A preliminary study of 99Tc measurement using matrix-assisted low energy AMS

A renewed study of Tc and Ru fluoride anion formation in a Cs sputter source has confirmed an earlier observation that the relative yields of RuF$_{5-n}$ are dependent on the sputter target matrix composition. The yield of RuF$_5$ can be suppressed relative to TcF$_5$ with the presence of a PbF$_2$-based sputter target of certain elements: some strongly as in the case of Nb and some modestly as in the case of Fe. This provides an opportunity for 99Tc to be detected by low energy AMS using 99TcF$_5$ with the assistance of a carefully composed matrix to form the sputter target. Depending on the Ru content in a sample and the effort to reduce it during sample preparation, the best detection limit obtained so far was ≤5 in the unit of “fg 99Tc per mg FeO$_x$Hy precipitate”, using targets made of (99Tc)FeO$_x$Hy+PbF$_2$ (≈1:10 by weight). In several preliminary linearity tests with the detection of +4 ions in the gas ionization detector, the determination of 99Tc concentration within a FeO$_x$Hy precipitate was best shown with ~15% uncertainty. The quantification was made by the average count rate of 99Tc, subtracting that of 99Ru (determined by multiplying the counts of the isobar-free 101Ru by the ratio of their natural abundances 0.748), over an hour long time under steady-sputtering conditions. This quantification method is required due to the lack of a stable Tc isotope. This method shows promise for analyzing 99Tc in seawater samples using ≤2L volumes.

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