



EGUsphere, referee comment RC5
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Comment on egusphere-2022-180

Anonymous Referee #3

Referee comment on "Strato-structural evolution of the deep-water Orange Basin: constraints from 3D reflection seismic data" by Nombuso G. Maduna et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-180-RC5>, 2022

Nombuso Maduna and co-authors have conducted a thorough study of a deep water fold-and-thrust belt in the Mesozoic Orange Basin, and the structural processes and features that are associated with this. The 3D seismic dataset interpreted here allows for more detailed analysis of this stratigraphy and interpretations that add to the current state of knowledge.

In this review, I recommend a careful check of how the results are presented, as sometimes they mix discussion points in this section, and that makes it difficult for a reader to discern what is new from what was previously published. I realise that this deep water fold-and-thrust belt has been published on before, but in the introduction I felt that a short description of what it is would be helpful for clarity. The reason for this is that although this is seemingly driven by gravitational activity, at first it appears strange in a context of Gondwana break-up to read about compression. In this regard, the composition of shale is important for the structural model of detachment. Have the shales been cored or sampled? I.e., how do we know that those reflectors and units are shale? A lot of your structural interpretation is based on the properties of this rock type, so please clarify this at the beginning. In the abstract too, I recommend up front adding a statement that this refers to gravity-driven compression on an extensional margin. Generally, as well, the angle of the slope required to generate these compressional faults seems to not be too steep. Perhaps look a little into this as well.

Specific comments:

Line 67: replace Lower with Early. And check the paper for consistency in this regard. The difference is that referring to time only, you'd say Early Cretaceous. But describing

deposits, it would be Lower Cretaceous rocks (for example).

Offshore structural framework: there is a 2020 publication by Baby et al. too, that may be worth checking out: Baby, G., Guillocheau, F., Boulogne, C., Robin, C. and Dall'Asta, M., 2018. Uplift history of a transform continental margin revealed by the stratigraphic record: The case of the Agulhas transform margin along the Southern African Plateau. *Tectonophysics* 731, 104-130.

Lines 93 and 94: comprises (not comprises of)

Line 101: was eustatic sea-level change. Here I would also recommend leaving out the word 'eustatic', as even into drift there was appreciable uplift and subsidence in this area.

Line 115: between 2012 and 2013

Line 127: data is plural of datum

Methods: please clarify which were the methods you applied, and which were done by the petroleum company.

Results and interpretation: I think in this manuscript it will be clearer to separate the results from the interpretation.

Line 161: The study area lies offshore of northwest South Africa, along the continental slope

Line 204: this is an example of where I am unsure whether this is your interpretation, or one from elsewhere, and why I suggest you separate the results and lay out only new ideas in that section.

Line 214: what about synclines? Surely with anticlines there are also associated synclines. And are these anti- and synclines, or anti- and synforms?

Line 219: A and B2

The paragraph including line 230 is all discussion.

Line 238: how did you interpret that this is a MFS? I suggest in the results, explaining the reasoning behind assigning these surfaces and units. Was it based on geometry, or truncation of what is below, for example? You could also consider tabulating this sort of information, but either way I think it is important to say something about how you arrived at your assigned surfaces. Also for the methods, which sequence stratigraphic terminology and methods did you follow and why?

Line 279: Cenozoic unit

Line 278: rather than earliest, perhaps say basal sediments within the unit

In the structural framework you describe features at depths measured in both ms and metres. If you have done a time/depth conversion, please also include these depths on the figures of profiles.

Line 311: what is spoon shaped geometry? I am not sure this is a recognised term? And it is not obvious to me, without looking at the image to go with this, what that means anyway. Maybe refer to convex or concave instead.

Line 315: replace 'compared to' with 'as'

Lines 319 and 320: another example of mixed interpretation in the results

Line 332: extremely is a bit too emotive

Line 371 onward: it is not clear to me which of these findings are new (from your work) and which were established previously. I suggest laying out what the accepted model was prior to your work, and then onward from that presenting the new model based on your data and interpretation thereof.

Line 393: this is the first time the Benguela Current is discussed and it needs to be introduced earlier in the regional setting. There is an appreciable amount of literature, in

particular by Uenzelmann-Neben and colleagues, on the role of oceanographic circulation on seafloor sediments and I think your paper will benefit by including this in your interpretations and your context. This erosion is an important part of the story of deposition and preservation on this margin.

Line 403: differs against what? Are you referring to within the sequences, or between them, for example? Please be more clear here.

Line 427: we propose a third model that

Line 432: 'much greater than 10 km' does not say too much. Have you got a sense of at least how long this may be?

Ahead of section 5.3, and following the paragraph where you propose a third scenario, I feel that a section explaining how you can get extension and compression at the same time is necessary.

Line 466: shelf, rather than coastline?

Line 476: which river is this canyon associated with?

Lines 492-494: check this sentence. Erosional undercutting is singular, and the sentence reads a little awkwardly.

In the section about Miocene Benguela Upwelling, I suggest starting by saying that you are interpreting an analogous situation to the present, and then expand upon this rather than explaining it and then getting to what you are saying.

The paragraph of line 515 seems redundant to me, as this is not an analogue to what you are describing for the Orange Basin continental slope deposits.

Line 525: reference for the overpressured shales?

In section 5.4, it is not very clear whether you are suggesting that this deformation is

ongoing, or that it took place during deposition and now may get reactivation along its planes of weakness. I think the latter, but please make this clearer?

Table 3: Perhaps add which of these units have been sampled – e.g., you have space in the rows below the ages. Alternatively, if there is well / borehole data, add a column for that or state in the caption that all units have been sampled geologically.

Figure 2: please add an inset box of where figure 2 is onto figure 1.

Figure 3: I think this should come ahead of table 3 in the text.

Figure 4: as in the methods text, I recommend indicating which of these techniques were done by you, and which were already applied to the data.

Figure 5: Make the text and black lines in panel B bolder and I suggest that the same positions of profiles should also be shown on A. Please also add a small inset of where this is?

Figure 11: Can you link this canyon to a specific river? If so, please name it.

Figure 13 is excellent. Please just add a modern coastline position for orientation?

I enjoyed the opportunity to review this manuscript and certainly hope to see the paper published, following revision.

Kind regards.