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Witness of fluid-flow organization during high-pressure antigorite dehydration

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The link between devolatilization reactions and fluid flow is crucial to unravel important geodynamic processes in subduction zones as deformation and element transfer is extremely controlled by the presence of water. At high confining pressure, significant fluid pressure gradients are expected in a reacting rock being dehydrated, because of its rather limited permeability [1]. Compactation-driven fluid flow seems to be an intrinsic mechanism occurring at devolatilization of viscolastic rocks. Nevertheless, and despite the important implications of this coupled deformation/fluid-migration mechanism for fluid transport, a conclusive confirmation of these processes by petrological and textural evidences in metamorphic terrains has been hampered by the scarcity of devolatilization fronts in the geological record. Evidences of high-pressure antigorite dehydration found at Cerro del Almirez (Betic Cordillera, Spain) [2] represent a noteworthy exception. Here, the transition between the hydrous protolith (antigorite serpentinite) and the prograde product assemblage (olivine + orthopyroxene + chlorite, chlorite harzburgite) is extremely well preserved and can be surveyed in detail. The maximum stability of the antigorite has been experimentally determined at ∼680ºC at 1.6-1.9 GPa [3]. Antigorite dehydration is accompanied by release of high amounts of high–pressure water-rich fluids (∼ 9 wt.% fluid). Distinctive layers (up to 1 m thick) of transitional lithologies occur in between atg-serpentinite and chl-harburgite all along the devolatilization front, consisting of (1) chlorite-antigorite olivine-serpentinite, which gradually changes to (2) chlorite-antigorite-olivine-orthopyroxene serpentinite. These transitional lithologies are more massive and darker in color than atg-serpentinite and largely consist of coarse sized grains of antigorite and chlorite (250-500 μm). Antigorite in these assemblages is characterized by microstructural disorder features, which are lacking in antigorite far from the devolatilization front [4]. The sharp appearance of chlorite (Chl-in), crosscutting the serpentinite foliation, and coarsening of olivine define the upper limit of the transitional lithologies, whereas the lower limit (Atg-out) is gradational to chl-harzburgite. The modal increase of orthopyroxene is concomitant with the gradual disappearance of antigorite. The gradual disappearance of antigorite over short distances leads to the final prograde assemblage in the Chl-harzburgite with two contrasting textures: (1) coarse granular texture and (2) an intriguing spinifex-like texture (arborescent growth of centimeter-sized olivine and orthopyroxene). Both textures alternate at the meter to tens of meters scale over the entire massif. We interpret these textures as the result of contrasting pore fluid overpressure, reaction rates and fluid-flow organization shortly after the antigorite breakdown. These observations will be discussed on the frame of the reaction kinetic and the propagation of deformation associated to fluid pressure gradients.

[1] Connolly, *Journal of Geophysical Research* **112** (B8), 18 (1997).

[2] Trommsdorff, López Sánchez-Vizcaíno, Gómez-Pugnaire et al., *Contrib Mineral Petr* **132** (2), 139 (1998).

[3] Padrón-Navarta, Hermann, Garrido et al., *Contrib Mineral Petr* **159** (1), 25 (2010).

[4] Padrón-Navarta, López Sánchez-Vizcaíno, Garrido et al., *Contrib Mineral Petr* **156** (5), 679 (2008).