# Suspended Organic Particle concentration and stable C and N isotopes (collected with McClane Pumps and GF/F filters) from the Eastern Tropical North Pacific on the R/V Thompson cruise TN278 in April 2012

**Website**: https://www.bco-dmo.org/dataset/948746
**Data Type**: Cruise Results
**Version**: 1
**Version Date**: 2025-01-17

**Project**
» The role of cryptic nutrient cycling within sinking particles on trace element transport in oxygen minimum zones (OMZ Nutrient Cycling)

| Contributors | Affiliation | Role |
|---|---|---|
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**Abstract**
Suspended organic carbon and nitrogen concentrations and stable isotopes were obtained on the R/V Thompson cruise TN278 at St P2 (16.5 N 107.1 W; known as BB2 on this cruise) and at St P1 (20.1 N 106.0 W; known as BB1 on this cruise) in the Eastern Tropical North Pacific Oxygen Deficient Zone in April 2012. The Oxygen Deficient Zone extended from 105 m to 820 m at St P2 and from 95 to 800 m at St P1. Water was filtered onto 142 mm pre-combusted GF/F filters in situ using McClane pumps (on average ~300-500 L) in a depth profile. Two 21 mm diameter punches were obtained from each 142 mm filter and used for organic matter analysis. Sample punches were wafted with HCl overnight to remove carbonate and sent to the UC Davis Stable Isotope Facility (Davis, CA) for C and N analysis. The purpose of this sampling was to quantify suspended organic matter in an offshore Oxygen Deficient Zone. Jacquelyn Neibauer and Rick Keil of the University of Washington deployed the McClane pumps on the cruise. Jacquelyn Neibauer was in charge of prepping the samples. Megan Duffy and Clara Fuchsman of the University of Washington analyzed the data.

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# Coverage

**Location**: Eastern Tropical North Pacific Oxygen Deficient Zone Depth profileSt P2 (16.5 N 107.1 W) and at St P1 (20.1 N 106.0 W)
**Spatial Extent**: **N**:20.19 **E**:-105.99 **S**:16.51 **W**:-107.17

**Temporal Extent**: 2012-03-30 - 2012-04-11

**Methods & Sampling**

Suspended organic carbon and nitrogen concentrations and stable isotopes were obtained on the R/V Thompson cruise TN278 at St P2 (16.53 N 107.15 W; known as BB2 on this cruise) and at St P1 (20.1 N 106.0 W; known as BB1 on this cruise) in the Eastern Tropical North Pacific Oxygen Deficient Zone in April 2012. Water was filtered onto 142 mm pre-combusted GF/F filters *in situ* using McClane pumps (on average ~300-500 L) in a depth profile. Two 21 mm diameter punches from a size 12 core bore punch were obtained from each 142 mm filter and used for organic matter analysis. Sample punches were wafted with HCl overnight to remove carbonate, dried at 40°C, packed into silver capsules, and sent to the UC Davis Stable Isotope Facility (Davis, CA) for C and N analysis utilizing an elemental analyzer (Elementar Vario EL Cube) attached to an isotope ratio mass spectrometer (Isoprim VisION). Blank combusted GF/F filters were included in analyses and did not show measurable material.

**Data Processing Description**

Data were processed in Microsoft Excel. In particularly, ug C and N were converted to concentrations using volume filtered.

**BCO-DMO Processing Description**

* Sheet 1 of submitted file "ETNP_2012_POM.xlsx" was imported into the BCO-DMO data system. Table will appear as Data File: 948746_v1_etnp-2012-mcclane-pump-pom.csv (along with other download format options).
** In the BCO-DMO data system missing data identifiers are displayed according to the format of data you access. For example, in csv files it will be blank (null) values. In Matlab .mat files it will be NaN values. When viewing data online at BCO-DMO, the missing value will be shown as blank (null) values.

* Completely blank rows removed within table.

* Date converted to ISO 8601 format

* lon values changed to negative (decimal degrees (south and west are negative))

* Supplemental reference table was attached without format changes.

**Problem Description**

None known

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# Data Files

| File |
| --- |
| **ETNP 2012 suspended POM McClane Pumps**<br>filename: 948746_v1_etnp-2012-mcclane-pump-pom.csv     (Comma Separated Values (.csv), 3.02 KB)<br>MD5:3970f922a1bba89b4947c52726364daa<br><br>Primary data file for dataset ID 948746, version 1.<br>Suspended organic carbon and nitrogen concentrations and stable isotopes obtained from McClane pumps onto GF/F filters in the Eastern Tropical North Pacific Oxygen Deficient Zone stations P2 and P1. |

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## Related Publications

Fuchsman, C. A., Duffy, M. E., Cram, J. A., Huanca-Valenzuela, P., Gregory, B. P., Plough, L., Pierson, J. J., Fitzgerald, C. L., Devol, A. H., & Keil, R. G. (2024). Contributions of Vertically Migrating Metazoans to Sinking and Suspended Particulate Matter Fuel N2 production in the Eastern Tropical North Pacific Oxygen Deficient Zone. https://doi.org/10.22541/essoar.172745075.56787778/v1
*Results*

