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1:24000 scale

latest USGS topo maps

1955 Jimtown } Sheets
1959 Geysers

40' contours.

June 26th, 1941.

Mr. Allen J. Wright,
1924 Broadway,
Oakland, Calif.

To Schuette & Wisser, Dr.

| | |
|---|---|
| To professional services, examination and report on Socrates mine | $250.00 |
| Films, photos | 2.06 |
| Blueprinting | 2.71 |
| Drawing andother supplies | 3.22 |
| Typing and preparing report | 7.50 |
| | $265.49 |
| Previously received | 100.00 |
| Balance due | $165.49 |

San Francisco, June 26th, 1941.

Mr. Allen J. Wright,
1924 Broadway,
Oakland, Calif.

Dear Sir:

Pursuant to your request, I have examined the Socrates quicksilver mine, Sonoma County, California, spending the period May 23rd-June 3rd, 1941, on the property. I wish to extend my appreciation for aid extended me there by Mr. Roy Hickman, superintendent.

The following report embodies my idea of the best method of developing the Socrates mine at depth.

Yours very truly,
Edward Wisser
Edward Wisser

# REPORT ON THE SOCRATES QUICKSILVER PROPERTY, SONOMA COUNTY, CALIF.

## SUMMARY STATEMENT.

The Socrates quicksilver mine, northeast of Healdsburg and on the divide between Big Sulphur and Little Sulphur Creeks, produced about 4500 flasks of quicksilver (to 1917), from about 30,000 tons of ore mined, the average grade of ore furnaced being therefore about 11 1/2 lbs. Hg per ton. The Socrates ore shoot lies on the northeast or footwall contact of a band of serpentine that follows the divide and dips southwest. The Contact mine lies down the southwest slope of the ridge, and its ore occurs along the southwest or footwall side of a smaller serpentine lens that dips northeast, toward the divide.

To develop the Socrates ore shoot at depth, an inclined shaft in the sandstone footwall is recommended, located northwest of the present mine workings. Through this shaft, a depth of 100' vertically below the Socrates No.3 level could be reached in four months at a cost of $10,500. Further sinking would depend on results of lateral exploration at this horizon.

On the Contact side of the ridge, a cross cut tunnel is proposed, to start from the gulch below the Contact plant; the tunnel should cut the Contact ledge at 1050', and 200' down the dip below the present bottom of the mine. Cost, $14,000. Should exploration from the Socrates shaft develop sufficient ore there,the Contact tunnel could be extended to the Socrates ledge;total distance 2500', cost $32,000 (total).

With upward connections to the Contact and Socrates workings,this extraction tunnel would permit unified operations at the two mines,with a single plant and camp, and might aid in continued exploitation of the two properties in times of low quicksilver prices.

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# REPORT ON THE SOCRATES QUICKSILVER PROPERTY, SONOMA COUNTY, CALIF.

## INTRODUCTION.

The following report is based on a stay of 10 days at the property, May 23rd-June 3rd, 1941; upon a report with maps by Wm. Forstner, 1907; and upon a report by L.E.Aubury, 1917. Although most of the workings are inaccessible, there seems no reason to doubt that ore was left in the lowest workings; but local conditions make the reaching of this ore for mining something of a problem. The object of my work was to determine the best method for doing this.

## LOCATION. TOPOGRAPHY.

The Socrates (originally Pioneer) property lies some twenty miles northeast of Healdsburg, and on the divide between Big Sulphur and Little Sulphur Creeks. It is reached by good mountain road from Healdsburg to the now defunct town of Pine Flat, thence by unimproved road to the mine. The property lies in Sections 32 and 33, Township 11 N, Range 8 W, and Sections 4 and 5, Township 10 N, Range 8 W, Mt. Diablo Base & Meridian. While the ridge reaches an elevation of over 3300', the country in the vicinity of the mine is only locally rugged, as is shown in the photographs at the end of this report.

## GENERAL GEOLOGY.

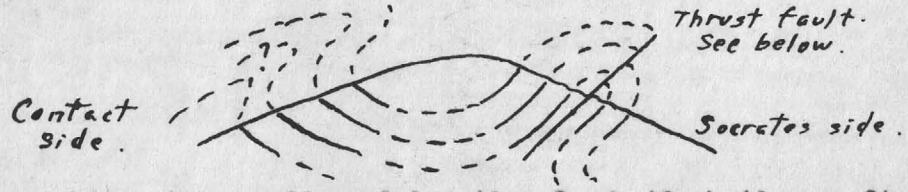
Rock Formations.- The chief rock of the region is Franciscan sandstone. Most of it is arkosic (made up of small fragments, mainly angular); much is shaly, and there are frequent thin intercalated horizons of soft dark shale. The sandstone usually weathers massive, but much is really thin-bedded.

A large mass of serpentine divides the mapped area ( see Geologic Plan of Surface), running roughly along the crest of the main ridge.

Several smaller masses occur. The serpentine was originally a basic porphyritic rock, and the degree to which it is serpentinized varies greatly. Where serpentinization is intense, the rock is typically soft and green; where slight, the rock is hard, weathering brown.

There are other igneous rocks: a sill or intercalated volcanic flow of "greenstone" is found within the Franciscan series northeast of the Contact camp site, and northwest of the camp is a mass of holocrystalline rock resembling diorite, apparently intrusive into the Franciscan sandstone.

