Possible polymetamorphism and brine infiltration recorded in the garnet-sillimanite gneiss, Skallevikshalsen, East Antarctica

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Chlorine-rich (>0.3wt%Cl) biotite (Bt) inclusions in the core of garnet porphyroblasts in the garnet-sillimanite (Grt-Sil) gneiss from Skallevikshalsen, Lützow-Holm Complex (LHC), East Antarctica is estimated to be stable under >1.2 GPa, 820-850 ºC, coexisted with granitic melt as suggested by the nanogranite/felsite inclusions. Rare occurrence of matrix Bt suggests almost complete consumption of pre-existed matrix Bt during the prograde to peak metamorphism. Brine infiltration during prograde to peak metamorphism is supported by Cl-rich scapolite [1]. Brine infiltration and progress of continuous Bt-consuming melting reactions were probably responsible for elevating the Cl content of Bt.

Electron microprobe U-Th-Pb dating of monazite (Mnz) and the *in situ* LA-ICPMS U-Pb dating of zircon (Zrn) in the Grt-Sil gneiss revealed that both Mnz and Zrn has the 'older age population' with ca. 650-580 Ma and the 'younger age population' with ca. 560-500 Ma. The REE and trace element pattern of one of the P-rich patches in the Grt core is different from the P-rich Grt rim. The isotope mapping of the same patch by LA-ICPMS revealed that the patch is also observed as a domain depleted in ^{51}V, ^{89}Y, ^{165}Ho, ^{166}Er, ^{169}Tm, ^{172}Yb, and ^{175}Lu. Clear difference in ^{51}V concentration between the patch and the Grt rim suggests that this patch is not a continuous part from the Grt rim, but is likely a relic of preexisted garnet. Kyanite included in the patch suggests that the precursor rock was presumably a medium- to high-pressure type metamorphic rock. Presence of the older age population (ca. 650-580 Ma) Mnz in Skallevikshalsen and Skallen [2] also suggest that rocks in these areas experienced polymetamorphism, and resetting by the ca. 560-500 Ma metamorphic event was incomplete in these areas. Taking into account the presence of Cl-rich Bt inclusions in Grt, infiltration of brine accompanied by partial melting is one probable event that took place at ca. 560-500 Ma in the Skallevikshalsen area, and part of the Mnz possibly recrystallized by this brine infiltration.

References: [1] Satish-Kumar et al., 2006, JMG. [2] Hokada and Motoyoshi, 2006, Polar Geosci.