# CTD log at the oxygen deficient zone of the Eastern Tropical North Pacific (ETNP) for RV/Atlantis cruise AT37-12, April-May 2017

**Website**: https://www.bco-dmo.org/dataset/738001
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2018-06-04

**Project**
» Collaborative Research: Environmental Drivers of Chemoautotrophic Carbon Production at Deep-Sea Hydrothermal Vents - Comparative Roles of Oxygen and Nitrate (vent O2 NO3 roles)


| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
A total of 10 CTD casts were performed on AT37-12 focusing on sampling the waters of the oxygen deficient zone of the Eastern Tropical North Pacific (ETNP). Cast 7 could not be completed due to problems with the wire. This dataset reports the station, date, location, water depth and sampling depth of individual Niskin bottles.


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## Coverage

**Spatial Extent**: **N**:14.03048 **E**:-89.9996 **S**:9.34142 **W**:-104.3462
**Temporal Extent**: 2017-04 - 2017-05

## Dataset Description

A total of 10 CTD casts were performed on AT37-12 focusing on sampling the waters of the oxygen deficient zone of the Eastern Tropical North Pacific (ETNP). Cast 7 could not be completed due to problems with the wire. This dataset reports the station, date, location, water depth and sampling depth of individual Niskin bottles.

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Station | station identifier | unitless |
| Date | cast date, formatted as m/d/yyyy. | unitless |
| Lat | latitude; north is positive | decimal degrees |
| Lon | longitude; east is positive | decimal degrees |
| Btm_depth | bottom depth | meters |
| Niskin | Niskin bottle number | unitless |
| Btl_Depth | bottle firing depth | meters |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | CTD Sea-Bird rosette as part of R/V Atlantis |
| **Generic Instrument Name** | CTD profiler |
| **Generic Instrument Description** | The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column and permits scientists observe the physical properties in real time via a conducting cable connecting the CTD to a deck unit and computer on the ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This instrument designation is used when specific make and model are not known. |

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## Deployments

**AT37-12**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/734074 |
| **Platform** | R/V Atlantis |
| **Report** | http://datadocs.bco-dmo.org/docs/Vent_O2_NO3_Roles/data_docs/AT37-12_Cruise_Report.pdf |
| **Start Date** | 2017-04-24 |
| **End Date** | 2017-05-15 |

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## Project Information

**Collaborative Research: Environmental Drivers of Chemoautotrophic Carbon Production at Deep-Sea Hydrothermal Vents - Comparative Roles of Oxygen and Nitrate (vent O2 NO3 roles)**

**Coverage**: Deep-Sea hydrothermal vent field at 9 deg N on the East Pacific Rise

NSF award abstract: Deep-sea hydrothermal vents, first discovered in 1977, are exemplary ecosystems where microbial chemosynthesis rather than photosynthesis is the primary source of organic carbon. Chemosynthetic microorganisms use the energy generated by oxidizing reduced inorganic chemicals contained in the vent fluids, like hydrogen sulfide or hydrogen gas, to convert carbon dioxide (CO2) into cell material. By doing so, they effectively transfer the energy from a geothermal source to higher trophic levels, in the process supporting the unique and fascinating ecosystems that are characterized by high productivity - oases in the otherwise barren deep ocean landscape. While the general view of the functioning of these ecosystems is established, there are still major gaps in our understanding of the microbiology and biogeochemistry of these systems. Particularly lacking are studies measuring rates of microbial activity in situ, which is ultimately needed to understand production of these ecosystems and to assess their impact on global biogeochemical cycles. This project makes use of the Vent-Submersible Incubation Device (Vent-SID), a robotic micro-laboratory that was recently developed and tested in the field. This instrument makes it possible for the first time to determine rates of carbon fixation at both in situ pressures and temperatures, revolutionizing the way we conduct microbial biogeochemical investigations at deep-sea hydrothermal vents. This is an interdisciplinary and collaborative effort between two US and foreign institutions, creating unique opportunities for networking and to foster international collaborations. This will also benefit two graduate students working in the project, who will get exposed to a wide range of instrumentation and scientific fields, facilitating their interdisciplinary education. In collaboration with Dr. Nitzan Resnick, academic dean of The Sage School, an elementary school outreach program will be developed and a long-term partnership with the school established. Further, a cruise blog site to disseminate the research to schools and the broader public will be set up. The results will be the topic of media coverage as well as be integrated into coursework and webpages existing either in the PI's labs or at the institution. This project is using a recently developed robotic micro-laboratory, the Vent-SID, to measure rates of chemoautotrophic production and to determine the relative importance of oxygen and nitrate in driving chemosynthesis at deep-sea hydrothermal vents at in situ pressures and temperatures and to tackle the following currently unresolved science objectives: 1) obtain in situ rates of chemoautotrophic carbon fixation, 2) obtain in situ nitrate reduction rate measurements, and 3) directly correlate the measurement of these processes with the expression of key genes involved in carbon and energy metabolism. Although recent data suggests that nitrate reduction either to N2 (denitrification) or to NH4+ (dissimilatory reduction of nitrate to ammonium) might be responsible for a significant fraction of chemoautotrophic production,

$NO_3$-reduction rates have never been measured in situ at hydrothermal vents. The researchers hypothesize that chemoautrophic growth is strongly coupled to nitrate respiration in vent microbial communities. During a cruise that will take place approximately 12 months into the project (~Feb 2017), the researchers will carry out a total of 4 deployments of the Vent-SID as well as ancillary sampling collection at the 9°46N to 9°53N segment of the East Pacific Rise. They will focus efforts on two diffuse-flow vent sites, "Crab Spa" and "Teddy Bear". "Crab Spa" is a diffuse flow vent site (T: 25°C) that has been used as a model system to gain insights into chemoautotrophic processes and has been frequently sampled over the last several years. This vent site has been very well characterized, both geochemically and microbiologically, providing excellent background data for the proposed process oriented studies. "Teddy Bear" is a diffuse-flow site that was discovered in Jan 2014, and it has a lower temperature (T: 12°C), making it a good comparative site. The researchers will perform a number of short duration time-course incubations to assess the role of different environmental parameters that have been identified as likely key variables (e.g., $O_2$, temperature, $NO_3^-$), and to link these process rate measurements to the expression of functional genes using metatranscriptomic analyses. This study will be the first attempt to measure critical metabolic processes of hydrothermal vent microbial assemblages under critical in situ conditions and to assess the quantitative importance of electron donor and acceptor pathways in situ. In the future, it is envisioned that the Vent-SID will become a routine application by the oceanographic community for measuring time series rates of relevant metabolic processes at hydrothermal vents under in situ pressures and vent fluid temperatures.

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## Funding


| Funding Source | Award |
|---|---|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1559198 |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1559042 |


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