Organic carbon, carbonate, and opal data from Multitracers sediment trap samples

Website: https://www.bco-dmo.org/dataset/865909
Data Type: Cruise Results, Other Field Results
Version: 1
Version Date: 2023-10-25

Project
» Multitracers to Predict Paleoproductivity in the California Current System from Sediment and Sediment Trap Materials (Multitracers Sediment Traps)
» Multitracers to Predict Paleoproductivity in the California Current System (Multitracers Paleoproductivity)
» Biogenic Chemical Records in Deep-Sea Sediments and Their Application to Paleo-Oceanographic Study (Biogenic Chemical Records)
» Multitracers II - Wintertime Particle Production, Transport and Sedimentation (Multitracers II)

Contributors	Affiliation	Role
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Abstract
This dataset includes organic carbon, carbonate, and opal concentrations from Multitracers sediment trap samples.

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Coverage

Spatial Extent: **N**:42.192 **E**:-125.761 **S**:40.087 **W**:-132
Temporal Extent: 1987-09-22 - 1991-09-01

Methods & Sampling

Sample collection
During the Multitracers Project (September 1987 to July 1991) bottom-moored sediments traps were deployed at three stations (Nearshore, Midway, and Gyre) in the Northeast Pacific Ocean.

Each mooring had sediment traps deployed at 500 m (Year 1 only), 1000 m, 1500 and/or 1750 m, and 500 m above the bottom (~2300 m at the Nearshore and Midway stations and ~3200 m at the Gyre site). Most traps, with the exception of the 1500 m trap, had 6 sample cups. The 1500 m traps, referred to as Whizbang (WzB) traps, had 13 sample cups. Data for cup opening dates and the number of days each cup was open are

provided in this dataset.

The trap sample cups were filled with unfiltered seawater collected from the near-bottom trap depth at each site and poisoned with 15g/L of sodium azide. To compare the effects of different "preservatives" a pair of traps were deployed at the Nearshore site (1750 m water depth) in Year 3; one set of cups was poisoned with sodium azide and the others preserved with formalin. No special trace metal clean sampling procedures were utilized during the Mulitracers Project; however, the traps were constructed out of plastic and fiberglass thus reducing possible trace metal contamination.

When the sediment traps were recovered the sample cups were removed, sealed, and not opened until they were ready to be processed in the laboratory. Once back at the lab the samples were allowed to sit undisturbed until the particulate material had settled. Once opened the supernatant was poured off and then used to rinse the particulate fraction through a 2 mm sieve. The ≥2 mm size-fraction was transferred to a bottle containing formalin and refrigerated for future use. The <2 mm size-fraction, which was used in this study, was split into 10 aliquots. Between 1 and 4 aliquots were frozen for future use. The other 6 to 9 aliquots were centrifuged and the supernatant was discarded. These samples were then rinsed with buffered distilled water and centrifuged; this step was carried out twice. Finally, the samples were freeze-dried and then homogenized using either an agate pestle and mortar or a Wig-L-Bug grinding mill with plastic vials.

Analytical methods
Particulate organic carbon (POC) concentrations were determined by measuring the total carbon using an elemental analyzer and then subtracting the percent carbonate carbon that was measured by coulometry. The amount of organic matter (OM) is 2.5 x the %Corg and the amount of carbonate (i.e., $CaCO_3$) is 8.33 x %Ccarb. The opal concentration was determined by Na_2CO_3 extraction of the opal followed by Atomic Adsorption Spectrophotometry analysis of the extracted Si (% Opal = Si x 2.59; Collier pers. comm.).

Known problems/issues
In Year 1, the 500 m trap at the Nearshore station failed after the third cup, presumably due to clogging during a high flux event. There is also evidence that the 500 m trap at the Gyre site under-collected material (i.e., lower fluxes at 500 m compared to 1000 m). The 1500 m trap, which was only deployed at the Nearshore station in Year 1, appears to have failed partway through or was programmed incorrectly. Other failed traps are indicated by MTT (column 1) and a sample description of "bulk" (column 2).

The Gyre mooring deployed in Year 3 was not recovered until Year 4 and is therefore named Gyre-4. However, the Date the Cup Opened (column 10) clearly shows these samples were collected between 9/21/89 and 6/25/90 (i.e., Year 3 and much of Year 4).

Data Processing Description

Data Notes:

NS-1 to 5= Nearshore sediment trap mooring site, years 1 to 5 (see below*)
MW-1 to 5= Midway sediment trap mooring site, years 1 to 5 (see below*)
Gyre-1 to 5 = Gyre sediment trap mooring site, years 1 to 5 (see below*)

MTT samples (column 1) = a bulk sample collected from a failed trap or if the sample description says "ALL" this is the calculated average value for the year. The cup number is designated at zero (0) in column 9.
nd = not determined
na = not applicable / available

Corg = organic carbon
Ccarb = carbonate (i.e., inorganic) carbon
OM = organic matter

* A year refers to the time from when a trap mooring is deployed to when it is recovered and the samples are collected. It does not refer to a calendar year. Traps are named based on the "year" of the project they were recovered. Therefore, Gyre-3 traps do not exist because this mooring was not recovered until "year 4" and thus is named Gyre-4.

