DEPARTMENT OF THE INTERIOR
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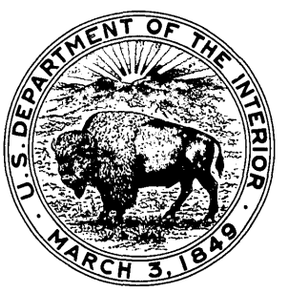
# GEOLOGIC MAP OF PAHUTE MESA, NEVADA TEST SITE AND VICINITY, NYE COUNTY, NEVADA

By

Paul P. Orkild, K. A. Sargent, and R. P. Snyder

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-567

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TO ACCOMPANY MAP I-567

# GEOLOGIC MAP OF PAHUTE MESA, NEVADA TEST SITE AND VICINITY, NYE COUNTY, NEVADA

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## DESCRIPTION OF MAP UNITS

**Qac** ALLUVIUM AND COLLUVIUM (0-800+ ft)—Unconsolidated bouldery to sandy stream (channel) deposits, fans, talus, and slope-wash deposits.

**Ql** LANDSLIDE BLOCKS—Large blocks of Grouse Canyon Member of Belted Range Tuff have slipped down the west slope of Saucer Mesa.

**QTac** ALLUVIUM AND COLLUVIUM (0-400+ ft)—Two undivided units; upper is Quaternary alluvium and colluvium; lower is sandy to bouldery alluvium interlayered with Labyrinth Canyon Member of Thirsty Canyon Tuff.

**QTb** BASALT OF BASALT RIDGE AND OF BUCKBOARD MESA (0-200 ft)—Dense black porphyritic basalt containing phenocrysts of labradorite and clinopyroxene as much as 30 mm long; at Buckboard Mesa, flows are nonporphyritic olivine basalt. Includes cinder beds beneath some basalt flows and agglomeratic spatter cone at Scrugham Peak.

**QTbd** FEEDER DIKES—Discontinuous thin dikes of scoriaceous porphyritic and nonporphyritic basalt.

THIRSTY CANYON TUFF:

**Ttl** LABYRINTH CANYON MEMBER (0-50 ft)—Simple cooling unit of comenditic ash-flow tuff underlain by ash-fall tuff; pale-pink to light-gray partially welded devitrified and vapor-phase altered tuff underlain by light-gray to buff nonwelded to partially welded and glassy ash-flow tuff at base; contains 5 percent phenocrysts (0.5-2 mm), mainly sodic sanidine, with less abundant iron-rich clinopyroxene, fayalite, amphibole, sodic plagioclase, accessory opaque oxides, and zircon.

**Ttg** GOLD FLAT MEMBER (0-200 ft)—Simple cooling unit of pantelleritic ash-flow tuff, yellowish- to reddish-brown, locally green to black at base, densely to partially welded, devitrified except for thin local basal vitrophyre; locally underlain by very thin ash-fall tuff; contains 15-25 percent of generally fractured phenocrysts, mainly alkali feldspar, chiefly sanidine but including numerous large (1-2+ cm) conspicuous euhedral crystals of calcic anorthoclase, with less abundant quartz, sodic plagioclase, fayalite, iron-rich clinopyroxene, opaque oxides, and accessory biotite, zircon, apatite, and chevkinite; uncommon to abundant lithic inclusions; youngest ash flows contain many phenocryst-rich cognate inclusions.

**Ttt** TRAIL RIDGE MEMBER (0-280 ft)—Simple cooling unit of metaluminous to subaluminous silicic ash-flow tuff with conspicuous white to buff pumice-rich ash-fall tuff at base; ash-flow tuff reddish brown, purplish brown, and pale pink, densely to partially welded, mainly devitrified but locally with glassy vitrophyric base; contains 2-30 percent phenocrysts (1-4 mm), mainly sanidine, with less abundant iron-rich clinopyroxene, fayalitic olivine, opaque oxides, and accessory biotite, zircon, and apatite; older ash flows generally contain abundant lithic inclusions.

