

### *Purpose*

This document was prepared by the US GEOTRACES Scientific Steering Committee (SSC) to serve as a resource for members of the chemical oceanography community when developing research plans for participation in the US GEOTRACES section between Alaska and Tahiti, tentatively scheduled for mid 2018. These guidelines also offer information that will aid in the preparation of individual research proposals, which should be submitted to the NSF Chemical Oceanography program by the 15 February 2017 deadline. Participation is open to anyone eligible to submit proposals to the US NSF.

### *Research Themes and Objectives*

A section between Alaska and Tahiti was selected by the SSC as a high priority for US GEOTRACES because several features along the section provide an excellent opportunity to examine the processes that influence the supply, removal and internal cycling of trace elements and their isotopes. These conditions include:

- 1) Trace element supply through dissolution of volcanogenic sediments surrounding the northern margin of the Pacific Ocean,
- 2) A strong meridional gradient in the supply of dust, and associated trace elements, derived from the deserts of East Asia,
- 3) A large gradient in biological productivity and export production that influence the internal cycling and removal of trace elements, where high fluxes are associated with the Alaskan coastal regime, the boundary between the subarctic and subtropical gyres, and the equatorial upwelling system whereas low productivity and export are anticipated in the subtropical gyres,
- 4) Oxygen minimum zones emanating from the eastern tropical North and South Pacific, and the opportunity to examine the far-field effects of these OMZs on trace element and isotope biogeochemistry,
- 5) The hydrothermal plume emanating from the northern and Southern East Pacific Rise and, possibly, from the Juan de Fuca Ridge and from Loihi Seamount, and
- 6) The oldest deep waters (radiocarbon age) in the ocean, where extreme end-members of the accumulation of regenerated material can be investigated.

These features offer excellent opportunities to examine the distribution and speciation of trace elements and isotopes, their interaction with marine organisms as well as their overall supply, removal and internal cycling. Individual proposals will benefit by demonstrating that their proposed research supports goals related to one or more of these themes. Furthermore, as the goal of the cruise is to integrate research across all of the themes, individual proposals will benefit if they are integrative as well.

In addition to these themes, the SSC encourages investigators to submit proposals that bring new ideas to the program, provided that they are justified in terms of objectives that support the mission and goals of GEOTRACES, as defined in the Science Plan.

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*Additional Information and Resources*

Several documents that can be helpful in planning for the Alaska-Tahiti section are available via the internet:

- 1) The GEOTRACES Science Plan defines the overall mission and goals of the program. The Alaska-Tahiti section will support that mission. The Science Plan is available at: <<http://www.geotraces.org/science/science-plan>>.
- 2) An international GEOTRACES workshop in 2007 provided a context for research throughout the Pacific Ocean, including the Alaska-Tahiti section. The report of this workshop is available at: <<http://www.geotraces.org/library-88/scientific-publications/reports/74-pacific-report>>.
- 3) A US GEOTRACES implementation workshop in 2008 refined the scientific goals of the Alaska-Tahiti section. The report from that workshop, which served as the basis for planning the Alaska-Tahiti section, is available at: <[http://www.usgeotraces.org/USGEOTRACES\\_website/documents/pacificDOC/Pacific\\_Report\\_Jun09\\_000.pdf](http://www.usgeotraces.org/USGEOTRACES_website/documents/pacificDOC/Pacific_Report_Jun09_000.pdf)>
- 4) A cruise planning workshop for the Alaska-Tahiti section was held 5 – 7 October 2016. Plenary presentations from the workshop are posted at: <[http://www.usgeotraces.org/USGEOTRACES\\_website/documents/pacificDOC/WSPac2016/PlenaryPacAla2016.html](http://www.usgeotraces.org/USGEOTRACES_website/documents/pacificDOC/WSPac2016/PlenaryPacAla2016.html)>
- 5) Cruise logistics will be supported via a management proposal. Once the proposal has been recommended for funding, the Project Description of the proposal will be posted at: <[http://www.usgeotraces.org/USGEOTRACES\\_website/documents/pacificDOC/WSPac2016/WSPAC%202016Proposal\\_Prep\\_Docs.html](http://www.usgeotraces.org/USGEOTRACES_website/documents/pacificDOC/WSPac2016/WSPAC%202016Proposal_Prep_Docs.html)>

Investigators planning to submit an individual research proposal should pay close attention to the management proposal, as it provides for the collection of water samples and particles collected by *in situ* filtration, as well as for hydrography and nutrient measurements. Collection of other types of samples (e.g., aerosols) must be covered by individual proposals, so it is vital that anyone interested in these types of samples coordinate the development and submission of their proposals (see next section).

*Research Coordination/Statements of Interest*

Investigators who need water samples for their research should be cognizant of sample size limitations. Following the precedent of previous US GEOTRACES sections, it is anticipated that the following will be collected at each sample depth at each regular full-depth station:

- 22 liters of filtered seawater collected using the trace metal-clean rosette

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- 30 liters of water collected using a standard Niskin bottle that will be divided as needed between unfiltered samples and water that is filtered through a 0.45-micron pore diameter Acropak capsule.

Analyses that require a substantial fraction of the available water cannot be accommodated at regular full depth stations. A small number of “super” stations (ca. 5) will provide additional casts to collect water for analyses that require larger volumes, up to approximately 20 liters from the standard Niskin rosette.

