May 8th, 11:00 AM - 1:00 PM

# Textural Investigation into Rapid Welding Transitions in the Tuff of Leslie Gulch along Succor Creek at the Mahogany Mountain-Three Fingers Rhyolite Field, Southeastern Oregon

Alicia J. Martinez-Garling
*Portland State University*

Martin J. Streck
*Portland State University*

# Textural Investigation into Rapid Welding Transitions in the Tuff of Leslie Gulch along Succor Creek at the Mahogany Mountain-Three Fingers Rhyolite Field, Southeast Oregon

Alicia J. Martinez-Garling (alic24@pdx.edu) and Martin J. Streck (streckm@pdx.edu)

Department of Geology, Portland State University

SCAN HERE FOR SOME GEOLOGY TERMS

## Abstract

The Mahogany Mountain-Three Fingers Rhyolite Field (MM-TFrf), a significant mid-Miocene rhyolite field associated with Columbia River flood basalts, encompasses the Mahogany Mountain caldera in southeastern Oregon. Previous studies by Vander Meulin (1989) suggested two distinct units, the tuff of Leslie Gulch (LGT) and the tuff of Spring Creek, originating from separate eruptions. However, Benson and Mahood (2006) challenged this view, proposing a singular ignimbrite event at 15.8 Ma. Discrepancies persist regarding the calderas sourcing these tuffs, prompting a reevaluation of the Mahogany Mountain—Three Fingers Rhyolite Field's geologic history.

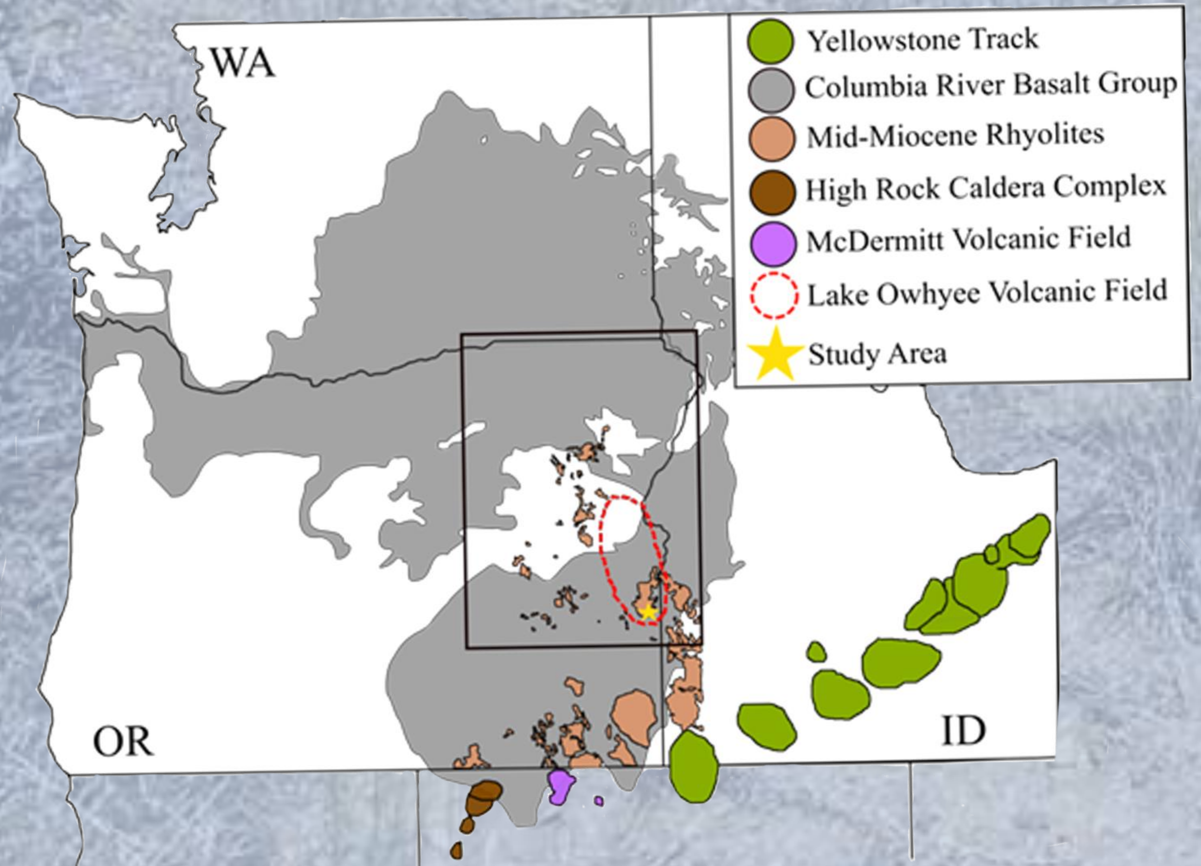
This research focuses on the tuff of Leslie Gulch, aiming to unravel the textural differences in pyroclastic particles between welded and non-welded tuff formations. Through detailed petrographic examinations, we explore the stages of transformation during the deposition of the pyroclastic tuff, elucidating the dynamic volcanological and magmatic processes influencing the development of welded and non-welded tuff units within close vertical and lateral proximity.

