

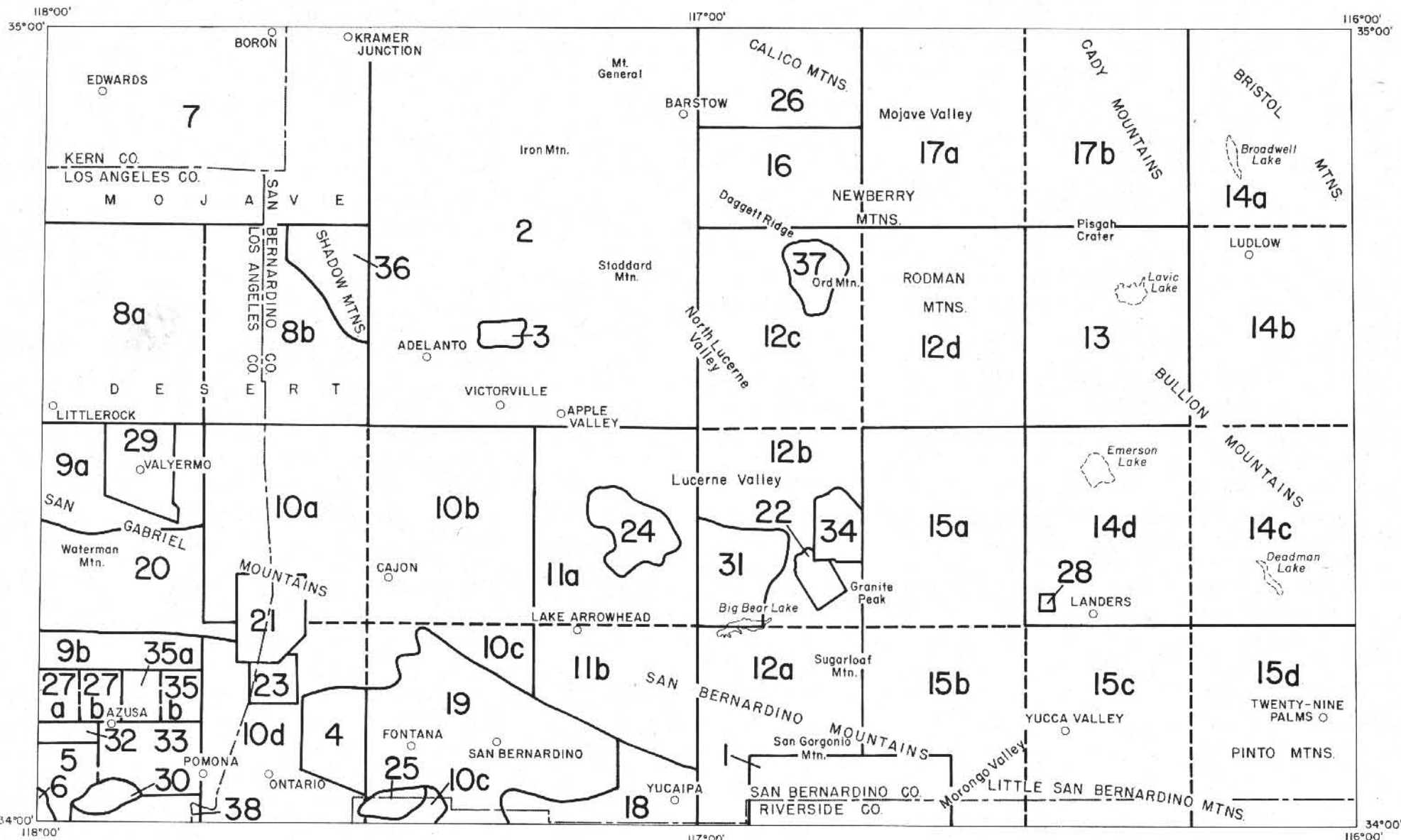
EXPLANATORY DATA
SAN BERNARDINO SHEET
GEOLOGIC MAP OF CALIFORNIA

OLAF P. JENKINS EDITION

Compiled by Thomas H. Rogers, 1967

Second printing, 1975

INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE SAN BERNARDINO SHEET



- *1. Allen, C. R., 1957, San Andreas fault zone in San Geronimo Pass, southern California: *Geol. Soc. America Bull.*, vol. 68, no. 3, pp. 315-350, Pl. 1, scale 1:63,360. Also in *Geology of Southern California: California Div. Mines Bull.* 170, 1954, map sheet 20: Geology of the north side of San Geronimo Pass, scale 1:62,500.
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- *8a. Dibblee, T. W., Jr., 1959, Geologic map of the Alpine Butte quadrangle, California: U. S. Geol. Survey Mineral Investigations Field Studies Map MF-222, scale 1:62,500.
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19. Dibblee, T. W., Jr., Geologic maps of the Valyermo and Pomona quadrangles, scale 1:62,500, U. S. Geol. Survey, unpublished, 1955-1958, 1967, 1968:
- a) Valyermo quadrangle.
- b) Pomona quadrangle.
10. Dibblee, T. W., Jr., Geologic maps of the San Antonio, Hesperia, Ontario, and San Bernardino quadrangles, scale 1:62,500, U. S. Geol. Survey, unpublished, 1953-1958, and 1963:
- a) San Antonio quadrangle (local additions from P. L. Ehlig, unpublished, reference no. 20).
- b) Hesperia quadrangle (local additions from California Dept. Water Resources, *Geologic Map of the Cedar Springs Reservoir-San Bernardino Tunnel area*, scale 1" = 1000', unpublished, 1967; and A. Smith, *Structural petrology, Crestmore, California*, scale 1 inch = 1/4 mile, California Institute Technology, unpublished PhD thesis, 1947).
- c) San Bernardino quadrangle (local additions as in b) above and from D. M. Morton, *Geologic mapping in the central part of the Cucamonga Peak 7 1/2' quadrangle, California Div. Mines and Geology*, 1968).
- d) Ontario quadrangle (local additions from California Div. Water Resources, 1934, *Geology and ground water storage capacity of valley fill—South Coastal Basin Investigation*, Bull. 45, Pl. C, scale 1 inch=approx. 2 miles; R. Streitz, *Preliminary geologic map of the SW 1/4 Mt. Baldy 7 1/2' quadrangle, California Div. Mines and Geology*, work in progress, 1967; and D. M. Morton, *Preliminary geologic map of the Devore 7 1/2' quadrangle, California Div. Mines and Geology*, work in progress, 1968).
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- c) Ord Mountains quadrangle, I-427.
- d) Rodman Mountains quadrangle, I-430.
- *13. Dibblee, T. W., Jr., 1966, Geologic map of the Lavic quadrangle, San Bernardino County, California: U. S. Geol. Survey Misc. Geol. Investigations Map I-472, scale 1:62,500 (local faults from W. S. Wise, University California, Santa Barbara, written communication, 5/12/67).
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- b) Ludlow quadrangle, I-477.
- c) Deadman Lake quadrangle, I-488.
- d) Emerson Lake quadrangle, I-490.
