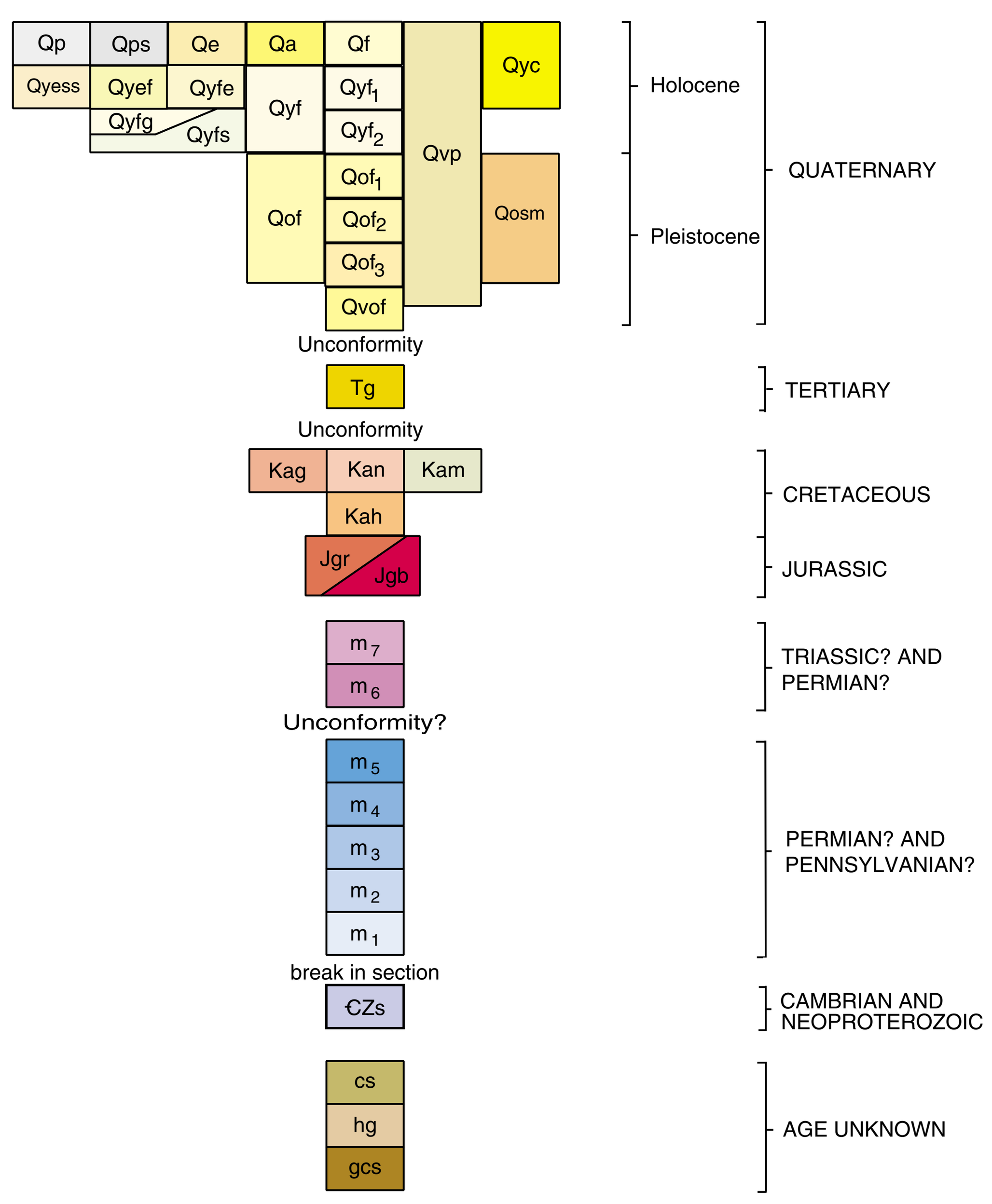
CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

