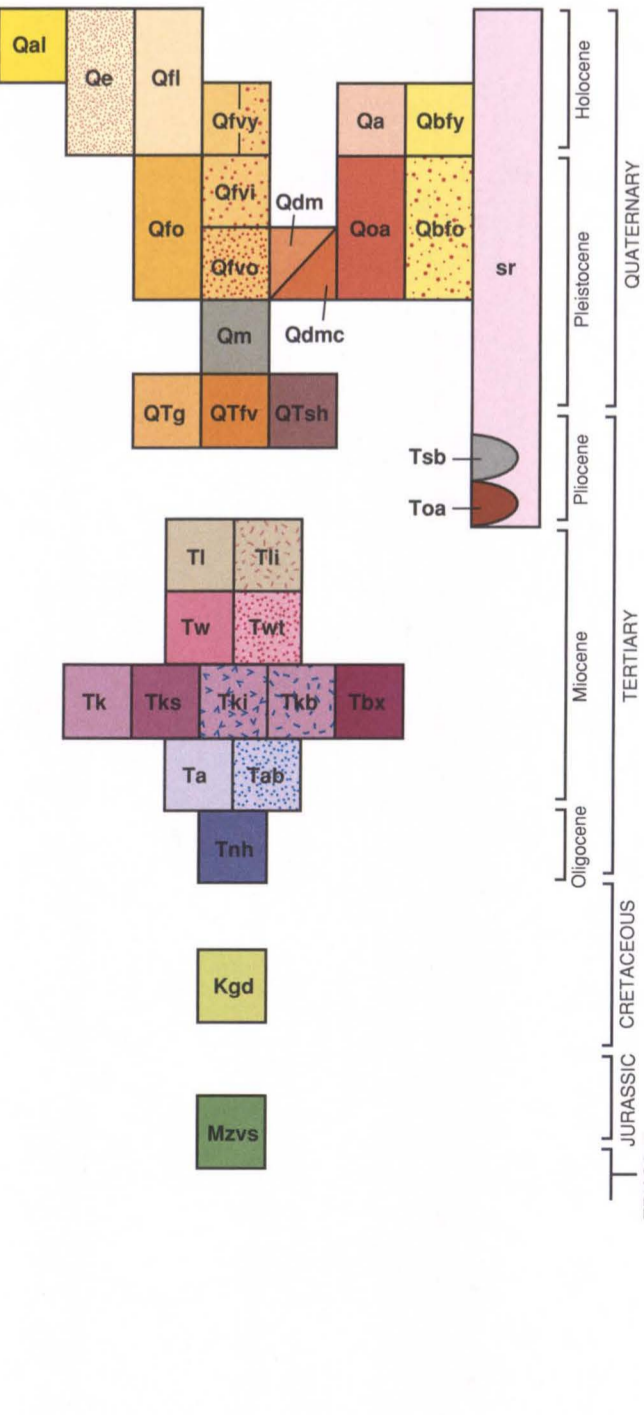
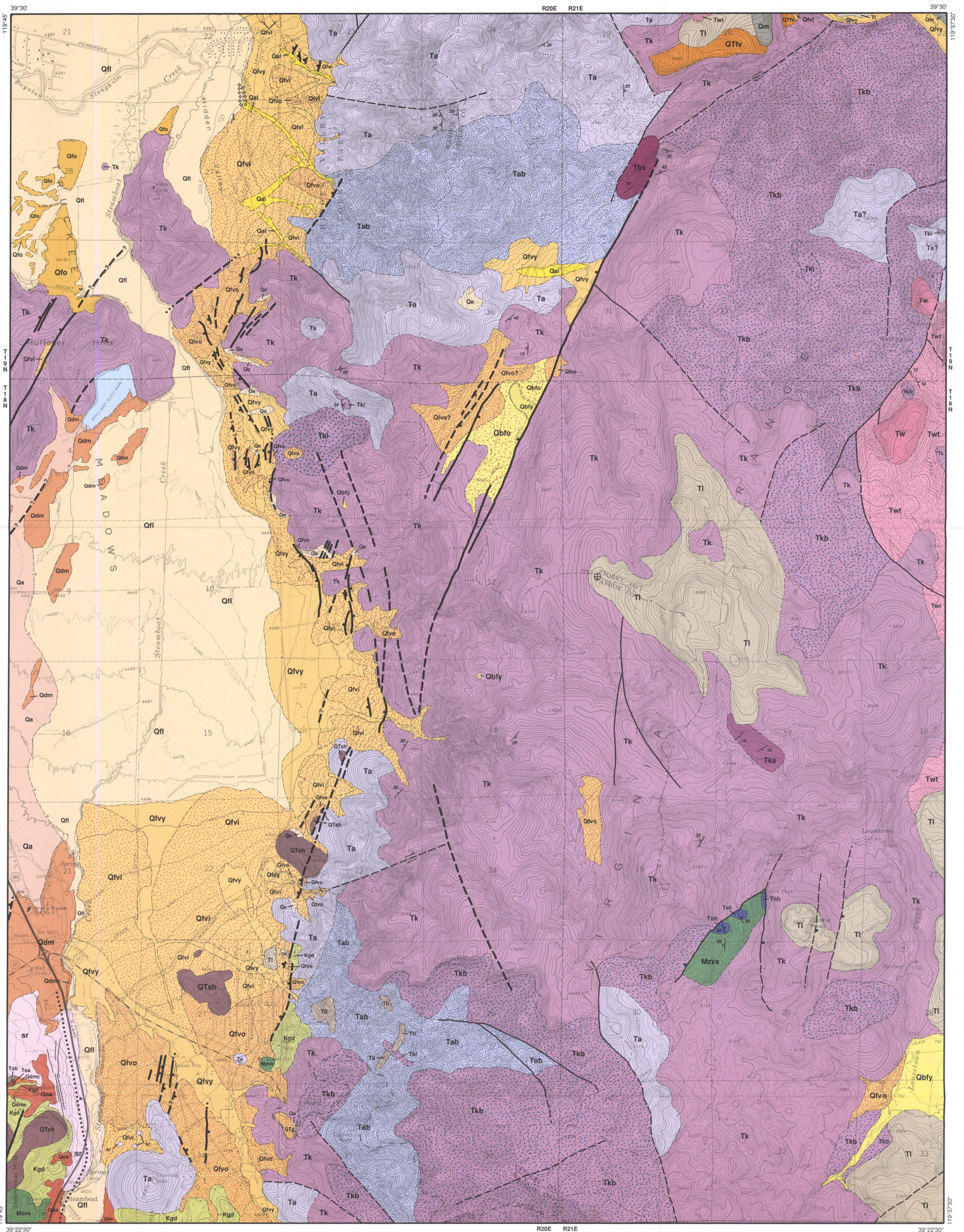


