GEOLOGY OF A PORTION OF THE SUNLAND QUADRANGLE

Los Angeles County, California

In partial fulfillment of the requirements
for the degree of Bachelor of Science

California Institute of Technology

Pasadena, California

June, 1940

Keith E. Anderson

INTRODUCTION

The area studied consists of a portion of the Sunland quadrangle in Southern California. The area is about seventeen miles northwest of Pasadena, California, and is best reached by automobile from Pasadena by driving westward on Foothill Boulevard.

The area is slightly over one mile square in size, and is bounded on the west by Bartholomaus Canyon, and on the east by Little Tujunga Canyon. The district is cultivated in orange and lemon groves in the southern section, and the entire area, especially Kagel Canyon, is well populated.

Field work was done with pace and Brunton compass on a photographic enlargement of a U.S.G.S. topographic map of the Sunland quadrangle. The mapping and report were done in partial fulfillment of the requirements for the degree of Bachelor of Science at the California Institute of Technology.

About twenty days were spent in the field in mapping and gathering of data. Work was done from January to June, 1940.

SUMMARY

The area contains a thick series of Tertiary and Quaternary sediments, both marine and non-marine in origin, which, though locally folded, dip regionally northward towards the San Gabriels. The folds are simple synclines and anticlines which, in some cases, plunge rather steeply to the west. Faulting is insignificant in its contribution to the structure of the area.. Possible overfolding has thickened the section

of Miocene shales and sandstones exposed east of Kagel Canyon.

The rocks involved are Miocene sandstones, shales and conglomerates, and Pliocene and Pleistocene sandstones and pebbly conglomerates.

PHYSICAL CONDITIONS

Relief in the area is moderate, with elevations from 1200 to 1500 feet above mean sea level. Drainage in the area is southward by intermittent streams running in Bartholomaus, Kagel, and Little Tujunga Canyons. Small east-west canyons feed these major channels.

Vegetation in the region is confined to chaparral growths which become very dense in the eastern portion of the area. Trees predominate in the more fertile valley floors. Exposures are generally good on the steep slopes and high ridges, but are entirely lacking in the alluviated valley bottoms. Large terrace deposits at high elevations cover exposures. Road cuts throughout the entire area are a good source of geologic data.

GEOLOGIC CONDITIONS

Stratigraphy

The region in the vicinity of the area studied contains several thousand feet of tilted and folded sediments which have been faulted against the granodiorite mass of the San Gabriel mountains. In the area mapped, the thickness of the sediments is from four to five thousand feet.

The Modelo is the oldest formation found, and consists of interbedded shales and sandstones with two strata of conglomerate.

The Modelo is about middle Miocene in age, determined by fossils found in nearby localities in formations that can be traced and correlated with the Kagel Canyon area. The Modelo is at least 1500 feet thick, and the base is not exposed in the area mapped. The thickness was measured by the width of outcrop on the map, considering the dip of the sediments in the calculation.

The Pico overlies the Modelo unconformably and is made of sandstones with some shaly sands. There is a marked angular discordance between Pico and Modelo east of Little Tujunga Canyon, according to Oakeshott[1], but shows little, if any, discordance in the area mapped.

The Pico was mapped as two units; 1) a darker, more shaly member, and 2) a lighter, more sandy member. The Pico is lower Pliocene in age, and has been traced to the type locality in Pico Canyon, California, where fossils have established the age. In the Kagel Canyon area, the Pico is about 1250 feet thick, as determined by the dip of the strata and their width of outcrop on the map.

The Saugus, which is probably lower Pleistocene according to Oakeshott[2], overlies the Pico unconformably with an angular discordance in the vicinity of Kagel Canyon. In other places the unconformity is very difficult to distinguish. The Saugus is the oldest non-marine formation in the area. Only about 500 feet of the Saugus lies within the area mapped.

Pleistocene and Recent terrace and alluvial deposits overly the Tertiary. They vary from a few feet to almost 100 feet in thickness.

---

[1] Oakeshott, G.B., Geology of Western San Gabriel Mts.: Calif. Jour. Mines and Geology, vol. 33, pp. 235.

