

Electrochemical data from sediments collected on R/V Savannah cruise SAV-16-16 at the Cape Lookout Continental Shelf and Slope during May 2016

Website: <https://www.bco-dmo.org/dataset/805916>

Data Type: Cruise Results

Version: 1

Version Date: 2020-03-16

Project

» [Source, Composition, and Stability of Soluble Iron Fluxing from Continental Margin Sediments](#) (Soluble Fe Fluxing)

| Contributors | Affiliation | Role |
|-------------------------------------|---|------------------------|
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Abstract

Electrochemical data from sediments collected on R/V Savannah cruise SAV-16-16 at the Cape Lookout Continental Shelf and Slope during May 2016.

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Coverage

Spatial Extent: N:34.635 E:-75.799 S:33.869 W:-76.605

Temporal Extent: 2016-05-17 - 2016-05-26

Methods & Sampling

Sediments were collected and profiled immediately with voltammetric Hg/Au microelectrodes deployed on a computer-controlled micromanipulator (Beckler et al., 2016).

Sediment cores were obtained by a MC-800 multi-corer and profiled within 30 minutes with voltammetric Hg/Au microelectrodes deployed on a computer-controlled micromanipulator. O₂(aq), Mn(II), Fe(II), Org-Fe(III), FeS(aq), and SH₂S were measured by voltammetry using non-invasive mercury/gold (Hg/Au) microelectrodes (Luther et al., 2008) in intact sediment cores. Org-Fe(III) and FeS(aq) cannot be quantified by these methods and are reported in current intensities.

Problem report: Some of the data are missing because of electrostatic interferences that typically occur at time on ships.

Data Processing Description

Electrochemical data were processed using Voltint (Bristow and Taillefert, 2008), a Matlab™-based software developed for these applications.

BCO-DMO Processing:

- added date column using original year, month, and day columns.

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Data Files

| File |
|--|
| electrochem_SAV16-16.csv (Comma Separated Values (.csv), 97.29 KB) MD5:1eb9d08e6d8a741bcdad7566e297fc78 Primary data file for dataset ID 805916 |

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Related Publications

Beckler, J. S., Kiriazis, N., Rabouille, C., Stewart, F. J., & Taillefert, M. (2016). Importance of microbial iron reduction in deep sediments of river-dominated continental-margins. *Marine Chemistry*, 178, 22–34.

doi:[10.1016/j.marchem.2015.12.003](https://doi.org/10.1016/j.marchem.2015.12.003)

Methods

Bristow, G., & Taillefert, M. (2008). VOLTINT: A Matlab®-based program for semi-automated processing of geochemical data acquired by voltammetry. *Computers & Geosciences*, 34(2), 153–162.

doi:[10.1016/j.cageo.2007.01.005](https://doi.org/10.1016/j.cageo.2007.01.005)

Methods

Eitel, E. M., Owings, S. M., Belli, K. M., Beckler, J. S., Williams, A., Fields, B. P., ... Taillefert, M. (2020). Variations in sediment production of dissolved iron across a continental margin not dominated by major upwelling or riverine inputs. *Marine Chemistry*, 220, 103750. doi:[10.1016/j.marchem.2020.103750](https://doi.org/10.1016/j.marchem.2020.103750)

Results

Luther, G. W., Glazer, B. T., Ma, S., Trouwborst, R. E., Moore, T. S., Metzger, E., ... Brendel, P. J. (2008). Use of voltammetric solid-state (micro)electrodes for studying biogeochemical processes: Laboratory measurements to real time measurements with an in situ electrochemical analyzer (ISEA). *Marine Chemistry*, 108(3-4), 221–235. doi:[10.1016/j.marchem.2007.03.002](https://doi.org/10.1016/j.marchem.2007.03.002)

