Macronutrient concentrations from samples collected using rosette on R/V Melville MV1405 (IRN-BRU) cruise in the California Current System in July 2014

Website: https://www.bco-dmo.org/dataset/942883
Data Type: Cruise Results
Version: 1
Version Date: 2024-11-18

Project
» Accomplishment Based Renewal: An iron limitation mosaic within the central California Current System (iron limitation mosaic)

Contributors	Affiliation	Role
Bruland, Kenneth W.	University of California-Santa Cruz (UCSC)	Principal Investigator
Coale, Tyler	University of California-Santa Cruz (UCSC)	Scientist
Till, Claire P.	University of California-Santa Cruz (UCSC)	Student
Mickle, Audrey	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes macronutrient concentrations from seawater samples collected on R/V Melville MV1405 while investigating the mosaic of the California Current System in July 2014 using the shipboard rosette. It includes depth profiles of an active upwelling site nearshore over the shelf in northern California (Station 2), a more aged upwelling site offshore of the shelf break in southern Oregon (Station 28), a station in the Santa Barbara Basin that got suboxic in the lower depths of the water column (Station 29), and a set of stations (9, 12 and 15) that show two cyclonic eddies, one two months younger (station 9) than the other (station 15), but both coming from roughly the same place and moving offshore, with station 12 in between them in an offshoot of the California Current. The chief scientist of the cruise was Ken Bruland. Nutrient samples were analyzed by Tyler Coale. See related datasets for additional macronutrient concentrations and dissolved trace metal concentrations found in GoFlo and surface samples collected on MV1405.

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Coverage

Location: The California Current System, 33-44N, 118-128W, surface to 1500m max
Spatial Extent: **N**:42.667 **E**:-120.026 **S**:34.231 **W**:-126.752
Temporal Extent: 2014-07-05 - 2014-07-24

Methods & Sampling

Nitrate-nitrite, Phosphate, Silicate, Nitrite

Samples were collected from the ship's rosette. Samples were analyzed shortly after collection at sea using standard spectrophotometric methods (Parsons 1984) on a Lachat QuickChem 8000 Flow Injection Analysis System.

BCO-DMO Processing Description

- Imported original file "IRNBRU macronutrient rosette data.xlsx" into the BCO-DMO system.
- Combined "Latitude_degrees" and "Latitude_mins"
- Combined "Longitude_degrees" and "Longitude_mins"
- Converted Latitude and Longitude to decimal degrees
- Converted "date" from %m-%d-%y to ISO format %Y-%m-%d and changed parameter name to "Sampling_date"
- Created flag field "Nitrate_plus_nitrite_flag" to account for - Renamed fields to comply with BCO-DMO naming conventions, removing special characters and spaces
- Saved the final file as "942883_v1_iron_limitation_rosette"

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Data Files

File	
942883_v1_iron_limitation_rosette.csv	(Comma Separated Values (.csv), 10.05 KB) MD5:51d1a3ca4748b46dab5ca6f41c1b76b7
Primary data file for dataset ID 942883, version 1	

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Related Publications

Abdala, Z. M., Clayton, S., Einarsson, S. V., Powell, K., Till, C. P., Coale, T. H., & Chappell, P. D. (2022). Examining ecological succession of diatoms in California Current System cyclonic mesoscale eddies. Limnology and Oceanography, 67(11), 2586–2602. Portico. https://doi.org/10.1002/lno.12224
Results

Biller, D. V., & Bruland, K. W. (2012). Analysis of Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb in seawater using the Nobias-chelate PA1 resin and magnetic sector inductively coupled plasma mass spectrometry (ICP-MS). Marine Chemistry, 130-131, 12–20. doi:10.1016/j.marchem.2011.12.001
Methods

Biller, D. V., Coale, T. H., Till, R. C., Smith, G. J., & Bruland, K. W. (2013). Coastal iron and nitrate distributions during the spring and summer upwelling season in the central California Current upwelling regime. Continental Shelf Research, 66, 58–72. https://doi.org/10.1016/j.csr.2013.07.003
Methods

