

GEOTRACES SCIENTIFIC STEERING COMMITTEE  
ANNUAL REPORT TO SCOR 2009/2010  
June 2010

SCOR Scientific Steering Committee for GEOTRACES

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Robert F. Anderson, USA  
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Andrew Bowie, Australia

Philip Boyd, New Zealand

Ken Bruland, USA

Pinghe Cai, China

Hein de Baar, Netherlands

Martin Frank, Germany

Toshitaka Gamo, Japan

The SSC membership (listed above) contains representatives of 15 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; Hydrothermal fluxes of trace elements; Tracers of ocean circulation; Tracers of contaminant transport; Controls on distribution and speciation of trace elements; and Ocean Modelling.

**SSC meeting**

The fourth meeting of the GEOTRACES SSC was held for three days (4th-6th November 2009) at the AGU headquarters in Washington DC, USA. Logistics were organized by Ed Urban from SCOR.

The meeting was attended by 19 member of the 2008/2009 SSC. Other attendees included: Greg Cutter (Chair of the GEOTRACES Intercalibration Subcommittee); Ed Urban (SCOR); Ed Mawji (GEOTRACES Data Assembly Centre); Norio Baba (Japanese Data Management); Don Rice (NSF Chemical Oceanography); Simon Metz (NSF Chemical Oceanography) and, on the afternoon of the first day, a number of representatives from various US funding agencies (details below)

The morning of the first day, following introductions and welcome, was spent in national reports detailing GEOTRACES activities of the last year in 16 countries. These reports outlined an impressive array of active and planned works, with particular highlights being the range of IPY results now starting to come from previous cruises, and the news that GEOTRACES in India has received funding for the coming 5 years totalling four million US dollars. Plans for other GEOTRACES Sections in the coming year were also discussed by countries including Germany, Holland, Japan, UK, and USA.

The afternoon of the first day presented an overview of the programme to agency representatives. For this section the meeting was joined by five additional representatives: Fred Lipschultz (NASA); Candace Major (NSF – Paleooceanography); Hedy Edmonds (NSF – Polar Programmes); Susan Roberts (Ocean Studies Board, National Academy of Sciences); Eric Itswiere (NSF – Physical Oceanography). David Kadko also joined the meeting to present US plans for Arctic work within the programme.

Presentations to introduce agency representatives to GEOTRACES consisted of:

- An overview of the programme (Gideon Henderson)
- Intercalibration (Greg Cutter)
- Data Management (Reiner Schlitzer)
- IPY (Hein de Baar)
- Arctic Workshop (Michiel Rutgers van der Loeff)
- USA Plans (Bob Anderson)
- USA Arctic Plans (Dave Kadko)

This afternoon session appeared well received and generated questions and discussion.

After departure of agency representatives there was brief discussion of plans for capacity building and training.

The second day of the SSC meeting initially focused on three issues that will be reported on elsewhere in this report: Data Management; planning and funding for the GEOTRACES IPO; and Intercalibration. Subsequent discussion addressed cross-national activities and included a report on Arctic Planning Workshop; details of European co-ordination through COST Action; plans for Mediterranean and Asian workshops, and discussion of links to other international programmes. The day finished by considering applications from four studies to become GEOTRACES process studies: Amandes and Pandora from France; Pine Island from The Netherlands; and PINTS from Australia. All four were considered to meet the published criteria and were accepted as approved process studies.

The third and final day of the SSC meeting started with discussion of BioGEOTRACES and Organic GEOTRACES – two initiative related to GEOTRACES. After some discussion about the practicalities, the SSC approved the plans for BioGEOTRACES – an effort to add a range of biological parameter measurements to GEOTRACES Sections. The SSC also noted the Organic GEOTRACES developments to run a global programme for organic marine chemistry with interest. Subsequent discussion addressed forthcoming workshops and conferences; programme budget, organisation of a formal launch of the field programme at AGU Ocean Sciences; and SSC rotation.

The next SSC meeting is scheduled for 22nd-24th September in Toulouse, France. The gap between SSC meetings is shorter than one year to accommodate the fact that many of those on the SSC will be at sea on GEOTRACES cruises during the later part of 2010.

### **Measurement Intercalibration during the GEOTRACES programme**

There was early recognition during the planning of GEOTRACES that intercalibration of measurements between laboratories would be critical to the success of the program. To that end, intercalibration, along with data management, has been one of the two primary “enabling” activities since the establishment of the GEOTRACES programme and has had a designated sub-committee to oversee its progress (Chaired by Greg Cutter).

Following two US-NSF led intercalibration cruises in 2008 (Atlantic) and early 2009 (Pacific), intercalibration efforts have concentrated on shore-based analysis of recovered samples and collation of results from laboratories worldwide. These results were brought together for public presentation at a special session at AGU Ocean Sciences, and then more fully discussed at a meeting in Norfolk, USA, 8th – 10th March 2010 hosted by Greg Cutter. This meeting was internationally attended and gave the ocean trace element community an opportunity to fully discuss the successes and difficulties of the intercalibration efforts.

In general, results from the intercalibration were successful, and there was marked improvement between samples from the first cruise and the second cruise. A manual of “Best Practices” documenting lessons learned from the intercalibration and making recommendations to facilitate acquisition of reliable data on future GEOTRACES cruises is very nearly complete. The manual will be completed in summer 2010 and made available via the GEOTRACES web site.

Further efforts to improve some elements and isotopes are required though, and it is generally important for the work of intercalibration to continue within the GEOTRACES programme. The intercalibration subcommittee will continue, and it is anticipated that its next meeting will be held in Europe with funding from the GEOTRACES related COST Action (<http://costaction.earth.ox.ac.uk/>).

### **Data Management for GEOTRACES**

GEOTRACES has sought to ensure, since the outset of the programme, that data management protocols would be firmly established before the main data collection phase of the programme. To that end a Data Management Committee is the second standing sub-committee of the programme. This committee, chaired by Chris Measures and Reiner Schlitzer, met immediately following the SSC meeting on 7th November in Washington DC.

This meeting reviewed national-level data management, with presentations from Norio Baba (Japan) and Cindy Chandler (USA) accompanied by over-view of summary information from other nations. It considered requirements for metadata, and for data reporting, and it discussed data mining of pre-GEOTRACES datasets. Other topics considered were the data policy for the programme, and how best to allow data search and retrieval.

Ed Mawji is the GEOTRACES Data Management Officer at the international GEOTRACES Data Assembly Centre (GDAC), hosted at the British Oceanographic Data Centre. He has set up a website which is now welcoming GEOTRACES data, starting with data from the GEOTRACES IPY cruises. This website (see <http://www.bodc.ac.uk/geotraces/>) also provides full details of forthcoming GEOTRACES cruises, and information about all aspects of the data management process and policy for the programme.

The Data Management Committee will next meet immediately before the 2010 SSC meeting to review progress as the main phase of GEOTRACE Section cruises commences.

### **GEOTRACES International Project Office**

A programme IPO has been set up during the past year, hosted in LEGOS, Toulouse, France, under the oversight of Catherine Jeandel. This office is presently staffed by a single person: the IPO Executive Officer, Elena Masferrer. Advertisements for this position were placed in early summer 2009 and attracted eight applicants. A selection panel consisting of the two programme chairs (Anderson, Henderson), the local host (Jeandel); and Ed Urban interviewed a short-list of three candidates and Elena emerged as the clear choice for the post. Her appointment has been made for an initial period of 3 years, which is the limit of available funding. This funding is from various sources, with US-NSF contributing the largest share, but other funds coming from CNRS and the local authority in France; from the UAB in Spain, and from German Oceanographic institutes. Seeking additional funding to secure this post (and the Data Management Officer post) beyond their initial periods of employment is a priority for GEOTRACES.

Initial work by the IPO Executive Officer has been to produce a brochure to advertise the programme; helping to organize the GEOTRACES launch (see below) and redesigning the programme website. The Executive Officer has recently taken maternity leave from the role, but will return in the autumn at which time the website will formally transfer to the new version. Additional tasks at that time will be the running of the SSC meeting in Toulouse, and the seeking of further funding for the management aspects of the programme.

## **Workshops and events**

### **2nd GEOTRACES Data Model Synergy Workshop:**

Building on the success of the first GEOTRACES data-model synergy workshop in 2007, a second meeting, chaired by Jean-Claude Dutay was held at the École Normale Supérieure in Paris, France from 7th to 10th December 2009. The workshop was funded by US-NSF, SCOR, COST Action ES0801 and INSU France. It had six sessions

- S1: Observation and modelling of particle concentration
- S2: Observation and Modelling particle reactive tracers, Th and Pa
- S3: Observation and Modelling particle reactive tracers – part 2 Nd isotopes and boundary exchange
- S4: cycling of micronutrient – The Fe cycle
- S5: Inverse modelling
- S6: Stable isotope modelling (N, C, Si, etc)

It was attended by some 50 people representing at least 13 countries. Additional information about this workshop, including a summary of its major discussion points, can be downloaded from <http://www.tiny.cc/ojfgu>

### **Launch of GEOTRACES field programme:**

A lunchtime sandwich lunch event was organized during the AGU Ocean Sciences meeting on 24th February 2010 in Portland, USA. The goal of this event was to inform a wider group of ocean scientists about the goals of the GEOTRACES programme as the major programme of dedicated GEOTRACES Sections commences. Gideon Henderson gave an overview presentation about the programme, which was followed by questions from the audience answered by the two programme chairs. The event was attended by more than 150 people and considered successful in publicising GEOTRACES.

