



Preliminary Analysis of Volcanic Sediment Sources in Copeland Creek Sonoma County, California.

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Abstract

- Copeland Creek is a small tributary of the Russian River watershed that drains areas underlain by volcanic rocks of the Sonoma Volcanics. This project investigates the volcanic provenance of Copeland Creek sediments through detailed geological mapping and analysis of volcanic material along the channel.
- Field mapping focused on identifying lithologic units, tracking the spatial distribution of volcanic materials, and constraining source regions. Sediment samples were collected at multiple locations outside of Fairfield Osborn Preserve to capture downstream changes in composition.
- Samples were analyzed using grain size measurements and visual identification of lithic fragments, with emphasis on distinguishing volcanic units. The abundance and distribution of volcanic material were quantified and used to construct a provenance map, identifying dominant source areas and trends in volcanic sediment contribution.
- Results highlight consistent volcanic signatures within the watershed and constrain the likely source region to the north of distinct volcanic materials observed in Copeland Creek sediments.

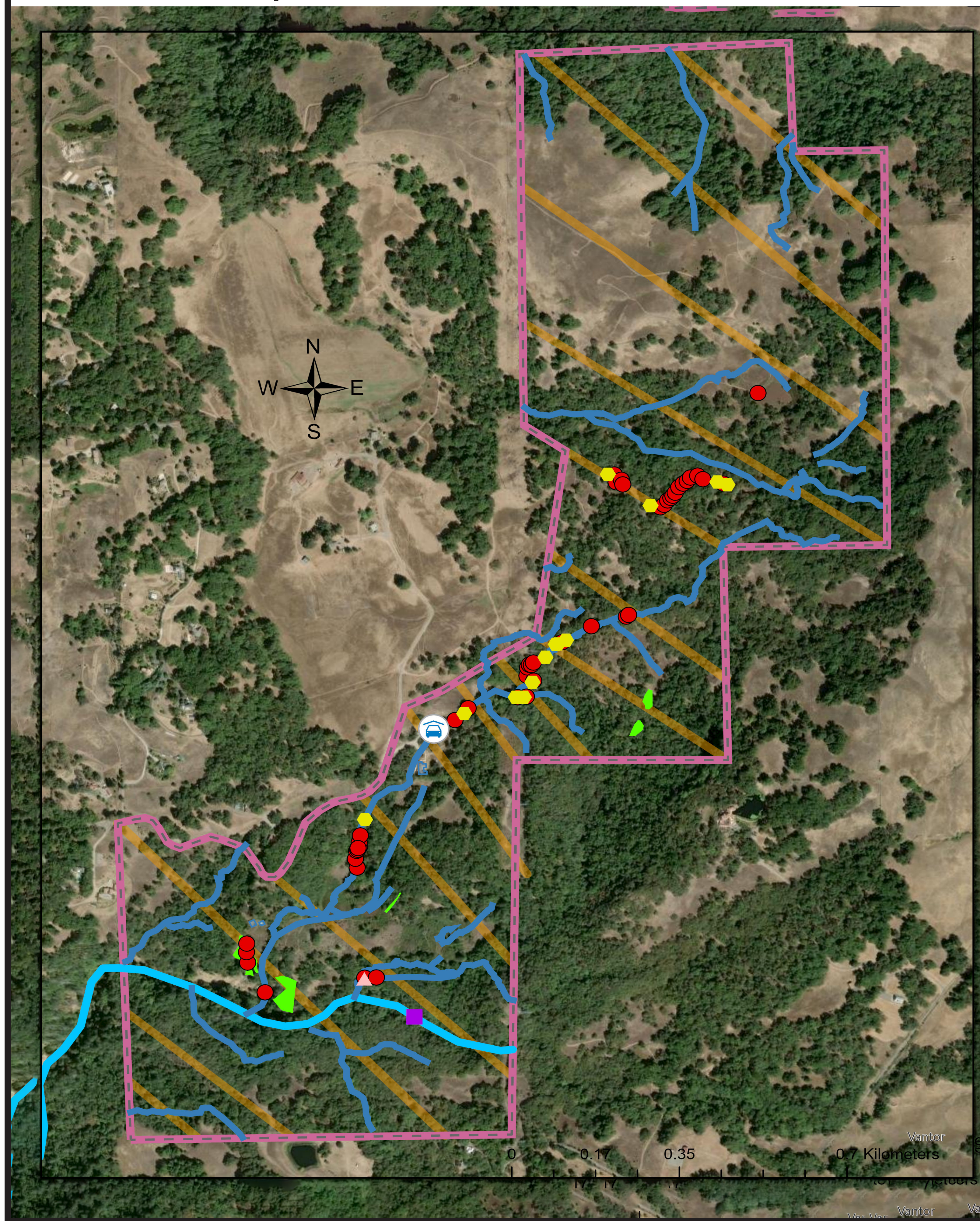
Background

The headwaters of Copeland Creek originate within a large group of varied volcanic rocks known collectively as the Sonoma Volcanics. These volcanic flows then transition downstream (east) into the alluvial deposits of the Santa Rosa plain 2 miles east of Sonoma State University. 2 miles west of SSU, Copeland Creek flows into the Laguna de Santa Rosa and Russian River watershed prior to entering the Pacific Ocean (Allen, 2009). To understand the provenance of sediment within Copeland Creek, a deeper understanding of the Sonoma Volcanics is needed.

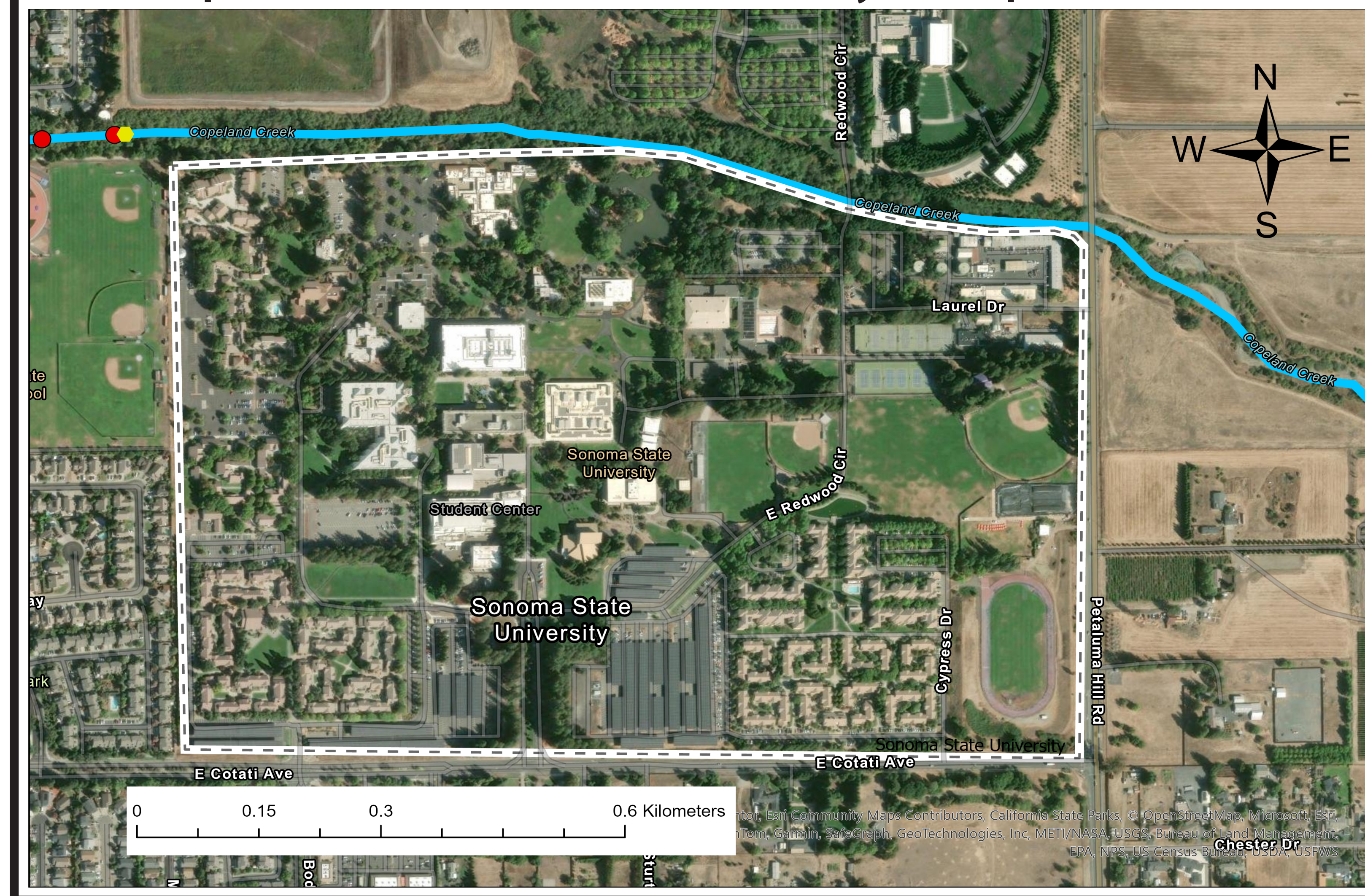
The origin of the Sonoma Volcanics, and its pattern of volcanism younging northward, is due to the formation of a “slab window” behind the northward propagating Mendocino Triple Junction (MTJ) (Mitchell, et al, 2023). The Sonoma Volcanics (and associated volcanic fields such as the Tolay volcanics and Burdell Mtn. volcanics contain a broad spectrum of volcanic rocks, from basalt to rhyolite.