In places surficial geologic units form thin (<1 m) veneers over older units. In areas where this relationship is prevalent the designators for both units are shown on the map, separated by a slash (/). The younger, or overlying, unit is indicated first. Thus, Qyf/Qof indicates an area where a veneer of young alluvial fan deposits overlies old alluvial deposits and Qyf/Kah indicates an area where a veneer of young alluvial fan deposits overlies Cretaceous hornblende granodiorite. The lateral extent of individual deposits is commonly too small to display at the 1:24,000 map scale. Where areas are covered numerous such deposits that are too small to show individually, the unit designators of each deposit are separated by a plus sign (+), with the most common deposit listed first. Thus, Qyf + Qof indicates an area having both Qyf and Qof deposits and associated surfaces, and that Qyf is more common than Qof. For the combined units, the color of the youngest unit is displayed on the map. For thin deposits over granite, a faint pattern is added that is keyed to the kind of granite beneath the deposit. A speckled pattern indicates deposits in which most clasts were derived from Pelona Schist (principally the Sheep Creek fan in the San Gabriel Mountains).

Qp — **Active playa deposits (Holocene)**—Dark brown and green micaceous clay and silt with minor fine to medium sand. Underlies El Mirage playa and smaller playas to east and north. White, reflective surface is characterized by mud-cracks. Supports little or no vegetation

Qps — **Active playa deposits overlain by sand (Holocene)**—Micaceous muddy playa deposits interbedded with and (or) overlain by eolian or alluvial sands, generally less than 50 cm thick. White and pale brown on aerial photographs. More vegetated than active playa deposits (unit Qp) but does not support dense cover

Qe — **Active eolian sand deposits (Holocene)**—Active barchan dunes and sand ramps of fine- to coarse-grained sand; dunes as tall as 4 m. Unvegetated or sparsely vegetated. Most eolian sand south of El Mirage Lake has pale green hue due to large component of mica and sand-sized lithic grains derived from Pelona Schist; transport direction is to the east

Qa — **Active valley axis deposits (Holocene)**—Sand, mud, and subordinate gravel in active braided washes within semi-bolson axes

Qf — **Active alluvial fan deposits (Holocene)**—Poorly sorted gravel, sand, and silt in active alluvial systems. Deposited in braided channels on alluvial fans, as alluvial floodplains bordering streams, and as braided-stream sediment in incised stream channels

Qvp — **Pediment veneer deposits (Holocene and Pleistocene)**—Poorly sorted gravel, sand, and silt in thin active and inactive alluvial systems. Overlie bedrock; less than 2 meters thick. Extensively developed east of El Mirage Lake

Qyc — **Young colluvial deposits (Holocene)**—Largely inactive gravel and sand on steep slopes of Black Mountain

Qyess — **Young eolian sand sheets (Holocene)**—Largely inactive sheets of fine- and medium-grained pale-green sand and minor silt; laminated to lenticular bedded with minor development of ripples. Surface is mounded, irregular; thickness 2 to 8 m. Most eolian sand is derived from sediment that was derived from Pelona Schist

Qyef — **Young eolian and alluvial fan deposits (Holocene)**—Eolian sand sheets and mounds with subordinate young alluvium; restricted to southeast part of map area. Composed largely of sand-sized component of granitic sediments carried north on Sheep Creek fan in gullies and then blown eastward into sand sheets. Thickness 1 to 4 m

Qyfe — **Young alluvial fan and eolian deposits (Holocene)**—Alluvium consisting of gravel, sand, and silt, irregularly overlain by subordinate eolian sand in mounds and small sheets. Forms main body of Sheep Creek fan. East of El Mirage Lake, consists of alluvium that represents reworked pale-green eolian sand blown from old playa bed. About 1 to 2 m thick

