

Direct determination of defect structures in kaolin minerals by High-Resolution Transmission Electron Microscopy (HRTEM), Toshihiro Kogure, *Graduate School of Science, the University of Tokyo, Japan*.
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Kaolinite is among the most abundant clay minerals and an important resource for industries. In addition, the mineral has been attracting many clay mineralogists because it shows diverse structural variations related to stacking defects. In X-ray powder diffraction, these defects or stacking disorder are mainly evaluated by the diffraction profiles with $k \neq 3n$. However, these stacking defects have not been completely understood yet and discussion has been continued since, e.g. Brindley and Robinson (1946) [1]. In the present study, near-atomic resolution TEM imaging has been successfully applied to determine the stacking defect structures in kaolin minerals, especially in kaolinite [2]. The specimen studied is at mid-stage of the depth-related kaolinite-to-dickite transformation in a sandstone reservoir. Although electron radiation damage is a serious obstacle, a number of high-quality images were recorded on films, in which the tetrahedral and octahedral positions in a kaolinite unit layer were clearly resolved. Electron diffraction and high-resolution imaging of dickite showed that few stacking defects exist in this polytype. On the other hand, kaolinite crystals contain high density of stacking defects. These defects or stacking disorder are formed by mixture of the two kinds of lateral interlayer shifts, t_1 (approximately $-a/3$) and t_2 ($-a/3 + b/3$), between adjacent layers. Disorder by the coexistence of B layer and C layer, or dickite-like stacking sequence was never observed. These results provide not only an unambiguous settlement for the long controversy of the defect structures in kaolinite, but also a new clue to understand kaolinite-to-dickite transformation mechanism.

[1] Brindley, G.W. and Robinson, K. (1946) *Transaction of Faraday Society*, 42B, 198-205.

[2] Kogure, T. and Inoue, A (2004) *American Mineralogist*, in review.