Dissolved rare earth element (REE) concentrations from the GEOTRACES North Atlantic Transect (Section GA03) collected on the R/V Knorr cruises KN199-04, KN199-05, and KN204-01 during 2010 and 2011

Website: https://www.bco-dmo.org/dataset/651138
Data Type: Cruise Results
Version: 2
Version Date: 2021-07-28

Project
» U.S. GEOTRACES North Atlantic Transect (GA03) (U.S. GEOTRACES NAT)
» Participation in October 2011 US GEOTRACES North Atlantic Zonal Section Continuation Cruise (NAT_Continue)

Program
» U.S. GEOTRACES (U.S. GEOTRACES)

Contributors	Affiliation	Role
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Abstract
Dissolved rare earth element (REE) concentrations from the GEOTRACES North Atlantic Transect (Section GA03) collected on the R/V Knorr cruises KN199-04, KN199-05, and KN204-01 during 2010 and 2011.

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Coverage

Spatial Extent: **N**:39.701 **E**:-9.66 **S**:16.8546 **W**:-78.8948
Temporal Extent: 2010-10-16 - 2011-12-10

Dataset Description

Dissolved rare earth element concentrations and additional surface water sampling across the North Atlantic Ocean, including GEOTRACES section GA03.

Methods & Sampling

Water column samples were taken from the GEOTRACES carousel and filtered through precleaned, 0.2 um Pall Acropak Supor filter capsules as described elsewhere (e.g., Cutter et al., 2012; Hatta et al., 2015). Near surface

water samples were collected using an underway towedfish pumped seawater system (Bruland et al., 2005) with samples filtered through sequential 0.45 um Osmonics and 0.2 um Polycarbonate (PCTE) cartridge filters. Filtered water was collected in 125 mL HDPE bottles (Nalgene) that had been precleaned by soaking in hot 1.2 M HCl (reagent grade) for at least 8 h with subsequent thorough rinsing with ultrapure distilled deionized water (Barnstead E-pure). Samples were acidified in a laminar flow bench aboard ship using 0.5 mL of ultrapure HCl per 125 mL sample.

For analysis of dissolved rare earth elements (including Y), 14 mL of sample was spiked with a mixture of isotopically-enriched Nd-145, Sm-149, Eu-153, Gd-155, Dy-161, Er-167, and Yb-171 (Oak Ridge Nat'l. Labs). Each spike was greater than 90% enriched in the listed isotopes. The sample/spike ratio was chosen so as to have the analytical isotope ratios approximately the geometric mean of the natural and enriched spike isotope ratios. Samples were then extracted/pre-concentrated using a SeaFAST system (Elemental Scientific, Inc.) operated in offline mode. A similar online SeaFAST extraction procedure is described by Hawthorn et al., 2012. The extracted samples were subsequently analyzed using a Thermo-Fisher high resolution ICP-MS with an Apex-FAST high efficiency sample introduction system with Spiro desolvator (Elemental Scientific, Inc.).

The instrument was operated in low resolution. The enriched isotope spikes also served to provide counts/sec. calibration factors for elements that were not spiked with enriched isotopes. This calibration was also examined with a standard made in dilute nitric acid. Precision and recovery were checked by analysis of a large-volume composite North Atlantic surface seawater sample. Spiked (with a natural isotopic abundance elemental spike) and unspiked aliquots of this sample were analyzed twice in each analytical run. A Ba standard was also run to check for BaO+ interference on several isotopes and Ba in the extracted samples was also monitored. Because the extraction resin in the SeaFAST system (Nobias PA-1) discriminates against Ba, plus the reduction of the BaO+ interference by the desolvation system, BaO+ was less than 0.1% of the counts in Eu-151, Eu-153, Gd-155, and Gd-157. Tests also revealed no significant low REE oxide interference on mid-/high-REEs.

Data Processing Description

For more information on intercalibration procedures, refer to the dataset's Intercalibration Report (PDF).

Quality Flags: Data were flagged using the SeaDataNet quality flag scheme. For more information on SeaDataNet flags, see: https://www.geotraces.org/geotraces-quality-flag-policy/ and https://www.seadatanet.org/Standards/Data-Quality-Control. Note that only for Y are there any quality flags that are not 1.

SeaDataNet quality flag definitions:
0 = No quality control;
1 = Good value;
2 = Probably good value;
3 = Probably bad value;
4 = Bad value;
5 = Changed value;
6 = Value below detection;
7 = Value in excess;
8 = Interpolated value;
9 = Missing value;
A = Value phenomenon uncertain.

BCO-DMO Processing:
- replaced 'NaN' with 'nd' to indicate 'no data' (in the .csv file, 'no data' values are blank);
- renamed fields to comply with BCO-DMO naming conventions (no spaces or special characters allowed);
- concatenated data from separate files into one dataset;
- changed the event start date to ISO8601 format;
- sorted by Cruise, Event, Sample_Number.

Version history:
- 2016-07-05 - version 1 published at BCO-DMO.
- 2021-07-28 (v2; current) - version 2 published, which includes corrections to data values. Description of changes in version 2: The elements that changed are Y, La, Ce, Pr, Tb, Ho, Tm, and Lu. The concentration changes are about 10%, but vary a little from sample to sample. Thus, there's not a simple correction factor that can be applied to the old data. For the other elements (Nd, Sm, Eu, Gd, Dy, Er, Yb), there may be some very slight (<0.5%) changes from the previous version. This results from the use of an actual density

correction (based on T & S) as opposed to an assumed density (1.025). The changes for this later group of 7 elements may be considered inconsequential.

