# Chemical analysis of sediment core pore water from the Shinnecock Bay tidal flat in February of 2019

**Website**: https://www.bco-dmo.org/dataset/871820
**Data Type**: Other Field Results
**Version**: 1
**Version Date**: 2022-04-04

**Project**
» Iron cycling in bioturbated sediments - Fluxes, diagenetic redistribution, and isotopic signatures (Fe flux)

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|---|---|---|
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**Abstract**
Chemical analysis of sediment core pore water from the FeJ field sampling Site 1 from the Shinnecock Bay tidal flat, Long Island, in February of 2019.

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## Coverage

**Spatial Extent**: **Lat**:40.841944 **Lon**:-72.498611
**Temporal Extent**: 2019-02-20

### Methods & Sampling

Sediment cores were collected by hand from a bioturbated tidal flat at low tide using clear core tubes. These were sealed at the bottom with rubber stoppers. Overlying water was kept on top and the cores were immediately transported into the lab in buckets. In the lab, pore-water samples were collected using Rhizon samples (Seeberg-Elverfeldt et al., 2015) through pre-drilled holes in the core tubes. Samples were collected in sterile plastic syringes and immediately distributed into different vials for sample preservation. All samples were stored in the fridge. Samples for trace metal analysis were preserved by addition of nitric acid (2% v/v).

Alkalinity was determined spectrophotometrically following the method by Sarazin et al. (1999) using a Spectrostar Nano or Polarstar Omega plate reader (BMG Labtech). Cl- was determined by potentiometric titration with Ag+ using a Radiometer CMT-10 titrator. Iron, manganese and aluminum were determined by Inductively Coupled Plasma Mass Spectrometry (ICP-MS; Thermo-Finnegan Element 2) following a 1:100 dilution of the samples with In-115, Y-89 and Fe-57 as internal standards. CRM-TMDW-A and in-house standards were used as external reference standards for the ICP-MS analysis.

**Data Processing Description**

**BCO-DMO processing description:**
- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date
- Added columns for "Site", "Latitude", "Longitude", "Date_Time_Local", Date_Time_UTC"

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## Data Files

| File |
|---|
| **fej_site_1.csv** (Comma Separated Values (.csv), 2.62 KB) MD5:c34633dc208ff5d5b7ee05699b8e60e9 |
| Primary data file for dataset ID 871820 |

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## Related Publications

Sarazin, G., Michard, G., & Prevot, F. (1999). A rapid and accurate spectroscopic method for alkalinity measurements in sea water samples. Water Research, 33(1), 290–294. doi:10.1016/s0043-1354(98)00168-7 https://doi.org/10.1016/S0043-1354(98)00168-7
*Methods*

Seeberg-Elverfeldt, J., Schlüter, M., Feseker, T., & Kölling, M. (2005). Rhizon sampling of porewaters near the sediment-water interface of aquatic systems. Limnology and Oceanography: Methods, 3(8), 361–371. doi:10.4319/lom.2005.3.361
*Methods*

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| Core_ID | Identifier of core taken | unitless |
| Site | Site identification | unitless |
| Latitude | Latitude, North | decimal degrees |
| Longitude | Longitude, East (West is negative) | decimal degrees |
| ISO_DateTime_Local | Sampling date and time (local) in format: YYYY-MM-DDThh:mm:ss | unitless |
| ISO_DateTime_UTC | Sampling date and time UTC in format: YYYY-MM-DDThh:mm:ssZ | unitless |
| Depth | Depth of sample interval in sediment core | centimeters (cm) |
| Cl | Chloride concentration | millimolar (mM) |
| Alk | Alkalinity | millimolar (mM) |
| Al | Aluminum concentration | micromolar (uM) |
| Mn | Manganese concentration | micromolar (uM) |
| Fe | Iron concentration | micromolar (uM) |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | Thermo-Finnegan Element 2 ICP-MS |
| **Generic Instrument Name** | Inductively Coupled Plasma Mass Spectrometer |
| **Generic Instrument Description** | An ICP Mass Spec is an instrument that passes nebulized samples into an inductively-coupled gas plasma (8-10000 K) where they are atomized and ionized. Ions of specific mass-to-charge ratios are quantified in a quadrupole mass spectrometer. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | BMG Polarstar Omega Microplate Reader |
| **Generic Instrument Name** | microplate |
| **Generic Instrument Description** | A flat dish with multiple individual wells that are arrayed in a standardized number, size, and arrangement. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | BMG Spectrostar Nano Microplate Reader |
| **Generic Instrument Name** | microplate |
| **Generic Instrument Description** | A flat dish with multiple individual wells that are arrayed in a standardized number, size, and arrangement. |

| | |
|---|---|
| **Dataset-specific Instrument Name** | Radiometer CMT-10 titrator |
| **Generic Instrument Name** | Titrator |
| **Generic Instrument Description** | Titrators are instruments that incrementally add quantified aliquots of a reagent to a sample until the end-point of a chemical reaction is reached. |