Structure.- The sandstone beds and the serpentine masses strike northwest-southeast. On the southwest slope of the main ridge, where the Contact mine is located, dips are gently northeast into the hill, and an impression is gained of gentle folding; on the northeast side of the ridge, however, where lies the Socrates mine, dips are steep and mainly southwest. (Section A-A'). This suggests a broad assymetric syncline. A conglomerate bed about 20' thick was picked up in the Franciscan and used as a marker (Geologic Plan of Surface, Sections A-A', B-B'). The distortion of this bed, with that of several shale layers used as markers also, suggests strongly that the structure, far from being one of broad, open folds, is one of intense, gigantic overturned folds, something like immense ocean waves:




This notion is confirmed by the fact that the soft shale layers are almost everywhere intensely sheared, forming loci for bedding faults (Section B-B'). The serpentine masses tend to lie conformably within the Franciscan beds (sill-like), but the serpentine cuts the beds intrusive-fashion in many places. The footwall of the Socrates seppentine mass is a zone of especially intense shearing (Section B-B', also composite

plan of workings) , and Section B-B' suggests strongly that the serpentine, which is narrow and dike-like here, forms the hangingwall of a strong thrust fault intimately connected with the intense overturned folding.

Northwest of the Socrates mine (Geologic Plan of Surface) the Socrates serpentine mass spreads out over a wide area; but within this area are numerous "islands" of sandstone, and it seems likely that here the serpentine has spread out from the dike-like mass that marks the northeastern contact of the serpentine, and formed a sill-like intrusion within the Franciscan beds, a sill that may have participated in the intense and complicated folding that affected the sandstone beds. If so, the northeastern edge of the serpentine in this area, being dike-like along the thrust fault, probably goes down, while the widespread serpentine mass southwest of it probably bottoms at shallow depth.

MINERALIZATION. ORE DEPOSITS.

The Socrates and Contact mines lie in the heart of the Mayacmas quicksilver district, one of the most productive in California, containing such famous old producers as the Oat Hill, Etna, Great Western and Mirabel mines. The trend of this zone is northwest-southeast, coinciding with the structural trend at the Socrates; this is indeed the structural and topographic trend of all this portion of the Coast Range.

In the Socrates region, quicksilver ore bodies occur typically along the footwall of serpentine masses, whether the latter dip southwest (Socrates) or northeast (Contact). Where these contacts carry ore, they commonly show "croppings" or "ledges" of silica-carbonate rock; this is an alteration product of the serpentine and is limited to the close vicinity of the contact, not extending into the main serpentine mass. Between this ledge matter and the underlying sandstone there is commonly, as Forstner says, a sheet-like mass of dark, soft gougy matter, called an "alta". Immediately beneath this alta, at the top of the permeable sandstone, occurs the ore. At the Contact and Socrates mines quick-

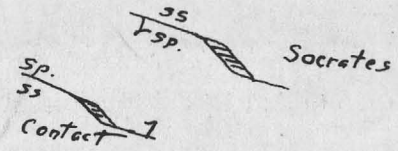
silver occurs both native and as cinnabar.

The ore is found in well-defined shoots. In the general region many short ore outcrops are found; perhaps one in ten of these goes down, and is something more than a surface pocket. Where ore goes down, it is not very thick, and not very long horizontally, but extends downward a relatively great distance along its pitch, so that its shape is that of a ribbon of toothpaste. The Contact ore body is of this type. The Socrates ore body shows a similar tendency (see Composite Plan and Longitudinal Vertical Projection), but here the strike length is greater, and the ore body developed to so slight a depth below the outcrop that the ribbon shape is not yet confirmed.

The quicksilver deposits of California are recent, so recent that the surface at the time of mineralization was essentially the same as that today. The age of the intense folding and thrusting in the Socrates region is unknown to the writer, but certainly it long antedated quicksilver deposition. Since the basic rock now serpentine intruded at a period closely linked with that of the intense folding and thrusting, it too antedates the mineralization. The association of quicksilver with serpentine must therefore be structural rather than genetic: certain physical features favoring ore deposition are associated with the serpentine masses.

The quicksilver ore, rising probably from considerable depth and depositing close to the present surface, needed (1) deep-going channels and (2) permeable rock to deposit in near the surface, and at the same time, a "trap" to prevent outflow at the surface and furnish concentration rather than dissemination of the cinnabar. Physical discontinuities furnish channels in the crust, because they tend to be zones of fracture and fissuring. The contact between impervious serpentine and permeable sandstone makes not only a discontinuity, but a channelway in itself, even without

accompanying fracturing. This is why nearly all serpentine footwall contacts are at least slightly mineralized in this region. The important deposits, however, are localized in those portions of such contacts where fissuring and fracturing were especially intense. Where a contact is straight, there may be sliding along it without the development of open spaces; a sharp bend in the contact, however, when accompanied by differential movement of the opposing walls, may create an open or permeable space:




This control seems to have governed both the Contact and Socrates ore bodies; if the bend or flexure in the contact continues to depth, the differential movement will create a pipe-like open space.

These "open spaces" however are seldom really open. Rather they are areas of small scale fracturing, of permeability. Rock fractures best if it is brittle, and enclosed between layers of softer rock. At the Socrates, the serpentine and massive silica-carbonate rock, in the hangingwall, were too hard and tough to crack; but beneath them lay soft alta. Beneath the alta was a layer of brittle sandstone, and beneath that, as I could see in the cross cut adit, No.3 level, another layer of soft squeezed matter, probably originally a band of shale. Conditions were therefore ideal for ore localization, especially within the flexure in the contact: intense fracturing with development of open spaces requires an increase in volume of the fractured ground. If this is inhibited, open spaces are suppressed. As shown in the diagram near the top of this page, the bend in the contact permitted the increase in volume and localized the ore.

THE SOCRATES MINE.

Refer to Composite Plan of Workings and Longitudinal Vertical Projection.

Past Performance.- Estimated total production for the Socrates (Quicksilver Resources of California, Bul.78, State Mining Bureau,1918, p.193) is about 4500 flasks, recorded production, 1900-1917, being 3500. Since the bulk of the production was made prior to Forstner's report, 1907, the grade of the furnaced ore may be estimated by dividing the total tonnage mined into the total pounds Hg produced. Guessing the average width of ore mined at 10',total tonnage is about 30,000 tons, giving the grade of the ore as furnaced about 11 1/2 lbs. Hg/ton. Forstner estimated a corresponding grade of 20 lbs. (p.2);his estimate is based on sampling, of doubtful value. It is probably safe to hope that further ore in the Socrates will furnace say 10-15 lbs. per ton.

