

## ***Interactive comment on “Mapping undercover: integrated geoscientific interpretation and 3D modelling of a Proterozoic basin” by Mark Lindsay et al.***

**Mark Lindsay et al.**

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Dear Mark,

Thank you for your informed and considerate review. We appreciate the time you have taken to provide us with comments and suggestions that we hope will result in a higher quality manuscript after revision.

First, we respond to the main concerns listed in the Interactive comment, then to specific comments made on a line-number basis.

Introduction We agree the introduction can be refined to describe the purpose of the

C1

study, and in accordance with reviewer 1’s comments, can also be shortened for clarity by editing the background on geophysical techniques. We will augment the geological description to better frame the geological question as to the source of high density material in the basin.

Structural interpretation We agree with the reviewer’s comments regarding the relevance of the structural interpretation. Sub-sections related to the structural interpretation (methods, results, discussion) should remain, as the reviewer states, however can be easily shortened as much of the detailed description is not relevant to the question.

Rock properties We will add a short description to how rock properties were obtained and measured from field sampling or from generic values (comments made by Reviewer 1 also address this issue). We would like to point out that the number of samples is indicated with each histogram.

Geochemistry We agree that the geochemistry section can be adjusted for clarity. It is important to include as it shows that the sources of mafic lavas are different, and supports the hypothesis that basin development is more complicated than currently thought. We appreciate the suggestion that the geochemistry can be brought into the discussion only with no loss of information.

Volume calculation of mafic material We will add a section to the results showing the volume of additional material required to adequately reproduce the observed gravity response. This will include a table for easy ‘before and after’ comparison.

Specific comments

We address comments in this section that make suggestions to a different description or interpretation. Comments that helpfully correct typographic errors or minor adjustments are not directly addressed here for brevity, though can be assumed to be accommodated into the revised manuscript according to the suggestion. Where there is a disagreement, we will state our case.

C2

L16 usage of 'amplitude' with reference to density. Thank you for pointing this out, we agree with the distinction between density and gravity. We will rephrase and remove the word 'amplitude'

L106 "I can see Windplain and Mooloogool Gps on fig 2, but how come Bryah isn't there?" Bryah is not there because we do not model these rocks in 3D. We understand this may cause confusion so we will clarify the reason for this omission.

L305 "so why didn't you generate a model which had the Killara Fm with a thickness of 1000m if this is the currently mapped thickness? I.e. – if 500m didn't work, and 2000 did, does the currently mapped thickness of 1000m fit the observed?" This was the aim of the 2D section forward modelling and inversion. The Noddy modelling was performed as an initial exploration to the problem.

L319 "it's not clear to me how the sensitivity of the dip direction of the Goodin Fault is relevant to the subcrop distribution of the Killara Fm" the dip direction has implications for basin development, which relates to the associated section in the discussion. i.e. if the fault dips to the northwest rather than the southeast, the evolution of the basin would be interpreted to be much different.

L474 This figure will be redrafted (comments by reviewer 1 and 2 reiterate this comment)

L545 Labels for the Goodin Fault will be added to other figures.

Figure 1 Similarity in colours - these are the official geological survey colours. We would prefer to maintain the colours for consistency with other publications. The shaded region is outside the RoI - clarification added to the caption. More detail in the sample locations - I agree with the reviewer that adding detail to these locations will make 'a mess of the map'. We think that as figures 5 and 6 distinguish different stratigraphic units, the reader is sufficiently informed.

Figure 2 - the reviewer has made helpful suggestions regarding improvements to this

C3

figure - these changes will be applied.

Figure 3 - this is the surface extent of the basin - clarification added to the caption. Display of the geophysical data - there is a tradeoff between accentuating features using sun-shading and colour tables, however we want to show the data as close to its original form for the purposes of rigour.

Figure 7 will be redrafted according to these comments and those made above for better clarity

Figure 8 will be removed in the revised manuscript.

Figure 11 - necessary details as suggested by the reviewer will be added to the text or caption as required.

Figure 12 will be enlarged

Figure 13 will be enlarged to enhance the details discussed in text

Figure 15 - clarification will be added in text

Figure 16 will be redrafted according to these comments and those made by the other reviewers

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Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-192>, 2020.

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