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ECSTALL RIVER MINE

Reports, Etc.

VOL I

N.T.S: 103H/13E Deposit No: 23

U.T.M: METALS: Fe; Zn, Cu, Ag, Au

Lat - Long. : 53°50.7' 129°31.1' PROPERTY: Ecstall

References: MMAR 1917, p 45; 1918, p 47; 1920, p 40; 1923, p 46; Ecstall
1952, pp 81-84 & fig 2; 1957, p 9; 1958, p 7; "
1966, p 54; "
MMAR 1938, p B28; 1939, p 100; 1940, p 86 Northern Pyrites
NMI 103H/13 Pyr. 1 Ecstall
MRD Corp Files: "B. C. Pyrites Co. Ltd."; "Northern Pyrites Ltd.";
"Ecstall Mining Co. Ltd."
Mines Br., Ottawa, 1952, Memorandum Series #118, p 78
Mines Br., Ottawa, 1948, Invest Rept #2297
Mines Br., Ottawa, 1912, Rept #167, p 86
MRD Metals File: MR-Cu-301.00
Engineering & Mining Journal, June 11, 1957, "Ecstoll - A Mine of the Future,"
H. J. C. McDonald Project 290

1917, p. 45

ECSTALL RIVER.

About twenty-five miles up from the mouth of the Ecstall river, a tributary of the Skeena flowing into it at Port Essington, is an immense deposit of iron pyrites which has been held by Victoria interests for the past twenty years. Work was commenced on it at the time of its discovery, and to facilitate the transportation of the ore two surface trams were built, one from the tunnel to a bin at the camp, and another, three-rail, from the camp to the river, about 1,700 feet. I believe that several tons were shipped at that time to the chemical-works for the manufacture of sulphuric acid.

The deposit consists of a mass of pyrite lying in a schist formation enclosed in the granodiorites, the schist-belt being about a mile wide crossing the river. The ore-body conforms to the general strike and dip of the schist, and varies in width from 20 feet in the tunnel to 300 feet on the upper end of the showing. The old work consisted of a crosscut tunnel 100 feet in length and drifts 20 feet each way from it on the ore.

The property was bonded late in 1916 by Mr. Hinman, of New York, who did 750 feet of diamond-drilling in the ore-body early in 1917. The first hole was put down just up the creek from the mouth of the tunnel. It was 86 feet on an incline of 55 degrees, encountering the ore at 50 feet and continuing in it for 15 feet. This proves the ore about 50 feet below the tunnel-level. The second hole is about 200 feet above the falls, at an elevation of 475 feet above sea-level, and is 275 feet deep at an angle of 15 degrees. It struck the ore at 75 feet and was in it for the remainder of the hole. The third hole is about 300 feet farther up the creek from the second, is about 400 feet deep at an angle of 35 or 40 degrees, and is ore all the way. No definite assays are available, but I am informed that the total cores averaged about 1.75 per cent. copper and less than $1 a ton in gold and silver. I understand that the property is under bond to the Granby Company, who will diamond-drill it in the spring.

Another group of claims was staked during the summer across the Ecstall river from the above property. No work has been done on them as yet; the surface shows a strong mineralization of pyrite for a width of 20 feet.

Pyrite-Zinc-Copper

1951, pp. 81-84

Ecstall (Sulgas Properties Ltd.)

(53° 129° N.W.) Sulgas Properties Ltd. is a private company, incorporated in 1951. Company office, 744 West Hastings Street, Vancouver. Directors: F. W. Guernsey, Vancouver; R. D. Mollison, H. R. Brainerd, B. G. Bedichek, all of New York. Capital: 2,000 shares, $100 per share. The Ecstall property consists of twenty-one Crown-granted claims and fractional claims which extend across the Ecstall River at a point 30 miles above its confluence with the Skeena River. The property is 45 miles southeast of Prince Rupert.

Large pyritic deposits on the Bluestone and Bell Helen claims have been investigated intermittently during the past fifty years. These two claims and the Red Bluff and Red Gulch comprise the original group located in 1900. In that year the property was purchased by Victoria interests and the British Columbia Pyrites Company Limited was formed. This company spent two years investigating the deposits by tunnels and drill-holes. A small shipment of pyritic material to the Victoria Chemical Works contained 45 per cent sulphur.

The property was idle from 1903 until 1917, when The Granby Mining Smelting and Power Company Limited, with a new smelter at Anyox, 110 miles north, took an option on the ground. Granby drilled the deposits in 1918 and 1919 and then dropped the option; a second option was obtained in 1923 but, after additional drilling, this, too, was dropped and the property reverted to the Victoria owners.

In 1937 the property was acquired by American interests represented by F. W. Guernsey, Vancouver. In that year Northern Pyrites Ltd. was formed and some diamond drilling was done to check the results of previous drilling. In 1938 underground development was begun, and by 1940 the new workings consisted of a 9- by 8-foot adit 2,780 feet long, seven crosscuts totalling 725 feet in length, and a 600-foot raise to surface.

No further work was done on the property until the summer of 1952, when the present company, which represents the same interests as did Northern Pyrites Ltd., engaged in a vigorous programme of further exploratory work. This included 1,378 feet of surface drilling, 8,880 feet of underground drilling, and geological reconnaissance of a considerable area surrounding the ore occurrences. In addition, geophysicists, using

* By W. R. Bacon.

a new low-frequency electromagnetic method, carried out experiments in the immediate vicinity of the known deposits.

The Ecstall River traverses an exceedingly rugged part of the Coast Range. Throughout much of its length the river has a low gradient and is shallow, flowing over and around innumerable sandbars. Tides are effective to the western boundary of the property, and at high tide boats of shallow draught, such as the average salmon troller, can reach the landing constructed at this point. From the landing an old tramway, 2,250 feet long, leads directly to the adit and mine buildings on the Red Gulch claim.

The deposits are in the canyon of Red Gulch Creek, a stream that flows due south into Ecstall River. Their regional setting is a northerly trending remnant of metamorphic rocks intruded by granitic rocks of the Coast Range. The metamorphic rocks occur on either side of the river and have been traced for 6 miles in a north-south direction. The remnant is 3 miles wide at the Ecstall River.

On the eastern slope of Red Gulch Creek good exposures of bedrock occur in half a dozen narrow gashes cut by intermittent tributary streams. The main rock type is a dark greyish-green, carbonatized chlorite-biotite schist in which there are bands of arenaceous limestone, quartzite, and dark-grey argillite. Sparse outcrops of chlorite-biotite schist occur immediately west of Red Gulch Creek.

The rocks in Red Gulch Creek are distinct from those that flank it. They form a band that has a maximum width of approximately 600 feet. These rocks are, at least in part, metamorphosed sediments consisting of quartz-biotite-chlorite schists, quartz-hornblende-chlorite schists, quartzite grading to quartz-mica schist, minor black argillite, and a granitic gneiss.

As shown in Figure 2, the granitic gneiss occurs in a band east of the deposits. This rock is called a granitic gneiss rather than a gneissic granite because certain facts suggest that it is a metamorphic rock. Two specimens examined petrographically consist of abundant quartz, biotite, plagioclase, muscovite, chlorite, clinozoisite, and minor carbonate and pyrite. The alignment of the micas and chlorite is strong, and the quartz grains are elongate parallel to the foliation. Plagioclase comprises less than 20 per cent of the rock or about one-third the normal content of Coast Range granodiorite. This and the lack of igneous texture is considered evidence that the gneissic band is probably of sedimentary origin and not a sill. For comparative purposes, a specimen of the Coast intrusives was obtained from a point just east of the eastern border of the metamorphic remnant. Although strongly gneissic, it is quite distinct from the rock described above. It is a granophyric rock composed of abundant andesine, hornblende, biotite, quartz, and minor potash feldspar.

In the vicinity of the deposits the rocks strike northward and dip eastward at 80 degrees or more. The secondary foliation is parallel to the bedding.

The deposits are massive sulphide replacements. The two main deposits are known as the North lens and the South lens, but, with the exception of the northern part of the North lens, these bodies are more tabular than lenticular. The mineralization consists of medium to coarse pyrite, minor sphalerite and chalcopyrite, and minute amounts of pyrrhotite and galena. Because of the granular nature of the pyrite, the mineralized outcrops tend to disintegrate readily.

The in echelon relationship of the North and South lenses is evident at the surface (*see* Fig. 2) and in the underground workings. These bodies conform to the attitude of the enclosing sediments and are relatively complete replacements of certain favourable beds. Although the nature of the replaced rock is not definitely known, three blocks of quartzite were noted within the northernmost exposures of the North lens.

The possibility that the two bodies occur in the same stratigraphic horizon was considered and rejected. Where best exposed (in Nos. 3 and 4 crosscuts), the rock between the two bodies exhibits no evidence of a fault or tight fold.

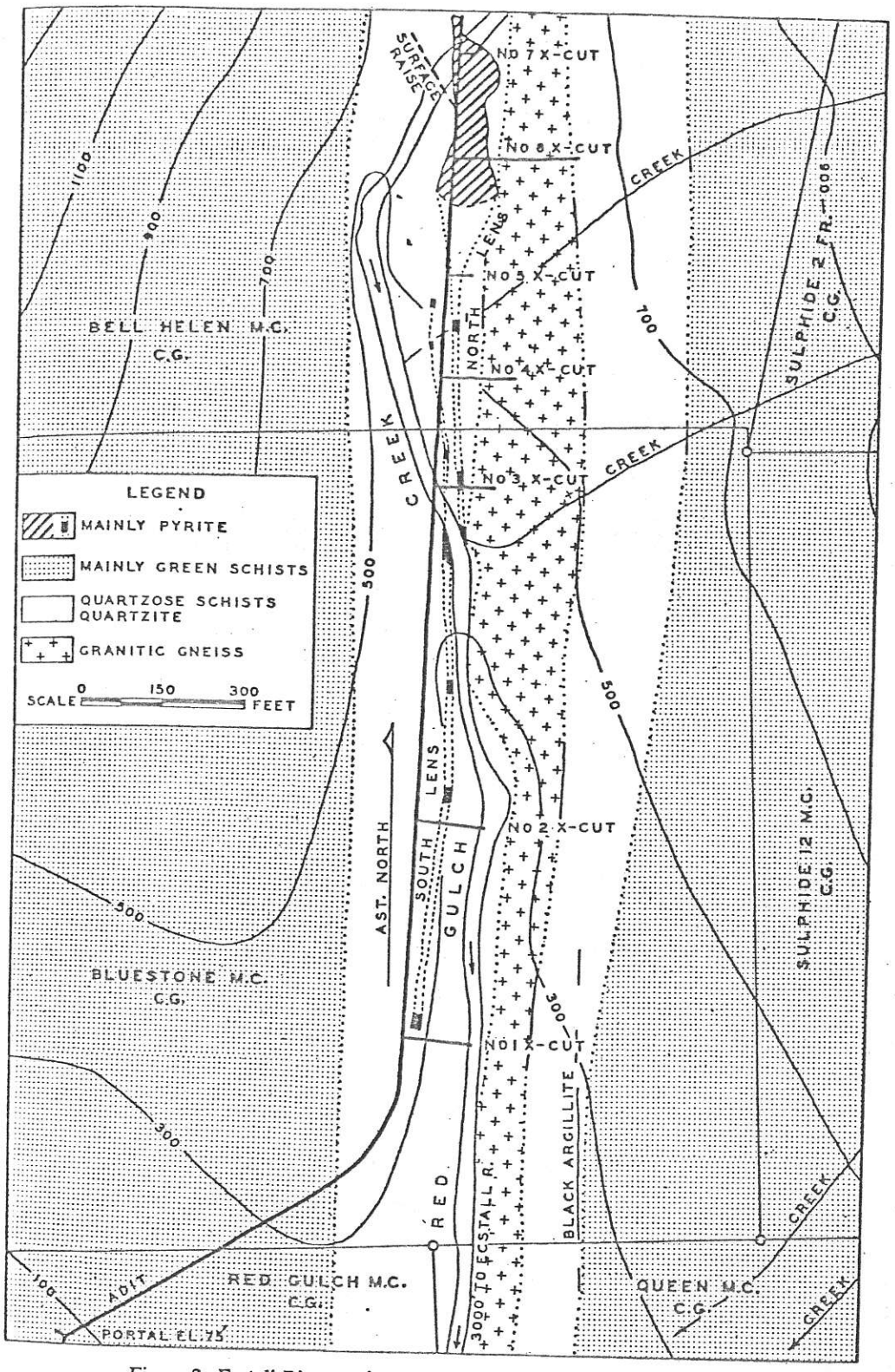

Figure 2. Ecstall River pyrite deposit—main deposit and workings.

Steeply plunging corrugations of unknown significance are not uncommon in the schistose rocks enclosing the deposits. Actual dragfolds are much less common. Dragfolds occur in the northern part of the North lens, where, in places, they can be traced in spite of the massive nature of the mineralization. Some are marked by thin bands of unmineralized sericite schist. These dragfolds plunge at 70 degrees in a south 35 degrees east direction and have been responsible for an appreciable thickening of the favourable horizon.

Sericite schist is found sporadically along the margins of the deposits. A band of this schist 40 to 50 feet wide can be traced northward from the North lens for more than 3,500 feet and is believed to have resulted from strong shearing along an argillaceous horizon. The possible extension of this shear zone south of the deposits is obscured by overburden.

The North and South lenses are large bodies. At the surface the North lens is exposed for a length of 950 feet and has a maximum width of 120 feet. At the adit level its indicated length is 700 feet; its greatest width is in No. 6 crosscut, where 96 feet of massive sulphides is exposed. The underground workings establish 500 feet of backs at the widest part of the North lens.

At the surface the South lens is exposed for a length of 1,300 feet. For 900 feet of this length, the lens is 15 feet wide or more. At the adit level its average width is 24 feet for a length of 1,000 feet. The underground workings establish 240 feet of backs.

Drilling appears to indicate that the North lens diminishes sharply below the adit level but that the South lens continues downward for hundreds of feet. The deepest drill-hole testing the South lens intersected that body at a depth of 900 feet below sea-level.

Although a full explanation for the setting of these deposits must await further study and development, two facts are considered significant. First, the deposits are confined to a band of distinctive quartzose rocks and, second, they occur along a shear zone within these rocks. Dragfolding is locally important, having controlled the form of the northern part of the North lens, but whether it was a major factor in the localization of the deposits as a whole is not known.

A smaller untested deposit, known as the Third Outcrop, occurs on the east bank of Red Gulch Creek, 2,500 feet north of the northern end of the North lens. Here, at an elevation of 1,100 feet, massive pyrite is exposed for a length of 100 feet and a maximum width of 8 feet.

One of the main handicaps to the successful development of the property has been its location. The mine production cannot be shipped by way of the Ecstall River. It is understood that the company plans a survey to establish the best route for a road or railway from the property east to Douglas Channel. The two main deposits contain low values in silver and gold as well as economically interesting amounts of zinc and copper. The property was originally considered solely as a source of pyrite or sulphur.

The main deposits have been tested to depths far below the adit level by means of an ingenious method of drilling. Because the workings traverse little more than the stratigraphic horizon in which the deposits occur, and suitable underground locations were not available for the normal drilling of deep holes, directional drilling was employed. For example, the South lens was tested to depths as much as 975 feet below the adit by holes collared at the ends of No. 1 and No. 2 crosscuts. These holes were started in the hangingwall of the South lens and were drilled downward in an easterly direction, away from the deposit. When desired depths were approached, the holes were progressively wedged until they were drilled westward at relatively low angles. In this way intersections approximating true widths were obtained at specific depths. The Tro-Pari compass was used for determining bearings and dips in the drill-holes.

From GSC Paper 66-1 (1966)
(Part of Activities May - Oct. '65)

[2] Jones, A.G.: Vernon map-area, British Columbia; Geol. Surv. Can., Mem. 296 (1959).

[3] Hyndman, D.W.: Petrology and structure of the Nakusp map-area, B.C.; Geol. Surv. Can., Bull. (in press).

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49. COAST MOUNTAINS PROJECT

J.A. Roddick, A.J. Baer, and W.W. Hutchison

Geological mapping on a reconnaissance scale of 1 inch to 4 miles was completed in the Coast Mountains between latitudes 52° and 55°N, an area of about 20,000 square miles, which includes the following map-areas: Prince Rupert (103J), Terrace W1/2 (103I), Hecate Strait (103G), Douglas Channel (103H), Laredo Sound (103A), and Bella Coola (93D). The operation was based on the research barge 'VELELLA' provided by the Fisheries Research Board and was supported by a Bell 47G-3B1 helicopter equipped with floats.

Accuracy in determining the composition of plutonic rocks and associated gneisses was greatly improved by determining the specific gravity of the specimens collected (5,575 such determinations were made during the season). Accuracy was further improved by etching and staining of many specimens, which facilitated the estimation of quartz and potassium feldspar content. The number of specimens etched and stained was 1,877.

In addition to the normal notes, IBM cards were used to record routine field data. Two files were set up, a card-per-station file and a card-per-specimen file. Punching of the cards did not entail a great deal of extra effort (the cards can be punched more rapidly than notes can be written) and is expected to expedite information retrieval and improve control over the large collection of specimens.

The best exposures in the area are along the shore and in some cliff-faces. The exposures on the ridges are good, but in many places detailed observation is hindered by lichen. Outcrops are rare in valley bottoms and on all but the steepest of valley sides owing to the luxuriant rain forest. Although the shore exposures are best, they may be misleading, especially along northwest-trending channels, as these have commonly been cut in bands of metasedimentary rocks, associated migmatite, and diorite, whereas farther inland massive plutonic rock is commonly found.

The project area is roughly divided into northeast and southwest parts by a discontinuous central band of metasediments, which extends from the vicinity of Prince Rupert southeast along the central part of the Coast Mountains. The band trends slightly obliquely to the axis of the Coast Mountain belt crossing from the west side in the north to the east side in the south. The rocks west of the metasedimentary band consist mainly of a variety of plutonic rocks, whereas those to the east of it are characterized by abundant gneisses north of latitude 53°N. The gneisses may terminate in the south-central part of Whitesail map-area (east of Douglas Channel map-area), or may only be interrupted there and pass beneath the volcanic rocks in the northeastern part of Bella Coola map-area.

The oldest rocks in the project area are thought to be the gneisses that underlie broad areas east of the central metasedimentary band in Terrace W 1/2 and Douglas Channel map-areas. They are closely associated with metasedimentary rocks in the vicinity of Khutzeymateen Inlet, where they appear to underlie them and in places grade into them. Over large areas the gneisses have shallow dips, 20° to 30°N being common south of Nass River and similar dips to the northeast south of Skeena River. The gentle attitudes of the gneisses are not necessarily indicative of simple structures, as large recumbent folds were seen in several places in Terrace W 1/2 map-area. These folds appear to be directed in conflicting directions (southwest and northerly). The relationship between the gneisses and the plutonic rocks is complex. The gneisses were seen to be intruded by, overlain by, and commonly gradational into, plutonic rock. In many places the gneisses grade into massive granodiorite. As the northeastern part of the gneisses especially is granitoid and the plutonic rocks are commonly foliated, the two rock types are in places difficult to distinguish. Parts of the area mapped as gneiss on the sketch map are in reality migmatites. Although commonly granitoid the gneisses appear to have been derived mainly from sedimentary rocks.

The metasedimentary rocks that form the central band and bodies to the west consist mainly of various schists, crystalline limestone and minor conglomerate. Quartzite with thin interbeds of limestone form most of the sedimentary bands on the outer islands. Volcanic rocks are associated with the metasediments only in the Prince Rupert map-area, but may be represented farther south by diorite. The conglomerates, although rare, commonly contain plutonic debris. This, however, is not surprising as some of the plutons in southeastern Alaska have yielded Early Palaeozoic dates. Organic remains but no diagnostic fossils have been found in the metasediments of the central band or in the bodies to the west. A Permian age is possible for some of the metasediments that contain thick limestone beds, such as are found northeast of Khutzeymateen Inlet, along the northeast shore of Grenville Channel and in the southeastern part of Douglas Channel map-area. It may be concluded only that most of the metasediments of the central band are probably pre-Jurassic and possibly Palaeozoic.

The volcanic rocks in the eastern part of Bella Coola map-area consist of two systems (excluding the Tertiary basalt): one pre-Hazelton Group, and one belonging to the Hazelton Group. The pre-Hazelton volcanic rocks are highly deformed, but the overlying Hazelton Group is only gently deformed. Baer had previously found Middle Jurassic (Middle Bajocian) fossils in sediments associated with the latter rocks. Volcanic rocks of the Hazelton Group also appear in the northeast corner of Douglas Channel map-area where they are highly deformed. In southeastern Laredo Sound map-area plant fossils were found in sediments associated with volcanic rocks. These rocks are probably Lower Cretaceous, but the fossil material has yet to be closely studied.

Gently tilted and faulted Tertiary basalt related to that east of the Coast Mountains appears in the project area only on the eastern edge of Bella Coola map-area.

The plutonic rocks in the project area range from gabbro to granite. Quartz diorite is slightly more abundant than granodiorite, which in turn is about twice as abundant as quartz monzonite or diorite. Granite is rare.

LEGEND

TERTIARY

Volcanic rocks. Miocene and Pliocene. Basalt flows.

CRETACEOUS AND OLDER

Metavolcanic rocks. Middle Jurassic (Hazelton Group) and pre-Middle Jurassic metavolcanic rocks of unknown age.
Lithology: Greenstone, breccia, flows, tuff and agglomerate

Metasedimentary rocks. Upper Jurassic, Lower Cretaceous (Bowser Group), Middle Jurassic (Hazelton Group) and possible Jurassic, Triassic, Upper Palaeozoic and metasedimentary rocks of unknown age.
Lithology: Upper Jurassic-Lower Cretaceous (Bowser Group). Argillite.
Middle Jurassic (Hazelton Group). Greywacke.
Triassic- Lower Jurassic ? Meta-argillite and schists (varying from lower greenschist facies to middle almandine-amphibolite facies), crystalline limestone, quartzite, conglomerate and graphitic slate.
Upper Palaeozoic ? (Permian ? in part).
Thick bedded limestone, schist and gneiss (almandine-amphibolite facies) and minor ribbon chert and quartzite.

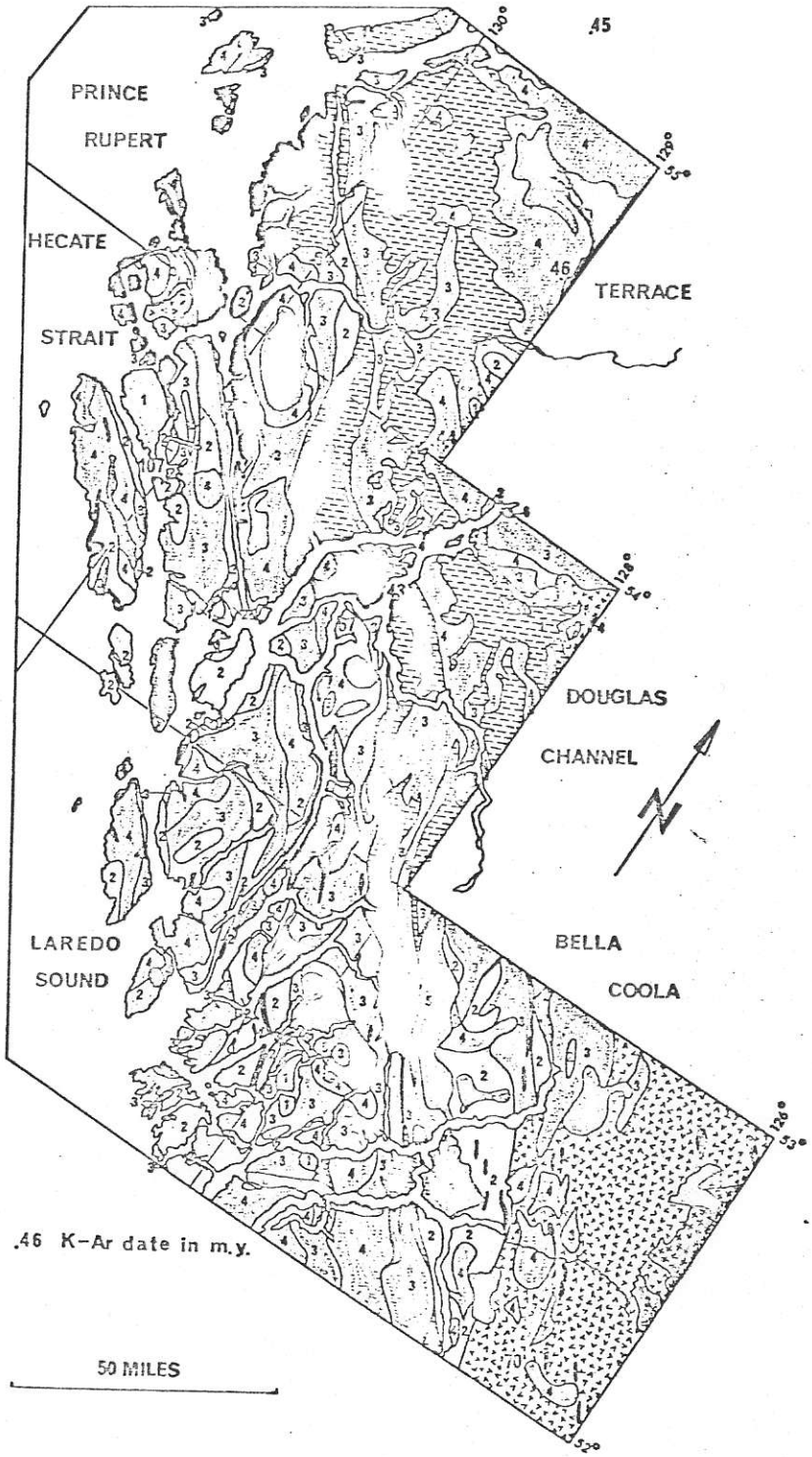
UPPER PALAEOZOIC ? AND/OR OLDER

Gneiss and migmatite; in part of probable pre-Permian age.

PLUTONIC ROCKS

6	Granite and syenite	Ages of most plutonic rocks unknown. K-Ar dating and, in places, field evidence suggests that some may be Cretaceous and early Tertiary. Field evidence indicates a possible pre-Jurassic or older age for some quartz diorites.
5	Quartz Monzonite	
4	Granodiorite	
3	Quartz Diorite	
2	Diorite	
1	Hornblende gabbro, gabbro, norite and olivine gabbro	

Geology by J.A. Roddick (1965), J.G. Souther (1963), A.J. Baer and W.W. Hutchison (1962, 1963, 1964 and 1965).


PRINCE
RUPERT
HECATE
STRAIT
TERRACE
DOUGLAS
CHANNEL
LAREDO
SOUND
BELLA
COOLA
.46 K-Ar date in m.y.
50 MILES

Except for a few very small bodies gabbro is restricted to the region southwest of the central metasedimentary band. Most of the gabbro is a coarse-grained, hornblende-plagioclase rock, which could be termed a coarse amphibolite. In thin section some of the gabbro is seen to be noritic. The body that occurs on the east edge of Terrace W 1/2 map-area is an olivine-bearing gabbro. The largest body of gabbro underlies much of McCauley Island. The gabbro commonly grades into hornblende diorite. In most places the gabbro seems to be older than the more leucocratic rock around it, but locally (on Aristazabal and Rennison Islands) the gabbro intrudes the country rock. Some of the gabbro has apparently formed from limestone beds.

Diorite also is found mainly southwest of the central metasedimentary belt. The chief exception is the belt of diorite that extends from South Bentinck Arm northwest across Bella Coola map-area. Most of the diorite is uneven textured, heterogeneous, and commonly gneissic. In many places it contains thin bands of metavolcanic and metasedimentary rocks. A distinct, massive diorite pluton appears on Aristazabal Island, but in most places the diorite grades into or is cut by more acid plutonic rocks.

Quartz diorite is more common southwest of the central metasedimentary belt, but considerable amounts lie also to the east. The most continuous body is the hornblende/biotite quartz diorite that extends from Portland Inlet to Douglas Channel. It is a clean, even-textured, sphene-bearing rock with foliated dioritic borders and a massive interior. The quartz diorite in northeast Douglas Channel and northern Bella Coola map-area is markedly chloritic, quartz-rich, and contains saussuritized plagioclase. It is distinctly different in appearance to the quartz diorite farther west. The quartz diorite adjacent to the east side of the metasedimentary band is intimately associated with the gneisses and appears to have been deformed with them.

Granodiorite is not concentrated in any particular part of the project area. Much of the granodiorite lying southwest of the gneisses is characterized by sphene and epidote, whereas that to the east is free of these minerals. In places granodiorite forms part of composite plutons, such as that near Ecstall River.

The quartz monzonite may form distinct young plutons, or form the core of granodiorite bodies. Most of the quartz monzonite is massive, leucocratic, even textured, and coarse grained. The distribution of quartz monzonite in the project area forms no obvious pattern. The largest body lies along the northeast side of the central metasedimentary band in Bella Coola map-area.

Bodies very rich in potassium feldspar are represented mainly by the west-trending, granite-syenite pluton on King Island (Bella Coola map-area) and a body of fine-grained syenite near the east edge of Bella Coola map-area, which intrudes Hazelton Group rocks and is overlain by Tertiary basalt.

Northeast-trending dyke swarms were noted in Portland Inlet, Douglas Channel, and Dean Channel. In the vicinity of Bella Bella dyke swarms of two ages were observed, the older trending east and the younger (probably Recent) trending north.

A quartz diorite line such as Moore[1] has drawn in the western part of the United States cannot easily be drawn through the project area. The potassium feldspar content, however, of the combined gneiss and plutonic rock east of the central metasedimentary band is considerably greater than that in the combined plutonic rocks west of the band.

The structure of the project area is dominated by the northwest regional trends, but an older northeast trend was observed in some places, especially along the east side of the gneisses. A regional flexure of the central metasedimentary band appears in the vicinity of Douglas Channel, but the cause is not known. Lineal features have a pronounced northerly plunge in Prince Rupert and Terrace W 1/2 map-areas. Major faults lie in many of the northwest-trending channels, and on the islands off the southwest side of Porcher Island (Hecate Strait map-area).

Potassium-argon age determinations on biotite have been made for nine points within the project area and for one point just north of the area. In the northern half of the project area, east of the central metasedimentary band, the dates range from 43 to 46 million years (Eocene). The date of 43 million years on schist in the eastern edge of the central metasedimentary belt (Hawkesbury Island) probably reflects the age of the plutonic rocks to the east rather than that of the main metamorphism of the metasediments. Other dates near the central metasedimentary band are 57, 64, and 67 million years (Upper Cretaceous to Palaeocene). The oldest date (mid-Cretaceous), 107 million years, was yielded by quartz diorite on Anger Island. The 70 million year date obtained from a granodiorite body in southeastern Bella Coola map-area appears to be anomalous.

No mineral deposits of economic interest were observed during the field season.

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[1] Moore, J.G.: The quartz diorite boundary line in the western United States; J. Geol., vol. 67, pp. 198-210 (1959).

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50. STRUCTURAL STUDIES, MT. REVELSTOKE AREA

J.V. Ross

The map-area covers the easternmost part of the Shuswap metamorphic complex where it is in contact with less metamorphosed rocks to the east. Field work has established that, within the map-area, gneisses presently referred to the Shuswap complex are more highly metamorphosed equivalents of rocks belonging to the Milford and Lardeau Groups to the east.

Structures within these different groups of rocks indicate a common origin and history. Recumbent folds, now plunging northerly and southwesterly, appear to be first structures that originally had axial-planes and limbs inclined at shallow angles to the east. These isoclinal folds were developed during an episode of dynamothermal metamorphism wherein the Shuswap gneisses were formed, metamorphic grade decreasing to the east. Sometime later than the development of the recumbent folds, a wedge of gneissic material, whose development of gneissossity predated the formation

REPORT ON

A PYRITIC DEPOSIT

— ON THE —

ECSTALL RIVER, BRITISH COLUMBIA

— BY —

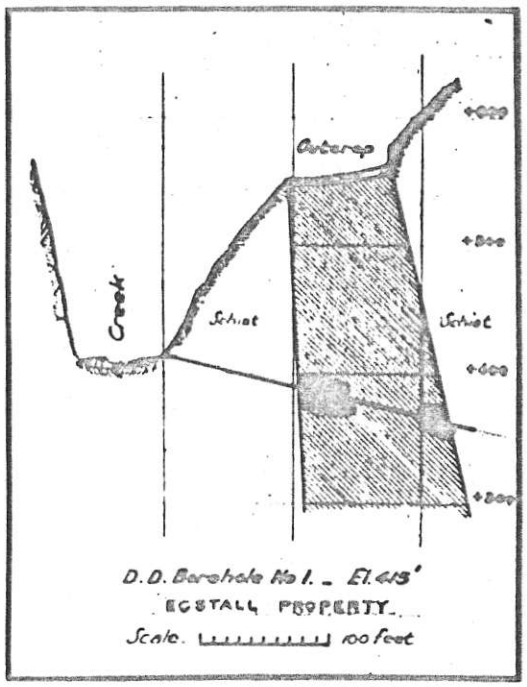
H. J. C. MacDONALD.

August 6th 1917

DIAMOND DRILLING.

With the variations in richness to be expected through the mass gold in mind - this top, side and spotted enrichment - it is of more interest to turn to the records of the work in diamond drilling already carried out on this property. In presenting this data it is necessary to state that it does not represent our work, or work on which I have personally checked the sampling from taking to assay. Tabulated results obtained in three diamond drill holes (Figure, Page 3) driven one in the south and two in the north lense were handed to us by a reputable mining engineer. We were also allowed to inspect the remaining drill core. The results are so consistent that I do not hesitate to place credence upon their being correct.

NORTH LENS



DIAMOND DRILLING
Hole #1

The first hole was drilled from the bed of the creek above the Falls to crosscut the north lense 175 feet below the outcrop. The hole shows 121 feet of massive sulphide of which the assays are given in detail on Page 16, in condensed form in the table below.

Type of Enrichment	Footage	Copper Percent	Gold Ounces	Silver Ounces
Foot Wall	40.5	2.01	0.05	1.11
Barren Centre	60.5	0.38	0.02	1.33
Hanging Wall	20	1.82	0.03	1.24
TOTAL	121 ft.	1.1	0.03	1.24

Attention should first be turned to the enriched foot and hanging walls and the barren centre of the body. The foot wall mineralization is the wider and the greater, although both walls bontain ore. Taking the assays at the extreme sides of the body, the first three feet - that is the foot wall close to the schist, gave the following result:-

2.9% Copper
0.16 oz. Gold
1.58 oz. Silver

Upon taking a sample of the last two and a half feet before the hanging wall was encountered, the following result was obtained:-

4.15% Copper
0.06 oz. Gold
2.24 oz. Silver

This hole shows plainly the enrichment of the body along the walls. No other form of enrichment is suggested. The hole intercepts the orebody too far below the outcrop to encounter the best of the top enrichment; no irregular bunches of ore above average value, or of unusual richness are in evidence.

Turning to the the value of the ore encountered; the ore for 40.5 feet from the foot wall is of good grade, comparable with Anyox ores in copper, exceeding them $1.27 in the value of the contained gold and silver. This foot wall streak, if persistent, could be selectively mined to give a tonnage of about one-third of that of the whole mass. Taking the ore on both sides of the body, one-half - or 60.5 feet - of the body assays 1.95% Copper with $1.38 in Gold and Silver. Taking the result of the entire hole, the copper is identical with that obtained from the Phoenix ores with $0.44 cents more in the gold and silver. This ore could be treated in the same bulk for about $1.00 less per ton than either Anyox or Phoenix ore, through concentrating and smelting the concentrate, in place of the present direct smelting practical at those plants. The recoveries obtained would be better in the copper; in the gold and silver it is still an open question until concentration tests are carried out on this ore. The gold, from the assays, varies with the copper values, but the silver is well disseminated through the body irrespective of the copper. This may point to a good gold with a poor silver recovery being obtained in concentration.

This hole, then, shows ore which can be treated by present day methods.

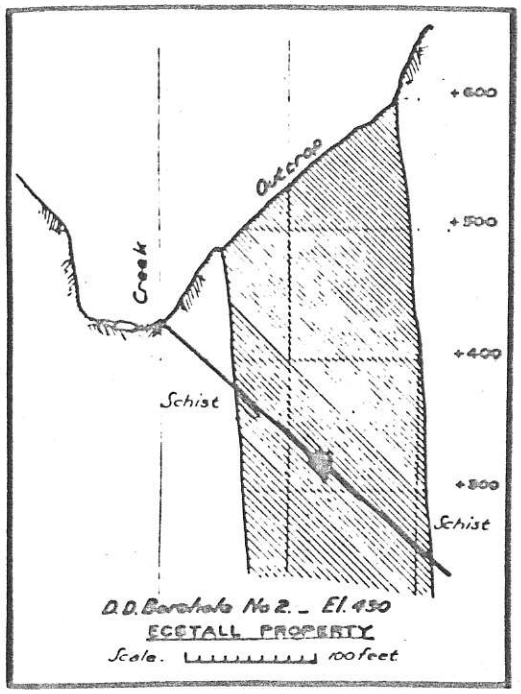
DIAMOND DRILL RECORD

Prop. - ECSTALL. Hole #1, Depth 247^{5}' Bearing E. Angle 15°30' Elev.445'(Bar)

Depth Feet	Formation	Sample Number	Length Feet	Analysis Gold ∂	Silver ounces	Copper %	Length Feet	Totals Ft.x % Copper
0-108	Mica Schist		108					
111	Massive Sulphide	4-A	3	3.20	1.58	2.90	3	8.7
116^{5}	" "	5-A	5^{5}			1.56	8^{5}	17.3
122	" "	6-A	5^{5}			1.67	14	26.5
127	" "	7-A	5	0.60	0.64	1.93	19	36.15
132	" "	8-A	5			1.66	24	44.45
108-132	Composite	1-C	24	1.20	0.94	2.10	24	50.4
138	Massive Sulphide	9-A	6			2.01	30	56.5
143	" "	10-A	5			2.00	35	66.5
148^{5}	" "	11-A	5^{5}			1.60	40^{5}	75.3
154	" "	12-A	5^{5}			0.5	46	78.05
159	" "	13-A	5			0.37	51	79.9
132-159	Composite	2-C	27	0.60	1.38	1.36	51	67.1
164	Massive Sulphide	14-A	5			0.32	56	81.5
171	" "	15-A	7			0.34	63	83.68
177	" "	16-A	6			0.37	69	86.10
182	" "	17-A	5			0.18	74	87.0
159-182	Composite	3-C	23	0.40	1.46	0.34	74	94.92
187	Massive Sulphide	18-A	5			0.25	79	88.25
193	" "	19-A	6			0.25	85	89.75
198	" "	20-A	5			0.32	90	91.35
204	" "	21-A	6			0.45	96	94.05
182-204	Composite	4-C	22	0.40	1.22	0.39	96	103.52
209	Massive Sulphide	22-A	5			0.45	101	96.30
215	" "	23-A	6			1.00	107	102.30
221	" "	24-A	6			1.50	113	111.30
226^{5}	" "	25-A	5^{5}			2.00	118^{5}	122.30
204-226^{5}	Composite	5-C	22^{5}	0.40	1.14	1.12	118^{5}	128.72
229	Mixed Sul.& Schist	26-A	2^{5}	1.20	2.24	4.15	121	132.68
232	Mica Schist	27-A	3					
237	" "		5					
242	" "		5					
247^{5}	" "		5^{5}					

Average Copper Percentage 121 Feet 1.1
Gold oz. 0.03
Silver oz. 1.24

NORTH LENS



DIAMOND DRILLING
Hole #2

The second hole was also drilled from beside the creek a hundred feet north of the first. The pyritic lense was cut 100 feet below the outcrop and traversed for 199 feet until the pitch of the hole brought it to the hanging wall 500 feet below the outcrop. A summary of the results obtained, shown in detail on page 19 is given below:-

Type of Enrichment	Footage	Copper Percent	Gold Ounces	Silver Ounces
Foot wall	21.5	2.[illegible]	[illegible].02	[illegible]
Barren Centre	31	0.38	0.02	[illegible]
Irregular Bunch	27	1.12	0.02	[illegible]
Barren Centre	32	0.53	0.02	0.70
Hanging Wall	6.5	1.10	0.02	2.02
TOTAL	199.0 ft.	0.8	0.02	0.74

The foot and hanging wall mineralization is well shown, the 4½ feet next the foot wall gave 1.1% Copper, the 6½ feet next the hanging wall gave 1.4% Copper. There is also an irregular bunch encountered of low grade ore in the otherwise barren interior of the body. The evidence of this hole in connection with that of the first hole, tends to show a rather permanent foot wall mineralization. The result of the hole is not so satisfactory. This can be explained in two ways: first, the hole is in the greater part of its length deeper beneath the outcrop; second, the outcrop is in the bottom of the canyon at this point in a place subject to vigorous erosion which could entirely remove the copper here from the body, before it had time to penetrate and re-deposit in the body.

The first point is self-evident, if the top of this body is richer than the bottom; the second point will be understood by comparing the outcrop of the two bodies at the surface as shown on the sections through the two drill holes. Over the #1 hole, the pyrite is weathered to a crumbling mass; over #2 hole, the outcrop - as also shown in photograph on Page 3 - of solid pyrite is encountered at the surface. In the latter case any gossan, any granular pyrite has by water, ice, freshet and snow slide been removed as fast as it has been formed. Neglecting these explanations it is always possible by chance, aided by the uneven distribution of copper, to drive a hole with low assay results through any pyritic body of this character. These bodies are most difficult to average in value with diamond drill holes.

These two holes are all the work done on this, the most important body in the area. There is scarcely any criticism to be levelled at the placing of these holes. The task became an impossibility when a few hundred feet of drill hole was given the task fitter for a few thousands; was asked to find in two lines the average value of an erratically mineralised body of 5,000,000 tons. The drilling has proven the existence of copper in a body burrn at the surface, has given to us some knowledge of the shape and size of this body. These discovered facts are favorable enough to warrant further seeking for the true average value, for continuance of foot wall enrichment, for top enrichment, for richer bunches and possible bonanzas.

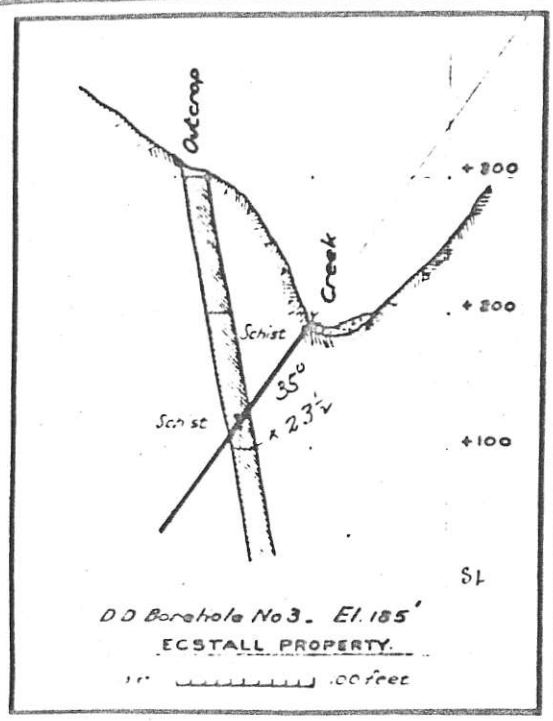
DIAMOND DRILL RECORD

Prop. - MCSTALL. Hole #2, Depth 299' Bearing E. Angle 43°0' Elev.430'(B

Depth Feet	Formation	Sample Number	Length Feet	Analysis Gold %	Silver ounces	Copper %	Length Feet	Totals Ft.x % Copper
0-82.5	Mica Schist		82.5					
87	Massive Sulphide	28-A	4.5			4.10	4.5	18.4
								18.4
93	" "	29-A	6			1.65	10.5	28.3
99	" "	30-A	6			1.50	16.5	37.3
104	" "	31-A	5			1.05	21.5	42.55
109	" "	32-A	5				26	46.55
115	" "	33-A	6			0.45	32.5	49.25
120	" "	34-A	5			0.62	37.5	52.35
126	" "	35-A	6			0.59	43.5	55.9
87-126	Composite	6-C	39	0.40	0.66	0.82	43.5	50.4
132	Massive Sulphide	36-A	6			0.62	49.5	59.02
138	" "	37-A	6			0.68	55.5	63.70
144	" "	38-A	6			0.46	61.5	66.46
150	" "	39-A	6			0.37	67.5	67.68
155	" "	40-A	5			0.37	72.5	69.53
126-155	Composite	7-C	29	0.40	0.84	0.61	72.5	68.1
160	Massive Sulphide	41-A	5			0.57	77.5	72.38
165	" "	42-A	5			0.96	82.5	77.18
170	" "	43-A	5			0.78	87.5	81.08
176	" "	44-A	6			0.48	93.5	83.96
182	Sulphide & Silica	45-A	6			1.30	99.5	91.76
155-182	Composite	8-C	27	0.40	0.88	1.12	99.5	98.4
187	Massive Sulphide	46-A	5			0.21	104.5	92.81
192.5	Massive Sulphide	47-A	5.5			0.15	110	93.64
198	" "	48-A	5.5			0.18	115.5	94.63
203.5	" "	49-A	5.5			0.16	121	95.46
209	" "	50-A	5.5			0.18	126.5	96.45
215	" "	51-A	6			0.19	132.5	97.59
182-215	Composite	9-C	33	0.20	0.62	0.30	132.5	108.3
221	Massive Sulphide	52-A	6			0.15	138.5	98.49
223	" "	53-A	2			0.42	140.5	99.33
229	" "	54-A	6			0.51	146.5	102.39
235	" "	55-A	6			0.72	152.5	106.77
240.5	" "	56-A	5.5			1.08	158	112.65
246	" "	57-A	5.5			0.78	163.5	116.95
252	Sulphide & Schist	58-A	6			0.72	169.5	121.27
215-252	Composite	10-C	37	0.40	0.68	0.82	169.5	138.6
257	Sulphide & Schist	59-A	5			0.33	174.5	122.93
263	Massive Sulphide	60-A	6			0.18	180.5	124.00
269	" "	61-A	6			0.05	186.5	124.30
275	Sulphide & Schist	62-A	6			0.95	192.5	130.0
252-275	Composite	11-C	23	0.40	0.82	0.43	192.5	148.5
281.5	Sulphide & Schist	63-A	6.5			1.40	199	139.1
287	Mica Schist		5.5					157.6
293	" "		6					
299	" "		6					

Avg.copper percentage 199 feet 0.8
Gold oz. 0.02
Silver oz. 0.74

TINMAN SOUTH LENS



DIAMOND DRILL HOLE #3

This hole is not at present important. Driven in the south lense, which is as the tail to the kite in its relation to the more bulky north lense, it passes at an angle through 23.5 feet of massive sulphide which gives an assay of 0.5 percent copper, 0.06 ounces gold and 1.20 ounces of silver. This hole is close to and below the previously mentioned tunnel. The south lense, with its own possibilities of being richer at the top and wider in the unknown centre, should wait on the development of the more important north lense.

