Event Logs from R/V Kilo Moana KM0812, KM0919 in the North Pacific Subtropical Gyre north of Hawaii from 2008-2009 (C-MORE project, Silica Cycling project)

Website: https://www.bco-dmo.org/dataset/3876
Version: 12 February 2013
Version Date: 2013-02-12

Project
» Center for Microbial Oceanography: Research and Education (C-MORE)
» Silica Cycling and the Role of Diatoms in the North Pacific Subtropical Gyre (Silica Cycling)

Contributors	Affiliation	Role
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Dataset Description

Event Logs for POOB2008 (KM0812) and POOB2009 (KM0919)

Methods & Sampling

Generated from original file: "POOB_ALLDATA.xlsx", sheets "Event Log POOB08" and "Event Log POOB09" contributed by Janice Jones

Data Processing Description

Generated from original file: "POOB_ALLDATA.xlsx", sheets "Event Log POOB08" and "Event Log POOB09" contributed by Janice Jones

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Data Files

File
EventLogs.csv (Comma Separated Values (.csv), 21.26 KB) MD5:892e3e1966f733afca9143a0c5356387 Primary data file for dataset ID 3876

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Parameters

Parameter	Description	Units
Cruise	Cruise Name	text
Event_Number	Event Number	yyjulhhhh GMT
Julian_Day	Julian Day	integer
Local_Date	Local Date	YYYYMMDD
Local_Time	Local Time	HHMM
Station	Station Number	text
Cast	CTD cast number	text
Cast_Type	Cast Type (CTD or sediment trap)	text
Latitude	Station Latitude (South is negative)	decimal degrees
Longitude	Station Longitude (West is negative)	decimal degrees
In_or_Out	In/Out status relative to North Pacific Subtropical Gyre	text
In_Charge	Responsible Party/Person	text
Activity	Activity or Operation	text
Page_of_Paper_Log	Page number in paper logbook	dimensionless

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Deployments

KM0812

Website	https://www.bco-dmo.org/deployment/58162
Platform	R/V Kilo Moana
Start Date	2008-07-01
End Date	2008-07-22
Description	This cruise was funded by NSF award OCE-0648130. Original cruise data are available from the NSF R2R data catalog. Note that the cruise dates were determined from the information reported in the UNOLS STRS system and the R2R catalog.

KM0919

Website	https://www.bco-dmo.org/deployment/58874
Platform	R/V Kilo Moana
Start Date	2009-07-29
End Date	2009-08-14
Description	This cruise was funded by NSF OCE-0648130. Original cruise data are available from the NSF R2R data catalog.

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Project Information

Center for Microbial Oceanography: Research and Education (C-MORE)

Website: http://cmore.soest.hawaii.edu/

Coverage: North Pacific Subtropical Gyre (large region around 22 45 N, 158 W)

Project summary

The **Center for Microbial Oceanography: Research and Education** (C-MORE) is a recently established (August 2006; NSF award: EF-0424599) NSF-sponsored Science and Technology Center designed to facilitate a more comprehensive understanding of the diverse assemblages of microorganisms in the sea, ranging from the genetic basis of marine microbial biogeochemistry including the metabolic regulation and environmental controls of gene expression, to the processes that underpin the fluxes of carbon, related bioelements and energy in the marine environment. Stated holistically, C-MORE's primary mission is: *Linking Genomes to Biomes*.

We believe that the time is right to address several major, long-standing questions in microbial oceanography. Recent advances in the application of molecular techniques have provided an unprecedented view of the structure, diversity and possible function of sea microbes. By combining these and other novel approaches with more well-established techniques in microbiology, oceanography and ecology, it may be possible to develop a meaningful predictive understanding of the ocean with respect to energy transduction, carbon sequestration, bioelement cycling and the probable response of marine ecosystems to global environmental variability and climate change. The strength of C-MORE resides in the synergy created by bringing together experts who traditionally have not worked together and this, in turn, will facilitate the creation and dissemination of new knowledge on the role of marine microbes in global habitability.

The new Center will design and conduct novel research, broker partnerships, increase diversity of human resources, implement education and outreach programs, and utilize comprehensive information about microbial life in the sea. The Center will bring together teams of scientists, educators and community members who otherwise do not have an opportunity to communicate, collaborate or design creative solutions to long-term ecosystem scale problems. The Center's research will be organized around four interconnected themes:

- (Theme I) microbial biodiversity,

- (Theme II) metabolism and C-N-P-energy flow,
- (Theme III) remote and continuous sensing and links to climate variability, and
- (Theme IV) ecosystem modeling, simulation and prediction.

Each theme will have a leader to help coordinate the research programs and to facilitate interactions among the other related themes. The education programs will focus on pre-college curriculum enhancements, in service teacher training and formal undergraduate/graduate and post-doctoral programs to prepare the next generation of microbial oceanographers. The Center will establish and maintain creative outreach programs to help diffuse the new knowledge gained into society at large including policymakers. The Center's activities will be dispersed among five partner institutions:

- Massachusetts Institute of Technology,
- Woods Hole Oceanographic Institution,
- Monterey Bay Aquarium Research Institute,
- University of California at Santa Cruz and
- Oregon State University

and will be coordinated at the University of Hawaii at Manoa.

Related Files:

Strategic plan (PDF file)

Silica Cycling and the Role of Diatoms in the North Pacific Subtropical Gyre (Silica Cycling)

Coverage: North Pacific Subtropical Gyre north of Hawaii, near (30 N, 140 W)

This study examines the unique silicon cycle of the North Pacific Subtropical Gyre (NPSG).

