TOPICAL REPORT

GEOLOGIC MAP OF THE SOUTH TWIN PEAK- COVE CREEK AREA, WEST-CENTRAL UTAH

By

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Geologic map of the South Twin Peak -
Cove Creek area, west-central Utah.

The area mapped is a portion of the Twin Peaks volcanic complex. Stratigraphic relations within the mapped area confirm chronologic relations established by potassium-argon age dating methods (Evans et al., 1980). The following is a summary of the geologic history of the Twin Peaks volcanic complex; a more detailed account is given by Crecraft et al. (1981).

The oldest dated volcanic event in the Twin Peaks area (about 2.7 m.y.) is the eruption of the Coyote Hills rhyodacite. The unit occurs in the southern portion of the Coyote Hills along the western margin of the mapped area and in the north and southwest portions of North Twin Peak to the north; it has an exposed volume of 1 km³.

The next series of silicic eruptions formed a number of coalescing domes, flows, and volcaniclastics consisting of high-silica obsidian and felsite of the Cudahy Mine unit. Whole rock ages on obsidian range from $2.63 \pm .10$ to $2.43 \pm .12$ m.y. A rapid sequence of eruptions within a short time interval is suggested by pervasive chemical homogeneity. This unit has an exposed volume of 2 km³; it comprises the bulk of Coyote Hills to the west of the mapped area. It also occurs just east of South Twin Peak, and a small vent is also exposed through a window in overlying basalt on the eastern margin of the complex. In addition, a tuffaceous member at least 80 m thick was encountered in a drill hole 10 km south of South Twin Peak.

The eruption of the Cudahy Mine unit resulted in local subsidence as revealed by the timing and distribution of a lacustrine sequence, and by the volume equivalency of the lacustrine sediments and the volcanic products of the first eruptive episode. The lowermost exposed sediments are fluvial

pebble conglomerates which grade rapidly upward into shoreline deposits and then 90 m of limestones. Volcanic detritus consists of crystals of orthopyroxene, hornblende, biotite, sodic plagioclase, alkali feldspar, and quartz, as well as lithic fragments of felsite, obsidian, and pumice derived from the Coyote Hills and Cudahy Mine volcanic units. Upper portions of the lacustrine sequence lie unconformably on rhyolite domes and pyroclastic deposits of the Cudahy Mine unit. Although lacustrine deposits of late Tertiary age are common along the eastern margin of the Basin and Range Province, indurated limestone is confined to the Twin Peaks area, and there is no direct evidence that the limestone facies is contemporaneous with other lake deposits of unknown age in the surrounding region.

The Twin Peaks lacustrine sequence post-dates the initiation of silicic volcanism at 2.7 m.y. and is capped by a major basaltic episode at 2.5 m.y. This interval corresponds to the period of major silicic eruptive activity in which an estimated 10 km^3 of material was erupted. Assuming a magma chamber approximately 12 km in diameter, 10 km^3 corresponds to a uniform drawdown of approximately 88 m which is nearly equivalent to the maximum measured thickness of the lacustrine sequence of 90 meters. This amount of subsidence is below the resolution limit for gravity modeling, and none was postulated at Twin Peaks (Carrier and Chapman, 1981). There is also a lack of structural evidence for subsidence, and I conclude that any subsidence-related structural features are covered by basalts or are buried by Quaternary alluvium.

Deposition of lacustrine limestones on top of the Lava Ridge basalt just north of the mapped area indicates that basaltic volcanism predated these sediments and probably eruption of the Cudahy Mine unit. Towards the end of and following deposition of the lacustrine limestones, a series of basalts

flowed into the lake. These Cove Creek basalts are intercalated with limestones and water-laid silicic tuffs in the upper portions of the lacustrine unit, and they subsequently covered the entire sequence. Dates of 2.53 ± 0.52 and 2.62 ± 0.35 for the Cove Creek basalts are consistent with these stratigraphic relations.

