Geochronology Discuss.,
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Interactive comment on "On the treatment of discordant detrital zircon U–Pb data" *by* Pieter Vermeesch

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I agree with all the reviewer's comments and will address them in the revised manuscript as follows:

> * Although there are a couple of mentions (line 170, Table 1), there isn't much detailed discussion about the treatment of reversely or negative discordant data. It would be useful to know, even if only for the sake of completeness, if the various discordance filters cause any biasing of negative discordance relative to positive discordance. (Or another aspect: the absolute discordance values in Table 1 are asymmetrical for negative and positive values – does this have any impact on how the data are treated?). I

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recognise this may be a whole topic into itself, but some advice in the paper would be useful.

I will add the following information about negative discordance:

1. I will extended the discordance envelope of Figure 3 to negative values, in response to a request by Reviewer Wang (see Figure 1 of this response).
2. I will added a paragraph to the discussion of the Stacey-Kramers discordance definition, pointing out that, even though this definition is mathematically able to produce negative discordance values, such values cease to have a geologically meaningful interpretation, because it is impossible for minerals to inherit negative amounts of common Pb. Thus it may be advisable to set a minimum cutoff of $d_{sk} > 0$ when using the Stacey-Kramers filter.
3. If will point out that both the Stacey-Kramers and absolute age filter may let physically impossible negative $^{207}Pb/^{206}Pb$ ages pass through them. This may be seen as an argument against these filters.

* The recommendation to use the Concordia distance is based on the argument that it appears to minimise 'the difference between the $^{207}Pb/^{235}U$, $^{206}Pb/^{238}U$, $^{207}Pb/^{206}Pb$ and concordia age spectra' (Line 235) via a visual assessment of Figure 8. The corollary is that the other discordance filters illustrated in Figure 8 have a greater difference between spectra – again via a visual assessment of the figure that may not be especially clear on screen. It would be great to quantify these differences between discordance filters – perhaps a Kolmogorov-Smirnov test, or similar, would provide an objective measure of 'best practice' among these discordance filters.

This is an excellent suggestion. I will add quantile-quantile plots and Kolmogorov-Smirnov statistics to Figure 8, not to inter-compare the different chronometers, but rather to compare each of the filtered datasets against the unfiltered dataset. This exercise provides a much stronger argument for the concordia distance than the previous version of Figure 8 did. I have attached the revised figure to my response (Figure 2 below).

> * It would also be interesting to see the discordance filters being further 'stress tested' with other datasets especially in the < 1000 Ma and > 3000 Ma age ranges. How well does the concordia distance filter work when there is a wide range of Neoproterozoic and Phanerozoic grains present? For instance, is there any discernible biasing between $\sim$1000 Ma and $\sim$100 Ma age groups that may impact interpretations for a detrital zircon study focusing on this age range?

I have contacted Reviewer Sircombe and his colleagues at Geoscience Australia to follow up on this comment. They have kindly provided me with a 1600 sample, 70000 grain SIMS dataset of superior quality to the 10000 grain LAICPMS dataset used in the previous version of the paper. The new database contains more grains at the young and old end of the age spectrum, confirming consistent behaviour across all time scales, i.e. the relative age discordance filter keeps rejecting a progressively large proportion of the young grains, and the Stacey-Kramers filter does the opposite (see Figure 2 of this response).

I will also extend the time scale of Figure 3 from 100 to 10 Myr, providing an extended view into the young timescales. This highlights a problem with the absolute age and Stacey-Kramers filters, which allow physially impossible negative ages to pass through (see Figure 1 of this response).

> * Line 24-26. The term 'chronometers' is introduced here after using 'de-

cay systems' and then used again to describe the U-Pb systems in Line 73. Perhaps a tidier and consistent use of terminology might help those unfamiliar with the geochronology methodology.

I have used hyphens (–) whenever decay systems are referred to and ratios to refer to the chronometers. For example, the ^{235}U–^{207}Pb decay system forms the basis of the ^{207}Pb/^{235}U chronometer.

Reviewer Sircombe's remaining comments are language suggestions, which will all be incorporated into the revised paper.

