Metamorphic evolution of Kontum massif, central Vietnam (I) -Evolution of high pressure granulites-

Nobuhiko Nakano[1], Yasuhito Osanai[1], Masaaki Owada[2], Tran N. Nam[3], Pham Binh[4], Hiroo Kagami[5], Satoko Suzuki[5]

[1] Earth Sci., Okayama Univ., [2] Dept. Earth Sci., Yamaguchi Univ., [3] Dept. Geosci., Hue Univ., [4] Research Inst. Geol. Min., Hanoi, [5] Grad.Sch.Sci.Tech., Niigata Univ.

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Kontum Massif of central Vietnam consists of amphibolite to granulite facies metamorphic rocks, which intruded by plutonic rocks. This massif was subdivided into Kannak and Ngoc Linh complexes on the basis of metamorphic grade. In early time, these complexes have been considered to be composed of mainly Archean granulites and Proterozoic amphibolites, respectively, but recently, some new data have been reported from Kannak complex. According to Osanai et al. (2001), the peak metamorphic condition of pelitic granulite is UHT condition as up to 1050 C and 1.2GPa with a clockwise evolution, and the peak metamorphic age of ca. 250 Ma (Nam et al., 2000; Osanai et al., 2001). Thus, We have understood the metamorphic evolution and age from Kannak complex. However these studies have not explained the P-T-t history of Ngoc Linh complex. So in this presentation, we discuss that of metamorphic rocks from Ngoc Linh complex, especially in mafic granulites.

Ngoc Linh complex is mainly composed of Son Re and Tac Po Formations. Grt-Bt gneiss, Grt-Crd-Sil-Bt gneiss, Grt amphibolite, amphibolite and Opx-Cpx-Hbl granulite are major lithology, which are metamorphosed under amphibolite to granulite facies condition. Mafic granulites discussed in this presentation occur as blocks enclosed in orthogneisses and lenses intercarated with pelitic gneisses.

The Grt-Cpx-Hbl granulite is commonly characterized by lack of plagioclase. Main constituents are garnet, clinopyroxene, hornblende, quartz and ilmenite, equivalent to eclogite facies and high pressure granulite facies. Later plagioclase forming reactions are also observed with small domains by following reactions;

(1) Grt+Cpx+Qtz=Opx+Pl, (2) Hbl+Qtz=Opx+Cpx+Pl+H2O, (3) Grt+Hbl+Qtz=Opx+Pl+H2O

These reactions could indicate isothermal decompression.

The high pressure Hbl-free Grt-Opx-Cpx granulite is composed of mainly garnet, orthopyroxene, clinopyroxene, plagioclase, quartz, magnetite and rutile. Rutile, kyanite and high-Al hornblende are included only in garnet porphyroblasts. Plagioclase is not present in the matrix, but observed only in symplectites by the following reactions;

(1) Grt+Cpx+Qtz=Opx+Pl+Mag, (2) Grt+Qtz=Opx+Pl+Mag+Spl

So primary assemblages of this rock, garnet-clinopyroxene-quartz could be stable under eclogite facies condition.

Estimated peak P-T conditions of Grt-Cpx-Hbl granulite and Grt-Opx-Cpx granulite are 920 C, 1.3GPa and 1050 C, 1.5GPa, respectively. Temperatures have been estimated from the coexisting equilibrium pairs of garnet and clinopyroxene, and pressures were estimated based on experimental data of Ernst and Liu (1998) and Green and Ringwood (1967). After the peak metamorphism, a near isothermal decompression would be taken place. This evolution is comparable with that of Kannak complex by Osanai et al. (2001).

A well defined Sm-Nd internal isochron ages of Grt-Cpx-Hbl granulite and pelitic gneiss which including mafic granulites show 240Ma and 247Ma, respectively. The closure temperature for Sm-Nd system in garnet is 600-850 C (Humphries and Cliff, 1982; Choen et al., 1988; Jagoutz, 1988; Mezger et al., 1992), in hornblende is 700-800 C (Burton and O'Nions, 1990) and in clinopyroxene is 800-850 C (Sneeringer et al., 1988; Jagoutz, 1988), therefore the age obtained here indicates the cooling age just after peak metamorphism.

We conclude on the basis of present study that there is no difference in the metamorphic condition and age between Kannak and Ngoc Linh complex. So that both complexes have been metamorphosed under UHT condition at the same time during East Asia collisional event at around ca. 250 Ma.