

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2022-25

Zoltán Kern (Referee)

Referee 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-RC2>, 2022

Dear Authors, Dear Editor,

The manuscript explores tritium activities from a cave ice deposit of Mt. Olympos. Based on the ^3H activities measured along a 2m high profile the Authors conclude that accumulated firn is younger than fifty years before 2017. The data can be interesting however some more details should be provided both about the studied deposit and about the analytical steps. I think the study needs major revision to reach publication.

General comments:

- 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.
- 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?
- 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.) 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
- 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.

Although I list few typos among the specific comments below, I note that I cannot provide a detailed linguistic review since I'm not a native English speaker.

specific comments:

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.

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: Perić, A. and Lauritzen, S. E., Elsevier, Amsterdam, the Netherlands, 385-397, <https://doi.org/10.1016/B978-0-12-811739-2.00018-8> 2018.

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

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 half-life of tritium. Journal of Research of the National Institute of Standards, Technology* 105, 541-49.

lines31-32: I think the end of this sentence seems to be a fragment which can be deleted.

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

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

line46: Please give numerical expression for "high average snowfall".

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

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

line81: I think ^{210}Pb should be written instead of "radon". In addition, please, capitalize Croatia in the same line.

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.

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.