

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN GERMANY MAY 2014 – JUNE 2015

Activities

- The Intermediate Data Product (IDP) Version 2 has been compiled and published by Reiner Schlitzer (<http://www.bodc.ac.uk/geotraces/data/idp2014/>). It contains both corrected and new data as well as additional data formats (excel and netCDF).
- The publication about the IDP14 in Marine Chemistry was lead by Reiner Schlitzer.
- GEOMAR received the winch (LEBUS) for the GO-FLO rosette, completing the acquisition of a trace metal clean sampling system. A short test cruise on R/V Alkor in the Baltic Sea is planned for the end of June 2015.
- Analysis of collected samples and publication of results continue.

Selected Research Highlights

South Atlantic Cd concentrations: New Cd concentration data along GEOTRACES GA02 in the southwest Atlantic suggest that the kink in the global dissolved Cd/PO₄ relationship is likely due to the injection of Subantarctic Mode Water (SAMW) into the thermocline. Significantly lower Cd concentrations in equatorial intermediate water compared to the southern stations is attributed to the influence of low-Cd waters originating in the oxygen-depleted zone of the Angola Basin that are brought in via the Benguela and Equatorial Currents. The study by Xie *et al.* is in press in Marine Chemistry.

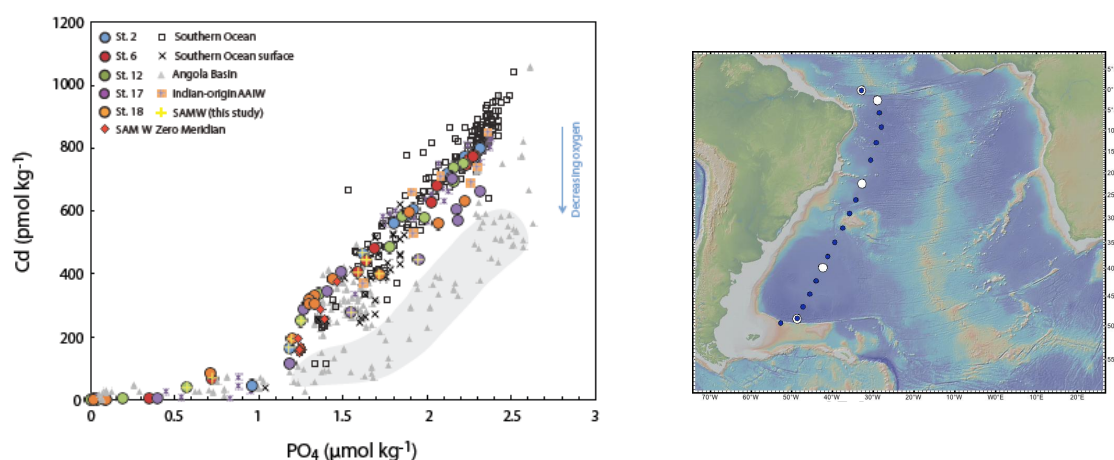


Figure 1: Evaluation of the Cd-PO₄ systematics at the scale of the South Atlantic Basin (colored circles - this study) and map of stations (GA02) (Xie *et al.*, Marine Chemistry, in press).

South Pacific [Nd] and ϵ_{Nd} : The first seawater ϵ_{Nd} and [Nd] profiles across the South Pacific circum-Antarctic fronts have been published recently (Basak *et al.*, EPSL, 2015). The GEOTRACES-compliant data, collected on R/V *Polarstern* cruise PS75, show a clear ϵ_{Nd} signature of Ross Sea Bottom Water ($\epsilon_{Nd} \sim -7$) and meridional [Nd] changes that follow the density structure of the South Pacific. The latter suggests a lateral component for the processes controlling [Nd] in the Southern Ocean.

