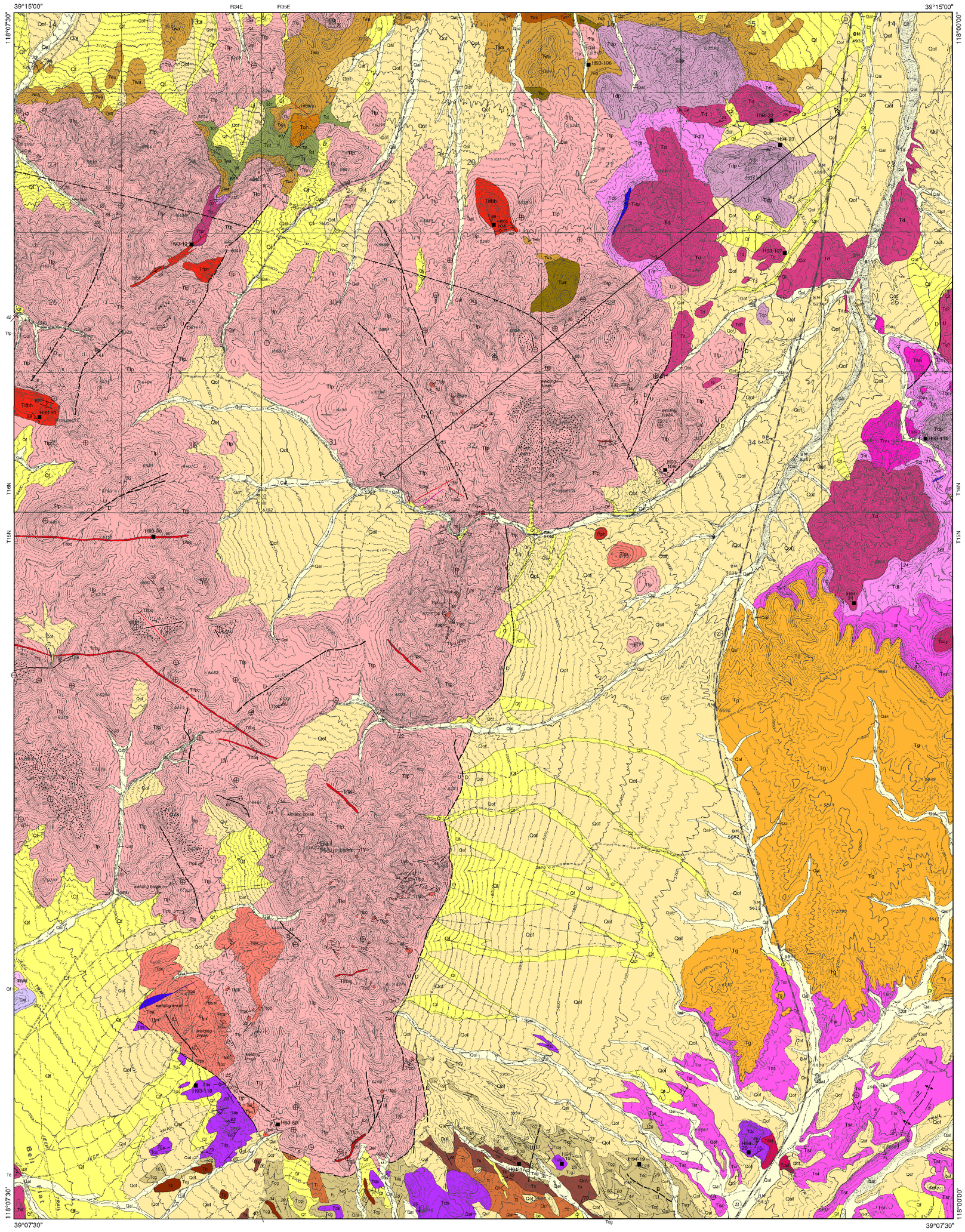


Scale 1:24,000

0 0.5 1 kilometer

0 0.5 1 mile

0 1000 2000 3000 4000 5000 feet

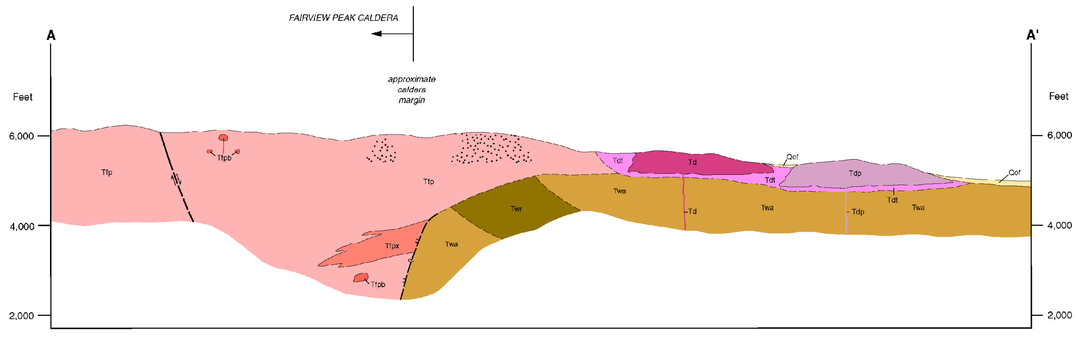
CONTOUR INTERVAL 20 FEET

Base map: U.S. Geological Survey Bell Mountain 7.5' Quadrangle, 1972
Digital Raster Graphic (DRG)

GEOLOGIC MAP OF THE BELL MOUNTAIN QUADRANGLE, WESTERN NEVADA

Christopher D. Henry

1996



Contact Dashed where approximately located, showing dip.

Normal fault Dashed where approximately located, dotted where concealed, queried where uncertain. On cross sections only, arrows show sense of displacement.

Caldera Topographic or buried structural margin of Fairview Peak caldera, dashed where approximately located, dotted where concealed, queried where uncertain.

Welding break Dashed where approximately located.

Anticline Dashed where approximately located.

Strike and dip of beds or compaction foliation in ash-flow tuff

Inclined Vertical Horizontal

Strike and dip of flow bands in lava or intrusion

Inclined Vertical

Vein Showing dip, dashed where approximately located.

Area of silicified rock

Sample location for $^{40}Ar/^{39}Ar$ date or chemical analysis.

SURFICIAL DEPOSITS

Qal **Channel deposits** Unconsolidated alluvium in active channels on alluvial fans and within highlands. Composed of poorly sorted sand- to boulder-sized clasts.

Qf **Alluvial fan deposits** Unconsolidated fluvial and debris-flow deposits in modern alluvial fans. Composed of poorly sorted sand to small cobbles mostly of tuff of Fairview Peak. Forms continuous fan deposits with smooth, little eroded, upper surface.

