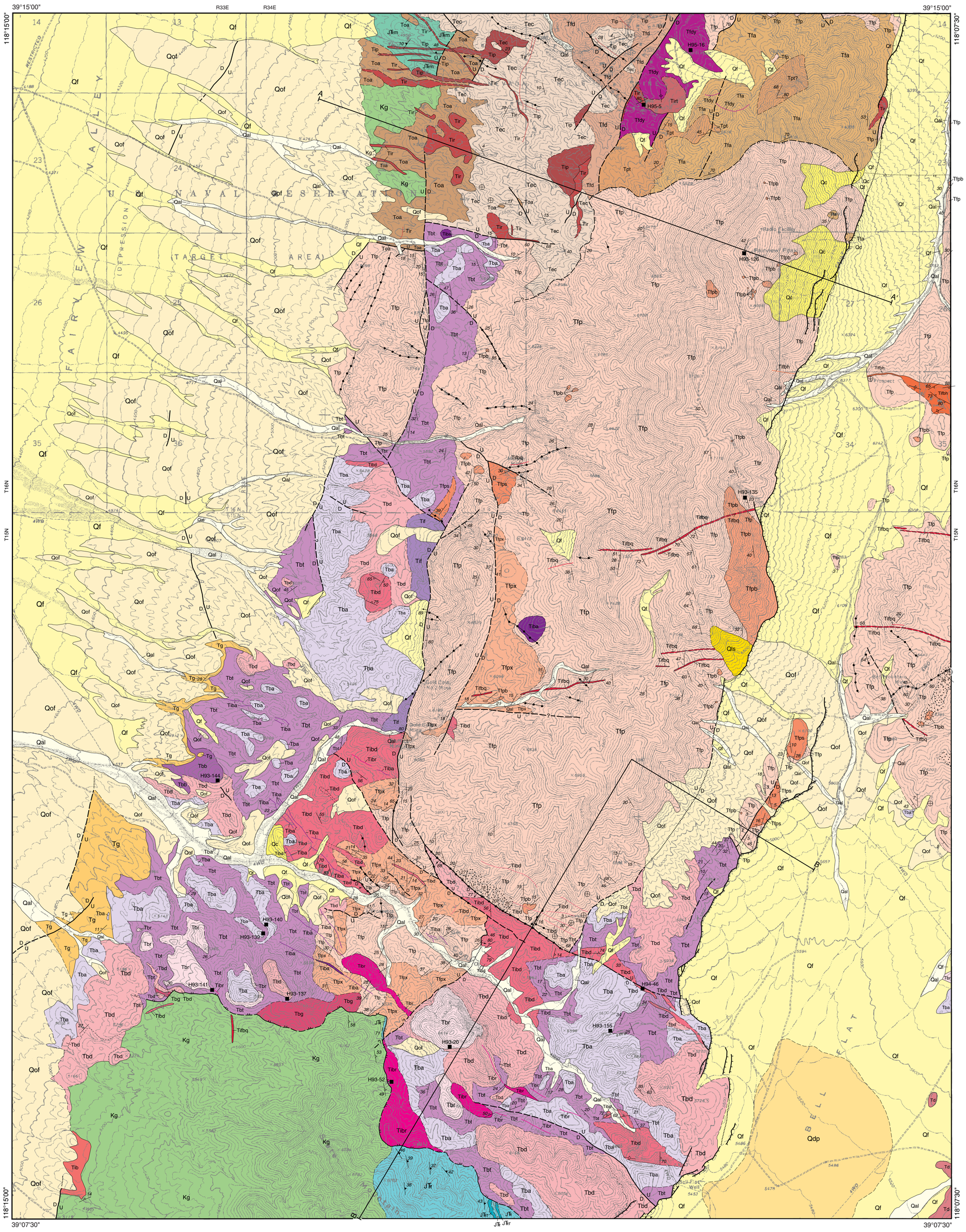


SURFICIAL DEPOSITS

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.

Qc **Colluvium** Loose debris along the steep eastern flanks of Fairview Peak; composed mostly of fragments of tuff of Fairview Peak. Only larger, more continuous deposits mapped.

