**GEOTRACES SCIENTIFIC STEERING COMMITTEE**
**ANNUAL REPORT TO SCOR 2015/2016**

June 1st, 2015 to April 30th, 2016

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## 1. SCOR Scientific Steering Committee (SSC) for GEOTRACES

*Co-Chairs*
Ed Boyle, USA
Reiner Schlitzer, Germany

*Members*
Eric Achterberg, Germany
Adrian Burd, USA
Zanna Chase, Australia
Ludmila L. Demina, Russia
Jordi Garcia-Orellana, Spain
Vanessa Hatje, Brazil
Tung-Yuan Ho, China-Taipei
Phoebe Lam, USA
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Maeve Lohan, UK
Olivier Marchal, USA
Hajime Obata, Japan
Katharina Pahnke, Germany
Micha Rijkenberg, Netherlands
Alakendra Roychoudhury, South Africa
Géraldine Sarthou, France
David Turner, Sweden
Liping Zhou, China-Beijing

The SSC membership (listed above) contains representatives of 14 different countries with diverse expertise, including marine biogeochemistry of carbon and nutrients; trace elements and isotopes as proxies for past climate conditions; land-sea fluxes of trace elements/sediment-water interactions; trace element effects on organisms; internal cycles of the elements in the oceans; hydrothermal fluxes of trace elements; tracers of ocean circulation; tracers of contaminant transport; controls on distribution and speciation of trace elements; and ocean modelling.

## 2. Progress on implementation of the project

GEOTRACES continues to work diligently and enthusiastically, enjoying a very successful implementation. Its cruise field programme has now 84 GEOTRACES cruises (including 11 International Polar Year cruises) with 946 section stations completed and about 678 peer-reviewed papers published.

### 2.1 Status of GEOTRACES field programme

During the past reporting year, GEOTRACES has successfully completed most of the expeditions of the international Arctic GEOTRACES Programme. This includes 4 section cruises (from Canada, USA and Germany). One more Arctic cruise (from Germany) will be undertaken in summer 2016. In addition, one German cruise in the southeastern Atlantic Ocean was successfully concluded. The Atlantic Ocean basin now has remarkable coverage.

In complement to the GEOTRACES Ocean sections cruises, 8 process study cruises have also been completed. The GEOTRACES field programme is progressing excellently.

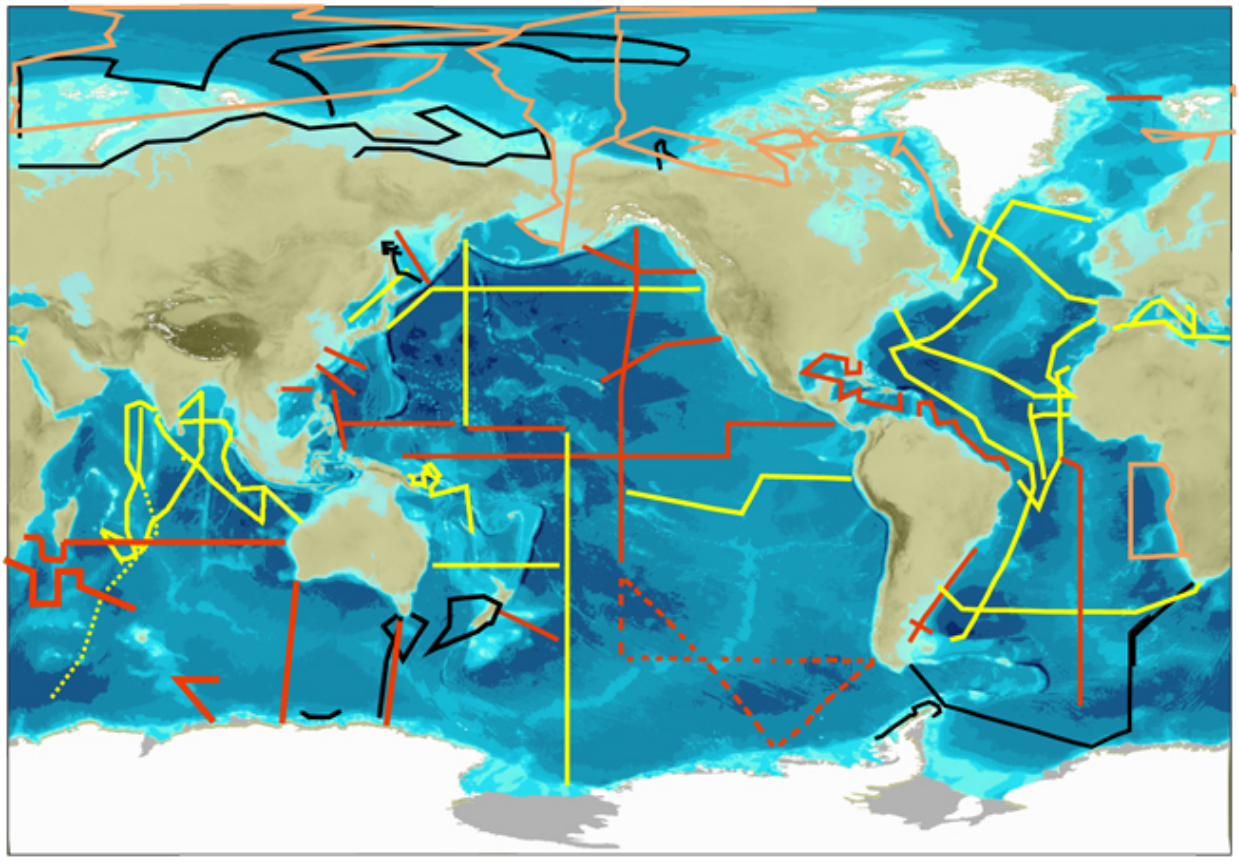

***Figure 1:*** *Status of GEOTRACES global survey of trace elements and their isotopes. In black: Sections completed as the GEOTRACES contribution to the International Polar Year. In yellow: Sections completed as part of the primary GEOTRACES global survey. In orange: Sections completed during the past year. In red: Planned Sections. An updated version of this map can be found on the GEOTRACES home page <http://www.geotraces.org>.*

***This year, one special field programme event merits to be highlighted.*** On the 7 September 2015, two cruises from the international Arctic GEOTRACES Programme, the U.S. cruise and the U.S. Coast Guard Cutter *Healy* and the German ship *RV Polarstern,* rendezvoused at the North Pole, having a memorable opportunity for occupying the same sampling station.

When the Standards and Intercalibration Committee created the idea of the crossover station—where two different GEOTRACES transect cruises occupy the same sampling station and subsequently compare their TEI data to facilitate intercalibration—they never imagined that two ships would be at the North Pole at the same time! They were both rafted up to the same ice floe and scientists could simply walk to visit each others' ships, labs, and share experiences and knowledge.

***Figure 2:*** *USCGC Healy and RV Polarstern at the North Pole ©Stefan Hendricks. Source: blogs.helmholtz.de.*

## 2.2 GEOTRACES Intermediate Data Products

The GEOTRACES community is working hard to prepare the next Intermediate Data Product (IDP), which will be released at the 2017 Goldschmidt Meeting (13-18 August 2017, Paris, France). The Intermediate Data Product 2017 (IDP2017) is being built upon the feedback received from the IDP2014 survey that collected 262 answers (the results were described in last year's report to SCOR).

To ensure timely release of the IDP2017, a clear procedure and timelines for data submission and review have been established and communicated broadly (see data management section in this report for further details).

*Promoting the use of IDP2014 data*
While working on the next IDP, GEOTRACES is continuing its efforts to publicise the IDP2014, promote its use and intensify collaboration of GEOTRACES with the broader ocean research community. To this end, a Town Hall was held at Ocean Sciences Meeting 2016 (21-26 February 2016, New Orleans, Louisiana). The Town Hall session on "Opportunities to Strengthen Your Science (and

Proposals) using GEOTRACES Data"1) informed the community about strategies to access, download and manipulate data from IDP2014 and provide preliminary information about IDP2017; 2) seek feedback from users of IDP2014 to improve IDP2017 and make it as user-friendly as possible; and 3) presented the outcome of the first Iron-Model Intercomparison Project (FeMIP), in which comparison to GEOTRACES data allowed an unprecedented assessment of model performance.

