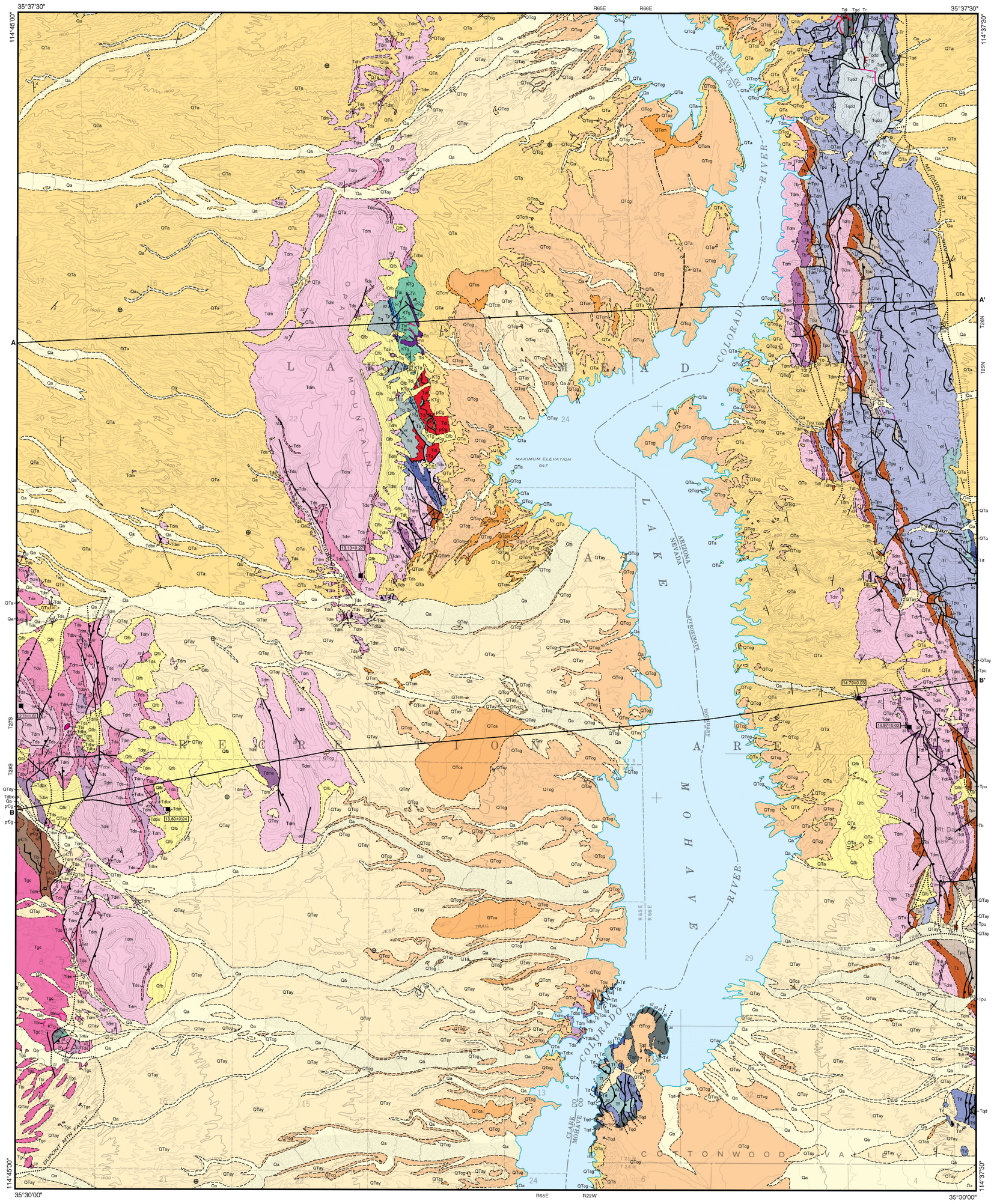


Scale 1:24,000

0 0.5 1 kilometer

0 0.5 1 mile

0 1000 2000 3000 4000 5000 feet

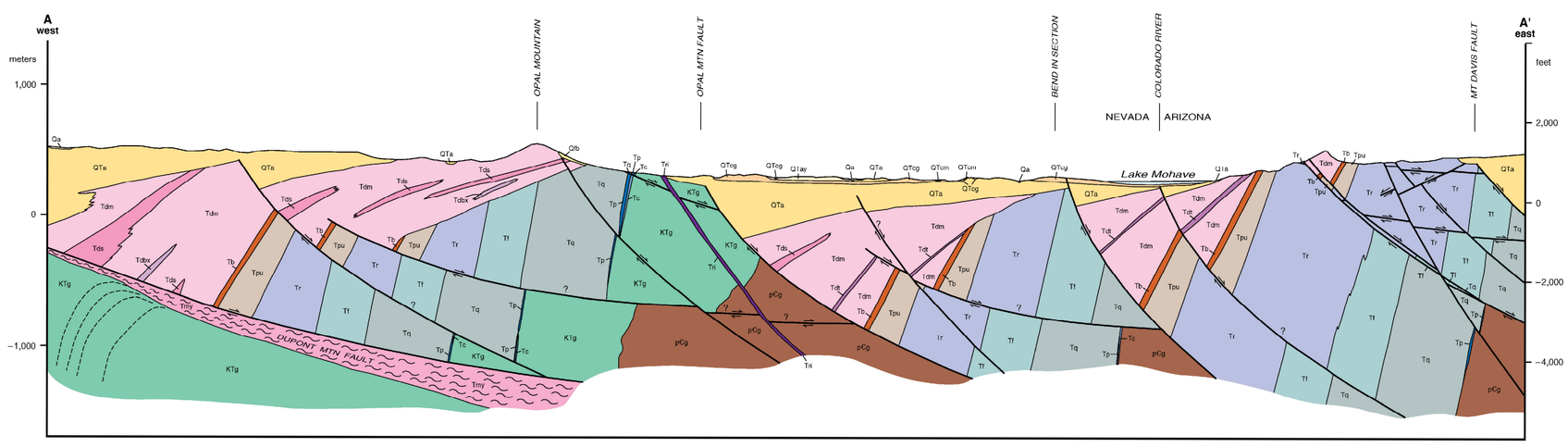
