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SAN BERNARDINO

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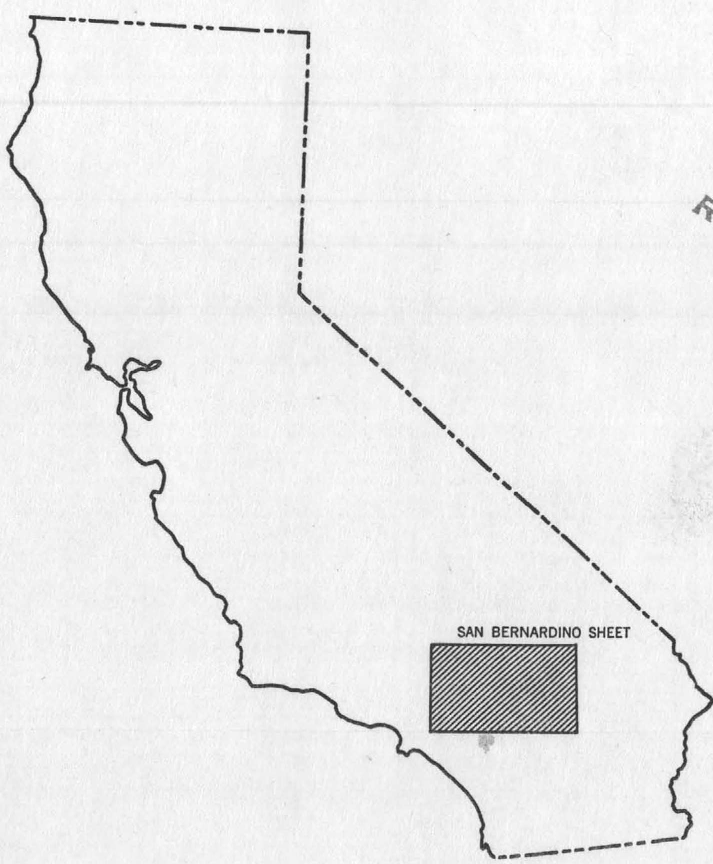
GEOLOGIC MAP OF CALIFORNIA

SAN BERNARDINO

Scale 1:250,000

1969



DIVISION OF MINES AND GEOLOGY

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SAN BERNARDINO

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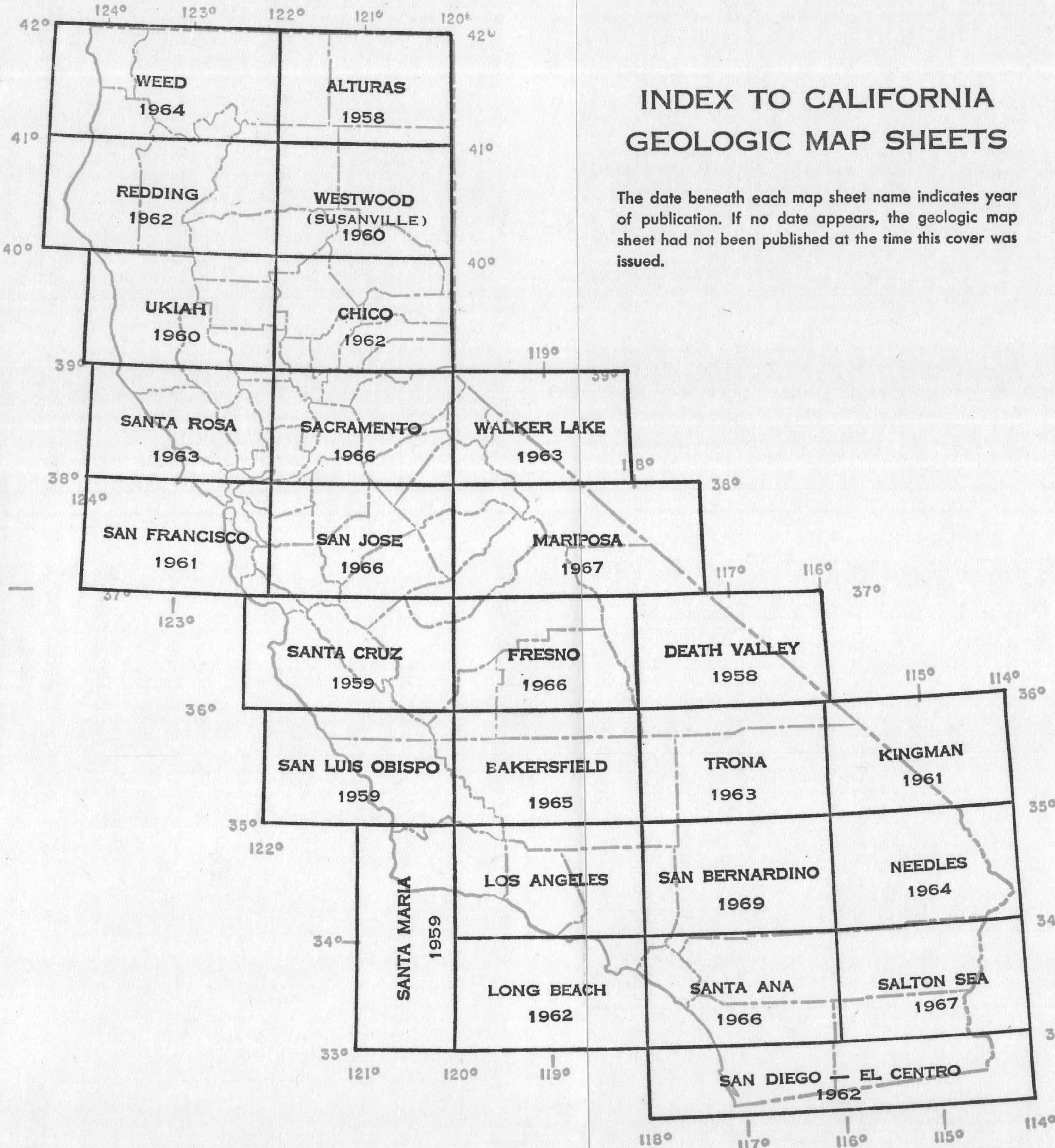