***Figure 3:*** *GEOTRACES Town Hall Meeting at Ocean Sciences 2016.*

Furthermore, the IDP2014 was also presented at the booth that SCOR had at the Exhibition Hall of the Ocean Sciences Meeting. At the booth, a GEOTRACES banner introducing the IDP2014 was displayed; promotional postcards of eGEOTRACES Atlas 3D scenes were distributed; and SSC members and IPO staff were available to inform visitors about the IDP2014 and the GEOTRACES Programme.


***Figure 4:*** *SCOR booth at Ocean Sciences 2016.*

## 2.3 GEOTRACES Publications

During the reporting period, 130 new papers have been added to the GEOTRACES peer-reviewed papers database (http://www.geotraces.org/library-88/scientific-publications/peer-reviewed-papers). In total the database includes 678 publications so far.

The following three special issues were published since the 2015 SCOR meeting, and two more are in preparation:

> Marine Chemistry (Volume 177, Part 1, Pages 1-202, December 2015)
> **Biogeochemistry of trace elements and their isotopes**
> Edited by Rob Middag, Claudine Stirling, Alessandro Tagliabue and Jingfeng Wu
> http://www.sciencedirect.com/science/journal/03044203/177/supp/P1
>
> Marine Chemistry (Volume 177, Part 3, Pages 409-582, December 2015)
> **Cycles of metals and carbon in the oceans - A tribute to the work stimulated by Hein de Baar**
> Edited by Loes J.A. Gerringa, Micha J.A. Rijkenberg, Patrick Laan and Klaas R. Timmermans
> http://www.sciencedirect.com/science/journal/03044203/177/part/P3
>
> Biogeosciences, special issue (Volumes 11 and 12)
> **KEOPS2: Kerguelen Ocean and Plateau Study 2**
> Edited by S. Blain, I. Obernosterer, B. Queguiner, T. Trull, and G. Herndl
> http://www.biogeosciences.net/special_issue164.html

Also, several publicity articles have been published in news magazines or journals in the past year. For example:

> Turner, D., & Urban, E. (2016). GEOTRACES: High-Quality Marine Analytical Chemistry on a Global Scale. Chemistry International, 38(1), 16–17. doi:10.1515/ci-2016-0108 (Open Access)

A complete list of the publicity articles is available here:
http://www.geotraces.org/outreach/publicity-documents

## 2.4 GEOTRACES Science highlights

The GEOTRACES International Project Office regularly edits highlights of published articles, which are posted in the website (http://www.geotraces.org/science/science-highlight) and in the electronic newsletter (http://www.geotraces.org/outreach/geotraces-enewsletter). Among the numerous highlights published since last year's report, we selected those which bring scientific messages related to the coupling (or not) of TEIs with nutrients: Zn and Si on the one hand, and the Cd and $PO_4$ paradigm on the other hand. High-resolution measurements conducted in the framework of GEOTRACES cruises are questioning well-established paradigms, as the famous $Cd/PO_4$ relationship classically used in paleoceanography. These high-resolution data are also confirming that a significant fraction of Al is released by sediments to the ocean.

## Decoupling between dissolved zinc and silicon in the North Atlantic Ocean driven by mixing of end-members

Roshan and Wu (2015, see reference below) reveal that the correlation between dissolved zinc (Zn) and silicon (Si) is relatively weak in the North Atlantic Ocean (GA03 US section). They use the results of an Optimum Multi-Parameter Water Mass Analysis to establish which parameter is mainly controlling the Zn distribution. Surprisingly, they present evidence that remineralization might have an insignificant effect on the zinc distribution in this region. They conclude that dissolved zinc in the North Atlantic Ocean is mainly controlled by water mass mixing, although some water mass end-members exhibit deviations in the Zn-Si correlation as, for example, the Mediterranean Outflow Waters. Unexpectedly large Zn inputs of hydrothermal origin are also perturbing the expected relationships.

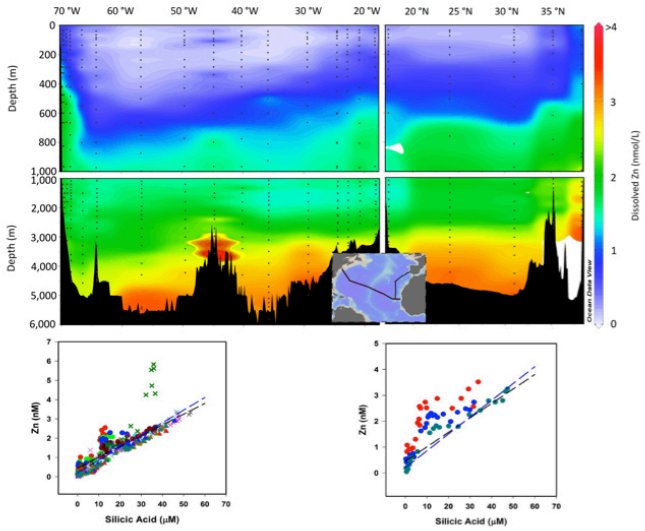


***Figure 5:*** *The Top panel shows the distribution of dissolved Zn along the GA03. Bottom panel shows the Zn-Si relationship for the zonal (left) and meridional (right) transect. Disappearance of a linear correlation is evident, particularly for the meridional transect where the Mediterranean waters have a great influence.*

Reference:

Roshan, S., & Wu, J. (2015). Water mass mixing: The dominant control on the zinc distribution in the North Atlantic Ocean. Global Biogeochemical Cycles, 29(7), 1060–1074. doi:10.1002/2014GB005026

## Changing the cadmium : phosphorus paradigm?

The well-established strong linear relationship linking dissolved cadmium (Cd) and phosphorus (P) concentrations in seawater is at the origin of the attraction of Cd as a proxy for $PO_4$ in the paleocean. However, exploring the dissolved Cd and $PO_4$ distributions in the ocean, Quay and co-workers (2015, see reference below) show that the Cd/P of particles exported from the surface ocean doubles in high-nutrient low chlorophyll (HNLC) regions. They also demonstrate that Cd/$PO_4$ variations in the surface ocean and deep sea depend on Cd/P of degraded particles. Using a box model, they present evidence that past changes in HNLC conditions would change the Cd-$PO_4$ relationship in deep sea... which has to be considered in paleo-reconstructions!

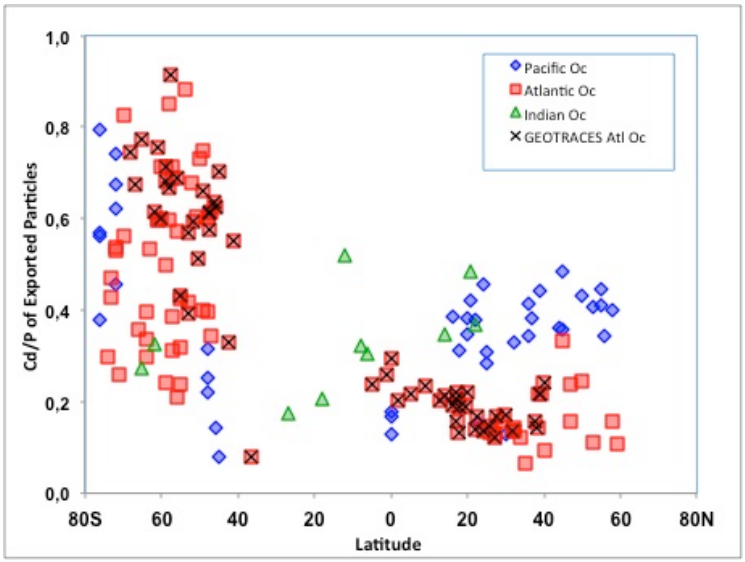


***Figure 6:*** *The meridional and interbasin trends in the estimated Cd/P ratio of particles exported from the surface ocean. The Cd/P of exported particles is a primary factor controlling the spatial variations of dissolved Cd/P in the surface ocean and in the deep sea where particles are degraded.*

Reference:

Quay, P., Cullen, J., Landing, W., & Morton, P. (2015). Processes controlling the distributions of Cd and $PO_4$ in the ocean. Global Biogeochemical Cycles, 29(6), 830–841. doi:10.1002/2014GB004998

## Impressive set of data reveal new features on the modern cadmium–phosphate relationship

Xie and co-authors (2015, see reference below) report vertical profiles of dissolved cadmium (Cd) in the western South Atlantic Ocean (GEOTRACES section GA02), which show nutrient-like distributions similar to those of the macronutrient phosphate (PO4). A close look at the data reveal

- In the surface ocean, preferential uptake of Cd over $PO_4$ by phytoplankton occurs along the transect, regardless of ambient iron (Fe) concentrations, suggesting Fe availability is not critical for biological Cd utilization in the southwest Atlantic;
- In addition, horizontal advection of Cd-depleted low oxygen waters originating from the Angola Basin and brought across the Atlantic Ocean via the Benguela and Equatorial currents imparts a Cd-depleted signature to equatorial intermediate waters distinguishing them from southerly intermediate waters.
- This new dataset provides further evidence that Subantarctic Mode Water plays an important role in generating the non-linearity of the global Cd-$PO_4$ correlation.

