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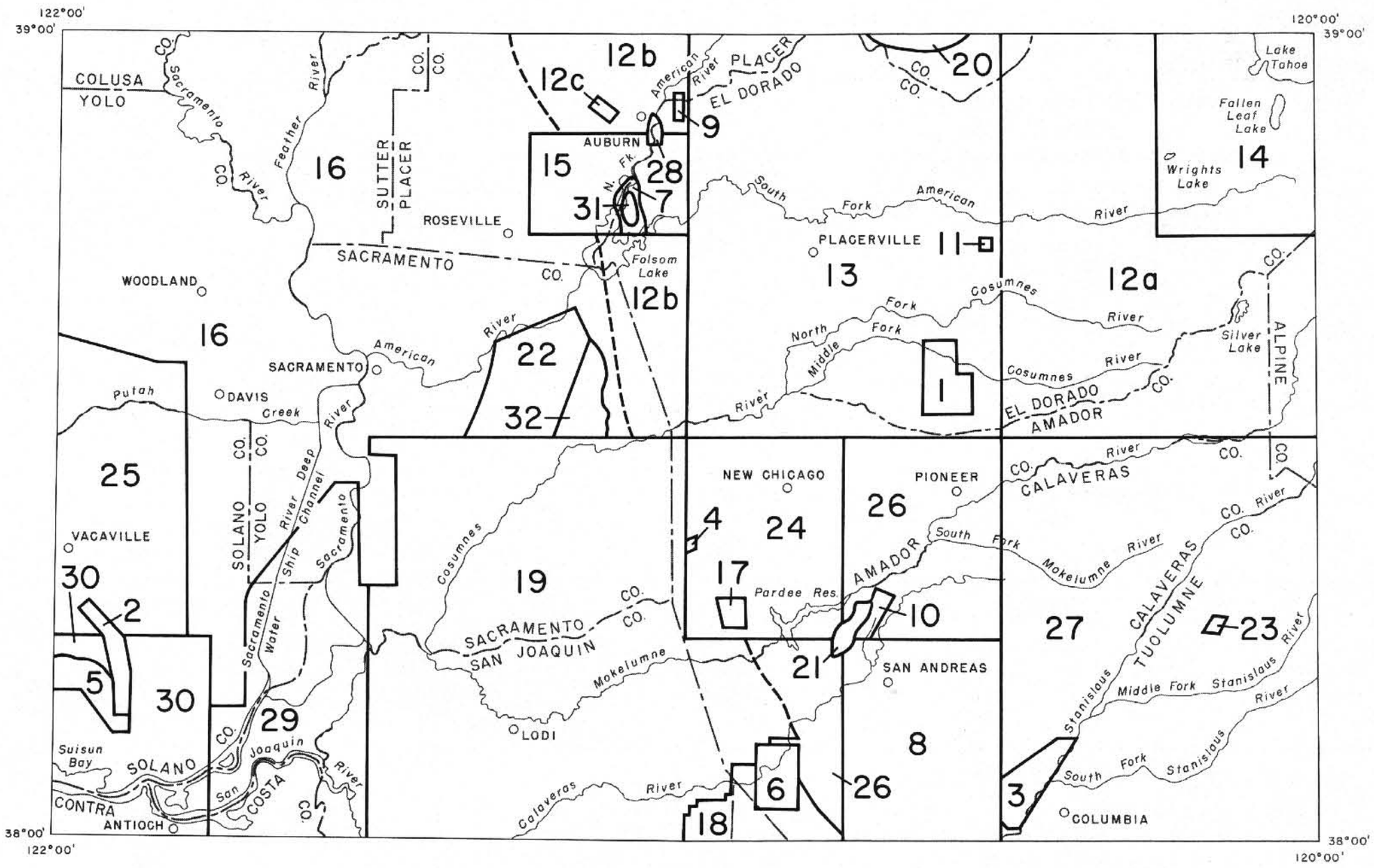
EXPLANATORY DATA
SACRAMENTO SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION

Compiled by Rudolph G. Strand and James B. Koenig, 1965

INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE SACRAMENTO SHEET



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12a. Lindgren, Waldemar, 1896, Pyramid Peak folio, California: U. S. Geol. Survey Geol. Atlas of the U. S., folio 31, Map: Areal Geology Sheet, scale 1:125,000. (Tertiary intrusive rocks in northeastern Silver Lake quadrangle based on Lindgren's text. Modifications in southeastern Silver Lake quadrangle from Ronald B. Parker written communication, 1959. Additions in northeastern Robbs Peak quadrangle from Alden Loomis, written communication, 1965.)

