

GEOLOGIC MAP OF CALIFORNIA

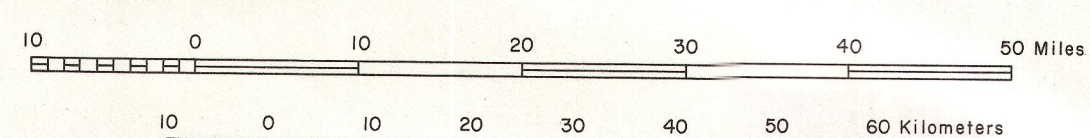
COMPILATION BY
CHARLES W. JENNINGS

WITH ASSISTANCE FROM
R. G. Strand and T. H. Rogers

1968-1973

GRAPHICS BY R. T. Boylan, R. R. Moar and R. A. Switzer

SCALE 1:750,000
(1 INCH EQUALS APPROXIMATELY 12 MILES)



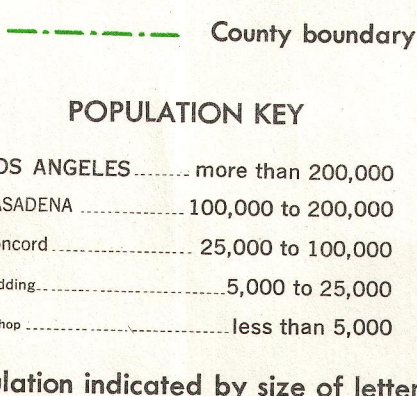
BATHYMETRIC CONTOUR INTERVAL: 10 FEET (30 METERS)

1977

EXPLANATION

This map is a generalization of the 1:250,000 scale GEOLOGIC ATLAS OF CALIFORNIA (1968-1969), which was compiled and published by the U.S. Geological Survey. It is being updated with new information in many areas. Data shown are essentially complete to 1973; preparation for printing, only data for selected areas were added. This compilation has benefited from new data generously provided during careful review of this map by numerous Federal, State, and local geologists familiar with California geology. To all these contributors, the State is especially grateful. Just as familiar with California geology, detailed source index maps, and bibliographic information published and unpublished reports and information used in this geologic compilation.

This map is a reduction of the 1:500,000 scale map published by the U.S. Geological Survey, American datum. Lambert conformal conic projection based on standard parallels 33° and 45° to 1960.

