Reply to editors' comments:

We thank the editor for going through the manuscript meticulously and providing constructive remarks and comments. We believe that this helped a lot in improving this manuscript.

General comments:

Comment: The manuscript is still very short. This can be fine, but it means that things need to be very clear in a very short text. However, in the current manuscript, it seems that important information is missing and descriptions are not always easy to follow. The authors have provided extensive details in their replies, and these details should be available to the reader in some form, if not in the main text, then in the supplement.

Reply: We thank the editor for the comment and we have made corrections and included descriptions wherever necessary as suggested by the editor.

Comment: The results section is really too short (17 lines only), followed by a multi-page discussion. This is a bit of a problem. Moreover, the authors should present their results in a logical order (see also below) and avoid presenting new details in the discussion (e.g. detailed description of the distribution of sediments → all information derived from analysis done in this study and that is touched upon in the discussion needs to be clearly laid out in the results section).

- When reading the methods, it seems that the sedimentary thickness maps are key to prepare the gravity analysis. So, when reading the current text, I would expect the following order of presentation (each with their own sub-section in the results):
  - Sedimentary thickness maps
  - Newly derived Bouguer anomaly maps → revealing key structures
  - Seismic sections → providing more detail on these key structures.
- Other orders of presentation could also work, e.g. first the seismic sections, then the sedimentary thickness map, then the Bouguer anomaly. Perhaps even the current one could be fine. But the order of things needs to be consistent in both the methods and results to make things easy to follow for the reader, and to set things up for the discussion, where the results are interpreted and combined with current knowledge to develop the tectonic history of the study area.

Reply: We thank the editor for pointing out this. We have tried that to present clean observations in results section as suggested in earlier revisions and later on we have synthesized the discussion by integrating the results from this study and in light of existing understanding of the study area. We have rearranged the results section as suggested.

Comment: The reasons for interpreting one series of grabens being older than the other are not very clearly explained. From geometries and basin distribution alone, this distinction cannot be easily made. The authors should make it very clear what the reasons for their interpretations are. N

- There are some reasons given here and there, but they are somewhat hidden in the text that seems to already assume that the case is clear. Instead, these reasons need to be highlighted.

Reply: We agree with the editor and more description is now included to make the case clear. This is now made clear in the first paragraph of discussion section in the revised MS.

Comment: The way the figures are presented is a bit confusing.

- Firstly, results Fig. 3 and 4 are shown before the results section. This is not a major issue, but needs to be corrected at some point (at the latest in the published paper, if the manuscript is accepted)
- There is still some ambiguity regarding the study area. There is an "area of interest" shown in Fig. 1b, but a smaller "study area" in later figures. Even so, the authors present seismic sections that are taken from outside the study area (G-G' and H-H'). This needs some fixing. A simple solution would be to state that the "study area" is simply as large as the "area of interest" (in other words, they are the same). The maps in Figs. 5-7 could be made a little larger to accommodate for this I would say. This way, there will be no ambiguity about the extent of the study.

Reply: We thank the editor for pointing out this. Now the figures are rearranged accordingly. Regarding the study area, we prefer the maintain the current structure as we would like to focus on the opening of the Laccadive Basin and adjoining area south of Tellicherry Arch in the manuscript. The larger area is shown to give a regional picture of the study area and to show how the orientation of grabens change when coming into the Laccadive Basin.

Comment: Some sentences have some grammar issues or are not very clear, I tried to point them out and propose solutions

Reply: We are grateful to the editor for going through the MS in detail and providing with these suggestions.

Specific comments:

Comment: Line 4: it may be better to use "situated" instead of "lying"
Reply: We thank the editor for the comment. The suggestion is included.

Comment: Line 7: "extensional directions" seems a bit confusing, I assume you mean "trends of extensional structures"? This needs some rephrasing
Reply: The suggestion is included.

Comment: Line 10: "associate" is used twice in this line, perhaps the last occurrence could be "linked"?

Reply: The text is modified accordingly.

Comment: Line 11: grabens are by definition extensional features, hence "extensional" should be removed here
Reply: We thank the editor for the comment. The text is modified accordingly.

Comment: Line 18: it should be something like "culminated into the development of the present northwest Indian Ocean" I would say.

Reply: The text is modified accordingly.

Comment: Line 18-20: I believe the abbreviations introduced here are not used later in the text?

As such, they can be removed here.

