GEOTRACES SCIENTIFIC STEERING COMMITTEE
ANNUAL REPORT TO SCOR 2013/2014
June 2014

ANNEX – NATIONAL REPORTS

Australia

Meetings

- GEOTRACES presentations by Australian scientists at the AGU/ASLO/TOS Ocean Sciences meeting (Honolulu, USA, February 2014), the SOLAS Summer School 2013, (Xiamen, China, September 2013), the Australian Meteorological and Oceanographic Society national conference (Hobart, February 2014) and the International Symposium on Sea Ice in a Changing Environment (Hobart, March 2014).

New funding

- Shiptime funding from the Marine National Facility for a 2-month research expedition in austral summer 2014-15 to study hydrothermalism and biospheric impacts around Heard/McDonald Islands in the Southern Ocean. GEOTRACES parameters will be sampled and the project will be proposed as a GEOTRACES Process Study 2014 SSC meeting.
- Several research voyages (including GEOTRACES process studies) proposed to the Marine National Facility and Australian Antarctic Science (results announced in the second half of 2014)
- The Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) has been refunded for 5 more years from 2014-2019, which will include future Australian GEOTRACES process studies.
- Funding for GEOTRACES activities in Australia continues to be tight, with most projects carried out using small University research funds and grants from the Australian Research Council. No dedicated national funds available for GEOTRACES activities, and currently a shortage of 'GEOTRACES researchers' nationally to undertake full sections.

New results

- Results of the French-led GEOTRACES Process Study KEOPS-2 (GIpr01; Project PI Stephane Blain), a natural iron fertilisation experiment around the Kerguelen Islands in the Southern Ocean will be submitted to a Biogeosciences special issue (deadline end June 2014).
- GEOTRACES GP13 (a zonal section in Southwest Pacific Ocean along approximately 30oS) data synthesis workshop to be held in July 2014.
- Submission of data from Australian cruises GIPY2 (au0703), GIPY3 (au0701), GIPY6 (au0806) and GPpr02 (SS10_v01 PINTS) to GDAC for the GEOTRACES Intermediate Data Product.
- Continuing analyses from SIPEX-2 (GIpr02), a multidisciplinary biogeochemistry experiment examining the role of Antarctic sea ice as a natural ocean fertilizer during the spring in the sea ice zone near east Antarctica in Sep/Oct 2012.
- Participation in the GEOTRACES intercalibration exercises for marine particulate trace elements (led by Phoebe Lam).

New publications (involving Australian GEOTRACES researchers)

- Tagliabue A., Sallee J.-B., Bowie A.R., Lévy M., Swart S., Boyd P.W., 2014. Surface water iron supplies in the Southern Ocean sustained by deep winter mixing. Nature Geoscience 7, 314–320. doi:10.1038/ngeo2101
- Queroue F., Townsend A., van der Merwe P., Lannuzel D., Sarthou G., Bucciarelli E., Bowie A.R., 2014. Advances in the offline trace metal extraction of Mn, Co, Ni, Cu, Cd, and Pb from open ocean seawater samples with determination by Sector Field ICP-MS analysis. Analytical Methods 6, 2837-2847. doi:10.1039/C3AY41312H

- Hassler C.S., Ridgway K., Bowie A.R., Butler E.C.V., Clementson L., Doblin M.A., Davies D.M., Law C.S., Ralph P., van der Merwe P., Watson R., Ellwood M., 2014. Primary productivity induced by iron and nitrogen in the Tasman Sea – An overview of the PINTS expedition. Marine and Freshwater Research, in press, doi:10.1071/ MF13137
- Ellwood M.J., Nodder S.D., King A., Hutchins D.A., Wilhelm S.W., Boyd P.W., 2014. Pelagic iron cycling during the subtropical spring bloom, east of New Zealand. Marine Chemistry 160, 18-33
- Thompson C.M., Ellwood M.J., Wille M., 2013. A solvent extraction technique for the isotopic measurement of dissolved copper in seawater. Analytica Chimica Acta 775: 106-113
- Thompson C.M., Ellwood M.J., Sander S.G., 2014. Dissolved copper biogeochemistry in the SW Pacific Ocean (Tasman Sea) Part I: organic copper speciation. Marine Chemistry, submitted
- Thompson C.M., Ellwood, M.J., 2014. Dissolved copper biogeochemistry in the SW Pacific Ocean (Tasman Sea) part II: stable copper isotope distributions and trends. Marine Chemistry, submitted
- Lannuzel D., van der Merwe P.C., Townsend A.T. and Bowie A.R., 2014. Size fractionation of iron, manganese and aluminium during a spring-summer time series in Antarctic fast ice. Marine Chemistry, in press
- Sedwick P.N., Sohst B.M., Ussher S., Bowie A.R., 2014. A zonal picture of the water column distribution of dissolved iron(II) during the U.S. GEOTRACES North Atlantic transect cruises. Deep-Sea Research II, submitted

Other activities (e.g., acquisition of new sampling systems)

- There has been a delay in the delivery of the new Australian oceanographic research vessel Investigator, which will now arrive in Hobart (Australia) in July 2014. The commissioning year will run through until end-2014.
- The ship has improved facilities to undertake GEOTRACES science, including new clean container laboratories, a clean underway supply, aerosol samplers, in situ pumps and a new Seabird trace metal rosette system. Procurement of new equipment is currently underway and should be completed by mid-2014.
- Australian scientists have worked closely with Seabird and Ocean Test Equipment (trace metal rosette), and McLane Research Laboratories (in situ pumps), to design improved sampling facilities for GEOTRACES parameters, including provision of a modified "Lam" intake baffle design for dual – head ISPs (6 ordered).

Submitted by Andrew Bowie (Andrew.Bowie@utas.edu.au).

Belgium

Meetings

- Carnat G., Zhou J., Tison J.-L., Delille B., Goossens T., Schoemann V., and T.Papakyriakou. Biological and physical controls on DMS,P dynamics in ice-shelf-influenced fast ice, IGS International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10-14 March 2014.
- Cavagna A.-J., K. Westwood, A. Roukaerts, D. Lannuzel, K. Meiners, F. Fripiat and F. Dehairs, Primary Production SIPEX 2 field tests: 14C and 13C-methods comparison, International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10–14 March 2014.
- Dehairs F., T. Trull, A.-J. Cavagna, F. Planchon and F. Fripiat, Nitrate isotopic composition in the Kerguelen area (Southern Ocean), Ocean Sciences 2014, Feb. 23-28, 2014, Honolulu, Hawaii.
- Delille B., Haskell T., Champenois W., Heinesch B., Zhou J., Schoemann V., Carnat G., Fripiat F., Goossens T., Moreau S., Vancoppenolle M., Vivier F., Lourenço, A. and J.-L Tison. Year Round survey of Ocean-Sea Ice-Air Exchanges – the YROSIAE survey, IGS International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10-14 March 2014.
- Fonseca Batista D. and F. Dehairs, Fixed-nitrogen and atmospheric N2 contribution to biological productivity in the eastern Atlantic Ocean, Ocean Sciences 2014, Feb. 23-28, 2014, Honolulu, Hawaii.
- Fripiat, F., D.M. Sigman, and J.-L. Tison, Nitrogen biogeochemical dynamics in Antarctic pack ice as reflected in the nitrogen isotopes, International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10–14 March 2014.
- Hassler, C., Norman, L., Schoemann, V. Influence of Australian desert dust on marine iron chemistry and bioavailability to phytoplankton. DUST 2014 International Conference on Atmospheric Dust, Castellaneta Marina (TA), Italy, 1-6 June 2014
- Lemaitre N., H. Planquette, A. Bowie, T. Trull, F. Dehairs, Biogeonic silica (BSi) and trace elements, Fe, Zn, Cu, Cd, Mn, Co, P, surca export fluxes near Kerguelen Island, Southern Ocean, Ocean Sciences 2014, Feb. 23-28, 2014, Honolulu, Hawaii.
- Li X., R. Mathieu, N. Roevros, F. Dehairs and L. Chou (2014) Combined Effects of pCO2 and Dust Deposition on Diatom Chaetoceros socialis. 6th International SOLAS Summer School, 23 August - 2 September 2013, Xiamen, China, Poster and Oral presentations.
- Li X., N. Roevros, F. Dehairs and L. Chou (2014) Response of diatom Chaetoceros socialis to a changing climate and dust deposition: role of iron. IMBER Open Science Conference "Future Oceans" 2014, 23-27 June 2014, Bergen, Norway. Poster.
- Planchon F., D. Ballas*, A.-J. Cavagna, T. Trull and F. Dehairs, Fe fertilization and carbon export production: the natural laboratory of the Kerguelen Island, Southern Ocean, Ocean Sciences 2014, Feb. 23-28, 2014, Honolulu, Hawaii.
- Roukaerts A., Cavagna* A.-J. and F. Dehairs, Nutrient uptake and primary production in East Antarctic sea-ice (SIPEX II results), International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10–14 March 2014.
- Roukaerts A., Cavagna A.-J. and F. Dehairs, Nitrate isotopic signatures (δ15N-NO3- and δ18O-NO3-) in East Antarctic sea-ice and the underlying water column (SIPEX II results), International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10–14 March 2014.
- Schoemann, V., de Jong, J.T.M., Tison, J.-L., Haskell, T., de Baar, H., Champenois, W., Zhou, J., Carnat, G., Fripiat, F., Goossens, T., Moreau, S. and B. Delille. Dust as a source of bio-essential trace elements for coastal sea ice in McMurdo Sound, Antarctica. DUST

2014 International Conference on Atmospheric Dust, Castellaneta Marina (TA), Italy, 1-6 June 2014

- Schoemann V., de Jong J.T.M., Tison J.-L., Haskell T., de Baar H., Champenois W., Zhou J., Carnat G., Fripiat F., Goossens T., Moreau S. and B. Delille. Land-fast sea ice of McMurdo Sound as a source of bio-essential trace metals for primary productivity in the Ross Sea, Antarctica, IGS International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10-14 March 2014.
- Tison J.-L., Delille B., Dieckmann G., de Jong J., Janssens J., Rintala J., Luthanen A. M., Gussone N., Uhlig C , Nomura D., Schoemann V., Zhou J., Carnat G., Fripiat F. Snow cover and short-term synoptic events drive biogeochemical dynamics in winter Weddell Sea pack ice (AWECS cruise - June to August 2013), EGU General Assembly, Vienna, Austria, 27 April-2 May 2014.
- Tison J.-L., Delille B., Dieckmann G., de Jong J., Janssens J., Rintala J., Luthanen A. M., Gussone N., Uhlig C , Nomura D., Schoemann V., Zhou J., Carnat G., Fripiat F. Snow cover and short-term synoptic events drive biogeochemical dynamics in winter Weddell Sea pack ice (AWECS cruise - June to August 2013), IGS International Symposium on Sea Ice in a Changing Environment, Hobart, Tasmania, Australia, 10-14 March 2014.
- Vanderstraeten, A., Bonneville, S., Mattielli, N., Schoemann,V. Flament, P., Deboudt,K., Grobéty, B., De Vleeschouwer, F., Le Roux, G., Gieré, R., Tison, J.-L. and V. Debaille. Dust Deposition in Snow from Northeast Antarctica: Mineralogical, Morphological and Chemical Characterisation, SEGH Conference, Newcastle, UK, 30 June-4 July 2014.

Cruises

- Antarctic Winter Ecosystem & Climate Study ANT XXIX/6 (AWECS): 8 Jun-12 Aug 2013, Weddell Sea sector, *RV Polarstern*; trace metals (e.g. Fe, Cu, Zn, Mn, Cd) and isotopes (Fe, Zn) in sea ice, brines and seawater.
- Belgica 2014/14 (21-30 May 2014): Bay of Biscay and Iberian Margin; nitrogen uptake and cycling; significance of N2 fixation; nitrate isotopic composition; Role of iron.
- GEOVIDE (13 May – 30 June 2014): An international GEOTRACES study along the OVIDE section in the North Atlantic and in the Labrador Sea.
- ARK-XXVIII/3 (July 2014, RV Polarstern): Central Arctic (Eurasian basin), Nitrate δ15N and δ18O
- Swedish-Russian-US Arctic Ocean investigation of climate-cryosphere-carbon interactions (July-August 2014, *RV Oden*): Arctic across-slope sections over the East-Siberian and Laptev shelves; Nitrate δ15N and δ18O.

New funding

- Belgian Science Policy, Science for Sustainable Development programme: Ecosystem Responses to global Change: A multi-scale approach in the Southern Ocean (vERSO); 2013-2018.
- LI Xuefeng (PhD grant). The marine iron biogeochemistry under a changing climate: impact on the phytoplankton and the diazotroph communities. PhD thesis, starting the academic year 2013-2014, under joint supervision between the Université Libre de Bruxelles (ULB-DSTE) and the Vrije Universeit Brussel (VUB), financed by the FNRS (Aspirant grant). Promoter at ULB: L. Chou, co-promoter at VUB: F. Dehairs.

New results

- Trace metals concentrations (Fe, Ni, Cu, Zn, Pb, Al, Mn and Cd) in snow, seawater, brines and sea ice in the Central Arctic (IceArc, Aug.-Oct 2012) and in McMurdo Sound (YROSIAE, Nov.-Dec 2011).

- Organic complexation of Fe (ligand concentration and conditional binding constant) in sea ice and seawater in Central Arctic (IceArc, Aug.-Oct 2012).
- Nitrate is mainly regenerated in spring sea ice with nitrification
- Mechanistic understanding of the nitrogen biogeochemical dynamics in productive sea ice (assimilation, convective supply, remineralisation including nitrification).
- Spring sea ice primary production evolves from new to regenerated production
- Sea ice processes alone are unlikely to explain the δ15N variation in the Antarctic sediments
- Significant contribution of surface nitrification to nitrate assimilation in an iron fertilized bloom of the Southern Ocean (Kerguelen Plateau)

Relevant publications

- Carnat, G., J. Zhou, T. Papakyriakou, B. Delille, T. Goossens, T. Haskell, V. Schoemann, F. Fripiat, J.-M. Rintala and J.-L. Tison, 2014. Physical and biological controls on DMS, DMSP dynamics in ice-shelf influenced fast ice during a winter-spring and a spring-summer transitions. Journal of Geophysical Research- Oceans 04/2014, doi:10.1002/2013JC00938.
- Cossa D., M. Harmelin-Vivien, C. Mellon-Duval, V. Loizeau, B. Averty, S. Crochet, L. Chou and J.-F. Cadiou, 2012. Influences of bioavailability, trophic position, and growth on methylmercury in hakes (Merluccius merluccius) from Northwestern Mediterranean and Northeastern Atlantic. Environ. Sci. Technol., 46, 4885 4893. DOI: 10.1021/es204269w.
- De Jong JTM, V. Schoemann, N., Maricq, N., Mattielli, P., Langhorne, T., Haskell and J.L., Tison, 2013. Iron in land-fast sea ice of McMurdo Sound derived from sediment resuspension and wind-blown dust attributes to primary productivity in the Ross Sea, Antarctica. Marine Chemistry, 157, 24-40, doi:10.1016/j.marchem.2013.07.001.
- Delille B., M. Vancoppenolle, N. X. Geilfus, B. Tilbrook, D. Lannuzel, V. Schoemann, S. Becquevort, G. Carnat, A.V. Borges, D. Delille, C. Lancelot, L. Chou, G. S. Dieckmann, and J.-L. Tison, (in revision). Southern Ocean CO2 sink: the contribution of the marine cryosphere. Journal of Geophysical Research - Oceans.
- Fripiat F., D.M. Sigman, S.E Fawcett, P.A. Rafter, M.A. Weigand, and J.-L. Tison, 2014. New insights into sea ice nitrogen biogeochemical dynamics from the nitrogen isotopes, Global Biogeochemical Cycles, 28, 115–130, doi:10.1002/2013GB004729.
- Fripiat F., J.-L. Tison, L. André, D. Notz, and B. Delille, 2013. Biogenic silica recycling in sea ice inferred from Si-isotopes: Constraints from winter Arctic winter first-year sea ice, Biogeochemistry, doi 10.1007/s10533-013-9911-8.
- Gledhill M, C.S. Hassler and V. Schoemann, 2013. The environmental bioinorganic chemistry of aquatic microbial organisms. Frontiers in Microbiology, 4, 100. doi: 10.3389/fmicb.2013.00100.
- Lannuzel, D., V. Schoemann, I. Dumont, M. Content, J. de Jong, J.-L. Tison, B. Delille, and S. Becquevort, 2013. Effect of melting Antarctic sea ice on the fate of microbial communities studied in microcosms. Polar Biology, 36, 1483-1497, doi: 10.1007/s00300-013-13-1368-7.
- Schmidt S., J. Harlay, A.V. Borges, S. Groom, B. Delille, N. Roevros, S. Christodoulou and L. Chou, 2013. Particle export during a bloom of Emiliania huxleyi in the North-Western Bay of Biscay, Journal of Marine Systems, 109-110, 182-190, doi: 10.1016/ j.jmarsys. 2011.12.005.

Submitted by F. Dehairs (fdehairs@vub.ac.be), M. Elskens, M. Leermakers, W. Baeyens, L. Chou, F. Fripiat, V. Schoemann and J.T.M. de Jong.

Brazil

Activities

- *Transects Rio Grande do Sul-Sao Paulo*
  Three institutions (FURG, UFPR and IPEN) will carry out a 14 days cruise in July 2014 on board of the *RV Atlantico Sul* from Rio Grande to Sao Paulo. In nine transects, in different latitudes, water samples will be taken from 3 depths in several stations up to the 200 m isobath. Intended measurements: all nutrients, POC, PN, carbon and nitrogen isotopes, trace metals (As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Zn), 234Th, 238U, 223, 224, 226, 288 Ra, Rn.

- *Acquisition of new sampling system*
  Although a new sampling system (listed below) has already been purchased and received at FURG it will not be used this time:
  - GEOTRACES WATER SAMPLER (custom) - 24-bottle sampler for use with modem equipped 911plus CTD and 12-liter Go-Flo or C-Free bottles. Includes titanium electronics/release and lifting bail, standard XSG series connectors all-welded aluminum guard frame with polyurethane electrostatic powder coat finish, and complete documentation. Bottles GOFLO 24 liters.
  - Winch from Dybnacon, model 10030.
  - Kevlar cable, /electro /mech Cable, from Cortland Cable Company.

- Brazil has now a research network dedicated to Ocean Acidification, called Brazilian Ocean Acidification Research Group (BrOA - www.broa.furg.br), recognized by the CNPq (Diretório de Grupos de Pesquisa). BrOA leaders are Prof. Rodrigo Kerr (IO-FURG) and Prof. Leticia Cotrim da Cunha (FAOC-UERJ). The network involves many aspects of OA research, from impacts in marine ecosystems, seawater chemistry, to biogeochemistry modelling.

- January 2014 - Leticia Cotrim da Cunha is the new SOLAS representative in Brazil. The 2013 activity report can be downloaded at http://www.solas-int.org/files/solas-int/content/downloads/Community/National%20Networks%202013/SOLAS_Annual_Report_2013_Brazil.pdf

Analyses of samples

- The Picarro Cavity Ring-Down Spectroscopy equipment had to be twice forward to US for repair and is now back in PUC finally allowing José M. Godoy the determinations of U, Ba e Mo, δD and δ18O in 1200 samples from the 2013 Mediterranean Cruise.

Training and Joint Research

- Vanessa Hatje from UFBa was in 2013 a Visiting Scholar at the lab of Ken Bruland. She worked with rare earths determination in seawater and analytical method development. The following publications resulted:
  Vanessa Hatje, Kenneth W. Bruland, A. Russell Flegal. Determination of rare earth elements after pre-concentration using NOBIAS-chelate PA-1(R)resin: Method development and application in the San Francisco Bay plume. Marine Chemistry 160, 2014, 34-41.
  A second article is in preparation reporting the evolution of rare earth concentration in the San Francisco Bay after analysis of archive water samples from 1994 to 2013.

Project MIT-PUC-Rio

- The project initiated in 2013 is progressing well and data is already available for lead isotopes in a short sediment core and for trace metals in coastal water samples. A PhD student from PUC-Rio is presently in the lab of Ed Boyle to determine lead isotopes in the long sediment cores. The main objective is to use dated sediments to understand the transport of land materials to the inner platform off Rio de Janeiro occurring during the last 500 years, since the beginning of colonization.
- Water samples were sampled for trace metal determination along a transect extending from the Guanabara Bay to the inner platform and results are now available.

Submitted by Angela Wagener (angela@puc-rio.br).

Canada

General overview

- We are having a meeting on May 22 at the DFO/Institute of Ocean Sciences (Sidney, BC) to start working on the details of the two upcoming Arctic cruises for 2015.
- We have arranged a cross over station with the French program GEOVIDE in the Labrador Sea (55.842°N/48.093°W) (the French cruise crosses the North Atlantic).
- We will have a cross over station with the US in Canada Basin.

Individual achievements

Alfonso Mucci, Professor of Geochemistry and Oceanography, Department of Earth and Planetary Science, McGill University.

