



## **Electrochemical development for *in situ* measurements in deep- sea environments**

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Examining the interactions between chemical and biological components in deep-sea environments is crucial for the comprehension of these ecosystems. Physico-chemical fluctuations can be considerable at various spatial and temporal scales in these environments and the development of observatories for biogeochemical studies with autonomous chemical sensors allows to clarify mid and long term biological processes. Electrochemistry seems to be a well adapted method for these extreme conditions such as high pressure and high temperature gradient.

Sulfide chemistry is a key element for deep sea chemosynthetic ecosystems because it is an essential electron donor for chemosynthetic primary production. We are currently exploring two ways for the development of autonomous sulfide monitoring devices. First we developed potentiometric sulfide electrodes (based on an Ag/Ag<sub>2</sub>S electrode) that have been implemented from a submersible at 2300 and 3600 meters depth for short term measurements in a hydrothermal environment. Second we performed laboratory studies to set up a protocol with cyclic voltammetry (using Ag electrode) that could be more suitable for precise sulfide measurement in long term deployments. The voltammetric methods developed exhibited satisfying sensitivities for the broad range of concentration encountered in deep-sea chemosynthetic environments (from 5  $\mu$ M to 10 mM).

In some of these environments, silicate can be used as an inert tracer of the geochemical fluid emission in seawater. Although it is not electrochemically active, its determination is also possible by voltammetry based on the reduction of a molybdate complex.

This study was done in parallel, for different oceanographic applications. Voltammetric detection of silicates was shown to be feasible within the range of concentration found in the ocean (between 0.3 and 160  $\mu\text{M}$ ) in about 6 minutes. A method is now being developed to avoid the use of reagent oxidizing molybdenum in molybdate for an *in situ* and long term detection method.