DIAMOND DRILL RECORD

Prop. - ECSTALL Hole 3, Depth 187^5 Bearing W. Angle $55^0 0'$ Elev.185'(Bar)

Depth Feet	Formation	Sample Number	Length Feet	Analysis Gold %	Silver ounces	Copper %	Length Feet	Totals Ft.x % Copper
0-5	Wash Gravel		5					
81	Mica Schist		76					
86	Massive Sulphide	65-A	5				5	
92	" "	66-A	5				11	
97	" "	67-A	5				16	
104^5	" "	68-A	7^5				23^5	
81-104^5	Composite	12-C	23^5	0.40	1.20	0.50	23^5	11.75
187^5	Mica Schist		83					

Average Copper Percentage 23.5 feet 0.5

Gold oz. 0.06
Silver oz. 1.20

PROGRESS REPORT

ON THE

KOSTAL EXPLORATION

BY

H.J.C. McDONALD

December 1918

DESCRIPTION OF THE MINERAL DEPOSIT

Two overlapping pyritic lenses have been discovered within the mineralized area: the South Lense, a long narrow vein like tabular deposit with tapering ends; the North Lense a shorter, thicker body, also with tapering ends, but of contorted outline and of, in general, less regularity of shape. Both of these sulphide bodies dip and strike parallel to the foliation of the enclosing schists.

The South Lense striking due North and dipping steeply 80° to the East, extends along an almost straight line 1760 feet in length, with as far as can be ascertained a uniform width of 22 feet throughout the central portion, narrowing gradually at the extremities to pointed ends. There is a likelihood that the surface exposure of this lense, by which we are at present constrained to judge its outline, is its thin edge, and that its bulge or greatest width, is at some unexplored depth below the surface. As there is reason to think that the northern part of this lense is economically mineralized, this leads directly to lively expectations of additional ore tonnage.

The exploration of this lense has been meagre, being pierced underground at only two points: by a tunnel driven into the west wall of the canyon which encounters the ledge 47 feet from the portal, a hundred feet below the outcrop, and drifts along the ledge 15 feet in either direction; by a cross-cutting drill hole near the tunnel, piercing the vein 90 feet below the tunnel level. The concentration of so much work, where so little has been done, in the relatively barren sulphides in the vicinity of this tunnel has been an unfortunate circumstance for the owners, as it has retarded an earlier development of the property. Upon a tabular body 1760 feet in length, the depth reached, 190 feet below the outcrop, is not commensurate with the depth which is probable, nor are two points of interception commensurate with so great an area. The outline very possibly will not appear so regular, the tonnage greater, when the body has been pierced at more points and at greater depths. A complete knowledge, both of the shape and content of this body is advisable; but, up to the present it is upon the North Lense that our investigation has been almost entirely directed.

GEOLOGY: Outline of the North Lense.

The tapered southern extremity of the North Lense overlaps in parallel, 25 feet to the East, the northern end of the South Lense, extending in rough alignment with the latter 1000 feet to the North. The general strike of the North Lense is therefore also due North.

and the dip 80° to the East, but possessing more of the bulge of a lense rather than the plane surfaces of a tabular body there exists several local variations of dip and strike along the foot and hanging walls. A still greater complication is introduced in the vicinity of the northern end by a sharp bend to the West, almost at right angles to the general strike. So sharp is this turn, so abrupt is this termination, that a fault is immediately suggested. However, after a study of the condition here found it is seen that this is a fold in the orebody coinciding with a fold in the enclosing schists, rather than a fault. The foliations in the schist being "wrapped around" the end of the orebody so as to closely follow an acute bend in the orebody to the West.

Continuation of the North Lense.

The peculiar conditions noted here suggests a repetition of a condition that occurs at the Kilkenny Mine in New Hampshire illustrated in Figure 1, reproduced from the description by W.H.Emmons in Bulletin #432 of the U.S.Geological Survey. The figure represents two limbs of the same original pyritic orebody - "torn apart during the process of regional metamorphism". Although it delineates a much smaller orebody, the figure is directly applicable to the present case if the supposition is made that the blue tinted southern limb represents the known portion of the North Lense, and that the red tinted northern limb represents the supposed continuation of the North Lense. Owing to the vegetation on the hillside it has been impossible to identify outcrops on this offset line of continuation in the immediate vicinity of the North Lense, nevertheless outcrops do occur further north and along the same general line. A displacement to the West into the mountain side of even 300 feet adds at least 300 feet of superimposed rock so that the outcrop of the continuation of the North Lense will occur at another horizon, at a higher level than where it outcrops in the creek, therefore it becomes natural to predict that should the lense have decreased in size as it goes upward, it may have pinched so that there is insufficient width or strength to the outcrop to make it a conspicuous feature upon the hillside. The immediate northern extension may even be a "blind" deposit, that is one having no outcrop. The only expedient manner to prove this northward extension is through drilling horizontal holes, at right angles to the supposed line, from setups in the bed of Red Gulch Canyon. This is the most important footwall problem to be solved in this field. The geological proof obtained, it is almost certain to be linked with the development of additional ore tonnage.

DESCRIPTION OF THE MINERAL DEPOSIT.

OUTLINE:

The elongated ends of these ore lenses stretch to extreme lengths. For example, through the sectional drill holes the end of the South Lense has been traced north and intercepted 360 feet from the cave (Fig. 2), where it is 7 feet in width, as a 4 foot wide band of mineralized schist. How much farther it could be traced were it exposed to view it is impossible to state. In a similar manner the North Lense tapers 500 feet south from a width of 12 feet at the cave before it is lost to inspection through a lack of rock exposures. Reduction of those features to an ideal sketch (Fig 2) brings out the en echelon arrangements of the South and the North, also of the so-called East Lense. The latter body is in all probability the tail of the next succeeding lense in the natural order, severed from its parent body by the same fold-fault that here dislocates the North Lense near its greatest width. Travelling northward along this series of lenses from the end of one to the end of the next is to turn each time to the right, that is to the east. A consistency in arrangement in this regard has been determined in other regions having similar chains of schist-enclosed pyritic lenses, so it can be taken for granted in this occurrence until there accumulates absolute proof to the contrary.

A horizontal section, therefore, discloses a series of overlapped ore lenses, so it becomes sensible to enquire if a vertical section of the same extent might not show a similar overlapping of lenses in depth. While there is no proof that this is the case, so reasonable is the inference, that future development should bear this possibility in mind.

GEOLOGY: Composition of the Outcrops.

The surface exposures of these ore bodies being, in former times, subject to intense glaciation, both local and regional, and being up to and in the present the object of vigorous ice and water erosion there now remains no "gossan" or iron oxides upon their surfaces. (Photographs Pages 59 & 77). Even where there is present a covering of moss or other vegetation there will be found underneath the solid appearing steel grey pyrites. That these outcrops are being attacked by surface waters at the present time is amply testified to by the perceptible amount of sulphur in solution in the Creek water and by the uniform red color of the iron oxide coated rocks which form its bed, making the name of this creek typical. Also at the bottom of the canyon walls conglomerate beds have been formed in two large occurrences through the cementation

DESCRIPTION OF THE MINERAL DEPOSIT.

of slide rock pebbles by iron oxide. So on every hand is seen the evidences of an energetic oxidation, solution, and mechanical disintegration, which gives rise to products that are being rapidly removed. With this condition in mind the composition of the orebody at or near the surface cannot be expected to be identical with the composition of the orebody at depth. A closer investigation of the outcrops shows these to be more porous from oxidation and solution than they appear at first glance; of lower specific gravity, principally in that the sulphides being first attacked and removed leave the more resistant but lighter quartzose gangue and siliceous schist inclusions as a greater proportionate part; and of a lower copper content, the chalcopyrite being quickly - if not the first mineral - removed. Then there is found within the orebody below. This condition is not, more over, limited to the immediate surface but extends downward, governed by the fracturing and permeability of the orebody, markedly for a distance of 50 feet and with varying shades of intensity along fractures open to water circulation to extreme depths of 150 to 200 feet below. Not until an appreciable depth is reached can the orebody be said to be in its normal state.

Almost the entire length of the South Lense outcrops upon and along the summit of the hill that forms the west wall of the Red Gulch Canyon; where it is traceable rather than noticeable, through the depression eroded in the sulphide body - now filled in part with iron oxide, sand pyrites, and covered by vegetation - and the resultant relief given by the resistant walls of silicified schist. (As the outcrop of this lense in the central length is obscured, there is a possibility which can only be verified by future exploration, that this lense may in reality be two distinct lenses occurring along the same line). The last southern outcrop of this body is 400 feet south of the tunnel where a vein of sulphides and interbanded silicified schist, with dip and strike in accordance with the remainder of the lense, is seen by an opencut into the slope of the hill. Further south the lense is lost beneath the deep debris at the mouth of Red Gulch creek. A one place a shaft sunk here, to search after a possible continuation in this direction, shows siliceous mineralized schist alone; perhaps representing the feathering out end of the lense, perhaps located too much to one side and missing the more intense mineralization of the sulphide lense. Further prospecting here will be, on account of natural obstacles, a very slow matter indeed. That definition the surface area of this lense lends through the obscurity of the southern extremity, it ends at its northern extremity, where the outcrop comes down from the hill top, ending

DESCRIPTION OF THE MINERAL DEPOSIT.

through the canyon wall and crossing the creek as a sharp-cut steel-gray stripe of pyrites. This occurs just below the 118 foot falls, formed in greater part through the marked difference in the ease and consequent rates of erosion of the sulphide body and the adjoining country rock. The vertical cliff so formed cuts and discloses to view both the north end of the South Lense, and the south end of the North Lense, at their tapering points. (Photograph, page 17). Upon this cliff the ends of the ore lenses are clearly shown through the caves formed in the crumbled pyrites.

The upstream outcrop of the North Lense above the falls lies along, and forms the lower portion of the Eastern wall of the canyon, of gentler declivity than where composed of schist above. Following north the solid sulphides, cleaned of any trace of oxides by the severe and rapid erosion in the creek bed, stretch in full visible width to the turn in the northern end of the orebody, and to the left beyond this sharp bend its dwindling end can be seen across the creek as it penetrates into the vertical west wall of the canyon. (Photographs, pages 21 and 37.) Where this crossing of the creek is made, the creek runs into the body with a twenty foot fall - formed undoubtedly through the same agencies as the lower falls - and flows over a greater part, especially in high water, of the northern end of this sulphide mass.

Extent of the Mineral Area.

North of the North Lense the outcrops do not occur in the bottom of the canyon, but several hundred feet to the left along its precipitous western wall. This wall forms one side of an arm like ridge which extends out from Red Gulch Mountain. The natural obstacles that hinder prospecting this lead continuously through a mountainous country, which is both steep and heavily covered with brush and timber, are such that the lead has not again been definitely picked up for 2000 feet in this direction. Here there is a width of 16 feet of copper containing sulphides and mineralized schist with about 500 feet beyond a second and similar isolated outcrop. Several thousand feet beyond where the canyon runs into and ends in the basin of Red Gulch Mountain the mineralized zone is distinctly shown going up to and on the bare summit of the mountain (Elev. 6,000 ft.) as a red streak of iron stained schists. The length along which distinct mineral bearing outcrops have so far been found is 6,000 feet.

DESCRIPTION OF THE MINERAL DEPOSIT.

length only partly covered by the claims owned by the B. C. Pyrites Company, Limited, under option, so upon fortunately vacant ground sufficient additional claims were staked and recorded during the 1918 season to protect the rights of the Granby Company for 10,000 feet along this zone (Map page 19). This entire length may not be economically mineralized but bolsting along the length 5,000 feet, dotted with known outcrops, this is a sufficient length of fissure - 600 linear feet of which alone has been explored to a moderate depth - to afford on the line of a proved mineral locus much virgin ground favorable for future ore exploration.

These bodies are in the main masses of fine grained granular pyrite having a sparse interstiture of interlocking quartz grains, and minor quartz and schist inclusions. The quartz inclusions are in general much smaller than the inclusions of altered schist, but neither are plentiful; the larger portion of the bodies consisting of crystallized pyrite. The chalcopyrite, the universal carrier of the copper and - as it appears - the greater part of the gold and silver, seems the more prevalent where the pyrite is the finer grained, and is the more noticeable in those portions where the gangue is the most siliceous. The chalcopyrite occurs seldom, however, within the quartz veinlets or inclusions but rather streaked along their walls. Of the other minerals galena and sphalerite occur in small but constant amount throughout. The iron sulphide being in the form of pyrite, and the absence of the form pyrrhotite is one of the marked and distinctive features of these bodies. While for sulphuric acid making pyrite, containing 53.3% sulphur, is to be preferred to pyrrhotite, containing 39.6% sulphur because of the 13.6% greater sulphur content, there is small difference in the smelting properties of these two minerals. This feature, barring the possible use of these ores for the manufacture of sulphuric acid for which they are peculiarly well adapted, has the greatest bearing as a guarantee of continued richness with depth, as the presence of a considerable amount of pyrrhotite effectively limits the downward migration of both silver and copper as will later be discussed. (Page 62). The following is a list of the identified minerals which occur in and about these sulphide bodies.

Actinolite	Epidote	Muscovite
Arsenopyrite	Feldspar	Pyrite
Albite	Galena	Quartz
Apatite	Garnet	Sericite
Biotite	Gold	Sphalerite
Calcite	Graphite	Stentite
Chalcopyrite	Hornblende	Silver
Chlorite	Magnetite	Titanite
Barite		Zoisite

DESCRIPTION OF THE MINERAL DEPOSIT:

The mineral garnet occurs in small isolated areas throughout the mica schist, while near and within the boundaries of the orebodies pale red or pinkish garnets in perfect crystal form, and of an average size 0.05 inch, have a sporadic distribution along certain definite lines, and within certain definite areas. These places of occurrence are: (1) In the dyke or tongue which separates the North from the East lense, especially in the northern and thinner part of this body. (2) In the schist near, or commonly in thin lines parallel to, the contact with the sulphide orebodies, where galena in similar distribution is a common accompanying mineral; (3) In the inclusions within the sulphides, whether these are of quartz or schist, garnet is common and again often associated with galena, also with aggregates of grey blades of zoisite, and the green needle like crystals of actinolite, these accompanying minerals are nearly always, however, in the greater quantity. It is to be understood that the garnet comprises a small part of the rock material at any point, and that in no place can garnet be said to be a gangue mineral of the sulphides, but rather a minor occurrence along the walls or within the included rock fragments of those orebodies.

COMPOSITION: The orebodies consist then of homogeneous lense shaped masses of granular crystalline pyrite of exceptional purity, and as no crustification, comb structure, druses, or vugs occur in the ore, of both uniform composition and physical character. The sulphides are recrystallized to an extent which obliterates the original forms of deposition and all record of movement, the massive ore in no place displaying a traceable schistosity. A minute search within the orebodies, however, can discover and follow the general schistosity of the surrounding zone through the small inclusions of sheared schist, and in the coincident directions of tiny veinlets of quartz, galena, and of chalcopyrite. The most complete and representative analysis made of the drill core samples, represents 220 feet across the north end (Section #3) of the North lense with the following results:-

Copper	2.1%	Silica	0.9%	Lime	1.8%
Gold	0.03 oz.	Sulphur	51.0%	Alum.	2.1%
Silver	0.9 "	Iron	43.6%	Mag.	0.3%

This analysis is, as can be seen on inspection of the others recorded (Pages 48 to 50) a close average for this entire lense. The above is comparable with the theoretical analysis of pyrite (Iron 46.6%, Sulphur 53.4%) the ratio of iron to sulphur in the ore, after deducting the small amount of these elements in the

chalcopyrite is 1 to 1.170, while in the pure pyrite it is 1 to 1.146, a very close agreement. The specific gravity of this entire orebody, as averaged from 87 separate determinations is 4.85 with the more solid portions giving 4.90-4.92, again approaches that of pure pyrites (4.95-5.10).

To complete the analysis given in the last paragraph the presence of zinc must be noted, the average amount is however appreciable, 2.1%; but in veinlets along the southern portion of the hanging wall a specimen selected for the large proportion of sphalerite which it showed gave 19.1% of zinc (# 23 Page 60). The percentage of lead present is also small, perhaps on an average about 0.2%; its constant presence being difficult to detect by the eye alone. At the present time an analysis representative of the entire orebody is not at hand (although one will shortly be), so the above amounts of, and proportions between the metallic elements must be regarded as an approximation; undoubtedly a fairly close one.

COMPOSITION: Although from wall to wall the pyrites appear to be uniform, the diamond drilling through varying amounts of drill core recovered denotes a marked and consistent difference in the porosity across the body. The greater the pore space existent within a granular mass of this character, the greater will be the amount of core which will crumble or be ground up, that is the smaller the footage recovered as coherent core. There are four such layers in the North Lense, starting from the footwall side; first a hard, then a soft, then another hard, and finally along the hanging wall another soft layer are successively penetrated. This is demonstrated in the percentage of core recovered along any typical hole. This phenomena cannot be detected by theeye, and also acts, as far as can be determined, irrespective of the analysis. A lateral variation in the original mineral deposit is suggested which has been almost entirely obscured by the latter crushing with its attendant recrystallization and resementation of the sulphides.

INCLUSIONS IN THE ORE: The inclusion of "waste" rock within the orebodies is not common, and where inclusions do occur the dimensions of these are small. They consist of quartz and of fragments of mica schist. The latter are typically small elongated masses, small lenses similar to the larger ore lenses within which they are included and similarly orientated with a schistosity - where this is not obscured by alteration - parallel to that of the schist walls of the orebody.

DESCRIPTION OF THE MINERAL DEPOSIT.

These inclusions are to be found in all degrees of alteration, but in every case more intense than that of the wall rock. Commonly at their edges are minute veinlets of garnet, galena, and chalcopyrite; in this the edges of these inclusions are analogous to the edges of the orebodies, which are ofttimes streaked in a similar manner. The centres are also garnetized with in some instances the extreme alteration to masses of zoisite and actinolite. The majority of these inclusions are plainly the alteration products of the typical dark mica schist and still retain traces of its texture, composition, and schistosity, but where a silicious fragment of schist is included the schistosity is at present shown entirely by the parallel arrangement of pyrite in a white silicious groundmass. There are also bunches of clear quartz included in the ore, the greater numberof these being undoubtedly the dislocated and metamorphic product of ruptured quartz veins, of which a few later persistent examples were noted, running in dip and strike with the general formation, but no where strongly developed, or of more than a few inches in width.

WALLS OF THE OREBODY: At the foot and hanging walls of the orebodies the mica schist is in abrupt contact, without gouge or other evidence of movement along these walls, with the sulphides. The mica schist in numerous occurrences is entirely unaltered at the contact although normally for a few feet away it is slightly silicified, the dark mica being changed to white mica. This light colored muscovite schist can be said to be typical of the contact although its usual development is not strong, or in great width. While there is a uniform and persistent pyritization in the schist walls there is no economic mineralization to be found here, the termination of the ore being sharp cut and easily perceptible. These features are especially characteristic of the foot and hanging walls, that is the sides of the ore lenses, while the tapering ends show a graduation for considerable distances, several hundreds of feet along the strike; the solid sulphides merging into a mineralized silicified schist which in turn merges through a mineralized mica schist into the typical unaltered mica schist. The valuable minerals do not, however, follow the full length of these slender pointed ends but terminate suddenly near the end of the massive sulphides after which the decreasing mineralization is shown entirely through pyritization.

WALL ROCKS: The mica schist walls the dark type, a biotite schist, with foliated aggregates of biotite crystals set with cleavage plans parallel to each other along thin lines in a fine

dark gray or green groundmass; the light type, a muscovite schist in which muscovite is in a similar arrangement in a white quartzose groundmass; both these types show an easily traced schistosity which is always closely parallel to the nearer wall of the adjacent orebody, roughly parallel to the further wall and to the strike of the ore lense. Across any section these two types alternate, so that along persistent sweeping lines, or broad folds, there is to be found a marked similarity in texture and composition of the rock within the mineralized area. Locally this feature may be obscured, as in spots the schists have even a whirly structure and a changing composition, but in its larger phases this statement is invariably true. The light colored schist is hard and compact and impermeable, seldom decomposed, but where it is alone a thin surface only to a soft talcy mass. The dark schist while normally of firm texture exists in all degrees of alteration, some considerable areas being relatively soft and permeable without the rock losing its customary outward appearance. Such a line or band ten to fifteen feet in width occurs along the footwall of the North lense, this permeable schist being undoubtedly responsible in part for the here found enriched western side of this orebody.

AMPHIBOLITE: The biotite schist grades through a change in the ferromagnesian mineral into a hornblende schist, or amphibolite, characterized by elongated prisms of black hornblende arranged not along the lines of schistosity but rather as a radial interlacement of rods in a fine green groundmass, to the partial or complete destruction of the fissile character of the rock. As far as the present exploration, supplemented by microscopic work, shows, this type of rock is the metamorphic product of an original diorite, while the surrounding, and by far greater part of the schists are of sedimentary origin. The structural relations suggest that the rock in the mineralized area was composed of a series of sedimentary beds, principally shales and sandstones, into which were later intruded a series of diorite dykes and sills, the whole being thereafter subjected to an extreme and thorough regional metamorphism which produced the present foliated beds of mica schist in which are interlayed the remains of the diorite sheets as narrow tabular beds of hornblende schist.

The structural characteristics of these ore deposits show them filling nearly vertical fissures, or a single fissure of great length and strength, forced,

not along slip planes between dissimilar beds but through tensional stresses. At the present time no proof is available that any movement or displacement has taken place along the plane of the principal fissure, that is, it has not been proven to be a fault-fissure. That an open fissure, or a series of open fissures, was the original channel taken by the mineralizing solutions, instead of a much broken and sheeted zone, is the best working hypothesis in view of the sharp-cut walls of relatively impermeable and unreplaced rock, and the lack of rock inclusions within the orebodies. That the original form of the ore deposit was vein like, not an equidimensional mass, is more readily conceivable in view of the extreme elongation of present system of imbricating lenses. Whatever the original shape and composition of the ore deposit, the metamorphism taking place in part when the rock was in a state of flowage and the sulphide body in a state of fracture, has resulted in the distortion of the outline, and the recrystallization of the sulphides, so as to completely obliterate the original deposit.

Post mineral fissuring and faulting is not in evidence within the North Lense or has been hidden through the intensity of the metamorphism.

An occurrence of minerals in the combination found in this deposit is typical of a contact metamorphic deposit, or of a vein deposit originating at a great depth and under great pressure, but this interpretation is clouded by the fact that all the minerals found here are also typical of, and can be produced through, dynamic metamorphism. The assumption is reasonable, however, that this is a deep vein deposit. The orebodies lined in very evident relation to a persistent fissure in the older Paleozoic rocks; the intense metamorphism the deposit has undergone; the lack of evidence of extensive hydrothermal alteration of the wall rocks; taken with the combination of minerals all point to deposition at great depth and under great pressure along a well defined fissure.

The question of origin can have a decided influence on our expectations in regard to this ore deposit. Deposition at great depths through ascending magmatic solutions in contradistinction to that taking place near the surface or at moderate depths, gives uniformity over great vertical distances. Take for instance the veins of the Alaska-Treadwell at Juneau, described to an identical origination - somewhat closely comparable in their location and relation to the Coast Batholith, the surrounding metamorphosed Paleozoic sediments, even

DESCRIPTION OF THE MINERAL DEPOSIT.

in the association of minerals - these veins show throughout a vertical distance of 4000 feet no change in their physical or mineralized character.

To sketch the geological history of this mineral deposit. The deeply buried bedded sediments in existence at the close of Paleozoic era were highly metamorphosed, tilted, and folded; later to be intruded by diorite in the form of intrusive sheets interleaved between the sedimentary beds. Contemporaneous with, or more probably near the end of this period, the gases and solutions exhaled by the magma become ascending mineralizers discovering conduits for themselves in fissures intersecting the overlying sediments. These fractures were consequent upon the readjustment of stresses, for the greater part those of tension, at the time of cooling and contraction of the magma. The source of the copper and precious metals is then this early intrusive diorite. Later the region with the contained ore deposit underwent a second and more extensive metamorphism attendant upon the intrusion of the granite batholith. This was an effusion, or differentiation of the same parent magma which supplied the former diorite. The abundant pneumatolytic action, concomitant with the cooling stages of this intrusion, is in evidence through the aplite and pegmatite dykes, and ribbon quartz veins abounding in the older rocks. The orthoclase, although deformed and recrystallized were not added to or enriched at this particular period. Since then, as in the former cycles of time, accompanying successive uplifts of the land, a vigorous erosion of the country has been taking place, at first rapidly through glaciation, then more slowly through the common agencies in action at this day. The superimposed rock has thus been removed until the orebodies were bared, a portion of the upper and enriched portions cut away and removed, leaving exposed at the surface the enriched, or the present day outcrops.

DRILL HOLE EXPLORATION

Location of Set-ups
Typical Hole
Striations
Samples
  Cuttings
  Core
Summary Results
Assays
Reco-d
Drill Hole Survey
Diamond Drill Record
Specific Gravity
Analyses
Plan
Sections #1 - #7

DRILL HOLE EXPLORATION

This section turns to a description of the methods used in, and a tabulation of the results of, the drill work, which is, in the final analysis, the basis of the greater part of the deductions in regard to the nature, structure, and composition of the mineral deposit given in the preceding geological description, and as to the content, tonnage, and persistence of the orebodies as discussed in the final economic section.

The drill set-ups were made at 100 foot intervals along a line roughly parallel to the creek, therefore also parallel to the long axis of the North Lense. This line was arbitrarily forced upon us by the canyon, not but that it was on the whole a most acceptable one, as the only feasible locus from which to drill without too great length of hole or too great a difficulty of set-up. The place from which each section was drilled was further restricted in a similar manner to one point of choice on nearly all of the sections through a combination of the sheer walls of the canyon, the creek, and the outcrop of the orebody, or in other words, by the small available space remaining beside the creek in the narrow bottom of the canyon. Thus the majority of the holes were drilled on parallel sections spaced a hundred feet apart from positions on the surface at or near the footwall side of the orebody.

It is possible because the greater number of the holes were thus driven upon east and west sections, each at right angles to the long axis of the North Lense, to indicate a specimen hole typical of this campaign. This similarity in the direction of the exploratory drill lines, constant in relation to the larger outlines of the orebody, will in a body possessing characteristic uniformity of content and structure, as this one surely does, accent markedly that uniformity. A parallel series of natural lines exists in the structure of this rock and sulphide mass; the laminations of the schist, the walls of the orebodies, the disposition and striation of the inclusions within, even the mineral values, all appear as if squeezed into leaves across which drill holes now pierce, to rule at right angles a second parallel series of artificial lines. A typical hole, then, starts from some point on the footwall side and penetrates along the plane of the section at some pointed angle - a hole directed 12° up would cut as a perpendicular all natural planes - the laminations of the soft footwall schist before it encounters abruptly the rich wall of the sulphide body; penetrates within, at first through the richer ore along the footwall, then through a lower

grade stratum, then through the low grade ore, or protore of the central portion, which continues until the high grade streak along the hanging wall is encountered and the hole passes out of the sulphide into the "schist-dyke" which separates the North from the East Lense, passing through this narrow prolongation of sulphide to finally bottom in the hard hanging wall schist. This general description will apply in entirety to some holes and in part to most of the others.

These holes cross and disclose a clean cut section of all this banded arrangement, this layered structure, and it becomes important to record and interpolate with care the various angles these lines or striations trace upon the drill core. Only in this manner, with the limited data at hand, can a correct section be constructed; the four layers of lean and rich sulphides be extended in true width and proper order, to the immediate aid of our ultimate purpose, the estimation of the grade and the tonnage of the ore.

First the methods used in the selection, assay, and record of samples will be described, followed by detail and summary tabulations, and ending with the construction of geological sections.

The drill holes were sampled through the two usual independent methods: by collection at the machine of the cuttings from the boring; by selection at the assay office of about one-half of the solid drill core.

The cuttings samples were caught in 15" x 30" cotton sacks fixed at the mouth of the drill hole in such a manner that all the returned circulation water flowed into and through them, while all the cuttings held in suspension were retained in the bags. These were changed every 5 feet, the sample interval standard throughout the work. The theoretical weight of the cuttings from 5 feet of hole driven in material of 4.5 specific gravity would be 2.27 pounds. The actual weight of the cuttings is of course increased where the sulphides fracture and break so as to enlarge the circumference of the hole, and increased by that proportion of the core which is ground up in the drilling. The actual weight of the cuttings obtained averaging for 288 samples 4.30 pounds each. There are always certain factors which make these samples less reliable than the core samples, especially where, as here, the ground cores well. The difficulty of enforcing the importance on the drill runners of filtering the whole of the returned

water, and even if this is accomplished, or samplers are kept constantly by the drill, there will always remain errors from unavoidable and unremovable causes, as when the hole intermittently loses in some underground passage or cavity some part of the water and cuttings returning along the hole. There is no surety, in other words, that a representative sample is being obtained. A careful consideration of the practical phase of this matter will rather lead one to rely more and more on core samples in any place where these represent a fair percentage of the driven footage, but, nevertheless, as used in this work the cuttings samples remain, even in this case, a very useful ever present check which eliminates some errors from entering the core results, and sometimes materially helps to form a clear image of the physical characteristics of the orebody.

It becomes of interest to compare the copper contents as determined either by the core or the cuttings samples, selecting for this comparison 977 linear feet of drill hole throughout which cuttings samples were recovered. For the entire length the core samples averaged 1.40% copper; the cuttings samples, 1.26% copper. This is a close agreement, 0.14% for the whole length, but upon inspecting separate samples referrable to the same footage the agreement is often not so marked. However, this could logically be expected, unless the cuttings from each 5 foot length were completely pumped up before starting the following sample. This procedure demands that each successive one of the serial pumping times be of ample duration, as required by the velocity of the circulating water and the depth of the hole, to thoroughly clean out the hole at the termination of each sample length. Throughout a greater part of the work this course is followed perforce as the "pulling of the rods" coincides with the end of the samples, but a careful and uniform avoidance of this, and other causes of error could only be obtained through the furnishing of reliable samplers constantly at the drill hole. Even then a part of the cuttings could lodge in crevices along the side of the hole so as to be irretrievably lost, or later dislodged, to be brought up mixed with a following sample. As overall comparisons between grouped results have given an considerable confidence in the core results, the cuttings samples have not been used in the copper averages, but are carried along as a check upon the core results in which use they have proven to be of great service, and also to prevent running unknown through rich ore too soft to core, as was encountered in the latter part of Hole #1 (Page 70). Moreover, in this work the greatest

hindrance to basing averages on the cuttings samples or to incorporate them into the general calculations has been present in that the deeper holes through either "losing" or "making" water have returned unreliable or no cuttings samples below certain depths (See Page 70).

The core was packed down the hill by the drill runners' helpers in small core boxes within which the proper continuity was retained and identified through filling the core into parallel grooves along which, at short intervals, were inserted blocks of wood marked with the proper footage. At the assay office the sampler first transfered the core in proper order to drawer trays, from which the samples were selected, each to represent, where this did not interfere with the right division between ore and waste, five feet in length along the drill hole. The core of one each sample was then transferred to a single grooved five foot weighing-box along one side of which a tape graduated in feet and inches was tacked. The actual length of the core recovered to represent the sample length of hole was read directly and recorded, then the core was weighed and the weight recorded. The physical and mineralogical nature of the core were then noted. After this the core was split longitudinally, as nearly as possible in half, by means of a small hammer and anvil - found in this material to be a more expeditious method than the core splitting machine supplied by Longyear & Hodge - one part was then weighed and sent to the assay office, and the other part returned to the drawer tray so that it still contained a continuous linear length of core to represent the drill hole. These trays (Fig. 8 Top Page 63) each holding 7 rows of 5 feet each, or 35 feet of core, inserted in racks in a temporary core house formed at all times an up to date and easily available file, retaining and showing the whole of the core without the orebody and one half of the core within the orebody, of the entire footage drilled.

To summarize the results of the sampling, the following table is inserted showing the results obtained from weights and measurements upon 289 core samples averaging 5.28 feet in length and each representing 5 feet along drill holes Nos. 1,3,4,9 10 11 12 13 & 14, in the sulphide body. These samples include all those from which the content and tonnage of the ore as hereinafter given is estimated:-

DRILL HOLE EXPLORATION

Footage sampled	1445 feet
Core recovered	950.5 "
or	65.8%
Weight, total	1002.80 pounds
per sample	5.47 "
per foot	1.08 "
Specific gravity	4.1
Cubic feet per ton (long)	7.8
Percentage taken for assay	46.1%

The equipment of an assay office constructed at the mine included a portable crushing and pulverizing unit (Fig. 4 Bottom page 33), consisting of a crusher and a Braun pulverizer belt driven from a 3 H.P. Fairbanks Morse gasoline engine. This outfit was assembled in Vancouver and shipped up the Sustut River complete, ready for immediate installation as shown in the accompanying photograph, (Page 33). This unit greatly facilitated the preparation of samples for shipment, and for assay, so that the assayer could keep well up to the drilling, the returns from the boring being definitely known shortly after the core was received at the assay office. These samples were assayed for copper alone on the spot but a proportionate part of each and every one was shipped to the Grand Forks assay office for a check assay of the copper content, here also upon selected groups of samples representing a continuous length of drill hole - some multiple of the sample length - the determination for gold and silver and the analyses were made.

The assays at the mine were by the cyanide method while those at Grand Forks were carried out through the permanganate method. The Grand Forks results have been used exclusively in this report.

A typed specimen of the form as used and filled in by the sampler and assayer is shown, Page 36. This record demands for each numbered sample, core or cuttings, the information summarized in the above paragraphs, constrasting in particular for the core samples the Grand Forks copper assay result, entered under Empire, with the mine copper assay on each 5 foot length. A record of this character is somewhat of a voucher that the samples have been handled at all times in the prescribed manner.

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DIAMOND DRILL EXPLORATION

Eastall Pyrites PROPERTY DATE July 22, 1918.

Core Sample No.	51	52	53	54	55
Hole No.	4	4	4	4	4
Footage from	56	61	66	71	127
to	61	66	71	73	132
Length Sample	5'	5'	5'	2'	5'
Core (1)	3'3"	3'3"	4'6"	1'2"	3'6"
Weight Core lbs.	3.37	3.50	4.50	1.06	3.26
Sample "	1.57	1.63	2.00	0.47	1.56
Character	sulphide	Sulphide	Sulphide	Sulphide	Sulphide
Copper %	2.4	3.1	2.2	2.7	1.8
Umpire %	3.0	3.3	2.1	2.9	1.7

Cuttings Sample No.	55	56	57	58	59
Hole No.	4	4	4	4	4
Footage from	165	170	175	180	185
to	170	175	180	185	190
Length Sample	5'	5'	5'	5'	5'
Weight lbs.	6.3	7.0	5.8	4.0	3.5
Copper %	2.1	2.4	2.0	3.5	1.6

Notes: (1) Core recovered in feet and inches. (2) Later added results of assays made at Grand Forks; George M. Lee, Assayer.

George Moffat Sampler G.H.Comrie Assayer.

SUMMARY OF DRILL HOLE RESULTS

HOLE	FOOTAGE FROM	FOOTAGE TO	FOOTAGE FEET	CORE RECOVERED LENGTH	CORE RECOVERED %	CORE RECOVERED WEIGHT	CORE RECOVERED PER FOOT	% COPPER
1	1.6	42	40.5	14.8	37.0%	15.8	0.93	1.4
	42.0	69	27.	12.7	47.0%	10.0	0.79	0.7
3	8.5	53.0	44.5	28.3	65.5	29.0	1.03	2.5
	53.	104	51	28.8	56.4	29.3	1.02	1.4
	104	136	32	23.5	73.4	24.8	1.03	0.7
4	56	73	17	12.3	72.3	12.4	1.02	2.8
	127	222	95	69.5	73.2	73.9	1.07	3.0
	222	282	60	32.8	54.5	32.9	1.01	1.5
	282	336	54	36.5	67.5	37.8	1.03	1.0
5	0	14	14	10.7	83.4	10.9	1.02	0.3
6	0	76	76	30.1	39.6	30.8	1.03	0.3
	76	101	25	18.7	74.5	20.0	1.07	0.2
	101	126	25	14.7	58.7	16.3	1.09	0.5
	126	146	20	11.3	61.4	11.8	1.04	0.8
7	0	50	50	32.7	65.2	33.3	1.02	0.2
8	0	50	50	29.3	58.5	34.3	1.17	0.2
	50	75	25	8.4	33.7	10.8	1.27	0.3
	75	105	30	16.4	54.5	17.8	1.08	0.8
9	74	129	55	33.4	60.5	36.0	1.08	1.7
	129	274	145	99.6	68.6	115.4	1.16	2.4
	274	329	55	23.0	40.0	25.5	1.11	1.8
	329	599	270	167.4	62.0	193.3	1.15	0.6
10	301	359	58	36.8	63.4	38.9	0.98	1.7
	359	479	120	84.0	70.0	87.0	1.04	0.5
11	166	191	25	22.3	89.1	25.5	1.12	0.9
	191	326	135	103.1	76.4	112.0	1.09	0.5
12	105	122	17	6.2	36.4	6.3	1.01	2.3
13	144	169	25	23.1	92.2	25.0	1.13	2.3
	169	251	82	55.1	67.3	58.0	1.05	0.4
14	103	123	20	11.7	58.7	11.1	0.97	2.5
	123	129	6	4.6	76.4	5.0	1.09	0.4

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DIAMOND DRILL RECORD

Rostell Mine — Scale—1 inch = 25 feet — Date June-July 1918

NUMBER	1	2	3	4	5
STARTED	June 22nd	June 26th	July 4th	July 7th	(continued)
COMPLETED	June 26th	June 31st	July 6th	July 17th	
DEPTH	127	189	175	484	
ANGLE	12° up	80° down	45° down	70° down	
COURSE	S.88°25' E.	S.88°25' E.	S.88°25' E.	S.88°25' E	
ELEVATION	557	552	552	552	
LATITUDE	7031.4	7031.5	7031.5	7031.5	
DEPARTURE	7587	7562	7565	7562.6	

LEGEND

Biotite Schist

Siliceous Schist

Quartz

Sulphides

5% & over

1% & over

2% & over

3% & over

4% & over

Strike

	1	2	3	4	5
	1.6-6 1.4				202-07 4.9
	6-11 1.5				207-12 3.[illegible]
	11-16 1.6	16	8.6-15 2.7		212-17 2.[illegible]
	16-22 1.6		15-17 1.6		217-22 3.6
	22-24 1.7		17-23 1.8		222-27 1.4
	24-29 1.8		23-30 1.8		227-32 1.[illegible]
	29-35 0.9		30-36 [illegible]		232-37 2.[illegible]
	35-42 1.0		36-40 3.[illegible]		237-42 1.[illegible]
			40-47 2.8		242-47 1.5
	42-49 0.5		47-53 6.8		247-52 2.[illegible]
	49-53 0.5				252-57 1.8
	53-58 0.8		53-58 1.5	58-61 3.0	257-62 1.[illegible]
	58-64 1.0		58-64 1.3	61-66 3.[illegible]	262-67 1.8
	64-69 0.9		64-70 1.6	66-71 2.1	267-72 1.8
			70-75 1.5	71-75 2.9	272-77 1.8
			75-80 1.2		277-82 1.4
	81-86 0.4		80-86 1.6		282-87 0.8
			86-92 1.0		287-92 1.0
			92-98 1.0		292-97 1.[illegible]
			98-04 2.0		297-02 1.[illegible]
					302-07 1.4
			104-10 0.6		307-12 1.0
			110-16 0.8		312-17 0.7
			116-21 0.6		317-22 0.9
			121-26 0.8		322-27 0.7
			126-31 0.5	127-32 1.7	327-32 0.6
	127		131-36 1.0	132-37 2.9	332-36 0.7
				137-42 3.8	
				142-47 4.8	
			142-47 0.5	147-52 4.0	
			147-52 0.3	152-57 3.1	352-57 1.0
			152-57 0.3	157-62 2.4	357-62 0.5
			157-62 0.2	162-67 2.5	362-67 0.2
			162-66 0.2	167-72 [illegible]	367-72 0.2
				172-77 3.4	372-77 0.5
			175	177-82 1.8	377-82 0.7
				182-87 1.7	382-87 0.4
		189		187-92 1.8	387-92 0.5
				192-97 3.2	392-97 0.2
				197-02 5.2	397-02 0.1

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DIAMOND DRILL RECORD

Scale—1 inch = 25 feet

Ecstall Mine — Date July 1911

NUMBER	4	5	6	7	8
STARTED	(continued)	July 20th	July 22nd	July 25th	July 27th
COMPLETED		July 22nd	July 25th	July 27th	July 30th
DEPTH		67	176	91	150
ANGLE		20° down	vertical	80° down	80° down
COURSE		N.86° 50' E	-	S.78° 10'E	N.78° 10'W
ELEVATION		578	576	576	576
LATITUDE		7111.8	7111.5	7111.6	7111.2
DEPARTURE		7622.4	7617.6	7617.6	7615.7

LEGEND

Biotite Schist

Silicous Schist

Quartz

Sulphides

½% & over

1% & over

2% & over

3% & over

4% & over

Striae

402-07 0.2	0-5 0.2	0-6 0.6	0-5 0.3	0-5 0.3
407-08 0.4	5-10 0.2	6-11 0.3	5-10 0.2	5-10 0.3
	10-14 0.4	11-16 0.5	10-15 0.2	10-15 0.3
		16-21 0.4	15-20 0.2	15-20 0.2
		21-26 0.3	20-25 0.2	20-25 0.2
		26-31 0.2	25-30 0.2	25-30 0.2
		31-36 0.2	30-35 0.2	30-35 0.1
		36-41 0.2	35-40 0.1	35-40 0.1
	43-48.50.3	41-46 0.2	40-45 0.1	40-45 0.1
		46-51 0.2	45-50 0.2	45-50 0.1
455		51-56 0.1		50-55 0.2
	61	56-61 0.1		55-60 0.1
464		61-67 0.1		60-65 0.1
		67-71 0.1		65-70 0.6
		71-76 0.1		70-75 0.7
		76-81 tr.		75-80 0.7
		81-86 0.1		80-85 0.9
		86-91 0.2		85-90 1.4
		91-96 0.1	91	90-95 0.9
		96-01 0.2		95-00 0.5
		101-06 0.2		100-05 0.8
		106-11 0.4		
		111-16 0.5		
		116-21 0.6		
		121-26 0.6		
		126-31 0.7		
		131-36 1.0		
		136-41 1.8		
		141-46 0.5		
				150
		176		

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Scale—1 inch = 25 feet

Bostall Mine — Date August 1918.

NUMBER	9	9	9	9	10
STARTED	July 31st	(continued)	(continued)	(continued)	August 19th
COMPLETED	Aug. 18th				Sept. 15th
DEPTH	604				513
ANGLE	70° down				70° down
COURSE	S.87° 30' E.				S.85° E
ELEVATION	536				523
LATITUDE	6935.8				6867.6
DEPARTURE	7544.1				7473

LEGEND

Diotite Schist

Siliceous Schist

Quartz

Sulphides

½% & over

1% & over

2% & over

3% & over

4% & over

Strike

		199-04 2.9	399-04 0.7	604	
		204-09 2.5	404-09 0.9		10
		209-14 3.[illegible]	409-14 0.7		
		214-19 2.5	414-19 0.6		
		219-24 2.5	419-24 0.[illegible]		
		224-29 1.8	424-29 0.[illegible]		
		229-34 2.4	429-34 0.4		
		234-39 2.5	434-39 0.4		41
		239-44 4.2	439-44 0.5		
		244-49 3.5	444-49 0.5		
		249-54 3.0	449-54 0.4		
		254-59 2.9	454-59 0.7		60
		259-64 2.3	459-64 0.3		
		264-69 2.1	464-69 0.3		
		269-74 1.9	469-74 0.3		
	74-79 4.8	274-79 1.4	474-479 0.3		
	79-84 1.4	279-84 1.1	479-84 0.3		
	84-89 1.3	284-89 1.6	484-89 0.3		
	89-94 1.7	289-94 1.5	489-94 0.4		95
	94-99 1.3	294-99 1.2	494-99 0.2		
	99-04 1.2	299-04 1.2	499-04 0.3		
	04-09 1.9	304-04 1.3	504-09 0.3		
	09-14 1.0	309-14 1.2	509-14 0.7		
	14-19 1.2	314-19 1.4	514-19 0.2		
	19-24 1.7	319-24 1.4	519-24 1.0		127
	24-29 1.4	324-29 1.2	524-29 0.4		132
	29-34 2.1	329-34 0.7	529-34 0.6		
	34-39 1.8	334-39 0.6	534-39 0.8		
	39-44 2.6	339-44 0.6	539-44 0.8		145
	44-49 1.8	344-49 0.6	544-49 1.3		
	49-54 1.5	349-54 0.5	549-54 1.1		165
	54-59 1.4	354-59 1.7	554-59 1.2		
	59-64 1.5	359-64 0.5	659-64 0.9		
	64-69 1.3	364-69 0.6	604-69 1.2		
	69-74 2.0	369-74 0.7	669-74 0.7		
	74-79 3.1	374-79 1.7	674-79 0.6		
	79-84 1.6	379-84 1.2	679-84 0.5		184
	84-89 2.6	384-89 0.5	684-89 0.5		
	89-94 2.3	389-94 0.6	689-94 0.6		
	94-99 2.6	394-99 0.6	694-99 0.6		

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Ecstall Mine — Scale—1 inch = 25 feet — Date Sept.1918.