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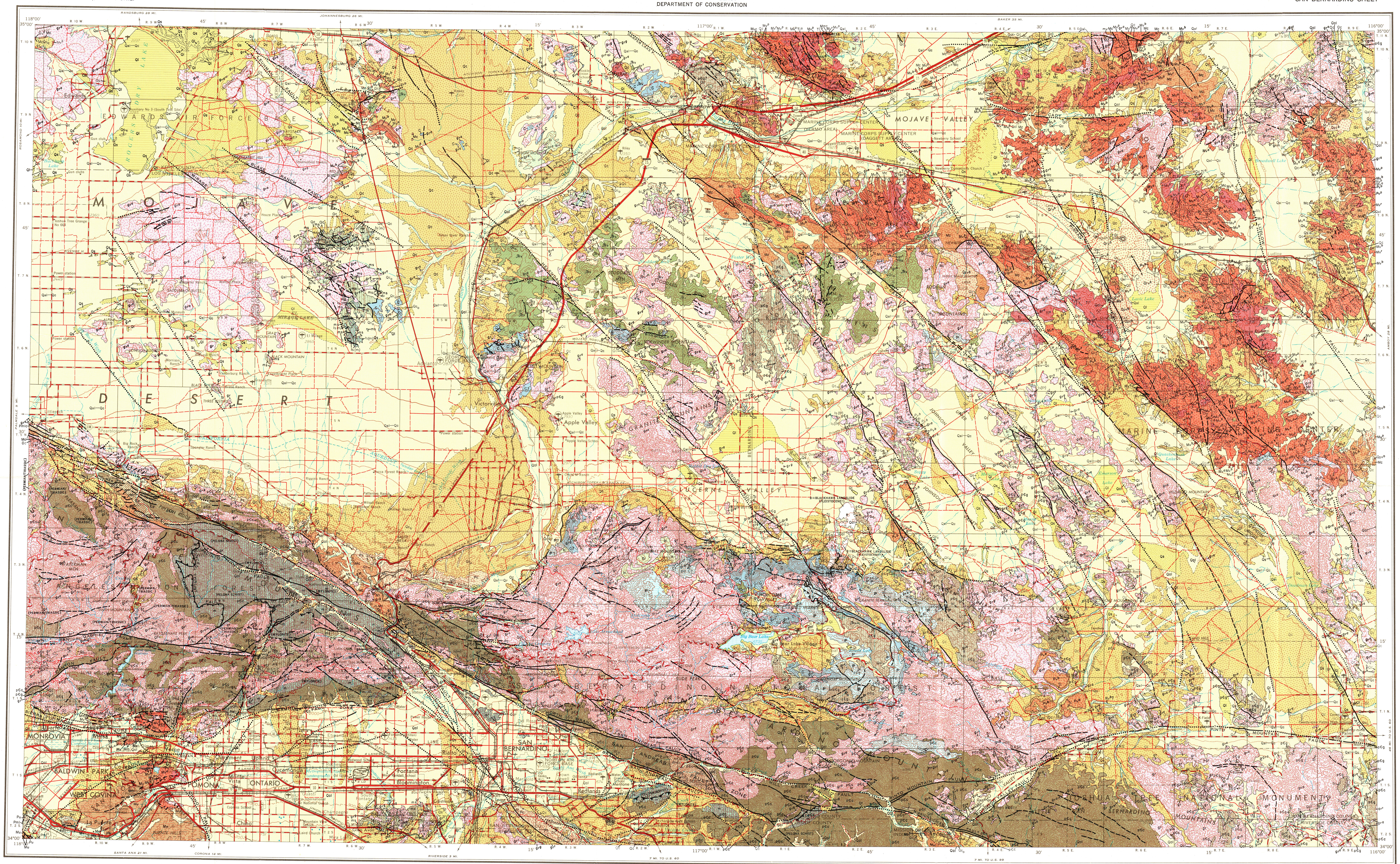
GEOLOGIC MAP OF CALIFORNIA
SAN BERNARDINO SHEET



EXPLANATION

SEDIMENTARY AND METASEDIMENTARY ROCKS / **IGNEOUS AND META-IGNEOUS ROCKS**

CENOZOIC

QUATERNARY

Recent
- Qs — Dune sand
- Qal — Alluvium
- Qsc — Stream channel deposits (GREAT VALLEY)
- Qf — Fan deposits (GREAT VALLEY)
- Qb — Basin deposits (GREAT VALLEY)
- Qrv — Recent volcanic: Qrv^r —rhyolite; Qrv^a —andesite; Qrv^b —basalt; Qrv^p —pyroclastic rocks
- Qst — Salt deposits
- Ql — Quaternary lake deposits
- Qg — Glacial deposits

Pleistocene
- Qt — Quaternary nonmarine terrace deposits
- Qm — Pleistocene marine and marine terrace deposits
- Qpv — Pleistocene volcanic: Qpv^r —rhyolite; Qpv^a —andesite; Qpv^b —basalt; Qpv^p —pyroclastic rocks
- Qc — Pleistocene nonmarine
- QP — Plio-Pleistocene nonmarine
- Quaternary and/or Pliocene cinder cones

TERTIARY

Pliocene
- Pc — Undivided Pliocene nonmarine
- Puc — Upper Pliocene nonmarine
- Pu — Upper Pliocene marine
- Pv — Pliocene volcanic: Pv^r —rhyolite; Pv^a —andesite; Pv^b —basalt; Pv^p —pyroclastic rocks
- Pmlc — Middle and/or lower Pliocene nonmarine
- Pml — Middle and/or lower Pliocene marine

Miocene
- Mc — Undivided Miocene nonmarine
- Muc — Upper Miocene nonmarine
- Mu — Upper Miocene marine
- Mv — Miocene volcanic: Mv^r —rhyolite; Mv^a —andesite; Mv^b —basalt; Mv^p —pyroclastic rocks
- Mmc — Middle Miocene nonmarine
- Mm — Middle Miocene marine
- Ml — Lower Miocene marine

Oligocene
- Φc — Oligocene nonmarine
- Φ — Oligocene marine
- Φv — Oligocene volcanic: Φv^r —rhyolite; Φv^a —andesite; Φv^b —basalt; Φv^p —pyroclastic rocks

Eocene
- Ec — Eocene nonmarine
- E — Eocene marine
- Ev — Eocene volcanic: Ev^r —rhyolite; Ev^a —andesite; Ev^b —basalt; Ev^p —pyroclastic rocks