Most marine silicon cycle studies have focused on the more productive coastal waters or the Southern Ocean where diatoms typically dominate the phytoplankton. Although diatom biomass is much lower in subtropical gyres, silica production is significant in global terms. Silicon cycle studies of the Sargasso Sea in the 1990's implied that subtropical gyres account for 13% of global marine silica production. More recent data from the NPSG show much higher rates of silica production that would increase the contribution of subtropical gyres to as much as 40%. The new estimate is uncertain and based on few data, but suggests that the contribution of subtropical gyres has been underestimated. Differences in the silicon cycle between the NPSG and the Sargasso Sea go beyond differences in average production rates. The two systems are several months out of phase with each other in terms of their seasonal silica production cycles. Unlike the Sargasso Sea, where diatoms bloom regularly in spring in response to winter convective overturn, permanent stratification prevents spring diatom blooms events in the NPSG, where annual diatom blooms occur in summer, when stratification is strongest and nutrient concentrations are at a seasonal minimum. These enigmatic summer blooms contribute significantly to carbon and nitrogen export in the NPSG and likely dominate the annual silicon cycle.

Time series of rate measurements will be made in collaboration with the HOT program to define the annual silicon cycle at station ALOHA. The project will also collaborate with the new "Center for Microbial Oceanography: Research and Education" (CMORE) Science and Technology Center at the University of Hawaii to study summer blooms. Funding for this portion of the project is from NSF OCE-0648130.

Separately funded laboratory studies (NSF OCE-0726726; Title: Biological characterization of the nitrogen-fixing Rhizosolenia-Richelia symbiosis), looked at the role of diatom-diazotroph associations (DDAs) in elemental cycling in the NPSG.

Nitrogen-fixation provides a key input of new nitrogen into oligotrophic, oceanic regions. Work over the past two decades has highlighted the role of Trichodesmium. More recently, the role of coccoid cyanobacteria as well as symbiotic associations of the filamentous cyanobacteria Richelia intracellularis with species of diatoms (Rhizosolenia and Hemiaulus) has received attention. Little is known of the growth rates, nutrient needs, chemical composition, or environmental tolerances of these DDAs. However, it is clear that DDAs are numerically important in some oceans and can play a major role in mediating new nitrogen inputs. Recent models have identified the need for species-specific parameters, but these are lacking for DDAs. In particular, temperature dependent properties require quantification for application to global warming scenarios.

Laboratory studies of both the Rhizosolenia-Richelia and Hemiaulus-Richelia DDA are now possible due to the reproducible cultivation of this association. This four-year research program will quantify temperature and salinity effects on growth rates and NB2B-fixation rates. It will explore the role of silicate and phosphate (inorganic and organic) in controlling growth rates, chemical composition and NB2B-fixation through host-symbiont interactions. Field studies will address the distribution of both these DDAs and their contribution to Si cycling in large diatom blooms reported from the central N. Pacific gyre.

The mass accumulation of the DDAs in sediment traps as well as in the sedimentary record suggest DDAs are important vectors to depth. The potentially high sinking rates relative to Trichodesmium permit rapid export of new N and sequestration of C. This work will quantify settling rates under conditions of phosphate and silicate-limited growth and provide the first estimates of potential losses due to sinking. This program will provide the first broad characterization of a DDA and provide valuable input data for models.

DDA blooms are potential means to remove C and N quickly from the euphotic zone via mass sedimentation of the diatom host. Diatom remains in sediments suggest this is an important vector for sedimentary deposition. The auteocological work in this study will produce information important for interpreting how such events can occur. In addition, temperature tolerance studies will yield data useful for understanding how this DDA could respond to warming oceans.

The proposed research on Si cycling combined with ongoing studies of C, N and P cycling at station ALOHA will allow, for the first time, an opportunity for a coordinated analysis the cycling of all four of these elements simultaneously in an oligotrophic gyre. The pairing of field work with laboratory studies to determine the role of DDAs will expand understanding of the mechanisms controlling the contribution of diatoms to elemental cycling in open ocean ecosystems.

RELATED PUBLICATIONS

Brzezinski MA, Krause JW, Church MJ, Karl DM, Li B, Jones JL, Updyke B. "The annual silica cycle of the North Pacific subtropical gyre," Deep Sea Research I, v.58, 2011, p. 998.

Duhamel S., Bjorkman K. M., Van Wambeke F., Moutin T., Karl DM. "Characterization of alkaline phosphatase activity in the North and South Pacific Subtropical Gyres: Implications for phosphorus cycling," Limnology and Oceanography, v.56, 2011, p. 1244.

Krause J.W., Brzezinski M.A., Jones J.L. "Application of low-level beta counting of 32Si for the measurement of silica production rates in aquatic environments," Marine Chemistry, v.127, 2011, p. 40.

Krause J.W., Brzezinski M.A., Villareal, T.A., Wilson C. "Increased kinetic efficiency for silicic acid uptake as a driver of summer diatom blooms in the North Pacific subtropical gyre," Limnology and Oceanography, v.57, 2012, p. 1084.

Villareal, T.A.; Adornato, L.; Wilson, C.; Shoenbachler, C.A. "Summer blooms of diatom-diazotroph assemblages (DDAs) and surface chlorophyll in the N. Pacific gyre - a disconnect" Journal of Geophysical Research-Oceans, v.116, 2011, p. DOI: 10.1.

Villareal T.A., Brown, C. G., Brzezinski M.A., Krause J.W., Wilson C.. "Summer Diatom Blooms in the North Pacific Subtropical Gyre: 2008-2009," PLos ONE, v.7, 2012, p. e33109.

Watkins-Brandt K.S., Letelier R.M., Spitz Y.H., Church M.J., Bottjer D., White Angelicque. "Addition of inorganic or organic phosphorus enhances nitrogen and carbon fixation in the oligotrophic North Pacific," Marine Ecology Progress Series, v.432, 2011, p. 17.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0623596
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