THE GEOLOGY OF A PORTION OF THE SAUGUS AND RED MOUNTAIN QUADRANGLES

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SENIOR THESIS AREA,
1938-1939

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SUMMARY

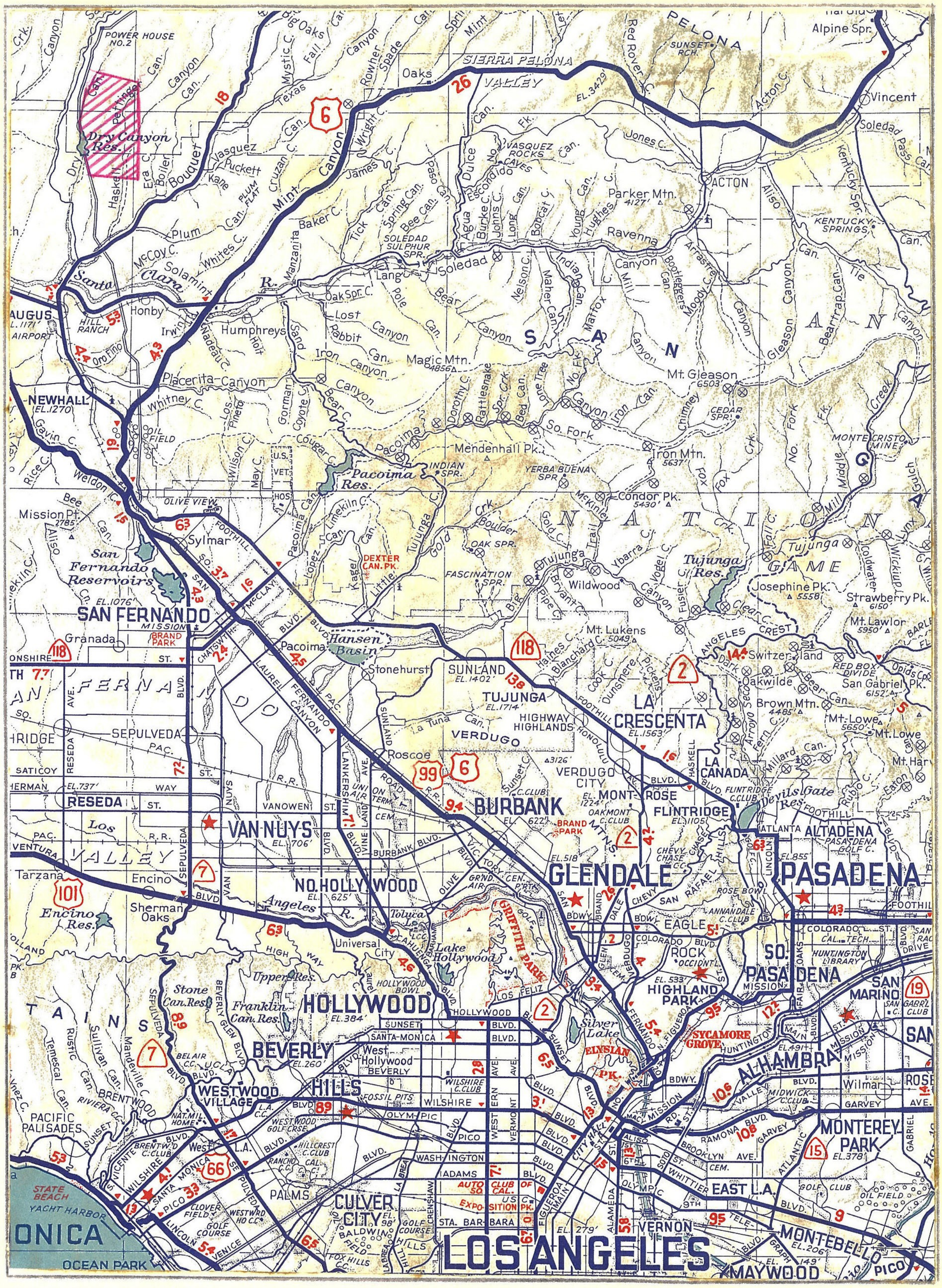
The area treated in this report lies in the Southern Coast Ranges, near Saugus, California. The rocks investigated include the Pelona Schist, a pre-Jurassic metasediment, the Mint Canyon formation, an upperMiocene terrestrial deposit, the Modelo Formation an upper Miocene marine deposit, and the Saugus Formation, an upper Pliocene terrestrial deposit.

The Mint Canyon rests in Normal fault contact on the Basement Complex. The Modelo rests unconformably on the Mint Canyon. The Saugus Formation rests with a disconformable contact on the Modelo.

Many of the ridges of the area are capped with a Pleistocene alluvium which rests unconformably on the Tertiary rocks. These alluvial deposits form remnants of an old land surface which is in the process of being dissected.

There were two periods of folding in the area. One after the deposition of the Mint Canyon, the other after the deposition of the Saugus. The axes of folding in these two periods were the same, and trend in an east-west direction.

