

# Sediment core porewater and particulate measurements from three sites on the Louisiana Shelf sampled during R/V Pelican cruises from December 2021 through August 2022

**Website:** <https://www.bco-dmo.org/dataset/915912>

**Data Type:** Cruise Results

**Version:** 1

**Version Date:** 2023-12-11

## Project

» [Collaborative Research: RAPID: Extreme disturbances/perturbations to coastal deposition systems](#) (Extreme Si)

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## Abstract

In the northern Gulf of Mexico seasonal water column stratification may impact how sedimentary biogenic silica (bSi) is processed and preserved by limiting oxygen injections into the benthos, seasonally driving bSi burial efficiency. Hurricane Ida moved through the Mississippi Delta and adjacent Louisiana shelf at the end of August 2021. Thirteen days prior to Hurricane Ida's landfall in Port Fourchon, LA we collected sediment cores at 3 sites in the topset delta sediment between the Southwest Pass (major Mississippi River distributary) and Cocodrie, LA aboard the R/V Pelican; all sites experienced Category 4 hurricane conditions from Ida with maximum sustained winds of 130 knots (67 m/s). Ida, a much stronger storm than either Hurricanes Harvey or Nate in 2017, likely introduced oxygen into the sediment of the proximal coastal zone, perhaps enough to turn most of the top ~1 m of the sediment column oxic. Whether or not these types of O<sub>2</sub>-injection events alter the modality of bSi sequestration (e.g., enhancement or reduction of bSi remineralization) in the sediments is unknown; understanding this effect is relevant to accurately determine burial (or recycling) efficiencies and the degree of coupling among bSi and major/trace elements (e.g. reverse weathering) in these coastal systems. Using a multi-proxy approach, this project analyzed how this major storm event altered this modality of bSi burial in the following 12 months. These data include operational particulate silica pools, particulate organic carbon/nitrogen and their stable isotopes, porewater constituents and general characteristics (e.g. porosity).

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## Coverage

**Spatial Extent:** N:29.218 E:-89.012 S:25.501 W:-90.501

**Temporal Extent:** 2021-12-15 - 2022-08-27

## Methods & Sampling

### I. Field sampling

Sample collection took place during R/V Pelican cruises on the Louisiana Shelf in the northern part of the Gulf of Mexico. At each site, an 8-spot Ocean Instruments Multi-corer collected sediment that was sectioned in 2 cm intervals and placed into 50mL metal clean, acid washed tubes, pre-weighed and labeled microcentrifuge tubes for porosity, and freezer-safe Ziploc bags. Tubes were centrifuged at 3500 rpm for 10 minutes to extract and filter supernatant. The filtered supernatant was placed into a metal clean/acid washed tube and frozen for later metal and dissolved silica analysis. The 50mL tube of sediment was frozen at -20°C for further analysis.

### II. Porewater Dissolved Constituents

Where there was sufficient supernatant (porewater) from the centrifuged sediment sample, it was divided for three different analyses: dissolved silica analysis, nutrient analysis, and metal concentrations.

1. **DSi analysis:** 50uL of porewater was analyzed for dissolved Si(OH)<sub>4</sub> concentration using a spectrophotometric molybdate-blue method (Brzezinski & Nelson, 1986).

2. **Skalar Analysis (N+N, NH<sub>4</sub>, PO<sub>4</sub>):** Porewater was diluted with Milli-Q (18.2 MΩ \* cm) water and run through a Skalar Analyzer for Nitrate and Nitrite, Phosphorus, and Ammonia. For detection limits, please refer to the descriptions in the Parameters section below.

3. **ICPMS (Metal Concentrations):** Porewater was reconstituted in dilute HNO<sub>3</sub> and diluted to minimize salt interferences before analysis on a Thermo Scientific Element XR High Resolution-ICP-MS housed at the University of Southern Mississippi at the Stennis Space Center. The following elements are reported in the data from the ICPMS analysis: magnesium (Mg), sulfur (S), calcium (Ca), manganese (Mn), iron (Fe), potassium (K), cesium (Cs), uranium (U), lithium (Li), vanadium (V), cobalt (Co), nickel (Ni), copper (Cu), strontium (Sr), molybdenum (Mo), barium (Ba), phosphorus (P), and aluminum (Al), along with phosphorus (P) and silica (Si). For each element's detection limit, please see the description in the Parameters section below.

