GEOLOGY OF A PORTION OF THE SUNLAND, CALIF. QUADRANGLE

Submitted in partial fulfillment of the requirements for the degree of Bachelor of Science at the California Institute of Technology

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INTRODUCTION

The area treated in this report is approximately one square mile in extent, and is located in the northern part of the Sunland quadrangle in Southern California, about seventeen miles northwest of Pasadena, California. The area studied is bounded on the west by Bartholomaus Canyon, on the east and south by Little Tujunga Canyon, and extends 1000 feet north of Dexter Park. The area is best reached from Pasadena by automobile by driving west on Foothill Blvd. twelve miles from Devil's Gate Dam. The area has been cultivated to some extent, largely in the form of small orange groves located in the Quaternary alluvium deposits of the larger canyons.

The area was investigated in partial fulfillment of the requirements for the degree of Bachelor of Science at the California Institute of Technology. The mapping was done with Brunton compass and pacing, using a photographic enlargement of a U. S. G. S. map, on a scale of one inch to 770 feet. Approximately twenty days were spent in the field.

SUMMARY

The area contains a thick section of Tertiary and Quaternary sediments, mostly of marine origin, dipping regionally to the north. The Tertiary sediments range in age from middle Miocene to lower Pliocene. In the vicinity of Kagel Canyon, the Tertiary sediments have been folded, to form a series of anticlines and synclines which pitch to the west.

In the vicinity of Little Tujunga Canyon, the Miocene sediments have been overturned to the south, producing a regional dip to the north which averages about 45 degrees.

Overlying the steeply dipping Miocene and Pliocene formations unconformably are Quaternary terrace deposits which are horizontal in attitude. Quaternary alluvium overlies sections of the area, its attitude varying according to present topography.

PHYSICAL CONDITIONS

Relief in the area is moderate, elevations ranging from 1200 feet to 1600 feet above sea level. Steep-walled canyons in the youthful stage of development, and broad terraces, horizontal in attitude, are characteristic of the locality.

Drainage in the area is principally into the intermittent streams flowing in the north-south canyons of Little Tujunga, Kagel, and Bartholomaus. Smaller east-west tributaries feed these main streams.

Vegetation in the district is the characteristic semi-arid chaparral growth, which is particularly dense in the eastern half of the area. Larger trees and a quantity of vines are found in the larger canyon floors, where more water is present. Exposures are good, and are found in road cuts and in the steep canyon walls. Terrace and Quaternary deposits tend, in places, to obscure outcrops.

STRATIGRAPHY

The total thickness of the section studied is about 3000-4000 feet. The bottom member of the section studied is a series of shales and sandstones, the shaly character becoming more pronounced toward the bottom of the series. These shales and sandstones are of Miocene age, and belong to the Modelo series. Their average thickness is about 1200 feet.

Overlying these shales and sandstones is a thin bed of coarse dark conglomerate about 75-145 feet thick, also of Modelo age. This bed pinches out in the eastern part of the area just to the west of Little Tujunga Canyon.

Overlying this bed of conglomerate is a second series of Modelo sandstones and sandy shales with a thickness of about 160 feet. These sandstones and shales lie directly on the first series of sandstones and shales in the eastern part of the area, where the conglomerate bed separating them has pinched out.

Lying conformably above the second sandstone-shale series is a second bed of conglomerate of about 175 feet thickness. The age of this bed is taken as Miocene because of similarity of composition between it and the lower bed of conglomerate, which is definitely of Miocene age.

Overlying the Miocene sediments is the Pliocene series, of Pico formation. The Pico formation is divided into two parts: the lower part, composed of about 850 feet of dark tan colored quartzitic sandstones with shaly stringers, and the upper part composed of 385 feet of light tan colored sandstones. The two divisions of the Pico formation are conformable.

The Saugus formation, composed of light gray colored gravels, sandstones, and fine conglomerates, overlies the Pico formation with no angular discordance between the two. The Saugus formation is Pleistocene in age.

The Saugus formation is about 280-560 feet thick in the area studied, but a brief examination of the area to the north of that treated in this paper indicates that the Saugus formation is many thousands of feet thick at this point. The Saugus formation is assigned a terrestial origin on the basis of studies to the east of this area made last year.

