

The authors have made extensive changes in response to the reviewers and editor, and these has substantially improved the paper. A few key changes include:

- Substantial additional method information and data quality discussion; Includes an updated methods description table covering EPMA and LA-ICP-MS following the approach of Abbott et al. (2020, <https://doi.org/10.5281/zenodo.3866266>)
- Reworking of data tables and figures and the addition of more supplementary material
- Outlier analyses are retained, commented, and moved to a separate section in the supplemental data tables

The manuscript also now indicates that the full data are accessible via the Pet Lab database at <https://pet.gns.cri.nz>. An earlier version was also archived at EarthChem as a file submission. Will this also be updated to the latest version of the dataset?

Since the manuscript and dataset were modified in accordance with the Abbott et al best practice document, those best practices should be cited in the manuscript.

The data tables still contain many entries labeled “Below LOD.” These still need to be replaced with the actual analyzed concentrations. Note the concluding statement of Kirchmer (1994, *Limits of detection and accuracy in trace elements analysis*): **“When reporting data, particularly monitoring data, the critical level, limit of detection, or limit of quantitation should not be used to censor data. To avoid information loss and biased calculations of mean sample concentrations, all data should be reported, together with an estimate of the uncertainty in the results. The critical level should be provided separately as an aid in interpreting the reported results.”**

In the track changes version:

Line 212 – If chemistry has differences, how are two samples known to be the same tephra?

Line 219 – Perhaps grain size and tephra samples would be better than glass-shard size and glass samples? Unless density separates are performed to concentrate glass or the original deposits are almost pure glass already, these samples technically aren’t composed of just glass.

Line 438 – Do you mean two different magmatic liquids (and therefore glasses) formed due to fractionation of different amounts of biotite?

Lines 906-908 – Perhaps “most responsible for the separation in PC1 and PC2 space” ?

Line 943 – At the time of this re-review, www.tephranz.com resolves to a page with an “Oops! That page can’t be found” message. However, the header on this page does allow navigation to the data.

Excel reports a formula error upon opening the Excel file which contains the tables and supplemental data. The problem may lie in the plots associated with supplemental Table 5.

Additional comparative sets of analyses for VG-568 may be found in the following references. The latter uses a high-precision approach with additional EPMA elements (Rb, Sr, Zr).

- Rowe et al., 2008, Catalog of Mount St. Helens 2004–2005 Tephra Samples with Major- and Trace-Element Chemistry, U.S. Geological Survey Open File Report 2008-1131. (see appendix in the pdf)
- Kuehn and Lyon, 2020, June Lake Tephra Dataset <https://zenodo.org/record/4074290#.YNEuSi2cZ38> (specifically see June Lake Glass DATA.xlsx)