

GEOLOGIC STUDIES
IN THE VICINITY OF DRY CANYON,
LOS ANGELES COUNTY, CALIFORNIA

By

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A Thesis Submitted in Partial Fulfillment
of the Requirements for the Degree of
Bachelor of Science

1936

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SUMMARY

Only sedimentary rocks are found in the field area. These have been divided into four formations which, beginning with the oldest, are the Mint Canyon, Dry Canyon, and Saugus formations, and Quaternary gravels. Unconformities separate each of these formations. The Mint Canyon formation is known to be of continental origin since remains of land vertebrates have been found in these strata. Marine fossils are found in the Dry Canyon formation. The Saugus formation and Quaternary gravels are very likely continental deposits.

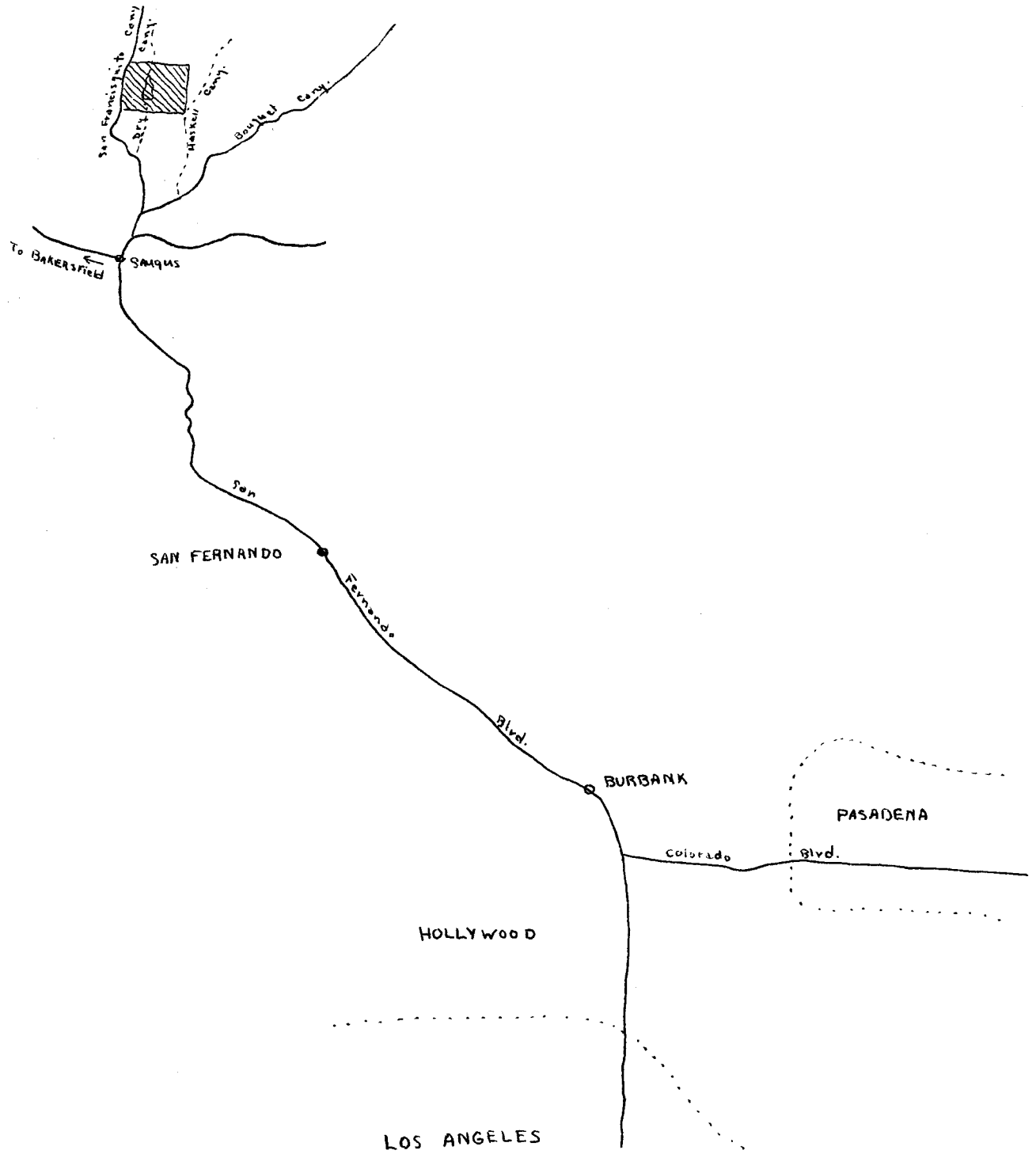
In general, the sedimentary beds have been gently deformed into fold structures whose axes trend in an E - W direction. Faulting may have accompanied the folding since several reverse types of faults were found. Later faulting of the Quaternary gravels also took place. A majority of the larger faults appear to be approximately parallel to the fold structures.