## Parameters

| Parameter | Description | Units |
|---|---|---|
| Sample | sample name | unitless |
| St | station sampled | unitless |
| latitude | location sampled (latitude) | decimal degrees |
| longitude | location sampled (longitude) | decimal degrees |
| Date | date sampled (ISO 8601 format) | unitless |
| Depth | depth sampled | meters (m) |
| Nitrogen | concentration of organic N. Detection limit for N is 5 ug | micromolar (uM) |
| Carbon | concentration of organic C. Detection limit for C is 30 ug. | micromolar (uM) |
| d15N_Air | isotopic composition of N (d15N with respect to reference standard air). | permil (0/00) |
| d13C_VPDB | isotopic composition of C (d13C). Reference standard VPDB="Vienna Pee Dee Belemnite" | permil (0/00) |
| C_to_N | ratio of molar carbon to nitrogen concentrations (C:N) | unitless |

## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | |
| **Generic Instrument Name** | Elementar Vario EL Cube elemental analyzer |
| **Dataset-specific Description** | UC Davis Stable Isotope Facility (Davis, CA) analysed for C and N utilizing an elemental analyzer (Elementar Vario EL Cube) attached to an isotope ratio mass spectrometer (Isoprim VisION). |
| **Generic Instrument Description** | A laboratory instrument used for quantifying organic elements. It can measure C, H, N and S and optionally O, Cl and TIC. It was first developed in 2006 as a successor to the vario EL III. It uses a high-temperature combustion unit that is able to complete sample digestion at up to 1200 deg C (or 1800 deg C at the point of combustion when tin foil is used) and a jet injection of oxygen directly to the sample during combustion. Separation of gas components are performed on up to 3 gas-selective columns which trap gases until they are heated up and the prior gas peak has reached the baseline during detection. It uses a Thermal Conductivity Detector (TCD) as standard. An infrared (IR) detector for sulfur and oxygen and electrochemical detector for chlorine are optionally available. The instrument can measure C / N elemental ratios of up to 12,000:1 and provides an elemental detection limit of < 40 ppm (TCD). |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Isoprim VisION |
| **Generic Instrument Name** | Isotope-ratio Mass Spectrometer |
| **Dataset-specific Description** | UC Davis Stable Isotope Facility (Davis, CA) analysed for C and N utilizing an elemental analyzer (Elementar Vario EL Cube) attached to an isotope ratio mass spectrometer (Isoprim VisION). |
| **Generic Instrument Description** | The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer). |

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## Deployments

### TN278

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/733752 |
| **Platform** | R/V Thomas G. Thompson |
| **Start Date** | 2012-03-17 |
| **End Date** | 2012-04-23 |
| **Description** | Additional cruise data are available from the Rolling Deck to Repository (R2R): http://www.rvdata.us/catalog/TN278 |

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## Project Information

**The role of cryptic nutrient cycling within sinking particles on trace element transport in oxygen minimum zones (OMZ Nutrient Cycling)**

**Coverage**: Eastern Tropical North Pacific

*NSF Award Abstract:*
The major process controlling the internal cycling of biologically active trace metals in the oceans is through uptake onto and remineralization from sinking particles. Uptake can occur through active biological uptake into living cells as micronutrients, or chemical adsorption onto sinking materials. This latter process is often referred to as scavenging. The relative importance of these processes is often unclear, especially for elements that are both biologically active and also "particle reactive." The latter characteristic is associated with sparing solubility in seawater and the formation of strong complexes with surface sites, with examples such as iron. Recent evidence suggests that the simplistic view of a sinking particle as a passive surface for metal complexation may require some revision. Investigators James Moffett and Seth John propose to study the chemistry of transition metals within large sinking particles and the resultant effects on metal biogeochemical cycling. They will collaborate with a group at the University of Washington, recently funded to study the microbiology and molecular biology of these particles. The central hypothesis of this project is that reducing microbial microenvironments within large particles support high rates of nitrogen and sulfur cycling, greatly enhancing the particles' influence on metal chemistry. The investigators will study these processes in the Eastern Tropical North Pacific Oxygen Minimum Zone (OMZ). This regime was selected because of the wide range of redox conditions in the water column, and strong preliminary evidence that microenvironments within sinking particles have major biogeochemical impacts.

The primary objective is to investigate the interactions of metals with particles containing microenvironments that are more highly reducing than the surrounding waters. Such microenvironments arise when the prevailing terminal electron acceptor (oxygen, or nitrate in oxygen minimum zones) becomes depleted and alternative terminal electron acceptors are utilized. Within reducing microenvironments metal redox state and coordination chemistry are different from the bulk water column, and these microenvironments may dominate metal particle interactions. For example, reduction of sulfate to sulfide could bind metals that form strong sulfide complexes, such as cadmium and zinc, processes previously thought to be confined to sulfidic environments. Reducing microenvironments may account for the production of reduced species such as iron(II), even when their formation is thermodynamically unfavorable in the bulk water column. Tasks include observational characterization of dissolved and particulate trace metals and stable isotopes in the study area, sampling and in situ manipulation of particles using large-dimension sediment traps, shipboard experimental incubations under a range of redox conditions, and modeling, providing insight from microscopic to global scales. The metal chemistry data will be interpreted within a rich context of complimentary data including rates of nitrogen and sulfur cycling, phylogenetics and proteomic characterization of the concentration of key enzymes. Broader impacts include training of a postdoctoral scientist, international collaborations with Mexican scientists, and involvement of undergraduate students in the research.

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# Funding

| Funding Source | Award |
| --- | --- |
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1636332 |

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