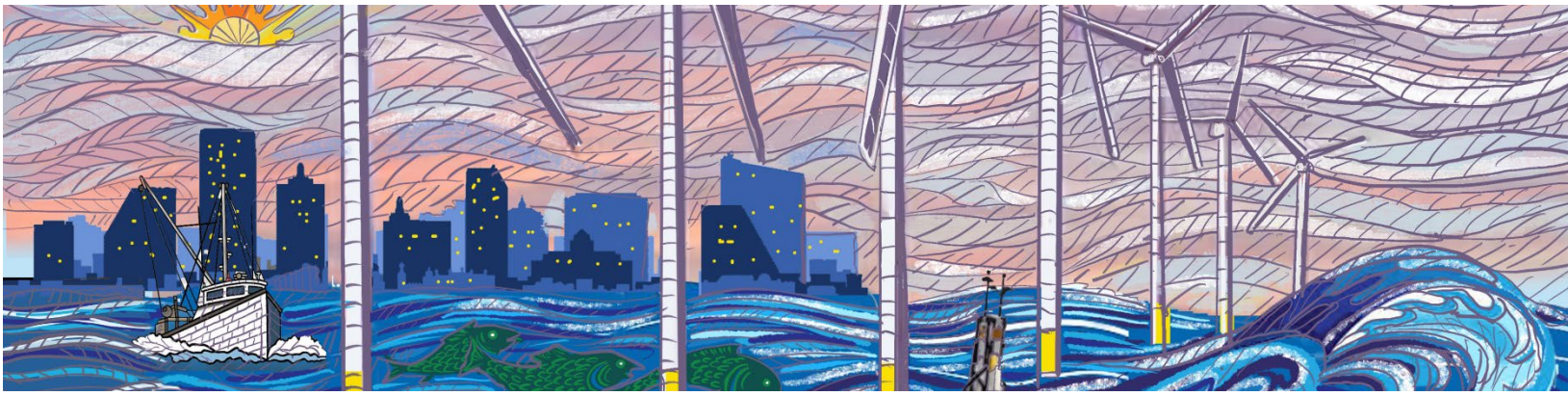

# Appendix II-G1

## Benthic Assessment Report - Buoy Installation Areas and Sites of Interest

Note:

On March 26, 2021, Atlantic Shores Offshore Wind, LLC (Atlantic Shores) submitted a Construction and Operations Plan (COP) to BOEM for the southern portion of Lease OCS-A 0499. On June 30, 2021, the New Jersey Board of Public Utilities (NJ BPU) awarded Atlantic Shores an Offshore Renewable Energy Credit (OREC) allowance to deliver 1,509.6 megawatts (MW) of offshore renewable wind energy into the State of New Jersey. In response to this award, Atlantic Shores updated Volume 1 of the COP to divide the southern portion of Lease OCS-A 0499 into two separate and electrically distinct Projects. Project 1 will deliver renewable energy under this OREC allowance and Project 2 will be developed to support future New Jersey solicitations and power purchase agreements.

As a result of the June 30, 2021 NJ BPU OREC award, Atlantic Shores updated Volume I (Project Information) of the COP in August 2021 to reflect the two Projects. COP Volume II (Affected Environment) and applicable Appendices do not currently include this update and will be updated to reflect Projects 1 and 2 as part Atlantic Shores' December 2021 COP revision.

# ATLANTIC SHORES OFFSHORE WIND

## Benthic Assessment Report – Buoy Installation Areas and Sites of Interest

**19-P-204565 Atlantic Shores**
**Benthic Assessment Report V4**
**Buoy Installation Areas**
**Terrasond - ASOW**

**February 14, 2020**

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Prepared for:

**Terrasond – Atlantic Shores Offshore Wind**

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## Table of Abbreviations

| | |
|---|---|
| ASOW | Atlantic Shores Offshore Wind |
| BOEM | Bureau of Ocean Energy Management |
| cm | Centimeters |
| CMECS | Coastal and Marine Ecological Classifications Standards |
| DDV | Drop Down Video |
| Dv | Volume Diameter |
| EPA | United States Environmental Protection Agency |
| EPSG | European Petroleum Survey Group code used for coordinate systems |
| EST | Eastern Standard Time |
| GPS | Global Positioning System |
| IA | Buoy Installation Area |
| kg | Kilogram |
| LPTL | Lowest Practical Taxonomic Level |
| m | Meters |
| mg | Milligrams |
| SOI | Sites of Interest |
| TOC | Total Organic Carbon |

# 1 INTRODUCTION

RPS was contracted by Terrasond to conduct benthic video and grab sampling, post-process the video collected, and compile this benthic assessment report for surveys conducted within four metocean data collection Buoy Installation Areas (IAs) and eight other Sites of Interest (SOIs) in the Atlantic Shores Offshore Wind (ASOW) Lease Area (OCS-A 0499) located offshore of New Jersey. The grab samples and video imagery data conclusions presented here will support interpretation of geophysical data to characterize surficial sediment conditions and classify the benthic habitat according to the Coastal and Marine Ecological Classifications Standards (CMECS; FGDC 2012) in accordance with Bureau of Ocean Energy Management (BOEM) guidelines. This report provides:

- A description of the benthic grab sampling methods, results, and analysis;
- The analysis of benthic grab sampling results using some key statistical analyses such as taxa richness, density per cubic meter, community composition, etc.;
- A description and analysis of the video data collected; and
- CMECS classifications of each sample site based on the video and grain size analyses.

# 2 METHODS

## 2.1 Field Survey

### 2.1.1 Drop-Down Video

Drop-down video (DDV) was taken in conjunction with grab samples to aid in sample collection and visual habitat classification on October 12-13, 2019. Two samples were taken from each IA with 8 additional grabs at SOIs (Figure 1). The video camera was equipped with an altimeter to record distance above sea floor, temperature probe, parallel-mounted scaling lasers 0.184 meter (m) apart, lights, and a 300-foot (ft) length of cable that provided real-time viewing of images from the vessel. A silver-colored hook was suspended 0.70 m below the camera with string to standardize image distance and is visible near the center or right side of some images. Due to poor visibility, images were captured just as the grab sampler reached bottom instead of stopping at the standard distance. A YSI EXO sensor with a pH sensor was deployed separately to record pH from a depth of about 5 m at each site and water depth from shipboard sonar was recorded. The video camera was affixed to the grab sampler which was deployed by the Terrasond crew. The equipment was lowered until positioned just above the seafloor (when visibility allowed) and sites were identified as free of sensitive habitat and material prohibitive to sampling (e.g., boulders, large cobbles, other hard bottom, or debris). Samples were then collected at or within 10 m of selected locations.

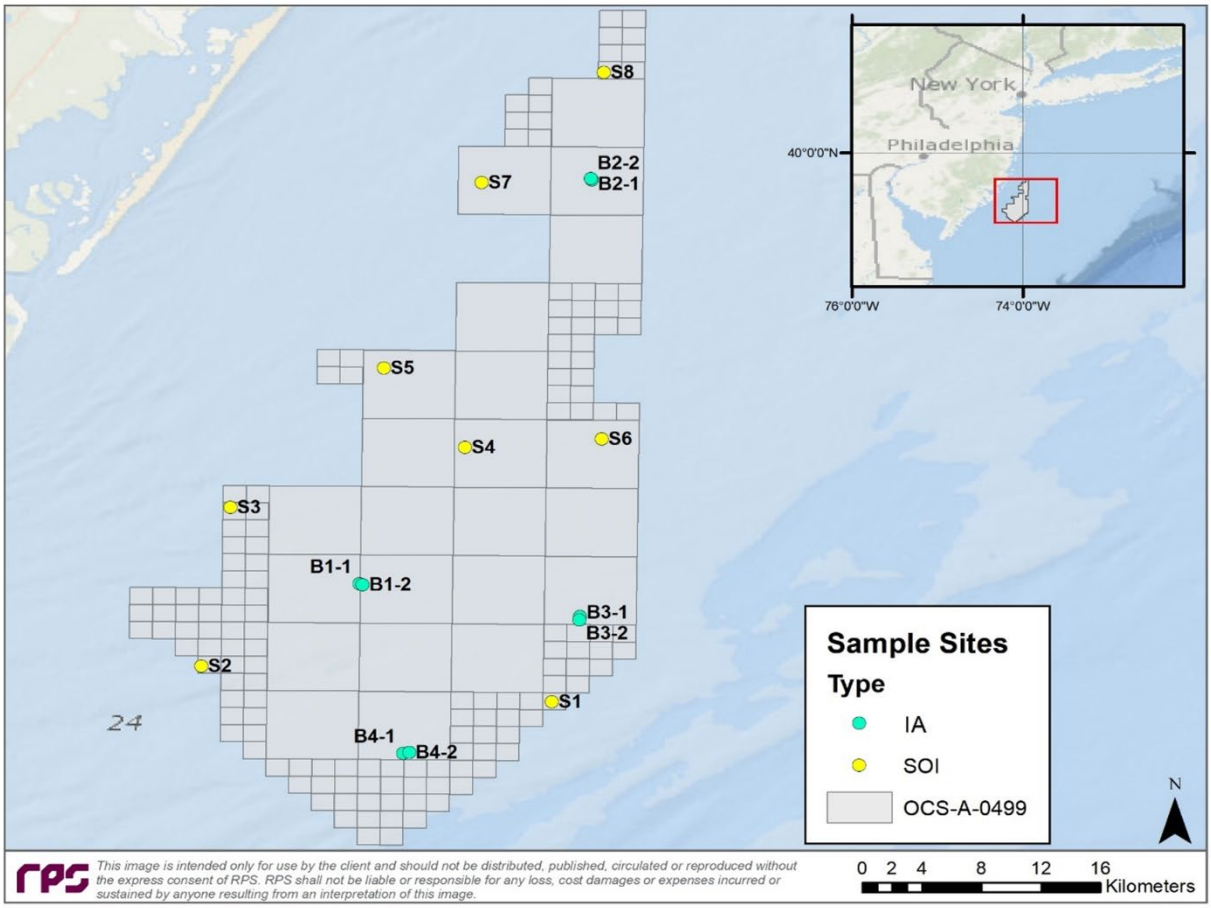



Figure 1: Map of sample stations. Note that "B" delineates buoy IAs (e.g., B3-2 is IA site 3 station 2) and "S" delineates SOIs.

While viewing the video feed for sampling suitability (i.e., if the site can be sampled with a grab sampler or not due to presence of obstructions and/or sensitive habitat), the sample information (date, time, global positioning satellite [GPS] coordinates, station ID, depth, and video file name) and initial observations of sediment/seafloor characteristics were recorded to aid in post-processing of video data. Grab sample identification numbers were recorded with the video file metadata for sites where they were retrieved. During video review, attention was given to noting if potentially sensitive benthic habitats (e.g., exposed hard bottom, seagrass/kelp/algal beds, coral species) were present, as per BOEM's Guidelines for Providing Benthic Habitat Survey Information for Renewable Energy Development on the Atlantic Outer Continental Shelf Pursuant to 30 CFR Part 585 (BOEM, 2019).

### 2.1.2 Grab Sampling

Benthic grab samples were acquired using an Ocean Instruments Salish Grab Standard SG-20 sampler. This grab is a modified version of a standard Van Veen sampler with a stainless-steel weighted frame and release system ideal for collection of sediments in soft to hard substrates with a penetration depth up to 20 centimeters (cm) and sampling area of 0.10 square meters ($m^2$). A virtual GPS node was placed just

off the stern of the vessel where the A-frame was deployed to obtain GPS coordinates for each sample. The actual location on the seafloor at which the sample was taken may have differed from the GPS coordinates by a few meters.

Upon retrieval, the grab sampler was examined for sample acceptability. A sample was deemed acceptable if:

- Sample was more than 50% full;
- Sample was not over penetrated (i.e., not full to the top); and
- Surface structures were undisturbed and even (i.e., not slumped).

If a sample did not fulfill these requirements, the entire contents were returned to the water and another sample attempt was made. If three failed sample attempts occurred at one station, sampling moved on to the next station (no more than two fails occurred in any one sampling station). The results of each attempted grab were recorded in field notes.

Once an acceptable sample was obtained, the following steps were taken:

1. Overlying water was drained using a siphon;
2. A photograph was taken of the sample next to an identification label containing sample identification number and a plastic ruler inserted to record sample depth;
3. Field notes included descriptions of physical features (apparent redox potential discontinuity depth, depth of penetration, sediment color, texture, odor, surface features) and surface macrofauna (e.g. longfin squid), which were then returned to the water.

The grab sample was then divided in two sections using a plexiglass divider. One half of the sample was processed for physical analysis (sediment grain size and total organic carbon [TOC]). For the TOC and grain size analysis, almost the entire top 2 cm of sediment on one half of the sample were collected using a stainless-steel spoon and placed in glass jars; this was approximately 150 milliliters (ml) of sediment for the grain size sample and 200 ml for the TOC sample. The grain size and TOC samples were stored on ice and sent to Eurofin Test America lab (5575 8$^{th}$ St E Tacoma, WA) for initial processing then to Particle Technology Labs (555 Rogers Street, Downers Grove, IL 60515) for completion of sediment analysis.

The other half of the grab sample (i.e., on the other side of the plexiglass divider) was measured for volume and processed for biological community analysis. The sample was then loaded onto a processing table and material washed in a 0.5-mm sieve, using seawater under gentle pressure. The seawater used for sample processing was filtered through a 0.5-mm mesh to prevent planktonic organisms from mixing with the benthic samples.

Organisms, shell fragments, and other material remaining on the sieve were placed into a plastic container using stainless-steel spoon and forceps as needed. The container was filled no more than one-half to two-thirds full with sample and seawater. If the quantity of sample exceeded this volume, it was placed in a second container. The sample was fixed/preserved with 10% buffered formalin solution by filling the remaining space within the bottle with solution. Containers were tightly sealed with tape and stored in a cooler at ambient temperature (not frozen or refrigerated). Prior to sieving the next sample, the sieve was cleaned by scrubbing with a stiff brush and backwashing with pressurized water. The infaunal benthic community samples were sent to EcoAnalysts (1420 S Blaine St ste. 14 Moscow, ID 83843) for processing. Grabs from two reconnaissance sites not in IAs (SOI 7 and SOI 8) were not sampled for infauna.

## 2.2 Lab Analysis

### 2.2.1 Grain Size and TOC Analysis

Grain size and TOC samples were analyzed by TestAmerica using ASTM D 422-63 Standard Method for Particle-size Analysis of Soils (ASTM, 2007). The TOC content of sediment samples was analyzed using EPA Method 9060 with results reported in milligrams per kilogram (mg/kg) and percent (EPA, 1986).

Laser diffraction was performed by Particle Technology Labs using the ISO 13320 Standard Method for Particle-size Analysis with a Malvern MasterSizer 3000 Laser diffractor. Laser diffraction is a method of grain size analysis that involves passing a laser beam through sediment samples in order to accurately estimate the grain size distribution of the sediment sample. The principle theory that is used for the Malvern MasterSizer 3000 Laser Diffractor is the Mie Theory, which describes the relationship between scattered light angles and absorption to the relative volume of a particle. Particle Technology Labs then prepared a document that detailed the cumulative volume percentage of each grain size that was analyzed for each sediment sample.

While majority of the sediment samples were made up particle sizes that the laser diffraction method could register, larger particulates that exceeded the upper limit of the MasterSizer 3000 Laser Diffractor (3.5 mm) were still present in some samples. To characterize the relative volume percentages of these larger grains, wet sieving was required. The wet sieving was also performed by Particle Technology Labs and the results were then presented as cumulative volume percentages of each grain size.

### 2.2.2 Benthic Infauna Analysis

The benthic infauna analysis was conducted by EcoAnalysts according to the following steps:

1. Benthic infaunal samples were catalogued and verified against the Chain of Custody to ensure samples received match those listed in the shipment.

2. Samples were rinsed with freshwater to remove the formalin and transferred to 70 percent ethanol alcohol for sorting and storage.

3. Organisms were identified to the lowest practical taxonomic level (LPTL) (at least to Family) and counted by taxonomists using the most appropriate taxonomic references for the region (Bousfield, 1973; Cutler, 1994; Winston and Hayward, 2012).

4. Species classification and abundance were recorded in Project data sheets and summarized in both tabular and graphical formats.

5. Prior to performing the infaunal data analyses, the overall dataset was scanned for non-infaunal taxa (i.e., pelagic or planktonic organisms) that were excluded from all analyses; examples include chaetognaths, hyperiid amphipods, and decapod zoea/megalopae.

6. Calculations of abundance included all taxa occurring in each sample whether identified to species level or not.

7. Calculations based on species (diversity, evenness, and number of species) included only those taxa identified to species level.

## 2.3 Video Post-Processing

Post-processing of video data was conducted by RPS to provide:

- General characterization of substrate including bottom type, texture, micro-topography, and presence and approximate thickness (absent, light, moderate, or heavy) of sedimentation ("drape") covering hard substrates;
- Evidence of benthic activity by organisms (burrows, trails, biogenic reefs);
- Identification of epibenthic macroinvertebrates larger than 4 cm (decapod crustaceans, mollusks [including squid egg mops], echinoderms) and habitat;
- Presence/evidence and general characterization of submerged aquatic vegetation (macroalgae, sea grass);
- Identification of fish and fish habitat (where feasible) as classified by Auster (1998), which can provide back-compatibility with prior sampling depending on what has been previously done in the region and is easily applicable to Essential Fish Habitat determination;
- Identification of organisms to the lowest practical taxonomic level (at least to Family) using standard taxonomic keys for the geographic area;
- Evidence of fishing activity, such as trawl scars, pots, and working nets; and
- Presence of derelict fishing gear, military expended materials, shipwrecks, cultural artifacts, or other marine debris.

All DDV stills were classified according to CMECS (FGDC, 2012). Auster (1998) classification is also included as it is indicative of overall habitat features that can be important to fish, while CMECS focuses more closely on grain size and composition. The BOEM Benthic Habitat guidelines (BOEM, 2019) also require that the developer characterize the benthic community composition which includes documentation of abundance, diversity, percent cover, and community structure. The following were recorded when present and identifiable:

- Characterization and delineation of any submerged aquatic vegetation (seagrass or macro-algae) that occurs within the area of potential adverse effect;

- Characterization and delineation of any hard bottom gradients of low to high relief such as coral (heads/reefs), rock or clay outcroppings, or other shelter-forming features; and

- Identification of communities of sessile and slow-moving marine invertebrates (clams, quahogs, mussels, polychaete worms, anemones, sponges, echinoderms) that may be within the area of potential adverse effect.

The video data were analyzed according to the following steps:

1. A single still image was analyzed from each site by selecting the first clear view of the seafloor at each grab site, with camera positioned approximately 46 cm above the seafloor.

2. The visible area of each still image was defined, measured, and reviewed for evidence of benthic species and activity, submerged aquatic vegetation (macroalgae, sea grass), fishing activity, derelict gear, military expended materials, shipwrecks, and other marine debris and presence/absence of these features were noted. In some instances of poor visibility, video was used in addition to still images to determine presence absence.

3. Selected stills were broadly characterized by texture, microtopography, presence/thickness of sedimentation over hard substrates (i.e., “drape”), and presence of coral heads/reefs, rock outcroppings, other shelter features, or Essential Fish Habitat for NMFS-designated species in the region.

4. The biological component was defined to furthest extent possible for each station when analyzed in conjunction with the grain size and benthic community results according to the CMECS (FGDC, 2012).

## 2.4 Benthic Community Data Post-Processing

The benthic community analysis was based on the benthic macroinfauna laboratory data from Ecoanalysts. Macroinfauna community statistics were calculated using species and abundance estimates in each sample, which were reported as count per 0.05 $m^2$ grab sample (i.e., half of the grab sample processed for biological analysis). Community composition parameters included: total abundance, number of phyla, number of taxa, Margalef’s Richness Index, Shannon Diversity Index, and Pielou’s Index of Evenness for each station and within each IA.

### 2.4.1 Taxonomic Composition

Taxa composition was assessed to characterize the high-level trends in taxa data. Taxa composition includes the relative proportions of taxonomic groups by number of identifiable taxa and number of individuals, used to evaluate dominance of common phyla across all samples. Taxa composition was summarized for both individual samples and across the four IAs.

### 2.4.2 Richness, Diversity, and Evenness

Species richness, evenness, and diversity are common ecological parameters used to measure the overall biodiversity of a community or discrete unit. Species richness is the number of unique species or taxonomic groups represented in an area of interest. In this assessment, species richness was calculated

using Margalef's Richness Index (Formula 1) for each station and IA to acquire individual and average richness indices.

*Formula 1. Margalef's Richness Index (RI).*

$$RI = \frac{(S-1)}{\ln(n)}$$

*Where:*

*S= the number of species*

*n= the total number of individuals in the sample*

*Interpretation: The higher the index, the greater the species richness.*

The diversity index for a community considers species richness and the proportion of each unique species. The Shannon Diversity Index (H'; Formula 2) was calculated using the number of each species, the proportion of each species relative to the total number of individuals, and the sum of the proportions. This index was used to assess diversity of each station and IA. The diversity index (H') increases with increasing species richness and evenness.

*Formula 2. H'- Shannon Diversity Index.*

$$H' = -\sum_{i=1}^{R} p_i \ln(p_i)$$

*Where:*

*$p_i$ is the proportion of individuals belonging to the with species in the dataset of interest*

*Interpretation: The greater the H', the greater the richness and evenness.*

Evenness of a community refers to the similarity in abundances of different species comprising a population or sample. Pielou's Index of Evenness includes H' (Shannon-Weiner Diversity Index) in its calculation.

*Formula 3. J'- Pielou's Index of Evenness.*

$$J' = \frac{H'}{H_{Max}}$$

*Where:*

*H' is the Shannon- Weiner Diversity Index*

*$H_{Max}$ is the maximum possible value of H', where each species occurs in equal abundances.*

$$H_{Max} = \ln(s)$$

*Where: s = Number of species*

*Interpretation: J' is constrained between 0 and 1. The greater the value of J', the more evenness in the sample.*

# 3 RESULTS

All samples were collected on October 12-13, 2019. Sampling stations were located in water between 21 and 35 m deep with bottom temperatures between 18.1°C and 18.9°C (Table 1).

Table 1: Grab-sample station locations and characteristics. Coordinates are North American Datum of 1983 (NAD 83), EPSG 4269.

| IA or SOI | Station | Date | Time (EST) | Latitude | Longitude | Sonar-Based Water Depth (m) | Temp (°C) | Penetration Depth (cm) | Infaunal Sample Volume ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|
| IA 1 | 1 | 10/12/19 | 17:25 | 39° 18.603' N | 74° 6.5923' W | 28.5 | 18.87 | 7.2 | 0.0021 |
| | 2 | 10/12/19 | 17:48 | 39° 18.5498' N | 74° 6.4631' W | 28.5 | 18.85 | 8.2 | 0.0021 |
| IA 2 | 1 | 10/13/19 | 10:06 | 39° 33.9308' N | 73° 58.1656' W | 25 | 18.57 | 5.1 | 0.0015 |
| | 2 | 10/13/19 | 10:35 | 39° 33.9907' N | 73° 58.1989' W | 25 | 18.57 | 9.1 | 0.0042 |
| IA 3 | 1 | 10/12/19 | 19:19 | 39° 17.3562' N | 73° 58.5943' W | 34.5 | 18.4 | 13.9 | 0.0036 |
| | 2 | 10/12/19 | 20:06 | 39° 17.2256' N | 73° 58.6107' W | 33.5 | 18.77 | 7.6 | 0.0021 |
| IA 4 | 1 | 10/12/19 | 22:35 | 39° 12.1396' N | 74° 5.0065' W | 26 | 18.75 | 9.0 | 0.0024 |
| | 2 | 10/12/19 | 23:03 | 39° 12.1881' N | 74° 4.7826' W | 25.5 | 18.77 | 8.5 | 0.0024 |
| SOI 1 | - | 10/12/19 | 21:14 | 39° 14.1066' N | 73° 59.616' W | 26 | 18.7 | 7.3 | 0.003 |
| SOI 2 | - | 10/12/19 | 0:40 | 39° 15.4624' N | 74° 12.3109' W | 26 | 18.57 | 9.1 | 0.003 |
| SOI 3 | - | 10/13/19 | 15:19 | 39° 21.5007' N | 74° 11.2525' W | 21 | 18.85 | 9.5 | 0.002 |
| SOI 4 | - | 10/13/19 | 13:43 | 39° 23.7691' N | 74° 2.7639' W | 26 | 18.75 | 9.5 | 0.003 |
| SOI 5 | - | 10/13/19 | 14:43 | 39° 26.7895' N | 74° 5.6972' W | 21 | 18.4 | 11.5 | 0.003 |
| SOI 6 | - | 10/13/19 | 12:39 | 39° 24.1021' N | 73° 57.8008' W | 28 | 18.59 | 9.2 | 0.0036 |
| SOI 7 | - | 10/13/19 | 16:48 | 39° 33.8481' N | 74° 2.1521' W | 24 | 18.68 | 11.8 | NA |
| SOI 8 | - | 10/13/19 | 18:07 | 39° 38.0361' N | 73° 57.7192' W | 26 | 18.14 | 8.5 | NA |

## 3.1 Visual Analysis

The following sections display and describe still images taken from the video camera affixed to the grab sampler (sampler visible in top of each image). Note that data overlaid on the screen may differ slightly from what is reported here due to a time lag in depth reporting (e.g., in Figure 8 the altimeter reads 1.35 m above the seafloor but the grab is resting on the seafloor). Parallel-mounted lasers visible in the center of the images are 0.184 m apart.

