

# Geochemistry of Sulfur in an inland acid sulfate soil system

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## Introduction

The Loveday basin was a natural flooded wetland adjacent to the River Murray. However, for three decades the site was used as a disposal basin for saline groundwater, which has led to an increased salinization of the area and accumulation of sulfidic sediments. The purpose of this study is to determine the effect of changing water regimes on S geochemistry.

## Results and Discussion

Surface sediments contain ~ 0.01 to 1% reduced S minerals and up to 10% gypsum, though concentrations are extremely heterogeneous due to the pedal structure that forms as a result of wetting and drying of the sediments. Total S concentrations generally decrease with depth [1]. Water samples collected from the basin are extremely saline, with Cl<sup>-</sup> ranging from ~ 9000 to 58,000 mg/L. Surface water sulfate is a mix of biological sulfate reduction (BSR) residual (enriched <sup>34</sup>S and <sup>18</sup>O) and sulfide oxidation (depleted <sup>34</sup>S and <sup>18</sup>O). Pit (pore)water sulfate has an oxidized sulfide (depleted <sup>34</sup>S and <sup>18</sup>O) source.

Experiments were conducted to determine S-oxidation/ S-flux from sediments collected from 'wet' (reduced), intermittantly wet-dry (partially oxidized and slightly acidic), and 'dry' parts of the basin to overlying water. Sediments were added to water, dilute HCl (pH ~ 2.4), and 1 mM FeCl<sub>3</sub> and allowed to incubate for weeks. The initial stages of the experiments show S flux from the surface sediments is dominated by gypsum dissolution. However, subsequent leaches of surface sediments, and experiments with sediments from deeper in the basin had increasing SO<sub>4</sub> concentrations over time, Ca/SO<sub>4</sub> ratios < 0.4 (g/g), indicating oxidation of reduced FeS minerals, though solutions did not become acidic and Fe concentration was below detection. Adding acid did not substantially increase sulfide oxidation rate (< 2 fold) compared to ~ neutral pH conditions. Ferric iron greatly increased Fe release to solution, ~ 2 to 4 orders of magnitude compared to acid conditions, but had minimal effect on S release, < 2 fold increase.

## References

[1] Wallace L et al 2006 GCA this volume