Algal pigment concentrations as measured by HPLC from RVIB Nathaniel B. Palmer cruises in the Ross Sea Southern Ocean from 2005 to 2006 (CORSACS project)

Website: https://www.bco-dmo.org/dataset/3360
Version: 08 September 2010
Version Date: 2010-09-08

Project
» Controls of Ross Sea Algal Community Structure (CORSACS)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

Algal pigment concentrations in the Ross Sea as measured by HPLC.

Methods & Sampling

Algal HPLC pigment samples were collected by gentle filtration under low vacuum through GF/F filters and frozen in LN for on-shore analyses. Samples were extracted in 90% acetone and analyzed using a HP 1050 HPLC system equipped with autosampler, photodiode array and fluorescence detectors. The gradient elution program utilized was a slight modification of the Zapata et al. method (2000). Complete details of the HPLC method are described elsewhere (DiTullio and Geesey 2002). Replicate injections of standard pigments (purified from algal cultures in lab) produced a coefficient of variation of 3% with a limit of detection of approximately 1 ng.

Data Processing Description

Pigment concentrations were determined using standard peak integration procedures and entered into Microsoft Excel Spreadsheets for submission to BCO-DMO. Parameters reported were: Magnesium-2,4-divinyl phaeoporphyrin a5 monomethyl ester, chlorophyll c2, chlorophyll c1, peridinin, 19-primebutanoyloxyfucoxanthin, fucoxanthin, neoxanthin, prasinoxanthin, violaxanthin, 19-prime hexanoyloxyfucoxanthin, diadinoxanthin, cis_fucoxanthin, alloxanthin, diatoxanthin, zeaxanthin, lutein, crocoxanthin, divinyl chlorophyll a, chlorophyll a, carotene-alpha, carotene-beta, chlorophyll c3, chlorophyll b,

pheophorbide a, pheophytin a, and antheraxanthin.

BCO-DMO Data Processing Note:
Station information including date and position were contributed with the data sets for all stations (except NBP0601 S06 and S20). PERL scripts were used to convert Excel files to plain text files prior to upload to BCO-DMO server. The NBP0608 HPLC data included the hydro station number (named cast in the original Excel file), but the NBP0601 data did not include the hydro station numbers.

Note that HPLC station number should not be confused with the hydrography station numbers. BCO-DMO created the sta_HPLC number from the HPLC sample_ID included in the original data file to allow grouping of HPLC data into full depth range profiles. It appears that for some stations, complete HPLC profiles were formed by combining samples from bottles fired during two successive hydro casts. For example, NBP0601 HPLC station S07, includes samples from bottles fired at depths between 200 and the surface, and bottles fired between the 'bottom' and 125. It is possible that the samples came from bottles fired on hydro stations 13 and 14, but the station positions are not identical. The original HPLC data file does not include enough information to match the HPLC stations definitively with the correct hydro stations.

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Data Files

File
HPLC_pigments.csv (Comma Separated Values (.csv), 299.85 KB) MD5:b7e94be795f31bd3dbfe505c1b23c20e Primary data file for dataset ID 3360

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Parameters

Parameter	Description	Units
cruise_id	Cruise identifier	dimensionless
date_local	local date the Niskin sample bottle was closed	YYYYMMDD
lat	latitude	decimal degrees
lon	longitude	decimal degrees
sta_HPLC	HPLC station number according to the HPLC sample scheme; BCO-DMO created this number to allow grouping of HPLC data into full depth range profiles; in many cases the HPLC data were sampled from bottles tripped on two successive casts	dimensionless
yrday	year day - unclear whether this is UTC or local day	dimensionless
time_local	local time the sample bottle was closed	HHMM
bottle	Niskin bottle	integer
sample_id	sample identification number for HPLC analysis	dimensionless
depth	depth of measurement	meters
depth_bottom	bottom depth	meters
mg_dvp_a5	Magnesium-2 4-divinyl phaeoporphyrin a5 monomethyl ester	nanograms/liter
chl_c2	chlorophyll c2	nanograms/liter
chl_c1	chlorophyll c1	nanograms/liter
peridinin	peridinin	nanograms/liter

fucox_but	19-prime-butanoyloxyfucoxanthin	nanograms/liter
fucox	fucoxanthin	nanograms/liter
neox	neoxanthin	nanograms/liter
prasinox	prasinoxanthin	nanograms/liter
violax	violaxanthin	nanograms/liter
fucox_hex	19-prime-hexanoyloxyfucoxanthin	nanograms/liter
diadinox	diadinoxanthin	nanograms/liter
cis_fucox	cis_fucoxanthin	nanograms/liter
allox	alloxanthin	nanograms/liter
diatox	diatoxanthin	nanograms/liter
zeax	zeaxanthin	nanograms/liter
lutein	lutein	nanograms/liter
crocox	crocoxanthin	nanograms/liter
chl_a2	divinyl chlorophyll a	nanograms/liter
chl_a	chlorophyll a	nanograms/liter
carotene_a	carotene-alpha	nanograms/liter
carotene_b	carotene-beta	nanograms/liter
chl_c3	chlorophyll c3	nanograms/liter
chl_b	chlorophyll b	nanograms/liter
p_phorbide	pheophorbide a	nanograms/liter
p_phytin	pheophytin a	nanograms/liter
monad	monadoxanthin	nanograms/liter
chlide	chlorophyllide	nanograms/liter
antherax	antheraxanthin	nanograms/liter
cast	the HPLC cast number; on NBP0601 these numbers do not match the hydro station numbers; they do match the hydro station numbers on NBP0608	dimensionless

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Instruments

Dataset-specific Instrument Name	High Performance Liquid Chromatograph
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	HP 1050 HPLC system equipped with autosampler, photodiode array and fluorescence detectors
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

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.

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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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