THE GEOLOGY OF A PORTION OF THE SAN JOSE HILLS

A thesis submitted in partial fulfillment of the requirements for the Degree of Master of Science, in Geology

by

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INDEX

ABSTRACT

The area discussed in this report, consisting of sixteen square miles, embraces a portion of the San Jose Hills approximately three miles south of the town of Covina, Los Angeles County, California. The area was mapped on a base map prepared from U. S. Geological Survey topographic maps, and the Brunton compass-pacing method of mapping was used.

The region is part of an upland that rises above the Los Angeles and San Gabriel basins, and consists of a group of rolling hills trending in an approximate east-west direction. The relief throughout the region is moderate, and as a result of the semi-arid climate vegetation in the area is sparse. Bedrock is well exposed, excepting in some of the areas underlain by shale, where slumping has distorted the rocks and soils and a dense grass growth further hinder exposure of the underlying formations.

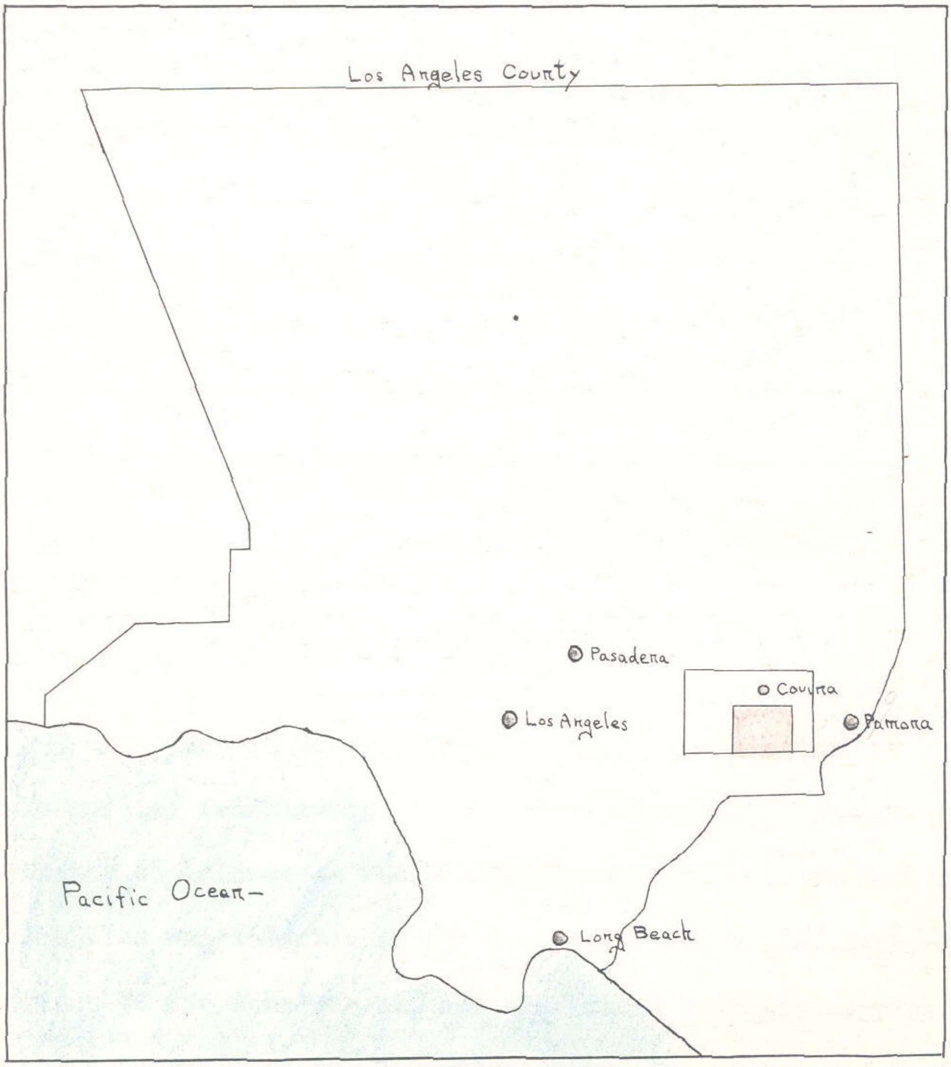
All of the rocks exposed in the area are of sedimentary origin, and, with the exception of Recent and Pleistocene alluvium, are part of the Puente formation of upper Miocene age. The Puente formation is divided into three members--a lower member of shale, a middle member of sandstone and conglomerate, and an upper member of shale, sandstone, and conglomerate. The subsurface rocks, knowledge of which has been derived from wells drilled in the area, consist of the Topanga formation,

the Glendora volcanics, the Mountain Meadows dacite porphyry, and the basement complex in that order with increasing depth.

There appear to have been two major periods of deformation in the San Jose Hills area during Tertiary time—one at the close of the Pliocene and one during and after the deposition of the Miocene Puente formation. The Puente deformation seems to have involved only gentle folding, but the post-Pliocene deformation was more severe, involving steep folding and some faulting. The general structural trend of the region is approximately N 60 E, and is parallel to the boundaries of the higher hills. Folding in the area has created a series of parallel anticlines and synclines, with the San Jose anticline in the northern half of the area being the major structure. The one fault of any magnitude in the area is the San Jose fault, which enters from the east and apparently dies out in the central part of the area. It is a vertical or steeply dipping reverse fault with considerable downthrow on the south side. There are other smaller faults in the southern half of the area.

The geologic history of the region largely involves erosion after the intrusion of the basement complex in Mesozoic time until the Miocene period, when the area became one of deposition. The Glendora volcanics were deposited in early middle Miocene time, followed by submergence of the area and deposition of the Topanga, Puente, and Pliocene formations. After the close of the Pliocene the region emerged from beneath the sea and again became an area of erosion.

