Multiple linear regression for isotopic measurements

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There are two typical applications of isotopic measurements: the detection of natural variations in isotopic systems and the detection man-made variations using enriched isotopes as indicators. For both type of measurements accurate and precise isotope ratio measurements are required. For the so-called non-traditional stable isotopes, multicollector ICP-MS instruments are usually applied. In many cases, chemical separation procedures are required before accurate isotope measurements can be performed.

The off-line separation of Rb and Sr or Nd and Sm is the classical procedure employed to eliminate isobaric interferences before multicollector ICP-MS measurement of Sr and Nd isotope ratios. Also, this procedure allows matrix separation for precise and accurate Sr and Nd isotope ratios to be obtained. In our laboratory we have evaluated the separation of Rb-Sr and Nd-Sm isobars by liquid chromatography and on-line multicollector ICP-MS detection. The combination of this chromatographic procedure with multiple linear regression of the raw chromatographic data resulted in Sr and Nd isotope ratios with precisions and accuracies typical of off-line sample preparation procedures.

On the other hand, methods for the labelling of individual organisms (such as a given plant, fish or animal) are required for population studies. We have developed a dual isotope labelling procedure which can be unique for a given individual, can be inherited in living organisms and it is stable. The detection of the isotopic signature is based also on multiple linear regression. The labelling of fish and its detection in otoliths by Laser Ablation ICP-MS will be discussed using trout and salmon as examples.

As a conclusion, isotope measurement procedures based on multiple linear regression can be a viable alternative in multicollector ICP-MS measurements.