

Biogeochemical cycling of uranium in redox-controlled environments: A $^{238}\text{U}/^{235}\text{U}$ case study of the Black Sea

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Recent studies have documented sizeable, permil-level U isotopic fractionation between ^{238}U and ^{235}U in Earth's low-temperature environments. By far the largest U isotopic shifts have been observed during U reduction. Therefore, the ^{238}U - ^{235}U system has emerged as a powerful tool for tracing redox processes in the environment, including bio-remediation following U exploration and mining, and quantifying the extent of anoxia in the ancient oceans. However, additional insights into the exact mechanisms controlling the biogeochemical cycling of U via the ^{238}U - ^{235}U system are required in order to continue to advance knowledge in these fields.

The Black Sea is the world's largest euxinic (anoxic and sulphidic) oceanic basin, providing an ideal natural laboratory for investigating the geochemical behaviour of trace metals during redox reactions. Using multiple-collector inductively coupled plasma mass spectrometry (MC-ICPMS) combined with double spiking techniques, we report the U isotopic composition of the entire water column of the Black Sea, based on full depth profiles collected at a series of stations along a west-east transect in this oceanic region during the recent 2013 Mediterranean and Black Sea GEOTRACES voyage (GA04). Sediments on the seafloor were collected in parallel. These U isotopic profiles take advantage of state-of-the-art trace metal clean techniques for sample collection and high-resolution sampling across the redox interface. These data are also interpreted in the context of the dissolved concentration gradients of a suite of other redox-sensitive and particle-reactive trace elements across the redox transition zone [1] and complementary datasets from other redox-controlled hydrological settings. These new data will help elucidate the mechanisms driving the uptake and removal of U from the dissolved phase and its export to the solid phase across a gradation of changing redox settings from oxic to anoxic and ultimately euxinic.

[1] J. Rolison, R. Middag, M.J.A. Rijkenberg, C.H. Stirling and H.J.W. de Baar. 2014 *Goldschmidt Conference* abstract.