U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the
U.S. FOREST SERVICE (San Bernardino National Forest) and the
CALIFORNIA DIVISION OF MINES AND GEOLOGY

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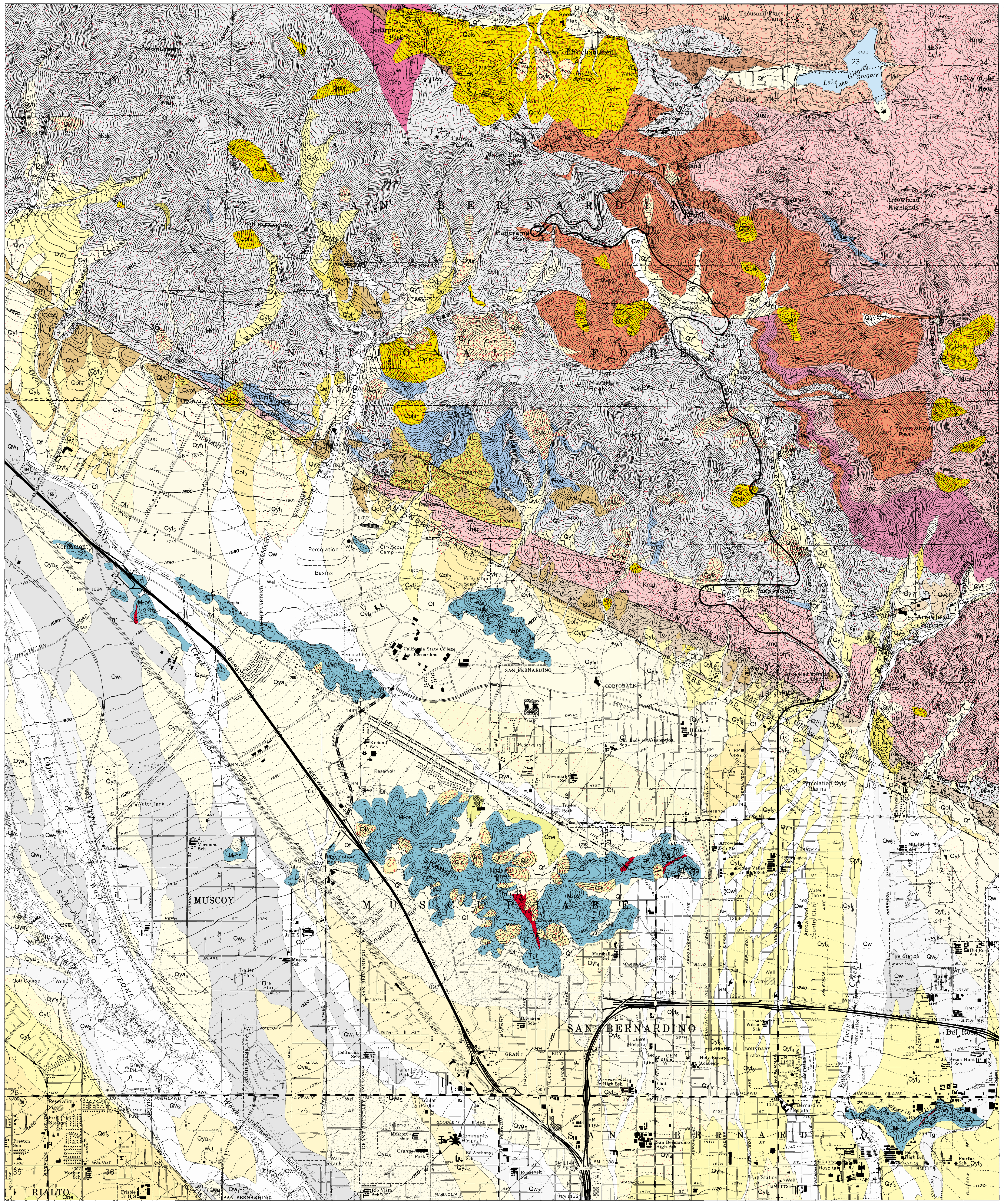
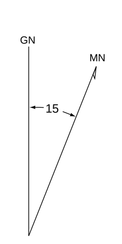
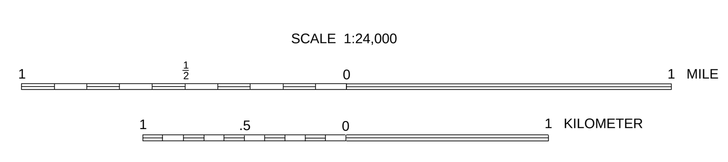


