

Geochemical composition of sediment samples collected in the Equatorial Pacific during October and November 2020 on R/V Kilo Moana cruise KM2012

Website: <https://www.bco-dmo.org/dataset/928400>

Data Type: Cruise Results

Version: 1

Version Date: 2024-05-23

Project

» [Collaborative Research: How and Why eNd Tracks Ocean Circulation](#) (Pacific Porewater Nd)

Contributors	Affiliation	Role
Haley, Brian	Oregon State University (OSU)	Co-Principal Investigator
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Abstract

Water column, sediment, and pore water samples were collected during R/V Kilo Moana cruise KM2012 in the Equatorial Pacific during October and November 2020. This dataset includes elemental concentrations, Neodymium isotope ratios, and XRD analyses of the mineralogy of the sediment samples.

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Coverage

Location: Equatorial Pacific

Spatial Extent: N:11 E:-152 S:3 W:-152

Temporal Extent: 2020-10-14 - 2020-10-24

Methods & Sampling

Water column, sediment, and pore water samples were collected following the methods in Abbott et al. (2015) during R/V Kilo Moana cruise KM2012 in October and November 2020. Sediment cores were collected using an MC800 multi-corer and sectioned at 1.2 centimeter (cm) intervals. Sediment samples were frozen onboard and freeze-dried in the lab. See 'Related Datasets' for the data from the water column and pore water samples.

Elemental concentrations, including the REEs, were analyzed at Oregon State University (OSU) using an Elemental Scientific seaFAST-pico offline preconcentration technique, and the procedure has been extensively documented as part of the GEOTRACES intercalibration effort (Behrens et al., 2016). Elemental concentrations of the ϵ Nd aliquots (~10 milliliters (mL)) were analyzed at ETH Zurich using Nobias Chelate-PA1 resin in a manual column procedure (K. Deng et al., 2022).

Isotope analysis of the ϵNd aliquots (400~700 mL of pore water or ~1.5 liters (L) of seawater) were done at ETH Zurich. Samples were buffered to a pH of 5.5 ± 5 and pre-concentrated using an in-house extraction manifold containing Nobias Chelate-PA1 resin. After pre-concentration, separation of Nd from the matrix elements and other REE was done using Eichrom RE and LN spec resins. Procedural blanks are <3 picograms (pg). Isotope analysis was done on a Neptune Plus MC-ICP-MS (Thermo-Fisher) following the procedure of Vance and Thirlwall (2002). Internally normalized sample data was renormalized to the $^{143}\text{Nd}/^{144}\text{Nd}$ ratio of La Jolla (Thirlwall, 1991). Repeated analysis of 8 parts per billion (ppb) La Jolla solutions results in a long-term external reproducibility of 0.27ϵ (2σ). Nd isotope analysis was also quality-controlled by repeated measurements of the USGS reference materials BCR-2 ($\epsilon\text{Nd} = -0.11 \pm 0.25$, 2σ) and BHVO-2 ($\epsilon\text{Nd} = 6.70 \pm 0.24$, 2σ) at the same concentration (5-10 ppb) as the pore water samples in agreement with literature results (Jochum et al., 2005).

Nutrients were analyzed at Oregon State University using Technicon AutoAnalyzer II (phosphate and ammonium) and Alpkem RFA 300 (silicic acid, nitrate+nitrite). The method and data processing follow Gordon et al. (1993). DOC was analyzed with a V-CSN/TNM-1 (Shimadzu Corp, Kyoto, Japan) at the Scripps Institution of Oceanography following White et al. (2023).

Sediment samples were analysed for total organic carbon contents using a GVI (now Elementar) Isoprime 1000 with Eurovector EA at Bigelow Laboratory for Ocean Sciences. Samples were measured for the total carbon (organic plus inorganic) and a separate sample split was acidified to remove carbonate and then measured for the organic fraction.

X-ray diffraction (XRD) of freeze-dried raw samples were made at K/T GeoServices Inc. (Colorado, USA), using a Siemens D500 automated powder diffractometer equipped with a copper X-ray source (40kV, 30mA) and a scintillation X-ray detector. Semi-quantitative determinations of whole-sediment mineral amounts were done using Jade Software (Materials Data, Inc.) with the Whole Pattern Fitting option.

