
Parameters Influencing Layer Stacking Types in Saponite and Vermiculite: A Review

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Abstract: Saponites and vermiculites may assume at least 11 ordered or semi-ordered layer stacking sequences. For a given relative humidity, the layer stacking type assumed is a function of the nature of the interlayer cation, the layer charge density, the mean size of the particles, and the di- or trioctahedral character of the sheets. For each interlayer cation, a succession of layer stacking types can be observed as relative humidity increases. For high relative humidity, some particular layer stacking types exist, but only for low-charge minerals. No other differences have been found for saponites and vermiculites in each successive layer stacking type. The degree of order that these layer stacking types imply is probably due to the existence of electrostatic bonds between hydrated interlayer cations and surface oxygens of the substituted tetrahedra. For octahedrally substituted 2:1 phyllosilicates, however, the disorder of the layer stacking sequences is related to a highly delocalized distribution of negative charges on the surface oxygens of the layers.

A study of the superstructures detected in saponites and vermiculites indicates that the interlayer cations tend to be located as far as possible from one another. The superstructures exist only with some cations and some layer stacking types and if the layer charge density is compatible with the charge produced by the cation distribution in this kind of superstructure.

Key Words: Layer charge • Layer stacking • Relative humidity • Saponite • Vermiculite

Clays and Clay Minerals; October 1987 v. 35; no. 5; p. 353-362; DOI: [10.1346/CCMN.1987.0350505](https://doi.org/10.1346/CCMN.1987.0350505)

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