[2] Idem, pp. 219

Petrography

In the Modelo, the sandstones are light colored, quartzitic, and medium grained in size. Soft shales are interbedded with the sands. Hard siliceous shales, showing good cleavage and jointing, also occur. The soft, punky shales appear to be oldest, followed by the light colored sands, and then the siliceous shales. The conglomerates are hard, dark brown to reddish color, and made of well rounded rocks from 1 to 10 inches in diameter.

The Pico was mapped as two units. The older is a dark brown sandstone, with some shaly patches, and some streaks of light conglomerates. The younger unit is a light colored, nearly white sandstone. The sandstones are quartzitic, moderately consolidated, and of a medium grain size. The younger unit overlies the older, darker rocks conformably, and outcrops to the north of the darker facies.

The Saugus is non-marine, almost white in color, and characterized by poorly consolidated pebble conglomerates. The rocks are usually less than one inch in diameter and are often quartzite or vein quartz. Sorting is fairly good and the rocks show rather good bedding. These pebbles show very good rounding, especially at the base of the formation, and they may represent a beach deposit.

Bedding in the terrace deposits is nearly horizontal, and are made of coarse gravels and conglomerates. The boulders are more angular and the conglomerates contain a greater variety of rock types than the Saugus. Such rock types that are found include granite, diorite, amphibolite (hornblende?), quartzite, anorthosite, syenite, and others. The deposits are soft and poorly sorted.

The alluvium which fills the valleys is mainly unconsolidated fine sands and gravels. In some cases, vegetation and humus deposits have contributed to a thick mantle of soil.

GEOLOGIC STRUCTURE

Folding is the dominant structure in the area, affecting both the Modelo and Pico. Folding to the west, near Kagel Canyon, is open in type. Farther east, near Little Tujunga Canyon, overturned folds are found.

One syncline-anticline in the Modelo, crossing Kagel Canyon about 2000 feet north of Tujunga Valley, plunges rather steeply westward. It is best recognized on the accompanying geologic map of the area by noting the S-shaped outcrop of the older Modelo conglomerate bed. In this fold, the more competent conglomerate stratum has controlled the folding.

Another broad fold occurs in the Pico sandstones at Kagel Canyon, just to the north of the folds mentioned above. The attitude of strata along this syncline-anticline does not indicate plunging of the folds.

Folding in the eastern part of the area, at Little Tujunga Canyon, is of the overturned type. A syncline-anticline structure has been overturned to the south to give nearly uniform northward dips to all exposures of the Modelo in that part of the area.

This overturning of folds explains the discrepancy between thicknesses of the oldest Modelo shales in the eastern and in the western portions of the area. Since no faults were found cutting through this section, the overturned folding was postulated as the explanation for this apparent thickening to the east.

Unconformities occur in the area between the Modelo and Pico formations, and again between the Pico and the Saugus. A sharp break in the lithologic characteristics of the Modelo-Pico boundary marks the former unconformity. The latter unconformity is recognized by a slight angular discordance in places. The terrace deposits and alluvium overly all other formations with a high angle of discordance.

Faulting is of secondary importance in the structure of the area. One fault cuts the north limb of the plunging anticline in the Modelo at Kagel Canyon, offsetting the older bed of conglomerate and the shales overlying it. The displacement is probably mainly dip slip, with an offset of a few hundred feet at most. The fault is not traceable for any great distance. A small fold is found along the road in Kagel Canyon in the Modelo shales between the two strata of conglomerate, probably produced by slipping on this adjacent fault.

One or two very small slips, with not over one foot total offset, were seen in the Modelo sandstone and shale between Kagel Canyon and Little Tujunga Canyon, and again in the dark Pico sandstones near Dexter Park.

GEOLOGIC HISTORY

The history of the area begins with the submergence below sea level and deposition of the Modelo shales, sandstones, and conglomerates. Following this deposition came emergence, with erosion but little tilting, and then re-submergence below sea level and the deposition of the marine Pico sediments.

