GEOTRACES Intercalibration

Intercalibration – *The process, procedures, and activities used to ensure that the several laboratories engaged in a monitoring program can produce compatible data. When compatible data outputs are achieved and this situation is maintained, the laboratories can be said to be intercalibrated* (Taylor, 1987).

Intercalibration therefore is an active process between laboratories that includes all steps from sampling to analyses, with the goal of achieving the same accurate results regardless of the method or lab.

US GEOTRACES Sampling Systems and Intercalibration (PIs: Cutter, Bruland, and Sherrell)

(1) Develop and test the US GEOTRACES sampling systems and procedures for dissolved and particulate TEIs. This equipment will be a community resource for use in all future US GEOTRACES cruises;

(2) Using these systems, conduct a thorough intercalibration for all the key GEOTRACES TEIs, and as many others as possible, in the dissolved and particulate phases through the participation of the worldwide TEI community;

(3) Establish GEOTRACES Baseline Stations in the western North Atlantic (BATS) and eastern North Pacific (SAFe) as part of the Intercalibration Cruises; and

(4) Fully document the intercalibration results and create "US GEOTRACES User Manuals and Procedures" for future US-sponsored GEOTRACES cruises.

Sampling facility for US GEOTRACES and other trace element biogeochemistry programs (PIs: Cutter, U. Delaware)

(1) Epoxy powder-coated clean rosette with 24 12 L GO-Flo sampling bottles capable of being triggered 3 at a time while on the up-cast into uncontaminated water

(2) CTD with oxygen probe, fluorometer, and transmissometer

(3) 8000 m Kevlar/polyester conducting cable for deploying the clean CTD/rosette

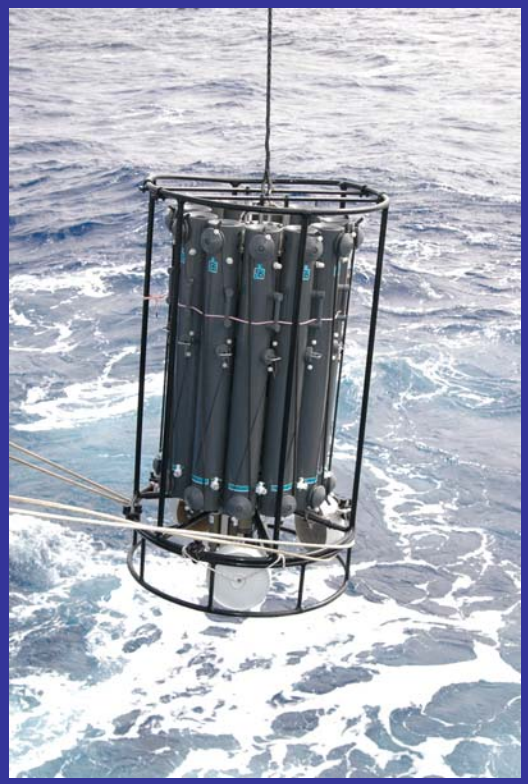
(4) Dynacon traction winch with composite sheaves and line monitoring, plus a composite block/sheave to be hung on the J frame

(5) UNOLS-approved trace metal-clean sampling van for processing the clean water and particle samples

(6) Shipping van for the rosette and winch; also has a removable winch and CTD control room

(7) Flatbed trailer to store and ship the 2 vans and all the associated equipment.

Sampling with a ‘clean’ rosette of 12 liter GO-Flo bottles



Bill Landing and Chris Measure’s rosette system of 12 each 12 liter GO-Flo samplers with their clean conducting cable used in the CLIVAR program. This system is limited to the upper 1000 meters. It was shown in the SAFe program to be able to take clean samples for iron. There are still some problems for zinc.

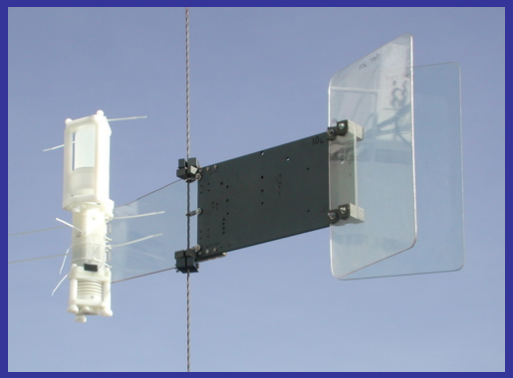
They sample on the way up with the rosette moving into clean water.

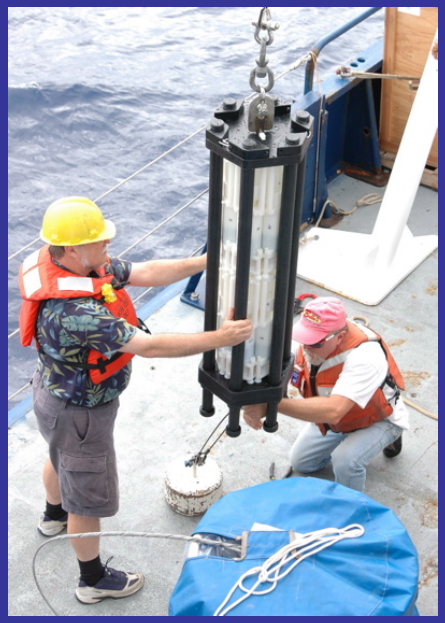
As part of the funded intercalibration program, Greg Cutter is building a GEOTRACES system that will have 24 sample bottles and 8000 meters of Kevlar conducting cable. It will be a community resource.

