[EJ] Evening Poster | S (Solid Earth Sciences) | S-MP Mineralogy & Petrology

[S-MP37]Deformed rocks, Metamorphic rocks and Tectonics

convener:Yoshihiro Nakamura(Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology), Yumiko Harigane(Geological Survey of Japan, National Institute of Advanced Industrial Science and Technology (AIST))

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We invite all researchers who aim to understand the dynamics of the earth's crust and mantle at the plate boundaries, to discuss the latest results from various viewpoints. The scope will include contributions through petrology and structural geology as well as various techniques including rheology and transformation of heat and mass.

[SMP37-P05]Metamorphic condition, age, and duration of the Takahama Metamorphic Rocks in Amakusa-Shimoshima, western Kyushu, Japan

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We have been investigating formation dynamics of the Takahama Metamorphic Rocks in Amakusa-Shimoshima, western Kyushu, Japan. We describe chemical composition of constituent minerals and zircon U-Pb ages of a migmatitic felsic gneiss, and constrain the peak metamorphic condition and time scale of the metamorphism.

The Takahama Metamorphic Rocks are divided into the lower and upper units. The lower unit is underlain mainly by pelitic schists while the upper unit is composed of mafic and felsic gneisses (e.g., Hattori and Isomi, 1976; Moriyama and Yamamoto, 2005). The metamorphic condition in the upper unit corresponds to the high-pressure granulite facies (Ikeda et al., 2005; Miyazaki et al., 2013).

The studied gneiss was collected from the upper unit. It is composed of garnet, quartz, muscovite, fine-grained aggregate of zoisite + plagioclase + muscovite, and zoisite with minor amount of graphite, zircon, apatite, rutile, chlorite, iron sulfide, and allanite. Preferred orientation of muscovite, quartz, and zoisite defines the foliation of the gneiss. The fine-grained aggregates are considered as a breakdown product of plagioclase. Zircon occurs not only in the matrix but also as inclusions in garnet and former plagioclase.

Garnet represents a roughly bimodal crystal size distribution. The coarse- and fine-grained crystals have different chemical zoning. The coarse-grained garnet exhibits prograde zoning in which pyrope content increases from core to rim, except for its rim. In its rim, pyrope content decreases toward periphery. The fine-grained garnet shows monotonous decrease of pyrope content, regarded as retrograde zoning. Al in muscovite in the matrix ranges from 4.97 to 5.35 apfu based on 22 oxygen. The aggregates after plagioclase are composed of almost pure zoisite, albite and muscovite. The Si/Al ratio calculated by using areal fraction among the three minerals indicates the anorthite content of original plagioclase of 0.31 - 0.60 with average of about 0.40.

We estimate the peak metamorphic condition. Al-rich muscovite and pyrope-rich composition of garnet are used to the garnet-muscovite geothemometer of Hynes and Forest (1988). Pressure is calculated using a method proposed by Ikeda (2004) which uses difference in pressure from a reference sample. The net-transfer reaction of zoisite + quartz = plagioclase + garnet + water is considered. As a result, the

peak metamorphic condition is estimated as 730 °C at 0.66 – 0.94 GPa (0.83 GPa when average anorthite content of 0.40 was used).
We obtained zircon U-Pb age from the studied felsic gneiss. Rims of zircon show ages ranging from 114.7 to 134.0 with average of 125.8±1.8 Ma. The significant variation in age represents the mean square weighted deviation (MSWD) as large as 4.0. In addition, detrital zircon ages show the youngest cluster at around 146 Ma.
The mode of occurrence of zircon suggests that the rims of zircon are formed not only at the peak of the metamorphism but also at prograde stage. Therefore, the significant variation of the ages can be explained as mixed ages of prograde and peak metamorphism. The present study suggests that the peak metamorphic age of 114.7 Ma with prograde duration of at least 19.3 Myrs.
Miyazaki et al. (2013) reported the range in metamorphic condition and zircon U-Pb ages as 600 – 780 °C at almost constant pressure of 1.1 GPa and 106 – 120 Ma. The present results are consistent with their estimation in terms of the metamorphic condition, peak metamorphic age of ca. 110 Ma, and duration of prograde metamorphism of several tens Myrs. The youngest cluster of detrital zircon age may constrain the oldest limit of depositional age of the original sedimentary body. The result suggests that the original sedimentary body of the Takahama Metamorphic Rocks was distinctly young as compared with that of the Suo and hence of Higo metamorphic complexes of ca. 200 Ma.