Chances for Further Ore.- The Socrates seems to have suffered from almost continual mismanagement during its active life. The ore streak was seldom followed for long, in drifts or raises. Salivation difficulties help account also for its poor financial showing. There is probably some developed but unmined ore above the No.3 level,and still more probably, undeveloped ore passed up by faulty prospecting, as suggested by Forstner,in his report and on his map,toward the northwest end of the No.3 level.

Nevertheless,inspection of the surface shows that the mine workings along the contact cover pretty well the best showings along the strike, and I am unwilling to assume any appreciable amount of ore above the No. 3 level. The best chances are clearly in depth. Forstner recognizes this fact, and points out a suggested rake of the main ore body down to the NW. The No.1 winze, shown in the longitudinal vertical projection, was sunk to test this rake. It was down 30' in Forstner's time ,and full of water,but J.C.Ansel,mine foreman,who I am told was entirely reliable, says the "ledge"averaged 110 lbs. per ton over a width of 15'.

During revival of the Socrates in 1917, the No.1 winze apparently

was deepened to 50', and a drift run from its bottom northwest to winze No.2 and 50' further, past this winze. (See longitudinal projection). This information comes from the Aubury report, 1917. According to Aubury, the face of this drift at the time of his report was in good ore, and a short stope started near the face, in good ore.

Thirty feet below the collar of No.2 winze (80' below No.3 level) a drift was run northwest as shown; it was partly caved in Aubury's time, but he says that high grade ore with cinnabar and native quicksilver was exposed in this drift at several points, and that "in general ore found on this level is high grade and of reasonable quantity."

Here then is all available evidence as to extension of the Socrates ore body in depth. Several points discourage over-optimism. The small stoe pe mentioned near the northwest end of the 50' level was only 14 ft. long, and suggests that ore was found only near the face of that level, The start of this level is directly beneath the main stopes above, and in general the level should have been mainly in ore if the main shoot continues downward. Secondly, the general tone of Aubury's description of the 80' level implies to me a lack of continuous ore there also. On the other side is the knowledge that quicksilver ore bodies are locally spotty; but certainly these suggestions militate against the idea of exploring the Socrates contact by a long cross cut tunnel and at great additional depth. Clearly proper and conservative exploration would call for sticking close to such apparently spotty ore.

Method of Exploration.- The Socrates deposit may be explored at depth in 3 possible ways:

1). By a cross cut tunnel from the NE (footwall), similar to the No.3 tunnel, but deeper and longer. The topography and dip of the contact are unfavorable; 1400' of tunnel would be needed to gain a depth of 300' below the No.3 tunnel, and the portal of the tunnel would lie in

the steep-walled canyon of the stream flowing northeast from the Socrates. (Photo 4, taken looking down on the No.3 tunnel dump from near the outcrop, shows rather poorly the constriction suffered by this canyon below the elevation of No.3 tunnel). Further, all this 1400' would be without hope of prospecting promising ground.

(2). By a cross cut tunnel from the southwest or hangingwall side. (Section A-A', also surface plan). This tunnel has more merit. It would explore: (a) several ledges southwest of the Contact ledge; (b) the Contact ledge at a horizon about 150' vertically below the present deepest workings; this gives over 200' on the dip and still more on the pitch of the ore shoot; (c) probably another serpentine mass between the Contact and Socrates masses. The tunnel as laid out would cut the Socrates contact along the projected rake of the ore shoot about 430 feet vertically below the No.3 level, and fully 600' down the line of rake or pitch. The position of the intersection of the tunnel with the Socrates ledge is shown on the longitudinal vertical projection. Viewed on this projection, this tunnel, so far as the Socrates is concerned, simply does not look reasonable: it's too big a bite, too long a chance. Length of this tunnel, about 2500', cost, about $32,000.

(3). By a shaft. The suggested position is shown on the surface plan and on the vertical projection, as well as the composite plan of workings. To be sunk in the sandstone footwall, say 60' NE of the contact. While the footwall as exposed in the No.3 adit is badly disturbed and makes heavy ground, toward the northwest the disturbance is thought to decrease; witness the No.2 winze, sunk 100' in the footwall sandstone, with no recorded difficulty.

The shaft has the following advantages: It would be sunk inclined in the footwall; cross cuts to the ledge would be short, and since the shaft enters the projected rake of the ore shoot not far below the No. 3 level, chances are good that each cross cut driven would cut the ledge in or close to ore. Further, there may be chances for ore above the No. 3 level and close to the shaft, for Forstner describes the northwest face, No.3 level, as in ore, and while the Auburry report indicates that further drifting was done here, all the ore may not have been explored or mined. Also, there seems to be a bend in the serpentine contact of the kind shown on page 5 close to the position of the projected shaft; this is further encouragement for a new ore shoot.

The spreading out of the serpentine into a possibly sill-like body has been suggested on page 3. This might make an excellent trap for ore. The proposed tunnel from the Contact area would pass beneath this serpentine at an elevation 600 or 800' lower than the probable bottom of this sill, probably far too low to catch any ore beneath the sill. From the shaft, this area may be explored at any desired horizon, preferably by drifting northwest along the Socrates contact and cross cutting southeast below the widespread serpentine mass exposed on the surface.

A further advantage of the shaft is speed in exploration. The estimated cost of the tunnel from the Contact area, $32,000 is based on a cost per foot of only $13. This goes with a speed of about 10 or 12 feet a day, say 200 days or nearly 7 months for the tunnel. Twice that speed is possible, but for this special equipment and special crews on bonus are needed, and this would boost the cost toward $50,000. When the tunnel cuss the Socrates contact, what have you? Extremely poor ventilation, probably gas, some heavy ground behind you; a raise to the surface would be needed, together with drifts at sublevels to explore the ledge. The distance to the surface vertically would be at least 800'. Hence a hoist would be needed in the raise. All this takes money and

above all, time.