Our field area within the Western Sonoma Volcanics (8.17 ma - 4.1 ma) is characterized by patterns of basalt and rhyolitic units preturbed by active tectonics due to its position on top of an active margin creating faults and landslide deposits. Alluvium and top soil layers contain sandstone, conglomerate and other sedimentary layers much younger than igneous units. Fairfield Osborn Preserve contains several tributaries and a main channel of Copeland Creek. Within Fairfield Osborn Preserve our main basaltic unit precedes a felsic discontinuous unit which contains a perlitic altered hydrated volcanic glass consistently found within landslide deposits.

Map of Fairfield Osborn Preserve



Map of Sonoma State University & Copeland Creek



Legend

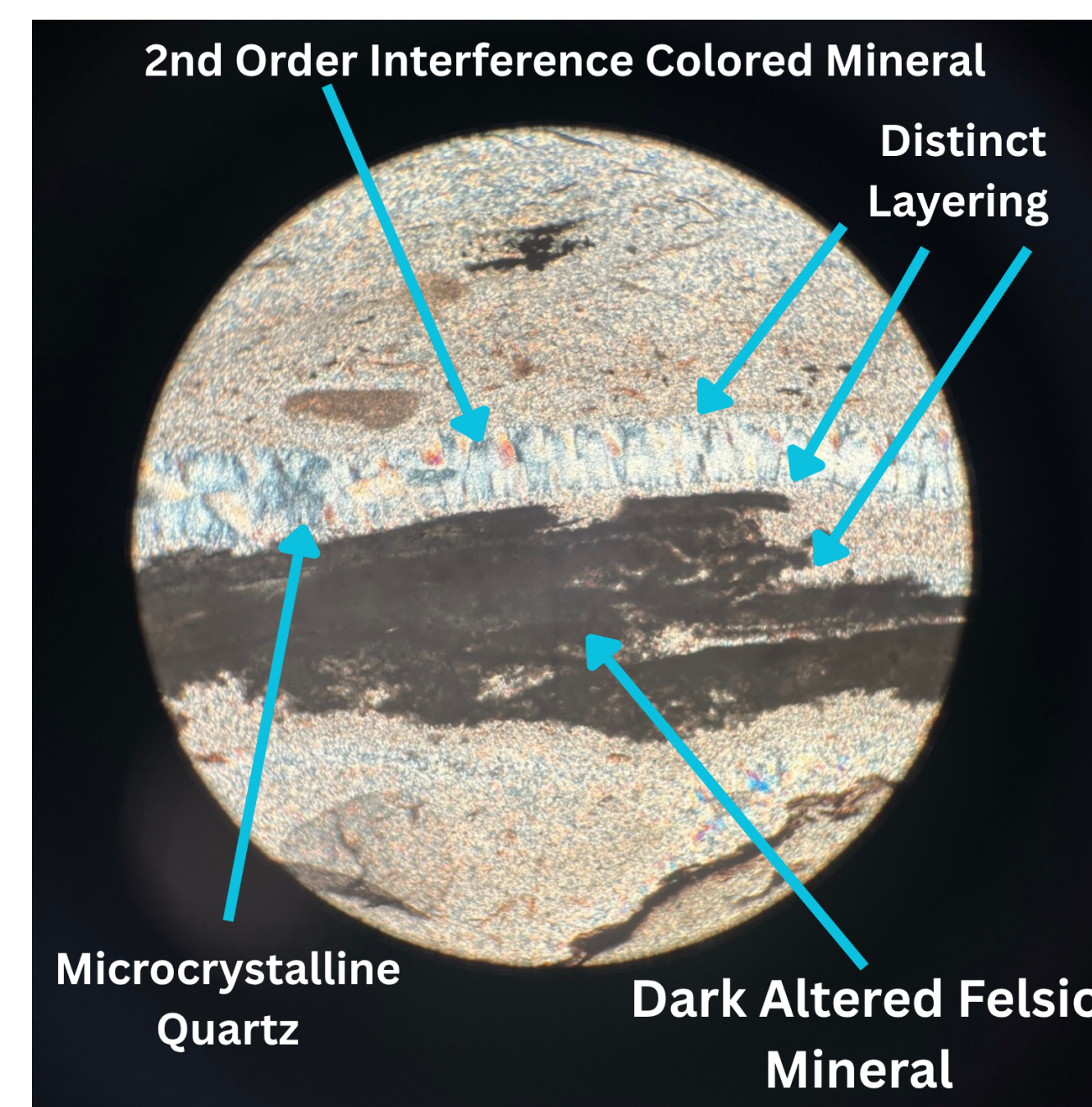
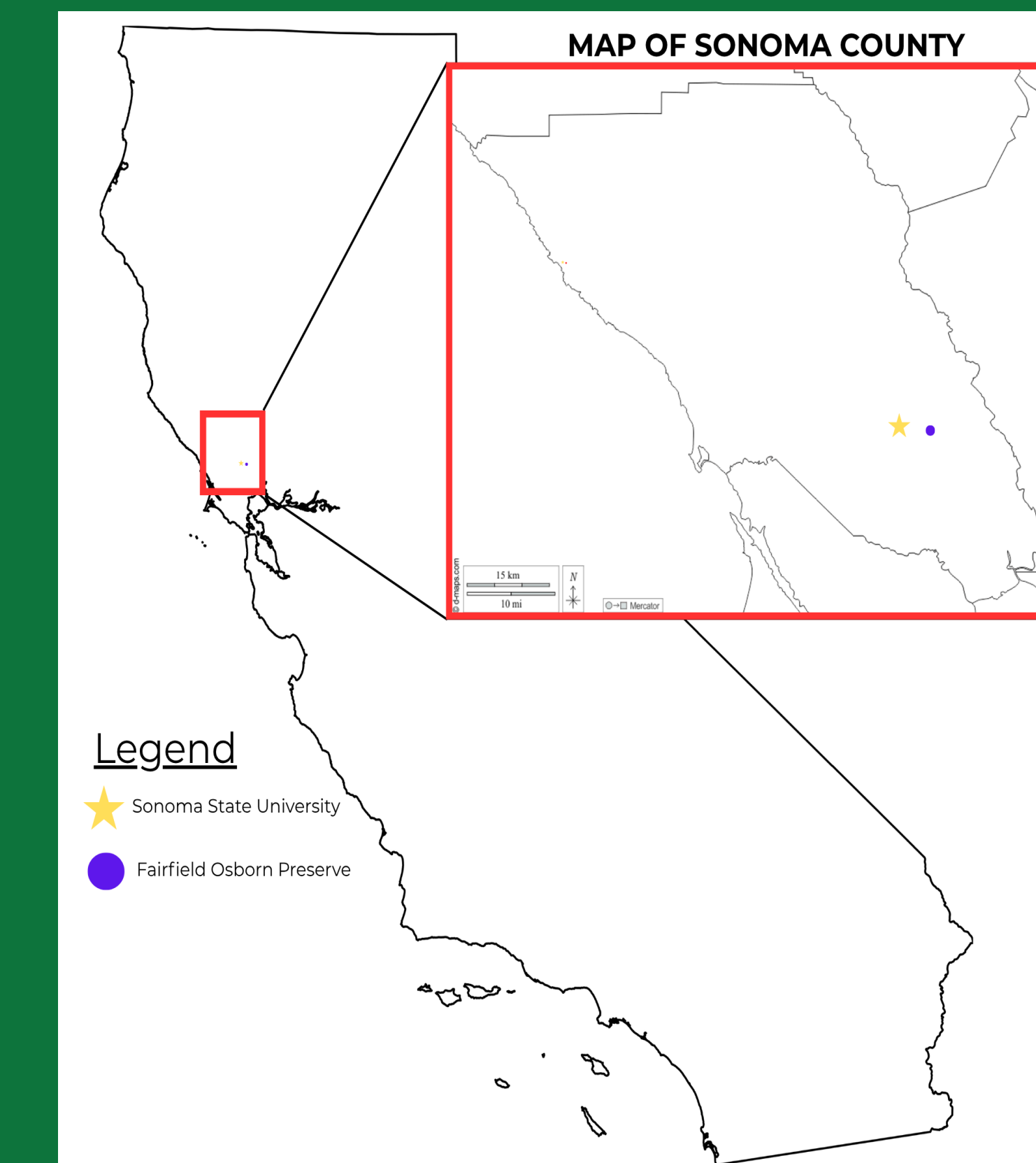
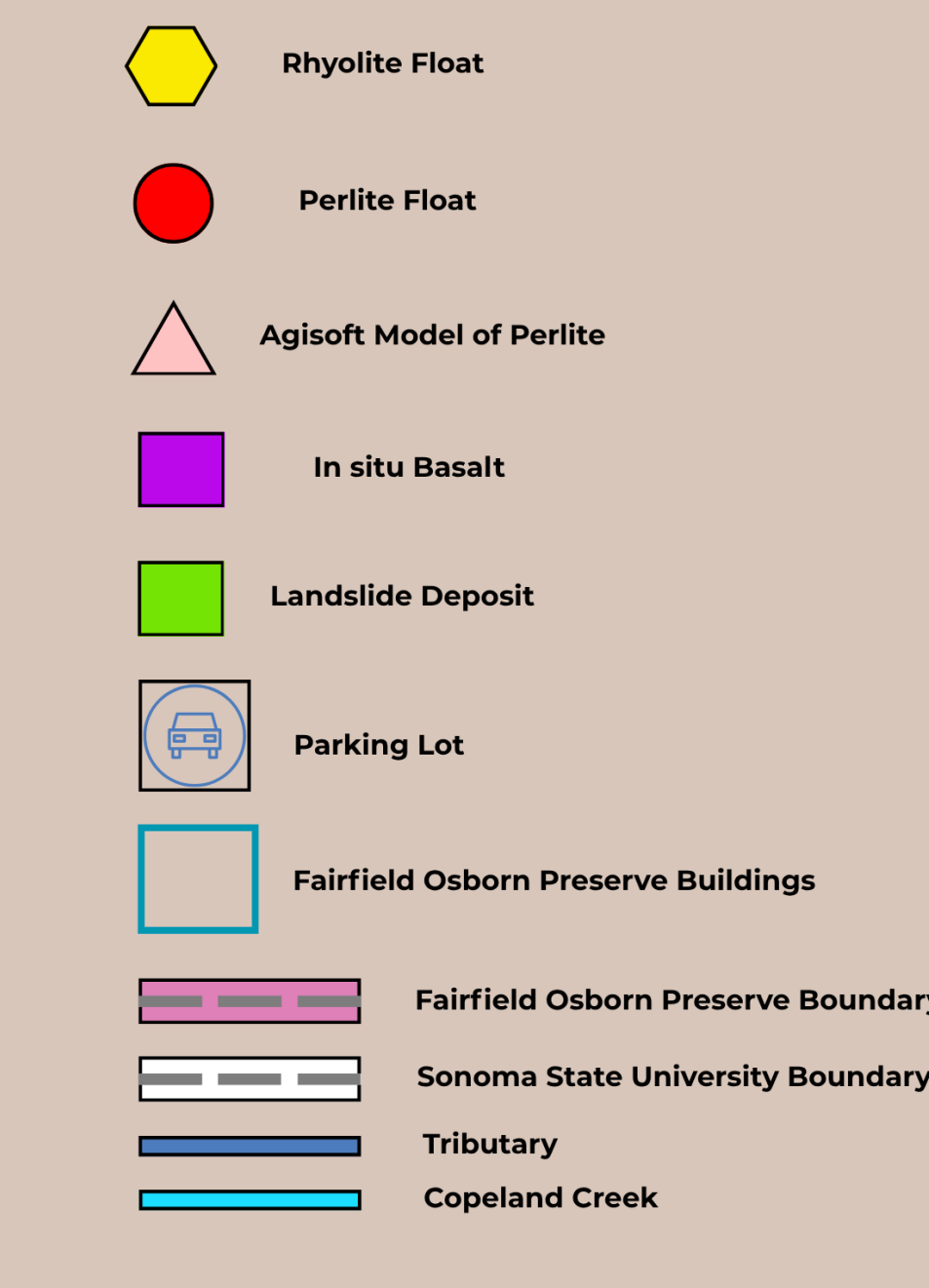


