GEOLOGY OF A PORTION OF THE SOUTH SIDE OF THE SANTA CLARA VALLEY NEAR NEWHALL, CALIFORNIA

A Report Submitted in
Fulfillment of the
Senior Thesis Course, Ge 21
of the
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by

Robert C. Hagen

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TABLE OF CONTENTS

TABLE OF ILLUSTRATIONS

GEOLOGY OF A PORTION OF THE SOUTH SIDE OF THE SANTA CLARA VALLEY NEAR NEWHALL, CALIFORNIA

INTRODUCTION

Location, size, and accessibility of the area

The area is located between the foot of the San Gabriel Mountains and the Santa Clara River and is about four miles east of Newhall and Saugus, California. It is about thirty-six miles north of Los Angeles, California.

The area is approximately two by two and a half miles in size and contains about five square miles. Is is bounded on the north by the Santa Clara River; on the east, by the area worked by John A. Battle; on the south, by the San Gabriel Mountains and Placerita Canyon; and on the west, by Longitude 118 28'.

The area is conveniently re ached by one of two roads. The side to the north is reached from the Palmdale-Los Angeles State Highway which runs along the northern bounda ry. Someday this highway will pa ss through the area. From this highway, dirt roads lead towards the center of the area, passing through the valleys draining into the Santa Clara River. The south side is entered by means of the Placerita Canyon Road which turns off just north of the outskirts of Newhall. This road is paved part way, but is dirt the rest of the way. It is, however, passable, and makes it easy to get into the southern end. From this road, the center of the area can be reached by hiking up abandoned roads and trails. No part of the area is more than one mile's hike to reach.

Purpose of the work

The work was undertaken to complete the requirements for the Senior Thesis Course, Ge 21, of the California Institute of Technology, with the further purpose of c ompleting in more detail the stratigraphy and structure of the area in an attempt to establish more definitely the controversal age of the Mint Canyon formation.

Field work

The base map used was one composed of a portion of the southern end of the U. S. G. S. topographic map of the Humphreys Quadrangle and a portion of the northern end of the U. S. G. S. topographic map of the Sylmar Quadrangle, editions of 1932 and 1935, respectively. On this map was plotted in the field, the contacts, the dips, and the strikes of the various formations and also the structure such as folding and faulting. The contacts were traced by their outcrops and located on the map by topographic features. The instrument used was the Brunton Compass and Clinometer for taking dips and strikes and locations. All work was done from Pasadena, California, driving to the area for the day. The field season was in the spring and winter of 1939.

Previous work

The area has previouly been worked by William S. W. Kew[1] and Dr. John H. Maxson[2], and many other prominent geologists. Also, the area has been done by almost every oil company in Southern California. These reports are well done and accurate

1. Kew, William S. W.: Geology and oil resources of a part of Los Angeles and Ventura Counties California; U.S.G.S. Bulletin 753, 1924.

2. Maxson, John H,: Thesis for his Doctor's Degree at C.I.T.

GEOGRAPHY

Land forms and surfaces

The greatest part of the area is composed of s teep ridges and valleys. There are two large valleys at the northern end which are hilly and not very steep. These are partially c ut valleys and partially alluviated valeys. Surrounding these valleys are steep sloped hills and sharp ridges. The northern end contains the broad Santa Clara River plain, lying at an altitude of about 1400'. The large valleys in the center of the area vary from 1500' to 1800' with a slope of approximately 15 . The steep-sided ridges start at about 1500' and go to a height of over 2000'. The slopes vay but average about 30 . The area as a whole slopes from the south to the north with the highes t elevation to the south at 2163'. Immediately south of the area the San Gabriel Mountains rise from a height of 1600' to a height of 2700' in less than a mile. The floor of Placerita Canyon lies at about 1500'. Several small cliffs rising vertically for several hundred feet are also found.

Drainage

The area drains north and south into Santa Clara River and Placerita Canyon, respectively, and then westward. The dividing ridge is about one-fifth the distance from the south so that about four-fifths of the area drains into the Santa Clara River while only one-fifth drains into Placerita Canyon.

Climate

The area is located in a semi-arid region. During the summer, the area is dry and very hot except for occasional high fogs from the coast. In winter, the area receives a moderate amount of rain and water flows in Placerita Canyon and the Santa

Clara River until well into the spring. Water is available throughout the year from underground storage basins.

