

Interactive comment on “An extended history of high-amplitude lake-level changes in tectonically active Lake Issyk-Kul (Kyrgyzstan), as revealed by high-resolution seismic reflection data” by A. C. Gebhardt et al.

Anonymous Referee #3

Received and published: 22 February 2016

Dear author, I have completed my review of “An extended history of high-amplitude lake-level changes in tectonically active Lake Issyk-Kul (Kyrgyzstan), as revealed by high-resolution seismic reflection data” by Gebhardt et al. The manuscript presents high-resolution sparker profiles from Lake Issyk-Kul and has the potential for being a broad and useful study. I personally enjoyed reading it and highly recommend for its publication. Though, it will need to undergo major revisions before it is acceptable for publication. In my review, I outline both major critiques and minor points in the lists below.

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Major Points:

-I strongly suggest the authors to present more seismic profiles from different parts of the lake; this is indeed lacking in the current manuscript. In particular, profiles showing deltas from the western margin would be great in order to compare their internal/external structure with the ones from eastern part of the lake.

-Significant lacking of citations in the results part. The authors, most of the times, do not cite or refer figures in the text. Sometimes, the figures are not large enough to see points mentioned in the text, for instance erosional boundaries, delta lobes. Hence, as a reader it is rather difficult to judge the interpretation.

-Would it be possible to correlate stratigraphic boundaries towards the deeper parts of the lake? I can see that deep lake sediments are characterized by alternating high- and low-amplitude seismic reflections which most likely reflect transgression and regression periods.

-I am also missing isopach or isochron maps of seismic units in order to understand their thickness variations and thus the source regions through lake evolution. If this is not applicable or doable, it is better to mention the average thickness of individual units and possible source regions in the text.

- I suggest the authors to make a new basemap and draw lakeward boundary of the deltas (color-coded) in order to see their lateral extent along the western and eastern shelves. The distribution of sublacustrine channels can also be superimposed on this map.

-The authors presents and discuss structural setting of the lake, however I do not see any structural map showing faults, anticlines, or synclines throughout the lake as well as its surroundings. I see several seismic profiles crossing the anticline structures on the base map but neither of them is shown. It is worth to discuss the relative timing of these structures based on thickness variations of overlying/underlying sediments. Also

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a normal fault in the southern part of Profile ik01 (Fig. 2) should be shown.

-I suggest the authors make schematic diagrams (with scale) from East to West showing the formation of deltas throughout the lake formation. The former lake levels should be indicated. This would definitely improve the quality of the manuscript.

Line points:

-Page 6, Line 24. “.presence of a series of faults..” It would be better to show these faults on a map.

-Page 6, Line 25-26. Please locate the “Main Terskey Fault (MTF)” on a map.

-Page 7, Line 2. Change “becaoem” to “became “ and “Miocene” to “Miocene”

-Page 7, Line 12. Modify so that it reads, “..However, it is quite likely that . . .”

-Page 7, Line 18-19. “In the southeastern part of the lake, the strata are not inclined as would be expected in this asymmetric basin”. Please refer to figure or show a seismic section. I can see that there are various seismic profiles traversing these anticline structures.

Page 7, Line 23-24. “Both anticlines are progressively buried by younger sediments, and the southern one is meanwhile completely leveled by sediments.” Please show a seismic section as I cannot confirm whether they are buried or leveled by sediments.

Page 8, Section 4.2 Facies Types. I suggest changing “Facies types” as “Seismic Facies” and the “Facies I” as “Seismic Facies 1 (SF1)”. It is easier for descriptions. It is also better to formulate as “SF1 is characterized by. . . “ than “this facies type is characterized. . .”

Page 8, Line 11. Clinoforms should be better illustrated; topsets-foresets transitions (if they exist) are not noticeable on the presented seismic profiles. I propose to the authors to add a figure as an example of interpreted delta (for instance, immediately below Fig. 3a; (3b, interpreted section of 3a) in which reflections of topset, foreset and

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bottomset are pointed.

