Argillization by Descending Acid at Steamboat Springs, Nevada*

Robert Schoen, Donald E. White and J. J. Hemley

U.S. Geological Survey, Washington, D.C. 20244, U.S.A. and Menlo Park, California 94025, U.S.A.

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Abstract: Steamboat Springs, Nevada, an area of present-day hot springs, clearly illustrates the genetic dependence of some kaolin deposits on hot-spring activity. Andesite, granodiorite and arkosic sediments are locally altered at the land surface to siliceous residues consisting of primary quartz and anatase, plus opal from primary silicates. These siliceous residues commonly exhibit the textural and structural features of their unaltered equivalents. Beneath the siliceous residues, kaolin and alunite replace primary silicates and fill open spaces, forming a blanketlike deposit. Beneath the kaolin-alunite zone, montmorillonite, commonly accompanied by pyrite, replaces the primary silicates. On the ground surface, the same alteration mineral zones can be traced outward from the siliceous residue; however, hematite rather than pyrite accompanies montmorillonite.

Chemical analysis indicates that sulfuric acid is the active altering agent. The acid forms from hydrogen sulfide that exsolves from deep thermal water, rises above the water table and is oxidized by sulfur-oxidizing bacteria living near the ground surface. This acid dissolves in precipitation or condensed water vapor and percolates downward destroying most of the primary minerals producing a siliceous residue. Coincidence of the water table with the downward transition from siliceous residue to kaolin-alunite signifies decreasing hydrogen metasomatism because of dilution of descending acid by ground water.

In hot-spring areas, beds of siliceous sinter deposited at the surface by hypogene thermal water look, superficially, like areas of surficial acid alteration. Features diagnostic of a surficial alteration are the relict rock structures of a siliceous residue and a kaolin-alunite zone immediately beneath.

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