Paleocene
- Epc — Paleocene nonmarine
- Ep — Paleocene marine

Undivided
- QTc — Cenozoic nonmarine
- QTv — Cenozoic volcanic: QTv^r —rhyolite; QTv^a —andesite; QTv^b —basalt; QTv^p —pyroclastic rocks
- Tc — Tertiary nonmarine
- Ti — Tertiary intrusive (hypabyssal) rocks: Ti^r —rhyolite; Ti^a —andesite; Ti^b —basalt
- Tl — Tertiary lake deposits
- Tv — Tertiary volcanic: Tv^r —rhyolite; Tv^a —andesite; Tv^b —basalt; Tv^p —pyroclastic rocks
- Tm — Tertiary marine

MESOZOIC

CRETACEOUS
- K — Undivided Cretaceous marine
- Ku — Upper Cretaceous marine
- Kl — Lower Cretaceous marine
- KJf — Franciscan Formation
- KJfv — Franciscan volcanic and metavolcanic rocks
- gr — Mesozoic granitic rocks: gr^a -granite and adamellite; gr^g -granodiorite; gr^t -tonalite and diorite

JURASSIC
- Jk — Knoxville Formation
- bi — Mesozoic basic intrusive rocks
- Ju — Upper Jurassic marine
- ub — Mesozoic ultrabasic intrusive rocks
- Jml — Middle and/or Lower Jurassic marine
- JRv — Jura-Trias metavolcanic rocks

TRIASSIC
- R — Triassic marine

UNDIVIDED
- m, ls — Pre-Cretaceous metamorphic rocks (ls = limestone or dolomite)
- mv — Pre-Cretaceous metavolcanic rocks
- ms — Pre-Cretaceous metasedimentary rocks
- gr-m — Pre-Cenozoic granitic and metamorphic rocks
- P, ls — Paleozoic marine (ls = limestone or dolomite)
- Pv — Paleozoic metavolcanic rocks

PALEOZOIC

PERMIAN
- Pm — Permian marine
- Pmv — Permian metavolcanic rocks

CARBONIFEROUS
- C — Undivided Carboniferous marine
- Cv — Carboniferous metavolcanic rocks
- CP — Pennsylvanian marine
- CM — Mississippian marine

DEVONIAN
- D — Devonian marine
- Dv — Devonian metavolcanic rocks
- Dv? — Devonian and pre-Devonian? metavolcanic rocks

SILURIAN
- S — Silurian marine
- pSs — Pre-Silurian metasedimentary rocks
- pS — Pre-Silurian metamorphic rocks
- pSv — Pre-Silurian metavolcanic rocks

ORDOVICIAN
- O — Ordovician marine

CAMBRIAN
- Є — Cambrian marine
- Є? — Cambrian – Precambrian marine
- pЄc — Precambrian igneous and metamorphic rock complex

PRECAMBRIAN
- pЄ — Undivided Precambrian metamorphic rocks; pЄg = gneiss, pЄs = schist
- pЄgr — Undivided Precambrian granitic rocks
- lpЄ — Later Precambrian sedimentary and metamorphic rocks
- epЄ — Earlier Precambrian metamorphic rocks

HEAVY BORDER ON BOXES INDICATES UNITS THAT APPEAR ON THIS SHEET

TOPOGRAPHIC BASE MAP

Prepared by the Army Map Service (KCLD), Corps of Engineers, U.S. Army, Washington, D.C. Compiled in 1957 by photogrammetric methods and from: United States Quadrangles, 1:20,000, 1:24,000, 1:25,000, 1:48,000, 1:50,000, 1:62,500, 1:125,000, U.S. Geological Survey and AMS, 1925-55. Planimetric detail revised by photoplanimetric methods. Control by USGS, USC&GS, Los Angeles County, CE, Metropolitan Water District of Southern California, and AMS. Map field checked 1958.

Minor corrections and additions to culture by California Division of Mines and Geology, 1968

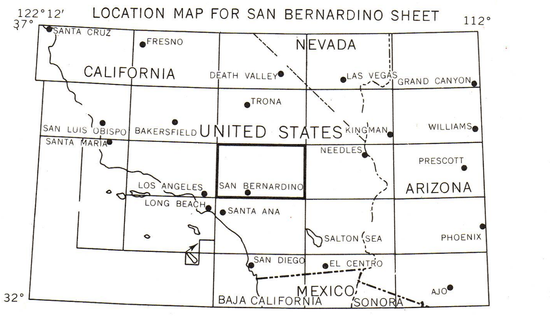
Land net prepared by U.S. Geological Survey

Contact
(Dashed where approximately located, gradational or inferred)

Fault
(Dashed where approximately located; dotted where concealed)

Thrust fault
(Barbs on upper plate; dashed where approximately located)

LOCATION MAP FOR SAN BERNARDINO SHEET



Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers

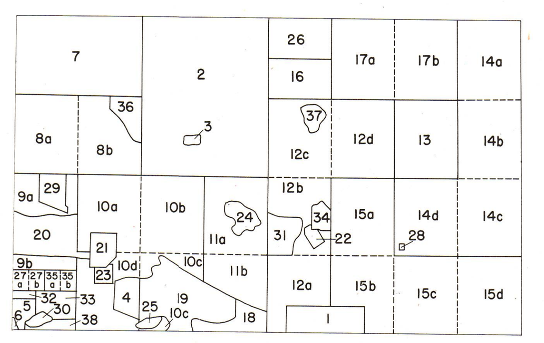
CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS

GEOLOGIC MAP OF CALIFORNIA

OLAF P. JENKINS EDITION

SAN BERNARDINO SHEET

COMPILATION BY THOMAS H. ROGERS, 1967



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TOPOGRAPHIC QUADRANGLES

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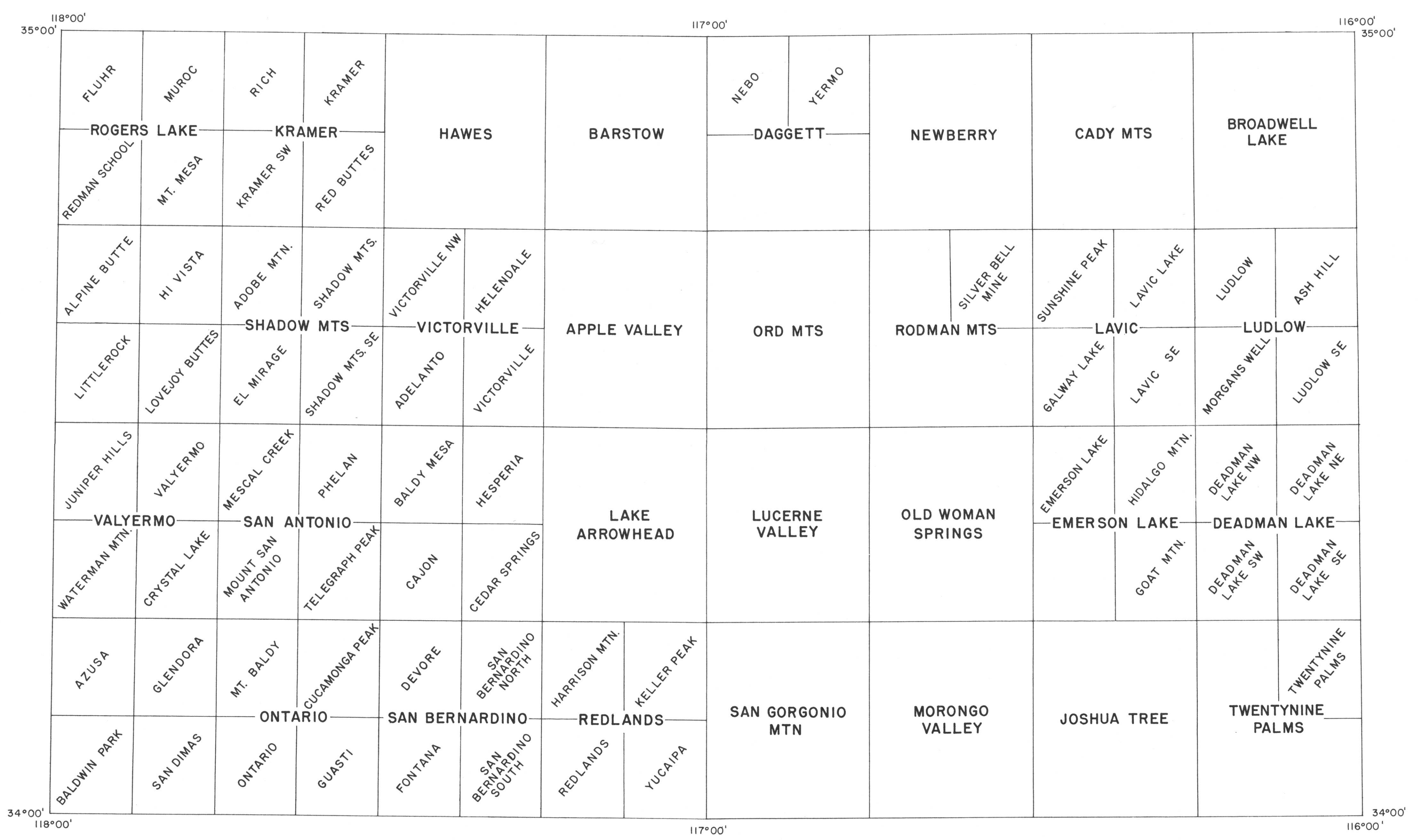

View northwest along the San Bernardino mountain front toward the city of San Bernardino, Cajon Pass, and the snow-capped San Gabriel Mountains. The linear boundary between the dark orange groves of the valley and the lighter brushy foothills of the San Bernardino Mountains coincides with the South Branch of the San Andreas fault. The North Branch of the San Andreas fault occupies a trough (NB) in the foothills, at the base of the higher more rugged part of the San Bernardino Mountains. These two branches converge into a much narrower fault zone in the distance near Cajon Pass. The rocks between these faults consist of Mesozoic granitic rocks (light colored outcrops) and severely deformed Pliocene or Miocene nonmarine beds. The remainder of the San Bernardino Mountains and the San Gabriel Mountains consists of a granitic and metamorphic complex of Mesozoic, Paleozoic and Precambrian age. *Photo by R. C. Frampton, 1955*

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EXPLANATORY DATA
SAN BERNARDINO SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION

Compiled by Thomas H. Rogers, 1967

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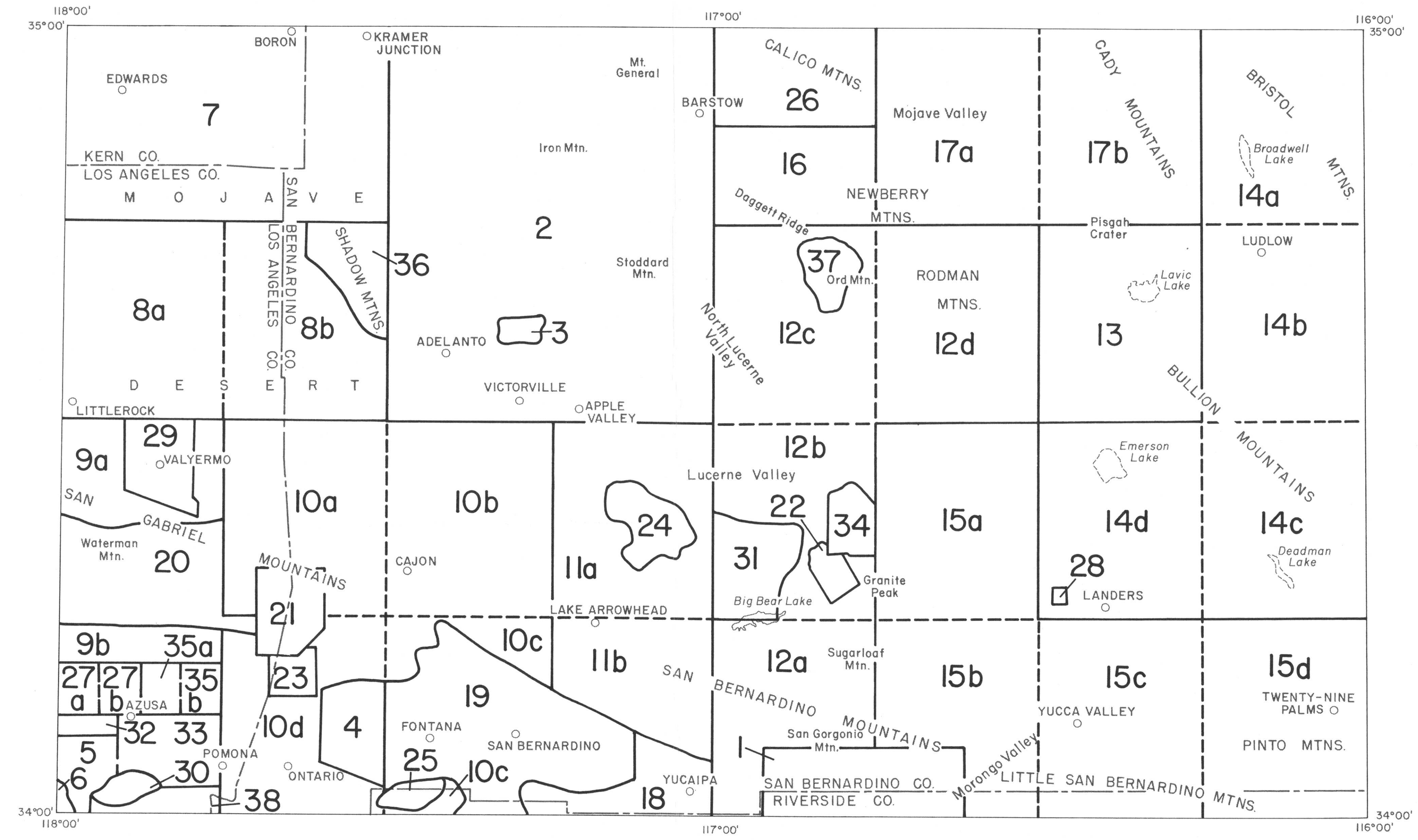

