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EXPLANATORY DATA

SAN JOSE SHEET

GEOLOGIC MAP OF CALIFORNIA

OLAF P. JENKINS EDITION

Compiled by Thomas H. Rogers 1966

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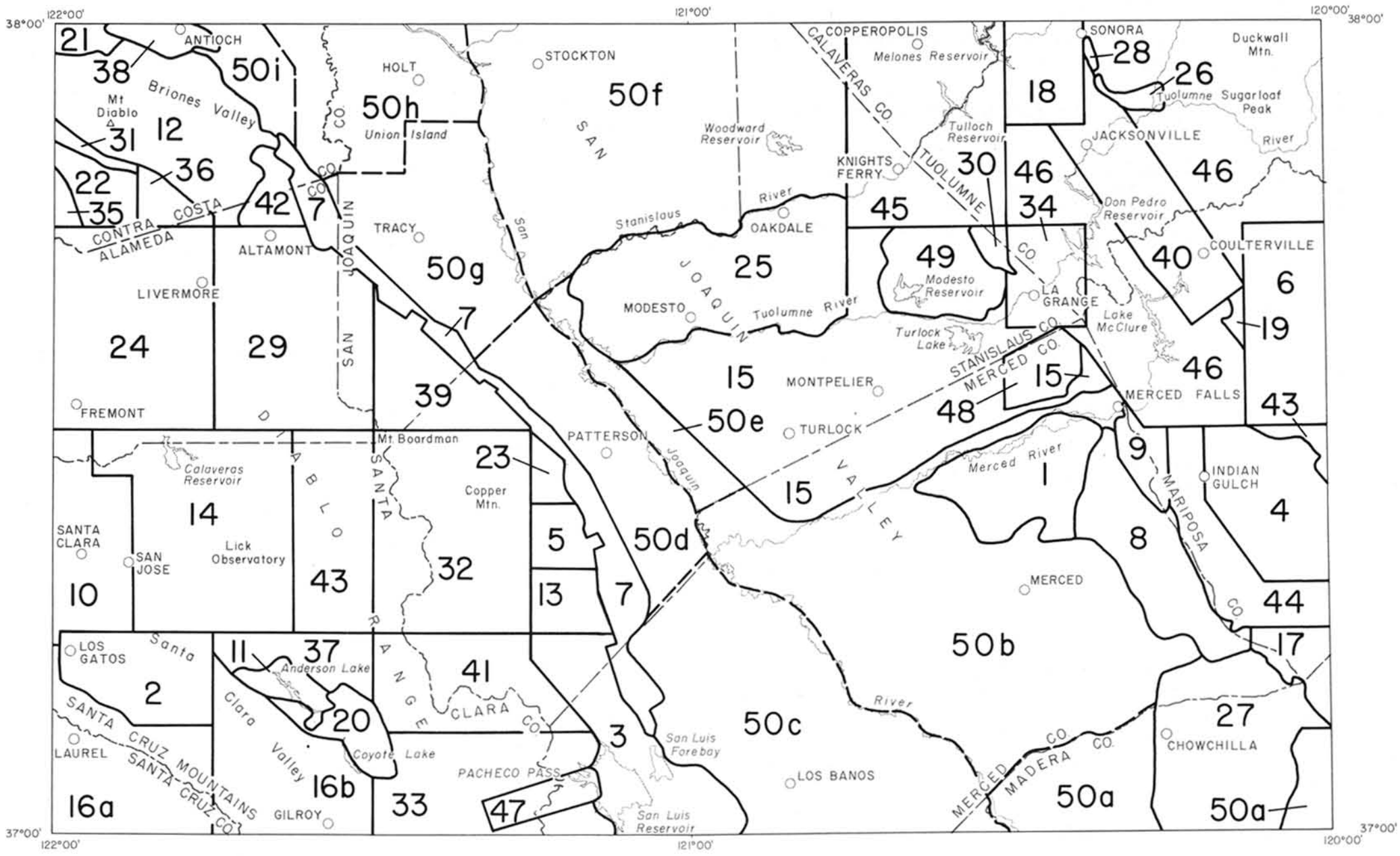
INDEX TO GEOLOGIC MAPPING
USED IN THE COMPILATION OF THE SAN JOSE SHEET



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‡ Aerial photo fault (?) linaments in Diablo Range southeast of Livermore Valley interpreted by California Division of Mines and Geology, 1966, from Aero Service Corp. aerial mosaic of the central Coast Ranges, 1954, scale 1:120,000.

