

# **2013 GEOTRACES National Reports**

## **Australia**

### ***Meetings and workshops***

- GEOTRACES presentations by Australian scientists at the ASLO Aquatic Sciences meeting (New Orleans, February 2013), the 45th International Liège Colloquium on Ocean Dynamics (Liège, May 2013), and the Strategic Science in Antarctica - a joint Australian & New Zealand Conference (Hobart, June 2013).
- Participation in GEOTRACES particle intercalibration workshop led by Phoebe Lam (Hawaii, March 2013)
- Participation to the SCOR Workgroup 139 in New Orleans in February 2013.

### ***Cruises***

- Completion of the GEOTRACES Process Study SIPEX-2 (GIpr02; Project PI: Klaus Meiners), 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 Casey station, east Antarctica in Sep/Oct 2012.

### ***New funding***

- Shiptime funding from the Marine National Facility of a major 2-month research expedition in austral summer 2014-15. The project will investigate submarine volcanism/hydrothermalism and biospheric impacts around the Heard/McDonald Islands in the Southern Ocean. GEOTRACES parameters will be sampled and the project will be proposed as a GEOTRACES Process Study at the next SSC meeting.
- The Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC) has been refunded for 5 more years from 2014-2019. Scientists at the ACE CRC have carried out several Australian GEOTRACES in the past 5 years. The planned research activities and fieldwork in the new ACE CRC are currently under discussion.
- Funding for GEOTRACES activities in Australia continues to be tight, with most projects carried out using small research grants. The major laboratories in Australia at the University of Tasmania and the Australian National University have applied for large grant funding (3-4 years) from the Australian Research Council (results known in October 2013). No dedicated national funds available for GEOTRACES activities. Recent departure of Christel Hassler to Europe has decreased the number of active GEOTRACES researchers in the region.

### ***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, are currently being prepared for a submission to a Biogeosciences special issue (manuscripts to be submitted in the period October-December 2013).
- Continuing analyses from GEOTRACES GP13 cruise (voyage ss2011\_v02), a zonal section in Southwest Pacific Ocean along approximately 30oS.
- 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.
- Publication of results from GPpr02 (SS10\_v01 PINTS): Hassler C.S., Ridgway K., Bowie A.R., Butler E.C.V., Clementson L., Doblin M.A., Ellwood M., Ralph P., Davies D.M., van der Merwe P.,

Watson R., 2013. Primary productivity induced by iron and nitrogen in the Tasman Sea – An overview of the PINTS expedition. Submitted to Marine and Freshwater Research, 1 June 2013.

### ***New publications***

- Butler, ECV and O'Sullivan, JE and Watson, RJ and Bowie, AR and Remenyi, TA and Lannuzel, D, 'Trace metals Cd, Co, Cu, Ni, and Zn in waters of the subantarctic and Polar Frontal Zones south of Tasmania during the 'SAZ-Sense' project', Marine Chemistry, 148 pp. 63-76. ISSN 0304-4203 (2013)
- Cropp, RA and Gabric, AJ and Lévassieur, M and McTainish, GH and Bowie, AR and Hassler, CS and Law, CS and McGowan, H and Tindale, N and Viscarra Rossel, R, 'The likelihood of observing dust-stimulated phytoplankton growth in waters proximal to the Australian continent', Journal of Marine Systems, 117-118 pp. 43-52. ISSN 0924-7963 (2013)
- C.S. Hassler, V. Schoemann, M. Boye, A. Tagliabue, Rozmarynowycz M, McKay, RML. Iron Bioavailability in the Southern Ocean. In: Oceanography and Marine Biology: An Annual Review. (eds) Gibson RN, Atkinson RJA, Gordon JDM, Hughes RN. CRC Press, London, 2012, 50, 1–64.
- Hassler C.S., Legiret F.-E., Butler, E.C.V. Measurement of iron chemical speciation in seawater at 4°C: the use of competitive ligand exchange - adsorptive cathodic stripping voltammetry. Marine Chemistry.149: 63-73. 2013.
- Morton, PL and Landing, WM and Hsu, S-C and Milne, A and Aguilar-Islas, AM and Baker, AR and Bowie, AR and Buck, CS and Gao, Y and Gichuki, S and Hastings, MG and Hatta, M and Johansen, AM and Losno, R and Mead, C and Patey, MD and Swarr, G and Vandermark, A and Zamora, LM, 'Methods for the sampling and analysis of marine aerosols: Results from the 2008 GEOTRACES aerosol intercalibration experiment', Limnology and Oceanography: Methods, 11 (FEB) pp. 62-78. ISSN 1541-5856 (2013)
- Smith, LV and McMin, A and Martin, AR and Nicol, S and Bowie, AR and Lannuzel, D and Van Der Merwe, P, 'Preliminary investigation into the stimulation of phytoplankton photophysiology and growth by whale faeces', Journal of Experimental Marine Biology and Ecology, 446 pp. 1-9. ISSN 0022-0981 (2013)
- Bown, J and Boye, M and Laan, P and Bowie, AR and Park, Y-H and Jeandel, C and Nelson, DM, 'Imprint of a dissolved cobalt basaltic source on the Kerguelen Plateau', Biogeosciences, 9 (12) pp. 5279-5290. ISSN 1726-4170 (2012)
- Remenyi, T and Nesterenko, P and Bowie, A and Butler, E and Haddad, P, 'Reversed phase high performance liquid chromatographic determination of dissolved aluminium in open ocean seawater', Limnology and Oceanography: Methods, 10 pp. 832-839. ISSN 1541-5856 (2012)
- Sinoir, M and Butler, ECV and Bowie, AR and Mongin, M and Nesterenko, PN and Hassler, CS, 'Zinc marine biogeochemistry in seawater: A review', Marine and Freshwater Research, 63 (7) pp. 644-657. ISSN 1323-1650 (2012)

### ***Other activities***

The new Australian oceanographic research vessel *Investigator* will be delivered to Hobart (Australia) in late 2013, and the commissioning year will run through until mid-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 end 2013.

Submitted by: Andrew Bowie

## Belgium

### *Meetings*

- ASLO 2013, New Orleans:
  - Cavagna A.-J., B. Quéguiner, F. Planchon, S. Jacquet, I. Closet, F. Dehairs, Production regime and potential for carbon export in the naturally iron fertilised Kerguelen area (Southern Ocean).
  - Dehairs F., T. Trull, C. Fernandez, D; Davies, A.-J. Cavagna, A.E. Piniella, Nitrate isotopic composition in the Kerguelen area (Southern Ocean) during KEOPS 2.
  - Jacquet S., F. Dehairs, A.J. Cavagna, F. Planchon, Ivia Closset, D. Cardinal Seasonal variability of mesopelagic organic carbon remineralization in the naturally iron-fertilized Kerguelen area (Southern Ocean).
  - de Brauwere A. et al., Putting the pieces together: A multi-tracer model to quantitatively identify the major processes related to the fertilized bloom on the Kerguelen Plateau (Southern Ocean).
- GRC on polar oceans, Ventura, USA, March 2013:
  - Nitrogen isotopic distribution in Antarctic Sea Ice; poster by F. Fripiat.
- The 45th International Liège colloquium: Primary production in the ocean: From the synoptic to the global scale:
  - Cavagna A.-J. and F. Dehairs, Primary production and potential for carbon export in naturally iron-fertilized waters in the Southern Ocean.
  - Roukaerts A., Cavagna A.J., Dehairs F., Carbon and Nitrogen uptake rates in the East Antarctic sea-ice zone (SIPEX II preliminary results).
  - Fonseca Batista D., F. Dehairs, L. Brunelli, C. Gil-Fernandez, M. Rembauville, D. Ribicic, T. Schwenke, Fixed-nitrogen and atmospheric N<sub>2</sub> contribution to biological productivity along a North-South transect in the Eastern Atlantic Ocean.
- Goldschmidt Conference, Montreal, June 2012: Session on biogeochemical cycling of nutrients and metals in high latitude marine environments.
  - Nitrate ( $\delta^{15}\text{N}$ ) isotopic distribution in Antarctic Sea Ice; poster by F. Fripiat.
- AGU fall meeting 2012, San Francisco: Session on Source, Sinks, and Speciation of marine micronutrient trace elements.
  - A. de Brauwere “Putting the pieces together: A multi-tracer model to quantitatively identify the major processes related to the fertilized bloom on the Kerguelen Plateau (Southern Ocean), poster.
- ASLO 2012, Lake Biwa (July 8-13):
  - Cavagna A.J., F. Dehairs, B. Quéguiner, C. Fernandez, M. Elskens, D. Lefèvre, Regimes of production and potential for carbon export in naturally iron-fertilized waters in the Southern Ocean.
- Symposium on Iron in the Oceans, 4 October 2012, Texel:
  - Schoemann, V., de Jong, J.T.M., Lannuzel, D., Hassler, C., Dellile, B., de Baar, H. Iron as a source of bioavailable iron to the Southern Ocean.
  - De Jong, J.T.M., Schoemann, V., de Baar, H., Lannuzel, D., Tison, J.-L., Mattielli, N. Dissolved and particulate Fe and Zn isotopes in Antarctic waters. Symposium on Iron in the Oceans, 4 October 2012. Texel, The Netherlands.
  - Rob Middag, R., Laan, P., Gerringa, L.J.A. van Aken, H.M., Schoemann, V., de Jong, J.T.M., van Haren, H., Hein J. W. de Baar, H.J.W. Sources and fluxes of Iron in the Atlantic Ocean; Symposium on Iron in the Oceans, 4 October 2012. Texel, The Netherlands. Oral presentation
- GEOTRACES Workshop – Stable isotopes of biologically important trace metals. 13-14 September 2012, London, UK:
  - Schoemann, V., de Jong, J.T.M., Lannuzel, D., Dellile, B., Chou, L., Becquevort, S., Mattielli, N., de Baar, H., Tison, J.L. Iron isotopes in Antarctic sea ice. Poster presentation.
  - De Jong, J.T.M., Schoemann, V., de Baar, H., Tison, J.-L., Ackley, S., Mattielli, N. Dissolved and particulate Fe and Zn isotopes in the Bellingshausen Sea, Antarctica. Oral presentation.

- SOLAS Open Science Conference, 7- 10 May 2012, Cle Elum, WA, USA:  
Schoemann, V., Lannuzel, D., Delille, B., de Baar, H., Tison, J.-L. Sea ice as a source of bioavailable iron. Invited plenary talk.  
Schoemann, V., de Jong, J.T.M., Lannuzel, D., Dellile, B., Chou, L., Becquevort, S., Mattielli, N., de Baar, H., Tison, J.L. Iron stable isotopes : a tool to trace biological processes in Antarctic sea ice. Poster presentation.
- Goldschmidt Conference 2012, 24-29 June 2012, Montreal, Canada:  
De Baar, H., M. Rijkenberg, L. Gerringa, R. Middag, M. van Hulten, P. Laan, V. Schoemann, J. de Jong, A. Sterl, H. van Aken. Contrasting Biogeochemical Cycling of Iron and Aluminium along the GEOTRACES West Atlantic Section. Oral presentation.
- Ocean Sciences Meeting, 20-24 February 2012, Salt Lake City, Utah, USA:  
Hassler, C., L. Norman, R. Watson, M. Doblin, C. Nichols, G. McTainsh, L. Clementson, V. Schoemann. Impact of various iron sources to Tasman Sea phytoplankton: From bioavailability to community shift. Poster presentation.

### ***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.
- Sea Ice Physics and Ecosystem eXperiment (SIPEX 2): Sep. - Nov. 2012; Australian-Antarctic Basin; R/V Aurora Australis; C, N uptake; nitrate isotopic composition
- European Universities and Research On board Polarstern in the Atlantic (EUROPA); Oct.-Nov. 2012; Bremerhaven – Cape Town; R/V Polarstern (ANT 29/1): C, N uptake; N<sub>2</sub> fixation; nitrate isotopic composition
- YROSLAE (Scott Base, Antarctica), Sea Ice in the McMurdo Sound, Nov. 2011-Dec. 2012:  $\delta^{15}\text{N}$  (particulate nitrogen, total dissolvable nitrogen, ammonium, nitrate),  $\delta^{18}\text{O}$  (nitrate),  $\delta^{30}\text{Si}$  (biogenic silica, dissolved silicon), dissolved and particulate trace metals concentrations (e.g. Fe, Zn, Cu, Mn) and isotopic composition ( $\delta^{56}\text{Fe}$  and  $\delta^{66}\text{Zn}$ ).
- IceArc ARK XXVII/3 on board the RV Polarstern in central Arctic. 2 Aug-8 Oct 2012: dissolved and particulate trace metals concentrations (e.g. Fe, Zn, Cu, Mn) isotopic composition ( $\delta^{56}\text{Fe}$  and  $\delta^{66}\text{Zn}$ ).
- ICELIPIDS (Dumont D'Urville, Antarctica), Sea Ice in Terre Adélie, Apr. -Nov. 2011:  $\delta^{15}\text{N}$  (particulate nitrogen, total dissolvable nitrogen, ammonium, nitrate),  $\delta^{18}\text{O}$  (nitrate),  $\delta^{30}\text{Si}$  (biogenic silica, dissolved silicon).

### ***New funding***

- Belgian Science Policy, Science for Sustainable Development programme; “BIOGeochemical cycles in the SOUTHERN ocean: Role within the Earth System” (BIGSOUTH); 2011 – 2014.
- Flanders Research Foundation, “The biological carbon pump and role of diazotrophs in open ocean carbon export”; 2011-2014.
- Fonds de la Recherche Scientifique (FNRS), “Year-Round Ocean-Sea-Ice-Atmosphere Exchanges”; 2011-2013.

### ***New results***

- Primary production, new production, POC export and mesopelagic remineralisation in the (naturally) iron-fertilised Kerguelen area (KEOPS 2)
- N, O isotopic composition of whole water column nitrate in the Kerguelen area (KEOPS 2)
- Sea-ice primary production, NO<sub>3</sub>, NH<sub>4</sub>, Si uptake; N, O isotopic composition of sea-ice nitrate (SIPEX 2)

- Primary production, new production, N<sub>2</sub>-fixation; C, N isotopic composition of suspended matter; N, O isotopic composition of nitrate in upper 700m (EUROPA)
- Whole water column dissolved Ba concentrations along CLIVAR/WOCE I9S line (R/V Aurora Australis, AU 1203; Jan. – Feb. 2012)
- Nitrogen isotopic composition (PN, TDN, NO<sub>3</sub>) in pack ice from the Weddell Sea (ISPOL, Dec. 2004), the Bellingshausen Sea (SIMBA, Oct. 2007), and Dumont D'Urville (ICELIPIDS, Apr. - Nov. 2011).
- Silicon isotopic composition (dissolved silicon) in landfast sea ice from a small Greenlandic bay (March. 2010).
- Trace metals concentrations (Fe, Ni, Cu, Zn, Pb, Al, Mn and Cd) in snow, seawater, brines and sea ice in Central Arctic (IceArc, Aug.-Oct 2012) and in McMurdo Sound (YROSIAE, Nov.-Dec 2011).

### ***Relevant publications***

- Baeyens W., Bowie A., Buesseler K., Elskens M., Gao Y., Lamborg C., Leermakers M., Remenyi T., Zhang H., 2011. Size-fractionated labile trace elements in the Northwest Pacific and Southern Oceans, *Marine Chemistry*, 126, 108 – 113.
- de Brauwere, A., Fripiat F., Cardinal D., Cavagna A.J., De Ridder F., André L. and Elskens, M. (2012). Isotopic model of oceanic silicon cycling: The Kerguelen Plateau case study. *Deep-Sea Research I*, 70, 42-59.
- Cavagna A.-J., F. Dehairs, V. Woule-Ebongué, S. Bouillon, F. Planchon, B. Delille, I. Bouloubassi, 2013. Whole water column distribution and carbon isotopic composition of POC-bulk, cholesterol and brassicasterol from the Cape Basin to the northern Weddell Gyre, *Biogeosciences* , 10, 2787-2801.
- de Brauwere A., F. Fripiat, D. Cardinal, A.-J. Cavagna, L. André and M. Elskens (2012). Isotopic model of oceanic silicon cycling: The Kerguelen Plateau case study, *Deep Sea Research I*, 70, 42-59.
- de Jong, J., V. Schoemann, D. Lannuzel, H. de Baar, J.-L. Tison. Natural iron fertilization of the Atlantic Southern Ocean by continental shelf sources of the Antarctic Peninsula. *Journal of Geophysical Research*, 117, G01029, doi:10.1029/2011JG001679.
- Fripiat F., A.-J. Cavagna, F. Dehairs, A. de Brauwere, L. André, and D. Cardinal, 2012. Processes controlling the Si-isotopic composition in the Southern Ocean and application for paleoceanography, *Biogeosciences*, 9, 2443-2457, doi:10.5194/bg-9-2443-2012
- 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 first-year sea ice, Submitted to *Biogeochemistry*.
- Fripiat F., D.M. Sigman, S.E Fawcett, P.A. Rafter, M.A. Weigand, and J.-L. Tison, 2013. Sea Ice nitrogen biogeochemical dynamics as reflected in the nitrogen isotopes, in preparation.
- Gledhill M, Hassler CS and Schoemann V (2013) The environmental bioinorganic chemistry of aquatic microbial organisms. *Frontiers in Microbiology*, 4, 100. doi: 10.3389/fmicb.2013.00100
- Hassler, C.S., V. Schoemann, M. Boye, A. Tagliabue, M. Rozmarynowycz and R.M.L. McKay. (2012) Iron availability in the Southern Ocean. *Oceanography and Marine Biology: An annual review*. 50, 1-64.
- Maiti K., K.O. Buesseler, S.M. Pike, C. Benitez-Nelson, P. Cai, W. Chen, K. Cochran, M. Dai, F. Dehairs, B. Gasser, R. P. Kelly, P. Masque, L. Miller, J.-C. Miquel, S. B. Moran, P.J. Morris, F. Peine, F. Planchon, A.A. Renfro, M. Rutgers van der Loeff, P. Santschi, R. Turnewitsch, J.T. Waples, C. Xu, 2012. Intercalibration studies of short lived Thorium-234 in the water column and marine particles, *Limnology & Oceanography - Methods*, 10, 631-642.
- Planchon F., A.-J. Cavagna, D. Cardinal, L. André and F. Dehairs, 2013. Late summer particulate organic carbon export from mixed layer to mesopelagic twilight zone in Atlantic sector of Southern Ocean, *Biogeosciences*, 10, 803-820.

- Schmidt S., J. Harlay, A.V. Borges, S. Groom, B. Delille, N. Røevros, S. Christodoulou and L. Chou, 2012. Particle export during a bloom of *Emiliana huxleyi* in the North-Western Bay of Biscay, *Journal of Marine Systems*, doi: 10.1016/j.jmarsys.2011.12.005 (in press).
- Vogt, M., C., O'Brien, J. Peloquin, V. Schoemann, E. Breton, M. Estrada, J. Gibson, D. Karentz, M.A. Van Leeuwe, J. Stefels, C. Widdicombe, L. Peperzak. (2012). Global marine plankton functional type biomass distributions: *Phaeocystis* spp. *Earth System Science Data*. 4 (1), 107-120.

Submitted by: F. Dehairs, M. Elskens, M. Leermakers, W. Baeyens, L. Chou, F. Fripiat, V. Schoemann, J.T.M. de Jong

## **Brazil**

### ***Meetings***

The 1st Latin American GEOTRACES workshop took place in Rio de Janeiro from November 12 to 15. The aim was to foster regional research activities and enrollment of scientists from the region in the GEOTRACES program. A total of about 45 scientists (including some students) participated in the meeting that was considered very productive. All the material related to the workshop is uploaded in the GEOTRACES site for consultation.

### ***Projects***

A joint project PUC-Rio/MIT was approved for financial support and a first joint campaign occurred in April 2013. 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. This project may seed other activities in the future specifically directed to GEOTRACES interests.

### ***Analyses of samples***

Prof José Godoy from PUC-Rio is enrolled in the analytical work of samples collected during the 2013 Mediterranean Cruise. He will determine U, Ba e Mo,  $\delta D$  and  $\delta^{18}O$  in 1200 samples.

### ***National Institute***

The Brazilian government announced at the end of July the foundation of the National Institute of Oceanography and Waterways as well as the purchase of a new oceanographic ship. Four new modern and well equipped research centers shall be installed in different regions of the country with the intention to conduct oceanographic and waterways studies (South Atlantic Oceanographic Center to be located in the South of Brazil; Tropical Atlantic Oceanographic Center to be located in the Northeast Brazil; Harbors and Waterways Center to be located in Rio or São Paulo; and Marine Fisheries and Aquaculture Center). The establishment of these centers will take time but the ship may become available still within the life time of GEOTRACES.