- *15. Dibblee, T. W., Jr., Geologic maps of the Old Woman Springs, Morongo Valley, Joshua Tree, and Twenty-nine Palms quadrangles, scale 1:62,500, U. S. Geol. Survey Misc. Geol. Investigations Maps:
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- b) Morongo Valley quad., I-517, 1967 (local additions from R. J. Proctor, *Geology of the Desert Hot Springs-Upper Coachella Valley area, California Div. Mines and Geology Special Report* 94, in press, 1967).
- c) Joshua Tree quadrangle, I-516.
- d) Twenty-nine Palms quadrangle, in press.
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- *31. Richmond, J. F., 1960, *Geology of the San Bernardino Mountains north of Big Bear Lake, California: California Div. Mines Special Report* 65, Pl. 1, scale 1:31,680.
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- * 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 <small>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</small>	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES <small>(The formally named formations grouped within an individual State Map Unit, are listed in stratigraphic sequence from youngest to oldest.)</small>	
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.	
	Pleistocene		RECENT VOLCANIC ROCKS:	
		Qrv ^b	BASALTIC Black vesicular basalt flows from Pisgah Crater (may be Pleistocene).	
		Ql	QUATERNARY LAKE DEPOSITS Manix Lake Beds— <i>light-gray, green, and buff sand, interbedded silt, clay and gravel</i> 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 Geronio 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 Geronio 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 Geronio 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— <i>fanglomerate and landslide breccia</i> 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).	
	Pliocene		PLEISTOCENE VOLCANIC ROCKS:	
		Qpv ^b	BASALTIC Black vesicular basalt flows from Sunshine and Malpais Craters. Black massive basalt flow on Broadwell Mesa.	
		Qvp ^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).	
			PLIOCENE VOLCANIC ROCKS:	
		Pvr	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.	
Pvb		BASALTIC Black massive vesicular and nonvesicular basalt (may be in part Pleistocene).		
Pvp		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 — <i>sandy siltstone, conglomerate, and sandstone</i> (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 — <i>siltstone, conglomerate, and fine sandstone</i> (southwest of Azusa).		
CENOZOIC	Miocene	Pmlc	MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS <i>Anaverde Formation—yellow and white arkosic sandstone and conglomerate, interbedded gray gypsiferous shale and red to green siltstone</i> (south of Little Rock on the north flank of the San Gabriel Mountains). <i>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</i> (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 — <i>light-gray massive conglomerate and local sandstone</i> (south flank San Gabriel Mountains). Crowder Formation ⁵ — <i>gray fanglomerate, conglomerate, and sandstone</i> (Cajon Pass area). San Timoteo