Geophysical Research Abstracts
Vol. 15, EGU2013-2682, 2013
EGU General Assembly 2013

Middle Devonian hornblende granite of the Imjingang Belt in South Korea: SHRIMP U-Pb zircon age and its implication on the depositional age of the Imjingang Belt

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The Yeoncheon Group, comprising the major part of the Imjingang belt in central Korean peninsula, is composed mainly of stratigraphically the lower Misan Formation, consisting of calc-silicates rocks alternating with pelitic schists, quartzite, marble and amphibolite, and the upper Daegwangri Formation, consisting of metapelites with rare intercalation of hornblende-bearing siliceous layers. The hornblende granite locally intrudes the lower part of the calc-silicate rocks. Pegmatite veins intrude both calc-silicate rocks and hornblende granite. All these rocks are strongly deformed during the Triassic collision orogeny to have the same geometry of structural elements. The granite is highly strained mylonite with isoclinal and sheath folds, and mineral stretching lineation parallel to the fold axis. On the other hand, competent pegmatite veins are deformed to have lens-shaped boudin structure. Shear criteria in mylonitized granite indicate the top-to-the-east sense of movement. Alkali-feldspar porphyroclasts (<3mm) are common in the fine grained matrix of the granite consisting mainly of quartz, alkali-feldspar and plagioclase with minor hornblende, biotite, titanite, garnet and zircon. The analyzed granite samples are meta-aluminous A-type granite based on their aluminum saturation index [ASI = molar $Al_2O_3/(CaO+K_2O+Na_2O)$] ranging from 0.94 to 1.04 and 10000Ga/Al ratio ranging from 2.83 to 4.19, and belong to within plate and ocean-ridge granites. The granite samples show similar chondrite-normalized REE pattern characterized by moderately enriched light REE and relatively unfractionated heavy REE. The negative Eu anomalies are distinctive (Eu/Eu*=0.3–0.7). Zircon grains separated from four different samples of the hornblende granites are transparent or translucent. Zircon grains show oscillatory zoned core, and rarely thin and dark overgrowth rim under cathodoluminescence image. The U and Th concentrations of the analyzed zircon grains are 70–800ppm and 12–216ppm, respectively, and Th/U ratios are 0.04–1.28. Weighted mean of $^{206}Pb/^{238}U$ age for the SHRIMP zircon U–Pb analysis yielded ca. 374.6±1.8 Ma (n=27), 374.2±1.3 Ma (n=22), 375.5±3.0 Ma (n=14) and 374.33±2.8 (n=14). There is no conspicuous age difference between the transparent and the translucent zircon grains. Consistent U–Pb ages from four different samples suggest the hornblende granite to be a Middle Devonian intrusive. The maximum depositional age of the Imjingang belt is known as ca. 447–397 Ma based on the SHRIMP U–Pb age of detrital zircons separated from the garnet-biotite paragneiss of stratigraphically the upper metapelites. These SHRIMP U–Pb ages of the hornblende granite and garnet-biotite gneiss may tightly constrain the depositional age of the Yeoncheon Group to be Middle Devonian (ca. 400–370 Ma). All these facts may be useful evidence in correlation between the Imjingang belt with South or North China blocks.