

Consideration of isotopic characters of porphyroblastic gneiss from the Ryeongnam Massif

Tomoharu Miyamoto[1]

[1] Earth and Planetary Sci., Kyushu Univ.

Porphyroblastic gneiss from the Korean Peninsula was analyzed to understand the crustal evolution at the eastern margin of Asian Continent. In the Peninsula, three major Massif (Nangrim, Kyeonggi, and Ryeongnam) are distributed from north to south in parallel. They are composed mainly of gneiss and schist formed under amphibolite to granulite facies conditions. They are partly emplaced by Mesozoic granite. Northeastern side of the Ryeongnam Massif were partly covered by Cambrian to Ordovician sediments. To know the lithologic movement in the crust during continental maturing, porphyroblastic gneiss from the Ryeongnam Massif were analyzed for its P-T history and geochronology.

Porphyroblastic gneiss was collected from GuRye area, Southwest Korea, in this study. They are psammitic to pelitic, and principal mineral assemblage is quartz+alkali-feldspar+plagioclase+biotite+/ garnet with opaque mineral and graphite. One of them was aluminous and composed of subsidiary cordierite and sillimanite. Considerable amounts of zircon occur as accessory minerals. Geothermometry of garnet-cordierite pair (e.g., Dwidevi et al., 1998) and garnet-biotite pair (e.g., Ferry and Spear, 1978) show 500-600 degree-C metamorphic conditions. Further compositional characters of garnet and cordierite suggest a possibility of former upper-amphibolite facies metamorphism.

Rb-Sr and Sm-Nd isotopic analyses were done on porphyroblastic gneisses and mineral fractions separated from them. Biotite was sieved to separate into size classes, since it could be expected to preserve heterogeneous Sr isotope compositions corresponding to different ages. Biotite fractions have different Rb and Sr compositions in differing grain sizes, however, their Rb-Sr isotope compositions arranged linearly with slope corresponding to 170-180 Ma on an isochron diagram. No evidence of older metamorphism could be detected from biotite dating. Biotite is susceptible to homogenization of Sr isotopic ratios under low-temperature conditions. Similarity of age between biotite fractions of differing grain sizes might reflect an influence of re-equilibration of Sr isotope ratios in them.

Zircon grains are all detrital with some scratches on their surfaces and partly lack sharp crystal edges. Zircon was fractionated from a population according to its crystal shape in an effort to get an age variation. Conventional isotope dilution methods were applied for U-Pb analysis. All zircon show 1.7-2.2 Ga apparent Pb-Pb age. Most U-Pb compositions of zircon arranged linearly on a concordia diagram, and the arrangement intersects 1.9-2.0 Ga and 0.2-0.3 Ga range of concordia. Some data plot around near the arrangement. No evidence of young zircon existence was detected from the gneiss. Their discordant U-Pb compositions show influence of alteration at Mesozoic metamorphism.

Porphyroblastic gneiss has $87\text{Sr}/86\text{Sr} = 0.755\text{-}0.756$, and estimates 2.12-2.17 Ga apparent Sr model ages based on bulk earth composition (Allegre et al., 1983). Nd model ages based on CHUR composition (Hamilton et al., 1983) are estimated to about 2.26-2.47 Ga. These evidences are consistent with occurrence of old zircon in the gneiss. Little fractionation of REE was expected from common stagnant characters of Sm and Nd in porphyroblastic gneiss during weathering or metamorphism. Geological history of porphyroblastic gneiss from Ryeongnam Massif was constructed to series granitic activity at 1.7-2.2 Ga as protolith formation from fractionated magma derived from mantle before 2.3 Ga, sedimentation of eroded protolith at near provenance, and then metamorphism of the sediments over 500 degree-C and formation of porphyroblastic gneiss before 170 Ma.