Qyf — **Young alluvial fan deposits (Holocene)**—Poorly sorted gravel, sand, and silt. Primarily deposited as alluvial fans, which in many places are coalesced to form piedmonts flanking mountain ranges. Alluvial fan deposits emanating from Shadow and Adobe Mountains mostly consist of coarse sand and gravel derived from granitic rocks. In Shadow Mountains, unit is generally 10-30 cm thick, resting on old alluvium. In Adobe Mountains, typically more than 1 m thick; base not exposed. Commonly covered by extensive biotic crusts. In places, subdivided into two units based on inset relationships, microtopography, and soil development:

Qyf1 — **Young alluvial fan deposits**—Inactive alluvial surfaces with bar and swale topography, no soil development

Qyf2 — **Young alluvial fan deposits**—Inactive alluvial surfaces with subdued bar and swale topography, incipient Av horizon of sandy silt, incipient desert pavement

Qyfg — **Young fan gravel (Holocene)**—Poorly sorted cobbles and pebbles in a matrix of medium- to coarse-grained sand. Cobbles commonly concentrated into lenses. Many cobbles derived from Pelona Schist, granite, and gneiss. Generally less than 1 m thick; partly covered by thin eolian deposits in many places

Qyfs — **Young fan sand (Holocene)**—Moderately to poorly sorted, micaceous, medium and fine sand, silt, and clay. Forms a poorly bedded sequence greater than 4 m thick underlying young fan gravel (Qyfg). Pale green due to abundant mica and lithic sand derived from Pelona Schist. Beds laterally continuous for greater than 50 m distance. Clay-rich beds typically parallel- and ripple-laminated. Lenticular bedding in sand and silt beds. Partly covered by thin eolian deposits in many places

Qof — **Old fan deposits (Pleistocene)**—Moderately compact gravel, sand, and mud deposits; typically has inactive, partly dissected surfaces characterized by well-developed pavements and varnished clasts. Soil development generally includes moderate to strong Av horizon, moderate to strong Bt horizon with white calcite stringers, and Stage I+ to III calcic horizon 10 to 150 cm thick. Deposits largely consist of sand near El Mirage Lake. In places, divided into subunits where inset relations exist and soils differ:

Qof1 — **Old fan deposits**—Alluvial fan deposits 1 to 2 m above active washes. Characterized by nearly flat surfaces with relic bar and swale topography visible, ~8 cm thick Av horizon that contains a little sand with the silt; slightly to moderately developed argillic horizon, Stage I+ calcic horizon, desert pavement, and moderate varnish

Qof2 — **Old fan deposits**—Alluvial fan deposits 2 to 3 m above active washes. Characterized by flat surfaces, ~10 cm thick silt Av horizon; moderately developed Bt horizon ~1.5 m thick, Stage II+ and III calcic horizon greater than 1 m thick, strong desert pavement and strong varnish

Qof3 — **Old fan deposits**—Alluvial fan deposits 3 to 5 m above active washes. Characterized by dissected surfaces, ~10 cm thick silt Av horizon; strongly developed Bt horizon ~1.5 m thick, Stage III+ calcic horizon 2.5 m thick, strong desert pavement and strong varnish

Qosm — **Old spring mound deposits (Pleistocene)**—White, friable, calcium carbonate deposits with pelletal structure and abundant plant impressions forming a spring mound complex. Mapped in piedmont of Shadow Mountains. Individual mounds and degraded remnants of mounds along piedmonts bounding Adobe Mountain and Shadow Mountains shown by symbol; commonly associated with young faults

Qvof — **Very old fan deposits (Pleistocene)**—Moderately compact gravel, sand, and mud deposits; typically underlie inactive, well-dissected ballenas with only fragments of original surfaces exposed. Soil development includes relic strong reddish-brown B horizon and Stage IV calcic horizon greater than 2 m thick

Tg — **Gravel (Tertiary)**—Moderately consolidated, crudely bedded, alluvial boulder- to pebble-gravel and sand underlying two hills north of El Mirage Lake. Sand is arkosic, derived from granitoids. Boulders consist of granitoid and metamorphic rock derived from Shadow Mountains. No obvious geomorphic connection to present topography remains

