

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 \(Soluble Fe Fluxing\)](#)

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Abstract

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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

Acquisition Description

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.

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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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) [details]

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) [details]

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) [details]

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) [details]

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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 Oceanologica Acta, 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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