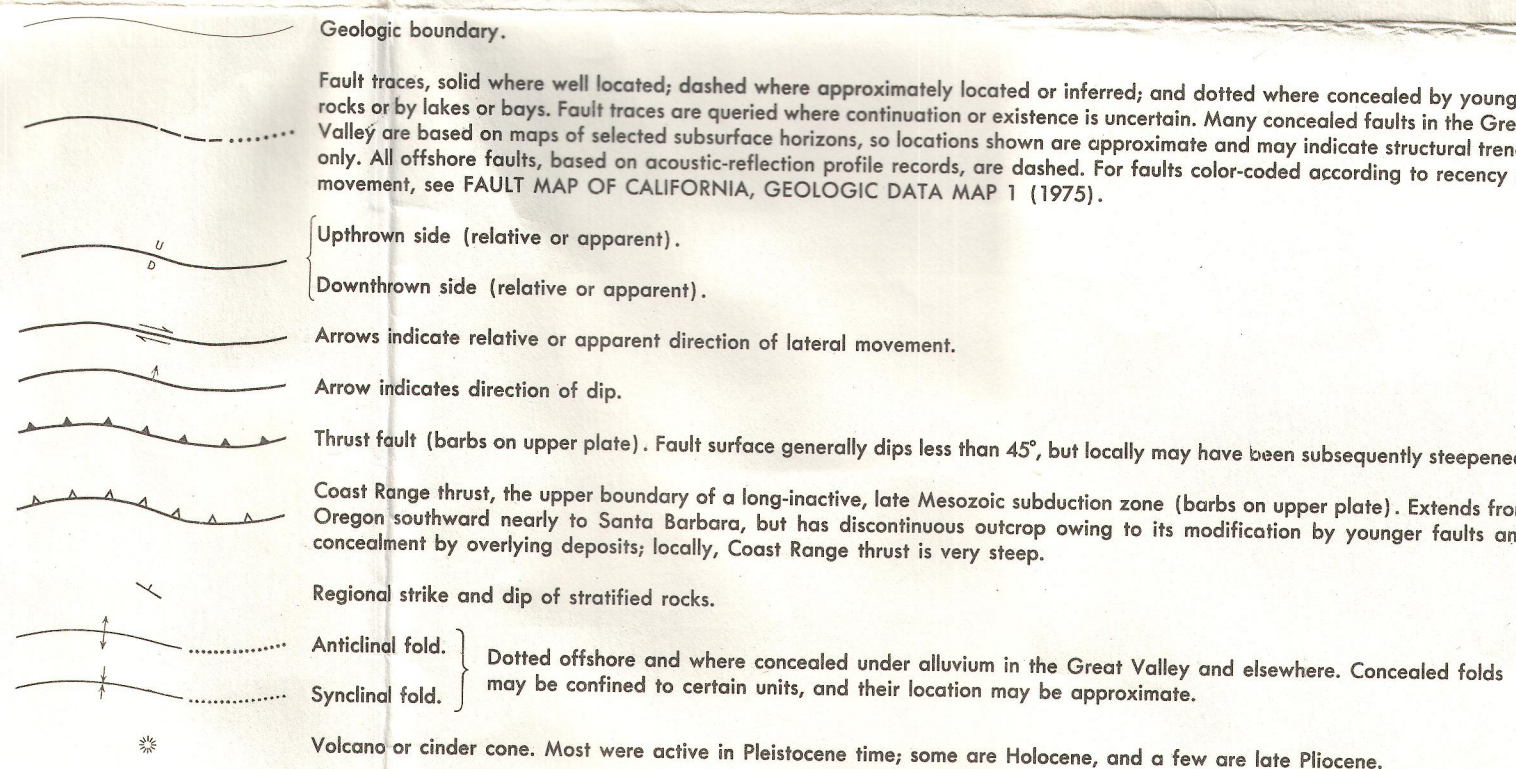


GEOLOGIC LEGEND

(GENERALIZED DESCRIPTION OF ROCK TYPES)