Vegetation

The area is well covered with vegetation. The hills and valleys are covered with low brush from two to six feet high. Along the lower parts of the ridges and especially in the ravines, the brush is almost impassable because of the thickness. In the valleys, low sage brush and grass grow making the passage a little easier. Also in the valleys are large California live oaks, which offer the only shade on a hot day.

The soil in the valleys is quite deep and allows for the more abundant growth while the tops of the ridges are devoid of soil permitting only smaller and scarcer brush. The abundance of soil and vegetation in the area make it difficult to always find good outcrops and often the contacts can not be traced.

Culture

Because of the presence of underground water, and good top soil, the area is well inhabitated by people. Many small farms and several large ranches are found in the area. The area itself is used only for cattle grazing but the valleys have some grain fields and a few truck farms. Placerita Canyon has a few cabins and during the winter and spring, it is a favorite place for many to picnic.

Economic resources

Although no work has been done in this area, oil wells have been drilled in the surrounding area and small pools of oil located. However, nothing large has yet been found, and it is not very likely that this area will ever be of importance as an

oil producing field. Placerita Canyon has some placer gold but the quantity is very small and is not of importance. It is worked by many for recreation but not for a living.

PHYSIOGRAPHY

Originally, the area was covered by alluvium fans which drained northward from the San Gabriel Mountains mee ting fans from the north and forming the Santa Clara river and valley. These fans deposited in the Tertiary can still be found to the west of the area. These fans had canyons draining into the river and were the beginning of what are now the north-south canyons.

Renewed movement along the San Gabriel fault formed a divide causing part of the drainage to flow southward. Retaining the same canyons, the water drained towards the fault, was stopped and had to flow along the base of the mountain, eroding out what is now Placerita Canyon. As the canyon was formed more and more water flowed southward until the canyon became entrenched near the base of the San Gabriel mountains. The more resistant conglomerates uplifted by the fault movement formed a high steep fault scarp. However, the movemnet wa s slow enough to allow the streams draining southward to form steep narrow canyons through the fault scarp and permitted the rapid erosion of the softer beds to the north. This erosion formed large amphitheaters behind the more resistant conglomerates.

As most of the drainage was still to the north, the greatest amount of erosion has taken place here. The larger amount of erosion has caused two large va lleys to be formed,

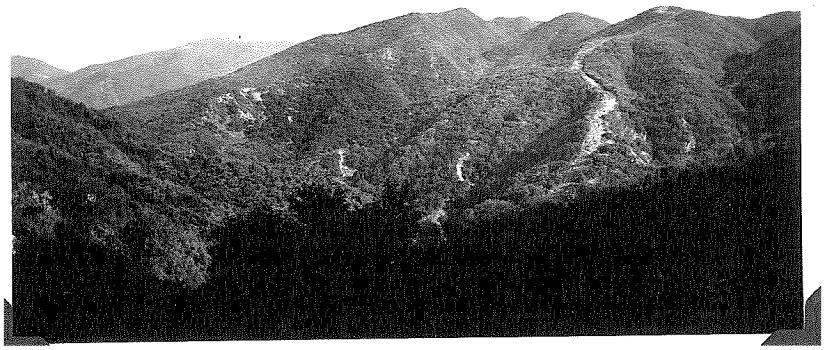


Figure 1. Looking south, this view shows the topography which has been eroded from the basement complex in the San Gabriel Mountains.

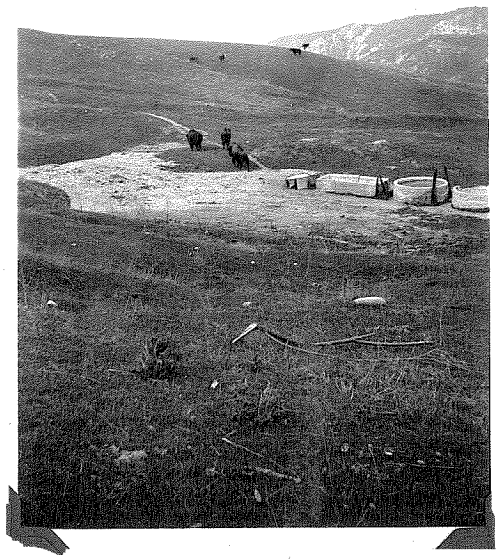


Figure 2. This gives an idea of the rolling topography of the middle valleys eroded out of a soft member of the Mint Canyon. The animals in the foreground are buffalo.

eroded from sofer silt members of the Mint Canyon formation. The two north-south valleys, eroding towards each other, have formed a sharp ridge between them. This ridge has c ross ridges formed by the more resistant beds and have a sharp rugged appearance. The drainage into these valleys has caused the forming of many strike canyons and ravines.