### **Mediterranean Workshop:**

A workshop will be held on 4th to 6th October in Nice, France, to discuss plans for a GEOTRACES section in the Mediterranean Sea, and to co-ordinate process studies and other relevant trace metal work in that basin. The meeting is organized by a committee representing several Mediterranean countries and chaired by Angelos Hannides from Cyprus. Funding to allow most participants at the meeting to be reimbursed for travel costs are in place from COST, SCOR and US-NSF and it is expected that 50 people representing most Mediterranean countries will attend. Announcements for the meeting are available at <http://www.tiny.cc/ctoyi>

#### GEOTRACES Asia Planning Workshop

A workshop will be held on 4th to 6th October in Taipei to discuss GEOTRACES activities and international co-ordination in east and south Asia. This meeting has been organized by Tung-Yuan Ho who chairs a committee with representatives from across the area. Full details of the workshop are available at <http://proj3.sinica.edu.tw/~geotrace/index.htm>

#### **GEOTRACES-related sessions at international conferences**

GEOTRACES research goals are regularly promoted through special sessions at international conferences. Events during the past year include:

Two special sessions were convened at the Ocean Sciences meeting (22 - 26 February, 2010; Portland, Oregon) to highlight results pertaining to trace elements and their isotopes:

- CO07: GEOTRACES in the International Polar Year, and
- CO09: Getting the Right Number: Precision and Accuracy in Chemical Oceanography.

#### Acknowledgements

We offer our special thanks to Ed Urban, who continues to provide tremendous support and valuable advice to the planning of the GEOTRACES programme.

## National Reports

### Australia

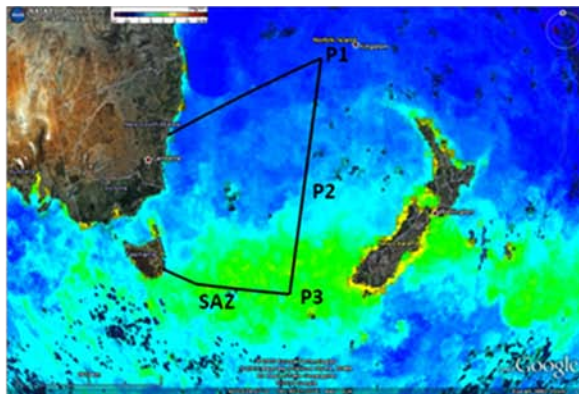
#### **Summary of Australian GEOTRACES activities in the period July 2009-June 2010:**

- Data from IPY-GEOTRACES projects *SIPEX*, *SAZ-Sense* and *SR3* submitted to the GEOTRACES Data Assembly Centre at BODC
- Several manuscripts published with results from IPY-GEOTRACES voyages (available on request)
- GEOTRACES process study ‘PINTS’ (voyage ss2010\_v01) in Tasman Sea completed February 2010 (see report below) (PI Hassler)
- Sea ice iron biogeochemistry time-series study undertaken at Casey Station (Antarctica) in November/December 2010 (PI Lannuzel)
- Design specifications for GEOTRACES sampling requirements fed into plans for new Australian oceanographic research vessel
- Preparations for GEOTRACES section along P06 (~30°S) in South Pacific (153°E to 150°W) underway (voyage ss2011\_v02), to be undertaken as joint Aus-NZ cruise in May/June 2011 (details presented to Bob Anderson to help planning of US-GEOTRACES Pacific sections) (PI Bowie)
- Participation and sample analyses of GEOTRACES intercalibration exercises for dissolved (Bruland), particulate (Sherrell) and aerosols (Landing) trace elements (Bowie lab)

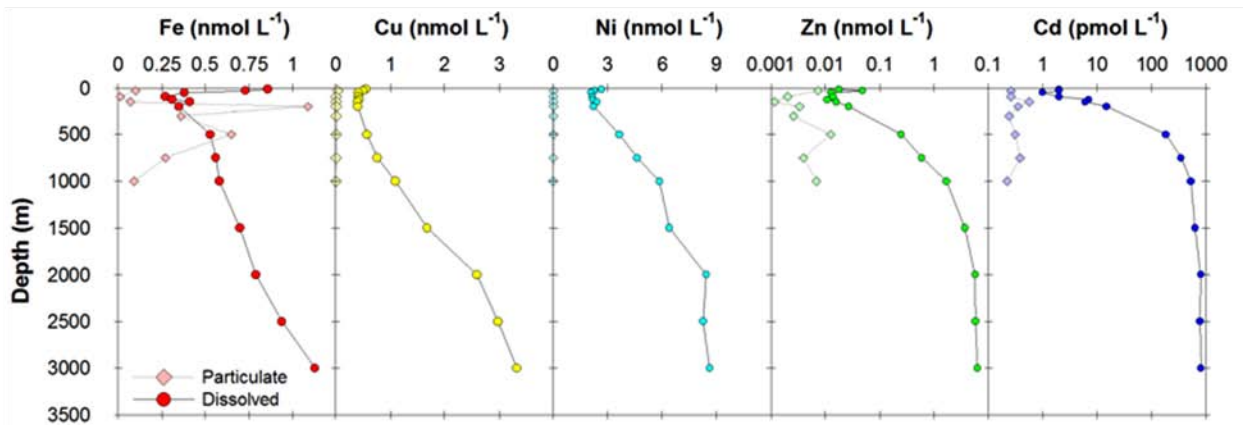
#### **PINTS voyage summary (‘Primary productivity Induced by Iron and Nitrogen in the Tasman Sea’)**

The research voyage studied iron bioavailability, sources and its biogeochemical cycling in the surface waters of the Tasman Sea. For this purpose samples for iron chemical speciation as well as dissolved and particulate concentrations were taken. Other trace metals can act as co-limiting factors on primary productivity. Therefore, samples were taken to analyse several other trace elements that are essential for phytoplankton growth such as Zn, Cu, Mo and Co. Other parameters that inform on biogeochemical processes and the sources at play, such as dissolved Cd and Pb, and Fe and Cu isotopic signatures were also studied. In addition to trace elements, macronutrients and especially nitrogen can limit primary productivity in the Tasman Sea. For this purpose samples were taken to determine the concentration of dissolved and particulate (organic) nitrogen, bacterial nitrogen recycling and the rate at which phytoplankton are able to fix atmospheric nitrogen. All these results on nutrients potentially limiting marine phytoplankton are being compared with phytoplankton biomass, biodiversity, productivity and physiological parameters to gain further insight on their control in the biology of the Tasman Sea. Data were gathered using a mapping approach (CTD, trace-metal-clean rosette and McLane pumps) along a voyage track (see figure below) designed to provide measurements on the effect of variable resources of iron (Australian continental dust, shelf sediments) on iron and nitrogen biogeochemistry. In addition on-deck incubations performed at process stations (P1 to P3) were used to determine how phytoplankton responded to variable perturbations relevant to nutrient limitation and climate change scenarios. The effect of variable source of organic iron and Australian desert dust, variable levels of pCO<sub>2</sub> and increasing temperature were investigated. Preliminary water column data are from P1 are presented in the figure below (Ellwood, unpublished data). Results from this voyage will improve our understanding of the parameters controlling primary productivity in the Tasman Sea and the biological response to

relevant climate change scenarios. A refined understanding of the dynamics of the Tasman Sea is required to improve existing models. Voyage plan and summary can be found online at [www.marine.csiro.au/nationalfacility/voyagedocs/index.htm](http://www.marine.csiro.au/nationalfacility/voyagedocs/index.htm).



Composite chlorophyll a image for January to February 2010 with the voyage track overlaid



Profiles of dissolved and particulate trace metals versus depth for station P1. Note the logarithmic concentration scale for the zinc and cadmium profiles.

### Update on outputs from GEOTRACES activities involving Australian researchers (July 2009-June 2010):

#### Journal articles:

- Bowie A.R., Townsend A.T., Lannuzel D., Remenyi T., van der Merwe P., 2010. Modern sampling and analytical methods for the determination of trace elements in marine particulate material using magnetic sector ICP-MS. *Analytica Chimica Acta*, submitted
- Bowie A.R., Lannuzel D., Remenyi T.A., Wagener T., Lam P., Boyd P.W., Guieu C., Townsend A.T., Trull T.W., 2009. Different processes structure biogeochemical iron budgets in the subantarctic and polar Southern Ocean south of Australia during summer. *Global Biogeochemical Cycles*, 23, GB4034, doi:10.1029/2009GB003500
- Cassar N., DiFiore P., Barnett B.A., Bender M.L., Bowie A.R., Tilbrook B., Petrou K., Westwood K., Wright S., Wagener T., 2010. The influence of light and iron on carbon export production in the subantarctic and polar frontal zones. *Geophysical Research Letters*, submitted
- Cossa D., Butler E., Heimbürger L.-E., Averty B., Bowie A.R., Watson R., Remenyi T., Rintoul S., 2009. Methylmercury formation and organic carbon oxidation in the Southern Ocean. *PNAS*, submitted

- Evans C., Thomson P.G., Davidson A.T., Bowie A.R., van den Enden R., Witte H., Brussaard C.P.D., 2010. Potential implications of climate change-induced shifts in microbial distribution for carbon cycling in the Australian Southern Ocean, Deep-Sea Research II, submitted
- Ibanami E.B., Hunter K.A., Sander S., Boyd P.W., Bowie A.R., 2009. Vertical distributions of iron-(III) complexing ligands in the Southern Ocean, Deep-Sea Research II, in press
- Lannuzel D., Schoemann V., Pasquer B., van der Merwe P., Bowie A.R., 2009. What controls the distribution of dissolved iron in Antarctic sea ice? Spatial, seasonal and inter-annual variability. Journal of Geophysical Research - Biogeosciences, doi:10.1029/2009JG001031, in press
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Prepared by:

Andrew Bowie (Antarctic Climate & Ecosystems CRC, University of Tasmania, Australia)



## **Brazil**

Brazil has a new member of the GEOTRACES SSC: Dr. Angela Wagner of the Departamento de Quimica, Pontificia Universidade Católica do Rio de Janeiro. She replaces Dr. Luis Felipe Niencheski of the Fundação Universidade Federal do Rio Grande, a founding member of the SSC.