INTRODUCTION

The area studied is located approximately 40 miles northwest of Pasadena, about 5 miles north of Saugus, and around Dry Canyon Reservoir. It covers about 3.5 square miles, extending from Haskell Canyon west to San Francisquito Canyon (see map on next page). This field problem was undertaken in partial fulfillment of the requirements for a Bachelor of Science Degree.

A Brunton compass and an enlarged portion (1"=1000') of the Saugus Quadrangle were used in the mapping work. Though the region is one of moderate relief, good outcrops are few. This is perhaps principally due to the softness of the sediments.

A coordinate system is used to facilitate the location of specific points on the geologic map. Numerals are used to give east-west positions and letters are used on the north-south coordinate lines.



STRATIGRAPHIC SUCCESSION

The formations exposed in the field area are entirely sedimentary. Beginning with the youngest, the formations are Quaternary gravels, Saugus formation, Dry Canyon formation, and Mint Canyon formation. The name Dry Canyon formation has been applied to those sediments which are thought to be marine in origin. This stratigraphic unit lies between the Mint Canyon and the Saugus formations. A very approximate estimation of the total thickness (1000'+) of the formations exposed in the area can be given. Very small portions of the Mint Canyon and Saugus formations were studied. The field work was confined principally to the Dry Canyon formation and its relations to those sediments which lie stratigraphically above and below.

Mint Canyon Formation

The Mint Canyon formation is exposed at the eastern and northern borders of the area. In general, the Mint Canyon formation is composed of inter bedded sandstones and conglomerates. The appearance of the rocks at the eastern border of the area is different from that of the Mint Canyon formation to the north. At the former place gray and brownish-red conglomerates prevail, and to the north of the area the Mint Canyon formation is composed of tan to light brown sandstones and conglomerates. A discussion of the Mint Canyon- Dry Canyon contact at both the northern and eastern borders of the area is found on page 6 .

The Mint Canyon formation to the north of the field area has the same general appearance in Smoke Canyon, Dry Canyon, and in San Francisquito Canyon. This is also true for some distance north from the contact. Though some of the types of the coarser materials may vary, the description of the Mint Canyon formation near the upper contact in Smoke Canyon will serve to characterize the formation in this part of the field area (17.5 - 1.5). Here are found poorly sorted, tan colored sandstones and conglomerates. Frequently the beds show a faint lavender color which is distinctive.

Lensing and lateral variation

are prevalent in many beds.

Scour channels are quite

abundant. The material

ranges in size from boulders

1.5 ft. in size, to coarse, of-

ten arkosic sands. Photograph 1

shows a characteris-

tic exposure of the Mint Can-

yon formation.

Granites, gray schists and gneisses of the type found

in the overlying formations, sandstone boulders and cobbles, massive smoky quartz cobbles, and some green and purple colored, porphyritic andesites (?) are the more common types of coarse clastics found at this locality. There are several features that serve to distinguish these beds from the Mint Canyon formation in Haskell Canyon. (1) Anorthosites are found in Haskell Canyon, (2) Red beds are more abundant, and these have a greater percentage of conglomeratic material, and (3) gray, conglomeratic sandstones with hard, concretionary red sandstone interbeds are also characteristic.



Photograph 1:

Beds of Mint Canyon formation in Dry Canyon formation. Notice largest boulder (15") is conglomeratic sandstone and in center of picture, well rounded igneous boulder.

Dry Canyon Formation

This stratigraphic unit is not difficult to distinguish from the other formations in that it is composed principally of yellow or yellowish brown sandstones and brown, silty shales with a few members to which the term shale can be applied in the strict sense. On the east side of Dry Canyon the contact of the Dry Canyon formation and the Mint Canyon formation is well exposed (see Photograph 2). The reasons for drawing the contact at this place are as follows, (1) angular discordance between the two conglomerate units, (2) presence of scour channels in the Mint Canyon formation at the contact, (3) lithologic and marked color differences of the two conglomerates, ^{and} (4) continuity of the overlying yellow conglomerate with the marine beds to the south. This latter evidence is seen in Wild Irish Canyon (see page). Part of the Mint Canyon formation is in fault contact with the Dry Canyon formation, and this will be discussed under the topic of Faulting (page 19).

