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Zircon behavior in the upper amphibolite facies metamorphic rocks from the Aoyama area, Ryoke metamorphic belt, SW Japan

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Recent researches on zircon behavior showed that zircon can crystallize at various stages of metamorphism. In order to interpret the results of the U-Pb zircon dating, it is essential to understand how zircon behaves and responds to the metamorphic processes (Harley et al. 2007). However, zircon-forming, zircon-consuming and zircon-modifying reactions are controlled by the whole-rock composition, pressure-temperature conditions, and fluid-melt-rock interactions. This complexity leaves zircon behavior in metamorphic rocks still unraveled. This research aims to describe the mode of occurrence of zircon in the upper amphibolite facies metamorphic rocks exposed in the western part of the Aoyama area (west of the Kachiji fault), Ryoke metamorphic belt, SW Japan (Yamaguchi and Kawakami, 2008), and to understand the behavior of zircon during the high-temperature metamorphism.

In the Aoyama area, upper amphibolite facies pelitic schists and pelitic-psammitic migmatites are widely exposed and the metamorphic grade increases from the north to the south (Takahashi & Nishioka, 1994; Kawakami, 2001). The metamorphic conditions of the study area estimated by the geothermobarometry were about 610 ^{o}C, 3 kbar in the north and about 715 ^{o}C, 6 kbar in the south. Kawakami and Suzuki (2008) reported the CHIME monazite age of the Ao granite that is intruded to the south of the Aoyama area to be 79.8+/-3.9 Ma.

Eighteen pelitic-psammitic metamorphic rock samples from the study area were examined under SEM-EDS and about 250 grains of zircon were described in detail. As a result, at the north of the study area, zircon grains larger than 20 um in diameter were abundant than in the south.

In order to confirm whether this trend is controlled by the whole-rock Zr composition or not, the remaining half of the chips that was used for the thin section preparation were powdered and analyzed by the XRF analysis. As a result, most of the whole-rock Zr was resided in the zircon grains larger than 20 um in the north, whereas zircon grains larger than 20 um occupied only 20-30 % of the whole-rock Zr in the south.

Based on the result above, a hypothesis is made that most of the coarse-grained zircon in the north larger than 20 um would be detrital. In contrast, at the south, zircon is likely dissolved and may have newly nucleated during the metamorphism, so that Zr may be resided in zircon smaller than 20 um and in other minerals.

In order to check this hypothesis, zircon U-Pb dating by LA-ICPMS was carried out. As a result, zircons ($>$ 20 um) in the north showed the Proterozoic to the Jurassic discordant ages both in the core and the rim. These ages would represent detrital ones. On the other hand, zircon grains in the south showed the Cretaceous discordant ages. This may represent the partial resetting of the old, detrital zircons during the Cretaceous or the Tertiary time. Therefore, it is likely that in the study area, detrital zircon grains including coarse ones dissolved and partially reset during the Ryoke metamorphism and/or during the contact metamorphism by the Ao granite and the Kabuto granodiorite intrusions postdating the Ryoke metamorphism. To confirm that new zircon grains nucleated in the south of the study area during the Ryoke metamorphism or not, the dating of tiny grains and thin overgrowths of zircon and check of the REE patterns of them are important.

Keywords: high-temperature metamorphism, zircon, U-Pb dating, laser ablation ICPMS, zirconium, Ryoke metamorphic belt