Methods

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Parameters

| Parameter | Description | Units |
|-----------------|-------------------------------------|-----------------------|
| Year | Year | unitless |
| Month | Month | unitless |
| Day | Day | unitless |
| Collection_Type | Instrument used for collection | unitless |
| Station | Station number | unitless |
| Lon | Longitude | decimal degrees East |
| Lat | Latitude | decimal degrees North |
| Sediment_depth | Sediment depth | millimeters (mm) |
| O2 | Dissolved oxygen | uM (micromolar) |
| sdO2 | Standard deviation of O2 | uM (micromolar) |
| Mn_II | Dissolved manganese(II) | uM (micromolar) |
| sdMn_II | Standard deviation of Mn_II | uM (micromolar) |
| Fe_II | Dissolved iron(II) | uM (micromolar) |
| sdFe_II | Standard deviation of Fe_II | uM (micromolar) |
| Org_Fe_III | Dissolved organic-Fe(III) complexes | nA |
| sdOrgFe_III | Standard deviation of Org_Fe_III | nA |
| FeS_aq | Dissolved molecular clusters of FeS | nA |
| sdFeS_aq | Standard deviation of FeS_aq | nA |
| SH2S | Dissolved inorganic sulfur | uM (micromolar) |
| sdSH2S | Standard deviation of SH2S | uM (micromolar) |
| date | Date; format: yyyy-mm-dd | unitless |

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Instruments

| | |
|---|---|
| Dataset-specific Instrument Name | MC-800 multi-corer |
| Generic Instrument Name | Multi Corer |
| Dataset-specific Description | Sediment cores were obtained by a MC-800 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 | Electrochemical analyzer |
| Generic Instrument Name | Voltammetry Analyzers |
| Dataset-specific Description | Electrochemical analyzer: DLK-100 and DLK-70 with EX-MAN-1 micromanipulator (Analytical Instrument Systems, Inc.). |
| Generic Instrument Description | Instruments that obtain information about an analyte by applying a potential and measuring the current produced in the analyte. |

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Deployments

SAV-16-16

| | |
|--------------------|---|
| Website | https://www.bco-dmo.org/deployment/805919 |
| Platform | R/V Savannah |
| Start Date | 2016-05-15 |
| End Date | 2016-05-30 |
| Description | More information from the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/SAV-16-16 |

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Project Information

Source, Composition, and Stability of Soluble Iron Fluxing from Continental Margin Sediments (Soluble Fe Fluxing)

Coverage: Northern South Atlantic Bight (Cape Lookout, NC) and Northern Gulf of Mexico

NSF Award Abstract:

Iron is a limiting nutrient in the world's oceans and plays a key role in regulating the growth of phytoplankton. The main sources of iron to the open ocean are the atmosphere, through wind-blown terrestrial dust, and the seafloor, through input from continental shelf sediments. While atmospheric inputs have been well-studied, the oceanic input of iron from sediments has only sparsely been measured and, as a result, the relative importance of the sediment-derived iron to the iron pool and, ultimately, primary productivity in the oceans is poorly understood. In this study, researchers will examine the chemical properties of sediment-derived iron in the oceans to assess its contribution to the iron used by phytoplankton. Results from this study will further our understanding of iron inputs to the ocean and their importance to ocean primary productivity. The project will contribute to the training of graduate students, as well as provide educational opportunities such as a day at sea for undergraduate students in engineering and physical science.

The atmosphere and continental margin sediments are the main source of the limiting nutrient iron (Fe) to the open ocean. Yet, the chemical form of iron from sediments has not been well examined and only quantified as reduced iron or the dissolved iron passing through 0.45 μm filters. The kinetics of iron oxygenation suggests it should precipitate rapidly in the overlying waters, challenging the view that sediments are important sources of iron for primary production. To establish whether the flux of iron from sediments has important implications for primary productivity, possibly rivaling atmospheric inputs, it is necessary to demonstrate that ferric iron originating in sediments is under the form of stable iron species with potential for a high residence time in the water column. The overall objective of this project is to test the hypotheses that iron fluxing across the sediment-water interface in continental margin sediments is dissolved under the form of organic-Fe(III) complexes and that the magnitude of the iron flux is influenced by the redox conditions in the overlying

waters, the composition of the complexes, and the biogeochemical processes in the underlying sediments. To test these hypotheses, the flux and speciation of dissolved Fe(III) will be quantified in the sediments of the Carolina depocenter and the Gulf of Mexico, and the biogeochemical processes regulating the production and the flux of iron as a function of the redox regime of the environment will be determined using in situ measurements and state-of-the-art voltammetric and chromatographic techniques.

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Funding

| Funding Source | Award |
|--|-----------------------------|
| NSF Division of Ocean Sciences (NSF OCE) | OCE-1438648 |

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