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Data Files

File
GT10-11 - REEs v2 filename: all_REE_data.csv (Comma Separated Values (.csv), 255.94 KB) MD5:5669c3818e58fbb0b0c3da2632569be8 Dissolved rare earth element (REE) concentrations from the GEOTRACES North Atlantic Transect (Section GA03) collected on the R/V Knorr cruises KN199-04, KN199-05, and KN204-01 during 2010 and 2011. This is version 2 of the dataset, last updated on 2021-07-28. Column names comply with GEOTRACES IDP naming conventions. Version history: - 2016-07-05 - version 1 published at BCO-DMO. - 2021-07-28 (v2; current) - version 2 published, which includes corrections to data values. Description of changes in version 2: The elements that changed are Y, La, Ce, Pr, Tb, Ho, Tm, and Lu. The concentration changes are about 10%, but vary a little from sample to sample. Thus, there's not a simple correction factor that can be applied to the old data. For the other elements (Nd, Sm, Eu, Gd, Dy, Er, Yb), there may be some very slight (<0.5%) changes from the previous version. This results from the use of an actual density correction (based on T & S) as opposed to an assumed density (1.025). The changes for this later group of 7 elements may be considered inconsequential.

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Supplemental Files

File
GT10-11 - REEs Intercalibration Report filename: Intercal_Shiller-YREE-0616.pdf (Portable Document Format (.pdf), 95.40 KB) MD5:7948146e47bb10cb387edc3bf90982f3 GEOTRACES Intercalibration Report for the GA03 REE dataset reported by Alan Shiller.

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Parameters

Parameter	Description	Units
Cruise	Cruise ID	unitless
Event	Event number	unitless
BODC_EVENT	BODC event number	unitless
Event_Start_ISO_DateTime_UTC	Date and time (UTC) at start of event in ISO8601 format: YYYY-MM-DDThh:mmZ	unitless
Lat	Latitude	decimal degrees North

Long	Longitude	decimal degrees East
BODC_Bottle	BODC bottle number	unitless
Sample_Number	GEOTRACES sample number	unitless
Bottle_depth	Bottle depth	meters (m)
Y_D_CONC_BOTTLE_dpaajk	dissolved Yitrium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Y_D_CONC_BOTTLE_dpaajk_StDev	standard deviation of dissolved Yitrium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Y_D_CONC_BOTTLE_dpaajk_SDN_Flag	SeaDataNet quality flag for dissolved Yitrium concentration from bottles on cruise KN199-04	unitless
La_D_CONC_BOTTLE_obuapv	dissolved Lanthanum concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
La_D_CONC_BOTTLE_obuapv_StDev	standard deviation of dissolved Lanthanum concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
La_D_CONC_BOTTLE_obuapv_SDN_Flag	SeaDataNet quality flag for dissolved Lanthanum concentration from bottles on cruise KN199-04	unitless
Ce_D_CONC_BOTTLE_ro68cd	dissolved Cerium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Ce_D_CONC_BOTTLE_ro68cd_StDev	standard deviation of dissolved Cerium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Ce_D_CONC_BOTTLE_ro68cd_SDN_Flag	SeaDataNet quality flag for dissolved Cerium concentration from bottles on cruise KN199-04	unitless
Pr_D_CONC_BOTTLE_oujgw6	dissolved Praseodymium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Pr_D_CONC_BOTTLE_oujgw6_StDev	standard deviation of dissolved Praseodymium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)

Pr_D_CONC_BOTTLE_oujgw6_SDN_Flag	SeaDataNet quality flag for dissolved Praseodymium concentration from bottles on cruise KN199-04	unitless
Nd_D_CONC_BOTTLE_m9d7tl	dissolved Neodymium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Nd_D_CONC_BOTTLE_m9d7tl_StDev	standard deviation of dissolved Neodymium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Nd_D_CONC_BOTTLE_m9d7tl_SDN_Flag	SeaDataNet quality flag for dissolved Neodymium concentration from bottles on cruise KN199-04	unitless
Sm_D_CONC_BOTTLE_rt8f34	dissolved Samarium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Sm_D_CONC_BOTTLE_rt8f34_StDev	standard deviation of dissolved Samarium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Sm_D_CONC_BOTTLE_rt8f34_SDN_Flag	SeaDataNet quality flag for dissolved Samarium concentration from bottles on cruise KN199-04	unitless
Eu_D_CONC_BOTTLE_9p8hut	dissolved Europium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Eu_D_CONC_BOTTLE_9p8hut_StDev	standard deviation of dissolved Europium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Eu_D_CONC_BOTTLE_9p8hut_SDN_Flag	SeaDataNet quality flag for dissolved Europium concentration from bottles on cruise KN199-04	unitless
Gd_D_CONC_BOTTLE_rqdu6n	dissolved Gadolinium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Gd_D_CONC_BOTTLE_rqdu6n_StDev	standard deviation of dissolved Gadolinium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Gd_D_CONC_BOTTLE_rqdu6n_SDN_Flag	SeaDataNet quality flag for dissolved Gadolinium concentration from bottles on cruise KN199-04	unitless
Tb_D_CONC_BOTTLE_yh5i77	dissolved Terbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)

Tb_D_CONC_BOTTLE_yh5i77_StDev	standard deviation of dissolved Terbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Tb_D_CONC_BOTTLE_yh5i77_SDN_Flag	SeaDataNet quality flag for dissolved Terbium concentration from bottles on cruise KN199-04	unitless
Dy_D_CONC_BOTTLE_7xfwor	dissolved Dysprosium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Dy_D_CONC_BOTTLE_7xfwor_StDev	standard deviation of dissolved Dysprosium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Dy_D_CONC_BOTTLE_7xfwor_SDN_Flag	SeaDataNet quality flag for dissolved Dysprosium concentration from bottles on cruise KN199-04	unitless
Ho_D_CONC_BOTTLE_jt2spm	dissolved Holmium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Ho_D_CONC_BOTTLE_jt2spm_StDev	standard deviation of dissolved Holmium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Ho_D_CONC_BOTTLE_jt2spm_SDN_Flag	SeaDataNet quality flag for dissolved Holmium concentration from bottles on cruise KN199-04	unitless
Er_D_CONC_BOTTLE_aubvsh	dissolved Erbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Er_D_CONC_BOTTLE_aubvsh_StDev	standard deviation of dissolved Erbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Er_D_CONC_BOTTLE_aubvsh_SDN_Flag	SeaDataNet quality flag for dissolved Erbium concentration from bottles on cruise KN199-04	unitless
Tm_D_CONC_BOTTLE_ilx27o	dissolved Thulium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Tm_D_CONC_BOTTLE_ilx27o_StDev	standard deviation of dissolved Thulium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Tm_D_CONC_BOTTLE_ilx27o_SDN_Flag	SeaDataNet quality flag for dissolved Thulium concentration from bottles on cruise KN199-04	unitless

