Scientific sampling event log collected from R/V Roger Revelle cruises RR_EB04 and RR_EB05 (2004, 2005) from the equatorial Pacific Ocean; upwelling zone of the EEP (135 - 140 W)

Website: https://www.bco-dmo.org/dataset/3116
Version:

Project
» Plankton dynamics and carbon cycling in the equatorial Pacific Ocean: Control by Fe, Si and grazing (Equatorial Pacific Plankton Dynamics)

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Dataset Description

scientific sampling event log for Nelson Equatorial Biocomplexity (EB) project cruises

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Parameters

Parameters for this dataset have not yet been identified

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Deployments

RR_EB04

Website	https://www.bco-dmo.org/deployment/57982
Platform	R/V Roger Revelle
Start Date	2004-12-03
End Date	2005-01-02
Description	This study was conducted in the eastern Equatorial Pacific along 110°W between 4°N and 3°S during the Equatorial Biocomplexity cruise (EB04) (December 2004) aboard R/V Revelle. Water samples were collected using a CTD rosette package equipped with 10L Niskin bottles. The ships Acoustic Dopler Current Profiling (ADCP) system was used to measure currents during transits between stations to help define the location of the EUC. Seawater samples were filtered through 0.6 µm polycarbonate filters and stored in acid-washed polypropylene or polycarbonate bottles at room temperature in the dark. This work was supported by National Science Foundation award OCE0322074, "Plankton dynamics and carbon cycling in the equatorial Pacific Ocean: Control by Fe, Si and grazing". The UNOLS ship scheduling system mistakenly used OCE0333074. cruise description is from: Charlotte P. Beucher, Mark A. Brzezinski, Janice L. Jones, Sources and biological fractionation of Silicon isotopes in the Eastern Equatorial Pacific, Geochimica et Cosmochimica Acta, Volume 72, Issue 13, 1 July 2008, Pages 3063-3073, ISSN 0016-7037, DOI: 10.1016/j.gca.2008.04.021

RR_EB05

Website	https://www.bco-dmo.org/deployment/57983
Platform	R/V Roger Revelle
Start Date	2005-09-02
End Date	2005-10-01
Description	This study was conducted in the eastern Equatorial Pacific along 110°W between 4°N and 3°S during the Equatorial Biocomplexity cruise (EB05) (September 2005) aboard R/V Revelle. Kinetic experiments of two kinds were performed. The first involved collecting seawater and immediately examining the response of Si uptake to added Si(OH)4, as has been done in several other systems described by investigators Brzezinski and Nelson. The second was designed to quantify the effect of the ambient [Fe] on the kinetics of Si uptake. In those experiments seawater was augmented with Fe and held for up to 4 days before examining the kinetics of Si uptake to allow time for the diatoms to adjust to the addition of Fe. These two types of experiments are referred to as standard kinetic experiments and delayed kinetic experiments, respectively. A total of 29 standard kinetic experiments were performed. Fifteen were performed along 110°W and along the equator between 09 and 29 December 2004 with an additional 14 conducted between 08 and 24 September 2005 along 140°W and along a longitudinal transect at 0.5°N in the vicinity of a tropical instability wave. Four delayed kinetic experiments were conducted in 2005. This work was supported by National Science Foundation award OCE0322074, "Plankton dynamics and carbon cycling in the equatorial Pacific Ocean: Control by Fe, Si and grazing". Reference: Brzezinski, Mark A., Cynthia Dumousseaud, Jeffrey W. Krause, Christopher I. Measures, and David M. Nelson. 2008. Iron and silicic acid concentrations together regulate Si uptake in the equatorial Pacific Ocean. Limnol. Oceanogr., 53(3), 2008, 875-889.

