Full Proposals for International Polar Year 2007-2008 Activities

Proposed IPY Activity Details

1.0 PROPOSER INFORMATION

(Activity ID No: 35)

1.1 Title of Activity
International Polar Year GEOTRACES: An international study of the biogeochemical cycles of Trace Elements and Isotopes in the Arctic and Southern Oceans

1.2 Short Form Title of Proposed Activity
IPY-GEOTRACES

1.3 Activity Leader Details
Hein De Baar
Royal Netherlands Institute for Sea Research
The Netherlands

1.4 Lead International Organisation(s) (if applicable)
GEOTRACES Core Program of SCOR
SCAR
SCOR
SCAR/SCOR Expert Group Oceanography

1.5 Other Countries involved in the activity
Australia
Belgium
Canada
France
Germany
Italy
Japan
Monaco
Russia
South Africa
Sweden
United Kingdom
United States of America
Switzerland
Norway
Bermuda

1.6 Expression of Intent ID #'s brought together in this proposed activity
269,45,131,147,271,321,323, 406,426,584,681,689,880,976

1.7 Location of Field Activities
Bipolar

1.8 Which IPY themes are addressed
1. Current state of the environment
2. Change in the polar regions
3. Polar-global linkages/tele-connections
4. Exploring new frontiers

1.9 What is the main IPY target addressed by this activity
1. Natural or social science

2.0 SUMMARY OF THE ACTIVITY

Biogeochemical processes in the polar oceans have profound impacts on the global ecosystem and climate, and the IPY provides a unique and valuable opportunity for bipolar coordination of marine biogeochemical studies. The international community represented by this IPY GEOTRACES cluster intends to conduct multidisciplinary studies of the processes affecting marine biogeochemical cycling, particularly those controling the distribution of key trace elements and isotopes (TEIs), and their sensitivity to changing environmental conditions in both the Arctic and Southern Oceans.
The international community of marine biogeochemists is developing a new research initiative (the GEOTRACES program) that aims to identify, characterize and quantify processes that control the distribution of key trace elements and isotopes (TEIs) in the global ocean and their sensitivity to changing environmental conditions. Doing so will elucidate the supply of micronutrients to phytoplankton, contaminant dispersal in the ocean, and tracers of past and present ocean conditions. This initiative is prompted by the increasing recognition that TEIs are playing a crucial role as regulators and recorders of important biogeochemical and physical processes that control the structure and productivity of marine ecosystems, the dispersion of contaminants in the marine environment, the level of greenhouse gases in the atmosphere, and global climate.
The primary objectives for the global GEOTRACES program are:
•Determine global ocean distributions of selected TEIs
•Evaluate the oceanic sources, sinks, and internal cycling of these TEIs and thereby characterize more completely their global biogeochemical cycles
•Provide a baseline distribution as reference for assessing past and future changes.
Directly associated with this global GEOTRACES program, our IPY polar oceans studies will help elucidate the supply of micronutrients to phytoplankton, contaminant dispersal in the ocean, and tracers of past and present ocean conditions. This initiative is prompted by the increasing recognition that TEIs are playing a crucial role as regulators and recorders of important biogeochemical and physical processes that control the structure and productivity of marine ecosystems, the dispersion of contaminants in the marine environment, the level of greenhouse gases in the atmosphere, and global climate.
The IPY offers the opportunity to obtain synoptic TEI distributions among all major Polar ocean basins. The strong projects that have been proposed for the synoptic studies (Arctic and Antarctic) within IPY will offer the hydrographic and biological context that is needed for a robust interpretation of the TEI fields.

2.1 What is the evidence of inter-disciplinarity in this activity?
Ocean chemistry is fundamentally an interdisciplinary activity. It underlies some of the basic observational tools of ocean physics and biology. It is of interest in its own right as ocean chemistry regulates our climate through cycling of CO2 and other radiatively active gases. An understanding of contemporary chemical cycles in the oceans has lead to the development of several paleoproxies that let us reconstruct past conditions. Basin scale surveys of chemical constituents under the GEOSECS program of the 1970's provided the underpinnings of understanding in these realms. Numerous advances in sampling and analytical methods along with recognition of new processes have occurred in the years intervening since GEOSECS. Thus the international chemical oceanography community is poised to embark on the next grand step

