Reply to Comment on essd-2022-446 by Jodie Pritchard (Referee)

Referee comment on "A strontium isoscape of northern Australia" by Patrice de Caritat et al., Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-446-RC3, 2023

General comments:

Congratulations to the authors. This paper contains a great quality, highly valuable largescale bulk soil 87/86Sr dataset that will be applicable to many areas of scientific research, for an area of Australia where there was previously very little information available. Within the paper the bulk soil 87/86Sr dataset is compared with catchment specific information including bedrock age, lithology and mineralisation.

Thank you for the comments.

Specific comments:

Soil samples were taken at the bottom of the catchment which is a unique and pragmatic approach for maximising coverage. How does this compare with previous approaches and effect interpretation?

This choice is a legacy of using a sample archive collected for the purposes of geochemical mapping. In large-scale geochemical mapping, sampling overbank or floodplain sediments is a well-established and widely used technique (references below). Several publications and our experience with the NGSA show that the floodplain sediment technique provides a realistic representation of the *average* conditions in the catchment. Having said that, there is no question that additional subsampling within catchment would add valuable granularity to the maps. But this is a balance between extent of coverage and density of sampling because resources are always finite. We believe that interpretations at this sub-continental scale are appropriate based on this sampling density.

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OTTESEN, R.T., BOGEN, J., BØLVIKEN, B. & VOLDEN, T., 1989. Overbank sediment: a representative sample medium for regional geochemical sampling. Journal of Geochemical Exploration, 32: 257-277. DOI: 10.1016/0375-6742%2889%2990061-7.

DARNLEY, A.G., BJÖRKLUND, A., BØLVIKEN, B., GUSTAVSSON, N., KOVAL, P.V., PLANT, J.A., STEENFELT, A., TAUCHID, M., XIE, X., GARRETT, R.G. & HALL, G.E.M., 1995. A Global Geochemical Database for Environmental and Resource Management. Recommendations for International Geochemical Mapping, Final Report of IGCP Project 259. UNESCO Publishing, 122 pp.

BØLVIKEN, B., BOGEN, J., JARTUN, M., LANGEDAL, M., OTTESEN, R.T. & VOLDEN, T., 2004. Overbank sediments: a natural bed blending sampling medium for large-scale geochemical mapping. Chemometrics and Intelligent Laboratory Systems, 74: 183-199. DOI: 10.1016/j.chemolab.2004.06.006.

de CARITAT, P. and COOPER, M.: National Geochemical Survey of Australia: Data Quality Assessment, Record, 2011/21, Geosci. Austral., Canberra, http://pid.geoscience.gov.au/dataset/ga/71971 (last access: 15 December 2022), 2011b.

It would be interesting to see how bulk soil 87/86Sr compares to 87/86Sr in other environmental materials within each catchment. I am interested in how it might compare to bioavailable 87/86Sr

leachates from soils for provenance studies. This is an idea for future work, rather than for inclusion in the current paper.

Thank you for the comment. We are working on acquiring complementary data for precisely such comparison.

Catchments with high 87/86Sr were compared to lithologies. It would be useful to see this comparison across all catchments.

We have added comparisons with carbonate and mafic lithologies, as also requested by Reviewer 2.

Technical comments:

Well structured, well written, easy to follow.

Thank you for the comment.

Figure 2a: Valuable diagram, but hard to make out bedrock units. Maybe adjust colour scheme and increase size?

The colours are standard geological colours so we prefer not to change these. We leave it to the **Editor** and the production team to ensure Figures are of an appropriate size.

Figure 4: May be worth including some of the major landmarks that you use in the discussion, for example, Cape York.

We feel that the Figures (maps) are already quite 'busy' so despite this being a great suggestion, fear that this could overload them. Also if you label Cape York, where do you stop?

Lines: 262 – 265: good points.

Thank you for the comment.

Table 1: Whilst digestion does hint at whether analyses were bulk soil versus bioavailable, I think it would be worthwhile making a clear distinction in the table which are which.

Whilst this is a great idea, we prefer not to enter the debate of what is 'bioavailable', as it is outside the scope of the paper. Some researchers will say it's only biological samples that represent bioavailable Sr, whilst others will accept weak/partial soil leaches. As the table is only for soils, the former definition is not applicable here.

