

On the interlayer structure in sodium micas

Toshihiro Kogure[1]; Yasuyuki Banno[2]; Ritsuro Miyawaki[3]

[1] Earth and Planetary Sci., Univ Tokyo; [2] GSJ, AIST; [3] Department of Geology, National Science Museum

The most common element for interlayer cations in micas is potassium but sodium or divalent large cations can replace it. For instance, paragonite is the sodium analogue of muscovite. A number of structure analyses confirmed that the interlayer structure in paragonite is almost the same as that in muscovite, although the interlayer separation is considerably decreased (about 0.03 nm) due to smaller ionic radii of sodium than potassium. On the other hand, few works have been reported with respect to the structure of sodium-bearing trioctahedral micas. Aspidolite, the Na analogue of phlogopite, was described by several researchers but only about its occurrence and chemistry were reported. We investigated the structure of aspidolite that is interleaved with phlogopite in a thermally metamorphosed rock, by X-ray diffraction using a Gandolfi camera. However, the obtained diffraction patterns could not be interpreted on the basis of an aspidolite structure similar to that of phlogopite in which decreased interlayer separation is assumed. Therefore the specimen was examined by high-resolution transmission electron microscopy (HRTEM), which resulted in the finding of a new interlayer structure occupied by sodium.

Aspidolite-phlogopite interleaved mica was found in a rock sample from granitic contact aureole in Kasuga-mura, Gifu-Prefecture, central Japan. HRTEM and electron diffraction analysis indicated that large layer offset, i.e. lateral shift between the two tetrahedral sheets across the interlayer region is formed in aspidolite (Fig. 1a). The amount of the offset is about 0.09 nm and the direction is one of $[-100]$, $[110]$ and $[1-10]$. These three offset directions are frequently disordered. By combination of the direction of the intralayer shift and that of the layer offset, the ordered aspidolite has two one-layer structures with monoclinic and triclinic cells. Both structures were also identified in powder X-ray diffraction patterns, probably the triclinic structure being dominant. This is the first report that structural variations (polytypes) are generated in micas, with combination of the intralayer shift and layer offset.

Furthermore, larger layer offset (0.125 nm) has been found in wonesite, an interlayer-deficient trioctahedral mica, from the Post Pond Volcanics, USA, by the similar analyses. The interlayer in sodium micas (preiswerkite, paragonite, aspidolite, wonesite, etc.) possesses various amounts of the layer offset, depending on the cavity space in the tetrahedral sheet that is primarily determined by the ditrigonal rotation angle (Fig. 1b).

Kogure, T., Banno, Y. and Miyawaki, R. (2004) *Eur. J. Mineral.* 16, 891-897.

Kogure, T., Miyawaki, R. and Banno, Y. (2005) *Am. Mineral.*, in press.

Figure 1. (a) Structure of the interlayer region in aspidolite, showing sodium ions and the two tetrahedral sheets. (b) Relationship between the cavity size ($d(C-O)$) in the tetrahedral sheet and the layer offset for several sodium micas.

