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REPORT ON THE
H.G. QUICKSILVER PROPERTY,
NEW IDRIA DISTRICT, SAN BENITO CO.,
CALIFORNIA.

Edward Wisser

December 2nd, 1941 .

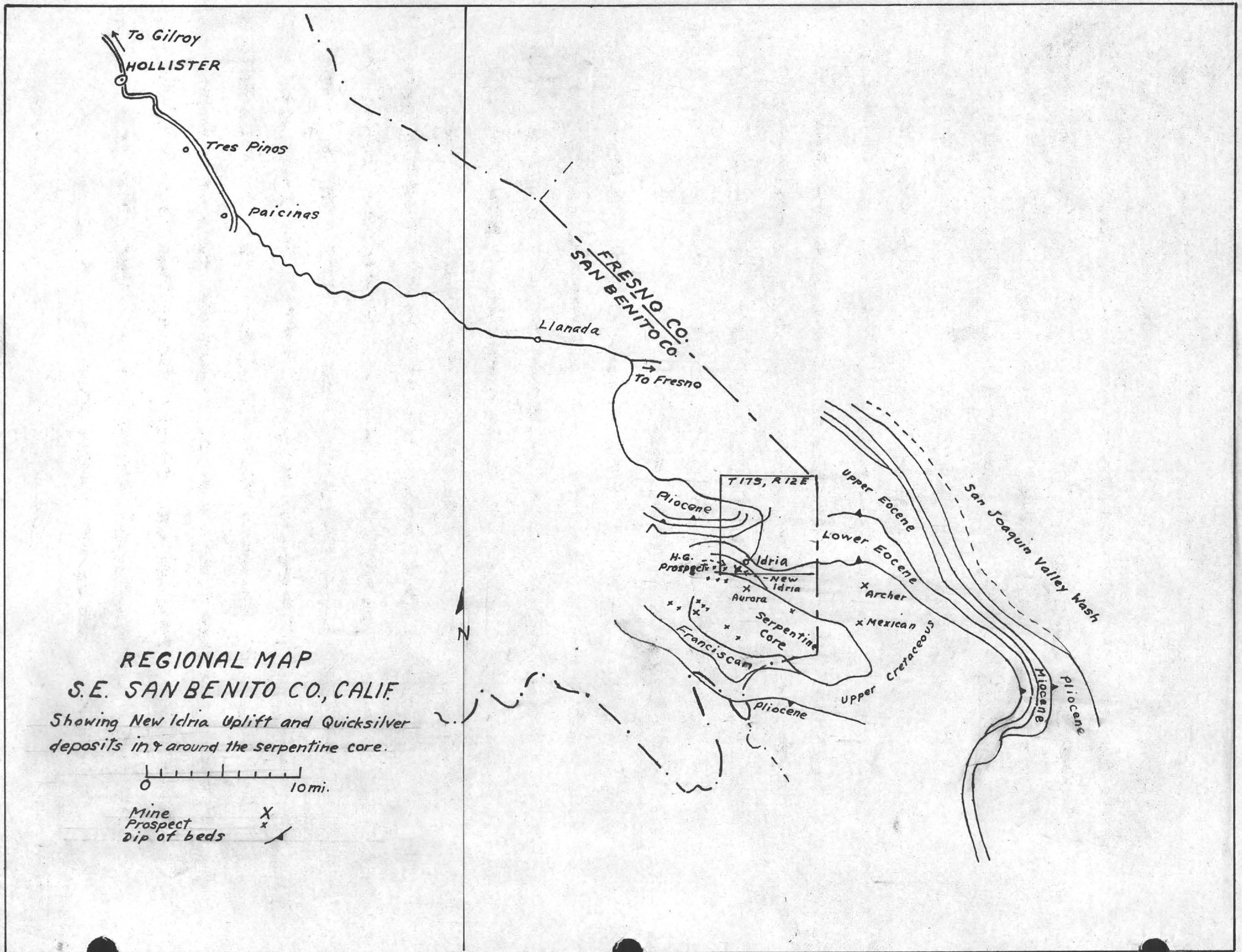
REPORT ON THE H.G.QUICKSILVER PROPERTY,NEW IDRIA DISTRICT, SAN BENITO COUNTY,CALIF.

Introduction.- The following report is based on a stay of about half a day at the property,November 30th,1941, on information furnished by Mr.C.D.Richardson,one of the owners,who accompanied me.,and on various State maps and publications.

Location.Claims. Ownership.- The property lies about a mile west of the New Idria No.2 camp,at which is located the quarry and glory-hole. The New Idria mine lies 56 miles southeast of Hollister over a road passable at all times except for the last 10 miles, stretches of which may be passable only with difficulty in very wet weather. The New Idria workings lie on the north slope of a high east-west ridge; The H.G.claim group lies on the westward continuation of this ridge. From a point on the New Idria road between Camp No.1(reduction plant and No.10 level) and Camp No.2, a narrow cliff road has been built to the camp and retorts on the H.G. property.(For retorts see sketch map of property). This road can hardly be negotiated in wet weather;but if the exploration and development by crosscut adit suggested below is done,the new camp will lie much closer to the New Idria road mentioned than does the present camp,and a road can be built to the new site without difficulty or great expense.

The country is one of strong relief;elevations on the property vary from 3400' above sea-level,on the north boundary of the group near the New Idria road,to 4160' on the crest of the ridge.

The H.G. property lies in Sec.31, T 17 S, R 12 E,Mt. Diablo Base & Meridian.(See regional map). It consists of 8 unpatented



To Gilroy
HOLLISTER
Tres Pinos
Paicinas
Llanada
To Fresno
FRESNO CO.
SAN BENITO CO.
T17S, R12E
Pliocene
Upper Eocene
Lower Eocene
San Joaquin Valley Wash
H.G. Prospect
Idria
New Idria
Aurora
Archer
Mexican
Serpentine Core
Franciscan
Upper Cretaceous
Pliocene
Miocene
Pliocene
N
REGIONAL MAP
S.E. SAN BENITO CO., CALIF.
Showing New Idria Uplift and Quicksilver deposits in & around the serpentine core.
0
10 mi.
Mine
Prospect
Dip of beds

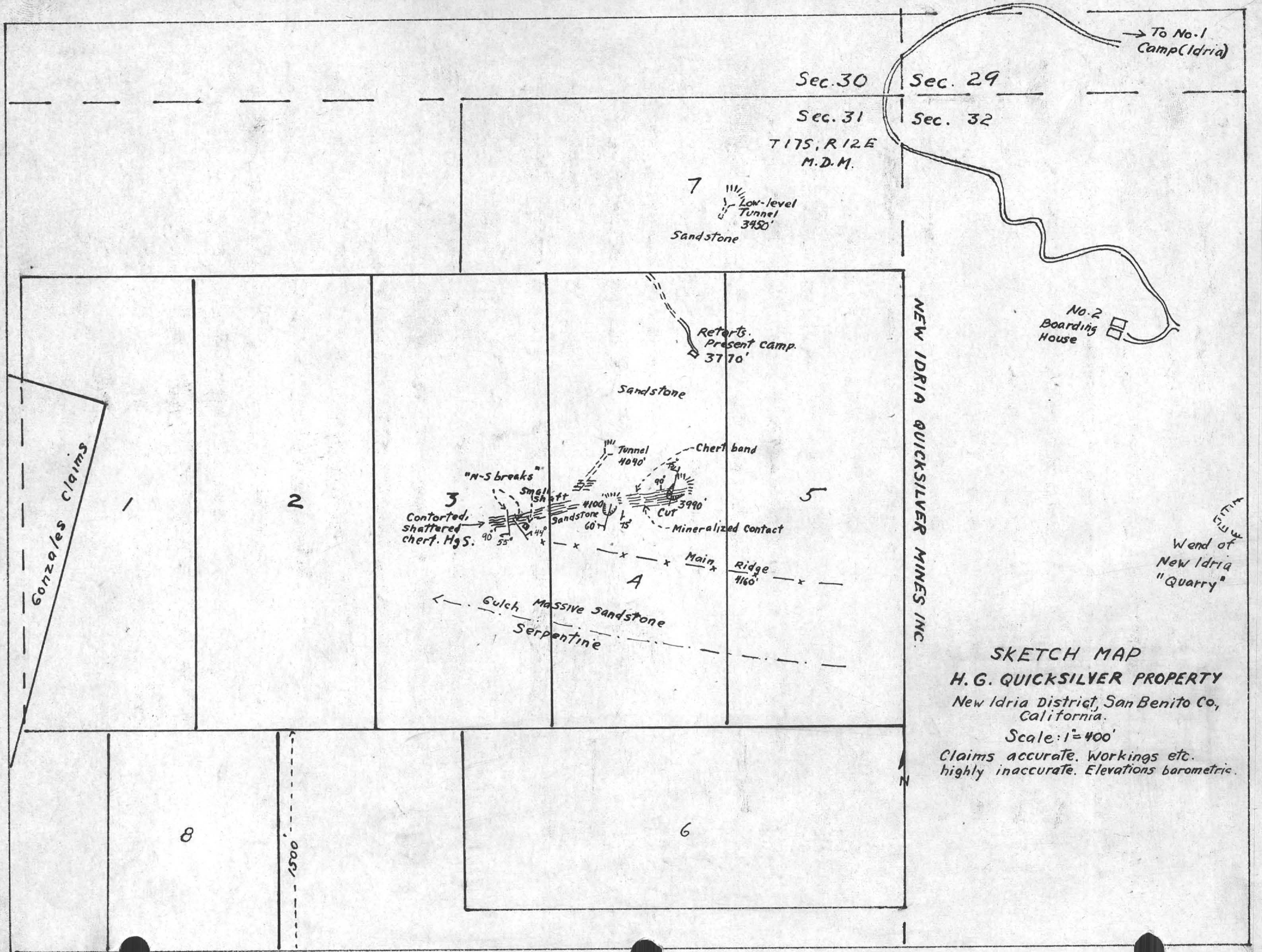
mining claims (see sketch map), located by Mr. C.D.Richardson, and held by him and the other owners by virtue of assessment work. The other owners are Peter Martin and Tony Martin of Hollister.

General Geology.- Refer to regional map. A great mass of serpentine, 12 miles long NW by 4 miles wide NE, forms the core of an elongated domal uplift. Arranged concentrically around this core, and dipping from the core outward in all directions, are sediments, of progressively younger age with increasing distance from the core. These sedimentary formations are, from the core outward, Franciscan (upper Jurassic), Cretaceous, Eocene, Oligocene, Miocene and Pliocene. The Franciscan consists mainly of sandstone, with lesser chert and shale. The younger formations were not examined in detail, but appear to include sandstone, shale and conglomerate.

Cinnabar occurs in thickly scattered localities around the NW periphery of the serpentine mass, in the narrow rim of Franciscan sediments bordering the mass (New Idria mine, H.G. prospect), and inside the mass, near its edge (Aurora, Alpine mines). The Archer and Mexican mines lie in the broad belt of Cretaceous, outside the Franciscan.

The ore bodies at New Idria, the most important mine of the district, formed within a zone of reverse faulting 200' wide, that forms the north contact of the serpentine mass in this area. In the upper levels the fault zone dips south, but it turns over at depth, dipping steeply north. The New Idria ore formed chiefly in fractured Franciscan sandstone within the fault zone.

H.G.Property.- The cinnabar showings that make this property of interest lie mainly on the north slope of the New Idria ridge, which trends N75°W here. Toward its west end the outcrop reaches the crest of the ridge. (See sketch map). The showings, explored by var-



To No. 1 Camp (Idria)
Sec. 30
Sec. 29
Sec. 31
Sec. 32
T17S, R12E M.D.M.
7
Low-level Tunnel 3450'
Sandstone
Retorts. Present camp. 3770'
No. 2 Boarding House
Sandstone
Tunnel 4040'
Chert band
"N-S breaks"
Small Shaft
4100
3
Contorted, shattered chert. HgS.
90°
55°
44°
Sandstone
60°
15°
90°
15°
Cut
3990'
Mineralized Contact
5
Main Ridge 4160'
A
Gulch
Massive Sandstone
Serpentine
1
2
Gonzales claims
NEW IDRIA QUICKSILVER MINES INC.
W end of New Idria "Quarry"
SKETCH MAP
H. G. QUICKSILVER PROPERTY
New Idria District, San Benito Co, California.
Scale: 1" = 400'
Claims accurate. Workings etc. highly inaccurate. Elevations barometric.
N
1500'
8
6

ious cuts,appear to be all on a single sedimentary contact,between thin-bedded Franciscan chert on the north, and massive Franciscan sandstone on the south. The contact strikes roughly east-west and is nearly vertical. The chert band is probably not over 150' thick. North of it lies barren,massive sandstone. South of the mineralized contact mentioned lies the Franciscan-serpentine contact,here as at New Idria, apparently a strong reverse fault, dipping south. The serpentine contact is marked by a small gulch trending N75°W,south of the H.G. ridge. On the surface the serpentine contact lies only about 250' south of the mineralized chert-sandstone contact. But since the serpentine contact seems to dip about 50° south, while the chert-sandstone contact stands nearly vertically,the two will diverge in depth unless the serpentine contact turns over in H.G. ground as it does in New Idria to the east.