### Sediments

Sediments were analyzed for physical properties, chemical properties, phases of silica, and isotopic composition. Each section below describes the specific methods in greater detail.

### III. Sediment properties

#### Porosity

For porosity measurements, microcentrifuge tubes were placed in a drying oven at 60°C until the sediment was dry. Once dried, tubes were weighed. Porosity was calculated as in Comeaux et al. (2012).

#### Loss on ignition (LOI)

For loss on ignition (LOI) analysis, dried sediment was ground into a fine consistency using a mortar and pestle. Then 1g of the ground sediment was weighed into pre-muffled and pre-weighed porcelain crucibles. To remove any carbon from the presence of calcium carbonate, samples were fumed by adding 1mL of milli-Q to each crucible and placing samples into a desiccator with 10 mL of 12M HCl for 6 hours (Harris et al. 2001, Ramnarine et al. 2011, Walthert et al. 2010). After 6 hours, samples were placed in a vacuum oven for roughly 16 hours, until dry (Ramnarine et al. 2011, Walthert et al. 2010). Once dry, samples were kept in the oven and weighed one at a time to keep moisture out of samples. If sample was still acidic (yellow in color), 1 mL of milli-Q was added and the sample was dried again. Sediment was ground again into a fine powder.

After the above preparation, fumed and ground sediment was weighed (100 mg) in triplicate into pre-weighed and muffled liquid scintillation (LSC) vials. Samples were combusted at 550°C for 6 hours (Kemp et al. 2021). After combustion, weights were recorded, and loss of organic matter was calculated (Kemp et al. 2021).

### IV. Sediment Silica Pools

#### Sequential Extractions

Frozen samples were thawed, homogenized, and 50 mg were weighed in triplicates (per depth) into pre-labeled 50 mL centrifuge tubes (Krause et al., 2017; Pickering et al., 2020). Samples with procedural blanks (in triplicate) then went through the sequential extraction process. The sequential extraction methodology separates silica into operationally defined pools based on kinetics, reaction conditions and reaction sequence (DeMaster, 1981; Michalopoulos and Aller, 2004; Rahman et al., 2016; Pickering et al., 2020).

#### Operational Definitions

Based on prior studies, we use the following nomenclature:

1. **Si-HCl**: Mild acid-leachable pre-treatment; Highly reactive silica associated with authigenic clays and metal oxide coatings (Michalopoulos and Aller, 2004).
2. **Si-Alk**: Mild alkaline-leachable digestion completed after acid pretreatment; Frees reactive silica associated with the biogenic silica pool (Michalopoulos and Aller, 2004).
3. **Si-NaOH (Alk)**: Harsh NaOH digestion done after Si-HCl and Si-Alk (Rahman et al., 2016; Rahman et al., 2017); Associated with the reactive lithogenic Si (LSi) pool and the comparatively refractory "dark bSiO<sub>2</sub>" (e.g. sponge spicules and Rhizaria).
4. **TbSi**: Following the traditional definition of biogenic silica (DeMaster, 1981), with no acid pre-treatment.
5. **Si-NaOH (TbSi)**: Harsh NaOH digestion done after T-bSi.

## **V. Sediment Organic matter**

### **Preparation**

Same preparation as that listed above for Loss on Ignition

### **Particulate Organic Carbon and Nitrogen content and isotopes ( $\delta^{13}C$ and $\delta^{15}N$ )**

After fumigation (explained above), ~60 to 70 mg of sediment were packed in 5x9mm silver capsules, which were then packed in tin 5x9mm capsules in triplicate (UC Davis protocol recommendation). Samples were placed in a 96 well plate and kept in a desiccator until shipped to UC Davis for isotopic ( $\delta^{13}C$  and  $\delta^{15}N$ ) analysis (Krause et al. 2017).

