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Controls on the characteristics and distribution of sedimentary organic matter in the Western Mediterranean Sea

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Marine sediments comprise the primary long-term sink of organic matter (OM) in marine systems. A key mechanism for stabilization of OM in marine sediments occurs via protection on mineral surfaces. However, fine-grained minerals are prone to resuspension and redistribution prior to final burial, potentially further exposing OM to degradation. Here, we examine the sedimentological properties and geochemical characteristics of organic carbon (OC) in surface sediments from the Western Mediterranean Sea to shed light on the origin of OM and the underlying mechanisms that determine its fate in this semi-enclosed basin. We analysed the isotopic ($\delta^{13}C$, $\delta^{15}N$, and $\Delta^{14}C$) and elemental (carbon and nitrogen content and C/N) composition of OC in 104 surface sediments retrieved from the Western Mediterranean Sea and the adjacent Atlantic Ocean, west of the Strait of Gibraltar. Corresponding grain-size and mineral surface area data were used to shed light on OM-mineral relationships and sedimentary transport mechanisms. The influence of this latter process was further evaluated by comparing the ^{14}C age of OC and planktic foraminifera and analysing excess ^{210}Pb concentration in surface sediments. The OC content and $\delta^{13}C$ and $\Delta^{14}C$ signatures depict a clear SW-NE gradient defined by strong differences between the westernmost (Alboran Sea) and the easternmost sub-basins (Northwestern and Balearic Sea). This gradient is attributed to differences in local primary productivity and delivery of terrestrial OC. When explored in a sedimentological context, our results suggest that both OM protection via association with mineral surfaces and selective degradation of labile OM during secondary transport plays an important role magnifying the contrast between endmembers manifested in these geochemical gradients.