essd-2022-125-Rebuttal RC2.docx

Title: A strontium isoscape of inland southeastern Australia
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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 2's comments are below and the revised manuscript file is attached.

General comments

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Each new Sr or other isotope dataset that is published is a valuable contribution to creating isotope maps of the world and in this case Australia. Collecting samples in the often remote Australian landscape and analysing Sr isotopes are both labour intensive activities and therefore the authors effort and making the data freely available is very much appreciated.

The quality of the analytical work seems excellent as can be expected from a collaboration of an experienced isotope lab with GA, so no concerns there.

Thank you for the comments.

Specific comments

P1L9: Disagree with "Ultimately….." the way the sentence is written seems to imply that only the locally underlying parent material determines Sr isotope ratios in soil. Later the authors actually argue for other sources also contributing to the Sr signal mix so I suggest rewording this sentence.

L.9: This was an overly broad generalisation, so thank you for pointing that out. We have modified the sentence to clarify the case of different components, in-situ and allochthonous.

P1L15: I question if reporting routine statistic parameters is very relevant for Sr isotope distributions as Sr distributions are not normal, always multimodal (in these kind of mapping surveys).

L.15: Although we understand the remark, there is nothing fundamentally wrong with reporting univariate statistics for any population (especially when plots are shown to illustrate the distributions). It is deplorable that this is rarely done these days in our view. We see it as part of a basic description of the data.

P1L28: I suggest referring to a good and critical discussion of Sr isotopes for proveniencing by Jane Evans as is nicely discusses its limitations 10.1080/00665983.2021.1911099

L.28: Reference to Madgwick et al. (2021) has been added.

P2L30: I note that any reference to the recent work of Bataille on the global Sr map and Hoogewerff on the European Sr map is absent? Either of these publications would provide large datasets to compare the current data with. Also these data sets can be used to show the global or large scale distributions of Sr isotope values, maybe allowing to better underpin the later argument for the suggested bi-modality of the presented data?

L.30: References to Bataille and Hoogewerff have been added.

P7L170-176, table 1and fig3: What is the evidence for bimodal, does bimodal make sense in the geological context? The CF curve shows several plateaux indicating more than 2 distributions and considering the paucity of measurements in some catchments I would be careful with reading too much in the descriptive stats and making decisions on sub-populations. I note that global data also shows a skewed population with a long RH tail, so how does this data compare with the global data, such comparison might be more relevant that using normal descriptive stats?

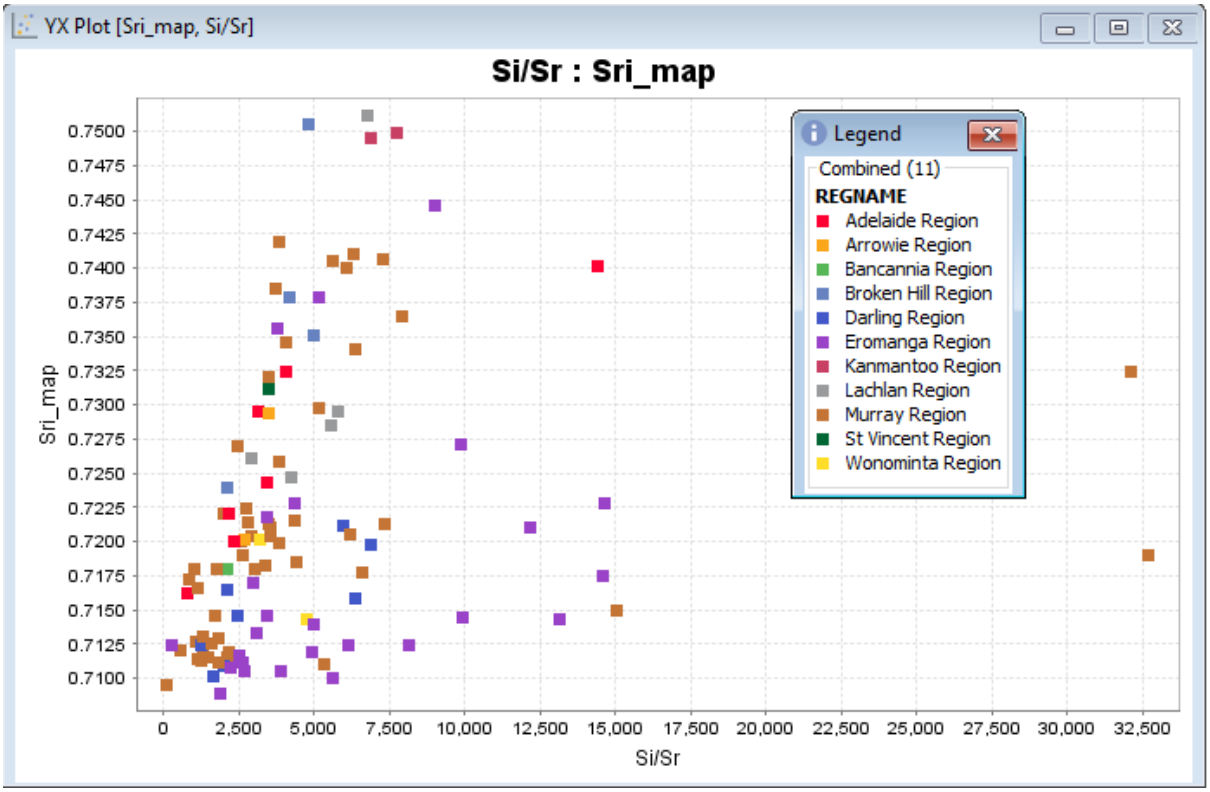
L.170-176: See comment above about descriptive statistics. We agree that the distribution is probably more complex, in detail, than just bimodal. We have qualified our words accordingly and added a comparison to the world dataset.

