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How diverse minerals affect soil organic matter age distribution and chemical composition

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Soil mineral characteristics have been shown to play a dominant role in stabilizing soil organic matter over medium to long term timescales. However, while great strides have been made (Kleber et al, 2021) toward understanding organic matter stabilization processes, there remain uncertainties about the chemistry, time scales, and age of carbon that is stored on soil minerals. We applied modern thermal analysis methods to investigate soil mineral effects on the thermal stability, chemical composition, and age distribution of soil organic matter. We selected subsoil mineral fractions that contained a single dominant stabilizing pathway (e.g. 2:1 clays, iron oxides, short-range order minerals, crystalline minerals) to isolate effects of individual minerals. We paired thermal fractionation with pyrolysis-GC/MS to describe the relationships of SOM age and chemical composition. Early results show that while certain minerals display heterogeneous thermal stabilities, single mineralogies contain generally narrow age ranges. In addition, organic matter chemistry associated with diverse minerals varies widely and indicates that certain minerals provide higher stability to complex, energy-rich molecules. Associated with this work, we also present novel continuous SOM radiocarbon distributions from thermal fractionation.