Anthropogenic lead as a signature of Mediterranean waters in the deep North Atlantic

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Anthropogenic activities have released lead into the environment on a global scale over the past century, mainly through leaded gasoline. A significant fraction of Pb is transported through the atmosphere, deposited onto marine surface waters and subsequently transported into the ocean interior. However, the processes controlling the fate of dPb and its transport are not well understood. Here, we report on a high-resolution study of dissolved Pb (dPb) in the shelf slope system in the Eastern North Atlantic. We show that anthropogenic lead is transported long distances in deep oceanic waters reaching European continental shelves. Furthermore, we demonstrate that dPb can be used as a tracer of anthropogenic contaminants in marine systems.

Vertical distributions of dPb showed persistently elevated concentrations of up to 60 pmol kg^{-1} in intermediate waters (~ 500 - 1500 m) that coincided with salinity maxima. Water mass analysis confirmed up to 38% Mediterranean Outflow Water (MOW) masses at the same depths, suggesting long distance transport (> 800 km) of dPb within MOW. Enhanced dPb concentrations (> 120 pmol kg^{-1}) were also observed towards the sediments in the Celtic Sea environment. The enhanced dPb correlated (r^2 = 0.97) with increased signals in beam attenuation suggesting a suspended sediments source. This implies that in the Celtic Sea region MOW and shelf sediments are the major sources of dPb with likely anthropogenic origin.