**Ttsr** SPEARHEAD AND ROCKET WASH MEMBERS (0-435 ft)—Compound cooling unit of comenditic to trachytic sodic rhyolitic ash-flow tuff with thin buff pumice-rich ash-fall tuff locally at base; ash-flow tuff dark gray to dark reddish brown, partially to densely welded, devitrified and in part vapor-phase altered except for a thin glassy zone at base; individual ash flows contain 3-25 percent phenocrysts (1-5 mm), mainly sodic sanidine in upper part and mainly sanidine-anorthoclase and sodic plagioclase in lower part, with less abundant quartz, iron-rich clinopyroxene and olivine, amphibole, opaque oxides, and accessory biotite, apatite, and zircon. Some ash flows are characterized by abundant dark-gray to brown scoriaceous pumice fragments as much as 2 feet in diameter.

**Tat** ASH-FALL AND REWORKED TUFF (0-175 ft)—Thin- to thick-bedded white, yellowish-gray, pinkish-gray, and light-brown vitric ash-fall tuff; locally lower part is zeolitic and cemented with calcium carbonate.

**Tgs** GRAVEL AND TUFFACEOUS SEDIMENTS (0-500 + ft)—Yellowish-gray to yellowish-brown bouldery volcanic gravel; poorly sorted and stratified; locally cemented by caliche near surface. May include gravel of Quaternary age.

**Tlh** LAVAS OF HIDDEN CLIFF (0-100+ ft)—Medium- to dark-gray massive to vesicular trachyte and mafic trachytic lava flows; contains 5-20 percent phenocrysts, mainly plagioclase,

with less abundant olivine, clinopyroxene, opaque oxides, and apatite in an intergranular seriate texture of trachytic groundmass of alkali feldspar, plagioclase, iron-rich clinopyroxene, opaque oxides, and, locally, sodic amphibole.

**Tlp** LAVAS OF PILLAR SPRING (0-1,000+ ft)—Medium- to purplish-gray trachytic sodic rhyolite and massive to vesicular trachytic lava flows; contains 25-40 percent phenocrysts of anorthoclase, sodic sanidine, and sodic plagioclase, with less abundant clinopyroxene, olivine, opaque oxides, apatite, and zircon. Generally strongly jointed and flow layered, resulting in sculptured weathering forms.

**Tly** ROCKS OF YELLOW CLEFT—Tuffs, lavas, and minor syenite. Trachyte, trachytic sodic rhyolite, and comenditic lava flows, breccias, tuff-breccias, and welded tuffs, generally dark-gray to reddish-brown; and light-gray to grayish-brown (weathering yellow orange) strongly jointed porphyritic to locally medium-grained hypidiomorphic-granular quartz syenite locally grading to trachyte; syenite contains abundant phenocrysts of anorthoclase and sodic plagioclase, and less abundant clinopyroxene, altered olivine, opaque oxides, and apatite set in a groundmass of alkali feldspar with minor quartz, sodic pyroboles, and(or) iron-rich biotite, and opaque oxides.

**Tlr** LAVAS OF RIBBON CLIFF (0-700+ ft)—Medium-gray to brown massive to flow-layered dense to vesicular trachytic sodic rhyolite, quartz trachyte, and trachyte lavas; generally crystallized except for local glassy tops and bases; contains 15-30 percent phenocrysts, mainly large (as much as 2 cm) anorthoclase, with less abundant clinopyroxene, iron-rich olivine, and opaque oxides; flows locally are underlain by thin units of gray to buff ash-fall tuff.

**Tlf** MAFIC LAVAS (0-60 ft)—Dark-brown to black massive to scoriaceous olivine-bearing basalt.

TIMBER MOUNTAIN TUFF:

**Tma** AMMONIA TANKS MEMBER (0-300± ft)—Compound cooling unit of ash-flow tuff consisting of partially to densely welded gray and buff glassy and devitrified quartz latitic tuff containing dark mafic scoria and pumice grading to flattened black glass as much as 2 feet long, which overlies partially to densely welded gray devitrified and glassy rhyolitic and quartz latitic tuff, which in turn overlies a thin basal zone of partially to densely welded pink, gray, and black glassy rhyolitic tuff. Tuff contains 10-35 percent phenocrysts (1-3 mm) of sanidine, quartz, and plagioclase, with less abundant biotite, clinopyroxene, hornblende, and accessory opaque iron oxides, sphene, zircon, and apatite. Xenoliths common, including rhyolite and fragments of Rainier Mesa Member.