CONTOUR INTERVAL 40 FEET
Supplemental contours at 20 feet

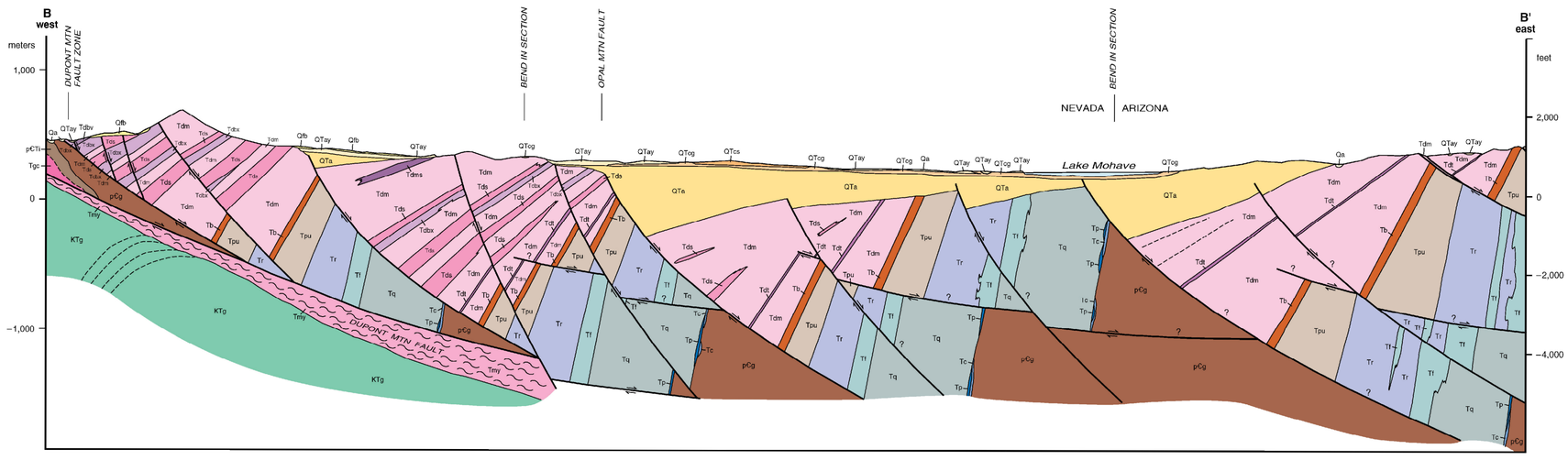
Base map: U.S. Geological Survey Mt. Davis 7.5' Quadrangle, 1973