Results from UC Davis had an absolute accuracy for calibrated reference materials of  $\pm 0.04$  ‰ ( $\pm 0.05$  ‰ SD) for  $\delta^{13}C$  and  $\pm 0.05$  ‰ ( $\pm 0.05$  ‰ SD) for  $\delta^{15}N$ . Core depth 24-26cm was the only sample below detection (9.7ug) for  $\delta^{15}N$ , which is represented as 0 on the data sheet.

## **Data Processing Description**

Raw data were input into Microsoft Excel (Version 2302) to calculate final reported values.

- Porosity was calculated as in Comeaux et al. (2012).
- Loss of organic matter was calculated as in Kemp et al. (2021).

## **BCO-DMO Processing Description**

- Imported data from source file "Extreme\_Si\_MASTER\_BCODMO.xlsx" into the BCO-DMO data system.
- Added R/V Pelican official cruise IDs corresponding to the submitted cruise name.
- Combined separate date and time columns into a single datetime column
- Kept local datetime but added a column for ISO8601 formatted UTC datetime
- Removed percent (%) signs from the column values
- Modified parameter (column) names to conform with BCO-DMO naming conventions. The only allowed characters are A-Z, a-z, 0-9, and underscores. Replaced spaces with underscores.

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## **Related Publications**

Brzezinski, M. A., & Nelson, D. M. (1986). A solvent extraction method for the colorimetric determination of nanomolar concentrations of silicic acid in seawater. *Marine Chemistry*, 19(2), 139–151. doi:[10.1016/0304-4203\(86\)90045-9](https://doi.org/10.1016/0304-4203(86)90045-9)  
*Methods*

Comeaux, R. S., Allison, M. A., & Bianchi, T. S. (2012). Mangrove expansion in the Gulf of Mexico with climate change: Implications for wetland health and resistance to rising sea levels. *Estuarine, Coastal and Shelf Science*, 96, 81–95. <https://doi.org/10.1016/j.ecss.2011.10.003>

*Methods*

DeMaster, D. J. (1981). The supply and accumulation of silica in the marine environment. *Geochimica et Cosmochimica Acta*, 45(10), 1715–1732. doi:[10.1016/0016-7037\(81\)90006-5](https://doi.org/10.1016/0016-7037(81)90006-5)

*Methods*

Harris, D., Horwáth, W. R., & van Kessel, C. (2001). Acid fumigation of soils to remove carbonates prior to total organic carbon or CARBON-13 isotopic analysis. *Soil Science Society of America Journal*, 65(6), 1853–1856. doi:[10.2136/sssaj2001.1853](https://doi.org/10.2136/sssaj2001.1853)

*Methods*

Kemp, E., Roseburrough, R., Elliott, E., & Krause, J. (2021). Spatial Variability of Sediment Amorphous Silica and its Reactivity in a Northern Gulf of Mexico Estuary and Coastal Zone. *Gulf and Caribbean Research*, 32, SC6–SC11. <https://doi.org/10.18785/gcr.3201.14>

*Methods*

Krause, J. W., Darrow, E. S., Pickering, R. A., Carmichael, R. H., Larson, A. M., & Basaldua, J. L. (2017). Reactive silica fractions in coastal lagoon sediments from the northern Gulf of Mexico. *Continental Shelf Research*, 151, 8–14. doi:[10.1016/j.csr.2017.09.014](https://doi.org/10.1016/j.csr.2017.09.014)

*Methods*

Michalopoulos, P., & Aller, R. C. (2004). Early diagenesis of biogenic silica in the Amazon delta: alteration, authigenic clay formation, and storage. *Geochimica et Cosmochimica Acta*, 68(5), 1061–1085.

doi:[10.1016/j.gca.2003.07.018](https://doi.org/10.1016/j.gca.2003.07.018)

