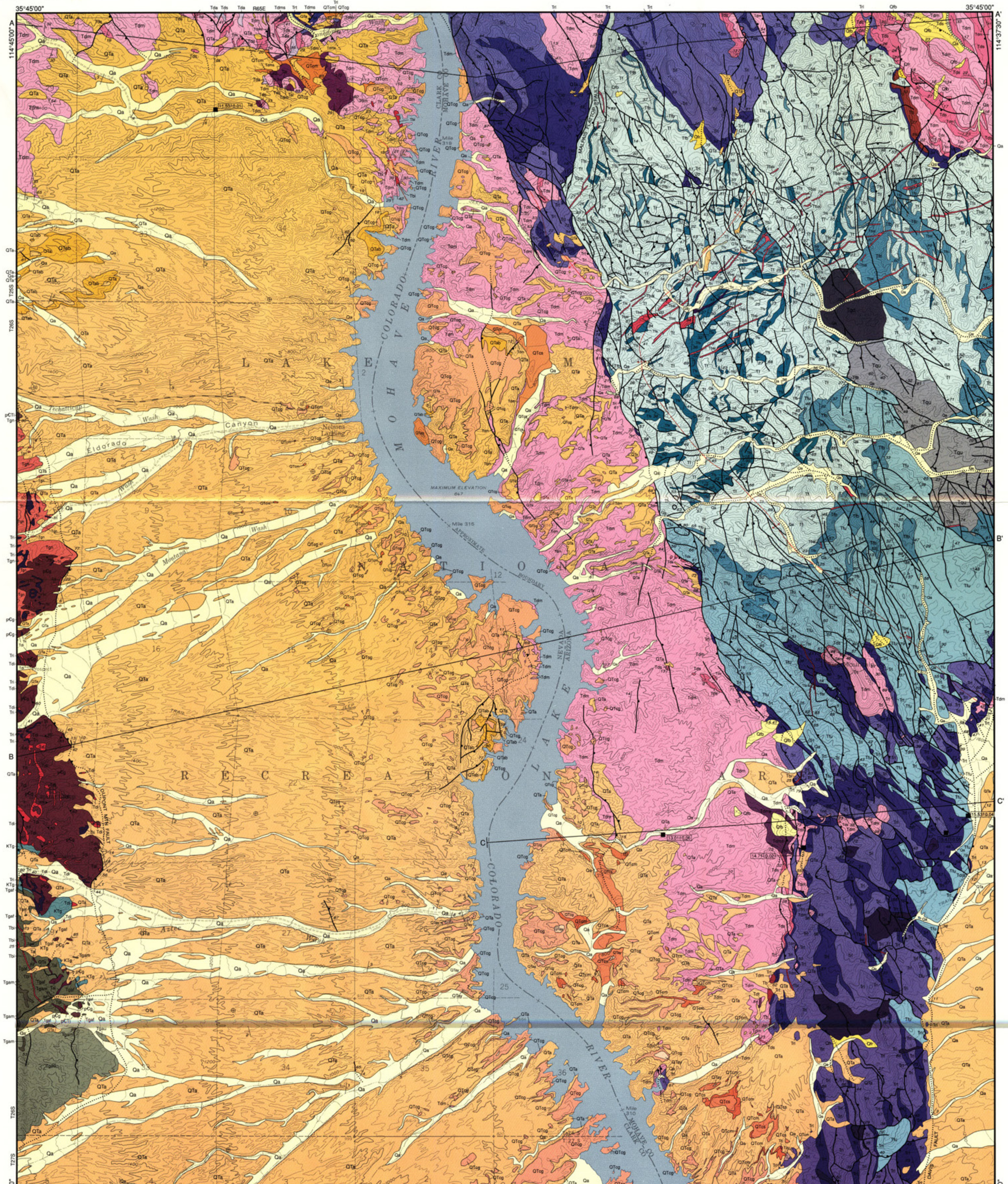


Scale 1:24,000

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 Fire Mountain 7.5' Quadrangle, 1973

GEOLOGIC MAP OF THE FIRE MOUNTAIN QUADRANGLE NEVADA AND ARIZONA

James E. Faulds

1996

Qa **Recent alluvium (Holocene)** Poorly sorted gravel, sand, and silt in active and recently active washes; erosionally inset below all older units; channels incised as much as 10 m; unvarnished to slight rock varnish; no organized desert pavement; maximum thickness is ~10 m.

Qfb **Alluvium of basaltic clasts (Holocene and upper Pleistocene)** Poorly sorted, angular gravel and boulders of basalt derived almost entirely from nearby exposures of mafic lavas of the Mount Davis Volcanics (Tdm); forms talus cones and alluvial fans beneath exposures of Tdm; best developed on the west flank of Fire Mountain and in the northeastern corner of the map area; mapped only where obscuring older units; most clasts contain moderate to extensive rock varnish; commonly associated with caliche; maximum thickness is ~10 m.

Qfr **Alluvium of rhyolitic clasts (Holocene and upper Pleistocene)** Poorly sorted, angular gravel and boulders of rhyolite derived primarily from nearby rhyolite lavas of the volcanics of Red Gap Mine (Trl) and locally from the tuff of Bridge Spring (Tb); generally forms talus cones beneath exposures of Trl; mapped only where obscuring older units; maximum thickness is ~10 m.

