Bottle and CTD data from the CARNE ASADA project from R/V New Horizon GoCAL4 in the Gulf of California and eastern tropical North Pacific from July to August 2008 (CARNE ASADA project)

Website: https://www.bco-dmo.org/dataset/3689
Version: 2012-08-02

Project
» The role of marine Crenarchaeota in nitrification and links among biogeochemical processes in the eastern tropical North Pacific and Gulf of California (CARNE ASADA)

Contributors	Affiliation	Role
Beman, John Michael	University of Hawai'i (UH)	Principal Investigator
Popp, Brian N.	University of Hawai'i (UH)	Co-Principal Investigator

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Dataset Description

Bottle nutrient data including Oxygen, Chlorophyl, and optical properies and corresponding CTD data from descrete depths associated with the 'Crenarchaeal Roles in Nitrification in the ETNP: Assessing Abundance, Diversity, and Activity (CARNE ASADA)' project.

This dataset is preliminary and not yet finalized by the PI.

Methods & Sampling

Temperature, conductivity and chlorophyll concentrations were measured using a Seabird SBE 9 conductivity-temperature-depth (CTD) sensor package equipped with a Seapoint fluorometer and photosynthetically active radiation sensor (Biospherical Instruments QSP-2300).

Nutrient and oxygen samples were collected using 10-liter PVC bottles deployed on the CTD rosette. NH4 concentrations were measured using fluorometric methods. NO2 and NO3 concentrations were measured using standard colormetric techniques. Oxygen concentrations were measured using a SBE oxygen sensor and corrected based on Winkler titrations.

For additional information on sampling and analytical methods, see Beman et al. 2012 Limnology and Oceanography 57: 711-726

Data Processing Description

BCO-DMO Processing Notes

Generated from original file CARNE_BCODMO.csv

BCO-DMO Edits
- Edited header parameters names to conform to BCO-DMO convention, of note:
  - chl edited to 'chl_a'
  - DO[umol/kg] edited to 'O2_umol_kg'
  - DO[%] edited to 'O2_sat_pcnt'
  - yyy-mm-dd edited to 'time_local'
- Edited missing data (e.g., no data, no sample collected) to 'nd'
- Edited reported Latitude from 360 degree to +/-180 degree representation
- Separated date and time; included ISO-formatted date/time.
- values of PAR equal to 1.0E -12 were edited to zero (0)
- At request of PI, data column 'type' was removed from the served view of the data, but remains in the data file.

NOTE:
Data columns for each parameter quality flag (*_QF) were removed from the served view of the data, but remain in the data file. These quality flags were added by ODV by default upon import and have subsequently followed the data. All quality flags (even for missing data) are set to "1" in the data file, which indicates "unknown quality" in the ODV software.

At request of PI, a second column describing publication station names was added to the data file as 'station_pub'. The station number at time of sample collection (i.e. from the cruise) is named 'station'.

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Data Files

File
GoCal4.csv (Comma Separated Values (.csv), 35.78 KB) MD5:8538232ba048a5bcf3342a2942213cb0 Primary data file for dataset ID 3689

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Parameters

Parameter	Description	Units
cruise_id	cruise id, originally submitted as 'cruise'	dimensionless
station	Station number given to stations at time of cruise. These designations differed from station numbers at time of publication. Distinction was added at the request of the PI.	dimensionless
date	Date, originally reported as format only (yyyy-mm-dd).	yyyy/mm/dd
time_local	Local time in hours and minutes, originally reported as units only (hh:mm).	hh:mm
lon	Longitude originally submitted in 360 degree format.	decimal degrees

lat	Latitude in decimal degrees.	decimal degrees
depth_w	Depth originally submitted as 'Bot. Depth'.	meters
depth	Sample or observation depth.	meters
NH4	Ammonium, reported in nanoMolar concentration.	nM
NO2	Nitrite reported in microMolar concentration.	microMolar
NO3	Nitrate, reported in microMolar concentration.	microMolar
PO4	Phosphate.	microMolar
temp1	Water temperature at observation depth.	degrees Celsius
temp2	Water temperature at observation depth.	degrees Celsius
sal	Salinity reported in parts per thousand (permille) units, originally reported as 'salinity'.	ppt
density	Water density.	kilograms/meter^3
PAR	Photosynthetically available radiation. Original PAR values equivalent to 1.0E12 were served as zero.	uE/m^2/sec
SPAR	Surface photosynthetically available radiation.	uE/m^2/sec
trans	Light transmission.	percent
chl_a	Chlorophyll pigment measurement, originally reported as chl.	micrograms/Liter
O2_umol_kg	Dissolved oxygen, originally reported as 'DO[umol/kg]'.	micromoles/kg
O2_sat_pcnt	Oxygen saturation reported as DO in percent, originally reported as 'DO[%]'.	percent
SPAR_pcnt	Percentage of surface PAR, originally submitted as 'SPAR[%]'.	percent

station_pub	Station number at time of publication. These designations differ from those given at the time of the cruise. This distinction was added at the request of the PI.	dimensionless