In the Haskell Canyon Anticline what are believed to be the basal beds of the Dry Canyon formation are soft, yellow sandstones and conglomerates. These overlie the previously described gray sandstones and conglomerates of the Mint Canyon formation. Additional field work will be necessary before an exact statement can be made. Consequently, the contact line has been dotted on the geologic map.

Much more is known regarding the relation of the Dry Canyon formation to the Saugus formation.

Evidence for the unconformable relation of the two formations is obtained from several sources. (1) The positions of marker beds in the Dry Canyon formation relative to the upper contact, (2) studies of the relative intensity of folding and faulting of the two formations, and (3) studies of outcrops in which the contact is exposed have provided sufficient evidence to conclude that the Saugus formation lies unconformably on the Dry Canyon formation .

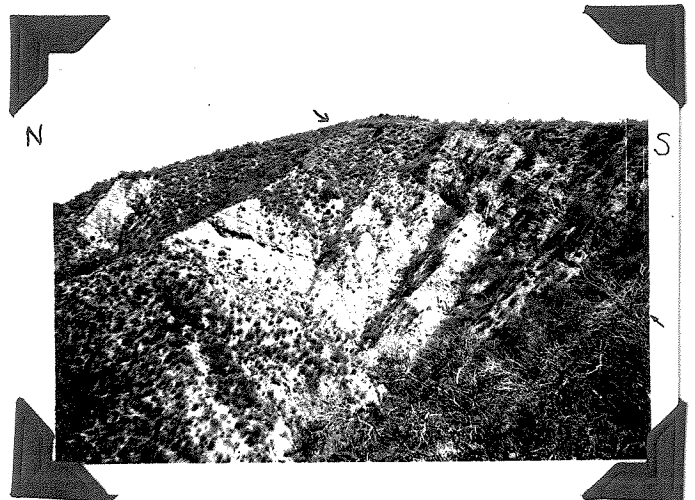
There are several excellent marker horizons in the area. The most persistent and distinctive is a white, platy, diatomaceous shale

horizon which can be recognized almost anywhere it is seen. A study of the Dry Canyon section in the Haskell Canyon Anticline has shown that this is the only horizon of its type in the marine section. The same cannot be said of the conglomerate

marker horizon which can be traced for some distance and recognized in several localities. However, the fact

that numerous mega-fossils occur at this particular horizon serves to lend distinction to these beds.

Referring to the geologic map, at 25 - C, the shale horizon lies approximately 70' stratigraphically below the Saugus Dry Canyon contact.



Photograph 22

Contact of the Mint Canyon and Dry Canyon formations. The Mint Canyon formation strikes more north easterly than the overlying beds.

At 19 - R and 23 - S.5 the shale is 100' - 125' below the Saugus contact. Varying distances of the conglomeratic marker horizon from the upper contact of the Dry Canyon formation can also be seen at 15.3 - Y and 17.3 - X.5. At the former locality the Saugus formation is less than 25' stratigraphically above the conglomerate beds, and at the latter locality, 30' - 40' of marine beds are found between the Saugus formation and the conglomerate. An attempt was made to trace the conglomerate horizon east of 17.3 - X.5, and the results afford additional indication of an unconformable relationship of the two formations.

The evidence found in the area regarding the degree of folding of the Dry Canyon and Saugus formations suggests that the Dry Canyon formation suffered very little folding before the Saugus formation was deposited. A study of the map will show that whatever structure appears in the Dry Canyon formation appears also in the Saugus formation. For further discussion of this problem refer to the topic of Folding (page 19).

Only one exposure of the contact between the Saugus and Dry Canyon formations was seen (see photograph 3). At this locality the beds of both formations dip at about the same angle, but the beds of the Dry Canyon formation appear to strike more toward the north-west. Some of the beds in this outcrop are cut off but at a very low angle.



