Geochronology Discuss.,
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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.

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We appreciate the constructive and very helpful comments on of anonymous referee #1 and we addressed suggestions in our revision. However, we relinquish from including more information about regional climate changes in Central Asia. It is the explicit aim of this study to develop a robust chronology for the Chatyr Kul sediment record based predominantly on varve counting. This is the first varve chronology for a Central Asian lake sediment record and detailed analyses of seasonal sedimentation processes were required to prove the existence of annual laminations. This chronology further enabled us through comparison with radiocarbon dating on aquatic matter for the first time (i) to

quantify reservoir ages in a Central Asian lake record and (ii) to demonstrate changes of reservoir ages throughout the Holocene. Our results are of general interest for lake sediment dating in this region in settings where only radiocarbon dating is possible. Hence, we consider our chronological data as valuable stand-alone results and, therefore, have chosen Geochronology as a target journal. We explicitly disclaim from discussing climate changes because this would have been far beyond the scope of this paper and, in contrast, even would have blurred its focus. We have clarified the focus of this paper in the manuscript (lines 51-54 in the revised manuscript). The results of this study form a robust chronological base for future environment and climate reconstructions from the Chatyr Kol sediments.

Specific, minor suggestions:

Referee comment: Lines 14-17. These first two sentences of the abstract appear to be repetitive and could be combined in shortened form.

Author′s response:corrected

Author′s change in the manuscript: Microfacies analysis of a sediment record from Lake Chatyr Kol (Kyrgyz Republic) reveals the presence of seasonal laminae (varves) from the sediment basis dated at 11,619 $\pm$ 603 years BP up to $\sim$360 $\pm$ 40 years BP. The Chatvd19 floating varve chronology relies on replicate varve counts on overlapping petrographic thin sections with an uncertainty of $\pm$ 5 %.

Referee comment: Line 44: Typo – "n" to be removed

Author′s response:corrected

Author′s change in the manuscript: . . .2) human influence (Boomer et al., 2000; Mathis et al., 2014; Schröter et al., 2019 in review),. . .

Referee comment: Lines 53-54: This information should be included into supplements. The aim of these projects is obviously the reconstruction of Holocene climate and so more information on this should be provided in the paper.

Author′s response: This was indeed misleading since we did not clearly distinguish between the overall project goals on climate reconstruction (which involves also other research groups) and the scope of this study, i.e. the construction of a robust age model for the entire project team. We have clarified the goal of this study in the revised version (lines 51-54).

Author′s change in the manuscript: The sediment record from Lake Chatyr Kol is the first varved record from CA covering most of the Holocene and the main goal of this study is to establish a robust age model through an integrated dating approach primarily based on varve counting. Varve counting requires an in-depth understanding of seasonal deposition of all varve types occurring in the sediment record.

Referee comment: Line 62: remove dash

Author′s response:corrected

Author′s change in the manuscript: Geologically, the surrounding mountain ranges belong to Silurian to Carboniferous sedimentary-volcanogenic complexes of marine-continental collision zones, consisting of limestones and dolomites, that crop out directly along the northern lake shore, as well as siliceous rocks, shales and scattered Permian granites that crop out in the south and north-east (Academy of Science of the Kyrgyz SSR, 1987).

Referee comment: Line 70: delete amounts

Author′s response:corrected

Author′s change in the manuscript: Mean annual precipitation is ∼275 mm/a as indicated by Aizen′s (2001) evaluation and spatial averaging of annual 70 precipitation amounts of historical records published by Hydrometeo (Reference Book of Climate USSR, Kyrgyz SSR, 1988).

Referee comment: Line 133: How long was the in-growth time (check also spelling to change to “in-growth-time”. The term photo peak activity sounds incorrect to me

and should be replaced with a more appropriate term. It is the gamma energy that is recorded in the gamma spectrometry.

Author′s response:We changed “photo peak activities” to gamma energies and changed ingrowth-time to in-growth-time.

Author′s change in the manuscript: After sufficient in-growth-time, the gamma energies of 210Pb (T1/2= 22 a) and 214Pb (T1/2= 26.8 min), which is a daughter nuclide of 222Rn (T1/2= 3.8 d), were measured at 46.54, 295.24 and 351.93 keV. Hardware control, data storage, and spectrum analysis were realized with the software Genie 2000 (Canberra Industries). Measurements were taken out for 1.5 to 7 days (Suppl. Tab. 1).

