Constraints on the timing of regional ductile deformation in the Wazuka area, Ryoke belt based on hornfels microstructures

*Hiroaki Saito[1], Tetsuo Kawakami[1], Fumiko Higashino[1]

1. Kyoto University

The Ryoke belt, low *P*/*T* type metamorphic belt distributed in SW Japan, consists of plutonic and metamorphic rocks formed during a Cretaceous flare-up event [1]. The formation of the Ryoke belt involved multiple deformation events [2], and the timing of deformation has been mainly constrained in the Yanai and Mikawa areas [2-5]. In the Wazuka-Kasagi area, plutonic and metamorphic rocks of the Ryoke belt are widely distributed, making this area suitable for investigating correlation between deformation and plutonometamorphism.
In the Wazuka area, the metamorphic grade increases from north to south. Metamorphic rocks generally exhibit an E-W trending schistosity, and sandstone and chert clasts within metapelites are ductilely deformed within the schistosity [6]. Radiolarian fossils in metachert are also deformed, whereas those in the Mino-Tanba belt are not [7]. Furthermore, deformation structures related to mylonitization (D2), and upright folding (D3), are not observed in this area. Therefore, the schistosity is interpreted to have formed during the formation of bedding-parallel schistosity (D1), rather than during the accretion [6].
Metamorphic rocks near the granitic bodies are affected by contact metamorphism [8] and contain cordierite and andalusite porphyroblasts. These hornfelses also exhibit E–W trending schistosity, suggesting its formation during D1. In this study, we attempted to constrain the relative timing between granitic intrusions and D1 in the Wazuka area by examining the textural relationships between porphyroblasts and schistosity. Because the timing of contact metamorphism is contemporaneous with granitic intrusion, the U–Th–total Pb ages of uraninite and thorite from granitoids [9] are regarded as contact metamorphic ages.
In pelitic hornfels around the Omine granodiorite, schistosity defined by biotite arrangement is deflected around pseudomorphs after cordierite and muscovite porphyroblasts. In addition, the arrangement of carbonaceous material in the matrix is continuous into the cordierite and muscovite porphyroblasts. Schistosity deflection in pelitic hornfels around the Koya granite is also observed. Biotite inclusions within andalusite porphyroblasts are oblique to the external foliation, and penetration of the matrix into andalusite porphyroblasts is also observed. These microstructures imply that the intrusion of the Omine granodiorite (ca. 104 Ma) and the Koya granite (ca. 98 Ma) occurred during D1.
In contrast, pelitic hornfels in the vicinity of the Yagyu granite contain cordierite porphyroblasts with inclusion trails of biotite and muscovite parallel to the matrix schistosity. Similar textures are recognized in muscovite porphyroblasts with inclusion trails of carbonaceous material. Schistosity deflection and pressure shadows are not observed around them. These features suggest post-tectonic growth.
Based on these textural features, D1 in the Wazuka area is interpreted to have initiated prior to the intrusion of the Omine granodiorite (ca. 104 Ma) and seized by the intrusion of the Yagyu granite. The Yagyu granite has been considered as a continuous granitic body with the Kabuto granodiorite [10]. Assuming the same crystallization age for these bodies and using the solidification age of the Kabuto granodiorite [11], D1 may have continued until ca. 80 Ma. To constrain the timing of D1 more precisely, future zircon U–Pb dating of granitoids is required.

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