Still images were successfully captured and analyzed for 1 station at IA 2 (Figure 3), two stations at IA 3 (Figure 5 and Figure 6), and one station at IA 4 (Figure 8). Still images from other stations were unsuccessful due to extreme turbidity from a recent storm event but video observation during deployment provided limited coverage of the seafloor in some instances in which no notable findings were observed. All IAs appeared to have sandy bottom with varying degrees of shell debris and sand-ripple relief. SOI 8, the northernmost sample site, was the only site with clear presence of gravel. The field of view of each image was measured by calibrating images with the known distance between laser points and measuring the area of a polygon overlaid on the visible seafloor (i.e. unobstructed by grab or darkness) portion of each image. If an image did not include any visible seafloor, it was assigned a field of view of 0 $cm^2$.

### 3.1.1 IA Sites

#### 3.1.1.1 IA 1

Two sites were sampled in IA 1 with limited visual coverage due to high turbidity (Figures 2 and 3). Still images were not adequate for identifying habitat types and presence of other features of interest (i.e., aquatic vegetation, evidence of fishing activity, anthropogenic debris). The equipment visible in the still images is the grab sampler to which the camera was attached. The IA 1 sample sites are the most centrally located within the Lease Area, in block 6786H (station 1) and 6787E (station 2).


Figure 2: Still image of DDV associated with benthic grab station 1 at IA 1 taken from 0.46 m above the seafloor; field of view: 0 $cm^2$.


Figure 3: Still image of DDV associated with benthic grab station 2 at IA 1 taken from 0.46 m above the seafloor; field of view: 0 $cm^2$.

#### 3.1.1.2 IA 2

IA 2 is the northernmost IA site in block 6489F, relatively near SOIs 7 and 8 (Table 2, Figure 4, Figure 5).

Table 2: Visual characterization of still images associated with two stations at IA 2.

| Site | IA 2 Station 1 | IA 2 Station 2 |
|---|---|---|
| **General Characterization** | Despite high turbidity, some sparse shell hash was observed on light-colored sand. Video analysis aided in determining presence/absence of features. | Despite high turbidity, some sparse shell hash was observed on light-colored sand. Video analysis aided in determining presence/absence of features. |
| **Field of View** | 2,445 $cm^2$ | 2,223 $cm^2$ |
| **Biotic Benthic Activity** | None detected | None detected |
| **Epibenthic Macroinvertebrates and Fishes** | None detected | None detected |
| **Macroinvertebrate and Fish Habitat** | Flat Sand | Shell Aggregate |
| **Aquatic Vegetation** | None detected | None detected |
| **Evidence of Fishing Activity** | None detected | None detected |
| **Anthropogenic Debris** | None detected | None detected |


Figure 4: Still image of DDV associated with benthic grab station 1 at IA 2 taken from 0.46 m above the seafloor; field of view: 2,445 $cm^2$.


Figure 5: Still image of DDV associated with benthic grab station 2 at IA 2 taken from 0.46 m above the seafloor; field of view: 2,223 $cm^2$.

### 3.1.1.3 IA 3

IA 3 is located along the southeast edge of the Lease Area in block 6789N, nearest SOI 1 (Table 3, Figure 6, Figure 7).

Table 3: Visual characterization of still images associated with two stations at IA 3.

| Site | IA 3 Station 1 | IA 3 Station 2 |
|---|---|---|
| **General Characterization** | Sandy with trace shell debris and presence of sand dollars, possible small sand waves/ripples | Sandy with sparse shell debris and presence of sand dollars, possible small sand waves/ripples |
| **Field of View** | 2,726 $cm^2$ | 2,229 $cm^2$ |
| **Biotic Benthic Activity** | None Detected | None Detected |
| **Epibenthic Macroinvertebrates and Fishes** | Sand Dollars | Sand Dollars |
| **Macroinvertebrate and Fish Habitat** | None Detected | None Detected |
| **Aquatic Vegetation** | None Detected | None Detected |
| **Evidence of Fishing Activity** | None Detected | None Detected |
| **Anthropogenic Debris** | None Detected | None Detected |


Figure 6: Still image of DDV associated with benthic grab station 1 at IA 3 taken from 0.46 m above the seafloor; field of view: 2,726 $cm^2$.


Figure 7: Still image of DDV associated with benthic grab station 2 at IA 3 taken from 0.46 m above the seafloor; field of view: 2,229 $cm^2$.

#### 3.1.1.4 IA 4

The first station sampled in IA 4 had limited visual coverage due to high turbidity. Still images were not adequate for identifying habitat types and presence of other objects of interest. IA 4 is the southernmost sample with stations in block 6887N (station 1) and 6887O (station 2; Table 4, Figure 8, Figure 9).

Table 4: Visual characterization of still images associated with two stations at IA 4.

| Site | IA 4 Station 1 | IA 4 Station 2 |
|---|---|---|
| **General Characterization** | NA | Sandy with sparse shell debris and presence of sand dollars, possible small sand waves/ripples |
| **Field of View** | 0 $cm^2$ | 2,563 $cm^2$ |
| **Biotic Benthic Activity** | NA | None Detected |
| **Epibenthic Macroinvertebrates and Fishes** | NA | Sand dollars |
| **Macroinvertebrate and Fish Habitat** | NA | None Detected |
| **Aquatic Vegetation** | NA | None Detected |
| **Evidence of Fishing Activity** | NA | None Detected |
| **Anthropogenic Debris** | NA | None Detected |


Figure 8: Still image of DDV associated with benthic grab station 1 at IA 4 taken from 0.46 m above the seafloor; field of view: 0 $cm^2$.


Figure 9: Still image of DDV associated with benthic grab station 2 at IA 4 taken from 0.46 m above the seafloor; field of view: 2,563 $cm^2$.

### 3.1.2 Northern SOI Sites

Imaging from site SOI 7 had limited visual coverage due to high turbidity. Still images were not adequate for identifying habitat types and presence of other features of interest. SOI 7 is located in the northern portion of the Lease Area, in block 6488J. SOI 8 is the northernmost sample site within the Lease Area, in block 6389O (Table 5, Figure 10, Figure 11).

Table 5: Visual characterization of still images associated with northern stations at SOI 7 and SOI 8.

| Site | SOI 7 | SOI 8 |
|---|---|---|
| **General Characterization** | NA | Gravel with shell debris |
| **Field of View** | 0 $cm^2$ | 1,293 $cm^2$ |
| **Biotic Benthic Activity** | NA | None Detected |
| **Epibenthic Macroinvertebrates and Fishes** | NA | None Detected |
| **Macroinvertebrate and Fish Habitat** | NA | None Detected |
| **Aquatic Vegetation** | NA | None Detected |
| **Evidence of Fishing Activity** | NA | None Detected |
| **Anthropogenic Debris** | NA | None Detected |


Figure 10: Still image of DDV associated with benthic grab station SOI 7 taken from 0.46 m above the seafloor; field of view: 0 $cm^2$.


Figure 11: Still image of DDV associated with benthic grab station SOI 8 taken from 0.46 m above the seafloor; field of view: 1,293 $cm^2$.

### 3.1.3 Central SOI Sites

Imaging from site SOI 3 (in block 6735G), SOI 4 (block 6688E), SOI 5 (block 6637E), and SOI 6 (block 6689G) had limited visual coverage due to high turbidity. Still images were not adequate for identifying habitat types and presence of other features of interest at SOI 3, 5, or 6 but the seafloor was more visible at SOI 4; thus, only images from SOI 4 are included here (Table 6, Figure 12).

Table 6: Visual characterization of still images associated with central stations at SOI 3, 4, 5, and 6.

| Site | SOI 3 | SOI 4 | SOI 5 | SOI 6 |
|---|---|---|---|---|
| **General Characterization** | NA | Sandy with trace shell debris | NA | NA |
| **Field of View** | 0 $cm^2$ | 1,393 $cm^2$ | 0 $cm^2$ | 0 $cm^2$ |
| **Biotic Benthic Activity** | NA | None Detected | NA | NA |
| **Epibenthic Macroinvertebrates and Fishes** | NA | None Detected | NA | NA |
| **Macroinvertebrate and Fish Habitat** | NA | None Detected | NA | NA |
| **Aquatic Vegetation** | NA | None Detected | NA | NA |
| **Evidence of Fishing Activity** | NA | None Detected | NA | NA |
| **Anthropogenic Debris** | NA | None Detected | NA | NA |


Figure 12: Still image of DDV associated with benthic grab station SOI 4 taken from 0.46 m above the seafloor; field of view: 1,393 $cm^2$.

### 3.1.4 Southern SOI Sites

SOI 1 is located along the eastern edge of the Lease Area in the southern portion of block 6889A and SOI 2 is located along the western edge of the Lease Area in block 6835J (Table 7, Figure 13, Figure 14).

Table 7: Visual characterization of still images associated with southern stations at SOI 1 and SOI 2.

| Site | SOI 1 | SOI 2 |
|---|---|---|
| **General Characterization** | Sandy with sparse shell debris, sand ripples present | Sandy with trace shell debris and presence of sand dollars, possible small sand waves/ripples |
| **Field of View** | 2,268 $cm^2$ | 2,146 $cm^2$ |
| **Biotic Benthic Activity** | None Detected | None Detected |
| **Epibenthic Macroinvertebrates and Fishes** | None Detected | Sand dollars |
| **Macroinvertebrate and Fish Habitat** | None Detected | None Detected |
| **Aquatic Vegetation** | None Detected | None Detected |
| **Evidence of Fishing Activity** | None Detected | None Detected |
| **Anthropogenic Debris** | None Detected | None Detected |


Figure 13: Still image of DDV associated with benthic grab station SOI 1 taken from 0.46 m above the seafloor; field of view: 2,268 $cm^2$.


Figure 14: Still image of DDV associated with benthic grab station SOI 2 taken from 0.46 m above the seafloor; field of view: 2,146 $cm^2$.

## 3.2 Sediment Analyses

The following section presents grain size composition and TOC quantification (Table 8 and Figure 15) results from the TestAmerica analyses and laser diffraction (Table 9) and Microscopy imaging results from the Particle Tech analyses (Appendix B). Note that the laser diffraction data from the Particle Tech analyses is presented as Dv(10), Dv(50), and Dv(90), which describe the size (volume) median that 10%, 50%, and 90% of the particles within the distribution are smaller than, while the TestAmerica data is presented as composition percentage of each grain size through sieving.

When looking at the grain size analysis from TestAmerica, samples were generally composed of >90% fine and/or medium sand, except for those from the northernmost sample sites in the Lease Area, SOI 7 (in block 6488J) and SOI 8 (in block 6389O). The sample from SOI 7 was composed of mostly medium to coarse sand (76.3%), while the SOI 8 sample was the coarsest, with mostly medium sand to gravel (84.5%) (Table 8). Based on visual analysis, shell hash from multiple species including Atlantic surf clam (*Spisula solidissima*) and ocean quahog (*Arctica Islandica*) was present in many samples with densities ranging from trace to sparse, likely accounting for some to most of the gravel-sized grain components reported in the grain size results.

When comparing the grain size results from TestAmerica to the results from the laser diffraction analysis performed by Particle Tech, they were mostly in agreement (Table 9). The laser diffraction results indicate that nearly all samples were composed of mostly fine to medium sand, except for IA 2, SOI 5, SOI 7, and SOI 8, where grains were typically composed of mostly (>50%) coarse sand.

Organic carbon content (i.e., TOC) was below the reporting limit of 2,000 mg/kg in all samples. Recent storms may have caused suspension of some organic matter into the water column, reducing TOC measures in the seabed.

Table 8: Grain size composition and total organic carbon content of grab samples.

| IA or SOI | Station | Gravel (%) | Coarse Sand (%) | Medium Sand (%) | Fine Sand (%) | Silt (%) | Clay (%) | Total Organic Carbon (mg/kg) |
|---|---|---|---|---|---|---|---|---|
| IA 1 | 1 | 0.7 | 3.6 | 36.3 | 54.6 | 1.0 | 3.8 | Not Detected |
| | 2 | 0.0 | 0.1 | 26.1 | 70.8 | 0.4 | 2.7 | Not Detected |
| IA 2 | 1 | 0.4 | 3.1 | 50.3 | 44.3 | 0.1 | 1.8 | Not Detected |
| | 2 | 0.7 | 1.4 | 52.0 | 43.9 | 0.4 | 1.6 | Not Detected |
| IA 3 | 1 | 1.8 | 0.6 | 20.1 | 73.9 | 0.1 | 3.5 | Not Detected |
| | 2 | 0.2 | 0.0 | 1.5 | 94.3 | 0.2 | 3.8 | Not Detected |
| IA 4 | 1 | 0.1 | 0.4 | 17.7 | 77.8 | 0.6 | 3.4 | Not Detected |
| | 2 | 1.6 | 2.9 | 33.5 | 59.4 | 0.1 | 2.6 | Not Detected |
| SOI 1 | - | 0.0 | 0.3 | 26.2 | 70.7 | 0.1 | 2.7 | Not Detected |
| SOI 2 | - | 0.0 | 0.0 | 5.4 | 91.8 | 0.1 | 2.7 | Not Detected |

| IA or SOI | Station | Gravel (%) | Coarse Sand (%) | Medium Sand (%) | Fine Sand (%) | Silt (%) | Clay (%) | Total Organic Carbon (mg/kg) |
|---|---|---|---|---|---|---|---|---|
| SOI 3 | - | 0.0 | 0.3 | 43.1 | 54.2 | 0.7 | 1.7 | Not Detected |
| SOI 4 | - | 0.0 | 0.4 | 27.2 | 68.5 | 0.3 | 3.6 | Not Detected |
| SOI 5 | - | 0.0 | 0.6 | 61.2 | 36.3 | 0.3 | 1.7 | Not Detected |
| SOI 6 | - | 0.0 | 0.1 | 50.0 | 47.2 | 0.1 | 2.6 | Not Detected |
| SOI 7 | - | 0.7 | 17.1 | 59.2 | 21.3 | 0.1 | 1.6 | Not Detected |
| SOI 8 | - | 8.6 | 40.7 | 35.2 | 13.6 | 0.4 | 1.5 | Not Detected |

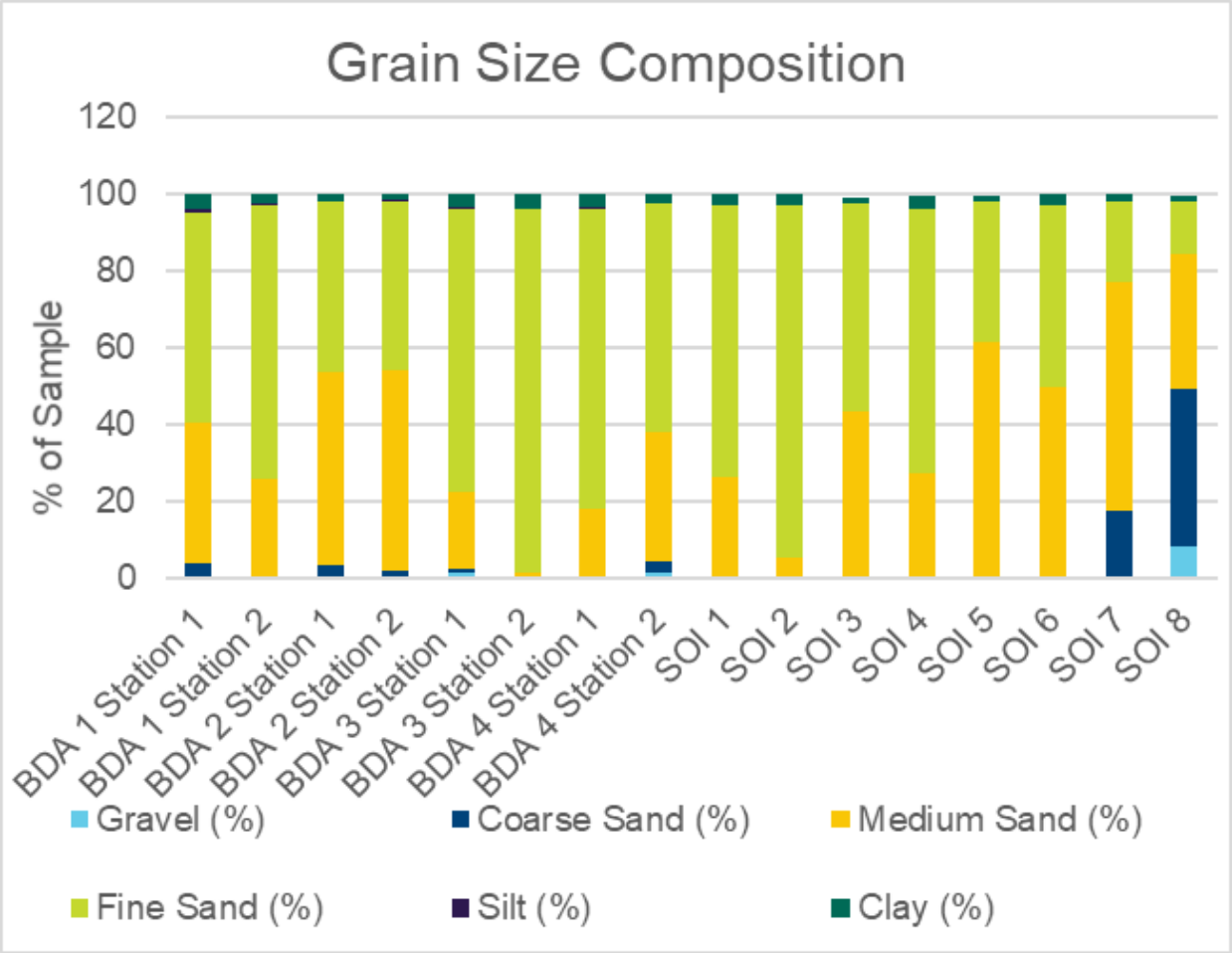



Figure 15: Grain size composition at each sample station.

Table 9: Laser diffraction results showing sizes which 10% (Dv [10]), 50% (Dv [50]), and 90% (Dv [90]) of particles in the distribution are smaller than and the volume-weighted mean (D[4,3]).

| IA or SOI | Station | Dv (10) | Dv (50) | Dv (90) | D[4,3] |
|---|---|---|---|---|---|
| IA 1 | 1 | 160 | 438 | 845 | 474 |
| | 2 | 270 | 439 | 743 | 479 |

| IA or SOI | Station | Dv (10) | Dv (50) | Dv (90) | D[4,3] |
|---|---|---|---|---|---|
| IA 2 | 1 | 320 | 548 | 936 | 592 |
| | 2 | 322 | 554 | 973 | 607 |
| IA 3 | 1 | 246 | 431 | 743 | 466 |
| | 2 | 177 | 282 | 443 | 296 |
| IA 4 | 1 | 271 | 431 | 694 | 460 |
| | 2 | 286 | 488 | 860 | 539 |
| SOI 1 | - | 279 | 465 | 791 | 505 |
| SOI 2 | - | 223 | 340 | 518 | 358 |
| SOI 3 | - | 286 | 474 | 801 | 514 |
| SOI 4 | - | 285 | 459 | 756 | 496 |
| SOI 5 | - | 367 | 632 | 1080 | 682 |
| SOI 6 | - | 325 | 544 | 936 | 594 |
| SOI 7 | - | 372 | 623 | 1030 | 665 |
| SOI 8 | - | 355 | 643 | 1130 | 692 |

## 3.3 Benthic Community Analysis

### 3.3.1 Taxonomic Composition

Fourteen of the sixteen benthic grab samples collected in this survey were analyzed for infauna and yielded a total of 1322 individual organisms from 8 unique phyla and 62 families (or LPTL; Table 10). The phyla Annelida, Arthropoda, and Mollusca dominated the samples in both abundance and unique number of taxa, representing 90% of all organisms and 91% of all unique taxa (Figure 16).

Table 10: Phyla present in the fourteen benthic grab samples.

| Phyla | Abundant Taxonomic Groups (common names) | Abundance[1] | Number of Unique Taxa[1] |
|---|---|---|---|
| Annelida | Polychaete worms, oligochaete worms | 535 | 46 |
| Arthropoda | Amphipods, isopods, tanaids | 555 | 26 |
| Chordata | Lancelet | 1 | 1 |
| Cnidaria | Sea anemone | 1 | 1 |
| Echinodermata | Sand dollar | 77 | 2 |
| Mollusca | Bivalves, sea snails | 106 | 18 |
| Nematoda | Nematodes | 40 | 1 |
| Nemertea | Ribbon worms | 7 | 4 |
| Total | | 1322 | 99 |

[1] Reported as sum of all fourteen 0.05 $m^2$ grab samples

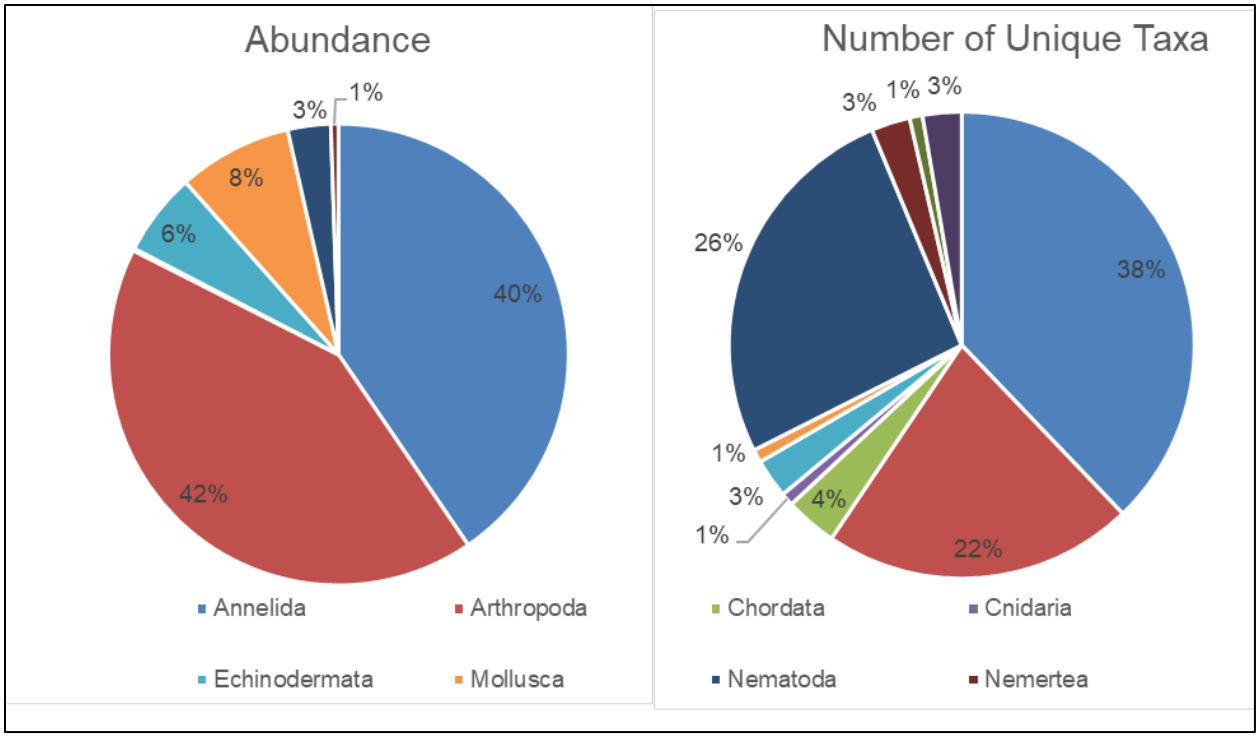



Figure 16: Proportional abundance and proportional number of unique taxa (species or LPTL) for each phylum collected in all benthic grab samples. Results presented as percentage of total.

Density within the benthic grab sites ranged from 18 organisms in IA 4 grab sample 2 to 280 organisms at SOI 2, with a mean density of 95 organisms per 0.05 $m^2$, averaged across all samples (Table 11). Of the IAs, IA 1 and IA 4 contained the highest and lowest densities of infauna with 285 organisms and 49 organisms (total of both grabs), respectively.