MAP OF LOS ANGELES COUNTY, CALIFORNIA
SHOWING THE LOCATION OF
THE SAN JOSE HILLS AREA



INTRODUCTION

LOCATION OF AREA

The area discussed in this report is a portion of the San Jose Hills, and is located approximately three miles south of the town of Covina, Los Angeles County, California. It is bounded on the south by Pomona Boulevard, on the north by Cameron Avenue, on the west by the Pass and Covina Road, and on the east by the road joining Cameron Avenue to Pomona Boulevard. Buzzard Peak, the highest part of the San Jose Hills, lies approximately two-thirds of a mile to the northeast of the eastern border of the area, and the town of Puente is about two miles northwest of the area's southwest corner. The area is approximately sixteen square miles in extent.

PURPOSE OF INVESTIGATION

The area considered in this report was studied and mapped in partial fulfillment of the requirements for the degree of Master of Science at the California Institute of Technology. The area was selected at the recommendation of Dr. Richard Jahns of the same school, and the actual geologic mapping of the area was done by the writer during the winter and spring terms of the 1946-1947 school year.

METHOD OF INVESTIGATION

The field procedure consisted of mapping the geology of the region on USGS topographic maps that had been enlarged two times. The scale of this actual base map was 1:12,000. Some of the mapping was done on aerial photographs of the region, and later transferred to the base map. Geologic data were gathered by walking outcrops and measuring the attitude of strata with a Brunton compass. All distances were measured by pacing. Structural features, such as folds and faults, were mapped wherever their magnitude warranted representation. Some rock specimens were collected and later identified, whereas others were identified in the field. No paleontological problem was studied, although a few fossils were collected from the area.

PREVIOUS GEOLOGICAL WORK IN THE REGION

The first important published work concerning the San Jose Hills and the region immediately adjacent to it is Bulletin 309 of the U. S. Geological Survey. It was published in 1907 and contains a discussion of the petroleum resources and geology of the Puente Hills oil district (Eldridge, 1907, pp. 1-250). The next work of importance was Bulletin 768 of the U. S. Geological Survey, published in 1926. In this report the writer, W. A. English, discussed the geology and oil resources of the Puente Hills region, including the San Jose Hills (English, 1926, pp. 1-101). In 1934 the California Division of Water Resources published Bulletin No. 45, a discussion of the geology and ground water of the California south coastal basin (Eskin, Wallis, 1934, pp. 39-76), which contained a discussion of this area.

The latest work in the San Jose Hills region has been Preliminary Map 23 of the Oil and Gas Investigations published by the U. S. Geological Survey. A. O. Woodford, who supervised this work, also has published an article on the Miocene conglomerates of the Puente and San Jose Hills (Woodford, 1946, pp. 514-561).

ACKNOWLEDGMENTS

The writer wishes to express his gratitude to Dr. Richard Jahns of the California Institute of Technology for his suggestion of the area to be studied, and for his helpful advice and criticism throughout the field work and the preparation of the geologic report. Dr. J. W. Durham and Dr. Hampton Smith of the same school also gave much helpful advice, and the photographic work of Lt. W. H. Moore is very much appreciated.

GEOGRAPHY

GENERAL GEOGRAPHY

The San Jose Hills, together with the Puente Hills to the south, form an upland that rises above the Los Angeles and San Gabriel basins and other physiographic basins to the east and southeast of the city of Los Angeles. The area is separated from the adjacent Puente Hills by the valley of San Jose Creek, which is located along the south and southeast border of the area. To the north the San Jose Hills are bordered by the alluvial plain of the San Gabriel basin, which extends southward from the San Gabriel Mountains. The Santa Ana Mountains lie beyond the Puente Hills to the south.

RELIEF AND ELEVATIONS

Elevations in the area range from about 380 to 1300 feet above sea level. The area consists largely of a group of rolling hills trending in a westward direction. These hills have been somewhat dissected by numerous intermittent streams cutting back into them. The relief throughout the region is moderate. The canyons, even though narrow, tend to be flat-bottomed, and the ridge slopes are convex upward, with the crests generally rounded. The canyon depths nowhere exceed 400 feet, and their average depths much less than that. No sharp peaks, gorge-like canyons, and other similar rugged features are present. To the north, west, and south the hills slope gently into the alluvial plains that surround the area on these three sides.

TOPOGRAPHY

Topographic features in the area are very much related to rock types and bedding planes. The less resistant shales of the upper and lower members of the Puente formation have been eroded to form gently rolling hills and open valleys. The more resistant middle member, however, forms steeper ridges with a more rugged appearance. In the central part of the area the dipping beds of this member form an elongate series of small cuesta-like ridges which approximate the strike of the beds with a fair amount of uniformity. The conglomerate beds of the upper member in most places differ little from the shales, so far as topographic features are concerned.

The topographic expression of the area is conditioned mainly by the geologic structure. The crests of the anticlines form the highs, and the lows tend to follow the troughs of the synclines. The streams of the region, especially in the southern portion of the area, are controlled somewhat by faults.

DRAINAGE

All of the streams in the San Jose Hills area are intermittent. There are several small springs in the area, but the small amount of water they bring to the surface is absorbed by the surrounding rocks almost immediately. A very large volume of water is carried by some of these intermittent streams, however, during the rainy seasons of the year. The streams flow from the area to the north, west, and south; the majority of them running for a short distance out into the alluvium that surrounds the area and thence disappearing. Two streams flowing to the north and west, however, unite to form Walnut Creek, which empties into the San Gabriel River farther northwest. Two other south flowing streams join San Jose Creek, which flows along the southern border of the area. Both San Jose Creek and Walnut Creek also are intermittent.

