Investigating Cascade Magmatism Through Dating and Chemical Analysis of the Hatchet Mountain and Pe Ell Formations, SW WA

Robyn Organ
*University of Puget*, rorgan@pugetsound.edu

Jeffery Tepper
*University of Puget Sound*, jtepper@pugetsound.edu

Wesely Von Dassow
*Washington Geologic Survey*

Tabor Reedy
*Washington Geologic Survey*

Follow this and additional works at: [https://soundideas.pugetsound.edu/summer_research](https://soundideas.pugetsound.edu/summer_research)

Part of the [Geochemistry Commons](https://soundideas.pugetsound.edu/summer_research), [Geology Commons](https://soundideas.pugetsound.edu/summer_research), and the [Volcanology Commons](https://soundideas.pugetsound.edu/summer_research)

**Recommended Citation**
Organ, Robyn; Tepper, Jeffery; Von Dassow, Wesely; and Reedy, Tabor, "Investigating Cascade Magmatism Through Dating and Chemical Analysis of the Hatchet Mountain and Pe Ell Formations, SW WA" (2019). *Summer Research*. 356.
[https://soundideas.pugetsound.edu/summer_research/356](https://soundideas.pugetsound.edu/summer_research/356)

This Article is brought to you for free and open access by Sound Ideas. It has been accepted for inclusion in Summer Research by an authorized administrator of Sound Ideas. For more information, please contact soundideas@pugetsound.edu.
Investigating Cascade Magmatism Through Dating and Chemical Analysis of the Hatchet Mountain and Pe Ell Formations, SW WA

Robyn Organ, Jeff Tepper, University of Puget Sound, Wesley Von Dassow, Tabor Reedy, Washington Geological Survey

Abstract

Modern Cascade arc magmatism began ~45 Ma creating the Goble Volcanics (GV) / Hatchet Mountain Formation (HM), the Pe Ell Formation (PE), and scattered unnamed basalts (UB) some of the earliest expressions of the modern arc (Fig. 1). I analyzed 2 samples from PE, 14 samples from HM, and 9 samples from UB all collected in SW WA (Fig. 1, 2) both chemically, isotopically, and in thin section.

Goals of the study:
1. To determine the elemental and isotopic compositions
2. To identify any differences between HM and GV
3. And to examine the evolution of the arc and the conditions of eruption.

My data suggest that magmatism was occurring in the forearc region and originated at temperatures and pressures associated with asthenospheric mantle.

Characteristics

- Compositions are fairly mafic, UB and PE samples are basaltic, GV and HM range from basalt to dacite (Fig. 3)
- Spidergram trendlines show arc characteristics for GV and HM, and OIB characteristics for UB and PE (Fig. 4)
- Units range from tholeiitic to calc-alkaline (Fig. 3)

Compositional Diversity

- Some UB are rich in Mg similar to Wolf Point (Fig. 7)
- UB experienced moderate REE fractionation and have an OIB source (Figs. 8-9)
- PE and UB most likely have garnet in their sources (Fig. 9)
- Applying a thermobarometer to UB magmas yields $T = 1572-1590°C$ and $P = 3.5-4.2$ Gpa correlating to a depth ranging from 105-126 km
- Isotopic data show that PE and UB have a crust like source while GV and HM originated from depleted mantle (Fig. 10)

Comparison to Goble

- HM and GV are chemically similar (Fig. 3,7)
- There is no statistically difference in trace or major elements
- They have similar mantle wedge sources (Figs. 4 and 10)
- Mapped continuously from GV into HMF

Field Summary

- All rocks were emplaced subaerially as lava flows, ash flows, and lahars
- Platy jointing may reveal eruptive centers(Fig.3)

Conclusions

- HM and GV are chemically similar should be considered the same unit
- PE and UB originated from OIB sources with garnet
- UB had more garnet in its source and originated from asthenospheric mantle suggesting a slab gap. (Fig. 11)

Acknowledgments

I would like to thank the Weyerhaeuser Company, the Washington Geologic Survey, and the University of Puget Sound. Funding for this project was provided by the Mellam Scholar research award.