Qof **Older alluvial fan deposits** Unconsolidated fluvial and debris-flow deposits in older alluvial fans. Composed mostly of poorly sorted sand to small cobbles of tuff of Fairview Peak. Forms discontinuous fan remnants with deeply to moderately dissected upper surface.

Tg **Gravel** Coarse poorly cemented gravel composed of rounded clasts of tuff of Fairview Peak (**Tfp**), rhyolitic lava domes (**Td, Tdp**), and other silicic volcanic rocks up to 50 cm in diameter. Forms large outcrop area east of State Route 361. Probably deposited as alluvial fans but unrelated to present topography. Age could range from middle Miocene, similar to gravels in Gabbs Valley 15 km to the south (Ekren and Byers, 1986), to Pliocene.

VOLCANIC, VOLCANICLASTIC, AND HYPABYSSAL INTRUSIVE ROCKS

Rocks of the Fairview Peak Caldera

LATE INTRACALDERA DIKES Series of generally east-striking dikes and small plugs that intrude tuff of Fairview Peak. Mostly rhyolite to dacite and one andesite. Dikes continue westward into Bell Canyon Quadrangle and may have been feeders to lavas that formerly overlaid the tuff within the Fairview Peak caldera.

Tifbq **Plagioclase-biotite-quartz phyric dikes** Several dikes up to 15 m wide and at least 4 km long and one small (40-m-diameter) stock in the central and southern parts of the caldera. Contain 20 to 40% phenocrysts of plagioclase, biotite, quartz, and minor hornblende.

