

Response to referee #1 for GChron-2020-15

We would like to thank anonymous referee #1 for their thorough but positive review as well as their constructive comments that have helped to greatly improve this manuscript. We agree with most comments and have added or adjusted text and figures accordingly. For the cases we did not agree with the recommendations made, we give explanations below (responses in green and italic). Also, we would especially like to thank referee #1 for their spelling and grammar suggestions. This is very much appreciated as none of the authors is a native English speaker.

General comments

This manuscript presents new data based on luminescence analyses of minerogenic sediments in a palaeovalley in Switzerland. As the title indicates, most focus is on the dating and quite little is spent on the implications of the actual ages and their geological context. The luminescence analyses are thorough, though: the authors have used quartz, feldspar and polymineral fractions of several different grain sizes and carried out different tests to evaluate the luminescence properties of the sampled sediment. Both dose and dose-rate related issues are discussed. The discussions are relevant and interesting for luminescence users not only in the Alps, but also in other parts of the world.

Apart for some specific comments, generally about clarifications, and some minor technical corrections as listed below, my main objection or concern about this manuscript is its structure. Though the headings follow the normal IMRAD standard, content-wise there is a mix between Methods, Results and Discussion. When reading Results, in particular, it is like following the project and measurements as they developed. Results are presented, comparisons and references to other studies are made to evaluate data and motivate the next methodological step, which is then described, etc. In a way, this is quite nice, and likely saves some flipping back and forth between pages to check Methods for what was done and how compared to the Results etc, but it also means that, for example, some details regarding methods are presented first in Results, making it hard to find information, and it is in places not that easy to distinguish what are the new results of the authors' in the text (though obvious from tables and figures).

It is indeed hard to present this type of data in a meaningful and readily comprehensible way. However, the raised issue about mixing methods, results and discussion is certainly justified. Accordingly, we have adjusted subheadings and re-structure the content where necessary to allow for a more appropriate fit between sub-headings and text. For ease of reading, methods, results and discussion are jointly presented in aspect specific subsections. This was previously done but is now implemented in a more stringent manner. Also, we have emphasised in the text when presented results were from a different study.

1. Does the paper address relevant scientific questions within the scope of GChron? Yes
2. Does the paper present novel concepts, ideas, tools, or data? Yes, new data from a combination of existing methods and ideas
3. Are substantial conclusions reached? Yes

4. Are the scientific methods and assumptions valid and clearly outlined? Yes, valid and largely clearly outlined *See below.*
5. Are the results sufficient to support the interpretations and conclusions? Yes
6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Overall, yes. Some minor details could be clarified. *See below.*
7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Proper credit, yes, own results partly and slightly lost in text.
8. Does the title clearly reflect the contents of the paper? Yes, but see specific comment about proglacial below. *See below.*
9. Does the abstract provide a concise and complete summary? Yes
10. Is the overall presentation well structured and clear? Yes and no, see above for general comment. *See below.*
11. Is the language fluent and precise? Yes, largely. Some spelling or grammar mistakes, but with one or two exceptions nothing that hampers understanding. *See below.*
12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? Yes, overall
13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes. Fig. 12 needs revision (too small and/or light text). Regarding text, see general comment above. *Fig. 12 has been revised – see below .*
14. Are the number and quality of references appropriate? Yes
15. Is the amount and quality of supplementary material appropriate? There is none.

Specific comments

- L83-86: Please provide some more detail about the sediments including interpretation. Are the sediments that you date really proglacial like the title says? It is not mentioned here. The dated sediments are only described as “sandy gravel” (no glacier indicated), “lacustrine” (no glacier indicated) and “diamicts and colluvium” (no glacier indicated).

We agree that the manuscript title might have been misleading and that details about the sediments was scarce. Indeed, the investigated deposits are of glacial/proglacial to periglacial origin. Therefore, text has been added and the title (‘Luminescence properties and dating of glacial to periglacial sediments from northern Switzerland’) has been changed accordingly.

- L125: Please explain the combined recycling and IR depletion step. Do you mean that this is one set of measurement (one column (or row) in the sequence) only or is it two? Combined to me sounds as if it is one, but then you would either have a proper recycling (using blue stimulation only as after the first regen doses) or an IR depletion test (using infrared + blue stimulation), not both. And if you have two measurements, it is not combined.

Only an IR depletion test was implemented. Text has been changed accordingly.

- L146 (and thereabouts): What was the cutheat?

Only preheats were used as is stated in 2.2 'Sample preparation and measurement': 'All performance tests [and measurements] were conducted using preheating previous to the natural, regenerative and test doses for which the aliquots were heated with 5 °C s⁻¹ to the tested temperature and held for 10 s (Q, fQ) or 60 s (F, PM).' To clarify [...] has been added.

- L157: Against what value was the normalisation done?

Normalised was against the same fixed dose of ca. 90 Gy. Text has been added accordingly.