**Tmr** RAINIER MESA MEMBER (0-1,300 ft)—Compound cooling unit of pale-red to dark-brown nonwelded to densely welded rhyolite to quartz latite ash-flow tuff; mainly devitrified but glassy at top and base; conspicuous vuggy-weathering light-gray vapor-phase zone at top; contains 20-30 percent phenocrysts (1-3 mm), mainly sanidine, quartz, and sodic plagioclase, with less abundant biotite, hornblende, clinopyroxene, opaque oxides, and accessory apatite and zircon; rare to sparse lithic fragments of aphanitic rhyolite.

**Tmfc** TUFF OF FALCON CANYON (0-190 ft)—Simple cooling unit of nonwelded to partially welded quartz latite ash-flow tuff; mainly glassy but locally zeolitized; contains 30-40 percent phenocrysts (1-3 mm), mainly alkali feldspar, sodic plagioclase, and quartz, with less abundant biotite, clinopyroxene, hornblende, opaque oxides, and accessory apatite and zircon; sparse to common lithic fragments of welded tuff and lava.

**Tdf** DEBRIS FLOW (0-200± ft)—Megabreccia in gray to grayish-orange tuffaceous matrix deposited on caldera wall; contains angular blocks, as large as 20 feet, consisting of locally derived rhyolite and welded tuff. Emplaced as result of collapse of Timber Mountain caldera.

**Trm** RHYOLITE LAVAS OF TIMBER MOUNTAIN CALDERA MOAT (0-600± ft)—Light- to purplish-gray massive to flow-layered dense to vesicular rhyolite lavas; generally crystallized except for locally glassy tops and bases; basal vitrophyre irregular and locally contained within underlying zone of fused bedded tuff; contains 5-10 percent phenocrysts, mainly quartz and alkali feldspar, with less abundant plagioclase, biotite, and opaque oxides. In northwestern part of the moat, quartz-free rhyolites contain alkali feldspar and plagioclase in a ratio of about 2:1.

PAINTBRUSH TUFF:

**Tpc** TIVA CANYON MEMBER (0-370 ft)—Compound cooling unit of gray to reddish-brown nonwelded to densely welded crystal-poor rhyolite to crystal-rich quartz-latite ash-flow tuff; mainly devitrified but glassy at top and base; locally light-gray vapor-phase zone at top; contains 10-15 percent phenocrysts (1-3 mm) in crystal-rich upper part and 1-2 percent phenocrysts (1 mm) in crystal-poor base, mainly alkali feldspar, with less abundant plagioclase, biotite, clinopyroxene, opaque oxides, and sphene.

**Tpb** TUFF OF BLACKTOP BUTTES (0-640 ft)—Simple cooling unit of pale-gray nonwelded to partially welded ash-flow tuff; contains 5-10 percent phenocrysts (1-1.5 mm), mainly alkali feldspar and plagioclase, with less abundant quartz, biotite, and minor opaque oxides. This ash flow is lenticular within bedded tuff 200 feet stratigraphically below the base of the Tiva Canyon Member on the south face of Pahute Mesa and is similar to Stockade Wash Member but lacks hornblende, is lower in biotite content and richer in lithic fragments than the ash-flow sequence mapped as Stockade Wash east of Split Ridge.

**Tpt** TOPOPAH SPRING MEMBER (0-450 ft)—Compound cooling unit of reddish-brown densely welded ash-flow tuff, mainly rhyolite but commonly grades into quartz-latite at its top; mainly devitrified but glassy at top and base; contains 10-20 percent phenocrysts (1-3 mm) in quartz latitic upper part and 1-3 percent phenocrysts (1 mm) in rhyolitic lower part, mainly alkali feldspar and plagioclase, with less abundant biotite, magnetite, and clinopyroxene.

**Tpw** STOCKADE WASH MEMBER (0-500 ft)—Simple cooling unit of pale-gray and brown nonwelded to partially welded rhyolite ash-flow tuff characterized by small (1 cm) orange-brown pumice fragments, rhyolitic lithic fragments, and by common large (1-2 mm) biotite flakes; contains 5-10 percent phenocrysts of alkali feldspar and plagioclase, with minor biotite, hornblende, and opaque oxides; numerous windmade cavities; columnar joints in thicker partially welded sections.

LAVAS OF SCRUGHAM PEAK QUADRANGLE:

**Trpr** QUARTZ-RICH RHYOLITE LAVA (0-565 ft)—Light- to brownish-gray devitrified and gray to green vitrophyric lava flows; contains 25-30 percent (1-3 mm) phenocrysts of alkali feldspar, plagioclase, and quartz, with less abundant biotite, hornblende, and sphene.