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Instruments

Dataset-specific Instrument Name	CTD Sea-Bird 9
Generic Instrument Name	CTD Sea-Bird 9
Dataset-specific Description	SBE 9 CTD was equipped with a Seapoint Fluorometer and Biospherical Instruments QSP-2300 PAR sensor.
Generic Instrument Description	The Sea-Bird SBE 9 is a type of CTD instrument package. The SBE 9 is the Underwater Unit and is most often combined with the SBE 11 Deck Unit (for real-time readout using conductive wire) when deployed from a research vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorometer, altimeter, etc.). Note that in most cases, it is more accurate to specify SBE 911 than SBE 9 since it is likely a SBE 11 deck unit was used. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Seapoint fluorometer attached to a Seabird SBE 9 CTD
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	Niskin bottle
Generic Instrument Name	Niskin bottle
Dataset-specific Description	10-liter PVC bottles were deployed on the CTD rosette.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Photosynthetically Available Radiation Sensor
Generic Instrument Name	Photosynthetically Available Radiation Sensor
Dataset-specific Description	Biospherical Instruments PAR sensor model QSP-2300 was employed for PAR mesurements.
Generic Instrument Description	A PAR sensor measures photosynthetically available (or active) radiation. The sensor measures photon flux density (photons per second per square meter) within the visible wavelength range (typically 400 to 700 nanometers). PAR gives an indication of the total energy available to plants for photosynthesis. This instrument name is used when specific type, make and model are not known.

Dataset-specific Instrument Name	SBE 43 Dissolved Oxygen Sensor
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Sensor values were corrected using Winkler titrations.
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. more information from Sea-Bird Electronics

Dataset-specific Instrument Name	Transmissometer
Generic Instrument Name	Transmissometer
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

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Deployments

GoCAL4

Website	https://www.bco-dmo.org/deployment/58841
Platform	R/V New Horizon
Start Date	2008-07-10
End Date	2008-08-07
Description	See Cruise Plan for planned activities. See Station Information Map for station locations and additional station information.

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Project Information

The role of marine Crenarchaeota in nitrification and links among biogeochemical processes in the eastern tropical North Pacific and Gulf of California (CARNE ASADA)

Coverage: Gulf of California and Eastern Tropical Northern Pacific

Nitrification, the two-step oxidation of ammonia to nitrate via nitrite, plays a critical role in the global nitrogen (N) cycle by changing the form in which N occurs, and consequently influencing the accessibility and availability of N to different groups of organisms and biogeochemical processes, indeed, the processes responsible for the fixation and removal of N from the ocean may ultimately be connected by nitrification. It has long been assumed that the first and rate-limiting step of nitrification, ammonia oxidation, is restricted to a few groups within the domain Bacteria. However, the recent discovery of ammonia-oxidizing Archaea (AOA) has seriously challenged our understanding of the microbial ecology and biogeochemistry of nitrification in the ocean.

In this project, researchers at Stanford University and the University of Hawaii at Manoa will attempt to constrain quantitatively the contribution of marine Crenarchaeota to oceanic nitrification and investigate connections to other forms of nitrogen metabolism in the Gulf of California (GOC) and the eastern tropical North Pacific (ETNP). The specific objectives are to: (1) quantify 15N-ammonium oxidation rates, and bacterial and archaeal amoA genes and transcripts, at seven stations in the upper water column (0-100m) of the GOC and ETNP; (2) determine if Crenarchaeota are actively fixing inorganic carbon (i.e., autotrophic) based on uptake of 13C--labeled bicarbonate into archaeal membrane lipids; (3) quantify nitrite oxidation rates and nitrite-oxidizer abundances at the same depths and stations; (4) extend these measurements to multiple depths within the oxygen minimum zone (OMZ); (5) examine potential coupling between ammonia-oxidizing archaea and nitrogen loss processes in the OMZ of the GOC and ETNP, and (6) place our results in a broader oceanographic perspective by tying into NSF-funded work examining nitrogen fixation in N-deficient waters ultimately generated in OMZs. The researchers predict that marine Crenarchaeota will play a dominant role in ammonia oxidation-based on amoA abundance, gene expression, active fixation of isotopically-labeled inorganic carbon, and correlation to measured rates?in both the upper water column and OMZ. They also expect that metabolic coupling between AOA and both oxidative (nitrite oxidation) and reductive N metabolisms (e.g., anammox) will be apparent.

With regard to broader impacts, nitrification plays a pivotal role in linking organic matter mineralization to anaerobic nitrogen removal, and this project will provide critical information regarding how nitrification and the underlying microbial communities are influenced by key environmental gradients, as well as their connections to other N-cycling processes. Ultimately, this multi-disciplinary study should provide insights into the ecology and regulation of this biogeochemically-important process in all marine systems. The proposed research has excellent educational opportunities, and the PIs have a history of successfully mentoring and graduating Masters and/or Ph.D. students and fostering student publications and presentations at national meetings. Undergraduate, graduate, and postdoctoral education will be furthered through active participation in the cruise and post-cruise analyses, where students will work collaboratively with experts in molecular microbial

ecology and stable isotope biogeochemistry, and learn a spectrum of state-of-the-art experimental and analytical methods.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1034943
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