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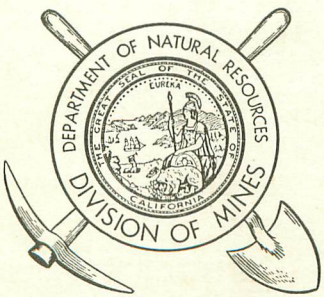


GEOLOGY OF THE PLACERITA OIL FIELD LOS ANGELES COUNTY, CALIFORNIA *

By Gordon B. Oakeshott **

OUTLINE OF REPORT

Illustrations

Tables

* Development in this field has been very rapid during the early part of 1949; information used as a basis for this report is not later than June 1, 1949.

** Associate Geologist, California State Division of Mines. Manuscript submitted for publication July 21, 1949.

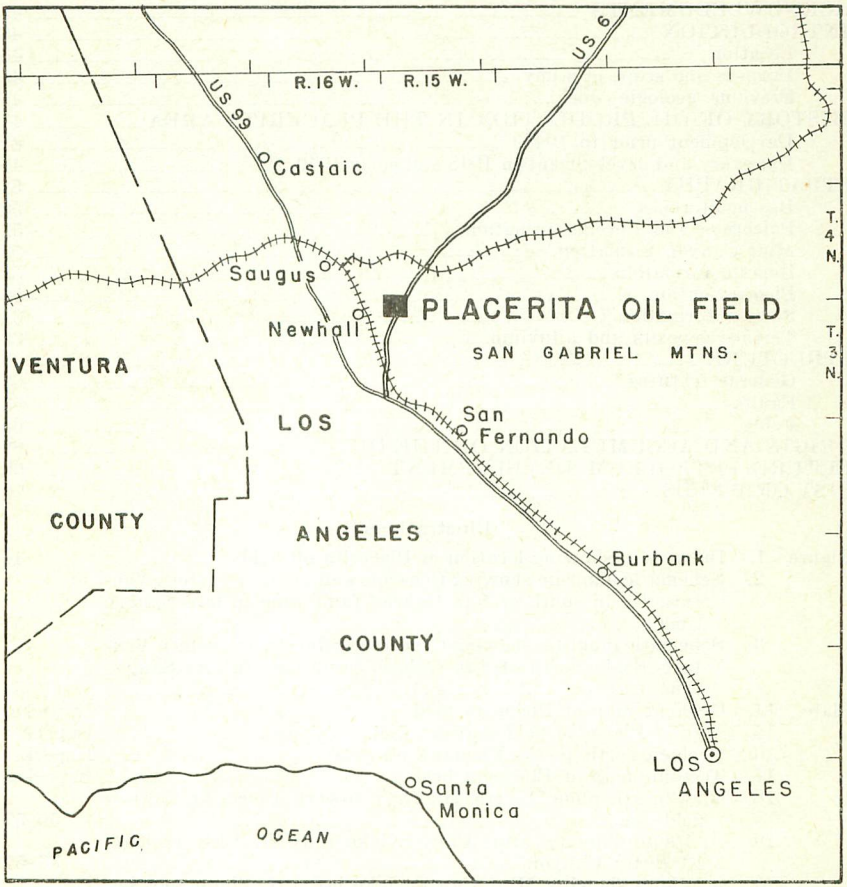


FIGURE 1. Index map showing location of Placerita Oil Field, Los Angeles County, California.

ABSTRACT

Nelson-Phillips Oil Company has been credited with a new field discovery in Placerita Canyon at Sierra Highway (U.S. 6) approximately 2 miles east of Newhall in western Los Angeles County, as a result of successful completion of their well Kraft 1 in the SE¼ sec. 31, T. 4 N., R. 15 W., S.B., in April, 1948. By the end of 1948, 20 wells were completed from locations on both sides of the highway; active development had increased that number to 68 producing wells by early June 1949. Actually, since 1920, a very small production has come from the same structure and horizon in the area less than 1 mile southwest of the new discovery well. The new wells in the discovery area are each producing from a few barrels to more than 100 barrels per day of 11° to 16° gravity oil from depths of 600 to 1600 feet. In January 1949, Ramon Somavia initiated a new development in a northward extension of the field, by bringing in well Juanita 1, a mile north of the Nelson-Phillips well. Wells in the north extension are averaging 550 barrels a day of 22° gravity clean oil from depths of 1300 to 2100 feet.

Geology of the area is complex but consists essentially of Tertiary sediments dipping northwestward off the very much older crystalline rocks of the basement complex which are exposed in the western San Gabriel Mountains as close as 1 mile to the southeast of the producing wells. The area is at the eastern end of the Cenozoic Ventura basin. Formations exposed, in the area mapped, include upper Miocene Mint Canyon, the Elsmere and Repetto siltstone members of the lower Pliocene Repetto formation, middle Pliocene lower Pico beds, marine beds of the upper Pliocene upper Pico member of the Pico formation, continental beds of upper Pliocene age, herein named the "Sunshine Ranch" member of the Pico formation, the lower Pleistocene Saugus formation, two stages of upper Pleistocene terrace gravels, and Recent alluvium.

The northwest-trending San Gabriel fault, with its branches, dominates local structure. A number of minor asymmetrical anticlines and synclines roughly parallel the fault and strike at low angles into it. Both folding and faulting had begun at least as early as upper Miocene time and continued into Recent time, but the major periods of such activity were post-Mint Canyon-pre-Elsmere, and post-Saugus-pre-older Terrace.

Wells producing June 1, 1949 were distributed in two principal groups: one, along or near the principal northeast-trending axis of the Placerita anticline and north to the middle of sec. 31, T. 4 N., R. 15 W., S.B.; a second, around the center of the north boundary line of sec. 31. In the first, oil production is coming from some 200 feet, more or less (including barren zones in between oil sands), of coarse to fine oil sands, of the Sunshine Ranch and upper Pico members of the upper Pliocene Pico formation; average production per well is 47 barrels per day of 11° to 16° gravity oil. Production in the north extension of the field is from the upper Pico formation also, but some of the wells are flowing and average 550 barrels per day of 21° to 23° gravity clean oil. About 430 acres were proven by June 1, 1949, and rather definite boundaries of the field were established.

Major structural features conditioning the accumulation of the oil are the westward-plunging Placerita nose and the San Gabriel fault and folds associated with it. Stratigraphically, up-dip lensing, crossbedding, and minor unconformities assisted in the formation of traps for oil. Source rocks may be found in nearby organic shales of Eocene, Miocene, and Pliocene ages.

Successful wells in this region appear extremely unlikely north of the San Gabriel fault zone where the continental upper Miocene Mint Canyon formation is widely exposed, and unlikely east of a north-south line marked by the Whitney fault. Some production may be obtained farther down dip to the west and southwest, but some recent dry holes in those areas minimize this prospect.

Successful development of this small shallow oil field directs attention to the fact that any semblance of favorable structure involving marine Tertiary beds dipping off basement rocks in southern California is worth exploration by shallow wells drilled to the basement.

ACKNOWLEDGMENTS

The writer is indebted to Dr. H. R. Gale for assistance in identifying Pliocene fossils; to Dr. John C. Hazzard for the results of his work on the Sunshine Ranch formation, and to the Union Oil Company for release of the latter. Dr. W. S. W. Kew and the Standard Oil Company furnished

data on the Standard Placerita fee wells, and Mr. H. D. Hobson furnished data on General Petroleum Corporation's well Castruccio No. 1. Dr. G. D. Hanna and Dr. Leo Hertlein made some helpful observations on the fossils and Dr. Richard Jahns was helpful in discussion of eastern Ventura basin problems. The State Division of Oil and Gas furnished a map showing well locations and also some data on dates of well completions and abandonment.

INTRODUCTION

Location

The new Placerita oil field extends from Placerita Canyon, at Sierra Highway, about a mile north and a mile west, 2 miles due east of Newhall in western Los Angeles County, at the western end of the San Gabriel Mountain range. The 68 producing wells, plus the 22 being drilled on June 1, 1949, are located in sec. 31, T. 4 N., R. 15 W., S.B., and adjacent borders of the sections north, south, and west. The field is approximately 1 mile north of the old Whitney Canyon area, abandoned since 1937; 1½ miles north of Elsmere area, which still has a few small wells pumping; and 2½ miles due west of the old Placerita Canyon schist area which produced a little high-gravity oil from basement rocks several years ago. A number of the wells are located on the flat floor of Placerita Canyon, others are on the adjacent low hills. Both the Placerita Canyon Road and Sierra Highway are paved and offer easy access to the field.

Purpose and Scope of Study

The Placerita field is in a part of Los Angeles County of considerable interest to petroleum producers; the shallow depth of oil sands, low cost of wells, and ease of transportation are attractive to both small and large operators. Principal interest in the region, however, attaches to the fact that commercial production is being obtained from a poorly defined, faulted structural nose, with the producing sands exposed nearby, and dipping off basement schists and granitic rocks which are exposed a mile from the field. The occurrence emphasizes possibilities in other similar situations.

Over a period of years the writer has been mapping the San Fernando quadrangle on 1:24000-scale topographic sheets and on photographs of the same scale. Field work has progressed from the east, so that the approach to the Placerita area has been from east to west in those portions of the Ventura and Los Angeles basins that are included in that quadrangle. Although much geological work has been done in the region, comparatively little of it has been published. Conclusions in the report are based mainly on surface geology, as the writer has had only limited access to well data.

Previous Geologic Work

It is not appropriate to the purpose of this report to review all published work bearing on the general area discussed, but mention will be made of the principal published accounts directly referring to some part of the area shown on the accompanying geologic map.

Basic geology of the region was worked by Kew [1] whose paper on the geology and oil resources included a geologic map on the scale

[1] Kew, W. S. W., Geology and oil resources of part of Los Angeles and Ventura Counties, California: U. S. Geol. Survey Bull. 753, 197 pp., 1924.

1:62500. Later he was co-author with Brown [2] of a paper dealing with the occurrence of oil in basement rocks in the old Placerita schist area, just 2½ miles due east, or upstream from the discovery well in the new Placerita field. The report is accompanied by a geologic map on a scale of approximately 1:24000, which extends into the eastern border of the geologic map of the present report. Kew [3] was also author of a paper on the Newhall oil field, including a brief discussion of the Elsmere Canyon, Whitney Canyon, and Placerita Canyon areas as known in 1942. Miller [4] published a paper and geologic map of the western San Gabriel Mountains but did not differentiate the Tertiary sedimentary rocks. Grant and Gale [5] made significant contributions to the stratigraphy and paleontology of the marine Pliocene of the region. Jahns' [6] study of the stratigraphic problems of the eastern Ventura basin has important bearing on the geology of the area mapped north of the San Gabriel fault, but his published map on a scale of approximately 1:62500 did not extend quite as far south as the area mapped for this paper. The history of oil developments of the Elsmere-Whitney-Placerita areas, up to 1934, was covered by Walling.[7]

HISTORY OF OIL PRODUCTION IN THE PLACERITA AREA

Development Prior to 1948 [8]

The first well drilled within the limits of the Placerita oil field (pl. 15) was Equity Oil Company, Daisy 1, completed in 1920 at a depth of 975 feet. It produced a little very heavy oil. The well has since been known as "Nile 1" and "York 1," and is now the Guiberson Oil Company York 1. It was deepened in 1921 to 1394 feet, and late in 1925 produced an average of 6 barrels per day of 14° gravity oil, used for fuel. Altogether, four wells were drilled between 1920 and 1933; maximum depth was 1563 feet, and production was 6 to 19 barrels per day. Walling [9] says "The wells are drilled into and secure their production from the cross-bedded, poorly assorted sediments of the Saugus formation. Water sands are found in immediate contact with the oil sands and their identification and exclusion has been difficult." Apparently the water difficulties, in addition to low gravity oil and small production, were major factors in the failure to develop the field until rediscovery in 1948. The four wells, shown as Guiberson Oil Company York 1, 2, 3, and 4 on plate 15, were producing an average of 8.9 barrels per day of 11.8° oil and 18.8 percent water, in April 1935. York 1, 2, and 3 are very close to

[2] Brown, Arthur B., and Kew, W. S. W., Occurrence of oil in metamorphic rocks of the San Gabriel Mountains, Los Angeles County, California: Am. Assoc. Petroleum Geologists Bull., vol. 16, pp. 777-785, 1932.

[3] Kew, W. S. W., Newhall oil field: California Div. Mines Bull. 118, pp. 412-416, 1943.

[4] Miller, W. J., Geology of the western San Gabriel Mountains of California: Univ. California Los Angeles, Pub. Math., Phys. Sci., vol. 1, no. 1, 114 pp., 1934.

[5] Grant, U. S. IV, and Gale, H. R., Catalogue of the marine Pliocene and Pleistocene mollusca of California: San Diego Soc. Nat. History Mem., vol. 1, 1036 pp., 1931.

[6] Jahns, Richard H., Stratigraphy of the easternmost Ventura basin, California, with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation: Carnegie Inst. Washington Pub. 514, pp. 145-194, June 1940.

[7] Walling, Rolla W., Report on Newhall oil field: Summary of operations, California oil fields, State Div. Oil and Gas, vol. 20, no. 2, pp. 50-58, 1934.

[8] Walling, R. W., op. cit., Elsmere area, pp. 38-43, Whitney Canyon area, pp. 43-46, Placerita Canyon area, pp. 46-50.

[9] Op. cit.

the prolonged axis of the Placerita anticline, and York 4 is about 1000 feet down the flank to the northwest.

The Elsmere Canyon field, 1½ miles south-southwest of Placerita Canyon, discovered in 1889 by Pacific Coast Oil Company (later Standard Oil), is on a separate structure. Thirty-three wells were drilled in the field. Six were producing in 1942. They were less than 840 feet deep, averaged 2 barrels per day of 14° to 16° oil, and 75 percent water; a few were still pumping in June 1949. Kew [10] says of the field: "Oil has accumulated in west-dipping beds against a fault which trends in a northwesterly direction along Elsmere Canyon. No production has been found north of the fault. The rocks exposed at the surface are a part of the Pico formation, probably the lower part, and rest unconformably upon rocks of middle Eocene age." Numerous tar seeps and extensive exposures of tar sands in Whitney Canyon, Elsmere Canyon and vicinity encouraged early exploration for oil in these areas.