STEAMBOAT QUAD

GEOLOGY



**Qal** Recent channel deposits Light-brown, pebbly, sandy mud deposited by recent waterfloods in major drainages. Associated with historic flashfloods and mudflows in the Hidden Valley area.

**Qfi** Floodplain deposits of the Truckee River and Steamboat Creek Gray, dark-gray-brown, and light-brown sand and sandy mud; locally may contain interbeds of pebble-cobble fluvial gravel and peat. Just north of the quadrangle, a <sup>14</sup>C date of 2100±155 years was obtained on a peat interbed (Bell and Bonham, 1987). Little to no soil (A-C profiles). Has been subject to large-scale historic flooding near Steamboat Springs. May be cemented by secondary Fe<sub>2</sub>O<sub>3</sub>.

**Qa** Alluvial bajada deposits of the Mt. Rose fan Light-brown to gray muddy sand and mud containing minor pebble-cobble gravel interbeds. Contact with **Qfi** is gradational. Little to no soil (A-C profiles).

**Qe** Eolian sand deposits Light-brown, well-sorted, medium sand; only major dunes and sheets mapped. Dominantly inactive, although local reworking is common. Many deposits exhibit a moderately to strongly developed reddish cambic (Bw) soil.

**Obly** Young basin-fill deposits Light-brown to brown sandy mud and pebbly, medium sand. Derived from low-gradient deposition in small, fault-controlled basins within the Virginia Range. Little to no soil (A-C profiles).