The shaft could be sunk small, since quicksilver tonnages handled are small, and with a proper crew, probably at the rate of about 4' a day, and at an over-all cost not exceeding $30 per ft. To reach a horizon 100' vertically below the No.3 level, 350' of sinking would be needed: time, 4 months, cost, $10,500. If the Socrates ore shoot extends this far down and the rake is as supposed, the shoot can be reached by 60' of cross cutting from the shaft at this level; drifts from the cross cut would be in ore from the start. Enough ore might be quickly indicated to justify a plant. Sinking would eventually but not immediately be resumed, probably by enlarging the capacity of the shaft, coming from below upward; in this way mining and sinking could go on together. If the shoot does not extend to this level, lateral exploration at this horizon should be tried.

The first 300' of shaft should be dry; eventually water, probably hot, would be met, if not in the shaft, certainly along the ledge. But deep sinking would only be done so long as ore continued in depth; and with proper lateral exploration at suitable level intervals, either enough ore should be found at ~~xxxx~~ and above water level to justify handling the water in some way, or enough information gained to justify abandonment of the sinking. This subject brings up a question connected with the low level tunnel and the Contact mine.

CONTACT MINE.

The Contact mine is developed by a small inclined shaft to the 200' level (140' vertically below the collar) and by a winze from the 150' level (105') to the 250'(175') level. Bottom of winze said to be about 300' down on the incline, or about 210' vertically below the shaft collar. The proposed tunnel, shown on the surface plan, would start at about 2500' elevation, and would pass about 140 ' vertically below the bottom

of the winze. Backs obtained would be about 200' on the dip of the ledge, and somewhat more on the pitch of the ore body, if the latter continues to this depth. Length of tunnel to Contact ledge, about 1050'; cost, say $14,000.

At present, ore from the lower workings must be handled in the winze (bucket) and transferred to the shaft skip. Sinking the shaft further would obviate this, but unfortunately the ore shoot is pitching radically to the southeast of the shaft with depth, necessitating continually longer drifts SE in waste from the shaft to the shoot, with increasing depth. To reach the 2500' elevation, that of the proposed tunnel, 300' of sinking would be needed, costing say $9000, or $5000 less than the tunnel.

The present camp and plant site, near the shaft collar, is unsatisfactory. Dangerous landslides have developed, due to water seeping down over the surface of the Contact serpentine lens. The uppermost stretches of the road, also, have steep grades, and motor vehicles are unable to reach the plant in wet weather.

The plant site tentatively selected near the mouth of the proposed tunnel seems very satisfactory, and a road with very moderate grade has been surveyed to it. Serious consideration should be given this tunnel, from the standpoint of the Contact mine, and I recommend it. If it is run, the distance to the Socrates contact will be cut to about 1400', and after connection has been made with present Contact workings, good air will be available 1100' inside the portal. Running out the remaining 1400' to the Contact of the Socrates serpentine mass would then appear in a different light, and might be justified should exploration from the proposed Socrates shaft develop sufficient ore. If the complete tunnel were run, then both Socrates and Contact could be exploited from a single plant and camp site; this would be a highly satisfactory set-up, and one calculated

to provide low-cost operations which might enable both mines to keep running in times of low quicksilver prices.

CONCLUSIONS.

The Socrates ore shoot probably continues below the lowest present workings, but information available throws some doubt on the strength of the continuation. Hence nearby exploration is indicated, through a shaft in the footwall,as indicated on the surface plan, underground plan, and vertical projection. A tunnel heading toward the Socrates from the gulch below the Contact plant seems justified from the standpoint of Contact operations. Some chances for ore exist between the Contact and the Socrates, and should the proposed Socrates shaft develop enough ore, it may be wise to push the Contact tunnel northeast to the Socrates ledge, securing unified operation of the two mines.

E.W.

San Francisco, Calif.
June, 26th,1941.

Edward Wisser.
Mining Geologist.

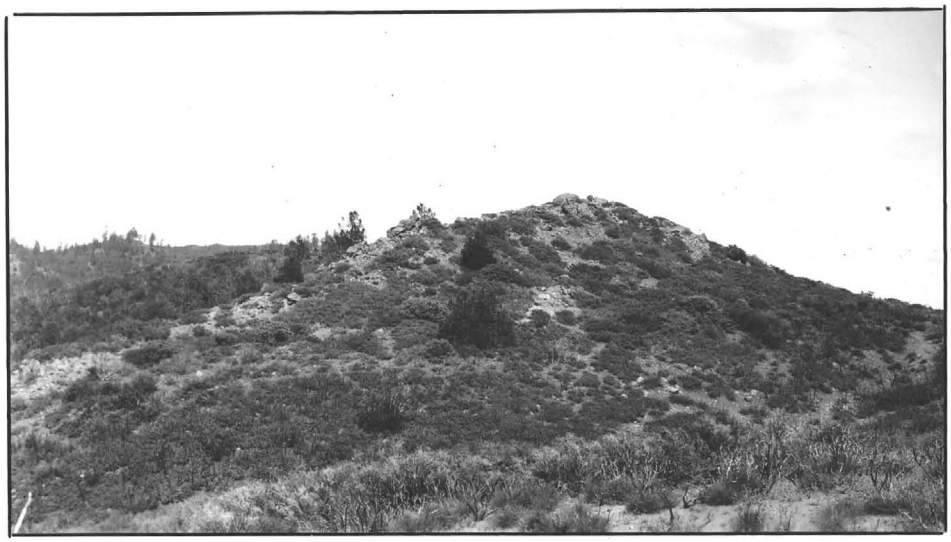


Photo No.1
Socrates serpentine mass, seen from hangingwall (SW) side. Outcrop of ore shoot lies just back of rocky serpentine ridge.