Submitted by: Angela Wagener

## Canada

### ***Cruise activities***

- The renewal of the Line P iron program (collaboration between UBC (Vancouver) UVic (Victoria) and DFO (Sydney). Three cruises a year (February, May and August)
- NSERC-CCAR funded 2 cruises in the Arctic in 2015. The Canadian Arctic GEOTRACES Program: Biogeochemical and tracer study of a rapidly changing Arctic Ocean. R. Francois plus 20 others (\$5,000,000 for 5 years).

### ***Publications***

- Fu, Y., Keats, K. F., Rivkin, R. B. and Lang, A. S. 2013. Water mass and depth determine the distribution and diversity of Rhodobacterales in an Arctic marine system FEMS. In Press
- 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, *J. Geophys. Res. Oceans*, 118, doi:10.1002/jgrc.20244.
- Melling, H., R. Francois, P. G. Myers, W. Perrie, A. Rochon, and R. L. Taylor. 2012. The Arctic Ocean—a Canadian perspective from IPY. *Climatic Change* DOI 10.1007/s10584-012-0576-4.
- Normandeau C, Hill A, KIENAST M, and Cullen J (subm. 2011, working on revisions) On the effect of salinity on alkenone concentrations and unsaturation: A culture study, *Organic Geochemistry*, ms# OG-1567
- MILLER L.A., GIESBRECHT K.E., MUCCI A. and ZIMMERMAN S. (2013) Decadal changes in the marine carbonate system of the western Canadian Arctic. Submitted to *Polar Research*.
- ELSE B.G.T., PAPAKYRIAKOU T., ASPLIN M., BARBER D., GALLEY R., MILLER L. and MUCCI A. (2013) Annual cycle of air-sea CO<sub>2</sub> exchange in an Arctic Polynya region. *Global Biogeochem. Cycles* (in press, accepted December 2012). doi:10.1002/gbc.20016
- 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. Measurements of the dissolved inorganic carbon system and associated biogeochemical parameters in the Canadian Arctic, 1974-2009. *Earth System Science Data Discussion* 6: 223-254. doi: 10.5194/essdd-6-223-2013.
- 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 CO<sub>2</sub> uptake capacity in the Canada Basin (Arctic Ocean) due to sea ice loss. *Geophys. Res. Letts.* 40: 1132–1137, doi:10.1002/grl.50268.
- ELSE B.G.T., GALLEY R.J., PAPAKYRIAKOU T.N., MILLER L.A., MUCCI A. and BARBER D. (2012) Sea surface pCO<sub>2</sub> cycles and CO<sub>2</sub> fluxes at landfast sea- ice edges in the Amundsen Gulf, Canada. *Journal of Geophysical Research-Oceans* 117: C09010, doi: 10.1029/2012JC007901.
- ELSE B.G.T., PAPAKYRIAKOU T.N., GALLEY R.J., MUCCI A., GOSSELIN M., MILLER L.A., SHADWICK E.H. and THOMAS H. (2012) Annual cycles of pCO<sub>2sw</sub> in the southeastern Beaufort Sea: New understandings in air-sea CO<sub>2</sub> exchange in arctic polynya regions. *J. Geophys. Res.-Oceans* 117: C00G13. 16 pp., doi:10.1029/2011JC007346.
- LANSARD B., MUCCI A., MILLER L.A., MACDONALD R.W. and GRATTON Y. (2012) Seasonal variability of water mass distribution in the southeastern Beaufort Sea determined by total alkalinity and δ<sup>18</sup>O. *J. Geophys. Res.-Oceans* 117: C03003, 19 pp., doi:10.1029/2011JC007299.
- Thomas, H., Shadwick, E.H., Dehairs, F., Lansard, B., Mucci, A., Navez, J., Gratton, Y., Prowe, A.E.F., Chierici, M., Fransson, A., Papakyriakou, T.N., Sternberg, E., Miller, L., Tremblay, J.-É., and Monnin, C. (2011). Barium and Carbon fluxes in the Canadian Arctic Archipelago *JOURNAL OF*

- Granger, J., M. G. Prokopenko, D. M. Sigman, C. W. Mordy, L. V. Morales, Z. M. Morse, R. N. Sambrotto. 2011. Nitrification-coupled denitrification in sediment of the eastern Bering Sea shelf leads to <sup>15</sup>N-enrichment of fixed N in shelf waters. *Journal of Geophysical Research – Oceans*, doi: 10.129/2010JC0006751.

### **Reports**

- PAPAKYRIAKOU T., CARNAT G., CHIERICI M., DELILLE B., ELSE B., FRANSSON A., GEILFUS N.-X., LANSARD B., MILLER L., MUCCI A., SHADWICK E., THOMAS H., and TISON J.-L. (2012) Balancing greenhouse gases. Chapt. 6, pp. 109-122. In: *On the Edge: From Knowledge to Action during the Fourth International Polar Year Circumpolar Flaw Lead System Study (2007-2008)*. Barber D., Tjaden T., Leitch D., Barber L. and Chan W. (Eds.) University of Manitoba, Winnipeg, Manitoba. 248 pp.

### **Communications, posters and abstracts**

- Cullen, J.T., J. Zhou, R.L. Taylor, D.M. Semeniuk, M.T. Maldonado. Dissolved iron and the co-limitation of phytoplankton growth in the Beaufort Sea, Arctic Ocean. Florence, Italy, August 2013.
- LANSARD B., MUCCI A., BROWN K. and BABIN M. (2012) A multi-proxy study of the Mackenzie Shelf waters (Canadian Arctic). Contributed poster presentation, 22st V.M. Goldschmidt Conference, June 24-29, Montréal, Canada. *Mineralogical Mag.* 76: 1973.
- ELSE B.G.T., PAPAKYRIAKOU T., GALLEY R., ASPLIN M., BARBER D., DRENNAN W., MUCCI A., MILLER L.A., SHADWICK E. and THOMAS H. (2012) New understandings of air-sea CO<sub>2</sub> exchange in polynya systems: Results from the IPY ArcticNet and CFL projects in the Cape Bathurst Polynya. Contributed oral presentation, IPY-2012 Conference, April 22-27, Montreal, Canada.
- FRANCOIS R., BROWN K., CULLEN J., GRANGER J., HOLMDEN C., KIENAST M., MALDONADO M., MILLER L., MUCCI A., ORIANI K., RIVKIN R.B., SAITO M., THOMAS H., TORTELL P. and VARELA D. (2012) Canadian IPY-GEOTRACES: Multi-tracer investigation of the effect of climate change on primary production, seawater chemistry and circulation of the Arctic Ocean. Contributed poster presentation, IPY-2012 Conference, April 22-27, Montreal, Canada.
- R. Francois, M. Soon, C. Not, C. Hillaire-Marcel. Recent incursion of deep water from the central Arctic into Canada Basin inferred from 230Th water column profiles measured during the IPY-GEOTRACES project. IPY-2012 Conference, April 22-27, Montreal, Canada.
- LANSARD B., MUCCI A., GRATTON Y., MILLER L.A., THOMAS H. (2012) Chemical and physical properties of the surface mixed layer during sea-ice formation in the Canadian Arctic. Contributed oral presentation, IPY-2012 Conference, April 22-27, Montreal, Canada.
- PAPAKYRIAKOU T., CARNAT G., CHIERICI M., DELILLE B., ELSE B.G.T., FRANSSON A., GEILFUS N.-X., MILLER L.A., MUCCI A., SHADWICK E., THOMAS H. and TISON J.-L. (2012) Seasonal evolution of the CO<sub>2</sub> source/sink dynamics and air-sea exchange in the Amundsen Gulf and southeastern Beaufort Sea: A synthesis of results from CFL. IPY-2012 Conference, April 22-27, Montreal, Canada.
- Rivkin, R. B., Tucker, J. Hamilton, A. and Hale. M. S. 2012. Microbial dynamics in the Beaufort Sea during the Fall 2009 IPY Geotraces Expedition. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- K. F. Keats, K. F., Hale, M. S. Rivkin, R. B. 2012. Nutrient regulation of heterotrophic bacterial growth in water masses of northern Baffin Bay and in the Canadian Arctic. International Polar Year 2012 Conference. Montreal, Canada, April 2012.



- Rivkin, R. B., and Way, C. J. 2012. Nutrient control of microzooplankton processes cold coastal and Arctic oceans. Association for the Sciences of Limnology and Oceanography. Otsu, Japan July 2012.
- Tucker, J. M., Rivkin, R. B., Li, W. K. and Moulard, R. 2011. Microbial processes in the Beaufort Sea. American Society of Limnology and Oceanography Meeting. San Juan Puerto Rico. February 2011
- K. Scheiderich, M. Amini, C.Holmden and R. Francois. Canadian IPY-GEOTRACES: Chromium isotope fractionation in Arctic Ocean waters. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- Taylor, R.D., D.M. Semeniuk, C. Payne, M.T. Maldonado. Co-limitation by Nitrate, Light, and Iron in the Beaufort Sea. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- K. Brown, F. McLaughlin, R. Francois, P. Tortell, M. Yamamoto-Kawai, and B. Hunt. Effects of Changing Sea Ice Thickness & Distribution on Carbon Cycling in the Canada Basin (C3O-JOIS: 2008-2009). International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- LANSARD B., MUCCI A., GRATTON Y., MILLER L.A., MACDONALD R.W., THOMAS H. CHIERICI M., FRANSSON A. and PAPAKYRIAKOU T. Chemical and physical properties of the surface mixed layer during sea-ice formation in the Canadian Arctic. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- Cullen J.T., T. Giesbrecht, N. Sim, A. Davidson, N.E. Sutherland, W. Keith Johnson, K.J. Orians. Tracing the relative impact of sea-ice melt and river input on bioactive trace metal distributions in the Arctic Ocean during the Canadian C3O and GEOTRACES programs. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- Zhou, J., A. Noble, R. E. Ramirez, M. Saito, J.T. Cullen. The distribution of iron and cobalt in the Beaufort Sea during the Canadian GEOTRACES IPY Arctic Ocean expedition. International Polar Year 2012 Conference. Montreal, Canada, April 2012.
- Zhou, J., R. E. Ramirez, J.T. Cullen. The redox speciation of dissolved iron in seawater of the Arctic Ocean: Observations from the GEOTRACES IPY Expedition in the Beaufort Sea. Ocean Sciences Meeting, Salt Lake City, UT USA, Feb. 20-24, 2012
- Granger, J. and D. M. Sigman. Distinction of Atlantic vs. Pacific Nitrate in the Beaufort Sea from Coupled N and O Isotope Ratios; Presentation; International Polar Year Conference Montreal April 25th, 2012. [oral]
- Granger, J. and D. M. Sigman. Distinction of Atlantic vs. Pacific Nitrate in the Beaufort Sea from Coupled N and O Isotope Ratios Ocean Sciences Meeting 2012, Salt Lake City [oral]

### ***Dissertations***

- Taylor, R.L. 2011. Studies in Fe bioavailability: co-limitation of primary productivity by iron, light, and nitrate in the Beaufort Sea, and direct iron-siderophore uptake mechanisms in Fe deficient phytoplankton. Master of Science Thesis. Oceanography. University of British Columbia, Vancouver, Canada. <https://circle.ubc.ca/handle/2429/39285>.

Submitted by: Maite Maldonado

## China-Beijing

### **Activities**

- A part of China-GEOTRACES is accommodated in the Japanese KH-13-4 cruise by the *R/V Hakuho Maru* and in the NN376 cruise by the *R/V Nagasaki-Maru* in June and July 2013 to collaborate in the East China Sea. Measurements for dissolved Al, Mn and As were conducted to understand where and how terrestrial material transport into the Sea of Japan and western North Pacific.
- There are several cruises carried out in the Yellow Sea and East China Sea during 2013, including May, July, August and October cruises. Measurements for dissolved REEs, Al, Mn and As are planned to be measured to understand the composition of water masses in the study area.

### **Capacity building**

- Clean lab is established in the OUC. Young researchers are trained by Prof. Jing Zhang from University of Toyama for the clean sampling protocols by attending Japanese cruises and also by attending testing cruise in July.
- A clean sampling system is to be purchased from the lab of C. Measure to accommodate the new vessel that is being built in XMU.

### **Publications**

- Li Fa-Ming, et al., 2012. The biogeochemical behavior of dissolved aluminum in the southern Yellow Sea: influence of the spring phytoplankton bloom. *Chinese Science Bulletin*, doi:10.1007/s11434-012-5512-5
- Gu, H., et al., Using radium isotopes to estimate the residence time and the contribution of submarine groundwater discharge (SGD) in the Changjiang effluent plume, East China. *Continental Shelf Research* 35:95-107.
- Wang, D., et al., 2012. Occurrences of dissolved trace Metals (Cu, Cd, and Mn) in the Pearl River Estuary (China), a large river-groundwater-estuary system. *Continental Shelf Research*, 50/51: 54-63.

Submitted by: Pinghe Cai

## China-Taipei

### **Cruises**

The first Taiwanese GEOTRACES test cruise will be carried out during July 14th-23rd 2013 in the Western Philippine Sea by using Taiwan most modern 2,700 ton research vessel, Ocean Research 5. The studied sites are shown in the Figure 9. The major objectives are to evaluate the sampling capability of OR/5 for trace metal clean sampling, to investigate the cycling and distribution of trace elements and their isotopes in the West Philippine Sea, and to determine the trace metal composition and fluxes in size-fractionated suspended particles and plankton, sinking particles and aerosols. Thirty scientists from 12 laboratories will join the cruise (PI: Tung-Yuan Ho), including the researchers from Xiamen University, HKUST, UC Santa Cruz, and the other 9 labs from Taiwanese research institutes. The 2nd Taiwanese GEOTRACES cruise will be carried out in March 2014 in the Western Philippine Sea.

### **Meetings**

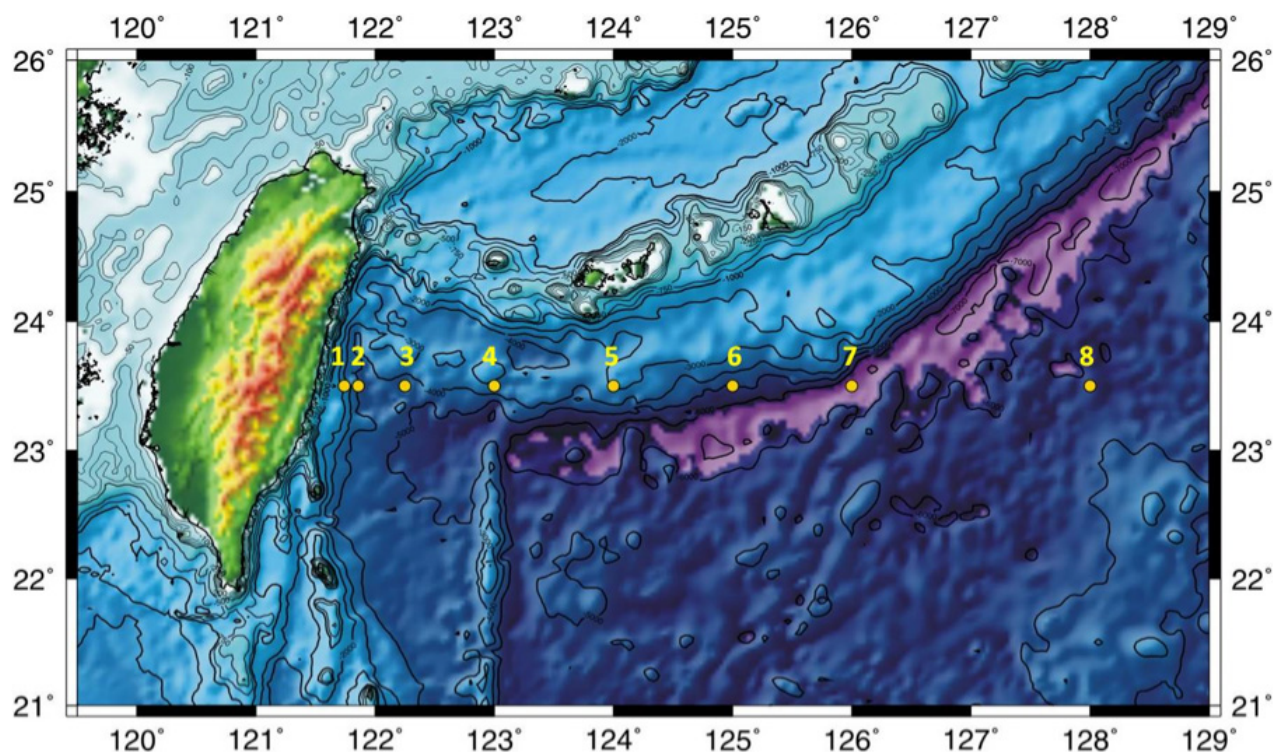
Tung-Yuan Ho, Yoshiki Sohrin, I-I Lin, and George Wong have proposed a GEOTRACES related session in 2013 AOGS meeting, with the following session title: (OS-19) Controls on the Biogeochemistry of the Northwestern Pacific Ocean and its Adjacent Marginal Seas. During the meeting,

Tung-Yuan Ho and Yoshiki Sohrin have discussed the possibility to hold the other Asian GEOTRACES workshop in 2014 in Taipei, Taiwan.

### **Publications**

There were about 10 marine trace metal biogeochemistry related research papers published by Taiwanese scientists in 2012-2013/6.

- Ho, T.-Y. (2013) Nickel limitation of nitrogen fixation by *Trichodesmium*. *Limnology and Oceanography* 58: 112-120.
- Ho, T.-Y., T.-H. Chu, and C.-L. Hu (2013) Interrelated influence of light and Ni on *Trichodesmium* growth. *Frontiers in Aquatic Microbiology*. doi: 10.3389/fmicb.2013.00139.
- Hsu, S.-C. C.-A. Huh, C.-Y. Lin (2012) Dust transport from non-East Asian sources to the North Pacific. *Geophysical Research Letters*. 39: DOI: 10.1029/2012GL051962
- Hung, C.-C., Gong, G.-C., Santschi, P.H., (2012) 234Th in different size classes of sediment trap collected particles from the Northwestern Pacific Ocean. *Geochim. Cosmochim. Acta*, 91, 60-74.
- Jiann, K.-T. and Wen, L.-S. (2012) Distribution and lability of dissolved iron in surface waters of marginal seas in southeastern Asia. *Estuarine Coastal and Shelf Science*. 10: 142-149.
- Lee, C.-S., C.-L. Wei, L.-S. Wen, D. D. Sheu, and W.-H. Lee (2013) Distribution and removal of silver and lead in the nearshore waters of western Taiwan. *Estuaries and Coasts*. 10.1007/s12237-013-9588-1
- Shen, C.-C., Wu C.-C., Cheng H., Edwards R. L., Hsieh Y.-T., Gallet S., Chang C.-C., Li T.-Y., Lam D. D., Kano A., Hori M., and Spötl C. (2012) High-precision and high-resolution carbonate 230Th dating by MC-ICP-MS with SEM protocols. *Geochim. Cosmochim. Acta*. 99: 71-86.
- Yang S.-C., D.-C. Lee, and T.-Y. Ho (2012) The isotopic composition of Cadmium in the water column of the South China Sea. *Geochimica et Cosmochimica Acta* 98: 66-77.
- Wei, C.-L., S.-Y. Lin, L.-S. Wen, and D. D. Sheu (2012) Geochemical behavior of 210Pb and 210Po in the nearshore waters off western Taiwan, *Marine Pollution Bulletin*, 64:214-220.
- Wei, C.-L., K.-T. Jiann, L.-S. Wen, and D. D. Sheu (2012) Distributions and removal fluxes of trace metals in the water column of the Hung-Tsai Trough off southwestern Taiwan, *Marine Pollution Bulletin*, 64: 1122-1128.



**Figure 9.** The 8 sampling stations of Taiwan 1<sup>st</sup> GEOTRACES test cruise. OR/5 equips with a 20-ft trace metal clean van, 12 L and 20 L Teflon coated Go-Flo bottles, and trace metal clean surface water pump but so far with normal hydrowire, CTD rosettes and winches. With the effort of related scientists, OR/5 management agency, TORI, is considering purchasing the related trace metal cleaning apparatus in 2014. The 2013 cruise will thus mainly focus on particle related studies, including total suspended particles, size-fractionated particles and plankton, sinking particles, total suspended aerosol, size-fractionated aerosols *et al.* The station 8 will become a GEOTRACES crossover station between Japan and Taiwan.