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Project Information

Plankton dynamics and carbon cycling in the equatorial Pacific Ocean: Control by Fe, Si and grazing (Equatorial Pacific Plankton Dynamics)

From NSF Award Abstract:

Intellectual merit: Of the many linkages among the cycles of biologically active elements in the ocean-atmosphere-biosphere system, regulation of the oceanic carbon cycle by the processes that supply nitrogen, phosphorus, silicon and iron to surface waters may be the most important. Phytoplankton photosynthesis, export of organic carbon from the surface layer and remineralization of that carbon in the deep sea comprise a biological pump, which transports CO2 from the atmosphere to the deep ocean at globally significant rates. Ice-core records suggest that oscillations in the global-scale efficiency of this pump may play a major role in controlling atmospheric CO2 concentrations on glacial/interglacial time scales.

Because N, P, Si and Fe availability are all known to limit organic matter production by phytoplankton or its export to depth in present-day ocean habitats, limitation by those elements may be the main biogeochemical mechanism regulating atmospheric CO2 levels In several large oceanic areas high surface concentrations of nitrate and phosphate persist throughout the year, suggesting Fe limitation of phytoplankton growth and/or Si limitation of diatom growth. In those high-nutrient, low-chlorophyll (HNLC) areas, relatively little of the dissolved inorganic carbon (DIC) delivered to surface waters is taken up, making the system either a greater source or smaller sink for atmospheric CO2 than it would be if all N and P were used. Two HNLC systems are of the greatest global importance with respect to these processes: In the Southern Ocean, glacial/interglacial changes in Fe supply may stimulate phytoplankton photosynthesis during glacial periods and limit it during interglacials, driving the well-documented changes in atmospheric CO2. In the Pacific Ocean, wind-driven upwelling at the equator and inefficient use of the upwelled N, P and DIC by phytoplankton combine to make the Eastern Equatorial Pacific (EEP) the largest oceanic source of CO2 to the atmosphere under present conditions. There is now direct experimental evidence of both Fe limitation and Si limitation in HNLC surface waters. In addition, diatoms (the only major phytoplankton group that requires Si) are usually stimulated more than other groups by release from Fe limitation. Fe and Si availability can also interact to control the production and export of organic matter in HNLC areas because low [Fe] increases the Si/C and Si/N uptake ratios of diatoms. This project will undertake a coordinated program of field research, biogeochemical modeling and education focused on the roles of Fe limitation, Si limitation and zooplankton grazing

in regulating the carbon cycle in HNLC areas. The experimental work and modeling will both stress effects of these control mechanisms on three functional groups within the phytoplankton -- diatoms, coccolithophores and picoplankton -- whose nutrient requirements differ significantly and which produce organic matter that has distinctly different fates in the ocean. The educational phase of the project will address both the Southern Ocean and the equatorial Pacific, the research phase will be conducted in the upwelling zone of the EEP (135 - 140 W). This research will combine field observations, manipulative field experiments and biogeochemical modeling, with all field observations and experiments designed to support a new generation of upper-ocean models that distinguish explicitly among the roles of diatoms, coccolithophores and picoplankton in the oceanic carbon cycle. The experiments and models are designed to examine competition among these groups under different nutrient regimes, their selective removal by zooplankton and the effects of changing light and nutrient conditions on their elemental composition. These interaction terms have not been explored well enough in previous models to address their effects on carbon cycling in any ocean system.

Broader impacts: An integral part of this project is an educational program for elementary and high school teachers, focused on ocean biogeochemistry, the global carbon cycle and their connections with global climate. The program's goal is to help teachers present these topics to their classes in an accurate and engaging way, leading to real understanding. Three workshops for teachers will illustrate physical and biological controls on the oceanic carbon cycle, explain the global-scale consequences of changes in that cycle and develop instructional materials for the teachers to use. Those educational tools will include an interactive web site where teachers and students can run biogeochemical models of the EEP, make their own assumptions about how the system might work and use the model to explore the consequences of those assumptions. In addition, one teacher will go on each cruise to experience seagoing research first-hand and interpret the results for students. There will also be a significant international collaboration with scientists at l'Institut Universitaire Europen de la Mer (IUEM) in Brest, France in both the seagoing and modeling phases of this project.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0322074