# Long-term soil water content and exchangeable Ca interact to stabilize organic matter

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Soil water conditions can influence how soil organic matter (SOM) interacts with minerals by driving mineral weathering and microbial processing. To understand how long-term soil water contents shape soil organic matter (SOM) stabilization mechanisms, we studied fallow soils from upstate New York situated on a naturally occurring water content gradient.

We isolated particulate and mineral-associated SOM fractions for determination of C and N contents and natural isotope abundances and C bound to exchangeable Ca and to reactive Fe+Al phases. We conducted $^{13}C$ NMR and NEXAFS spectroscopy to investigate the chemical nature of SOM in these mineral-organic associations.

Wetter (but not saturated) soils had higher Ca content due to carbonate dissolution and capillary rise, which reduced SOM mineralization, despite having higher SOM content and microbial biomass. Mineral-associated SOM in wetter soils had lower C:N values indicating greater microbial processing. This was supported by $^{13}C$ NMR and NEXAFS spectroscopy which showed that mineral associated C in wetter soils was more carboxylic and less aromatic than in drier soils. Carboxylic functional groups may have been preferentially stabilized by interactions with Ca.

Current work involving NanoSIMS analysis on soils incubated with labelled litter ($^{13}C^{15}N$) and $^{44}Ca$ aims at uncovering the molecular mechanisms underlying Ca-mediated organo-mineral interactions.