BCO-DMO Curation Notes

- converted dates for YYYY-MM-DD format;
- renamed fields to conform with BCO-DMO naming conventions.

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Data Files

File	
865909_v1_biogenic.csv	(Comma Separated Values (.csv), 61.49 KB) MD5:38bb995e99bbd308adf57f8e029b02c4
Primary data file for dataset ID 865909, version 1.	

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Supplemental Files

File	
Multitracers_Cruise_Information.pdf	(Portable Document Format (.pdf), 399.10 KB) MD5:52268c14befc6f33fac8c68aa154ca9a
This file contains information about the Multitracers cruises, including cruise IDs, start and end dates, stations where traps were deployed, and deployment and recovery dates. Some information is not known for some cruises (represented by "na" or "?").	

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Related Publications

Dymond, J., Suess, E., & Lyle, M. (1992). Barium in deep-sea sediment: A geochemical proxy for Paleoproductivity. Paleoceanography, 7(2), 163–181. https://doi.org/10.1029/92pa00181 https://doi.org/10.1029/92PA00181
Results

Lyle, M., Zahn, R., Prahl, F., Dymond, J., Collier, R., Pisias, N., & Suess, E. (1992). Paleoproductivity and carbon burial across the California Current: The multitracers transect, 42°N. Paleoceanography, 7(3), 251–272. doi:10.1029/92pa00696 https://doi.org/10.1029/92PA00696
Results

McKay (in prep). Particulate Trace Metal (Cd, Ag, Mo) fluxes to the Deep Northeast Pacific Ocean.
Results

Prahl, F.G., Collier, R.B., Dymond, J., Lyle, M., & Sparrow, M.A. (1993). A biomarker perspective on prymnesiophyte productivity in the northeast Pacific Ocean. Deep-Sea Research Part I, 40(10), 2061-2076. doi: 10.1016/0967-0637(93)90045-5
Results

Sancetta, C. (1992). Comparison of phytoplankton in sediment trap time series and surface sediments along a productivity gradient. Paleoceanography, 7(2), 183-194. doi: 10.1029/92PA00156
Results

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Parameters

Parameter	Description	Units

Sample_ID	sample identifier	unitless
Sample_Description	sample description	unitless
Mooring_ID	mooring identifier	unitless
Sample_Type	sample type	unitless
Latitude	latitude	degrees North
Longitude	longitude	degrees East
Water_Depth	water depth	meters (m)
Trap_Depth	trap depth	meters (m)
Cup_num	cup number	unitless
Date_Cup_Opened	date when cup was opened; format: YYYY-MM-DD	unitless
Days_Cup_Open	number of days cup was open	days
Cup_vol	cup volume	milliliters (ml)
Area	area	square meters (m2)
Wt_in_cup	weight in cup	grams (g)
Wt_Fract	weight fraction	unitless
Chlorine	chlorine	percent (%)
Salt	salt	percent (%)
Total_Flux_mg_cm2_y	total flux	milligrams per square centimeter per year (mg/cm2/y)
Total_Flux_mg_m2_d	total flux	milligrams per square meter per day (mg/m2/d)

Corg	organic carbon	percent (%)
OM	organic matter	percent (%)
Ccarb	carbonate (i.e. inorganic) carbon	percent (%)
CaCO3	calcium carbonate	percent (%)
Biogenic_SiO2	biogenic SiO2	percent (%)
Corg_Flux	organic carbon flux	milligrams per square meter per day (mg/m2/d)
OM_flux	organic matter flux	milligrams per square meter per day (mg/m2/d)
Ccarb_flux	inorganic carbon flux	milligrams per square meter per day (mg/m2/d)
CaCO3_flux	calcium carbonate flux	milligrams per square meter per day (mg/m2/d)
Biogenic_SiO2_flux	biogenic SiO2 flux	milligrams per square meter per day (mg/m2/d)

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Instruments

Dataset-specific Instrument Name	elemental analyzer
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	agate pestle and mortar or a Wig-L-Bug grinding mill
Generic Instrument Name	Homogenizer
Generic Instrument Description	A homogenizer is a piece of laboratory equipment used for the homogenization of various types of material, such as tissue, plant, food, soil, and many others.

Dataset-specific Instrument Name	sediment traps
Generic Instrument Name	Sediment Trap
Generic Instrument Description	Sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. In general a sediment trap has a jar at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. This designation is used when the specific type of sediment trap was not specified by the contributing investigator.