The Whitney Canyon [11] field has been developed by small companies since 1893 but all wells were idle or abandoned by 1937. The wells were less than 1,500 feet deep and produced less than 25 barrels per day of 14° oil from Pliocene beds and 30° oil from the underlying Eocene. Kew [12] indicates "The oil here was accumulated on a northwestward-dipping series of Saugus beds (uppermost Pliocene and Pleistocene) and a thin section of Pico formation (Pliocene) overlying unconformably the middle Eocene. In the Whitney Canyon area a north-trending fault lies a short distance east of the wells." Kew believes it "possible that the oil has migrated into the Pliocene beds from the underlying Eocene, or lenticularity of the beds has been the controlling factor." Oil was produced from all three formations.

A very small amount of light oil was produced from the basement rocks in upper Placerita Canyon 2½ miles east of the new Placerita field, an occurrence discussed by Brown and Kew.[13] For a time, the wells averaged about a barrel per day of 26° to 38° gravity white oil. Brown and Kew believed that the oil migrated from Eocene strata underlying the Saugus in the San Gabriel fault zone, into the crystalline rocks. Their geologic map, on a scale of 1:24000, is just east of the geologic map included with the present report. The crystalline rock exposed in the vicinity of the wells and immediately south of the Placerita fault consists of Rubio diorite gneiss and fragments of the Placerita metasedimentary series. The wells have not produced for many years.

Discovery and Development in 1948 and Early 1949

In late April of 1948 Nelson-Phillips Oil Company brought in Kraft 1 in Placerita Canyon near the south central boundary of sec. 31, T. 4 N., R. 15 W., S.B., initiating development of a "new" field. The well is approximately 4000 feet northeast of York 1 and higher on the same structure. It came in flowing an estimated 70 to 100 barrels per day, later settling down to pump 60 barrels a day of 15.6° oil. The well was drilled by Shamrock Drilling Company to a total depth of 2242 feet and

[10] Kew, W. S. W., Newhall oil field: California Div. Mines Bull. 118, p. 415, 1943.
[11] Kew, W. S. W., op. cit., p. 415.
[12] Op. cit., p. 415.
[13] Brown, Arthur B., and Kew, W. S. W., Occurrence of oil in metamorphic rocks of San Gabriel Mountains, Los Angeles County, California: Am. Assoc. Petroleum Geologists Bull., vol. 16, pp. 777-785, 1932.

plugged back to 717 feet; about 130 feet of oil sand was opened to production; 7-inch casing was perforated between 580 and 717 feet. In June, Kraft 2, 400 feet southwest of the discovery well, was successfully brought in by the company, flowing 80 barrels a day of 16.0° oil, water cut 1 percent, from a total depth of 782 feet. Nelson-Phillips Swall-Ferrier 1, 600 feet due east of Kraft 1, was abandoned, in the same month, as a dry hole after producing salt water only from a total depth of 502 feet. Swall-Ferrier 2 and 3 were also abandoned.

Crawford and Hiles Oil Company brought in their first successful well in the field, Newhall 1, in July 1948, for 15 barrels per day of 8.8° gravity oil; total depth of the well was 946 feet.

Standard Oil Company became a producer in the new field when Placerita 1 was brought in during July 1948 for 21 barrels per day of 12.9° gravity oil; total depth was 820 feet. Late in December, Standard had completed six small wells; Placerita 6 produced 24 barrels per day of 15.5° gravity oil; its total depth was 650 feet.

Parbe Oil Company entered production in August with completion of its Philbert Community 3-1, which pumped an estimated 57 barrels per day; its total depth was 1205 feet. Indian Oil Company Wanda Kraft 1 and 2 and Placerita 1 were successfull shallow wells.

By the end of 1948 there were 20 shallow wells producing an average of approximately 40 barrels per day of 11° to 16° gravity oil. Production extended about half a mile on each side of Sierra Highway. The wells were roughly grouped along the flexure on the Placerita nose, here called the Placerita anticline.

In January 1949 Ramon Somavia brought in Juanita 1 flowing 340 barrels per day of 22.4° gravity oil cutting 3 percent water. Bottom of the producing zone is at 1830 feet. Location of the well is near the north border of sec. 31, T. 4 N., R. 15 W., S.B., approximately a mile north of Nelson-Phillips Kraft 1. Additional wells in the vicinity were drilled in rapid succession by Somavia, Rothschild Oil Company, Gordon Oil Company, Trical Oil Company, and Independent Exploration Company. Independent Exploration Company's Newhall Royal Community 1 was completed in early June 1949 for 725 barrels per day of 23° gravity oil, producing from about 100 feet of oil sand; its total depth was 2037 feet. This well, in sec. 30, T. 4 N., R. 15 W., S.B., just north of the south border of that section and a few hundred feet south of the San Gabriel fault, represents the most northerly production in the field to the early part of June 1949. Ten wells in this north extension of the Placerita field were averaging 550 barrels per day of 22° gravity clean oil from depths of 1300 to 2100 feet at that time.

Production in the original southern portion of the field was from 58 wells averaging 47 barrels a day of 14° gravity oil from depths of 600 to 1600 feet.

The northern and southern sections were separated by 1000 feet of untested land.

On June 1, 1949, the Placerita field had 68 producing wells, 22 wells drilling, and 23 abandoned as dry holes. There were 14 operators of producing wells and an estimated 430 acres had been proven.

Table 1. Summary of exposed rock formations.

Age	Formation or member	Description	Maximum thickness in area mapped (feet)	Economic interest
Recent	Alluvium	Stream sands and gravels of Placerita Canyon and Santa Clara River.	100+	Water supply. Gold in Placerita Canyon.
	Unconformity			
Upper Pleistocene	Later terrace deposits	Elevated, but unfolded, older alluvium, terrace gravels, and fanglomerate.	175+	Gold in Placerita Canyon.
	Older terrace deposits	Similar to later terrace, but affected by folding and faulting.	500	None recognized.
	Major unconformity			
Lower Pleistocene	Saugus formation	Continental sands and gravels; little consolidated; usually light colors of gray, white, or buff.	2000±	Basal beds may contain petroleum.
	Local unconformity			
Upper Pliocene	Sunshine Ranch member	Continental and brackish water conglomerate, greenish sandstone and mudstone; thin fresh-water limestone beds; red beds.	1300	Basal beds include oil sands of Placerita field.
	Local unconformity			
	Pico formation: Upper Pico member	Marine coarse to fine sandstone; fossiliferous uppermost Pliocene (probably Santa Barbara zone).	1000	Upper beds include oil sands of Placerita field.
Middle Pliocene	Pico formation: Lower Pico member	Marine sandstone and conglomerate; massive fine sandstone and siltstone; fossiliferous calcareous sandstone beds (San Diego fauna).	700	Oil sand in many outcrops; oil seeps.

		Unconformity		
Lower Pliocene	Repetto formation	Repetto siltstone member	Marine brown and gray siltstone and fine sandstone; some brown conglomerate.	300	Some oil sand and seeps in exposures.
		Elsmere member	Marine fossiliferous coarse sandstone and conglomerate; interbedded fine sandstone. Only the continental N.E. extension of these beds in the area mapped.	100+	Much oil sand and many seeps south of area mapped.
		Major unconformity			
Upper Miocene		Mint Canyon	Continental coarse gray and buff sandstone and conglomerate; brown and greenish sandstone; greenish mudstone, thin red sandstone and claystone; white tuff beds; lake beds common.	2400+	None recognized.
		Unconformity?			
Eocene		Domengine and Martinez (?)	Well-indurated shale, sandstone, conglomerate	?	Reservoir for light oil in nearby fields; may have been important source rock.
		Major unconformity			
Pre-Tertiary		Granitic rocks; Rubio diorite gneiss; Placerita series.	Irregular remnants of Placerita crystalline limestone and other metasedimentary rocks (Paleozoic?) intruded by Rubio diorite gneiss (late Paleozoic?) and both intruded by granitic rocks (upper Jurassic?).	?	Reservoir rock for a little light oil in Placerita schist area. Some Placerita crystalline limestone has been quarried in the Little Tujunga quadrangle adjoining the Sylmar quadrangle on the east. Large quantities of Upper Jurassic (?) granodiorite for dam construction quarried in the same quadrangle.

STRATIGRAPHY

Basement Rocks

A series of metamorphic and intrusive granitic rocks of pre-Tertiary age is widely exposed throughout the western San Gabriel Mountains and crops out within a mile of the southeast border of the new oil field. The oldest group is the Placerita series, consisting of scattered remnants of once-extensive and thick limestone, dolomite, shale, and sandstone, metamorphosed to marble, schist, and quartzite. The Placerita metasedimentary rocks were intruded by the Rubio diorite, mostly coarsely banded hornblende and biotite diorite gneiss. These two formations were mapped, named, and described by Miller [14] and were later mapped on a larger scale in a section across the western San Gabriel Mountains by Oakeshott.[15] The Placerita and Rubio formations have been irregularly intruded by the very much later granitic plutonic rocks, which probably average a granodiorite in composition. The plutonic rocks exposed nearest the Placerita field include chiefly pinkish, gray and light brown biotite granite and granodiorite. The ages tentatively assigned are Paleozoic (?) for Placerita and Rubio, and Upper Jurassic (?) for the granitic series.

Shattered basement rock in the San Gabriel fault zone in upper Placerita Canyon has been reported as the reservoir rock for a light oil, probably derived from an Eocene source.[16]

Paleocene and Eocene Formations

Kew [17] first recognized a hard sandstone exposed in Elsmere Canyon as Domengine and later Brown and Kew [18] called attention to "hard sand and conglomerate of probable Eocene age" cored in a Placerita well in sec. 31, T. 4 N., R. 15 W., S.B. An exposure of lower Pliocene Elsmere sandstone lying unconformably on middle Eocene Domengine gray pebbly sandstone may be seen in a branch of upper Elsmere Canyon 2 miles south of Placerita Canyon. The Elsmere strikes N. 70° E. and dips 10° N.; the Domengine strikes N. 20° W. and dips 35° W. Nelson-Phillips Oil Company discovery well, Kraft 1, in the southeast quarter of that section, bottomed in hard shale at 2242 feet, which is probably Eocene, but found it barren and plugged back to 717 feet to obtain production from the Sunshine Ranch-upper Pico. Dr. Kew [19] has informed the writer that Standard Placerita 3 cored steeply dipping Eocene shale at 1050 feet; no Eocene production was obtained.

Brecciated hard conglomerate and sandstone of the Paleocene Martinez formation crops out in slivers along the San Gabriel fault zone approximately 5½ miles east-southeast of Kraft 1.[20] Eocene rocks encoun-

[14] Miller, W. J., Geology of the western San Gabriel Mountains of California: Univ. California Los Angeles, Pub. Math. Phys. Sci., vol. 1, no. 1, 114 pp., 1934.

[15] Oakeshott, Gordon B., Geology and mineral deposits of the western San Gabriel Mountains, Los Angeles County: California Jour. Mines and Geology, vol. 33, pp. 215-249, 1937.

[16] Brown, Arthur B., and Kew, W. S. W., Occurrence of oil in metamorphic rocks of San Gabriel Mountains, Los Angeles County, California: Am. Assoc. Petroleum Geologists Bull., vol. 16, pp. 777-782, 1932.

[17] Kew, W. S. W., Paper read before Geology and Paleontology Club, California Inst. Technology, March 31, 1931.

[18] Brown and Kew, op. cit., p. 780.

[19] Written communication.

[20] Clements, Thomas, and Oakeshott, Gordon B., Lower Eocene (Martinez) of the San Gabriel Mountains, southern California (abstract): Geol. Soc. America, Proc. 1934, p. 310, June 1935.

tered in wells in Elsinore and Whitney Canyons, have yielded higher gravity oil than that from the Pliocene formations. Eocene formations may be a rather important source of petroleum, as well as a reservoir, in the region of the Newhall field. They are widely distributed north and west of the crystalline basement rocks of the western San Gabriel Mountains.

Mint Canyon Formation

The Mint Canyon formation, exposed north of the San Gabriel fault in the area mapped, and widely distributed for several miles to the north and northeast, has been mapped and described in some detail by Jahns.[21] Numerous other workers have attacked its problems, particularly students of the California Institute of Technology and the University of Southern California, and petroleum geologists. The formation is entirely of continental origin and consists of conglomerate; coarse- to fine-grained gray, buff, and greenish sandstones; red beds; fine lake sediments including clays, mudstones, and siltstones; and thin beds of tuff at various horizons. In the area mapped the formation is more than 2400 feet thick. Just north of this area Jahns [22] has measured a thickness of 4044 feet across Puckett Mesa. He believes it to be upper Miocene in age, as it lies unconformably on the lower Miocene Tick Canyon and Vasquez formations and unconformably below upper Miocene Modelo beds.

A marked angular unconformity between fossiliferous Modelo sandstone and shale and Mint Canyon sandstone and conglomerate is exposed on the south slopes of Reynier Canyon near the center of the south line of sec. 35, T. 4 N., R. 15 W., S.B., 4 miles due east of the crossing of Sierra Highway at Placerita Canyon. According to petroleum geologists,[23] the Modelo in question has yielded foraminifera of Delmontian age. Consequently the Modelo-Mint Canyon unconformity in this locality may belong just below the Delmontian stage of upper Miocene time. Dibblee [24] has recognized and named the Rafaelan orogeny of similar age in the Los Alamos trough and San Rafael Mountains northeast of Santa Maria, Santa Barbara County.

In the Placerita area, the Modelo includes gray and brownish conglomerate beds, well-stratified thin pebbly sandstone, dark greenish sandstone and mudstone, thin brown calcareous beds, clay shales, and beds of white vitreous tuff. At fossil localities, noted on the geologic map, numerous small gastropods were found which Dr. G. D. Hanna indicated were fresh-water forms including *Amnicola*. On the Sierra Highway at the north boundary of the Sylmar quadrangle, the gastropods were found in brown shales, interbedded with light-brown sandstone and a tuff bed 1 foot thick; on that highway 3400 feet NE. of the previous locality, in greenish mudstone interbedded with brown shale and conglomerate; and 3000 feet due west of the last named, in a gray-brown medium-grained calcareous sandstone bed containing abundant carbon fragments. This section of the Mint Canyon appears to be of lacustrine origin.