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—SAN JOSE 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 Formally named formations grouped in sequence (separated by semicolons) are listed from youngest to oldest.
CENOZOIC — QUATERNARY — Recent	Qs	**RECENT DUNE SAND**	Wind blown sand, including dune sand, in the San Joaquin Valley derived from Pleistocene alluvial fan deposits (includes the Oakley and Delhi soil series).
	Qal	**RECENT ALLUVIUM**	Stream alluvial deposits. Tideland deposits near San Jose. Alluvial fan and flood-plain deposits in Livermore and Santa Clara Valleys.
	Qsc	**RECENT RIVER AND MAJOR STREAM CHANNEL DEPOSITS IN THE GREAT VALLEY**	Sediments along river channels and major streams including adjacent natural levees.
	Qb	**RECENT BASIN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited during flood stages of major streams in areas between natural stream levees and alluvial fans. San Joaquin-Sacramento River delta deposits west of Stockton, including muck, peat, and other organic soils.
	Qf	**RECENT ALLUVIAL FAN DEPOSITS IN THE GREAT VALLEY**	Sediments deposited during flood stages of major streams in the areas between natural stream levees and fans. Modesto Formation—*brown to gray sand and silt, with an even westward-sloping surface* (eastern Stanislaus and Merced Counties; probably of late Pleistocene age according to Davis and Hall, 1959).
	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	Stream terrace deposits of cobble and pebble gravel, sand, and silt, locally cemented (contain late Pleistocene vertebrate fauna in Livermore Valley).
Pleistocene	Qm	**PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS**	Marine terrace deposits (southwest slope of the Santa Cruz Mountains).
	Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Riverbank Formation—*brown to gray sand, locally pebbly, minor silt and clay* (forms low slightly dissected hills; east side of San Joaquin Valley; south of Le Grand includes rocks mapped by E. J. Helley as Turlock Lake Formation and North Merced Gravel, both considered to be Pleistocene). Aromas Red Sands—*red to yellow, friable, cross-bedded sand* (Santa Cruz Mountains). Unnamed Pleistocene river gravels (in part auriferous) and older dissected alluvium in the Sierra Nevada.
	Qpv	**PLEISTOCENE VOLCANIC ROCKS: UNDIFFERENTIATED**	Olivine basalt flows, dikes, basaltic scoria and agglomerate, vitric tuff, and tuff-breccia interbedded within the San Benito Gravels in Santa Clara Valley (may be in part Pliocene).
	Ql	**QUATERNARY LAKE DEPOSITS**	Corcoran Clay—*olive gray, firm, massive clay and silt* (south of Los Banos).[1]
	QP	**PLIOCENE-PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Turlock Lake Formation—*fluvial pebbly sand and gravel, interbedded silt and lacustrine clay* (forms dissected rolling hills; east side of San Joaquin Valley; includes blue diatomaceous Corcoran Clay in subsurface according to R. J. Arkley, 1962. North Merced Gravel—*unconsolidated pediment gravel* (north of Merced). China Hat Gravel—*unconsolidated pediment gravel* (north of Merced). Tulare Formation—*unconsolidated, cross-bedded sand, silt, and minor gravel, conglomerate lenses, diatomaceous silt, and clay* (west side of San Joaquin Valley; includes Corcoran Clay). Livermore Gravel—*loosely consolidated sand, gravel, clay, and local tuff beds* (contains Pliocene fresh water invertebrate fauna and Pleistocene vertebrate fauna). Irvington Gravel—*poorly consolidated, cross-bedded, stream sand and gravel, including possible lake deposits* (contains early Pleistocene vertebrate fauna). Packwood Gravel—*poorly consolidated gravel, pebbly sand, silt, clay, and well consolidated cross-bedded sandstone and sandy conglomerate* (near San Jose). Santa Clara Formation—*unconsolidated poorly sorted gravel, pebbly sand, silt, clay, and local lenses of fresh water limestone.