A second sequence of silicic eruptions began with the eruption of the rhyolite of North Twin Peak, dated at $2.43 \pm .08$ and $2.35 \pm .08$ m.y., followed in turn by eruptions of the rhyolite at the Mid Dome, at $2.51 \pm .08$ m.y., and the rhyolite of South Twin Peak, the youngest silicic volcanic in the area, at $2.35 \pm .08$ m.y. Sanidine in rhyolite at the Mid Dome rhyolite exhibits incipient alteration which may have affected its calculated age. These rhyolites define a second trend of increasing silica content. These later silicic eruptions spanned a relatively short time and produced a much smaller exposed volume of only $.7 \text{ km}^3$. Possibly associated with the emplacement of these later domes was the development of a doubly plunging anticline which extends from the east side of South Twin Peak southward for 12 km. The anticline produced a maximum 400 meters of uplift of the lacustrine sequence, which is exposed in its core, together with the overlying Cove Creek basalts. Younger flows of the Burnt Mountain basalts were erupted from two cinder cones along the axis of the anticline and flowed down its eroded eastern flanks. These flows have not been dated, but clearly postdate the development of the anticline. The absence of a gravity anomaly along the anticline (Carrier and Chapman, 1981) indicates that the uplift is not the result of the emplacement of a large mafic body.

Fig. 1. Schematic cross section of the eastern half of the Twin Peaks volcanic system, projected to line A-A' of plate 2. The depth to basement and the top of the magma chamber is based upon the gravity interpretation of Carrier and Chapman (1981). The section illustrates the sequential eruption of Coyote Hills, Cudahy Mine and South Twin Peak rhyolites from a solidifying magma chamber. The post-rhyolite basalts of Burnt Mountain were erupted through a solidified portion of the magma chamber.

LITHOLOGIES AND AGES OF MAP UNITS

- Qal: Quaternary alluvium and deposits of Lake Bonneville
- Qt: Terrace deposits consisting of clastic material composed of calc-alkaline volcanic debris derived from the east together with Paleozoic material. In addition, clastic material was also contributed from the highland areas of the Twin Peaks volcanic center. This unit was deposited as terraces by streams probably ancestral to the present Cove Creek drainage system. These deposits overlie the Cove Fort volcanic field dated at 0.5 m.y. (Best et al., 1980).
- Qcf: Basaltic andesite of the Cove Fort volcanic field. Lavas emanate from a prominent cinder cone immediately south of the map area.
- QTbm: Basaltic andesite of Burnt Mountain. Pyroclastic deposits and lava flows of basaltic andesite issuing from two vents in the southern portion of the area. These lavas post date local doming of the region, and flow down the eroded flanks of the eastern side of the doubly plunging anticline.
- Tstp: Rhyolite of South Twin Peak. A high silica rhyolite with phenocryst contents ranging from 3 to 20%. Phenocrysts include quartz, plagioclase, sanidine and biotite. The groundmass consists of fine grained quartz, sanidine, plagioclase, oxides and accessory zircon. The rock is often oxidized and gives this unit a characteristic red hue in hand specimen. The unit has been dated at $2.35 \pm .08$ m.y. (Evans et al., 1980).
- Tcc: Basalt of Cove Creek. Tholeiitic basalts ranging in composition from olivine to quartz normative. Potassium-argon age dates on these lavas are 2.53 ± 0.52 and 2.63 ± 0.35 m.y. (Crecraft et al., 1981).
- Tl: Tertiary lacustrine sediments. A sedimentary sequence with fluvial pebble conglomerates at the base which grade rapidly upward into shallow shoreline deposits and then into 90 meters of tuffaceous limestones and limestones of deeper water facies. The volcanic detritus consists of crystals of orthopyroxene, hornblende, biotite, sodic plagioclase, alkali feldspar and quartz, as well as lithic fragments of felsite, obsidian and pumice derived from the Coyote Hills and Cudahy Mine volcanic units. Upper portions of the lacustrine sequence lie unconformably on rhyolite domes and pyroclastic deposits of the Cudahy Mine unit.
- Tcm: Rhyolite of the Cudahy Mine, a high-silica unit consisting of obsidian flows and volcaniclastic material. All rock type of this unit are typically aphyric and contain traces of quartz, sanidine, plagioclase, biotite, hornblende, augite, orthopyroxene, fayalite, magnetite, and ilmenite. The unit is made up of a number of coalescing domes, flows and volcaniclastics. Whole rock ages on obsidian range from $2.63 \pm .10$ to $2.43 \pm .12$ m.y. (Evans et al., 1980). This unit has an exposed volume of 2 km³.

