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.

Yours sincerely,

Ben-Tami Abdelhay on behalf of all co-authors

Response to reviewer 1

General comments to the style, language and grammar of the manuscript

- The Results and Discussion parts should be strictly separated.
  We have separated the Results and Discussion parts accordingly
- The manuscript is written in English with numerous mistakes. The language requires revision by native speaker. The text tends to wordy and repetitive, and in places does not flow linearly. It can be certainly condensed substantially without a loss of its informative value. Currently it is extensively long. I urge the senior co-authors (and native speakers among them) to take care of these issues.
  We have made the necessary corrections to enhance the English quality. The manuscript benefited from an external reading. We have shortened the text and streamlined it to be concise as possible without losing core details.
- Reduce, if possible, the plethora of local names. All of these remaining need to be shown on some map.
  We have kept the regional names that are only visible on Fig. 1, and Fig.2, and shortened the section accordingly.
- Consider capitalization of the whole formal names, including words such as Orogeny, Group, Pluton or Complex.
  Corrected accordingly.
- All abbreviations are to be explained just once, at the first occurrence. Except in figure captions, where I would always explain all of those present.
  Corrected accordingly.
- Past tense should be used always when referring to events in geological past or previous publications.
  Corrected accordingly.
- Hypotheses should be expressed by some element of uncertainty, e.g. by conditionals.
  Corrected accordingly.
- In English text (e.g., Table 2), one should use exclusively decimal points, and not commas.
  Corrected accordingly.
- All the measured/calculated values should be rounded up to their precision.
  Corrected accordingly.
- All Figures (and their parts), Tables and electronic supplementary materials (ESM) should be quoted in the text, and exactly in the correct sequence.

Corrected and adopted accordingly.

- Define how you calculate some geochemical parameters. For Eu anomalies, use the standard Eu/Eu* notation. Add all these extra parameters to the data table.
  Calculations and formulas are given in supplementary table 3 for geochemical data, and also in the manuscript text.

Graphics

- The quality and readability of all graphs should be improved. The isotopic plots are terrible.
  We have modified the figures quality. The isotopic plots are produced according to your suggestions.
- Plotting symbols/colours should be chosen carefully and kept the same for all plots.
  Done accordingly in all figures.
- In geochemical plots, label the samples specifically mentioned in the text.
  Done accordingly.
- Add references as appropriate, including those referring to the plotted geochemical reservoirs and trends. Format those on plots according to the Journal in house rules.
  Done accordingly.
- Avoid using underscore, _ as a replacement for space.
  Removed and corrected accordingly.
- In some figures (most notably Fig. 1), text seems to be interlaced, and is very difficult to read. But maybe it is just some compatibility issue.
  Redrawn and corrected accordingly.

Typography

- More attention should be paid to correct, and consistent, typography, placing spaces where necessary, correctly using hyphens and en dashes, etc. For example, the ranges should be indicated by en-dashes, without spaces around. Minus is en-dash, with no space following.
  We have corrected it accordingly.
- Special care should be paid to correctly marking super- and subscripts, e.g. in names of major-element oxides.
  We have corrected it accordingly.
- There should be always a space between a number and unit, or a percent symbol. There is no space before punctuation marks such as .:;.
  We have corrected it accordingly.
- There should be no space between a sign and the number, e.g. +5.5 or –2.7.
  We have corrected it accordingly.

References

- The authors should adhere strictly to the journal's style as given in the Instructions to authors.
  We have corrected it accordingly.
- What is the logic behind ordering of multiple references in the text? I would say that they are currently completely erratic. Order them consistently; chronologically, or alphabetically, depending on your preference.
  The references are ordered chronologically in all text.
- The same applies for Bibliography. See https://www.solid earth.net/submission.html#references. Check that if there is more than one paper in the

same year for a first author (independent of the rest of the team), a letter (a, b, c) is added to the year both in the in-text citation as well as in the reference list.
Corrected accordingly.

- The bibliography is rather accurate; there is only a handful of references missing in the list, see the annotated PDF.
Corrected accordingly.