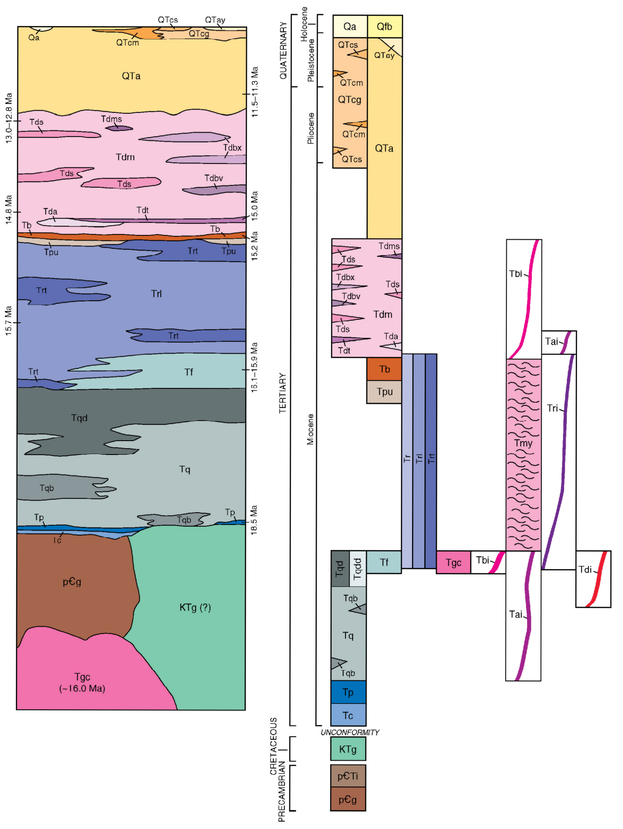
GEOLOGIC MAP OF THE MT. DAVIS QUADRANGLE NEVADA AND ARIZONA

James E. Faulds

1995







Qa **Alluvium (Holocene)** Poorly sorted gravel, sand, and silt in active and recently active washes; erosionally inset below all older units; generally distributive drainage pattern; channels incised up to 10 m; unvarnished to slight rock varnish; no organized pavement; thickness ranges up to 10 m.

Qfb **Locally derived basaltic alluvium (Holcene to upper Pleistocene)** Poorly sorted angular gravel and boulders of basalt derived almost entirely from mafic lavas of the Mount Davis Volcanics (Tdm); forms talus cones beneath exposures of Tdm; best developed on the east flank of Opal Mountain; mapped only where obscuring older units; most clasts contain moderate to extensive rock varnish; commonly associated with caliche; thickness ranges up to ~10 m.

QTcg QTcm QTcs **Chemehuevi Formation (Pleistocene to upper Miocene)** The Chemehuevi Formation (Longwell, 1963) consists of well-rounded gravels, sand, silt, and mudstone associated with the Colorado River. It straddles Lake Mohave, cropping out up to 4.2 km away from the modern-day course of the Colorado River and up to 135 m (317 m in elevation) above the river. Isolated lag deposits of rounded gravels are present at higher elevations. The thickness is greatest near present-day course of Colorado River and ranges up to 60 m. The sediments interfinger with the upper part of the Cottonwood basin alluvium (QTa). The very well-rounded and polished clasts contrast sharply with the subangular to angular detritus of QTa. This flat-lying, essentially unfaulted unit postdates extension. It records the evolution of the Colorado River and excavation of the Grand Canyon. **QTcg:** Grayish-brown to light-gray, clast-supported pebbles and cobbles and lesser sand, silt, and mudstone; generally unconsolidated but locally weakly indurated; subrounded to very well-rounded and polished clasts; beds range from 5 cm to 2 m in thickness; contains interbedded, cross bedded sands; cross beds generally indicate a southerly flow direction; commonly grades laterally into QTcm and QTcs; clasts of Paleozoic sandstone, quartzite, chert, and fossiliferous limestone dominate most deposits; Paleozoic clasts range up to 25 cm in length; the Grand Canyon is the most probable source for most of the Paleozoic clasts, locally derived, well-rounded clasts are common in some deposits and range up to 35 cm in length; some deposits also contain isolated subangular clasts or very thin layers of subangular detritus of local derivation; subangular clasts range up to 50 cm in length; clasts commonly contain moderate rock varnish; pavement is locally developed on terrace-like surfaces that straddle Lake Mohave; pavement surfaces have a distinct orangish-brown color due to coatings of rock varnish. Thickness ranges up to 60 m. **QTcm:** Pale-reddish-brown to greenish-yellow siltstone and mudstone; locally contains stringers of gypsum; bedding characterized by fine laminae up to 5 mm thick; some shaly layers contain raindrop impressions, burrows, and possibly worm tracks; interfingers and/or grades laterally into QTcg; generally found near periphery of thick gravel deposits; interpreted as paleo-floodplain deposits of the Colorado River. Thickness ranges up to 30 m. **QTcs:** Pale-brown, moderately sorted medium-grained sands; subrounded to well-rounded grains predominate; contains both rounded and subangular pebbles and cobbles; angular clasts of scoriaceous basalt are found in most deposits. Thickness ranges up to 30 m.