BCO-DMO Processing Description

- Imported sheet "BCO-DMO sediment" from original file "BCO-DMOv2.xlsx" into the BCO-DMO system.
- Renamed fields to comply with BCO-DMO naming conventions.
- Corrected bottom depth of station 4 from 505 to 5050.
- Saved the final file as "928400_v1_sediment_geochemical_composition.csv".

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Data Files

File
928400_v1_sediment_geochemical_composition.csv (Comma Separated Values (.csv), 21.97 KB) MD5:41adb2e842015eb958d2c808fc5bbd0e
Primary data file for dataset ID 928400, version 1

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Related Publications

Abbott, A. N., Haley, B. A., McManus, J., & Reimers, C. E. (2015). The sedimentary flux of dissolved rare earth elements to the ocean. *Geochimica et Cosmochimica Acta*, 154, 186–200.

<https://doi.org/10.1016/j.gca.2015.01.010>

Methods

Behrens, M. K., Muratli, J., Pradoux, C., Wu, Y., Böning, P., Brumsack, H.-J., ... Pahnke, K. (2016). Rapid and precise analysis of rare earth elements in small volumes of seawater - Method and intercomparison. *Marine Chemistry*, 186, 110–120. doi:[10.1016/j.marchem.2016.08.006](https://doi.org/10.1016/j.marchem.2016.08.006)

Methods

Deng, Kai, Yang, Shouye, Du, Jianghui, Lian, Ergang, & Vance, Derek. (2022). Dominance of benthic flux of

REEs on continental shelves: implications for oceanic budgets. *ETH Zurich*. <https://doi.org/10.3929/ETHZ-B-000559675> <https://doi.org/10.3929/ethz-b-000559675>

Methods

Gordon, L.I., J.C. Jennings, Jr., A.A. Ross, and J.M. Krest (1993) A Suggested Protocol For Continuous Flow Automated Analysis of Seawater Nutrients, in WOCE Operation Manual, WHP Office Report 90-1, WOCE Report 77 No. 68/91, 1-52. https://cchdo.github.io/hdo-assets/documentation/manuals/pdf/91_1/gordnut.pdf

Methods

Jochum, K. P., Nohl, U., Herwig, K., Lammel, E., Stoll, B., & Hofmann, A. W. (2005). GeoReM: A New Geochemical Database for Reference Materials and Isotopic Standards. *Geostandards and Geoanalytical Research*, 29(3), 333–338. <https://doi.org/10.1111/j.1751-908x.2005.tb00904.x>

<https://doi.org/10.1111/j.1751-908X.2005.tb00904.x>

Methods

Thirlwall, M. F. (1991). Long-term reproducibility of multicollector Sr and Nd isotope ratio analysis. *Chemical Geology*, 94(2), 85–104. [https://doi.org/10.1016/s0009-2541\(10\)80021-x](https://doi.org/10.1016/s0009-2541(10)80021-x) [https://doi.org/10.1016/S0009-2541\(10\)80021-X](https://doi.org/10.1016/S0009-2541(10)80021-X)

[https://doi.org/10.1016/S0009-2541\(10\)80021-X](https://doi.org/10.1016/S0009-2541(10)80021-X)

Methods

Vance, D., & Thirlwall, M. (2002). An assessment of mass discrimination in MC-ICPMS using Nd isotopes. *Chemical Geology*, 185(3–4), 227–240. [https://doi.org/10.1016/s0009-2541\(01\)00402-8](https://doi.org/10.1016/s0009-2541(01)00402-8)

[https://doi.org/10.1016/S0009-2541\(01\)00402-8](https://doi.org/10.1016/S0009-2541(01)00402-8)

Methods

White, M. E., Nguyen, T. B., Koester, I., Lardie Gaylord, M. C., Beman, J. M., Smith, K. L., McNichol, A. P., Beaupré, S. R., & Aluwihare, L. I. (2023). Refractory Dissolved Organic Matter has Similar Chemical Characteristics but Different Radiocarbon Signatures With Depth in the Marine Water Column. *Global Biogeochemical Cycles*, 37(4). Portico. <https://doi.org/10.1029/2022gb007603>