Dataset-specific Instrument Name	Atomic Adsorption Spectrophotometry
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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Project Information

Multitracers to Predict Paleoproductivity in the California Current System from Sediment and Sediment Trap Materials (Multitracers Sediment Traps)

Coverage: California Current System

NSF Award Abstract:
Long-term sediment trap deployment provide an opportunity to examine the fidelity of deep-sea sediments as recorders of near- surface oceanic processes. Such studies are important because a fundamental assumption of paleoceanographic research is that the micropaleontologic and sediment chemistry record can be used to examine changes in sea surface conditions over long geologic time scales. The present recommended award will support a multitracer study of the relation of "imput" and "preservation" in marine sediments. The use of stable isotope, geochemical, and micropaleontologic criteria should allow an accurate assessment of differences between deposited sediments and the initial surface water input. The field phase of the project will deploy an array of sediment traps in the California Current system which has strong seasonal gradients in net productivity and surface oceanography. Analyses on the sediment trap material and surface sediments will be used to develop a set of independent proxies for net productivity. Components most likely to provide this information include: biogenous, calcareous, and siliceous microfossils; barite and bio-limiting trace elements such as copper and zinc; and organic matter and certain of its nitrogenous compounds including iodine, bromine, and phosphorous. Such analyses should allow an accurate definition of those signal carriers most highly correlated to net biologic productivity. The principal investigators are highly qualified to undertake the field and analysis portion of the project and have successfully completed previous sediment trap projects. Funding is strongly recommended at the following levels: FY87 = $224,750; FY88 = $229,615; FY89 = $201,299.

Multitracers to Predict Paleoproductivity in the California Current System (Multitracers Paleoproductivity)

Coverage: California Current System

NSF Award Abstract:
Long-term sediment trap deployment provide an opportunity to examine the fidelity of deep-sea sediments as recorders of near-surface oceanic processes. Such studies are important because a fundamental assumption of paleoceanographic research is that the micropaleontologic and sediment chemistry record can be used to examine changes in sea surface conditions over long geologic time scales. The present recommended award will support a multitracer study of the relation of "input" and "preservation" in marine sediments. The use of stable isotope, geochemical, and micropaleontologic criteria should allow an accurate assessment surface water input. The field phase of the project will deploy an array of sediment traps in the California Current system which has strong seasonal gradients in net productivity and surface oceanography. Analyses on the sediment trap material and surface sediments will be used to develop a set of independent proxies for net productivity. Components most likely to provide this information include: biogenous, calcareous, and siliceous microfossils; barite and bio-limiting trace elements such as copper and zinc; and organic matter and certain of its nitrogenous compounds including iodine, bromine, and phosphorous. Such analyses should correlated to net biologic productivity

Biogenic Chemical Records in Deep-Sea Sediments and Their Application to Paleo-Oceanographic Study (Biogenic Chemical Records)

NSF Award Abstract:
This research will continue a project to study climatically induced changes in biogenic sedimentation in the oceans. The type of biogenic material found in core samples varies with the paleoclimate and, therefore, appears to be temperature controlled. This research project will develop more rapid methods for doing the analysis of the biogenic material, and extend the earlier studies to both older sediment and other cores where independent estimates of paleotemperature have been made. The results of this research will lead to the understanding of causes for changes in primary productivity in the oceans during climatic changes.

Multitracers II - Wintertime Particle Production, Transport and Sedimentation (Multitracers II)

NSF Award Abstract:
An important goal of the Multitracers Project is to quantify paleoproductivity (defined as organic carbon flux out of the euphotic zone) off the coast of Oregon from the peak of the last glacial maximum to the present. By accomplishing this goal the PIs will also develop paleoproductivity tracers that can be applied elsewhere in the oceans, and establish the limitations of each tracer. Three sediment trap moorings forming a transect away from the Oregon coast are a key aspect of the tracer calibration. The approach is to apply multipletracers for productivity the bulk organic fraction, inorganic elements (Cu,Zn,Ba), organic geochemical biomarkers, and microfossils to determine when all give consistent information and to determine when each begins to track paleoceanogrphic variables other than productivity. Funding is provided for an additional field season for the Multitracers Project, consisting of two 6 month trap deployments at the two inshore sites. The high-solution sediment trap data and the water column information from the springtime should enable to adequately define winter-spring productivity events in the region. In addition, the three-year time series of sediment trap fluxes will help understand the interannual variability of productivity in the California Current. This represents a modification to the previously funded project entitled "Multitracers to predict paleoproductivity in the California Current System from sediment and sediment trap materials" (OCE-8609366).

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-8609366
NSF Division of Ocean Sciences (NSF OCE)	OCE-8919956
NSF Division of Ocean Sciences (NSF OCE)	OCE-8812340
NSF Division of Ocean Sciences (NSF OCE)	OCE-9000945

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