The mineralized contact, that between the chert on the north and the sandstone on the south,has been the scene of strong movement and crushing. The thin chert beds close to the contact have been twisted and in places shattered. The massive sandstone cracked in places near the contact,the cracks or breaks,which are rather widely spaced,striking nearly north-south or perpendicular to the contact and to the chert beds. These north-south breaks extend from the sandstone north into the chert.

The shattered contact has been a channel for upward passage of solutions that laid down quartz,calcite,cinnabar and probably some pyrite in places along the contact where openings favored deposition. Small ore lenses formed where the chert was especially shattered or the thin beds pulled apart. The north-south breaks carry seams of cinnabar. Where they cross the chert band,the chert is more shattered than elsewhere,and most of the small ore showings seem localized in such places. Cinnabar is also found plastered on the north wall of the massive sandstone itself,directly at the contact with the chert.

The cinnabar is fine- to medium-crystalline; also earthy and as paint. It occurs as coatings of fine-grained crystals along fracture planes,as paint on fracture planes,and as small bunches of crystals filling interstices between chert fragments in the shattered zone. The shattered chert fragments are in the main re-cemented by silica and earthy material;this has cut down the amount of openings available for cinnabar deposition,which came later. Nevertheless some of this breccia material is quite high-grade.

Workings.-The property is explored by three or four small cuts, by a shallow shaft near the crest of the ridge,and by two shallow crosscut tunnels. These workings are strung out along a stretch of the mineralized chert-sandstone contact about 600' long. (See sketch map). The upper tunnel,100' below the outcrop and shown on the map, entered the chert band but failed to reach the mineralized south contact. It shows a little cinnabar within the chert.

Small ore showings are visible in each of the cuts,and elsewhere along the outcrop. No sizable ore body is indicated. However, Coast Range ore shoots of cinnabar formed recently,when the surface was about where it is at present. They formed commonly not far below that surface,with only a few cinnabar seams and irregular,very small shoots,reaching up to the actual surface. Such small seams form in countless places without coalescing in depth to sizable ore bodies, especially where no strong structural feature,such as a fault or sharp contact,exists. On the H.G. property the chert-sandstone contact is a sharp and extensive structural feature,offering a chance for important ore shoots on it at depth.

Chances for Ore.- The H.G. property lies in a productive district, and close to the serpentine contact that made the New Idria mine. The New Idria ore lay practically along the contact, whereas in H.G. ground the contact itself looks barren and the showings lie along a formational contact within the Franciscan and some 250' north of the serpentine contact, on the surface. It is in a general way only, therefore, that the H.G. prospect may be said to lie on the westward extension of the New Idria ore-bearing structure.

The New Idria quarry and glory-hole, on the main ore body of that mine, lie some 3000' east of the H.G. showings. New Idria ground extends about 1200' west of the quarry to the H.G. east line. No ore has been mined in this stretch of the serpentine contact and fault zone. An 800' drift tunnel was driven west from the west end of the quarry, along the contact zone, and toward H.G. ground. Richardson got 400' into this tunnel, being stopped at that point by a cave. He says a narrow cinnabar seam was followed; no stoping was done. Although, therefore, the H.G. property adjoins New Idria on the west, it contains no westward extensions of known New Idria ore bodies. While the presence of a major mine half a mile away is an encouraging feature, the H.G. prospect must stand on its own feet.

Some features of New Idria, however, may be useful as standards of comparison in judging the H.G. showings. The New Idria outcrop above the main ore body has been removed, but parts of the glory-hole probably preserve the ledge within 50-100' of its original outcrop. It seems safe to assume that the H.G. outcrop does not compare in strength with that above the main New Idria ore body. This is not to be expected, for if it had, the H.G. ground would have been extensively explored long ago. The New Idria outcrop lay at about 3600' elevation above sea-level, while that at the H.G. prospect lies at elevations from 4000' to 4160'. Since quicksilver ore tended to approach the surface wherever the surface lay, these relative elevations may have little significance. It cannot be said, therefore, that the relatively weak showings on H.G. ground are nevertheless not to be compared to the New Idria outcrop, since they lie so much higher. The two outcrops must be compared as they look, with no such allowance, because, if important ore exists in H.G. ground, it will probably have its top only 100' or so beneath the outcrop, no matter how high that outcrop lies. No such ore bodies as at New Idria may be expected in the H.G. prospect; fair-sized ore bodies may nevertheless exist there.

A feature of New Idria with a possible bearing on exploration in H.G. ground is the great vertical extent of New Idria ore, which bottomed at 1000' -1400' beneath the outcrop. While small ore bodies do not extend to as great depths as large ones, the vertical range of quicksilver deposition in this district encourages the notion of exploring the H.G. mineralized chert-sandstone contact, and the serpentine contact south of it, at considerable depth. The north slope of the main ridge is steep, giving good backs with relatively short crosscut adits. A low-level tunnel is in 45', at an elevation of 3450', or 710' below the highest part of the outcrop (chert-sandstone contact); it would cut this contact about 1100' from its portal. The known vertical extent of cinnabar deposition in the district makes exploration through such a tunnel less risky than elsewhere.

The writer thinks the H.G. prospect a good <u>gamble</u>, with reasonable chances to make a moderate-size mine. There is a slimmer chance to make a big mine, for the serpentine contact, along which the New Idria ore formed, passes through the property and could be explored by any deep adit that cut the chert-sandstone contact. The barren nature of the serpentine contact in H.G. ground somewhat discourages this hope. The chert-sandstone contact, however, is s strong enough, and shows sufficient surface mineralization to suggest the possibility of a moderate-size mine.

Method of Exploration.-If indications of sizable ore existed at the surface, and if it looked as if such a showing could be easily followed down, a prospect shaft on this ore would be indicated, and a lower tunnel only when the shaft had proved up sizable ore. The irregularity of the surface mineralization, however, would seem to make such a method impracticable; an attempt to follow the irregular seams downward would result only in a lot of poking around, with dubious results. If it is desired to undertake this gamble, the property should be explored by a crosscut adit, down the north slope of the ridge and driven south toward the surface showings. The present low-level tunnel, 45' long, starts at the foot of a steep bluff, so that sacrificing 150' or so of backs would not greatly shorten the tunnel. The 700' of backs that this tunnel would furnish seems excessive to me, however. I should prefer to cut the H.G. ledge at a less distance than 700' below its outcrop. 700' is too much of a bite.

East of the low-level tunnel a gulch heads south toward the outcrop workings. Before a tunnel site is selected a topographic map of the north slope of the ridge should be made, and the site selected with the aid of this map, possibly in the gulch mentioned. A site should be sought to cut the ledge say 400'-500' beneath its outcrop, at an appreciable saving in distance compared with the 1100' required by the present low-level tunnel now 45' in. The site should be in an area open enough to give room for a reduction plant without extensive excavation, in case sufficient ore is found to justify a plant. This tunnel should be headed south toward the center of the 600' of mineralized chert-sandstone contact;on reaching the contact,it would be explored in the usual way, by drifts, crosscuts, raises etc.

Conclusions.- The H.G. quicksilver prospect has no measurable ore in sight. Exploration has however been negligible on the chert-sandstone contact, which shows promising seams and bunches of cinnabar, and structural strength sufficient to offer hopes for sizable ore shoots at depth. The property lies between the New Idria mine on the east and the Gonzales mine on the west, a producer,from limited and shallow workings, of quicksilver ore for many years.

South of the chert-sandstone contact lies the chief structural feature of the district,the serpentine-Franciscan fault contact; while this contact is unattractive at the surface in H.G. ground, it remains an interesting speculation at depth.

For an outfit willing to gamble, and prepared to face the possibility of writing off its investment,the H.G. property looks attractive. It is, however, a two-way gamble: (1) that the spotty cinnabar seams at the surface will coalesce at depth to form ore bodies;(2) that the war will last well beyond the 15 months or so required to explore the chert sandstone contact,and, if enough ore is found, to put the mine in production.

The size of the gamble might be about as follows. It is hoped that a site can be found on the north slope of the ridge for a low-level crosscut adit giving 400'-500' of backs with a length of cross-cut of about 800'. The cost of machinery for driving the adit, and of driving the adit itself to the ledge, would be about as follows:

Rail, 12 lbs., 800' of tunnel........	$250.00	(all prices new).
Ties, 4"x6"........................	60.00	
2" air pipe........................	170.00	
3/4" water pipe....................	60.00	
315 cu.ft.portable I-R compressor..	5000.00	
Mounted jackhammer.................	400.00	
One 1-ton car......................	150.00	
Receiver...........................	150.00	
Buildings etc......................	300.00	
	$6540.00	plant.
Driving crosscut, 800' @ $10/ft....	8000.00	
	$14540.00	

After the ledge is reached, drifting, raising etc. may cost another $10,000, possibly a good deal more, before enough work is done either to indicate a mine or justify throwing up the gamble. The speculative part of the enterprise would be, therefore, at least $25,000 worth of underground exploration. When that is spent, and if ore is found, the additional $30,000 to $50,000 to build a reduction plant should not constitute a gamble with regard to ore, because no plant should be built unless a goodpart of the cost is put in sight by ore exposed. This additional expense, however, might still be a gamble on the continuance of the war.

On this basis, I recommend the exploration outlined. If it is decided on, it would be an excellent idea, while the crosscut is being run, a matter of about 6 months for an 800' crosscut, to sublease the outcrop. Leasers or "licencees" working there for retort ore, might well open up something that would guide exploration on the contact on the new tunnel level.

Edward Wisser

Almaden, Calif.
December 2nd, 1941.

Edward Wisser
Mining Geologist.

A

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INTRODUCTION

The New Idria Quicksilver mine is in the dry, brushy, mountains 45 miles southeast of Hollister, in San Benito County, California. These mountains are a segment of the California Coast Range Mountains, and have a maximum elevation of 6000 feet. New Idria itself is at an elevation of 3500 feet.

The field work for this report was done in the period from March to September in 1946, during a six weeks period in August and September in 1947, and a certain amount of mapping was done on weekend trips to the New Idria mine. Laboratory and research work was done during the fall semester in 1947 and the spring semester in 1948 at the University of California at Berkeley.

Stadia and plane-table were used in the surface mapping of the faulted area between San Carlos and Idria. The points used for the transit set-ups were triangulated and were accurate to a maximum error of less than five feet over the three mile distance. This accuracy was more than necessary because few contacts could be located that accurately. Most of the former mapping of this area was apparently done with a contour map of dubious accuracy, and therefore some contacts were found to be in error as much as 150 feet. However the surface mapping done in the immediate New Idria and San Carlos mine areas was found to be quite accurate.

Most faults and contacts shown in the underground maps of the western portion of the mine were located from surveyed points with a steel tape. Dips were taken at several points along each fault, and the strikes of faults were checked in each case by at least two Brunton compass shots to nullify the probable magnetic errors. The underground mapping was done on a 40 foot to the inch map. Where this mapping overlapped the mapping done by the United States Geological Survey (7), the mapping checked fairly closely. The only important disagreement is in the interpretation of the work. Because of the greater area of mine working exposed it was possible to work out several of the structural problems which were hitherto unsolved.

The New Idria area has been described by several geologists, including Anderson and Pack (8), Mielenz (11), Phillips (12), and Eckel and Meyers (7), In addition Richard Crippin, McLaren Forbes, A. Lake, and C. H. Lewis (mine superintendent), and others have mapped the mine area and the immediate vicinity. Their work was available on mine maps and was freely drawn from in areas of the mine which were not accessible at the time of the mapping by the author.

GENERAL GEOLOGY

The sedimentary rocks of the New Idria area vary in age from Jurassic to Pliocene, the Fransiscan formation being the oldest. Lying unconformably on the Fransiscan, are the Panoche and Moreno formations of Cretaceous age. Conformably above them are a thick series of Tertiary beds which were deposited continually through to the Pliocene.

Two formations are of direct interest to the New Idria Mine, the Fransiscan and the Panoche. Actually within the area of present mining operations only the Panoche is to be seen, although the Fransiscan formation and some serpentine ~~are~~ have been picked up in drill cores.

The Fransiscan formation of the New Idria area is mostly represented by a slightly metamorphosed arkosic sandstone. The extent of metamorphism is a tendency toward parallel banding of the mafic grains with sufficient recrystallization of the salic minerals to cause this rock to be exceedingly tough.

On weathered surfaces this sandstone's surface is dark brown to greenish, but on freshly broken surfaces it is gray or greenish gray. Its color is distinctive, but the slight segregation of the mafic minerals into bands and its toughness are its most distinctive megascopic characteristic.

