POM concentrations for carbon, nitrogen, phosphorus, and chemical oxygen from GO-SHIP Line P18 Legs 1 and 2 in 2016 and 2017

Website: https://www.bco-dmo.org/dataset/816347
Data Type: Cruise Results
Version: 1
Version Date: 2020-06-22

Project
» Convergence: RAISE: Linking the adaptive dynamics of plankton with emergent global ocean biogeochemistry (Ocean Stoichiometry)

Contributors	Affiliation	Role
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Abstract
POM concentrations for carbon, nitrogen, phosphorus, and chemical oxygen from GO-SHIP Line P18 Legs 1 and 2 in 2016 and 2017. These data will be published in Moreno et al. (in press).

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Coverage

Spatial Extent: **N**:28.9071 **E**:-100.3721 **S**:-69.9027 **W**:-116.0561
Temporal Extent: 2016-11-13 - 2017-01-28

Dataset Description

POM concentrations for carbon, nitrogen, phosphorus, and chemical oxygen from GO-SHIP Line P18 Legs 1 and 2 in 2016 and 2017.

These data will be published in Moreno et al. (in press).

Methods & Sampling

POM sample collection

General equipment preparation in the lab before shipment included an HCl bath (1.0 M HCl overnight) and milli-Q rinse for the 8 L carboys, tubing, and filter holders. Additionally, the carboys were autoclaved. The 25 mm, 0.7 µm GF/F filters and aluminum foil used to wrap the filters were combusted (500 °C for 5 hours) in aluminum foil packets to remove any traces of carbon present. The forceps that came in contact with the samples were wiped with 70% ethanol before and between uses.
Seawater for the POM samples was collected from the onboard flow through underway system. The underway intake was located off the bow of the ship at a depth of approximately 5.3 m from the sea surface and the length of the pipe from the intake location to the output lab was 11.8 m. A 30 µm nylon mesh pre-filter was attached to the underway outlet for all standard samples to remove large plankton and particulates. Before sampling, the carboys used were rinsed twice with the pre-filtered underway seawater. Triplicate sampling occurred roughly at four-hour intervals with a shift forward of one hour each day. For example, if samples were taken at 01:00, 05:00, and 09:00 on one day, samples would be taken at 02:00, 06:00, and 10:00 the following day to avoid any diurnal bias. The water was vacuum filtered through combusted GF/F filters and the volume of seawater filtered was determined on a per station basis, ranging from 3-8 L. The volume was raised if the previous stations' filtration times exhibited a decreasing trend and lowered if filtration time exhibited an increasing trend in an attempt to normalize the amount of collected material. The large sampling volume and initial rinsing steps limit the effect of a time delay from underway inlet to sampling station. Additional "total POM" samples were taken in the Southern Ocean by removing the 30 µm pre-filter during the rinse and sample collection steps. After filtration, all POP triplicates were rinsed with approximately 2-5 mL of a 0.17 M $Na2SO4$ solution to remove dissolved phosphorus. All POM samples were folded in half with the top sides toward each other, sealed inside pieces of combusted aluminum foil, and stored in a -20 C freezer until analysis.

POP assay

The POP data were obtained using an ash/hydrolysis method and comparing the samples to a set of standard phosphorus concentrations (Lomas et al., 2010). The sample filters were unfolded and placed face up into acid-bathed and combusted scintillation vials. Along with each set of samples, 10 different volumes (ranging 0 - 0.5 mL) of 0.1 M $KH2PO4$ solution were added to scintillation vials. 2 mL of a 0.017 M $MgSO4$ drying solution was added to each scintillation vial and then all vials were placed into an 80-90 °C oven overnight to dry. After drying, the vials were heated at 500 °C for 2 hours, then left to cool before adding 5 mL of 0.2 M HCl to each vial and being returned to the 80-90 °C oven for 30 minutes after being brought up to temperature. The solutions were then transferred to 15 mL glass centrifuge tubes (prepared in the same way as the scintillation vials). The sample vials were rinsed with 5 mL of milli-Q each, which was also added to the centrifuge tubes. 1 mL of a mixed reagent containing 2:5:1:2 parts Ammonium Molybdate ($(NH4)6Mo7O24$), 5.0 N $H2SO4$, Potassium Antimonyl Tartrate ($C8H4K2O12Sb2$), and Ascorbic Acid ($C6H8O6$) respectively was added to each centrifuge tube in 30-second intervals. Each of the sample tubes was centrifuged to isolate any glass fibers that could interfere with the absorbance reading. Lastly, after allowing the mixed reagent to react for exactly 30 min, the standards and samples were analyzed in 30-second intervals in a spectrophotometer at an 885 nm wavelength using a blank of ~0.1 M HCl solution and rinsing the cuvette with the blank solution between measurements.