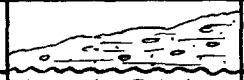
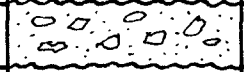
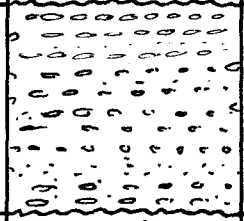
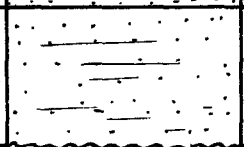
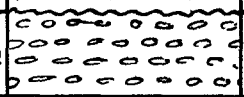
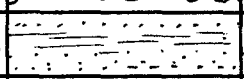
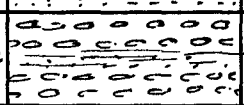
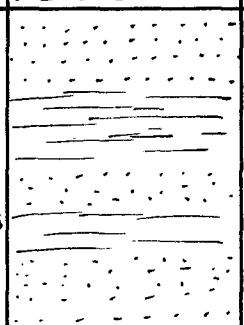
The area then emerged again and the following erosion was accompanied by: 1) folding in the Modelo and Pico, and 2) minor faulting throughout the area. After the area had been eroded to a smooth level, the terrestrial deposits of the Saugus were deposited at only slight angular discordance.

Materials for the sediments in the area were probably derived from an elevated land mass to the north, at the present site of the San Gabriels.

In post-Saugus time there has been strong tilting, at which time the large faults along the front of the San Gabriels came into existence. Following this tilting, the terrace and alluvial deposits were laid down with erosion and deposition continuing to the present time. The terrace materials are everywhere post-faulting and post-folding.