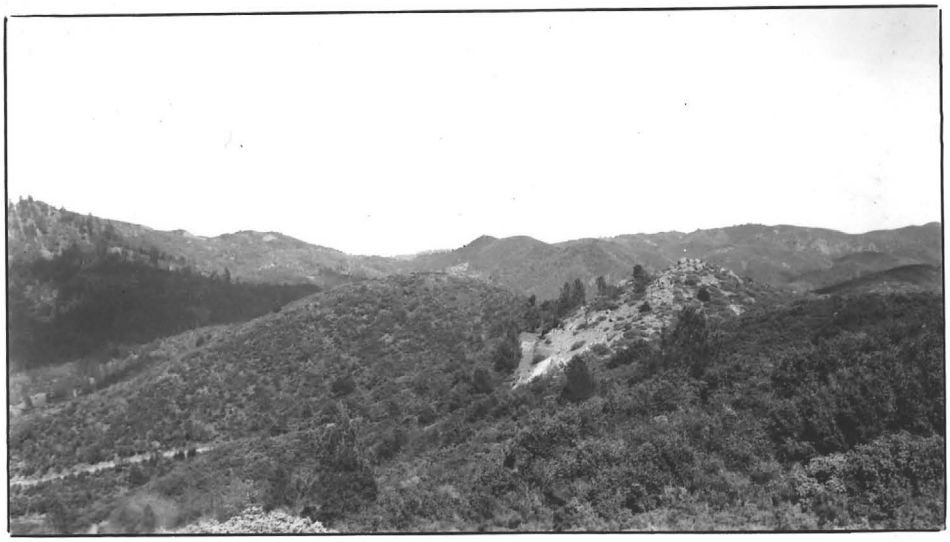


Photo No.2.
Socrates outcrop, from point looking SE along main ridge.

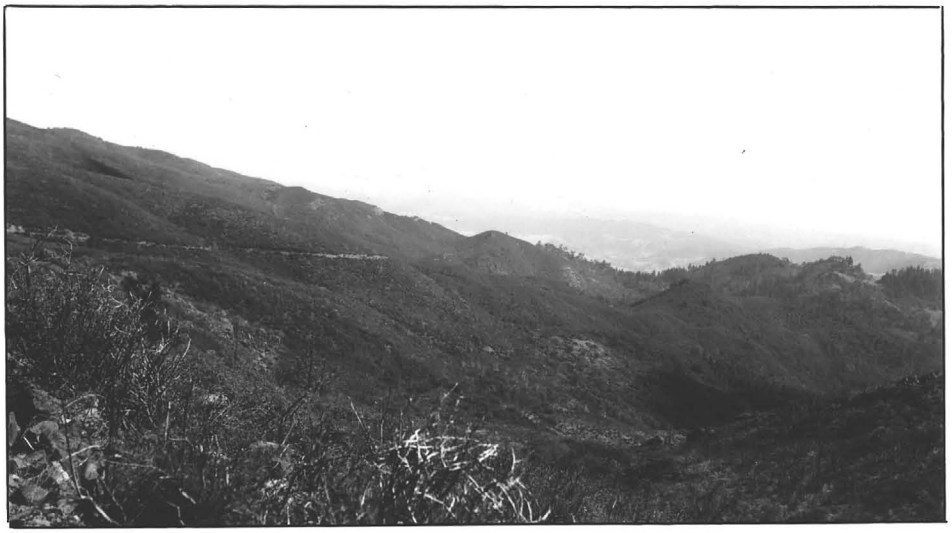


Photo No.3.
SE extension, Socrates serpentine belt. Road from Pine Flat to Socrates mine in left background.

