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NOMENCLATURE FOR STACKING IN PHYLLOSILICATES: REPORT OF THE ASSOCIATION INTERNATIONALE POUR L'ETUDE DES ARGILES (AIPEA) NOMENCLATURE COMMITTEE FOR 2008

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Kogure and co-workers have published several papers reporting the stacking structures of various 2:1 layer phyllosilicates (*e.g.* aspidolite, Kogure *et al.* (2004); wonesite, Kogure *et al.* (2005); pyrophyllite, Kogure *et al.* (2006)), mainly by using high-resolution transmission electron microscopy (HR-TEM). However, there is ambiguity in wording that refers to the lateral displacement between two tetrahedral sheets across the interlayer regions. Zvyagin *et al.* (1969) used the symbol "τ" for this displacement, which describes the structures of pyrophyllite and talc, but no universally accepted wording was used for other 2:1 phyllosilicates or 1:1 phyllosilicates. Bailey (1984, p. 32) referred to the "layer offset" for this displacement in mica, but the original meaning of 'layer offset' can be taken as the 'displacement' to offset the *intralayer* shift of the 2:1 layer. A more precise meaning of these terms is needed that can be applied to not only the micas, but to other 2:1 layer phyllosilicates also. Recommendations are also included for 1:1 layers.

2:1 LAYERS

Discussion

The adjective 'interlayer' is ambiguous. Interlayer implies 'the region between the two adjacent layers' or 'the relation between the two adjacent layers.' Hence, this adjective can be used for both the displacement at the interlayer region and relative displacement between the adjacent layers themselves.

An alternative is to use 'interlayer displacement' or 'interlayer shift' for the displacement only (Figure 1) between the two tetrahedral sheets across the interlayer region, as the counterpart of the intralayer displacement or intralayer shift in the 2:1 layer. In this case, the terms 'layer displacement' or 'adjacent layer displacement' (and not just 'interlayer') must be used to refer to the relative displacement between the adjacent layers, *i.e.* $-c(\cos\beta)/a$ for the 1*M* polytype. In other words:

Layer displacement =
Intralayer displacement + Interlayer displacement.

Recommendation

The layer displacement for 2:1 layers is defined as the sum of the intralayer displacement and the interlayer displacement. The intralayer displacement refers to the intralayer shift of Bailey (1984, p. 32) of the upper tetrahedral sheet relative to the lower tetrahedral sheet of a 2:1 layer (as measured from the geometric centers of the ditrigonal rings and is ideally $a/3$). The interlayer displacement refers to the lateral displacement between the two tetrahedral sheets of adjacent 2:1 layers across the interlayer space. This displacement is measured either from the geometric centers of the ditrigonal rings or from the tetrahedral cations in adjacent layers, and is typically 0.02 Å in muscovite and 0.23 Å in paragonite (Bailey, 1984). Similarly, the interlayer distance (commonly based on the average z coordinate of the basal oxygen atoms) refers to the spacing between the two

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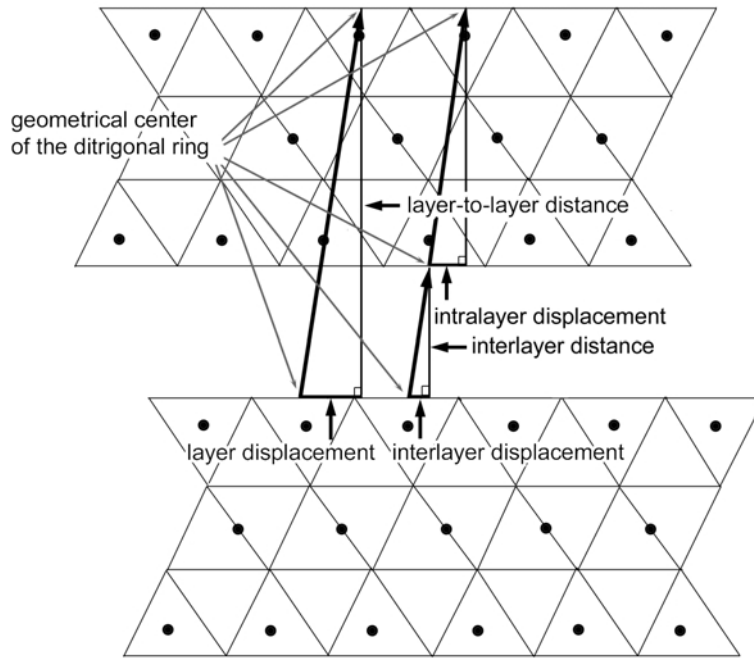

Figure 1. Illustration of the terms used in this report for 2:1 phyllosilicates. The view is down the [010] direction and no interlayer cation is shown for simplicity.

basal oxygen planes across the interlayer region. The "structure unit" is defined by Bailey (1980) as the total assemblage of the layer plus the interlayer. The layer-to-layer distance for a one-layer structure (Figure 1) is the distance consistent with the structure-unit definition. A two-layer structure would have twice the basal spacing compared to a one-layer (*e.g.* for mica-2*M*, basal spacing approximately equal to 20 Å, but a layer-to-layer distance consistent with the structure unit of ~10 Å). Finally, interlayer material refers to any substance between two basal oxygen planes across the interlayer region; see Guggenheim *et al.* (2006).

1:1 LAYERS

Discussion

For 1:1 layers, the layer displacement can also be defined as the relative lateral displacement between adjacent layers. However, Bailey (1988) termed this displacement "interlayer shift." The definitions of an intralayer displacement and interlayer displacement in 1:1 layers, similar to those in 2:1 layers, are problematic, especially for trioctahedral cases, but in part also because there is no upper (tetrahedral) sheet to consider.

Recommendation

To avoid confusion and to maintain parallelism with 2:1 layers, the term 'layer displacement' should be used instead of 'interlayer shift.' The terms 'adjacent layer displacement' and 'layer shift' are equivalent to 'layer displacement.'

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