**Trpq** QUARTZ-BEARING RHYOLITE LAVAS (0-1,140 ft)—Light- to dark-gray devitrified to vitrophyric lava flow; contains 10-11 percent phenocrysts (1-2 mm) of alkali feldspar and plagioclase, with less abundant quartz, biotite, sphene, opaque oxides, and hornblende.

**Trpb** BIOTITE RHYOLITE LAVAS (0-1,000± ft)—Light- to dark-gray devitrified to vitrophyric lava flow; 10-12 percent phenocrysts (1-2 mm), mainly alkali feldspar and plagioclase in subequal amounts, with less abundant biotite, minor sphene, opaque oxides, clinopyroxene, and hornblende.

**Trph** HORNBLENDE RHYOLITE LAVAS (0-400± ft)—Light- to greenish-gray devitrified to vitrophyric lava flow; 4-5 percent phenocrysts (1-2 mm), mainly alkali feldspar, with minor plagioclase, hornblende, opaque oxides, sphene, and biotite.

**Trpp** PYROXENE-BEARING RHYOLITE LAVAS (0-980± ft)—Light- to dark-gray devitrified and vitrophyric lava flow; contains 8-10 percent phenocrysts (1-3 mm), mainly alkali feldspar and plagioclase, with less abundant biotite, opaque oxides, sphene, and clinopyroxene (augite).

**Tl** LATITE LAVAS OF SOUTH KAWICH VALLEY (0-80 ft)—Fine-grained dark-gray to black phenocryst-poor olivine latite lava; not distinguishable from basalt in outcrop.

**Tb** BEDDED TUFF (0-1,080+ ft)—White to brown glassy to zeolitized ash-fall, reworked, and nonwelded ash-flow tuff; sparse to abundant crystals of quartz, feldspar, and biotite.

TUFFS AND RHYOLITES OF AREA 20—Phenocrysts, principally of quartz and feldspar, range from a few percent to about 25 percent of the rock. Quartz ranges from about 10 percent of the phenocrysts in the phenocryst-rich rhyolites to as much as 40 percent in the phenocryst-poor rhyolites. With increase in phenocrysts, the feldspars become larger, as much as 7 mm, and the plagioclase ratio increases from a few percent to about 50 percent of the feldspar. The accessory-mineral suite is characterized by allanite and pyroxene in upper part (Trau) and allanite and abundant hornblende in lower part (Tral).

**Trau** UPPER RHYOLITE LAVAS (0-2,040 ft)—Gray to light-greenish-gray massive to conspicuously flow-layered devitrified to vitrophyric lava flows with conspicuous biotite phenocrysts; contains 10-25 percent phenocrysts (1-4 mm), mainly quartz, alkali feldspar, plagioclase, and biotite, with less abundant allanite, zircon, apatite, clinopyroxene, hypersthene, and rare hornblende; flows locally are underlain by thin blocky flow breccias.

**Tral** LOWER RHYOLITE LAVAS (0-1,700 ft)—Gray to light-reddish-brown massive to flow-layered devitrified to vitrophyric lava flows with conspicuous biotite phenocrysts; contains 10-25 percent phenocrysts (1-6 mm), mainly alkali feldspar, plagioclase, quartz, and biotite, with less abundant allanite, hornblende, apatite, and clinopyroxene.

**Trab** BEDDED AND ASH-FLOW TUFFS (0-2,457+ ft)—Light-gray to yellow to orange-pink lithic-rich zeolitized bedded tuff and nonwelded commonly zeolitized and argillized ash-flow tuff; intercalated with upper and lower rhyolite flows of Area 20. Contains 5-20 percent phenocrysts of quartz, alkali feldspar, plagioclase, sparse biotite, and rare allanite, pyroxene, and hornblende.

**Trat** LITHIC-RICH ASH-FLOW TUFF (0-2,100+ ft)—Gray to light-brown, zeolitized, nonwelded to partially welded; contains as much as 50 percent lithic fragments of gray to reddish-brown welded tuff and rhyolite as large as 4 inches; mineralogy of upper part similar to bedded and ash-flow tuff (Trab); lower part of tuff commonly contains zircon in excess of allanite.