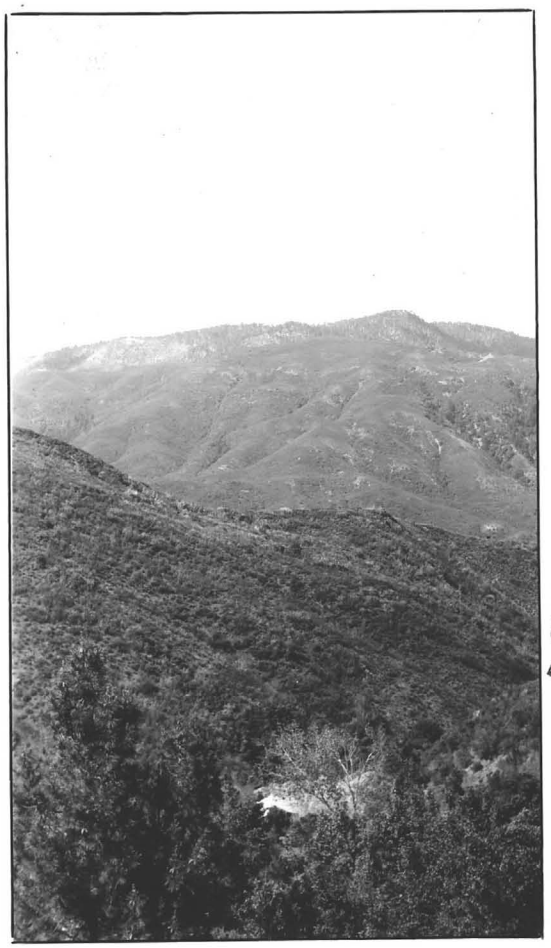
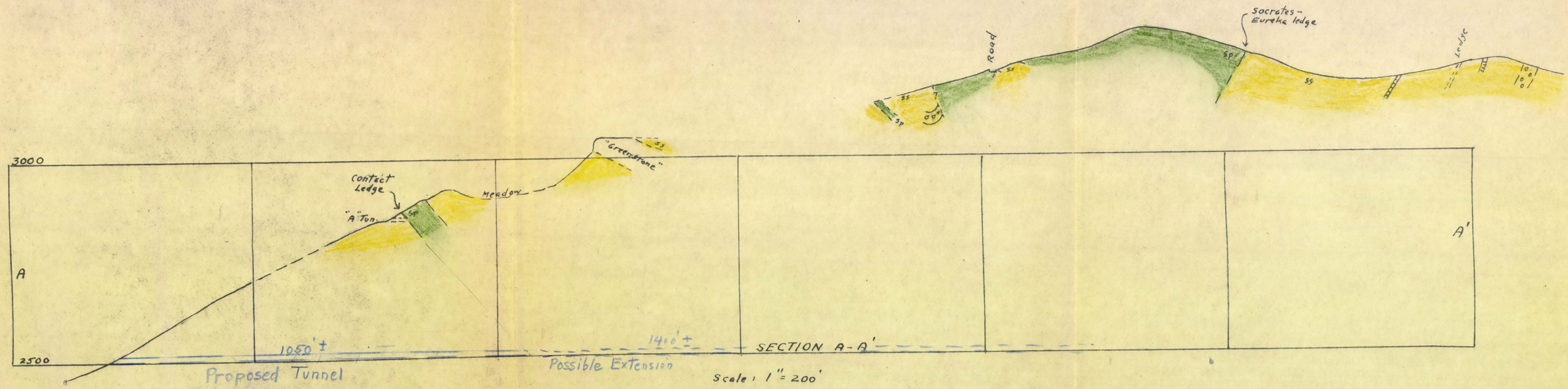
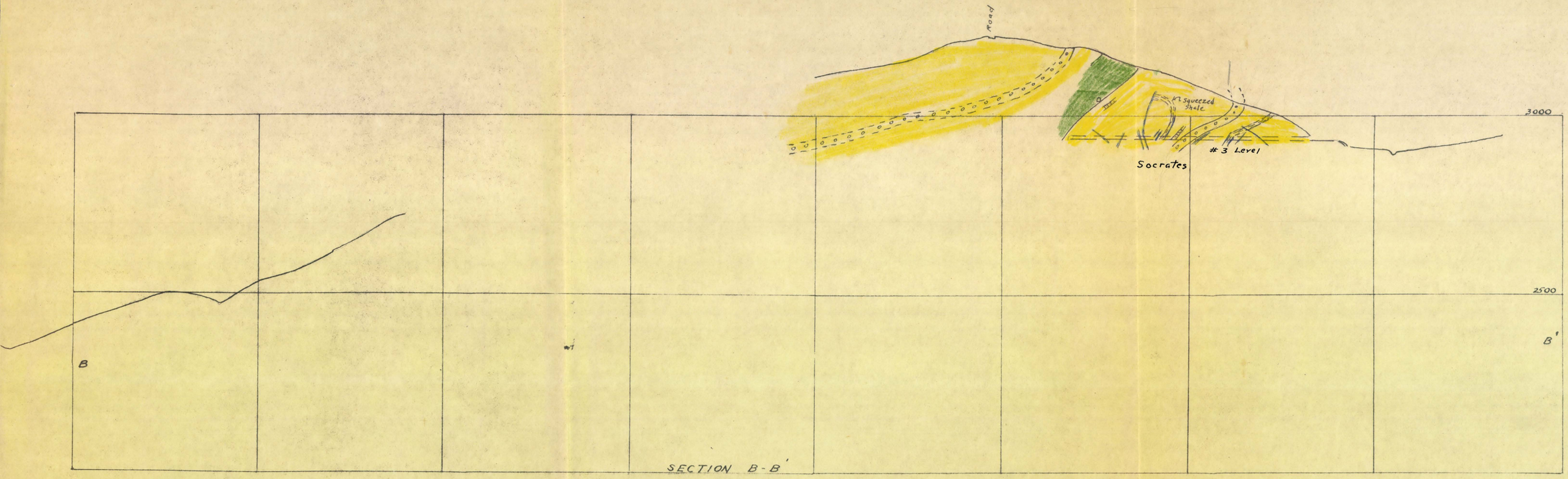



Photo No.4.
Looking down on No.3 Tunnel dump from point near outcrop.Canyon narrows below dump;wide amphitheater to left,above dump elevation.


Socrates-
Eureka ledge
Road
Ledge
SS
SP
3000
2500
A
A'
Contact
Ledge
"A" Ton
Meadow
"Greenstone"
1050' ±
1410' ±
SECTION A-A'
Proposed Tunnel
Possible Extension
Scale: 1" = 200'

Section A-A'