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b) Pomona quadrangle.

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c) Ord Mountains quadrangle, I-427.
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38. Woodford, A. O., Shelton, J. S., and Moran, T. G., 1944, Geology and oil possibilities of the Puente and San Jose Hills, California: U. S. Geol. Survey Oil and Gas Investigations Preliminary Map 23, scale 1:62,500.

* Additional mapping by T. W. Dibblee, Jr.

† Part of this area is also covered by geologic maps of the Southern Pacific Co., Land Dept., Regional geologic mapping program, scale 1:24,000, unpublished, 1956–1960. For information concerning these maps contact Manager—Land Dept., Southern Pacific Co., 65 Market St., San Francisco, California 94105.

For a complete list of published geologic maps of this area see Division of Mines and Geology Special Reports 52 and 52-A.

STRATIGRAPHIC NOMENCLATURE—SAN BERNARDINO SHEET

AGE	STATE MAP SYMBOL	STATE MAP UNIT (State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California)	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES (The formally named formations grouped within an individual State Map Unit, are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC — QUATERNARY — Recent	Qs	**RECENT DUNE SAND**	Windblown sand, local dunes. Wave-deposited sandbars at north end of Rogers Dry Lake.
	Qal	**RECENT ALLUVIUM**	Stream, river channel, and alluvial fan deposits. Alluvial deposits in Mojave Desert of Pleistocene to Recent age shown as Qal-Qc. Playa clay and windblown sand near Rogers Dry Lake.
		RECENT VOLCANIC ROCKS:	
	Qrv^{b}	**BASALTIC**	Black vesicular basalt flows from Pisgah Crater (may be Pleistocene).
Pleistocene	Ql	**QUATERNARY LAKE DEPOSITS**	Manix Lake Beds—*light-gray, green, and buff sand, interbedded silt, clay and gravel* east of Manix (contain late Pleistocene vertebrate fossils). Unnamed clay, silt, and marl, local alkaline efflorescences, and windblown sand (Mojave Desert).
	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	Stream and river terrace deposits.
	Qg	**QUATERNARY GLACIAL DEPOSITS**	Glacial till on north flank of San Gorgonio Mountain.
	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Qc: dissected, undeformed or slightly deformed alluvial fan deposits locally cemented by caliche: Burnt Canyon Breccia and Heights Fanglomerate south of San Gorgonio Mountain. San Dimas Formation along south flank of San Gabriel Mountains (includes local terrace remnants). Unnamed silt, sand, and gravel elsewhere. Qc_o (older than Qc): folded, faulted, and dissected alluvial fan deposits locally cemented by caliche: Cabezon Fanglomerate and deformed gravels of Whitewater River south of San Gorgonio Mountain. Shoemaker Gravel and Harold Formation (includes interbedded brown to green shale and white marly clay) along north flank of San Gabriel Mountains. Cushenbury Springs Formation—*fanglomerate and landslide breccia* on north flank of San Bernardino Mountains. Unnamed gray, brown, and red-brown fanglomerate and conglomerate elsewhere (possibly in part late Pliocene east of Barstow).
		PLEISTOCENE VOLCANIC ROCKS:	
	Qpv^{b}	**BASALTIC**	Black vesicular basalt flows from Sunshine and Malpais Craters. Black massive basalt flow on Broadwell Mesa.
	Qpv^{p}	**PYROCLASTIC**	Gray, white, and buff massive tuff south of Lavic Lake.
	✳	**QUATERNARY CINDER CONES**	Black and brown-black basaltic pumice of Pisgah Crater (Recent) and Sunshine Crater (Pleistocene).
TERTIARY — Pliocene		**PLIOCENE VOLCANIC ROCKS:**	
	Pv^{r}	**RHYOLITIC**	Gray to light-brown massive fine-grained felsite and dacite (may be in part Pleistocene). Red rhyolitic to dacitic flow breccia in Ord Mountains.
	Pv^{b}	**BASALTIC**	Black massive vesicular and nonvesicular basalt (may be in part Pleistocene).
	Pv^{p}	**PYROCLASTIC**	Light-gray massive rhyolitic tuff and tuff breccia (may be in part Pleistocene).
	Pu	**UPPER PLIOCENE MARINE SEDIMENTARY ROCKS**	Upper Member of the Fernando Formation (includes rocks commonly called Pico Formation)[1]—*sandy siltstone, conglomerate, and sandstone* (southwest of Azusa).
	Pml	**MIDDLE AND/OR LOWER PLIOCENE MARINE SEDIMENTARY ROCKS**	Lower Member of the Fernando Formation (includes rocks commonly called Repetto Formation)[2]—*siltstone, conglomerate, and fine sandstone* (southwest of Azusa).
	Pmlc	**MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Anaverde Formation—*yellow and white arkosic sandstone and conglomerate, interbedded gray gypsiferous shale and red to green siltstone* (south of Little Rock on the north flank of the San Gabriel Mountains). Potato Sandstone—*red, gray, and white massive conglomerate, buff arkosic sandstone and siltstone, green to gray rhythmically-bedded shale and pebbly sandstone, minor gray limestone* (according to D. I. Axelrod, in R. E. Smith,[3] upper part of this formation contains an early Pliocene flora; lower part of formation may be Miocene; north of Redlands).
	Pc	**UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Duarte Conglomerate[4]—*light-gray massive conglomerate and local sandstone* (south flank San Gabriel Mountains). Crowder Formation[4]—*gray fanglomerate, conglomerate, and sandstone* (Cajon Pass area). San Timoteo Formation—*gray, yellow, and brown semi-consolidated gravel, sand, silt, and clay* (contains a late Blancan vertebrate fauna now regarded as early Pleistocene according to R. H. Tedford, written communication 6/12/67). Santa Ana Sandstone[4]—*buff to gray, friable, arkosic sandstone, minor micaceous siltstone and pebble conglomerate, local black basalt* (San Bernardino Mountains). Unnamed brown, gray, and white sandstone, fanglomerate and marl in Mojave Desert[4].