LAVA AND TUFF OF DEAD HORSE FLAT:

**Tdhr** RHYOLITE LAVAS (0-3,385 ft)—Several flows of light-brownish-gray to yellowish-gray devitrified flow-laminated to coarsely flow-layered crystal-poor (3-10 percent) comenditic lavas; phenocrysts consist of sodic sanidine, quartz, and rare clinopyroxene and fayalite.

**Tdhb** BEDDED TUFF (0-500+ ft)—Ash-fall and reworked tuff, and volcanic sandstone and tuffaceous conglomerate locally interlensing with lavas and welded tuffs of Dead Horse Flat; rocks are yellow, greenish gray, and reddish brown and commonly zeolitized.

**Tdha** ASH-FLOW TUFF (0-1,450+ ft)—Reddish-brown, brown, and green nonwelded to densely welded devitrified comenditic ash-flow and ash-fall tuff; sparse to common

phenocrysts of sodic sanidine, quartz, and sparse clinopyroxene. Some ash flows are similar to Tub Spring Member of Belted Range Tuff but phenocrysts lack the euhedralism of those of Tub Spring, and Tub Spring crystals have smaller average grain size and generally smaller pumice and lithic fragments.

**Tdp** TRACHYTIC SODIC RHYOLITE LAVA OF DEAD HORSE FLAT (0-615 ft)—Dark-greenish-gray and grayish-purple, flow-laminated; 20 percent phenocrysts, mainly sodic sanidine, plagioclase, and clinopyroxene, with rare to sparse apatite, in a trachytic groundmass of alkali feldspar, quartz, and sodic amphibole.

RHYOLITE OF SAUCER MESA AND TUFF OF BASKET VALLEY:

**Trsu** UPPER LAVA FLOWS OF SAUCER MESA (0-500+ ft)—Several flows and dikes of green-gray and purplish-gray mainly devitrified flow-laminated and massive comenditic lavas and trachytic sodic rhyolite lavas; sparse phenocrysts of sodic sanidine, sparse to rare clinopyroxene, and fayalite. Unit locally includes thin lenses of ash-fall tuff.

**Trsf** FEEDER DIKE.

**Trsl** LOWER LAVA FLOWS OF SAUCER MESA 0-500+ ft)—Several flows and dikes of crystal-poor and crystal-rich lavas. Rocks in western part are mostly crystal poor and lithologically identical to upper flows (Trsu); in eastern part unit includes red and reddish-gray trachytic rhyolite with abundant large phenocrysts of sodic sanidine, sparse clinopyroxene, and fayalite.

**Tbv** TUFF OF BASKET VALLEY (0-300 ft)—Densely welded to nonwelded black, brown, reddish-brown, and green vitric and devitrified trachytic sodic rhyolite ash-fall tuff; well-developed eutaxitic structure; common phenocrysts of sodic sanidine, sparse clinopyroxene, and fayalite.

**Trt** TRACHYTIC SODIC RHYOLITE LAVA OF SAUCER MESA (0-300 ft)—Dark-gray, flow-laminated and layered; 10 percent small phenocrysts of sodic sanidine, clinopyroxene, and fayalite in a trachytic groundmass of alkali feldspar, sodic amphibole, and iron ore; gas cavities contain vapor-phase crystals of sodic amphibole.

BELTED RANGE TUFF:

**Tbg** GROUSE CANYON MEMBER (0-1,760 ft)—Compound cooling unit of densely welded comenditic ash-flow tuff, greenish-gray to pale-brownish-gray and red; devitrified except for thin vitrophyre locally present at base; prominently developed compaction and flow foliation and flow lineation present in most outcrops; lenticular gas cavities containing vapor-phase crystals of quartz, sanidine, and sodic amphibole common in upper and middle parts of unit; lithophysae locally present near base; rare to uncommon phenocrysts of sodic sanidine, very rare to sparse quartz, clinopyroxene, and fayalite. Maximum exposed thickness within the map area is 250 feet, but the member is 1,760 feet thick in drill hole UE19$_g$ near the center of the Silent Canyon caldera.

**Tbt** TUB SPRING MEMBER (0-1,705 ft)—Compound cooling unit of densely welded to nonwelded buff to bluish-gray and brick-red devitrified comenditic ash-flow tuff; 20-25 percent phenocrysts of sodic sanidine, quartz, and sparse clinopyroxene and fayalite. Maximum exposed thickness within the map area is 200 feet, but the member is 1,705 feet thick in drill hole PM1 near the center of the Silent Canyon caldera.