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(ii) anonymous geologic map, approx. 1:125,000.

II. Folsom Dam area:
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20. Redmond, John L., Structural analysis of the Blue Canyon Formation, Placer County, California: Univ. of Oregon, unpublished Ph.D. thesis in progress, 1964, scale 1:24,000.

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*Contains modifications which essentially reflect the structural interpretation and stratigraphic correlations in the Sierra Nevada foothill belt by Lorin Clark of the U. S. Geological Survey. See: i) Clark, Lorin D., 1964, Stratigraphy and structure of part of the western Sierra Nevada metamorphic belt, California: U. S. Geol. Survey Prof. Paper 410, 70 p., Pl. 1, scale 1:316,800, and ii) Clark, Lorin D., Report on the geology of the northwestern Sierra Nevada, California: U. S. Geol. Survey, in progress, 1965; map scale 1:250,000.

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

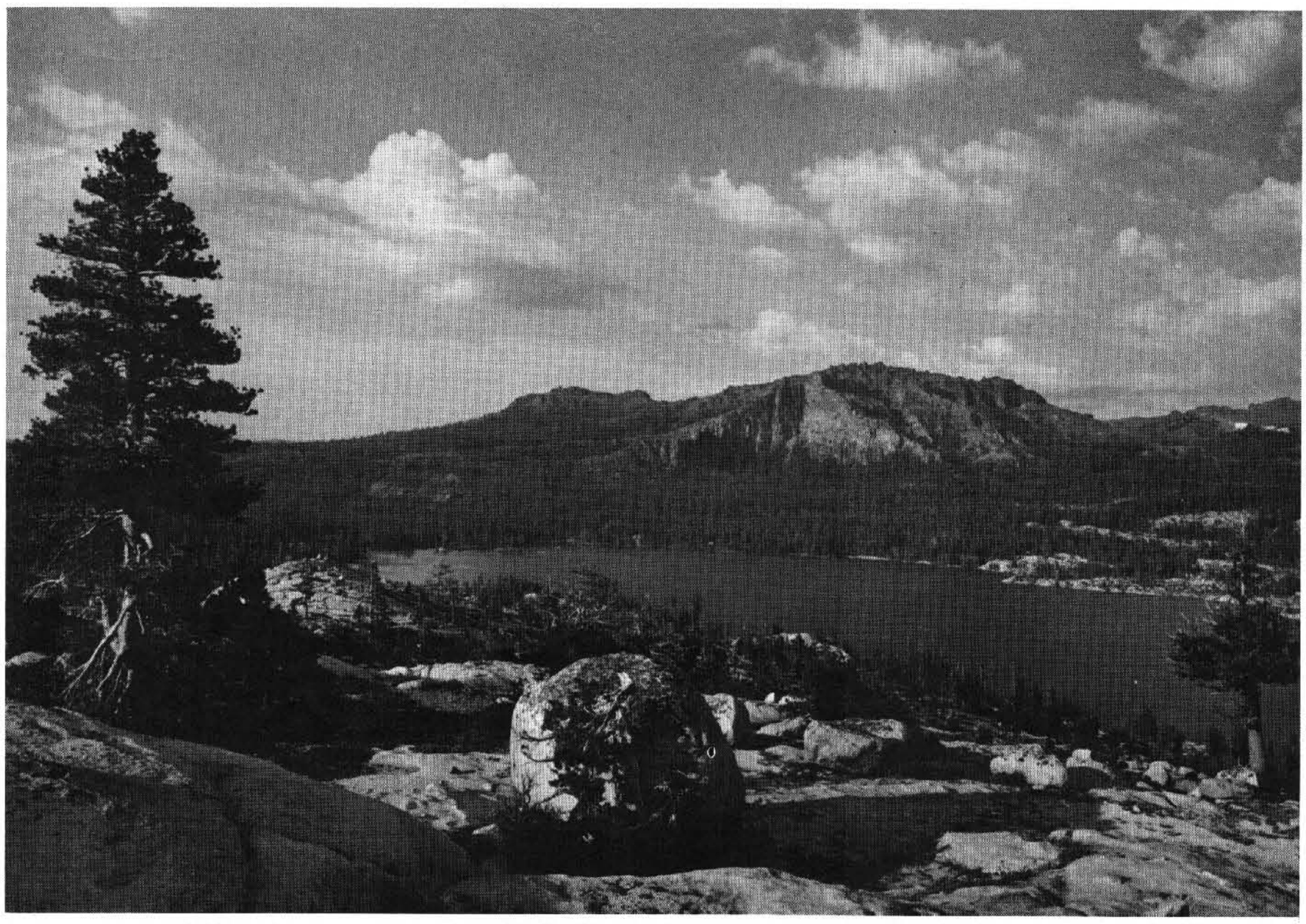
AGE	STATE MAP SYMBOL	STATE MAP UNIT State Map Units listed here are not necessarily in stratigraphic sequence; the sequence used has been standardized for all sheets of the Geologic Map of California	STRATIGRAPHIC UNITS AND CHARACTERISTIC LITHOLOGIES (The formally named formations grouped within an individual State Map Unit are listed in stratigraphic sequence from youngest to oldest.)
CENOZOIC – QUATERNARY – Recent	Qs	**RECENT DUNE SAND**	Deposits of wind-blown sand east of Antioch.
	Qal	**RECENT ALLUVIUM**	Poorly sorted stream deposits of clay to boulder size, some colluvium and glacial outwash gravels.
	Qsc	**RECENT RIVER AND MAJOR STREAM CHANNEL DEPOSITS IN THE GREAT VALLEY**	Sediments along river channels and major streams including adjacent natural levees.
	Qf	**RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited from streams emerging from high lands surrounding the Great Valley—Recent and Pleistocene alluvial fan deposits composed of heterogeneous sediments ranging in size from clay to gravel. Includes Victor Formation—*lenticular stream deposits of sand, silt, gravel, and clay.*
	Qb	**RECENT BASIN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited during flood stages of major streams in the areas between natural stream levees and fans.
	Ql	**QUATERNARY LAKE DEPOSITS**	Sand and fine gravel in terraces in the vicinity of Lake Tahoe.
Pleistocene	Qg	**QUATERNARY GLACIAL DEPOSITS**	Terminal, lateral, and ground moraines in the Pyramid Peak 30′ quadrangle (mapping limited to thick deposits only); moraines in the Placerville 30′ quadrangle (thin deposits).
	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	[1] Montezuma Formation—*obscurely stratified, slightly consolidated, clayey sand, cross-bedded pebbly sand, clay, and gravel, locally contains calcareous lenses (hardpan).* [1] Red Bluff Formation and related terrace deposits—*poorly sorted gravel in reddish silty or sandy matrix.*
	Qpv^b	**PLEISTOCENE VOLCANIC ROCKS:** **BASALTIC**	Black, fine-grained, partly scoriaceous basalt flows (in Robbs Peak quadrangle; may be Pliocene).
