

U-Pb zircon ages of migmatitic rocks from the Ryoke belt in the Mikawa and eastern Sanuki areas

*Keiichi Kazuratachi¹, Tetsuo Kawakami¹, Etienne Skrzypek¹, Shuhei Sakata², Takafumi Hirata³

1. Kyoto University, 2. Gakushuin University, 3. The University of Tokyo

Petrochronological studies of the migmatitic part of the high-temperature, low-pressure type Ryoke metamorphic belt enables us to understand the duration of partial melting of the mid-crustal depths during the Cretaceous ignimbrite flare-up event (Takatsuka et al., 2018a). In order to link multiple metamorphic zircon growths in migmatitic rocks with metamorphic stages of the Ryoke metamorphism, we performed LA-ICP-MS U-Pb zircon dating for samples from the Mikawa and eastern Sanuki areas (Ryoke belt, SW Japan).

In the Mikawa area, U-Pb ages of zircon from ~20 cm thick leucosome subparallel to the migmatitic banding of the psammitic metatexite has been already reported (Takatsuka et al., 2018a). The U-Pb dates of metamorphic rims in this part continuously spread on concordia from ~103 Ma to ~83 Ma. These metamorphic rims were separated into two stages of rim growth by discontinuous zoning in CL images, supported by their chronological and chemical difference: Inner rims were interpreted as the zircon growth during prograde metamorphism (97.0 ± 4.4 Ma) and outer rim as the zircon crystallization from the partial melt during early retrograde metamorphism (88.5 ± 2.5 Ma) (Takatsuka et al., 2018a). However, since the sample used in Takatsuka et al. (2018a) was a notably thick leucosome sample different from the surrounding metatexite leucosomes, whether zircon in the typical metatexite migmatites from the same area give the similar characteristics or not has been not clear.

In this study, we performed LA-ICP-MS U-Pb zircon dating for 4 migmatitic rock samples from the high-grade part of the Mikawa area. Migmatite samples mainly consist of Qtz+Pl+Kfs+Bt±Crd+Sil±Grt. Zircon grains commonly have metamorphic rims in which sillimanite and muscovite inclusions are found. We obtained continuous spread of U-Pb dates on concordia from ~98 Ma to ~81 Ma. Based on presence/absence of sillimanite inclusions, Th/U ratio, and U concentration of zircon rims in addition to the U-Pb dates, three metamorphic stages were recognized; (1) 91.4 ± 0.8 Ma (weighted average age, MSWD=1.4, Th/U<0.08, n=29) possibly representing the zircon rim growth in the presence of partial melts during regional metamorphism, (2) 87.1 ± 1.7 Ma (weighted average age, MSWD=2.1, Th/U= ~ 0.002 -0.01, n=3) representing the formation of U-rich zircon through fluid-rock interaction at early retrograde metamorphism, (3) ~81 Ma (80.9 ± 2.9 Ma and 81.5 ± 7.3 Ma; Th/U<0.03) overgrowth on metamorphic rim (1). The zircon rim (3) might represent the growth or recrystallization during contact metamorphism caused by the intrusion of 81-75 Ma granitoids (Takatsuka et al., 2018b), as sampling point of the migmatite was 1.7 km distant from the 81-75 Ma granitoids and the obtained U-Pb zircon dates are close to the granitoids.

We also determined U-Pb ages of metamorphic zircon in 2 samples from the eastern Sanuki area (Kutsukake et al., 1979) where ages of metamorphic zircon have not been reported so far. One sample is a pelitic gneiss from a metamorphic rock body of about 800 m in size surrounded by granitoids, and mainly consists of Qtz+Pl+Kfs+Bt+Grt. Zircon grains in this sample have metamorphic rims (Th/U= ~ 0.02 -0.18). The weighted average U-Pb age of the metamorphic zircon rims is 93.4 ± 0.7 Ma (MSWD=0.85, n=27). Another sample is a pelitic gneiss from a metamorphic rock body of 4 km wide, surrounded by gneissose granitoids. The gneissose structure of pelitic gneiss is concordant with surrounding granitoids. This sample mainly consists of Qtz+Pl+Kfs+Bt+Sil. Metamorphic rims (Th/U= ~ 0.05 -0.08) of zircon include sillimanite, and the weighted average U-Pb age is 95.4 ± 2.4 Ma (MSWD=0.47, n=6). As these ages are consistent with U-Pb zircon ages of surrounding ~93 Ma gneissose granitoids (Iida et al., 2015), it is likely

that the rims grew during contact metamorphism by the granitoids under sillimanite-stable condition.

Keywords: U-Pb zircon dating, migmatite, high-temperature metamorphism