forward in understanding our earth system. A few examples of interdisciplinary areas of interest are specified below. Every living cell and organism on our planet needs the trace metals iron, zinc, copper, manganese, nickel and cobalt, roughly in that order by concentration, for many functions, including as co-factors in enzymes. Biological systems likely took advantage of the fact that hese first row transition metals of the periodic table of elements are relatively abundant on Earth in evolving life's building blocks. Within the oceans, however, their concentrations tend to be low, and recently it was discovered that iron is limiting plankton ecosystems in some 40 % of the oceans, notably the Southern Ocean. Zinc is the co-factor for CO2 metabolism, by carbonic anhydrase for CO2 metabolism, the most common enzyme in the biosphere. Together with the key role of iron in photosynthesis, Zn may well regulate the response of ocean biota in a future high-CO2 world affecting the biosynthesis of shells and coral reefs. The community is just beginning to understand marine productivity regulation by co-limitation by Fe and Zn as well as Cu, Mn, Ni, and Co. GEOTRACES will advance the cause by providing the fundamental distributions of the elements required by life in this case in polar regions which are most susceptible to change by Greenhouse gas warming. Many processes controlling oceanic distributions hence availability of trace metals in the oceans have been identified such as chemical complexation, scavenging by settling particles, river input and atmospheric dust input from land as affected by desertification, biological activities,high and low temperature interactions with rocks and sediments, and ocean circulation and mixing To make progress, the relative importance of these processes must be deciphered for elements of interest. Continental inputs, rivers in the Arctic and glaciers in the Antarctic, can be well characterized in the polar regions where their signals are large. In addition, polar regions provide GEOTRACES to examine the effects of ice on geochemical cycling.. Certain trace elements and isotopes can track fluid or particulate cycling some even providing rate information this resulting from radioactivity. Tracers are key for sorting out ocean mixing and circulation in polar regions where surface salinity signals can be confounded by ice melt, precipitation and riverine input. Isotopic signatures of oxygen and hydrogen in water and elements such as Ba have already proven useful in this regard. Tracers in various phases in the sediment offer the possibility of reconstructing past conditions in the polar regions on Earth. For example, cadmium which correlates with the nutrient phosphoric acid in the oceans is taken up in foraminifera in proportion to surrounding seawater concentrations. Hence it has been used to examine glacial/interglacial variability in deep ocean circulation. Stable isotopes of Si may serve similarly for past productivity of diatoms which use Si for building their external frustules. Stable isotopes of Fe, Cd, Ca may have comparable potential for understanding processes in the past. Naturally occurring radioisotopes have proven to be a very powerful tool for assessing pathways and the rates of transport and aggregation/disintegration of biogenic particles. Hence interdisciplinary GEOTRACES IPY efforts will provide the bases for comprehending the changes and variability we are observing today in the polar and global climate.

2.2 What will be the significant advances/developments from this activity? What will be the major deliverables? What are the outputs for your peers?

Anticipated products of the GEOTRACES Program map onto the following IPY Themes:

Theme 1-Present environmental status:

• GEOTRACES will Characterize sources, sinks and internal cycling of trace elements that serve as essential micronutrients, including sources of material delivered to the ocean by rivers (primarily Arctic) and by glacial weathering (primarily Antarctic) of adjacent land masses;

• In collaboration with companion IPY initiatives, GEOTRACES will establish the role of micronutrient trace elements in regulating the structure and variability of polar marine ecosystems, with implications for interests ranging from fisheries (primarily Arctic) to the ocean-atmosphere exchange of carbon dioxide (primarily Southern Ocean);

• In collaboration with SEARCH and ASOF, GEOTRACES will contribute new understanding to the fate of river waters, their impact on upper ocean circulation and freshwater exported from the Arctic to areas of the North Atlantic where it conditions global thermohaline circulation.

Theme 2-Understand past changes:

Polar regions are thought to be the most sensitive to climate change.

• GEOTRACES will ground-truth existing geochemical paleoceanographic proxies and set the stage for development of new ones for both the Arctic and Antarctic environments to improve our understanding of past changes in these sensitive regions of our globe.