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## Project Information

**Iron cycling in bioturbated sediments - Fluxes, diagenetic redistribution, and isotopic signatures (Fe flux)**

**Coverage**: Long Island

NSF Award Abstract:

Dissolved iron (Fe) is an important nutrient for photosynthetic microalgae in the surface ocean and low concentrations in seawater can limit their growth. Because microalgae are the basis of marine food webs, scientists strive to improve our understanding of Fe availability in the oceans and the importance of different iron sources. Iron enters the ocean via rivers, groundwater, and wind-blown dust; however, release from the seafloor can be an additional source but this contribution is not well known. In this project, scientists from the State University of New York, Stony Brook (SUNY-SB) will investigate how chemical reactions in ocean sediments and bottom-dwelling organisms, such as burrowing clams and worms, affect the transport of Fe from the seafloor into the overlying water. Animals pump water through their burrows to obtain oxygen and in the process, transport dissolved Fe out of the sediment and into the overlying water. We will analyze the Fe concentration in both muddy and sandy sediment and in the water that enters and exits animal burrows, as well as determine the isotope composition of the Fe. Different sources of Fe can have different isotope compositions which may help trace the origin of this element found in different parts of the ocean. An improved understanding of Fe cycling at the ocean seafloor will help us to better predict how changing environmental conditions, for example due to human influence, will affect important processes in the ocean, such as primary production by microalgae.

The project will allow two PhD students and several undergraduate students to take part in laboratory experimental work, sediment sampling during research cruises and train in chemical analysis of sediment and water. Undergraduate student involvement will be facilitated through the Undergraduate Research and Creative Activities (URECA) program at SUNY-SB. Also, in collaboration with the Science and Technology Entry Program (STEP), a summer module "Buried Alive" will be offered to historically underrepresented and economically disadvantaged high school students. It combines field sampling, laboratory experimentation, data analyses, and scientific communication. Students will set-up their own "seafloor ant farms" and record the activities of animals living in the sediment using photographic equipment. Students will be trained in using image analysis software to produce time-lapse movies which they will present on the final day of the program. Public outreach

will be fostered through annual hands-on demonstrations of "seafloor slices" at the New York Marine Science Festival "Submerge" and at SUNY-SB earth celebration day "Earthstock" with real-time visualizations of pressure dynamics in the sediment induced by living organisms or by injecting water with syringes. The project supports the advancement and development of two Early Career Scientists with no prior NSF research support.

Dissolved Fe is an important nutrient for photosynthetic microalgae in the surface ocean and can limit their productivity. Iron is supplied to the ocean from multiple sources, including rivers, groundwater, hydrothermal vents, and by release from the seabed. This project will fill key gaps in our knowledge of seabed sources, and emphasizes the interconnected effects of bioturbation by infaunal organisms, bottom water oxygen (O2) concentrations, sedimentary organic matter content, and sediment permeability on iron cycling and isotopic redistribution in continental margin sediments. Specifically, we will gain a mechanistic understanding of the impact of variable O2 concentrations within infaunal burrows (as a function of irrigation activity and sedimentary setting) and in the overlying water (in response to large scale environmental change) on dissolved Fe fluxes and re-precipitation, the isotopic fractionation related to these processes, and the consequences for isotopic signatures of dissolved Fe in the water column and particulate Fe preserved in sediments. This project will significantly advance understanding of sedimentary Fe cycling and the use of Fe isotopes to constrain the magnitude and dynamics of the benthic Fe source to the ocean. Improved understanding of sedimentary Fe cycle will enhance prediction of future responses of biogeochemical processes such as primary production to rapidly changing environmental conditions and to optimally infer past conditions from authigenic Fe minerals preserved in the sedimentary record. This knowledge is particularly valuable with regard to continental shelf environments where anthropogenic effects are altering deposition patterns of organic carbon and expanding oxygen minimum zones.

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-1757045 |


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