Table 11: Density (# of individuals per 0.05 $m^2$) of each Phylum present within each grab sample and the mean density for IA grab sample stations.

| IA or SOI | Station | Annelida | Arthropoda | Chordata | Cnidaria | Echinoderm ata | Mollusca | Nematoda | Nemertea | Total Abundance |
|---|---|---|---|---|---|---|---|---|---|---|
| IA 1 | 1 | 105 | 66 | 0 | 0 | 0 | 20 | 5 | 1 | 198 |
| | 2 | 19 | 55 | 0 | 0 | 4 | 5 | 2 | 0 | 87 |
| | Average | 62 | 61 | 0 | 0 | 2 | 13 | 4 | 1 | 141 |
| IA 2 | 1 | 46 | 10 | 0 | 1 | 1 | 7 | 0 | 1 | 67 |
| | 2 | 65 | 22 | 0 | 0 | 0 | 11 | 6 | 0 | 106 |
| | Average | 56 | 16 | 0 | 1 | 1 | 9 | 3 | 1 | 85 |
| IA 3 | 1 | 39 | 9 | 0 | 0 | 0 | 9 | 1 | 0 | 59 |
| | 2 | 32 | 50 | 0 | 0 | 22 | 1 | 1 | 2 | 110 |
| | Average | 36 | 30 | 0 | 0 | 11 | 5 | 1 | 1 | 83 |
| IA 4 | 1 | 6 | 7 | 0 | 0 | 2 | 11 | 4 | 0 | 31 |
| | 2 | 7 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 18 |
| | Average | 7 | 8 | 0 | 0 | 1 | 6 | 2 | 0 | 23 |
| SOI 1 | - | 10 | 12 | 0 | 0 | 5 | 7 | 2 | 1 | 37 |
| SOI 2 | - | 59 | 209 | 1 | 0 | 5 | 3 | 2 | 1 | 280 |
| SOI 3 | - | 82 | 9 | 0 | 0 | 0 | 4 | 4 | 0 | 99 |
| SOI 4 | - | 7 | 76 | 0 | 0 | 29 | 3 | 4 | 0 | 119 |
| SOI 5 | - | 27 | 4 | 0 | 0 | 5 | 9 | 4 | 0 | 49 |
| SOI 6 | - | 31 | 18 | 0 | 0 | 4 | 15 | 5 | 1 | 74 |

### 3.3.1.1 IA 1

Organisms collected in IA 1 were classified into 6 phyla and 49 different taxa (LPTLs) (Table 12). The infaunal community recorded from the grabs in IA 1 were dominated by amphipods, polychaete worms, and tanaids. Species of direct economic importance identified in IA 1 included Atlantic rock crab (*Cancer irroratus*) and Atlantic surf clam (*Spisula solidissima*).

Table 12: Density of each phyla and taxa (LPTLs) collected at the two grab stations (data combined) in IA 1.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 13 |
| | Dipolydora socialis | 10 |
| | Marenzelleria viridis | 9 |
| | Goniadella gracilis | 8 |
| | Cirratulidae | 3 |
| | Nephtyidae | 3 |
| | Scoletoma fragilis | 3 |
| | Ampharete oculata | 2 |
| | Exogone hebes | 2 |
| | Neanthes acuminata Complex | 2 |
| | Protodorvillea kefersteini | 2 |
| | Aphroditella hastata | 1 |
| | Cabira incerta | 1 |
| | Lepidonotus sublevis | 1 |
| | Magelona papillicornis | 1 |
| | Magelona rosea | 1 |
| | Nephtys picta | 1 |
| | Oligochaeta | 1 |
| | Paradoneis lyra | 1 |
| | Phyllodoce mucosa | 1 |
| | Prionospio sp. | 1 |
| | Sphaerodoropsis corrugata | 1 |
| | Sthenelais boa | 1 |
| | Tharyx sp. A sensu MWRA 2007 | 1 |
| | **TOTAL** | **70** |
| Arthropoda | Pseudunciola obliquua | 16 |
| | Unciola irrorata | 14 |
| | Ampelisca vadorum | 10 |
| | Ampelisca verrilli | 6 |
| | Tanaissus psammophilus | 5 |
| | Monocorophium acherusicum | 4 |

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| | Phoxocephalus holbolli | 2 |
| | Rhepoxynius hudsoni | 2 |
| | Cancer irroratus | 1 |
| | Chiridotea tuftsii | 1 |
| | Edotea triloba | 1 |
| | Eobrolgus spinosus | 1 |
| | Pagurus arcuatus | 1 |
| | **TOTAL** | **64** |
| Echinodermata | Echinarachnius parma | 1 |
| | Echinoidea | 1 |
| | **TOTAL** | **2** |
| Mollusca | Tritia trivittata | 7 |
| | Angulus versicolor | 2 |
| | Astyris lunata | 1 |
| | Bivalvia | 1 |
| | Cyclocardia borealis | 1 |
| | Periploma leanum | 1 |
| | Spisula solidissima | 1 |
| | Tellinidae | 1 |
| | **TOTAL** | **15** |
| Nematoda | Nematoda | 4 |
| Nemertea | Palaeonemertea | 1 |
| **TOTAL DENSITY OF ALL PHYLA** | | **156** |

### 3.3.1.2 IA 2

Organisms collected in IA 2 were classified into 7 phyla and 28 different taxa (LPTLs) (Table 13). The infaunal community was dominated by polychaete worms, oligochaete worms, tanaids, and bivalves. One species of direct economic importance, Atlantic surf clam (*Spisula solidissima*), was identified in IA 2.

Table 13: Density of each phyla and taxa (LPTL) collected at the two grab stations (data combined) in IA 2.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 33 |
| | Oligochaeta | 17 |
| | Dispio uncinata | 2 |
| | Cirratulidae | 1 |
| | Eulalia bilineata | 1 |
| | Goniadella gracilis | 1 |
| | Marenzelleria viridis | 1 |
| | Nephtys picta | 1 |
| | Sigalion arenicola | 1 |
| | Sphaerodoropsis corrugata | 1 |
| | **TOTAL** | **59** |
| Arthropoda | Tanaissus psammophilus | 12 |
| | Unciola irrorata | 1 |
| | Rhepoxynius hudsoni | 1 |
| | Pseudunciola obliquua | 1 |
| | Pseudoleptocuma minus | 1 |
| | Politolana polita | 1 |
| | Chiridotea arenicola | 1 |
| | Ampelisca verrilli | 1 |
| | **TOTAL** | **19** |
| Cnidaria | Edwardsia elegans | 1 |
| Echinodermata | Echinarachnius parma | 1 |
| Mollusca | Periploma leanum | 5 |
| | Astarte castanea | 2 |
| | Spisula solidissima | 2 |
| | Angulus tenellus | 1 |
| | Angulus versicolor | 1 |
| | Crenella sp. | 1 |
| | **TOTAL** | **14** |
| Nematoda | Nematoda | 3 |
| Nemertea | Tubulanus pellucidus | 1 |
| **TOTAL DENSITY OF ALL PHYLA** | | **96** |

### 3.3.1.3 IA 3

Organisms collected in IA 3 were classified into 6 phyla and 44 different taxa (LPTLs) (Table 14). The infaunal community recorded from the grabs in IA 3 were dominated by ostracods, polychaete worms, and common sand dollars (*Echinarachnius parma*). A single species of direct economic importance, Atlantic surf clam (*Spisula solidissima*), was identified in IA 3.

Table 14: Density of each phyla and taxa (LPTL) collected at the two grab stations (data combined) in IA 3.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 13 |
| | Ampharete oculata | 3 |
| | Aricidea (Aricidea) wassi | 3 |
| | Scoletoma fragilis | 3 |
| | Sthenelais sp. | 3 |
| | Onuphis eremita | 2 |
| | Ampharete acutifrons | 1 |
| | Caulleriella venefica | 1 |
| | Cirratulidae | 1 |
| | Cirrophorus furcatus | 1 |
| | Clymenella mucosa | 1 |
| | Dipolydora socialis | 1 |
| | Goniadella gracilis | 1 |
| | Harmothoe extenuata | 1 |
| | Magelona papillicornis | 1 |
| | Nephtyidae | 1 |
| | Nephtys picta | 1 |
| | Oligochaeta | 1 |
| | Pherusa affinis | 1 |
| | Phyllodoce mucosa | 1 |
| | Sthenelais limicola | 1 |
| | **TOTAL** | **42** |
| Arthropoda | Ostracoda | 14 |
| | Edotea triloba | 4 |
| | Ampelisca verrilli | 2 |
| | Pagurus arcuatus | 2 |
| | Pseudunciola obliquua | 2 |
| | Rhepoxynius hudsoni | 2 |
| | Unciola irrorata | 2 |

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| | Americhelidium americanum | 1 |
| | Jassa falcata | 1 |
| | Oxyurostylis smithi | 1 |
| | Tanaissus psammophilus | 1 |
| | **TOTAL** | **32** |
| Echinodermata | Echinarachnius parma | 9 |
| | Echinoidea | 3 |
| | **TOTAL** | **12** |
| Mollusca | Angulus versicolor | 2 |
| | Crepidula fornicata | 1 |
| | Crepidula plana | 1 |
| | Pandora inornata | 1 |
| | Pleurobranchaea tarda | 1 |
| | Spisula solidissima | 1 |
| | Tritia trivittata | 1 |
| | **TOTAL** | **8** |
| Nematoda | Nematoda | 1 |
| Nemertea | Carinoma mutabilis | 1 |
| | Tubulanus pellucidus | 1 |
| | **TOTAL** | **2** |
| **TOTAL DENSITY OF ALL PHYLA** | | **97** |

#### 3.3.1.4 IA 4

Organisms collected in IA 4 were classified into 5 phyla and 19 different taxa (LPTLs) (Table 15). Overall density of infauna was relatively low compared to other IAs. The infaunal community recorded from the grabs in IA 4 was not dominated by any one species, but polychaete worms, tanaids, and a few species of bivalves were most abundant. Species of direct economic importance identified in IA 4 included Atlantic rock crab (*Cancer irroratus*) and Atlantic surf clam (*Spisula solidissima*).

Table 15: Density of each phyla and taxa (LPTL) collected at the two grab stations (data combined) in IA 4.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 3 |
| | Nephtyidae | 2 |
| | Ampharete oculata | 1 |
| | Hemipodia simplex | 1 |
| | Sigalion arenicola | 1 |
| | **TOTAL** | **8** |

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Arthropoda | Tanaissus psammophilus | 4 |
| | Pagurus sp. | 2 |
| | Bathyporeia quoddyensis | 1 |
| | Cancer irroratus | 1 |
| | Jassa falcata | 1 |
| | Parahaustorius attenuatus | 1 |
| | Unciola irrorata | 1 |
| | **TOTAL** | **11** |
| Echinodermata | Echinoidea | 1 |
| Mollusca | Angulus tenellus | 3 |
| | Spisula solidissima | 2 |
| | Astarte sp. | 1 |
| | Crenella sp. | 1 |
| | Tritia trivittata | 1 |
| | **TOTAL** | **9** |
| Nematoda | Nematoda | 2 |
| **TOTAL DENSITY OF ALL PHYLA** | | **30** |

### 3.3.1.5 SOI 1

Organisms collected in SOI 1 were classified into 6 phyla and 17 different taxa (LPTLs) (Table 16).

Table 16: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 1.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Exogone hebes | 3 |
| | Polygordius jouinae | 3 |
| | Eulalia bilineata | 1 |
| | Leitoscoloplos robustus | 1 |
| | Magelona papillicornis | 1 |
| | Onuphis eremita | 1 |
| | **TOTAL** | **10** |
| Arthropoda | Tanaissus psammophilus | 7 |
| | Rhepoxynius hudsoni | 3 |
| | Protohaustorius deichmannae | 1 |
| | Unciola irrorata | 1 |
| | **TOTAL** | **12** |
| Echinodermata | Echinoidea | 3 |
| | Echinarachnius parma | 2 |

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| | **TOTAL** | **5** |
| Mollusca | Angulus tenellus | 3 |
| | Astarte castanea | 2 |
| | Periploma leanum | 2 |
| | **TOTAL** | **7** |
| Nematoda | Nematoda | 2 |
| Nemertea | Carinoma mutabilis | 1 |
| **TOTAL DENSITY OF ALL PHYLA** | | **37** |

### 3.3.1.6 SOI 2

Organisms collected in SOI 2 were classified into 7 phyla and 30 different taxa (LPTLs) (Table 17).

Table 17: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 2.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Magelona papillicornis | 22 |
| | Cirrophorus furcatus | 5 |
| | Polygordius jouinae | 5 |
| | Caulleriella venefica | 3 |
| | Cirratulidae | 3 |
| | Exogone hebes | 3 |
| | Nephtyidae | 3 |
| | Oligochaeta | 3 |
| | Aricidea (Aricidea) wassi | 2 |
| | Aricidea sp. | 2 |
| | Tharyx sp. A sensu MWRA 2007 | 2 |
| | Nephtys picta | 1 |
| | Onuphis eremita | 1 |
| | Sigalion arenicola | 1 |
| | Spiochaetopterus oculatus | 1 |
| | Spiophanes bombyx Complex | 1 |
| | Streptosyllis arenae | 1 |
| | **TOTAL** | **59** |
| Arthropoda | Pseudunciola obliquua | 157 |
| | Ampelisca verrilli | 32 |
| | Tanaissus psammophilus | 15 |
| | Ostracoda | 3 |
| | Rhepoxynius hudsoni | 2 |

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| | **TOTAL** | **209** |
| Chordata | Branchiostoma virginiae | 1 |
| Echinodermata | Echinarachnius parma | 4 |
| | Echinoidea | 1 |
| | **TOTAL** | **6** |
| Mollusca | Nucula proxima | 1 |
| | Tellinidae | 1 |
| | Tritia trivittata | 1 |
| | **TOTAL** | **3** |
| Nematoda | Nematoda | 2 |
| Nemertea | Lineidae | 1 |
| | **DENSITY OF ALL PHYLA** | **280** |

#### 3.3.1.7 SOI 3

Organisms collected in SOI 3 were classified into 4 phyla and 13 different taxa (LPTLs) (Table 18).

Table 18: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 3.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 65 |
| | Oligochaeta | 6 |
| | Hemipodia simplex | 4 |
| | Parapionosyllis longicirrata | 3 |
| | Exogone hebes | 1 |
| | Lumbrinerides acuta | 1 |
| | Sigalion arenicola | 1 |
| | Streptosyllis arenae | 1 |
| | **TOTAL** | **82** |
| Arthropoda | Rhepoxynius hudsoni | 4 |
| | Pseudunciola obliquua | 3 |
| | Tanaissus psammophilus | 2 |
| | **TOTAL** | **9** |
| Mollusca | Angulus tenellus | 4 |
| Nematoda | Nematoda | 4 |
| | **DENSITY OF ALL PHYLA** | **99** |

### 3.3.1.8 SOI 4

Organisms collected in SOI 4 were classified into 5 phyla and 19 different taxa (LPTLs) (Table 19).

Table 19: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 4.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Sigalion arenicola | 2 |
| | Aricidea (Aricidea) wassi | 1 |
| | Caulleriella venefica | 1 |
| | Magelona papillicornis | 1 |
| | Nephtyidae | 1 |
| | Oligochaeta | 1 |
| | **TOTAL** | **7** |
| Arthropoda | Pseudunciola obliquua | 35 |
| | Tanaissus psammophilus | 32 |
| | Rhepoxynius hudsoni | 4 |
| | Americhelidium americanum | 1 |
| | Bathyporeia quoddyensis | 1 |
| | Oxyurostylis smithi | 1 |
| | Protohaustorius deichmannae | 1 |
| | Ptilanthura tenuis | 1 |
| | **TOTAL** | **76** |
| Echinodermata | Echinoidea | 26 |
| | Echinarachnius parma | 3 |
| | **TOTAL** | **29** |
| Mollusca | Tritia trivittata | 2 |
| | Periploma sp. | 1 |
| | **TOTAL** | **3** |
| Nematoda | Nematoda | 4 |
| **DENSITY OF ALL PHYLA** | | **119** |

### 3.3.1.9 SOI 5

Organisms collected in SOI 5 were classified into 5 phyla and 18 different taxa (LPTLs) (Table 20).

Table 20: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 5.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Polygordius jouinae | 10 |
| | Sigalion arenicola | 7 |
| | Travisia forbesii | 3 |
| | Dipolydora socialis | 2 |
| | Dispio uncinata | 1 |
| | Eulalia bilineata | 1 |
| | Hemipodia simplex | 1 |
| | Nephtys picta | 1 |
| | Sphaerodoropsis corrugata | 1 |
| | **TOTAL** | **27** |
| Arthropoda | Bathyporeia quoddyensis | 2 |
| | Oxyurostylis smithi | 1 |
| | Protohaustorius wigleyi | 1 |
| | **TOTAL** | **4** |
| Echinodermata | Echinoidea | 3 |
| | Echinarachnius parma | 2 |
| | **TOTAL** | **5** |
| Mollusca | Periploma sp. | 4 |
| | Astarte castanea | 3 |
| | Spisula solidissima | 2 |
| | **TOTAL** | **9** |
| Nematoda | Nematoda | 4 |
| **DENSITY OF ALL PHYLA** | | **49** |

#### 3.3.1.10 SOI 6

Organisms collected in SOI 6 were classified into 6 phyla and 19 different taxa (LPTLs) (Table 21).

Table 21: Density of each phyla and taxa (LPTL) collected at the grab station at SOI 6.

| Phyla | Taxa (LPTL) | Density (# / 0.05 $m^2$) |
|---|---|---|
| Annelida | Hemipodia simplex | 9 |
| | Goniadella gracilis | 8 |
| | Polygordius jouinae | 5 |
| | Dipolydora socialis | 2 |
| | Nephtys picta | 2 |
| | Caulleriella venefica | 1 |
| | Dispio uncinata | 1 |
| | Lumbrinerides acuta | 1 |
| | Sigalion arenicola | 1 |
| | Spiophanes bombyx Complex | 1 |
| | TOTAL | 31 |
| Arthropoda | Tanaissus psammophilus | 16 |
| | Americhelidium americanum | 1 |
| | Rhepoxynius hudsoni | 1 |
| | TOTAL | 18 |
| Echinodermata | Echinoidea | 4 |
| Mollusca | Periploma sp. | 9 |
| | Angulus tenellus | 4 |
| | Spisula solidissima | 2 |
| | TOTAL | 19 |
| Nematoda | Nematoda | 5 |
| Nemertea | Tubulanus pellucidus | 1 |
| | DENSITY OF ALL PHYLA | 74 |

### 3.3.2 Richness, Diversity, and Evenness

Taxonomic richness ranged from 2.18 at SOI 3 to 5.77 at station 2 in IA 3 with a mean richness of 3.96 overall (Table 22). Diversity was consistent between grab stations ranging from 1.39 at SOI 3 to 2.83 at station 2 of IA 3. Evenness ranged from 0.55 at station 1 in IA 2 to 0.94 at station 1 in IA 4. While considering both grabs from each IA, IA 3 had the highest infaunal richness, IA 1 had the most infaunal diversity, and IA 4 had the most even infaunal species composition according to the ecological indices (Figure 17).

Table 22: Community composition parameters calculated for each grab sample station and for each IA. Combined values for individual stations within the four IAs were either averaged ($\bar{x}$) or summed ($\sum$) depending on parameter.

| IA | Station | Density (# of individuals per 0.05 $m^2$) | # of Unique Taxa | Ecological Indices | | |
|---|---|---|---|---|---|---|
| | | | | Richness | Diversity | Evenness |
| IA 1 | 1 | 197 | 32 | 5.30 | 2.70 | 0.80 |
| | 2 | 85 | 22 | 4.05 | 2.30 | 0.78 |
| | Combined | $\bar{x}$ = 141 | $\sum$ = 49 | $\bar{x}$ = 4.68 | $\bar{x}$ = 2.50 | $\bar{x}$ = 0.79 |
| IA 2 | 1 | 66 | 16 | 3.10 | 1.45 | 0.55 |
| | 2 | 104 | 17 | 3.45 | 2.03 | 0.72 |
| | Combined | $\bar{x}$ = 85 | $\sum$ = 28 | $\bar{x}$ = 3.28 | $\bar{x}$ = 1.74 | $\bar{x}$ = 0.63 |
| IA 3 | 1 | 58 | 19 | 4.19 | 2.08 | 0.72 |
| | 2 | 108 | 31 | 5.77 | 2.83 | 0.75 |
| | Combined | $\bar{x}$ = 83 | $\sum$ = 44 | $\bar{x}$ = 4.98 | $\bar{x}$ = 2.45 | $\bar{x}$ = 0.78 |
| IA 4 | 1 | 30 | 16 | 4.41 | 2.61 | 0.94 |
| | 2 | 16 | 9 | 2.89 | 1.92 | 0.88 |
| | Combined | $\bar{x}$ = 23 | $\sum$ = 19 | $\bar{x}$ = 3.65 | $\bar{x}$ = 2.27 | $\bar{x}$ = 0.91 |
| SOI 1 | - | 37 | 17 | 4.43 | 2.65 | 0.93 |
| SOI 2 | - | 280 | 30 | 4.08 | 1.76 | 0.56 |
| SOI 3 | - | 99 | 13 | 2.18 | 1.39 | 0.58 |
| SOI 4 | - | 119 | 19 | 3.77 | 1.95 | 0.66 |
| SOI 5 | - | 49 | 18 | 4.11 | 2.56 | 0.90 |
| SOI 6 | - | 74 | 19 | 3.72 | 2.47 | 0.87 |

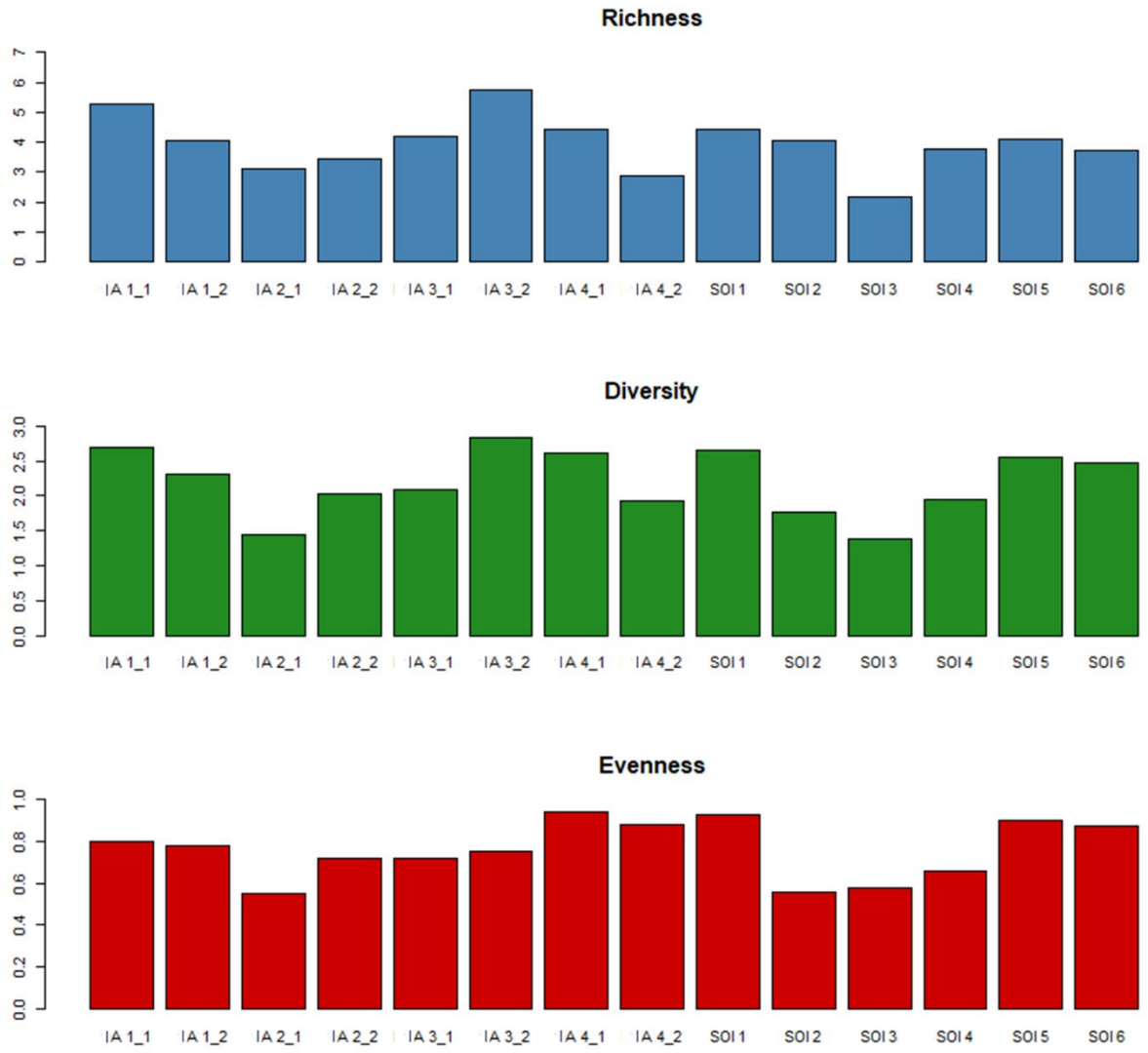



Figure 17: Richness (top) Diversity (middle) and Evenness (bottom) index values for each IA and SOI.

