

GEOTRACES PLANNING GROUP  
ANNUAL REPORT TO SCOR 2006/2007  
July 2008

SCOR Scientific Steering Committee for GEOTRACES

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The SSC membership (listed above) contains representatives of 13 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.

SCOR-supported meetings during 2007/2008

SSC meeting: The second meeting of the GEOTRACES SSC was held for three days (6th-8th November 2007) in Barcelona, Spain, hosted by CMIMA – Centre Mediterrani d'Investigacions Marine i Ambientals. This was attended by all but one of the SSC members along with one alternate (Jing Zhang, Japan, complementing Toshi Gamo). The chair of the GEOTRACES Intercalibration Subcommittee (Greg Cutter) also attended, as did Ed Urban, representing SCOR.

SSC discussions were wide ranging. In addition to relationships with other programmes, major issues for discussion included measurement intercalibration, data management, ocean modelling, criteria for GEOTRACES participation, and reports of national activities. Topics that received special emphasis include:

- International Project office - potential locations and funding strategy
- Intercalibration cruise - sampling systems; strategies for collecting and distributing samples
- Data Management - The SSC endorsed the proposal of the Data Management Committee (see below) to host the GEOTRACES International data Management Office at the British Oceanographic data Centre, and to hire a Data Liaison Officer as rapidly as possible. The first priority for the DLO will be to define metadata standards and policy for GEOTRACES.
- Basin Workshop Reports - The SSC reviewed the reports from each basin workshop (see below) and made recommendations for revisions and final editing. Once the reports are completed, the

SSC will take responsibility for developing an overview document that extracts the highlights from the basin workshop reports and presents a view of the global plan for GEOTRACES in a format suitable for non-specialists.

The next SSC meeting is scheduled for 6-8 November, 2008 in Toyama, Japan. Jing Zhang will serve as the local host.

Ocean Basin Workshops in 2007 Three international workshops were held in 2007 to set research priorities and plan the implementation of GEOTRACES science in each of the major ocean basins – Pacific, Atlantic, and Indian (note: initial work on the high latitude oceans has been planned under International Polar Year (IPY), as detailed below). These workshop were held in the following venues:  
Honolulu, Hawaii, USA. 26th to 29th June 2007 – Pacific Ocean  
Oxford, UK, 10th to 13th September 2007 – Atlantic Ocean  
Goa, India, 24th to 26th October 2007 – Indian Ocean

Information about these workshops was publicized on the GEOTRACES website. Each meeting was open to interested participants, and each was attended by between 50 and 60 scientists with interests in GEOTRACES-related research in the relevant ocean basin. Travel subsidies were provided for many participants with support from SCOR and from a variety of national sources. At each meeting, workshop participants identified the key regions and research questions for that basin, and planned ocean sections (and to some extent process studies) to address the goals laid out in the GEOTRACES science plan. A draft report on each Basin Workshop was reviewed by the SSC at its meeting in November, 2007 (see above), and modifications were made based on SSC recommendations. The revised reports were completed in February, 2008, at which time it was pointed out that GEOTRACES should follow SCOR policy of obtaining permission from publishers for reproducing published figures in workshop reports. The process of securing permission has been underway since February and at the time of this writing (31 July 2008) all but one permission has been secured. In some cases it has taken a substantial amount of time to locate the origin of figures used in the basin workshop reports.

The basin reports will be published on the GEOTRACES web site, and are intended mainly for use by national and regional planning groups for implementing GEOTRACES cruises. As noted above, the SSC will extract material from these reports to prepare an overview document to be disseminated more widely.

Modelling and GEOTRACES A fourth workshop held during 2007 addressed the role of modelling in the GEOTRACES program. This workshop was held at the Hanse Wissenschaftskolleg, Delmenhorst, Germany from 6th to 8th September, 2007 and was hosted by Reiner Schlitzer (Alfred Wegener Institute, Germany) and Jim Orr (IAEA, Monaco). The workshop was attended by 53 participants from 7 countries with good mix of modellers and observationalists, including several modelling groups new to GEOTRACES. Speakers reviewed the present state of models of trace elements and isotopes (TEI) in the marine environment and discussed promising new modelling approaches and projects in the light of recent advances in our understanding of TEI cycles and the expected increase in quality and quantity of TEI observations during GEOTRACES. The workshop initiated a dialog that will facilitate interaction between modelers and observationalists on a number of issues, and made two general recommendations relevant to the planning and implementation of GEOTRACES sections:

1) The consensus was that for complex TEIs the models are probably not yet good enough to guide the sampling design for GEOTRACES sections; and

2) The consensus was that there is no particular advantage of following old WOCE/CLIVAR lines, and GEOTRACES scientists should be free to select the sampling strategy that best addresses geochemical issues.

