First Occurrence of a Stacking Sequence including (± 60 °, 180 °) Rotations in Mg-Rich Annite

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Abstract: Transmission electron microscopy (TEM) observation shows narrow regions in a Ti-containing Mg-rich annite of composition $(K_{0.90}Na_{0.02})(Mg_{0.72}Fe^{2+}_{1.78}Mn_{0.03}Ti_{0.27}Al_{0.05})(Si_{2.77}Al_{1.23})O_{10}(OH,F)_2$ from a granitic rock, where the ± 60 ° and 180 ° stacking angles occur extensively. These regions are a few hundreds of nanometers thick along the [001]* direction and are within 1*M* or $2M_1$ annite. The stacking sequence in one of these regions was determined by two atomic-resolution images recorded along $[1\bar{1}0]$ and [010] of the same crystal. Stacking sequences with ± 120 ° or 180 ° rotations are dominant, although those with ± 60 ° rotations occur also. Locally 2*O* and more complex sequences exist. Compositional analysis by TEM indicated no difference in the chemical compositions between these regions and the adjacent ones with regular 1*M* or $2M_1$ stacking sequence. The origin of these unusual stacking sequences in annite is discussed.

Key Words: Annite • Biotite • HRTEM • Mica • Polytype-2*O* • Polytypism • Stacking Disorder

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