Yb_D_CONC_BOTTLE_au9lq8	dissolved Ytterbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Yb_D_CONC_BOTTLE_au9lq8_StDev	standard deviation of dissolved Ytterbium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Yb_D_CONC_BOTTLE_au9lq8_SDN_Flag	SeaDataNet quality flag for dissolved Ytterbium concentration from bottles on cruise KN199-04	unitless
Lu_D_CONC_BOTTLE_v8nb1s	dissolved Lutetium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Lu_D_CONC_BOTTLE_v8nb1s_StDev	standard deviation of dissolved Lutetium concentration from bottles on cruise KN199-04	picomoles per kilogram (pmol/kg)
Lu_D_CONC_BOTTLE_v8nb1s_SDN_Flag	SeaDataNet quality flag for dissolved Lutetium concentration from bottles on cruise KN199-04	unitless
Y_D_CONC_BOTTLE_nfhgrm	dissolved Yitrium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Y_D_CONC_BOTTLE_nfhgrm_StDev	standard deviation of dissolved Yitrium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Y_D_CONC_BOTTLE_nfhgrm_SDN_Flag	SeaDataNet quality flag for dissolved Yitrium concentration from bottles on cruise KN204	unitless
La_D_CONC_BOTTLE_abyl0y	dissolved Lanthanum concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
La_D_CONC_BOTTLE_abyl0y_StDev	standard deviation of dissolved Lanthanum concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
La_D_CONC_BOTTLE_abyl0y_SDN_Flag	SeaDataNet quality flag for dissolved Lanthanum concentration from bottles on cruise KN204	unitless
Ce_D_CONC_BOTTLE_4eeu3a	dissolved Cerium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Ce_D_CONC_BOTTLE_4eeu3a_StDev	standard deviation of dissolved Cerium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Ce_D_CONC_BOTTLE_4eeu3a_SDN_Flag	SeaDataNet quality flag for dissolved Cerium concentration from bottles on cruise KN204	unitless

Pr_D_CONC_BOTTLE_i0m9rs	dissolved Praseodymium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Pr_D_CONC_BOTTLE_i0m9rs_StDev	standard deviation of dissolved Praseodymium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Pr_D_CONC_BOTTLE_i0m9rs_SDN_Flag	SeaDataNet quality flag for dissolved Praseodymium concentration from bottles on cruise KN204	unitless
Nd_D_CONC_BOTTLE_71vfrq	dissolved Neodymium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Nd_D_CONC_BOTTLE_71vfrq_StDev	standard deviation of dissolved Neodymium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Nd_D_CONC_BOTTLE_71vfrq_SDN_Flag	SeaDataNet quality flag for dissolved Neodymium concentration from bottles on cruise KN204	unitless
Sm_D_CONC_BOTTLE_cjyiud	dissolved Samarium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Sm_D_CONC_BOTTLE_cjyiud_StDev	standard deviation of dissolved Samarium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Sm_D_CONC_BOTTLE_cjyiud_SDN_Flag	SeaDataNet quality flag for dissolved Samarium concentration from bottles on cruise KN204	unitless
Eu_D_CONC_BOTTLE_4gxlzx	dissolved Europium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Eu_D_CONC_BOTTLE_4gxlzx_StDev	standard deviation of dissolved Europium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Eu_D_CONC_BOTTLE_4gxlzx_SDN_Flag	SeaDataNet quality flag for dissolved Europium concentration from bottles on cruise KN204	unitless
Gd_D_CONC_BOTTLE_xzdcx5	dissolved Gadolinium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Gd_D_CONC_BOTTLE_xzdcx5_StDev	standard deviation of dissolved Gadolinium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)

Gd_D_CONC_BOTTLE_xzdcx5_SDN_Flag	SeaDataNet quality flag for dissolved Gadolinium concentration from bottles on cruise KN204	unitless
Tb_D_CONC_BOTTLE_frdpac	dissolved Terbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Tb_D_CONC_BOTTLE_frdpac_StDev	standard deviation of dissolved Terbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Tb_D_CONC_BOTTLE_frdpac_SDN_Flag	SeaDataNet quality flag for dissolved Terbium concentration from bottles on cruise KN204	unitless
Dy_D_CONC_BOTTLE_xkeykn	dissolved Dysprosium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Dy_D_CONC_BOTTLE_xkeykn_StDev	standard deviation of dissolved Dysprosium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Dy_D_CONC_BOTTLE_xkeykn_SDN_Flag	SeaDataNet quality flag for dissolved Dysprosium concentration from bottles on cruise KN204	unitless
Ho_D_CONC_BOTTLE_rfh3ky	dissolved Holmium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Ho_D_CONC_BOTTLE_rfh3ky_StDev	standard deviation of dissolved Holmium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Ho_D_CONC_BOTTLE_rfh3ky_SDN_Flag	SeaDataNet quality flag for dissolved Holmium concentration from bottles on cruise KN204	unitless
Er_D_CONC_BOTTLE_2igl1c	dissolved Erbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Er_D_CONC_BOTTLE_2igl1c_StDev	standard deviation of dissolved Erbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Er_D_CONC_BOTTLE_2igl1c_SDN_Flag	SeaDataNet quality flag for dissolved Erbium concentration from bottles on cruise KN204	unitless
Tm_D_CONC_BOTTLE_q9bogq	dissolved Thulium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)