Refereed journal publications

- Miller L.A., Giesbrecht K.E., Mucci A. and Zimmerman S. (2014) Changes in the marine carbonate system of the western Arctic: Patterns in a rescued data set. Polar Research (in press, accepted April 10, 2014)
- Giesbrecht K.E., Miller L.A., Zimmerman S., Carmack E., Johnson W.K., Macdonald R.W., McLaughlin F., Mucci A., Williams W.J. and Wong C.S. and Yamamoto-Kawai M. (2014) Measurements of the dissolved inorganic carbon system and associated biogeochemical parameters in the Canadian Arctic, 1974-2009. Earth System Science Data 6: 91-104. doi: 10.5194/essdd-6-91-2014.
- Else B.G.T., Papakyriakou T., Asplin M., Barber D., Galley R., Miller L. and MucciA. (2013) Annual cycle of air-sea CO2 exchange in an Arctic Polynya Region. Global Biogeochem. Cycles 27: 388-398. doi:10.1002/gbc.20016
- Else B.G.T., Galley R.J., Lansard B., Barber D.G., Brown K., Miller L.A., Mucci A., Papakyriakou T.N., Tremblay J.-É. and Rysgaard S. (2013) Further observations of a decreasing atmospheric CO2 uptake capacity in the Canada Basin (Arctic Ocean) due to sea ice loss. Geophys. Res. Letts. 40: 1132–1137, doi:10.1002/grl.50268.

Abstracts and conference presentations

- MUCCI A., MICHEL C., NIEMI A. and HÉLIE J.-F. (2014) Kinetic fractionation of stable hydrogen and oxygen isotopes upon sea-ice formation. Contributed poster presentation. 24rd V.M. Goldschmidt Conference, June 8-13, Sacramento, California.
- MUCCI A., MICHEL C., NIEMI A. and HÉLIE J.-F. (2014) Kinetic fractionation of stable hydrogen and oxygen isotopes upon sea-ice formation. Contributed oral presentation. Annual Congress of the Canadian Meteorological and Oceanographic Society, June 1-5, Rimouski, Quebec.
- EVANS W., MATHIS, J., CROSS, J., FREY K., ELSE B., PAPAKYRIAKOU T., BATES N., DEGRANPRE M., PETERSON B., CAI W.-J., CHEN B., MUCCI A., YAMAMOTA-KAWAI M., MILLER L., CARMACK E., WILLIAMS B., and TAKAHASHI T. (2014) A synthesis of Arctic coastal sea-air CO2 fluxes surrounding the Canada Basin. Contributed oral presentation. Ocean Sciences Meeting, February 23-28, Honolulu, Hawaii.
- CULLEN J., ZHOU J., LANSARD B. and MUCCI A. (2013) Dissolved iron in the Beaufort Sea and Canada Basin, Arctic Ocean. Contributed poster, Gordon Research Conference in Chemical Oceanography, August 4-9, University of New England in Biddeford, Maine, U.S.A.

Jay Cullen, Associate Professor, School of Earth and Ocean Sciences, University of Victoria, BC

Refereed journal publications (**indicates UVic graduate student/HQP)

- **Janssen, D. J., T. M. Conway, S. G. John, J. R. Christian, D. I. Kramer, T. F. Pedersen, and J. T. Cullen (2014), Undocumented water column sink for cadmium in open ocean oxygen-deficient zones, Proceedings of the National Academy of Sciences, 111(19), 6888-6893.
- **Giesbrecht, T., N. Sim, K. J. Orians, and J. T. Cullen (2013), The distribution of dissolved and total dissolvable aluminum in the Beaufort Sea and Canada Basin region of the Arctic Ocean, Journal of Geophysical Research-Oceans, 118(12), 6824-6837.
- Taylor R. L., D. M. Semeniuk, C. D. Payne, **J. Zhou, J. E. Tremblay, J. T. Cullen, and M. T. Maldonado (2013), Colimitation by light, nitrate, and iron in the Beaufort Sea in late summer, Journal of Geophysical Research-Oceans, 118(7), 3260-3277.

Abstracts and conference presentations (* indicates invited presentation, **indicates UVic graduate student/HQP, ***indicates UVic undergraduate student)

- R. L., D. M. Semeniuk, C. D. Payne, **J. Zhou, J. E. Tremblay, J. T. Cullen, and M. T. Maldonado (2013), Colimitation by light, nitrate, and iron in the Beaufort Sea in late summer, Journal of Geophysical Research-Oceans, 118(7), 3260-327
- 2014 Cullen, J.T., **D.J. Janssen, J. Christian, T.M. Conway and S.G. John. An Undocumented Water Column Sink for Cadmium in Open Ocean Oxygen Minimum Zones. Goldschmidt 2014, Jun. 8-13, Sacramento, CA USA.
- 2014 Galer, S.J.G., W. Abouchami, R. Xie, **D.J. Janssen, M. Rijkenberg, L. Gerringa, J.T. Cullen and H. de Baar. Global Oceanic Cadmium Isotope Distribution. Goldschmidt 2014, Jun. 8-13, Sacramento, CA USA.
- 2014 John, S.G., T.M. Conway, **D.J. Janssen and J.T. Cullen. Cadmium Sulfide Formation in Low-Oxygen Waters of the North Atlantic. Goldschmidt 2014, Jun. 8-13, Sacramento, CA USA.
- 2014 **Janssen, D.J., J.T. Cullen, W. Abouchami, S.J.G. Galer and H. de Baar. Cadmium Isotopes along the Line-P Transect in the Northeast Subarctic Pacific. Goldschmidt 2014, Jun. 8-13, Sacramento, CA USA
- 2014 *Cullen, J.T. and **J. Zhou. Deep-sea Loss of Dissolved Iron in the Arctic Ocean: Potential Insight into the Oceanic Budget of an Essential Trace Nutrient. Canadian Chemistry Conference and Exhibition, Jun. 1-5, Vancouver, BC Canada.
- 2014 Semeniuk, D.M., M.T. Maldonado, A. Posacka, C.P. Payne, J.T. Cullen, R.M. Bundy and K.A. Barbeau. Assessing Copper Nutrition of Natural Marine Phytoplankton Populations Using 67Cu. Canadian Chemistry Conference and Exhibition, Jun. 1-5, Vancouver, BC Canada.
- 2014 **D.J. Janssen and J.T. Cullen. Improvements to a Fluorescence-Based Flow-Injection Method For Shipboard Determination of Dissolved Zn. 2014 Ocean Sciences Meeting, Feb. 23-28, Honolulu, HI USA.
- 2014 **Schallenberg, C., ***A.B. Davidson and J.T. Cullen. Iron(II) Variability in the Northeast Subarctic Pacific Ocean. 2014 Ocean Sciences Meeting, Feb. 23-28, Honolulu, HI USA.
- 2014 Vance, D., S. Little, Y. Zhao, J.T. Cullen, G. de Souza and M.C. Lohan. The Oceanic Cycle of Zinc and its Isotopes: The Key Roles of Southern Ocean Export and Vertical Biogeochemical Cycling

- 2013 Cullen, J.T., **J. Zhou, R. Taylor, D. Semeniuk and M.T. Maldonado. Dissolved Iron and the Co-limitation of Phytoplankton Growth in the Beaufort Sea, Arctic Ocean. Goldschmidt 2013, Aug. 25-30, Florence, Italy.
- 2013 Cullen, J.T., **J. Zhou, B. Lansard, A.L. Mucci. Dissolved Iron in the Beaufort Sea and Canada Basin, Arctic Ocean. Gordon Research Conference (Chemical Oceanography), Aug.4-9, University of New England, Biddeford ME USA.

SCOR Working Groups
- Associate Member SCOR WG-139 on Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean

Research Cruises
- Continued involvement in Line P Time-Series Cruises in the subarctic Pacific (Chief Scientist Marie Robert, IOS DFO Canada)

Susan Allen, Associate Professor, Earth, Ocean & Atmospheric Sciences, UBC, Vancouver, BC.

Modelling Meeting
- Organized a GEOTRACES Canada Modelling Meeting at UBC on April 25, 2014. Participants: Paul Myers, Xianmin Hu (University of Alberta, Edmonton), Nadja Steiner, Tessa Sou (Environment Canada/Fisheries and Oceans Canada, Victoria), Susan Allen and Doug Latornell (University of British Columbia, Vancouver)

Andrew Ross (Environment Canada/Fisheries and Oceans Canada, Sidney, BC)

- Applied for the Line-P Iron Program to be recognized as a Process Study by GEOTRACES
- Method development for metal ligand extraction for the Canadian Arctic GEOTRACES project (in collaboration with M. Maldonado).
- Presented a poster on the Line-P Iron Program at the 2014 Ocean Sciences Meeting.
- Attended a Town Hall Meeting of the SCOR Working Group 139 on Organic Ligands during OSM 2014.
- Responded to a request from the OSM Session 80 Chair (Rob Middag, University of Otago) for papers relating to presentations made during that "Biogeochemistry of Trace Elements and their Isotopes" session; proposed title for paper: "The Line-P Iron Program: Exploring the Biogeochemistry of Trace Elements and Isotopes in the NE Pacific".

Roger Francois, Professor Earth, Ocean & Atmospheric Sciences, UBC, Vancouver, BC.

- Developing our method to measure Nd isotopes in seawater.
- Participated in the International particle intercalibration lead by Phoebe Lam, measured biogenic Si, POC, TIC.

Chris Holmden, Professor and Director, Saskatchewan Isotope Laboratory

- Cr isotope profiles from the IPY cruise in 2009. A paper will be submitted by the end of June.

Maite Maldonado, Associate Professor, Earth, Ocean & Atmospheric Sciences, UBC, Vancouver, BC.

Refereed journal publications

- Taylor, R.L, D.M. Semeniuk, C. D. Payne, J. Zhou, J.E. Tremblay, J. T. Cullen, and M.T. Maldonado. 2013. Co-limitation by Light, Nitrate and Iron in the Beaufort Sea in Late Summer. JGR Oceans 118, 1–17, doi:10.1002/jgrc.20244.

Abstracts and conference presentations

- Schuback, N., C. Schallenberg, C. Duckham, P.D. Tortell, M.T. Maldonado. FRRF as a tool to assess Phytoplankton Photo-Physiology and Primary Productivity - Field Studies in the iron limited subarctic NE Pacific Ocean. Ocean Sciences Meeting. Honolulu, Hawaii, USA. February 2014.
- Semeniuk, D. M., A. Posacka, R. Bundy, K. Barbeau, M. T. Maldonado. Impact of Cu speciation on primary productivity in the northeast subarctic Pacific Ocean. Ocean Sciences Meeting. Honolulu, Hawaii, USA. February 2014.

SCOR Working Groups

- Full Member of the proposed SCOR Working Group: chemical speciation modelling Proposal submitted by Simon Clegg and David Turner on April 2014.
- My PhD student, Carolyn Duckham has joined the SCOR Working Group (WG139) "Organic Ligands-A key control on trace metal cycling in the ocean".

Research Cruises

- Participated in Line P Time-Series Cruises in the subarctic Pacific in August-September 2013 (Chief Scientist Marie Robert, IOS DFO Canada)

Kristin Orians, Associate Professor, Earth, Ocean & Atmospheric Sciences, UBC, Vancouver, BC.

- PhD student Nari Sim participated in the International Particle Intercalibration lead by Phoebe Lam, measured trace elements (Al, Ti, Fe, Cu, Mn).

Research Cruises

Participated in Line P Time-Series Cruises in the subarctic Pacific in August-September 2013 (Chief Scientist Marie Robert, IOS DFO Canada).

Paul Myers, Professor, Earth & Atmospheric Sciences, University of Alberta, Edmonton, Alberta, CA.

Presentations

- Arctic-Subarctic Ocean Fluxes (ASOF) Workshop, Helsiniki, Nov. 2013.
- Danish Meteorological Institute Seminar, Copenhagen, Nov. 2013.

Posters

- North-Atlantic Arctic Planning Workshop, Washington, D.C., April 2014.

SCOR activities

- Chair of the Canadian National Committee for SCOR.

Submitted by Maite Maldonado (mmaldonado@eos.ubc.ca).

China-Beijing

Activities

- Two cruises were carried out to investigate the role of injection of interstitial waters on the mass balance of 224Ra, Mn, and Fe in the water column of the Pearl River Estuary and the Jiulingjiang Estuary
- We participated in two GEOTRACES cruises in the western North Pacific held by Tung-Yuan Ho in Taiwan. Mo and 230Th samples were collected and analyzed during the two cruises.
- Two cruises in 2013 summer and fall were carried out to investigate mercury、mercury methylation and Demethylation in the Bohai Sea and Yellow Sea.

Capacity building

- Clean sampling facilities which can be used in normal research vessels (X-Niskin, Kevlar cable and special winch) have been ordered by Ocean University of China and will be inter-calibrated with Japanese research vessel (by Prof. Jing Zhang from University of Toyama) at cross station of PN section in the East China Sea.

New funding

- "The role of dissolved organic matter (DOM) in methyl mercury photo degradation in natural aquatic environments", funded by National Natural Science Foundation of China (2013/1-2016/12, PI: Jingling Ren).
- "Reconstruct the deep circulation in South China Sea over the past 150ka based on the proxy of sedimentary 231Pa/230Th activity ratio", funded by National Natural Science Fundation of China (2013/1-2016/12, PI: Yihua Cai).

Publications

- Cai Pinghe, Williard Moore, Xiangming Shi, Shiyun Peng, Guizhi Wang, Minhan Dai (2014), 224Ra:228Th disequilibrium in coastal sediments: Implications for solute transfer across the sediment-water interface. Geochimica et Cosmochimica Acta 125,68-84.
- Yan Li, Rujun Yang, Aibin Zhang, Shirong Wang. The distribution of dissolved lead in thecoastal waters of the East China Sea. Marine Pollution Bulletin (2014), http://dx.doi.org/10.1016/j.marpolbul.2014.02.010.
- Lei Li, Jing-Ling Ren, Zhe Yan, Su-Mei Liu, Ying Wu, Feng Zhou, Cheng-Gang Liu and Jing Zhang. Behavior of arsenic in the coastal area of the Changjiang (Yangtze River) Estuary: Influences of water mass mixing, the spring bloom and hypoxia. Continental Shelf Research, doi.org/10.1016/j.csr.2014.02.021.
- Wang D.*, Zhao, Z., Dai, M., 2013. Tracing the recently increasing anthropogenic Pb inputs into the East China Shelf sediments using Pb isotopic analysis. Marine Pollution Bulletin, 10.1016/j.marpolbul.2013.11.032.
- Du J, Moore W. S, Hsh H. F, Wang G, Scholten J, Henderson P, Men W, Rengarajan R, Sha Z, Jiao J. (2013) Inter-comparison of radium analysis in coastal sea water of the Asian region. Marine Chemistry 156: 138-145.

Submitted by Pinghe Cai (caiph@xmu.edu.cn).

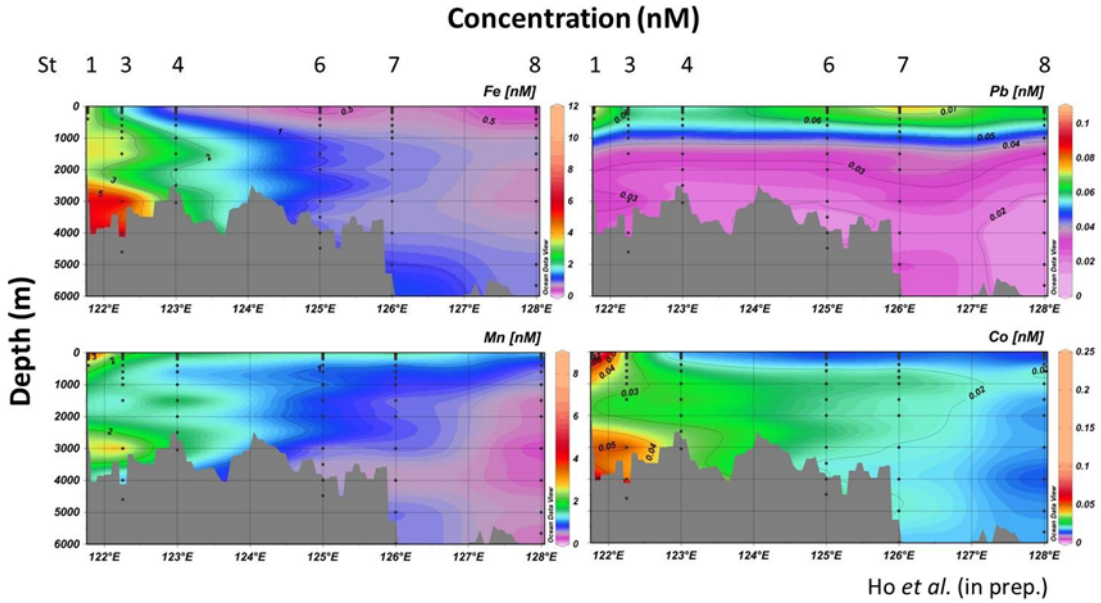
China-Taipei

Cruises

The 2nd Taiwan GEOTRACES cruise was carried out during March 25th - April 3rd 2014 in the Western Philippine Sea by using Taiwan new 3,000 ton research vessel, *Ocean Research 5* (*OR/5*). The 8 sampling sites, located between 122° and 128°E at 23.5°N, are exactly the same as our first test cruise. Please see our 2013 National report for the exact locations. The major objectives of this cruise are to investigate the seasonal variations of the distribution of trace elements and their isotopes in the Western Philippine Sea, particularly focusing on the impact of anthropogenic and natural aerosols brought to the region by East Asian winter monsoon. We have also studied the roles of particles on trace metal cycling in the sea. We have collected various particulate samples, including total suspended particles, size-fractionated particles and plankton, sinking particles, total suspended aerosols, and size-fractionated aerosols. Twenty-nine scientists, students, and technicians from 12 laboratories joined the cruise (Chief scientist: Tung-Yuan Ho), including 5 foreign students and researchers from Xiamen University, HKUST, and UC Santa Cruz.

New results

We have been determining the trace metal and isotopic composition of the dissolved and particulate samples collected in our first GEOTRACES cruise, carried out in July 2013. We have obtained many reliable TEI data, witnessed by the systematic concentration gradients among elements (e.g., the following figure). We have also observed interesting composition interaction among dissolved seawater, size-fractionated SPM, and sinking particles. A few manuscripts are under preparation.



Relevant Publications (2013/6-2014/5)

- Huang, K.-F., C.-F. You, C.-H. Chung, Y.-H. Lin, and F.Z. Liu (2014) Tracing the Nd isotope evolution of North Pacific Intermediate and Deep Waters through the last deglaciation from South China Sea sediments. Journal of Asian Earth Sciences 79, 564-573.
- Jiann, K.-T., L.-S. Wen, and C.-L. Wei (2013) Spatial and temporal distribution of trace metals (Cd, Cu, Ni, Pb, and Zn) in near-shore waters off the west coast of Taiwan. Terrestrial, Atmospheric and Oceanic Sciences. 25, 121-135.

- Lee, C.-S., C.-L. Wei, L.-S. Wen, D. D.-D Sheu, and W.-H. Lee. (2013) Distribution and removal of silver and lead in the near shore waters of Western Taiwan. Estuaries and Coasts. 36, 854-865.
- Rodriguez, I. B. and T.-Y. Ho (2014) Diel nitrogen fixation pattern of Trichodesmium: the interactive control of light and Ni. Scientific Reports /4:4445/DOI: 10.1038/srep04445.
- Wang, B.-S., C.-P. Lee, and T.-Y. Ho (2014) Trace metal determination in natural waters by automated solid phase extraction system and ICP-MS: the influence of low level Mg and Ca. Talanta 10.1016/j.talanta.2014.04.077.
- Wang, R.-M. and C.-F. You (2013) Uranium and strontium isotopic evidence for strong submarine groundwater discharge in an estuary of a mountainous island: A case study in the Gaoping River Estuary, Southwestern Taiwan Marine Chemistry 157, 106-116.
- Yang S.-C., D.-C. Lee, and T.-Y. Ho (2014) Reply to the "Comment by Murphy et al. (2014) on 'the isotopic composition of Cadmium in the water column of the South China Sea'" Geochimica et Cosmochimica Acta /10.1016/j.gca.2014.02.015.

Other activities

- Dr. Tung-Yuan Ho has received 3-yr funding from 2013 to 2016 to carry out GEOTRACES related research in the Western Philippine Sea. He plans to lead a scientific cruise by using *OR/5* to the region every year. The *OR/5* management agency, Taiwan Ocean Research Institute (TORI), is purchasing a Kevlar wire with 8,500 m long and a related winch.
- Two young oceanographers, Drs. Kuo-Fang Huang and Haojia Ren, have recently settled down in Taiwan to start their academic career. Both have expressed their strong interests in GEOTRACES related research. It is expected that GEOTRACES research in Taiwan will become more active in the near future.

Submitted by Tung-Yuan Ho (tyho@gate.sinica.edu.tw).

Croatia

The Croatian GEOTRACES activities in the last year were mainly related to: 1) improvement of electrochemical methods which, in combination with ICPMS, are used for trace metals speciation (including interaction with organic matter and sulfur species), determination and quantification (mostly Zn, Cd, Pb, Cu, Fe, Ni, Co); 2) development of an automated system for determination of trace metals in natural waters (Voltammetric AutoAnalyser - Volt-AA); 3) research on development of electroanalytical methods for chalcogenide and other metal containing nanoparticles determination in natural waters.

