Project Progress Report (September 2025 to February 2026)

Project No. 066: "Resuspension of contaminants in the Matagorda Bay due to storms, ship traffic, and dredging activities"

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Sample processing

During this quarter, we focused on sample processing and analysis. All collected cores have been processed using the Gust Erosion Microcosm (UGEM) System (Figure 1). Cores in the sediment resuspension experiment were subjected to one of four treatment groups: control (zero shear stress), 0.2 Pa shear stress, 0.45 Pa shear stress, and 140 RPM shaker table disturbance. After being disturbed for 20 minutes, cores were allowed to rest for another 20 minutes in order to allow coarse particles to settle. After this, aliquots of 400mL for PAHs/PCBs, 30 mL for trace metals, 10 mL for Hg, and 10 mL for scanning electron microscopy (SEM) particle grain size analysis were collected from the overlying water of each core. Trace metal and Hg water samples were acidified with nitric acid to a pH < 2 and were stored at 4 ˚C along with the PAH/PCB water samples. Sediments were then sectioned for contaminant analysis at every 1 cm for the first 5 cm depth, then at every 5 cm for the remainder of the core. After sectioning, sediments were stored in a -20 ˚C freezer.

Cores in the sediment erodibility experiment were subjected to a series of 5 different shear stresses over the course of 2 hr. During the first 30 min of the experiment, a shear stress of 0.01 Pa was applied to flush the system of any overlying sediment. After this, the shear stress was increased to 0.05, 0.1, 0.2, 0.3, and 0.45 Pa at 20 min intervals. Different from the resuspension simulation, a stream of water collected from the field site was pumped into the core-cosm at a rate needed to sustain that applied stress, and the effluent containing the eroded material was passed through the flow cell of a connected turbidimeter, which recorded the absorbance of the effluent. The effluent from each shear stress step was collected in glass jars and then filtered onto a 0.7 μm glass-fiber filter to calibrate the turbidimeters and to determine the total mass of sediment eroded from both cores. Filters were dried in an oven for 12 h at 60 ˚C, and both the wet and dry masses were recorded.

After all cores from sites MB01–MB05 are processed, a second sampling trip in May 2026 will be conducted to collect cores from sites MB06–MB10, and the Liu Lab at UTMSI will begin analysis of PAHs/PCBs in water and sediment samples via GC-MS.

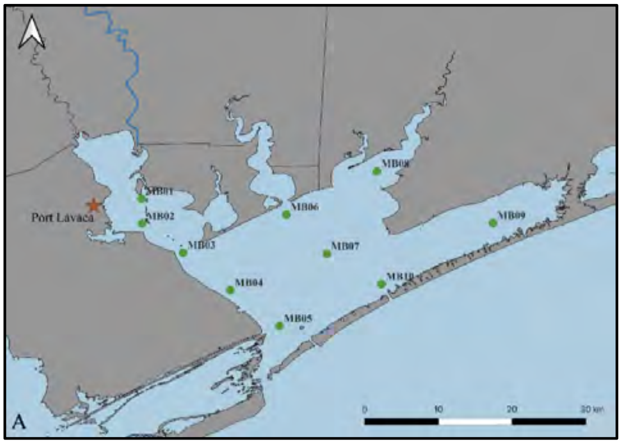

Figure 1. Map of sampling locations.

Figure 2. The UGEM system for sample processing.