Abstract

[23] Instead of sample names, specify the lithologies dated.

We have corrected it accordingly. Sample names are specified in section 5.4.2; line: 545.

[28] Formed from a dominantly juvenile, mantle-derived source – confusing. Do you mean direct contribution of mantle-derived basaltic melts or remelting of metabasic crust?

We acknowledge this ambiguity. We mean the direct contribution of mantle-derived basaltic melts, generated from the activation of a Sub-Continental Lithospheric Mantle source that was metasomatized during previous Cryogenian Pan-African subduction. (explanations in lines 440, 441 for the near-pristine mantle signature; and lines 581, 582, and 583).

Introduction

[39–43] Complex sentence, revise.

Removed and revised accordingly (similar comment from Reviewer 2).

[47–48] Repetitive. It was said above, combine.

Removed and revised accordingly (similar comment from Reviewer 2).

[58] Sirwa or Siroua as on the map?

Sirwa for corrections. Corrected in Fig. 1 and in all text

[60] Mafic and intermediate units? Please be more specific.

We adopted magmatic rocks. Removed from the Introduction and moved to sub-section 2.1 on Field characteristics and sample distribution (lines 116, and 117).

Geological setting

[73] Distinguish between orogeny (the orogenic process) and orogen (its product).

We have corrected it accordingly (lines 66, and 67).

[114–148] Are all these details and local names indeed necessary?

This chapter has been modified and corrected following the recommendations from Reviewer 2, with a new sub-chapter on 'Field characteristics and sample distribution' (lines: 111-137).

[128] Provide errors of age determinations, and dated material/method, whenever possible. [128] Slightly younger? Probably identical within the error.

Corrected and made visible from the new revised chapter 'Geological background' (lines: 64-137)

[Table 1] Should be moved to electronic supplement. What is the logic behind ordering the individual samples?

Moved to electronic supplements as supplementary table 4. They have been grouped to be differentiated for each Group (Saghro Group and Ouarzazate Group).

U–Pb zircon geochronology – methodology

[154] Show sample Zg-119 on the map.

The Zg-119 corresponds to a sample taken from a diamond drill hole, plus, all underground samples are not plotted in Fig.2. We remain open to provide the relevant cross-sections for all underground samples locations. However, the data will be restricted to the review phase and cannot be provided as supplementary data, due to company restrictions (as most of the drill-holes are not yet published). Please be aware that we are at your disposal for any further clarifications.

[159] ± 2 sigma error? Not found, reviewer referring to [159] for correction.

Petrography

[175] I would rather call this texture ophitic(?)

We have corrected it accordingly.

[189] pyroxene? Could you please be more concrete, or at least to write “clinopyroxene”?

We have corrected it accordingly.

[189] List the minerals in the order of decreasing modal abundance.

We have corrected it accordingly.

U–Pb zircon geochronology

[220] Moderate in size? Please be more concrete.
We have corrected it accordingly. The description was done following the recommendations from Reviewer 2. See section 4.2 in the revised version.

The CL images are too tiny to see any detail.
We have modified it accordingly. Refer to Fig. 4 for the reproduced CL images, and to supplementary data 2 for all the analyzed zircons in all samples;

[235–236] Both? What do you refer to?

Referring to the two tails of ages. Removed from the interpretations.

[238] Poor style. The age of the sandstone Zg 132 has not been introduced yet.

We have revised it and corrected it accordingly. See sub-section 4.2.3.

[243–252] Perhaps it would be interesting to discuss the youngest zircons constraining the maximum age of sedimentation.

We have corrected it accordingly. Chapter on U-Pb Zircon geochronology is corrected based on the comments of Reviewer 2, taking into consideration these comments as well. See sub-section 4.2.1; lines: 205-208.

Whole-rock geochemistry

[265] But, if I understand it right, a lot of them are altered.

We have corrected it accordingly. See sub-section 4.3.1; lines: 234-240.

[274] In general, label the samples specifically mentioned in the text on the geochemical plots.

We have corrected it accordingly.

[280 and elsewhere] The Eu anomalies should be expressed in consistent way. δEu, Eu/Eu*)N Eu/Eu* are all used. Eu/Eu* is the standard.