NUMBER	10	10	11	11	11
STARTED	(continued)	(continued)	Sept.12th	(continued)	(continued)
COMPLETED			Sept.26th		
DEPTH			451		
ANGLE			60° down		
COURSE			N.87° 30' E		
ELEVATION			507		
LATITUDE			6765		
DEPARTURE			7463		

LEGEND

Biotite Schist

Siliceous Schist

Quartz

Sulphides

½% & over

1% & over

2% & over

3% & over

4% & over

Striae

		399-04 0.5		201-06 0.2	
		404-09 0.4		206-11 0.3	
		409-14 0.6		211-16 0.3	
		414-19 0.7		216-21 0.3	
		419-24 0.4		221-26 0.3	
		424-29 0.2		226-31 0.3	
		429-34 0.2		231-36 0.2	
		434-39 0.2		236-41 0.1	
		439-44 0.3		241-46 0.2	
		444-49 0.6		246-51 0.1	
		449-54 0.2		251-56 0.2	
		454-59 0.2		256-61 0.3	
		459-64 0.3		261-66 0.2	
		464-69 0.2		266-71 0.2	
		469-74 0.1		271-76 0.1	
		474-79 2.[illegible]		276-81 0.2	
				281-86 0.3	
				286-91 0.3	
	297			291-96 0.4	
				296-01 0.7	
	301-06 1.4			301-05 0.8	
	306-09 .6			305-11 0.8	
	309-14 0.8			311-16 1.1	
	314-19 1.3			316-21 3.[illegible]	
	319-24 2.[illegible]	523		321-26 0.7	
	324-29 3.5				
	329-34 3.1				
	334-39 3.1				
	339-44 1.7				
	344-49 1.3				
	349-54 0.9				
	354-59 0.7				
	359-64 0.5				
	364-69 0.4		166-71 1.8		
	369-74 0.4		171-76 0.8		
	374-79 0.3		176-81 0.8		
	379-84 0.4		181-86 0.6		
	384-89 0.6		186-91 0.7		
	384-94 0.9		191-96 0.2		
	294-99 0.7		196-01 0.3		

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Scale—1 inch = 25 feet

Eastall Mine — Date Oct. 1918.

NUMBER	12	12	13	13	14
STARTED	Sept. 25th	(continued)	Oct. 1st	(continued)	Oct. 8th
COMPLETED	Sept. 30th		Oct. 7th		Oct. 14th
DEPTH	280		262		158
ANGLE	12° Up		45° down		45° down
COURSE	N. 80° 51' E		N. 80° 51' E		N. 79° 30' E
ELEVATION	501		496		490
LATITUDE	6668.4		6668		6570
DEPARTURE	7464		7461		7480

LEGEND

Biotite Schist

Siliceous Schist

Quartz

Sulphides

2% & over

1% & over

2% & over

3% & over

4% & over

Stride

				199-04 0.5	
				204-09 0.5	
				209-14 0.1	
				214-19 0.2	
				219-24 0.2	
				224-29 0.6	
				229-34 0.7	
				234-39 0.6	
				239-44 0.6	
				244-49 0.6	
				249-51 2.1	
					65-70 2.3
					70-75 1.1
	105-10 1.9				103-08 1.0
	110-15 1.5				108-13 1.1
	115-20 1.0				113-18 1.5
	120-22 0.3				118-23 1.7
					123-28 0.4
					128-29 0.2
			144-49 2.1		
			149-54 1.7		
			154-59 1.5		
			159-64 0.7		
			164-69 0.6		
			169-74 0.3		
			174-79 0.2		
			179-84 0.4		
			184-89 0.7		
			189-94 0.1		
			194-99 0.2		

SPECIFIC GRAVITIES.

The specific gravities of inch long pieces of the drill core, selected as representative, were determined by means of the chemical balance using the usual water displacement methods. The average of 87 such determinations, summarized on the following page gave 4.85, or 5.6 cubic feet to a ton of ore in place. As a check upon this result the weighing of 1002 linear feet of drill core gave an average weight of 1.08 pounds a foot; equivalent to a specific gravity of 4.11, or 7.8 cubic feet to a ton. Without detail discussion of the relative merits of the two methods the results obtained in the former water displacement method, depending as it does upon selected compact specimens of the sulphides and eliminating to a degree the porosity as a factor, may give results too heavy to represent the entire sulphide mass, so that nearwithin 8 cubic feet is taken as the volume of a ton of ore in place.

SPECIFIC GRAVITIES

HOLE #2

22'	4.77
60'	4.82

HOLE #3

38'	4.75
71'	4.76
85'	4.85
110'	4.87
121'	4.80
147'	4.80
162'	4.70

HOLE #4

158'	4.89
197'	4.78
216'	4.92
237'	4.85
248'	4.86
267'	4.90
287'	4.82
322'	4.87
357'	4.83
377'	4.89
392'	4.80

HOLE #9

74'	4.74
89'	4.85
104'	4.90
119'	4.89
134'	4.84
144'	4.69
159'	4.89
174'	4.85
189'	4.84
204'	4.83
219'	4.89
234'	4.88
249'	4.84
264'	4.83
279'	4.83
294'	4.90
314'	4.87
329'	4.88
344'	4.76
359'	4.79
374'	4.79
389'	4.90
404'	4.87
424'	4.90
439'	4.87
444'	4.90
454'	4.80
469'	4.90
484'	4.90
498'	4.89
509'	4.83
529'	4.84
538'	4.90
554'	4.88
579'	4.89
589'	4.92
598'	4.57

HOLE #10

314'	4.87
319'	4.92
329'	4.83
339'	4.84
354'	4.90
369'	4.89
386'	4.88
404'	4.83
424'	4.81
439'	4.84
469'	4.65

HOLE #11

166'	4.85
181'	4.88
196'	4.89
216'	4.81
231'	4.83
241'	4.86
256'	4.79
266'	4.87
281'	4.87
296'	4.90
311'	4.90
316'	4.75

HOLE #12

105'	4.78
125'	4.84
154'	4.92

HOLE #13

144'	4.78
154'	4.87
159'	4.81
164'	4.80

HOLES	NUMBER DETERMINATIONS	MULTIPLE	AVERAGE
2	2	9.89	4.70
3	7	33.63	4.79
4	11	53.49	4.86
9	37	179.42	4.85
10	14	53.38	4.84
11	12	58.21	4.86
12	3	14.14	4.71
13	4	19.26	4.82
TOTAL	87	421.96	4.85

363 lbs

ANALYSES

ALSO

GOLD AND SILVER,

LEAD AND ZINC.

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

CERTIFICATE OF ASSAY AND ANALYSIS

VANCOUVER, B.C., June-October 1918.

SAMPLE NUMBERS		1	2	3	4	5	6	7	8	9	10
COPPER	%	1.1	2.5	1.4	0.7	2.8	3.0	1.8	3.6	1.0	1.2
GOLD	oz	0.02	.04	.04	Tr.	.04	.06	.02	.06	.04	.02
SILVER	oz	0.6	0.7	0.7	0.6	1.1	1.2	0.6	1.2	0.7	0.7
LEAD	%										
ZINC	%										
IRON	%	41.7	42.6	44.7	42.8	37.8	43.7	45.3	46.4	40.2	46.3
ALUMINA	%										
INSOLUBLE	%	6.0	3.8	2.0	2.8	14.8	3.2	3.6	2.4	9.8	2.0
SILICA	%										
SULPHUR	%	42.1	44.7	46.0	44.0	40.3	48.8	49.0	48.2	45.3	49.0
LIME	%	1.8	3.5	3.5	2.9	1.9	2.0	1.6	2.3	3.1	1.2
MAGNESIA	%										
WATER	%										

#1 Hole #1 0-69 footwall

#2 Hole #3 8.5-53

#3 " " 53-98

#4 " " 98-136

5 Hole #4 56-73 hanging wall

#6 Hole #4 127-172

#7 " " 172-192

#8 " " 192-222

#9 " " 222-272

#10 " " 272-322

GEORGE S. LEE, ASSAYER.

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

CERTIFICATE OF ASSAY AND ANALYSIS

Vancouver, B.C., June-October 1918.

SAMPLE NUMBERS		11	12	13	14	15	16	17	18	19	20
COPPER	%	0.4	1.7	2.4	1.3	0.8	2.1				
GOLD	%	.02	.04	.04	.02	Tr.	.03	.04	.02	.04	.02
SILVER	%	0.8	0.7	0.7	0.4	0.3	0.3	0.6	0.5	0.6	0.7
LEAD	%							0.2			
ZINC	%							0.3			
IRON	%	43.4	44.8	48.9	46.6	43.8	43.6	38.8	44.1	36.1	43.0
ALUMINA	%						2.1				
INSOLUBLE	%	2.4	1.2	1.4	0.8	2.0		1.0	0.6	1.4	1.8
SILICA	%						0.9				
SULPHUR	%	48.9	51.0	50.2	50.8	50.0	51.0	42.0	49.6	39.4	50.4
LIME	%	1.8	1.5	1.9	2.0	1.4	1.8	2.3	2.9	3.1	1.7
MAGNESIA	%						0.5				
WATER	%		0								
ARSENIC								Tr.			

#11 Hole #4	322-407	#16 Hole #9	74-294
#12 Hole #9	74-129	#17 Hole #10	301-349
#13 Hole #9	129-274	#18 Hole #10	349-399
#14 Hole #9	274-329	#19 Hole #10	399-484
#15 Hole #9	329-399	#20 Hole #11	166-191

Geo. E. Lee ASSAYER

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

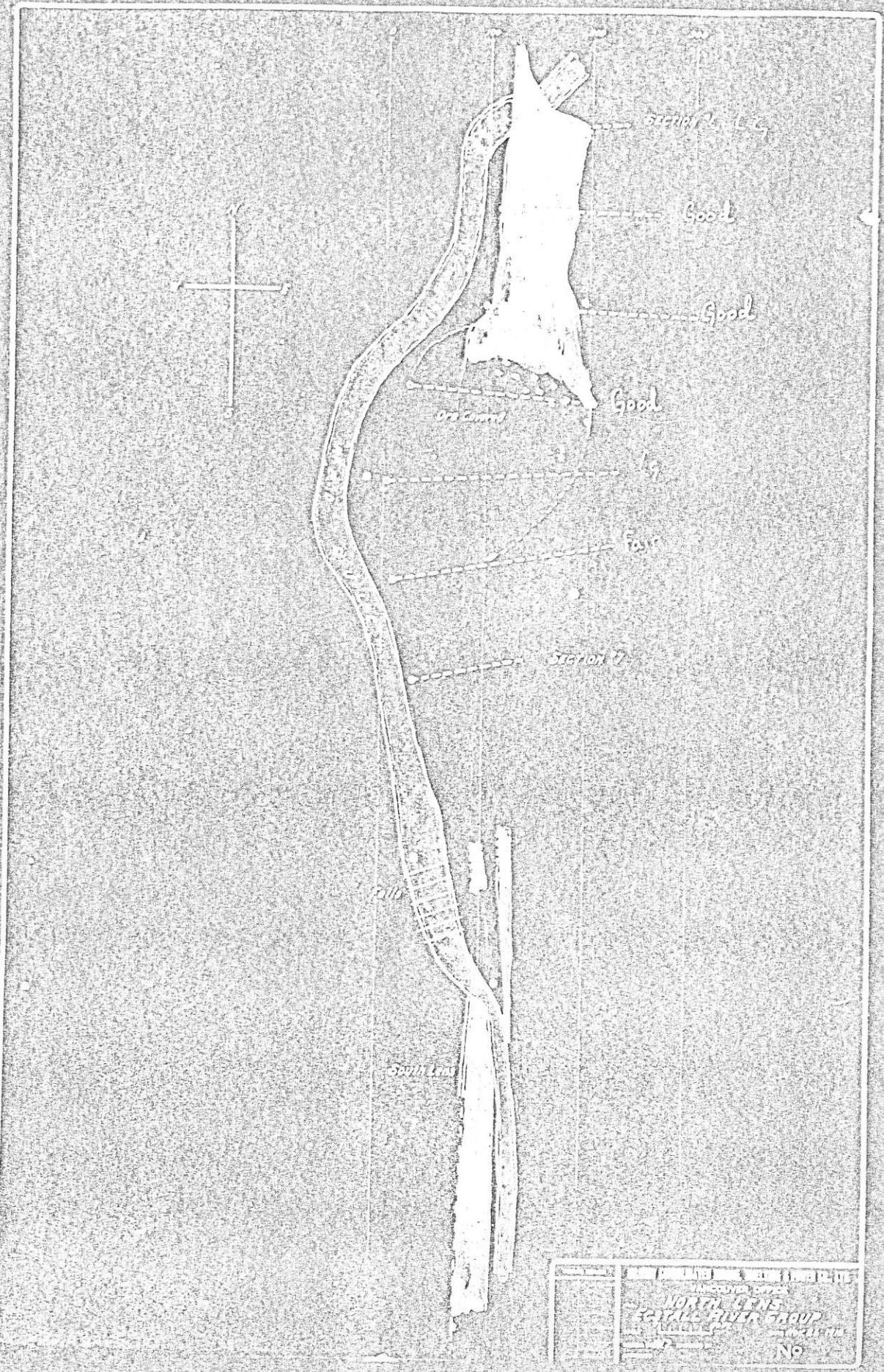
CERTIFICATE OF ASSAY AND ANALYSIS

Vancouver, B.C., June-October 1918.

SAMPLE NUMBERS		21	22	23	24	25	26	27	28	29	30
COPPER	%			1.02							
GOLD	%	.02	.04	.02	.04	tr.	.02	.02	.04	.02	.02
SILVER	%	0.8	1.2	0.4	0.5	0.3	0.8	0.8	2.7	0.5	0.9
LEAD	%			1.6							
ZINC	%			19.3							
IRON	%	41.9	36.6		41.6	26.5	43.0	40.8	35.6	26.2	39.5
ALUMINA	%										
INSOLUBLE	%	2.8	16.8		6.9	33.4	3.5	5.0	13.7	35.9	8.0
SILICA	%										
SULPHUR	%	50.4	41.6		48.0	28.6	48.1	47.0	41.1	28.5	45.4
LIME	%	1.3	1.7		0.5	1.7	0.8	0.7	0.7	0.4	0.8
MAGNESIA	%										
WATER	%										

#21 Hole #11	191-301	#26 Hole #13	144-164
#22 Hole #11	301-325	#27 Hole #13	164-249
#23 Hole #11	316	#28 Hole #13	249-251
#24 Hole #12	105-122	#29 Hole #14	65-75
#25 Hole #12	151-160	#30 Hole #14	103-129

George E. Lee, Assayer.


Good
Good
Good
Fair
Fair
Fair
South Lens
NORTH LENS
EGYPTIAN RIVER GROUP
No

SECTION #1 HOLES

DRILL HOLE #5

0-14 Sulphides
14-42 Schist, Str. 45°
42-47 Sulphides
47-87 Biotite Schist, Str. 50°
at 56 Silicious.

DRILL HOLE #6

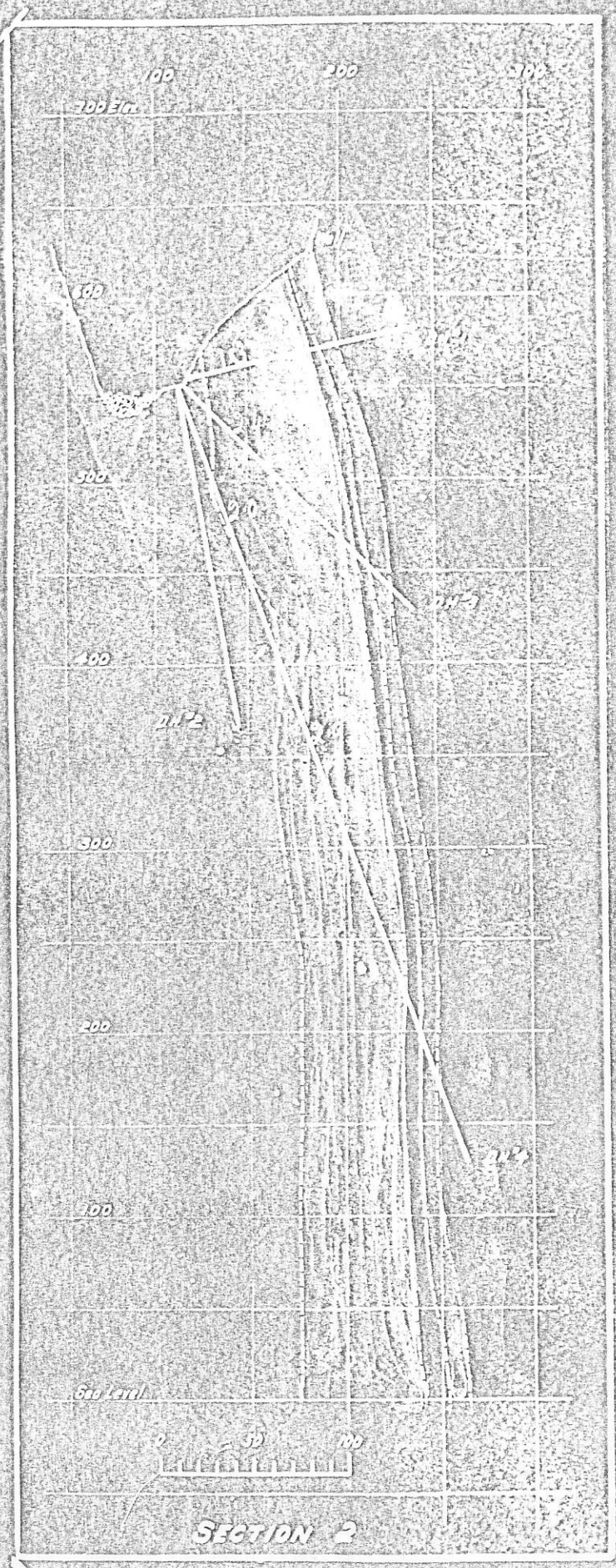
0-146 Sulphides
at 127-9" Quartz
at 128-2" Quartz
146-176 Schist, Str. 30°

DRILL HOLE #7

0-50 Sulphides
50-86 Biotite Schist, Str. 0°
at 50-1" Quartz vein
86-91 Silicious Schist

DRILL HOLE #8

0-103 Sulphides
at 85 - Schist
103-150 Biotite Schist, Str. 40°



SECTION #2 HOLES

DRILL HOLE #1

0-1.5	Biotite Schist, Str. 90°
1.5-69.5	Sulphides, 42-58 silicio schist
69.5-77	Schist well altered
77-83	Sulphide, East Lense
83-87	Schist, Str. 90°
87-89	Silicious Schist
89-127	Biotite schist, Str. 90°

DRILL HOLE #2

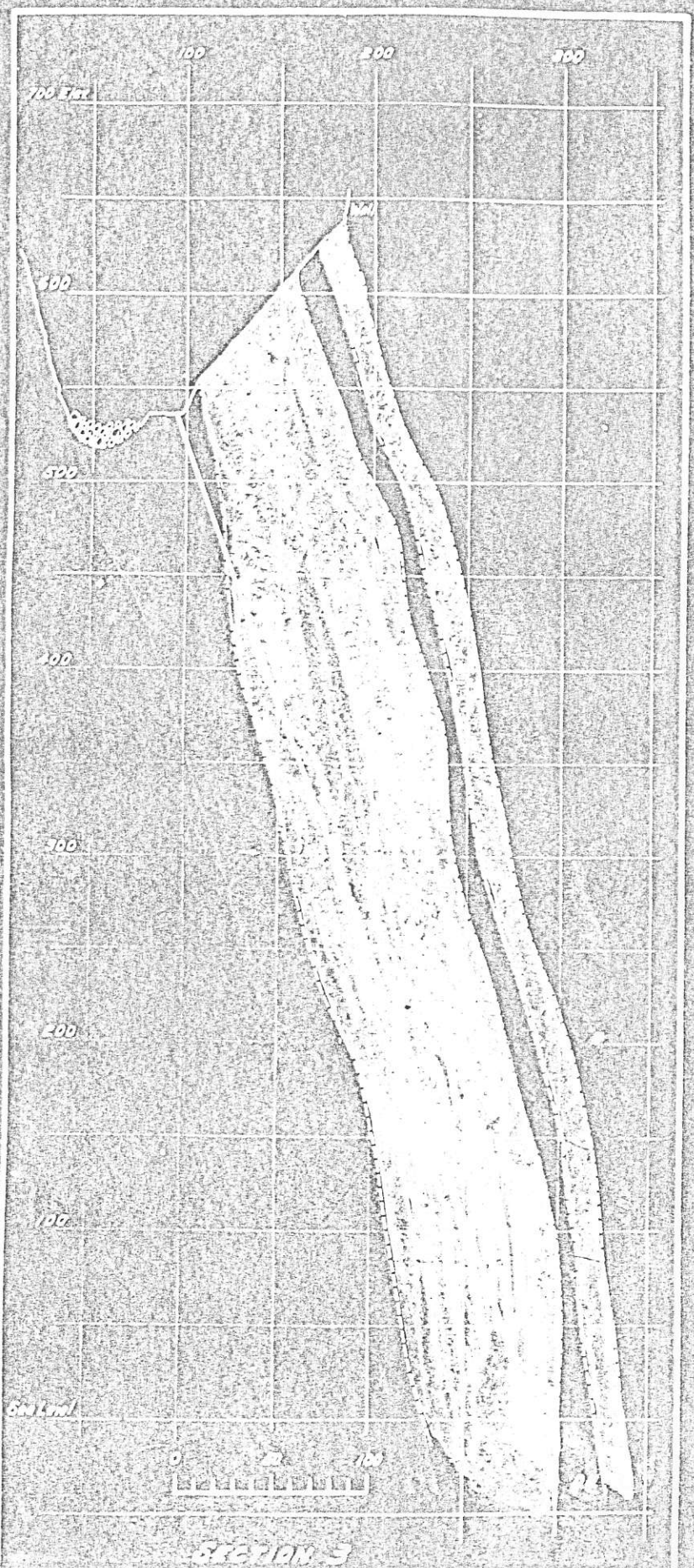
0-16	Silicious Schist
16-189	Biotite Schist, Str. 0°
	180-189 some mineral

DRILL HOLE #3

0-8.5	Biotite Schist, Str. 35°
8.5-136	Sulphides
	At 16.5-1' Quartz
	32-1" Schist
	35-1' Schist
	38-2" Schist
136-142	Schist, Str. 35°
142-163	Sulphides
163-175	Biotite Schist, Str. 35°

DRILL HOLE #4

0-56	Biotite Schist, Str. 5°
56-70	Sulphides
70-127	Silicified Schist, Str. 0
127-336	Sulphides
	At 156-1" Quartz vein
	160-1" Quartz vein
	193-1" Quartz vein
	218-2" Schist
	227-2' Schist
	241-2' Schist
336-352	Schist, Str. 10°-15°
352-408	Sulphides
408-455	Biotite Schist, Str. 15°
455-464	Siliciona Schist



SECTION #3 HOLES

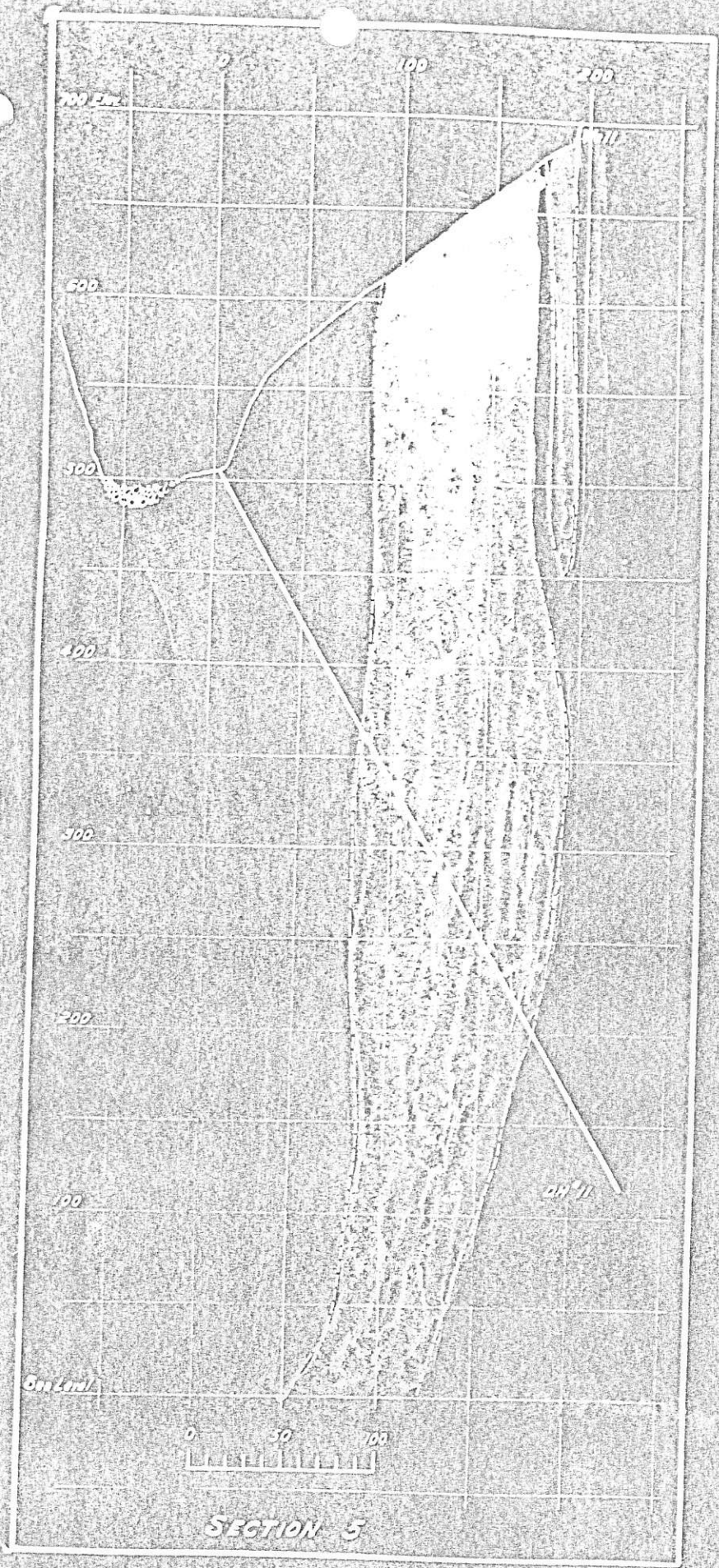
HOLE #9

0-74	Schist Str. 5-10°
74-599	Sulphides
-143-6"	Actinolite
149-1'	Actinolite
174-1'	Quartz vein
175-6"	Quartz
235-3"	Zoisite
239-1"	Quartz
518-1½'	Schist
599-604	Silicious Schist
600-3"	Quartz vein

SECTION #4 HOLES

HOLE #10

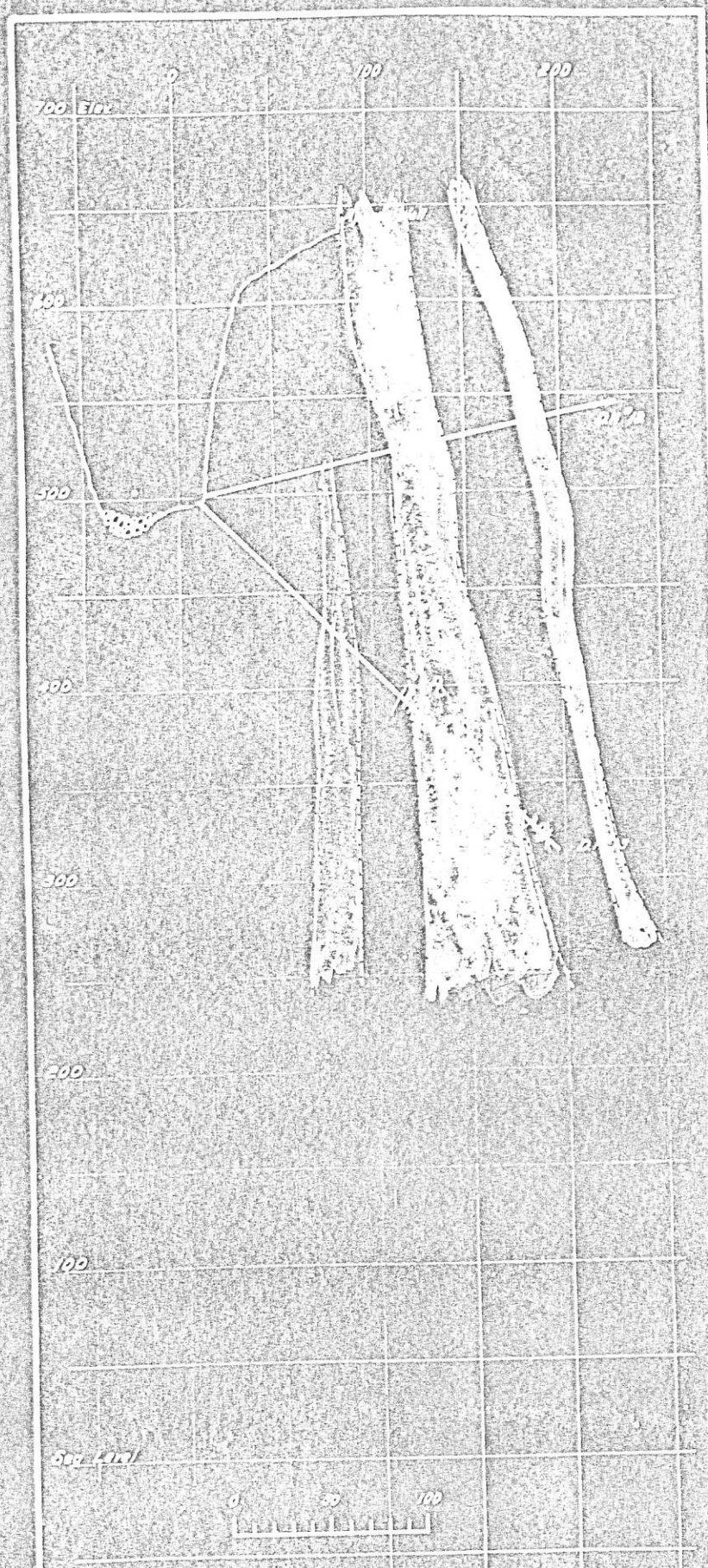
0-308	Schist, Str. 5-25°
0-10	Silicious, Str. 25°
10-41	Biotite, Str. 7°
41-60	Silicious, Str. 5°
60-95	Biotite, Str. 10°
95-127	Silicious, Str. 15°
127-132	Muscovite, Str. 20°
132-145	Biotite, Str. 20°
145-155	Silicious, Str. 20°
155-184	Biotite, mineralized
184-297	Biotite, Str. 25°
297-308	Silicious - Garnet
308-463	Sulphides
	444-1" Alt. Schist.
463-478	Silicious Schist
478-479	Sulphides
479-513	Schist, Str. 45°



SECTION #5 HOLES

HOLE #11

0-166 Schist
0-58 Biotite, Str. 80°
68-80 Silicious, Str. 80°
80-107 Biotite, Str. 40°
Banded
107-114 Muscovite, Str. 40°
114-132 Biotite
132-136 Mineralized
136-166 Biotite
166-321 Sulphides
321-331 Muscovite Schist
331-353 Biotite Schist, Str. 50°
353-360 Silicious Schist
360-451 Biotite Schist 60°



SECTION 6

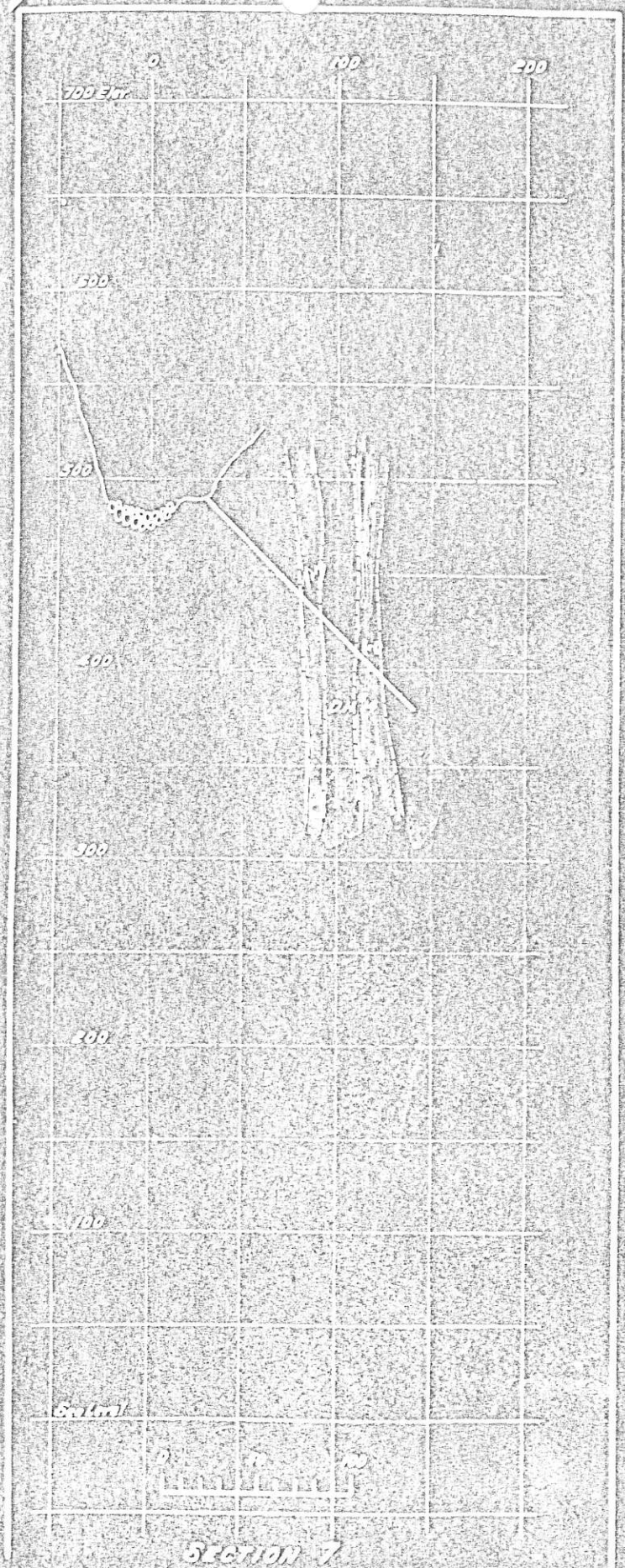
SECTION #6 HOLES

HOLE #12

0-90	Schist, Str. 90°
0-6	Biotite
6-38	Silicious
38-42	Muscovite
42-93	Biotite
93-99	Muscovite
99-122	Sulphides
99-106	no core
122-152	Biotite Schist
152-157	Sulphides
157-181	Silicious Schist
181-220	Biotite Schist, Str. 90°

HOLE #13

0-144	Schist
0-56	Biotite, Str. 50-60°
56-65	Silicious
65-98	Biotite
98-104	Mineralized
104-144	Biotite, Str. 80°
144-251	Sulphides
244-71	Sphalerite
251-262	Biotite Schist, 80°
254	Quartz vein



SECTION #7 HOLES

HOLE #14

0-103	Schist
0-66	Biotite, Str. 45°
65-75	Mineralized
75-103	Biotite 70°
103-129	Sulphides
129-158	Biotite Schist

ESTIMATE

OF

ORE RESERVES

Distribution of Metals
Primary Sulphides
Effect Pyrrhotite
Secondary Enrichment
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Content And Analysis
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ESTIMATE OF ORE RESERVES

Any estimation of the ore reserves must be based upon a study of the distribution of the copper, gold, and silver within the pyritic body. This was, to all intents, somewhat desperately foreshadowed in my previous Sentell report, especially as to the persistence of an enrichment along the roof and the hanging walls; but neither scattered samples of rich ore have been encountered, nor any a vertical difference in the richness been detected.

The latter circumstance must seem, at the first glance, in accord with the established order in a country where the zone of rich ores caused by secondary enrichment is absent from most if not all of the ore deposits. But to regard British Columbia as an area wherein all mineral deposits, or the greater number, exist as primary sulphides, having no relation to the present surface, having ore of the same richness at all depths, at any level, as some geologists have fallen into a habit or custom of doing, is an utter fallacy, or an idealistic perversion of the truth. The following extract from Bulletin #529 of the U.S.Geological Survey by W.H.Emmons, throws light on this point.

> "The copper content of pyrrhotite deposits in glaciated areas decreases with increase in depth. Possibly a former chalcocite zone was planed off by ice and a secondary chalcopyrite zone not completely removed. This is strongly suggested by relations in the Boundary District, B.C."

This is fully substantiated by my own observations in this territory, also that the greater part of the copper prospects and properties in British Columbia belong to the classification "pyrrhotite". The prospects of this region as a whole, besides being subject to what R.V.Winchell has termed a "superficial concentration" at the very surface are subject in the usual case to a progressive decrease in value with depth. A point being sooner or later reached where economic exploitation must cease.

I mention this point because British Columbia being a country of immense possibilities needs no biased brief, and because the Sentell deposit is an exceptional one in this region in that it cannot be classed as a "pyrrhotite" deposit. Upon first examination I believed that it contained pyrrhotite, as per usual type, but this summer's work has proved this mineral to be very scarce,

or lacking, the pyrite being the universal iron mineral, I expected, therefore, and the original forecast assumed a "top" enrichment which now seems in error as the work to date has unearthed no change or decrease in the valuable mineral content with depth.

To give a resume of the theory of secondary enrichment, which has been studied in exhaustive detail, and has a wide application to ore deposits, taking for example a normal copper deposit, as we sink below the oxidized surface zone into the compact sulphides, first is encountered a narrow zone of rich chalcocite ores, then below, a zone of considerably greater vertical extent of lower grade chalcopyrite ores, while greater depth encounters the primary sulphides. This phenomenon, abstractly caused by a readjustment of the valuable minerals within the orebodies through waters which dissolve, then downward percolate and redeposit the minerals, depends on numerous physical and chemical conditions, as climate, temperature, rainfall, altitude, relief, permeability, ground water level, dip, and the composition of the deposit. Among the commonest minerals pyrrhotite has a marked and characteristic effect; present, it contracts the vertical extent of the two enriched zones, absent a much greater vertical extent can be expected in each. It can be assumed in the greater number of northern deposits that the leaking zone of chalcopyrite enrichment has been removed by glaciation, and the surface now planes through the broader zone of chalcopyrite enrichment. This is rather an irregular frayed out zone in which the mineralization has extended downward into the primary sulphides along the other fractures or water courses open to circulation, all in all, analogous to the roots of a tooth, from which has been removed the crown.

While the sulphide body under discussion is impermeable it is well to note that this impermeability is relative, and to recognize that there exists in or near the sulphides certain lines or planes which are water courses. These do not appear to be due to post mineral faulting, unless this occurred directly following the mineral deposition to create fissures remained in the metamorphism, as they do not seem as well defined faults and fissures, or show any displacement through gouge, selvage, or that peculiar metallic slickensides noticeable in most deposits of this character. There are three such planes dated parallel to the long axial plane of the orebody; one in the footwall rock close to the body; one in the centre of the body at the side of the richer ore of the footwall - that is this band of ore is cut on both sides by permeable planes; the third, a narrower belt, near and in part

coincident with the ore along the hanging wall. These are three planes down which meteoric waters percolate at the present time, and reasonable planes to suggest a possible explanation of the present distribution of the copper in this body, through a so-controlled downward secondary chalcopyrite enrichment.

The explored upper portions of the Eastall deposit represent, therefore, either a zone of chalcopyrite enrichment, or plain primary sulphide ores. If the first case is true, in the absence of pyrrhotite, and in comparison with other mineral deposits in this region in which this mineral does occur, it is reasonable to assume a very great depth to the economic mineralization. If the second case is true, the present disclosed mineral value of the ore deposit will extend as far down as the physical body, and at all horizons can be expected "continued and indefinite discoveries of ore" adopting, for this particular case only, that theory which testows an inexhaustible depth upon British Columbia ore deposits.

A mineral occurrence consisting of seven orebodies 260 to 1500 feet in length, 23 to 90 feet in greatest width, and 380 to 1400 feet in proved depth are described as "The Pyritic Copper Deposits of Kystitim, Russia", by A.W.Stickney, in Economic Geology, Vol. X, Page 600. The following extracts show the close similarity which exists between those deposits and the Eastall.

"The climate of this portion of the Urals corresponds closely with that of northwestern Montana---- The pyritic copper orebodies are confined to one of those longitudinal portions of ---- uralite schist where the rock has been largely altered to zones of a thinly foliated fissile, chlorite and epidote schist. ----------The orebodies are arranged in series in this belt with two exceptions, in these instances the orebodies are arranged en echelon.---------- In form the orebodies present an elongated, somewhat lenticular appearance in horizontal section. --- The orebodies invariably conform in dip and strike with the schistosity of the enclosing wall-rock. -- The dip varies for the several orebodies from 55 to 70 degrees ---------- The vein walls are generally well-defined, relatively sharp.

"Smooth, and straight, but marked by no clay selvage or gouge---------- The orebodies are composed predominantly of a homogeneous mass of granular pyrite and remarkably free from edwixed wall-rock.----------The absence of a well-developed and well-defined zone of downward (secondary-sulphide) enrichment."

The description applies above, also a greater part of that mapped, tallies so closely with the Eastail that it is of interest to investigate how the values have carried down in this deposit.

"these relations appear to suggest that the ore in the extension below the present deepest level (760 feet vertical) should average at least as high in copper, and higher in the precious metals."

This statement is also true of the Eastail, as the trend of the evidence brought to light there is that the copper content will continue downwards in constant amount as far as the physical sulphide body, and that depth may bring, moreover, an increase in the gold and silver values.

Granted that no radical or startling changes in mineral content can be expected in depth but instead an uniform downward extension, then this is not a clear case of secondary enrichment or at least it has not become in this occurrence a commercial factor. But what could be called an incipient stage of the process is in evidence through the weathering of the surface area of the sulphides, with a decided improvisement to varying depths, positively traced, and a suggestion, given that some part of the mineral removed from the upper portions must have been redeposited within the already of an enrichment below. This is here shown through the following tabulations of holes #1, #3, and #4, drilled on Section #2 (page 63) which pierces the footwall ore at various depths.

Hole	Feet below outcrop	Avg. % copper
1	0-40	1.4
3	0-75	3.5
4	80-105	2.5
4	175-290	3.0

The holes drilled on Section #1 (#5, 6, 7 & 8) disclose an extreme case and the greatest depth of surface impoverishment.

The vertical effect of this process is well shown on Section 3 (page 64) by hole #9, which starting

ESTIMATE OF ORE RESERVES.

on the outcrop, Elevation 640-640, follows down the orebody to a length of 599 feet in the sulphides, or 30 feet below the level of the sea. This gives to the body a vertical dimension of from 670 to 670 feet. So a depth of 500 feet appears a reasonable basis for use in the present calculations. In this deposit it is more probable that the downward extension of ore will be limited by the termination of the mineral body rather than by any decrease in the value of its content, therefore, with the assurance that the lense does go down 600 feet it is safe to assume a constant content to that depth.

In all estimates of ore reserves a volume of 8 cubic feet is to be taken as occupied by a ton of ore in place, and the content based on core samples as assayed at Grand Forks. Could the cuttings samples have been correctly interpolated, and all of these recovered, a higher value would, I believe, have resulted.

To determine roughly the content of the entire sulphide body, the following holes are averaged:-

Hole	Feet	Copper	Gold	Silver
1	67.6	1.12%	.02 oz.	0.6 oz.
3	127.6	1.51	.03	0.7
4	226.0	2.11	.04	0.9
9	525.0	1.29	.02	0.5
10	178.0	0.90	.03	0.6
11	160.0	0.53	.02	0.8
12	17.0	1.30	.04	0.5
13	107.0	0.63	.02	0.8
14	26.	1.18	.02	0.9
TOTAL	1445.0 Feet	Avg. 1.24%	0.03 oz	0.6 oz

An estimate of the tonnage of this grade, based on the sectional areas of the North Lense, would be 4,036,875 tons. To this a probable tonnage of 900,000 tons in the South Lense would run likewise, or a total of 4,936,875 tons is disclosed by our present knowledge. Thorough exploration would undoubtedly allow of a substantial increase in this tonnage estimate.

As this report is being closed a more complete and representative analysis than given on pages 22 and 2 comes to hand, although it does not alter to any extent the figures quoted at that place. This is the result of the analysis of all the core samples taken

ESTIMATE OF ORE RESERVES

from all the holes drilled, #1-#14. This grouping combines the sulphide cores of the North Lense with those from the more barren East Lense, so the slight discrepancy in the copper, gold, and silver values with the above estimate, pertaining to the North Lense alone, is to be expected. The figures are as follows:-

Copper	1.1%	Lead	0.2%	Silica	4.1%	Lime	0.7%
Gold	0.02 oz.	Zinc	8.1%	Iron	42.0%	Alum.	1.6%
Silver	0.62 oz.	Arsenic	0.07%	Sulphur	47.6%	Mag.	0.7%
		Antimony	trace	Barium	0.7%		

The sulphur content of this tonnage, 47.6%, 51.0% is comparable with the Rio Tinto pyrite imported into the eastern United States from Huelva, Spain. For the production of sulphuric acid it would therefore be unexcelled. On the other hand ore so high in sulphur might allow of a closer approach to "pyritic smelting" at Anyox, and so materially reduce the amount of coke consumed upon those furnaces.