Tm_D_CONC_BOTTLE_q9bogq_StDev	standard deviation of dissolved Thulium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Tm_D_CONC_BOTTLE_q9bogq_SDN_Flag	SeaDataNet quality flag for dissolved Thulium concentration from bottles on cruise KN204	unitless
Yb_D_CONC_BOTTLE_xabbly	dissolved Ytterbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Yb_D_CONC_BOTTLE_xabbly_StDev	standard deviation of dissolved Ytterbium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Yb_D_CONC_BOTTLE_xabbly_SDN_Flag	SeaDataNet quality flag for dissolved Ytterbium concentration from bottles on cruise KN204	unitless
Lu_D_CONC_BOTTLE_o2y7rl	dissolved Lutetium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Lu_D_CONC_BOTTLE_o2y7rl_StDev	standard deviation of dissolved Lutetium concentration from bottles on cruise KN204	picomoles per kilogram (pmol/kg)
Lu_D_CONC_BOTTLE_o2y7rl_SDN_Flag	SeaDataNet quality flag for dissolved Lutetium concentration from bottles on cruise KN204	unitless
Y_D_CONC_FISH_irqa1k	dissolved Yitrium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Y_D_CONC_FISH_irqa1k_StDev	standard deviation of dissolved Yitrium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Y_D_CONC_FISH_irqa1k_SDN_Flag	SeaDataNet quality flag for dissolved Yitrium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
La_D_CONC_FISH_n4rciu	dissolved Lanthanum concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
La_D_CONC_FISH_n4rciu_StDev	standard deviation of dissolved Lanthanum concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
La_D_CONC_FISH_n4rciu_SDN_Flag	SeaDataNet quality flag for dissolved Lanthanum concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless

Ce_D_CONC_FISH_lbon3c	dissolved Cerium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Ce_D_CONC_FISH_lbon3c_StDev	standard deviation of dissolved Cerium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Ce_D_CONC_FISH_lbon3c_SDN_Flag	SeaDataNet quality flag for dissolved Cerium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Pr_D_CONC_FISH_iuqe6g	dissolved Praseodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Pr_D_CONC_FISH_iuqe6g_StDev	standard deviation of dissolved Praseodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Pr_D_CONC_FISH_iuqe6g_SDN_Flag	SeaDataNet quality flag for dissolved Praseodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Nd_D_CONC_FISH_daifdw	dissolved Neodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Nd_D_CONC_FISH_daifdw_StDev	standard deviation of dissolved Neodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Nd_D_CONC_FISH_daifdw_SDN_Flag	SeaDataNet quality flag for dissolved Neodymium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Sm_D_CONC_FISH_um5amy	dissolved Samarium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Sm_D_CONC_FISH_um5amy_StDev	standard deviation of dissolved Samarium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Sm_D_CONC_FISH_um5amy_SDN_Flag	SeaDataNet quality flag for dissolved Samarium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Eu_D_CONC_FISH_qdwqgc	dissolved Europium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)

Eu_D_CONC_FISH_qdwqgc_StDev	standard deviation of dissolved Europium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Eu_D_CONC_FISH_qdwqgc_SDN_Flag	SeaDataNet quality flag for dissolved Europium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Gd_D_CONC_FISH_nk1gmw	dissolved Gadolinium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Gd_D_CONC_FISH_nk1gmw_StDev	standard deviation of dissolved Gadolinium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Gd_D_CONC_FISH_nk1gmw_SDN_Flag	SeaDataNet quality flag for dissolved Gadolinium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Tb_D_CONC_FISH_2vxwr2	dissolved Terbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Tb_D_CONC_FISH_2vxwr2_StDev	standard deviation of dissolved Terbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Tb_D_CONC_FISH_2vxwr2_SDN_Flag	SeaDataNet quality flag for dissolved Terbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Dy_D_CONC_FISH_bt2ehm	dissolved Dysprosium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Dy_D_CONC_FISH_bt2ehm_StDev	standard deviation of dissolved Dysprosium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Dy_D_CONC_FISH_bt2ehm_SDN_Flag	SeaDataNet quality flag for dissolved Dysprosium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Ho_D_CONC_FISH_qhydtq	dissolved Holmium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)

Ho_D_CONC_FISH_qhydtq_StDev	standard deviation of dissolved Holmium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Ho_D_CONC_FISH_qhydtq_SDN_Flag	SeaDataNet quality flag for dissolved Holmium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Er_D_CONC_FISH_cc1dnz	dissolved Erbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Er_D_CONC_FISH_cc1dnz_StDev	standard deviation of dissolved Erbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Er_D_CONC_FISH_cc1dnz_SDN_Flag	SeaDataNet quality flag for dissolved Erbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Tm_D_CONC_FISH_acdwda	dissolved Thulium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Tm_D_CONC_FISH_acdwda_StDev	standard deviation of dissolved Thulium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Tm_D_CONC_FISH_acdwda_SDN_Flag	SeaDataNet quality flag for dissolved Thulium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Yb_D_CONC_FISH_pahssi	dissolved Ytterbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Yb_D_CONC_FISH_pahssi_StDev	standard deviation of dissolved Ytterbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Yb_D_CONC_FISH_pahssi_SDN_Flag	SeaDataNet quality flag for dissolved Ytterbium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Lu_D_CONC_FISH_2cpmme	dissolved Lutetium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)
Lu_D_CONC_FISH_2cpmme_StDev	standard deviation of dissolved Lutetium concentration from GeoFish samples on cruises KN199-04 and KN199-05	picomoles per kilogram (pmol/kg)