QTcg, QTcm, QTcs **Chemehuevi Formation (Pleistocene to upper Miocene?)** The Chemehuevi Formation (Longwell, 1963) consists of very well-rounded gravels, sand, and weakly indurated siltstone and mudstone. It straddles Lake Mohave, cropping out as much as 2.0 km away from the modern-day course of the Colorado River and as much as 135 m (317 m in elevation) above the river. Isolated lag deposits of rounded gravels are present at higher elevations. The maximum thickness (~60 m) occurs near the present course of the Colorado River. Especially thick deposits occupy abandoned river channels directly east of Nelsons Landing and the mouth of Aztec Wash. South of the Aztec Wash area, the Chemehuevi Formation interfingers with the upper part of the alluvium of the Cottonwood basin (QTa), whereas to the north it generally mantles QTa. The gravels and sands (QTcg and QTcs) within the Chemehuevi Formation are interpreted as mainstream deposits of the ancestral Colorado River, whereas the mudstones and siltstones (QTcm) are inferred to represent floodplain deposits. Thus, the Chemehuevi Formation partially records the excavation of the Grand Canyon. The flat-lying and unfaulted character of the formation indicates that it postdates extension. **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 thick; 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 are as much as 25 cm long; 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 are as much as 35 cm long; some deposits also contain isolated subangular clasts or very thin layers of subangular detritus of local derivation; subangular clasts are as much as 50 cm long; clasts commonly contain moderate rock varnish; desert pavement is locally developed on terrace-like surfaces that straddle Lake Mohave; desert pavement surfaces have a distinct orangish-brown color due to coatings of rock varnish; rounded clasts contrast sharply with the angular detritus of the alluvium of the Cottonwood basin (QTa). Thickness is as much as 60 m. **QTcm:** Pale-reddish-brown to greenish-yellow, weakly indurated siltstone and mudstone, locally including stringers of gypsum; bedding characterized by fine laminae as much as 5 mm thick; some shaly layers contain raindrop impressions, burrows, and possible worm tracks; interfingers and/or grades laterally into QTcg; generally found near periphery of thick gravel deposits; north of Nelsons Landing, some thin deposits were locally included with the alluvium of Cottonwood basin (QTa) or QTcg; maximum thickness is ~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; maximum thickness is ~30 m.

QTa, QTay, QTab **Alluvium of Cottonwood basin (Pleistocene to middle Miocene)** The alluvium of Cottonwood basin consists primarily of fanglomerate deposits that accumulated in the large structural depression situated between Black Canyon to the north, the Black Mountains to the east, the Eldorado and Newberry Mountains to the west, and an east-trending bedrock ridge linking the Newberry and southern Black Mountains to the south. This structural depression has been known as the Cottonwood Valley (Lee, 1908) but is here referred to as the Cottonwood basin due to its probable origin as a series of half grabens. Thus, the basin-filling clastic strata is here referred to as the alluvium of Cottonwood basin. **QTa, conglomerate, undivided**: Pale-brown to light-gray, poorly sorted, pebble to cobble conglomerate and subordinate medium- to coarse-grained sandstone; conglomerate contains subangular clasts of local derivation; locally includes thin (<1 m) layers of air-fall tuff; generally matrix supported; matrix consists of subangular coarse-grained sand; poorly to moderately indurated with calcite cement; induration generally greater in lower parts of section; contains poorly to moderately developed bedding; beds are generally 1–40 cm thick, but locally as much as 2 m; angular boulders are locally as much as 4 m long, but are generally <50 cm; clasts of plutonic rock dominate in the southwestern part of the map area west of the Colorado River, whereas volcanic clasts dominate east of the Colorado River and in the northwesternmost part of the map area; locally includes thin layers of mudstone and sand of the Chemehuevi Formation (QTcm and QTcs); south of the Aztec Wash area, uppermost deposits locally fill channels cut into the Chemehuevi Formation; dark-gray to black desert pavement is locally well-developed and contrasts with the orangish-brown desert pavement developed on gravels of the Chemehuevi Formation (QTcg); lower parts of the section are gently tilted (≤15°) and mildly faulted, whereas upper parts are essentially flat-lying and unfaulted; biotite from a very gently tilted (<5°) air-fall tuff, intercalated in the lower part of the section 3.9 km northwest of Nelsons Landing, yielded an $^{40}Ar/^{39}Ar$ age of 11.53 ± 0.01 Ma; a basalt flow that overlies flat-lying, poorly indurated QTa, 5 km southwest of the map area, yielded an 11.35 ± 0.10 Ma $^{40}Ar/^{39}Ar$ whole-rock age (Faulds and others, 1995); much of the unit is probably significantly younger than 11 Ma; younger deposits that mantle the Chemehuevi Formation near the Colorado River merge with older deposits farther from the river, which precludes subdividing QTa into upper and lower members in most areas; most of the conglomerate was probably deposited on alluvial fans; temporally correlative, at least in part, with the Muddy Creek Formation of Anderson (1977, 1978). Maximum thickness is ~1.0 km. **QTay, younger fanglomerates**: Pale-brown to light-gray pebble to cobble conglomerate similar in composition to QTa, but clearly overlies the 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. **QTab, breccia**: Sheets of crackle breccia (Yarnold and Lombard, 1989) and isolated coherent blocks of older volcanic rock intercalated in QTa; probable rock-avalanche origin; lithologies include mafic lavas of the Mount Davis Volcanics (Tdm) between Nelsons Landing and Aztec Wash, tuff of Bridge Spring (Tb) to the north of Nelsons Landing near Lake Mohave, and Tdm and Tb northwest of Nelsons Landing near the western margin of the map area; deposits north of Nelsons Landing occur just below the section containing the 11.5 Ma air-fall tuff; estimated age here is 11.5–12.0 Ma; thickness of individual sheets is as much as ~50 m.