<u>Next steps: Sample analysis and further sampling</u>

The mercury and trace metal samples have been sent to Dr. Dutton's lab for analysis. Trace metal water results indicate that mercury (Hg) concentrations in the top 5 cm at all five sites prior to UGEM disturbance were below the method detection limit (0.25 µg/L). Results from the UGEM contaminant resuspension experiments are shown in Figures 3-7. Generally, trace metal concentrations increased as shear stress increased. Strontium (Sr) was the most abundant trace metal at all sites and at all shear stresses (~2500-6200 µg/L), followed by those likely sourced from clay minerals (Al, Mn, Fe; ~47–70,000 µg/L). At lower concentrations, Zn and Ba were the next most abundant trace metals (~17–490 µg/L). About 60% of sediments for trace metal analysis have been freeze dried and powdered, and sediment analysis will begin next week. Sediment erodibility experiments indicated that eroded sediment mass increased as shear stress increased (Figure 8), although there was no apparent spatial pattern in eroded mass. Liu Lab will analyze PAHs and PCBs in the samples. The analysis is currently ongoing; all water samples have been extracted and are awaiting analysis via GC-MS. Sediment samples are currently being extracted. We proposed covering 10 stations, but rather than rushing to collect all the samples, we opted to wait until we have at least part of the data from the 5 stations already covered, which should offer guidance on how we further collect the samples. For example, it is unclear at this point whether we may be able to see differences in the levels of contaminants among the 5 stress levels, although trace metal results indicate that concentrations generally increase with increasing shear stress. If not, we may have to adjust the shear stress levels. Also, it is unclear what differences we will see among the 5 sites. We expect to have the PAH and PCB data at the end of March.

In addition to the contaminant analyses, other ancillary geochemical parameters will also be analyzed to aid data interpretation, including organic carbon content, and mineral grain size.

<u>Challenges and obstacles</u>

The project experienced some delays in Fall 2025 due to technical difficulties with the UGEMS instrument, which broke down a couple of times. Once fixed, the project has been progressing as expected.

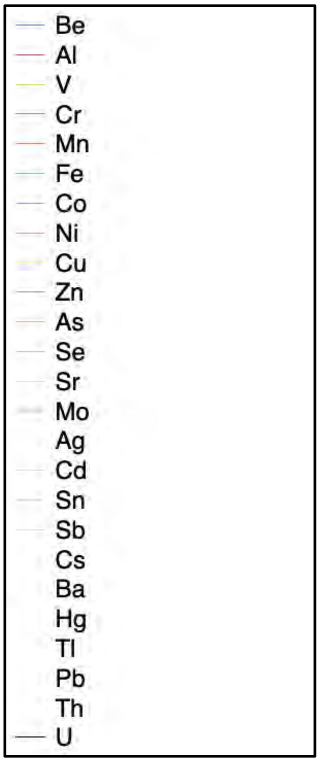

Figure 3. Legend for Figures 4-7 describing trace metal concentrations in cores undergoing UGEMS contaminant resuspension experiments.

