

Interactive comment on “Lowlands fluvial sedimentation enlightens glacial dynamics in narrow valleys during the Last Glacial Maximum (Venetian Forealps, Italy)” by Sandro Rossato et al.

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A) General comments

The discussion paper by Sandro Rossato and co-authors presents an interesting approach to infer LGM dynamics in a narrow valley in the southern Alps, mainly using a provenance tracing technique applied to sediments in the corresponding lowland. Overall the paper is well structured and it is easy to follow the central theme. The methodological description of the provenance tracing approach could be improved with regards to the following 3 points:

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1) I feel that the explanation of the mixing modeling approach used to infer the relative contributions of the modern Brenta, Cisonon and Piave rivers to the sediments is a bit short. Sure, your approach basically uses the same strategy as described in Vezzoli & Garzanti (2009) and the river endmembers defined in Garzanti et al. (2006), but it needs to be explained a bit more in detail (goodness of fit, errors, etc.).

2) In sections 4.2 to 4.4 I couldn't follow the definition of the “petrofacies” and the “units”, respectively. Were the “units” of the cores defined based on the petrofacies? Or the other way round? The text is a bit ambiguous in this regard and needs clarifying. Perhaps it would make sense to describe the cores first (section 4.4) and then interpret the petrography/mineralogy/geochemistry (sections 4.2 and 4.3)?

3) I would highly recommend using principal component analysis (PCA) for the interpretation and visualization of the petrographical, mineralogical and chemical datasets. PCA has become a standard tool in provenance analysis and the compositional biplots really help visualizing differences between samples and identifying clusters (see e.g. Aitchison, 1982, *Biometrika*; Aitchison & Greenacre, 2002, *Applied Statistics*; Vermeesch, 2013, *Chemical Geology*). The ternary plots are okay to use for a first visualization, but I wonder which additional conclusions could be drawn from a compositional biplot. You could for example try plotting all parameters together (petrography, mineralogy, chemistry) to see how the clustering goes. Don't forget to also plot your modern river endmembers.

I would recommend the CoDaPack from the group at the University of Girona: <http://www.compositionaldata.com/codapack.php> (reference to use: Comas, M., Thió-Henestrosa, S., 2011. CoDaPack 2.0: a stand-alone multi-platform compositional software. In: Egozcue, J.J., Tolosana-Delgado, R., Ortego, M.I. (Eds.), *CoDaWork'11: 4th International Workshop on Compositional Data Analysis*. Saint Feliu de Guixols, Girona, Spain). You just import your table as a .csv or .txt file and then go to Graphs/centered-log-ratio (CLR) biplot. Alternatively, if you like playing with R, you might consider using the “Provenance” toolbox of Pieter Vermeesch (Vermeesch, P.,

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Resentini, A. and Garzanti, E., 2016. An R package for statistical provenance analysis. *Sedimentary Geology*, 336, 14-25)

B) Detailed comments (page and line numbers refer to the online version of the manuscript)

p. 2 line 20: "allow FOR" instead of "allow to TO"

p. 2 line 32: there is no plural for "evidence".

p. 3 line 17: "Last glaciation". Either you use Last Glaciation (both capital letters) if you use this as a proper noun or "last glaciation" without any capital letters.

p. 3 line 20: Add "(Fig. 1)" after "left well-preserved terminal moraines".

p. 4 line 12: use either the singular or the plural for the rock types. I suggest to use "porphyries" instead of "porphyry" here

p. 4 lines 11-14: This paragraph about the geology doesn't really fit into "3.1 Field survey". Either you move this paragraph to "2 Setting" if it's just a description of the geology or into another heading if your aim is to describe your provenance strategy.

I am a bit confused by the "granites, porphyries and metamorphic rocks" you mention. In Fig. 1 you only show group of rocks ("volcanic" or "plutonic"), which is understandable in order for the figure to be legible, but into which groups do the "granites, porphyries and metamorphic rocks" belong? I guess the metamorphic rocks belong to the Variscan basement and the porphyries into the "Permian volcanic rocks"?

