Seawater Nd isotopes and concentrations from the US-GEOTRACES North Atlantic zonal transect (NAZT), 2010 and 2011 on cruises KN199-04 and KN204-01, analyzed by USC

Website: https://www.bco-dmo.org/dataset/3832
Data Type: Cruise Results
Version: 9
Version Date: 2019-11-04

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

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

Contributors	Affiliation	Role
Goldstein, Steven L.	Lamont-Doherty Earth Observatory (LDEO)	Principal Investigator
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Abstract
Seawater Nd isotopes and concentrations from the US-GEOTRACES North Atlantic zonal transect (NAZT), 2010 and 2011 on cruises KN199-04 and KN204-01, analyzed by USC.

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Coverage

Spatial Extent: **N**:39.7014 **E**:-9.6601 **S**:17.3487 **W**:-69.8644
Temporal Extent: 2010-10-16 - 2011-12-10

Dataset Description

These data are from the collaboration of three different institutes: The University of South Carolina (USC).

Please contact the PI for further information.

See also associated data from the at Manoa (UH) and Lamont-Doherty Earth Observatory (LDEO) of Columbia University.

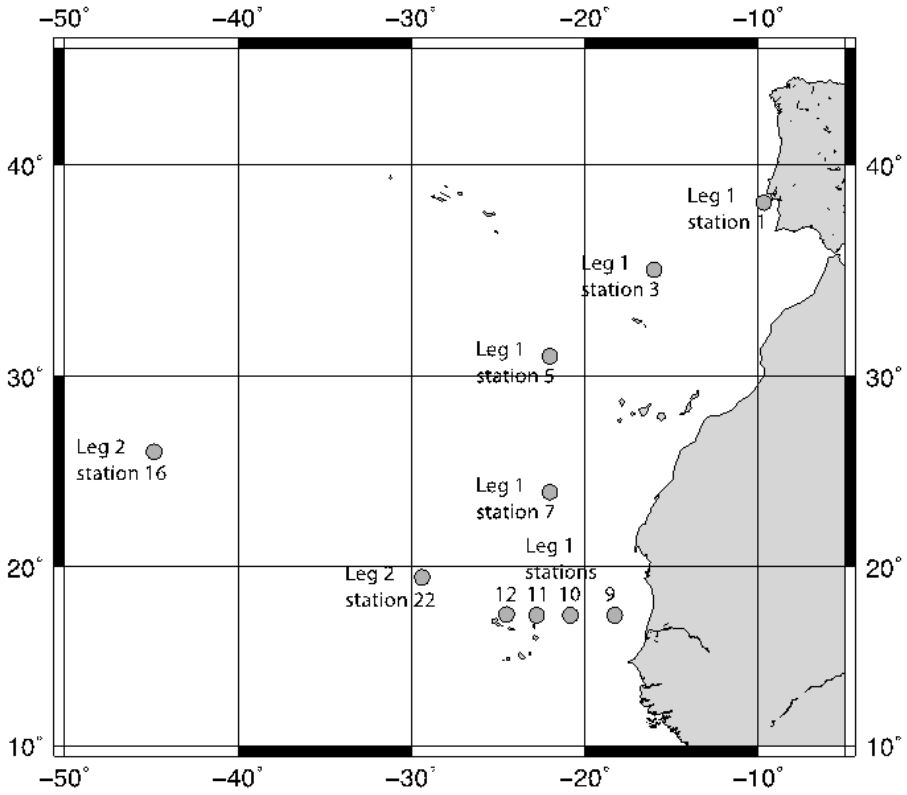
Methods & Sampling

Methodology: A detailed description can be found in Stichel et al. (2015). See the links below for summaries of the described methodology from the paper.

KN199-04 Methodology (pdf)

KN204-01 Methodology (pdf)

Fig. 1: Sample locations for the Intermediate Data Product.



References: (References listed in the data are codes [1], [2], or [3], corresponding with the following publications/manuscripts)

[1] Stichel, T., Hartman, A.E., Duggan, B., Goldstein, S.L., Scher, H., Pahnke, K., 2015. Separating biogeochemical cycling of neodymium from water mass mixing in the Eastern North Atlantic. Earth Planet. Sci. Lett. 412, 245–260. doi:10.1016/j.epsl.2014.12.008

[2] Hartman, A., Goldstein, S., Pena Gonzalez, L. D., Duggan, B., Pahnke, K., Scher, H., Stichel, T., in prep. Seawater neodymium composition in the open ocean North Atlantic: water mass signatures and transport.

