**Microprobe analysis of glass shards**

**Measuring and reporting analytical accuracy and precision**

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Any quantitative geochemical analysis has an associated level of accuracy and precision, assessment of which separates a quantitative from qualitative analysis. Accuracy and precision are associated with the quality of the calibration for a given element, the count rate and associated counting statistic error, and well as other factors. Determining the analytical accuracy and precision are a key part of a quantitative analysis process.

Assessment of analytical precision and accuracy for electron microprobe analyses of glass shards in tephra samples is a first critical step to assessing geochemical correlations among tephra layers as well as to source volcanic centers. Precision and accuracy may both be determined through analysis of reference materials (secondary standards) as unknowns, during every analytical run on the electron microprobe. Accuracy may be assessed by comparing the average value, measured on one or more reference materials, for each element to the certified, or accepted, value for the same reference materials, and precision may be determined by comparing standard deviation for measurements of reference materials. Analytical precision may be measured within a single analytical run, or could also be assessed across multiple analytical runs, if the same reference materials were run in both. Use of the same reference material at multiple microprobe labs can allow analyses from different laboratories to be quantitatively assessed and compared.

Examples of glass reference materials of many chemical compositions are presented in Table 1. Best practices would recommend that electron microprobe laboratory make a mount (standard block) that contain a range of compositions of reference material glasses. Or, if an individual researcher plans to do glass analyses at more than one microprobe lab during a project, they may choose to prepare a personal reference material block used in the different labs. The composition of reference materials analyzed during a given run should provide as close a match as possible to the unknown glasses to be analyzed.

The following protocol is suggested for analysis of reference materials:

1. Choose a suitable number of reference materials that are compositionally close to the unknown glasses to be analyzed. For instance if rhyolitic glass is being run as an unknown, rhyolite VG568 and alkaline glass KN18 could be selected. We would suggest choosing at least 2 glass reference materials for each analytical run.
2. Run 4 points on each reference material at the beginning off the run, and 4 at the end of the run. If the run is going to be longer than 12 hours, consider running 4 points on each reference material (every 8-10 hours).
3. Examine the reference material compositions from a given run to assess whether or not any drift exceeding an acceptable percentage has taken place during the run.
4. When compiling data for a given project, aggregate all of the data for each reference material in the data spreadsheet, with analysis dates associated with each analysis.
5. Calculate the mean and standard deviation for each reference material, and prepare a table including this information as well as the certified, or accepted, composition for the reference material (see example in Table 2). When reporting analytical precision in a paper, for a given element select the reference material which has a composition that is most similar to the unknown glass.