Figure 3. Thin section of Perlite Hydrated Volcanic Glass. The brown band is a felsic mineral. Extinction is undulosed.

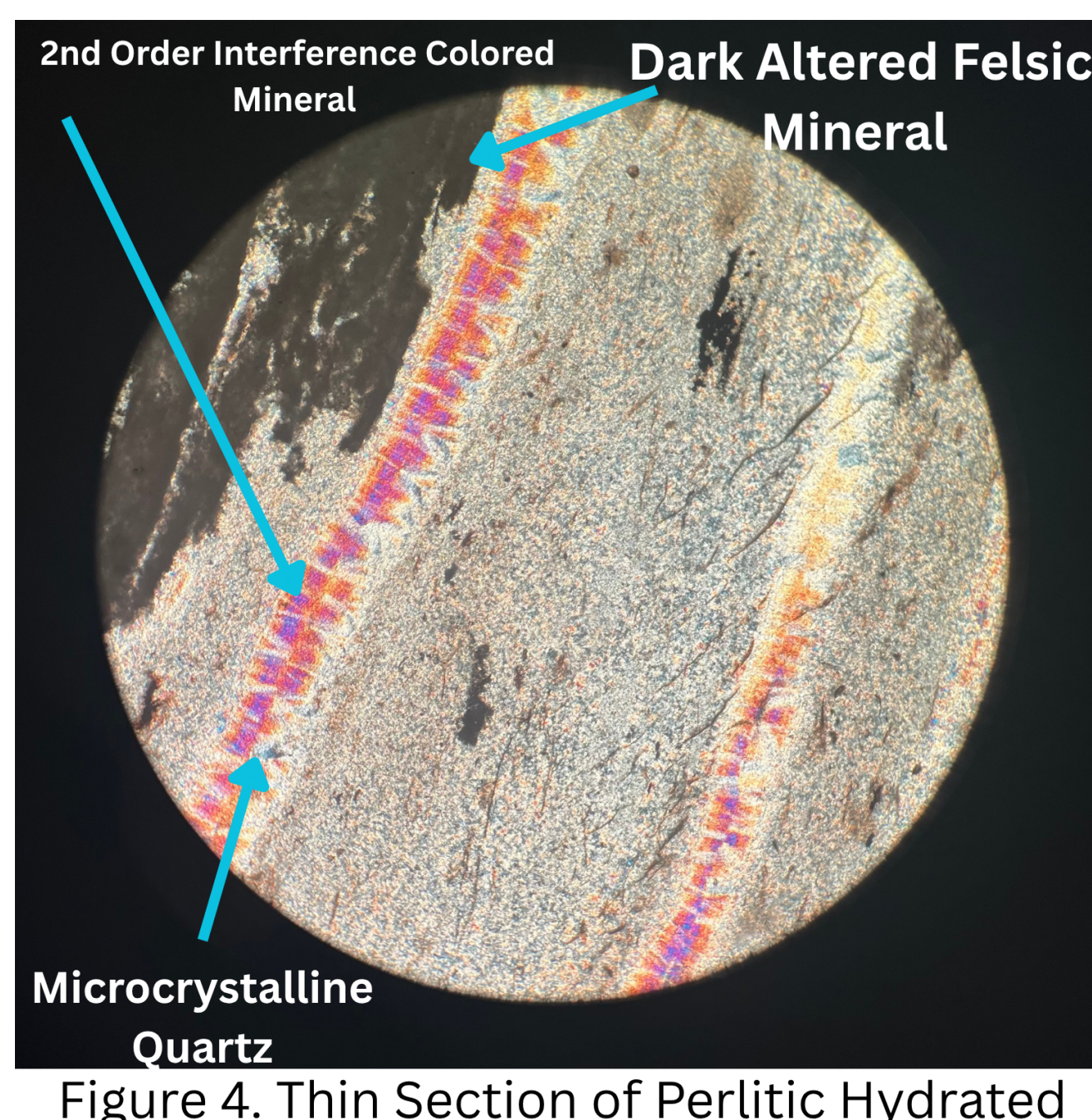


Figure 4. Thin Section of Perlite Hydrated Volcanic Glass. The thin section is rotated and displays. The birefringence is fibrous and a precipitate.



Figure 2. Agisoft Metashape model of largest Perlite hydrated altered volcanic glass found in walls of a riverbed on lower preserve

References Cited

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- Wagner, D.L., Saucedo, G.J., Clahan, K.B., Fleck, R.J., Langenheim, V.E., McLaughlin, R.J., Sarna-Wojcicki, A.M., Allen, J.R., and Deino, A.L., 2011, Geology, geochronology, and paleogeography of the southern Sonoma volcanic field and adjacent areas, northern San Francisco Bay region, California: Geosphere, v. 7, no. 3, p. 658–683, <https://doi.org/10.1130/GES00626.1>
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Discussions

- The Sonoma Volcanics units exposed in-situ within the study area at Fairfield Osborn Preserve are most commonly basalt with some evidence of in-situ rhyolitic tuff and occasional dacite. The vast majority of the field area is covered in Quaternary landslide deposits that conceal the nature of the bedrock geology. In-situ rhyolitic tuff was only documented in one area of the preserve, and it was in a location of considerable outcrop of the volcanic glass deposits that are the central focus of this project. With regard to the volcanic glass deposits, the following characteristics were observed: The perlitic devitrified volcanic glass displays layering that indicates flow, a hardness of 7, and textures showing amorphous glass occupying pore space rather than precipitating. No visible phenocrysts are present.
- The volcanic glass demonstrates a Mohs hardness of approximately 6-7, while the devitrified perlite typically displays a hardness of 3-4.