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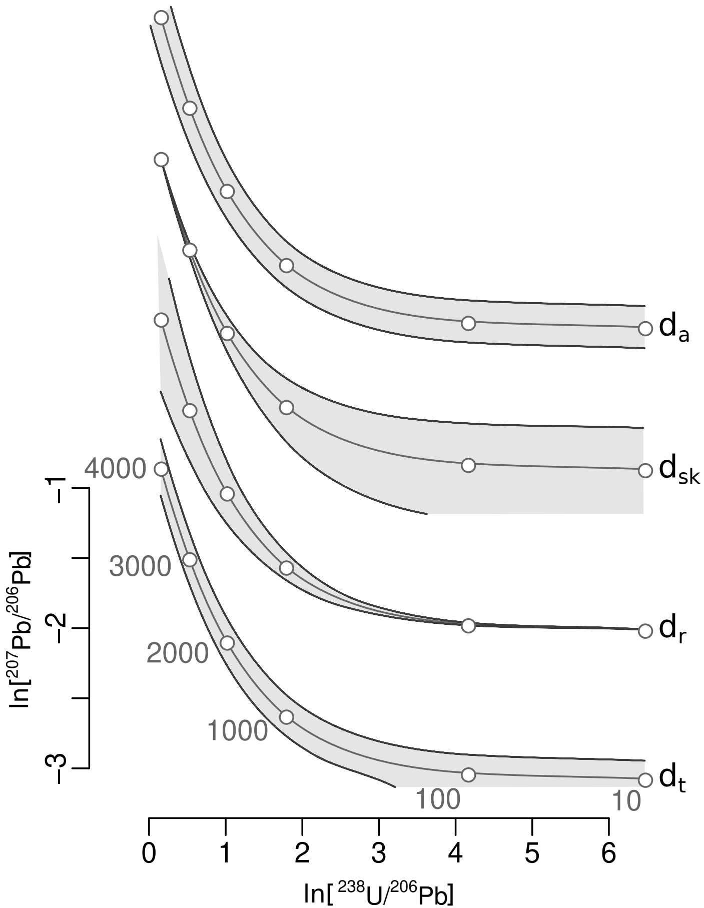

Fig. 1.

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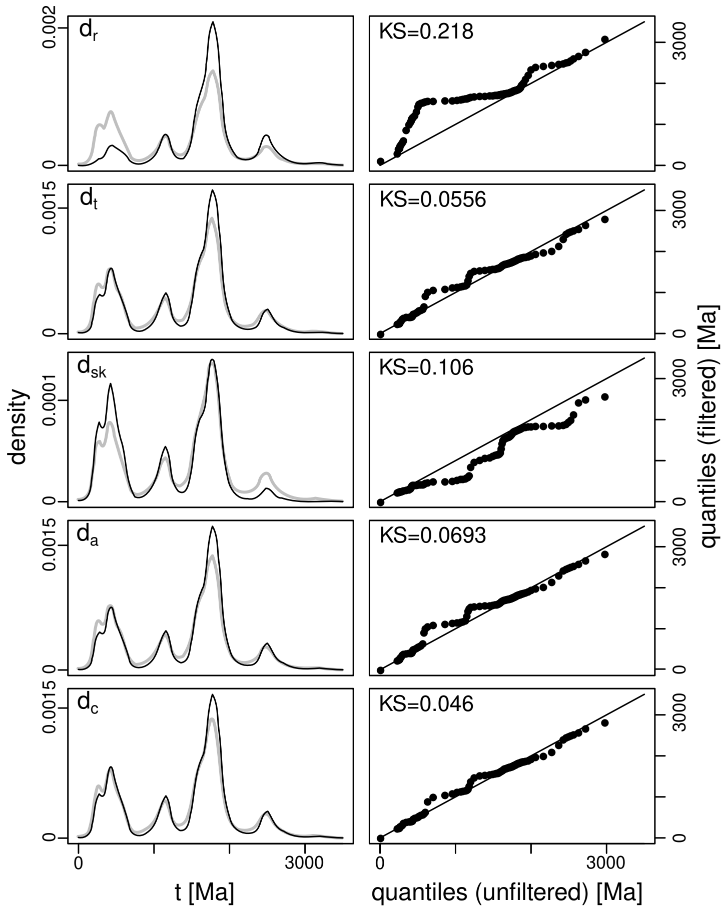

Fig. 2.

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