*Methods*

Pickering, R. A., Cassarino, L., Hendry, K. R., Wang, X. L., Maiti, K., & Krause, J. W. (2020). Using Stable Isotopes to Disentangle Marine Sedimentary Signals in Reactive Silicon Pools. *Geophysical Research Letters*, 47(15). doi:[10.1029/2020gl087877](https://doi.org/10.1029/2020gl087877)

*Methods*

Rahman, S., Aller, R. C., & Cochran, J. K. (2016). Cosmogenic  $^{32}\text{Si}$  as a tracer of biogenic silica burial and diagenesis: Major deltaic sinks in the silica cycle. *Geophysical Research Letters*, 43(13), 7124–7132.

doi:10.1002/2016gl069929 <https://doi.org/10.1002/2016GL069929>

*Methods*

Rahman, S., Aller, R. C., & Cochran, J. K. (2017). The Missing Silica Sink: Revisiting the Marine Sedimentary Si Cycle Using Cosmogenic  $^{32}\text{Si}$ . *Global Biogeochemical Cycles*, 31(10), 1559–1578. doi:10.1002/2017gb005746

<https://doi.org/10.1002/2017GB005746>

*Methods*

Ramnarine, R., Voroney, R. P., Wagner-Riddle, C., & Dunfield, K. E. (2011). Carbonate removal by acid fumigation for measuring the  $\delta^{13}\text{C}$  of soil organic carbon. *Canadian Journal of Soil Science*, 91(2), 247–250.

<https://doi.org/10.4141/cjss10066>

*Methods*

Walther, L., Graf, U., Kammer, A., Luster, J., Pezzotta, D., Zimmermann, S., & Hagedorn, F. (2010). Determination of organic and inorganic carbon,  $\delta^{13}\text{C}$ , and nitrogen in soils containing carbonates after acid fumigation with HCl. *Journal of Plant Nutrition and Soil Science*, 173(2), 207–216. Portico.

<https://doi.org/10.1002/jpln.200900158>

*Methods*

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## Parameters

| Parameter      | Description                                 | Units    |
|----------------|---|----------|
| Cruise         | Cruise name                                 | unitless |
| Cruise_ID      | Cruise ID                                   | unitless |
| DateTime_Local | Local datetime of event                     | unitless |
| Event_number   | Event number described by GMT date and time | unitless |

|                                 |   |                               |
|---------------------------------|---|-------------------------------|
| Activity                        | Sediment collection activity for event  | unitless                      |
| Latitude                        | Latitude for event  | decimal degrees               |
| Longitude                       | Longitude for event   | decimal degrees               |
| Station_Number                  | Station number of event   | unitless                      |
| Bottom_Depth                    | Station bottom depth  | meters (m)                    |
| Core_Section_Depth              | Core depth shallow and deep range for each sample collected   | centimeter (cm)               |
| Core_Section_Mid_Depth          | Core depth median for each sample collected   | centimeter (cm)               |
| PW_orthosilicic_acid_avg_spec   | Average particulate dissolved silica in porewater using spectrophotometric method                             | micromoles per liter (umol/L) |
| PW_orthosilicic_acid_stdev_spec | Standard deviation of particulate dissolved silica in porewater using spectrophotometric method               | micromoles per liter (umol/L) |
| PW_Phosphate_AA                 | Porewater nutrients: Phosphate measured using an autoanalyzer. Detection limit = 0.062 umol/L.                | micromoles per liter (umol/L) |
| PW_Nitrate_AA                   | Porewater nutrients: Nitrate measured using an autoanalyzer. Below detection (0.857 umol/L) represented as 0. | micromoles per liter (umol/L) |
| PW_Nitrite_AA                   | Porewater nutrients: Nitrite measured using an autoanalyzer. Below detection (0.041 umol/L) represented as 0. | micromoles per liter (umol/L) |
| PW_Ammonium_AA                  | Porewater nutrients: Ammonium measured using an autoanalyzer. Below detection = 1.704 umol/L.                 | micromoles per liter (umol/L) |
| PW_Mg_ICPMS                     | ICPMS derived Porewater concentration: Magnesium. Estimated detection limit = 625 ppb.                        | parts per billion (ppb)       |
| PW_Si_ICPMS                     | ICPMS derived Porewater concentration: Silicon. Estimated detection limit = 2018 ppb.                         | parts per billion (ppb)       |
| PW_S_ICPMS                      | ICPMS derived Porewater concentration: Sulfur. Estimated detection limit = 580 ppb.                           | parts per billion (ppb)       |
| PW_Ca_ICPMS                     | ICPMS derived Porewater concentration: Calcium. Estimated detection limit = 297 ppb.                          | parts per billion (ppb)       |
| PW_Mn_ICPMS                     | ICPMS derived Porewater concentration: Manganese. Estimated detection limit = 6 ppb.                          | parts per billion (ppb)       |
| PW_Fe_ICPMS                     | ICPMS derived Porewater concentration: Iron. Estimated detection limit = 20 ppb.                              | parts per billion (ppb)       |
| PW_K_ICPMS                      | ICPMS derived Porewater concentration: Potassium. Estimated detection limit = 207 ppb.                        | parts per billion (ppb)       |
| PW_Cs_ICPMS                     | ICPMS derived Porewater concentration: Cesium. Estimated detection limit = 0.01 ppb.                          | parts per billion (ppb)       |
| PW_U_ICPMS                      | ICPMS derived Porewater concentration: Uranium. Estimated detection limit =                                   | parts per billion (ppb)       |
| PW_Li_ICPMS                     | ICPMS derived Porewater concentration: Lithium. Estimated detection limit = 1.1 ppb.                          | parts per billion (ppb)       |