The only remaining component (except the iron) recoverable to possible advantage through the working out of a suitable metallurgical process is the zinc, which constitutes 8.06% of the entire body. The separate drill holes averaged as follows:-

Drill Hole	Zinc Percent
#1	1.8%
3	2.0
4	1.8
5	3.0
6	2.1
7	3.7
8	2.0
9	1.6
10	2.2
11	3.4
12	2.4
13	3.6
14	3.4

The above zinc content could not interfere with the smelting of the ore in bulk, still it would at least indicate that the alternate method of mill concentration should be investigated so as to compare the costs and recoveries of the two methods.

Estimate of Ore Reserves

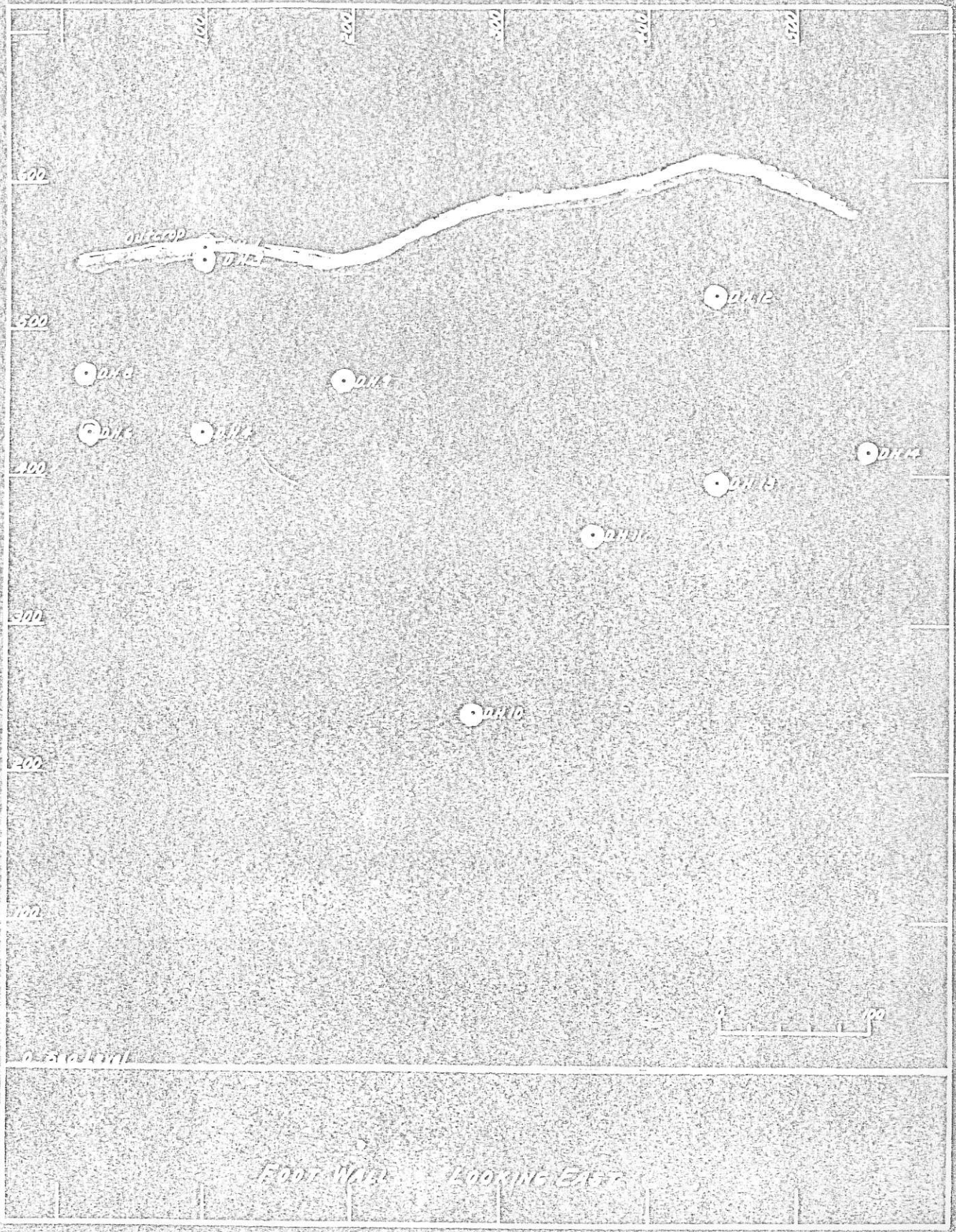
An increase in zinc is to be looked for at greater depth in the orebody. This increase would then have a parallel in the Kyshtim deposits, above mentioned (page 63), as shown in the following table which gives an analysis of one of these pritis bodies at three vertical depths, 280, 560 and 900 feet below the surface.

Vertical Depth Width	280 ft. 21 ft. %		560 ft. 18 ft. %		900 ft. 22½ ft. %	
Cu.	4.0		4.0		4.1	
Fe.	40.3	88.7%	35.5	78.4%	32.0	70.6%
S.	46.4		43.1		38.6	
SiO2	0.4	1.0%	2.3	5.1%	4.8	6.0%
Al2O3	0.6		0.8		1.2	
BaSO4	3.1		8.0		10.5	
Zn	1.8		4.3		6.7	
CaO	0.7		0.5		0.7	
MgO	0.2		0.6		0.2	
Pb	0.2		0.2		0.2	
As	0.2		0.2		0.4	
	99.9		100.0		99.5	
Au.Oz.T.	0.10		0.12		0.18	
Ag.Oz.T.	1.05		1.88		2.12	

With the exception of the percentage in the above analysis of barium, and the smaller amount of calcium, there is here a marked similarity to the Rossall ore. The Pacific Coast of America has closer at home, in the deposits of copper in Shasta County, California (described in Bulletin 1430, U. S. G. S., Pages 71-111, by L. C. Graton) ore deposits which have much in common in their mineralogy and geology with the Rossall deposits. Second only to the above quoted analysis, an analysis of the largest orebody at the Balaklala Consolidated is strikingly comparable, especially when its higher silica is overlooked or assumed to be displaced by iron and sulphur in the proportions natural to the mineral pyrite. This is shown by the following figures.

Copper	2.7%	Silica	21.5%	Alumina	3.6%
Silver	0.90 oz.	Iron	21.0%	Zinc	1.5%
Gold	0.03 oz.	Lime	0.9%	Sulphur	36.9%

Pollucite also occurs in the Bonsall copper deposit as scattered crystals of pollucite, spodumene and lepidolite in the form of irregular masses of pollucite and lepidolite or intimately mixed, in which the spodumene and pollucite are more or less parallel. A complete analysis of this



FOOT WALL LOOKING EAST

ores I have not at hand beyond the information that these run as shown in the 5,000,000 tons developed at the Hornet Mine, 1% copper, small gold and silver values, and 47 to 50% sulphur. A complete analysis might therefore be the closest of all to Ecstall ore.

The entire Ecstall North Lense does not have to be mined should this not prove advisable, as the bulk of the best grade ore is segregated in a broad band 6 to 50 feet in width along the footwall side, while along the hanging wall a narrow high-grade vein-like streak is encountered. This somewhat regular arrangement has been checked and shown to be persistent by all the holes drilled in the orebody.

This can be shown and an insight gained of the relative location of the drilled holes, through the inspection of Figures 5 & 6 which represent respectively the west side, the foot wall, and the east side, the hanging wall, of the North Lense as plane surfaces pierced by the various holes.

The footwall (Figure, Page 68) is cut by eleven drill holes, the copper assay of the first five feet of this sulphide core in each is given in the table below. This is substantially the same as to suppose the represented plane surface to be thickened to a tabular body of sulphide of a maximum width of five feet. These assays are not the average value of the holes in question, but will be used by way of variety, as they show plainly the relative richness of the holes.

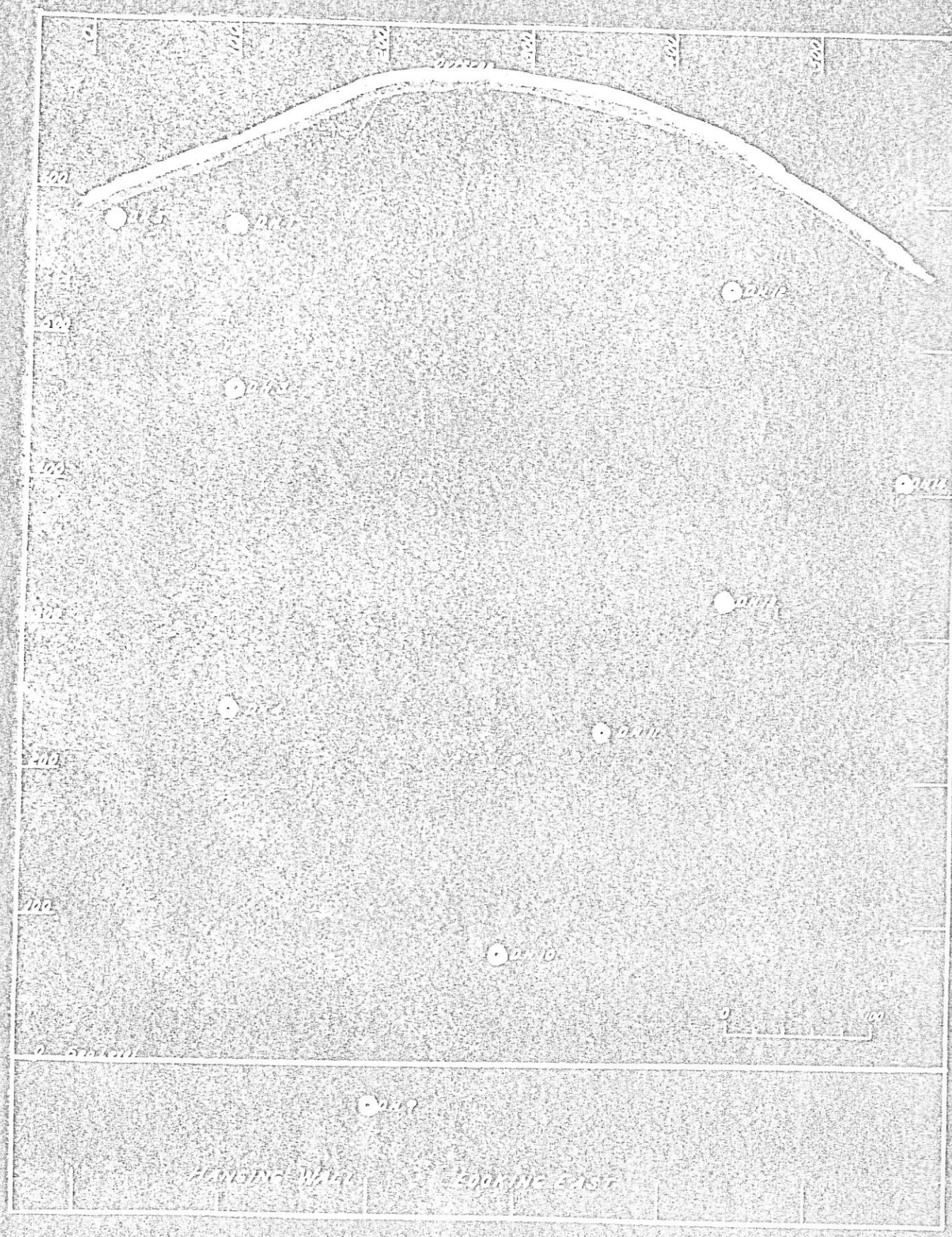
Hole #1	1.4%	Hole #9	4.6%
#3	2.4%	#10	1.2%
#4	3.0%	#11	1.8%
#6	0.7%	#12	1.9%
#8	0.6%	#13	2.1%
	Hole #14	1.0%	

Of these holes, #1 shows the effect of leaching at the surface, and #6 and #8 of leaching at greater depths below in the more disturbed portion of the lode. The deepest hole, as it pierces this plane is Hole #10, this shows a lower mineralization at this point in comparison with the upper holes, still this feature is not so pronounced when all the assays in the hole are scanned, and also when it is taken into regard that the northern portion of this lense is undoubtedly richer than the southern portion, the hole being located midway. The above hole is not, however, the deepest in the body, that place is occupied by Hole #9, which pierces the footwall at a much greater

elevation, and whose extreme range can be seen by turning to the hanging wall (Figure 5 Page 71) which it pierces at the greatest depth yet attained in the body. The evidence of this hole (especially when taken in conjunction with its prototype in diminished size, Hole #4) is, I believe, of continued richness in depth, that is of primary mineralization. Of all the holes the tendency of this one is to be the most crushed in that it courses in, across, and through the sulphides so that its great crosscutting length gives a proper weight to the barren spots, into which some of the other holes may have in greater part fallen, and gives, all in all, the closest average which has so far been attained of the entire sulphide mass.

There exists an elusive narrow belt of high grade ore along the hanging wall which is in most places too soft to be recovered as core. A hard, siliceous portion of this streak was, after careful search, found on the surface between sections #3 and #4, and the following four assays obtained: 1.5, 2.0, 2.6 and 4.9 percents. There is evidence of it only in the cores of Hole #11, 316-321 4.46% copper and Hole #13, 249-261, 3.5% copper. (These are Kootall River assays). While the cuttings of Hole #1 gave from 50 to 75 feet 1.9%, from 70 to 75 feet 3.0%, and those of Hole #2, 135-156, 3.0%, very few cuttings were recovered from Holes 4, 9 and 11, after they had reached lengths of 300, 245, and 271 feet respectively, as at these points the holes began to lose through underground channels their circulating water. The cuttings from the entire Hole #10 are unreliable because of this circumstance, and from other causes the latter part of the cuttings from Holes #12, 13 and 14 cannot be taken as representative. From the holes 9, 10 and 11, after they had reached lengths of 396, 390 and 320 feet respectively there were on account of the holes striking a flow of water, that is acting as artesian wells, no more cuttings recovered. Thus the majority of the holes would not show the existence of a layer of ore along the hanging wall should this be too soft to core, as it has been shown to be in part.

The fact is significant that drill holes #4, #9, and #11, began to lose their circulation water at practically the same elevations, 270, 305 and 270 feet above the level of the sea. This might be explained by leakage through open lateral fractures but in view of the correspondence of the elevations, it is more probable that at this elevation there is encountered a permeable zone in the sulphide mass made so by a very active solution at and immediately above the upper limits of an oscillating water table. As the holes at about a hundred foot lower elevation strike a persistent flow of water, Holes 9, 10 and 11 at elevations 170, 167 and 226 feet, unquotedly within these limits will be found the level of the top of the ground water at the time of the drilling, say at 185 feet above sea level.


HOVING WALL
LOOKING EAST

ESTIMATE OF ORE RESERVES

This elevation would coincide with the top of a secondary sulphide zone were one being formed at the present time, or reversely, would indicate the top of a previously formed secondary sulphide zone should the ground water level have remained stationary. The latter hypothesis is hardly tenable. An enrichment below the ground water level is highly speculative and problematical, but it will be of future interest to note if there has been formed, if not an economic, a perceptible enrichment of the body at or below this level.

The following estimates of ore are made in the full knowledge that the mineral deposit is at present under-drilled and in consequence under-defined, so that in their construction reliance has been placed in large part upon a study of the nature of the occurrence. Nevertheless, the estimates stated are, I believe, both a reasonable and a conservative basis of expectations which must be definitely assured prior to any considerable capital outlay.

Summarizing on each of the seven sections just what data is used in the ore estimates:-

Section #1:- The drill set up on this section in the only available spot left in the canyon bottom by the creek gave an unfortunate location upon the top of the ore. As the orebody is here limited in part by the end wall (Page 51), the section showed deep leaching and a very contorted outline, as was discovered when four short holes #5, #6, #7, #8, driven in fan shape did not gain a depth greater than 150 feet, recovering little core and hardly any copper (Page 38). Time as well as footage of drilling at my disposal being limited, this section had to be abandoned, and is at present lost, no ore being computed here, although it could well be later recovered through going across the creek and blasting a drill station in the canyon wall, or by inclined holes from a set up farther up the creek piercing but not in the plane of this section. This work gave useful evidence, however, that the abrupt termination at this end of the orebody has not been caused by a fault but by a fold in the schist.

Section #2:- This is the sole section drilled to a degree which allows a reasonable assurance in the estimate. The following were the drill hole results:-

Hole	Footage	Feet	Copper	Gold	Silver
1	1.5-42	40.5	1.4	.02	0.6
3	6.5-104	95.5	1.9	.04	0.7
4	56 - 73	17	2.8	.04	1.1
4	127-282	155	2.4	.05	0.9
	Total	308.0 Avg.	2.14	.04	0.8

ESTIMATE OF ORE RESERVES

Area: Ore Section 28,375 sq. feet
Area: North Lease 38,850 sq. feet

Section #3:- There is one hole on this section, Hole #9, which follows the sulphide main below 200 level, and, while it does not actually follow the rich footwall ore to this depth, it gives evidence that the content of valuable metals is unimpaired at this depth through showing the poorer hanging wall portion to be as well mineralized at lower as at higher elevations. The results used from this hole are as follows:-

Hole	Footage	Feet	Copper	Gold	Silver
#9	74-296	220	2.7%	.08 oz.	0.9 oz.

Area: Ore Section 23,150 sq. feet
Area: North Lease 58,450 sq. feet

Section #4:- Second only to the preceding this section is the largest in total area, although the ore area now appears to be much smaller and confined closely to the footwall. A hole drilled by former owners of the property shows the upper portion of this section to have a width of some 150 feet. (Hole #2, Page 17, first Kontell report). This hole gave 21.5 feet along the footwall of 2% ore. From the hole we drilled, Hole #10 the body appears to wedge in depth, although at the diminished rate of contraction it would not wedge out until the body has extended below a depth greater than any under present consideration (Page 55). The value to be given this section is taken from the below data.

Hole	Footage	Feet	Copper	Gold	Silver
#10	301-359	58	1.74%	0.04	0.6

Area: Ore Section 10,845 sq. feet
Area: North Lease 53,475 sq. feet

Section #5:- Present indications limit the occurrence of the high grade ore to sections 2, 3 and 4; that is the northern portion of the North Lease appears the richer. Even if this is so, which the drilling has not been thorough enough to advance a proof positive, the Hole #11 drilled on this section pierces the lense at an abnormally barren spot, giving only five feet along the footwall of 1.8% copper ore containing 0.02 oz. gold and 0.7 oz. silver. As another hole - at a higher elevation - drilled by the previous owners of the property, Hole #1, Page 14, first Kontell report, falls within 25 feet of this section, and shows 40.5 feet along the footwall of 2.0% ore carrying

ESTIMATE OF ORE RESERVES

0.05 oz. gold and 1.1 oz. silver. It is probable that this section should be given an area and value above that recorded by hole #11.

Area: Ore Section 4,225 sq. feet
Area: North Lense 58,300 sq. feet

Section #5:- The increased cross section of the North Lense on the lower of the two holes drilled upon this section, seems to show when compared with sections 4 and 6, that the greatest horizontal area of the North Lense is between elevations 300 and 400 feet above sea level. As at present the body is considered as extending from 0 to 600 feet in elevation, the greatest width is close to the middle distance, that is at elevation 300 feet, or reversally 300 feet below the surface. Were it possible, which strictly speaking it is not, to use this outline for the South Lense, its horizontal area would increase to a maximum 100 feet below the surface. That the South Lense does increase in area with depth is somewhat indicated by the upper hole on this section, #12, showing not a trace of the end of the lense, while the lower hole, #13, has 6 feet of mineralized schist, evidently the end of this lense. The following data is used in this section.

Hole	Footage	Feet	Copper	Gold	Silver
#12	106-115	10	1.7%	.04 oz.	0.5 oz.
#13	144-159	15	1.8%	.02 oz.	0.8 oz.

Area: Ore Section 9,425 sq. feet
Area: North Lense 44,425 sq. feet

Section #7:- The single hole drilled on this section, Hole #14, cut at 65-75 feet the siliceous end of the South Lense assaying 1.7% copper, 0.02 oz. gold and 0.5 oz. silver. The North Lense was encountered at 102-126 assaying 1.6% copper, 0.02 oz. gold and 0.9 oz. silver. This was the last section drilled although the North Lense tapers north from this point a distance of 700 feet.

Area: Ore Section 5,100 sq. feet
Area: North Lense 10,200 sq. feet

Summary Sectional Tonnage and Grade

Section	Tonnage	Copper	Gold	Silver
2	354,700	2.14%	.05 oz.	0.8 oz.
3	289,400	2.10	.03	0.9
4	155,600	1.70	.04	0.6
5	52,800	1.80	.02	0.7
6	117,800	1.76	.03	0.7
7	63,800	1.60	.02	0.9
Total	1,014,100	1.97%	.033 oz	0.8 oz.

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HIGH GRADE ORE

A certain amount of the above tonnage is of relatively higher grade, and segregated so that by keeping close to the footwall selective mining along with some sorting could easily separate a considerable tonnage. Considering each section to cast its influence 50 feet to either side, the following tonnage is calculated not based on areas, but on a uniform band of ore of given width. The use of this method is feasible through the structure of the orebody.

FOOT WALL ORE:

Section #2

	Footages	Feet	Copper %
Hole #3	8.5-53	44.5	2.46
" 4	56-61	17.	2.8
" 4	127-223	96.	3.0
	Total Feet	156.5	Avg. 2.82%

$\frac{(20) \times (600) \times (100)}{8} = 150,000$ tons 2.82% copper.

Section #3

Hole #9	174-259	85.	2.7%

$\frac{(20) \times (600) \times (100)}{8} = 150,000$ tons 2.7% copper.

Section #4

Hole #10	319-339	20.	2.97%

(7) x (600) x (100) = 52,500 tons 2.97% copper.

SUMMARY:		
Section #2	150,000	tons 2.82% copper
Section #3	150,000	tons 2.70% copper
Section #4	52,500	tons 2.97% copper
Avg. total	352,500	tons 2.79% copper
Gold 0.05 oz.		Silver 1.2 oz.

EXTIMATE OF ORE RESERVES

HANGING WALL ORE: This ore discussed in a paragraph above (Page 70), can only be indicated as forming a layer 3-5 feet wide no doubt persistent over the entire hanging wall which would give from 135,000 to 225,000 tons. A very safe approximation would be to take a width of 3 feet and the area over which the layer is now well defined by drill holes (400 x 400), this gives a tonnage of 60,000 tons. The grade of this ore appears well above that on the footwall, but the latter content will be assumed at present.

TOTAL HIGH GRADE: This indicates 412,500 tons of 2.79% copper ore carrying 0.05 oz. of gold and 1.2 oz. of silver to the ton. The recovered metals in ore of this grade if smelted at Anyox would bring $8.50 a ton. (Copper $0.15, Gold $20.00, Silver $0.50). This ore in its iron content is on a par with Mamie ore, and possibly could be treated as cheaply, say $6.00 a ton, (Mamie Mine 105,002 tons mined, shipped and smelted up to June 30, 1917, at a total operating expense of $5.89 per ton), with installation expenditures at the mine held at a minimum, and economical shipping arrangements provided for, there would appear a fair margin of profit in even the above tonnage.

PROBABLE ORE: North Lense: Could Section #1 be reclaimed there would be an addition of about 300,000 tons of 2% ore, or 125,000 tons 2.8% of these estimates.

South Lense: Upon Section #7 the Hole #14, encounters the mineralized northern tip of the South Lense, which outcrops below the falls, 350 feet south, 21 feet wide; again 400 feet south 27 feet wide; and at 450 feet south of the drill hole the last uncovered exposure occurs, but the full width is at this point hidden. Assays of these outcrops showed sufficient copper along one side of the body to indicate a good grade of ore below. The probable ore here would be - 337,500 tons 2.0%, or 150,000 tons of 2.0% copper ore.

The fact established that the South Lense contains copper by means of the above indicatory drill hole and confirmatory surface assays, the possibilities of tonnage opened here, both for a large tonnage of low grade, and a small tonnage of high grade ore, are by no means exhausted through the above estimates.

POSSIBLE ORE: Extension of mineralized area: Between the tunnel in the South Lense and the end of the North Lense there is estimated 1,661,600 tons of proved and probable 2.0% ore, so that should the known

ESTIMATE OF ORE RESERVES

northward extension of the mineralized zone, a length one and a half times as great, be as responsive to development in ultimate tonnage of 4,189,000 tons of 2% ore would result, accompanied perhaps with a proportional increase in the contained high grade portions.

Extension in Depth: So far the investigation makes it seem improbable that these ore bearing lenses are limited to 500 vertical feet. Because of the great length, a partially explored length of 2,000 feet and an additional unexplored but traceable length of 3,000 feet, or a total of 5,000 feet, double this depth, or 1,000 feet below the outcrop, becomes a very reasonable assumption, substantiated by our knowledge of the shape of the North Lense. There might be a suspicion that the mineral content shades off before this depth is reached, still the bulk of the diamond facts strongly point contrawise, so that again a very possible doubling of the proved and probable ore can be considered, or, 8,378,200 tons of 2% ore.

It is premature to combine at this time the expectations of vertical and horizontal extensions as, in fact, all I hope to express by the estimate of possible area, is that the possibilities of this mineral area are by no means exhausted through the above estimates of proved and probable ore.

The above inventory of expected ores does, however, lend its direction to the future exploration of the deposit. This is well worth continuing, and will have to proceed with greater despatch to enable a decision as to the merits of the proposition before the first instalment of the purchase price falls due next December. As similar mineralized areas have yielded their ores only through intensive development, usually spread over some years of continuous work, there is little to make one believe that this extensive area, with its great vertical and horizontal extent, will give a quicker response, or that a small footage of drill holes will discover more than a small proportion of the ore resources.

The producing mines illustrate this in the large footages of exploratory drilling it has taken to secure to them their ore reserves. Take the flat-lying chalcocite "blankets" of the South West, drilled in checkerboard fashion on the corners of 200 foot squares, at the time when these deposits were in a state of mature development, or at about the commencement of the operating period, each foot of drill hole had indicated at Ohio 420 tons, at Ray 885 tons, at Inspiration 686 tons, at Miami 742 tons of ore of shipping grade. The task of confirmatory drilling upon these secondarily enriched copper deposits

ESTIMATE OF ORE RESERVES

must not be likened, but contrasted to the much more intricate task of the development of primary sulphide deposits, or those slightly enriched by secondary chalcopyrite, the prevalent type of ore deposit in the North West. The larger examples of such deposits are in reality more or less extensive mineralized zones containing sporadically grouped sulphide bodies, within which the valuable metals are seldom in a concentration to make the whole ore, but the value of each is to be found in erratic ore shoots within, and the value of the entire group therefore sums the content of a number of small and separately outlined ore tonnages. The problem now before us demands an increased length of exploratory drill lines.

At the Phoenix mines on July 1st 1916 a total of 112,620 feet of diamond drilling has shown (neglecting the part played by surface trenching and underground development) 15,759,130 tons of ore, or in the ratio of 140 tons to each linear foot of drill hole. This amount of drilling does not of course block out a new found deposit, but instead exhausts the possibilities of a mineralized zone through prospecting it so thoroughly that no reasonable doubt can remain of the existence there of an undiscovered body of workable ore. Still to block out ore in a mineral area - the limits of which are roughly known through a prospect and geological survey of the surface - to a degree which will present a sound and conservative basis for an economic mine establishment, is no small task, especially where there is not a ready response to the first drilling, or the orebodies are small and widely scattered, or the ultimate resources of the area barely suffice to justify the establishment. Any or all of these causes may have been active in the drilling undertaken by the Canada Copper Corporation at Copper Mountain, as against 10,000,000 tons of proved ore there has to be placed 118,323 feet of drilling, or only 85 tons of ore to the foot. To turn again to the Company mines, the Hidden Creek Mine, Anyox, at about the commencement of shipping, January 1st 1915, yields the following data:-

OREBODY	LENGTH OF HOLE	TONNAGE	TONS PER FOOT
#1	24,360	6,659,000	268
#2	11,611	8,766,000	755
#3	5,223	2,550,000	474
#4	2,397	178,000	
TOTAL	43,591	18,153,000	417

ESTIMATE OF ORE RESERVES

This tonnage represents, however, the "geological orebodies" rather than the "commercial orebodies", as 9,750,600 tons alone of the above estimate was 2.2% ore (average of remainder 0.6% copper), or 224 tons of 2.2% ore to the foot was then developed. The closest example of the Coastal North Lense is found in the heavy sulphide #1 orebody given above, which at this date had 3,905,600 tons of 2.2% ore, enveloped by the low grade, or 160 tons to the foot drilled. This drilling, it is to be noted in passing, was at the time barely sufficient to satisfy several competent examining mining engineers. For the 2639 feet drilled on the Coastal North Lense there is estimated herein 1,110 tons of 1.24% ore to the foot, or 279 tons of 2.0% ore to the foot. This compared with the drilling on the #1 orebody denotes that the North Lense has not yet had its low grade ore thoroughly searched, and that all the high grade ore the footage will stand has been estimated.

The advisable campaign for the 1919 season should be left elastic enough to be turned in any direction found to be particularly favorable as the work proceeds; but one can be sketched along four lines led up to by, and fully discussed in the above text.

FIRST: Investigation of the South Lense by drilling two sections, somewhat widely spaced, will give an idea of the outline, content, and tonnage in this body. About 1500 feet of drilling could be used in this manner.

SECOND: Extension in Depth: This is difficult of accomplishment as the canyon walls interfere with the placing of the machine any great distance to either side of the steeply dipping lenses. However, inclined holes parallel to the long axis of the North Lense, driven from a set-up to the north of this body, will accomplish the result nearly as well as crosscutting holes. At least two drill holes and a total of 2,800 feet will have to be used here.

THIRD: Continuation of the North Lense: This should be sought for as fully discussed in the body of this report, using about 2,000 feet of drilling in the search.

FOURTH: Extension to the North of the Mineral Area: Should any footage now remain at our disposal, a few short holes, a footage of about 1,000 feet, could be driven from the great bed into the

ESTIMATE OF ORE RESERVES

FOURTH: northern portion of the mineralized zone,
that is: A thorough exploration of this region would involve us beyond a season's work, and a normal footage, and had better wait until we find what response the better known portions of the zone will give.

The second and third of these points are of major importance: that is to determine the vertical extent of the deposit, and its content at depth, and to find, should one exist as we surmise, the continuation of the north zone. This work calls for a total footage of 7,000 feet of drill hole, at an over-all expenditure between $25,000. and $30,000. The camp now being built, the outfit on the ground, and the routine of the work clearly settled along an efficient line, the coming season's expenditures will be upon a most economical basis.

THE END.

SULPHIDE DEPT. FILE

FINAL REPORT

on the

ECSTALL EXPLORATION

by

H. J. G. MACDONALD

March 1st 1920

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PHOTOGRAPH "THE ECSTALL VALLEY"

Survey Maps and Sections V. H. Todd
Assay, Analysis, and Experiments R. J. C. Harvant
Plate Page 137 H C. Cousten
Typed by N. E. Markley

EXPLORATION.

The first holes drilled during the 1919 season had for their double objective, the southern arm of the mineralized zone, marked by an elongated sulphide lens, the South Lense, and the northern arm, traced as an iron-stained schist band up Red Gulch Creek into the basin of Red Gulch Mountain. Later in the season both drills were drawn back from their outlying locations to the North Lense, the nucleus of the mineral zone, in order to thoroughly test this lens in extension and confirmation of the previous work done here. The campaign is thus readily summarized under three headings: The South Lense, the Northern Extension of the mineral area, and the North Lense.

THE SOUTH LENSE This is a pyritic lens 1750 feet in length, 20 to 30 feet in central width, tapering towards either end. Prior work here consists of a tunnel and one drill hole through its southern end, returning an average sample content of 0.5% copper with $1.60 in gold and silver; also a second drill hole through the northern end giving an average of 1.7% copper with $1.30 in the precious metals. The latter result gives presumptive evidence that certain sections of this lens have a commercial mineralization.

The season's drilling, therefore, began along the middle length and on the hanging-wall side of this lens with two set-ups, spaced 195 feet apart, two holes, one of slight and one of steep incline, being driven from each set up down through the sulphide body as it pitched with a 70 degree dip beneath the machine. Tabled below are the returns from these four holes.

South Lense Drill Holes					
Hole	Sulphide feet	Copper %	Gold oz.	Silver oz.	Zinc %
#15	36 30	0.5	0.01	0.7	2.6
#16	46	0.4	0.01	0.6	2.6
#17	39 35	0.4	0.02	0.6	3.1
#18	61	0.4	0.02	0.6	3.3

This table does not check with logs

EXPLORATION.

These holes so far failed to fulfill favorable expectations as to give to the South Lense an average copper content of less than one half of one percent. Singularly, the amounts of the other elements, except gold, closely approach those percentages found in the North Lense. As the matter stands, the probability remains that there are rich spots within so large a bulk of pyrites, one to three million tons, which could easily be missed by the limited number of intercepts of the ledge that have been made - the lens has been, up to date, pierced on seven random lines, the deepest 300 feet below the outcrop - and that those enrichments do exist, and have in fact not been hit. The lack of an immediate response, however, made it appear that there was little chance for the speedy disclosure of any considerable tonnage of ore with the small drill footage that could be spared, so all work in this locality was stopped upon the completion of the 704 feet of drilling enumerated above. No tonnage of ore from this lens, whatsoever, is counted upon in our present consideration.

NORTHERN EXTENSION OF THE MINERAL AREA Driven from a set-up in the creek, 300 feet north of the North Lense, a flat hole, #20, was pointed into the western canyon to tap the continuation of the North Lense. A talcose mineralized zone in the green schist, a pinched lead, 30 feet wide, was crossed at from 92 to 122 feet, and the hole was continued beyond to a length of 317 feet in lateral exploration. The sparse mineral encountered here was not in a strength to encourage further work at this point.

The drill was then moved 500 feet further up the creek, just over the north line of the Bell Helen on to the Blue Bird mineral claim, staked and owned by the Company. Two holes, a flat one 220 feet in length and a steep one 367 feet in length, were here driven to tap the mineral zone. This was cross-cut 200 feet in the canyon wall as a 50 foot wide, 70 degree dipping band of mineralized schist. With contents, however, not valuable. The cost of this particular piece of work exactly covered, and was recorded to fulfill, the statutory requirements for the first and second years assessment work on a group of eight of the mineral claims held by the Company.

EXPLORATION.

The holes drilled in this area were barren, yet it is always expecting a great deal where a small footage is given the task of exploring an extensive mineral zone whose centers of maximum mineralization are ill defined. There remains a reasonable chance of a workable sulphide body, particularly at a lower horizon, being found in this northern zone. In surface prospecting this summer a clue given through finding the slide-rock in the creek bed cemented by iron-oxide into a loosely bonded conglomerate was followed up, the eastern canyon wall being scaled and searched with the resulting discovery of the sulphide body which had supplied the iron oxide cement. This lens, judged from its surface section, 4 feet wide by 80 feet long, is of limited tonnage. The location is 2500 feet north of the North Lense, within the boundaries of the Albermarle mineral claim. This find is significant of the occurrence of other bodies in this locality. To open up this rather inaccessible area a good deal of trail work has been carried out, which, in furtherance of a finer combing of this ground, may later yield worth-while results.

NORTH LENSE As a mineral body this is a pyritic lens 1000 feet long, 75 to 150 feet wide, and of unknown, but as far as known, great depth. There occurs a wide band of ore along the footwall, a narrow band along the hanging wall, enveloping a more or less barren core. The tenor of all the sulphide is 0.86% copper, 0.02 oz. gold and 0.74 oz. silver. The tenor of the average ore sections is a 2% copper ore; below grade and narrower in width in the southern portions of the lens; above grade and wider in the northern portion of the lens, where also is found the richest ore, grade of 2.8% average, confined to a distinct steep pitching ore shoot. The values depended on for its commercial importance are at present the copper along with a gold and silver content greater than commonly found in orebodies of this type.

The characteristics of this orebody and the nature of its occurrence have been fully portrayed in the two former reports. I hope that these previous descriptions have conveyed the idea of magnitude, as the Kostall North Lense can be compared with the Burra Burra, the sizable orebody of the Tennessee Copper Company, and also with the large orebody at the Mount Lyall Mine in Tasmania. The likeness to the latter orebody becomes strengthened through a great similarity in the content and composition of the two ores.

EXPLORATION

The location of the outcrop of the Kestell deposit at the bottom of a deep and narrow canyon so that the drill set-ups needs must be close to the top of, or on top of the lode, has been at all times a great obstacle to the driving of deep holes into this orebody. During the past season there were encountered more and greater difficulties in the placing of effective depth-holes than I have ever before experienced. In those driven in the first part of the season from points outside of the orebody the two deepest, #2 and #23, were a total loss through excessive deviation caused by the alternate hard and soft layers which interleave the schist. This hurried all the later drilling when holes had to be pushed from set-ups on the top of the orebody itself, through the very much faster-drilling pyrites, in a vain endeavor to gain depth. but here again the soft decomposed pyrites near the surface formed so ill a support for the drill rods that the desired pointed directions could not be maintained, nor could the degree of this variable deflection be foretold and forestalled. (Inclined holes had to be driven as the downward range of any vertical hole which could be driven in the orebody would not be over 300 to 400 feet before the wall of the body was pierced). A careful hydrofluoric acid survey of all the drill holes driven was carried out, and (with the possible exception of Hole #30) the positions plotted on the enclosed sections are accurate. Late in the season a deviation of Hole #30 was attempted through the setting of a deflection wedge along its lower length, the deviation itself being successfully accomplished (See Section #3) but later movement of the wedge stopped the deflected hole before any useful depth was gained. This sort of work requires a good deal of care, which used up much time, and this was just what was lacking in the face of a fast approaching winter.

The greatest depth gained was by Hole #28 which penetrated downward through the solid pyrites, of an analysis as below, encountering only 2 feet of waste rock (0.27 of 1%) throughout its entire length and depth below the outcrop of 752 feet. (Section #4). The evidence of this hole being that there exists the same degree of mineralization at this depth - 100 feet below Sea Level - as in the upper portions of the mineral body.

EXPLORATION

Analysis of Season's Drill Holes in the North Lense 1919								
Hole	Pyrites ft	Silica %	Iron %	Lime %	Sulphur %	Alumina %	Zinc %	Lead %
23	65	4.49	41.5	0.5	47.0	0.3	2.3	0.1
24	216	0.68	43.6	0.7	49.5	1.0	2.5	0.2
25	251	0.93	43.0	0.2	49.1	1.5	2.6	0.1
26	296	1.35	43.0	0.4	49.3	0.7	2.7	0.1
27	166	2.49	42.0	0.4	48.2	0.7	3.7	0.1
28	752	0.69	43.1	0.2	50.7	0.8	2.4	0.2
29	403	0.98	43.1	0.2	50.4	0.9	1.5	0.1
30	626	0.83	43.2	0.2	51.2	0.8	2.4	0.1
31	362	1.08	43.3	0.3	51.2	0.4	1.4	0.1

All the holes were this season assayed for gold and silver, (besides the usual copper) upon every 5 foot sample of core. Complete analyses were run on the spot so that the completed records enclosed are now reliable in all regards. The distribution of the metals within the mineral body becomes worthy of some notice in passing. There shows upon the plotting of the zinc assays on the drill holes a slight but nevertheless noticeable enrichment at two horizons below the surface, one around 100 feet and the other around 175 to 225 feet, while the silver is higher than normal at two near coincident horizons, the first, 50 to 80 feet below the surface, and the second, 100 to 185 feet below. The Gold content is also high in the upper portions of the body. These features do not at any place approach what would be termed an economic secondary enrichment, but undoubtedly represent an incipient secondary enrichment. The Copper distribution remains the same as described in detail in the last report, and in fact the same as forecasted in the first Eastall report. The horizontal distribution being now well authenticated by the closely spaced drill holes, but the extension in depth of the described richer portions has not been substantiated, so that whether or not the upper portions of this body have been enriched by the roots of a secondary enrichment still remains a moot question.

That the width of the higher grade ore has heretofore been accurately estimated can be concisely seen through the inspection of section #3, where the Holes #29 and #31 drilled this year, starting at widely

divergent angles but deviating until close together returned the following assays for their latter lengths as they crossed over the richer footwall section:-

Hole	From To	Feet	Copper
#29	296' - 403'	107	2.2%
#31	365' - 362"	97	2.2%

The downward extension of the ore sections has been assured by several of the drill holes to a depth of 350 to 400 feet below the surface. The tonnage estimates of assured ore have been in this report cut off sharply at the latter depth. The probabilities remain that this ore shoot will extend to much greater depths although the probable ore has been conservatively reckoned at a third more which would carry the ore down to 600 feet in a mineral body which has been determined to be homogeneous in other regards to a depth of 750 feet.

FUTURE EXPLORATION Upon the enclosed sections the position of a lower working tunnel cutting the North Lense has been plainly shown. Such a tunnel would be 2400 feet in length with 500 feet of the North Lense sulphides above it, and would besides exploring the orebody on this level form a vantage ground from which to measure the entire mineral area cheaply and expeditiously with short drill holes. Owing to the impediments to making advantageous set-ups in the mine canyon, to the difficulty of following the relatively smaller footwall ore shoot to a depth, and to interpolating long steep drill holes whose angle nearly coincides with the dip of the orebody, I do not believe that any more drilling at the Destail would be warranted until such a tunnel has been driven. This adit would then open up the orebody on a horizon which would guarantee all the tonnages now estimated, and from which the deposit could easily be explored with 400 to 600 foot drill holes to a depth of over 1000 feet. This would immediately show what additions can be made to the estimated amount of shipping ore (the whole or any part of which could be shipped through this tunnel), and also display the total tonnage of low grade ore at hand, which, should it be found in sufficient bulk, would justify strenuous efforts to find a satisfactory solution of the treatment problem.

DIAMOND

DRILL

RADIUS

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Mostall Mine

Scale—1 inch - 25 feet

Date 1916-1919

NUMBER	1	2	2	2	2
STARTED	June 22nd/18	June 26/18	continued	continued	continued
COMPLETED	June 25th/18	1919			
DEPTH	127'	815'			
ANGLE	12° up	60° down			
COURSE	S.68° 25' E.	S.66° 25' E.			
ELEVATION	557	553			
LATITUDE	7031.4	7031.5			
DEPARTURE	7567	7562			

LEGEND

Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

1.5-6	1.4	
6-11	1.5	
11-16	1.6	16
16-22	1.6	
22-24	1.7	
24-29	1.6	
29-35	0.9	
35-42	1.0	
42-49	0.5	
49-53	0.5	
53-58	0.8	
58-64	1.0	
64-69	0.9	
81-86	0.4	
		127

Light shade Blueon original

Colours compared fairly accurately

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Eastall Mine — Scale—1 inch - 25 feet — Date 1918-1919

NUMBER	2	3	4	4	4
STARTED	continued	July 4th/18	July 7th/18	continued	continued
COMPLETED		July 6th/18	July 17/18		
DEPTH		175'	464'		
ANGLE		45° down	70° down		
COURSE		S.88° 25' E.	S.88° 25' E		
ELEVATION		552	552		
LATITUDE		7031.5	7031.5		
DEPARTURE		7565	7562.6		

LEGEND

Biotite schist

Silicic schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

			202-07 4.9	202-07 0.2
			207-12 3.3	207-08 0.4
013	0.5-13 2.4		212-17 2.5	
	13-17 1.6		217-22 3.6	
	17-23 1.5		222-27 1.4	
	23-30 1.8		227-32 1.3	
	30-35 3.2		232-37 2.1	
	35-40 2.5		237-42 1.3	
	40-47 2.8		242-47 1.3	
	47-53 3.5		247-52 2.0	
			252-57 1.8	455
	53-58 1.5	56-61 3.0	257-62 1.4	464
	58-64 1.3	61-66 3.3	262-67 1.2	
	64-70 1.6	66-71 2.1	267-72 1.2	
	70-73 1.3	71-73 2.9	272-77 1.5	
	73-80 1.2		277-82 1.4	
	80-86 1.6		282-87 0.8	
	86-92 1.0		287-92 1.5	
	92-98 1.0		292-97 1.2	
	98-04 2.0		297-02 1.5	
			302-07 1.4	
	104-10 0.6		307-12 1.0	
	110-16 0.6		312-17 0.7	
	116-21 0.6		317-22 0.9	
	121-26 0.6		322-27 0.7	
	126-31 0.3	127-32 1.7	327-32 0.6	
	131-36 1.0	132-37 2.9	332-36 0.7	
		137-42 3.5	332- 85.0	
		142-47 4.5		
	142-47 0.5	147-52 4.0		
	147-52 0.5	152-57 3.1	52-57 1.0	352-57
	152-57 0.3	157-62 2.4	57-62 0.3	357-62
	157-62 0.3	162-67 2.3	62-67 0.2	362-67
	162-66 0.9	167-72 2.4	67-72 0.2	367-72
		172-77 1.4	72-77 0.3	372-77
	175	177-82 1.6	77-82 0.3	377-82
		182-87 1.7	82-87 0.4	382-87
		187-92 1.6	87-92 0.3	387-92
		192-97 3.2	92-97 0.2	392-97
		197-02 5.2	97-02 0.1	397-02

GRANBY C[illegible]SOLIDATED MINING, SMEL[illegible]NG & POWER CO., LTD.

