

Preliminary Mapping of Late Miocene to Early Pliocene Volcanic Rocks in Southern Clayton Valley and Implications for the Lithium Enrichment

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The burgeoning lithium district near Tonopah in western Nevada, within the Walker Lane, represents one of the regions in the United States with the greatest potential for future lithium production. These emerging deposits form through the leaching of lithium from volcanic products followed by subsequent concentration in lacustrine basin deposits. The Rhyolite Ridge Formation has traditionally been considered the primary source of lithium in the volcanic sequence, although recent research indicates that the overlying Argentite Canyon Formation also exhibits elevated lithium concentrations. Despite the significance of this lithium district, the processes by which lithium became concentrated in the original volcanic materials remain poorly understood. A key uncertainty in this process is the volcanic source and evolution of the magmas that supplied lithium to the basins.

We present new preliminary geologic mapping southeast of the Silver Peak Volcanic Center in southern Clayton Valley, emphasizing volcanic stratigraphy, eruptive interpretation, and major- and trace-element geochemistry. Our mapping documents a previously unrecognized, continuous stratigraphic transition from Rhyolite Ridge formation rhyolite tuffs and lavas at the base to conformable Argentite Canyon latite and trachy-andesite tuffs and lavas at the top. This succession is not preserved in existing geologic maps west of the volcanic center, suggesting that critical portions of the volcanic record are absent or unexposed in those areas.

These newly mapped units may represent a continuous compositional and temporal transition within a single evolving magmatic system, rather than two distinct volcanic systems as previously interpreted. Additionally, we identify a mingled ash-flow tuff containing pumice clasts of distinct compositions, recording interaction between coexisting rhyolitic and latitic magmas.

Together, these observations suggest a more complex and integrated magmatic system than previously recognized and provide new constraints on the volcanic architecture and processes that contributed to lithium enrichment in the region.