Dead or Alive: Comparing Organo-Mineral Assoications in the Rhizosphere and Detritosphere

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Mineral surfaces provide key sites for carbon stabilization in soils, protecting soil organic matter (SOM) from microbial degradation. Roots are the primary source of this soil carbon (C), through exudation in the rhizosphere, or, when they die, in the detritosphere. Here we compare the fate of ^{13}C labeled rhizodeposits vs. ^{13}C rich root detritus, examining association with mineral surfaces. We hypothesize that mineral-SOM associations in the rhizosphere differ from those in the detritosphere, possibly altering the persistance and fluxes of this C. To study these effects in a living rhizosphere, we grew *Avena barbata*, a Mediterranean annual grass, with 99 atom% $^{13}CO_2$ and traced ^{13}C from roots into soil microcosms where we incubated density-fractionated soil minerals and three pure minerals: FeO-coated quartz, kaolinite, and quartz. To target the detritosphere, ground ^{13}C labeled roots were incubated in soil microcosms with the same minerals. For both studies, mineral microbial communities and C associations were characterized using 16S and ITS Illumina sequencing, total C, ^{13}C, ^{13}C-NMR, STXM, and NanoSIMS. Minerals from the living rhizosphere had unique SOM composition, and were notably more enriched in aromatic compounds. These aromatics, likely derived from the bulk soil, suggest growing roots may stimulate re-mobilization of SOM. Our work also illustrates distinct roles of the microbial communities that associate with soil minerals, as C degraders, C mobilizers, and as C sources (i.e. “zombie C”).