CLIMATE AND VEGETATION

The climate of the San Jose Hills is typical of the semi-arid climate of the southern California coastal region. The average rainfall for the area is about 15 inches, and this comes almost entirely during the winter months. As a result of this semi-arid climate the region supports only a sparse growth of vegetation, particularly on the lower slopes and hilltops. The vegetation tends to vary more or less with the character of the underlying rocks. Thus the shales are covered almost entirely with grasses, whereas the sandstones and conglomerates are covered predominantly with chamisal and cactus. Scattered clumps of small trees occur locally in the small canyons cut into the area by intermittent streams.

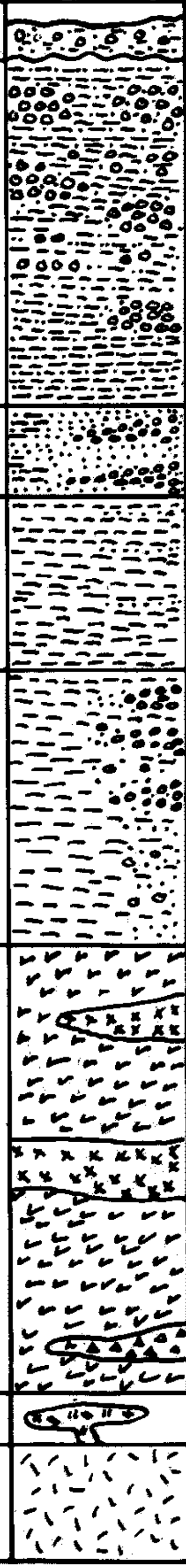
ROCK EXPOSURES

The rocks of the San Jose Hills are fairly well exposed throughout the area. Canyon walls and the steeper slopes furnish fairly abundant and good exposures in most places, although in some of the shale areas slumping and creep have taken place and distorted the true picture of the rocks.

The more resistant sandstones and conglomerates of the middle Puente member form excellent outcrops, especially in the central and eastern part of the area. The lesser slopes and smaller hills surrounding the area, underlain almost entirely by upper Puente shales, tend to be covered with soil and grass, and good exposures of the underlying rocks are rare. Numerous excellent exposures are afforded by the many roadcuts around the borders of the area. Excavations and building sites also have exposed the underlying rocks in many places.

-COLUMNAR SECTION-

Scale 1"-1500'

Period	Formation	Thickness	Section	Character of rocks
Recent Pleist.	Alluvium	0-150		Sand, gravel, clays
Upper Miocene	Puente upper member	3000		Finely bedded silt-stones and shales with large lenses of conglomerates
	Puente middle member	600		Sandstones and conglomerate grading into shales
	Puente lower member	1500		Diatomaceous, silicious, and clayey shales--some siltstones
Middle Miocene	Topanga	3000		Diatomaceous, silicious, and clayey shales--some conglomerate and sandstone
	Glendora Volcanics	4000		Chiefly flows and breccias of andesite--some basalt and dacite
Pre-vol. Post-base.	Mountain Meadows	500		Dacite porphyry dikes
Mesozoic	Basement complex	- - -		Gneissic quartz diorite and plutonites

STRATIGRAPHY AND PETROLOGY

GENERAL STATEMENT

All the rocks exposed in the area covered by this report are of sedimentary origin, and, with the exception of Recent and Pleistocene alluvium, all are parts of the Puente formation. The Puente formation was named from the Puente Hills (Eldridge, 1907, p. 7), and it is upper Miocene in age. The Modelo formation, which is found to the west in Ventura and western Los Angeles counties, is lithologically very similar and of approximately the same age. In the central part of the state rocks corresponding to the Puente formation, both lithologically and in age, are known as the Salinas shale and Maricopa shale. The Puente formation also corresponds to the upper part of the Monterey shale of many districts.

In this report, the procedure of Eldridge, English, and Woodford is followed, in that the Puente formation is divided into three members: a lower member of shale, a middle member of sandstone and conglomerate, and an upper member of shale, sandstone and conglomerate. Further division is locally possible, especially in the upper member, where large lenses of conglomerates have been deposited. According to Woodford (1946, p. 519) the boundaries of the middle member cut across time-stratigraphic units as determined by fossils. This is also evident in the mapping of individual beds. For this reason parts of the middle Puente member are mapped as upper Puente on the geologic map.

In Bulletin 768 of the U. S. Geologic Survey, English described the entire area discussed in this report as a portion of the upper member of the Puente formation. He divided the upper Puente member into two parts—a shale unit and a sandstone unit. All shale in the area was mapped as upper Puente shale and all sandstone and conglomerate were mapped as upper Puente sandstone. This procedure was more or less followed until 1945, when Woodford (1945) correlated the thick sandstones and conglomerates of the area with the middle member of the Puente formation in the nearby Puente Hills. The previously named upper Puente shales were divided by Woodford into upper and lower members of the Puente formation. Woodford's correlations are based on foraminiferal zoning by M. N. Bramlette and fish-scale zoning by L. R. David. The writer followed the above correlations in interpreting the rocks of the area.

Knowledge of the subsurface rocks in this area is derived entirely from the records of a few wells that have been drilled in the region. The Puente formation overlies with apparent conformity the Topanga formation, which, in the greater part of this area, is lithologically identical with the overlying shales of the lower Puente member. Eastward, however, the Topanga shales grade into conglomerates that are well exposed near Buzzard Peak about 1/2 mile east of the area's eastern border. The Topanga formation is underlain by a series of volcanic rocks consisting mostly of massive and fragmental andesite. Shelton (in press) is proposing the term Glendora volcanics for the middle Miocene flows and pyroclastics of the region and of which these are a part. The basement complex, composed chiefly of gneissic quartz diorite, underlies the volcanic rocks in most of the area. A thin layer of dacite porphyry has been penetrated by a well in the eastern portion of the area, however, where it has been named the Mountain Meadows dacite porphyry. This rock lies between the basement complex and the andesite. The andesitic volcanic rocks are believed to be middle Miocene in age, and of the age of the basement complex, other than believed to be of Mesozoic age, little is known. The age of the Mountain Meadows dacite porphyry is also rather indefinite--post-basement, pre-volcanics.