<https://doi.org/10.1029/2022GB007603>

Methods

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Related Datasets

IsRelatedTo

Haley, B., McManus, J. (2024) **Geochemical composition of sediment pore water samples collected in the Equatorial Pacific during October and November 2020 on R/V Kilo Moana cruise KM2012.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-23 doi:10.26008/1912/bco-dmo.928246.1 [[view at BCO-DMO](#)]

Haley, B., McManus, J. (2024) **Geochemical composition of water column samples collected in the Equatorial Pacific during October and November 2020 on R/V Kilo Moana cruise KM2012.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-23 doi:10.26008/1912/bco-dmo.928152.1 [[view at BCO-DMO](#)]

Haley, B., McManus, J. (2024) **Geochemical composition of water column samples collected in the Equatorial Pacific during October and November 2020 on R/V Kilo Moana cruise KM2012.** Biological and Chemical Oceanography Data Management Office (BCO-DMO). (Version 1) Version Date 2024-05-23 doi:10.26008/1912/bco-dmo.928152.1 [[view at BCO-DMO](#)]

doi:10.26008/1912/bco-dmo.928152.1 [[view at BCO-DMO](#)]

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Parameters

Parameter	Description	Units
Station_Number	Station number	unitless
Latitude	Latitude of sampling site in degrees North	degrees North

Longitude	Longitude of sampling site in degrees East (negative values are West)	degrees East
Date	Date of sampling	unitless
bottom_depth	Depth to seafloor	meters (m)
nominal_depth	Due to the nature of pore water sampling, the exact depth of sampling is not exact. We have provided the best median-depth for the sample taken such that it is comparable to other data/pore water/sediment. The resolution we used for these "nominal depths" is 0.5 cm.	centimeters (cm)
Be_ug_g	Beryllium micrograms per gram sediment digested	micrograms per gram (ug/g)
Be_error	Beryllium error of analysis	micrograms per gram (ug/g)
Na_wt_pcnt	Sodium micrograms per gram sediment digested	weight %
Na_error	Sodium error of analysis	weight %
Mg_wt_pcnt	Magnesium micrograms per gram sediment digested	weight %
Mg_error	Magnesium error of analysis	weight %
Al_wt_pcnt	Aluminium micrograms per gram sediment digested	weight %
Al_error	Aluminium error of analysis	weight %
S_wt_pcnt	Sulfur g per g sediment digested	weight %
S_error	Sulfur error of analysis	weight %
K_wt_pcnt	Potassium g per g sediment digested	weight %
K_error	Potassium error of analysis	weight %
Ca_wt_pcnt	Calcium g per g sediment digested	weight %
Ca_error	Calcium error of analysis	weight %

Sc_ug_g	Scandium micrograms per gram sediment digested	weight %
Sc_error	Scandium error of anlysis	weight %
Ti_wt_pcnt	Titanium g per g sediment digested	weight %
Ti_error	Titanium error of anlysis	weight %
V_ug_g	Vanadium micrograms per gram sediment digested	micrograms per gram (ug/g)
V_error	Vanadium error of anlysis	micrograms per gram (ug/g)
Cr_ug_g	Chromium micrograms per gram sediment digested	micrograms per gram (ug/g)
Cr_error	Chromium error of anlysis	micrograms per gram (ug/g)
Mn_ug_g	Manganese micrograms per gram sediment digested	micrograms per gram (ug/g)
Mn_error	Manganese error of anlysis	micrograms per gram (ug/g)
Fe_wt_pcnt	Iron g per g sediment digested	weight %
Fe_error	Iron error of anlysis	weight %
Co_ug_g	Cobalt micrograms per gram sediment digested	micrograms per gram (ug/g)
Co_error	Cobalt error of analysis	micrograms per gram (ug/g)
Ni_ug_g	Nickel nanograms per gram sediment digested	micrograms per gram (ug/g)
Ni_error	Nickel error of analysis	micrograms per gram (ug/g)
Cu_ug_g	Copper micrograms per gram sediment digested	micrograms per gram (ug/g)
Cu_error	Copper error of analysis	micrograms per gram (ug/g)
Zn_ug_g	Zinc micrograms per gram sediment digested	micrograms per gram (ug/g)