### **Guarani Aquifer and coastal zone**

The Guaraní Aquifer, located beneath the surface of Argentina, Brazil, Paraguay and Uruguay is one of the world's largest aquifer systems and is an important source of fresh water.

Brazilian scientists are studying the interference of the Guarani Aquifer in the coastal zone through a project entitled “Chemical processes and groundwater discharge associated to coastal continental margins” sponsored by CNPq. We have realized observations of naturally occurring geochemical tracers ( $^{222}\text{Rn}$ ,  $^{223}\text{Ra}$ ,  $^{224}\text{Ra}$ ) in the coastal waters as proxies of Submarine Groundwater Discharge. More than 600 km of coast line in Southern Brazil (close to the Uruguayan borders) was investigated. Coastal seawater and shallow beach groundwater (<4m deep) were sampled in 2009.

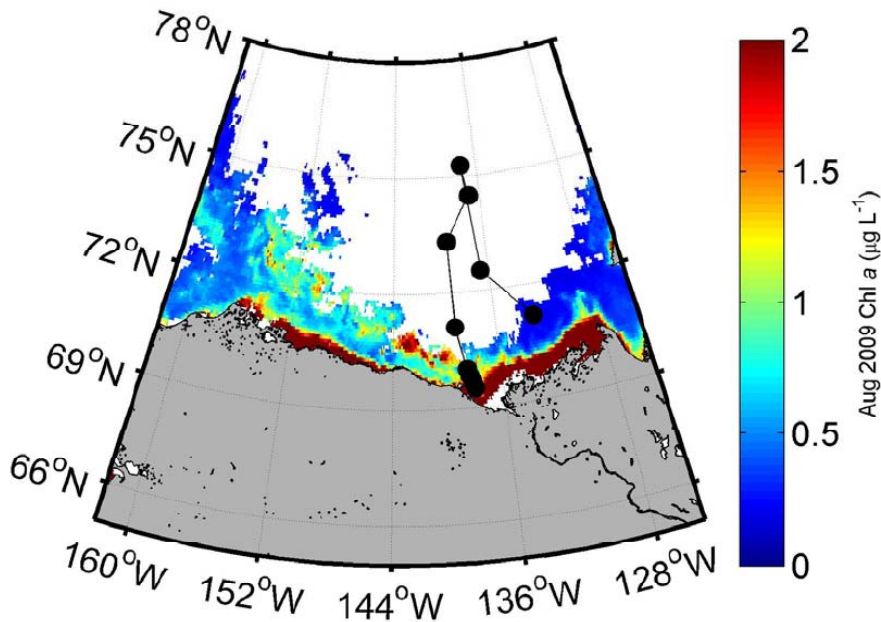
A cooperative program between Brazil and Argentina is entitled “Connections and interactions between surface water and groundwater in the region of the Middle Paraná River System, Lagoon Patos-Mirim and Costa Patagonia: isotopic evaluation”. Participating scientists include Luis Felipe Hax Niencheski (Brazil) as well as Jose Luis Esteves (Centro Nacional Patagónico) and Pedro Depetris (Universidad Nacional de Cordoba) from Argentina.

### **Ocean**

The first detailed investigation carried out by Brazilian scientists on trace metal concentration (Fe, Al, Ba, B, Cu, Cr, Pb, Cd, Zn, Ni, V, Mn, Hg and As) in ocean surface waters and sediments is under way in the Campos Basin, where the largest offshore petroleum reservoirs are found in Brazil. Two seasonal sampling campaigns were completed in 108 stations distributed in transects extending (09 transects; from 25 m to 3000 m depth) from the continental shelf to the continental slope and including mature as well as immature canyons. The entire research program addresses, in addition, the origin of the organic matter in sediments by using molecular markers (hydrocarbons, hopanes, steranes, sterols, fatty alcohols and acids, lignin, amino-acids, black carbon) as well as stable isotope signature. The leading scientists are: Angela Wagener, José Marcus Godoy, Reinaldo Campos (Pontificia Universidade Católica do Rio de Janeiro), Renato Carreira (Universidade Estadual do Rio de Janeiro) and Carlos Rezende (Universidade Estadual Norte Fluminense). The overall goal is to provide baseline information but also to understand the influence of river discharge, of the Cabo Frio upwelling and of different water masses on the chemical, geological and biological properties.

## Canada

Canadian scientists successfully completed an IPY-GEOTRACES cruise aboard the CCGS Amundsen from 27 August - 12 September, 2009 in support of the project entitled “Multi-tracer investigation of the effect of climate change on nutrient and carbon cycles in the Arctic Ocean”. This cruise is the last in a series of IPY-GEOTRACES cruises encompassing both Arctic and Antarctic regions. Samples were collected for all key GEOTRACES parameters with the exception of aerosols. The cruise track is shown below superimposed on a monthly composite of chlorophyll concentration.



A total of 44 standard rosette casts and 18 casts of a trace metal clean rosette were completed. In addition, particulate material was collected with in situ pumps during 14 casts. In addition to studies of the biogeochemical cycles of trace elements and their isotopes, experiments were conducted to examine interactions between trace elements (micronutrients) and biota.

Preliminary findings indicate that melting sea ice is a significant source of iron, and that by late summer primary production is limited by nitrate rather than iron. Over the course of a year, iron and nitrate may each serve as limiting factors for phytoplankton growth. In deep waters, large changes in the distribution of dissolved  $^{230}\text{Th}$  over the past 15 years record changes in circulation and exchange among the deep basing of the Arctic Ocean.

The Canadian GEOTRACES community is developing plans for a strategic network that would include collaboration with other nations in a larger study of the Arctic Ocean.

**GEOTRACES Activities in China**

**An annual report for 2009-2010**

**June 2, 2010**

**By China-GEOTRACES Working Group**

**A. Activities:**

- 1) Participation to the international GEOTRACES activities- intercomparison (second round): Th, Ra, Cd, Cu, Al, Pb, Ag (by Xiamen University, East China Normal University and Ocean University of China).
- 2) Invite Prof. Billy Moore from University of South Carolina to train researchers in China to run the Radecc system for measurement of radium isotopes.
- 3) “973” Carbon project—part of China-GEOTRACES has been accommodated in this project and there have been two cruises to Chinese Marginal Seas.
- 4) Field observations were carried out in the Changjiang drainage basin (main stream and major tributaries) during September-October of 2009 to understand the impacts of Three Gorges Dam’s construction on the weathering characteristics of the drainage basin and also the variations of terrestrial flux on the marginal seas of China.
- 5) Planning of a GEOTRACES process cruise in the Pacific in the spring of 2012

**B. Products:**

- 1) Preliminary results from GEOTRACES inter-calibration exercise are available. Details not shown.
- 2) Preliminary results from Ra study indicate that Ra distribution is strongly influenced by submarine groundwater discharge (SGD), coastal upwelling, and river plumes. Based on a mass-balance model, a crude estimate of SGD into the northern South China Sea is about 25% of that of Pear River.

**C. Promotion of GEOTRACES in China:**

- 1) A “clean” systems has been tested for underway and stationary trace metal sampling in the “973” cruises to the South China Sea.
- 2) A new MC-ICP-MS system (Nu) has been set up in Xiamen University and we have used it to measure Pb, Cu, and Fe isotopes in seawater samples.
- 3) A New ICP-MS system (Agilent 7700) has been set up in Xiamen University. Trace metal samples have been run in this system.

## China-Taipei

Scientists in Taiwan have secured funds from the National Science Council and Academia Sinica to host a GEOTRACES-Asia planning workshop, to be held 4-6 October, 2010, in Taipei. The objective of the workshop is to coordinate planning of GEOTRACES activities throughout Asia, including research in the Indian Ocean as well as in the western Pacific Ocean. Announcements of the workshop have been distributed to GEOTRACES email lists and a web site has been set up to provide additional information and to accommodate reservations at: <http://proj3.sinica.edu.tw/%7Egeotrace/index.htm>.

