DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE CALIFORNIA DIVISION OF MINES AND GEOLOGY

# GEOLOGIC MAP OF THE EMERSON LAKE QUADRANGLE SAN BERNARDINO COUNTY, CALIFORNIA

By

T. W. Dibblee, Jr.

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-490


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TO ACCOMPANY MAP I-490

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## DESCRIPTION OF MAP UNITS*

### CENOZOIC SEDIMENTARY AND VOLCANIC ROCKS

#### Surficial sediments

Undissected, unconsolidated sedimentary fill of valleys and flood plains derived from adjacent high-land areas. In most large valleys, fill presumably about 100 feet thick, gradational downward into the older valley sediments; elsewhere, thinner and unconformable on the older valley sediments and on older formations. Age, very late Pleistocene and Recent. Composed of the following units:

Windblown sand.--Loose fine sand deposited on the alluvium by prevailing westerly winds.

Landslide rubble.--Rock rubble slumped from mountain slope.

Fan gravel.--Gravel of unsorted subangular boulders and cobbles in coarse sandy matrix, derived from Mesozoic rocks of Hidalgo Mountain. Grades downslope into gravel of the alluvium.

Alluvium.--Detrital sediments ranging from cobble-pebble gravel to fine silty sand; mostly granitic pebbly sand.

Clay.--Light-grayish-tan clay of Emerson (dry) Lake and other playa lakes; in places contains micaceous silt; generally alkaline; mud when wet; top surface is level.

#### Older surficial sediments

Valley fill, generally weakly consolidated. Dissected where elevated by regional tilt or local deformation. Maximum exposed thickness about 500 feet; may be thicker in some valleys where covered by surficial sediments; unconformable on pre-Tertiary rocks where base is exposed. Age, presumably Pleistocene, possibly in part late Tertiary. Composed of the following units, all gradational or interwedging:

Older alluvium.--Light-gray, poorly bedded to nonbedded gravel, composed of cobbles that are mostly of granitic rocks but include cobbles of dioritic and gneissic rocks, quartzite, schist, Mesozoic dike rocks, and, in places, a few of Cenozoic basalt and andesite, in matrix of pebbly arkosic sand. In southern part of quadrangle, mostly coarse arkosic sand. As thick as 150 feet. In northeastern part of quadrangle, conformable on the older sand and gravel unit or the older marl and clay unit; elsewhere, unconformable on Tertiary or pre-Tertiary rocks.

Older gravel of volcanic detritus.--Similar to the older alluvium but dark brown and composed chiefly of cobbles and pebbles of Tertiary basalt and andesite in matrix of basaltic and andesitic sand; derived from Bullion Mountains north of quadrangle.

Older fanglomerate and gravel.--Light-gray, poorly bedded to nonbedded, composed of cobbles and pebbles derived largely from pre-Tertiary granitic rocks and dikes and metamorphic rocks, including some of quartzite and gneiss, in matrix of arkosic sand. Conformably overlies the boulder gravel northwest of Quackenbush Lake.

Older marl and clay.--White, poorly bedded marl and some interbedded light-greenish-gray marly clay, exposed east of Hidalgo Mountain. At east border of quadrangle as thick as 150 feet, wedging out westward between the underlying older sand and gravel unit and the overlying older alluvium. Deposited, probably in a lake.

Older sand and gravel.--Light-gray to pinkish-gray, poorly bedded, medium- to fine-grained arkosic sand and lesser amounts of micaceous siltstone and gravel, mostly of granitic pebbles and cobbles. About 200 feet thick east of Hidalgo Mountain; base unexposed.

Boulder gravel.--Gray, massive, composed of unsorted boulders and cobbles, mostly of Mesozoic biotite quartz monzonite but some of dike rocks, in weakly consolidated matrix of granitic sandstone; as thick as 150 feet. Unconformable on the biotite quartz monzonite 2 miles northwest of Quackenbush Lake.

