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Imaging of dioctahedral 2:1 layers by high-resolution transmission electron microscopy (HRTEM): Possibility of recording the dehydroxylate

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ABSTRACT

High-resolution transmission electron microscopy (HRTEM) images of dioctahedral 2:1 phyllosilicates (muscovite, paragonite, pyrophyllite, etc.) acquired by intense electron radiation may not record the natural state but rather the dehydroxylate phase, e.g., $NaAl_2Si_3AlO_{11}$ in the case of paragonite, $NaAl_2Si_3AlO_{10}(OH)_2$. Intense electron radiation on paragonite changes its electron diffraction pattern by a small increase in cell edges and a considerable decrease of the β angle, which are consistent with dehydroxylation. Comparison between experimental and simulated HRTEM images also indicates that the experimental image contrast is in better agreement with that for the dehydroxylate structure than the natural state. Thus, special care is necessary when analyzing the structures of dioctahedral 2:1 phyllosilicates from their HRTEM images, e.g., positions of octahedral cations that were proposed to change by migration during the dehydroxylation process.

Keywords: Electron microscopy, dioctahedral 2:1 phyllosilicates, paragonite, electron diffraction, phase transition