Overlying both Miocene and Pliocene sediments, which have been tilted, are Pleistocene gravels with a maximum thickness of about 70 feet. The angular discordance between the terrace gravels and the Miocene and Pliocene sediments varies from 20 degrees to a maximum of 70 degrees. The gravels are in all outcrops nearly horizontal in attitude.

Alluvium is found in the area in attitudes corresponding to the present topography. It is found principally in canyon bottoms, and overlying the terrace deposits.

PETROGRAPHY

The Modelo sandstone-shale series consists of some well-bedded, badly jointed shales, and great quantities of quartzitic sandstones, with stringers of siliceous shales. The formation has crumpled badly under stress, and much of the shale has been badly mashed.

The Modelo conglomerate is reddish in color, is badly oxidized, and poorly bedded. Individual particles vary in size from 1" to 10" in diameter.

The lower Pico formation consists of a dark-tan colored quartzitic sandstone, with lenses and stringers of siliceous shales, and a little light colored conglomerate. The upper part of the Pico formation is a very light-tan colored sandstone, well bedded, and fairly well consolidated.

The Saugus formation is characterized by its light gray color, is composed of fine conglomerates, gravels, and coarse sandstones. The formation is fairly well sorted. Average size of individual particles is about one inch.

The terrace deposits are of poorly sorted, poorly consolidated conglomerates. Individual particles vary widely in size, boulders up to two feet in diameter being fairly common. In general, terrace deposits in the eastern half of the area have been oxidized more than those in the western part of the area. The formation is composed mainly of grano-diorite fragments probably derived from the San Gabriel Mts. to the north. Also included in the deposits are quartzitic boulders.

The alluvium varies from fine-grained soil to the very coarse material found in the canyons. The finer material is found on the gentle slopes at the edge of the larger canyons, and supports several orange orchards. The stream material is grano-diorite weathered and transported from the San Gabriels.

STRUCTURE

Folding has affected the Modelo and Pico formations in the immediate vicinity of Kagel Canyon. The folding consists of alternating anticlines and synclines, all of which pitch to the west. At least two anticlines and three synclines are visible along the Kagel Canyon road, with the possibility of others in the highly incompetent Modelo shale. Dips are rather unreliable, and the deformation has been such as to develop numerous flexures, and there is a strong possibility that there are small flexures hidden beneath the alluvium.

The area near Little Tujunga Canyon has suffered overturning in the Modelo sandstone-shale facies. The regional dip is to the north, with alternating steep dips and shallow dips. This overturning explains the thinning of the sandstone-shale toward the west. Particularly in the upper of the two sandstone-shale formations, the overturning has sufficed to thin the outcrop on the surface in Kagel Canyon to a fraction of the outcrop on the surface in Little Tujunga Canyon. Evidence of the overturning is indicated by a marker bed of hard siliceous shale, overlain by punky shales. This marker bed occurs three times in the area, each time dipping to the north, but at angles alternately steep and shallow.