Field works

- Participation in the field work at Rogoznica Lake in Croatia where we used electrochemical and ICPMS methods for sulfur and trace metals speciation in oxic and anoxic water column.

Projects

- A multilateral project in the frame of the French MERMEX program called "Metal contaminants in Mediterranean Coastal Environment" (COMECOM/MERMEX) started in January 2014. Partners from France, Italy, Croatia, Lebanon and Algeria will focus their research to target locations such are river inputs, large coastal cities and ports. Behavior of trace metals in relation to their distribution and speciation influenced by variable local environmental conditions (e.g. salinity), as well as by global problem of ocean acidification will be of particular concern.
- Chinese - Croatian bilateral project: "Determination of trace metal speciation in coastal waters: towards developing new criteria for water quality control and risk assessment" (project leaders Rujun Yang and Ivanka Pizeta, members of SCOR WG139). Croatian scientists visited Ocean University of China in Qingdao (10. to 18. April 2014.)
- Germany – Croatian bilateral project "Arsenic speciation on the phase boundaries: salt/fresh water and oxia/anoxia (project leaders E. Bura-Nakić, Britta Planer-Friedrich, Bayreuth University, Bayreuth, Germany).

One PhD student completed Short Term Scientific Missions (STSM) (February-April 2014) in the frame of COST action ES1205 within the project *"Characterization of chalcogenide nanoparticles by electrochemical methods and comparison with sizing techniques (Dynamic Light, Scattering, Fluorescence Correlation Spectroscopy and Nanoparticle Tracking Analysis) in environmentally relevant conditions".*

Participation at international conferences

- I. Pizeta, S.G. Sander, Intercomparison of estimating metal binding ligand parameters from simulated titration data using different fitting approaches (Abstract ID:13696), Ocean Sciences Meeting 23.-28. February 2014 in Honolulu, Hawaii.
- I. Ciglenečki, E. Bura-Nakić, M. Marguš, M. Čanković, M. Carić, C. Viličić, Z. Ljubešić, F.Kršinić, M.Batistić, I.Janeković, F.Plavčić, Rogoznica Lake (Croatia), a unique anoxic seawater system on the Adriatic coast under the anthropogenic pressures // Geophysical Research Abstracts Vol. 16, EGU2014-7925, EGU meeting, Vienna 2014.

Publications

- CONTREIRA-PEREIRA, Leonardo; YÜCEL, Mustafa; OMANOVIĆ, Dario; BRULPORT, Jean-Pierre; Le BRIS, Nadine. Compact autonomous voltammetric sensor

for sulfide monitoring in deep sea vent habitats. // Deep-sea research. Part 1. Oceanographic research papers. 80 (2013); 47-57.

- CUKROV, Neven; CUCULIĆ, Vlado; BARIŠIĆ, Delko; LOJEN, Sonja; LOVRENČIĆ MIKELIĆ, Ivanka; OREŠČANIN, Višnja; VDOVIĆ, Neda; FIKET, Željka; ČERMELJ, Branko; MLAKAR, Marina. Elemental and isotopic records in recent fluvio-lacustrine sediments in karstic river Krka, Croatia. // Journal of geochemical exploration. 134 (2013); 51-60.
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- FILIPOVIĆ, Josip; GRČIĆ, Ivana; BERMANEC, Vladimir; KNIEWALD, Goran. Monitoring of total metal concentration in sludge samples: Case study for the mechanical-biological wastewater treatment plant in Velika Gorica, Croatia. // Science of the Total Environment. 447 (2013); 17-24.
- FRANČIŠKOVIĆ-BILINSKI, Stanislav; CUCULIĆ, Vlado; BILINSKI, Halka; HÄUSLER, Hermann; STADLER, Philipp. Geochemical and stable isotopic variability within two rivers rising under the same mountain, but belonging to two distant watersheds. // Chemie der Erde - Geochemistry. 73 (2013), 3; 293-308.
- GRAHEK, Željko; MILANOVIĆ, Ivana; NODILO, Marijana; ROŽMARIĆ, Martina. Sequential separation of Fe and Sr from liquid samples by using Sr resin and rapid determination of 55Fe and 89,90Sr. // Applied radiation and isotopes. 81 (2013); 42-48.
- JURINA, Irena; IVANIĆ, Maja; TROSKOT- ORBI, Tamara; BARIŠIĆ, Delko; VDOVIĆ, Neda; SONDI, Ivan. Activity concentrations and distribution of radionuclides in surface and core sediments of the Neretva Channel (Adriatic Sea, Croatia). // Geologia Croatica. 66 (2013), 2; 143-150.
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- KARAVOLTSOS, S.; SAKELLARI, A.; STRMEČKI, Slađana; PLAVŠIĆ, Marta; IOANNOU, E.; ROUSSIS, V.; DASSENAKIS, M.; SCOULLOS, M. Copper complexing properties of exudates and metabolites of macroalgae from the Aegean Sea. // Chemosphere. 91 (2013), 11; 1590-1595.
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- LENOBLE, Veronique; OMANOVIĆ, Dario; GARNIER, Cedric; MOUNIER, Stephane; ĐONLAGIĆ, Nusreta; Le POUPON, Christophe; PIŽETA, Ivanka. Distribution and chemical speciation of arsenic and heavy metals in highly contaminated waters used for health care purposes (Srebrenica, Bosnia and Herzegovina). // Science of the total environment. 443 (2013); 420-428.
- LOVRENČIĆ MIKELIĆ, Ivanka; OREŠČANIN, Višnja; BARIŠIĆ, Delko. Distribution and origin of major, minor, and trace elements in sediments and sedimentary rocks of the

Kaštela Bay (Croatia) coastal area. // Journal of geochemical exploration. 128 (2013); 1-13.

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- OURSEL, Benjamin; GARNIER, Cédric; DURRIEU, Gaël; MOUNIER, Stéphane; OMANOVIĆ, Dario; LUCAS, Yves. Dynamics and fates of trace metals chronically input in a Mediterranean coastal zone impacted by a large urban area. // Marine pollution bulletin. 69 (2013), 1/2; 137-149.
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- ŽIC Vesna; CARIĆ Marina; CIGLENEČKI JUŠIĆ Irena. The impact of natural water column mixing on iodine and nutrient speciation in a eutrophic anchialine pond (Rogoznica Lake, Croatia). // Estuarine, coastal and shelf science. 133 (2013); 260-272.
- Milanović, Ivana; Krznarić, Damir; Bura-Nakić, Elvira; Ciglenečki, Irena. Deposition and dissolution of metal sulfide layers at a Hg electrode surface in seawater electrolyte conditions. // Environmental chemistry. 11 (2014) 167-175.
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- Cobelo-Garcia, Antonio; Santos-Echeandia, Juan; Lopez-Sanchez, Daniel; Almecija, Clara; Omanović, Dario. Improving the voltammetric quantification of ill- defined peaks using second derivative signal transformation: example of the determination of platinum in water and sediments. Analytical chemistry. 86 (2014) 2308-2313.
- Dang, Huy D.; Tessier, Erwan; Lenoble, Véronique; Durrieu, Gaël; Omanović, Dario; Mullot, Jean- Ulrich; Pfeifer, Hans-Rudolf; Mounier, Stéphane; Garnier, Cédric. Key parameters controlling arsenic dynamics in coastal sediments: An analytical and modeling approach. // Marine chemistry. 161 (2014) 34-46.
- Oursel, Benjamin; Garnier, Cédric; Pairaud, Ivane; Omanović, Dario; Durrieu, Gaël; Syakti, Agung Dhamar; Le Poupon, Christophe; Thouvenin, Bénédicte; Lucas, Yves. Behaviour and fate of urban particles in coastal waters: Settling rate, size distribution and metals contamination characterization. Estuarine, coastal and shelf science. 138 (2014) 14-26.

Submitted by Irena Ciglenečki-Jušić (irena@irb.hr).

France

New publications

- Annett A., Henley S., van Beek P., Souhaut M., Ganeshram R., Venables H., Meredith M., Geibert W., 2013. Use of radium isotopes to estimate mixing rates and trace sediment inputs to surface waters in northern Marguerite Bay (Antarctic Peninsula), Antarctic Science 25(3), 445–456, doi:10.1017/S0954102012000892
- Garcia-Solsona, E., Jeandel, C. Labatut M., Lacan F., Vance D., Chavagnac V. Rare Earth Elements and Nd isotopes tracing water mass mixing and particle-seawater interactions in the SE Atlantic. 2014. Geochimica et Cosmochimica Acta, doi:10.1016/j.gca.2013.10.009.
- Geibert W., Rodellas V., Annett A., van Beek P., Garcia-Orellana J., Hsieh Y.-T., Masque P., 2013. 226Ra determination via the rate of 222Rn ingrowth with the Radium Delayed Coincidence Counter (RaDeCC), Limnology and Oceanography : Methods 11, 2013, 594-603.
- Jeandel C., Delattre M., Grenier M., Pradoux C. and Lacan F. 2013. Rare Earth Concentrations and Nd isotopes reveal exchange processes along the East Pacific Rise, South East Pacific Ocean. Geochemistry, Geophysics, and Geosystems. doi:10.1029/2012GC004309
- Grenier M., Jeandel C., Lacan F., Vance D., Venchiarutti C., Cros A., Cravatte S. 2013. From the subtropics to the central equatorial Pacific Ocean: neodymium isotopic composition and rare earth element concentration variations. Journal of Geophysical Research Oceans., doi:10.1029/2012JC008239.
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- Quéroué, F., Townsende, A., van der Merwe, P., Lannuzel, D., Sarthou, G., Bucciarelli, E. and Bowie, A., 2014. Advances in the offline trace metal extraction of Mn, Co, Ni, Cu, Cd, Pb in open ocean seawaters with Sector Field ICP-MS analysis. Anal. Meth., DOI: 10.1039/c3ay41312h.
- Rochelle-Newall, E. Ridame, C. Dimier-Hugueney C., L'Helguen S. Impact of iron limitation on primary production (dissolved and particulate) and secondary production in cultured Trichodesmium sp., AME, accepted, 10.3354/ame01690, 2014.
- Rousseau T. , Sonke J.E., Chmeleff J., Candaudap F., Lacan F., Boaventura G., Seyler P., Jeandel C. (2013) Rare earth element analysis in natural waters by multiple isotope dilution - sector field ICP-MS. Journal of Analytical Atomic Spectrometry, doi:10.1039/C3JA30332B.
- Sanial V., van Beek P., Lansard B., d'Ovidio F. , Kestenare E., Souhaut M., Zhou M., Blain S., 2013. Study of the phytoplankton plume dynamics off the Crozet Islands (Southern Ocean): A geochemical-physical coupled approach. Journal of Geophysical Research-Oceans,119, doi:10.1002/2013JC009305.

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International conferences

2013

- Abadie, C., Lacan, F., Radic, A., Poitrasson, F. Iron concentrations and isotopic compositions in the Southern Ocean along the zero meridian. Ocean Science Meeting, Hawaii, Feb. 2014.
- Abadie C., Lacan F., Radic, A. and Poitrasson F. Dissolved and Particulate Iron Concentrations and Isotopic Compositions in the South Atlantic and Southern Ocean. Goldschmidt Conference. Florence, Italy, August 2013.
- Blain S., B. Quéguiner, KEOPS 2 Team. Spatial and temporal responses of the southern ocean to large scale natural iron fertilization (Kerguelen region). ASLO 2013 Aquatic Sciences Meeting 'Learning for the Future', Special session 51 'Iron, Carbon Cycling, and Ecosystem Dynamics in the Southern Ocean', Nouvelle Orleans, février 2013.
- Blain S, B. Quéguiner, KEOPS2 Team, OISO Team. Response of the southern ocean to large scale natural iron fertilization (Kerguelen region). 2014 Ocean Science Meeting AGU/ASLO/Oceanography Society, Session 072 'The Sou-thern Ocean and Its Role In the Climate System: Observations and Modeling of Physical and Biogeochemical Processes', Hawaii, février 2014.
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- Cavagna A., B. Quéguiner, F. Planchon, S. Jacquet, I. Closset, F. Dehairs. Production regime and potential for carbon export in the naturally iron fertilized kerguelen area (Southern Ocean). ASLO 2013 Aquatic Sciences Meeting 'Learning for the Future', Special session 51 'Iron, Carbon Cycling, and Ecosystem Dynamics in the Southern Ocean', Nouvelle Orleans, février 2013.
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- Dulaquais, G., Boye, M., Middag, R., Planquette, H., Puigcorbe, V. (2014). Comparative atmospheric contributions to dissolved cobalt in the mixed layer: case of the Western North Atlantic and Mediterranean Sea (GEOTRACES sections A02 and A04N). Ocean Sciences Meeting, Février 2014 - Honolulu, U.S.A
- Grenier, M., E. Garcia Solsona, N. Lemaître, V. Bouvier, T. Trull, and C. Jeandel, Rare Earth Element Concentrations and Nd isotopic compositions of seawater around the Kerguelen plateau: Tracing land-to-ocean sources and ocean circulation Ocean Sciences Meeting, Hawaii, USA, February 2014
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Cruises

- GEOVIDE (15 May-30 June): http://geovide.tumblr.com/, http://www.geovide.obs-vlfr.fr/
- MED-Black: participation to the intercalibration exercices for:
  - Trace element concentrations in suspended particles
  - Iron isotopes in the dissolved and particulate phases
  - US-GEOTRACES PACIFIC (Collaboration WHOI)
- GEOTRACES GA04 (*R/V Pelagia*, May-July 2013, without embarking): determination of particulate trace metals.
- GEOVIDE (*R/V Pourquoi Pas ?* scheduled for May-June 2014, embarking): determination of particulate trace metals in different size fractions.

New funding

- GEOVIDE project: ANR/INSU/IFREMER

Other activities (e.g., acquisition of new sampling systems)

- A first in-situ pump was modified and will be tested during the GEOVIDE cruise.
- GEOVIDE precruise meeting. 6-7 February 2014, in Brest, France.

Submitted by Geraldine Sarthou (Geraldine.Sarthou@univ-brest.fr).

Germany

Meetings

- Meetings of the Data Management Committee and the Standards and Intercalibration Committee were held in Bremerhaven in conjunction with the SSC meeting (organized by Reiner Schlitzer, AWI).

Cruises

- There have been no dedicated GEOTRACES cruises in 2013.

New Funding

- The requested 2015 (central Arctic) and 2016 (Fram Strait) Polarstern expeditions with GEOTRACES programs have been funded and scheduled.

National and international service

- Germany is represented on the International GEOTRACES Standards and Intercalibration Committee by Michiel Rutgers van der Loeff and on the International Scientific Steering Committee by Katharina Pahnke. Reiner Schlitzer serves as co-chair of the international SSC.

New Results

- Seawater 143Nd/144Nd profiles from the West Pacific (*R/V Sonne* cruise SO223T, South Korea-Fiji, GEOTRACES Process Study) (Melanie Behrens, Katharina Pahnke, Max Planck Institute for Marine Microbiology and University of Oldenburg, presented at Ocean Sciences Meeting 2014).
- Seawater 143Nd/144Nd profiles from Station ALOHA and coastal waters around Oahu, Hawaii (*R/V Kilo* Moana cruise KM1107, GEOTRACES Process Study) (Henning Fröllje, Katharina Pahnke, Max Planck Institute for Marine Microbiology and University of Oldenburg).

Publications

Together with the GDAC at BODC, AWI compiled hydrographic and TEI data from 15 IPY and GEOTRACES cruises and created the IDP2014 digital data packages that are now publicly available for download at http://www.bodc.ac.uk/geotraces/data/idp2014/. In addition, AWI created the eGEOTRACES electronic atlas (http://www.egeotraces.org) containing more than 300 section plots and 80 animated 3D scenes for a large number of hydrographic parameters as well as trace elements and isotopes measured along GEOTRACES cruise tracks.

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- Hathorne, E., Frank, M., Rutgers van der Loeff, M., Roeske, T., Rickli, J. (2013). Rare Earth Elements in the surface Ocean under the Saharan dust belt. Mineralogical Magazine, 77(5), 1271.
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- Pahnke, K., Stichel, T., Hartman, A., Duggan, B., Scher, H. (2014). US GEOTRACES North Atlantic zonal transect of dissolved Nd isotopes and concentrations, Ocean Sciences Conference, Honolulu, HI, USA, Abstract ID: 14598.
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Greece

There were several GEOTRACES related activities in Greece the last year (June 2013-May 2014).

Meetings

- Profs. Kanakidou Maria and Mihalopoulos Nikolaos both from University of Crete organized in two international conferences, sessions relevant to GEOTRACES.
  The first entitled "Atmospheric Deposition of Aerosols to the Land and Oceans and their Impact on Ecosystems and Climate" was organized during Goldschmidt (25-30th of August in Florence, Italy) and the second entitled "Atmospheric Deposition to the Ocean: Impacts on Marine Biogeochemistry and Climate" was organized during EGU in Vienna (28/4-2/5 2014).

Research activities

- Within the framework of the National projects ADAMANT (Thalis project) and PANOPLY (Aristeia project) a consortium of Greek scientists from University of Crete, Hellenic Center of Marine Research (HCMR) and Aegean University performed studies i) on nutrients and trace metals solubility both in seawater and rainwater, ii) on factors controlling their levels in the marine atmosphere (via sampling at Finokalia sampling site, a regional background station, www.finokalia.chemistry.uoc.gr) iii) on their impact on marine productivity by using HCMR mesocosms facilities and finally iv) on their fate in the atmosphere using modeling tools. Results from these studies will be presented in International conferences and scientific journals.

Some indicative publications relevant to GEOTRACES activities

- C. Theodosi, S. Stavrakakis, F. Koulaki, I. Stavrakaki, S. Moncheva, E. Papathanasiou, A. Sanchez-Vidal, M. Koçak, N. Mihalopoulos, The significance of atmospheric inputs of major and trace metals to the Black Sea, Journal of Marine Systems, Volume 109-110, 94-102, 2013.
- Christodoulaki, S., Petihakis, G., Kanakidou, M., Mihalopoulos, N., Tsiaras, K., Triantafyllou, G., Atmospheric deposition in the eastern Mediterranean. A driving force for ecosystem dynamics, Journal of Marine Systems, doi: 10.1016/j.jmarsys.2012.07.007.
- Hood, R.R., Drinkwater, K.F., Mihalopoulos, N., Introduction: Large-scale regional comparisons of marine biogeochemistry and ecosystem processes - Research approaches and results (Editorial), Journal of Marine Systems, Volume 109-110, 1-3, 2013.
- Im, U., Christodoulaki, S., Violaki, K., Zarmpas, P., Kocak, M., Daskalakis, N., Mihalopoulos, N., Kanakidou, M., Atmospheric deposition of nitrogen and sulfur over southern Europe with focus on the Mediterranean and the Black Sea, Atmos. Environ., Volume 81, December 2013, Pages 660-670

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India

Significant studies are continuing under GOTRACES programme in India. Complete clean sampling system is working fine which was successfully used during sampling section GI03 during March – May, 2013. We are carrying out measurements of key parameters of GEOTRACES in these samples using FIS, Q- and MC-ICP-MS in the samples collected last year in GEOTRACES section GI03. We have undertaken a major GEOTRACES cruise onboard *Sagar Kanya* to cover significant part of the Indian Ocean including GI01 and GI02 during March – May 2014. The cruise started from Chennai and its first part terminated at Mauritius after sampling the Bay of Bengal and Indian Ocean. During second part it is moving from Mauritius towards Goa. In its route it has also sampled in hydrothermal regions. For the first time, we are measuring dissolved Fe, Al, Mn and Zn onboard using FIS. In addition, Mo and Si isotopes are being studied in the Bay of Bengal and the Arabian Sea and in several Indian estuaries. Few results are documented below:

Si isotopes in the Bay of Bengal: The dissolved Si concentration and δ^{30}Si have been measured in water column of the Bay of Bengal (BoB) along the 87°E transect (GI01 section of International GEOTRACES Program) to explore its biogeochemistry, particularly the role of internal cycling through particle–water interactions and lateral Si transport by water mixing to the bay. The dissolved Si concentration and δ^{30}Si in the water column of the BoB vary from ~0.6 to ~152.5 µmol/kg and ~1.2 to ~3.6 ‰, respectively. The depth profiles of dissolved Si concentration show lower abundances in shallow waters (depth ~0–100 m) and an increase in deeper depths, while the pattern reverses in case of δ^{30}Si. Apart from different water masses, the discharge from the Ganga–Brahmaputra river system, intrusion of high saline waters from the Arabian Sea and particle–water interactions seem to influence the observed δ^{30}Si in the water column of the Bay of Bengal.

Lighter Mo isotope in the Bay of Bengal: Dissolved Mo isotope composition in water columns of the Arabian Sea and the Bay of Bengal are analysed to assess the impact of (i) perennial oxygen minimum zone (OMZ) present in both the basins and (ii) large riverine particulate flux. δ^{98}Mo in the open ocean water of the Arabian Sea and the Bay of Bengal indicates conservative behavior with negligible variation with depth, averaging 2.41 ± 0.05 with no impact of water column suboxic condition on the Mo isotope composition. Notable exception is the northern Bay of Bengal in the proximity to the mouth of the Ganga (Hooghly) river, which displays quite different δ^{98}Mo, from 0.9 at surface with salinity 32.4 to 1.9 at bottom with salinity 35, much lower than the open ocean value. The lighter Mo observed in the water column near river mouth could be due to its supply from release of lighter Mo from particulates due to change in oxidation state.

