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西南日本金剛山地に分布する葛城トーナル岩の希土類元素組成
REE composition of the Katsuragi tonalite, Kongo Mountains, southwestern Japan

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Adakitic rocks are important for understanding the crust-forming processes on the earth. Adakitic rocks are characterized by Sr-rich and Y-poor chemical composition. Petrogenesis of adakitic rocks are commonly explained by slab melting of the subducted oceanic crust or fractional crystallization of a basaltic magma under high pressure conditions.

Some of the adakitic rocks including the Katsuragi tonalite have been reported in southwestern Japan (Nishioka, 2008). The Katsuragi tonalite, however, have not been systematically analyzed for rare earth element (REE). In the study, we report whole-rock major, trace and REE compositions of the Katsuragi tonalite, and discuss the petrogenesis of the pluton. The Katsuragi tonalite is situated around Mt. Kongo and Mt. Katsuragi in Kongo Mountains, southern part of Osaka prefecture, southwestern Japan, and consists of a 10 km (north-south) x 15 km (east-west) body. The pluton is divided into three rock types with different lithology: type I, II and III (Masaoka, 1982). Type I is weakly schistosed medium-grained granodiorite to quartz diorite. It is distributed in the southern half and marginal part of the pluton. Type II is weakly schistosed to massive coarse-grained granodiorite distributed in the eastern part of the Mt. Katsuragi. Type III is massive to weakly schistosed medium-grained granodiorite distributed in the western part of the Mt. Katsuragi (Masaoka, 1982). A total of 15 samples of Katsuragi tonalite were analyzed for chemical composition. The major-trace element compositions and REE compositions were obtained by XRF and ICP-MS, respectively. The chemical compositions of the Katsuragi tonalite are SiO_2 = 62.0-68.7 wt.%, Sr = 420-611 ppm, Y = 6.8-12.3 ppm, Sr/Y ratios = 44-72. All samples of the Katsuragi tonalite were plotted within the field of adakite on a graph of Sr/Y vs. Y (Defant et al., 1991). Each types of the Katsuragi tonalite shows different trend on the Harker's diagram. REE compositions normalized by CI-chondrite show high-LREE, low-HREE pattern. Type I and some samples of type III show no Eu anomaly, however, type II and the other samples of type III show the positive Eu anomaly. Magma genesis of type II and III might be concerned with feldspar crystallization.

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玄武岩の変成過程における輝石と長石の再結晶、アメリカ北カルフォルニア
Recrystallization of igneous pyroxene and feldspar during metamorphism of basalts, northern California USA

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Relict crystals of feldspar and clinopyroxene are replaced by white mica and chlorite, respectively, from pillow interiors toward pillow margins in meta-basalts of the Slate Creek Complex, an arc-ophiolite in the northern Sierra Nevada, California, USA. These textures are a product of alteration on the sea-floor and regional metamorphism of the North American continental margin. The goals of this study are to: (1) characterize specific minerals in the replacement textures; (2) determine the spatial scale over which replacement occurred; (3) identify likely controls on these mineral replacement reactions; (4) distinguish effects of sea-floor alteration from regional metamorphism.
We collected samples from pillows at a large outcrop (approx. 100x30 meters) that was exposed for dam construction. The pillows at this outcrop show broadly curving tops, well-developed keels and are somewhat flattened. Exposed cross-sections of pillows are less than one meter across. These basalts were erupted originally with pyroxene and plagioclase feldspar phenocrysts. The pillows are close-packed with epidote-rich seams separating adjacent pillows. Mineral assemblages in tuffs to the east and west of the main outcrop indicate that the pillow basalts were metamorphosed at greenschist facies conditions (approx 400C) during regional metamorphism. Three pillow margins were studied using petrographic microscope, a secondary electron microcscope (SEM) with energy dispersive X-ray spectrometer (EDS) at National Institute of Polar Research (NIPR) in Tachikawa (JEOL JSM-5900), and electron probe microanalysis (EPMA) at Waseda University (JEOL JXA-8900 Super Probe).
Four textural stages of feldspar replacement were defined from pillow interior to margin: stage 1, albite with minor sausserite; stage 2, albite + sausserite; stage 3, albite + white mica + sausserite; stage 4, white mica + sausserite with or without albite. Five textural stages of pyroxene replacement were also defined. Relict pyroxene (stage 1) is gradually replaced by chlorite (stages 2, 3 and 4), and at pillow edges, pyroxene is almost completely replaced by chlorite (stage 5). Matrix minerals include epidote, quartz, chlorite, white mica, albite, K-feldspar, titanite. Metamorphic amphibole was identified in pillow interiors. In two margins, the textural variation of feldspar and pyroxene from pillow edge to pillow interior occurs over the length of one thin section (~4 cm). In the third margin, replaced and partially replaced feldspar and pyroxene extend at least 10 cm into pillow interiors. This pillow margin has abundant amygdules near the pillow edge, in contrast to the other two margins. This suggests that higher porosity resulted in greater replacement of feldspar and pyroxene by white mica and chlorite respectively.
Hydration and enrichment in K of the pillow margins probably took place on the sea-floor, by exchange with sea water. Igneous water originally dissolved in basaltic liquid might also have hydrated the pillow margins, as indicated by the amygdules. Igneous feldspar in pillow margins were replaced by albite, and chlorite and fine-grained white mica also crystallized during this stage. In contrast, pillow cores were relatively unaltered. Coarse white mica phenocrysts of feldspar and coarsening of chlorite occurred during regional metamorphism. Mass balances suggest that abundant epidote formed with the white mica phenocrysts, and Na released at this stage might have been released to pillow interiors, where original feldspar was albitized.