

Size Fractionated Particulate Organic Carbon (POC) and Particulate Organic Nitrogen (PON) collected during BIOSCOPE cruises (2018-2023) aboard the R/V Atlantic Explorer

Website: <https://www.bco-dmo.org/dataset/964826>

Data Type: Cruise Results

Version: 1

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Project

» [Bermuda Institute of Ocean Sciences Simons Collaboration on Ocean Processes and Ecology](#) (BIOSCOPE)

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Abstract

Included in this dataset are chemical analyses of size-fractionated particle samples collected during BIOSCOPE project cruises in the Sargasso Sea (2018-2023). Samples were collected using McLane WTS-LV in-situ pumps and analyzed for bulk particulate organic carbon (POC) and particulate organic nitrogen (PON).

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Coverage

Location: North Atlantic Subtropical Gyre - Bermuda Atlantic Time Series (BATS) site

Spatial Extent: N:32.19 E:-63.8 S:30.75 W:-64.5

Temporal Extent: 2018-07-03 - 2023-07-15

Methods & Sampling

Samples were collected during BIOS-SCOPE cruises aboard the R/V Atlantic Explorer in July 2018 (AE1819), July 2019 (AE1916), August 2021 (AE2114), November 2021 (AE2123), July 2022 (AE2213), and July 2023 (AE2315) at or near the BATS site (31°40' N, 64°10' W) or at Hydrostation S (32°10' N, 64°30' W).

Size-fractionated particle samples were collected using McLane WTS-LV *in-situ* pumps (4 L min⁻¹ maximum pumping rate; McLane Research Laboratories, Inc.) during all sampling periods. Five to eight depths were sampled between the surface and 200 meters during each cruise. Most pumps were dual-flow, collecting water through two filter holders simultaneously for geochemical and taxonomic analyses, as described by Henderson et al. (2024) and Comstock et al. (2024). Each filter holder was a vertical-intake (McLane) or mini-MULVFS style and contained four 142 mm diameter filter tiers equipped as follows (from top to bottom) for the geochemical analyses reported here: [1] 20 µm Nitex filter, [2] 6 µm Nitex filter (with the exception of AE2213 and AE2315, 5 µm polyester filter), [3] two stacked 1.2 µm glass fiber filters (GF/C), [4] two stacked 0.3 µm glass fiber filters (GF75). A 150 µm Nitex backing filter was placed beneath the filter(s) of interest on the first three tiers of all filter holders to ensure filter structural integrity. Nitex filters were acid- and methanol-washed before use, and glass fiber filters were pre-combusted (450°C) for 5 hours. After pump recovery, filter holders were drained with a weak vacuum to remove excess seawater. Filters were photographed, removed and folded with clean forceps, stored in combusted foil, and transported and stored at -80°C. Flow meters were placed in-line on each flow path of the pumps, and exact filtered volumes for each flow path were determined; flow rates through filter stacks used for organic analyses averaged <3 Liters per minutes (L/min). We collected dip blanks – filters that did not have any water pumped through them, but were submerged in natural seawater – along with our samples.

Processing of large particle (>20 µm) samples

Samples were stored at -80°C until processing. Once in the lab, particles collected on 20 µm Nitex filters were rinsed off the filters onto 47-mm diameter, pre-combusted (450°C, for 5 hr) glass fiber filters with a nominal pore size of 0.7 µm (GF/F) using 0.2 µm-filtered seawater and combusted glass filter towers. Briefly, particles were rinsed from the Nitex filters using an acid-clean squirt bottle to spray across the filter. The Nitex mesh was then sonicated for three minutes in an acid-clean polypropylene Nalgene bottle with more filtered seawater. After sonication, this water was poured into the filter tower. The process was repeated three times, with all filtered seawater being drained from the filter tower with gentle vacuum after each rinse and sonication onto the same GF/F filter. Samples were then freeze-dried and inspected under a dissecting microscope to visually characterize the particles and remove intact zooplankton swimmers or contaminant fibers, which were both rare in the samples.

Concentrations of bulk POC and PN

Glass fiber filters of both pore sizes (0.3 and 1.2 µm) and 47-mm GF/F filters containing the washed-down particles from the Nitex size fractions were quantitatively split radially while frozen, and portions were freeze-dried. Freeze-dried filters were quantitatively split radially by weight for separate elemental analyses for POC (after acidification) and for PN (without acidification) for samples collected during all six cruises. For acidified filter splits, carbonates were removed via direct, dropwise addition of concentrated sulfurous acid to the filters, which were then dried at 60°C overnight. Bulk POC and PN concentrations and isotope compositions were measured using a Thermo Flash elemental analyzer coupled to a Conflo IV and MAT 253 Plus isotope ratio mass spectrometer (EA-IRMS, Thermo Scientific). The EA oxidation and reduction reactors were held at 980°C and 650°C, respectively, and the gas chromatography column was held at 65°C. Acetanilide and glycine standards (Schimmelmann Lab, Indiana University) of known mass (range 5-600 µg) were analyzed alongside samples to calculate sample concentrations. Dip blanks were analyzed alongside samples, and the POC and PN concentrations measured for these samples were subtracted from those of samples on a filter area basis. POC/PN (C:N) ratios were calculated from acidified measurements of POC and nonacidified measurements of PN for each size fraction.