Publications

- Singh S. P., Singh S. K., Bhushan R., Dissolved Boron in the Tapi, Narmada and the Mandovi Estuaries, the Western Coast of India: Evidence for Conservative Behavior, Estuaries and Coasts, 2013
- Rahaman W., Goswami V., Singh S. K. and Rai V. K., Molybdenum isotopes in two Indian estuaries: Mixing characteristics and input to oceans, Under revision, GCA, 2014.

Submitted by Sunil Kumar Singh (sunil@prl.res.in).

Italy

Cruises, sampling activities

Paolo Montagna (ISMAR-CNR, Bologna)

Mediterranean Sea

- 24 seawater samples were collected from 9 profiles along the major Mediterranean sub-basins (Aegean, Ionian Sea, Adriatic and Tyrrhenian Sea) during Leg 3 of the GEOTRACES Mediterranean and Black Sea cruise (25 July – 12 August 2013). Seawater samples were collected in 4L acid-cleaned (0.5M HCl) cubitainers (Fisher Scientific) from the Ultraclean titanium CTD system. Seawater was filtered (Sartorius Sartobran® 0.2 mm) before being collected into the cubitainers. For station 17, seawater samples were also collected for the analysis of the Rare Earth Element (REE) concentration in 125ml acid-cleaned (1M HCl) bottles, acidified to pH ~ 2, sealed with parafilm and stored with double-bags. The samples for Nd isotopes were immediately acidified with trace metal grade HCl to pH = 2 and mixed with Fe solution in preparation for pre-concentration of the lanthanide and actinide elements. After one day of equilibration the samples were treated with Optima grade ammonium hydroxide to force the precipitation of ferric hydroxide by adjusting the pH to ~ 8. After the precipitation of Fe/REEs the cubitainers were sealed with parafilm and stored in double-bags.
  The Rare Earth Elements co-precipitated with Fe will be processed and analysed at the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) in Gif-sur-Yvette. Neodymium will be isolated from the other REEs through column chemistry and Nd isotopes will be analysed by multi-collector ICPMS (NeptunePlus).
  The REEs concentration will be analysed by a X-seriesII CCT (Thermo Fisher Scientific) ICPQMS following a standard addition technique.
- During the RECORD cruise (ISMAR-CNR, chief scientist: Paolo Montagna) in November 2013, seawater samples were collected along the Siculo-Tunisian Strait and the Sardinian Channel (Fig. 1) for O and C isotopes (n = 34), Nd isotopes (n = 3), pH (n = 135), alkalinity (n = 39), 14C (n = 42), 3He (n = 48) and 226Ra/Ra (n = 3). The sample were collected using a 24x10L CTD-Rosette system. All the samples will be analysed at the Laboratoire des Sciences du Climat et de l'Environnement (LSCE) in Gif-sur-Yvette.

Ross Sea (Antarctica)

- 13 seawater samples were collected in Terra Nova Bay (Ross Sea) during the XXIX Italian Expedition in Antarctica under the GEOSMART project (GEOchemical Signatures in the Antarctic MARine carbonate sysTem: present, past and future implications; PI Paolo Montagna). The samples were collected using a 20L GO-FLO bottle from the small vessel Malippo present at the Italian Base "Mario Zucchelli" and they will be analysed for alkalinity, nutrients, Nd and B isotopes.

Table 1. Locations and depths of the seawater samples collected for Neodymium isotopes during Leg 3 (Geotraces Mediterranean and Black Sea)

Station Number	Date	Latitude	Longitude	Depth (m)	Code
1	27/07/13	35 38.20 N	024 55.19 E	25.19 935.80	3.1.1.23 3.1.1.1
3	28/07/13	35 56.21 N	022 10.99 E	3911.11	3.3.1.1
8	31/07/13	40 09.23 N	018 32.14 E	24.50 234.74 873.81	3.8.1.23 3.8.1.9 3.8.1.1

9	31/07/13	40 09.25 N	018 49.01 E	739.28	3.9.1.1
11	01/08/13	37 24.04 N	015 58.23 E	24.81 2542.83	3.11.1.23 3.11.1.1
12	02/08/13	39 00.43 N	014 30.13 E	3464.05	3.12.1.1
13	03/08/13	39 52.68 N	013 00.60 E	19.71 400.04 499.47 999.99 1999.58 3576.27	3.13.3.4 3.13.1.13 3.13.1.12 3.13.1.10 3.13.1.6 3.13.1.1
15	04/08/13	42 03.05 N	010 34.05 E	24.80 299.41 1244.20	3.15.3.23 3.15.3.7 3.15.3.1
17	06/08/13	40 04.17 N	005 56.83 E	24.80 199.36 1499.77 2823.85 2499.07	3.17.1.23 3.17.1.14 3.17.1.7 3.17.1.1 3.17.3.3

Table 2. Locations and depths of the seawater samples collected in Terra Nova Bay during the XXIX Italian Expedition in Antarctica

Sample	Date	Latitude	Longitude	Depth (m)
A1	27/01/2014	74° 40.073' S	164° 08.513' E	40
1	02/02/2014	74° 41.008' S	164° 07.545' E	40
2	02/02/2014	74° 40.743' S	164° 08.852' E	60
3	02/02/2014	74° 40.737' S	164° 08.958' E	300
4	02/02/2014	74° 40.805' S	164° 08.623' E	200
5	02/02/2014	74° 40.915' S	164° 08.368' E	100
6	02/02/2014	74° 40.967' S	164° 08.233' E	80
7	02/02/2014	74° 41.025' S	164° 08.198' E	50
8	02/02/2014	74° 41.072' S	164° 08.172' E	20
9	02/02/2014	74° 41.120' S	164° 08.167' E	10
10	02/02/2014	74° 41.148' S	164° 08.162' E	1
11	02/02/2014	74° 41.767' S	164° 12.752' E	475
A2	02/02/2014	74° 41.767' S	164° 12.752' E	475

Clara Turetta (IDPA-CNR, Venice)

Adriatic Sea

Seawater, sediments and biota samples were collected along the north-western coast of the Adriatic Sea, from Adige River mouth to Venice Lagoon, during some seasonal sampling surveys in the framework of Q-ALiVe Project-II, funded by the Regione Veneto (Italy, L.R. 15/2007) to recognise the input from rivers and lagoon and to verify the environmental quality. Samples were preserved refrigerated until the arrival in laboratory where were prepared in the clean-room (Class 100) of IDPA-CNR for analyses.

Samples were analysed to determine some organic pollutant (PAH, PCB, POP and PBDE), the concentration of trace elements and REE by ICP-SFMS (Element2, Finnigan-MAT, Bremen, Germany) and speciation of Hg following the methodologies developed in our laboratories.

In figure are reported the sampling sites of Q-ALiVe Project-II.

Ross Sea (Antarctica)

Seawater samples were collected during the XXIX Italian Expedition in Antarctica (R/V Italica) in the Ross Sea for direct determination of Rare Earth Elements. The sampling cruise was funded by the Italian National Reseach Program in Antarctica (PNRA). Seawater were collected using a rosette equipped by 24 Niskin bottles (12 L). Samples will be analysed at IDPA-CNR/Ca' Foscari University laboratory. The samples will be also analysed to determine δ18O.

Meetings

- Andrea Spolaor (IDPA-CNR, Venice) attended to EGU General Assembly 2013, AS3.2-EGU2013-4914, Vienna, Austria, 7 – 12 April 2013. Andrea Spolaor presented "Sea ice dynamics as a control for halogen deposition in polar regions".
- Fabiana Corami (IDPA-CNR, Venice) attended to the International Conference on Environmental Pollution and Remediation, Toronto, Ontario, Canada, July 15-17, 2013. Fabiana Corami presented "To methylate or not to methylate? Study of Mercury Speciation along the Venetian Littoral System (Q-ALiVe project)" and "Persistent Organic Pollutant in the Venetian coastal environment".

Submitted by Clara Turetta (clara.turetta@idpa.cnr.it).

Japan

Meetings

- An international GEOTRACES relevant scientific session "Controls on the biogeochemistry of the northwestern Pacific Ocean and its adjacent marginal seas" (8 oral presentations) was co-convened by T-Y. Ho, Y. Sohrin, I-I. Lin and G.T.F. Wong in the 2013 Asia Oceania Geosciences Society (AOGS 2013) on 24 June 2013, at Brisbane, Australia.
- A national GEOTRACES session in Annual Meeting of the Geochemical Society of Japan was co-convened by H. Obata, J. Zhang, K. Norisuye and K. Horikawa on 13 Sep 2013 at Tsukuba Univ, Tsukuba, Japan. There were 11 oral presentations and 2 posters, awaking fruitful discussions on trace elements and isotopes in the Pacific and Indian Oceans.
- A national sub-committee meeting on GEOTRACES (affiliated to the national SCOR committee) in the Science Council of Japan was chaired by T. Gamo at Atmosphere and Ocean Research Institute, the University of Tokyo at Kashiwa (Japan) on March 14, 2014, for the purpose of the overall exchange and discussion of recent information on the international GEOTRACES program. Just before the sub-committee meeting, a research symposium "Advancement and new challenges in marine researches of trace elements and their isotopes" was convened by T. Gamo on March 13 and 14 at the same location. There were 18 oral presentations including a special lecture by Dr. Ken Buesseler (WHOI) entitled "Fukushima --- a view from the ocean".

Cruises

- No GEOTRACES cruises were conducted in the past year.

Funding

- A Monkasho (Japanese government) grant-in-aid for scientific research (A) from 2011 to 2015 for GEOTRACES studies and travel fees, etc.

New publications

- Sano, Y., Hara, T., Takahata, N., Kawagucci, S., Honda, M., Nishio, Y., Tanikawa, W., Hasegawa, A. & Hattori, K. (2014): Helium anomalies suggest a fluid pathway from mantle to trench during the 2011 Tohoku-Oki earthquake. Nature Commun., 5, doi: 10.1038/ncomms4084.
- Otosaka, S. & Kato, Y. (2014): Radiocesium derived from the Fukushima Daiichi Nuclear Power Plant accident in seabed sediments: Initial deposition and inventories. Environmental Science: Processes & Impacts, 16, 978-990 (2014).
- Kumamoto, Y., Aoyama, M., Hamajima, Y., Aono, T., Kouketsu, S., Murata, A. & Kawano, T. (2014): Southward spreading of the Fukushima-derived radiocesium across the Kuroshio Extension in the North Pacific. Sci. Rep., 4, doi: 10.1038/srep04276.
- Gamo, T. (2014): Excess 222Rn in the bottom layer of the Japan Sea and their implication for bottom water dynamics. Prog. Oceanogr., 121, 94-97.
- Takano, S., Tanimizu, M., Hirata, T. & Sohrin, Y. (2013): Determination of isotopic composition of dissolved copper in seawater by multi-collector inductively coupled plasma mass spectrometry after pre-concentration using an ethylenediaminetriacetic acid chelating resin. Anal. Chim. Acta 784, 33-41, doi: http://dx.doi.org/10.1016/j.aca.2013.04.032.
- Suzuki, T., Otosaka, S., Kuwabara, J., Kawamura, H. & Kobayashi, T. (2013): Iodine-129 concentration in seawater near Fukushima before and after the accident at the Fukushima Daiichi Nuclear Power Plant. Biogeosciences, 10, 3839-3747.

- Okubo, A., Takeda, S. & Obata, H. (2013): Atmospheric deposition of trace metals to the western North Pacific Ocean observed at coastal station in Japan. Atm. Res., 129, 20-32, doi: 10.1016/j.atmosres.2013.03.014.
- Okubo, A., Obata, H., Magara, M., Kimura, T. & Ogawa, H. (2013): Rapid collection of iron hydroxide for determination of Th isotopes in seawater. Anal. Chim. Acta, 804, 120-125, doi: 10.1016/j.aca.2013.10.004.
- Kumamoto, Y., Murata, A., Kawano, T., Watanabe, S. & Fukasawa, M. (2013): Decadal Changes in Bomb-Produced Radiocarbon in the Pacific Ocean from the 1990s to 2000s. Radiocarbon, 55, doi: 10.2458/azu_js_rc.55.16238.

Submitted by Toshitaka Gamo (gamo@aori.u-tokyo.ac.jp).

Mexico

Meetings

- Oral presentations on XXth Congreso Nacional de Ciencia y Tecnología del Mar (Los Cabos, B.C.S., October 1-4, 2013), on XXIIIth Congreso Nacional de Geoquímica (October 14-17, 2013, Cuernavaca, Morelos), on The Coastal and Estuarine Federation (CERF -2013) 22 nd biennal conference "Toward Resilent Coasts and Estuaries, Science for Sustainable Solutions (November 3-7, 2013, San Diego, California, USA), and on XXth International Conference on Marine Geology (Moscow, November 18-22, 2013). Poster on the AGU 2013 Fall meeting (December 9-13, 2013, San Francisco, CA, USA).

Cruises

- *R/V Alpha Helix* (CICESE) was used in April 2014 south-west of Ensenada (North-Eastern Pacific Ocean) to install an automatic sediment trap for next year to measure the fluxes of major and trace components of the settling particulate matter and to study vertical profiles of dissolved oxygen and other characteristics of the water column.
- A small research boat "CICIMAR-XV" was used in February 2014 to study vertical profiles of salinity, temperature, dissolved oxygen, suspended particulate matter and nutrients the La Paz Bay (south-western Gulf of California) at 28 stations aiming to know the principal features of their spatial and vertical distribution during the winter season. The surface sediments at 130 stations were collected also to know their textural and chemical composition aiming to delimit the area of the influence of the depletion of water in oxygen on the accumulation of redox-sensitive elements such as molybdenum and uranium on the sea bottom.

New funding

- There is no direct funding for GEOTRACES activities in Mexico. However, GEOTRACES related projects obtain financial support from CONACyT (Mexican Council for Science and Technology) fundamental research funds. Limited financial support for the research and educational centers at the Mexican universities, research centers like CICESE and in the National Polytechnic Institute of Mexico system is also available.
- Multidisciplinary scientific project "Composition and fluxes of sedimentary material as a reflexion of the environmental changes in the La Paz Bay, Gulf of California" was approved in March 2014 with the funding of $1,100,000 pesos from Instituto Politécnico Nacional, code 1608 (P.I.- Dr. Evgueni Shumilin; duration: 2014-2015).
- A project for strengthening of the infrastructure "Renovation and reinforcement of the oceanographic equipment for the platform of the monitoring of the fluxes of the carbon, major and trace metals in the Mexican Northwestern Pacific" was recently approved by CONACyT (grant number CN-13-563, amount requested 5,000,000 pesos and 3,398,423.33 of them will be the contribution of CONACyT and a resting amount will be funded by Instituto Politécnico Nacional of Mexico). PI: Dr. E. Choumiline (Shumilin), Department of Oceanology, Centro Interdisciplinario de Ciencias Marinas-Instituto Politécnico Nacional, La Paz, Baja California Sur, Mexico.

Ongoing projects

a) CONACyT funding:

- "Biogeochemistry of trace metals in the southern part of the Southern California Bight: a region influenced by the California Current, upwelling and anthropogenic inputs". Multidisciplinary project awarded to Universidad Autónoma de Baja California, Mexico

with the funding of $2,500,000 pesos (P.I.- Dr. Francisco Delgadillo-Hinojosa; duration: 2010-2014).

- "Atmospheric fluxes of bioactive metals and their solubility in the Gulf of California: a scene towards climate change". Multidisciplinary project awarded to Universidad Autónoma de Baja California, Mexico, with the funding of $3,619,000 pesos (P.I. - Dr. José A. Segovia-Zavala; duration: 2012-2015).
- "High resolution geochemical reconstructions of recent climate and oxygenation history in La Paz Bay, Gulf of California" (July 2013-December 2014) UC MEXUS-CONACyT (grant number CN-13-563, amount requested 25,000 US $). PIs: Dr. T. Lyons, Department of Earth Sciences, University California, Riverside (USA) and Dr. E. Choumiline (Shumilin), Department of Oceanology, Centro Interdisciplinario de Ciencias Marinas-Instituto Politécnico Nacional, La Paz, Baja California Sur, Mexico
- "Influence of the dinoflagellate Lingulodinium polyedrum (Stein) Dodge, a red tide producer, on the biogeochemistry of Cd, Pb and other trace metals (Cu, Pb, Mo) in Todos Santos Bay, Baja California" Multidisciplinary project awarded to Centro de Investigación Científica y Educación Superior de Ensenada, B.C., with funding of 2 250 000 pesos (P.I. - Dr. María Lucila del C. Lares Reyes; duration: 2011-2014).

b) Other funding from "Secretaría de Investigación y Posgrado" of the National Polytechnic Institute of Mexico (Instituto Politécnico Nacional):

- Individual scientific project 20131764 "Arsenic and other potentially toxic elements in the sediments of the La Paz Lagoon, Baja California Sur: actual levels and historical record of the natural and anthropogenic contamination", with the funding of $65,000 pesos from Instituto Politécnico Nacional (P.I.- Dr. E. Shumilin; duration: February 2013-January 2014) was concluded successfully in January 2014.

New results

Scientific highlights

- Biogeochemical cycles of elements in the ocean lie at the center of our understanding of the functioning of ecosystems on different scales, whether global or regional. Some major, trace elements and lanthanides are known to be useful indicators of the origin of settling particulate matter, especially in contrasting environments.

  It is important to compare trace element composition of settling particulate matter (SPM) from the Alfonso Basin, southwestern Gulf of California with the elemental composition of settling particulate matter and particulate trace element fluxes of the sediment trap samples, collected in North-Eastern Pacific south-east from the Ensenada.
- Marine sediments from the coastal zone of Santa Rosalía copper mining region (Baja California Sur, Mexico) are strongly polluted with Co, Cu, Mn, U and Zn. Most of these trace metals are supplied to the marine sedimentary environment from sources related to the ore-forming mineralization in this mining district, or as the constituents of smelter slugs. Some ideas about the sources of enriched elements for the sediments can appear after the measurement of uranium isotope ratios using MC-ICPMS and range from uncovering the extent of past anoxia/euxinia registered in sedimentary rocks to tracking mineral weathering processes.

  Copper mineral, smelting wastes, beach and marine sediments were analyzed for 238U/235U and 234U/238U ratios. Some of the results indicate a large variability in U isotopic composition. This suggests complex physicochemical processes that produce isotopic fractionation, mainly involving the interaction between the mineralization/industrial wastes and the marine environment, probably upon contact with sea water. Values of ε235U (around -20) and δ234U (approx. 100 ‰) detected for the

copper mineral, were not as similar to the values from most of the clearly polluted and nonpolluted samples, with the exception of two samples. One of them has a similar δ234U value than the mineral mentioned above. The second one, being a marine sediment sample, displays a very negative δ234U (-74‰) and peculiar ε235U (-11.5) value.
Finally, historical data indicate that the local smelter at Santa Rosalía processed copper mineral extracted not only from the adjacent area, but also from other distant ore deposits (Sonora state, Mexico; as well as Chile). Those copper minerals might have had a distinct uranium isotopic fingerprint. This effect should not be discarded as we interpret complex systems like Santa Rosalia.

- The study of biogeochemical cycles of elements is important because they are actively involved in the functioning of coastal marine ecosystems. To determine the factors controlling the distribution of trace elements (TEs) in surface sediments of the La Paz Lagoon, their possible sources and background levels, 91 surface sediment samples were collected by free diving and a fine sediment core of 46 cm in length was extracted in the deepest portion of the lagoon. To determine total concentrations of TEs in surface sediments and in each horizon of the core, the sediments were digested with a mixture of concentrated strong acids and then the concentrations of 61 elements were measured by analytical techniques of ICP- MS and ICP- AES. The core sections were dated with the method of unsupported Pb -210 by alpha spectrometry of Po-210. The data set of total concentrations of TEs in the sediments was used to calculate the enrichment factor of the elements and the Müller´s index of geo- accumulation. Total concentrations of the contaminants were also compared with the criteria for sediment quality given by Long et al. (1995) and a factor analysis was done. The results indicate the existence of natural enrichment of elements such as Se> As> Cd reflecting the influence of the lithology of geological formations around the lagoon. The highest enrichments of As, Cd, P and U were found adjacent to El Mogote peninsula, which could reflect alongshore transport of phosphatic material enriched in some TEs, delivered to the Bay of La Paz by arroyos that cut the different geological formations. The Pb probably has anthropogenic origin, because its higher concentrations up to 36.8 mg kg-1 were recorded near the La Paz city due to the input from petro products and local municipal effluents. The metal concentration and associations are often strongly controlled by the sulphide or organic phases which helps binds the elements together.
  Sediment quality indices of the potential toxic elements give no indication of possible impairment to the biota of the lagoon by trace elements with the exception of As in 30% of the sampling stations and Cu in 20% of them.
  The dated sediment core suggests a rate of sedimentation in the deepest part of the lagoon, averaging, 6.5 mm yr- 1 and an accumulation rate of 0.27 g cm -2 yr-1. The vertical profiles of the total concentrations of TEs in the core indicate an increase in the contribution of elements with terrigenous origin with opposite trend for the elements of biogenic origin Ba, Sr and Corg , while the contents of some elements such as Pb, Cu, Cr, among others, show the influence of sporadic events like hurricanes and/or pulses of contamination.

