

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-149

Anonymous Referee #1

Referee comment on "Expression of the "4.2□ka event" in the southern Rocky Mountains, USA" by David T. Liefert and Bryan N. Shuman, Clim. Past Discuss.,
<https://doi.org/10.5194/cp-2021-149-RC1>, 2021

- Does the paper address relevant scientific questions within the scope of CP? Yes
- Does the paper present novel concepts, ideas, tools, or data? Yes, interesting interpretation of new lake record.
- Are substantial conclusions reached? Yes, adds to our knowledge of regional palaeoclimatology.
- Are the scientific methods and assumptions valid and clearly outlined? Yes
- Are the results sufficient to support the interpretations and conclusions? Yes, although pity there are no sediment trap data to really show when carbonate precipitates.
- Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes
- Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Yes
- Does the title clearly reflect the contents of the paper? To an extent, but you use the word "drought" in the title, but if it turns out that the $\delta^{18}O$ is just changing due to a decrease in snowpack then maybe change in "hydroclimate" is a safer word to use - because maybe you don't have less precipitation but rather less snow/more rain, and therefore $\delta^{18}O$ is higher?
- Does the abstract provide a concise and complete summary? Yes
- Is the overall presentation well structured and clear? Yes
- Is the language fluent and precise? Yes very well written.
- Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes
- Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Minor comments below
- Are the number and quality of references appropriate? Yes
- Is the amount and quality of supplementary material appropriate? Yes

This is a well written paper that presents new data and justifies in detail their interpretation, making findings that move the science forward with regard to Holocene

palaeoclimate from this part of the world.

Data clearly show hydroclimate change at 4.2ka and whether this was due to reduced effective moisture or less snowfall, it is clear that something happened. As you say, other records also show a hydrological change at this time, and while others don't there are valid reasons why certain proxies or archives may not be recording this event. So this study is useful in moving the science forward and helping us to really understand that there was a significant hydrological event at 4.2ka.

Obviously your interpretation rests on $\delta^{18}\text{O}$ being weighted more towards the spring. You do justify this well using the conductivity data, $\delta^{18}\text{O}$ - $\delta^{13}\text{C}$ covariance, etc. Ideally you would have used sediment traps to establish when most carbonate is deposited in a year – maybe something to think about if you continue your work on this lake as then you'd be able to know with more certainty when carbonate precipitated.

As I say above, if the $\delta^{18}\text{O}$ is just influenced by snowpack change, is "drought" really the best word to describe the 4.2ka event here? But anyway, clear some hydroclimate change going on, which is useful to know.

I'm not really sure why you have plotted the age model and the LOI on the same graph.

You say "Ostracod tests were present in less than 10 of the 300 samples." Obviously these could have different $\delta^{18}\text{O}$ to endogenic calcite. Can you just briefly confirm that these aren't all around 4.2ka or something, to check they aren't responsible for the excursion at that time.

Line 382 – just Shipley et al., 2008

Overall, after the minor points above are addressed, I believe this manuscript is worthy of publication.