Analysis of $^{186}Os/^{188}Os$ ratios by NTIMS using amplifiers equipped with 10^{13} ohm resistors

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The tracer ^{187}Os has now become a standard tool in isotope geochemistry, used to study subjects ranging from the evolution of the Earth's mantle, to continental erosion, to the generation of hydrocarbons. However, its sister isotope, ^{186}Os, has been much less exploited. This is because ^{190}Pt, the radioactive parent of ^{186}Os, has both a low isotopic abundance and an extremely long half life, producing only a very small range of $^{186}Os/^{188}Os$ ratios in most natural samples. As a result, $^{186}Os/^{188}Os$ studies have been mostly limited to samples with relatively high Os abundances, such as meteorites and peridotites. ^{186}Os studies of samples with lower Os concentrations currently require preconcentration of Os from huge quantities of powder (100s of g to >1kg), placing obvious limitations on the number and the types of samples that can be analyzed.

For this reason we are developing a method to analyze ^{186}Os by negative thermal ionization mass spectrometry (NTIMS) on a Triton mass spectrometer equipped with three amplifiers with 10^{13} ohm resistors. As shown by Koornneef et al. [1] for Sr and Nd isotopic analyses, the use of amplifiers of this type greatly reduces the signal/noise ratio relative to traditional amplifiers with 10^{11} ohm resistors, thus decreasing the amount of sample required for analysis by nearly an order of magnitude. We obtain in-run precisions of <100 ppm for signal intensities of < $4x10^{-14}$ A (corresponding to < 4 mV measured with a 10^{11} ohm amplifier), using a static multicollection routine with 10^{13} ohm amplifiers on masses 234, 236 and 240. This is the maximum signal intensity that can be measured in this configuration, if saturation of the mass 240 peak is to be avoided. Measurement routines using combinations of 10^{11} ohm and 10^{13} ohm amplifiers are being investigated to allow analyses of signals larger than 4 mV on mass 234, though such measurements are complicated by the very different decay times of the 10^{11} and 10^{13} ohm amplifiers.

[1] Koornneef et al. (2014) Anal. Chim. Acta 819, 49-55