Theme 3-Links to other regions: Processes in the Southern Ocean regulate the supply of nutrients to tropical ocean regions (impacting fisheries) and the concentration of CO2 in the atmosphere (impacting climate).
• GEOTRACES will identify the processes in polar oceans that influence the availability of trace elements (micronutrients) in low-latitude regimes;
• The circulation of the upper Arctic Ocean plays an important role in global thermohaline circulation for which tracers will provide new insights for past and present conditions. Understanding of tracer pathways within the Arctic has important implications for the fate of contaminants, of great interest to the Arctic nations and their populations, in addition to better understanding the role of Arctic processes in global ocean thermohaline circulation.
Theme 4-Frontiers: A complex interplay of physical and chemical conditions influences the unique character of polar marine ecosystems. This work provides an essential component of an interdisciplinary study that will establish the sensitivity of polar marine systems to changing environmental conditions, and the implications for global biogeochemical cycles of carbon and related substances. IPY presents that opportunity to undertake pioneering measurements of a number of constituents never before determined in the polar environments. The IPY provides a unique chance to obtain synoptic tracer distributions in areas that are so remote that this is not achievable in normal years.
In addition to its major contributions to the above IPY Themes, some other benefits may be summarized as follows:
•Basis for developing 'third-generation' plankton ecosystem models and biogeochemical models [i.e. those that incorporate micronutrients in the nutrients' module—initial parameterisation and subsequent validation]
•Extensive opportunities to evaluate the efficacy of trace elements (individually, and in combination as element ratios and/or isotopic ratio distributions) as water mass tracers, and markers of biogeochemical processes
•Improved understanding of the importance of sea ice, its age, and its structure, on controlling the transport of trace elements and gases. Parameterizations of sources versus sinks in the presence of sea ice for incorporation into climate change models.
•Finally IPY GEOTRACES will also archive water samples to serve future investigations that may not have ready access to remote areas of the Arctic Ocean and Southern Ocean.

2.3 Outline the geographical location(s) for the proposed field work (approximate coordinates will be helpful if possible)

Locations	Coordindates
#681 Canadian Arctic Margin Expedition (CAME); E. Carmack	Circumpolar band between ~70ºN-85N starting at 0ºE and finishing at ~100
#045 Arctic (Synoptic transects): major Arctic shelves and basins	>~75N, ~0E to ~150E
#689 Arctic: Pan-Arctic in collaboration with CAME (#681)	~70ºN-85?N starting at 0ºE and finishing at ~100?W
#147 Arctic (ATOS): Expedition Spanish R.V. Hesperides	Canadian Arctic
#321 Arctic (ATMER): Canadian Arctic; exact location to be decided	Canadian Arctic
#XYZ? Arctic (US GEOTRACES): Kelly Falkner: coordination with a range of planned programs	Shelf-Basin Exchange section in Chukchi-Beaufort sector; Sections by Polarstern
#976 Arctic C-SOLAS (Lisa Miller): Northern Baffin Bay	50-90 W, 75-85 N
#271 Southern Ocean (US GEOTRACES): New-Zealand to Ross Sea	~46S, ~172E to ~75S, 160W

2.4 Define the approximate timeframe(s) for proposed field activities?

Arctic Fieldwork time frame(s)	Antarctic Fieldwork time frame(s)
No timeframes have been added.	

2.5 What major logistic support/facilities will be required for this project?
Icebreaker
Icebreaker
Ice strengthened research ship
Ice strengthened research ship
Submarines
Fixed wing transport aircraft

Further details – Applications for Rv Polarstern Arctic (#045) and Southern Ocean (#880) were submitted 1 December 2004 to national Polarstern shiptime allocation panel of Germany. Southern Ocean ZERO&DRAKE (#880) complementary to parallel Clivar/Clic and transient tracers (CO2, CFC's) shiptime proposals towards joint expedition. Very favorable evaluation reports will soon be on the table of Polarstern allocation committee. Application (#584) for French funding in preparation for 1 October deadline to national agency and for French research vessel in preparation for January 2006. The US NSF will have a proposal deadline in November, 2005, for IPY. We will submit a proposal at that time for the US GEOTRACES section from New Zealand to the Ross Sea, and we will request ship time as part of that proposal. Application (#147 and #321) for RV Hesperides to be submitted fall 2005 to dedicated IPY call by the Polar Research Program of the Spanish National Program for Science and Technology. Application (#321) for Canadian vessel in preparation for 15 October 2005 deadline national ships agency. Logistics (#426) is being arranged with Australian Antarctic Science scheme (administered by Australian Antarctic Division). C-SOLAS application (#976) for Amundsen shiptime to be submitted August 1, 2005. For elements and isotopes (#XYZ) not requiring ultra clean sampling conditions, Arctic seawater samples can be collected by submarines of opportunity through their intakes upon request to the US Navy. USCGS Healy time will be requested by J. Grebmeier and activities will be coordinated with the SBE program. Allocations of shiptime and/or berth space aboard Japan research vessels in 2007-2009 IPY period subject to currently ongoing regular decision scheme within Japan (pers. comm. dr. S. Takeda). Ultraclean sampling equipment (#880 and #406) and clean containers partly existing and partly being constructed at Royal NIOZ with support of national seagoing equipment funds; test cruise October 2005. Participation (#880) of Netherlands scientists, transport of equipment, consumables and extra salaries for extra to be appointed junior scientists subject to envisioned extra IPY funding round of Netherlands Polar Program.