Submitted by: Tung-Yuan Ho

## Croatia

The Croatian GEOTRACES activities are mainly related to: 1) improvement of electrochemical methods which, in combination with ICPMS, are used for trace metals speciation (including interaction with organic matter), 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) and solid (gold wire) micro sensors for on-site and in-situ metal analysis in seawater, 3) assessment of metal bioavailability in aquatic environment using passive samplers for metals (DGT) and cytosolic metal levels in tissues of aquatic organisms. Research on development of electroanalytical methods for chalcogenide nanoparticles determination in natural waters is in progress.

The Croatian GEOTRACES activities of the past year were mainly characterized by preparations and organisation for marine voltammetry themed workshop: “Voltammetry and GEOTRACES“, which was held in Šibenik, Croatia, at the Rudjer Boskovic Institute marine station Martinska, from October 6th to October 9th 2012.

In June 2013, we participated in organization of MERMEX International workshop. The workshop was related to French project MERMEX (*Marine Ecosystems Responses to climatic and anthropogenic forcings in the Mediterranean*, <http://mermex.pytheas.univ-amu.fr>) and was held at Rudjer Boskovic Institute, Zagreb.

One PhD student completed (24.09.-02.11.2012) Short Term Scientific Missions (STSM) in the frame of COST action ES0801 (The Ocean Chemistry of Bioactive Trace Metals and Paleoclimate Proxies) with the subject:

- Determination of trace metal concentrations by ICP-MS in seawater and biological matrices (Host: Prof. Dr. Andreas Prange, Helmholtz-Zentrum Geesthacht, Department for Marine Bioanalytical Chemistry, Geesthacht, Germany).

### ***Meetings***

Dr. Ivanka Pižeta participated at a second meeting of the SCOR working group 139 on 'Organic Ligands – A Key Control on Trace Metal Biogeochemistry in the Ocean' in New Orleans, SAD on the 16<sup>th</sup> February 2013 as a full member.

### ***Field works***

- Participation in the field work at Kinneret Lake in Israel where we used electrochemical methods for sulfur and trace metals speciation in anoxic water layers. (October 2013).
- Participation in the 2013 EuroBASIN cruise to Atlantic PAP 2 station, Research Cruise No. JC87), where we work on organic matter speciation.

### ***Participation at international conferences***

- Helmholtz, H., Strižak, Ž., Ruhnu, C., Erk, M., Prange, A., Utilization of Proteomic Techniques for the Identification of Potential Contaminant-related Biomarker - Environmental Proteomics, Proteomic Forum 2013, Berlin, Germany 17.-21.03.2013.
- M. Furdek, J Cavalheiro, M Monperrus, M Bueno, E Tessier, N Mikac. Investigation on organotin compounds reactivity using enriched isotopic traces in polluted coastal sediments from the Eastern Adriatic, Croatia. European Winter Conference on Plasma Spectrochemistry, Krakow, Poland, 10-15 February 2013.
- M. Furdek, M Ivanić, M Monperrus, M Bueno, E Tessier, N Mikac, Persistence of butyltin (BuT) compounds in the contaminated sediments from the Croatian Adriatic coast, 14th EuCheMS International Conference on Chemistry and the Environment; ICCE 2013, Barcelona, June 25 - 28, 2013.
- M. Marguš, E. Bura-Nakić, D. Jurašin, I. Milanović, I. Ciglencečki, Chronoamperometry as a tool for detecting nano- and microparticles: Example of Chalcogenide nanoparticles, 9th ECHEMS Meeting Electrochemistry in Particles, Droplets, and Bubbles; Lochow, Poland, June 23-26, 2013.
- Strmečki Kos, Slađana; Plavšić, Marta. Electrochemical analysis of polysaccharides on static mercury drop electrode, Fourth Regional Symposium on Electrochemistry South- East Europe, Ljubljana, Slovenia, May 24-27th 2013.

### ***Publications***

- M. Furdek, M. Vahčić, J. Ščančar, R. Milačić, G. Kniewald, N. Mikac, Organotin compounds in seawater and *Mytilus galloprovincialis* mussels along the Croatian Adriatic Coast, *Marine Pollution Bulletin*, 64 (2012) 189-199.
- Bura-Nakić, E. Viollier, Ciglencečki, I., Electrochemical and colorimetric measurements show the dominant role of FeS in a permanently anoxic lake, *Environ.Sci.Technol.* 47 (2013) 741–749.

- Dautović, J; Strmečki, S; Pestorić, B; Vojvodić, V; Plavšić, M; Krivokapić, S; Ćosović, B, Organic matter in the karstic enclosed bay (Boka Kotorska Bay, south Adriatic Sea). Influence of freshwater input. *Fresenius env. bull.* 21 (2012); 995-1006.
- Gašparović, B, Decreased production of surface-active organic substances as a consequence of the oligotrophication in the northern Adriatic Sea. *Estuar. Coast. Shelf Sci.* 115, (2012) 33-39.
- Plavšić, M; Strmečki, S, Dautović, J, Vojvodić, V, Olujić, G. Ćosović, B, Characterization and distribution of organic matter using specific physico-chemical methods: a case study of the southeast Adriatic continental and shelf slope (Albania). // *Continental shelf res.* 39/40 (2012); 41-48 .
- Frka, S; Pogorzelski, S, Kozarac, Z, Ćosović, B, Physicochemical Signatures of Natural Sea Films from Middle Adriatic Stations. // *J. Phy.Chem. A.* 116 (2012), 25; 6552-6559.
- Strmečki, S; Plavšić, M, Adsorptive transfer chronopotentiometric stripping of sulphated polysaccharides. *Electrochem.Comm.* 18 (2012); 100-103.
- Frka, S; Dautović, J, Kozarac, Z, Ćosović, B, Hoffer, A, Kiss, G, Surface active substances in atmospheric aerosol: an electrochemical approach. *Tellus. Series B, Chemical and physical meteorology.* 64 (2012), 18490; 1-12.

Submitted by: Irena Ciglonečki-Jušić

## France

### *International conferences*

#### 2013

- Abadie C., Lacan F., Radic, A. and Poitrasson F. Dissolved and particulate iron concentrations and isotopic compositions in the Southern Ocean. Goldschmidt Conference. Florence, Italy, August 2013.
- Bowie, A.R., Quéroué F., Sarthou G., Chever F., van der Merwe P., Bucciarelli E., Townsend A., Blain S., 2013, Dissolved and particulate trace metals in the vicinity of the Kerguelen Islands, Southern Ocean, during the KEOPS 2 experiment, Aquatic Sciences meeting, New Orleans, USA, 17-22 February.
- Cavagna, A.; Quéguiner, B.; Planchon, F.; Jacquet, S.; Closset, I.; Dehairs, F., Production regime and potential for carbon export in the naturally iron-fertilized Kerguelen area (Southern Ocean), Aquatic Sciences meeting, New Orleans, USA, 17-22 February.
- de Brauwere A., Jeandel C., Lacan F., van Beek P., Venchiarutti C., Fripiat F. Putting the pieces together: A multi-tracer model to quantitatively identify the major processes related to the fertilized bloom on the Kerguelen Plateau (TALK) ASLO, New Orleans, USA, February 2013.
- Dulaquais, G. R.; Boye, M.; Carton, X.: Contrasting features of the biogeochemical cycle of cobalt in the west atlantic ocean, Aquatic Sciences meeting, New Orleans, USA, 17-22 February.
- Heimbürger LE, Sonke JE, Cossa D, Galfond B, Laffont L, Point D, Lagane C, and Rutgers van der Loeff M, 2013. Arctic Ocean methylmercury profiles suggest a marine origin, influenced by the carbon cycle - Results from the 2011 GEOTRACES Arctic cruise, 11th International Conference on Mercury as a Global Pollutant, Edinburgh, Scotland 28 July-2 August 2013.
- Heimbürger LE, Sonke JE, Labatut M, Lacan F, Pradoux C, Lagane C, Point D, Jeandel C and Eldin G, 2013. Marine methylmercury production and marine boundary exchange - Results of the 2012 GEOTRACES PANDORA cruise 11th International Conference on Mercury as a Global Pollutant, Edinburgh, Scotland, 28 July-2 August 2013.
- Heimbürger LE, Sonke JE, Labatut M, Lacan F, Pradoux C, Lagane C, Point D, Jeandel C and Eldin G, 2013. Marine methylmercury production and marine boundary exchange - Results of the 2012 GEOTRACES PANDORA cruise. 29th International Conference of the Society for Environmental Geochemistry and Health, Toulouse, France, 8-12 July 2013.

- Jacquet, S. H.; Dehairs, F.; Cavagna, A. J.; Planchon, F.; Closset, I.; Cardinal, D., Seasonal variability of mesopelagic organic carbon remineralization in the naturally iron-fertilized Kerguelen area (Southern Ocean), Aquatic Sciences meeting, New Orleans, USA, 17-22 February.
- Lacan F., Tachikawa K., Tachikawa, K., Arsouze T., Bayon G., Bory A., Colin C., Dutay J-C., Frank N., Gherardi J., Gurlan A. T., Grousset F., Hillaire-Marcel C., Jeandel C., Meynadier L., Montagna P., Pucéat E., Roy-Barman M., Waelbroeck C. A new database for Nd isotopes in marine environments. Goldschmidt Conference. Florence, Italy, August 2013.
- Labatut M., Radic A., Lacan F., Poitrasson F. and Murray J. Oceanic cycle of Fe in the western equatorial Pacific: A story of Fe in the western equatorial Pacific: Insights from its isotopic composition in the dissolved and particulate fractions of seawater and in potential sources. Submitted to ASLO. New Orleans, USA, February 2013.
- Planquette, H., M.P. Field. Improving absolute detection limits and minimizing sample size requirements for marine particulate trace metal determination by SF-ICP-MS, Thermo Scientific – Les Ulis, France. Innovations Technologiques en ICP-MS, 18 Jun 2013.
- Point D., Lorrain A., Heimbürger L-E, Lagane C., Menkes C., Masboul J., Allain V., Sonke J. E., Labaut M., Lacan F., Pradoux C., Jeandel C., Eldin G. Methylmercury origin, accumulation and distribution in tuna and swordfish from the southwestern Pacific Ocean. 11th International Conference on Mercury as a Global Pollutant. Edinburgh, UK, July 2013.
- Quérroué, F., A.T. Townsend, D. Lannuzel, P. van der Merwe, G. Sarthou, E. Bucciarelli, A.R. Bowie, 2013, Trace metal (Fe, Mn, Co, Cu, Pb, Cd, Ni, Al) analysis in open ocean samples using Sector Field ICP-MS, Collaborative on Oceanographic Chemical Analysis Meeting, Hawaii, March 26-29, 2013.
- Sanial V., van Beek P., Lansard B., Souhaut M., Kestenare E. and Zhou M. Use of the radium quartet to study the natural iron fertilization off Kerguelen Islands. Aslo' 2013 Aquatic Sciences Meeting, News Orleans (Louisiana, USA), February 2013.
- van Beek P., Sanial V., Lansard B., Souhaut M., Kestenare E., F. D'Ovidio, Zhou M., S. Blain. Study of the Natural Iron Fertilization off Crozet and Kerguelen Islands (Southern Ocean) Using Radium Isotopes as Tracers, Goldschmidt conference, August 2013.
- Zhou M., d'Ovidio F., Park Y.H., Durand I., Kestenare E., Sanial V., van Beek P., Queguiner B. and Blain S. Estimates of horizontal surface circulation and upwelling using surface drifters in Kerguelen Plateau regions during the 2011 austral spring cruise. ASLO' 2013 Aquatic Sciences Meeting, New Orleans (Louisiana, USA), February 2013.

## 2012

- de Brauwere A., Jeandel C., Lacan F., van Beek P., Venchiarutti C., Fripiat F. Putting the Pieces Together: A Multi-Tracer Model to Quantitatively Identify the Major Processes Related to the Fertilized Bloom on the Kerguelen Plateau (Southern Ocean). POSTER. AGU. San Francisco, USA, December 2012.
- Eldin, G., A. Ganachaud, S. Cravatte and C. Jeandel The Pandora cruise, July 2012 : an integrated approach of the circulation in the Solomon Sea (POSTER) 10th ICSHMO, Noumea (New Caledonia), April 2012.
- Garcia-Solsona E., Labatut M., Lacan F., Pradoux C., Vance D., Jeandel C., Distribution of REE and Nd isotopes along the Bonus Goodhope section in the Southeast Atlantic Ocean. Ocean Sciences Meeting, Abstract ID: 9695. Salt Lake City, USA, February 2012.
- Grenier M., Cravatte S., Blanke B., Menkes C., Koch-Larrouy A., Durand F., Melet A., and Jeandel C. (ORAL) From the western boundary currents to the Pacific Equatorial Undercurrent: modeled pathways and water mass evolutions. 10th ICSHMO, Noumea (New Caledonia), April 2012.
- Grenier M., C. Jeandel, F. Lacan, S. Cravatte, and F. Durand. From the subtropics to the equatorial Pacific: along the route, the neodymium relates. POSTER Ocean Sciences Meeting, Salt Lake City (Utah, USA), February 2012.

- Grenier M., S. Cravatte, and C. Jeandel. Origins and fates of the Solomon Sea thermocline waters: from the subduction areas to the Equatorial Undercurrent. Open Ocean Symposium on Western Pacific Ocean Circulation and Climate (TALK) Qingdao (China), October 2012.
- Grenier, Melanie, Catherine Jeandel, Francois Lacan, Derek Vance, Celia Venchiarutti, Alexandre Cros, S. Cravatte From the subtropics to the equatorial Pacific: along the route, the Neodymium relates., OSS on Western Pacific Ocean Circulation and Climate, October 15-17, 2012, Qingdao, China
- Grenier, M., C. Jeandel, F. Lacan et S. Cravatte REE & isotopes du Nd dans le Pacifique Sud, Workshop NEOSYMPA, Paris, 14 octobre 2012
- Jeandel, C., P. Behra, E. Oelkers, J. Sonke and M. Jones Particle/dissolve exchange processes at the land to ocean boundary: how to improve our understanding of the processes? INVITED ORAL Ocean Sciences Meeting, Abstract ID: 9695. Salt Lake City, USA, February 2012
- Jeandel Catherine (2012) AMANDES: a multidisciplinary GEOTRACES process study on the Amazon shelf Invited talk, GEOTRACES Latino-American workshop. Rio de Janeiro, Novembre 2012.
- Jeandel C., Grenier M., Garcia-Solsona E., Rousseau T., Jones M., and Pearce C. Rare earth Elements (REE) and Nd isotopes in the ocean. INVITED TALK Le STUDIUM® conference, Orléans, May 2012.
- Labatut M., Radic A., Lacan F., Poitrasson F. and Murray J. Oceanic cycle of Fe in the western equatorial Pacific: Insights from its isotopic composition in the dissolved and particulate fractions. Ocean Sciences Meeting, Abstract ID: 10247. Salt Lake City, USA, February 2012.
- Lacan F., Labatut M., Radic A., C. Abadie. Invited talk. Fe isotopic signatures in the seawater and suspended particles from the Equatorial Pacific and the Southern Ocean. AGU. San Francisco, USA, December 2012.
- Marchandise, S., E. Robin, S. Ayrault and M. Roy-Barman (2012) U-Th-REE-Hf-rich phases in marine sediments reflect weathering effect. Goldschmidt conference, Montréal
- Pearce, C.R., Jones, M.T., Oelkers, E.H., Jeandel, C. and Pradoux, C. Marine particulate weathering: A significant seawater source? Rip Meeting 2012, Int Conference, Open Univ. Milton, Keynes
- Pearce, C.R., Jones, M.T., Oelkers, E.H., Jeandel, C. and Pradoux, C. Marine particulate weathering: A significant seawater source? Geochemist group workshop, Oxford University, February 2012
- Planquette H., James R.H. & Parkinson I.J. (2012) Characterisation of the Cr isotopic signature of marine sediments deposited in the S1 Mediterranean sapropel, Mineralogical Magazine, 76(6) : 2239. Goldschmidt Conference, Montréal, Canada
- Planquette, H., James, R.H., Parkinson, I.J. (2012). Characterization of the Cr isotopic signature of marine sediments deposited in the S1 Mediterranean sapropel GEOTRACES Workshop Stable isotopes of biologically important trace metals, London, UK, September 2012.
- Rousseau, T., Jeandel C., Sonke JE, Boaventura G R and Seyler P Nd isotopes in the western equatorial Atlantic water masses: Amazon river and margin contributions.(POSTER) Ocean Sciences Meeting, Abstract ID: 9695. Salt Lake City, USA, February 2012.
- Roy-Barman, M and S. Marchandise (2012) A short oceanic residence time for Hf: element/isotope comparison. Goldschmidt conference, Montréal.
- Sanial V., van Beek P., Lansard B., Souhaut M. and Zhou M. Land-Ocean Connectivity : Tracing and quantifying the iron input that fuels phytoplankton blooms off Kerguelen and Crozet Islands. Land-Ocean Connectivity Meeting : from hydrological to ecological understanding of Groundwater effects in the coastal zone. L'Aber Wrac'h, Brittany (France), September 2012.
- Sarthou G., Quéroù F., Chever F., Bowie A., van der Merwe P., Bucciarelli E., Fourquez M., Blain S., 2012, Dissolved iron in the vicinity of the Kerguelen Islands, Southern Ocean, during the KEOPS 2 experiment, Goldschmidt Conference, Montreal, Canada, 24-29 June.



### ***Workshops, Seminars, etc...***

- Abadie C., Radic A., Labatut M., Pradoux C., Lacan F., Poitrasson F. Particulate Iron Concentrations and Isotopic Compositions in the Southern Ocean, Atlantic Sector. GEOTRACES Workshop, Stable isotopes of biologically important trace metals. Imperial College London, UK. Sept. 2012. Poster
- Grenier M., Jeandel C., Delattre H., Lacan F., Cravatte S. REE et isotopes du Nd dans le Pacifique Sud. NEOSYMPA Workshop. Paris 6 University, Oct. 2012.
- Lacan F. Equipe de Géochimie marine du LEGOS. Journées Scientifiques du LEGOS. Toulouse, March 2013.
- Lacan F., Radic A., Labatut M., C. Abadie, C. Pradoux. Les isotopes du fer pour l'étude des cycles biogéochimiques océaniques. Après-Midi Scientifique de la Société Française des Isotopes Stables, Toulouse, Nov. 2012.
- Lacan F., Labatut M., C. Abadie., Radic A. – Iron isotopes in the dissolved and particulate phases of seawater: sources and processes. GEOTRACES Workshop, Stable isotopes of biologically important trace metals. Imperial College London, UK. Sept. 2012.
- Lansard B, Sanial V., van Beek P., Souhaut M., d'Ovidio F. and Zhou M. What do we learn from radium isotopes about natural iron fertilization off Crozet and Kerguelen Islands ? 4th International Ra-Rn Workshop. Narragansett, June 2012.
- Souhaut, M., van Beek P. Presentation of the LAFARA underground laboratory of Ferrières, French Pyrénées, Collaboration of European Low-level Underground Laboratories (CELLAR) meeting, Lingolsheim, France, 16.-17 October 2012.
- Tachikawa K., Meeting Neo-SYMPA (Workshop NEodymium isotopes in marine environments: SYnergy between Modern, Modelling and PAleo communities), Paris 6 University, Oct. 2012.
- van Beek P., Souhaut M., Sanial V., Lansard B. Study of the ocean using low-background gamma spectrometry, Collaboration of European Low-level Underground Laboratories (CELLAR) meeting, Lingolsheim, France, 16.-17 October 2012.

