

ANNUAL REPORT ON GEOTRACES ACTIVITIES IN GERMANY

May 1st, 2016 to April 30th, 2017

New scientific results

Two international intercalibration studies (co-) led by German scientists were successfully completed:

- Dissolved Si isotope intercalibration on seawater from ALOHA, led by P. Grasse (Geomar, Germany) and M. Brzezinski (USA): Grasse *et al.* (2016) (see below)
- Dissolved rare earth element intercalibration on seawater from SAFe, North Pacific, led by M. Behrens and K. Pahnke (ICBM, Germany): Behrens *et al.* (2016) (see below)

New publications (published or in press)

- Behrens, M. K., 2017. Controls on rare earth element and neodymium isotope distributions in the West Pacific: local imprint vs. lateral transport, PhD thesis, University of Oldenburg, pp. 143.
- Behrens, M.K., Muratli, J., Pradoux, C., Wu, Y., Böning, P., Brumsack, H.-J., Goldstein, S.L., Haley, B., Jeandel, C., Paffrath, R., Pena, L.D., Schnetger, B., Pahnke, K., 2016. Rapid and precise analysis of rare earth elements in small volumes of seawater - Method and intercomparison. *Marine Chemistry* 186, 110-120. doi: doi:10.1016/j.marchem.2016.08.006.
- Bridgestock, L., van de Flierdt, T., Rehkämper, M., Paul, M., Middag, R., Milne, A., Lohan, M.C., Baker, A.R., Chance, R., Khondoker, R., Strekopytov, S., Humphreys-Williams, E., Achterberg, E.P., Rijkenberg, M.J.A., Gerringa, L.J.A., de Baar, H.J.W., 2016. Return of naturally sourced Pb to Atlantic surface waters. *Nature Communications* 7, 12921.
- Bridgestock, L., Rehkämper, M., van de Flierdt, T., Murphy, K., Khondoker, R., Baker, A.R., Chance, R., Strekopytov, S., Humphreys-Williams, E., Achterberg, E.P., 2017. The Cd isotope composition of atmospheric aerosols from the Tropical Atlantic Ocean. *Geophysical Research Letters* 44, 2932-2940. doi: 10.1002/2017GL072748.
- Casacuberta, N., Masqué, P., Henderson, G., Rutgers van-der-Loeff, M., Bauch, D., Vockenhuber, C., Daraoui, A., Walther, C., Synal, H.A., Christl, M., 2016. First ²³⁶U data from the Arctic Ocean and use of ²³⁶U/²³⁸U and ¹²⁹I/²³⁶U as a new dual tracer. *Earth and Planetary Science Letters* 440, 127-134.
- Charette, M.A., Lam, P.J., Lohan, M.C., Kwon, E.Y., Hatje, V., Jeandel, C., Shiller, A.M., Cutter, G.A., Thomas, A., Boyd, P.W., Homoky, W.B., Milne, A., Thomas, H., Andersson, P.S., Porcelli, D., Tanaka, T., Geibert, W., Dehairs, F., Garcia-Orellana, J., 2016. Coastal ocean and shelf-sea biogeochemical cycling of trace elements and isotopes: lessons learned from GEOTRACES. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374.
- Ehlert, C., Reckhardt, A., Greskowiak, J., Liguori, B.T.P., Böning, P., Paffrath, R., Brumsack, H.-J., Pahnke, K., 2016. Transformation of silicon in a sandy beach ecosystem: Insights from stable silicon isotopes from fresh and saline groundwaters. *Chemical Geology* 440, 207-218.