[3] Duggan, B., Hartman, A.E., Stichel, T., Goldstein, S.L., Pahnke, K., Bizimis, M., Scher, H., in prep. Neodymium Concentrations and Isotopic Signature of the Deep Western Boundary Current Across Line W

Table 1: Summary of the procedures applied in the involved laboratories of University of Hawaii at Mano (UH), Lamont-Doherty Earth Observatory (LDEO) and University of South Carolina (USC).

Step	UH	LDEO	USC
Pre-concentration	Spiked with ^{146}Nd prior to co-precipitation with FeOOH (~20mg Fe per sample)	Spiked with ^{150}Nd prior to co-precipitation with FeOOH (~20mg Fe per sample)	Nd and REE extraction with C18 cartridges, not spiked
Chromatographic separation	2-step separation: 1. 1.4ml AG50W-X8 (200-400µm) as primary column. 2. 0.7ml AG50W-X8 (200-400µm) with Alpha-HIBA to purify Nd. 3. ~100µl TRU-Spec column for removal of any remaining Alpha-HIBA in samples.	2-step separation: 1. 100µl RE-Spec (100-150µm) as primary column. 2. 0.7ml AG50W-X8 (200-400µm) with Alpha-HIBA to purify Nd.	1-step separation: 2ml LN-Spec (50-100µm) for Nd purification. No primary column needed because major ions were removed during pre-concentration
Mass spectrometry	VG-Sector TIMS, NdO+, spiked for simultaneous isotope dilution and composition analysis	VG-Sector54 TIMS, NdO+, spiked for simultaneous isotope dilution and composition analysis	Thermo Neptune Plus MC-ICPMS
Other			Concentrations were determined on a previously separated 500ml aliquot by isotope dilution

Data Processing Description

Data Processing:
The measured 143Nd/144Nd isotope ratios were normalized to those of the JNdi-1 Nd standard (0.512115,

Tanaka et al., 2000). Please see attached methodology files for further information on the data processing.

BCO-DMO Processing Notes:
- Added the sample_GEOTRC column by copying the original sample column and removing the '_2' from sample duplicates.
- Added Cast_ISO_DateTime_UTC from the original date and time fields.

SUMMARY OF CORRECTIONS MADE TO SUBMITTED DATA:

2017-07-17: parameter descriptions revised as per request by R. Anderson: ND_143_ND_144RATIO and int_ND_143_ND_144RATIO.

version 8: The data for version 8 (April 2016) completely replaced those from version 7.
- The quality flag scheme was changed in accordance with ODV.
- New parameters: EPSILON_Nd, EPSILON_ND_FLAG_W, EPSILON_ND_2SD, Instrument, and Reference were added which are described in the documentation.
- Column cruise_part was removed.
- Version 8b: changed quality flags for KN204-01, stations 3 and 8 from 0 to 2

- 07 March 2013: Made the following corrections after consulting with dataset scientist:

KN199-04
-- Changed cast number of event 3176 from 2 to 8.
-- Changed cast number of event 3169 from 8 to 2.
-- Changed event number of KN199-04 station 3 cast 6 from 2059 to 2061.
-- Changed event number of KN199-04 station 7 cast 6 from 2107 to 2132.
-- Changed event number of KN199-04 station 9 cast 3 from 2059 to 2165.
-- Changed event number of KN199-04 station 10 cast 6 from 2191 to 2194.
-- Changed event number of KN199-04 station 11 cast 6 from 2206 to 2208.
-- Changed bottle number of sample #5393 from 5 to 4 (station 5, cast 6).
-- Changed bottle number of sample #5394 from 4 to 3 (station 5, cast 6).
-- Changed time of event #2024 from 2129 to 1202.

KN204-01
-- Changed bottle number of sample #7955 from 8 to 9 (station 22, cast 4).

Additional data and revisions were served 19 Sept. 2013.

version 9: The last version (8b) of the dataset was split into three datasets by LAB (LDEO, UH, and USC).
See also UH dataset: https://www.bco-dmo.org/dataset/780664
LDEO dataset: https://www.bco-dmo.org/dataset/780582

Additional GEOTRACES Processing:
After the data were submitted to the International Data Management Office, BODC, the office noticed that important identifying information was missing in many datasets. With the agreement of BODC and the US GEOTRACES lead PIs, BCO-DMO added standard US GEOTRACES information, such as the US GEOTRACES event number, to each submitted dataset lacking this information. To accomplish this, BCO-DMO compiled a 'master' dataset composed of the following parameters: station_GEOTRC, cast_GEOTRC (bottle and pump data only), event_GEOTRC, sample_GEOTRC, sample_bottle_GEOTRC (bottle data only), bottle_GEOTRC (bottle data only), depth_GEOTRC_CTD (bottle data only), depth_GEOTRC_CTD_rounded (bottle data only), BTL_ISO_DateTime_UTC (bottle data only), and GeoFish_id (GeoFish data only). This added information will facilitate subsequent analysis and inter comparison of the datasets.