## Geology Overview and Location

Silicic volcanism during the Mid-Miocene, coinciding with the primary phase of the Columbia River magmatic province, is extensive and is believed to result from bimodal volcanism associated with the interaction of the Yellowstone mantle plume with the North American continental lithosphere

Tholeiitic magmas, originating from the mantle plume, assimilated continental crust within a centralized magma reservoir system between the North American craton and accreted terranes of Idaho and Oregon

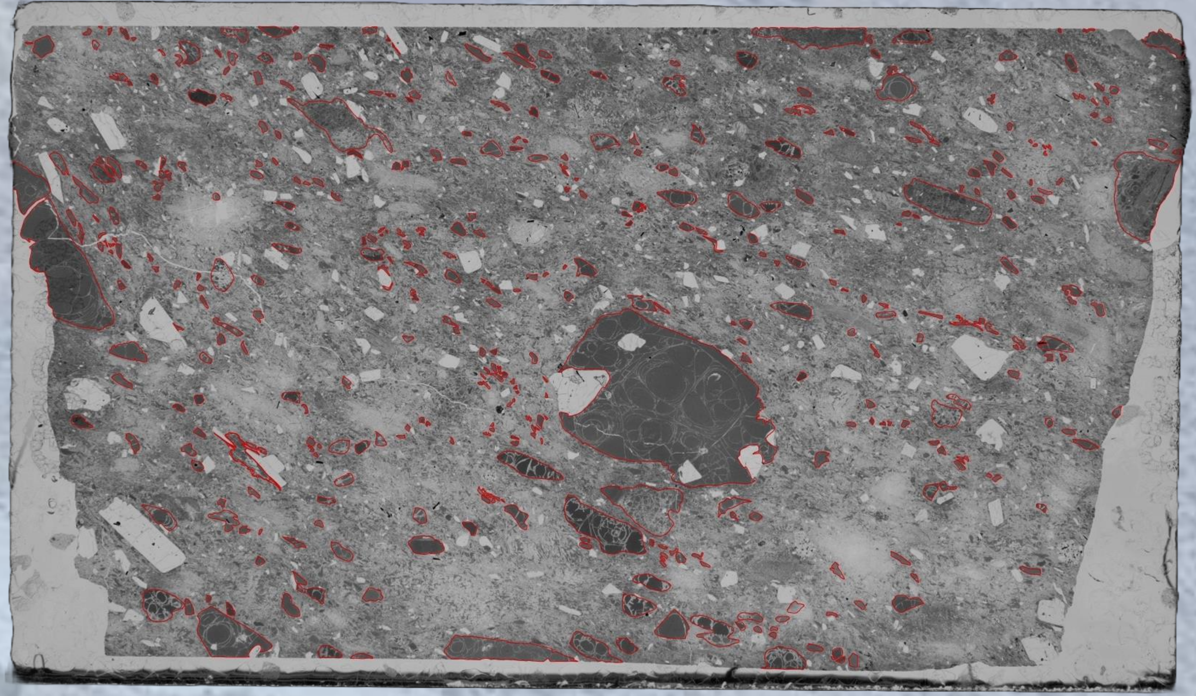
This interaction led to eruptions of mafic lavas and voluminous tholeiitic flood basalt from dike swarms in eastern Oregon, eastern Washington, and western Idaho.