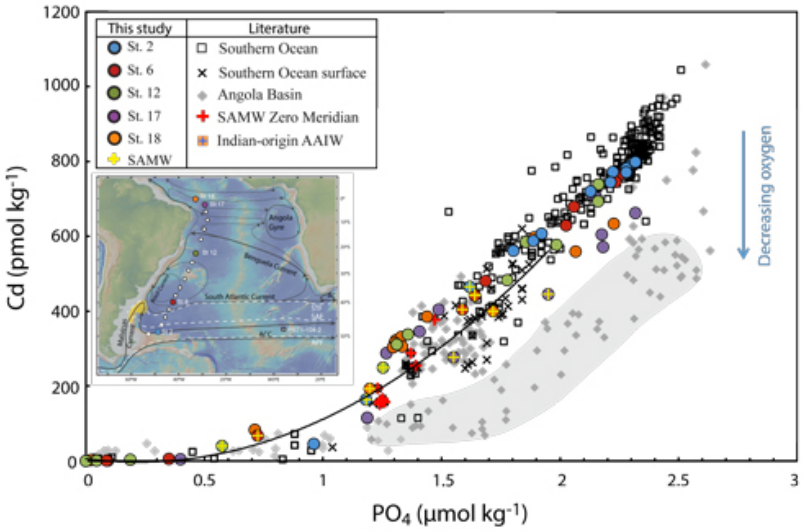


***Figure 7:*** *Evaluation of Cd–$PO_4$ systematics using new data from GEOTRACES GA02 Leg 3 (colored circles; see inset for location) and literature data (Southern Ocean: Abouchami et al., 2014; Baars et al., 2014; Boyé et al., 2012; Xue et al., 2013; Indian Ocean: Vu and Sohrin, 2013; Angola Basin: Waeles et al., 2013) at the scale of the South Atlantic Basin. The Cd–$PO_4$ relationship for samples with $PO_4$ >1.3 µmol $kg^{-1}$ in this study exhibits two parallel linear correlations. The influence of low-oxygen waters originating in the Angola Basin (grey shading) is noticeable in intermediate waters at the equatorial stations. The clear kink at $PO_4$ ~ 1.3 µmol $kg^{-1}$ in the South Atlantic is attributed to northward flowing, nutrient-rich Subantarctic Mode Water.*

Reference:

Xie, R. C., Galer, S. J. G., Abouchami, W., Rijkenberg, M. J. A., De Jong, J., de Baar, H. J. W., & Andreae, M. O. (2015). The cadmium–phosphate relationship in the western South Atlantic — The importance of mode and intermediate waters on the global systematics. Marine Chemistry, 177, 110–123. doi:10.1016/j.marchem.2015.06.011

## Large fluxes of dissolved aluminium exported from the coast to the ocean

In the Eastern China Sea (ECS), the continental shelf serves as an important source of dissolved aluminium (DAl) for the overlaying waters via resuspension of sediments and benthic fluxes. This was demonstrated by Ren et al. (2015, see reference below), who identified cross-shelf transport in the subsurface water over the ECS. The DAl export from the 100 m isobath is 1.67 x $10^{10}$ g yr.
Thanks to the Kuroshio current, more than half of this Al is transported northward within the region enclosed by the 100 m and 200 m isobaths to the Japan Sea/East Sea. The remaining flux is transported out of the shelf across the 200 m isobath. This highlights the importance of coastal processes and subsurface cross-shelf transport as a source of dissolved trace elements to the open ocean.

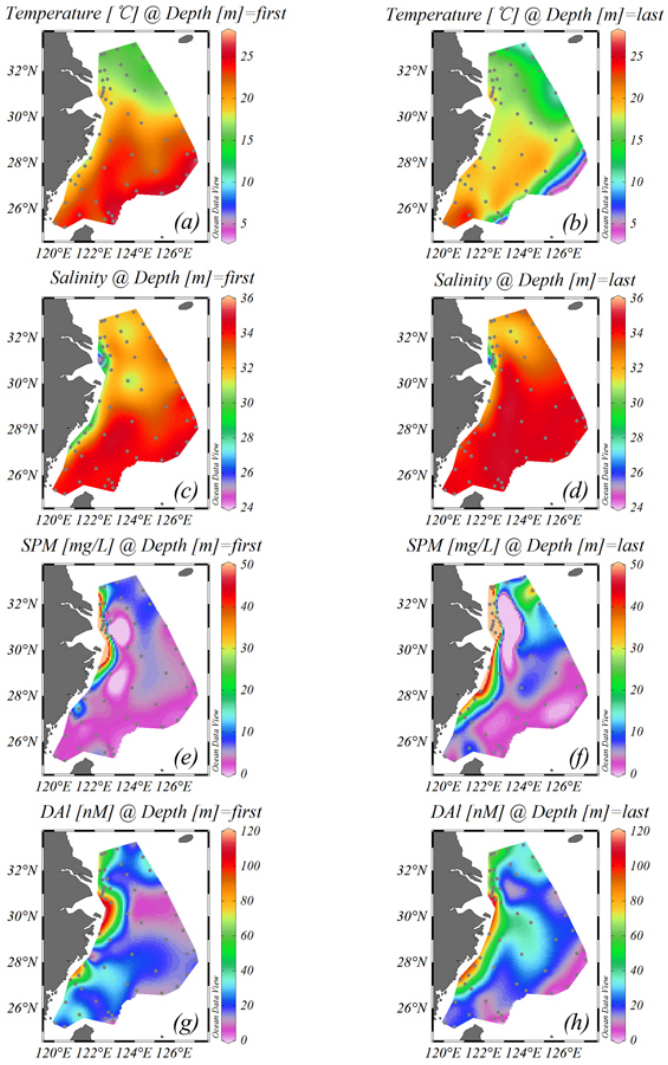


***Figure 8:*** *Horizontal distributions of temperature, salinity, SPM (mg/L), and dissolved Al (nM) in the surface water (a, c, e, g) and bottom water (b, d, f, h, with water depth ranging from 13 m to 1200 m) of the East China Sea. Changjiang Diluted Water (CDW) expanded southeastward in the surface, and was restricted to the coastal area by the incursion of Kuroshio Waters (KW). The incursion of Kuroshio Subsurface Water (KSSW) in the bottom layer can reach 30°N near the Changjiang Estuary. The concentration of dissolved Al decreased gradually from the coastal area to the central shelf, and then decreased sharply at the shelf break. The bottom layer had higher concentrations of dissolved Al than in the surface layer in the coastal and middle shelf, consistent with their higher concentrations of SPM.*

Reference:

Ren, J.-L., Xuan, J.-L., Wang, Z.-W., Huang, D., & Zhang, J. (2015). Cross-shelf transport of terrestrial Al enhanced by the transition of northeasterly to southwesterly monsoon wind over the East China Sea. Journal of Geophysical Research: Oceans, 120(7), 5054–5073. doi:10.1002/2014JC010655

## Multiple controls on the dissolved aluminium fate in the western Atlantic Ocean

Thanks to the most impressive set of dissolved aluminium (Al) and silicon (Si) data ever published in the Atlantic Ocean, Middag and co-workers (2015, see reference below) are thoroughly scanning the processes determining their oceanic distributions. They reveal that i) atmospheric inputs are affecting only the surface and subsurface waters; ii) there is an elusive but obvious coupling between Si-containing biogenic particles and Al; iii) scavenging is occurring faster than the horizontal advective transports, preventing the use of Al as quantitative water mass tracer; and iv) not observed at a basin-wide scale before, suspended sediments are a significant source for dissolved Al in the deep waters.

