
Relevance of Different Intercalation Tests for Distinguishing Halloysite from Kaolinite in Soils

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Abstract: The expandabilities of kaolin-group minerals in different horizons in 10 soils from New Zealand and Fiji were measured immediately after the application of formamide and after the sequential application of hydrazine, water, and glycerol (HWG treatment). The expandabilities of these minerals in some of the soil samples with dimethylsulphoxide (DMSO) and after long-term (4-day) formamide treatments were also measured. The abundance of characteristic halloysite shapes was determined from electron micrographs of selected samples. The expandabilities of several non-soil kaolinite samples with the DMSO and HWG treatments were also measured.

The expansion of kaolin-group minerals showed the same trends within almost all profiles, whether determined using formamide (by the immediate-formamide treatment) or glycerol (by the HWG treatment). Except where both treatments led to complete intercalation, the HWG treatment always caused more expansion of kaolin-group minerals than obtained immediately after formamide application. The HWG treatment expanded some non-soil kaolinite samples, but well-crystallized kaolinite was not affected by this treatment. The DMSO treatment expanded kaolin-group minerals in the soils to a similar extent as the HWG treatment and also expanded well-crystallized kaolinite. The degree of expansion resulting from the immediate-formamide treatment matched abundance of typical halloysite particle shapes more closely than the degree of expansion given by the other intercalation treatments. The degree of expansion immediately following formamide application could be diminished, if the samples were heated at $40 \pm 5^\circ \text{C}$.

Key Words: Expansion treatment • Halloysite • Intercalation • Kaolinite • Soil clay

Clays and Clay Minerals; December 1990 v. 38; no. 6; p. 591-599; DOI: [10.1346/CCMN.1990.0380604](https://doi.org/10.1346/CCMN.1990.0380604)

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