B.S., M.S. and Ph.D. theses related to local "GEOTRACES" problems.

- Cuauhlte-Mora D. Heavy metal levels in marine sediments and their bioaccumulation in the clam Megapitaria squalida in the coastal zone of the Santa Rosalía mining region, Gulf of California. M.S. Thesis, Postgraduate Program in Marine Sciences and Limnology, Universidad Nacional Autónoma de México, México, D.F. (in process).

- Salamanca-Quevedo E. (2013). Spatial distribution and temporal variability of cadmium in Bahía de Todos Santos: the region influenced by the California current and upwellings. M.S. Thesis in Coastal Oceanography. Universidad Autónoma de Baja California. Ensenada, Mexico, 89 p.
- Pérez Tribouillier H. Biogeochemistry of trace elements in the La Paz Lagoon. M.S. Thesis. Centro Interdisciplinario de Ciencias Marinas-Instituto Politécnico Nacional, La Paz, Baja California Sur, Mexico (to be concluded in june 2014).
- Reyes-Bravo M. (2014) Temporal variability of the dissolved copper in the coastal zone of the Bahía de Todos Santos, Baja California. B.S. Thesis in Oceanology. Universidad Autónoma de Baja California. Ensenada, Mexico (to be concluded in May 2014)

Publications

Journal articles

- Cervantes-Duarte R., Prego,R., López-López S., Aguirre-Bahena F. and N. Ospina-Alvarez, 2013. Annual patterns of nutrients and chlorophyll in a subtropical coastal lagoon under the upwelling influence (SW of Baja-California Peninsula). Estuarine, Coastal and Shelf Science, 120, 54-63.
- Galindo-Bect M.S., Santa-Ríos A., Hernández-Ayón J.M., Huerta-Díaz M.A, and F. Delgadillo-Hinojosa, 2013. The use of urban wastewater for the Colorado River delta restoration. Procedia Environmental Sciences, 18, 829 - 835.
- Hernández-Ayón J.M., Chapa-Balcorta C., Delgadillo-Hinojosa F., Camacho-Ibar V.F., Huerta-Díaz M.A., Santamaria-del-Ángel E., Galindo-Bect S. and J. A. Segovia-Zavala, 2013. Dynamics of dissolved inorganic carbon in the Midriff Islands region of the Gulf of California: Influence of water masses. Ciencias Marinas, 39, 65–83.
- Leal-Acosta M.L., Shumilin E., Mirlean N., Delgadillo-Hinojosa F. and I. Sánchez-Rodríguez, 2013.The impact of marine shallow-water hydrothermal venting on arsenic and mercury accumulation by seaweeds Sargassum sinicola in Concepcion Bay, Gulf of California. Environmental Science: Processes & Impacts, 15, 470-477.
- Leal Acosta M.L., Shumilin E. and N. Mirlean, 2013. Sediment geochemistry of marine shallow-water hydrothermal vents in Mapachitos, bahía Concepción, Baja California peninsula, Mexico. Revista Mexicana de Ciencias Geológicas, 30, 233-245.
- Prol-Ledesma R.M., Torres-Vera M.A., Rodolfo-Metalpa R., Ángeles C., Lechuga Deveze C.H., Villanueva-Estrada R. E., Shumilin E. and C.Robinson, 2012. High heat flow and ocean acidification at a nascent rift in the northern Gulf of California. Nature Communications, 4: 1388; doi: 10.1038/ncomms2390.
- Segovia-Zavala J.A., Delgadillo-Hinojosa F., Huerta-Díaz M.A., Muñoz-Barbosa A., Galindo-Bect S., Hernández-Ayón J.M. and E.V. Torres-Delgado, 2013. Concentration of dissolved iron in the oxygen minimum zone off San Esteban sill, Gulf of California. Ciencias Marinas, 39, 231–237.
- Shumilin E.N., Jiménez -Illescas A.R. and S. López-López, 2013. Anthropogenic contamination of metals in sediments of the Santa Rosalía harbor, Baja California Peninsula. Bulletin of Environmental Contamination and Toxicology, 90, 333-337.
- Shumilin E., Rodríguez Figueroa G., Sapozhnikov D. and N. Mirlean, 2013.Vertical profiles of cobalt and zinc in the marine sediments of the Santa Rosalía mining region, Gulf of California, Mexico. J. Iberian Geology, 39, 89-96.
- Torres-Delgado E.V., Delgadillo-Hinojosa F., Camacho-Ibar V.F., Huerta-Díaz M.A., Segovia-Zavala J.A., Hernández-Ayón J.M. and S. Galindo-Bect (2013). Wintertime enrichment of inorganic nutrients in the Ballenas Channel, Gulf of California. Ciencias Marinas, 39, 47–64

- Valdivieso-Ojeda J.A., MA Huerta-Díaz M.A. and F Delgadillo-Hinojosa (2014). High enrichment of molybdenum in hypersaline microbial mats of Guerrero Negro, Baja California Sur, Mexico. Chemical Geology, 363, 341 –354
- Delgadillo-Hinojosa F., V Camacho-Ibar V., Huerta-Díaz M.A., V Torres-Delgado V., et al. Seasonal behavior of dissolved cadmium and Cd/PO4 ratio in Todos Santos Bay: a retention site of upwelled waters in the Baja California peninsula, Mexico. Submitted to Marine Chemistry.

Extended abstracts:

- Pérez-Tribouiller H. y E.Choumiline, 2013. Evaluación de los niveles actuales de elementos tras en los sedimentos marinos de la Laguna de La Paz, B.C.S., México. In: XX Congreso Nacional de Ciencia y Tecnología del Mar, Los Cabos, B.C.S., 1-4 de octubre del 2013. 10 p. en CD con programa y resúmenes en extenso.
- Aksentov K.I., Astakhov A.S., Shumilin E.N., 2013. Fluxes of anthropogenic mercury in the bottom sediment of the Peter the Great Gulf of the Sea of Japan. Pp.192-195. In: Geology of Seas and Oceans. Proceedings of XX International Conference on Marine Geology (Moscow, November 18-22, 2013). Volume 4, GEOS, Moscow.

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Netherlands

Activities

Western Atlantic Ocean: The Dutch GEOTRACES cruises between 2010-2012 aimed to map the distribution of important trace elements and isotopes (PI: Hein de Baar) and to investigate the deep-sea microbiology (PI: Gerhard Herndl) in the West Atlantic Ocean. Gerhard Herndl is also involved in bioGEOTRACES together with Penny Chisholm (MIT) and Julie LaRoche (now at Dalhousie University). In 2013-2014 we focused with our west Atlantic work on the compilation and analysis of the data collected in the western Atlantic Ocean in 2010 – 2012. The first publications appeared and various data sets were accepted for implementation in the GEOTRACES Intermediate Data Product.

Mediterranean Sea and the Black Sea: In 2012/2013 funding was granted by the Dutch Organization for Scientific Research (NWO) for GEOTRACES cruises in the Mediterranean Sea and the Black Sea (PI: Hein de Baar). The Dutch GEOTRACES cruises in the Mediterranean Sea (GA04N) was organized in concert with a cruise of the Spanish Mediterranean GEOTRACES program (GA04S). In 2013/14 our work in the Mediterranean and Black Seas focused on; i) the execution of three research cruises in the Mediterranean Sea and Black Sea, ii) measurements of samples, iii) calibration of CTD data.

Meetings

- GEOTRACES SSC meeting: Hein de Baar and Micha Rijkenberg attended the GEOTRACES Scientific Steering Committee meeting on 2-4 October in Bremerhaven, Germany.
- GRIFF/GROCE workshop GEOTRACES Fram Strait 2016: Micha Rijkenberg attended the workshop on 24-25 March in Bremen, Germany.
- Goldschmidt conference 2013, Florence, Italy: Hein de Baar presented work at the Goldschmidt conference 2013 in Italy.
- Ocean Sciences Meeting 2014, Hawaii, USA: Hein de Baar presented work at the Ocean Science Meeting 2014 on Hawaii.

Cruises

Three research cruises (64PE370, 64PE373, 64PE374) have been completed sampling a total of 68 full depth stations to map the distribution of trace elements and isotopes in the Mediterranean Sea and Black Sea (Figure 1). The first leg started in Lisbon 14 May 2013 to sample the southern parts of the Mediterranean Sea and arrived in Istanbul on 5 June 2013. The second leg of the MedBlack GEOTRACES cruises left Istanbul on 13 July 2013 for the Black Sea to return in Istanbul on 25 July 2013. The third leg left Istanbul on 25 July for the northern parts of the Mediterranean and arrived in Lisbon on 11 August 2013.

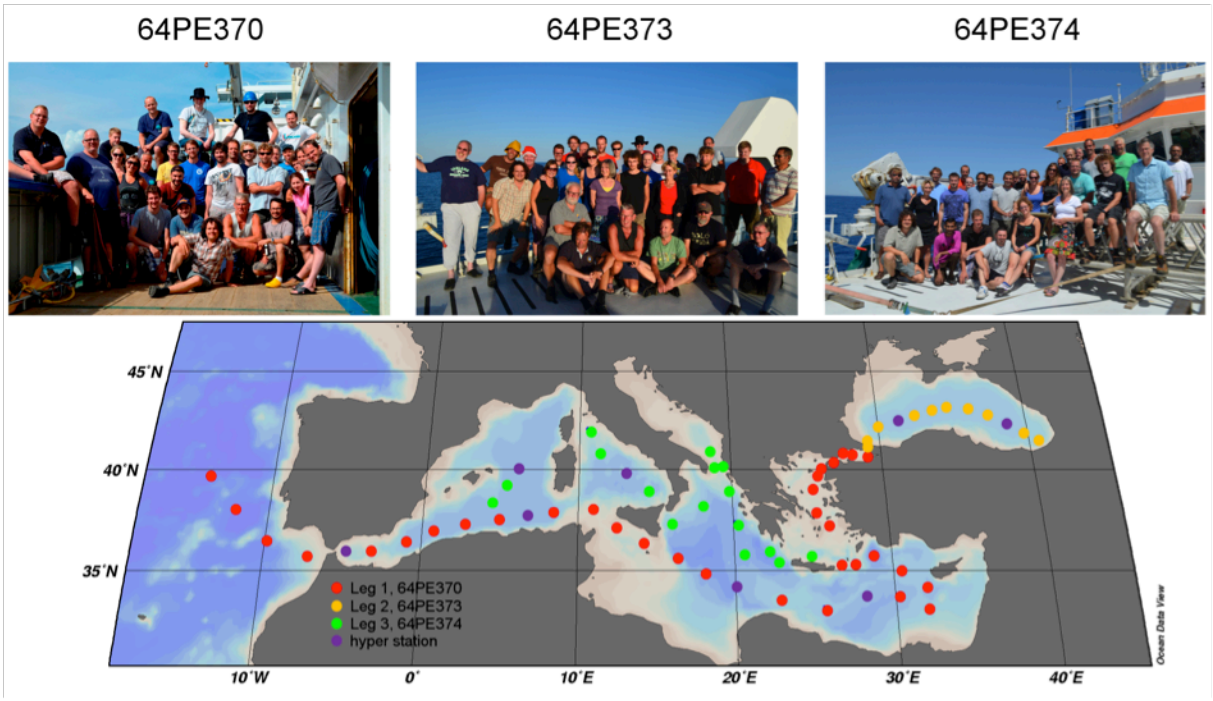

Figure 1. *The crew and participants on RV Pelagia and the cruise track of the MedBlack GEOTRACES cruises (GA04N) in 2013.*

New results

- Investigators are making good progress in the sample analysis and subsequent interpretation of the data collected in the western Atlantic Ocean. Many results of the western Atlantic transect have been presented at international conferences and start to appear in journal publications. Most of the results of the International Polar Year/GEOTRACES cruises in the Arctic and Antarctic have been published now.
- The first new data of the MedBlack GEOTRACES cruises have been measured on board during 64PE370, 64PE373 and 64PE374 (DFe, DAl, DIC & alkalinity and the micro and nanomolar nutrient concentrations). Other trace elements like Y, Cd, La, Pb, Sc, Ti, V, Mn, Fe, Ni, Zn and Ga have in the mean time been measured by ICP-MS. Some results have been presented at the Ocean Sciences Meeting 2014 on Hawaii.

Presentations

- de Baar H, van Heuven S, Middag R, Neven I, Klunder M, van Ooijen J, Xue Z, Abouchami W, Rehkamper M & Galer S (2013) Interactions of Dissolved CO2 with Cadmium Isotopes in the Southern Ocean, Goldschmidt conference 2013, Florence, Italy.
- de Baar, H. J.; Conway, T. M.; Middag, R.; Noble, A. E.; Wyatt, N. J.: GEOTRACES 3-D distribution of accurate concentrations of dissolved trace metals Manganese, Iron, Nickel, Zinc, Cadmium and Lead in the Atlantic Ocean, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Boye, M.; Dulaquais, G.; Carton, X.; Rijkenberg, M.; De Baar, H.: First assessment of the dissolved cobalt partitioning between the soluble and colloddal fractions in the upper Westnorthern Atlantic, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Dulaquais, G. R.; Boye, M.; Middag, R.; Planquette, H.; Puigcorbe, V.: Comparative atmospheric contributions to dissolved Cobalt in the mixed layer: case of the Western North.
- Aatlantic and Mediterranean sea (sections GA02 & GA04n), Ocean Sciences Meeting 2014, Honolulu, Hawaii.

- van Hulten M, de Baar H, Middag R, Sterl A, Dutay J-C, Gehlen M & Tagliabue A (2013) Aluminium in an Ocean General Circulation Model and Observations, Goldschmidt conference 2013, Florence, Italy.
- Lambelet M, van de Flierdt T, Crocket K, Rehkämper M, Kreissig K, Coles B, Rijkenberg M, Gerringa L, van Aken H & de Baar H. Neodymium Isotopic Composition and Concentration in Equatorial to North Atlantic Seawater, Goldschmidt conference 2013, Florence, Italy.
- Lambelet, M.; van de Flierdt, T.; Crocket, K.; Rehkamper, M.; de Baar, H.: The Neodymium isotopic composition of North Atlantic Deep Water revisited, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Little, S. H.; Vance, D.; Lyons, T. W.; McManus, J.; Rijkenberg, M. J.: The significance of anoxic settings to the oceanic cycling of Cu and Zn isotopes, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Lohan, M. C.; Wyatt, N.; Milne, A.; Middag, R.; Conway, T. M.: Zinc distributions in the Atlantic Ocean: the use of a new tracer Zn*, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Middag, R.; Bruland, K. W.; de Baar, H. J.; van Heuven, S. M.: The relationships of Cadmium, Nickel and Zinc with major nutrients in the West Aatlantic ocean, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Rijkenberg, M.; Middag, R.; Conway, T.; Bruland, K.; de Baar, H.: Excellent consistency of dissolved Manganese, Iron, Cobalt, Nickel, Copper, Zinc, Cadmium and Lead at the Bermuda crossover station of two GEOTRACES sections, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Rolison, J. M.; Middag, R.; Stirling, C. H.; Rijkenberg, M. J.; de Baar, H. J.: MedBlack GEOTRACES expedition: distribution of dissolved Aluminium, Ocean Sciences Meeting 2014, Honolulu, Hawaii.
- Xie, R. C.; Galer, S.; Abouchami, W.; Rijkenberg, M.; De Jong, J.: Cadmium isotope distribution along the western boundary of the South Atlantic, Ocean Sciences Meeting 2014, Honolulu, Hawaii.

PhD theses

- Lesley Salt successfully defended her thesis on CO2 in coastal and ocean environments of the Atlantic Ocean on 21 March 20134 at the University of Groningen (http://irs.ub.rug.nl/ppn/373486987).

Publications

Published:

- Bruland, K. W., R. Middag, and M. C. Lohan (2014), Controls of Trace Metals in Seawater, in Treatise on Geochemistry, edited by H. D. Holland and K. K. Turekian, pp. 19-51, Elsevier, Oxford.
- Casacuberta, N., M. Christl, J. Lachner, M. R. van der Loeff, P. Masqué, and H. A. Synal (2014), A first transect of 236U in the North Atlantic Ocean, Geochimica et Cosmochimica Acta, 133(0), 34-46, doi: http://dx.doi.org/10.1016/j.gca.2014.02.012.
- Deng, F., A. L. Thomas, M. J. A. Rijkenberg, and G. M. Henderson (2014), Controls on seawater 231Pa, 230Th and 232Th concentrations along the flow paths of deep waters in the Southwest Atlantic, Earth Planet. Sci. Lett., 390, 93-102.
- Dulaquais, G., M. Boye, M. J. A. Rijkenberg, and X. Carton (2014), Physical and remineralization processes govern the cobalt distribution in the deep western Atlantic Ocean, Biogeosciences, 11(6), 1561-1580, doi: 10.5194/bg-11-1561-2014.

- Gerringa, L. J. A., M. J. A. Rijkenberg, C.-E. Thuroczy, and L. R. M. Maas (2014), A critical look at the calculation of the binding characteristics and concentration of iron complexing ligands in seawater with suggested improvements, Environ. Chem., doi: 10.1071/EN13072.
- Klunder, M. B., P. Laan, H. J. W. De Baar, I. Neven, R. Middag, and J. Van Ooijen (2014), Dissolved Fe across the Weddell Sea and Drake Passage: impact of DFe on nutrients uptake in the Weddell Sea, Biogeosciences, 10(4), 7433-7489, doi: 10.5194/bg-11-651-2014.
- Rijkenberg, Micha J.A., Rob Middag, Patrick Laan, Loes J. A. Gerringa, Hendrik M. van Aken, Véronique Schoemann, Jeroen T. M. de Jong, Hein J. W. de Baar. The distribution of dissolved iron to the West Atlantic Ocean. PlosONE, in press.

Submitted:

- Middag, R., T. Conway, S. John, K. W. Bruland, and H. J. W. de Baar, Intercomparison of dissolved trace elements at the Bermuda Atlantic Time Series Station, submitted.
- Middag, R., M. van Hulten, M. van Aken, M. Rijkenberg, L. Gerringa, P. Laan and H. de Baar. Aluminium in the Oceans: Unique Mirror Image of the Biological Cycle, submitted.
- Rijkenberg, M. J. A., De Baar, H. J. W., K. Bakker, L. J. G. Gerringa, E. Keijzer, M. Laan, P. Laan, R. Middag, S. Ober, and M. G. Smit. "PRISTINE": a new high volume sampler for ultraclean sampling of trace metals and isotopes, submitted.

Submitted on behalf of all participants by Micha Rijkenberg (Micha.Rijkenberg@nioz.nl).

New Zealand

The NZ GEOTRACES research voyage (June 2011) data workshop took place at Wellington, New Zealand in April 2013, with 12 scientists in attendance. Hydrographic and biogeochemical data were presented and discussed arising from the transect along the GP13 line, west to east along 32.5oS from 172 °W to 150°W in the South Pacific gyre.

The first paper from the NZ Geotraces research voyage was published in June 2012: "Law, C.S., Breitbarth, E., Hoffmann, L.J., McGraw, C.M., Langlois, R.J., LaRoche, J., Marriner, A. and Safi, K.A. 2012. No stimulation of nitrogen fixation by non-filamentous diazotrophs under elevated CO2 in the South Pacific, Global Change Biology, 18:3004–3014, doi: 10.1111/j.1365-2486.2012.02777.x

Three NZ scientists (PhD student Mr John Rolison, PhD student Mr Ejin George and Dr Rob Middag) participated in the 3 legs of the Netherlands GEOTRACES cruises in the Mediterranean and Black Sea (Leg 1: (# 64PE370) Lisbon to Istanbul – May 14, 2013 to June 5, 2013; Leg 2: (# 64PE373) Istanbul to Istanbul – July 13, 2013 to July 25, 2013; Leg 3: (# 64PE374) Istanbul to Lisbon – July 25, 2013 to August 11, 2013). Shipboard measurements were done for dissolved aluminium at 65 stations resulting in 1401 samples. At 64 stations samples were collected and extracted shipboard for the metals Y, Cd, La, Pb, Sc, Ti, Mn, Fe, Ni, Zn and Ga, resulting in 1422 extracts that were analysed at the ICP-MS facility of the University of California Santa Cruz during a 1 week visit. Samples for Fe and Cd isotopes were collected at all three legs resulting in 289 samples from 9 full depth stations and 24 surface stations. Additionally samples for Zn isotopes were collected at leg 1 and 3 (7 full depth stations and 20 surface stations) and samples for U isotopes at leg 2 (2 full depth stations and 4 surface stations). The U samples have been analysed and the results will be presented as an invited talk at the upcoming Goldschmidt Conference in Sacramento (June 2014, California, USA) by Assoc. Prof. Claudine Stirling. Dissolved trace metal concentrations for the Black Sea leg of this cruise will also be presented at this year's Goldschmidt Conference by PhD student Mr John Rolison.

First results of the Mediterranean cruise were presented by NZ scientists at the Ocean Science Meeting (February 2014) in Honolulu (Hawaii, USA).

Cadmium isotopic and concentration results from the NZ GEOTRACES research voyage (June 2011) will be presented at the 2014 Goldschmidt Conference, to be held in Sacramento, USA by PhD student Mr Ejin George.