Motivation for the workshop is summarized as follows (from the web site):

*East and South Asia, the most populous region on Earth, face the Western Pacific Ocean, the Indian Ocean, and their marginal seas. Diverse anthropogenic and natural forcings coexist and interact in the biogeochemical cycling of trace elements and isotopes (TEIs) in these waters. However, their key regulating processes remain largely to be explored. In this workshop, potential key processes that regulate and control the biogeochemical cycles of TEIs, such as their sources, distributions, internal cycling, sinks, and their use as tracers or proxies, will be identified and discussed. These discussions will culminate in the formation of a future action plan in TEIs research in the region. Contributors are invited to present highlights of their relevant research and provide suggestions on future actions and cruise plans. Here, we would like to invite researchers to participate in this workshop.*

Contact person for the workshop is Tung-Yuan Ho <tyho@gate.sinica.edu.tw>.

SCOR will provide travel funds for participants from developing nations.

Taiwan has a small society but active research on TEIs:

- 4 labs focus on trace metal concentrations in seawater, particles, aerosols, plankton et al. (T.Y. Ho, S.C. Hsu, K.T. Jiann, L.S. Wen), with clean sampling technology & HR-ICPMS
- 3 labs on isotopic composition in seawater, aerosols, corals, marine sediments (D.C. Lee, C.C. Shen, C.F. You) all 3 labs are equipped with both HR-ICPMS & MC-ICPMS
- 7 labs on using radioactive and C/N isotopes to study marine geochemistry & biogeochemistry (C.A. Huh, C.C. Hung, S.J. Kao, K.K. Liu, S.D. Luo, D.D. Sheu, C.L. Wei)
- More than 30 papers focusing on TEIs in the ocean were published during the past 3 years, mainly in the East China Sea and South China Sea.
- Cruise schedules of the 3 RVs are tight. New 3,000 ton RV will be launched in 2012. Will be used for open ocean research, including GEOTRACES !

## Cyprus

Angelos K. Hannides of the University of Cyprus has taken the lead in organizing a GEOTRACES planning workshop on the Mediterranean Sea, to be held 4-6 October, 2010, in Villefranche-Sur-Mer, France. Research on the Mediterranean Sea requires special planning due to unique processes (e.g., dust deposition) and its international character. In addition, discussions are underway to jointly organize this workshop with SOLAS, with a view toward coordinating a GEOTRACES section across the sea with a SOLAS process study. Additional information concerning the workshop can be found at: <http://www.cybaes.org/gtmed/>.

Beyond the immediate objective of developing plans for GEOTRACES research in the Mediterranean Sea, it is hoped that the publicity provided by this workshop will contribute toward expanding research on trace elements and their isotopes in Cyprus.

Email contact for Hannides is < [hannides@cybaes.org](mailto:hannides@cybaes.org) >.

SCOR will provide travel funds for participants from developing nations.

## France

Below are the French activities related to GEOTRACES this year

- AMANDES (process study on the Amazon shelf in 2009): current post-cruise activities (measurements, modelling...). National funds from INSU/CNRS are supporting these lab works: 14000 euros for 2009 and 2010

- BONUS-GOODHOPE (IPY cruise): current post-cruise activities (measurements, modelling...) national funds from CNRS/INSU supporting this activity: 25000 euros/y from 2008 to 2011

- PANDORA (cruise in the marginal seas of the western tropical Pacific Ocean): Ship time is approved but not scheduled at this date (more information is anticipated on June 28 th). The science is funded. Two sources of national funds: CNRS/INSU: 220000 euros and ANR: 550000 euros (both covering 2009-2013). CNRS/INSU is also providing material from our national center of material (Brest, C. Marec).

- COMETS (Time series in the Mediterranean Sea, off Nice, at the DYFAMED station...requires the label "process study" for GEOTRACES)

The goal of the 4-year project COMET (CONstructing MEDITerranean Time-series) is to identify the causes and mechanisms responsible for the flux variability at seasonal to inter-annual time scales over the last two decades in the Ligurian Sea (NW Mediterranean Sea). This will be achieved by characterizing the chemical composition of sinking material collected at 200 and 1000m depth every 2 weeks using bulk parameters (POC, PON, POP,  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ), organic biomarkers and some TEIs ( $^{230}\text{Th}$ , REE, Nd isotopes...). National funds from INSU/CNRS: 10000 euros/y from 2008 to 2011.

- IPO: settled in Toulouse on January 15th. Elena Masferrer provided a short report on IPO activities that is incorporated above into this annual report for GEOTRACES. The French yearly contribution to the IPO: 18500 euros

- Organisation of the SCOR and SSC meetings in Toulouse. CNRS contribution: 5000 euros.

Submitted by Catherine Jeandel, 10 June 2010

## Germany

The main German GEOTRACES activity of the past year was the preparation and realization of the RV Meteor cruise M81/1 (GEOTRACES cruise A11, chief scientist M. Frank, IFM-GEOMAR, Kiel) to the tropical Atlantic Ocean (Las Palmas, Canary Islands - Port of Spain, Trinidad and Tobago, 4<sup>th</sup> February until 8<sup>th</sup> March 2010), which was funded by the German Science Foundation. For this cruise, which was exclusively dedicated to GEOTRACES, the trace metal clean rosette, mobile winch with 8 km Kevlar cable and the clean van of the U.S. GEOTRACES programme had been borrowed. The system was successfully operated over the A-Frame of RV Meteor alternating with a normal rosette for less contaminant prone trace metals, as well as in situ pumps for particulate sampling, which were handled in a second clean laboratory container of the University of Bremen. A total of 17 full water depth stations were sampled for all core and ancillary parameters of the GEOTRACES program complemented by continuous surface water sampling with a towed fish (see Figure below). In addition to the core parameters, samples were taken for analyses of dissolved transition metals (Ti-Zr-Hf, V-Nb-Ta, Cr-Mo-W), stable Fe-, Cd-, and Si-isotope composition, dissolved Hf isotopes, REEs,  $^{234}\text{Th}$ ,  $^{227}\text{Ac}$  concentration, Ra isotopes, and anthropogenic radionuclides ( $^{239}\text{Pu}$ ,  $^{240}\text{Pu}$ ,  $^{237}\text{Np}$ , and  $^{137}\text{Cs}$ ). Two crossover stations for the forthcoming U.S. RV Knorr (eastern tropical Atlantic; see map) and the Dutch RV Pelagia cruises (western tropical Atlantic; see map) were occupied. All samples arrived back in the home laboratories safely and will be measured in the coming 2 years, for which a proposal for funding 4 PhD students will be submitted to the German Science Foundation in summer 2010.

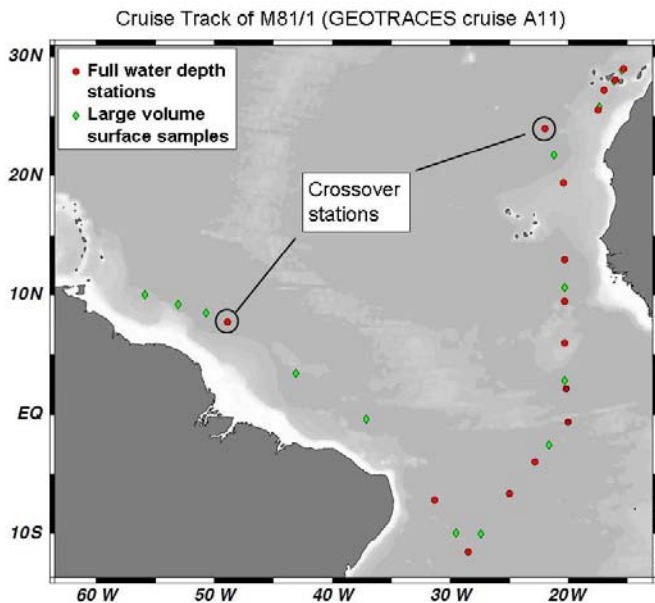


Figure: Track of RV Meteor cruise M81/1 (Las Palmas – Port of Spain, Feb.-March 2010).

In addition, German GEOTRACES scientists (group of M. Rutgers van der Loeff) took part in Leg 1 of Dutch RV Pelagia cruise (GEOTRACES) in the western North Atlantic and will receive samples from Leg 2 of this cruise for measurements of GEOTRACES core parameters  $^{231}\text{Pa}$  and  $^{230}\text{Th}$  and a number of additional profiles for Nd isotope measurements to complement and extend the section of cruise M81/1.

The main planning activities of the German GEOTRACES community over the past year was the Arctic planning workshop in Delmenhorst (June 6-8, 2009) mainly funded by the EU GEOTRACES COST program ES801 (The Ocean Chemistry of Bioactive Trace Elements and Paleoclimate Proxies). The workshop report is available on the GEOTRACES website.

## **India**

**GEOTRACES (India)**  
**Sunil Kumar Singh**  
**Physical Research Laboratory**  
**Ahmedabad - 380009**  
**India**

The Ministry of Earth Sciences (MoES), India accepted the nine proposals submitted under GEOTRACES (India) programme from various laboratories and universities. The ministry has approved a total of Rs. 20 crores (US\$ 4 million) for these projects for five-year duration. Majority of the funding will be utilised in buying clean sampling system and establishing a shore based state of the art laboratory to analyse TEIs in the water and sediment samples. In addition to this budget, the ministry will provide us the ship time required for sampling during this programme. The National Joint Scientific and Technology Advisory Committee (October 28, 2009) has identified the Oceanography Research Vessel *Sagar Kanya* to house the proposed clean sampling system to be procured under GEOTRACES (India) and first cruise with the clean sampling system for the GEOTRACES (India) will be carried out onboard ORV *Sagar Kanya* during January 15 – February 13, 2011 in the Arabian Sea following with a cruise in the Bay of Bengal during March April, 2011. Committee has allotted four cruises during 2010 for coastal research pertaining to GEOTRACES onboard Coastal Research Vessels *Sagar Poorvi* and *Sagar Paschimi*. One of the coastal cruises in western coast of India in the Arabian Sea is concluded recently (May 3 –May12, 2010). In addition, two geotracer from India participated in the Japanese cruise Hakuho-Maru during November, 2009- January, 2010 in the Indian and Southern Oceans.

