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Do clay minerals affect dissolved organic matter bioavailability in batch experiments?

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Soil organic matter is a typical source for dissolved organic matter (DOM) and is often protected from microbial processing when present in aggregates. Clay minerals play an important role in aggregate formation, hence, the presence of clays could lead to decreased DOM bioavailability. However, a previous study found sustained growth of microorganisms in the presence of swelling clays in low solid:liquid batch experiments [1]. It is unclear whether clays actually protect C in such dilute aqueous systems and we designed an experiment to test this interaction: we incubated DOM from leaf litter leachate with dilute clay suspensions (KGa-1 Kaolinite and SWy-2 Na-Montmorillonite) and monitored changes in gaseous, dissolved and solid carbon over 4 weeks. Increases in CO₂ due to respiration were monitored with a LiCOR8100a infrared gas detector, changes in DOM concentration and quality were assessed with a Shimadzu C analyzer and an Aqualog fluorescence spectrometer. Particle size using laser diffraction was analysed after the completion of the experiment to investigate the link between aggregate size and C dynamics. Compared to clay free leaf litter leachate, clay suspensions had lower aqueous C concentrations and but similar respiration rates. Particle size distribution of DOM-free clay varied but was generally lower compared to DOM clay. These preliminary results indicate that clays in suspensions did likely form aggregates (removing DOM from solution) but did not lead to decreased respiration rates.

[1] Perdrial JN et al. 2009. Chemical Geology: 281-294.