Tdm, Tds, Tdbx, Tdms, 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 Mount Davis Volcanics were deposited during the main episode of Tertiary extension, as evidenced by well developed growth-fault relations. For example, in the Fire Mountain area, tilts decrease upward from ~30° to ~10–15° between the 14.7 and 13.0 Ma lavas in the lower and upper parts of the section, respectively (cross section C–C'). The Mount Davis Volcanics were deposited primarily within half grabens, where thicknesses may locally exceed 1.3 km. The age of the Mount Davis Volcanics within the map area is bracketed between 15.2 and 13.0 Ma. In the northeastern corner of the map area, east-tilted clastic material within the Mount Davis Volcanics (Tds) records the tectonic and erosional unroofing of the southern part of the Wilson Ridge crystalline terrane in the northern Black Mountains. Conglomerates in this area contain abundant clasts of plutonic and metamorphic rock derived from the southern part of Wilson Ridge. Conversely, west-tilted Tds deposits that crop out just to the south of the map area in the Mount Davis Quadrangle record the tectonic and erosional unroofing of the southern Eldorado Mountains crystalline terrane, which lies in the footwall of the Dupont Mountain fault. Similar deposits probably occur within the western part of the map area south of Nelsons Landing but are covered by thick accumulations of alluvium of the Cottonwood basin (QTa) (cross section B–B'). **Tdm, mafic lavas:** Medium- to dark-gray basalt and basaltic andesite lava and flow breccia containing 5–15% phenocrysts of olivine, pyroxene, and plagioclase; phenocrysts are as much as 5 mm long; olivine is generally altered to iddingsite; olivine is usually much more abundant than pyroxene in contrast to the upper part of the Patsy Mine Volcanics (Tpu); locally includes thin layers of conglomerate, sandstone, scoria, and lapilli; lower part of section is generally conformable with the tuff of Bridge Spring (Tb) and/or volcanics of Red Gap Mine (Tru), but upper flows locally rest in angular unconformity on all older rock types (for example, at Fire Mountain); thickness ranges from 0 to 1.3 km. **Tds, sedimentary rocks**: Pale-brown to pale-reddish-brown, pebble to cobble conglomerate and medium- to coarse-grained, moderately to poorly sorted sandstone; matrix supported; matrix consists of subangular, coarse-grained sandstone; moderately indurated with calcite cement; moderately developed bedding; beds generally range from 2–15 cm thick; angular to subangular clasts; volcanic clasts dominate in the northwest, whereas plutonic and metamorphic clasts are common in the northeasternmost part of the map area; individual units are as much as 70 m thick. **Tdbx, crystalline breccia**: Sheets of monolithologic breccia composed of plutonic and metamorphic rock; lithologies include Miocene and Cretaceous(?) granite and hypabyssal dikes and Proterozoic orthogneiss, amphibolite, and pegmatite; probable rock-avalanche origin, includes relatively coherent blocks and crackle breccia (Yarnold and Lombard, 1989); does not crop out in map area; shown only in cross section; intercalated throughout the section of Mount Davis Volcanics west of the Colorado River directly south of map area; individual sheets generally thicken westward; lithologies indicate derivation from the southern Eldorado Mountains to the west of the map area; thickness ranges from 0 to ~120 m. **Tdms, scoria**: Basaltic lapilli and scoria accumulations intercalated in Tdm; found directly southwest of Fire Mountain and in the Lonesome Wash area in the northwestern part of the quadrangle; thickness ranges from 0 to 60 m. **Tdbv, volcanic breccia**: Sheets of monolithologic breccia composed of basaltic andesite lavas; found only in the northeastern part of the map area; includes relatively coherent blocks as well as crackle breccia; probable rock-avalanche origin; maximum thickness is ~20 m. **Tdt, tuff of Mount Davis**: Pale-brown, poorly to 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 are as much as 4 mm long; lithic fragments of basaltic andesite and basalt are common; compared to the tuff of Bridge Spring (Tb), biotite is more abundant and less commonly altered, sphene is 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); only exposed in the southeastern part of the map area; reverse polarity; thickness ranges from 0 to 30 m. **Tda, andesite lavas**: Light-gray to purplish-brown andesite lava containing 5–10% oxyhornblende and lesser plagioclase phenocrysts; oxyhornblende shows resorption effects and is peripherally to completely replaced by magnetite, hematite, and minor pyroxene; found only in the northwestern part of the map area; thickness ranges from 0 to 70 m.

Tb **Tuff of Bridge Spring (middle Miocene)** Purplish-gray to pale-brown, moderately welded rhyolitic ash-flow tuff; contains 10–20% anhedral to subhedral phenocrysts composed of ~65% sanidine, 18% biotite, 3% clinopyroxene, 4–10% sphene, 3% magnetite, and 1–3% plagioclase; phenocrysts are as much as 5 mm long in the northeastern part of the map area; weathers brown; lithic fragments of basaltic andesite are common; compared to tuff of Mount Davis (Tdt), biotite is less abundant and more commonly altered, sphene is more abundant, and lithic fragments are less common; sanidine from a sample collected in the Mount Davis area yielded a 15.21 ± 0.01 Ma $^{40}Ar/^{39}Ar$ age; the age, composition, and stratigraphic position strongly suggest a correlation with the tuff of Bridge Spring in the northern Eldorado Mountains (Anderson, 1971); probably derived from a caldera in the northern Eldorado Mountains (Gans and others, 1994); crops out in the southeastern and northeastern parts of the map area, but missing in the Fire Mountain area; reverse polarity; thickness ranges from 0 to 50 m.

Tpu **Upper part, Patsy Mine Volcanics (middle Miocene)** Mainly basaltic andesite lava and flow breccia containing 5–15% phenocrysts of augite, olivine, and plagioclase as much as 5 mm long; augite phenocrysts generally predominate in contrast to olivine-dominated, mafic lavas of Mount Davis Volcanics (Tdm); crops out only in the southeastern part of the map area; grouped with mafic lavas of Mount Davis Volcanics, where resting on thick sections of the volcanics of Red Gap Mine and the tuff of Bridge Spring is absent; may also merge with the upper mafic lavas of the volcanics of Fire Mountain (Tfu), where the volcanics of Red Gap Mine are thin or absent (for example, northeastern part of the quadrangle); best exposed directly north and northeast of Nelson, Nevada (Anderson, 1971); thickness ranges from 0 to 120 m.