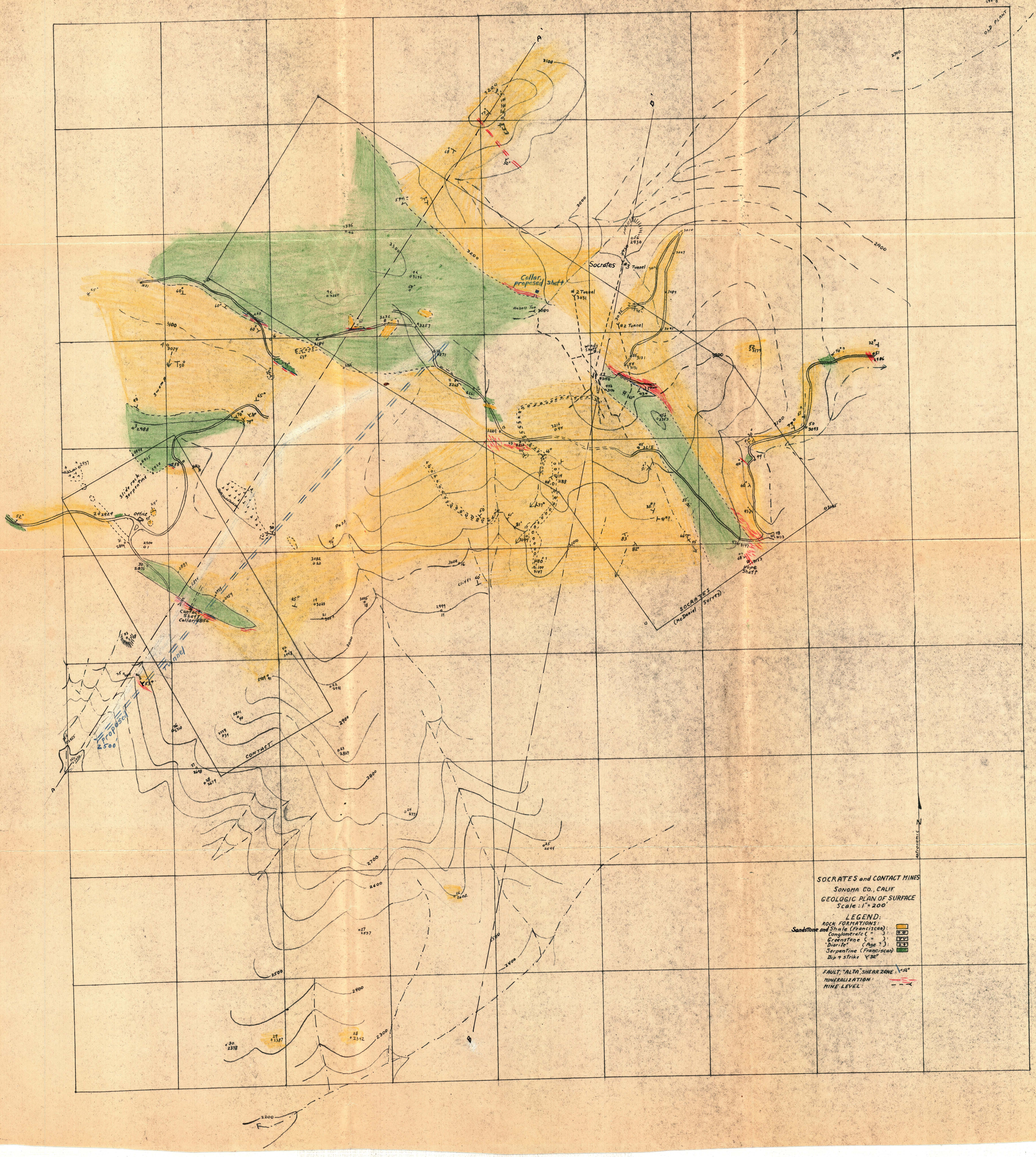



SECTION B-B'

Scale: 1" = 200'

Section B-B'

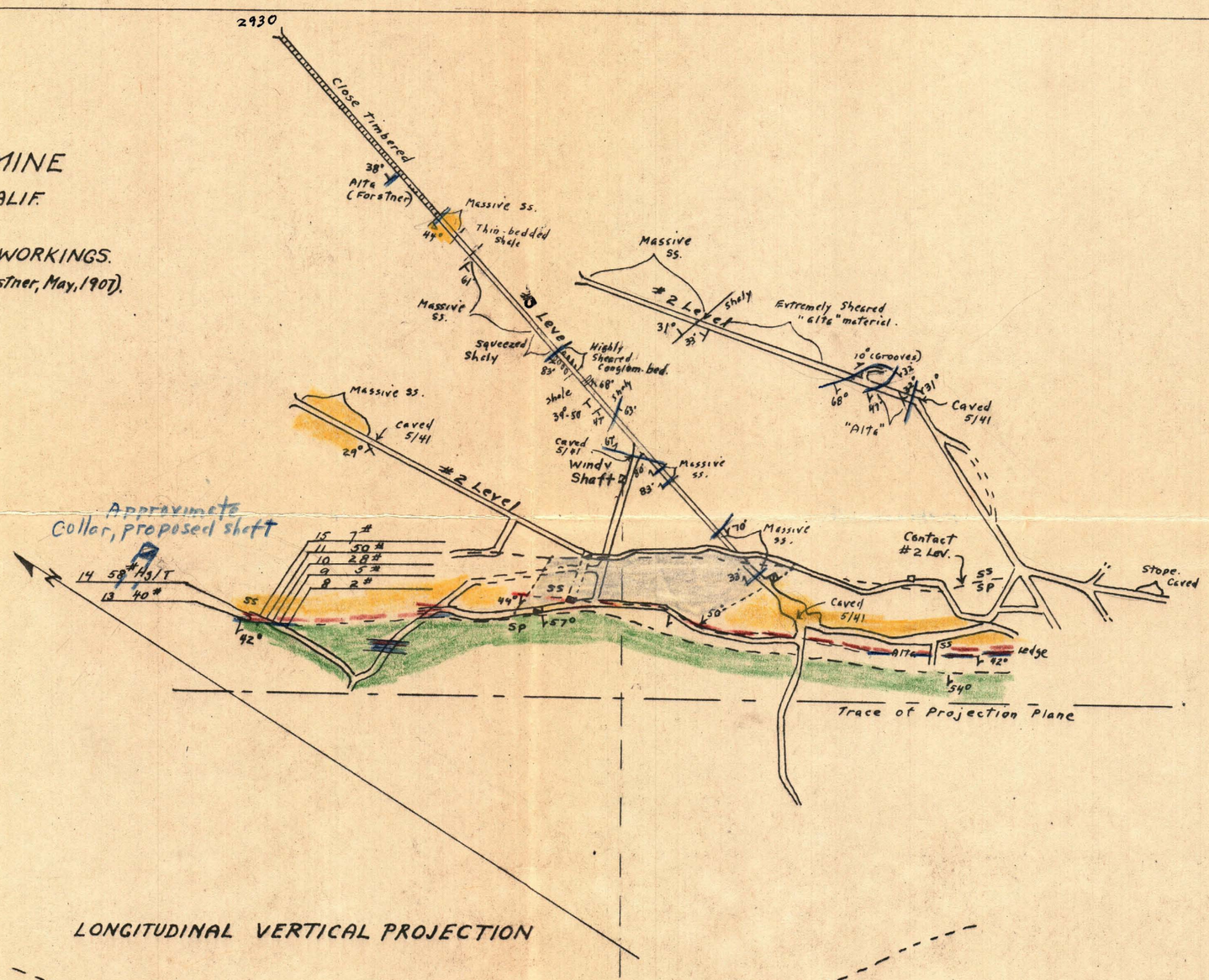
SURFACE MAP
SOCRATES MINE
Sonoma County, Calif.
Scale 1 inch = 200 feet
LEGEND
Ansel Tunnel
Tunnel No 1
" " 2
" " 3
Triangulation Lines
Stations
Wagon Roads
Triangulations by O.C. Huebner and J.D. Cox.
All courses referred to the Magnetic Meridian which has an eastern variation of 17°30' from the True Meridian
GEOLOGY
Sandstone
Serpentine
Schist
Croppings
To accompany Report by
W. Forstner
SOCRATES MINE
Sandstone
Serpentine
Schist
Croppings
Socrates Mine Road
Creek
Flows
Hope Shaft
Prospect Hole
Prospect Shaft
Wooden Shaft
House
Bell Boarding House
Upper Stone Road
Bungalow
True
Magnetic