GRANITOID ROCKS OF ADOBE MOUNTAIN AND SOUTH AND EAST

Suite of granitoids underlying Adobe Mountain area. All are cut by numerous aplite and pegmatite dikes. Divided into:

Kag — **Monzogranite of Adobe Mountain (Cretaceous)**—Medium-grained porphyritic biotite monzogranite containing minor hornblende. Ranges to coarse grained in a few places. Biotite 8-15%, hornblende 1-3%, quartz 30-35%. Potassium feldspar phenocrysts commonly 12 mm but as large as 17 mm. Quartz light gray to milky. Feldspars white to pale yellow. Minor sphene. Matrix to phenocrysts is inequigranular. Some biotite forms as distinctive barrel-shaped crystals 4 mm x 10 mm. Rock is white to light gray, weathering to pale brown; commonly forms disintegrated granite on pediments. Dike in granite near Shadow Mountains dated at 74.1 ± 2.2 Ma (biotite) by Miller and Morton (1980). Underlies much of low relief area south of Adobe Mountain and in Mirage Valley, and probably far to west and north of map area

Kan — **Monzogranite of Nash Hill (Cretaceous)**—Fine- to medium-grained, seriate, leucocratic biotite monzogranite. Color index from 4 to 8. Biotite 2 to 8 mm diameter; partly as distinctive barrel-shaped crystals as large as 4 mm x 10 mm that commonly include plagioclase. Quartz light gray to milky, about 35 percent. Feldspars white to creamy; sparse potassium feldspar phenocrysts as large as 1.5 cm. Trace amount of sphene. Forms craggy resistant hills with closely spaced jointing. Rock is pale gray, weathering light tan. Crops out at Nash Hill, Gray Mountain, and nearby areas. Appears to grade into monzogranite of Adobe Mountain. Highly silicified at Black Mountain. Quartz veins and muscovite selvages along joints in Nash Hill. Sample from Adobe Mountain dated by K-Ar at 76.2 ± 2.3 Ma (biotite); sample from Gray Mountain at 82.2 ± 2.5 Ma (biotite) and 84.3 ± 2.5 Ma (hornblende) (Miller and Morton, 1980)

Kam — **Microgranite (Cretaceous)**—Very fine- to fine-grained, hypidiomorphic, leucocratic biotite monzogranite. Biotite 2 to 5 mm in diameter; color index 2 to 5. Quartz light gray to milky, about 35 percent. Feldspars white to yellowish to pale pink. Rock is light gray and pale pink on fresh surfaces, weathering to light brown to rust-brown. Forms low hills south of Adobe Mountain

Kah — **Hornblende granodiorite (Cretaceous)**—Medium- and-coarse grained biotite-hornblende granodiorite, generally subequigranular to porphyritic with sparse hornblende phenocrysts. Hornblende predominates over biotite; together they compose 12 to 30 percent of rock, and range in size from 6 to 10 mm. Quartz about 25 percent of rock. Sphene prominent: it is medium grained and 4-6% of rock. Rock is white to light tan or gray, weathering dark to medium gray. Locally mylonitic at Mt. Elmo. At Mt. Elmo and Black Mountain, contains common inclusions, screens, and wispy trails of metamorphic rocks: hornblendite, hornblende gneiss and schist, tremolite schist, and chlorite schist. Altered at many locations to

GRANITOID ROCKS IN THE SHADOW MOUNTAINS

Jgr — **Granodiorite, granite and related rocks (Jurassic)**—Biotite granite, hornblende granite, biotite-hornblende granodiorite and biotite-hornblende quartz monzodiorite. Medium- to coarse-grained, but compositionally and texturally variable. Granodiorite is most common rock type; relatively mafic rocks such as quartz monzodiorite distinctively subordinate. Aplite and pegmatite dikes are common; some contain tourmaline, muscovite, and garnet. U-Pb date on granodiorite by Martin (1992) is 143 to 148 Ma

