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Analytical Chemistry in environmental monitoring and chemistry studies

Keynote Speaker

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“Marine Analytical Chemistry in the Iron Age”

Trace metal micronutrients, particularly iron, are involved in regulating primary production in the marine environment and therefore play a key role in controlling global climate via their impact on the global carbon cycle. The availability of iron regulates the growth, biomass and species composition of phytoplankton over large areas of the surface ocean and CO₂ drawdown has been observed in iron fertilisation studies. The marine biogeochemistry of iron therefore has great scientific, ecological and political significance. Reliable determinations of dissolved iron at sub-nM concentrations in marine waters are therefore needed to enhance our understanding of their impact on ocean productivity and processes such as ocean acidification. However, iron species are analytically challenging to measure due to their very low concentrations, the presence of labile and complexed forms of the element and the potential for contamination. Hence methods need to be sufficiently validated (via intercomparison exercises and uncertainty estimation) to allow comparison between data sets from different spatial and temporal regimes. This presentation overviews flow injection (FI) methods for the determination of iron in marine waters using chemiluminescence detection for shipboard use and inductively coupled plasma-mass spectrometry for laboratory applications. The FI manifolds used incorporate an immobilised chelating ligand for on-line preconcentration and matrix removal. Results from the application of these methods to seawater samples, together with supporting hydrographic data, are used to elucidate important iron marine biogeochemical processes. The relative contributions of all sources of uncertainty associated with the measurement process are discussed in the context of fit for purpose methodologies. Laboratory microcosm experiments to investigate aerosol iron dissolution in seawater and quantification of iron binding siderophores are also considered.