ANNUAL REPORT ON GEOTRACES ACTIVITIES IN SOUTH AFRICA

May 1st, 2021 to April 30th, 2022

New GEOTRACES or GEOTRACES relevant scientific results

- *Cloete et al. 2021 https://doi.org/10.1016/j.marchem.2021.104031*: First winter dissolved zinc (dZn) and particulate zinc (pZn) concentrations were measured at seven stations between 41 and 58°S in the Indian Sector of the Southern Ocean. This unique spatial and seasonal dataset provided the opportunity to investigate Zn biogeochemical cycling in a region which is extremely data scarce and during a period when conditions are unfavourable for phytoplankton growth. Surface comparisons of our winter dZn and pZn to previous measurements during spring and summer revealed that Zn seasonality is most pronounced at the higher latitudes where higher dZn (and higher ratios of dZn to phosphate; dZn:PO_4) and lower pZn in winter reflect decreased biological uptake and preferential dZn resupply (relative to PO_4) to surface waters through deep winter mixing. The composition of pZn was majorly biogenic however localised lithogenic inputs were attributed to potential hydrothermal activity and transport of continental sediment via Agulhas waters.

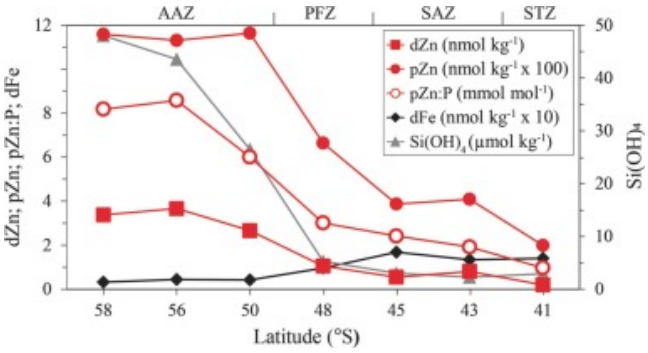
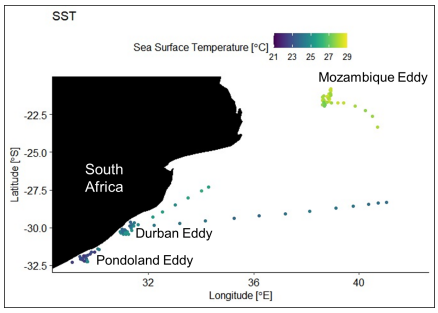


Figure 1. Surface water (~25 m) dZn, pZn, pZn:P, dFe and Si(OH)4 across the transect. Note: where necessary units were converted to plot on a single vertical axis for direct comparison. The biogeochemical zones crossed during the transect are shown on the top horizontal axis. Source: Cloete et al. 2021 https://doi.org/10.1016/j.marchem.2021.104031

GEOTRACES or GEOTRACES relevant cruises

Participation in intl. cruises

- Oceanographic campaign 'Resilience' in the Mozambique channel April - May 2022 on board RV Marion Dufresne. South African team members on board: Dr Ryan Cloete, Dr Saumik Samanta, MSc candidate Lide Jansen van Vuuren, MSc candidate Nadine Ellis (Stellenbosch University). During RESILIENCE, the TracEx team sampled roughly 100 stations from the South West Indian Ocean using a towed fish. The primary focus was high resolution (2 hrs) surface trace metal measurements (including soluble, dissolved and particulate size fractions as well as isotopic composition) across contrasting (in terms of origin and direction of rotation) mesoscale eddies in the Mozambique Channel and Agulhas Current.



- TARA Mission Microbiomes, part of the European AtlantECO project, June 2022. South African chief scientist: Prof Thulani Makhalanyane (University of Pretoria)

Ongoing/extended projects and/or funding

- Dr T. Ryan-Keogh (Early Career Researcher), National Research Foundation of South Africa (NRF; 2021-2023): "Seasonal iron speciation in the Southern Ocean, from open ocean environments to naturally fertilised sub-Antarctic Islands"

Outreach activities conducted

- Mkandla A, Fietz S, Marine and Environmental science promotion. Debating competition & Career Expo. CLS-SA, Cape Town, October 2021.

Other GEOTRACES activities

- Vichi, Marcello; Ryan-Keogh, Thomas, SCALE Cruise report 2019 (Winter and Summer Cruise); Southern Ocean Seasonal Experiment, http://hdl.handle.net/123456789/28739
- Zenodo data upload, SCALE 2019, https://zenodo.org/communities/scale_south_africa

New GEOTRACES or GEOTRACES-relevant publications

- Cloete R., J.C. Loock, N.R. van Horsten, J-L. Menzel Barraqueta, S. Fietz, T.N. Mtshali, H. Planquette, M.I. García-Ibáñez, A.N. Roychoudhury (2021). Winter dissolved and particulate zinc in the Indian Sector of the Southern Ocean: Distribution and relation to major nutrients (GEOTRACES GIpr07 transect). Marine Chemistry 236, #104031. https://doi.org/10.1016/j.marchem.2021.104031
- Cloete R, Loock JC, van Horsten N, Fietz S, Mtshali TN, Planquette H, Roychoudhury AN (2021). Winter biogeochemical cycling of dissolved and particulate cadmium in the Indian sector of the Southern Ocean (GEOTRACES GIpr07 transect). Front. Mar. Sci. 8:656321. https://doi.org/10.3389/fmars.2021.656321
- Ogundare, M.O., Fransson, A., Chierici, M., Joubert, W.R., Roychoudhury, A.N. Variability of Sea-Air Carbon Dioxide Flux in Autumn Across the Weddell Gyre and Offshore Dronning Maud Land in the Southern Ocean. Frontiers in Marine Science, 2021, 7, 614263. https://doi.org/10.3389/fmars.2020.614263
- Mdutyana, M., Sun, X., Burger, J.M., ...Ward, B.B., Fawcett, S.E. The kinetics of ammonium uptake and oxidation across the Southern Ocean. Limnology and Oceanography, 2022, 67(4), pp. 973–991. https://doi.org/10.1002/lno.12050
- Ryan-Keogh, T.J., Smith, W.O. Temporal patterns of iron limitation in the Ross Sea as determined from chlorophyll fluorescence. Journal of Marine Systems, 2021, 215, 103500. https://doi.org/10.1016/j.jmarsys.2020.103500

Completed GEOTRACES PhD or Master theses

PhD

- Asmita Singh, Stellenbosch University/CSIR: Southern Ocean phytoplankton response to iron, https://scholar.sun.ac.za/handle/10019.1/124657
- Natasha van Horsten, Stellenbosch University/CSIR: Dissolved iron and remineralisation, https://scholar.sun.ac.za/handle/10019.1/124817
- Kakauruaee Ismael Kangueehi, Stellenbosch University: Southern African dust aerosols, https://scholar.sun.ac.za/handle/10019.1/123923
- Mhlangabezi Mdutyana, University of Cape Town: Southern Ocean biogeochemistry, http://hdl.handle.net/11427/35931

MSc

- Andile Mkandla, Stellenbosch University: Molybdenum in the Southern Ocean , https://scholar.sun.ac.za/handle/10019.1/123826
- Tara de Jongh, Stellenbosch University: Dissolved aluminum in the surface Southern Ocean




From left to right: Dr Asmita Singh, Dr Kakauruaee Ismael Kangueehi, Dr Mhlangabezi Mdutyana, Mr Andile Mkandla

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Submitted by **Susanne Fietz (sfietz@sun.ac.za)**