Glass geochemistry of the set B Castle/Pine Creek tephra beds at Mount St. Helens, Washington State

JR Harvey[a], and BJ Jensen[a]

[a] Earth and Atmospheric Sciences, University of Alberta, AB, Canada

Mount St. Helens is one of the most active and historically dangerous volcanoes in North America. Its hazardous background and unique eruption history have inspired researchers to study the volcano's past in order to better predict future behaviour. However, the eruptive history of Mount St. Helens has been determined largely through general stratigraphy, mineralogy, and whole-rock geochemical analysis. Although these methods are valid and informative, we can also use the glass geochemistry of tephra to differentiate units more precisely than other methods such as whole-rock geochemistry. Glass geochemistry has been selectively applied to some eruptive sets but is heavily under-utilized in developing an understanding of Mount St. Helens eruption history and magmatic processes.

Set B is a series of interbedded ash, scoria, and pumice beds that were deposited in the Castle Creek/Pine Creek periods (~1700 to 3000 years B.P). Set B is important because it represents the first event where St. Helens had erupted basalts to the surface, in addition to andesitic and dacitic tephra that were all deposited within a relatively short time frame. This tephra set's stratigraphy is based entirely on mineralogical variations between units, with very little bulk, and no glass, geochemistry. Here we have mapped three exposures of set B around Mount St. Helens, and collected glass geochemical data on scoria and pumice samples from four main tephra units of set B. Through this process, we were able to clearly differentiate the four layers, including Bh and Bo which are visibly indistinguishable from each other in situ. Furthermore, we used the precision of the glass geochemical data to differentiate sub-units within some of the layers, which were previously grouped together as one unit. This adds another level of information that can be used to interpret the eruptive set.

The glass geochemistry of the set B tephra beds allows us to reliably differentiate its layers and revise the classifications of the layers given by previous studies. As no set B glass data has been published in the past, we present a foundational dataset to be used in association with prior stratigraphic and mineralogic records to further our understanding of Mount St. Helen's eruptive behaviours. In addition, this dataset can contribute to tephrochronological studies by providing proximal reference data that can correlate to previously unidentifiable distal tephra beds.

Corresponding author: jharvey1@ualberta.ca