NCBI Accessions for 16S rRNA clone libraries made with bacterial 8F and 519R primers collected on R/V Knorr KN192-05 in the South Atlantic subtropical gyre and Benguela upwelling region from November to December 2007 (CoFeMUG project)

Website: https://www.bco-dmo.org/dataset/3443
Version: 10 March 2011
Version Date: 2011-03-10

Project
» Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre (GAc01) (CoFeMUG)

Programs
» U.S. GEOTRACES (U.S. GEOTRACES)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

NCBI Accessions for 16S rRNA clone libraries made with bacterial 8F and 519R primers. GenBank Accession: GU460426-GU461274.

Reference:
Morris, R. M., B. Nunn, C. Frazar, D. Goodlett, Y.S. Ting and G. Rocap. 2010. Comparative metaproteomics reveals ocean-scale shifts in microbial nutrient utilization and energy transduction ISME Journal 4:673-685

Methods & Sampling

Microorganisms were concentrated from large volume (100-200 l) surface seawater samples (5-8 m) collected from either a Niskin rosette or a surface pump. We targeted the < 0.8 um size fraction to obtain the same bacterioplankton community used for GOS shotgun sequencing (Rusch et al., 2007). All concentrations were performed in a 50 l polystyrene reservoir using a Pellicon 2 cassette tangential flow filtration system equipped with one 30kD Biomax Polyethersulfone cassette (Millipore Corporation, Billerica, MA, USA). Seawater was continuously added to the concentration reservoir until cell densities reached ~10^8 cells/ml. In all, 100-200 ml of cell concentrate was obtained in 1.5-3h. Concentrated cells were flash frozen in liquid nitrogen and stored at -80 C until further processing on shore.

A cell pellet was prepared from each tangential flow filtration concentrated sample by centrifugation at 4 C for 60 min (17 000 g). The supernatant was discarded and cell pellets were resuspended in 3 ml of 20 mM Tris

buffer pH 7.4. Crude extracts were prepared by passing the cells through a French pressure mini cell at 8000 lb/inch - 2 two times and subsequent centrifugation at 4 1C for 30 min (18 000 g). Crude pellet and soluble fractions were separated and pellets were rinsed with 100ml 20mM Tris buffer pH 7.4. Bacterial 16S rRNA gene clone libraries were constructed from the soluble cell fractions.

Data Processing Description

Community genomic DNA was extracted from 200 ml of cell lysate using a DNeasy Blood and Tissue kit (QIAGEN, Germantown, MD, USA). DNA was extracted according to the manufacturer's instructions. Ribosomal RNA genes were amplified from community genomic DNA for cloning by PCR with Taq polymerase (Fermentas, Hanover, MD, USA) and variations of commonly used bacterial primers, 8F and 519R. Briefly, amplifications were performed in a C1000 thermal cycler (Bio-Rad Laboratories, Hercules, CA, USA) using the following conditions: 35 cycles, annealing at 55 1C for 1 min, elongation at 72 1C for 2 min and denaturation at 94 1C for 30 s. A single band of the predicted length was observed by agarose gel electrophoresis, excised and purified using a DNeasy minelute kit (QIAGEN) according to the manufacturer's instructions. Clone libraries were constructed using the resulting mixed-template amplicons and the pGEM-T-Easy vector (Promega) following the manufacturer's instructions. Clone sequences were obtained from transformations by plating, rolling-circle amplification and cycle sequencing at the High-Throughput Genomics Unit (University of Washington, Seattle, WA, USA). Clones from each station were assigned library and station prefixes and numbered sequentially from 1 to 96 (GenBank Accession: GU460426-GU461274). Cloned 16S rRNA gene sequences were aligned in the ARB software package (Ludwig et al., 2004) using a custom database that contained 151 952 sequences from cultured organisms and environmental gene clone libraries. Unambiguously aligned nucleotide sequences were added to a custom tree using the parsimony insertion tool for phylogenetic identification available in ARB. Taxonomic assignments were determined by phylogenetic inference.

