Characterization of soluble carbon in soil pore waters sampled with different suctions

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The spatial separation of substrate, microbes, and extracellular activity is an important mechanism of soil organic carbon (SOC) protection in soils. Macropore networks and their connectivity control microbial access to physically protected soil C. Under conditions of partial to full water saturation, potentially labile compounds can diffuse from micropore domains to macropore networks to locations accessible to microorganisms. Therefore, the quality of the SOC in pore waters held with different tensions is a key characteristic needed to differentiate physical and chemical SOC protection mechanisms. The decomposability of this C is needed to determine the potential contribution of this protected C pool to net greenhouse gas fluxes as the protection mechanism breaks down through changing local environmental conditions.

We studied intact soil cores collected from the Disney Wilderness Preserve, FL. These soils are dominated by sandy textures, and depending local topographic position, show moderate to high levels of SOM accumulation at the surface. Samples of soil pore water held at two different water tensions (15, 500 mb) were collected from three continuous-depth soil cores (0-30, 30-60, and 60-90 cm), from three transect locations (dry, intermittently wet, and wet). The more tightly held pore waters (500 mb) had significantly more condensed hydrocarbons and tannins compared to the loosely held water (15 mb), which had more lipids. These differences were consistent for all transect positions and soil depths. These pore waters were then used as growth substrates for cultivation of selected bacteria (*Streptomyces cellulosae*, *Cellvibrio japonicus*) and fungi (*Trichoderma reesei*). For all organisms, significantly more CO_2 was respired from the higher-tension pore waters with the more complex C compounds. Our findings indicate that fine pore associated-C may be more chemically complex than C in larger pores, yet these C compounds are highly decomposable. If mobilized, this fine-pore associated SOC would contribute to the net greenhouse gas fluxes we currently seek to minimize.