Criteria for GEOTRACES Ocean Section Cruises
Revised by the Scientific Steering Committee (SSC) in December 2019

The following information is to guide cruise leaders who wish to develop a cruise to be designated as a GEOTRACES section cruise. General characteristics of GEOTRACES ocean sections are described in Section 8.1.2 of the Science Plan (available on the web at www.geotraces.org), the text of which is reproduced below.

Cruise leaders must obtain GEOTRACES SSC approval before submitting a proposal to a funding agency for a cruise that is called a GEOTRACES section cruise in the proposal. Requests to the SSC should be submitted 2 months in advance of submission of the proposal.

The SSC has established seven criteria that must be met by a GEOTRACES section cruise:

1. It must provide full-depth water column measurements of all the GEOTRACES key parameters (listed in Table 2 of the Science Plan, reproduced below).

2. It must have an average station-spacing for full depth sampling of no more than 555 km (equivalent to 5º of latitude) for at least the majority of GEOTRACES key parameters.

3. It will collect sufficient ancillary data to allow interpretation of the TEI data. These include at least temperature, salinity, nutrients and oxygen. Collection of CTD and other data that aid in interpreting TEI data should follow GO-SHIP guidelines on how to produce good-quality hydrographic data: http://www.go-ship.org/HydroMan.html

4. It will follow GEOTRACES Intercalibration procedures to allow comparison with data collected elsewhere. These procedures will be updated periodically on the GEOTRACES web site:
http://www.geotraces.org/library-88/geotraces-policies/946-intercalibration-procedures-2
More detailed information is available in the GEOTRACES cookbook:
http://www.geotraces.org/libraries/documents/Intercalibration/Cookbook.pdf

5. It will follow GEOTRACES Data Management protocols, including:

a) Once the cruise is funded, the chief scientist or the lead GEOTRACES scientist must inform the GEOTRACES Data Assembly Centre (GDAC, geotraces.dac@bodc.ac.uk) and the International Project Office (IPO, ipo@geotraces.org) that the cruise has been funded.

b) Submission of post-cruise metadata form and cruise report, ensuring that the waypoints of the cruise track are included in the cruise report. Guidelines for preparing the cruise report and a metadata template form are available at: http://www.bodc.ac.uk/geotraces/cruises/documentation/

c) Submission of data and metadata for all datasets, including ancillary data, to the PI's national data centre (for American, French, Dutch and Chinese researchers) or to GDAC in a timely manner, and no more than two years after the analysis of samples.

d) Permit public access to the data beginning two years after collection of the data. This policy recognizes that some analyses are labour intensive and post-cruise sample analyses may require a substantial amount of time.

6. PIs must contact GDAC to request information about possible crossover stations when planning the cruise.

7. PIs must commit in advance to acknowledging GEOTRACES in products of the project.

Recommendations

I. GEOTRACES encourages measurement of diverse other trace elements and isotopes. Examples of such additional parameters that are widely measured during GEOTRACES cruises include, but are not limited to, Co; Fe and Si isotopes; ^{234}Th; Ba/Baxs; Hg concentration and speciation….

The SSC will assist cruise leaders in locating scientists who can help expand the number of TEIs to be measured. Also, a database of GEOTRACES Researchers' Analytical Expertise is available on the GEOTRACES web site to help search for particular TEI expertise:
http://www.geotraces.org/science/geotraces-researchers-analytical-expertise-database

In addition, cruise leaders are requested to contact the GEOTRACES International Project Office (IPO, ipo@geotraces.org) to inquire about investigators studying new tracers who are searching for cruises to provide sampling opportunities.

II. When possible, chief scientists shall include a funding contribution to GDAC in their proposals to help provide financial support for data management.

III. GEOTRACES encourages cruise leaders to welcome scientists from developing countries to be trained on board GEOTRACES cruises. Limited funding to cover the airfare of the trainee is available through SCOR.

Process to seek endorsement

-To seek endorsement, project leader(s) should approach a national or regional SSC member with a 1-page summary of the proposal (see example here: http://www.geotraces.org/images/stories/documents/Australian_GS01_cruise.pdf) that addresses the criteria above and including a map showing the cruise track (the list of SSC members is available at the following web page: http://www.geotraces.org/about-us/ssc-members/ssc-members-and-officers). This SSC member will provide the project leader(s) with advice during preparation of the document, and forward the final document to the International Project Office (ipo@geotraces.org). The SSC will either make decisions during the annual SSC meeting or by email for those proposals arriving out of cycle (i.e., those that require approval prior to the next SSC meeting).