The Eu anomalies are expressed in the standard Eu/Eu* notation, the calculation (Eu/Eu∗=2EuN/(SmN+GdN)) has been added to the supplementary table 3, and to the manuscript text; line 258.

[284] Be specific: what is the "early gabbro sample from Sirwa"?

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

[296] What is the unit of Na2O + K2O? Is their ratio calculated by weight?

The Na2O + K2O ratio is calculated by weight, and the calculation is added to the supplementary table 3.

[297–298] These rock groups are not distinguished in the plot.

We have corrected it accordingly; lines: 267-269.

[299] Some nomenclature diagram is to be shown to name the rocks discussed in this text.

We have corrected it accordingly, we added Fig. 6b for these rocks; line 267 for text.

[309] This is a hypothesis that should not appear in the Results, but in Discussion. K-feldspar fractionation would have the same effect.

Revised and corrected accordingly.

[316–320] Very confusing. First of all, such a discussion is out of scope of the Results section. There is a lot of local information we are not familiar with and these analyses are not plotted here.

Revised and deleted accordingly, we have removed all of these local names from the interpretations.

ESM 4

- In text and in the relevant **ESM** table: round off all the data to match the precision of each of the oxides/elements (some are precise to three decimal places, others to none, I suspect). Even add trailing zeroes whenever needed to indicate the real precision.
  We have corrected it accordingly.
- Mg numbers are calculated wrongly! The calculation should be based on molar and not weight percentages.
  We have recalculate the Mg# accordingly. The equation is given in supplementary table 3 and in the text; lines: 252-253, and the results are projected versus SiO_2 (wt.%) in Fig. 6f.

Sm–Nd isotopes

- The Analytical techniques (**ESM 2**) lack the necessary details of Nd isotopic data recalculation, including the relevant references for decay constant, CHUR composition and model ages computations.

We have corrected it accordingly. The necessary details are given below table 1 in the manuscript text.

Table 2

- Sample names should come into the first column.
  We have corrected it accordingly. Table 1 for corrections; line 295.
- Add a column with age (Ma) used for correction each of the analyses.
  We have corrected it accordingly.
- Format all super- and subscripts as appropriate.
  We have corrected it accordingly.
- Show initial Nd ratios, but not the present-day epsilon values.
  We have corrected it accordingly.
- The column with initial ratios should be labelled ε_i^{Nd} or similar. Some analyses were not recalculated to 570 Ma.
  We have corrected it accordingly, we added the column for Age (Ma) for both groups.
- Model ages should be given in Ga and rounded to two decimal places.
  We have corrected it accordingly.
- What is the difference between *TDM (Goldstein) Ma* and *TDM Ga*? Are these single- or two-stage models? Give all these details of model age calculations in the Analytical techniques. As you know, single-stage ones are more appropriate for mantle-derived, mafic rocks, two-stage model ages (Liew and Hofmann 1988) for crustally-derived, felsic rocks.
  Modified it accordingly, we have added a column for two-stage model in Ga.
- The initial ratios of Nd isotopes and epsilon values should have a consistent – and simple – symbology. Ideally, they should be labelled by subscripts '570' or '620', directly indicating the age used for their correction. E.g. ε_{570}^{Nd}.
  We have corrected it accordingly.

[338] There are just two values for Saghro rocks, it is thus misleading to describe them as an interval.

We have corrected it accordingly.

[341–343] This is misconception! Intermediate positive epsilon values per se may be equally well explained by derivation from less depleted mantle domains, or remelting of fairly juvenile metabasic crust. Additional evidence is needed.

We have corrected it accordingly. Explanations are given in lines 440, 441 for the near-pristine mantle signature; and lines 581, 582, and 583).

[345–346] This, and some other parts of this section, should move to Discussion.

We have corrected it accordingly.