A large serpentine mass lying just south of New Idria is the principal igneous rock of the area. This serpentine is 13 miles long and 4 miles wide, with its axis striking northwest, parallel to the trend of the folds of the region.

The only rocks found in the parts of the mine worked at present are Panoche sandstones and shales and their altered equivalents. Unaltered Panoche sandstone is a rather poorly consolidated greenish to brownish rock of medium grain size. There is about 10% quartz. An occasional biotite fragment, some benitoite crystals (of microscopic size), and shale fragments are also present. Most of the feldspars have been partially altered to sericite or kaolin minerals.

The comparatively fresh sandstone mentioned above is absent in the ore zones. Instead there are two alteration products. One is a very hard silicified sandstone, and the other is a kaolinized sandstone in which the only unaltered mineral is quartz. The Sulfur Spring ore body is in such a silicified sandstone. The spatial relationships between the silicified sandstone and the ore bodies in shale is indefinite. Directly under D-stope most of the sandstone is silicified, but some of it is kaolinized. Mapping the relationships of these silicified sandstone zones and the shale ore bodies to each other, along with the possible solution channels, may be of possible value as an ore guide. It would take a considerable amount of detailed work, but perhaps some of the recent work on wall rock alteration which was done at Butte might be of assistance.

The unaltered Panoche shales are black to gray and easily scratched with a knife. The shales bearing the cinnabar, however, are quite hard. In places these hard shales grade into the soft. Eckle and Meyers found that the hardest shales were less favorable for cinnabar than the medium hard shales. However, in the portions of the mine studied by the author no evidence for this could be found.

THE MINERALIZATION

The only metallic minerals are cinnabar, marcasite, and pyrite. Pyrite is by far the more abundant of the two. Metacinnabar was present in the old western mine workings, sometimes in large quantities, and may be disseminated in some of the ores now worked. The only non-metallic mineral which entered in any appreciable quantity is black chalcedony. Vein quartz is a rarity in the part of the mine opened at present, but was fairly common in the old mine to the west. Calcite is present in small, lenticular masses in the footwall, and is apparently of secondary origin.

Microscopic examination of a breccia cemented by cinnabar has shown that what appeared to be pure shale in the hand specimen in reality was itself a breccia. This breccia contains fragments of black, indurated shale, fine grained sandstone, and pyrite or marcasite all cemented by black chalcedony.

W. W. Brannock (7, p.100) made analyses of a specimen of soft shale and a specimen of hard shale taken along the strike of the beds. The comparison of the two analyses is not conclusive, but the increase in silica content of 5% from soft to hard shale is quite possibly indicative. Similar analyses were made of sandstone, but the character of the altered sandstone was not specified, other than stating that it was altered. An indurated sandstone would have a considerably different composition than a kaolinized sandstone.

The black chalcedony, which apparently has not been noted before, poses some interesting questions about the mineralization. There are many openings in the mine, some over a foot across, through which solutions have passed depositing clusters of cinnabar crystals. Yet with such large openings present, no botryoidal chalcedony has been found. Veinlets of black chalcedony could be missed very easily because of their similarity in appearance to the black slate, but botryoidal chalcedony, no matter what the color, would not. Because of the absence of such chalcedony and the near-absence of quartz, one must assume that the three or four quartz veinlets of only an inch in thickness were the only silica veins of any sort deposited in open spaces in the portion of the mine investigated.

In order to explain the presence of the chalcedony it seems necessary to envisage a mineralizing solution undersaturated in silica, which was able to replace certain minerals, but not able to deposit silica as vein matter. This conclusion also would explain the induration of the shale. The process was probably not a simple addition of silica however, for there was a reduction in the Na_2O and K_2O content.

The chalcedony was observed adjacent to a shale breccia cemented by cinnabar. The time sequence there was (1) brecciation, (2) deposition of iron sulfide, (3) brecciation, (4) deposition of chalcedony, (5) brecciation (6) deposition of cinnabar. There may have been a period of chalcedony deposition before the deposition of iron sulfide, but it was not definite. In the above case the chalcedony was in and immediately adjacent to a small fault. The percentage of silica probably decreases outward from this vein, until the shale becomes the "normal" indurated material, with a small silica increase. In an active fault zone such as that at New Idria, many such openings exist and maintain their permeability because of constant rock movements. Such shifting and the migration and deposition of silica is the probable cause of the hardening of the shale.

The alternative theory explaining the induration is that the shales have been either metamorphosed at depth and dragged up or metamorphosed by phyllonitization. The distribution of the hardened zones eliminated this possibility. Several hundred feet into the footwall of the thrust zone on 3 level there is a wide zone of hardened shale, but no major faulting such as would cause pyllonitization exists. The continuity of the beds with the country rocks eliminates the possibility of that shale's being dragged up by faults. At the Molino Mine, about a mile southeast of New Idria, along the same fault zone, the hardened shale is gradational into the normal soft Panoche shales. Hardening by solution activity seems to be the only explanation which would fit all cases.

The first mineral to enter was probably quartz. It definitely was first at the San Carlos Mine, where it was deposited as comb quartz. Comb quartz was present in the old working of the New Idria mine and the time relations are probably similar. The fact that comb quartz was deposited suggests that the silica content was low and supersaturation of silica in solution a slow process. As the content of silica decreased the solution could no longer become supersaturated in silica under the conditions of deposition. Then the silica was able to be deposited only as a replacement in the form of chalcedony. A certain amount of chalcedonization was taking place in the lower portions of the mine during the entry of the first silica. The silica replaced the interstitial pulverized material. It replaced this rather than the larger breccia fragments, because finely divided materials, with their sharp edges and smaller radii of curvature are more easily attacked chemically. However, the silica bearing solutions did saturate the rest of the rock, and although they did not completely replace this rock, they did add enough silica, probably by replacement, to harden the shales and sandstones.

This chalcedonization continued into the period of deposition of the pyrite and possibly even into the period of cinnabar deposition. There was a probable break, however, between the comb quartz deposition and the pyrite and cinnabar deposition, for wherever seen together the pyrite and cinnabar are after the quartz. A certain amount of finely divided iron sulfide was also deposited in the shales and sandstones, and this undoubtedly was an added factor in the hardening.

During the entry of hydrothermal minerals there was repeated brecciation and deposition of chalcedony and pyrite. The cinnabar entered last, possibly with some silica. No evidence of overlap of pyrite and cinnabar was seen. The few tiny stringers of quartz found in the mine were deposited in open spaces and are before both the iron sulfide and cinnabar.

THE STRUCTURE

Major Aspects:

The New Idria ore bodies in the present mine are located exclusively between a thick hanging wall and footwall fault gouge zones. These fault gouge zones vary from zero to 100 feet apart and are movement planes of the New Idria thrust fault. Where good attitudes can be taken on these fault zones they are found to have the same strike as the country rock and at least part of the time the same dip as the immediate country rock. The average strike is N. 55° W. and the dip of these gouge zones is usually about 45°. SW.

This thrust was probably caused by the overriding of an intrusion of a cold plastic serpentine body. The country rocks were first domed, and then by continued upward movement the serpentine cuased the rocks to break along planes of weakness. Because the strike of the beds paralleled the edge of the serpentine, and the shales were very soft, the lines of least resistance to fracture were along the shales beds. These movements ground the shale into gouge zones of 40 to over a hundred feet thick.

The amount of motion which took place along the thrust need not have been great. The gouge formed in the shale beds could have been largely the result of bedding plane slip ing which took place during the overturning of the beds, because in several places the clayey fault gouge is gradational into normal Panoche shale and sometimes is gradational into silicified shale.

The New Idria thrust fault was never a single movement line. It broke across beds in part and often followed bedding planes. Even saying that the fault was two approximately parallel breaks is an idealization. For instance, 8-level has three parallel-striking thick fault gouge zones. Certainly the original movement was one of great complexity.

Two other major sets of faults are present. One set is called the 5-east group. They strike N. 65-75° E. and dip southeast at angles from 45° to 70°. Striations on these fault planes pitch from 20° to 30° to the east with the south side moving east. The other fault group is here called the N-S group although the strike is usually from N. 10° W. to N. 20° W. They dip steeply to the west, averaging about 75°, and vary from N-S to N. 40° W. Striations on these faults are mostly horizontal, but may dip 20° northward. The east side of these faults has moved south.

In the portion of the mine mapped by the author the N-S group predominantly off-sets the 5-east group. Eckel and Meyer (7) found the time relations to be reversed, and there is evidence at the southeast end of D-stope, on 5-level, of recurrent movements along a 5-east fault after a north-south fault had cut through it.

Actually it seems probable that movement was taking place on both sets of faults at the same time. The intersection of the average of these two fault groups lies in the plane of the original thrust fault, i.e., dipping about 45° and bearing S 35° W. Because of the dip and the direction of the intersection of the faults, it is probable that they are related to the thrust fault (the serpentine-Fransiscan or Fransiscan-Panoche contacts).

The movement on the N-S and 5-east fault systems and their angle of intersection suggests a strain ellipsoid shear pair in which the direction of maximum elongation was horizontal. It is difficult to concieve of a pair of fault groups of that type forming by any but a rotary movement of some sort with the axis of rotation dipping in the same direction as the intersection of the average of the two sets of faults. The same set of faults may have been formed by direct compression if there were sufficient hydrostatic pressure, but this deposit was formed very close to the earth's surface.

There are two possible causes of the rotation. The first is the possibility of a more or less horizontal flow of the serpentine along the sediments at its northern edge during its northwest-southeast elongation. The other is some force of unknown character which caused the axes folds of the region to swing from the normal northwest south and north of Idria to almost eastwest near Idria. Plate 2 shows the trend of the fold axes.

According to Eckel and Meyer (7) the serpentine intrusive south of Idria was exposed in the Cretaceous and was a lowland. The presence of serpentine fragments in the Cretaceous sandstones was the basis of this assumption. If it were exposed, however, it must have been very low because of the scarcity of serpentine fragments in the Cretaceous sandstones.

There is a great thinning of the Cretaceous Panoche and Chico sediments in the New Idria area. The Panoche varies from over 4000 feet thick south of the exposed serpentine mass to less than 500 feet at New Idria. Only a small amount of this decrease in thickness can be accounted for by the thrust faulting. It is probable that the serpentine was exposed in the New Idria area for a very short period of time at the beginning of Panoche deposition, but that it sank below the sea to become a high zone of the sea's bottom with a basin to the southeast. The whole area was then covered with Cretaceous sediment, with the greatest sedimentation in the basin.

There was then no folding until the end of the deposition of the Tertiary formations of the area in the Miocene. Then, at the time of the folding of the surrounding country, the serpentine was pushed up in the apex of the Coalinga anticline. Because the overlying beds were thinner in the northern area the

the serpentine was able to push northwestward in its rise overturning and thrusting the beds on its northern and northwestern boundary.

As it pushed northwestward, elongating itself along a northwest-southeast axis, the serpentine flowed around the northeast shoulder, a ratational movement. Figure 1, below, demonstrates the possible mechanism.

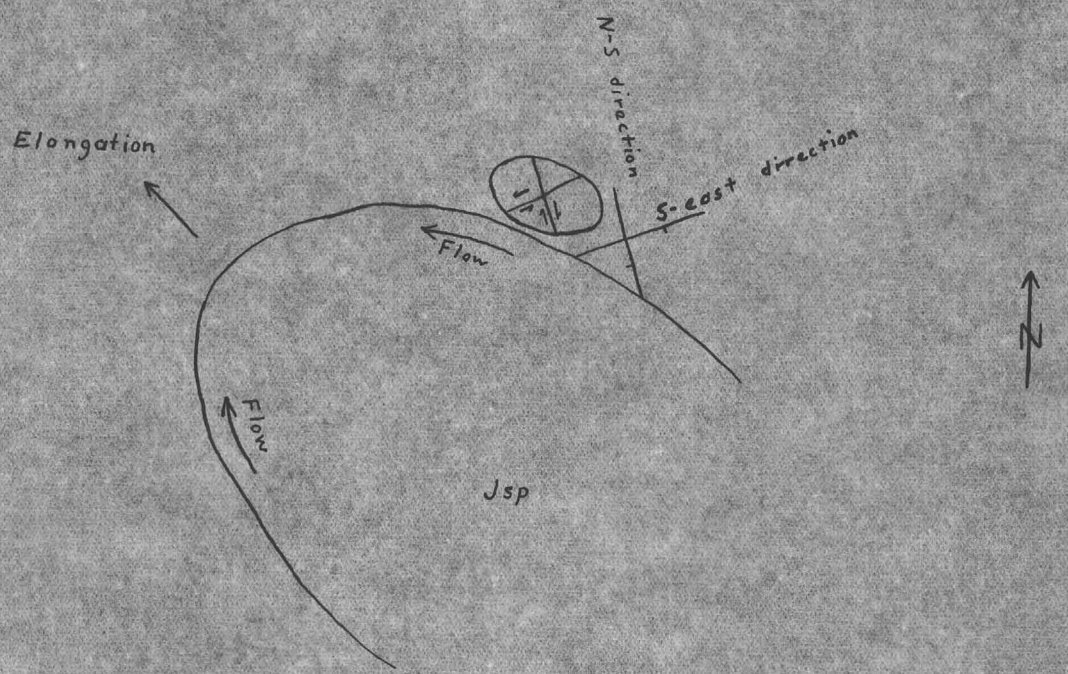

Figure 1

This action, the author believes, would give the required direction of elongation and could account for the set of conjugate shear planes seen in the New Idria mine.