Detailed mapping in this area, and in other parts of the San Fernando quadrangle, shows that the Mint Canyon formation does not crop

[21] Jahns, Richard H., Stratigraphy of the easternmost Ventura basin, California, with a description of a new lower Miocene mammalian fauna from the Tick Canyon formation: Carnegie Inst. Washington Pub. 514, pp. 147-194, 1940.
[22] Op. cit.
[23] Oral communications, sources confidential.
[24] Dibblee, T. W., Jr., Geology of southwestern Santa Barbara County, California: California Div. Mines Bull. 150, 1949 (in press).

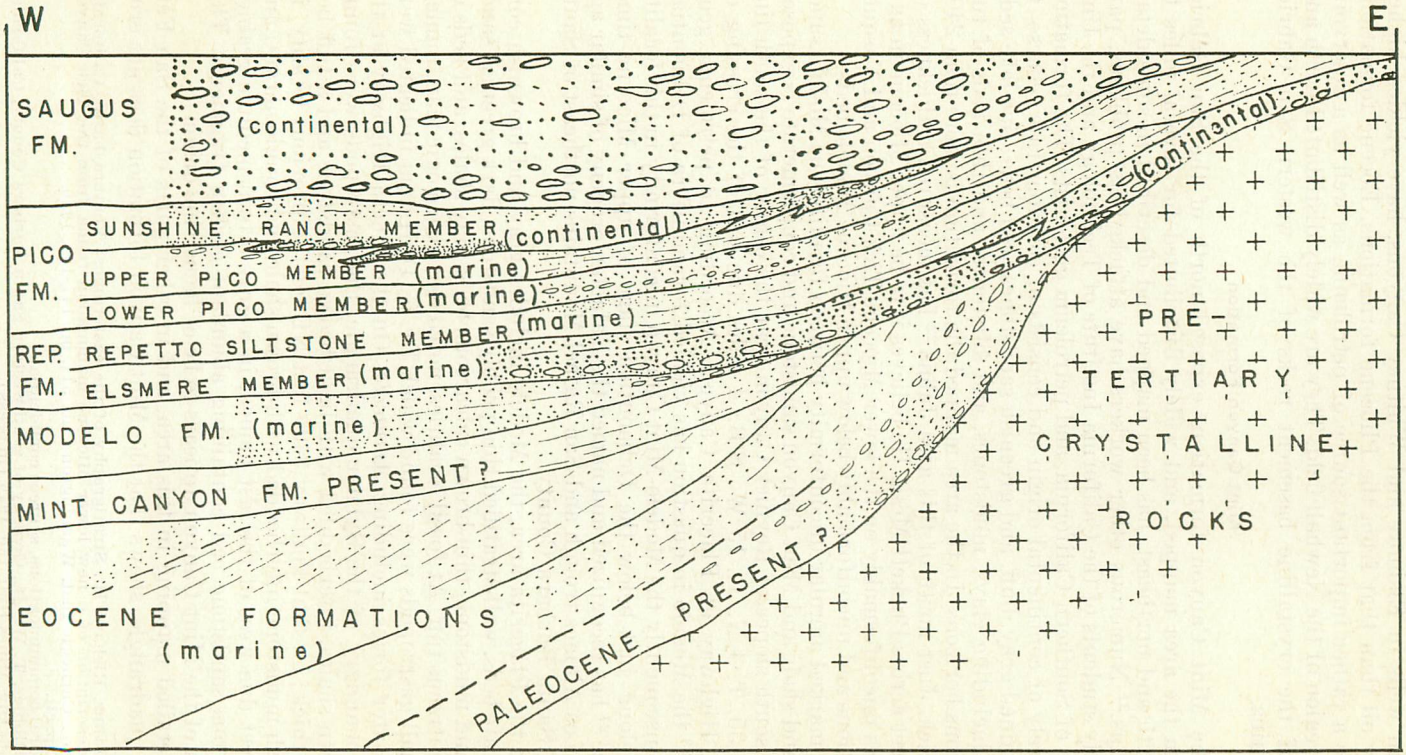


FIGURE 2. Schematic diagram showing Cenozoic sediments in eastern Ventura Basin south of San Gabriel fault zone in late Saugus time. Section about three miles long. Not to scale.

out south of the San Gabriel fault. However, it may be present at depth west of the Placerita field.

Repetto Formation

The name Repetto formation is here used for the lower Pliocene sedimentary rocks, including the basal Elsmere member and the Repetto siltstone member.

Elsmere Member. The Elsmere member of the lower Pliocene Repetto formation is best exposed in the type locality in Elsmere Canyon, and to the south and east around the western border of the San Gabriel Mountains. It has yielded a rich basal Pliocene (Jacalitos) fauna fully described by Grant and Gale.[25] It consists of coarse marine sandstone, conglomerate, siltstone and mudstone, commonly oil-saturated, and dips off the crystalline basement rocks on which it lies unconformably. Contact with Eocene beds in upper Elsmere Canyon is unconformable.

Northward from the Elsmere Canyon region, along the Elsmere-crystalline-rock contact, fossiliferous marine basal Elsmere loses its fossils and appears to grade into coarse conglomerate and sandstone of continental origin. In the same direction, it is overlapped by marine beds containing a middle Pliocene San Diego fauna (Grant and Gale locality 201).[26]

Repetto Siltstone Member. The Repetto siltstone member of the lower Pliocene Repetto formation is exposed in two small areas north of the San Gabriel fault. It consists of gray and chocolate-brown shale, siltstone, mudstone, and thin-bedded calcareous sandstone. Grant and Gale [27] (locality 232) found a lower Pliocene molluscan fauna in the northeast corner of sec. 32, T. 4 N., R. 15 W., S.B. There a well-marked angular unconformity between Repetto siltstone and Mint Canyon lake beds, the latter including a prominent white tuff bed, is well-exposed. In the same region Sunshine Ranch sandstone and conglomerate unconformably overlies the Repetto with clear angular discordance. Repetto siltstone beds, immediately above the lower unconformity, contain a lower Pliocene fauna described by Grant and Gale [28] from their locality 232.

The second area of Repetto siltstone is best exposed along the Southern Pacific railroad about a quarter of a mile southeast of Honby School. Similar lithology and similar fossil molluscs make it appear probable that the exposure should be correlated with that previously mentioned. In this instance the Repetto-Mint Canyon contact is not well exposed but attitudes in both formations are such that no large angular discordance seems likely. The Sunshine Ranch beds lie unconformably on the Repetto with markedly lower dips, and overlap onto the Mint Canyon a third of a mile south of the railroad.

The age relationship between the Elsmere and Repetto siltstone members of the Repetto formation is not certain. The term "Repetto formation" is applied to all lower Pliocene beds; "Elsmere member"

[25] Grant, U. S. IV., and Gale, H. R., Pliocene and Pleistocene mollusca of California: San Diego Soc. Nat. History Mem., vol. 1, 1931.
[26] Op. cit., p. 33.
[27] Op. cit.
[28] Grant, U. S., IV, and Gale, H. R., Pliocene and Pleistocene mollusca of California: San Diego Soc. Nat. History Mem., vol. 1, p. 104, 1931.

is used for lower Pliocene beds including the typical Elsmere fauna as described by Grant and Gale; and "Repetto siltstone" is used for the siltstone and fine sandstone beds of lower Pliocene age. The two members may be contemporaneous, in part, although from mapping farther south, the writer believes that the siltstone member probably overlies Elsmere.

Pico Formation

The term "Pico formation", in accordance with present common usage, is here applied to members of middle and upper Pliocene age. Three members are recognized: lower Pico marine middle Pliocene, upper Pico marine upper Pliocene, and the continental upper Pliocene Sunshine Ranch member.

Lower Pico Member. The Lower Pico member, which in the area mapped reaches a maximum thickness of 700 feet, appears south of the Placerita fault where it dips generally northwest off the pre-Tertiary crystalline rocks. A sliver of steeply dipping brownish sandstone and conglomerate in the San Gabriel fault zone is tentatively correlated with it; no middle Pliocene has been recognized north of that fault. The middle Pliocene beds include white pebble conglomerate, coarse sandstone with fine sandstone lenses, and thin brown siltstone beds, very much crossbedded and irregularly impregnated with petroleum. Live tar seeps occur just west of the Whitney fault 4000 feet due south of Whitney Canyon at the base of a boulder conglomerate which lies on Repetto siltstone and fine brown sandstone.

Lower Pico shows no marked angular discordance with the underlying Elsmere member but gradually overlaps the latter and lies directly on the crystalline rocks at Whitney Canyon and north. The Lower Pico is overlain by Upper Pico at Placerita Canyon and by Saugus and Sunshine Ranch beds south of Placerita Canyon, but mapping from the south strongly suggests the Lower Pico member never extended much farther north but probably thinned to the Lower Pico shoreline not far from the San Gabriel fault zone. Lower Pico in the vicinity of Placerita Canyon and north may well be partly continental in origin.

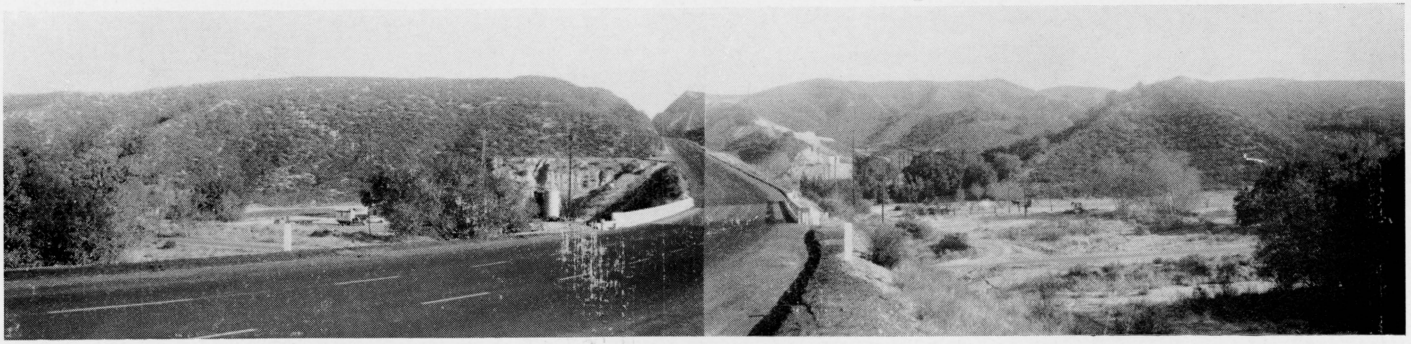
Grant and Gale [29] fossil locality 201 is not far from the base of the Lower Pico member 2800 feet south of Whitney Canyon. They say of that locality: [30]

"The most easterly occurrence of the middle Pliocene faunal zone may be at locality 201 S.D.S.N.H. in the upper horizon at Elsmere Canyon. Here the section is very thin, probably near the apex of the marine Pliocene wedge, and the upper and lower littoral zones are separated by only 200 or 300 feet of oil-stained shaly sandstone . . . The fauna at locality 201 is poorly preserved and fragmentary; but it contains several fragments of *Pecten estrellanus* variety *cerrosensis,* and as its stratigraphic position corresponds to that of other occurrences of the middle Pliocene fossiliferous horizon, it is here assigned tentatively to the upper littoral zone. A small *Ficus* also occurs at this locality; but it is not well enough preserved to show whether it is a typical Ficus or a *Trophosycon* that had survived a short time after the sea had begun to retreat, living on there into the middle Pliocene as other individuals of the same species did at San Diego. It is, of course, possible that this

[29] Grant, U. S., IV, and Gale, H. R., Pliocene and Pleistocene mollusca of California: San Diego Soc. Nat. History Mem., vol. 1, 1931.

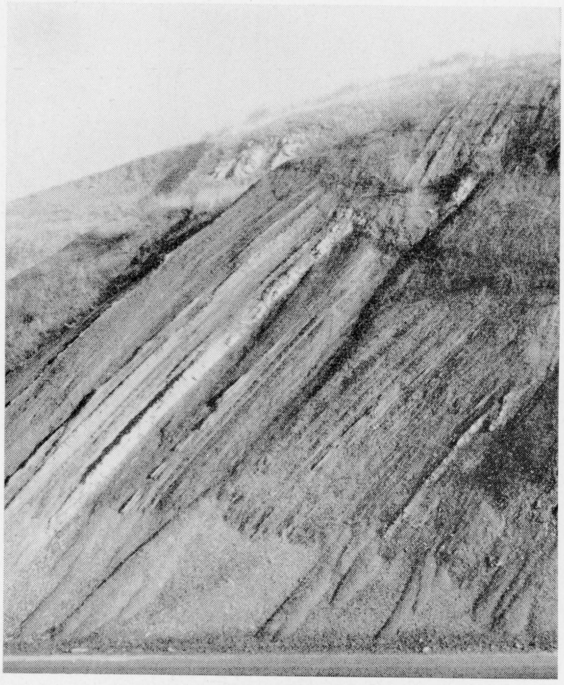
[30] Op. cit., p. 33, and diagram B (p. 31).

5—12900B



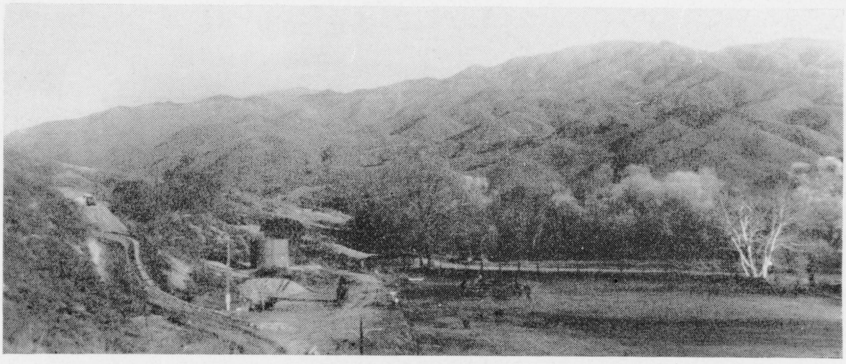
VIEW NORTH ALONG SIERRA HIGHWAY TOWARD PLACERITA
CANYON FIELD, NOVEMBER 1948

The main ridge is made up of gently westward-dipping older terrace gravels. The underlying Saugus coarse sands and gravels are best exposed in the highway cuts and cuts made for well and tank locations.



