Solid Earth Discussions

Solid Earth Discuss., author comment AC3
https://doi.org/10.5194/se-2021-108-AC3, 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Reply on RC2

Malcolm Aranha et al.

Author comment on "Rare earth elements associated with carbonatite–alkaline complexes in western Rajasthan, India: exploration targeting at regional scale" by Malcolm Aranha et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-108-AC3, 2022

Response to RC2

We thank Reviewer 2 for the positive assessment of the manuscript and constructive and insightful comments and suggestions. We have addressed all comments and suggestions in the revised manuscript.

In the manuscript with the title "REE's associated with carbonatite-alkaline complexes in western Rajasthan, India: exploration targeting at a regional scale", the authors present a mineral prospectivity approach to determine potential target sites for REE exploration. The work is based on extensive previous experience by the authors in the field of mineral prospectivity analysis and uses state-of-the-art methods, applied to a regional case study. As such, it is an interesting contribution to the field and suitable for a publication in a scientific journal, specifically for the special topic on the state of the art in mineral exploration.

Overall, the manuscript contains all elements that are relevant for a scientific publication, but I do have several concerns about the structure itself.

- **The manuscript contains an excessive amount of tables. Even if one can usually argue that tables help summarising information, it appears quite the opposite here: as a reader, one is constantly shifting between reading text in the main document, and reading text in the tables. In my point of view, this is really not helping and distracts from the main contribution of the manuscript. In addition, almost all tables contain a very high amount of redundant information (see comments below). I would strongly suggest to re-structure the document in a form that the relevant aspects are in the main text, and to place all tables (if they should be kept) in the appendix.**

- *Response: We agree that the paper and tables needed restructuring. In the revised manuscript, we have reduced the number of tables within the body of the manuscript and moved some of them to an appendix. The revised manuscript has six tables. The original Tables 1 and 6A, B and C have been moved to the appendix. Also, all tables have been revised and simplified to improve the readability and to avoid cluttering and*

repetition of information.

- **Another point concerns the results section: this is almost non-existent (two short paragraphs) and actually a lot of outcomes are missing here. They are then described in the discussion (e.g., lines 318-334). Also here, I would suggest to carefully revise results and discussion section to place the content at the part where a typical reader would expect them - this is to some extent always up to personal choice, but I think that a restructuring will definitely help clarifying the main contribution of the work.**

- *Response: We appreciate the suggestion and agree that the results and discussion sections in the original manuscript needed restructuring to improve the readability. In the revised version, the Results and Discussion have been combined in a single section, "Results and Discussion". The recommendations have been moved to the Conclusion section.*

- **Concerning the scientific contribution: all main components of the used data sets are well described and justified. What is missing is a description of the approach itself (the fuzzy inference system). The authors refer to previous publications on the topic - but actually, they are partly paywalled and will not be accessible to all readers (I also could not find openly available preprints). I would suggest to include some more details into the manuscript. In the current form, it is very difficult to understand how exactly uncertainties are considered and which of the novel approaches are implemented. Also, the description would benefit from some of the base references (if I am not mistaken, then the approaches go back to the work of Duda in the 1970's).**

- *Response: Thank you for flagging this point. We agree that a complete description of the theory and implementation of fuzzy logic will undoubtedly add value to the paper. We completely understand the concerns regarding a background to the approach. To address this, we have cited some additional publications in the text in lines 61 – 63 on page 2 and also provided some examples of open-source applications that can be used to implement FIS in lines 199 – 206 on page 10. We have also cited the background available on the webpage of MathWorks® on FIS, which can be freely accessed at: https://in.mathworks.com/help/fuzzy/fuzzy-inference-process.html. We think that an exhaustive description of the FIS approach is not feasible and would shift the focus away from the paper's central idea, and a brief introduction cannot do justice to the approach.*

- **In the interest of open science and in order to better understand the approach itself (and to make it reproducible), it would also be very beneficial to make the processing scripts available on an open repository (e.g, GitHub or an institutional repository).**

- *Response: In this study, we used the commercial software Fuzzy Logic Toolbox of MathWorks® to implement the model. The Monte Carlo simulations were implemented using a trial version of the proprietary software XLSTAT®.*
- *However, we appreciate and agree with the comment of the Reviewer. We have provided some open open-source applications that can be used to implement FIS (Section 6, page 10, lines 199 – 206). These tools can be used to replicate the approach.*

- **One key aspect of the approach is that the authors estimate uncertainties in the resulting prediction maps. This is an important extension, when compared to conventional prospectivity mapping approaches. It should be mentioned, thought, that the analysed systemic uncertainties only address a small part of**

the overall set of uncertainties (here called "systemic", similar to "epistemic"?): the uncertainties in the hyper-parameters of the distributions. Many other uncertainties which, I think, the authors would also group under the term "systemic" are not included (choice of the distribution, model structure, choice of using a FIS, …). To be sure, this is acceptable, as no approach yet exists to consider all uncertainties, but it should at least be mentioned that the uncertainty estimates are limited to this specific aspect.

- *Response: We thank the Reviewer for pointing out this limitation. We have incorporated this comment on Page 12, Section 6, lines 237-239.*

Further (minor) comments to specific sections in text (identified by line numbers):

75: In the UQ literature, the terms epistemic and aleatory are commonly used. How do the terms systemic and stochastic refer to these?

Response: As clarified on Page 3, Section 1, lines 64-70, the term systemic corresponds to epistemic and stochastic corresponds to aleatory.

97: Please describe the geologic/ geodynamic setting instead of a list of continents and countries.

Response: Thank you for the suggestion. We have added the geodynamic setting in lines 88-89, page 3, section 1.

147: As the presented work strongly depends on the mineral system model, it would be important to include the full reference here - or, at least, to provide an accessible version of a preprint (if the paper is not yet accepted). In the current form, this model cannot be evaluated.

Response: We agree. However, as a preprint of the paper containing the exhaustive details of the mineral systems model is currently unavailable, the model has been summarised briefly in section 4. We have provided all the relevant references.

Table 4B, C: highly redundant information - see general comments above.

Response: As suggested, the table has been revised. Please see Table 3 in the revised manuscript.

Table 5: last column: why Piece-wise linear twice? Overall, also highly redundant.

Response: As suggested, the table has been revised. Please see Table 4 in the revised manuscript.

Fig. 4: Also here, a lot of redundant information. A more compact description would help for a clearer representation.

Response: We have modified Figure 4 in the revised version.

233, FIS-model(s): Were the three separate models chosen on basis of a geodynamic/ mineral systems consideration or on basis of the operator functions (into "AND" and "Product" branches)?

Response: The three separate FIS models are used to combine the respective predictor

maps of the three essential components of the mineral systems model (namely, Fertility/geodynamic setting, transportation and emplacement architecture) in order to generate fuzzy prospectivity maps for the respective component. We used the conjunctive fuzzy AND operator in these three FIS to combine the respective predictor maps.

The second stage FIS was used to combine the above three sets of fuzzy prospectivity maps for fertility/geodynamic settings, transportation and emplacement architecture using the fuzzy product operator to generate the final prospectivity map for REEs.

The above has been clearly explained in Section 6, page 14, lines 252-262.

Fig. 5: scale, colorbar, missing, difficult to interpret. Suggestion: include subfigures for detailed areas and include description in results section (instead of discussion).

Response: Thank you for pointing it out. We have included these critical elements in the revised figures.