Tru, Trl, Trt **Volcanics of Red Gap Mine (middle Miocene)** The volcanics of Red Gap Mine consist of synextensional rhyolite flows and tuffaceous rocks informally named herein for unusually thick (~1.5 km) exposures in the Red Gap Mine area ~12 km southeast of the map area. 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. For example, in the Fire Mountain area west tilts decrease upward from ~60 to 30° between the lower and upper parts of the section (cross section C–C'). The age of the unit is bracketed between ~15.8 and 14.7 Ma. Biotite from a rhyolite flow near the base of the section, 1.6 km southeast of Fire Mountain, yielded an $^{40}Ar/^{39}Ar$ age of 15.47 ± 0.05 Ma. The volcanics of Red Gap Mine were deposited primarily within half grabens, where thicknesses locally approach 1.3 km (cross section A–A'). The volcanics of Red Gap Mine are temporally correlative with the middle part of the Patsy Mine Volcanics of Anderson (1971). **Tru, undivided**: Undifferentiated rhyolite flows and tuffaceous rocks that contain phenocrysts of sanidine, plagioclase, biotite, and quartz in varying proportions and amounts. Does not crop out in map area; shown only in cross section. **Trl, rhyolite lava**: Pinkish-gray to white rhyolite flows; commonly flow-banded; contain 2–15% subhedral phenocrysts of sanidine, biotite, ± plagioclase, ± quartz; and ± accessory sphene, hornblende, and clinopyroxene; thickness of individual flow sequences ranges from 0 to 400 m. **Trt, tuffaceous rocks**: White to yellowish-brown tuffaceous sedimentary rocks, thin pyroclastic flows, surge deposits, and air-fall tuff; tuffs contain as much as 15% anhedral to subhedral phenocrysts of sanidine, plagioclase, biotite, quartz, and clinopyroxene in various proportions; some tuffs lack quartz and clinopyroxene phenocrysts; thickness of individual sequences ranges from 0 to >300 m.

Tf, Tfu, Tfb, Tfs **Volcanics of Fire Mountain (middle to lower Miocene)** The volcanics of Fire Mountain consist of preextensional basaltic andesite flows, volcanic breccia, and volcaniclastic sandstone informally named herein for excellent eposures and unusually thick deposits (~1.3 km) directly north of Fire Mountain. The volcanics of Fire Mountain were deposited prior to the onset of major extension, as evidenced by conformable tilt magnitudes between the lower and upper parts of the section. This does not rule out the possibility, however, that minor amounts of extension may have accompanied the eruption of these volcanics. The age of the volcanics of Fire Mountain is bracketed between 18.5 and 15.9 Ma, but the bulk of the unit was probably deposited between 17.5 and 15.9 Ma. The highly faulted area stretching from 1.5 to 4.5 km north of Fire Mountain is interpreted as a major volcanic center for the volcanics of Fire Mountain, because it contains a swarm of east-northeast-striking basaltic andesite dikes and an unusually thick section of the volcanics of Fire Mountain. The dike swarm and inferred volcano are here referred to as the Eldorado Canyon dike swarm and Fire Mountain volcano, respectively. Much of the section was probably erupted from the Eldorado Canyon dike swarm. The dike swarm is on trend with the easterly trending, granodioritic to dioritic Nelson pluton (Tgn), which crops out along the western margin of the map area in the footwall of the Dupont Mountain fault and extends west of the quadrangle for ~10 km. The Nelson pluton has yielded a 16.9 ± 0.5 Ma K/Ar age on biotite (Faulds and others, 1992). The apparent age, composition, and trend of the Nelson pluton suggest that it continues eastward beneath the Fire Mountain area and represents the source of the volcanics of Fire Mountain. The volcanics of Fire Mountain are the same age as the Patsy Mine Volcanics of Anderson (1971, 1978). The volcanics of Fire Mountain thin appreciably southward in the southern part of the map area and give way to the trachydacitic lavas within the volcanics of Dixie Queen Mine. **Tf, undivided**: Mainly purplish-brown to gray basaltic andesite lava containing 5–15% phenocrysts of augite, plagioclase, and lesser olivine and biotite, but locally includes multiple flows of light-gray to greenish-gray hornblende andesite to dacite (for example, 1.5 to 2.0 km north of Fire Mountain); lower parts of section are commonly mildly altered; mafic constituents are generally altered to iron oxides; plagioclase is partially altered to sericite. **Tfu, upper mafic lavas**: Mainly basaltic andesite lava and flow breccia containing 1–10% augite, plagioclase, and olivine phenocrysts; augite phenocrysts predominate in contrast to mafic lavas of Mount Davis Volcanics (Tdm); olivine is generally altered to iddingsite; locally includes, especially in the upper part of the section, trachyandesite and trachydacite lava containing plagioclase, biotite, and clinopyroxene phenocrysts; directly east of the map area, age is bracketed between 16.1 and 15.9 Ma by $^{40}Ar/^{39}Ar$ whole-rock ages (J.E. Faulds and P.B. Gans, unpubl. data); forms a distinct upper part to the volcanics of Fire Mountain in the Fire Mountain area and areas directly east of the quadrangle, but merges imperceptibly with lower parts of the section in the vicinity of and to the north of the Eldorado Canyon dike swarm; thickness ranges from 0 to ~700 m. **Tfb, volcanic breccia**: Mainly yellowish-green to reddish-brown volcanic breccia and lesser amounts of light-gray to pale-reddish-brown volcaniclastic sandstone; directly north of Fire Mountain and just to the east of the map area, this unit forms a distinct, continuous sheet beneath Tfu and commonly includes abundant sandstone; north of the Eldorado Canyon dike swarm, this unit consists of thin lenticular bodies that are scattered throughout the section and composed almost entirely of volcanic breccia; thickness of individual units is as much as 150 m within the map area; bulk of the unit probably originated as clastic debris (such as mudflows and talus cones) shed from volcanic centers; directly east of the map area, an unusually thick section (800 m) may represent a large clastic wedge shed from the inferred Fire Mountain volcano. **Tfs, sandstone**: Mainly purplish-brown to pale-reddish-brown, medium- to coarse-grained volcaniclastic sandstone consisting of moderately sorted subrounded to subangular grains and sparse subangular pebbles of volcanic rock; moderately indurated; locally includes yellowish-green to reddish-brown volcanic breccia and light-brown to yellowish-brown tuffaceous sedimentary rock; generally forms thin discontinuous, lenticular layers; most abundant in lower part of the section; thickness of individual units is locally as much as 80 m.