QTa QTay **Alluvium of Cottonwood basin (Pleistocene to middle Miocene) QTa, undifferentiated:** Pale-brown to light-gray pebble to cobble conglomerate, containing subangular clasts of local derivation, and subordinate medium- to coarse-grained sandstone; locally includes thin (<1 m) layers of air-fall tuff, especially near base of section; generally matrix supported; matrix generally consists of subangular coarse-grained sand; poorly sorted; poorly to moderately indurated with calcite cement; induration generally increases with depth; poorly to moderately developed bedding; beds are generally 1-40 cm thick, but locally range up to 2 m; angular boulders locally range up to 4 m in length, but are mainly <50 cm; primarily of fanglomerate origin; clasts of plutonic rock dominate west of the Colorado River in Nevada, whereas volcanic clasts dominate in Arizona; locally includes thin layers of mudstone and sand of the Chemehuevi Formation (QTcm, QTcs); uppermost deposits locally fill channels cut into the Chemehuevi Formation; dark-gray to black pavement is locally well-developed and contrasts with the orangish-brown pavement developed on QTcg; lower parts of the section are gently tilted (15°) and mildly faulted, whereas upper parts are essentially flat-lying and unfaulted; 11.3 Ma basalt flow overlies flat-lying, poorly indurated QTa 1 km west of map area; 11.5 Ma air-fall tuff is intercalated in flat-lying, moderately indurated QTa 10.5 km north of the map area; younger deposits that mantle QTcg deposits near the Colorado River merge with older deposits away from the river, which precludes subdividing QTa into upper and lower members in most areas; lower parts are temporally correlative with the Muddy Creek Formation of Anderson (1977, 1978). **QTay, younger fanglomerates:** Pale-brown to light-gray pebble to cobble conglomerate similar in composition to QTa, but clearly overlies Chemehuevi Formation and thus postdates the early development of the Colorado River; difficult to distinguish from older deposits of QTa where Chemehuevi Formation is absent.

