Activation energy characterization of free and mineral-associated SOM

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Density fractionation physically separates unassociated from mineral-associated soil organic matter (SOM). However, the relative decomposability of the isolated fractions can be difficult to assess. We characterized decomposition-specific parameters (activation energy, E_a; energy density, ED) of SOM fractions using thermal analyses. We hypothesize that ED and E_a will provide information about the biogeochemical reactivity and composition of SOM fractions.

Surface and subsurface soils were collected along a climosequence in the Sierra Nevada Mts., USA and subjected to density fractionation (1.7 g/cm^3 SPT) to isolate free light fraction (fLF), occluded light fraction (oLF), and heavy fraction (HF) fractions. Samples were analyzed via differential scanning calorimetry (synthetic air, 10 K/min) and evolved CO_2 analysis. ED was the energy released per unit mass during decompostion of SOM. E_a was the minimum energy required to decompose SOM.

In surface soils, HF OM had the lowest ED and E_a values (Fig. 1), suggesting the preservation of more chemically labile OM in this pool. H:C analyses also indicate decreased aromaticity in the HF. This data supports previous findings of the preferential sorption and stabilization of relatively labile compounds onto mineral surfaces.

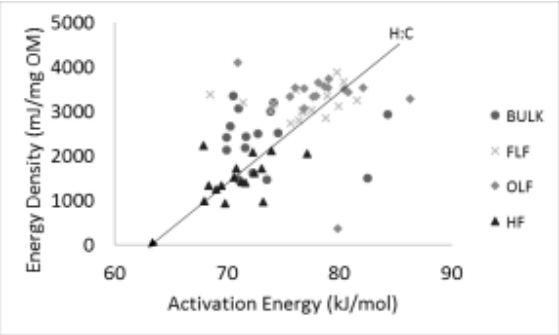

Figure 1: Thermal indicators of decomposability of surface soils and density fractions.