Tqu, Tqd **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 volcanics of Dixie Queen Mine are informally named herein for excellent exposures in the Dixie Queen Mine area ~15 km southeast 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 age of the volcanics of Dixie Queen Mine is bracketed between 18.5 and 15.8 Ma by $^{40}Ar/^{39}Ar$ ages on the Peach Springs Tuff (Tp) and basal part of the volcanics of Red Gap Mine (Faulds and others, 1995), respectively. In the map area, this unit either predates or interfingers with the lower part of the volcanics of Fire Mountain and was therefore probably erupted between 18.5 and ~17 Ma. The volcanics of Dixie Queen Mine are the same age as the lower part of the Patsy Mine Volcanics of Anderson (1971). **Tqu, undivided**: Gray to purplish-brown trachydacite and trachyandesite lavas and domes and subordinate volcanic breccia; lavas contain 5–25% phenocrysts of plagioclase, biotite, hornblende, and augite; mafic constituents and plagioclase are commonly altered to iron oxides and sericite, respectively; thickness ranges from 500 to 700 m. **Tqd, dacite lavas**: Medium-gray, weathering pale-reddish- to purplish-brown, dacite and/or trachydacite lava containing 10–20% phenocrysts; plagioclase and biotite phenocrysts occur in all flows; sanidine, hornblende, and pyroxene phenocrysts are present in some flows; phenocrysts are as much as 6 mm long; locally includes minor amounts of trachyandesite and/or basaltic andesite flows that generally contain both augite and biotite phenocrysts; a massive body in the northeastern part of the map area may be a dacite dome; thickness is as much as ~300 m.

Tp **Peach Springs Tuff (lower Miocene)** Poorly welded, rhyolitic ash-flow tuff that contains anhedral to subhedral phenocrysts of plagioclase, sanidine, and biotite; feldspars are largely altered to sericite; correlation with 18.5 Ma Peach Springs Tuff (Glazner and others, 1986; Nielson and others, 1990) based on the composition of phenocrysts, 18.46 ± 0.05 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; inferred thickness ranges from 0 to 10 m. A slight angular unconformity (~10°) is locally developed between the Peach Springs Tuff and basal conglomerate (Tc). Does not crop out in map area; shown only in cross section.

Tc **Conglomerate of Cottonwood Pass (lower Miocene)** Reddish-brown to purplish-gray, prevolcanic poorly sorted, pebble to cobble arkosic conglomerate and coarse-grained sandstone; conglomerate is matrix supported; sandstone generally consists of coarse, subangular grains; contains angular to subangular clasts of Proterozoic and Cretaceous metamorphic and plutonic rock; well exposed ~6 km west of the map area in the Eldorado Mountains and ~15 km southeast of the map area along the Cottonwood Road; informally named herein for excellent exposures near Cottonwood Pass (crest of Black Mountains) along the Cottonwood Road; in the northern Black and northern Cerbat Mountains east of the map area, this unit is locally conformably overlain by basalt flows that have yielded 19–20 Ma $^{40}Ar/^{39}Ar$ whole-rock ages (J.E. Faulds and P.B. Gans, unpubl. data); estimated age is therefore ~20 Ma; inferred thickness ranges from 0 to 20 m. Does not crop out in map area; shown only in cross section.

INTRUSIVE ROCKS

Tbi **Basalt dikes (Miocene)** Medium- to dark-gray basaltic dikes that contain up to 5% phenocrysts of olivine, plagioclase, and pyroxene; olivine is commonly altered to iddingsite.

Tai **Andesite dikes (Miocene)** Light-gray to purplish-brown andesite dikes that contain phenocrysts of plagioclase, ± biotite, ± clinopyroxene, and ± hornblende; dikes in the northwestern part of the map area contain 5–10% phenocrysts of oxyhornblende and lesser plagioclase; oxyhornblende shows resorption effects and is peripherally to completely replaced by magnetite, hematite, and minor pyroxene; dikes in the northwestern part of the map area were largely emplaced along west-dipping normal faults and are spatially associated with thick scoria deposits (Tdms) near the base of the Mount Davis Volcanics.

Tmy **Mylonite (Miocene)** Mylonitic gneiss developed along the Dupont Mountain fault zone; exposed ~12 km south of the map area; asymmetric microstructures indicate a top-to-the-east sense of shear; protolith includes granitoids of Cretaceous and Miocene age. Not exposed in the map area; shown only in cross section.