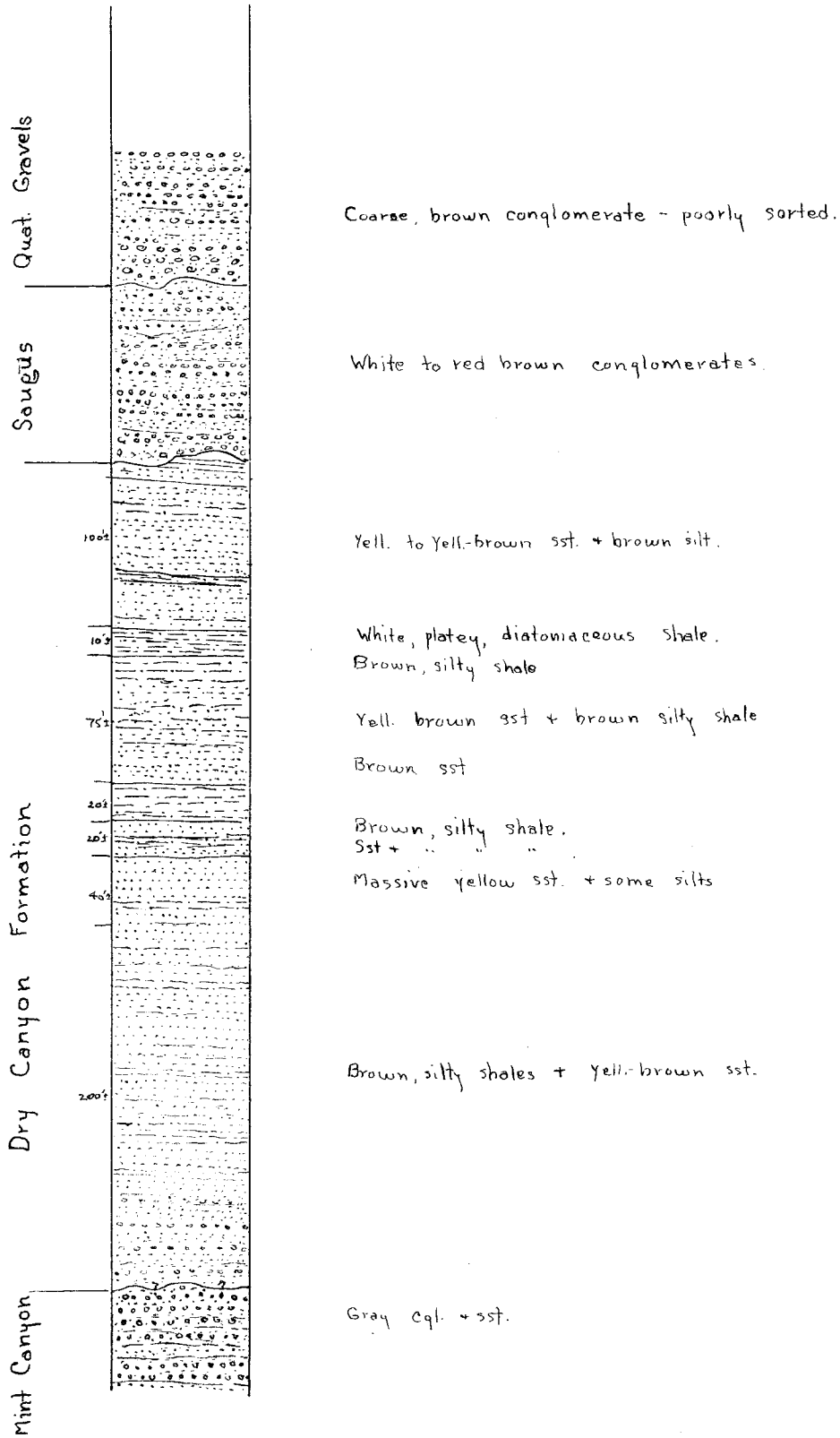
Photograph 3
Saugus formation overlying the Dry Canyon formation. Location 22 - C

The only place in the field area where the Dry Canyon formation is exposed in a normal succession of strata from the Mint Canyon contact to the Saugus contact is in the Haskell Canyon Anticline in Haskell Canyon. At this locality the stratigraphic sequence and thicknesses of the various lithologic units of the Dry Canyon formation were obtained. Two methods were used to find the approximate thickness of the Dry Canyon formation at this locality. The first approximation (500' ±) was obtained from estimation of the thicknesses of the various stratigraphic units, and the second approximation (475' ±) was obtained by calculation from data on the geologic map. Refer to the stratigraphic column on page 10.