- L184/214: What do you mean by “rarely inherit luminescent behaviour”? That the sediments are efficiently bleached (no inherited signal/dose)? That the grains do not reflect the properties of the source rocks? Please explain.

Meant was that only few of the grains actually give a luminescence signal after artificial irradiation. Text has been changed to clarify.

- L187: The reduction of the signal to background level after 15-20 s is not shown in the figure 7, which is referred to. The Q and fQ plots there only cover 6 s. Also, the background seems to me to be reached already after 2-4 s.

This is correct and the text has been changed accordingly.

- You touch upon the issue of incomplete bleaching in a couple of places, but you do not really evaluate/discuss it for your samples, apart from a few lines about RIN 8 and 13 (L300-). Yet, also samples RIN1-4 have significantly skewed dose distributions, and diamictons (RIN1-3) are not obviously well-bleached sediments. With easy-to-bleach quartz ages older than or similar to harder-to-bleach feldspar ages, it may not be a problem, but that is also an interesting result that could be discussed, even if only briefly.

We agree and have added a text to briefly present these findings.

- Will the implications of the ages be presented and discussed in some other paper? If not, I think that part should be expanded a bit here.

This is a good point and yes there will be a summary paper discussing the sedimentological context and the implications of the derived ages. This manuscript will use ages from outcrops, two cores from the Lower Aare Valley and the core presented here. The PhD student within the project (Lukas Gegg) will present this work.

Technical corrections

- L30: replace “waters which both” with “waters, both of which”

Text has been changed.

- L80: remove comma after Rinikerfeld

Text has been changed.

- L85: “transition” should be “transitions”

Text has been changed.

- L87: remove “in” after “10 cm”

Text has been changed.

- L89: exchange “embrace” for a verb that more clearly indicates over- and underlying, rather than incorporating

Text has been changed.

- L118: “an” should be “a”

Text has been changed.

- L184: Please add something after “1%”. Is it 1% of the aliquots, of the grains...?

Text has been changed.

- L184: replace “BSL” with blue light

Text has been changed.

- L186: clarify that 200 grains are for Q only, not fQ

Text has been changed.

- L186: “rains” should be “grains”

Text has been changed.

- L208: “FQ” should be “fQ”

Text has been changed.

- L215/219: Please check figure order. Fig. 10 must be referred to before Fig. 11.

Order has been changed accordingly.

- L241: Add “Of” in front of “the measured”

Text has been changed.

- L241: Replace “saturation only allowing” with “saturation, allowing only”

Text has been changed.

- L253: remove “RIN13 with” before “216.8”

Text has been changed.

- L258 and elsewhere: It is confusing that you use the same letter symbol, D, both for dose and dose rate. A subscript (here e and total) typically indicates different versions of the same entity, not different entities. When I first read “D_{total}” I interpreted it as ‘total dose’, which did not make sense, and it was only after looking at table 2 that I found out that you meant ‘total dose rate’. Please exchange one of the symbols.

Nomenclature has been changed and total dose rates are now presented with DR_{total} .

- L266: Please rephrase the last sentence. I do not understand what you mean. What is the offset less pronounced than? The difference between the Q and fQ? The offset between F (or PM) and Q (or fQ)?

Following suggestions of referee #2, the entire subsection has been changed and this sentence became redundant.

- L280 and elsewhere: Either use ‘ ‘ for both corrections or for none. I.e, either “Lamothe correction” and “Kars correction”, or “‘Lamothe’ correction” and “‘Kars’ correction”.

The use of ‘ ‘ has been adopted and was implemented in a stringent manner.

- L296: remove “according”

Text has been changed.

- L297: replace “this” with “the age”

Text has been changed.

- L311: specify which g-value is referred to (F or PM)

Text has been changed.

- L317: Should it be “1.9 % per decade” or do you mean that the values are 0.5-1.9 % lower than some other value? Please clarify.

Meant was ‘% per decade’ and the text has been changed.

- L328: Add “the” after “However, “

Text has been changed.

- L347: Replace “were” with “have been”

Text has been changed.

- Fig. 1: check spelling of diamicts and carbonaceous

Text has been changed.

- Fig. 9 caption: add also RIN 5 fQ and PM.

Text has been changed.

- Fig. 11 caption: check spelling of luminescence on second line

Text has been changed.

- Fig. 11: the greens rings are hardly discernible from the white rings, consider using another colour

Lines of the green circles have been dashed to help distinguish between them and the white circles. Unfortunately, other tested colours did not improve distinguishability.

- Fig. 12: the text inside the plots is not legible, it is way too small. The light grey colour in the four lower plots is hard to see, particularly for the text.

The colour has been changed and the text for RIN13 has been adjusted to make it easier to read.

- Fig. 13. Would it be possible to indicate the stratigraphy (e.g. unit numbers and boundaries) in these plots? It would help a reader to remember the stratigraphic context and which samples belong where.

The top part of the log have been added to the figure.