

RELATIONSHIPS BETWEEN CLAY MINERALS AND WATER: INFLUENCE OF EXTERNAL AND STRUCTURAL FACTORS

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The combination of diffractometric (X-rays and neutrons) and thermal (TGA and DTA) analyses has revealed the existence of seven hydration states in 2:1 clay minerals (synthetic saponites), as a function of the partial water vapour pressure (P/P_0). For low water vapour pressures, only layer edges and surfaces are concerned. With increasing P/P_0 , a progressive hydration of the compensating cation is observed, with an increase, by steps, of the basal distance d_{001} , from about 10 Å to about 15 Å. However, the classical model “one-layer” and “two-layers” is much more complicated.

For high P/P_0 values ($> 85\%$), pore water appears, indicating a saturation (edges, surface and interlayer space).

Compositional variations which strongly modify the clay mineral structures mainly influence the hydration properties. Structural factors like the ditrigonal distor-

tion of the tetrahedral sheet and the layer stacking strongly affect the relationships between clay minerals and water. This has been demonstrated on the saponite group, with layer charge 0.33–1.0 [i.e., aspidolite, $\text{NaMg}_3(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_2$] and on the aspidolite-preiswerkite join [$\text{Na}(\text{Mg}_2\text{Al})(\text{Si}_2\text{Al}_2)\text{O}_{10}(\text{OH})_2$].

On the whole, the influence of the layer charge is negligible, as well as the origin of the charge (tetrahedral and/or octahedral). The main factors are the local structure and the layer stacking which determine the coordination of the compensating cation. When the coordination number of the interlayer cation drops from [12] to [6], the hydration properties progressively decrease, and when the six-fold coordination is reached, no water molecule can enter the interlayer space. The minor hydration is only due to the adsorption of water molecules on edges and surface.