Comments on "TephAta - An online data collection of tephra data from the Atacama Desert" by N. Leicher and co-authors submitted to ESSD

This manuscript introduces a large database of tephras from the Atacama Desert, northern Andes. The database comprises comprehensive information of the occurrence, high quality major, minor and trace element glass composition, and compilation of age determinations of about 100 individual tephra samples covering the age interval from Quaternary to Miocene. The majority of the data including Ar-Ar dating results were obtained by the authors; some literature data have been also included. The database is available in web and also as Excel files making it very convenient to use on-line or on local computer. The structure of the database is aligned with recommendations from the tephra community and thus is compatible with other databases (e.g. EarthCHEM). I want to specially emphasize that all the data is accompanied by comprehensive information on reference materials analyzed during the same analytical sessions. This is excellent example of how geochemical tephra data should be reported in any publication. The manuscript provides quite detailed analysis of the age data, compositional variations of tephras, their clustering, and possible implications for the ongoing and future research. The manuscript is very well written and without doubts is a major contribution to the tephrochronology of Andes with many important applications.

My major recommendation to authors is to try clean the database as thoroughly as possible already on this stage (when it is not too large), exclude all data of questionable quality or not supported by data on reference materials, exclude data with totals less than 90-92% and more than 101.5%, exclude obvious compositional outliers, check the correctness of web output (I specify the questions below).

Overall, I strongly recommend publication of this contribution after minor revisions, suggestions for which are placed below and mainly concern geochemical methods and results.

Line 65: Perhaps magma-crust interaction is particularly important in Andes, but in general it is not prerequisite for eruption- or volcano-specific fingerprint. Common factors resulting in volcanic glass variability is different extent of crystallization and variations in parental magma compositions.

Line 71: Are sedimentation rates high enough in the Atacama Desert to provide high temporal resolution of the archives?

Line 82: Whole-rock analysis is also technically more complicated, time-consuming and expensive compared to glass analysis by microanalytical techniques.

Line 83: not only lateral variations; crystal/glass in tephra layers are often vertically/temporally variable.

Line 165 and the above description of the database and web interface:
This is great web tool! I really like it. However, the authors may want to check the data and web output more thoroughly. For example, for randomly selected sample #TSdU, the output table contains wrong original totals (117% etc.). Supplementary table is correct.

Apparently, the 100%-normalized data in the web tables and supplementary table to this manuscript does not account for the substitution of halogens for oxygen, though it is said in the heading line of the supplementary table. Minor thing but better do it or explain clearly that Cl, F and S were not included in normalization and this is deviation from the recommended by Wallace et al. 2022 procedure.

Presumably, the authors did quality checks before entering this data into database. Or not? Was there any screen based on the values of original total? Do authors believe that totals as low as 90% and less are real, that is, due to glass hydration? One of the samples in Supplement has original total of 58% - check it.

Line 277: Please, clarify that grain-specific SiO2 was applied only to samples with heterogeneous composition (as explained below). What was criteria of "heterogeneous composition"? SiO2 range?

Line 296: Was Ca by LA-ICP-MS compared with Ca from EMPA data to monitor potential contamination by mineral phases? In general, how precisely was Ca content reproduced by LA-ICP-MS?

This is unfortunate that some more major/minor elements were not analyzed (Ti, Na, P etc.); this precludes rigorous analysis of the data quality and screening out of contaminated data.

After having a quick look at the data, I suggest that some variations of trace elements can be compromised by contamination during laser ablation. As an example, let us look at the composition #TIB4-TEPH1. Major elements are relatively homogeneous with SiO2 range of 76.5-78% with only one obvious outlier having Na2O=1.5%. Trace elements were calculated using sample-averaged SiO2. The trace element and also Ca concentrations are quite variable (~2x variations, 2 points have very contrasting compositions). How the authors can prove that these variations reflect heterogeneous glass composition and do not result from contamination by mineral phases during laser ablation? Another example, analysis #52.4-PAG17.2/008-12 with high Ca and Sr, which is very likely contaminated by plagioclase during analysis.

I should mention that this is a common problem of all studies which do not analyze major elements by LA-ICP-MS. Perhaps, the authors can write a kind of disclaimer that some contaminated data may be present in the database and should be used with caution.

Line 309: One standard deviation or two? Two SD (or RSD) should be reported that corresponds to ~95% probability.

Line 340: “Crypto” refers to invisible tephra layers, disseminated in host sediments/ice.

Line 428: This is unclear why the legacy data for sample #2-3-5-2, which are not supported by standard measurements, are included in the database. I suggest to delete all questionable data from the database. This will increase the database value, consistency and reliability.

Line 453: As most of the samples are rhyolites, many trace elements behave as rather compatible elements due to strong partitioning into major and accessory mineral phases: Zr-Hf, U in zircon, Sr in plagioclase, Rb, Nb, Cs, Ba in biotite, Ba, Sr is sanidine, LREE in apatite and allanite, HREE in garnet and amphibole. Thus, the argument for using trace elements should be reformulated.

Figure 4. Lead should be placed between Ce and Pr on spider-diagrams if the elements are ordered according to their incompatibility in basaltic systems. Then, the subduction-related Pb enrichment will be seen better.

In plots 4 (f-i), what is shown by black symbols placed between 1 and 2?

Line 501: It is clear from the above that CG1, CG2 and CG9 are not “layers” but “groups of tephras of similar composition”.

Line 540: Perhaps I missed some text but would it be possible to identify volcanic sources of some tephras and give this information in separate chapter?

Maxim Portnyagin

Kiel, 16-01-2026