Text and references accompanying Nevada Bureau of Mines and Geology Open-File Report 19-5

# Geologic Map of the Granite Peak Quadrangle, Washoe County, Nevada

*by*

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## GEOLOGIC UNITS

### Quaternary Deposits

**Qa Active alluvium (Holocene)** Alluvium in recently to annually active washes generally consisting of cobble-pebble gravels and sands. Clasts are generally subrounded to rounded, but subangular clasts are locally common. Age-correlative, and commonly lumped, with Qfy. Deposits typically 0.5 m to more than 3 m thick.

**Qc Colluvial deposits (Holocene)** Colluvial and talus deposits generally occurring at the base of steep slopes. Deposits typically consist of poorly sorted, angular to subangular, clast-supported cobbles and boulders. Deposits are generally less than 3 m thick.

**Qgwd Groundwater discharge deposits (Holocene)** Organic-rich fine silt and clay around and down slope from active springs. The fine-grained materials are dominated by eolian material trapped by vegetation associated with spring discharge, but may include material transported by surface water. The deposits are variably calcareous and locally weakly stratified. Commonly deposited at active springs aligned along faults with late Quaternary activity. Deposits are generally less than 2 m thick.

**Qfy Younger alluvial-fan deposits (Holocene)** Cobbly, pebbly, coarse sands with boulders; moderately sorted, matrix- and clast-supported deposits with angular to subangular clasts. Deposited by debris flows and flood events in active washes and active, or recently active, alluvial fans. Surfaces commonly have rough bar-and-swale morphology. In Red Rock Valley, Qfy fines basinward into a low-gradient silty sand deposit. Soil development ranges from absent to weak A/Bw/C profiles, where cambic (Bw) horizons are weakly developed and as much as 20 cm thick. Deposits are as much as 3 m thick.

**Qfi Intermediate-aged alluvial-fan deposits (late Pleistocene)** Cobbly, pebbly, silty, coarse sand with boulders, moderately sorted, matrix- and clast-supported deposits with angular to subangular clasts. Surfaces are generally smooth, planar, and moderately dissected. Soil profiles typically have eolian silt caps (A or Av) with varying thicknesses, iron-stained horizons (Bw) up to 50 cm thick, and moderately developed, structured argillic horizons (Bt) up to 40 cm thick. Qfi soils were exposed and described in detail during a paleoseismic trenching investigation of the Petersen Mountain fault (Koehler et al. 2019). Deposits are up to 4 m thick.

**Qfo Older alluvial-fan deposits (middle Pleistocene)** Cobbly, pebbly, silty, coarse sands with boulders, moderately sorted, matrix- supported deposits with subangular to subrounded clasts. Clast rounding may have resulted in part from in-situ weathering of granitic clasts. Surfaces are generally smoothed, broadly rounded, and well dissected. Soil profiles typically have eolian silt caps (A or Av) with varying thicknesses, iron-stained horizons (Bw) up to 1 m thick, and well-developed structured argillic (Bt) horizons up to 70 cm thick. Deposits are as much as 4 m thick.

**Qls Landslide deposits (Holocene to late Pleistocene)** Coarse, unconsolidated debris composed of granitic clasts derived from the steep flanks of Petersen Mountain and nearby highlands. Blocks up to 10+ m in diameter. Deposits are up to 20 meters thick.

### Pliocene to Late Miocene Sedimentary Deposits

**Tss Sandstone (Pliocene?)** Grayish brown to reddish brown silty arkosic sandstone with pebbles, massive to thickly bedded, very poorly exposed. Lithic clasts are largely derived from Cretaceous granitic rocks. In the vicinity of Red Rock Road, Tss overlies Tsl with an unexposed and

likely gradational contact. To the west, Tss nonconformably onlaps onto Cretacous quartz monzonite (Kgg). Thickness is poorly constrained but locally may be greater than 80 m.

**Tst Siltstone (Miocene)** Light gray and brownish gray siltstone with interbedded pebbly sandstone, lacustrine. Poorly exposed with outcrops only in road cuts west of Freds Mountain. Siltstone is thinly bedded and locally tuffaceous. Well-rounded pebbles and gravel, up to 10 cm in diameter are common as surface lag on slopes. Clast lithology is largely comprised of volcanic rocks with lesser Cretaceous granitic clasts. Tsl overlies the prominent boulder bed (Tb) on the west side of Freds Mountain. Thickness is poorly constrained but likely greater than 150 m in the axis of the basin.

