

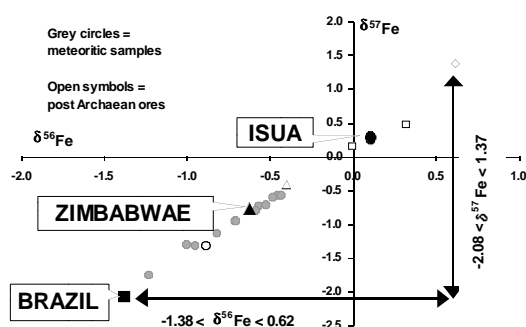
Iron Isotope Fractionation in an Archaean BIF Sample Suite

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Introduction: Using new MC-ICPMS techniques, the isotopic behaviour of iron is being gradually characterised in a wide variety of systems e.g. [1]. This study examines the Fe-isotope signatures of a number of banded iron formation (BIF) samples of different ages, i.e. Isua, Greenland (>3.8Ga), Zimbabwe (2.7Ga), and Minas Geras, Brazil (2.4Ga). BIFs represent the oldest known mineralised horizons on Earth, and as water-lain rocks, provide evidence for a hydrosphere which supported sediment deposition by c.3.9Ga. Analytical methods used have been reported elsewhere [2,3].

Results: Fractionation of up to 2.0 and 3.45‰ for $\delta^{56}\text{Fe}$ and $\delta^{57}\text{Fe}$ respectively is observed (Fig. 1). All measured samples lie on (a) a single mass fractionation line, passing through the origin and on (b) the same mass fractionation line as a selection of meteoritic and post-Archaean ore samples also studied (Fig. 1). The oldest BIF samples are isotopically light, grading to isotopically lighter for the youngest.



Discussion: Signatures for the above BIFs suggest an evolution towards isotopically lighter Fe-isotope composition within the represented time frame. BIFs are a diagenetic product of chemical precipitates from a seawater - hydrothermal fluid mixture. These results might indicate (a) systematic change in the composition of both elemental reservoirs with time, or (b) changing relative contributions from each. Both organic and inorganic fractionation are viable pathways for these changes, e.g. [4,5] The progressive change may arise from the emergence of iron processing chemosynthetic micro-organisms during the time frame. Another possibility is the progressive oxygenation of the atmosphere, resulting in changing Fe-redox state, producing differential fractionation behaviour between ferrous (early) and ferric (later) minerals.

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Tl and Au in low T hydrothermal fluids: An experimental study

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Introduction

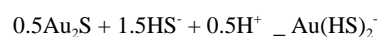
High concentrations of metals, including Au, Ag, As, Sb, Tl, Hg and W, are present in sinters from hot springs in New Zealand. At Waiotapu, 100 mg/kg Au and 320 mg/kg Tl have been measured (Hedenquist, 1986). In this study we focus on the speciation of Au and Tl as HS⁻ complexes in low T hydrothermal fluids from hot springs (T<100°C).

Method

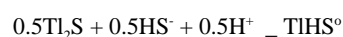
A flow system has been constructed to measure sulphide solubilities under varying pH and ligand concentrations between 25-100°C. It consists of an input solution flask, a HPLC pump, an oven containing a column packed with the relevant metal sulphide, and a fraction collector that collects the output solution. Total S concentration and pH are measured at the start and end of each experiment. Metal concentrations are determined by AAS.

Results

To test the apparatus, the solubility of Au₂S was measured at 25°C. Seventy samples were collected over 700 minutes at 0.2 ml/min. Initial Au concentrations were high (>900 mg/kg), attributed to the dissolution of AuCN. After 100 minutes, Au concentration declined to between 3 and 6 mg/kg and remained stable. Renders and Seward (1989) determined the log K for the Au₂S dissolution reaction



as $\log K_{\text{Au}} = +2.25$. Using our measurements, we obtained a value of +2.1. The solubility of Tl₂S was also measured. Using the speciation scheme of Gübeli and Retel (1972), at neutral pH, carlinite solubility can be expressed as



At 25°C, we were unable to detect Tl in the effluent. This is consistent with measurements of Gübeli and Retel (1972) which gave a solubility below the detection limit of AAS. At 95°C, Tl concentrations of between 0.8 and 1.2 mg/kg were measured. An estimate of the equilibrium constant of the carlinite dissolution reaction as hydrosulphide complex was determined as $\log K_{\text{Tl}} = -1.0$ at 95°C.

References

Gübeli A.O. and Retel J.P., (1972), *Helv. Chim. Acta* 55, 1429-1436.
Hedenquist J.W., (1986), *Mon. Ser. Min. Dep.* 26, Gebrüder Borntraeger, 65-79.
Renders P.J. and Seward T.M., (1989), *Geochim. Cosmochim. Acta* 53, 245-253.