# 4 CMECS CLASSIFICATIONS

We applied CMECS to each grab site using the substrate and biotic component information collected. The substrate component was classified by a combination of the visual observations of the grab samples after they were brought aboard (Table 23) and the grain size composition from the sediment analysis (Section 3.2). Results are presented as a hierarchy in Table 24. IA 2, 3 and 4 contained slightly gravelly sand with either trace or sparse clam hash. IA 2 had slightly gravelly sand with sparse worm and clam hash at station 1 and fine sand at station 2. The SOIs contained fine sand with trace or sparse clam hash except for sites located near the northwest boundary of the lease area; SOI 5, 7, and 8. These sites

contained coarser sediments with large proportions of medium and/or coarse sand (Figure 18). No hard bottom or sensitive benthic habitats or taxa were sampled.

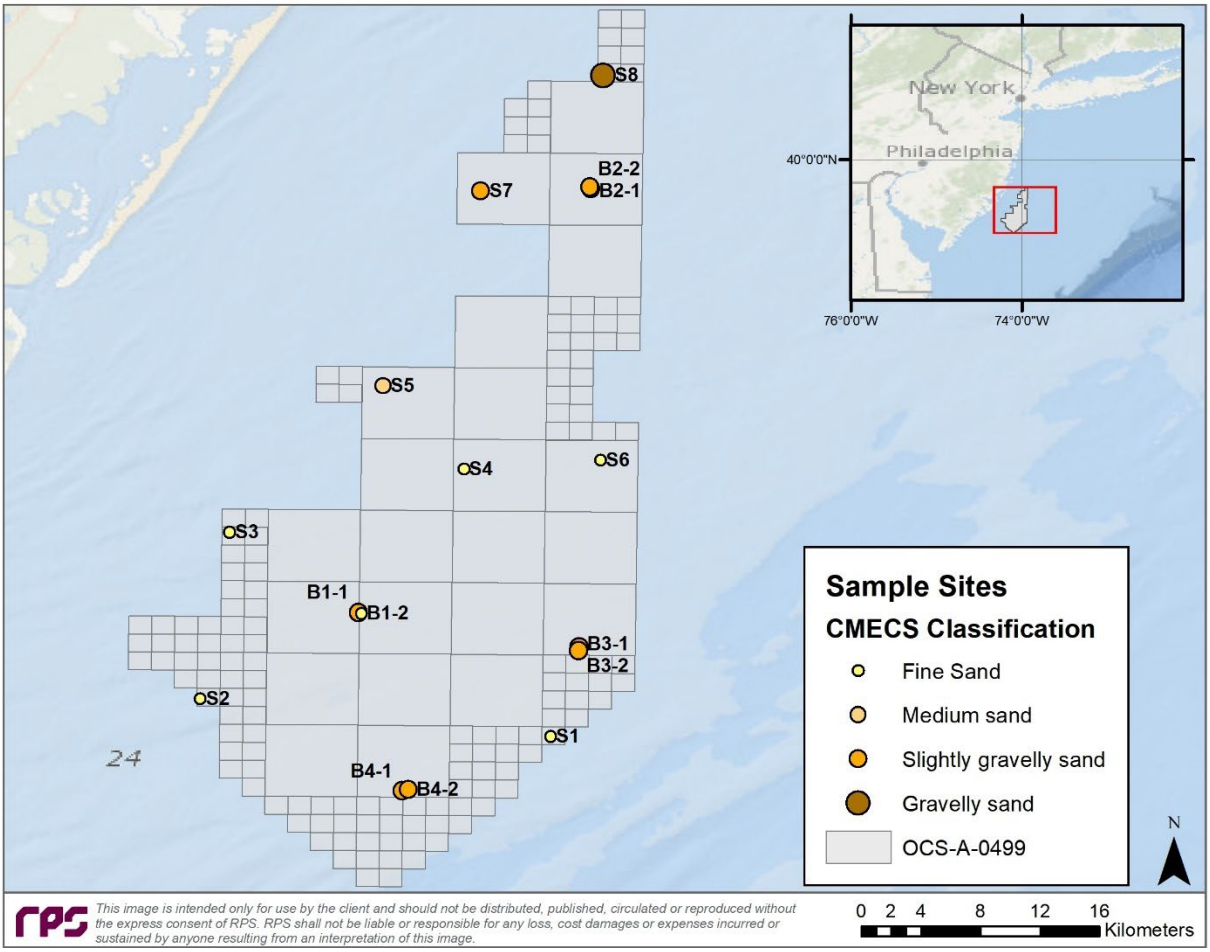
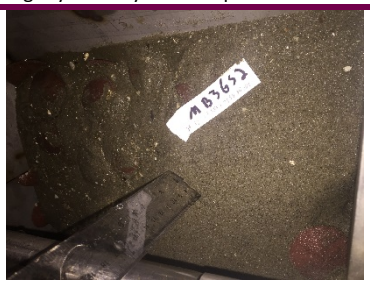
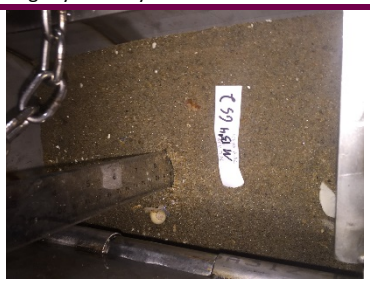


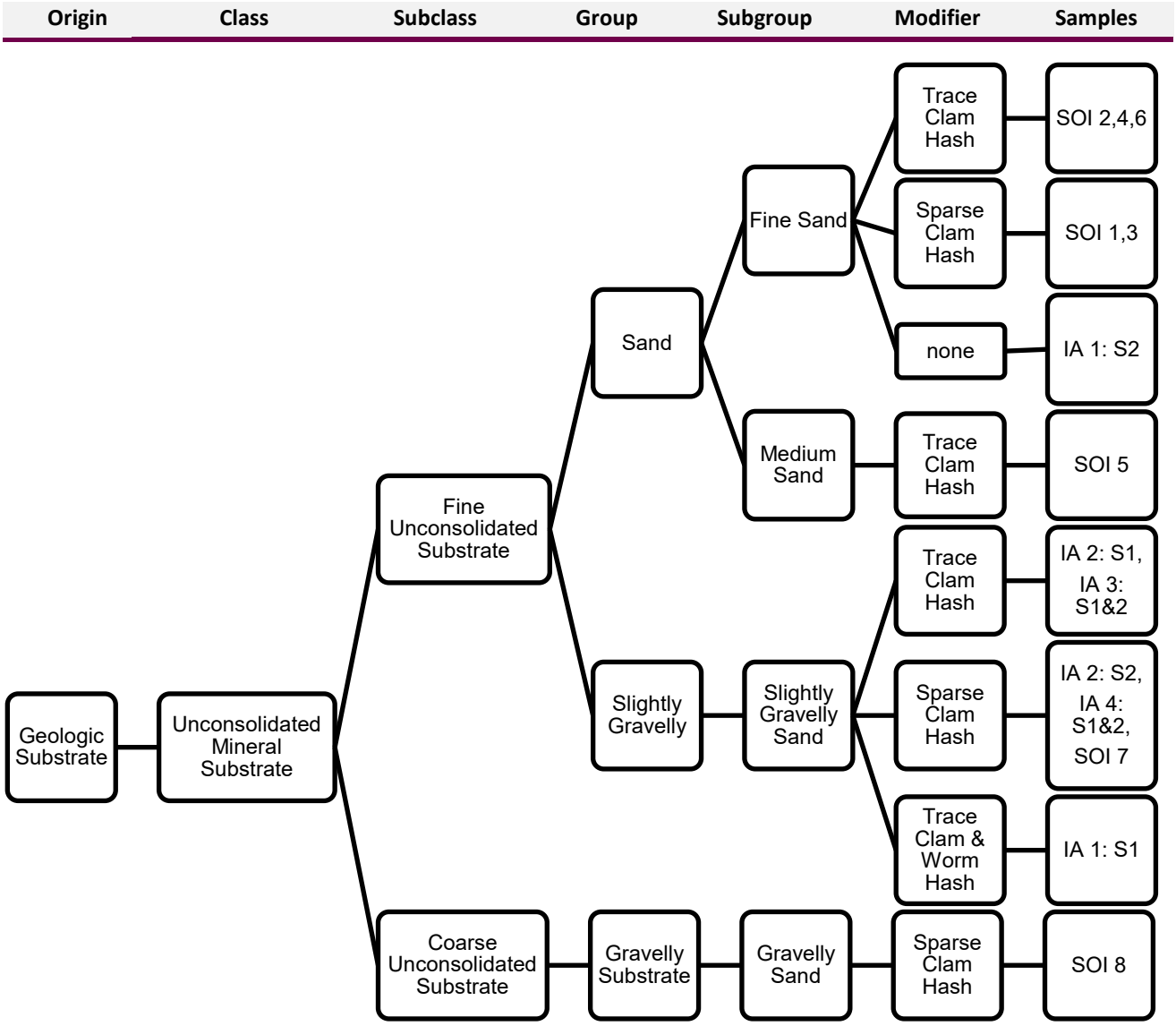

Figure 18: Substrate CMECS classifications by sample site. Note that “B” delineates buoy IAs (e.g., B3-2 is IA site 3 station 2) and “S” delineates SOIs.

Table 23: Images of grab samples prior to processing, along with CMECS classifications (Substrate & Biological modifier).

| IA or SOI | Station 1 | Station 2 |
|---|---|---|
| IA 1 |  Slightly Gravelly Sand & Sparse Worm and Clam Hash |  Fine Sand |
| IA 2 |  Slightly Gravelly Sand & Trace Clam Hash |  Slightly Gravelly Sand & Sparse Clam Hash |
| IA 3 |  Slightly Gravelly Sand & Trace Clam Hash |  Slightly Gravelly Sand & Trace Clam Hash |
| IA 4 |  Slightly Gravelly Sand & Sparse Clam Hash |  Slightly Gravelly Sand & Sparse Clam Hash |
| SOI 1 / SOI 2 |  Fine Sand & Sparse Clam Hash |  Fine Sand & Trace Clam Hash |

| IA or SOI | Station 1 | Station 2 |
|---|---|---|
| SOI 3 / SOI 4 |  Fine Sand & Sparse Clam Hash |  Fine Sand & Trace Clam Hash |
| SOI 5 / SOI 6 |  Medium Sand & Trace Clam Hash |  Fine Sand & Trace Clam Hash |
| SOI 7 / SOI 8 |  Slightly Gravelly Sand & Sparse Clam Hash |  Gravelly Sand & Sparse Clam Hash |

Table 24: CMECS hierarchical classification of substrates collected at each station (S) in each IA.



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# APPENDIX A
# FIELD DATASHEETS

video/grab datasheet

| date: 10 / 12 / 2019 | cruise: Atlantic Shores | samplers: JZ |
|---|---|---|

station: RL653 lat: 39 21.5007 start time: 15:15:00 file name:
depth: 21M long: -74 11.2525 end time: 15:19:30 $O_2$: 7.85 mg/L
YSI depth: 8.7ft YSI temp: 18.9 YSI pH: 8.9

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: Sandy, few small sand fragments

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 95 mm TOC/bio/sed ID# RL653 bio volume (inches high) 1.75
Sediment characterization: Sandy

station: MBA1651 lat: 39 18.603 start time: file name:
depth: 28.5m long: 74 6.5983 end time: 17:25 7.87 mg/L
YSI depth: 8.01ft YSI temp: 18.93 YSI pH: 8.91

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: GPS Feed froze for a while

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 72 mm TOC/bio/sed ID# MBA1651 bio volume (inches high) 1.75
Sediment characterization:

station: MBA1652 lat: 39 18.5498 start time: 17:47:02 file name:
depth: 28.7 long: 74 06.4631 end time: 17:48:10 7.87 mg/L
YSI depth: 18.13 YSI temp: 18.992 YSI pH: 8.91

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments:

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 82 mm TOC/bio/sed ID# bio volume (inches high) 1.75
Sediment characterization:

station: MBA3651 lat: 39 17.3568 start time: 19:18:23 file name:
depth: 34.7 long: -73 58.5943 end time: 19:19:40 7.89 mg/L
YSI depth: 11.87 YSI temp: 18.74 YSI pH: 8.95

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: some shell hash, 1 scallop shell

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 139 TOC/bio/sed ID# bio volume (inches high) 3
Sediment characterization:

video/grab datasheet

2

| date: 10 / 12 / 2019 | cruise: Atlantic Shores | samplers: JZ, Felipe |
|---|---|---|

station: MBA3652 lat: start time: 19:46 file name:
depth: 33.5 long: end time: 19:49
YSI depth: 12.47ft YSI temp: 18.643 YSI pH: 8.94 7.85mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: didn't close

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: TOC/bio/sed ID# bio volume (inches high)
Sediment characterization:

---

station: MBA3652 lat: 39 17.2256 start time: 20:05:31 file name:
depth: 33.5 long: 73 58.6107 end time: 20:06
YSI depth: 12.47ft YSI temp: 18.643 YSI pH: 8.94 7.85mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: Sand dollars + Longfin Inshore Squid (photo + release)

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 76 TOC/bio/sed ID# bio volume (inches high) 1.75
Sediment characterization:

---

station: RL651 lat: 39 14.1066 start time: 21:13 file name:
depth: 30 long: 73 59.6160 end time: 21:14:26
YSI depth: 14.06 YSI temp: 18.748 YSI pH: 8.95 7.96mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: Failed 1st attempt, relowered

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 73 TOC/bio/sed ID# bio volume (inches high) 2.5"
Sediment characterization:

---

station: MBA4651 lat: 39 12.1396 start time: 22:05 file name:
depth: 26 long: 74 5.0065 end time: 22:35
YSI depth: 11.6ft YSI temp: 18.703 YSI pH: 8.94 8.03mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: some shell hash, some sand dollars

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 90 TOC/bio/sed ID# bio volume (inches high) 2
Sediment characterization:

# video/grab datasheet

| date: 10 / 12 / 2019 | cruise: Atlantic Shores | samplers: JZ / Edgar |
|---|---|---|

station: MBA 9 652 lat: 39 12.1881 start time: 23:01 file name:
depth: 25.5 long: 74 4.7886 end time: 23:03
YSI depth: 14.6 YSI temp: 18.209 YSI pH: 8.96 8.02 mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, (sand), sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: Some shell hash

**Grab** Failed Y / (N) | >50% Full (Y) / N | <100% Full (Y) / N | Undisturbed Surface (Y) / N
Pen. depth: 85 TOC/bio/sed ID# bio volume (inches high) 2"
Sediment characterization:

---

station: RL652 lat: 39 15.4624 start time: 00:38 file name:
depth: 26 long: 74 12.3109 end time: 00:40
YSI depth: 9.3 ft YSI temp: 18.551 YSI pH: 8.04 7.81 mg/L

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: Sand dollars

**Grab** Failed Y / (N) | >50% Full (Y) / N | <100% Full (Y) / N | Undisturbed Surface (Y) / N
Pen. depth: 91 TOC/bio/sed ID# bio volume (inches high) 2.5
Sediment characterization:

---

station: lat: start time: file name:
depth: long: end time:
YSI depth: YSI temp: YSI pH:

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments:

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: TOC/bio/sed ID# bio volume (inches high)
Sediment characterization:

---

station: lat: start time: file name:
depth: long: end time:
YSI depth: YSI temp: YSI pH:

| | |
|---|---|
| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments:

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: TOC/bio/sed ID# bio volume (inches high)
Sediment characterization:

# video/grab datasheet

| date: 10 / 13 / 2019 | cruise: Atlantic Shores | samplers: JZ, Felipe |
|---|---|---|

station: MBA2651 lat: 39.33,9308 start time: 10:08 file name:
depth: 25 long: 73 58.1656 end time: 10:06
YSI depth: 8.91 YSI temp: 18.962 YSI pH: 8.78 7.86 mg/L

rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg
gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs

comments: Some gravel, 1 sand dollar

**Grab** Failed Y / (N) | >50% Full (Y) / N | <100% Full (Y) / N | Undisturbed Surface (Y) / N
Pen. depth: 51 TOC/bio/sed ID# bio volume (inches high)
Sediment characterization:

---

station: MBA2652 lat: 39 33.9907 start time: file name:
depth: 25 long: 73 58.1989 end time: 10:35
YSI depth: 5.46 YSI temp: 18.987 YSI pH: 8.90 7.87 mg/L

rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg
gravel, gravel mix, gravelly, slightly gravelly, (sand) sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs

comments: Some shells, sandy

**Grab** Failed Y / (N) | >50% Full (Y) / N | <100% Full (Y) / N | Undisturbed Surface (Y) / N
Pen. depth: 91 TOC/bio/sed ID# bio volume (inches high) 3.5
Sediment characterization:

---

station: RL656 lat: 39 24.1021 start time: file name:
depth: 28 long: 73 57.8608 end time: 12:39
YSI depth: 11.45 YSI temp: 18.706 YSI pH: 8.97 7.88 mg/L

rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg
gravel, gravel mix, gravelly, slightly gravelly, (sand), sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs

comments: Ocean quahog

**Grab** Failed Y / (N) | >50% Full (Y) / N | <100% Full (Y) / N | Undisturbed Surface (Y) / N
Pen. depth: 92 TOC/bio/sed ID# bio volume (inches high) 3
Sediment characterization:

---

station: RL654 lat: 39 23.7891 start time: file name:
depth: 26 long: 74 21.7639 end time: 13:43
YSI depth: 8.11 ft YSI temp: 18.825 YSI pH: 9.04 7.69 mg/L

rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg
gravel, gravel mix, gravelly, slightly gravelly, (sand), sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs

comments: Urchin, some shell hash some clay deposits / clumps?

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 95 TOC/bio/sed ID# bio volume (inches high) 2.5
Sediment characterization:

# video/grab datasheet

| date: 10 / 13 / 2019 | cruise: Atlantic Shores | samplers: |
|---|---|---|

station: RL655 lat: 39 26.7896 start time: file name:
depth: 21 long: 74 5.6972 end time: 14:43
YSI depth: 14.32 ft YSI temp: 18.645 YSI pH: 8.98 7.90 mg/L

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments:

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 115 mm TOC/bio/sed ID# bio volume (inches high) 2.5
Sediment characterization:

---

station: RL657 lat: 39 33.8481 start time: 16:46 file name:
depth: 24 long: 74 8.1521 end time: 16:48
YSI depth: 8.97 YSI temp: 18.697 YSI pH: 8.90 7.79 mg/L

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: failed dx

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 118 TOC/bio/sed ID# bio volume (inches high) No Bio Sample
Sediment characterization:

---

station: RL658 lat: 39 38.0361 start time: file name:
depth: 26 long: 73 57.7192 end time: 18:07
YSI depth: 5.2 YSI temp: 18.454 YSI pH: 8.87 8.15 mg/L

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments: small worm tubes some gravel

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: 85 TOC/bio/sed ID# bio volume (inches high) No Bio Sample
Sediment characterization:

---

station: lat: start time: file name:
depth: long: end time:
YSI depth: YSI temp: YSI pH:

| rock, **unconsolidated mineral**, algal, coral, organic, ooze, shell, worm | flat sand and mud, sand waves, biogenic xtures, shell aggreg |
|---|---|
| gravel, gravel mix, gravelly, slightly gravelly, sand, sandy mud, mud | pebble-cobble, p-c w sponge, buried/disp boulders, piled bldrs |

comments:

**Grab** Failed Y / N | >50% Full Y / N | <100% Full Y / N | Undisturbed Surface Y / N
Pen. depth: TOC/bio/sed ID# bio volume (inches high)
Sediment characterization:

# APPENDIX B
# PHOTOMICROSCOPY IMAGES

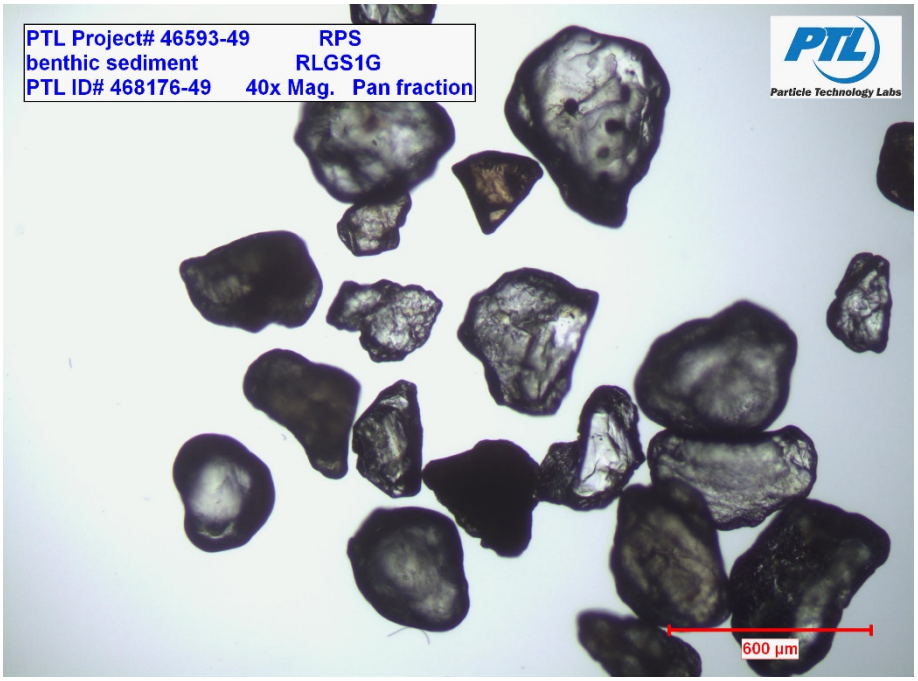


Figure B- 1. Photomicrograph (1 of 2) of sediment sample from SOI 1 taken at 40x magnification.

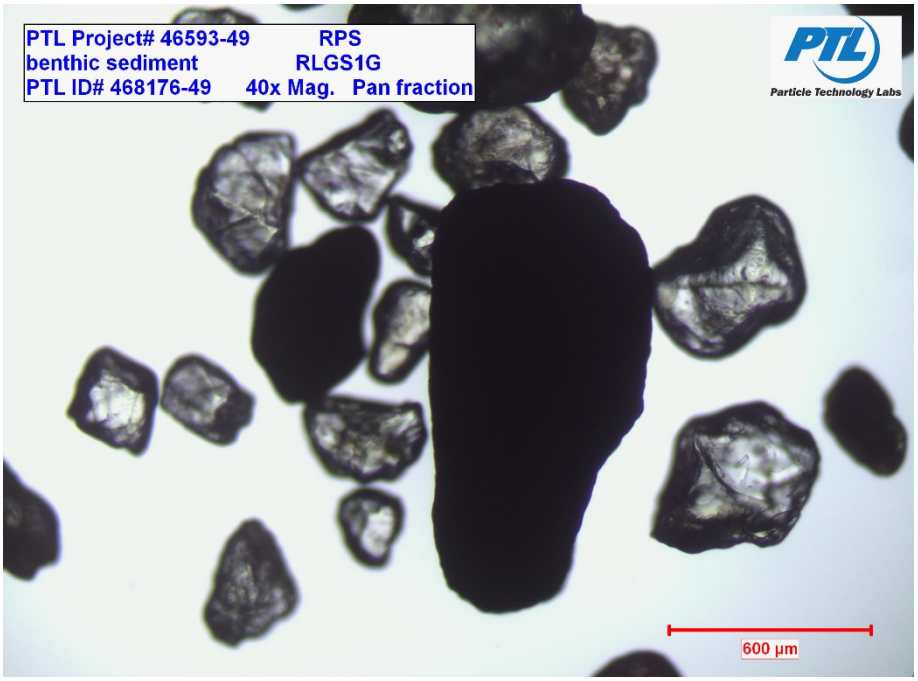


Figure B- 2. Photomicrograph (2 of 2) of sediment sample from SOI 1 taken at 40x magnification.

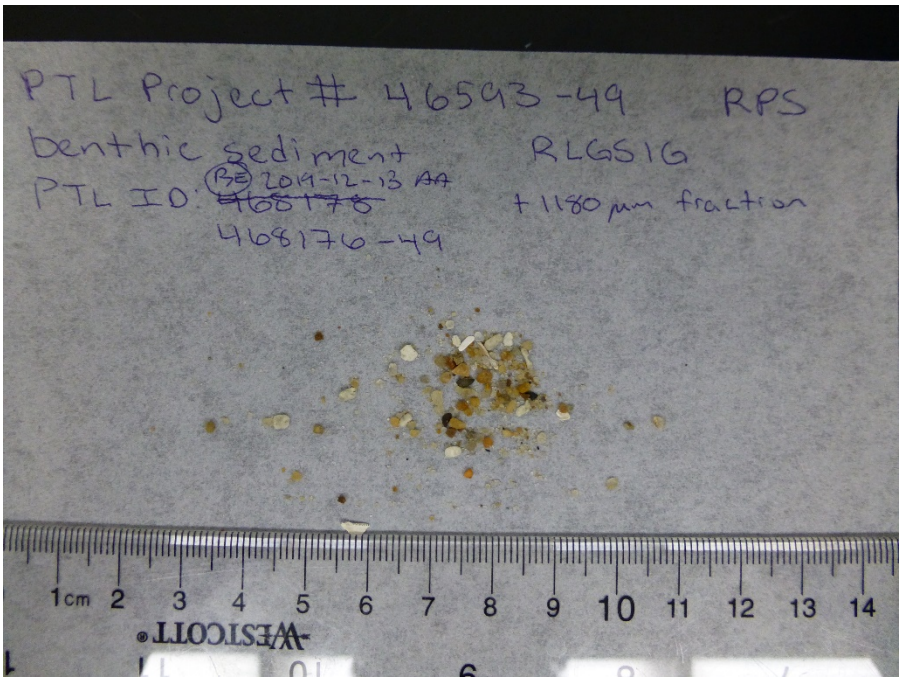

Figure B- 3. Photo of 1180 µm fraction of sediment sample from SOI 1.