The SCOR WG 139, co-chaired by Res. Assoc. Prof. Sylvia Sander from University of Otago, met in Honolulu, Hawaii on 23rd February 2014 for the third time with 14 members and three guests in attendance. Besides other business the group also discussed intercalibration efforts for organic ligand analysis as part of the GEOTRACES program. Databases for several trace metal ligand data are currently being set up in a similar way to those being accumulated for other trace metal data by GEOTRACES. The need for BIO-GEOTRACES was discussed.

New Funding

The University of Otago has funded the purchase of a Nu Attom HR-ICP-MS that will be housed in the Community Trust of Otago Centre for Trace Element Analysis.

Submitted by Rob Middag (rob.middag@otago.ac.nz).

Norway

New runs on the simulation of radionuclides over the Anthropocene period:

Repeated series of model simulations over the Anthropocene (calendar years 1700 - 2300) have been carried out with the HAMOCC2s biogeochemical ocean general circulation model (annual mean, fixed ocean circulation, realistic CO2 emissions to the atmospheric reservoir which is coupled to the water column). We explored primarily the scavenging of the radionuclide Th-230. It turned out that still large uncertainties exist on how to choose the equilibration constants (Kd values) and potential particle specific attachment of Th-230 in simulations. Experiments have been carried out in particular on simulating Th-230 in areas which are poor in suspended CaCO3 (which potentially is the main carrier phase of Th-230). In these areas, small CaCO3 concentrations could lead to assumed too high reactive surface areas (many tiny particles) which would result in a too strong reduction of the dissolved phase of Th-230 at low particle concentrations. Shifting to alternative carrier species (such as particulate organic carbon or biogenic silica) has been explored in sensitivity experiments as well.

Submitted by Christoph Heinze (Christoph.Heinze@gfi.uib.no).

Poland

Institute of Oceanology in the previous year concentrated mostly on dissolved metals in pore waters. This included Hg, Cd, Cr, Zn, Cu, Mn, Pb and As. Most of the studies performed dealt with submarine groundwater discharge as a source of metals to coastal areas. Studies concerning mercury were published in Szymczycha et al. Water Air Soil Pollut (2013) 224:1542. Below short outline of this study:

Both groundwater flow and mercury concentrations in pore water and seawater were quantified in the groundwater seeping site of the Bay of Puck, southern Baltic Sea. Total dissolved mercury (HgTD) in pore water ranged from 0.51 to 4.90 ng l−1. Seawater samples were characterized by elevated HgTD concentrations, ranging from 4.41 to 6.37 ng l−1, while HgTD concentrations in groundwater samples ranged from 0.51 to 1.15 ng l−1. High HgTD concentrations in pore water of the uppermost sediment layers were attributed to seawater intrusion into the sediment. The relationship between HgTD concentrations and salinity of pore water was non-conservative, indicating removal of dissolved mercury upon mixing seawater with groundwater. The mechanism of dissolved mercury removal was further elucidated by examining its relationships with both dissolved organic matter, dissolved manganese (Mn II), and redox potential. The flux of HgTD to the Bay of Puck was estimated to be 18.9 ± 6.3 g year−1. The submarine groundwater discharge-derived mercury load is substantially smaller than atmospheric deposition and riverine discharge to the Bay of Puck. Thus, groundwater is a factor that dilutes the mercury concentrations in pore water and, as a result, dilutes the mercury concentrations in the water column.

Submitted by Jacek Bełdowski (hyron@iopan.gda.pl).

Russia

Meetings

- In 2013 – early 2014 Russian scientists participated in 14 conference, where they have done more than 350 presentations. Among the conferences there were the three ones relevant to GEOTRACES.
- Shirshov Institute of Oceanology in Moscow (18-21 November, 2013) has held the 20-th International Scientific School - Conference on Marine Geology under the leadership of academician Alexander Lisitzin, where about 500 scientists from different institutes took part. The GEOTRACES related topics were the following: Biogeochemical processes in seas and oceans; Nano- and microparticles in the marine sedimentation processes; Geochemical processes in the deep-sea hydrothermal systems, Marine geology of the Arctic Ocean; Anthropogenic influence on the trace substances' sedimentation processes.
- Russian Lithology Conference «Sedimentation basins and post-sedimentation processes over the geological history" was held in the Institute of Oil and Gas geology RAS, Novosibirsk (28–31 October, 2013). About 200 scientists participated, many presentations was aimed to search geochemical, mineralogical and biomolecular indicators of paleoenvironmental sedimentation and ore deposits.
- Russian Conference "Geochemistry of Lithogenesis" was held in Syktyvkar, March 17-19, 2014 by the Geology Institute of the Ural branch of RAS. There were about 60 participants. Among the themes of presentations related to GEOTRACES I may mention presentations on the methodical geochemical issues as well as mineralogical and geochemical indicators of the sedimentary phases.

Cruises

- During 2013 the five expeditions were held: Multidisciplinary investigations in the White Sea on *R/V Ecolog* (17-27 August 2013), in the Caspian Sea on *R/V Capitan Shurekov* (21 August -10 September 2013), in the Kara Sea on *R/V Professor Shtokman* (3-23 September 2013), in the NE Pacific on *R/V Akademic Lavrent'ev* (area close to the Piip Volcano). In addition Russian scientist dr. Sergey Pisarev (Shirshov Institute of Oceanology) participated in the international cruise of the ice boat "TARA TSG"(France) in the Kara and Laptev Seas.
- In December 2013 the ship time proposals have been submitted for cruises in 2014. Until now we have not a response.

New funding

- We have information about supporting of the 5 initiative projects from the Russian Foundation on Basic Research (RFBR), but forthcoming funding (grants) is not sufficient for the Arctic expedition. A special proposal for this was submitted to a new Russian Scientific Foundation.

New results

- A new indicator of the fresh and saline water mixing for areas of strong river run-off influence was offered by Prof. Peter Makkaveev and dr. Yury Nalbandov (Shirshov Institute of Oceanology, Moscow): it is the Alkalinity/Salinity ratio. When the river waters mix with sea water the Alk/Cl ratio increases. These results from the fact that in river water the Alk/Cl ratio is much higher than that in the sea water. Value of the Alk/Cl ratio > 0.06 – 0.08 points to the presence of the river water. In areas under the strong river run-off influence, value of Alk/Cl ratio may reach up to 5 - 7 and even more. Based on the hydrochemical data base for the Ob River estuary (Obskaja Guba) an evolution of the

Alk/Cl ratio over 37 years (1976 - 2013) was studied (figure 2, unpublished data). A river water - sea water contact zone' location was found to have not only a seasonal change but interannual ones also, that depends on variation in the river-runoff volume.

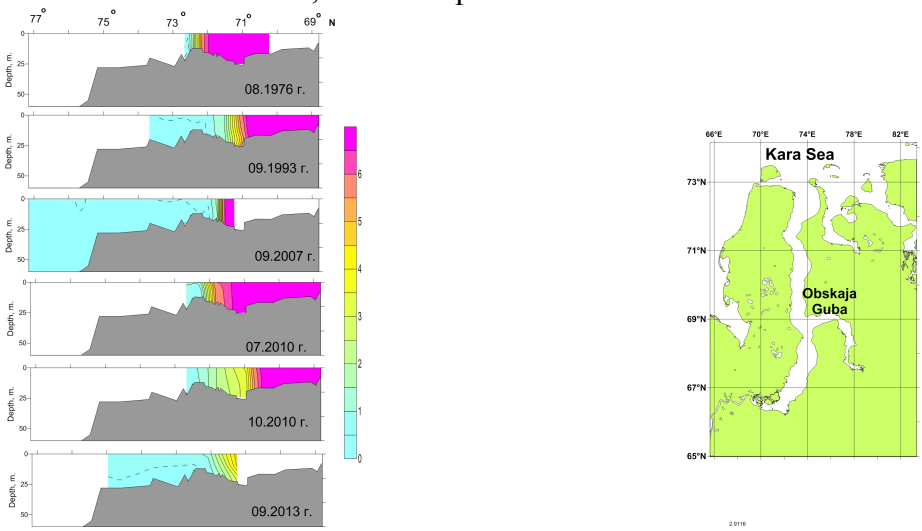

Figure 2. *Evolution of the Alk/Cl ratio in the Ob River estuary (Obskaja Guba)-the Kara Sea longitudinal transect over 37 years (unpublished data of Makkaveev and Nalbandov, IORAS).*

- Distribution of total dissolved molybdenum, tungsten, vanadium, and uranium in the surface water of the Atlantic Ocean was studied by dr. Maria Rimskaya-Korsakova and prof. Alexander Dubinin (figure 3) (Rimskaya-Korsakova, Dubinin, et al., 2013).

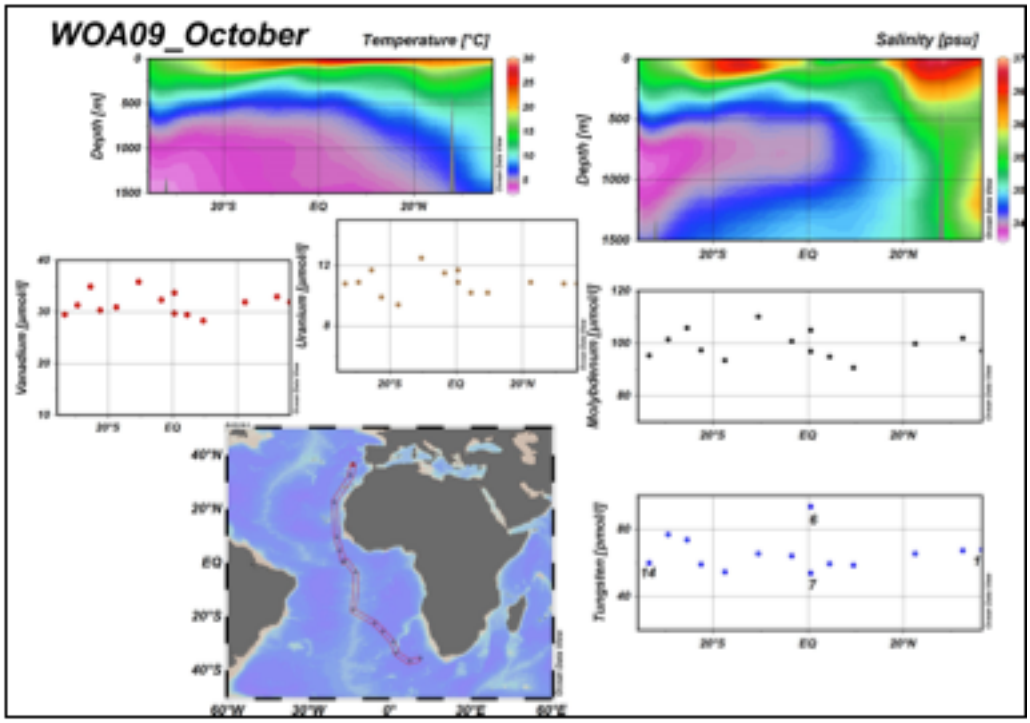

Figure 3. *Distribution of total dissolved molybdenum, tungsten, vanadium, and uranium in the surface water of the Atlantic Ocean*

- For the first time the abundance of algae Pseudo-nitzschia seriata that are enriched in Chlorophyll-a was detected in the near-bottom water (depth of 295–424 m) in the Caspian Sea. The low boundary of phytoplankton prevalence is the depth of 500 m. In the open Caspian Sea the Chlorophyll-a maximum was found to be deepen to the low boundary of a

seasonal thermocline (from 20 to 60 m, figure 4). From this it follows that the primary production' estimation based on satellite data may be incorrect in this basin as soon as the light scanners cover only surface water layer that doesn't exceed a few meters.

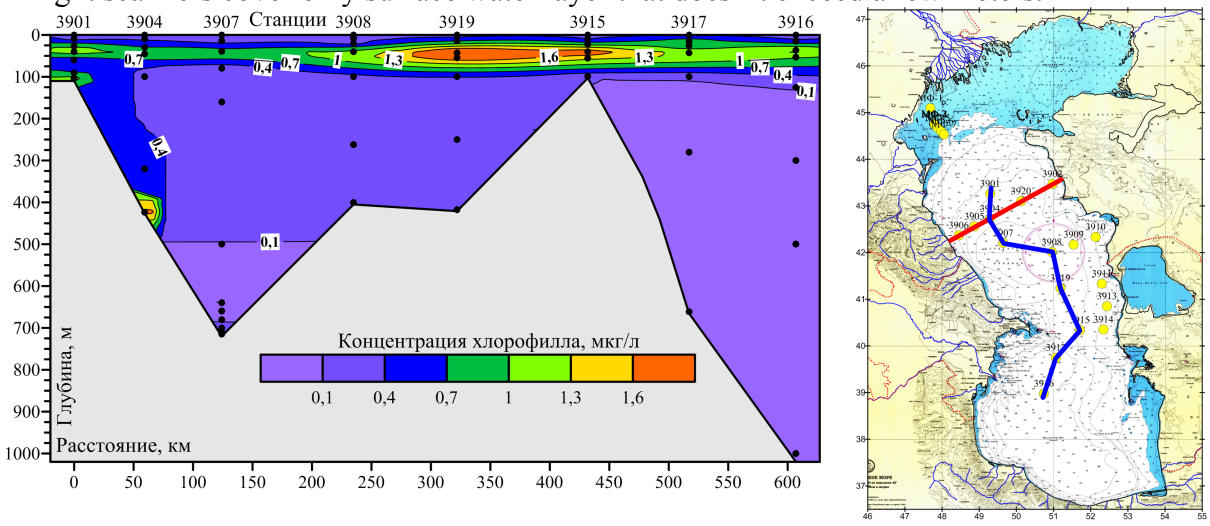

Figure 4. *Chlorophyll-a distribution along the longitudinal transect (blue color) in the Caspian Sea in May-June 2013, cruise 39 of R/V «Rift». Unpublished data of dr. Marina Kravchishina, Shirshov Institute of Oceanology, Moscow. Abscissa axis is the transect length, km; axis of ordinates is sea depth, m; Chlorophyll-a concentrations, µg/l, are shown in different colours.*

- Examination of the distribution pattern of total dissolved Fe and Mn at the deep-sea hydrothermal vent field 9o50'N, East Pacific Rise (fig. 5) let us to suppose that the TDFe/TDMn ratio might be a tracer of the hydrothermal fluids and ocean water mixing' processes (Demina et al., 2013), along with earlier well documented tracers such as temperature, pH and H2S concentration (Sarradin et al., 1999; German et al., 2010).

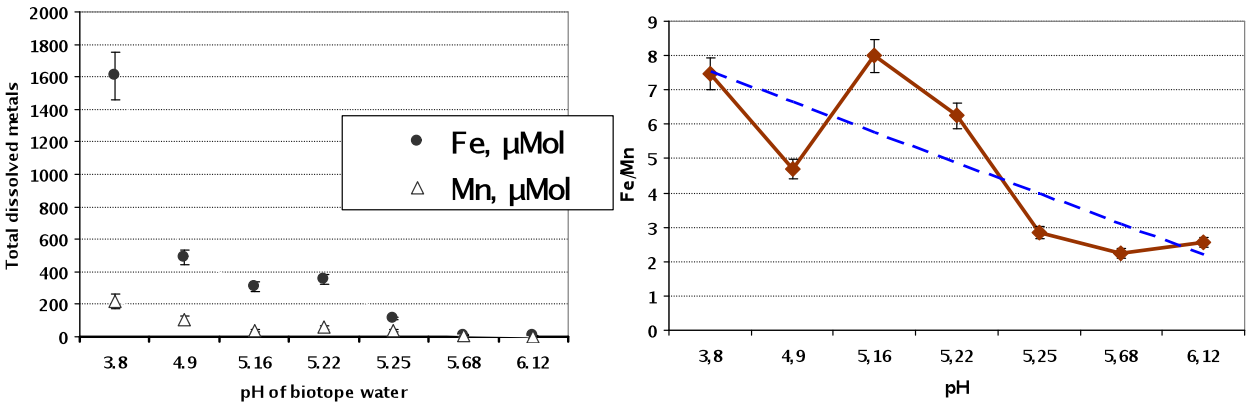

Figure 5. *Concentrations of TDFe and TDMn (a) and the TDFe/TDMn ratio versus pH in the biotope water of the Mussel Bed site (the 9°50'N hydrothermal vent field, the East Pacific Rise) (Demina et al., 2013).*

New publications

Monographies

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Submitted by Liudmila Demina (l_demina@mail.ru).

Slovenia

New results

- Our research performed in the Gulf of Trieste confirmed that the Gulf is the sink of CO2 throughout the year. The river plumes of particulate matter and dissolved nutrients play an important role in carbon cycling by direct inputs of terrigenic carbon, enhancing increased biological activity of the Gulf through the supply of riverine nutrients.
- Measurement of 226Ra activity concentrations are often used to estimate supported levels of 210Pb for purposes of geochronology. However, the implicit assumption that supported 210Pb and 226Ra are in secular equilibrium may not always be true because the migration of an intermediate product, gaseous 222Rn. As a consequence, supported 210Pb activity concentration might be lower than the measured 226Ra value, which was the case in a core collected from the South Adriatic Pit. Therefore, we proposed a new approach to improve the determination of supported 210Pb, which is based on correction of 226Ra activity concentrations using the average (210Pb/226Ra) activity ratio in deeper sediment layers.
- Mercury (Hg) concentrations and isotopic compositions were examined in surficial sediments in Mediterranean Sea to assess the use of Hg isotopes to trace sources of Hg in deep-sea sediments. The concentrations of total Hg in selected sediments ranged between 0.07 and 0.76 nmol g-1 and vary irregularly with depth, which may reflect changes or redistribution during diagenetic processes. The highest concentrations were determined in Algerian Sea, while the lowest was found in Levantine Basin. At most sampling locations the data deviate from an average δ202Hg of -0.76 ± 0.16‰ established for background sediments in Mediterranean Sea. The δ202Hg values were variable ranging between -2.30 and 0.02‰ indicating different Hg origin. Both odd isotopes deviate from the theoretical mass-dependent fractionation line (Δ199Hg, Δ201Hg), showing that surface sediments were subject to mass-independent fractionation (MIF) with Δ199Hg = +0.10 ± 0.04‰ and Δ201Hg = +0.04 ± 0.02‰. These slightly positive values indicate that the cause of MIF could be photochemical reduction of Hg2+. Down-core δ202Hg values do not show a clear pattern and were site specific implying either multiple sources, or varying amounts of microbial Hg reduction and loss, or a combination of both. Further evaluation is in progress in order to fully explain the distribution of Hg stable isotopes in Mediterranean Sea.
- In the framework of the GMOS project further measurements of Hg in air, precipitation, and water continued. In 2013 the measurements of Hg in air using research aircraft were done in the western part of Slovenia.

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Original scientific articles

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Submitted by Nives Ogrinc (nives.ogrinc@ijs.si).

South Africa

In 2013, South African scientists participated in the SANAE53 Cruise to the Southern Ocean on the BONUS-GOODHOPE line. Three collaborative projects were combined to constitute the South Atlantic Fe Pool project: "SAFePool project": The first project "Bioactive trace elements in the Southern Ocean" (PI: Prof. A. Roychoudhury) focuses on the regional and vertical distribution of different Iron species (i.e., particulate, dissolved, and soluble species) across Southern Ocean fronts. The second project focuses on the impact of dissolved iron addition on phytoplankton photosynthetic performance and production under different light regimes Fe, light limitations in Antarctic phytoplankton (PI: Dr. Thato Mtshali) and the third one "Speciation of particulate iron: Photochemical and biological transformation" (PI: Dr P. Lam) focuses on the distribution of Fe mineralogy and its lability for phytoplankton uptake.

Aims of this project are to:

1. Characterize and quantify the ferricline region in the south Atlantic Ocean region.
2. Understand the distribution and processes of Fe pool in this ocean region
3. Understand how Southern Ocean phytoplankton community responds to Fe and light deprivation and what control the phytoplankton growth?
4. Investigate the biologically and photo-chemically-mediated transformations of particulate iron minerals for phytoplankton uptake.

Apart from the on-board deck experiments, much of the work, however, focused on calibrating the sampling system and trouble shooting contamination issues related to dissolved iron measurement. There are still problems with the sampling protocol using the CTD system. We believe that some of the contamination issues encountered are related to the sampling vials used. Cross-over station data show somewhat higher than previously measured Fe concentrations and replicates show random variation.

Conferences

- B.P. von der Heyden, A.N. Roychoudhury and S.C.B. Myneni (2013) Quantification and speciation study of the marine solid-phase iron pool. 23rd Annual V M Goldschmidt Conference, Florence, Italy, August 25 –31, 2013.