2.6 How will the required logistics be supplied? Have operators been approached?

Source of logistic support	Likely potential sources	Support agreed
Consortium of national polar operators		
Own national polar operator	Y	
Another national polar operator		
National agency	Y	Y
Military support		
Commercial operator		
Own support	Y	Y
Other		

2.7 If working in the Arctic regions, has there been contact with local indigenous groups or relevant authorities regarding access?

3.0 STRUCTURE OF THE ACTIVITY

3.1 Origin of the activity
This activity is the start of a new programme that will outlive IPY

If part of an existing programme please name the programme – GEOTRACES

3.2 How will the activity be organised and managed? Describe the proposed management structure and means for coordinating across the cluster
The GEOTRACES SSC now is finalizing its Science Plan for submission before 30 June deadline towards final approval by parent organization SCOR. This will be the start of the worldwide GEOTRACES program, where the here proposed IPY GEOTRACES would be the very first activity/implementation. In other words, the IPY will be the launching period of the overall ~10 years GEOTRACES program.

The revised GEOTRACES Science Plan (30 June version) is available from IPY GEOTRACES lead applicant dr. R.F. Anderson. The preceding February 2005 draft version of the worldwide GEOTRACES Science Plan is at SCOR website http://www.jhu.edu/scor/ under large scale ocean research projects or at: http://www.ldeo.columbia.edu/res/pi/geotraces/index.html

Under the aegis of the worldwide Scientific Steering Committee of SCOR-GEOTRACES there will be a special Task Team for IPY-GEOTRACES. This team consists of the project leaders of the field implementation programs:
dr. G. Sarthou, prof. R.Francois, dr. M.Rutgers vanderLoeff, dr. E. Butler, prof. C.M. Duarte, prof. D. Planas, prof. K.Falkner and co-chairs prof. H.deBaar and dr. R.Anderson.
The CASO/Clivar/Clic colleagues S.Rintoul, A.Gordon, E.Fahrbach and S. Speich will be included in all communications of the IPY-GEOTRACES Task Team. This will further be strengthened by individual liaisons R.Anderson/A.Gordon, G.Sarthou/S.Speich and M.RutgersvanderLoeff/ E.Fahrbach at their respective home institutes LDGO (New York), UBO (Brest) and AWI (Bremerhaven).

GEOTRACES represents an unprecedented integration and synthesis on a global scale of research on the marine biogeochemical cycles of trace elements and isotopes. As such, GEOTRACES requires strong coordination and management to address a number of issues including, but not limited to:
• ensuring the compatibility of analytical methods used by different participating groups;
• integrating modelling and observational studies to achieve a comprehensive synthesis and interpretation of the findings;
• collecting, archiving and serving data generated throughout the programme;
• liaison with other research programmes sharing common interests and goals;
• engaging scientists from developing nations to expand the capacity worldwide for research on trace elements and isotopes; and
• pursuing complementary funding strategies among various national and international agencies.
A Scientific Steering Committee will have the primary responsibility for the coordination and management of international GEOTRACES activities. The SSC will oversee an International Programme Office, a Data Management System/Office, and various standing committees to ensure that the common needs of GEOTRACES activities are met. The SSC will interact with national committees and organise planning workshops as needed to establish research priorities and implement GEOTRACES. Partnering with national committees, the SSC will seek financial resources from national and international funding agencies to support the implementation of GEOTRACES. Later, these same partnerships will play a vital role in disseminating the findings of the GEOTRACES programme. The SSC will provide regular reports to SCOR, the principal body providing oversight of GEOTRACES. SCOR, in turn, will advise the SSC on strategies to achieve GEOTRACES goals. SCOR will also assist GEOTRACES in making beneficial contacts with other programmes sharing common research objectives, as well as with national and international funding agencies and with intergovernmental agencies that can offer financial, logistical or political support.

