$\delta^{34}S$ analyses of human hair and single red blood cells

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The stable isotopic composition of sulphur in single blood cells and hair strands has been measured using the new SHRIMP-SI ion probe at the Australian National University, using Faraday cups equipped with rate-of-charge electrometers [1]. For the blood cells, silicon wafer matrix was used for low backgrounds, conductivity, and tuning. The small signals released and chemical fixing procedures required to allow the cells to withstand vacuum create several analytical challenges. Carbon isotopic measurements were imprecise due to backgrounds from fixative chemicals, and oxygen ion yield was insufficient for permil-level counting statistics on ^{18}O in the ~40 second burn through time for single red blood cells. Despite these complications, we were able to measure red blood cells to a cell-to cell $\delta^{34}S$ reproducibility (standard deviation) of 3.5‰, and hair to a reproducibility of 0.5‰. It is not clear how much of this variability is biological vs instrumental. As archaeological human populations have $\delta^{34}S$ variations on the order of 20‰, this precision might be adequate for investigating a variety of anthropological, athletic, or forensic applications. However, results of a month-long intercontinental travel study from Australia to Japan and an investigation into isotopic fractionation of malaria-infected cells show only limited isotopic change in the hair and no change within analytical error in the blood cells.

[1] Ireland, T. R., N. Schram, P. Holden, P. Lanc, J. Ávila, R. Armstrong, Y. Amelin, et al. 2014. 'Charge-Mode Electrometer Measurements of S-Isotopic Compositions on SHRIMP-SI'. *International Journal of Mass Spectrometry* **359** (February): 26–37. doi:10.1016/j.ijms.2013.12.020.