Base from U.S. Geological Survey
7.5' San Bernardino North quadrangle, 1967

Polyconic projection





Geology mapped by F.K. Miller, 1974 and 1978;
J.C. Matti, 1991-1996; S.E. Carson, 1991

GEOLOGIC MAP OF THE SAN BERNARDINO NORTH 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA

Version 1.0

By

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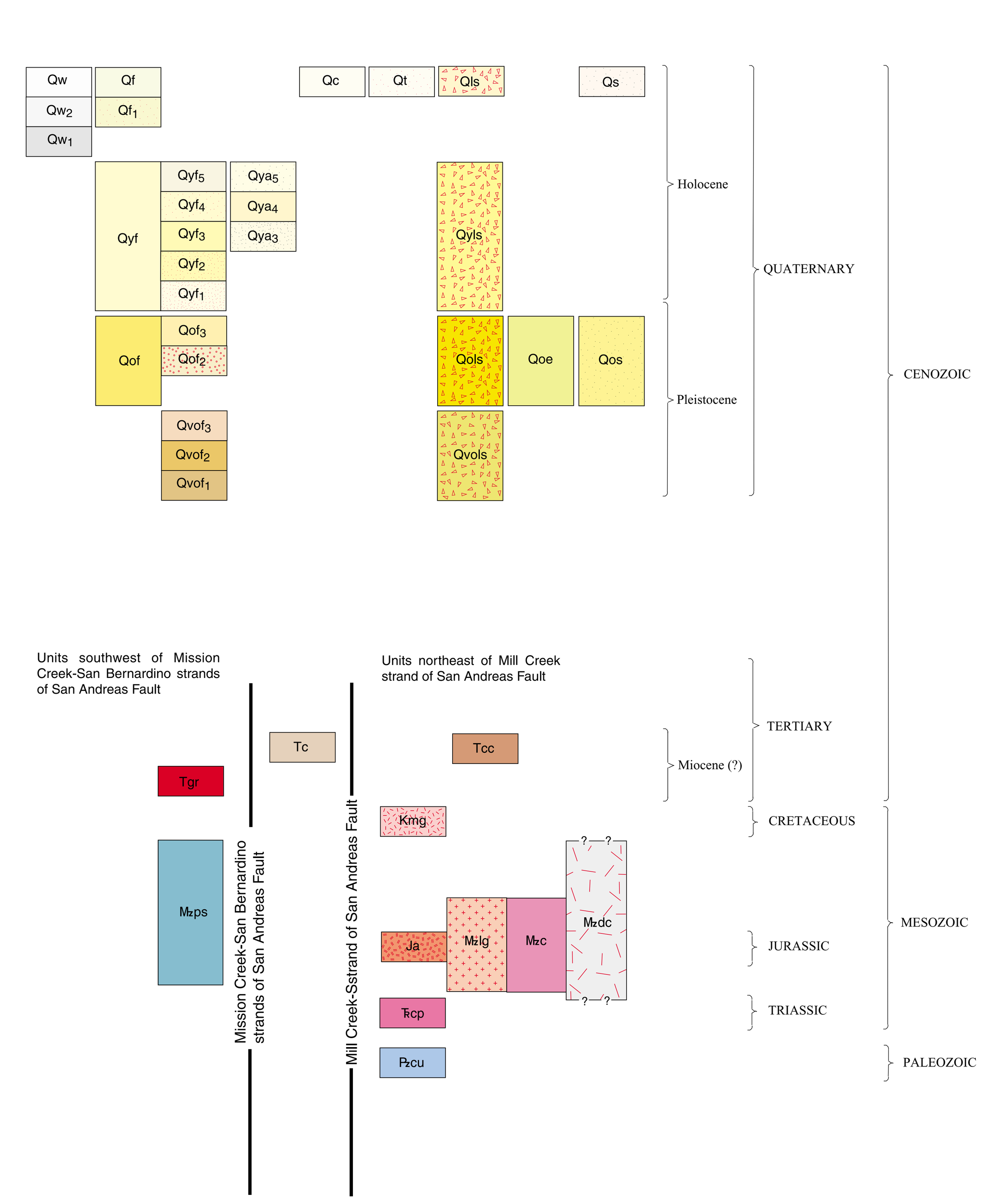
CORRELATION OF MAP UNITS