ASH-FLOW, ASH-FALL, AND BEDDED REWORKED TUFF:

**Tba** BEDDED REWORKED AND MINOR ASH-FLOW TUFF (0-655 ft)—Ash-flow tuff, volcanic sandstone, and conglomerate; generally rich in rhyolite fragments; rock is buff, yellow, red, and gray, commonly zeolitized.

**Tbb** ASH-FALL TUFF AND MINOR BEDDED REWORKED TUFF (0-1,700 ft)—Gray vitric and yellow zeolitic fine to lapilli tuff; generally underlie the Grouse Canyon Member and are intercalated between flows of rhyolite of Split Ridge (Trsr).

**Trq** RHYOLITE LAVA OF QUARTET DOME (0-1,775+ ft)—Thick flows and endogenous rhyolitic domes of light-gray to grayish-red generally devitrified coarsely flow-layered comenditic lava; 5-30 percent phenocrysts of quartz, alkali feldspar, and sparse clinopyroxene and fayalite.

**Trsr** RHYOLITE LAVA OF SPLIT RIDGE (0-1,100+ ft)—Flow and dikes of devitrified greenish-gray and brown nonporphyritic to very sparsely porphyritic strongly flow-laminated lava; vitrophyric basal zones and dike margins occur locally; less than 1 percent phenocrysts of alkali feldspar, aegirite-augite, and fayalitic olivine.

**Trsd** DIKE.

QUARTZ LATITE WEST OF SPLIT RIDGE:

**Tql** LAVA FLOWS (0-820 ft)—Dark-bluish-gray vitric and orange to reddish-brown devitrified massive quartz latite flows; upper flow contains 10 percent phenocrysts, mainly plagioclase, with less abundant alkali feldspar, biotite, hornblende, quartz, and opaque oxides; lower flow contains 15 percent phenocrysts (as large as 5 mm), mainly plagioclase, with less abundant biotite, hornblende, and magnetite.

**Tqt** BEDDED TUFF (0-675 ft)—Pale-gray and yellow fine- to coarse-bedded zeolitic tuff containing locally common to abundant subangular to rounded lapilli- to cobble-sized fragments of dark welded tuff and silicic lava.

**Tad** TRACHYTE LAVA OF SAUCER MESA (0-300 ft)—Reddish-gray or green (weathering to dark red or brown) peralkaline trachyte lava; 10-30 percent large phenocrysts of sodic sanidine, clinopyroxene, and rare crystals of iron-rich olivine in either a vitric or a trachytic groundmass of alkali feldspar and sodic amphibole.

**Trk** RHYOLITE LAVA OF KAWICH VALLEY (0-500+ ft)—Light- to medium-gray devitrified and glassy well-flow-laminated comenditic lavas; sparse to common phenocrysts of sodium-rich sanidine, quartz, and rare clinopyroxene and fayalite; spherulitic devitrification and zeolitic alteration common.

**Tca** CALC-ALKALINE ASH-FLOW TUFF IN DRILL HOLE UE20f (492 ft)—Slightly to densely welded-calc-alkaline; occurs from 9,740- to 10,232-foot depth; contains less than 5 percent phenocrysts, mainly alkali feldspar, quartz, and sparse plagioclase biotite, apatite, zircon, and iron oxide.

**Tto** TUFF OF TOLICHA PEAK(?) (0-195 ft)—Pink to buff densely welded devitrified shard-rich tuff; 1-2 percent phenocrysts of quartz, plagioclase, and alkali feldspar; rock weathers to hard "clinkstone."

**Tnwt** NONWELDED TO SLIGHTLY WELDED ASH-FLOW TUFF IN DRILL HOLE UE20f (465 ft)—Calc-alkaline; occurs from 11,082- to 11,547-foot depth; contains 10-20 percent phenocrysts (1 mm), mainly plagioclase, with less abundant quartz, alkali feldspar, biotite, and sparse apatite, zircon, and opaque oxides.

**Tqr** QUARTZ LATITIC LAVA IN DRILL HOLE PM1 (343+ ft)—Rhyolite flow; occurs from 7,515- to 7,858-foot depth.

**Tcf** TUFF OF CRATER FLAT (0-559 ft)—Simple(?) cooling unit of reddish-brown to gray densely welded devitrified ash-flow tuff; contains 10-25 percent phenocrysts (1-2 mm), mainly plagioclase, alkali feldspar, and quartz, with less abundant biotite.

