

Chemical weathering process of the Kita-Matsuura basalt, southwestern Japan

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Understanding the chemistry of rock weathering processes is important not only for understanding geochemical or soil formation processes, but also from a disaster science perspective. Recently, the weathering processes of basalts are also of interest from the perspective of carbon dioxide capture and storage (CCS). In this study, the chemical weathering processes of the Kita-Matsuura basalt in the Matsuura area in the northern part of Kyushu Island, southwestern Japan, was investigated from a geochemical aspect. The Kita-Matsuura basalt is the largest lava among the Cenozoic basalts in southwestern Japan e.g.[1][2]. It forms a lava plateau extending around Imari, Sasebo and Hirado areas. A number of landslides have also occurred in this area. In this study, we focused on the process of transformation of primary minerals into secondary minerals in basalts. X-ray fluorescence spectroscopy, X-ray diffraction and Raman spectroscopic analyses were carried out. Samples were classified by appearance as fresh, moderately weathered or weathered. As weathering progressed, primary minerals such as olivine, pyroxene or plagioclase decreased and secondary minerals such as montmorillonite, nontronite, kaolinite and hematite increased. The whole-rock chemical composition showed that highly mobile elements such as Ca, Na, K and Mg tended to decrease in the early stages of weathering, while the concentrations of more residual elements such as Al, Fe and Si increased relatively as weathering progressed. Elemental dissolution and residues in primary minerals in basalts contribute to the formation of clay minerals. Raman spectroscopy was used to identify the minerals in the outer margin altered parts of the olivine. Serpentine and amorphous phases were identified in addition to olivine. The interaction between chemical weathering and the mineralogical composition of the basalt can potentially lead to the occurrence of geological hazards, particularly landslides in this area.

Reference [1] Kurasawa, H. (1963), Chishitsu News, 108, 18-22.

[2] Kakubuchi et al. (1994), Journal of Mineralogy, Petrology and Economic Geology, 89, 41-55.