Page 9, Lines 1-2. “Facies IV may be interpreted as former delta sediments that have been affected by post-depositional processes (e.g. sediment remobilization, slumping, liquefaction) that caused them to lose their internal structure”. They are indeed former delta deposits but I am not sure such reflection configuration was caused by slumping etc. Looking at reflections within Sequences 3/4 in Fig. 4, as a whole package, I do not think it has something to do with slump deposits. Would it be possible that such reflections were due to coarse-grained sediments resulted from rapid loading of rivers?

Page 9, Line 18-19. “The topset-foreset roll-over point is considered as a proxy for the lake level at the time of its forming”. Please give a reference.

Page 9, Line 23. Modify so that it reads, “Sequence 7 (S7) is the...” In the following parts you can shorten its name as “S7” instead of “Sequence 7”.

Page 9, Line 16. Please delete “lacustrine”

Page 10, Line 2. “..Some of these occur only in the western delta area (7.5, 7.4)” Please refer or show a seismic section.

Page 10, Line 7. “Sequence 6 is clearly visible both on the western and eastern delta areas.” Please refer to Fig.

Page 10 , Line 8. “... rather thin...” How much?

Page 10, Line 9. “... delta lobes could be identified at 461 (no. 6.1) and 361 m bl (6.2).” Could you please label these delta lobes in the seismic sections?

Page 10, Line 13. “Sequence 5 is overlaying sequence 6 with an erosional boundary in between (Fig. xx??).”

Page 10, Line 14-15. “The bathymetrically higher delta 5.1 exhibits extensive erosion (Fig. 6b)”. I am looking at this figure and it is almost impossible to see the erosional surface. I suggest the authors to show close-up sections to show these features.

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Page 10, Line 21. Modify so that it reads, “Sequence 4 overlies . . .”

Page 10, Line 24-25. Modify so that it reads, “In Sequence 4, the delta lobes are characterized by predominantly SF4, but. . .”

Page 10, Line 26. Change “well-layered” into “well-stratified”. Please also make the colors of sequences more transparent so that the internal reflections can be seen clearly.

Page 11, Lines 1-2. “Three delta lobes were identified: the oldest (4.1) at ca. 319 m bll, followed by a delta (4.2) at approximately 250 m bll and a third, younger (4.3), at 397 m bll.” Where are they in the seismic section? Please mark the locations of these deltas.

Page 11, Line 6. “ Sequence 3 could only be clearly identified in the western delta areas; . . .” Please show a seismic profile from the western area which clearly depicts S3.

Page 11, Lines 8-9. “In the western delta complex, Sequence 3 is characterized by a lower boundary that was partially erosive into the underlying sediments but grades into a correlative conformity in other places.” I cannot judge this interpretation as I do not see any figure showing this relationship.

Page 13, Lines 4-5. Instead of using lake level decrease and increase, how about using regression and transgression?

Page 14, Line 3. Change “Subaquatic channels” into “ Sublacustrine channels”

Page 15, Line 18. “. . .subsidence seems to have been relatively constant through time.” Can you quantify the fault activity by looking at thickness variations towards it?

Figure Captions Overall, the figure captions should be improved.

Figures

Fig. 1. Please add an inset map showing large areas of the regions. With the current

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map, I cannot say where the Lake Issyk-Kul is located. The depth color bar is missing as well. What about the bathymetry of the lake reconstructed from seismic reflection profiles?

Fig. 2. I suggest including vertical exaggeration for all seismic profiles. Locate the fault on the southern end of the profile. Can you please enlarge the MTDs?

Fig. 3. Please add vertical and horizontal scales.

Fig. 4. It would also be better to give names for the sequence boundaries, such as Sequence boundary 1 (SB1) to SB7. But it is your choice.

Fig. 5. Please switch the Figure 5a and 5b. It should be displayed in an order and should start from Sequence 7. Please do this for the following figures.

Regards

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