A Mössbauer Investigation of Glauconite and Its Geological Significance

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Abstract: Mössbauer spectra of 9 glauconite samples from Upper Cretaceous and Lower Tertiary strata in the South Island of New Zealand contain a broad shoulder due to low intensity absorption continuous between 1.0 and 2.5 mm/sec when the absorber is at room temperature; the shoulder is absent, and sharp peaks are apparent in spectra taken with the absorber at 80 ° K. The data suggest that electron transfer occurs between adjacent Fe^{3+} and Fe^{2+} ions at room temperature. The low temperature spectra indicate that all Fe in the glauconites is in octahedral coordination. Fe^{2+} and Fe^{2+} ions occur in both cis and trans sites; Fe^{3+} shows a strong preference for cis sites whereas Fe^{2+} shows an even stronger preference for trans sites.

The partially variable oxidation state of Fe in glauconite is interpreted in terms of a geochemical model for glauconitization of a degraded or incomplete progenitor phyllosilicate. The model involves exchange of Fe^{2+} for other cations which temporarily stabilize the progenitor, followed by $Fe^{2+} - Fe^{3+}$ charge transfer reactions. Each reaction results from the system's tendency towards equilibrium. The model is supported by the observation that artificially leached glauconite increases both its Fe^{3+} and its Fe^{2+} content when placed in a solution containing Fe^{2+} as the only Fe ion present.

Key Words: Genesis • Glauconite • Iron oxidation • Mössbauer spectroscopy

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