High-precision Pb isotope analysis of seawater using a Nobias chelate resin and a ^{207}Pb-^{204}Pb double-spike on a MC-ICP-MS

A. GRIFFITHS[1*], H. PACKMAN[1], S.H. LITTLE[1], M. REHKAMPER[1], T. VAN DE FLIERDT[1]

[1]Department of Earth Science and Engineering, Imperial College London, South Kensington Campus, London, SW7 2AZ (*correspondence: a.griffiths15@ic.ac.uk)

Lead isotopes are an effective tracer of the sources and circulation pathways of anthropogenic pollutants in the ocean [1]. The number of Pb isotopic measurements in seawater, however, is currently limited by analytical challenges such as sample contamination, time-consuming extraction procedures and insufficient instrumental detection limits.

A new method has been developed to increase the analytical throughput without increasing procedural contamination or compromising the ability to measure precisely and accurately nano-gram levels of Pb. The procedure involves the initial extraction of Pb from seawater using a Nobias chelate PA-1 resin, followed by purification using an anion exchange protocol. The Pb isotope measurements are carried out by MC-ICP-MS using a ^{207}Pb–^{204}Pb double-spike for correction of instrumental mass fractionation.

The total procedural Pb blank was 70±24 pg (1sd) and typical yields were 65–95%. Both the blanks and yields were higher than the $Mg(OH)_2$ co-precipitation extraction technique (25±20 pg, 1sd; 60-85%). The greater efficiency of Pb extraction by the Nobias chelate resin compensates for the higher blank values and, in fact, reduces the relative blank contribution. The typical precision for Pb isotope analyses of low concentration seawater samples (~ 5 pmol kg^{-1}) were 950-1200 ppm and 500-1200 ppm for $^{207}Pb/^{206}Pb$, $^{208}Pb/^{206}Pb$ and $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, $^{208}Pb/^{204}Pb$, respectively. When compared to an established double-spike TIMS method [3], the results demonstrate improved precision for the $^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$ ratios and greater reproducibility by at least a factor of two for the ratios involving the minor ^{204}Pb isotope. The accuracy of the method was confirmed by inter-laboratory calibration using intercomparison samples from the GEOTRACES programme.

[1] Alleman et al. (1999), *Geophys. Res. Letters*, **26**, 1477-1480. [2] Paul et al. (2015), *Analytica Chimica Acta*, **863**, 59–69.