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Comparison of Precision and Accuracy between Faraday, Faraday-Ion Counter and Ion Counter Measurements of Pb-isotopes by MC-ICP-MS

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Over the past decade further advancements in front-end designs and collector arrays utilized in MC-ICP-MS instruments have resulted in enhanced ion transfer, increasing instrument sensitivity and measureable analytical dynamic range. The practical result of these advancements is two-fold: 1) on one hand the amount of sample required to achieve highly precise "standard" Pb-isotope measurements has decreased; positively impacting sample throughput, expanding data sets and lowering analytical blanks, while, 2) on the other hand, simultaneously enhancing the capability to characterize samples on smaller and smaller spatial and/or temporal scales. Our investigation focuses on the second of these two benefits with a particular emphasis on the implication these advancements have on micro-sampling techniques (e.g. micro-drilling and LA-MC-ICP-MS).

Our contribution will compare instrument performance across a wide range of lead concentrations by characterizing the internal and external errors achieved for Pb isotope measurements including ^{204}Pb. Results will be presented for natural rock standard materials AGV-1 and STM-1 across several orders of magnitude in total Pb-signal utilizing NBS981 and a standard-sample bracketing approach [1]. This study will describe the relationship between signal intensity and analytical precision through the comparison of measurements made utilizing standard Faraday collectors (10^{11} Ω resistors), varied Faraday collectors (^{204}Pb measured on 10^{12} Ω resistor) and measurements made exclusively on a full ion counting detector array (combination of Daly and EM detectors). Initial investigation indicates analytical uncertainty, defined by internal precision, converges for the different detector setups at ^{204}Pb ≤ 0.010-0.015 V, equal to ~1ng Pb/mL (~0.7-1.0V total-Pb signal). Any limitations and the feasibility of using the different detector arrays for LA-MC-ICP-MS will also be discussed.

[1] Elburg et al. (2005), Chemical Geology 223, 196-207