**Tsb Boulder bed (Miocene)** Coarse boulder deposit and conglomerate composed almost entirely of round to subrounded clasts of Cretaceous quartz monzodiorite (Kd), debris flow deposits sourced from Freds Mountain to the east. Clasts up to 10 m in diameter with common clasts in the 3–4 m range. Boulders are within a tan silt dominated matrix. The boulder bed overlies unit Tsfl on the west flank of Freds Mountain and forms a high standing resistant hill in the southeast corner of the map area. The boulder bed is associated with debris flows eroding off the exhuming Freds Mountain fault block. Up to 60 m thick.

**Ts Siltstone-sandstone (Miocene)** Poorly indurated siltstone and fluvial sandstone, lacustrine. Exposed along the western flank of Freds Mountain in the easternmost part of the map. A basal, massive, greenish gray sandstone comprised of lithic sub-angular to sub-rounded sand and gravel sized clasts of dioritic bedrock derived from the adjacent highlands, lies nonconformably on Kd bedrock. The sandstone grades upward into a yellowish tan, thinly bedded siltstone with sandy horizons. Siltstone is likely lacustrine and has local convolute bedding. 50–60 m thick.

**Th Hallelujah formation (Miocene)** Poorly exposed sandstone and siltstone on the west side of Petersen Mountain. Age is younger than the 11.66±0.25 Ma date from unit Tba (Henry et al., 2007). Correlative with unit Thl in the Chilcoot 15' quadrangle (Grose and Mergner, 2000).

## Miocene and Oligocene Volcanic Rocks

**Tba Basaltic andesite lava (Miocene)** Dark brown aphyric basaltic andesite lava flows that lie unconformably above the Tt ash flow tuffs on the west flank of Petersen Mountain. 11.66±0.25 Ma (Henry et al., 2007). 10–15 m thick.

**Trc Tuff of Rattlesnake Canyon (Oligocene)** White, pink or yellowish gray, poorly welded grading upward to densely welded ash-flow tuff characterized by large and abundant sanidine. Dense part weathers to rounded corestone boulders and shows nubbly texture on exposed surfaces. Lower, poorly welded part is more finely porphyritic and contains ~10% pumice up to 20 cm long. Rounded lithic clasts up to 2 cm across are common near the base. Exposed on the west flank of Petersen Mountain with an outcrop pattern that suggests deposition into a low-relief paleovalley. $^{40}Ar/^{39}Ar$ dates from the Seven Lakes Mountain quadrangle are 31.07 $\pm$ 0.05 and 31.02 $\pm$ 0.05 Ma (Henry et al., 2009). Equivalent to unit Tru in the Chilcoot 15' quadrangle (Grose and Mergner, 2000). Maximum exposed thickness is approximately 120 m.

**Trc Tuff of Axehandle Canyon (Oligocene)** Gray to reddish brown, poorly welded grading upward to densely welded ash-flow tuff characterized by the presence of biotite, plagioclase and sanidine phenocrysts. Sparsely porphyritic and biotite poor near the base with biotite phenocrysts increasing upward, up to 5% of rock composition. Common white pumice up to 10 cm long. Lies nonconformably on Cretaceous plutonic rocks on the west flank of Petersen Mountain with an outcrop pattern that suggests deposition into a low-relief paleovalley. A discontinuous, basal, <5 m thick, conglomerate bed locally underlies the tuff, comprised of largely rounded granitic clasts. A 31.22 $\pm$ 0.05 Ma $^{40}Ar/^{39}Ar$ date was acquired from the Seven Lakes Mountain quadrangle (Henry et al., 2009). Equivalent to unit Tru in the Chilcoot 15' quadrangle (Grose and Mergner, 2000). Maximum exposed thickness is approximately 120 m.

## Cretaceous Granitic Rocks

**Kgg Granite of Granite Peak (Cretaceous)** Medium-grained, white to pinkish white, equigranular granite. Pervasively intruded by parallel aplitic and pegmatitic dikes up to 1.5 m wide. Locally the aplite and pegmatite intrusions make up 20–30% of the rock creating an igneous foliation, or compositionally banded character. This foliation commonly parallels the Kgg intrusive contact with adjacent, older plutonic rocks. Much less mafic than unit Kgp and Kd with subhedral biotite and hornblende grains up to 3 mm comprising less than 5% of the rock. Feldspar makes up 45–60% of the rock composition with plagioclase in slightly greater abundance than K-feldspar. TAS classification of whole rock geochemistry from one Kgg sample plots as a granite (Fig. 1; Table 1). Kgg intrudes Kd along a sharp contact with a prominent chilled margin. Intrusive contact with Kgp is locally sharp but typically more diffuse. Commonly deeply weathered to grus in the eastern part of the quadrangle. Equivalent to unit Mzqm in the Reno NW 7.5' quadrangle (Soeller and Nielsen, 1980) and the Bedell Flat 7.5' quadrangle (Garside, 1993). Sample GP1434 submitted for U-Pb dating of zircon, age pending, see map for sample location.

