

Sinking Titanic (Ti^{IV}) – Insights into the speciation and distribution of Titanium in the Atlantic Ocean

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Titanium is a major component of the continental crust but is found in very low concentrations (< 300 pM) in seawater due to the strong hydrolysis of titanate (Ti^{IV}) and/or titanyl (TiO²⁺) ions resulting in the formation of the poorly soluble TiO₂ (or TiO(OH)₂). The reduced form of Ti, titanous (Ti^{III}), is a strong reducing agent and is subsequently rapidly reoxidized to Ti^{IV} under all but the strongest reducing conditions.

There is no known biological enzyme that utilizes titanium and no organism has been found to require it for growth. However in recent years, research has been focused on Ti-complexes as potential anti-cancer drugs and in the utilization of Ti^{IV} to form nano-structures by the same enzymes that diatoms use to construct their silicate shells. Other recent developments include the common useage of Ti as a bio-inert substrate in the body and the increasing use of nanoparticle TiO₂ in a range of products. This increased exposure to Ti in our daily lives has new investigations into the biochemistry of Ti and revealed the potential for Ti competition for strong Fe(III) binding sites in organisms (e.g. transferrin).

To investigate the biogeochemistry of Ti in the ocean we recently developed a new sea-going voltammetric technique capable of rapidly measuring pM dissolved Ti, and we have applied this to work on a number of cruises in the Atlantic, including the preliminary German GEOTRACES cruise of 2005 and the IPY GEOTRACES Zero-Drake cruise in the Atlantic sector of the Southern Ocean. In this presentation we will outline our new findings on the speciation of dissolved Ti in the ocean, focusing on the evidence, or lack of it, for the existence of titanium-organic complexes in seawater. Finally we will show the distribution of dissolved Ti throughout the water column in the Atlantic ocean and comment on its potential for use as a tracer of dust input similar to Al and Fe.

Gas Phase Low Volatility Organic Compounds (LVOCs): Measurements from chambers, planes and automobiles

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Gas phase low volatility organic compounds (LVOCs) comprise an atmospherically important, largely *unmeasured* class of organic species in the atmosphere. LVOCs consist of intermediate volatility organic compounds (IVOCs; *i.e.* C₁₃-C₂₀ *n*-alkanes) and semivolatile organic compounds (SVOCs; *i.e.* C₂₁-C₃₂ *n*-alkanes). Atmospheric oxidation of gas phase LVOCs results in the formation of secondary organic aerosol (SOA) which in turn has direct implications for climate and human health. The rates and the chemical properties of LVOC emissions and oxidation products (in the gas phase and particle phase) are poorly characterized and not accurately parameterized in atmospheric chemistry models.

This paper will provide an overview of experimental results obtained with a novel technique called the Total Gas Phase Organics (TGO) instrument that provides a volatility-resolved, quantitative measure of gas phase LVOCs (and LVOC oxidation products) in the atmosphere. Experimental results from instrument characterization studies, chamber oxidation studies, and LVOC emissions characterization studies (including a medium duty diesel engine and the NASA DC-8 aircraft engine) will be presented. The capability of the TGO instrument for tracking total gas phase carbon during a chamber oxidation experiment will be discussed.