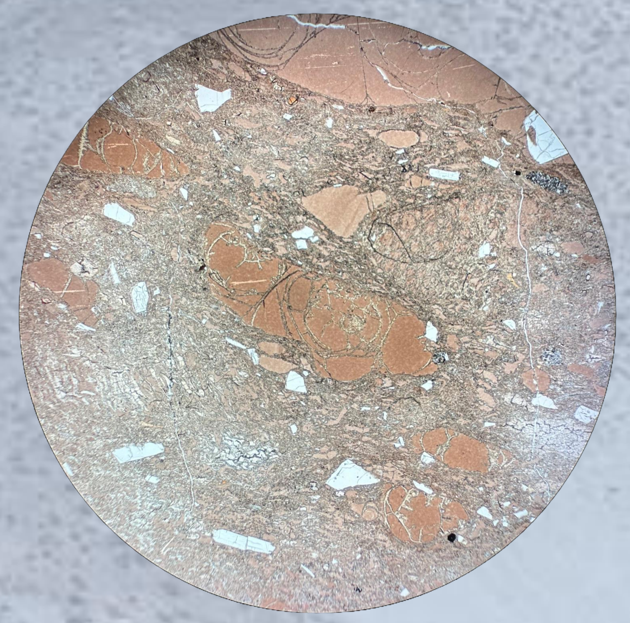


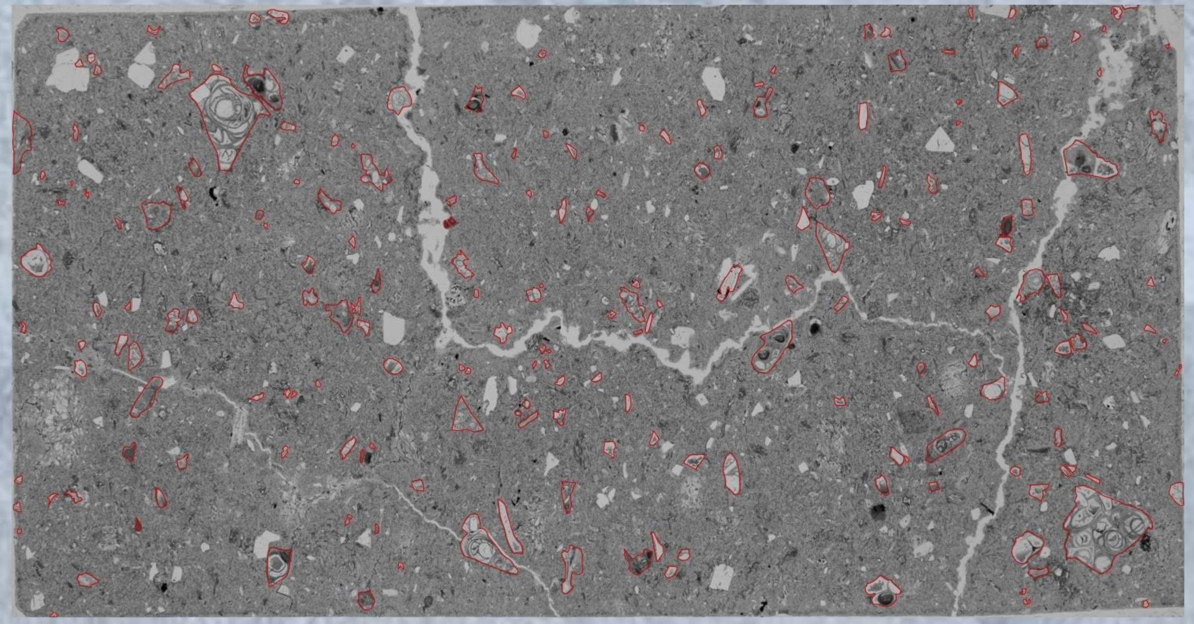

## Methods and Results

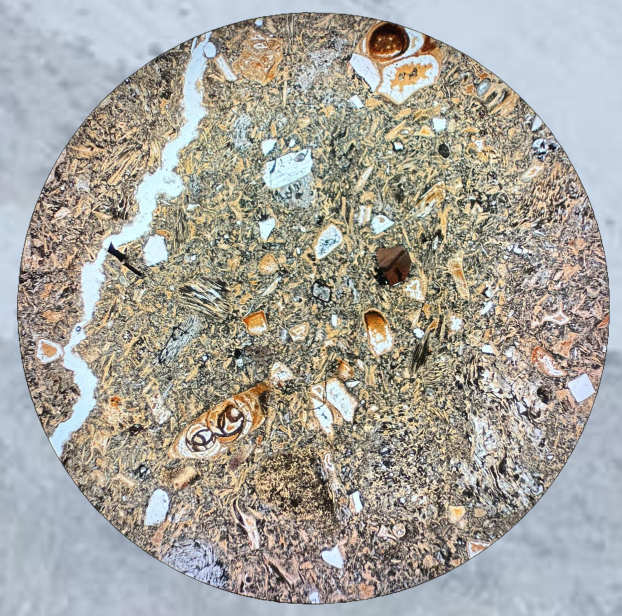
My investigation predominantly relies on petrographic data acquired through light microscopy techniques, enabling a thorough examination of thin sections. Thin sections to be used are those prepared by the study of Cassandra Black and new ones to supplement the existing collection.