INDEX MAP SHOWING THE LOCATION OF THE AREA



INTRODUCTION

Location of the Area-

The area discussed in this report lies in the southern part of the California Coast Ranges, and includes the north-eastern part of the Saugus Quadrangle, and the south-eastern part of the Red Mountain Quadrangle. The area is located about 4o miles north-east of Los Angeles, and is easily accessible by roads. From Los Angeles it is reached by route 99 through San Fernando, and then by route 6, which joins route 99 about 2 miles north of San Fernando, for about 2 miles to the junction with the Bouquet Canyon road. One should turn left on the Bouquet Canyon road, which passes the mouth of Haskell Canyon. There is a fairly good dirt road in Haskell Canyon.

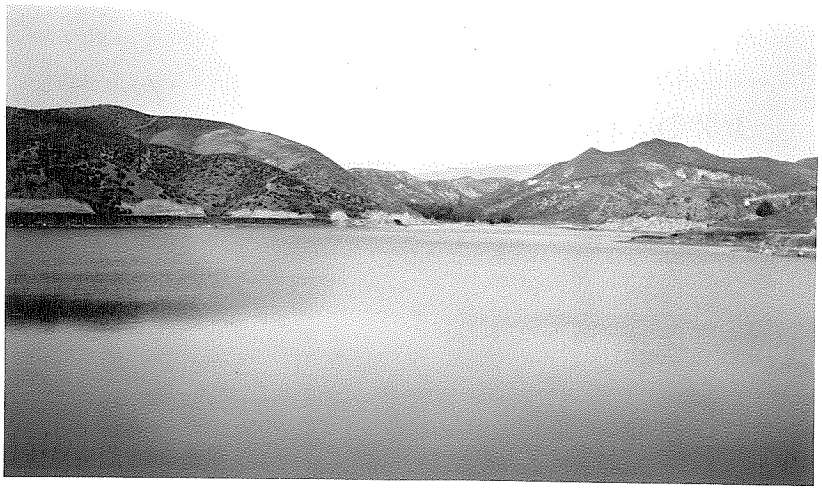
Size of the Area-

The area investigated comprises some 6-8 square miles. The geology was mapped on each side of Haskell Canyon, giving a north-south trending strip reaching from the Saugus Formation on the south to the Basement Complex. On the east the mapping was carried from Haskell Canyon to the edge of the Saugus Quadrangle; on the west, to Dry Canyon, the next large canyon west of Haskell Canyon.

Purpose of Investigation-

The investigation was carried out as a partial fullfillment of the requirements for the degree of Bachelor of Science at the California Institute of Technology. The mapping was done during the school year of 1938-1939.

A View Looking North
up Haskell Canyon



A View Looking North up Dry Canyon
Showing the Resevoir

Method of Investigation-

The areal geology of the area was plotted on photographic enlargements taken from the U.S.G.S. topographic maps of the Saugus and Red Mountain Quadrangles. Contacts were traced, structures were plotted, and in a few cases marker beds were also plotted. Locations were made and structure obtained by Brunton Compass.

Acknowledgments-

The discussion of the geology of Los Angeles and Ventura Counties by Kew in the U.S.G.S. Bulletin 753 was found very helpfull. The writer is also indebted to Dr. J. H. Maxson for valuable suggestions given in the field.

PHYSICAL CONDITIONS

Relief, Elevations, and Topography-

The relief in the area is not great, the lowest elevations being around 1400 feet and the highest around 2500 feet. In general, the topography is made up of north-south trending ridges and valleys. The ridges show a more or less gentle slope along their length. The valleys are rather narrow and steep walled at the north, and broader with gentler walls at the southern end of the area.

The recent physiographic history of the region is quite complicated but a few generalities can be made. Many of the ridges are flat topped, and are clearly remnants of an old surface. We might picture an early stage of the physiograpy

a mature, nearly flat surface, sloping gently toward the south. On this surface the drainage was to the south. The surface was covered with a layer of alluvium, typical alluvial fan material, and unquestionably of a fluviatile origin. The next event in the physiographic history was an uplift of the area, which began the dissection of the old land surface. The old streams entrenched themselves, forming north-south trending valleys. Some of these streams were larger than others and were able to cut faster. More of less east-west flowing tributaries developed, and gradually the larger streams captured the drainage of the smaller. The result of these processes was to produce a topography made up of north-south trending ridges and valleys with east-west tributaires. The ridges are flat topped, capped with old alluvium, and bear small valleys which often terminate in wind gaps.

Drainage-

As mentioned above, the drainage is to the south, Haskell Canyon and Dry Canyon draining into the Santa Clara River. Most of the streams in the area are intermittent. The Santa Clara River itself dwindles considerably in the dry season. In the wet season, however, these streams become veritable torrents of water, capable of doing considerable damage.

Climate-

The climate in this region is of the semiarid type. The annual rainfall is around 17-18 inches, but it is nearly all confined to the months from November to March. The temperature in winter

months is quite agreeable, but in the summer months soares to well over 100 degrees F.

