

Granitic magma evolution as recorded by monazite: A case from the Busetsu pluton, central Japan

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Granitic rocks constitute the upper continental crust and are enriched in incompatible trace elements such as rare earth element (REE). Granitic magmatism involves various processes such as crystal fractionation, crustal contamination, and magma mixing. Thus, knowledge of granitic magma evolution is a key to understanding crustal differentiation. In granitic rocks, the trace elements are concentrated in accessory minerals. Therefore, trace element and isotope analysis of accessory mineral is a powerful tool for the study of granitic magma evolution.

In this study, we focus on geochemical composition of monazite (light-REE phosphate). Monazite is a common accessory mineral in the S-type granites and plays an important role for the behavior of REE in granitic magma. We have conducted the REE analyses of monazites in granitic rocks from the Cretaceous Busetsu pluton in central Japan. The Busetsu pluton comprises S-type and ilmenite-series granitic rocks in which monazite, xenotime, apatite, and zircon occur as accessory minerals. Petrological data showed that the granitic rocks vary from monzogranite to granodiorite, where monazite occurs in most of them: one granodiorite sample most abundant in plagioclase does not yield monazite. While all of the REE patterns of the monazites showed negative Eu anomalies, Heavy-REE depletions are generally various within a single rock sample. The monazites with the largest negative Eu anomalies in the most evolved rock showed the weakest Heavy-REE depletions. This signature cannot be explained only by crystal fractionation of homogeneous parental magma. Based on the accessory mineral assemblages and geochemical data, it is suggested that significant changes in local bulk composition via crustal contamination or the heterogeneous metasedimentary precursors largely affect the magma evolution of the Busetsu Granite. For further investigation, Nd isotope analysis of the monazite is in progress.