MB01

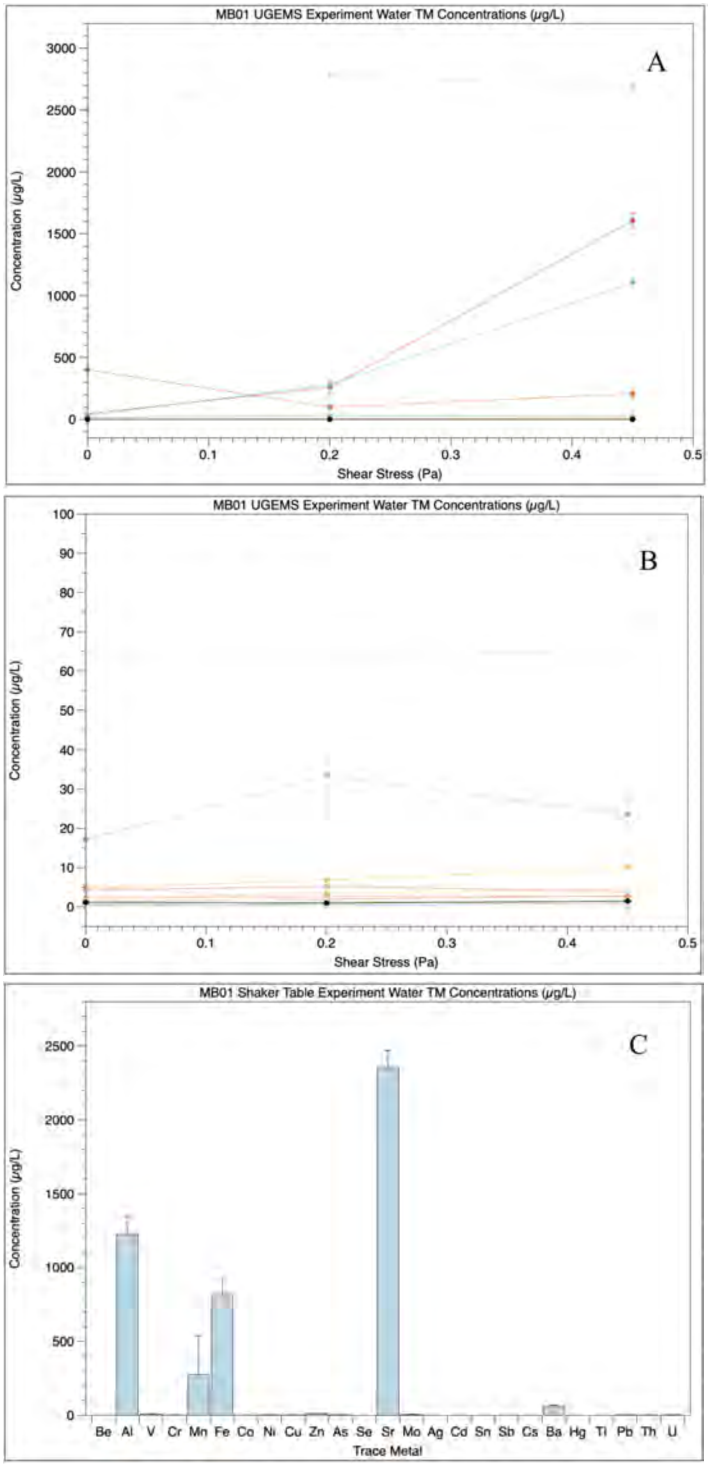

Figure 3. Concentration of suspended trace metals vs shear stress in MB01 cores subjected to UGEMS experiment (A, B). Concentration of suspended trace metals in MB01 cores subjected to shaker table disturbance (C).

