

Solid Earth Discuss., referee comment RC2  
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## Comment on se-2021-8

Anonymous Referee #2

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Referee comment on "Thermal history of the East European Platform margin in Poland based on apatite and zircon low-temperature thermochronology" by Dariusz Botor et al., Solid Earth Discuss., <https://doi.org/10.5194/se-2021-8-RC2>, 2021

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### Review for

Title: Paleozoic-Mesozoic thermal evolution along the East European Platform margin based on kerogen thermal maturity analysis combined with apatite and zircon low temperature thermochronology in NE Poland

Author(s): Dariusz Botor et al.

MS No.: se-2021-8

MS type: Research article

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The submitted manuscript by Botor et al. represents an interesting and, to some extent, an essential contribution to thermal history reconstructions performed for the borehole-derived samples from Eastern Poland. The project scale (i.e., number of samples analyzed) and used multi-tool approach defines this study as an important contribution to the general understanding of Palaeozoic and Mesozoic thermal evolution of intracontinental setting within Central Europe. The authors presented a set of new AFT (21) and ZHe (40) dating results, which have been combined with thermal maturity (e.g., VR) and stratigraphic data. Since the study area is mainly covered with the Cenozoic strata, using borehole samples was indispensable for this study, and authors processed an extensive set of samples, both for sedimentary and crystalline complexes. Based on the results obtained and literature data, the authors performed thermal modelling, concluding a crucial role of an early Carboniferous burial and exhumation in the East European Platform thermal evolution.

Submitted work is a well-written and comprehensive study, at the scale never before presented for the research area, therefore after minor corrections (listed below), it should be considered for publication.

Nevertheless, on this occasion, some remarks for authors' considerations, followed by figures and table comments and secondary technical issues, should be emphasized.

### **Specific comments**

- Since all the apatite fission-track data reported in the text are based on borehole samples, the reader might expect that the authors would at least refer to and discuss their results in the context of some known issues regarding the application of low-temperature thermochronometry to the deep borehole samples. It includes i.a., defects for fission-track dating reported by Wauschkuhn et al. (2015 and references therein).
- Throughout the text, any information on how the length of the confined tracks have been presented (c-axis corrected or not) could hardly be found. This information must be declared in the text since the effect of bias in length distribution might be a significant component (see Ketcham et al., 2007).
- It is confusing to use the capital letters through the text, tables, and figures for the epochs/series names (e.g., Table 1: Triassic lower; Jurassic Middle). This needs to be clarified and homogenized throughout the manuscript following the ICS recommendations.
- In table 2, many reported Zr grains contain inclusions. Does it possibly have any influence on the reported ZHe ages?
- Szewczyk & Gientka (2009) reported some heat flow density perturbations for the NE Poland reaching up to 2000 m depth, so in the range of many of the analyzed borehole samples. In this context, please better explain which present-day temperatures (e.g., line 491) do you present in your text and use for thermal modeling.

### **Comments to figures and tables**

#### **Fig.1**

This figure does not contain scale and geographical coordinates; hence it should not be termed a 'map'; please adjust it accordingly.

Please also add to the figure caption word 'borehole' to have 'the location of borehole samples' to avoid confusion.

#### **Fig.2**

Some abbreviations used seem not to fit its meaning, for example: Pcm – Paleoproterozoic, which fits Precambrian better; please adjust it accordingly. On the chronostratigraphic abbreviations list, Carboniferous is omitted (there is C-Cambrian instead).

### **Fig.3**

Please name the stratigraphic units by using only singular forms, not plural, neither mixed.

### **Fig.4**

On the map, the EEC acronym is used (East European Craton), but there is EEP (EE Platform) in the caption.

### **Fig.6**

Please stay uniform using only one English language standard ('Palaeozoic' vs. 'paleotemperature' (ae vs. e)). Please scan the whole text to verify the spelling.

### **Fig.13**

There are some issues that should be explained regarding the thermal modeling performed. Does it exist any information regarding the age of detrital zircon grains? It would be helpful to use it when designing a modeling strategy.

Please add to the models basic information, including GOF, modeled vs. measured ages and lengths, youngest grains, horizontal lines for APAZ, ZHePRZ zones.

### **Fig.14**

This figure does not contain scale and geographical coordinates; hence it should not be termed a 'map'; please adjust it accordingly.

Yellow asterisk – maybe better would be ‘Wells with thermal models...’ ?

### **Fig. A1**

Please add a number of apatite grains analyzed for each radial plot (n=XX)

### **Table 1**

Some stratigraphic units and lithologies listed in the table do not have correct English names (i.a., Proterozoik; granitoide).

### **Table 4**

Please see the comment above.

### **Technical corrections**

There are text and graphical elements listed below which need some minor corrections.

Line 30: ‘These basins form an extensive platform cover resting upon the SW slope of the East European Craton, comprising Paleoproterozoic to Mesoproterozoic crystalline basement.’ This sentence would benefit from a relevant literature reference

Lines 42-45: this sentence is a direct repetition of the paper abstract and should be discarded

Line 51: ‘Phanerozoic’ – some of reported ZHe ages go far beyond Phanerozoic timescale. Furthermore, this section's last sentence (lines 51-53) fits much better into Abstract than Introduction

Line 58: you mention in the text a geological unit ‘West European Palaeozoic Platform’ and refer the reader to Fig.1, however on this figure, no such a unit exists

Lines 99-100: This sentence would benefit from a relevant literature reference

Line 131: please add some additional explanation about the basis of Poprawa's (2010) conclusions regarding peak temperatures

Line 141: 'thermochronology' should be replaced by 'analyses'

Line 143: should be 'Farley (2002)' instead of '(Farley, 2002)

Lines 170-171: what about the c-axis angle correction for confined tracks measurements?

Line 196: at which depth was this temperature measured?

Lines 238-242: please add information about c-axis angle correction (see comment above)

Lines 253-254: It sounds like a conclusion or plausible explanation here; please be more specific by adding relevant arguments.

Line 259: AFTA – do you explain anywhere before in the text this acronym?

Line 261: 'fluid flow' explanation would benefit from i.e., relevant citation

Line 313: should be 'fission track lengths distribution'

Line 317: should be 'T<sub>0</sub>uszcz'

Line 351: basing on only 3 apatite grains might not give a meaningful result from the methodological point of view; therefore, if you'd like to use it still, please clarify this issue and explain possible shortcomings

Line 362: which kind of thermal modeling has been used (forward, inverse?)

Line 448: does this 'Mesozoic geothermal gradient' has been independently confirmed

Lines 566-567: how does Variscan orogeny can cause erosion? In what sense?

Lines 582-588: Dniepr-Donets-Donbas Rift does not exist on any of your maps, so it might be hard for the reader to get an idea about logical (geographical) connection with your research area

Line 600: Pripyat Trough does not exist on any of your maps, so it might be hard for the reader to get an idea about logical (geographical) connection with your research area

Lines 644-648: This conclusion remains speculative due to no solid arguments for the heat transfer change

### **References cited:**

Ketcham R.A., Carter A., Donelick R.A., Barbarand J., Hurford A.J. (2017) Improved measurement of fission track annealing in apatite using c-axis projection. *American Mineralogist* 92, 789-798.

Szewczyk J., Gientka D. (2009) Terrestrial heat flow density in Poland — a new approach. *Geological Quarterly* 53(1):125–140.

Wauschkuhn B., Jonckheere R., Ratschbacher L. (2015) The KTB apatite fission-track profiles: Building on a firm foundation? *Geochim Cosmochim Acta* 167:27–62.