Dear Editors and Reviewers,

We would like to express our sincere gratitude for the insightful and constructive evaluation of our manuscript. Each comment has been carefully considered, and we have revised the manuscript accordingly to improve its quality. Our point-by-point responses and explanations are provided below.

All authors have approved this revised version and agree with its resubmission. We have extensively revised and rewritten most sections of the manuscript to improve clarity and scientific reasoning. We sincerely hope these improvements meet your expectations for publication. We remain at your disposal for any further clarifications.

Yours sincerely,

Ben-Tami Abdelhay on behalf of the authors.

Note: all author responses to Reviewer 2 are highlighted in green.

Author response to Reviewer 2

Major comments:

Abstract and Introduction

In my opinion, the term "Pan-African orogeny" is used confusingly in the paper in several places. This usually refers to the Neoproterozoic internal collisional orogenic systems developed between individual cratons during Gondwana formation (Trans-Saharan, Mozambique, Kaoko, Damara belts etc.). However, if I understand your model correctly, in your case it is a peripheral active continental margin along West African Craton. The term Cadomian Orogeny is used for the identical setting in current European parts of northern Gondwana, as you correctly mention later in the text. In the case of Pan-African, it is unclear what you mean, and this should be clearly explained.

The introduction is rewritten, as we acknowledge this ambiguity.

Line 34: write the rock types rather than the sample numbers.

We have corrected it accordingly. Sample names are specified in section 5.4.2; line: 544.

Line 39: The entire history is significantly older, there is already the Paleoproterozoic basement there.

We have corrected it accordingly. Refer to section 2 on Geological background for relevant details; lines: 67–72.

Line 40: Here you write that the formation of passive margin and island arc in the Tonian-Cryogenian is recorded. This seems like a contradiction (passive margin and subduction together). Are these not rather two models from different authors/papers?

We have corrected it accordingly. Refer to lines: 42–45 for relevant explanations.

Line 46: Add references to the paleogeographic models and correlations mentioned.

We have added the requested references. Refer to lines: 49–50.

Lines 47–48: What means peri-Gondwana terranes accreted in Ediacaran? It is commonly used for crustal fragments lately separated from the northern Gondwana. Additionally, I disagree with the statement that the Cadomian subduction was responsible for the amalgamation of Gondwana. Pan-African collisions resulted into Gondwana formation. Cadomian belt developed at the similar time as accretionary system along Gondwana periphery.

We have corrected it accordingly. Refer to lines: 48–54 in the revised version for relevant corrections.

Geological setting

The geological setting is quite detailed and bit chaotic, and readers who are not familiar with the geology of region may find it difficult to understand the division of units. This chapter needs to be simplified and made more systematic. There are also many regional names that are not on the map.

We have corrected it accordingly. Refer to section 2 on Geological background for relevant details. All regional names that are not referred to in Fig. 1 are removed from the text.

Results

A fundamental problem is the absence of description of field macro scale geological relationships. Without field information, it is impossible to correctly interpret your data. It is not clear from the petrological description which lithologies are present in the individual units. It is unclear whether the description covers all the rocks represented or only your samples.

We have corrected it accordingly. We have added a sub-section 2.1 on Field characteristics and sample distribution (lines: 112–138).

L 170: Write directly rock types instead general volcanics. Moreover, gabbro is not volcanic rock.

We have corrected it accordingly. Refer to sub-section 4.1.1; line: 158.

L177: Describe the relationship between sedimentary parts and magmatic rocks of the Saghro Group. This is crucial in the context of your geochronological results.

We have corrected it accordingly. We have added a sub-section 2.1 on Field characteristics and sample distribution (lines: 112–138).

L179–181: Interpretation of depositional environment belongs to the discussion.

We have corrected it accordingly, and removed to the discussion in sub-section 5.4.1; lines: 524–526.

L194–199: Again, it is necessary to clarify the relationships between plutonic and volcanic members of the Ouarzazate Group before in the new separate subchapter.