MB02

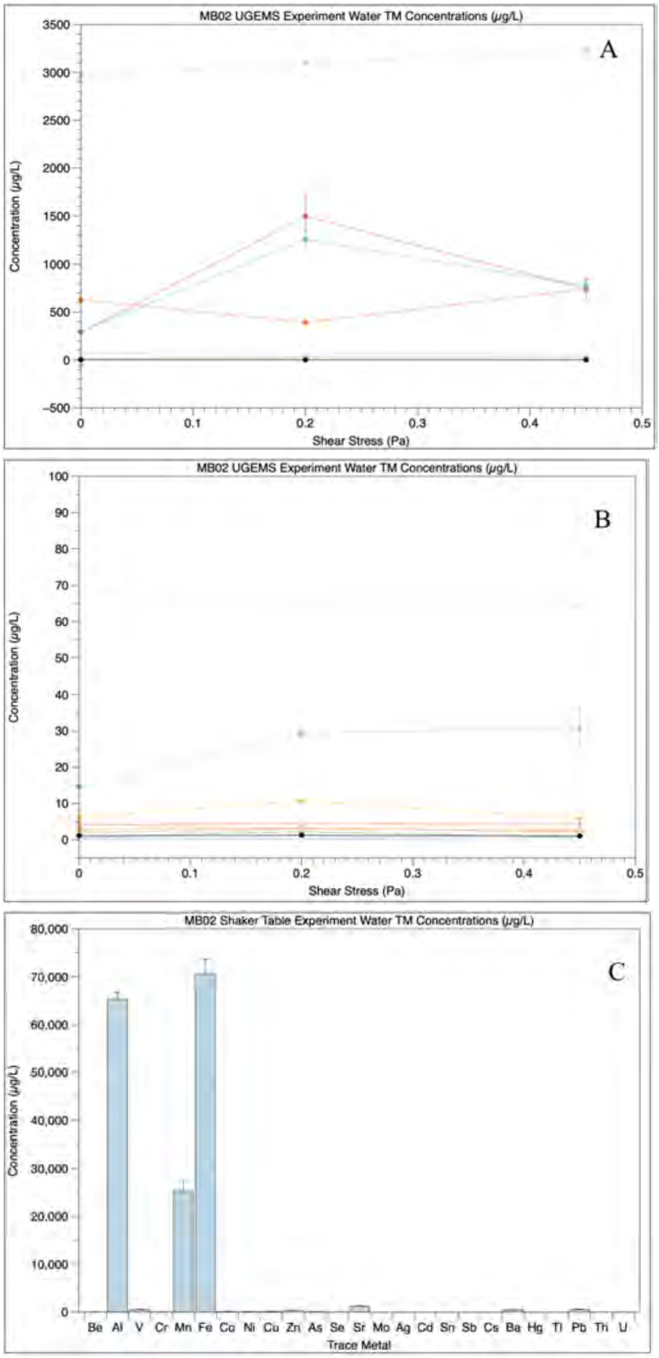

Figure 4. Concentration of suspended trace metals vs shear stress in MB02 cores subjected to UGEMS experiment (A, B). Concentration of suspended trace metals in MB02 cores subjected to shaker table disturbance (C).

MB03

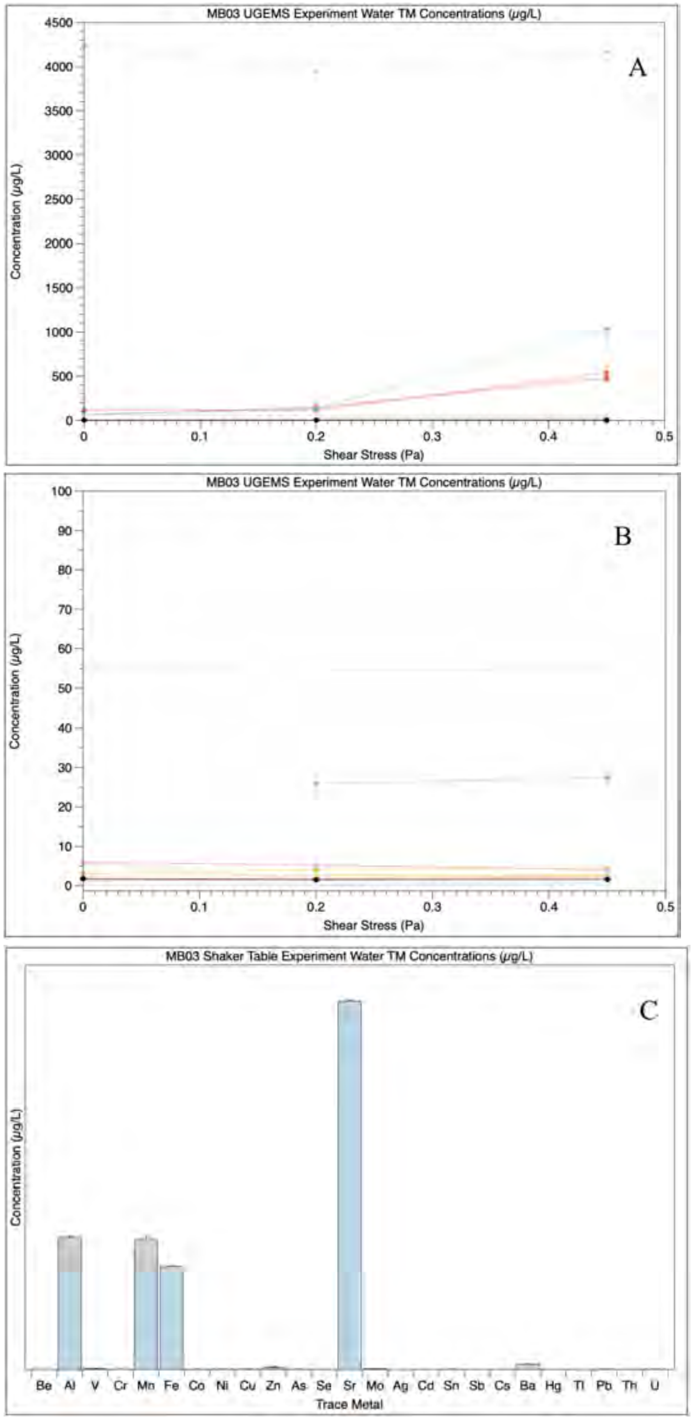

Figure 5. Concentration of suspended trace metals vs shear stress in MB03 cores subjected to UGEMS experiment (A, B). Concentration of suspended trace metals in MB03 cores subjected to shaker table disturbance (C).