3.3 Will the activity leave a legacy of infrastructure and if so in what form?

There will be NO legacy in terms of new permanent bases in either Arctic or Antarctic, NOR in terms of new vessels dedicated to polar research. There will be a legacy of various currently developed and custom-built ultraclean equipment for seawater sampling and initial sample handling to be used in the IPY for first time. This consists of a dedicated kevlar wire (16 mm diameter, 8000 m length) deep sea cable with internal signal cables and large winch, ultraclean titanium frame with two rows of 12 teflon-coated samplers each, ultraclean container van within which the frame with 2 x12 samplers is placed once onboard, where the seawater is drafted from the samplers via filtration devices into pre-cleaned storage bottles. Latter bottles are distributed to the various analysts, both directly on shipboard as well as after the cruise, for their study of a given trace element and/or isotope. Last but not least the IPY 2007-2008 will be the launching period of the overall ~10 years GEOTRACES program, and therefore IPY will be credited by leaving a vigorous GEOTRACES as one of its legacies. There is some analogy here with preceding IPY's (1882-1883) and international Geophysical Year (1957-1958) having been the starting point of since then successful international programs (see http://www.ipy.org/about/what-is-ipy.htm)

3.4 Will the activity involve nations other than traditional polar nations? How will this be addressed?
Bermuda, Monaco, Switzerland

3.5 Will this activity be linked with other IPY core activities? If yes please specify
The strongest links are with other major clusters ICCED and OASIS in the overall Category: Oceans: Biogeochemistry and Ecosystems, as well as with major clusters CASO, SASSI/iAnZone and iAOOS in the overall Category: Oceans: Circulation. Specifically several EoI topics are full partners in both this IPY GEOTRACES cluster and IPY-ICCED and/or IPY/OASIS. Moreover there are liaisons of various kinds.

EoI Topics being full partners in both IPY GEOTRACES and other IPY clusters are as follows: #131. The cycling of mercury etc. (Robbie MacDonald). The cycling of mercury in the ocean will be investigated by collecting sectional data for total mercury and methyl-mercury in the water as well as mercury in zooplankton and sediments in context of the CAME project (#681). It is envisioned that the CAME section will include a wide suite of chemical tracers including but not limited to GEOTRACES tracers. Mercury cycling has direct links to the organic carbon cycle in the ocean. #681 Canadian Arctic Margin Expedition (Eddy Carmack) This project proposes to provide a synoptic, sectional survey of the Pan-Arctic margin by producing ocean profile data from shelf into basin for standard ocean properties (CTD, O2, %T,Fluor) accompanied by bottle data for properties such as nutrients, CFCs. This will be combined with GEOTRACES' trace elemental and isotope tracer measurements. In addition to this synoptic survey, it is planned to collect data on the biogeochemical cycling along the transects and to collect sediment cores, both of which will provide further opportunities to conduct GEOTRACES work. #147 ATOS (Carlos Duarte) will also contribute to the OASIS and ICCED programs, thereby providing a convenient link between the thematically related GEOTRACES, OASIS and ICCED.#321 ATMER (Dolors Planas). Through collaboration with the ATOS project (#147) this will also contribute to the OASIS program, thereby providing a convenient link between thematically related GEOTRACES and OASIS. The project will also contribute to the ICED-IPY project (EoI 417), as it aims to investigate the presence of THg and MeHg in the organisms at the base of the food web. #323 CRYOEOL (Dr. Vladimir Shevchenko) is full partner in both GEOTRACES and OASIS. #584 BONUS (Dr. Geraldine Sarthou) is full partner in both GEOTRACES and ICCED. #976 Carbon in sea-ice: Fluxes and Biogeochemistry (Lisa Miller) is also integrally linked with both #344 (OASIS) and #417 (ICCED), providing bi-polar coordination and perspective on the role of sea ice in controlling air-sea exchange fluxes. #406 Effect on CaCO3 etc. (John Runcie) is also full partner in the umbrella project ICCED. The EoI topic #406 has become expanded with national funded 'The Southern Ocean in a High CO2 World' (Netherlands Polar Program, DeBaar) including co-limitations of Fe and Zn, and with a EUROCEANS project to study Zn, Cd, Co co-limitation with the CO2 system for phytoplankton growth (Boyé). Within GEOTRACES joint research at sea is foreseen with project ZERO&DRAKE (EoI 880, De Baar)
.
Envisioned liaisons in the overall Category: Oceans: Biogeochemistry and Ecosystems are with