The rotational movement which caused the turning of the fold axes could also have caused a rotational movement along the New Idria thrust fault giving the sets of fractures seen in the mine. The forces within the mine area would have been similar to those of the elongating serpentine.

In the upper part of the mine, above 6-level, the 5-east and north-south faults, as well as other lines of weakness, are marked by striae which were caused by dip-slip movements which were geometrically either normal or reversed. These striae are often on cinnabar and pyrite, and some faults with dip-slip movements contain cinnabar-cemented breccias. Because this type of movement can be seen only in the upper portions of the mine, a relaxing of pressures and a late settling of the rock between the hanging and footwall fault gouge zones is the probable explanation.

In addition to the thrust, the 5-east, and the N-S, and slip-slip series of faults, two other important faults are evident. They are very important, but little is known about them. These faults strike from N. 30° W. to N 45° W, dip shallowly southward, 30°-45°, and the striae show that the last movements were strike slip with the north side moved eastward. One of these faults is the one which forms the contact between the hanging wall sandstone and the silicified shales from 6-level to 5-level in the eastern portion of the mine. The other is the fault which cut off the Sulfur Springs sandstone along its strike. Because the sandstone seen on the footwall of 10,9, and 8-level is the only sandstone which could correspond with the Sulfur Springs sandstone, it is probable that the latter fault had a horizontal component of over 700 feet. The horizontal striae on the fault between the hanging wall sandstone and the silicified shales polish cinnabar, but it has been displaced by some of the dip-slip faults. Therefore, this fault was quite late. The time of the fault cutting off the Sulfur Springs sandstone is not known.

ORE LOCALIZATION AND RECOMMENDATIONS

Because of the exceeding complexity of the New Idria Mine no recommendations can be made which have any degree of certainty. However several possibilities for future development exist.

In the area of the mine worked at present the ore is localized in the most highly fractured zones of the silicified shale between the hanging and footwall of the thrust fault and in the sandstone at Sulfur Springs. The ore may be either on the hanging wall or footwall of the thrust fault and also may be founded by either north-south or 5-east faults. The only reason for localization of ore is the presence of numerous openings, which are most likely to occur in the mineralized shale. Inverted troughs (6) may at times be a boundary on the hanging wall side of ore bodies.

D-stope and C-stope are above five level where the hanging and footwall gouge zones close. B-stope is between five and six level and is bounded by during and post mineral N-S faults, a slightly earlier 5-east fault, and hanging and footwall of the pre-mineral thrust zone. E-stope is bounded by the thrust on the hanging wall, a pre-and post-mineral 5-east fault, and a shallow-dipping post-mineral N. 30° W. fault. C and D-stopes are mostly footwall ore bodies, E-stope a hanging wall ore body, and B-stope crosses from hanging to footwall.

On sections A A' and B B' there is an unexplained structure above three level. On section B B' it is necessary to place a north-south fault between three level and the surface in order to raise the Fransiscan to its position on the surface. Because of the indefinite nature of the surface geology caused by slide zones, the surface contact may be in error a few feet, but probably not enough to account for the discrepancy in dip of the thrust fault. In the section B B' the top of the ore is rounded off, but it may have been cut off by a N-S fault which carried fault gouge and Panoche shales in against the top of C-stope, at 4-level.

Section A A' also has an unexplained structure above 3-level. There is hardened shale at the surface but no apparent connection with the 4-level hardened zone. A set of N-S faults could be the cause of this, especially if the factors of a possible flat subsidiary N-S fault and a 5-east are added to the other possibilities. There was not enough information obtainable, however, to make any definite recommendations for the area above 3-level.

In the area from C-stope downward to 10-level most of the possibilities for ore have been explored with the exception of 6½ level south of E-stope. In the extension of the same structure on 6-level abundant pyrite was found, and there is a possibility therefore, of cinnabar mineralization lower down. However, because the spatial relations between the pyrite and cinnabar are so irregular it has not been possible to predict the location of ore bodies from the nearness of pyrite, except that pyrite and cinnabar are likely to be associated.

The Sulfur Springs area undoubtedly has more ore. A hole drilled on 5-level southwest from the 5-level raise which goes up to the Sulfur Springs stope showed a strip of sandstone ore which is apparently a continuation of the Sulfur Springs ore body.

From hydrostatic considerations ore should not be expected in silicified shales adjacent to sandstone ore bodies provided there was easy access to the surface for the ore-forming solutions. The reason for this is that the silicified shale is so much more permeable than the sandstone, because of its ability to fracture, that upward moving solutions would travel in the shales to the almost total exclusion of the sandstone. An ore body in sandstone suggests then that there was no hardened shale nearby in which the solutions could travel, whereas an ore body in shale would lessen the probability of an ore body in sandstone in the vicinity.

With increase in pressure shale is less likely to fracture, and therefore, in the deeper portions of the mine the sandstone is likely to be more permeable than the shale, and the ore should be expected to be in the sandstone rather than the shale. Below 5-level in and around the Sulfur Springs sandstone more ore can be expected. The shales adjacent to the Sulfur Springs sandstone should be prospected, particularly in any area where the sandstone carries no ore.

ACKNOWLEDGEMENTS

I would like to thank Mr. C. H. Lewis, the superintendent of the New Idria mine for his cooperation in the field work and his helpful criticism of the mapping and of the ideas here expressed. The assistance of James Vernon in the mapping was invaluable, and the practical knowledge of Wesley Shattuck was very helpful. Mr. Edward Wisser and Dr. C. D. Hulin, of the University of California, have contributed stimulating thoughts in the course of the writing of this paper.

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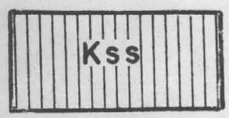
NEW IDRIA QUICKSILVER MINE

Explanation To Level Maps

Indurated Panoche sandstone, Cretaceous. May contain cinnabar.

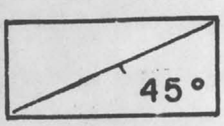
Indurated Panoche shale, Cretaceous. Contains principal ore bodies.



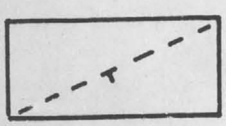
Panoche sandstone, Cretaceous.

Panoche shale, Cretaceous.

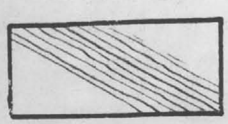
Fransiscan sandstone, Jurassic.



Fault



Fault, projected or indefinite.



Fault gouge, showing trend of layering.

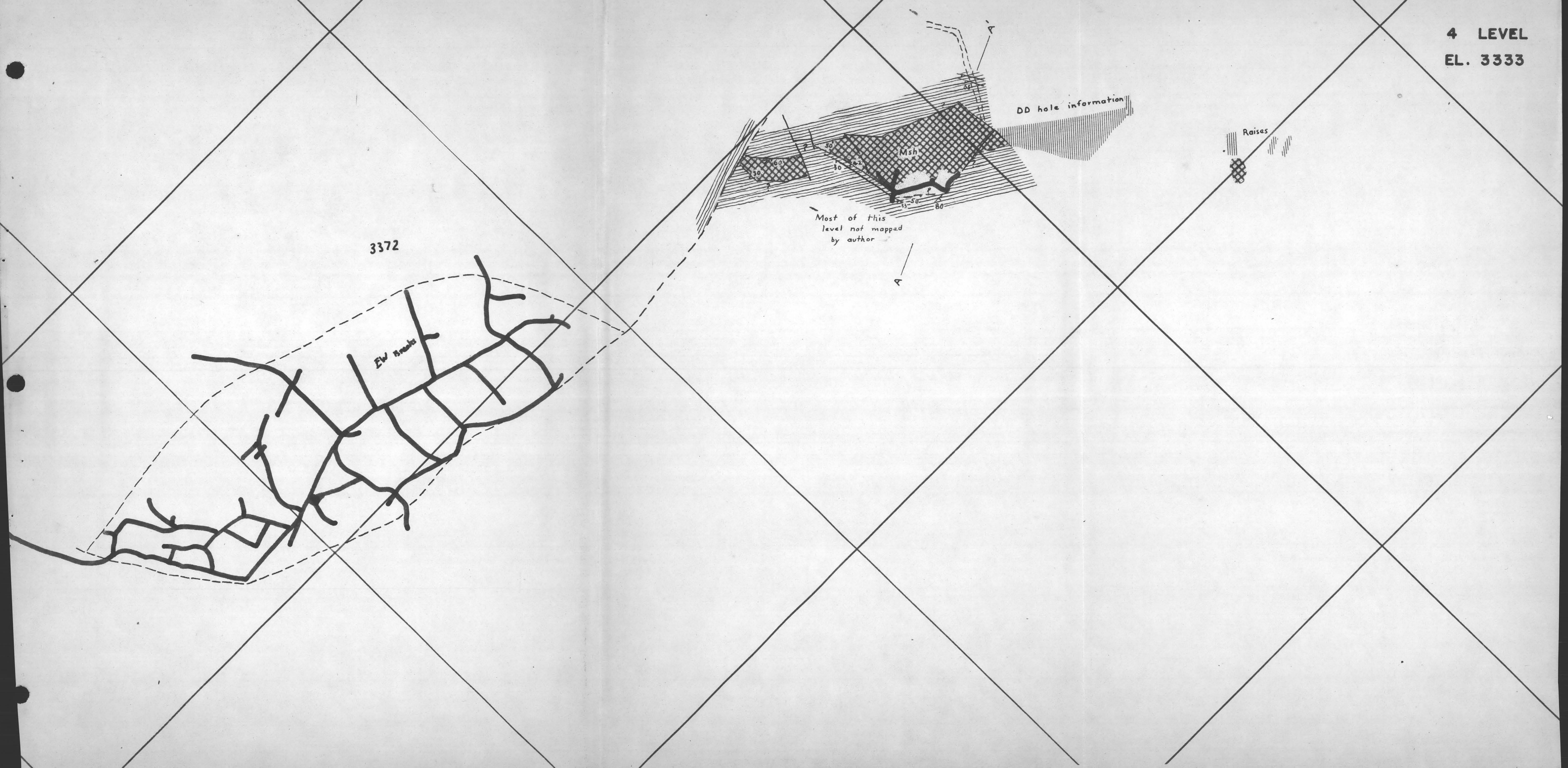
Drifts and cross-cuts.


NEW IDRIA
3 LEVEL
EL. 3419
Sulfur Springs
Stope
Creek
Surface
Workings
El. 3410
50
20