Line 283: There is a good correlation between TOS and BOS 87/86Sr. Will you please explain why you would want to recalculate TOS for BOS?

We had TOS only available for some of the samples, but the majority were BOS. Therefore we needed a conversion of TOS to BOS as to not mix 'apples and oranges'. Some researchers interested in surface processes may prefer to use the TOS values. Therefore we provided the conversion between the two. We added the following sentence in Subsection 5.2:

A TOS map and values would be useful when studying surface processes, such as plant and animal uptake or the effect of landuse on sediment composition and dynamics.

Line 302-305: It would be great to compare this with all catchments and graph it similarly to Figure 6.

The relationship between Rb and 87Sr/86Sr is shown in the diagram below, which we don't think is clear enough to insert in the manuscript or supplement per se. It does however support the

statement made in the paper, namely that catchments with high 87Sr/86Sr values contain lithologies enriched in Rb relative to Sr

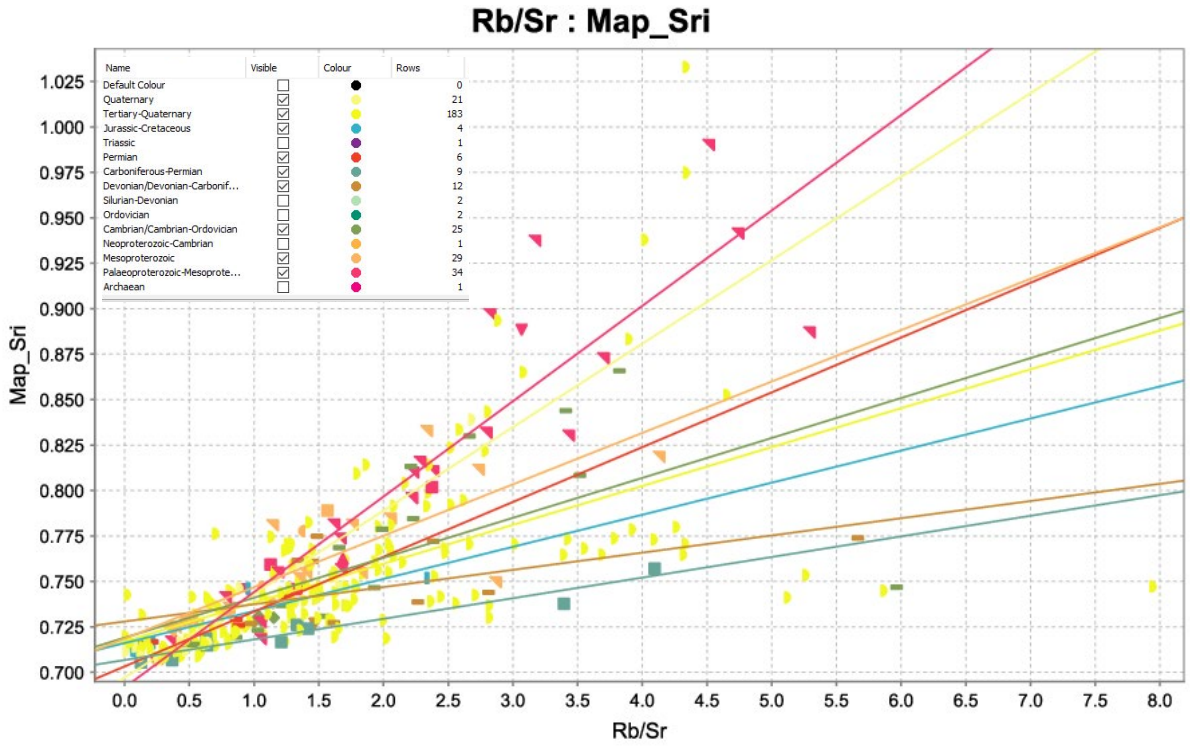

Figure: 87Sr/86Sr isotope ratio (total digestion) vs Rb/Sr ratio (total digestion) for northern Australia NGSA BOS samples. Data subseted by geological age groups, as per Legend inset (note subsets with two or fewer samples not shown).