東南極セール・ロンダーネ山地における高温変成作用と流体の挙動 —ザクロ石とジルコンの微量元素組成からの制約

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High-temperature metamorphism and fluid behavior in the Sør Rondane Mountains, East Antarctica- constraints from trace element compositions of garnet and zircon

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In high-temperature metamorphic rocks, the U-Pb geochronology of zircon is a powerful tool to understand metamorphic events. This is because zircon represents relatively high closure temperature of U-Pb system and because its atomic structure remains stable over long periods of geological time. Since zircon could record various metamorphic ages in high-grade metamorphic terranes (e.g., Harley et al., 2007), the appropriate interpretation of their ages is significant. Geological information in addition to ages could be available from single zircon grain, for example, using Ti in zircon thermometer (Watson et al., 2006), relationship between Th/U ratio in zircon and igneous/metamorphic process (e.g., Hoskin and Ireland, 2000), and REE pattern of zircon (e.g., Harley et al., 2001; Rubatto, 2002). Among them, the REE pattern of zircon and distribution of REE between garnet and zircon would be useful tools to establish the link between zircon geochronology and timing of garnet formation.

In the Sør Rondane Mountains (SRM), East Antarctica, Late Proterozoic to Cambrian granulites are widely exposed (e.g., Osanai et al., 1992; 1996; Jacobs and Thomas, 2004; Shiraishi et al., 2008; Osanai et al., 2013; Elburg et al., 2016). Distribution of Cl-rich biotite and hornblende has also been investigated in the SRM (e.g., Higashino et al., 2013; 2015; Kawakami et al., under review). The Cl-rich biotite and hornblende show localized distribution along the large-scale shear zones and detachments irrespective of the rock types, corresponding well with the boundaries of magnetic anomaly domains of Mieth et al. (2014). Therefore, constraining the timing of Cl-rich mineral formations could be a key to understand the formation process of the SRM.

Using LA-ICPMS, the U-Pb dating of zircon and quantitative analysis of REE in garnet and zircon have been performed on 7 mafic and pelitic gneisses including Cl-rich biotite and/or hornblende from the SRM. Zircon shows REE pattern with positive slope or flat REE pattern. In the case of sample TK2010011501A, for example, Higashino et al. (2013) reports that rounded, coarse-grained zircon is exclusively included in garnet rim and not in the garnet core and that *P-T-t* conditions of Cl-rich fluid or melt infiltration is estimated to be ~800°C, ~0.8 GPa at 603+/-14 Ma. The zircon included in the garnet rim shows REE pattern with positive slope, while the garnet rim shows flat REE pattern. This might means that the garnet rim was not equilibrium with the zircon included in the garent rim. The relationship between such REE pattern and mode of occurrence of zircon possibly results from timing of garnet and zircon growth as well as other HREE-bearing minerals. The timing of garnet and Cl-rich mineral formation will be discussed based on REE distribution between garnet and zircon, microstructure and chemical zoning of minerals.

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