Formation— <i>gray, yellow, and brown semi-consolidated gravel, sand, silt, and clay</i> (contains a late Blancan vertebrate fauna now regarded as early Pleistocene according to R. H. Tedford, written communication 6/12/67). Santa Ana Sandstone ⁶ — <i>buff to gray, friable, arkosic sandstone, minor micaceous siltstone and pebble conglomerate, local black basalt</i> (San Bernardino Mountains). Unnamed brown, gray, and white sandstone, fanglomerate and marl in Mojave Desert ⁴ .	
		Mc	UNDIVIDED MIOCENE NONMARINE SEDIMENTARY ROCKS Tropico Group— <i>undifferentiated sandstone, chert, clay shale, granitic breccia, limestone or dolomite, and local rhyolitic tuff</i> (may be in part Pliocene; Rogers Dry Lake-Kramer Hills area). Bissell Formation (of Tropico Group)— <i>limestone and/or dolomite</i> . Punchbowl Formation— <i>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</i> (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, 1961, 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— <i>fluviatile and lacustrine sandstone and shale, locally silicified</i> (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— <i>red-brown massive conglomerate and sandstone</i> (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"— <i>undifferentiated massive andesite, basalt, dacite(?), and rhyolite, interbedded tuff and tuff breccia</i> (Azusa-Glendora area).	
		Mvr	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)— <i>black quartz-bearing volcanic rocks</i> (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.	
Mvp	PYROCLASTIC Gem Hill Formation (of Tropico Group)— <i>rhyolitic tuff</i> (Rogers Dry Lake-Kramer Hills area). Pickhandle Formation— <i>undifferentiated tuff, buff-breccia, agglomerate, and tuffaceous sandstone</i> (Calico Mountains). Andesitic tuff, tuff breccia, and tuffaceous sediments of the Glendora "Volcanics" (Azusa area). Unnamed varicolored tuff, tuff breccia, and agglomerate elsewhere.			
TERTIARY	Oligocene	Mu	UPPER MIOCENE MARINE SEDIMENTARY ROCKS Puente Formation— <i>white and tan, well-bedded siltstone, shale, siliceous shale, and conglomerate, minor feldspathic sandstone and tuff</i> (south of Azusa).	
		Mm	MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS Topanga Formation— <i>buff conglomerate, sandstone, siltstone, and shale, interbedded vesicular basalt flows</i> (Azusa area). Volcanic conglomerate and reworked tuffs associated with Glendora "Volcanics" (San Jose Hills).	
		MI	LOWER MIOCENE MARINE SEDIMENTARY ROCKS Vaqueros Formation— <i>fossiliferous arkosic sandstone and conglomerate</i> (near Cajon Canyon).	
		Φc	OLIGOCENE NONMARINE SEDIMENTARY ROCKS Vasquez Formation— <i>conglomerate, arkosic sandstone, and siltstone, associated andesitic and basaltic volcanic rocks</i> (northwest of Valyermo).	
		Ep	PALEOCENE MARINE SEDIMENTARY ROCKS San Francisquito Formation— <i>dark gray to black shale, coarse conglomerate, tan to gray sandstone, abundant thin lignite seams and limestone lenses</i> (formerly mapped as "Martinez Formation"; Cajon Pass-Valyermo area).	

