Water-column Biogenic silica concentrations from RVIB Nathaniel B. Palmer NBP0601, NBP0608 cruises in the Ross Sea Southern Ocean (CORSACS project)

Website: https://www.bco-dmo.org/dataset/3122
Version: 11 September 2010
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Project
» Controls of Ross Sea Algal Community Structure (CORSACS)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
Hutchins, David A.	University of Southern California (USC-HIMS)	Principal Investigator, Contact
DiTullio, Giacomo	College of Charleston - Hollings Marine Lab (CoC-HML)	Contact
Chandler, Cynthia L.	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Water-column Biogenic silica concentrations from CORSACS 1 cruise (NBP-0601) and CORSACS2 cruise (NBP-0608) to the Ross Sea

Methods & Sampling

Water-column samples for biogenic silica were collected in 10-L Niskin samplers (General Oceanics Inc.) attached to the CTD rosette, during 2 cruises in the Ross Sea, ca. 65.21°S-78.65°S, 164.98°E-164.70°W, 6-1265 m depth. Biogenic silica (BSi) analyses were performed by filtering 250-1000 mL aliquots of seawater onto 0.6-um 47-mm polycarbonate filters. The filters were dried at 60oC, and stored at room temperature until analysis. The samples were analyzed following the method of Brzezinski & Nelson (1995).

Brzezinski, M.A., Nelson D.M., 1995. The annual silica cycle in the Sargasso Sea near Bermuda. Deep-Sea Research I 42:1215-1237

Data Processing Description

Appropriate information on blanks and linear regressions of the standard curves is included within the original

spreadsheet. A field blank value of 0.013 was subtracted for each measurement. The slope of the standard silicate curve was approximately 0.011 with an r-squared value of >0.99.

Original data as Excel spreadsheets:

CORSACS 1 Biogenic silica (XLS)
CORSACS 2 Biogenic silica (XLS)

BCO-DMO processing:

Biogenic Silica data were contributed in Microsoft Office Excel Spreadsheets -- one for each deployment (NBP0601 and NBP0608.) Both data sets reported sample depth, volume filtered, and Biogenic Silica in micromoles per liter, along with linear regressions of the standard curves used in the analysis. The spreadsheets were manually edited for upload to the BCO-DMO database. Neither data set included position information. As submitted, the original data lacked lat and lon and 0608 lacked date_local. These columns were added by BCO-DMO as follows: lat and lon values are from hydro station metadata and date_local for NBP0608 was also taken from the hydro data as reported in another data set from this research project.

NBP0601 processing notes:
For NBP0601, a station number, date, bottle number, and sample depth were reported for each sample. Position information was not included. In order to be sure that Biogenic Silica station numbers matched Hydro casts station numbers, plots of the common information were prepared.

Sample depths were plotted against station number for the hydrographic data with Biogenic silica station number and sample depths overlaid. The points matched up nicely, confirming that station numbers were the same, therefore geographic position and time, as submitted with the hydrographic data, could be assigned to Biogenic Silica samples. (see comparison plot PDF file)

It should be noted that station+date_local for NBP0601 did not always match the hydro data. 21 of the 61 NBP0601 BioSi stations had a different date_local than the hydro stas; in every case, the BioSi sta number was 1 day ahead (e.g. station 18 hydro date = 12/30 and BioSi = 12/31)

The CTD/hydro data clearly stated that date was local, however if hydro date was in fact GMT then local time (GMT +13 for this timezone in December) would be 13 hours later (often one day ahead); if NBP0601 hydro data had date in GMT, and BioSi used local date, then the 1 day date offset could be explained. However, we have been unable to confirm this theory. Note that this means it is possible that the date_local column now has a mix of time zones; NBP0601 has original BioSi dates which might be local and NBP0608 has 'date' from hydro (called date_local) but might really be GMT.