Vegetation-

To a certain extent the type of soil controls the type of vegetation found in the area. In the shaley soils, the vegetation is limited to grassy types, or at least to a very light growth of sage. On the other hand, on the coarser sediments one finds very thick growths of chaparral, yucca, and sage, sometimes so thick that it is difficult to penetrate. Trees, particularly oaks and sycamores, are common in canyons along streams.

Exposures-

Outcrops in the area are for the most part fairly abundant. In the upper part of the Mint Canyon Formation in Haskell Canyon, where the structure is rather complicated, outcrops, although fairly abundant, are not entirely satisfactory. In some places, particularily in the western part of the area, the Modelo-Mint Canyon contact is obscurred by the old terrace alluvium. The Modelo formation is prone to weather, and is commonly covered over by a layer of soil.

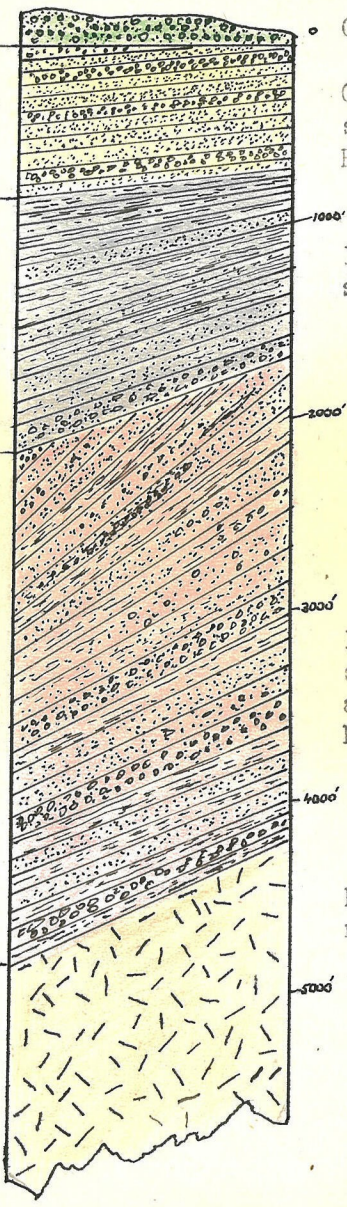
GEOLOGIC CONDITIONS

STRATIGRAPHY

Basement Rocks-

The basement rocks in the area are metamorphics, known as the Pelona schist. This rock is a dark bluish gray micaceous

A SOMEWHAT GENERALIZED VERTICAL SECTION



QUATERNARY ALLUVIUM — Conglomerates

SAUGUS FORMATION
(UPPER PLIOCENE) — Conglomerates and sandstones interbedded. Highly colored.

MODELO FORMATION
(UPPER MIOCENE) — Interbedded sandstone and shales.

MINT CANYON FORMATION
(UPPER MIOCENE) — Interbedded sandstones, shales, conglomerates, ash beds. Upper part highly colored.

PELONA SCHIST
(PRE-JURASSIC) — Metasediments, cut by numerous quarts veins.

schist, veined by white quartz veins. The color of the fresh rock varies from black to light gray. The weathered schist is often stained yellow with iron oxide. The planes of schistosity is the schist dip southward at a high angle. In many places it is quite clear that this rock is derived from old sediments, for one sees a very definite bedding which dips southward at from 50 to 60 degrees.

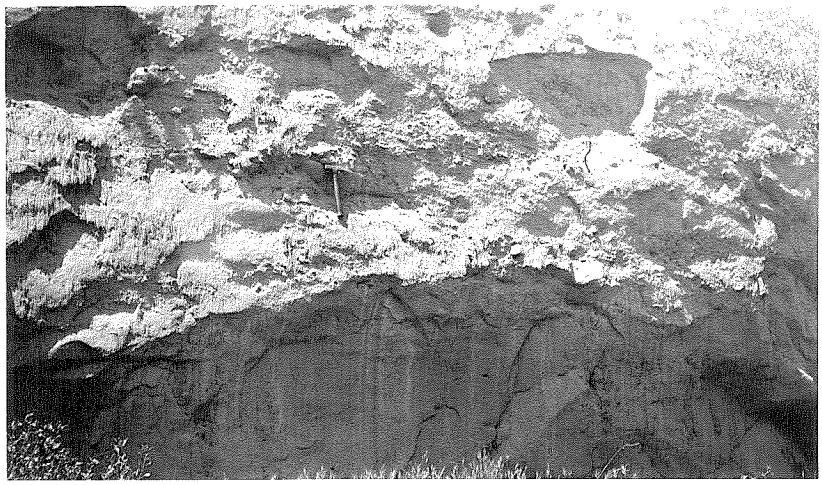
The Pelona Schist outcrops in the northern part of the area. Exposures of this rock are excellent.

The age of the Pelona Schist is not definitely known. However, it is assumed to be pre-Jurassic, because it is intruded by granites in nearby localities, which are thought to have been contemporaneous with the Seirra Nevada Granites, which are late Jurassic or early Cretaceous.

