Review of manuscriptNr. gchron-2021-11 submitted to Geochronology: Noble gas extraction procedure and performance of the Cologne Helix MC Plus …by B. Ritter, A. Vogt and T. J. Dunai

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Rainer Wieler

The manuscript presents a new noble gas mass spectrometer system and its performance set up at the Institute of Geology and Mineralogy at the University of Cologne. The system will be used (mainly?) for the analysis of cosmogenic noble gases (primarily Ne) in terrestrial samples. The manuscript is basically well written and gives a very detailed description of the mass spectrometer and its extraction line, including a description of its operation etc. The authors also present an extensive data set on international standard quartz sample. These data document a very good reproducibility of the Ne analyses with the new Cologne instrument and also a very good agreement with data by other laboratories. In summary, this manuscript will be a welcome addition to the technical literature on noble gas mass spectrometry and deserves to be published with minor to moderate modifications as detailed in the following (numbers in the following refer to line numbers in the pdf manuscript file).

Though the manuscript in general is written in a satisfactorily style, it nevertheless requires some language polishing (including corrections of clear mistakes). I urge the senior author to keep an eye on this! In the following, I just note some of the grammatical/stylistic issues that should be considered, but this list is not exhausive!

19: automATized
24: ..is equal TO or better
36: delete "isotope geochronology"
38: delete "applying"
44: For THE evaluation of ..
49: delete one of the "atmospheric"
52: this not only holds for quartz

62ff: There has been quite some controversy recently about the 21Ne/22Ne ratio in the atmosphere. If Wielandt and Storey 2019 are mentioned here, also Saxton J.M (2020) J. Anal. Atomic Spectroscopy should be addressed. Also there is another paper on the issue by the Glasgow group (about which I am sceptical but this is my personal opinion).

section 2.2., first paragraph: refer to Fig. 1 already at the beginning of this section, when you refer to "the original …extraction ..line (now the reader has to wait until the end of the first paragraph to find this reference to the figure.

105: What is the "original" extraction and purification line. Is there any subsequent modification of this line, and who would have provided the "original"?

110: MADE of metal

127f: I had a few problems to follow this paragraph. E.g. what is a fiberlaser? or, e.g..at 131f "heating occurs with a defocussed continuous …scanning over the lids for 15 min." Perhaps it would be halpful here to start the explanations with the sample revolver (now introduced at 139-142). I even recommend to explain all this with a figure (which might be more instructive than, e.g., the lowermost panel of the present Fig.1, see below). I note that you plan to publish this new furnace elsewhere, but here it will just be very difficult to follow your description.

148 – 153, please reformulate, split long sentences.

159ff: where are all these numbers from? The manufacturer? In any case, can it be taken for granted that the isotopic composition fo Ne-Xe is exactly atmospheric, and not perhaps slightly fractionated? For example, has this been verified by comparative analyses of noble gases directly taken from air? Or can the manufacturer convincinly guarantee for a negligible isotopic fractionation?

167: It would be nice to get some additional information about the accuracy of this volume determination. At 174 we learn that the Redair pipette has a volume of ~1.5 cm3, corresponding to rougly 2 g of air. How large is the mass of the pipette and how well can then the ~2g be measured as difference of two weight measurements? ( I presume for the 8.7 l reservoir the problem will be much less severe?)

198: "distilled-off in disequilibrium". Explain this in more detail. In 277 we learn that He is removed from the sample gas by pumping during 5 min. Is this the same as what is said at 198? If so, how sure are you that no Ne gets lost in this process?

203: is this liquid nitrogen cooled trap filled with charcoal or another material?

Fig. 1: In my view, the large lowermost panel is unnecessary, as it does not convey any real information. As noted above, a figure of the furnace would be more instructive.

231: exlain better what a "VI" is.

293: somewhat awkward English

Fig. 2: Also this figure is not very helpful (it would in any case have to be blown up quite a bit to be readable).

255: awkward English (the lid has an opening in the lid).

261: ..transferred from the glass vials into the cup through…

277: see 198

311: please quantify: how much larger is the dispersion compared to the formal analytical uncertainties. This is a bit difficult to see in Fig. 3, as error bars are mostly not shown, and no

statement is given in the figure caption whether error bars not shown are smaller than symbol size (as I presume).

314: Is the "uncertainty of the mean" equal to the standard deviation/sqrt(n-1)? Or do you mean the standard deviation?

Fig. 5, caption: CGN? This is the first time in the manuscript this acronym is used. It must refer to the Cologne Lab, but what does it mean? Explain please (here or earlier in the text).
Apart from this, your data in this figure look really nice!

357: it would be "BuilT-up" but this is not a good word here anyway, I guess.