Stable Association? - The influence of mineralogy, microbiology and plant growth on the fate of soil carbon

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Mineral surfaces provide sites for carbon stabilization in soils, protecting soil organic matter (SOM) from microbial degradation for up to thousands of years. Our research investigates the intersection of microbiology and geochemistry, and aims to build a mechanistic understanding of plant-derived C association with mineral surfaces and the factors that determine SOM fate in soil. We grew *Avena barbata*, an oat grass, in 99 atom% $^{13}CO_2$, following ^{13}C-labeled photosynthates in soil microcosms incubated with three mineral types representing a spectrum of reactivity: quartz, kaolinite, and ferrihydrite. These minerals, isolated in mesh bags to exclude roots but not microorganisms, were extracted and measured for total C and ^{13}C at multiple plant growth stages. At plant senescence, the quartz had the least mineral-bound C (0.40 mg-g^{-1}) and ferrihydrite the most (0.78 mg-g^{-1}). Ferrihydrite and kaolinite also accumulated more plant-derived C (3.0 and 3.1% ^{13}C, respectively). Through ^{13}C-NMR and FTIR analyses of SOM composition, along with quantification microbial DNA extracted from mineral surfaces, we examine the transformation plant-derived C undergoes prior to mineral association. In a new experiment, we are studying the stability of this mineral-associated C, incubating the same ^{13}C-labeled minerals in the presence and absence of plant metabolites to trace the fate of mineral-associated C over time.