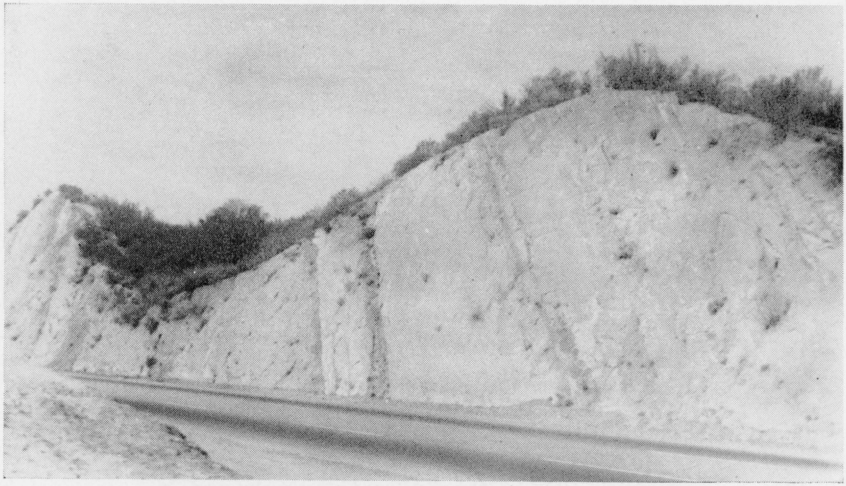
A, MINT CANYON LAKE BEDS

Beds include 8-inch layer of white tuff. This cut is on southeast side of Sierra Highway at boundary of Sylmar and Humphreys quadrangles.



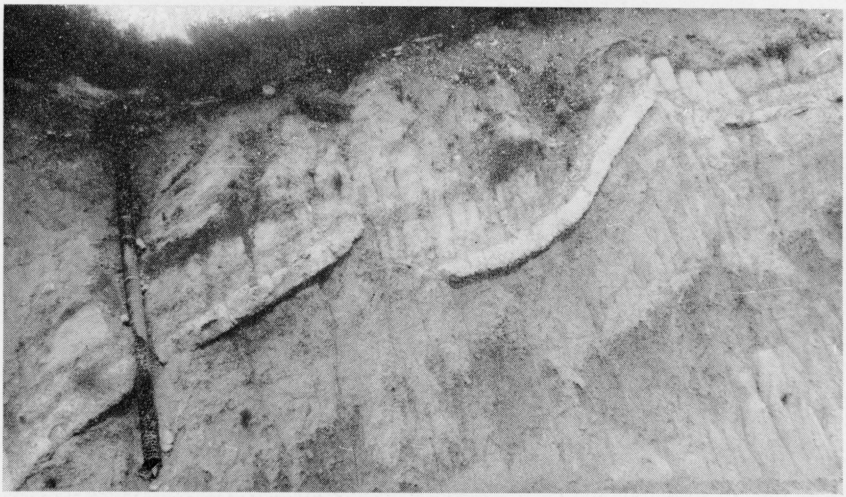
B, VIEW EAST UP PLACERITA CANYON FROM BRIGE ON SIERRA HIGHWAY

Standard well Placerita No. 6 is on the far left. Saugus beds, underlain by lower Pico, dip toward the camera in the low foothills; the higher hills in the background are pre-Tertiary crystalline rocks.



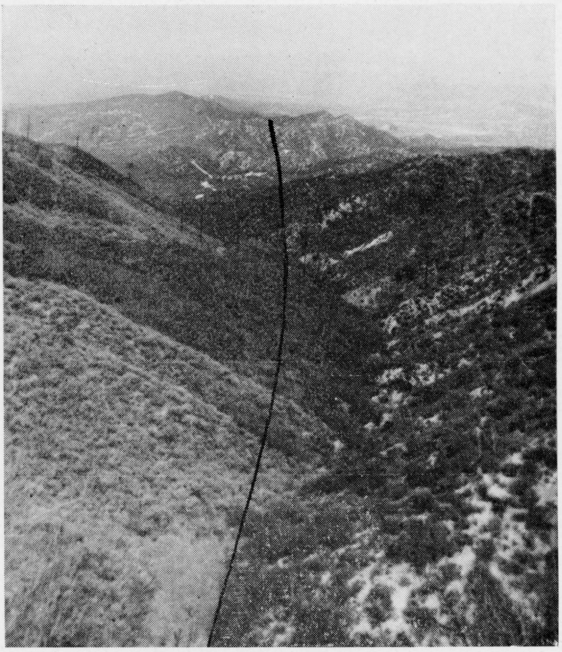
A, MINT CANYON LAKE BEDS

North-dipping sandstone, mudstone, and conglomerate on Sierra Highway three-quarters of a mile south of Solamint.



B, WHITE FRESH-WATER LIMESTONE

Bed 18 inches thick, with colored sandstones and mudstones of the Sunshine Ranch member of the upper Pico formation. On Sierra Highway, looking northwest near southeast corner sec. 30. Note two small faults.



A, VIEW N 60° W ALONG SAN GABRIEL FAULT
From first saddle west of Sierra Highway Saugus gravels on right dipping steeply south into fault; gently folded older terrace deposits on south side of fault.

B, VIEW SOUTHEAST ALONG SAN GABRIEL FAULT ZONE FROM SIERRA HIGHWAY

upper horizon in Elsmere Canyon is just another fossiliferous lens of the better known fossil zone found below, and may not have the significance here attached to it. In that case it would probably be necessary to assume that the upper littoral zone had been washed away before the deposition of the thin layer of overlying alluvial gravels of the Saugus formation."

Detailed mapping south of Whitney Canyon in the vicinity of locality 201, and also north of that canyon, has revealed evidence that the lower Pico (San Diego) is a separate mappable unit unconformably lying on the Elsmere member of the lower Pliocene Repetto formation and overlapping it onto the crystalline rocks. Lower Pico is overlain by upper Pico beds just north of Placerita Canyon, and is unconformably overlain by the Saugus formation south of the canyon.

Upper Pico Member. The term "Upper Pico member" of the Pico formation is here applied to marine upper Pliocene beds which overlie, with apparent conformity, the lower Pico just north of Placerita Canyon. Here the Upper Pico member is unconformably overlain by the Saugus formation.

Upper Pico is best exposed in the Placerita anticline northeast of the Placerita discovery well. In that region it consists of well-stratified coarse brown and buff sandstone, medium-grained sandstone, and conglomerate; coarse- to fine-grained dry tar sandstone is common; some yellowish-green sandstones are present. In the field it was judged to be marine, although it may be continental in part; no fossils were found in the outcrops. Two branches of a dome on the Placerita anticline appear, with a reverse fault along the south limb of the south branch. At the northeast end of the south branch of the structure, basal Saugus beds of coarse sulphur-yellow and white sandstone and poorly sorted gravel dipping 20° NNE. lie unconformably on fine to coarse oil sandstone of the Upper Pico member, which dips 30° NNE.

Very little coring has been done in the Placerita field but fragments of cores were examined from Nelson-Phillips Kraft 1, the discovery well. They indicate that the well penetrated continental gravels (Saugus and Sunshine Ranch) to about 420 feet and then entered the Upper Pico zone consisting of alternating beds of fine gray sandstone, gray fossiliferous siltstone and shale, and coarse oil sand. Dr. Leo Hertlein [31] recognized ostracods and a "species of *Cryptomya* resembling upper Pliocene forms in San Joaquin Valley" in the siltstone. Word from a petroleum geologist [32] indicates the presence of uppermost Pliocene foraminifera in these beds. Casing in the well is perforated between 580 and 717 feet. Thus oil production appears to be coming from oil sands in the marine Upper Pico and possibly also from basal continental Sunshine Ranch beds which may here interfinger with the Upper Pico.

The Upper Pico member between the Placerita and San Gabriel faults includes light brownish poorly sorted fanglomerate, conglomerate, and beds of coarse greenish sandstone. Although mapped as Upper Pico, it is quite likely these beds are continental, in part, and that the region is one of gradation and intercalation of marine Upper Pico and continental brackish-water Sunshine Ranch members of the upper Pliocene.

Marine members of the Pico formation have not been recognized north of the San Gabriel fault.

[31] Oral communication.
[32] Confidential source.

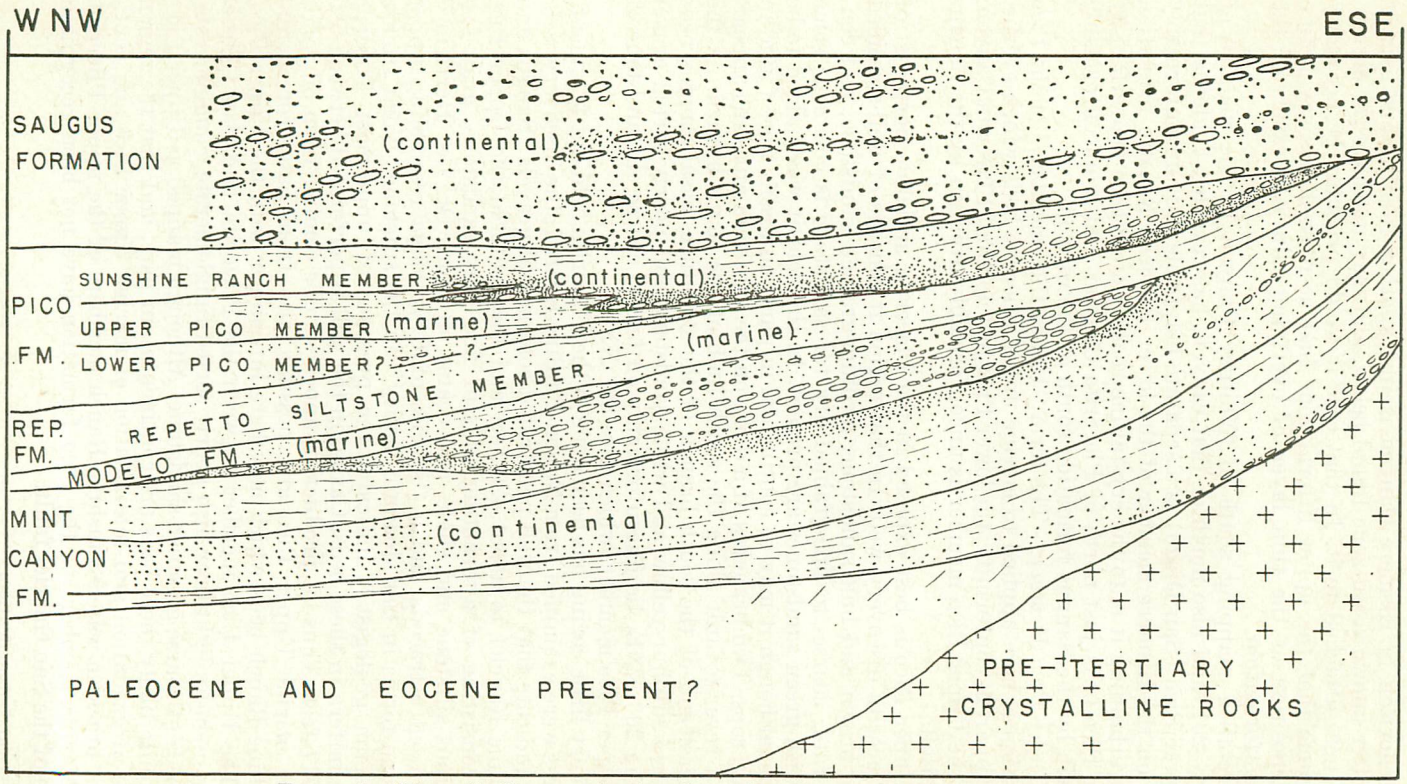


FIGURE 3. Schematic diagram showing Cenozoic sediments in eastern Ventura Basin north of San Gabriel fault zone in late Saugus time. Section about three miles long. Not to scale.

Sunshine Ranch Member. The term "Sunshine Ranch member" of the Pico formation is applied here to upper Pliocene continental beds lying below the continental lower Pleistocene Saugus formation and above marine beds commonly called Pico. The term has been modified from Hazzard's "Sunshine Ranch formation" used in a recent unpublished report.[33] Portions of that report, dealing with a part of the Santa Susana Mountains west and southwest of the Placerita area, are as follows:

> "Lithologically, the Sunshine Ranch formation is quite distinctive and field recognition of the unit was based upon rock characteristics in practically all cases. As originally mapped by W. S. W. Kew the rocks of the formation were grouped within the Saugus formation, hence the name here used is new. As typically developed the Sunshine Ranch beds are exposed in the foothill area north of Sunshine Ranch between the axial region of the Reservoir anticline and Balboa Avenue [west of San Fernando Reservoir]. This area is designated as the type locality.
>
> "In the type area the basal portion of the Sunshine Ranch formation consists of about 20 feet of cross-bedded pebbly to cobbly sandstone which at its base locally includes boulders of the underlying Pico sandstones and shows irregular 'cut and fill' contact relations with the older beds. Above the basal sandstone is a coquina 'reef bed' which varies in thickness along the strike but averages about 35 feet. Following is an interbedded series of gray, coarse-grained to pebbly, friable sandstone and gray to greenish-gray very fine-grained sandstone, silty sandstone or sandy siltstone. These fine-grained greenish-gray beds are the most characteristic lithologic type of the formation. As a rule, their mere presence, even in thin beds, is indicative of their stratigraphic position.
>
> "Some of the fine-grained material is in massive beds 1 to 2 feet thick; other portions show a poorly developed shaly parting which is in part controlled by a fine lamination within the rock. The greenish-gray color is due at least in part to an abundance of unaltered biotitic mica. Most of the finer-grained material is angular to subangular in outline. Good rounding occurs only in the coarser component of the pebbly gray sandstones. At various horizons throughout the formation the silty sandstones or siltstones are limy and at some places soft, white limestone and impure bentonitic (?) clays are present.
>
> "The number, thickness, and stratigraphic position of the coquina 'reefs' and fossiliferous beds are likewise quite variable.
>
> "A basal or near basal fossiliferous zone, usually a coquina 'reef bed' extends from the western limit of the formation as mapped west of Brown's Canyon, eastward at least to the east side of Balboa Avenue. The maximum vertical range of fossiliferous material is not known. . . .
>
> ". . . . In the vicinity of the type locality fossils occur at least as high as the middle of the formation and in the basal portion as many as three or four extremely fossiliferous zones can be mapped. Locally, the basal coquina beds are of sufficient thickness and extent to have been mined for lime . . . .
>
> "Macro-faunal samples from the Sunshine Ranch formation . . . . were reported as upper Pico or lower Pleistocene in age. One sample . . . . yielded a micro-fauna of brackish-water or lagoonal character of possible Pliocene age and brackish-water ostracods were reported in a sample . . . . collected very near the top of the formation . . . .
>
> "The general distribution of the marine, brackish-water, and fresh-water faunas in the Sunshine Ranch formation indicate that the bulk of the formation is definitely shallow-water marine or lagoonal, grading into fresh-water deposits toward the east. The change from shallow marine to fresh-water deposits is believed to occur in the general region between Balboa Avenue and lower San Fernando Reservoir for within those limits the basal coquina reef, as well as marine fossils higher in the formation, disappear.
>
> "Correlation is made on basis of lithology, fauna, and stratigraphic position with the Sunshine Ranch formation north of the Santa Susana

[33] Written communication from John C. Hazzard including extracts from his report to the Union Oil Company; published here by permission of that company.

fault. Evidence has already been presented for the upper Pliocene age for the beds in that region and the same age is necessarily assigned to the Sunshine Ranch formation of the foothill belt."

