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[C2.4-3] Minerals as Regulators of Carbon Flow through Soils

**Comparing the Stability and Chemistry of Soil Organic Carbon Protected via Pyrogenesis,  
Aggregation and Mineral-association**Eleanor Hobley<sup>1</sup>, Garry Willgoose<sup>2</sup>, Silvia Frisia<sup>3</sup> and Geraldine Jacobsen<sup>4</sup><sup>1</sup> *The University of Newcastle, Australia*<sup>2</sup> *School of Engineering, The University of Newcastle, Australia*<sup>3</sup> *School of Environmental and Life Sciences, The University of Newcastle, Australia*<sup>4</sup> *Australian Nuclear Science and Technology Organization, Australia*

We investigated the influence of soil texture and mineralogy on soil organic carbon (SOC) stability in two native soils of different texture and mineralogy from the Southern Highlands of NSW, Australia. To do this, a heavy-textured (clayey) soil and coarse-textured (sandy) soil were sampled at various depths to bedrock. The bulk samples were then fractionated into different particle-sizes and SOC content and stability measured using elemental analysis and radiocarbon analysis. Diffuse-reflectance infrared Fourier Transform spectroscopy was applied to infer molecular chemistry and variability in the soils, and investigate to SOC chemical structures associated with shifts in radiocarbon content of the soils. In both soils, the highest SOC content was found in the finest fraction, indicating that particle-size is a dominant control on SOC retention, independent of soil texture. In contrast, the mechanisms of SOC stabilization varied between the two soils, which we attribute to the differences in mineralogy and texture. In the coarse-textured soil, the chemical recalcitrance of charcoal was found to be the dominant stabilization mechanism in most of the soil profile, and the chemical recalcitrance of other aromatic structures may have contributed to SOC stability in subsoils. In the clayey soil, the most important stabilization mechanism throughout the soil profile was aggregation, which was centuries older than the mineral-associated organic matter in the soil. SOC was highly correlated with radiocarbon content and depth in both soils, so that SOC turnover may be limited by substrate availability at depths near bedrock in the soils. Comparing the radiocarbon ages of the two soils, the most stable carbon was (1) C stored in charcoal, followed by (2) C occluded within aggregates consisting of highly-charged clay minerals, (3) C associated with highly-charged clay minerals and Fe/Mn oxides, and (4) C associated with lowly-charged silicates or sandy aggregates. Our results indicate that there is a disconnect between SOC storage and SOC stability. Our findings have implications for SOC sequestration schemes, namely that trade-offs exist between enhancing SOC storage and enhancing SOC stability, and that texture and mineralogy should be considered when tailoring these schemes within an ecosystem.