Tifbh **Plagioclase-biotite-hornblende phyric dikes** Several dikes up to 50 m wide and irregular stocks up to 400 m in diameter in the northern part of the caldera. Contain 30 to 35% phenocrysts of plagioclase, biotite, hornblende, and, in one sample, sanidine. $^{40}Ar/^{39}Ar$ ages are 18.82 ± 0.08 Ma (sanidine; H93-91), 18.82 ± 0.23 Ma (plagioclase; H93-12), and 18.37 ± 0.35 Ma (plagioclase; H93-104) on three different intrusions.

Tia **Andesite dike** A single dike of porphyritic andesite approximately 300 m long and 2 to 3 m wide. Contains 25% phenocrysts of plagioclase and clinopyroxene. Petrographically similar to andesite of lavas of Bell Canyon.

RHYOLITIC LAVA DOMES, RELATED TUFFS, DIKES, AND BASALTIC ANDESITE Group of nearly aphyric to abundantly porphyritic rhyolite lava domes, related air-fall tuffs and near-source pyroclastic deposits, feeder dikes, and contemporaneous basaltic andesite lava. Rhyolitic domes were emplaced along or just outside the ring fracture of the Fairview Peak caldera and are divided into three groups based on distribution and petrography.

Tba_2 **Younger basaltic andesite lavas** Several flows of sparsely and very finely porphyritic basaltic andesite that overlie sedimentary rock (**Tsr**) at eastern edge of quadrangle and are more extensive to east in Quartz Mountain NW Quadrangle. Contain a few percent small (<1 mm) phenocrysts of plagioclase, iddingsitized olivine, and clinopyroxene. May be significantly younger than units **Td**, **Tdp**, and **Tba_1**. Approximately 40 m thick.

Tsr **Sedimentary rocks** Sequence of poorly cemented brown sandstone composed of volcanic rock and mineral fragments and white, tuffaceous sandstone. Both sandstone types overlie rhyolitic domes (**Td**, **Tdp**) and air-fall tuff (**Tdt**) along eastern edge of quadrangle. Approximately 60 m thick.

Tdp **Porphyritic rhyolite lava domes** Forms series of distinct topographic domes along the northeastern margin of the Fairview Peak caldera. Moderately porphyritic, massive to strongly flow-banded and flow-folded lava domes of high-silica rhyolite. Locally vesicular and vitrophyric along margins. Contain 10 to 20% phenocrysts of plagioclase, sanidine, biotite, and hornblende, and a few mafic inclusions, possibly of contemporaneous basaltic andesite. $^{40}Ar/^{39}Ar$ ages are 18.94 ± 0.06 Ma (sanidine; H93-114) and 18.87 ± 0.09 Ma (sanidine; H94-23).

Tdp **Porphyritic rhyolite dikes** Petrographically similar to porphyritic rhyolite lava domes (**Tdp**) and probably feeders to them. Dikes cut domes and related air-fall tuff.

Td **Sparsely porphyritic rhyolite lava domes** Rhyolitic lava domes similar to those of porphyritic rhyolite (**Tdp**) except contain at most 4% small (2 mm) phenocrysts of plagioclase, sanidine, and minor biotite and hornblende. $^{40}Ar/^{39}Ar$ ages are 19.05 ± 0.09 Ma (sanidine; H94-21), 18.86 ± 0.04 Ma (sanidine; H93-107), and 20.06 ± 1.00 (plagioclase; H94-22).

Tdt **Tuff related to northeastern lava domes** Coarse to fine air-fall tuff, poorly welded ash-flow tuff, and tuffaceous sedimentary rock near contacts with lava domes. Air-fall tuff consists of beds, mostly less than 1 cm to 20 cm thick but up to approximately 1 m, composed of glass shards, pumice, and rock and mineral fragments, including devitrified to glassy fragments of adjacent lava dome. Clasts are up to 20 cm in diameter near domes and become finer away from domes. Tuffaceous sedimentary rock consists of laminar to cross-bedded sandstone and pebbly sandstone. Soft-sediment deformation is common. Proportion of tuffaceous sediment increases away from domes. Air-fall tuff mostly underlies lava domes and probably immediately preceded lava extrusion.