MB04

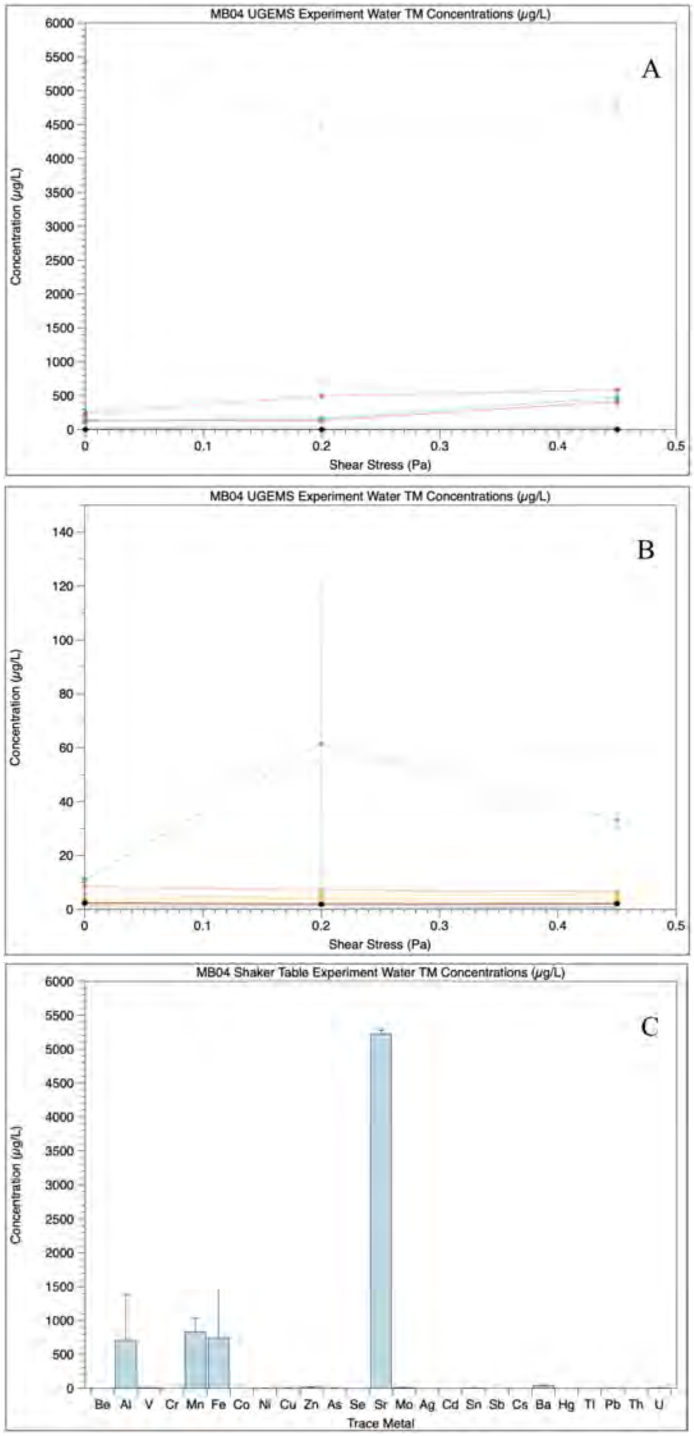

Figure 6. Concentration of suspended trace metals vs shear stress in MB04 cores subjected to UGEMS experiment (A, B). Concentration of suspended trace metals in MB04 cores subjected to shaker table disturbance (C).