Qls **Landslide deposits** Unconsolidated debris composed of coarse blocks of tuff of Fairview Peak. Forms single area along east face of range approximately 4.5 km south of Fairview Peak.

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. Older alluvial fan deposits on different sides of Fairview Peak are not necessarily contemporaneous.

Qdp **Dissected playa** Unconsolidated silt and other fine sedimentary deposits in Bell Flat. Area was probably a closed depression on downthrown side of Fairview fault before headward erosion of Bell Canyon allowed drainage westward to Fairview Valley.

Tg **Gravel** Coarse, poorly to moderately cemented gravel composed of rounded clasts of tuff of Fairview Peak, lavas of Bell Canyon, and other volcanic rocks up to 50 cm in diameter. Occurs along west side of the Fairview Range near Bell Canyon, where it was probably deposited by alluvial fans draining the Fairview Range. Dips shallowly to west so involved in some tilting. Locally difficult to distinguish from, and probably gradational into, older alluvial fan deposits (**Qof**). Probably late Miocene to Pliocene.

VOLCANIC, VOLCANICLASTIC, AND HYPABYSSAL INTRUSIVE ROCKS

Rocks of the Fairview Peak Caldera

LATE INTRACALDERA DIKES Rhyolitic to dacitic, mostly east-striking dikes that intrude tuff of Fairview Peak and continue eastward into Bell Mountain Quadrangle. May have been feeders to lavas that formerly overlaid the tuff within the caldera.

Tifbq **Plagioclase-biotite-quartz phyric dikes** Several dikes up to 15 m wide that form partly en-echelon sets several kilometers long. Contain 20 to 40% phenocrysts of plagioclase, biotite, quartz, and minor hornblende.

Tifbh **Plagioclase-biotite-hornblende phyric dikes** A single thick dike that widens into an irregular stock about 300 m across at the eastern edge of the quadrangle. Contain 30 to 35% phenocrysts of plagioclase, biotite, hornblende, and, rarely, sanidine. $^{40}Ar/^{39}Ar$ age on the stock in the Bell Mountain Quadrangle 300 m east of the boundary is 18.82 ± 0.08 Ma (sanidine; H93-91).

RHYOLITIC LAVA DOMES

Td **Sparsely porphyritic rhyolite** Forms several low ridges of strongly flow-banded, high-silica rhyolite near the probable buried continuation of the southern margin of the Fairview Peak caldera in Bell Flat. Contains a few percent small (2 mm) phenocrysts of plagioclase and sanidine in a strongly oxidized groundmass. Similar rocks, as well as related air-fall tuff, near-source pyroclastic deposits, and feeder dikes, are extensive along the northeastern margin of the caldera in the Bell Mountain Quadrangle and may be related. $^{40}Ar/^{39}Ar$ ages on rocks in the Bell Mountain Quadrangle range from 18.86 ± 0.04 Ma (sanidine; H93-107) to 19.05 ± 0.09 Ma (sanidine; H94-21).

LAVAS OF BELL CANYON Complex assemblage of rhyolitic to andesitic and one basaltic andesite lava, lava domes, dikes and other shallow intrusions, and related pyroclastic and sedimentary deposits that crop out extensively in Bell Canyon along the southern edge of the Fairview Peak caldera. Cumulatively at least 500 m thick. Dikes strike predominantly west-northwest, parallel to caldera margin and to the major resurgent fault. Rocks in the western part of Bell Canyon are extensively hydrothermally altered.

Tbb **Basaltic andesite lava** Single, black, massive to scoriaceous flow containing 10% phenocrysts of plagioclase, iddingsitized olivine, and magnetite. Approximately 20 m thick.

Tbr **Rhyolite lavas** Thick, massive, light-gray flows of devitrified to rarely perlitic rhyolite. Individual flows are as much as 120 m thick. Contains 3 to 8% phenocrysts, including subequal amounts of plagioclase and sanidine, lesser biotite, and minor hornblende and oxides. $^{40}Ar/^{39}Ar$ age is 18.98 ± 0.06 Ma (sanidine; H93-20).