Zn_error	Zinc error of analysis	micrograms per gram (ug/g)
As_ug_g	Arsenic micrograms per gram sediment digested	micrograms per gram (ug/g)
As_error	Arsenic error of analysis	micrograms per gram (ug/g)
Sr_ug_g	Strontium micrograms per gram sediment digested	micrograms per gram (ug/g)
Sr_error	Strontium error of analysis	micrograms per gram (ug/g)
Y_ug_g	Ytterbium micrograms per gram sediment digested	micrograms per gram (ug/g)
Y_error	Ytterbium error of analysis	micrograms per gram (ug/g)
Zr_ug_g	Zirconium micrograms per gram sediment digested	micrograms per gram (ug/g)
Zr_error	Zirconium error of analysis	micrograms per gram (ug/g)
Nb_ug_g	Niobium micrograms per gram sediment digested	micrograms per gram (ug/g)
Nb_error	Niobium error of analysis	micrograms per gram (ug/g)
Mo_ug_g	Molybdenum micrograms per gram sediment digested	micrograms per gram (ug/g)
Mo_error	Molybdenum error of analysis	micrograms per gram (ug/g)
Cd_ug_g	Cadmium micrograms per gram sediment digested	micrograms per gram (ug/g)
Cd_error	Cadmium error of analysis	micrograms per gram (ug/g)
Ba_ug_g	Barium micrograms per gram sediment digested	micrograms per gram (ug/g)
Ba_error	Barium error of analysis	micrograms per gram (ug/g)
La_ug_g	Lanthanum micrograms per gram sediment digested	micrograms per gram (ug/g)
La_error	Lanthanum error of analysis	micrograms per gram (ug/g)

Ce_ug_g	Cerium micrograms per gram sediment digested	micrograms per gram (ug/g)
Ce_error	Cerium error of analysis	micrograms per gram (ug/g)
Pr_ug_g	Praeseodymium micrograms per gram sediment digested	micrograms per gram (ug/g)
Pr_error	Praeseodymium error of analysis	micrograms per gram (ug/g)
Nd_ug_g	Neodymium micrograms per gram sediment digested	micrograms per gram (ug/g)
Nd_error	Neodymium error of analysis	micrograms per gram (ug/g)
Sm_ug_g	Samarium micrograms per gram sediment digested	micrograms per gram (ug/g)
Sm_error	Samarium error of analysis	micrograms per gram (ug/g)
Eu_ug_g	Europium micrograms per gram sediment digested	micrograms per gram (ug/g)
Eu_error	Europium error of analysis	micrograms per gram (ug/g)
Gd_ug_g	Gadolinium micrograms per gram sediment digested	micrograms per gram (ug/g)
Gd_error	Gadolinium error of analysis	micrograms per gram (ug/g)
Tb_ug_g	Terbium micrograms per gram sediment digested	micrograms per gram (ug/g)
Tb_error	Terbium error of analysis	micrograms per gram (ug/g)
Dy_ug_g	Dysprosium micrograms per gram sediment digested	micrograms per gram (ug/g)
Dy_error	Dysprosium error of analysis	micrograms per gram (ug/g)
Ho_ug_g	Holmium micrograms per gram sediment digested	micrograms per gram (ug/g)
Ho_error	Holmium error of analysis	micrograms per gram (ug/g)
Er_ug_g	Erbium micrograms per gram sediment digested	micrograms per gram (ug/g)

Er_error	Erbium error of analysis	micrograms per gram (ug/g)
Tm_ug_g	Thulium micrograms per gram sediment digested	micrograms per gram (ug/g)
Tm_error	Thulium error of analysis	micrograms per gram (ug/g)
Yb_ug_g	Ytterbium micrograms per gram sediment digested	micrograms per gram (ug/g)
Yb_error	Ytterbium error of analysis	micrograms per gram (ug/g)
Lu_ug_g	Lutetium micrograms per gram sediment digested	micrograms per gram (ug/g)
Lu_error	Lutetium error of analysis	micrograms per gram (ug/g)
Re_ng_ml	Rhenium nanograms per gram sediment digested	nanograms/gram (ng/g)
Re_error	Rhenium error of analysis	nanograms/gram (ng/g)
Pb_ug_g	Lead micrograms per gram sediment digested	micrograms per gram (ug/g)
Pb_error	Lead error of analysis	micrograms per gram (ug/g)
U_ug_g	Uranium micrograms per gram sediment digested	micrograms per gram (ug/g)
U_error	Uranium error of analysis	micrograms per gram (ug/g)
Quartz	XRD analyses of mineralogy: Quartz	% of total
K_Feldspar	XRD analyses of mineralogy: Potassium feldspar	% of total
Plagioclase	XRD analyses of mineralogy: Plagioclase feldspar	% of total
Calcite	XRD analyses of mineralogy: Calcite	% of total
Barite	XRD analyses of mineralogy: Barite	% of total
Gypsum	XRD analyses of mineralogy: Gypsum	% of total