BASEMENT COMPLEX

A fair knowledge of the basement complex has been gained from the records of wells drilled in the area and from exposures to the north and south of the region. In the San Jose Hills region the basement complex is composed chiefly of gneissic quartz diorites and other plutonites. It underlies the entire area at an average depth of 7,000 feet. As mentioned above its age, other than being Mesozoic, is unknown.

LOWER MEMBER OF THE PUENTE FORMATION

The lower member of the Puente formation consists of a single shale unit throughout the area mapped. It is well exposed in the northern half of the area, and underlies all the higher hills along the crest of the main westward plunging anticline. From the crest of this anticline the beds dip moderately to the north and to the south. Around the western nose of the anticline the beds dip to the west. This member is also well exposed, although not so extensively, along the crestal part of a smaller anticline in the central part of the region.

The lower member of the Puente formation belongs to the lower part of Kleinpell's Mohnian stage (Woodford, 1946, p. 520). Thin sections from the San Jose Hills include both the basal Bolivina modeloensis (or Baggina californica) foraminiferal zone and the overlying Bulimina uvigerina formis zone (Woodford, 1946, p. 519).

No megafossils of any sort have been found in this member, with the exception of a single horse tooth identified as belonging to the species Hipparion mohavense Merriam (Stock, 1928, pp. 51-53). According to H. E. Wood and the committee on the nomenclature and correlation of the North American continental Tertiary (Wood, 1941, pp. 1 and 12) Hipparion mohavense Merriam belongs to the Clarendonian age, which corresponds to lower Pliocene. Thus, according to the invertebrate time scale the Puente formation is upper Miocene in age, and according to the vertebrate time scale the same formation is lower Pliocene in age. Until the vertebrate and invertebrate time scales coincide with respect to the upper Miocene-lower Pliocene boundary, no correlation using the two types of fauna can be in agreement.

English (1926, pp. 36-37) considered it possible that a portion of the shales and conglomerates regarded as upper Puente might belong to the Fernando group, which is lower Pliocene in age. This would favor the vertebrate classification and be in agreement with the fossil horse tooth found. In the final classification of the formation, however, English included the beds in the Puente formation because of lithologic similarities and the lack of any evidence of unconformity which separates the Puente formation from the Fernando group in other areas. The new correlation by Woodford, moreover, places the beds in which the vertebrate fossil was found in the lower member of the Puente formation instead of the upper member as named by English, so the chance of the beds in question belonging to the Fernando group is lessened even more.

The shales composing the lower member of the Puente formation vary considerably throughout the area. Where diatomaceous the shales are white to grey in color, chalky, poorly stratified, and rather punky. In other places silicious shales predominate. These generally have well defined bedding planes, and vary in color from grey to a tawny yellow. The hardness of these shales is very high. A large portion of the shales are typical clay shales, buff in color and well stratified. The shales of this member noticeably lack the sandy siltstones so typical of the upper Puente member.

MIDDLE MEMBER OF THE PUENTE FORMATION

The middle member of the Puente formation is well exposed on both the north and south flanks of the main anticline in the northern half of the region. The member is composed of alternating sandstones and conglomerates in the eastern portion of the area, but to the west and southwest these grade first into massive fine-grained sandstones and thence into shale and sandy siltstones which are indistinguishable from the rocks of the overlying upper Puente member. For this reason rocks correlated with the middle Puente member are mapped as rocks of the upper Puente member around the nose of the plunging anticline in the western portion of the map.

Owing in large part to this gradation into finer material to the west and southwest, the sandstones and conglomerates of the middle Puente member vary greatly throughout the area. In the eastern portion of the area the sandstones, where associated with the conglomerates, are buff to yellow in color, and consist of both coarse-grained and fine-grained material. To the southwest and west the conglomerate beds tend to disappear, but the change appears to be one of substitution of finer material for the conglomerate rather than a simple thinning of the beds. The conglomerates have a coarse sandy matrix, and the pebbles consist largely of granitoid rocks, with some metamorphic types and extremely few volcanic rocks. The average pebble diameter is approximately 3 inches to 5 inches, although some boulders as much as 14 inches in diameter were found.

The local distribution of the conglomerates and the lateral gradation into finer sediments to the west suggest a near-shore area of deposition, perhaps immediately offshore from river mouths, with the conglomerates being deposited near the mouths and the sand being carried out a greater distance.

A few fragments of marine fossils were found by the writer in the middle member of the Puente formation in the area adjacent to the nose of the main anticline. Identification, other than very general, was impossible because of the poor material. Fragments of the genus Pecten seemed to predominate, although some fragments of echinoids and gastropods also were present.

UPPER MEMBER OF THE PUENTE FORMATION

The upper member of the Puente formation consists largely of thinly interbedded shales and sandy siltstones, together with large lenses of conglomerate that are scattered throughout the area. Some very small lenses of sandstone also are present, but these are rare and are associated with the conglomerates.

The upper Puente member belongs almost entirely in the upper part of Kleinpell's Mohnian stage, the Bolivina hughesi zone, according to Woodford (1946, p. 521). Early workers, because of the presence of the thick conglomerate lenses similar to those in the overlying Pliocene (Fernando group or Repetto formation), called the upper Puente lower Pliocene.

