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Dissolved trace metals, rare earth elements and Pb isotopes in the eastern Mediterranean Sea

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Inputs from continental margins and human activities exert strong controls over trace metal biogeochemical cycles. Of which, oceanic Pb and its isotopes serve as a well-established traces for quantifying human pollution and natural sources to the oceans. Here, we present high spatial resolution of dissolved trace metal (Al, Zn, Mn, Fe, Ni, Cu, Co, Cd, and Pb), rare earth elements, nutrient (PO_4, NO_3, and $SiOH_4$), and Pb isotope profiles sampled during two offshore transect cruises carried out in April 2018 and June 2021 at the deep and warm oligotrophic eastern Mediterranean Sea.

The isotopic composition of Pb reflects a mixture between atmospheric aerosols compositions and local terrestrial inputs. Elevated concentrations of Zn, Mn, Co, Cu, and Pb were registered at the coastal stations along the continental shelf, corresponding with Pb isotopic signals associated with terrestrial inputs. An enrichment in Zn, Cd, Ni and NO_3 and a depletion in Pb concentrations was observed along intermediate depths (~200-700 m), in tandem with terrestrial Pb isotopic compositions and a negative Ce anomaly. These imply that a shelf-break sourced intermediate nepheloid layer acts as both a source and a sink for trace metals through partial dissolution of, and scavenging onto, suspended particles. Open sea trace metal profiles suggest that the effects of the nepheloid layer may resonate further away to the remote Mediterranean Sea.

The different trends in dissolved trace metal and Pb isotope distributions and concentration range observed between the two cruises emphasizes the dynamic nature of the continental margin environment as varying atmospheric, terrestrial and anthropogenic inputs may transiently alter elemental water column distributions and potentially impact open water biogeochemical cycles.