[351–352] This again should be moved to the Discussion, and additional petrological and geochemical evidence should be considered, also from literature. What do you mean, a mantle source contaminated by older crustal component? On which evidence? Why not, for instance, AFC or assimilation of crustal material during ascent of doleritic magmas? What compositions of mantle and crust do you envisage? Was the mantle close to canonical depleted mantle, or CHUR-like? Do you really assume that the felsic magmas were generated from mantle-sourced magmas? Or did they come from remelting of a pre-existing crust?

We have corrected it accordingly. Explanations are given in section 5.2; lines: 433-438.

[352–353] If the dolerite came from CHUR-like mantle, the DM model age is just meaningless.

We have corrected it accordingly, recalculated to two-stage model ages, and interpreted accordingly.

[352–359] Again, this belongs to Discussion.

We have modified it accordingly, and moved to section 5.1; lines: 359-398, and section 5.2; lines: 429-438.

[358–359] Last sentence seems an over interpretation of your data.

Figure 8:

- Plotting symbols/colours should be the same like in other plots. Here are even used the same symbols in panels a–b vs. c–d for different things!
  We have corrected it accordingly.
- It is graphically very poor, having been apparently exported directly from Excel. It lacks any formatting – superscripts, epsilon letters etc. Needs to be redrawn.
  Done accordingly.
- I suggest a better representation – in the form of two plots: (**1**) a Nd growth diagram (age vs. epsilon Nd, it can also incorporate the model ages and (**2**) some independent geochemical parameter (e.g., SiO2), vs. initial epsilon Nd values. See below, BTW graphs were generated by our software GCDkit (Janoušek et al. 2006) and obviously would need to be supplemented by literature data.
  We have modified it according to your suggestions, and all calculations and diagrams are produced using GCDkit (Janoušek et al., 2006).

Discussion – Petrogenesis

This chapter is very confusing and scientific argumentation is not sufficient or misleading. It needs to be rewritten completely.

This chapter is completely rewritten.

[374–380] There are no such plots shown, neither in the text, nor in the **ESM 4**. So, the hypothesis cannot be tested. Add these plots, justify your model and do not forget to consider alternatives, such as partial melting. Perhaps better would be diagrams against Mg#, rather than Zr.

We have presented plots against Mg# as recommended and interpreted accordingly. These plots are visible in Fig. 9a-f.

[380–385] Mg# are calculated wrongly, so this paragraph needs to be rewritten. What is the evidence for this mixing?

The Mg# calculations are recalculated following your recommendations, and interpreted accordingly. Equation is given in supplementary table 3 and in the manuscript text; lines: 252-253.

[386] I do not know this “contamination-sensitive” diagram. Contamination by what material? How is it supposed to work? Give a reference. Note that in most magmatic rocks, La and Ce will be strongly correlated and behaving very similarly during fractional crystallization or partial melting. I guess this projection is of very little value in distinguishing closed-system differentiation from continental crustal contamination and I would drop it. Using Nd isotopes for this purpose is definitely a much more powerful approach.

We have corrected it accordingly, as this chapter is completely rewritten.

[389–392] But not like this! The “mixing model” in ESM 4 is calculated without taking the contrasting Nd concentrations (ppm) in the both end-members. The correct approach is (Janoušek et al. 2016).

We have corrected it accordingly, following the correct approach in Janoušek et al. (2016). For calculations and formulas; refer to lines: 334-354. For results interpretation; refer to lines: 439-446.

[398–340] I cannot see this, rephrase. Perhaps this is not the best projection, either.

We have corrected it accordingly, as this chapter is completely rewritten.

[402–403] This diagram is designed solely to judge the nature of crustal protoliths melted. It does not make sense for mantle-derived rocks and also does not show any effects of fractional crystallization and contamination of primary magmas. Revise.

We have corrected it accordingly, as this chapter is completely rewritten.

[404] Enriched in what sense? Enriched mantle? The whole sentence is a bit daring and premature. Neodymium isotopes need to be assessed first.

We have corrected it accordingly, as this chapter is completely rewritten.