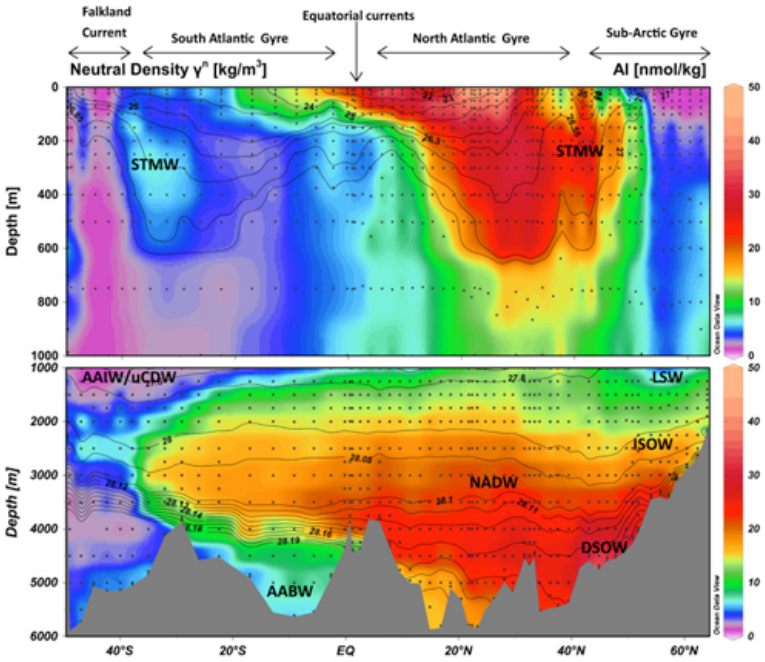


***Figure 9:*** *The distribution of Aluminium (Al) is depicted in colour scale overlain with neutral density isopycnals and main water masses labelled for the upper 1000m and the deep ocean. The effects on the Al concentrations of sediment resuspension in the deep ocean and atmospheric deposition in the surface ocean are clearly visible.*

Reference:

Middag, R., van Hulten, M. M. P., Van Aken, H. M., Rijkenberg, M. J. A., Gerringa, L. J. A., Laan, P., & de Baar, H. J. W. (2015). Dissolved aluminium in the ocean conveyor of the West Atlantic Ocean: Effects of the biological cycle, scavenging, sediment resuspension and hydrography. Marine Chemistry. doi:10.1016/j.marchem.2015.02.015

## 3. Activities

### 3.1 GEOTRACES intercalibration activities

The S&I Committee is currently composed of Karen Casciotti, Peter Croot, Tina van de Flierdt, Walter Geibert, Lars-Eric Heimbürger, Maeve Lohan, and Hélène Planquette (who joined since the last reporting period). Greg Cutter has stepped down from the committee and we thank him for all his efforts. Walter Geibert is now a co-chair, together with Maeve Lohan. Since their meeting in Galway, Ireland in January 2015, a virtual meeting was held in January 2016, and a three-day meeting took place at Stanford University from 27 to 29 April. The committee is in constant communication via email and through a shared online resource.

The main task of the committee in the past year was preparing for IDP2017 and ensuring the submission of data to be intercalibrated well in advance of the completion of the data product. The improvements of the submission procedure from the last reporting period are working well and we are pleased with the response from the community. The committee has provided details on requirements for different types of cruises and parameters, which made the intercalibration process more transparent for data submitters. In addition, a new flowchart of the submission procedure was designed and put on the website (http://www.geotraces.org/dp/intermediate-data-product-2017/steps-to-ensure-that-your-data-are-in-idp2017). This better description of the process, combined with regular reminders, individual letters, and written instructions for specific parameters, all contributed to receiving a large number of S&I reports from the analysts from the Atlantic and Pacific oceans. The submission of data for approval has been split into three deadlines, of which the second has now passed. While the submission of reports for data intercalibration can take place at any time before the final deadline, early submission is encouraged so that the committee can resolve issues before the final meeting for approval.

The S&I Committee received approximately 200 datasets from the Atlantic, 50 from the Pacific, 2 from the Indian Ocean, 6 from past IPY cruises, 8 from process studies and 4 GEOTRACES-compliant datasets for the April deadline. During the April meeting of the S&I Committee, all datasets were introduced by the assigned committee members, and discussed by the full committee. A number of intercalibration reports were of outstanding quality, providing excellent detail on intercalibration procedures, which was seen as a clear improvement to submissions for the the 2014 IDP. There are some remaining issues with some sections where no data has been submitted, or very little data. A particular issue has been the hydrography and nutrient datasets.

Some data in IDP2014 was not intercalibrated due to late submissions and lack of crossover stations. Because all data to appear in IDP2017 must be intercalibrated we have therefore contacted all data generators whose data was not intercalibrated for IDP2014 and asked for a report to be submitted for IDP2017. We have received many of these reports, but some have not yet been submitted, and the S&I Committee will contact these analysts once more.

Elemental co-ordinators, who have been contributing substantially to GEOTRACES by producing reference materials, standards, and organising intercalibration studies, play a key role in ensuring good data quality and improving the abilities of the communities. The existing list of elemental co-ordinators on the web page has been re-assessed, all elemental co-ordinators contacted to ask if they wished to continue in this role. The responses were overwhelmingly positive, and only a few changes are required. The committee points out in this context that it is critical to involve the S&I Committee in

decisions that have a potential influence on the choice, the availability and the characterization of reference materials, as this is our main tool to ensure consistent data sets.

The S&I Committee also discussed how analyses of consensus materials should be archived and distributed in the future. This discussion is on-going and it includes defining committee interaction with elemental co-ordinators, defining how values should be published, the level of anonymity required, and how consensus values can be updated in a manner that is transparent to the community.

The committee is in the process of re-designing the web page and obtaining a dedicated email address (sic@geotraces.org) to make electronic interaction with the S&I Committee more transparent.

## 3.2 Data management for GEOTRACES

The GEOTRACES Data Assembly Centre (GDAC) is hosted by the British Oceanography Data Centre (BODC), with the head office located in Liverpool; the GEOTRACES Data Manager (Abby Bull) is based at the BODC office in Southampton, UK. Regular communication is maintained between the two sites so that support and assistance can be offered to the GEOTRACES Data Manager when required.

GDAC is responsible for the entirety of the GEOTRACES data activities from inception to completion. This takes into account the following components:

- interaction between PIs and national data centres in order to encourage regular and timely data/ metadata submissions
- maintaining and modifying GDAC web pages to include updated ocean basin maps (http://www.bodc.ac.uk/geotraces/cruises/section_maps/) and upcoming cruises on the programme page (http://www.bodc.ac.uk/geotraces/cruises/programme/)
- liaising with the Data Management Committee and Standards and Intercalibration Committee to ensure issues/questions relating to GEOTRACES and its progress can be discussed, and deadlines can be met accordingly.
- input of metadata and data into the BODC database and compilation of documentation to include analysis methodologies
- Collation of data/ metadata for the IDP2017

BODC has recently assigned extra resources to the GEOTRACES Project in order to aid and provide support to Abby, focusing entirely on processing data to be included in the IDP2017. When the GEOTRACES Project expects to experience busy periods (i.e. from Summer 2016 – May 2017) this extra resource will be invaluable.

This year, GDAC would like to highlight and report on the following tasks:

**Working with the IPO**
The IPO continues to offer support to GDAC when required. The IPO continues to help GDAC stay up to date with new cruises, as well as serving reminders of when certain people should be contacted in order to extract various information at relevant times.

**Working with BCO-DMO**
GDAC and BCO-DMO have worked closely together over the past year. GDAC has liaised with BCO-DMO about how they can offer support and decrease the data processing time from GDAC's point of view via the use of the GDAC metadata template/methodology form. Communication is regular and BCO-DMO informs GDAC when new U.S. GEOTRACES data are submitted, as well as providing an estimated data processing time. Working with BCO-DMO has also helped to streamline data submission and processing procedures.

**GDAC website updates**
The GDAC basic delivery mechanism has been removed from the GDAC website as it was not being used. GEOTRACES would like to see an interactive map re-established on the GDAC website rather than the static maps, however, this will consume resources and is therefore not a current priority. All basin maps have been updated and pre/post cruise metadata forms added to the information section about each cruise situated below the basin maps. Contact information of each Chief Scientist/GEOTRACES Scientist for each cruise have also been included on these pages.