NEW IDRIA

4 LEVEL

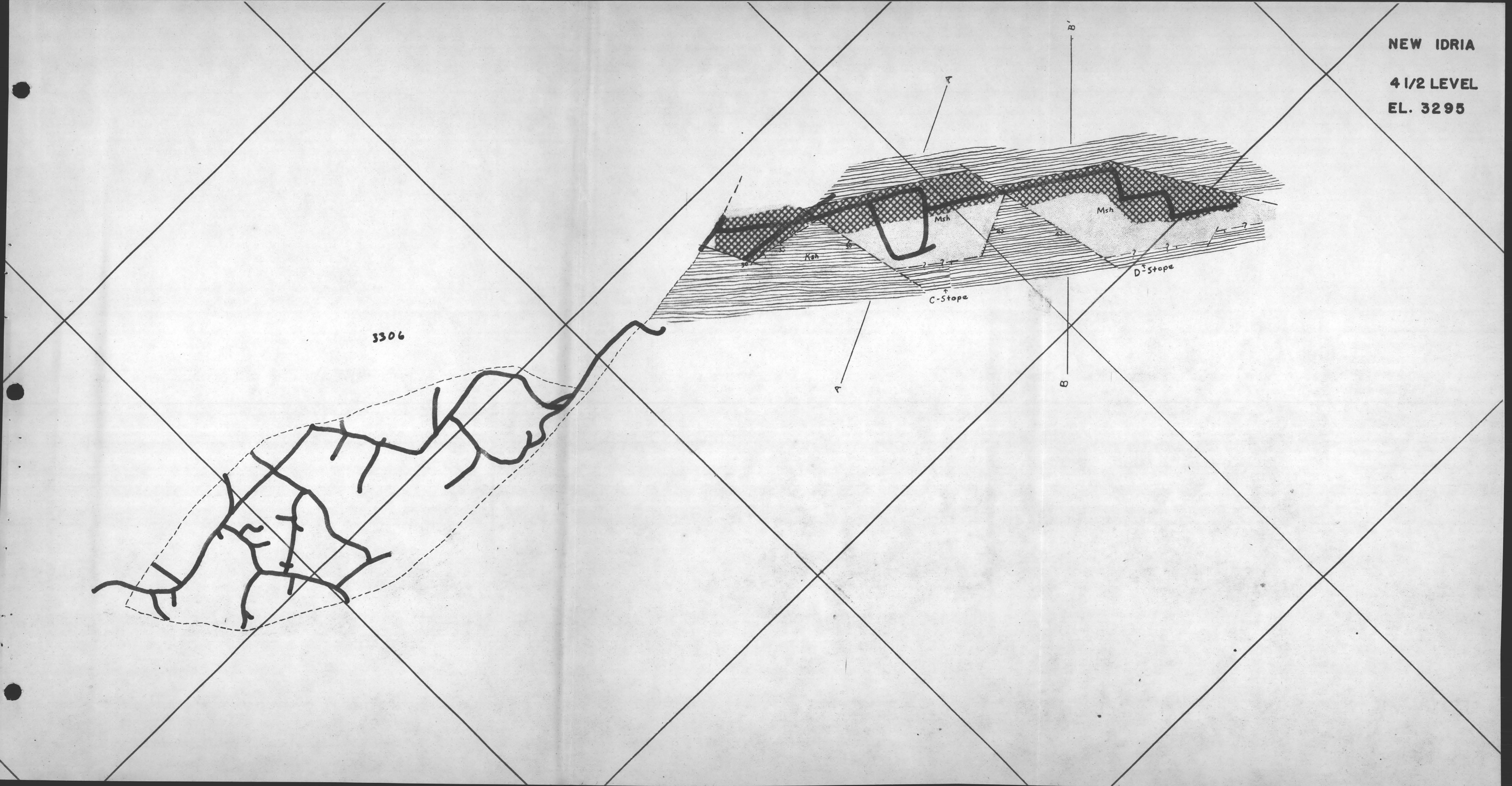
EL. 3333



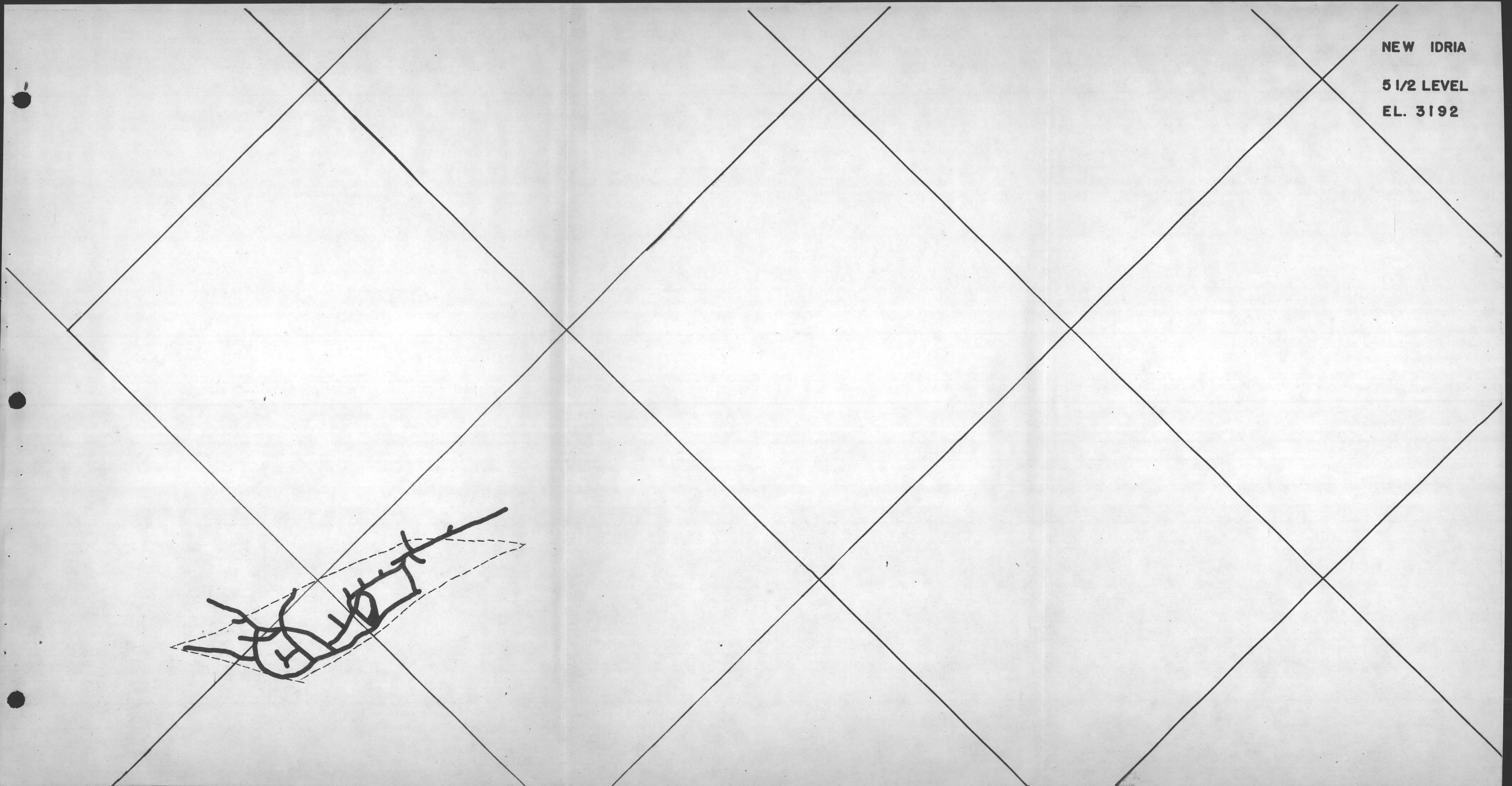
NEW IDRIA

4 1/2 LEVEL

EL. 3295



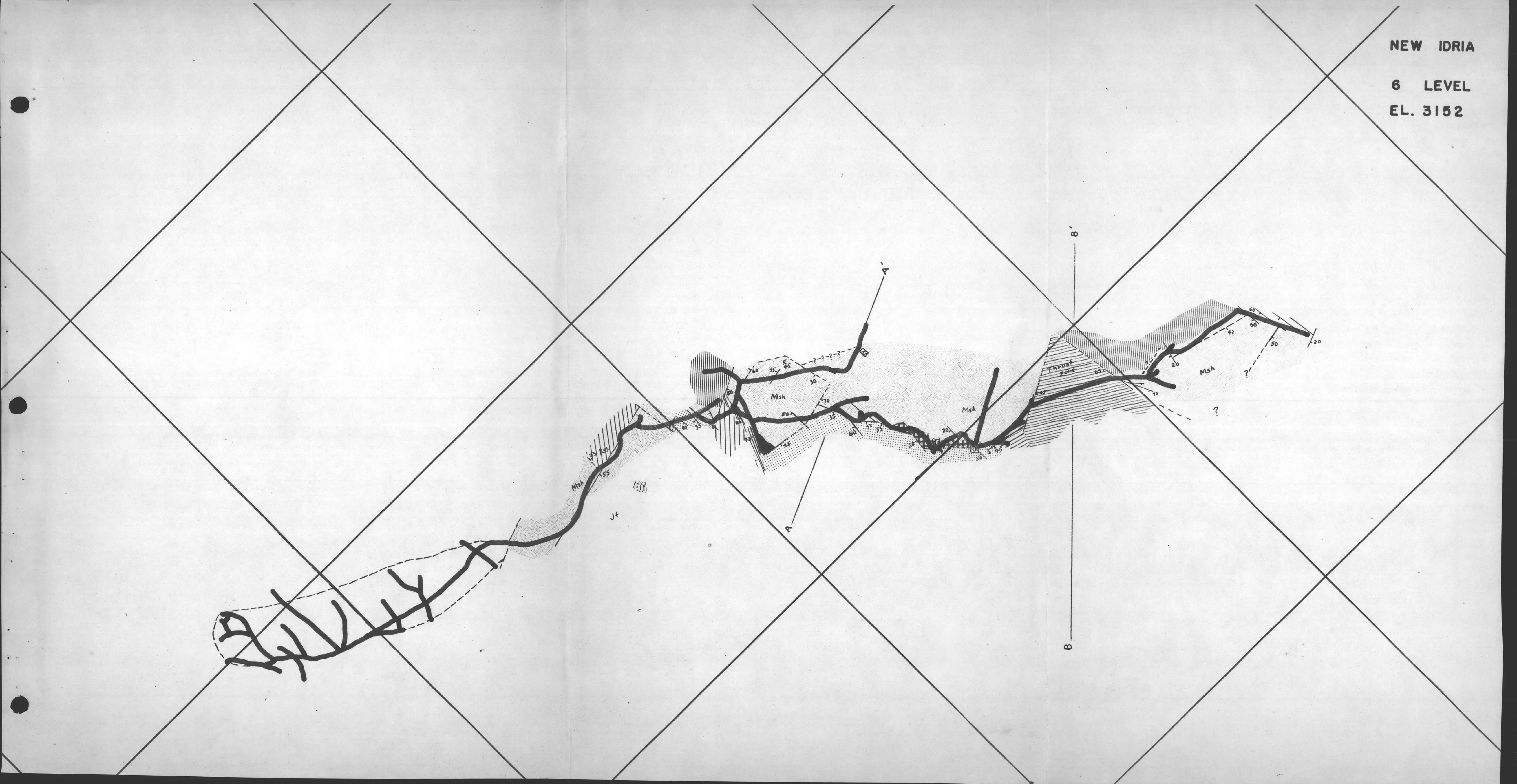

NEW IDRIA
5 LEVEL
EL. 3254
Zone of Ksh, Largely Fault Gouge
Thrust
Msh
Mss
Ksh
A
A'
B
B'


