

CTD - Discrete Samples from R/V Melville, R/V Roger Revelle cruises MV1101, RR1202 in the Southern Ocean (30-60S); 2011-2012 (Great Calcite Belt project)

Website: <https://www.bco-dmo.org/dataset/560357>

Version: 10 June 2015

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Project

» [The Great Southern Coccolithophore Belt](#) (Great Calcite Belt)

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Table of Contents

- [Dataset Description](#)
 - [Methods & Sampling](#)
 - [Data Processing Description](#)
- [Data Files](#)
- [Parameters](#)
- [Instruments](#)
- [Deployments](#)
- [Project Information](#)
- [Funding](#)

Dataset Description

Discrete Samples from CTD Casts

Nutrients, Chlorophyll, Phaeopigments, POC, PIC, PON and cell count data from CTD casts

Methods & Sampling

Nutrients were processed by Scripps Science team, using their standard protocols. "Top bottle" chlorophylls were done in triplicate; deeper bottles were done as single samples. Samples with a Niskin number of -999 were samples taken from the ships non-contaminated seawater system, but were done while on station for casts where no bottles were tripped.

Data Processing Description

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BCO-DMO Processing Notes

- Generated from original files "MV1101 discrete samples.csv" and "RR1202 discrete samples.csv" contributed by Bruce Bowler
- Parameter names modified to conform to BCO-DMO convention
- ISO formatted date/time added
- data reported to number of decimal places as appropriate

Data Files

File
CTD_DISCRETE_SAMPLES.csv (Comma Separated Values (.csv), 300.51 KB) MD5:3a196dc76d1a03ee0114ef2e5ec0e8da Primary data file for dataset ID 560357

Parameters

Parameter	Description	Units
CruiseId	Official UNOLS cruise id	text
Station	Station Number	dimensionless
ISO_DateTime_UTC	ISO Date Time UTC	iso_format
date	date	YYYYMMDD
time	time	HHMMSS
Longitude	Station longitude (West is negative)	decimal degrees
Latitude	Station latitude (South is negative)	decimal degrees
cast	Cast Number	integer
Niskin_No	Niskin Bottle Number Samples with a Niskin number of -999 were samples taken from the ships non-contaminated seawater system.	integer
Depth	Sample depth	meters
CTD_Oxygen	CTD Oxygen	mL L ⁻¹
CTD_Fluorescence	CTD Fluorescence	volts
CTD_Transmittance	CTD Transmittance	percentage

CTD_Beam_C_Attenuation	CTD Beam C Attenuation	M ⁻¹
CTD_PAR	CTD PAR	uEinstein/m ² /Sec
Dissolved_O2	Dissolved O2	mL L ⁻¹
SIL	SIL	umol L ⁻¹
NO3	NO3	umol L ⁻¹
NO2	NO2	umol L ⁻¹
PO4	PO4	umol L ⁻¹
NH4	NH4	umol L ⁻¹
Avg_Corr_Chla	Avg Corr Chl a	ug L ⁻¹
Avg_Corr_Phaeo	Avg Corr Phaeo	ug L ⁻¹
Avg_Corr_Chla_plus_Phaeo	Avg Corr Chl a + Phaeo	ug L ⁻¹
Bsi	Bsi	umol L ⁻¹
POC	POC	ug L ⁻¹
PON	PON	ug L ⁻¹
PIC	PIC	ug L ⁻¹
Quadruple_Lith	the number of whole birefringent plates from coccolithophorids observed with optical microscopy	ML ⁻¹
Cell_plus_Agg	the number of birefringent plated cells and aggregates observed with optical microscopy	mL ⁻¹

[[table of contents](#) | [back to top](#)]

Instruments

Dataset-specific Instrument Name	CTD Sea-Bird 911
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

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.

[[table of contents](#) | [back to top](#)]

Deployments

MV1101

Website	https://www.bco-dmo.org/deployment/473222
Platform	R/V Melville
Start Date	2011-01-11
End Date	2011-02-16
Description	Original data are available from the NSF R2R data catalog

RR1202

Website	https://www.bco-dmo.org/deployment/473230
Platform	R/V Roger Revelle
Start Date	2012-02-18
End Date	2012-03-23
Description	Original data are available from the NSF R2R data catalog

[[table of contents](#) | [back to top](#)]

Project Information

The Great Southern Coccolithophore Belt (Great Calcite Belt)

Website: <http://greatbeltresearchcruise.com/gbr11/>

Coverage: Southern Ocean. 60W to 120E; 30S to 60S;