I guess you mean that the Brenta drainage area comprises plutonic and volcanic rocks, which are not present in the neighboring Astico and Piave valleys, and that this difference makes it possible to identify the respective deposits? Please make all of this clearer by writing 2-3 more sentences.

p. 5 line 2: "0.0625-2" Did you use this particular grain size fraction in order to compare your dataset with the river endmembers from Garzanti et al. (2006)? If so, please state

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this in the methods. By taking such a wide grain size window one risks to introduce bias by grain size sorting. . .

p. 5 lines 4-5: Please rephrase the sentence about the point counting, for example "Following the Gazzi-Dickinson method 400 points per thin section were counted using a 0.5 mm grid spacing (Ingersoll et al. 1984)." Did you use the same grain classes as Vezzoli & Garzanti (2009)? If so, please state so in this paragraph.

p. 5 line 6 "Data and parameters were reported in Table 2 AND plotted in ternary diagrams."

p. 5 lines 6-9: Please describe more thoroughly the strategy behind this approach (defining endmembers, applying a linear mixing model, reporting the goodness of fit, . . .)

p. 5 line 12: Avoid the word "adopt" in this context.

p. 7 line 4: left side? Please use geographic directions (west/east)

p. 7 line 27: "found at THE surface"

p. 7 line 28: "Evidence" has no plural: "All evidence shows. . ."

p. 7 line 29: ". . .which was collecting material from an area located at least 25 km to the north. . ."

p. 8 line 10: right side? Please use geographic directions (west/east)

p. 9 line 1: "The lower unit could be attributed to. . ."

p. 9 line 19: What is "CE"? I couldn't find it in the text.

p. 9 line 22: ". . .while the content of felsic volcanic fragments remains high."

p. 9 line 23-24: Please rephrase to something like "Although the spectrum of lithic fragments contained in petrofacies 2 is similar to that of petrofacies 1, petrofacies 2 contains more carbonate clasts, generally above 35%. Micritic limestone fragments

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are particularly common.”

p. 9 lines 25-28. This is a long and convoluted sentence. Rephrase to something like “The single sample of petrofacies 3 shows a completely different composition. The carbonate fragment content increases to 55% at the expense of quartz (only 10 %) and other grain types (below 10 %).” . . . Also I do not understand how the chert is embedded into the limestone. . . is it a partially dissolved and then recrystallized limestone or . . . ? Please specify by including a better petrographic description.

p. 10 line 2: “. . .with an enrichment of carbonate rock fragments. . .”

p. 10 lines 5-6: “Finally, petrofacies 3 with its high carbonate clast content is more similar to the modern Piave River sediment.”

p. 10 lines 6-9: Couldn't this be interpreted simply as a reworking of deposits from the Piave catchment?

p. 10 lines 13-25: Do “unit 1” and “unit 2” refer to “petrofacies 1” and “petrofacies 2” from before? If so, please use the same name, either “petrofacies” or “unit”.

p. 11 lines 7-8: No capital letters for quartz and feldspar!

p. 11 line 10: “. . .” and two of them have been dated”

p. 11 line 14: Again, no capital letters for quartz and feldspar.

p. 11 line 21: Again, no capital letters for quartz and feldspar.

p. 11 lines 22-23: “. . . the dolomite content is significantly higher (Fig. 8).”

p. 12 lines 2-3: Again, no capital letters for quartz and feldspar.

p. 12 line 28: parts

p. 13 line 2: left valley side? Please use geographic directions (west/east)

p. 13 line 8: “Based” instead of “Basing”

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p. 13 lines 8-11: I do not understand this interpretation. . . Which of your data supports this? Please specify

p. 13 line 23: consisted of

p. 13 line 33: the “so” in the sentence can be deleted

p. 15 line 13: Not sure what you mean by “looked to”? Linked to?

p. 16 line 1: in respect to

C) References

I did not thoroughly check all the references, but there are at least two where author's names are not capitalized (e.g. page 19 line 23 “Andò” or page 20, line 1 “Anderson”).

D) Comments on figures and tables

Figure 1: In the legend you use UPPER Permian for the sandstones but EARLY Permian for the plutonic rocks. Use either “Upper and Lower” or “Early and Late” to make this consistent. See for instance Haile 1987 (Marine and Petroleum Geology) for the use of this nomenclature.

Figure 2: Increase the size of the yellow square indicating the drill site.

Figure 6: What is the red square in the uppermost left corner and why is it red?

Figure 7: Add to the figure caption the explanations of the ternary corners (CE, Lm, Lv, Ls. . .). Did you group together certain grain classes?

Table 2: Add a heading for the last column of this table (e.g. “Relative contribution of endmembers” or something like that). Do the numbers (0.886 and so on) refer to R2? Please explain this! What's up with sample RB1-8? Why is it “not representative”?

Interactive comment on Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2018-22>, 2018.

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