92F/10E

L49-124 NE.
B.R. Group - B.R. 1 - 3 .
McElroy, Bernard.
McNaughton, Duncan A., Engineer

0003 Lyons Group

3

CERTIFIED A TRUE COPY OF REPORT BY

MR. DUNCAN A. MC NAUGHTON ON

GEOLOGICAL SURVEY OF THE "B.R."

AND "L & M" GROUPS OF MINERAL CLAIMS

NEAR VAN ANDA ON TEXADA ISLAND, B.C.

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GEOLOGICAL INVESTIGATION

OF

LYONS GROUP OF CLAIMS

TEXADA ISLAND, B.C.

INTRODUCTION

Location:

The Lyons group of claims lies immediately to the east of the Little Billy mining property on the north east coast of Texada Island. The town of Van Anda, about one half mile west of the Lyons claims, is the largest settlement on Texada Island.

Purpose of Investigation:

The results of exploration work at the Little Billy Mine have been encouraging and have stimulated interests in the possibilities of developing gold copper deposits on adjacent properties. The purpose of the present investigation is to determine-,

(1) The geological factors that appear to have controlled ore deposition at the Little Billy Mine.

(2) The possibilities of finding similar geological conditions on the Lyons group of claims.

Method of Investigation:

The first step in the investigation was to study the available geological information on the Little Billy Mine. Surface and underground maps, diamond drill cores etc. were examined. Following this, geological mapping of the Lyons group was carried out during August, 1946.

Acknowledgements:

Complete co-operation from the officials at the Little Billy Mine was essential to the success of the investigation and it is with a feeling of sincere gratitude that I acknowledge the courtesy and co-operation of Mr. C. Cox, manager and Mr. H. McCrae, geologist at this mine.

Mr. A. Waters, acting manager at the Marble Bay Mine, kindly permitted me to examine drill cores from that property and to collect a few representative cores for microscopic examination.

Free use has been made of information obtained from other sources. The excellent geological map of the Little Billy, Marble Bay, Copper Queen and Cornell Mining properties, compiled by Mr. C. Ney of the Pioneer Mining Company, forms a part of the map submitted by the writer. The map by Mr. W.H. Mathews of the British Columbia Department of Mines, showing the distribution of the Marble Bay formation, has also been reproduced for this report.

Interpretation of the data shown on these maps has been, in some cases, extended beyond the interpretation shown on the original maps and for these extensions the writer assumes responsibility.

GENERAL GEOLOGY

The oldest rocks exposed on the north end of Texada Island are a group of greenstones consisting of lavas, tuffs and agglomerates. This group comprises the Texada formation. Conformably overlying the greenstone intrusive bodies of diorite and quartz diorite cut both the Texada and Marble Bay formations. These intrusives are generally regarded as the source of the mineralizing solutions that have produced the important gold copper deposits of Texada Island.

Texada Formation:

Altered volcanic rocks forming a part of this formation are exposed along the eastern boundary of the Lyons property. They are andesitic to dacitic in composition and contain much disseminated pyrite. Both fine grained and porphyritic varieties are common but no medium or coarse grained rocks were seen in this group by the writer. Limestone beds up to 2 feet in thickness are intercalated with the greenstones near their contact with the Marble Bay limestone. Fragmental types consisting of agglomerates and tuffs were seen on the north side of the Raven Bay road near the eastern boundary of the Lyons Group of claims. Fine grained, amygdaloidal lavas are well exposed along the coastline to the southeast of Beale Quarries. Structural observations along the contact between the two formations indicate that the greenstones have a general northerly strike and dip at moderate to steep angles to the west.

A different interpretation of the stratigraphic succession on Texada Island was advanced by R.G. McConnell (1) and followed by C. Ney (2). They have considered the greenstones to be altered intrusives which are younger than the Marble Bay formation. In support of this interpretation McConnel states that evidence of intrusion can be found at many localities along the contact between the two formations. It is certainly true that dyke rocks of a similar composition to the greenstones cut the limestones in numerous places but they <u>also cut the Texada formation</u> and are thus younger.

(1) Memoir 58, Geological Survey, Canada, ~~1886~~ 1914 p. 416

(2) Geological Map of Vananda Mines (accompanies this report).

These dykes may have been feeders for a group of younger volcanics which subsequently have been removed by erosion from the local geologic section. George M. Dawson (1) in 1886, considered the greenstones on nearby Lasqueti Island to be altered lavas. More recently W.H. Mathews (2) has remapped the northern part of Texada Island and he also considers that the greenstones are altered lavas, tuffs and agglomerates. The petrologic character of the rocks and their structural conformity with bedding in the limestone strongly favor this interpretation.

In passing it may be well to note that this question of stratigraphic succession is not merely an academic battlefield for geologists but is of practical significance to such questions as the probable continuation of ore at depth, the interpretation of regional and local structure and the interpretation of anomalies found by geophysical surveys.

Marble Bay Formation:

The Marble Bay formation conformably overlies the Texada formation and forms most of the northern part of the island. Mathews (3) who has studied this formation in detail states: "The Marble Bay formation consisting of at least 2,000 feet of limestones, likewise of Triassic age, overlies the Texada formation conformably. This formation can be subdivided chiefly on the basis of grade of the limestone, into three members."

"The lowest of these three members, approximately 500 feet in thickness, is composed, except for the lowermost few feet, probably entirely of high calcium limestone. The rock is massive, stratification is inconspicuous and variations in chemical composition throughout the section are slight."

"The second member, at least 1,500 and probably over 2,000 feet thick is composed chiefly of calcium limestone. In the lower part a few, generally thin, magnesian and dolomitic beds are known, and their presence alone serves to distinguish this member from the first ....Higher in this section magnesian and dolomitic beds are thicker and more closely spaced and the calcium beds of lower grade........The third and highest member, like the second, shows marked variations in composition of the beds, but in this magnesian and dolomitic limestone generally predominates over calcium limestone. Probably nowhere on the island has more than 200 or 300 feet of this member been spared by erosion hence its former thickness is not known."

(1) Annual Report, Geological Survey Canada 1886, p. 416

(2) Western Miner, February, 1946, Geology of the Limestone Deposits of the Northern part of Texada Island, B.C., P.40.

(3) Op. Cit.

The lowest member of the Marble Bay formation on the Lyons Group probably contains somewhat more impurities in the lower 200 feet than is evident from Mathews' description. Chert Nodules and lenses were noted in places and argillaceous limestones seem to be fairly common.

Recrystallization of the limestones adjacent to intrusive bodies of quartz diorite and diorite has entirely altered the character of the original rock and in some cases has produced an unusually coarse grained, grey marble made up of calcite crystals up to 1" in length. Silication (skarn) is another type of alteration which has affected the limestones on the mining properties to the west of the Lyons Group but it is rare to absent on this property.

Diorite and Quartz Diorite Stocks:

Both the Texada and Marble Bay formations have been intruded by diorite and quartz diorite. The so called diorites are made up of a variety of rock types generally of dioritic or gabbroic composition. They are characteristically coarse grained, dark colored rocks made up largely of plagioclase feldspar and either hornblende or augite, but both fine grained and porphyritic varieties were encountered during diamond drilling on the Marble Bay property. They differ from the quartz diorite in the absence of quartz as a major mineral and have a patchy, streaked appearance on weathered surfaces that is in marked contrast with the massive character of the quartz diorite.

The distribution of the larger bodies of diorite is shown on the geological map of the Vananda property. It will be noted that the diorite stocks are aligned along a general northwesterly trending axis and are located close to the Vananda synclinal axis.

Alteration of diorite to masses of lime silicate minerals (skarn) was noted in the Marble Bay diamond drill cores. Margins of the diorite at the Cornell Mine are serpentinized - possibly indicating that the marginal portions of this stock were originally composed of peridotite or pyroxenite.

Quartz diorite forms an elongate stock-like body extending along the coast from the Little Billy Mine to Beale Quarry. The quartz diorite is a medium grained, non porphyritic rock, light grey in color containing quartz, plagioclase feldspar and biotite. The rock is massive and in most places seems to maintain its character up to limestone contacts. Two different phases of the quartz diorite were seen along contacts. The so called "white granite" is well exposed near its contact with limestone to the northwest of the Little Billy Mine. This rock appears to have a higher quartz content than the normal quartz diorite and the ferromagnesian minerals are either rare or absent. Similar light colored phases of the quartz diorite are found adjacent to ore bodies underground at the Little Billy and there they contain disseminated molybdenite. White granite has also been logged in diamond drill cores of the quartz diorite at some distance from the limestone contact so it is not confined to contact zones. Pending microscopic examination of thin sections it is regarded as a hydrothermally altered phase of the quartz diorite. Dioritic contact varieties of the quartz diorite have been noted in diamond drill cores from near Beale Quarries and underground on the 480 level of the Little Billy Mine. It would be interesting to determine whether or not the quartz diorite adjacent to ore shows any significant changes of petrologic character. If a distinctive alteration type such as the white granite commonly occurs near ore it might enlarge our target in the proposed drilling at Beale Quarry.

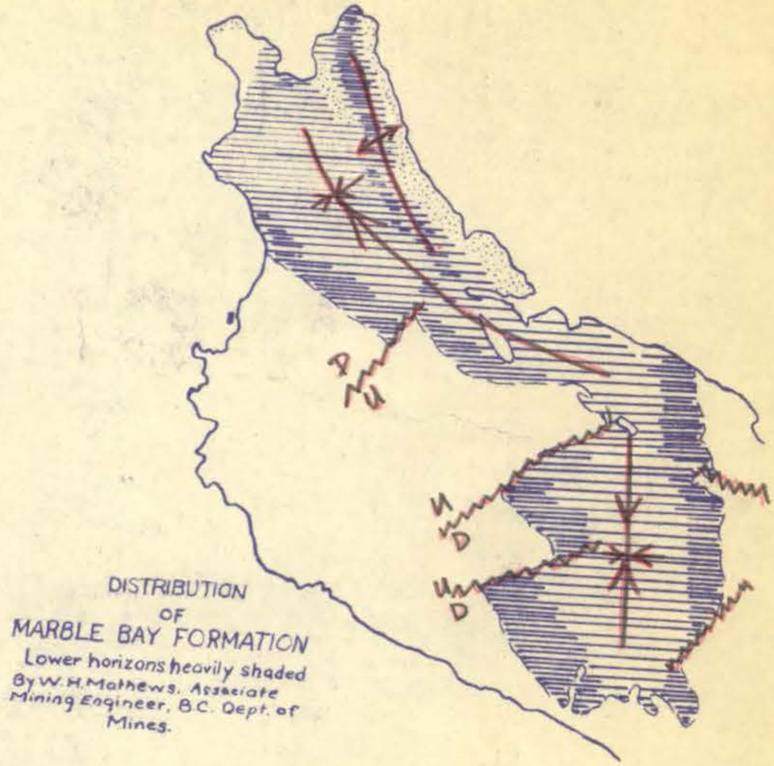
<u>Dykes</u>:

Dykes of at least two and more probably three different ages cut the limestones. The youngest known dykes are feldspar porphyries which have occupied fissures in the quartz diorite. These dykes are considered by the writer to be post-mineral in age but as John S. Stevenson (1) points out this age relationship deserves careful study. The oldest dykes are dark green in color, and are highly altered. They are definitely older than the quartz diorite and may be in part older than the diorite intrusives. Intermediate between these old and young dykes are a group of fresh appearing even grained and porphyritic rocks of probable dioritic composition. These rocks form general easterly trending dykes on the Lyons property and are comparatively common. They are mineralized in places, containing small amounts of magnetite, pyrite and chalcopyrite. They have been grouped with the younger dykes on the geological map due to the difficulty of separating them with any degree of certainty. A complete suite of specimens was collected from these dykes during mapping and it is hoped that microscopic study of these rocks will settle some of the currently doubtful points concerning parentage and age relationships.

