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Pre-eruptive Magma Evolution of the ~6.7 ka BA Tephra, Mount Baker, WA: Insights from Lake Core Stratigraphy and Crystal Chemistry

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The ~6.7 ka BA tephra represents the most recent explosive magmatic eruption of Mount Baker, an intermediate arc stratovolcano in the northern Cascade Range. In this study, we analyzed high-resolution lacustrine core records from small alpine lakes and bogs northeast and southwest of the vent, which preserve undisturbed, stratigraphically continuous tephra layers. Our goal is to update and refine previous petrologic interpretations [1] and to reconstruct the eruptive sequence and pre-eruptive magmatic evolution of the BA tephra within a stratigraphic context.

We assessed the physical and geochemical changes across the deposit using a combination of SEM-EDS, EPMA, and LA-ICP-MS, with a focus on characterizing phenocryst populations (plagioclase, pyroxene, and olivine) and matrix glass compositions. Our analysis identified two main co-crystallizing assemblages: 1) an assemblage with plagioclase, orthopyroxene, and clinopyroxene consistent with crystallization of a single liquid evolving from trachy-andesite to trachy-dacite that is in agreement with previous work, and 2) a newly identified assemblage with olivine and clinopyroxene indicative of crystallization from a basaltic or basaltic andesitic liquid. Notably, the matrix glass chemistry and mineral abundances of both co-crystallizing assemblages change little over the course of the eruption, despite evidence for numerous individual paroxysms in the lake core stratigraphy. Outstanding questions remain about the physical and chemical relationships of the magmas that produced the co-crystallizing assemblages. This work provides new constraints on how the evolution and interaction of magmas in the crust may influence eruptive behavior at Cascade Arc volcanoes, and new insights into the plumbing system beneath Mount Baker during its most recent explosive eruption.

[1] Aughenbaugh, K. (2025), Pre-eruptive storage conditions and initiation mechanisms for the most recent explosive magmatic eruption of Mount Baker, northern Cascade volcanic arc, USA, M.S. Thesis, Western Washington University.