DIAMOND DRILL RECORD

Mostall Mine — Date July & Aug. 1918

Scale – 1 inch - 25 feet

NUMBER	5	6	7	8	9 18
STARTED	July 20/18	July 22/18	July 25/18	July 27/18	July 31/18
COMPLETED	July 22/18	July 25/18	July 27/18	July 30/18	Aug. 18/18
DEPTH	67'	176'	91'	150'	604'
ANGLE	20° down	Vertical	80° down	80° down	70° down
COURSE	N.86° 50' E.	-	S.78° 10' E.	N.78° 10' W	S.87° 30' E
ELEVATION	578	576	576	576	536
LATITUDE	7111.8	7111.5	7111.6	7111.2	6935.8
DEPARTURE	7622.4	7617.6	7617.6	7615.7	7544.1

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

0-5 0.2	0-6 0.6	0-5 0.3	0-5 0.3	
5-10 0.2	6-11 0.3	5-10 0.2	5-10 0.3	
10-14 0.4	11-16 0.5	10-15 0.2	10-15 0.3	
	16-21 0.4	15-20 0.2	15-20 0.2	
	21-26 0.3	20-25 0.2	20-25 0.2	
	26-31 0.2	25-30 0.2	25-30 0.2	
	31-36 0.2	30-35 0.2	30-35 0.1	
	36-41 0.2	35-40 0.1	35-40 0.1	
43-48 5.3	41-46 0.2	40-45 0.1	40-45 0.1	
	46-51 0.2	45-50 0.2	45-50 0.1	
	51-56 0.1		50-55 0.2	
61	56-61 0.1		55-60 0.1	
	61-67 0.1		60-65 0.1	
	67-71 0.1		65-70 0.6	
	71-76 0.1		70-75 0.7	
	76-81 Tr.		75-80 0.7	74-79 4.8
	81-86 0.1		80-85 0.9	79-84 1.4
	86-91 0.2		85-90 1.4	84-89 1.3
	91-96 0.1	91	90-95 0.9	89-94 1.7
	96-01 0.2		95-100 0.5	94-99 1.3
	101-06 0.2		100-05 0.8	99-04 1.2
	106-11 0.4			104-09 1.9
	111-16 0.5			109-14 1.0
	116-21 0.6			114-19 1.2
	121-26 0.6			119-24 1.7
	126-31 0.7			124-29 1.4
	131-36 1.0			129-34 2.1
	136-41 1.8			134-39 1.6
	141-46 0.5			139-44 2.5
			150	144-49 1.5
				149-54 1.5
				154-59 1.4
				159-64 1.6
				164-69 1.3
				169-74 2.0
	176			174-79 3.1
				179-84 1.6
				184-89 2.5
				189-94 2.3
				194-99 2.6

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Ecstell Mine — Scale—1 inch - 25 feet — Date Aug. & Sep. 1918

NUMBER	9	9	9	10	10
STARTED	continued	continued	continued	Aug. 19/18	continued
COMPLETED				Sep. 15/18	
DEPTH				513'	
ANGLE				70° down	
COURSE				S. 65° E.	
ELEVATION				523	
LATITUDE				6857.6	
DEPARTURE				7473	

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Cr. .7%

Cr. 1.7%

199-04 2.9	399-04 0.7	604		
204-09 2.5	404-09 0.9		10	
209-14 3.1	409-14 0.7			
214-19 2.5	414-19 0.5			
219-24 2.5	419-24 0.5	+19-24		
224-29 1.8	424-29 0.4			
229-34 2.4	429-34 0.4			
234-39 2.5	434-39 0.4		41	
239-44 4.2	439-44 0.5			
244-49 3.5	444-49 0.5			
249-54 3.0	449-54 0.4			
254-59 2.9	454-59 0.7		60	
259-64 2.3	459-64 0.3			
264-69 2.1	464-69 0.3			
269-74 1.9	469-74 0.3			
274-79 1.4	474-79 0.3			
279-84 1.1	479-84 0.3			
284-89 1.8	484-89 0.3			
289-94 1.5	489-94 0.4		95	297
294-99 1.2	494-99 0.2			
299-04 1.2	499-04 0.3	+99-		301-06 1.2
304-09 1.3	504-09 0.2	504-		306-09 0.6
309-14 1.2	509-14 0.7			309-14 0.8
314-19 1.4	514-19 1.2			314-19 1.3
319-24 1.4	519-24 1.0		127	319-24 2.2
324-29 1.2	524-29 0.4		132	324-29 3.5
329-34 0.7	529-34 0.5			329-34 3.1
334-39 0.5	534-39 0.8			334-39 3.1
339-44 0.6	539-44 0.8		145	339-44 1.7
344-49 0.6	544-49 1.3			344-49 1.3
349-54 0.5	549-54 1.1		155	349-54 0.9
354-59 0.7	554-59 1.2			354-59 0.7
359-64 0.5	559-64 1.0	559-64		359-64 0.5
364-69 0.6	564-69 1.2			364-69 0.4
369-74 0.7	569-74 0.7			369-74 0.4
374-79 1.7	574-79 0.6			374-79 0.3
379-84 1.2	579-84 0.5		184	379-84 0.4
384-89 0.5	584-89 0.5			384-89 0.6
389-94 0.5	589-94 0.6			389-94 0.9
394-99 0.6	594-99 0.6			394-99 0.7

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Eastall Mine — Scale—1 inch - 25 feet — Date September 1918

NUMBER	10	11	11	11	12
STARTED	Continued	Sept. 12/18	Continued	Continued	Sept. 25/18
COMPLETED		Sept. 24/18			Sept. 30/18
DEPTH		451'			220
ANGLE		60° down			12° up
COURSE		N.87° 30' E			N.80° 51' E
ELEVATION		507			501
LATITUDE		6768			6668.4
DEPARTURE		7453			7464

LEGEND
Biotite Schist
Silica Schist
Quartz
Sulphide
Ore .7%
Ore 1.7%

10	11	11	12
399-04 0.5		201-06 0.2	
404-09 0.4		206-11 0.3	
409-14 0.6		211-16 0.3	
414-19 0.7		216-21 0.5	
419-24 0.4		221-26 0.3	
424-29 0.5		226-31 0.3	
429-34 0.2		231-36 0.2	
434-39 0.2		236-41 0.1	
439-44 0.3		241-46 0.2	
444-49 0.6		246-51 0.1	
449-54 0.2		251-56 0.2	
454-59 0.2		256-61 0.3	
459-64 0.3		261-66 0.2	
464-69 0.2		266-71 0.2	
469-74 0.1		271-76 0.1	
474-79 2.6		276-81 0.2	
		281-86 0.3	
		286-91 0.3	
		291-96 0.4	
		296-01 0.7	
		301-05 0.8	
		306-11 0.8	105-10 1.9
		311-16 1.1	110-15 1.5
		316-21 3.1	115-20 1.0
523		321-26 0.7	120-22 0.3
	166-71 1.8		
	171-76 0.8		
	176-81 0.8		
	181-86 0.6		
	186-91 0.7		
	191-96 0.2		
	196-01 0.3		

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Scale—1 inch - 25 feet

Eastall Mine Date Oct. 1918 May 1919

NUMBER	12	13	13	14	15
STARTED	Continued	Oct. 1/18	continued	Oct. 8/18	May 15/19
COMPLETED		Oct. 7/18		Oct. 14/18	May 20/19
DEPTH		262'		150'	130'
ANGLE		45° down		45° down	15° down
COURSE		N.80° 51' E.		N.70° 30' E	West
ELEVATION		496		490	301.5
LATITUDE		6668		6570	5854.3
DEPARTURE		7461		7480	7613.2

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

		199-04 0.3		
		204-09 0.3		
		209-14 0.1		
		214-19 0.2		
		219-24 0.2		
		224-29 0.6		
		229-34 0.7		
		234-39 0.6		
		239-44 0.6		
		244-49 0.6		
		249-51 2.1		
			65-70 2.3	66-71-0.1
			70-75 1.1	71-76 0.2
				76-81 0.5
				81-86 0.3
				86-91 0.5
				91-96 0.5
				96-01 0.3
				101-06 0.3
			103-08 1.0	106-11 0.7
			108-13 1.1	111-16 1.1
			113-18 1.5	116-21 0.5
			118-23 1.7	
			123-28 0.4	
			128-29 0.8	
		144-49 2.1		
		149-54 1.7		
		154-59 1.5		
		159-64 0.7		
		164-69 0.6		
		169-74 0.3		
		174-79 0.2		
		179-84 0.4		
		184-89 0.7		
		189-94 0.1		
		194-99 0.2		

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Eastall Mine — Scale—1 inch - 25 feet — Date May-June 1919

	15	16	17	18	19
NUMBER					
STARTED	May 21/19	Continued	June 13/19	June 16/19	June 21/19
COMPLETED	June 3/19		June 15/19	June 20/19	June 30/19
DEPTH	284'		92'	161'	189'
ANGLE	80°		15°	15° down	85°
COURSE	West		West	East	West
ELEVATION	304.6		317.7	328.5	331
LATITUDE	5558.9		6043.7	6044.6	6044.9
DEPARTURE	7640		7581.8	7594.8	7598.8

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

15	16	17	18	19
	198-03 0.2			
	203-08 0.2			
	208-13 0.5			
	213-18 0.6			
	218-23 0.3			
	223-28 0.4			
	228-33 0.2	26-31 0.1		
		31-36 0.9		
		36-41 0.5		
		41-46 0.6		
		56-61 0.4		
		61-66 0.3		
		66-71 0.4		
		71-76 0.1		
		76-81 0.1		
				85-90 0.4
				90-95 0.9
				95-0[illegible] 0.6
				100-05 0.4
				105-10 0.2
				110-15 0.5
				115-20 0.3
				120-25 0.3
				125-30 0.3
				130-35 0.2
				135-40 0.2
				140-45 0.2
				145-50 0.5
153-58 0.2				150-55 0.4
158-63 0.3				
163-68 0.5				
168-73 0.3			164-69 0.1	
173-78 0.5				
178-83 0.2				
183-88 0.2				
188-93 0.3				
193-98 0.3				

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Eostall Mine — Scale — 1 inch - 25 feet — Date July - Aug. 1919

NUMBER	20	20	21	21	22
STARTED	June 20/19	Continued	July 12/19	Continued	July 24/19
COMPLETED	July 6/19		July 24/19		Aug. 15/19
DEPTH	317'		320'		367'
ANGLE	15° down		15° down		70° down
COURSE	N. 89° W		West		790.4
ELEVATION	612.5		791.8		790.4
LATITUDE	7290.9		8159		8158.6
DEPARTURE	7683.2		7741		7746.3

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Eastall Mine — Scale—1 inch - 25 feet — Date August & Sep. 1919

NUMBER	22	23	23	23	23
STARTED	Continued	Aug. 1/19	Continued	Continued	Continued
COMPLETED		Sep.27/19			
DEPTH		1064'			
ANGLE		75° down			
COURSE		S.89½° W.			
ELEVATION		886.8			
LATITUDE		6961.0			
DEPARTURE		8061			

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

599-04	1.5
604-09	1.5
609-14	0.7
614-19	0.5
619-24	0.6
624-29	0.5
629-34	0.7
634-39	1.0
639-44	0.7
644-49	0.3
649-54	0.4
654-59	1.2
659-64	3.5
679-84	1.5
684-89	1.4
689-94	0.5
694-99	1.0

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Scale—1 inch - 25 feet

Eastall Mine Date Aug. 26 Sep. 1919

NUMBER	23	23	24	24	25
STARTED	Continued	Continued	Aug. 23/19	Continued	Sep. 1/19
COMPLETED			Aug. 30/19		Sep. 6/19
DEPTH			269'		300'
ANGLE			85° down		80° down
COURSE			East		East
ELEVATION			640		640
LATITUDE			6800.7		6800.7
DEPARTURE			7554.6		7554.6
				99-04 0.6	
				04-09 0.8	
				09-14 1.2	
				14-16 4.9	
LEGEND					
Biotite Schist					
Silica Schist					35- 1.3
			45-50 0.2		
Quartz					
Sulphide					69-74 0.5
					74-79 0.3
					79-84 0.4
Ore.7%					84.89 0.8
			90-95 0.5		89-94 0.2
			95-100 0.5		94-99 0.5
Ore 1.7%					99-04 0.3
					104-09 0.4
					109-14 0.3
					114-19 0.6
			119-24 0.5		119-24 0.4
			124-29 0.5		124-29 0.4
			129-34 0.4		129-34 0.4
			134-39 0.8		134-39 0.5
			139-44 0.6		139-44 0.5
			144-49 0.6		144-49 0.3
			149-54 0.5		149-54 0.2
			154-59 0.6		154-59 0.3
			159-64 0.4		159-64 0.2
			164-69 0.4		164-69 0.2
			169-74 0.4		169-74 0.4
			174-79 0.6		174-79 0.5
			179-84 0.5		179-84 0.5
			184-89 0.9		184-89 0.2
			189-94 0.7		189-94 0.6
			194-99 0.7		194-99 0.5

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DIAMOND DRILL RECORD

Eostall Mine — Scale—1 inch - 25 feet — Date Sep. & Oct. 1919

NUMBER	25	26	26	27	28
STARTED	Continued	Sep. 7/19	Continued	Sep. 19/19	Sep. 29/19
COMPLETED		Sep. 28/19		Sep. 27/19	Oct. 20/19
DEPTH		374'		245'	765'
ANGLE		75° down		50° down	70° down
COURSE		East		East	East
ELEVATION		640		640	640
LATITUDE		6800.7		6800.7	6800.7
DEPARTURE		7554.6		7554.6	7554.6
	199-04 0.6		200-05 0.2		
	204-10 0.8		205-10 0.3		
LEGEND	210		210-15 0.2		
			215-20 0.4		
Biotite Schist	222-27 0.7		220-25 0.8		
	227-32 1.4		225-27 0.4		
	232-37 1.3				
Silica Schist	237-40 1.6		234-39 0.8	35-40 0.3	
		40-45 0.7	239-44 0.7		
		45-50 0.7	244-49 0.7	40-50 0.5	
Quartz		50-55 0.4	249-54 0.6	50-55 0.2	
		55-60 0.4	254-59 0.8	55-60 0.2	57-62 0.3
		60-65 0.3	259-64 0.6	60-65 0.2	62-70 0.8
			264-69 0.8	65-70 0.3	
Sulphide	270-76 6.0		269-74 0.6	70-75 0.2	70-76 0.4
			274-79 0.7	75-80 0.2	
		80-85 0.4	279-84 1.0	80-85 0.3	
Ore .7%		85-90 0.5	284-89 1.6	85-90 0.2	
		90-95 0.5	289-94 1.8	90-95 [illegible]	
		95-00 0.4	294-98 2.1	95-00 [illegible]	
Ore 1.7%		100-05 0.4		100-05 0.5	
		105-10 0.3		105-10 0.7	
		110-15 0.4		110-15 0.4	
		115-20 0.5		115-20 0.3	116-21 0.2
		120-25 0.3		120-25 0.2	121-26 0.1
		125-30 0.3		125-27 0.4	126-31 0.3
		130-35 0.4			131-36 0.2
		135-40 0.3		135-40 1.0	136-41 0.5
		140-45 0.2			141-46 0.5
		145-50 0.1			146-51 0.4
		150-55 0.2		148-53 0.9	151-55 0.2
		155-60 0.3		153-58 1.1	156-61 0.3
		160-65 0.2		158-63 1.2	
		165-70 0.3		163-66 0.9	
		170-75 0.2			173-78 0.3
		175-80 0.2			
		180-85 0.1			
		190-95 0.2			
		[illegible]-00 0.2			192-99 0.2

GRANBY CO[illegible]SOLIDATED MINING, SMELT[illegible]G & POWER CO., LTD. 19

DIAMOND DRILL RECORD

Eastall Mine Scale—1 inch - 25 feet Date Oct. 1919

NUMBER	28	28	28	29	29
STARTED	[illegible]	[illegible]	[illegible]	Oct.10/19	[illegible]
COMPLETED				Oct.15/19	
DEPTH				441'	
ANGLE				76° down	
COURSE				East	
ELEVATION				608'	
LATITUDE				6935.5	
DEPARTURE				7597.5	

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7

Ore 1.7

		399-04 0.3	601-06 0.5		199-06 1.1
	205-11 0.1	404-09 0.3	606-11 0.4		204-09 1.6
	211-16 0.2	409-14 0.3	611-16 0.6	10-15 0.2	209-14 2.2
	216-21 0.2	414-19 0.2	616-21 1.8	15-20 0.3	214-19 1.8
	221-26 0.1	419-24 0.4	621-26 1.9	20-25 0.3	219-24 0.8
	226-31 0.2	424-29 0.5	626-34 0.7	25-30 0.2	224-29 0.4
	231-33 0.3	429-34 0.9		30-35 0.4	229-34 0.5
		434-39 0.7		35-40 0.6	234-39 0.5
		439-44 1.2		40-45 0.7	239-44 0.5
	246-51 0.2	444-49 0.6	644-49 0.6	45-50 0.7	244-49 0.9
	251-56 0.2	449-54 0.6	649-54 0.7	50-55 0.[illegible]	249-56 1.5
	256-61 0.2	454-59 0.8	654-59 0.7	55-60 0.7	
	261-66 0.1	459-64 0.6	659-64 0.8	60-65 0.6	256-66 1.3
	266-71 0.2	464-72 0.7	664-69 0.8	65-70 0.7	266-71 1.1
	271-76 0.2		669-74 0.8	70-75 0.5	271-76 1.0
	276-81 0.1		674-79 0.8		276-81 1.4
	281-86 0.1		679-84 1.9		281-86 1.0
	286-91 0.1	483-88 0.9	684-89 1.8	85-90 0.8	286-91 1.1
	291-96 0.3	488-93 0.8	689-94 0.8	90-95 1.9	291-96 1.0
	296-01 0.2		694-99 0.8	95-00 0.8	296-01 1.5
	301-06 0.3		699-04 1.9	100-06 0.4	301-06 1.8
	306-11 0.2		704-09 1.3	106-10 0.6	306-11 2.3
	311-16 0.2		709-14 1.4	110-115 0.[illegible]	311-16 2.3
	316-21 0.2		714-19 2.7	115-20 0.6	316-21 2.9
	321-27 0.3	521-26 0.9	719-24 2.3	124-25 0.5	321-26 2.3
		526-31 0.7	724-29 1.2	128-30 0.4	326-31 2.0
		531-36 0.8	729-34 0.8	130-35 0.7	331-36 2.1
	334-39 0.3	536-41 1.9	734-39 0.9	135-40 0.6	336-41 2.4
	339-44 0.2	541-46 0.6	739-44 1.1	140-45 0.6	341-46 2.6
	344-49 0.4	546-51 0.5	744-49 1.9	145-50 0.4	346-51 2.7
	349-54 0.5	551-56 0.6	749-52 1.9		351-56 2.6
	354-59 0.4	556-61 0.6		154-59 0.5	356-61 2.4
	359-64 0.3	561-66 0.6		159-64 0.7	361-66 2.3
	364-69 0.3	566-71 0.6		164-69 0.7	366-71 3.2
	369-74 0.4	571-76 1.9		169-74 0.8	371-76 1.6
	374-79 0.6	576-81 1.3		174-79 0.6	376-81 1.4
	379-84 0.4	581-86 0.8		179-84 0.7	381-86 1.4
	384-89 0.4	586-91 0.7		184-89 0.8	386-91 1.4
	389-94 0.4	591-96 0.7		189-94 0.8	391-96 1.7
	394-99 0.7	596-01 0.6		194-99 0.8	396-01 1.6

GRANBY CONSOLIDATED MINING, SMELTING & POWER CO., LTD.

DIAMOND DRILL RECORD

Scale—1 inch - 25 feet

Mine | Date

NUMBER	30 0	31	31		
STARTED	Nov. 1/19	Oct. 22/19	Continued		
COMPLETED	Nov. 17/19	Nov. 1/19			
DEPTH	96'	367'			
ANGLE		73½°			
COURSE		East			
ELEVATION		605			
LATITUDE		6935.5			
DEPARTURE		7697.5			

LEGEND

Biotite Schist

Silica Schist

Quartz

Sulphide

Ore .7%

Ore 1.7%

284-89	0.7			200-05	0.8
289-94	0.8			205-10	1.3
294-99	0.8	10-20	0.4	210-15	1.4
299-04	0.6			215-20	0.6
304-09	0.8	20-30	0.4	220-25	0.4
309-14	0.6			225-30	0.4
314-19	0.6	30-35	0.4	230-35	0.6
319-24	0.6	35-40	0.3	235-40	1.0
324-29	0.4	40-45	0.7	240-45	2.4
329-34	0.4	45-50	0.8	245-50	1.2
334-39	0.6	50-55	0.6	250-55	1.0
339-44	1.0	55-60	0.6	255-60	0.9
344-49	0.6	60-65	0.6	260-65	1.0
349-54	1.1	65-70	0.7	265-70	1.5
354-59	0.4	70-75	0.5	270-75	1.5
359-64	0.4	75-80	0.6	275-80	2.0
364-69	0.4	80-85	0.8	280-85	2.2
369-74	0.7	85-90	1.0	285-90	2.2
374-80	0.7	90-95	1.2	290-95	2.8
		95-00	0.8	295-00	2.3
		100-05	0.7	300-05	2.4
		105-10	0.7	305-10	1.8
		110-15	0.8	310-15	1.0
		115-20	0.4	315-20	1.2
		120-25	0.6	320-25	3.8
		125-30	0.6	325-30	3.4
		130-35	0.7	330-35	2.2
		135-40	0.6	335-40	2.0
		140-45	0.6	340-45	1.2
		145-50	0.5	345-52	3.4
		150-55	0.4		
		155-60	0.5	357-62	3.0
		160-65	0.5		
		165-70	0.6		
		170-75	0.6		
		175-80	0.9		
		180-85	0.7		
		185-90	0.9		
		190-95	1.2		
		195-00	1.2		

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PYRITES As a mineral deposit, though not at present bottomed, the outcrop occurrence takes rank among the great deposits of the world. The uniformity of composition is also remarkable, and brought out clearly by an excess of minerals having metallic lustre, and by the lack of waste wall or dike rock included within the sulphide bodies. The characteristic material is a clean zinciferous copper bearing pyrites, in tonnage and content as follows:

	Tons	Copper %	Gold oz.	Silver oz.	Zinc %
North Lense	3,843,495	0.85	0.02	0.74	2.2
South Lense	1,000,000	0.50	0.01	0.60	2.9
TOTAL	4,843,476	0.70	0.02	0.71	2.3

The relative proportions of the elements of note are as by the following table of gross content.

Copper	76,501,000	pounds
Zinc	226,312,900	"
Lead	19,373,900	"
Iron	2,054,600	tons
Sulphur	2,331,100	"
Gold	86,820	ounces
Silver	3,444,200	"

An analysis of the North Lense pyrites based upon a weighted computation which embraces all footages now drilled in this body, is given below:-

	Copper	0.86 %	Gold 0.02 oz. Silver 0.74 oz.
	Zinc	2.20	
3.35%	Lead	0.20	
	Arsenic	0.07	
	Antimony	tr.	
	Silica	2.13	
	Alumina	1.09	
4.72%	Lime	0.45	
	Magnesia	0.35	
	Barium	0.70	
	Iron	42.75	
92.10%	Sulphur	43.35	
	Total	100.18%	

The strict enforcement of a policy of conservation of mineral resources would demand the bulk-treatment of this entire tonnage. On the other hand, present day insistence upon an adequate immediate return from the capital invested makes it appear that so low grade an ore, (although higher grade in copper, gold, and silver, than the ores of the Bosnia camp at that) linked to the medium tonnage which can be estimated at this time, bears the basis of a project which might fall into the endangered position of a marginal producer. A sharp increase in the assured tonnage through the deep and strong downward extension of the known orebodies, or finds of new orebodies, could radically change this view point. As there exists here the ground-work for the belief that this will be the actual case, the critical examination of the four methods of bulk-treatment which suggest themselves,- (1) Smelting at Mestall; (2) Flotation; (3) Lixiviation of the Crude Ore; and (4) Crushing, Screening, or Classification followed by lixiviation, are worthy of some attention at this time.

SMELTING AT MOSTALL. The chemical and physical character of the ore is ideal for peritic smelting, that is at a low coke cost. The only injurious element present, the zinc, is as now indicated in a quantity too small to be deleterious, but as it is apt to increase in depth assurance that it will not seriously interfere with the future smelting will have to be gained before and. As in the other three of the four large scale methods here commented upon, the success of this one must in the first place be guaranteed by a vital augmentation of the tonnage at hand. In which case a one or two blast-furnace plant at Mestall could economically smelt the mine ore, perhaps shipping the resultant matte to Anyox for conversion there into blister copper, the success of the whole operation being also dependent on an adequate supply of the needed fluxes being found in the vicinity. Of these fluxes, limestone does occur close to the mine. The greatest expense in the smelting of ores of this character has always entered through a large and unavoidable use of quartz as a silicious flux, even to an amount one quarter of the charge on the furnaces. This requirement in large scale plants usually quickly depleted the deposits of payable quartz ores in the vicinity of the smelter, which must then use the more barren quartz rock accessible, to secure fluxes afield, at an increased burden

of expense, all the later quartz supplies. There exist a multitude of small quartz veins and inclusions in the surrounding schist at Estell, and from the nature of the country one might reasonably expect some considerable bodies of clean quartz to be found having a gold and silver content to pay their own way. Should such discoveries be made in a degree to approach the tonnage requirement, a perfect smelting mixture would be on the spot, and so present a set of circumstances in which this disposition of the matter should receive due consideration.

The burden of freight - Estell to Anyox - is lightened by this method; as it is by any concentration of the mine ore at the mine. Unless the transfer costs on crude ore can be appreciably reduced below the present estimate of $1.30 a ton over all, mine terminal to smelter bins, there would be a saving of at least a dollar the ton mined. On several million tons the measure of an economy that soon outruns a major plant cost becomes a decisive factor.

FLOTATION To an all-sulphide ore of this class, the flotation process, whose forte is the separation of sulphide from gangue, not sulphide from sulphide, becomes of doubtful application at the present day. The tendency to impoverish the concentrate with barren pyrite is so great that it is the seat of trouble at some large plants where liberal net returns were expected but which now find themselves milling ores of this character at a small or no profit. Laboratory tests made at Vancouver show the Estell ore to be even more refractory to the process than other ores in the same class. A fact explained perhaps by the fine physical admixture, or perhaps t. a great part of the copper being in the trouble-making mineral form, Bornite, recently identified as present in fine disseminated crystals, instead of in the usual form of Chalcopyrite. Along with a gold and silver that must not be lost although laggard to follow the copper into the concentrate, and a zinc content of questionable disposition, the application of flotation to this ore as a primary process, becomes a precarious experiment.

LIXIVIATION OF THE CRUDE ORE Recent success in the electrochemical deposition of zinc by the Anaconda Copper Mining Company at Great Falls, Mont., (1916); by the Consolidated Mining and

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Smelting Company of Canada, at Trail, B. C. (1916); by the American Smelting and Refining Company, at Murray, Utah; by the United States Smelting Company, at Kennett, Cal., and by the Judge Mining and Smelting Company, at Park City, Utah, (1917); opens a new chapter in ore dressing pertinent to an ore 2.1% to 2.5% zinc of which 35 pounds saved and sold at 7 cents the pound adds $2.45 a ton to the gross value. The proposed process would (1) mine, (2) crush, and (3) roast the ore, with the incidental generation of the needed sulphuric acid to (4) leach the ore, followed by the (5) precipitation of the gold and silver, and the (6) electrochemical deposition of the copper and the zinc, or the copper and silver could be precipitated from solution by "scrap iron" or by "sponge iron" made of the residual iron in the cinder. A comparable procedure is in use at Anaconda to recover copper and silver from sulphide mill tailings, while the New Cornelia and Chili Copper companies are well-known, latter-day, large-scale examples of the leaching and electrolytic recovery of copper from oxide run-of-mine ores. A series of 50 tentative experiments by R.C.C.Marsant carried out in the Westall assay laboratory upon 1% mine ore, given a preliminary chlorodizing roast followed by hyposulphite and sulphuric acid leaching, resulted in the recovery of 90% of the copper, 75% of the zinc, 50% of the gold, and 88% of the silver from this ore. This indicated procedure applied in a 2000 ton plant gives a calculated paper-profit on Westall 1.2% ore, with copper at 15 cents and zinc at 5 cents, in excess of $1.00 the ton treated. Such a type of plant would be compact, operate upon a small volume of ingoing supplies, ship a condensed outgoing metallic product, and will be, where ample cheap water-power is available, the ideal ore reduction works of the future to treat refractory ores located in somewhat inaccessible regions, and occurring in mineral deposits of moderate magnitude.

In a technical work exhaustive of the theory and practice of that day, entitled "The Hydrometallurgy of Copper" by William H. Greenawalt, (McGraw-Hill Company, 1912) under the chapter heading "Treatment of Zinciferous Copper Ores" the statement is made, - ".....but in the electrolysis of the zinc salts is the crux of the entire problem. The commercial electrolysis of zinc solutions, either acid or alkaline, has not yet been accomplished, although as the cause of the difficulties

"are becoming better understood, the problem may sooner or later be satisfactorily solved". - As cited at the beginning of the last paragraph above, since this book was written and published, 7 years ago, commercial electrolytic zinc plants have been devised, perfected, and are now in continuous operation, and I believe that this advance in metallurgical practice points to a process commercially applicable to the Ecstall sulphides, should their final tonnage profitably counterbalance the required installation, with the satisfactory recovery of the copper, zinc, gold and silver, also with the promise of increased returns from the sale of all or a part of the by-product iron and sulphur.

SULPHURIC ACID Were a market to be found for the by-product sulphuric acid, unsaleable at present on this coast in any quantity, the above process becomes a sure financial success on ore containing, as it does 49.4% of sulphur. No other known body of pyrites of this size and purity exists on the tidewaters of the Pacific Coast of North America. No concentration of the mine ore would be necessary to ship a product equal to Spanish pyrites. One ton of such pyrite makes 1.2 tons of 66° acid quoted around $12.00 a ton in 1914, rising to $35.00 a ton during the war. At a greater distance from Vancouver the Hidden Creek Mine shipped last year 8,500 tons of pyrites, ten percent lower in sulphur than Ecstall pyrites, to the chemical works near Vancouver, a future distribution point for chemicals and fertilizers comparable to San Francisco, where at present the dozen acid works in the vicinity of the City burn on an average of 75,000 tons a year of pyrites which is transported to them, 300 miles by rail, from the Shasta County deposits. The pre-war price at this place for a 45 to 48% sulphur ore was about $5.00 a ton delivered to the acid works, while the present eastern price for the same grade of ore would be about $8.20 a ton. It is not visionary to state that a future demand will arise on the Pacific Coast - certainly accompanying the inevitable reduction in the fertility of Western agricultural lands - in some measure as there is and has been a demand on the Atlantic seaboard. (The consumption of pyrites in the United States was 625,000 long tons in 1903, with a steady increase in the intervening years to over double or 1,430,000 long tons in 1917).

Surely in the coming time, a tonnage of pyrites such as Westall, in entirety, or the part that remains after the extraction of the high grade portions, will have a great future appreciation in value.

Sulphuric acid has become the universal reagent used in the production of acid phosphoric fertilizers from the natural phosphate rock. Immense deposits of the latter occur in the Western States, as one of the Pacific seaports as a future acidulation and distribution point for the fertilizer, in any case for that proportion to be applied to the soils of British Columbia, Washington, Oregon, and California, perhaps for shipment abroad, becomes a very probable selection, and one which would allow the Westall pyrites to undersell any competitive sulphur bearing material at such a point of distribution.

The bulk of the sulphur consumption along the British Columbia coast today arises out of the recently established and rapidly growing pulp industry, which imports trans Pacific Ocean, Japanese sulphur. Corralled by contracts, these and the majority of the smaller consumers could to their advantage displace this imported sulphur with sulphuric acid, or with liquid sulphur dioxide, thus guaranteeing a commercial requirement equivalent to the sulphur gases given off by 75 tons of pyrites burned daily. An experimental plant at Westall of slightly greater capacity could then be constructed and operated at a profit from this source alone, and at the same time sustain a series of tests which would perfect the working details of a process to recover the remaining metals in the calcine. Treating in this manner the low grade ore there would be a return of, besides the sulphur, about $5.00 a ton from the copper, zinc, gold, and silver, or, as so small a plant might do, treating solely the selected richer ores there would be about $12.00 a ton from the same metals. Under these conditions one could reasonably expect that this type of plant would be profitable besides aiding materially in the opening up of the mine and in the determination of the second future policy.

PYRITIC CINDER. In burning the pyrite solely for sulphuric acid the cinder that remains would not stand shipment to a copper smelter. The roasting does drive off 90% of the sulphur but at the same time so much oxygen is taken on that the reduction

in weight is only about one third. The assay of roasted 1% Westall ore has been determined to be 1.3% copper, 1 ounce in silver, and 0.03 ounces in gold. Comparison between the assay of the pyrites shipped from the Hideen Creek Mine To Barnet, and the assay of the burnt cinder therefrom elucidates this point, as below:-

	Copper	Silver	Gold
Anyox Mine Sulphide	1.38%	0.25 oz.	0.01 oz.
Nichols Chemical Co. Cinder	1.82%	0.49 "	0.01 "

There are dumps of 60,000 tons of like cinder about the Frisco gold works although these are close to existing smelters. The utilization of this waste product presents a perplexing and interesting metallurgical problem much complicated by the small tonnage to work upon. One that will be solved perhaps by wet methods, or by taking advantage of the zinc content where present, or of the usual 60 - 70% iron content which has become an established source of revenue in similar European plants.

IRON Treatment of an ore 43% iron by a lixiviation process leaves a residue valuable as an iron ore when it can be shipped direct to an iron blast-furnace, but no plant of this nature exists on this coast. An agitation in British Columbia of many years duration advocates such an establishment in the vicinity of Vancouver, to smelt the known immense aggregate tonnage of magnetite ore which occurs in scattered but numerous deposits along the British Columbian coast. Many natural obstacles now exist to this plan, nevertheless the promoters, aided by a persistent publicity, may be successful in the diversion of Government funds to this end, or better still the general interest aroused by the active discussion may stimulate prospecting which will unearth deposits more adapted to the purpose - as a large body of iron ore recently discovered further into the interior but still tributary to the coast appears to be - and a sometime result could possibly be the veritable establishment of an iron smelter on this coast. A more probable disposition, looking from the present time, of an accumulation of several million tons of non-phosphorous iron in this form, would be its transportation in large lots, on ore carrying steamers, through the Panama Canal to the existing, though distant, Eastern markets for iron ores.

[illegible]

In regard to the latter disposal, the Bethlehem Steel Company transport iron ore from its Tofo mines in Chili, via the Canal, to New York, in steamers of 15,000 tons capacity. Their rate for this service has not been fixed, but as a comparison they quote a standard rate for iron ore from Narvik in Sweden, "-- shipped to us at Philadelphia ----- the rate prior to the war was about 2.00 per ton for a distance of 4500 miles, the steamers in all cases taking either coal or cereals back to the port from which they sailed".

CRUSHING AND SCREENING OF CLASSIFICATION FOLLOWED BY LIXIVIATION Confirmatory to that part of the genesis in which the hypothesis was taken that this sulphide was subjected to an intense metamorphism at the time of the intrusion of the granite, the marked physical characteristic of the body is its even-granular structure, in which the small, all-of-a-size, grains of pure recrystallized pyrites make up 90% of the whole mass. The complementary fact then becomes that the remaining 10% of this matrix contain the copper and zinc minerals, along with the gold and silver, all these being found in the interstices between the pyrite crystals. Therefore when the whole mass be lightly crushed so as to free and separate the crystals of pyrite, but at the same time breaking or grinding these as little as possible, these barren grains can be screened out, yielding a fine residue which contains the bulk of the economic minerals. The screen analysis below illustrates this marked feature.

Screen Test Upon Coarse Crushed Pyrites

Screen	Weight %	Weight Cu.Ln	Copper %	Zinc %	Iron %	Insol. %	Silver oz.	Gold oz.	VALUE TON
On									
10 M	1.47	1.5	0.84	2.9	40.7	6.8	---	---	7.70
16	3.15	4.6	0.74	2.8	42.3	3.2	0.77	0.01	7.11
20	5.97	10.6	0.51	2.5	44.2	1.4	0.61	0.01	5.84
30	23.55	34.2	0.49	2.0	44.5	1.1	0.28	0.005	4.64
40	18.82	53.0	0.45	1.6	44.6	1.1	0.42	0.005	4.11
50	16.25	69.2	0.44	1.5	44.6	1.5	0.42	0.01	4.04
60 M	6.45	75.7	0.48	1.8	43.8	2.0	0.47	0.015	4.73
80	9.62	85.3	0.60	2.0	43.3	2.4	0.58	0.015	5.58
100	5.72	91.0	0.91	3.3	41.5	3.4	0.90	0.025	8.75
120	2.42	93.5	1.32	4.4	40.0	4.2	1.36	0.025	11.98
150	2.30	95.8	1.93	6.0	37.4	5.0	1.75	0.03	16.54
200	1.56	97.3	2.64	8.0	34.7	6.3	2.27	0.04	22.19
T200	2.72	100.0	4.11	10.4	30.7	9.4	4.49	0.095	33.28

An experiment in screen sizing gave an ore containing copper 0.73%, zinc 2.3%, silver 0.77 oz. and gold 0.02 oz. which was dry crushed so as to pass through a 40 mesh screen, the following concentrate, in about a 4 to 1 ratio of concentration, through a 100 mesh screen.

Concentrate Assayed		Extraction Percentage
Copper	1.96%	70.2%
Zinc	5.1%	60.5
Gold	0.045 oz.	59.6
Silver	1.66 "	57.0

This example is only one of a series of like experiments which gave similar results. Instead of by screen sizing, the same principle was now employed in water classification tests, the averaged result of the last four run being as follows:-

Ratio of Concentration 5, 2 to 1 (5.2 to 1)

Ore Assayed		Concentrate Assayed		Extraction Percentage
Copper	0.63%	Copper	2.83%	76.2%
Zinc	2.2%	Zinc	7.9%	69.1
Gold	0.02 oz.	Gold	0.05 oz.	47.7
Silver	0.75 oz.	Silver	2.75 oz.	70.4

Take the supposition that the above concentrate could be treated hydrometallurgically in the lots of 200 tons a day resulting from mining and screening 1000 tons of mine ore a day. Taking figures of wet extractions which we have arrived at in the laboratory, the following results would be obtained:-

90% of 2.83 copper or 45.5 pounds at 15¢	$6.83
75% of 7.90% zinc or 118.5 pounds at 5 cents	5.92
50% of 0.05 oz. gold or 0.025 oz. at $20.00	0.50
80% of 2.75 oz. silver or 2.42 oz. at $1.00	2.42
Return from a ton of concentrates	$15.67

[illegible]

Brought for ore			$15.67

Take trial costs as follows:

Mine	5.2 tons	$1.00	5.20
Crush and screen	5.2 tons	0.50	2.60
Lixiviation of a ton of concentrates			1.25

Total cost a ton of concentrate	10.05
Profit ton concentrates	5.62
Profit ton crude ore	$1.08

Seeing that there are at least 5,000,000 tons in sight of material having a somewhat higher grade than the above experimental ore, a careful investigation of such a process as is here indicated should be made. Briefly it would have the following advantages.

1. Mining could be carried on at a large economical output, 1000 to 2000 tons a day.

2. The crushing, screening, or classification operation would be extremely simple and the cost would perhaps be cut to 25 cents a ton.

3. The concentrate would give sufficient by-product acid in the roasting for the leaching.

4. The lixiviation plant would be 1/5 the size were crude ore to be treated direct by this method. This would greatly reduce the installation costs.

5. There exists an abundance of cheap water power for such a process. No transportation need be provided as the river could well serve this type of plant.

6. Some help would be gained through the sale of the by-product pyrites, condensed out, to sulphuric acid manufacturers or to other users. An analysis of this product gave 53.1% of sulphur.

7. Metals other than copper yield 56% of the return, resulting in a sound broadening of the metallic output of this company.

TONNAGE

SUMMARY OF TREATMENT IN BULK The present tonnage outlook is for 7,000,000 to 8,000,000 of tons, which can with downward extension exceed 10,000,000 tons or more, and lateral exploration may add to this. These tonnage figures alone are an index of an immense mineral deposit. As such it is a rare occurrence. Natural resources of this nature are a common, and are fast passing, one by one, into the strong hands that are actuated by a broad vision. Anyone who has watched ore deposits through a term of years has seen some truly great deposits, evident to many as great deposits, rejected and passed over because of their refractory ores, being perhaps too siliceous for smelting, to later yield to flotation, or being too sinciferous, to later yield to the electrolytic zinc process. If this teaches a lesson, a large mineral deposit having metal values commensurate with the costs and expense of a possible method of extraction, should be given a very careful, a very serious consideration.

This entire tonnage can therefore grow valuable out of all proportion to the purchase price, in the near future by the adaptation of an adequate process of treatment, or in the more distant future through the growth of demand. As a mining proposition its position is unique in that it hangs on a peg in the future that insures the project, or at least makes it an attractive speculation in mineral land. The proposition, however, becomes independent of time-to-come guarantees of reimbursement through being assured in the present by the existence of certain higher grade ores so placed and segregated within the sulphide lenses as to allow of their easy selection.

TONNAGE

2. [illegible] A series of stopes, 30 feet wide, 600 feet long, and 6[illegible] feet deep, along the footwall of the North Lense would break close to a 2% grade of ore. Along the hanging wall also, there is ore, outlined in part only at present, but apparently a small but rich tonnage such as could be mined in narrow stopes to raise or to maintain the grade of the mine ore. Keeping the schist on one side, the other side of the stope would trace the extent of this ore into the sulphide mass. No unusual obstacles should be encountered in the mining as both the schist and sulphide walls stand well, need [illegible] support, which permits of cheap mining in ores, or in shrinkage stopes. In practice, with careful placing of the stope boundaries ore of this grade could be broken with little or no sorting.

Sectional estimates of the assured ore of this grade are given below:-

Section	Tonnage	Copper	Gold	Silver
2	190,600	2.15		
3	126,700	1.99		
4	118,100	1.70		
4½	70,000	1.47		
6	117,800	1.75		
TOTAL	623,200	1.89%	0.03 Oz.	0.8 Oz.

This is estimated on the following drill hole lengths:-

Section #2	Footage	Percentage
Hole #1	40.5	1.6[illegible]%
Hole #3	44.5	2.5
Hole #3	81.0	1.4
Hole #4	17.0	2.8
Hole #4	95.0	3.0
Hole #4	60.0	1.5

FOOTAGE

	Footage	Percentage
Section #3		
Hole #9	55	1.7%
Hole #9	145	2.4
Hole #9	55	1.3
Hole #29	107	2.2
Hole #29	45	1.2
Hole #31	97	2.5
Hole #31	26	1.2
Section #4		
Hole #10	58	1.7%
Section #4½		
Hole #24	12	1.7%
Hole #25	13	1.5
Hole #26	20	1.6
Hole #28	50	1.3
Hole #11	5	1.8
Section #6		
Hole #12	10	1.7
Hole #13	15	1.8

A simple conception of the worth of this ore, one which lacks strict accuracy but is still illuminating, shows that the gold and silver content should offset its water transport to Anyox, so that 2% Kestall ore unloaded on Anyox dock is on a parity with Hidden Creek ore at the smelter, having overcome its handicap of distance through the increased value in the precious metals. The equivalent of one year's ore production at Anyox, or about 900,000 tons of Kestall ore would yield substantially the same profit as a year's operation of the Anyox plant.

3% ORE To mine on the lines of the foot and hanging walls, in narrow stopes less than ten feet wide, breaks 2.8% copper ore. Careful selection and close sorting would raise this grade to 3% and over.

TOLEDO

Below is an estimate of the high grade ore that can be counted upon as assured. Several sample lengths of core of very rich ore have been encountered in the holes drilled on Section #5 this year, but as these are of questionable interpretation they will have to be omitted for the present. They probably indicate the extension of the high grade further to the south than below estimated. Also the hanging wall ore of which no doubt a quantity can be mined has been omitted for the same reason

		Feet	Copper
Section #2			
	Hole #3	44.5	2.46
	Hole #4	17	2.80
	Hole #4	95	3.00
Section #3			
	Hole #9	85	2.70
	Hole #29	60	2.53
	Hole #31	55	2.47
Section #4			
	Hole #10	20	2.97

Summary			
	Section #2	100,000	2.82%
	Section #3	100,000	2.59
	Section #4	35,000	2.97
	Total	235,000	2.72%
Gold 0.05 oz.		Silver 1.2 oz.	

The gold and silver content of these ores is seldom below a minimum of 0.01 ounces of gold and 0.6 ounces of silver even in the leanest copper bearing pyrites; averages 0.03 ounces gold and 0.8 ounces silver for the 2" ore; then rises decidedly in the enriched sections, as the following assays of typical sample lengths makes evident.

TABLE

Content			Value per ton	
Copper %	Gold oz.	Silver oz.	Gold and Silver	Gross
2.8	.04	1.2	$2.00	$10.40
3.0	.06	1.2	2.40	11.40
3.5	.08	1.9	3.20	14.00
4.9	.07	1.9	3.40	18.25
6.0	.04	2.0	2.60	20.60

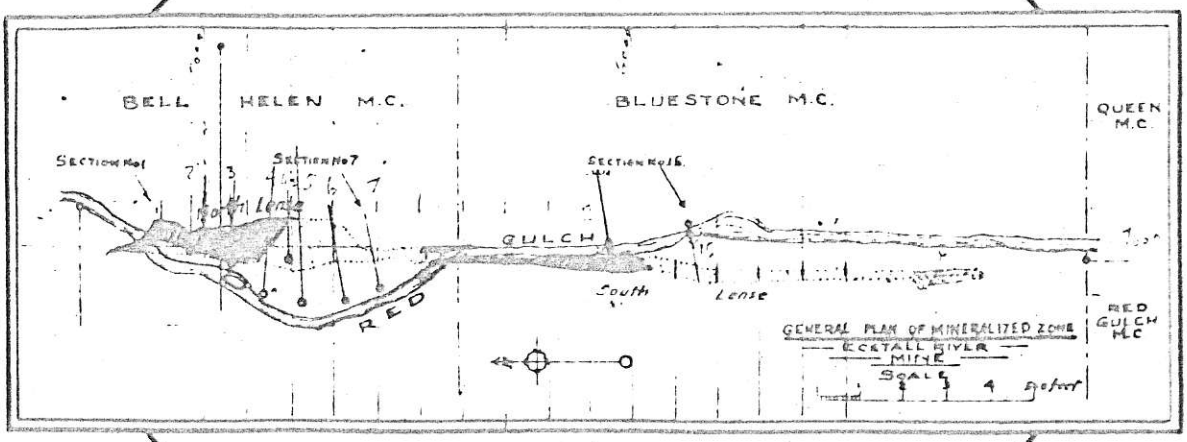
Copper at 15¢; Gold at $20.00; Silver at $1.00

The transportation to, and the charges at, the smelter are easily borne by this higher grade ore and, all in all, to restrict the shipments to this grade makes a most attractive proposition because it can be started with a small capital expenditure.

