Recent Scientific Applications of Underwater Mass Spectrometry

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Approximately two-thirds of the U.S. continental shelf seafloor consists of permeable sediments. Currently, a disconnect exists between what is known about permeable sediment geochemistry from small lab-scale experiments and how continental shelf biogeochemistry is represented in a modeling framework. Filling this gap requires a set of reliable tools to measure dynamic biogeochemical processes in the field to provide more realistic, high-resolution data for models. Critical to that effort is matching the time and spatial scales of external forcing to biogeochemical responses within the sediments. Researchers from SRI, BU, and SkIO are creating a system to collect high temporal resolution data on biogeochemical processes in permeable sediments for periods of days to weeks. The in situ system will collect porewater samples from various sediment depths and deliver them to an underwater mass spectrometer (UMS) to analyze a suite of dissolved gases to estimate rates of production and consumption.

At depths where light penetrates, the ocean produces 50-70% of the oxygen in the atmosphere, but we cannot say with certainty which ocean regions are net producers and which are net consumers of oxygen. Ocean stratification, cloud cover, water depth, strong seasonality, and complicated air-sea exchange processes all confound the budgets of oxygen production and consumption. If the budget is changing, we would have difficulty detecting where and determining why. Researchers at SRI and URI-GSO are developing new methods to estimate net ocean oxygen production using a UMS and undulating tow vehicle to better capture the variability in primary productivity throughout the entire euphotic zone by measuring dissolved gas concentrations. A calibration system from SRI is being used to improve the precision and accuracy of these in situ measurements.

This workshop will review recent progress in both projects.

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