essd-2022-125-Rebuttal RC3.docx

Title: A strontium isoscape of inland southeastern Australia
Author(s): Patrice de Caritat et al.
MS No.: essd-2022-125
MS type: Data description paper

Dear Editor

Thank you for the opportunity to revise the above manuscript. Our responses to Reviewer 3's comments are below and the revised manuscript file is attached.

General comments

The paper of de Caritat et al. presents a novel robust database of non-biovailable Sr isotope ratios from southeastern Australia. In general I think that the measured data are of high-quality and well-constrained in the framework of Australia geology. However, I'm not convinced that these data can be used to trace the provenance of biological samples (i.e. isoscape purpose). Indeed, as the authors themselves wrote, non-bioavailable Sr isotopes are rarely good proxies for biological materials, due to the different end-members contributing to the two classes (i.e. bioavailable vs. non-bioavailable) final isotope ratios. This clearly limits the possible use of such data. Moreover, the fact that the samples represent 'averaged' catchment site (5200 km^2 on average) is definitely 'blurring' the potential resolution and thus prediction power of any isoscape built on the data. The authors clearly state this on L200 page 8, however I think that such issues need to be discussed more in depth maybe in the introduction, to warn the reader on the limits of the current dataset. My suggestion is also to adapt the title as: 'A non-bioavailable Sr isoscape of inland southeastern Australia'.

Thank you for the comments. We agree that our total Sr data will not be directly useable by researchers interested in bioavailable Sr patterns and processes. Nor have we proposed so in the paper. Our focus has been on geological processes that involve whole minerals such as tracing fluvial sediment and aeolian dust provenance and identifying major sources/reservoirs in the geology. Thus our methodology (from sample selection to analytical method) was designed with this aim in mind. However, total Sr isotope will be a useful predictor, we expect, of bioavailable Sr, e.g., via machine learning (as mentioned in Subsection 4.1). In fact we plan to develop some new research in that area shortly.

Sampling density is always a trade-off between detail and coverage. As we are interested in the first instance in large-scale processes, an ultralow density sampling scheme such as afforded by the NGSA samples seems appropriate. Of course, it would be desirable to fill-in the sampling grid with smaller catchment data, which future studies may well take on. We have added some more details in the Introduction, as suggested, but not in Section 1 rather in Subsection 3.1, Materials:

The sampling medium and density were both strategically chosen in the NGSA project to prioritise coverage over resolution. This was justified by the fact that the NGSA was Australia's first, and to date only, fully integrated, internally consistent geochemical survey with a truly national scope. In terms of the DCD, it is clear that these choices have implications on the granularity of the patterns revealed by the Sr isoscape; as the collection of Sr isotope data in Australia using NGSA samples grows in the future, it is hoped the value of coverage will prevail over a relative low resolution of detailed features.

We acknowledge the suggestion for a modification of the title of the paper, but respectfully disagree (see below).

Specific comments

Isoscape terminology. Although many works on isoscape are purely descriptive, an isoscape should represent a modelled map of a specific isotope distribution. This mean that the data should be accompanied by a modelling outline and validation, to show the prediction power of the model itself. This is the main reason why I feel that this paper mostly represents a new dataset rather than an isoscape of the area. I'm not asking to entirely change the terminology used in the manuscript, but I think it is something that we (as community) should keep in mind for future works.

Isoscape terminology: Although it is possible that some researchers exclusively associate the term isoscape with bioavailability, this is compatible with neither the original meaning of the

term nor its broader usage (e.g., for other isotopic systems or for non biological media such as groundwater or precipitation). The earliest reference to isoscape we could find cites a personal communication from G.J. Bowen to the author, Keith Hobson, mentioning *'"isotopic landscape" or "isoscape"'* (Hobson, 2005). This is also how West et al. (2010) in their authoritative book entitled **Isoscapes** define the word: *'This volume provides a comprehensive overview of the theory, methods, and applications that are enabling new disciplinary and cross-disciplinary advances through the study of "isoscapes": isotopic landscapes.'* Thus we respectfully maintain that we present *a* strontium isoscape of inland SE Australia (noting that we do not state *the* strontium isoscape). We agree that all in the community should keep this difference in usage in mind for future works.

Technical corrections

'Robust standard deviation' is a truly un-used descriptive statistic term. I suggest to report data as median ± median absolute deviation (MAD).

Robust standard deviation: we have changed this to MAD. Thank you for pointing that out.

Table 1: a single line table is not very useful. Maybe you can add here the descriptive statistics for each geological region (as Figure 7).

Thank you for the excellent suggestion, which we have taken on board. Table 1 now has the various regions listed.

L172 p.7: the link is incomplete. Will It be updated during/after the publication process?

Yes, the link will be updated at the proofs stage. When the paper is accepted, we will make the dataset 'live' on the portal.

We wish to thank reviewer #3 for devoting time to this task. The comments are much appreciated.