(1) Annual Report of the Minister of Mines of the Province of British Columbia, 1944, Little Billy Mine, Texada Island, p. 166.

Structure:

The Texada and Marble Bay formations have been folded along northerly and northwesterly trending axes. (See Plate I). The major structure is a northerly trending syncline. The continuity of this syncline has been broken by northeasterly trending faults, by intrusions of diorite along the synclinal axis and by intrusions of quartz diorite along the southern and eastern limbs of the fold. This generalized picture of the regional structure should be carefully checked by mapping and a careful study should be made of the northeasterly trending faults as they may have played a part in the localization of ore deposition.



Anticline
Syncline
Fault

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3 MAP #1

Mineral Deposits

Gold copper deposits of the contact metamorphic type are the most important mineral deposits on the island. These deposits were worked intermittently over a long period of years and recent developments at the Little Billy Mine have indicated that careful exploration work will result in the discovery of new deposits in favourable localities. The ore deposits have many features in common insofar as can be determined from a study of the old records and their significance to ore finding are summarized below.

A Type:

Contact metamorphic replacements deposits in limestone at or near intrusive bodies of diorite and quartz diorite. At the Little Billy Mine practically all of the ore deposits are located at or very close to the margin of the quartz diorite. The same relationship exists at the Cornell Mine between the ore deposits and the diorite. The Marble Bay deposits are situated immediately to the west of a small body of diorite and at depth dykes and pipe-like bodies of diorite were encountered. No large intrusives are exposed in the vicinity of the Copper Queen Mine but it is reasonable to assume that the mineralizing solutions could not have travelled very far and that they probably originated from a buried stock.

Significance - Diorite and quartz diorite contacts with limestone are favourable. Limestone lying above buried stocks should also be considered a favourable environment.

Mineralogy:

The ore bodies contain bornite, chalcopyrite and, in places, magnetite in a lime silicate (skarn) gangue. Molybdenite is present in altered phases of the quartz diorite but not in sufficient quantities to constitute ore. The gangue minerals include garnet (andradite and grossularite), wollastonite, epidote, diopside and tremolite. The richest ore at the Little Billy is generally associated with wollastonite-rich skarn zones.

Significance - All skarn deposits should be regarded as potential ore carriers. Tan coloured skarn zones largely made up of grossularite are not mineralized to any extent at the Little Billy Mine and are thus not regarded as ore carriers but until such time as this observation has been confirmed elsewhere it is advisable to adhere to the first statement.

Shape of Ore Bodies:

The known ore deposits on the island are characterized by relatively long vertical or nearly vertical axes and short horizontal axes - pipe-like or pear shaped deposits.

Significance - The shape of the ore bodies suggests that they are located along vertical or nearly vertical fissure intersections.

Structure:

Minor structural features such as dykes, faults and possibly local folding have produced secondary openings in the limestones and have played the major role in the localization of ore deposition at or near diorite and quartz diorite contacts. Where these features are absent, ore has not been found. Frank Joubin of Pioneer Mines, who has studied the surface and underground picture at the Little Billy Mine states: (1) "I believe that the configuration of the quartz diorite, that is the west prong, east dyke and the crotch (see surface geological map of Little Billy Mine) have had a considerable bearing on the presence of ore in the Little Billy Mine. I also think, and I share Dolmage's opinion in this, that the zone of minor intrusives trending southwesterly from the Little Billy towards the Copper Queen mark the upper horizon of other quartz diorite prongs that may also be "juicy"..........Quite evidently other attractive exploration possibilities are present when the structure of the Little Billy Mine becomes better understood and the time comes to develop ore prospects outside of the immediate vicinity of the Little Billy Mine." An unusual number and an unusual variety of dykes have been mapped in the immediate vicinity of the Little Billy Mine. This may be due in part to mapping in greater detail but it can also be regarded as evidence of a disturbed area through which channelways existed for movement of both melts (dykes) and mineralizing solutions. "Watch the dykes" is the favored advice of old time mining men in the district and it is well worth following, particularly near dyke intersections with contacts between limestone and diorite or quartz diorite.

(1) Geological Notes. Little Billy Mine. January 21st, 1946 (Memorandum to Dr. James of Pioneer Mining Company).

Other structural features which are used with some success as a guide to ore finding in the Little Billy Mine are bays in the limestone along its contact with quartz diorite. These embayments, particularly on the limestone side of skarn zones, are regarded as favourable locations for ore. Gentle folding and zones of local crumpling which are described by John S. Stevenson (1) may have produced secondary openings in the limestone and thus have facilitated the movement of mineralizing solutions.

Significance - Favourable structural conditions in the limestones at or close to quartz diorite stocks have controlled the deposition of gold copper ores on Texada Island. Intersections of faults or strong fissures with diorite and quartz diorite contacts and fissure intersections adjacent to contacts are regarded as favourable structural conditions by the writer. Many of these faults and fissures have been filled by pre-mineral dyke rocks and in this case they can be readily recognized (e.g. Southerly trending quartz diorite dykes at the Little Billy) while others may only be marked by obscure healed limestone breccias and thus be difficult to find and trace on the surface. In any event surface work along these lines will be relatively inexpensive and should serve to focus attention on favourable localities along contacts which can then be tested by drilling. This line of reasoning was followed in the location of the proposed test holes in Beale Quarry where a pre-mineral dyke intersection with the quartz diorite contact should be crossed at a comparatively shallow depth (about 150 feet) in hole #1.

(1) Annual Report, B.C. Minister of Mines, 1944, Little Billy Mine, Texada Island, p. 168.

CONCLUSION

Inasmuch as quartz diorite and diorite stocks are not present at the surface on the Lyons Group, the property is not considered to be a favourable area for prospecting. Both intrusive types may be present at shallow depths as is suggested by the coarsely crystalline character of the limestone in Beale Quarry and to the southeast of the Cornell Mine (note outlines of zones of maximum alteration shown on map of Lyons Group of claims). Even if this is the case, tracing their contacts would be an expensive undertaking which can hardly be justified by the expectable returns.

RECOMMENDATIONS

1. The option on the Lyons Group of claims should be retained and a small amount of diamond drilling should be done to test the limestone quartz diorite contact in Beale Quarry.

2. A determined effort should be made to acquire more property covering the diorite intrusives between Cornell Mine and Sturt Bay. This area is considered to be very attractive prospecting ground and one in which thorough and thoughtful geological work will materially reduce the ever present risk rate in ore finding. Our present holdings would be very much more attractive if we could obtain an option on the Cornell and McLeod #5 Mineral Claims. Failing this an effort should be made to option the Marble Bay Mine. Dr. Dolmage, who was on the bottom level of the mine before it closed down, reports good ore on the deepest level (1700') and this makes the property an attractive possibility to consider it a satisfactory working agreement can be obtained from the present owners.

3. If additional property can be obtained, surface geological mapping should be continued along the lines indicated by the writer in the section of the report on structure of the mineral deposits.

APPENDIX A

Diamond drill logs and sections of surface drilling between the Little Billy Mine and Beale Quarry.

HOLE #3 - SURFACE (Prosser)

Lat:	98	90		Bearing:	--
Dept.	99	24		Angle:	Vertical
Elev:	503 ft.			Depth:	495 Ft.

0	-	11	Casing. 6 inches garnetite. 1 ft. limestone. This may not be in place
11	-	37	Dark diorite - porphyry dyke Rounded phenocrysts of dark mineral Irregular light (skarny) alteration. Considerable disseminated pyrite.
22.5	-	23.5	Limestone
37	-	83	Gray moderately coarse limestone.
83	-	105	Fine dark limestone
105	-	109	Dense white limestone
109	-	112	Gray limestone
	112		Four inch dyke of granite with 1-1/2" of wall-rock alteration on each side, but no skarn. Grosses at an angle of 80°.
112.5	-	178	Chiefly moderately coarse gray limestone.
178	-	187	Diorite dyke. (limestone 179 - 180). altered 181.5 - 184 and other places to a hard gray rock. This is altered to garnetite as at 184 - 185, etc. Some specks of chalcopyrite.
187	-	189	Limestone
189	-	189.7	Siliceous pyritic dykes
189.7	-	206	Limestone
206	-	231.3	Diorite (feldspar porphyry) dyke. Ends with a small band of skarn.
231	-	236.5	Varied limestone with much dark banding
236.5	-	244	Fine gray dyke broken up.
244	-	269	Limestone. First foot very dark with black bands at 90°. Pure white then to 250, then gray.
269	-	272	Fine grained gray dyke.

HOLE #3 (Cont.)

272	-	273.5	White granite with molybdenite.
273.5	-	279	Pale brown skarn by gradation. Some pyrite and chalcopyrite.
			(Sample 273 - 279 6' - Au 0.10 Cu 2.0)
279	-	289	Gray limestone
289	-	290	Felsite dyke with mineralized borders.
290	-	358	Limestone. Moderately coarse white.
358	-	360	Crumbled limestone and gouge. Mineralized.
			(Sample: 2 ft. 0.16 Au 1.8 Cu)
360	-	362.5	Weak skarn with some chalcopyrite and bornite.
362.5	-	364	Felsite dyke with chalcopyrite.
364	-	366.5	Weak skarn with limy inclusions. Fair bornite min.
366.5	-	367	Rich chalcopyrite in calcite.
			(Sample 364 - 368 4 ft. Au. 0.20 Cu. 2.0)
367	-	378	Siliceous skarny rock. 376 - 78 - Mud.
378	-	386	Limestone, dark and crossed with seams of serpentine carrying a little chalcopyrite.
386	-	389	Weak skarn, grading to dyke rock.
			(Sample: 3 ft. 0.04 Au 0.40 Cu.)
389	-	391	Dark dioritic rock with pyrite
391	-	392	Soft altered skarny granite with some chalco.
392	-	408	Irregular textured porphyry granite. Much dissem. pyrite and a little chalcopyrite.
408	-	417.5	Darker porphyry granite. Some seams of garnetite, running parallel to core.
417.5	-	423	Weak skarn
	423		Mud Seam.

HOLE #3 (Cont.)

423 - 428		White wollastonite with some garnet and fine bornite.
428 - 456		Finely crystalline wollastonite in concentric bands, dark with very fine bornite. Uniform.

