
The Release of Aluminum from Aluminosilicate Minerals. II. Acid-Base Potentiometric Titrations

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Abstract: Acidified suspensions of Al-saturated kaolinite, montmorillonite, mica, illite, and biotite in 10^{-3} M NaNO_3 were potentiometrically titrated with 0.1 N NaOH and 0.1 N HNO_3 in succession in a CO_2 -free nitrogen atmosphere. The resulting curves were compared with those for $\text{Al}(\text{NO}_3)_3$ solutions of similar Al concentration in the supernatant solution and corrected for Al in the entrained solution in the clay.

Base titrations of Al ions adsorbed on all the minerals, except montmorillonite, showed two pH inflections separated by a buffering range. With montmorillonite, there were three pH inflections similar to those for Al in solution. The first inflections in the titration of suspensions occurred at lower pHs and were less pronounced than for Al in solution. These represent the titration of H_3O^+ sorbed during the pretreatment. The buffering by adsorbed Al ions is also less than that by Al in solution.

The OH^- used up by adsorbed Al ions between the first and last inflections was equal to, or slightly greater than, the CEC of the minerals, except for mica where it was more than twice the CEC, because new interlayer surfaces were formed during the acid pretreatment. Acid titration curves of Al ions in the adsorbed and solution states showed hysteresis when related to the base titration curves. The use of two titration speeds (3 and 0.3 pH units/hr) only slightly affected the titration curves of the minerals suggesting that the observed effects were not caused by lack of equilibrium with added base or acid.

Key Words: Aluminum • Biotite • Buffer • Illite • Kaolinite • Mica • Montmorillonite

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