As discussed earlier, sampling related to GEOTRACES studies were done in the Arabian Sea, the Bay of Bengal and the Southern Ocean onboard *Sagar Sampada* and *Boris Petrov* during the expedition carried out during November – December, 2008 and January- March 2009 respectively. The sampling was done on the cruise track finalised in the Indian Basin Planning workshop. Dissolved Nd isotope compositions in the three vertical profiles in the Arabian Sea (Fig. 1) were measured showing significant variation.



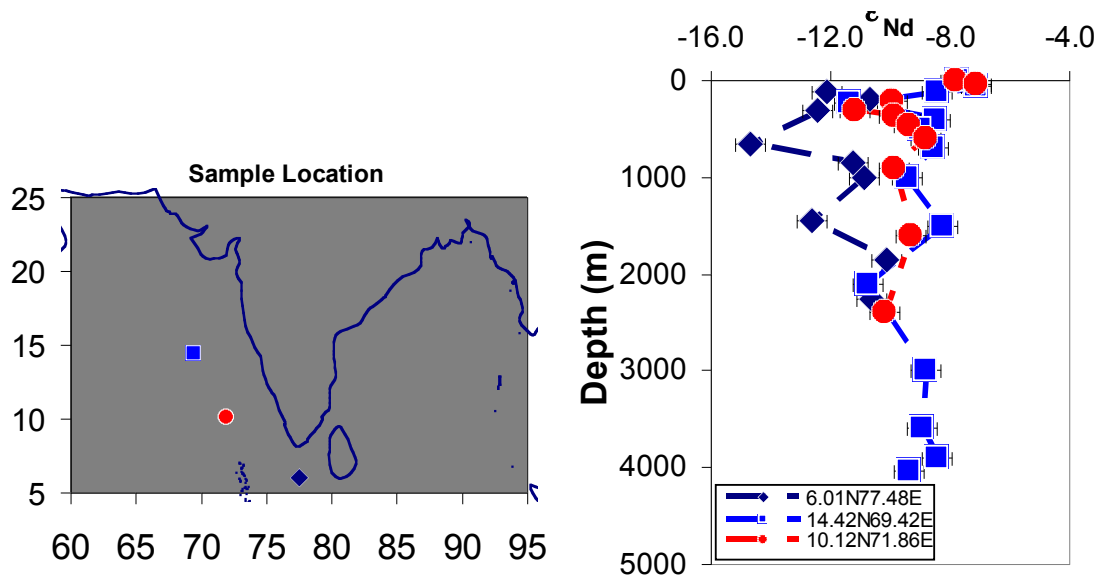


Fig. 1: Sampling location and dissolved Nd isotopic composition  $\epsilon_{Nd}$  in the Arabian Sea

Dissolved Mo was analyzed in four Indian estuaries i.e. the Narmada, Tapi, Mandovi and the Hooghly, falling into the Arabian Sea and the Bay of Bengal respectively. Among these four estuaries, Mo shows nonconservative mixing in the Hooghly (Fig. 2) and the Mandovi with its significant removal in lower salinity ranges (0 to 15‰). Mo seems to be removed due to the local

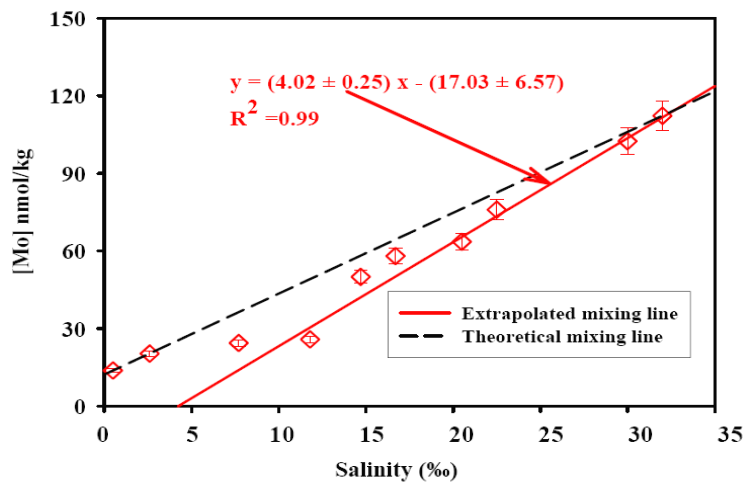


Fig. 2: Mo vs salinity in the Hooghly Estuary

anoxia resulting from the widespread mangrove swamp. Available data on Mo supply ( $2.0 - 2.6 \times 10^8$  mol/y) to the ocean and removal ( $1.1 - 1.7 \times 10^8$  mol/y) from the ocean indicate a significant missing sink of Mo if it is in steady state with respect to input/output. The current study provides an estimate of an additional Mo sink in the range of  $0.4$  to  $3.1 \times 10^8$  mol/y caused by the presence of mangrove swamps in the worldwide oceans.

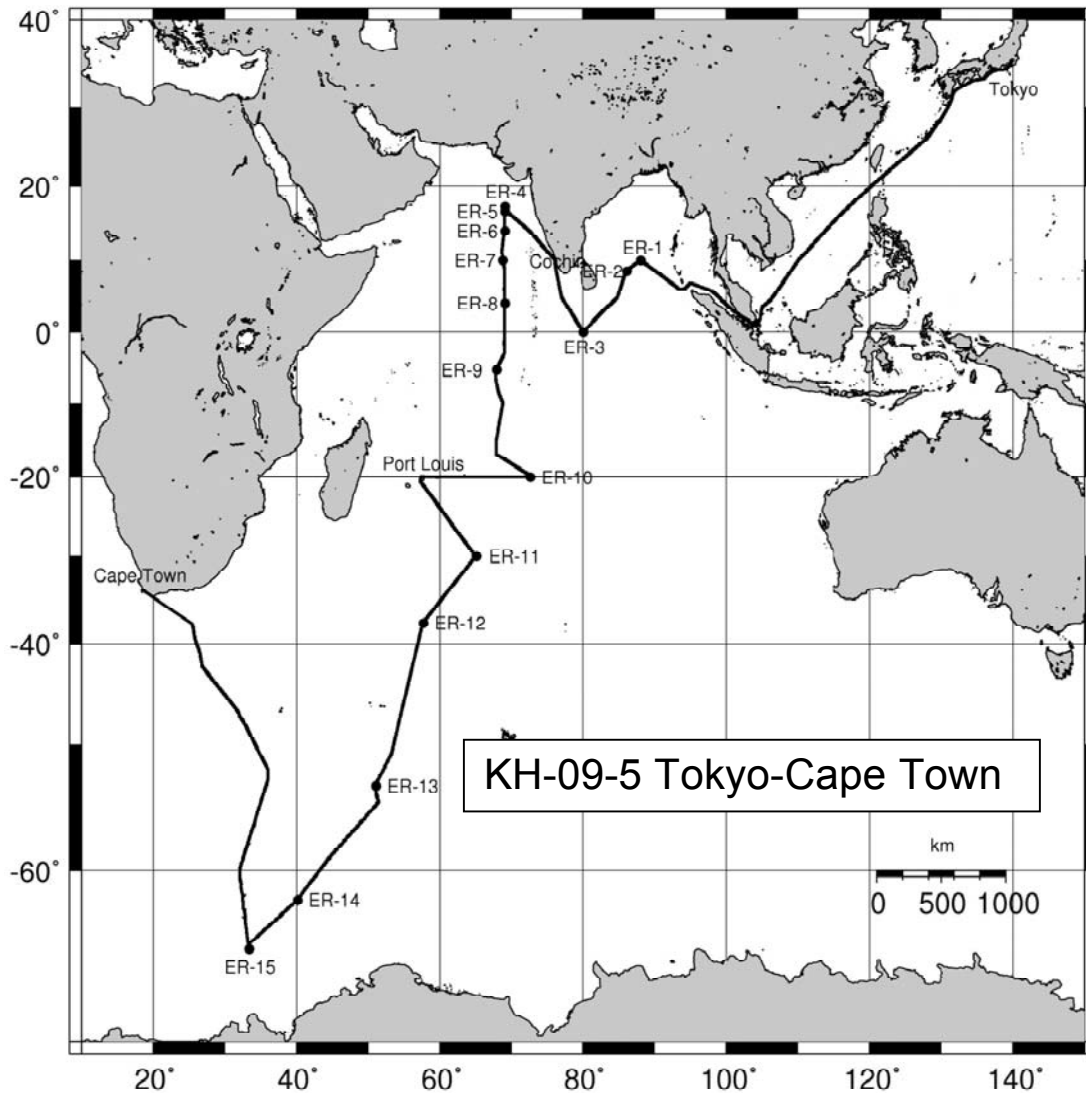
## Japan

The first three legs of the *Hakuho Maru* KH-09-5 cruise were successfully conducted as a GEOTRACES cruise as shown below from 6 November 2009 to 10 January 2010 (66 days in total) in the north and western Indian Ocean including the Antarctic Sea.

