Aerosol and Precipitation Sampling and Analysis for US Arctic GEOTRACES Cruises

From: Clifton S. Buck, Skidaway Institute of Oceanography
William M. Landing, Florida State University

Re: Letter of intent for US GEOTRACES Arctic - *Project Aerosol and Precipitation Sampling and Analysis for US Arctic GEOTRACES Cruises*

Our proposal will focus on aerosol and precipitation sampling, analysis, and subsample distribution to the community. The collection of aerosol and precipitation samples is a critical component of GEOTRACES sections, as atmospheric deposition represents an important input of TEIs to the remote surface ocean. Key TEIs will be analyzed on rain and snow samples, bulk and size-fractionated aerosol samples, and from aerosol leachates conducted with ultrapure water and freshly-collected surface seawater. Additional analytes will be determined through collaborative efforts to address the specific objectives for this section.

We would deploy the atmospheric sampling equipment that was purchased (by us) for US GEOTRACES cruises. This includes three high-volume aerosol samplers for total and size-fractionated aerosols, and two automated rainfall collectors. The aerosol samplers are controlled with respect to wind speed and sector to avoid contamination from ship's exhaust. We will also be prepared to collect blowing snow using small-volume open-ended polyethylene bottles attached to a pole above the bridge of the ship.

The aerosols are collected on replicate filters for distribution to the aerosol community. One sampler is deployed with 12 pre-baked glass fiber filters (GFF) for volatile analytes including water-soluble nitrate (N isotopes), water soluble organic compounds, and aerosol Hg. One sampler is deployed with 12 pre-cleaned 47mm Whatman-41 filters (W41) for total and soluble aerosol TEI measurements. The third sampler is deployed with a slotted Sierra-style cascade impactor and pre-cleaned W41 slotted filters, generating 9 replicate sets of size-fractionated aerosol samples. One rain sampler is deployed with a polyethylene receiving bottle for TEI measurements, and one is deployed with a Teflon bottle for Hg analysis. The rain and snow samples are recovered immediately after each precipitation event. When sufficient sample is collected (>200 mL) the sample is split into filtered (0.4 um) and unfiltered subsamples.

We will propose to work with others to characterize atmospheric input and constrain atmospheric input estimates using TEIs as tracers, and to explore the speciation of soluble aerosol TEIs with a particular focus on pollutant aerosols, bioactive trace elements and other important TEIs. One berth will be requested for the sampling and on-board processing of rain, snow, and aerosols. We will require filtered surface water from the towed fish to leach aerosols onboard and provide leach solutions to collaborators.

Collaborations with other participants are expected and welcomed. This list is based on previous collaborations on US GEOTRACES cruises, although we do not know at this time which groups might want to participate:

- Investigating the use of 232Th as a tracer of aerosol TEI input to surface waters
- Aerosol input of 210Pb and 210Po
- Mercury concentrations in rain and aerosols
- Nitrogen species and nitrogen isotopes in soluble aerosols
- Fe isotopes in soluble and total aerosols
- The use of 7Be as a tracer of atmospheric TEI input
- Compound-specific analysis of water soluble organic carbon

Clifton S. Buck (SkIO), William M. Landing (FSU)