Tdm Tds Tdms Tdbx Tdbv Tdt Tda **Mount Davis Volcanics (middle Miocene)** The Mount Davis Volcanics (Anderson, 1971) primarily consist of *synextensional* basalt and basaltic andesite lavas, but also include distinct layers of conglomerate and monolithologic breccia. The type locality for the Mount Davis Volcanics is in the southeastern part of the quadrangle, where only the lower part of section is exposed. More complete sections crop out near the western margin of the map area, southwest of Opal Mountain, and north of the map area in the northern Eldorado Mountains northeast of Nelson, Nevada. The Mount Davis Volcanics were deposited during the main episode of Tertiary extension, as evidenced by well developed growth-fault relations within the section. For example, tilts decrease upward from ~60° directly above the tuff of Bridge Spring to ~15° in capping 12.8 Ma lavas. The Mount Davis Volcanics were deposited primarily within half graben, where thicknesses locally exceed 1.3 km. The age of the Mount Davis Volcanics within the map area is bracketed between 15.2 and 12.8 Ma. Clastic material within the Mount Davis Volcanics (Tds and Tdb) records the tectonic and erosional unroofing of the crystalline core of the southern Eldorado Mountains. Conglomerates within the lower part of the section are mainly volcaniclastic, whereas those in the upper part contain abundant clasts of plutonic and metamorphic rock derived from the southern Eldorado Mountains crystalline terrane. The amount of clastic material increases significantly westward toward the southern Eldorado Mountains and Dupont Mountain fault zone. In addition, most of the intercalated monolithologic breccias are composed of plutonic and metamorphic rock derived from the southern Eldorado Mountains. **Tdm, mafic lavas:** Medium- to dark-gray basalt and basaltic andesite lavas and flow breccias containing 5-10% phenocrysts of olivine, pyroxene, and plagioclase; phenocrysts range up to 5 mm in length; olivine is generally altered to iddingsite; olivine is usually much more abundant than pyroxene in contrast to upper part of Patsy Mine Volcanics (Tpu); locally includes thin layers of conglomerate, sandstone, scoria, and lapilli; base of section directly northeast of Mount Davis more closely resembles Tpu, as clinopyroxene phenocrysts predominate; lower part of section is conformable with tuff of Bridge Spring (Tb), but uppermost flows locally rest in angular unconformity on all older rock types, thickness ranges from 0 to 1.3 km. **Tds, sedimentary rocks:** Pale-brown to pale-reddish-brown, pebble to cobble conglomerate and coarse-grained sandstone; matrix supported; matrix consists of subangular, coarse-grained sand; poorly sorted; moderately indurated with calcite cement; moderately developed bedding; beds generally range from 2-15 cm thick; angular to subangular clasts; volcanic clasts dominate lower units and those east of the Colorado River; units west of the Colorado River contain abundant (generally >50%) clasts of plutonic and metamorphic rock derived from the southern Eldorado Mountains; individual sequences range from 0 to 150 m thick. **Tdms, scoria:** Lapilli and scoria accumulations intercalated in Tdm; only thicker, more conspicuous deposits were mapped; thickness ranges from 0 to 60 m. **Tdbx, crystalline breccia:** Sheets of monolithologic breccia composed of plutonic and metamorphic rock; lithologies include Miocene and late Cretaceous(?) granite and hypabyssal dikes and Proterozoic orthogneiss, amphibolite, and pegmatite; probable rock-avalanche origin, includes relatively coherent blocks and crackle and jigsaw breccia facies (Yarnold and Lombard, 1989); intercalated throughout the section of Mount Davis Volcanics, but confined to the area west of the Colorado River; individual sheets generally thicken westward; lithologies indicate derivation from the southern Eldorado Mountains to the west of the map area; deposit on the western shoreline of Lake Mohave in the south-central part of the map area consists of hornblende-sphene granite, which may have been derived from the Copper Mountain pluton (Tgc); thickness of individual sheets ranges up to ~120 m. **Tdbv, volcanic breccia:** Sheets of monolithologic breccia composed of volcanic rock; lithologies include rhyolite, dacite, and basaltic andesite lavas; probable rock-avalanche origin, includes relatively coherent blocks as well as crackle and jigsaw breccia facies (Yarnold and Lombard, 1989); intercalated throughout the section of Mount Davis Volcanics, but confined to the area west of the Colorado Hiver; individual sheets generally thicken westward; thickness of individual sheets ranges up to ~50 m. **Tdt, tuff of Mount Davis:** Pale-brown, poorly to locally moderately welded, rhyolitic ash-flow tuff; contains 15-20% subhedral to anhedral phenocrysts composed of 55-65% sanidine, 25-30% biotite, 3-12% clinopyroxene, 2-4% plagioclase, and rare sphene and hornblende; phenocrysts range up to 4 mm in length; lithic fragments of basaltic andesite and basalt are common; compared to the tuff of Bridge Spring (Tb), welding is generally poorly developed; sanidine is coarser grained, biotite is more abundant and less commonly altered, sphene is very rare, and lithic fragments are more common; sanidine yielded an $^{40}Ar/^{39}Ar$ age of 14.97 ± 0.02 Ma (Faulds and others, 1995); best exposed on the east flank of Mount Davis; reverse polarity; thickness ranges from 0 to 40 m. **Tda, andesite-dacite lavas:** Purplish-gray porphyritic andesite and dacite lavas containing plagioclase; biotite, and pyroxene phenocrysts; found only on the southeast flank of Opal Mountain; interfingers with and gives way southward to basaltic andesite flows in the lower part of the Tdm section; plagioclase is generally altered to sericite; mafic constituents are altered to Fe oxides; thickness ranges from 0 to 60 m.

