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# Formation of Allophane and Beidellite During Hydrothermal Alteration of Volcanic Glass Below 200° C

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**Abstract:** Experimental alteration of volcanic glass has been carried out in distilled water at 200° C and 150° C. The formation and transformation processes of alteration products have been examined by scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray powder diffraction (XRD), infrared absorption analysis, and X-ray photoelectron spectroscopy. SEM and TEM clearly show that amorphous aluminum-silicate coatings with allophane particles precipitate on the surface of volcanic glass during the earliest alteration stage. Noncrystalline flaky and/or fibrous materials are formed from the allophane aggregates and from the amorphous coatings as new reaction products. The flaky and/or fibrous materials curl inward and transform into 100– 500 nm circular smectite. The Al/Si atomic ratio of 1.09 for allophane decreases progressively to 0.65 for smectite through 0.86 for noncrystalline transitional material. The smectite has d(06) spacing of 1.497 Å and consists mainly of Si, Al, and small amounts of Fe, Ca, and Na.

**Key Words:** Allophane • Amorphous aluminum-silicate coating • Experimental alteration • Smectite • Transitional material • Volcanic glass

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