Bottle parameters in the master file were taken from the GT-C_Bottle_GT10, GT-C_Bottle_GT11, ODF_Bottle_GT10, and ODF_Bottle_GT11 datasets. Non-bottle parameters, including those from GeoFish tows, Aerosol sampling, and McLane Pumps, were taken from the Event_Log_GT10 and Event_Log_GT11 datasets. McLane pump cast numbers missing in event logs were taken from the Particulate Th-234 dataset submitted by Ken Buesseler.

A standardized BCO-DMO method (called "join") was then used to merge the missing parameters to each US GEOTRACES dataset, most often by matching on sample_GEOTRC or on some unique combination of other parameters.

If the master parameters were included in the original data file and the values did not differ from the master file, the original data columns were retained and the names of the parameters were changed from the PI-submitted

names to the standardized master names. If there were differences between the PI-supplied parameter values and those in the master file, both columns were retained. If the original data submission included all of the master parameters, no additional columns were added, but parameter names were modified to match the naming conventions of the master file.

See the dataset parameters documentation for a description of which parameters were supplied by the PI and which were added via the join method.

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Data Files

File
Nd_GT10-11_v8b_joined.csv (Comma Separated Values (.csv), 19.62 KB) MD5:7d4455f08eb200d0b44b355727bf3b48 Primary data file for dataset ID 3832

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Supplemental Files

File
KN199-4 DATASET description Metadata for GDAC filename: data_desc_GDAC_Stichel_199-04.pdf (Portable Document Format (.pdf), 453.72 KB) MD5:1030eae374b4abdb421b8524491025c7 KN199-4 DATASET description Metadata for GDAC
KN204-1 DATASET description Metadata for GDAC filename: data_desc_GDAC_Stichel_204-01.pdf (Portable Document Format (.pdf), 442.37 KB) MD5:877f9c034458c9b0fee6d13699484a66 KN204-1 DATASET description Metadata for GDAC

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Related Publications

Antle, R.(2013). Tidal Flux of Trace Metals and Rare Earth Elements in a Barrier Island Salt Marsh. (Master's thesis). See https://scholarcommons.sc.edu/etd/1317
Methods

Basak, C., Pahnke, K., Frank, M., Lamy, F., & Gersonde, R. (2015). Neodymium isotopic characterization of Ross Sea Bottom Water and its advection through the southern South Pacific. Earth and Planetary Science Letters, 419, 211–221. doi:10.1016/j.epsl.2015.03.011
Methods

Jacobsen, S. B., & Wasserburg, G. J. (1980). Sm-Nd isotopic evolution of chondrites. Earth and Planetary Science Letters, 50(1), 139–155. doi:10.1016/0012-821x(80)90125-9 https://doi.org/10.1016/0012-821X(80)90125-9
Methods

Lambelet, M., van de Flierdt, T., Crocket, K., Rehkämper, M., Kreissig, K., Coles, B., … Steinfeldt, R. (2016). Neodymium isotopic composition and concentration in the western North Atlantic Ocean: Results from the GEOTRACES GA02 section. Geochimica et Cosmochimica Acta, 177, 1–29. doi:10.1016/j.gca.2015.12.019
Methods

Pahnke, K., van de Flierdt, T., Jones, K. M., Lambelet, M., Hemming, S. R., & Goldstein, S. L. (2012). GEOTRACES intercalibration of neodymium isotopes and rare earth element concentrations in seawater and suspended particles. Part 2: Systematic tests and baseline profiles. Limnology and Oceanography: Methods, 10(4), 252–269. doi:10.4319/lom.2012.10.252
Methods

Pin, C., & Zalduegui, J. S. (1997). Sequential separation of light rare-earth elements, thorium and uranium by miniaturized extraction chromatography: Application to isotopic analyses of silicate rocks. Analytica Chimica Acta, 339(1-2), 79–89. doi:10.1016/s0003-2670(96)00499-0 https://doi.org/10.1016/S0003-2670(96)00499-0
Methods

Shabani, M. B., Akagi, T., & Masuda, A. (1992). Preconcentration of trace rare-earth elements in seawater by complexation with bis(2-ethylhexyl) hydrogen phosphate and 2-ethylhexyl dihydrogen phosphate adsorbed on a C18 cartridge and determination by inductively coupled plasma mass spectrometry. Analytical Chemistry, 64(7), 737–743. doi:10.1021/ac00031a008
Methods