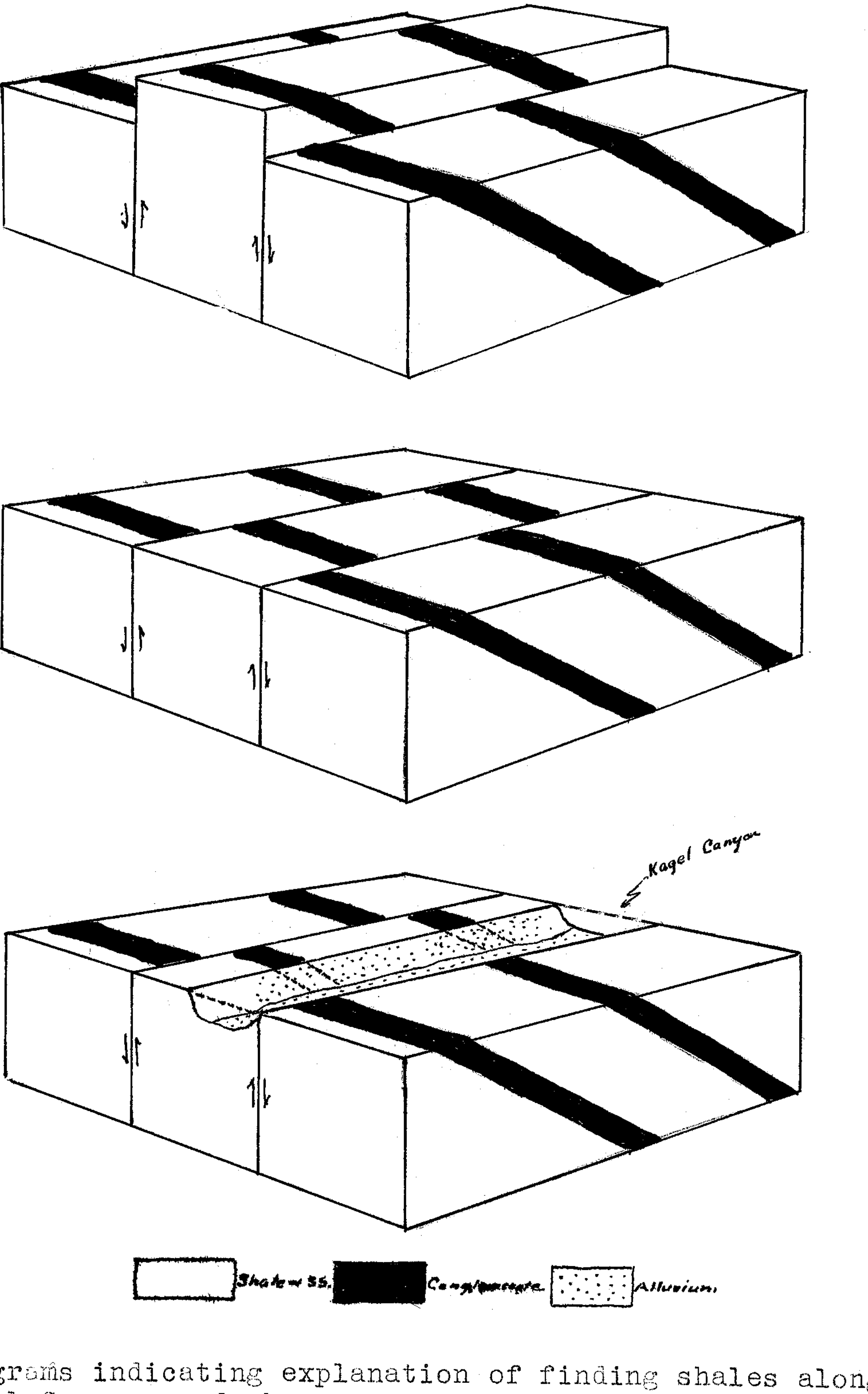
The lower conglomerate bed serves a marker bed for the pitching anticlines and synclines in the Modelo sandstone-shale series in Kagel Canyon. The sinuosity of its outcrop indicates the course of the axes of the anticlines and synclines.

Unconformities in the region exist between the Modelo and the Pico formations, and again between the Pico and Saugus formations. The unconformity between the Modelo and Pico is to be inferred mainly from the abrupt change in lithology, as there is no angular discordance between the two formations. The unconformity between Pico and Saugus formations likewise is not an angular one, but is one of time, since the Saugus is taken to be of non-marine origin, while the Pico formation is of marine origin.

Unconformities are present between terrace material and both Pliocene and Miocene sediments. The angular unconformity ranges from 20 degrees to about 70 degrees.

Faulting has played a very small part in the geologic history of the area studied. One small fault cuts both the Modelo conglomerate beds just west of Kagel Canyon. The fault has approximately a north-south strike, and movement appears to have been dominantly in a vertical direction. Slickensides were observed in a cellar in the side of the bluff just west of Kagel Canyon which indicated approximately vertical movement. The fault is not traceable for any distance, as alluvium covers the trace of the strike. The best evidence of the faulting is the termination of both the conglomerate beds, west of Kagel Canyon.

