

# IN SITU ANALYZERS AND SAMPLERS

Oceanographers are becoming more aware that most oceanic cycles are not steady state processes. More and more marine biogeochemical cycles are hypothesized to be controlled by short-term and sporadic events. Such events, including storms, plankton blooms,

episodic upwelling, seafloor faulting, and volcanic activities are difficult to observe with traditional coarse-resolution methods. We cannot understand the functioning of the seafloor-ocean-atmosphere system until we understand the chemical variability of important major and minor elements in the ocean.

To address questions like these, it is imperative to develop long-term high resolution instrumentation capable of directly measuring dissolved concentrations of scientifically significant chemical tracers. This project has thus continued to focus on developing novel long-term (months to years) *in situ* chemical analyzers and samplers to continuously monitor chemical concentrations in the upper and benthic ocean.

During 1998, several approaches were developed and tested to increase the overall OsmoAnalyzer reliability. Most importantly, the analyzer redesign effort has been completed and several of the new systems are undergoing testing. To address problems associated with deployments in high-nutrient areas, a new in-line acidification method was proven in local waters and is now being field tested in Hawaii. Nitrate Osmo-Analyzers were systematically deployed

on moorings M1 and M3, within the Monterey Bay Aquarium's kelp forest exhibit, and on the Hawaii Ocean Time Series mooring off Oahu. For benthic studies, the iron OsmoAnalyzer is now operational and has been successfully deployed in Monterey Bay. The sulfide OsmoAnalyzer is also operational over concentration ranges from about 2 to 400 microns.

For monitoring concentrations for numerous chemical species simultaneously, several advances in the OsmoSampler have been developed and tested. Faster pumping OsmoSamplers for shorter deployments (weeks) use reverse-osmosis membranes and have been successfully deployed at several locations. To prevent trace element precipitation and clogging when sampling from reducing environments, some OsmoSamplers have been modified with a second smaller osmotic pump to permit in-line sample acidification. These systems have been tested in the lab and are now deployed on Loihi and Axial Seamounts. Furthermore, OsmoSamplers using copper tubing were developed for gas analyses and successfully deployed to collect venting water from borehole 892B off Oregon (for methane analysis) and on Axial (for helium analysis). A second generation three-port profiling OsmoSampler, which incorporated in-line acidification, was designed and also deployed at Axial Seamount.

## Principal Investigators

Hans Jannasch

Carole Sakamoto

Thomas Chapin

## Co-Investigators

Francisco Chavez

Debra Stakes

James Barry

## Collaborators

Tom Dickey  
University of  
California, Berkeley

Dave Karl  
University of Hawaii

Geoff Wheat  
National Undersea  
Research Program

Miriam Kastner  
Scripps Institution of  
Oceanography

Ken Johnson  
Moss Landing  
Marine Laboratories

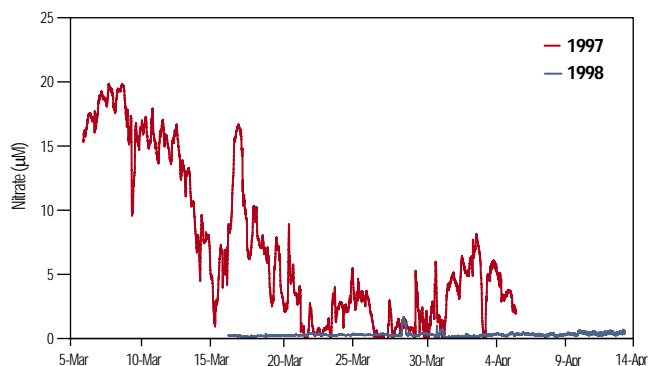


Figure 7. Surface nitrate as measured *in situ* on the M1 mooring during the spring upwelling season in both 1997 and 1998. The influence of El Niño is apparent in the 1998 data which shows very low nitrate concentrations.