Lu_D_CONC_FISH_2cpmme_SDN_Flag	SeaDataNet quality flag for dissolved Lutetium concentration from GeoFish samples on cruises KN199-04 and KN199-05	unitless
Y_D_CONC_FISH_5fvso9	dissolved Yitrium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Y_D_CONC_FISH_5fvso9_StDev	standard deviation of dissolved Yitrium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Y_D_CONC_FISH_5fvso9_SDN_Flag	SeaDataNet quality flag for dissolved Yitrium concentration from GeoFish samples on cruise KN204	unitless
La_D_CONC_FISH_tpli3y	dissolved Lanthanum concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
La_D_CONC_FISH_tpli3y_StDev	standard deviation of dissolved Lanthanum concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
La_D_CONC_FISH_tpli3y_SDN_Flag	SeaDataNet quality flag for dissolved Lanthanum concentration from GeoFish samples on cruise KN204	unitless
Ce_D_CONC_FISH_yj3bee	dissolved Cerium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Ce_D_CONC_FISH_yj3bee_StDev	standard deviation of dissolved Cerium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Ce_D_CONC_FISH_yj3bee_SDN_Flag	SeaDataNet quality flag for dissolved Cerium concentration from GeoFish samples on cruise KN204	unitless
Pr_D_CONC_FISH_6r6skj	dissolved Praseodymium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Pr_D_CONC_FISH_6r6skj_StDev	standard deviation of dissolved Praseodymium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Pr_D_CONC_FISH_6r6skj_SDN_Flag	SeaDataNet quality flag for dissolved Praseodymium concentration from GeoFish samples on cruise KN204	unitless

Nd_D_CONC_FISH_5jb6zv	dissolved Neodymium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Nd_D_CONC_FISH_5jb6zv_StDev	standard deviation of dissolved Neodymium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Nd_D_CONC_FISH_5jb6zv_SDN_Flag	SeaDataNet quality flag for dissolved Neodymium concentration from GeoFish samples on cruise KN204	unitless
Sm_D_CONC_FISH_n0f071	dissolved Samarium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Sm_D_CONC_FISH_n0f071_StDev	standard deviation of dissolved Samarium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Sm_D_CONC_FISH_n0f071_SDN_Flag	SeaDataNet quality flag for dissolved Samarium concentration from GeoFish samples on cruise KN204	unitless
Eu_D_CONC_FISH_sh8rkn	dissolved Europium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Eu_D_CONC_FISH_sh8rkn_StDev	standard deviation of dissolved Europium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Eu_D_CONC_FISH_sh8rkn_SDN_Flag	SeaDataNet quality flag for dissolved Europium concentration from GeoFish samples on cruise KN204	unitless
Gd_D_CONC_FISH_dpexrq	dissolved Gadolinium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Gd_D_CONC_FISH_dpexrq_StDev	standard deviation of dissolved Gadolinium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Gd_D_CONC_FISH_dpexrq_SDN_Flag	SeaDataNet quality flag for dissolved Gadolinium concentration from GeoFish samples on cruise KN204	unitless
Tb_D_CONC_FISH_dvedon	dissolved Terbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)

Tb_D_CONC_FISH_dvedon_StDev	standard deviation of dissolved Terbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Tb_D_CONC_FISH_dvedon_SDN_Flag	SeaDataNet quality flag for dissolved Terbium concentration from GeoFish samples on cruise KN204	unitless
Dy_D_CONC_FISH_m5r8cw	dissolved Dysprosium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Dy_D_CONC_FISH_m5r8cw_StDev	standard deviation of dissolved Dysprosium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Dy_D_CONC_FISH_m5r8cw_SDN_Flag	SeaDataNet quality flag for dissolved Dysprosium concentration from GeoFish samples on cruise KN204	unitless
Ho_D_CONC_FISH_y1kfzz	dissolved Holmium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Ho_D_CONC_FISH_y1kfzz_StDev	standard deviation of dissolved Holmium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Ho_D_CONC_FISH_y1kfzz_SDN_Flag	SeaDataNet quality flag for dissolved Holmium concentration from GeoFish samples on cruise KN204	unitless
Er_D_CONC_FISH_qwojt1	dissolved Erbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Er_D_CONC_FISH_qwojt1_StDev	standard deviation of dissolved Erbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Er_D_CONC_FISH_qwojt1_SDN_Flag	SeaDataNet quality flag for dissolved Erbium concentration from GeoFish samples on cruise KN204	unitless
Tm_D_CONC_FISH_mnpj1m	dissolved Thulium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Tm_D_CONC_FISH_mnpj1m_StDev	standard deviation of dissolved Thulium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)

Tm_D_CONC_FISH_mnpj1m_SDN_Flag	SeaDataNet quality flag for dissolved Thulium concentration from GeoFish samples on cruise KN204	unitless
Yb_D_CONC_FISH_rpovml	dissolved Ytterbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Yb_D_CONC_FISH_rpovml_StDev	standard deviation of dissolved Ytterbium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Yb_D_CONC_FISH_rpovml_SDN_Flag	SeaDataNet quality flag for dissolved Ytterbium concentration from GeoFish samples on cruise KN204	unitless
Lu_D_CONC_FISH_gm7ijo	dissolved Lutetium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Lu_D_CONC_FISH_gm7ijo_StDev	standard deviation of dissolved Lutetium concentration from GeoFish samples on cruise KN204	picomoles per kilogram (pmol/kg)
Lu_D_CONC_FISH_gm7ijo_SDN_Flag	SeaDataNet quality flag for dissolved Lutetium concentration from GeoFish samples on cruise KN204	unitless