Tbd **Dacite lavas** Thick, massive to brecciated flows of devitrified to perlitic dacite. Contains 20 to 40% phenocrysts, mostly of plagioclase with abundant biotite and hornblende in variable proportions, and Fe-Ti oxides.

Tba **Andesite lavas** Moderately thick, massive flows and black, vitrophyric flow breccia of abundantly porphyritic andesite. Crystalline andesites typically have coarse, platy, subhorizontal flow bands. Contains 35 to 40% phenocrysts of plagioclase, clinopyroxene, and oxides.

Tif **Intermediate intrusion** Finely porphyritic to aphyric, highly altered, platy, andesitic(?) intrusion. Contains sparse phenocrysts of plagioclase altered to clay and abundant pyrite. Occurs along north-striking part of resurgent fault through the Gold Coin Mines and possibly emplaced along this fault.

Tibr **Rhyolite dikes** Dikes of sparsely porphyritic rhyolite petrographically similar to rhyolite lavas (**Tbr**) and probably feeders for them. Dikes range from 3 m to rarely as much as 150 m wide. One dike was emplaced along contact between lavas of Bell Canyon and pre-Tertiary rocks in the caldera wall. $^{40}Ar/^{39}Ar$ age of this dike is 18.97 ± 0.03 Ma (sanidine; H93-52)

Tibd **Dacite intrusions** Dikes and larger, irregular intrusions of moderately to abundantly porphyritic dacite petrographically similar to dacite lavas (**Tbd**) and probably feeders for them. Dikes range from a few meters to as much as 40 m wide; larger intrusions are as much as 1 km in diameter. Dikes were emplaced along the major resurgent fault in the northern part of Bell Canyon that uplifted tuff of Fairview Peak on north against lavas of Bell Canyon on south. $^{40}Ar/^{39}Ar$ age on this dike is 18.85 ± 0.13 Ma (hornblende; H94-46)

Tiba **Andesite dikes** Dikes of abundantly porphyritic andesite petrographically similar to andesite lavas (**Tba**) and probably feeders for them. Dikes are a few meters to about 10 m wide and up to 1 km long.

Tbt **Tuff and volcaniclastic sedimentary rock** Heterogeneous assemblage of coarse to fine tuff and volcaniclastic sedimentary rock. Coarse, massive tuff, probably proximal fall deposits, contains blocks of lavas of Bell Canyon up to several meters in diameter in a locally pumiceous matrix that is commonly altered to clay in the western part of Bell Canyon. Bedded air-fall tuff is in beds 3 to 20 cm thick composed of clasts of lavas of Bell Canyon and vitric pumice containing phenocryst assemblages similar to those of the lavas. Sedimentary rocks range from coarse, debris-flow deposits similar to those in unit **Tfpx** through coarse conglomerate to massive to finely laminated, tuffaceous sandstone and siltstone. Clasts are mostly of lavas of Bell Canyon but debris deposits commonly contain amphibolite and granite.

Tbg **Granitic debris** Coarse, unconsolidated debris shed from the southern wall of the Fairview Peak caldera and consisting entirely of blocks of Cretaceous granitic rocks. Similar depositional environment to debris deposits (**Tfpx**) but contemporaneous with lavas of Bell Canyon.

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

Tfps **Sedimentary rocks** Well-bedded, pebbly, tuffaceous conglomerate, sandstone, and siltstone that overlie the ash-flow tuff (**Tfp**) in low hills southwest of the Bell Mountain mine. Overall sequence appears to fine upward. Probably grades vertically into unit **Tbt** and, in part, is laterally equivalent. Exposed thickness is approximately 40 m.

Tfpx **Debris deposits** Lenses and irregular masses of breccia, coarse, massive to crudely bedded debris-flow deposits, and minor bedded tuff composed of material collapsed from caldera walls. Breccia consists of angular clasts, generally of a single rock type, up to several meters in diameter in a matrix of more finely ground material of the same type. Debris-flow deposits consist of angular to moderately rounded, matrix- to locally clast-supported, and lithologically diverse fragments also up to several meters in diameter in a granular, mostly nontuffaceous matrix. Clasts include amphibolite, granite, and various volcanic rocks, rock types that make up the adjacent caldera wall. Interbedded with and overlying uppermost part of unit **Tfp**.