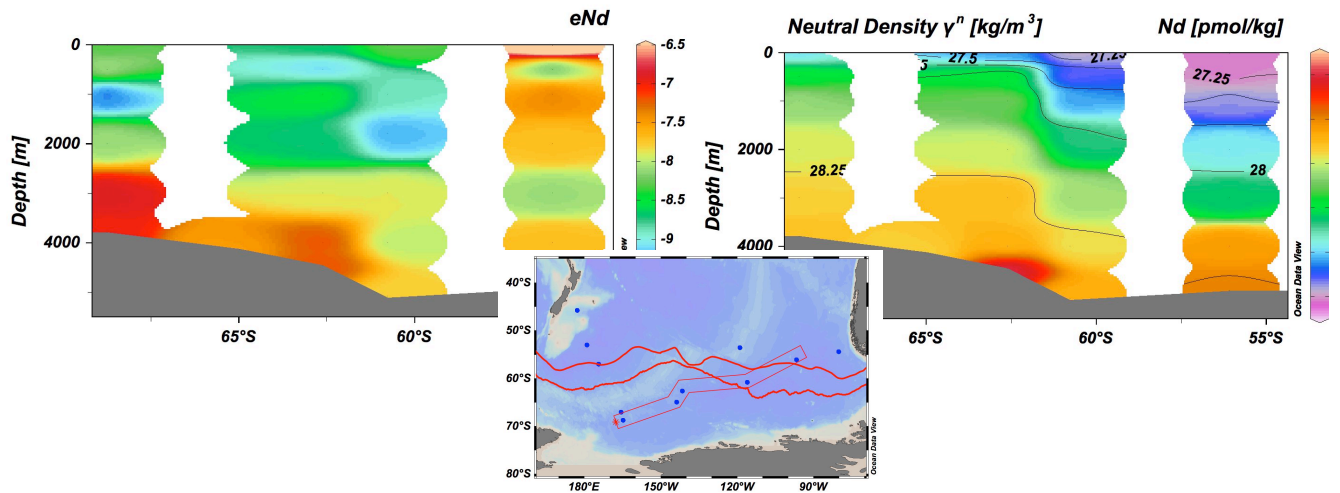


Figure 2: Distribution of ϵ_{Nd} and $[Nd]$ across the South Pacific frontal system (map) from the Ross Sea into the southeast Pacific. **Left:** Distribution of dissolved ϵ_{Nd} ; **right:** Distribution of $[Nd]$ with neutral density contours. Data from Basak et al. (2015).

Cruises

- GEOTRACES Southeast Atlantic cruise (GA08) on R/V Meteor has been approved and will take place Nov. 22 – Dec 26, 2015 (PIs: E. Achterberg, M. Frank, A. Koschinsky). The cruise will focus on the distribution of TEIs in the South East Atlantic under the influence of the Benguela upwelling, the Namibian desert, and the Congo and Orange river discharge.
- GEOTRACES Indian Ocean cruise (GI05) on R/V Sonne has been approved and will likely be scheduled for early 2017 (PIs: E. Achterberg, M. Frank).
- GEOTRACES Arctic cruise (TransArcII, Aug.-Oct. 2015) on R/V Polarstern: Several planning meetings were held at the Alfred Wegener Institute in Bremerhaven in 2014. GEOTRACES PIs: Michiel Rutgers van der Loeff (GEOTRACES chief-scientist), Lars-Eric Heimbürger (Univ. Bremen), Michael Staubwasser (Univ. Köln), Stephen Galer (MPI Mainz), Katharina Pahnke (MPI, Univ. Oldenburg).
- GEOTRACES Process Study: The cruise to the oligotrophic South Pacific gyre on R/V Sonne is scheduled for Dec. 2015-Jan. 2016. GEOTRACES PIs: K. Pahnke (Nd isotopes, REE), P. Croot (trace metals), R. Anderson (Th, Pa isotopes), C. Ehlert (Si isotopes).

Proposals

- Proposal submitted to the DFG (PI: A. Koschinsky): ‘Input, particle reactivity, and (bio)geochemical cycling of the transition metals from subgroups IV, V and VI (Ti-Zr-Hf, V-Nb-Ta, Cr-Mo-W)’ (renewal proposal for an extension of the original DFG-project related to cruise M81/1 (GA11)). The project will focus on the distribution of V and Mo, and Cr redox species in the South and North Atlantic, and the application of a recently published method for the determination of Ti, Hf, and Ta in seawater (samples from ANT-XXVIII/5, 2012, and M81/1, 2010).

Workshops & Meetings

Organized by German GEOTRACES people:

- Workshop: *GEOTRACES Intercalibration exercises for Hg species in seawater discussion forum*: http://mercury2015.com/sub/sub02_05_pop16.asp, L.-E. Heimbürger 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea
- Workshop: *Water & sediment sampling*, Jim Hurley, Seunghee Han, L.-E. Heimbürger, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea

National and international service

- Germany is represented on the International GEOTRACES Standards and Intercalibration Committee by Walter Geibert (AWI) and Lars-Eric Heimbürger (Univ. Bremen), and on the SSC by Reiner Schlitzer (co-chair, AWI) and Katharina Pahnke (MPI/ICBM).
- Lars-Eric Heimbürger and Daniel Cossa coordinated the 2014 GEOTRACES intercalibration exercise for total mercury and methylmercury in seawater on the GEOVIDE cruise.

Other

- Lars-Eric Heimbürger moved to the University of Bremen
- Walter Geibert moved to the Alfred-Wegener Institute, Bremerhaven

