Comparing ozone and nitrous oxide as reaction cell gases for Rb-Sr isotope analyses with QQQ ICPMS

CHARLOTTE M. ALLEN[1*], MITCHELL DEBRUYN[1], DAVID L. MARSHALL[1], KARINE HAROUMI MORMIZATO[1], BERWYCK POAD[1], AND STEPHEN J. BLANKSBY[1]

[1]QUEENSLAND UNIVERSITY OF TECHNOLOGY, BRISBANE QLD 4000, AUSTRALIA
(*CORRESPONDENCE:CM.ALLEN@QUT.EDU.AU)

Since Zack and co-workers applied knowledge of gas reactions for ICPMS use, the community has sought to improve precision and accuracy in the measurement of isotope pairs of geological interest such as $^{87}Rb/^{86}Sr$. QQQ or "triple quad" technology has a reaction cell (also a quad) sandwiched between 2 quadrupoles. After passing through the plasma, ions can be selected for entry into the reaction cell by the first quadrupole, reacted, and then filtered again by the second one. The strategy for separating isotopes of elements that are very similar in mass is straightforward: to use gas reaction to mass-shift the more reactive species (Sr^+) from the less reactive one (Rb^+) thus providing an on-line separation of ^{87}Rb from ^{87}Sr (measured as 87+16=103=SrO^+). Reaction efficiency is measured by comparing counts on mass and at the oxygen-mass-shifted mass. ^{87}Rb is estimated from ^{85}Rb. Instrument effects like mass bias are dealt with by using a reference material to derive a correction factor for each ratio required, the known/measured ratio, and this factor is applied to the unknown. Hogmalm and Zack [1] compared the efficiencies of reaction using O_2 and N_2O and SF_6, and found that N_2O produces more abundant oxygen-mass-shifted species as compared to O_2. We examine O_3.

Experiments on NIST SRM 987 in solution were conducted using an Agilent 8800 ICPMS. High purity N_2O was plumbed into an onboard mass flow controller. In a separate session an ozone generator source was plumbed into the same controller. We found that ozone was more efficient, producing a greater abundance of reaction products overall compared to N_2O but that the product species were more numerous and spanned a greater mass range. First impression is that this is undesirable but given the analytical problems of ICPMS pulse/analog detector crossover for targets with widely varying Rb/Sr, having more products of varying abundance of may be useful. A second finding is that ozone generator products should be filtered for contaminating minor species (H_2O, etc).

[1] Hogmalm and Zack, 2017, *J. Anal. At. Spectrom.*, **32**, 305–313.