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New insights into the nature of glauconite

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Abstract

Glauconite must be assessed as mica-rich mica-smectite R3 interstratified mineral, with the pure end-member mica also having intrinsic K-deficient chemical characteristics ($K^+ \sim 0.8$ apfu). This assertion is in accordance with our X-ray diffraction (XRD) and high-resolution tranmission electron microscopy (HRTEM) studies and chemical analyses by electron probe microanalysis (EPMA) of mature glauconites in Cenozoic Antarctic sediments that indicate that: (1) It consists of a glauconite-smectite (R3 ordered) mixed-layer silicate, composed mainly of mica-type layers (>90%), but displaying slightly different proportions of Fe(III)-smectite layers (<10%). (2) More mature glaucony grains are characterized by major K^+ and $^{VI}Fe^{2+}$ (mica layers) and minor $^{VI}Fe^{3+}$ (smectite layers) content in the interstratified glauconite-smectite. (3) Potassium is stabilized at the interlayer site by the octahedrally coordinated Fe^{2+}. (4) Microtexture of the glauconite crystals are comparable with those of other micas and illite minerals, with straight, defect-free lattice fringes of ~10 Å spacings glauconite packets characteristic of mica with minor interstratified poorly crystalline smectite layers. In addition, our new findings give insights into the glauconitization process and at the same time investigate the potassium-deficient character of the dioctahedral mica "*glauconite*." These findings show that glauconite crystallizes by a layer-growth mechanism at the expense of a poorly crystalline smectite precursor and that smectite-to-glauconite transformations are accompanied by a gradually higher octahedral charge deficiency (Fe^{2+}/Fe^{3+}) stabilized by K^+ uptake into the interlayer sheet.

Keywords: Glaucony, glauconite, interstratified glauconite-smectite, HRTEM, XRD