Collaborative Research: The Great Southern Coccolithophore Belt

Intellectual merit: Recent advances in satellite remote sensing enable estimation of suspended calcium carbonate (particulate inorganic carbon or 'PIC') from space. This radiative approach is operationally specific to marine coccolithophores (Haptophyceae) and sensitive enough to quantify PIC concentrations in oligotrophic gyres. Global images of suspended PIC taken over the seven years of the MODIS Aqua mission show a 'Great Belt' of PIC near the sub-Antarctic front of the Southern Ocean that circles the globe. This feature occurs every year during austral summer and appears to be within the high-nutrient, low chlorophyll region of the Southern Ocean. The area of the Great Belt is ~88 million km², 26% of the global ocean. Evidence from several cruises into the Great Belt region of the Atlantic, Indian and Pacific sectors has verified elevated concentrations of coccolithophores; previous work in the Atlantic sector verified high optical scattering from PIC. The few ship observations we have are entirely consistent with the satellite views. In this project, the investigators will systematically study the coccolithophores of the Great Belt guided by the following science goals: (a) identify the coccolithophore species within this belt; (b) measure the abundance of coccolithophores and associated PIC; (c) measure coccolithophore calcification rates; (d) elucidate factors that may limit coccolithophore latitudinal range (e.g. stratification, temperature, macronutrients, trace metals, grazing); (e) demonstrate whether the variability in PIC relates to shallow export flux; (f) define how variability in PIC production relates to the pCO₂, total alkalinity and dissolved inorganic carbon budgets; and (g) examine the impact of short-term ocean acidification on coccolithophore growth and calcite dissolution.

The research will involve cruises along the 50 S parallel to sample the Great Belt, during the austral summer. The investigators will use a combination of underway surface sampling (primarily optical and hydrographic) and vertical station profiles (using CTD/rosette and large volume submersible pumps) to address hypotheses related to the above goals. The cruise track will elucidate both zonal and meridional variability in the Great Belt. Controlled carboy incubation experiments will examine the impact of ocean acidification at various future scenarios on coccolithophore growth and dissolution. Dilution experiments will address grazing-related mortality and dissolution questions. Controlled metal-addition incubations will focus on potential iron, zinc and cobalt limitation of the coccolithophores or competition from diatoms related to silica availability. The proposed field observations and metal-addition experiments will provide important information on the current status of the Great Belt in the context of global biogeochemistry. The ocean acidification experiments to be undertaken are more forward-looking in terms of the fate of the Southern Ocean coccolithophores in a future acidified ocean.

Broader impacts: The globally significant size of the Great Belt indicates that it likely plays a major role in global biogeochemistry and climate change feedbacks. Thus, the investigators expect this work to have broad, transformative impacts in biological and chemical oceanography. Ocean acidification from the burning of fossil fuels is predicted to lower the pH of the surface ocean by 0.3 units in the next century and up to 0.7 units - a 5-fold increase in the proton concentration by the year 2300. A major goal of this study is to examine the effects of ocean acidification on coccolithophores in a region of low calcite saturation (i.e., one of the first regions expected to become sub-saturating for calcite). The results of these experiments will therefore be highly relevant to our basic understanding of the marine carbon cycle. Related to career development and Criterion II activities, the project includes field experience on two cruises for NSF REU undergraduates from Maine universities or colleges, providing funds for them to attend a scientific meeting. Participation of undergraduate students from Maine colleges builds capacity in our rural coastal state and helps thwart the serious issue of 'brain drain', in which the best students are leaving Maine to seek opportunity in wealthier, more populated states. A teacher will also participate on the cruises (via the NSF-sponsored ARMADA program). This teacher will develop learning modules for students about such topics as coccolithophores, calcification, export production, metal-plankton interactions, ocean acidification and climate change.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

Balch, WM; Drapeau, DT; Bowler, BC; Lyczkowski, E; Booth, ES; Alley, D. "The contribution of coccolithophores to the optical and inorganic carbon budgets during the Southern Ocean Gas Exchange Experiment: New evidence in support of the "Great Calcite Belt" hypothesis," *JOURNAL OF GEOPHYSICAL*

RESEARCH-OCEANS, v.116, 2011. View record at Web of Science

Poulton, AJ; Young, JR; Bates, NR; Balch, WM. "Biometry of detached *Emiliana huxleyi* coccoliths along the Patagonian Shelf," *MARINE ECOLOGY-PROGRESS SERIES*, v.443, 2011, p. 1. View record at Web of Science

BOOKS/ONE TIME PROCEEDING

Brown, Michael S, W. Balch, S. Craig, B. Bowler, D. Drapeau, J. Grant. "Optical closure within a Patagonian Shelf coccolithophore bloom", 06/01/2011-05/31/2012, 2012, "ACCESS'12. Atlantic Canada Coastal & Estuarine Science Society. Dalhousie University, Halifax, Nova Scotia. 10-13 May, 2012."

[[table of contents](#) | [back to top](#)]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0961660

[[table of contents](#) | [back to top](#)]