Bacterial abundance and production from bottle samples from R/V Melville cruise COOK19MV from the Southern Ocean, south of New Zealand in 2002 (SOFeX project)

Website: https://www.bco-dmo.org/dataset/2964
Version: 15 August 2008
Version Date: 2008-08-15

Project
» Southern Ocean Iron Experiment (SOFeX)

Programs
» Iron Synthesis (FeSynth)
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
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Dataset Description

Bacterial Abundance and Production from bottle samples

Methods & Sampling

dates: 24 January 2002 to 21 February 2002 (20020124-20020221)
location: N: -52.56100 S: -66.61150 W: -172.69267 E: -166.94733

15 August 2008: Prepared for OCB data system by Cyndy Chandler, OCB DMO (WHOI) from documentation contributed by Jacques Olivier, Helen Quinby, Robert Daniels, and Hugh Ducklow

Original Excel file contributed: 8 November, 2002

and downloaded from MBARI by OCB DMO:
copy of original Excel file

Contact: Jacques Oliver (Email: jloliver@vims.edu)

R/V Melville Bacterial Measurements Methodology

Bacterial Abundance Flow cytometry (FCM)

1. 9.5 ml sample from CTD or TM rosette, fixed to final concentration of 1% formaldehyde

2. Sample frozen at -80 C

3. On land, triplicate samples were analyzed using a Beckman-Coulter Epics Altra equipped with an Enterprise II laser at 488 nm using 190mV (intra-sample variation).

4. About 100 ml of sample were measured following Troussellier et al. (1999) with addition of 2.5 mM SYTO 13 and a 10 minute incubation.

5. This analysis was done on triplicate 1.0 ml samples to which 1.0 mm beads (Molecular Probes, Fluo Spheres, F-8888) were also added at a 10E6/ml concentration.

The beads determined flow rate and uniformity in fluorescence signal. Discrimination was done on a positive green fluorescence and the plot was green fluorescence (devoid of any red fluorescence) against side scatter. Analytical variation was 3%.

Reference: Troussellier, M., C. Courties, P. Lebaron, and P.Servais. 1999. FEMS Microbiology Ecology 29: 319-330.

Bacterial Abundance Acridine orange direct counts (AODC)

1. 10-15 ml sample fixed to final concentration of 1% formaldehyde
2. Sample filtered onto 0.2 micron blackened polycarbonate filter
3. Filter stained with 45% (w/v) acridine orange
4. Filter mounted onto glass slide with immersion oil and coverslip
5. Bacteria enumerated via epifluorescence microscopy
6. Intra-sample variation reported

Reference: Kirchman, D., Sigda, J., Kapuscinski, R., and Mitchell, R. 1982. Appl. Envrion. Microbiol. 44:376-382

Bacterial Production Thymidine (TdR) and Leucine (Leu) Incorporation

1. 1.6 ml sample spiked with tritiated thymidine or tritiated leucine
2. Samples run in triplicate with one negative control containing 6% trichloroacetic acid (TCA)
3. Samples incubated at in situ temperatures in the dark for 8-20 hours (depending on water temp)
4. Incubation stopped by adding TCA (6% final conc.) to each sample
5. Nucleic acid extracted with TCA and ethanol
6. 1.6 ml Ultima Gold scintillation cocktail added
7. 3 minute counts on each sample on scintillation counter

Reference: Smith, D.C. and Azam, F. 1992. Mar. Microb. Food Webs. 6:107-114.

Data Processing Description

Change history:
070509: downloaded original data (SOFeX_melville_Bacterial_Data.xls) from SOFeX project data web site.
data prepared database by Dave DuBois (OCB DMO, WHOI)
080815: added to OCB database by Cyndy Chandler, OCB DMO, (cchandler@whoi.edu)

OCB DMO Note: Four worksheets were contained in the original file: Methods, North Patch, South Patch, and Transects. The Methods worksheet was extracted to file Methods_Melville_Bact_Abund_Prod.xls. The other three worksheets were combined into one and were sorted by date. The Latitude value for Transect 3, Station 42 was changed from

6 07.06 S to 66 07.06 S before converting all Lat and Lon values to decimal degrees.
Two bottle cast entries were included for USCG Polar Star on 16-Feb in the original file
and are retained here with data collected during the Melville cruise.

PI note: Date = Local Day (Kiwi). Event # = Julian Day, UTC.
North Patch Summary: 2 IN, 2 OUT.
South Patch Summary: 7 IN, 4 OUT (R/V Melville); 1 IN, 1 OUT (USCG Polar Star).
Transect Summary: 3 transects.