P10L225-233: Is there a contradictive argument here? At one place in discussion it is argued that wind-blown deposits are mostly quartz with low Sr isotope values but here it is suggested that radiogenic minerals are blown in?

L.225-233: This is not contradictory in our view. The Sr isotopic composition of any aeolian contribution will depend on where the transported material is sourced from and its nature (e.g., mineralogy). Most often it will be quartzose silt and fine sand with a low Sr isotopic signature, but if a nearby source region has radiogenic minerals and they are eroded and available for winnowing, they can be transported and deposited down-wind. This is what we speculate here. In other words it's not the process that control the Sr isotopic value of the material, but the material itself and hence its source(s).

P13/14 section 4.5 and Fig 6: if some samples are diluted by aeolian quartz and affecting/diluting the 1/Sr ratio, would it be useful to make an additional plot of 87Sr/86Sr versus Rb/Sr or Al/Sr to compensate for the quartz dilution?

Fig.6: This is an excellent suggestion and we had done this. The Si/Sr plot is below, but does not add anything particularly useful, in this case.



P16 fig7B: I am somewhat concerned about the bias caused by very differencing sample numbers in each category, maybe giving a wrong impression of the distributions?

Fig.7b: This comment mirrors that of reviewer #1 and has been addressed by explicitly giving the size of each subpopulation in the caption. As we expand our work on Sr isoscapes in Australia, more geological regions will become increasingly populated with Sr isotopic data so we hope to alleviate this in the future.

P17 section 4.6: I suggest exploring the relations with other element a bit more to find out if a regression or machine learning model could predict the Sr isotope data, or maybe this will be attempted in a separate paper?

Subsection 4.6: This is beyond the scope of this paper, which is focused on presenting Australia's largest Sr isotopic dataset to date. As we and other groups publish more Sr isotopic data, the possibility of machine learning/modelling 87Sr/86Sr distributions more widely and with higher resolution will be explored in detail.

P17 Conclusions: partly seem a somewhat repeat of stats that have already been mentioned twice, in abstract and discussion.

Conclusions: Yes. In our experience, many people read the Conclusions of papers without having time to read the whole article. Thus we take the view that it is useful to restate the fundamentals of the contribution, at the risk of a degree of repetition for the assiduous reader (*cfr* reviewer 1's comment to reiterate the applications of Sr isotopes in the Conclusions). Being a new Sr isotopic dataset for Australia, and a significant one on terms of size, it is particularly appropriate to have basic statistics in the Conclusions. We think the Conclusions are a detailed and informative yet concise and correct summary of our contribution.

Technical corrections

P2 Fig1: seems small in publication, fig a has a lot of redundant place names?

Fig.1: Full resolution figures will be provided for final publication; they can be zoomed in for detailed analysis. Named places are based on a population threshold. Ultimately, the interested user will be able to view and manipulate the dataset on the GA portal so all presentation choices can be made on the fly.

P4 fig2 Are some colours missing in figure 2A map, most seems white?? And again seems small in publication

Fig.2: Yes the maps are correct. Most of the region is covered by the Regolith/Other category as discussed. See comment above about resolution and future portal availability.

P7L174: are 4 digits relevant for summary stats like skewness and kurtosis?

L.174: We used the same number of decimal places as for the Sr isotopic data, the choice of which is justified in the text (Subsection 3.3).

P12 Fig4: too may digits in R^2? what is significance of 3rd and 4th decimals in intercept and/or R^2 if slope has only one digit? Slope would need more significant figures?

Fig.4: The slopes are in scientific notation because smaller than the four decimal places would be useful for. It is clear the slopes of the two regression lines are similar as they are almost perfectly parallel. The R values have now been rounded to two decimal places in the figure and text.

P14/15: maybe better to put n=x for each catchment in figure 7a, rather than as text?

Fig.7: N per region (not catchment) has been added as requested by reviewer #1.

P16 Fig 7a: personally, I would prefer a Violin plot as that shows the distributions in each catchment better (when there is enough data)

Fig.7a: Agreed, violin plots would be more informative than standard box plots, but these are not available in the software used.

We wish to thank reviewer #2 for devoting time to this task. The comments are much appreciated.