Tfpb **Megabreccia** Large blocks, consisting mostly of andesite and flow-banded rhyolite, slumped from the caldera wall and incorporated within units **Tfp** and **Tfpx**. Commonly up to about 70 m in diameter, with one composite block nearly 2 km long. Mapped only where greater than about 3 m in diameter.

Tfp **Ash-flow tuff** Compound cooling unit of light red-brown, devitrified, densely to poorly welded, rhyolitic ash-flow tuff. Mostly deposited within the Fairview Peak caldera except for outflow deposits in the northern part of the quadrangle. Minimum intracaldera thickness of 700 m estimated from outcrops in the east face of Fairview Peak. Contains 7 to 10%, and rarely up to 15%, phenocrysts of plagioclase, sanidine, biotite, and quartz. Contains mostly small, sparse lithic fragments except near caldera margins, although 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 of 19.25 ± 0.03 Ma and 19.22 ± 0.03 Ma were determined on sanidine from samples from the Bell Mountain Quadrangle.

Rocks of the Fairview Mining District

Heterogeneous assemblage of intermediate to silicic volcanic and shallow intrusive rocks. The rhyolite intrusions (**Tir**), rhyolite tuff (**Tirt**), and tuff of the Pyramid (**Tpt**) are probably related to the Fairview Peak caldera whereas the tuff of Elevenmile canyonn (**Tec**) and older andesite (**Toa**) may be from distal or much older sources. Most rocks are propylitically altered and contain abundant epidote, sericite, chlorite, calcite, and pyrite. They are also commonly silicified, especially along the prominent west-northwest-striking veins that hosted ore in the Fairview district.

Tir **Rhyolite intrusions** Numerous, mostly bleached white, flow-banded dikes and small intrusive domes. Aphyric to moderately porphyritic; contain phenocrysts of sanidine, plagioclase, quartz, and biotite. $^{40}Ar/^{39}Ar$ age is 19.31 ± 0.06 Ma (sanidine; H95-5).

Tirt **Rhyolite tuff** Apron of coarse debris to bedded tuff adjacent to and probably eruptive equivalent of rhyolite dome (**Tir**) in the center of the Fairview district. Coarsest deposits contain angular, matrix-supported blocks of sparsely porphyritic rhyolite, lithologically similar to adjacent dome, in a matrix of pumice and finer clasts. Bedded tuff is platy to finely laminated and silicified.

Tpt **Tuff of the Pyramid** Coarse, lithic, densely to poorly welded ash-flow tuff that rests depositionally upon andesite intrusion (**Tfa**) in the eastern part of the district. Contains 15 to 25% phenocrysts, mostly of plagioclase with quartz, sanidine, and biotite. Lithic fragments include spherulitic rhyolite, porphyritic intermediate volcanic rock, and Cretaceous granitic rock up to 40 cm in diameter. Also includes an area of coarse, crudely bedded tuff containing blocks up to 2 m in diameter that crops out along the ridge approximately 1.5 km north of Fairview Peak.

Tfdy **Younger dacite** Medium- to dark-gray, massive, porphyritic dacite or andesite that is probably mostly intrusive, including one dike, and possibly some lava. Contains 20 to 25% phenocrysts of plagioclase, prominent hornblende, biotite, and Fe-Ti oxides. Biotite is mostly altered to chlorite ± epidote. $^{40}Ar/^{39}Ar$ age is 20.02 ± 0.10 Ma (hornblende; H95-16).

Tfa **Andesite intrusion** Medium-gray, massive to commonly flow banded, porphyritic andesite makes a large, probably intrusive body at least 2 km across. It extends from the eastern part of the Fairview district to northeast of Fairview Peak, makes up much of the northern part of the caldera wall, and is a common clast within the tuff of Fairview Peak. Contains 30 to 40% phenocrysts, mostly of trachytic plagioclase and clinopyroxene, with minor biotite, possible altered orthopyroxene, and Fe-Ti oxides.