the ICCED cluster as follows:
#419 IFESS (Victor Smetacek) The natural background concentrations of dissolved Fe in surface waters to be measured in context of IPY GEOTRACES, will be of use for the 419 IFESS when interpreting their findings. Here the IFESS participant Dr. Peter Croot would be the perfect liaison with GEOTRACES as dr. Croot is an expert on analytical chemistry of Fe in seawater. #818. SASIE (Igor Melnikov) The success of sea ice ecosystems somehow must be dependent also on availability of iron for the in-ice algal community, but until now this has only scarcely been investigated. This has been discussed before between Melnikov and deBaar as possible joint venture. #862. BASICS (Jean-Louis Tison) Obvious link with #976 (Lisa Miller). Moreover the EoI #862 mentions study of the iron cycle. Participant Jacqeline Stefels of BASICS is at same university department as H.deBaar of GEOTRACES, thus allowing good communications. Similarly project leader Tison at ULB may easily communicate with Frank Dehairs of GEOTRACES at VUB adjacent campus in Brussels.
Existing or envisioned liaisons in the overall Category: Oceans: Circulation are as follows: #109. CASO-Oceans (Clivar/CLIC) by Steve Rintoul, in collaboration withEberhard Fahrbach and colleagues. This is most relevant for GEOTRACES. Liaison already exists by Rintoul and Fahrbach also being involved in GEOTRACES. Similarly the GoodHope project is part of Clivar and led by dr. Sabrina Speich also being involved in the GEOTRACES BONUS project. #80 and #522. iAOOS, Integrated Arctic Ocean Observing System. This cluster provides the hydrographic background for our Arctic tracer studies and includes the shelf basin exchange (SBE) transects most relevant for GEOTRACES. Liaison exists through M. Rutgers van der Loeff who is also involved in EU-DAMOCLES. EOIs #522 Shelf Basin Exchange (Jacqueline Grebmeier) and #562 IASC (Leif Anderson) are projects included in the iAOOS cluster where Arctic Shelf Basin Exchanges will be studied including transects in the Canada Basin. These projects, although no direct part of GEOTRACES, will include tracer studies. Further links exist with EoI #18 SPACE (Ursula Schauer, Germany), EoI #126 Ocean Fluxes and Flows (MacDonald, Canada). Finally both the Canada and US GEOTRACES (Roger Francois and Kelly Falkner respectively) also have several Arctic/River estuary sampling opportunities. #009. SASSI/iAnZone, ocean circulation in coastal waters, Karen Heywood leader.

Links also with #193 CLICOPEN (Doris Abele)
and PLATES & GATES (Karsten Gohl)

3.6 How will the activity manage its data? Is there a viable plan and which data management organisations/structures will be involved?
The members of the IPY-GEOTRACES Task Team will each appoint one of the scientists in their field implementation program as data manager. The overall 8 data managers will among themselves elect a chair. The data management team will ensure proper and timely delivery of data and metadata into the overall SCOR-GEOTRACES database in addition to other specific requirements of the project funding agencies. (e.g. US NSF will likely sponsor a competition for management of Arctic IPY-SEARCH data through a portal approach and that will result in program requirements).

Throughout the duration of the GEOTRACES programme, data will be generated from all major ocean basins by many investigators representing a large number of participating nations. For many TEIs, GEOTRACES will achieve basin-wide to global coverage for the first time. The successful synthesis of these data in working toward a complete knowledge of the global marine biogeochemical cycles of TEIs will require integration of the global data sets, and making them available from a central point of contact.

To ensure completeness, quality and consistency of the global datasets, GEOTRACES will implement a data management infrastructure responsible for the compilation, quality control and dissemination of TEI datasets. At the heart of such a system is an international GEOTRACES data assembly center (GDAC) that will be established at the start of the programme. The institution that hosts the GDAC must have experience with TEI data and must maintain good contacts with international groups participating in GEOTRACES. The GDAC will handle all GEOTRACES data from all countries participating in the programme. For reliable and efficient data quality control and inter-calibration of data from different cruises, the GDAC should seek

cooperation with experts in the field, whenever needed.

A GEOTRACES data management committee (GDMC) will be established to (1) recommend to the SSC standards and formats for submission of data and metadata, (2) recommend to the SSC policies for the submission, archival and dissemination of data, and (3) oversee the activities of the GDAC. The data sharing policy for GEOTRACES should be consistent with SCOR guidelines and should assure timely and open data access to the scientific community, while respecting the legitimate interests of data producers during the publication rights period. Originating investigators should be strongly encouraged to share their data before the end of the publication rights period.