Contact—Solid where located within ±15 meters; dashed where located within ±30 meters

Contact—Separates terraced alluvial units, hachers point towards topographically lower surface. Located within ±15 meters

Fault—High angle. Solid where located within ±15 meters; dashed where located within ±30 meters; dotted where concealed. Hachures indicate scarp; hachures on down-dropped block. Opposed arrows indicate relative movement. Arrow and number indicate direction and amount of dip. MLS, Mill Creek strand; MCS, Mission Creek strand; SBS, San Bernardino strand of San Andreas Fault zone

Strike and dip of beds

70 **Inclined**

70 **Overturned**

Strike and dip of metamorphic foliation

70 **Inclined**

Bearing and plunge of linear features

70 **Minor fold axes**

70 **Aligned metamorphic minerals**

70 **Lineation, general**

DESCRIPTION OF MAP UNITS

VERY YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existant to minimal. Includes:

Qw **Very young wash deposits (late Holocene)**—Unconsolidated to locally cemented sand, gravel, and boulder deposits in active washes of streams and on active surfaces of alluvial fans. Typically shows fresh flood scours and channel-and-bar morphology. Locally includes small areas of older surficial deposits. Most deposits are centimeters to a few meters thick. Includes:

Qw2 **Very young wash deposits, Unit 2 (late Holocene)**—Chiefly sand and gravel. Distinguished as lower level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant

Qw1 **Very young wash deposits, Unit 1 (late Holocene)**—Chiefly sand and gravel. Distinguished as upper level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant

Qf **Very young alluvial-fan deposits (late Holocene)**—Unconsolidated to locally cemented, undissected deposits of gravel and sand that for active parts of alluvial fans. Essentially no pedogenic soil development

Qf1 **Very young alluvial-fan deposits, Unit 1 (late Holocene)**—Undissected, unconsolidated to loosely compacted deposits of gravel and sand. Distinguished as high-level terrace in Qf terrace sequence

Qc **Very young colluvial deposits (late Holocene)**—Unconsolidated to slightly consolidated sandy and pebbly deposits of hillslopes and base of slopes. No pedogenic soil development

Qt **Very young talus deposits (late Holocene)**—Unconsolidated deposits of angular and sub-angular pebble-, cobble-, and boulder-sized clasts that form scree and rubble on hillslopes and at bases of slopes

Qls **Very young landslide deposits (late Holocene)**—Slope-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Most deposits are probably active or recently active

Qs **Very young surficial deposits, undifferentiated (late Holocene)**—Sand and pebble to small cobble gravel deposits not assigned to any specific surficial materials unit. Unconsolidated to slightly consolidated. Includes wash, alluvial fan, colluvial, and valley-filling deposits

YOUNGER SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits (Qyf series) typically have high Coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to A/AC/$B_{cambric}C_{ox}$ profiles). Includes:

Qyf **Young alluvial-fan deposits (Holocene and late Pleistocene)**—Slightly consolidated to cemented, undissected to slightly dissected deposits of unsorted boulders, cobbles, gravel, and sand that form inactive parts of alluvial fans. Many have unsorted clast and matrix supported debris-flow fabrics. Subunits of Qyf generally form a nested series of thin fills that include from younger to older:

Qyf5 **Young alluvial-fan deposits, Unit 5 (late Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Occupies topographically highest position relative to other Qyf units

Qyf4 **Young alluvial-fan deposits, Unit 4 (late Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Differs from Qyf_5 and from Qyf_3 by relative position in terrace sequence, consolidation, and surface dissection

Qyf3 **Young alluvial-fan deposits, Unit 3 (late and middle Holocene)**—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated, sand is fine to coarse grained. Differs from Qyf_4 and from Qyf_2 by relative position in terrace sequence, consolidation, and surface dissection

Qyf2 **Young alluvial-fan deposits, Unit 2 (early Holocene)**—Sand, silty sand, and granule-pebble gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_3 by relative position in terrace sequence, consolidation, surface dissection, and average grainsize and from Qyf_1 by relative topographic position and slight differences in average grain size

Qyf1 **Young alluvial-fan deposits, Unit 1 (early Holocene and late Pleistocene)**—Sand and pebble-boulder gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_2 by relative position in terrace sequence, consolidation, surface dissection, and slight difference in average grainsize

Young alluvial-valley deposits (Holocene and late Pleistocene)—Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Generally finer grained than Qyf units Includes:

Qya5 **Young alluvial-valley deposits, Unit 5 (Holocene and late Pleistocene)—**Slightly dissected, slightly consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_4 by relative position in terrace sequence, consolidation, and surface dissection

Qya4 **Young alluvial-valley deposits, Unit 4 (Holocene and late Pleistocene)—**Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_5 and Qya_3 by relative position in terrace sequence, consolidation, and surface dissection

Qya3 **Young alluvial-valley deposits, Unit 3 (Holocene and late Pleistocene)—**Slightly to moderately dissected, moderately well consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_4 by relative position in terrace sequence, consolidation, and surface dissection

Qyls **Young landslide deposits (Holocene and late Pleistocene)—**Landslide-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Deposits are probably inactive under current climatic conditions and moderate to strong ground-shaking conditions

OLDER SURFICIAL DEPOSITS—Sedimentary units that are moderately consolidated and slightly to moderately dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils (A/AB/B/C_{ox} profiles and Bt horizons as much as 1 to 2 m thick and maximum hues in the range of 10YR 5/4 and 6/4 through 7.5YR 6/4 to 4/4 and mature Bt horizons reaching 5YR 5/6). Includes:

Qof **Old alluvial-fan deposits (late to middle Pleistocene)—**Sedimentary units that are moderately consolidated and slightly to moderately dissected. Includes from younger to older:

Qof3 **Old alluvial-fan deposits, Unit 3 (late Pleistocene)**—Slightly to moderately dissected alluvial fan deposits. Moderately to well consolidated brownish sand, gravelly sand, and granule-boulder gravel mainly having matrix-supported debris-flow fabrics; lenses of sediment having clast-supported, imbricated fluvial fabrics are subordinate

Qof2 **Old alluvial-fan deposits, Unit 2 (late Pleistocene)**—Slightly to moderately dissected alluvial fan deposits. Moderately to well consolidated brownish sand, gravelly sand, and granule-boulder gravel mainly having matrix-supported debris-flow fabrics

Qols **Old landslide deposits (late to middle Pleistocene)**—Slope-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Deposits are probably inactive under current climatic conditions and moderate to strong ground-shaking conditions

Qoe **Old eolian deposits (late to middle Pleistocene)**—Fine and medium grained sand and silt; grayish-brown. Slightly dissected; no dune or eolian forms preserved. Slightly consolidated

Qos **Old alluvial deposits, undivided (late to middle Pleistocene)**—Sand and pebble to small cobble gravel deposits not assigned to any specific surficial materials unit. Moderately well consolidated; reddish-brown. Probably includes alluvial fan, colluvial, and valley-filling deposits

VERY OLD SURFICIAL DEPOSITS—Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils (A/AB/B/C_{ox} profiles having Bt horizons as much as 2 to 3 m thick and maximum hues in the range 7.5YR 6/4 and 4/4 to 2.5YR 5/6)