Tfd **Dacite** Massive, dark-gray, moderately porphyritic dacite that forms most outcrops in the central part of the Fairview district. It is intensely propylitically altered and commonly kaolinized. The unit is probably mostly intrusive into tuff of Elevenmile Canyon (**Tec**) but may include some lava. Contains 20 to 25% phenocrysts, mostly of plagioclase with minor quartz and altered biotite, hornblende, and sanidine(?). Unit is the dominant host of precious-metal-bearing quartz veins of the district. Equivalent to lode andesite of Schrader (1947).

Tip **Porphyritic intrusions** Numerous east-striking dikes and irregular bodies of porphyritic dacite that grades into more equigranular rock in the interior of large bodies. Contains similar phenocryst assemblage as dacite (**Tfd**) and may be related. Contains 20 to 25% phenocrysts, mostly of plagioclase, with lesser quartz and biotite, and, rarely, sanidine.

Tec **Tuff of Elevenmile Canyon (?)** Green, abundantly porphyritic, coarsely lithic, rhyolitic to dacitic(?) ash-flow tuff. Contains about 50% phenocrysts, mostly of plagioclase, with quartz, sanidine, and altered biotite and hornblende. Lithic fragments up to 50 cm in diameter include Cretaceous granodiorite and various Tertiary porphyritic igneous rocks. Crops out extensively in the Fairview district and to the north in the southern part of the Drumm Summit Quadrangle. Approximately 180 m thick. Tentatively correlated with Tuff of Elevenmile Canyon (John, 1992b, 1995a, b; D. A. John, personal commun., 1994), which erupted at about 25 Ma from a caldera in the Stillwater Range 30 km to the north. However, thickness and presence of coarse lithic fragments suggests a source in the Fairview area.

Toa **Older andesite lavas** Dark-gray, abundantly porphyritic andesite lava flows. Contains 60% phenocrysts, mostly of fine plagioclase laths, with lesser clinopyroxene and altered hornblende(?). Forms several flows that rest upon pre-Tertiary granitic and metamorphic rocks and underlies tuff of Elevenmile Canyon(?) southwest of the Fairview district. Approximately 150 m thick.

Miscellaneous Intrusion

Tib **Basalt intrusion** Single body of porphyritic basalt or basaltic andesite that intrudes Cretaceous granodiorite near the southwestern corner of the quadrangle. Phenocrysts are abundant plagioclase laths up to 1.5 cm long and mostly altered olivine and clinopyroxene. Petrographically similar to and probably related to a sequence of Oligocene basaltic andesite lavas that are extensive in the northern part of the Slate Mountain Quadrangle to the south.

CRETACEOUS

Kg **Granitic intrusion** Medium- to coarse-grained, equigranular to coarsely porphyritic biotite-hornblende granodiorite. Sphene up to 1 mm long is a ubiquitous accessory. Granodiorite at Slate Mountain contains common megacrysts of potassium feldspar up to 5 cm long. Pegmatite and aplite form numerous, mostly east-striking dikes at the northern end of Slate Mountain. Intrusion there may be a laccolith because the contact parallels foliation and numerous sills occur in adjacent metamorphic rock. John (1992a) reported a Rb-Sr age of 82-81 Ma for intrusion at Slate Mountain.

METAMORPHIC ROCKS
JURASSIC-TRIASSIC(?)

All metamorphic rocks in the Bell Canyon Quadrangle were included in the Triassic-Jurassic volcaniclastic rocks and limestone unit of Willden and Speed (1974) and within the Sand Springs terrane by Greene and others (1991) and Oldow and others (1993). A minimum age for these rocks is indicated by a U-Pb age on zircon of 237±5 Ma (early Middle Triassic) for a quartz-porphyry intrusion that cuts metasedimentary rocks in the Sand Springs Range west of the Bell Canyon Quadrangle (Satterfield and Oldow, 1996). In contrast, Greene and others (1991) reported sparse Late Triassic and Early Jurassic fossils from similar rocks elsewhere in the Reno 1° x 2° Quadrangle. Rocks at Slate Mountain are lithologically distinct from, and have higher metamorphic grade (amphibolite) than, rocks in the Fairview district (greenschist).