Tba_1 **Older basaltic andesite lavas** Several flows of black to dark gray, moderately porphyritic basaltic andesite. Underlie rhyolitic domes (**Td, Tdp**) and interbedded with air-fall tuff (**Tdt**) at eastern edge of quadrangle. Has basal scoria breccia that passes upward into massive, vesicular lava. Contain 20% phenocrysts of plagioclase and clinopyroxene.

Tib **Basaltic andesite dikes** Petrographically similar to lavas (**Tba_1**) and probably feeders to them. Only one dike present in Bell Mountain Quadrangle but several in Quartz Mountain NW Quadrangle immediately to east.

Tds **Southern rhyolite domes** Group of dark-gray, low-silica rhyolite domes that occur along and outside the southern and southeastern margin of the Fairview Peak caldera. Probably both extrusive and shallow intrusive phases are present. Contain about 30% phenocrysts, mostly of plagioclase with prominent hornblende and biotite, minor quartz in a few samples, and minor sanidine in one sample. Commonly have vitrophyric margins, and smallest dome is almost entirely vitrophyre. $^{40}Ar/^{39}Ar$ ages are 18.94 ± 0.06 Ma and 19.10 ± 0.10 Ma (hornblende and biotite, respectively; H94-20) and 18.53 ± 0.08 Ma (plagioclase; H93-118).

Tids **Dikes related to southern domes** Petrographically similar to southern rhyolite domes. Dikes cut conglomerate (**Tcg**) southeast of caldera.

Tdst **Tuff related to southern domes** Coarse air-fall tuff(?) adjacent, and probably related, to the easternmost of the southern domes.

LAVAS OF BELL CANYON Complex assemblage of rhyolitic to andesitic lavas, flow domes, dikes and other shallow intrusions, and related pyroclastic deposits that crop out extensively in Bell Canyon in the southern part of the Bell Canyon Quadrangle to the west. Only two small outcrops of rhyolite and andesite lava and one andesite dike are present in the southwestern part of the Bell Mountain Quadrangle. Three $^{40}Ar/^{39}Ar$ ages on related rocks in Bell Canyon range from 18.85 ± 0.13 Ma to 18.98 ± 0.06 Ma

LAVAS OF BELL CANYON *(continued)*

Tba **Andesite lava** Massive, black flow of abundantly porphyritic andesite. Contains about 35% phenocrysts of plagioclase, clinopyroxene, and Fe-Ti oxides.

Tbr **Rhyolite lava** Massive, light-gray to bleached-white flow of devitrified, sparsely porphyritic rhyolite. Contains about 5% phenocrysts of subequal amounts of plagioclase and sanidine in an oxidized groundmass with no preserved mafic phenocrysts.

Tiba **Andesite dike** Single dike of porphyritic andesite approximately 700 m long and 5 m wide. Consists mostly of vitrophyre containing 25 to 30% phenocrysts of plagioclase and clinopyroxene.

TUFF OF FAIRVIEW PEAK Complex assemblage of densely to poorly welded ash-flow tuff, megabreccia (coarse caldera-collapse breccia), and debris-flow deposits that accumulated almost entirely within the Fairview Peak caldera. Caldera collapse occurred during eruption of the tuff of Fairview Peak.

Tfph **Hydrothermal breccia** Intensely silicified and brecciated, bedded tuff containing clasts of flow-banded rhyolite, pumice, and other volcanic rocks. Probably uppermost part of a hydrothermal system related to Fairview Peak caldera.

Tfpx **Late debris deposits** Lenses of coarse, massive to crudely bedded debris-flow deposits, breccia, and minor bedded tuff composed of material collapsed from caldera walls. Debris-flow deposits consist of angular to moderately rounded, matrix- to locally clast-supported, and lithologically diverse fragments up to several meters in diameter in a granular, mostly nontuffaceous matrix. Interbedded with and overlying uppermost part of unit **Tfp**.

Tfpv **Ash-flow vent** Dike-like bodies of vitrophyric and devitrified tuff with vertical eutaxitic foliation. Bodies cut vertically through flat-lying or gently dipping devitrified tuff. Petrographically similar to unit **Tfp**. A definite vent east of hill 6483 in the east-central part of the quadrangle is lozenge-shaped in plan and has a vitrophyric margin and a devitrified core. A probable vent near the southern edge of the quadrangle consists entirely of vitrophyre.

