

Project Summary

The ocean plays a critical role in regulating Earth's climate system through its physical redistribution of equatorial heat via circulation and its chemical role in moderating atmospheric carbon dioxide levels by surface dissolution and biological uptake. Understanding how the oceanic system has changed in the past as a result of variations in the forces driving these processes is limited by our ability to understand these processes in the contemporary ocean and also by our ability to interpret the chemical record of these processes in the sediments of the oceans. While great progress has been made to understand the way individual tracers can record and affect particular biogeochemical and physical processes, there has been no concerted effort to harness the interrogative power attainable through combining simultaneous determination of multiple trace elements and isotopes. The International GEOTRACES program has been developed to produce a global framework of key trace elements and isotopes (TEI) that will describe the contemporary distributions of these properties in the ocean that can then be used to constrain models of the processes and fluxes of biogeochemically important elements and key tracers that trace flux processes and transformations.

This proposal seeks funds to participate in the first US GEOTRACES section cruise that will sample across the N Atlantic Ocean between 40°N in the west to 20°N in the east. Specifically, we propose a collaborative project between Measures at the University of Hawaii and Wu at the University of Miami (RSMAS). The proposed work will result in the determination on board the ship of dissolved Fe, Al, Mn and Zn using Flow Injection Analysis methodology that will allow us to identify and rectify any sampling problems associated with the equipment and to identify any unexpected features that would require adaptation of our sampling strategy. We will also return samples for shorebased determination of these same elements and also Cd by ICP MS, which will enable the calibration the shipboard data sets, fill any gaps in the shipboard analysis, and to provide quality control on the precision and accuracy of the measurements.

Intellectual Merit and Broader Impacts: The basin-wide sections of dissolved and particulate trace elements and total and soluble aerosol trace elements that the GEOTRACES project will produce will significantly improve our understanding of how global ocean biogeochemical cycles operate. The dissolved and colloidal trace elements that we propose to determine will be used to improve and constrain coupled ocean/atmosphere nutrient and carbon cycling models, and permit more accurate prediction of the role played by atmosphere in providing biogeochemically important trace elements to the surface ocean and the mechanisms by which they are transferred to the interior of the ocean. Education and training of the next generation of oceanographic scientists, namely a Post Doctoral researcher and a graduate student, are essential components of this proposal. Measures regularly teaches specialist and non-undergraduate and graduate classes and incorporates the results of his field work into lecture materials thus providing an immediate dissemination of the latest research to motivate both the next generation of Earth scientists, as well as non-science students who are interested in understanding global ocean processes. The researchers (PIs, Post Doc and student) will benefit from participation in a large research project that brings scientists of different backgrounds together creating a collaborative cohort that will outlast the specific project. Our results will be presented at national/international scientific meetings, and published in peer-reviewed journals. The data will be submitted in a timely manner according to the requirements of NSF/OCE and the GEOTRACES program.