The shales of the upper Puente formation are fairly uniform in composition and color throughout the entire region. The alternate layers of sandy siltstone tend to weather to a rich brown or chocolate-brown color, which makes the interbedding with the buff colored clayey shales even more distinctive. The thickness of these alternating layers is small, varying from 1/4 inch to 2 inches, with the thickness of the siltstone layers much less than that of the shale layers.

The conglomerates of the upper member of the Puente formation are concentrated in the northwestern and central eastern portions of this area. Though thick and fairly extensive, they are not as coarse grained as the conglomerates of the middle Puente member. The pebbles tend to be small (averaging about 2 inches in diameter) and well rounded, and are composed chiefly of granitoid rocks. Volcanic and metamorphic pebbles also are well represented. The size of the pebbles decrease somewhat westward. In the eastern portion of the area the percentage of volcanic pebbles is greater than in the western portion, and there seems to be an increase in the percentage westward.

Woodford (1946, p. 535) believes that the conglomerates of the western portion of the area possibly have the San Gabriel Mountains as their source area, basing his conclusion on lithologic similarities. Although he makes no definite statement as to the source areas of the conglomerates of the western portion of the region, he does mention that he finds little evidence to favor the Perris Block area to southeast. This is in direct disagreement with Edwards (1934, p. 822), who holds that the Perris Block is probably the source area for all the conglomerates in this area, and that the contribution of the San Gabriel Mountains was negligible.

ALLUVIUM

The shales and conglomerates of the upper Puente member grade outward into alluvium in all directions, except to the east. The slopes on the borders of the area are made up of sands and pebbles, but the material grades gradually into clays away from the hills where the slopes gradually flatten out. There is no definite contact between the alluvium and the underlying formations--merely a gradation from one into the other. The alluvium is of Recent and Pleistocene age.

SUBSURFACE ROCKS

Underlying the lower member of the Puente formation with apparent conformity is the Topanga formation. This formation is represented by shales indistinguishable lithologically from the shales of the overlying lower Puente member throughout the majority of the area, but near the area's eastern border the shales grade into conglomerate, which increases rapidly in thickness eastward. These conglomerates outcrop a few hundred feet from the area's eastern border and are called the Buzzard Peak conglomerate member of the Topanga formation. Both the shales and conglomerates are middle Miocene in age and can be correlated with part of the Topanga formation of the Santa Monica Mountains.

A sequence of andesites and other volcanic rocks (Glendora volcanics) underlies the Topanga formation throughout the area. In the central portion of the region a thickness of 3,000 feet has been recorded. Well records farther to the east show a gradual decrease in thickness, and where the area outcrops several miles east of the area the thickness is only around 1,200 feet. Wells to the west of the area have not penetrated below the Topanga formation.

The Glendora volcanics rest directly on the basement complex over most of the area, excepting along the area's eastern border where well records show a relatively thin layer of Mountain Meadow dacite porphyry between the basement complex and volcanics. Several miles to the east nearly identical rocks intrude and overly the basement complex, and have an outcrop area of approximately 1/2 square mile.

GEOLOGIC STRUCTURE

GENERAL STATEMENT

There appears to have been two major periods of deformation in the San Jose Hills area during Tertiary time--one at the close of the Pliocene and one during and after the deposition of the Miocene Puente formation. The post-Pliocene deformation was by far the more severe. The Puente deformation seems to have involved only gentle folding, although other minor results are noticeable. The diatomaceous shales and silicious shales of the Puente formation are not present in the overlying Repetto formation, which indicates some sort of a physical change in the derivation of sediments. Also, the various types of sediments in the Puente formation show that the land areas from which the sediments were being derived in Puente time were undergoing changes.

The magnitude of the post-Pliocene deformation is well shown by the series of anticlines and synclines in the area, by the steep dip of the beds, by the westward tilting of a large portion of the area, and by the faulting that has occurred in the area.

The general structural trend in the region is approximately N 60 E, and is parallel to the boundaries of the higher hills. There are no unconformities of any magnitude in the area, although numerous small unconformities or diastems were observed.

FOLDING

Folding in the San Jose Hills area has created a series of more or less parallel anticlines and synclines trending approximately N 60 E. The major anticline (San Jose anticline) of the region, which is in the northern half of the area, extends into the area from the vicinity of Buzzard Peak and plunges to the west in the western portion of the area. The crest of this anticline approximates the crests of the higher hills. The folding is symmetrical, and there appears to have been no overturning.

South of the San Jose anticline there is a well-defined syncline which trends approximately in the same direction. This syncline extends completely across the area, and is easily traceable. A small valley approximates the synclinal trough through most of the area. The folding here is also symmetrical, with no evidence of any overturning.

Still farther to the south an anticlinal structure is once again evident, and its trend is the same general direction as the folds to the north. It is uncertain, however, whether the structure consists of a single large fold or several smaller folds in alignment. Other small local structures are present in the area but their magnitude seemed too small to warrant representation on the map.

FAULTING

The San Jose fault, which is in the east-central part of the area just south of the San Jose anticline, is the one fault of any magnitude in the region. It appears to be a vertical fault with considerable downthrow on the south side. The actual displacement in this area was impossible to determine, but several miles to the east displacement of more than 1,000 feet has been determined by ground-water evidence. The displacement in this area, however, is probably less as the fault appears to die out in the central part of the area. Evidence of the fault in this area consists of fracture zones and surface indications due to erosion of the fractured rock along the strike of the fault. The fault is a dip-slip fault, with little, if any, strike-slip movement, and the majority of movement probably took place during the post-Pliocene deformation period. According to Woodford (1945) the San Jose fault may be a very steep reverse fault.

There appears to have been a slight uplift of a block between two small faults in the southern part of the area. The actual amount of displacement is not known, but appears to be fairly small. Evidence for faulting consists of off-set streams, existence of springs along the fault trace, and different types of rock on opposite sides of the fault.

