American Mineralogist, Volume 95, pages 81–91, 2010

Retrograde hydration sequence in disordered Mg amphiboles: A TEM investigation

Marco Ferrari* and Cecilia Viti

Dipartimento di Scienze della Terra, Università degli Studi di Siena, via Laterina 8, 53100 Siena, Italy

Abstract

Acicular Mg amphibole in thermal-metamorphic serpentinites from Elba Island, Italy, is affected by polytypic disorder (with the possible coexistence of *Pnmn*, *Pnma*, and *C*2/*m* structures), chain-width defects, and retrograde hydration reactions. Based on HR-TEM nanostructures, we documented three main hydration stages: (1) formation of chain-multiplicity faults (CMFs); (2) formation of fibrous topotactic talc, elongated parallel to $[001]_{Tlc}$ and resulting from progressive polymerization of CMFs; and (3) pervasive serpentinization.

Incipient serpentinization produces isolated inclusions within Mg amphibole, rhombic in shape and parallel to $\{210\}_{Mg\text{-}Am}$, or elongated parallel to $(100)_{Mg\text{-}Am}$; the inclusions are filled by not-topotactic, curved $(001)_{Srp}$ layers or chrysotile partial fibers. As the Mg amphibole-to-serpentine replacement proceeds, the isolated serpentine inclusions merge together, producing a sponge-like texture, with interconnected fluid paths, from which serpentine can rapidly grow at the expense of enclosing amphibole.

We suggest that whereas the first hydration reactions to CMFs and fibrous talc take place at relatively high *T* and low fluid/rock ratio (fluid circulation confined to microfractures, cleavage planes, and subgrain boundaries), subsequent serpentinization requires significant changes in physical conditions, with definitely lower *T* and pervasive fluid circulation.

Keywords: Mg amphibole, hydration reactions, talc, serpentinization, TEM