**DMC/ SSC meeting – July 2015**
The DMC/ SSC meeting in July 2015, Vancouver, was the first opportunity for Abby to meet most of the key GEOTRACES participants and country representatives. At the DMC meeting, Abby presented various data management areas. These included:

1. Summary of the GEOTRACES transition process from Ed Mawji to Abby Bull
2. A break-down of GEOTRACES data visits since being in position
3. Information and highlights on version 2 of the IDP2014
4. A GDAC website report
5. A process study update
6. A comparison/ interpretation of version 1 and version 2 IDP download statistics

The DMC meeting also focused on the agreement of IDP2017 data and S&I Committee submission deadlines. These are as follows:

| S & I/ data deadlines | S & I approval | Anticipated large amounts of data submitted to GDAC | Significance |
|---|---|---|---|
| 1 November 2015 | January 2016 | January – February 2016 | Earliest deadline |
| 1 April 2016 | May 2016 | April – June 2016 | Data guaranteed to be in IDP2017 |
| 1 December 2016 | March 2017 | December 2016 – March 2017 | Final deadline – data not guaranteed to be in IDP2017 |

All data for IDP2017 need to be submitted to Reiner Schlitzer by end of May 2017.

The 1 November deadline saw very little data submitted to GDAC and the S&I Committee (Nd and REE data from 4 cruises). This was expected, however, given the 3 deadlines. On the other hand, the guaranteed 1 April deadline experienced an increase in data/ intercalibration report submission of around 50 GEOTRACES datasets. At this moment in time, GDAC has received 271 datasets, which are currently being processed and 93 which are completed and 'Reiner ready'. Abby is expecting a steady stream of data to be submitted over the course of the summer in the lead up to and after the DMC/SSC meeting in September 2016.

Maeve Lohan and Greg Cutter (as co-chairs of the S&I Committee) and Abby have put together a document which allows us to determine which analysts have sent both data and intercalibration reports, only sent data, or only intercalibration reports. In the latter 2 situations, communication is required in order to encourage data or intercalibration report submission. This document allows us to keep on top of what has been received and what still needs chasing for data to be successfully included in the IDP2017. This document will also detail approval so Abby is aware of what data have been intercalibrated and what data require further work. This, in turn, alerts Abby whether data values need to be changed in the GDAC database.

A flowchart, created as a joint effort of the S&I Committee, GDAC and the IPO, details how scientists can ensure that their GEOTRACES data are present in the IDP2017. The flowchart illustrates 2 parallel pathways – data submission to GDAC, and the intercalibration process for the dataset via the S&I Committee. Both pathways must be followed (*which can be done concurrently*) in order to have data included in the IDP2017. This flowchart can be accessed on the following GDAC web page : http://www.bodc.ac.uk/geotraces/data/submission/intermediate_data_product/

**BioGEOTRACES meeting – November 2015**

BioGEOTRACES discussions at the SSC meeting highlighted the need for a BioGEOTRACES workshop involving GEOTRACES and BioGEOTRACES researchers, as well as GDAC, in order to decide how to prepare for the submission of biological parameters for inclusion in the IDP2017.

A BioGEOTRACES meeting was held in November 2015 at Woods Hole, Massachusetts. It was decided that in order for BioGEOTRACES data to be included in the IDP2017 the following procedure would be followed:

1. GDAC to provide a metadata form to BioGEOTRACES participants so that scientists are aware of what information is required.
2. BioGEOTRACES scientists to provide GDAC example datasets with accompanying metadata so GDAC can provide feedback.
3. Guaranteed IDP2017 submission deadline on 1 April 2016 for BioGEOTRACES data.
4. Maite Maldonado to provide recommendations for methodologies and intercalibration protocols/ efforts for each BioGEOTRACES parameter that has been chosen to be included in the IDP2017.

GDAC has provided feedback on example BioGEOTRACES datasets which were submitted and used biological data management resources at BODC for support and expertise. Only 'element quotas of individual phytoplankton cells' were submitted by the guaranteed IDP2017 deadline. GEOTRACES datasets will still continue to be prioritised over BioGEOTRACES datasets.

**GDAC data wiki page**

One change to note since July 2015 is that there is now a wiki page which details the number of outstanding, received and processed datasets (those ready for the IDP2017). This tool has proved to be invaluable in regard to tracking outstanding data and monitoring the throughput of data into the BODC system so priorities are more easily defined and work efforts/extra resource can be targeted as required. This wiki page (https://wiki.ceh.ac.uk/display/GDM/GEOTRACES+IDP17+Progress) is updated at the end of every month so changes can be easily identified, and pressure can be applied where needed. Through the use of this tool it is hoped we will see a steady stream of data submitted to GDAC rather than a large submission close to the final deadline (December 2016), therefore lifting a potential burden from the GDAC data manager. Through the use of the wiki page, updates can be discussed further with the DMC co-chairs.

**Data overview**

The data management of the GEOTRACES programme is a large undertaking, with a total of 84 associated cruises (including all cruise legs; this takes into account all section cruises, process studies and compliant data), and 64 sections/studies. More than 800 scientists have taken part in the GEOTRACES cruises, with 15 different nations having run a major GEOTRACES IPY/section/process study cruise.

The 2015/2016 period has witnessed the submission of outstanding data, with metadata becoming more forthcoming. It has been recognised that a way of encouraging PIs to submit their data to GDAC more readily is to use the IDP2017 as an incentive.

***Summary of completed GEOTRACES cruises to date:***

| **Section cruises** | **IPY cruises** | **Process studies** | **Compliant data** |
|---|---|---|---|
| 31 cruises (including all legs) with 23 sections | 11 | 35 (including all legs) with 23 studies | 5 |

***Summary of GEOTRACES cruises which have taken place in 2015/2016:***

This year the International GEOTRACES Arctic research programme focused on field effort from the United States, Canada and Germany. Four Arctic cruises were planned, funded and took place between July to October 2015. The German **section** cruise (M121 (GA08)) focused on the SE Atlantic with cruise dates of 22 November-28 December 2015. Other cruises which took place were **Process Study** cruises, and are as follows:

- Japanese cruise (KH15-3 – GPpr12) in the East China Sea – October – November 2015
- Netherlands cruise (PE401 ViciFe – GApr05) in the Black Sea – August – September 2015
- German cruise (SO245 UltraPac– GPpr09) in the ultra-oligotrophic South Pacific – December 2015 – January 2016
- Australian cruises (K-axis - GIpr06) and (HEOBI GIpr05) – both in the Indian sector of the Southern Ocean – January – March 2016
- Canadian cruise (LineP- 2015-10 - GPpr07) in the Pacific Ocean – August - September 2015
- UK cruise (Shelf Seas – DY033 - GApr04 leg 3) in the Celtic Sea – July – August 2015

***Summary of GEOTRACES cruises to take place in 2016/2017:***

Process Studies

- **ViciFe** – Netherlands - Arctic Pelagia – Summer 2016 – further information to be provided shortly.
- **SOSCEx II** – South Africa – (PI: Pedro Montero)
- **Peacetime** – France – (PI: Dr Guieu Cecile) – of which further information will be provided shortly.

Section cruises

- **GN05 – GRIFF** – Germany (PI: Torsten Kanzow) – Arctic Ocean – 19/07/2016 – 09/09/2016

**In summary**
The collection and processing of data to be included in the IDP2017 will be the focal point of GDAC's data activities over the coming year.

In summary, GDAC is receiving more and more data/metadata via the use of the metadata templates. Scientists are consulting the GDAC web pages before submitting, which is an indication that this part of the data submission process is improving. The methodology information is crucial when it comes to assigning BODC parameter codes, instrumentation and writing documentation for the user.

## 3.3 GEOTRACES International Project Office

The GEOTRACES International Project Office (IPO) is based at the Laboratoire d'Etudes en Géophysique et Océanographie Spatiales (LEGOS) in Toulouse, France. The IPO is staffed by a single person, the IPO Executive Officer, Elena Masferrer Dodas. She works under the scientific supervision of Catherine Jeandel (CNRS, LEGOS, France).