In the upper of the two conglomerate beds, good north dips are obtained within 200 feet of the Kagel Canyon road, yet on the road itself good south dips are obtained, in sediments which are definitely shales. Assuming a block containing Kagel Canyon were to move upwards with respect to the blocks on either side, then the contact of the conglomerate beds with the surface would move north, and be buried beneath the alluvium. (See block diagrams). This would account for the finding of shales along the road where one would expect conglomerate. Further, the vertical movement involves no north-south displacement of the conglomerate beds on either wall of Kagel Canyon, and would explain why one finds no offset of the contacts at this point. The vertical displacement would be of an order of magnitude of about 200 feet.



Diagrams indicating explanation of finding shales along Kagel Canyon road where one would expect to find conglomerate contact continued.

GEOLOGIC HISTORY

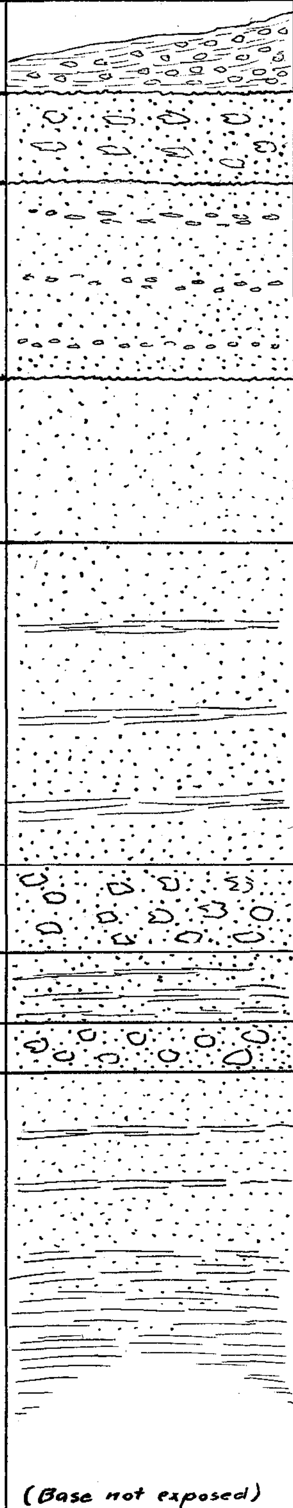
The Modelo sandstone-shale series was laid down under the ocean. This was followed by marine deposition of the first bed of Modelo conglomerate. Then more of the sandstone and shale was laid down. This in turn was followed by marine deposition of the second Modelo conglomerate. The area was then elevated, eroded, and agin submerged. The Pico sandstones were then laid down.

Again the region was elevated, eroded, and folded. Tilting also accompanied this movement. The Saugus was then laid down sub-aerially, possibly of fluviatile origin, and further tilting occured. Faulting then occured on a large and regional scale. That the regional faulting was post-Saugus in age is seen from the fact that about a mile north of the area treated in this paper the Saugus beds are seen to dip steeply into the main mountain mass of the San Gabriels.

Subsequent erosion of the blocks elevated by this regional faulting gave rise to the terrace material, which still retains its original horizontal attitude of deposition, showing that little tilting has occured since the rise of the San Gabriels. Sub-aerial erosion of the San Gabriels has accounted for the alluvium present in the area.

The fault west of Kagel Canyon cannot be placed exactly as to age, but it is at least post-Miocene in age, since it terminates Miocene beds.

GEOLOGIC SECTION

SYSTEM	SERIES	FORMATION	SYMBOL	COLUMNAR SECTION	THICKNESS	CHARACTER ~ DISTRIBUTION
Quaternary	Recent	Alluvium	Qal		0-?	Soils, sands, gravels in river and canyon bottoms.
		UNCONFORMITY				
		Terrace	Qt		0-70'±	Conglomerate and other coarse material. Poorly consolidated.
		UNCONFORMITY				
	Pleistocene	Saugus	Pls		280'-560'±	Light gray, poorly consolidated sandstones, with fine conglomerates and gravels.
		UNCONFORMITY(?)				
Tertiary	Pliocene	Pico	Ppl		385'±	Light colored Sandstone
			Ppd		845'±	Darker colored Sandstone (Some sandy shale)
		UNCONFORMITY				
	Miocene	Modelo	Mmc		175'±	Coarse brown conglomerate
			Mms		160±	Light colored ss and sandy sh.
			Mmc		75'-145'±	Coarse brown conglomerate
			Mms		1200+	Sandstones, and sandy shales, also shales which are well bedded. Becomes more shaly toward bottom of section

