
Analytical Electron Microscopic Study of the Noncrystalline Products Formed at Early Weathering Stages of Volcanic Glass

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Abstract: Formation processes of weathering products of pumice collected from a rhyolitic pyroclastic flow deposit were investigated by X-ray powder diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM) and energy dispersive X-ray analysis (EDX). SEM clearly showed the presence of some weathering products adhering to the surface of pumice. XRD showed that the products were composed mainly of noncrystalline materials with a relatively small amount of halloysite (10 Å). TEM and EDX revealed texture transformation sequences from the earliest weathering product to a final product of halloysite as follows: 1) precipitation of very thin flaky or film-like noncrystalline Al-hydroxide; 2) transformation into irregularly aggregated Al-Fe-Si-rich fibrous material; 3) morphological changes to rounded aggregates; 4) development of halloysite-like curled domains with successive decrease in Fe content; and 5) further development of curled domains in rounded aggregates. These materials must be metastable phases at early reaction stages with kinetics limiting formation of the stable equilibrium phase of kaolinite.

Key Words: Formation Process • Halloysite • Noncrystalline Material • Pumice • Weathering Product

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