|                                  |   |                              |
|----------------------------------|---|------------------------------|
| PW_V_ICPMS                       | ICPMS derived Porewater concentration: Vanadium. Estimated detection limit = 0.2 ppb.       | parts per billion (ppb)      |
| PW_Co_ICPMS                      | ICPMS derived Porewater concentration: Cobalt. Estimated detection limit = 0.2 ppb.         | parts per billion (ppb)      |
| PW_Ni_ICPMS                      | ICPMS derived Porewater concentration: Nickel. Estimated detection limit = 0.3 ppb.         | parts per billion (ppb)      |
| PW_Cu_ICPMS                      | ICPMS derived Porewater concentration: Copper. Estimated detection limit = 0.2 ppb.         | parts per billion (ppb)      |
| PW_Sr_ICPMS                      | ICPMS derived Porewater concentration: Strontium. Estimated detection limit = 14 ppb.       | parts per billion (ppb)      |
| PW_Mo_ICPMS                      | ICPMS derived Porewater concentration: Molybdenum. Estimated detection limit = 0.1 ppb.     | parts per billion (ppb)      |
| PW_Ba_ICPMS                      | ICPMS derived Porewater concentration: Barium. Estimated detection limit = 1.9 ppb.         | parts per billion (ppb)      |
| PW_P_ICPMS                       | ICPMS derived Porewater concentration: Phosphorus. Estimated detection limit = 8.1 ppb.     | parts per billion (ppb)      |
| PW_Al_ICPMS                      | ICPMS derived Porewater concentration: Aluminum. Estimated detection limit = 27 ppb.        | parts per billion (ppb)      |
| Sediment_Porosity_pct            | Porosity of each core sediment sample   | dimensionless                |
| Partic_Si_HCl_avg                | Average particulate silica after HCl leach  | micromoles per gram (umol/g) |
| Partic_Si_HCl_stdev              | Standard deviation of dissolved particulate silica after HCl leach                          | micromoles per gram (umol/g) |
| Partic_Si_Alk_avg                | Particulate average of dissolved silica after Si-Alk leach                                  | micromoles per gram (umol/g) |
| Partic_Si_Alk_stdev              | Particulate standard deviation of dissolved silica after Si-Alk leach                       | micromoles per gram (umol/g) |
| Partic_tbSi_avg                  | Particulate average of dissolved silica after tbSi leach                                    | micromoles per gram (umol/g) |
| Partic_tbSi_stdev                | Particulate standard deviation of dissolved silica after tbSi leach                         | micromoles per gram (umol/g) |
| Partic_Si_NaOH_from_Si_Alk_avg   | Particulate average of dissolved silica after Si-NaOH from Si-Alk leach material            | micromoles per gram (umol/g) |
| Partic_Si_NaOH_from_Si_Alk_stdev | Particulate standard deviation of dissolved silica after Si-NaOH from Si-Alk leach material | micromoles per gram (umol/g) |
| Partic_Si_NaOH_from_tbSi_avg     | Particulate average of dissolved silica after Si-NaOH from tbSi leach material              | micromoles per gram (umol/g) |
| Partic_Si_NaOH_from_tbSi_stdev   | Particulate standard deviation of dissolved silica after Si-NaOH from tbSi leach material   | micromoles per gram (umol/g) |
| POC_d13C_avg                     | Average particulate organic carbon isotopic composition                                     | parts per mil (‰)            |