- No visible phenocrysts have been observed in any sample.
- A diffuse source region for the volcanic glass was identified within Fairfield Osborn Preserve, mostly within landslide deposits adjacent to Copeland Creek.
- Thin section analysis reveals cryptocrystalline quartz and bands of highly birefringent minerals, consistent with devitrified volcanic glass.
- Geological mapping was challenging due to limited exposure and field conditions; however, results were internally consistent across the study area
- A continuous distribution of perlitic, devitrified volcanic glass was identified, occurring higher in the stratigraphic sequence than initially expected.

Summary and Conclusions.

- Areas southeast of the creek and tributary do not source the perlitic volcanic glass and only incise basalt, narrowing the source region to the north.
- A history of mass wasting events, especially landslides, complicates stratigraphic interpretation away from active fluvial systems, but consistent patterns still emerge across the study area.
- Distinct horizontal layering and textural characteristics indicate flow during emplacement and cooling with water. However devitrified perlitic volcanic glass patterns are unique especially for volcanic glass which typically are amorphous
- Unit compositions reflect an evolving volcanic system in which early basaltic units were later infiltrated by groundwater and subsequently overlain by more silicic (rhyolitic to dacitic) flows. While most igneous units follow expected stratigraphic relationships, the presence of perlitic volcanic glass within the felsic unit represents a notable exception. The occurrence of rhyolitic to dacitic units above disturbed basalt suggests a complex volcanic history, likely influenced by nearby fault activity and associated tectonic processes.

Acknowledgements

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