To ensure timely submission of data. the IPO will track upcoming field programmes, and identify data to be generated as well as the individuals responsible for generating these data. Staff of the IPO will be knowledgeable about the various types of data, including methods used to collect the data. IPO staff will contact scientists involved in upcoming field programmes to inform them of data submission requirements.

Within BONUS (#584) for each parameter measured on board, meta data will be written before the cruises. A priori, two data centres will be solicited to collect and archive BONUS data: the SISMER (Brest) for the dynamical data and the JGOFS-national centre (Villefranche/mer) for the biogeochemical data and a strong link with the international GEOTRACES data base will be established.

3.7 Data Policy Agreement
Will this activity sign up to the IPY draft Data Policy (see website)
Yes

3.8 How will the activity contribute to developing the next generation of polar scientists, logisticians, etc.?
One of the central objectives of the GEOTRACES program is education, building and maintaining a core community of marine scientists who understand and are able to integrate the chemical, physical and biological processes regulating the distribution and properties of TEIs well enough to exploit them reliably in future interdisciplinary studies.

For example in BONUS (#584) several masters and Ph-D theses will be performed; communications of our “marine scientist diary” towards schools (using internet) will be established. Participation to summer schools (e.g. within the coordination of the CASO programme) will be highly encouraged.

3.9 How will this activity address education, outreach and communication issues outlined in the Framework document?
One of the central objectives of the GEOTRACES program is education, building and maintaining a core community of marine scientists who understand and are able to integrate the chemical, physical and biological processes regulating the distribution and properties of TEIs well enough to exploit them reliably in future interdisciplinary studies. Outreach and communication will be conducted through various media outlets, internet, brochures and by promoting school participation through interactive distance learning websites. The Southern Ocean “Iron Hypothesis” has received substantial public attention, and will be used as a centerpiece for engaging widespread interest in our public outreach efforts. Teacher participation in cruises in the Arctic has proven to be an effective means of reaching a broader audience. We would aim to take advantage of outreach and public relations efforts being coordinated at national levels. For example, we would seek to work with the US multi-agency IPY outreach group efforts that will involve multiple media. Sub-project #406 will interact with the Australian student education program EoI 81 with a combination of active student participation and real-time video communication.

Royal Society of Victoria (RSV) has initiated a project that will address IPY Education, Outreach and Communications to Australian school children (K-Y12), the community and 'Decision

makers'. An Australian Education, Outreach and Communications Coordinating Committee (AUSTEOC) is a key component of the Royal Society's own RSV-INTREPID proposal for IPY, and RSV have offered te Australian GEOTRACES partners to use this framework, in consultation with the Australian National Committee for IPY, to assist with the broader EO&C requirements of other Australian IPY activities. RSV will be establishing specialist working groups of science educators and communicators, working with project leaders, to design suitable education and outreach activities for the three target sectors. Already creative and imaginative activities including symposia, historic functions, media facilities, dedicated websites and electronic interactive facilities (field to classrooms, to the public and parliament, etc) are proposed. The Australian IPY GEOTRACES investigators have joined this initiative via contact David Dodd at the Royal Society of Victoria (austeoc@sciencevictoria.org.au).

In addition to the conventional outreach vectors of institutional websites, newsletters, and school and scout troupe visits, the Canada GEOTRACES scientists will make early contact with the Canadian Schools on Board program, to directly involve Canadian, and particularly Northern Community, high school students in our field programs.

3.10 What are the proposed sources of funding for this activity?
GEOTRACES- will seek funding from appropriate national funding programs.This includes shiptime being applied for in the respective national programs. See further details in above item 2.5. For example in Canada: C-SOLAS has submitted a Letter of Intent to the Canadian Foundation for Climate and Atmospheric Sciences; other proposals are anticipated to go to the National Science and Engineering Research Council, the Department of Fisheries and Oceans, Environment Canada, and any targetted IPY funds that come available.

