## ISUS BACKGROUND:

UV absorbance spectra for compounds of interest to oceanographers, including nitrate, nitrite, bisulfide (HS-) and bromide are shown in graph (below) at concentrations typical in the marine environment. In the past 40 years, there have been several analytical methods developed for the direct determination of these compounds based on their UV absorption , including an APHA standard method for nitrate analysis. These methods have not become widely used, in part because the analytical methods were usually based on measurements at a single wavelength. A measurement at a single wavelength does not allow chemicals with overlapping spectra to be differentiated. However, advances in the development of diode array spectrophotometers now make it simple to rapidly collect full spectra in the UV region. Spectral deconvolution techniques make it feasible to determine these compounds directly in seawater, without any interferences, and with no chemical manipulations.



## MBARI-ISUS Sensor:

The MBARI-ISUS technology was developed by Dr. Kenneth Johnson and Mr. Luke Coletti of the Monterey Bay Aquarium Research Institute. A paper describing the ISUS, along with a number of applications, has been published in Deep-Sea Research (Johnson, K. S. and L. J. Coletti. 2002. In situ ultraviolet spectrophotometry for high resolution and long term monitoring of nitrate, bromide and bisulfide in the ocean. Deep-Sea Research I, 49, 1291-1305). The ISUS technology has been successfully licensed to Satlantic, Inc. and instruments have been commercially available since late 2002. Another paper describing the use of UV spectrometry for bisulfide determination (Guenther et al., 2001) was also authored as part of the ISUS development.



In-Situ ISUS Application:

ISUS has been deployed from the MBARI ROV (Reomtely Operated Vehicle) Ventana over cold seeps with clam communities in the Monterey Bay at depths of 960m to measure ambient bisulfide. It was initially believed that no sulfides would be detectable in the water column, however, small scale vertical profiles (image sequence below) revealed that significant concentrations do exist directly over these seeps. The ROV was fitted with a special vertical profiler, built by MBARI personnel, that controlled the height of ISUS above the sediments.



Seep Site and Clam Community at Extravert Cliff, Monterey Bay, California



ISUS 10 cm above seep.



ISUS 4 cm above seep.



ISUS 2cm above seep.



Distribution of bisulfide (HS-) concentrations above cold seep in Monterey Bay, California References

Johnson, K. S. and L. J. Coletti. 2002. In situ ultraviolet spectrophotometry for high resolution and monitoring of nitrate, bromide and bisulfide in the ocean. Deep-Sea Research I, 49, 1291-1305.

Guenther, E. A., K. S. Johnson, K. H. Coale. 2001. Direct ultraviolet spectrophotometric determination of total sulfide and iodide in natural waters. Analytical Chemistry 73, 3481-3487.