

## LEAD ISOTOPIC RATIO MEASUREMENTS USING ICP-QMS

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### SUMMARY

Isotopic ratio (IR) measurement is a widely used method for tracing the source and pathways of various elements in the environment. Lead is present in four natural isotopes, <sup>208</sup>Pb (52.4%), <sup>206</sup>Pb(24.1%), <sup>207</sup>Pb(22.1%) and <sup>204</sup>Pb (1.4%). Only <sup>204</sup>Pb isotope is primordial, the others are final products of decaying thorium and uranium radioactive isotopes. Because of this, the ratio of <sup>208</sup>Pb, <sup>206</sup>Pb and <sup>207</sup>Pb is not constant over the earth (within a given timeframe), making possible to trace the lead from a specific sample, according to its isotopic ratio.

Measuring isotopic ratio of lead requires a sensitive instrument, since differences between isotopes are very small. A standard quadrupole, single collector ICP-MS can be tuned for proper IR measurements, if very precise measurements are not required. Also, a fast analysis is preferred when handling large volumes of samples every day.

For a single collector quadrupole, the worst part is that it reads the signal from different isotopes sequentially, thus little change in plasma parameters can affect the RSD of the measurements up to a value that becomes impractical for use. Hence, a good statistics is needed and this can be achieved by increasing the reading time, or the concentration of the sample, but both methods have their limits. A standard mass tuning of the spectrometer is required. We've also optimized total reading time, concentration, sweeps, dwell time and the DRC-specific RPq parameter (proportional with the q parameter from the Mathieu equation for stability trajectory inside a quadrupole) and finally obtained decent RSD values that are sufficient in marking the difference between samples coming from different sources. Our RSD values (0.02% – 0.10%) are not as accurate as the one obtained by TIMS technique, but are much more cost effective and samples require no special treatment before the analysis. NIST 981 (natural lead) standard reference material was used during analysis as a standard and a verification element.

For environment tracing isotope ratio measurements, single collector, quadrupole based ICP-MS can be a fast and not that expensive solution, if RSD smaller than 0.02% are not expected.

### REFERENCES

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