VERTICAL SECTIONS

OF THE

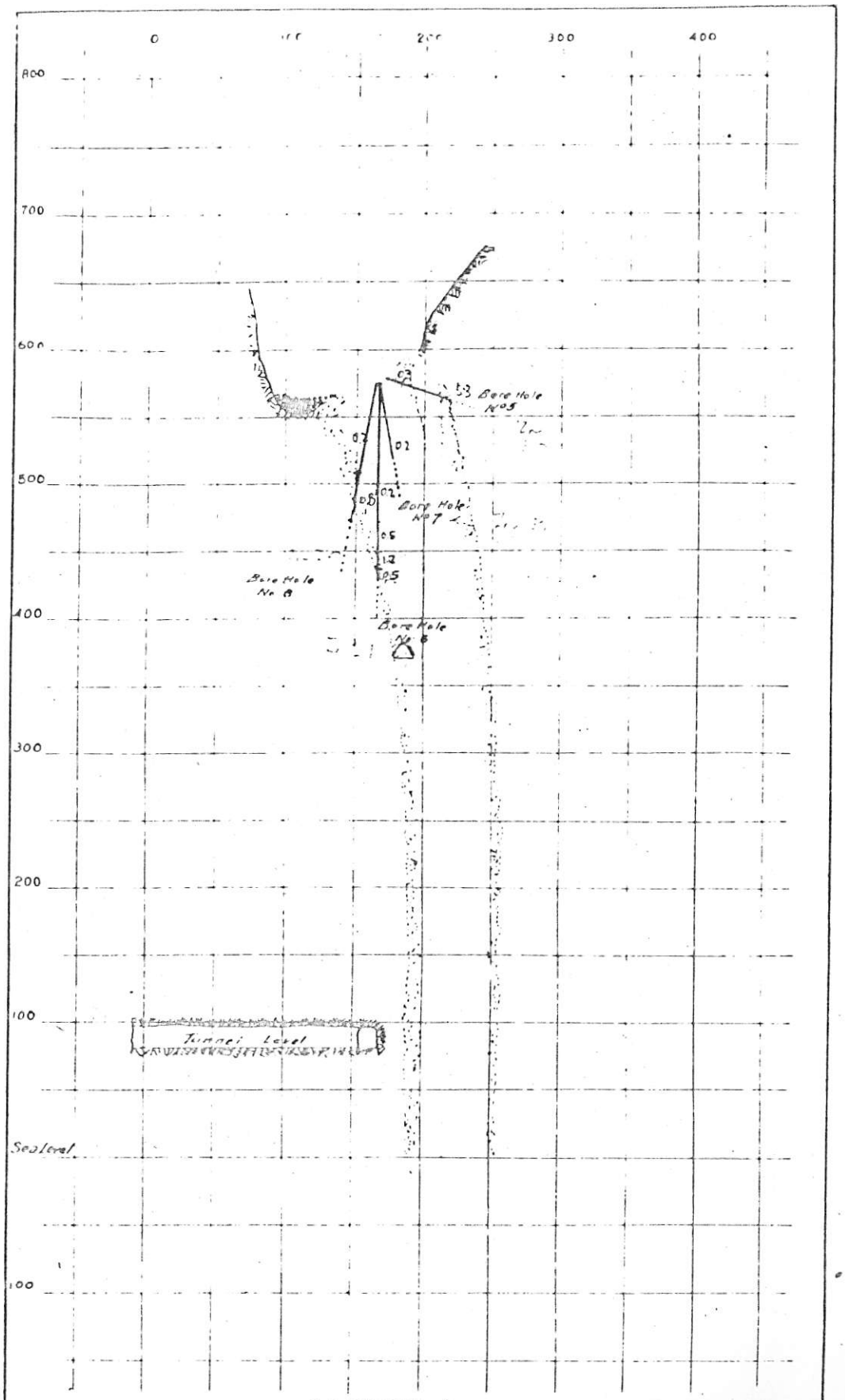
ECSTALL RIVER MINE



GENERAL PLAN

NORTH LENSE

SECTIONS TAKEN AT APPROXIMATELY 100 FEET INTERVALS.
LOCATION OF PROPOSED TUNNEL SHOWN.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200
300
400
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700
600
500
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300
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Sea level
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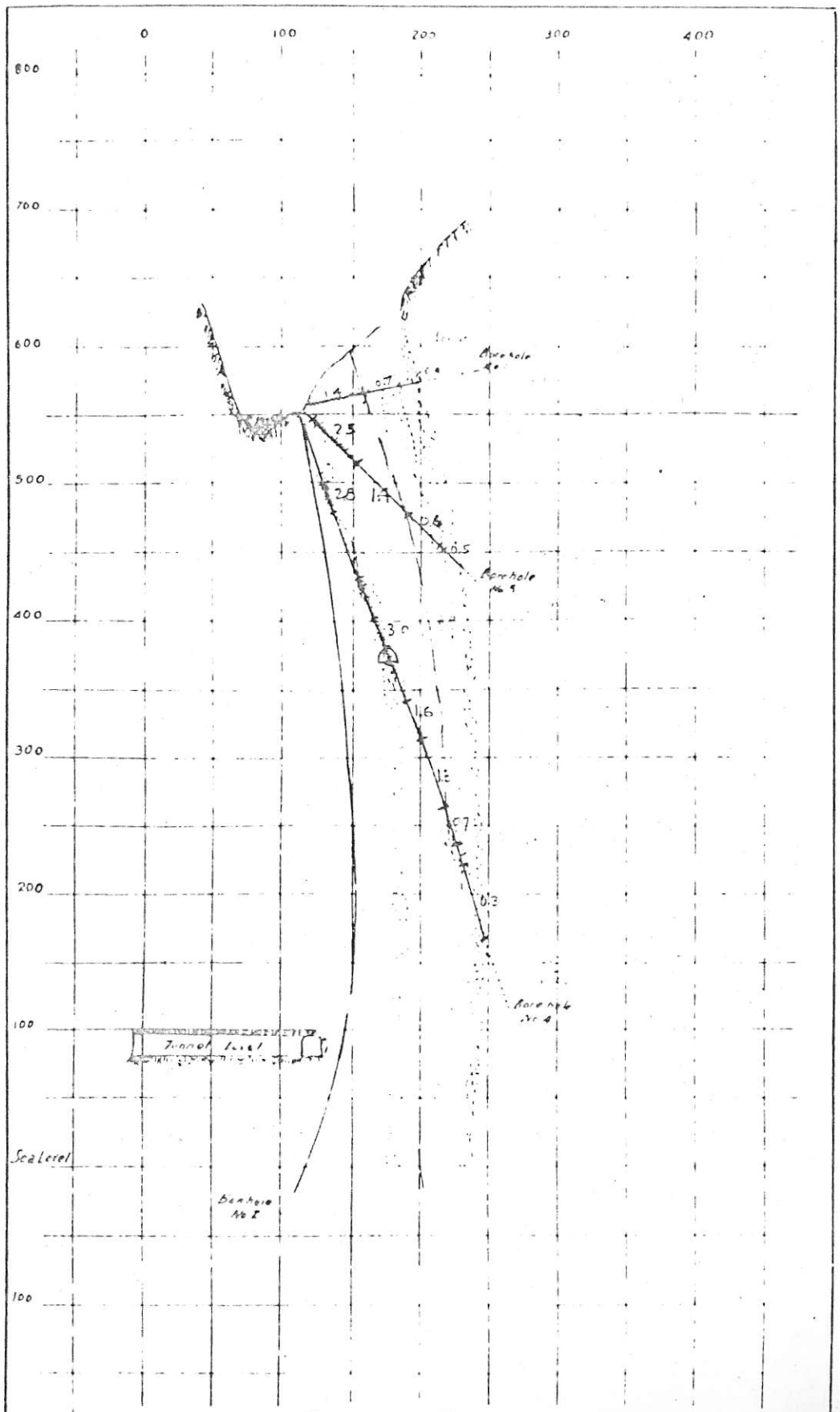
Bore Hole No 5
Bore Hole No 7
Bore Hole No 8
Bore Hole No 6
Tunnel Level

SECTION. I.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Sea Level
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Borehole No 5
Borehole No 4
Tunnel Level
Borehole No I
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1.6
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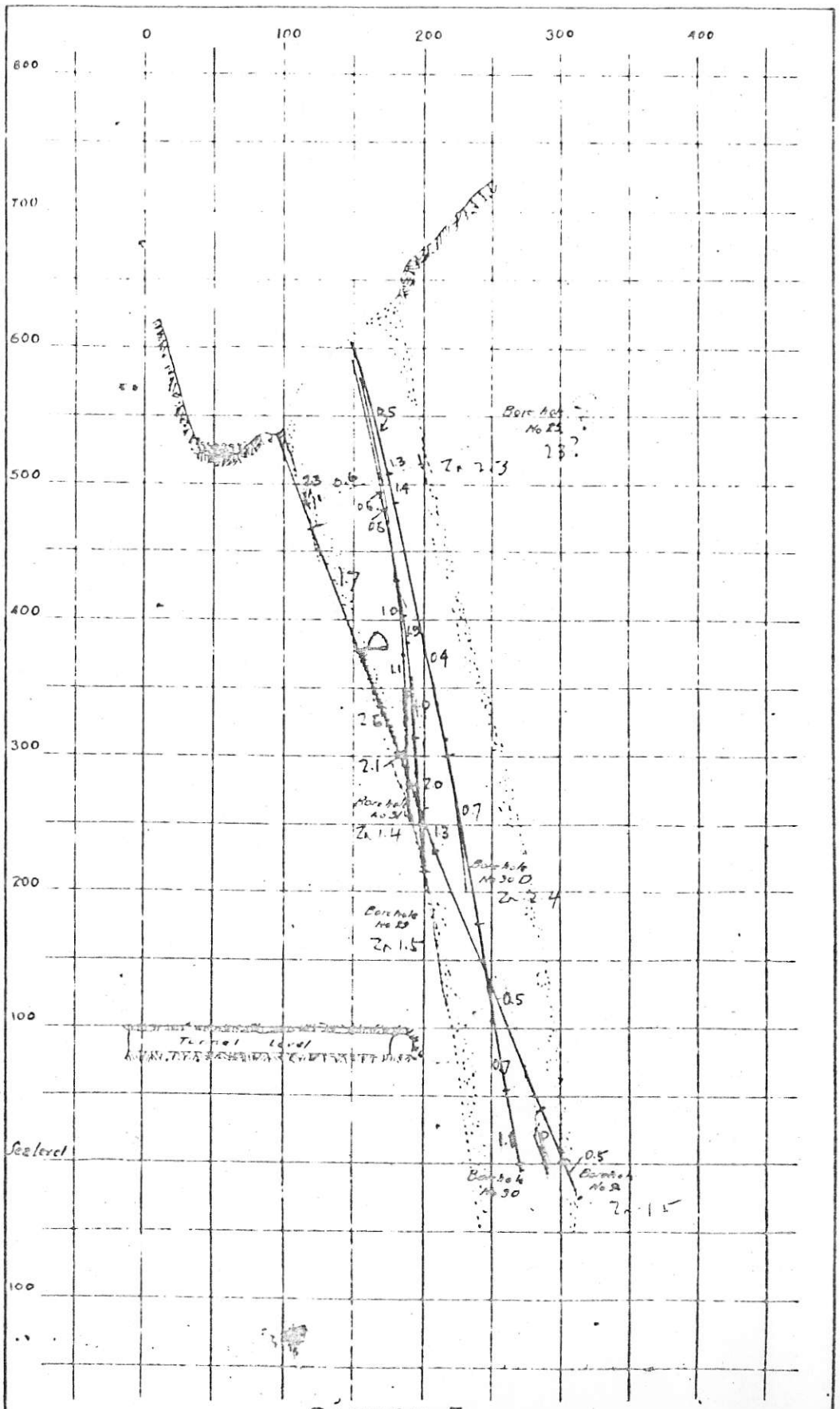
0.3

SECTION 2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Sea level
100
Tunnel level
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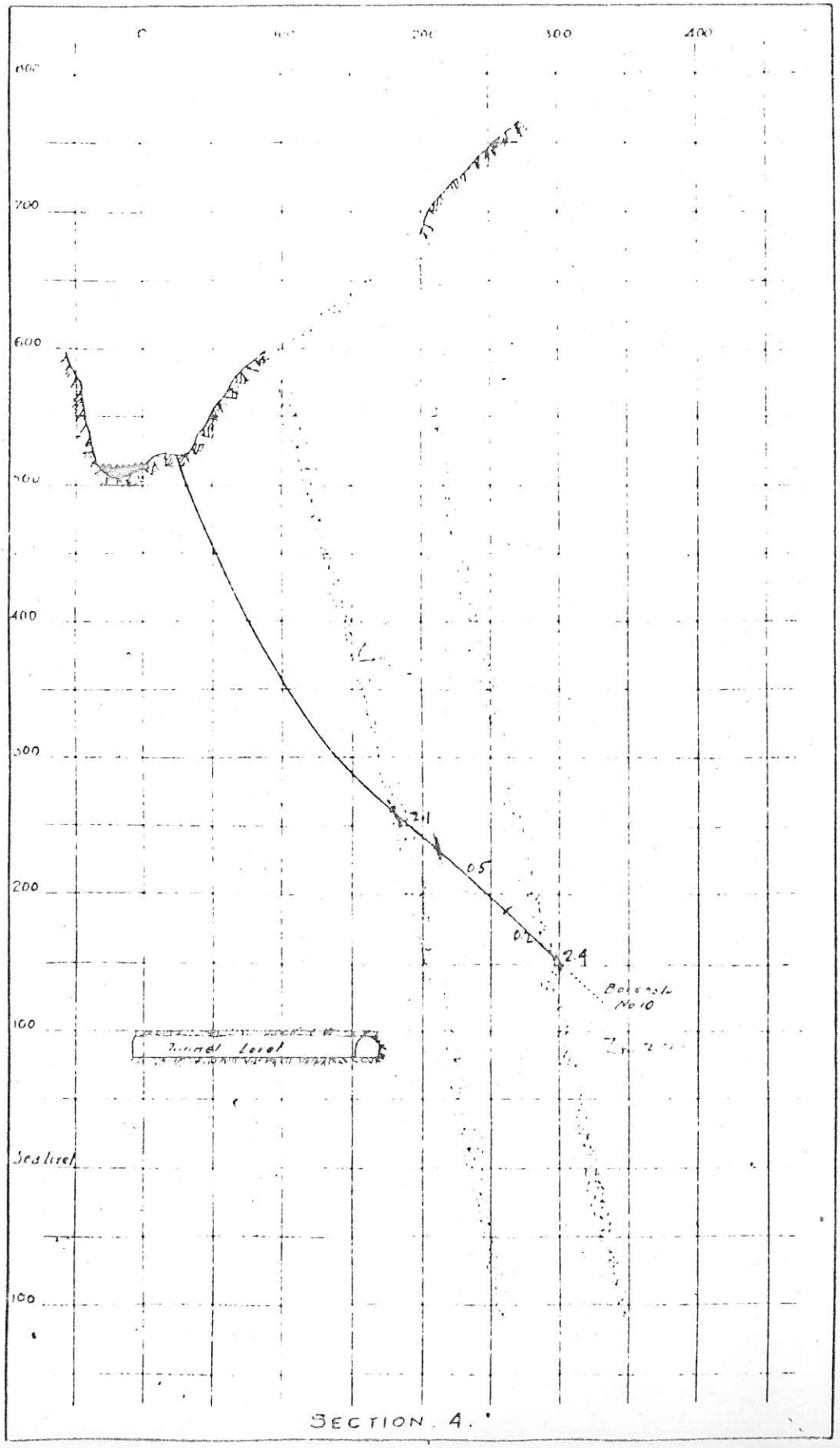
Borehole No 31
Zn 1.4
Borehole No 30 D
Zn 2.4
Borehole No 29
Zn 1.5
Borehole No 30
Zn 1.5

SECTION. 3.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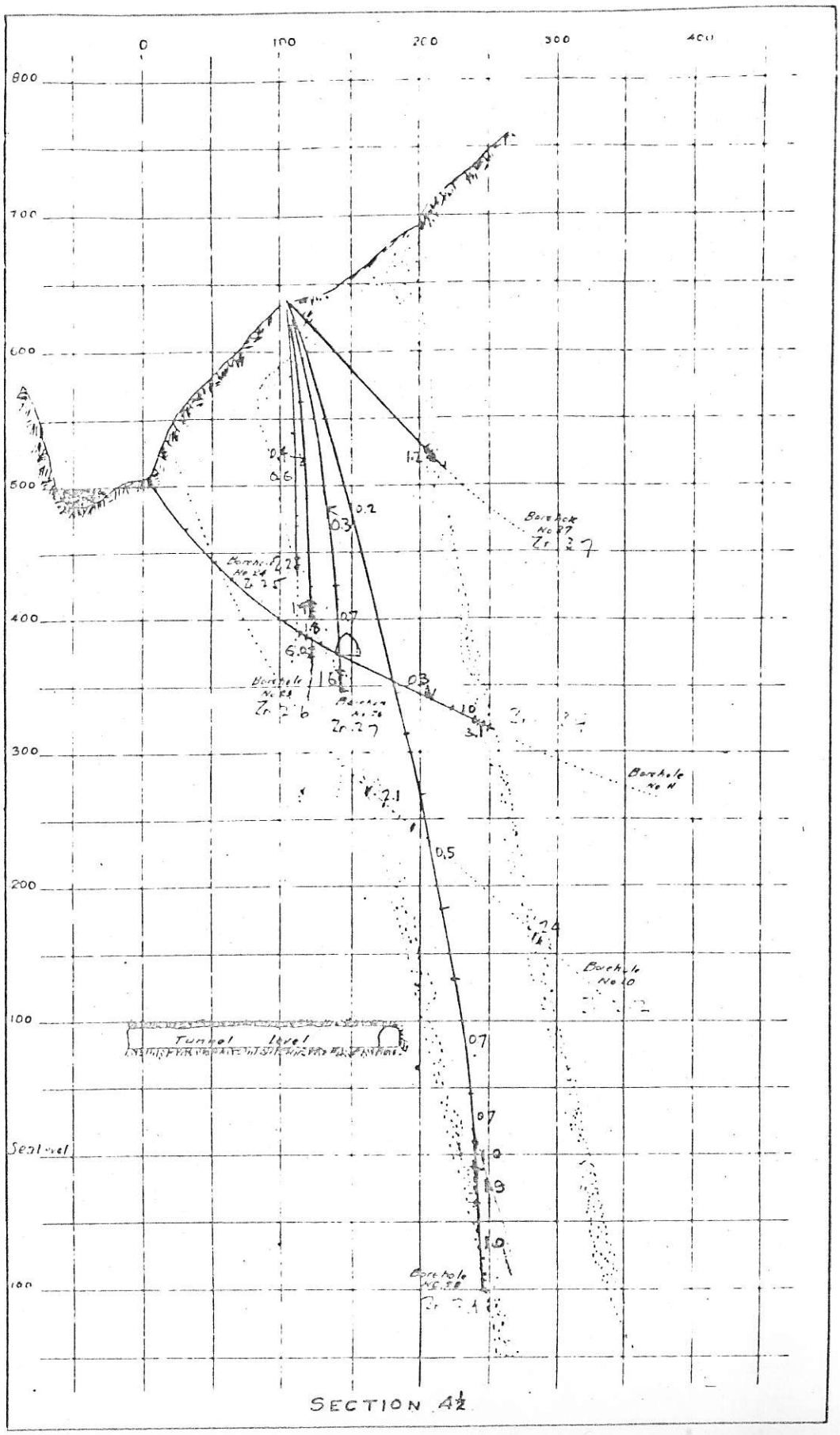
2.4
Borehole No 10
Tunnel Level

SECTION. 4.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500
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300
200
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Sea level
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Tunnel level
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Borehole No 24
Borehole No 26
Borehole No 11
Borehole No 10
Borehole No 38
0.2
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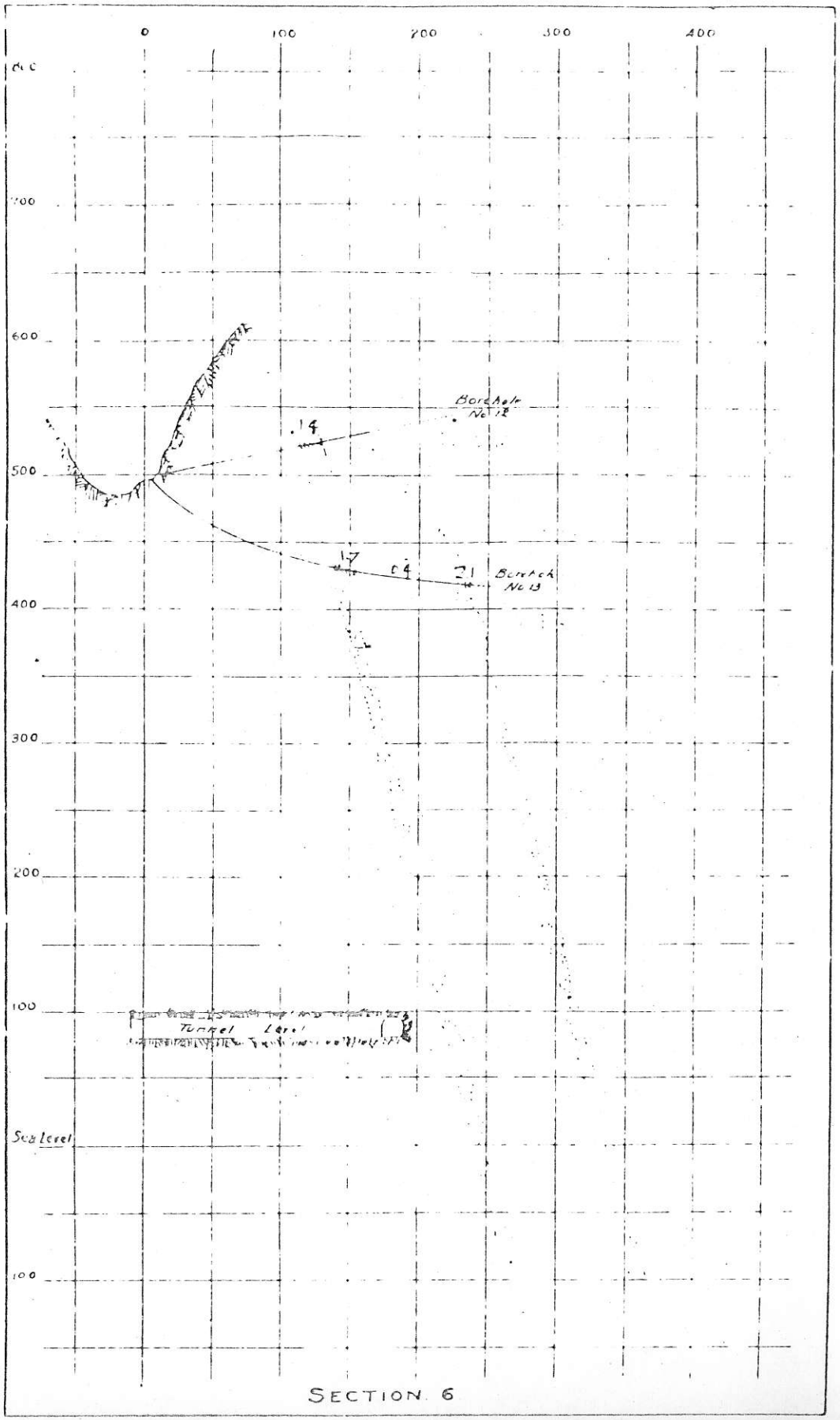
SECTION 4½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Sea level
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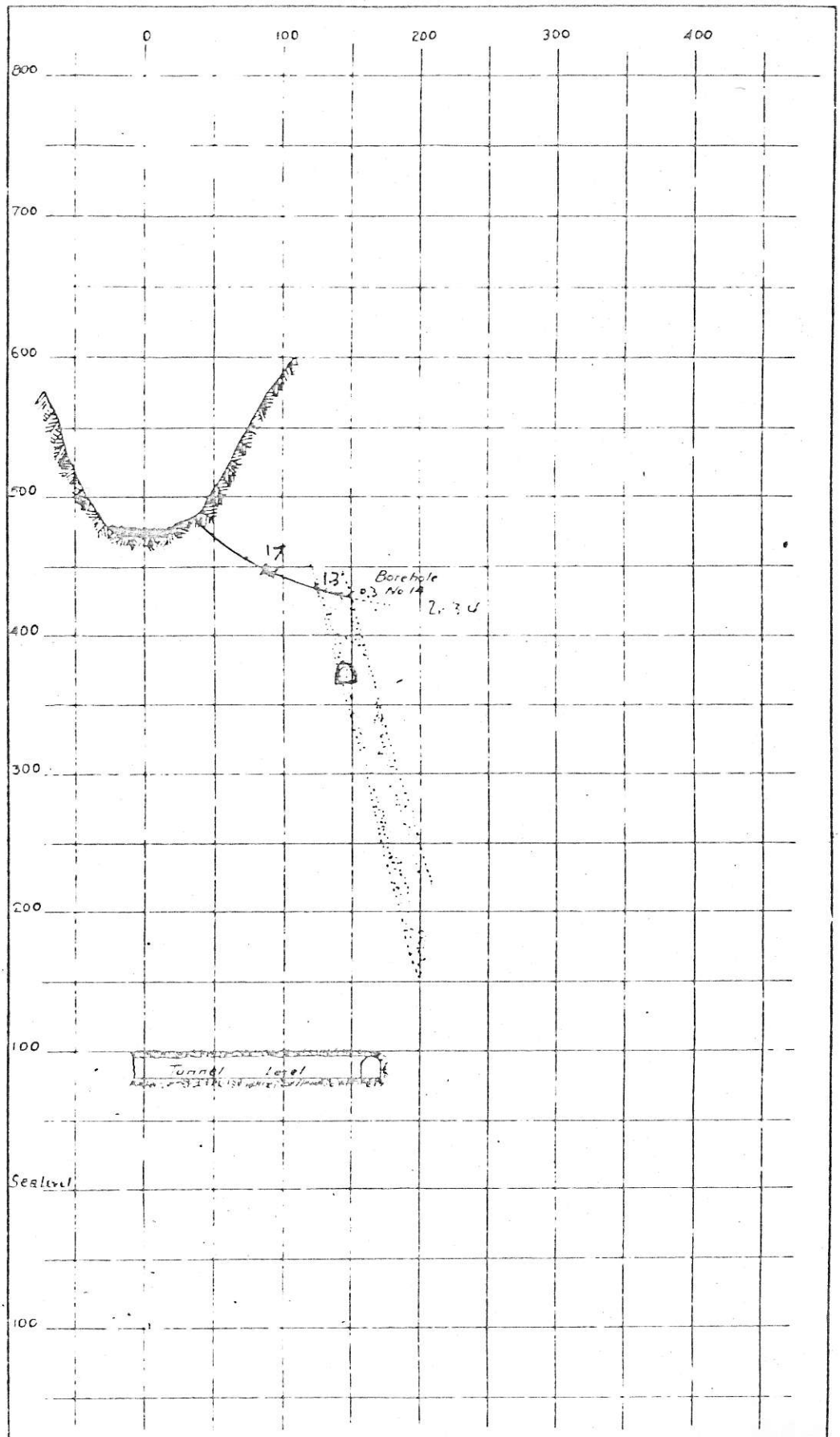
Borehole No 12
14
17
04
21
Borehole No 13
Tunnel Level

SECTION 6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700
600
500
400
300
200
100
Sea level
100
17
13
Borehole
No 14
Tunnel level

SECTION. 7.

NORTHERN PYRITES LTD.
ROOM 212
744 WEST HASTINGS STREET
VANCOUVER, B.C.

September 19, 1940

Mr. Wilber Judson,
75 East 45th Street,
New York City, N. Y.

My dear Wilber:

I attach a plan on a scale of 50 feet to one inch, showing the location of the diamond drill holes, also a list of assays on holes 14 to 21. I have not received the results of the assays on the outher holes, and as soon as I do so, will forward them to you.

You will note that holes 24 and 26, drilled from No. 7 crosscut, were blanks, and it looks as if the lens was raking towards the south. This is also confirmed by holes 14 and 16, drilled from No. 5 crosscut, which shows a much greater width on the tunnel level than is apparent on the surface. Mason has sketched the approximate outline of the ore body on the tunnel level.

In his last report, he contemplated drilling a 45 degree and a 60 degree hole from a station on the west side in the tunnel opposite No. 6 crosscut. Each of these holes, it is hoped, will give an idea of the section considerably below sea level, (the 45 degree hole 150 to 250 feet below, and the 60 degree hole, 300 to 400 feet below). I advised Mason that a 60 degree hole might be driven from No. 5 crosscut, and also one from No. 4

Pat Stewart has been out of town for some weeks, and I have been awaiting his return in order to discuss the position of other holes, particularly in the south lens district, as it is quite possible this body will increase in width as greater depth is obtained.

Yours very truly,

F W Guernsey

FWG/HK
Enc.

c.c. Houston, Texas

Lestall Mine,
Port Essington, B. C.
Sept. 24th, 1940.

F. W. Guernsey, Vice-President,
Northern Pyrites Limited,
744 West Hastings Street,
Vancouver, B. C.

Dear Sir:

Reporting for the period Sept. 16th to Sept. 23rd inclusive:

Raise

Fifteen shifts were worked in eight days. Sunday, September 22nd, was "change" Sunday, and one shift laid off. The Raise was advanced to a slope distance of 476 feet and the timbering to 437 feet from the track. A round and a slash were also taken out of the back, beginning cutting of the 1st Level station.

Diamond Drilling:

Hole 29 was finished at 133 feet, completing drilling on the 2nd Level station. The drill was then moved to the drill station at the opposite side of the tunnel from No. 6 Crosscut (No. 6 Crosscut West). Here Hole 30 was drilled and Hole 31 commenced. Total footage for the period amounted to 476 feet. Following is a summary of the work:

Hole No.	Bearing	Dip	Length	Ore
29	N 45° E	flat	71 - 133	79 - 102.5
30	due E	- 45°	0 - 298	(196 - 203 (214 - 225.5
31	S 60° E	- 60°	0 - 118	(Incomplete)

General

Rainfall for the first four days of the period amounted to 3.1 inches. It has since been cool and dry with sunshine. There has been no snowfall visible on the mountains to date.

The portal of the Dunsmuir Tunnel was mucked out, and is now awaiting re-timbering.

Yours faithfully,

E. E. Mason

EEM/H

September 27, 1940

Mr. Wilber Judson,
75 East 45th Street,
New York City, N. Y.

My dear Wilber:

I herewith attach a list of assays of diamond drill cores as follows:

DH 22 -	Samples 177 to 184	inclusive,	3rd level raise
DH 23 -	Samples 185 to 193	"	No. 4 Crosscut
DH 25 -	Samples 194 to 202	"	No. 7 Crosscut
DH 27 -	Samples 203 to 213	"	2nd level raise

Pat Stewart has not yet returned to Vancouver, and consequently I have not discussed with him the drilling of down holes.

Yours very truly,

F.W. Greer

F.W.G/HK
Enc.

c.c. Houston, Texas

October 1st, 1940.

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.
U. S. A.

My dear Wilber:-

Pat Stewart has just returned and we have discussed the matter of further diamond drilling at Northern Pyrites.

I attach the progress report for the period September 16th to 23rd and you will note that Hole 30, drilled from No. 6 crosscut indicates the bottom of the north lens was not far away. We have suggested to Mason that further down holes should be drilled as follows:-

No. 5 crosscut:	60° hole.
No. 4 crosscut:	60° hole.
No. 3 crosscut:	60° hole from the station cut in the west side of the tunnel.
No. 2 crosscut:	Drive the crosscut 50 ft. further into the hanging and drill a 60° or 70° hole from the end of the completed crosscut.
No. 1 crosscut:	Drive the crosscut 50 ft. further and put down a 60° or 70° hole.

The order of the driving of these is of course left to Mason.

Will you please advise me if the above meets with your approval and if you have any suggestions to make.

Mr. Wilber Judson October 1st, 1940.

Mason has just written he expects the raise to be completed about October 10th and that it will take two weeks longer to strip pipe and fittings, remove the 20 lb. rail and store these for future use, and put the machinery in ship-shape order until required again. Possibly this work will be completed before the diamond drilling can be finished and I would like your suggestion as to whether it would be advisable to finish the diamond drill campaign, before closing down for the winter.

Yours very truly,

F.W. Greenway

FWG/BCJ.

Kestell Mine,
Port Essington, B. C.
Oct. 9th, 1940.

F. W. Guernsey, Vice-President,
Northern Pyrites Ltd.,
744 West Hastings St.,
Vancouver, B. C.

Dear Sir:

Reporting for the period October 1st to October 8th inclusive:

Raise

Fourteen shifts were worked in eight days. October 6th was "change" Sunday, and one shift laid off. Another shift was lost October 6th, when a round required re-blasting due to faulty wiring.

On October 8th, the face of the Raise was 534 feet slope distance from the track, and the timbering within 9 feet of the face.

A smaller opening, roughly 5-feet by 8-feet, was then commenced to be driven S 60° E at a 55-degree slope to break out to surface, a distance roughly of 30 feet. One round was taken out before the end of the period.

Diamond Drilling

Hole No. 32 was drilled from No. 5 Crosscut, and Hole No. 33 commenced from No. 4 Crosscut. Total footage for the period amounted to 628 feet. Following is a description of these holes:

Hole No.	Bearing	Dip	Length	Ore
32	due E	- 65°	0 - 398	nil
33	due E	- 60°	0 - 230	211 - (incomplete)

General

Fine weather continued into October 5th, the water supply getting quite low. Rainfall for the balance of the period amounted to 4.58 inches.

Yours faithfully,

E E Mason

EEM/M

October 10th, 1940.

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.
U. S. A.

My dear Wilber:-

Hole 31, 60° downward from No. 6 crosscut west has drawn a blank and evidently has passed under the ore body. Judging from Hole 30 the bottom of the ore is around 150 ft. below sea level.

Owing to the extending of crosscuts No. 2 & 3, the shut-down will be set back somewhat. Mason, however, thinks he can finish all the drilling about the middle of the month.

Yours very truly,

F.W. Greenway

FWG/BCJ.

Bestall Mine,
Port Essington, B. C.
Oct. 16th, 1940.

F. W. Guernsey, Vice-President,
Northern Pyrites Limited,
744 West Hastings St.,
Vancouver, B. C.

Dear Sir:

Reporting for the period October 9th to October 15th inclusive:

Raise

Eight shifts were worked in four days. The Raise broke through to surface on the fifth shift on October 11th at a slope distance of 562 feet. The remaining shifts were spent timbering the break-through.

Tunnel

Three shifts were spent in preparing a station for diamond drilling in the East wall of the tunnel opposite No. 3 Crosscut. Two rounds forward, and a raise round in the back were taken, for a total advance of 16 feet.

On October 15th, extension of No. 2 Crosscut was commenced. Two rounds were taken for an advance of 10 feet.

Diamond Drilling

Hole No. 33 was completed at the mouth of No. 5 Crosscut. The short holes Nos. 34, 35 and 36 were then drilled in the Tunnel at 200 feet north of No. 2 Crosscut, 200 feet north of No. 1 Crosscut, and 400 feet north of No. 2 Crosscut respectively. Next, Hole No. 37 was drilled on the 1st Level station, and subsequently Hole 38 was commenced in the diamond drill station located opposite No. 3 Crosscut. Total footage for the week amounted to 508. Following is a description of these holes:

Hole No.	Bearing	Dip	Length	Ore
33	due E	- 60°	230 - 733	(211 - 284 (291 - 293.5
34	S 88° E	flat	0 - 70	(12.5 - 19.5 (23 - 54
35	S 86° E	flat	0 - 100	23 - 39.5
36	S 88° E	flat	0 - 62	28 - 50.5
37	N 45° E	flat	0 - 146	91 - 94
38	due E	- 60°	0 - 27	(incomplete)

F.W.G. - P. 2.

Oct. 16th, 1940.

General

The weather has been fairly wet, rainfall for the period amounting to 4.38 inches.

Yours faithfully,

E.E. Mason.

EEM/M

Bestall Mine,
Port Essington, B. C.
Oct. 24th, 1940.

F. W. Guernsey, Vice-President,
Northern Pyrites Limited,
744 West Hastings St.,
Vancouver, B. C.

Dear Sir:

Reporting for the period October 16th to October 23rd inclusive:

Tunnel

Fifteen shifts were worked extending the Nos. 1 and 2 crosscuts eastward for diamond drilling. One miner and two muckers were employed on each shift. Dimensions of these crosscut extensions are 7-feet by 5-feet.

Eight shifts were worked in No. 2 crosscut for an advance of 40 feet, bringing the total extension to the required length of 50 feet. The remaining seven shifts were worked in No. 1 crosscut for an advance of 34 feet.

Raise

Two men have been employed in cleaning down and repairing the manway, and in stripping some of pipe and equipment.

Diamond Drilling

Hole No. 38, set up in the drill station opposite No. 3 crosscut, was completed, and Hole No. 39 commenced in No. 2 crosscut. Footage for the week amounted to 519 feet. Following is a description of the work:

Hole No.	Bearing	Dip	Length	Ore
38	due E	- 60°	27 - 399	nil
39	due W	- 70°	0 - 147	110 - (incomplete)

General

The weather has been very wet, rainfall for the week amounting to 12.41 inches. On October 19th and 20th the river level was 2.5 and 3 feet above the dock respectively. Also on October 19th, following a short, violent gale with heavy rain, flood water in Red Gulch creek cleared its bed of windfalls and other debris and formed a new and deeper channel. The measuring weir and part of the trail to the Outcrops was washed out.

Yours faithfully,

Kestall Mine,
Port Essington, B. C.
Nov. 1st, 1940.

F. W. Guernsey, Vice-President,
Northern Pyrites Limited,
744 West Hastings St.,
Vancouver, B. C.

Dear Sir:

Reporting for the period October 24th to October 31st inclusive:

Tunnel

Four shifts work completed the extension of No. 1 Crosscut. An advance of 20 feet was made, bringing total length of this crosscut to 126 feet from the collar. A back-slash was also taken in the face to provide head-room for diamond drilling.

Raise

Drawing of the Raise chute was commenced October 27th, immediately upon completing the crosscuts. Four shifts have been worked, and the muck is down to the 3rd Level.

A portion of the Collar opening was plugged with 1½ yards of concrete to support the tendency to overhang, and to divert surface water. A 4-inch plank cover has also been provided, with a locked hatchway for re-entry.

Additional support has been provided where necessary within the Raise, the runways cleaned down and repaired, and all equipment removed.

Diamond Drilling:

Hole 39 was completed from the new face of No. 2 Crosscut, and Hole 32 in No. 4 Crosscut extended 155 feet. Finally, Hole 40 was drilled from the face of No. 1 Crosscut, completing the drilling programme. Footage for the week amounted to 366 feet. Following is a description of the work:

Hole No.	Bearing	Dip	Length	Ore
39	due W	- 70°	147 - 197	(110 - 167.5 (177 - 184.8
32	due E	- 60°	398 - 553	nil
40	due W	- 70°	0 - 181	(129 - 132 (140 - 171

General

The portal of the Dunsmuir Tunnel was cleaned out and re-timbered. Fill of the Wharf cribwork and bank has also been completed. Two men were sent down the trail to Big Falls to re-open sections covered by loggers.

The weather has been fair, rainfall for the period amounting to 3.98 inches. The snow-line is now about 3000 feet elevation.

Yours faithfully,

E E Mason

EEM/M

November 7th, 1940.

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.
U. S. A.

My dear Wilber:-

I herewith attach list of assays of diamond drill cores as follows:-

Balance of results of D. D. Hole No. 27. Results of samples from D.D. Holes No. 28, 29, 30, 33, 34, 35, 36 & 37.

Holes No. 31 & 32 did not cut ore.

I have not received results from Holes No. 38 & 39, and I presume Hole No. 40 will complete the drilling.

Mason is putting everything into shape for a long shut-down and if he can sell any of the machinery before he leaves, it will be crated and shipped.

We have disposed of the surplus powder, power pipe cutter, drill steel and horse. We returned a quantity of drill parts to the Ingersoll-Rand Company and have received credit note for them.

Pat has not heard from the Consolidated as to whether they will take the compressor and engine.

A complete list of the material we have for sale up there will be made out with the cost price etc., and this will be placed in the hands of machinery dealers here.

Yours very truly,

F W Guernsey

FWG/BCJ.
Encl.
c.c. Houston, Texas.

November 19th, 1940.

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.,
U. S. A.

My dear Wilber:-

I herewith attach analyses of Diamond Drill holes Nos. 38 & 39.

I have not yet received the samples of Hole No. 40, which was drilled in the extension of No. 1 crosscut, the completion of which finished the campaign.

Mason wired that ice had already formed on the river, but the milder weather since with rain had cleared it out, and he was leaving the mine with the balance of the men about November 18th after having placed everything in ship-shape order.

Two watchmen were left on the property.

I expect he will arrive in Vancouver shortly and all the maps will be brought up to date, the reports of the season's operation made out and a revised estimate of the probable ore made up.

Yours very truly,

H Guernsey

F.G/BCJ
Encl. 1.
c.c. Houston, Texas.

November 22nd, 1940.

AIR

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.,
U. S. A.

My dear Wilber:-

I have just received advice from Mr. Mason of the shipment by freight of nineteen bulk general samples taken in No. 6 crosscut.

This will be a cross-section of the North lens and the results should check with those taken from Nos. 27 to 45 inclusive, which were sent you with a sketch of the cross-cut on August 2nd last.

As soon as the samples are received, I will have an analysis made here and then forward a portion of the pulp from each sample to New Gulf for information regarding arsenic, selenium and phosphorus. As regards the analysis for flourine, Eldridge and Company, who assay the samples advised me that they have a connection in Seattle who does spectroscopic work. The University here, have a spectroscope and are to advise me if they can do the analysis. You mentioned last year about sending bulk samples to the General Engineering Company, Salt Lake and to the Ore Testing Department of the Colorado School of Mines. Pat says they do good work at the testing plant at Consolidated at Kimberley, and he is writing to find out if they could make a test of samples from the Northern Pyrites.

My idea is to have a test made of the footwall zone and ascertain if a satisfactory seperation of the copper can be made, also a test of the hanging-wall, which as a general rule is heavy in zinc.

However, after Mason arrives and the maps are completed, we may be able to judge better as to the testing requirements.

Have you any suggestions to make.

Yours very truly,

H W Guernsey

FWG/BCJ.

c.c. HOUSTON, TEXAS.

December 5th, 1940.

Mr. Wilber Judson
Texas Gulf Sulphur Company
75 East 45th Street
New York City, N. Y.,
U. S. A.

My dear Wilber:-

I enclose a list of the results of assays of core from Hole No. 40 drilled at the extension of No. 1 crosscut. Also results from general samples cut from No. 6 crosscut. This latter gives a section of the main orebody, and I have had portions of each sample forwarded to Mr. Treichler at New Gulf for analyses to determine arsenic, selenium and phosphorus.

The balance of these samples are in store here.

Mr. Mason is here bringing the maps up-to-date.

Yours sincerely,

F W Guernsey

FWG/BCJ.

c.c. Houston, Texas,
Encl.

TRANSPORTATION ON THE ECSTALL RIVER

TONNAGE POSSIBILITIES

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Upper Section Skeena River 4

SUMMARY

Access to the property is by water route via the Skeena river estuary, 34.5 miles up the Ecstall river to the mine. The lower 28½ miles is available to boats of five to six feet draught within 4 hours around the peak of a 16-foot tide. A boat of 42-inch draught can reach within 3½ miles of the mine wharf on a similar tide. Tides of 18 feet height and over form about 75% of all tides.

The river may be divided into two parts; first, the lower 28½ miles to Terminal "B", and secondly the upper and shallower section. The lower section is open to navigation on an average of all but six weeks of the year. The upper section may be said to be closed by ice any time during the months December, January and February, and sometimes for short periods in November and March.

The construction of a light narrow gauge railway from the mine to Terminal "B" would make available the use of scows and tug-boats of five to six feet draught at any time during the year except when the lower river is closed by ice.

Several convenient sites are available for deep-sea terminals on the Skeena river estuary and its approaches, capable of furnishing anchorage for boats of 30-feet draught.

GENERAL

The property is situated in a broad, low valley parallelling the Grenville Channel of British Columbia inland coastal waters some 16 miles to the east. The surrounding mountains of the Coast Range are very steep and rocky, and rise sharply from the valley floor to a general elevation of 4000 feet. Two rivers flow through this valley into the sea. One, the Ecstall river, flows northward past the mine into the estuary of the Skeena river; the second, the Quaal river, flows southward into the Douglas Channel. A low divide, elevation 210 feet, divides these watersheds about 11 miles southward of the mine. The distance from the mine to the Skeena river following the water contour is roughly 34.5 miles, and to the Douglas Channel about 24 miles.

Present means of access to the property is by the Ecstall river. Coastal steamers call at Port Essington, a fishing village situated at the junction of the Ecstall with the Skeena. The Canadian National Railway has a flag-stop at Haysport on the opposite bank of the Skeena river. The nearest deep-sea port is Prince Rupert, terminal of the Canadian National Railway, a distance of 25 miles by coastal waters from Port Essington. It is about 35 miles by river from the mine to Port Essington.

The Ecstall river is a wide, shallow stream dependent chiefly upon the ebb and flow of tides for the volume of its water. High tides as logged at Prince Rupert range from 15 feet to 24 feet in height, and the low tides as from 9 feet to 1 foot respectively. That is, the difference between high and low water on a 15-foot tide is 6 feet and on a

24-foot tide is 23 feet. A 16-foot tide effects a rise of four feet of water at Clearwater Creek, some 5 miles below the mine, roughly 1½ hours past Prince Rupert peak time. An 18-foot tide effects a rise of 2 feet at the mine wharf about 2¼ hours past Prince Rupert peak. At least one of the two tides daily rises to an height of 17 feet.