Reply: We thank the editor for pointing out this. The is now removed.
Comment: Line 29: it should be "with the eastern Madagascar margin"

Reply: The text is modified accordingly.

Comment: Line 29: "based on the matching of the major shear zones and reconstructed to 1000 m isobath" seems to be missing some words in the latter part of the sentence. Please rephrase

Reply: We thank the editor for the comment. Katz and Premoli 1979 explained the fit of India and Madagascar based on matching shear zones onland India and Madagascar and the coastlines fitted to 1000 m isobath. It was mistakenly written as 2000 m isobath which is corrected now and the sentence is modified for clarity.

Comment: Line 30-33: "However, recent close-fit reconstruction models have incorporated the continental fragments like Laccadive Ridge (Bhattacharya and Yatheesh, 2015) or Mauritia, comprising of Mauritius, the Southern Mascarene Plateau, the Laccadive Plateau and the Chagos Bank (Torsvik et al., 2013) between India and Madagascar in the India-Madagascar pre-drift scenario, and suggest a breakup timing of around 83 Ma." → it could be better to use:

- "However, recent close-fit reconstruction models have incorporated the continental fragments like **the** Laccadive Ridge (Bhattacharya and Yatheesh, 2015) or Mauritia (comprising of Mauritius, the Southern Mascarene Plateau, the Laccadive Plateau and the Chagos Bank between India and Madagascar in the India- Madagascar pre-drift scenario, Torsvik et al., 2013), and suggest a breakup timing of around 83 Ma.
- Here the extent of Mauritia is more clearly defined.

Reply: We thank the editor for the comment. Now the text is modified as *"However, recent close-fit reconstruction models have incorporated the continental fragments like the Laccadive Ridge (Bhattacharya and Yatheesh, 2015) or Mauritia (comprising of Mauritius, the Southern Mascarene Plateau, the Laccadive Plateau and the Chagos Bank) (Torsvik et al., 2013) between India and Madagascar in the India-Madagascar pre-drift scenario, and suggest a breakup timing of around 83 Ma."*

Comment: Line 34: "Laccadive Ridge (Plateau)" is confusing, as this suggests there are two names (for the same structure?). Please stick to one name and use it consistently through the text. Please also add "The" at the start of this sentence

Reply: The text is modified accordingly.

Comment: Line 35: add a figure reference directly after "India"

Reply: The suggestion is incorporated.

Comment: Line 36: it may have to be "it is well-known" that"

Reply: The text is modified accordingly.

Comment: Line 36: the SW margin of what? Please specify in the text.

Reply: The text is modified for clarity as per the suggestion.

Comment: Line 36: it should be "the end of the Cretaceous"

Reply: The text is modified accordingly.

Comment: Line 37: "of wide-spread trap layers" or "of a wide-spread trap layer"

Reply: The text is modified accordingly.

Comment: Line 38: please specify to whom the vintage data was not of much help (it now reads a bit as this was not helpful in this manuscript, which is not the case I believe)

Reply: We thank the editor for pointing out this and this sentence is reframed for clarity.

Comment: Line 40: see comment on wells in Fig 2 (where is this key well located? Please indicate on a map).

Reply: We thank the editor for the suggestion and the location of the key well CH-1-1 is now included in the diagram.

Comment: Line 41-43: "One of the key question that was not resolved is the absence of Late Cretaceous sediments in the Laccadive basin as a whole and the long time gap of more than 20 Ma between the India-Madagascar breakup at 83 Ma and the oldest sediments of Paleocene age."

- This sentence is not very clear. I believe it should be something like:
    - "One of the key questions that have not been resolved concerns the absence of Late Cretaceous sediments in the Laccadive basin as a whole: what caused this more than 20 Myr gap in the sedimentary record between India-Madagascar breakup at 83 Ma and the oldest Paleogene sediments?"

Reply: The text is modified as per the suggestion of the editor.

Comment: Line 45-46: it should be something like "makes **for** a complex geodynamic setting, **considering** how this separation took place, and therefore provides some insights into the **impact of** pre-existing lithospheric inheritance."

- It was not very clear why inheritance is mentioned.

Reply: The text is modified accordingly. We believe and the data suggest that the inheritance has impacted the formation and orientation of grabens in the study area. Hence, we have mentioned inheritance here.

Comment: Line 48: "margin" → perhaps use "Western Continental Margin of India" or WCMI to remind the reader (make it very clear)

Reply: We thank the editor for the suggestion and the text is modified accordingly.

