1Atg = 4Clin + 6Fo + 6En + 15H_2O. The growth time and water flux per lens was computed using experimental olivine growth rates for granular and dendritic, spinifex-like olivine. Preliminary results show that formation of spinifex and granofels lenses imply temporal variations of the volumetric water fluxes ranging from 0.12 to 0.02 $m^3m^{-2}yr^{-1}$, respectively. If the time of formation of lenses is inversely proportional to its relative distance to the dehydration front, the 52m thick, chl-harzburgite lens network in Almirez records ca. 315 yrs of antigorite dehydration. Our results show that antigorite dehydration in subduction zones occurs in a highly non-steady regime with yearly to decadal variations of water fluxes that record variations in the dynamics of slab and fluid expulsion mechanisms.