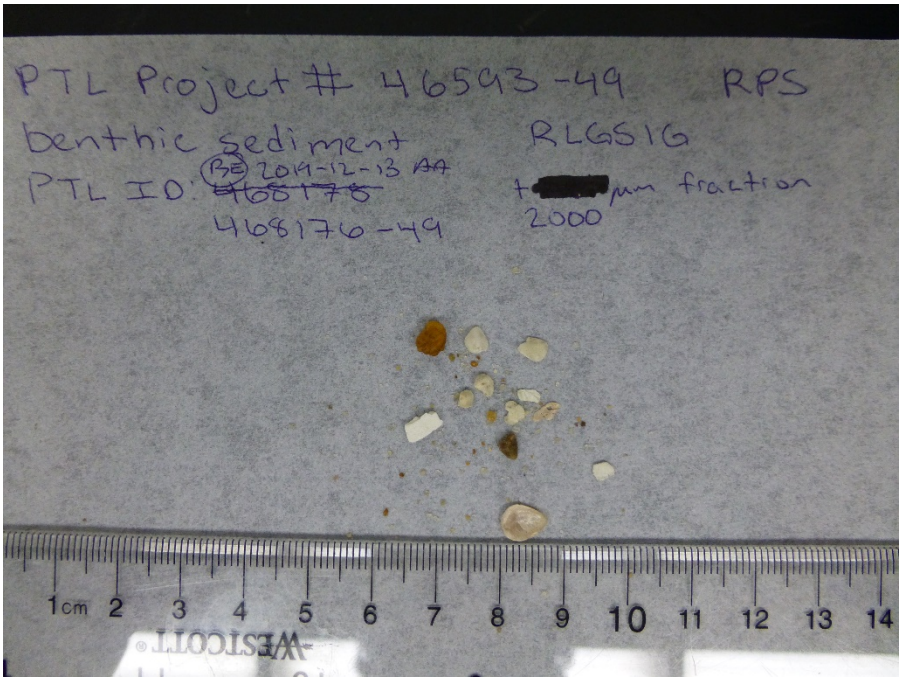

Figure B- 4. Photo of 2000 µm fraction of sediment sample from SOI 1.

Figure B- 5. Photomicrograph (1 of 2) of sediment sample from SOI 2 taken at 40x magnification.

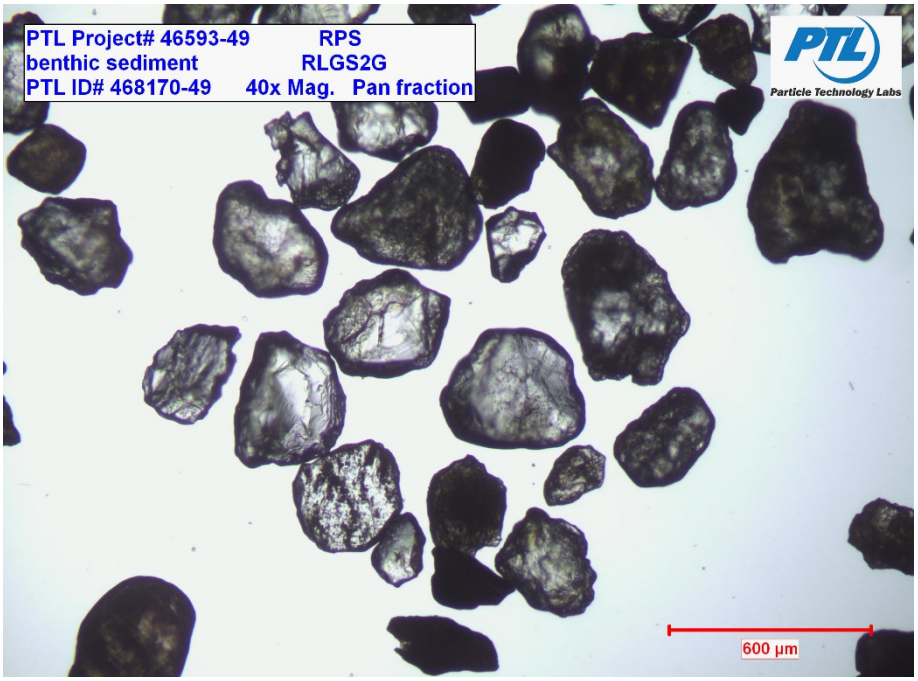

Figure B- 6. Photomicrograph (2 of 2) of sediment sample from SOI 2 taken at 40x magnification.

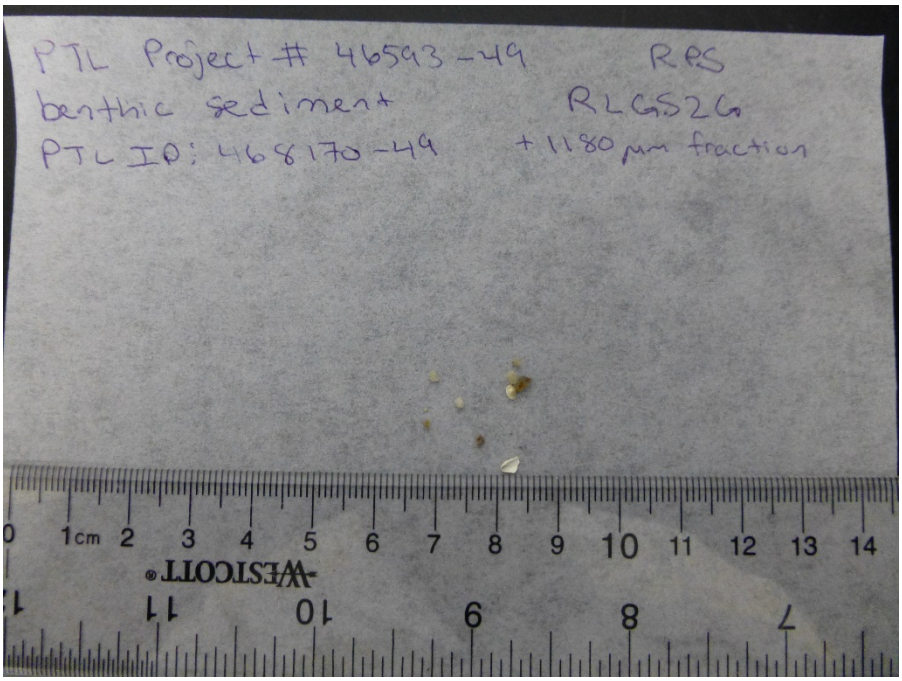

Figure B- 7. Photo of 1180 µm fraction of sediment sample from SOI 2.

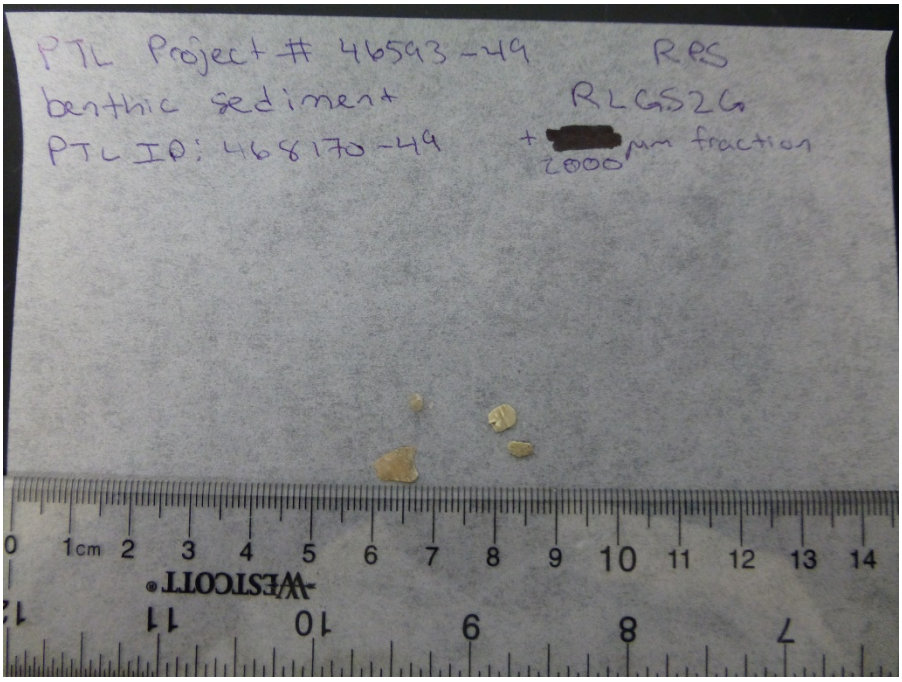

Figure B- 8. Photo of 2000 µm fraction of sediment sample from SOI 2.

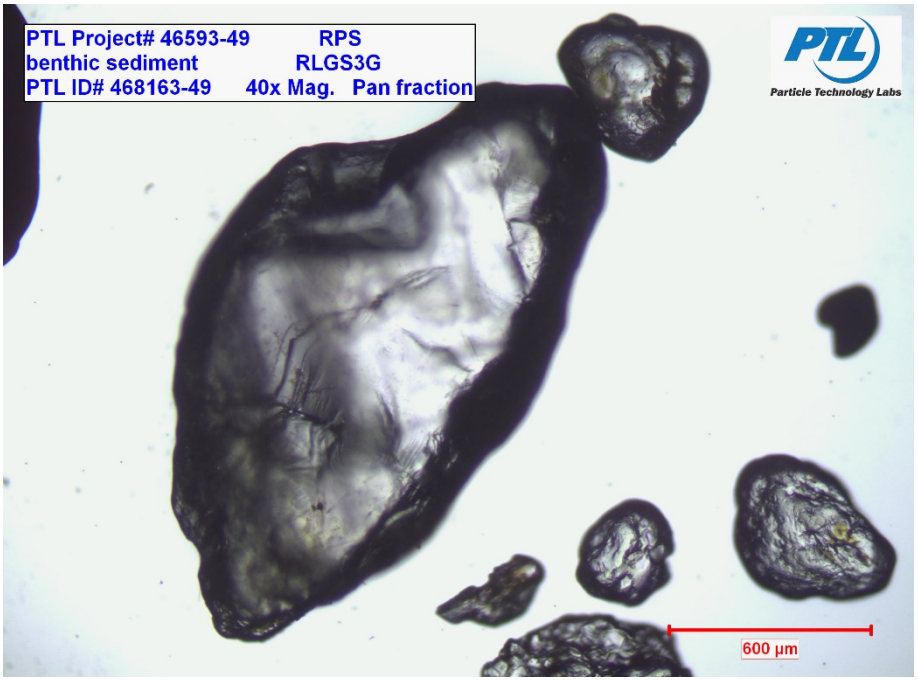


Figure B- 9. Photomicrograph (1 of 2) of sediment sample from SOI 3 taken at 40x magnification


Figure B- 10. Photomicrograph (2 of 2) of sediment sample from SOI 3 taken at 40x magnification.

Figure B- 11. Photo of 1180 µm fraction of sediment sample from SOI 3.

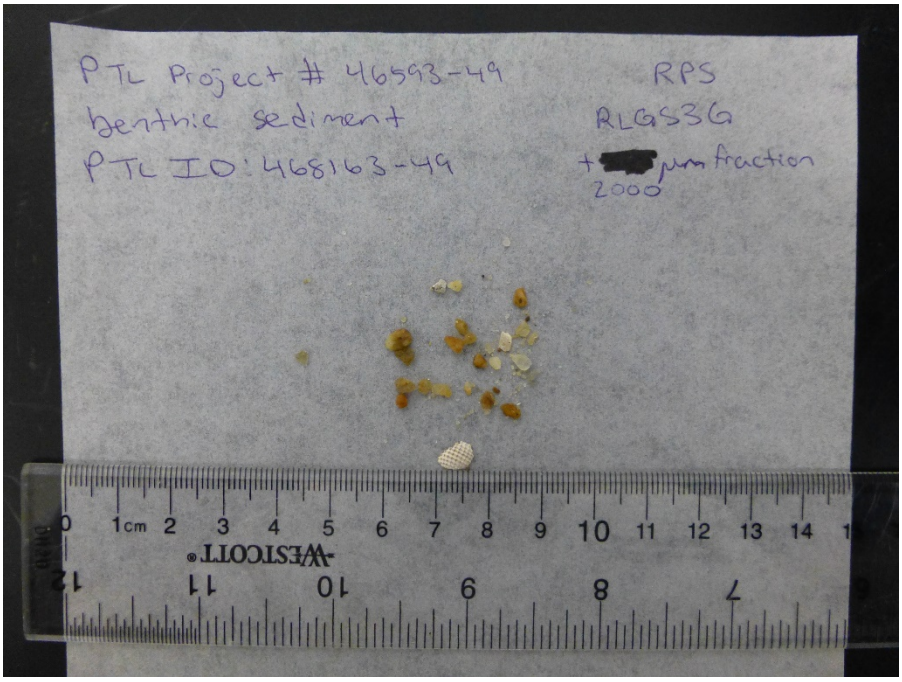

Figure B- 12. Photo of 2000 µm fraction of sediment sample from SOI 3.

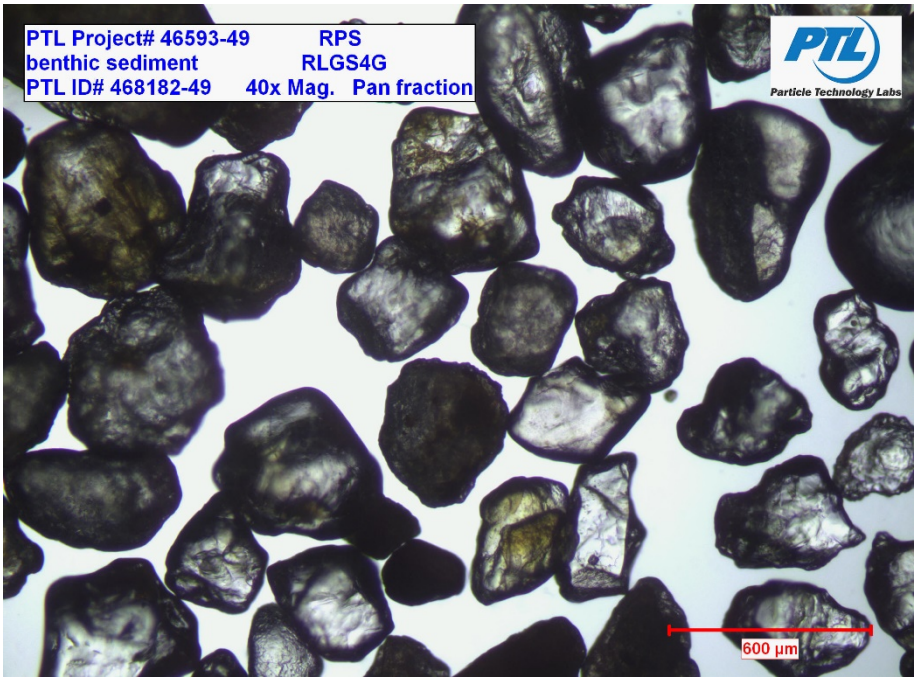

Figure B- 13. Photomicrograph (1 of 2) of sediment sample from SOI 4 taken at 40x magnification.

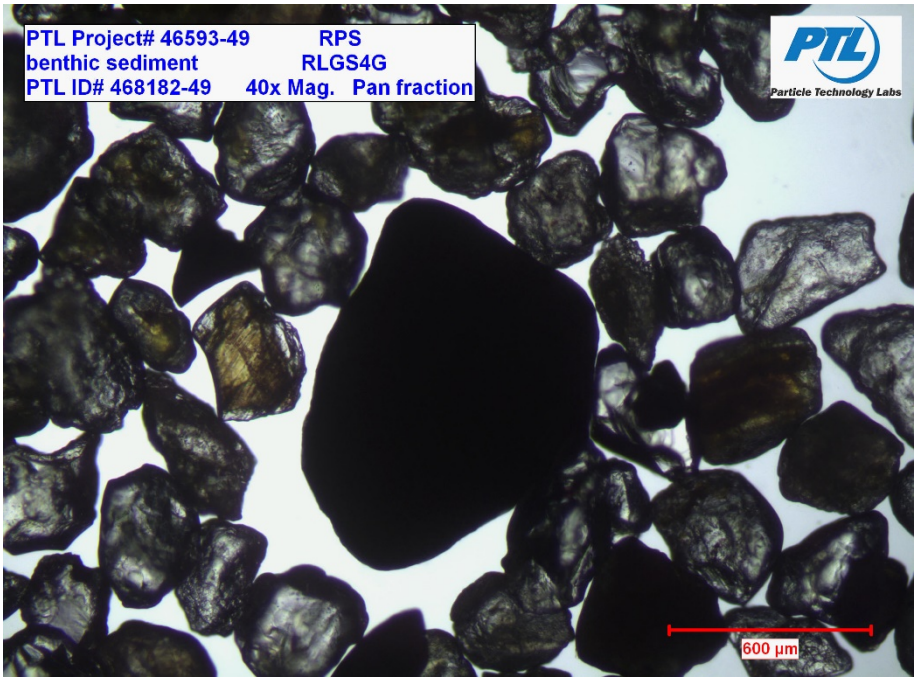

Figure B- 14. Photomicrograph (2 of 2) of sediment sample from SOI 4 taken at 40x magnification.

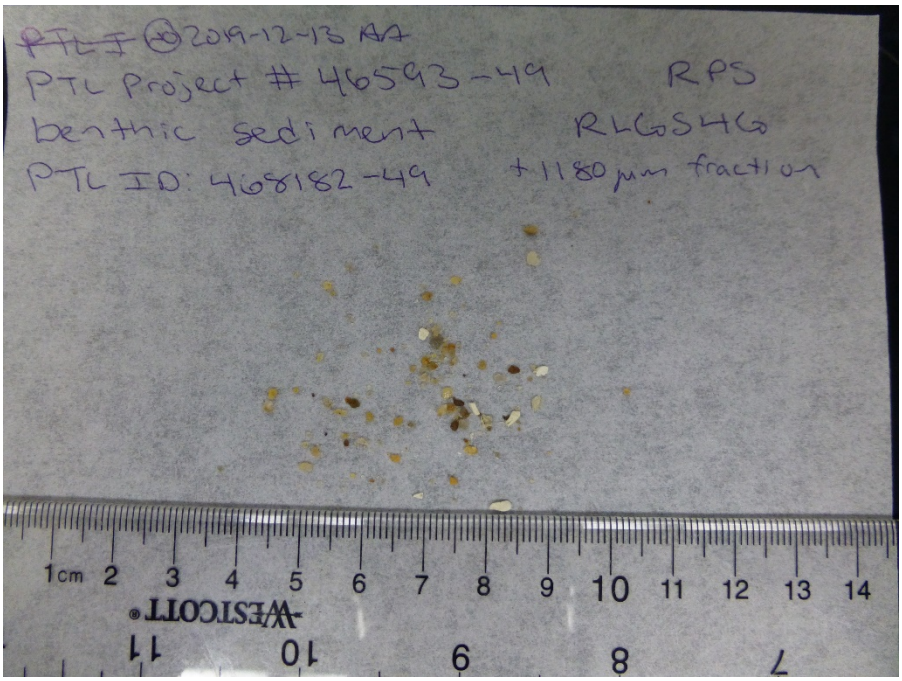

Figure B- 15. Photo of 1180 µm fraction of sediment sample from SOI 4.

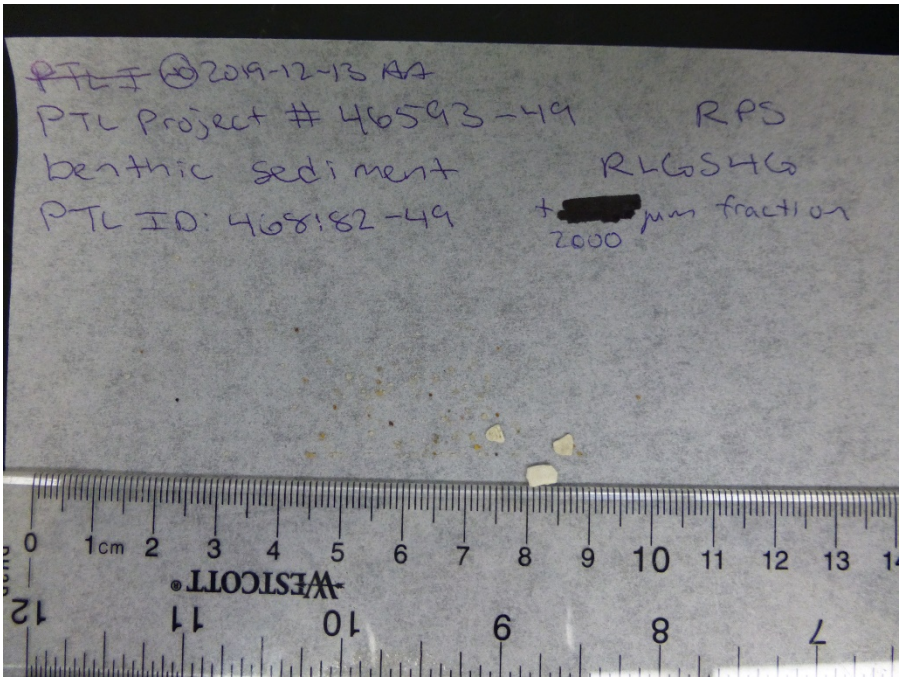

Figure B- 16. Photo of 2000 µm fraction of sediment sample from SOI 4.

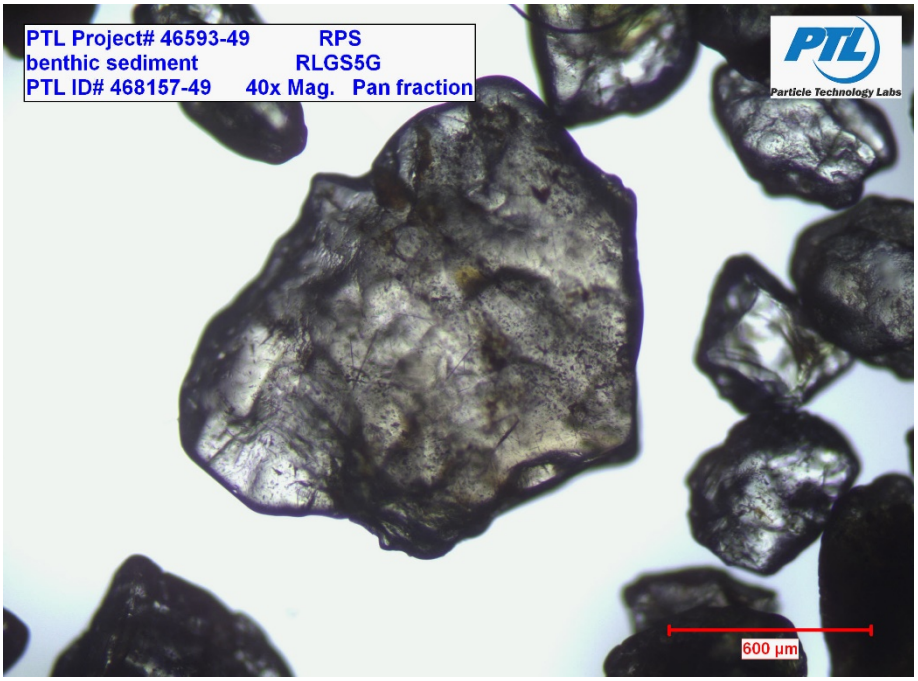

Figure B- 17. Photomicrograph (1 of 2) of sediment sample from SOI 5 taken at 40x magnification.