Comment: Line 48: consider starting a new paragraph at "In this study …" to emphasize that the goal of the current manuscript is being introduced.

Reply: We agree with the editor and the text is modified accordingly.

Comment: Line 49: it should be “at the southwestern part of the margin” to avoid confusion (we are still talking about the WCMI here, not another margin)

Reply: We agree with the editor and the text is modified accordingly.

Comment: Line 51: use “improved **plate** tectonic reconstruction models”

Reply: The text is modified accordingly.

Comment: Line 55: the ATTC is never used in the figures (?) → instead “TT” and “AP” is shown please use a consistent name (I would suggest Trivandrum Terrace/TT (shorter and easier).

- After consideration, perhaps just remove the abbreviation “ATTC” from the main text. Including an abbreviation suggests it is a very important term/feature, which it does not seem to be later in the text (?)

Reply: We thank the editor for pointing out this. The abbreviation is now removed from the MS.

Comment: Line 59: “to this” could be removed

Reply: The text is modified accordingly.

Comment: Line 61: it may be better to use “DGH 2024” to make it clear this is a citation that can be found in the reference list (now it is only an abbreviation).

Reply: The text is modified accordingly.

Comment: Line 63: it should probably be “from the General …”

Reply: The text is modified accordingly.

Comment: Line 63-64: these data are shown in Fig. 3 I believe? A reference to this figure would be needed.

Reply: The text is modified accordingly.

Comment: Line 64-66: it is not clear whether a new seismic analysis is performed, or whether the authors simply adopted the data from Unnikrishnan et al. (2023). This needs to be made very clear. If the authors did a new analysis, they should explain how the analysis was done (in the main manuscript, or otherwise in the Supplement).

Reply: We thank the editor for asking this. New seismic data interpretation was carried out in the study whereas sediment isochron maps were directly adopted from Unnikrishnan et al., 2023 and interpreted on the basis of inputs from seismic interpretation and gravity data. This is now made clear in the MS.

Comment: Line 66: double “and” → please remove

Reply: The text is modified accordingly.

Comment: Line 74: it should be "for the water column are used, respectively" I believe

Reply: The text is modified accordingly.

Comment: Line 83-85: it can be rephrased: "We correlated these structures with the gravity anomaly trends and noticed that the grabens are oriented NNW-SSE in the area north of the Tellicherry Arch, whereas the grabens are oriented NNE- SSW south of Tellicherry Arch."

Reply: We thank the editor for the comment. The text is modified accordingly.

Comment: Line 85-86: it should be "anomalies, the continuity of which"

Reply: The text is modified accordingly.

Comment: Line 91: it should be "with much less sedimentation" I believe (or "with limited sedimentation")

Reply: The text is modified accordingly.

Comment: Line 94: "is" should be "was"

Reply: The text is modified accordingly.
Comment: Line 96: it should be "to recent times" and "sedimentation has been uniform"

Reply: The text is modified accordingly.

Comment: Line 101-103: very important to get this right, as this is a key point. The text should be something like "This study identifies two major extensional events in the southern part of WCMI, **the first being recorded by** the NNW-SSE oriented grabens over the Laccadive Ridge north of Tellicherry Arch, **and the second by the** NNE-SSW graben system in the Laccadive Basin area south of Tellicherry Arch (fig. 3).

- It is (still) not very clear from the text why the NNW-SSE grabens should be the older structures.

Reply: We thank the editor for the comment and the suggestion is incorporated in the MS. More arguments are now included in the text regarding the relative age of the extensional features.

Comment: Line 104 and 105: see previous comment on DGH citation.

Reply: The text is modified accordingly.

Comment: Line 105: the acronym for the directorate is already specified earlier in the text, so why not just use "DGH here"?

Reply: The text is modified accordingly.

Comment: Line 104-105: the citation of Zwaan et al. 2021 may be misleading, they did not work on this study area.

- The authors need to indicate the Dharwar structure on a map (it is not clear what this trend is, and where it can be found)

- If they intend to cite the Zwaan et al. study, they need to specify that (and why) the structures in the present study area can be compared with the analogue modelling results by Zwaan et al. (2021).

Reply: Dharwar trend in now marked in figure 1D. We agree to the comment and the reference to the study of Zwaan et al., 2021 is removed.