	QP	**PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Arroyo Seco Gravel—*brick-red soil that encloses gravel composed of well-rounded clasts of quartz and quartzite;* Laguna Formation—*compacted, nonandesitic sediments of silt, clay, sand, and gravel size.* "Gravel deposits of uncertain age" of Piper and Gale including surficial deposits of well-rounded cobbles and boulders set in a matrix of deep red to reddish-brown soil (some may be Early Tertiary and others Quaternary). Old alluvium in the vicinity of Folsom Dam.
Pliocene	Puc	**UPPER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Tehama Formation—*silty sand, fine- to medium-grained sand, interbedded conglomerate and sandstone, and silty to sandy clay that is massive.* (Early Pleistocene in part; locally contains undifferentiated Red Bluff (?) Formation and post-Red Bluff stream terrace deposits). Pumice-pebble tuff of probable mud-flow origin interbedded with coarse to medium, greenish, chert pebble conglomerate, and tuff (south side of Potrero Hills; resembles the Orinda Formation). Chert, limestone conglomerate, and limestone breccia (north side of Potrero Hills).
	Pmlc	**MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Mehrten Formation—*coarse alluvial and mudflow deposits, chiefly of hornblende andesite fragments, includes gravel, sandstone, and tuffaceous beds* (generally considered upper Miocene in part; contains some locally derived rhyodacite clasts near Golden Gate Hill). Unnamed rhyolite tuff, rhyolitic and diatomaceous sand and silt (in the Indian Diggings area, Omo Ranch quadrangle; contains diatoms considered to be "Pliocene, probably lower" according to G. D. Hanna, written communication from Q. Aune 9/29/64). North of 38° 30′ N. Lat. along the eastern edge of the Great Valley, the Pmlc unit contains some Valley Springs Fm. which was not differentiated from the more abundant Mehrten Fm. Sandy clay shales containing cross-bedded, pebbly sandstone and conglomerate, and thin layers of tuff (southwest of Pittsburg; unit has been called Orinda Fm., "Los Medanos Fm.", and "Wolfskill Fm.").
		PLIOCENE VOLCANIC ROCKS:	
	Pv^a	**ANDESITIC**	Light- to dark-gray, porphyritic latite (one flow has been called "Table Mountain Latite"; informally considered to be a part of the Mehrten Formation).
	Pv^b	**BASALTIC**	Black basalt in northern Blue Mtn. quadrangle.
	Pv^p	**PYROCLASTIC**	[1] Lawlor Tuff—*lapilli tuff consisting of angular broken fragments of pumice set in a matrix of pumicite.* [1] Volcanic rocks of the Sierra Nevada commonly referred to the Mehrten Formation—*thick andesitic mudflows, breccia, tuff, gravel, and some massive andesitic lava in the Silver Lake quadrangle* (possibly includes strata not correlative with Mehrten Fm. in the Foothills area). Rhyolite tuff near Columbia believed to be younger than the Mehrten Fm., Q. Aune, written communication 6/30/64. Light-brown to pale-red, pumiceous, dacitic tuff beds of probable fluviatile origin, near base of the Tehama Fm. on west side of Great Valley.
TERTIARY – Miocene	Mc	**UNDIVIDED MIOCENE NONMARINE SEDIMENTARY ROCKS**	Valley Springs Formation—*pumice-bearing sandstone, siltstone, and conglomerate, white and pink rhyolitic vitreous tuff beds, some of which contain conglomerate composed of clasts of pre-Cretaceous metamorphic rock and clasts of Tertiary rhyolite* (possibly Oligocene in part).
