The Cryosphere Discussions

The Cryosphere Discuss., author comment AC2
https://doi.org/10.5194/tc-2022-25-AC2, 2022

Reply on RC2

Georgios Lazaridis et al.

Author comment on "Brief communication: Tritium concentration and age of firn accumulation in an ice cave of Mount Olympus (Greece)" by Georgios Lazaridis et al., The Cryosphere Discuss., https://doi.org/10.5194/tc-2022-25-AC2, 2022

- As a basic requirement site photos and/or sketched stratigraphic profile should be mandatory to understand the sampling strategy and see the visual occurrence of the deposit and the sampling spots. In lack of such evidence a statement like "indistinguishable ice layers and thus it was impossible to make a direct estimation of the age of the ice in the column.” " is unsubstantiated.

Due to the ablation of the firn (late September sampling period) there was no clear evidence of the stratigraphy as can be derived from the provided photo. So, the sampling strategy was to take samples in a subsequent way, also as seen in the provided photo, although not clearly.

- Methodological description needs some more details. E.g., Did you applied electrolytic enrichment? If yes please give some details, if no please mention that. What was the critical limit and/or detection limit?

We did not perform electrolytic enrichment because the Laboratory does not have well established curves of tritium enrichment efficiencies (line 68). The detection limit is added in the text (Detection Limit =3sqrt(B)/(T eff V a) where B=backround counts, T= measurement time (min), eff=efficiency of the detector for Tritium=0.25, V=8mL, a=0.11919 Bq/L/TU) DL=1.1 TU. All mentioned in lines71-75 in revised manuscript.

- The caption of Fig 2 says that the annual mean tritium values of various Greek stations are used as reference. It is not a bad approach however I think it would be necessary to show the location of the considered stations in a map. (By the way, Fig 1 should be completed with an additional panel showing the location of the cave, so the nearest GNIP stations can be marked in this map.)

Table with the stations GNIP in Greece. Short introduction is added in the caption of Fig. 2 and this table in the supplement.

Site	*Latitude*	*Longitude*	*Altitude*

Alexadroupolis	*40.849998*	*25.879999*	*6*
Athens	*37.900002*	*23.73*	*27*
Heraklion	*35.330002*	*25.18*	*47*
Methoni	*36.830002*	*21.719999*	*33*
Patras	*38.279999*	*21.790001*	*100*
Rhodes	*36.380001*	*28.1*	*42*
Thessaloniki	*40.669998*	*22.959999*	*32*
Ioannina (non GNIP)	*39.663611*	*20.852222*	*480*
Christaki pothole	*40.068954*	*22.313373*	*2290*

- However, I suggest considering the prediction from the recently released study (Terzer-Wassmuth et al., 2022) as a reference or as a continuous interpolated product covering the 1950 to 2010 period (Jasechko&Taylor 2015) could be used.
  - Terzer-Wassmuth, S., Araguás-Araguás, L.J., Copia, L. et al. High spatial resolution prediction of tritium (3H) in contemporary global precipitation. Sci Rep 12, 10271 (2022). https://doi.org/10.1038/s41598-022-14227-5
  - Jasechko, S., & Taylor, R. G. (2015). Intensive rainfall recharges tropical groundwaters. Environmental Research Letters, 10(12), 124015

Studying the Terzer-Wassmuth et al. (2022) paper we tried to predict tritium values in the

investigation area using the models provided but the calculated values were obviously very high maybe due to the misunderstanding of the parameters and their values that must be used for the site. In any case the map provided for the area of Greece give values of tritium concentrations in the range we measured in our Laboratory.

- The authors explain why the studied ice samples could not represent accumulation from the so-called bomb-peak period. However, I think, it should be also explained in a sentence or in a brief section how they can exclude pre-1950 origin.

The samples were collected from the top of the firn to a depth of 2 meters in a back-to-back way. Thus, the samples from the top are from the previous years. If there were ice residues from years before 50s then we should measure at some samples high tritium concentrations from the 60s as mentioned in detail into the manuscript. Short discussion is added into the manuscript (lines 98-99).

Technical revisions

line 13: I think "indicating" would be a more suitable word here instead of "because". In addition, the range of the measured 3H activities could be mentioned in the abstract.

Followed in lines 13-14

line 18: I suggest citing the chapter (Pennos et al., 2018) of the Ice Cave Book here. Pennos, C., Styllas, M., Sotiriadis, Y., and Vaxevanopoulos, M.: Ice caves in Greece, in: Ice caves, edited by: Persoiu, A. and Lauritzen, S. E., Elsevier, Amsterdam, the Netherlands, 385-397, https://doi.org/10.1016/B978-0-12-811739-2.00018-8 2018.

The research that we mention (Lazaridis et al., 2018) contains data from 76 caves, the one that is suggested here contains only three of the already included in the mentioned research caves. We thank the referee for the comment, but we don't find useful and necessary the suggested citation.

line23: I think a supporting reference for this statement is needed.

Unfortunately, there is not a reference for this statement. The information comes from interviews with local people. However, we find it very interesting and useful to publish.

line26: I think Lucas&Unterweger 2000 should be cited after the half-life of tritium. Lucas, L.L. and Unterweger, M.P. 2000: Comprehensive review and critical evaluation of the halflife of tritium. Journal of Research of the National Institute of Standards, Technology 105, 541–49.

The suggested reference was added and the Ehhalt et al. 2002 as well.

ines31-32: I think the end of this sentence seems to be a fragment which can be deleted.

The sentence has already been modified due to a comment form the first referee.

line42-43: Why these info (e.g., total thickness of limestone sequence, dolomitic composition) is useful for this study?

We prefer to keep this sentence as part of the description of the gelogical setting of the cave.

line 44: I suspect you should replace "gas" with "air".

The sentence has already been modified due to a comment form the first referee.

line46: Please give numerical expression for “high average snowfall”.

The sentence has already been modified due to a comment form the first referee.

lines6 60-61: Unclear sentence. Did you mean that ice layers (or any stratigraphic units) were indistinguishable in the sampled ice column?

The sentence has already been modified due to a comment form the first referee.

line 68: I suggest replacing “0.9-11” with “0.9 to 11”.

The suggestion was followed.

line81: I think 210Pb should be written instead of “radon”. In addition, please, capitalize Croatia in the same line.

Replaced and correctly spelled line 105

Finally, I think a recent TC paper (https://doi.org/10.5194/tc-15-2383-2021) should be considered in an extended discussion since similar deposits were considered also in that study.

We followed the suggestion, we advised the paper and added to the references.

In an ultimate comment I’d like to refer to the other review. I completely agree with the comments and suggestions of Dr Tanguy Racine. A related suggestion is that beside 2011 paper about Mammuthöhle ice cave I suggest that a more recent one (DOI:10.1017/RDC.2018.96) could be a more useful reference for the revision.

The suggestion was followed as we find the research relevant and necessary to refer to.