Comment: Line 105-109: the identification of the CRS seems to be a result, and should be included in the results section, before it is introduced in the discussion. (it needs to be clear what the new results are, and what is interpretation and discussion).

Reply: The DGH identified the outline and orientation of the CRS on the Laccadive ridge through the analysis of large set of unpublished seismic data. The rift identifications and its orientation from this study fall within the outline of CRS as identified by DGH (source: DGH2024). The objective of the study is to examine the seismic lines in this region is to understand the difference in rift orientation north and south of Tellicherry Arch in context of Laccadive Basin formation. Hence, we only presented the rift identifications in the results section.

Comment: Line 112-114: It is not fully clear to me how this conclusion can be drawn. What is the evidence for the age of these grabens? Is there some previous work that provides age constraints? After all, all extensional structures shown (both north and south of the Tellicherry Arch, but also on the Trivandrum Terrace could form in a roughly E-W extensional system). This needs some clarification in the text.

Reply: We thank the editor for pointing out the Lack of clarity in this part. Unfortunately, there is no age constrain to draw this conclusion regarding the relative age of the extensional features. But we believe there are some factors to be considered which help to get some idea about the timing of the extensional features. Firstly, the Dharwar trend is observed in the shelf region (Singh and Lal, 1993) and further offshore (Kolla & Cumes, 1990). The initial spreading in the Mascarene Basin was E-W which is orthogonal to the Precambrian Dharwar trend and hence we infer that the NNW-SSE oriented grabens formed during this period. Secondly, the study area was next to the spreading centre in the Mascarene Basin and the spreading was characterized by large transform faults. The spreading was more active in the southern Mascarene basin which was next to southern part of the margin (south of Tellicherry Arch). This evidence comes from the magnetic anomalies in the Mascarene basin and Shuhail et al., 2018 proposed that the spreading was connected to CKE through a long transform fault. Hence, we prefer to interpret the development of the NNE-SSE oriented rift system during this time. This is now clarified in the discussion part.

Comment: Line 114-119: I do not follow what is meant here. What trend is expected to continue southward? What is different? I assume the orientations of the grabens? Even so, the text needs some clarification.

Reply: Yes, we meant the orientation of grabens. The text is modified for clarity.

Comment: Line 156: please add a reference to Fig. 8 here.

Reply: The reference is now added.

Comment: Line 159-161: what is meant with a large number of sutures? Sutures are major

boundaries between tectonic plates, so there should generally be a single one. Perhaps the authors mean inherited structures or so? Please rephrase.

Reply: We thank the editor for pointing out this. We mistakenly mentioned suture zone instead of shear zones. This is now corrected in the MS.

Comment: Line 164-165: it would be better to put the Peron-Pinvidic etc. references at the end of this sentence, and to specify that these are more general studies/studies focusing on other areas (which could still be used for interpretation here).

Reply: The text is modified accordingly.

Comment: Line 168: see previous comment on the Dharwarian trend → it is not made clear what this is

Reply: We thank the editor for asking this. Dharwar trend is now marked in figure 1C and is the trend of the Precambrian Dharwar Craton (DC) on the onshore.

Comment: Line 170: what spreading center? I assume the one in the Mascarene basin? Please specify

Reply: Yes, we meant the spreading in the Mascarene basin. This is now clarified in the text.

Comment: Line 170-171: where was it stated that the lithosphere was weak? Please check.

Reply: We meant to say that lithosphere had zones of weakness as evidence by the presence of number of shear zones. We have clarified this in the text now.

Comment: Line 174-176: in fact, this seems to not be show in section 5.1 (?) please rework
Comment: Line 176-178: what is meant here? That magma from the Réunion (hotspot) magma intruded into transform faults? Please clarify in the text.
Comment: Line 176: the Réunion hotspot?
Comment: Line 178: what are "similar arguments"? → please specify in the text

Reply: We thank the editor for pointing out the mistakes and lack of clarity through the above comments. We have rewritten the part for more clarity as follows. *"As discussed in section 5.2 distribution of bathymetric highs and intrusives south of Tellicherry Arch provide some evidence for this. It is very likely that, later when the Réunion plume passed over the area, magma may have migrated through the faults formed during this stage giving rise to the preferred orientation of intrusive and bathymetric features in this area. It is worthwhile to note that Bijesh et al. (2018) related the genesis of the bathymetric features to hotspot volcanism"*

Comment on figures:

Comment: Fig. 1: this is very nice figure now. Some comments

- In panel A, the altitude scale is too small (text is not readily readable).
- In panel B, there are numerous abbreviations for the various plates/cratons, which should be specified in the caption
- In Panel B, I would recommend using a bright red dot, instead of a blue dot to indicate the Deccan Volcanic Province

- It may be useful to merge figures 1 and 2 (by simply putting the two panels of Fig. 2 below those of Fig. 1).
  → see what it may look like on next page
    - Caption text can be merged, saving space.
    - Font size may have to be adjusted in the panels derived from Fig. 2
    - See comment on the order of the panels in Fig. 2

Comment: Fig. 2. Some comments:

- See idea of merging Fig. 2 with Fig. 1
- Consider swapping panels A and B to respect the geographical arrangement shown in Fig. 1a (Madagascar lies to the west of India, so it would only be natural to have Madagascar in Panel A and India in Panel B)
- Panel A: consider filling the well location symbols with a white center to make them stand out
    - Is one of these the CH-1-1 well that is mentioned in the text? Please indicate it (if possible, indicate the names of all wells shown in the figure please
- Panel B: the green on blue lines are poorly visible. Please try black for (old) transform faults and white for the magnetic anomalies
    - Note that it is not very clear which anomaly is which (the annotation indicating the name of the anomalies is not clearly linked to specific anomalies it seems)
- The topography scale is too large, please reduce it a bit in size
- If Fig. 2 will not be merged with Fig. 1, the caption should contain a mention that the location of these maps is shown in Fig 1a.

Reply to comment on figure 1& 2: We thank the editor for the comment. Figure 1&2 are merged and the panels rearranged as suggest by the editor. All changes are made as per the suggestion. The magnetic anomalies in the Mascarene basin is are reproduced from Bhattacharya and Yatheesh 2015 & Shuhail et al., 2018. We suggest the readers to go through the references for more details.

Comment: Fig. 3. Very nice figure. Some comments:

- Please specify in the caption that panel A shows gravity data, this is not clear
- In both panels: the reddish arrow indicating the Tellicherry Arch is poorly visible. An easy and effective solution is to add a black outline to the arrow to make it stand out.
    - This issue also occurs in various other figures
- The broken red line is very poorly visible in both panels → please use another color (e.g. black)
- The caption should contain a mention that the location of these maps is shown in Fig 1a.

Reply to comment: All suggestions are incorporated in the revised figure.

Comment: Fig 4: very nice figure, some comments:

- The dotted circles help to show the interpreted intrusions. However, would it be possible to draw in the actual intrusions themselves? Now the reader still needs to identify these intrusions. I think some transparent grey could work well (?)
- Note that the map indicating the locations of the sections has the same issues as Fig. 3a

Reply to comment: All suggestions are incorporated in the revised figure.

Comment: Fig. 5: Very nice figure, but same issues as Fig. 3a: “Tellicherry arrow” needs a black outline

- The brown, green and blue colors used to indicate the lows, CKE and volcanic ridge are often poorly visible. Please use black instead
- Please check the alignment of the color scale and annotation, it seems like there is some overlap with other elements of the figure

Reply to comment: All suggestions are incorporated in the revised figure.

Comment: Fig. 6: some comments:

- See previous comments on the “Tellicherry arrows”
- Is this a new results map, or rather a

Reply to comment: This map is taken from Unnikrishnan et al., 2023 (which is a clean map without any interpretation.) and interpreted incorporating inputs from the seismic interpretation and analysis of gravity maps. All suggestions are incorporated in the revised figure.

Comment: Fig. 7: some comments:

- Panel A: See comments on color use in for instance Fig. 3a.
- The seismic section should have its own labeling (D)
- Caption: please specify what “LB” stands for

Reply to comment: We thank the editor for the comment. All suggestions are incorporated in the revised figure.

Comment: Fig. 8: some comments:

- Please make sure to use the same font in all panels (the “Stage” indications are in Times New Roman, the rest in Arial it seems).
- It would be good to add arrows indicating the direction of plate motion in each panel (not 100% clear at the moment)
- Please make sure to (re)align the annotation, it should probably be a bit smaller and perhaps not bold. NB: headers seem fine
- Consider removing (at least) the outer box, as it distracts from the actual figure.
- Stage II: “spreading” is misspelled

Reply to comment: We thank the editor for the comment and pointing out the mistakes. All suggestions are incorporated in the revised figure.