

We thank the editors and reviewers for their very thorough and insightful comments. These comments greatly helped us to clarify the scope of this manuscript and to emphasize our key points throughout. We have studied comments carefully and have made correction which we hope meet with approval.

Referee 1

My major concerns are well addressed in the revised version. However, I find that there are many minor issues (grammar, vague wording, etc.), especially in those revised parts (highlighted in the tracked version) that should be carefully corrected. I list some of them below.

Reply: We would like to thank the referee 1 for his thorough evaluations with constructive comments that certainly will improve the manuscript. In the following, we will address the referee 1 comments point by point. We mark black the comments given by the referee, give our answers and comments in blue.

L122 one million years?

Reply: Thanks, we corrected it.

L166 Pan-Third pole?

Reply: Yes, because the locations of these data are beyond the area of Third Pole. The most of studies named these regions as Pan-Third pole.

L172-174 rewrite, poor grammar.

Reply: Thank you, done.

L174-176 rewrite, poor grammar

Reply: We rewrote it.

L199 remove “slightly”, the grain-size effect is much more significant for $^{87}\text{Sr}/^{86}\text{Sr}$ indeed.

Reply: Done.

L208 It is unclear the meaning of “enrichment”. Do you mean the radiogenic isotope enrichment, which means a higher $^{87}\text{Sr}/^{86}\text{Sr}$ ratio and a $^{143}\text{Nd}/^{144}\text{Nd}$ ratio? Please specify it.

Reply: We added it in line 206.

L203 You need to explain the carbonate effect because you have mentioned the grain-size effect before but never mentioned carbonate effect.

Reply: Thanks, we deleted “the carbonate effect” in revised manuscript.

L204-205 I guess you mean” exhibits less grain-size-dependent variability...”

Reply: Yes, we revised it in line 202.

L210 no than? Less than? Rewrite.

Reply: Thanks, it is corrected in line 208.

L219 such a linear relationship from a reference or this paper?

Reply: We added the reference in revised manuscript.

L225 before what ? Do you mean the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of acid residue is higher than the bulk sample before acid leaching? Please specify it.

Reply: Yes, $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of acid residue is higher than without acid treatment or bulk sample. We added it in revised manuscript.

L350 I am not sure whether it is wise to use the abbreviation PSA to show potential source area, also at L430, L440. Too many abbreviations in this paper always confused me.

Reply: Thanks, we still used the abbreviation PSA because there are about 20 abbreviations. This abbreviation was used in mediums of snow or ice.

L391 what is the meaning “for bulk”?

Reply: We added the explanation in line 389.

L431 the sample number is >2

Reply: Thanks, done.

L436 Sr and Nd isotopic contours

Reply: Added it.

L444 I am not sure the meaning of “many more sample numbers”

Reply: Corrected it.

L529 poor grammar, rewrite.

Reply: Done.

L538 Sr-Nd isotopic data

Reply: Thanks, added it.

Table 1 Tibet Plateau to Tibetan Plateau

Reply: Thank you, done.

Table 2 Tiean Shan to Tien Shan

Reply: Thanks. We changed it.

Table 2 Kulun to Kunlun?

Reply: Kunlun. Sorry, we corrected it in revised manuscript.

Fig. 2 You use Tianshan in the figure and caption but Tien Shan in the Table.

Reply: We used the Tien Shan in all manuscript.

Fig. 2 The is not easy to read with such a colourful background.

Reply: We changed the colour of the numbers in Fig.2 in revised manuscript.

By **Cécile Blanchet** (GFZ Potsdam), 21 September 2022

Thanks to the authors for the extensive corrections they have performed on the manuscript and their detailed responses. I have only a few minor corrections before this paper can be published.

- The goals of the paper are clearer.
- The complexity of source versus sink determination in the third pole is well explained.
- The three poles are better defined in the text and Fig. 1 is very helpful.
- The figures have been largely improved, with number of data analysed for each box plot (Fig. 3 and 6), proper legends (Fig. 4 and 7) and isoscapes (Fig. 8).

Reply: We thank Prof. Cécile Blanchet for their careful and thorough review of the manuscript. Below we copy the referee comments in black and write our responses in blue.

I quickly checked the attached dataset, which is a lot clearer and better organised than the previous version. However, a metadata description is still missing, indicating what kind of information is given in the columns and the different spreadsheets. It is an important part of the dataset that help users to select and reuse the data.

Reply: Thanks for your suggestion, we added a metadata description in revised dataset.

L. 111: (...) and literature from the three poles (which refers to the high mountainous regions in Asia, the Arctic and Antarctica).

Reply: Thanks, added it.

L. 166: what is the “pan-Third pole”?

Reply: The Pan-Third Pole included Tibetan Plateau, Pamir, Hindu Kush, Tianshan,

Iranian Plateau, Caucasus, Carpathians, as well as the surrounding deserts and coasts (2018AGUFMGC51B..01Y). Because the Sr-Nd data is also collected from this region, therefore, we used the name in dataset. We added the explanation in revised manuscript.

Section 3.1: I am not sure how much of this section is really useful for the paper. All considerations on paleoceanography seems a bit out of scope.

Reply: We discussed it again, and think that Section 3.1 is needed, because it presented the different mediums, which had the different Sr-Nd values. Therefore, we keep these data in dataset. However, we agreed that the paleoceanography indeed seems a bit out of scope, we deleted some sentences.