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# **$^{57}\text{Fe}$ Mössbauer Spectroscopy of Montmorillonites: A New Interpretation**

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**Abstract:** The  $^{57}\text{Fe}$  Mössbauer spectra of several montmorillonites, measured at room temperature and 453 K, showed a considerably broadened  $\text{Fe}^{3+}$  resonance which can be computer-fitted with a similarly broadened  $\text{Fe}^{3+}$  doublet. In some spectra, particularly if all linewidths were constrained to be equal, this broadened  $\text{Fe}^{3+}$  resonance was further resolved into overlapping inner and outer  $\text{Fe}^{3+}$  doublets, also having broad linewidths. In accordance with recent electron diffraction evidence, the assignment by previous workers of the inner doublet to  $\text{Fe}^{3+}$  in the octahedral sites having the cis-arrangement of OH groups and the outer doublet to the octahedral site having the trans-arrangement of OH groups is incorrect. Instead, the  $\text{Fe}^{3+}$  was found to be located largely in the trans-octahedral sites. Because of the relatively low iron content of the montmorillonite examined, the next and more distant neighboring-cation environment varied considerably about the octahedral  $\text{Fe}^{3+}$  ions. This variation produced a broadened experimental resonance, and the resulting two-doublet computer fits probably represent the mean extremes of a continuum of slightly different  $\text{Fe}^{3+}$  resonances arising from the variable nature of the environment surrounding these such trans-sites, rather than distinct cis- and trans-sites. In addition, a small resonance indicating the substitution of  $\text{Fe}^{3+}$  into the tetrahedral sites was observed. The interlayer species probably influenced the Mössbauer resonance of  $\text{Fe}^{3+}$  in the tetrahedral and octahedral sites.

**Key Words:** Iron • Montmorillonite • Mössbauer spectroscopy • Octahedral sites • Tetrahedral sites

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