Effects of Octahedral-Iron Reduction and Swelling Pressure on Interlayer Distances in Na-Nontronite[1]

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Abstract: A new type of environmental chamber for X-ray diffraction was designed that could sustain elevated, internal pressures of nitrogen or any other gas under oxygen-free conditions and that allowed the positions of the specimen and edge aperture to be adjusted by remote control. It was used to determine the values of the interlayer spacing, λ, of nontronite from Garfield, Washington, in different stages of reduction at different values of II, the swelling pressure of the nontronite. At equilibrium, II was equal to the pressure under which water was expressed from the clay. Both partially and fully expanded layers were found to exist in the reduced nontronite, the fraction of partially expanded layers increasing with increasing II and Fe^{2+}/Fe^{3+}, the ratio of Fe^{2+} to Fe^{3+} in octahedral sites. Also, λ for the partially expanded layers was found to depend on Fe^{2+} but not on II, and λ for the fully expanded layers was found to depend on II but not on Fe^{2+}/Fe^{3+}. These findings were interpreted to mean that the reduction of Fe affected the short-range interlayer forces, but not the long-range ones.

Key Words: Interlayer distance • Iron • Nontronite • Reduction • Swelling pressure • X-ray powder diffraction

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