Microbial oxidation of lithospheric organic carbon in rapidly eroding mountain soils

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Lithospheric organic carbon ("petrogenic"; OC_{petro}) is oxidized during exhumation and subsequent erosion within mountain ranges. This process is a significant source of CO_2 to the atmosphere over geologic timescales, but the mechanisms that govern oxidation rates in mountain landscapes remain poorly constrained. We demonstrate that, on average, 67 ± 11 % of OC_{petro} initially present in bedrock exhumed from the tropical, rapidly eroding Central Range of Taiwan is oxidized within soils, leading to CO_2 emissions of 6.1 – 18.6 tons C km^{-2} yr^{-1}. The molecular and isotopic evolution of bulk OC and lipid biomarkers during soil formation reveals that OC_{petro} remineralization is microbially mediated. Rapid oxidation in mountain soils drives CO_2 emissions fluxes that increase with erosion rate, thereby counteracting CO_2 drawdown by silicate weathering and biospheric OC burial.