	MARINE SEDIMENTARY ROCKS	NONMARINE (CONTINENTAL) SEDIMENTARY ROCKS	VOLCANIC ROCKS	PLUTONIC ROCKS	
QUATERNARY	<p>Qd Extensive marine and nonmarine sand deposits, generally near the coast or desert playas.</p> <p>Qp Alluvium, lake, playa, and terrace deposits; unconsolidated and semi-consolidated. Mostly nonmarine, but includes marine deposits near the coast.</p> <p>Qc Sandstone, siltstone, shale, and conglomerate; mostly moderately consolidated.</p> <p>Qm Sandstone, shale, siltstone, conglomerate, and breccia; moderately to well consolidated.</p> <p>Qv Sandstone, shale, and conglomerate; mostly well consolidated.</p> <p>Qs Shale, sandstone, conglomerate, minor limestone; mostly well consolidated.</p> <p>Qt Sandstone, shale, and conglomerate; mostly well consolidated.</p>	<p>Qh Selected large landfills, such as Blackhawk Slide on north side of San Gabriel Mountains, early to late Quaternary.</p> <p>Qg Glacial till and moraines. Found at high elevations mostly in the Sierra Nevada and Klamath Mountains.</p> <p>Qn Plicose and/or Pleistocene sandstone, shale, and gravel deposits; mostly loosely consolidated.</p> <p>Qf Sandstone, shale, conglomerate, and conglomerite; moderately to well consolidated.</p> <p>Qe Undivided Tertiary sandstone, shale, conglomerate, breccia, and ancient lake deposits.</p> <p>Qd Sandstone, shale, and conglomerate; mostly well consolidated.</p> <p>Qc Sandstone, shale, conglomerate; moderately to well consolidated.</p>	<p>Qv Recent (Holocene) volcanic flow rocks; minor pyroclastic deposits.</p> <p>Qp Recent (Holocene) pyroclastic and volcanic mudflow deposits.</p> <p>Qc Quaternary volcanic flow rocks; minor pyroclastic deposits.</p> <p>Qm Quaternary pyroclastic and volcanic mudflow deposits.</p> <p>Qv Tertiary volcanic flow rocks; minor pyroclastic deposits.</p> <p>Qp Tertiary pyroclastic and volcanic mudflow deposits.</p> <p>Qs Tertiary intrusive rocks; mostly shallow (hypabyssal) dykes and sills.</p>	<p>Qc Cenozoic (Tertiary) granitic rocks—quartz monzonite, quartz diorite, and minor monzonite, granodiorite, and granite; found in the Kings, Penas, Amegans, and Greenhorn Ranges in northeastern California.</p>	
MESZOZOIC	<p>Md Sandstone, shale, and minor conglomerate in coastal belt of northwestern California, included by some in Franciscan Complex. Presumably considered Cretaceous, but now known to contain early Tertiary microfossils in places.</p> <p>Mp Upper Cretaceous sandstone, shale, and conglomerate.</p> <p>Ml Lower Cretaceous sandstone, shale, and conglomerate.</p> <p>Ms Shale, sandstone, minor conglomerate, chert, silt, limestone, minor pyroclastic rocks.</p> <p>Md Shale, conglomerate, limestone and dolomite, sandstone, slate, hornfels, quartzite, minor pyroclastic rocks.</p> <p>Ml Shale, conglomerate, limestone and dolomite, sandstone, slate, hornfels, quartzite, minor pyroclastic rocks.</p> <p>Md Shale, sandstone, conglomerate, limestone, dolomite, chert, hornfels, marble, quartzite; in part pyroclastic rocks.</p> <p>Ml Limestone and dolomite, sandstone and shale; in part luffaceous.</p> <p>Md Sandstone, shale, conglomerate, chert, silt, quartzite, hornfels, marble, dolomite, phyllite; some greenstone.</p> <p>Ml Sandstone, shale, limestone, dolomite, chert, quartzite, and phyllite; includes some rocks that are possibly Precambrian.</p> <p>Md Conglomerate, shale, sandstone, limestone, dolomite, marble, gneiss, hornfels, and quartzite may be Paleozoic in part.</p>	<p>Md Undivided Cretaceous sandstone, shale, and conglomerate; minor nonmarine rocks in Peninsular Ranges.</p> <p>Mp K-1) Franciscan Complex: Cretaceous and Jurassic sandstone with smaller amount of shale, chert, limestone, and conglomerate. Includes Franciscan subgroups except where overruled as K-2.</p> <p>Ml K-2) Midrange of Jugangetan and Abasco Franciscan Complex rocks.</p> <p>Md K-3) Blockfall and semi-schist of Franciscan Complex.</p> <p>Ml Schists of various types; mostly Paleozoic or Mesozoic age, some Precambrian.</p> <p>Md Limestone, dolomite, and marble whose age is uncertain but probably Paleozoic or Mesozoic.</p> <p>Ml Undivided Paleozoic metamorphic rocks. Includes slate, sandstone, shale, chert, conglomerate, limestone, dolomite, marble, phyllite, schist, hornfels, and quartzite.</p>	<p>Md Oligocene and metamorphic rocks, mostly gneiss and other metamorphic rocks injected by granitic rocks. Mesozoic to Tertiary.</p> <p>Ml Undivided pre-Cenozoic metamorphic and metavolcanic rocks of great variety. Mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble.</p> <p>Md Complex of Precambrian igneous and metamorphic rocks. Mostly gneiss and schist intruded by igneous rocks; may be Mesozoic in part.</p>	<p>Md Undivided Mesozoic volcanic and metavolcanic rocks. Andesite and rhyolite flow rocks, greenstone, volcanic breccia, and other pyroclastic rocks; in part strongly metamorphosed. Includes volcanic rocks of Franciscan Complex: basaltic pillow lava, diabase, greenstone, and minor pyroclastic rocks.</p> <p>Ml Undivided pre-Cenozoic metamorphic rocks. In shades of blue, dark, light, and greenstone commonly siltstone.</p> <p>Md Undivided Paleozoic metamorphic rocks. Mostly flow, breccia, and tuff, including greenstone, diorite and pillow lava; minor interbedded sedimentary rocks.</p>	<p>Md Mesozoic granite, quartz monzonite, granodiorite, and quartz diorite.</p> <p>Ml Ultramafic rocks, mostly serpentinite. Minor peridotite, gabbro, and diabase. Cherty Mesozoic.</p> <p>Md Gabbro and dark dioritic rocks; chiefly Mesozoic.</p> <p>Ml Undivided granitic rocks.</p> <p>Md Paleozoic and Pennsylvanian granitic rocks in the San Gabriel and Klamath Mountains.</p> <p>Ml Precambrian granite, quartzite, amphibolite, and gabbroic rocks in the San Gabriel Mountains; also various Precambrian plutonic rocks elsewhere in southeastern California.</p>
PALEOZOIC					
PRECAMBRIAN					