Where marker beds are not found it is difficult to determine just where the sediments of the Dry Canyon formation belong. This is true in the case of the Dry Canyon formation exposed in the northern part of the area. Perhaps the best way in which to obtain an idea of the distribution of the various types of sediments of the Dry Canyon formation in the northern half of the field area is to refer to the geologic map. What is thought to be the succession of beds in this part of the area is given in the stratigraphic column (page). The succession of strata found in the Haskell Canyon anticline can be seen in the stratigraphic column (page 10). The types of sediments above and below the marker beds will be discussed in the following paragraphs.

The platy shale marker horizon varies in thickness from 15' to 25'+. Sufficient description of these beds is given in the preceding and following pages to give the reader a knowledge of the general character of these shales. Diatoms, radiolaria (marine only), silice-flagellates, and small fragments of volcanic glass are the predominant

STRATIGRAPHIC COLUMN



constituents of the platy shale horizon.

The conglomeratic marker horizon will need additional discussion (Photograph 4). In following outline is a rather complete description of the beds at 15.3 - Y.2 which, in general, holds good at other localities where these conglomerates outcrop.

I General character of the beds.

- A. Light brown to brown in color.
- B. Poorly sorted. Maximum size 1' . Average size 4".
- C. Coarse materials well rounded to sub-angular.
- D. Conglomerates with inter-bedded coarse sandstone to granule gravel.

II Types of conglomeratic material

- A. Anorthosites
- B. Lavas
 - 1. Gray, very vesicular lavas which show flow structure.
 - 2. Rhyolites.
 - 3. Andesites (?)
- C. Granites.
- D. Quartzites and gneisses.
- E. Sedimentary rocks
 - 1. Abundance of brownish, medium to coarse grained sandstone.
 - 2. Siliceous shales with chert bands.
- F. Matrix - coarse, brown sand.

III Fossils

- A. Pecten Sp.?
- B. Ostrea Sp.?
- C. Gastropods - several small species were found at this locality, but at 16.4 - W. 7 and 19.5 - S. 9 two or three species of very large forms were found. The determinations are not yet made.

Mega-fossils were found at a number of localities in the Dry Canyon formation. The lower beds are apparently not so fossiliferous. Pecten sp? and Ostrea sp? are the forms most frequently found in these lower beds. Collections but no determinations of the mega-fossils have been made, however, a number of foraminiferal samples were collected. A number of species of foraminifera were determined by Mr. F. W. Bell of the Shell Oil Company, and these are listed on the following page.



Photograph 4.

Conglomeratic marker horizon in Dry Canyon formation at 15.3 - Y.2.

According to Mr. Bell, "sample 47 is very interesting because of the presence of Bulimina uvigerenaeformis, which suggests that these beds are older than upper-most Miocene, that is the lower-most upper Miocene or upper middle Miocene. Of course, it is possible that this

Faunal List of Foraminifera

- Angulogerina occidentalis (Cushman)
Bulimina uvigerinaeformis Cushman and Kleinpell
Buliminella subfusiformis? Cushman
Bolivina sp.
Bolivina barbarana (?) Cushman and Kleinpell
Bolivina marginata Cushman
Bolivina marginata Cushman var. multicosata Cushman
"Cibicides americanus" Cushman
Glohigerina sp.
Lagena cf. acuticostata Ruess
Pullenia salisburyi(?) R. E. and K. C. Stewart
Robulus sp.
Rotalia cf. bassleri Cushman and Cahill
Uvigerinella californica (?) Cushman var. (Small)

form may have a longer range in this area than the others we have studied."

There are certain other features of the Dry Canyon formation that should be discussed. Evidence of lateral variation within the formation was found by tracing out the fossiliferous conglomerate marker bed (designated by -o-o- on the geologic map). In following this bed to the east of 17.8 - X.8 the conglomerates were seen to grade into yellow and brown sandstones.

Inspection of the beds exposed in the Haskell Canyon Anticline also provided evidence for lateral variation within the formation.

For example, the white, diatomaceous shale varied somewhat. Near the crest of the anticline the beds of this horizon are very white in color, this perhaps being due to a high percentage of organic remains. On the north flank of the anticline, near the fault, the beds take on a somewhat reddish-brown color on unweathered surfaces and may also have a few fine, silty shale interbeds. However, the platey, diatomaceous character of the shale beds is maintained.