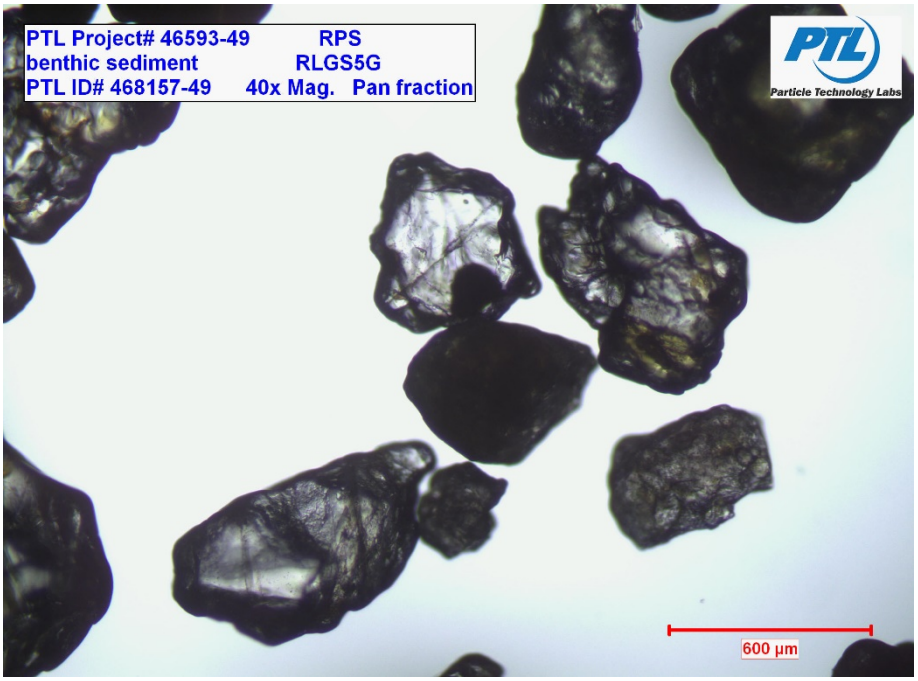

Figure B- 18. Photomicrograph (2 of 2) of sediment sample from SOI 5 taken at 40x magnification.

Figure B- 19. Photo of 1180 µm fraction of sediment sample from SOI 5.

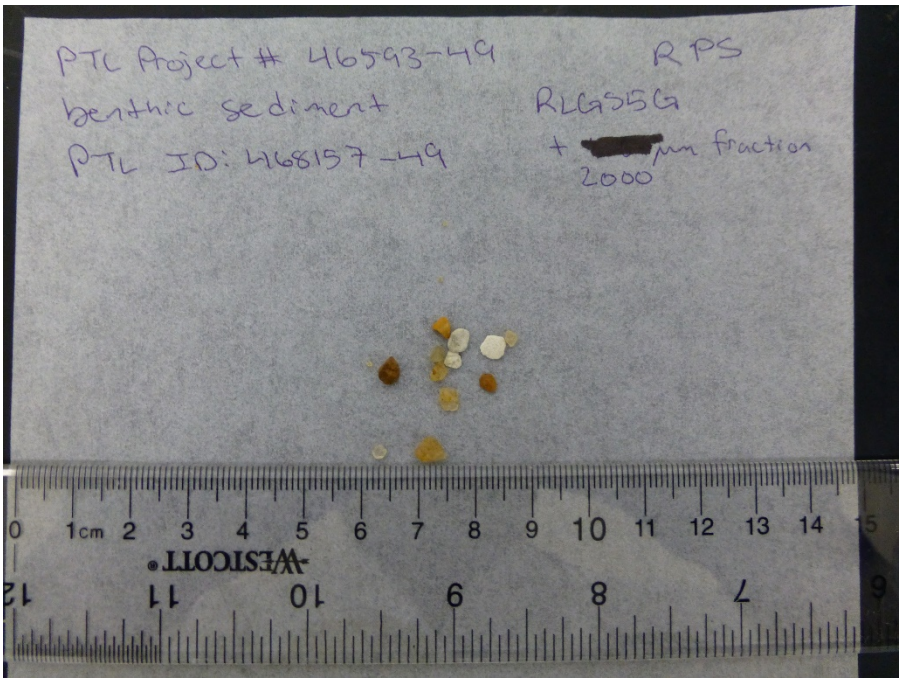

Figure B- 20. Photo of 2000 µm fraction of sediment sample from SOI 5.

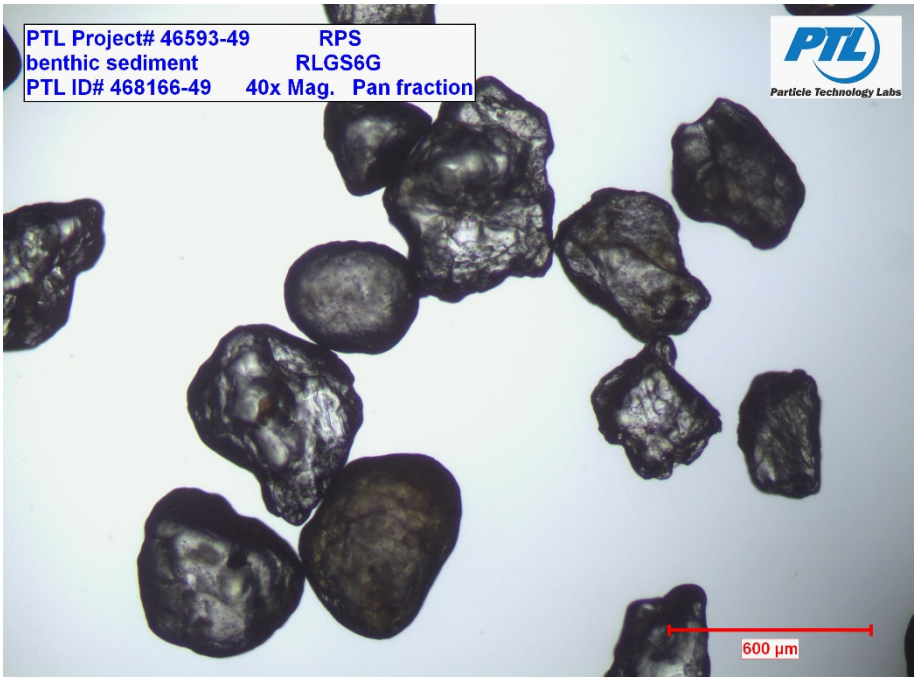


Figure B- 21. Photomicrograph (1 of 2) of sediment sample from SOI 6 taken at 40x magnification.

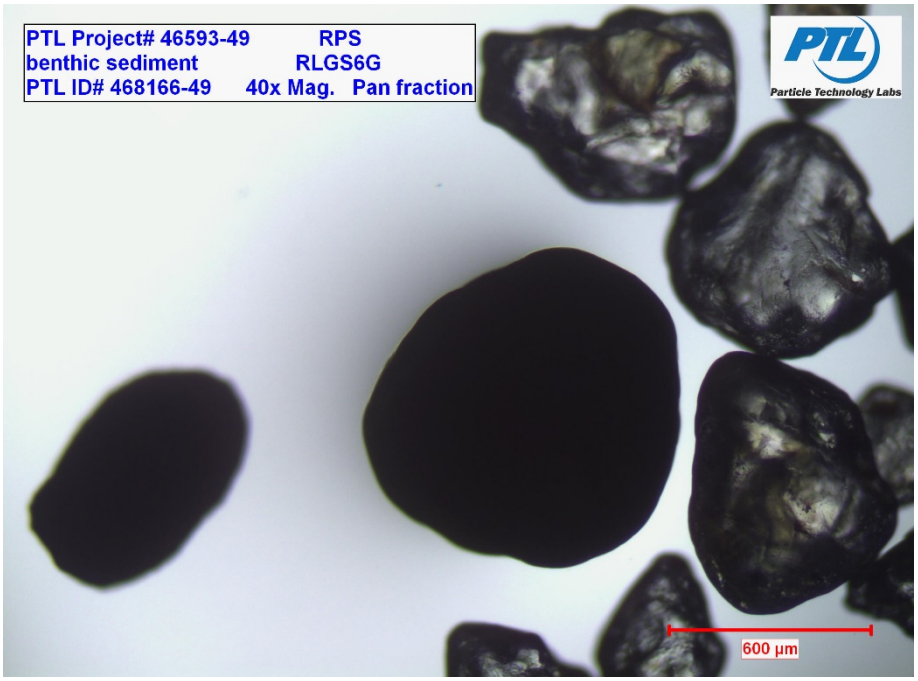


Figure B- 22. Photomicrograph (2 of 2) of sediment sample from SOI 6 taken at 40x magnification.

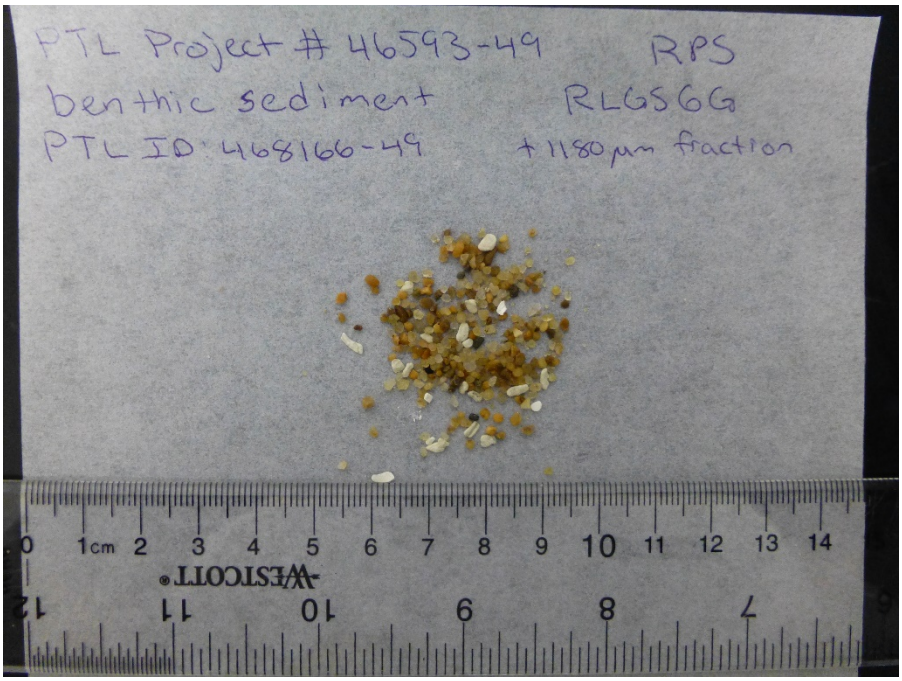

Figure B- 23. Photo of 1180 µm fraction of sediment sample from SOI 6.

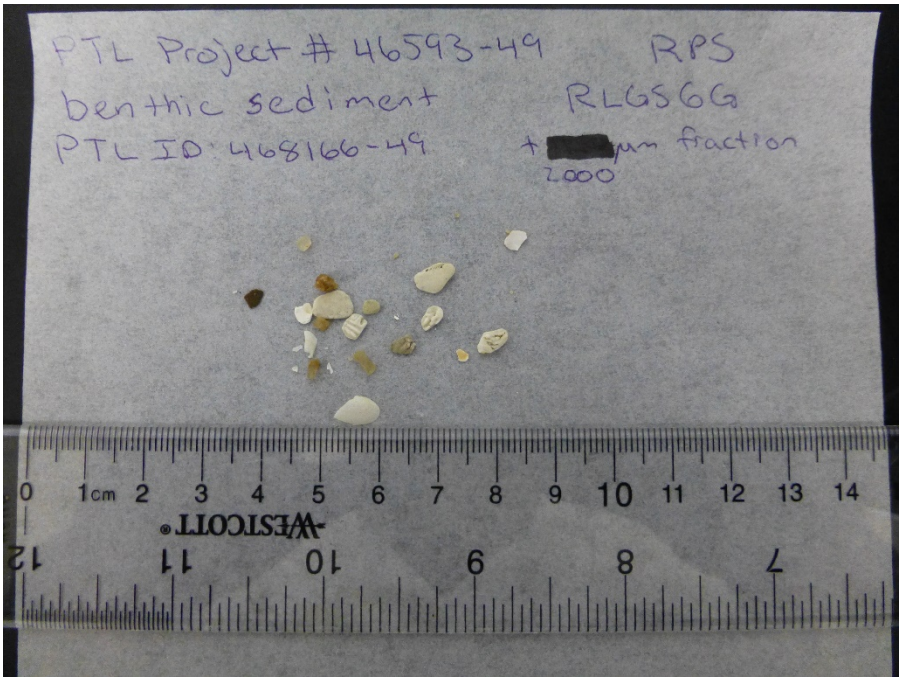

Figure B- 24. Photo of 2000 µm fraction of sediment sample from SOI 6.

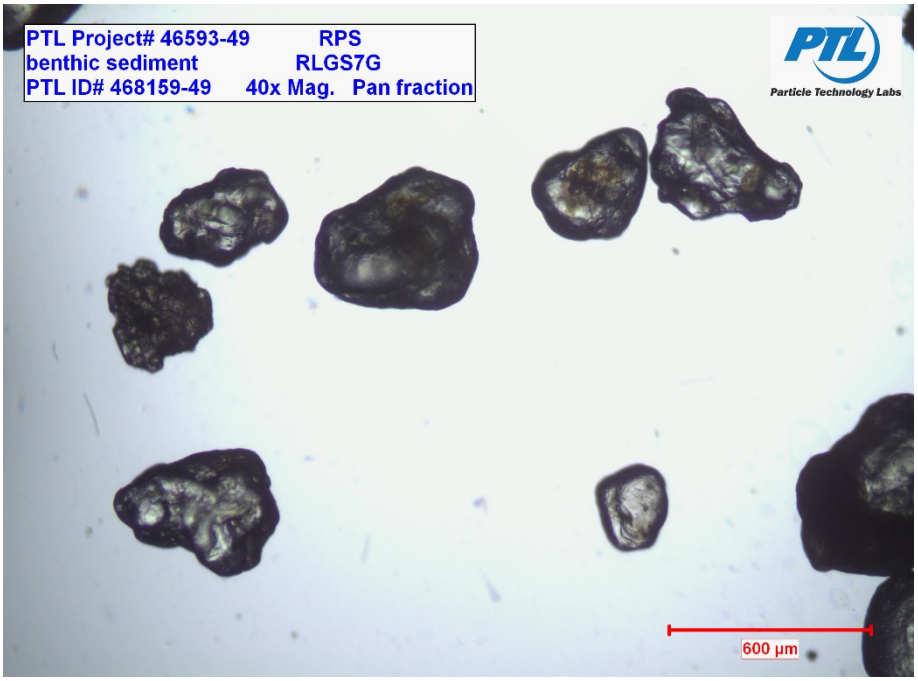


Figure B- 25. Photomicrograph (1 of 2) of sediment sample from SOI 7 taken at 40x magnification.

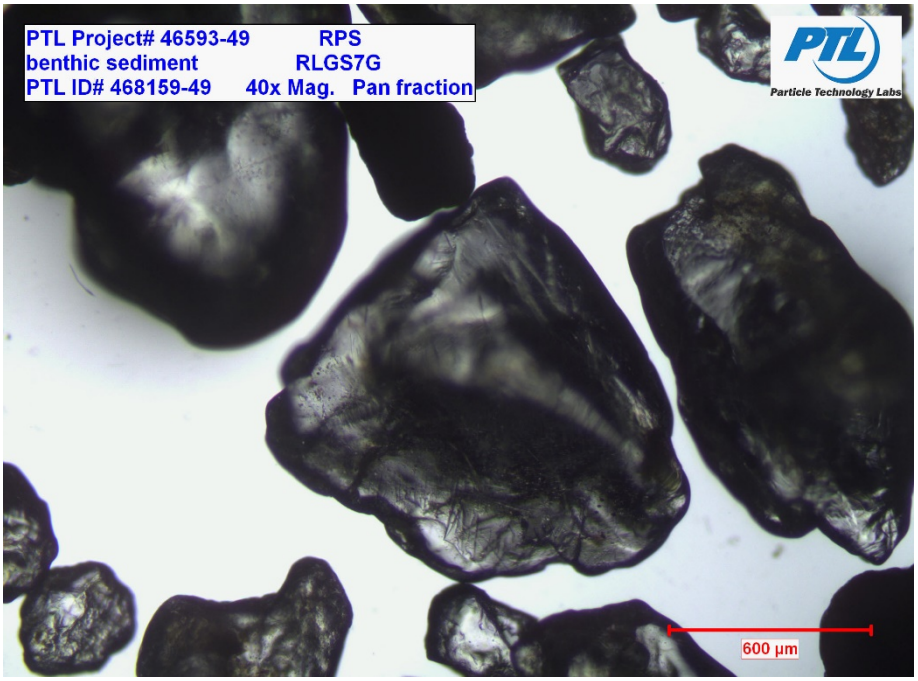


Figure B- 26. Photomicrograph (2 of 2) of sediment sample from SOI 7 taken at 40x magnification.

Figure B- 27. Photo of 1180 µm fraction of sediment sample from SOI 7.

Figure B- 28. Photo of 2000 µm fraction of sediment sample from SOI 7.

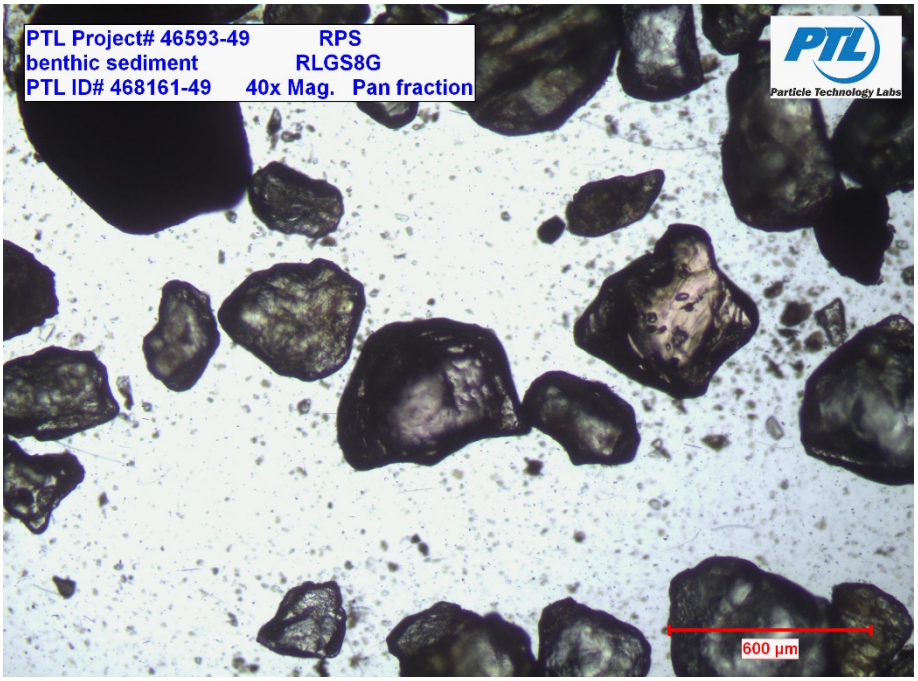


Figure B- 29. Photomicrograph (1 of 2) of sediment sample from SOI 8 taken at 40x magnification.

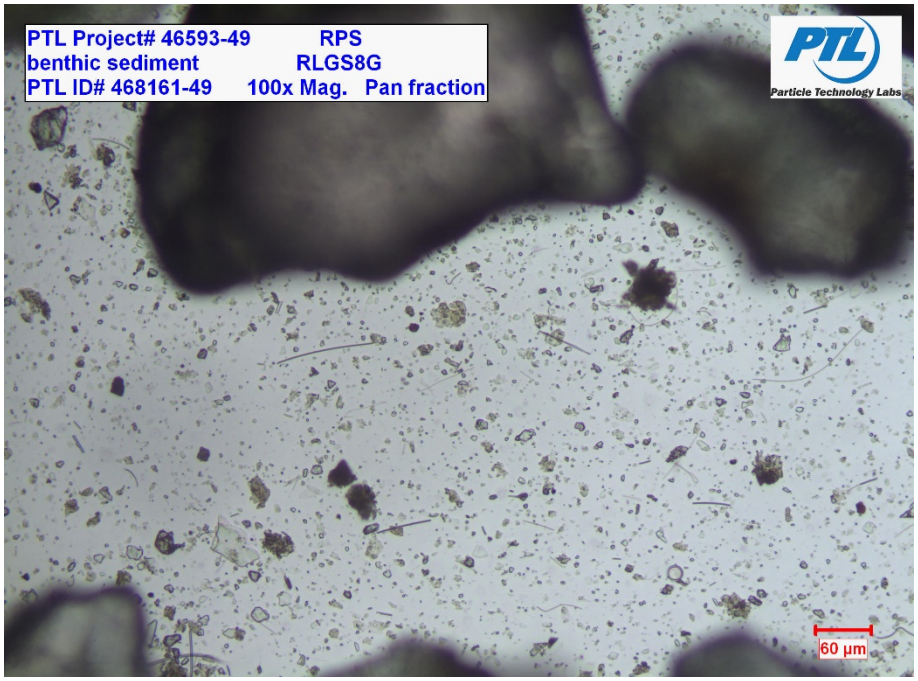


Figure B- 30. Photomicrograph (2 of 2) of sediment sample from SOI 8 taken at 100x magnification.

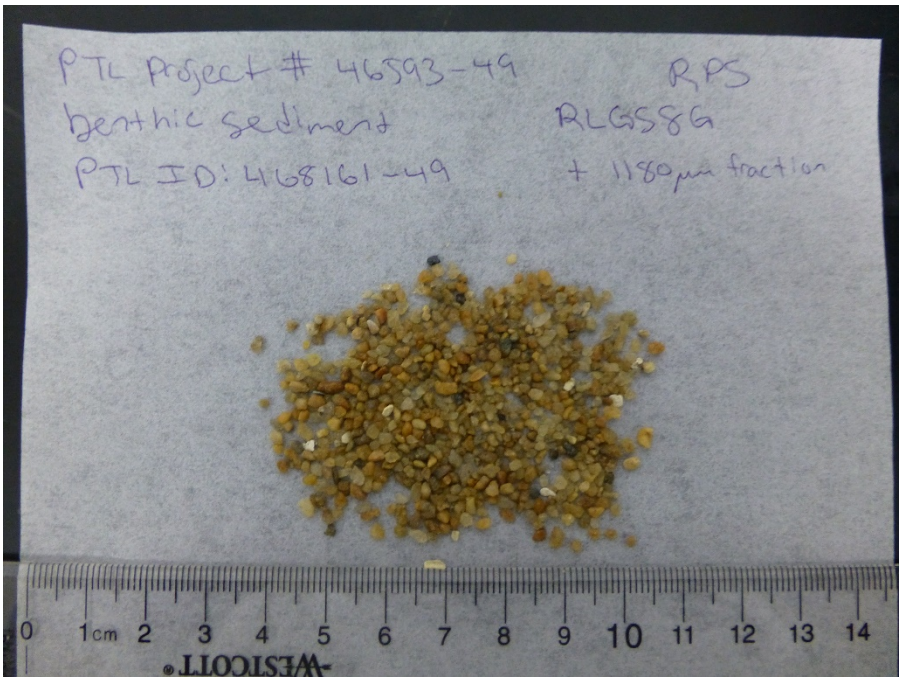

Figure B- 31. Photo of 1180 µm fraction of sediment sample from SOI 8.

Figure B- 32. Photo of 2000 µm fraction of sediment sample from SOI 8.

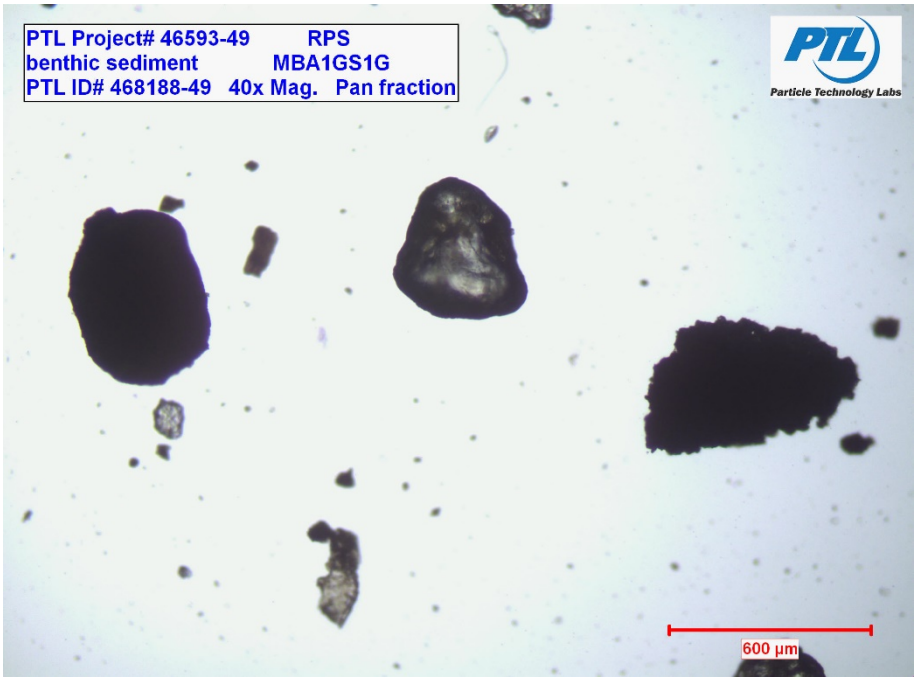


Figure B- 33. Photomicrograph (1 of 2) of sediment sample from grab 1 of 2 from IA 1 taken at 40x magnification.

