Presence and abundance of blue particles in Oceanic Flux Program (OFP) samples collected from 1984-2019 at the OFP mooring in the Sargasso Sea

Website: https://www.bco-dmo.org/dataset/960203
Data Type: Cruise Results
Version: 1
Version Date: 2025-05-06

Project
» OCE-PRF: Towards Quantifying Calcium Carbonate Sediment Dissolution During Marine Diagenesis (Marine CaCO3 and ocean chemistry)

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Abstract
These data are compiled from the Oceanic Flux Program (OFP) archive and show a number of OFP samples that contain blue particles along with the date of the collection period, depth, sample size fraction, and the presence/absence and abundance of the blue particles.

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Coverage

Location: North Atlantic, Sargasso Sea, OFP location

Spatial Extent: **Lat**:31.9167 **Lon**:-64.0833
Temporal Extent: 1984-12-16 - 2019-04-05

Methods & Sampling

The Oceanic Flux Program (OFP) sample collection involves three 0.5-square-meter (m^2)PARFLUX Mark 8 sediment traps (McLane Labs, Falmouth, MA) with programmable, rotating sampling carousels that are affixed to the OFP mooring at depths of 500, 1500, and 3200 meters (m). The sediment traps continuously sample the sinking particle flux at a nominal biweekly integration period. Sample collection bottles affixed to the carousel are low density polyethylene (LDPE) and filled with seawater brine of ~40 grams per kilogram (g/kg) (40‰) poisoned with ultra-high purity mercuric chloride at a concentration of 0.74 millimoles per liter (mmol/L). After recovery, samples are refrigerated (at 4 degrees Celsius) until processing. Samples are fractionated into four size fractions (>1000, 500-1000, 125-500, and <125 micrometers (µm)).

Samples visually noted to contain blue particles were targeted for various analyses in this study. Most of the blue particle-containing samples have been processed and dried as described above. The blue particles in dried samples, identified based on color, shape, and size, were picked using a brush wetted with ethanol under a dissecting microscope. Additionally, in a few samples, the blue particle aggregates were picked out during processing and preserved in the trap collection brine. These blue particles were briefly rinsed with MilliQ water and then dried for analysis.

Data Processing Description

See: https://www.mbl.edu/research/research-centers/ecosystems-center/research-projects/oceanic-flux-program-ofp

BCO-DMO Processing Description

- Imported original file "OFP and BP presence and abundance.xlsx" into the BCO-DMO system.
- Split column "Mid date of collection period (days sampling)" into two separate columns: Mid_date and Days_sampling.
- Changed format of Mid_date from %m/%d/%Y to %Y-%m-%d.
- Added columns for Latitude and Longitude.
- Renamed fields to comply with BCO-DMO naming conventions.
- Saved the final file as "960203_v1_ofp_bp_presence_abundance.csv".

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Data Files

File	
960203_v1_ofp_bp_presence_abundance.csv	(Comma Separated Values (.csv), 3.84 KB) MD5:932ffb7832e177cc19ed2df534d8f4ae
Primary data file for dataset ID 960203, version 1	

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Related Publications

Conte, M. H., Pedrosa-Pàmies, R., Weber, J. C., & Johnson, R. J. (2025). The climatology of the deep particle flux in the oligotrophic western North Atlantic gyre, 1978–2022. Progress in Oceanography, 234, 103433. https://doi.org/10.1016/j.pocean.2025.103433
Software

Conte, M. H., Ralph, N., & Ross, E. H. (2001). Seasonal and interannual variability in deep ocean particle fluxes at the Oceanic Flux Program (OFP)/Bermuda Atlantic Time Series (BATS) site in the western Sargasso Sea near Bermuda. Deep Sea Research Part II: Topical Studies in Oceanography, 48(8-9), 1471–1505. doi:10.1016/s0967-0645(00)00150-8 https://doi.org/10.1016/S0967-0645(00)00150-8
Methods

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General

Hashim, M., Conte, M., Salter, M., A., Pedrosa-Pamies, R. Weber, J. C., Hayden M., Wilson R., Perry, C., Crowley, S.F., Dennis, P.F., Bish, D., and Subhas, A.V. 2025. Fish Carbonates in the Open Ocean and Their Role in the Carbon Cycle. In revision at Global Biogeochemical Cycles.
Results

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Parameters

Parameter	Description	Units
OFP_Sample_ID	Oceanic Flux Program Sample ID (cruise date (mm-yy)-carousal number)	unitless
Latitude	Latitude of sample collection	decimal degrees
Longitude	Longitude of sample collection	decimal degrees
Mid_date	Mid date of collection period	unitless
Days_sampling	Number of sampling days	unitless
Depth	Sample depth	meters (m)
Size_fraction	Size fraction	micrometers (um)
Blue_particle_present	Inidicates if blue particles were present: yes (y) or no (n)	unitless
Num_blue_particles	Number of blue particles	unitless