**Qlvi** Alluvial fan deposits of the Virginia Range Composed dominantly of subangular to subrounded clasts of gray to dark-gray andesite with varying proportions of white to red altered andesite clasts depending upon source area; poorly to moderately stratified; poorly to very poorly sorted. From oldest to youngest, units comprise a descending set of successively inset and nested fans and stream terraces typically having little vertical separation. Similar geomorphic characteristics make differentiation very difficult without the use of petrologic data. **Qlvi**: light-brown to brown muddy, sandy, pebble gravel; locally cobble to boulder gravel. Soils have A-C to cambic (Bw) profiles. Stippled where deposit is dominantly a pebbly sand derived from reworking of older **Qe** deposits. Where bouldery, commonly displays bar-and-channel microtopography. **Qlvi**: light-brown to brown muddy, sandy, cobble to boulder gravel; maximum boulder diameter >1 m. Typically contains a well-developed argillic (B) soil about 30 cm thick. **Qlvo**: light-brown to brown muddy, sandy, cobble to boulder gravel; maximum boulder diameter >1 m. Surface clasts are strongly weathered. Soils contain a well-developed argillic (B) horizon ranging from 1/2 to 1 m thick, locally underlain by a carbonate- and silica-cemented durpan as much as 1 m thick. East of Steamboat Creek in the Steamboat Springs area, unit forms a prominent terrace which is stratigraphically equivalent to **Qdm**.

**Qoa** Older alluvium of the Steamboat Hills Brown sandy, pebble to cobble gravel composed of angular metasedimentary and metavolcanic clasts in the Steamboat Hills area. Soil contains argillic (B) horizon 30 to 60 cm thick.

**Obfo** Old basin-fill deposits Gray-brown to reddish-brown pebbly, muddy, medium sand. Derived from low-gradient deposition in

small fault-controlled basins within the Virginia Range. Soils have argillic (B) horizons as much as 1 m thick.

**Qlo** Older floodplain alluvium Gray to brown muddy sand and mud. Soils have argillic (B) horizons 30 to 60 cm thick, locally underlain by a silica- and carbonate-cemented durpan. Occupies terrace remnants standing slightly higher than **Qfi** north of 2.55 Ma (Morton and others, 1980).

**Qdm** Donner Lake outwash-Mt. Rose fan complex **Qdm**: Brown muddy, sandy, cobble to boulder gravel; near Huffaker Hills consists of brown to gray, well-rounded, small pebble gravel and coarse sand; poorly to moderately stratified, locally crossbedded; generally poorly to very poorly sorted. Composed dominantly of andesite clasts with subordinate granitic clasts. Where present, granitic clasts are deeply weathered and generally noncoherent on the surface. Deposit is derived from major streams draining the Carson Range; near Steamboat Hills, unit is locally overlain by unmapped veneer (1 to 2 m) of Tahoe-age alluvium containing unweathered granitic clasts; near Huffaker Hills, unit consists of scattered eroded fan remnants. Soils typically have a strongly developed argillic (B) horizon 60 cm thick, locally underlain by a silica- and carbonate-cemented durpan 1 m thick. Deposit is locally well cemented by sinter and/or is hydrothermally altered in the Steamboat Hills area (**Qdmc**).

**Qm** McClellan Peak Olivine Basalt Flow of black to dark-gray basalt with prominent green olivine phenocrysts. Age approximately 1.5 Ma (Morton and others, 1980).

**Qlvt** Finglometeers of Lagomarsino Canyon Light- to dark-gray, well-cemented, cobble to boulder gravel and sandstone; underlies McClellan Peak Olivine Basalt. Deposit consists of subangular to well-rounded volcanic clasts derived from the Virginia Range. Soil has an argillic (B) horizon more than 1.5 m thick.

**Qlg** Old alluvium of Geiger Grade Dark-gray pebble to cobble sandy gravel; subangular to rounded porphyritic andesite and altered andesite clasts.

**Qlsh** Steamboat Hills Rhyolite Rhyolite domes. The rhyolite is light gray and contains small (1-3 mm) phenocrysts of sanidine, sodic plagioclase, quartz, and minor biotite in a matrix of microcline, perthite, glass. The rhyolite domes have been dated by K-Ar methods from 1.14 to 1.51 Ma (Silberman and others, 1979).

**Tsb** Basaltic andesite of Steamboat Hills Dark-gray flows of basaltic andesite containing abundant phenocrysts of plagioclase, common olivine, and sparse pyroxene in a fine-grained groundmass of microlites. Plagioclase phenocrysts typically contain partially resorbed, sieve-textured cores. K-Ar age 2.52 to 2.55 Ma (Silberman and others, 1979).