|                              |   |                   |
|------------------------------|---|-------------------|
| POC_d13C_stdev               | Standard deviation of particulate organic carbon isotopic composition   | parts per mil (‰) |
| POC_Total_C_pct_avg          | Average total of particulate organic carbon   | percent (%)       |
| POC_Total_C_pct_stdev        | Standard deviation of averaged total particulate organic carbon   | percent (%)       |
| POC_d15N_Air_avg             | Average particulate organic nitrogen isotopic composition. Below detection represented as 0 (Below detection = 9.7ug) | parts per mil (‰) |
| POC_d15N_Air_stdev           | Standard deviation of particulate organic nitrogen isotopic composition   | parts per mil (‰) |
| POC_Total_N_pct_avg          | Average total of particulate organic nitrogen   | percent (%)       |
| POC_Total_N_pct_stdev        | Standard deviation of averaged total particulate organic nitrogen   | percent (%)       |
| Particulate_Sediment_LOI_pct | Amount of organic matter lost per sediment sample   | percent (%)       |
| ISO_DateTime.UTC             | Datetime of event in UTC and ISO8601 format   | unitless          |

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## Instruments

|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | Box core   |
| <b>Generic Instrument Name</b>          | Box Corer  |
| <b>Dataset-specific Description</b>     | A box core was used on the December 2021 cruise to sample sediments  |
| <b>Generic Instrument Description</b>   | <p>General description of a box corer: A box corer is a marine geological tool that recovers undisturbed soft surface sediments. It is designed for minimum disturbance of the sediment surface by bow wave effects. Traditionally, it consists of a weighted stem fitted to a square sampling box. The corer is lowered vertically until it impacts with the seabed. At this point the instrument is triggered by a trip as the main coring stem passes through its frame. While pulling the corer out of the sediment a spade swings underneath the sample to prevent loss. When hauled back on board, the spade is under the box. (definition from the SeaVox Device Catalog)</p> <p>Box corers are one of the simplest and most commonly used types of sediment corers. The stainless steel sampling box can contain a surface sediment block as large as 50cm x 50cm x 75cm with negligible disturbance. Once the sediment is recovered onboard, the sediment box can be detached from the frame and taken to a laboratory for subsampling and further analysis. The core sample size is controlled by the speed at which the corer is lowered into the ocean bottom. When the bottom is firm, a higher speed is required to obtain a complete sample. A depth pinger or other depth indicator is generally used to determine when the box is completely filled with sediment. Once the core box is filled with sediment, the sample is secured by moving the spade-closing lever arm to lower the cutting edge of the spade into the sediment, until the spade completely covers the bottom of the sediment box. (definition from Woods Hole Oceanographic Institution).</p> |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | centrifuge  |
| <b>Generic Instrument Name</b>          | Centrifuge  |
| <b>Dataset-specific Description</b>     | Multicorer samples were placed into tubes and centrifuged at 3500 rpm for 10 minutes to extract and filter supernatant, which was later used for dissolved silica analysis.                     |
| <b>Generic Instrument Description</b>   | A machine with a rapidly rotating container that applies centrifugal force to its contents, typically to separate fluids of different densities (e.g., cream from milk) or liquids from solids. |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Skalar San++ Automated Wet Chemistry Analyzer   |
| <b>Generic Instrument Name</b>          | Continuous Flow Analyzer  |
| <b>Dataset-specific Description</b>     | The Skalar San++ Automated Wet Chemistry Analyzer, also known as continuous flow analyzer, was used to analyze porewater for nitrate, nitrite, phosphorus, and ammonia. |