Referee comment: Line 139: lab-internal – please note which lab, and where these samples were analyzed.

Author′s response:Information has been added.

Author′s change in the manuscript: For this purpose, the Kryal© tubes were placed into two well-type germanium detectors G1 and G2 (Canberra Industries) located in a basement lab of a concrete building at GFZ Potsdam which is actively ventilated (Schettler et al., 2006).

Referee comment: Line 167: use a, b, c to refer to each group of laminae more easily and use this instead of “LZ + number” in the references to Fig 4 throughout the text

Author′s response:corrected

Author′s change in the manuscript: Figure captions and figure 4 have been changed accordingly, also in the text.

Referee comment: Line 204: Add current institute/university of Ms Schwarz within brackets as well

Author′s response:Information has been added.

Author′s change in the manuscript: The third sublayer is formed by diatom blooms exclusively consisting of the planktic diatom species Cyclotella choctawhatcheeana (pers. comm. Anja Schwarz, TU Braunschweig) (Fig. 4.1 b upper part).

Referee comment: Line 231: Add picture of homogeneous sediment to Fig 4 as well to see how it com-pares to the varved intervals. In particular, this is useful to show the faint, discontinuous laminae in the uppermost cm

Author′s response:agreed.

Author′s change in the manuscript: Pictures of homogenous sediments with faint laminae have been added to figure 4.

Referee comment: Lines 269-270: Is this assumption justified? +/- 40 years BP uncertainty could be higher or lower? Why is it not possible to more precise that this? On the basis of the data presented, I would be surprised if the error is as high as 40 year

Author′s response: We consider an uncertainty of +/- 40 years at the anchor point as justified for the non-varved interval given the counting uncertainty of ca 5% in laminated sections. We agree to the reviewer that this error might be over-estimated but we prefer to provide a conservative estimate and clarified in the revised text that this uncertainty is considered a maximum range.

Author′s change in the manuscript: We assume a conservative uncertainty of ca. 10% as a maximum error for our interpolation.

Referee comment: Line 386: change to effect

Author′s response:done.

Author′s change in the manuscript: The abrupt decrease of the reservoir effect after ∼AD 1150, despite an increase in detrital carbonate supply (Sect. 5.3.5, Fig. 9) might be related to the silting up of the basin leading to a shallower water depth, which is more susceptible to water circulation and an enhanced atmospheric CO2 exchange

(c.f. Geyh et al., 1997).

Referee comment: Line 491 (data availability statement): Please add the data into this database during the review process, so you can include the doi of the dataset in this statement. I think itis very important to add the doi to the final paper, so the future reader can access the datasets easily

Author′s response: done. We further added a link to the newly established VARDA database

Author′s change in the manuscript: https://doi.pangaea.de/10.1594/PANGAEA.909981 https://varve.gfz-potsdam.de

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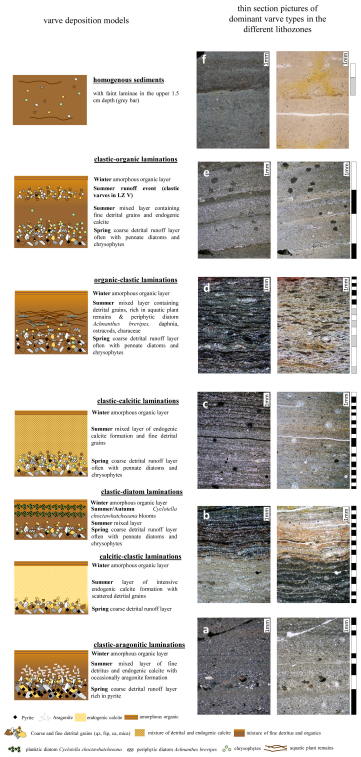

Fig. 1. Figure 4:1 Thin section pictures of different lamination (varve) types in cross-polarized (left) and plane polarized (right) light of the different lithozones LZ I to LZ V. a) Clastic-organic laminati