Thank you to the anonymous reviewer for their comments! Please see responses in bold text below:

Reviewer 1: A 2700-yr record of Cascadia megathrust and crustal/ slab earthquakes from Upper and Lower Squaw Lakes, Oregon

By Ann Morey and Chris Goldfinger

The manuscript presents important paleoseimic data from a lacustrine archive at the southern end of the Cascadia subduction zone, where records have been scarce compared to the northern part. It also contributes knowledge to the characterization of so-called (disturbance) event deposits in organic-rich lake sediments where the identification of events can be difficult due to the homogeneous nature of such deposits as well as other factors such as low sedimentation rates etc. The amount of data presented is sufficient to support the main messages of the paper.

Despite the clear scientific merit, the concept used to identify earthquake-induced deposits and how these are generated remains somewhat unclear. There are also weaknesses in the background information and the structure of the paper. I believe these can be addressed but require some revision. Here are my major concerns:

1) It looks like that there is a companion paper to this paper characterizing the 1700 deposit in greater detail. Even if references are made, I believe that in order for this paper to stand alone, it must include more background information. I am wondering if the authors have considered to merge both papers?

**RESPONSE: Merging both papers was considered prior to submission but rejected based on the extended and complex arguments made in the first paper describing the 1700 deposit and timing. It seemed too much for one paper to combine them into a single paper.**

2) The seismicity of the southern Cascadia subduction zone has to be mentioned. For example, it is important to know the estimated groundshaking at the lake site for the historic earthquake in 1873 as well as the 1700 earthquake (or other large megathrust earthquakes).

**RESPONSE: Agreed. This will be addressed in a revision.**

3) More importantly, the geologic setting of the lake must be beter characterized to understand the concept that is used to distinguish between large megathrust and smaller earthquakes. This includes the geology and geomorphology in the watershed of the lake as well as lake basin geometry and any delta or landslide deposits within the lake that could be destabilized during ground-shaking. This information is crucial to understand the source of the sediments found in type 1 deposits in contrast to the source of mineralogies found in type II deposits.

**RESPONSE: This has been adequately addressed in the first of the companion papers, but I can see the need to include this information in this paper as well. We will add a section on this.**

4) While the two types of deposits are relatively well characterized, I think that the processes that lead to the formation of these two types of event deposits remain somewhat uncertain. For example, I am having difficulties understanding what is meant by the watershed sourced turbidites. Do these turbidites incorporate sediment that comes from steep slopes in the surrounding watershed destabilized during ground shaking and subsequently transported into the lake (similar to NZ lakes in Howarth et al. 2014)? Is the other type of turbidite generated from slope failures within the lake? Is the difference of the two types just an effect of the amount of groundshaking at the site? I think I am not clear how you can distinguish between the different earthquake sources.

**RESPONSE: We will clarify that the watershed sourced portion of the disturbance event deposits (inferred to result from subduction earthquakes) are not strictly turbidites, but rather are inferred to be the result of the release of sediment (watershed sourced) and water into the water column**

**during shaking which settles onto the organic sediment below as shaking ceases. These deposits do not incorporate sediment that comes from steep slopes in the surrounding watershed destabilized during ground shaking. Yes, the other type of disturbance event deposit is generated from slope failures within the lake. I can see that this needs clarification in the text.**

5) I think that it is not necessary to correlate physical proxies of other lake studies as shown in figure 9 and 10. I would merge these records with figure 8 or include a similar figure that just shows the correlation of the ages for those sites. I think this will also streamline the discussion section.

**RESPONSE: It is very important to show the similarities in the physical property data between the onshore and offshore data (figure 9) because it demonstrates the underlying cause of the physical property data for both types of records is likely the same. We therefore think it's necessary to keep figure 9 as a stand-alone figure. We could add age ranges to figure 8, but none of the other distributions have ages; in other words, adding ages to figure 8 may not add anything. Likewise, it seems important that other regional lake records contain disturbance event deposits at the same time as the deposits inferred to reflect subduction earthquakes as support of this inference. However, there are multiple factors that influence how disturbance event deposits are recorded in each lake setting. Because of this, the relationships between records is not as clear; it may be acceptable to remove figure 10.**

Minor comments:

**Abstract:**

I would avoid specific deposit names such as deposit J, turbidite T1, T2 etc. in the abstract and the introduction since they have not been introduced, yet. Consider some rephrasing and add a sentence on the methods used.