Publications

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- Coleen L. Moloney, Sean Fennessy, Mark J. Gibbons, Alakendra Roychoudhury, Frank A. Shillington, Bjorn P. von der Heyden, Kate Watermeyer (2013) What is the evidence for offshore marine ecosystem 1 change in South Africa? African Journal of Marine Science, 35(3), pp 427-448. DOI: 10.2989/1814232X.2013.836135.
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Activities of interest

As representative of South African GEOTRACES program, Prof. Roychoudhury attended the Western Indian Ocean Regional Focus Group Meeting to help plan the IIOE-2 initiative in Mauritius. SCOR is thanked for providing travel funds. Representatives of 18 countries attended the meeting and the outcome of the meeting was a participant statement confirming broad regional cooperation through facilitation of collegial interactions, collaborative working relationships, and mutual synergistic engagement in planning exercises. Establishment of IIOE-2 was strongly supported by all:

"*We strongly support the establishment of an IIOE-2 for 2015-20, as a unique opportunity for regional collaboration in marine research, training, capacity-building and societal application, in alignment with the Decision of the 27th meeting of the 146 Member States of the Assembly of the IOC of UNESCO in 2013. That Decision called for an IIOE-2 proposal to be addressed at the 47th meeting of the Executive Council of the IOC of UNESCO in 2014.*"

New Funding

- Fietz, S, Roychoudhury, AN and Bjorn Munro_Jenssen (2013 – 2015) Southern Ocean Phytoplankton Adaption to mimicked future changes in light and iron availability - Molecular bases and modelling (SOPA) South Africa – Norway Bilateral cooperation grant, R 2,500,000

Submitted by Prof. AN Roychoudhury (roy@sun.ac.za).

Spain

National committee (under SCOR-Spain)

- P. Masqué, E. Garcia-Solsona, J. Garcia-Orellana (Barcelona-UAB)
- A. Tovar-Sanchez (Mallorca-CSIC)
- A. Cobelo, R. Prego, J. Santos (Vigo-CSIC)
- J. Magdalena Santana-Casiano, Melchor González-Dávila (Canarias-ULPGC)

We co-organized the GEOTRACES section GA04-S (Mediterranean Sea) on board the R/V Ángeles Alvariño between May 2nd and June 1st 2013. We sampled about 100 depths at 10 stations to analyze a suite of isotopes including ^{231}Pa/^{230}Th, ^{236}U, ^{238}U, Pu isotopes, ^{137}Cs, ^{90}Sr, ^{129}I, ^{234}Th, ^{237}Np, ^{228,226}Ra, Nd-isotopes and Deuterium. We also carried out some experiments on ^{210}Pb and ^{210}Po using several techniques to evaluate potential differences between methods. We also deployed ISP (n=6) in order to collect particles to analyze particulate trace metals.

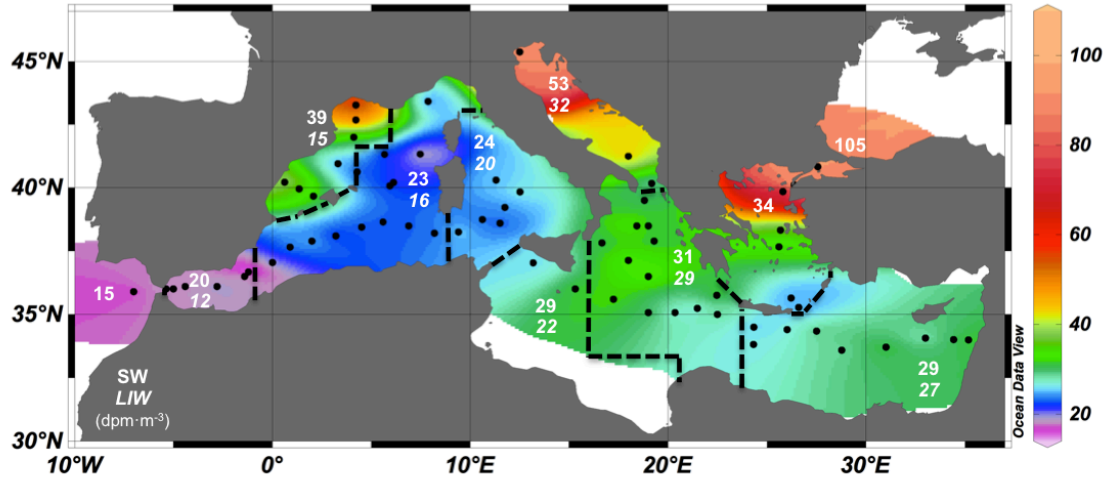

Figure 6. Distribution of ^{228}Ra in the upper MS. *The contour plot is based on the ^{228}Ra concentrations measured in SW of the MS. ^{228}Ra inputs from continental margins are revealed from the highest concentrations in coastal areas and the progressive enrichment in ^{228}Ra when surface waters move to the easternmost part of the basin. The average ^{228}Ra concentration in each sub-basin was used to determine the contribution of SGD to the Mediterranean Sea. (Rodellas et al., submitted),*

- Participation at a meeting held at ETH-Zurich in March 2013 to coordinate U-236 studies in the frame of GEOTRACES. Samples from the Arctic, Southern Ocean, Atlantic, Mediterranean and Pacific have been collected during the last year to evaluate the usefulness of 236U as tracer of water masses.
- Participation in the French GEOVIDE cruise on May 2014 to undertake an integrated oceanographic transect in the North Atlantic Ocean and Labrador Sea (GEOTRACES GA01 section), collecting samples for artificial (i.e. 236U, Pu isotopes, 137Cs, 90Sr, 129I) and natural (i.e. 7Be, 210Po and 210Pb) radionuclides.
- Participation in the planning activities of two expeditions lead by Germany in the Arctic Ocean onboard Polarstern in 2015 and 2016.
- Participation at the Mediterranean GEOTRACES workshop that will be held in Barcelona in July 10th, that lead to share data from different labs and determine the contributions from each lab involved in the cruise.

GEOTRACES-related projects/grants

- PROJECT TITLE: Land-sea exchange of trace metals and its importance for marine phytoplankton in an upwelling coast (MITOFITO).
  IPs: Manuel Varela and Ricardo Prego.
  Funded by the 'Ministerio de Economía y Competitividad' of Spain, CTM2011-28792-C02. http://www.co.ieo.es/proyectos/mitofito/
- PROJECT TITLE: Carbon export of the upper ocean under diverse ice covre regimes in the Arctic Ocean (CARICE)
  IP: Pere Masqué.
  Funded by: 'Ministerio de Ciencia e Innovación' of Spain, CTM2011-28452.
- PROJECT TITLE: Metal Transport in the Environment (MetTrans).
  IP: Don Porcelli (U. Oxford).
  Funded by EU FP7-People-2011-ITN, 290336.
- PROJECT TITLE: Iron biogeochemistry in acidified marine environments (ECOFEMA).
  IP: J. Magdalena Santana Casiano
  Funded by Ministerio de Ciencia e Innovación. CTM2010-19517 (subprograma MAR), 2010-2013.
- PROJECT TITLE: Volcanic eruption at El Hierro island. Sensitivity and recovery of the marine ecosystem (VULCANO).
  IP: E. Fraile Nuez (IEO). Researchers: J. Magdalena Santana-Casiano, M. González-Dávila, Milagro Rico (ULPGC).
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GEOTRACES-related articles

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- Caetano M, Vale C, Anes B, Raimundo J, Drago T, Schimdt S, Nogueira M, Oliveira A, Prego R. 2013. The Condor Seamount at MidAtlantic Ridge as a supplementary source of trace and rare earth elements to the sediments. Deep-Sea Research II, 98A: 24-37.
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- Rigaud S, Puigcorbé V, Camara-Mor P, Casacuberta N, Roca-Martí M, Garcia-Orellana J, Benitez-Nelson CR, Masque P and Church T. 2013. A methods assessment and recommendations for improving calculations and reducing uncertainties in the determination of 210Po and 210Pb activities in seawater. Limnology and Oceanography Methods 11, 561-571.
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- Casacuberta N, Christl M, Lachner J, Rutgers van der Loeff M, Masqué P, Arno Synal H. A first transect of U-236 in the Noth Atlantic Ocean. Geochimica et Cosmochimica Acta 133, 34 – 46.
- Garcia-Solsona E, Jeandel J, Labatut M, Lacan L, Vance D, Chavagnac V, Pradoux C. 2014. Rare earth elements and Nd isotopes tracing water mass mixing and particle-seawater interactions in the SE Atlantic. Geochimica et Cosmochimica Acta, Volume 125, 351-372.
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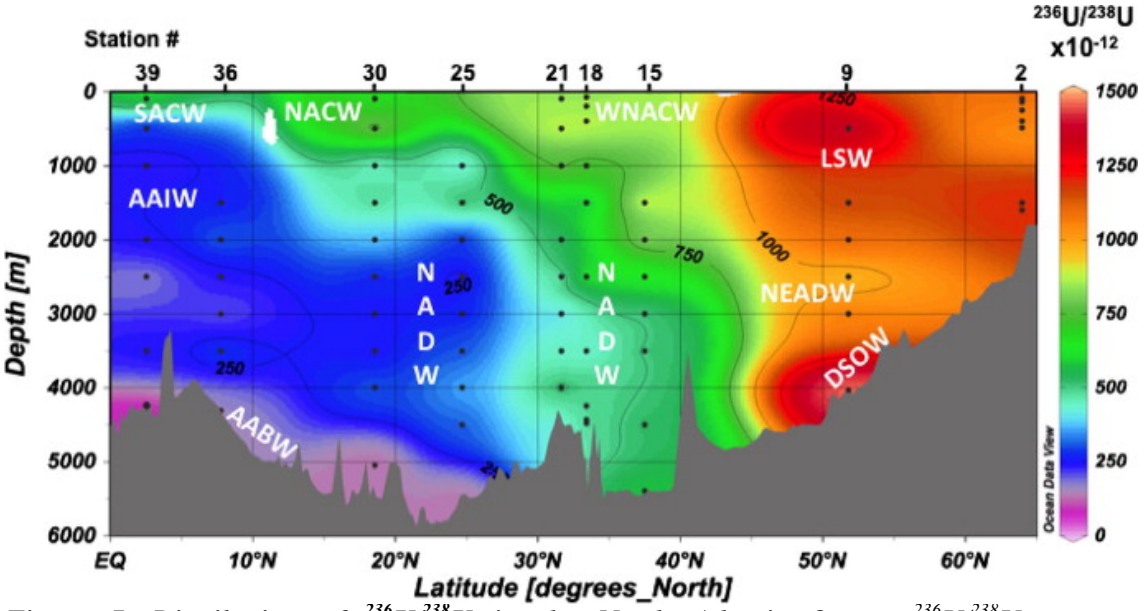

Figure 7. Distribution of $^{236}U/^{238}U$ in the North Atlantic Ocean. *$^{236}U/^{238}U$ ratios are in correspondence to the different water masses in the region. Casacuberta et al., 2014.*

Contributions to conferences

- 12th International Estuarine Biogeochemistry Symposium (IEBS2013). http://www.iebs2013.org/ Plymouth University, 30th June - 4th July 2013.
- Grenier, M., E. Garcia Solsona, N. Lemaître, T. Trull, and C. Jeandel. Rare Earth Element concentration and neodymium isotopic compositions of seawater around the Kerguelen Plateau: Tracing Land-to-Ocean sources and ocean circulation. Ocean Sciences Meeting, Hawaii, 23-28 February 2014.
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- Cobelo-García A, Prego R, Santos-Echeandia J, Doval MD, Varela M. Seasonal Patterns of Nutrients and Bioactive Trace Elements in the North Atlantic Upwelling System (NW Iberian Peninsula). 12th International Estuarine Biogeochemistry Symposium (IEBS2013) Plymouth University, 30th June - 4th July 2013.
- Kenna, T. and Masqué, P. (2014). Anthropogenic radionuclides in the Atlantic Ocean. ICRER 2014 - Third International Conference on Radioecology and Environmental Radioactivity. Barcelona (Spain). 7-12 September 2014.
- Buesseler, K.O., Black, E., Pike, S., T. Kenna and Masqué, P. (2014). Plutonium isotopes in the ocean off Japan after Fukushima. ICRER 2014 - Third International Conference on Radioecology and Environmental Radioactivity. Barcelona (Spain). 7-12 September 2014.
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global fallout and the Fukushima Dai-ichi accident. European Geosciences Union - General Assembly 2014. Vienna (Austria). 27 April – 02 May 2014.

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- Masqué, P., Casacuberta, N., Pike, S., Castrillejo, M. and Buesseler, K.O. (2014). Evolution of Cs-137, Cs-134 and Sr-90 in the Pacific Ocean derived from the Fukushima Dai-ichi nuclear accident. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Kenna, T.C. and Masqué, P. (2014). Anthropogenic radionuclides in the Atlantic Ocean: results from U.S. GEOTRACES North Atlantic zonal transect GA03. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Casacuberta, N., Christl., M., Vockenhuber, C., Walther C., Rutgers van der Loeff, M., Masqué, P. and Synal, H.-A. (2014). Distribution of 236U, 129I and 240Pu/239Pu ratios in Arctic Ocean waters. 2014 Ocean Sciences Meeting. Honolulu (USA), 23-28 February 2014.
- Jonkers, L., Zahn, R., Masque, P., Thomas, A., Henderson, G., Abouchami, W., François, R. and Bickert, T. (2013). Water mass influence on sedimentary Pa/Th: insights from a paired Pa/Th and neodymium isotope record from the South Atlantic. 11th International Conference on Paleoceanography. Sitges-Barcelona (Spain). 1-6 September, 2013.
- Casacuberta, N., Christl, M., Lachner, J., Rutgers van der Loeff, M., Puigcorbé, V., Synal, H. A., Masqué, P. (2013). The first transect of U-236 in the North Atlantic Ocean. ASLO 2013 Aquatic Sciences Meeting. New Orleans (USA), 17-22 February 2013.
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- M. González-Dávila, J. M. Santana-Casiano, A. González, M. Rico, A. López. Characterization of phenolic exudates from Phaeodactylum tricornutum and their effects on the chemistry of Fe(II)-Fe(III). Gordon Research Conference. Chemical Oceanography. University of New England, Biddeford, ME, August 4-9, 2013
- J. M. Santana-Casiano, M. González-Dávila, E. Fraile-Nuez The natural ocean acidification and fertilization event caused by the submarine eruption of El Hierro. Gordon Research Conference. Chemical Oceanography. University of New England, Biddeford, ME, August 4-9, 2013
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- N. Pérez-Almeida, M. González-Dávila, J. M. Santana-Casiano, A. G. González, M. Suárez de Tangil. Oxidation of Cu(I) in Seawater at Low Oxygen Concentrations. Goldschmidt Conference. Florence, Italy, August 25-30. 2013
- E. Fraile-Nuez, J. M. Santana-Casiano, M. González-Dávila. The submarine volcano eruption at the island of El Hierro: physical-chemical perturbation and biological response. AGU Fall meeting. San Francisco, USA, December, 9-13, 2013
- J. M. Santana-Casiano, M. González-Dávila, E. Fraile-Nuez. The natural ocean acidification and fertilization event caused by the submarine eruption of El Hierro. AGU Fall meeting. San Francisco, USA, December, 9-13, 2013

Submitted by Jordi Garcia-Orellana (Jordi.Garcia@uab.cat).

Sweden

Meetings

- Ocean Sciences 2014: David Turner participated in the SCOR WG139 meeting, and also gave a talk "CLE-CSV titrations in seawater: chemical speciation modelling" at the session organised by WG139.
- David Turner participated in a chemical speciation workshop in Liverpool, April 2014.
- Intercalibration committee meeting 1 to 3 May 2013 in Stockholm, Sweden. Host; Swedish Museum of Natural History, Department of Geosciences Per Andersson. Participants; Greg Cutter (Chair), Lou Codispoti, Rutgers van der Loeff, Roger Francois, Maeve Lohan, Peter Croot and Hajime Obata).
- Per Andersson participated in Intercalibration committee and Data management committee meeting in Bremerhaven 30 Sept. to 1 Oct. 2014.

New proposals

- David Turner, together with Simon Clegg (University of East Anglia, UK), submitted a proposal for a new SCOR WG "MARCHEMSPEC: Chemical Speciation Modelling in Seawater to Meet 21st Century Needs"
- David Turner has applied to the Swedish Research Council for the Tage Erlander Guest Professorship, to fund a 9 month visit to Gothenburg for Simon Clegg in 2015. The planned work coincides to a large extent with the SCOR proposal.

Project start

- "Particle transport derived from isotope tracers and its impact on ocean biogeochemistry: a GEOTRACES project in the Arctic Ocean". A joint French-Swedish project to study particle transport by U-series nuclides with start-up meeting 31 March 2013 in Paris. A PhD-student, Sandra Gdaniec started 1 November 2013.

Related projects

- "Climate warming in Siberian Permafrost Regions; tracing the delivery of carbon and trace metals to the Arctic Ocean". The main objective is to study a large basin dominated by permafrost and the impact of changing temperatures on the delivery of TEI to the Arctic Ocean. Second field season with 4 weeks of work along the Lena River and tributaries during 2013.

Forward look: Icebreaker Oden will not contribute to GEOTRACES in the Arctic Ocean 2015

- While Oden is "booked" for GEOTRACES in 2015, the Swedish Polar Research Secretariat (SPRS) does not have funds for more than 15 days, enough for a return trip to Svalbard. GEOTRACES needs an additional 20 days at 50 k€ per day, 1 M€ in total. Approaches to the major Swedish funding agencies have thus far drawn a blank.
- The use of Oden for a GEOTRACES cruise in the Arctic 2015 has now been cancelled. It has not been possible to secure funds for the entire cruise. Because the planning window is becoming too narrow for a 2015 cruise, discussions with SPRS lead to the conclusion to stop active planning for 2015 cruise using Oden. However, SPRS will continue to work out alternative sampling plans for the funded Joint-Swedish-French Arctic GEOTRACES project.

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United Kingdom

Meetings and workshops

- GA10 workshop and synthesis of results was held in Oxford University on the 8-9th January 2014. Plans for new publications and synthesis papers were discussed.
- Maeve Lohan (University of Plymouth) attended 2 intercalibration meetings in Stockholm Sweden in May 2013 and Bremerhaven in October 2013 as part of the Standard and Intercalibration Committee.
- Participation in SCOR Working group 139 in Hawaii in February 2014.

- Presentations at Goldschmidt 2013:

  1. Understanding the marine biogeochemical cycle of Pb in the Equatorial Atlantic. Luke J. Bridgestock, Maxence Paul, Tina van de Flierdt, Mark Rehkämper, Eric Achterberg, Maeve Lohan
  2. Iron availability controls phytoplankton ecophysiology in the South Atlantic Subtropical Convergence Zone Thomas J. Browning, Heather Bouman, Gideon Henderson, Mark Moore, Christian Schlosser, Glen A. Tarran and Malcolm Woodward
  3. Assessing the dissolution of marine sediment with 230Th, and the impact of dissolution on sedimentary 231Pa/230Th Feifei Deng, Gideon Henderson, Alex Thomas, William Homoky and Rachel Mills
  4. The role of the Mid-Atlantic Ridge for chemical fluxes in the Atlantic: Clues from Ra and Ac isotopes Walter Geibert, Yu-Te Hsieh and Gideon Henderson
  5. Rare Earth Element distributions as tracers of micronutrient input and Nd cycling in the South Atlantic Deborah Hembury, Xinyuan Zheng, Philip Holdship, Peter Scott, Matthew Pointing and Gideon Henderson
  6. Trace metal inputs from river-fed and river-starved margin sediments of the South Atlantic Ocean William Homoky, Rachel Mills, Yu-Te Hsieh, Deborah Hembury, Malcolm Woodward and Gideon Henderson
  7. Suboxic sediments as an oceanic sink of isotopically-light cadmium T. J. Horner, W. B. Homoky, S. V. Georgiev, H. J. Sterin, J. L. Hannah, R. A. Mills, M. Rehkämper and G. M. Henderson
  8. Comparison of 228Ra and microstructure derived ocean mixing rates and chemical fluxes in the Cape Basin Yu-Te Hsieh, Walter Geibert, Matthew Palmer, Malcolm Woodward and Gideon Henderson
  9. Provenance tracing of aerosols in the South Atlantic ocean using Pb and Nd isotopes and select trace and rare earth elements. Roulin Khondoker, Dominik Weiss, Tina van de Flierdt, Mark Rehkämper, Rosie Chance, Alex Baker, Stanislav Strekopytov, Emma Williams, Jens Najorka
  10. A low blank technique for the measurement of iron isotopes in seawater and results from the tropical Atlantic Ocean Jesscia Klar, Rachel James, I. J. Parkinson, Eric Achterberg and Christain Schlosser
  11. Neodymium isotopic composition and concentration in equatorial to North Atlantic seawater. Myriam Lambelet, Tina van de Flierdt, Kirsty Crocket, Mark Rehkämper, Katharina Kreissig, Barry Coles, Micha J.A. Rijkenberg, Loes Gerringa, Henrik M. van Aaken, Hein J.W. De Baar
  12. Biogeochemical cycle of dissolved zinc and cobalt in the South Atlantic Maeve Lohan, Neil Wyatt, Angela Milne and Malcolm Woodward
  13. Lead isotopes and concentrations in the South Atlantic from the UK GEOTRACES transect along 40S Maxence Paul, Tina van De Flierdt, Mark Rehkämper, Dominic Weiss, Maeve Lohan and Gideon Henderson

14. Modelling scavenged ocean tracers: Rare earth element transport and fractionation Yves Plancherel, Xinyuan Zheng, Peter Scott, Samar Khatiwala and Gideon M. Henderson
15. Nitrogen isotope biogeochemistry of the South Atlantic R. E. Tuerena, R. S. Ganeshram, A. Fallick, J. Dougans, A. Tait, E. M. S. Woodward

- Presentations at Hawaii 2014

1. Phytoplankton biogeography and photoacclimatory status revealed from optical signature. Heather Bouman, Tom Browning, Tom Jackson and S. Sathyendranath
2. Understanding the marine biogeochemical cycle of Pb in the Equatorial Atlantic Luke J. Bridgestock, Maxence Paul, Tina van de Flierdt, Mark Rehkämper, Eric Achterberg
3. Satellite-detected fluorescence: decoupling non-photochemical quenching from iron stress signals in the South Atlantic and Southern Ocean. Tom Browning Heather Bouman, and Mark Moore.
4. Controls on ^{232}Th, ^{230}Th and ^{231}Pa in the South Atlantic: Assessing paleo-circulation and dust-flux proxies. Gideon Henderson, Feifei Deng, Peter Scott and Alex Thomas
5. The neodymium isotopic composition of North Atlantic Deep Water revisited. Myriam Lambelet, Tina van de Flierdt, Kirsty Crocket, Mark Rehkämper, Hein J.W. De Baar
6. Zinc distributions in the Atlantic Ocean: the use of a new tracer Zn*. Maeve Lohan, Neil Wyatt, Angie Milne, Malcolm Woodward, Rob Middag and Tim Conway
7. Identifying the sources of iron to the subtropical North Atlantic: presenting particulate and dissolved data from the UK GEOTRACES A06 cruise. Angela Milne, Maeve Lohan, Christain Schlosser, Jessica Klar, Eric Achterberg
8. Lead isotope and concentration profiles from the UK-GEOTRACES South Atlantic transect along 40oS Maxence Paul, Tina Van de Flierdt, Mark Rehkamper, Dominik Weiss, and Gideon Henderson
9. Amino acids along a South Atlantic Transect (40oS) A.J.M. Sabadel, E.M.S. Woodward, R. Van Hale, R.D. Frew and P.W. Boyd
10. UK GEOTRACES: Coupled Nitrogen and Oxygen isotopes trace nitrate movement within South Atlantic water masses (40°S) Robin Tuerena, R. S. Ganeshram, Walter Geibert, A. E Fallick, A. Tait, J. Dougans and E. M. S. Woodward.
11. Basin scale distributions and interactions of ammonium. Malcolm Woodward, Tom Browning, Heather Bauman and Amandine Sabadel
12. Trace metal – nutrient stoichiometries in the Southeast Atlantic: the nutritional role of Zn Co and Cd. Neil Wyatt, Angie Milne, Tom Browning, Christian Schlosser, Jessy Klar and Maeve Lohan
13. Shelf supply and vertical mixing determine the trace metal content of surface waters in the South Atlantic Ocean along 40oS. Christian Schlosser, Jessy Klar and Maeve Lohan, Mark Moore, Eric Achterberg

National and International service

- The UK continues to host the GEOTRACES Data Assembly Centre (GDAC) at the British Oceanographic Data Centre in Southampton Oceanography centre.
- The UK is represented on the International GEOTRACES SSC and on the International Standards and Intercalibration Committee by Maeve Lohan.