Miocene	Mc	**UNDIVIDED MIOCENE NONMARINE SEDIMENTARY ROCKS**	Tropico Group—*undifferentiated sandstone, chert, clay shale, granitic breccia, limestone or dolomite, and local rhyolitic tuff* (may be in part Pliocene; Rogers Dry Lake-Kramer Hills area). Bissell Formation (of Tropico Group)—*limestone and/or dolomite*. Punchbowl Formation—*buff, massive, conglomeratic sandstone and siltstone, interbedded red, green, and brown siltstone and shale, local brown and gray gypsiferous shale and coarse conglomerate west of San Andreas fault* (contains a late Miocene and a middle Miocene vertebrate fauna east of San Andreas fault and an early Pliocene vertebrate fauna west of San Andreas fault: R. H. Tedford and T. Downs, 1965, Geol. Soc. America, Spec. Paper 87, p. 234; Cajon Pass-Valyermo area). Unnamed nonmarine sediments east of Barstow including light-colored locally tuffaceous sand, variegated locally-opaline shale, varicolored claystone and siltstone, light-colored limestone, dolomite, and magnesite, minor conglomerate, fanglomerate, sedimentary breccia, chert, celestite beds, rhyolitic tuff, olivine basalt, and dacite mudflow breccia (unnamed sediments contain a middle and a late Miocene vertebrate fauna in the northern Cady Mountains and a middle Miocene fauna at Daggett Ridge: D. P. Whistler, written communication, 5/17/67; correlation of fossiliferous strata with similar unnamed sediments elsewhere in map area is uncertain; may be in part Oligocene elsewhere).
	Muc	**UPPER MIOCENE NONMARINE SEDIMENTARY ROCKS**	Barstow Formation—*fluvatile and lacustrine sandstone and shale, locally silicified* (contains a late Miocene and a late middle Miocene vertebrate fauna in the Calico Mountains according to D. P. Whistler, written communication, 5/17/67 and R. H. Tedford, written communication, 6/12/67). Coachella Fanglomerate—*red-brown massive conglomerate and sandstone* (south of Morongo Valley).
	Mmc	**MIDDLE MIOCENE NONMARINE SEDIMENTARY ROCKS**	Unnamed lacustrine limestone, sandstone, shale, conglomerate, sedimentary breccia, and interbedded olivine basalt flows (Calico Mountains). Biotite dacite mudflow breccia of the Pickhandle Formation (Calico Mountains).
		MIOCENE VOLCANIC ROCKS:	
	Mv	**UNDIFFERENTIATED**	Glendora "Volcanics"—*undifferentiated massive andesite, basalt, dacite(?), and rhyolite, interbedded tuff and tuff breccia* (Azusa-Glendora area).
	Mv^{r}	**RHYOLITIC**	Dacite vitrophyre and dacite of the Tropico Group (Rogers Dry Lake-Kramer Hills area). Rhyolitic felsite and dacite porphyry east of Ludlow. Dacite and rhyolite of the Glendora "Volcanics" (Azusa area).
	Mv^{a}	**ANDESITIC**	Brown, red, green, and gray porphyritic andesite flows and breccia of the Glendora "Volcanics" (Azusa area). Andesite associated with the Barstow Formation (Calico Mountains). Unnamed andesite flow breccia, andesite-dacite breccia, and hornblende andesite elsewhere (contains early Miocene vertebrate fauna in the southern Cady Mountains according to D. P. Whistler, written communication, 5/17/67).
	Mv^{b}	**BASALTIC**	Red Buttes Quartz Basalt (of Tropico Group)—*black quartz-bearing volcanic rocks* (referred to as quartz basalt by T. W. Dibblee, Jr., 1960, ref. no. 7, and quartz andesite by O. E. Bowen, 1954, ref. no. 2; may be in part Pliocene). Olivine basalt flows of Tropico Group (may be in part Pliocene). Basalt porphyry, pillow lava, associated palagonite tuff of the Glendora "Volcanics" (Azusa area). Unnamed black massive vesicular and nonvesicular basalt and basalt breccia elsewhere.
	Mv^{p}	**PYROCLASTIC**	Gem Hill Formation (of Tropico Group)—*rhyolitic tuff* (Rogers Dry Lake-Kramer Hills area). Pickhandle Formation—*undifferentiated tuff, tuff-breccia, agglomerate, and tuffaceous sandstone* (Calico Mountains). Andesitic tuff, tuff breccia, and tuffaceous sediments of the Glendora "Volcanics" (Azusa area). Unnamed varicolored tuff, tuff breccia, and agglomerate elsewhere.
	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	Puente Formation—*white and tan, well-bedded siltstone, shale, siliceous shale, and conglomerate, minor feldspathic sandstone and tuff* (south of Azusa).
	Mm	**MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS**	Topanga Formation—*buff conglomerate, sandstone, siltstone, and shale, interbedded vesicular basalt flows* (Azusa area). Volcanic conglomerate and reworked tuffs associated with Glendora "Volcanics" (San Jose Hills).
	Ml	**LOWER MIOCENE MARINE SEDIMENTARY ROCKS**	Vaqueros Formation—*fossiliferous arkosic sandstone and conglomerate* (near Cajon Canyon).
Oligocene	Φc	**OLIGOCENE NONMARINE SEDIMENTARY ROCKS**	Vasquez Formation—*conglomerate, arkosic sandstone, and siltstone, associated andesitic and basaltic volcanic rocks* (northwest of Valyermo).
Paleocene	Ep	**PALEOCENE MARINE SEDIMENTARY ROCKS**	San Francisquito Formation—*dark gray to black shale, coarse conglomerate, tan to gray sandstone, abundant thin lignite seams and limestone lenses* (formerly mapped as "Martinez Formation"; Cajon Pass-Valyermo area).