The IPO is responsible for:

- assisting the Scientific Steering Committee (SSC) in implementing the GEOTRACES Science Plan and implementation plans of the programme;
- organising and staffing meetings of the SSC, working groups and task teams;
- liaising with the sponsors and other relevant organisations;
- seeking and managing programme finances;
- representing the project at international meetings;
- maintaining the project website and Facebook and Twitter pages;
- maintaining the project mailing lists;
- preparing GEOTRACES science highlights and the bimonthly GEOTRACES eNewsletter;
- maintaining the GEOTRACES publications database and the GEOTRACES Scientists Analytical Expertise Database;
- assisting the GDAC in securing information about upcoming cruises; and
- interacting with GEOTRACES national committees and groups, as well as other international projects.

**Outreach**
The following outreach activities merit to be reported:

- GEOTRACES Outreach web page
  The IPO has continued to compile and make available on the GEOTRACES Outreach web page educational and outreach materials. This year, a remarkable effort was invested in outreach for the GEOTRACES International Arctic Programme. This includes:

  - 17 cruise blogs
  - 58 videos
  - participation of a PolarTREC science teacher on board the U.S. expedition who posted over 65 blogs to the PolarTREC website (www.polartrec.com/expeditions/us-arctic-geotraces/journals)
  - the "Float the Boat" programme (programme designed to involve students and public with an Arctic research on the U.S. *Healy* where over 1,300 boats on the ice were deployed as drifters to track the ice movement across the Arctic: http://floatboat.org
  - radio interviews
  - Educational outreach to U.S. Coast Guard personnel
  - outreach to local populations who depend on the Arctic Ocean for their livelihood (U.S. researchers put together a package for presentation at Kawerak Conference (31 May-4 June, 2015, Alaska) and presented GEOTRACES at the meeting for rural natives.

- GEOTRACES eNewsletter Special Issue devoted to Outreach activities
  In order to provide visibility to the numerous GEOTRACES outreach activities, the IPO published a special issue of the e-Newsletter devoted to outreach. This issue was published and broadly distributed coincidently with the opening of the COP21 conference on climate change (30 November 2015), to reinforce the message that GEOTRACES research is closely linked to climate change. The special issue is available here:

  http://www.geotraces.org/index.php?option=com_acymailing&ctrl=archive&task=view&mailid=501&key=pEtJKupG&tmpl=component

  After the release of the special issue, the IPO sought feedback from the GEOTRACES SSC members, end users and experts in communication and outreach. Feedback received was positive and very encouraging.

- Booth at Ocean Sciences Meeting 2016
  The IPO helped SCOR in coordinating, setting and staffing the SCOR booth at Ocean Sciences Meeting (21-26 February 2016, New Orleans, LA, USA). This year SCOR invited GEOTRACES, SOLAS, IMBER and SOOS international projects.

  For this booth, the IPO prepared several ad-hoc materials, including:

  - A new roll-up banner introducing the GEOTRACES programme, the IDP2014 and a selected science highlight.

- A set of 4 postcards showing 4 different eGEOTRACES Atlas 3D scenes. The aim of these postcards was to attract visitors at the booth at the same time as helping to promote and give visibility to the GEOTRACES products.
- A video display documenting scientific activities of several SCOR-sponsored projects. This video is available here: https://youtu.be/lx1cnNx2dhY.

- Goldschmidt 2015
  A new poster introducing GEOTRACES and the Intermediate Data Product was presented at the Goldschmidt 2015 meeting (16 - 21 August 2015, Prague, Czech Republic).

In addition, this year we would like to highlight the following tasks:

- GEOTRACES website:
  After the major overhaul done last year, the IPO has continued to improve the GEOTRACES website (<http://www.geotraces.org>) and fix several bugs of the new template. In addition, 3 upgrades have been done. As an example of new features, the GDAC cruise programme is now embedded in the IPO website so that there exists one cruise programme in both websites, facilitating navigation through them.

- IDP2017 Flowchart
  As initiative of the IPO, a flowchart describing the process to follow in order to ensure that data are in IDP2017, has been created as a joint effort of the S&I Committee, GDAC and the IPO. This flowchart is available on both the GDAC and the IPO websites:
  http://www.geotraces.org/dp/intermediate-data-product-2017/steps-to-ensure-that-your-data-are-in-idp2017

- Meeting and Workshop organisation
  The IPO has been solicited to assist at a different level in the following meetings and workshops: 2016 SSC and DMC meetings; Goldschmidt 2016 Workshop "Exploring GEOTRACES Data with ODV"; Ocean Sciences Meeting Town Hall "Opportunities to Strengthen Your Science (and Proposals) using GEOTRACES Data"; Workshop "Biochemical cycling of trace elements within the ocean: A synthesis workshop", Workshop "Biogeochemical studies in the Siberian Shelf"; "GEOTRACES Royal Society coupled workshop and meeting". Please read section "GEOTRACES Workshops" for further information about these workshops.

- Funding
  A new agreement has been concluded within the sponsors of the GEOTRACES IPO. From now on, the University Paul Sabatier replaces the Centre National de la Recherche Scientifique (CNRS) in the financial management of the agreement. Attaining this new agreement has required a substantial time investment from both the IPO science director and the executive officer.

  In addition, since the IPO is hosting the 2016 SSC and DMC meetings, additional funding has been secured through the University Paul Sabatier.

- Some statistics
  25 new highlights published (105 in total)
  5 eNewsletter published (bimonthly newsletter, 20 in total)
  130 new peer-reviewed papers included in the GEOTRACES Publication Database (678 in total)
  179 new articles published on the GEOTRACES website (from them 35 jobs/student positions)
  140 announcements sent through the GEOTRACES mailing list
  110 new posts on Facebook and 281 likes (top post reach 1.556)
  70 new tweets and 211 followers
  81 new subscribers on the GEOTRACES website

## 3.4 GEOTRACES Workshops

Coupled meeting and workshop to discuss and synthesise findings from the GEOTRACES programme, 7–10 December 2015, UK.

This meeting was organised in two parts, with two different venues: the first part (#1 below, a Royal Society Scientific Discussion Meeting) was dedicated to a broad audience, the goal being to give an overview of the up-to-date research in marine biogeochemistry and the role of ocean trace-element cycling in earth systems. The second part was a workshop (#2) occurring in Buckinghamshire (Chicheley Hall). Plenary sessions and small group meetings alternated. The different workshops discussed and synthesised the present knowledge of the fluxes of trace elements at the four ocean boundaries: from continents across the shelf; from marine sediments; from mid-ocean-ridges; and from the atmosphere. Poster sessions allowed discussions around the most recent results.

All the authors were requested to submit a paper in a dedicated issue of *Philosophical Transactions A* of the Royal Society.

1) The biological and climatic impacts of ocean trace-element chemistry, 7–8 December 2015, The Royal Society, London, UK.
For further information (recorded audio presentations are available):
https://royalsociety.org/events/2015/12/ocean-chemistry/

2) Quantifying fluxes and processes of trace-metal cycling at ocean boundaries, 9–10 December 2015, Chicheley Hall, Buckinghamshire, UK.
For further information:
https://royalsociety.org/events/2015/12/ocean-chemistry/

Biogeochemical studies in the Siberian Shelf Seas, 27–28 January, Kiel, Germany.

The aim of this workshop, supported by IASC, TRANSDRIFT (System Laptev Sea) and GEOTRACES, was to bring together various groups working on biogeochemical cycles in the Siberian shelf seas and explore possibilities of cooperation. As a result, two possibilities emerged for cooperation with Russia in the field of tracer studies: (1) the participation of a GEOTRACES scientist in the Russian 2017 Expedition to the Barents, Kara Laptev Seas and, (2) GEOTRACES scientists are

encouraged to host a Russia student/scientist on a GEOTRACES cruise or lab, with support from SCOR.

***Forthcoming:***

Exploring GEOTRACES data with Ocean Data View (Goldschmidt 2016 Workshop), 26 June 2016, Yokohama, Japan.

This hands-on workshop will teach standard and advanced ODV methods for the exploration and scientific analysis of environmental data. The GEOTRACES Intermediate Data Product 2014 (IDP2014) will be used as example dataset. Participants will learn how to create publication-ready maps, property-property plots and sections, and how to apply simple or advanced station and sample filters. In addition, an overview over the wide range of derived variables available in ODV will be given and a number of variables often needed in geochemical research will be described and applied. This includes aggregation, interpolation, unit conversion, differentiation and integration. The creation of spinning 3D scenes is beyond the scope of this workshop. The workshop will start with presentations of general software concepts and capabilities, followed by hands-on sessions for the creation of specific plot types and scientific discussion rounds explaining the findings. Participants are encouraged to bring their own laptop computer with ODV (http://odv.awi.de/) and the IDP2014 dataset (http://www.bodc.ac.uk/geotraces/data/idp2014/) already installed.