STRATIGRAPHIC NOMENCLATURE—Continued

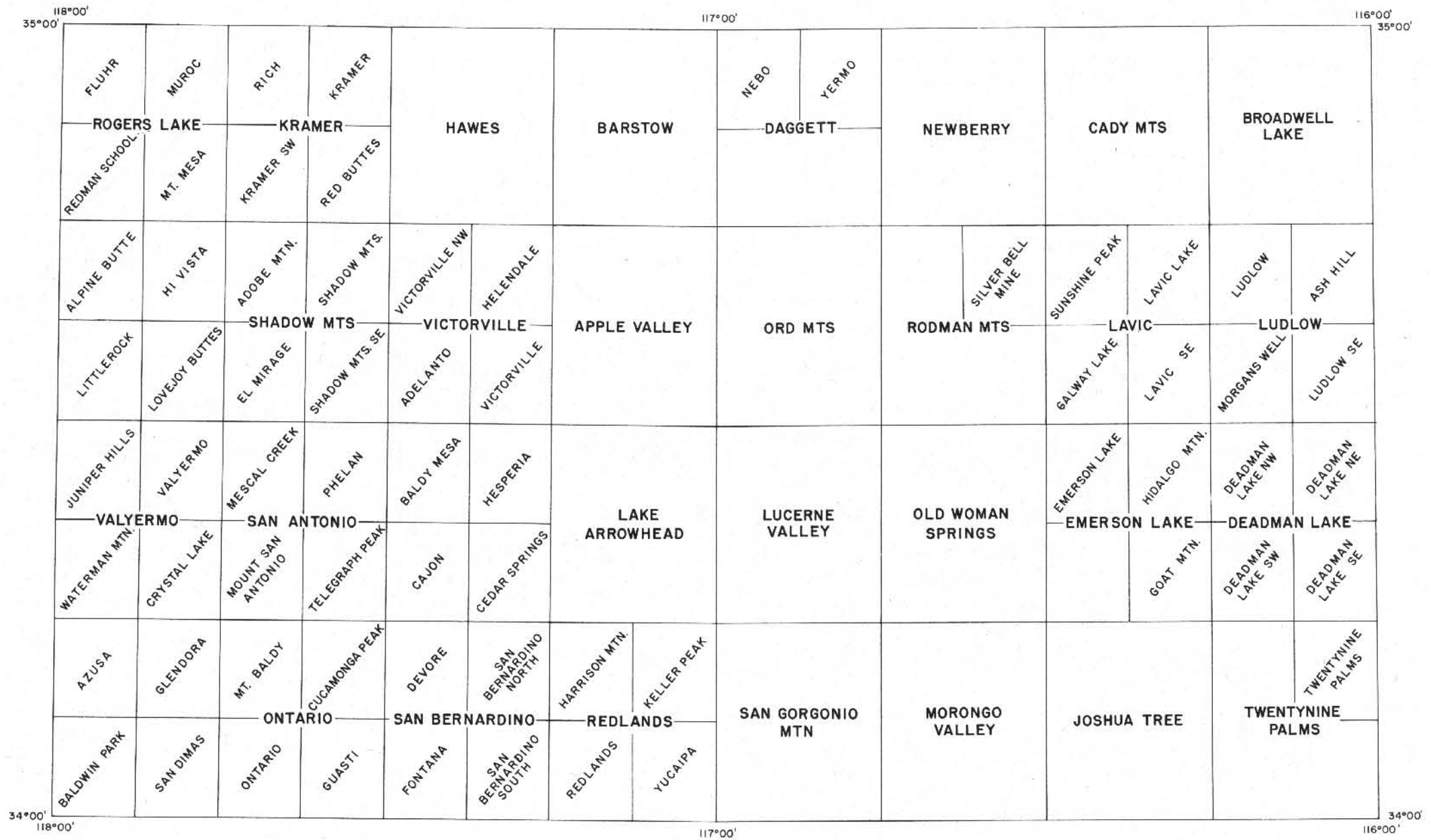
AGE	STATE MAP SYMBOL	STATE MAP UNIT <small>State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California</small>	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES <small>(The formally named formations grouped within an individual State Map Unit, are listed in stratigraphic sequence from youngest to oldest.)</small>	
CENOZOIC	TERTIARY UNDIVIDED	Tc	TERTIARY NONMARINE SEDIMENTARY ROCKS Old Woman Sandstone— <i>buff to pink massive arkosic sandstone, interbedded conglomerate, siltstone, and mudstone</i> (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").	
		Ti	TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
		Ti ^r	UNDIFFERENTIATED Felsite east of the Rodman Mountains. Stoddard Canyon Quartz Monzonite ² — <i>light-gray quartz monzonite porphyry forming stocks and dikes, local chilled border phases resembling quartz latite and dacite</i> (San Gabriel Mtns.).	
		Ti ^d	RHYOLITIC Mountain Meadows Dacite Porphyry ³ — <i>buff, gray, or green massive biotite dacite porphyry</i> (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 CRETACEOUS	gr	MESOZOIC GRANITIC ROCKS 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 ⁴ — <i>light-colored, foliated, quartz-poor granitic rock of monzonitic to dioritic composition</i> (Permian-Triassic; San Gabriel Mountains).
			gr ^a	GRANITE AND ADAMELLITE (QUARTZ MONZONITE) White Tank Quartz Monzonite and Palms "Granite"— <i>white to gray biotite quartz monzonite</i> (Twentynine Palms area). Cactus Quartz Monzonite— <i>gray-buff biotite quartz monzonite</i> (San Bernardino Mountains). Holcomb Quartz Monzonite— <i>gray to pink quartz monzonite</i> (Valermo 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— <i>light-colored granodiorite, scattered small dark inclusions</i> (Jurupa Mountains). Unnamed biotite granodiorite and biotite granodiorite porphyry.