Very old alluvial fan deposits (middle to early Pleistocene)—Sedimentary units that are moderately consolidated and moderately to well dissected. Includes from younger to older:

Qvof3 **Very old alluvial-fan deposits, Unit 3 (early Pleistocene)**—Moderately consolidated to indurated, sandy gravel and gravely sand. Moderately dissected alluvial fan deposits. Upper 0.5 to 2 m is commonly well developed reddish-brown soil. Distinguished as upper level terraces in Qvof terrace sequence

Qvof2 **Very old alluvial-fan deposits, Unit 2 (early Pleistocene)**—Moderately well consolidated to well indurated, sandy gravel and gravely sand. Moderately dissected alluvial fan deposits. Upper 0.5 to 2 m is commonly well developed reddish-brown soil. Distinguished as mid-level terraces in Qvof terrace sequence

Qvof1 **Very old alluvial-fan deposits, Unit 1 (early Pleistocene)**—Well consolidated to well indurated, sandy gravel and gravely sand. Moderately to well dissected alluvial fan deposits; rarely has fan morphology preserved. Upper 0.5 to 2 m is commonly well developed reddish-brown soil; more intense coloration than younger Qvof units. Distinguished as lower level terraces in Qvof terrace sequence

Qvols **Very old landslide deposits (middle to early Pleistocene)**—Landslide-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Geomorphic form of landslides poorly, or not at all, preserved. Deposits of this unit inferred to have accumulated during late uplift history of San Bernardino Mountains

Tc **Conglomerate and arkose (Miocene?)**—Conglomerate and lithic, conglomeratic arkose. Clasts range from 1 cm to about 20 cm, poorly sorted, subangular to well rounded. Matrix- and clast-supported Most derived from granitic and gneissic rocks, but subordinate amount of quartzite, vein quartz, calcsilicate rock, and silicic volcanic rocks. Arkose is pink, gray, and greenish-brown. Most of unit lacks conspicuous bedding, but locally well bedded where arkose lenses are abundant. May include more than one unit separated by unconformities. Thickness unknown. Restricted to zone bounded by Mill Creek and Mission Creek strands of San Andreas Fault

Tcc **Conglomerate of Crestline (Miocene?)**—Conglomerate and conglomeratic arkose. Clasts range from pebbles to small boulders, poorly sorted, subangular to rounded. Dominantly matrix-supported. Clasts appear to be derived from San Bernardino Mountains granitic units. Gray, and greenish-gray. Bedding is indistinct, except where arkose lenses are abundant. Relation to conglomerate and arkose unit bounded by San Andreas Fault is unknown

Tgr **Hypabyssal granitic dikes (Miocene)**—Hornblende-biotite granodiorite in Shandin Hill area and leucocratic biotite-quartz-plagioclase porphyry in Perris Hill area. Granodiorite is medium and fine grained, porphyry is fine grained. Presumed to be early Miocene to late Oligocene because of similarity to dated rocks intruding Pelona Schist in other areas

Kmg **Biotite monzogranite (Cretaceous)**—Medium- to coarse-grained, porphyritic biotite monzogranite. Concentration of 1 to 2 cm potassium feldspar phenocrysts varies throughout unit; in places phenocrysts are absent. Color index ranges from 5 to 15, averages about 9; biotite is only mafic mineral. Composition variable, especially near intrusive contacts with older mafic rocks. Texture is hypidiomorphic-granular, but in some places is moderately to highly foliate; probably not primary igneous foliation. Locally cut by diffuse cataclastic and gouge zones. Unit strongly resembles monzogranite of Keller Peak, which extends westwardward from Big Bear Lake and appears to underlie several hundred km^2. Biotite monzogranite may be western part of Keller Peak body, but could represent a separate pluton. In Coldwater Canyon area and east of East Twin Creek, unit is extremely hetrogeneous, and includes small, bodies of quartz monzodiorite of Crestline (Mzc) and granodiorite of Arrowhead Peak (Ja) closely intermixed with biotite monzogranite. Six conventional K/Ar ages on biotite range from 66 to 74 Ma; latter may approach emplacement age, but entire region reflects complex and protracted intrusion and cooling history