Many other small faults of negligible displacement were observed, especially in the weaker shale beds, but were not mapped because of their relative unimportance.

GEOLOGIC HISTORY

The vast majority of the rocks in the San Jose Hills area are of Miocene age, so that much of the Miocene geologic history of the region is known. The geologic history of the other periods of Tertiary time in the area must be more or less inferred from evidence in the surrounding regions. In general, the San Jose Hills region was an area of erosion during the early part of Tertiary time (Eocene and Oligocene), changing to an area of deposition sometime during the early Miocene. The source of all the sediments deposited in the area appear to have been derived from land areas lying to the east and northeast. The major divisions in the area's geologic history are as follows:

1 - At some time during the Mesozoic era the basement complex was intruded into the region in the form of a large batholith. This intrusion was undoubtedly accompanied by intense metamorphism and much deformation of the overlying rocks.

2 - The region was next intruded by the Mountain Meadows dacite porphyry, the exact time being unknown (post-basement-pre-Glendora volcanics). This intrusive appears to be widespread, as it has been found in several places in the San Jose Hills and is thought to be present in the San Gabriel Mountains.

3 - Erosion of the area probably had commenced previous to the Mountain Meadows intrusion, and probably continued up to Miocene time, furnishing sediments to the basin farther to the west. By Miocene time the basement complex and scattered

portions of the Mountain Meadows dacite porphyry were exposed.

4 - During the early part of middle Miocene time volcanic activity to the east deposited the Glendora volcanics over the exposed basement complex and Mountain Meadows intrusive. The contact at the base of the Glendora volcanics dips gently to the west, but whether this is an initial dip or due to a slight tilting of the area to the west (or both) is uncertain.

5 - A transgressing shore line moving eastward crossed over the area during middle Miocene time, and the Topanga formation was deposited over the Glendora volcanics. During the later part of the middle Miocene the type of sediments being deposited changed from shales to conglomerates in the eastern part of the area (Buzzard Peak member of the Topanga formation).

6 - During upper Miocene time the Puente formation was deposited over the Topanga formation. The type of sediments deposited varied from shale to conglomerate, due to changing factors effecting erosion and deposition. Four major periods of deposition are evident in the Puente formation:

a - lower Puente shales

b - middle Puente sandstones and conglomerates

c - upper Puente shales and siltstones

d - upper Puente conglomerates

7 - Evidence from other areas shows that deformation in the form of folding occurred during and after the deposition of the Puente formation. The region probably was folded along the structural trends of the area today.

8 - The Repetto formation was deposited unconformably over the Puente formation during Pliocene time.

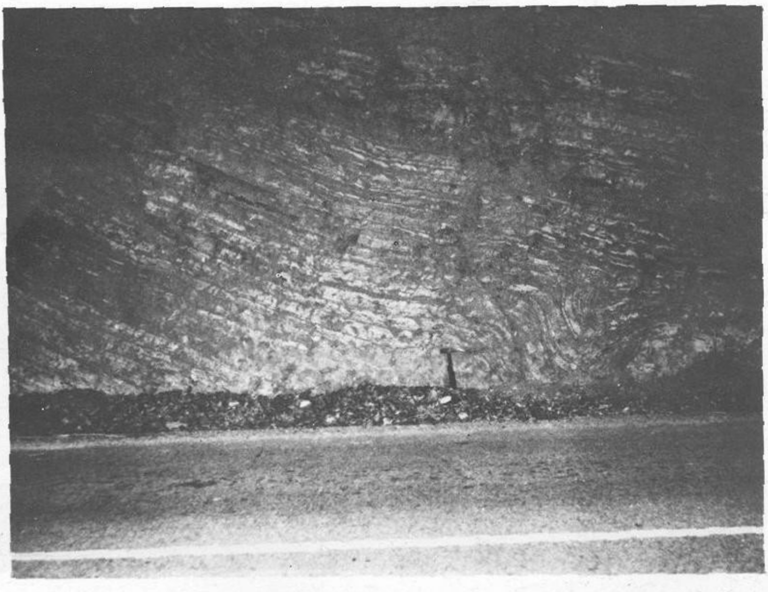
9 - At the close of the Pliocene the most severe folding of the area's history took place. The region was folded into the anticlines and synclines that are present today. The shore line also regressed to the west at this time.

10- Along with the folding at the close of Pliocene time, faulting occurred in the area.

11- During Pleistocene and Recent time the area has undergone erosion. All of the Repetto formation and some of the Puente formation have been removed. The alluvium in the valleys and in the basins surrounding the area were deposited during this time.

-Plate 1-

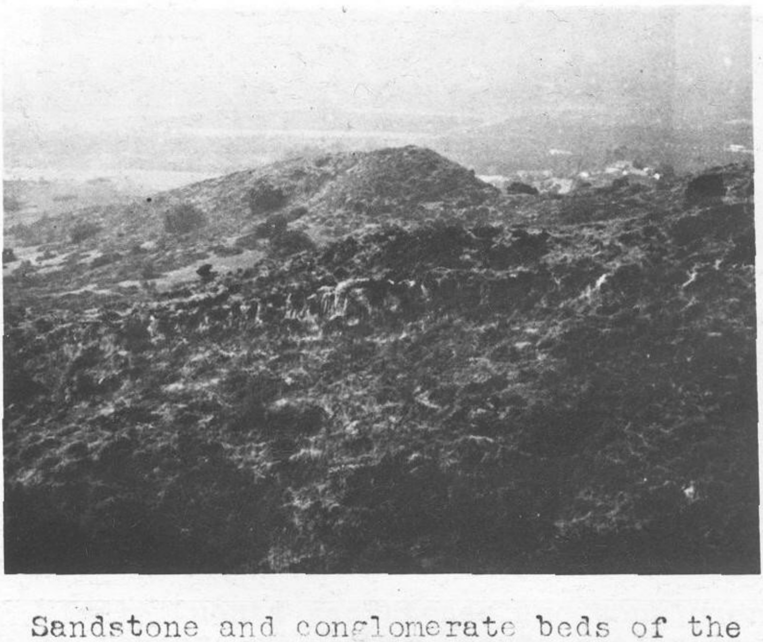
Bed of diatomaceous shale--lower member of the Puente formation--on crest of San Jose anticline