Hazzard noted an "angular unconformity with a maximum discordance of about 20°" on Pico beds at the narrows in Brown's Canyon, six miles west of the San Fernando Reservoir, but at other localities little evidence of any angular discordance. He says: "Tentatively, the two units (Pico and Sunshine Ranch) will be designated as regionally disconformable with local unconformable relations."

In the Placerita field the Sunshine Ranch member is best exposed in deep road cuts along the Sierra Highway just north of the San Gabriel fault where it has a thickness of approximately 1300 feet and has been folded to form an asymmetrical anticline. A section paced along the highway is as follows:

San Gabriel fault	
Saugus formation	
Gravel and coarse sandstone	100 feet
Disconformity (?)	
Sunshine Ranch member of Pico formation	
Coarse light-grayish gravel; boulders up to 2 feet in diameter	100
Brown sandy mudstone	40
Light-grayish gravel	30
Brown sandy mudstone	30
Coarse grayish gravels	40
Gray sandstone, greenish-gray mudstone, light-brown sandstone, 4-inch bed white sandy limestone	40
Coarse gray gravel	20
Brown and greenish sandstone	40
Coarse gravel	20
Alternating reddish and greenish beds, white concretionary limestone beds, coarse sandstone, and conglomerate	90
Greenish and reddish mudstones and 2-foot bed white fresh-water limestone	50
Alternating pale-brownish, gray, and greenish sandstones and mudstone, thin white concretionary limestone, and coarse gray and brown sandstone	800
Total thickness Sunshine Ranch	1300±
Angular unconformity	
Mint Canyon formation	

Lithologic similarity between the Saugus and Sunshine Ranch is strong but several distinctions, in addition to stratigraphic position, were used in field mapping. There is a general color difference, the Sunshine Ranch being particularly marked by greenish shades and fewer red and brown beds, although both these latter are common. The thin white fresh-water limestone beds are rarely developed in the Saugus and their occurrence in a sequence of greenish-gray and reddish sandy mudstones is very characteristic of the Sunshine Ranch member. The lower part of the Sunshine Ranch on Sierra Highway includes a 3-foot bed of dark brownish titanomagnetite sandstone resembling a dry oil sand. Sunshine Ranch beds also bear a rather close resemblance to certain horizons in the Mint Canyon formation and the two formations might well be confused where stratigraphic position is not clear.

It is rather difficult to locate an exact contact between the Saugus and Sunshine Ranch because of the lithologic similarity and lack of angular discordance, but mapping just north of the San Gabriel fault

shows that Saugus beds overlap the Sunshine Ranch eastward, onto the Repetto siltstone. However, the Sunshine Ranch probably originally thinned in that direction also, as the margin of the basin of deposition was approached. Recognition of the contact between Saugus and Sunshine Ranch beds from well logs is uncertain but stratigraphic position and the greenish color of the latter are most useful. Many geologists have recognized "lower Saugus" or "upper Pliocene portion of the Saugus," probably conforming rather closely to "Sunshine Ranch" as used in this paper. Sunshine Ranch has been recognized in a number of the Placerita wells and probably has been penetrated by most of them.

A steeply north-dipping section of the Sunshine Ranch sediments is exposed by cuts along the overflow canal on the west side of the San Fernando reservoir, northwest corner of the Pacoima 6-minute quadrangle. It is lithologically almost identical with the Sierra Highway section described above but is more than 3000 feet thick. At the reservoir locality it unconformably overlies a fossiliferous lower Pico (San Diego) calcareous sandstone and is disconformably (?) below a section of the Saugus formation which is also more than 3000 feet thick.

Saugus Formation

The Saugus formation, as the term is used here, lies above the upper Pliocene continental Sunshine Ranch beds. It is overlain with angular unconformity by the oldest of the terrace deposits (older alluvium). In accordance with current usage and for reasons given below, it is regarded as lower Pleistocene in age. It is very widely distributed north and south of the San Gabriel fault and reaches a maximum thickness of about 2000 feet in this area. All of the Placerita wells start in Saugus beds or penetrate that formation at shallow depth after passing through Recent alluvium or terrace gravels. The Saugus formation increases in thickness westward toward the type locality near the town of Saugus.

The Saugus formation in the Placerita field consists largely of poorly sorted grayish, buff and brownish conglomerate and coarse sandstone, much of it crossbedded. Brown conglomerate-sandstone lenses are common but the sediments are predominately quite light colored. Lenticularity and crossbedding make determination of attitudes inexact, especially where dips are not high. Pebbles are largely various granitic rocks, gneisses, schists, and anorthosite; all are of local origin, showing derivation from the crystalline rocks of the San Gabriel Mountains and from the Tertiary sedimentary and volcanic series.

The Saugus-Sunshine Ranch contact seems to be a disconformable one, with little angular discordance, but north of the San Gabriel fault, southeast of the highway, the Saugus formation overlaps Sunshine Ranch and Repetto formations and finally lies directly on the Mint Canyon 1 mile southeast of the east boundary of the accompanying geologic map. In lower Whitney Canyon the Saugus formation overlaps Sunshine Ranch (?) onto lower Pico.

Age of the Saugus Formation. The work of Putnam and Bailey [34] has well established the age of the principal orogenic period in the Ventura basin as post-lower Pleistocene and pre-upper Pleistocene and offers good evidence of the lower Pleistocene age of the Saugus formation.

[34] Putnam, W. C., and Bailey, T. L., Geomorphology of the Ventura region, California: Geol. Soc. America Bull., vol. 53, pp. 691-754, 1942.
Bailey, T. L., Late Pleistocene Coast Range orogenesis in southern California: Geol. Soc. America Bull. 54, pp. 1549-1568, 1943.

Their Pleistocene succession, based on paleontological evidence, is as follows:

Upper Pleistocene—Terrace gravels and fanglomerate, tilted in older parts.
Upper Pleistocene—Terrace deposits, dipping 8° to 20°.
Major unconformity
Lower Pleistocene—San Pedro = Las Posas = Waterfall's [35]
Saugus in Hall Canyon = Kew's [36] Saugus
on south side of south mountain west of Long Canyon.

Correlation of the beds exposed on the Sierra Highway north of the San Gabriel fault with Sunshine Ranch beds west of the lower San Fernando reservoir in the northwest corner of the Pacoima 6-minute quadrangle was previously mentioned, as was Hazzard's [37] statement indicating that upper Pliocene Sunshine Ranch beds of that area represent fresh-water deposits gradational into fossiliferous shallow-water marine or lagoonal beds to the west. The writer, in mapping the reservoir region, found a thickness of over 3000 feet of north-dipping Sunshine Ranch beds followed by another 3000 feet of Saugus beds. The contact between the two was placed 1500 feet south of the Pacoima-Sylmar quadrangle boundary at Sepulveda Boulevard. Later he found a horse tooth in Saugus gravels 800 feet stratigraphically above the base of the steep north-dipping Saugus at a point in a road cut on the west side of Sepulveda Boulevard 400 feet southeast of the Pacoima-Sylmar quadrangle boundary. Dr. Chester Stock, who examined the tooth, cautioned against regarding his statement as a final word because of the fragile and fragmentary condition, but had this to say concerning it:

> "The tooth is of course an upper tooth of a horse. I cannot be entirely sure of its position, although I suspect it is a molar tooth. The crown is definitely of the straight type that you would expect to find in *Equus*. What remains of the protocone, and that is a cross section seen near the root of the tooth, shows a style which has a flattened inner side. In other words, it doesn't have the indentation normally seen in teeth of *Equus*. The straightening on the inner face, however, may result from the position of the cross section close to the root end of the tooth. I would be inclined to say that it is a more primitive type of *Equus* than that found in the later Pleistocene deposits, but still definitely Pleistocene in age."

Extreme scarcity of fossils reported from the Saugus formation makes the occurrence of interest, particularly since the Saugus beds on Sepulveda lie disconformably (?) on a thick section of Sunshine Ranch and unconformably below slightly tilted terrace deposits. Dr. Stock's statement of age is not inconsistent with assignment of the Saugus formation to the lower Pleistocene.

Terrace Deposits and Alluvium

Remnants of older alluvial deposits uplifted and eroded to form terraces are very common in the region. A number of stages in the development of such terraces are recognizable but two are prominent in the Placerita field. The older deposit consists of coarse, poorly sorted fanglomerate, gravel, and sand, generally weathered to a brownish color and distinctly folded in some places. An exposure adjacent to the San Gabriel fault on the south side in a road cut on the Sierra Highway shows

[35] Waterfall, Louis N., A contribution to the paleontology of the Fernando group, Ventura County, California: Univ. California Dept. Geol. Sci. Bull., vol. 18, no. 3, pp. 71-92, 1929.
[36] Kew, W. S. W., Geology and oil resources of a part of Los Angeles and Ventura Counties, California: U. S. Geol. Surv., Bull. 753, 1924.
[37] Op. cit.

the older terrace deposits dipping westward at angles as high as 15° off Saugus beds with a 35° dip. West of the highway the San Gabriel fault has brought the terrace gravels in contact with Saugus-Sunshine Ranch beds. Thus the older unit of terrace gravels has been affected by faulting and mild folding. The older terrace deposits blanket the area of the most productive part of the new oil field in sec. 31, T. 4 N., R. 15 W., S.B., where they reach a thickness of as much as 500 feet.

The later terrace gravels of the area appear as benches along the north side of Placerita Canyon, undisturbed by folding or faulting as far as could be determined. The site of discovery of gold in California in 1842 is in alluvium at the base of these bench gravels in Placerita Canyon very near B. M. 1513. The bench gravels, as well as Recent alluvium in the canyon, have yielded placer gold. Thickness of the younger terrace gravels is as much as 175 feet.

Age of the two terrace deposits is probably upper Pleistocene, as they were deposited after the mid-Pleistocene Coast Range orogenesis and before Recent alluvium.

Stream sands and gravels of Placerita Canyon and the Santa Clara River constitute the principal Recent deposits; their maximum thickness is unknown.

STRUCTURE

General Features

The structure and Cenozoic history of the Placerita area are complicated by the fact that three important geologic provinces adjoin in this small region: the western end of the San Gabriel Mountain positive block, the northwestern portion of the Los Angeles basin, and the eastern end of the Ventura basin. That part of the Cenozoic record which is preserved shows that almost continual uplift of the San Gabriel block took place, at times at an accelerated rate, with folding, faulting, and readjustments around the margins of that competent crystalline block and consequent geologically rapid fluctuations of the shorelines and variety of sedimentation. This general picture of the structural history of the area finds supporting evidence in regional dip of the late Tertiary-Quaternary sediments off the pre-Tertiary crystalline rocks; very irregular marginal faults and folds, as well as the major San Gabriel fault system extending across the San Gabriel block into the Ventura basin; a large number of unconformities, from minor local disconformities to major regional unconformities; very rapid variations in thicknesses of formations and gradations through marine, lagoonal, lacustrine, and fluviatile sediments; and the large proportion of very coarse sediments in the Cenozoic sections.

Faults

San Gabriel Fault Zone. One of the major structural features of this area is the San Gabriel fault zone. It strikes generally N. 65° W. to northwest for more than 60 miles obliquely across the San Gabriel crystalline block from the south front of the range north of Pasadena to the Frazier Mountain thrust a few miles southwest of Lebec. It has many of the features of the San Andreas rift and probably is closely related to it in origin.

It is characteristic of the San Gabriel fault zone that a single fault *plane can be traced* for only 2 or 3 miles, and then the displacement appears to die out and to be absorbed by movement along another fault

plane roughly parallel to the first. Near-parallel fault planes with narrow slivers between them, either uplifted or down-dropped, of folded and contorted sedimentary strata, are common. An example is the 500-foot-wide sliver of Lower Pico (?) beds apparently uplifted between two San Gabriel fault planes southeast of Sierra Highway. The Lower Pico (?) beds are steep, possibly overturned in part, and there is evidence of a sharp narrow anticlinal structure. These two fault planes dip steeply north. North of the north plane Saugus-Sunshine Ranch beds lie unconformably on Repetto siltstone which, in turn, lies with a strong angular unconformity on the Mint Canyon formation. South of the north plane Sunshine Ranch, Repetto, and Mint Canyon formations do not appear. In the same general area, a sliver some 1300 feet wide between the south plane of the San Gabriel fault and the Placerita fault (the latter merging with the San Gabriel fault 2 miles to the east) is a down-dropped block of Upper Pico beds folded to form a syncline. This would require an apparent 1000-foot post-Saugus vertical component of displacement on the Placerita fault, in which relative movement was down on the north side. On the south plane of the San Gabriel fault there is an apparent vertical component of displacement of 700 feet, up on the north side. At the highway the most logical section that can be drawn shows the north block to have been raised a minimum of 1500 feet. Just east of the highway Saugus beds on the south are folded against the fault to form a syncline, probably a continuation of the synclinal axis between the Placerita and south San Gabriel fault planes a mile to the southeast; continuation of this syncline farther west is uncertain. On the north block of the San Gabriel fault the south limb of the highway anticline is turned sharply down against the fault. This displacement was post-Saugus and, at least in part, post-older terrace.