It is possible for boats of five to six feet draught to navigate the river at low water from Port Essington to within 10 miles of the mine; that is, to a point about 600 feet below Spalding's (I.R.67-L.2587) and 1½ miles downstream from Lockaby Creek. The course is tortuous, and is a matter of navigating about and between large areas of shallows formed by sand-bars rather than of following a narrow channel. These sand-bars are visible at low tide. At high water the course is greatly simplified. A 16-foot tide effects a rise of 6 feet at this point.

Continuing upstream, such navigation is possible for another 3¾ miles within the 4 hours around the peak of a 16-foot tide. This would reach to a point just above Muddy Creek, Terminal "B" of a proposed light railway. Within 2 hours around the peak of a similar tide navigation can be continued to Clearwater Creek. Such available navigating time lengthens with higher tides to the 19-foot mark.

At Clearwater Creek, the river narrows down and follows a tortuous course for the remaining 5 miles to the mine wharf. Severe constrictions of the river banks occur at three points, which serve to throttle the tides. Ice-jams are also inclined to form at these points and at a point below Clearwater Creek, at a much earlier date than general conditions would

justify. There are also three lengths of shallows that effectively restrict draughts and loads at normal times. In the last 2½ miles there is a strong river current which maintains its direction and much of its speed against the rising of tides. A tide in this section would seem to come in as an under-current below the surface stream, thus intensifying the formation and shifting of sand-bars. River transport to the mine for the past four seasons has further aggravated this condition by breaking down the river banks. Sand-bars have increased in extent in the last 4 miles since 1937.

Due to the three constrictions of the river banks and the action of the river current, the effective limits of sixteen and seventeen foot tides are located roughly at Frizzell's camp and Brook's camp, about 3½ and 2¼ miles respectively downstream from the mine wharf. Such tides yield a rise of 2 feet respectively at these points. An 18-foot tide effects a similar rise at the mine wharf. The effect of river current must also be normally considered downstream to Frizzell's camp and at times to Clearwater Creek. This current runs from one to four miles per hour. Immediately below Frizzell's camp, there is a short stretch of shallow water containing some large rocks originating in the slide on the opposite bank. However, this point under normal conditions can be serviced by boats of 42-inch draught. The use of such a draught to proceed upstream is limited to the crest of tides over 19.5 feet. Wet weather and consequent higher river usually accompany the higher tides.

Heavy freight was delivered to the mine from Port Essington on a 35-ton scow towed by a gas-boat of 16-inch draught. The mine launch had

a 24-inch draught. Normally it was required that they travel on the crest of a tide of not less than 18-feet. An heavily laden scow more often than not required the aid of a second tide to complete the trip. This was due to the river current. At other times, with a tow-boat of 42-inch draught the trip could be made comfortably on a single tide, the heavier boat being better powered. For almost continuous service, however, it would seem necessary to restrict draughts to 16-inches. This would allow the use of a scow of about 120 tons gross load with tow-boat suitably powered. Were transportation confined to tides of 18 feet and over, draughts of 24 inches and possibly 30 inches might serve. The landing would require to be made within the hour around high tide at the mine wharf. Such tides are 74.5% of all tides of 1941.

Such are the existing transportation facilities on the river during the open season. It is possible to deliver heavy loads up to 42-inch draught to and from the mine, but conditions are too variable to maintain outbound shipments of a product totalling any considerable tonnage. Improvement of present facilities is required or some provision of new ones. Such would be dependent upon the quantities it is finally determined to move. There is also the question of winter conditions.

CLIMATIC CONDITIONS

During the winter months ice comes down to the estuary of the Skeena river from the interior. There is a tendency for this ice to move back upstream with the tides, and up the Ecstall river to form pack-ice. Depending upon the severity of the local temperatures is the seriousness with which this pack-ice may impede navigation. There have been occasions

when access to Port Essington has been closed at high tide for several days. Navigation on the Ecstall river has also been closed for several weeks due to the formation of great masses of pack-ice and floes. These tend to jam the river at two points, about the two islands opposite Brown's Creek, and in the bottleneck immediately below the mouth of Big Falls Creek. Local temperatures may also cause the formation of ice on the narrower sections of the Ecstall river upstream.

The only definite information on climatic conditions on the Ecstall river obtainable is from the weather reports of the Falls River plant of the Northern B. C. Power Corporation at Big Falls Creek. These extend from 1932 inclusive to date. Our own records are from April 1939, with some general information collected by the watchmen and others from December 1937. Copies of this data are herewith attached.

The winters appear to vary considerably, hence also the interference with open navigation. The worst season reported is the winter of 1933, when navigation to the Falls River plant was closed by ice for nine weeks. In the winters since 1937, the river remained open except for the narrower sections near the mine, which were closed by local ice for about two weeks. It is reported that navigation to Clearwater Creek may be estimated on the average as being closed for four weeks of the year during the months of December, January and February. This appears an optimistic estimate, and yet it is borne out to some extent by the record of the last eight years. However, it would seem safer to assume the waterway closed by ice to Terminal "B" or to Clearwater Creek for an average of 6 weeks annually.

The upper section of the river above Clearwater Creek, as has already been noted, suffers from local ice conditions. The wide section between Terminal "B" and Clearwater Creek is very shallow. On this and on the numerous shallows upstream ice forms at low tide at night, moves up with the rising tide and forms jams at Brook's camp, Frizzell's camp, a constriction a $\frac{3}{4}$-mile below Frizzell's camp, and at the bottleneck immediately below Clearwater Creek. This section of the river may become entirely frozen over during the winter, the ice breaking with the tides, but packing and re-consolidating at night low tides. The ice might thus attain quite a thickness, but is hardly safe travelling. Ice-jams at the points enumerated will also form and exist at an unseasonably early and late date. To take full advantage of all possible navigation during the season, therefore, it is necessary to eliminate this section of the river as a means of transportation.

There are no other particular handicaps in the climatic conditions in the Ecstall river valley. The climate is very wet, the records showing a total precipitation of from 125.16 inches to 205.40 inches annually. Average for the eight years recorded is 162.33 inches. Very heavy falls of snow also occur at times, but these are usually followed by rising temperatures and rain. Hence depths of snow on the ground seldom exceed three feet at the river bank.

Heavy rainstorms also occur. A fall of 8 inches in 24 hours is recorded on March 3rd, 1939. Rainfall for the three days June 23rd and 25th amounted to 15.66 inches, and 48.43 inches for the month. Similar heavy rainfalls of from four to six inches per 24 hours may occur

three or four times at any time during a year, and usually in conjunction with the higher tides of the month. Sudden floods thus result, the river at the mine wharf rising from an unsuspicious low to as much as six feet over the banks in 24 hours. Recession of flood waters is also as fast.

IMPROVEMENTS

The question of improvement of the present water route, or provision of additional transportation facilities, hinges upon the quantities of product that require to be removed. There are several alternatives that might be considered in this relation and also in relation to the cost. An easy railway grade is obtainable from the mine to deep water at Kitkiata Inlet on Douglas Channel. This is a distance of 24 miles. A reconnaissance of the route has been described elsewhere. A railway route to the Skeena would not be as practical, nor would it furnish as comparable a deep-sea terminus. However, a rough narrow gauge track might be utilized to eliminate the shallower portions of the waterway near the mine. For comparatively lesser tonnages also, a certain amount of dredging of these shallows might prove sufficient.

Due to the quantities of sediment brought down by the river in freshets, and the reversal of currents in the sections near the mine, dredging of sand-bars would require to be a job of maintenance. Therefore, such work is necessarily limited to the opening of a practical depth that can be kept open at minimum expense. Thus, it may prove practical to maintain a waterway for 30-inch draughts to the mine wharf by intermittent pumping of intervening sand-bars. So also, passage of boats of 48-inch draught to Frizzell's camp could be maintained for any tide of the open

season. In both instances, passage would necessarily be limited to the crest of tides, and occasional difficulties might occur.

The construction of a light railway to Frizzell's camp, Terminal "A", a distance of 3 miles, would make the deeper draught available for outward shipments. To take fullest advantage of the draughts possible in the lower portion of the river, also of the longer period of open navigation, the light railway would require to be extended to Terminal "B", a distance of 4¾ miles from the mine.

Such a light railway could be constructed at a moderate cost. The route along the river bank is fairly even grade. Certain sections are swampy because of overflow of flood waters from the river. One major stream, Swinnerton creek, requires a bridge of 100-feet length. There is about 600 feet in length of large boulders to be traversed at the foot of an old slide opposite Brook's camp. Roughly 300 feet of rock work is required in the rock bluff immediately adjacent Frizzell's camp. Finally, about a ½-mile of the route passes through log jams, immediately preceding the terminus. The cost of a 36-inch gauge line, built on low trestles and logs, was estimated at between nine and ten thousand dollars per mile complete.

DEEP-SEA TERMINALS

The quantity shipment of a product on scows from the mine requires the location of a deep-sea terminal available to ships of 30-feet draught. Tidal currents in these waters are strong, and the distance from Terminal "B" to the Skeena river is about 28 miles. To complete a trip from the river terminal to the deep-sea terminal on a following tide

and subsequent slack, therefore, the latter will require to be located on the Skeena river estuary or its approaches. Five such sites have been suggested for which land is available.

(1) Lot 103, 5 acres, with a flat rock shore-line, is situated immediately south of Lot 11, BALMORAL CANNERY, property of the B. C. Packers, also available. Depth of water at normal low tide is 8 fathoms. This site is most advantageous from the point of view of barge transportation, but it is the most difficult of access from the open sea. It has been pointed out, however, that any coastal navigation requires a pilot by statute, and that in such hands access can be safely had on the courses provided on Chart 313 (Can. Dept. of Marine) on any high tide.

(2) LELU ISLAND, at the west end of Inverness Passage is open land. The proposed terminal would be located on the south-east shore, east of Lear Pt., at 7½ fathoms of water. It also provides a flat rock shore-line. Scow traffic would be routed through Inverness Passage travelling on slack of tide.

(3) Two locations have been suggested on the north-west shore of SMITH ISLAND, south of Tsum Tsadai Inlet (locally Smith's Lagoon), yielding 6½ and 7 fathoms of water respectively. These points mark the extreme limit accessible from the mine terminus on a single tide. The final lap of the trip would probably include bucking the initial stages of the next rising tide.

(4) South of CLAXTON CANNERY, on Telegraph Passage, south of Hegan Pt., land is available from which a site may be chosen, yielding 6½ fathoms of anchorage. This location is, however, open to the westerly winds.

Of these sites, the best would appear to be afforded at Balmoral, both in regard to depth of anchorage and protection from wind. The Lelu Island and Smith Island sites are partly exposed to the force of south-west gales that occur occasionally during the fall and winter. The Claxton site is exposed to westerlys, which blow fresh for several days at a time, but seldom blow into gales. Claxton is serviced by weekly coastal steamers on schedule and without particular difficulty. The main handicap to the Balmoral site is the entry. Two very good harbours, Prince Rupert Harbour and Porpoise Harbour, would be available were provision made to relay the tows with heavier tug-boats from Port Essington or Balmoral.

E E Nixon

March 1st, 1941.

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
40	DH 14	Pyrites	41.5	44	49.1	2.0	0.7			
41	" "	"	46	51	49.6	1.2	0.6			
42	" "	"	51	56	50.4	1.2	0.7			
43	" "	"	56	61	50.5	1.7	0.5	0.02	0.34	42.7
44	" "	"	61	66	49.0	2.2	0.4			
45	" "	"	66	71	49.8	1.2	0.7			
46	" "	"	71	76	49.5	0.9	1.1			
47	" "	"	76	81	47.3	0.6	1.0			
48	" "	"	81	85	49.0	0.4	0.8			
49	" "	"	85	91	50.1	0.4	1.0	0.02	0.62	41.9
50	" "	"	91	95	48.2	0.2	2.4			
51	" "	"	96	101	49.0	0.4	2.3			
52	" "	"	101	106	41.6	2.0	2.0			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
53	DH 15	Pyrites	75	80	49.0	0.7	0.6			
54	" "	"	80	85	50.2	2.2	1.0			
55	" "	"	85	90	49.4	2.0	0.3	0.04	0.54	44.7
56	" "	"	90	95	49.3	1.5	0.6			
57	" "	"	95	100	51.5	0.7	0.2			
58	" "	"	100	105	50.1	0.7	1.5			
59	" "	"	105	110	49.7	0.6	0.6			
60	" "	"	110	115	50.8	0.7	0.8			
61	" "	"	115	120	49.6	0.5	1.6	0.02	0.52	43.9
62	" "	"	120	125	49.8	0.4	1.9			
63	" "	"	125	130	50.0	0.4	0.8			
64	" "	"	130	135	50.9	0.6	0.4			
65	" "	"	135	140	51.0	0.3	0.2			
66	" "	"	140	145	50.0	0.4	1.2			
67	" "	"	145	150	50.4	0.7	0.2			
68	" "	"	150	155	50.1	0.6	2.5			
69	" "	"	155	160	51.1	0.3	0.1	0.01	0.34	43.7
70	" "	"	160	165	50.4	0.3	2.0			
71	" "	"	165	170	50.4	0.1	2.5			
72	" "	"	170	175	50.2	0.3	1.9			
73	" "	"	175	180	43.2	0.4	1.9			
74	" "	"	180	185	48.7	0.4	3.5			
75	" "	"	185	190	48.9	0.3	4.3	0.02	0.84	41.0
76	" "	"	190	195	48.5	0.3	3.2			
77	" "	"	195	200	46.6	0.6	2.3			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
78	DH 16	Pyrites	54.5	60	48.4	1.5	1.1			
79	" "	"	60	65	49.3	1.2	1.5			
80	" "	"	65	70	50.2	0.9	0.9	0.03	0.76	44.3
81	" "	"	70	75	51.0	1.1	0.2			
82	" "	"	75	80	51.1	1.5	0.3			
83	" "	"	80	85	50.3	2.3	0.3			
84	" "	"	85	90	50.7	1.5	Trace			
85	" "	"	90	95	51.1	1.2	0.1			
86	" "	"	95	100	51.1	1.7	0.2	0.04	0.58	43.8
87	" "	"	100	105	50.4	1.6	0.1			
88	" "	"	105	110	48.5	1.6	1.6			
89	" "	"	110	115	49.9	1.5	1.0			
90	" "	"	115	120	49.9	1.2	0.7			
91	" "	"	120	125	43.4	1.5	1.5			
92	" "	"	125	135	48.5	0.7	3.2	0.03	1.10	37.7
93	" "	"	135	140	39.7	3.4	1.9			
94	" "	"	140	142	45.1	4.9	1.8			
95	" "	"	142	149	17.6	3.5	0.5			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
96	DH 17	Pyrites	91.5	95.5	45.6	1.2	2.1			
97	" "	"	107	112	49.5	0.7	1.4			
98	" "	"	112	117	50.4	0.8	1.3	0.02	0.54	42.8
99	" "	"	117	122	50.6	2.0	0.5			
100	" "	"	122	127	49.9	1.2	1.2			
101	" "	"	127	132	48.9	0.7	1.8			
102	" "	"	132	137	50.1	0.7	2.2			
103	" "	"	137	142	50.6	0.6	1.7			
104	" "	"	142	147	50.5	0.4	3.0			
105	" "	"	147	152	50.1	0.4	2.0	0.005	0.20	43.9
106	" "	"	152	157	49.8	0.4	1.8			
107	" "	"	157	162	50.6	0.7	0.9			
108	" "	"	162	167	49.7	0.4	1.3			
109	" "	"	167	172	41.1	0.7				50.9
110	" "	"	172	177	42.5	0.7				47.7
111	" "	"	177	180.5	46.3	0.2	0.2			
112	" "	"	184	189	46.0	0.4	2.6	Trace	0.08	40.5
113	" "	"	189	194	48.0	0.5	1.9			
114	" "	"	194	197	43.9	0.7	3.8			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
115	DH 18	Pyrites	50	55	48.5	1.7	1.0			
116	" "	"	55	60	49.2	1.1	2.7			
117	" "	"	60	65	51.0	1.9	0.5	0.03	0.82	43.3
118	" "	"	65	70	49.4	3.3	0.9			
119	" "	"	70	75	48.5	1.7	0.7			
120	" "	"	75	80	50.5	1.1	0.8			
121	" "	"	80	85	48.7	1.0	0.9			
122	" "	"	85	90	45.8	0.6	2.2			
123	" "	"	90	95	50.2	0.6	1.4			
24	" "	"	95	100	50.7	0.8	1.2			
125	" "	"	100	105	48.0	0.4	3.0	0.02	0.60	43.2
126	" "	"	105	110	49.6	0.7	1.8			
127	" "	"	110	115	48.2	0.4	2.6			
128	" "	"	115	120	50.4	0.6	1.1			
129	" "	"	120	125	49.8	0.4	3.5			
130	" "	"	125	130	49.9	0.5	2.2			
131	" "	"	130	135	48.2	0.2	4.3			
132	" "	"	135	140	46.7	None	6.4			
133	" "	"	140	145	48.1	0.1	3.9	0.01	1.10	39.8
134	" "	"	145	150.5	46.8	0.1	5.6			
135	" "	"	152.5	154.5	37.4	10.5	2.0			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
135½	DH 20	Pyrites	55	60	48.7	1.7	0.7			
136	" "	"	60	65	44.6	2.6	0.1			
137	" "	"	65	70	47.8	2.6	0.4	0.04	0.80	43.7
138	" "	"	70	75	50.6	2.3	0.5			
139	" "	"	75	80	50.9	1.7	0.5			
140	" "	"	80	85	51.1	1.5	Trace			
141	" "	"	85	90	51.4	1.1	0.5	0.03	0.62	45.4
142	" "	"	90	95	51.2	0.7	1.4			
143	" "	"	95	100	50.8	1.7	1.0			
144	" "	"	100	105	50.6	1.1	1.5			
145	" "	"	105	110	51.2	0.6	0.8			
146	" "	"	110	115	50.9	0.4	2.5	0.15	0.42	44.2
147	" "	"	115	120	50.3	0.2	3.5			
148	" "	"	120	125	50.4	0.1	1.9			
149	" "	"	125	129.5	48.7	0.4	1.9			
150	" "	"	133	138	50.6	0.1	3.1			
151	" "	"	138	143	49.8	0.2	2.7	0.01	0.30	42.8
152	" "	"	143	148	50.1	0.2	2.9			
153	" "	"	148	155	48.3	0.2	4.9			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
154	DH 21	Pyrites	81	86	47.9	3.9	0.5			
155	" "	"	86	91	49.1	3.1	0.7			
156	" "	"	91	96	50.7	2.4	0.6	0.04	0.86	44.6
157	" "	"	96	101	51.3	0.9	0.3			
158	" "	"	101	106	51.5	1.2	0.4			
159	" "	"	106	111	51.3	1.1	0.5			
160	" "	"	111	116	50.6	0.9	0.8			
161	" "	"	116	121	50.6	0.4	1.2			
162	" "	"	121	126	50.9	0.4	1.7	0.02	0.52	44.6
163	" "	"	126	131	49.9	0.4	1.8			
164	" "	"	131	136	50.5	0.4	0.9			
165	" "	"	136	141	50.0	0.1	2.3			
166	" "	"	141	146	50.7	0.1	2.2			
167	" "	"	146	151	50.4	0.2	2.3			
168	" "	"	151	156	50.7	0.4	1.4	0.01	0.64	43.8
169	" "	"	156	161	50.1	0.4	1.7			
170	" "	"	161	166	50.3	0.2	2.1			
171	" "	"	166	171	48.2	0.2	4.6			
172	" "	"	171	176	47.4	0.2	5.0			
173	" "	"	176	181	46.6	0.2	3.6			
174	" "	"	181	186	35.8	0.7	3.7	0.02	0.32	38.4
175	" "	"	186	191	45.0	0.2	3.6			
176	" "	"	214	215.5	36.9	1.5	3.0			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
177	DH 22	Pyrites	71	76	48.7	1.1	0.6			
178	" "	"	76	81	48.5	2.0	0.5	0.02	0.36	44.2
179	" "	"	81	83	52.0	1.0	0.2			
180	" "	"	90.5	96	49.4	1.5	1.7			
181	" "	"	96	101	50.8	0.4	1.5			
182	" "	"	101	106	51.2	0.2	1.7	0.02	0.32	44.7
183	" "	"	106	111	51.4	0.4	0.8			
184	" "	"	111	115	50.4	0.4	1.6			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	Length of core to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
185	DH 23	Pyrites	82	87	48.4	0.4	1.8			
186	" "	"	87	92	47.7	0.7	1.9			
187	" "	"	92	97	48.4	0.9	2.7			
188	" "	"	97	102	43.0	0.7	4.2	0.015	0.40	40.3
189	" "	"	102	107	46.6	0.4	3.0			
190	" "	"	107	112	40.7	0.3	4.7			
191	" "	"	112	118.5	48.9	0.6	1.7			
192		Silicious	118.5	119.5		1.5	0.5	0.02	1.20	
193		"	127.5	130		1.1	3.0	0.15	0.48	

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
194	DH 25	Pyrites	130.5	136	50.5	0.7	1.1			
195	" "	"	136	141	51.8	0.5	1.0			
196	" "	"	141	146	51.5	0.9	0.4	0.01	0.16	45.9
197	" "	"	146	151	51.8	0.8	0.5			
198	" "	"	151	156	51.2	0.5	1.7			
199	" "	"	156	161	51.4	0.4	1.8			
200	" "	"	161	166	51.4	0.2	0.8	0.005	0.32	44.1
201	" "	"	166	171	50.9	0.3	1.4			
202	" "	"	171	177	48.0	0.2	2.1			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
203	DH 27	Pyrites	56	61	50.8	0.9	1.2			
204	" "	"	61	66	51.3	2.7	0.5			
205	" "	"	66	71	50.6	3.0	0.7	0.025	0.64	46.0
206	" "	"	71	76	50.0	2.1	0.5			
207	" "	"	76	81	51.0	0.9	1.7			
208	" "	"	81	86	51.0	0.3	1.4			
209	" "	"	86	91	51.4	0.6	1.2			
210	" "	"	91	96	51.2	0.3	2.6			
211	" "	"	96	101	51.6	0.5	2.3	0.005	0.32	44.7
212	" "	"	101	106	51.5	0.4	1.6			
213	" "	"	106	111	51.7	0.9	0.8			

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214	"	"	"	111	116	50.7	0.3	2.8			
215	"	"	"	116	121	51.1	0.4	2.4			
216	"	"	"	121	126	50.4	0.2	2.5	.005	0.82	43.1
217	"	"	"	126	131	50.1	0.2	2.0			
218	"	"	"	131	136	50.4	0.4	2.6			
219	"	"	"	136	142	48.9	0.2	4.1			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
220	DH 28	Pyrites	86.5	87.5	38.2	3.7	1.6	0.02	1.10	34.2
221	" "	"	90.5	95	49.8	2.2	0.5			
222	" "	"	95	100	50.7	1.7	0.3			
223	" "	"	100	105	50.2	2.8	0.7			
224	" "	"	105	110	50.6	2.2	0.9	0.025	0.80	44.2
225	" "	"	110	115	51.2	1.0	1.0			
226	" "	"	115	120	50.9	1.3	1.1			
227	" "	"	120	125	50.3	0.4	1.9			
228	" "	"	125	130	50.5	1.2	1.6			
229	" "	"	130	135	50.8	1.0	1.7			
230	" "	"	135	140	51.5	0.7	1.3			
231	" "	"	140	145	50.7	0.7	2.2			
232	" "	"	145	150	50.9	0.6	3.6	0.015	0.66	43.3
233	" "	"	150	155	50.5	0.2	2.5			
234	" "	"	155	160	50.9	0.2	1.3			
235	" "	"	160	165	49.2	0.1	2.6			
236	" "	"	165	170	48.3	None	4.7			
237	" "	"	170	175	49.5	0.1	3.2			
238	" "	"	175	180	48.6	0.1	4.2			
239	" "	"	180	185	50.1	Tr.	2.6			
240	" "	"	185	190	50.1	0.2	3.2	0.01	0.82	41.3
241	" "	"	190	195	49.6	0.2	3.6			
242	" "	"	195	200	48.5	0.2	5.2			
243	" "	"	200	205	47.5	0.2	7.3			
244	" "	"	205	210	49.0	0.3	4.2			
245	" "	"	210	215	46.4	0.9	4.7			
246	" "	"	215	219	43.8	1.0	4.4			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
247	DH 29	Pyrites	79	84	49.4	1.1	1.0			
248	" "	"	84	89	49.7	1.2	0.8			
249	" "	"	89	94	51.4	0.7	0.4	0.01	0.48	43.3
250	" "	"	94	99	50.1	0.2	3.2			
251	" "	"	99	102.5	49.5	0.2	3.8			

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
252	DH 30	Pyrites	196	201	49.2	0.4	0.7			
253	" "	"	201	203	48.5	0.2	0.1			
254	" "	"	214	219	51.0	0.9	0.3	0.01	0.38	44.6
255	" "	"	219	224	50.8	1.1	1.0			
256	" "	"	224	226	49.5	0.9	1.3			
256 A	" "	"			50.6	0.6	1.0			

HC x Cut -45°

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
257	DH 33	Pyrites	211	216	46.2	0.9	0.8			
258	" "	"	216	221	46.9	1.2	0.6			
259	" "	"	221	226	50.7	1.2	0.3	0.02	0.46	43.9
260	" "	"	226	231	51.1	1.2	0.1			
261	" "	"	231	236	51.1	0.9	0.7			
262	" "	"	236	241	39.4	1.0	0.9			
263	" "	"	241	246	50.1	0.9	0.6			
264	" "	"	246	251	50.4	0.9	1.0			
265	" "	"	251	256	50.4	0.6	0.9			
267	" "	"	261	266	50.3	0.8	0.8			
268	" "	"	266	271	49.6	0.6	0.4	0.01	0.58	45.0
269	" "	"	271	276	51.0	0.4	0.4			
270	" "	"	276	281	49.6	0.5	0.8			
271	" "	"	281	284	48.2	1.0	1.1			
272	" "	"	291	293.5	45.4	2.0	0.4			

-60°

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
273	DH 34	Pyrites	12.5	19.5	44.5	3.6	1.4			
274	" "	"	23	28	47.4	0.5	4.2			
275	" "	"	28	33	46.5	0.3	3.4			
276	" "	"	33	38	50.0	0.2	3.3	0.01	0.84	40.9
277	" "	"	38	43	51.5	0.4	1.8			
278	" "	"	43	48	49.9	0.3	4.6			
279			48	54	42.7	0.9	1.7			
280	DH 35	"	23	28	48.5	0.2	4.6			
281	" "	"	28	33	47.9	0.2	4.5	0.015	1.10	38.8
282	" "	"	33	39.5	49.8	0.1	4.1			
283	" "	"	39.5	45.5	35.5	2.5	2.0			
284	DH 36	"	28	33	46.1	0.2	3.8			
285	" "	"	33	38	48.8	0.1	3.8			
286	" "	"	38	43	50.7	0.4	2.1	0.015	0.64	41.3
287	" "	"	43	48	48.8	0.3	5.0			
288	" "	"	48	50.5	48.4	1.2	1.9			
289	DH 37	"	91	94	51.2	0.1	1.3	0.025	0.86	44.2

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au %	Ag %	Fe %
290	DH 38	Pyrites	91	96	47.7	2.2	3.7	0.03	1.0	42.1
291	" "	"	96	101.5	49.4	2.9	2.7			
292	DH 39	"	110	115	51.7	0.2	3.0			
293	" "	"	115	120	50.6	0.2	3.5			
294	" "	"	120	125	49.2	0.2	4.9			
295	" "	"	125	130	50.1	Tr.	5.2	0.01	0.98	42
296	" "	"	130	135	49.6	0.1	5.0			
297	" "	"	135	140	50.7	0.3	2.4			
298	" "	"	140	145	50.4	0.2	2.8			
299	" "	"	145	150	42.2	0.4	1.3			
300	" "	"	150	155	48.6	0.1	4.7			
301	" "	"	155	160	47.5	0.1	5.7			
302	" "	"	160	165	49.7	0.1	3.2	0.01	0.82	
303	" "	"	165	167.5	49.3	0.2	3.0			
304	" "	"	173	177	41.4	1.1	4.0			
305	" "	"	177	182	49.2	0.9	4.5			
306	" "	"	182	184.8	49.8	0.4	2.3			

ANALYSIS

NOTHERN PYRITES

NO.	Location	Description	Length of core from to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
307	DH 40	Pyrites	129 - 132	45.9	Tr.	3.0	0.005	0.30	39.7
308	" "	"	140 - 145	47.3	0.2	4.3			
309	" "	"	145 - 150	47.3	0.1	6.0			
310	" "	"	150 - 155	48.5	0.3	4.6	0.015	1.20	39.1
311	" "	"	155 - 160	47.0	0.2	4.7			
312	" "	"	160 - 164.5	43.6	0.4	4.6			
313	" "	"	166 - 171	40.1	0.2	3.4	0.01	0.64	34.4

ANALYSIS

NORTHERN PYRITES

No.	Location	Description	Length of core from	to	S %	Cu %	Zn %	Au oz	Ag oz	Fe %
A	No. 6	Crosscut	0	5	43.9	1.1	0.7			
B	" "	"	8	10	49.0	1.2	0.3			
C	" "	"	10	15	51.1	1.2	0.3	0.025	0.52	43.6
D	" "	"	15	20	51.5	1.1	0.9			
E	" "	"	20	25	51.0	1.6	0.6			
F	" "	"	25	30	51.0	0.7	2.4			
G	" "	"	30	35	51.1	0.6	1.7			
H	" "	"	35	40	50.9	0.4	2.2			
I	" "	"	40	45	51.2	0.6	0.9	0.005	0.24	44.6
J	" "	"	45	50	51.1	0.5	1.5			
K	" "	"	50	55	51.2	0.5	1.2			
L	" "	"	55	60	51.0	0.2	1.3			
M	" "	"	60	63.5	46.2	0.1	1.4			
N	" "	"	67.5	70	48.7	0.4	1.5			
O	" "	"	70	75	51.2	0.7	1.0			
P	" "	"	75	80	51.7	0.5	1.6	0.007	0.60	43.2
Q	" "	"	80	85	50.7	0.3	3.1			
R	" "	"	85	90	51.0	0.1	1.6			
S	" "	"	90	96	44.7	0.2	4.1			

NORTHERN PYRITES LTD.

2% COPPER ORE

1940

ESTIMATE OF 2% COPPER ORE MINEABLE SEPARATELY ABOVE THE TUNNEL LEVEL

It would seem possible to segregate for selective mining a certain tonnage of ore in the footwall of the North Lense approximating 2% copper content. Such segregation would require some additional work to amplify the present data as to its extent and occurrence. From this data, however, the following rough figures are available:

Section	Height	Width	Tons	% Cu.
"I"	350	20	100,000	2.1
"J"	450	15	96,400	2.0
"K"	400	10	57,000	1.6
"L"	400	15	85,700	1.8
"M"	400	15	85,700	1.6

Thus, from the first four sections a total of 339,100 tons of ore is obtained averaging 1.91% copper. A total of all five sections yields 424,800 tons of ore averaging 1.85% copper.

Due to irregular spacing and location of the diamond drill holes with reference to the sections, widths and grade averages are very approximate. The grades have been averaged numerically for each section. Taking into consideration the continuity of some of the higher grade obtained in the steep holes in the footwall, it is possible that actual average grade may prove slightly higher. It would seem reasonable, however, to estimate a probable tonnage of from 300,000 to 500,000 tons of ore approximating 2% copper in the footwall of the North Lense above the adit level.

An estimate of gold and silver values in this tonnage is, gold at 0.028 ozs. per ton, and silver at 0.52 ozs. per ton.

March 1, 1941.

E E Mason

D.D.H. No.	FOOTWALL Core Length Feet	FOOTWALL Average % Cu.	HANGING WALL Core Length Feet	HANGING WALL Average % Cu.
Section "H"				
G-5	-	-	5	5.3
G-6	-	-	5	1.8
G-7	-	-	-	-
G-8	-	-	5	1.4
29	10	1.1	-	-
Section "I"				
G-1	40.5	1.4	-	-
9	44	2.1	3	1.0
G-3	44.5	2.5	-	-
10	320	2.1	3	1.3
G-4	(17	2.8	-	-
	(130	2.7	-	-
27	15	2.9	-	-
28	24	2.0	4	1.0
20	30	2.1	-	-
22	12	1.5	-	-
Section "J"				
8	30	1.3	5	4.2
28	24	2.0	4	1.0
12	10	1.6	5	3.6
G-9	(95	1.7	-	-
	(135	2.5	-	-
7	(19	2.2	-	-
	(85	(No Cu. Assays)	-	-
	(110	2.0	-	-
G-29	107	2.2	-	-
G-30	-	-	-	-
G-31	97	2.3	-	-
21	15	3.1	1.5	1.5
#6 Crosscut	15	1.3	-	-
Surface (G)	-	-	3	3.0
Section "K"				
G-27	-	-	-	-
G-11	5	1.8	10	2.1
11	-	-	-	-
13	10	1.1	4	10.9
G-24	9	2.3	-	-
G-25	13	1.5	-	-
G-26	20	1.6	-	-
G-10	35	2.3	5	2.4
15	15	1.9	-	-
28	25	1.7	-	-

D.D.H. No.	FOOTWALL Core Length Feet	FOOTWALL Average % Cu.	HANGING WALL Core Length Feet	HANGING WALL Average % Cu.
Section "L"				
G-12	10	1.7	-	-
G-13	15	1.8	2	2.1
18	25	1.9	2	10.5
14	19.5	1.8	5	2.0
17	10	1.6	14	3.6
33	15	1.2	2.5	2.0
Section "M"				
G-14	10	1.7	-	-
16	40	1.6	14	3.6
Section "N"				
(North Lense) #4) Crosscut)	10	1.3	-	-
23	-	-	-	-
(South Lense) #4) Crosscut)	3	3.4	-	-
Section "O"				
(No Information)				
Section "P"				
#3 Crosscut	-	-	5	2.0
38	6.5	2.5	-	-
Section "Q"				
36	-	-	2.5	1.2
G-17	-	-	-	-
G-19	-	-	-	-
Section "R"				
34	7	3.6	-	-
Section "S"				
#2 Crosscut	-	-	-	-
39	-	-	-	-
Section "T"				
G-15	-	-	5	1.1
35	-	-	6	2.5

D.D.H. No.	FOOTWALL Core Length Feet	FOOTWALL Average % Cu.	HANGING WALL Core Length Feet	HANGING WALL Average % Cu.
Section "U"				
Dunsmuir Tunnel	(composite sample assay only)			
#1 Crosscut	-	-	-	-
40	-	-	-	-

RANGE

The work of crosscutting and diamond drilling during 1940 has practically confirmed the former tonnage estimates.

The following gives the results based on the work done in 1940.

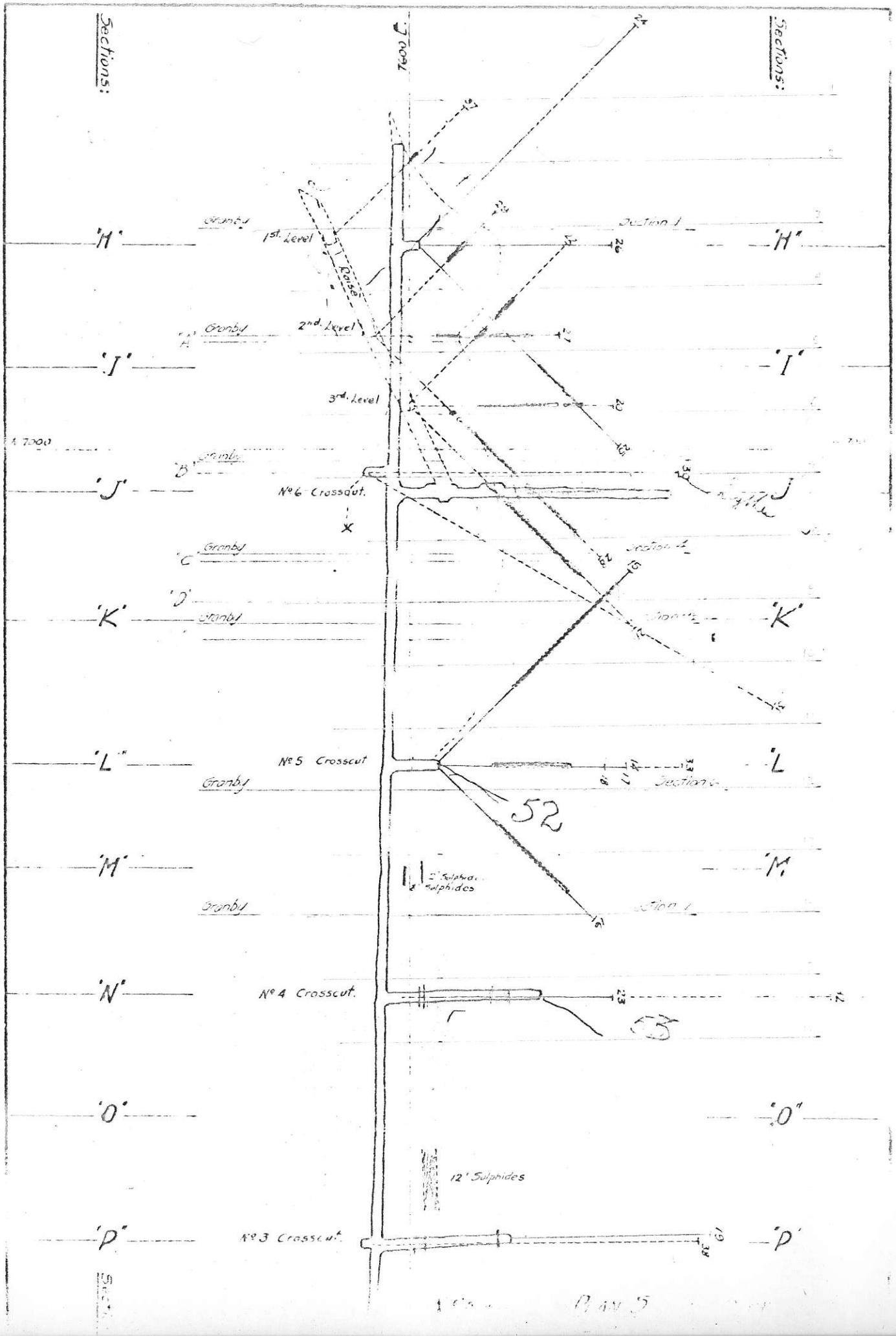
	North Lens	South Lens	Total
Above Adit Level	2,814,257	824,409	3,638,66[illegible]
Adit to Sea Level	366,381	287,070	653,45[illegible]
Sea Level to 100 ft. Below Sea	219,618	358,835	578,45[illegible]
	3,400,256	1,470,314	4,870,570

The average analysis of the above is as follows:

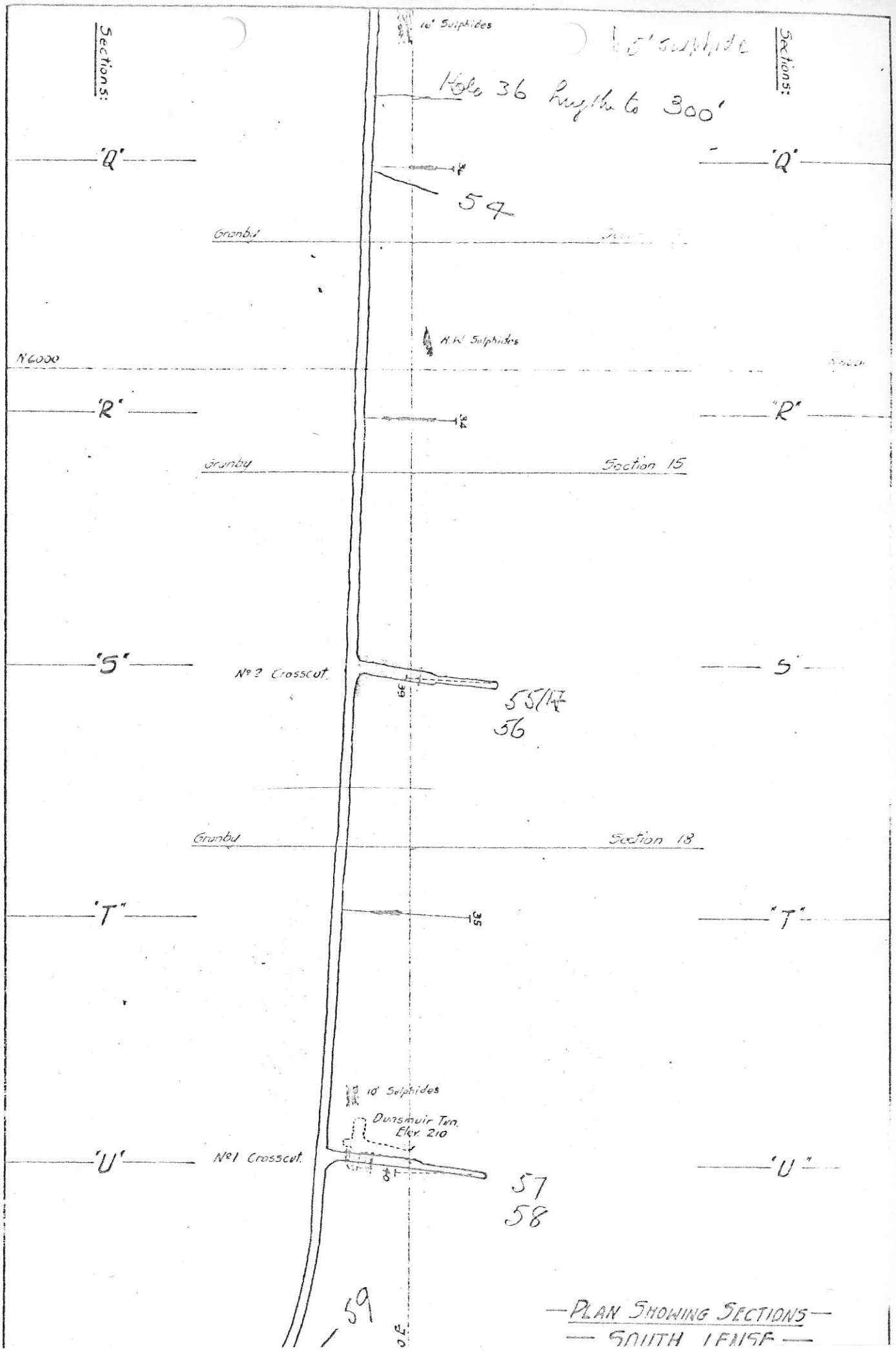
	Sulphur %	Iron %	Copper %	Zinc %	Gold oz.	Silver oz.
GENERAL AVERAGE	49.0	43.0	0.8	2.0	0.015	0.6
Diamond Drill Cores						
North Lens, Average	49.5	43.5	0.8	2.0	0.015	0.5
South Lens, Average	47.5	41.	0.9	3.1	0.013	0.8
Crosscuts						
North Lens No. 4 Crosscut 15 ft.	48.3	42.2	1.0	1.3	0.02	0.26
" " No. 6 Crosscut 90 ft.	49.4	43.8	0.6	1.4	0.012	0.4[illegible]
South Lens No. 1 Crosscut 19 ft.	43.1	37.0	0.3	---	0.03	----
" " No. 2 Crosscut 49 ft.	47.7	41.3	0.13	2.7	0.04	0.56
" " No. 3 Crosscut 10 ft.	44.3	39.0	1.4	2.2	0.04	0.97

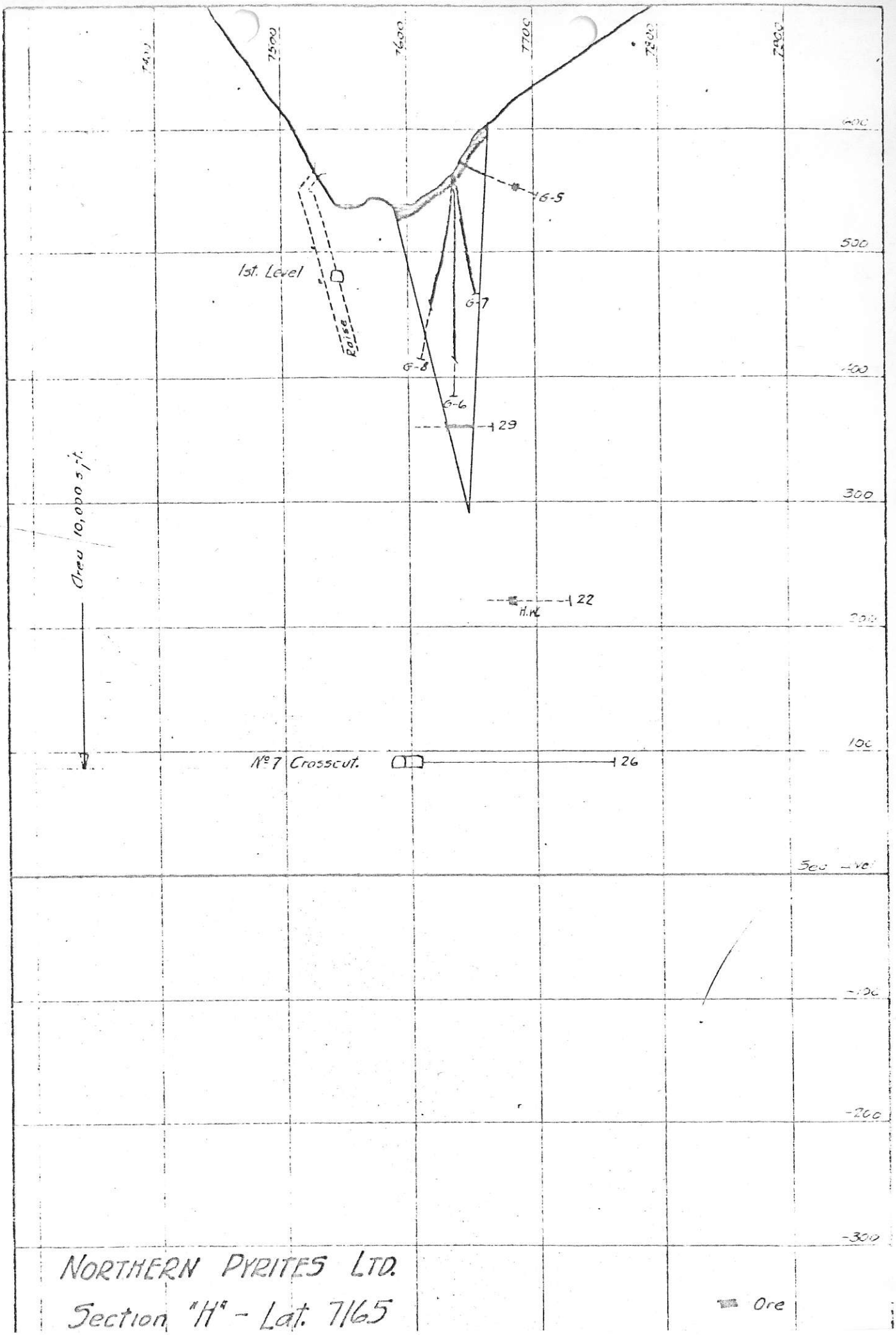
Analyses for Selenium, Arsenic and Phosphorous were made on Average Samples with the following results.