Samples:		Au.	Cu.
423 - 430	7 ft.	0.30	1.0
430 - 435	5 ft.	0.36	1.8
435 - 440	5 ft.	0.36	2.0
440 - 445	5 ft.	0.41	2.3
445 - 449	4 ft.	0.37	2.1
449 - 456	7 ft.	0.34	3.0

456 - 462 Few inches of skarn then a fine grained felsitic dyke. This has considerable chalco- in small lenticular disseminations.

Sample:		Au.	Cu.
456 - 461	5 ft.	Tr:	0.5

462 - 463 Garnetite and mineralized dyke.

463 - 467.5 Wollastonite, well mineralized with bornite, coarse in comparison to previous material.

Sample:		Au.	Cu.
461 - 466	5 ft.	0.21	2.4

467.5 - 469.5 Garnetite with considerable bornite.

Sample:			
466 - 471	5 ft.	0.30	2.5

469.5 - 472 White limestone.

472 - 473.5 Porphyritic siliceous rock well mineralized with bornite.

Sample:		Au.	Cu.
472 - 476.5	4.5 ft.	0.12	1.1

473 - 475 Weak skarn

475 - 476.5 Dyke with chalcopyrite.

476.5 - 480 Dyke, dark and dioritic.

480 - 481.5 Skarn and silicified lime. Low angled contact with limestone following.

Sample:	Au.	Cu.
480 - 481.5	0.22	2.5

480 - 495 Gray to white coarse limestone.

VANANDA MINING COMPANY

D. D. HOLE 4S

Lat:	9402	Bearing:	--
Dept:	10,179	Angle:	Vertical
Elev:	478	Depth:	254 ft.

0	-	16	Casing
16	-	28.5	Dark, medium grained diorite with diffused hornblende phenocrysts.
28.5	-	43.5	Lighter, siliceous dyke, contacts not definite
43.5	-	109	Much the same, dark diorite porphyry. Some pyritic slips here and there. 52 - 54 Intrusive granitic dyke.
109	-	111	White granite
111	-	115.5	Diorite porphyry.
115.5	-	116.5	Limestone
116.5	-	125	Diorite? Contact at 40° to limestone. A thin layer of black argillite separates the lime and the diorite. This contains abundant pyrite.
125	-	149.5	White, moderately coarse limestone. From 128 to 135 white lime is irregularly mottled with dark. 145 - 149.5 very coarse grained, white ls.
149.5	-	151.5	Diorite porphyry dyke.
151.5	-	154	Limestone
154	-	155	Relatively coarse diorite porphyry.
155	-	174	Moderately coarse limestone.
174	-	180.5	Dark diorite porphyry. Nearly fully crystallized.
180.5	-	254	Gray granite. Uniform.
	251		Some slips at 40° - 50°.

VANANDA MINING COMPANY

D. D. HOLE 10S

Lat:	10,040	Bearing:	N.15 E.
Dept:	10,467	Angle:	37 degrees down
Elev:	530	Depth:	192 ft.

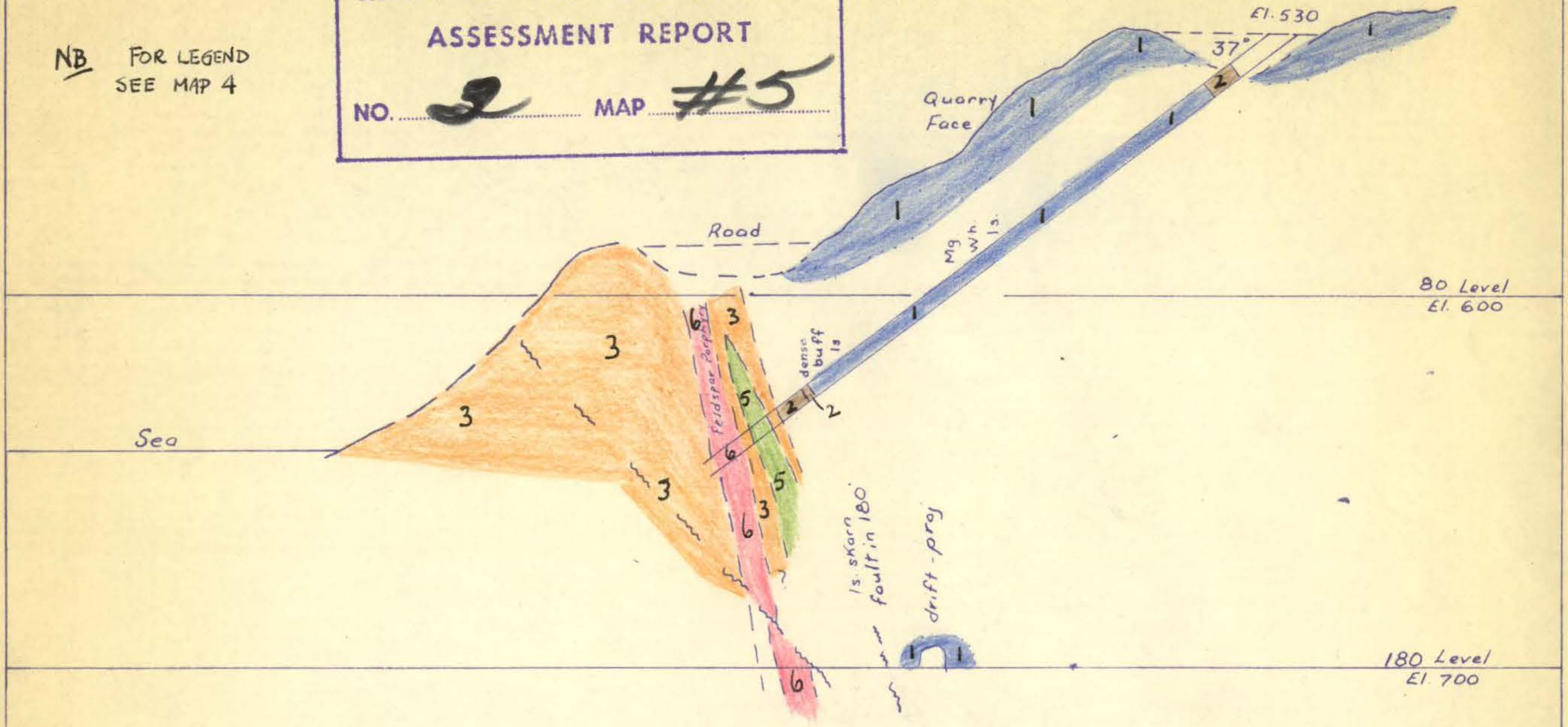
0	-	11	Overburden
11	-	22	Dark, fine-grained diorite dyke. Some pyrite slips.
22	-	28	Limestone. Core not all recovered. Probably still overburden to 28 ft.
28	-	137.5	Medium grained white and gray limestone. At 86 ft. a small argillaceous band with pyrite. Crosses at 40 degrees.
137.5	-	155.5	Dense white granular limestone like that in 180 level. Some banding at 55° angle.
155.5	-	157.5	Fine grained green diorite.
157.5	-	166'3"	Dark feldspar porphyry. Varied with alteration. Some small granite sections?
166'3"	-	169	Varied gray granite, full of inclusions.
169	-	171	Granite, altering to skarn.
171	-	174	Gray green skarn, probably altered granite. Unmineralized.
174	-	177.5	Gray granite.
177.5	-	188	Gray porphyry with abundant feldspar phenocrysts.
188	-	192	Gray granite.

HOLE 10 S

1" = 40'

NB FOR LEGEND SEE MAP 4

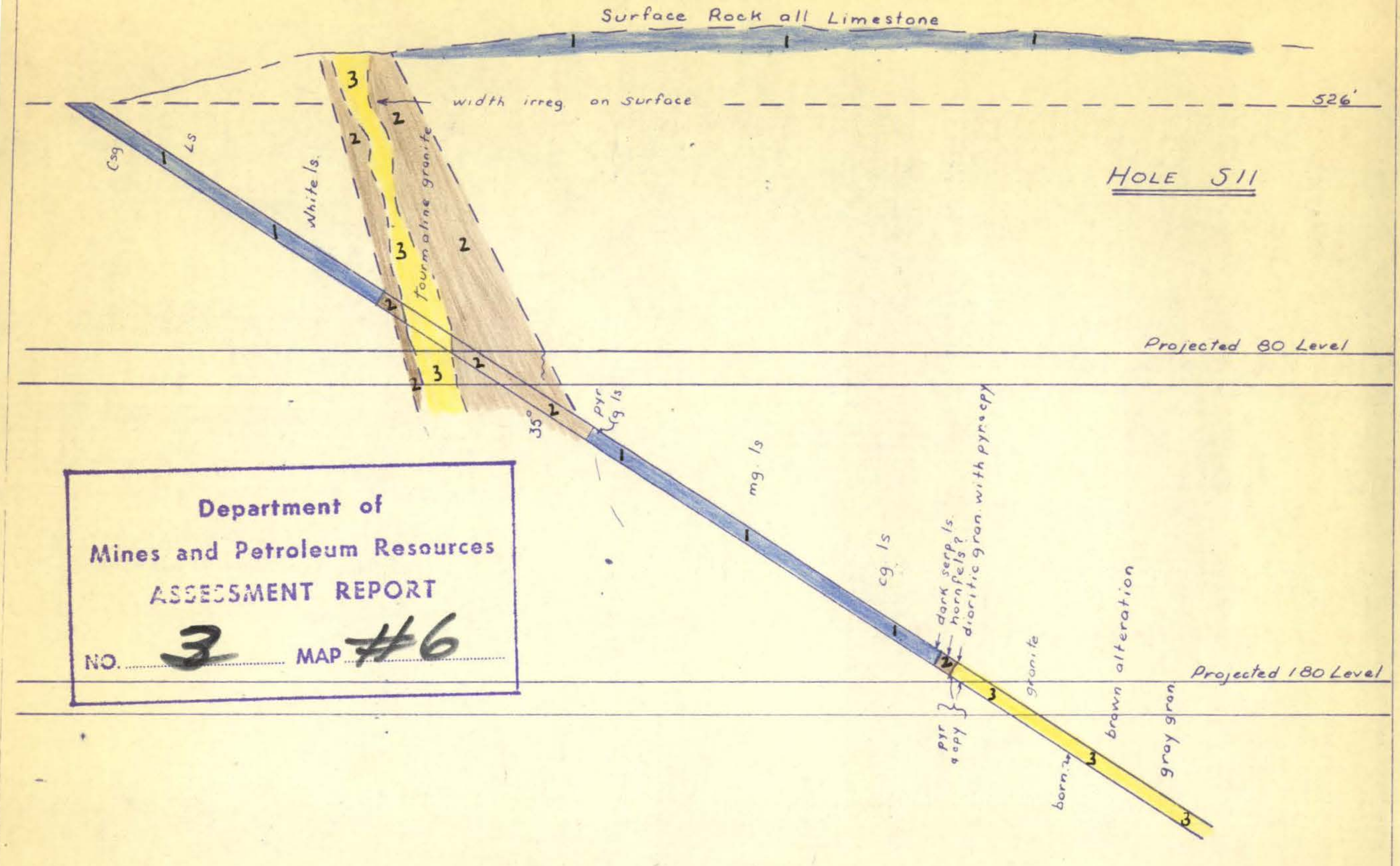
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 2 MAP #5



HOLE #11 - SURFACE

Lat:	11,033	Bearing:	S 55° E.
Depth:	10,372	Angle:	33° down
Elev:	526	Depth:	402 ft.