The lack of Pico beds north of the San Gabriel fault is probably the result of relative upward movement of the north block along the fault, or at least a positive position of that block, during Pico time.

The apparent absence of the Mint Canyon formation just south of the San Gabriel fault and the great thickness and coarseness of that formation north of the fault could best be explained if an ancestral San Gabriel fault were present in Mint Canyon time (possibly originating earlier) and active upward movements of the south block were taking place with consequent deposition of Mint Canyon sediments adjacent to and north of the fault zone. The thickness of Mint Canyon beds just north of the fault at present (2400+ feet) is some indication of the magnitude of that movement.

Evidence for a considerable horizontal component of displacement along the San Gabriel fault may also be noted in the Placerita region. A contact between Tertiary sedimentary rocks and the pre-Tertiary crystalline rocks south of the San Gabriel fault in Placerita Canyon appears 2½ miles east of that point on the north side of the fault, suggesting right lateral movement of that general magnitude. A few miles east, in the Little Tujunga quadrangle, the long-established Pacoima Creek drainage system has an apparent right-angle offset along the trace of the San Gabriel fault zone, with a right-lateral displacement of nearly 1½ miles. In each case the movement indicated is probably only that of Quaternary time; there is little evidence of the magnitude of pre-Quaternary horizontal movement.

Evidence in the Placerita region shows the San Gabriel fault has probably been an important structural feature since at least as early

as middle Miocene time with a minimum vertical displacement, south block relatively up, of over 2000 feet and a possible horizontal component of displacement of several miles during late Tertiary time; the direction of vertical movement was reversed in post-Saugus time, with the south block relatively down a minimum of 1500 feet and a probable right-lateral horizontal component of displacement of at least 2½ miles. Movement has continued into very late Quaternary time as shown by displacement of terrace deposits and by the preservation of geologically recent minor topographic effects.

Whitney Fault. The name Whitney fault is suggested for a probable north-striking transverse fault recognized by Walling,[38] which seemingly limits production at the east end of the Whitney Canyon area. It has no surface expression in Whitney Canyon and does not appear to have affected Saugus beds, but about a mile south of Whitney Canyon, Pico and Elsmere beds appear to be faulted against Eocene sandstone and conglomerate in Elsmere Canyon. Production on the east of the Placerita field may be limited, in part, by this fault. Changes in attitudes of Pico and Elsmere beds adjacent to the fault south of Whitney Canyon suggest some left-lateral horizontal movement with a vertical component also; the west block is the upthrown side. The Whitney fault may be post-Pico and pre-Saugus in age; it may die out toward the north before being cut off by the San Gabriel fault.

Other Faults. On the highway, six thousand feet southwest of Solemint, locally contorted Mint Canyon beds appear on the northwestward projection of the trace of a pre-Pliocene fault, described by Kew [39] and shown on his geologic map in the Sand Canyon area, a few miles to the southeast. Movement along the fault seems to die out gradually to the northwest from Sand Canyon and to be largely absorbed in contortions of the Mint Canyon beds at Sierra Highway.

Another fault, possibly of local importance, strikes east-northeast toward the Placerita fault on the north side of Placerita Canyon. It is a reverse fault, dipping 75° S., and has brought Upper Pico beds on the south side up into contact with Saugus beds on the north. It lies parallel to, and between, the axis of a small syncline and axis of the southwest-plunging Placerita anticline. This fault, and adjacent flexures north and south of it, seems related to right lateral movement along the main San Gabriel fault.

Folds

General regional dips of the Tertiary sedimentary formations in the Placerita Canyon field are off the pre-Tertiary crystalline rocks toward the north and northwest. Faulting and accompanying folding, beginning as early as pre-Mint Canyon time, have superimposed a number of complex subordinate structures. In the movements involved the older crystalline rocks have behaved essentially as a competent block, undergoing intermittent elevation with adjustments within that block accomplished by faulting and shearing. Around the margins of the crystalline block the sedimentary strata have reacted, according to

[38] Walling, R. W., Report on Newhall oil field: California Div. Oil and Gas, Summary of operations, vol. 20, no. 2, p. 46 and plate I, 1934.

[39] Kew, W. S. W., Geology and oil resources of part of Los Angeles and Ventura Counties, California: U. S. Geol. Survey Bull. 753, 1924.

their competence and the local intensity of stresses applied, by development of a discontinuous series of synclines and anticlines of local extent. A number of these, as may be seen from the geologic cross section, are closely related to the faults, local synclines developing on the down-dropped blocks and anticlines on the upthrown blocks. Apparently accumulating stresses were first relieved by folding and as such folding was renewed and continued fault movements resulted.

Placerita Nose. The main Placerita structure is a poorly defined nose involving Upper Pico and older terrace beds which generally dip northwestward off the crystalline rocks in the area between Whitney Canyon and the San Gabriel fault. An axis on this structure, the Placerita anticline, trends N. 70° E. across the junction of Placerita Canyon and Sierra Highway. About half a mile northeast of the highway it divides to form two minor axes; plunge is southwestward but a closed high is developed, exposing Upper Pico beds, in the area of the divided axis; closure is on the northeast where the beds are downfolded against the San Gabriel fault. Northwest of the highway in sec. 31, T. 4 N., R. 15 W., S.B., the older terrace deposits, with flat to gentle west dips, tend to obscure the older structure, but underlying Saugus beds dip from 15° to 30° NW.; approaching the San Gabriel fault, their strike changes to near-parallelism with the fault and dips increase to 35° N. Therefore, there is good closure to the north against the fault, a strong regional plunge, averaging about 10°, toward the west and southwest, and minor closure on the south. The structure narrows rapidly to the east and, after rising to a minor dome exposing Upper Pico beds, closes in the narrow syncline between the Placerita fault and the south plane of the San Gabriel fault.

Highway Anticlines. Two well-defined northwest-trending anticlines appear crossing the highway north of the San Gabriel fault. The southerly of the two, involving Mint Canyon, Sunshine Ranch, and Saugus beds, is a reflection of uplift of the north block of the San Gabriel fault. On the south limb Saugus and Sunshine Ranch beds are turned steeply down against the fault, but on the north limb very gently dipping Sunshine Ranch strata lie on the steeply dipping locally-contorted Mint Canyon formation. After the thick Mint Canyon beds had accumulated in this downdropped area north of the San Gabriel fault, and before Sunshine Ranch beds were deposited, a reversal of movement began on the fault and Mint Canyon strata were folded to form an asymmetrical anticline with steep north limb and very gently tilted south limb. Deposition of the Sunshine Ranch-Saugus beds took place across a relatively inactive San Gabriel fault; then, in post-Saugus time, renewed uplift and folding of the north block developed the later Sunshine Ranch-Saugus anticline with its steep south limb and very gentle north limb.

The northern highway anticline shows steep dips on both limbs and a 25° W. plunge, bringing down Repetto siltstone, Sunshine Ranch, and Saugus strata in turn around the west end. The anticlinal axis curves southeast and is cut off by the pre-Pliocene fault[40] previously mentioned. In the history of development of this anticline it is clear that post-Mint Canyon-pre-Sunshine Ranch folding and faulting took place and that folding was renewed in post-Saugus time.

Other Folds. Several minor folds have previously been mentioned in connection with faults. A series of tight steep-limbed synclines occurs

[40] Kew, W. S. W., op. cit.

east of Sierra Highway between the San Gabriel fault and pre-Pliocene fault. A number of these were probably developed principally prior to the time of deposition of Sunshine Ranch beds, as they could not be clearly recognized in the gently dipping Sunshine Ranch-Saugus formations northwest of the highway.

Table 2. Outline of the Geologic History

I. Pre-Tertiary
   - A. Deposition of unknown thickness of the Placerita marine (?) sediments, including limestone; possibly in Upper Paleozoic time.
   - B. Intrusion of Rubio diorite and metamorphism of Placerita sedimentary rocks to form schists and marble; accompanying mountain building in late Paleozoic (?) time.
   - C. Upper Jurassic (?) granitic intrusion and accompanying orogeny.

Unrecorded interval

II. Paleocene-Eocene
   - A. Deposition of marine conglomerate, sandstone, and shale of the Martinez formation. (Not certainly known to have been deposited over the Placerita area, but remnants remain as slivers in San Gabriel fault zone 5 miles to southeast.)
   - B. Deposition of marine sandstone, shale, and conglomerate of Eocene age; including probable Domengine formation.

Folding and erosion

Beginning of movement on San Gabriel fault, north block down (?)

III. Upper Miocene
   - A. Deposition of more than 2400 feet of Mint Canyon coarse continental sediments, lake beds, and thin tuff beds; sediments partly derived from uplifted south block of San Gabriel fault.
   - B. Post-Mint Canyon uplift of north block of San Gabriel fault; probably also right-lateral horizontal movement along the fault.

Continued uplift and erosion

IV. Lower Pliocene
   - A. Deposition of 100+ feet of Elsmere sands and gravels on the pre-Tertiary crystalline rocks in shallow water at the shoreline of a sea from the west and southwest; gradation northward into continental deposits south of San Gabriel fault.
   - B. Deposition of Repetto silt and fine sand in slightly later seas which extended farther to the north and northeast.

Renewed uplift and erosion of north block San Gabriel fault

V. Middle Pliocene
   - A. Deposition of about 700 feet of lower Pico shallow-water marine sand, gravel, and silt overlapping the Elsmere beds south of the San Gabriel fault. Lower Pico seas probably did not extend north of the San Gabriel fault in the Placerita area. North block of fault above sea level.

VI. Upper Pliocene
   - A. Deposition of about 1000 feet upper Pico shallow-water marine sand, gravel, and mud. Gradational, especially in upper part, into the lagoonal, brackish-water, and landlaid Sunshine Ranch beds deposited widely across the San Gabriel fault zone. North block of San Gabriel fault above sea level during Upper Pico; entire area, north and south, above sea level in Sunshine Ranch time.

VII. Lower Pleistocene
   - A. Deposition of 2000 feet of coarse continental sands and gravels of the Saugus formation around the margin of the rising crystalline rock mass and across the San Gabriel fault zone; fault relatively inactive during deposition of Sunshine Ranch and Saugus beds.

VIII. Middle Pleistocene

A. Principal orogenic epoch, coinciding with Coast Range orogeny. Uplift, faulting, and shearing of San Gabriel crystalline massif, with severe folding and faulting of the marginal stratified rocks of Saugus age and older. Sharply renewed movement along the San Gabriel fault, involving a probable right-lateral horizontal component of displacement of more than 2½ miles, with apparent vertical component amounting to a 1500-foot uplift of the north block at Sierra Highway, but varying widely along the strike of the fault. Principal migration of petroleum into the reservoir rocks began at this time.

Erosion and continued orogenic movements

IX. Upper Pleistocene

A. Deposition of older alluvium along stream valleys and in alluvial fans.

B. Continuation of uplift and faulting with slight westward tilting of older alluvial deposits to form the older terraces.

C. Continued deposition of coarse alluvium, and vertical uplift, resulting in in the younger group of terrace deposits.

X. Recent

A. Deposition of recent alluvium in stream valleys and development of present land forms, accompanied by probable continued uplift and local movements along faults.

ORIGIN AND ACCUMULATION OF THE OIL

In the Placerita field the oil occurs in the Sunshine Ranch and Upper Pico members of the upper Pliocene Pico formation. Sunshine Ranch beds are highly lenticular crossbedded sandstone, sandy mudstone, and conglomerate, and grade into lenticular nearshore marine beds of the Upper Pico member. Producing zones range in thickness from a few feet to more than 250 feet, but no single oil sand reaches that maximum. Pico beds, in the new oil field, are unconformably underlain by steeply dipping Eocene sandstone and shale which have yielded no oil, although the nearby Whitney Canyon and Elsmere Canyon areas have produced some light oil from Eocene beds.

Source of the oil is not specifically known but petroleum has been found, or occurs in outcrops in the region, in several formations, including the Rubio gneiss and Placerita metasedimentary series, Eocene sediments, the lower Pliocene Elsmere and Repetto siltstone members, all of the members of the Pico formation, and probably also the lower Saugus formation. It is most likely that oil has migrated up-dip from source rocks of several ages including marine organic shales of the Eocene, Miocene, and Pliocene epochs. Migration and accumulation of petroleum may have begun as early as Miocene time, but accumulation in the present reservoir sands must have taken place during and after the mid-Pleistocene orogeny.

A combination of structural and stratigraphic factors accounts for the Placerita field. Chief among these are the westward-plunging Placerita nose of late Tertiary-Quaternary sediments off the pre-Tertiary crystalline rocks, and up-dip lensing in the Upper Pico-Sunshine Ranch members. Overlap of Upper Pico beds by Sunshine Ranch beds, and overlap of both these formations by Saugus beds may also have influenced accumulation. Minor flexures in the Placerita nose, particularly the Placerita anticline in the southern section of the oil field, and downfolding against the south side of the San Gabriel fault are important. The Whitney fault, Placerita fault, San Gabriel fault, branches of these,

and minor folds associated with the faults are structural factors which, with up-dip thinning and lensing of the sediments, have limited extension of the field to the east.

FUTURE PETROLEUM DEVELOPMENT

At the close of 1948, proven acreage in the Placerita field was 240; reserves were estimated at 300,000 barrels.[41] At that time 20 wells were producing an average of 40 to 50 barrels a day of 11° to 16° gravity oil. On June 1, 1949, the writer considers a total of 430 acres have been proven, with 68 producing wells. About 10 of the latter were averaging 550 barrels a day of 21° to 23° gravity oil, and 20 wells were drilling in proven acreage.

