

Understanding modern biogeochemical cycles in the context of the international GEOTRACES project – Lead, zinc, and cadmium isotopes

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One of the key concerns of current environmental research is the **triple threat posed by climate change, biodiversity loss and pollution**. All three topics require a detailed understanding of the complex feedback mechanisms between climate, oceanic and atmospheric circulation patterns, (land-based) sources of pollution, and the carbon cycle.



Set up to filter seawater directly from the ship's rosette on the first GEOTRACES intercalibration cruise in June/July 2008.

Documenting and understanding modern biogeochemical cycles in the ocean is, therefore, critical not only for unravelling the ocean's role in climate change but also vital for qualitative and quantitative understanding of other potential threats to marine ecosystems and environments.

This project will target seawater, particulate and aerosol samples from an upcoming GEOTRACES cruise in the Indian Ocean, with the possibility to extend to available samples from other areas of the ocean.

GEOTRACES (www.geotraces.org) is an international study of the global marine biogeochemical cycles of trace elements and their isotopes. Its mission is to identify processes and quantify fluxes that control the distributions of key trace elements and isotopes in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions.

As PhD student, you will hence be part of a large international project and work on samples that will be characterized for other trace elements & isotopes in

laboratories around the world.

The project is deliberately described in broad terms. Depending on your interest, the PhD research can address a range of topics such as tracing anthropogenic pollution or biological fractionation of trace metals.

The sample processing and analyses that form part of this project will mostly be carried out in the **clean room and mass spectrometry facilities of the MAGIC Laboratories** at the Department of Earth Science & Engineering, Imperial College London (<http://www.imperial.ac.uk/earth-science/research/research-groups/magic/>). The project may also include participation in a research cruise to collect samples.

The project is suitable for a student with a background in marine sciences, earth sciences/geology, chemistry or an equivalent qualification. Further information on the research can be obtained from Mark Rehkämper (markrehk@imperial.ac.uk). Don't hesitate to get in touch if you are interested.

Selected literature:

Olivelli, A., Murphy, K., Bridgestock, L., Wilson, D.J., Rijkenberg, M., Middag, R., Weiss, D.J., van de Flierdt, T., Rehkämper, M., 2023. Decline of anthropogenic lead in South Atlantic Ocean surface waters from 1990 to 2011: New constraints from concentration and isotope data. *Mar. Pollut. Bull.* 189, 114798. doi.org/https://doi.org/10.1016/j.marpolbul.2023.114798.

Xie, R.C., Rehkämper, M., Grasse, P., van de Flierdt, T., Frank, M., Xue, Z., 2019. Isotopic evidence for complex biogeochemical cycling of Cd in the eastern tropical South Pacific. *Earth Planet. Sci. Lett.* 512, 134-146. doi.org/https://doi.org/10.1016/j.epsl.2019.02.001.