3.11 Additional Comments
Due to small number of data fields under above items 2.3. and 2.4. and 2.5. of this website it was not possible to upload all activities. Please find below a non-formatted account of all activities.
2.3. LOCATIONS AND COORDINATES
#681 Canadian Arctic Margin Expedition (CAME); E. Carmack Circumpolar band between ~70ºN-85N starting at 0ºE and finishing at ~100W

#045 Arctic (Synoptic transects): major Arctic shelves and basins Eurasian Arctic, (Polarstern/DAMOCLES) >~75N, ~0E to ~150E

#689 Arctic: Pan-Arctic in collaboration with CAME (#681) ~70ºN-85?N starting at 0ºE and finishing at ~100?W

#147 Arctic (ATOS): Expedition Spanish R.V. Hesperides Canadian Arctic

#321 Arctic (ATMER): Canadian Arctic; exact location to be decided Canadian Arctic

#323 Arctic (CRYOEOL) (Shevchenko)

#XYZ? Arctic (US GEOTRACES): Kelly Falkner: coordination with a range of planned programs Shelf-Basin Exchange section in Chukchi-Beaufort sector; Sections by Polarstern exact locations yet to be determined; rivers; submarine intake samples of opportunity

#976 Arctic C-SOLAS (Lisa Miller): Northern Baffin Bay 50-90 W, 75-85 N

#271 Southern Ocean (US GEOTRACES): New-Zealand to Ross Sea ~46S, ~172E to ~75S, 160W

#584 Southern Ocean (BONUS/GoodHope): section Capetown to and beyond Polar Front ~34S, ~18E to 45S, 00W; and 45S, 00W to ~54S, 00W

#880 Southern Ocean: (Polarstern GEOTRACES/Clivar): ZERO meridian & DRAKE passage 45S, 00W to 70S, 00W; and

60S, 60W to ~55S, 63W

#426 Southern Ocean (Micro-Nutrients): from off Tasmania to offshore Adelie Land (possibly also off Wilkes Land) including repeat SR-3 section ~45S to ~65S, 110-150 E

#147 Southern Ocean (ATOS): Expedition Spanish R.V. Hesperides Bellingshausen Sea, Polar Front, Weddell Sea

#321 Southern Ocean (ATMER): Expedition Spanish R.V. Hesperides Bellingshausen Sea, Bransfield Strait, Weddell Sea

#406 Southern Ocean (Adverse effects CaCO3) (Runcie, DeBaar, Boyé) 45S, 00W to 70S, 00W; and 60S, 60W to ~55S, 63W

Japan GEOTRACES; RV Hahuko-maru (ORI, Univ. Tokyo) from Sydney (Australia) to Dumont d'Urville to Syowa station, to be decided ~40S, 150E to ~70S, 150E; ~70S, 150E to ~70S, 40E

Japan GEOTRACES; RV Shirase from Fremantle (Australia) to nearby Casey station to Syowa station, to be decided ~35S, 115E to 60S, 115E; 60S, 115E to ~70S, 40E

2.4. TIMEFRAMES ARCTIC

(045) June-Sept 2007; June-Sept 2008

(689) Summer 2007 and/or 2008 (TBD)

(147) June-July 2008; Spanish R.V. Hesperides

(321) June-July 2007

(XYZ) Kelly Falkner, spring 07-late fall 08

(976) (C-SOLAS) April-June 2007

(681) (CAME) Summer 2007 and/or 2008

2.4. TIMEFRAMES ANTARCTIC

(271) US GEOTRACES cruise in November 2008-March 2009 austral season

(426) Exact period within 01/2007 to 12/2008 to be decided by Australina Antarctic Division; this also for SR-3 section of Butler cum suis versus SAZ-SENSE program for early 2007 of Tom Trull

(584) December 2007 - January 2008

(880) December 2007 - January 2008

(147) Nov 2007- Feb 2008; Spanish R.V. Hesperides

(321) Nov 2007- Feb 2008; Spanish R.V. Hesperides

Japan GEOTRACES 2007-2008

Japan GEOTRACES 2008-2009

2.5. ARCTIC MAJOR LOGISTIC FACILITIES

(045) RV Polarstern

(689) Application for ship in preparation

(147) Spanish RV Hesperides

(321) RV Hesperides

(XYZ) USCGC Healy, US naval submarines LA class, possibly aircraft such as through NPEO, international cooperation such as RV Polarstern

(976) (C-SOLAS) Canada icebreaker Amundsen

(681) Application for ship in preparation

2.5. ANTARCTIC MAJOR LOGISTIC FACILITIES

(271) US research vessel and/or icebreaker

(426) Australian ice-breaker research/supply ship

(584) French research vessel

(880) RV Polarstern

(147) Spanish RV Hesperides

(321) RV Hesperides

RV Hahuko-maru

RV Shiraso (chief scientist dr. Tsuneo Odate)

4.0 CONSORTIUM INFORMATION

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