Another evidence of lateral variation in the Dry Canyon formation is provided by comparison of the types of sediments that occur directly above the platey shale marker horizon. The difficulty in determining the position of various beds within the Dry Canyon formation is perhaps principally due to lateral variation.

Much carbonaceous material is found in both the sandstones and the silty shales. The occurrence of the material in combination with the types of sediments, deposition, and fossils found in the area indicates that the Dry Canyon formation was probably deposited in fairly shallow, marine waters. At times such as when the white, platy, diatomaceous shales were deposited, the land source must have furnished very little sediment. However the presence of conglomerates high up in the section indicate the other extreme.

SAUGUS FORMATION

The Saugus formation directly overlies the Dry Canyon formation and is not found lying on the Mint Canyon formation within the field area. Since the Saugus formation is composed principally of conglomerates and coarse sandstones, it is easy to locate small outliers on the Dry Canyon formation. This fact proved helpful in determining the structure of the Saugus formation where attitudes could not be obtained. Obviously, from the previous discussion of the Dry Canyon-Saugus contact it is seen that the contact serves a double purpose, (1) to show the relationship of the Saugus formation to the Dry Canyon formation, and (2) to determine the structure of the Saugus formation not only where attitudes cannot be obtained but where a check is needed.

Quaternary gravels lie unconformably on the Saugus formation. Excellent exposures of the contact are shown in Photographs 5, 6, 8. In the Photograph 5 the Quaternary gravels dip westward at about 4° and the Saugus beds dip southward at approximately 11° . Note the difference in degree of consolidation and the darker color of the Quaternary gravels. An excellent example of a scour channel is shown

in the upper right hand corner of the Photograph.

Where such exposures are found it is simple to determine the contact accurately, but in other places such as at 19.5 - P and 10.8 - S.7 questionable determinations arise. At these localities the Quaternary gravels and the Saugus beds appear to have similar compositions, this perhaps being due to the fact that the former clastics may be made up of reworked Saugus materials. Thus, it is possible that some of the Quaternary gravels may be included in the Saugus formation or vice versa.

To the west of Dry Canyon white conglomerates and sandstones lie on the Dry Canyon formation. The basal beds on the south flank of the Haskell Canyon anticline possess an abundance of gray gneisses and schists. In the remaining localities where the Saugus formation is found, conglomerates similar to those to the west of Dry Canyon are predominant near the contact.



Photograph 5

Quaternary gravels overlying the Saugus formation.

The beds of the Saugus formation at P - 10.5 are composed principally of white to red-brown conglomerates and conglomeratic sandstones which are arkosic. The coarser materials are rounded to sub-angular in character and are loosely consolidated. These poorly sorted materials range in size from 8" to fine sand, the average size being approxi-

mately 3". Distinct stratification makes it possible to obtain attitudes (see Photograph⁶). The above description is fairly representative of the Saugus formation throughout the field area. The assemblages of conglomeratic materials vary, however, granites, milky quartz, lavas and gray gneisses and schists are predominant. Several beds of



Photograph 6

Saugus formation at Q - 8.5
White Conglomerate.

volcanic ash were found (5.1 - R.3) but no amorthosites. The type of deposition and the apparent lack of marine fossils might serve to indicate that the Saugus formation is of Continental origin.

Quaternary Gravels

The Quaternary gravels lie unconformably on the Saugus, Dry Canyon, and Mint Canyon formations. These sediments outcrop almost entirely in the northern half of the area. The thickest accumulations are found in the northeast corner. In general, the basal beds of the Quaternary gravels lie at 1700' to 1900' elevation. Photograph 7 gives an indication that these sediments were laid on a relatively uneven surface, however, the behavior of the contact line shown on the map may be partially due to very gentle tilting and some faulting in combination with the previously described phenomena.

The Quaternary gravels are predominantly boulder gravels. In the

vicinity of 10 - M material as small as pebble gravel is found. Medium grained, gray gneisses and schists of the types that occur in the Pelona schists to the northeast are abundant in the Quaternary gravels. The abundance of milky quartz boulders is also characteristic as well as the softness and brown color of the sediments.



Photograph 7

Quaternary gravels lying unconformably on the Mint Canyon formation.



Photograph 8

Quaternary gravels copying the Saugus formation.

