A GEOLOGICAL REPORT ON A SMALL PART OF THE

SANTA MONICA MOUNTAINS

SUBMITTED AS REQUIRED WORK FOR THE SENIOR

YEAR IN THE GEOLOGY COURSE AT THE CALIF-

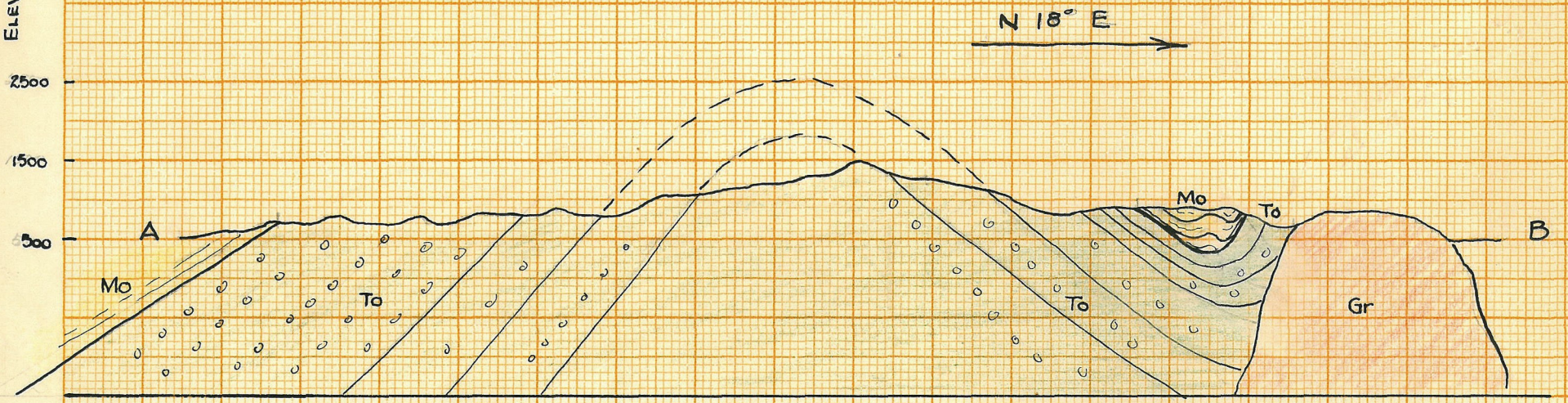
ORNIA INSTITUTE OF TECHNOLGY. BY

EDWARD JOUJON-ROCHE.

PLATE ONE

E. Joujon-Roche

CROSS SECTION *of the* SANTA MONICA MOUNTAINS



Legend

Tert. Seds. presumably of these ages { Mo = Modelo; To = Topango }

Gr = Granite

La = Lava

Both vertical and horizontal scale 1" = 2000'