For further information: http://www.geotraces.org/meetings/geotraces-events/eventdetail/263/-/exploring-geotraces-data-with-ocean-data-view

Joint GEOTRACES/OCB Workshop: "Biogeochemical cycling of trace elements within the ocean: A synthesis workshop", 1 – 4 August 2016, Lamont-Doherty Earth Observatory, Palisades, New York, USA.

The workshop will launch a synthesis initiative on the biogeochemical cycling of trace elements and their isotopes within the ocean. The aim is to bring together expertise from GEOTRACES, OCB, and the broader oceanographic community of observationalists and modelers to explore the biological–chemical–physical underpinnings of trace element cycling, including (but not limited to) bioavailability, uptake, scavenging, and regeneration. The workshop will identify a small number of high-priority synthesis objectives that can be achieved over the next decade, exploiting the rapidly expanding set of data from GEOTRACES and related studies. The workshop will also outline strategies to reach those goals, which may include new modeling and observational initiatives.

For further information: http://www.geotraces.org/meetings/geotraces-events/eventdetail/254/-/joint-geotraces-ocb-workshop-on-internal-cycling-of-trace-elements

## 3.5 Special sessions at international conferences featuring GEOTRACES findings

Several special sessions with relevance to GEOTRACES were featured in major international conferences including:

2016 Ocean Sciences Meeting, 21–26 February 2016, New Orleans, Louisiana, USA.
For further information: http://osm.agu.org/2016/

*GEOTRACES Town Hall:*

*Town Hall "Opportunities to Strengthen Your Science (and Proposals) using GEOTRACES Data", Thursday, February 25, 2016: 6:30 PM - 7:30 PM

*GEOTRACES Tutorial:*

*T014: What Controls the Distribution of Dissolved Iron in the Ocean?, Tuesday, February 23, 2016, 03:30 PM - 04:00 PM
Primary Chair: Alessandro Tagliabue, University of Liverpool.

*GEOTRACES-sessions:*

*Atmospheric deposition and ocean biogeochemistry
*Primary Chair:* Ana M Aguilar-Islas, University of Alaska Fairbanks, Fairbanks, AK, United States
*Chairs:* Clifton S Buck, Skidaway Institute of Oceanography, Savannah, GA, United States and Meredith Galanter Hastings, Brown Univ-Geological Sciences, Providence, RI, United States

*The role of particles in the cycling of trace elements and their isotopes in the ocean
*Primary Chair:* Hélène Planquette, LEMAR, CNRS, Plouzané, France
*Chairs:* Phoebe J. Lam, University of California Santa Cruz, Department of Ocean Sciences, Santa Cruz, CA, United States and Benjamin S. Twining, Bigelow Lab for Ocean Sciences, East Boothbay, ME, United States

*Trace Elements and Isotopes at the Interfaces of the Atlantic Ocean
*Primary Chair:* Geraldine Sarthou, LEMAR UMR 6539 CNRS UBO IRD IFREMER, IUEM, Plouzané, France
*Chairs:* Edward A. Boyle, Massachusetts Institute of Technology, Earth Atmospheric and Planetary Sciences, Cambridge, MA, United States, Gideon Mark Henderson, University of Oxford, Earth Sciences, Oxford, United Kingdom and Micha J.A. Rijkenberg, Royal Netherlands Institute for Sea Research, Den Burg, Netherlands

*Trace Metal Bioavailability and Metal-Microorganism Interactions
*Primary Chair:* Julia M. Gauglitz, Woods Hole Oceanographic Institution, Marine Chemistry and Geochemistry, Woods Hole, MA, United States
*Chairs:* Randelle Bundy, Woods Hole Oceanographic Institution, Marine Chemistry and

Geochemistry, Woods Hole, MA, United States and Jill N. Sutton, IUEM/UBO, Technopôle Brest-Iroise, Place Nicolas Copernic, Plouzané, France

*Trace metal speciation in seawater: measurements, modelling and impact on marine biogeochemistry
*Primary Chair:* David R. Turner, University of Gothenburg, Gothenburg, Sweden
*Chairs:* Stan M.G. van den Berg, University of Liverpool, Liverpool, L69, United Kingdom, Sylvia Gertrud Sander, University of Otago, Dunedin, New Zealand, Kristen N. Buck, University of South Florida Tampa, Tampa, FL, United States, Rachel Shelley, LEMAR/UBO, Brest, France, Peter L Morton, Florida State University, Department of Earth, Ocean, and Atmospheric Science, Tallahassee, FL, United States, Christian Schlosser, GEOMAR Helmholtz Centre for Ocean Research Kiel, Chemical Oceanography, Kiel, Germany and Eric P. Achterberg, GEOMAR Helmholtz Centre for Ocean Research Kiel

Goldschmidt 2015, 16–21 August 2015, Prague, Czech Republic.
For further information: http://goldschmidt.info/2015/index

** Theme 2: Ocean Geochemistry. Present Conditions and Past Variation: fluxes, reservoirs and processes
Co-coordinators: Geraldine Sarthou (Brest University, France) and Andrew Bowie (University of Tasmania).
Team members: Katherine Barbeau (Scripps, USA), Kristen Buck (Univ South Florida, USA), Zanna Chase (Institute for Marine and Antarctic Studies, Australia, Rob Middag (Univ Otago, New Zealand), James Moffett (Univ. South Carolina, USA)

*02a: Trace Metals in the Ocean: Distributions, Isotopic Variation and Speciation

Convenors: Katherine Barbeau (UC San Diego, Scripps Institution of Oceanography, USA), Andrew Bowie (University of Tasmania), Kristen Buck (University of South Florida, College of Marine Science, USA), Rob Middag (Univ Otago, New Zealand), Christopher Pearce (National Oceanography Centre), Phil Pogge von Strandmann (Earth Sciences, University College London, UK), Géraldine Sarthou (LEMAR CNRS, Brest, France).

*02b: Radionuclides in the Ocean

Session Convenors: Bob Anderson (Lamont-Doherty Earth Observatory, USA), Ken Buesseler (Woods Hole Oceanographic Institution, USA), Pere Masque (Universitat Autònoma de Barcelona)

*02c: Past Changes in Ocean Biogeochemistry and Circulation and their Interaction with Climate

Session Convenors: Zanna Chase (Institute for Marine and Antarctic Studies, Australia), Martin Frank (GEOMAR Helmholtz Centre for ocean research Kiel, Germany), Norbert Frank (University of Heidelberg, Germany), Katharina Pahnke (ICBM and MPI for Marine Microbiology, Germany), Laetitia Pichevin (University of Edinburgh, UK), Laura Robinson (University of Bristol, UK), Tina van de Flierdt (Imperial College London, UK), Kazuyo Tachikawa (Cerege, CNRS, France)

*02d: What are the unifying principles common to all three Oxygen Minimum Zones (OMZs)?

Session Convenors: Jim Moffett (Univ. Southern Carolina, USA), Aurélien Paulmier (LEGOS, France)

*02e: Air-Sea Exchange, the Biological Pump, and Ocean Acidification

Session Convenors: Steve Emerson (University of Washington, USA), Doug Wallace (Dalhousie University, Canada)

*02f: Biogeochemistry of Arctic and Antarctic sea ice systems

Session Convenors: Jun Nishioka (Univ. Hokkaido, Japan), Delphine Lannuzel (University of Tasmania, Australia)

*02g: Advances in marine N, P and Si biogeochemistry

Session Convenors: Damien Cardinal (University Pierre and Marie Curie, LOCEAN, Paris), Albert Colman (University of Chicago, USA), Masha Prokopenko (University of Southern California, USA), Christian März (Newcastle University, UK)

*02s: Goldschmidt 25th Anniversary

The 25th anniversary talk is an overview of the progress and breakthroughs made in this theme over the last 25 years. Invited speaker: Catherine Jeandel

22nd International Society for Environmental Biogeochemistry (ISEB) Symposium Dynamics of Biogeochemical Systems: Processes and Modeling, 28 September - 2 October 2015, Piran, Slovenia.
For further information: http://www.iseb22.ijs.si

*Marine and coastal environments – Special session: GMOS and GEOTRACES

American Geophysical Union Fall 2015 Meeting, 14–18 December 2015, San Francisco, California, USA.
For further information: http://fallmeeting.agu.org/2015/

*GC067: Trace Metal Cycling in the Environment – 40 Years of Advancements

Convenors: Priya Ganguli, Frank Black, Sergio Sanudo-Wilhelmy and Ed Boyle

***Forthcoming:***

2016 Goldschmidt Meeting, 26 June–1 July, 2016, Yokohama, Japan.
For further information: http://goldschmidt.info/2016/

*12d: Oceanic Cycling of Trace Elements Using Elemental, Isotopic, and Modeling Approaches: Geotracers and Beyond...

