Geochronology Discuss.,
https://doi.org/10.5194/gchron-2020-4-AC4, 2020

Interactive comment on "Robust Isochron Calculation" *by* Roger Powell et al.

Roger Powell et al.

powell@unimelb.edu.au

Received and published: 3 May 2020

[The response-to-review lodged earlier was before we knew that 2 more reviews would be forthcoming. The main change to this response is the addition of the 3rd paragraph **]**

As noted by the reviewer, the regression attempted is not simple linear regression, as is explicit in the development of YORK. This is a given in the standard isochron calculations that the current manuscript intends to augment or supercede. Section 2 of the manuscript has been expanded to bring out this idea; see also the response to review 4.

Suggestion (a) of the reviewer is certainly relevant and is now considered in the Discussion of the manuscript. High leverage data particularly in small datasets is an unresolved problem. As covered in Maronna et al. (2019), ch. 5, there are several

difficulties in general, the first being what to use as ρ in the estimator, as in Appendix 1 of the manuscript. Whereas a HAMPEL (a re-descending ρ) is advocated in Maronna, this is inadvisable in small datasets, not wishing to "lose" information. A second problem is what to use as the initial estimate of the linear trend—prior to using this ρ—given that the $L1$ estimate used in our algorithm is not robust in the presence of such data. The suggestion in review 4 of using Siegel's repeated median, not $L1$, might resolve this problem. Although Maronna et al. (2019) make detailed suggestions in their Section 5.8.1 for handling high leverage data, it is not clear how they could be married with using the analytical uncertainties in the algorithm, as also noted in review 4. A way forward is simply to follow Huber and Rochetti (2009), e.g. their p. 150 and p.161, who note that trying to automate safeguarding against high leverage data is overrated, and that it is better to rely on diagnostics (e.g. `hat` to identify high leverage) and human judgement in data assessment.

The datapoint at highest x in Fig. 6 is pointed to by the reviewer as a high leverage point. If this datapoint is omitted, then HUBER gives $13.75\,\mathrm{Ma}$ rather than $13.69\,\mathrm{Ma}$. The difference normalised to the standard deviation on the age is only 0.47. The datapoint might be omitted only if there is a good geological reason to do it. This example is also included in the Discussion now.

Relating to suggestion (b), (A1) is simply the uncertainties for datapoint k in covariance matrix form, derived from the analytical measurements. It is not clear what is being referred to by the reviewer here? The newer Maronna is now cited, an edition we were unaware of (thank you).

Interactive comment on Geochronology Discuss., https://doi.org/10.5194/gchron-2020-4, 2020.