### ***Working groups***

- Working group on results from the KEOPS 2 cruise (GEOTRACES Process Study), 23-24 May 2013 at LEMAR-IUEM in Brest. 17 scientists from France, Belgium and Australia attended this meeting. <http://www.geotraces.org/meetings/geotraces-events/eventdetail/152/-/working-group-on-fe-budget-during-the-keops-2-cruise>

### ***New Publications***

- Annett A., Henley S., van Beek P., Souhaut M., Ganeshram R., Venables H., Meredith M., Geibert W., Use of radium isotopes to estimate mixing rates and trace sediment inputs to surface waters in northern Marguerite Bay (Antarctic Peninsula), Antarctic Science, Antarctic Science 25(3), 445–456, doi:10.1017/S0954102012000892.
- Bown, J., Boye, M., Nelson, D.M., 2012, New insights on the role of organic speciation in the biogeochemical cycle of dissolved cobalt in the southeastern Atlantic and the Southern Ocean. Biogeosciences, 9, 2719-2736, doi:10.5194/bg-9-2719-2012.
- Bown, J., Boye, M., Laan, P., Bowie, A., Park, H.-Y., Jeandel, C., Nelson, D.M. (2012) Imprint of a dissolved cobalt basaltic source on the Kerguelen Plateau. Biogeosciences, 9, 5279–5290, doi:10.5194/bg-9-5279-2012
- Boye, M., Wake, B.D., Lopez Garcia, P., Bown, J., Baker, A.R., Achterberg, E.P., 2012, Distributions of dissolved trace metals (Cd, Cu, Mn, Pb, Ag) in the southeastern Atlantic and the Southern Ocean. Biogeosciences, 9, 3231-3246, doi:10.5194/bg-9-3231-2012.
- Boyle E.A., John S., Abouchami W., Adkins J.F., Echegoyen-Sanz Y., Ellwood M., Flegal R., Fornace K., Gallon C., Galer S., Gault-Ringold M., Lacan F., Radic A., Rehkamper M., Rouxel O., Sohrin Y., Stirling C., Thompson C., Vance D., Xue Z., Zhao Y. 2012. GEOTRACES IC1 (BATS)

contamination-prone trace element isotopes Cd, Fe, Pb, Zn, Cu, and Mo intercalibration. *Limnology and Oceanography Methods*, 10:653-665, DOI: 10.4319/lom.2012.10.653.

- Bressac M., C. Guieu. Organic complexation versus scavenging: What really happens to new atmospheric iron in the ocean surface? Submitted to *Global Biogeochemical Cycles*, in revision
- Cavagna, A.J., Dehairs, F., Bouillon, S., Woule-Ebongué, V., Planchon, F., Delille, B., Bouloubassi, I., 2013. Water column distribution and carbon isotopic signal of cholesterol, brassicasterol and particulate organic carbon in the Atlantic sector of the Southern Ocean. *Biogeosciences* 10, 2787-2801.
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- Grenier, M., C. Jeandel, F. Lacan, D. Vance, C. Venchiarutti, A. Cros, and S. Cravatte From the subtropics to the central equatorial Pacific Ocean: neodymium isotopic composition and rare earth element concentration variations. *J. Geophys. Res. Oceans*, 118, 592–618, doi: 10.1029/2012JC008239.
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- Stichel T., Frank M., Rickli J., Hathorne E.C., Haley B., Jeandel C. and Pradoux C. Sources and input mechanisms of Hf and Nd in surface waters of the Atlantic sector of the Southern Ocean. *Geochim. Cosmochim. Acta*, 94, 2012, 22-37 <http://dx.doi.org/10.1016/j.gca.2012.07.005>
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### ***Cruises***

- Monopole cruise (may-15th June 22nd-2012, PI: F. Bassinot). During this paleo-oceanographic cruise in the Gulf of Bengal, seawater, ISP and top surface sediment samples were collected for Pa-Th, Ra, Nd and Os analysis (Matthieu Roy-Barman, LSCE).
- The GEOTRACES French Pandora Cruise GP12 was completed from 27 June 2012 to 7 August 2012 (<http://www.geotraces.org/news-50/news/446-geotraces-french-cruise-in-the-solomon-sea-successfully-completed>), with scientists from France (LEGOS, GET, LOCEAN and LEMAR) Hawaii, Washington and Princeton universities (USA), British Columbia University (Ca), Bristol University (GB) and Max Plank Institute Mainz (G).
- GEOTRACES-A02 section extended in the west-northern Atlantic (LEG4), August 2012, RV Pelagia, Chief Scientist M. Rijkenberg (Gabriel Dulaquais, LEMAR).
- GEOTRACES-A04N in the Mediterranean and Black Seas, May-August 2013, RV Pelagia, Chief Scientist M. Rijkenberg (Gabriel Dulaquais and Marie Boyé, LEMAR; Lars-Eric Heimbürger, GET).

### ***New funding***

- French-Swedish funding for a project in the Arctic Ocean. PIs: Per Andersson and Matthieu Roy-Barman
- CHIPIE (Comportement des éléments d'intérêt biogéochimiques et du carbone Particulaire aux Interfaces atmosphère-océan et continent-océan dans un contexte d'évolution des conditions Environnementales; PI C. Guieu) fundings UPMC and INSU: Main goal of CHIPIE is to quantify by the mean of well controlled experiments conducted in clean room, the evolution of the behavior of chemical elements with biogeochemical interest (N, P, Fe etc.) and carbon at the atmosphere-ocean interface in a context of evolving environmental conditions (ocean acidification, increase in temperature). We propose to develop an original experimental approach to simultaneously follow the behavior of chemical elements and the fate of particles combining atmospheric deposition and various environmental conditions such as pH, temperature, mixing, quality of organic material.
- ANR RPDOC BITMAP : Bioavailability of Iron and other Trace Metals in marine Particles, 480 k€ (12/2012-12/2015), PI Hélène Planquette UMR 6539 LEMAR. Collaborators: LEMAR (E. Bucciarelli, S; LHelguen, F. Planchon, G. Sarthou); LEGOS (F. Lacan, C. Pradoux ; IPGP (E. Viollier), IMCS Rutgers (R. Sherrell)
- Pieter van Beek, Marc Souhaut (coll. Erika Sternberg; Roger François) : Analysis of the radium activities ( $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ ) in water samples collected during ArcticNet 0903 – LEG 3a (Paulatuk – Paulatuk on board CCGS Amundsen) ; August 27 – September 12, 2009
- OPTIMISP project (F. Lacan) in 2012: optimization of in situ pumps (ISP).
- The 5 French McLane ISP should be modified by the end of 2013 in order to fit simultaneously 3 membranes (nuclepore for surface studies; SUPOR for trace metals and QMA or GFF for carbon) and 2 Mn impregnated cartridges for in situ preconcentration of dissolved elements such as radium. The prototype has been already modified by DT INSU (picture below).



### ***Other activities***

- Participation to cross-over station trace metal calibration (BGH/UK, BGH/NL, GA02/US, GA02/UK).
- Marine Hg and methylHg intercalibration exercise on the GEOTRACES Mediterranean / Black Sea cruise (PI Lars-Eric Heimbürger).

- Participation to the next intercalibration effort organised by P. Lam (WHOI): “Particles intercal. during GA04N section”, H. Planquette.

Submitted by: Geraldine Sarthou

## Germany

GEOTRACES activities in Germany mainly focused on the analysis of samples collected on cruises in previous years and the submission of two cruise proposals for the Arctic Ocean in 2015 (Central Arctic) and 2016 (Fram Strait) on *R/V Polarstern*.

### ***Cruise proposals***

We have submitted proposals for two *R/V Polarstern* expeditions 2015 and 2016, both with GEOTRACES components as part of the coordinated GEOTRACES program for the Arctic Ocean. The proposal for the 2015 expedition aims at sampling the central Arctic Ocean, while our part in the 2016 proposal has the objective to study the Fram Strait in order to quantify the tracer exchanges through this gateway to the Atlantic Ocean. Both proposals have received excellent reviews and have been selected to be scheduled as requested. A final decision is expected in July 2013.

Proposal for 2015: *Trans-Arctic Survey of the Arctic Ocean in Transition*, R/V Polarstern, 2015 (PIs: U. Schauer, M. R. v.d. Loeff, H.de Baar, M. Rijkenberg, P. Masqué, K. Pahnke, M. Frank).

Proposal for 2016: *FRAM Strait oceanography and GEOTRACES, East Greenland glacier melt*, R/V Polarstern, 2016 (PIs: U. Schauer, M. R. v.d. Loeff, H.de Baar, M. Rijkenberg, P. Masqué, K. Pahnke, M. Frank).

### ***New results***

Data for the intermediate data product obtained during M81/1 (GA11) (M. Frank, GEOMAR) and ANTXXVI-2 (Nd isotope data, C. Basak, K. Pahnke, U. of Oldenburg) have been submitted. The cruise report of M81/1 has been approved by the funding agency. A publication on the Nd/Hf isotope data obtained during the Baltic Sea process study has been submitted to GCA.

Cd isotope profiles from Pelagia cruise PE369 and stable Sr and Ca isotopes in seawater have been acquired.

The first five water column profiles from *R/V Sonne* cruise SO223T (GEOTRACES Process Study) have been analyzed for dissolved Nd isotopes.

### ***Other activities***

The trace metal clean rosette and CTD of GEOMAR has been purchased and delivered. The clean van for taking clean samples is close to being finished and a mobile winch is in the ordering process at GEOMAR. Eric Achterberg will join GEOMAR in August and will be a new player in the German GEOTRACES activities. Submission of a joint cruise proposal, most likely for the Indian Ocean, is planned for September.

Samples for the intercalibration of Nd isotopes, REE concentrations, and Si isotopes to be measured at GEOMAR have been collected on the GEOTRACES Mediterranean cruise.

### ***Publications***

*Submitted manuscripts*

- Abouchami, W., Galer, S.J.G., de Baar, H.J.W., Middag, R., Klunder, M., Mezger, K., Feldmann, H., Andreae, M.O. (2013), Cadmium isotopes in the Southern Ocean – a tracer of nutrient cycling, *Geochimica Cosmochimica Acta* (in revision).
- Chen, T.-Y., Stumpf, R., Frank, M., Beldowski J. and Staubwasser, M. (2013) Contrasting geochemical cycling of hafnium and neodymium in the central Baltic Sea. *Geochimica Cosmochimica Acta* (submitted).

*Oral and poster presentations*

- Abouchami, W., Galer, S.J.G., Feldmann, H., Andreae, M. O., de Baar, H.J.W., Middag, R., Klunder, M., Laan, P. (2012) Micronutrient Cadmium, distribution and stable isotope fractionation. AGU Fall Meeting, San Francisco, 2012 (invited talk).
- Abouchami, W., Galer, S.J.G., Feldmann, H., Andreae, M. O., de Baar, H.J.W., Middag, R., Klunder, M., Laan, P., Rijkenberg, M., Gerringa, L., de Jong, J., Timmermanns, K., Schuback, N. (2012). Stable Cd Isotopes in Seawater, UK Geotraces Meeting, London, September 2012 (Talk).
- Basak, C., Pahnke, K. (2012). Bottom Water Changes in the South Pacific Over the Last 30 ka Documented by Nd Isotopes. Goldschmidt Conference, Montréal, Canada, *Mineralogical Magazine* 76, 1458 (Talk).
- Basak, C., Pahnke, K. (2012). South Pacific Water Mass Structure From Nd Isotopes: Present And Past, AGU Fall Meeting, San Francisco (Talk).
- Chen, T., Frank, M. und Stumpf, R. (2012) *Nd & Hf concentrations and isotopic compositions in the Baltic Sea*. Goldschmidt Conference, Montréal, Canada (Talk).
- Pahnke, K., Basak, C., Gersonde, R. (2012) Neodymium isotopic composition of South Pacific bottom water. Goldschmidt Conference, Montréal, Canada, *Mineralogical Magazine* 76, 2199.
- Pöhle, S., Koschinsky, A., and Schmidt, K. (2012) Determination of Zr, Hf, Nb and Ta in seawater by the use of an online-preconcentrations system connected to inductively coupled mass-spectrometry (ICPMS). *Geoanalysis, 8th International Conference on the Analysis of Geological and Environmental Materials*, Buzios (Brazil), Sept. 16-20, 2012. (Talk)
- Pöhle, S., Koschinsky, A., Moos, S., and Sander, S., Chromium speciation in the oceanic water column. ASLO 2013 Ocean Sciences Meeting, New Orleans, 2013. (Talk)
- Zieringer, M., Frank, M. und Hathorne, E. (2012) *The distribution of neodymium isotopes and REE patterns in the water column of the tropical Atlantic Ocean*. Goldschmidt Conference, Montréal, Canada (Talk).

Submitted by: Katharina Pahnke

## Greece

### **Meetings**

- Participation in Davos Atmosphere and Cryosphere Assembly 2013, Switzerland.
- Scheduled participation in CIESM meeting next October in Marseille.
- Convener of a session at Goldschmidt conference (Aerosols deposition and their role on ecosystem and climate).

### **New funding**

- University of Crete will start a new project to study whether interaction between anthropogenic and natural sources (namely dust) can affect solubility of important nutrients such as P and Fe.

### **Other activities**

Within the framework of the Crete mesocosms facilities changes in dissolved and particulate abiotic components and the impact of dust on the autotrophic and heterotrophic surface microbial populations during a transitional spring season that is characterized by high inputs of dust events was studied by an international consortium composed by scientists from Israel, Turkey, UK, France and Greece (University of Crete, HCMR, University of Athens). Two different treatments were deployed : In the first treatment, Saharan dust event material collected in Crete was added to the mesocosms (3 replicates). In the second treatment aerosol also collected in Crete containing a natural mixture of desert dust and polluted European particles was added to the mesocosm. The results will be presented at CIESM and Goldschmidt international conferences.

### **Publications**

- Parinos, C., Gogou, A., Bouloubassi, I., Stavrakakis, S., Plakidi, E., Hatzianestis, I. Sources and downward fluxes of polycyclic aromatic hydrocarbons in the open southwestern Black Sea, *Organic Geochemistry*, Volume 57, Pages 65-75, 2013.
- 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.
- C. Theodosi, C. Parinos, A. Gogou, A. Kokotos, S. Stavrakakis, V. Lykousis, J. Hatzianestis, and N. Mihalopoulos, Downward fluxes of elemental carbon, metals and polycyclic aromatic hydrocarbons in settling particles from the deep Ionian Sea (NESTOR site), Eastern Mediterranean, *Biogeosciences*, 10, 4449–4464, 2013, doi:10.5194/bg-10-4449-2013.

Submitted by: Nikos Mihalopoulos

## India

During last two years, GEOTRACES (India) were in process of acquiring clean sampling system. Finally the clean sampling system has been acquired as per the following details:

- (i) Carousel Water Sampler with 24 Niskin X Teflon coated bottles(12 l) and CTD unit from Seabird
- (ii) 14 mm Kevlar Cable from Cortland – 8000 m
- (iii) Metal free CTD winch from Lebus International
- (iv) Potable Clean Van from Silhouette, Canada

### ***Cruises***

Cruise of Section GI03 in Indian Ocean were undertaken during March 3 to May 10, 2013 onboard Sagar Kanya. This was first GEOTRACES – India cruise equipped with complete clean sampling system. All the key parameters are being measured in this section. Cruise track is shown in Figure 10. The initial planned track was modified after commencement of the cruise due to problems with dynamic positioning system of the vessel which was later rectified during the cruise.



**Figure 10.** Cruise track of section GI03 in the Indian Ocean.

Altogether 28 participants from 9 Indian institutions participated in this cruise. The entire cruise was divided in two legs, Leg 1: Goa, India to Jakarta, Indonesia and Leg 2: Jakarta, Indonesia to Chennai India. Water samples for measurements of key trace elements along with high volume samples for Hf, Nd, Ra, Th isotopes were collected on this cruise. Aerosol samples were collected all along this track. Water leachable ions from these aerosols were continuously monitored onboard.

### ***Science***

#### *Internal cycling of dissolved barium in water column of the Bay of Bengal*

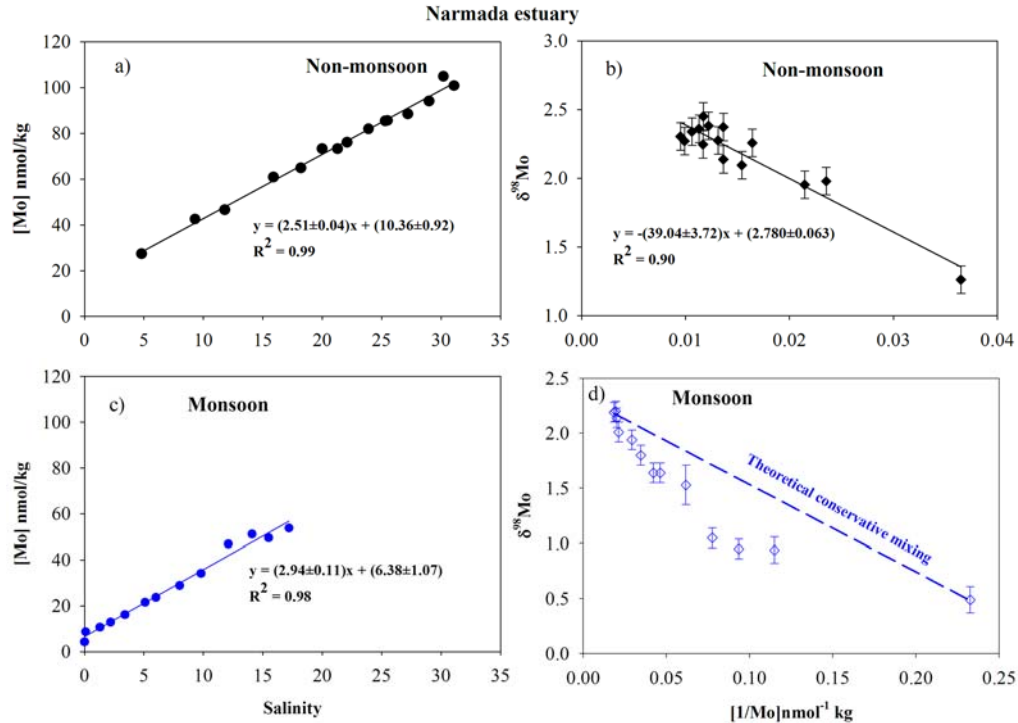
Dissolved barium concentrations in water column of the Bay of Bengal along the 87°E transect (~6°N to ~21°N) have been measured to track the dispersion of its large influx from the Ganga–Brahmaputra river system and the outflow to the equatorial Indian Ocean. A typical barium concentration–depth profile shows relatively higher Ba concentration in surface waters (depth <5 m) followed by a minimum in the depth interval ~50–150 m, which further increase with depth. The barium concentrations in surface



waters (depth  $\leq 5$  m) of the Bay of Bengal vary from  $\sim 34.9$  nmol/kg in the southern BoBt to  $\sim 112.8$  nmol/kg close to mouth of the Hooghly. The dissolved Ba in the surface water of BoB is dominated by its supply from the G–B river system. The Ba concentrations in deep waters (depth  $\geq 500$  m) is controlled dominantly by water mixing as suggested by a very strong and significant inverse correlation with salinity. Exceptions to this conservative behavior are the “hot-spots” of dissolved Ba in bottom waters, which are probably resulted by the dissolution of sediments at and/or below the sediment–water interface. Under the steady state the annual Ba influx from the Ganga–Brahmaputra river system seems to be balanced through its removal via sinking particulates as a result there is no lateral outflow of dissolved Ba from the G–B to the equatorial Indian Ocean through top  $\sim 100$  m of the BoB. Most of this sinking particulate Ba ( $\sim 95$  %) is regenerated again in the lower box, preferentially in the intermediate waters  $\sim 100$ – $500$  m. Therefore, frequently ventilated intermediate waters of the Bay of Bengal, receiving a large input of dissolved Ba through particle remineralization can be the significant source of dissolved Ba to the Indian Ocean.

### *Molybdenum isotope composition in Narmada and Tapi estuaries*

Behaviour of Mo isotope composition in dissolved phase has been studied in the Narmada and Tapi rivers and estuaries. Mo isotope composition in these water were measured using double spike by MC-ICP-MS.  $\delta^{98}\text{Mo}$  of dissolved Mo of these rivers display higher values compared to that of the basalt, the major lithology of these rivers indicating adsorption of lighter Mo on Fe, Mn oxy hydroxide during riverine transport. Mo isotope display non-conservative behaviour in both the Narmada and the Tapi estuary. In the Narmada estuary, lighter Mo being contributed either by particle desorption or from submarine groundwater discharge. In the Tapi estuary, lighter Mo is being supplied by anthropogenic activities such as from steel industry situated nearby. This study underscores the need to characterize the Mo isotope composition of global rivers and estuaries before using it as a proxy of paleo-redox condition.



**Figure 11.** Mo isotope displays non-conservative behaviour in the Narmada Estuary indicating supply of lighter Mo either from particulates or from submarine groundwater discharge

### ***Meeting Arranged***

- GEOTRACES SSC meeting during October 29-31, 2013 at Goa, India.
- Data Management Committee meeting during October 27-28, 2013 at Goa, India.

### ***Planned Cruise***

- Arabian Sea: Cochin – Goa, January, 2014: along 68° E from 1° N to 21° N.

