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The Tseel terrane of the Central Asian Orogenic Belt, SW Mongolia, contains a record of amphibolite-facies (locally granulite-facies) metamorphism related to several igneous activities. In the central part of the Tseel area, the andalusite (And) + sillimanite (Sil) + kyanite (Ky)-bearing quartz veins occur, whereas only sillimanite occurs in host pelitic gneisses, that contain garnet + biotite + plagioclase + quartz. Textural relations indicate that aluminosilicate polymorphs formed in the order of And-Ky-Sil. Garnet in a sample of gneiss collected from near an aluminosilicates-bearing quartz vein shows compositional zoning, characterized by decreases in Ca and Mn from core to rim, and increases in Fe and Mg, along with minor retrograde zoning at the outermost rim.

We calculate P?T conditions by garnet-biotite geothermometry and garnet-biotite-plagioclase geobarometry based on compositional zoning in garnet, assuming constant compositions for biotite and plagioclase, to roughly constrain the P?T path during garnet growth. This approach is based on the following assumptions: (1) biotite, plagioclase and quartz coexisted with garnet; (2) the compositional ranges of biotite and plagioclase during garnet growth were retained in the thin section; and (3) intracrystalline diffusion was negligible within the crystals. For individual samples, we selected the biotite compositions with highest and lowest Mg/Fe2+ ratio and plagioclase compositions with anorthite content, X_{An}. The P-T estimates along the garnet zoning is carried out for four cases as follows: (1) highest X_{An}, highest MgFe^{2+}Bt; (2) highest X_{An}, lowest Mg/Fe^{2+}Bt; (3) lowest X_{An}, highest Mg/Fe^{2+}Bt; and (4) lowest X_{An}, lowest Mg/Fe^{2+}Bt.

We obtained the decompression P?T path from the kyanite stability field (530-570 C and 6.0-9.6 kbar) to the sillimanite stability field (590-620 C and 2?6 kbar), with slight increase in temperature. Although garnet does not record the P-T conditions at the burial stage, the occurrence of aluminosilicates indicates the change from the andalusite stability field to kyanite stability field. These observations suggest that the metamorphic rocks in the Tseel terrane experienced a clockwise P?T path, although the peak pressure remains unknown.

Microthermometry was based on analyses of fluid inclusions in quartz in an aluminosilicates-bearing quartz vein collected from the locality of sample 0701c. Heating and cooling experiments were performed for the primary inclusions within quartz to measure the homogenization (Th) and ice melting (Tim) temperatures. The values of Th are scattered over the range 110?240 C, with most between 160 and 200 C (mean value, 171 +/- 28 (1?) C). The values of Tim range from ?4.0 to ?9.6 C, with a mean value of ?6.8 +/- 1.3 (1?) C, corresponding to salinity of 10.2 +/- 1.6 wt.% NaCl equivalent. Microthermometric analyses of fluid inclusions reveal that the aluminosilicates-bearing quartz veins formed in the kyanite stability field (530-600 C and 6.0-8.5 kbar). Abundant fluid supply along fractures would have enhanced the formation of coarse-grained kyanite in quartz veins.

The P-T path during the exhumation in the Tseel area cannot be explained by subduction of old slab, but is well consistent with the geothermal gradient along the interface between the slab and the arc crust just after the ridge subduction (after c. 1 Myr). The intrusion of granitoids and mafic dikes and high temperature metamorphism of the Tseel terrane would be caused by the subduction of young oceanic lithosphere during the evolution of CAOB in the Devonian ages.

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