

Effect of Residence Time on the Mechanisms of Metal Retention/Release on Soils. D.L. SPARKS*, A.M. SCHEIDEGGER, D.R.

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Understanding the kinetics and mechanisms of metal sorption on soil minerals and soils is fundamental in assessing the speciation, mobility, and bioavailability of metals in natural systems. The mechanisms of metal (Ni, Zn) sorption and precipitate transformation on soil minerals via macroscopic and molecular approaches (x-ray absorption fine structure [XAFS] and diffuse reflectance spectroscopies [DRS] and scanning probe microscopy [SPM]) were studied over short and long time periods. Mixed metal-Al precipitates formed on an array of common mineral surfaces and on the clay fraction of soils. The precipitates formed on rapid time scales (as short as 15 min) at low metal surface loadings, and in a pH range well below that at which metal hydroxide precipitates would be expected to form. Time-resolved characterization of the mixed cation hydroxide precipitates shows that metal stabilization occurs during stepwise transformation of an initial metal-Al hydroxide to a precursor metal-Al phyllosilicate phase. These findings are significant in the long-term evaluation of toxic metals.