**Kgp Granodiorite of Petersen Mountain (Cretaceous)** Medium to coarse-grained, speckled white to light gray, porphyritic to equigranular granodiorite and granite, characterized by a salt and pepper appearance and knobby outcrops. Variable texture and grain size. Massive with rare zones of discontinues foliation defined by mineral alignment. Mafic component is typically 10–20% of the rock comprised of biotite and hornblende, local euhedral phencrysts of biotite up to 10 mm and hornblende up to 5

mm. Feldspar makes up 60–75% of the rock composition with plagioclase in greater abundance than K-feldspar. TAS classification of whole rock geochemistry from three Kgp samples plot as granodiorite and granite (Fig. 1; Table 1). Locally plagioclase and quartz occur as phenocrysts up to 8 mm in a groundmass of quartz and K-feldspar. Also occurs as medium grained and equigranular. Sphene is a common accessory mineral visible with hand lens. Locally intruded by aplitic to pegmatitic dikes up to 0.7 m wide and possibly associated with the intrusion of unit Kgg. Kgp intrudes unit Kd, and the contact is commonly diffuse. Kgg intrudes Kgp and the contact varies from sharp, with a chilled margin in Kgg, to diffuse and poorly exposed. Commonly deeply weathered to grus in the eastern part of the quadrangle. Equivalent to units Kgs and Kgp in the Seven Lakes Mountain 7.5' quadrangle (Henry et al., 2009), unit Kgd on the Chilcoot 15' quadrangle (Grose and Mergner, 2000). Sample GP1369 submitted for U-Pb dating of zircon, age pending, see map for sample location.

**Kd Dioritic rocks (Cretaceous)** Medium to coarse-grained, dark gray, equigranular dioritic rocks. The typical Kd hand sample composition is classified as quartz monzodiorite, but the mineral assemblage is variable with areas of quartz rich granodiorite, and K-feldspar poor quartz diorite. TAS classification of whole rock geochemistry from three Kd samples plot as diorite (Fig. 1; Table 1). Massive with rare zones of discontinues foliation defined by mineral alignment. Higher mafic mineral composition than unit Kgp, with subhedral to euhedral biotite and hornblende grains up to 7 mm comprising 25–35% of Kd. Anhedral feldspar makes up 35–65% of the rock composition with plagioclase in far greater abundance than K-feldspar. Anhedral quartz makes up 5–30% of the rock and commonly forms a medium grained granular groundmass. Kd is intruded by Kgp and the contact is typically diffuse. Kgg intrudes Kd along a sharp contact with a prominent chilled margin in Kgg. Equivalent to unit Mzqd in the Reno NW 7.5' quadrangle (Soeller and Nielsen, 1980) and the Bedell Flat 7.5' quadrangle (Garside, 1993). Sample GP1431 submitted for U-Pb dating of zircon, age pending, see map for sample location.

## Metamorphic Rocks

**Jmv Metavolcanic rocks (Jurassic?)** Dark gray metamorphosed andesite and light gray dacite. Identified in one small outcrop east of the Petersen Mountain range front in the southernmost part of the quadrangle. Exposure is surrounded by dioritic plutonic rock and is interpreted as a screen of country rock preserved within Kd. The small exposure is heterogeneous and foliated with porphyritic dacitic rock adjacent to porphyritic andesite. May be equivalent to the Peavine sequence in adjacent geologic maps (Soeller and Nielsen, 1980; Garside, 1993) and unit Jmv in the Chilcoot 15' quadrangle (Grose and Mergner, 2000).