Participants agreed that there is a particular value in workshops like this because it helps keep modelers on track looking at real-life problems. That is, observationalists are closest to the cutting-edge questions, so interaction between modelers and observationalists can help steer modeling toward the most pressing problems. Now is the time to be steering the modelers, rather than trying to engage the modelers long after the data are collected. The workshop also provided cross fertilization among modelers. There were very different types of models represented, from 1-D complex biogeochemistry models to high-resolution models (e.g., ECCO) that assimilate many types of data to improve ocean circulation.

Workshop participants recommended that it would be good to have a repeat workshop in 2 years, and eventually have annual model-data workshops. A potential theme for the next workshop would be to examine preliminary results from GEOTRACES IPY cruises.

### 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, a major activity for GEOTRACES during the past year was an intercalibration cruise (8 June - 12 July, 2008; sampling mainly at the Bermuda Atlantic Time Series Station, but also in continental slope waters near the east coast of the U.S.). Some of the principal activities, objectives and findings of the cruise include:

- A variety of water sampling systems were tested for contamination of trace metals that are known to be particularly prone to contamination. Analyses conducted at sea showed that the new GO-Flo rosette constructed for US GEOTRACES collected samples that are uncontaminated with Fe, Zn and Hg, as determined by comparison with individual GO-Flo bottles hung on a Kevlar wire. This is particularly valuable for Hg because it means that the contaminant metal of greatest societal concern can be measured routinely on GEOTRACES cruises.

- A variety of filter types and pore sizes were tested to identify artefacts (e.g., contamination; absorption of dissolved TEIs) and to establish filter types and filtration protocols that are suitable for GEOTRACES cruises.

- Two types of *in situ* filtration systems were used, and samples of particulate material at the same locations were collected by filtering water from GO-Flo bottles to establish (a) if the two strategies (bottles and pumps) for collecting particulate TEIs can be used interchangeably, and (b) if either *in situ* pumping system experienced detectable contamination or other artefacts.

Thousands of samples were recovered during the cruise for distribution to labs worldwide. Sample distribution and the comparison of results is being handled by 15 self-organized groups representing key GEOTRACES TEIs as well as selected additional trace elements and isotopes.

Results from the intercalibration will be assessed at a workshop to be held in San Francisco immediately prior to the Fall AGU meeting. A priority for the workshop is to identify problems based on results from the first intercalibration cruise, and to recommend solutions that can be implemented and tested during a second intercalibration cruise, tentatively set for May, 2009. The second cruise will be held in the eastern North Pacific Ocean.

### Data Management for GEOTRACES

The Data Management Committee, chaired by Chris Measures and Reiner Schlitzer, met immediately following the Modelling workshop on 8th September in Delmenhorst, Germany to plan initiation of Data Management procedures. There it was decided to establish an international GEOTRACES Data Management Office in the UK affiliated with the British Oceanographic Data Centre. Requests to the UK NERC and to the US NSF resulted in each agency committing resources to cover one half of the funds needed to support a data management officer at BODC for a period of 2 years. A search to fill this position led to the hiring of Dr. Ed Mawji in June, 2008.

It is anticipated that future support for the GEOTRACES data management office will be provided via a national subscription policy. Each nation that carries out a GEOTRACES cruise is expected to include in the overall cruise budget a request for data management funds. The precise level of funding expected from each cruise remains to be established by the data management committee.

### Links with other programmes

GEOTRACES remains committed to maintaining strong links to other relevant programmes. Martin Frank (SSC member) attended the IMAGES SSC meeting in Shanghai (September, 2007). Bob Anderson (co-chair) attended the SSC meetings of IMBER and SOLAS associated with the IGBP congress in Cape Town (May, 2008). Informal discussions have taken place between European members of the GEOTRACES SSC and European members of the SOLAS SSC to explore overlapping interests in seeking a call within the EU FP7.

### Capacity Building

It became evident during the basin planning workshops that many nations with scientists interested in GEOTRACES lack the experience and expertise to collect and process seawater samples free of contamination of certain trace elements. Consequently, it was decided that a training workshop that included the collection and processing of samples at sea would be a valuable capacity building activity for GEOTRACES. Chris Measures (University of Hawaii) volunteered to take the lead in seeking support for the workshop, and to host the workshop in Hawaii. However, despite intense enthusiasm among GEOTRACES SSC members for this capacity building effort, initial requests for support (to the Asia Pacific Network and to the U.S. NSF) have met with discouraging responses. At this time, the leaders of this effort are searching for alternative sources of funding for the workshop.