* San Benito Gravel—*lenticular sandy gravel, sand, and minor clay, locally cemented.*
	Pc	**UNDIVIDED PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Oro Loma Formation—*cobble to pebble conglomerate, interbedded sandstone and claystone* (contains vertebrate fauna of early Pliocene age near Patterson equivalent to the Black Hawk Ranch fauna of the Green Valley Formation).
		PLIOCENE VOLCANIC ROCKS:	
	P_v^r	**RHYOLITIC**	Leona Rhyolite—*rhyolite flow* (north of Fremont; may be Pleistocene).
	P_v^a	**ANDESITIC**	Table Mountain Latite—*dark gray to black latite containing large euhedral labradorite phenocrysts* (Copperopolis quadrangle).
Pliocene	P_vP	**PYROCLASTIC**	Volcanic rocks of the Sierra Nevada commonly referred to the Mehrten Formation—*andesitic tuff, tuff breccia, and interbedded andesitic gravel and sandstone.* Lawlor Tuff—*white massive tuff with large pumice fragments and angular fragments of vesicular lava* (northeast flank of Mt. Diablo). Pinole Tuff(?)—*white, soft, pumiceous tuff* (southwest flank of Mt. Diablo).
	Pmlc	**MIDDLE AND/OR LOWER PLIOCENE NONMARINE SEDIMENTARY ROCKS**	Mehrten Formation—*fluvial, andesitic sand, sandstone, gravel, conglomerate, siltstone, claystone, and interbedded altered rhyolitic ash near base, locally includes hornblende andesite, basaltic agglomerate, tuff, and tuff breccia* in the Sonora quadrangle (may be late Miocene in part). Orinda Formation[2]—*red, gray, or brown, loosely consolidated sandstone and conglomerate, subordinate amounts of shale, claystone, limestone lenses, and tuffaceous bentonitic clay.* Tassajero Formation—*brown to gray mudstone, andesitic sandstone, conglomerate, and minor bentonitic and pumiceous tuff* (south of Mt. Diablo; contains vertebrate fauna of middle Pliocene age). Green Valley Formation—*similar to Tassajero Formation except for a greater percentage of coarse clastic rocks* (south of Mt. Diablo; contains early Pliocene Black Hawk Ranch vertebrate fauna and flora). "Neroly Formation" (of Huey)—*blue andesitic sandstone, conglomerate, clay, and brown unconsolidated sand in upper part* (contains a vertebrate fauna of early Pliocene age and a flora of Mio-Pliocene age).[3]
	Pml	**MIDDLE AND/OR LOWER PLIOCENE MARINE SEDIMENTARY ROCKS**	Purisima Formation—*cross-bedded sand, sandstone, siltstone, and siliceous mudstone* (Santa Cruz Mountains; in part late Miocene).
	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	San Pablo Group (includes Neroly, Cierbo, and Briones Formations)—*blue andesitic sandstone and conglomerate, white quartzose sandstone and claystone, and massive conglomeratic sandstone*[4] Cierbo Formation—*white, friable, pebbly sandstone, interbedded conglomerate, tuff, carbonaceous brown shale, and siltstone* (Tesla and Carbona quadrangles). Santa Margarita Formation—*unconsolidated white sand* (Santa Cruz Mountains; in part early Pliocene).