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Instruments

Dataset-specific Instrument Name	GeoFish
Generic Instrument Name	GeoFish-type Near-surface Towfish Sampler
Dataset-specific Description	Near surface water samples were collected using an underway towedfish pumped seawater system (Bruland et al., 2005) with samples filtered through sequential 0.45 um Osmonics and 0.2 um Polycarbonate (PCTE) cartridge filters.
Generic Instrument Description	This term describes a family of custom-designed, trace-metal-clean, near-surface seawater sampling systems based on the 'GeoFish' design developed by Geoffrey Smith and Ken Bruland at the University of California, Santa Cruz (UCSC). The systems consist of a weighted towed body or torpedo, clean intake tubing, a shipboard pneumatic pump, and a sampling manifold. They are deployed alongside a moving vessel, outside the ship's wake, with the intake typically positioned approximately 1 to 3 meters below the sea surface. Seawater is continuously pumped through the clean tubing to the ship for filtered and unfiltered sampling and, in some applications, direct connection to analytical instruments. This term includes the original GeoFish sampler, Super-GeoFISH variants, and subsequent modified towfish systems used on U.S. GEOTRACES cruises. These systems share the same basic sampling principle but may differ in body construction, depressor or stabilization design, deployment hardware, tubing, pump configuration, flow rate, and sampling manifold. The systems have been used for trace-metal, nutrient, biological, and other chemical measurements in both GEOTRACES and non-GEOTRACES studies, including Bruland et al. (2005).

Dataset-specific Instrument Name	Bottle
Generic Instrument Name	GO-FLO Teflon Trace Metal Bottle
Dataset-specific Description	Filtered water was collected in 125 mL HDPE bottles (Nalgene) that had been precleaned by soaking in hot 1.2 M HCl (reagent grade) for at least 8 h with subsequent thorough rinsing with ultrapure distilled deionized water (Barnstead E-pure).
Generic Instrument Description	GO-FLO Teflon-lined Trace Metal free sampling bottles are used for collecting water samples for trace metal, nutrient and pigment analysis. The GO-FLO sampling bottle is designed specifically to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	ICP-MS
Generic Instrument Name	Inductively Coupled Plasma Mass Spectrometer
Dataset-specific Description	The extracted samples were analyzed using a Thermo-Fisher high resolution ICP-MS with an Apex-FAST high efficiency sample introduction system with Spiro desolvator (Elemental Scientific, Inc.). The instrument was operated in low resolution.
Generic Instrument Description	An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer.

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Deployments

KN199-04

Website	https://www.bco-dmo.org/deployment/58066
Platform	R/V Knorr
Report	http://bcodata.whoi.edu/US_GEOTRACES/AtlanticSection/Cruise_Report_for_Knorr_199_Final_v3.pdf
Start Date	2010-10-15
End Date	2010-11-04
Description	This cruise constitutes the first survey section as part of the U.S. participation in an international program named GEOTRACES. Funding: NSF OCE award 0926423 Science Objectives: To obtain state of the art trace metal and isotope measurements on a suite of samples taken on a mid-latitude zonal transect of the North Atlantic. In particular, sampling targeted the oxygen minimum zone extending off the west African coast near Mauritania, the TAG hydrothermal field, and the western boundary current system along Line W. For additional information, please refer to the GEOTRACES program Web site (https://www.geotraces.org/) for overall program objectives and a summary of properties measured. Science Activities include seawater sampling via GoFLO and Niskin carousels, in situ pumping (and filtration), CTDO2 and transmissometer sensors, underway pumped sampling of surface waters, and collection of aerosols and rain. Hydrography, CTD and nutrient measurements were supported by the Ocean Data Facility (J. Swift) at Scripps Institution of Oceanography and funded through NSF Facilities. They provided an additional CTD rosette system along with nephelometer and LADCP. A trace metal clean Go-Flo Rosette and winch were provided by the group at Old Dominion University (G. Cutter) along with a towed underway pumping system. Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KN199-04 Other Relevant Links: List of cruise participants: [PDF] Cruise track: JPEG image (from Woods Hole Oceanographic Institution, vessel operator) ADCP data are available from the Currents ADCP group at the University of Hawaii: KN199-04 ADCP

KN199-05

Website	https://www.bco-dmo.org/deployment/58142
Platform	R/V Knorr
Start Date	2010-11-08
End Date	2010-11-26
Description	KN199-05 is the completion of the US GEOTRACES Zonal North Atlantic Survey Section cruise originally planned for late Fall 2010 from Lisboa, Portugal to Woods Hole, MA, USA. Due to engine failure, the science activities scheduled for the KN199-04 cruise were canceled on 2 November 2010. On 4 November the R/V Knorr put in at Porto Grande, Cape Verde (ending KN199 leg 4) and was scheduled to depart November 8, under the direction of Acting Chief Scientist Oliver Wurl of Old Dominion University. The objective of KN199 leg 5 (KN199-05) was to carry the vessel in transit to Charleston, SC while conducting abbreviated science activities originally planned for KN199-04. Funding: NSF OCE award 0926423 Science Objectives: To obtain state of the art trace metal and isotope measurements on a suite of samples taken on a mid-latitude zonal transect of the North Atlantic. In particular, sampling targeted the oxygen minimum zone extending off the west African coast near Mauritania, the TAG hydrothermal field, and the western boundary current system along Line W. For additional information, please refer to the GEOTRACES program Web site (https://www.geotraces.org/) for overall program objectives and a summary of properties measured. Science Activities include seawater sampling via GoFLO and Niskin carousels, in situ pumping (and filtration), CTDO2 and transmissometer sensors, underway pumped sampling of surface waters, and collection of aerosols and rain. Hydrography, CTD and nutrient measurements were supported by the Ocean Data Facility (J. Swift) at Scripps Institution of Oceanography and funded through NSF Facilities. They provided an additional CTD rosette system along with nephelometer and LADCP. A trace metal clean Go-Flo Rosette and winch were provided by the group at Old Dominion University (G. Cutter) along with a towed underway pumping system. Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KN199-05 Other Relevant Links: List of cruise participants: [PDF] ADCP data are available from the Currents ADCP group at the University of Hawaii: KN199-05 ADCP