**Trv** TUFF OF REDROCK VALLEY (190 ft)—Orange to reddish-brown moderately to densely welded devitrified ash-flow tuff; contains 10-20 percent phenocrysts (0.5-1 mm), mainly plagioclase, with less abundant alkali feldspar and biotite, and sparse quartz, apatite, zircon, and allanite.

**Tpar** PERALKALINE RHYOLITE LAVA IN DRILL HOLE UE20f (1,682+ ft)—Flows; occurs from 12,004- to 13,686-foot depth; lavas are very similar to rhyolites of Split Ridge (Trsr) and Quartet Dome (Trq).

**Tri** RHYOLITE INTRUSIVE—Dominantly light-orange-brown devitrified massive calc-alkaline lava; sparse phenocrysts of quartz, alkali feldspar, and biotite.

**Td** LAVAS OF INTERMEDIATE COMPOSITION (0-4,600+ ft)—Dominantly brown and brownish-gray porphyritic andesite to rhyodacite; andesite contains 20-30 percent small phenocrysts of plagioclase, clinopyroxene, and hypersthene in a pilotaxitic groundmass of plagioclase and iron ore; rhyodacite contains 20 percent large (as much as 1 cm) phenocrysts of plagioclase, brown hornblende, biotite, and clinopyroxene in a hyalopilitic groundmass of plagioclase microlites and brown glass.

**Twc** TUFF OF WILSONS CAMP(?) (100-200 ft)—Simple cooling unit of nonwelded to densely welded quartz latite or rhyodacite ash-flow tuff; dark gray where glassy, light gray to reddish brown where devitrified; contains 25-35 percent phenocrysts, mainly plagioclase, with less abundant alkali feldspar, quartz, biotite, hornblende, clinopyroxene, orthopyroxene, and opaque oxides; abundant small lithic inclusions.

**Tbs** BASALT (25 ft)—Single dark-gray flow containing about 30 percent phenocrysts (0.25-3 mm) of plagioclase, clinopyroxene, and iddingsite after olivine in a hyalopilitic groundmass of plagioclase, olivine, glass rich in opaque oxides, and chlorophaeite.

**Tab** BEDDED TUFF (0-2,000+ ft)—White to pale-brown thin- to thick-bedded tuffaceous sediments and ash-fall tuff; locally ash-fall tuffs contain abundant pumice averaging 1 cm in length; some beds are reworked and conglomeratic; locally rich in dacite lithic fragments; commonly zeolitized.

**Tgi** GRANITIC INTRUSIVE—Grayish-orange-pink sericitized chloritized granodiorite porphyry with interstitial granophyric texture; contains 20 percent quartz, 60 percent sericitized albitized plagioclase, 10 percent potassium-rich feldspar altered to sericite, 9 percent chlorite after biotite, 1 percent pyrite and magnetite, and trace of zircon, apatite, and calcite. Average grain size about 1 mm; plagioclase phenocrysts as large as 1 cm.

**Mzg** LEUCOGRANITE—Reddish-brown, equigranular to medium-grained; contains about 40 percent quartz and 60 percent perthite; plagioclase averages less then 1 percent; a few shreds of muscovite constitute the only micaceous mineral.

STIRLING QUARTZITE:

**pCse** UNIT E (795 ft)—Predominantly micaceous siltstone and quartzite; small amount of sandstone, argillite, and carbonate material in lower part.

**pCsd** UNIT D (270 ft)—Light- to medium-gray limestone and dolomite; silty in upper part.

**pCsc** UNIT C (835 ft)—Upper part predominantly greenish-gray silty phyllite, which grades locally to argillite; several thin dolomite layers near top. Lower 600 feet gray to grayish-purple silty phyllite with abundant micaceous siltstone and quartzite; minor thin dolomite layers near base.

**pCsl** LOWER PART (2,970 ft)—Upper part (1,130 ft) purple to greenish-gray sequence containing nonmicaceous to highly sericitic silty sandstone, quartzite, and siltstone; uppermost beds transitional to unit C. Lower part (1,840 ft) predominantly purplish-gray to gray and pink quartzite; minor micaceous siltstone or phyllite, which becomes less abundant downward.