
Diagenetic Alteration of Perlite in the Guryongpo Area, Republic of Korea

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Abstract: Perlite, which occurs at the contacts between dacite and lacustrine tuffs of Miocene age in the Guryongpo area, Korea, has undergone more sluggish and incomplete diagenetic alteration than the surrounding zeolitic tufts. Alkali-clinoptilolite, mordenite, smectite, K-rich gel-like glass, low-cristobalite, and K-feldspar are characteristic diagenetic phases in the altered perlite.

Hydration of the glass to form perlite resulted in the expulsion of cations, mainly Na, from the glass into the pore fluid and in the relative enrichment of K in the perlite. Hydration of the glass also resulted in increased alkalinity of the pore fluid, which, in turn, affected the nature and behavior of subsequent glass dissolution. Textural observations and chemical data on the early diagenetic phases indicate a sequence of incongruent dissolution reactions, which depended on silica activity and alkalinity of the ambient pore fluid: Reaction (1) $12.5 \text{ perlitic glass} + 3.88 \text{ K}^+ + 0.65 \text{ H}^+ + 15.4 \text{ H}_2\text{O} = \text{smectite} + 9.5 \text{ gel-like glass} + 4.03 \text{ Na}^+ + 0.25 \text{ Ca}^{2+} + 10.55 \text{ H}_4\text{SiO}_4$ released Ca and silica which were consumed by reaction (2) $\text{perlitic glass} + 0.1 \text{ Ca}^{2+} + 0.1 \text{ H}_4\text{SiO}_4 + 0.1 \text{ H}^+ + \text{H}_2\text{O} = \text{clinoptilolite} + 0.1 \text{ K}^+ + 0.2 \text{ Na}^+$. The paragenesis from glass via smectite to alkali zeolites in most glass-bearing rocks may be explained by a sequence of such dissolution reactions. Still later reactions involved the transition from less-silicic clinoptilolite to an assemblage of silicic Na-clinoptilolite + mordenite and the crystallization of the gel-like glass to K-feldspar.

Key Words: Clinoptilolite • Diagenesis • Dissolution • Glass • Mordenite • Perlite • Smectite • Zeolite

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