KN204-01

Website	https://www.bco-dmo.org/deployment/58786
Platform	R/V Knorr
Report	http://bcodata.whoi.edu/US_GEOTRACES/AtlanticSection/STS_Prelim_GT11_Doc.pdf
Start Date	2011-11-06
End Date	2011-12-11
Description	The US GEOTRACES North Atlantic cruise aboard the R/V Knorr completed the section between Lisbon and Woods Hole that began in October 2010 but was rescheduled for November-December 2011. The R/V Knorr made a brief stop in Bermuda to exchange samples and personnel before continuing across the basin. Scientists disembarked in Praia, Cape Verde, on 11 December. The cruise was identified as KN204-01A (first part before Bermuda) and KN204-01B (after the Bermuda stop). However, the official deployment name for this cruise is KN204-01 and includes both part A and B. Science activities included: ODF 30 liter rosette CTD casts, ODU Trace metal rosette CTD casts, McLane particulate pump casts, underway sampling with towed fish and sampling from the shipboard "uncontaminated" flow-through system. Full depth stations are shown in the accompanying figure (see below). Additional stations to sample for selected trace metals to a depth of 1000 m are not shown. Standard stations are shown in red (as are the ports) and "super" stations, with extra casts to provide large-volume samples for selected parameters, are shown in green. Station spacing is concentrated along the western margin to evaluate the transport of trace elements and isotopes by western boundary currents. Stations across the gyre will allow scientists to examine trace element supply by Saharan dust, while also contrasting trace element and isotope distributions in the oligotrophic gyre with conditions near biologically productive ocean margins, both in the west, to be sampled now, and within the eastern boundary upwelling system off Mauritania, sampled last year. Funding: The cruise was funded by NSF OCE awards 0926204, 0926433 and 0926659. Additional cruise information is available from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/KN204-01 Other Relevant Links: ADCP data are available from the Currents ADCP group at the University of Hawaii at the links below: KN204-01A (part 1 of 2011 cruise; Woods Hole, MA to Bermuda) KN204-01B (part 2 of 2011 cruise; Bermuda to Cape Verde)

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Project Information

U.S. GEOTRACES North Atlantic Transect (GA03) (U.S. GEOTRACES NAT)

Website: https://www.geotraces.org/

Coverage: Subtropical western and eastern North Atlantic Ocean (GA03)

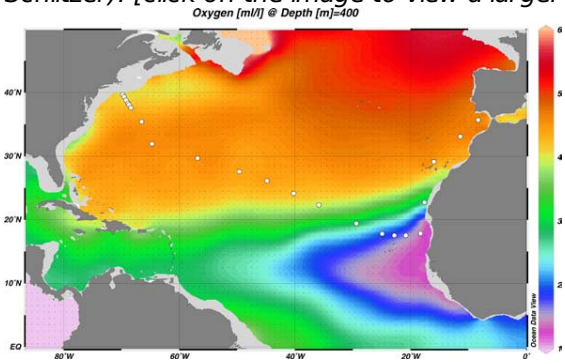
Much of this text appeared in an article published in OCB News, October 2008, by the OCB Project Office.

The first U.S. GEOTRACES Atlantic Section will be specifically centered around a sampling cruise to be carried out in the North Atlantic in 2010. Ed Boyle (MIT) and Bill Jenkins (WHOI) organized a three-day planning workshop that was held September 22-24, 2008 at the Woods Hole Oceanographic Institution. The main goal of the workshop, sponsored by the National Science Foundation and the U.S. GEOTRACES Scientific Steering Committee, was to design the implementation plan for the first U.S. GEOTRACES Atlantic Section. The primary cruise design motivation was to improve knowledge of the sources, sinks and internal cycling of Trace Elements and their Isotopes (TEIs) by studying their distributions along a section in the North Atlantic (Figure 1). The North Atlantic has the full suite of processes that affect TEIs, including strong meridional advection, boundary scavenging and source effects, aeolian deposition, and the salty Mediterranean Outflow. The North Atlantic is particularly important as it lies at the "origin" of the global Meridional Overturning Circulation.

It is well understood that many trace metals play important roles in biogeochemical processes and the carbon cycle, yet very little is known about their large-scale distributions and the regional scale processes that affect them. Recent advances in sampling and analytical techniques, along with advances in our understanding of their

roles in enzymatic and catalytic processes in the open ocean provide a natural opportunity to make substantial advances in our understanding of these important elements. Moreover, we are motivated by the prospect of global change and the need to understand the present and future workings of the ocean's biogeochemistry. The GEOTRACES strategy is to measure a broad suite of TEIs to constrain the critical biogeochemical processes that influence their distributions. In addition to these "exotic" substances, more traditional properties, including macronutrients (at micromolar and nanomolar levels), CTD, bio-optical parameters, and carbon system characteristics will be measured. The cruise starts at Line W, a repeat hydrographic section southeast of Cape Cod, extends to Bermuda and subsequently through the North Atlantic oligotrophic subtropical gyre, then transects into the African coast in the northern limb of the coastal upwelling region. From there, the cruise goes northward into the Mediterranean outflow. The station locations shown on the map are for the "fulldepth TEI" stations, and constitute approximately half of the stations to be ultimately occupied.