### International Project Office

After considering several possibilities, the SSC selected Toulouse, France, to be the site of the IPO. At the time of this report, the SSC is exploring mechanisms to fund the IPO. As soon as sufficient funds are committed, an IPO executive officer will be hired. Until then, Catherine Jeandel (SSC member) is leading the effort to secure facilities and local support in Toulouse for the IPO.

### National Reports

*USA:* U.S. GEOTRACES activities during the past year have focused on the intercalibration effort described above. In addition, the U.S. GEOTRACES SSC met in May, 2008, at which time they reviewed all of the sections in the basin planning reports identified as being led, or potentially led, by the U.S. From among these, the US SSC selected two (one each in the Atlantic and Pacific Oceans) as having priority for earliest development. Implementation workshops to design section cruise plans will

be held 22-24 September, 2008 (Woods Hole, Atlantic section) and 1-3 October, 2008 (Los Angeles, Pacific section). The workshops are open to all interested scientists, although funds for travel support are limited.

*Canada:* Canadian plans for a GEOTRACES IPY cruise in the Arctic Ocean have been deferred from 2008 to 2009. A benefit of delaying the cruise is that a ship with better lab facilities will be provided.

*Germany/Netherlands:* Two major IPY cruises were held during the past year aboard the Polarstern. Each cruise was led by scientists from Germany and the Netherlands, with additional participants from other nations. The Arctic cruise (SPACE) sampled 105 hydrostations, with 43 stations for sampling TEIs. This cruise involved the first routine deployment of the TITAN trace-metal clean sampling system. Preliminary results show evidence for trace metal fluxes associated with hydrothermal venting on the Gakkel Ridge. The Antarctic cruise (Zero and Drake; 6 February - 16 April, 2008) transited from South Africa to Antarctic, across the Weddell Sea, and then north to South America. As in the Arctic, evidence for hydrothermal venting from the mid-ocean ridge was evident in dissolved trace metal profiles.

*Japan:* A major Japanese GEOTRACES expedition in the Indian Ocean, originally scheduled to begin in late 2008, has been deferred by approximately a year due to escalating fuel costs.

*Sweden:* An IPY cruise program aboard leased Russian vessels is underway at the time of the writing of this report.

*France:* An IPY cruise aboard the Marion Dufresne (8 Feb – 24 March 2008) sampled along a cruise track running SW from Cape Town to 57°S. The sampling program included 77 hydro stations, 6 “Large” stations (hydro plus GO-Flo), and 5 “Super” stations, including hydro, GO-Flo, in situ pumps, and coring. Repeat stations were occupied by both the Polarstern and the Marion Dufresne for intercalibration.

*Australia:* Australian scientists mounted a joint CASO/GEOTRACES IPY cruise in March/April 2008 aboard the Aurora Australis along the Repeat WOCE SR3 line from Tasmania to Antarctica. Australian participants included scientists from the Antarctic Climate & Ecosystems CRC, CSIRO Marine & Atmospheric Research, University of Tasmania, and the Australian National University. International collaborators included scientists from several French institutions (IFREMER (La Seyne-sur-mer), LOV (Villefranche-sur-mer), and LPCE (Paris)). A total of 27 stations were sampled to a depth of 1000m (one degree of spatial resolution) using a trace metal clean sampling system on loan from NIWA (New Zealand). Deeper samples were collected at 7 stations using a standard CD rosette modified to reduce contamination. Quality control tests show no evidence for contamination of Fe or Hg.

*UK:* Proposals were submitted to NERC requesting support for two GEOTRACES sections. One (South Atlantic zonal section) was designated for funding whereas the other (equatorial Atlantic) was declined. It is anticipated that the equatorial Atlantic proposal will be revised and resubmitted.

*China:* The China-GEOTRACES working group has been formally acknowledged by the government of China. It is hoped that this will help generate funding calls specifically relevant to GEOTRACES.

The above represent the most significant national developments, but GEOTRACES activities have also taken place in a number of other countries including: Spain, Brazil, India and New Zealand.

#### GEOTRACES sessions at international conferences

A special session entitled “GEOTRACES/trace element distributions/cycling in the oceans” was held at the 2008 Goldschmidt Conference, Vancouver, Canada, 13 - 18 July, 2008. Session 15a: Convenors: Roger Francois, Catherine Jeandel

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