Geochemical Mechanics for the Dissolution, Transport, and Deposition of Aluminum in the Zone of Weathering

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Abstract: Organic acids in the 0 · 01M concentration range representing amino-, aliphatic, and aromatic types present in humus dissolve 70 – 85 ppm Al from Arkansas bauxite at room temperature, whereas 0 · 03 ppm is dissolved in water. The species of Al in aqueous solution, calculated from stability data, range from Al^{3+} at pH 3 and lower, through $Al_2(OH)_2^{4+}$ at a maximum concentration at pH 4 · 5, $Al(OH)^{2+}$ at a maximum at pH 4 · 7, $Al(OH)_2^{+}$ at a maximum at pH 6 · 0, to $Al(OH)_4^{-}$ at pH 8 · 5 and higher. In salicylic acid an $Al\text{-}Sal^{+}$ complex occurs between pH 1 · 5 and 8 · 5, and is at a maximum at pH 4 · 2. Solubility of Al obviously is pH dependent; also because of the vulnerability of organic acids to oxidation, the solubility and transport of Al is indirectly Eh dependent. Anions that combine with Al include OH^{-} to form bauxite, PO_4^{3-} to form lateritic phosphate such as the Bone Valley Formation, Fla., and SiO_4^{4-} to form allophane or kaolin as noted in the kaolin synthesis by Linares and Huartes. Spongelike, pisolitic or oolitic structures, and mineral veins in bauxites, lateritic phosphates, and some flint clays attest to mobilization of Al in solution. Lignites and humus zones associated with laterites are a logical geologic source of these complexing organic solvents. Although Al is inherently mobile, such commonly available precipitating anions render Al relatively immobile.

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