NEW IDRIA
5 1/2 LEVEL
EL. 3192

NEW IDRIA

6 LEVEL

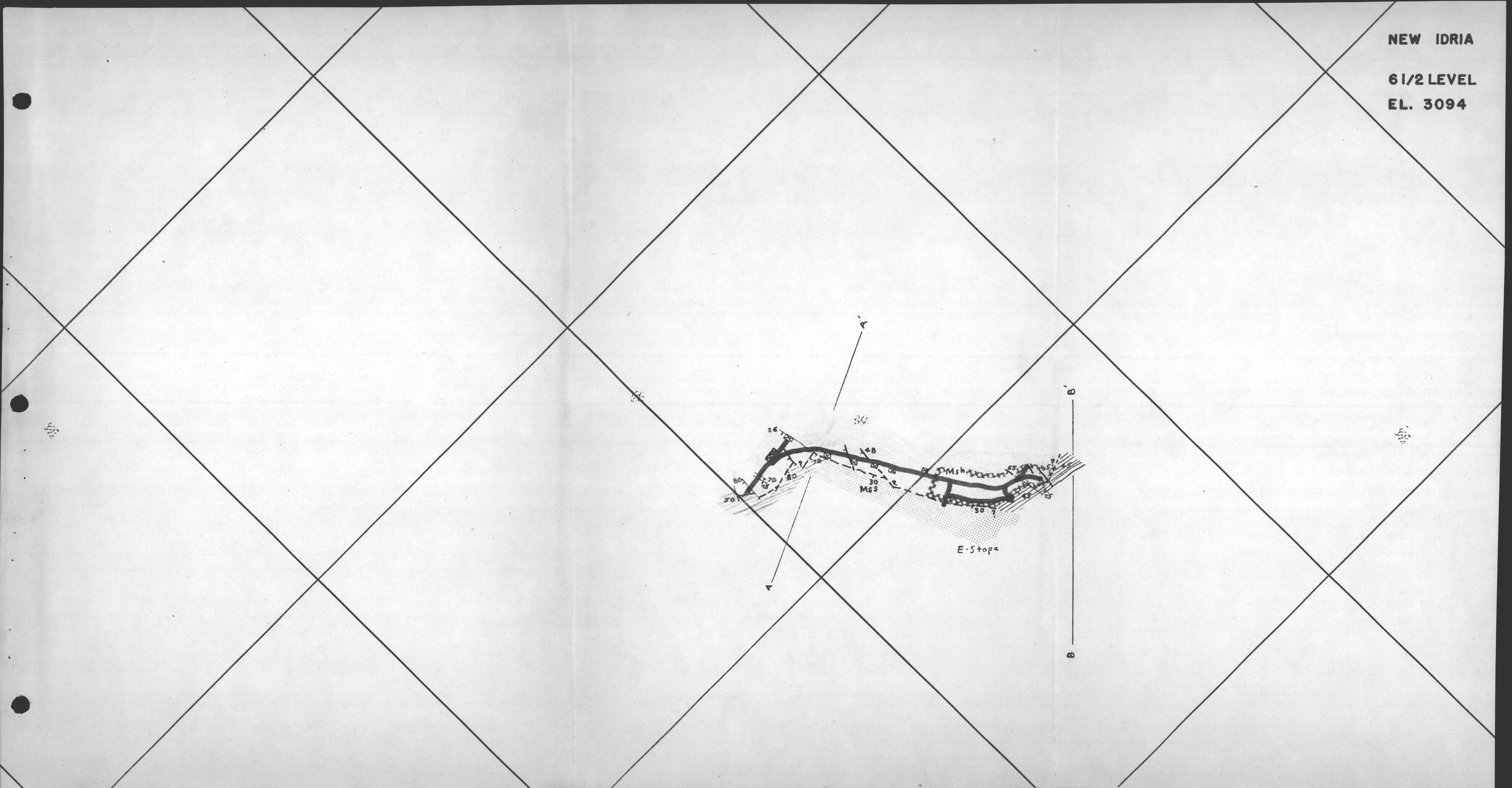
EL. 3152



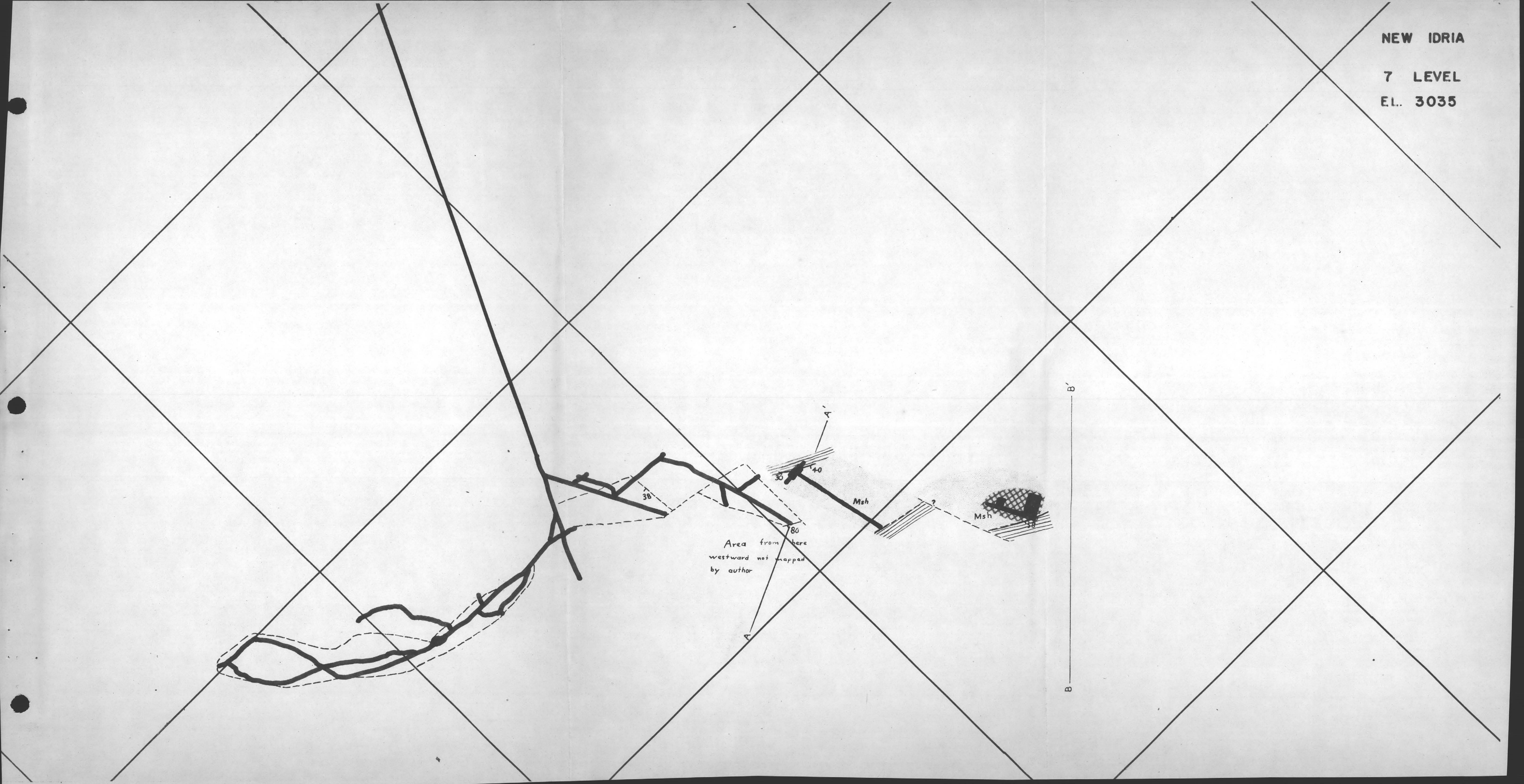
NEW IDRIA

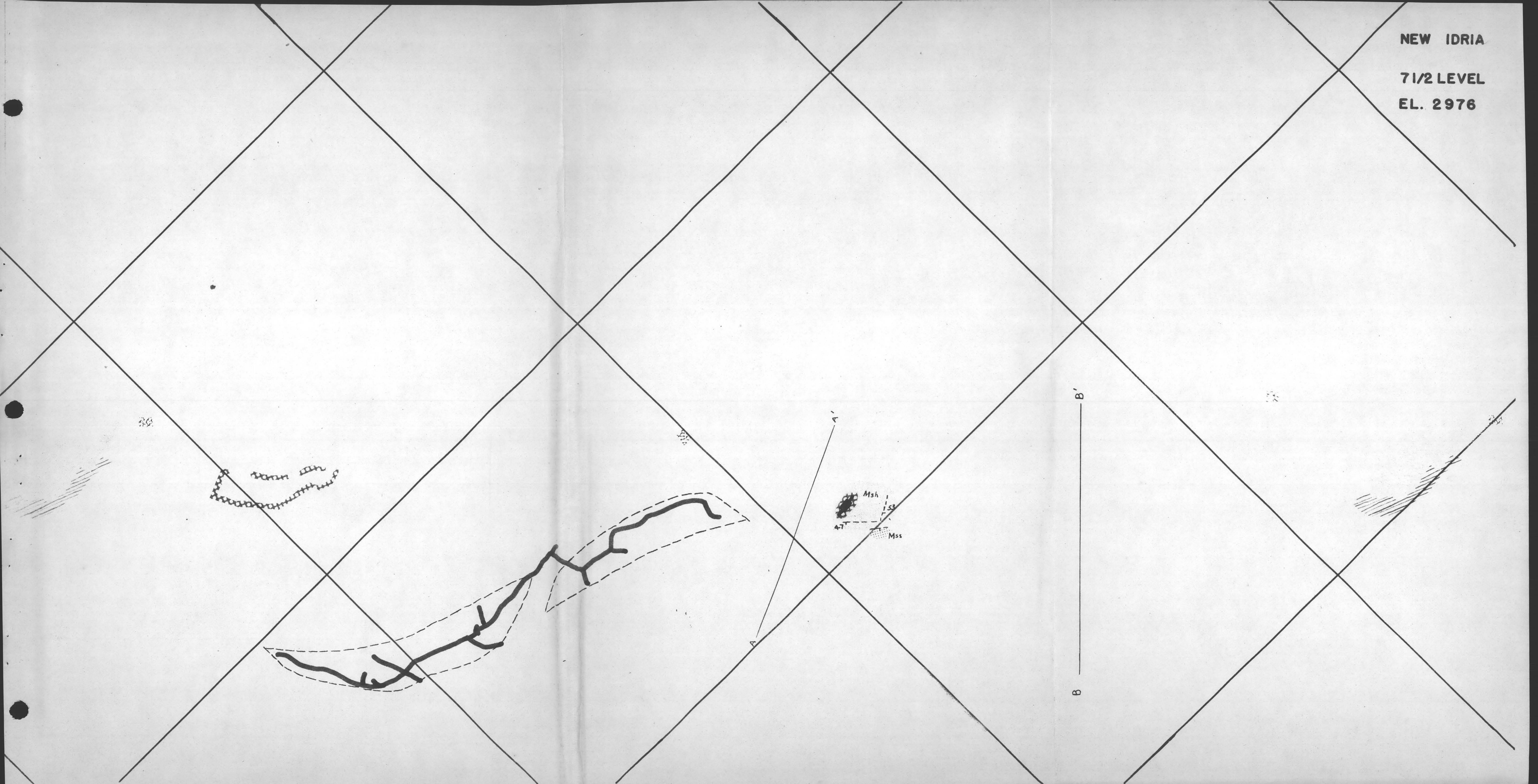
6 1/2 LEVEL

EL. 3094



NEW IDRIA
7 LEVEL
EL. 3035

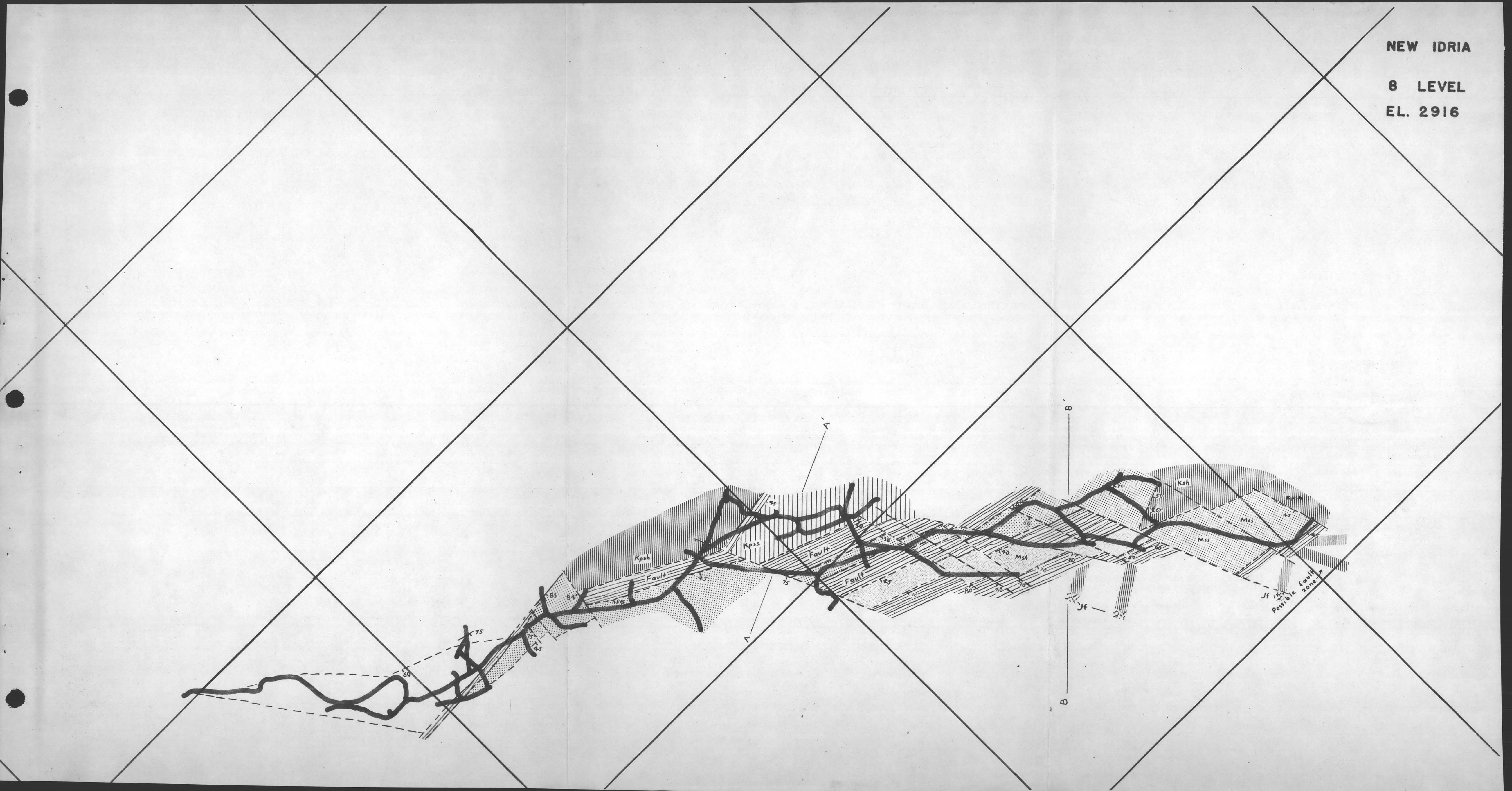



NEW IDRIA
7 1/2 LEVEL
EL. 2976
A
A'
B
B'
Msh
53
47
Mss

NEW IDRIA

8 LEVEL

EL. 2916



NEW IDRIA

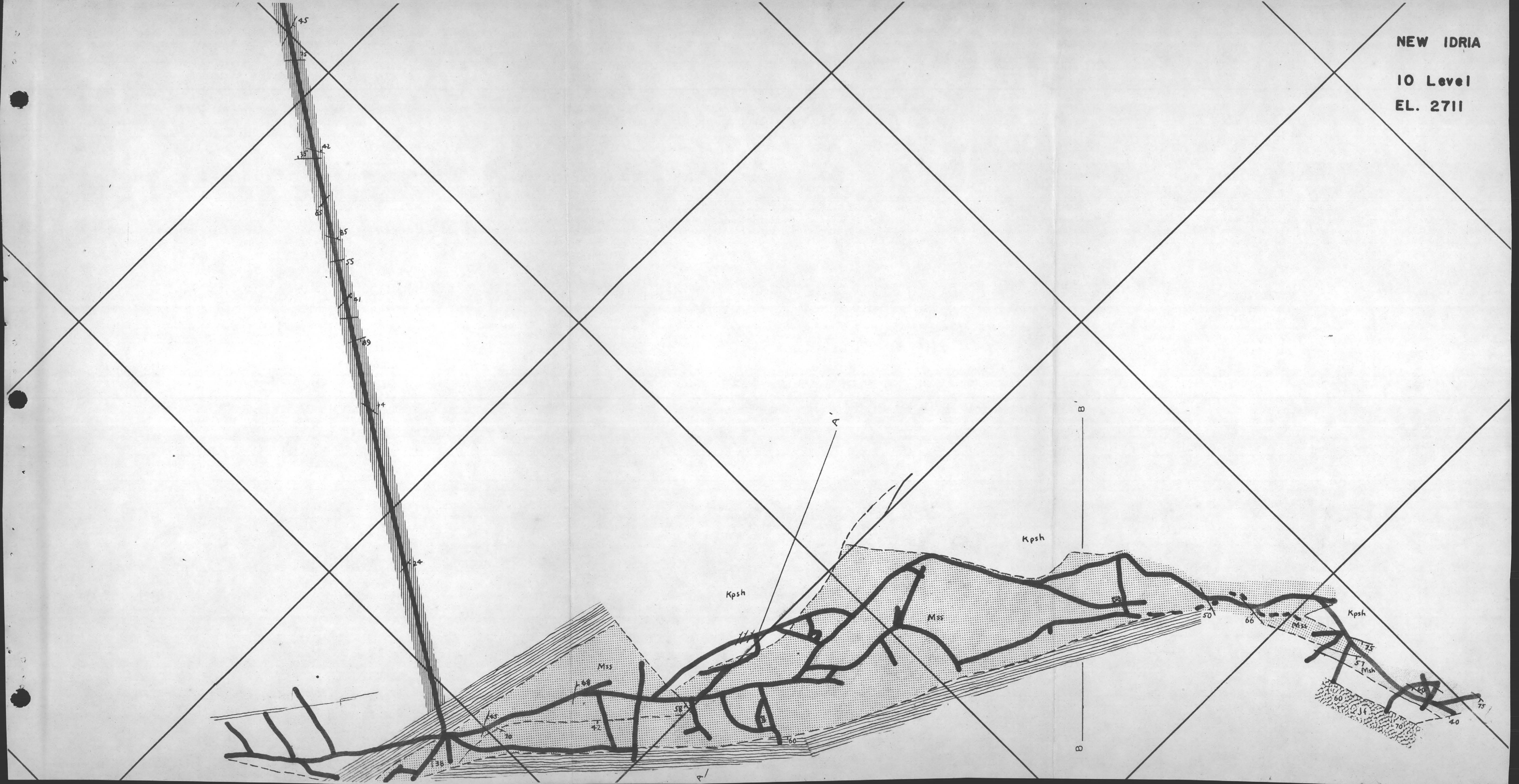
9 LEVEL

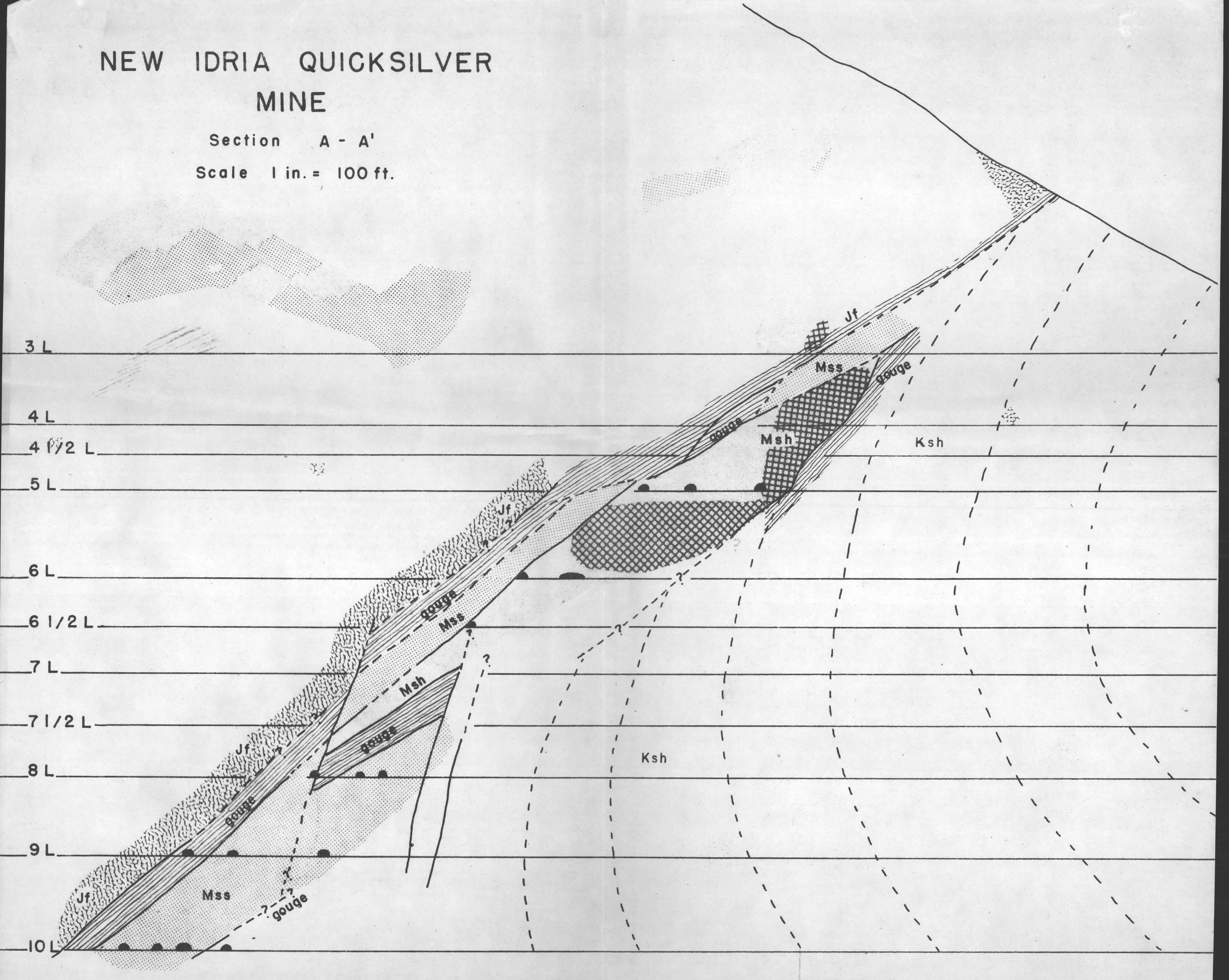
EL. 2826

NEW IDRIA

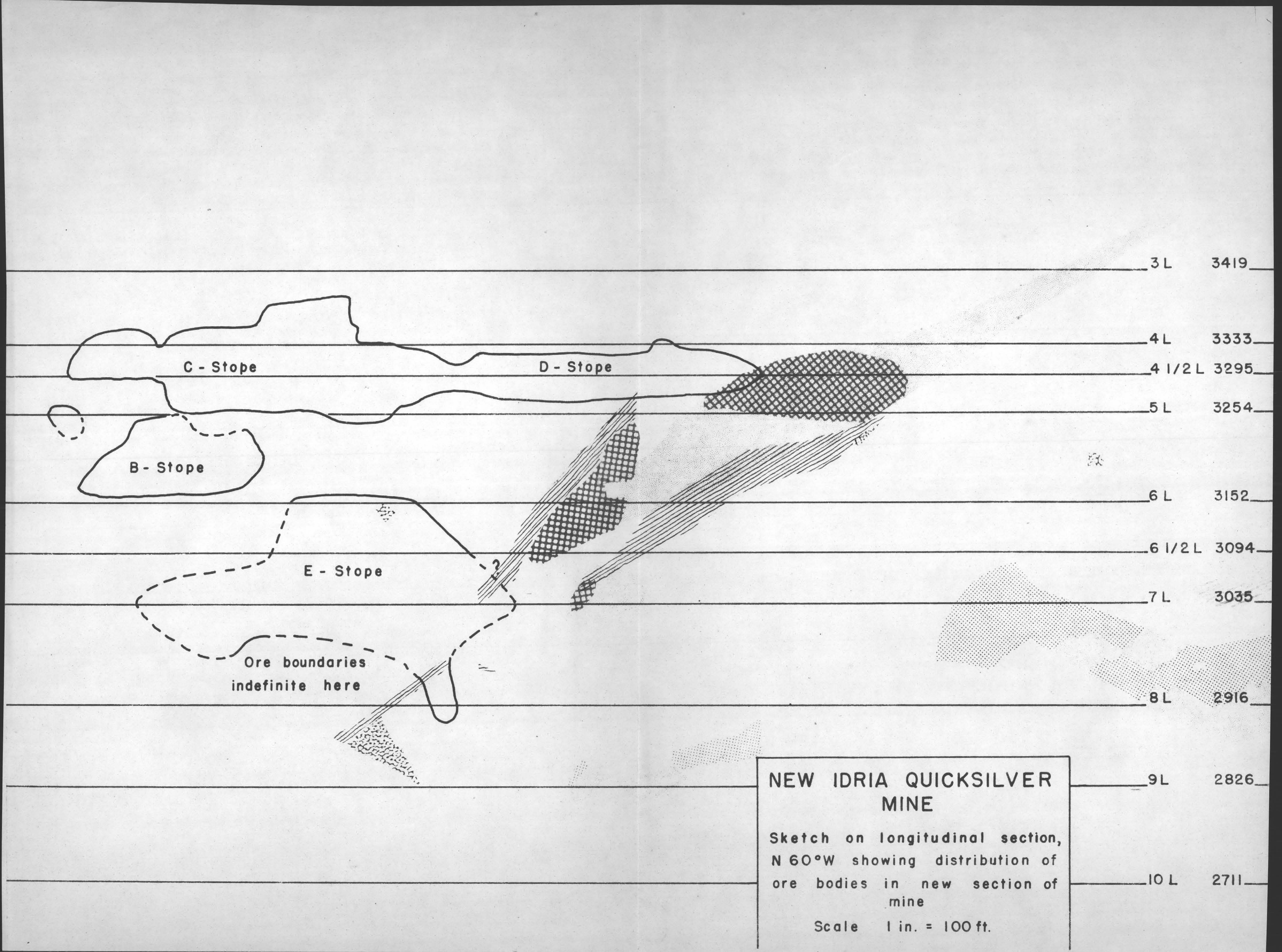
10 Level

EL. 2711





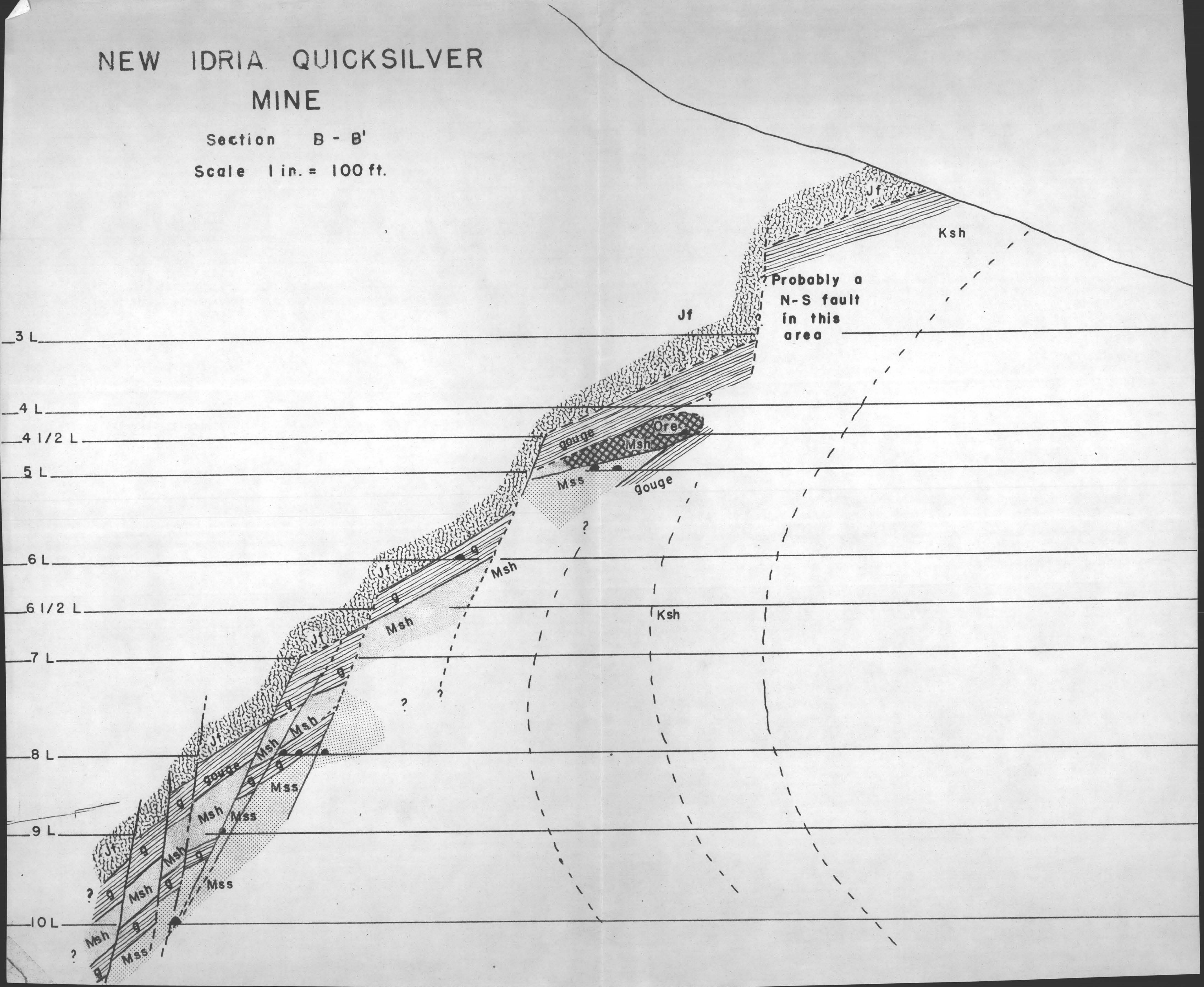
NEW IDRIA QUICKSILVER
MINE
Section A - A'
Scale 1 in. = 100 ft.
3 L
4 L
4 1/2 L
5 L
6 L
6 1/2 L
7 L
7 1/2 L
8 L
9 L
10 L
Jf
Mss
gouge
Msh
Ksh
Jf
gouge
Mss
Msh
gouge
Ksh
Jf
gouge
Jf
Mss
gouge

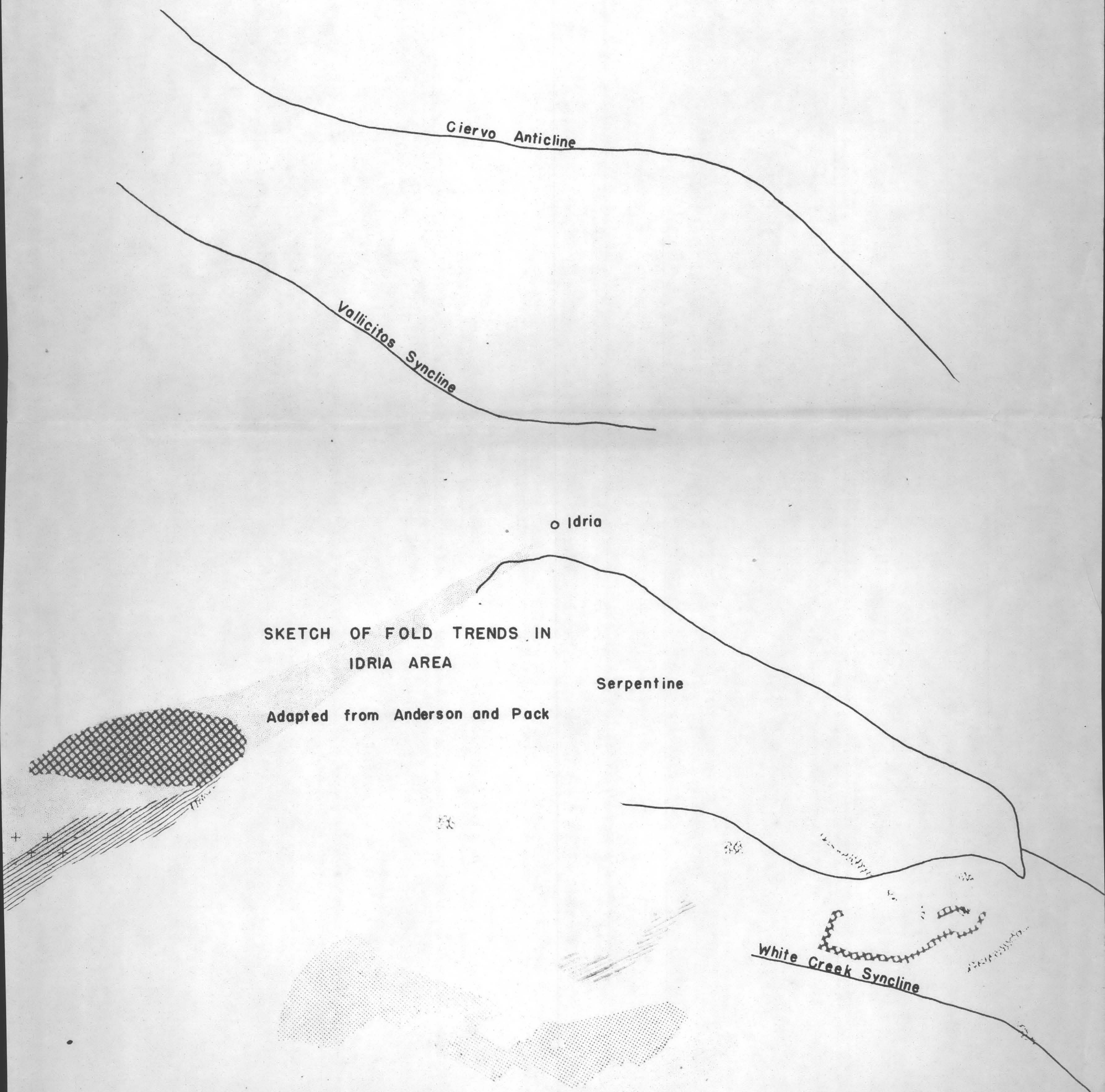

3 L 3419
4 L 3333
4 1/2 L 3295
5 L 3254
6 L 3152
6 1/2 L 3094
7 L 3035
8 L 2916
9 L 2826
10 L 2711
C - Stope
D - Stope
B - Stope
