Anninou, P. 2007. **Arsenic in Irish marine waters and its potential as a water mass tracer**. Ph.D. Thesis. National University of Ireland, Galway.

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Abstract

Arsenic is a metalloid, met in both reduced (+3) and oxidised (+5) states, in a variety of inorganic and organic compounds. It is naturally and anthropogenically introduced. Globally, anthropogenic loads of arsenic exceed the natural ones. It is highly toxic, especially inorganic arsenic. Its toxicity is due to structural similarities with the essential nutrient phosphate. The phenomenon is natural and known as competitive inhibition. First order speciation between hydride (mostly inorganic) and non-hydride (mostly organic) arsenic took place during this project. An in-house, batch type system of hydride generation, electrothermal atomic absorption spectrometry was used.

This study has produced baseline concentrations in aquatic environments (rivers, lakes, mines, coastal, shelf edge, oceanic), mainly from the west coast of Ireland. The measured concentrations fall within normal for seawater (15-20nM) and fresh water (0-5nM). Exceptionally high concentration (~50nM) was observed in the effluent of the Avoca Mines, in Co. Wicklow; low concentrations are restored up and downstream of the mines.

Results coupled to phosphate findings, showed biological uptake of arsenic being much slower process than physical mixing of water masses. Mixing of coastal seawater with fresh water of low arsenic resulted in near linear increase in the concentration of hydride arsenic with increasing salinity (rivers Corrib and Shannon plumes). This is reversed at high salinities for a small salinity range, where fronts are formed between mixed coastal and open ocean seawater (Thermal Shelf Edge). It is proposed that enhanced biological activity in the highly active frontal zones removes arsenic from the dissolved phase. In the open ocean the positive distribution is restored to some degree, but overall a wide range of arsenic concentrations characterises different water masses despite the small salinity range. Among water masses, Mediterranean Sea Outflow Water displays great potential of being traced by its distinctive arsenic concentration.