Mzps **Pelona Schist (Mesozoic)**—Muscovite-chlorite-albite-quartz schist; contains numerous, but volumetrically minor, layers of fine-grained quartzite and greenstone. Typically fine-grained, green, gray, and brown. Layering ranges from fine laminations to massive zones several meters thick. Layering is probably all transposed bedding, but locally some could be primary bedding; no primary sedimentary structures identified. Unit is highly susceptible to landsliding. Age is very poorly constrained; based primarily upon plutonic intrusions into Pelona (Mukasa and others, 1984; Silver and Nourse, 1986) which have ambiguous contact relations

Mzlg **Granodiorite of Lake Gregory (Mesozoic)**—Medium- to coarse-grained hornblende-biotite granodiorite; locally porphyritic, having sparse, 2-cm-long potassium feldspar phenocrysts. Color index averages 15; biotite more abundant than hornblende, latter locally absent. Texture is hypidiomorphic-granular, but in places rock has poorly developed secondary foliation. Contains abundant lenticular inclusions of gneiss and schist, some over 100 m in length. Cut by numerous leucocratic dikes that are probably related to biotite monzogranite (Kmg). Resembles quartz monzodiorite of Crestline (Mzc), but is distinctly more leucocratic most places. Appears to intrude gneiss of Devil Canyon (Mzdc), and intruded by biotite monzogranite (Kmg); relation to granodiorite of Arrowhead Peak (Ja) unknown. Mineralogy and overall composition most similar to Jurassic rocks in nearby areas

Mzc **Quartz monzodiorite of Crestline (Mesozoic)**—Medium- to coarse-grained biotite-hornblende quartz monzodiorite, ranging to quartz diorite and granodiorite. Color index averages 20, and hornblende is more abundant than biotite. Characterized by very abundant sphene. Rock is typically foliate and in places lineate. Nonporphyritic. Appears to intrude gneiss of Devil Canyon, and is intruded by biotite monzogranite (Kmg); relation to granodiorite of Arrowhead Peak (Ja) unknown. Mineralogy and overall composition most similar to Jurassic rocks in nearby areas

Ja **Granodiorite of Arrowhead Peak (Jurassic)**—Very porphyritic, medium- to coarse-grained biotite-hornblende granodiorite. Characterized by potassium feldspar phenocrysts averaging 3 cm in length and as large as 5 cm. Color index between 15 and 20; hornblende generally more abundant than biotite, but not in all rocks. Rock has irregular foliation and commonly contains lineation similar to that in quartz monzodiorite of Crestline (Mzc). Irregular foliation imparts swirled appearance to rocks at some places. Unit is very similar to wide-spread porphyritic biotite-hornblende rocks in Mojave Desert that yield K/Ar ages between 165 Ma and 170 Ma (Miller and Morton, 1980)

Mzdc **Gneiss of Devil Canyon (Cretaceous and Jurassic?)**—Gneiss, schist, migmatite, and granitic rock. Includes numerous pods of Paleozoic(?) marble too small to show at scale of map, especially in lower part of Devil Canyon; also may include larger, undetected marble bodies in very poorly exposed area between Devil Canyon and Cable Canyon. Most of unit is layered biotite-quartz-microcline-plagioclase gneiss, but muscovite and garnet zones are present locally, and hornblende-rich zones are common. Large, irregular, foliate granitic pods are also common. Highly schistose biotite-rich zones are narrow and have limited extent. Parts of unit lack prominent layering and resemble massive augen gneiss and metamorphosed pegmatitic rocks. Discordant granitic dikes, pods, and small bodies strongly resemble, and are probably related to, Cretaceous biotite monzogranite (Kmg) and possibly Jurassic plutons. Age of gneissic part of unit is uncertain, probably early to mid-Mesozoic, but possibly as old as Proterozoic. Appears to be intruded by granodiorite of Lake Gregory (Mzlg) and quartz monzodiorite of Crestline (Mzc). Intrusive relationship with Monzonite of Cedarpines Park (Tkcp) is uncertain