Tri **Rhyolite dikes (Miocene)** Pale-brown to white, weathering dark-brown, rhyolite dikes containing ~5% phenocrysts of K-feldspar, plagioclase, quartz, and biotite; in the western part of the map area, the feldspar is commonly altered to sericite; dikes near the western margin of the map area are probably co-genetic with the Aztec Wash pluton; a few dikes directly south of Aztec Wash appear to emanate from the Aztec Wash pluton; dikes in the southeastern part of the map area are spatially associated with thick deposits of the volcanics of Red Gap Mine and clearly represent a source for some of these deposits; some of the larger dikes in the southeastern part of the map area may be rhyolite domes.

Tgau, Tgaf, Tgam **Aztec Wash pluton (Miocene)** **Tgau, undivided**: Pluton composed of quartz monzonite, diorite, and abundant, laterally discontinuous mafic dikes and enclaves; locally includes minor amounts of older granite and Proterozoic gneiss. This 50 km^2 intrusive complex is described in detail by Falkner and others (1995). The eastern margin of the complex crops out in the Aztec Wash area in the westernmost part of the quadrangle. Biotite from the pluton has yielded an $^{40}Ar/^{39}Ar$ age of 15.70 ± 0.04 Ma (Falkner and others, 1995). The pluton may be co-genetic with the middle part of the Patsy Mine Volcanics in the northern Eldorado Mountains (Falkner and others, 1995) and possibly with part of the volcanics of Red Gap Mine in the Fire Mountain area. **Tgaf, felsic phase**: Fine to coarse-grained granite to quartz monzonite composed of 40–45% K-feldspar, 25–35% quartz, 20–25% plagioclase, 5% biotite, and accessory sphene, magnetite, and apatite; most dominant rock type within the pluton. **Tgam, mafic phase**: Mainly diorite consisting of 50% plagioclase, 25–30% hornblende, 5–15% biotite, and accessory sphene, magnetite, and clinopyroxene; only the largest and most conspicuous exposures of the mafic phase were mapped.

Tdi **Dacite dikes (Miocene)** Trachydacite, dacite, and rhyodacite dikes that contain 1–15% phenocrysts of sanidine, biotite, and plagioclase; some dikes also contain quartz, clinopyroxene, and/or hornblende phenocrysts; isolated dike in southeastern part of the map area was emplaced along a minor, gently east-dipping normal fault.

Tbai **Basaltic andesite dikes (Miocene)** Basaltic andesite dikes that contain 5–15% phenocrysts of augite, plagioclase, and olivine; olivine is generally altered to iddingsite; includes east-northeast-striking Eldorado Canyon dike swarm in northeastern part of the map area; probably co-genetic with the volcanics of Fire Mountain and possibly with the Nelson pluton.

Tdi **Diorite dikes (Miocene)** Porphyritic diorite to granodiorite dikes that contain 25–30% phenocrysts of feldspar, clinopyroxene, and biotite; most dikes are pervasively altered; feldspars are largely altered to sericite; mafic constituents are altered to epidote and iron oxides; crops out along the western margin of the map area in the footwall of the Dupont Mountain fault; probably co-genetic with the Nelson pluton; inferred beneath the hinge zone of the Fire Mountain anticline (cross section B–B') because major intrusions are common within the hinge zones of similar anticlines elsewhere in the Colorado River extensional corridor (Faulds and others, 1994).

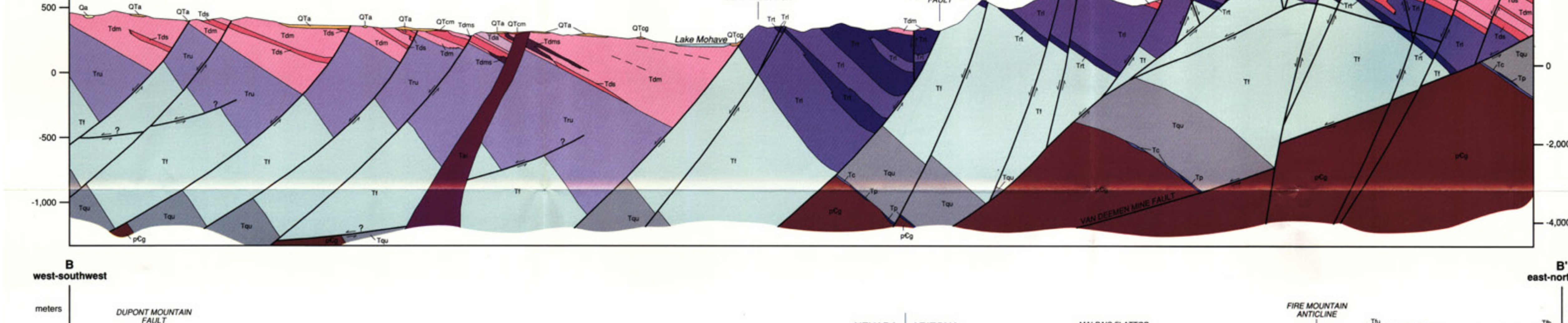
Tgn **Nelson pluton (Miocene)** Granodiorite to diorite pluton that consists of 25–55% plagioclase, 20–40% K-feldspar, 10–20% quartz, 5% biotite, 5% hornblende, and accessory clinopyroxene, sphene, and magnetite; crops out along the western margin of the map area in the footwall of the Dupont Mountain fault; the pluton trends east-west and extends ~10 km west of the map area; exposed part of the pluton projects eastward beneath the east-northeast-striking Eldorado Canyon dike swarm and inferred Fire Mountain volcano; probably co-genetic with at least part of the volcanics of Fire Mountain; intruded by rhyolite (Tri) dikes that are probably co-genetic with the Aztec Wash pluton; biotite has yielded a K/Ar age of 16.9 ± 0.5 Ma (Faulds and others, 1992).