Tch: Rhyodacite of the Coyote Hills. This unit is the least silicic felsic rock in the Twin Peaks complex. It contains phenocrysts of zoned plagioclase and sanidine. Quartz phenocrysts are extremely rare. Phenocrysts of augite and hypersthene commonly occur in cumulophyric aggregates with oxides and commonly with plagioclase. The groundmass typically comprises 87% of the rhyodacite and consists predominantly of plagioclase, quartz, sanidine, oxides and zircon. Potassium argon age dates on this unit are 2.74 ± 0.9 and 2.67 ± 0.10 . (Evans et al., 1980).

Tlr: Basaltic andesite of lava ridge. These lavas underlie the lacustrine sediments and are exposed in a horst block in the northern portion of the map area.

Pu: Undifferentiated Paleozoic sediments consisting of Ordovician Eureka Quarzite and Fish Haven Dolomite, Devonian Sevy Dolomite and Guilmette (?) Formation, Mississippian Deseret Limestone, and Pennsylvanian Oquirrh Formation (Zimmerman, 1961). The units are overturned and dip to the north.

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UTAH-MILLARD CO.
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BLACK ROCK 4 NW, UTAH
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GEOLOGIC MAP OF THE SOUTH TWIN PEAK- COVE CREEK AREA, MILLARD COUNTY, UTAH

EXPLANATION

- Qal** Quaternary alluvium and deposits of Lake Bonneville
- Q1** Terrace deposits consisting of clastic material composed of calcalkaline volcanic debris from the east together with Paleozoic material. In addition, clastic material was also contributed from the highland areas of the Twin Peaks volcanic center. This unit was deposited as terraces by streams probably ancestral to the present Cove Creek drainage system. These deposits overlie the Cove Fort volcanic field dated at 0.5 m.y. (Best et al., 1980).
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- Ts1p** Rhyolite of South Twin Peak. A high silica rhyolite with phenocrysts contents ranging from 3 to 20%. Phenocrysts include quartz, plagioclase, sanidine and biotite. The groundmass consists of fine grained quartz, sanidine, plagioclase, oxides and accessory zircon. The rock is often oxidized and gives this unit a characteristic red hue in hand specimen. The unit has been dated at $2.35 \pm .05$ m.y. (Evans et al., 1980).
- Tcc** Basalt of Cove Creek. Tholeiitic Basalts ranging in composition from olivine to quartz normative. Potassium-argon age dates on these lavas are 2.53 ± 0.52 and 2.63 ± 0.35 m.y. (Crecraft et al., 1981).
- TI** Tertiary lacustrine sediments. A sedimentary sequence with fluvial pebble conglomerates at the base which grade rapidly upward into shallow shoreline deposits and then into 90 meters of tuffaceous limestones and limestones of deeper water facies. The volcanic detritus consists of crystals of orthopyroxene, hornblende, biotite, sodic plagioclase, alkali feldspar and quartz, as well as lithic fragments of felsite, obsidian and pumice derived from the Coyote Hills and Cudahy Mine volcanic units. Upper portions of the lacustrine sequence lie unconformably on rhyolite domes and pyroclastic deposits of the Cudahy Mine unit.
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Geology by W.P. Nash
1981

1 1/2 0 1 MILE
1 .5 0 1 KILOMETRE
SCALE 1:24000