So it can be seen that the area is one controlled by drainage, faulting, and the striking and diping of the more resistant beds. The softer beds erode into large valleys with rolling hills, while the more resistant beds form cliffs and sharp, strike ridges .

STRATIGRAPHY

In the area are found pre-Jurassic, Jurassic, Tertiary, and recent formations. The rocks found include igneous, metamorphic, and sedimentary rocks.

The Mesozoic Era is the era of the granitic intrusions. Probably in Jurassic time, the large batholithic intrusions composing most of the San Gabriel Mountains were intruded into the pre-Jurassic sedimentary schists.

The greatest part of the rocks in the area a re sedimentary rocks of the Cenozoic Era. They range from Upper Mioc ene to Recent. These include sandstones, shales, silts, ash beds and conglomerates. The thickest of these series exposed are the Mint Canyon Series.

Pre-Jurassic schists

The pre-Jurassic schists are found in that complex block, the San Gabriel Mountains. They are old sedimentary rocks which, because of thermodynamic forces, have bee n metamor-

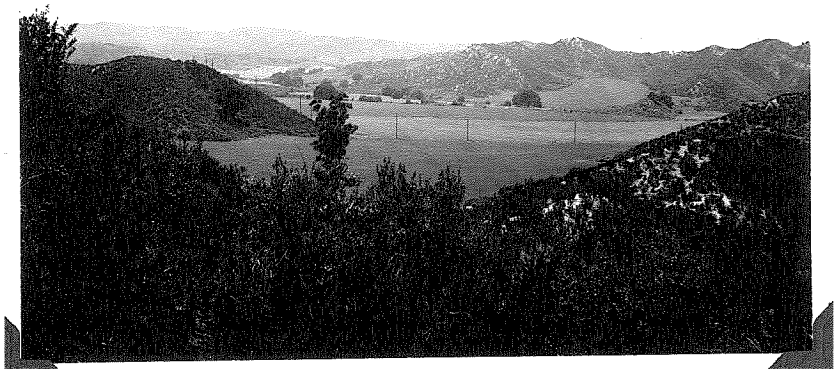


Figure 3. A view of one of the wide canyons in the northern part of the area which run north and south. This shows the alluviation of the valleys. The ridge in the background is Mint Canyon with Saugus composing the distant hills.

Figure 4. Topography as is typicall formed by erosion in the Saugus.

phosed to mica schists. They are found in Placerita Canyon Gorge and further back as inclusions in the San Gabriel Mountains.

Jurassic Granites

The Jurassic period saw the intrusion of a large batholith into the schists. This intrusion was composed of diorites and related types of rocks. They are found in the entire San Gabriel Mountains and are exposed in the area in Placerita Canyon along with the schists. They are coars e-grained rocks some of which show a gneissic structure. They are composed of orthoclae, biotite, plagioclase, hornblende, and some have quartz. The hornblende is much more predominant than the biotite and is often porphyritic. The hornblende rocks can be called hornblende diorites. Those containing quartz are quartz diorites. Cutting the intrusion and the schists are s mall dikes of aplite. The rock is still strong and not decomposed. However, because of the extensive faulting in the San Gabriel Mountains, the rock is well shook up and scattered in many parts of the mountains. The rocks therefore are not exactly fresh and much of the feldspar has been altered to kaolin.

Upper Miocene formations

Mint Canyon series: The Mint Canyon is by far the largest and most diversified series in the area. It extends over most of the northern half of the area. It is composed of sandstones, shales, conglomerates, and ash beds.

