Core data collected in the Brazos River Plume, TX during 2017-2018

Website: https://www.bco-dmo.org/dataset/844548
Data Type: Cruise Results
Version: 1
Version Date: 2021-03-11

Project
» NSFOCE-BSF: Collaborative Research: The Role and Mechanisms of Nuclei-induced Calcium Carbonate Precipitation in the Coastal Carbon Cycle: A First In-depth Study (Nuclei CaCO3 Precip)
» RAPID: Collaborative Research: Tracking the Flood Pulse of a Record Discharge of the Brazos River in the Gulf of Mexico (Flood Pulse Brazos)

Contributors	Affiliation	Role
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Abstract
Core data collected in the Brazos River Plume, TX during three cruises conducted in 2017 and 2018. Cores were analyzed for grain size and mercury content.

Table of Contents

Coverage

Spatial Extent: **N**:28.8746 **E**:-95.25045 **S**:28.6391533 **W**:-95.520612
Temporal Extent: 2017-09-10 - 2018-07-12

Dataset Description

This dataset contains core data collected in the Brazos River Plume, TX during three cruises conducted in 2017 and 2018. Cores were analyzed for grain size and mercury content. The sample collection that took place on September 10, 2017 was supported by NSF award OCE-1635893. Award OCE-1829221 supported the rest of the data collection.

Methods & Sampling

Data were collected on three cruises on the Brazos River Plume in the Northern Gulf of Mexico. Cores were

collected from: 11 stations on September 10, 2017; 23 stations on October 29, 2017; and 26 stations on July 12, 2018. The September 2017 cruise was conducted on R/V Pelican (PE18-09); the two subsequent cruises were conducted on R/V Trident.

On each cruise, a series of box cores were collected in a grid pattern. From those box cores, a series of sub-cores were collected. Those included: x-radiograph trays, a 3-inch aluminum and/or polycarbonate core, and a 6-inch core. They were stored in a refrigerator at 2 °C and later split into 1 cm sections, x-rayed, and stored in bags until further analysis.

To collect water content, a basic oven was used at 60 °C. They were dried in pre-weighed aluminum tins, and then the water content was calculated after weighing the dry weight.

The grain size was processed in a Malvern Mastersizer 2000 that uses laser diffraction to analyze the grains.

The Mercury content was analyzed in a Milestone DMA-80 that combusts the sample to get a total mercury content.

Data Processing Description

Data Processing: Most of the data were processed in Excel, Matlab R2020a, or ArcPro 2.6.3. The data were stored in Excel sheets, then graphs and maps were created using Matlab or ArcPro.

BCO-DMO Processing:
- concatenated three separate data files into one dataset;
- added Date column;
- re-named fields to conform with BCO-DMO naming conventions (replaced spaces with underscores);
- rounded Hg_Content and Water_Content columns.

[table of contents | back to top]

Data Files

File
brazos_core.csv (Comma Separated Values (.csv), 84.06 KB) MD5:6321857065e773508e70c06adb1b4872 Primary data file for dataset ID 844548

[table of contents | back to top]

Parameters

Parameter	Description	Units
Date	Date of sample collection; format: YYYY-MM-DD	unitless
Core_Name	Site name	unitless
Lat	Latitude	decimal degrees North
Long	Longitude	decimal degrees East
Depth	Depth in the sediment	centimeters (cm)
Water_Content	Percent water in sample	unitless (percent)
Hg_Content	Total Mercury in sample	micrograms per kilogram (ug/kg)
Sand	Percent Sand size	unitless (percent)
Silt	Percent Silt size	unitless (percent)
Clay	Percent Clay size	unitless (percent)
STD	Standard deviation of grain size	micrometers (um)
D50	Median grain size	micrometers (um)

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	box cores
Generic Instrument Name	Box Corer
Generic Instrument Description	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) 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).

Dataset-specific Instrument Name	Malvern Mastersizer 2000
Generic Instrument Name	Laser Diffraction Particle Size Analyzer
Generic Instrument Description	Laser diffraction is particle sizing technique for materials ranging from hundreds of nanometers up to several millimeters in size. Laser diffraction measures particle size distributions by measuring the angular variation in intensity of light scattered as a laser beam passes through a dispersed particulate sample. One example is the Beckman Coulter LS200.

Dataset-specific Instrument Name	Milestone DMA-80
Generic Instrument Name	Milestone Direct Mercury Analyzer
Generic Instrument Description	The Milestone DMA-80 is a mercury analyzer used to determine mercury concentrations in liquid and solid samples. The DMA-80 is based on the principles of sample thermal decomposition, mercury amalgamation, and atomic absorption detection. See more: https://milestonesci.com/direct-mercury-analyzer/

[table of contents | back to top]

Deployments

Brazos_Harvey_Cruises

Website	https://www.bco-dmo.org/deployment/844637
Platform	R/V Trident
Start Date	2017-10-29
End Date	2018-07-12
Description	Research cruises were conducted on October 29, 2017 and on July 12, 2018 as part of the project "RAPID: Collaborative Research: Tracking the Flood Pulse of a Record Discharge of the Brazos River in the Gulf of Mexico".