	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	San Pablo Group: Neroly Formation—*bluish-gray, medium- to coarse-grained sandstone containing interbedded light-gray tuff, shale, and conglomerate* (unfossiliferous, possibly nonmarine; may be lower Pliocene); Cierbo Sandstone—*alternating layers of fine- and coarse-grained brownish-gray sandstone, and light-colored, concretionary, medium-grained sandstone* (may be lower Pliocene in part).
		MIOCENE VOLCANIC ROCKS:	
	Mv^p	**PYROCLASTIC**	Volcanic rocks of the Sierra Nevada commonly referred to the Valley Springs Formation—*white to buff-colored, massively bedded rhyolite tuff, some thin lenses of pebble conglomerate, sandstone, and rhyolite* (may not be entirely correlative with Valley Springs Fm. of the Foothills area).
Eocene	Ec	**EOCENE NONMARINE SEDIMENTARY ROCKS**	Ione Formation—*massive, white quartzose sandstone, lenses of white or light-colored anauxitic clay and white sandstone, gray or bluish shale and clay, lignite, and other carbonaceous beds.* (In minor part marine. Includes some Valley Springs Fm. in the Buffalo Creek quadrangle.)
	E	**EOCENE MARINE SEDIMENTARY ROCKS**	Markley Formation—*massively bedded, poorly sorted, richly micaceous, arkosic sandstone, and minor beds of clay shale and siltstone* (upper Eocene); Domengine Formation—*sandy siltstone, silty shale, argillaceous sandstone, medium- to fine-grained sandstone, and massive, medium- to coarse-grained sandstone and grit* (middle Eocene).
Paleocene	Ep	**PALEOCENE MARINE SEDIMENTARY ROCKS**	Martinez Formation—*silty to sandy, massive-bedded to slightly laminated clay shale, medium- to fine-grained calcareous sandstone, and ferruginous concretionary sandstone.* Undifferentiated Paleocene sedimentary rocks. Chocolate-colored shale in eastern part of Potrero Hills, considered to be Eocene by Thomas Bailey, written communication, 1965.
Undivided	Tc	**TERTIARY NONMARINE SEDIMENTARY ROCKS**	Volcanic sedimentary rocks near Vacaville—*massive pale-pink to white ashy claystone, mudstone, or siltstone, lenses of cross-bedded coarse- to very coarse-grained, blue, friable sandstone, and lenses of andesitic pebble and cobble conglomerate.* (May be marine in part, and part of the San Pablo Group). Auriferous (and nonauriferous) gravel deposits of uncertain age in the Sierra Nevada.
		TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
	Ti ?	**UNDIFFERENTIATED**	Mafic intrusive rock of uncertain age (Omo Ranch quadrangle).
	Ti^r	**RHYOLITIC**	Gray and brown porphyritic hornblende-biotite dacite, and gray, aphanitic, hornblende rhyodacite volcanic domes near Jackson (some intrusions were contemporaneous with the deposition of the Mehrten Fm.).
	Ti^a	**ANDESITIC**	Volcanic neck of massive hornblende andesite (a presumed source vent of the surrounding Pliocene volcanic ejecta; located in northeastern part of Silver Lake quadrangle).
		TERTIARY VOLCANIC ROCKS:	
	Tv^b	**BASALTIC**	Putnam Peak Basalt—*iron-black, dense, augite basalt, locally containing pillow structure* (near Vacaville; probably Miocene, however, tentative ages range from Eocene to Pliocene).