POC/PON assay

POC and PON measurements were analyzed both in-lab at UCI and at the UC Santa Barbara Marine Science Institute Analytical Lab. An ANOVA analysis determined that the two methods did not produce significantly different results. The preparation for all samples was the same; the samples were each removed from their foil packets and placed into acid-bathed and combusted scintillation vials and dried in a 55 °C oven overnight. The scintillation vials were then placed in a desiccator containing a beaker of 12 M HCl overnight before being dried at 55 °C at least overnight once more. Samples sent to UCSB were then capped and shipped to the lab. Samples analyzed at UCI were packed into tin packets alongside Atropine ($C17H23NO3$) standards (ranging 0.2-1.5 mg) and measured using a Flash EA elemental analyzer.

PCOD assay

Particulate chemical oxygen demand was quantified using a modified assay for sea water (Moreno et al. 2020). GF/F filters for PCOD were dried at 55°C overnight, before oxidizing the filters plus 2ml milli-Q in HACH COD HR+ reagent vials (Product # 241915) at 150°C for 2 h. Mercuric sulfate was added to reagent vials mixture to prevent chloride ion interference. Next, silver chloride was precipitated out with an additional 92.1 µL of 9.5 M NaCl for consistent precipitation. Precipitate was removed by centrifuging for 30 min at 2500 rpm. The residual potassium dichromate was quantified by absorbance at 600 nm against HACH certified phthalate-based COD

standards.

Note about data columns: Rep 1-6 indicate replicates collected separately at same timepoint.

Associated CLIVAR P18 underway and bottle datasets can be found on the National Centers for Environmental Information (NCEI) CLIVAR Repeat Section P18 page:
https://www.nodc.noaa.gov/ocads/oceans/RepeatSections/clivar_p18.html

Data Processing Description

BCO-DMO Data Manager Processing Notes:
* Data submitted as Excel file P18-POM.xlsx extracted to csv file.
* added a conventional header with dataset name, PI name, version date
* modified parameter names to conform with BCO-DMO naming conventions (spaces, +, and - changed to underscores). Units in parentheses removed and added to Parameter Description metadata section.
* blank values in this dataset are displayed as "nd" for "no data." nd is the default missing data identifier in the BCO-DMO system.
* asterisk removed from Volume values for samples P18-134 and P18-136. Indicated additional notes taken (not provided).
* Timestamp converted to ISO 8601 format yyyy-mm-ddTHH:MMZ

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Data Files

File	
p18_pom.csv	(Comma Separated Values (.csv), 36.79 KB) MD5:51005f84b31809c956b1628dedbde555
Primary data file for dataset ID 816347	

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Related Publications

Lomas, M. W., Burke, A. L., Lomas, D. A., Bell, D. W., Shen, C., Dyhrman, S. T., & Ammerman, J. W. (2010). Sargasso Sea phosphorus biogeochemistry: an important role for dissolved organic phosphorus (DOP). Biogeosciences, 7(2), 695–710. doi:10.5194/bg-7-695-2010
Methods

Moreno, A. R., Garcia, C. A., Larkin, A. A., Lee, J. A., Wang, W.-L., Moore, J. K., Primeau, F. W., & Martiny, A. C. (2020). Latitudinal gradient in the respiration quotient and the implications for ocean oxygen availability. Proceedings of the National Academy of Sciences, 117(37), 22866–22872. https://doi.org/10.1073/pnas.2004986117
Results

