

# GEOC: Division of Geochemistry

## 163 - Ternary complexation of dissolved organic matter in kaolinite-Fe(III)-organic acid systems: An EXAFS spectroscopic study

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**Abstract:** Chemical interactions of dissolved organic matter (DOM) with minerals at the water-mineral interface play an important role in soil C sequestration. In oxic soil solutions, aqueous Fe(III) tends to form Fe(III) hydroxides, and subsequently trap DOM through coprecipitation and/or adsorption. Ligand exchange between DOM functional groups (e.g. carboxyl) and mineral surface hydroxyls is considered a major binding mechanism. Due to the low solubility of Fe(III) hydroxides, ternary complexation via Fe bridging between DOM and minerals is generally neglected due to the low concentration of aqueous Fe(III). In this study, two common soil containing dissolved organic acids (DOA, malic and citric acids) were selected to represent DOM, and synchrotron-based Fe K-edge EXAFS was applied to characterize the transformation of Fe after adding Fe(III) to kaolinite-DOA systems with different DOA/Fe ratios ranging from 1:10 to 1:1 under acidic conditions. Our results indicate that the presence of DOA greatly influenced the transformation Fe(III) to ferrihydrite, and, unexpectedly, ternary complexation contributes to the retention of DOA by mineral surfaces at both low (DOA/Fe ratio = 1 : 10) and high (DOA/Fe ratio = 1 : 1) DOA loadings. These results strongly suggest a significant influence of ternary complexation via Fe(III) bridging on soil DOM stability which could be quite important in the natural environment.