Geochemistry and zircon U-Pb dating of volcanic rocks in Mineoka-Setogawa Belt

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The Mineoka-Setogawa Belt is distributed from the Boso Peninsula to eastern Shizuoka Prefecture, central Japan and is known as a Paleogene accretionary complex. This belt contains fragments of ultramafic rocks, mafic rocks (gabbro, dolerite, basalt), and pelagic and terrigenous sedimentary rocks, which are interpreted as an ophiolite mélange. However, it has been still controversial for the origin of this ophiolitic mélange. In this study, we aimed to focus on the relationship between the geochemical composition and radiometric ages of the volcanic rocks of the Mineoka-Setogawa Belt.
The collected samples are subdivided into three types on the basis of the mineral assemblage. Type 1 consists mainly of plagioclase and clinopyroxene. Type 2 and 3 are characterized by the presence of biotite + apatite and quartz in addition to plagioclase and clinopyroxene, respectively. The whole-rock compositions of Type 1 and 3 are similar to those of mid-ocean ridge basalt (MORB) and island-arc tholeiite, respectively. On the other hand, the composition of Type 2 is similar to those of intra-plate alkaline basalt. The rare earth element (REE) patterns of Type 1 and 3 exhibit slight depletion in light REE. The REE patterns of Type2 are characterized by light REE-enrichment and heavy REE-depletion. We tried to determine the zircon U-Pb dating from five coarse-grained doleritic samples and succeeded to collect zircon grains from a Type 3 sample. The zircon U-Pb dating using LA-ICP-MS resulted in 18.51±0.82 Ma. This age is close to the whole-rock K-Ar ages (5.8Ma and 15.6Ma) for andesitic tuff breccia by Mori et al. (2011).
The whole-rock K-Ar ages obtained in the previous studies show a wide range from 19 to 42 Ma, which is probable to be affected by secondary alteration. Hirano et al. (2003) and Mori et al. (2011) reported Ar-Ar plateau ages (about 50 Ma and 80 Ma) from MORB-like basalts equivalent to Type1. These ages are probably reliable because they are almost consistent with those of microfossils in pelagic sediments. The compositional difference between these MORB-type basalts of about 50 Ma and 80 Ma is unclear, but, at least, the 80 Ma MORB-type basalt formed in the Pacific Ocean because any other oceanic plate formed in this period is not known. On the other hand, there are several likely candidates for the origin of the 50 Ma MORB-type basalt: Pacific Ocean MORB, West Philippine Sea back-arc basin basalt (BABB), and Mariana fore-arc basalt (FAB). Comparing the Type 1 basalt with these candidates using the REE pattern and the Ti-V diagram of Shervais (1982), the Mineoka-Setogawa MORB-like basalt (Type 1) is similar to Pacific Ocean MORB and West Philippine Sea BABB, but not to Mariana FAB. Hirano et al. (2003) and Mori et al. (2011) also reported Ar-Ar plateau age (25.5 Ma) and Ar-Ar isochron age (19.6 Ma) for intra-plate alkaline basalts equivalent to Type 2. These ages are supported by the occurrence of intra-plate basalt erupted at the same time as Early Miocene mudstone (Sugiyama, 1995). Around this time, the Shikoku Basin had been already formed. We compared the Mineoka-Setogawa Belt Type 2 basalt with alkaline basalts from seamounts on the Pacific Plate and Shikoku Basin. As a result, The Type 2 basalt is closely similar to the former in the point of view of significant enrichment in LREE and depletion in HREE. The island-arc tholeiite (Type 3) formed in around 19 Ma was probably generated by the early volcanism in the Izu-Bonin-Mariana Arc after the Shikoku Basin formation.

Keywords: Mineoka-Setogawa Belt, Paleogene accretionary complex, ophiolite, zircon U-Pb dating

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