Boiteau, R. M., Till, C. P., Coale, T. H., Fitzsimmons, J. N., Bruland, K. W., & Repeta, D. J. (2018). Patterns of iron and siderophore distributions across the California Current System. Limnology and Oceanography, 64(1), 376–389. Portico. https://doi.org/10.1002/lno.11046
Results

Bruland, K. W., Rue, E. L., & Smith, G. J. (2001). Iron and macronutrients in California coastal upwelling regimes: Implications for diatom blooms. Limnology and Oceanography, 46(7), 1661–1674. Portico. https://doi.org/10.4319/lo.2001.46.7.1661
Methods

Cutter, G.A., Andersson, P., Codispoti, L., Croot, P., Francois, R., Lohan, M., Obata, H., van der Loeff, M. R. (2014) Sampling and Sample-Handing Protocols for GEOTRACES Cruises (cookbook) Version 2.0; December 2014. http://www.geotraces.org/images/stories/documents/intercalibration/Cookbook_v2.pdf
Methods

Lohan, M. C., Aguilar-Islas, A. M., & Bruland, K. W. (2006). Direct determination of iron in acidified (pH 1.7)

seawater samples by flow injection analysis with catalytic spectrophotometric detection: Application and intercomparison. Limnology and Oceanography: Methods, 4(6), 164–171. Portico. https://doi.org/10.4319/lom.2006.4.164
Methods

McNair, H. M., Brzezinski, M. A., Till, C. P., & Krause, J. W. (2017). Taxon-specific contributions to silica production in natural diatom assemblages. Limnology and Oceanography, 63(3), 1056–1075. Portico. https://doi.org/10.1002/lno.10754
Results

Parker, C. E., Brown, M. T., & Bruland, K. W. (2016). Scandium in the open ocean: A comparison with other group 3 trivalent metals. Geophysical Research Letters, 43(6), 2758–2764. Portico. https://doi.org/10.1002/2016gl067827 https://doi.org/10.1002/2016GL067827
Methods

Parsons, T. R., Maita, Y., & Lalli, C.M. (1984). A manual of chemical and biological methods for seawater analysis. Pergamon Press. doi:10.1016/c2009-0-07774-5 https://doi.org/10.1016/C2009-0-07774-5
Methods

Till, C. P., Solomon, J. R., Cohen, N. R., Lampe, R. H., Marchetti, A., Coale, T. H., & Bruland, K. W. (2018). The iron limitation mosaic in the California Current System: Factors governing Fe availability in the shelf/near-shelf region. Limnology and Oceanography, 64(1), 109–123. Portico. https://doi.org/10.1002/lno.11022
Results

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Related Datasets

IsRelatedTo

Till, C. P., Coale, T., Bruland, K. W. (2024) **Dissolved trace metals and macronutrients from samples collected using GoFlo on R/V Melville MV1405 (IRN-BRU) cruise in the California Current System in July 2014.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-11-05 doi:10.26008/1912/bco-dmo.942928.1 [view at BCO-DMO]

Till, C. P., Coale, T., Bruland, K. W. (2024) **Dissolved trace metals and macronutrients from samples collected using a tow-fish system on R/V Melville MV1405 (IRN-BRU) cruise in the California Current System in July 2014.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-11-20 doi:10.26008/1912/bco-dmo.943015.1 [view at BCO-DMO]

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Parameters

Parameter	Description	Units
Sample_date	Date of sample collection	unitless
Latitude	Latitude of sampling site, negative values = South	decimal degrees
Longitude	Longitude of sampling site, negative values = West	decimal degrees
Station_number	Station identification	unitless
Station_notes	Station notes	unitless
Depth	Sample depth	m
Phosphate	Phosphate concentrations	umol/kg
Silicic_acid	Silicic_acid concentrations	umol/kg
Nitrate_plus_nitrite	Nitrate and nitrite concentrations	umol/kg
Nitrate_plus_nitrite_flag	Flag indicates wether the nitrate+nitrite measurement was detectable; values less than detection limit are marked "<LOD"	unitless
Nitrite	Nitrate, NO2	umol/kg
Nitrate	Nitrate, NO3	umol/kg

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Instruments

Dataset-specific Instrument Name	Rosette
Generic Instrument Name	CTD - profiler
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934.