Tb **Tuff of Bridge Spring (middle Miocene)** Purplish-gray to pale-brown, moderately to densely welded rhyolitic ash-flow tuff; contains 5-15% anhedral to subhedral phenocrysts composed of 68-75% sanidine, 12-23% biotite, 3-6% clinopyroxene, 2-6% sphene, 2% magnetite, and 1-2% plagioclase; phenocrysts generally range up to 2 mm in length, weathers brown; lithic fragments of basaltic andesite are common; typically includes 1 m thick vitrophyre at or near base of densely welded section below which lies up to 1 m of basal, nonwelded tuff; compared to the tuff of Mount Davis (Tdt), sanidine is finer-grained, biotite is less abundant and more commonly altered, sphene is more abundant, and lithic fragments are less common; sanidine from a sample collected 250 m east of the map area yielded a 15.21 ± 0.01 Ma $^{40}Ar/^{39}Ar$ age (Faulds and others, 1995); the age, composition, and stratigraphic position strongly suggest a correlation with the tuff of Bridge Spring of Anderson (1971) in the northern Eldorado Mountains; widely distributed, found throughout the map area where appropriate part of the section is exposed; probably erupted from a caldera in the northern Eldorado Mountains (Gans and others, 1994); reverse polarity; generally tilted ~60-70°; thickness ranges from 10 to 70 m.

Tpu **Upper Part, Patsy Mine Volcanics (middle Miocene)** (Anderson, 1971) Mainly basaltic andesite lavas and flow breccias containing 5-15% phenocrysts of augite, olivine, and plagioclase ranging up to 5 mm in length; augite phenocrysts generally predominate in contrast to mafic lavas of Mount Davis Volcanics (Tdm); locally contains thin (<10 m) discontinuous layers of tuffaceous sedimentary rock; locally pinches out in the northeastern part of the quadrangle; thickness ranges from 0 to 600 m. **Upper Part, Patsy Mine Volcanics** (Anderson, 1971) Mainly basaltic andesite lavas and flow breccias containing 5-15% phenocrysts of augite, olivine, and plagioclase ranging up to 5 mm in length; augite phenocrysts generally predominate in contrast to mafic lavas of Mount Davis Volcanics (Tdm); locally contains thin (<10 m) discontinuous layers of tuffaceous sedimentary rock; locally pinches out in the northeastern part of the quadrangle; thickness ranges from 0 to 600 m.

Tr Trl Trt **Volcanics of Red Gap Mine (middle Miocene)** The volcanics of Red Gap Mine consist of *synextensional* rhyolite lavas and tuffaceous rocks. The type locality of the volcanics of Red Gap Mine is about 6 km east of Mount Davis, where the section approaches 1.5 km in thickness. The volcanics of Red Gap Mine were deposited during the onset of major extension, as significant tilt fanning begins in the lower part of the section. Tilts generally decrease upward from ~80 to 60° between the lower and upper parts of the section. The volcanics of Red Gap Mine are best exposed in the northeastern part of the map area. This unit is probably widely distributed throughout the map area but may thin significantly west of the Opal Mountain fault. The age of the unit is bracketed between ~16.0 and 15.2 Ma ~6 km east of the map area and 15.8 and 14.5 Ma directly northeast of the quadrangle. At least some of the section was derived from a major volcanic center in the Mount Perkins area directly east of the quadrangle (Faulds and others, 1995). This unit is temporally correlative with the Middle Part of the Patsy Mine Volcanics of Anderson (1971). **Tr, undifferentiated:** Undifferentiated rhyolite lavas and tuffaceous rocks containing phenocrysts of sanidine, plagioclase, biotite, and quartz in varying proportions and amounts; interfingers with basaltic andesite and dacite flows of the volcanics of Fire Mountain (Tf) in the eastern part of the map area; thickness ranges from 300 to 900 m. **Trt, rhyolite lavas:** Pinkish-gray to white rhyolite flows; commonly flow-banded; contain 2-15% subhedral phenocrysts of sanidine, plagioclase, biotite, ± quartz; and ± accessory sphene; quartz phenocrysts are usually partly resorbed; thickness ranges from 0 to >300 m. **Trl, tuffaceous rocks:** White to yellowish-brown tuffaceous sedimentary rocks, thin pyroclastic flows, surge deposits, and air-fall tuff; tuffs contain up to 15% anhedral to subhedral phenocrysts of sanidine, plagioclase, biotite, quartz, and clinopyroxene in varying proportions; some tuffs lack quartz and clinopyroxene phenocrysts; thickness ranges from 0 to >300 m.