BCO-DMO Processing Description

- Imported data from source file "SizeFrac_Bulk_POCPON_BS2018-2023.xlsx" into the BCO-DMO data system.
- Modified parameter (column) names to conform with BCO-DMO naming conventions.
- Converted latitude and longitude columns to decimal degrees
- Changed date format to ISO format of yyyy-mm-dd

Problem Description

Data from the 0.3-1.2 μm , 1.2-6 μm and >20 μm size fractions are reported here because the 6-20 μm size fraction did not contain enough material to obtain reliable measurements.

On two cruises (AE2213 and AE2315), a 5 micron polyester filter was used rather than a 6 micron Nitex filter, so the size fractions were 1.2-5 μm rather than 1.2-6 μm .

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Data Files

File
964826_v1_pump_poc_pon_biosscope.csv (Comma Separated Values (.csv), 11.38 KB) MD5:a7382cd4114f35b740e2e8d1f560932b Primary data file for dataset ID 964826, version 1. Bulk particulate organic matter data (POC and PON) for BIOSSCOPE cruises 2018-2023

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Parameters

Parameter	Description	Units
Sample_ID	Internal sample ID	unitless
Cruise	BIOSSCOPE cruise identifier	unitless
Latitude	Latitude of sampling	decimal degrees
Longitude	Longitude of sampling	decimal degrees
Date	Date of sampling	unitless
Size_fraction	Particle size range for water fraction	micrometers (um)
Filter_type	Filter type used for particle fraction (Nitex, GF/C ,GF75)	unitless
Depth	Water column depth of sample averaged over sampling period (duration of pump time)	meters (m)
Depth_sd	standard deviation of the depth	meters (m)
PN	PN; average bulk particulate nitrogen (one sample filter analyzed, replicate blanks used to incorporate uncertainty)	micrograms per liter (ug/L)
PN_sd	standard deviation for bulk particulate nitrogen	micrograms per liter (ug/L)
POC	POC; average bulk particulate organic carbon (one sample filter analyzed, replicate blanks used to incorporate uncertainty)	micrograms per liter (ug/L)
POC_sd	standard deviation for bulk particulate organic carbon	micrograms per liter (ug/L)
CN_acnonac	Carbon to nitrogen ratio of acidified POC to non-acidified PN	mole to mole (mol/mol)
CN_acnonac_sd	standard deviation of CN ratio (propagated error from POC and PN)	mole to mole (mol/mol)

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Instruments

Dataset-specific Instrument Name	Conflo IV
Generic Instrument Name	Continuous Flow Interface for Mass Spectrometers
Dataset-specific Description	Bulk POC and PN concentrations and isotope compositions were measured using a Thermo Flash elemental analyzer coupled to a Conflo IV and MAT 253 Plus isotope ratio mass spectrometer.
Generic Instrument Description	A Continuous Flow Interface connects solid and liquid sample preparation devices to instruments that measure isotopic composition. It allows the introduction of the sample and also reference and carrier gases. Examples: Finnigan MATConFlo II, ThermoScientific ConFlo IV, and Picarro Caddy. Note: This is NOT an analyzer

Dataset-specific Instrument Name	Thermo Flash elemental analyzer
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Bulk POC and PN concentrations and isotope compositions were measured using a Thermo Flash elemental analyzer coupled to a Conflo IV and MAT 253 Plus isotope ratio mass spectrometer.
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	flow meter
Generic Instrument Name	Flow Meter
Dataset-specific Description	Flow meters were placed in-line on each flow path of the pumps, and exact filtered volumes for each flow path were determined.
Generic Instrument Description	General term for a sensor that quantifies the rate at which fluids (e.g. water or air) pass through sensor packages, instruments, or sampling devices. A flow meter may be mechanical, optical, electromagnetic, etc.

