Tin stable isotope analysis: A comparison between measurements corrected using different internal normalization and external mass-bias method

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Introduction: Tin is one of the elements in periodic-table with the highest number of 10 stable isotopes. This renders possibility to explore this element for isotopic fractionation due to various natural processes. Tin isotopic varation was explored in terrestrial and meteoritic samples [5,6,7,8], but with not much success, mainly because the high first ionization potential of tin (7.3 eV) makes it difficult for TIMS analysis. With the advent of new generation MC-ICP-MS, work on tin isotopy became much easier. Much of recent work on tin isotopy is focused around provenance determination of raw materials in archaeological artifacts using [4,9]. In this work, we present the results of our first tin isotopic measurements, with an approach to better understand the applicability of a internally-standardized mass bias correction, in comparison with other mass-bias correcting techniques.

Methods: A range of commercially available tin and antimony solutions were routinely measured in an MC-ICP-MS (Neptune Plus, ThermoFisher) using the spray chamber set-up. The above standard solutions were also mixed with solutions of 23 other elements and passed through two-stage column chromatography, and yields of 100 ± 2% - 100 ± 6% with analytically insignificant inclusion of interfering elements was found. These separation procedure was then applied for standard rock samples available from USGS.

Results: The external reproducibility (2SD) of a most widely measured Sn-isotope ratio $^{122}Sn/^{116}Sn$ in a 200 ppb NIST SRM 3161a tin solution (our in-house reference standard) measured repeatedly (n=11) on a single day was ±11 ppm, for both the data corrected for mass-bias internally using $^{116}Sn/^{120}Sn = 0.4460$ [3] as well as using internally standardized "Antimony-doping" by external normalization [1,2].

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