TERTIARY	Mc	**UNDIVIDED MIOCENE NONMARINE SEDIMENTARY ROCKS**	Valley Springs Formation—*dominantly fluvial sequence of white tuffaceous sand, sandy clay, and siliceous gravel; interbedded rhyolitic tuff partly altered to bentonitic clay.*
	Mm	**MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS**	Monterey Formation—*sandstone, siliceous shale, rhythmically interbedded chert and siliceous shale, local limestone lenses.* (Includes Hambre Sandstone, Tice Shale, Oursan Sandstone, Claremont Shale, and Sobrante Sandstone Members. In part late Miocene.)
Miocene	Ml	**LOWER MIOCENE MARINE SEDIMENTARY ROCKS**	Temblor Formation—*sandstone and conglomerate, locally glauconitic, minor shale and thin dacitic tuff-breccia* (south of San Jose; in part middle Miocene). Vaqueros Formation—*interbedded sandstone, conglomerate, siltstone, and siliceous shale* (Santa Cruz Mountains). Unnamed sandstone, interbedded conglomerate and shale (east of San Jose; contains early Saucesian fauna).
		MIOCENE VOLCANIC ROCKS:	
	M_v^r	**RHYOLITIC**	Tuff, perlitic dacite, and massive dacite within the Temblor Formation (Lone Hill, south of San Jose).
	M_v^a	**ANDESITIC**	Andesitic pyroclastic and intrusive rocks on Pacheco Peak (probably equivalent to the Quien Sabe Volcanics to the south).
Oligocene	Φ	**OLIGOCENE MARINE SEDIMENTARY ROCKS**	Kirker Formation—*tuffaceous sandstone, massive white reworked tuff, and minor conglomerate* (northeast of Mt. Diablo). San Lorenzo Formation—*mudstone, clay shale, and sandstone* (Eocene in part; Santa Cruz Mountains). Unnamed white claystone, siltstone, and micaceous sandstone, stained red, brown, and purple in the Orestimba quadrangle (contains a possible Oligocene fauna and shown on the map as Φ?).
Eocene	Ec	**EOCENE NONMARINE SEDIMENTARY ROCKS**	Ione Formation—*pink, yellow, red, and gray, quartzose, anauxite-bearing sandstone and conglomerate; white sandy clay at base* (Sierran foothills; includes marine fossiliferous sandstone near Merced Falls).
	E	**EOCENE MARINE SEDIMENTARY ROCKS**	Kreyenhagen Formation—*white platy diatomite, gypsiferous shale, clayey sand, and sandstone* (south of Patterson). Butano Sandstone—*sandstone, conglomeratic sandstone, and clay shale* (Santa Cruz Mountains). Tolman Formation—*highly fossiliferous sandstone and conglomerate* (north of Fremont; contains fauna of possible Eocene age; shown on the map as E?). Markley Formation—*massive, friable sandstone with interbedded carbonaceous mudstone, siltstone and white diatomaceous shale;* "Nortonville Formation"—*mudstone, shale, siltstone, and sandstone;* Domengine Formation—*white, red, and brown, quartzose sandstone, with interbedded glauconitic mudstone, siltstone, lignite, and carbonaceous shale;* Meganos Formation—*interbedded sandstone and mudstone, minor conglomerate and coquina* (in part Paleocene). Telsa Formation—*interbedded white quartzose sand, dark carbonaceous shale, siltstone, and clay* (Tesla and Carbona quadrangles; lower part possibly Paleocene).
Paleocene	Ep	**PALEOCENE MARINE SEDIMENTARY ROCKS**	Laguna Seca Formation—*glauconitic sandstone, micaceous or anauxitic cross-bedded sandstone, and sandy shale* (Pacheco Pass and Orestimba quadrangles; in part non-marine; in part Eocene; locally referred to as the Tesla Formation). Martinez Formation—*mudstone and sandstone, locally pebbly and glauconitic* (northeast of Mt. Diablo). Unnamed quartzose sandstone and calcareous clay shale (Morgan Hill quadrangle; possibly early Eocene in part).

