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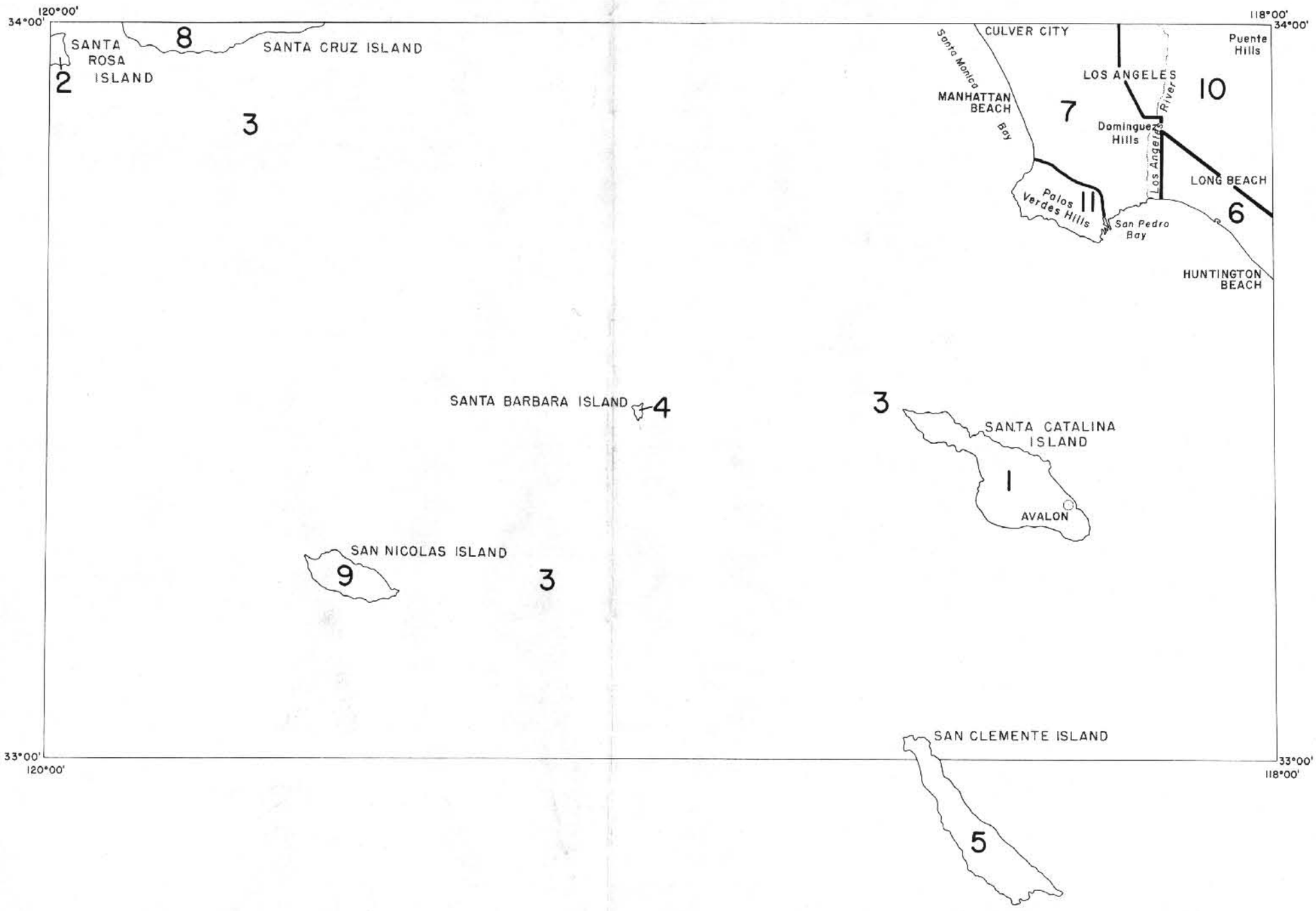
EXPLANATORY DATA
LONG BEACH SHEET
GEOLOGIC MAP OF CALIFORNIA
OLAF P. JENKINS EDITION