In January 1949, Ramon Somavia brought in Juanita 1 near the north-central border of sec. 31, T. 4 N., R. 15 W., S.B., flowing 340 barrels per day of 22.4° gravity clean oil. Several additional wells in the north half of section 31 and along the south margin of section 30 have maintained that standard, the best to June 1949 being Somavia's Ashley 1, which was producing 1000 barrels per day. Oil is coming from the Upper Pico formation at depths of 1300 to 2100 feet. Surface geology in the region is obscured by the older terrace deposits, and drilling has left a gap of more than 1000 feet between the original area and the northern extension of the field, which produces higher-gravity oil. Whether the two pools are connected and the producing horizons are the same remains to be seen. However, the writer believes the producing horizon is the same, although lenses of oil sands in the two sections may not be continuous; the higher-gravity oil may be accounted for by greater depth and less chance for loss of the lighter fractions. Faulting, which is obscure at the surface, may separate the pools at depth.

Surface geology and wells drilled to early June 1949 indicate that limits of the new field are rather well defined. It is unlikely that production will extend farther east than the trace of the Whitney fault and its northern projection; the San Gabriel fault will mark the northern limit of the field. The southern limit of production seems to be parallel to the axis of the Placerita anticline and a fraction of a mile south of it. Some possibility of extension of the field to the west remains but several dry holes have been drilled west and southwest of section 31, including Ned Barmore Hays 1, abandoned at 2387 feet after no showings, Federal Oil Company Oakgrove 1 and York Oil Company York 5. Several wells being drilled in this region will help to define the western limit of the field.

[41] Oil and Gas Jour., p. 278, Jan. 27, 1949.

LIST OF WELLS

Table 3. Wells drilled in Placerita Canyon area to and including 1934 *

Operator	Well S-T-R	Yr. comp. or aband.	Depth	Geology	Geology at bottom	Daily amts. oil, gas, water	Remarks	Status 6-1-49
Guiberson Oil Co. (formerly York Oil Co.; also Nile Oil Co.)	York 1 6-3-15	1920	Td 1394	No record		6 B/D 14° during late 1925	Disc. well. Pumped very heavy oil from 975 ft. Deepened to 1394 in 1921	Prod.
Guiberson Oil Co.	York 2 1-3-16	1924-25	Perf. liner landed 1402	No record		10 B/D 14° during late 1925	Producing in 1934	Prod.
Guiberson Oil Co.	York 3 6-3-15	1925-32	Td. 1598 Pgd. 1495	Qs to 1060 (?) Tsr 1060 (?) Tp 1460 (?)	Tp	14 B/D 12° in May 1934		Prod.
York Oil Co.	York 4 1-3-16	1932-33	Td 1563 Pgd. 1509	Qs to 1160 (?) Tsr (?) to bottom	Tsr (?)	19 B/D 11° 5%	Producing in 1934	Prod.
Sec. 31 Pet. Corp.	1 31-41-15	1930	Td 2008					Aband.
Morgan Pet. Corp.	Dunlap 1 31-4-15	1924	Td 983?					Aband.
General Pet.	Stabler 4 30-4-15	9-20	Td 3514					Aband.
Morgan Pet.	Stabler 3 31-4-15	9-20	Td 2640					Aband.
Occidental Pet.	1 31-4-15	8-22	Td 605					Aband.
North Star Min. & Dev. Co.	Shepard 1 1-3-16	8-31					Acquired by North Star March 1940	Aband.
Richfield Oil Co.	Shepard 1 1-3-16	12-24						Suspended

*Table 4. Wells drilled in Placerita Canyon schist area * (2½ miles east of Sierra Highway)*

Operator	Well S-T-R	Yr. comp. or aband.	Depth	Geology	Geology at bottom	Daily amts. oil, gas, water	Remarks	6-1-49
Freeman & Nelson White Oil Co.	1 4-3-15	1899	Td 520	All wells started in Placerita metasedimentary rocks and Rubio diorite gneiss near the Placerita fault, and bottomed in same formations			2½ B/D	Aband.
Freeman & Nelson White Oil Co.	2 4-3-15	1900	Td 1030				Trace	Aband.
Freeman & Nelson White Oil Co.	3 4-3-15	?	Td 457				Trace	Aband.
New Century Oil Co.	1 4-3-15	1900-01	Td 720				"Several" 43°	Aband.
New Century Oil Co.	2 4-3-15	1900-01	Td 700				Traces	Aband.
New Century Oil Co.	3 4-3-15	1901?	Td 900				Dry	Aband.
New Century Oil Co.	4 4-3-15	1901?	Td 1000				Small show white oil	Aband.
Pioneer White Oil Co.	1 3-3-15	1901	Td 1270				Very little white oil; gas	Aband.
San Miguel Oil & Development Co.	1 3-3-15	1902	Td 1000				Traces white oil	Aband.
Harrison Well	1 3-3-15	1905	Td 2100				Dry	Aband.
Los Angeles & Kern Co. Oil Mining Co.	1 4-3-15	1912	Td 450+				Unknown results	

*Table 5. Wells drilled in Whitney Canyon area **

Operator	Well S-T-R	Yr. comp. or aband.	Depth	Geology	Geology at bottom	Daily amts. oil, gas, water	Remarks	Status † 6-1-49
Republic Petroleum Co., Ltd. (Operator in 1934)	Banner 1 6-3-15	1917-18	2117	Tsr? Tp? Oil sd 1030-1175 Eo. at 1225?	Eo.?	25 B/D 15° 50%	Showings light oil between 1380-2117. Prod. at 911?	Aband.
	Banner 2 6-3-15	1919-20	1692				Never produced	Aband.
	Banner 3 6-3-15	1893	850	Top oil sd. 750		100 B/D?	Discovery well. No water shut-off.	Aband.
	Golden West 1 6-3-15	1894	930			250 B/D?	Water broke in; could not shut off.	Aband.
	Fink 1 7-3-15	1899-1900	1450		Eo.?	? 40°	Light green oil; prod. declined rapidly.	Aband.
	Fink 2 7-3-15	1900	1000				Never produced	Aband.
	Kellerman 3 7-3-15	?	?				No record	Aband.
	Price 1 6-3-15	1908	950			? 17°	Prod. brownish-green oil from below 835.	Aband.
	Price 2 6-3-15	1908?	1100	Heavy oil sd. 600. Second sd. 1000+.			Could not shut off water.	Aband.
	Price 3 6-3-15	1909?	650±	Heavy oil sd. over 600.		?		Aband.
	Price 4 6-3-15	1930-33	2842		Middle Eo.	2 B/D 26° 5 B/D water	Pliocene-Eocene contact 1174	Aband.
	Tunnel 1 6-3-15	1916-17	1548	Oil sd. 1038-1418 Tsr.? Tp.?		25 B/D 14° 83%		Aband.
	Yankee Doodle 1 6-3-15	1900	705				Some oil reported	Aband.

Table 6. Wells drilled in Placerita Canyon area since 1934
(April 1948 to June 1949)

Operator	Well S-T-R	Yr. and mon. comp. or aband.	Depth—total producing	Geology	Geology at bottom	Daily amts. oil, gas, & water	Remarks	Status 6-1-49
Standard Oil Company	Placerita 1 1 6-3-15	7–48	820 TD 820 Perf. int. 652-820	Qs-Tsr (?) to 215 (?) Tp 215-821	Tp	21 B/D 12.9° 1 M/D est. 1 B/D	Top Pico contact est. from elec. log only in wells 1-7	Prod.
Standard Oil Company	Placerita 2 1 6-3-15	8–48	1400 TD 1150 Perf. int. 993-1140	Qs-Tsr (?) to 495 (?) Tp 495-1385 Eo. 1385-1400 (?)	Eo.	11 B/D 12.9° 1 M/D est. 2 B/D	No core or ditch samples of Eocene	Prod.
Standard Oil Company	Placerita 3 1 6-3-15	8–48	1061 TD 740 Perf. int. 509-731	Qs-Tsr (?) to 125 (?) Tp 125-870. Eo. 870-1061	Eo.	25 B/D 15.1° 1 M/D est. 53 B/D	Cored Eocene 1050-61	Prod.
Standard Oil Company	Placerita 4 1 6-3-15	9–48	1051 TD 1051 Perf. int. 775-1051	Qs-Tsr (?) to 395 (?) Tp 395-1046	Tp	31 B/D 12.6 1 M/D est. 2 B/D		Prod.
Standard Oil Company	Placerita 5 1 6-3-15	12–48	1380 TD 1380 Perf. int. 1114-1378	Qs-Tsr (?) to 845 (?) Tp 845-1370	Tp	116 B/D 11.9 4 M/D est. 3 B/D		Prod.
Standard Oil Company	Placerita 6 1 6-3-15	12-48	650 TD 650 Perf. int. 297-648	Qs-Tsr (?) to 100 (?) Tp 100-653	Tp	24 B/D 15.5 10/M/D est. 152 B/D		Prod.
Standard Oil Company	Placerita 7 1 6-3-15	1-49	1460	Qs-Tsr (?) to 925 (?) Tp 925-1460	Tp			Prod.
Algord Oil Company	Shepard 5 1-3-16	10-48	TD 1225				Dry	Aband.

Table 6. Wells drilled in Placerita Canyon area since 1934—Continued
(April 1948 to June 1949)

Operator	Well S-T-R	Yr. and mon. comp. or aband.	Depth—total producing	Geology	Geology at bottom	Daily amts. oil, gas, & water	Remarks	Status 6-1-49
W. Y. Lee	Heil 1 32-4-15	5-49	TD 1435				Dry	Aband.
W. J. Carter	Carter-Earl 1 5-3-15	9-48	TD 205		"Granite"		Dry	Aband.
W. J. Carter	Carter-Earl 2 5-3-15	10-48	TD 653		"Granite"		Dry	Aband.
W. J. Carter	Carter-Earl 3 5-3-15	9-48	TD 1038		"Granite"		Dry	Aband.
W. J. Carter	Carter-Earl 4 5-3-15	2-49	TD 1248				Dry	Aband.
Republic Petroleum Co.	Price 5 6-3-15	5-35	TD 1080					Aband.
Republic Petroleum Co.	Wm. G. McAdoo, Jr. 1 6-3-15	7-37	TD 835?					Aband.
Crawford & Hiles	Aqueduct 1 6-3-15	12-48	TD 1395					Prod.
Crawford & Hiles	Aqueduct 2 6-3-15	1-49						Prod.
M-C Oil Co.	Dudley 1 6-3-15	10-48						Prod.
M-C Oil Co.	Dudley 2 6-3-15	11-48						Prod.
M-C Oil Co.	Dudley 3 6-3-15	4-49						Prod.
Guiberson Oil Company	Shepard 1 1-3-16							Drilling
Guiberson Oil Company	Shepard 5 1-3-16							Drilling
Guiberson Oil Company	Shepard 5A 1-3-16							Drilling
Guiberson Oil Company	Schisler 1 1-3-16	3-49						Prod.
Guiberson Oil Company	Schisler 2 1-3-16	4-49						Prod.

Guiberson Oil Company	Schisler 3 1-3-16	5-49						Prod.
Guiberson Oil Company	Schisler 4 1-3-16	2-49						Prod.
Guiberson Oil Company	Schisler 5 1-3-16	3-49						Prod.
Guiberson Oil Company	Schisler 6 1-3-16							Drilling
Guiberson Oil Company	Schisler 7 1-3-16	3-49						Prod.
Ramon Somavia	Juanita 1 31-4-15	1-49	Prod. 1830 TD 1835	Wells in this section producing from Upper Pico fm. at depths of 1300-2100		340 B/D 22.4° 3%	First flowing well; also highest gravity	Prod.
Ramon Somavia	Juanita 2 31-4-15	5-49	TD 1942			720 B/D 23° 0.5%		Prod.
Ramon Somavia	Ashley 1 31-4-15		TD 1976			1000 B/D 21°		Prod.
Ramon Somavia	Ashley 2 31-4-15							Drilling
Ramon Somavia	Jean 1 31-4-15							Drilling
Ramon Somavia	Jean 2 31-4-15	4-49				430 B/D		Prod.
Trical Oil Co.	Fehsel 1 31-4-15							Drilling
Rothschild Co.	Rassp Comm. 1 31-4-15							Drilling
Rothschild Co.	Rassp Comm. 2 31-4-15							Drilling
Rothschild Co.	Rassp 1 31-4-15	5-49				400 B/D 22.5°		Prod.
Rothschild Co.	Cole Comm. 1 31-4-15							Drilling
Rothschild Co.	Boyd Comm. 1							Drilling
General Petroleum Corp.	Orwig 1 31-4-15	4-49				210 B/D 22°	Flowing	Prod.
Gordon Oil Co.	Peggy Moore 2 31-4-15	5-49						Prod.
Gordon Oil Co.	Peggy Moore 3 31-4-15	5-49						Drilling

Table 6. Wells drilled in Placerita Canyon area since 1934—Continued
(April 1948 to June 1949)

Operator	Well S-T-R	Yr. and mon. comp. or aband.	Depth—total producing	Geology	Geology at bottom	Daily amts. oil, gas, & water	Remarks	Status 6-1-49
Nelson-Phillips Oil Co.	Kraft 1 31-4-15	4-48	TD 2242 Perf. 580-714	Qs to 420 Tsr-Tpu oil sand 130 ft. thick	Eo. hard ss-sh	60 B/D 16° 5%	Discovery well	Prod.
Nelson-Phillips Oil Co.	Kraft 2 31-4-15	6-48	TD 782			80 B/D 16° 1%		Prod.
Nelson-Phillips Oil Co.	Kraft 3 31-4-15	7-48				100 B/D 16° 2%		Prod.
Nelson-Phillips Oil Co.	Kraft 4 31-4-15	9-48				50 B/D 15°		Prod.
Nelson-Phillips Oil Co.	Kraft 5 31-4-15	11-48	Prod. 605			35 B/D		Prod.
Nelson-Phillips Oil Co.	Kraft 6 31-4-15	10-48						Prod.
Nelson-Phillips Oil Co.	Kraft 7 31-4-15	1-49						Prod.
Nelson-Phillips Oil Co.	Kraft 8 31-4-15	2-49						Prod.
Nelson-Phillips Oil Co.	Kraft 9 31-4-15	2-49						Prod.
Nelson-Phillips Oil Co.	Kraft 10 31-4-15							Drilling
Myers & Wilhite	Swall-Ferrier 1 31-4-15	2-49	TD 652					Aband.
Nelson-Phillips Oil Co.	Swall-Ferrier 1 31-4-15	6-48	TD 500				Salt water	Aband.
Nelson-Phillips Oil Co.	Swall-Ferrier 3 31-4-15	11-48	TD 842					Aband.
Indian Oil Company	Wanda Kraft 1 31-4-15	6-48						Prod.