**Toa** Old alluvium of Steamboat Hills Light-brown pebble to cobble gravelly sandstone; well cemented; hydrothermally altered. Composed of arkosic sand with scattered andesite clasts.

**sr** Hot-spring sinter Siliceous sinter ranging in age from late Pliocene to present. Older sinter is white to gray chalcocyan; locally contains mercury sulfides; younger sinter is light-gray to tan porous opal.

**Tl** Lousetown Formation **Tl**: flows of platy basaltic andesite and basalt. Flows range from pyroxene andesite to olivine-pyroxene basalt. Flows are typically dark gray to black, dark brown on weathered surfaces. **Tli**: intrusive plugs and dikes of basalt and basaltic andesite, petrographically identical to **Tl**. Age 7.4-9.7 Ma (Dalrymple and others, 1967; Morton and others, 1980).

**Tw** Washington Hill Rhyolite **Tw**: rhyolite flow domes, margins locally composed of pumiceous glass, perlite, and minor obsidian; sparsely porphyritic with glomeroporphyratic, sodic plagioclase and biotite. **Twf**: rhyolite air-fall tuff, minor pyroclastic flows, water-laid tuff and tuffaceous mudstone. Equivalent in part to rocks of the Truckee and Coale Valley formations and to the sandstone of Hunter Creek. K-Ar age 9.7-10.9 Ma (Vikre and others, 1988).

**Tk** Kate Peak Formation **Tk**: flows, domes, lahars, pyroclastics, plugs and dikes. **Tks**: air-fall tuff, tuffaceous and diatomaceous sedimentary rocks. **Tki**: mapped intrusive phases of the Kate Peak Formation; undifferentiated intrusions are present in unit **Tkb**, particularly in areas of intense hydrothermal alteration. **Tkb**: hydrothermally altered rocks of high-sulfidation type; includes extensive areas of surficial oxidation of pyritized, propylitically altered rock, producing supergene argillic alteration (bleached rock). May contain small unmapped areas of **Ta** or **Tab**. Rocks of the Kate Peak Formation range in composition from andesite to rhyolite, but are chiefly dacite and rhyodacite. They typically contain prominent phenocrysts of sodic plagioclase, clinopyroxene, and orthopyroxene, hornblende, and biotite in a felsitic matrix. Flow rocks commonly are microvesicular and exhibit spherulitic weathering. Ages range from 12.4 to 16.9 Ma and ages of high sulfidation alteration range about 9.5 to 16.3 Ma based upon K-Ar dating (Vikre and others, 1988). **Tbx**: bedded hydrothermal eruption breccia, composed of silicified and opalized pebbles to boulder-sized fragments of Kate Peak volcanic rocks in a bright-red, hematitic matrix; some native sulfur present in vugs. Formed by hydrothermal explosions at paleo-surface.

**Ta** Alta Formation **Ta**: pyroxene, pyroxene-hornblende, and hornblende andesite flows, lahars, and pyroclastic flows. Phenocrysts of plagioclase (An40-60), clinopyroxene, and/or basaltic hornblende in a fine-grained matrix of plagioclase, pyroxene, hornblende, apatite, and magnetite. Flow rocks are typically medium to dark gray on fresh surfaces, weathering to brown shades. **Tab**: hydrothermally altered Alta Formation. Areas of hypogene advanced argillic and argillic alteration of high-sulfidation type and bleached areas of argillic rocks related to shallow supergene oxidation of pyritized, propylitically altered andesite. Argillized rocks typically are composed of montmorillonite and/or kaolinite. Extensive zones of quartz-aluminate alteration producing resistant ledges composed of quartz, alunitic iron oxides, and lesser amounts of zircon, diaspore, and barite. Ledges contain abundant sulfides, principally pyrite, below zone of surficial oxidation. Hydrothermal alteration is time equivalent to **Tkb** and areas mapped as **Tab** may contain small unmapped areas of **Tkb**. K-Ar ages on hornblende from Alta Formation andesites are 16.5, 18.1, and 20.1 Ma. Plagioclase ages 14.4 and 16.5 Ma (Vikre and others, 1988). The older two hornblende ages are the ones that we believe are the most accurate. **Ta?**: pyroxene-hornblende andesite flows and breccias in the Washington Hill area that are probably correlative with the Alta Formation but may represent a new formation.

