Peer Review Report

Review Report on Dam emplacement and water level changes affect sublacustrine geomorphology and recent sedimentation in Jackson Lake, Grand Teton National Park (Wyoming, USA)

Original Research, Earth Sci. Syst. Soc.

Reviewer: Michael Hofmann
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EVALUATION

Q 1 **Please summarize the main findings of the study.**

This manuscript presents an interesting case study from Jackson Lake, Wyoming (USA) on visualizing and interpreting the recent lake fill history. Of particular interest to the authors is the impact that the construction of the dam at the outlet of Jackson Lake had on lake levels and the subsequent sedimentary fill. The conclusions are drawn from a variety of data, mainly relying on shallow seismic reflection (CHIRP) data, two shallow cores and some additional grab samples. The sedimentary data has been subsequently analyzed in the lab, including MS, XRF, and TOC among others.

Q 2 **Please highlight the limitations and strengths.**

I found this paper interesting, because changes in sediment storage and dispersal as result of dam construction are important to better understand watershed budgets, and this manuscript establishes a case study in an understudied region. The manuscript is generally well written and well supported by data and figures. Most of my textual corrections are small.
Some of my comments relate to the discussion section as I feel the discussion of the multiple data sets could be better connected. Other comments are pertaining some redundancy in the text and reduction of, what I believe, some unnecessary sections. In particular, if something had to reduced, in my opinion it would be the PCA and some figures – I understand that the PCA might be important to the authors, but its contributions to the argument is achieved by discussing the individual variable (which is done throughout the manuscript). The number of figures, in my opinion, could be reduced by combining multiple figures into one.

Q 3 **Please comment on the methods, results and data interpretation. If there are any objective errors, or if the conclusions are not supported, you should detail your concerns.**

No major comments. See my detailed comments below for minor comments.

Q 4 **Check List**

Is the English language of sufficient quality?
Yes.

Is the quality of the figures and tables satisfactory?
Yes.

Does the reference list cover the relevant literature adequately and in an unbiased manner?
Yes.

Are the statistical methods valid and correctly applied? (e.g. sample size, choice of test)
No.

If relevant, are the methods sufficiently documented to allow replication studies?

Yes.

Are the data underlying the study available in either the article, supplement, or deposited in a repository? (Sequence/expression data, protein/molecule characterizations, annotations, and taxonomy data are required to be deposited in public repositories prior to publication)
Yes.

Does the study adhere to ethical standards including ethics committee approval and consent procedure?
Yes.

If relevant, have standard biosecurity and institutional safety procedures been adhered to?
Not Applicable.

Q 5 **Please provide your detailed review report to the editor and authors (including any comments on the Q4 Check List):**

Review of:
Dam emplacement and water level changes affect sublacustrine geomorphology and recent sedimentation in Jackson Lake, Grand Teton National Park (Wyoming, USA)
by McGlue et al.

This manuscript presents an interesting case study from Jackson Lake, Wyoming (USA) on visualizing and interpreting the recent lake fill history. Of particular interest to the authors is the impact that the construction of the dam at the outlet of Jackson Lake had on lake levels and the subsequent sedimentary fill. The conclusions are drawn from a variety of data, mainly relying on shallow seismic reflection (CHIRP) data, two shallow cores and some additional grab samples. The sedimentary data has been subsequently analyzed in the lab, including MS, XRF, and TOC among others.

I found this paper interesting, because changes in sediment storage and dispersal as result of dam construction are important to better understand watershed budgets, and this manuscript establishes a case study in an understudied region. The manuscript is generally well written and well supported by data and figures. Most of my textual corrections are small.
Some of my comments relate to the discussion section as I feel the discussion of the multiple data sets could be better connected. Other comments are pertaining some redundancy in the text and reduction of, what I believe, some unnecessary sections. In particular, if something had to reduced, in my opinion it would be the PCA and some figures – I understand that the PCA might be important to the authors, but its contributions to the argument is achieved by discussing the individual variable (which is done throughout the manuscript). The number of figures, in my opinion, could be reduced by combining multiple figures into one.
Below I present detailed comments in line by line format. All my comments in the list below are aimed to make the story stronger.

