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Robotic Oceanography: Revealing Hydrothermal Influence on Ocean Biogeochemistry

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The ocean water column contains gradients that are difficult to resolve using observing platforms commonly employed for marine biogeochemical and microbiology studies. These studies have relied heavily on wire-deployed platforms inherently limited in spatial and temporal resolution. When autonomous robotic vehicles are equipped with sufficient integrated sampling capacity, they overcome these limitations and can target biogeochemical and biochemical gradients in the water column in ways not previously possible. This challenge has been particularly critical to overcome in the deep sea where discrete hydrothermal plumes create biogeochemical and microbial hotspots. Processes within these plumes repartition dissolved and particle phase material, sourced from the lithosphere, in ways that influence its transport and residence time in the ocean. This is particularly important for iron. In this talk, I will describe the development of robotic sampling instruments for ROVs and AUVs and results from their use in studies of abiotic, biotic, and physical processes in hydrothermal plumes in the Pacific and Atlantic. Of particular focus will be a recent study of hydrothermal circulation and discharge at Kama'ehuakanaloa Seamount, where the oxygen and hydrogen isotopic composition of seawater within Pele's Pit was used to trace the depth of hydrothermal recharge. I will also discuss work in progress to quantify trace metal transport at Kama'ehuakanaloa Seamount and the Main Endeavor segment of the Juan de Fuca Ridge and recent advances in robotic oceanography with AUVs Clio and Sentry that are applying these techniques to broader scales - up to and including ocean basins.

Dr. Breier is a candidate for an open ORE faculty position in Oceanographic Engineering

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