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Instruments

Dataset-specific Instrument Name	PARFLUX Mark 8 sediment traps
Generic Instrument Name	McLane PARFLUX Mark 8 Sediment Trap
Generic Instrument Description	The Mark 8 Sediment Trap is a time-series instrument that autonomously collects the flux of settling particles on an operator-defined schedule. The wide top funnel accumulates particulate specimens into individual sample bottles. The cone interior is natural polyethylene. Deploys from a stand-alone mooring or a large high-tension vertical array. McLane Mark 8 Data Sheet (PDF) McLane website: https://mclanelabs.com/sediment-traps/

Dataset-specific Instrument Name	dissecting microscope
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

OFP_Time-Series

Website	https://www.bco-dmo.org/deployment/704779
Platform	OFP_mooring
Start Date	1978-04-06
Description	The Oceanic Flux Program (OFP) time-series began in 1978 at the Hydrostation S hydrographic time-series site (32 05N, 64 15W), located approximately 45 km southeast of Bermuda. The time-series was originally called the SCIFF (Seasonal Changes in Isotopes and Flux of Foraminifera) program. Location: 1978-1984: 31deg 10min N, 64deg 30min W, 3300m (SCIFF site) 1984-2010: 31deg 50min N, 64deg 10min W, 4500m 2011-present: 31deg 55 N, 64deg 05 W, 4550m

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Project Information

OCE-PRF: Towards Quantifying Calcium Carbonate Sediment Dissolution During Marine Diagenesis (Marine CaCO3 and ocean chemistry)

NSF Award Abstract:
OCE-PRF Towards Quantifying Calcium Carbonate Sediment Dissolution During Marine Diagenesis The goal of the project is to investigate dissolution of calcium carbonate (CaCO3) in sediments below the seafloor and determine its importance to the chemistry of seawater. This project uses sediment samples and chemical data collected from different parts of the ocean during the past five decades by scientific ocean drilling programs. Sediment dissolution of carbonate can lessen the impact of ocean acidification, the process that causes the pH

of the ocean to decrease due to the uptake of carbon dioxide (CO2) from the atmosphere. Ocean acidification threatens the survival of marine organisms, such as oysters, clams, and coral reefs, which could alter marine food chains and food supply to humans. By improving understanding of carbonate dissolution in the ocean, results from this project will enable better predictions of the effects of ocean acidification on marine organisms. This will advance the progress of science and contribute to the knowledge that can inform public policy. In addition, understanding carbonate sediment dissolution serves other important purposes. For example, dissolution can create small spaces between sediments that may get filled with groundwater once sediments convert to rocks over millions of years. Thus, understanding the occurrence and spatial distribution of spaces within rocks may help determine the volume and movement of groundwater in subsurface aquifers. This project provides support for a postdoctoral research fellow and research training opportunities for students through the Summer Student Fellowship and Woods Hole-wide Partnership Education Programs at the Woods Hole Oceanographic Institution.

Carbonate mineral dissolution is an integral part of the alkalinity and carbon cycles in the ocean and is expected to play an increasingly significant role in mediating changes in ocean chemistry as atmospheric CO2 continues to rise. The goal of this project is to provide thermodynamic constraints necessary for quantifying carbonate sediment dissolution in marine diagenetic environments. Specifically, the CaCO3 saturation state of pore fluids will be calculated in 365 globally distributed sites from previous scientific ocean drilling expeditions using a specially developed Pitzer ion activity model which is particularly useful for calculating activity coefficients in high ionic strength solutions such as those that characterize most diagenetic environments. These calculations will be substantiated with geochemical and textural analyses of sediment samples from four representative sites to identify the specific diagenetic processes (e.g., dissolution, precipitation, and recrystallization) and document the conditions responsible for their occurrence and prevalence. The immediate advantage of calculating the saturation state of pore fluids is that such data can be used to estimate carbonate sediment dissolution below the seafloor and quantify its contribution to the alkalinity and carbon cycles, which will lead to more accurate predictions of the consequences of ocean acidification. Another benefit of the global saturation state dataset is that it will improve our understanding of authigenic carbonate precipitation and its link to the carbon cycle over Earth history, which has been proposed as a significant sink for carbon. Furthermore, by complementing the thermodynamic calculations with textural and geochemical analyses, this project will parse out various diagenetic processes and identify the sedimentological and geochemical conditions responsible for their occurrence. Such knowledge is crucial for evaluating the impact of diagenesis on the carbonate-hosted paleoenvironmental proxies. Collectively, this project will pave the way towards a mechanistic understanding of carbonate diagenesis. This will provide important constraints on the oceanic alkalinity cycle, carbon burial rates, and geochemical proxies, which ultimately help us better understand the future of our ocean system in the context of climate change.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2205984

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