Dataset-specific Instrument Name	Lachat QuickChem 8000 Flow Injection Analysis System
Generic Instrument Name	Lachat QuikChem 8500 flow injection analysis system
Dataset-specific Description	Nutrients were analyzed with a Lachat QuickChem 8000 Flow Injection Analysis System.
Generic Instrument Description	The Lachat QuikChem 8500 Series 2 Flow Injection Analysis System features high sample throughput and simple, but rapid, method changeover. The QuikChem 8500 Series 2 system maximises productivity in determining ionic species in a variety of sample types, from sub-ppb to percent concentrations. Analysis takes 20 to 60 seconds, with a sample throughput of 60 to 120 samples per hour.

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Deployments

MV1405

Website	https://www.bco-dmo.org/deployment/559966
Platform	R/V Melville
Start Date	2014-07-03
End Date	2014-07-26
Description	Deployment MV1405 on R/V Melville. Cruise took place during July 2014.

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Project Information

Accomplishment Based Renewal: An iron limitation mosaic within the central California Current System (iron limitation mosaic)

NSF Award Abstract:

NSF Award Abstract:
Eastern boundary upwelling systems have long been recognized for their high phytoplankton productivity. Carr and Kearns (2003), in a detailed comparison of eastern boundary current systems, reported that biomass sustained by a given macronutrient concentration in Atlantic eastern boundary current systems was twice as large as those systems in the Pacific. The authors concluded "It is not clear whether the apparent difference in biomass supported by available nutrients is due to differences in the efficiency of the phytoplankton community, perhaps related to the availability of iron, or to grazing pressure." They suggested that the width of the shelf might be considered a proxy for the benthic availability of iron. The lowest biomass for a given macronutrient concentration was in the Peru-Humboldt Current and in the northern California region of the California Current System, both areas with low dust inputs and a relatively narrow shelf.

In this Accomplishment Based Renewal project, a marine trace metal geochemist at the University of California - Santa Cruz and his students and colleagues will continue a decades-old quest to understand the role of iron in the central California Current System (cCCS). Field efforts will combine continuous underway iron and nutrient data in surface waters and a series of vertical profiles. The focus will include three regions within the cCCS: a variety of active Fe-replete and Fe-deplete coastal upwelling regimes, the eddy-rich California Current transition zone that is Fe-limited and has elevated nitrate but relatively low and uniform chlorophyll concentrations, and the offshore, oligotrophic California Current. They will map surface and depth distributions of Fe and other micro- and macronutrients. There are four specific goals dealing with characterizing the organic Fe(III)-binding organic ligands, determining Fe(II) and Fe(III) concentrations in hypoxic waters over the shelf, examining the exchange between particulate and dissolved forms of Fe, and studying the roles of eddies in the eddy-rich transition waters of the cCCS.

Broader Impacts

Direct Benefits to Science: There is a great deal of interest in the CCS because of its importance in terms of phytoplankton productivity and the support of higher trophic levels. Until now, the emphasis in studies of the CCS has been on relationships between physics and biology. This study will insert the important role of micronutrient chemistry into the picture. It will also serve an important role in securing ship time in advance and providing logistical support for other collaborative studies. This is extremely valuable and cost effective for collaborating scientists since with the hydrography, nutrient and trace metal data provided, they can focus on their complimentary research efforts.

Outreach and Education: The project will provide funding for two current graduate students at UCSC, where they will also receive course training in a curriculum that includes i) scientific communication, ii) careers in marine science, and iii) grant writing. A broader impact goal of this project is to facilitate teaching and learning on marine science-related topics through translating research objectives into widely distributed educational materials for classroom use. To accomplish this, the team will partner with the Seymour Discovery Center at the Long Marine Lab, UCSC. The Discovery Center receives 14,000 visitors each year, and the project will provide funds to develop an interactive display on limiting nutrients and phytoplankton bloom development in the CCS.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1259776

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