Tfpb **Megabreccia** Large blocks, consisting mostly of andesite and flow-banded rhyolite, that slumped from the caldera wall and were incorporated within units **Tfp** and **Tfpx**. Up to about 70 m in diameter and mapped only where greater than about 3 m in diameter.

Tfp **Ash-flow tuff** Compound cooling unit of light-red-brown, densely to poorly welded, rhyolitic ash-flow tuff. Mostly deposited within the Fairview Peak caldera except for outflow deposits north of the buried caldera margin in the northern part of the quadrangle. A single, densely welded cooling unit within most of the caldera, but several cooling units in uppermost part of the tuff around Bell Mountain. Devitrified except for thin lenses of basal vitrophyre near the southern and northern edges and east-central part of the quadrangle. Minimum intracaldera thickness of 700 m estimated from outcrop in the Bell Canyon Quadrangle. Contains 7 to 10%, and rarely up to 15%, phenocrysts of plagioclase, subequal sanidine, and minor biotite and quartz. Contains mostly small, sparse lithic fragments except near caldera margins, and scattered fragments of Cretaceous granitic rock up to 40 cm in diameter occur throughout the caldera. Propylitically altered throughout most of the caldera. $^{40}Ar/^{39}Ar$ ages are 19.25 ± 0.03 Ma (sanidine; H93-58) and 19.22 ± 0.03 Ma (sanidine; H93-108).

Sedimentary Rocks, Basaltic Andesite, and Dacite South of the Caldera

Sequence of coarse conglomerate, sandstone, and several thin flows of basaltic andesite and thicker dacite lava. Sequence crops out south of the Fairview Peak caldera and continues into the northern part of the Broken Hills Quadrangle.

Ts **Sandstone and tuff** Massive to finely laminated, white to light-brown volcanic sandstone, siltstone, and pebbly, pumiceous sandstone. Pebbles are rounded tuff and pumice to 8 cm in diameter. Forms two belts: (1) an eastern belt in the lower part of the sequence, overlying dacite lava and (2) a western belt in the upper part, overlying conglomerate, that forms low, widely scattered outcrops between Quaternary deposits. $^{40}Ar/^{39}Ar$ age is 19.36 ± 0.12 Ma (sanidine in coarse pumice in lower part; H94-17).

Tcg **Coarse to pebbly conglomerate** Massive to poorly bedded to rarely well-stratified conglomerate. Clasts are moderately rounded, mostly 10 to 40 cm in diameter but rarely up to 2 m, and consist of mafic to intermediate to felsic lavas, including interbedded basaltic andesite (up to 2 m) and dacite, and minor, probable Cretaceous granite (up to 40 cm). Contains minor lenses of pebbly sandstone and pumiceous air-fall tuff.

Tb **Basaltic andesite lava** Several thin (3-10 m) flows and flow breccias. Flows have massive interiors and upper scoria zones. Flow breccias consist of coarse, scoriaceous and lesser massive blocks of basaltic andesite in poorly exposed matrix. Contains 35% phenocrysts of plagioclase, iddingsitized olivine, and clino-pyroxene.

Tl **Dacite lava** Massive, commonly vitrophyric, porphyritic dacite lava and related coarse pyroclastic deposits. Contains 20 to 30% phenocrysts of plagioclase, hornblende, and minor biotite. One of most common clasts in conglomerate. Forms the stratigraphically lowest part of the sequence in the quadrangle. Some large bodies could be landslide blocks. $^{40}Ar/^{39}Ar$ ages are 20.04 ± 0.10 Ma and 19.88 ± 0.07 Ma (hornblende and biotite, respectively; H94-19).

Lavas of West Gate

Thick sequence of rhyolitic to andesitic lava and minor tuff and sedimentary rock that crops out north of the Fairview Peak caldera in the northern part of the Bell Mountain Quadrangle and more extensively in the West Gate Quadrangle. Rocks strike west-northwest and dip moderately to steeply(?) to the southwest and northeast.

