Goldschmidt2017 Abstract

Impact of Calcium on the Retention and Stability of OM in Fe-(Ca)-OM Adsorption Complexes

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On a global scale, soil organic matter (OM) sequesters more carbon (C) than any other terrestrial sink. The sequestration of C as OM prevents additional C transfer to the atmosphere. Instability of OM may lead to increased atmospheric C inputs, a primary mechanism of climate change. Recent research has suggested that the stability of OM is controlled by complex interactions with environmental constituents. In particular, minerals, such as iron (Fe) oxides, are thought to have a profound effect on soil OM stability. In addition, recent literature and work by our research group have shown the presence of C is highly correlated with calcium (Ca); however, current understanding of the impacts of Fe and Ca on OM sequestration extent and stability in soil systems is limited. To begin to fully elucidate the mineral-controlled processes mediating soil OM stability and turnover, we investigated the formation and stability of Fe-Ca-OM adsorption complexes through laboratory batch experiments. 2-line ferrihydrite was reacted with leaf litter-extracted dissolved OM and Ca at varying initial C:Fe:Ca ratios. Synthesized complexes and the remaining supernatant were analyzed for C, Fe, and Ca. Stability of Fe-Ca-OM complexes were probed by conducting desorption experiments. For natural OM sorption samples, Ca was found to have a synergistic effect on C sorption to 2-line ferrihydrite (approximately 10%). ATR-IR data for sorption complexes also suggests differences in carboxylate stretching between samples with and without Ca addition. XAS and TGA will be performed in the future to probe the mechanism of Fe-Ca-OM binding and thermal stability of generated complexes.