

Cruise track position data from cruises MV1101 and RR1202 (Great Calcite Belt project)

Website: <https://www.bco-dmo.org/dataset/473241>

Data Type: Cruise Results

Version: 1

Version Date: 2013-12-19

Project

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

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Abstract

Cruise track position data from cruises MV1101 and RR1202.

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Coverage

Spatial Extent: N:-29.842043 E:115.765233 S:-60.019873 W:-70.906657

Temporal Extent: 2011-01-11 - 2012-03-22

Dataset Description

Cruise tracks generated from R2R Archive files
Cruise Id, Date/Time UTC, Lat, Lon, SOG, COG
1 minute fixes

Acquisition Description

Generated by BCO-DMO staff from R2R Archive files

File Creation Date for MV1101 from R2R Header: // Creation date: 2012-05-11T01:25:07Z

File Creation Date for RR1202 from R2R Header: // Creation date: 2013-05-17T01:11:40Z

Processing Description

Generated by BCO-DMO staff from R2R Archive files

File Creation Date for MV1101 from R2R Header: // Creation date: 2012-05-11T01:25:07Z

File Creation Date for RR1202 from R2R Header: // Creation date: 2013-05-17T01:11:40Z

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Parameters

Parameter	Description	Units
CruiseId	Official UNOLS cruise id	text
ISO_DateTime_UTC	ISO formatted UTC Date and Time	YYYY-MM-DDTHH:MM:SSZ
Latitude	Latitude Position (South is negative)	decimal degrees
Longitude	Longitude Position (West is negative)	decimal degrees
SOG	Instantaneous Speed-over-ground	meters/sec
COG	Instantaneous Course-over-ground [deg. clockwise from North]	decimal degrees

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Instruments

Dataset-specific Instrument Name	GPS
Generic Instrument Name	Global Positioning System Receiver
Generic Instrument Description	The Global Positioning System (GPS) is a U.S. space-based radionavigation system that provides reliable positioning, navigation, and timing services to civilian users on a continuous worldwide basis. The U.S. Air Force develops, maintains, and operates the space and control segments of the NAVSTAR GPS transmitter system. Ships use a variety of receivers (e.g. Trimble and Ashtech) to interpret the GPS signal and determine accurate latitude and longitude.

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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

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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; Lyczskowski, 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."

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Funding

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

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