Prograde infiltration of Cl-rich fluid into the granulitic continental crust from a collision zone in Perlebandet, Sør Rondane Mountains, East Antarctica

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Timing of Cl-rich fluid infiltration is correlated with the pressure-temperature-time (*P-T-t*) path of upper amphibolite- to granulite-facies metamorphic rocks utilizing microstructures of Cl-bearing biotite in pelitic and felsic metamorphic rock from the continental collision zone (Perlebandet, Sør Rondane Mountains (SRM), East Antarctica). Microstructural observation indicates that the stable Al_2SiO_5 polymorph changed from sillimanite to kyanite + andalusite + sillimanite, and *P-T* estimates from geothermobarometry point to a counterclockwise *P-T* path characteristic of the SW terrane of the SRM (e.g., Osanai et al., 2013) *In situ* LA-ICPMS U-Pb dating of zircon inclusions in garnet yielded ca. 580 Ma, likely representing the age of garnet-forming metamorphism at Perlebandet.
Inclusion-host relationships among garnet, sillimanite, and Cl-rich biotite (Cl > 0.4 wt%) reveal that formation of Cl-rich biotite took place during prograde metamorphism in the sillimanite stability field. This process probably predated partial melting consuming biotite (Cl = 0.1-0.3 wt%). This was followed by retrograde, moderately Cl-bearing biotite (Cl = 0.1-0.3 wt%) replacing garnet. Similar timings of Cl-rich biotite formation in different samples, and similar $f(H_2O)/f(HCl)$ values of coexisting fluid estimated for each stage can be best explained by Cl-rich fluid infiltration during prograde metamorphism.
Fluid-present partial melting at the onset of prograde metamorphism probably contributed to elevate Cl concentration (and possibly salinity) of the fluid, and consumption of the fluid resulted in the progress of dehydration melting. The retrograde fluid was released from crystallizing Cl-bearing partial melts or derived externally.
The prograde Cl-rich fluid infiltration in Perlebandet presumably took place at the uppermost part of the footwall of the collision boundary. Localized distribution of Cl-rich biotite and hornblende along large-scale shear zones and detachments in the SRM (Higashino et al., 2013; 2015) supports external input of Cl-rich fluids through tectonic boundaries during continental collision.

Keywords: Fluid, Metamorphism, Partial melting, Chlorine, Continental collision