0	-	14	Casing
14	-	106	Limestone - mostly medium grained gray or white. 26 - 36 Very coarse grained, white.
106	-	110	Black, fine grained varied dyke. Considerable pyrite. Some skarny sections.
110	-	127.5	Contact at 30° to a peculiar quartz - Tourmaline granite.
127.5	-	160	Black diorite porphyry dyke.
160	-	162.5	Calcite serpentine and pyrite. Possibly a fault zone.
162.5	-	178	Dyke, ending with a very low angling contact.
178	-	181	Very coarse limestone.
181	-	303	Moderately coarse - gray or white limestone.
303	-	306	Banded dark lime with serpentine and pyrite and some fine bornite.
306	-	310	Hard pyrite hornfels. Resemble dyke rock.
310	-	313.5	Coarse dioritic granite. Some chalcopyrite associated with masses of pyrite.
313.5	-	314.5	Dyke rock. Streaked with pyrite and chalcopyrite.
314.5	-	365	Moderately coarse gray granite.
	350 ft.		Spherical mass of alteration with garnet and bornite.
365	-	369	Considerable pyrite in the granite.
369	-	402	Gray granite. Core lost from 389 - 392.


Surface Rock all Limestone
width irreg. on surface
526'
HOLE S11
Csg
LS
White ls.
tourmaline granite
Projected 80 Level
35°
pyr
cg ls
mg. ls
cg. ls
dark serp. ls.
hornfels?
dioritic gran. with pyr. cpy
granite
brown alteration
gray gran.
born.
Projected 180 Level
pyr
apy

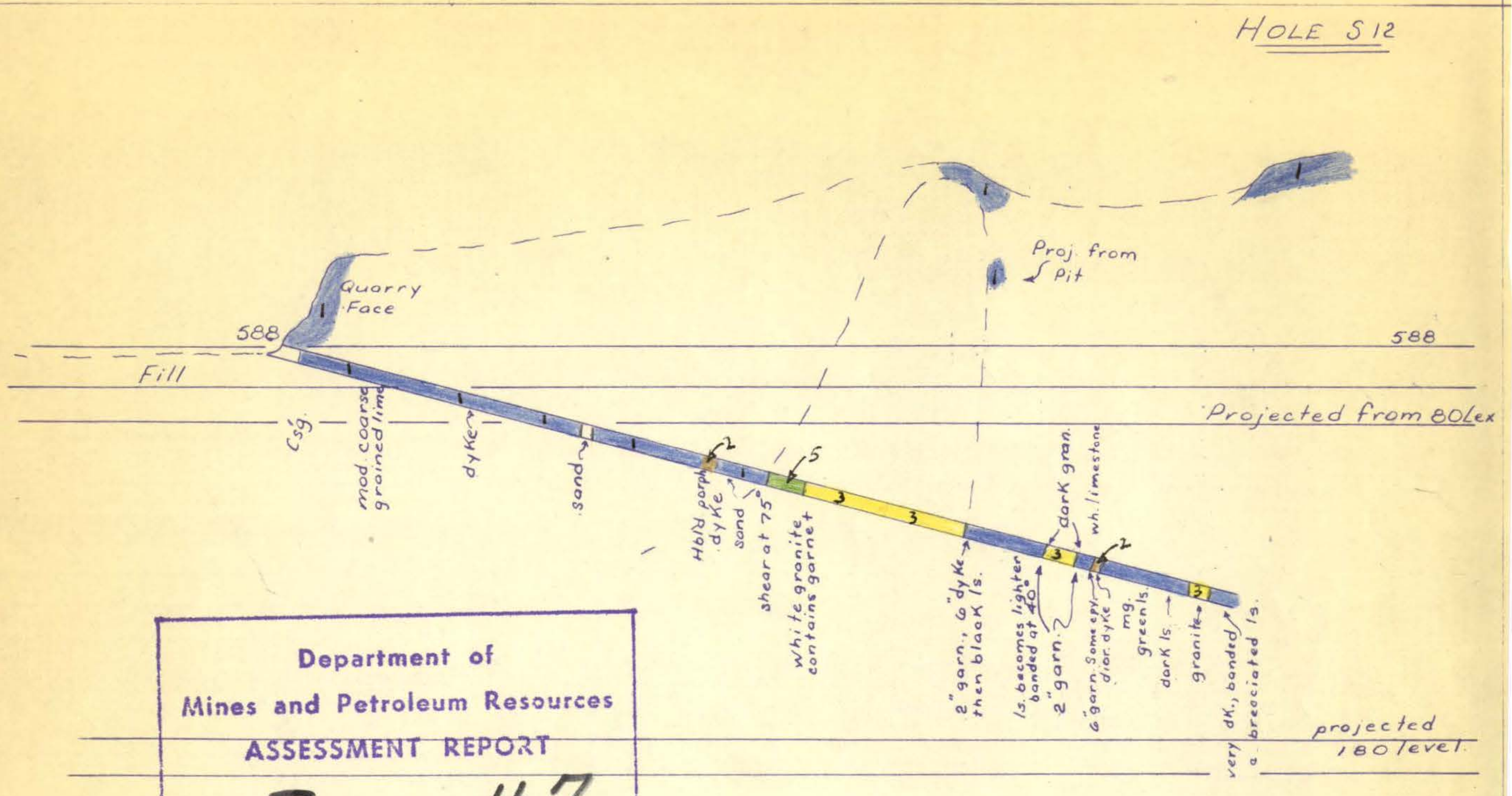
HOLE # 12 - SURFACE

Lat:	9965	Bearing:	S 26° E
Dept:	10,767	Angle:	15° down
Elev:	588	Depth:	250 ft.

0	-	6	Casing
6	-	42	Moderately coarse lime
42	-	54	White lime with gray banding.
	54		Few inches of dyke.
54	-	87	Moderately coarse limestone
87	-	90	Sand seam
90	-	123.5	Limestone
123.5	-	128	Hornblende porphyry dyke with some granite seams. Considerable pyrite.
128	-	130	Sand seam.
130	-	141	Banded white and dark limestone.
141	-	143	Dark serpentinous slightly sheared limestone. Contains much fine pyrite. Shearing at steep angle.
143	-	143.5	Small pyritic greenstone dyke.
143.5	-	154.5	White granite with some inclusions of garnet.
154.5	-	202	Normal gray granite.
202	-	203.5	Two inches of garnetite, followed by six inches of gray dyke or hornfels, then very black banded lime.
203.5	-	224.5	Light gray medium - grained limestone.
224.5	-	234.5	Rather dark dioritic granite. Begins with two inches of garnetite carrying a little chalcopyrite.
234.5	-	238	Three inches of garnetite then coarse white limestone.
238	-	238.5	Garnetite band crossing at 45°. Has pyrite and a little chalcopyrite.

HOLE #12 - SURFACE (Cont.)

238.5	-	239.5	Light granite.
239.5	-	241	Dark diorite with stringers of granite, and some alteration to garnetite.
241	-	257.5	Green serpentine limestone. Begins with contact at 40°.
257.5	-	267	Dark irregularly banded limestone with considerable disseminated pyrite.
267	-	274	Granite.
274	-	280	Banded, very black limestone.



HOLE S12
Quarry Face
588
588
Fill
Proj. from Pit
Projected from 80Lex
Csg.
mod. coarse grained lime
dyke
sand
Hbl'd porph. dyke
sand
shear at 75°
white granite contains garnet
2" garn., 6" dyke then black ls.
ls. becomes lighter banded at 40°
2" garn.
dark gran.
wh. limestone
6" garn. Some epy. dior. dyke
mg. green ls.
dark ls.
granite
very dk., banded a breciated ls.
projected 180 level.

HOLE S # 13

Lat:	10,059	Bearing:	S 86 W
Dept:	10,643	Angle:	Flat
Elev:	585	Depth:	43'

0	-	3	Diorite dyke
3	-	6	Granite
6	-	17	5 ft. core lost. Fine grained black diorite dyke.
17	-	21.8"	Light brown skarn with patches of free calcite and epidote. Fairly well mineralized with chalcopyrite.
			Sample: 37687 - 0.06 Au. 2.00 Cu.
21.8	-	27.5	Diorite dyke. Partly altered and skarny.
27.5	-	29	Granite.
29	-	40	Diorite
40	-	42.5	Diorite.
42.5	-	43	Coarse white lime

HOLE S #14

Lat:	10,046	Bearing:	S 89W
Dept.	10,040	Angle:	Flat
Elev:	585	Depth:	73'

0	-	9	Medium grained limestone.
9	-	18	Black hornblend porphyry
18	-	21	White limestone
21	-	21'3"	Skarny diorite
21'3"	-	21'9	Diorite
21'9	-	22'7	Light green skarn with chalcopyrite Sample: Alternating skarn and diorite
24	-	28.5	Garnetite with some wollastonite. Fair copper min.

Sample:	Au	Cu
37686	.07	3.0

28.5	-	32.5	Black diorite with some chalcopyrite - Garnet stringers.
32.5	-	33	Granite
33	-	44.5	Black diorite. Some chalcopyrite Ucinlets.
44.5	-	73	Limestone.

HOLE #15 - SURFACE

Lat:	10,047	Bearing:	S 89 W
Dept:	10,642	Angle:	24° down
Elev:	587 ft.	Depth:	51 ft.

0	-	4.5	Casing
4.5	-	6	White limestone
6	-	6'8"	Garnetite well mineralized with chalcopyrite
6'8"	-	24.5	Black dyke, partly granitized.
24.5	-	26	Quartz diorite with very diffused.
26	-	28	Partly granitized dyke with pyrrhotite and a little chalcopyrite.
28	-	39.5	Black diorite dyke. Altered and pyritic.
39.5	-	51	Limestone.