**Tnh** Nine Hill Tuff Densely welded, reomorphic, rhyolite ash-flow tuff containing phenocrysts of alkali feldspar, minor quartz and thoroughly oxidized hornblende(?). Pumice has been replaced by aggregates of tridymite and alkali feldspar. Hydrothermally altered and bleached in outcrops near Castle Peak. K-Ar age approximately 24 Ma (Bingler, 1978).

**Kgd** Granddiorite Medium-grained plutonic rocks containing sodic plagioclase, microcline, quartz, hornblende, biotite, and accessory sphene, magnetite, apatite, and zircon. Argillized and acid-leached in Steamboat Springs area. Late Cretaceous in age.

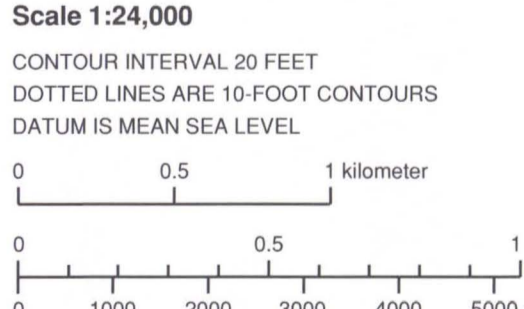
**Mzvs** Gardnerville Formation(?) Metavolcanic and metasedimentary rocks near Castle Peak and in the Steamboat Hills. The metavolcanic rocks in the Castle Peak area are rhyodacitic tuff. The metasedimentary rocks are dark gray to black tuffaceous argillite, minor dark gray to black limestone, and volcaniclastic sandstone and conglomerate. Tuffaceous argillite locally contains abundant impressions of wood, possibly Araucarioxylon, a conifer of Triassic age (Thompson, 1956).

REFERENCES

- Bell, J. W., and Bonham, H. F., Jr., 1987. Geologic map, Vista quadrangle, Nevada Bureau of Mines and Geology Map 44g.
- Bingler, E. C., 1978. Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geological Survey Bulletin 1457-D, 19 p.
- Dalrymple, G. B., Cox, A., Doell, R. R., and Grommé, C. S., 1967. Pleistocene geomagnetic polarity epochs: Earth and Planetary Science Letters, v. 2, p. 163-172.
- Morton, J. L., Silberman, M. L., Thompson, G. A., and Brookins, D. G., 1980. New K-Ar ages and strontium isotopic data from late Miocene and younger volcanic rocks of the northern Virginia Range, Nevada. Washington State University Bulletin 1144, 52 p.
- Thompson, G. A., and White, D. E., 1964. Regional geology of the Steamboat Springs area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-A, 52 p.
- Vikre, P. G., McKee, E. H., and Silberman, M. L., 1988. Chronology of Miocene hydrothermal and igneous events in the western Virginia Range, Washoe, Storey and Lyon Counties, Nevada: Economic Geology, v. 83, p. 865-874.
- White, D. E., Thompson, G. A., and Sandberg, C. H., 1964. Rocks, structure, and geologic history of Steamboat Springs thermal area, Washoe County, Nevada: U.S. Geological Survey Professional Paper 458-B, 63 p.

Harold F. Bonham, Jr. and John W. Bell, 1993

Fieldwork in support of the U.S. Geological Survey COGECOMAP program



Contact: Dashed where approximately located; queried where uncertain.

Quaternary fault: Dashed where approximately located; dotted where uncertain; queried where located; ball on downthrown side.

Pre-Quaternary fault: Dashed where approximately located; ball on downthrown side; Quaternary movement not precluded; arrows indicate relative movement.

Fissures Possible faults. Symbols for strike and dip of beds, horizontal beds, strike of vertical beds, and strike and dip of flow layering.

NEVADA BUREAU OF MINES AND GEOLOGY MACKAY SCHOOL OF MINES. Base map: U.S. Geological Survey Steamboat 7.5 Quadrangle, 1967. First edition, first printing, 1963, 1000 copies. Printing: A. Carlisle & Co., Reno, Nevada. Reviewed by: Jim Yount, USGS; Stephen Peters, USGS; Larry Garstke, NEMG. Edited by: Dick Muevigh. Cartography: Susan L. Tingley. Typography: Hayetta Buckley and Susan L. Tingley. For sale by the Nevada Bureau of Mines and Geology/178, University of Nevada, Reno, Nevada, 89557-0088.