SOCRATES and CONTACT MINES
SONOMA CO., CALIF
GEOLOGIC PLAN OF SURFACE
Scale: 1" = 200'
LEGEND:
ROCK FORMATIONS:
Sandstone and Shale (Franciscan):
Conglomerate ( " ):
Greenstone ( " ):
"Diorite" (Age ?):
Serpentine (Franciscan)
Dip & Strike
FAULT, "ALTA" SHEAR ZONE:
MINERALIZATION:
MINE LEVEL:
Socrates
#3 Tunnel
#2 Tunnel
Cellar, proposed shaft
Ansell Tun
Hope Shaft
Contact Shaft Collar 1856
Office
Slide rock Serpentine
Tunnel
proposed 2500
CONTACT
SOCRATES (McDaniel Survey)
OLD PLANT
astronomic N
A
A'
B
B'

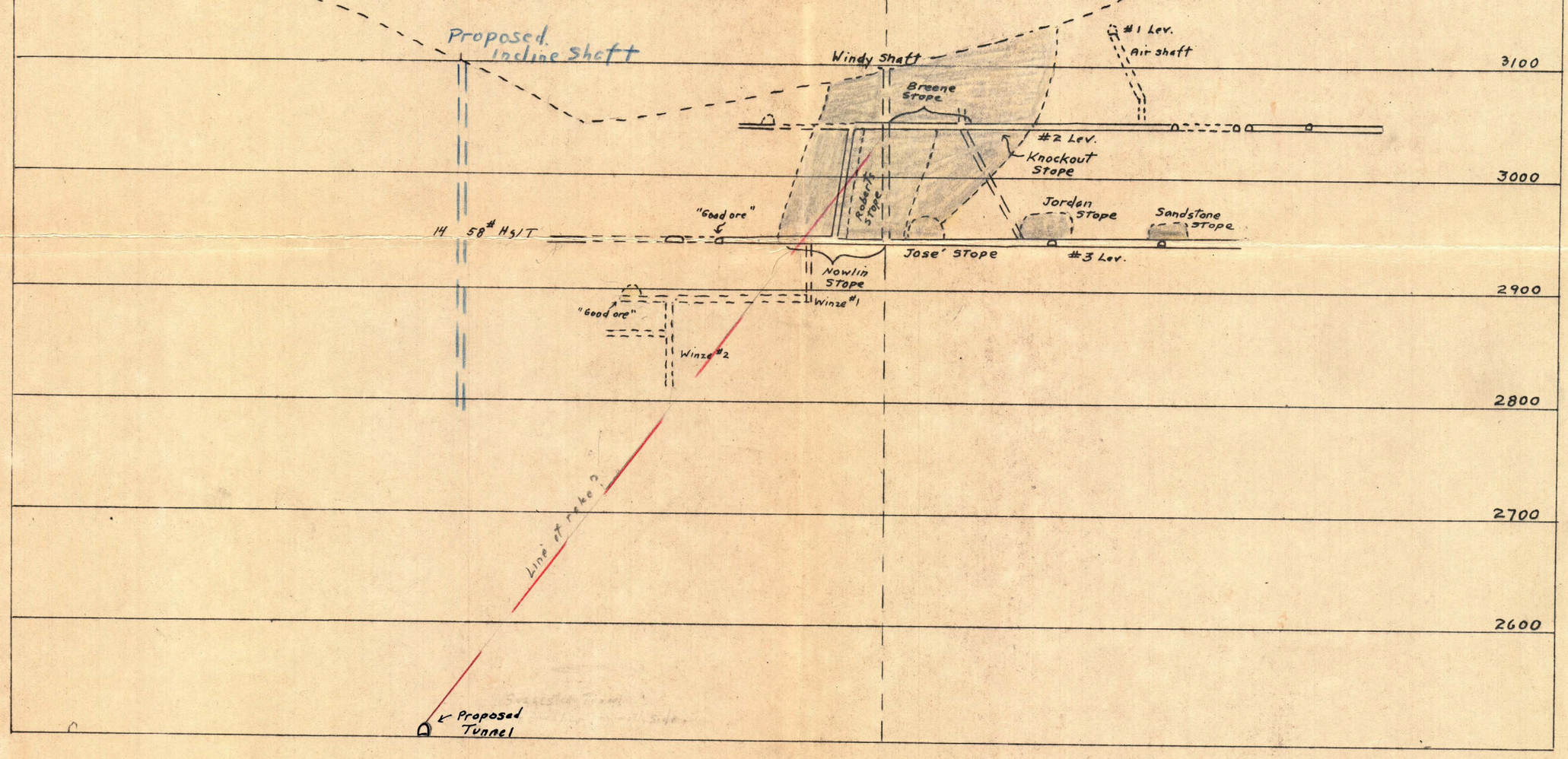
# SOCRATES MINE

SONOMA CO., CALIF.

COMPOSITE PLAN OF WORKINGS.
(After Report by Wm. Forstner, May, 1907).
Scale: 1" = 100'.




LONGITUDINAL VERTICAL PROJECTION



Composite Plan
Vertical Projection