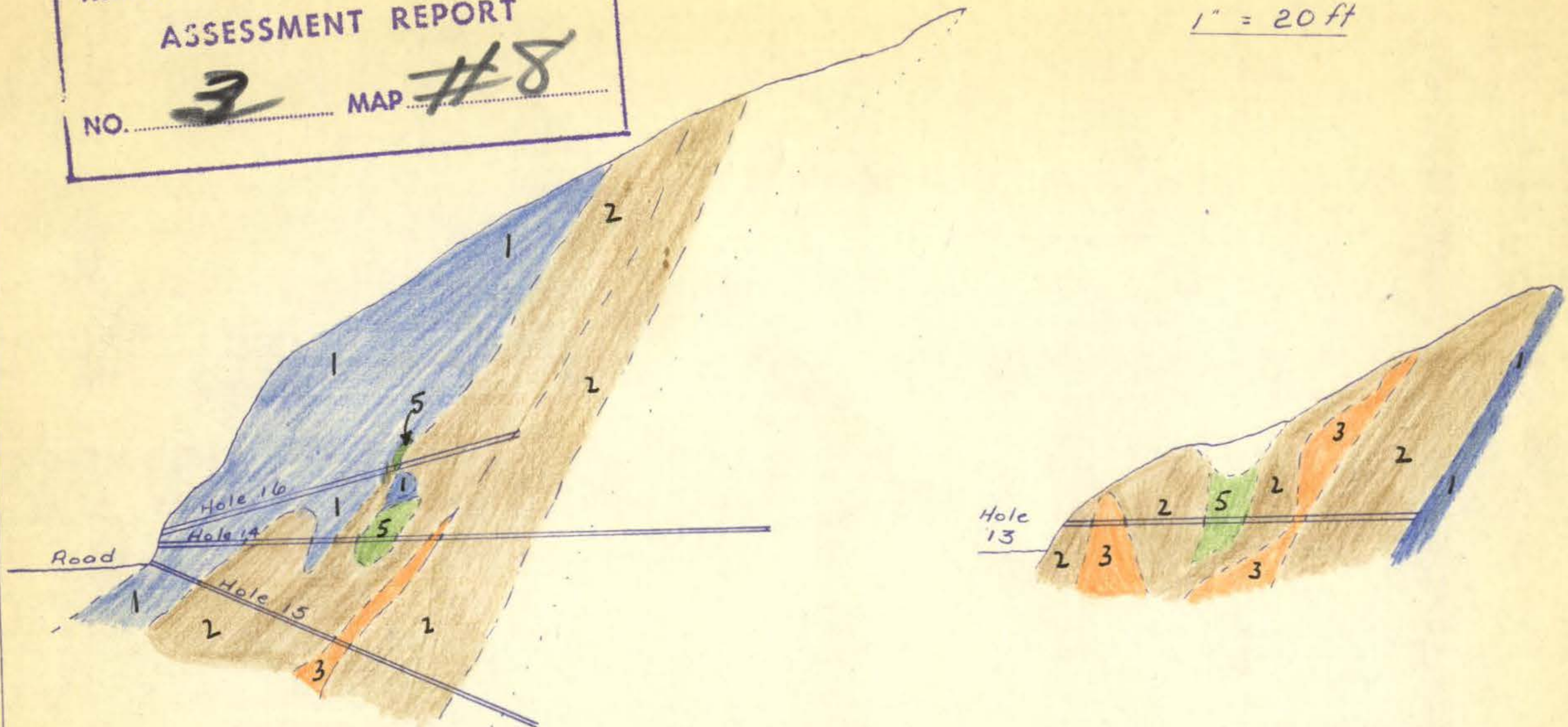
HOLE #16 - SURFACE

Lat:	10,047	Bearing:	S 89° W
Dept:	10,640	Angle:	14° up
Elev:	584 ft.	Depth:	44 ft.

0	-	28	Limestone
28	-	28.5	Skarn and chalcopyrite
28.5	-	29.5	Dyke
2 inches limestone?			
	-	35	Dyke
35	-		Two feet cave
35	-	44	Dyke

HOLES 13-16

1" = 20 ft

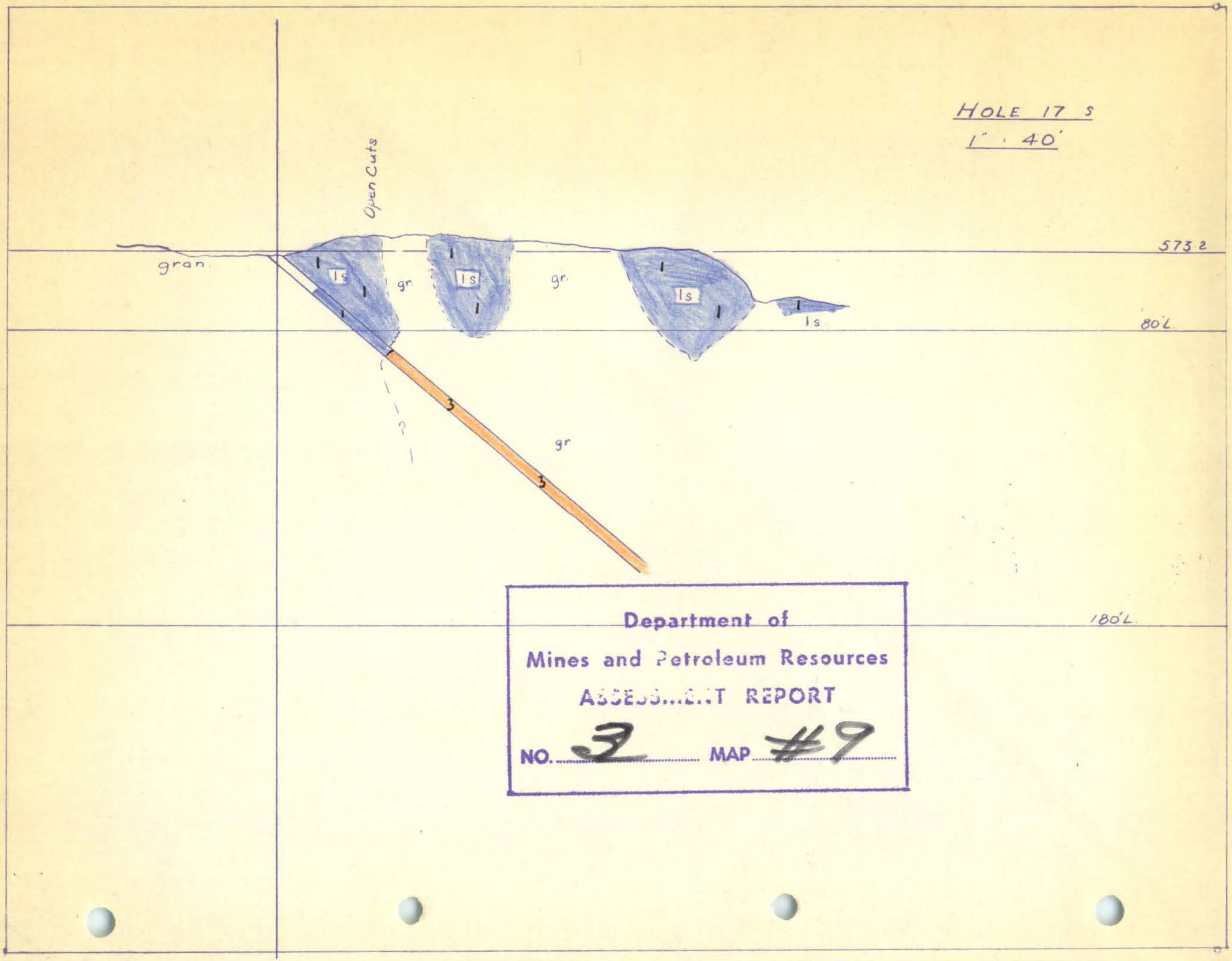


				Au	Cu
Hole 15	6'-7'	1'	37685	.05	8.9%
14	24-28.5'	-3' core	37686	.07	3.0%
13	17.2-21.7	4½	37687	.06	2.0%
14	Not Assayed				

HOLE #17 - SURFACE

Lat:	9763	Bearing:	N 31° 30'W
Dept:	10,948	Angle:	40° down
Elev:	573.2	Depth:	165 ft.

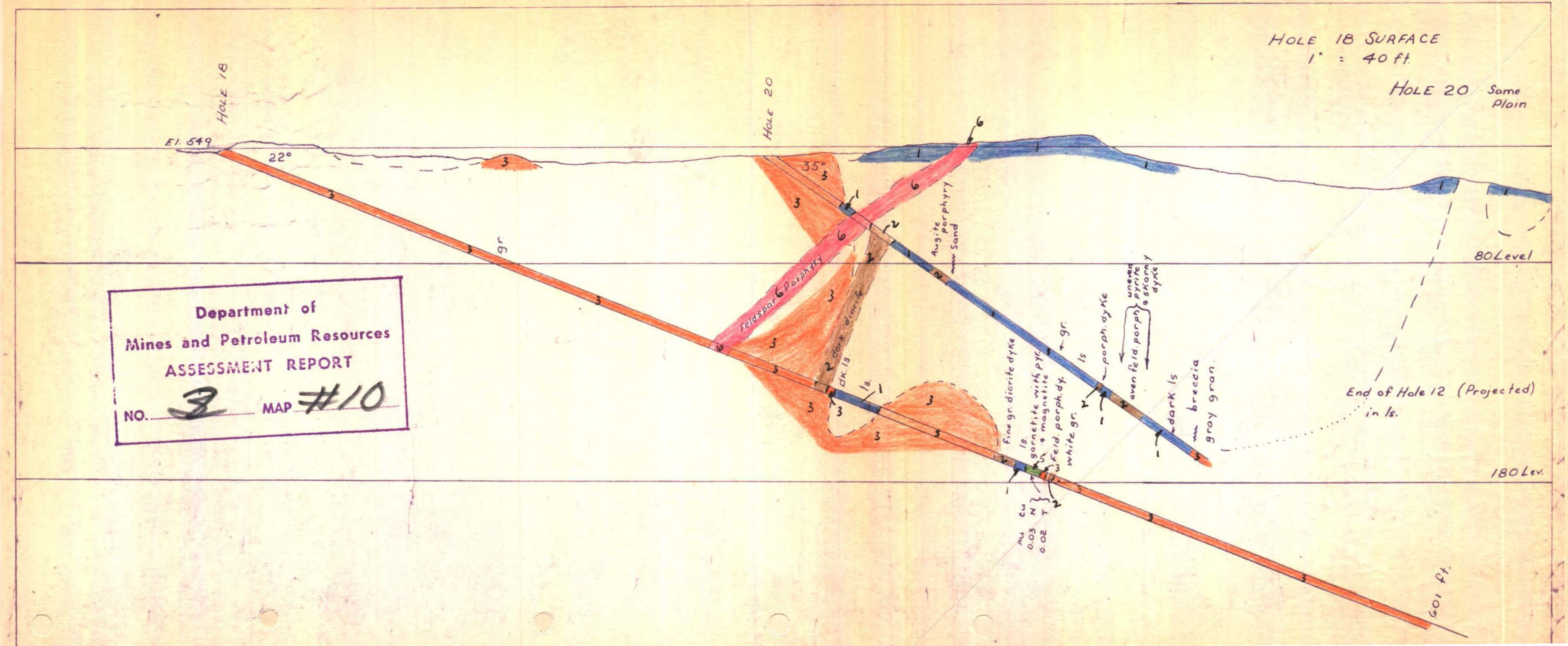
0	-	19	Casing
19	-	49	Medium gray limestone
49	-	50.5	White, coarse, crumbled limestone.
50.5	-	51	Light brown garnetite. Barren
51	-	165	Gray granite - unaltered.


HOLE 17 S
1" : 40'
Open Cuts
gran.
ls
gr.
ls
gr.
ls
ls
573.2
80'L.
3
?
gr
3
180'L.

HOLE #18 - SURFACE

Lat:	9249	Bearing:	N 15W
Dept.	11,062	Angle:	22^{o} down
Elev:	549	Depth:	601 ft.