Dips shown are true dips; i.e. perpendicular to strikes

PLATE TWO

E. Joujon-Roche

CROSS SECTION *of the* SANTA MONICA MOUNTAINS

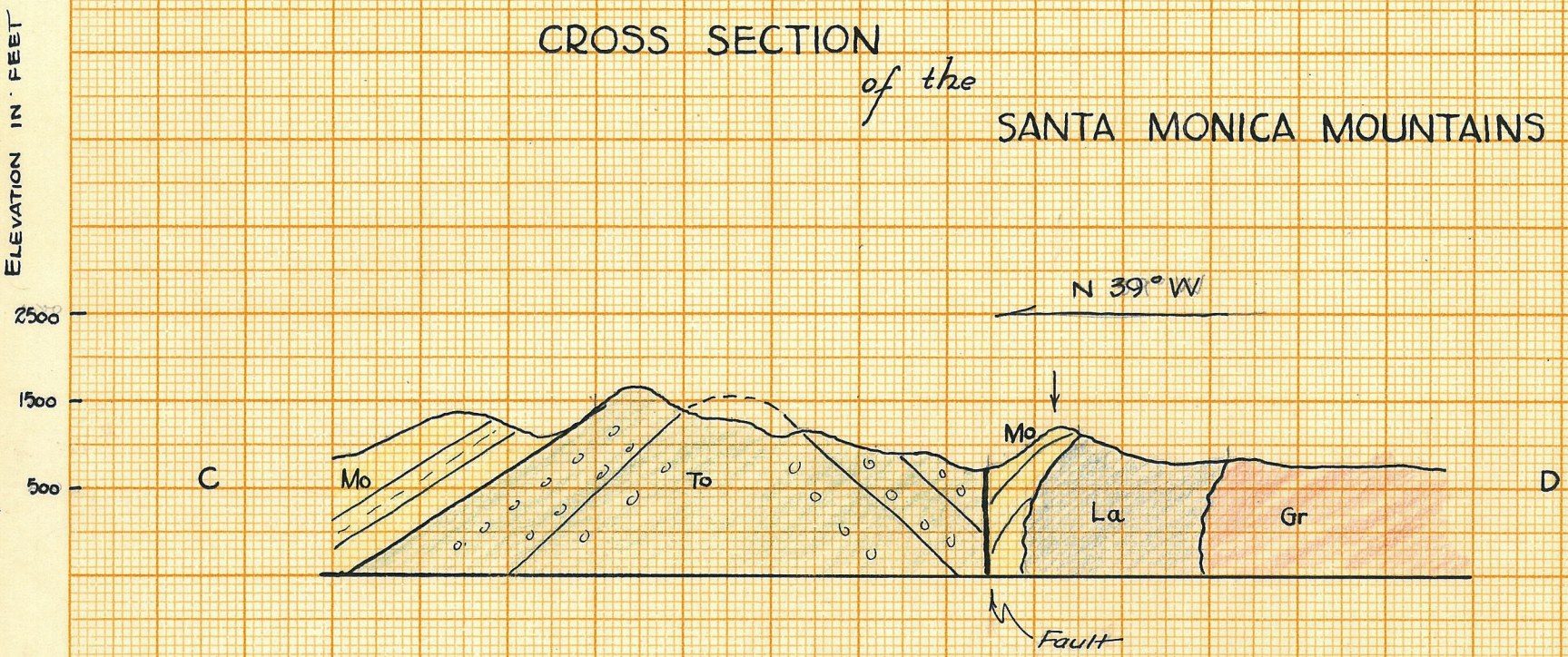


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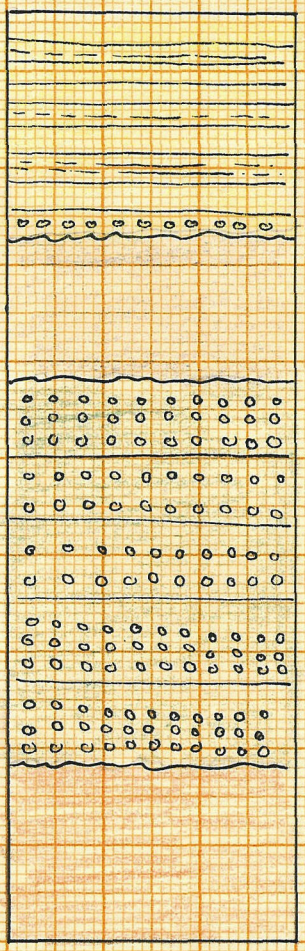
PLATE THREE. VERTICAL COLUMN

Showing succession of formations and approximate thickness of each.



2000 feet + Sandstones & shales

Later Tertiary Sediments
(presumably Modelo)

Lavas - Intrusion depth?
Some extrusive

4000 feet +

Earlier Tertiary Sediments
(presumably Topango)
ALL CONGLOMERATE - VERY COARSE

Granite

INTRODUCTION.

The area of investigation is located at the East end of the Santa Monica Mountains, and is a strip extending from Hollywood Lake East, about a mile and a half in width, and the width of the range in length. This area is immediately North of the City of Hollywood, California. It comprises a little more than five square miles. The purpose of investigation was to make a fairly detailed geologic survey, considering the formations and the structures thereof. Before a detailed study was started, a day was spent in reconnaissance.

