Images corresponding to some of the samples that underwent 16S and 18S V4 amplicon sequencing of microbial communities in sinking particles collected during R/V Atlantic Explorer cruises AE1718 and AE1809 in 2017 and 2018 at BATS in Bermuda

Website: https://www.bco-dmo.org/dataset/855320
Data Type: Cruise Results
Version: 1
Version Date: 2021-07-08

Project
» Aggregation of Marine Picoplankton (Marine Plankton Aggregation)

Contributors	Affiliation	Role
Neuer, Susanne	Arizona State University (ASU)	Principal Investigator
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Abstract
Images corresponding to some of the samples that underwent 16S and 18S V4 amplicon sequencing of microbial communities in sinking particles collected during R/V Atlantic Explorer cruises AE1718 and AE1809 in 2017 and 2018 at BATS in Bermuda. These data were published in Neuer et al. (2021).

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Coverage

Spatial Extent: **N**:31.97 **E**:-64.42 **S**:31.57 **W**:-64.57
Temporal Extent: 2017-09-12 - 2018-03-15

Methods & Sampling

Methodology:
Particles to be subjected to prokaryotic and eukaryotic microbial community analyses were imaged whilst embedded within polyacrylamide gels. Images were taken at various magnifications and calibrated using a 1.0 mm object micrometer slide. Particles were subsequently picked, pooled, and subjected to DNA extraction and microbial community analyses as outlined in the Methods text in Neuer et al. (2021).

Although 8 particles were pooled per sample, a limited number of particles were imaged. Magnification metadata is not available for sample PA_150m_Fall.

Data Processing Description

Images were taken using ToupView (version released 2020-12-21), as well as cropped and calibrated with the addition of a scale bar using ImageJ (version 153).

BCO-DMO data manager processing notes:
* converted lat and lon from degrees north and east to decimal degrees.
* replaced line returns separating image names within values for "media" column to semicolons. Replacement made to support interoperable file formats.

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Data Files

File	
image_metadata.csv Primary data file for dataset ID 855320	(Comma Separated Values (.csv), 1.60 KB) MD5:3c5a9f04b4deb130d1addafb9d5a5a0f
Sinking Particle Images filename: sinking_particle_images.zip Images of sinking particles collected during R/V Atlantic Explorer cruises AE1718 and AE1809 in 2017 and 2018 at BATS in Bermuda.	(ZIP Archive (ZIP), 262.46 MB) MD5:b42f05fb41bf69350020f41bae5c305d

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Related Publications

Cruz, B. N., Brozak, S., & Neuer, S. (2021). Microscopy and DNA-based characterization of sinking particles at the Bermuda Atlantic Time-series Study station point to zooplankton mediation of particle flux. Limnology and Oceanography. doi:10.1002/lno.11910
Results

Schneider, C. A., Rasband, W. S., ... (n.d.). ImageJ. US National Institutes of Health, Bethesda, MD, USA. Available from https://imagej.nih.gov/ij/
Software

ToupTek Photonics (2015). ToupView for ToupCam Camera. Information accessible from http://www.touptek.com/product/showproduct.php?lang=en&id=103
Software

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Related Datasets

IsRelatedTo

Arizona State University (2020). Prokaryotic and eukaryotic microbial communities within sinking particles from the Bermuda Atlantic Time-series Study (BATS) site. 7-Nov-2020. In: NCBI:BioProject: PRJNA675293. [Internet]. Bethesda, MD: National Library of Medicine (US), National Center for Biotechnology Information; Available from: http://www.ncbi.nlm.nih.gov/bioproject/PRJNA675293.

Neuer, S. (2021) **Prokaryote and eukaryote abundance in phytodetrital aggregates (PA), fecal aggregates (FA), and the ambient seawater from samples collected during R/V Atlantic Explorer cruises AE1718 and AE1809 in 2017 and 2018 at BATS in Bermuda.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2021-07-08 doi:10.26008/1912/bco-dmo.855296.1 [view at BCO-DMO]

Relationship Description: Data from the same sinking particle samples.

Neuer, S., Cruz, B. N. (2021) **Sample information for 16S and 18S V4 amplicon sequencing of microbial communities in sinking particles and water column samples collected during R/V Atlantic Explorer cruises AE1718 and AE1809 in 2017 and 2018 at BATS in Bermuda.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2020-11-16 doi:10.26008/1912/bco-dmo.828922.1 [view at BCO-DMO]
Relationship Description: Sample information and genetic accession info for the same sinking particle samples.