Compiled by Charles W. Jennings, 1962

Second Printing, 1971

INDEX TO GEOLOGIC MAPPING
USED IN COMPILATION OF THE LONG BEACH SHEET



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

View north toward Santa Barbara Island and Sutil Island (lower left). The islands are largely composed of vesicular massive basalt, overlain by basaltic agglomerate. A thin bed of middle Miocene foraminiferal shale separates the two volcanic units. The surface of Santa Barbara Island is partly mantled by Pleistocene marine deposits, and retains the remnants of several marine terraces.

Photo by U. S. National Park Service, 1957

STRATIGRAPHIC NOMENCLATURE— LONG BEACH 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**	Recent dune and beach sand. Includes Pleistocene dune sand in the Westchester-Torrance area.
			Qal	**RECENT ALLUVIUM**	Alluvium and alluvial fan deposits. In the Los Angeles area includes flood plain deposits, marsh deposits, artificial fill, and some natural and artificial beach deposits.
		Pleistocene	Qt	**QUATERNARY NONMARINE TERRACE DEPOSITS**	Stream terrace deposits on Santa Catalina Island. Nonmarine terrace cover in the Palos Verdes Hills area and the area between Inglewood and Long Beach (largely overlies wave-cut terrace surfaces).
			Qc	**PLEISTOCENE NONMARINE SEDIMENTARY DEPOSITS**	Older alluvium and semi-consolidated alluvial terrace deposits in the Whittier-Norwalk area. Older sand deposits, mostly weathered and locally cemented (San Clemente Island). La Habra Formation—*Conglomerate, sandstone, and mudstone.*
			Qm	**PLEISTOCENE MARINE DEPOSITS AND MARINE TERRACE DEPOSITS**	Marine terrace deposits including some nonmarine terrace deposits on wave-cut terrace surfaces. Palos Verdes Sand [1]—*upper Pleistocene marine sand and gravel deposits on the lowest (youngest) terraces;* San Pedro Formation [1]—*lower Pleistocene marine sand, silt, and gravel;* Timms Point silt [1]—*lower Pleistocene marine sandy silt, silty sand* and Lomita Marl [1]—*lower Pleistocene marine marl, calcareous sand, and gravel.*
		Pliocene	Pu	**UPPER PLIOCENE MARINE SEDIMENTARY ROCKS**	Upper Pliocene rocks commonly called Pico Formation [2]—*siltstone, sandstone, and conglomerate* (Whittier Hills area).
			Pml	**MIDDLE AND/OR LOWER PLIOCENE MARINE SEDIMENTARY ROCKS**	Lower Pliocene rocks commonly called Repetto Formation [3]—*lower Pliocene marine siltstone with minor sandstone and conglomerate* (Whittier Hills area and Palos Verdes Hills area).
	TERTIARY	Miocene	Mu	**UPPER MIOCENE MARINE SEDIMENTARY ROCKS**	"Santa Margarita Formation"—*sandstone, shale, tuff, and agglomerates* on Santa Rosa Island. Malaga Mudstone [4]—*radiolarian mudstone and diatomite;* Valmonte Diatomite [4]—*diatomite, diatomaceous shale and diatomaceous mudstone.* Sycamore Canyon Member [5]—*conglomerate, sandstone, and siltstone;* Yorba Member [5]—*siltstone and sandstone;* Soquel Member [5]—*sandstone, siltstone, and locally conglomerate and breccia;* La Vida Member [5]—*siltstone, and sandstone, with local tuff beds.* Unnamed fossiliferous upper Miocene clastic limestone on Santa Catalina Island.
			Mm	**MIDDLE MIOCENE MARINE SEDIMENTARY ROCKS**	Altamira Shale [6]—*porcelaneous shale, cherty shale, chert, siltstone, diatomite, sandstone, conglomerate, and tuff beds.* Middle Miocene Monterey Formation (undifferentiated)—*thin bedded diatomaceous, siliceous, and tuffaceous shales with thin beds of limestone near the base* (Santa Cruz Island), *siliceous shales and sandstone* on Santa Rosa Island. Unnamed middle Miocene thin-bedded siltstone, shale, diatomite, and basal sandstone with local beds of tuff breccia, ash, and pumice on San Clemente Island.