Additional information

REPRODUCED FROM THE GEOTRACES SCIENCE PLAN

8.1.2 Ocean sections

Measurement of a range of TEIs along full-depth ocean sections through each of the major ocean basins represents the core activity of the GEOTRACES programme. This measurement strategy is clearly identified as providing maximum scientific rewards (see, for instance, Section 2.4, and various 'implementation strategies' throughout Sections 3–5). It will identify, at a global scale, the wide range of chemical, physical and biological processes involved in the cycling of TEIs in the ocean. For example, measuring multiple diagnostic TEIs in the principal regions for deposition of continental mineral aerosols will lead to an assessment of micronutrient (e.g., Fe) delivery by this process (Sections 2.4 and 3.1). Similar strategies will be exploited during ocean sections to evaluate the net supply of TEIs by continental runoff (Section 3.2); the net supply and removal of TEIs through exchange with ocean margin sediments (Section 3.3); and the sources and sinks of TEIs associated with hydrothermal systems (Section 3.4). Information about the internal cycling of TEIs will be derived by measuring vertical and lateral TEI gradients along ocean sections (Section 4; see also Figure 5 and associated text in Section 2.4). Coupling these measured distributions with ocean-circulation models will also allow the rates of these processes to be constrained (Section 6).

Mapping the present distribution of TEIs along ocean sections will provide a basis for evaluating future changes to their distribution, with relevance to global change research. And it will allow relationships between different TEIs to be exploited to better understand their chemical behaviour, and their use as proxies for past change. Global datasets, of certified quality, from these ocean sections will be one of the major legacies of the programme and will provide important information to a wide variety of related disciplines including global carbon cycle modelling, climate modelling, ocean ecosystem studies, and research into ocean contaminants.

The principal criterion for selecting and approving ocean sections (Section 9) will be their potential to provide insight into the sources, sinks, speciation and internal cycling of TEIs, as well as the sensitivity of these parameters to changing environmental conditions. Although no commitments have yet been made to particular ocean sections, priority will be assigned to regions of prominent sources or sinks, such as dust plumes, major rivers, hydrothermal plumes and continental margins (Figure 29). Ocean sections will also be designed to sample the principal regions of water-mass formation to characterise the TEI composition of each end-member water mass, and to identify the processes regulating these endmember compositions. And sections will be selected to cross major biogeographic provinces and gradients of biological productivity (Figure 29). Precise ocean section locations and ship tracks represent an implementation issue that lies outside the scope of this science plan. This planning will be coordinated by the GEOTRACES Scientific Steering Committee (see Section 9) to ensure global coverage without unnecessary duplication during the ocean sections campaign.

It is anticipated that ocean sections will involve mainly water sampling. Coring, bottom landers, sediment traps, plankton tows, etc. will be used mainly within process studies, although some exceptions will be made, particularly in ocean sections passing into remote regions of the ocean where opportunities to collect sediment samples are rare.

Parameters to be measured along ocean sections can be separated into several categories (see Section 8.2 below), and there will be a hierarchy of sampling frequency depending on the sampling method and type of measurement. For example, total concentrations of TEIs will be measured with greater sampling frequency than will be the physical form (e.g., dissolved, colloidal, particulate) and chemical speciation of TEIs. To qualify as a GEOTRACES section, it is anticipated that the key parameters identified in Section 8.2 will be measured, and that measurements will be contributed promptly to the established GEOTRACES data management system.

Modelling will play an integral part in planning the ocean sections, and all resulting measurements will be integrated into models of appropriate complexity. The global view of TEI distributions provided by the section approach will be particularly useful for construction of accurate global models. One example is that improved knowledge of micronutrient cycles will allow their accurate modelling in global carbon cycle models.

Table 2. GEOTRACES Key parameters

Key Parameter	Examples of use
Trace Elements	
Fe	Essential micronutrient
Al	Tracer of Fe inputs (from mineral dust and elsewhere)
Zn	Micronutrient; potentially toxic at high concentration
Mn	Tracer of Fe inputs and redox cycling
Cd	Essential micronutrient; palaeoproxy for nutrient content of waters
Cu	Micronutrient; potentially toxic at high concentration
Stable isotopes	
δ15N (nitrate)	Modern and palaeoproxy for nitrate cycling
δ13C	Modern and palaeoproxy for nutrient content and ocean circulation
Radioactive isotopes	
230Th	Constant flux monitor in sediments; tracer of modern ocean circulation and particle scavenging
231Pa	Palaeoproxy for circulation and productivity; tracer of modern particle processes
Radiogenic isotopes	
Pb isotopes	Tracer of natural and contaminant sources to the ocean
Nd isotopes	Tracer of natural sources of TEIs to the ocean
Other parameters	
Stored sample	To allow future work
Particles	Essential transport vector for many TEIs
Aerosols	Essential source of TEIs to the surface ocean