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## **Development of a Fluorescence-Based in-situ Barium Sensor**

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### **LONG-TERM GOAL**

My long term goal is to contribute to our understanding of coastal ocean circulation through the application of tracer signals for water mass identification. Of particular interest to me is the distinction of freshwater sources, be they riverine, local precipitation or ice melt and the effects of their transport pathways and chemical contents on the health of coastal ecosystems.

### **OBJECTIVES**

My laboratory group has shown that its biogeochemical characteristics render barium a useful tracer of riverine inputs on the 10's to 100's of km spatial scales. The ultimate objective of this project is to establish a technique for the in-situ determination of barium in seawaters. An intermediate step toward achieving that goal is the development of a ship-board technique so as to be able to use barium distributions to make near real time sampling decisions in the field.

### **APPROACH**

The approach is to capitalize upon "designer" chelating agents which are highly specific to Ba and fluoresce in the UV-Vis wavelength range upon complexation. The specialized chelating agents under examination include those multi-dentate fluorescent analogues to diethylene-triaminepentaacetic acid. The major challenge will be to overcome interference from the more abundant cations of seawater Ca, Mg and Sr.

### **WORK COMPLETED**

We have signed a formal agreement with the company, Molecular Probes of Eugene, Oregon which manufactures "designer" fluorescent chelates largely for the health industry. They are providing us with samples of a variety of chelating agents to examine and proprietary information regarding their chemical composition in exchange for providing them information from our findings for the seawater medium. During 1998 a mothballed Perkin Elmer UV/VIS 3840 Lambda Array Spectrophotometer and MPF-66 Fluorescence Spectrometer were installed in our laboratory and brought into working condition by research technician, Tim Wagner. This involved replacement of several electrical components and power supplies in addition to devising methods to record spectra on modern storage media for subsequent computer processing. We have been joined this fall by student Xuemei Qiu, recipient of the COAS Dean's merit-based entry-year scholarship. Xuemei comes to us with a master's thesis in fluorescence based environmental chemistry. She is presently embarking on a series

of systematic experiments checking the effects of temperature, pH, salinity and chemical composition on the fluorescent signals. Once suitable conditions are identified, the means of adapting the method to the proven Zero-Angle Profiling System (ZAPS) in-situ chemical fluorometer developed by Gary Klinkhammer will be researched. We expect to capitalize on reagent delivery technology Klinkhammer developed for the ZAPS in-situ Mn detection capability.

## **RESULTS**

It is too early in the project to report results from our experiments.

## **IMPACT/APPLICATION**

We expect to apply at least the ship-board technique to our ongoing field programs in the Arctic and to develop an expanded field program in the Gulf of Alaska to study the significance of buoyancy driven boundary currents on the successful recruitment of salmon yearlings in the Northeast Pacific.

## **TRANSITIONS**

Not yet applicable.

## **RELATED PROJECTS**

1 – Work has been recently accomplished by G. Klinkhammer which demonstrates the viability of sensitive and precise absorption measurements by ZAPS; nitrate was determined at 1 micromolar levels in both fresh and seawater matrices. Field trials are presently underway which will allow us to determine whether we can expand our strategy for in-situ barium determinations.