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Data Files

File
bacteria.csv (Comma Separated Values (.csv), 14.80 KB) MD5:436ebecb5f923eed5d5bf17bf2a54bac Primary data file for dataset ID 2964

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Parameters

Parameter	Description	Units
event	unique sampling event number from event log (day of year and time (UTC))	doYhhmm
date_L	NZ local day	dimensionless
day_S	South patch local date days since start of first fertilization, day zero=24-Jan ??	integer days
lon	longitude; negative denotes West	decimal degrees
lat	latitude; negative denotes South	decimal degrees
patch_loc	sampling location relative to patch see explanation in cruise event log), T = transect	dimensionless
station	station location number	dimensionless
ev_type	event type descriptor string	dimensionless
bot	Niskin bottle number	dimensionless
depth	depth, calculted from pressure??	meters
light_lev	light level	percent
bact_cyt	bacterial abundance, Flow Cytometry (FCM)	cells/liter
bact_aodc	bacterial abundance, Acridine Orange Direct Count (AODC)	cells/liter
thy_incorp	Thymidine (TdR) incorporation rate	picomoles/liter/hour
thy_sd	standard deviation of thymidine incorporation rate	picomoles/liter/hour
leuc_incorp	Leucine incorporation rate	picomoles/liter/hour
leuc_sd	standard deviation of leucine incorporation rate	picomoles/liter/hour

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Instruments

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.

Dataset-specific Instrument Name	Trace Metal Bottle
Generic Instrument Name	Trace Metal Bottle
Generic Instrument Description	Trace metal (TM) clean rosette bottle used for collecting trace metal clean seawater samples.

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Deployments

COOK19MV

Website	https://www.bco-dmo.org/deployment/57826
Platform	R/V Melville
Report	http://ocb.whoi.edu/SOFeX/CRUISES/proj_description.pdf
Start Date	2002-01-19
End Date	2002-02-26

Description	Brief cruise plan description: Three ships were involved in the SOFeX experiment. Each ship operated in the study area at a different time to afford the longest observation time. The designations SOFeX-N and SOFeX-S are sometimes used to distinguish between two iron enriched patches - one in low silicate waters north of the polar front (SOFEX-N), and the other in high silicate waters south of the polar front (SOFEX-S). All three ships, Melville (MV), Revelle (RR) and Polar Star (PS), worked in SOFEX-S, but only the Revelle and Melville worked in the SOFeX N patch and shuttled between the two patches. The R/V MELVILLE sailed several weeks after the R/V REVELLE to arrive in the study area just as the 'patches' were forming in response to iron fertilization. The MELVILLE's team planned to make detailed measurements of phytoplankton physiology and rate processes, and to sample daily for phytoplankton growth rates and biomass, soluble and particulate iron and zooplankton biomass. A cruise logbook includes daily entries filed by the Chief Scientist aboard each vessel. **Methods & Sampling** dates: 24 January 2002 to 21 February 2002 (20020124-20020221) location: N: -52.56100 S: -66.61150 W: -172.69267 E: -166.94733 15 August 2008: Prepared for OCB data system by Cyndy Chandler, OCB DMO (WHOI) from documentation contributed by Jacques Olivier, Helen Quinby, Robert Daniels, and Hugh Ducklow Original Excel file contributed: 8 November, 2002 and downloaded from MBARI by OCB DMO: copy of original Excel file Contact: Jacques Oliver (Email: jloliver@vims.edu) R/V Melville Bacterial Measurements Methodology Bacterial Abundance Flow cytometry (FCM) 1. 9.5 ml sample from CTD or TM rosette, fixed to final concentration of 1% formaldehyde 2. Sample frozen at -80 C 3. On land, triplicate samples were analyzed using a Beckman-Coulter Epics Altra equipped with an Enterprise II laser at 488 nm using 190mV (intra-sample variation). 4. About 100 ml of sample were measured following Troussellier et al. (1999) with addition of 2.5 mM SYTO 13 and a 10 minute incubation. 5. This analysis was done on triplicate 1.0 ml samples to which 1.0 mm beads (Molecular Probes, Fluo Spheres, F-8888) were also added at a 10E6/ml concentration. The beads determined flow rate and uniformity in fluorescence signal. Discrimination was done on a positive green fluorescence and the plot was green fluorescence (devoid of any red fluorescence) against side scatter. Analytical variation was 3%. Reference: Troussellier, M., C. Courties, P. Lebaron, and P.Servais. 1999. FEMS Microbiology Ecology 29: 319-330. Bacterial Abundance Acridine orange direct counts (AODC) 1. 10-15 ml sample fixed to final concentration of 1% formaldehyde 2. Sample filtered onto 0.2 micron blackened polycarbonate filter 3. Filter stained with 45% (w/v) acridine orange 4. Filter mounted onto glass slide with immersion oil and coverslip 5. Bacteria enumerated via epifluorescence microscopy 6. Intra-sample variation reported Reference: Kirchman, D., Sigda, J., Kapuscinski, R., and Mitchell, R. 1982. Appl. Envrion. Microbiol. 44:376-382 Bacterial Production Thymidine (TdR) and Leucine (Leu) Incorporation 1. 1.6 ml sample spiked with tritiated thymidine or tritiated leucine 2. Samples run in triplicate with one negative control containing 6% trichloroacetic acid (TCA) 3. Samples incubated at in situ temperatures in the dark for 8-20 hours (depending on water temp) 4. Incubation stopped by adding TCA (6% final conc.) to each sample 5. Nucleic acid extracted with TCA and ethanol 6. 1.6 ml Ultima Gold scintillation cocktail added 7. 3 minute counts on each sample on scintillation counter Reference: Smith, D.C. and Azam, F. 1992. Mar. Microb. Food Webs. 6:107-114. **Processing Description** Change history: 070509: downloaded original data (SOFeX_melville_Bacterial_Data.xls) from SOFeX project data web site. data prepared database by Dave DuBois (OCB DMO, WHOI) 080815: added to OCB database by Cyndy Chandler, OCB DMO, (cchandler@whoi.edu) OCB DMO Note: Four worksheets were contained in the original file: Methods, North Patch, South Patch, and Transects. The Methods worksheet was extracted to file Methods_Melville_Bact_Abund_Prod.xls. The other three worksheets were combined into one and were sorted by date. The Latitude value for Transect 3, Station 42 was changed from 6 07.06 S to 66 07.06 S before converting all Lat and Lon values to decimal degrees. Two bottle cast entries were included for USCG Polar Star on 16-Feb in the original file and are retained here with data collected during the Melville cruise. PI note: Date = Local Day (Kiwi). Event # = Julian Day, UTC. North Patch Summary: 2 IN, 2 OUT. South Patch Summary: 7 IN, 4 OUT (R/V Melville); 1 IN, 1 OUT (USCG Polar Star). Transect Summary: 3 transects.