Convenors: Tim Conway, Tristan Horner, Jessica Fitzsimmons, Hajime Obata, Catherine Jeandel, Andrew Bowie, Phoebe Lam

*12f: Elemental and Isotopic Marine Biogeochemistry at a Range of Scales: The Global Ocean, Marginal Seas, and Polar Atmosphere–Sea Ice–ocean Systems
Convenors: Susan Little, Daiki Nomura, Gregory de Souza, Markus Frey, Delphine Lannuzel, Jun Nishioka, Patrick Rafter, Martin Vancoppenolle

*16d: Models of Life and Geochemistry: Integrating Large-Scale Datasets into Global Climate Models
Convenors: Seth John, Tatiana Ilyina, Andy Ridgwell

Challenger Society 2016 Conference - Oceans and Climate, 5–8 September 2016, Liverpool, UK.
For further information: https://www.liverpool.ac.uk/challenger-conference-2016/

*Trace element and isotope exchange at ocean boundaries
Conveners: Will Homoky (Oxford), Torben Stichel (Southampton) & Susan Little (Imperial)

### 3.6 Capacity building

At-Sea Training GEOTRACES gratefully acknowledges support from SCOR to enable one scientist per year from a developing nation to participate in a GEOTRACES cruise. These opportunities are vital to the development of technical expertise in sampling and sample handling for contamination-prone elements aboard "dirty" ships.

Sampling Systems It is a goal of GEOTRACES that every nation carrying out oceanographic research should have access to a trace metal-clean sampling system. GEOTRACES offers guidance based on past experience in the design and construction of sampling systems as well as advice in operating these systems as shared facilities. A complementary goal is to establish a programme whereby scientists who have accrued experience in operating these systems can share that knowledge with scientists from nations that either are in the process of acquiring clean sampling systems.

An updated status of trace metal-clean sampling systems to support GEOTRACES research is provided in the table below. Scientists interested in developing one of these systems for their own use are encouraged to contact the GEOTRACES IPO or any member of the SSC, who will arrange for contact with an appropriate person to provide technical information about the design, construction and cost of a system.

| Nation | Status | System/ Carousel | Bottles | Depth |
|---|---|---|---|---|
| Australia | Complete | Powder coated aluminium, autonomous 1018 intelligent rosette system | 12 x 10-L Teflon-lined Niskin-1010X | 6000 m; 6 mm Dynex rope |
| Australia | 2nd system (complete) | Polyurethane powder-coated aluminium autonomous Seabird rosette with CTD and other sensors, auto-fire module, and all titanium housings and fittings | 12 x 12-L Teflon-lined OTE external-spring Niskin-style bottles | 1750 m 9mm Dyneema rope or 200 m 6 mm Dyneema rope wth coupling to 6000 m CTD wire |
| Brazil | Complete | GEOTRACES WATER SAMPLER - 24-bottle sampler for use with modem equipped 911plus CTD | 24 X 12-L GO-Flo | 3000 m; Kevlar cable |
| Canada | Complete | Powder coated aluminium with titanium CTD housing, Seabird Rosette | 24 X 12-L GO-Flo | 5000 m conducting Vectran |
| China - Beijing | Complete | Towed fish | NA | Surface |
| China - Taipei | Complete | Teflon coated rosette | Multi- size GO-Flo | 3000 m; Kevlar line |
| France | Complete | Powder coated aluminium with titanium pressure housing for CTD | 24 X 12-L GO-Flo | 8000 m; conducting Kevlar |
| Germany | CTD and bottles purchased, winch planned | Powder coated aluminium with titanium pressure housings and fittings | 27 x 12-L OTE GO-Flo | 8000 m; conducting Kevlar |
| India | Complete | Powder coated aluminium with titanium pressure housings and fittings | 24 X 12-L Niskin-X | 8000 m; conducting Kevlar |
| Israel | Complete | Powder coated aluminium, SeaBird Rosette | 12 X 12-L Niskin; 8 X 12-L GO-Flo (Teflon coated) | 2000 m, steel conducting cable |

| Nation | Status | System/ Carousel | Bottles | Depth |
|---|---|---|---|---|
| Italy | Complete | Go-Flo bottles on Kevlar line | 5 x 20-L Go-Flos | Kevlar |
| Japan | Complete | Powder coated aluminium | 12-L Niskin-X | 10000 m; titanium armored cable |
| Netherlands | Complete | Titanium frame | 24 X 12-liter GO-Flo | 10000 m; conducting Kevlar |
| Netherlands | Complete | Titanium frame | 24 X 27-liter ultraclean PVDF | 10000 m; conducting Kevlar |
| New Zealand | Complete | Powder coated aluminium | 13 X 5-L Teflon-lined Niskin-X; 13 X 5GO-Flo | 4000 m; 8 mm Kevlar line |
| Norway | In development | Standard 12 positions CTD Rosette GO | 5-L Niskin-X | |
| Poland | Complete* (although the steel cable) | Powder coated aluminum, SeaBird Rosette | 8x 10L GoFlo | 3000m, steel conducting cable |
| Poland | Complete | Single bottle | 10l G-FLO X Teflon coated | 300m Kevlar |
| Poland | Complete | Teflon pump on-line | Surface water pump | 1.5m fixed |
| Poland | In development | Pump CTD | Teflon hose 10mm | Up to 200m |
| South Africa | Complete | Powder coated aluminium, titanium housing/fittings | 24 X 12-liter GO-Flo | 6500 m; Kevlar cable |
| UK | Complete | 2 x Titanium frame, Ti pressure housings | 24 10-L OTE 24 10-L OTE | 2 x 8000m conducting Kevlar |
| USA - CLIVAR | Complete | Powder coated aluminium | 12 X 12-L GO-Flo | 1500 m; conducting Kevlar |
| USA - GEOTRACES | Complete | Powder coated aluminium with titanium pressure housings and fittings | 24 X 12-L GO-Flo | 8000 m; conducting Kevlar |
| USA- University of Alaska Fairbanks | Complete | Seabird Rosette. Powder coated aluminium with Ti parts and pressure housing. Fires at pre-programmable depths | 12 X 5-L Teflon-lined Niskin-X | No Kevlar line available yet. |

| Nation | Status | System/ Carousel | Bottles | Depth |
|---|---|---|---|---|
| USA-<br>Old Dominion University | Complete | Seabird Rosette. SBE-19 plusV2 CTD unit. Powder coated aluminium with Ti parts and pressure housing. Fires at pre-programmable depths | 12 X 5-L Teflon-lined Niskin-X | 2000 m 0.5-inch Kevlar wire |
| USA – Polar Programs | Complete | Powder coated aluminium with titanium pressure housings and fittings | 12 X12-L Niskin-X | 3000 m; conducting Kevlar |

## 4. Plans for coming year

While continuing to progress with the field programme, the top priority for next reporting year will be the release of the second **Intermediate Data Product at the Goldschmidt Meeting 2017** (13-18 August 2017, Paris, France). This will require a huge effort from the GEOTRACES community, GDAC, and IPO and, thus, most of the GEOTRACES work will be centred in making the IDP2017 possible, with several meetings to be held.

In addition, GEOTRACES will continue to implement the **GEOTRACES synthesis of results strategy** with (1) a workshop focused on the internal cycling of TEIs within the ocean to be held in August 2016, organised by U.S. GEOTRACES, in collaboration with the Ocean Carbon and Biogeochemistry Programme (OCB) and (2) a workshop centred on geochemical tracers used as paleoceanographic proxies, proposed for 2018. A proposal has been submitted to the Past Global Changes project (PAGES) to explore partnership with them to host the workshop.

## Acknowledgements

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