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Elemental Behavior during the weathering of basaltic rocks: a case study of southwestern Japan

MOTOHIRO TSUBOI, MISAKI NAKATA AND KAZUYA SHIMOOKA

Kwansei Gakuin University

The weathering process of rocks is a significant research topic from the perspectives of mineral resources and disaster prevention. Among various rocks, the weathering process of basalt in particular has recently drawn attention in connection with carbon dioxide sequestration. The present study examined the behavior of elements associated with the weathering of basalt. The study focused on the Ueno volcanic rocks of southwestern Japan as a case study. The Ueno volcanic group is a monogenetic volcanic group composed of Pliocene to Pleistocene basaltic rocks. These rocks are distributed from the southern part of Takayama area to the Nakatsugawa area, around the boundary between Gifu and Nagano prefectures, in southwestern Japan. These basaltic rocks have been dated by the K-Ar dating method ranging from 2.5 to 0.9 million years [1]. This study focuses on the Sakashita body, which is located among the Ueno basaltic rocks. The Sakashita body is constituted of pyroxene-olivine basalt or basaltic andesite [2]. The K-Ar ages of the Sakashita body range from 1.4 to 1.7 Ma (e.g., the compiled data from Nakano, 2000 [3]). The observation of thin sections revealed that olivine has been altered to iddingsite during the process of weathering. Comprehensive research has been conducted on the chemical composition and texture of the sample. This analysis involved the use of X-ray fluorescence analysis, loss on ignition (LOI) measurement, and thin section observation. The study encompassed a range of rock samples, from fresh to weathered, with varying degrees of weathering. Isocon diagrams demonstrate that as weathering progressed, the major elements, such as, Mn, Ti, Fe, and Al, increased in abundance, while Na, Mg, Ca, Si, and K decreased. Among trace elements, Pb, Nb, Co, Ni, Zn, V, Cr, Zr, and Ba showed an increase, while Sr showed a decrease. The behaviour of these elements can be correlated with the minerals constituting the basalt.

Reference [1] Ujike et al. (1992) Journal of Mineralogy, Petrology and Economic Geology, 87, 102-106. [2] Nakano (1993) Journal of Mineralogy, Petrology and Economic Geology, 88, 272-288. [3] Nakano et al. (2000) Bulletin of the Volcanological Society of Japan, 45, 87-105.