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.)
MESOZOIC — CRETACEOUS	Ku	**UPPER CRETACEOUS MARINE SEDIMENTARY ROCKS**	Chico Formation—*fine-grained sandstone, shale, siltstone, and conglomerate* (east side of Great Valley). Gray, silty clay shale, greenish-gray calcareous and ferruginous sandstone (near Vacaville).
		MESOZOIC GRANITIC ROCKS:	
	gr	**UNDIFFERENTIATED**	Amphibole syenite in the northwest corner of the Blue Mountain quadrangle. Granodiorite, quartz monzonite, quartz diorite, granite, some hornblende gabbro and some fine-grained gneiss (not differentiated into separate cartographic units).
	gr^a	**GRANITE AND ADAMELLITE (QUARTZ MONZONITE)**	Granite, quartz monzonite, mafic quartz monzonite, and alaskite.
	gr^g	**GRANODIORITE**	Hornblende-biotite granodiorite; some "quartz porphyrite" in the Placerville 30′ quadrangle.
	gr^t	**TONALITE (QUARTZ DIORITE) AND DIORITE**	Mottled, gray, medium- to coarse-grained tonalite; dark-green, medium- to coarse-grained diorite; trondhjemite; and dioritic rocks in the San Andreas quadrangle.
	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	Medium- to coarse-grained hornblende gabbro, pyroxenite, noritic anorthosite and related rocks, some diorite, some mafic porphyritic hypabyssal intrusive rocks and metagabbro (may be Late Paleozoic in part).
	ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	Serpentine (some silicified), peridotite, dunite, olivine pyroxenite, some ankerite and talc schist, lherzolite, and amphibolite derived from pyroxenite.
MESOZOIC — JURASSIC	Ju	**UPPER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	[1] Mariposa Formation—*dark-gray to black, clay slate, tuff, graywacke, and conglomerate.* [1] Salt Spring Slate—*dark-gray slate derived from siltstone, tuff, graywacke, and conglomerate.* [1] Cosumnes Formation of the Amador Group—*dark-gray clay slate, sheared graywacke, thin-bedded tuff, some basic lava, red and green chert, and a basal conglomerate* (may be Middle Jurassic in part).
	Jml	**MIDDLE AND/OR LOWER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Blue-black metamorphosed mudstone, wacke, siltstone, sandstone and siltstone, pebble, cobble, and boulder conglomerate, quartzite, minor schist and highly altered tuff (perhaps correlative with the Sailor Canyon Fm. entirely or in part; older than adjacent " JTRv " rocks in the Fallen Leaf Lake quadrangle).