--0--00--0--

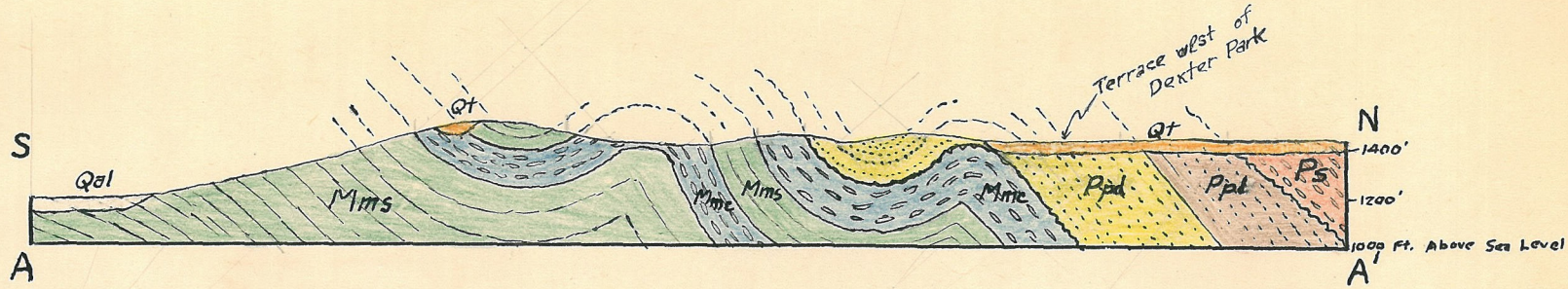
GEOLOGIC COLUMN

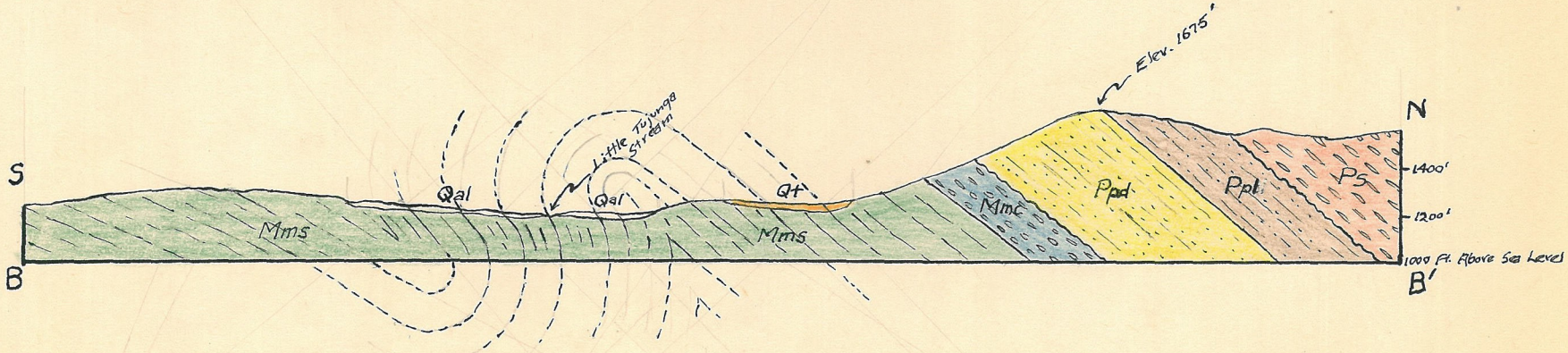
SYSTEM	SERIES	FORMATION	SYMBOL	COLUMNAR SECTION	THICKNESS IN FEET	CHARACTER AND DISTRIBUTION
Quaternary	Recent	Alluvium	Qal		0 - ?	Sands, gravels, soils. River and valley floors.
		UNCONFORMITY				
	Pleistocene	Terrace	Qt		0 - 70 ±	Conglomerates and coarse gravels. Poor consolidation.
		UNCONFORMITY				
		Saugus	Ps		280-560+	Fine grained, light colored, poorly consolidated conglomerates. Non-marine origin.
		UNCONFORMITY				
Tertiary	Pliocene	Pico	Ppl		385 ±	Light colored sandstone.
			Ppd		845 ±	Dark colored sandstone. Shaly lenses interbedded.
		UNCONFORMITY				
	Miocene	Modelo	Mmc		175 ±	Brown, coarse conglomerates.
			Mms		160 +	Light colored ss., siliceous shale.
			Mmc		75-145 ±	Brown, coarse conglomerate.
			Mms	 (base not exposed)	1200 +	Series of tan colored punky shale, white sandstone, and hard siliceous shale.

A generalized section, showing thicknesses and succession of beds, in the Kagel Canyon area. Thicknesses measured from dip and width of exposure of each formation, averaging when necessary.

K. Anderson - 1940

GEOLOGIC SECTIONS





Horizontal and Vertical Scale - 1" = 770'

K. Anderson - June 1940

1 Mile 1/2 0

5000 Feet 4000 3000 2000 1000 0

Contour interval 25 feet

One Inch = 770 Ft.

Scale 1/9,240

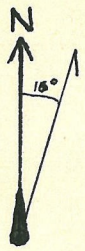
by K. Anderson

GEOLOGIC MAP

KAGEL CANYON

SUNLAND QUADRANGLE, L.A. CO., CALIF.

June, 1940



GEOLOGY BY:
K.E. Anderson and G.B. Weir

TOPOGRAPHY BY:
U.S. Geological Survey and
Los Angeles County Engineers

LEGEND

QUATERNARY
- Qal — Alluvium
- UNCONFORMITY
- Qt — Terrace

UNCONFORMITY

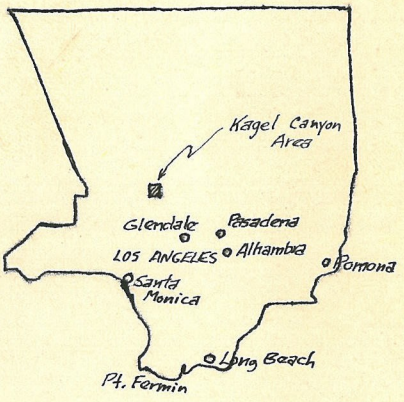
PLEISTOCENE
- Ps — Saugus

UNCONFORMITY (?)

PLIOCENE
- Ppl — Pico (light)
- Ppd — Pico (dark)

UNCONFORMITY

MIOCENE
- Mmc — Modelo - cg.
- Mms — Modelo - ss., sh.



Los Angeles County Map
Showing Location
of Area Mapped

45 dip - strike of beds

contacts

synclinal axis

anticlinal axis

fault