

### Introduction and Setting

The goal of this research project is to compare the TVC deposits according to their proposed correlations using CL imaging in order to determine if there is a shared history recorded in the quartz and plagioclase feldspar growth zoning. The 780-km³ Tumalo Volcanic Center (TVC) is in central Oregon between the city of Bend and the Three Sisters volcanoes. It consists of mid-to-late Pleistocene intermediate-to-acidic lava and explosive deposits. The TVC has produced three large pyroclastic deposits (Hildreth, 2007): (1) Desert Spring Tuff (~650 ka), dacitic, welded, pink and tan tuff (2) Tumalo Tuff/Bend Pumice (~300-440 ka), rhyolitic pyroclastic flow airfall deposits (3) Shevlin Park Tuff (~260 ka), a mixed andesitic tuff. The source vent locations and magmatic origins of these events are not well known. Desert Spring Tuff (~650 ka), a dacitic welded pink and tan tuff; the source vent location is unknown. Shevlin Park Tuff (~260 ka), an andesitic tuff; the source vent location is unknown. Tumalo Tuff/Bend Pumice (~300-440 ka), rhyolitic pyroclastic flow airfall deposits; the source vent location is unknown. Shevlin Park Tuff (~260 ka), an andesitic tuff; the source vent location is unknown. The source vent locations and magmatic origins of these events are not well known.

Cathodoluminescence (CL) is created by the interaction between an electron beam and a solid. CL images show the growth textures of crystals. Zoning occurs due to an inconsistent environment in which a crystal grows (Barbee, 2020). Cathodoluminescence (CL) is created by the interaction between an electron beam and a solid. CL images show the growth textures of crystals. Zoning occurs due to an inconsistent environment in which a crystal grows (Barbee, 2020).

### Methods

- Examined thin sections from each of the three large pyroclastic deposits, as well as, from the minor tephra units to identify quartz and feldspar crystals.
- Used the JEOL JSM-IT500HR scanning electron microscope (SEM) and Deben Centaurus cathodoluminescence (CL) detector at Denison, to image the thin sections.
- The images collected were analyzed for similarities using Photopea and ImageJ software.
- Examining thin sections from each of the three large pyroclastic deposits, as well as, from the minor tephra units to identify quartz and feldspar crystals.
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### Observations of Potential Correlations

- Desert Spring Tuff → Bearwallow Butte
- Tumalo Tuff, Bend Pumice, & Tumalo Tuff/Bend Pumice Contact → Three Creek Butte & Melvin Butte
- Desert Spring Tuff/Bend Pumice Contact → Tumalo Tuff, Bend Pumice, & Tumalo Tuff/Bend Pumice Contact
- Shevlin Park Tuff & Columbia Canal Pumice → Triangle Hill
- Shevlin Park Tuff & Columbia Canal Pumice & Tumalo Tuff/Bend Pumice Contact → Shevlin Park Tuff & Columbia Canal Pumice

### Discussion

- Bearwallow Butte and Desert Spring Tuff are lack shared zoning and characteristics. However, within each crystal set, there is distinct zoning, which suggests correlation. While the zoning in both Bearwallow Butte and Desert Spring Tuff crystals show that the crystals have gone through a complex history, it is hard to tell if they share the same complex history. Correlation: Inconclusive
- Crystals from the Tumalo Tuff/Bend Pumice unit are distinct from the crystals from Bend Pumice and Tumalo Tuff individually, hinting at unique history for these crystals. However, given that the crystals from Bend Pumice, Tumalo Tuff, the Bend Pumice/Tumalo Tuff contact area, Three Creek Butte and Melvin Butte do not share many characteristics, it is hard to definitively say whether they correlate. Three Creek Butte and Melvin Butte have similarities of CL texture and zoning. Correlations: Bearwallow Butte & Desert Spring Tuff; Inconclusive, Melvin and Three Creek Buttes: Likely correlated.
- In ambiguous whether Shevlin Park Tuff, Columbia Canal Pumice and Triangle Hill correlate. Triangle Hill exhibits 3 populations of textures, one of which is shared with the Shevlin Park Tuff. The variety in the Triangle Hill crystals could be related to different events which correlate to Shevlin Park Tuff and Columbia Canal Pumice. Correlation: Inconclusive but suggestive.

In the future, I plan to create elemental maps on the SEM of the samples in order to determine whether there is specific compositional variation in zoning within the crystals. Completing elemental mapping will help us clarify the correlations between the pyroclastic deposits and their potential origins.

### References


