
Clay Minerals in the 1980 Deposits from Mount St. Helens

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Abstract: Phyllosilicates are major components of the <2- μm fraction (1– 3 wt. % of most bulk specimens) in more than 50 samples of air-fall tephra from several 1980 eruptions of Mount St. Helens. In all samples, trioctahedral smectite is the major clay mineral. The integral series of $00l$ reflections in ethylene glycol-treated samples indicates a lack of interstratification; absence of a peak near 5 Å after heat treatment, the 060 peak at 1.54 Å, and energy dispersive chemical analyses indicate that the smectite is a Mg- and Fe- rich, trioctahedral saponite. Minor mica and chlorite are present in the <2- μm fraction of most samples, and some samples show a peak near 12 Å after heating to 550° C which is probably due to the presence of an interstratified chlorite/collapsed smectite or chlorite/collapsed vermiculite. The tephra contains glass and crystals originating from new magma and lithic fragments incorporated from the pre-existing cone. The clay minerals in the tephra are lithic components stripped from older, hydrothermally altered rocks during explosive ejection. Cleaned pumice fragments, which are new magmatic components, lack smectite, but contain rare biotite in xenoliths. Old, hydrothermally altered rocks from the volcano's summit and from the debris-avalanche (former north flank) contain saponite together with chlorite and chlorite/smectite which may have formed from it. Saponite and zeolites that precipitated from neutral to alkaline hydrothermal solutions line cavities in some of these rocks. The saponite was probably not subjected to magmatic temperatures because heating this material for 5 min at 750° C collapses it irreversibly to 10 Å. Kaolinite, alunite, and opal, indicative of acid-sulfate alteration, were found only in the pre-1980 summit crater and the southwest thermal area, but were not evident in the lithic components of the 1980 deposits.

Key Words: Chlorite/smectite • Mt. St. Helens • Saponite • Smectite • Tephra • Volcanic ash

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