Tf **Volcanics of Fire Mountain (middle to lower Miocene)** Mainly basaltic andesite lavas and flow breccias containing 1-10% augite, plagioclase, and olivine phenocrysts; augite phenocrysts predominate; olivine is generally altered to iddingsite; locally includes dacite lavas containing plagioclase, biotite, and clinopyroxene phenocrysts; interfingers with the lower part of the volcanics of Red Gap Mine (Tr) in the eastern part of the map area and directly east of the quadrangle in the Mount Davis area; upper part is bracketed between 16.1 and 15.9 Ma to the northeast of the map area (Eldorado Canyon, Black Mountains) by $^{40}Ar/^{39}Ar$ whole-rock dates (Faulds and Gans, unpubl. data); mainly exposed in the eastern part of the map area; thickens significantly northward directly north of the map area toward a major volcanic center in the Fire Mountain area; thickness within the map area ranges from 0 to ~300 m.

Tq Tqd Tqdd Tqb **Volcanics of Dixie Queen Mine (middle to lower Miocene)** The volcanics of Dixie Queen Mine consist of *preextensional* trachydacite and trachyandesite lavas and domes, volcanic breccia, and subordinate basaltic andesite flows. The type locality of the volcanics of Dixie Queen Mine is about 8 km east of the map area, where the section exceeds 2 km in thickness. The volcanics of Dixie Queen Mine were deposited prior to any appreciable extension. The magnitude of tilting differs little between the lower and upper parts of the section. The section is generally tilted 70-90°. The volcanics of Dixie Queen Mine are probably widely distributed but are only exposed on the east flank of Opal Mountain and in the south-central and extreme northeastern parts of the map area. The age of the volcanics of Dixie Queen Mine is bracketed between 18.5 and ~16.0 Ma by $^{40}Ar/^{39}Ar$ ages on the Peach Springs Tuff (Tp) and lower part of the volcanics of Red Gap Mine (Faulds and others, 1995). The volcanics of Dixie Queen Mine locally interfinger with the volcanics of Fire Mountain and the lower part of the volcanics of Red Gap Mine. This unit is temporally correlative with the Lower Part of the Patsy Mine Volcanics of Anderson (1971). **Tq:** Undifferentiated, gray to purplish-brown trachydacite and trachyandesite lavas and domes and subordinate volcanic breccia; lavas contain 5-25% phenocrysts; thickness ranges from 600 to 800 m. **Tqd:** Medium-gray weathering dark-reddish- to purplish-brown, trachydacite lavas containing 5-25% phenocrysts; plagioclase and biotite phenocrysts occur in all flows; sanidine, quartz, and hornblende phenocrysts are present in some flows; phenocrysts range up to 5 mm in length; locally includes minor amounts of trachydacite and/or basaltic andesite flows that generally contain both augite and biotite phenocrysts; thickness ranges up to 800 m. **Tqdd:** Trachydacite domes containing 5-15% phenocrysts of plagioclase, sanidine, biotite, quartz, and accessory sphene; found only in northeastern part of the map area; thickness ranges up to 700 m. **Tqb:** Dark-brown to reddish-brown volcanic breccia containing clasts of trachydacite, trachyandesite, and basaltic andesite; thickness ranges from 0 to 150 m.

Tp **Peach Springs Tuff (lower Miocene)** Poorly welded, rhyolitic ash-flow tuff containing anhedral to subhedral phenocrysts of plagioclase, sanidine, and biotite; feldspars are largely altered to sericite; exposed only on the east flank of Opal Mountain; correlation with 18.5 Ma Peach Springs Tuff (Glazner and others, 1986; Nielson and others, 1990) based on the composition of phenocrysts, 18.46 ± 0.06 Ma age on sanidine (Faulds and others, 1995) from an unaltered exposure in the northern Black Mountains northeast of the map area, and a general southward increase in thickness across the region; thickness ranges from 0 to 20 m. A slight angular unconformity (~10°) is locally developed between the Peach Springs Tuff and basal conglomerate (Tc).