STRUCTURE

Folding

In general, the sediments of the field area have been gently folded. There are three groups into which the folds can be divided, (1) two major folds and two minor folds which trend approximately E-W, (2) three smaller folds which trend about N 60° E, and (3) three folds whose axes trend N-S. The folding is expressed in the structure of both the Dry Canyon and Saugus formations. However, it is difficult to determine if the Quaternary gravels have been folded, at least from evidence found in the field area. It appears that the folding is predominant in the southern part of the area and faulting in the northern portion of the area.

The Haskell Canyon anticline is a quite persistent structure since it can be seen in the west side of San Francisco Canyon. Near Haskell Canyon the folding becomes more intense, and the axis of the anticline plunges rapidly to the west. This increase in intensity of folding is seen in the Haskell Canyon Syncline also (Photograph 10).

During the time of deposition of the Dry Canyon formation some deformation probably occurred (Photograph 11). This is shown by evidence of a local hiatus found at 18.8 - H. However, the field evidence seems to indicate that not a great deal of folding of the Dry Canyon formation took place before the deposition of the Saugus formation.

Faulting

Faulting is apparently more prevalent in the northern part of the area, however, the magnitude of throw of any one of these is probably



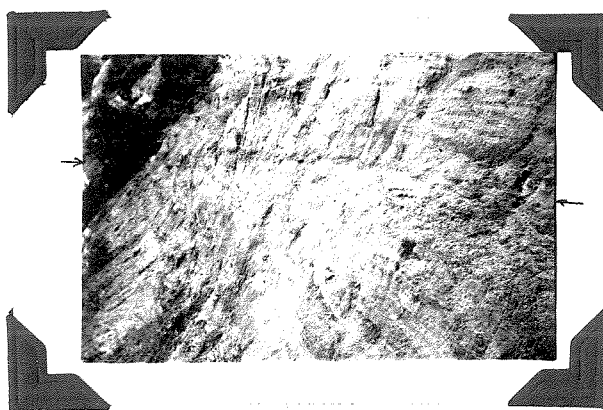
Photograph 9

Haskell Canyon anticline in Haskell Canyon



Photograph 10

Haskell Canyon syncline as seen from a point west of 1888' peak.



Photograph 11

Indication of a hiatus as seen in the Dry Canyon formation.

not very great. Field evidence indicates that fault movement has taken place at several times. Some of the faults might reasonably have developed contemporaneously with the folding. In general, most of the faults trend in the direction of the axes of the folds. The larger faults seem to take an approximately E - W direction which is the trend of the major fold structures of the area.

Considerable evidence was found for the reverse fault between the Mint Canyon and Dry Canyon formations near the northern border of the area. Exposures of the fault were found on the east side of Dry Canyon (Photograph 12) and San Francisquito Canyon (Photograph 13). At the former locality a gouge zone of from 6" to 8" was found. The beds of the Dry Canyon formation are dragged upward as seen in the photograph of this locality, and these beds are butted against strata of the Mint Canyon formation.

After tracing this fault up the very narrow, steep ravine along whose bottom the fault was exposed in many places, it was found the fault dipped steeply to the north. This was also true of the fault dip in San Francisquito Canyon only here the angle was about 65°N . Since the contact of the Mint Canyon and Dry Canyon formations was not found on the south block in Dry Canyon, only an estimation of 100' can be given. The amount of displacement is probably not much greater than this since the basalt conglomerates of the Dry Canyon formation were seen on the south block. In the vicinity of San Francisquito Canyon the displacement probably becomes greater. The fault outcrop was not found in Wild Irish Canyon which might indicate that it dies out or is displaced by the next fault to the south.



Photograph 12

Fault between the Dry Canyon and Mint Canyon formations in east side of Dry Canyon at north border of the area.



Photograph 13

Same fault as that shown in Photograph 12 as seen in east side of San Francisquito Canyon.

The next fault south which passes through the point 10 - E,2 has displaced the Quaternary gravels approximately 75'. In the west side of Dry Canyon can be seen interbedded sandstones and brown, silty shales against coarse, yellow sandstones with some interbedded conglomerates. The types of sediments found in each fault block and the direction of the displacement of the Quaternary gravels indicates that the south block moved down relative to the north block. Discontinuity and distortion of beds, presence of much slickensided material, and crushed concretions are the evidences used in determining the presence of the NE fault which intersects the previously described fault.