PHYSICAL CONDITIONS.

Cahuenga Peak is the highest point in the area, being 1821 feet high. The backbone of the range extends in an East-West direction, turning off to the South near Mt. Hollywood. All the higher peaks are located in this ridge. The elevations of both the South and North borders of this range are about 500 feet above sea level, thus giving a maximum relief of 1300 feet, which is not so great in comparison with the relief of other mountain ranges in Southern California.

TOPOGRAPHY

The topography is fairly rugged in the middle part of the area, but the Southern half of the area is rather subdued. The Northern half is much more rugged due to the great amount of coarse Topango conglomerate and the granitic rocks. The granite parts of the area stand up better under weathering than do the sedementaries, especially the sedementaries of the Modelo formation which are shales and fine sandstones. Two types of topography are exhibited by the lavas because of their character. There are intrusive and extrusive lavas. The extrusive lavas are red and practically aphanitic. Due to the fact that they are found on several peaks, one would assume that they are harder, and besides, the form of the peaks is much more sharp than the rounded ridges of the intrusive lavas. The granite has been eroded a great deal, and one does not find the sharp topography one would expect in such rock. The Topango conglomerate, on the other hand, being well cemented and containing granite, quartzite and andesite boulders, is very resistant, and exhibits a sharp topography. The Modelo formation, composed of soft shales and sandstones, is eroded extensively. Its topography is rather rounded and resembles that of the intrusive lavas.

DRAINAGE.

There are no streams in the area in which there is water the year around. Just during the winter months, and then only during and after the rains, do the drainage courses carry water. In general,the drainage flows two ways off the watershed, North and South. The drain- is a little interrupted in its approximate North course, in the North-

FIGURE 1. Hills south of Mt. Hollywood as seen from Los Feliz Road.

FIGURE 2. Looking south down Brush Canyon from the Griffith Park Road.

east part of the area. The run-off from this watershed is considerable because the vegetation is not luxuriant by any means, on the South slope especially. Hollywood Lake is fed by three intermittant streams which drain only four square miles. This is indeed a huge run-off, as Hollywood Lake has a capacity of 7,400 acre feet.

VEGETATION.

The vegetation on the South side, as was mentioned above, is, as a whole, scanty. This is due to the South exposure, character of soil, aridness and slope. The South exposure in these latitudes, is always drier than the North. The Modelo formation has a tendency to support a grassy vegetation which may be quite luxuriant in favored spots. The Topango formation has a more scanty vegetation than any of the formations, due to the lithologic character of the formation, which will be described later. Decomposed granite supports a surprisingly profuse vegetation; that is, in relation to what one would expect to find. The lavas are just mediocre in their fertilities. Sometimes the vegetation is abundant on the lavas. In general then, the Modelo is characterized by a grassy vegetation; the Topango by Mesquite and Sagebrush vegetation. It is hard to generalize much further. In the canyons and gullies there are quite a few sycamores and scrub oaks, while on the small hills of Modelo at the extreme North part of the area, there are quite large live oak trees. It is true, moreover, that the vegetation seems to change more in accordance with the general slope; and on the North slope, right behind the ridge, the vegetation is much more luxuriant than on the South side, and exposures are very rare as a result.

EXPOSURES.

Exposures are numerous in the Southern half of the area, due to many road cuts and bridle paths. This helped out a great deal. In the Northern half, however, there are no road cuts to speak of, except the Griffith Park Road, and a few bridle paths in the granite. In the region just North of Cahuenga Peak where good exposures would have been exceedingly valuable, there were practically none because of the comparatively heavy vegetation. There are one or two bridle paths in that vicinity, but they were not of much aid, as they did not cut down very far below the top soil, if at all. On the whole, though, the exposures were quite good, and it was indeed fortunate because of the fairly complicated structure encountered.

FIGURE 3. The hills in the north central part of the area, composed of Modelo(?) and Topango(?)

FIGURE 4. Showing the steep back slope north of Cahuenga Peak.