### ***Publication***

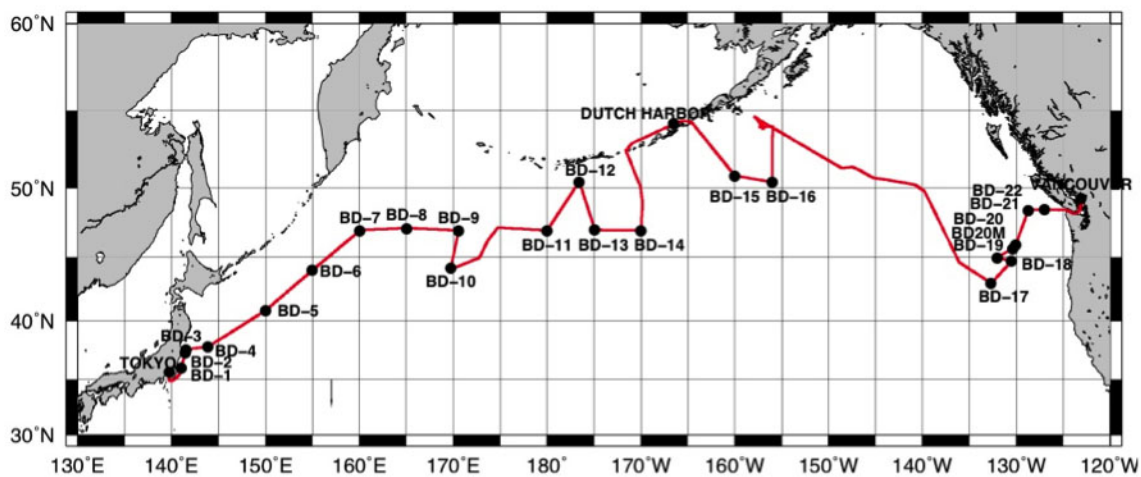
- Singh S.P., Singh S. K. and Bhushan R. (2013) Internal cycling of dissolved barium in water column of the Bay of Bengal, *Marine Chemistry* 154, 12–23.

Submitted by: Sunil Kumar Singh

## **Japan**

### ***Cruise***

The GEOTRACES GP02 (R/V *Hakuho Maru* KH-12-4) cruise, nicknamed “Big Dipper (BD) Expedition, for the purpose of a zonal (~47°N) transect in the subarctic North Pacific Ocean was conducted from 23 Aug. to 3 Oct. 2012. Thirty three scientists including technical supporting staffs and graduate students joined the cruise (chief scientist: Toshitaka Gamo). Although the cruise had to omit several stations in the northeastern Pacific due to severe weather conditions, 22 stations as shown in the following figure were successfully occupied for clean seawater sampling from surface to bottom using a Seabird CTD-Carousel system with Teflon-coated Niskin-X (12L) bottles and a large volume (250 L) water sampling system. Bottom sediments were taken with a multiple corer. Measurements of chemical constituents and isotopes were and will be performed in clean rooms on board the ship and in shore-based laboratories. Inter-calibration was also conducted by comparing the GEOTRACES-recommended Kevlar wire hydrocast with the R/V *Hakuho Maru*'s titanium wire hydrocast. We visited a baseline station, K2 (BD-7) (47°N, 160°E) in the northwest Pacific Ocean, taking seawater samples not only for shipboard scientists but also for other international scientists who will be interested in measuring some of the GEOTRACES key parameters for comparison.



**Figure 12.** GEOTRACES GP02 (R/V *Hakuho Maru* KH-12-4) cruise track

### ***Meetings***

- GEOTRACES session in Annual Meeting of the Geochemical Society of Japan (in Japanese) was convened by Y. Sohrin and J. Zhang on 11 Sep 2012 at Kyushu Univ, Hakata. There were 11 oral presentations and fruitful discussions.
- National sub-committee on GEOTRACES (affiliated to the national SCOR committee) in the Science Council of Japan was held at Tokyo University of Marine Science and Technology on March 24, 2013, during the Spring Meeting of Oceanographic Society of Japan. International and national problems and information on GEOTRACES program were widely discussed and exchanged.

### ***Recent publications***

- Nishioka, J. Obata, H., Tsumune, D.: Evidence of an extensive spread of hydrothermal dissolved iron in the Indian Ocean. *Earth Planet Sci. Lett.*, 361, 26-33 (2013).
- Vu, H.T.D. and Sohrin, Y.: Diverse stoichiometry of dissolved trace metals in the Indian Ocean. *Sci. Reports*, 3, DOI: 10.1038/srep01745 (2013).

### ***New research vessel***

R/V *Tansei Maru* (JAMSTEC) was retired at the end of January 2013. The successive new vessel *Shinsei Maru* (1630t, 15 scientists) is now being constructed by JAMSTEC, and will be completed in June 2013. R/V *Shinsei Maru* is equipped with a Kevlar armored cable and a clean container laboratory, which will be useful for trace element studies chiefly in coastal areas.

Submitted by: Toshitaka Gamo

## **Mexico**

### ***Meetings***

- Two oral presentations and two posters were exposed by Mexican participants on the GEOTRACES Latin American Workshop (12-15 November 2012, Pontifical Catholic University of Rio de Janeiro, Brazil).
- Six oral presentations were given in international conferences such as AOGS-AGU (WPGM) Joint Assembly (13-17 August, 2012, Resorts World Convention Centre, Singapore), Primer congreso internacional de la red de medio ambiente. Instituto Politécnico Nacional (7 – 9 de noviembre del 2012. Querétaro, México), VII International Symposium on the Sea of Cortéz (Ensenada, Baja California, 8 a 12 de abril del 2013)
- Presentación oral en la XIII Reunión Anual IMECOCAL, Estudios Oceanográficos de la Corriente de California, Ensenada, BC, México, 29-30 de noviembre del 2012.
- Presentación oral en el IV Simposio Internacional del Carbono en México, Texcoco, Estado de México, 21-24 de mayo de 2013 RCD

### ***Cruises***

R/V “ El Puma” (UNAM) was used in June 2013 in the western Gulf of California, in front of Santa Rosalía copper mining region to collect surface sediments and to study vertical profiles of dissolved oxygen in water column, because the deficit of the dissolved oxygen affects the accumulation of redox-sensitive elements such as uranium the marine sediments. The samples are necessary for geochemical studies of heavy metal pollution of the marine environment occurred as a consequence of ancient mining, as well as for the assessment of the combined impact of anthropogenic sources and water column oxygen minimum zone influence on the geochemistry of redox-sensitive trace elements with special attention to uranium and lanthanides.

### ***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 fund. Limited financial support for the research and educational centers in the National Polytechnic Institute of Mexico system is also available.

New collaborative project “High resolution geochemical reconstructions of recent climate and oxygenation history in La Paz Bay, Gulf of California” was recently approved for next 18 months by 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. Choumilin (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: 2010-2013).
- “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).

#### **b) Funding from “Secretaría de Investigación y Posgrado” of the National Polytechnic Institute of Mexico (Instituto Politécnico Nacional).**

- Multidisciplinary scientific project “Geochemical and ecotoxicological evaluation of the contamination state by heavy metals of the coastal environment of Santa Rosalía mining region (Southern Baja California)”, with the funding of \$750,000 pesos from Instituto Politécnico Nacional (P.I.- Dr. Evgueni Shumilin; duration: 2011-2012) was successfully terminated in the January of 2013.
- 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).
- Individual scientific project 20130611 “Ecology of the pelagic system of the Magdalena Bay, Baja California Sur, Mexico”, with the funding of \$48,000 pesos (P.I. –Dr. R. Cervantes Duarte; duration February 2013-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 and marine sediments, especially in contrasting environments with distinctive features such as active tectonics or environmental pollution.

The objective of this study is to characterize shale-normalized lanthanide patterns as well as trace element composition of settling particulate matter (SPM) and marine sediments of the Alfonso Basin, southwestern Gulf of California.

The SPM was collected with an automated sediment trap during 2002-2010 with a periodicity of 7-15 days near the bottom of Alfonso Basin. A recent sediment core was obtained with a box corer near the trap location. The major, trace element and lanthanide contents were determined using instrumental neutron activation analysis, aided with suitable standard reference materials. The core was dated using the Pb-210 method.

The trap material composition and sediment core analyses helped establishing fluvial supply, mostly during tropical cyclones (Sc and Fe), biogenic contribution (Ca, Ba and U), aeolian effect (Sc, Fe and As) and authigenic particle formation due to suboxic conditions of the water column or associated to organic matter (U and As). The shale-normalized patterns in SPM show an alternation between light and heavy lanthanides, as well as a typical negative Eu anomaly, which becomes positive during some events. The light/heavy (normalized La/Yb ratio) in the core, representing the time span between 1850 and 2008, showed the same alternation as the settling particles. Mostly the core has a negative Eu anomaly with rare positive Eu prominent peaks. The positive Eu anomaly in both cases is presumably related to hydrothermal activity of Gulf of California tectonics. Calcium values in the sediment core show an increase tendency after the year 1950 which seem to coincide with a superficial temperature reconstruction (NOAA ERSST v3b).

- Marine sediments from the coastal zone of Santa Rosalía are characterized by high contents of heavy metals due to ancient mining and smelting of copper ores. In order to find out the present-day levels of metals and specially due to the soon opening of the new mining and metallurgic company of “El Boleo”, 75 surficial sediment samples were collected in September 2011. The total contents of 50 elements in the sediments were measured by a combination of ICP-AES and ICP-MS instruments after concentrated strong acid digestion and heating at 250°C. “Mobile” metals in the sediments were determined after cold acid leaching. The Principal Component Analysis with Varimax rotation was applied to the obtained dataset, which allowed distinguishing three associations of elements with high positive scores (> 0.5). The association I (Ag, Ba, Be, Bi, Cd, Co, Cu, Fe, In, Li, Mg, Mn, Mo, Ni, lanthanides, Pb, Sr, Tl, U, V, Y and Zn) presumably corresponds to the input of mineralized terrigenous material of ore deposits, naturally formed at first or modified during a smelting of ore minerals afterwards. The association II (Cs, Hf, K, Rb, Re, S, Se, Th and Corg ) probably reflects the contribution of fine natural clayey material, enriched in organic matter. The association III (Al and Sc) is probably due to the supply of the terrigenous aluminosilicates. The enrichment factors (EFs) of Ag, Ba, Bi, Cd, Co, Cu, Mn, Ni, Pb, Sb, U, V and Zn in sediments, calculated using Al as a normalizing crustal element, are higher than unity. With respect to the average EFs for the marine sediments with Cu content higher than the effect range medium guideline value (ERM) of 270 mg kg<sup>-1</sup>, these enriched elements showed the following sequence: Cu (115) > Zn (29) > Co (27) > Mn (23) > Cd (12.6) > U (11) > Bi (10.9) > Pb (6.7) > Sb (5.0) > Ag (4.1) > Ba (4.0) > Ni (3.2) > V(2.6). All these elements 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.

The spatial distributions of total and acid leachable Cd, Co, Cu, Mn, Pb and Zn contents in the surface sediments delimit the principal “hot spots”, associated with the dumped smelting wastes. About 50% of the surface sediment samples exceeded the ERM guideline value of 270 mg kg<sup>-1</sup> proposed for Cu, the principal pollutant of this specific environment.

- The study of the biogeochemical cycles of the elements is important because they regulate the functioning of marine coastal ecosystems. To determine the factors that control the distribution of potentially toxic elements (PTEs) in surface sediments of the La Paz Lagoon (south -western Gulf of California) and their possible sources, 91 sediment samples were collected by free diving. After a total digestion of oven-dried (60 oC, 24 h) sediments with a mixture of concentrated strong acids (HF+HCNO<sub>3</sub>+HClO<sub>4</sub>) the concentrations for over 50 elements were measured with inductively

coupled plasma mass spectrometry. The enrichment factors and the Müller's geoaccumulation index of the analyzed elements were calculated using obtained data to distinguish naturally or anthropogenically enriched PTEs.

A principal component analysis was also used to determine the possible associations between elements. The results obtained allow us to establish that there are natural inputs of elements such as Se, Ag, As, Cd and Sb into the sediments, which reflect mainly the lithology of the geological formations surrounding the lagoon. Greatest enrichments of As and Cd were found in the area adjacent to the Mogote peninsula which may reflect litoral transport of phosphatic materials rich in some trace elements, supplied to the sea by arroyos that cut through the Lomas de la Virgen geologic formation. The Pb probably has anthropogenic origin, because its higher concentrations up to 36.8 mg kg<sup>-1</sup> were recorded near the La Paz city.

*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).
- Félix-Bermúdez A., 2012. Biogeochemistry of Mn, Cu and Cd in the Colorado River delta. M.S. Thesis in Coastal Oceanography. Universidad Autónoma de Baja California. Ensenada, Mexico (concluded).
- Salamanca-Quevedo E. 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 (in process).
- 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 (in process).
- Reyes-Bravo M. 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 (in process).

## ***Publications***

### *Journal articles*

- Cervantes-Duarte R., López-López S., Aguirre-Bahena F., González-Rodríguez E. and S. Futema-Jiménez, 2012. Relevancia de fuentes nitrogenadas nuevas y regeneradas en la columna de agua en Bahía Magdalena (SO) Península de Baja California), México. *Revista de Biología Marina y Oceanografía*, 47 (3): 587-592.
- 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.
- 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(2): 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.  
**doi:** 10.1039/C2EM30866E .

- 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 (1), 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(2): 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 (3):333-337; doi: 10.1007/s00128-012-0923.
- Shumilin E., Rodríguez-Figueroa G., Sapozhnikov D., Yuri Sapozhnikov Yu. and K. Choumiline, 2012. Anthropogenic and authigenic uranium in the marine sediments of the Central Gulf of California adjacent to the Santa Rosalía mining region. *Archives of Environmental Contamination and Toxicology*, 63: 309-322; doi: 10.1007/s00244-012-9776-1.
- 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 (1), 89-96. Doi: 10.5209/rev\_JIGE 2013v39.n1.41750.
- 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. Wintertime enrichment of inorganic nutrients in the Ballenas Channel, Gulf of California. *Ciencias Marinas*, 39(2): 47–64.

#### ***Other activities***

- Dr. R. Cervantes Duarte from CICIMAR –IPN during 2012 passed his sabbatical year in the Laboratory of the Marine Biogeochemistry of the Instituto de Investigaciones Marinas (CSIC) in Vigo (Spain). He had participated in the project “The inputs of trace elements to the coastal zone during different oceanographic periods. The influence of phytoplankton on trace metal concentrations “ (CTM2011-28792-C02-02).
- Dr. M. L. Leal Acosta (ex-Ph.D. student of CICIMAR-IPN) has a 8-month duration stay (October 2012-June 2013) in Bermuda Institute of Ocean Studies obtaining theoretical knowledge and practical experience of doing oceanographic research, which included also the marine element biogeochemical studies with the use of the sediment traps.
- M.S. K. Choumiline, ex-student of CICIMAR-IPN) is accepted as a Ph.D. student to the Biogeochemistry Laboratory of Dr. Timothy Lyons in the Department of Earth Sciences of the University California-Riverside (California, USA).

Submitted by: Evgueni Choumiline

## *The Netherlands*

**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 2012-2013 we focused with our west Atlantic work on the compilation and analysis of the data collected in the western Atlantic Ocean in 2010 – 2012.

**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) are organized in concert with a cruise of the Spanish Mediterranean GEOTRACES program (GA04S). In 2012/13 our work in the Mediterranean and Black Seas focused on: i) the preparation of 3 research cruises to the Mediterranean Sea and Black Sea, and ii) the execution of the first leg in the Mediterranean Sea (14 May-05 June 2013).

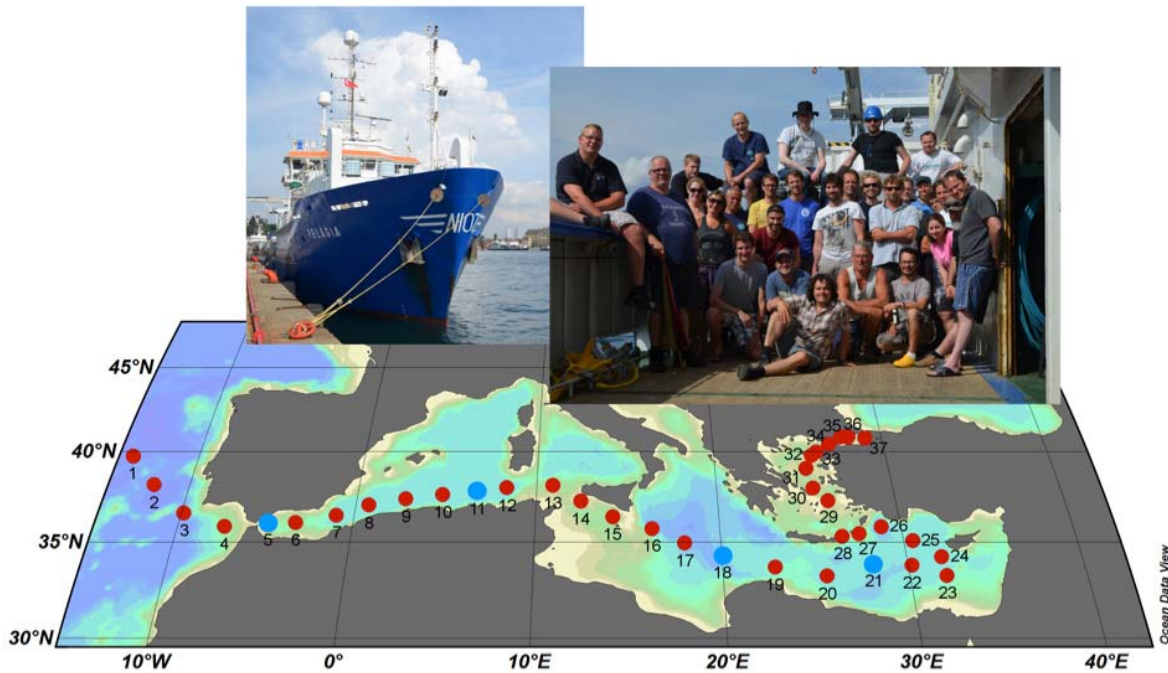
### ***Meetings***

- GEOTRACES SSC meeting: Micha Rijkenberg attended the GEOTRACES Scientific Steering Committee meeting on 29-31 October in Goa, India.
- Planning of Mediterranean GEOTRACES: Micha Rijkenberg visited Jordi Garcia-Orellana and Patrizia Ziveri at the Universitat Autònoma de Barcelona on 18 January 2013 to discuss the coordination between the Spanish and the Dutch Mediterranean GEOTRACES cruises.
- Ocean Sciences 2013 conference in New Orleans, USA: Micha Rijkenberg presented work at the Ocean Sciences 2013 conference in New Orleans.

### ***Cruises***

With Micha Rijkenberg as chief scientist 18 participants left Lisbon on board RV *Pelagia* on 14 May 2013 for the first Dutch leg of the MedBlack GEOTRACES cruises (GA04N), see Figure 13. We completed this first leg sampling 37 full depth stations starting in the eastern North Atlantic Ocean, through the Strait of Gibraltar, the western and eastern basins of the Mediterranean Sea and northward into the Aegean Sea, followed by the Dardanelles and the Sea of Marmara before arriving in Istanbul on 05 June 2013. The second leg of the MedBlack GEOTRACES cruises will leave Istanbul on 13 July 2013 for the Black Sea to return in Istanbul on 25 July 2013. The third leg will leave Istanbul on 25 July for the northern parts of the Mediterranean and arrives in Lisbon on 12 August 2013.





**Figure 13.** The RV *Pelagia*, its crew and participants, and the cruise track of leg 1 of the MedBlack GEOTRACES cruises (GA04N, 64PE370).

### ***New funding***

The proposal “GEOTRACES, the biogeochemical cycles of bio-essential trace metals and isotopes in the Mediterranean Sea and Black Sea” (300 kEuro and 50 ship days) by Hein de Baar & Micha Rijkenberg was funded by Dutch NWO Open Competition for GEOTRACES transects in the Mediterranean Sea and Black Sea.

### ***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 (DFe, DA1 and the micro and nanomolar nutrient concentrations).

