Variation of garnet zoning pattern in the pelitic gneisses and it’s implications to thermal history of Tseel terrane, SW Mongolia

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Thermal history and exhumation processes were examined by garnet chemical components during its growth in the Tseel area, SW Mongolia within the Central Asian Orogenic Belt (CAOB). Devonian-Carboniferous Tseel terrane is mainly composed of pelitic rocks, amphibolites and granitoids. Petrological studies of metamorphic rocks are would be explaining tectonic evolution of Paleozoic history in CAOB. Because Tseel metamorphic terrane (composed of five blocks including Tseel area) is approximately 600 km extended in SW Mongolia and this belt is extends into Northwestern China and Kazakhstan in the CAOB. We detail studied petrology of pelitic gneisses, especially garnet chemical components during growth with explain P-T paths in Tseel area. The garnet chemical components in pelitic gneisses show systematically changes as defined by metamorphic zones from Tseel area in the Tseel metamorphic terrane, SW Mongolia. There are three zones (1) Sillimanite zone Grt + Bt + Pl + Sil ± St ± Crd + Ms + Chl + Qtz; (2) Garnet zone Grt + Bt + Pl ± Sil + Ms + Chl + Qtz and (3) Biotite zone Bt + Pl + Ms + Chl + Qtz were clarified in the pelitic gneisses from center to outer of the Tseel area. Garnet is occurs in the sillimanite and garnet zones. The sillimanite zone was divided into Sil A (Zoned from high Ca to low Ca garnet) and Sil B (low Ca homogeneous; granitoids mainly occurred in this zone) zones based on the Ca component of garnet. High Ca homogeneous garnet only occurred in the garnet zone. Garnet in the Sil B zone occurred near the granitoid, shows homogeneous (X_{Alm} = 0.68-0.72, X_{Prp} = 0.09-0.12, X_{Sps} = 0.10-0.12, X_{Grs} = 0.05-0.09), slightly increased by X_{Alm}, X_{Grs} and decreased by X_{Prp}, X_{Sps} at rim. Garnet in the Sil A zone decreases in Ca and Mn (X_{Grs} = 0.05-0.22, X_{Sps} = 0.09-0.18) from core to rim, and increases in Fe and Mg (X_{Alm} = 0.56-0.72, X_{Prp} = 0.06-0.13), along with minor retrograde zoning at the outermost rim. Garnet in the garnet zone, chemical components shows (X_{Alm} = 0.41-0.50, X_{Prp} = 0.04-0.05, X_{Sps} = 0.24-0.33 and X_{Grs} = 0.18-0.23) homogeneous and slightly increases X_{Alm}, X_{Grs} and decreased by X_{Sps} at rim. The P-T paths during garnet growth were examined by garnet isopleth thermobarometry based on a P-T pseudosection and by conventional Grt-Bt geothermometry and Grt-Bt-Pl-Qtz geobarometry (Burenjargal et al., 2012). The P-T conditions in the garnet zone indicating 540 ± 10°C and 6.0 ± 0.5 kbar in kyanite stability field. The two approach yield similar P-T paths in the Sil A zone, with the decompression P-T path extending from the kyanite (Ky) stability field (560 ± 10°C and 6.5 ± 0.5 kbar) to the sillimanite stability field (600 ± 5°C and 3.8 ± 0.5 kbar), accompanied by a slight increase in temperature (by 40-50°C). The Sil B zone of P-T conditions indicate 590 ± 5°C and 1.0 – 5.0 kbar. Sil B zone is near the granitoid lack of high-Ca core and yield P-T conditions of the sillimanite stability field, suggesting the thermal effect of a granitoid intrusion at shallow crustal depths.

Reference