

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN NEW ZEALAND

May 1st, 2016 to April 30th, 2017

New scientific results

- **GEOTRACES GA04N Black Sea and Mediterranean Sea Expedition.** The unique oceanographic properties of the Black Sea and Mediterranean Sea were exploited to better understand how specific processes influence the distributions of trace metals and their isotopes. The Mediterranean Sea receives the largest flux of atmospheric deposition of any modern marine basin, is strongly impacted by anthropogenic activity, and experiences overturning circulation analogous to the global ocean. The Black Sea is the world's largest anoxic marine basin and is an ideal natural laboratory for investigating the behavior of trace metals and their isotopes under variable redox conditions. Using multiple-collector inductively coupled plasma mass spectrometry (MC-ICPMS) combined with double spiking techniques, we have measured the isotopic composition of U, Fe and Cd for the entire water column and underlying sediments of the Black Sea across oxic-suboxic-anoxic-euxinic transitions. These results form the basis of the PhD research programmes of recently completed graduate students John Rolison and Ejin George. We have also measured the Fe and Cd isotopic compositions of surface waters collected from the Mediterranean Sea. This will be followed by Zn isotope analysis of surface waters, and a combined Cd, Zn and Fe isotope investigation of water samples collected from depth profiles in the Mediterranean Sea.
- **GEOTRACES GP13 South Pacific Ocean Expedition.** Using techniques in double spiking and MC-ICPMS, we have obtained measurements of Cd isotopic composition and Cd concentration for water column samples collected from a suite of 8 depth profiles and an additional 15 surface locations along the GEOTRACES GP13 zonal section. This cruise transect extends for 5,500 km from offshore Australia to the remote interior of the subtropical Pacific Ocean, an understudied region of the world's oceans, where Cd concentrations in the upper water column are at ultra-trace levels, and some of the lowest detected globally. These results form the basis of the PhD research of graduate student Ejin George, who submitted his thesis and passed his oral exam in March 2017. These results were presented at the 2016 Goldschmidt Conference in Japan. The Cd isotope and Cd concentration datasets for the GP13 expedition were submitted to the 2017 International Data Product.

New publications (published or in press)

- J.M. Rolison, C.H. Stirling, R. Middag, M.J.A. Rijkenberg (2017). Uranium stable isotope fractionation in the Black Sea: Calibration of the $^{238}\text{U}/^{235}\text{U}$ paleoredox proxy. *Geochim. Cosmochim. Acta.* 203, 69-88.

PhD theses

- John Rolison – University of Otago (supervisors: Claudine Stirling and Rob Middag). Title: ‘The biogeochemical cycling of zinc and iron in the Mediterranean and Black Seas’. PhD conferred: August 2016.
- Ejin George – University of Otago (supervisors: Claudine Stirling, Rob Middag, Sylvia Sander). Title: ‘The biogeochemical cycling of cadmium in the southwest Pacific Ocean and Black Sea’. PhD exam passed: April 2017.

Meetings

- C.H. Stirling, E. George, M. Gault-Ringold. Biogeochemical cycling of ultra-trace levels of cadmium in the Southwest Pacific Ocean. *International Goldschmidt Conference*, Yokohama, Japan, June–July 2016.

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