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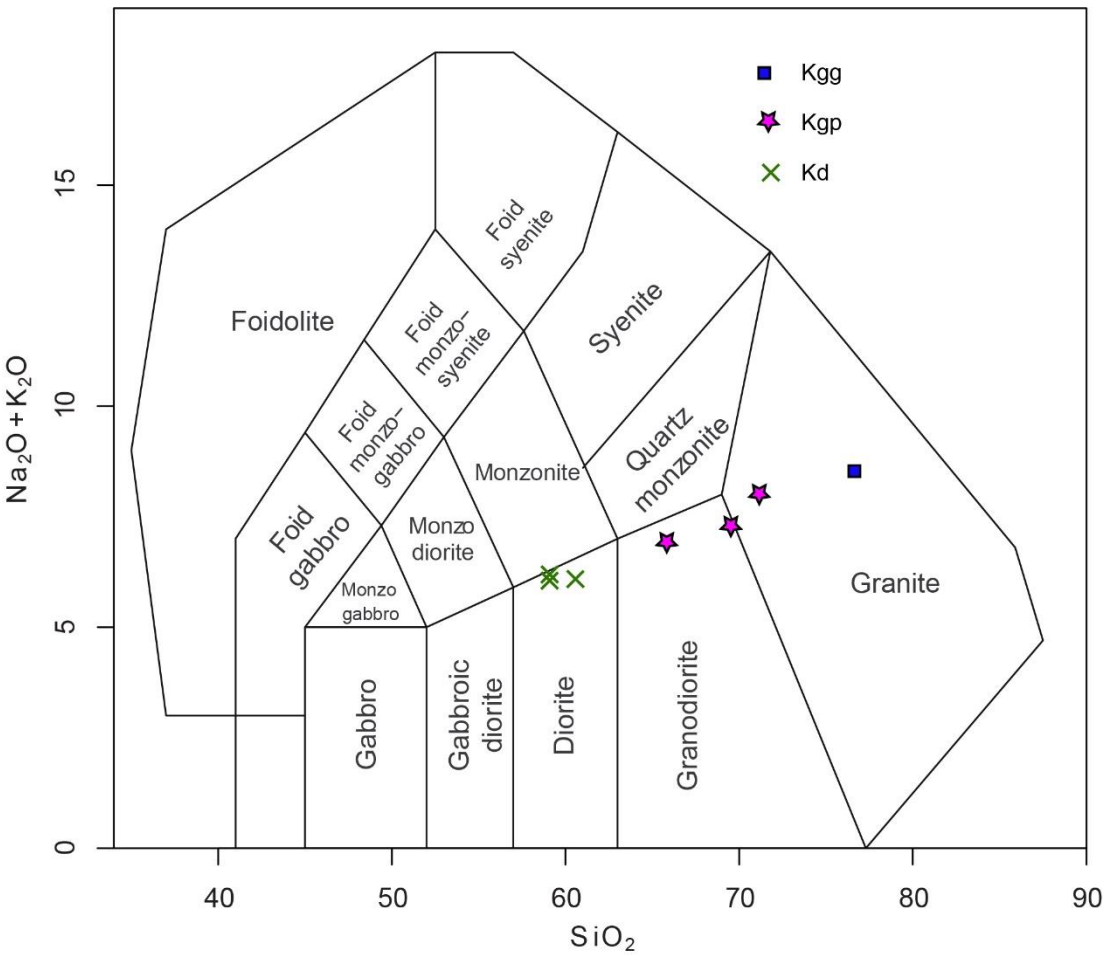


**Figure 1.** Total alkalis-silica (TAS) plot (Middlemost, 1994) of whole rock geochemistry from samples in the Granite Peak quadrangle. Unit abbreviations correlate to the text and legend on the map sheet. Full geochemical data shown in Table 1.

