Decoupled distribution of plant- and microbial-derived organic carbon in Mongolian grassland soils

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Plant- and microbial-derived organic matter are main components of soil organic carbon (SOC). However, their distribution has rarely been compared over large spatial scales due to analytical challenges in quantifying their contribution to SOC. Even less is known about the preservation patterns of plant- versus microbial-derived organic carbon in soils. Here we employ two groups of widely accepted biomarkers to represent microbial necromass- and plant-derived carbon, i.e., amino sugars and lignin phenols, respectively. Their distribution in the grassland surface soils is analyzed along a 2000-km east-to-west transect and a 900-km north-to-south transect across the Mongolian Plateau, spanning a broad range of climatic and geochemical conditions. Amino sugars and lignin phenols exhibit contrasting distribution patterns with arid regions (deserts) having a higher concentration of lignin phenols and a lower abundance of amino sugars per unit of SOC. Furthermore, amino sugars decrease with increasing soil pH while lignin phenols increase ($p < 0.05$), suggesting that microbial carbon accruement coincides with elevated lignin decomposition at low pHs. Opposite correlations with soil mineral contents (including reactive iron, aluminum, silt and sand) are also observed for amino sugars versus lignin phenols. Collectively, our results suggest a decoupled distribution and contrasting preservation patterns for plant- and microbial-derived organic carbon in the Mongolian grassland soils. A detailed investigation on the underlying mechanisms will provide novel insights on SOC cycling in the future.

[1] Cotrufo et al. (2015). Nature Geoscience **8**(10): 776-779.
[2] Schmidt et al., (2011). Nature **478**: 49-56.