| <b>Generic Instrument Description</b>   | A sample is injected into a flowing carrier solution passing rapidly through small-bore tubing.   |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | continuous flow interface at UC Davis   |
| <b>Generic Instrument Name</b>          | Continuous Flow Interface for Mass Spectrometers  |
| <b>Dataset-specific Description</b>     | Samples measured at University of California Davis were run on an elemental analyzer interfaced to a continuous flow isotope ratio mass spectrometer. See Stable Isotope Facility instrument descriptions here: <a href="https://stableisotopefacility.ucdavis.edu">https://stableisotopefacility.ucdavis.edu</a>               |
| <b>Generic Instrument Description</b>   | A Continuous Flow Interface connects solid and liquid sample preparation devices to instruments that measure isotopic composition. It allows the introduction of the sample and also reference and carrier gases. Examples: Finnigan MATConFlo II, ThermoScientific ConFlo IV, and Picarro Caddy. Note: This is NOT an analyzer |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Elemental analyzer at UC Davis  |
| <b>Generic Instrument Name</b>          | Elemental Analyzer  |
| <b>Dataset-specific Description</b>     | Samples measured at University of California Davis were run on an elemental analyzer interfaced to a continuous flow isotope ratio mass spectrometer. See Stable Isotope Facility instrument descriptions here: <a href="https://stableisotopefacility.ucdavis.edu">https://stableisotopefacility.ucdavis.edu</a> |
| <b>Generic Instrument Description</b>   | 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.   |



|   |  |
|---|--|
| <b>Dataset-specific Instrument Name</b> | Thermo Scientific Element XR high resolution inductively coupled plasma-mass spectrometer (HR-ICP-MS)  |
| <b>Generic Instrument Name</b>          | Inductively Coupled Plasma Mass Spectrometer   |
| <b>Dataset-specific Description</b>     | Porewater was reconstituted in dilute HNO <sub>3</sub> and diluted to minimize salt interferences before analysis on a Thermo Scientific Element XR High Resolution-ICP-MS housed at the University of Southern Mississippi at the Stennis Space Center. |
| <b>Generic Instrument Description</b>   | 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.         |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | CF-IRMS at UC Davis (continuous flow isotope ratio mass spectrometer)   |
| <b>Generic Instrument Name</b>          | Isotope-ratio Mass Spectrometer   |
| <b>Dataset-specific Description</b>     | Samples measured at University of California Davis were run on an elemental analyzer interfaced to a continuous flow isotope ratio mass spectrometer. See Stable Isotope Facility instrument descriptions here: <a href="https://stableisotopefacility.ucdavis.edu">https://stableisotopefacility.ucdavis.edu</a> |
| <b>Generic Instrument Description</b>   | 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).  |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Ocean Instruments Multicorer  |
| <b>Generic Instrument Name</b>          | Multi Corer   |
| <b>Dataset-specific Description</b>     | At each site, an 8-spot Ocean Instruments Multi-corer collected sediment that was sectioned in 2 centimeter intervals   |
| <b>Generic Instrument Description</b>   | 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. |

|   |   |
|---|---|
| <b>Dataset-specific Instrument Name</b> | Thermo Scientific Genesys 10S UV-Vis Spectrophotometer  |
| <b>Generic Instrument Name</b>          | Spectrophotometer   |
| <b>Dataset-specific Description</b>     | Porewater was analyzed for dissolved Si(OH) <sub>4</sub> concentration using a spectrophotometric molybdate-blue method and a Thermo Scientific Genesys 10S UV-Vis Spectrophotometer. |
| <b>Generic Instrument Description</b>   | An instrument used to measure the relative absorption of electromagnetic radiation of different wavelengths in the near infra-red, visible and ultraviolet wavebands by samples.      |