Cruises

- Shelf Sea processes study was delayed until October 2014 due to issues with the new Ship the RSS Discovery and there will now be 3 cruises in 2015.

New funding

- Shelf Sea Biogeochemistry was funded by NERC 2013-2017 which is a processes study within GEOTRACES. The planned research activities involve 4 cruises over a seasonal cycle to the Celtic Sea.

New results

- Results from the GA06 and GA10 cruise are currently being prepared for publication with manuscripts being prepared for submission by September 2014.
- Data from GA10 was submitted for the IDP.

New Publications

- Browning, T.J., Bouman, H.A., Moore, C.M., Schlosser, C., Tarran, G.A., Woodward, E.M.S. and Henderson, G.M. (2014). Nutrient regimes control phytoplankton ecophysiology in the South Atlantic. Biogeosciences 11, 463-479. doi:10.5194/bg-11-463-2014.
- Browning, T.J., Bouman, H.A., Henderson, G.M., Mather, T., Pyle, D., Schlosser, C., Woodward, E.M. and Moore, (2014). Nutrient String responses of Southern Ocean phytoplankton communities to volcanic ash. Geophysical Research Letters, 41, 2581-2587 doi:10.1002/2014GL059364.
- Deng, F., Thomas, A.L., Rijkenberg, M.J.A. and Henderson, G.M. (2014). Controls on seawater 231Pa, 230Th and 232Th concentrations along the flow paths of deep waters in the Southwest Atlantic. Earth Planet. Sci. Lett. 390, 93-102.
- Wyatt, N., Milne, A., Woodward, E.M.S., Rees, A.P., Browning, T.J., Bouman, H.A., Worsfold, P.J. and Lohan, M.C. (2014) Biogeochemical cycling of dissolved zinc along the GEOTRACES South Atlantic transect GA10 at 40oS. Global Biogeochemical Cycles doi: 10.1002/2013GB004637.
- Zhao, Y., Vance, D., Abouchami, W. and deBaar, H.J.W. (2014) Biogeochemical cycling of zinc and its isotopes in the Southern Ocean. Geochemica et Cosmochimica Acta 125, 653-672 doi: 10.1010/j.cgc.2013.07.045.
- Schlosser, C., Klar, J.K., Wake, B.D., Snow, J., Honey, D.J., Woodward, E.M.S., Lohan, M.C., Achterberg E.P. and Moore, C.M. (2013) Seasonal ITCZ migration dynamically controls the location of the (sub-) tropical Atlantic biogeochemical divide. PNAS doi: 10.1073/pnas.1318670111.
- Horner, T.J., Lee, R.B.Y., Henderson, G.M., Rickaby, R.E.M. (2013) Nonspecific uptake and homeostasis drive the oceanic cadmium cycle. PNAS 110, 2500-2505. 10.1073/pnas.1213857110.
- Geibert, W., Rodellas, V., Annett, A., van Beek, P., Garcia-Orellana, J., Hsieh, Y.-T., Masque, P. (2013) 226Ra determination via the rate of 222Rn ingrowth with the Radium Delayed Coincidence Counter (RaDeCC). Limnology and Oceanography: Methods 11, 2013, 594–603. DOI 10.4319/lom.2013.11.594.
- Xue, Z. Rehkämper, M., Horner, T.J., Abouchami, W., Middag, R., van de Flierdt, T. de Baar, H.J.W. (2013) Cadmium isotope variations in the Southern Ocean. Earth Planet Sci. Lett., 382, 161-172. doi:10.1016/j.epsl.2013.09.014.

PhD theses

- Neil Wyatt successfully defended his thesis on 'The biogeochemistry of iron, Zinc and cobalt in the Atlantic Ocean: The Atlantic Meridional Transect and the UK GEOTRACES sections' in December 2013.

Other Activities

- New UK oceanographic research vessel *RSS Discovery* was delivered to Southampton in March 2013. This ship has improved facilities to undertake GEOTRACES science, including a new clean sampling container, a clean underway supply and a new conducting Kevlar winch system.
- UK announces plans for a new polar oceanographic research vessel for 2017.
- Participation in intercalibration of marine particulates.

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United States

Principal activities of the U.S. GEOTRACES program include:
1) Submitting manuscripts from a North Atlantic zonal section (GA03),
2) Completion of a Pacific section between Peru and Tahiti (GP16), and
3) Submission of proposals for work in the Arctic Ocean

Activities

North Atlantic US GEOTRACES investigators remain active in the synthesis and interpretation of results from section GA03 in the North Atlantic. Twenty-three manuscripts were submitted for a special issue of Deep-Sea Research Part-II featuring results from GA03. Bill Jenkins, Ed Boyle, Greg Cutter, Rana Fine and Bob Anderson serve as guest editors. Most of the manuscripts are currently under revision following review. A few have already been recommended for publication. It is anticipated that the review and revision process will be completed over the next few months.

A substantial amount of work remains to complete the interpretation and publication of results from GA03, especially for the more labor-intensive and time-consuming measurements. US GEOTRACES will decide at a meeting of its SSC (23-24 June 2014) whether to pursue a second DSR-II volume or to allow investigators to publish in a journal of their choice.

Eastern Tropical Pacific The second major section carried out by US GEOTRACES, in the eastern tropical Pacific roughly between Peru and Tahiti (GP16, see figure below), was completed in October - December 2013. Chief scientists were James Moffett (University of Southern California) and Christopher German (Woods Hole Oceanographic Institution).

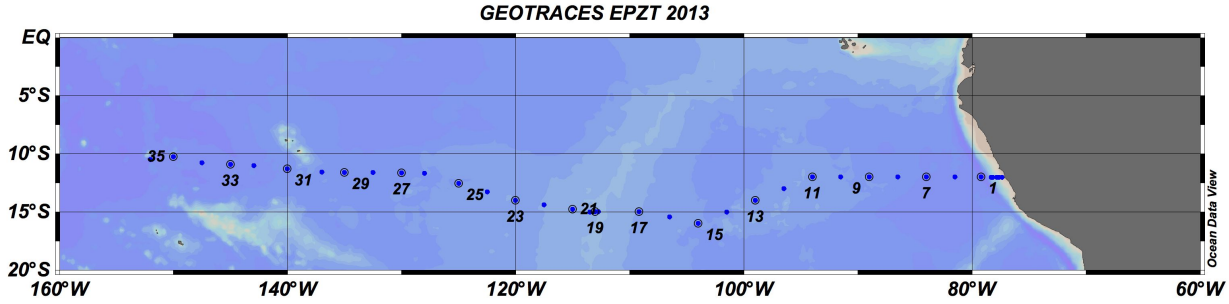

Figure 8. *Locations of stations occupied on cruise TGT303 of the Thomas G Thompson in support of the US GEOTRACES completion of section GP16.*

Cruise objectives included a comprehensive study of the biogeochemical cycle of trace elements and isotopes within: 1) the highly productive Peru upwelling system, 2) the intense oxygen minimum zone off Peru, and 3) the hydrothermal plume that extends eastward from the East Pacific Rise for up to 3000 km. Preliminary shipboard results from the cruise are presented in the figure below. These results, and other shipboard data, were presented at the Ocean Sciences Meeting (Honolulu, Hawaii, February 2014).

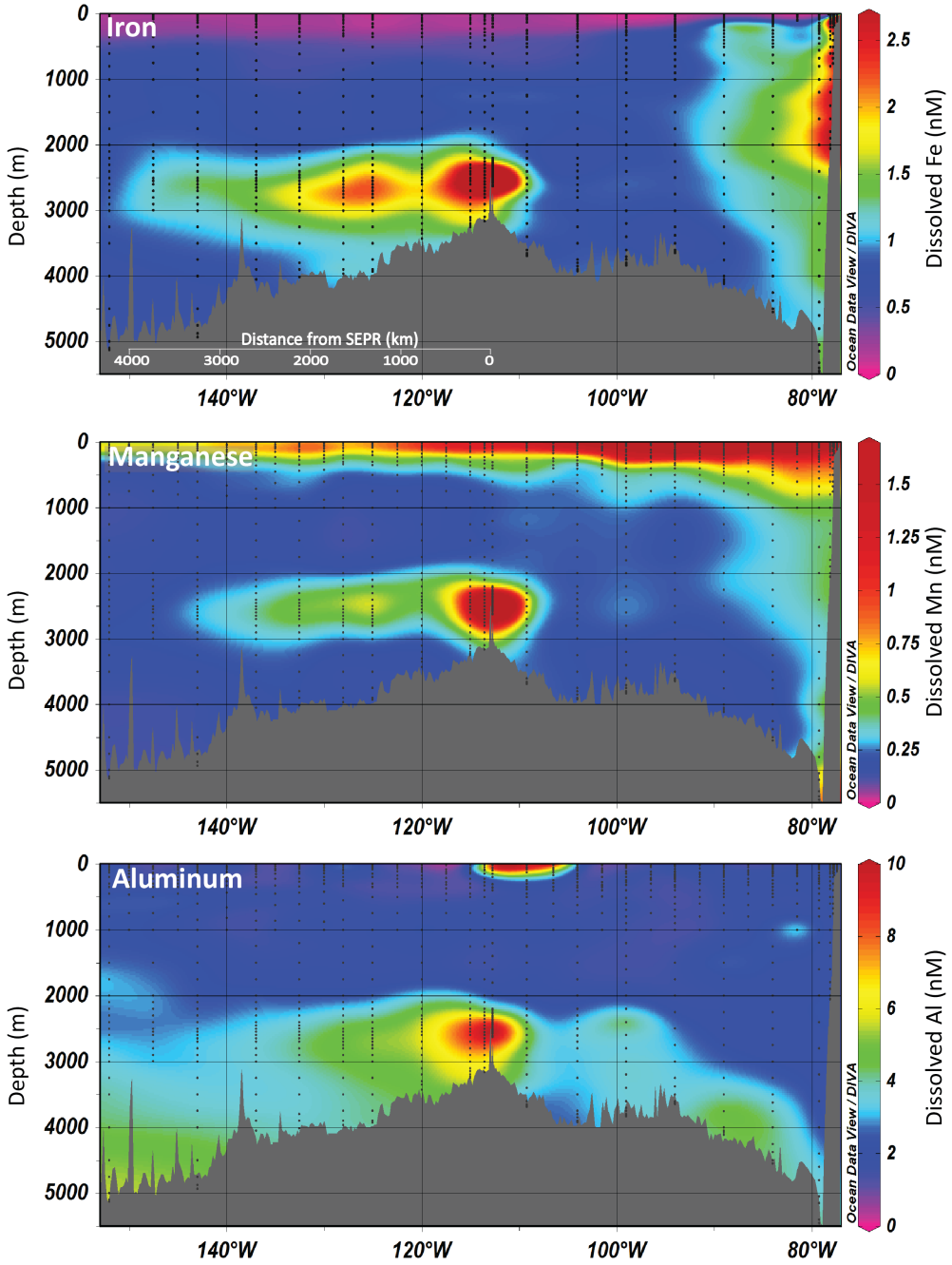

Figure 9. *Shipboard data for dissolved Fe, Mn and Al collected along section (GP16) illustrate the chemical imprint of the hydrothermal plume extending more than 3000 km (see scale) to the west of the East Pacific Rise. Additional noteworthy features include surface enrichment of Mn, enrichment of Fe and Mn near the eastern boundary, potentially related to redox cycling, and an apparent benthic source of Al. Figure credit: Joe Resing (University of Washington) and Pete Sedwick (Old Dominion University).*

Selected Research Highlights

<u>*Atlantic and Global*</u> A method for distinguishing between pollution and natural mercury in the ocean has recently been published (Lamborg et al., Nature, in press, see publications below), which relies heavily on GEOTRACES data and sampling strategy. That study found that about 300 megamoles (1500 metric tons) of pollution mercury currently resides in the ocean, a number which has never been measured before but is in agreement with some models. The

data suggest that ocean waters shallower than 1000 m have more than doubled in their mercury concentration since pre-anthropogenic conditions.

Pacific
1) See results for Fe, Mn and Al above.
2) Measured distributions of ^{7}Be along GP16 have been modeled to constrain upwelling rates and vertical diffusion in the upper thermocline. (PI, David Kadko).
3) Over 900 samples of suspended particulate material were collected along GP16, accompanied by over 300 samples of co-occurring plankton cells that can be examined for trace metal contents across TEI gradients. (PIs Ben Twining and Rob Sherrell).
4) Complementary to results for dissolved Fe, Mn and Al, shown above, particulate (>0.45 um) Fe and Mn derived from the southern East Pacific Rise (EPR) hydrothermal system are advected west at least 3300km from the ridge crest as a distinct concentration maximum centered on ~2500m depth. This is evidence of the largest hydrothermal particulate plume ever observed in the ocean. Additionally, a strong nepheloid layer is evident as a >5-fold increases in particulate metals from 4000m to near the bottom (5000m) in these central South Pacific waters (PIs Jessica Fitzsimmons and Rob Sherrell).

Planning for an Arctic Expedition
US GEOTRACES submitted a proposal to the US National Science Foundation in October 2012 requesting funding for management and logistics support of an Arctic cruise in 2015, contributing to the international GEOTRACES initiative. That proposal was declined. The management team (David Kadko, Bill Landing, Greg Cutter) submitted a revised proposal to NSF on 15 August 2013. That proposal was recommended for funding, although an award (grant) has not yet been made.

Individual investigators submitted proposals to the US NSF on 15 February 2014 requesting support for their Arctic research. Evaluation of those proposals will be completed by the end of May. It is hoped that funding decisions will be released shortly thereafter.

In anticipation that the expedition will be funded, cruise leaders for the Arctic expedition (Dave Kadko and Greg Cutter) met in March 2014 (Seattle Washington, USA) with the captain and operators of the US Coast Guard Cutter Healy, the ship that will be used in the Arctic if the expedition is funded. The meeting resolved logistics issues concerning GEOTRACES operations aboard the ship, specifically addressing procedures for operating within ice-covered waters.

New Funding
As noted above, the Arctic management proposal (providing the ship and logistic support) was recommended for funding, although an award (grant) has not yet been made.

Presentation of results
A large number of presentations based on results from the North Atlantic cruise as well as a few presentations based on preliminary results from the Pacific cruise were made at the Ocean Sciences Meeting (Honolulu Hawaii, February 2014). Additional presentations are planned for the Goldschmidt Conference (Sacramento California, June 2014).

U.S. GEOTRACES Meetings
No meetings were held during the past year. However, the US GEOTRACES SSC is scheduled to meet at the US NSF on 23 and 24 June 2014.

Publications (GEOTRACES, GEOTRACES Compliant and GEOTRACES-related)

- Conway, T.M., Rosenberg, A.D., Adkins, J.F. and John, S.G., 2013. A new method for precise determination of iron, zinc and cadmium stable isotope ratios in seawater by double-spike mass spectrometry. Analytica Chimica Acta, 793: 44-52.
- Cutter, G.A., 2013. Intercalibration in chemical oceanography-Getting the right number. Limnology and Oceanography-Methods, 11: 418-424.
- Du, J.Z., Moore, W.S., Hsh, H.F., Wang, G.Z., Scholten, J., Henderson, P., Men, W., Rengarajan, R., Sha, Z.J. and Jiao, J.J., 2013. Inter-comparison of radium analysis in coastal sea water of the Asian region. Marine Chemistry, 156: 138-145.
- Fitzsimmons, J.N. and Boyle, E.A., 2014. Assessment and comparison of Anopore and cross flow filtration methods for the determination of dissolved iron size fractionation into soluble and colloidal phases in seawater. Limnology and Oceanography: Methods, 12: 244-261.
- Hayes, C.T., Anderson, R.F., Fleisher, M.Q., Serno, S., Winckler, G. and Gersonde, R., 2013a. Quantifying lithogenic inputs to the North Pacific Ocean using the long-lived thorium isotopes. Earth and Planetary Science Letters, 383: 16-25.
- Hayes, C.T., Anderson, R.F., Jaccard, S.L., Francois, R., Fleisher, M.Q., Soon, M. and Gersonde, R., 2013b. A new perspective on boundary scavenging in the North Pacific Ocean. Earth and Planetary Science Letters, 369: 86-97.
- Homoky, W.B., John, S.G., Conway, T.M. and Mills, R.A., 2013. Distinct iron isotopic signatures and supply from marine sediment dissolution. Nature Communications, r: DOI: 10.1038/ncomms3143.
- Hong, G.H., Baskaran, M., Church, T.M. and Conte, M., 2013. Scavenging, cycling and removal fluxes of 210Po and 210Pb at the Bermuda time-series study site. Deep Sea Research Part II: Topical Studies in Oceanography, 93: 108-118.
- Janssen, D.J., Conway, T.M., John, S.G., Christian, J.R., Kramer, D.I., Pedersen, T.F. and Cullen, J.T., 2014. Undocumented water column sink for cadmium in open ocean oxygen-deficient zones. Proceedings of the National Academy of Sciences, 111(19): 6888-6893.
- John, S.G. and Conway, T.M., 2014. A role for scavenging in the marine biogeochemical cycling of zinc and zinc isotopes. Earth and Planetary Science Letters, 394(0): 159-167.
- Lagerström, M.E., Field, M.P., Séguret, M., Fischer, L., Hann, S. and Sherrell, R.M., 2013. Automated on-line flow-injection ICP-MS determination of trace metals (Mn, Fe, Co, Ni, Cu and Zn) in open ocean seawater: Application to the GEOTRACES program. Marine Chemistry, 155: 71-80.
- 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. and Saito, M.A., in press. A global ocean anthropogenic mercury inventory based on water column measurements. Nature.
- Lee, H.M., Hong, G.H., Baskaran, M., Kim, S.H., Kim, Y.I. and Cho, K.C., 2014. Evaluation of plating conditions on the recovery of 210Po onto the Ag planchet. Applied Radiation and Isotopes, 90: 170-176.
- Peucker-Ehrenbrink, B., Sharma, M. and Reisberg, L., 2013. Meeting Report: Recommendations for Analysis of Dissolved Osmium in Seawater. EOS, Transactions of the American Geophysical Union, 94: 12 February 2013.
- Zurbrick, C.M., Gallon, C. and Flegal, A.R., 2013. A new method for stable lead isotope extraction from seawater. Analytica Chimica Acta, 800: 29-35.

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