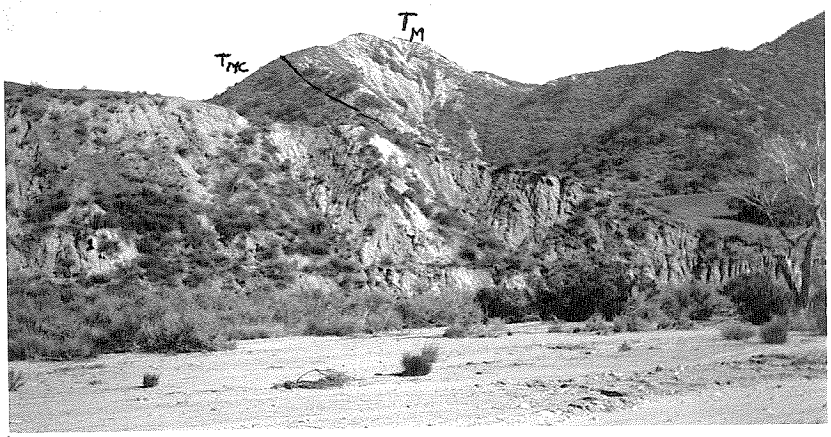
The Mint Canyon Formation-

Above the Pelona Schist in the Haskell Canyon section lies the Mint Canyon Formation. It forms a strip about one mile across, which outcrops obliquely across Haskell Canyon.

The Mint Canyon Formation consists of sandstones, conglomerates, shales, and ash beds. In Haskell Canyon, the uppermost member of the formation is a buff colored pebbly sandstone, which is perhaps 50 feet thick. Immediately underlying this is a highly colored red sandy conglomerate, which contains some ashy beds. This red member is some 150-200 feet thick and is quite persistent. Below the red member the Mint Canyon assumes a much more uniform character. It is largely made up of very



Above is a view showing the massive character of the Lower Mint Canyon. This is a very massive sandstone containing pebbles. It is very light colored, poorly stratified, but fairly well cemented with gypsum. Below is a view to contrast with the one above. This is a view of the sandy, red, poorly consolidated bed in the upper Mint Canyon, mentioned in the text. Note the badlands type of erosion. In the distance is the Modelo-Mint Canyon contact.



massive light yellow-brown to white sandstones and conglomerates interbedded with some clays. There are a few ash beds and a few reddish colored conglomerates interbedded with these beds, but for the most part the rocks are uniform, throughout the lower part of the section. The sandstones and conglomerates are quite massive, poorly sorted, crudely bedded, and poorly cemented rocks.

The lower part of the Mint Canyon section is missing. According to Kew, the lower Mint Canyon is made up of conglomerates, sandstones and clays of various colors of red, green, gray, though predominately reddish, which weather to a typical badlands type of erosion. In Haskell canyon the lower Mint Canyon is uniform, and a so eroding and so colored series is lacking.

The character of the sediments indicates that they were derived from a granitic source rock. The sediments are arkosic, and contain boulders and pebbles of granitic rock, along with fragments clearly derived from the metasediments.

The lithology of the Mint Canyon formation as well as the fauna found there-in point to a terrestrial origin for these rocks. The unsorted beds of sandstone and conglomerate are typical alluvial fan material. It seems logical to infer that the Mint Canyon formation was deposited in a large valley surrounded by mountains made up of granitic and metamorphic rocks. This valley was probably a closed or nearly closed basin, containing a lake, in which silt stones and fresh water mollusks were deposited.

The exact age of the Mint Canyon formation is still a question. It is probably upper Miocene, since it underlies the Modelo which is upper Miocene in age. It contains a meager

Another view of the lower part of the Mint Canyon Formation showing the very massive character of the rocks, and also this view gives some idea of the uniformity of the lower part of the section. This is typical of the Haskell Canyon Mint Canyon.

amount of vertebrate fossil remains.

The Modelo Formation-

Overlying the Mint Canyon Formation, outcropping in a strip of maximum width of one mile, and running obliquely across Haskell Canyon is the Modelo formation.

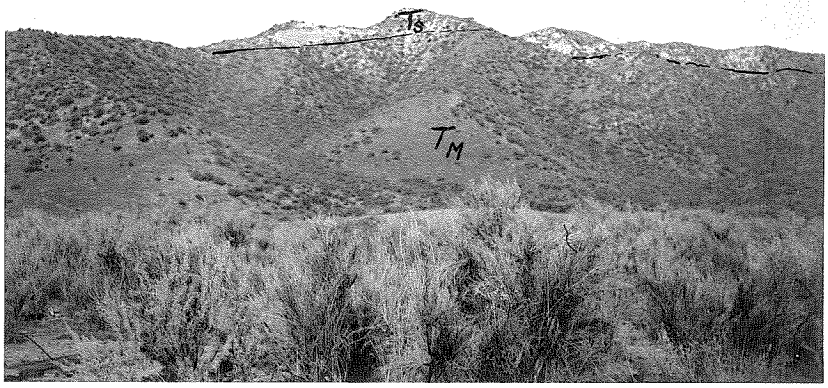
At the base of the Modelo is a pebble conglomerate, containing lenses of concretionary material. The thickness of this bed varies, but its maximum is about 12 feet. The bed is very hard, and is light gray in color. It is lenticular and pinches out to the west. Where this bed is found, the contact is very clear, because of the excellent outcrops formed by it.