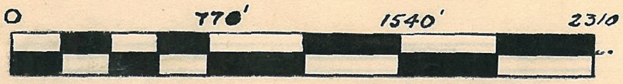
GEOLOGIC SECTIONS

OF A PORTION OF SUNLAND, CALIFORNIA QUADRANGLE

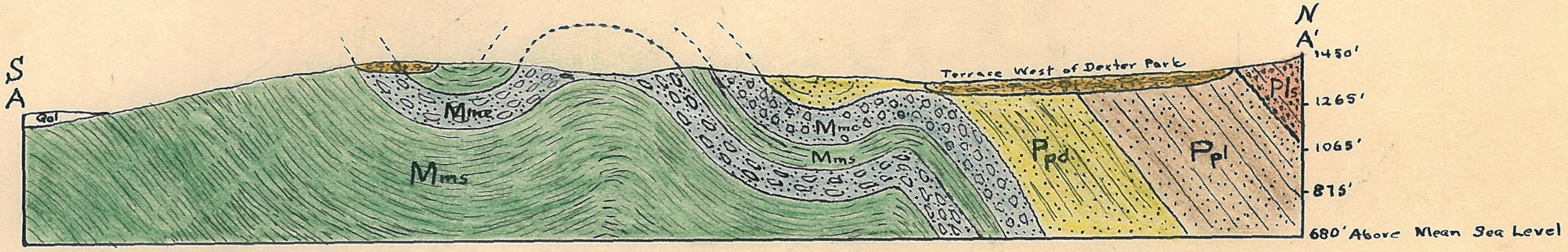
GORDON B. WEIR

JUNE, 1940

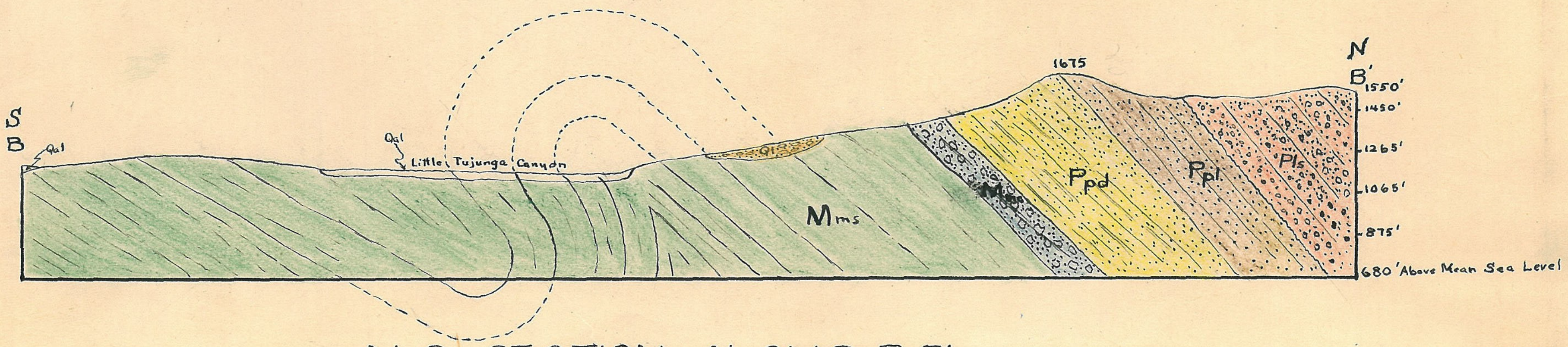
HORIZONTAL AND VERTICAL SCALE 1" = 770'



