Solid Earth Discuss., referee comment RC1
https://doi.org/10.5194/se-2020-221-RC1, 2021

Comment on se-2020-221

Reinhard Gaupp (Referee)

Referee comment on "Rock alteration at the post-Variscan nonconformity: implications for Carboniferous–Permian surface weathering versus burial diagenesis and paleoclimate evaluation" by Fei Liang et al., Solid Earth Discuss., https://doi.org/10.5194/se-2020-221-RC1, 2021

Referee comments Solid Earth se-2020-221

Authors: Fei Liang, Jun Niu, Adrian Linsel, Matthias Hinderer, Dirk Scheuvens, Rainer Petschick

Title:

Rock alteration at the post-Variscan nonconformity: implications for

Carboniferous-Permian surface weathering versus burial diagenesis

and paleoclimate evaluation

Referee: Reinhard Gaupp

- **General comments**

The article addresses an interesting case of stacked lithologies with intermediate exposure surfaces with obviously different times of weathering alteration. The time lengths of exposure and geochemical-mineralogical alterations are not controlled by other independent evidence, like geochronology etc., but other factors of alteration are well constrained by the investigation. The authors attempt to evaluate thermal effects afer volcanic effusion with assumed "hydrothermal" alteration by fluids during burial history.

The manuscript has an overall very good quality with a target interesting for a wide audience. I cannot fully support the author's conviction that this case history is well suited to provide a workflow for data reliability analysis for *paleoclimate* research. But the elaborated workflow is helpful to unravel multistage low temperature (<200°C) overprints of (magmatic) rocks.

I suggest acceptance of the manuscript with minor corrections (see 2. and 3.)

- **Specific comments.** Question issues
- a) Chapter 5.4. Climate: The timing of Permian deglaciation cycles fixed into the climate curve of Roscher & Schneider 2006 is not a reliable base to evaluate the ages of the observed nonconformities (see Fig.12). This pretends the possibility to estimate the lengths of exposure to atmospheric influence and erosion.
- b) The term "hydrothermal" is not clearly constrained in this article. Unfortunately this is often the case in the present papers. What evidence is given to define the fluid as "hydrothermal"? We should know the geothermal situation at the time of influx or mineralization and evaluate the deltaT to the observable mineralization or fluid inclusion data. Otherwise it is "possibly or likely hydrothermal".
- c) Mesozoic sedimentary cover of the investigated sequence: 600 to 1500m given in Line130; the minimum value of 600m is not justified by evidence within the preserved stratigraphy, and also by thermal consideration (>130°C in the Odenwald top

basement)

- d) Kaolinite in lithologies like the basalt. Table S1 does not include the mineralogy of the Rotliegend sediments. Can we exclude that kaolinite is a subrecent surface related weathering effect from petrography (present Telodiagenesis)? With an assumed maximum Mesozoic burial of the post-Variscan nonconformity of ca. 1500m, the illitisation of the small kaolinite contents would have occurred. This illitization of kaolinite (K-metasomatism?) would be supported by the assumed hydrothermal processes. Fig.2I shows adularia and kaolinite (replacing the adularia?)
- e) A very interesting aspect of the study is the interpretation of K-Metasomatism. An increase in K in clastic deposits downsection in wells is observed frequently, with diverse attempts to get a grip on the sources and mechanisms. Metasomatism presumes the export from one volume to import in another volume of rock. In this study the increase of alkali elements is quantified for the gabbroic diorite and the basaltic andesite. Why should an export of potassium from the overlaying Rotliegend arkosic sediments be impossible? The Neogene to Quaternary weathering and erosion effect on the investigated section is only poorly touched.

- 3**. Technical corrections**

Diverse annotations and comments, corrections are included in the manuscript (see pdf).

Here I present only few:

- a) Line 118: Barruelian, compare Nelson & Lucas 2021: The Cantabrian and Barruelian substages…; in

Fossil Record 7. New Mexico Museum of Natural History and Science Bulletin 82._ please adjust to their suggestions (?)

- b) Fig 11: "retrograde" trend is not explained beyond his figure caption. Please omit or explain.

Retrograde is a term in metamorphic petrology; does it apply here for K+ trends, metasomatism??

- c) Line 445: we do not need subhumid climatic conditions to promote eventual flood events that create alluvial massflows. This occurs even in very arid conditions (Jahrtausend-Ereignisse).

- Final assessment:
- Does the paper address relevant scientific questions within the scope of SE? yes
- Does the paper present novel concepts, ideas, tools, or data? Not really novel concepts, but interesting case study
- Are substantial conclusions reached? Some conclusions are well based on evidence, others are less.
- Are the scientific methods and assumptions valid and clearly outlined? yes
- Are the results sufficient to support the interpretations and conclusions? In general yes, but see comments
- Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? yes
- Do the authors give proper credit to related work and clearly indicate their own new/original contribution? Most essential relevant literature is cited
- Does the title clearly reflect the contents of the paper? I suggest to omit "and palaeoclimate evaluation", since this part of the paper is least supported by evidence.
- Does the abstract provide a concise and complete summary? Yes acceptable
- Is the overall presentation well structured and clear? yes
- Is the language fluent and precise? Good, but may have a native speaker looking at….
- Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? n.a.
- Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? See comments
- Are the number and quality of references appropriate? See 7.
- Is the amount and quality of supplementary material appropriate? Yes fine

Please also note the supplement to this comment:
https://se.copernicus.org/preprints/se-2020-221/se-2020-221-RC1-supplement.pdf