Thank you for the opportunity to review this interesting contribution to Quaternary geology in an understudied but important region.

Sincerely,
Michael Hofmann

Line 66–70: The two sentences about the turbidites seem to be misleading. I would love to learn more about this topic, but to my understanding this is not the main focus of the manuscript in front of us and therefore should not be included in the abstract.

Line 180–181: Add a reference for this ¼ rule. Readers might not be familiar with it.

Line 183: Add a sentence or two to justify why the 1500m/s was used in water and all the way to the acoustic basement. Dewatering occurs immediately after deposition and velocities even in the shallow subsurface will

be faster than through water. If this is not the case here, please explain why. The core data seems to show that the sediment is already significantly dewatered and not water logged.

Line 204: The cores are shown at 2 different locations (granted close to each other) on the map (figure 1), but only one coordinate is given for both. I'd suggest to give the detailed coordinates for both core locations to match the map display.

Line 223: First mention of CE. Explain acronym here instead of later in the manuscript (currently line 246)

Line 265: Give reference for the statement that C/N is a provenance indicator. And explain what provenance it indicates.

Line 291: Faults don't 'run', they 'trend'

Line 295: Here only TWT is given (same in line 299 and many other places throughout the manuscript), while in other instances TWT and depth are mentioned. For consistency I would recommend to add calculated depth every time TWT is mentioned in text.

Line 295: Between 'tapers' and 'to' there might be an extra space (it appears that way in the pdf). If that's the case, delete the extra space.

Line 302-311: If figure 4 is changed as I recommend (see figure 4 comment), then this paragraph will have to change accordingly.

Line 333-334: Delete part after comma. This is an interpretation and appears to be better included in the discussion.

Line 334: Use 'is located' instead of 'sit'

Line 337-339: Include the actual calculated angle in the manuscript to support this statement. The vertically exaggerated displays make those look more dramatic than they are. What would be the expected grain size. Gilbert deltas in the type section in Utah contain gravel, is this the expectation here, and do the seismic reflection characteristics support a coarse-grained sediment interpretation? From grab samples it appears that clayey sand is the main grain size (line 349), would those sediments support the angle of repose observed from seismic? Any additional data (and accompanying discussion) that is available will help build confidence in the interpretation. Also, if figure 7 is changed as I recommend (see figure 7 comments), then this paragraph will have to be edited accordingly.

Line 361-382 (and reservoir effect discussion later in manuscript): I did not comment much on the age model as the authors do acknowledge and discuss the limitations of the age model. The interpretations/discussion are clearly presented with these limitations in mind and in my mind, despite some of the uncertainty, are acceptable until additional data becomes available (some future study).

Line 384-424: When describing the core facies, mention the corresponding acoustic facies. I have no doubt that the authors have a clear idea what acoustic facies corresponds to the sedimentary facies, but this connection seems to be somewhat vague in the manuscript (see also my comment on the discussion chapter).

Line 426-440: The PCA relevance escapes me. It seems that there are very limited number of variables to start and PCA does not seem to be necessary. In addition, the discussion in the reminder of the manuscript is largely focused on the individual variables, rather than PCA. This section, together with figure 11A seem to be unnecessary in my mind.

442-732: Discussion general: The discussion appears to be somewhat fragmented and the acoustic facies is discussed independent of the core facies. Connecting these two, in the context of the core facies discussion (lines 595-732) would make it easier to establish (and for the reader to follow) the genetic relationship

between these two data sets. I would recommend to keep the current core facies order, but add the relevant acoustic facies to those sections and discuss together.

Line 447: Delete ‘space’ after ‘accommodation’. It is repetitive, as accommodation implies space.

Line 450: Capitalize ‘Range’ after ‘Teton’. This is an established geographic name.

Line 472: This is just a side note, and not any revision relevant to this manuscript. I just wanted to mention that it would be fantastic to see a long core taken in Jackson Lake and to learn more about the greater infill history of this basin. I wish you the best of luck to get funding for a long core. Seeing this record would be marvelous.

Line 475-476: The facies has already been described previously. Shorten sentence to ‘The dominant shallow acoustic facies, facies AF1, is interpreted to have formed from suspension settling of fine detritus, OM, and 478 biochemical opal, as well as thin gravity flows (i.e., turbidites) (Figure 5).’