NBP0608 processing notes:
For NBP0608, samples were identified using CTD cast number and depth. Position and time information were not reported. In order to be sure that Biogenic Silica station numbers matched the hydrographic station numbers, plots of the common information in both datasets were prepared. (see comparison plot PDF file)

Sample depths were plotted against station number for the hydrographic data with Biogenic silica station number and sample depths overlaid. The points matched up nicely, confirming that station numbers were the same, therefore geographic position and time, as submitted with the hydrographic data, could be assigned to Biogenic Silica samples.

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Data Files

File
biogenic_silica.csv (Comma Separated Values (.csv), 69.53 KB) MD5:8a5af87c678247b2cd5d777e53c01bbe Primary data file for dataset ID 3122

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Parameters

Parameter	Description	Units
cruise_id	ship's cruise designation	dimensionless
date_local	local date of sampling	YYYYMMDD
sta	station number	dimensionless
bot	bottle number	dimensionless
depth	depth	meters
vol_filt	volume of water filtered	liters
Si_bio	biogenic silica concentration	micromoles Si per liter
lat	latitude, in decimal degrees, North is positive, negative denotes South; lat and lon values are from hydro station metadata as the biogenic silica data were contributed without station position information	decimal degrees
lon	longitude, in decimal degrees, East is positive, negative denotes West; lat and lon values are from hydro station metadata as the biogenic silica data were contributed without station position information	decimal degrees
ev_Si	event number from original data file; definition was not specified by contributing PI	dimensionless

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Instruments

Dataset-specific Instrument Name	Niskin Bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	10-L Niskin samplers (General Oceanics Inc.) attached to the CTD rosette
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

NBP0601

Website	https://www.bco-dmo.org/deployment/57985
Platform	RVIB Nathaniel B. Palmer
Report	http://data.bco-dmo.org/CORSACS/cruises/Dunbar_Hydrography_report_NBP0601.pdf
Start Date	2005-12-17
End Date	2006-01-30
Description	This was the first of two Controls of Ross Sea Algal Community Structure (CORSACS) project cruises and was funded by the NSF Office of Polar Programs. The NBP0601 cruise was conducted in the Ross Sea in December 2005 and January 2006, Ross Sea, ca. 65.21°S-78.65°S, 164.98°E-164.70°W, and supported by NSF research grant, OPP-0338097. The 'Science Pan and Project Description' document includes details of the cruise sampling strategy. Related Files: Science Plan and Project Descriptions (PDF file)Cruise track map (PDF file)Photo of Ice Breaker Nathaniel B. Palmer on station near Beaufort Island (JPG image) Related Sites: MGDS catalog: http://www.marine-geo.org/tools/search/entry.php?id=NBP0601

NBP0608

Website	https://www.bco-dmo.org/deployment/57986
Platform	RVIB Nathaniel B. Palmer
Report	http://data.bco-dmo.org/CORSACS/cruises/Dunbar_Hydrography_report_NBP0608.pdf
Start Date	2006-11-01
End Date	2006-12-15
Description	This was the second of two Controls of Ross Sea Algal Community Structure (CORSACS) project cruises and was funded by the NSF Office of Polar Programs. The NBP0608 cruise was conducted in the Ross Sea in November and December 2006, ca. 65.21°S-78.65°S, 164.98°E-164.70°W. Related files: Cruise track map (PDF file) Related Sites: MGDS catalog: http://www.marine-geo.org/tools/search/entry.php?id=NBP0608

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Project Information

Controls of Ross Sea Algal Community Structure (CORSACS)

Website: http://www.whoi.edu/sites/corsacs

Coverage: Ross Sea Southern Ocean

Project summary

The Controls of Ross Sea Algal Community Structure (CORSACS) project was funded by the NSF Office of Polar Programs as "Collaborative Research: Interactive Effects of Iron, Light and Carbon Dioxide on Phytoplankton Community Dynamics in the Ross Sea". Two cruises were completed in 2006 to investigate the interactions between the primary productivity of the Ross Sea and pCO2, iron and other trace elements. Data sets of carbon, nutrient, metal, and biological measurements will be reported.