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Project Information

Southern Ocean Iron Experiment (SOFeX)

Website: http://www.mbari.org/expeditions/SOFeX2002/

Coverage: Southern Ocean, south of New Zealand

Before he passed away in 1993, John Martin suggested that an increase in the flow of iron-rich dust to the ocean causes phytoplankton (single celled algae) to grow. The increased photosynthesis removes carbon dioxide from surface waters as the algae create biomass. This carbon dioxide is replaced by carbon dioxide gas that flows into the sea from the atmosphere. Reduced carbon dioxide in the atmosphere cools the planet (CO2 is a greenhouse gas that warms the earth). The results of this work, funded by the National Science Foundation, the Department of Energy, and the US Coast Guard, will be a much better understanding of how biological processes may regulate climate. (see Related Info: Fe cycle)

A direct test of the 'Martin Hypothesis' that trace concentrations of Fe are responsible for phytoplankton's ability to grow by direct experimental addition of Fe to the surface waters. Consequently the distribution of bioavailable Fe in the surface waters determines large geographical areas primary production and the following flux of fixed organic matter to the deep sea. The aim of the SOFeX project is to investigate the effects of iron fertilization on the productivity of the Southern Ocean. The results of this work will contribute significantly to our understanding of important biogeochemical processes which bear directly on the global carbon cycle, atmospheric carbon dioxide concentration, and climate control.

The SOFeX-N and SOFeX-S designations are sometimes used to distinguish between two iron enriched patches - one in low silicate waters north of the polar front (SOFEX-N), and the other in high silicate waters south of the polar front (SOFEX-S). All three ships, Melville (MV), Revelle (RR) and Polar Star (PS), worked in SOFEX-S, but only the Revelle and Melville worked in the SOFeX N patch and shuttled between the two patches.

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Program Information

Iron Synthesis (FeSynth)

Coverage: Global

The two main objectives of the Iron Synthesis program (SCOR Working Group proposal, 2005), are:
1. Data compilation: assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIREE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP); similarly for the natural fertilizations S.O.JGOFS (1992), CROZEX (2004/2005) and KEOPS (2005).

2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO2 budgeting, nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

SCOR Working Group proposal, 2005. "The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling".
http://www.scor-int.org/Working_Groups/wg131.htm

See also: SCOR Proceedings Vol. 42 Concepcion, Chile October 2006, pgs: 13-16 2.3.3 Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling.

The first objective of the Iron Synthesis program involves a data recovery effort aimed at assembling a common, open-access database of data and metadata from a series of *in-situ* ocean iron fertilization

experiments conducted between 1993 and 2005. Initially, funding for this effort is being provided by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

Through the combined efforts of the principal investigators of the individual projects and the staff of Biological and Chemical Oceanography Data Management Office (BCO-DMO), data currently available primarily through individuals, disparate reports and data agencies, and in multiple formats, are being collected and prepared for addition to the BCO-DMO database from which they will be freely available to the community.

As data are contributed to the BCO-DMO office, they are organized into four overlapping categories:
1. Level 1, basic metadata
(e.g., description of project/study, general location, PI(s), participants);
2. Level 2, detailed metadata and basic shipboard data and routine ship's operations
(e.g., CTDs, underway measurements, sampling event logs);
3. Level 3, detailed metadata and data from specialized observations
(e.g., discrete observations, experimental results, rate measurements) and
4. Level 4, remaining datasets
(e.g., highest level of detailed data available from each study).

Collaboration with BCO-DMO staff began in March of 2008 and initial efforts have been directed toward basic project descriptions, levels 1 and 2 metadata and basic data, with detailed and more detailed data files being incorporated as they become available and are processed.

Related file

Program Documentation

The Iron Synthesis Program is funded jointly by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

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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