Leg-1: Tokyo, Japan (6 Nov. 2009) to Cochin, India (24 Nov. 2009)

Leg-2: Cochin, India (27 Nov. 2009) to Port Louis, Mauritius (16 Dec. 2009)

Leg-3: Port Louis, Mauritius (16 Dec. 2009) to Cape Town, South Africa (10 Jan. 2010)



The main study theme of this cruise was marine geochemical observations in the northern (chiefly in the Bengal Bay) and western Indian Ocean from the Arabian Sea to the Antarctic Sea along a meridional line along 65°E. It is a pity that we had to slightly modify the planned course, because of i) the threat of Somalian pirates in the Arabian Sea, ii) an approaching cyclone in the southern equatorial region, and iii) severe weather condition in the Antarctic Sea. The Indian Ocean occupies a vast area of the world ocean, but little is known about the marine biogeochemical cycles on trace elements and isotopes (TEIs). Thus, it is important to understand

the role of the Indian Ocean in the global carbon cycle including its temporal variations recorded in marine sediments. We occupied 15 stations to conduct CTD-hydrocast, large volume water sampling, multiple coring, piston coring etc. TEIs measurements were partly done on board the ship and most of them are now ongoing in shore-based laboratories in Japan and other countries.

We conducted intercalibration studies during the cruise, by comparing the GEOTRACES-recommended Kevlar wire hydrocast with the R/V Hakuho Maru's titanium wire hydrocast. We have also established a GEOTRACES baseline station at (20°S, 72°33'E) in the central Indian Basin, taking seawater samples not only for shipboard scientists but also for other international scientists who will measure in future some of the GEOTRACES key parameters for intercomparisons.

Forty three scientists (including graduate students) from various universities and research institutes in Japan, three technical supporting staffs from Marine Work Japan Ltd., one scientist from U.S.A., one scientist from Canada, two scientists from China, and three scientists from India, total 53 scientists took part in the cruise to pursue international collaborative studies on GEOTRACES. We hope that the obtained data by this cruise will play an important role in the GEOTRACES program as its first accomplishment in the Indian Ocean.

Toshitaka Gamo (Chief Scientist of the Leg-2 and -3)  
Hajime Obata (Chief Scientist of the Leg-1)

### **Korea**

Korean scientists G. H. Hong and Y. I. Kim, both of the Korean Ocean Research and Development Institute, plan to attend the GEOTRACES Asia planning workshop in October. In addition, Drs. Hong and Kim have secured seed funding to begin isotope work in support of GEOTRACES.

## Netherlands

### 1) IPY GEOTRACES

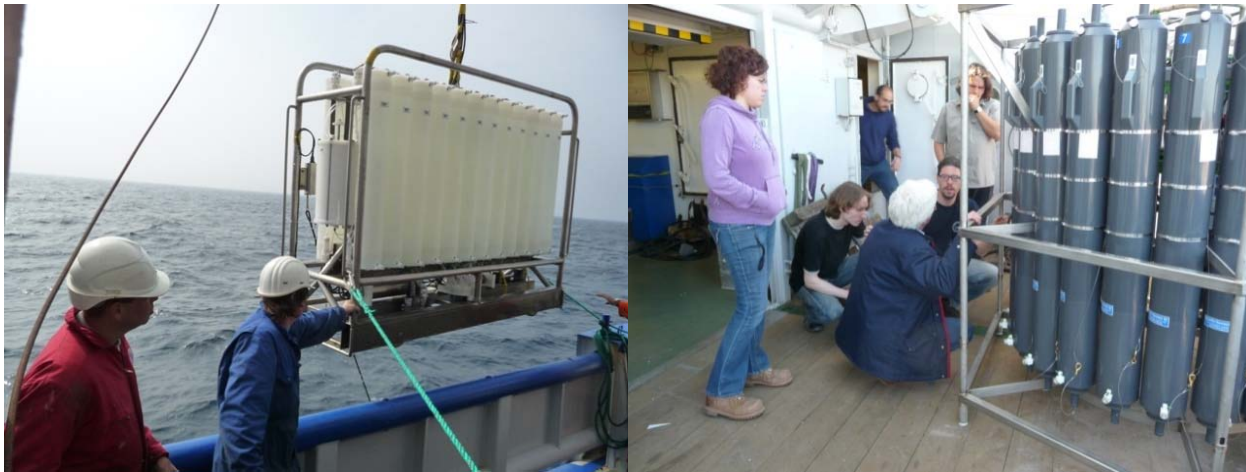
Throughout 2009 and 2010 much progress was made in writing, submitting and publishing articles based on the 2007 Arctic and 2008 Antarctic IPY-GEOTRACES cruises aboard Polarstern. Rob Middag completed his PhD thesis comprising nine research articles on Al and Mn in the Polar Oceans. One article on Al in the Arctic Ocean is published in Marine Chemistry (2009). Similarly several manuscripts/chapters are completed of the theses in progress of Maarten Klunder on Fe in Polar Oceans and Charles-Edouard Thuroczy on Fe Physical-Chemical Speciation in Polar Oceans. Several articles of the Antarctic Polarstern expedition ANT XXIV/3 will appear in a special issue of Deep-Sea Research II.

### 2) WEST-ATLANTIC GEOTRACES

**PELAGIA 64PE318**, 23-27 April 2010, Texel (Netherlands) to Scrabster (Scotland), chief scientist Dr. Loes Gerringa (loes.gerringa@nioz.nl).

In the preceding months RV PELAGIA had undergone mid-life refit including new main engine at Santander (Spain) and returned home at Sunday 18 April 2010. Throughout 19-22 April there was intensive completion and testing of electronic, hydraulic and mechanical systems of the vessel, and installation of winches and other scientific equipment. Participation of two GEOTRACES guest scientists of China and India for observing our new clean sampling system was cancelled due to general airline flights cancellations (due to volcanic ash plume from Iceland). Similarly 3 junior scientist observers of Europe could not reach The Netherlands either, yet two others Ana-Maria Blataric (Croatia) and Gregory de Souza (Switzerland) were able to reach Texel and join this brief test and transit cruise. At the Friday 23 April departure news came that the Reykjavik airport was closed and the ship was diverted to Scrabster Harbour (Scotland). Similarly the 9 scientists scheduled to join in Reykjavik were diverted by train, ferryboat or occasional airline to Scotland, and the itinerary of 5 leaving the ship at Scrabster diverted via Aberdeen to home.

After 2 days transit to deeper waters west of Scotland several tests were done. The 24 novel ultraclean PVDF-plastic butterfly valve samplers of 27L each mounted on the Titanium CTD frame (Fig. 1) functioned perfectly, as did the 24 new Niskin-type samplers of 25L each on a new stainless steel CTD frame. Both sampling systems are deployed alternatingly, using a new 9800m length, 22mm diameter super-aramide (Kevlar) hydrowire with internal copper conducting cables plus glassfibre communication cable, spooled on the completely overhauled KleyFrance winch.

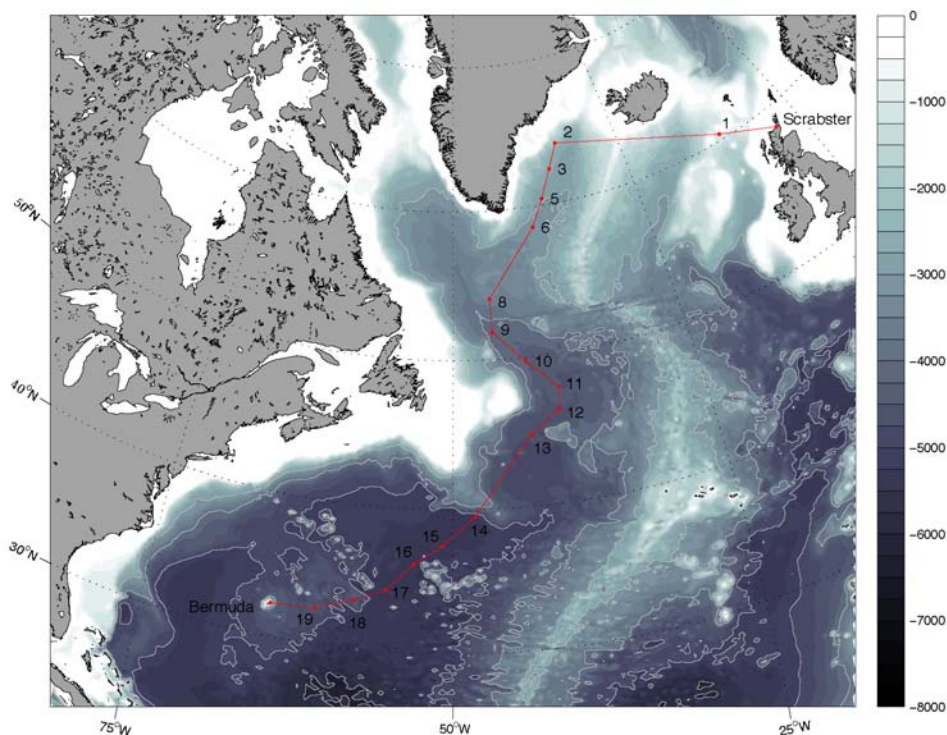


**Fig 1.** Left is the Titanium frame with new white PVDF 27L butterfly-valve samplers; right is the new set of 25L Niskin-type samplers on new stainless steel CTD frame, Ana-Maria Blataric standing in purple sweater, Gregory de Souza in behind doorway.