Distorted clayey shale beds in north flank of San Jose anticline--road cut along eastern boundary of area--lower member of the Puente formation

-Plate 2-

Looking east along crest of San Jose anticline--all lower Puente shales



Sandstone and conglomerate beds of the middle member of the Puente formation--north flank of San Jose anticline

Interbedded clayey shales and siltstones of the upper member of the Puente formation--exposed in an intermittent stream gulley in northwest part of area

Middle Puente sandstones and conglomerates in foreground--lower Puente shales in background--looking south from northern border of area

EXPLANATION

FOR STRUCTURE CROSS SECTIONS

Recent / Pleist.	Qal	Alluvium	
Upper Miocene	Tup	Upper member	Puente formation
	Tmp	Middle member	
	Tlp	Lower member	
Middle Miocene	Tt	Topanga formation	
	Tgv	Glendora volcanics	
(?)	Tdp (?)	Mountain Meadows dacite porphyry	
Mesozoic	bc	Basement complex	

—?—?—?—?— doubtful fault

———————— fault

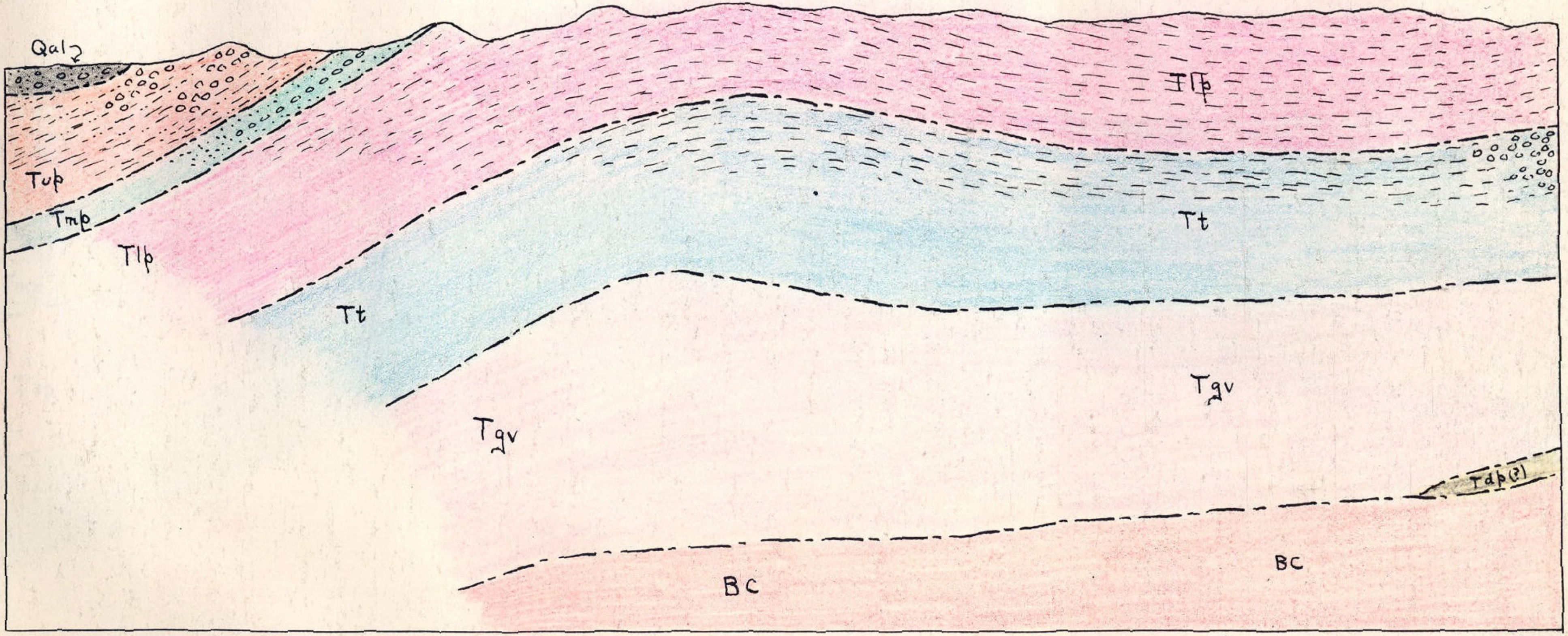
—-—-—-—-— probable contact

STRUCTURE SECTION TO ACCOMPANY THE GEOLOGIC MAP

OF

A PORTION OF THE SAN JOSE HILLS

Section A--A'

