# Dissolved trace metal distributions in the Black Sea: results from the MedBlack GEOTRACES expedition

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Trace metals play many important roles in the biogeochemistry of the oceans, but their distributions are significantly influenced by the concentration of dissolved oxygen. Crucially, future climate system projections imply significant increases in the size of oxygen depleted zones (ODZs) in the oceans due to global warming. Therefore, it is desirable to understand the influence of expanding ODZs on the distributions of trace elements and their isotopes (TEIs). Furthermore, the utilization of TEIs as tracers of the redox conditions in the ancient oceans, especially under 'super-greenhouse' conditions, requires a firm understanding of the behaviour of trace metals in modern ODZs.

The Black Sea is the world's largest euxinic (anoxic and sulfidic) basin and it is therefore an ideal natural laboratory to study the reduction and oxidation reactions of trace metals. Deep water in the Black Sea is characterized by high hydrogen sulfide concentrations due to anoxic and euxinic conditions below the redox interface. The GEOTRACES (GA04N) expedition to the Mediterranean and Black Seas in 2013 provided an opportunity to examine the concentration gradients of a suite of trace elements across the oxic-suboxic-euxinic transitions whilst utilizing the latest trace metal clean techniques for sample collection, processing, and analysis. All samples were preconcentrated shipboard.

We present a series of high-resolution full depth profiles of dissolved trace metal concentrations that span the entire Black Sea from east to west. A suite of trace metals were quantified including: Al, Sc, Ti, V, Mn, Ni, Zn, Ga, Y, Zr, Cd, La, and Pb. The vertical profiles of trace metals can be used to assess the processes controlling their distributions. For example, Al displayed surface maxima (up to ~25 nM) followed abruptly by minima of ~2 nM between 50-60 m depth corresponding with fluorescence maxima. Broad mid-depth maxima across the $O_2/H_2S$ interface may be indicative of remineralization processes and adsorbed Al, while decreasing concentrations of Al (to <2 nM) in deep water are interpreted as scavenging by metal sulfides.