Publications

- Abouchami, W., Galer, S.J.G., de Baar, H.J.W., Middag, R., Vance, D., Zhao, Y., Klunder, M., Mezger, K., Feldmann, H., Andreae, M.O., 2014. Biogeochemical cycling of cadmium isotopes in the Southern Ocean along the Zero Meridian. *Geochimica et Cosmochimica Acta* 127, 348-367. doi:10.1016/j.gca.2013.10.022.
- Basak, C., Pahnke, K., Frank, M., Lamy, F., Gersonde, R., 2015. Neodymium isotopic characterization of Ross Sea Bottom Water and its advection through the southern South Pacific. *Earth and Planetary Science Letters* 419, 211-221. doi:10.1016/j.epsl.2015.03.011.
- Hathorne, E., Stichel, T., Brück, B., and Frank, M. (accepted): Rare earth element distribution in the Atlantic sector of the Southern Ocean: the balance between particle scavenging and vertical supply. *Marine Chemistry*.
- Heimbürger, L.-E., Sonke, J.E., Cossa, D., Point, D., Lagane, C., Laffont, L., Galfond, B.T., Nicolaus, M., Rabe, B., van der Loeff, M.R., 2015. Shallow methylmercury production in the marginal sea ice zone of the central Arctic Ocean. *Scientific Reports* 5. doi:10.1038/srep10318
- Heimbürger, L.-E., Migon, C., Losno, R., Miquel, J.-C., Thibodeau, B., Stabholz, M., Dufour, A., Leblond, N., 2014. Vertical export flux of metals in the Mediterranean Sea. *Deep Sea Research Part I: Oceanographic Research Papers* 87, 14-23. doi:10.1016/j.dsr.2014.02.001.
- Lamborg, C.H., Hammerschmidt, C.R., Bowman, K.L., Swarr, G.J., Munson, K.M., Ohnemus, D.C., Lam, P.J., Heimbürger, L.-E., Rijkenberg, M.J.A., Saito, M.A., 2014. A global ocean inventory of anthropogenic mercury based on water column measurements. *Nature* 512, 65-68. doi: 10.1038/nature13563
- Mawji, E., Schlitzer, R. et al., in press. The GEOTRACES Intermediate Data Product 2014. *Marine Chemistry*. doi:10.1016/j.marchem.2015.04.005.

- Stichel, T., Hartman, A.E., Duggan, B., Goldstein, S.L., Scher, H., Pahnke, K., 2015. Separating biogeochemical cycling of neodymium from water mass mixing in the Eastern North Atlantic. *Earth and Planetary Science Letters* 412, 245-260. doi:10.1016/j.epsl.2014.12.008.
- Xie, R.C., Galer, S.J.G., Abouchami, W., Rijkenberg, M.J.A., De Jong, J., de Baar, H.J.W., Andreae, M.O., in press. The cadmium-phosphate relationship in the western South Atlantic – the importance of mode and intermediate waters on the global systematics. *Marine Chemistry*. doi:10.1016/j.marchem.2015.06.011.

Abstracts

- Heimbürger, L.-E., Lagane, C., Laffont, L., Cossa, D., Sonke, J.E., 2015. Mercury measurements in the oceans - results of the 2013 and 2014 GEOTRACES intercalibration exercises, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015 (invited talk).
- Heimbürger, L.-E., Cossa, D., Schartup, A., Lagane, C., Laffont, L., Sonke, J.E., 2015. Methylmercury production in the oceans: links to physics, chemistry and biology, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015 (invited talk).
- Cossa, D., Heimbürger, L.-E., Sonke, J.E., Zhang, Y., Lacan, F., Lherminier, P., Sarthou, G., 2015. Mercury in the North Atlantic Ocean - results of the 2014 GEOTRACES GEOVIDE cruise, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015.
- Rosati, G., Heimbürger, L.-E., Sonke, J.E., Rijkenberg, M., Gerringa, L., de Baar, H., 2015. Developing a methylmercury dynamic model for the Black Sea, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015.
- Soerensen, A., Jacob, D., Schartup, A., Fisher, J., Lehnher, I., StLouis, V., Heimbürger, L.-E., Sonke, J.E., 2015. An evaluation of internal production and external sources of methylmercury in the Arctic Ocean, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015.
- Zhang, Y., Heimbürger, L.-E., Cossa, D., Sonke, J.E., Lacan, F., Lherminier, P., Sarthou, G., 2015. Mercury in the North Atlantic Ocean - direct comparison of model and observations along the 2014 GEOTRACES GEOVIDE cruise transect, 12th International Conference on Mercury as a Global Pollutant, Jeju, South Korea, June 2015.
- Heimbürger, L.-E., Cossa, D., Sonke, J.E., Lacan, F., Lherminier, P., Sarthou, G., 2014. Mercury in the North Atlantic - results of the 2014 GEOTRACES GEOVIDE cruise, AGU Fall Meeting, San Francisco, USA.
- Heimbürger, L.-E., Sonke, J.E., Rijkenberg, M., Gerringa, L., de Baar, H., 2014. Mercury in the Black Sea - results of the 2013 GEOTRACES MEDBlack cruise, AGU Fall Meeting 2014, San Francisco, USA.
- Heimbürger, L.-E., 2014. Mercury in the Oceans, Reunion des Sciences de la Terre, Pau, France (keynote talk)
- Cossa, D., Heimbürger, L.-E., Sonke, J.E., Lacan, F., Lherminier, P., Sarthou, G., 2014. Mercury distribution in the North Atlantic Ocean - results of the 2014 GEOTRACES GEOVIDE cruise, Reunion des Sciences de la Terre, Pau, France.
- Heimbürger, L.-E., 2014. Current status and future needs in Hg research and management, 2014 International Mercury Symposium, Jeju, South Korea.

Submitted by Katharina Pahnke (k.pahnke@icbm.de).