Biogeochemical Impacts of Basalt Fiber Bags on Estuarine Sediment Microbial Activity

Cadie L. Barnes, *Lisa G. Chambers*
University of Central Florida, Orlando, FL, USA

Coastal ecosystems are becoming increasingly degraded, facing threats from erosion, sea level rise, and urban development. Aquaculture-grade plastic bags filled with oyster shells are commonly used as a nature-based solution to stabilize sediment, absorb wave energy, and support living shorelines. While favorable for their durability and low-cost, plastics can still degrade over time into secondary microplastics, which can be ingested by filter feeding organisms. Due to concern over the effects of microplastics on estuarine ecosystems and public health, coastal restoration practitioners are switching from plastic materials to more "environmentally friendly" materials. One of the most recent materials to gain popularity is basalt fiber bags, which are made from basalt rock that has been melted down and spun into fibers. However, little is known about the effects of basalt bags on biogeochemical cycling within estuaries. In this study, we will characterize the chemical composition of the bags and conduct controlled laboratory experiments to test the impacts of basalt on sediment microbial activity. Microcosm bottles will be prepared in replicates of 5 using study materials, site sediment, and water collected from the Indian River Lagoon in east central Florida, with controls consisting of only site sediment and water. Respiration rates, microbial biomass, and enzyme activity will be quantified under aerobic and anaerobic conditions to assess the impact of the materials on microbial activity. Basalt fibers are expected to increase microbial biomass, respiration, and enzyme activity. While inorganic, basalt fibers contain trace elements such as iron and zinc, which are necessary for microbial growth. Thus, we predict basalt fibers will result in an increase in microbial biomass, respiration, and enzyme activity. Microbes play a key role in the cycling of nutrients and carbon in coastal systems. These results will give restoration practitioners a better understanding of the potential impacts of basalt bags and assist decisions on appropriate use of this material.