Formation of shear zone in Akebono Rock, Prince Olav Coast, East Antarctica

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Akebono Rock (68°05'–68°06'S, 42°54'–43°00') is located near the central part of the Prince Olav Coast, East Antarctica. The exposure situated about 12 km northeast from the Cape Hinode. Basement rocks in the Akebono rock consist of a layered gneisses, amphibolite, migmatite granite and pegmatite, and associated with recrystallized mafic dyke. Western part of this area was characterized by appearances of the shear zone. In addition, distinctive lithologies of garnet-bearing leucogranite (S-type) and large garnet porphyroblast (up to 3cm)-bearing amphibolite also have reported (Hiroi et al., 1986). We have obtained following information about deformation process in the shear zone.

L-tectonite and mylonite occur along the shear zone. The mylonite and L-tectonite associated with mineral lineation identified by elongation of amphibole and quartz are developed. Garnet porphyroclasts were replaced by secondary biotite and muscovite forming an asymmetric tail. Their asymmetric textures suggest an oblique slip normal fault with right lateral motion. This sense of shear is assumed to represent late deformation.

Isoclinal to tight asymmetric folds were dominantly developed in north side of the shear zone. The axial plane of the fold is almost parallel to the external foliation. The axial plane is orientated to NW-SE, and steeply plunges to NE and SW, and is well clustered. These fold axis lie in the NW–SE plane and the variability of the NW to SE plunges (vertical to gentle to horizontal). The stereo net pattern is interpreted as presence of the sheath fold.

Two types of large garnet porphyroblasts, euhedral and sigmoidal grains are present in the Grt-amphibolite. Euhedral garnet in sample 2904B have maximum up to 30 mm in long. The garnet core have randomly orientated fine grained ilmenite, quartz and plagioclase inclusions, and the rim have elongated ilmenite inclusions which are parallel with the external foliation. The core and rim are divided by coarse quartz inclusions-rich domain. The overgrowth rim developed on the euhedral crystal surface is sometime recognized. The garnet shows a compositional zoning with decrease in Mn and Ca, and increase in Mg and Fe from core to rim. Fine inclusion-rich core is relatively homogenous in composition. Overgrowth rim have high Mg and Fe content, but the Ca content abrupt decrease.

Large sigmoidal garnet porphyroblast is found in sample 2806A. The garnet have S-shaped inclusion trails in the core, and Z-shaped inclusion trails in the mantle to rims. The garnet shows a weak compositional zoning with decrease in Mn and Ca, and increase in Fe towards the rim. The compositional zoning profile reveals discontinuous compositional changes in Fe, Ca and Mg, and is indicative of the garnet growth associated with rotation. Presence of shearing during an early stage of metamorphism is assumable. However, they occur as large blocks in the garnet-bearing leucogranite, thus the orientations of these structures are not reliable by transposition.

Early deformation was progressed in the middle crustal levels during the prograde metamorphism, that is evidenced by sigmoidal garnet in amphibolite. Garnet-bearing leuco-granite probably intrude along the proto-shear zone. Subsequently, asymmetric shearing occurs to form dominant foliation in the western region. This shearing is almost parallel to the orientation of present shear zone and axial plane for isoclinal to tight asymmetric fold (sheath fold). Final deformation along the shear zone formed a mylonite and tectonite due to oblique slip with right lateral movement.

References

Hiroi, Y., Shraishi, K. and Sasaki, K., Explanatory text of geological map of Akebono Rock, Antarctica. Antarctic Geologicai Map Series, Sheet 16 Akebono Rock. NIPR, Tokyo, 1986.