FIGURE 5. The high east-west ridge in the area, Cahuenga Peak at extreme left.

GEOLOGIC CONDITIONS.

STRATIGRAPHY AND GEOLOGY.

The area comprises Tertiary sedimentaries of the Modelo and Topango formations, granites and lavas.

THE MODELO FORMATION.

The Modelo formation consists of finely and well bedded shales and sandstones. Their dip and strike varies considerably because of their susceptibility to deformation with the application of stresses. It was thought not necessary to show all these minor details on the map, but, on the other hand, general tendencies were shown as nearly as they could be generalized. The dip varied from horizontal up to 35° on the Southern part of the Modelo. The folding never went to the extent exhibited in the North section of the Modelo; it was much more gentle.

The Modelo shales are quite siliceous and relatively hard for shales. They vary in color from almost black to a light grayish-yellow, and are rather brittle. The sandstones are medium grained, though inclined to be somewhat fine and composed of subangular to rounded grains. They are predominantly feldspathic and quite homogeneous in appearance.

In the basal conglomerate of the Modelo, exposed in pits in the Northeast hill section of the area, there is a surprisingly great amount of calcite, cementing together the boulder elements. The origin of this calcite is very problematical, but the most probable source is from an unexposed intrusion of some kind, and the basal Modelo being thus cracked, has been filled with calcite.

The small patch on the map marked with a question mark, has a very peculiar appearance. It is of sedimentary origin, and strange to say, the material is volcanic in character. It is mediumly fine-grained and massive. The occurance of this, further proves, to some extent at least, the age of the lava intrusion as post Topango. Much more work should be done on this especially, so as to definitely determine its significance.

The age of this formation, as well as the age of the Topango, and that of the granite, is based on the similarity of these various formations, as to physical character, to formations determined in other parts of the Santa Monica Mountains by Dr. Hoots and other authorities. Though this may not be proper, as it was not possible to devote further and really intensive study to these determinations, such assumptions were thought justified.

Invertebrate material has been found in the Modelo, but no great attempt was made in this study, to work with such material because of lack of time. Some fossils were found, of course, but they were not at all good specimens.

THE TOPANGO FORMATION.

In this area, the Topango formation consists of a very coarse conglomerate, sometimes containing boulders that are immense. The Topango throughout the Santa Monica Mountains, is distinguished from the basal Modelo conglomerate by the presence of quartzite boulders. Granite, andesite and basalt boulders make up the major portion of this conglomerate. The granite element is outstandingly predominant in some localities, but time did not permit further investigation of this matter. On the West side of the upper part of Brush Canyon, a

striking exposure of this granitic conglomerate is to be found. The part of the conglomerate in this Canyon is very compact and hard and composed of angular material. The boulder material is very well rounded as a rule, and ill sorted. The granites are well weathered, as are also the andesites and basalts. The material as a whole, is fairly well consolidated, but not exceedingly so by any means. The conglomerate has a slaty, baked appearance in some localities, due, no doubt, to the lava intrusion.

Strikes and dips are very hard to obtain in this coarse Topango conglomerate, due to poor bedding. On Cahuenga Peak and the ridge immediately East, such observations may be made fairly easily, but elsewhere in the Topango it is difficult.

There were no fossils found in the Topango conglomerate.

THE GRANITE.

The granite is intrusive and quite old. It is jointed considerably and cut by dikes of a rock rich in ferromagnesian minerals, presumably a gabbro. The granite is very ordinary, having orthoclase, quartz and biotite for major elements, and having meniumly large crystals.

THE LAVAS.

There are two distinct types of lavas in this region, namely; intrusive and extrusive.

The intrusive lavas are chiefly pyroxene andesites, which are filled with large amygdules in many localities. These amygdules are thought to be of some zeolite, particularly stilbite, though it is hard to ascertain accurately because of the weathered condition of the

rock. In color, these intrusive lavas are a greenish-yellow brown, and vary in shade considerably.