### ***Presentations***

- De Baar, H.J.W., Klunder, M.A., Thuróczy, C.-E., Laan, P., Gerringa, L.J.A., Alderkamp, A.-C., Middag, R., Arrigo, K.R.. Dissolved Iron in the Arctic and Antarctic Oceans. Oral presentation at the 2012 Goldschmidt Conference 28-07-2012, Montreal, Canada.
- De Baar, H.J.W., Rijkenberg, M.J.A., Gerringa, L.J.A., Middag, R., Van Hulten, M.M.P., Laan, P., Schoemann, V., De Jong, J.T.M., Sterl, A., Van Aken, H.M.. Contrasting Biogeochemical Cycling of Iron and Aluminium along the GEOTRACES West Atlantic section. Oral presentation at the 2012 Goldschmidt Conference, 26-07-2012, Montreal, Canada.
- Lambelet, M., van de Flierdt, T., Crocket, K., Rehkämper, M., Kreissig, K., Coles, B., Rijkenberg, M.J.A., Gerringa, L.J.A., van Aken, H.M., de Baar, H.J.W. (2013) Neodymium isotopic composition and concentration in equatorial to North Atlantic seawater, Goldschmidt conference, Florence, Italy, oral

- Rijkenberg, Micha J.A., Gerringa, Loes, J.A., Laan, Patrick, Schoemann, Veronique, Middag, Rob, van Aken, Hendrik M., de Jong, Jeroen T.M., van Haren, Hans, and de Baar, Hein J.W. (2013) GEOTRACES: The accessibility of dissolved Fe for phytoplankton in the western Atlantic Ocean, ASLO Meeting, New Orleans, US, oral
- Rijkenberg, Micha J.A., Gerringa, Loes, J.A., Laan, Patrick, Schoemann, Veronique, Middag, Rob, van Aken, Hendrik M., de Jong, Jeroen T.M., van Haren, Hans, and de Baar, Hein J.W. (Nov 2012) GEOTRACES: What we learnt from the distribution of dissolved iron in the western Atlantic Ocean, ZKO funding agency Symposium, The Hague, oral

### ***PhD theses***

- Maarten Klunder successfully defended his thesis on Fe in Polar Oceans on 5 October 2012 at the University of Groningen (<http://irs.ub.rug.nl/ppn/345817559>).
- Steven van Heuven successfully defended his thesis on CO<sub>2</sub> in the Southern Ocean on 8 February 2013 also at the University of Groningen (<http://irs.ub.rug.nl/ppn/354004719>).

### ***Publications***

#### *Published:*

- van Hulten, M.M.P., Sterl, A., Tagliabue, A., Dutay, J.-C., Gehlen, M., de Baar, H.J.W. and Middag, R., 2012. Aluminium in an ocean general circulation model compared with the West Atlantic Geotraces cruises. *J. Mar. Syst.*, doi: 10.1016/j.jmarsys.2012.05.005
- Middag, R., De Baar, H.J.W., Klunder, M.B., Laan, P., 2013. Fluxes of dissolved aluminum and manganese to the Weddell Sea and indications for manganese co-limitation. *Limnology and Oceanography* 58 (1), 287-300.
- Roeske, T., Rutgers vd Loeff, M., Middag, R., Bakker, K., 2012. Deep water circulation and composition in the Arctic Ocean by dissolved barium, aluminium and silicate. *Marine Chemistry*, 132-133, 56-67.

#### *Submitted:*

- De Baar, H. J. W., K. Bakker, L. J. G. Gerringa, E. Keijzer, M. Laan, P. Laan, R. Middag, S. Ober, M. J. A. Rijkenberg, and M. G. Smit. Ultraclean PRISTINE samplers for the GEOTRACES program. intercomparison of hydrography and major nutrients at the Bermuda Atlantic Time Series Station. submitted to *Limnol. Oceanogr. Methods*.
- Gerringa, L.J.A., M.J.A. Rijkenberg, C-E. Thuróczy, L. R.M. Maas. A critical look at the calculation of the binding characteristics of Fe binding organic ligands, submitted to *Research Front 'Applications of Voltammetry to Environmental Chemistry*
- Klunder, M.B., Laan, P., de Baar, H.J.W., Neven, I., Middag, R. and van Ooijen, J. (submitted) Dissolved Fe across the Weddell Sea and Drake Passage: impact of Dfe on nutrient uptake in the Wedell Sea, *Biogeosciences Discuss.*, 10, 7433-7489, doi: 10.5194/bgd-107433-2013
- Middag, R., K.W. Bruland and H.J.W de Baar (submitted) GEOTRACES Intercomparison of Dissolved Trace Elements at the Bermuda Atlantic Time Series Station. *Limnol. Oceanogr. Methods*, 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, Micha J.A., Rob Middag, Patrick Laan, Loes J. A. Gerringa, Hendrik M. van Aken, Véronique Schoemann, Jeroen T. M. de Jong, Hans van Haren, Hein J. W. de Baar. Multiple sources of dissolved iron to the West Atlantic Ocean. Submitted.

Submitted by: Micha Rijkenberg

## Norway

### **Overview**

Scientific work on trace elements and their isotopes in the ocean was carried out mainly through global biogeochemical ocean modeling at The University of Bergen (Geophysical Institute and Bjerknes Centre for Climate Research/Centre for Climate Dynamics). In 2012, a revised version of the HAMOCC2s model for simulations of  $^{230}\text{Th}$  and  $^{231}\text{Pa}$  was provided. More specifically, the particle flux scheme was changed in order to allow for a more realistic concentration of particles in the water column (and to adjust the equilibrium constants accordingly). With the present model set up improved simulations of the particle attached and dissolved phases of  $^{230}\text{Th}$  and  $^{231}\text{Pa}$  in the water column as well as the sediment bioturbated layer could be carried out (pre-industrial, under elevated  $\text{CO}_2$ ).

On the analytical side, apart from minor work on trace metals, continued work on  $\delta^{13}\text{C}$  was carried out. A re-evaluation of natural  $\delta^{13}\text{C}$  distributions (Suess corrected) in the global ocean is ongoing (by M. Eide, A. Olsen, U. Ninnemann et al.) as part of the NARE funded SOVAR project. A new project SNACS (coordinator A. Olsen) is funded through NORKLIMA which will include support for a new North Atlantic cruise and sampling for carbon isotope work tracing signals back to source regions and calibrating proxy recorders.

### **Presentations at meetings**

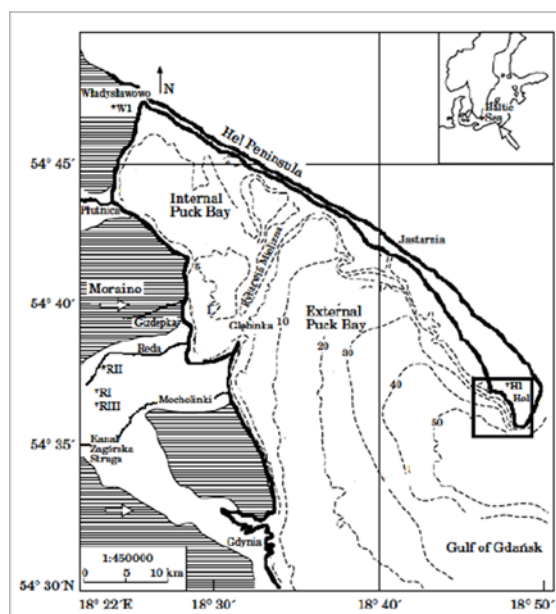
- Heinze, C., 2012, BIOFEEDBACK – Biogeochemical feedbacks in the climate system, plenary presentations at SKD Days (annual meeting of core project BIOFEEDBACK of the Centre of Climate Dynamics), held at Hotel Augustin, 28 November 2012, Bjerknes Centre for Climate Research, Bergen Norway.

Submitted by: Christoph Heinze

## Poland

### **Cruises**

In May 2012 one sampling campaign was performed in order to analyse metals in seawater and groundwater discharged to the Bay of Puck both at Sea and in rivers and groundwater wells (Figure 14) were also analysed.



**Figure 14.** The map of the Bay of Puck with the location of the study area indicated by a square. Gizdepka, Zagórska Struga, Płutnica, Reda are names of the sampled rivers while: RI (Reda I), RII (Reda II), RIII (Reda III), H1 (Hel), W1 (Władysławowo) correspond to the positions of the groundwater wells.

Groundwater lances and seepage meters were used to collect water samples in the study area.

### **Measurements**

Concentrations of dissolved metals (Cu, Co, Cd, Ni, Mn, Pb, Zn, Cr) were determined by ICP-MS method (Elan 9000, Perkin Elmer). Analysis of standard reference material (SLEW 3), and groundwater samples spiked with standard solution (2.5 and 5  $\mu\text{g L}^{-1}$ -final volume) served as a quality check. Average recovery of metals were in the range 95-103% (depending on the metal), while the precision given as relative standard deviation (RSD,  $n=3$ ) was smaller than 3.5 %. The obtained metals concentrations of the procedural blank samples never exceeded 5 % of concentrations measured in the actual samples. The analysis for Hg concentration in water were made by CV-AFS method (TEKRAN 2600, Canada), according to US EPA method 1631 (US EPA, 2002). Quality control included the analysis of blanks ( $n=5$ ), and estimating accuracy and precision based on the analysis of water samples ( $n=3$ ) (groundwater, seepage water and seawater) spiked with mercury nitrate to give the final concentrations in the range of 0.5-2.5  $\text{ng Hg l}^{-1}$ . Adequate precision (6%; given as Relative Standard Deviation - RSD) and recovery (96%) was obtained throughout the study. During each sampling campaign procedural blank samples ( $n=5$ ) were run. The obtained mercury concentrations of the procedural blank samples were lower than the detection limit (0.2  $\text{ng Hg L}^{-1}$ ) and never exceeded 10 % of concentrations measured in the actual samples.

In addition Mercury and organic mercury fraction were determined in suspended matter collected in years 2011-2012 in western Spitsbergen and Baltic. Results were published in PhD Dissertation of Michał Miotk and presented on scientific conferences.

### **Conferences**

- Szymczycha B, Pempkowiak J, 2012. Nutrients, DIC, DOC and trace metal discharges to the coastal zone via Submarine Groundwater Discharge. The case of the Puck Bay, the Southern Baltic Sea. LAND OCEAN CONNECTIVITY Conference, Brest, France.
- Szymczycha B, 2012. Coastal monitoring strategy, 20th Annual Conference in Lillestrom, Norway.

- Miotk M., Beldowski J., Pempkowiak J. Mercury and Methylmercury in Southern Baltic Sea Sediments, International Conference on Heavy Metals in the Environment, Rome, Italy

### ***Publications***

- Szymczycha B, Miotk M, Pempkowiak J, 2013. Submarine Groundwater Discharge as a Source of Mercury in the Bay of Puck, the Southern Baltic Sea. *Water, Air and Soil Pollution* 224, DOI 10.1007/s11270-013-1542-0.

### ***PhD Thesis***

- Submarine Groundwater Discharge (SGD) as a source of nutrients, carbon and heavy metals to the Bay of Puck, off Hel. Beata Szymczycha.
- Bioavailability and methylation potential of mercury in the marine environment: case study of the Baltic Sea and Spitsbergen Fjords.

Submitted by: Jacek Beldowski

## **Russia**

### ***Meetings and Workshops***

- Russian GEOTRACES Workshop: From 27th to 29th November 2012 the first Russian workshop of the GEOTRACES International program was held in Moscow at the Shirshov Institute of Oceanology, Russian academy of sciences. About ninety persons including Russian scientists from seven institutes participated, together with scientists leading the GEOTRACES program in Europe and the USA. During the workshop about 30 oral presentations were made (including 8 talks of the young Russian scientists), along with 15 poster presentations. The workshop showed that research themes of Russian scientists in many respects correspond to the main GEOTRACES scientific goals. Particular Russian interests include estuarine chemistry (trace metals, radionuclides, and organic carbon compounds) of major rivers, biogeochemical processes, (including trace metals and gases such as methane) on the Russian shelf, sedimentary and chemical fluxes between the shelf and open Arctic Ocean as well as the fluxes from atmosphere to the Arctic Seas.

The Russian workshop established international contacts and identified priorities for research into the marine chemistry of the Arctic Ocean. Research cruises that would address the main GEOTRACES scientific goals have been identified during discussion at the workshop. Issues linked with a correct clean sampling and analysis of trace metals were discussed as soon as one of the main Russian problem is lack of special equipment to collect uncontaminated seawater samples for analysis of heavy metals. An obvious necessity of participation of Russian colleagues in intercalibration of the sampling procedures followed by the trace metal analysis, as well as training of the young Russian scientists in the leading GEOTRACES' laboratories was emphasized. All the participants supported a joint declaration

([http://www.geotraces.org/images/stories/documents/workshops/Russian/Russian\\_GEOTRACES\\_Statement.pdf](http://www.geotraces.org/images/stories/documents/workshops/Russian/Russian_GEOTRACES_Statement.pdf)). Workshop participants suggested the rapid formation of Russian GEOTRACES Committee to develop GEOTRACES activities and guide the scientific goals and implementation of the program in Russia.

The workshop was followed by the round table "Prospects for the Arctic Ocean: International Expedition 2015" (held in the framework of the 2nd International Exhibition "Oceans 2012" in Moscow 30th November 2012). The round table aimed to support the Russian initiative for an International Polar Decade, and considered proposals of representatives from the GEOTRACES Scientific Steering Committee to hold Arctic Ocean International Expeditions in 2015.

- The organizational meeting of Russian nation committee took place at the Shirshov Institute of Oceanology, Russian academy of sciences, on the 24-th of April. The Russian committee includes twenty-one high-level scientists representing leading Russian institutes with geochemical, oceanographic and related expertise. Sixteen scientists from the different institutes were present at the meeting where the following issues were under consideration:
  - Preparing of the GEOTRACES National program based on researches proposed in the Russian scientific institutes' program plans;
  - Address the leadership of the country to provide organizational and financial support to perform work on the Russian side;
  - Participation in the intercalibration of the total heavy metal content in the suspended particulate matter from the Mediterranean and Black Seas collected by professor Hein de Baar group (NIOZ);
  - Collection and treatment of oceanographic and geochemical data on the White Sea' for creation of data base.
 Academician Alexander Lisitzin (Shirshov Institute of Oceanology RAS, Moscow) and academician Valentin Sergienko (Far Eastern Branch RAS, Vladivostok) agreed to be Co-chairmen of the Russian nation Committee, as well as prof. Ludmila Demina, prof. Alexander Dubinin, Prof. Anatoly Astakhov, and Dr. Igor Ashik were approved as vice-chairmen.

Submitted by: Liudmila L. Demina

## Slovenia

### **Meetings**

Participation at the Workshop “The ocean chemistry of bioactive trace elements and paleoclimate proxies” May 29 to June 1, 2012, Geel, Belgium (L. Benedik – acting as an invited speaker, M. Vahčič as a participant).

### **Cruises**

Participation of J. Kotnik, M. Vahčič and A. Bratkič on the FENICE 2012 cruise in W Mediterranean led by F. Sprovieri (CNR-IIA, Italy) from August 11 to August 29 2012. The cruise was organized within the EU project GMOS (Global Mercury Observation Systems). The activities were related to the cycling of Hg species in marine environment including deep water profiles of dissolved gaseous Hg (DGM), total (THg), monomethyl Hg (MeHg) and dimethyl Hg (DMeHg) in open ocean waters. All these analysis are still in progress.

### **New results**

Results obtained during the James Cook cruise represent a part of PhD study of A. Bratkič entitled: “Mercury biotransformations in marine environments” defended in July 2013. All Hg speciation analyses were performed at the Department of Environmental Sciences at Jožef Stefan Institute under the supervision of M. Horvat.

The primary goal of the South Atlantic Ocean expedition was to perform Hg speciation analysis in ocean water at very high vertical and spatial frequency, which would indicate whether Hg transformation in the deep sea is a more active process than is currently reported. Secondary goals were to apply new strategies for sample storage and transport; and to obtain all the necessary supporting data on nutrients and physico-chemical parameters which could help with the interpretation of the data.

Oceanographic sampling for Hg speciation was demanding from the logistical point of view and particular attention was given to the issues of storage and transport of samples. During the time of storage

and transport, samples never thawed, which contributed to the results being accurate and representative of the actual environmental conditions. The combination of freezers and dry ice proved to be sufficient for the safe transport of samples to the laboratory, where they could be stored in freezers with an uninterrupted power supply. Particularly useful was simple, but efficient double packing in zip-lock plastic bags. Besides preventing contamination of the bottles, they also prevented some physical damage to them.

The South Atlantic Ocean cruise from South Africa to Uruguay along the 40°S parallel resulted in a remarkably high spatial (both vertical and horizontal) frequency of Hg speciation measurements. Up to 24 depths per station were measured, which was indeed an above average number of sampling depths in this region, and in the ocean in general.

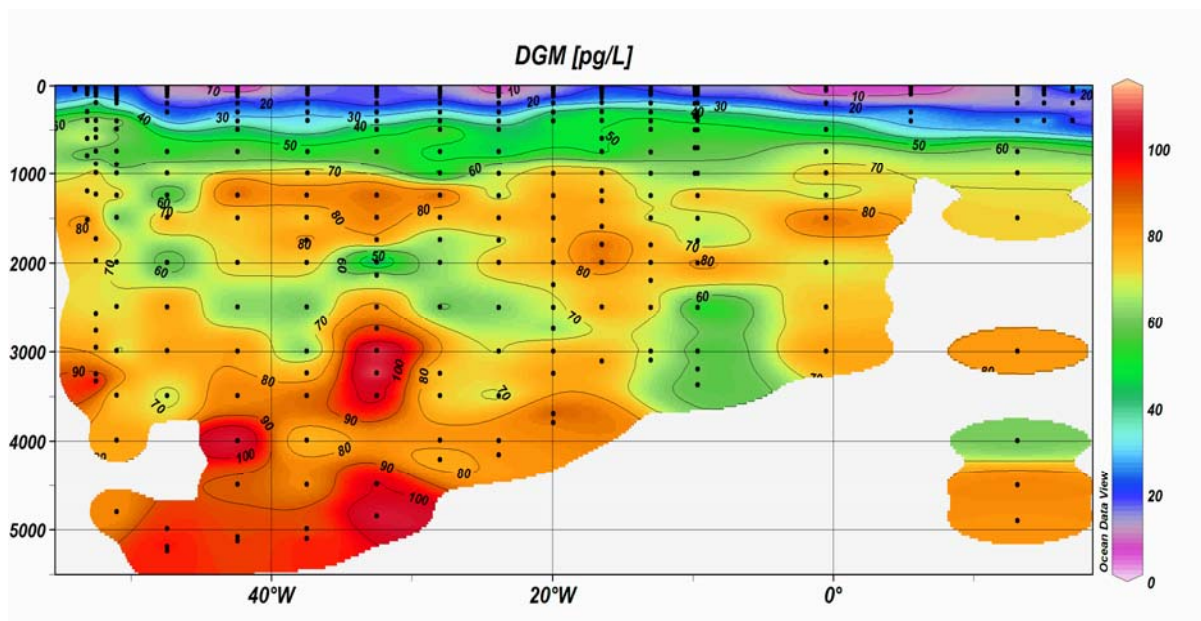
Total Hg (THg) profiles indicated a possible increase in deep waters as a result of the geothermal activity of the Mid-Atlantic Ridge. THg values were lower in the uppermost water layers, suggesting degassing of  $\text{Hg}^0$  to the atmosphere. This is globally important because the large ocean surface represents a great potential flux of  $\text{Hg}^0$  to the atmosphere. Even small changes in conditions that would affect dissolved gaseous mercury (DGM) formation in the ocean would also result in regionally significant Hg evasion or retention.

THg values in seawater were higher off the coast of South America, probably due to the influence of large cities and transport by the Rio de la Plata. The Argentine Basin also showed an increase.

Interestingly, water masses could be distinguished by DGM content, but not by THg. Upper Circumpolar Deep Water (UCDW) mass in the South Atlantic had higher DGM concentrations than North Atlantic Deep Water (NADW). Higher values in the Argentine Basin were unexpected, but might easily be explained by higher DGM solubility under high pressure, or might result from a Hg increase in newly formed Antarctic Bottom Water (AABW). Moreover, surface DGM distribution closely resembled that of Chl *a* (and hence photosynthetic organisms), but not of the bacterial community. This suggested that DGM might be formed principally by photosynthetic microbes and algae without the *mer* operon, and not by *mer* containing heterotrophic microbes. In addition, *merA* was not detected, but that was likely a consequence of unsuitable oligonucleotides which did not cover the marine *merA* diversity.

Methyl mercury (MeHg) concentrations were often below the limit of detection. Nevertheless, MeHg is formed in the South Atlantic Ocean water column as there were no increases of this species above the sediment or in the surface waters, where aerial deposition might be a source. The general decrease formed at the surface might be indicative of photodemethylation. In two instances MeHg coincided with the Chl *a* peak, which might be indicative that its formation is connected with primary production. Bacterial and archaeal 16S rRNA sequences were detected at all depths at one deep ocean station; therefore it is likely that heterotrophic activity contributes to the observed MeHg levels.

Dimethyl methyl mercury (DMeHg) was measured only at one station. As expected, it was higher below 1000 m and very low above that depth, especially in the surface waters. It reached its highest concentration in UCDW, similarly to DGM, probably due to lower oxygen concentrations and hence lower oxidation potential.