Tkcp **Monzonite of Cedarpines Park (Triassic)**—Medium-grained biotite-hornblende monzonite and hornblende monzonite; locally porphyritic. Contains sparse quartz. Average color index 20; hornblende:biotite ratio everywhere greater than 10:1. Hornblende commonly has cores of pyroxene. Most of body has poorly developed, highly irregular foliation and lineation, probably primary, that gives rocks a swirled or folded appearance. Rock is very similar to monzonite of Fawnskin 27 km to east, which yielded a zircon U/Pb age of 231 Ma (J.E. Wooden, written commun.). Also resembles monzodiorite of Manzanita Springs (Morton and others,1980), which yielded a zircon U/Pb age of 245 Ma (J.E. Wooden, written commun.)

Pzcu **Carbonate rocks, undivided (Paleozoic)**—Coarse- to medium-grained marble and dolomitic marble. Most is thickly layered to massive, white to gray, and has few recognizable sedimentary structures that survived metamorphism, other than traces of bedding. Highly deformed, and tectonically intermixed with the gneiss of Devil Canyon (Mzdc). Typically shows little development of contact metamorphic minerals adjacent to Mesozoic granitic rocks, but locally, especially in Devil Canyon and Bailey Canyon areas, diopside-actinolite-quartz-plagioclase-calcite hornfels is developed in marble bodies near contacts with granitic rocks

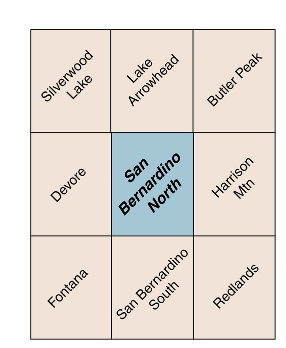
REFERENCES

Miller, F.K., and Morton, D.M., 1980, Potassium-Argon geochronology of the eastern Transverse Ranges and southern Mojave Desert, southern California: U.S. Geological Survey Professional Paper 1152, 30 p.

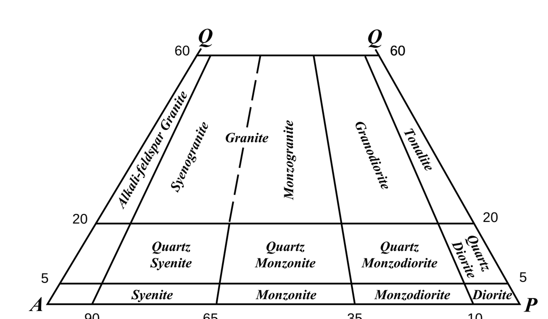
Morton, D.M., Cox, B.F., and Matti, J.C., 1980, Geologic map of the San Gorgonio Wilderness: U.S. Geological Survey Miscellaneous Field Studies Map MF-1164-A, Scale, 1:62,500

Mukasa, S.B., Dillon, J.T., and Tosdal, R.M., 1984, A late Jurassic minimum age for the Pelona-Oricopia Schist protolith, southern California: Geological Society of America Abstracts and Programs, v. 16, p. 323

Silver, L.T., and Nourse, J.A., 1986, The Rand Mountains "thrust" complex in comparison with the Vincent thrust-Pelona Schist relationship, southern California: Geological Society of America Abstracts and Programs, v. 18, p. 185