			Ml	**LOWER MIOCENE MARINE SEDIMENTARY ROCKS**	Lower Miocene sandstone and conglomerate on Santa Cruz Island. Includes glaucophane-schist-bearing breccias and conglomerates of Saucesian stage on Santa Cruz Island ("San Onofre Breccia" of Rand, 1931, and Kennett, 1952).
				MIOCENE VOLCANIC ROCKS:	
			Mv	**UNDIFFERENTIATED**	Dense, generally nonvesicular dacite flows (San Clemente Island).
			Mv^r	**RHYOLITIC**	Massive to predominately flow-banded porphyritic rhyolite flows (San Clemente Island). Rhyolite on Santa Catalina Island.
			Mv^a	**ANDESITIC**	Heterogeneous sequence of andesite flows and pyroclastic rocks on San Clemente Island. Augite-hypersthene andesite on Santa Catalina Island.
			Mv^b	**BASALTIC**	Olivine basalt on Santa Catalina Island. Olivine basalt flows with overlying basaltic pyroclastic rocks on Santa Cruz Island. Vesicular pillow basalt flows on Santa Barbara Island (middle Miocene age).
			Mv^p	**PYROCLASTIC**	Basaltic agglomerate (middle Miocene) on Santa Barbara Island. Upper Miocene rhyolite, andesite, and basalt breccia, agglomerate, scoriaceous flows, tuff, and tuff breccia on Santa Cruz Island ("Blanca Tuff" of Rand, 1931, and "Rhyolite Series" of Bremner, 1932).
		Eocene	E	**EOCENE MARINE SEDIMENTARY ROCKS**	Middle and upper Eocene sandstone, siltstone, and shale on San Nicolas Island. Upper and lower Eocene shales, sandstone, and conglomerates, on Santa Cruz Island ("Domengine Formation" of Bremner, 1932, and Rand, 1931).
		Paleocene	Ep	**PALEOCENE MARINE SEDIMENTARY ROCKS**	Paleocene sandstone interbedded with thin shale and some conglomerate on Santa Cruz Island ("Martinez Formation" of Bremner, 1932, and Rand, 1931).
		Undivided		**TERTIARY INTRUSIVE (HYPABYSSAL) ROCKS:**	
			Ti	**UNDIFFERENTIATED**	Dacite porphyry (hornblende quartz diorite porphyry of Bailey) on Santa Catalina Island. (Contains numerous inclusions of Franciscan-type metamorphic rocks.)
			Tib	**BASALTIC**	Miocene basaltic sills and irregular intrusive basalts in the Palos Verdes Hills. Diabase dikes on San Nicolas Island of Miocene(?) age.
			Ti^r	**RHYOLITIC**	Rhyolite of probable Miocene age comprising Begg Rock (northwest of San Nicolas Island) thought to be an eroded volcanic neck.
MESOZOIC	JURASSIC—CRETACEOUS		KJf	**FRANCISCAN FORMATION**	Metamorphic rocks on Santa Catalina Island (correlative with the Franciscan Formation in the Coast Ranges) derived from eugeosynclinal sedimentary and volcanic rocks, consisting of metasandstone with up to 30 percent lawsonite and glaucophane, fine grained glaucophane schist, quartzite, metaconglomerate, metavolcanic rocks, talc-actinolite schist, and local green or red chert. Catalina Schist—*quartz-sericite schist, quartz-talc schist, quartz-glaucophane schist, and altered basic igneous rocks* (Palos Verdes Hills; may be correlative with the Franciscan-type rocks on Santa Catalina Island or may be older).[7]
			KJfv	**FRANCISCAN VOLCANIC AND METAVOLCANIC ROCKS**	Greenstone of Franciscan Formation on Santa Catalina Island.
			grt	**MESOZOIC GRANITIC ROCKS** **TONALITE (QUARTZ DIORITE) AND DIORITE**	Quartz diorite and hornblende quartz diorite on Santa Cruz Island.
			ub	**MESOZOIC ULTRABASIC INTRUSIVE ROCKS**	Serpentine (largely metamorphosed) containing actinolite, chlorite, talc, and locally tremolite on Santa Catalina Island.
			m	**PRE-CRETACEOUS METAMORPHIC ROCKS, UNDIFFERENTIATED**	"Older" metamorphic rocks on Santa Catalina Island, chiefly gneissic or massive, consisting of chlorite-actinolite complex, quartz-muscovite-garnet rock, and green hornblende-zoisite-kyanite gneiss. Pre-Cretaceous metamorphic rocks on Santa Cruz Island consisting mainly of phyllite, chlorite schist, and greenstone.