E - Stope
?
Ore boundaries
indefinite here
NEW IDRIA QUICKSILVER
MINE
Sketch on longitudinal section,
N 60°W showing distribution of
ore bodies in new section of
mine
Scale 1 in. = 100 ft.

NEW IDRIA QUICKSILVER MINE

Section B - B'

Scale 1 in. = 100 ft.




Ciervo Anticline
Vallicitos Syncline
o Idria
SKETCH OF FOLD TRENDS IN
IDRIA AREA
Adapted from Anderson and Pack
Serpentine
White Creek Syncline

December 6th, 1941.

Mr. J. O. Ziegler,
P. O. Box 2294,
Sacramento, Calif.

<u>To</u> <u>Edward</u> <u>Wisser</u>, <u>Dr</u>.

To professional services, examination of H. G. Quicksilver property, Idria, Calif., and preparation of report..........................$150.00

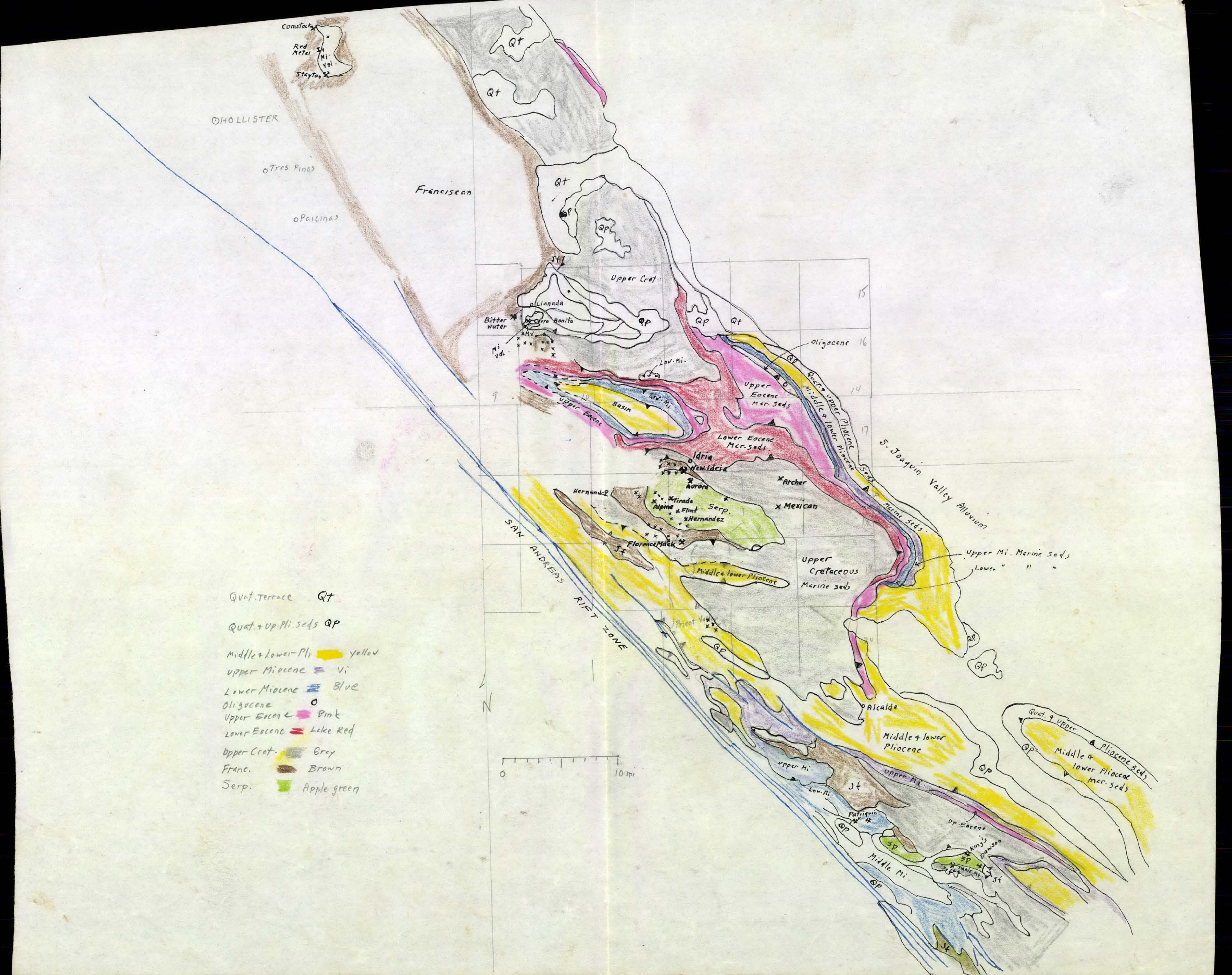
Receipted

March 26th, 1942.

Mr. Jack Ziegler,
914 14th Street,
Sacramento, Calif.

To Edward Wisser, Dr.,

To professional services, office work in connection with diamond drilling at H.G. quicksilver property, and preparing additional copy of report............................$20.00