In general, the lower part of the Modelo is rather sandy in character. About 75 feet above the contact there is one persistent bed of ash or tuff. Directly above this bed are a few beds of diatomaceous shales. Immediately above this diatomaceous shale is a sandy bed which is fairly rich in fossils.

The Modelo contains great quantities of gypsum, as well as concretions. In a few places it is fossiliferous, and four localities were found, which yielded a small collection of invertebrates. The upper part of the Modelo is somewhat more shaley than the lower, although it all contains sand.

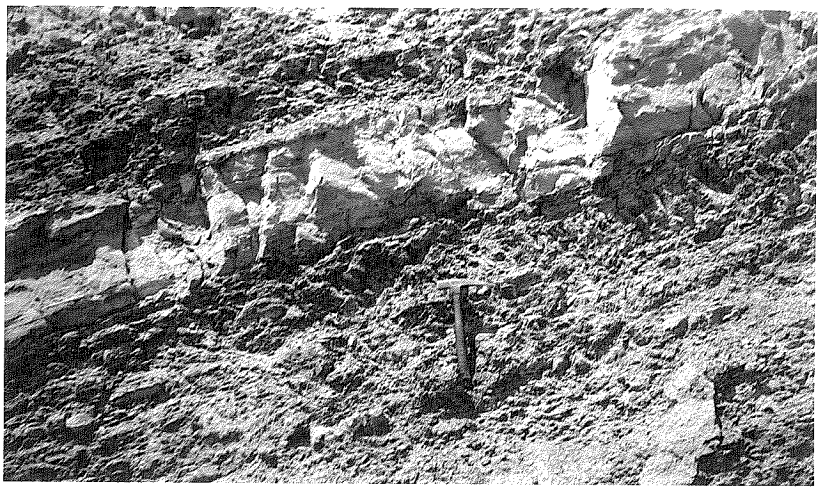
These sandstones and shales weather readily, and are generally covered by a layer of soil and grass. There are, however, often hard sandy beds which outcrop.

The Modelo Formation is definitely a marine formation, as



A view of the Saugus-Modelo contact, taken from the Haskell Canyon road. Note how very flat dipping this contact is, and compare it with the Modelo-Mint Canyon contact.

Below is a view of the Modelo as it appears in a road cut in Dry Canyon. It is quite pure shale here, except for the bed of sandstone in the middle of the picture.



evidenced by the prescence of a marine fauna; Forams, Brachiopods, Pelecypoda, and Gastropoda. The conglomerate at the base of the section, and the increasing fineness of grain towards the top of the formation, would seem to indicate deposition under more or less continued subsidence.

The Modelo Formation has been fairly definitly established as upper Miocene in age, on the basis of its fossil content.

The Saugus Formation-

The Saugus formation rests on the Modelo in this area, and forms a strip outcropping diagonally across Haskell Canyon.

These rocks are poorly consolidated, poorly bedded sands and gravels. The color varies from red to white, but all are rather light colored. The rocks vary from very coarse grained conglomerates to rather fine sands.

The Saugus formation contains boulders of the metamorphic and granitic basement, as well as from the older sediments. In this area it has the lithologic characters of a land laid deposit. Much of it is the typical alluvial fan type of sediment, and it is quite plausible to assume that it was laid down as a fluviatile deposit.

The Saugus in localities outside of the scope of this report has been shown to be marine, and carries a marine fauna. Its age has been determined by Kew and previous workers as upper Pliocene, on the basis of the marine fauna, as well as some vertebrate material which has been discovered in it.

Quaternary Alluvium-

As was mentioned above the tops of many of the ridges of the area are capped with a layer of old alluvium. This capping varies in thickness from less than a foot to over a hundred feet. These deposits are probably pleistocene in age and rest unconformably on the tertiary rocks. They are bright red in color, and made up of poorly sorted, poorly consolidated, roughly bedded conglomerates, and unquestionably represent alluvial fan materials.

In the bottoms of all the valleys there is a layer of very recent alluvium.