Faulting of the Quaternary gravels against the Dry Canyon formation was seen at 19.4 - H (Photograph 14). South about 2000' is a body of Quaternary gravels which lie approximately 100' below the basal beds of the larger gravel deposits to the northeast. On the east side of the former body of Quaternary gravels were found sag ponds (?) which might have been formed as the result of land sliding or faulting of the gravels to the west (Photograph 15).

The trace of the N - S fault near the northern border of the area in Wild Irish Canyon was determined by discontinuity and distortion of the strata near the place where gray sandstones and brown silts were against coarse, yellowish brown sandstones. Since the finer grained sediments were found in the east block and the faulting occurred near the contact, it is believed that the east block moved down relative to the west block.

At the localities 14.5 - G, 16.3 - G.5, 18.3 - I a northwesterly trending fault was seen to outcrop. The sediments of the southern block



Photograph 14

Faulting of the Quaternary gravels
against the Dry Canyon formation as seen
at 19.4 - H

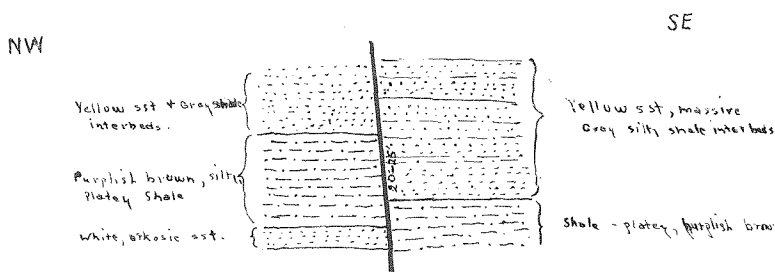


Photograph 15

Depression formed by landsliding or
faulting of the Quaternary gravels at
20 - N.

seemed to possess a higher percentage of shales, especially at the latter locality. Much caliche was found at the second locality, and this made it possible to trace the fault to the first locality where the fault was again seen to outcrop. Horizontal movement, as shown on the geologic map, might be indicated by the change in strikes of the beds just north of the fault.

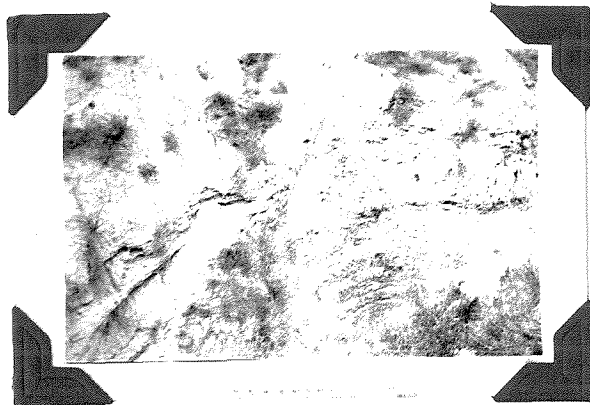
The fault which was seen to outcrop at 16.3 - H.5 has a displacement of about 25' as shown by the accompanying sketch. Its trend was determined by locating an exposure of the fault to the northeast on the other side of the spur. This fault dipped steeply to the southeast.



The reverse fault which passes through 17.2 - P.3 displaced the platey shale marker horizon about 50'. At 18.0 - R.2 the fault was seen to outcrop, and at this locality the dip of the fault was determined to be approximately 75° SW (Photograph 1b). Just south of the previously described fault, evidence for a northeasterly trending fault was found. A 100^{\pm} displacement of what is thought to be the same fossiliferous horizon, anomalous physiographic features, and the outcrop of a nearly vertical fault in a roadcut along the Dry Canyon Reservoir road were the evidences used to determine the presence of the fault.

There is excellent evidence available for the E-W fault along the

north flank of the Haskell Canyon anticline. This fault has displaced the platey shale marker horizon 100' downward on the north block. The trend of the fault is given by the direction of the U-shaped valley (Photograph 17). It is likely that this fault begins as a bedding fault along the Dry Canyon - Saugus contact and becomes a vertical fault to the east. This statement is substantiated by the fact that no displacement can be seen in the beds of the Haskell Canyon syncline which is exposed in its entire cross-section on the west side of the 1888' peak.



Photograph 16

Fault at 18.9 - R.2



Photograph 17

Fault valley of fault on north side of the Haskell Canyon anticline.