Comstock
Red Metal
Mi. Vol.
Stayton
HOLLISTER
Tres Pinos
Paicinas
Franciscan
Qt
Qp
St
Upper Cret.
Llanada
Bitter water
Cerro Bonito
MV
Mi. vol.
Low. Mi.
Basin
Upper Eocene
Upper Eocene Mar. Seds
Lower Eocene Mar. seds
Oligocene
Quat. & upper Pliocene
Middle & lower Pliocene
Seds
Marine Seds
S. Joaquin Valley Alluvium
15
16
14
17
9
10
Idria
New Idria
Aurora
Archer
Mexican
Hernandez
Tirado
Alpine
Flint
Hernandez
Serp.
Florence Mack
Middle & lower Pliocene
Upper Cretaceous Marine seds
Upper Mi. Marine Seds
Lower " " "
SAN ANDREAS RIFT ZONE
Priest Valley
Alcalde
Middle & lower Pliocene
Quat. & upper Pliocene seds
Middle & lower Pliocene mar. seds
Upper Mi.
Low. Mi.
Upper Mi.
Patriquin
Up. Eocene
King's
Dawson
Sp
Middle Mi.
N
0
10 mi
Quat. Terrace Qt
Quat. & Up. Pli. seds Qp
Middle & Lower Pli. Yellow
Upper Miocene Vi
Lower Miocene Blue
Oligocene O
Upper Eocene Pink
Lower Eocene Lake Red
Upper Cret. Grey
Franc. Brown
Serp. Apple green