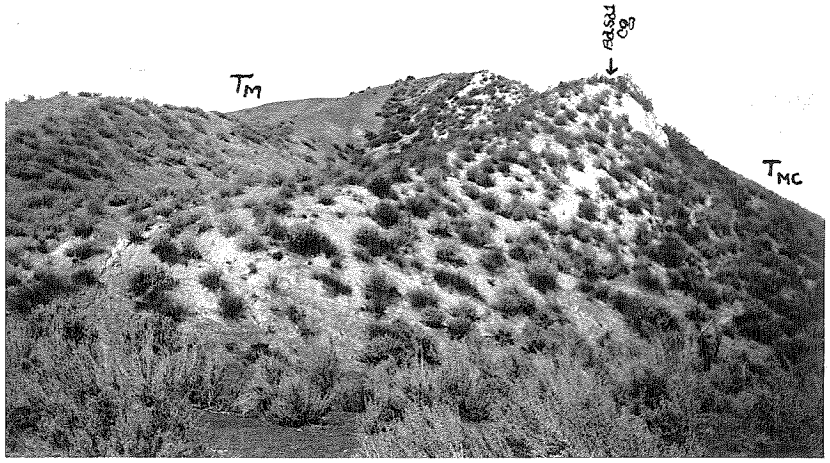
STRUCTURAL GEOLOGY

REGIONAL-

The typical structure of the California Coast Ranges is a series of more or less parallel folds, which are complicated by faulting. In general these structures trend more east-westerly than the mountains themselves.

The Santa Clara Valley represents an area of sediments which is bounded on the north and south by a pre-Jurassic basement Complex of metamorphics and granite. The sediments are sometimes in depositional contact sometimes in fault contact with the basement.

The San Gabriel Mountains are bounded by faults on both the north and south sides. On the north by the San Andreas, and on the south by the Sierra Madre, San Gabriel, and other faults.



A view showing the basal conglomerate at the base of the Modelo. Note the vegetational difference on the two types of rocks.

Below is another view showing the basal conglomerate of the Modelo formation. This anticline is the southernmost anticline shown on the map. The cliff in the background is Modelo and the ash bed mentioned in the text may be seen on the left about half way up the cliff.

GEOLOGIC STRUCTURE--(LOCAL)

Faulting-

The only fault of any size in the area is the fault contact between the Mint Canyon formation and the Basement Complex. This fault strikes about N30W and dips at a rather high angle to the south. The average dip is probably of the order of 60 degrees. The movement on this fault was probably normal, with the north side moving up.

As was mentioned above, the lower Mint Canyon is missing in the Haskell Canyon Section. It is quite possible that this was caused by the movement on the fault. In that case, the fault must have broken through the Mint Canyon, so that the lower Mint Canyon could be uplifted with the upthrown block and eroded.

Since the fault has not disturbed the Quaternary alluvium, it can be dated as post-Miocene and pre-Quaternary.

Folding--

There has been considerable folding in the area. The axis of these folds all trend within a few degrees of east-west.

The southernmost of these folds is the largest flexure in the area. It is an anticline which plunges rather steeply to the west. This fold occurs in both the Mint Canyon and Modelo formations, but the fold is somewhat tighter in the Mint Canyon. A few hundred feet to the north of this anticline, there is a syncline, which also plunges to the west. However, one interesting thing about this fold is that in the Mint Canyon rocks this fold is plunging fairly steeply, while in the island of Saugus which lies in the syncline(see map), the axis is nearly horizontal. These two folds have produced an S shaped bend in in the Modelo-Mint Canyon contact.

Above is a view of the syncline, containing an island of Saugus, surrounded by Modelo, as is shown on the map. Note that the structure is somewhct overturned.
Below is a closer view of the Saugus in this area. Note its poorly consolidated character, its poor bedding, and the way in which it is eroding, which is typical of much of the Saugus. The rocks in this picture are brilliantly colored, red and white.

About a mile north of the Syncline there is another anticline in the Mint Canyon formation, which was not found in the Modelo. This fold turns into a monocline to the east. North of this anticline there is another syncline.

There have been at least two periods of folding. The first of these occured after the period of deposition of the Mint Canyon formation, and before the deposition of the Modelo. The second period of folding occured after the deposition of the Modello and Saugus formations, but before the deposition of the Quaternary alluvium, which is undeformed. The position of the axis in these two periods of folding were about the same. The evidence that there have been two periods of folding is simply that the Mint Canyon is much more severely deformed than the younger rocks.

Unconformities-

The Modelo-Mint Canyon contact is an angular unconformity. In general, the Mint Canyon near the contact dips about 15 degrees more steeply than the Modelo. This angular difference is quite apparent on the east side of Haskell Canyon.

The contact between the Saugus and Modelo Formations is a disconformity. No angular difference was noted, though in general the Saugus is dipping more gently than the Modelo. In the complete section in this general region, the Pico conglomerate should occur between the Modelo and Saugus. Since it is not present in the Haskell section, a period of erosion can be inferred.

The contact between the Quaternary alluvium and the Tertiary rocks is an angular unconformity. The alluvium is practically horizontal

on the tilted and truncated tertiary rocks.

Thickness of the section-

The thickness of the Mint Canyon Formation in the vicinity of Haskell Canyon is variable. Its maximum thickness is around 3000 feet, and its minimum perhaps 2000 feet.

The thickness of the Modello formation is also quite variable, but its minimum thickness can be rather accurately calculated. The minimum thickness is about 700-800 feet. the maximum thickness is perhaps 1600 feet.

No estimate can be made as to the thickness of the Saugus Formation, because the map does not extend far enough to the south.