NOTES

[1] Palos Verdes Hills area.
[2] 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 is abandoning the name Pico and will use "upper member of Fernando Formation" in the Repetto Hills area (Durham, D. L. and Yerkes, R. F., Geology and oil resources of the eastern Puente Hills area: U. S. Geol. Survey Prof. Paper 420-B, in press).
[3] "Repetto" properly used only for stage designation; the U. S. Geological Survey is abandoning the name Repetto Formation and will use "lower member of the Fernando Formation" in the Puente Hills area (Durham, D. L., and Yerkes, R. F., U.S.G.S. Prof. Paper 420-B, in press).
[4] Upper Miocene member of the Monterey Formation in the Palos Verdes Hills area.
[5] Upper Miocene member of the Puente Formation in the Puente Hills area.
[6] Middle and upper Miocene member of the Monterey Formation in the Palos Verdes Hills area.
[7] A. O. Woodford, 1960, Bedrock patterns and strike slip faulting in southwestern California: Amer. Jour. Science, Bradley Volume, vol. 258-A, p. 400-417.

SANTA

CATALINA

ISLAND

View of Little Harbor embayment on the west side of Santa Catalina Island, site of many "south sea island" movies. The rocks in this view are Franciscan-type consisting largely of glaucophane-bearing metasandstone.
Photo courtesy Santa Catalina Island Company.