#### Basalt of Ruby Mountain area

Basalt exposed in extreme southwest part of quadrangle. Similar to, and probably correlative with, extensive basalt flow of presumed Pliocene or early Pleistocene age exposed just south of quadrangle; unlike the basalt exposed at northeast corner of quadrangle. Composed of the following units:

*Potassic and sodic-calcic (plagioclase) feldspar content of igneous rocks determined by chemical staining of sawed surface of samples by M. B. Norman.

Basalt flow.--Extrusive flow as thick as 50 feet, unconformable on pre-Tertiary rocks; basalt black, massive, hard, nonvesicular, microcrystalline; composed mainly of basaltic glass, calcic plagioclase and pyroxene, and small amounts of olivine and iron oxides (magnetite?).

Intrusive basalt.--Same as basalt described above, but forms small plugs intrusive into pre-Tertiary rocks.

### Basalt

Basalt exposed at northeast corner of quadrangle and more extensively beyond the quadrangle to the north and northeast in northern Bullion Mountains and in Cady Mountains, where it forms flows in thick assemblage of volcanic and sedimentary rocks of presumed Oligocene or early Miocene age as indicated by stratigraphic position (Dibblee, 1966; Dibblee and Bassett, 1966). Basalt black, massive, finely crystalline, composed of calcic plagioclase, pyroxene, olivine, and minor amounts of iron oxides (magnetite?); weathers to fine black sand. Unconformable on Mesozoic plutonic rocks east of quadrangle.

## MESOZOIC HYPABYSSAL AND PLUTONIC IGNEOUS ROCKS

### Quartz latite dikes

Quartz latite porphyry forms thick dikes (some as thick as 100 feet); rock light-gray, massive (nonfoliated), composed of numerous phenocrysts of quartz, potassic feldspar, sodic plagioclase, and plates of biotite in microcrystalline groundmass. Phenocrysts, as large as 3 mm, make up as much as 60 percent of rock mass. Groundmass composed of same minerals as those that occur as phenocrysts and traces of iron oxides. At outer margins of thick dikes porphyry grades to nearly white, brittle, silicic felsite a few feet thick; felsite similar to ground mass of the porphyry. Thin dikes only a few feet thick are felsite. Dikes cut the quartz monzonite and the gneiss. Age, probably Mesozoic, presumably Cretaceous; possibly Tertiary.

### Quartz pod

Massive milky white quartz, much fractured; forms pod 10 feet by 30 feet in the quartz monzonite near Giant Rock. Age, Mesozoic if formed soon after quartz monzonite was emplaced.

### Quartz monzonite

Gray-white, massive (nongneissoid), generally medium- to coarse-grained crystalline equigranular granitic rock, friable where weathered. Composed of quartz, potassic feldspar (orthoclase), and plagioclase (oligoclase or andesine) in generally equal proportions; about 5 percent biotite (generally as small euhedral plates); a total of less than 2 percent sphene, zircon, and iron oxides; rarely, hornblende. Intrusive into the biotite quartz monzonite, biotite diorite, hornblende diorite or gabbro, and gneiss. Age, Mesozoic, probably Cretaceous; age of sample from locality about 5 miles northwest of southwest corner of quadrangle estimated from lead-alpha ratio in zircon content to be 89 ± m.y. (T. W. Stern, written communication to D. F. Hewett and W. C. Smith, October 2, 1957).

### Dike rocks

Hard, massive (nonfoliated), finely crystalline rocks; form swarm of parallel dikes in Hidalgo Mountain area and scattered dikes elsewhere, generally less than 10 feet thick but some as thick as 70 feet; intrusive into the biotite quartz monzonite and dioritic rocks but not into the quartz monzonite. Age, probably Mesozoic, as indicated by field relationships of similar dike rocks northwest of quadrangle (Dibblee, 1964a, b). Composed of two types:

Felsitic dikes.--White to pale-gray quartz diorite or dacite composed mostly of sodic plagioclase, some potassic feldspar, minor amounts of quartz and biotite; contains a few small phenocrysts of sodic plagioclase, potassic feldspar, and quartz.

Mafic (dioritic to andesitic) dikes.--Gray to nearly black diorite or andesite composed of plagioclase (in places as minute laths), biotite, hornblende(?), and iron oxides; some dikes contain few small phenocrysts of plagioclase.