The sandstones and conglomerates are fairly well cons o-lidated and form most of the topographical features of this part of the area. They are well consolidated, sorted, and bed -

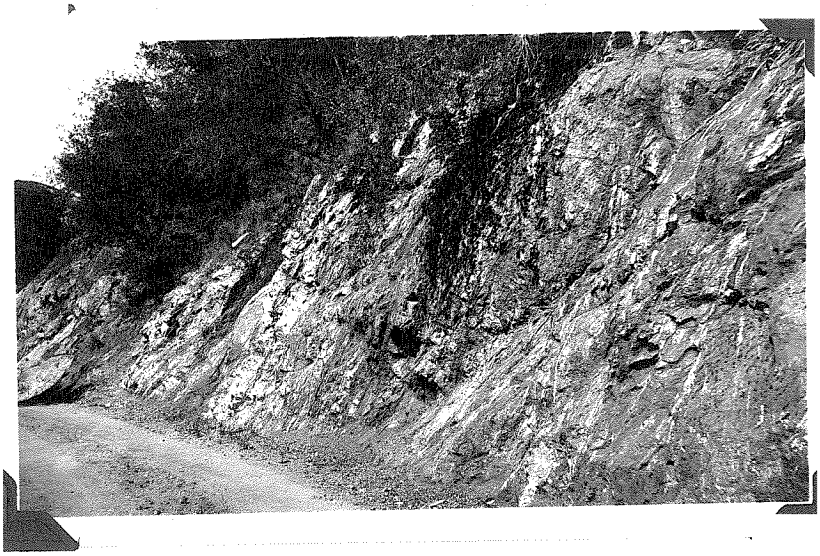


Figure 5. An exposure of the basement complex in Placerita Canyon showing the schists and the granitic intrusives.

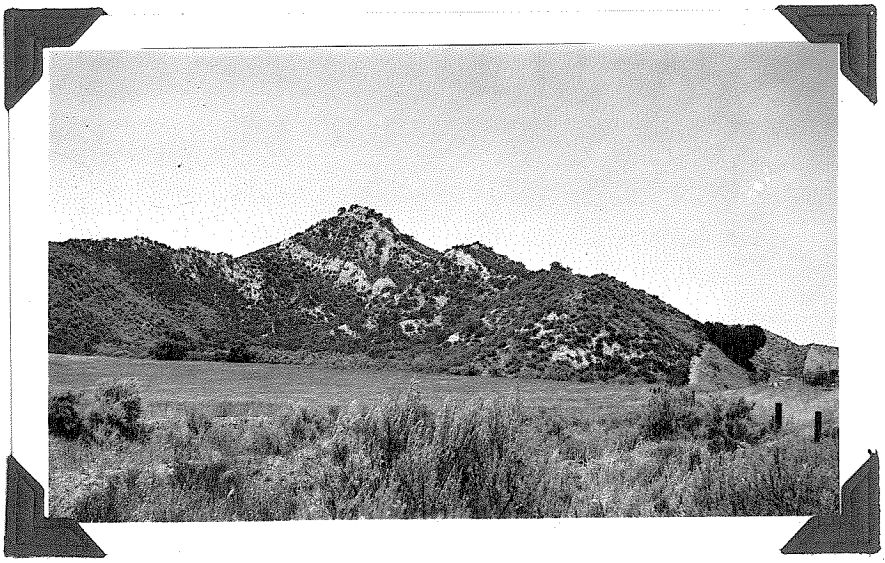


Figure 6. A typical exposure of the more resistant Mint Canyon sandstones and conglomerates showing the bedding which is dipping northward.

ded sediments. The outcroppings are well exposed and dips and strikes easy to obtain. They erode as strike ridges and valleys with a steep slope as the front and the back side with the same slope as the dip of the beds. The soil is only several inches thick and beds are thus more easy to distinguish from the other formations. The sandstones are medium-grained and the beds sometimes show ripple marks and faint cross bedding. The conglomerates carry boulders up to about four inches in diameter but are usually less then this and more like a gravel. The beds are particularly noted by their gray c o-lor and good bedding and sorting. However, when they contain veinlets of gypsum, as in the beds exposed along the San Gabriel fault, the beds have a red color to them. The sandtones and conglomerates are exposed on the sides of the two central valleys and on the ridge separating them. Also a thin s trip is exposed along the south side of the San Gabriel fault.

The shales are really silts. They are very loosely consolidated and are found in the lower part of the series. They cause the two valleys in the central part of the area because of their fine silt and loose consolidation. They form a little less then half of the exposed Mint Canyon series. The silts are often hidden by a mantle of soil so that strikes and dips are almost impossible. Also, such that are obtainable have usually slumped and are not useable. It is this member of the Mint Canyon in which have been found the vertebrate fossils in the Mint Canyon region. This series is a dark gray color and often causes a badlands type of erosion. This formation is exposed in the middle of the area and at the southern end of the Mint Canyon outcrop.