The isotope studies of trace metals (Fe, Zn, Cd, Pb) require the larger volume clean samplers (27L), similarly for the suite of non-contamination-prone isotopes large volume samples (25L) were chosen. Silicate increases steadily with depth, and comparison of silicate analyses showed that all samplers of the two independent frames close perfectly at intended depth. Moreover the PVDF samplers were found to be very trace-metal clean at first use, hence superior than the internal teflon-sprayed PVC of GO-FLO samplers thus far used. Upon several convincing tests and analyses of Fe, Al and nutrients, the ship returned eastward to arrive at 27 April at Scrabster, Scotland, for exchanging several staff and fuel bunkering and supplies.

**PELAGIA 64PE319**, 28 April through 25 May 2010, Scrabster (Scotland) to Bermuda, chief scientist Dr. Loes Gerringa (loes.gerringa@nioz.nl).

Overall 18 stations (Fig. 2) were occupied very successfully according to plan along the West Atlantic transect. Due to 2 days time loss as result of diversion to Scrabster (due to volcanic ash causing airline cancellations) and very heavy storms several other stations had to be cancelled. Intense storms were encountered off the south tip of Greenland and off Newfoundland, headwinds also affecting ship velocity down from normal 10 knots to merely 2 knots. Even the intended final Bermuda Atlantic Time Series intercalibration site had to be cancelled due to a nasty small storm exactly there and then.



**Fig. 2** Cruise track with stations 2-19 at the West Atlantic transect of cruise 64PE319.

Each station comprised 1 ultraclean and 1 regular hydrocast. At selected 6 super- and 3 hyper-stations additional hydrocasts as well as deep pump sampling were undertaken. Upon recovery the ultraclean Titan frame with PVDF samplers was immediately placed inside its clean laboratory container, where sub-sampling of a large variety of filtered or unfiltered seawater was done for (shipboard or afterwards) determinations of concentrations of Fe, Mn, Al, Co, Cu, Ni, Zn, Ag, Cd, Lanthanides, Pt, Pb; physical-chemical speciation of Fe; large volumes for natural isotope systematics of Si, Fe, Zn, Cd, Pb; major nutrients;  $^{14}\text{CO}_2$  and  $^{13}\text{CO}_2$ . Underway clean sampling was done for aerosols with air filter units, and for surface waters for extra samples for Fe speciation and natural Pt, Pb with a torpedo towed alongside the ship from which water is pumped through a tube entering inside one of the shipboard clean laboratory vans.

The regular Niskin-type samplers and the submersible pumps provided the often required large volumes for natural or anthropogenic (radio)-isotopes systematics of  $^{15}\text{N}$ ,  $^{99}\text{Tc}$ ,  $^{129}\text{I}$ ,  $^{137}\text{Cs}$ ,  $^{143}\text{Nd}/^{144}\text{Nd}$ , Hf,  $^{210}\text{Pb}$ ,  $^{210}\text{Po}$ ,  $^{223}\text{Ra}$ ,  $^{224}\text{Ra}$ ,  $^{226}\text{Ra}$ ,  $^{228}\text{Ra}$ ,  $^{227}\text{Ac}$ ,  $^{230}\text{Th}$ ,  $^{234}\text{Th}$ ,  $^{231}\text{Pa}$ , Np,  $^{239,240}\text{Pu}$ ,  $^{238}\text{Pu}$  and supporting parameter Dissolved Organic Matter (DOM). Complementary to GEOTRACES, many samples were collected for a transient tracers program comprising DIC, ALK,  $\text{O}_2$ , nutrients, CFC's,  $\text{SF}_6$ ,  $^3\text{H}/^3\text{He}$  and above mentioned  $^{14}\text{CO}_2$  and  $^{13}\text{CO}_2$ , and for a microbial oceanography program comprising DOC, DON, bacterial and viral abundance, bacterial and archaeal and viral production,  $^3\text{H}$ -FISH,  $^{14}\text{C}$ -FISH and DNA microbial biodiversity and POC,  $^{13}\text{C}$  plus  $^{15}\text{N}$  by NanoSims, Nitrification, qPCR. We reckon some of these complementary transient tracers and microbial oceanography variables to support unraveling the processes controlling the GEOTRACES variables, and vice-versa.

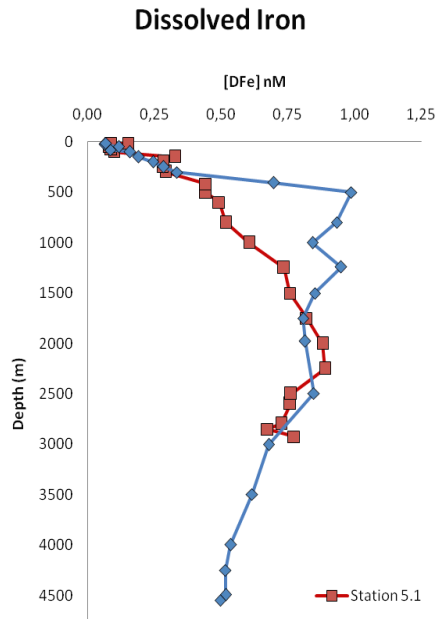


Fig. 3. Dissolved Fe at stations 5 and 11 (see above Fig. 2) of cruise 64PE319.

**PELAGIA 64PE321**, 11 June through 8 July 2010, Bermuda to Fortaleza (Brazil), chief scientist Dr. Micha Rijkenberg ([micha.rijkenberg@nioz.nl](mailto:micha.rijkenberg@nioz.nl)). Weather permitting this cruise intends first another effort to occupy the Bermuda Atlantic Time Series intercalibration station. Next a similar program as above 64PE319 is pursued, where it is hoped some 20-25 stations can be done on a transect extending just across the equator.

Finally in 2011 the West Atlantic section will be completed in the South Atlantic from about 55°S to the equator aboard RV COOK departing 2 March 2011 from Punta Arenas and arriving 7 April 2011 at Las Palmas (Canary Islands).

For general information about Netherlands GEOTRACES contact by email to: [Hein.de.Baar@nioz.nl](mailto:Hein.de.Baar@nioz.nl)

## *New Zealand*

In 2009 and 2010 the following GEOTRACES activities have taken place.

i) GEOTRACES-IPY data & metadata

The datasets (trace metal profiles and CTD) have been sent to the GEOTRACES Data Assembly Centre at BODC, UK.

ii) Workshop - GEOTRACES process study

In December 2009 we hosted a 5 day workshop in Wellington to discuss the results from our FeCycle II voyage that took place in September/October 2008. Twenty participants from New Zealand, Australia, USA and Chile presented results and commenced the construction of a coupled Fe and C budget from the upper water column during the development and decline of the spring diatom bloom. Plans to send metadata and data to BODC were finalised on the final day of the workshop.

iii) Planning for mid June 2011 P04 zonal section (North Queensland to Tahiti).

We have now confirmed dates for this voyage, and have been liaising with Andrew Bowie and Michael Ellwood in Australia to co-ordinate this joint 2 leg Australia-New Zealand voyage.

iv) Other activities: We have continued ship-of-opportunity dust sampling between Japan and New Zealand, New Zealand and Australia, and Australia and Antarctica in 2009/2010. We recently participated in a Dust-Phytoplankton Workshop In Brisbane which brought together, dust scientists, trace metal chemists and ocean scientists.

During the Australian PINTS voyage transect of the Tasman Sea (January 2010), we characterised water column biogeochemistry by measuring a suite of parameters including nanomolar nutrient and trace metals. In addition the impact of dust and variable CO<sub>2</sub> on surface water biology and biogeochemistry was determined by a series of deckboard manipulation experiments.

Submitted by Philip Boyd



## Spain

- National committee (under SCOR-Spain)
  - P. Masqué (Barcelona-UAB)
  - A. Tovar-Sanchez (Mallorca-CSIC)
  - A. Cobelo & R. Prego (Vigo-CSIC)
- Universitat Autònoma de Barcelona (UAB) contributing 10 k€/y (2 years) to IPO
- Participation in intercalibration activities (metals and radionuclides)
- Participation in EU funded COST Action ES0801
- First results of BONUS-GOODHOPE, SPACE and ATOS cruises presented at international conferences (i.e. ASLO-Nice; Goldschmidt-Davos, IPY-Oslo). Several papers published + manuscripts submitted + others in preparation.
- Participation at the Arctic Planning Workshop (Delmenhorst, June 2009)
- Participation in GEOTRACES expeditions in the Atlantic:
  - German RV Meteor GEOTRACES M81/1 (PI: M. Frank, 2010)
  - The Netherlands RV Pelagia cruises 64PE319 and 64PE321 (PI: H. De Baar, L. Gerringa, M. Rijkenberg, 2010)
- Co-organization of the GEOTRACES - Mediterranean Workshop to be held in Nice in October 2010.

## **Sweden**

The Swedish GEOTRACE activities during 2009 include participation in planning activities for a GEOTRACE project in the Arctic and also in COST action ES0801 and the GEOTRACES intercalibration effort.