Jgb — **Gabbro, diorite, and quartz diorite (Jurassic)**—Dark brown to black hornblende gabbro, hornblende diorite, hornblende-biotite quartz diorite, and mafic porphyritic hornblende-biotite quartz monzonite. Medium- and coarse-grained. Mafic minerals are biotite, hornblende, and augite. U-Pb date on quartz diorite is 148 Ma by U-Pb (Martin, 1992)

PRE-BATHOLITHIC METAMORPHIC ROCKS OF THE SHADOW MOUNTAINS —

Assigned generic unit names because correlations with established, unmetamorphosed, sedimentary rocks is uncertain

m7 — **Schist (Triassic? and Permian?)**—Quartz-feldspar-biotite schist interlayered with minor quartzite and calc-silicate rock, generally fine-grained. Correlated by Martin (1992; map unit PM4) to late Paleozoic and early Mesozoic strata of central and western Mojave Desert

m6 — **Calc-silicate rocks (Triassic? and Permian?)**—Calc-silicate rock and calcite marble, generally fine-grained and dark colored. Correlated by Martin (1992; map unit PMcl) to late Paleozoic and early Mesozoic strata of central and western Mojave Desert

Marble (Permian? and Pennsylvanian?)—Calcite marble, siliceous marble, calcsilicate rock and minor quartzite. Divided by Martin (1992) into four stratigraphic units and other units of uncertain position. Here subdivided into five units, but original stratigraphic superposition is highly uncertain. Sequence is highly folded and may contain layer-parallel faults.

m5 — **Metamorphosed siliceous rocks**—Includes layered calcsilicate, feldspathic quartzite, and interlayers of marble. About 750 m thick (unit P4 of Martin, 1992). Queried where assignment to unit m5 uncertain

m4 — **Calcite and dolomite marble**—White to tan, massive. About 30 m thick (unit P3 of Martin, 1992)

m3 — **Schistose feldspathic quartzite**—Dark gray to brown, fine- to medium-grained, and thin to medium layered; contains a few layers of massive quartzite. About 30 to 100 m thick (unit P2 of Martin, 1992)

m2 — **Calcite marble**—Dark gray and thinly layered. Includes distinctive layers of metamorphosed carbonate pebbles and rare siliceous marble and white quartzite. About 500 m thick (unit P1 of Martin, 1992). Queried where assignment to unit m5 uncertain

m1 — **Siliceous marble**—Thinly layered. Base not exposed. Greater than 100 m thick (underlies unit P1 of Martin, 1992)

PRE-BATHOLITHIC METAMORPHIC ROCKS OF BLACK MOUNTAIN AND MOUNT ELMO

CZs — **Siliciclastic rocks (Cambrian and Late Proterozoic)**—Interlayered biotite schist, biotite-bearing quartzite, and quartzite, with minor tremolite schist and mafic gneiss. May represent the Zabriskie Quartzite, Wood Canyon Formation, Stirling Quartzite and Johnnie Formation. In map area, restricted to Mt. Elmo and Black Mountain

cs — **Calc-silicate rocks (age unknown)**—Undivided green and brown calc-silicate rocks at Black Mountain consisting of variably foliated rock with varying proportions of Ca-amphibole, pyroxene, quartz, chlorite, calcite, and plagioclase. Much rock is fine grained green amphibole skarn, but some is coarse actinolite schist and gneiss with minerals as long as 6 cm. Fine-grained chlorite schist is distinctive component; it carries actinolite porphyroblasts, as much as 1.5 cm long, in some cases. Locally mylonitic

hg — **Hornblende gneiss (age unknown)**—Black and dark brown, hornblende-rich gneiss and schist, hornblendite, and minor calc-silicate rock at Black Mountain. Hornblendite is finely laminated, fine-grained, and contains 75 to 95% hornblende. Locally mylonitic and retrograded to chlorite schist

gcs — **Garnet calc-silicate rocks (age unknown)**—Calc-silicate rocks at Black Mountain similar to the calc-silicate rock unit described above, but containing more muscovite and two distinctive subunits a few meters thick of brown rock composed almost entirely of zoned euhedral garnet. Most of unit is medium- to coarse-grained gneiss composed of Ca-amphibole and muscovite; hornblende schist, chlorite ± actinolite schist, and calc-silicate-bearing marble are distinctive minor components. Locally mylonitic

