

Isotopic analysis of small neon samples by high resolution ion counting on a Helix MC plus

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Neon isotope measurements are widely used in geo- and cosmo-chemistry to study presolar and protoplanetary components in meteorites, extraterrestrial components in deep sea sediments, and cosmic ray exposure ages in both meteorites and terrestrial surface rocks. Although the composition of the modern terrestrial atmosphere is important for a number of these applications including standardization, it is particularly important for accurate and precise determination of terrestrial ²¹Ne cosmic ray exposure ages (e.g. when dating Holocene glacier deposits), where it is utilized to deconvolve trapped air components [1,2,3].

Significant differences between published values for the relative ²¹Ne abundance in the terrestrial atmosphere however remain in spite of efforts to minimize the complicating effects of molecular and atomic interferences such as ⁴⁰Ar⁺⁺, ²⁰NeH and CO₂⁺⁺ on ²⁰Ne⁺, ²¹Ne⁺ and ²²Ne⁺ respectively. These differences could instead be due to differences in analytical procedures such as the use of ion counters and/or Faraday collectors and the so far unrecognized effects of magnet hysteresis during dynamic measurement routines[4]. Following our recent redetermination of the atmospheric ²¹Ne abundance using large purified atmospheric samples to perform high intensity measurements using Faraday cups, we have investigated strategies for reproducible and accurate ion counting measurement of smaller aliquots more akin to previous investigations and actual cosmogenic aliquots.

We present initial results from various strategies for accurate neon ion counting on our Thermo Helix MC plus, including purification of Ne using a Janis cryostat, static multicollection, minimization of peak jumps during detector intercalibration, use of an additional liquid N₂ cold finger within the effective mass spectrometer volume itself, and modeling of cup collection efficiency with respect to measurement position.

[1] Honda et al. (2015) International Journal of Mass Spectrometry 387, 1-7. [2] Eberhardt et al. (1965), Zeitschrift für Naturforschung, 20a, 623-624. [3] Saxton et al. (2015) Goldschmidt Abstracts, 2015 2781. [4] Wielandt et al. (2019) Journal of Analytical Atomic Spectrometry, 34, 535-549.