Line 488-490: Delete sentence. Doesn’t seem to be relevant for this manuscript.

Line 486-493: Clarify the control on AF1. From this description it is not clear to me whether AF1 drapes the mass wasting deposits triggered by faulting, or the glacial deposits, or both? And if only one underlying facies then discuss the relevance.

Line 506-511: This could be left out, as the consistent clinoform position, and the earlier statement about seismic activity already supports these being deltas formed prior to dam construction. Also, the comparison to the major East African rift basins might be somewhat out of context, as their lowstand deltas are not controlled by the construction of a dam, but by climatically induced lake level changes and tectonics.

Line 514-515: Similar to one of my earlier comments about whether the grain size data available from these creeks support the grain size interpretation and angle of repose of these Gilbert style delta clinoforms?

Lines 734-782: The conclusions should be shortened. To my understanding, the main points of this manuscript are the findings mentioned in points 3-5.

Figures

Figure 3: I would recommend to minimize the vertical exaggeration when interpreting faults. The exaggeration in the subsequent figures (the ones showing the seismic facies) is fine, but for structural interpretation it should be avoided (or at least minimized). The position of core 9 in the water column is somewhat confusing.

Figure 4: I think this figure is not necessary and parts of it could be combined with other figures. For example, the isopach map would be great to integrate with the DEM map shown in figure 1. The depth to acoustic basement (B) and the isopach map (C) are pretty much showing a similar distribution. I would recommend to get rid of figure B and combine C with subsequent figure 5. Figure 5 focuses on the acoustic facies and having the different facies superimposed on the isopach would work well together.

Figure 5: Make fault polygons yellow to match the yellow dashed lines on figure 2

Figures 6/7: Change order of figure captions to match figures 6 and 7.

Figure 6 (figure caption 7): Examples B and C are the most convincing examples of these clinoforms. From the figures presented, to the layman’s eye examples A and D could also be interpreted as steep fault scarps. I have no doubt that the authors have additional data to support their interpretation, but examples A and D are not very convincing. Given the size of the figures, I would recommend to only show figures B and C as examples, but make them bigger so they become clearly visible to the reader.

If the authors feel strongly about leaving all four examples I would recommend to discuss the vastly different clinoformal characteristics shown for B and C (which are fantastic), and A and D (which are somewhat less convincing).

Figure 7: Annotate the channel cut surface

Figures 7/8: I'd recommend to combine the seismic lines shown in figures 7 and 8 into one figure. They should fit on a letter size page and would show a wonderful N to S transect. Seeing those changes in one figure would make a powerful display.

Figures 9-11: These figures could be combined into one full page figure in landscape format. It would be beneficial to see the chemical changes (fig. 10 and 11B) in the context of age and facies (fig 9). As mentioned previously, the importance of the PCA in this manuscript escapes me and I would delete figure 11A.

Table 3: I received Table 3 as part of the supplemental information. This table should be included in the main manuscript.

Some Additional References that might be of interest to the authors (they do not necessarily have to be included in a revised manuscript, but might be informative for future studies)
Deglaciation of nearby Beartooth Plateau (this might be relevant to the LIA discussion):
Barth, A.M., Ceperley, E.G., Vavrus, C., Marcott, S.A., Shakun, J.D. and Caffee, M.W., 2022. 10 Be age control of glaciation in the Beartooth Mountains, USA from the latest Pleistocene through the Holocene. Geochronology Discussions, pp.1-18.

Example of hyperpycnal flows in glacial lakes (this might be relevant to a future turbidite manuscript):
Hofmann, M.H. and Hendrix, M.S., 2010. Depositional processes and the inferred history of ice-margin retreat associated with the deglaciation of the Cordilleran Ice Sheet: The sedimentary record from Flathead Lake, northwest Montana, USA. Sedimentary Geology, 223(1-2), pp.61-74.

QUALITY ASSESSMENT

Q 6	Originality	
Q 7	Rigor	
Q 8	Significance to the field	
Q 9	Interest to a general audience	
Q 10	Quality of the writing	
Q 11	Overall quality of the study