Biogenic and lithogenic silica concentrations from marine suspended particles collected during the 2011 CLIVAR S04P expedition on RVIB Nathaniel B. Palmer from February 19 to April 19, 2011

Website: https://www.bco-dmo.org/dataset/931843
Data Type: Cruise Results
Version: 1
Version Date: 2025-09-03

Project
» Collaborative Research: Iron Incorporation into Biogenic Silica (SO-Fe-bSi)

Program
» U. S. Climate Variability and Predictability (U.S. CLIVAR)

Contributors	Affiliation	Role
Morton, Peter L.	Florida State University (FSU)	Principal Investigator
Krause, Jeffrey W.	Dauphin Island Sea Lab (DISL)	Scientist
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset reports biogenic and lithogenic silica concentrations (in micromoles per liter (µmol/L)) from marine suspended particles collected during the 2011 CLIVAR S04P expedition on RVIB Nathaniel B. Palmer, 19 Feb-19 April 2011, which followed the 67° South parallel in the Pacific sector of the Southern Ocean, from the Ross Sea to the Western Antarctic Peninsula. Water from the upper 1000 meters was collected using a contamination-free trace metal rosette (12-liter Teflon-coated GO-Flo bottles). Samples were collected by Dr. Chris Measures (University of Hawaii-Manoa), Dr. William Landing (Florida State University), and Mr. Brian Kilgore (Florida State University). Samples were processed by Dr. Pete Morton (Florida State University) in the laboratory of Dr. Jeffrey Krause (Dauphin Island Sea Lab). These data serve as a proxy for the abundance and biogeographic distribution of siliceous phytoplankton, especially diatoms.

Table of Contents

Coverage

Location: Pacific sector of the Southern Ocean
Spatial Extent: **N**:-67 **E**:-175.47 **S**:-75.46 **W**:179.42
Temporal Extent: 2011-02-23 - 2011-04-19

Methods & Sampling

Water (2-10.9 liters) from each GO-Flo was filtered over a 47-millimeter (mm) diameter, 0.4-micrometer (µm) pore size PCTE filter (Measures et al., 2008). Samples were stored in new Whatman petri slides, double-bagged, at room temperature until ready for processing. The filters were subdivided into thirds or quarters using a ceramic rotary blade on a clean acrylic panel.

One subsection (1/3 or 1/4) was processed for biogenic and lithogenic silica concentrations, according to Krause et al. (2009) and Brzezinski and Nelson (1995). In brief, the filter subsample was submerged in 0.2 N NaOH for 2 hours in Teflon tubes to dissolve the silica. The resulting solution was reacted with ammonium molybdate, metol, and oxalic acid to produce silicomolybous acid, the absorbance of which was measured spectrophotometrically.

Lithogenic silica concentrations were determined using a subsample of the original NaOH digest solution, which was diluted with DI water and centrifuged. The supernatant was taken to dryness then digested again using HF over 48 hours. Boric acid was added to the HF solution, which was then reacted and analyzed in the same way as the biogenic silica digest solutions.

Concentrations were determined using matrix-matched standards for both the biogenic and lithogenic digest solutions.

Data Processing Description

Data were processed using Microsoft Excel (quantification by external standards using 1 centimeter (cm) or 10 cm cell).

BCO-DMO Processing Description

- Imported original file "S04P 2011 bSi lSi 2024_05_15.xlsx" into the BCO-DMO system.
- Imported bottle file "320620110219_hy1.csv" obtained from CCHDO on 2024-07-08 (source: https://cchdo.ucsd.edu/cruise/320620110219).
- Added DATE column from the bottle file; joining data by station number.
- Converted DATE column to YYYY-MM-DD format.
- Saved the final file as "931843_v1_nbp1102_biogenic_and_lithogenic_silica.csv".

[table of contents | back to top]

Data Files

File	
931843_v1_nbp1102_biogenic_and_lithogenic_silica.csv	(Comma Separated Values (.csv), 12.86 KB) MD5:f1ae486fbdad0c51471552220d637d45
Primary data file for dataset ID 931843, version 1	

[table of contents | back to top]

Related Publications

Brzezinski, M. A., & Nelson, D. M. (1995). The annual silica cycle in the Sargasso Sea near Bermuda. Deep Sea Research Part I: Oceanographic Research Papers, 42(7), 1215–1237. doi:10.1016/0967-0637(95)93592-3
Methods

Krause, J. W., Nelson, D. M., & Lomas, M. W. (2009). Biogeochemical responses to late-winter storms in the Sargasso Sea, II: Increased rates of biogenic silica production and export. Deep Sea Research Part I: Oceanographic Research Papers, 56(6), 861–874. doi:10.1016/j.dsr.2009.01.002
Methods

Measures, C. I., Landing, W. M., Brown, M. T., & Buck, C. S. (2008). High-resolution Al and Fe data from the Atlantic Ocean CLIVAR-CO2 Repeat Hydrography A16N transect: Extensive linkages between atmospheric dust and upper ocean geochemistry. Global Biogeochemical Cycles, 22(1). Portico. https://doi.org/10.1029/2007gb003042 https://doi.org/10.1029/2007GB003042
Methods

[table of contents | back to top]