Fig. 9

- I would omit literature data, as only several points are plotted on a single panel.
- Instead of panels a, b I would rather plot Nb/Yb vs. Th/Yb and Nb/Yb vs. TiO2/Yb (Pearce 2008) – the first you have as a current Fig. 12b.
- Panel b: normalized by what (reference).
- Panel c: IAT is not shown.
- All abbreviations need to be explained. Give references for compositions of each of the reservoirs plotted.
  We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 9 in the revised version.

[411] Why there are not discussed effects of alteration like in the case of SG above?

We have corrected it accordingly. The effects of alteration are discussed for both groups in section 4.3.1 Effects of weathering.

[414] Again, these diagrams are not plotted.

We have corrected it accordingly, as this chapter is completely rewritten.

[421] Calcic phase? Feldspars.

We have corrected it accordingly, as this chapter is completely rewritten.

[423–425] High LREE contents can be also due to direct derivation from crustal sources and would be further modified by fractional crystallization.

We have corrected it accordingly, as this chapter is completely rewritten.

[424–425] Speculations.

We have corrected it accordingly, as this chapter is completely rewritten.

[427] The “trend” is too scattered to reveal anything. The plutonic rocks are not distinguished on the plot.

We have corrected it accordingly, as this chapter is completely rewritten.

[431–432] Hydrous metasomatism? What do you mean? Why should be P anomalies linked to Nb and Ti depletions?

We have corrected it accordingly, as this chapter is completely rewritten.

[442] Or Nb and Ti anomalies can reflect subduction setting.

We have corrected it accordingly, as this chapter is completely rewritten.

[443–444] I cannot understand the bit starting from “as supported by epsilon Nd values…”

We have corrected it accordingly, as this chapter is completely rewritten.

Fig. 10

- Not only OG, but also SG rocks. Add legend.
- Technically speaking, Harker plots are binary diagrams of SiO2 vs. major elements, not traces.
- Nickel will not show anything else than Cr, and determinations of the former are rounded to tens ppm, so rather imprecise. Omit. Are the rocks fresh enough so that Rb and Ba can be used?
- How were the BA, AFC and FC trends obtained? Reference? Assimilation of what? How much? Fractional crystallization of what minerals and in which proportions? What was the degree of crystallization? What Kd values were used (references)?
- Panel b – for intermediate and felsic rocks, the La concentration will be controlled, to a large extent, by accessories, such as allanite or monazite.
- Panel c – why Y/Nb of 1.2? Would not be Nd isotopes much better for this purpose?
  We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 10 in the revised version

[445] What is “enriched continental crust”?

We have corrected it accordingly, as this chapter is completely rewritten.

[448] Moderate epsilon Nd values? Not clear, be more specific. Everything depends on local mantle composition, it could have been CHUR-like easily.

We have corrected it accordingly, as this chapter is completely rewritten.

[450] What is “sediment zone enrichment”?

We have corrected it accordingly, as this chapter is completely rewritten.

[448–452] I am completely lost. What is your preferred scenario? Genesis from earlier (oceanic) subduction-modified mantle or contamination (AFC) of E-MORB-like melts by continental crust?

We have corrected it accordingly, as this chapter is completely rewritten.

Fig. 11

- Explain all abbreviations and give the references for compositions of various average mantle and crustal reservoirs.
- Panel c: missing is explanation of the trends for various processes. How were they constructed (see also my previous comment)? BABB symbols look just terrible.
  We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 11b, and c in the revised version

Fig. 12

- Explain all abbreviations and give the references for compositions of various average mantle and crustal reservoirs.
- What is the difference between the Ta/Yb vs. Th/Yb and Nb/Yb vs. Th/Yb projections? Should be giving moreless the same information….
- Panel a: missing is reference, explanation of the trends. How were they constructed?
- We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 12 in the revised version.

Discussion – Geodynamic implications

Again, this section requires a thorough revision.

[466] Show it! This is not acceptable.

We have corrected it accordingly, as this chapter is completely rewritten

[469] Or simply rifting. I would suggest some other diagrams that could help you resolving the geodynamic setting, namely those of Wood (1980), Cabanis and Lecolle (1989), Pearce et al. (2021) or Shervais (2022). Surprisingly, the basic rocks of the SG and OG look like continental flood basalts in the Ti/V vs. Th/Nb plot of Shervais (2022). I do not know much about local geology, but is any role of plume ruled out?