Halite	XRD analyses of mineralogy: Halite	% of total
Amorphous	XRD analyses of mineralogy: Amorphous phases	% of total
Illite_Mica	XRD analyses of mineralogy: Illite plus Mica	% of total
Kaolinite	XRD analyses of mineralogy: Kaolinite	% of total
Chlorite	XRD analyses of mineralogy: Chlorite	% of total
RO_M_L_I_S_90_pcmt_S	XRD analyses of mineralogy	% of total
total	XRD analyses of mineralogy	% of total
Nd143_Nd144	Isotope ratio of Neodymium-143 to Neodymium-144 (2 s.d. std. dev. = 0.000021)	unitless
eNd	Neodymium isotope composition given in epsilon notation (deviation of $^{143}\text{Nd}/^{144}\text{Nd}$ ratio from CHUR; 2 s.d. std. dev. = 0.4)	unitless

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Instruments

Dataset-specific Instrument Name	Alpkem RFA 300
Generic Instrument Name	Alpkem RFA300
Generic Instrument Description	A rapid flow analyser (RFA) that may be used to measure nutrient concentrations in seawater. It is an air-segmented, continuous flow instrument comprising a sampler, a peristaltic pump which simultaneously pumps samples, reagents and air bubbles through the system, analytical cartridge, heating bath, colorimeter, data station, and printer. The RFA-300 was a precursor to the smaller Alpkem RFA/2 (also RFA II or RFA-2).

Dataset-specific Instrument Name	GVI (now Elementar) Isoprime 1000
Generic Instrument Name	Elemental Analyzer
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	MC800 multi-corer
Generic Instrument Name	Multi Corer
Generic Instrument Description	The Multi Corer is a benthic coring device used to collect multiple, simultaneous, undisturbed sediment/water samples from the seafloor. Multiple coring tubes with varying sampling capacity depending on tube dimensions are mounted in a frame designed to sample the deep ocean seafloor. For more information, see Barnett et al. (1984) in <i>Oceanologica Acta</i> , 7, pp. 399-408.

Dataset-specific Instrument Name	Elemental Scientific seaFAST-pico
Generic Instrument Name	SeaFAST Automated Preconcentration System
Generic Instrument Description	The seaFAST is an automated sample introduction system for analysis of seawater and other high matrix samples for analyses by ICPMS (Inductively Coupled Plasma Mass Spectrometry).

Dataset-specific Instrument Name	V-CSN/TNM-1 (Shimadzu Corp)
Generic Instrument Name	Shimadzu TOC-V Analyzer
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

Dataset-specific Instrument Name	Technicon AutoAnalyzer II
Generic Instrument Name	Technicon AutoAnalyzer II
Generic Instrument Description	A rapid flow analyzer that may be used to measure nutrient concentrations in seawater. It is a continuous segmented flow instrument consisting of a sampler, peristaltic pump, analytical cartridge, heating bath, and colorimeter. See more information about this instrument from the manufacturer.

Dataset-specific Instrument Name	Neptune Plus MC-ICP-MS (Thermo-Fisher)
Generic Instrument Name	Thermo Finnigan Neptune inductively coupled plasma mass spectrometer
Generic Instrument Description	A laboratory high mass resolution inductively coupled plasma mass spectrometer (ICP-MS) designed for elemental and isotopic analysis. The instrument is based on a multicollector platform, comprising eight moveable collector supports and one fixed center channel equipped with a Faraday cup and, optionally, an ion counter with or without a retardation lens. The Faraday cup is connected to a current amplifier, whose signal is digitized by a high linearity voltage to frequency converter. The instrument was originally manufactured by Thermo Finnigan, which has since been replaced by Thermo Scientific (part of Thermo Fisher Scientific). This model is no longer in production.