### Older granitic rocks

Massive (nongneissoid) granitic rocks, mostly quartz monzonite but ranging to granite and quartz diorite in composition. Age, Mesozoic, on the basis of field relations outside of quadrangle (Dibblee, 1964a, b). Composed of the following units:

Quartz monzonite of Emerson Lake area.--Gray-white to gray, hard, resistant, generally medium-grained granitic rock, composed largely of quartz, potassic feldspar, and plagioclase (sodic andesine to albite) either in generally equal proportions or with predominance of potassic feldspar or plagioclase; generally less than 5 percent biotite; a total of less than 1 percent muscovite, sphene, and iron oxides. Near Los Padres mine much of rock inequigranular with aplitic to subpegmatitic texture. In places intrusive into, and in other places gradational into, the biotite quartz monzonite.

Leucocratic quartz diorite.--Nearly white fine-grained granitic rock, weathers gray; composed of quartz and plagioclase (albite and oligoclase-andesine). Intrusive into the biotite quartz monzonite and biotite diorite.

Biotite quartz monzonite.--Gray, hard, resistant, medium-grained, generally porphyritic granitic rock; composed of 10 to 30 percent quartz, 35 to 50 percent plagioclase (andesine), 15 to 30 percent potassic feldspar, 3 to 20 percent biotite, 0 to 5 percent hornblende, and a total of about 1 percent sphene, ziron, and iron oxides. All feldspars are gray in hand specimen. Much of potassic feldspar (orthoclase) occurs as rectangular phenocrysts as long as 2 cm. Biotite occurs mostly as clusters of minute flakes. Locally rock contains few to numerous dark fine-grained biotite-rich inclusions as long as 2 cm; also veinlets of epidote. In some places, especially on Hidalgo Mountain and hills to northwest, rock is bleached white; the feldspars--including orthoclase phenocrysts--having been altered to or replaced by white albite and most of the biotite leached out. Intrusive into the gneiss.

### Dioritic rocks

Massive (nongneissoid) medium- to coarsely crystalline dioritic rocks, occurring as pendants engulfed in the older granitic rocks. Age, probably Mesozoic, possibly in part older. Composed of the following types:

Hornblende diorite or gabbro.--Dark-gray to black, composed mostly of calcic plagioclase (labradorite?) and hornblende in variable proportions; some biotite and very small amounts of iron oxides, chlorite, and epidote.

Biotite diorite.--Dark-gray, composed mostly of calcic plagioclase and biotite; small amounts of hornblende, chlorite, and iron oxides; in some places, as at Goat Mountain, contains small amounts of potassic feldspar and quartz.

## PRECAMBRIAN(?) METAMORPHIC ROCKS

### Gneissic rocks

Generally banded or laminated gneisses with laminae generally undulating, locally contorted; in places lineation formed parallel to plunging axes of minute folds. Metamorphosed, probably from metasedimentary rocks of probable Precambrian or possibly Paleozoic or Mesozoic age. Lithologic units mapped as follows:

Gneiss.--Mostly light-gray, fine- to locally medium- or coarse-grained granitic gneiss composed mainly of quartz, potassic feldspar, and plagioclase (oligoclase?) in generally equal proportions; some mica (mostly biotite), rarely a little hornblende, and traces of iron oxides. Faintly to moderately laminated due to variation in proportions of constituent minerals, with white to light-gray (leucocratic) laminae rich in quartz and feldspars alternating with lesser amounts of dark-gray (melanocratic) laminae rich in biotite.

Gneissic aplite.--Light-gray to buff, faintly banded to massive, fine-grained granitic rock or aplite composed of quartz, potassic feldspar, and sodic plagioclase in generally equal proportions, and less than 2 percent mica (mostly biotite) as minute flakes.

Marble.--White, thick-bedded, medium- to coarsely crystalline marble; forms lens as thick as 250 feet in the gneiss.

