

# Evaluating magmatic storage conditions and the regional tectonic constraints of the Tumalo Volcanic Center, Central Oregon, USA

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The Tumalo Volcanic Center (TVC) is a major but relatively understudied ~700 km<sup>2</sup> geologic area associated with the Cascade arc, located west of the city of Bend, OR, and east of South Sister Volcano. The TVC is composed of intermediate to high silica pyroclastic flows, tephra, and domes and lava flows, totaling at least 30-50 km<sup>3</sup> of erupted material. Located within a complex tectonic region, the TVC resides at the intersection of the High Cascades subduction zone and the intraplate age-progressive High Lava Plains volcanism trend. In addition, the normal faults of the High Cascades Graben also flank the TVC. This study aims to determine whether TVC magmatism is attributed to subduction zone or intraplate volcanic processes by 1) using petrography and geochemistry to determine magma storage conditions (“hot-dry” vs. “cold-wet”) and 2) using <sup>40</sup>Ar-<sup>39</sup>Ar age information to thoroughly evaluate the timing of TVC eruptions relative to regional tectonics.

Petrographic analysis has revealed that most TVC units are crystal-poor (<10 vol %) with an anhydrous mineral assemblage (plag + cpx + opx + ox). Additionally, TVC units exhibit high FeO\*, FeO\*/MgO, and Zr/Sr, undepleted middle REE trends, and high temperature (~800 to >1000°C) thermometry (Plag-Melt, Cpx, Fe-Ti Oxides); all of which indicate “hot-dry” storage conditions. Fe-Ti fO<sub>2</sub> data indicate slightly more reducing conditions (between NNO-1 and NNO+1) than average Cascades data, including rhyolites from nearby South Sister volcano, which lies on the Cascade arc front. <sup>40</sup>Ar-<sup>39</sup>Ar ages indicate volcanism occurred between ~200 to 650 Ka, with a major magmatic episode at ~400 Ka that includes a large ignimbrite, tephra fall, and several domes and lava flows along a NW-SE trend that is parallel to local normal faults. Preliminary oxygen isotope values ( $\delta^{18}\text{O}_{\text{plagioclase}}=5.92$  to 7.18 ‰) are consistent with the assimilation of some high  $\delta^{18}\text{O}$  crust. Current results suggest that melt generation within the TVC may be dominated by intraplate volcanic processes, possibly related to extension along normal faults within the area, with some additional contribution from the nearby subduction zone.