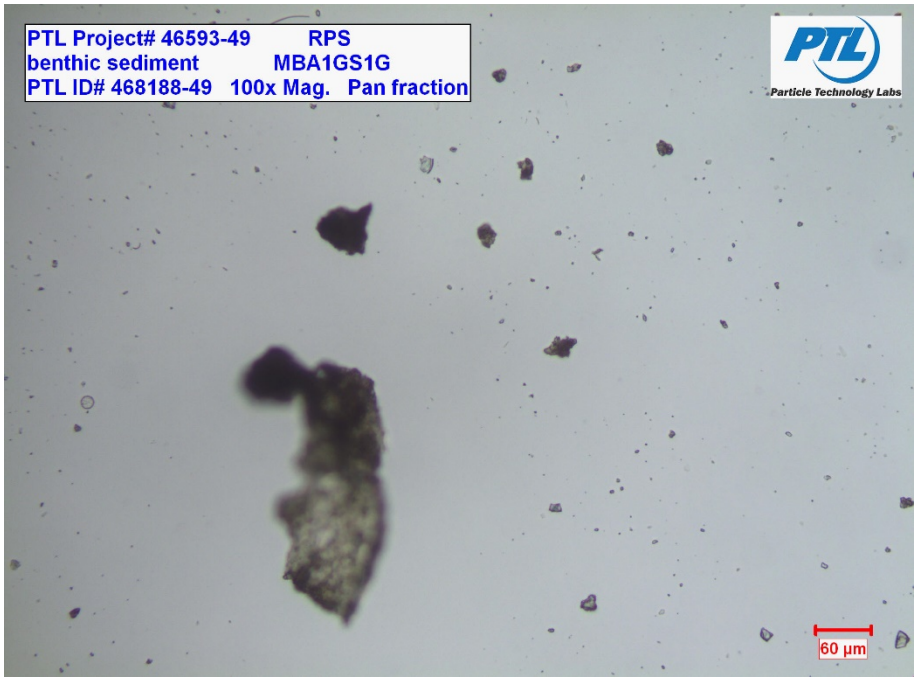


Figure B- 34. Photomicrograph (2 of 2) of sediment sample from grab 1 of 2 from IA 1 taken at 100x magnification.


Figure B- 35. Photo of 1180 µm fraction of sediment grab 1 of 2 from IA 1.

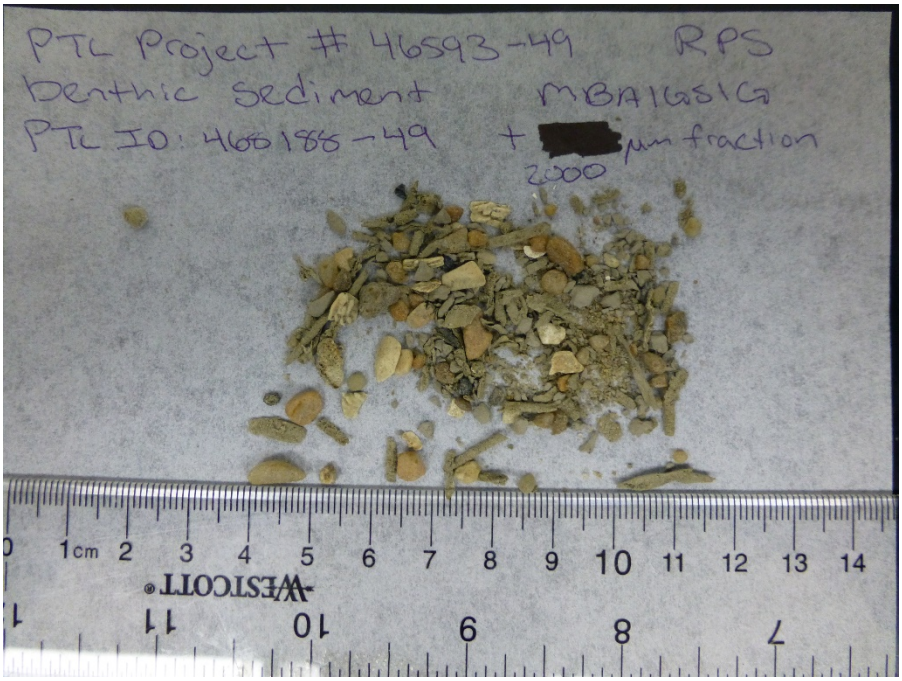


Figure B- 36. Photo of 2000 µm fraction of sediment grab 1 of 2 from IA 1.

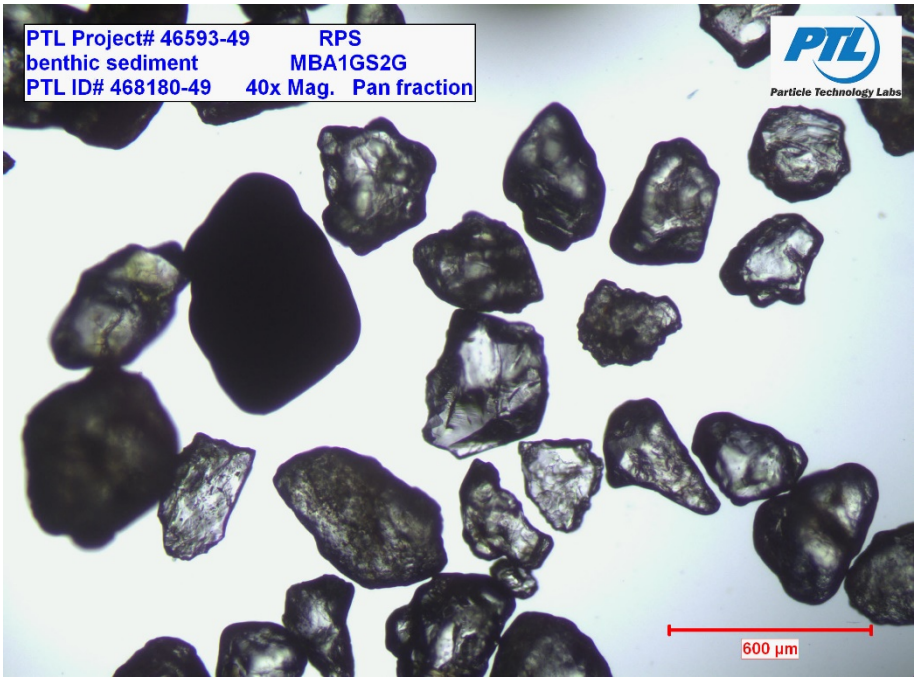

Figure B- 37. Photomicrograph (1 of 2) of sediment grab 2 of 2 from IA 1 taken at 40X magnification.

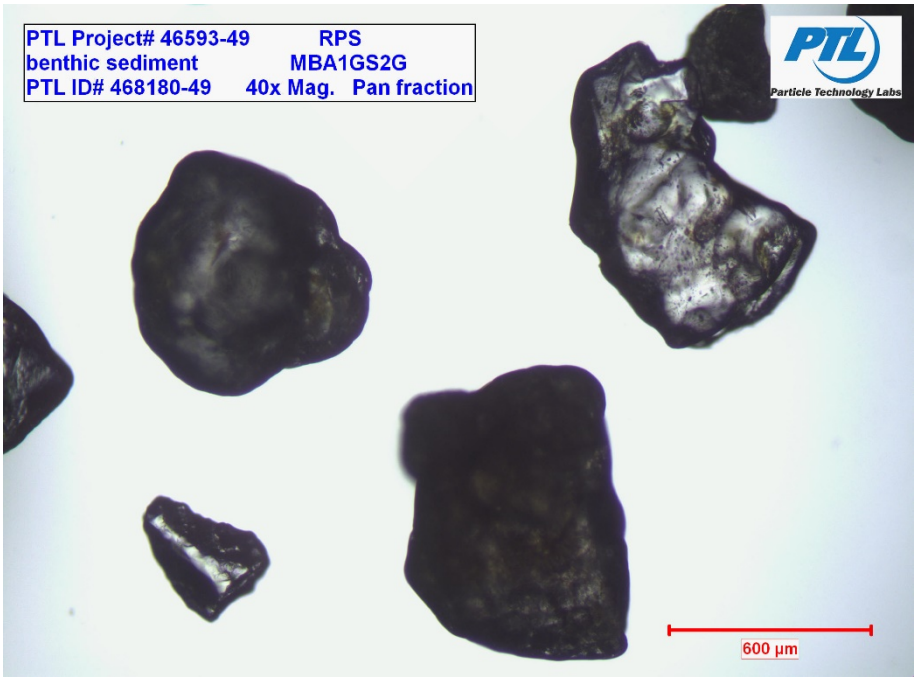

Figure B- 38. Photomicrograph (2 of 2) of sediment grab 2 of 2 from IA 1 taken at 100X magnification.

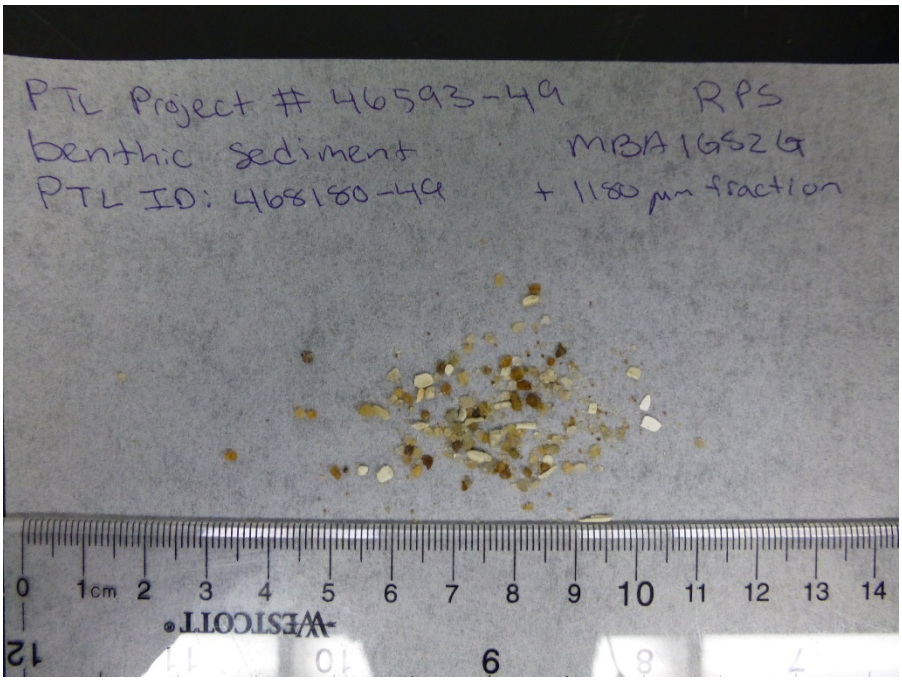

Figure B- 39. Photo of 1180 µm fraction of sediment grab 2 of 2 from IA 1.

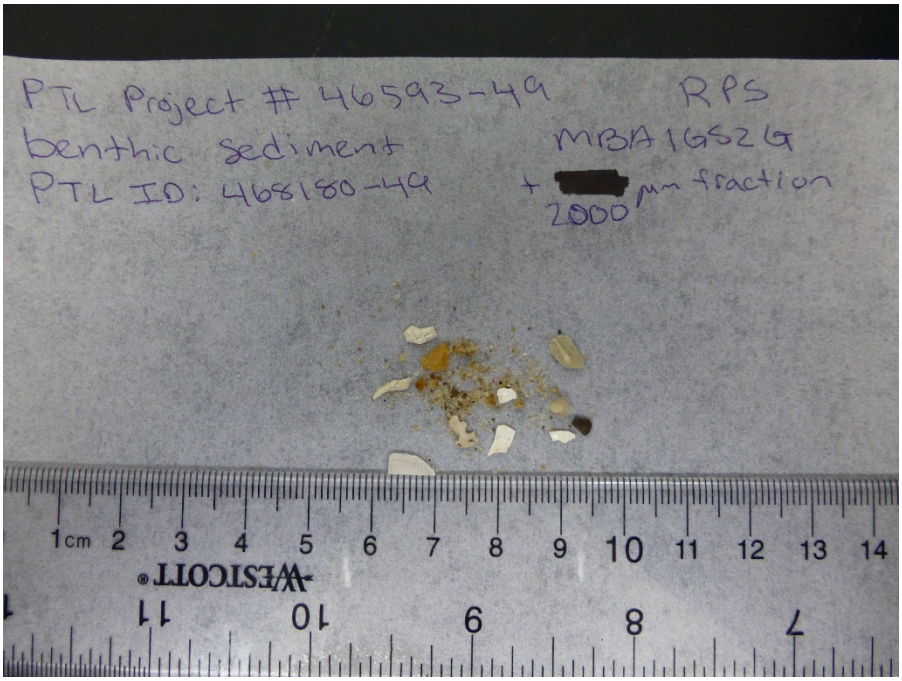

Figure B- 40. Photo of 2000 µm fraction of sediment grab 2 of 2 from IA 1.

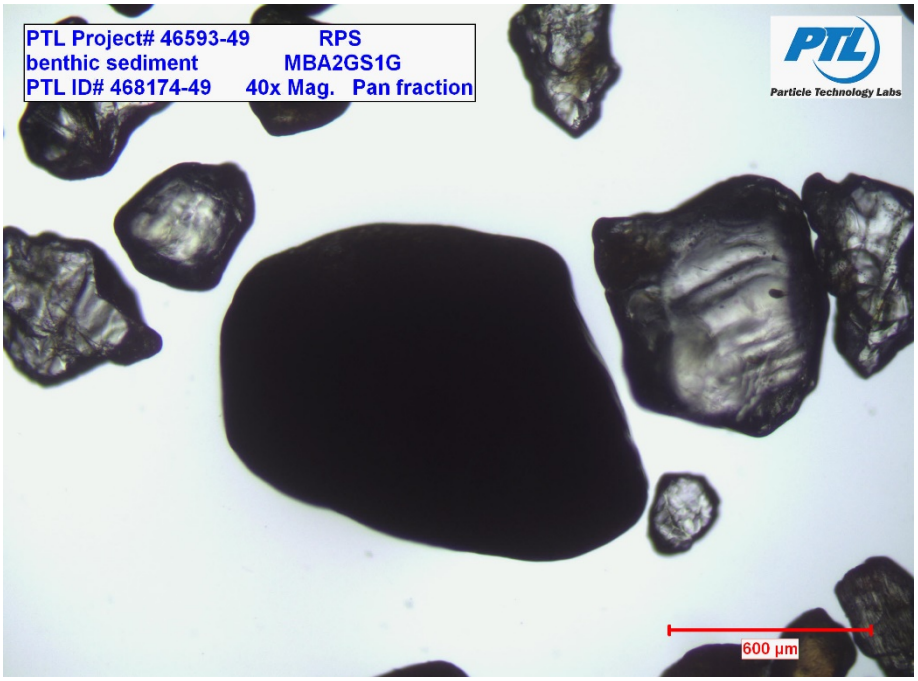


Figure B- 41. Photomicrograph (1 of 2) of sediment grab 1 of 2 from IA 2 taken at 40x magnification.

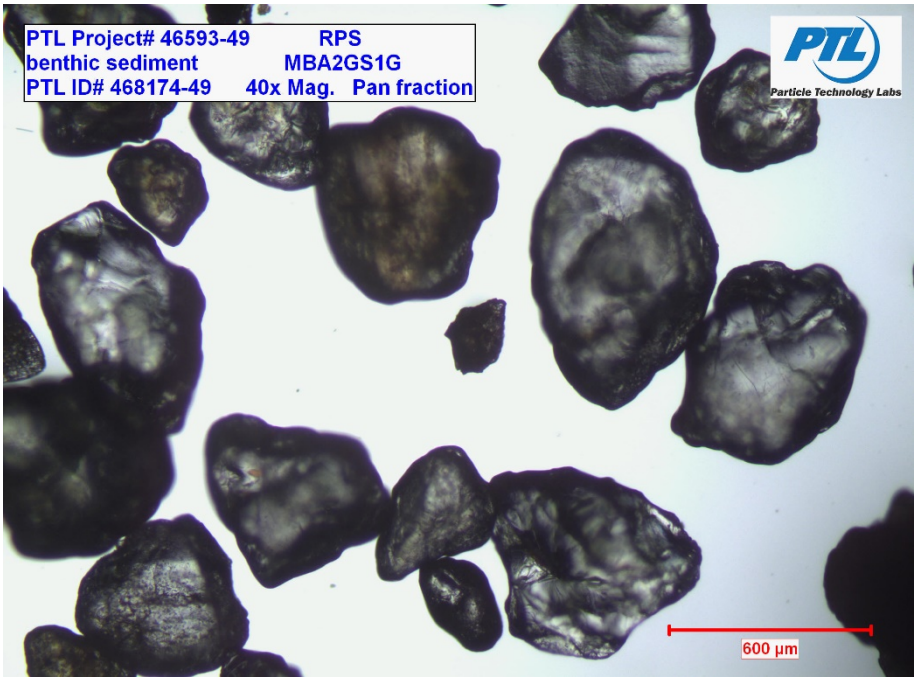


Figure B- 42. Photomicrograph (2 of 2) of sediment grab 1 of 2 from IA 2 taken at 40x magnification.


Figure B- 43. Photo of 1180 µm fraction of sediment grab 1 of 2 at IA 2.

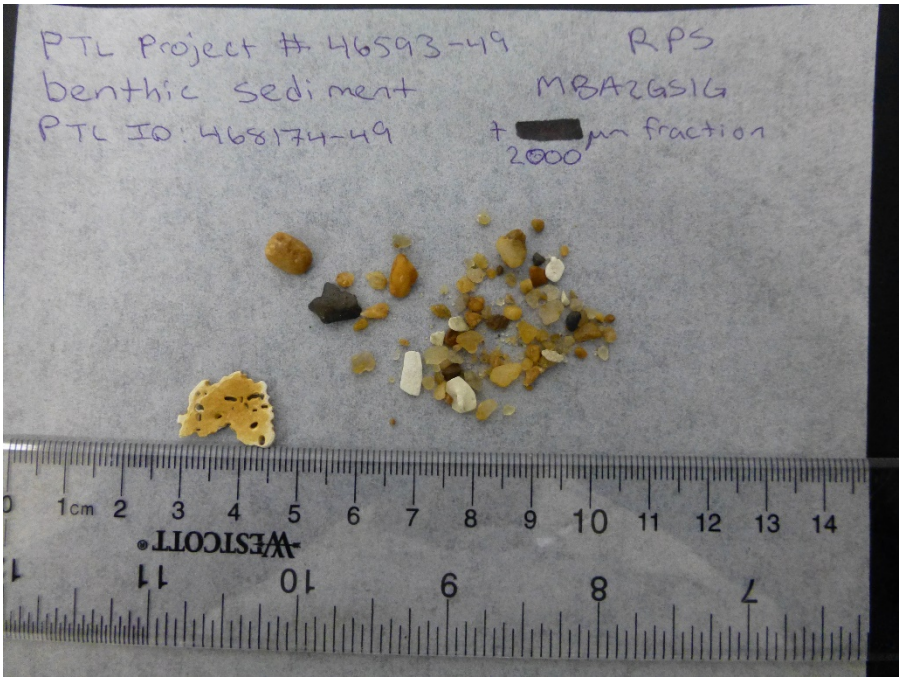


Figure B- 44. Photo of 2000 µm fraction of sediment grab 1 of 2 at IA 2.

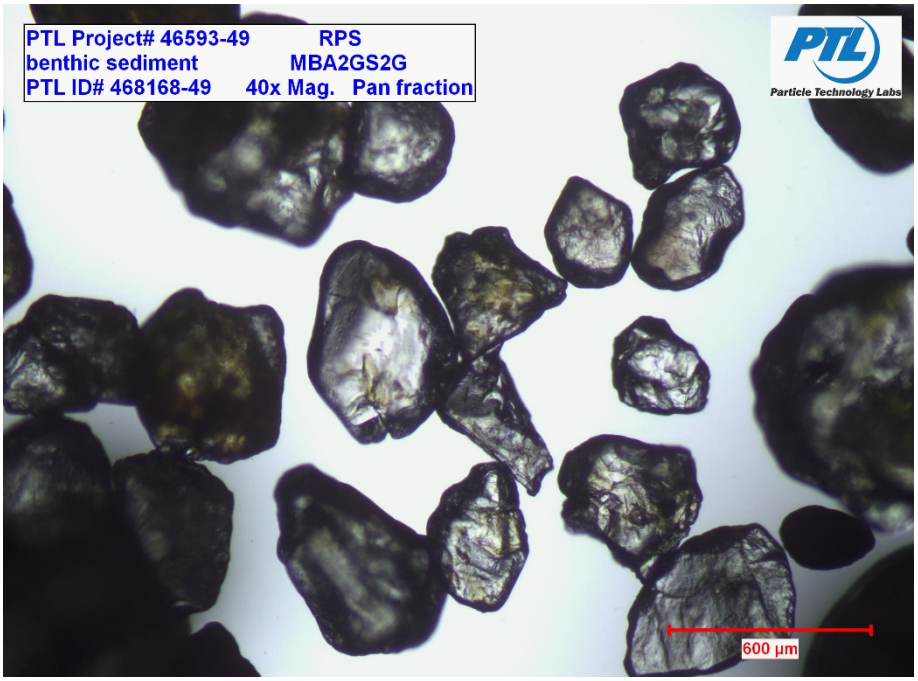

Figure B- 45. Photomicrograph (1 of 2) of sediment from grab 2 of 2 at IA 2 taken at 40x magnification.

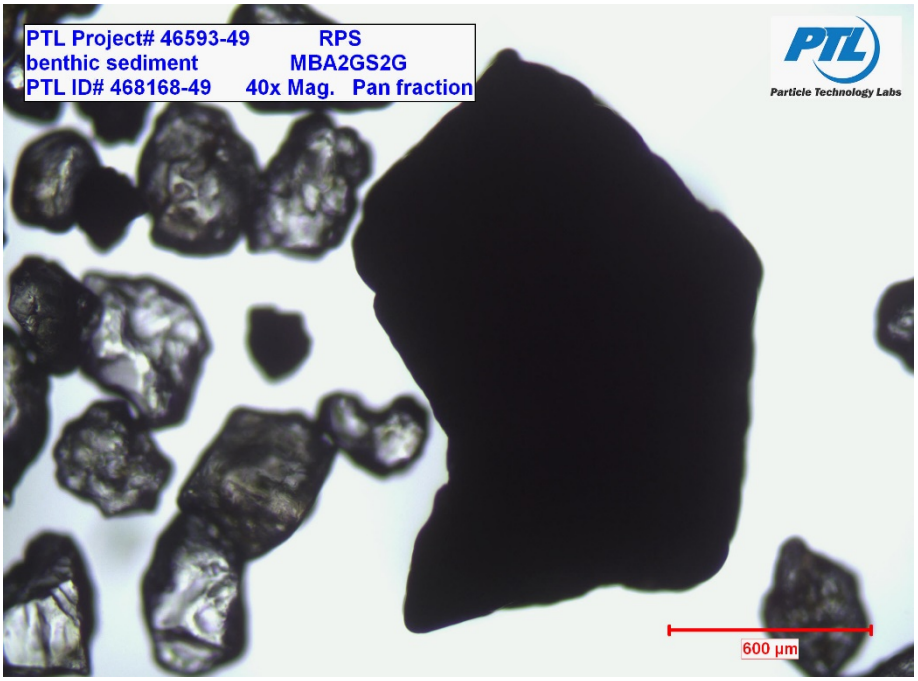

Figure B- 46. Photomicrograph (2 of 2) of sediment from grab 2 of 2 at IA 2 taken at 40x magnification.


Figure B- 47. Photo of 1180 µm fraction of sediment from grab 2 of 2 at IA 2.


Figure B- 48. Photo of 2000 µm fraction of sediment from grab 2 of 2 at IA 2.