The management team has also proposed to collect samples of size-fractionated (0.8 – 51  $\mu\text{m}$  and  $> 51 \mu\text{m}$ ) suspended particulate material by *in situ* filtration. Aliquots will be distributed to participants funded to work with them. Each pump collects samples using two filter holders: about 1000 L through one containing a 51  $\mu\text{m}$  polyester prefilter upstream of paired quartz microfiber filters (QMA), and about 450 L through the other with a 51  $\mu\text{m}$  polyester prefilter upstream of paired 0.8  $\mu\text{m}$  pore diameter polyethersulfone filters (Supor). Investigators who propose analyses that require material collected by *in situ* filtration are encouraged to contact Phoebe Lam [pjlam@ucsc.edu](mailto:pjlam@ucsc.edu) to make their sample needs known.

Other samples will be available in limited quantity as well. For example, a single sample of total suspended matter will be collected at each depth from one GO-Flo bottle on the trace metal clean rosette. It is anticipated that these filters will be used primarily to determine concentrations of particulate trace elements. Proposals that apply non-destructive analytical methods to the filters prior to digestion for trace element analysis are welcome provided that the methods can be demonstrated to avoid contaminating the filters and that the non-destructive analyses are coordinated with the primary trace element measurements.

The collection of aerosol samples depends on the submission of an individual proposal to collect these samples that passes review successfully. Investigators planning to submit a proposal for collection of aerosol samples should incorporate a plan for sharing aliquots of the filters with other investigators. Other investigators proposing analyses of aerosols are encouraged to coordinate their sampling and sample needs in advance of preparing their proposals. Statements of Interest posted on the US GEOTRACES web site (see below) will identify those investigators who are likely to propose to collect aerosols.

Following the precedent of previous US GEOTRACES sections, proposals may be submitted to collect samples from underway pumping systems as well as from over-the-side pumping systems while on station. The management team plans to operate a towed fish to collect trace metal clean water while the ship is underway.

Investigators who contemplate submitting a proposal to participate in the Alaska-Tahiti section are encouraged to submit a statement of interest to the US GEOTRACES Project Office <[geotraces@ldeo.columbia.edu](mailto:geotraces@ldeo.columbia.edu)> describing their plans. The statements are posted on the US GEOTRACES web site to facilitate coordination of research activities

among those investigators with common interests

<[http://www.usgeotraces.org/USGEOTRACES\\_website/documents/pacificDOC/WSPac2016/Sol\\_Pacific2016.html](http://www.usgeotraces.org/USGEOTRACES_website/documents/pacificDOC/WSPac2016/Sol_Pacific2016.html)>.

Berths will be at a premium during the Alaska-Tahiti cruise. Due to the large number of sampling activities, each person at sea will be expected to contribute to the collection of samples for a number of groups. If a dedicated berth is required, for example to perform analyses at sea, then this should be justified in the proposal.

### *Strategies to Reduce Costs*

The SSC identified the following recommendations to minimize unnecessary costs for the Alaska-Tahiti expedition:

- 1) Proposals that cover multiple parameters are encouraged.
- 2) Collaborative proposals that cover measurements to be made along the entire section are encouraged. Splitting the cruise track between separate proposals creates a liability that one proposal will be funded and the other declined.
- 3) Investigators involved in collaborative proposals are urged to eliminate unnecessary redundancies. It will be helpful to identify a lead PI for each collaborative proposal who will make the effort a major part of their research program in 2018 and 2019, thereby taking on most of the responsibilities and associated expenses. Collaborating PIs are encouraged to take a supporting role, thereby keeping their budgets as low as possible.
- 4) Junior scientists are encouraged to participate, either with their own stand-alone proposal or, if they prefer, as part of a collaborative proposal.
- 5) It is essential that PIs share sampling responsibilities at sea. This will be dictated in any case by berth limitations. NSF review of proposals will be aided if PIs indicate in their proposals where resources (e.g., sampling equipment, seagoing personnel) will be shared. A sound plan for sharing resources at sea will also be viewed favorably during proposal review.
- 6) PIs are advised to submit proposals that cover the full cost of their research while also indicating where costs can be cut if other specific proposals are funded that allow resources to be shared.

### *Overlapping or Redundant Measurements*

The US GEOTRACES SSC, at its meeting on October 7, 2016, discussed how PIs who are planning to make the same TEI measurements on the GP 15 section should go about preparing their proposals. There are obvious pros and cons to submitting either collaborative or competing proposals. For key TEIs, there may be cases where redundancy might be viewed as important to resolving important analytical or oceanographic issues. For other elements, there may be no clear rationale for redundant efforts. The SSC is not charged with making specific recommendations to individual PIs about how to proceed. However, we offer the following general suggestions:

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a) Investigators who choose to submit competing proposals might still wish to consider whether there is a case where some redundancy in effort is warranted, why that redundancy is warranted, and what will be done by the respective groups to fully intercalibrate their data using GEOTRACES protocols.

b) Investigators who choose to submit collaborative proposals should clearly explain the nature and advantages of their collaborative approach, the rationale for any division of labor, and the advantages to any redundancies. For collaborators, we encourage PIs to include data sharing over the entire section, as descriptions of the entire section will likely have more impact. This could mean dividing the work plan by elements for multi-element datasets, or by process, rather than geographically. Importantly, collaborators should be explicit about the plans for synthesis and publication so as to avoid misunderstandings.

All PI's must describe a plan for GEOTRACES-compliant intercalibration via crossover stations and replicate sample analyses. Replicate analyses between the labs are especially important for collaborative proposals to quantitatively demonstrate consistently accurate data. However, the PIs must consider the impact of replicate sampling on the water or filter budgets for the GEOTRACES carousel, in situ pumps, or conventional ODF rosette, as described above.

*Priority Guidelines*

At the request of the NSF Chemical Oceanography program, the SSC has developed a set of priorities to facilitate the writing and reviewing of individual proposals. Priorities are organized by sampling activity and according to variables to be determined in a companion document posted on the US GEOTRACES web site <GP15\_Parameter\_Priorities.pdf>.