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Collaborative Research: Towards Quantifying Elemental Fluxes and Fluid Origins from Margins Using Novel Submarine Instrumentation

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Program Manager Donald L. Rice
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Investigator Gary M. McMurtry
garym@soest.hawaii.edu (Principal Investigator current)
Sponsor U of Hawaii
2530 Dole Street
Honolulu, HI 968222225
808/956-7800

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Abstract

ABSTRACT

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In this project, a team of researchers from the Scripps Institution of Oceanography, University of Hawaii, and the University of Alaska at Fairbanks will develop and test new submarine technology to both measure in-situ the scale of the elemental (including volatile) flux from submarine margin environments as well as to capture a temporal record of the fluids for associated isotopic analyses. The isotopic studies will include the stable isotope systematics of carbon-bearing species (CH4 and CO2) and the light noble gases (He, Ne, Ar). By developing sampling and deployment strategies for two complementary instruments -the Mass SURFER which measures concentrations in-situ together with the CA meter which records fluid flux rates and preserves samples for later analyses - the team will make new estimates of the rate of loss to the ocean and atmosphere for a number of elements via this important, but hitherto largely neglected, pathway. A major focus of this study will be development of and inter-comparison between the two instrument packages. For the most part, this development will occur in the laboratory and at a number of well-characterized fluids in the Monterey Bay region. The unique analytical capability of these technologies holds great potential for future studies in margin and other submarine environments.

In addition to development work along the Pacific

coast of the United States, the chief scientific focus area will be the Costa Rica margin, an area identified by the MARGINS community as one of two designated study areas particularly amenable to a multi-disciplinary approach. The research team plans to investigate the forearc region between the Nicoya and Osa peninsulas where subducting seamounts have disrupted the forearc and allowed seepage of fluids along normal faults. The key questions that will be addressed with this study are the nature and sources of these leaking fluids and whether that there are temporal variations in both flow rate and/or chemistry.

The longer-term objectives of the project are to quantify the rate of elemental loss to the ocean and atmosphere via this active fore-arc margin and to determine if seepage variability and earthquakes are linked. The investigators believe that this the study will afford a unique opportunity to understand the factors controlling the release and movement of carbon associated with the subduction process and to place quantitative constraints on the flux of volatiles from this vital yet poorly studied segment of the terrestrial carbon cycle.
