^{14}C characteristics of bulk organic carbon and various molecular components in grassland soil profiles

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Unravelling the fate of organic carbon (OC) in soils is essential to understanding the impact of global changes on the global carbon cycle. Previous studies have shown that while various soil OC components have different decomposability, chemically labile OC can have old ^{14}C ages. However, few studies have compared the ^{14}C age of various soil OC components on a large scale, which may provide important information on the link between the age or turnover of soil OC components to their sources, molecular structures as well as environmental variables. In this project, a suite of soil profiles were sampled along a large-scale transect of temperate and alpine grasslands across the Tibetan and Mongolian Plateaus in China with contrasting climatic, vegetation and soil properties. Bulk OC and source-specific compounds (including fatty acids (FAs), diacids (DAs) and lignin phenols) were radiocarbon-dated to investigate the age and turnover dynamics of different OC pools and the mechanisms controlling their stability. Our results show that lignin phenols displayed a large ^{14}C variability. Short-chain ($C_{16,\ 18}$) FAs sourced from vascular plants as well as microorganisms were younger than plant-derived long-chain FAs and DAs, indicating that short-chain FAs were easier to be decomposed or newly synthesized. In the temperate grasslands, long-chain DAs were younger than FAs, while the opposite trend was observed in the alpine grasslands. Preliminary correlation analysis suggests that the age of short-chain FAs were mainly influenced by clay contents and climate, while reactive minerals, clay or silt particles were important factors in the stabilization of long-chain FAs, DAs and lignin phenols. Overall, our study provided a unique ^{14}C dataset of soil OC components in grasslands, which will provide important constraints on soil carbon turnover in future investigations.