

CHIME monazite dating of high-grade metamorphic rocks from Khao Chao, east of Chon Buri, Eastern Thailand

Tetsuo Kawakami[1]; Yasuhito Osanai[2]; Tomokazu Hokada[3]; Nobuhiko Nakano[2]; Tomoharu Miyamoto[4]; Kazuhiro Yonemura[2]; Punya Charusiri[5]

[1] Kyoto Univ.; [2] Earth Sci., Kyushu Univ.; [3] NIPR; [4] Earth and Planetary Sci., Kyushu Univ.; [5] Dept. Geol., Fac. Sci., Chula. Univ.

The metamorphic rocks in Khao Chao, east of Chon Buri, Eastern Thailand are one of the best studied high-grade metamorphic rocks in Thailand (e.g., Areesiri, 1983). Areesiri (1983) mapped in detail the northern half of this area and reported that the Khao Chao gneiss consists of quartzofeldspathic Bt gneiss, Bt-Hb gneiss, Hb-Di gneiss, Bt-Sil gneiss and Bt-Di gneiss. Calc silicate, marble and amphibolites (normal amphibolite, Bt amphibolite, Di amphibolite, Grt amphibolite and Hb amphibolite) are commonly associated with these gneisses. The Khao Chao gneisses are thought to have subjected to at least 2 episodes of metamorphism. The first phase of metamorphism is believed to have taken place during the Late Carboniferous orogeny, and the second one during the Permo-Triassic orogeny (Salyapongse et al., 1997). However, detailed analysis on the P-T conditions of metamorphism is not available. Radiometric dating of foliated equigranular granite found within Khao Chao gneisses using Rb/Sr isochron method gave 75 ± 22 Ma (Darbyshire, 1988). Other age dating using the method with high closure temperature is unavailable yet, which makes it difficult to evaluate the geological significance of these metamorphic rocks. Present study aims to constrain the metamorphic P-T conditions and the age of the Khao Chao gneisses.

The pressure-temperature condition of the high-grade metamorphic rocks from Khao Chao was estimated based on the geothermobarometry. Two outcrop samples of Grt-Bt gneiss and one boulder rock sample of the Sil-Grt-Bt gneiss were used. Because Grt, Sil, Bt, Pl and Qtz are present in the matrix of Sil-Grt-Bt gneiss, Grt-Bt geothermometers (Ferry and Spear, 1978; Hodges and Spear, 1982; Dasgupta et al., 1991) and GASP geobarometers (Ghent, 1976; Hodges and Spear, 1982) can be applied to constrain the metamorphic P-T conditions. Averaged matrix Bt and Grt-core composition may give the peak metamorphic temperature. Retrograde re-equilibrium condition can be obtained from Grt rim and matrix Bt (located near Grt) pair. Sillimanite is present in the matrix, whereas aluminosilicate is not found as an inclusion in Grt. However, we preliminarily assume the presence of Sil in the Grt-core stage. As a result, the P-T condition for the metamorphic peak is estimated to be 730°C , 0.7 GPa to 840°C , 0.95 GPa, and that for the retrograde re-equilibrium stage is 580°C , 0.50 GPa to 700°C , 0.71 GPa. The peak P-T condition is well above the dehydration melting reaction of $\text{Ms} + \text{Ab} + \text{Qtz}$, and is concordant with the observation that the rock is Ms-free and has euhedral Pl inclusions in the garnet core indicative of partial melting. The results of Grt-Bt geothermometry from the outcrop samples are concordant with the above conditions.

Monazite is found as inclusions in the garnet and as a matrix mineral of the Sil-Grt-Bt gneiss. Dating of the inclusion and matrix Mnz would constrain the timing of the high-T metamorphism. The CHIME Mnz dating gave young ages around Tertiary to Cretaceous time both for inclusion and matrix Mnz, although the error (1-sigma) is relatively large (~ 50 Ma). It would be concluded that the high-T metamorphic rocks around Khao Chao is not Late Carboniferous or even Precambrian as previously believed but is as young as Tertiary to Cretaceous.

References

- Areesiri, S. 1983. Proceedings of the Annual Technical Meeting, Dept. Geol. Sc., Chiangmai Univ., 81-100.
Darbyshire, D.P.F. 1988. Natural Environment Research Council, Isotope Geology Center Report, 88/5, 43p.
Dasgupta, S., Sengupta, P., Guha, D., Fukuoka, M. 1991. CMP, 109, 130-137.
Ferry, J.M., Spear, F.S. 1978. CMP, 66, 113-117.
Ghent, E.D. 1976. Am Min, 61, 710-714.
Hodges, K.V., Spear, F.S. 1982. Am Min, 67, 1118-1134.
Salyapongse, S., Fontaine, H., Putthapiban, P., Lamjuan, A. 1997. Geology of the eastern Thailand, Field excursion guidebook. Department of Mineral Resources. 69p.