Dataset-specific Instrument Name	Siemens D500 automated powder diffractometer
Generic Instrument Name	X-ray diffractometer
Generic Instrument Description	Instruments that identify crystalline solids by measuring the characteristic spaces between layers of atoms or molecules in a crystal.

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Deployments

KM2012

Website	https://www.bco-dmo.org/deployment/928159
Platform	R/V Kilo Moana
Start Date	2020-10-09
End Date	2020-11-02
Description	See more information at R2R: https://www.rvdata.us/search/cruise/KM2012

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Project Information

Collaborative Research: How and Why eNd Tracks Ocean Circulation (Pacific Porewater Nd)

Coverage: Central Pacific

NSF Award Abstract:

Circulation of water is a fundamental trait of the oceans that impacts its physics, chemistry and biology; however, understanding modern and past patterns of circulation - especially in the vast bodies of deep water - is challenging because global circulation defies direct measurement. The problems with direct measurement largely stem from the vast scales of space and time that are of interest in understanding global circulation. One tool for estimating global circulation patterns that holds promise is seen in neodymium isotopes which appear to be powerful tracers of deep ocean circulation, over a variety of timescales. Unfortunately, the elemental behavior of neodymium contrasts the isotopic behavior of neodymium in the oceans, a puzzle branded the "neodymium paradox." This inconsistency of geochemical behavior opens to question the application of

neodymium isotopes as a tracer of circulation. Therefore, scientists from Oregon State University, Tulane University, and Bigelow Laboratory of Ocean Sciences propose to test the hypothesis that there is a yet unconstrained (even poorly identified) source of neodymium to the oceans that can explain the discrepancies seen between the elemental and isotopic neodymium marine budgets. The scientists further seek to understand the mechanistic cause of this source and thus be able to start making global constraints on its influence. Understanding these processes will fundamentally change our interpretations of neodymium data and allow us to more accurately quantify ocean circulation with a greater degree of confidence. For outreach activities, the scientists plan to participate in open house days held at Oregon State University, da Vinci days, National Ocean Science Bowls, Salmon Bowl and Bigelow Laboratory for Ocean Sciences' Cafe Scientifique. Undergraduate students and one graduate student from Tulane University would be supported and trained as part of this project.

Scientists from Oregon State University, Tulane University, and Bigelow Laboratory for Ocean Sciences propose to test the hypothesis that there is a benthic source of neodymium (Nd) to the oceans that exerts a primary control over the distribution of this element and its isotopes (eNd) in the ocean. This benthic flux results from early diagenetic reactions that release rare earth elements (REEs) from the solid phase to pore fluid. The scientists contend this flux will explain eNd distributions throughout the modern and past global oceans. The planned research will be guided by three questions:

- (1) What are the mechanisms that control the magnitude and isotope composition of the benthic flux?
- (2) What are the relationships among bottom water, pore fluid, and the terminal solid phase compositions? Particularly, how and under what chemical conditions does an eNd signature become part of a preserved archival record of [Nd] and eNd?
- (3) Can our understanding of the deep water benthic fluxes account for the integrated bottom water eNd as a function of apparent water mass age and circulation path (e.g., how do the pore fluid and solid phase values reconcile with the existing water column signature and water mass age data)?

To test these ideas, sediments and their pore fluids will be collected from a diverse set of deep sea sites in the Pacific Ocean that reflect slow-to-fast sedimentation rates, carbonate-, terrigenous-, volcanoclastic- and siliceous-sediment, and low-to-high organic carbon. The sediments and porewater samples, as well as samples from the overlying water column will be characterized for the following parameters: major, minor, and trace metals, Nd isotopes, carbonate chemistry, oxygen, nutrients, particulate organic carbon, particulate organic nitrogen, radiocarbon, porosity, and grain size. With these observations we will build a quantitative numeric geochemical model (e.g., PHREEQC, Geochemist's Workbench, Humic Ion Binding Model) that can capture the cardinal controls over the benthic source. Our goal is to provide a new interpretive framework for Nd and eNd, such that we can offer quantitative estimates of benthic fluxes for use in models of global circulation. This work has potentially transformative implications on our understanding and application of REEs and Nd isotope data in both the modern and ancient oceans.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1850765
NSF Division of Ocean Sciences (NSF OCE)	OCE-1850789

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