0	-	241	Gray granite. Deeply weathered and sandy in many places.
241	-	251	Fresh feldspar and hornblende porphyry dyke.
251	-	294	Granite
294	-	301	Dark diorite porphyry dyke
301	-	302.5	Granite
302.5	-	310	Dark medium grained limestone.
	310		Few inches of felsite dyke with pyrite.
310	-	324	Coarse white limestone.
324	-	383.5	Granite
383.5	-	394	Black diorite dyke. At 384.5 a slip crosses at 30^{o} and following this 9 ft. of core is lost.
394	-	398	Limestone. White, moderately coarse.
398	-	402	Granular brown garnetite. Mineralized with pyrite, magnetite, and a little cholcopyrite. Starts with a sharp contact at 30^{o}.
			<u>Sample:</u> 37694 - 4 ft. 0.03 Au Nil Cu
402	-	407	Garnetite with much magnetite. Slip planes through this at 65 - 70^{o} angle. Small amount of chalcopyrite.
			<u>Sample:</u> 37695 - 5 ft. .02 Au Tr. Cu
407	-	409.5	Dark gray feldspar porphyry dyke.
309.5	-	412.5	Skarny felsite dyke. Some streaks of chalcopyrite and magnetite.
412.5	-	418	Granite - First few inches white.
418	-	421.5	White granite.
421.5	-	601	Gray granite 557 - 567 Slightly finer.


HOLE 18 SURFACE
1" = 40 ft.
HOLE 20 Same Plain
HOLE 18
HOLE 20
El. 549
22°
35°
80 Level
180 Lev.
Feldspar 6 Porphyry
dark diorite
dk. ls.
Augite Porphyry Sand
porph. dyke
uneven feld. porph.
pyrite & skarny dyke
dark ls
breccia
gray gran.
fine gr. diorite dyke
garnetite with pyr. & magnetite
feld. porph. dy.
white gr.
Au 0.03 0.02
Cu N T
End of Hole 12 (Projected) in ls.
601 ft.
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3 MAP #10

HOLE # 19 - LITTLE BILLIE

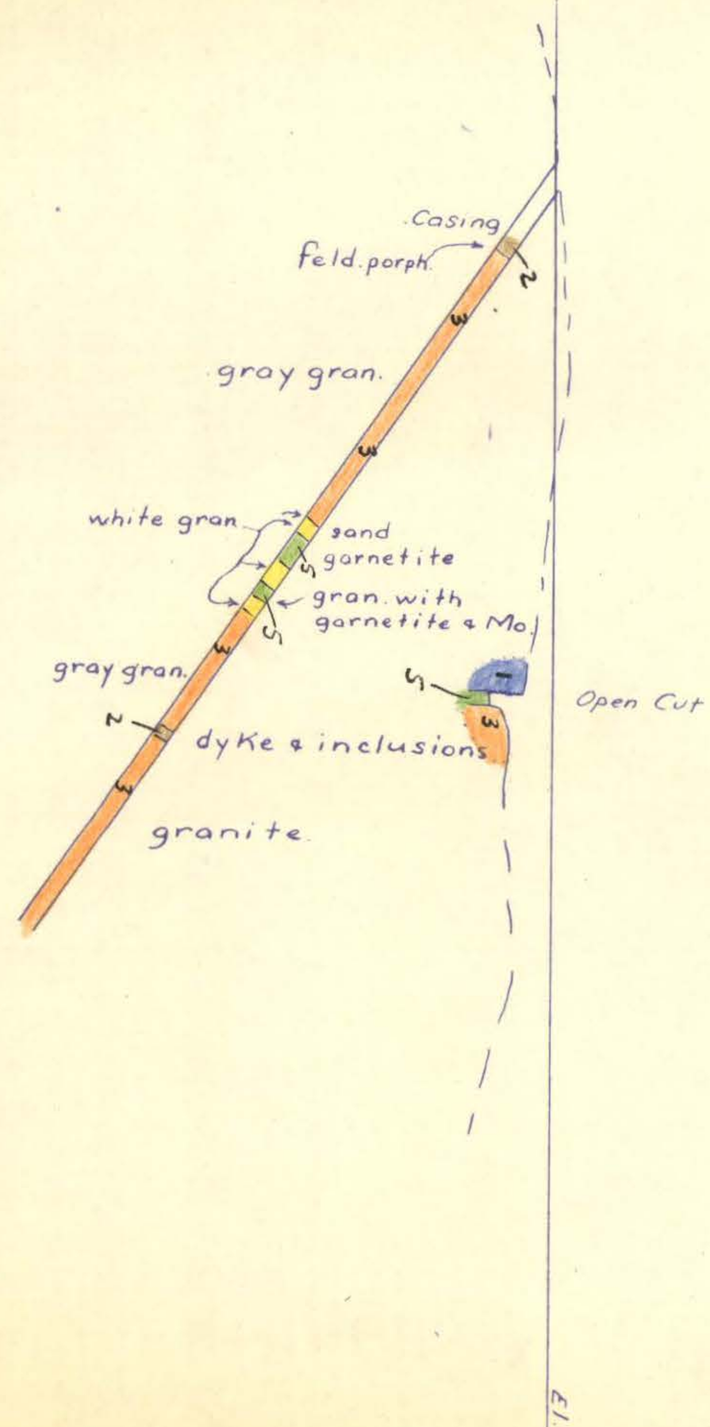
			Casing to 10'
10	-		Casing
16	-	17	Felspar hornblende porphyry dyke
16	-	60	Granite
60	-	135	Missing
135	-	141	Mixed quartz diorite and fine grained diorite porphyry. The latter probably a border phase of quartz diorite.
141	-	153	Quartz diorite
153	-	154	White granite
154	-	188	Granite

HOLE #19 - SURFACE

Lat:	9494	Bearing:	Due N.
Dept:	11,073	Angle:	35° down
Elev:	5654	Depth:	188 ft.

0	-	10 (16?)	Casing
16	-	17	Gray feldspar porphyry dyke
17	-	60	Gray granite - 14' core lost
60	-	84	Gray granite - 11' core lost
84	-	86	White granite
86	-	86.5	Sand
86.5	-	89	White granite
89	-	89.5	Granite altering to garnetite
89.5	-	91.5	Brown garnetite with pyrite. Occasionally grades to granite.
91.5	-	95.5	Granite locally altered to garnetite. Crossed with fractures containing pyrite.
95.5	-	102	White granite
102	-	105	Dark granite with pale brown garnets of large size and some clusters of epidote. Some molybdenite.
105	-	110	White granite
110	-	135	Gray granite, locally inclining to white.
135	-	138	Granite with many dioritic inclusions.
138	-	141	Greenstone dyke. Probably an old pregranite dyke not entirely absorbed. Core lost 139 - 141.
141	-	188	Gray granite. 152 - 155 slightly white, and crossed by white fractures (zeolite) at steep angle. 169 - 172. Many white fractures at 30 - 35°.

HOLE 19 SURFACE
1" : 40 ft



El. 565

700' - 180 Level.

HOLE #20 - SURFACE

Lat:	9477	Bearing:	N 15W
Dept:	10999	Angle:	35°
Elev:	552 ft.	Depth:	248 ft.

0	-	34.5	Casing
34.5	-	42	Mostly sand recovered. Probably granite.
42	-	48	Limestone.
48	-	71	Dyke
71	-	87.5	Limestone, gray porphyritic
87.5	-	93	Augite porphyry dyke
93	-	102.6	Limestone
102.6	-		Sand seam
102.6	-	127	Limestone, often porphyritic
127	-	128	Greenstone dyke
128	-	146.5	Limestone. Medium grained gray mostly, with some creamy sections.
146.5	-	150	Augite porphyry dyke
150	-	163	Limestone
163	-	164	Greenstone dyke.
164	-	186	Limestone, mostly medium grained gray
186	-	188	Slightly porphyritic dyke (feldspar)
188	-	192.5	Medium grained gray limestone.
192.5	-	211	Dyke. To 199 ft, an irregular textured porphyry with much disseminated pyrite. Slightly skarny. 199 - 206 Fairly regular dark feldspar porphyry. 206 - 211 skarny pyritic dyke, as 192 - 199 ft.
211	-	226	Moderately coarse grained limestone.

HOLE #20 - Cont.

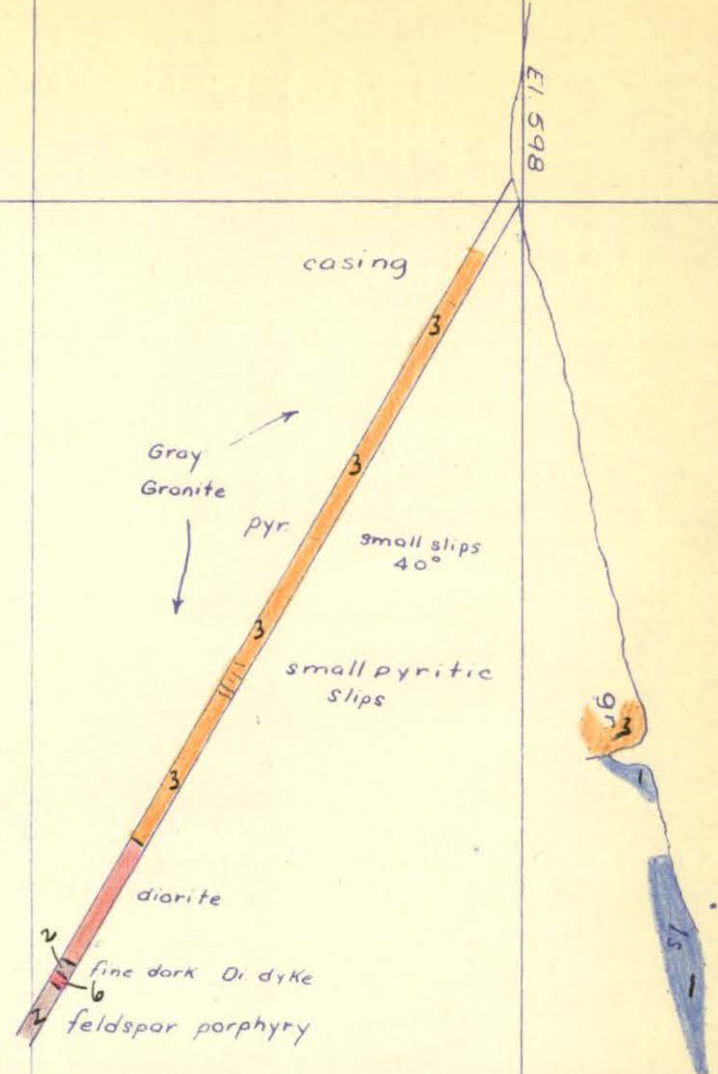
226	-	228	Dark coarse limestone.
228	-	238	Coarse grained gray limestone.
238	-	238.4	Dark (carbonaceous) banding at 30°. Then a few inches of breccia of granite fragments in calcite.
238.4	-	248	Gray granite.