STRATIGRAPHIC NOMENCLATURE—Continued

AGE	STATE MAP SYMBOL	STATE MAP UNIT (State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California)	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES (The formally named formations grouped within an individual State Map Unit, are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC — TERTIARY — UNDIVIDED	Tc	**TERTIARY NONMARINE SEDIMENTARY ROCKS**	Old Woman Sandstone—*buff to pink massive arkosic sandstone, interbedded conglomerate, siltstone, and mudstone* (probably late Tertiary; north flank San Bernardino Mountains).
	Tl	**TERTIARY LAKE DEPOSITS**	Unnamed red-brown and green massive claystone, white vuggy limestone, interbedded white bentonitic tuff (west of Pisgah Crater; altered tuff marketed as "hectorite").
		TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
	Ti	**UNDIFFERENTIATED**	Felsite east of the Rodman Mountains. Stoddard Canyon Quartz Monzonite[5]—*light-gray quartz monzonite porphyry forming stocks and dikes, local chilled border phases resembling quartz latite and dacite* (San Gabriel Mtns.).
	Ti^{r}	**RHYOLITIC**	Mountain Meadows Dacite Porphyry[6]—*buff, gray, or green massive biotite dacite porphyry* (San Gabriel Mountains). Unnamed intrusive dacite, rhyolitic and dacitic breccia, dacite porphyry, and perlite breccia in the Mojave Desert (locally extrusive in Barstow area).
	Ti^{a}	**ANDESITIC**	Intrusive andesite, andesite breccia, and andesite porphyry in the Mojave Desert.
	Ti^{b}	**BASALTIC**	Intrusive basalt, diabase, and olivine diabase in the Mojave Desert (may be Pleistocene).
MESOZOIC — UNDIVIDED		**MESOZOIC GRANITIC ROCKS**	
	gr	**UNDIFFERENTIATED**	Quartz monzonite, granodiorite, quartz diorite, and monzonite. An intrusive complex of quartz monzonite porphyry, latite porphyry, and porphyritic felsite near Stoddard Well. Mount Lowe Granodiorite[7]—*light-colored, foliated, quartz-poor granitic rock of monzonitic to dioritic composition* (Permian-Triassic; San Gabriel Mountains).
CRETACEOUS	gr^{a}	**GRANITE AND ADAMELLITE (QUARTZ MONZONITE)**	White Tank Quartz Monzonite and Palms "Granite"—*white to gray biotite quartz monzonite* (Twentynine Palms area). Cactus Quartz Monzonite—*gray-buff biotite quartz monzonite* (San Bernardino Mountains). Holcomb Quartz Monzonite—*gray to pink quartz monzonite* (Valyermo area). Unnamed light-colored unfoliated or slightly foliated, biotite and biotite-hornblende quartz monzonite, hornblende quartz monzonite, hornblende granite, granite porphyry, aplite, and pegmatite.
	gr^{g}	**GRANODIORITE**	Woodson Mountain Granodiorite—*light-colored granodiorite, scattered small dark inclusions* (Jurupa Mountains). Unnamed biotite granodiorite and biotite granodiorite porphyry.
	gr^{t}	**TONALITE (QUARTZ DIORITE) AND DIORITE**	Bonsall Tonalite—*light- to dark-gray tonalite containing abundant, large, oriented inclusions* (Jurupa Mountains). Unnamed hornblende-biotite quartz diorite, quartz diorite porphyry, dark-colored locally foliated diorite, local thin cataclastic and mylonitic zones.
	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	San Marcos Gabbro—*dark-gray and white, mottled hornblende gabbro* (Jurupa Mountains). Gold Park Gabbro-Diorite—*highly variable hornblende gabbro and diorite* (near Twentynine Palms; possibly Precambrian re. W. J. Miller, 1938, Geol. Soc. America Bull., p. 438). Unnamed black, massive, hornblende gabbro and diorite-gabbro.
TRIASSIC–JURASSIC	J̄R̄v	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS**	Sidewinder Volcanic "Series"—*highly variable, locally metamorphosed pyroclastic, volcanic, and some hypabyssal intrusive rocks including light-colored dacitic and rhyolitic tuff and vitrophyre, dark-colored andesitic tuff, latitic agglomerate, lark-gray andesite, latite, and basalt, brown and white rhyolite and dacite, blue-gray massive keratophyre, and dark-gray basalt porphyry and diorite porphyry, local piemontite* (may range from Late Permian to Jurassic in age). Ord Mountain Group—*andesitic flows, tuff, and breccia, hypabyssal porphyritic andesite and monzonite.*
PALEOZOIC — PERMIAN	P̄m	**PERMIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Fairview Valley Formation—*dark-gray massive limestone conglomerate, thin-bedded gray-green silty and sandy limestone (metamorphosed locally to hornfels), minor thin-bedded calcareous siltstone and shale* (contains Permian fossils in limestone clasts; may be in part Triassic).
CARBONIFEROUS	C	**UNDIVIDED CARBONIFEROUS MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Oro Grande "Series"—*blue-gray and white, massive, calcite and dolomite marble, dark-colored quartz-mica schist and argillite, quartz-biotite hornfels, green thin-bedded calc-silicate hornfels, pink to white quartzite, local quartzite breccia, dolomite marble breccia, and metasiltstone* (possibly in part older than Carboniferous). Furnace Limestone—*white and blue gray, massive and thin-bedded, calcite and dolomite marble, minor pink calc-silicate hornfels, dark-gray micaceous phyllite, and gray to white quartzite.*
UNDIVIDED	P̄	**PALEOZOIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Saragossa Quartzite—*light-gray to white, massive, cross-bedded, vitreous quartzite, dark-gray phyllite, and dark-gray fine-grained schist.* Chicopee Canyon Formation—*white, cross-bedded and ripple-marked, thin-bedded, micaceous quartzite and calc-silicate hornfels* (mapped as part of Saragossa Quartzite by T. W. Dibblee, Jr., ref. no. 12b). Unnamed gray, white, and pink quartzite, gray-brown massive metaconglomerate, pink to green hornfels, and black fine-grained schist in Mojave Desert.
	ls	**LIMESTONE AND/OR DOLOMITE**	White calcite and dolomite marble, green to red-brown tactite, minor graphitic and micaceous schist.
?	gr-m	**PRE-CENOZOIC GRANITIC AND METAMORPHIC ROCKS**	Injection gneiss, granitic gneiss intruded by pegmatite and aplite, and gneissic hornblende diorite in Barstow area (possibly Paleozoic). Migmatites of biotite quartz monzonite south of Lucerne Valley (probably Mesozoic). Granite-migmatite complex near Broadwell Lake (probably Mesozoic, possibly older).
	mv	**PRE-CRETACEOUS METAVOLCANIC ROCKS**	Hodge Volcanic Formation—*dark-colored quartz latite and dacite, light-colored, commonly schistose, tuffaceous metasedimentary and metavolcanic rocks including gray biotite schist, red-brown massive metatuff, and white to pink quartzite* (older than the Sidewinder Volcanic "Series" according to O. E. Bowen (ref. no. 2)). Unnamed gray massive metavolcanic rocks in Cady Mountains.
	ms	**PRE-CRETACEOUS METASEDIMENTARY ROCKS**	San Antonio Canyon Group—*quartzite, thin-bedded graphitic schists, dark-colored gneiss, and light-colored migmatite* (San Gabriel Mountains). Unnamed quartzitic schist, quartz-biotite hornfels, calc-silicate hornfels, and calcite marble.
	m	**PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED**	Pelona Schist—*gray and green feldspar-quartz-mica schist, massive amphibolite, minor thin quartzite, and piemontite-bearing metachert* (age uncertain and in dispute; believed to be Mesozoic by some geologists and as old as Precambrian by others). Light-colored schistose to gneissic granitic rocks near Victorville. Mylonite, mylonite gneiss, mylonite schist, granite cataclasite, flaser gneiss, cataclastic quartz diorite gneiss, and cataclastic metasediments in San Gabriel and San Bernardino Mountains.
	ls	**LIMESTONE AND/OR DOLOMITE**	Light-colored marble, associated tactite and skarn.
PRECAMBRIAN	p€c	**PRECAMBRIAN IGNEOUS AND METAMORPHIC ROCK COMPLEX:**	San Gabriel Complex[8]—*hornblende, biotite, quartz, feldspar gneiss-migmatite complex, transected by dikes of amphibolite, aplite, pegmatite, and semi-concordant bodies of quartz diorite.* San Gorgonio Igneous-Metamorphic Complex[8]—*migmatite-gneiss, flaser gneiss, piemontite-bearing gneiss, and greenschist, pervasively intruded by quartz monzonite and associated pegmatite.* Cucamonga Complex[8]—*quartz diorite gneiss, paragneiss, graphitic marble, quartz monzonite mylonite, pegmatite.* Unnamed gray banded gneiss cut by abundant granitic rocks and locally sheared and folded[8] (Little San Bernardino Mountains and Mojave Desert).
		UNDIVIDED PRECAMBRIAN METAMORPHIC ROCKS:	
	p€	**UNDIFFERENTIATED**	Tan to gray vitreous quartzite[8] in Mill Creek Canyon.
	p€s	**SCHIST**	Gray, black, and green, fine- to medium-grained schist in the Mojave Desert (age uncertain).
	p€g	**GNEISS**	Pinto Gneiss[8]—*dark-colored, strongly foliated, quartz-biotite gneiss* (Twentynine Palms area). Baldwin Gneiss[8]—*fine-grained gneiss and schist, augen gneiss, and granitic gneiss.* Waterman Gneiss[8]—*dark-colored hornblende-feldspar-mica gneiss, local diorite and pegmatite dikes, marble, and quartzite* (rocks shown as pCg? in the Barstow area may be Paleozoic). Unnamed dark-gray, banded, quartz diorite gneiss and augen gneiss, light-gray granitic gneiss, minor gray and green schist, amphibolite, and marble, local thin cataclastic zones, tight folds, and intrusive granitic rocks[8].