The extrusive lavas are a deep red in color and are not very widespread, being found only in a few places:-- on the peaks just East of the quarry and West of the road. These lavas are basaltic and are hard, brittle and aphanitic.

GEOLOGIC STRUCTURE.

The Topango formation was laid down on the granite, thus the contact between the Topango and the granite is depositional. This is brought out clearly in the field, as there is not the slightest trace of any fault. The Modelo lies unconformably on the Topango, as was plainly shown in field observations. The lavas were intruded past Topango, and after deposition of Modelo on the lava, some Modelo was left as float upon its erosion. In other places the lava broke through and assumed an extrusive character.

The intrusive lava exhibits a very characteristic spalling structure due to weathering. This is a spherical shell structure, and parts of the shells are eroded off upon exposure.

The folding in the Topango and Modelo may be the result of compression, due to causes which are provincial and not able to be ascertained from a brief study of such a small area.

The fault seen in cross section in PLATE TWO between the Modelo and Topango, is simply a normal fault. There was no indication of the plane of the fault, so it was assumed vertical. There is, of course, a distinct lithological difference between the rocks on either side of the fault.. At the extreme Northern end of this fault, that is where it intersects the road and is shown in the road cut, fault relations are splendidly exhibited. There is much fault gouge, which is

FIGURE 6. Sandstone of Modelo (?) resting on top of lava. This lava has spalling structure, but does not show up well in picture.

FIGURE 7. Fault indicating movement Modelo (?) sandstone over the lava.

unmistakeably evidence of much movement. The intrusive lava probably was reheated, due to magma beneath, and as it cooled, this started a downward movement, and the Modelo floating on top, was overcome by the momentum of the movement and were fractured. The dip of the Modelo alongside the lavas is due to the movement.

In PLATE ONE it is easy to see how the Modelo and Topango were eroded after folding, and thus leaving the present folded Modelo in the syncline of the Topango. The Modelo, being much more incompetent, was folded a great deal in the movement.

ECONOMIC CONSIDERATIONS.

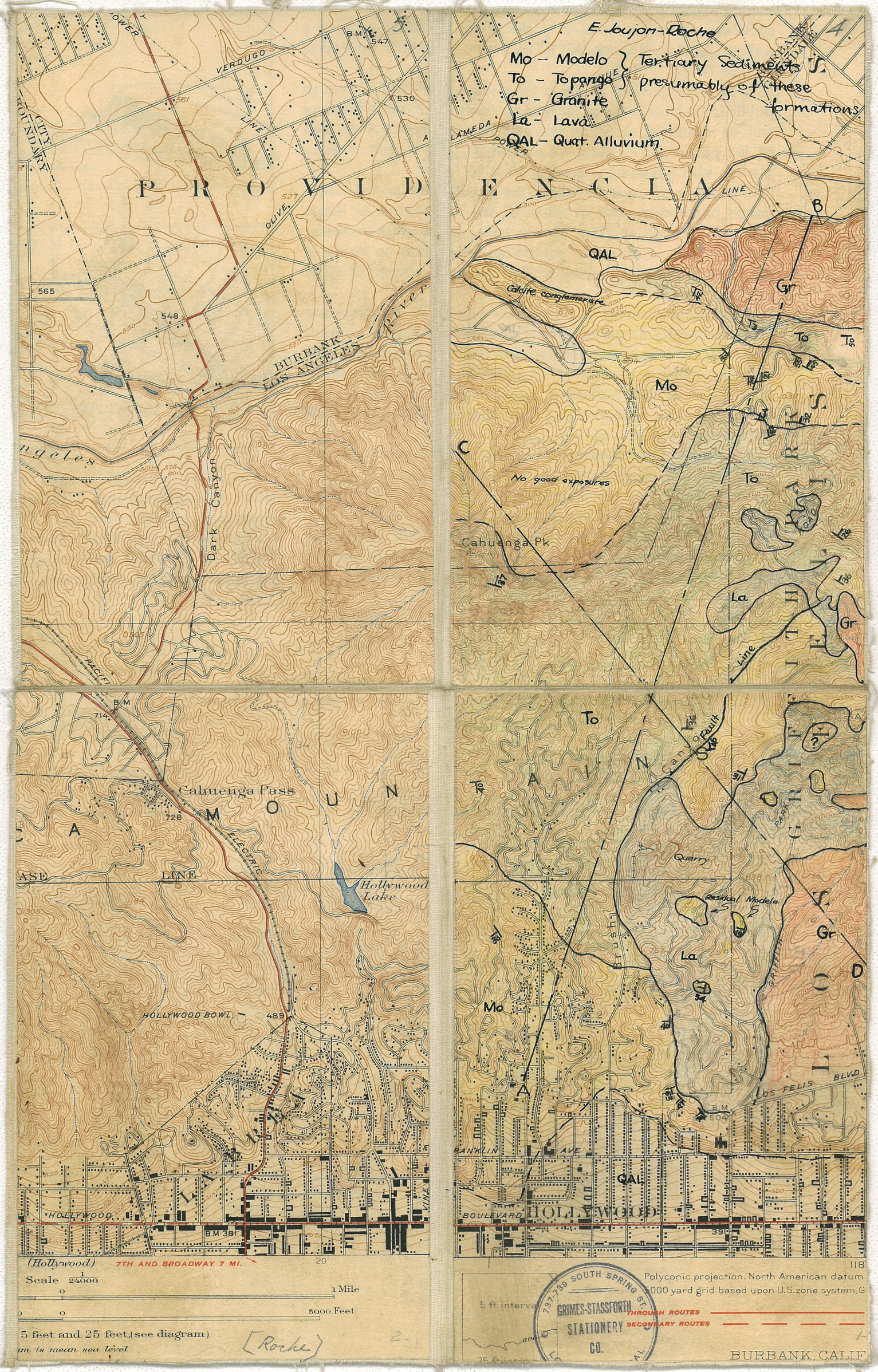
Up Brush Canyon there is a quarry which is being operated by a crushed rock concern. The basalt is being taken out and crushed, and then used for building material.