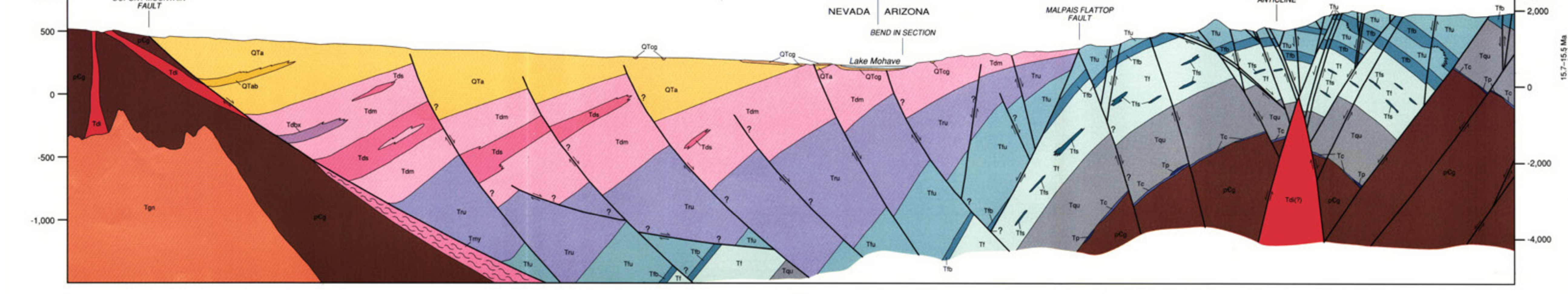
KTg **Granite (Cretaceous?)** Highly altered, weakly foliated, coarse grained granite composed of feldspar, quartz, and biotite; exposed in the Aztec Wash area in the footwall of the Dupont Mountain fault; highly silicified; feldspars are altered to sericite, mafic constituents are altered to iron oxides; presumed Cretaceous-Tertiary age is tentative; roughly 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 to a garnet-bearing, two-mica granite exposed in the southern Eldorado Mountains southwest of the map area that has yielded a 15.18 ± 0.02 Ma $^{40}Ar/^{39}Ar$ age on biotite (J.E. Faulds and P.B. Gans, unpubl. data) and a possible Miocene U-Pb age (Miller and others, 1995), but could also represent an altered Proterozoic granite; pervasively altered rock hinders definitive estimate of age; altered rocks are associated with the margin of the Aztec Wash pluton.

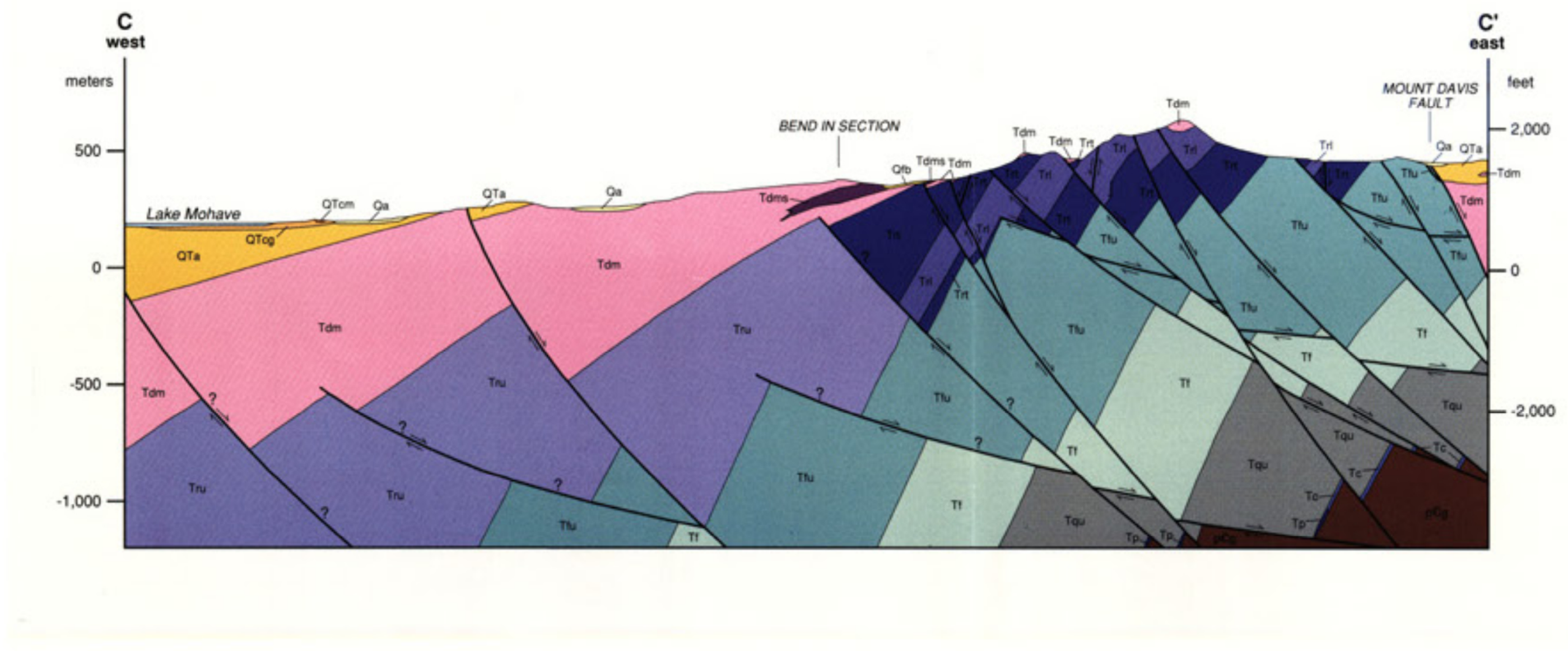
p€Ti **Gneiss and dikes (Early Proterozoic and Miocene)** Complex assemblage of Early Proterozoic orthogneiss (p€g) laced with abundant intermediate to silicic dikes of probable Miocene age.

