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# Organic carbon recycling in subduction zones

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Abiotic solid organic compounds constitute an ubiquitous byproduct of oceanic lithosphere serpentinization but their evolution and fate during subduction remains largely unexplored. Here, we assess the role of prograde metamorphism in modifying the chemical structure and isotopic signature of both biological and abiotic organic carbon hosted in sediments and serpentinites, respectively. Our findings demonstrate that these two carbon types undergo distinct maturation pathways under increasing pressure and temperature, with abiotic solid organic compounds retaining H-, O- and N-bearing organic functional groups along subduction. Notably, abiotic solid organic compounds are the sole carriers of isotopically light carbon in eclogitic terrains thanks to silicate armoring. Their recycling into the deep mantle therefore provides a plausible source for the extremely light $\delta^{13}C$ signatures observed in some mantle reservoirs, including sub-lithospheric and eclogitic diamonds, and more broadly represents a key factor in generating mantle carbon isotope variability