SURROUNDING 7.5' QUADRANGLES



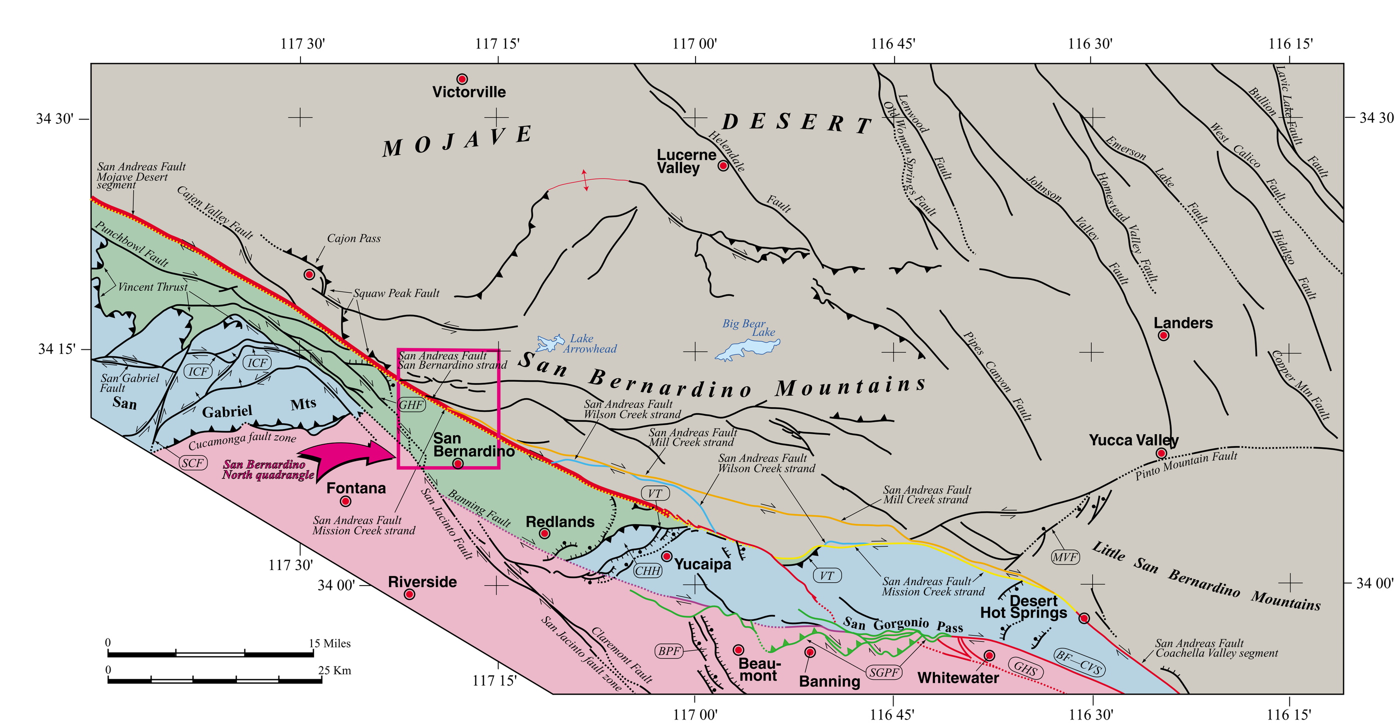
Classification of plutonic rock types (from IUGS, 1976, and Streckeisen, 1976). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

Basement rocks of Peninsular Ranges-type

Basement rocks of San Bernardino Mountains- and Mojave Desert-types

Basement rocks of San Gabriel Mountains-type (upper plate of Vincent Thrust)

Basement rocks of San Gabriel Mountains-type (Pelona Schist in lower plate of Vincent Thrust)



Map showing regional geologic framework and location of San Bernardino North 7.5' quadrangle. Faults modified from Matti and others (1992), Matti and Morton (1993), and Rogers (1967). Faults shown in colors are strands of the San Andreas Fault; red indicates modern traces of the San Andreas Fault. *BF—CVS*, Banning Fault—Coachella Valley segment; *GHS*, San Andreas Fault—Garnet Hill strand; *BPF*, Beaumont Plain fault zone; *CHH*, Crafton Hills horst-and-graben complex; *GHF*, Glen Helen Fault; ICF, Icehouse Canyon Fault; *MVF*, Morongo Valley Fault; *SCF*, San Antonio Canyon Fault; *VT*, Vincent Thrust