

Interactive comment on “On the treatment of discordant detrital zircon U–Pb data” by Pieter Vermeesch

Keith Sircombe (Referee)

keith.sircombe@ga.gov.au

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— General comments —

Detrital zircon geochronology (DZG) analysis is a very active field of research and papers like this one are very important to continually improve the fundamental mathematical basis of the research regardless of analytical method. The review and proposed solutions presented by this paper will make a big step toward an ideal state where acquired DZG data are treated with a consistent methodology and resulting interpretations are grounded in a thorough understanding of the underlying assumptions and potential biases.

The paper provides a suitably brief overview of the current approaches to treating ac-

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quired DZG isotopic data and a presentation of a proposed ‘best practice’ solution for optimising data and avoiding arbitrary and subjective thresholds. Given the high levels of research activity using DZG analysis, this paper will find a broad audience of interest both from analysts acquiring data and scientists applying the results to geological problems.

I recommend publication with minor revisions.

— Specific comments —

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

* The recommendation to use the Concordia distance is based on the argument that it appears to minimise ‘the difference between the $^{207}\text{Pb}/^{235}\text{U}$, $^{206}\text{Pb}/^{238}\text{U}$, $^{207}\text{Pb}/^{206}\text{Pb}$ 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.

* 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

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between ~ 1000 Ma and ~ 100 Ma age groups that may impact interpretations for a detrital zircon study focusing on this age range?

— Technical comments —

Just a few minor notes, and largely an individual style choice, so no big deal:

* Line 24-26. The term ‘chronometers’ is introduced here after using ‘decay 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.

* Line 30: should be singular ‘...fulfil this requirement...’

* Line 30: The intent of the last sentence might be clearer if written ‘Those that fail to meet this requirement are ‘discordant’.’

* Line 120: I think I get what you are aiming for in this part, but the term ‘unfair’ strikes me as the incorrect phrase. ‘Fairness’ is a subjective concept more pertinent to ethical or legal considerations. Perhaps this part needs to be better phrased to reflect that a method favouring an imprecise method over a precise method is simply poor science that will encourage biasing – I’m sure there are better and more precise, ways of putting it, but the words escape me at the moment. . . Perhaps it something related to ‘small-study effects’ where small studies, often earlier ones with less precision, can report (or be interpreted with) larger effects.

* Line 157: this might be better phrased as ‘We introduce two ways to do so here.’ And while the use of ‘we’ in the manuscript is a good active narrative tool, in this particular sentence it may be better as ‘I’ because you are the sole author introducing an idea to the readers.

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