

Seawater Dissolved Inorganic Carbon Measurements (DIC and alkalinity) on the US GEOTRACES Arctic Cruise.

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Objectives:

1. Direct measurement of dissolved inorganic carbon (DIC; or total carbon dioxide) and total alkalinity (TA) along the anticipated Arctic Ocean transect (e.g., Bering Strait, Chukchi Sea, Canada and Makarov Basins) as part of the US GEOTRACES Arctic effort. Samples will be collected at all CTD-hydrocast stations (from non-trace metal casts) and at all depths. This effort is considered as a **service component** to the core hydrography and biogeochemistry sampled on GEOTRACES conducted as a basis for trace element and isotope (TEI) work.
2. Samples will be analyzed for DIC/TA using highly precise and accurate techniques (WOCE, CLIVAR-CO₂ repeat, US time-series standard) with samples calibrated with certified reference materials. These data will be used to calculate other parameters such as pH and other seawater carbonate chemistry parameters ($p\text{CO}_2$, Revelle buffer factor and CaCO₃ mineral saturation state, i.e., for aragonite and calcite). These data will provide quickly to the GEOTRACES data center to facilitate other funded TEI work and provide a thermodynamic context that GEOTRACES PIs can use to help to assess inorganic speciation of many trace elements and isotopes (TEIs).
3. This proposed sampling of inorganic carbon builds on previously funded US Atlantic and Pacific GEOTRACES conducted by Bates. Sampling for inorganic carbon and subsequent interpretation and synthesis efforts using US Arctic GEOTRACES data also leverages and builds upon Bates's involvement in ocean carbon cycle, air-sea gas exchange and ocean acidification studies in the Arctic Ocean over the last fifteen years (funded by NSF, NOAA and NASA on projects such as Shelf-Basin Interactions (SBI), RUSALCA and ICESCAPE).

Anticipated Collaborations (selected):

1. Anticipate numerous collaborations with TEI/ GEOTRACES funded PI's as previously undertaken for the U.S. Atlantic and Pacific GEOTRACES cruises. For example this likely includes collaborations with those undertaking studies of, for example: organic complexation of dissolved Fe, Cu, and Co; mercury speciation; redox speciation and geochemistry of suspended particles; organic complexation and associated TEI removal.
2. Anticipate collaborations with PI's proposing dissolved organic carbon measurements and assessments of vertical and horizontal gradients in the organic carbon field in the Arctic Ocean.

Sample Requirements: Samples for DIC and TA require approximately 500 ml of seawater that will be drawn into ~300 ml glass sample bottles from Niskin samplers on the CTD/rosette. Typically, the DIC/TA samples will be drawn after the DO samples or sampled first on a subsequent cast. It is anticipated that approximately 700-900 samples will be collected over the entire water column for DIC/TA (both deep Arctic Ocean and shallow shelves) on the non-trace metal hydrocasts.

Berth Requirements: Ideally, one berth is required to sample for both DIC and TA. Sampling takes approximately 5 minutes per depth. Given anticipated berth space pressures, sampling can also be conducted by a "Supertech", as part of the management/CTD/hydrography group.