

## ***Interactive comment on “Seasonal deposition processes and chronology of a varved Holocene lake sediment record from Lake Chatyr Kol (Kyrgyz Republic)” by Julia Kalanke et al.***

**Anonymous Referee #3**

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This paper presents an annually-laminated sediment record from Lake Chatyr Kol. The paper focusses on establishing a process model for varve formation and then explaining how the floating varve chronology is ‘fixed’ to an absolute timescale. The paper is succinct and achieves the two aims that are set out at the end of the Introduction section. There is plentiful data that describes and explains the different microfacies that are observed in 6.235 m core sequence, detailed explanation of the generation of error from the varve counts and the use of  $^{210}\text{Pb}$  and radiocarbon dates. The radiocarbon dating programme identifies a significant reservoir effect that decreases in magnitude toward the younger sediments and explanations for the likely causes of this are included in the later section 5. Whilst the palaeoenvironmental interpretation in

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Section 5 is limited, and concentrates on an initial interpretation of the different microfacies, it would appear deliberate in that the authors wish to establish the process model for varve formation and also the chronology development in this paper, before exploring the palaeoenvironmental significance of the sequence in later publications. Consequently, the current focus of the paper is appropriate and meets the scope of this journal. There are ways of possibly improving the manuscript to aid the readers understanding of the sequence and also make the varve microfacies sections a little easier to follow.

1. There are several points in Section 5 (eg. Line 298; Line 401; Line 435) that refer to the role of glacial meltwater in the supply of detrital clastic material into the basin and their presence in the varve microfacies. Is it possible to include the area that is/was glaciated in Figure 1? There is no mention of this in Section 2 (Study Site) other than meltwater run-off and it is not clear if this is from a glaciated catchment. A little more detail on this would be helpful to the reader. Also permafrost thaw is considered a possible contributor to older carbon in the lake water to explain the reservoir but this is not described within the site context. Could this also be included in the site context?

2. Microfacies section – the introduction to section 4.2 might be considered contradictory in that Line 166 states ‘consists of mainly clastic lamination’ but Figure 4 has clastic material in all of the microfacies. Later in the paragraph, it is stated that ‘subtypes were named according to the order of their dominant contents’, which has two occasions where either organic or calcitic laminations dominate the microfacies making the earlier statement invalid. If the first sentence said ‘Clastic material is present in all of the macroscopically visible laminations below 63.0 cm depth, and intercalates with calcitic, aragonitic and organic sublayers that build-up cyclic successions. And then the final three sentences can remain and it is a truer reflection of the microfacies. Also it could be useful to state how the subtypes are named according to the their dominant contents ( I assume that the dominant component comes first?).

3. Figure 4 is good at showing the broader differences in the microfacies in each of

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the LZ's. However, the detail in the schematic (varve depositional model) is difficult to evaluate within the images from the thin sections at their current magnification. Could a higher magnification image that reflected more closely the elements shown in the schematic also be included? Also a key for the symbols in the schematic is necessary, and I note that there is no obvious winter layer detected in the clastic-diatom and clastic organic/clastic aragonitic microfacies. Related to this, in the text is 'section 4.2.1 Clastic-organic laminae' the lower schematic or the upper schematic? What is the difference between these two? It appears to be the aragonite and this is what is identified in the text, but the clastic-organic coming first in the Figure confuses this distinction. It would also be helpful that the order that is in the text was followed by the order in the figure to remove this confusion.

4. Section 5.4 provides a nice explanation of the broad environmental changes that lead to variations in the microfacies through the sequence. A criticism is that it is difficult to evaluate the thickness data of the different microfacies against the text, which starts by describing the frequency of the different microfacies in each of the Lithozones. A suggestion that could help the reader and also highlight the differences in microfacies that are observed between the LZ's would be to include on Figure 9 some percentage bar charts that collate the relative proportion of the different microfacies in each LZ. Such that for LZ I with clas-org 57%, clas-calc 29% and clas-arag 14%, clas-dia 0%, org-clas 0% calc-clas 0%. Then using the same order for the microfacies there could be a bar chart for LZ II, LZ III etc and then if aligned vertically the reader could draw a direct comparison between LZ's seeing the changes through the sequence. This could be a column on the righthand side of the current Figure. It would also be useful to arrange the thickness graphs for each of the microfacies in the same order as their description in Figure 4 and in the text of Section 4.

Technical Corrections: Throughout the manuscript superscript is used inconsistently when it should be used e.g. for 14C. Lead-210 is used interchangeably with 210Pb, and cm-1 should be cm<sup>-1</sup>.

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Spaces should be included between ages and the  $\pm$  symbol.

Line 39 – states '....which cover approximately 7,100 cal years BP....', is that the duration of the record or the base of the sequence is dated using varves to 7,100 cal years BP. Is this also the case for Lake Sugan and is this also in cal yrs BP?.

Line 44 – remove 'n'

Line 92 – where they are archived in a cold store at 4° C

Line 97 – remove 'continuously' and put 'Continuous' at the start of the sentence.

Line 138- should a value for keV be included after 5.9%?

Line 175 – is there an image that illustrates how it is possible to distinguish between detrital and endogenic calcite?

Line 301- I was unclear on 'laminar denudation' is that erosion of the lamination?

Line 311 – replace 'overserved' with 'observed'?

Line 343-344 – I was not clear on the meaning of 'for each individual thin section comprising 324 and 13 years varve. My assumption is that this is the range, or maximum and minimum, in total number of varves observed on a single 10 cm thin section. However, I may have misread this.

Line 474 – unclear on the meaning of 'robust fundament'. Do you mean 'This robust chronology is fundamental for further detailed palaeoenvironmental.....'?

Line 479 – I assume that the increased windiness enable increased mixing of the lake waters and CO<sub>2</sub> exchange with the atmosphere. Perhaps be explicit here.

Line 480 replace 'which allowed developing' with '...that allowed the development of seasonal deposition models

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