	JTRv	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS**	[1] Copper Hill Volcanics—*mafic, intermediate, and sparse felsic volcanic rocks, tuff, volcanic breccia, and amygdaloidal mafic lava.* [1] Brower Creek Volcanic Member of the Mariposa Fm.—*dark-green mafic volcanic breccia, some tuff, and rare pillow lava.* [1] Gopher Ridge Volcanics—*bedded mafic or intermediate tuff and volcanic breccia.* [1] Logtown Ridge Formation—*coarse mafic volcanic breccia, in part porphyritic, subordinate tuff, lapilli tuff, and minor pillow lava.* Volcanic rocks of uncertain stratigraphic position, chiefly mafic volcanic breccia and tuff. Amphibolite schist, quartz porphyry "feeders" for dacite volcanics; Upper Jurassic basic sills and dikes (Mother Lode belt). Early or Middle Jurassic recrystallized tuff-breccia, tuffaceous sandstone and tuff of andesitic and basaltic composition, andesite and basalt flows in the Fallen Leaf Lake quadrangle.
PALEOZOIC	m	**PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED**	Paleozoic and Mesozoic mafic pyroclastic rocks, slate, phyllite, and metaconglomerate.
	ls	ls = **LIMESTONE AND/OR DOLOMITE**	Bluish-gray, dense, recrystallized limestone.
	ms	**PRE-CRETACEOUS METASEDIMENTARY ROCKS**	Dark-gray slate, some graywacke, conglomerate, and tuff. Phyllite and metavolcanic rocks in Columbia and San Andreas quadrangles.
	mv	**PRE-CRETACEOUS METAVOLCANIC ROCKS**	Green schist derived from basaltic and andesitic breccia and tuff (possibly in part equivalent to the metavolcanic rocks of the Calaveras Fm.). Porphyritic flows, flow breccia, and some amphibolite.
	gr-m	**PRE-CENOZOIC GRANITIC AND METAMORPHIC ROCKS**	Granitic dikes and metamorphic rocks undifferentiated (in the Omo Ranch quadrangle). Contiguous areas bordering the Pyramid Peak and Big Trees 30′ quadrangles mapped as Calaveras Fm. and as granitic rocks respectively.
	ℙ	**PALEOZOIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Calaveras Formation—*slate, phyllite, sheared sandstone, quartz-mica schist, gneiss, graphitic schist, crushed and elongated pebble conglomerate, quartzite, and rhythmically bedded slightly recrystallized to completely recrystallized radiolarian chert.* ("Calaveras" is applied as a general name for Sierra Nevada Paleozoic rocks.) Some areas shown as ℙ may be Mesozoic.
	ls	ls = **LIMESTONE AND/OR DOLOMITE**	White, blue-gray, and black recrystallized limestone, marble, dolomite, dolomitic limestone, and silicified marble.
	ℙv	**PALEOZOIC METAVOLCANIC ROCKS**	Metavolcanic rocks of the Calaveras Formation—*mafic pyroclastic rocks, in part porphyritic, minor pillow lava, green schist, amphibolite schist, massive amphibolite, and minor black slate.*