- Filippova, A., Frank, M., Kienast, M., Rickli, J., Hathorne, E.C., Yashayaev, I., Böning, P., Pahnke, K., 2017. Water mass circulation and weathering inputs in the Labrador Sea based on coupled Hf-Nd isotope composition and rare earth element distribution. *Geochimica et Cosmochimica Acta* 199, 164-184.
- Fröllje, H., Pahnke, K., Schnetger, B., Brumsack, H.-J., Dulai, H., Fitzsimmons, J.N., 2016. Hawaiian imprint on dissolved Nd and Ra isotopes and rare earth elements in the central North Pacific: local survey and seasonal variability. *Geochimica et Cosmochimica Acta* 189, 110-131. doi: 10.1016/j.gca.2016.06.001.
- Fröllje, H., 2016. Rare Earth Element and Neodymium Isotope Tracing of Element Input and Past Ocean Circulation: Study From North and South Pacific Seawater and Sediments. PhD thesis, University of Oldenburg, pp. 168.
- German, C.R., Casciotti, K.A., Dutay, J.C., Heimbürger, L.E., Jenkins, W.J., Measures, C.I., Mills, R.A., Obata, H., Schlitzer, R., Tagliabue, A., Turner, D.R., Whitby, H., 2016. Hydrothermal impacts on trace element and isotope ocean biogeochemistry. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374.
- Grasse, P., Brzezinski, M., Cardinal, D., de Souza, G.F., Andersson, P., Closset, I., Cao, Z., Dai, M., Ehlert, C., Estrade, N., Francois, R., Frank, M., Jiang, G., Jones, J.L., Kooijman, E., Liu, Q., Lu, D., Pahnke, K., Ponzevera, E., Schmitt, M., Sun, X., Sutton, J., Thil, F., Weis, D., Wetzel, F., Zhang, A., Zhang, J., Zhang, Z., 2016. GEOTRACES Intercalibration of the Stable Silicon Isotope Composition of Dissolved Silicic Acid in Seawater. *Journal of Analytical Atomic Spectrometry*, 32(3), 562–578. <http://doi.org/10.1039/C6JA00302H>.
- Laukert, G., 2017. Ocean circulation and shelf processes in the Arctic Mediterranean traced by radiogenic neodymium isotopes, rare earth elements and stable oxygen isotope, PhD thesis, University of Kiel, pp. 172.
- Laukert, G., Frank, M., Bauch, D., Hathorne, E.C., Rabe, B., von Appen, W.-J., Wegner, C., Zieringer, M., Kassens, H., 2017. Ocean circulation and freshwater pathways in the Arctic Mediterranean based on a combined Nd isotope, REE and oxygen isotope section across Fram Strait. *Geochimica et Cosmochimica Acta* 202, 285-309.
- Milne, A., Schlosser, C., Wake, B.D., Achterberg, E.P., Chance, R., Baker, A.R., Forryan, A., Lohan, M.C., 2017. Particulate phases are key in controlling dissolved iron concentrations in the (sub)tropical North Atlantic. *Geophysical Research Letters* 44, 2377-2387. doi: 10.1002/2016GL072314.
- Poehle, S., Koschinsky, A., 2017. Depth distribution of Zr and Nb in seawater: The potential role of colloids or organic complexation to explain non-scavenging-type behavior. *Marine Chemistry* 188, 18-32.
- Rutgers van der Loeff, M., Venchiarutti, C., Stimac, I., van Ooijen, J., Huhn, O., Rohardt, G., Strass, V., 2016. Meridional circulation across the Antarctic Circumpolar Current serves as a double ²³¹Pa and ²³⁰Th trap. *Earth and Planetary Science Letters* 455, 73-84.
- Schlitzer, R., 2016. Quantifying He fluxes from the mantle using multi-tracer data assimilation. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374.

- Xie, R., Galer, S.G., Abouchami, W., Rijkenberg, M., de Baar, H., De Jong, J., Andreae, M.O., in press. Non-Rayleigh control of upper-ocean Cd isotope fractionation in the western South Atlantic. *Earth and Planetary Science Letters*.

Cruises

- **GEOTRACES Process Study GPpr09**, R/V Sonne cruise SO245 to the oligotrophic South Pacific gyre (Antofagasta, Chile-Wellington, New Zealand, Dec. 17, 2015 – Jan. 28, 2016). Chief-Scientist: Tim Ferdelman, MPI Bremen, GEOTRACES PIs: Katharina Pahnke (ICBM, Oldenburg), Peter Croot (Galway), Bob Anderson (LDEO).
- **GEOTRACES Section GN05**, R/V Polarstern cruise PS100 to the Fram Strait (Tromsø-Tromsø, Norway, July 18-Sept. 6, 2016). Chief-Scientist: Torsten Kanzow, AWI. GEOTRACES PIs: Michiel Rutgers van der Loeff, Walter Geibert (AWI), Martin Frank (Geomar), Micha Rijkenberg (NIOZ).

New projects and/or funding

- The cruise proposal for a detailed study on trace metals and dissolved organic matter in the Amazon estuary and in the associated plume of the freshwater discharge into the Atlantic Ocean (*RV Meteor*) has been approved (PIs: Andrea Koschinsky (main PI), Thorsten Dittmar, Martin Frank). Once the cruise is included in the cruise schedule of *RV Meteor*, the cruise will be proposed to GEOTRACES as a process study.

PhD theses

- Henning Fröllje (summa cum laude), 2016, Rare Earth Element and Neodymium Isotope Tracing of Element Input and Past Ocean Circulation: Study From North and South Pacific Seawater and Sediments. ICBM University of Oldenburg (Supervisor: K. Pahnke)
- Melanie Behrens, 2017, Controls on rare earth element and neodymium isotope distributions in the West Pacific: local imprint vs. lateral transport. ICBM University of Oldenburg (Supervisor: K. Pahnke)
- Georgi Laukert (summa cum laude), 2017, Ocean circulation and shelf processes in the Arctic Mediterranean traced by radiogenic neodymium isotopes, rare earth elements and stable oxygen isotopes. University of Kiel (Supervisor: M. Frank)
- Sandra Pöhle, 2017 (submitted), Input and Particle Reactivity of Transition Metals from subgroups IV, V and VI in the water column of the Atlantic Ocean. Jacobs University Bremen (Supervisor: A. Koschinsky)

Other activities

The seaFAST system of Jacobs University, Bremen (A. Koschinsky), is currently being installed in the clean lab of the Alfred Wegener Institute in Bremerhaven for the preparation and analysis of contamination-prone elements in seawater such as Ti. Samples from GEOTRACES cruise M121 (GA08, Nov.-Dec. 2015) in the SE Atlantic will be analyzed for dissolved Ti, Zr, Nb, V, Mo, and W.

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