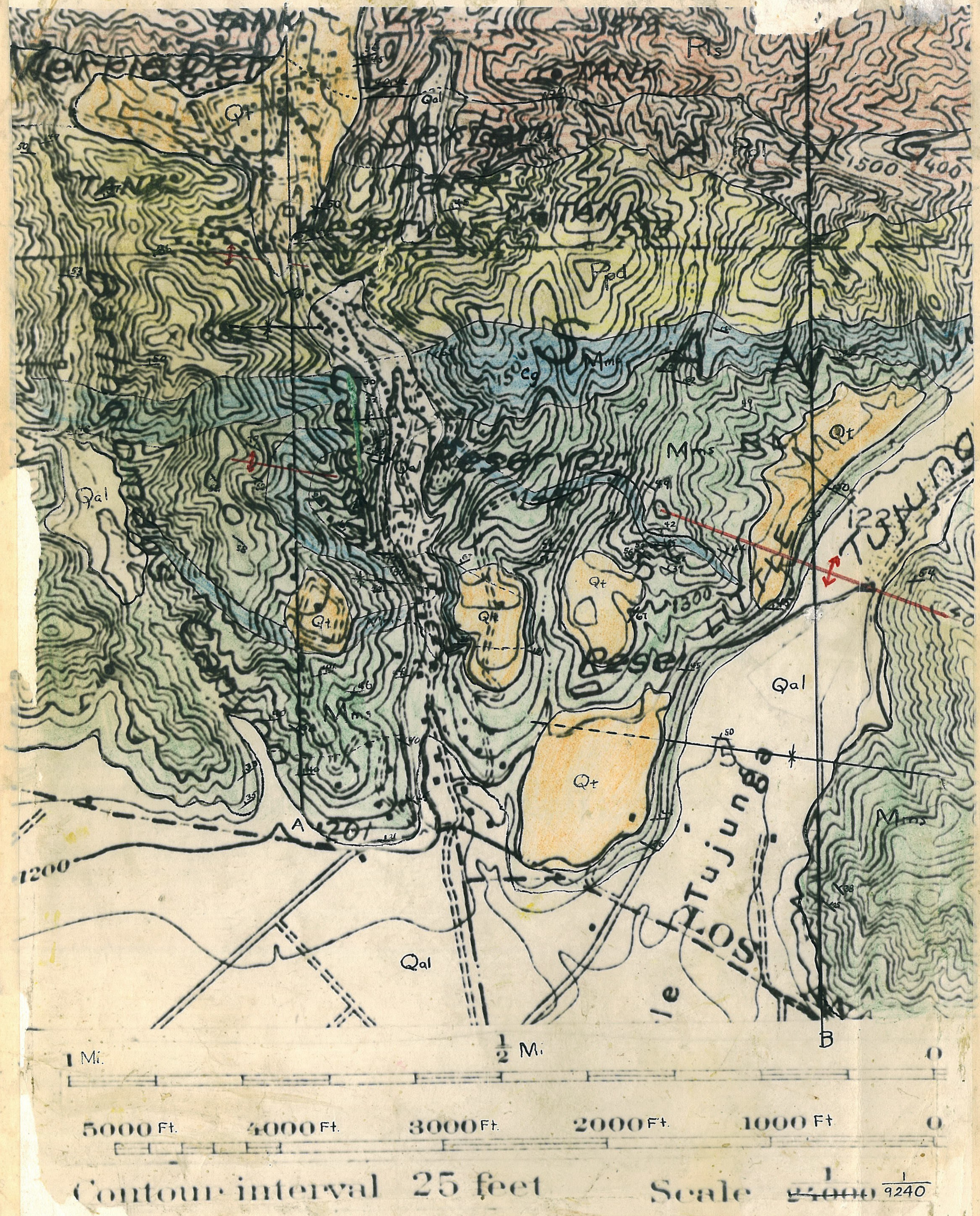
LEGEND - SEE MAP



N-S SECTION ALONG A-A'



N-S SECTION ALONG B-B'



GEOLOGIC MAP OF A PORTION OF SUNLAND QUADRANGLE

JUNE, 1940

GEOLOGY BY K. ANDERSON AND G. WEIR

TOPOGRAPHY BY U.S. GEOL. SURVEY

SCALE 1" = 770'

0 770' 1540' 2310'

N

15°

LEGEND

Qal	Alluvium
Qt	Terrace Gravels
Pls	Saugus Cgl.
Ppl	Pico Light ss.
Ppd	Pico Dark ss.
Mmc	Modelo Cgl.
Mms	Modelo sh.

- Dip - Strike
- Contact
- Synclinal Axis
- Anticlinal Axis
- Fault Axis