The terrace alluvium has a variable thickness, extending from less than a foot to over a hundred feet.

HISTORICAL GEOLOGY

Pre-Jurassic-

1. Deposition of the metasediments, as sedimentary rocks.

Jurassic-Cretaceous-

2. Intrusion of granites and metamorphism of the pre-Jurassic sediments.

Cretaceous to Miocene-

3. No record of this period- probably a period of deformation and erosion.

Miocene

4. Deposition of the Mint Canyon Formation as a terrestrial

deposit.

5. Period of folding, then erosion.

6. Gradual subsidence of the region into the sea. Deposition of the Modelo Formation.

Pliocene

7. Period of erosion, after emergence from the sea, during which time the Pico was deposited elsewhere.

8. Deposition of the Saugus. In this particular region as a terrestrial deposit.

9. Period of folding, then erosion

10. The fault at the Basement contact developed.

Quaternary-

11. The Quaternary alluvium was deposited as a terrestrial deposit. A mature land surface developed.

12. Uplift, and subsequent dissection to the present topography.

KEY TO THE GEOLOGIC MAP

AGE	NAME OF FORMATION	SYMBOL
PLEISTOCENE	ALLUVIUM	Q_{AL}
UPPER PLIOCENE	SAUGUS	T_S
UPPER MIOCENE	MODELO	T_M
UPPER MIOCENE	MINT CANYON	T_{MC}
PRE-JURASSIC	PELONA SCHIST	$PRE\text{-}J_P$

AN ASH OR TUFF BED.....

AN ANTICLINE.....

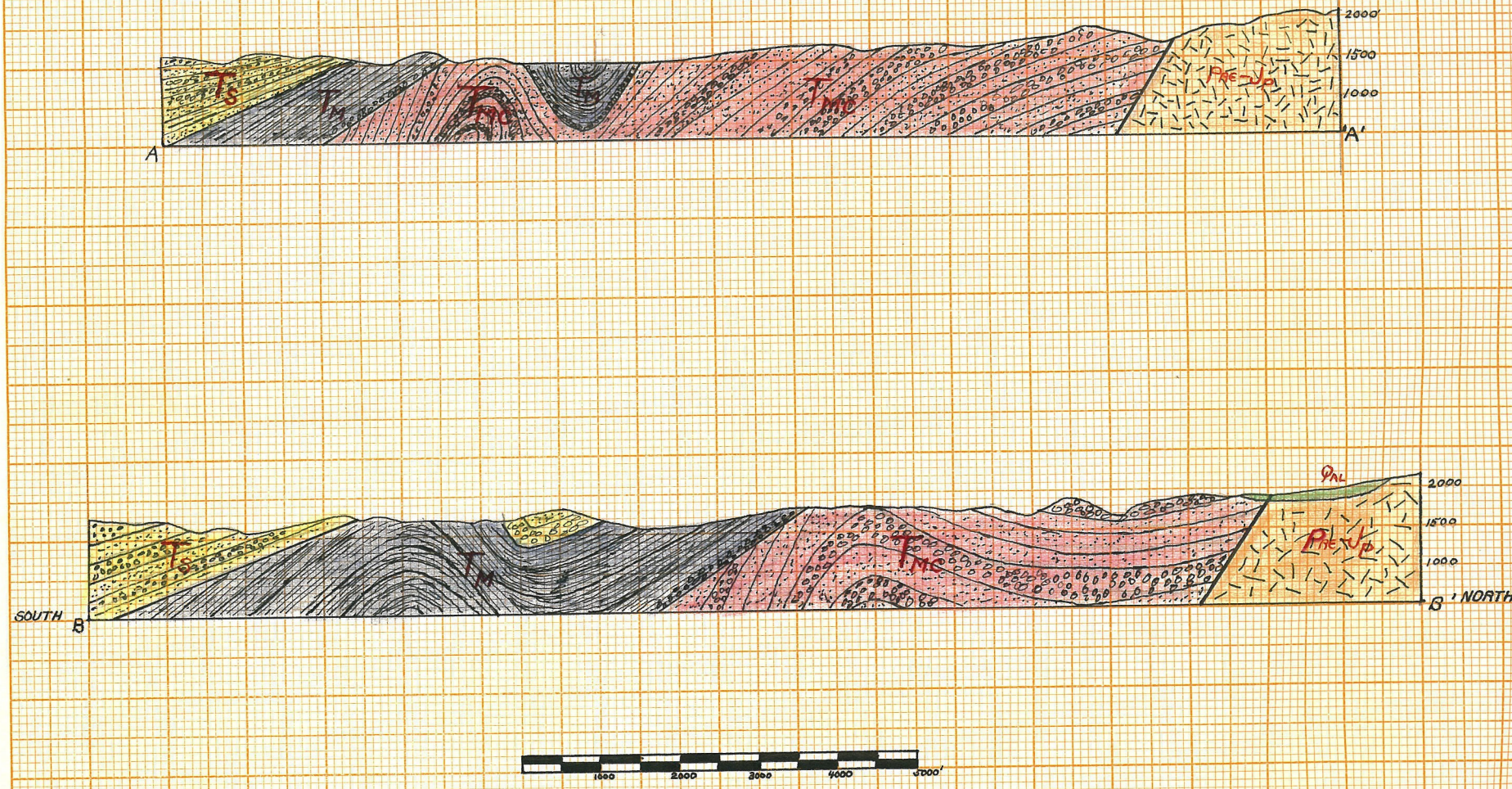
A SYNCLINE.....

