Methods for the determination of Te isotope compositions of minerals in the system Au-Ag-Te by MC-ICP-MS

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The high precision of multicollector ICP-MS (MC-ICP-MS) analyses has led to the investigation of stable isotope variability of increasingly heavy elements (e.g., Cu, Se, Hg) found in ore-forming systems. Tellurium is commonly associated with Au and Ag in epithermal and orogenic ore systems. To date, there have been no high-precision studies of the natural variability of tellurium isotopes in ore-forming systems.

Using a micromill, a sufficient mass of telluride or native Te sample can be isolated and extracted from coexisting ore and gangue minerals from ~50 μm wide by ~50 μm deep drilled holes. Dissolution of those samples and subsequent ion exchange chromatography isolates Te from matrix metals, with a tellurium yield of $\geq$ 95%. The chromatography procedure causes no net fractionation of Te.

MC-ICP-MS analyses were completed using two techniques, both of which employ the doping of samples using Cd to correct for drift in instrumental mass bias. The first method was the introduction of 100 ppb Te bearing solutions (with 100 ppb Cd) using a desolvating nebulizer (DSN). The second method was direct introduction of 2 ppm solutions of Te (with 1 ppm Cd) into the MC-ICP-MS. The average precision using the DSN is ±0.17 ‰, whereas that for the wet method is ±0.08 ‰.

Natural, hypogene tellurides (n = 17) and native Te have shown an isotopic range of $^{130/125}$Te of ~1.9 ‰, demonstrating resolvable disparate isotope ratios between samples, including in samples from the same locality (i.e., Cripple Creek).

The understanding of isotope systematics for Te will lead to a better understanding of the geochemistry of Te, as well as its transport and deposition mechanisms. Systematic spatial variation of Te isotopes within an orebody may serve as an exploration vector for associated Au (as Au only has one stable isotope) and other precious metals.

The relationship between CO_2 and ice-volume on geological timescales

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Sea-level is arguably the most serious impact of anthropogenic climage change [1]. Unfortunately, changes in sea-level cannot simply be predicted by numerical climate models because they do not physically describe the dynamics of processes associated with the volume reduction of continental ice sheets. This compounds the issue of long range prediction as retreat of these ice masses will increasingly contribute to sea-level rise as the 21st century progresses. Consequently, the likely magnitude of future sea-level change remains uncertain [1]. One way in which the uncertainty in future sea-level predications can be reduced is to study the behaviour of the ice sheets and sea-level in the past in relation to greenhouse gas forcing.

Here we compile several recent records of pCO_2 and ice-volume from the last 40 million years. A consistent pattern emerges that clearly demonstrates a non-linear relationship between these variables, largely consitent with our understanding based on ice sheet modelling [2]. Given an estimate of the current climate forcing by CO_2 we use the relationship we observe on geological timescales to provide an estimate of the modern long-term equilibrium sea-level. This treatment supports the notion of significantly elevated long-term sea level response to anthropogenic CO_2 forcing even if CO_2 levels are stablised at current levels [3].

[1] Vermeer and Rahmstorf (2009) *PNAS* **106**, 21527-21535. [2] Deconto et al. (2008) *Nature* **455**, 652-656. [3] Rohling et al. (2009) *Nature Geoscience*, **2**, 500-504.