As part of the Intercalibration effort, the new system will be compared with "old fashioned" methods such as individual 30 liter GO-Flo bottles deployed on Kevlar hydroline

Sampling with 30-Liter GO-Flo samplers - teflon coated, modified, deployed on Kevlar hydroline, tripped with teflon messengers, and with our own winch (Bruland et al. 1979). A "proven" method, but unfeasible for the GEOTRACES Program.

The new rosette system will also be compared with smaller volume vane samplers such as those of Boyle and Wu. The small sample sizes make these unfeasible for GEOTRACES.





Ed Boyle's MITESS samplers. The vane sampler on the left is used to collect an individual smaller sample. The sampler on the right is used to collect multiple samples to either provide a larger volume or used with a timer to collect at multiple depths. Funding for participation is pending.

Jingfeng Wu's sampler based upon a modification of the original MITESS ATE/vane sampler that Ed Boyle developed. Funding for participation is pending.

- To conduct the intercalibration for GEOTRACES TEIs, we will use two 500 liter tanks and a clean van. We plan on surface and deep composite samples.
- This system was used successfully during the SAFe program for the iron intercalibration.
- We are funded to provide and fill 0.5 L LDPE bottles for dissolved TEI intercalibrations. This will follow the guidelines of the SAFe program.
- We also plan on filling the tanks for other "more exotic" TEI intercalibration efforts.
- For SAFe Intercalibration samples, send an email request to: requestsafestandard@ucsc.edu - include FEDEX billing number.

Our surface “fish” sampling system for collecting clean surface water underway. We use it for clean sampling at depths of 1 to 20 meters off the side of the ship. A slightly modified system will be used while on station to collect large volume samples in the upper 200 m.

Deck pump

Clean bench with filtered and unfiltered clean water taps from fish/pump supply

In situ pumping for large volume suspended particle collection and distribution

Funding for participation by pumping groups is pending.

Particles on filter - an intercalibration challenge

Due to the heterogeneity seen here, we will be distributing replicate whole filters rather than sub-sampling from one filter.

Filtration from Niskin bottles. A similar system will be used with the GEOTRACES GO-Flo bottles (direct pressure filtration), and filter pore sizes and materials will be examined.

GEOTRACES Baseline Stations

- Ocean stations where TEI distributions, concentrations, and speciation have been extensively studied (established). Ideally, there should be > 2 per ocean basin.
- Occupying these during a GEOTRACES transect allows de facto intercalibration for each cruise. In addition, these locations facilitate the testing of new sampling or analytical methods.
- Each GEOTRACES section cruise should occupy 1-2 existing Baseline Stations, or establish new ones when cruise tracks overlap at 1-2 stations.
- Ocean Time Series Stations are potentially good Baseline Stations – regular occupation, large data base, and most are logistically convenient or located in GEOTRACES-relevant ocean regimes

Intercalibration Time Line

- June 2007. Interim GEOTRACES User's Manuals for IPY Cruises.
- Dec. 2007. First Intercalibration workshop (AGU): planning for 1st cruise
- June – July 2008. 1st Intercalibration cruise (Sargasso Sea): evaluate sampling apparati and handling methods (diss and part), collect and distribute intercalibration samples, sample storage experiments, establish Baseline Station at BATS
- Dec. 2008. Second Intercalibration workshop (AGU): evaluate and interpret intercalibration results, planning for 2nd cruise
- Spring 2009. 2nd Intercalibration cruise (eastern North Pacific): final testing of complete sampling system and procedures, intercalibrate with other (non-US) sampling systems, speciation + total TEI intercalibration, determine the time to occupy one GEOTRACES station (for cruise planning purposes)
- Jan.-Feb 2010. Third Intercalibration workshop: finalize complete intercalibration results, begin assembling GEOTRACES User Manuals

Elemental Coordinators/Leaders for GEOTRACES Intercalibration

- **Dissolved and particulate sampling systems, "core" trace elements** – G. Cutter, K. Bruland, and R. Sherrell; gcutter@odu.edu
- **Si isotopes** - Mark Brzezinski, brzezins@lifesci.ucsb.edu
- **N (and O) isotopes**– Karen Casciotti, kcasciotti@whoi.edu
- **P (O isotopes)** – Albert Colman, colman@umbi.umd.edu
- **Hg** – Carl Lamborg, clamborg@whoi.edu
- Metal **stable isotopes** – Ed Boyle, eaboyle@mit.edu
- **Nd and Hf** – Tina van de Flierdt, tina@ldeo.columbia.edu
- **Os** - Bernhard Peucker-Ehrenbrink, behrenbrink@whoi.edu
- **Th** - Ken Buesseler, kbuesseler@whoi.edu
- **Ra** – Billy Moore, moore@geol.sc.edu
- **Pb-, Po-210** – Mark Baskaran, ag4231@wayne.edu
- **Aerosols** - Bill Landing, wlanding@fsu.edu
- Speciation - Jim Moffett, moffett@usc.edu
- 130Th, 231Pa ,10Be- Bob Anderson, boba@ldeo.columbia.edu
- Pu,137Cs - Tim Kenna, tkenna@ldeo.columbia.edu

Intercalibration during GEOTRACES Basin Surveys: items to consider

- Use GEOTRACES methods (documented in the User Manuals) for accurate sample acquisition and handling.
- Occupy 1-2 Baseline Stations during a transect, or overlap transects to reoccupy 1-2 stations, thereby creating new Baseline Stations.
- If a Baseline Station cannot be occupied, at 2 stations per transect, acquire replicate samples for distribution to various labs to evaluate sample storage and analytical accuracy.
- Samples will include both seawater and suspended particles.
- Conduct post-cruise evaluation of intercalibration results as soon as possible to verify accurate results.