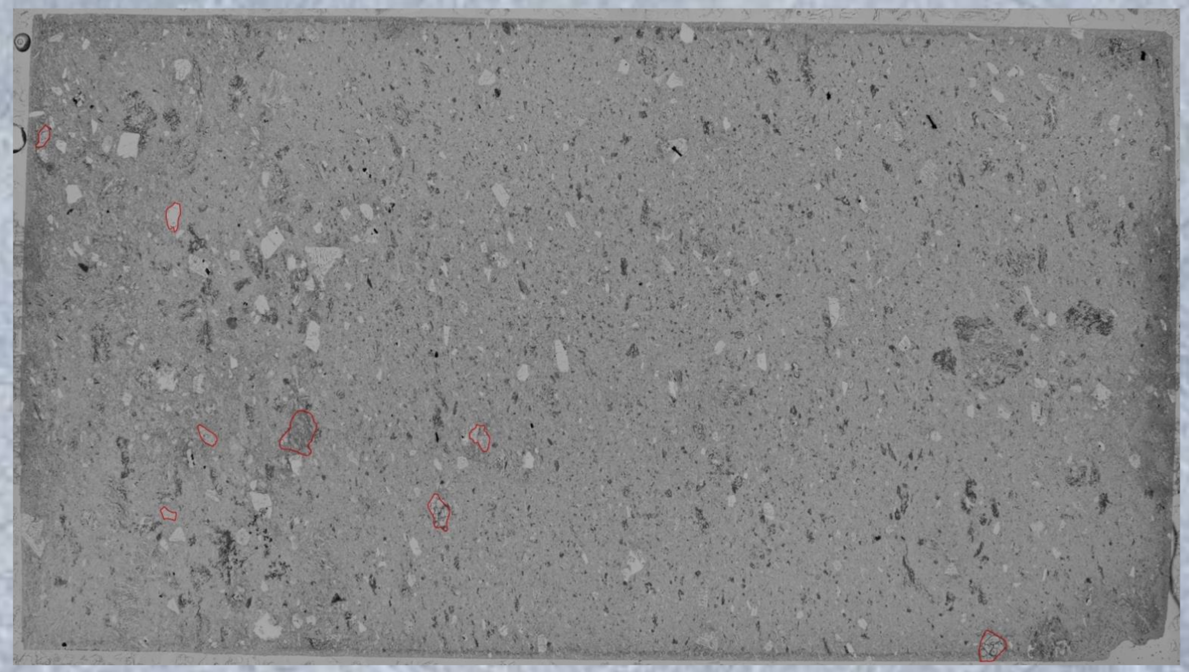
The microscope facilitates a detailed observation of pyroclastic grains, their boundaries, and any observable alterations or deformations. Focus will be given on size, vesicularity, and shape of pyroclastic fragments. Although the welding process will have altered some of the original features, one can typically reconstruct if a particle was vesicular or non-vesicular, how large, and whether angular or round.