The ash beds are composed of fine grains of volcanic material as quartz, feldspar, and glass and are water lain. They are very porous and fracture with a sub-conchoidal fracture. They are well consolidated and as such, often form ridges and slopes of the ridges and offer good exposures. The are quiet noticeable by their whiteness. They are found with the sandstones and conglomerate beds and there are at least three distinct series in the area. There may be more but because of the folding and faulting and erosion it can not be stated definitely if more should be included as separate beds. They vary from two to eight feet in thickness and would make good marker beds if the exposures were longer. However, in this area, the beds dip down under the alluvium after traveling only several hundreds of feet.

The Mint Canyon is a water laid sediment as is seen by the sandstanes, shales, and well sorted conglomerates. However they are a fresh water deposit as seen by the presence of vertebrates and fresh water gastropods (none found in this area) and the absense of marine fossils. The total thickness of the Mint Canyon exposed in this area is approximately 3500 feet.

Modelo formation: The Modelo formation lies on the Mint Canyon series with no evidence of an unconformity. It is composed of shales and fine-grained sandstones. It is only exposed in a small part of the area on the eastern edge. It is well bedded and stands almost vertically. It is distinguishable from the Mint Canyon in that the s hales are better consolidated and the beds contain marine fossils. It is only noticed if one works from the east towards the area, following

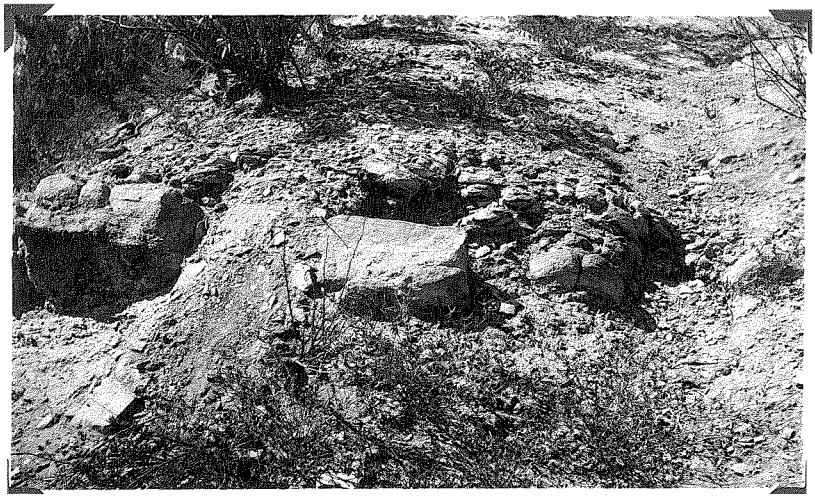


Figure 7. Type of exposures in the Mint Canyon from which strikes and dips are easily obtained.

Figure 8. This shows the more resistant Pico forming steep eroded hills. Saugus is in the foreground.

the Modelo from the east. The thickness exposed is about 900 feet.

Pliocene

Pico formation: The Pico formation is composed of well sorted conglomerates and sandstones. The beds are very well consolidated and form the high steep scarp along the San Gabriel fault. The conglomerates are of boulders up to six inches in diameter, well rounded and surrounded by medium sized sand grains. The coloring is from pale red to white. Parts of the Pico in other areas contain marine fossils but none are found in this area. The resistance of the beds and the bedding make it easy to obtain good strikes and dips. The Pico is only found along the northern edge of the San Gabriel and has exposed only a thickness of about 125 feet.

Saugus formation: The Saugus formation lies non-conformable upon all of the preseding formations. It is an ill-sorted conglomerate formed as fans over the area. It has some water-lain deposits at the base but is distinctly non-marine at the top of the formation. The water-lain deposits consist of fine to coarse grained sandstones, fairly well bedded, poorly consolidated, but offer enough resistance to erosion to give good outcrops at the bottom of canyons. The land lain deposits are of conglomerates containing large boulders and s mall ones, particularly of aplite. They are found to be poorly consolidated if at all and are only found as outcrops at the beginning of canyons and ravines where they are exposed by an amphitheater type of erosion. The water-lain beds are red to gray in color while the conglomerates have a distinctness of white because of the aplite boulders. They are distinguished from the other formations by their coarseness, the white aplite boulders,