Dataset-specific Instrument Name	MAT 253 Plus isotope ratio mass spectrometer
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Bulk POC and PN concentrations and isotope compositions were measured using a Thermo Flash elemental analyzer coupled to a Conflo IV and MAT 253 Plus isotope ratio mass spectrometer (EA-IRMS, Thermo Scientific).
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	McLane WTS-LV in-situ pumps (4 L min ⁻¹ maximum pumping rate; McLane Research Laboratories, Inc.)
Generic Instrument Name	McLane Large Volume Pumping System WTS-LV
Dataset-specific Description	Size-fractionated particle samples were collected using McLane WTS-LV in-situ pumps (4 L min ⁻¹ maximum pumping rate; McLane Research Laboratories, Inc.) during all sampling periods.
Generic Instrument Description	The WTS-LV is a Water Transfer System (WTS) Large Volume (LV) pumping instrument designed and manufactured by McLane Research Labs (Falmouth, MA, USA). It is a large-volume, single-event sampler that collects suspended and dissolved particulate samples in situ. Ambient water is drawn through a modular filter holder onto a 142-millimeter (mm) membrane without passing through the pump. The standard two-tier filter holder provides prefiltering and size fractioning. Collection targets include chlorophyll maximum, particulate trace metals, and phytoplankton. It features different flow rates and filter porosity to support a range of specimen collection. Sampling can be programmed to start at a scheduled time or begin with a countdown delay. It also features a dynamic pump speed algorithm that adjusts flow to protect the sample as material accumulates on the filter. Several pump options range from 0.5 to 30 liters per minute, with a max volume of 2,500 to 36,000 liters depending on the pump and battery pack used. The standard model is depth rated to 5,500 meters, with a deeper 7,000-meter option available. The operating temperature is -4 to 35 degrees Celsius. The WTS-LV is available in four different configurations: Standard, Upright, Bore Hole, and Dual Filter Sampler. The high-capacity upright WTS-LV model provides three times the battery life of the standard model. The Bore-Hole WTS-LV is designed to fit through a narrow opening such as a 30-centimeter borehole. The dual filter WTS-LV features two vertical intake 142 mm filter holders to allow simultaneous filtering using two different porosities.

Dataset-specific Instrument Name	dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Samples were inspected under a dissecting microscope to visually characterize the particles and remove intact zooplankton swimmers or contaminant fibers, which were both rare in the samples.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	sonicator
Generic Instrument Name	ultrasonic cell disrupter (sonicator)
Dataset-specific Description	The mesh filter was sonicated for three minutes in an acid-clean polypropylene Nalgene bottle with filtered seawater.
Generic Instrument Description	Instrument that applies sound energy to agitate particles in a sample.

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Deployments

AE2114

Website	https://www.bco-dmo.org/deployment/964699
Platform	R/V Atlantic Explorer
Start Date	2021-08-05
End Date	2021-08-08

AE2123

Website	https://www.bco-dmo.org/deployment/964707
Platform	R/V Atlantic Explorer
Start Date	2021-11-10
End Date	2021-11-13

AE1819

Website	https://www.bco-dmo.org/deployment/857784
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1819_CS_narrative_v1.pdf
Start Date	2018-07-03
End Date	2018-07-06
Description	Project BIOS-SCOPE

AE1916

Website	https://www.bco-dmo.org/deployment/861272
Platform	R/V Atlantic Explorer
Report	https://datadocs.bco-dmo.org/docs/305/BIOSSCOPE/data_docs/AE1916_CS_narrative_FINAL.pdf
Start Date	2019-07-08
End Date	2019-07-11
Description	Project BIOS-SCOPE

AE2213

Website	https://www.bco-dmo.org/deployment/965101
Platform	R/V Atlantic Explorer
Start Date	2022-07-07
End Date	2022-07-10

AE2315

Website	https://www.bco-dmo.org/deployment/965100
Platform	R/V Atlantic Explorer
Start Date	2023-07-01
End Date	2023-07-19

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Project Information

Bermuda Institute of Ocean Sciences Simons Collaboration on Ocean Processes and Ecology (BIOSSCOPE)

Website: <http://scope.bios.edu/>

Coverage: North Atlantic Subtropical Gyre, Bermuda Atlantic Time Series (BATS) site

The aim of BIOS-SCOPE is to expand knowledge about the BATS ecosystem and achieve a better understanding of ocean food web sources, sinks and transformations of DOM. Advances in knowledge and technology now pose us to investigate the specific mechanisms of DOM incorporation, oxidation and transformation by zooplankton and the distinct microbial plankton communities that have been discovered at BATS.

The overarching goal of the BIOS-SCOPE is to form and foster collaborations of cross disciplinary science that utilize a broad suite of genomic, chemical, ecological, and biogeochemical approaches to evaluate microbial process, structure and function on various scales. These scales will range from organism-compound and organism-organism interactions to large biogeochemical patterns on the ecosystem scale. For this purpose we have assembled a cross-disciplinary team including microbial oceanographers (Carlson and Giovannoni), a chemical oceanographer (Kujawinski), biological oceanographer / zooplankton ecologists (Maas and Blanco-Bercial) and microbial bioinformatician (Temperton) with the expertise and technical acuity that are needed to study complex interactions between food web processes, microbes and DOM quantity and quality in the oligotrophic ocean. This scientific team has a vision of harnessing this potential to produce new discoveries that provide a mechanistic understanding of the carbon cycle and explain the many emergent phenomenon that have yet to be understood.

For additional details:

- **BIOS-SCOPE Narrative:**
https://datadocs.bco-dmo.org/docs/302/BIOSSCOPE/data_docs/BIOS-SCOPE_Narrative_FINAL.pdf
- **Physical Framework:**
https://datadocs.bco-dmo.org/docs/302/BIOSSCOPE/data_docs/Physical_Framework.pdf

BIOSSCOPE I: November 1st, 2015 through October 31st, 2020
Current: November 1st, 2020 to October 31st, 2025

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Funding

Funding Source	Award
Simons Foundation (Simons)	409923

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