## MINES AND PROSPECTS

### Copper-gold

A. Blue Ribbon mine. SW¼ sec. 3, SE¼ sec. 4, T. 4 N., R. 5 E., west of Emerson Lake. Group of narrow quartz stringers that contain small amounts of copper sulfides and gold reportedly in granite porphyry and worked by 100-foot vertical shaft (Wright and others, 1953, tabulated list, p. 4). Only workings seen in 1964 are along Emerson fault, which bounds porphyritic biotite quartz monzonite to southwest; vertical zone 2 to 6 feet wide of white pulverized rock altered to kaolinite along fault, prospected by trenches and shallow pits for half a mile.

B. North Maumee prospects. S½ projected sec. 10, T. 4 N., R. 5 E., west of Emerson Lake. Shear zone containing quartz and very small amounts of iron and copper sulfides in the biotite diorite on west slope of ridge. Prospected by adit, driven southeast 20 feet. Shallow shaft a quarter of a mile southwest in small quartz vein in the quartz monzonite of Emerson Lake area.

C. Maumee prospects. S½ projected sec. 15, T. 4 N., R. 5 E., 2 miles southwest of Emerson Lake. Vertical shear zone from 2 to 5 feet wide striking northwest in biotite diorite contains quartz, some copper and iron sulfides and possibly gold. Prospected by three vertical shafts--one more than 60 feet deep--about 300 feet apart, and by shallow trenches. Shallow shaft in another minor shear zone about a quarter of a mile south and two shafts in a minor shear zone half a mile southeast, all in the biotite diorite. Last active in early 1960's.

D. Prospects. One mile southwest of Emerson Lake. Projected sec. 24, T. 4 N., R. 5 E. Quartz stringer in shear zones, possibly carrying copper and gold, in the biotite diorite and quartz monzonite of Emerson Lake area. Prospected by pits and shallow shaft; long idle.

E. Prospects 2 miles northeast of Means Lake. NE¼ projected sec. 20, T. 4 N., R. 5 E. Blue copper oxides in fracture zone in quartz monzonite of Emerson Lake area near contact with the gneiss. Prospected by shaft 15 feet deep in 1964 by Virgil Oyster.

F. Los Padres mine. Center of projected sec. 36, T. 4 N., R. 5 E., 3 miles south of Emerson Lake. Fractured quartz vein and stringers contain oxides and sulfides of iron and copper that carry gold, some in wire form, in gneiss near contact with the quartz monzonite of Emerson Lake area to northeast. Main vein 2 to 3 feet wide, nearly vertical, strikes northwest. Developed from 150-foot shaft inclined northwest sunk on vein; connects with a drift adit at 50 feet, and a drift at 150 feet off a 700-foot crosscut; drifts at these levels explored vein for 380 feet; high-grade ore reported from upper workings (Wright and others, 1953, tabulated list, p. 46, in part).

G. Crystal mine. SW¼ sec. 22, T. 4 N., R. 6 E., 2 miles southeast of Emerson Lake. Pulverized quartz vein, reportedly containing gold and copper minerals, 2 to 3 feet wide, vertical, strikes north, in nonporphyritic biotite quartz monzonite. Prospected from vertical shaft 140 feet deep; small production reported (Wright and others, 1953, tabulated list, p. 31, in part).

H. Prospect. One mile northeast of Goat Mountain. SE¼ sec. 28, T. 3 N., R. 6 E. Fracture zone with quartz and iron oxides that may carry gold; as wide as 3 feet, strikes southeast in biotite quartz monzonite. Prospect from 20-foot shaft and adit driven southeast 50 feet.

### Radioactive minerals

J, K. Thorium-uranium prospects in Rock Corral area. Projected secs. 4 and 9, T. 2 N., R. 5 E., southwest part of quadrangle. Thorium-bearing allanite, as well as radioactive zircon and monazite, found in small quantities in biotite-rich inclusions in the gneissic rocks and associated older granitic rocks in a few places (Moxham, Walker, and Baumgardner,

1955; Walker, Lovering, and Stephens, 1956, p. 23-24). Occurrences prospected by shallow pits, mostly in S½ sec. 9 in early 1950's, but radioactive minerals not found in commercial quantities. Idle since 1958.

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