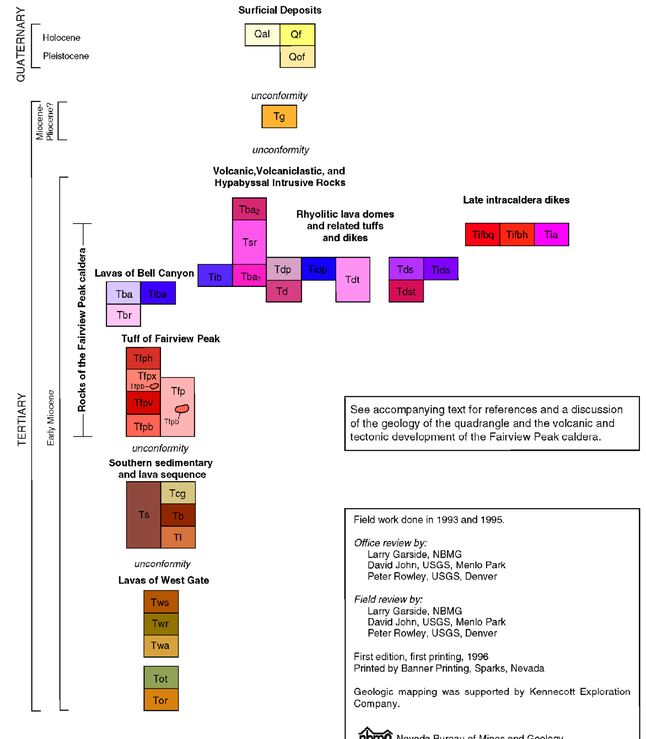
Tws **Tuffaceous sedimentary rocks** Poorly indurated, white to light brown, pebbly sandstone and more indurated, coarsely bedded pumiceous tuff that crop out in a thin belt at the northern edge of the quadrangle. Sandstone contains pumice and lithic fragments up to about 1 cm in diameter. $^{40}Ar/^{39}Ar$ age on sanidine from a poorly welded ash-flow tuff in the West Gate Quadrangle is 22.46 ±0.06 Ma (H93-102).

Twr **Rhyolite lavas** Aphyric to sparsely porphyritic, platy, flow-banded and flow-folded, rhyolitic lavas that are mostly bleached white. Contain up to a few percent phenocrysts of small (1 mm) sanidine, plagioclase, and biotite. $^{40}Ar/^{39}Ar$ age on sanidine from porphyritic dacite in West Gate Quadrangle is 22.53 ±0.09 Ma (H93-85).

Twa **Andesite lavas** Dark-gray to brown, abundantly and coarsely porphyritic, andesitic lavas with massive interiors and poorly exposed, scoriaceous and brecciated tops and bottoms. Contain 30 to 40% phenocrysts of plagioclase, hornblende, biotite, clinopyroxene, Fe-Ti oxides, and sparse xenocrystic(?) quartz. Mafic phenocrysts are commonly altered to aggregates of iron oxides. Several flows contain probable autoliths of fine-grained diorite with similar mineralogy as the host.

Tot **Bedded tuff** Sequence of coarse to fine tuffaceous sedimentary rock, air-fall tuff, and minor ash-flow tuff, probably shed from adjacent older rhyolite dome. Uppermost exposed rocks are finely laminated tuffaceous siltstone and sandstone and thick-bedded, pumiceous sandstone with minor conglomerate lenses. Beds show soft-sediment deformation. Sedimentary rocks pass downward into massive, sparsely lithic ash-flow tuff that rests upon older rhyolite dome (**Tor**).

Tor **Older rhyolite lava dome** Massive to brecciated, steeply flow-banded and flow-folded, rhyolite lava dome. Contains a few percent phenocrysts of sanidine, plagioclase, biotite, and quartz in a devitrified, locally spherulitic groundmass. Units **Tot** and **Tor** underlie andesite lava (**Twa**) and the tuff of Fairview Peak (**Tfp**) just north of the probable caldera margin and may be related to the West Gate lavas.



See accompanying text for references and a discussion of the geology of the quadrangle and the volcanic and tectonic development of the Fairview Peak caldera.

Field work done in 1993 and 1995.

Office review by:
Larry Garside, NBMG
David John, USGS, Menlo Park
Peter Rowley, USGS, Denver

Field review by:
Larry Garside, NBMG
David John, USGS, Menlo Park
Peter Rowley, USGS, Denver

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Nevada Bureau of Mines and Geology
University of Nevada, Mail Stop 178
Reno, Nevada 89557-0088