## Deployments

### PE23-05

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/916086">https://www.bco-dmo.org/deployment/916086</a> |
| <b>Platform</b>   | R/V Pelican   |
| <b>Start Date</b> | 2022-08-26  |
| <b>End Date</b>   | 2022-08-27  |

### PE22-27

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/916085">https://www.bco-dmo.org/deployment/916085</a> |
| <b>Platform</b>   | R/V Pelican   |
| <b>Start Date</b> | 2022-06-01  |
| <b>End Date</b>   | 2022-06-02  |

### PE22-20

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/916082">https://www.bco-dmo.org/deployment/916082</a> |
| <b>Platform</b>   | R/V Pelican   |
| <b>Start Date</b> | 2022-03-17  |
| <b>End Date</b>   | 2022-03-19  |

### PE22-15

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/916079">https://www.bco-dmo.org/deployment/916079</a> |
| <b>Platform</b>   | R/V Pelican   |
| <b>Start Date</b> | 2021-12-15  |
| <b>End Date</b>   | 2021-12-15  |

## Project Information

### **Collaborative Research: RAPID: Extreme disturbances/perturbations to coastal deposition systems (Extreme Si)**

**Coverage:** Northern Gulf of Mexico, specifically the Louisiana Shelf region dominated by the discharge of the Mississippi River on the western side of the delta (28.2 to 29.1°N, -89.4 to -91.7°E)

#### *NSF Award Abstract:*

This project will take advantage of the passage of Hurricane Ida across the northern Gulf of Mexico shelf in August, 2021 to study important aspects of the cycling of silica in coastal sediments. In coastal systems, water column primary productivity is dominated by diatoms, a group of phytoplankton which produce a shell of amorphous biogenic silica. This biogenic silica can either be buried in its original unaltered form or undergo chemical reactions that convert it to aluminosilicate minerals (e.g. marine clays). This latter process is important in global chemical budgets for many elements, including carbon. One of the factors that influences whether

silicon is buried as biogenic silica or converted to aluminosilicates may be the amount of oxygen in the sediments. Storms mix the ocean waters and can add oxygen to sediments in shallow water, potentially changing the silica balance. The investigators collected sediment samples in early August, 2021, two weeks before Hurricane Ida. Sampling through the year after the storm will allow them to test whether storms affect silica cycling. This project will support an early-career investigator and undergraduate student researchers.

Tropical and subtropical coastal deposition systems sequester 25-40% of the global silica sink, a disproportionately large impact relative to their area. In the northern Gulf of Mexico seasonal water column stratification may impact how sedimentary biogenic silica is processed and preserved by limiting oxygen injections into the benthos, seasonally driving biogenic silica burial efficiency. Hurricane Ida moved through the Mississippi Delta and adjacent Louisiana shelf at the end of August 2021. Thirteen days prior to Hurricane Ida's landfall in Port Fourchon, LA, in August 2021, the team collected sediment cores at 3 sites in the topset delta sediment between the Southwest Pass (major Mississippi River distributary) and Cocodrie, LA; all sites experienced Category 4 hurricane conditions from Ida with maximum sustained winds of 130 knots (67 m/s). Ida, a much stronger storm than either Hurricanes Harvey or Nate in 2017, likely introduced oxygen into the sediment of the proximal coastal zone, perhaps enough to turn most of the top meter or so of the sediment column oxic. The investigators hypothesize that the storm-induced change in redox and diagenetic conditions initially favored burial of biogenic silica rather than an authigenic aluminosilicate. Using a multi-proxy approach, this project will analyze how this major storm event altered biogenic silica burial over the course of ten months.

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                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-2205277</a> |
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-2205278</a> |

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