FAIRVIEW DISTRICT

JŦrm **Metsedimentary rocks** Dark-gray quartzite grading to phyllitic sandstone and shale. Sandstone and shale form fining upward sequences up to 1 m thick. Metamorphic minerals include muscovite, epidote, and chlorite. Blocks of limestone occur in breccia along the contact with Tertiary rocks but were not found in place. One outcrop-scale fold strikes N35°E and is overturned toward the east.

SLATE MOUNTAIN

JŦr **Metarhyolite** Two 3- to 4-m thick, massive porphyritic lenses that parallel foliation and probable bedding in amphibolite. Thinness of lenses and lack of breccias or pyroclastic features such as lithic fragments suggest that the rhyolites are sills. Phenocrysts consist of quartz, now mostly polycrystalline aggregates (5%), plagioclase partly altered to muscovite (5%), and probable biotite altered to aggregates of Fe-Ti oxides (1%). These intrusions may be the same age as the 237±5-Ma quartz porphyry reported by Satterfield and Oldow (1996).

JŦa **Amphibolite and biotite schist** Mostly strongly banded amphibolite containing hornblende and minor quartz, epidote, plagioclase, and biotite; potassium feldspar forms rare porphyroblasts. Quartz commonly forms elongate mosaics that may have been quartz pebbles. Amphibolite locally is massive and contains plagioclase porphyroblasts or relict phenocrysts to 2 mm long. Schist contains biotite, quartz, plagioclase, muscovite, and hornblende. Schist layers show suggestions of relict cross beds. Compositional layering and metamorphic foliation are parallel and strike north and dip 40° to 60° to the east. Protoliths of most rocks were probably volcanic sediments. Massive amphibolites may have been basalt lavas or sills. Exposed thickness is nearly 1,000 m, but rocks may be repeated by folding and faulting.