Related Datasets

IsRelatedTo

CCHDO Hydrographic Data Office (2023). CCHDO Hydrographic Data Archive, Hydrographic Cruise: 320620110219. In CCHDO Hydrographic Data Archive. UC San Diego Library Digital Collections. https://cchdo.ucsd.edu/cruise/320620110219

[table of contents | back to top]

Parameters

Parameter	Description	Units
Station	station identification number	unitless
DATE	date of sample collection	unitless
LATITUDE	latitude of sample collection; negative values = South	decimal degrees
LONGITUDE	longitude of sample collection; negative values = West	decimal degrees
Depth	sample depth	meters (m)
BSi	biogenic silica	micromoles per liter (umol/L)
Lsi	lithogenic silica	micromoles per liter (umol/L)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	General Oceanics GO-Flo bottles
Generic Instrument Name	GO-FLO Bottle
Generic Instrument Description	GO-FLO bottle cast used to collect water samples for pigment, nutrient, plankton, etc. The GO-FLO sampling bottle is specially designed 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	Thermo Genesys 10s Uv-Vis spectrophotometer
Generic Instrument Name	Spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

[table of contents | back to top]

Deployments

NBP1102

Website	https://www.bco-dmo.org/deployment/931853
Platform	RVIB Nathaniel B. Palmer
Report	https://cchdo.ucsd.edu/data/10405/s04p_320620110219do.pdf
Start Date	2011-02-19
End Date	2011-04-23
Description	For more information, see: https://www.rvdata.us/search/cruise/NBP1102 https://www.marine-geo.org/tools/entry/NBP1102

[table of contents | back to top]

Project Information

Collaborative Research: Iron Incorporation into Biogenic Silica (SO-Fe-bSi)

Coverage: Southern Ocean (Pacific Sector) – 2011 S04P CLIVAR

NSF Award Abstract:
Ocean research over the last several decades has increasingly shown the great importance of iron chemistry on marine biological processes. In certain areas of the ocean where iron is scarce, it can limit biological growth even though other essential nutrients like nitrogen and phosphorus are abundant. Consequently, to fully understand and quantify biological productivity in the ocean, a complete knowledge of all sources and sinks for iron is essential. The researchers funded for this project have already generated exciting preliminary data that suggest a potentially large, yet, unquantified pathway for iron removal. Diatoms, phytoplankton with shells made of silica, are shown to incorporate traces of iron into their shells, making it unavailable for rapid recycling

or use by marine organisms in surface waters. Given the great abundance of diatoms in many parts of the ocean, this could represent a major, unstudied removal mechanism that regulates the concentration of iron in seawater. This research could transform current understanding of how iron is removed from the ocean, and it will impact understanding of both the chemical and biological processes involving iron in seawater. The investigator also plans outreach in K-12 schools by providing educational courses for Earth Science teachers and will support graduate student training in advanced chemical analysis and oceanography.

High-resolution synchrotron-based chemical techniques will allow determination of the concentration and oxidation state of iron bound within diatom frustules. This analytical advance has created the ability for unique evaluation of iron sequestration into biogenic silica as a major pathway for iron removal from the ocean. Samples from the Pacific sector of the Southern Ocean have been collected in a previous CLIVAR field campaign and a subset of these are available for new synchrotron analysis of iron (Fe) with Near Edge X-ray Fluorescence Spectroscopy (Fe-NEXFS) and submicron scale X-ray fluorescence mapping, as well as a variety of other chemical characterizations. With these methods, the project will determine the importance of iron sequestered into biogenic silica as a new and unquantified loss term in the oceanic Fe cycle and examine the changing chemical complexes of iron during vertical transport of silica particles through the water column.

[table of contents | back to top]

Program Information

U. S. Climate Variability and Predictability (U.S. CLIVAR)

Website: http://www.usclivar.org/

Coverage: global

Note: The official U.S. CLIVAR program description will be supplied by Steve Diggs.

A temporary description copied from the US CLIVAR Web site is:

CLIVAR (Climate Variability and Predictability) is an international, interdisciplinary research effort within the World Climate Research Programme (WCRP) focusing on the variability and predictability of the slowly varying components of the climate system. CLIVAR investigates the physical and dynamical processes in the climate system that occur on seasonal, interannual, decadal and centennial time-scales. CLIVAR recognizes that a critical measure of success in its research program is a transferal of insight and knowledge to routine production of climate forecasts, information and products.

The goals of U.S. CLIVAR include:

- Identifying and understanding the major patterns of climate variability on seasonal, decadal and longer time scales and evaluating their predictability;
- Expanding our capacity in short term (seasonal to interannual) climate predictability and searching for ways to predict decadal variability;
- Better documenting the record of rapid climate changes and the mechanisms for these events, and evaluating the potential for abrupt climate changes in the future;
- Evaluating and enhancing the models used to project climate change due to human activity, including anthropogenically induced changes in atmospheric composition, and:
- Detecting and describing any climate changes that may occur.

Program Data: The data from most projects associated with the US CLIVAR program are not managed by BCO-DMO. Information about these projects and their results are available from the Program and Data site URLs shown above. However, there are a few exceptions, and those projects are listed below when the project section is expanded.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658311

[table of contents | back to top]