Pattern overprinted on any unit color indicates most sediment derived from eroded Pelona Schist; restricted principally to Sheep Creek fan

Contact—Dashed where location uncertain

Contact—Gradational

? ? ? Fault—Dashed where location uncertain, dotted where covered; queried where existence uncertain

Anticline—Showing direction of plunge

Syncline—Showing direction of plunge

Lineament—Line of enhanced vegetation on playa

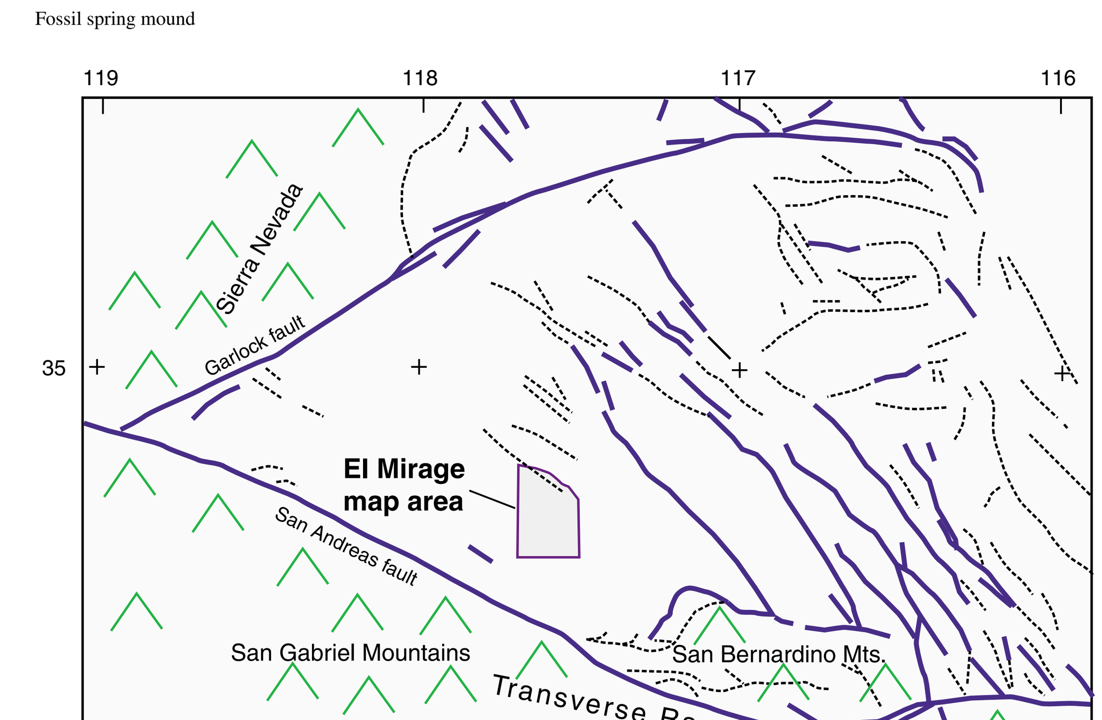
35 Bedding—Giving amount of dip

35 Foliation—Giving amount of dip

Vertical Foliation

Sample locality for K-Ar dating by Miller and Morton (1980)

Fossil spring mound



Map of active (Holocene - heavy blue lines) and inactive (Pleistocene - light dashed lines) young faults in the western Mojave Desert and Basin and Range Province to the north. El Mirage map area and major faults and mountain ranges are labeled.

Geologic Map Database of the El Mirage Lake Area, San Bernardino and Los Angeles Counties, California

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