**Figure 15.** DGM concentrations for the whole water column from JC068 South Atlantic cruise (40°S parallel). Black dots represent sampling depths. Distinct layering of DGM can be observed. Deep waters in the Argentine Basin were characterized by the highest DGM values measured during the cruise.

In order to understand Hg biogeochemical transformations in the South Atlantic Ocean better, more sampling campaigns with such resolution are needed. The deep ocean is very important where Hg cycling is probably more intensive than is generally accepted.

### ***Other activities***

S. Tamše obtained GEOTRACES fellowship to perform his research on stable isotope composition of N and O in nitrates in marine samples. The research was conducted at the Laboratoire de Glaciologie et Géophysique de l'Environnement (CNRS/UJF), Grenoble, France during September 3 to October 26 2012.

### ***Publications***

#### ***Original scientific article***

- KORON, Neža, BRATKIČ, Arne, RIBEIRO GUEVARA, Sergio, VAHČIČ, Mitja, HORVAT, Milena. Mercury methylation and reduction potentials in marine water. *Appl. radiat. isotopes*. [Print ed.], 2012, vol. 70, issue 1, str. 46-50, doi: 10.1016/j.apradiso.2011.07.015.
- ACQUAVITA, Alessandro, COVELLI, Stefano, EMILI, Andrea, BERTO, Daniela, FAGANELI, Jadran, GIANI, Michele, HORVAT, Milena, KORON, Neža, RAMPAZZO, Federico. Mercury in the sediments of the Marano and Grado Lagoon (northern Adriatic Sea): sources, distribution and speciation. *Estuar., coast. shelf sci.*, 2012, vol. 113, str. 20-31, doi: 10.1016/j.ecss.2012.02.012.
- EMILI, Andrea, ACQUAVITA, Alessandro, KORON, Neža, COVELLI, Stefano, FAGANELI, Jadran, HORVAT, Milena, ŽIŽEK, Suzana, FAJON, Vesna. Benthic flux measurements of Hg species in a northern Adriatic lagoon environment (Marano and Grado Lagoon, Italy). *Estuar., coast. shelf sci.*, 2012, vol. 113, str. 71-84, doi: 10.1016/j.ecss.2012.05.018.
- HINES, Mark E., POITRAS, Erin N., COVELLI, Stefano, FAGANELI, Jadran, EMILI, Andrea, ŽIŽEK, Suzana, HORVAT, Milena. Mercury methylation and demethylation in Hg-contaminated lagoon sediments (Marano & Grado Lagoons, Italy). *Estuar., coast. shelf sci.*, 2012, vol. 113, issue 10, str. 85-95, doi: 10.1016/j.ecss.2011.12.021.



- BALDI, Franco, GALLO, Michele, MARCHETTO, Davide, FANI, Renato, MAIDA, Isabel, HORVAT, Milena, FAJON, Vesna, ŽIŽEK, Suzana, HINES, Mark E. Seasonal mercury transformation and surficial sediment detoxification by bacteria of Marano and Grado lagoons. *Estuar., coast. shelf sci.*, 2012, vol. 113, issue 10, str. 105-115, doi: 10.1016/j.ecss.2012.02.008.
- COZZI, Stefano, FALCONI, Claus, CORNICI, Cinzia, ČERMELJ, Branko, KOVAČ, Nives, TURK, Valentina, GIANI, Michele. Recent evolution of river discharges in the Gulf of Trieste and their potential response to climate changes and anthropogenic pressure. *Estuar., coast. shelf sci.*, 2012, 115, 14-24, doi: 10.1016/j.ecss.2012.03.005.
- DE VITTOR, Cinzia, FAGANELI, Jadran, EMILI, Andrea, COVELLI, Stefano, PREDONZANI, Sergio, ACQUAVITA, Alessandro. Benthic fluxes of oxygen, carbon and nutrients in the Marano and Grado Lagoon (northern Adriatic Sea, Italy). *Estuar., coast. shelf sci.*, 2012, vol. 113, str. 57-70, doi: 10.1016/j.ecss.2012.03.031.
- KORON, Neža, FAGANELI, Jadran. Benthic fluxes of mercury during redox changes in pristine coastal marine sediments from the Gulf of Trieste (northern Adriatic Sea). *Journal of soils and sediments*, 2012, vol. 12, 10, 1604-1614, graf. prikazi. <http://dx.doi.org/10.1007/s11368-012-0602-1>.
- BRATKIČ, Arne, OGRINC, Nives, KOTNIK, Jože, FAGANELI, Jadran, ŽAGAR, Dušan, YANO, Shinichiro, TADA, Akihide, HORVAT, Milena. Mercury speciation driven by seasonal changes in a contaminated estuarine environment. *Environ. res. (N.Y.)*, [in press] 2013, 8 str., doi: 10.1016/j.envres.2013.01.004.
- RAMŠAK, Vanja, MALAČIČ, Vlado, LIČER, Matjaž, KOTNIK, Jože, HORVAT, Milena, ŽAGAR, Dušan. High-resolution pollutant dispersion modelling in contaminated coastal sites. *Environ. res. (N.Y.)*, 2013, letn. XX, št. XX, str. 1-10, ilustr., doi: 10.1016/j.envres.2012.12.013.
- KOTNIK Jože, HORVAT Milena, OGRINC Nives, FAJON vesna, ŽAGAR Dušan, COSSA Daniel, SPROVIERI Francesca, PIRRONE Nicola. Mercury and its species in the Adriatic Sea. *Mar. Chem.*, in press.
- KOTNIK Jože, OGRINC Nives, HORVAT Milena, PIRRONE Nicola, SPROVIERI Francesca. Mercury in the Mediterranean Part I: spatial and temporal trends. *Environ. Sci. Poll. Res.*, under review.
- ŽAGAR Dušan, SIRNIK Nataša, ČETINA Matjaž, HORVAT Milena, KOTNIK Jože, OGRINC Nives, HEDGECKOCK Ian, CINNIRELLA Sergio, DE SIMONE Francesco, GENCARELLI Christian N., PIRRONE Nicola, Mercury in the Mediterranean Part 2: processes and mass balance. *Environ. Sci. Poll. Res.*, under review.

#### *Book chapter*

- OGRINC, Nives, COVELLI, Stefano, OGORELEC, Bojan, FAGANELI, Jadran, BUDJA, Mihael. Reconstruction of the Holocene palaeoenvironment of the Gulf of Trieste by using geochemical methods. V: ANDRIČ, Maja (ur.). *Dolgoročne spremembe okolja 1*, (Opera Instituti Archaeologici Sloveniae, 25). Ljubljana: Inštitut za arheologijo ZRC SAZU, 2012, 81-88.

#### *Scientific conference contribution*

- HORVAT, Milena, PIRRONE, Nicola, SPROVIERI, Francesca, CINNIRELLA, Sergio, KOTNIK, Jože, OGRINC, Nives, ŽAGAR, Dušan, CINNIRELLA, Sergio. Mercury in the Mediterranean status and mass balance. V: 6th SETAC World Congress/SETAC Europe [and] 22nd Annual Meeting, 20-24 May 2012, Berlin, Germany. Abstract book. Brussels: SETAC, 2012, 126.
- HORVAT, Milena, VAHČIČ, Mitja. Comparability, traceability and uncertainty of the results for mercury analysis and speciation in the marine environment. V: 6th SETAC World Congress/SETAC Europe [and] 22nd Annual Meeting, 20-24 May 2012, Berlin, Germany. Abstract book. Brussels: SETAC, 2012, 401.

- OGRINC, Nives, VAHČIČ, Mitja, BRATKIČ, Arne, KOTNIK, Jože, SPROVIERI, Francesca, PIRRONE, Nicola, HORVAT, Milena. Mercury speciation in deep-sea waters of the Mediterranean Sea. V: The 22nd V. M. Goldschmidt Conference, 24-29 June 2012, Montréal, Canada. Earth in evolution, 2012.
- HORVAT, Milena, KOTNIK, Jože, KOČMAN, David, MIKLAVČIČ, Ana, ŽAGAR, Dušan, FAGANELI, Jadran, FAJON, Vesna, BEGU, Ermira, BRATKIČ, Arne, KORON, Neža. Mercury in the Mediterranean: presented at Symposium of the Institute of Oceanography and Fisheries, 26-27 February, 2013, Split, Croatia. 2013.

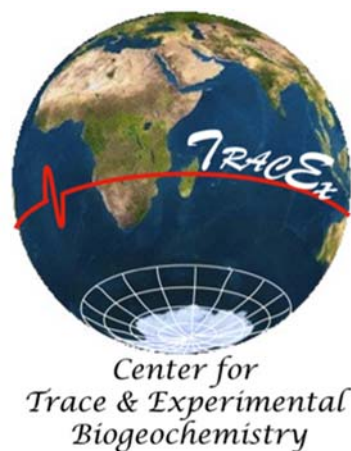
*Technical Report*

- KOČMAN, David, HORVAT, Milena, WILSON, Simon, OUTRIDGE, Peter, TELMER, Kevin. Global releases of mercury to aquatic environments. V: BIEBER, Elke. /Technical background report for the global mercury assessment 2013/. Oslo: UNEP = United Nations Environment Programme, 2013, 69-81.
- OUTRIDGE, Peter, MASON, Robert P., KOČMAN, David, HORVAT, Milena, MUNTHE, John. Aquatic pathways, transport and fate. V: BIEBER, Elke. /Technical background report for the global mercury assessment 2013/. Oslo: UNEP = United Nations Environment Programme, 2013, 82-94.

Submitted by: Nives Ogrinc

*South Africa*

South African scientists are now on par with their international peers with the completion of the first ‘Trace and Experimental Biogeochemistry Clean Lab’ on the African continent at Stellenbosch University (SU). With this world-class facility now up and running, scientists are able to participate in long term international observational programs such as GEOTRACES, which aims to improve the understanding of biogeochemical cycles and large-scale distribution of trace elements and their isotopes in all the major ocean basins over the next.



**Figure 16.** New Class-10 trace clean laboratory at Stellenbosch University fitted with Pico-trace laminar flow benches

The R2.2 million laboratory was funded by the SU Rector’s strategic fund and the Department of Science

and Technology through the CSIR's [Southern Ocean Carbon-Climate Observatory](#) (SOCCO) program. This facility is part of an integrated research infrastructure development strategy, which also includes new analytical equipment and ultra-clean container labs for ocean sampling in the new research ship SA Agulhas II, managed by the Department of Environmental Affairs.

### ***Activities of Interest and Personnel Training***

Raimund Rentel and Dr Thato Mtshali visited Maeve Lohan's lab at the University of Plymouth to trouble-shoot the FIA set-up for measurement of dissolved iron. Riana Rossouw, trained on ICP-MS to measure Fe and other bioactive elements at Bill Landing's lab (FSU). Dr Mtshali participated in the training of FRRF system set-up, data collection and analysis (Ocean Business exhibition) at Southampton National Oceanographic Center under supervision of Dr. Kevin Oxborough (Chelsea technology).



### ***Conferences***

- Satish Myneni, Alakendra Roychoudhury, Tolek Tyliczszak, Gustavo Martinez, Bjorn van der Heyden (2012) Speciation of colloidal Fe in terrestrial and marine environments using synchrotron X-ray spectroscopy and microscopy. 22nd Annual V M Goldschmidt Conference, Montreal, Canada June 24-29, 2012.

### ***Publications***

- B.P. von der Heyden, A.N. Roychoudhury, T.N. Mtshali, T. Tyliczszak and S.C.B. Myneni. Chemically and Geographically Distinct Solid-Phase Iron Pools in the Southern Ocean. *Science*. Vol. 338. No. 1199 – 1201.
- A. Tagliabue, T. Mtshali, O. Aumont, A. R. Bowie, M. B. Klunder, A. N. Roychoudhury, and S. Swart. A Global compilation of DFe measurements: Focus on distribution and processes in the Southern Ocean. *Biogeosciences*, 9, 2333–2349, 2012.
- Sebastiaan Swart, Nicolette Chang, Nicolas Fauchereau, Warren Joubert, Mike Lucas, Thato Mtshali, Alakendra Roychoudhury, Alessandro Tagliabue, Sandy Thomalla, Howard Waldron, Pedro M.S. Monteiro (2012) Southern Ocean Seasonal Cycle Experiment – 2012 (SOSCEx2012): Coupling of Climate and Carbon Cycling at the Seasonal Scale, *South African Journal of Science*. 189(3/4), pp 1-3.

### ***Cruises***

SOSCEX cruise was conducted along the Bonus Good Hole line to 55 °S between 15/02/2013 and 11/03/2013. Samples were collected along the 'transect' and during a Lagrangian 'process' studies. Onboard, two bioassay Fe and light incubation experiments were conducted for a period of 6 days as part of the SOSCEx program. The aim was to understand how southern ocean phytoplankton physiology adapts to Fe and light deprivation.

Samples were also collected to look at the spatial distribution of Fe pools (DFe, TDFe, SFe and PFe) along the transect and during the lagrangian study.

### ***New Funding***

- Roychoudhury, AN (2012 – 2014) Bioactive trace metals in the Southern Ocean: Capacity development and an integrated measurement-modeling approach to understand ocean primary productivity, SANAP, R 1,200,000.

- Roychoudhury, AN (2012) Building of a class 100 clean laboratory at Earth Sciences, Stellenbosch University Strategic funds and co-funding from DST, R 2,200,000.

Submitted by: Alakendra Roychoudhury

## Spain

National committee (under SCOR-Spain)

- P. Masqué & J. Garcia-Orellana (Barcelona-UAB)
- A. Tovar-Sanchez (Mallorca-CSIC)
- A. Cobelo & R. Prego (Vigo-CSIC)

## **Meetings**

- We co-organized the GEOTRACES section GA04-S on board *RV Ángeles Alvariño* between May 2nd and June 1st. We took circa 85 samples in 10 stations to analyze different isotopes such as  $^{231}\text{Pa}/^{230}\text{Th}$ ,  $^{236,238}\text{U}$ , Pu isotopes,  $^{137}\text{Cs}$ ,  $^{90}\text{Sr}$ ,  $^{129}\text{I}$ ,  $^{234}\text{Th}$ ,  $^{237}\text{Np}$ ,  $^{228,226}\text{Ra}$ , Nd-isotopes and Deuterium. We also organized some experiments related to analyze  $^{210}\text{Pb}$  and  $^{210}\text{Po}$  in different ways to check the differences between some methods. We also deployed ISP (n=6) in order to collect particles to analyze particulate trace metals.
- Participation at the Arctic GEOTRACES Meeting, Bremerhaven, April 2012 and submission of two Polarstern proposals for expeditions in 2015 and 2016.
- Participation at the GEOTRACES Latin America Meeting, Rio de Janeiro, November 2012, we did some presentations and also started the collaboration with some south American labs.
- Participation in the Workshop on Voltammetry and GEOTRACES, Sibenik (Croacia), 6-9 October 2012.

## **Publications**

GEOTRACES-related papers

- Rodellas V, Garcia-Orellana J, Tovar-Sánchez A, Basterretxea G, López-García JM, Sánchez-Quiles D, Garcia-Solsona E, Masqué P. Submarine groundwater discharge as a source of nutrients and trace metals in a Mediterranean Bay (Palma Beach, Balearic Islands). Submitted to *Limnology and Oceanography*.
- Geibert W, Rodellas R, Annett A, van Beek P, Garcia-Orellana J, Hsieh Y-T, Masqué P. The measurement of  $^{226}\text{Ra}$  via the rate of  $^{222}\text{Rn}$  ingrowth with the radium delayed coincidence counter. Submitted to *Limnology and Oceanography Methods*.
- Santos-Echendia J, Caetano M, Brito P, Canario J, Vale C, 2012. The relevance of defining trace metal baselines in coastal waters at a regional scale: The case of the Portuguese coast (SW Europe). *Marine Environmental Research* 79: 86-99. doi: 10.1016/j.marenvres.2012.05.010
- Prego, R., Santos-Echeandía, J., Bernárdez, P., Cobelo-García, A. & Varela, M. 2013. Trace metals in the NE Atlantic coastal zone of Finisterre (Iberian Peninsula): terrestrial and marine sources and rates of sedimentation. *Journal of Marine Systems*, in press, 10.1016/j.jmarsys.2012.05.008
- Rigaud S, Puigcorbé V, Camara-Mor P, Casacuberta N, Roca-Martí M, Garcia-Orellana J, Benitez-Nelson CR, Masque P and Church T. A methods assessment and recommendations for improving calculations and reducing uncertainties in the determination of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  activities in seawater. Submitted to *Limnology and Oceanography Methods*.
- Casacuberta N, Masqué P, Garcia-Orellana J, Garcia-Tenorio R and Buesseler KO (2013)  $^{90}\text{Sr}$  and  $^{89}\text{Sr}$  in seawater off Japan as a consequence of the Fukushima Dai-ichi nuclear accident. *Biogeosciences* 10, 3649-3659.

Coauthoring several papers of the Intercalibration special issue in *Limnology and Oceanography Methods*:

- Church, T., Rigaud, S., Baskaran, M., Kumar, A., Friedrich, J., Masqué, P., Puigcorbé, V., Kim, G., Radakovitch, O., Hong, G., Choi, H.-Y. and Stewart, G. (2012). Inter-calibration studies of <sup>210</sup>Po and <sup>210</sup>Pb in dissolved and particulate sea water samples. *Limnology and Oceanography: Methods* 10, 776-789.
- Kenna, T.C., Masqué P., Mas, J.L., Camara-Mor, P., Chamizo, C., Scholten, S., Eriksson, M., Sanchez-Cabeza, J.A., Gastaud, J., Levy, I., Herrmann, J., Lindahl, P. and Nielsen, S. (2012). Intercal: Intercalibration of selected anthropogenic radionuclides for the GEOTRACES Program. *Limnology and Oceanography: Methods* 10, 590-607.
- Maiti, K., Buesseler, K.O., Pike, S.M., Benitez-Nelson, C., Cai, P., Chen, W., Cochran, J.K., Dai, M., Dehairs, F., Gasser, B., Kelly, R., Masque, P., Miller, L., Miquel, J.C., Moran, S.B., Morris, P., Peine, F., Planchon, F., Renfro, A.A., Rutgers van der Loeff, M., Santschi, P., Turnewitsch, R., Waples, J. and Xu, C. (2012). Intercalibration studies of short lived Thorium-234 in the water column and marine particles. *Limnology and Oceanography: Methods* 10, 631-644.

### ***Meetings***

Several contributions to:

- 2012 Ocean Sciences Meeting, Salt Lake City, Utah (USA), 20-24 February 2012.
- 2012 Goldschmidt Meeting, Montreal, 25-29 June 2012.
- 2013 ASLO Aquatic Sciences Meeting, 17-22 February 2013, New Orleans.
- 40th CIESM Congress – Marseille, France, 28 October - 1 November 2013.
- 12th International Estuarine Biogeochemistry Symposium (IEBS2013). <http://www.iebs2013.org/> Plymouth University, 30th June - 4th July 2013.

Submitted by: Jordi Garcia-Orellana

### **Sweden**

#### ***Meetings***

- Per Andersson participated and presented GEOTRACES in the following meetings:
  - Arctic Council Meeting hosted at The Swedish Museum of Natural History during 28 to 30 March, 2012. Presented Arctic GEOTRACES and results from ISSS-08 (International Siberian Shelf Study 2008) as poster during the meeting.
  - Arctic GEOTRACES Planning workshop in Vancouver, Canada, 2 to 4 May, 2013. Presented and discussed Swedish Arctic planning.
  - Arctic GEOTRACES workshop in Moscow, 27 to 29 November, 2012. Presented and discussed Swedish GEOTRACES Arctic plans.
- David Turner participated in the workshop “Voltammetry and GEOTRACES”, Sibenik, Croatia, 6-9 October 2012

### ***New funding (Per Andersson)***

- “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 in the Arctic Ocean. This is a three year grant, including two PhD-students, with about 112 k€ for each institution. The funding starts during 2013.

### ***GEOTRACES intercalibration work***

- Per Andersson participated in the GEOTRACES intercalibration committee work. Hosted the GEOTRACES intercalibration meeting in Stockholm from 1 to 3 May, 2013.