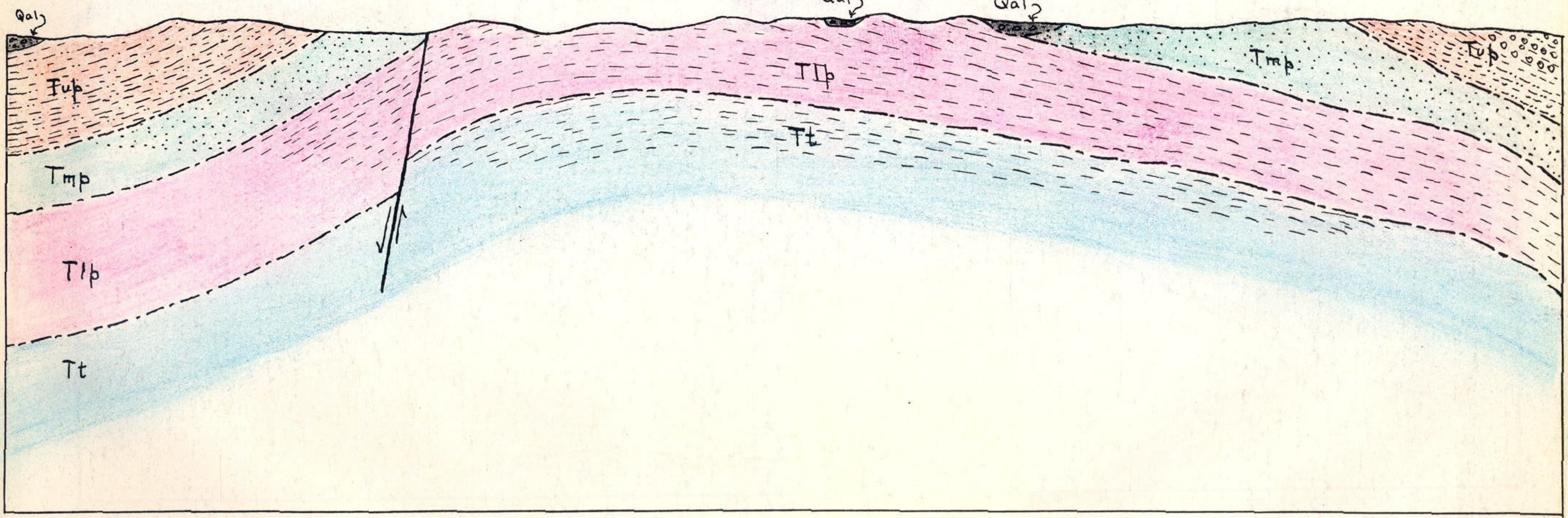


STRUCTURE SECTION TO ACCOMPANY THE GEOLOGIC MAP

OF

A PORTION OF THE SAN JOSE HILLS

Section B--B'

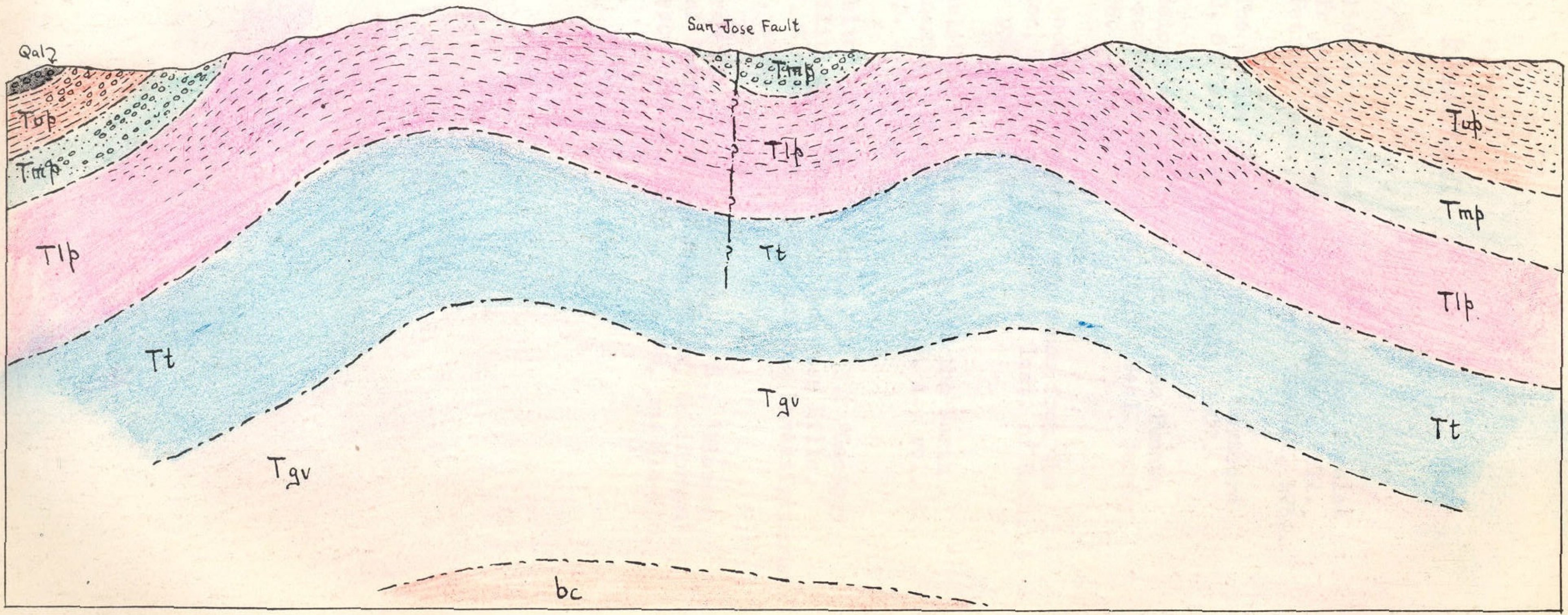


STRUCTURE SECTION TO ACCOMPANY THE GEOLOGIC MAP

OF

A PORTION OF THE SAN JOSE HILLS

Section C--C'



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Geologic Map
of a portion of the San Jose Hills
Los Angeles County, California

-Explanation-

Recent Pleist.	Qal	Alluvium	
Upper Miocene	Tup	Upper member	Puente formation
	Tmp	Middle member	
	Tlp	Lower member	

axis of anticline

axis of syncline

buried fault

contact

strike and dip of beds

-DHC-