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Data Files

File
GenBankClones.csv (Comma Separated Values (.csv), 168.98 KB) MD5:ad8d2c29a63d5397631572dc36c391e0 Primary data file for dataset ID 3443

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Parameters

Parameter	Description	Units
NCBI_Accession	NCBI Accession linked to GenBank.	text
New_ARB_Grouping	New ARB Grouping	text
Subgroup	Subgroup	text
Publication_Grouping	Publication Grouping	text
Publication_Subgrouping	Publication Subgrouping	text
Clone_STNno	Clone (STN #)	text
Station	Station	integer
Cast	Cast	text
Depth	Depth	integer

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Instruments

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
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.

Dataset-specific Instrument Name	Pump surface
Generic Instrument Name	Pump - Surface Underway Ship Intake
Generic Instrument Description	The 'Pump-underway ship intake' system indicates that samples are from the ship's clean water intake pump. This is essentially a surface water sample from a source of uncontaminated near-surface (commonly 3 to 7 m) seawater that can be pumped continuously to shipboard laboratories on research vessels. There is typically a temperature sensor near the intake (known as the hull temperature) to provide measurements that are as close as possible to the ambient water temperature. The flow from the supply is typically directed through continuously logged sensors such as a thermosalinograph and a fluorometer. Water samples are often collected from the underway supply that may also be referred to as the non-toxic supply. Ideally the data contributor has specified the depth in the ship's hull at which the pump is mounted.

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Deployments

KN192-05

Website	https://www.bco-dmo.org/deployment/57852
Platform	R/V Knorr
Report	http://bcodata.whoi.edu/CoFeMUG/CruiseReport_KN192-5.pdf
Start Date	2007-11-16
End Date	2007-12-13

Description	The South Atlantic subtropical gyre and Benguela Upwelling region were sampled for chemistry and biological properties relating to the trace metal nutrition and phytoplankton diversity and productivity. Specifically cobalt and iron dissolved seawater concentrations will be measured and related to the abundance of cyanobacteria including nitrogen fixers and eukaryotic phytoplankton. The phytoplankton of the Benguela Upwelling region were also examined to determine if their growth was iron or cobalt limited. A total of 27 station locations were occupied in the study area to collect the water chemistry and biological samples for these analyses (see cruise track). Iron and cobalt analyses will be conducted using inductively coupled plasma mass spectrometry and cathodic stripping voltammetry electrochemical methods. The sample preparation and subsequent analyses are technically demanding, but data generated from the cruise samples are being contributed beginning in mid 2009. The CoFeMUG KN192-5 cruise was supported by NSF OCE award # 0452883 http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=0452883 A station map showing the 27 sampling locations is available as a PDF file. Original cruise data are available from the NSF R2R data catalog CoFeMUG - South Atlantic 2007 Cruise Participant List 1. Mak Saito (Chief Scientist/WHOI) 2. Abigail Noble (Saito/WHOI) 3. Alysia Cox (Saito/WHOI) 4. Whitney Krey (Delong/Saito/MIT/WHOI) 5. Carl Lamborg (clamborg AT whoi.edu/WHOI) 6. Phoebe Lam (pjlam AT whoi.edu WHOI) 7. Chad Hammerschmidt (chammerschmidt AT whoi.edu, Wright State) 8. Caitlin Frame (cframe AT whoi.edu, WHOI/Casciotti Student) 9. Tyler Goepfert (tgoepfert AT whoi.edu Webb/Saito) 10. Jill Sohm (sohm AT usc.edu) 11. Maria Intermaggio 12. Jack DiTullio (leep AT cofc.edu U. Charleston) 13. Peter Lee (DiTullio U. Charleston) 14. Sarah Riseman (DiTullio U. Charleston) 15. Amanda McLenan (amanda.mclennon AT gmail.com, DiTullio U. Charleston) 16. Mike Seracki (Bigelow) 17. Nicole Poulton (Bigelow) 18. Juan Alba, juanalba AT usp.br (Bigelow) 19. Jane Heywood (Bigelow) 20. Gabrielle Rocap (rocap AT whoi.edu, U. Washington) 21. Emily Nahas (enahas AT u.washington.edu) 22. Michele Wrable (mlw22 AT u.washington.edu) 23. Bob Morris (rmorris AT lifesci.ucsb.edu) 24. Christian Frazar (Chris, U. Washington, Morris lab) 25. Jason Hilton (Zehr, UCSC) 26. Reserved for Angolan Observers 27. Reserved for Angolan Observers Collecting GEOTRACES-compliant samples for: 1. Laura Robinson (Pa Th isotopes) 2. Bob Anderson (Pa Th isotopes - intercalibration) 3. Olivier Rouxel (Se and Fe isotopes) 4. Karen Casciotti (N isotopes) 5. Ben Reynolds (Si and Fe isotopes) 6. Chris Measures (Al) 7. Kristin Buck (FeL)