Scale 1:24,000

0 0.5 1 kilometer

0 0.5 1 mile

0 1000 2000 3000 4000 5000 feet

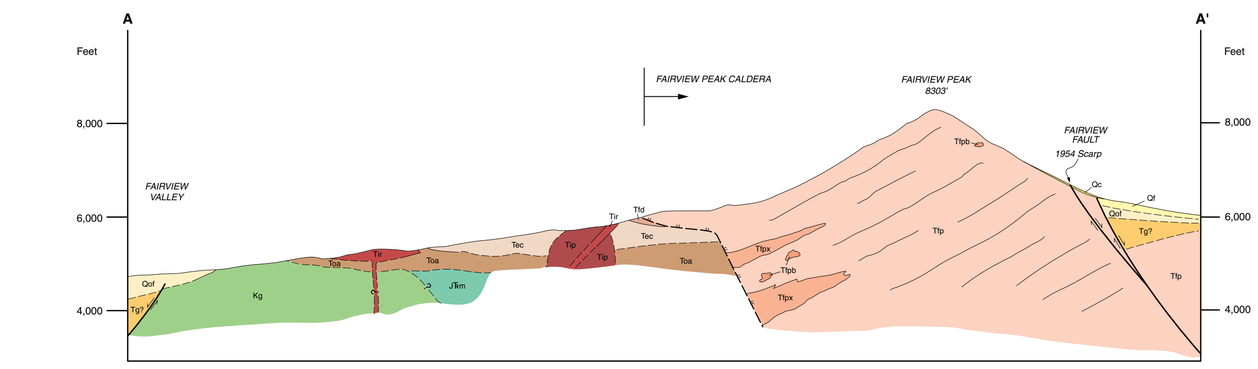
CONTOUR INTERVAL 40 FEET

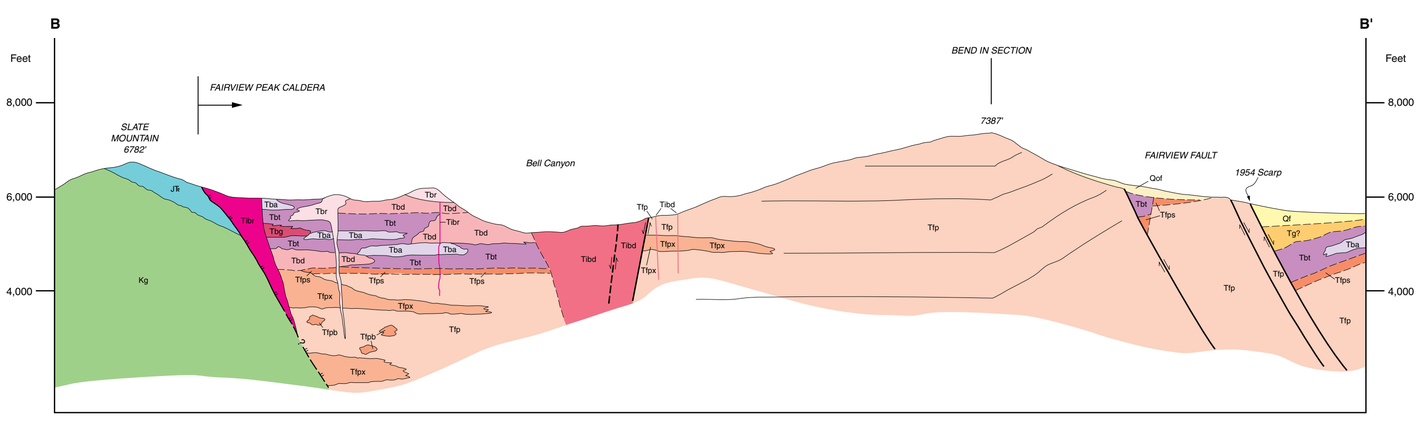
Base map: U.S. Geological Survey Bell Canyon 7.5' Quadrangle, 1980
Digital Raster Graphic (DRG)

GEOLOGIC MAP OF THE BELL CANYON QUADRANGLE, WESTERN NEVADA

Christopher D. Henry

1996





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.

Contact Long dashes where approximately located, short dashes between different flows or fans within the same unit.

Normal fault Showing sense of displacement and dip; dashed where approximately located, dotted where concealed, queried where uncertain; arrow shows plunge of linear features. On cross sections only, arrows show sense of displacement.

1954 fault scarp Hachures on downthrown side.

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

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

Inclined Horizontal

Strike and dip of flow bands in lava or intrusion

Inclined Vertical

Strike and dip of metamorphic foliation

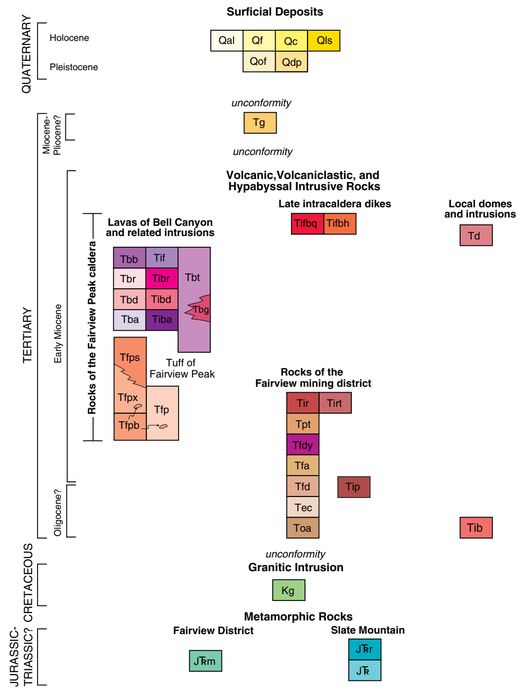
Inclined

Vein Showing dip, dashed where approximately located.

Vein coincident with normal fault Showing dip, dashed where approximately located, arrow shows plunge of linear features.

Area of silicified rock

H95-16
Sample location for $^{40}Ar/^{39}Ar$ date or chemical analysis.



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