gr ^t			TONALITE (QUARTZ DIORITE) AND DIORITE Bonsall Tonalite— <i>light- to dark-gray tonalite containing abundant, large, oriented inclusions</i> (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— <i>dark-gray and white, mottled hornblende gabbro</i> (Jurupa Mountains). Gold Park Gabbro-Diorite— <i>highly variable hornblende gabbro and diorite</i> (near Twentynine Palms; possibly Precambrian re. W. J. Miller, 1938, Geol. Soc. America Bull., p. 438). Unnamed black, massive, hornblende gabbro and diorite-gabbro.		
PALEOZOIC	TRIASSIC-JURASSIC	J _{Rv}	JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS Sidewinder Volcanic "Series"— <i>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</i> (may range from Late Permian to Jurassic in age). Ord Mountain Group— <i>andesitic flows, tuff, and breccia, hypabyssal porphyritic andesite and monzonite</i> .	
		P	PERMIAN MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS Fairview Valley Formation— <i>dark-gray massive limestone conglomerate, thin-bedded gray-green silty and sandy limestone (metamorphosed locally to hornfels), minor thin-bedded calcareous siltstone and shale</i> (contains Permian fossils in limestone clasts; may be in part Triassic).	
	CARBONIFEROUS PERMIAN	C	UNDIVIDED CARBONIFEROUS MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS Oro Grande "Series"— <i>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 metasilstone</i> (possibly in part older than Carboniferous). Furnace Limestone— <i>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</i> .	
		P	PALEOZOIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS Saragossa Quartzite— <i>light-gray to white, massive, cross-bedded, vitreous quartzite, dark-gray phyllite, and dark-gray fine-grained schist</i> . Chicopee Canyon Formation— <i>white, cross-bedded and ripple-marked, thin-bedded, micaceous quartzite and calc-silicate hornfels</i> (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).	
	UNDIVIDED	mv	PRE-CRETACEOUS METAVOLCANIC ROCKS Hodge Volcanic Formation— <i>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</i> (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— <i>quartzite, thin-bedded graphitic schists, dark-colored gneiss, and light-colored migmatite</i> (San Gabriel Mountains). Unnamed quartzitic schist, quartz-biotite hornfels, calc-silicate hornfels, and calcite marble.	