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Related Datasets

Related Research

National Centers for Environmental Information (NCEI). (2020, May 22). CLIVAR Repeat Section P18. Retrieved August 25, 2020, from https://www.nodc.noaa.gov/ocads/oceans/RepeatSections/clivar_p18.html

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Parameters

Parameter	Description	Units
Sample	Sample identifier	unitless
Station	GO-SHIP station or "underway"	unitless
Latitude	Latitude	decimal degrees
Longitude	Longitude	decimal degrees
ISO_DateTime_UTC	Date and time of collection (UTC) in ISO 8601 format yyyy-mm-ddTHH:MMZ	unitless
Volume	Filtration volume	liters (L)
POC_Rep1	Particulate organic carbon < 30 µm for replicate 1	micromoles per liter (µM)
POC_Rep2	Particulate organic carbon < 30 µm for replicate 2	micromoles per liter (µM)
POC_Rep3	Particulate organic carbon < 30 µm for replicate 3	micromoles per liter (µM)
PON_Rep1	Particulate organic nitrogen < 30 µm for replicate 1	micromoles per liter (µM)
PON_Rep2	Particulate organic nitrogen < 30 µm for replicate 2	micromoles per liter (µM)
PON_Rep3	Particulate organic nitrogen < 30 µm for replicate 3	micromoles per liter (µM)
POP_Rep1	Particulate organic phosphorus < 30 µm for replicate 1	nanomoles per liter (nM)
POP_Rep2	Particulate organic phosphorus < 30 µm for replicate 2	nanomoles per liter (nM)
POP_Rep3	Particulate organic phosphorus < 30 µm for replicate 3	nanomoles per liter (nM)
TPOC_Rep1	Total particulate organic carbon for replicate 1	micromoles per liter (µM)
TPOC_Rep2	Total particulate organic carbon for replicate 2	micromoles per liter (µM)
TPOC_Rep3	Total particulate organic carbon for replicate 3	micromoles per liter (µM)
TPON_Rep1	Total particulate organic nitrogen for replicate 1	micromoles per liter (µM)
TPON_Rep2	Total particulate organic nitrogen for replicate 2	micromoles per liter (µM)
TPON_Rep3	Total particulate organic nitrogen for replicate 3	micromoles per liter (µM)
TPOP_Rep1	Total particulate organic phosphorus for replicate 1	nanomoles per liter (nM)
TPOP_Rep2	Total particulate organic phosphorus for replicate 2	nanomoles per liter (nM)
TPOP_Rep3	Total particulate organic phosphorus for replicate 3	nanomoles per liter (nM)

PCOD_Rep_1	Particulate chemical oxygen demand < 30 µm for replicate 1. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)
PCOD_Rep_2	Particulate chemical oxygen demand < 30 µm for replicate 2. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)
PCOD_Rep_3	Particulate chemical oxygen demand < 30 µm for replicate 3. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)
PCOD_Rep_4	Particulate chemical oxygen demand < 30 µm for replicate 4. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)
PCOD_Rep_5	Particulate chemical oxygen demand < 30 µm for replicate 5. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)
PCOD_Rep_6	Particulate chemical oxygen demand < 30 µm for replicate 6. Rep 1-6 indicate replicates collected separately at same timepoint.	micromoles per liter (µM)

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Instruments

Dataset-specific Instrument Name	CN FlashEA 1112 Elemental Analyzer (Thermo Scientific, Waltham, Massachusetts)
Generic Instrument Name	Elemental Analyzer
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	Genesys 10vis spectrophotometer (#840-208100, Thermo Scientific, Waltham, Massachusetts)
Generic Instrument Name	Spectrophotometer
Generic Instrument Description	An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.