SYMBOLS





This map is based on the work of many geologists but has been extended during sorting and by the comments of independent geologists. BULLETIN 201, p. 1. references to all the maps.
 The topographic map is based on the 1970, 1927 North American Albers projection.

GEOLOGIC TIME SCALE

RELATIVE GEOLOGIC TIME			TIME in millions of years before present	TIME OF APPEARANCE OF DIFFERENT FORMS OF LIFE	
Era	Period	Epoch			
Age of Mammals	Quaternary	Holocene	0.011*	Historic record in California, 200 years Post-glacial period	
		Pleistocene	1.5-2	Ice age, evolution of man.	
	Cenozoic	Tertiary	Pliocene	5-7	Age of mammoths.
			Miocene	23-26	Spread of anthropoid apes.
			Oligocene	37-38	Origin of more modern families of mammals, grazing animals.
		Paleocene	Eocene	53-54	Origin of many modern families of mammals, giant mammals.
			Oligocene	53-54	Origin of many modern families of mammals, giant mammals.
			Paleocene	53-54	Origin of many modern families of mammals, giant mammals.
	Age of Reptiles	Mesozoic	Cretaceous	65	Appearance of flowering plants; extinction of dinosaurs at end; appearance of a few modern orders and families of mammals.
			Jurassic	136	Appearance of some modern genera of conifers; origin of mammals and birds; height of dinosaur evolution.
Paleozoic		Triassic	190-195	Dominance of mammal-like reptiles.	
		Permian	225	Appearance of modern insect orders.	
		Carboniferous	280	Dominance of amphibians and of primitive tropical forests which formed cool, earliest reptiles.	
Age of Invertebrates	Paleozoic	Devonian	320	Earliest amphibians.	
		Devonian	345	Earliest seed plants; rise of bony fishes.	
		Silurian	395	Earliest land plants.	
	Cambrian	Ordovician	430-440	Earliest known vertebrates.	
		Cambrian	500	Appearance of most phyla of invertebrates.	
PreCambrian		570	Origin of life; algae, worm burrows.		
		4,500	Estimated age of earth.		

Modified from U.S. Geological Survey, Geologic Names Committee, 1972, and G. Leonard Shubbin, Processes of organic evolution, 1966, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
 * 11,000 years. Zary et al., 1974, U.S. Geological Survey Map MF-585.