### ***Related projects***

- Per Andersson: “Climate warming in Siberian Permafrost Regions; tracing the delivery of carbon and trace metals to the Arctic Ocean”. Field work in the Lena River and tributaries during 2012-2013, total six weeks. 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.
- David Turner: Two new projects that will provide a platform for chemical speciation modelling relevant to GEOTRACES:
  - OCEAN CERTAIN: **Ocean** Food web Patrol – **Climate** Effects: **Reducing Targeted** Uncertainties with an **Integrated Network**. This is a large EU-FP7 project (10 M€; 2014 – 2017) led by NTNU (Trondheim, Norway) focusing on the effect of multi-stressors on marine biogeochemical cycles. I will contribute with chemical speciation modelling of key trace metals including interactions with natural organic ligands (ca. 300 k€).
  - Commercial shipping as a source of acidification in the Baltic Sea (Swedish funding, ca. 850 k€ in total, 2013 - 2016; ca. 200 k€ for development of chemical speciation modelling).

### ***Forward look: Icebreaker Oden in the Arctic Ocean 2015***

- Oden is “booked” for GEOTRACES in 2015, but the Swedish Polar Research Secretariat 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. Financial support from outside Sweden will be needed to ensure that GEOTRACES can make use of Oden in 2015.

Submitted by: David Turner

## ***United Kingdom***

Further details about UK GEOTRACES activity is available at: <http://www.ukgeotraces.com/>

### ***Cruises and analysis***

There have been no dedicated UK GEOTRACES cruises since January 2012. UK scientists have received samples from other GEOTRACES cruises, but the majority of UK effort in the last 12 months has continued to focus on analysis of samples from the two main UK cruises so far (GA06; Tropical Atlantic; and GA10 South Atlantic) and samples recovered from other cruises with significant UK involvement (e.g. Baltic GEOTRACES)

### ***Meetings***

- UK scientists have presented results GEOTRACES results at AGU, Ocean Sciences, and Goldschmidt conferences.
- UK scientists attending the Latin American and Russian GEOTRACES Workshops at the end of 2012.
- UK scientists continue to be involved in planning for future Arctic GEOTRACES efforts through international meetings and dialogue.
- A post-cruise meeting for GA10 was held in September 2012 and demonstrated the wide range of measurements conducted on this cruise, as well as initiating plans for publications.
- A COST and SCOR sponsored meeting focused on trace metal isotopes in seawater was held in September in London, organized by scientists from Imperial College (Mark Rehkamper and Tina van der Fleirdt). The final report of this meeting and lists of participants can be downloaded from: <http://www.geotraces.org/meetings/meetings-by-year/eventdetail/121/-/geotraces-cost-workshop-stable-isotopes-of-biologically-important-trace-metals>
- Maeve Lohan (University of Plymouth) attending intercalibration meetings in Hawaii (on particulates) and in Sweden (on cross-over stations).

#### ***National and international service***

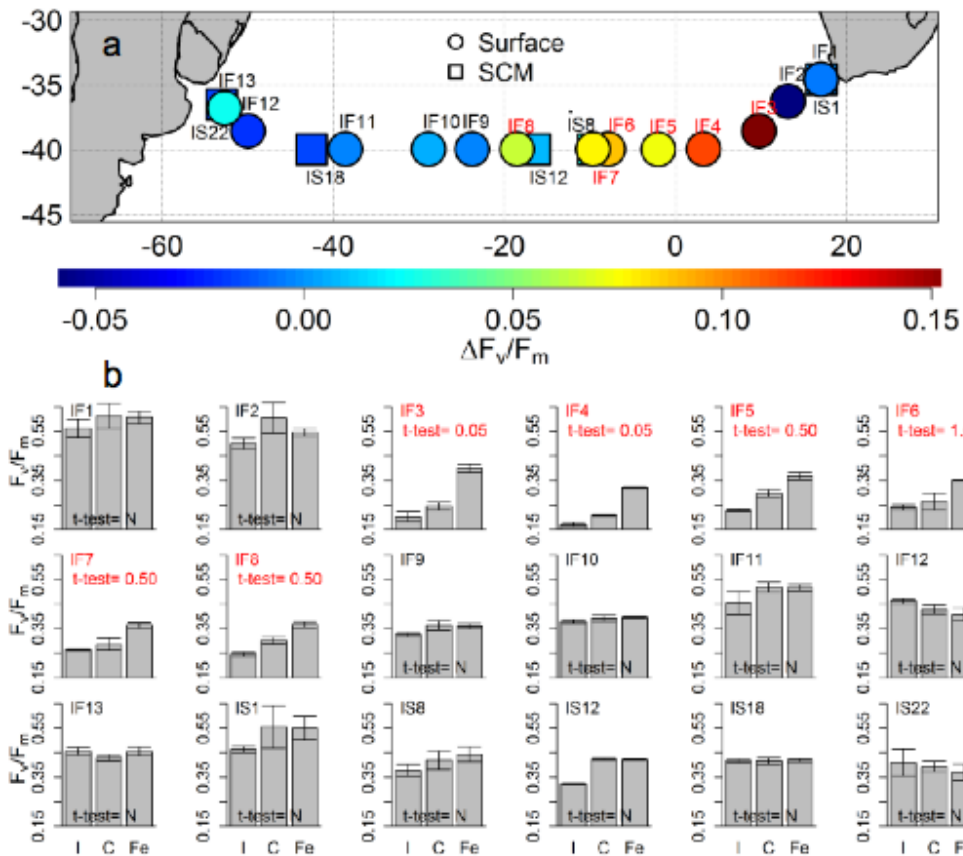
- The UK continues to host the GEOTRACES Data Assembly Centre at the British Oceanographic Data Centre in Liverpool.
- The UK is represented on the International GEOTRACES SSC and on the International Standards and Intercalibration Committee by Maeve Lohan.

#### ***Publications***

A large number of publications from GA06 and GA10 are approaching publication or submission. Two early publications from these cruises are:

- Homoky, W.B., John, S.G., Conway, T.M., Mills, R.A., 2013. Distinct iron isotopic signatures and supply from marine sediment dissolution. *Nature Communications* 4.  
<http://www.nature.com/ncomms/2013/130719/ncomms3143/full/ncomms3143.html>
- T. J. Browning, H. A. Bouman, C. M. Moore, C. Schlosser, G. A. Tarran, E. M. S. Woodward, and G. M. Henderson, “Nutrient regimes control phytoplankton ecophysiology in the South Atlantic” *Biogeosciences*  
<http://www.biogeosciences-discuss.net/10/11969/2013/bgd-10-11969-2013.pdf>

The latter included clear identification of Fe limitation in the eastern South Atlantic through a series of incubation experiments.



**Figure 17.** Red colours are regions where incubations showed a clear increase in phytoplankton growth in response to Fe addition.

Submitted by: Gideon Henderson

## US

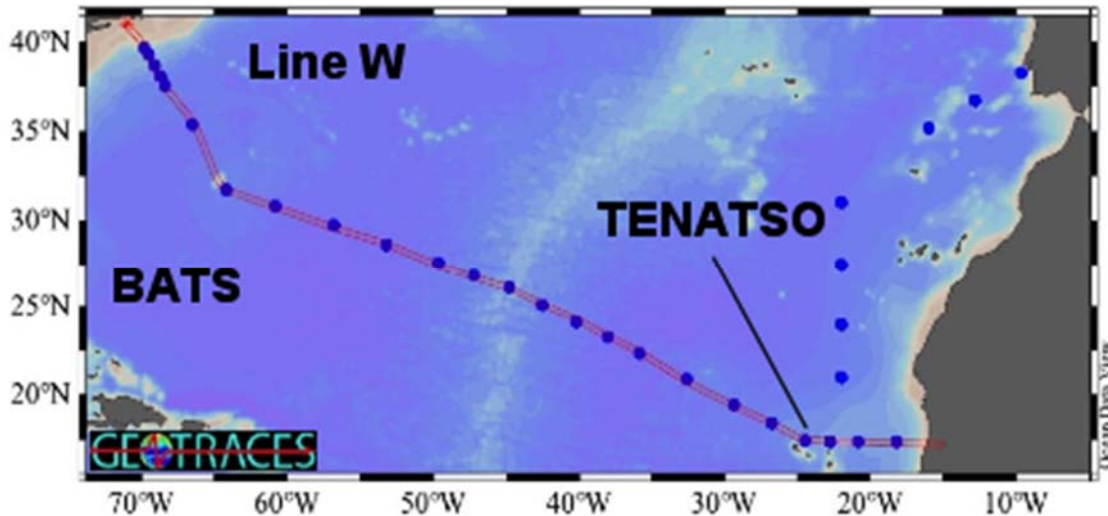
Principal activities of the U.S. GEOTRACES program include:

- 1) Data synthesis a North Atlantic zonal section,
- 2) Preparation for a Pacific section between Peru and Tahiti, and
- 3) Sustained planning for work in the Arctic Ocean

### **Activities**

North Atlantic: A highlight of US GEOTRACES activity during the past year was a data workshop to examine results from the North Atlantic section GA03 (Figure 18).





**Figure 18.** Locations of stations occupied during the U.S. North Atlantic zonal section GA03. Stations from Portugal to TENATSO were occupied during R/V Knorr cruise KN199-4 in October-November 2010. Stations from Woods Hole (upper left) to TENATSO were occupied during KN204-1 in November-December, 2011.

More than 60 scientists (including students and post docs) representing 30 TEI groups (trace elements, isotopes and supporting variables) assembled 11-15 March 2013 at Old Dominion University (Norfolk, Virginia) to examine the results from the US GEOTRACES North Atlantic section (GA03). Members of the US GEOTRACES Scientific Steering Committee met concurrently with the data workshop to assess the overall performance of the expedition and to make recommendations for future US GEOTRACES cruises.

The first two days of the workshop were devoted to presentation of results by each group, after which participants broke into working groups to compare results pertaining to specific processes (e.g., particle transport and mineral aerosols, boundary exchange, benthic nepheloid layer processes, sources and sinks associated with the hydrothermal plume, transformations across the chlorophyll maximum, oxygen minimum zone processes). Workshop participants repeatedly returned to questions about hydrography and ocean circulation in the context of interpreting TEI distributions, and developed a plan for optimal multiparameter analysis to characterize contributions of various end-member water masses and their respective supply of TEIs along the section.

An important aspect of the workshop was attention to the ongoing intercalibration process. In addition to crossover stations with other cruises, multiple US labs measured certain TEIs, especially at “superstations” (e.g., as many as 5 labs measured dissolved Fe at selected stations). Careful examination of the results indicated that whereas agreement was generally good, thanks to previous intercalibration work, some analytical issues remain unresolved. These findings emphasize the critical importance of sustaining intercalibration efforts on all GEOTRACES cruises.

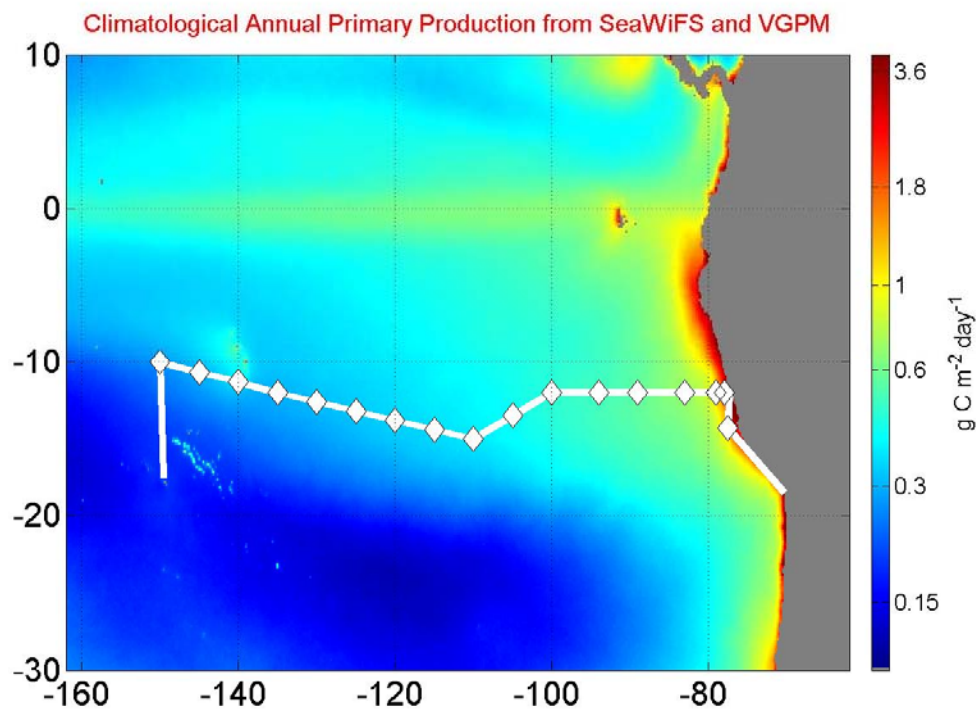
The true potential of the GEOTRACES philosophy was realized as investigators compared results for different TEIs and supporting variables when interpreting the processes affecting TEI distributions along the section. For example, within the “margin section” between Mauritania and the Cape Verde Islands, iron isotopes, radium isotopes, circulation tracers, nutrients and oxygen were combined with distributions of a suite of trace elements to discriminate between dust and boundary exchange with margin sediments

as a source of iron and other TEIs. Workshop participants identified a number of synthesis topics like this to be developed for publication over the next year or so.

Preparations are underway for a special issue of Deep-Sea Research Part-II featuring results from GA03. Bill Jenkins, Ed Boyle, Greg Cutter and Bob Anderson will serve as guest editors.

Eastern Tropical Pacific: The second major section planned by US GEOTRACES is a zonal section in the eastern tropical Pacific roughly between Peru and Tahiti (GP16, Figure 19).

Approximately 60 representatives of the U.S. GEOTRACES community met on 22-24 April 2013 at the Woods Hole Oceanographic Institution to refine station and sampling protocols for the planned section between Peru and Tahiti scheduled for October - December 2013. The objectives of the workshop were to maximize coordination of sampling and analytical efforts, develop deck utilization plans, shipping and loading logistics, and explore data management protocols. The group resolved a critical situation in which the number of berths requires to cover all of the essential science operations at sea greatly exceed available bunks. Teams of specialists were established to assure that shipboard operations would be covered and that samples would be collected and archived for all funded projects. Station plans for the cruise were refined to provide a telescoping sampling resolution in regions of greatest anticipated gradients in the concentrations of trace elements and isotopes. The research vessel (Thompson) will be loaded in Seattle 5-7 October before steaming to Manta Ecuador where the scientific party will depart on 25 October for a two-month expedition scheduled to end just before Christmas in Tahiti.



**Figure 19.** Tentative locations of full depth stations planned for the U.S. eastern tropical south Pacific zonal section (GP16). Shallow stations to 1000 m are not shown. The cruise is planned for late 2013. Map and productivity calculations courtesy of M-E Carr.

Arctic: US GEOTRACES submitted a proposal to the US National Science Foundation in October 2012 requesting support for management and logistics support of an Arctic cruise in 2015, contributing to the international GEOTRACES initiative. That proposal was declined. The management team met with

representatives from NSF to discuss a strategy to strengthen the proposal. We plan to submit a revised proposal for a NSF deadline on 15 August 2013.

### ***New Funding***

Funding for individual investigators to participate in the Peru-Tahiti section is now in place. Approximately 35 independent projects, involving more than 60 principal investigators as well as numerous students and post docs, have been funded. Completion of GP16 will generate a wealth of new data, both for TEIs and for complementary parameters that will facilitate the interpretation of TEI distributions.

### ***Presentation of results***

Preliminary results from the North Atlantic cruise (Figure 1) were presented at two international conferences:

- Fall 2012 AGU meeting (3 - 7 December 2012, San Francisco, California, USA).
- 93rd annual meeting of the American Meteorological Society (6 - 11 January 2013, Austin, Texas USA).

### ***U.S. GEOTRACES Meetings***

US GEOTRACES sponsored two large workshops during the past year. These are described above under “Activities”. In addition, members of the US GEOTRACES community participated in two international planning workshops:

- Nine members of the US GEOTRACES community participated in the International GEOTRACES Latin America workshop (12 - 15 November 2012, Rio de Janeiro, Brazil).
- Seven members of the US GEOTRACES community participated in the GEOTRACES Russia planning workshop (27 - 29 November 2012, Moscow, Russia).

### ***Publications (GEOTRACES and GEOTRACES-related\*)***

- \* Fitzsimmons, J. N., R. Zhang, and E. A. Boyle (2013), Dissolved iron in the tropical North Atlantic Ocean, *Marine Chemistry*, 154, 87-99.

US GEOTRACES publications 2012 - 2013:

- Baskaran, M., Church, T., Hong, G., Kumar, A., Qiang, M., Choi, H., Rigaud, S. and Maiti, K., 2013. Effects of flow rates and composition of the filter, and decay/ingrowth correction factors involved with the determination of in situ particulate 210Po and 210Pb in seawater. *Limnology and Oceanography: Methods*, 11: 126-138.
- Bishop, J.K.B., Lam, P.J. and Wood, T.J., 2012. Getting good particles: Accurate sampling of particles by large volume in-situ filtration. *Limnology and Oceanography: Methods*, 10: 681-710.
- Boyle, E.A., John, S., Abouchami, W., Adkins, J.F., Echevoyen-Sanz, Y., Ellwood, M., Flegal, A.R., Fornace, K., Gallon, C. and Galer, S., 2012. GEOTRACES IC1 (BATS) contamination-prone trace element isotopes Cd, Fe, Pb, Zn, Cu, and Mo intercalibration. *Limnology and Oceanography: Methods*, 10: 653-665.
- Buck, C.S. and Paytan, A., 2012. Evaluation of commonly used filter substrates for the measurement of aerosol trace element solubility. *Limnology and Oceanography: Methods*, 10: 790-806.
- Church, T., Rigaud, S., Baskaran, M., Kumar, A., Friedrich, J., Masque, P., Puigcorb , V., Kim, G., Radakovitch, O. and Hong, G., 2012. Intercalibration studies of 210Po and 210Pb in dissolved and particulate seawater samples. *Limnology and Oceanography: Methods*, 10: 776-789.
- Henderson, P.B., Morris, P.J., Moore, W.S. and Charette, M.A., 2012. Methodological advances for measuring low-level radium isotopes in seawater. *Journal of Radioanalytical and Nuclear Chemistry*, 296(1): 357-362.

- Kenna, T.C., Masqué, P., Mas, J.L., Camara-Mor, P., Chamizo, E., Scholten, J., Eriksson, M., Sanchez-Cabeza, J.-A., Gastaud, J. and Levy, I., 2012. Intercalibration of selected anthropogenic radionuclides for the GEOTRACES Program. *Limnology and Oceanography: Methods*, 10: 590-607.
- Maiti, K., Buesseler, K.O., Pike, S.M., Benitez-Nelson, C., Cai, P., Chen, W., Cochran, K., Dai, M., Dehairs, F. and Gasser, B., 2012. Intercalibration studies of short-lived thorium-234 in the water column and marine particles. *Limnology and Oceanography: Methods*, 10: 631-644.
- Morton, P.L., Landing, W.M., Hsu, S.-C., Milne, A., Aguilar-Islas, A.M., Baker, A.R., Bowie, A.R., Buck, C.S., Gao, Y. and Gichuki, S., 2013. Methods for the sampling and analysis of marine aerosols: results from the 2008 GEOTRACES aerosol intercalibration experiment. *Limnology and Oceanography: Methods*, 11: 62-78.
- Sharma, M., Chen, C. and Blazina, T., 2012. Osmium contamination of seawater samples stored in polyethylene bottles. *Limnology and Oceanography: Methods*, 10: 618-630.
- Twining, B.S. and Baines, S.B., 2013. The Trace Metal Composition of Marine Phytoplankton. *Annual Review of Marine Science*, 5(1): 191-215.
- Twining, B.S., Baines, S.B., Vogt, S. and Nelson, D.M., 2012. Role of diatoms in nickel biogeochemistry in the ocean. *Global Biogeochemical Cycles*, 26(4): GB4001 doi:10.1029/2011GB004233.
- Wozniak, A.S., Shelley, R.U., Sleighter, R.L., Abdulla, H.A.N., Morton, P.L., Landing, W.M. and Hatcher, P.G., 2013. Relationships among aerosol water soluble organic matter, iron and aluminum in European, North African, and Marine air masses from the 2010 US GEOTRACES cruise. *Marine Chemistry*, 154: 24-33.
- Wurl, O., Zimmer, L. and Cutter, G.A., 2013. Arsenic and phosphorus biogeochemistry in the ocean: Arsenic species as proxies for P-limitation. *Limnology and Oceanography*, 58(2): 729-740.
- Zimmer, L.A. and Cutter, G.A., 2012. High resolution determination of nanomolar concentrations of dissolved reactive phosphate in ocean surface waters using long path liquid waveguide capillary cells (LWCC) and spectrometric detection. *Limnology and Oceanography: Methods*, 10: 568-580.

Submitted by: Bob Anderson