<u>HOLE # 21</u>

Lat:	9537	Bearing:	Due East
Dept:	11862	Angle:	30° down
Elev:	598 ft.	Depth:	203 '

0	-	26	Casing
26	-	156	Gray granite. 26 - 65 (10' lost) 83 ft. - thin fault slip with pyrite at 40°. 113 - 121 - Numerous pyritic slips Gradational contact to a dark feldspathic diorite. More like a large inclusion than a dyke.
156	-	185	Diorite as described. 160 - 167. much epidote alteration.
185	-	187	Fine grained dark diorite intrusive.
187	-	190.5	Diorite as described, highly altered with epidote.
190.5	-	203	Fresh gray feldspar porphyry.

HOLE 21 - S

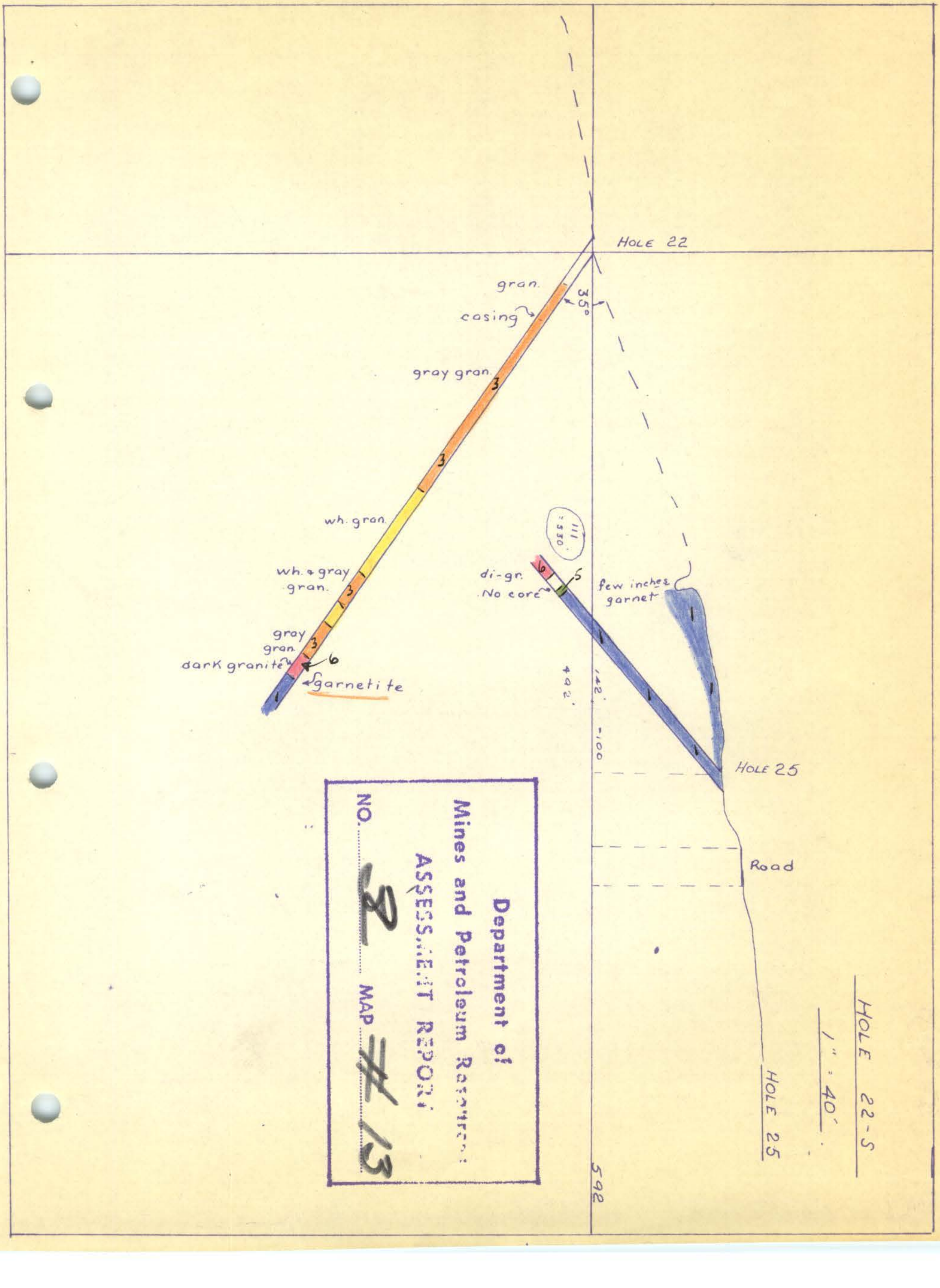


El. 598
casing
Gray
Granite
pyr.
small slips
40°
small pyritic
Slips
diorite
fine dark Di. dyke
feldspar porphyry

HOLE # 22

Lat:	9536	Bearing:	S 63° E.
Dept.	11862	Angle:	35° down
Elev:	592	Depth:	186 .5'

0	-	28	Casing Core from 13'
13	-	98	Gray granite. 28' lost. 45.5 to 46.5. Irregular low angled fracture with considerable pyrite.
98	-	132	White granite.
132	-	145	Alternating gray to white granite.
145	-	153	White Granite
153	-	166.5	Gray granite partially altered to white.
166.5	-	174	Varied. Diorite medium phase of granite.
174	-	175.5	Medium grained green garnetite.
175.5	-	186.5	Medium to coarse grained gray limestone. First foot is banded with dark matter at 65 - 70°. Tanned garnetite to 174 - 175.


HOLE 22
gran.
casing
35°
gray gran.
3
3
wh. gran.
wh. & gray gran.
3
gray gran.
3
dark granite
6
garnetite
di-gr.
No core
6
5
few inches garnet
HOLE 25
Road
HOLE 22-S
1" = 40'
HOLE 25
592

LITTLE BILLIE

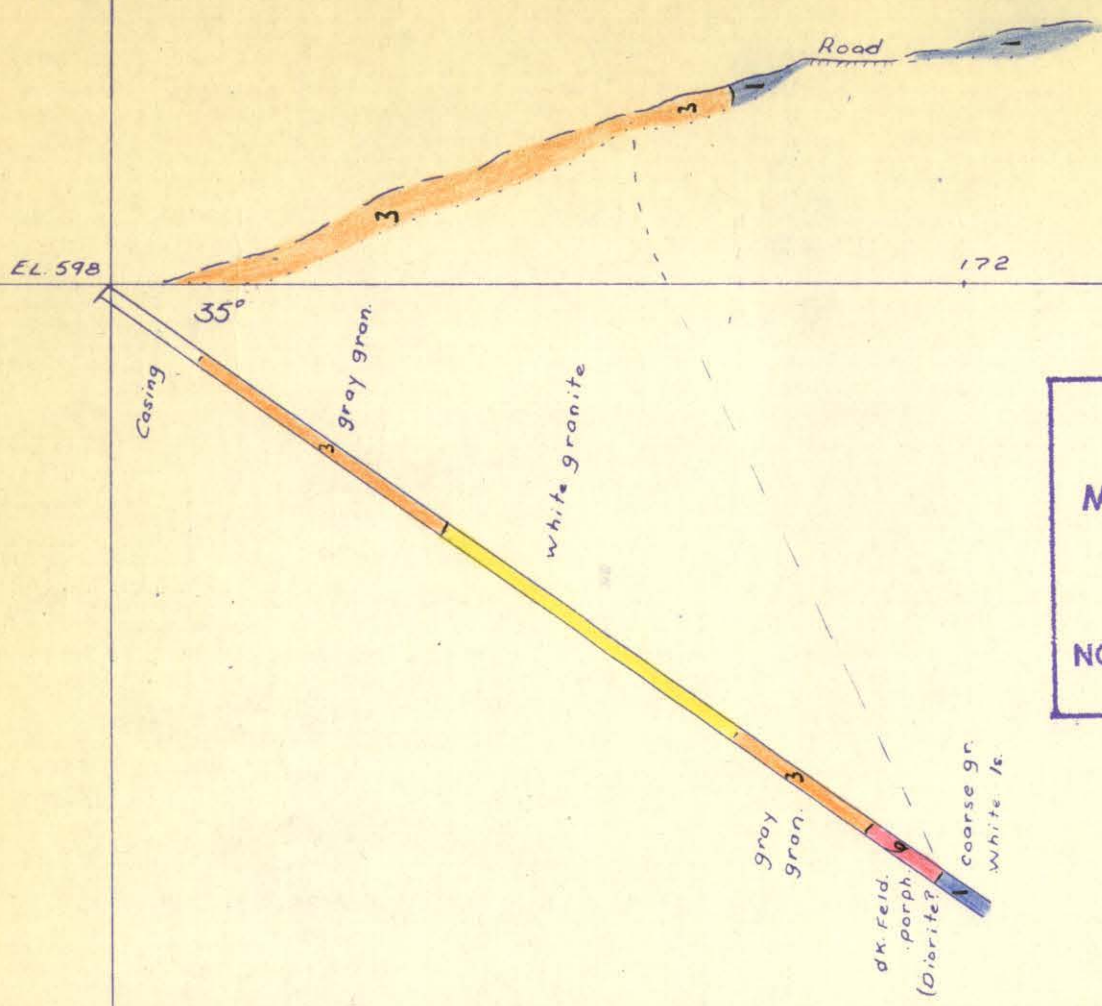
HOLE # 23 - SURFACE

Lat:	9533	Bearing:	S 48 E
Dept:	11864	Angle:	35° down
Elev:	553	Depth:	225 ft.

0	-	24	Casing
9	-	87	Gray granite
87	-	161	White granite
161	-	195	Gray granite
195	-	213	Dark gray feldspar porphyry, rather coarse, and may be a phase of granite rather than a dyke.
213	-	225	Coarse-grained white limestone.

HOLE 23 S

1" = 40'


EL. 598
172
Road
3
1
35°
Casing
gray gran.
white granite
gray gran.
dk. Feld. porph. (Diorite?
coarse gr. White ls.
6

HOLE #24 - SURFACE

Lat:	9477	Bearing:	N 12° E
Dept.	10998	Angle:	35° down
Elev:	552	Depth:	250 ft.

0	-	41	Casing
41	-	42	Gray granite
42	-	55	Fresh gray feldspar porphyry
55	-	69	Gray granite.
69	-	74	Sand. Probably granite.
74	-	75	Feldspar porphyry dyke
75	-	113	Limestone. Mostly medium grained light gray.
113	-	119.5	Dark diorite porphyry dyke.
119.5	-	163	Limestone. Coarse to 125 ft.
163	-	173.5	Coarse dark, feldspar and hornblende porphyry.
173.5	-	219.5	Varied, mostly medium grained gray limestone.
219.5	-	220.5	Garnetite and much magnetite in limestone.
220.5	-	224	Medium grained gray limestone.
224	-	230.5	Garnetite. Some chalcopyrite in the first few feet, considerable pyrite and much magnetite.
(230.5	-	237)	Sample: E 209 223.5 - 225.5
			Sample: E 210 225.5 - 230.5
230.5	-	237	Fine grained greenstone dyke. Very broken up at lower end.
237	-	238	Mud seam.
238	-	250	Granite. Mostly white.