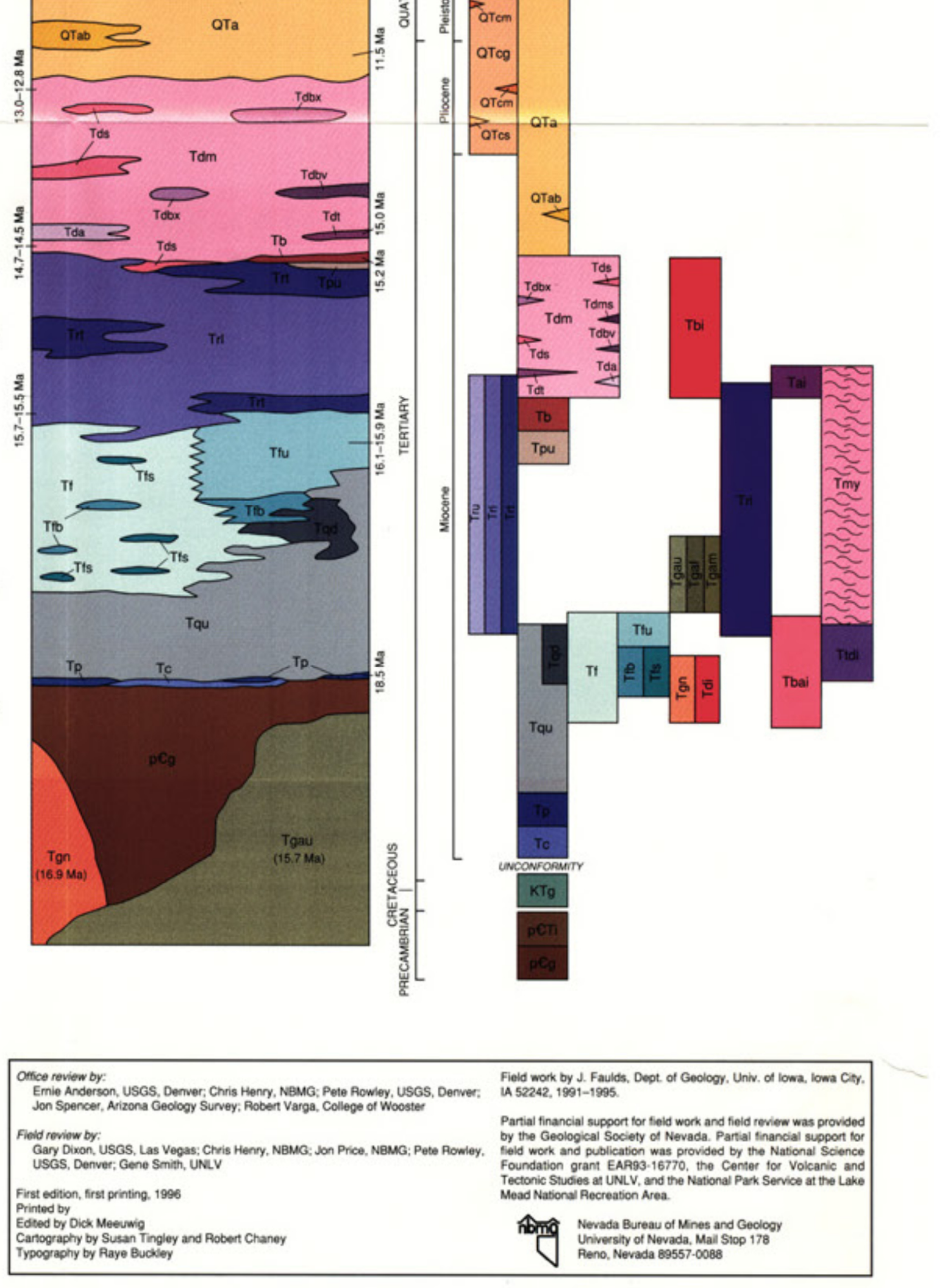
p€g **Orthogneiss (Early Proterozoic)** Quartzo-feldspathic granitic gneiss that generally contains biotite and garnet; garnet locally comprises as much as 15% of the gneiss; locally mylonitic.

See accompanying text for references and discussion of the stratigraphic and structural framework of the quadrangle.









Contact Showing dip, approximately located.

Moderately to steeply dipping fault Showing dip of fault and trend of striae; ball on downthrown side; solid where approximately or precisely located, dotted where concealed.

Gently dipping normal fault Showing dip of fault and trend of striae; hachures on downthrown side; solid where approximately or precisely located, dotted where concealed.

Anticline Trace of axial surface, dashed where approximately located.

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.

13.01±0.06

Office review by:
Ernie Anderson, USGS, Denver; Chris Henry, NBMG; Pete Rowley, USGS, Denver; Jon Spencer, Arizona Geology Survey; Robert Varga, College of Wooster

Field review by:
Gary Dixon, USGS, Las Vegas; Chris Henry, NBMG; Jon Price, NBMG; Pete Rowley, USGS, Denver; Gene Smith, UNLV

First edition, first printing, 1996
Printed by
Edited by Dick Meeuwig
Cartography by Susan Tingley and Robert Chaney
Typography by Raye Buckley

Field work by J. Faulds, Dept. of Geology, Univ. of Iowa, Iowa City, IA 52242, 1991–1995.

Partial financial support for field work and field review was provided by the Geological Society of Nevada. Partial financial support for field work and publication was provided by the National Science Foundation grant EAR93-16770, the Center for Volcanic and Tectonic Studies at UNLV, and the National Park Service at the Lake Mead National Recreation Area.

Nevada Bureau of Mines and Geology
University of Nevada, Mail Stop 178
Reno, Nevada 89557-0088