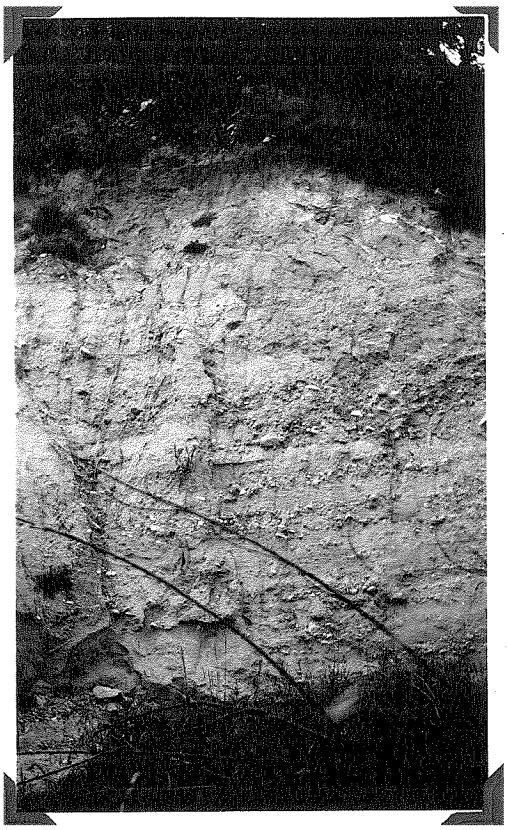


Figure 9. This is the type of exposure of the Saugus found in the stream cutting of it. Note the ill-sorting of the material and the slight dip northward.

and the poor bedding as found in fan alluviums. The Saugus is exposed in the southern part of the area of which it forms the greatest part. It is also found at the northwesternmost corner of the area. The total thickness exposed is about 200 feet.

The Saugus began in the Upper Pliocene and overlaps into the Early Pliestoc ene.

Pliestocene

Terrace alluviums: In the western edge of the area is a small patch of Tertiary gravels which form a part of a large fan which at one time covered the area muc h as the Saugus used to. Due to uplift, most of these fans have been eroded away leaving this terrace on top of the Saugus. It is composed of sands and boulders washed down from the upper regions of the San Gabriel Mountains. They are not consolidated and are only rudely bedded. Their thickness is about 20 to 30 feet.

Recent alluvium

In the floors of the valleys is deposited the recent alluviums which has been washed down from all the surrounding region. It is composed of fine sands to coarse gravels to large boulders a foot in diameter. The rocks are of those found in the above formations and the San Gabriel Mountains. The alluvium is gradually filling the valleys. The thickness is unknown but it is likely that in the floor of the Santa Clara Valley it reaches a thickness of several hundred feet.

GEOLOGICAL STRUCTURE

Faulting

Peculiar to California structure, the area has very little faulting. There are only three mapable faults in the area. These faults all have an east-west trend as do the folds.

The most southern fault is the one at the base of the San Gabriel Mountains. This fault is one that has raised the San Gabriel Mountains to their present height. The fault plane is exposed at only one place and is a vertical plane. As most faults in Southern California are vertical or reverse faults, it seems logical to place this one in the same category on the basis of this one exposure. The fault plane would in this case dip southward.

The San Gabriel fault is the most recent fault in the area. Movement began probably in the Late Tertiary but the exact age is undetermineable. The fault today shows displacement of Saugus, Pico, and Mint Canyon formations, so movement has occurred since these were formed. It probably started in Pliocene time and movement continued until Late Pliestocene.

There has been no recent movement. The northern side has gone down bringing the Pico in place against the Mint Canyon. Erosion took place forming a valley and a fault scarp on the northern side which was later covered by the Saugus. More recent faulting and erosion has given the prominent fault scarp. The fault is a steep reverse fault as can be seen in several places along the fault. The fault plane dips southward. There is no evidence to call the exposed Mint Canyon a fault slice and it seems reasonable to believe that it is just a re-exposed scarp