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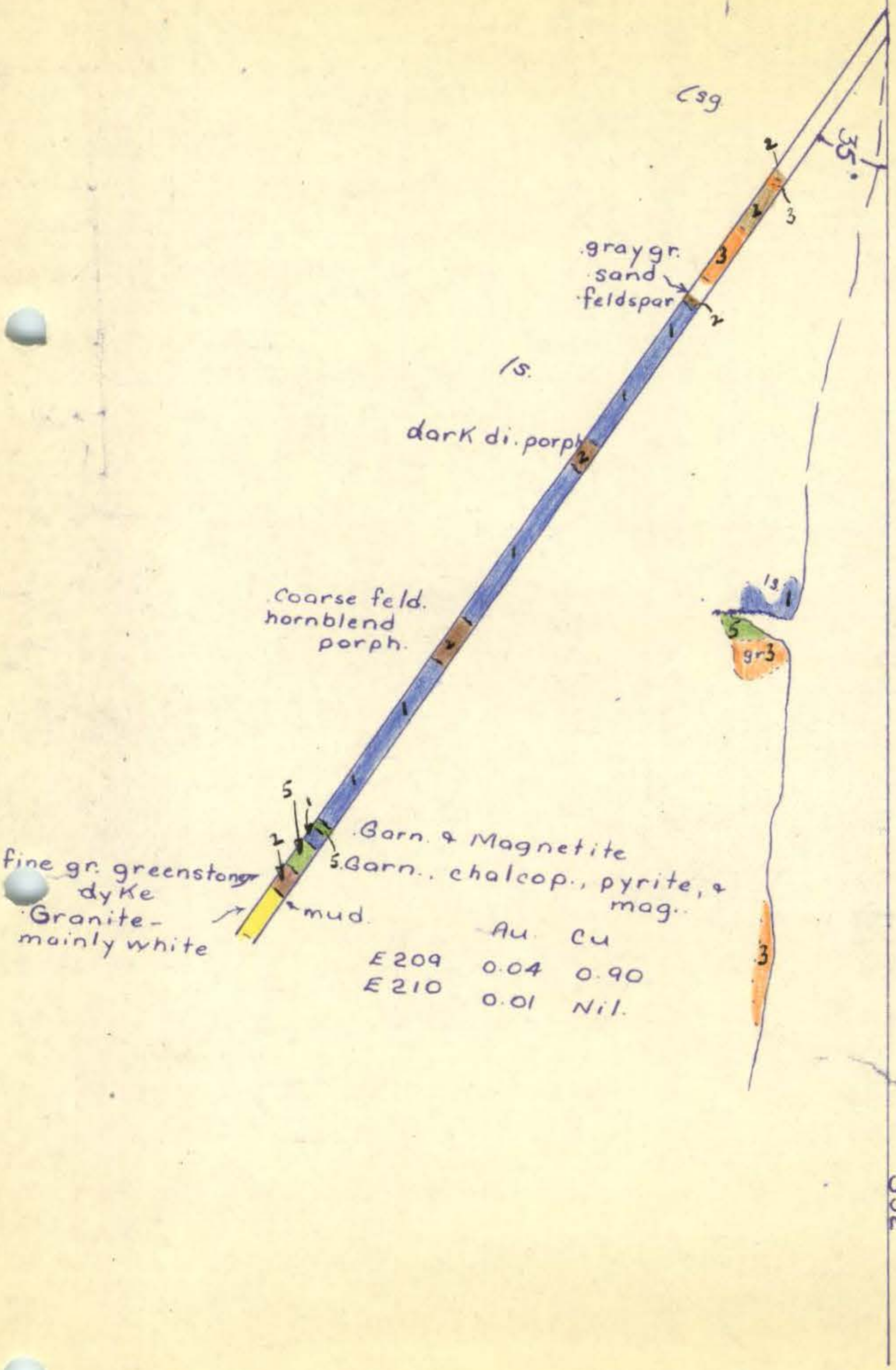
ASSESSMENT REPORT
NO. 2 MAP #15

HOLE 24
1" = 40'



LITTLE BILLY

HOLE #25 - SURFACE

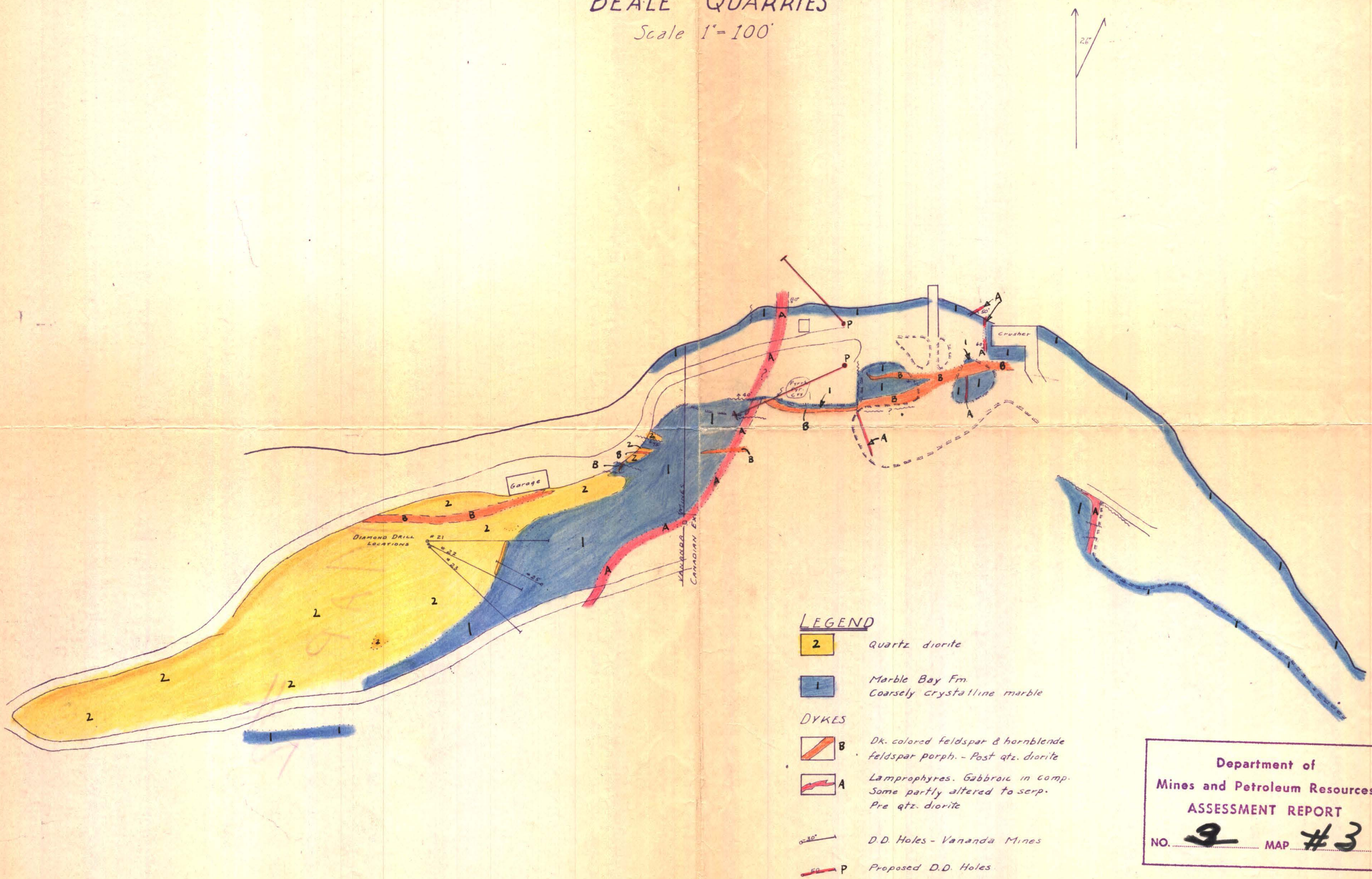
Lat:	9475	Bearing:	N	63° W
Dept:	12029	Angle:		40° down
Elev:	553.2	Depth:		97'

0	-	12	Casing
12	-	14.5	Dark dyke with diffused feldspar phenocrysts.
14.5	-	54	Mostly coarse grained gray and white limestone.
54	-	55	Fine grained dark pyritic dyke
55	-	83.5	Limestone, mostly coarse grained white.
83.5	-	84	Few inches of garnetite mineralized with pyrite and mud.
84	-	89	Five feet of core lost - mud.
89	-	97	Feldspathic dark rock. Probably a phase of the granite.

VANANDA MINES & LYONS GROUP
TEXADA IS., B.C.
STURT BAY
MARBLE BAY
VANANDA BAY
MALASPINA STRAIT
Gillies Bay
Charles Dickens
Little Billie Mine
Marble Bay Mine
Copper Queen Mine
Cornell Mine
Florence
Security
Hazel Ruth
To Raven Bay
See detailed map of Quarry
Approximate Position of Vananda Syncline (After McNaughton)
LEGEND
small nos Heavy Colour - Mapped outcrops
large nos Light Colour - Approx. known distribution
Quartz Diorite 4
Diorite + D. porph. Stocks 3a
Porphyrite Group 1
Marble Bay Limestone 2
Dykes (A) A (B) B (C) C
Coarse - + 0.1"
Medium .01" to 0.1"
Fine - Amorph.
C.M. Alteration
Partial Rplct + Silicificat.
Complete Rplct. (Garnetite) 5
Pyrite in Dykes
Mineralization (Cu, Fe etc)
DYKES
(A) Light coloured, non porph., pyritic. Erratic, discontinuous. Same age or younger than (B) Probably equiv. of Qtz. Dior.
(B) Dark porph. & non porph. Pyritic. Erratic. Probably related to diorite stocks.
(C) Feld. porph. - Several types + ages. Some related to porph. group others to A + B
Shaft
Open Cut
Geological Boundary
Limit of continuous otcs.
Trail
Attitude on Bedding
Attitude on Shearing
Roads
Railroad grade
Swamp
Geology by C. Ney. - Pioneer Gold Mines Ltd.
LEGEND
JURASSIC
TRIASSIC
4 Quartz diorite
3 Diorite & gabbro
2 MARBLE BAY FM. Limestone
1 TEXADA FM. Flows, tuffs & agglomerates
A Feldspar porph. & hornblende feldspar porph. Post qtz. dior. in part.
? Lamprophyres. Dioritic to gabbroic in composition. Older than qtz. dior. Some related to Triassic volcanics; others to Jurassic diorite intrusives.
Fault
Geological boundary - located, approximate, assumed
Approximate limits of zones of maximum alteration of limestones on Lyon's Group
Geology by D.A. McNaughton
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3 MAP #2

BEALE QUARRIES

Scale 1" = 100'



Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 9 MAP #3


LEGEND
Late Dykes - Feldspar-Porphyry 6
Skarn and Ore 5
Granite-Porphyry 4
Granite 3
Diorite Porphyry Dykes 2
Limestone 1
80 Lev. El. 600'
180 Lev. 700'
280 Lev. 800'
480 Lev. 1000'
Open Cuts
Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3 MAP #4
LITTLE BILLY MINE
SURFACE PLAN
Scale: 1" = 40'
May 20 '46
Contours at 5' increasing downward
Datum BM at Shaft Collar = 530 ft.
REPORT #3
MAP #4