Figure B- 49. Photomicrograph (1 of 2) of sediment from grab 1 of 2 at IA 3 taken at 40x magnification

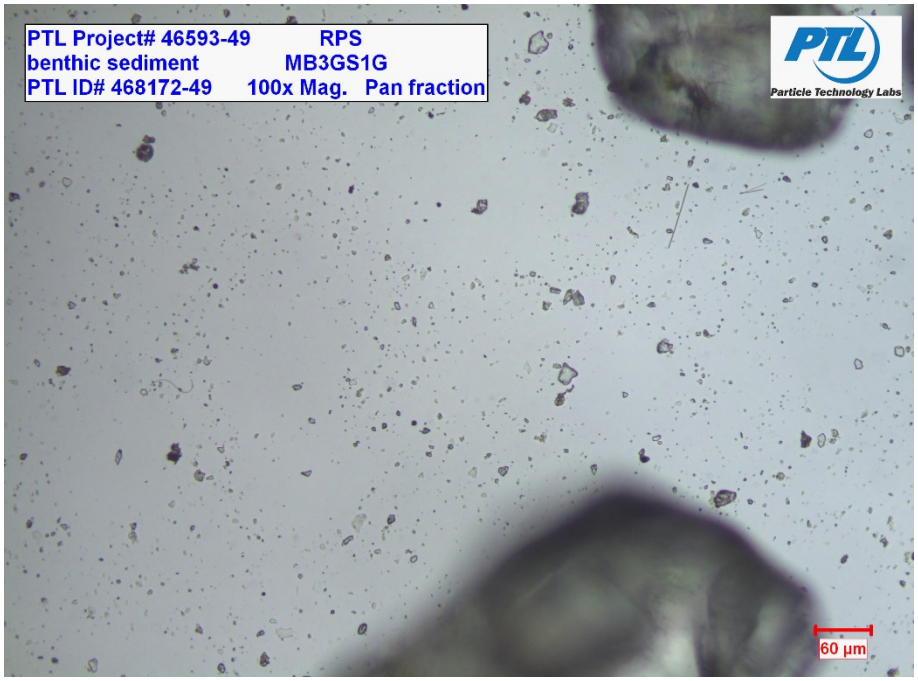


Figure B- 50. Photomicrograph (2 of 2) of sediment grab 1 of 2 from IA 3 taken at 100x magnification

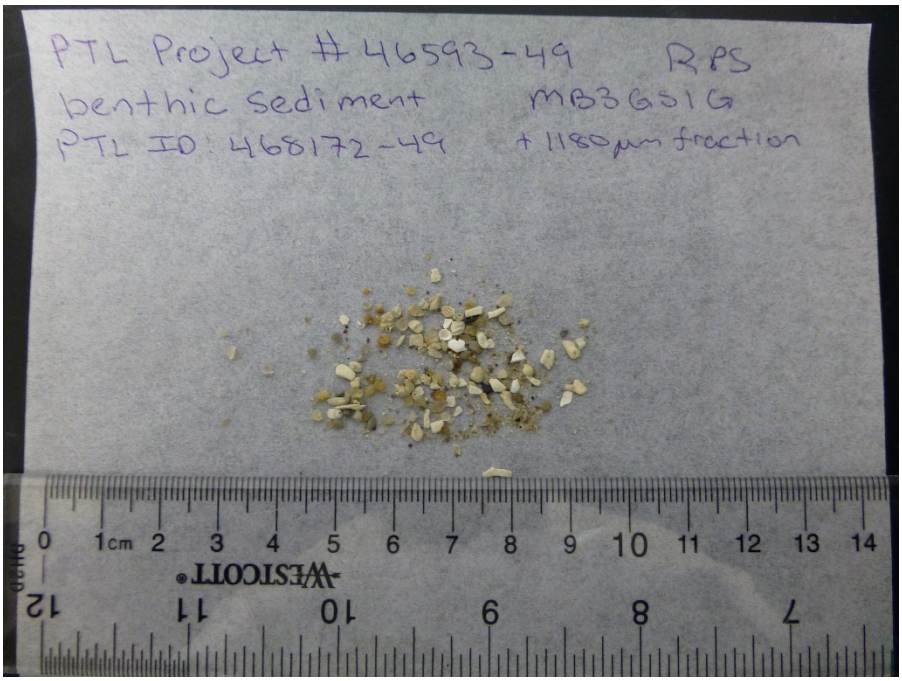

Figure B- 51. Photo of 1180 µm fraction of sediment grab 1 of 2 from IA 3.

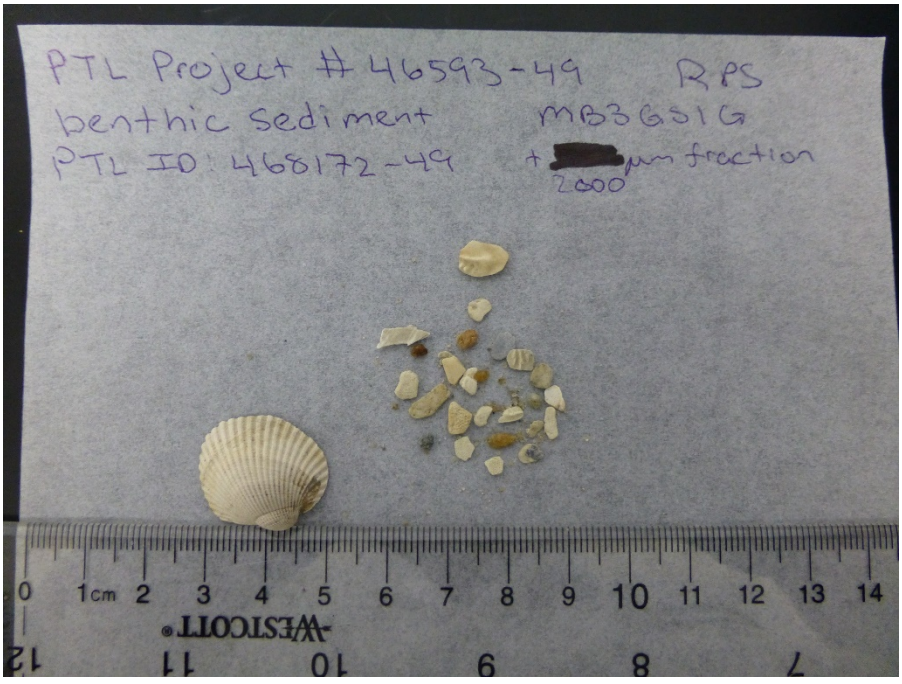

Figure B- 52. Photo of 2000 µm fraction of sediment grab 1 of 2 at IA 3.

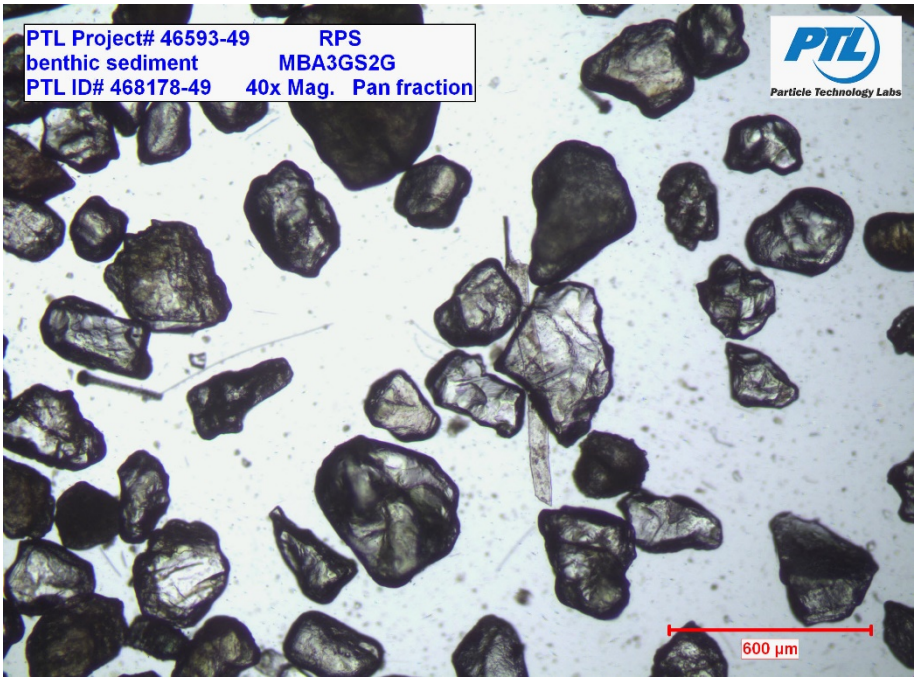

Figure B- 53. Photomicrograph (1 of 2) of sediment grab 2 of 2 from IA 3 taken at 40X magnification.

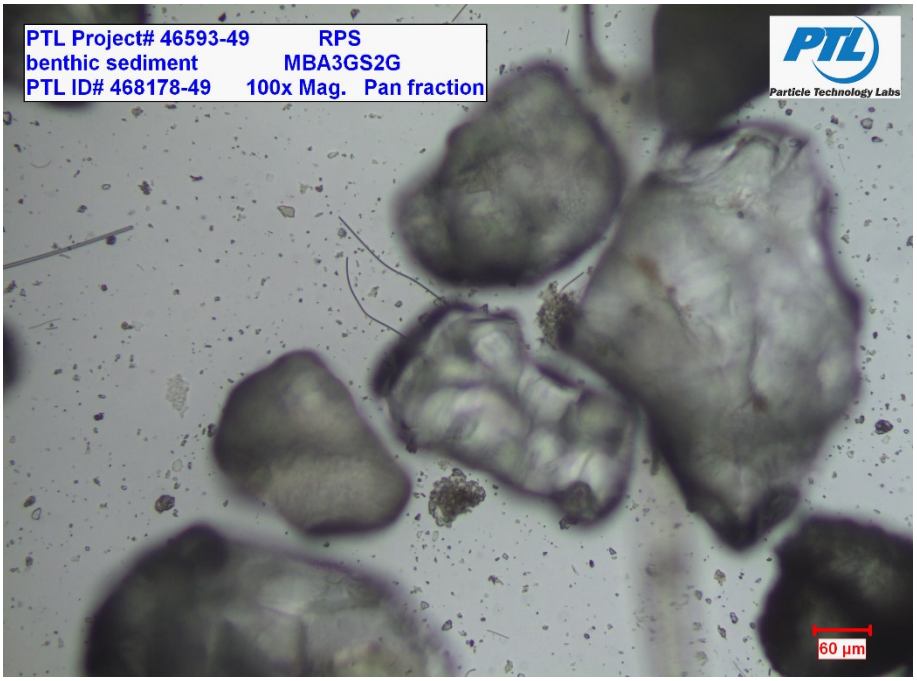

Figure B- 54. Photomicrograph (2 of 2) of sediment grab 2 of 2 from IA 3 taken at 100X magnification.

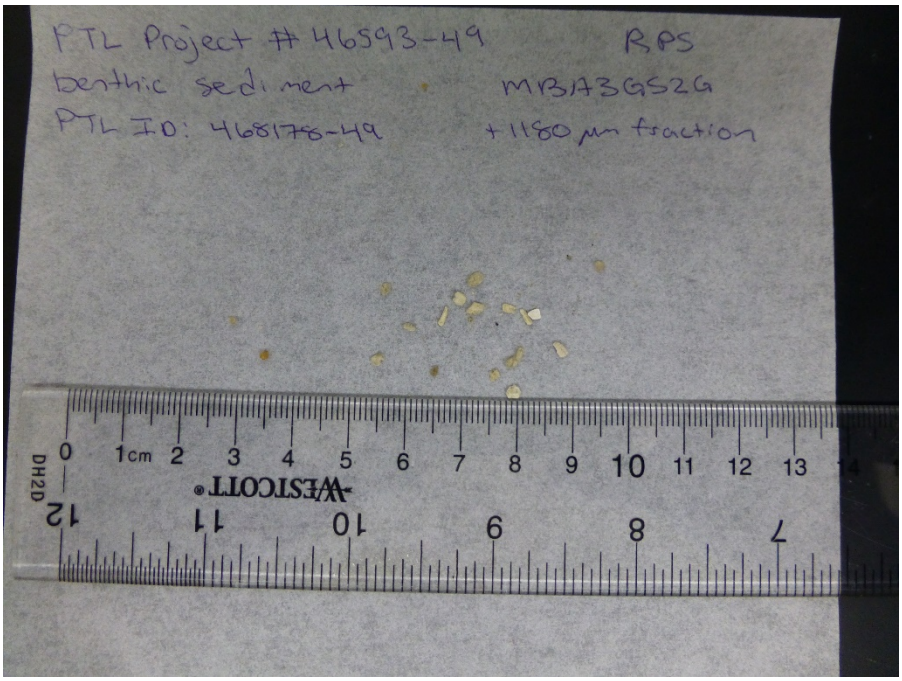


Figure B- 55. Photo of 1180 µm fraction of sediment grab 2 of 2 at IA 3.


Figure B- 56. Photo of 2000 µm fraction of sediment grab 2 of 2 at IA 3.

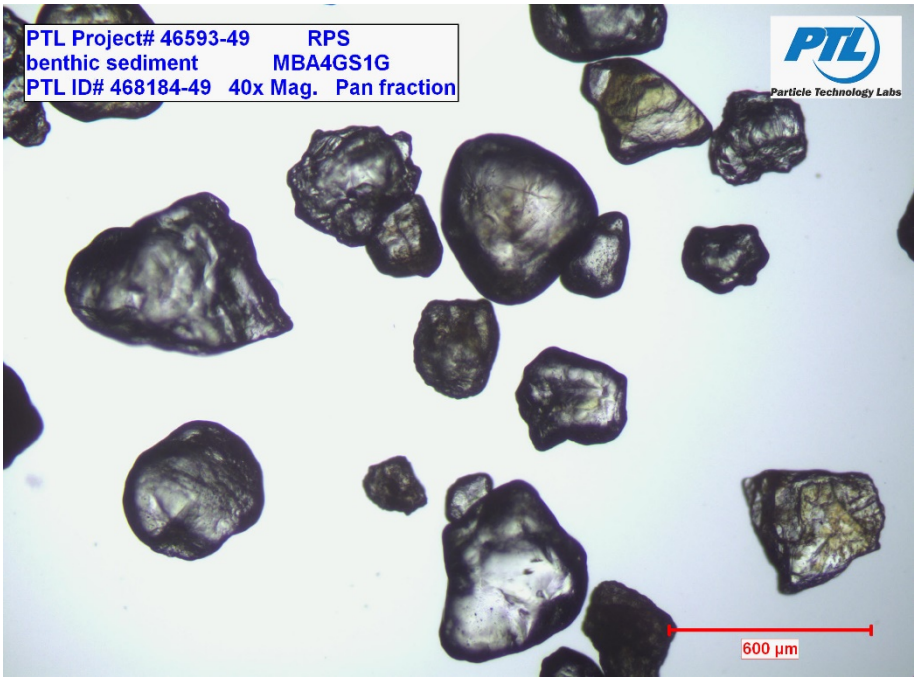


Figure B- 57. Photomicrograph (1 of 2) of sediment sample from grab 1 of 2 from IA 4 taken at 40x magnification.

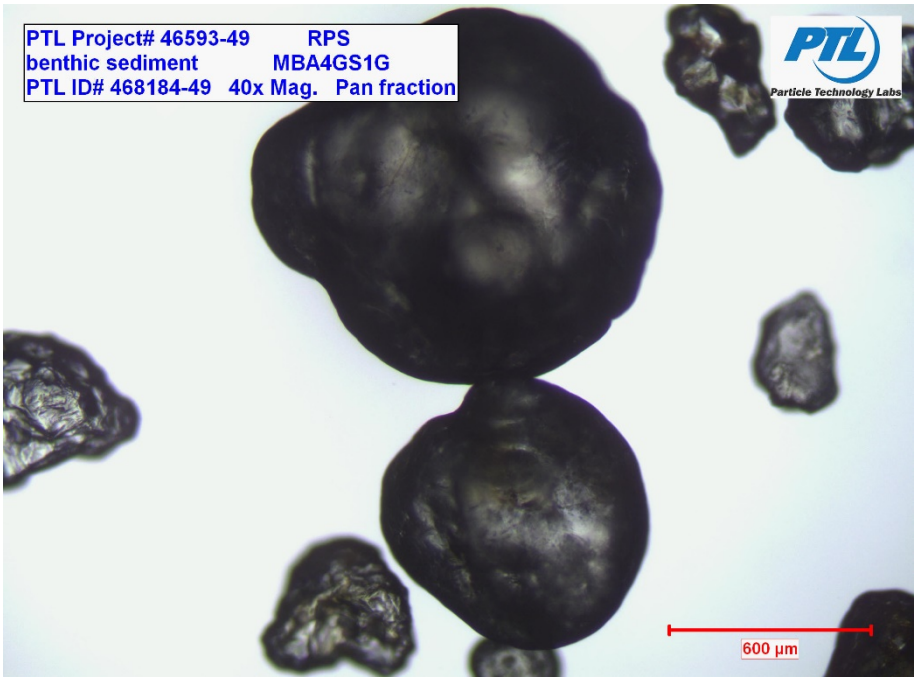


Figure B- 58. Photomicrograph (2 of 2) of sediment sample from grab 1 of 2 from IA 4 taken at 40x magnification.

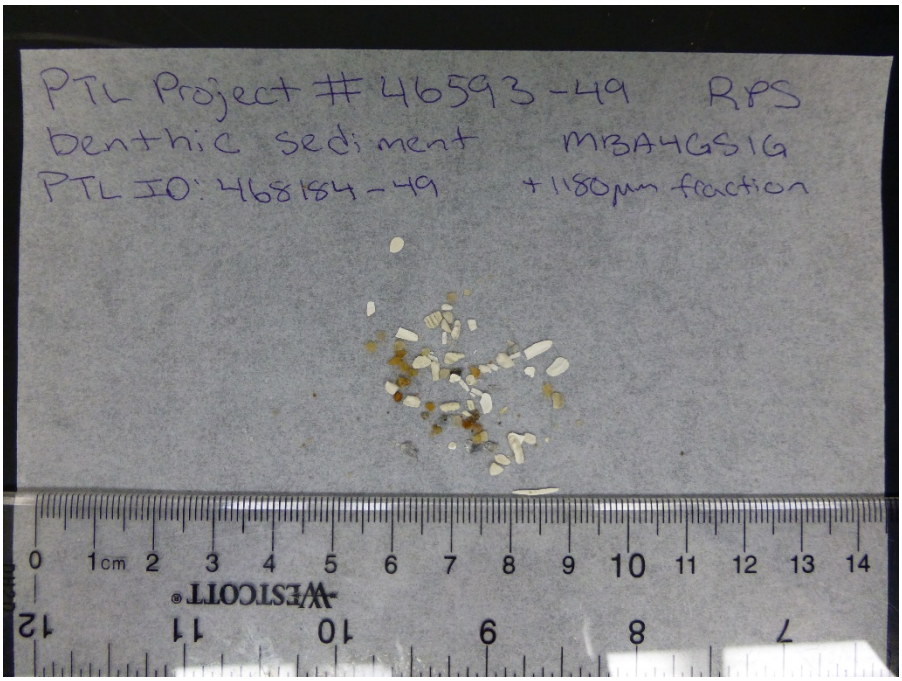

Figure B- 59. Photo of 1180 µm fraction of sediment grab 1 of 2 at IA 4.

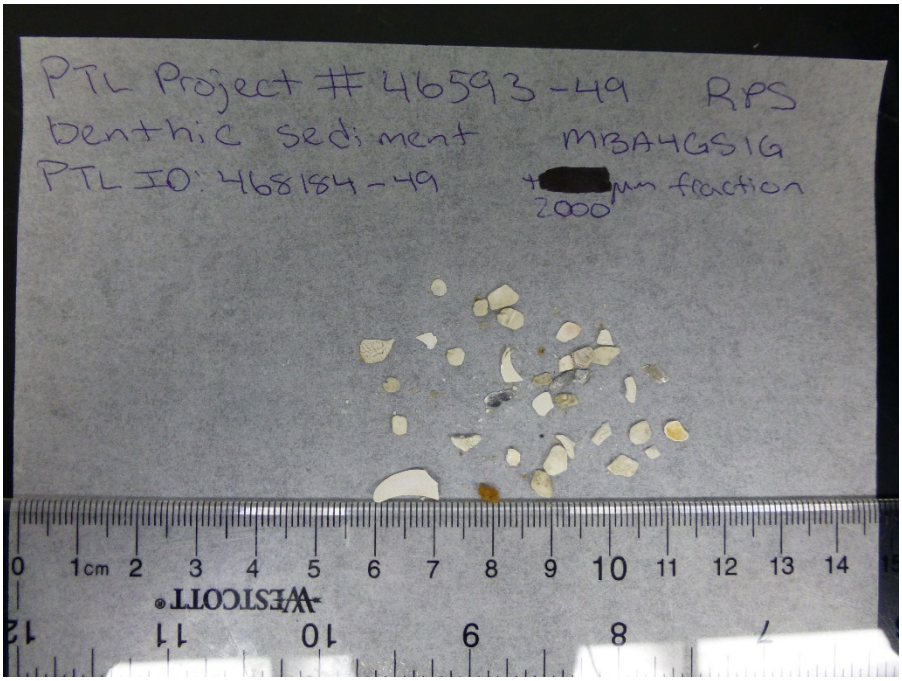

Figure B- 60. Photo of 2000 µm fraction of sediment grab 1 of 2 at IA 4.

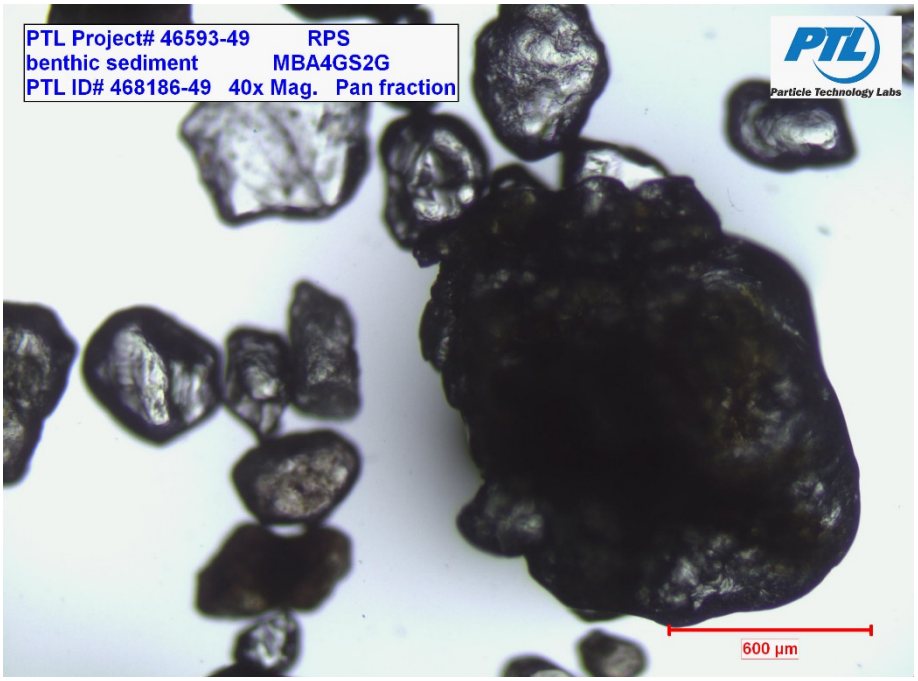


Figure B- 61. Photomicrograph (1 of 2) of sediment sample from grab 2 of 2 from IA 4 taken at 40x magnification.

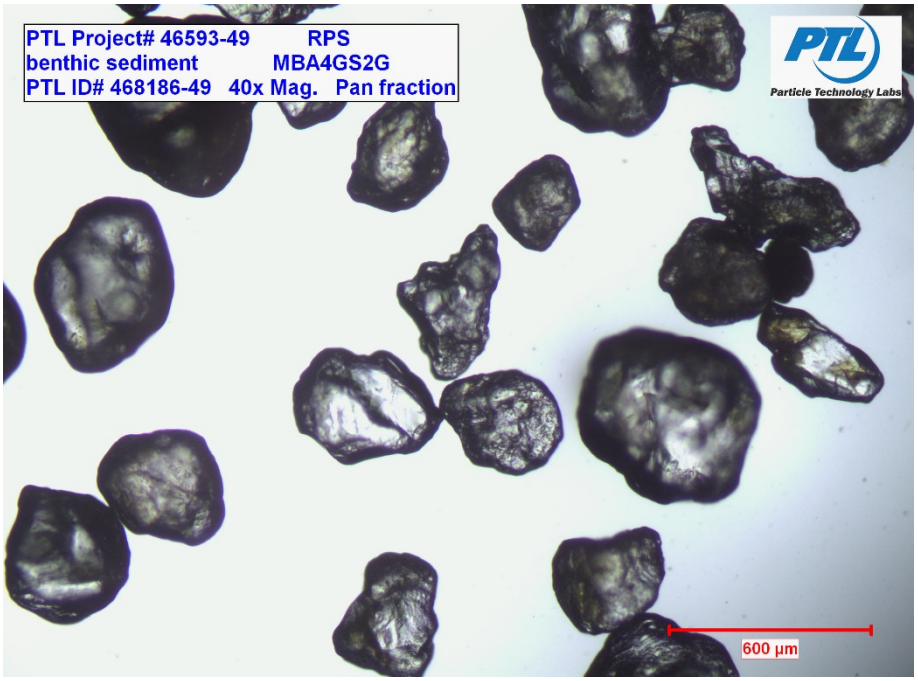


Figure B- 62. Photomicrograph (2 of 2) of sediment sample from grab 2 of 2 from IA 4 taken at 40x magnification.


Figure B- 63. Photo of 1180 µm fraction of sediment grab 2 of 2 at IA 4.


Figure B- 64. Photo of 2000 µm fraction of sediment grab 2 of 2 at IA 4.