Strategies for the determination of the atmospheric ^{21}Ne abundance using 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. For accurate and precise determination of terrestrial ^{21}Ne cosmic ray exposure ages (e.g. when dating Holocene glacier deposits), accurate knowledge of the atmospheric neon isotope composition is critical to ensure proper determination and deconvolution of trapped components [1,2,3].

Accurate measurements of neon isotopes are, however, complicated by molecular and atomic interferences, in particular the presence of doubly charged $^{40}Ar^{++}$ and CO_2^{++} on ^{20}Ne and ^{22}Ne respectively, and ^{20}NeH on ^{21}Ne. These effects are compounded by the comparatively low abundances of Ne as compared to these interferences, or in the case of ^{20}NeH, the presence of hydrogen-supplying compounds in the instrument.

The new noble gas isotope laboratory at the Natural History Museum of Denmark is equipped with a Thermo-Fischer Helix MC Plus with a dedicated noble gas extraction line, a 6 K^0 capable Janis cryostat for purifying gasses, and a 250 watt diode laser for stepwise heating of large samples (e.g. quartz for ^{21}Ne cosmogenic dating). Although the high resolution Helix MC plus (5-95% mass resolving power of > 7000) can minimize the $^{40}Ar^{++}$ ($m/\Delta m \approx 1780$) and ^{20}NeH ($m/\Delta m \approx 3270$) interferences, correction for the CO_2^{++} interference on $^{22}Ne^{+}$ remains problematic, given its high instrumental background and small mass difference ($m/\Delta m \approx 6230$). We will present initial results from various strategies to mitigate these effects, including repeat purification of Ne using the Janis cryostat, measurement of large Ne-aliquots on Faraday cups linked to 10^{13} ohm amplifiers, use of an additional liquid N_2 cold finger within the effective mass spectrometer volume itself, and modelling 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.