Growth and demise of chloritoid along a metamorphic P-T path: an example from the South Carpathians

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Metapelites with Mg-rich chloritoid occur associated with eclogites and metagabbronorites in the Bughea Complex of the Leaota Massif (South Carpathians), a complex interpreted to represent a subduction mélange [1]. These metapelites are composed of garnet porphyroblasts embedded in a matrix of chlorite, phengite, paragonite, epidote, ilmenite, rutile, and quartz. Garnet contains inclusions of chloritoid, phengite, paragonite, chlorite, quartz, epidote, and rare amphibole and kyanite. The internal structure of the porphyroblasts is outlined by their chemical zoning, the array of mineral inclusions and the chemical variation of included chloritoid. Compositional maps of garnets and core-to-rim chemical profiles document a prograde zoning characterized by a continuous decrease of Mn and Ca and an increase of Mg towards the rims. The array of mineral inclusions portrays three zones which are well correlated with the chemical composition: (1) high-Mn core rich in chloritoid and small epidote inclusions, (2) inner mantle also rich in chloritoid inclusions, and (3) high-Mg rims, free of chloritoid but containing Mg-chlorite along with kyanite appearing for the first time in the assemblage. The chemical composition of chloritoid is characterized by gradual Mg increase from the inclusions located in garnet cores (X_{Mg}=0.26–0.28) towards those placed near rims (X_{Mg}=0.38–0.42).

A calculated pseudosection for the P-T range 400-700°C, 4-24 kbar in the system KNCFMMnASTH predicts the occurrence of chloritoid at temperatures of 400-590°C and P>12 kbar. The X_{Mg} isopleths of chloritoid and garnet, and Si isopleths of phengite constrain a prograde path in the range 520-570°C and 16-18 kbar. The rare kyanite inclusions in garnet are in equilibrium with garnet rims at 600-620°C and P>21 kbar, beyond the predicted P-T field of chloritoid.

The occurrence of chloritoid, gradual change in the Mg-Fe partition with the surrounding phases in response to changing PT-conditions, and finally its thermal breakdown represent a valuable tool in constraining the prograde path of subducted pelitic sediments, leading to a better understanding of the dynamics of subduction channels.

[1] Negulescu *et al* (2009) *J. Petrol.* **50**, 103-125.