We have corrected it accordingly, as this chapter is completely rewritten. We have adopted Shervais (2022), Pearce et al. (2021), and Cabanis and Lecolle (1989) plots as Fig. 11b, Fig. 11d, and Fig.11e, respectively. Refer to section 5.3 on tectonic implications for relevant interpretations.

[472] Why is low U/Th ratio indicative of active margin signature?

We have corrected it accordingly, as this chapter is completely rewritten

[473–474] Normalized to what? To my eyes, the SG nicely follow the NMORB–OIB array. CAB should have higher ThN.

We have corrected it accordingly, as this chapter is completely rewritten. Refer to section 5.3 for relevant interpretations; lines: 477-478.

[476–479] References missing.

We have corrected it accordingly, as this chapter is completely rewritten. References are added accordingly, refer to lines: 570-573.

[501] A fragment, a sentence should have a verb. Rephrase. Fig. 11a shows Y vs. Zr, not K, Rb, Ba etc. Plus, these are extremely mobile elements, could not they be compromised by alteration?

We have corrected it accordingly, as this chapter is completely rewritten.

[508] Be specific, how?

We have corrected it accordingly, as this chapter is completely rewritten.

[510] And what was the cause of such post-collisional event?

We have corrected it accordingly, as this chapter is completely rewritten. Refer to lines: 595-600 for explanations.

[515] evolution?

We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 12c in the revised version.

Discussion – U–Pb ages

[518] Please specify the sample lithologies, this is more important than the sample numbers.

We have corrected it accordingly. Sample names are specified in section 5.4.2; line: 545.

[520] Extension of the magmatism? Rephrase.

We have corrected it accordingly. Refer to line: 547. We have changed extension with expression.

[532] How about the dating by Ferraq et al. (2024)?

We have added the dating by Ferraq et al. (2024); lines: 557-558.

[535] What is sub-alkaline-calcic?

We have corrected it accordingly.

[538] Did you observe any inheritance?

We have corrected it accordingly. Refer to lines: 562-564

[549] What is “a prolonged tectono-magmatic event emplaced over multiple pulses over the whole Anti-Atlas belt”?

We have corrected it accordingly, as this chapter is completely rewritten.

[551] “SLIP deposited in a strictly continental environment”? I cannot follow this.

We have corrected it accordingly, as this chapter is completely rewritten

[551–556] Tedious and repetitive. Condense.

We have corrected it accordingly, as this chapter is completely rewritten.

[558–560] Rephrase and expand the part dealing with regional correlation of the Cadomian arc magmatism and how does it relate to the inferred geodynamic setting of the studied rock units.

We have corrected it accordingly, as this chapter is completely rewritten.

[590–593] I cannot follow this argument. Clarify.

We have removed it and corrected it accordingly, as this chapter is completely rewritten.

[595] “The mono-peak…” does not make any sense to me.

We have corrected it accordingly, as this chapter is completely rewritten.

[601] Cryogenian should be older than 635 Ma. These sediments are Ediacaran, or younger.

We have corrected it accordingly, as this chapter is completely rewritten. Refer to lines: 537-538.

[610] Reference missing here.

We have rephrased it accordingly.

Fig. 12

- Explain all the abbreviations.
- We have corrected it accordingly, as this chapter is completely rewritten. We removed Fig. 12 in the revised version.

Conclusions

[627–628] What is the evidence for contamination of the mantle source by continental crust? How does it go with the presumed oceanic subduction context?

We have corrected it accordingly.

[636] How about your sediments?

We have corrected it accordingly. Indeed, the inherited age in sample Zg-119 (granite) supports the reworking of ancient Paleoproterozoic basement during the genesis of the Ouarzazate Group rocks. Refer to lines: 562-564 for relevant interpretations.

[637–638] “post-collisional syn-orogenic magmatism (WACadomian arc)”? I am again lost. Regardless, how can you infer this from U–Pb ages only?

We have corrected it accordingly, as this chapter is completely rewritten.