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Project Information

Cobalt, Iron and Micro-organisms from the Upwelling zone to the Gyre (GAc01) (CoFeMUG)

Coverage: South Atlantic subtropical gyre and Benguela upwelling region

The geochemistries of dissolved cobalt (Co) and iron (Fe) in the oceanic water column share several characteristics such as extremely low concentrations, redox chemistry, low solubility,and utilization as micronutrients by marine microbes. Iron has been the subject of considerable research focus in recent years due to its role in limiting phytoplankton productivity in oceanic and coastal upwelling environments. Cobalt has been much less studied, but recent data show it may be important in influencing primary productivity or phytoplankton community composition in certain geographical areas.

The CoFeMUG project predated GEOTRACES, so while it is not formally recognized as a GEOTRACES section, it is considered a GEOTRACES-related project and the CoFeMUG data are GEOTRACES compliant.

State-of-the-art geochemical and molecular biological techniques were used to address biogeochemical questions in the South Atlantic, and focus especially on the two trace metals, cobalt and iron. The 27-day cruise in November and December 2007 to the South Atlantic was designed to study cobalt and iron biogeochemistry and focus on four major hypotheses.

(1) Large fluxes of labile cobalt are associated with upwelling systems even in Aeolian dominated environments. (2) Cobalt and phosphate show correlations in (and only in) surface waters due to micronutrient utilization and

rapid remineralization. The slope of the correlation is dependent on the chemical speciation of cobalt.
(3) The absence of Trichodesmium populations in the subtropical and tropical South Atlantic is caused by iron limitation.
(4) Based on work from the California and Peru Upwelling regimes, primary productivity in the Benguela upwelling regime off of South West Africa may be iron limited or iron-cobalt colimited.

A combination of geochemical and biological/molecular analyses were made across an oligotrophic-upwelling transition to examine how changing metal regimes affect the physiology and growth of the important primary producers Trichodesmium and Synechococcus.

CoFeMUG project results are published in:
Noble, Abigail E., Carl H. Lamborg, Dan C. Ohnemus, Phoebe J. Lam, Tyler J. Goepfert, Chris I. Measures, Caitlin H. Frame, Karen L. Casciotti, Giacomo R. DiTullio, Joe Jennings, and Mak A. Saito (2012) Basin-scale inputs of cobalt, iron, and manganese from the Benguela-Angola front to the South Atlantic Ocean. Limnology & Oceanography. Vol. 57(4), July 2012. pgs 989-1010. doi:10.4319/lo.2012.57.4.0989 (www.aslo.org/lo/toc/vol_57/issue_4/0989.pdf)

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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.

Ocean Carbon and Biogeochemistry (OCB)

Website: http://us-ocb.org/

Coverage: Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO2 and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0723866

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