The main objective in the proposed research was to investigate the relative importance and potential interactive effects of iron, light and CO2 levels in structuring algal assemblages and growth rates in the Ross Sea. The investigators hypothesized that the interaction of these three variables largely determines the bottom-up control on these two dominant Southern Ocean phytoplankton taxa. While grazing and other loss processes are important variables in determining the relative dominance of these two taxa, the CORSACS research project was designed to focus on the bottom-up control mechanisms. It is important to understand such

environmentally-driven taxonomic shifts in primary production, since they are expected to impact the fixation and export of carbon and nutrients, and the production of DMS, thus potentially providing both positive and negative feedbacks on climate.

The CORSACS investigators considered a range of ambient iron, light and pCO2 levels that span those typically observed in the Ross Sea during the growing season. That is, dissolved iron ranging from ~0.1 nM (low iron) to greater than 1 nM (high iron) (Fitzwater et al. 2000; Sedwick et al. 2000); mean irradiance (resulting from vertical mixing/self shading) ranging from less than 10% Io (low light) to greater than 40% (high light) (Arrigo et al., 1998, 1999), possibly adjusted based on field observations during the CORSACS cruises; and pCO2 ranging (Sweeney et al. 2001) from ~150 ppm (low CO2) to the probable higher levels of pCO2 - 750 ppm as a conservative estimate - that are likely to be attained later this century due to anthropogenic perturbation of the global carbon cycle (IPCC, 2001).

From the information previously available from both field observations and experiments, the investigators formulated the following specific hypotheses regarding the interactive role of iron, light and CO2 in regulating algal composition in the Ross Sea: diatoms bloom in the southern Ross Sea only under optimum conditions of high iron, light and pCO2; colonial Phaeocystis dominate under conditions of high iron with either (or both) low light or low pCO2; and solitary Phaeocystis are predominant under conditions of low iron with either (or both) low light or low pCO2.

References:

Fitzwater, S.E., K.S. Johnson, R.M. Gordon, K.H. Coale, and W.O. Smith, Jr. (2000). Trace metal concentrations in the Ross Sea and their relationship with nutrients and growth. Deep-Sea Research II, 47: 3159-3179.

Martin JH, Gordon RM, Fitzwater SE. Iron in Antarctic waters. Nature 1990 ;345(6271):156-158. Martin JH. 1990. Glacial-interglacial CO2 change: The iron hypothesis. Paleoceanography 5(1):1-13

P. N. Sedwick, G. R. DiTullio, and D. J. Mackey, Iron and manganese in the Ross Sea, Antarctica: Seasonal iron limitation in Antarctic shelf waters, Journal of Geophysical Research, 105 (C5), 11,321-11,336, 2000.

Sweeney, C. K. Arrigo, and G. van Gijken (2001). Prediction of seasonal changes in surface pCO2 in the Ross Sea, Antarctica using ocean color satellite data. 2001 Annual AGU meeting, San Fransisco, CA Dec. 10-15.

IPCC, 2001: Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of theIntegovernmental Panel on Climate Change [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge,United Kingdom, and New York, NY, USA, 398 pp.

Publications

Saito, M. A., Goepfert, T. J., Noble, A. E., Bertrand, E. M., Sedwick, P. N., and DiTullio, G. R.: A seasonal study of dissolved cobalt in the Ross Sea, Antarctica: micronutrient behavior, absence of scavenging, and relationships with Zn, Cd, and P, Biogeosciences, 7, 4059-4082, doi:10.5194/bg-7-4059-2010, 2010 (http://www.biogeosciences.net/7/4059/2010/bg-7-4059-2010.html)

Bertrand EM, Saito MA, Lee PA, Dunbar RB, Sedwick PN and DiTullio GR (2011) Iron limitation of a springtime bacterial and phytoplankton community in the Ross Sea: implications for vitamin B12 nutrition. Front. Microbio. 2:160. doi: 10.3389/fmicb.2011.00160 (http://www.frontiersin.org/Aquatic_Microbiology/10.3389/fmicb.2011.00160/abstract)

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Program Information

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 Office of Polar Programs (formerly NSF PLR) (NSF OPP)	OPP-0338097

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