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**	Quartzose river gravels (in the Sierra Nevada; in part auriferous).
		TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:	
	Ti	**UNDIFFERENTIATED**	Felsic intrusive at Loma Prieta (Santa Cruz Mountains).
	Tir	**RHYOLITIC**	Alum Rock Rhyolite—*fine grained rhyolite plug* (northeast of San Jose). Rhyodacite dikes east of Mt. Diablo.
	Tia	**ANDESITIC**	Black glassy andesite dikes intruding serpentine southeast of San Jose.
	Tib	**BASALTIC**	Diabase dikes east of Mt. Diablo.
		TERTIARY VOLCANIC ROCKS:	
	Tv	**UNDIFFERENTIATED**	Olivine basalt, scoria, agglomerate, interbedded red fluvial sedimentary rocks and minor andesite (near San Luis Dam).
	Tvb	**BASALTIC**	Basalt in Clayton quadrangle. Basalt in east half of Mt. Hamilton quadrangle.
MESOZOIC / CRETACEOUS	K	**UNDIVIDED CRETACEOUS MARINE SEDIMENTARY ROCKS**	Niles Canyon Formation—*sandstone, sandy shale, local conglomerate, abundant carbonaceous fragments* (Early Cretaceous according to C. A. Hall, Jr., 1958; may be all or in part Late Cretaceous according to D. L. Jones, U. S. Geol. Survey, oral communication 11/2/65; contains Late Cretaceous pollen according to W. R. Evitt, Stanford University, written communication 12/8/65). Berryessa Formation—*siltstone, shale, and massive sandstone* (contains both Late Cretaceous and Early Cretaceous fossils). Rocks mapped as Oakland (?) Conglomerate—*massive cobble and boulder conglomerate in coarse sand matrix* (contains both Late Cretaceous and Early Cretaceous fossils). Undifferentiated silty shale, thin arkosic sandstone, and minor conglomerate (northeast of Gilroy; may include some Tertiary rocks in the Mt. Sizer quadrangle). Undifferentiated sandstone and mudstone, minor conglomerate, white porcelaneous shale, limestone, and tuff (contains both Early and Late Cretaceous fossils, near Mt. Diablo).
	Ku	**UPPER CRETACEOUS MARINE SEDIMENTARY ROCKS**	Moreno Formation—*chocolate brown organic shale with limestone concretions, interbedded massive concretionary sandstone and siltstone, abundant gypsum, local sandstone dikes;* Panoche Formation—*massive, locally cavernous-weathering, concretionary sandstone, shale, siltstone, and conglomerate lenses;* Adobe Flat Shale Member of Panoche Formation—*brittle silty shale, minor interbedded sandstone, local limestone lenses* (east flank of Diablo Range). Rocks mapped as Garzas Sandstone (east flank of Diablo Range). Del Valle Formation—*massive concretionary sandstone, interbedded siltstone, shale, and conglomerate* (Livermore quadrangle). "Sedimentary rocks in the Sierra Azul"—*rhythmically-bedded graywacke, conglomerate, and shale,* and "Sedimentary rocks in the Santa Teresa Hills"—*massive concretionary sandstone and minor shale* (Santa Cruz Mountains).
	Kl	**LOWER CRETACEOUS MARINE SEDIMENTARY ROCKS**	"Horsetown Formation"—*hard nodular shale and friable sandstone, local thin sandy fossiliferous limestone* (Carbona and Tesla quadrangles; partly Late Cretaceous in Hospital Canyon). Unnamed shale and siltstone, minor sandstone and limestone lenses (Pacheco Pass quadrangle; in part Late Jurassic).
	Jk	**KNOXVILLE FORMATION**	Knoxville(?) Formation—*black shale and siltstone, abundant ellipsoidal concretions of aphanitic gray limestone, local sandstone, and fossiliferous conglomerate* (Diablo Range).
	KJf	**FRANCISCAN FORMATION**	Franciscan Formation—*graywacke, locally abundant red and green thin-bedded chert, siltstone and silty shale, minor conglomerate, limestone, blue-gray glaucophane-bearing schist and related metamorphic rocks* (graywacke extensively jadeitized in Pacheco Pass, Mt. Boardman, and Mt. Hamilton areas). The Franciscan Formation in the Diablo Range is generally considered to be of Jurassic and possibly pre-Jurassic age.
	KJfv	**FRANCISCAN VOLCANIC AND METAVOLCANIC ROCKS**	Pillow basalt, andesite, and mafic metavolcanic rock (greenstone), local quartz porphyry, intrusive diabase, and diorite. Lotta Creek Tuff Member—*white, crystal, lithic tuff, interbedded dark siliceous shale;* Del Puerto Keratophyre Member—*keratophyre and quartz keratophyre flows* (Mt. Boardman quadrangle).
