Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SMP055-P10 Room: Convention Hall Time: May 23 17:15-18:45

Spatial variation of pressure-temperature conditions in the low P/T type metamorphic belt

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Field PT curves of low P/T type metamorphism are higher than any steady-state geotherms of continental crust. One model explaining this feature is proposed by Hanson and Barton (1989). They have explained that low P/T type metamorphic belt is formed by intrusion of a large amount of granitic magma within a short period. Additionally, they expected the presence of temperature variation not only in vertical direction but also in horizontal direction. The presence of temperature variation has been detected by Ikeda (2004). He found that temperature of high grade metamorphic rocks vary even their pressure is similar to each other in Yanai district of Ryoke metamorphic belt, which is typical low P/T type metamorphic belt.
This study performed metamorphic zonation in Kudamatsu-Yanai area which is west part of Yanai area, and estimated pressure-temperature conditions of the sillimanite-K-feldspar zone. The results revealed spatial variation of pressure-temperature conditions in the study area.
Using pelitic and psammitic mineral assemblages, the study area can be divided into six zones, i.e. chlorite-biotite, biotite, muscovite-cordierite, K-feldspar-cordierite, garnet-cordierite, sillimanite-K-feldspar zones. The K-feldspar-cordierite, garnet-cordierite and sillimanite- K-feldspar zones are continued to east part where Ikeda (1998) preformed metamorphic zonation. The garnet-cordierite zone is deceases its width toward west and disappears in around Hikari city. On the other hand, the sillimanite-K-feldspar zone is widely distributed in Murothsu -Kudamatsu area.
Pressure-temperature conditions of seven samples from the sillimanite-K-feldspar zone were estimated by using the garnet-biotite thermometer of Hodges and Spear (1982) and the GASP barometers of Ghent(1976). The sillimanite-K-feldspar zone has temperature ranging from 630 C to 830 C and pressure variation from 3 to 6kbar.
Addition of result of Ikeda (2004) enables us to reveal the thermobaric structure of the area. Temperature increases toward southeast, exceeding over 800 C in relatively-limited area around Hizumi area, and decrease farther toward south below 800 C. In contrast, pressure increases toward southeast monotonously and it reaches 5-6kbar in the south of Hizumi district-Cape Kandori. The isotherms are oblique to isobaric lines, suggesting that temperature have variation at the same depth.
The pressure-temperature conditions of the garnet-cordierite zone are as wide as the sillimanite-K-feldspar zone, because the boundary between two zones is oblique to isotherms and isobaric lines. Three geotherms were obtained along the lines perpendicular to the isobaric lines. These geotherms are high as compared with any steady-state geotherms of continental crust. This feature requires a widespread heat source within crust.
Furthermore, geotherm increases toward east, suggesting that temperature increased locally in the east after geotherms have been regionally high in wide range.
According to the Hanson and Barton`s model, the following story is proposed. Temperature increased in study area by intrusion of a large amount of the Older Ryoke granitic magma within a short period. Then, temperature increased locally in the east parts by intrusion of a later granitic magma.

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Keywords: low P/T type metamorphic belt, Ryoke belt, metamorphic zonation, pressure-temperature structure