We have corrected it accordingly. We have added a sub-section 2.1 on Field characteristics and sample distribution (lines: 112–138). Additionally, table 1 was moved to electronic supplements as supplementary table 4.

Cathodoluminescence (CL) imaging and LA-ICP-MS U-Pb zircon geochronology

The description of the U-Pb data is quite unsystematic. I would recommend to start with description of the crystal shapes and textures of zircons, followed by the U-Pb data and Th/U ratios itself. Another important weakness is that not all data are described. You only deal with the data used for the weighted mean age calculation (21 from 40 for the first sample). How did you select the data for this calculation, and what is the age distribution of the other data? Especially for detrital populations, the youngest part of the age spectrum is crucial for determining the time of sedimentation. For one detrital sample, it would be useful to calculate Maximum Depositional Age (e.g. Dickinson and Gehrels, 2009) and later discuss it thoroughly.

We have corrected it accordingly, and the chapter on Cathodoluminescence (CL) imaging and LA-ICP-MS U-Pb zircon geochronology is completely rewritten. Refer to new chapter in section 4.2. We have followed your recommendation on the description of the U-Pb data. Please refer to sub-sections 4.2.1, 4.2.2, and 4.2.3 for sandstone (Zg-132), OG rhyolite (Zg-106), and OG granite (Zg-119), respectively.

L215–219: This section describing structural relationships and petrography belongs somewhere at the beginning, or possibly also to the discussion.

We have corrected it accordingly. Lines: 215-217 from the old version were moved to the new sub-section 2.1 on Field characteristics and sample distribution in the revised version (see lines 135, and 136). Lines 217-219 from the old version were also rephrased and moved to sub-section 5.4.2; lines: 549–550 in the revised version.

L219: You probably meant Th/U.

Yes, and we have corrected it accordingly. Th/U ratios are measured and given for all samples following your recommendations. Please refer to sub-sections 4.2.1, 4.2.2, and 4.2.3 for sandstone (Zg-132), rhyolite (Zg-106), and granite (Zg-119), respectively.

L221–223: Move the description of the method of data selection according to concordance to the methodology section so that it does not have to be repeated each time.

We have corrected it accordingly. The description of the method of data selection according to concordance was moved to analytical methods, given as electronic supplements (supplementary data 1).

L234–235, 237: You consider the wide age range to be a consequence of Pb loss and inheritance. Do these youngest and oldest zircons have any specific textural features or compositions that would support these interpretations? This needs to be added and explained.

We have corrected it accordingly.

L238: rather detritic signature of magma source.

We have corrected it accordingly, and removed from the interpretations.

L240–241: The statement that older zircons are not inherited contradicts the inferred magmatic age. This needs to be clarified. Furthermore, the conclusion that inherited grains are not apparent in CL would be beneficial to prove. However, in Figure 4 2a, the zircons are only from the cluster around the calculated magmatic age, and the older ones are missing.

We have corrected it accordingly. Please refer to Fig. 4 for relevant CL images, and to supplementary data 2 for CL images of all the analyzed zircons from all samples.

L243: Ag-Hg is probably mineralization

Yes, it refers to the Zgounder Ag-Hg deposit; line 114. We have corrected it accordingly.

L244–245: direction of what? Bedding? This should be described in the field observations.

Yes, and we have added a sub-section 2.1 on Field characteristics and sample distribution (lines: 112–138) for field relationships. Please refer to lines: 122–124 for relevant explanations.

L245–248: interpretations – move to the Geological Setting or Discussion

We have corrected it accordingly. Line 245 from the old version was rephrased and moved to sub-section 2.1 on Field characteristics and sample distribution in the revised version (refer to lines: 122–124). Lines 246-248 were also rephrased and moved to sub-section 5.4.1; lines: 524–526 in the revised version.

Significance of Sm-Nd isotopic data

I believe that, at least for some samples (crustaly derived), it would be more appropriate to use two-stage Nd model ages. Data should also be presented as εNd vs. age plot.

We have corrected this section accordingly. Please refer to table 1 in the revised version, and to Fig. 8 for relevant plots.