		m	PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED Pelona Schist— <i>gray and green feldspar-quartz-mica schist, massive amphibolite, minor thin quartzite, and piemontite-bearing metabert</i> (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 cataclasis, 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.	
p-c		PRECAMBRIAN IGNEOUS AND METAMORPHIC ROCK COMPLEX: San Gabriel Complex ⁵ — <i>hornblende, biotite, quartz, feldspar gneiss-migmatite complex, transected by dikes of amphibolite, aplite, pegmatite, and semi-concordant bodies of quartz diorite</i> . San Geronimo Igneous-Metamorphic Complex ⁶ — <i>migmatite-gneiss, flaser gneiss, piemontite-bearing gneiss, and greenschist, pervasively intruded by quartz monzonite and associated pegmatite</i> . Cucamonga Complex ⁷ — <i>quartz diorite gneiss, paragneiss, graphitic marble, quartz monzonite mylonite, pegmatite</i> . Unnamed gray banded gneiss cut by abundant granitic rocks and locally sheared and folded ⁸ (Little San Bernardino Mountains and Mojave Desert).		
PRECAMBRIAN		p-c	UNDIVIDED PRECAMBRIAN METAMORPHIC ROCKS: UNDIFFERENTIATED Tan to gray vitreous quartzite ⁹ in Mill Creek Canyon.	
	p-cs	SCHIST Gray, black, and green, fine- to medium-grained schist in the Mojave Desert (age uncertain).		
	p-cg	GNEISS Pinto Gneiss ¹⁰ — <i>dark-colored, strongly foliated, quartz-biotite gneiss</i> (Twentynine Palms area). Baldwin Gneiss ¹¹ — <i>fine-grained gneiss and schist, augen gneiss, and granitic gneiss</i> . Waterman Gneiss ¹² — <i>dark-colored hornblende-feldspar-mica gneiss, local diorite and pegmatite dikes, marble, and quartzite</i> (rocks shown as p-cg? 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 ¹³ .		

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 (Pb²⁰⁶/U²³⁸) 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.

TOPOGRAPHIC QUADRANGLES

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY
 FEDERAL CENTER, DENVER, COLORADO 80225
 1968



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