Stichel, T., Hartman, A. E., Duggan, B., Goldstein, S. L., Scher, H., & Pahnke, K. (2015). Separating biogeochemical cycling of neodymium from water mass mixing in the Eastern North Atlantic. Earth and Planetary Science Letters, 412, 245–260. doi:10.1016/j.epsl.2014.12.008
Methods

Stichel, T., Pahnke, K., Duggan, B., Goldstein, S. L., Hartman, A. E., Paffrath, R., & Scher, H. D. (2018). TAG Plume: Revisiting the Hydrothermal Neodymium Contribution to Seawater. Frontiers in Marine Science, 5. doi:10.3389/fmars.2018.00096
Results

Tanaka, T., Togashi, S., Kamioka, H., Amakawa, H., Kagami, H., Hamamoto, T., … Dragusanu, C. (2000). JNdi-1: a neodymium isotopic reference in consistency with LaJolla neodymium. Chemical Geology, 168(3-4), 279–281. doi:10.1016/s0009-2541(00)00198-4 https://doi.org/10.1016/S0009-2541(00)00198-4
Methods

Van de Flierdt, T., Pahnke, K., Amakawa, H., Andersson, P., Basak, C., Coles, B., Colin, C., Crocket, K., Frank, M. Frank, N., Goldstein, S., Goswami, V., Haley, B., Hathorne, E., Hemming, S., Henderson, G., Jeandel, C.… Yang, J. (2012). GEOTRACES intercalibration of neodymium isotopes and rare earth element concentrations in seawater and suspended particles. Part 1: reproducibility of results for the international intercomparison. Limnology and Oceanography: Methods, 10(4), 234–251. doi:10.4319/lom.2012.10.234
Methods

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Parameters

Parameter	Description	Units
cruise_id	Official cruise identifier	unitless
cruise_name	agreed nomenclature on cruise section during ODU-GEOTRACES workshop in March 2013	unitless
station_GEOTRC	station number; provided in original data submission	unitless
depth_ctd	sampling depth of CTD; also added are depths of surface sampled by GeoFish. Values provided by PI.	meters
depth_GEOTRC_CTD_round	sampling depth rounded to nearest meter	meters
cast_GEOTRC	cast number	unitless
event_GEOTRC	event number; provided in original data submission	unitless

date	date of cast; UTC	yyyymmdd
time	time of collection; UTC	HHMM
BTL_ISO_DateTime_UTC	Date and time (UTC) variable recorded at the bottle sampling time in ISO compliant format. Values were added from the intermediate US GEOTRACES master file (see Processing Description).	YYYY-MM-DDTHH:MM:SS[.xx][+/-TZ]
lat	latitude; North is positive.Values were added from the intermediate US GEOTRACES master file (see Processing Description).	decimal degrees
lon	longitude; East is positive.Values were added from the intermediate US GEOTRACES master file (see Processing Description).	decimal degrees
sample_GEOTRC	GEOTRACES sample number; provided in original data submission. Values were added from the intermediate US GEOTRACES master file (see Processing Description) and match those provided by PI.	unitless
ND_143_ND_144RATIO	Final atom ratio of 143Nd/144Nd after correcting mass bias and instrumental offset	unitless
ND_143_ND_144_FLAG_W	Quality flag: Flag 0: good value; Flag 1: no value or unknown value; Flag 2: replacement considered good value; Flag 4: not trusted; -999: missing value	unitless
int_ND_143_ND_144RATIO	Standard error of the mean using standard deviation divided by the square root of ratios in one measurement (e.g. UH used normally 378 ratios for one measurement)	unitless
EPSILON_Nd	final 143Nd/144Nd normalized to 0.512638 (143Nd1/44Nd of the Chondritic Uniform Reservoir in Jacobsen and Wasserburg - 1980) in parts per 10000.	parts per 10000
EPSILON_ND_FLAG_W	Quality flag: Flag 0: good value; Flag 1: no value or unknown value; Flag 2: replacement considered good value; Flag 4: not trusted; -999: missing value	unitless
EPSILON_ND_2SD	2 standard deviations of the repeatedly measured standards during the analysis	parts per 10000
diss_Nd_pmol_kg	dissolved Nd concentration	pmol/kg

