

Title: A strontium isoscape of inland southeastern Australia

Author(s): Patrice de Caritat et al.

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MS type: Data description paper

Dear Editor

Thank you for the opportunity to revise the above manuscript. Our responses to Reviewer 1's comments are below and the revised manuscript file is attached.

- 1. The article contains a very important data set. The use of the data will be of great value for a number of applications such as forensic science to determine the origin of wine for example, the sourcing of airborne dust in marine cores as well as in ice cores in Antarctica, determining the origin and possibly quantity of sediment loads from different catchments like attempted in the paper by Gingele, F.X. & De Deckker, P. (2005). Clay mineral, geochemical and Sr-Nd-isotopic fingerprinting of sediments in the Murray-Darling fluvial system, SE Australia. *Australian Journal of Earth Sciences* 52, 965-974. And finally, it has the potential to determine the extent of migration of early Australians by studying the Sr isotopic composition or human bones. Unveiled in archaeological sites.**

We note the reviewer's assessment of the importance of the contributed dataset and its multiple potential applications, and we thank the reviewer for that.

- 2. This is a significant data set and very thorough. However, no mention is made of the paper by De Deckker (2020). Airborne dust traffic from Australia in modern and Late Quaternary times. *Global and Planetary Change* 184, Article 103056, 19 pp. The Sr isotopic data provided in that paper could be included in the data currently being assessed. Hence the data set is not complete as is.**

The paper mentioned by the reviewer, De Deckker (2020), has been cited and added to the References. As it is not the purpose of this contribution to collate and combine all existing data from the region, we prefer to leave this task to others/later, at this stage. The main purpose of the present ESSD contribution is to present a new dataset.

- 3. The data set is definitely of high quality.**

Thank you.

- 4. The figures are adequate provided they can be enlarged. I am wondering as to whether it may be possible to use a program like google map and click on one site [a cross in the case of the figures] and obtain directly from the data set, the location, description of the site and the raw Sr data? Is it asking too much?**

Full resolution figures will be provided with final submission. In addition, once published, the data will be visible and accessible via the Geoscience Australia portal in exactly the manner suggested.

5. By reading the article and downloading the data set, my answer is YES to the question: “would you be able to understand and (re-)use the data set in the future?”

Thank you.

6. Rating: 1 for excellent

Thank you.

Additional comments (line numbers refer to the originally submitted version as reviewed):

Line 12: is the word ‘coarse’ really correct? This is the clay-size fraction (e.g. <2µm).

L.12: Yes, the term ‘coarse’ designating the <2 mm fraction is correct, as used in the NGS project and multiple reports.

Line 29: after Madgwick et al., 2019) add: Dust sourcing in ice core’ and add a reference or 2 such as Revel-Rolland, M., et al. (2006). Eastern Australia: A possible source of dust in East Antarctica interglacial ice. *Earth and Planetary Science* 249, 1-13. and De Deckker (2020). Airborne dust traffic from Australia in modern and Late Quaternary times. *Global and Planetary Change* 184, Article 103056, 19 pp. but there are many others.

L.29: Suggested references added.

Line 35. Perhaps add the reference of De Deckker, P. (2020) op. cit.

L.35: We are talking about new projects currently underway at Geoscience Australia here. De Deckker is mentioned now 6 lines above, where relevant.

Line 56. Mention also that the fluctuating ENSO signals strongly affects rainfall variability over the years.

L.56: Sentence ‘Long-term weather patterns are strongly affected by El Niño/La Niña cycles.’ added.

Line 62: Really, the Murray River starts much higher near Charlotte Pass with the Snowy River and its mouth is not near Victor Harbour by Goolwa instead! Also after ‘Southern Ocean’ add in brackets “(Southeast Indian Ocean sector)” to be more precise as the Southern Ocean commences below the Subtropical Convergence.

L.62: The source of the Murray River as described (‘in the Australian Alps at 1430 m above sea level (asl) (on the border between NSW and Vic)’) is entirely in agreement with the reviewer’s comment. The mouth of the river is described in terms of the maps shown, where the closest labelled town is Victor Harbour. Of course at higher resolution, Goolwa would be visible. The detail about the Southern Ocean label seems unnecessarily detailed in the context; this map/label is for general orientation.

Line 70 give the range of altitudes form the Flinders Ranges. At present it is a bit misleading as 139 m asl is not representative

L.70: The mean altitude of the study area is 139 m asl. It is mentioned that both the Victorian Highlands and the Flinders Ranges have elevations >900 m asl.

Line 77: add: ‘plus aeolian dust input”

L.77: Mention of aeolian processes has been added.

Line 79: replace 'lack' with 'absence'

L.79: Done.

Line 220: can you postulate on the origin of the sediments??

L.220: We wouldn't be able to speculate further than stated, given the spatial resolution of the samples.

Line 235, Perhaps quote some of the values listed in De Deckker (2020) op cit.

L.235: As that study is concerned with a much finer grain size fraction than the dataset presented, we feel it is unwarranted to quote numbers that may not be comparable. This could be part of a discussion in a separate study collating all regional Sr isotope data.

Line 245: you should check the following article on Lake Frome east of the Flinders Ranges and quote some of the isotope data from it as it also gives values for groundwaters for the Great Artesian Basin. W. J. Ullman & K. D. Collerson (1994) The Sr-isotope record of Late Quaternary hydrologic changes around Lake Frome, South Australia, Australian Journal of Earth Sciences, 41:1, 37-45, DOI: 10.1080/08120099408728111

L.245: Thank you for the suggestion. The reference to Ullman and Collerson has been added in Section 4.3, however, where it seems more appropriate (as the values reported are relatively unradiogenic compared to the dataset presented here).

Somewhere near line 255: you should mention the possibility of contamination in areas where fertilizers are used as their Sr isotopic composition is well known but can affect some of your results. Fertilisers can be transferred down to the depths of your sampling. Check Martin CE & McCulloch MT 1999. Nd-Sr isotopic and trace element geochemistry of river sediments and soils in a fertilized catchment, New South Wales, Australia. GCA 63 (2), 287-305.

Somewhere near L.255: Thank you for the suggestion. The reference to Martin and McCulloch and a discussion of the potential role of fertilizers have been added to Subsection 4.3.

Line 350 caption. It would be nice in the top figure to list the number of analyses carried out for each boxplot. Concerning the bottom figure, it is a pity in a way to plot a box for each of the single samples for Bancannia and St Vincent as they only represent a single sample.

L.350: Thank you for the suggestion. The caption of Figure 7a has been modified to include the number of observations for each boxplot, as suggested. As for Figure 7b we believe it is best to show the values reported, as this is more informative than not showing them at all. It is clear from the size of the box in the histogram that there are single data points, thus this is not misleading. In fact it could spur further data collection in these regions.

Line 397: Would you consider reiterating the possible uses of your data such as I mentioned earlier in my comments?

L.397: Thank you for the suggestion. We have taken this advice.

In summary: an excellent data set, something that was lacking for Australia. Can the same be done using Nd isotopes as a combination of both Sr and Nd isotopes would be a much more formidable tool.

We wish to thank reviewer #1 for devoting time to this task. The comments are much appreciated.

The collection of Nd isotope data on NGSA samples would indeed deliver a formidable tool and has actually been piloted; more work could be done if/when funding is identified.