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Sediment provenance and transport pathways along the Atlantic Iberian Margin

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The Atlantic Iberian Margin is a dynamic region where oceanographic processes interact with sediment dynamics, influencing transport and deposition. To identify the provenance of the sediment and the dominant sedimentary dynamics along the margin, we combine $^{87}Sr/^{86}Sr$ and ε_{Nd} measurements on terrigenous sediments and ^{14}C dating of planktonic foraminifera from surface sediment along the entire margin (from the Gulf of Cadiz to Le Danois bank on the Cantabrian margin). Additionally, we present a new comprehensive dataset of Sr-Nd isotope data from different lithological formations in the Iberian Peninsula to better characterize the isotopic composition of the main river basins as potential sediment source areas. By solving a ternary system of isotope mixing equations, in combination with a Monte-Carlo approach to account for end-member isotopic distributions, we can quantify the relative contribution of the defined source areas to our sediment samples. Our results reveal three isotopically distinct regions in the margin: South, Center and North; and identify four dominant sediment sources: North African dust, Guadalquivir, Tagus and Douro. Aeolian input is significant across all regions, while distinct riverine sources shape regional sediment compositions: the southern margin is mainly influenced by Guadalquivir, the central margin is dominated by the Tagus, and the northern margin is primarily fed by the Douro. A south-to-north sediment transport pattern is evident, which we attributed to the northward flowing Mediterranean Outflow Water (MOW), which entrains and redistributes sediments along the slope. This is further supported by a set of foraminifera ^{14}C ages, showing older radiocarbon ages along the MOW path, indicating sediment erosion and transport. In contrast, younger radiocarbon ages are consistently found below MOW depths. Overall, the combined $^{87}Sr/^{86}Sr$, ε_{Nd} and ^{14}C data suggest that MOW flow reduces sediment deposition along its path, transporting sediments northward, where they predominantly settle below the interface between MOW and the underlying North Atlantic Deep Water.