

Sulfur isotope fractionation during broadband low pressure SO₂ UV photolysis: Testing SO₂ self-shielding hypothesis in the laboratory

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Non-mass dependent sulfur isotope fractionations associated with SO₂ UV photochemistry are widely accepted as the cause of the anomalous sulfur isotope signals observed in Archean sulfides and sulfates [1], but the exact mechanism of this fractionation process is uncertain. Several hypotheses have been proposed to explain these fractionations, including SO₂ self-shielding, SO₂ photo-oxidation, SO₃ photolysis, SO photolysis and S₃ recombination reactions. Here, we present preliminary results from broadband low pressure SO₂ UV photolysis experiments and compare them with theoretical predictions from self-shielding calculations. Our goal is to evaluate whether SO₂ self-shielding fully explains the Archean signals [2], or if other reactions also participate.

Experiments were undertaken using a three-chamber cylindrical photocell, a 300W Deuterium lamp, and SO₂ gas pressures of 0.4-1 torr. The SO₂ pressures are lower than the 10-900 torr used in prior studies [e.g. 1, 3, 4] and minimize contributions from reactions other than SO₂ photo-dissociation. Residual SO₂ in each chamber was collected after irradiation, and analyzed using a CF-IRMS (ThermoFinnigan Delta-V mass spectrometer coupled with a Gas Bench II) by simultaneous monitoring of ion beams with m/e⁻ of 48, 49, 50 and 64, 65, 66 which allows simultaneous determination of δ³⁴S, δ³³S, δ¹⁸O and δ¹⁷O of SO₂.

Both δ³⁴S and δ³³S of the residual SO₂ in all three chambers decreased after the irradiation with a Δ (Δ³³S)/ Δ (δ³⁴S) slope of ~-0.2. This slope broadly agrees with the theoretical predictions from self-shielding calculations based on published ultraviolet absorption cross sections of SO₂ [5]. Detailed comparison between experimental results from each chamber and predictions from the self-shielding calculations will be presented and discussed.

[1] Farquhar *et al.* (2001) *JGR* **106**, 32829–32839. [2] Lyons (2007) *GRL* **34**, L22811. [3] Pen & Clayton (2008) *GCA* **72**, A734. [4] Masterson *et al.* (2008) *Eos Trans. AGU* **89**, #A511-0211. [5] Danielache *et al.* (2008) *JGR* **113**, D17314.

Assessment of factors responsible for climate change and human health

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Weather and climate play important roles in determining patterns of air quality over multiple scales in time and space. Air quality is strongly dependent on weather and is therefore sensitive to climate change. There is growing recognition that development of optimal control strategies for key pollutants like fine particles now requires assessment of potential future climate conditions and their influence on the attainment of air quality objectives. Climate change induced by anthropogenic warming of the earth's atmosphere is a daunting problem. In addition, other air contaminants of relevance to human health, including smoke from wildfires and airborne pollens and molds, may be influenced by climate change. While further research is needed, climate change coupled with air pollutant exposures may have potentially serious adverse consequences for human health in urban and polluted regions. Climate change producing alterations in: food webs, lipid dynamics, ice and snow melt, and organic carbon cycling could result in increased PMs level in air. In this study, the focus is on the ways in which health-relevant measures of air quality, including particulate matter, and aeroallergens, may be affected by climate variability and change. The small but growing literature focusing on climate impacts on air quality, how these influences may play out in future decades, and the implications for human health is reviewed. In the present study to find out the particulate dust in air, the sampling of particulate matters from different locations were carried out during December, 2006 - February, 2007 in Raipur city, one of the most industrialized parts of India, to characterize the ambient mass concentrations of coarse particulate matter (PM₁₀) and their sources. Techniques i.e. thermal method, proton induced X-ray emission spectrophotometry and ion chromatography was used for monitoring the species i.e. trace elements and water soluble ions, respectively and it is observed that the particulates are accompanied by high fractions trace elements (9.7%) and water soluble ions (15.5%), which play an important role in climate change.