NOTES

[1] The type locality of the Pico Formation is in the Ventura Basin; upper Pliocene strata in the Los Angeles basin commonly are assigned to the Pico Formation on the basis of foraminiferal correlation; the U. S. Geological Survey has abandoned the name Pico, and for the Los Angeles basin assigns these rocks to the Upper Member of the Fernando Formation (Durham, D. L. and Yerkes, R. F., 1964. Geology and oil resources of the eastern Puente Hills area: U. S. Geol. Survey Prof. Paper 420-B).

[2] The "Repetto" is defined and properly used only as a stage designation. The U. S. Geological Survey has abandoned the name "Repetto Formation" and assigns these rocks to the "Lower Member of the Fernando Formation" (Durham, D. L. and Yerkes, R. F., 1964, U. S. Geol. Survey Prof. Paper 420-B).

[3] R. E. Smith, Geology of the Mill Creek area, San Bernardino County, California, University California, Los Angeles, unpublished M.A. thesis, 1959.

[4] No fossils have been reported from these rocks; Pliocene age is based on stratigraphic position.

[5] Radiometric age dates (K/A) of 17 ± 5 m.y. and 26 ± 3 m.y. are reported by K. J. Hsu (1963) Geol. Soc. America Bull., v. 74, pp. 507–512.

[6] Radiometric age date (K/A) of 27.5 ± 2.5 m.y. is reported by R. Streitz (1964), ref. no. 35.

[7] Radiometric age date (Pb^{206}/U^{238}) of 245 ± 10 m.y. determined by L. T. Silver, 1968, Preliminary history for the crystalline complex of the central Transverse Ranges, Los Angeles County, California: Geol. Soc. Amer. Spec. Paper No. 101 (abstract), p. 201–202. Subsequent determinations indicate the age of these rocks is younger and may be Triassic—L. T. Silver, oral communication 5/1968.

[8] The age of some of these rocks is uncertain and actually may be younger than Precambrian.