



Microfluidic technology for in-situ detection of iron at low concentration in seawater

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In-situ sensors are of crucial importance for gaining a deeper understanding of key physico-chemical processes that occur in the ocean. Current laboratory methods cannot provide the spatial and temporal resolution needed to characterise the chemical parameters of marine ecosystems and they are expensive, time consuming, and are often affected by manual handling, contamination and storage artefacts. In-situ analysers minimise these drawbacks and provide a tool to obtain long term data sets which will allow a more synoptic interpretation of biogeochemical cycles in the oceans.

Trace elements are of particular biological relevance in seawater, and iron is of major interest because of the essential role it plays in controlling phytoplankton growth and in deep-sea processes.

We developed an analyser for the detection of Fe(II) in seawater at nanomolar levels. The spectrophotometric sensor relies on the Ferrozine technique, a well characterised and robust analytical method, and is based on lab-on-a-chip technology. The analyser carries on-board standards and performs in-situ calibrations, which allow correction for potential instrumental drift. It has been deployed at 1700 m depth and it can be programmed to perform a measurement every 3 minutes.

The system has been tested on the bench at different temperatures and has then been successfully calibrated in a pressure and temperature conditioned chamber which mimicked the physical conditions of a deep-waters deployment (low temperature (4 °C) and high pressure (1700 m depth)). The analyser has been deployed in dock waters at NOC (National Oceanography Centre), Southampton, for two full tidal cycles. Further applications of the new analyser will be discussed.

The sensor can be modified for total Fe analysis by incorporating a reduction step prior to the detection of reduced Fe. Preliminary work on the engineering and chemical steps needed to achieve this target will be presented.