HISTORICAL GEOLOGY AND SUMMARY.

In the Santa Monica Mountains, the granites are believed to arise from an intrusion in Jurassic time. Later, in the lower part of the Miocene, the coarse conglomerate of the Topango formation, was deposited upon the granite. The Topango formation is of terrestrial origin in this locality. This was due to the uplift of mountains, probably to the North, and erosion resulting in the deposition of the materials of erosion in this locality. From its appearance, the material was carried by torrential streams. Next came the lava intrusion under the Topango. The lava broke through in some places and assumed an extrusive character. Erosion then took place, and much of the Topango was eroded off the lava in the part of the area where the Modelo rests on the lavas. This was followed by submergence by the ocean and

simultaneous tilting of the land. The Modelo was then deposited in upper Miocene time, while the land was submerged. After the emergence of the land, erosion again took place and started the present physiographic features.

The fault movement occured in post Modelo time. The lava was probably reheated, due to stresses, and the movement as previously described, took place.


E. Joujon-Roche
Mo – Modelo } Tertiary Sediments S.
To – Topanga } presumably of these
Gr – Granite formations
La – Lava
QAL – Quat. Alluvium
PROVID
ENCIA
VERDUGO
OLIVE
LINE
BURBANK
LOS ANGELES
RIVER
Dark Canyon
QAL
Calabasas conglomerate
Gr
To
Mo
No good exposures
Cahuenga Pk
La
Gr
Cahuenga Pass
MOUN
ELECTRIC
Hollywood Lake
HOLLYWOOD BOWL
HOLLYWOOD
7TH AND BROADWAY 7 MI.
Fault
Quarry
Residual Modelo
Brush
GRIFFITH PARK
LOS FELIS BLVD
FRANKLIN AVE
QAL
BOULEVARD
HOLLYWOOD
Polyconic projection. North American datum
5000 yard grid based upon U.S. zone system, G
THROUGH ROUTES
SECONDARY ROUTES
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5000 Feet
5 feet and 25 feet (see diagram)
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