PE18-09

Website	https://www.bco-dmo.org/deployment/821124
Platform	R/V Pelican
Start Date	2017-09-09
End Date	2017-09-15

[table of contents | back to top]

Project Information

NSFOCE-BSF: Collaborative Research: The Role and Mechanisms of Nuclei-induced Calcium Carbonate Precipitation in the Coastal Carbon Cycle: A First In-depth Study (Nuclei CaCO3 Precip)

Coverage: Northern Red Sea (Eilat, Israel), Mississippi / Sabine/ Brazos River plumes and Galveston Bay in the northern Gulf of Mexico

NSF Abstract:

The formation of calcium carbonate (CaCO3) in seawater is a fundamental pathway in the marine carbon cycle. Calcium carbonate formation may occur through biological production (calcification by organisms building shells or skeletal material) or through non-biological (abiotic, or chemical) processes. Although most surface seawater in both open and coastal waters is supersaturated in calcium carbonate, several factors inhibit the abiotic production of calcium carbonate. Therefore the current paradigm is that most calcium carbonate formation in seawater is biological. However, laboratory experiments have demonstrated that addition of solid-phase particles to supersaturated seawater promotes nuclei-induced CaCO3 precipitation (NICP) by providing "seeds" for precipitation. NICP has been demonstrated in the Little Bahama Banks during events of re-suspension of CaCO3-rich sediments. Until very recently, essentially no evidence has shown that NICP occurs in typical marine systems where suspended particles have relatively low CaCO3 content. A recent study by the Israeli partners in this project provides evidence that NICP may play a significant role in the carbon budget in the Red Sea, as a result of an influx of particulate material caused by flash floods and potentially airborne dusts. Such a finding suggests that NICP may be an important CaCO3 formation pathway that has been mostly ignored in the ocean carbon cycle. The goal of this project is to conduct the first comprehensive, in-depth study to evaluate the significance of NICP in the oceans. The project is an international collaboration between U.S. and Israeli scientists, jointly funded by NSF and the U.S.-Israel Binational Science Foundation. A postdoctoral researcher whose Ph.D. work forms the foundation for this study will be supported through this project. An Israeli masters-level student and one U.S. minority undergraduate intern will be advised and trained in this project.

The project will use an integrated approach to assess different mechanisms that may result in NICP, including riverine sediment input, land-derived particle influx via flash floods, bottom sediment resuspension, and atmospheric dust input. Field investigations will be done in a suite of coastal environments: the northern Red Sea, the Mississippi and Sabine River plumes and Galveston Bay in the northern Gulf of Mexico, each of which receive significant quantities of non-carbonate rich sediments. The investigators will also conduct controlled laboratory experiments to verify and extend field observations. If NICP is shown to be significant, this finding could promote a reexamination of important parts of the carbon cycle and the response of the ocean carbon system to ongoing perturbations.

RAPID: Collaborative Research: Tracking the Flood Pulse of a Record Discharge of the Brazos River in the Gulf of Mexico (Flood Pulse Brazos)

Coverage: Brazos River Plume, offshore Texas coast

NSF Award Abstract:
The transport and fate of sediment carried by rivers to the coastal ocean is of great ecological and societal importance. River input is the primary source of land-derived sediment to the marine environment. These particles have significant impacts on the health of coastal ecosystems and the geology and bathymetry of coastal oceans and shipping channels. They directly and indirectly affect fisheries and navigation. This research focuses on the movement of sediments carried into the Gulf of Mexico, via the Brazos River, during the unprecedented rainfall and flooding event that occurred during Hurricane Harvey. The Brazos River ranks as the second largest contributor of nutrients and organic matter to the Gulf of Mexico, after the Mississippi River. Unlike the Mississippi, however, most sediment delivered to the Gulf of Mexico from the Brazos is carried during flooding events like that which accompanied Hurricane Harvey. Little is known about the fate of this sediment. It is not clear if it is retained in the coastal zone, where the nutrients and chemicals it carries affect the coastal environment, or is carried offshore and deposited in the deep waters of the Gulf of Mexico. Through intensive sampling of sediments just offshore the mouth of the Brazos River and further offshore in the Gulf of Mexico in what is known as the Texas Mud Blanket, this project will determine the principal repository of sediments delivered to the western Gulf of Mexico by a major Texas river.

The overall goal of this research is to investigate the hypothesis that flood-borne sediment from the Brazos River is initially deposited in the coastal zone and subsequently mobilized and carried offshore with a large

fraction of it being deposited in the Texas Mud Blanket. The work builds on the analysis of sea-bottom sediment samples collected in 2017 during flooding associated with Hurricane Harvey. This new program will include two sampling cruises to augment already collected data. The first cruise will entail acquisition of ~25 cores that will indicate sediment deposition and transport in the near-shore region near the Brazos River mouth. Preliminary work indicates that much of the initial deposition of Brazos River sediment occurred east of the original sampling region. The second cruise in will collect additional Brazos region cores and expand sampling into the Texas Mud Blanket, with the goal of documenting changes in Brazos sediment deposition from the Hurricane Harvey flooding. During both cruises, complementary hydrography data will be collected. This includes water column velocities and suspended sediment loads. Provenance of individual layers, within the sediment samples and box cores, will be determined by digital photos and x-radiographs of intact core slabs that show sediment fabric and structures. To differentiate Gulf of Mexico from Brazos River sediments, sub-samples of collected cores will be geochemically analyzed and profiled for short-lived-radioisotope geochronology, water content, grainsize distribution, and mercury and carbonate content. These indicators will help identify the origin of the sediments deposited in the system.

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.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1635893
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829221

[table of contents | back to top]