		MESOZOIC GRANITIC ROCKS	
	gr	**UNDIFFERENTIATED**	Various granitic rocks in the Sierra Nevada, including granodiorite, quartz diorite, diorite, pegmatite, aplite, and some gabbro (not differentiated into separate cartographic units). Albitite dikes along Melones Fault Zone. Granodiorite(?) in Los Gatos quadrangle.
	gra	**GRANITE AND ADAMELLITE (QUARTZ MONZONITE)**	Quartz monzonite, granite, granophyre and dikes of leucogranite and pegmatite.
	grt	**TONALITE (QUARTZ DIORITE) AND DIORITE**	Tonalite and diorite.
	bi	**MESOZOIC BASIC INTRUSIVE ROCKS**	Gabbro, hornblende gabbro, olivine gabbro, norite, troctolite, diabase dikes and sills, and meta-diabase in Sierra Nevada.
	ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	In Sierra Nevada: massive serpentine, hornblendite, silica-carbonate rock associated with serpentine, peridotite, and gabbro (highly sheared along Melones Fault Zone). In Coast Ranges: massive serpentine, peridotite, dunite, pyroxenite, olivine gabbro, norite, and silica-carbonate rock derived from highly sheared and altered serpentine along fault zones.
	Ju	**UPPER JURASSIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS**	Mariposa Formation—*slate, locally tuffaceous metasandstone, metagraywacke, metaconglomerate, metasiltstone, and minor sandy metatuff; local chiastolite slate* in Indian Gulch (15′) quadrangle. Agua Fria Formation—*quartzose and volcanic metasedimentary rocks, minor mafic metatuff, meta-agglomerate, and metachert.* Hunter Valley Cherts—*varicolored banded metachert interbedded in metavolcanic rocks.* Merced Falls Slate—*slate and metasiltstone, interbedded metagraywacke and minor metaconglomerate.* Salt Spring Slate—*slate, metagraywacke, and metaconglomerate, minor metatuff.* "Cosumnes Formation"—*slate and metatuff, minor metachert and metaconglomerate.*
	JRv	**JURASSIC AND/OR TRIASSIC METAVOLCANIC ROCKS**	Logtown Ridge Formation—*massive metavolcanic rocks including local metamorphosed tuffaceous sediments and metachert, associated intrusive quartz porphyry.* Penyon (Peñon) Blanco Volcanics—*massive metavolcanic rocks, including local mafic pillow lava and metachert.* Peaslee Creek Volcanics—*metamorphosed mafic pyroclastic rocks and metamorphosed massive porphyritic felsic lava; includes hypabyssal intrusive rocks.* Copper Hill Volcanics—*metamorphosed mafic pyroclastic rocks and pillow lava; some metamorphosed massive felsic flows and pyroclastic rocks.* Gopher Ridge Volcanics—*metamorphosed mafic pyroclastic rocks, metamorphosed pillow lava and massive felsic flows.* Unnamed metadiabase and intrusive metarhyolite in Indian Gulch (7½′) and La Grange (7½′) quadrangles. Dark green massive to schistose metavolcanic rocks (east of Melones Fault Zone).
PALEOZOIC / UNDIVIDED	m	**PRE-CRETACEOUS METAMORPHIC ROCKS UNDIFFERENTIATED**	Metasedimentary and metavolcanic rocks undifferentiated (Sonora quadrangle).
	ls	**LIMESTONE AND/OR DOLOMITE**	Crystalline limestone lens in Mariposa Formation (north of Hornitos).
	ms	**PRE-CRETACEOUS METASEDIMENTARY ROCKS**	Phyllite, stretched conglomerate, thin-bedded tuff and slate (Sonora quadrangle).
	mv	**PRE-CRETACEOUS METAVOLCANIC ROCKS**	Dark green fibrous amphibolite schist and sericite schist (Sierra Nevada).
	gr-m	**PRE-CENOZOIC GRANITIC AND METAMORPHIC ROCKS**	Hornblende-quartz-plagioclase gneiss, locally associated with gabbro, gneissic quartz monzonite, migmatite, and flaser gabbro (Indian Gulch 15′ quadrangle).
	ℙ	**PALEOZOIC MARINE SEDIMENTARY AND METASEDIMENTARY ROCKS,**	Calaveras Formation—*quartz-mica schist, slate, quartzite, and metachert; minor metaconglomerate, phyllite, crushed conglomerate, and local lenses of amphibolite schist.* ("Calaveras" is applied as a general name for Sierra Nevada Palezoic rocks.) Some areas shown as ℙ may be Mesozoic.
	ls	**LIMESTONE AND/OR DOLOMITE**	Recrystallized limestone, dolomite, and dolomitic limestone in the Calaveras Formation, locally brecciated and sheared (contains fossils of possible "Late Paleozoic" age in Sonora quadrangle).