L341–346: interpretations – move to the Discussion

We have corrected this section accordingly.

L353: I don't understand what is meant by this effect is limited. Moreover, potential presence of the Mesoproterozoic crust in the WAC is very interesting and important. Could it be a mixed value caused by a combination of young mantle source and involved Paleoproterozoic crust? This issue needs to be carefully explained and discussed.

We have corrected it accordingly, using two-stage model ages, and interpreted accordingly. For the mixing proportions; refer to lines: 334–353. For results interpretation; refer to sub-section 5.2; lines: 437–444.

L353–359: interpretations – move to the Discussion

We have corrected it accordingly.

Discussion

Discussion and particularly last subchapter are rather confusing. It is difficult to trace how the proposed model in Figure 13 is related to the data from this study and what is based on published opinions. It is not clear to me, for example, on what basis the final phase of collapse is deduced. The last subchapter needs to be completely reworked to make the sequence of arguments and the final model clear and straightforwardly explained.

We have corrected it accordingly, as the whole discussion chapter is rewritten.

I see the interpretation of the magmatic age of rhyolitic sample and detrital zircon age pattern of sedimentary sample as a major problems. If the sample Zg-106 is a dyke that crosscut the Tittalt Formation, then it cannot be taken as the age of this formation. Especially if the sequence is deformed, which is not fully clear from the text, then the rhyolite is significantly younger. Similarly, from the text, it seems that you interpret sedimentation age of the dated sandstone as Ediacaran. However, this requires showing the youngest part of the population and MDA, as I mentioned above. In the case of back-arc basin, it is highly unlikely that material from active extensional magmatism would not be recorded. Mentioned structural record and detrital age population suggest that it most likely represents older Paleoproterozoic or Mesoproterozoic succession, intruded by Ediacaran magmas. In my opinion, sandstone is only slightly younger than single Paleoproterozoic magmatic source of detritus, which was very proximal (euhedral zircons indicate very short transport). For the correct interpretation of these data, it is necessary to consider field geological context.

We have corrected it accordingly. Refer to sub-section 2.1 on Field characteristics and sample distribution; lines: 135–136 for the Ouarzazate Group rhyolite (Zg-106). Plus, we have calculated the maximum depositional age (MDA) for the sandstone (Zg-132); lines: 206–209, and lines: 526–530 for its interpretation. Also, refer to sub-section 4.2.1 for CL images description for the sandstone (Zg-132), and to supplementary data 2 for all the analyzed zircons for Zg-132. Lastly, please refer to lines: 534–536 for the general interpretations of the MDA of the sandstone and the 2.1 Ga Paleoproterozoic peak.

L559–560: not only Iberia, also to many other parts of Variscan belt

We have corrected it accordingly, as the whole chapter is rewritten.

L562–577: Entire section is too detailed and unnecessary. It can be condensed to three sentences and few references.

We have corrected and shortened accordingly. Refer to sub-section 5.4.1; lines: 513–521.

Minor comments:

For ranges (e.g. age or values), use en dash instead hyphen everywhere.

We have corrected it accordingly.

Unify the use of early vs. Early vs. lower, late vs Late (e.g. L30 vs L66 vs L86 vs L98 vs L99).

We have corrected it accordingly. We have also unified the capitalization of words like: Orogeny, Group, Pluton or Complex based on comments from Reviewer 1.

Formatting of references in the text is inconsistent. Please edit according to the journal's instructions.

We have corrected it accordingly.

English is poor in many places and definitely needs careful language correction.

We have made the necessary corrections to enhance the English quality. The manuscript also benefited from an external reading.

Figures:

The map Fig. 2 lacks many regional names used in the text, which must be corrected. Add ages (periods) for the main units in legend.

We have made the necessary modifications and corrections to Fig. 2. All regional names that are on the text are visible from in Fig.2. Plus, ages were added for the main units.

Fig. 4: explain the abbreviation KDE.

We have corrected it accordingly. Please refer to Fig. 5 for relevant modifications; line: 231 for KDE abbreviation.