**RESPONSE: This makes sense and will be done.**

**Introduction:**

Maybe include short review on how earthquake induced event deposits look like and what other lake studies have found in the area. I am wondering about overlap with the referenced paper Morey et al. 2023. Can the two papers be merged?

**RESPONSE: This makes sense and will be done, however there are no other studies on earthquake induced event deposits in regional lakes to compare with (other than Morey et al., 2013). As for merging the two papers, there are complex discussions in the first of the companion papers that would make combining the two papers very difficult to follow.**

**Setting:**

The first paragraph under "Methods" seems to be geologic setting. As mentioned above, this has to be expanded significantly regarding seismicity of the area and geologic setting of the lake.

**RESPONSE: This makes sense and will be done.**

**Methods:**

The Title of the manuscript implies that there is also a record from Upper Squaw Lake. However, the methods only describe cores taken from Lower Squaw Lake. Has data from Upper Squaw Lake already

been published?

**RESPONSE: Yes. We will make sure that this is clearly referenced in the paper.**

Mention also XRD measurements that are mentioned later in the text.

**RESPONSE: Will do.**

I believe the last three paragraphs of the methods section can be shortened and possibly restructured.

**RESPONSE: Will do.**

**Inferred characteristics for earthquake types**

See my major comment 4. It is not clear what is meant by "Sediment sourced from watershed" and "Turbidite sourced from lake margin bedrock".

**RESPONSE: This will be clarified as previously mentioned.**

Yes, the structures at the base look like load structures. The question is, if these formed due to rapid sedimentation at the time of turbidite deposition or subsequent seismic loading. Maybe you can disucss later?

**RESPONSE: We will include a paragraph on this.**

For both types I am missing a short statement about the lateral, lake basin wide distribution.

**RESPONSE: This is because the cores from the deep water have some coring deformation due to the contrasting sediment and are more complex as they are sensitive to even minor disturbances compared to the shallower water, lake margin cores. That said, a short statement about the lateral distribution can be made.**

The list of characteristics at the end of this section seems to be a repetition.

**RESPONSE: OK**

**Results**

3.1: I would avoid the term "schist layers"

It seems as if the last two paragraphs that talk about correlation to Upper Squaw Lake should be under 3.2. I think the results section in general could be restructured a bit.

**RESPONSE: OK**

**Discussion**

The process of earthquake disturbance layers has to be described in more detail.

"Physical property peaks" is a litle too vague.

I think the post-fire and flood-related erosional events can be shortened especially since fires are already excluded as a trigger in Upper Squaw Lake sediments.

I would leave section 4.2.2 and Figure 9 out. It is tricky to correlate selected physical proxies from two

very different environments..

4.3: There are some references and terms in this section that don't seem related to the paper.

Section 4.4. is based on figure 9 and 10 which I would leave out and just add the age distributions to figure 8. See my comment 5. **RESPONSE: See our previous comments on this topic.**

From the manuscript it is not clear how the summary of ideal lake characteristics was established. Under Summary and Conclusions there is another paragraph that talks about the suitability of regional lakes.
Consider merging/ rephrasing.

**RESPONSE: We agree to these comments other than the concerns about removing figures 9 and 10; see previous responses.**

**References** not checked – sorry!

Figures: I am not sure if I have access to the highest resolution possible for these figures. Some seem fuzzy and are hard to read.

Figure 1: Could it be cut above northernmost location mentioned in text (I believe above ~45 deg N). Could you add a smaller overview figure showing the entire Cascadia subduction zone/ northwest Pacific and mark extent of southern Cascadia?

Figure 2: I have a hard time reading the core names but it looks like this study is mostly based on cores from the lake side and not from the deep basin? It is important to explain why those were chosen since deep basin cores would probably show a more complete record.

Figure 3: What is meant by calcium minerals? If CaCO3 data exits from LOI it might be useful to plot here especially if it correlates with a specific source area for the turbidites. I think the figure can be simplified. Not all smear slide pictures and detailed descriptions are necessary.

Figure 4: very hard to see details. I suggest plotting only selected cores at a larger scale.

Figure 6: I don't think D is necessary. Maybe merge information with A, B and C and enlarge.

Figure 8: Is it possible to add ages of events from Figure 9 and 10 here? Also, can you indicate what archive each site represents (marsh record, lake, offshore, etc.)

**Thank you for your helpful comments!**