NOTES

[1] Not necessarily in stratigraphic sequence.
[2] Some structures indicated as faults in the foothills of the western Sierra Nevada are perhaps "zones of penetrative slip folding," A. Baird, Pomona College, Claremont, Calif., written communication March 11, 1965.



View northeastward across Silver Lake, Amador County. The mountains across the lake are composed of andesitic tuffs and breccias with subordinate lava flows. These Pliocene volcanic rocks rest upon Mesozoic granodiorite visible in the cleared areas on the far side of lake and also in the foreground. *Photo by Robert C. Frampton, 1962.*

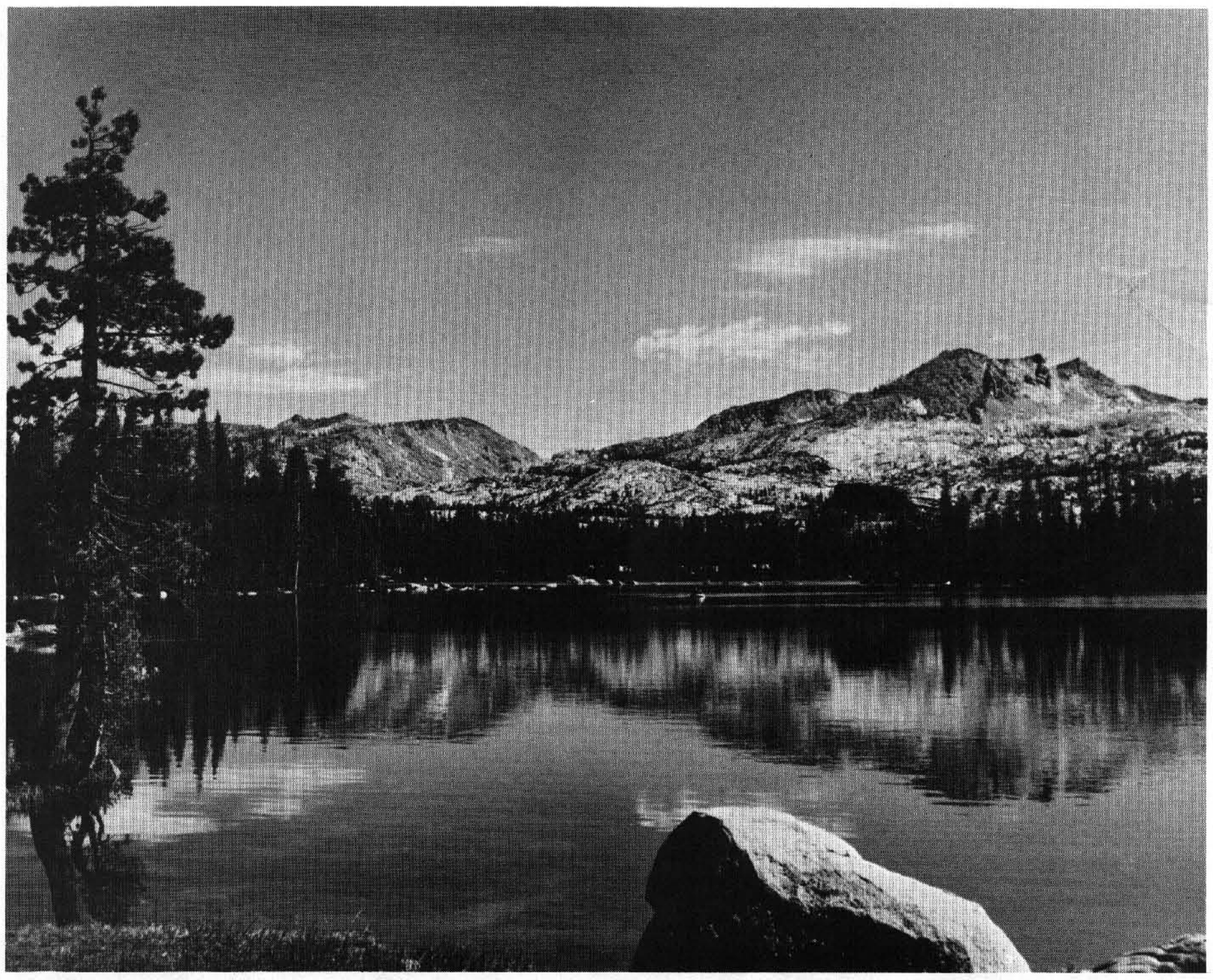
TOPOGRAPHIC QUADRANGLES

WITHIN THE SACRAMENTO SHEET

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY

FEDERAL CENTER, DENVER, COLORADO 80225

1965



View northeastward of a part of the glaciated Crystal Range from the southern end of Wrights Lake twelve miles southwest of Lake Tahoe. The upper part of the mountain on the right is composed of granite and the lower part, in the left middle ground, is composed of granodiorite. The prominent notch in the skyline is Rockbound Pass, to the left of which older diorite and gabbro have been intruded by granite. Granitic bedrock and glacial moraines form the natural confines of Wrights Lake. *Photo by C. W. Jennings, July 1965.*