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Parameters

Parameter	Description	Units
media	Media. List of imagenames for the sample. List delimiter is a semicolon.	unitless
sample_name	Sample name	unitless
depth	Sample depth	meters (m)
latitude	latitude	decimal degrees
longitude	longitude	decimal degrees
particle_trap_deployment_date	Particle trap deployment date (ISO 8601 format YYYY-MM-DD)	unitless
particle_trap_recovery_date	Particle trap recovery date (ISO 8601 format YYYY-MM-DD)	unitless

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Instruments

Dataset-specific Instrument Name	Microscope color camera: OMAX Microscopy 3.2MP
Generic Instrument Name	Camera
Generic Instrument Description	All types of photographic equipment including stills, video, film and digital systems.

Dataset-specific Instrument Name	Stereomicroscope: Zeiss Stemi 2000-C (Carl Zeiss Microscopy, LLC)
Generic Instrument Name	Microscope - Optical
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".

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Deployments

AE1718

Website	https://www.bco-dmo.org/deployment/775032
Platform	R/V Atlantic Explorer
Start Date	2017-09-11
End Date	2017-09-16

AE1809

Website	https://www.bco-dmo.org/deployment/828987
Platform	R/V Atlantic Explorer
Start Date	2018-03-12
End Date	2018-03-15

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Project Information

Aggregation of Marine Picoplankton (Marine Plankton Aggregation)

Coverage: Bermuda Atlantic Time-Series station

NSF abstract:

Marine phytoplankton are microscopic algae that live in the sunlit zone of the ocean. They play an important role in the uptake of carbon dioxide from the atmosphere through photosynthesis, similar to what plants do on land, and are the basis of the marine food web. However, instead of storing this organic carbon in leaf tissue and roots, marine phytoplankton are grazed by planktonic animals, or die and subsequently sink out of the sunlit zone in the form of aggregates, also called "Marine Snow". These particles not only export the organic carbon contained in their cells to the deep ocean, but also serve as food for animals and bacteria that live in the deep. A considerable portion of these phytoplankton are extremely small, among the tiniest of all organisms known. These extremely small cells have not been thought to play an important role in the formation and sinking of marine snow; however, recent findings challenge this view. This project will investigate how the smallest of these phytoplankton contribute to the rain of sinking particles from the sunlit surface to the deep ocean. This research is important because, in some of the largest expanses of the open oceans, these minute cells dominate the phytoplankton community, and larger plankton organisms are very sparse. The project, through a combination of work in the laboratory and at a field station, will shed light on how these tiny phytoplankton cells make aggregates, which ultimately enable them to sink as "Marine Snow". The project also provides unique opportunities for undergraduate students at Arizona State University, a land-locked public university, to gain experience in working with marine research. The project will serve to educate one PhD student, one MS student in an accelerated BS-MS program, and 8-10 undergraduate students/semester in a unique, inquiry based learning effort termed Microbial EducatioN Training and OutReach (MENTOR). The undergraduate students will also participate in Arizona State University (ASU)'s School of Life Sciences, Undergraduate Research Program (SOLUR), which seeks to increase the participation of minorities in science. They will also contribute towards developing web and classroom materials, based on this project, which will then be distributed through a partnership with the award-winning ASU-sponsored Ask A Biologist K-12 web site.

The oceanic "biological carbon pump", the photosynthetically mediated transformation of dissolved inorganic carbon into particulate and dissolved organic carbon and its subsequent export to deep water, functions as a significant driver of atmospheric carbon uptake by the oceans. The traditional view of the biological carbon pump in the ocean is that of sinking of large aggregates (marine snow) or fecal pellets, which are made up of large, mineral ballasted cells of phytoplankton. However, recent evidence, stemming from in situ investigations of particulate matter, trap studies and modelling studies, have shown that micron-sized phytoplankton such as picocyanobacteria as well as picoeukaryotes can contribute significantly to the sinking of particulate matter. The specific mechanisms behind the sinking of these micrometer sized cells remain elusive as the cells are too

small to sink on their own, and mesozooplankton is likely unable to ingest single cells. Intriguingly, recent research by the investigators has shown that the ubiquitous picocyanobacteria Synechococcus are able to form aggregates and sink at velocities comparable to those of marine snow. They found that the matrix of the Synechococcus aggregates was made of Transparent Exopolymeric Particles (TEP), and that TEP production was enhanced under nutrient limited culture conditions. Interaction with clays and presence of heterotrophic bacteria also enhanced aggregation and sinking velocity. This study aims to further investigate aggregation of other common picoplankton in the laboratory and aggregation occurring in natural settings at an oligotrophic open ocean site, the Bermuda Atlantic Time-series Site (BATS). Ultimately, this project will increase and refine our understanding of the role of the smallest phytoplankton in aggregation and sinking - information vital to understanding carbon cycling processes in the oceans.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1658527

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