High precision Fe isotopes of human blood for adults

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Mass dependent fractionation for metal stable isotopes e.g., Fe, Cu, Zn, Ca, Mg, and S, has been widely used in cosmochemistry, geochemistry, marine science, biology, and more recently, biomedicine. In particular, isotopic fractionation in response to the uptake, metabolism, and excretion of these metals in humans and mammals offers the possibility of applying them to the study of early detection of various diseases, and also monitoring the progress of these diseases throughout the treatments. However, earlier studies suggested that the observed isotopic fractionation within a healthy population might be related to differences in choices of diet, races, and aging. Consequently, a reference database from within a race or community is essential in order to apply the metal stable isotopes in biomedical studies.

We have undertaken a pioneer study of applying metal stable isotopes in biomedical studies in Taiwan, and as a starting point, the iron isotope compositions of whole blood, serum, and red blood cells (erythrocytes) from 17 healthy male and female Han Chinese adults in Taiwan are measured on Neptune MC-ICPMS. We employed for the very first time the double-spike technique for Fe isotopic measurement of human samples. The difference in Fe isotope composition between erythrocytes and plasma is barely resolvable due to limits of analytical precision [1]. However, with improvement of methodology and measurement, the Fe isotope difference between whole blood and serum can be resolved. The precision (external reproducibility) on $\delta^{56/54}$Fe in this study is 0.04‰ (2 s.d.), and the requirement of sample amount is also significantly reduced. Our results show that the Fe isotope compositions of Han Chinese adults are similar to Caucasian adults in the whole blood but around 1‰ lighter on the mean $\delta^{56/54}$Fe of serum, and the underlying reason needs further investigation.

[1] von Blanckenburg et al. (2014). *Metallomics* **6** 2052-2061.