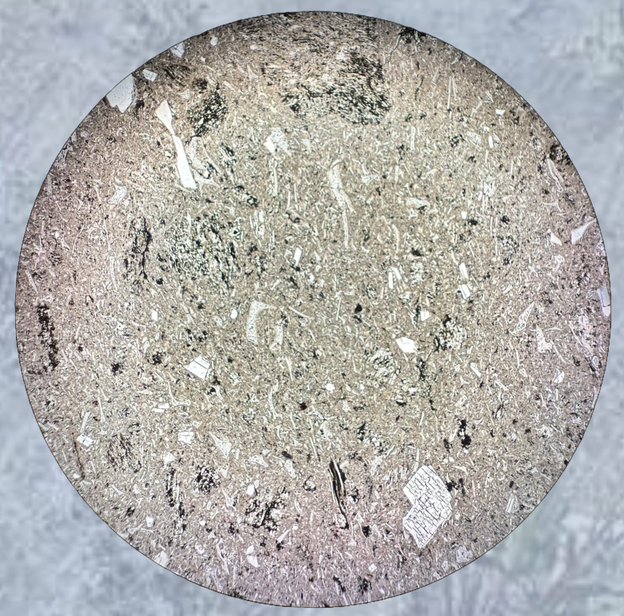

A welded Ignimbrite, sample CB-19-67




A partially welded Tuff, sample CB-19-69




A non welded Tuff, sample CB-19-68b



As each sample becomes less welded, the glass shards become more rounded in shape, which indicates a process called degassing.

During volcanic eruptions, gases, such as water vapor, carbon dioxide, and sulfur dioxide, are released from the molten magma. When these gases escape, they can cause bubbles to form within the magma. As the magma cools and solidifies, these bubbles can get trapped within the rock, creating voids or vesicles. The formation of vesicles can lead to the rounding of glass shards within volcanic rocks. As the magma loses gas through degassing, the bubbles within it collapse, causing the surrounding material to deform and the edges of the glass shards to become more rounded.

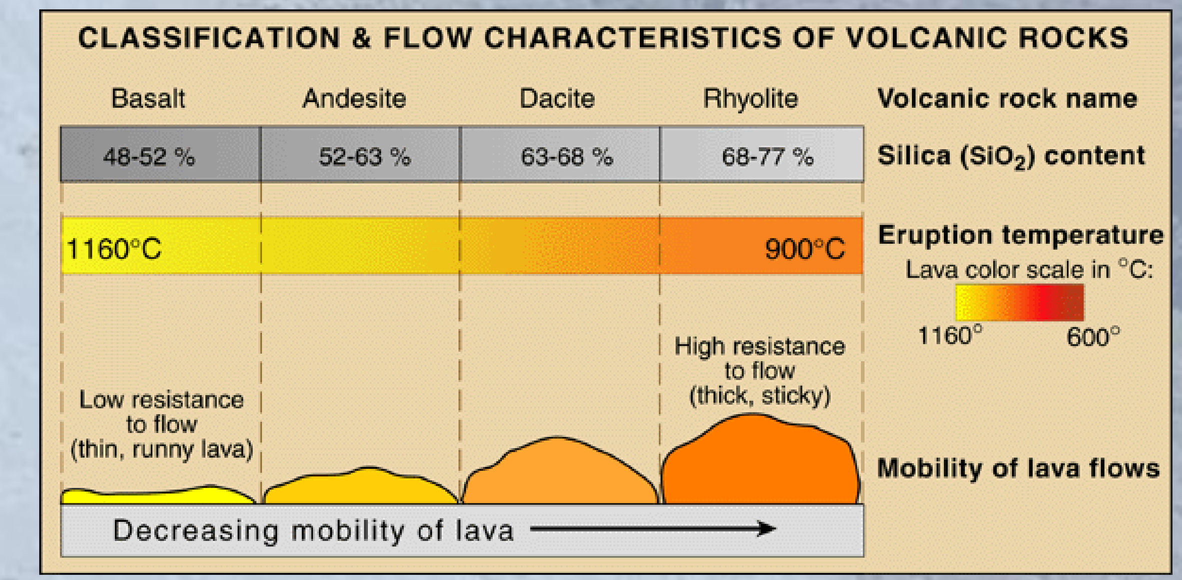
## Conclusion

By examining the textural differences between the welded to non-welded tuff formations, we can gain knowledge on the processes that influenced the deposition as well as the subsequent alteration of the pyroclastic material.

The welded tuff exhibits finer grained, more densely packed pyroclastic particles compared to the non welded sample.

As of right now, the main hypothesis as to why there was such large alteration within a small proximity is due to the degassing that occurs.

In this case, the magma is rhyolitic in composition, meaning it contains a high amount of Silica as well as has a high viscosity.




The viscosity is what tends to trap all the gasses during an eruption. As this happens, the magma ascends and encounters lower pressure conditions, thus forming bubbles. The degree of degassing influences the welding characteristics of rhyolitic tuff. In instances where degassing is rapid and extensive, the resulting tuff may exhibit a more porous and less welded texture due to the presence of numerous vesicles and reduced bonding between particles. Conversely, slower degassing may allow for more complete welding of the pyroclastic material, resulting in denser and more cohesive tuff deposits.

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