REE_ND_UH_FLAG_W	Quality flag: Flag 0: good value; Flag 1: no value or unknown value; Flag 2: replacement considered good value; Flag 4: not trusted; -999: missing value	unitless
LAB	the lab group that analyzed the sample: LDEO = Lamont-Doherty Earth Observatory: UH = Univ. of Hawaii; USC = Univ. of South Carolina	unitless
Instrument	instrument used for analysis: TIMS: Thermal ionization mass spectrometer (VG-Sector (UH) or VG-Sector54 (LDEO)); ICPMS: Multi-Collector Inductively Coupled Mass Spectrometer (NeptunePlus)	unitless
Reference	Publication reference; see Description for details	unitless

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird
Generic Instrument Name	CTD Sea-Bird
Dataset-specific Description	SeaBird CTD, oxygen, fluorescence and transmissometer sensors were attached to the frame in stainless steel or anodized aluminum housings.
Generic Instrument Description	A Conductivity, Temperature, Depth (CTD) sensor package from SeaBird Electronics. This instrument designation is used when specific make and model are not known or when a more specific term is not available in the BCO-DMO vocabulary. Refer to the dataset-specific metadata for more information about the specific CTD used. More information from: http://www.seabird.com/

Dataset-specific Instrument Name	GeoFish
Generic Instrument Name	GeoFish-type Near-surface Towfish Sampler
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	Mass Spectrometer
Generic Instrument Name	Mass Spectrometer
Dataset-specific Description	Neodymium was measured as NdO+ on a VG TIMS Sector (at UH) and VG TIMS Sector54 (at LDEO). At USC, the Nd isotope composition was measured on a Thermo Neptune Plus MC-ICPMS.
Generic Instrument Description	General term for instruments used to measure the mass-to-charge ratio of ions; generally used to find the composition of a sample by generating a mass spectrum representing the masses of sample components.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	30L Niskin bottles with Nylon-coated internal stainless steel springs and Viton o-rings, mounted on a powder-coated aluminum frame.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

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Deployments

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)

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

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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)

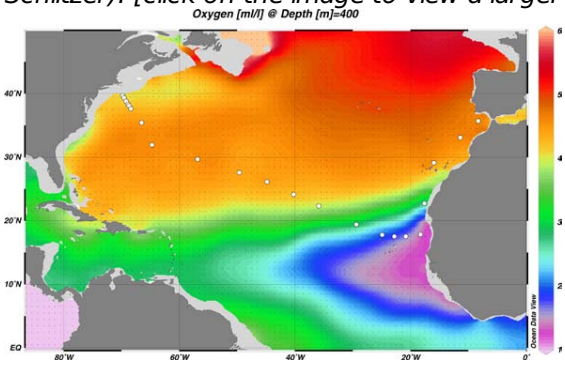
Much of this text appeared in an article published in OCB News, October 2008, by the OCB Project Office.

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]

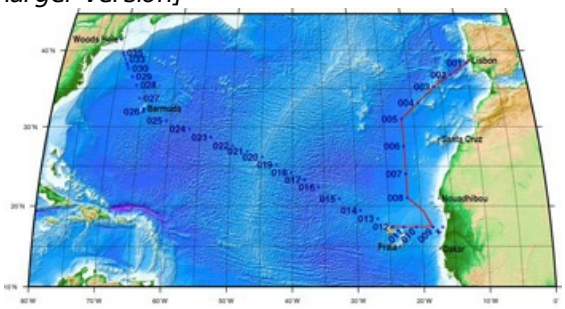


Hydrography, CTD and nutrient measurements will be supported by the Ocean Data Facility (J. Swift) at Scripps Institution of Oceanography and funded through NSF Facilities. They will be providing an additional CTD rosette system along with nephelometer and LADCP. A trace metal clean Go-Flo Rosette and 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)

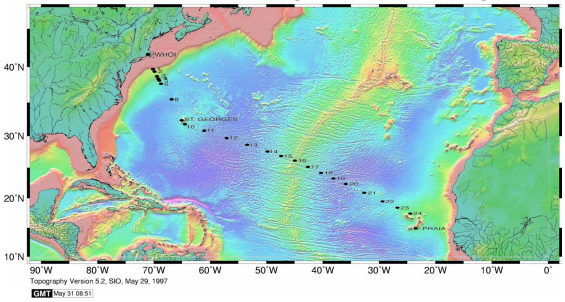
Figure 2. The red line shows the cruise track for the first leg of the US Geotraces North Atlantic Transect on the R/V Knorr in October 2010. The rest of the stations (beginning with 13) will be completed in October-December 2011 on the R/V Knorr (courtesy of Bill Jenkins, Chief Scientist, GNAT first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

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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-0927241
NSF Division of Ocean Sciences (NSF OCE)	OCE-0928409
NSF Division of Ocean Sciences (NSF OCE)	OCE-0926981

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