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The Rhyolite of Separation Creek—A product of interacting magmatic systems, Three Sisters Volcanic Complex, Oregon Cascades, USA

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The rhyolite of Separation Creek (rsc) erupted ca. 25 ka in the saddle between the neighboring, both recently active (50-2 ka), Middle Sister (MS; primarily mafic-intermediate) and South Sister (SS; primarily intermediate-felsic) volcanoes in central Oregon. This rhyolite is of interest because it erupted during a transition in volcanic activity from mainly MS to mainly SS and it contains abundant mafic enclaves and crystal clots within a rhyolitic host. The differing magmatic components associated with the enclaves and crystal clots can offer information about the magmas that contributed to the erupted magma body, as well as possible interactions between the MS and SS magma systems and triggers for the eruption of rsc. This study characterizes mineral populations and magmatic constituents based on the compositions and textures of major mineral phases in both the host rhyolite and mafic component and compares them to populations present in other MS and SS lavas. The presence of amphibole in the rsc rhyolitic host supports the association of the host magma with SS, as all amphibole-bearing rhyolites in the volcanic complex are associated with SS. However, compositions of olivine from the mafic enclaves and clots overlap with those of olivine found in MS basaltic andesites, but not olivine found in the basaltic andesite from SS. These findings suggest that rsc records the recharge of a SS-type rhyolitic reservoir by MS-type mafic magma. Preliminary amphibole-liquid thermometry and barometry yields an average temperature of 911±30 ˚C and an average pressure of 2.6 kbar with a standard deviation of 0.8 kbar. This is slightly hotter than expected for rhyolite, reflecting crystallization from a less evolved, hotter stage in the system, which cooled as the amphibole crystalized, since rims have lower averages than cores. The solitary amphiboles also have a lower average temperature (893±30 ˚C) than amphibole found in clots (919±30 ˚C), which suggests that they are separate components, crystalizing under different conditions. The nominal average pressure of 2.6 kbar correlates to about 9 km depth, which is deeper than the inferred injection causing the ongoing uplift near SS.