Geochronology Discuss., author comment AC2
https://doi.org/10.5194/gchron-2021-11-AC2, 2021

Reply on RC2

Benedikt Ritter et al.

Author comment on "Technical Note: Noble gas extraction procedure and performance of the Cologne Helix MC Plus multi-collector noble gas mass spectrometer for cosmogenic neon isotope analysis" by Benedikt Ritter et al., Geochronology Discuss., https://doi.org/10.5194/gchron-2021-11-AC2, 2021

We want to thank the anonymous reviewer for the detailed review of our manuscript and for the helpful suggestions which, from our perspective, improved our manuscript a lot. In the following we will outline every change made, based on the comments of the reviewer and where appropriate provide suitable rebuttals.

The manuscript would benefit from better proof reading. There are a few themes throughout:

- use of semi colons rather than commas (e.g., lines 21, 33, 34) and hard to read sentences (e.g., line 239) --> *checked and corrected accordingly throughout the manuscript*

- missing gaps between number and unit (e.g., lines 133, 134, 192...) -->*checked and corrected accordingly throughout the manuscript*

- incorrect capitalisation (e.g., lines 17, 152, 154) --> *checked and corrected accordingly throughout the manuscript*

- Please consider accessibility with the plots. Some are hard to read because the text is too small. If you haven't already, check that some of the more colourful plots and schematics are colour-blind friendly, and consider using symbols to differentiate, rather than for example "the green cluster".

-->Thank you for this valuable comment. We modified our figures. In Fig. 4 and Fig. 5, we changed the symbology.

Specific comments:

89 - 103: L1, Ax and H1 seem to be just thrown in here with no definition. Perhaps in line 85 you could define these?

--> We now added: "The central, axial module (Ax) is fixed in position, the four remaining modules (L1, L2 on the low mass side, and H1, H2 on the high mass side of Ax) can be moved.". Line 86-88

195-207: Do you have any quantitative data to support the calibration of the bare cold trap. I'd be more interested in seeing plots of how the ad/desorption varies with temperature (and that 100% of the neon is released at 80K), and what the RGA sees when you de-gas the cold trap, rather than Fig 1B. This is particularly of interest because you make comparisons with the disadvantages of a liquid nitrogen cold trap. It would be good to see the data or citations backing this up.

--> We now provide a figure (Fig. 2) with the desorption characteristics of the cold trap used.

220- 222: Be very careful saying that automation helps 'prevent' oversight and negligence on the part of an operator! This view could bring in errors due to the _expectation_ that automation is infallible. Do you have safeguards in place, will you know if a automatic valve failed to open during a run? Also, later when you talk about in-house software, is this available to scrutiny?

--> We do not have specific safeguard protocols for the pneumatic valves. A failure of a valve would show up during a subsequent calibration. Spring loaded diaphragm valves (normally closed) don't fail to open and then 'decide' to work again at a later time (as is sometimes the case with gate valves or bellow sealed valves). If the pressurized air supply that powers the valves fails, we will notice immediately since no gas would be inlet into the mass spectrometer (the inlet valve is attenuated by the same pressure reservoir as are all other Fujikin valves). We write with reason 'helps to prevent' rather than 'prevents' as we concur that no system is failproof. The LabView code we wrote to integrate devices is not available for the public.

263 - The pressure being less than the gauge is capable of is good, but it does depend on where the pressure gauge is. If it right next to the turbo pump (it's hard to see from Fig. 1B but this appears to be the case), you're not measuring the pressure in the furnace, you're measuring the pressure at the pump. It that's the case the blank is more important to report here than the pressure.

--> We report the pressure since we describe the protocol. We decide to start a sample run after sample reload when the pressure reading is low (i.e., in the 10^{-9}mbar range), then we measure blanks. We provide the information on typical blank levels (~0.3 fmol Neon) before, in the section where we describe the laser furnace.

275 - define "hot" - what temperature are you running the hot getter at?

--> We originally did not provide the temperature, since we cannot measure it (the cartridges are internally heated and have no thermocouple). We will now report the heating current (1.6 A) of the SAES cartridge and the estimated temperature (~300ºC) derived from the corresponding diagram in the SAES data sheet.

302: You calibrate with RedAir once per day to check mass discrimination, sensitivity and multiplier vs faraday gain. Is this enough? Do you observe changes (particularly multiplier vs faraday) over the course of the day as you run experiments? I'd expect at the start of a day the mass spec has had time to 'reset' overnight, so a calibration run every morning might be broadly consistent with the previous day, but over the course of the day there could be lots of sensitivity changes (especially with large signals). Also, you say "at least" once per day. Are there reasons why you might do more than one, or is there no set pattern?

--> After changing the isotope system (from He to Ne), reloading of samples or after starting a new measurement series after the machine was idle for some time, we measure several (>5) RedAirs to 'wake-up' the multipliers and asses their stability, and that of the

mass-spectrometer. After this initial wake-up protocol we do not observe changes in the sensitivity over the course of a day, or between days. Thus, the default is to run one calibration per day, as first measurement of a given day. To date all samples had Ne-abundances small than the calibration gas, thus do not modify multiplier sensitivity. In cases where the operator judges that any sample's result is in any way unusual, they can perform (an) additional RedAir calibration(s) at any day, to ensure that the extraction sequence and the mass spectrometer is running normally (which is, so far, always the case). Running an additional calibration at the end of a given day comes at little time expense, since the gases are purified automatically, and the gas inlet can be performed remotely (via. TeamViewer).

322 - Figure 3. I cannot tell if this is just me seeing a pattern in the data, but does the dispersion increase with time? It would also be helpful, for accessibility, to have the symbols in the key, not just the colours.

--> *Similar to the reviewer we can't discern a significant trend in the dispersion with the current data; concerning accessibility Fig. 3 will be modified following the reviewer's suggestions.*

Typos etc (not a complete list):

Line 13 - The opening line seems a bit cluncky - use "dedicated to" rather than "dedicated for"? (first few sentences could do with reworking) ---> *corrected*

17 - mass spectrometer, not Mass-spectrometer --> *corrected*

19 - automated would read better than automized (section 2.3 is subtitled automation) --> *corrected*

62 - 65 - This sentence is hard to read. Maybe "Common isobaric..... are at: m/e = 20 (interferences on 20Ne+ are 40Ar2+, H19F+, H218O+), m/e=21 (interferences on 21Ne+ are ....) ....etc" --> *corrected*

85 - "five CFM modules" or "five CFMs", not "five CFMs modules" --> *corrected*

110 - made of metal --> *corrected*

198 ion pump not ion-pump --> *checked and corrected throughout the manuscript*

152 - 5*10 - use 'x' instead of * and 156.6 not 156,6 -->*corrected*

171 - gases not gasses --> *corrected*

189 - the starcell is referred to here as an iongetter (should be ion getter?) pump but in 193 as an ion pump. Maybe just use ion pump here -->*corrected*

280 - resulting rather than ensuing? --> *Changed to "Subsequently, Ne gas …"*