Indian Oil Company	Wanda Kraft 2 31-4-15	8-48	TD 840			80 B/D		Prod.
Indian Oil Company	Wanda Kraft 3 31-4-15	4-49						Prod.
Indian Oil Company	Wanda Kraft 4 31-4-15	11-48						Prod.
Indian Oil Company	Placerita 1 31-4-15	9-48						Prod.
Indian Oil Company	Placerita 2 31-4-15	3-49						Prod.
Spinel Oil Company	K. D. 1 31-4-15	11-48						Prod.
Crawford & Hiles	Newhall Highway 1 31-4-15	7-48	TD 946			75 B/D 12°		Prod.
Crawford & Hiles	Newhall Highway 2 21-4-15	9-48						Prod.
Crawford & Hiles	Newhall Highway 3 31-4-15	11-48						Prod.
Rothschild Company	Placerita Comm. 1 31-4-15	6-49	TD 1836			402 B/D		Prod.
Rothschild Company	Placerita Comm. 2 31-4-15							Drilling
Rothschild Company	Placerita Comm. 3 31-4-15							Drilling
Independent Exploration Company	Newhall Royal Comm. 1 30-4-15	6-49	TD 2037	Top oil sd. at depth approx. 2000 ft. (150 ft. below sea level) 100 ft. oil sd.		725 B/D 23°	N. limit of prod. to date. First prod. on sec. 30	Prod.
King Oil and Gas Co.	Peggy Moore 1 31-4-15	2-49						Prod.
King Oil and Gas Co.	Peggy Moore 2 31-4-15	3-49				100 B/D 16°		Prod.

Table 6. Wells drilled in Placerita Canyon area since 1934—Continued

(April 1948 to June 1949)

Operator	Well S-T-R	Yr. and mon. comp. or aband.	Depth—total producing	Geology	Geology at bottom	Daily amts. oil, gas, & water	Remarks	Status 6-1-49
King Oil and Gas Co.	Peggy Moore 3 31-4-15	3-49						Prod.
King Oil and Gas Co.	Peggy Moore 4 31-4-15	3-49						Prod.
Gordon Oil Co.	Wickman-Ferrier 1 31-4-15	5-49						Prod.
Gordon Oil Co.	Wickman-Ferrier 2 31-4-15	6-49						Prod.
Gordon Oil Co.	Wickman-Ferrier 3 31-4-15							Drilling
Gordon Oil Co.	Wickman-Ferrier 4 31-4-15							Drilling
Newhall Refining Co.	Philbert 1 31-4-15	9-48	TD 1400			30 B/D 15° 1%	On gas lift	Prod.
Newhall Refining Co.	Philbert 2 31-4-15	2-49						Prod.
General Petroleum Corp.	Castruccio 1 31-4-15	1-49	TD 1460 Prod. 1240-1460	Qs-Tsr (?) top to bottom	Tsr (?)	80-90 B/D 12° 9%	Some oil between 1005-1160	Prod.
General Petroleum Corp.	Castruccio 2 31-4-15	2-49						Prod.
General Petroleum Corp.	Castruccio 3 31-4-15	2-49						Prod.
General Petroleum Corp.	Castruccio 7 31-4-15	3-49						Prod.

Newhall Refining Co.	Philbert Comm. 1-1 31-4-15	7-48						Prod.
Newhall Refining Co.	Philbert Comm. 3-1 31-4-15	11-48						Prod.
Richfield Oil Corp.	Shepard 1 1-3-16							Aband.
Bettymac Oil	Warren 1 1-3-16							Drilling
York Oil Co.	York 5 36-4-16	Comp. 36 Aband. 43	TD 2735					Aband.
B. B. Breckenridge	Atomic 1 36-4-16	12-48						Prod.
B. B. Breckenridge	Atomic 2 36-4-16	1-49						Prod.
George Terry Drilling Co.	Breckenridge 1 36-4-16	3-49						Prod.
George Terry Drilling Co.	Breckenridge 2 36-4-16	4-49	TD 1596			25 B/D 12.8° 10%		Prod.
George Terry Drilling Co.	Breckenridge 3 36-4-16							Drilling
Federal Oil Co.	Oakgrove 1 36-4-16	1-49						Aband.
Ned Barmore	Hays 1 36-4-16	8-48	TD 2387				No showings	Aband.
Terminal-McBurney	Thompson 1 36-4-16		TD 2524 in April		Being deepened to test Eo.		Aband. in April; being deepened in June	Drilling
Crawford & Hiles	Placerita 1 32-4-15	6-49	TD 3307 Prod. 1695			1000 B/D 22°		Prod.

* Based on data from Walling, R. N., Report on Newhall oil field: California Div. Oil and Gas, Summary of Operations, vol. 20, no. 2, table 9, p. 49, table 10, p. 53, pl. 4, 1934.
† All wells abandoned by 1937.
[1] Based on data supplied by Standard Oil Co.

Base from parts of the Saugus, Humphreys, Newhall and Sylmar quadrangles.

Geology by G.B. Oakeshott.

TOPOGRAPHIC AND GEOLOGIC MAP OF THE PLACERITA OIL FIELD

LOS ANGELES COUNTY, CALIFORNIA

SCALE
1 0 1 MILE

SEDIMENTARY ROCKS

QUATERNARY

Recent

Qal — Alluvium

Pleistocene

Upper

Qt_2 — Later terrace deposits *(fanglomerate and stream gravels.)*

Qt_1 — Older terrace deposits *(fanglomerate and stream gravels.)*

Lower

Qs — Saugus formation *(continental conglomerate and sandstone; often little consolidated.)*

TERTIARY

Pliocene

Upper

Tsr — Sunshine Ranch member *(continental greenish sandstone, mudstone, conglomerate, red beds and thin limestone beds.)*

Tpu — Upper Pico member *(marine coarse to fine sandstone and mudstone; conglomerate; fossiliferous.)*

Middle

Tpl — Lower Pico member *(marine conglomerate and sandstone; massive fine sandstone and siltstone fossiliferrous calcareous sandstone.)*

Pico formation

Lower

Tr — Repetto siltstone member *(marine brown and gray siltstone and mudstone.)*

Te — Elsmere member *(marine fossiliferous, often petroliferous, coarse sandstone and conglomerate; interbedded medium and fine grained sandstone and siltstone.)*

Repetto formation

Miocene

Tmc — Mint Canyon formation *(continental coarse gray and buff sandstone and conglomerate; brown and greenish sandstone; greenish mudstone; thin red sandstone and claystone beds; tuff beds; lake beds.)*

IGNEOUS AND METAMORPHIC ROCKS

PRE-TERTIARY

Upper Jurassic ?

gd — Granite, granodiorite, monzonite.

Paleozoic ?

rd + pm — Rubio diorite gneiss and Placerita metasedimentary rocks.

GEOLOGIC SYMBOLS

Contacts: definite trace; uncertain trace

Faults: definite trace; apparent trace; concealed

Dip and strike: determined; approximate; horizontal

Exposed oil sand

Fossil locality

Conglomerate bed

Tuff bed

Limestone

Axis of anticline showing plunge

Axis of syncline

NORTHEAST PORTION
NEWHALL OIL FIELD
INCLUDING
PLACERITA OIL FIELD

Modified June 1949 from map of Newhall Oil Field no. 18 A, revised June 4, 1949, Division of Oil and Gas, R. D. Bush, State Oil and Gas Supervisor

LEGEND

- Uncompleted, drilling
- Uncompleted, idle
- Uncompleted, abandoned
- Completed, producing
- Completed, idle
- Completed, abandoned

PLACERITA OIL FIELD

NEWHALL

SAUGUS

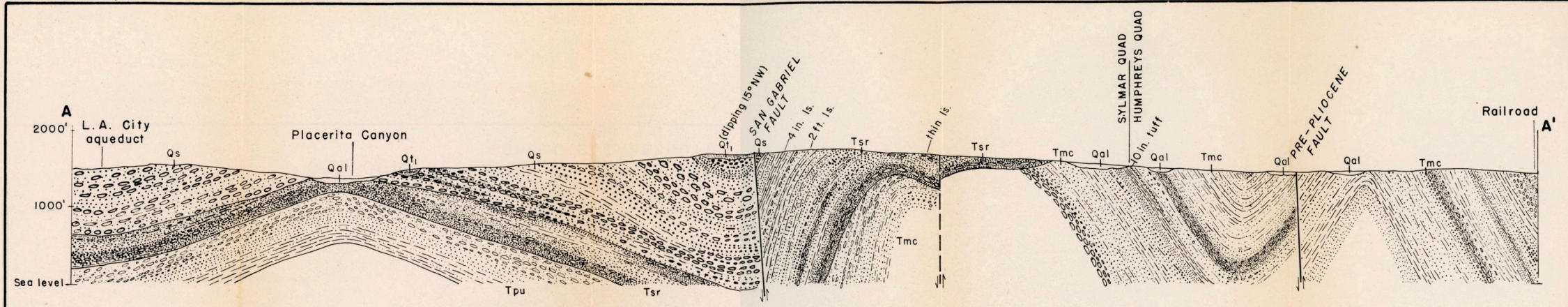
WHITNEY CANYON AREA
Republic Pet. Co.

SCALE
2000 0 2000 4000 6000 FT.

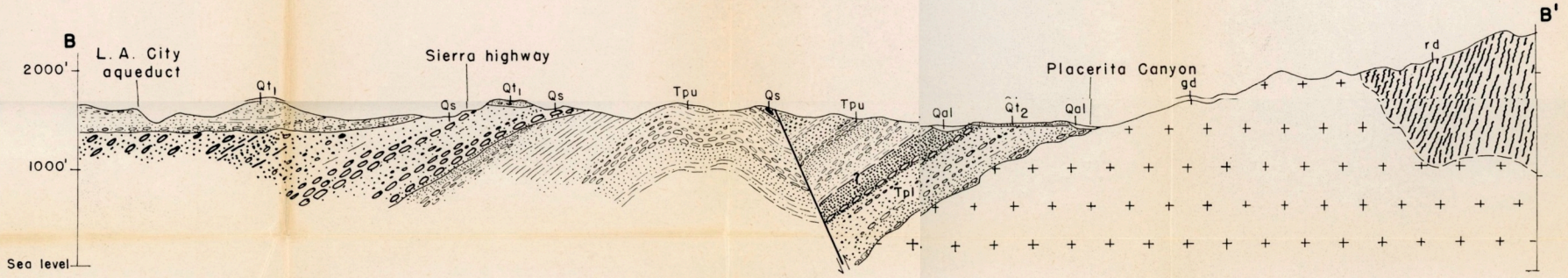
DIVISION OF MINES
OLAF P. JENKINS, *Chief*

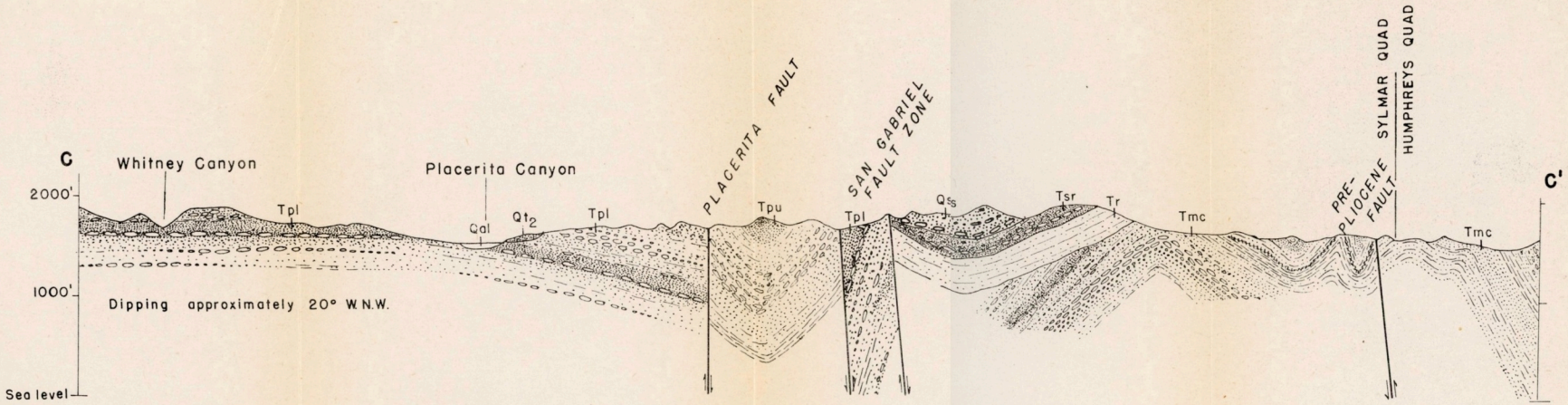
STATE OF CALIFORNIA
DEPARTMENT OF NATURAL RESOURCES

JOURNAL
VOL. 46, PLATE 16



SECTION A-A' ALONG SIERRA HIGHWAY





LEGEND

Qal	Alluvium
Qt2	Later terrace deposits
Qt1	Older terrace deposits
Qs	Saugus formation
Tsr	Sunshine Ranch member
Tpu	Upper Pico member
Tpl	Lower Pico member
	Pico formation
Tr	Repetto siltstone member
Tmc	Mint Canyon formation
gd	Granite, granodiorite, monzonite
rd	Rubio diorite gneiss

SCALE

0 500 1000 2000 3000 feet
horizontal and vertical

GEOLOGIC SECTIONS OF THE PLACERITA OIL FIELD

GORDON B. OAKESHOTT

1949

TECTONIC MAP

OF THE

PLACERITA OIL FIELD