### **Planning work related to GEOTRACES**

The GEOTRACES Arctic Cruise Planning Meeting 8-10 June 2009 in Delmenhorst, Germany was attended by four Swedish scientists. Building upon the outcome of the Delmenhorst meeting a proposal has been submitted to the Swedish research council with the aim to use the icebreaker *Oden* as a research vessel for a GEOTRACES cruise in the Arctic Ocean. The proposal includes international collaboration and the time frame for the proposed cruise is within the coming 3 to 10 year period.

Within the COST action *the ocean chemistry of bioactive trace elements and paleoclimate proxies* (ES0801) students have participated in the following activities:

- The Paris modelling workshop, December 2009
- The test and training cruise organised by Dutch researcher on R/V Pelagia from Texel to Iceland (unfortunately the trip was cancelled due to the volcanic ash over European air space)

### **GEOTRACES intercalibration work**

Swedish laboratories participated in the intercalibration effort of Nd isotopes, U-Th isotopes, Si isotopes and some trace elements.

### **The International Siberian Shelf Study 2008 (ISSS-08)**

During 2009 extensive work has been conducted on the samples collected during the ISSS-08. Results have been presented at the Goldschmidt conference in Davos in June 2009 and at the EGU meeting in Vienna (May 2010) with a special session devoted to ISSS-08 results. Publications are prepared and in press.

### **GEOTRACES promotion activities within Sweden**

- An e-mail list is kept and maintained by Per Andersson for distribution of information about the GEOTRACES project among marine scientists in Sweden

-Presentations of the GEOTRACES project at the Swedish Society for Marine Sciences meeting in November 2009 and at the Swedish SCOR group meeting in March 2010.

Per Andersson/

Stockholm 10 June, 2010

## UK

### ANNUAL REPORT ON GEOTRACES ACTIVITIES IN THE UK

The last twelve months have seen significant funding successes in the UK and we are now preparing for two fully-funded full GEOTRACES Sections in the Atlantic.

Further details of UK GEOTRACES activities are now available at a dedicated website at <http://www.ukgeotraces.com/>

#### GEOTRACES A10: 40°S Zonal Section: Micronutrients and Paleoproxies

Ship time for this cruise had been secured with an earlier NERC Standard Grant to Henderson and Rickaby (Oxford), Mills (Southampton) and Pancost (Bristol). That grant was focused on paleoproxy calibration and did not cover costs for the majority of the GEOTRACES key parameters. In Jan 2010 we learnt of the success of a larger Consortium Proposal to NERC for 2.5 million pounds. This budget enables the full suite of GEOTRACES key parameters and a range of other measurements to be made, and includes a component of biological research, physical oceanography, and ocean modelling. That proposal involved 10 UK organizations and one from the US (WHOI), and had support from both South Africa and Uruguay. The funded work focuses on understanding the sources and cycling micronutrients to the highly productive 40°S region of the Atlantic, and on the importance of deep water micronutrients to the Equatorial Atlantic and Southern Ocean.

The cruise will sail 17th October to 25th November 2010 from Cape Town to Montevideo with 24 scientists on board the RRS Discovery. It plans 22 full depth stations with multiple casts at each station, and will also set up an aerosol station on the Falkland Islands and support analysis for a complementary proposal within Uruguay to sample the Plata River at regular intervals.

#### GEOTRACES A06: Tropics: Micronutrients and nitrogen fixation

Eric Achterberg (Southampton) led a group which also contained Maeve Lohan (Plymouth), Alex Baker (UEA) and Ric Williams (Liverpool) in a successful bid to NERC for 900 thousand pounds to run a tropical Atlantic cruise to assess the relationship between micronutrient supply and ecosystem function, with a particularly focus on nitrogen fixation. The cruise will sample waters influenced by the Sahara dust plume and also contains a transect to the coast to investigate low-oxygen conditions. The cruise will sail on the RRS Discovery in Feb and March 2011. Funding has so far only been secured for a limited number of the GEOTRACES key parameters, but there are plans to identify people to complete the list of parameters, and an expectation that this should be possible with the resources that have recently come to GEOTRACES from NERC.

#### Other activities

*Purchase of clean sampling equipment:* Funds have been secured this year for a UK clean winch and cable system. It is likely that this will fund the purchase of LeBus winch and Nexans conducting cable for full-water column trace metal clean work. The UK already has two 24 position titanium rosettes which will be deployed from this system. It is unlikely that the winch will be ready for the A10 cruise, which will instead deploy the Ti rosette from a high-breaking strain plastic rope with a depth trigger.

*Data Management:* BODC in Liverpool continues to host the International GEOTRACES Data Assembly Centre, with Ed Mawji as the dedicated Data Management Officer for GEOTRACES. Initial NERC funding for to set up this post is close to its end and, although some additional funds have been secured in recent grants, efforts to provide continued support for this activity are important.

*Planning for future activities:* UK efforts are presently focused on A10 and A06, but discussions have begun on possible future UK interests. Several UK scientists attended the Arctic Basin Workshop this year and are interested in extending existing UK interest in the Arctic into GEOTRACES subject areas. There is also early discussion about possibly working in the Southern Indian Ocean in future years.

Gideon Henderson June 2010-06-11

## USA

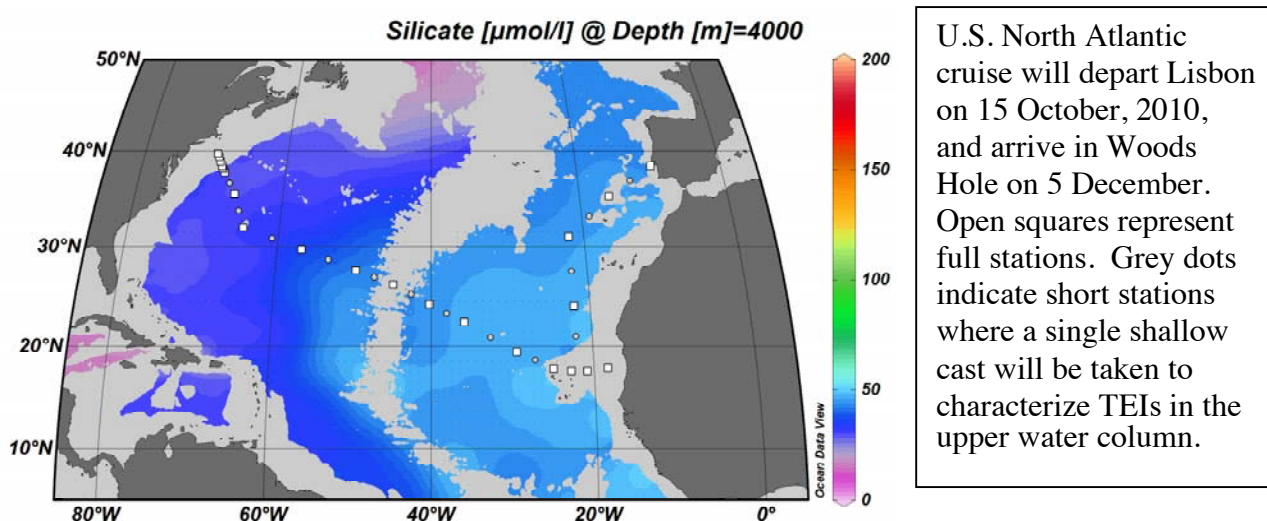
U.S. GEOTRACES scientists have been involved in the following activities during the past year.

1) Intercalibration: U.S. GEOTRACES, together with Greg Cutter (Chair, GEOTRACES Standards and Intercalibrations Committee), hosted the third and final Intercalibration workshop at Old Dominion University, Norfolk, Virginia (8-10 March, 2010). Members of the Standards and Intercalibration standing committee of the international GEOTRACES program participated and reviewed the results of the intercalibration activities. While some further work is required to improve on blanks and on reproducibility for some trace elements and isotopes, it was generally concluded that the international community is ready to proceed with the main phase of the global GEOTRACES field program.

The workshop also provided an opportunity for scientists to complete the GEOTRACES methods manual. The last section was revised during the first week of June, and Greg Cutter reports that he anticipates final editing and distribution of the document for review in July.

2) Planning Workshops: A planning workshop for the U.S. GEOTRACES North Atlantic Zonal Section was held 11-12 March, 2010, at Old Dominion University (hosted by Greg Cutter). Station plans and water budgets were resolved during the workshop. In addition, the cruise was heavily oversubscribed compared to the number of berths available. An important activity of the workshop was to allocate the available berths in a way that enabled all funded projects to carry out their intended sampling. Approximately 24 projects involving approximately 40 principal investigators are funded to participate in, or receive samples from, this cruise. All GEOTRACES key parameters will be covered, as well as a number of additional parameters that will assist in understanding the biogeochemical cycles of trace elements and their isotopes. Additional sampling will be carried out for a number of unfunded studies.

The track for the U.S. North Atlantic cruise has been changed to reduce the number of nations for which permission to work in their EEZ is required. The revised track is shown in the figure below.



3) The U.S. GEOTRACES SSC met 1-2 June, 2010 at the Scripps Institution of Oceanography. The U.S. SSC decided to delay the Tahiti-Peru section until early 2013 so that a second planning workshop can be held (tentatively in June, 2011). The general plan for this section was established during a planning workshop in October, 2008. The primary goal of the workshop in 2011 will be to establish priorities among a large suite of parameters that could be measured along the section, but which are not considered to be key TEIs for the GEOTRACES program.

Submitted by Bob Anderson 10 June 2010