MB05

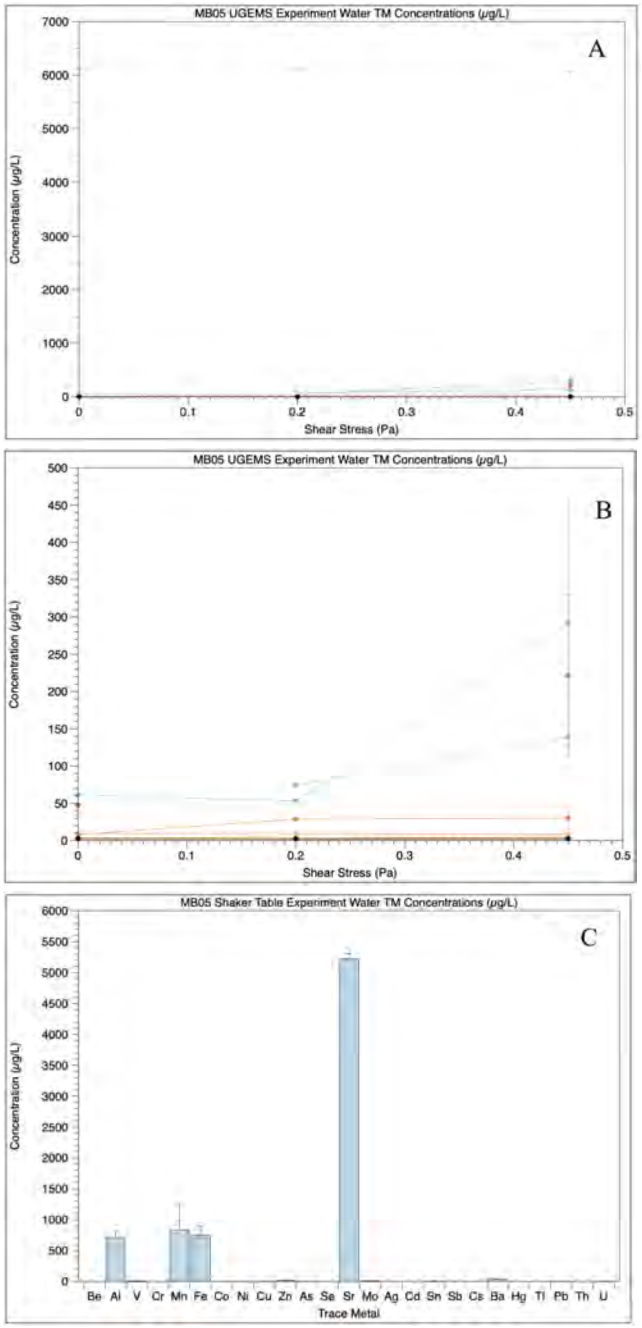

Figure 6. Concentration of suspended trace metals vs shear stress in MB05 cores subjected to UGEMS experiment (A, B). Concentration of suspended trace metals in MB05 cores subjected to shaker table disturbance (C).

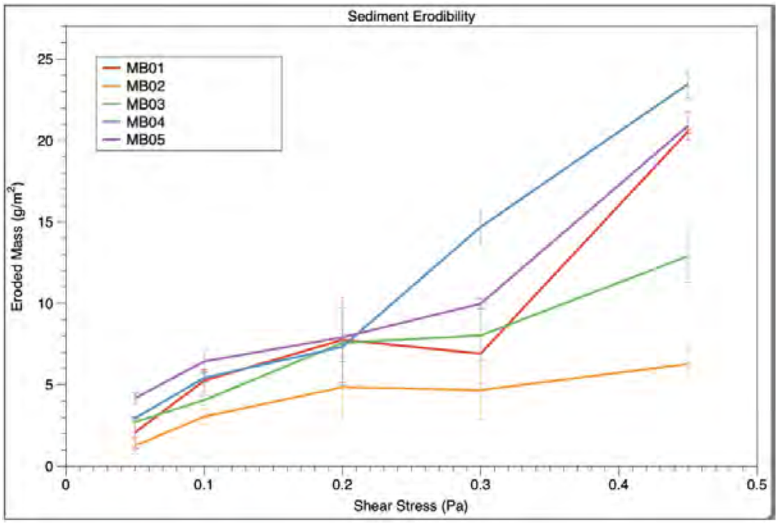

Figure 8. Shear stress (Pa) vs eroded mass (g/m^2) for cores in the sediment erodibility experiments.