The pressure–temperature path of a mylonitized pelitic granulite in the Hidaka metamorphic belt, Hokkaido, Japan

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The Hidaka metamorphic belt is an exposed island arc crsutal section located at the south of cetral Hokkaido in central Japan along the Hidaka mountains. The belt consits of sedimeantary to metamorphic rocks and plutonic rocks (e.g., Komatsu et al., 1994; Osanai et al., 2006). The metamorphic grade increases contenuously from unmetamorphosed sedimentary rocks in the east to the granulite-facies in the west (e.g., Komatsu et al., 1994). The western end of the belt is bounded by the Hidaka Main Thrust which is associated with the intensive mylinitization in some granulites and basal tonalites (e.g., Osanai et al., 2006). The mylonitized granulite and tonalites are key to elucidate the exhumation process of lower crust materials by a precise reconstraction of pressure–temperature paths these recorded. This study will report the pressure–temperature path of a mylonitized pelitic granulite collected as a boulder from the Sogabetsu-river in the central Hidaka mountains.

Analyzed sample is garnet-cordierite-sillimanite-biotite gneiss which could be equivalent to a part of mylonitized granulite in unit IV of lower metamorphic rocks. The gneiss is mylonatized and associated with some leucosome. The mineral assemblage is garnet, cordierite, sillimanite, plagioclase and quartz with minor staurolite, K-feldspar, pyrrhotite, rutile, illmenite, graphite, zircon, monazite and apatite. Garnet and cordierite occur as porphyroblasts and include sillimanite. The aggregate of acicular sillimanite also occurs along the margin of garnet, cordierite and plagioclase. A cordierite grain in the leucosome is partly replaced by an association of staulorite + sillimanite + quartz.

The Grt porphyroblasts preserve sector zoning in the center and chemical zoning with the decrease of Ca and Mn contents and increase of Mg and Fe ones toward margin, and increase of Mn content and decrease of Mg one at the margin. Cordierite has an alomost homogeneous of X_{Mg} values (0.59–0.61) regardless of its occurrence, although the X_{Mg} value of cordierite tends to slightly increase at the margin. Biotite in the matrix shows X_{Mg} values of 0.43–0.50 that are silimar range to those of biotite inclusion in cordierite (0.42–0.48). Biotite inclusions in sector zoned part of garnet has higher X_{Mg} values of 0.66–0.67 than those of biotite inclusions in other part of garnet (0.49–0.57). The anorthite contents of plagioclase in the matrix are various within an grain in range of 0.14–0.24, while those of plagioclase inclusion in sector zoned garnet are 0.48–0.53.

The application of some geothermobarometers such as garnet–biotite geothermometer and garnet–biotite–plagioclase–quartz geobarometer provided the *P*–*T* conditions of *ca.* 3–4 kbar, 450–550 °C on prograde stage, *ca.* 5–7.5 kbar, 750–850 °C on peak stage, *ca.* 2.5–6 kbar, 550–600 °C on retrograde stage. The pseudosection modeling using local bulk chemistry of staulorite + sillimanite + quartz after cordierite indicated their stability *P*–*T* field which is consistent with above condition on cooling stage. Also, the peak metamorphic condition of analyzed sample is overlapped with the *P*–*T* condition of unit IV in the southern Hidaka metamorphic belt (5–6 kbar, 750–800 °C: Osanai et al., 2006). Therefore, the results suggest the mylonatized pelitic granulite experienced the clockwise *P*–*T* path with a peak granulite-facies condition as well as granulites in unit IV of the southern Hidaka metamorphic belt. However, its retrograde path which could be characterized by near-isobaric cooling with mylonitization are different from the dominant decompression ones of granulites in unit IV (Osanai et al., 2006).

References

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