SANTA

CRUZ

ISLAND

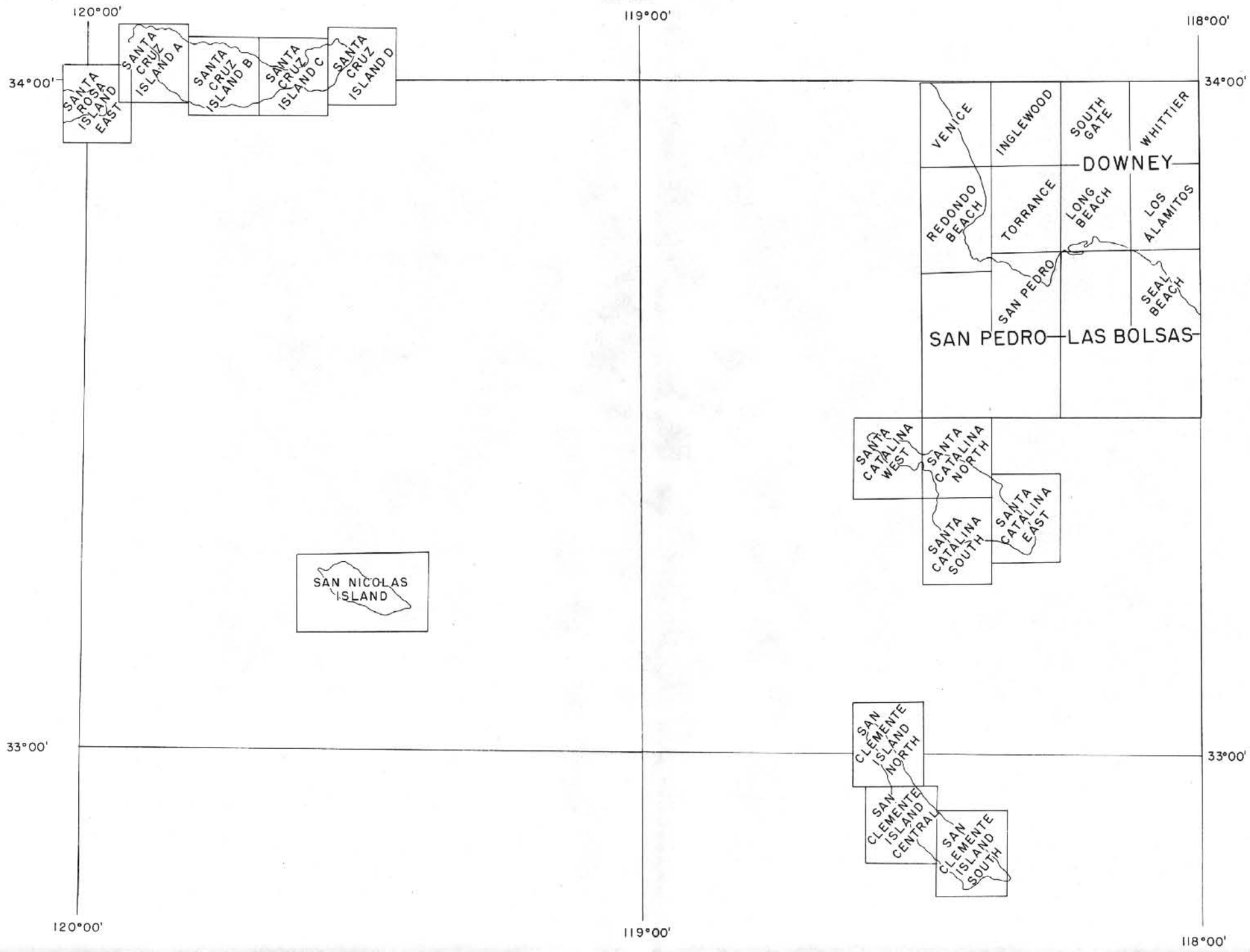
View toward north across the central part of Santa Cruz Island. Prominent rift valley (diagonally across middleground) marks the Santa Cruz Island Fault and contains Stanton Ranch (right of center). Area in background, across the fault valley, is composed of middle Miocene pyroclastic rocks and volcanic flows. The foreground, on observer's side of fault valley, consists of pre-Cretaceous metamorphic rocks (dark gray area) in fault contact with light colored upper Miocene pyroclastic rocks.
Photo courtesy Roland von Huene, 1962

TOPOGRAPHIC QUADRANGLES

WITHIN THE LONG BEACH SHEET

AVAILABLE FROM THE U.S. GEOLOGICAL SURVEY

1962



View northward of Palos Verdes Hills with Los Angeles City in background. At least five of the thirteen major late Pleistocene terraces are prominently displayed in this view. Marineland, on Long Point in center foreground, is situated on one of the lowest emergent terraces. The extensive amphitheater-like feature in the right foreground is the Portuguese Bend landslide. The Palos Verdes Hills is an uplifted block, composed largely of the middle Miocene Altamira Shale Member of the Monterey Formation. The Los Angeles basin, containing a thickness of at least 20,000 feet of Miocene and younger sedimentary rocks, is the site of several major oil fields, some of which are marked by rows of light-colored storage tanks. Plutonic and gneissic rocks comprise the San Gabriel Mountains (upper right horizon).

Photo by John S. Shelton, 1958

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