THE BASAL CONGLOMERATE
AT BASE OF THE MODELO.....

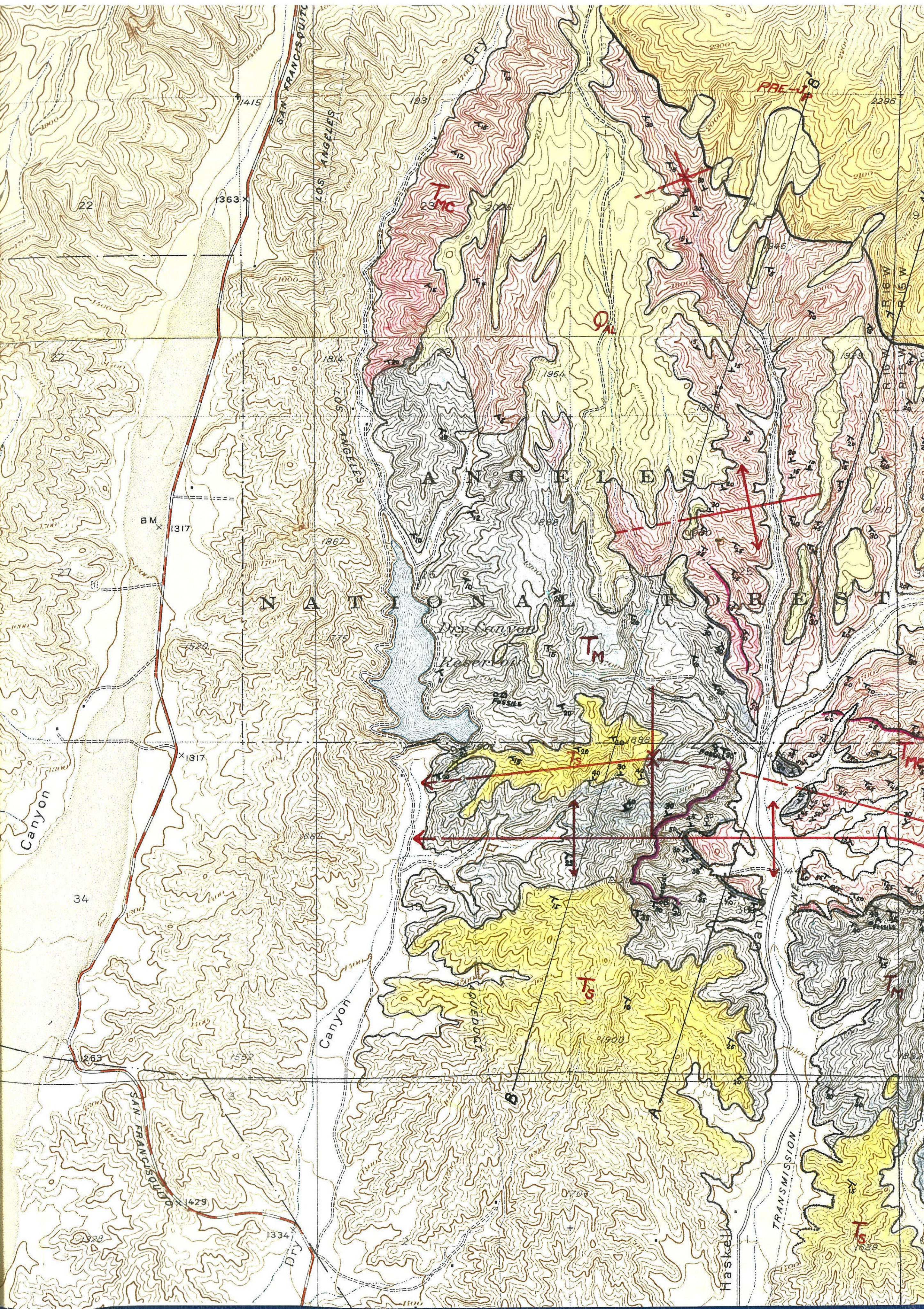
DEPOSITIONAL CONTACT.....

FAULT CONTACT.....

DIP AND STRIKE..... 10



STRUCTURE SECTIONS ALONG LINES AA' AND BB'



ANGELES
NATIONAL FOREST
Dry Canyon Reservoir
SAN FRANCISQUITO
LOS ANGELES
Canyon
Dry
Haskell
TRANSMISSION
Tmc
Qal
Tm
Ts
A
B
22
27
34
BM 1317
1317
1363
1415
1263
1429
1334