**Table 1. Geochemical data from the Granite Peak quadrangle.**

| Sample | Gp972 | Gp1398 | Gp1369 | Gp1434 | Gp1016 | Gp1431 | Gp1154 |
|---|---|---|---|---|---|---|---|
| Unit | Kgp | Kgp | Kgp | Kgg | Kd | Kd | Kd |
| Lat83 | 39.79204 | 39.84426 | 39.83755 | 39.76907 | 39.75015 | 39.76992 | 39.76373 |
| Long83 | -119.9959 | -119.8952 | -119.9500 | -119.9229 | -119.9897 | -119.9299 | -119.8754 |
| | | | | Percentage % | | | |
| SiO2 | 64.4 | 70.6 | 68.6 | 76.4 | 59.6 | 57.1 | 58.2 |
| Al2O3 | 15.5 | 15.3 | 15.65 | 13.3 | 16.4 | 16.85 | 17.05 |
| Fe2O3 | 5.05 | 2.27 | 3.04 | 0.72 | 6.98 | 7.34 | 7.28 |
| CaO | 4.03 | 2.31 | 2.96 | 0.87 | 5.66 | 5.88 | 6.06 |
| MgO | 1.9 | 0.64 | 0.87 | 0.03 | 3.2 | 3.31 | 3.29 |
| Na2O | 3.14 | 4.05 | 4.06 | 4.03 | 3.24 | 3.32 | 3.45 |
| K2O | 3.65 | 3.84 | 3.12 | 4.48 | 2.79 | 2.57 | 2.63 |
| Cr2O3 | 0.002 | <0.002 | 0.002 | <0.002 | 0.006 | 0.005 | 0.006 |
| TiO2 | 0.55 | 0.31 | 0.38 | 0.04 | 0.8 | 0.79 | 0.86 |
| MnO | 0.07 | 0.04 | 0.05 | 0.02 | 0.11 | 0.11 | 0.12 |
| P2O5 | 0.1 | 0.09 | 0.11 | <0.01 | 0.15 | 0.17 | 0.17 |
| SrO | 0.03 | 0.05 | 0.05 | <0.01 | 0.03 | 0.04 | 0.04 |
| BaO | 0.07 | 0.13 | 0.11 | <0.01 | 0.06 | 0.06 | 0.06 |
| LOI | 0.42 | 0.45 | 0.64 | 0.17 | 0.45 | 0.7 | 0.48 |
| Total | 98.91 | 100.08 | 99.64 | 100.06 | 99.48 | 98.25 | 99.7 |
| | | | | PPM (parts per million) | | | |
| Ba | 644 | 1085 | 957 | 20.4 | 559 | 525 | 626 |
| Ce | 34.7 | 27.4 | 25.8 | 10.4 | 35.1 | 31.6 | 37.2 |
| Cr | 10 | 10 | 10 | <10 | 40 | 40 | 50 |
| Cs | 8.59 | 3.06 | 4.05 | 5.63 | 9.08 | 8.23 | 9.08 |
| Dy | 3.85 | 1.1 | 1.24 | 0.18 | 4.2 | 3.72 | 4.08 |
| Er | 2.19 | 0.59 | 0.67 | 0.19 | 2.4 | 2.16 | 2.35 |
| Eu | 0.79 | 0.55 | 0.55 | 0.07 | 0.88 | 0.88 | 0.96 |
| Ga | 17.3 | 19.1 | 18.4 | 19.9 | 19.7 | 17.8 | 20.4 |
| Gd | 4.18 | 1.74 | 1.74 | 0.21 | 4.59 | 4.03 | 4.46 |
| Hf | 5.4 | 3.4 | 2.9 | 2.3 | 5.6 | 5.2 | 3.9 |
| Ho | 0.76 | 0.2 | 0.22 | 0.05 | 0.81 | 0.75 | 0.82 |
| La | 16.3 | 15.6 | 14.2 | 8.2 | 16.5 | 14.6 | 17.5 |
| Lu | 0.32 | 0.11 | 0.11 | 0.09 | 0.34 | 0.32 | 0.34 |
| Nb | 5.4 | 4.6 | 4 | 4.6 | 5.6 | 4.7 | 5.7 |
| Nd | 17.8 | 11.8 | 11.1 | 1.9 | 18.7 | 16.6 | 19.8 |
| Pr | 4.43 | 3.21 | 2.96 | 0.8 | 4.55 | 4.13 | 4.8 |
| Rb | 170.5 | 133.5 | 99.7 | 178 | 148.5 | 141 | 128 |
| Sm | 4.09 | 2.18 | 2.11 | 0.26 | 4.24 | 4.07 | 4.66 |
| Sn | 2 | 2 | 1 | <1 | 2 | 1 | 2 |
| Sr | 291 | 402 | 421 | 41.6 | 341 | 346 | 359 |
| Ta | 0.6 | 0.5 | 0.4 | 0.4 | 0.5 | 1 | 1 |
| Tb | 0.58 | 0.21 | 0.22 | 0.03 | 0.66 | 0.63 | 0.71 |
| Th | 21.4 | 11.65 | 8.97 | 16.7 | 18.25 | 14.6 | 14.5 |
| Tm | 0.35 | 0.09 | 0.1 | 0.04 | 0.37 | 0.31 | 0.32 |
| U | 2.91 | 3.41 | 2.23 | 3.43 | 6.33 | 4.03 | 3.83 |
| V | 116 | 33 | 49 | <5 | 182 | 187 | 195 |
| W | 1 | 1 | 1 | <1 | 4 | 2.00 | 2.00 |
| Y | 21.7 | 6.2 | 6.8 | 1.9 | 23.3 | 20.7 | 22.8 |
| Yb | 2.2 | 0.6 | 0.7 | 0.4 | 2.3 | 2.1 | 2.1 |
| Zr | 180.0 | 113.0 | 98.0 | 34.0 | 196.0 | 200.0 | 130.0 |