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# Reduction and Reoxidation of Nontronite: Extent of Reduction and Reaction Rates

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**Abstract:** The reduction and reoxidation of three nontronite samples, GAN (API H-33a, Garfield, Washington), SWa-1 (ferruginous Washington smectite), and NG-1 (Hohen Hagen, Federal Republic of Germany) were studied with visible absorption and Mössbauer spectroscopy. The intensity of the intervalence electron transfer (IT) band at 730 nm in these nontronites was monitored during reduction and reoxidation at 277, 294, and 348 K. The results showed that the intensity of the band followed the number of Fe(II)-O-Fe(III) groups in the clay crystal, increasing to a maximum at about Fe(II):total Fe = 0.4; upon complete reduction, the band decreased to about the intensity of the unaltered, oxidized sample. With reoxidation of the sample with O<sub>2</sub>, the intensity of the band increased sharply, followed by a gradual decay back to the original, oxidized intensity. The ultimate level of Fe reduction achieved was at least 92%. Concomitantly, the color changed from yellow through green, blue-green, dark blue, light blue, and light gray as the Fe(II) content increased. The GAN nontronite was more difficult to reduce than the SWa-1 or NG-1 samples. The rate and level of reduction increased with the amount of reducing agent added.

**Key Words:** Color change • Mössbauer spectroscopy • Nontronite • Oxidation • Reduction • Visible absorption spectroscopy

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