NOTES

[1] Early Pleistocene vertebrate fauna reported in the San Luis Canal excavations south of the San Jose sheet (C. E. Hall, 1965, Las Aguilas land surface *in* Guidebook for Field Conference I, INQUA, VIIth Congress, p. 145).

[2] The rocks mapped as Orinda south of Mt. Diablo are younger (early to middle Pliocene) than the rocks mapped as Orinda in the Berkeley Hills (Mio-Pliocene). Locally this formation has been subdivided into the Tassajero and Green Valley Formations.

[3] In the Tesla quadrangle, Huey (1948) considers these rocks to be flood plain or coastal plain deposits which are marginal to and transitional into the marine facies of the "Neroly" Formation in the Mt. Diablo area.

[4] On the southwest flank of Mt. Diablo, the uppermost part of the "Neroly" Formation, sometimes referred to as the "Diablo Formation," contains a late Miocene invertebrate marine fauna and an early Pliocene flora and vertebrate nonmarine fauna. These rocks are believed to represent an estaurine-deltaic environment transitional between Miocene marine deposition and Pliocene continental deposition (Webb, S. D., and Woodburne, M. O., 1964, Geol. Soc. of Sacramento Guide Book and Field Trip to the Mt. Diablo Area, p. 76).

TOPOGRAPHIC QUADRANGLES

WITHIN THE SAN JOSE SHEET

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY

FEDERAL CENTER, DENVER, COLORADO 80225

1966

View southwest along the sinuous flat-topped Tuolumne Table Mountain. This mountain can be traced for more than 40 miles across the Mother Lode gold belt, gradually descending through the Sierra Nevada foothills at a gentle slope of approximately one degree.

The mountain is capped by ancient lava (approximately 10 million years old) which erupted from volcanoes then existing high in the Sierra Nevada. The lava flowed southwestward down a meandering river channel carved in soft sand and gravel. Erosion since that event has removed the surrounding soft sediments, leaving the relatively resistant lava standing high above the present landscape.

Photo by John S. Shelton.