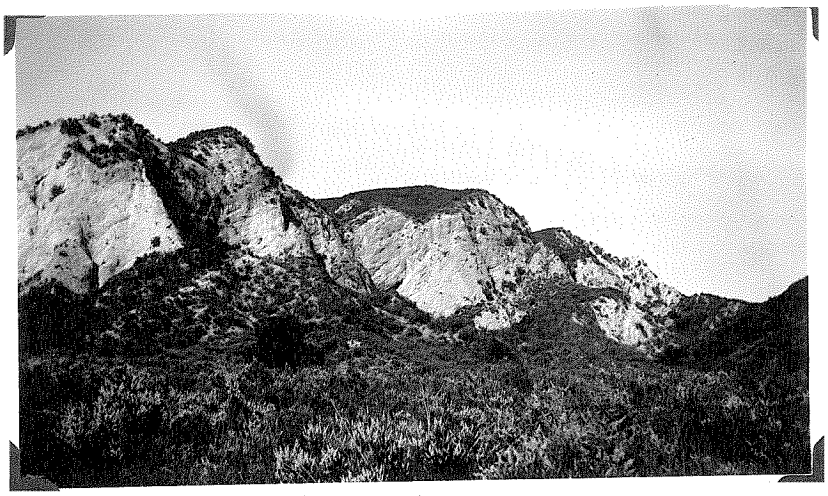


Figure 10. A view along the San Gabriel fault s howing the Pico forming the steep cliffed fault scarp. Mint Canyon is exposed at the base with Saugus to the extreme right.

Figure 11. The fault itself as seen in one of the canyons cutting through the San Gabriel fault scarp. The fault can be seen to be almost vertical, dipping steeply to the north.

of the fault scarp.

The third fault runs through the center of the area. It has brought the Modelo down in contact with the Mint Canyon. It can be proved that it is post-Miocene and pre-Pliocene in age because farther east, the Pico overlies the fault trace. Evidence points to a vertical fault or a s teep angled fault because of the high dip of the surrounding beds and the nature of the other faults. Besides the displacement of the beds, the presences of the fault can be shown farther west by the cutting off of folds and the difference in the strike of the beds.

Great as the difference of displacement of these faults may be, there is no means of measuring it as not one of the formations has its total thickness exposed, but it is probably hundreds of feet.

Folding

Like the faults, the general trend of the folding and folds strike southeast-northwest but more westerly. The major fold is a large anticline near the Saugus-Mint Canyon contact. This fold has brought the softer Mint Canyon silts beds up high enough to be eroded forming the two large upper valleys in the area. This is the longest fold in the area, extending across its total width.

In the Saugus at the southern end are found two synclines which are very shallow compared to the others in the area. These are more recent folds and probably are controlled by movement along the fault which bent the beds.

In the middle of the northern edge are two folds, a syncline and an anticline which trend more northernly than the others. They are in the more resistant beds of the Mint Can-

yon and are cut off by a fault making them shorter in length. They are therefore pre-Pliocene and post-Miocene in age.

The picture thus obtained is more intensive folding in the Mint Canyon in pre-Pliocene and Post-Miocene age forming the large anticline in the middle of the area and several smaller folds on the limb.

Later, in late Pliestocene or later, the faulting along the San Gabriel fault caused small synclines to be formed in the Saugus.

GEOLOGICAL HISTORY

Pre-Jurassic: Laying down of sediments and later metamorphism into the mica schists.

Jurassic: Intrusion of the diorites and related types and aplite dikes into the older schists. Following this, the rising of the San Gabriel mountains and deposition at its base.

Cretaceous to Upper Miocene: This section is not exposed but probably not deposited or underlies the Mint Canyon.