Tc **Arkosic conglomerate of Cottonwood Pass (lower Miocene)** Reddish-brown to purplish-gray, prevolcanic pebble to cobble conglomerate and coarse-grained sandstone; exposed on the east flank of Opal Mountain; contains angular to subangular clasts of Proterozoic gneiss and weakly foliated, two-mica granite (KTg); poorly sorted; matrix supported; matrix consists of subangular, coarse-grained sandstone; best exposed along the Cottonwood Road ~10 km east-southeast of the map area; thickness ranges up to 20 m.

Tbi **Basalt and basaltic andesite dikes (Miocene)** Medium- to dark-gray mafic dikes that generally contain 1-5% phenocrysts of pyroxene and olivine.

Tai **Andesite dikes (Miocene)** Medium-gray to purplish-gray porphyritic andesite dikes containing phenocrysts of plagioclase, biotite, ± clinopyroxene, and ± hornblende.

Tri **Rhyolite dikes (Miocene)** Pale-brown weathering dark-brown rhyolite dikes containing ~5% phenocrysts of biotite, feldspar, and quartz; feldspar is commonly altered to sericite.

Tmy **Mylonite (Miocene)** Mylonitic gneiss developed along the Dupont Mountain fault zone; not exposed in the map area; shown only in cross section; exposed ~1.2 km west of the map area; asymmetric microstructures indicate a top-to-the east sense of shear; thickness ranges from 0 to ~100 m; probably thickens at depth; protolith includes granitoids of Cretaceous(?) and Miocene age.

Tgc **Granitic pluton of Copper Mountain (Miocene)** Unfoliated, coarse-grained granite composed of 50-60% potassium feldspar, ~25% quartz, 15-25% plagioclase, 1-10% biotite, and accessory sphene and magnetite; similar in composition to the 15.99 ± 0.08 Ma Searchlight pluton (Faulds and Gans, unpubl. data) exposed ~10 km west of the map area.

Tdi **Dacite dikes (Miocene)** Trachydacite, dacite, and rhyodacite dikes containing 1-15% phenocrysts of sanidine, biotite, and plagioclase; some dikes also contain quartz, clinopyroxene, and/or hornblende phenocrysts; dikes in northeastern part of the map area were emplaced along gently east-dipping normal faults.

KTg **Granite (Cretaceous?)** Weakly foliated, coarse-grained granite composed of ~50% potassium feldspar, 25% quartz, 20% plagioclase, and accessory biotite, muscovite, garnet, and sillimanite; exposed on the east flank of Opal Mountain and in the southwestern corner of the map area; similar in composition to a garnet-bearing, two-mica granite in the central Black Mountains that has yielded a 73.3 Ma K/Ar age on muscovite (Faulds and others, 1992) and a garnet-bearing, two-mica granite exposed in the southern Eldorado Mountains, ~1.6 km west of the map area, that has yielded a 15.18 ± 0.02 Ma $^{40}Ar/^{39}Ar$ age on biotite (Faulds and Gans, unpubl. data) and a possible middle Tertiary U-Pb age (Miller and others, 1995).

pCTi **Gneiss and dikes (Miocene and Precambrian)** Complex assemblage of Proterozoic orthogneiss (p€g) laced with abundant intermediate to silicic dikes of probable Miocene age; found only in the southwestern part of the quadrangle.

pCg **Orthogneiss (Precambrian)** Quartzo-feldspathic granitic gneiss that generally contains biotite and garnet; locally mylonitic; crops out in the southwestern part of the map area and on the east flank of Opal Mountain.

Contact Showing dip, dashed where approximately located.

Moderately to steeply dipping fault Showing dip; ball on downthrown side; dashed where approximately located or inferred, dotted where concealed.

Gently dipping normal fault Hachures on downthrown side; dashed where approximately located, dotted where concealed.

Reverse fault Teeth on upthrown side; dashed where approximately located, dotted where concealed.

Structural lineament Possible fault or fracture in alluvium.

Strike and dip of bedding or layering

Inclined Overturned Vertical Horizontal

Strike and dip of foliation in volcanic rocks

Inclined

Strike and dip of foliation in metamorphic/plutonic rocks

Inclined

Sample locality for isotopic age determination $^{40}Ar/^{39}Ar$ dates are weighted mean plateau ages.

■ 5.44±0.14

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