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Deployments

RB1606_leg1

Website	https://www.bco-dmo.org/deployment/821809
Platform	NOAA Ship Ronald H. Brown
Report	http://dx.doi.org/10.7942/C21T0F
Start Date	2016-11-19
End Date	2016-12-24
Description	P18 US GO-SHIP Reoccupation Leg 1 (2016/2017). Leg 1 of the 2016/2017 occupation of the P18 hydrographic section aboard the National Oceanic and Atmospheric Administration (NOAA) vessel the Ronald H. Brown acting under the auspices of the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP). The Cruise Report and additional data from the cruise are available from CCHDO: Sonnerup, R., Carter, B., Purkey, S., and Bourbonnais, A. (2017) . Hydrographic Cruise: 33RO20161119, exchange version. Accessed from CCHDO https://cchdo.ucsd.edu/cruise/33RO20161119. Access date 2021-05-21. CCHDO cruise DOI: 10.7942/C21T0F

RB1606_leg2

Website	https://www.bco-dmo.org/deployment/821815
Platform	NOAA Ship Ronald H. Brown
Report	http://dx.doi.org/10.7942/C21T0F
Start Date	2016-12-30
End Date	2017-02-03
Description	P18 US GO-SHIP Reoccupation Leg 2 (2016/2017). Leg 2 or the 2016/2017 occupation of the P18 hydrographic section aboard the National Oceanic and Atmospheric Administration (NOAA) vessel the Ronald H. Brown acting under the auspices of the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP). The Cruise Report and additional data from the cruise are available from CCHDO: Sonnerup, R., Carter, B., Purkey, S., and Bourbonnais, A. (2017). Hydrographic Cruise: 33RO20161119, exchange version. Accessed from CCHDO https://cchdo.ucsd.edu/cruise/33RO20161119. Access date 2021-05-21. CCHDO cruise DOI: 10.7942/C21T0F

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Project Information

Convergence: RAISE: Linking the adaptive dynamics of plankton with emergent global ocean biogeochemistry (Ocean Stoichiometry)

NSF Award Abstract:
Due to their sheer abundance and high activity, microorganisms have the potential to greatly influence how ecosystems are affected by changes in their environment. However, descriptions of microbial physiology and diversity are local and highly complex and thus rarely considered in Earth System Models. Thus, the researchers focus on a convergence research framework that can qualitatively and quantitatively integrate eco-evolutionary changes in microorganisms with global biogeochemistry. Here, the investigators will develop an approach that integrates the knowledge and tools of biologists, mathematicians, engineers, and geoscientists to understand the link between the ocean nutrient and carbon cycles. The integration of data and knowledge from diverse fields will provide a robust, biologically rich, and computationally efficient prediction for the variation in plankton resource requirements and the biogeochemical implications, addressing a fundamental challenge in ocean science. In addition, the project can serve as a road map for many other research groups facing a similar lack of convergence between biology and geoscience.

Traditionally, the cellular elemental ratios of Carbon, Nitrogen, and Phosphorus (C:N:P) of marine communities

have been considered static at Redfield proportions but recent studies have demonstrated strong latitudinal variation. Such regional variation may have large - but poorly constrained - implications for marine biodiversity, biogeochemical functioning, and atmospheric carbon dioxide levels. As such, variations in ocean community C:N:P may represent an important biological feedback. Here, the investigators propose a convergence research framework integrating cellular and ecological processes controlling microbial resource allocations with an Earth System model. The approach combines culture experiments and omics measurements to provide a molecular understanding of cellular resource allocations. Using a mathematical framework of increasing complexity describing communicating, moving demes, the team will quantify the extent to which local mixing, environmental heterogeneity and evolution lead to systematic deviations in plankton resource allocations and C:N:P. Optimization tools from engineering science will be used to facilitate the quantitative integration of models and observations across a range of scales and complexity levels. Finally, global ocean modeling will enable understanding of how plankton resource use impacts Earth System processes. By integrating data and knowledge across fields, scales and complexity, the investigators will develop a robust link between variation in plankton C:N:P and global biogeochemical cycles.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1559002
NSF Division of Ocean Sciences (NSF OCE)	OCE-1848576

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