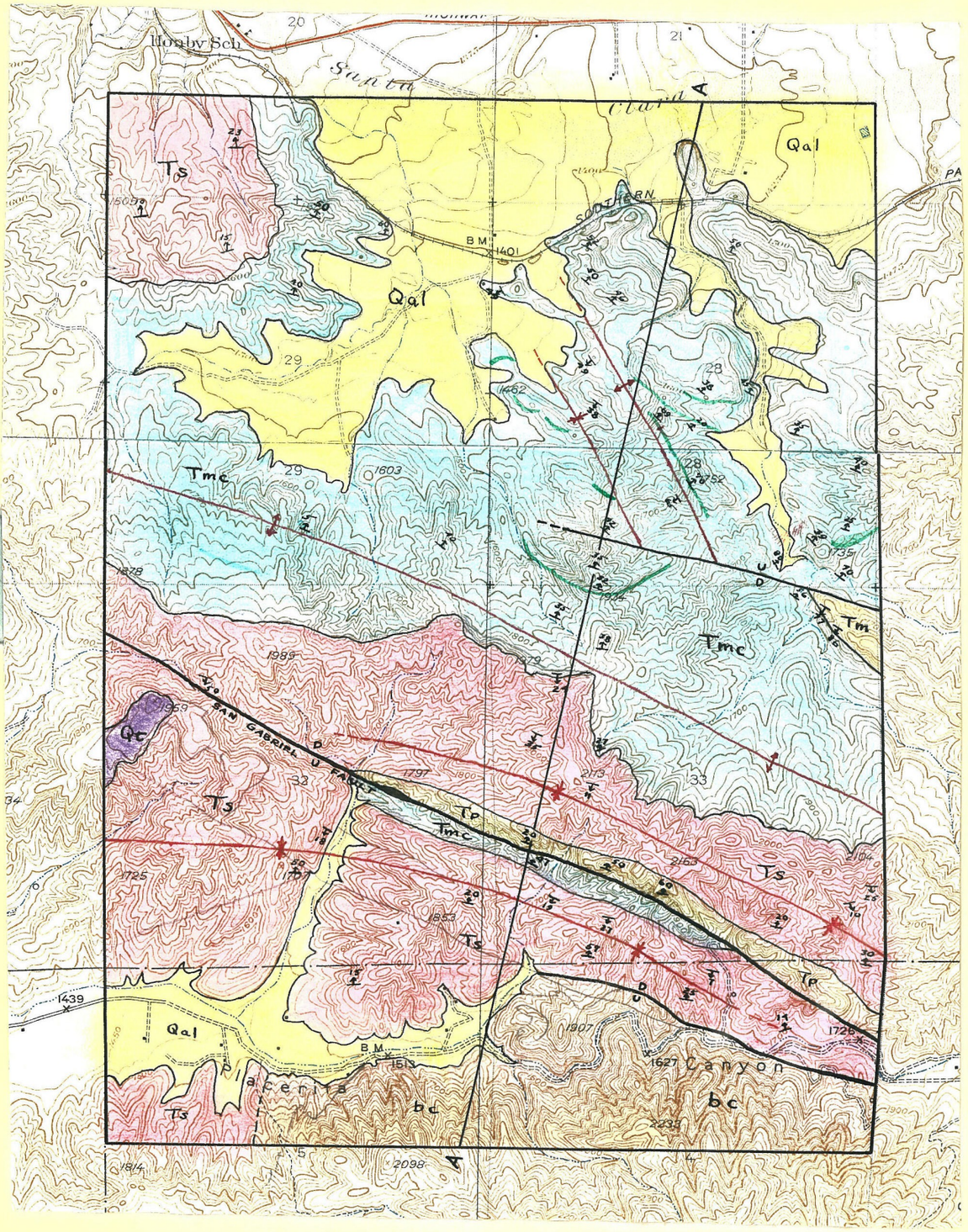
Upper Miocene: A large inland body of water covered the area in which was deposited the Mint Canyon. Volcanic action took place near the area as seen by the presence of the ash beds. Later the land was invaded by the ocean and the Modelo was deposited on the Mint Canyon. Faulting then brought the Mint Canyon up to the Modelo.

Pliocene. Area still under ocean as seen by the marine fossils. The area is closer to land as shown by the coarse conglomerate members. The area is rising.

After the area had risen, the Saugus was deposited as a fan series over the area. Faulting along the San Gabriel fault before this deposition brought the Pico into contact with the Mint Canyon. This fault scarp was later covered by the Saugus.

Pliestocene: Saugus continued to be deposited. Later, lowering of the area caused the terrace gravels to be deposited over the area.

Recent: Uplift of the area started the present erosion cycle, eroding away most of the terrace gravels and exposing the older beds. Alluvium now being deposited in the valleys.



LEGEND

scale 1" = 2000'

QUATERNARY	Recent	Qal	Alluvium
	Pliestocene	Qt	Terrace Gravels
		Ts	Saugus Sandstone and Conglomerates
TERTIARY	Pliocene	Tp	Pico Sandstones, shales and Conglomerates
	Upper Miocene	Tm	Modelo Sandstones and shales.
		Tmc	Mint Canyon Sandstones, shales, Conglomerates and ash beds
	Jurrassic	bc	Basement Complex Schists and Intrusives

D
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FAULT

SYNCLINE AND ANTICLINE

CONTACTS

ASH BEDS