Figure 1. The proposed 2010 Atlantic GEOTRACES cruise track plotted on dissolved oxygen at 400 m depth. Data from the World Ocean Atlas (Levitus et al., 2005) were plotted using Ocean Data View (courtesy Reiner Schlitzer). [click on the image to view a larger version]

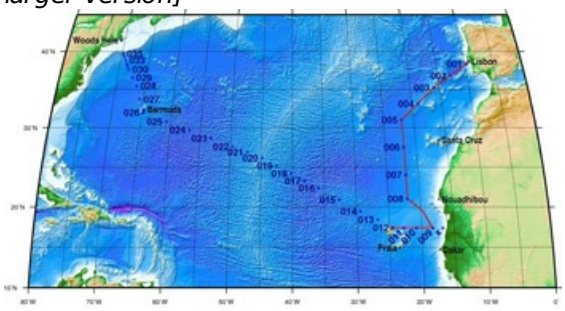


Hydrography, CTD and nutrient measurements will be supported by the Ocean Data Facility (J. Swift) at Scripps Institution of Oceanography and funded through NSF Facilities. They will be providing an additional CTD rosette system along with nephelometer and LADCP. A trace metal clean Go-Flo Rosette and winch will be provided by the group at Old Dominion University (G. Cutter) along with a towed underway pumping system.

The North Atlantic Transect cruise began in 2010 with KN199 leg 4 (station sampling) and leg 5 (underway sampling only) (Figure 2).

KN199-04 Cruise Report (PDF)

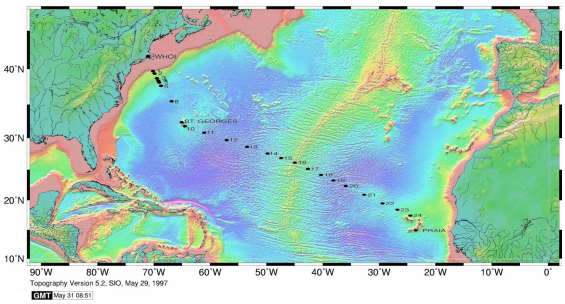
Figure 2. The red line shows the cruise track for the first leg of the US Geotraces North Atlantic Transect on the R/V Knorr in October 2010. The rest of the stations (beginning with 13) will be completed in October-December 2011 on the R/V Knorr (courtesy of Bill Jenkins, Chief Scientist, GNAT first leg). [click on the image to view a larger version]



The section completion effort resumed again in November 2011 with KN204-01A,B (Figure 3).

KN204-01A,B Cruise Report (PDF)

Figure 3. Station locations occupied on the US Geotraces North Atlantic Transect on the R/V Knorr in November 2011. [click on the image to view a larger version]



Data from the North Atlantic Transect cruises are available under the Datasets heading below, and consensus values for the SAFe and North Atlantic GEOTRACES Reference Seawater Samples are available from the GEOTRACES Program Office: Standards and Reference Materials

ADCP data are available from the Currents ADCP group at the University of Hawaii at the links below:
KN199-04 (leg 1 of 2010 cruise; Lisbon to Cape Verde)
KN199-05 (leg 2 of 2010 cruise; Cape Verde to Charleston, NC)
KN204-01A (part 1 of 2011 cruise; Woods Hole, MA to Bermuda)
KN204-01B (part 2 of 2011 cruise; Bermuda to Cape Verde)

Participation in October 2011 US GEOTRACES North Atlantic Zonal Section Continuation Cruise (NAT_Continue)

Coverage: North Atlantic: Lisbon to Cape Verde Is. (2010) and Woods Hole to Bermuda to Cape Verde Is. (2011).

The U.S. GEOTRACES North Atlantic zonal section cruise was scheduled for 15 October through 5 December 2010. Because of a major irresolvable mechanical failure of the ship's propulsion system, the expedition had to be terminated in the Cape Verde Islands on 4 November after completing about one third of the planned track. This required on-the-spot changes in return travel for all sea-going investigators as well as in shipping arrangements for all their samples and equipment. The funds requested in this proposal address the PI's need to cover a graduate student and purchase supplies associated with his participation in the continuation of the North Atlantic section cruise scheduled for autumn 2011. The additional funds for the graduate student would cover the effort to prepare for a second cruise whereas the supply request is to replace those lost during the first cruise. The proposed research would significantly improve our knowledge of cross margin exchange of trace elements, as well as the impact of atmospheric inputs on ocean chemistry. (From award abstract)

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Program Information

U.S. GEOTRACES (U.S. GEOTRACES)

Website: http://www.geotraces.org/

Coverage: Global

GEOTRACES is a SCOR sponsored program; and funding for program infrastructure development is provided by the U.S. National Science Foundation.

GEOTRACES gained momentum following a special symposium, S02: Biogeochemical cycling of trace elements and isotopes in the ocean and applications to constrain contemporary marine processes (GEOSECS II), at a 2003 Goldschmidt meeting convened in Japan. The GEOSECS II acronym referred to the Geochemical Ocean Section Studies To determine full water column distributions of selected trace elements and isotopes, including

their concentration, chemical speciation, and physical form, along a sufficient number of sections in each ocean basin to establish the principal relationships between these distributions and with more traditional hydrographic parameters;

* To evaluate the sources, sinks, and internal cycling of these species and thereby characterize more completely the physical, chemical and biological processes regulating their distributions, and the sensitivity of these processes to global change; and

* To understand the processes that control the concentrations of geochemical species used for proxies of the past environment, both in the water column and in the substrates that reflect the water column.

GEOTRACES will be global in scope, consisting of ocean sections complemented by regional process studies. Sections and process studies will combine fieldwork, laboratory experiments and modelling. Beyond realizing the scientific objectives identified above, a natural outcome of this work will be to build a community of marine scientists who understand the processes regulating trace element cycles sufficiently well to exploit this knowledge reliably in future interdisciplinary studies.

Expand "Projects" below for information about and data resulting from individual US GEOTRACES research projects.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0927951
NSF Division of Ocean Sciences (NSF OCE)	OCE-1137851

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