		Selenium Parts per Million	Arsenic Parts per Million	Phosphorous Parts per Million
North Lens				
No. 6 Crosscut	90 feet	60	430	10
Footwall Side	20 feet	100	625	
Hanging Wall Side	60 feet	50	360	
Across Orebody	70 feet	60	500	
Across Orebody	100 feet	40	420	



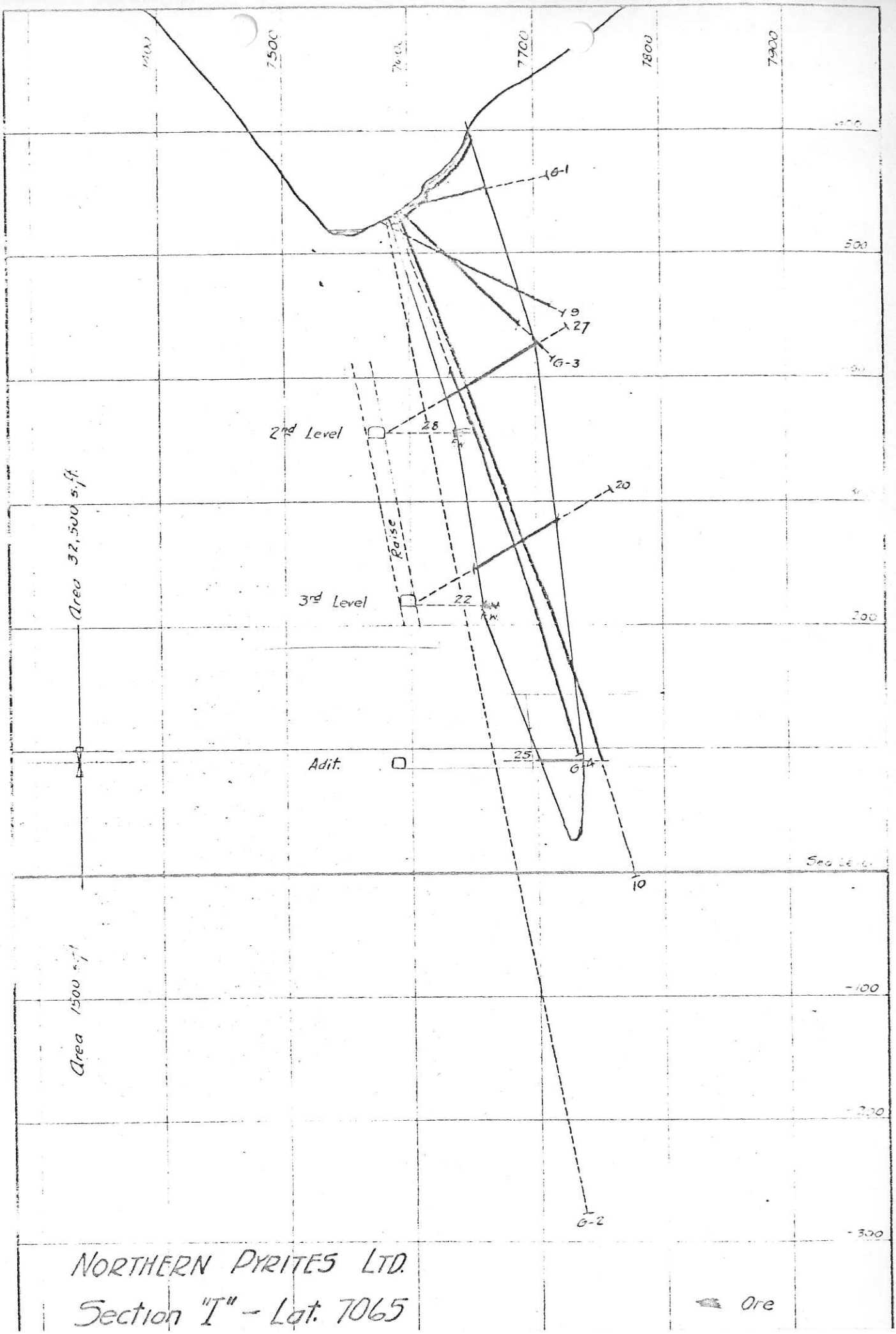
Sections:
Sections:
7000 ℄
'H'
'I'
'J'
'K'
'L'
'M'
'N'
'O'
'P'
Granby
1st. Level
Raise
2nd. Level
3rd. Level
Section 1
Section 4
Section 6
Nº 6 Crosscut.
Nº 5 Crosscut
Nº 4 Crosscut.
Nº 3 Crosscut.
52
53
12' Sulphides


Sections:
Sections:
10' Sulphides
5' Sulphide
Hole 36 length to 300'
'Q'
'Q'
54
Granby
Section 14
N.W. Sulphides
N6000
'R'
'R'
34
Granby
Section 15
'S'
'S'
No 2 Crosscut.
39
55/57
56
Granby
Section 18
'T'
'T'
35
10' Sulphides
Dunsmuir Tun.
Elev. 210
'U'
'U'
No 1 Crosscut.
57
58
59
PLAN SHOWING SECTIONS
SOUTH LENSE



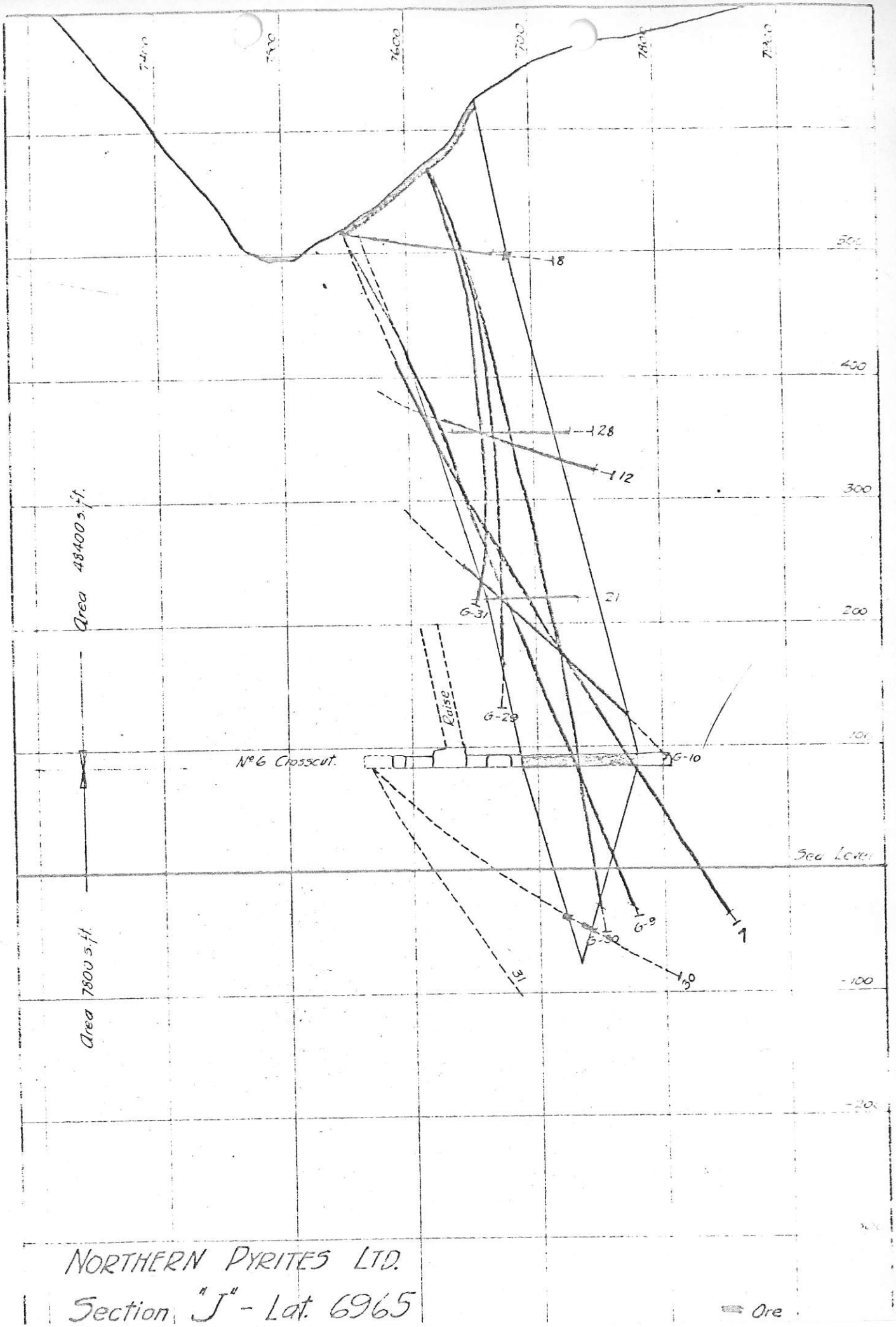
NORTHERN PYRITES LTD.

Section "H" - Lat. 7165



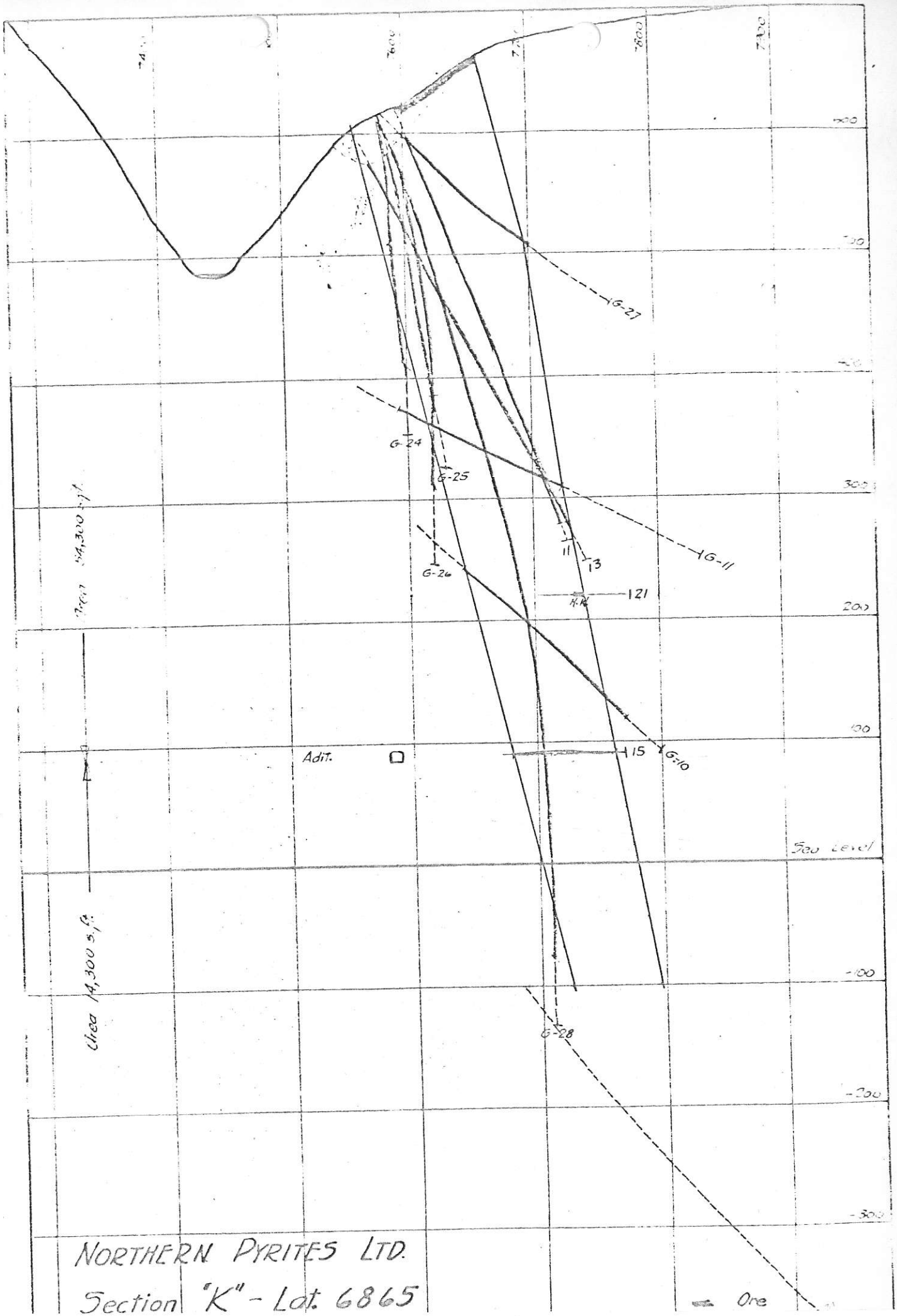
NORTHERN PYRITES LTD.

Section "I" - Lat. 7065



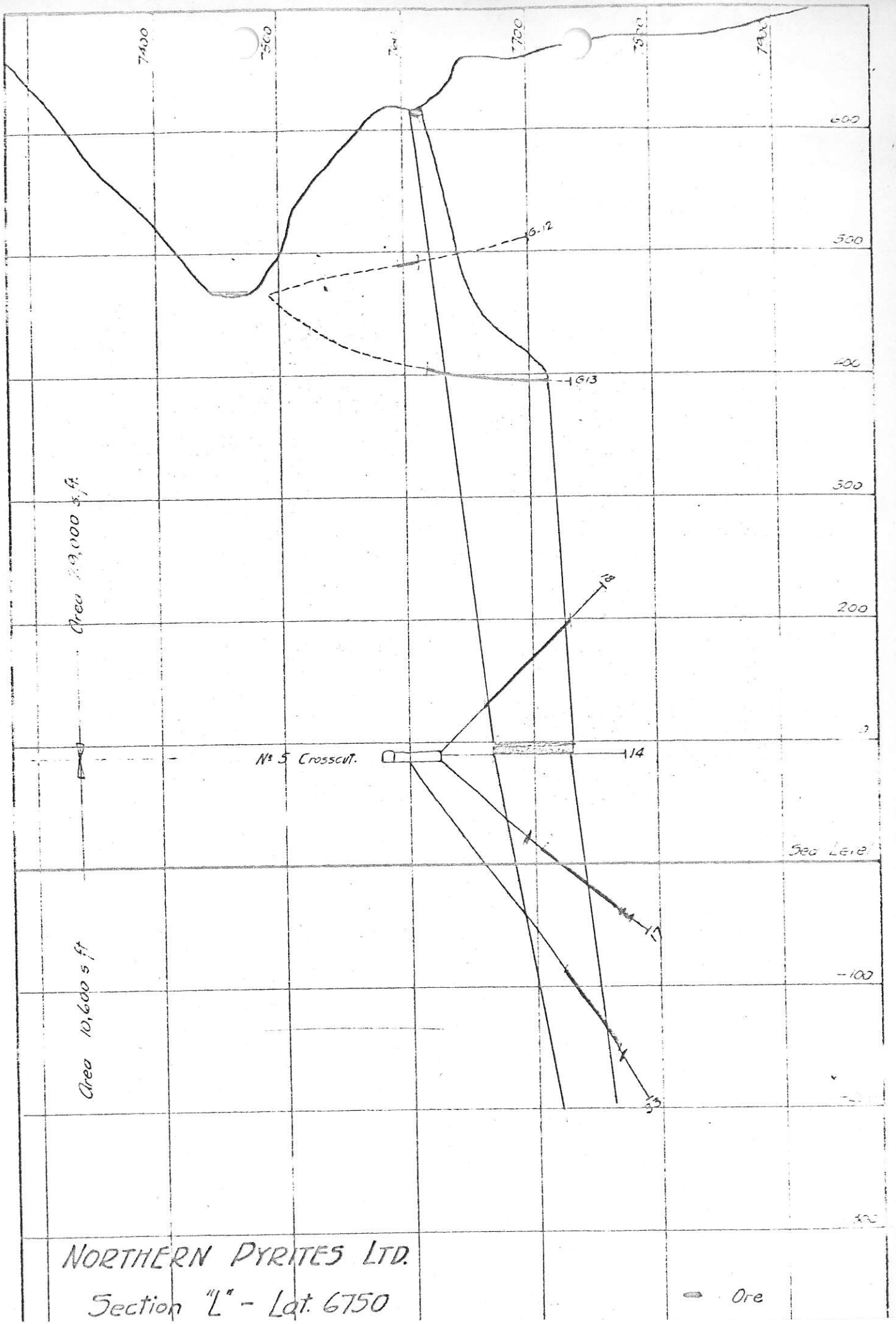
NORTHERN PYRITES LTD.

Section "J" - Lat. 6965



NORTHERN PYRITES LTD.

Section "K" - Lat. 6865

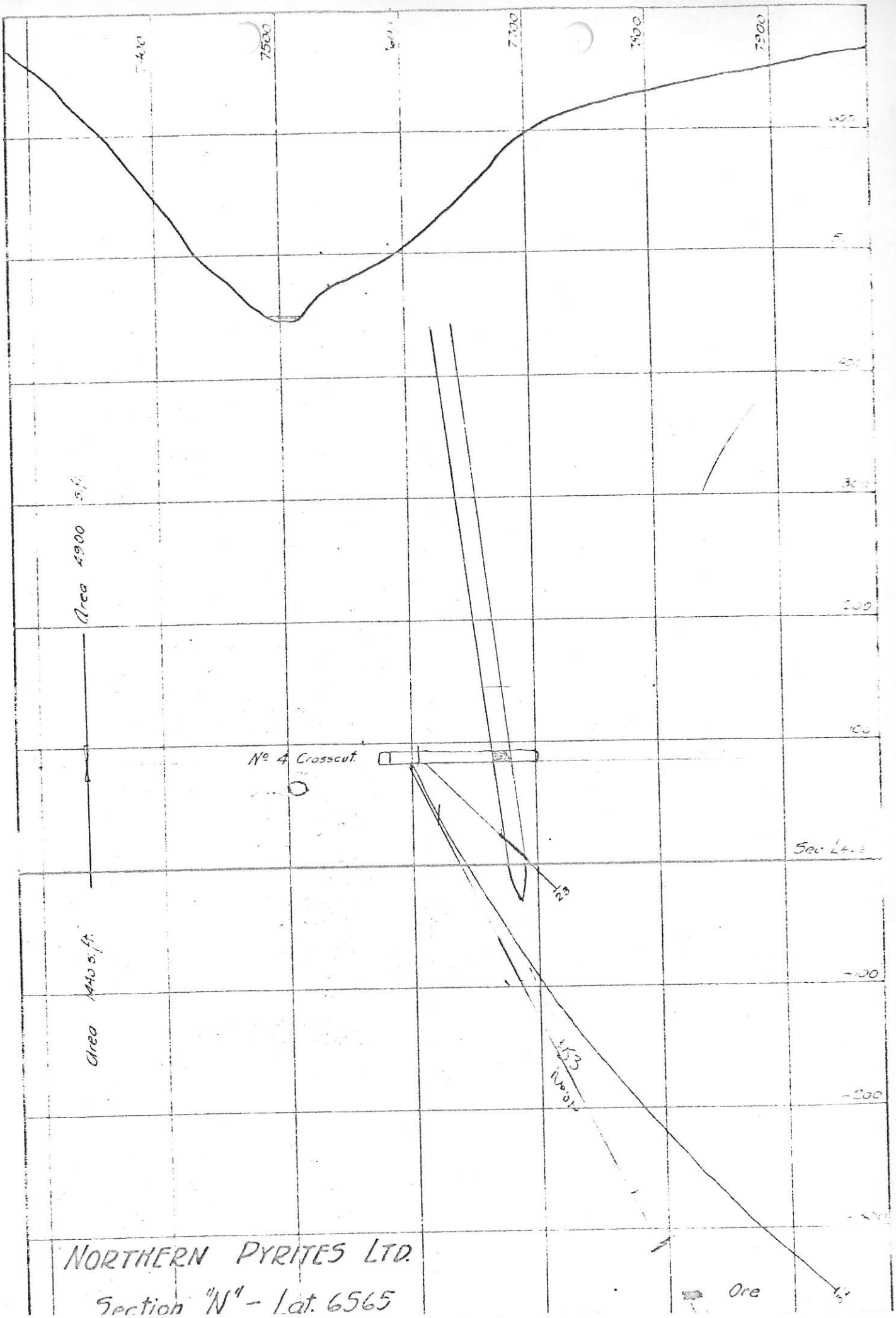


NORTHERN PYRITES LTD.

Section "L" - Lat. 6750

NORTHERN PYRITES LTD.

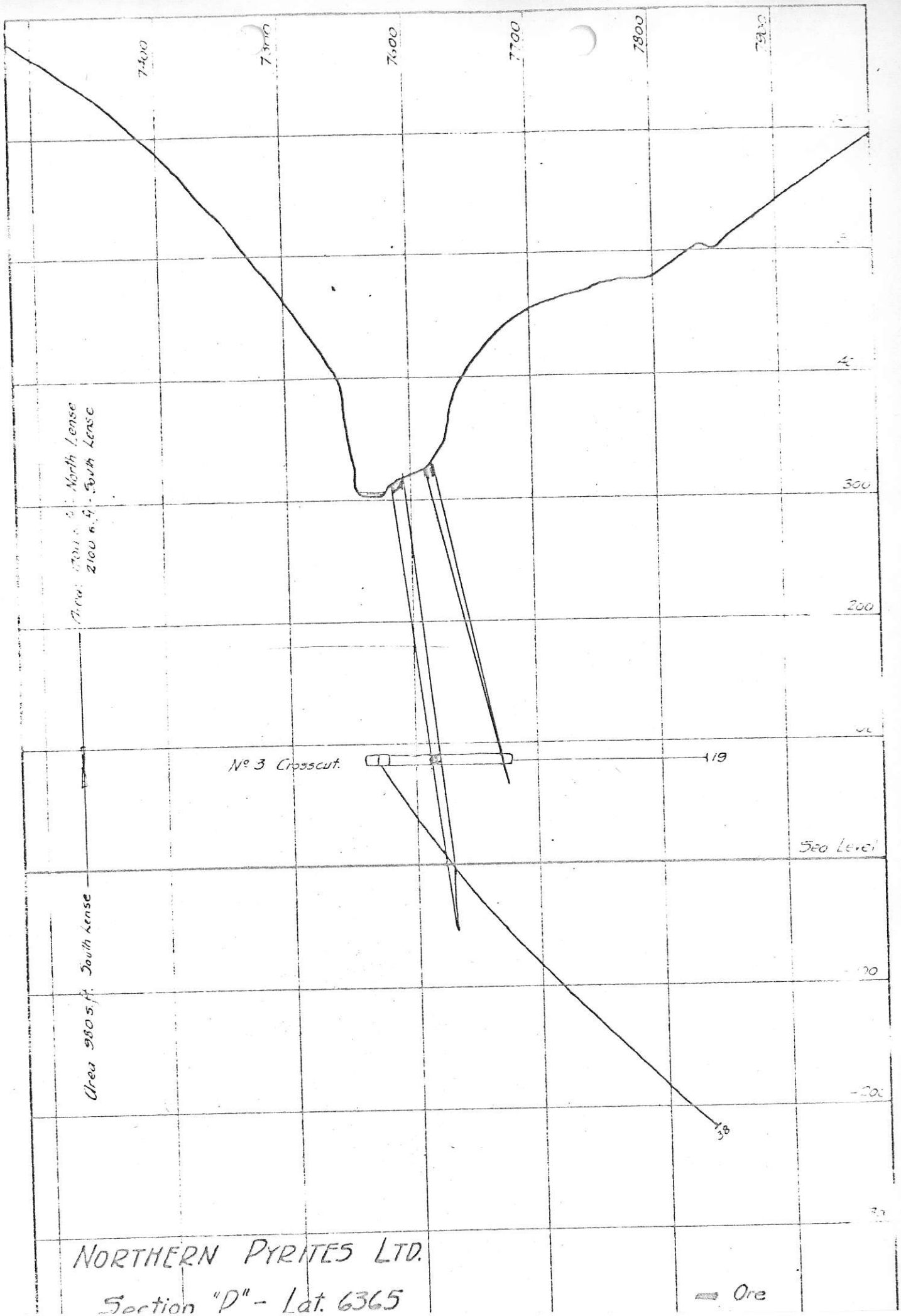
Section "M" – 1 at 6665



NORTHERN PYRITES LTD.

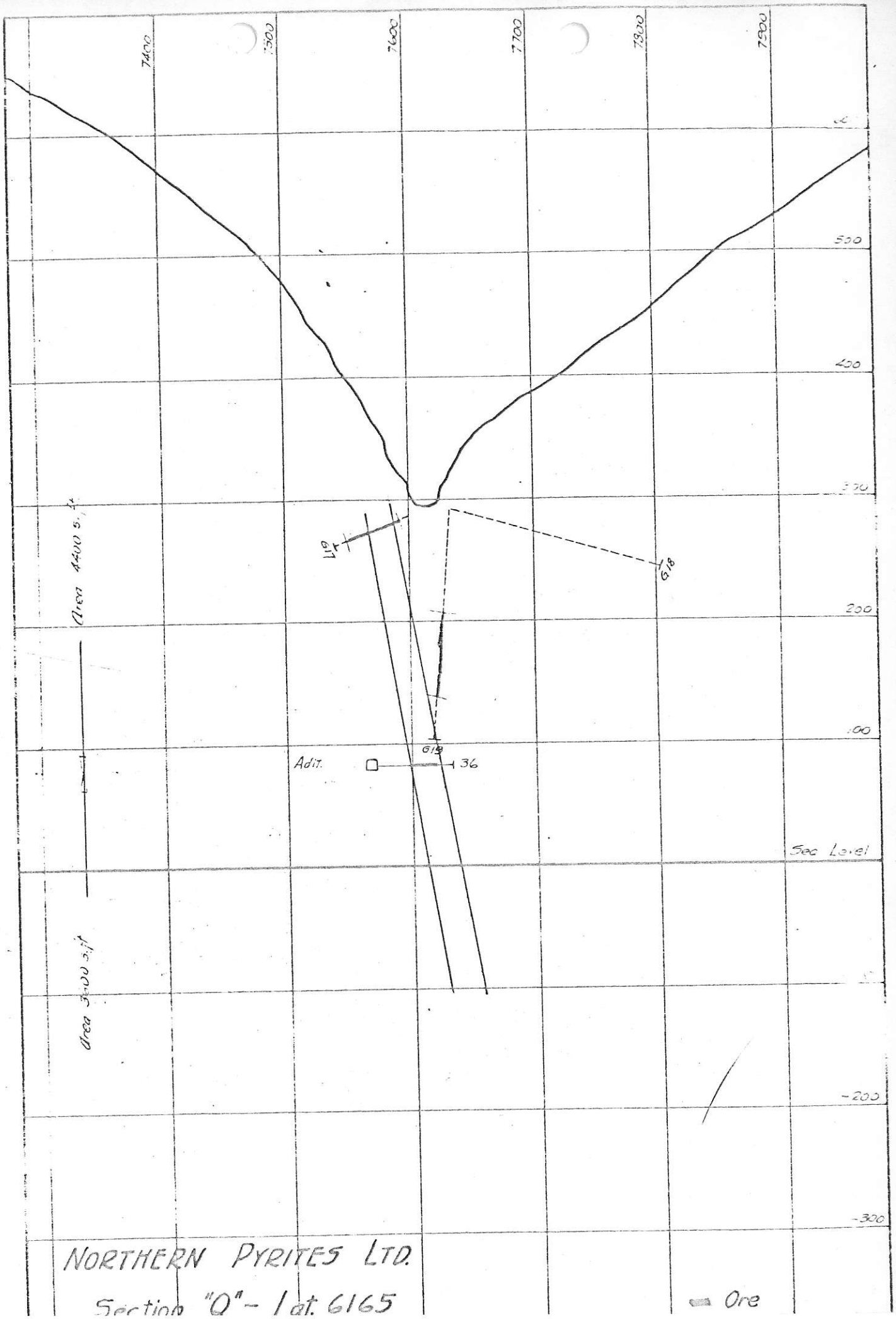
Section "N" - Lat. 6565

7400
7500
7600
7700
7800
7900
600
500
400
300
200
100
Sea Level
-100
-200
-300
Area 2560 s.ft. (North Lens)
Area 400 s.ft.
Adit
NORTHERN PYRITES LTD.
Section "O" - Lat. 6465



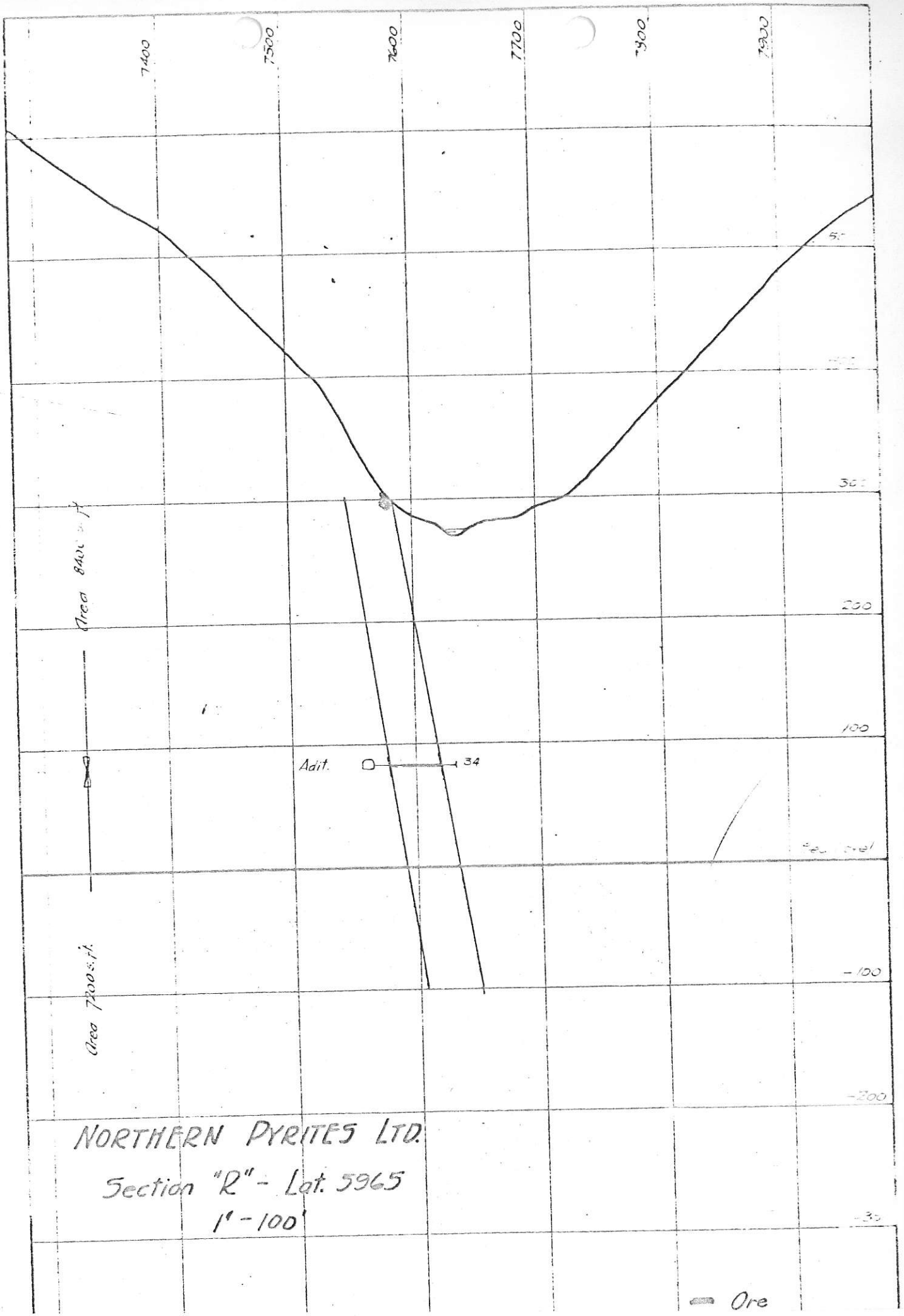
NORTHERN PYRITES LTD.

Section "D" - Lat. 6365



NORTHERN PYRITES LTD.

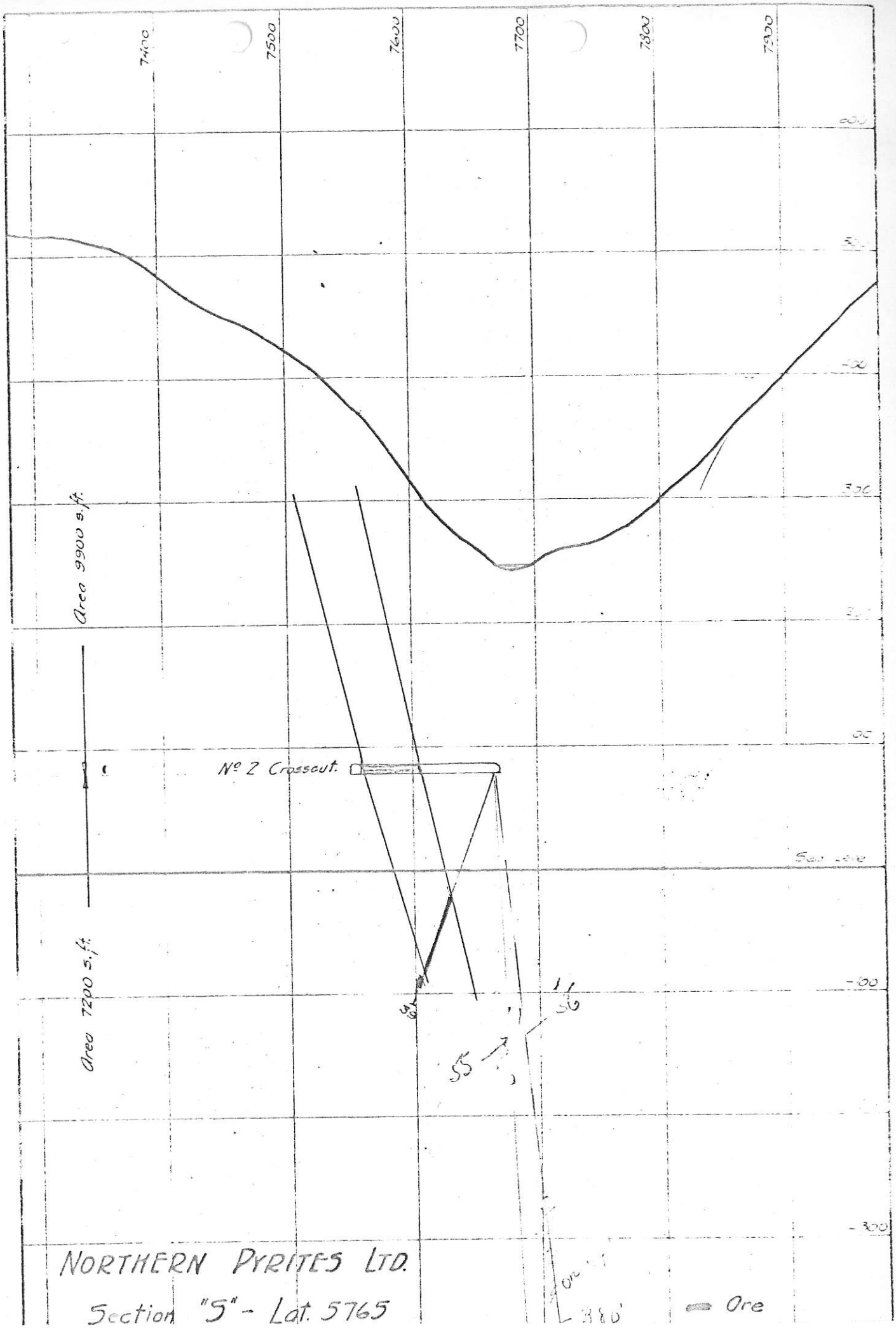
Section "Q" - 1 at. 6165



NORTHERN PYRITES LTD.

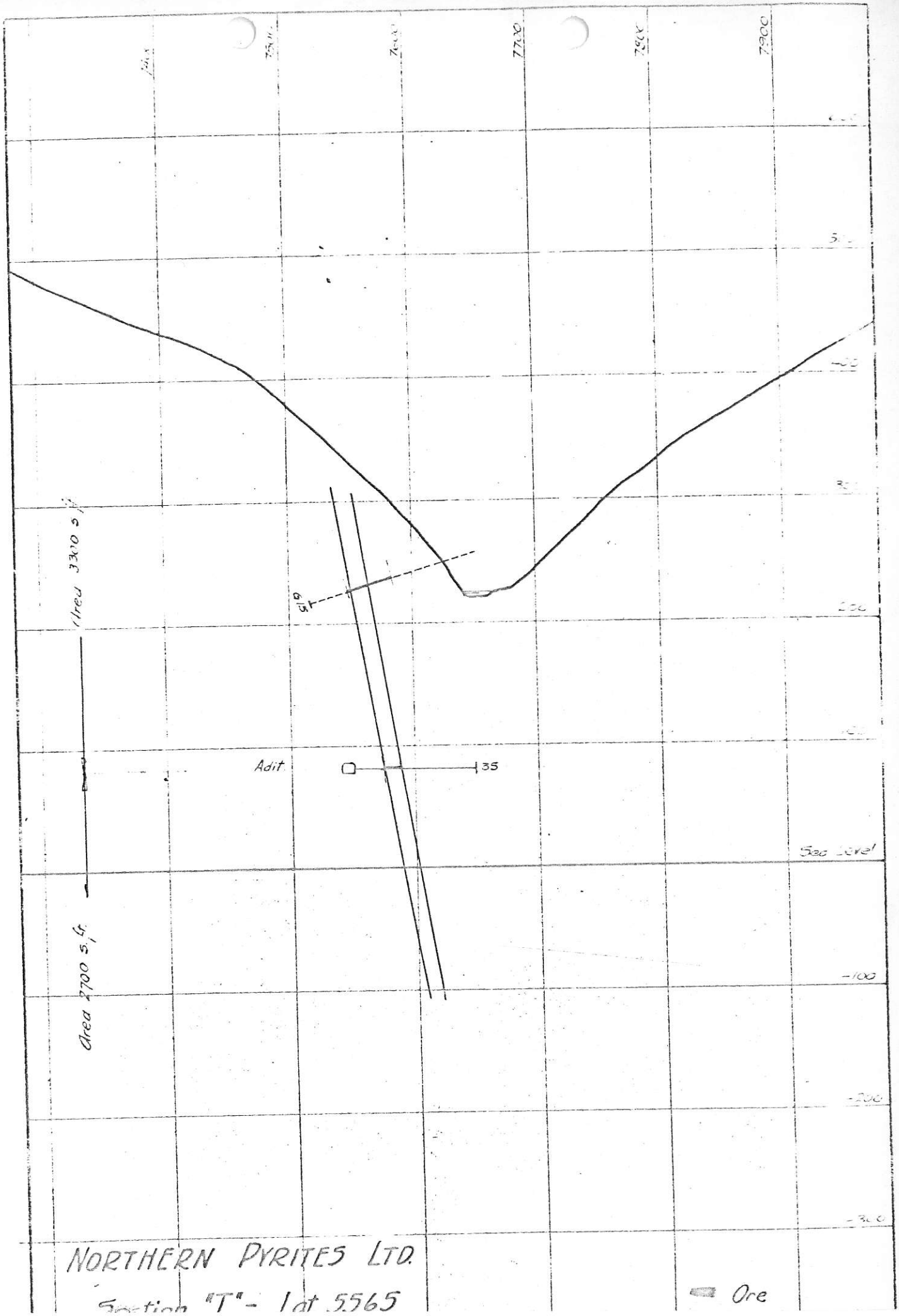
Section "R" - Lat. 5965

1" - 100'



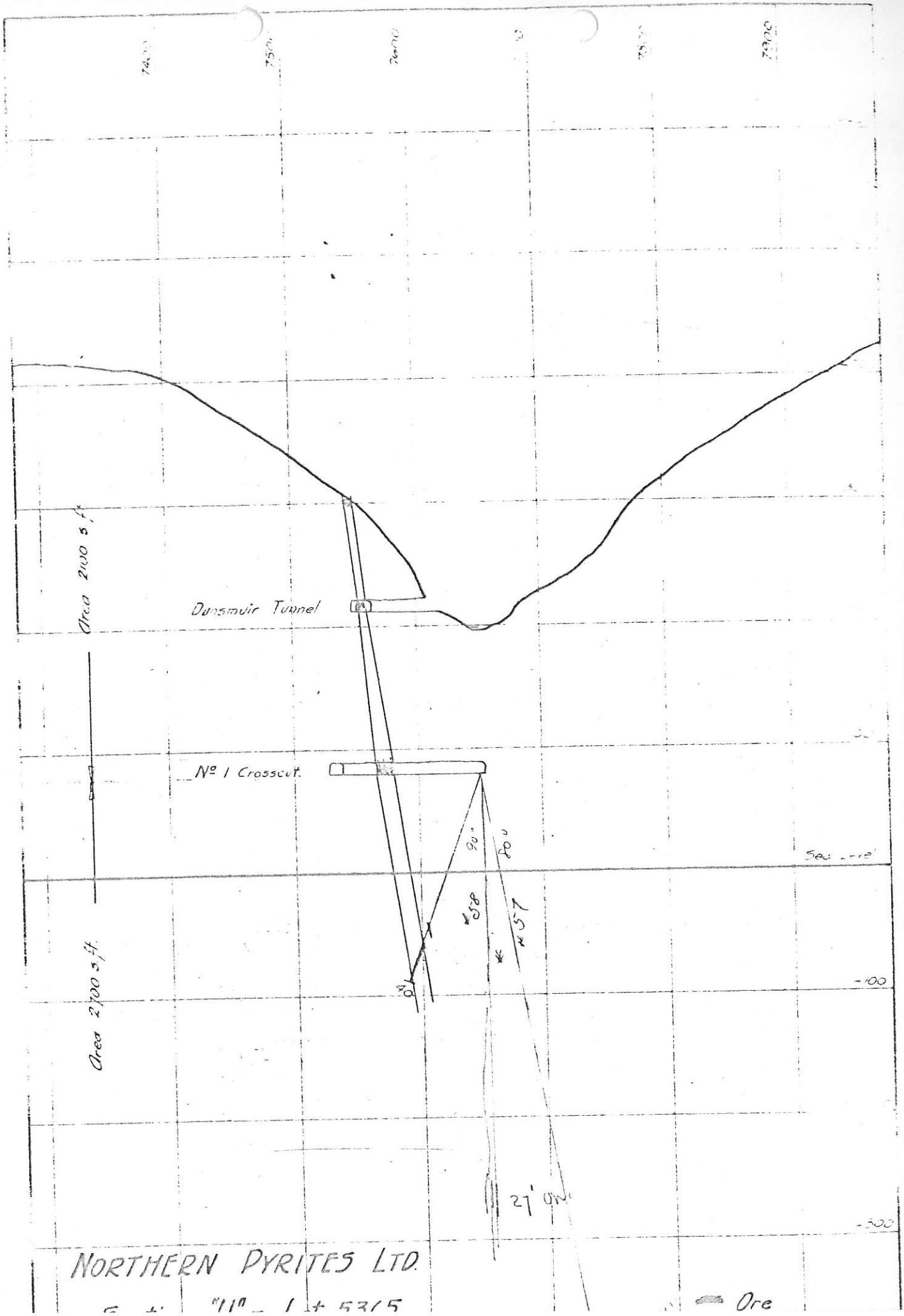
NORTHERN PYRITES LTD.

Section "5" - Lat. 5765



NORTHERN PYRITES LTD.

Section "T" - 1 at 5565



7400
7500
7600
7900
Area 2100 s.ft.
Dunsmuir Tunnel
Nº 1 Crosscut.
90°
80°
58
57
40
Area 2700 s.ft.
-100
-300
27' ON
NORTHERN PYRITES LTD.
Ore

ESTIMATE OF ORE RESERVES

AT THE ECSTALL MINE, BRITISH COLUMBIA

ESTIMATE OF ORE RESERVES

AT THE ECSTALL MINE, BRITISH COLUMBIA

CONCLUSIONS

The following is the tonnage estimated in 1952, taking 7.85 cubic feet of ore to the long ton:-

	North Lens	South Lens	Total
Developed	3,030,000*	3,356,000	6,386,000
Indicated		1,400,000	1,400,000
			7,786,000

Average analysis of the above tonnages determined from diamond drill cores:-

	S %	Fe %	Cu %	Zn %
South lens average				
Above minus 100' (1940)	47.5	41.0	0.9	3.1
Below minus 100' (1952)	47.6	41.5	0.28	2.9
Combined average	47.5	41.3	0.44	2.95
North lens average (1940)	49.5	43.0	0.8	2.0

* Basis: 1940 drilling

INTRODUCTION

This report is a tonnage estimate of the Ecstall Mine based upon the 1952 diamond-drilling, and upon drilling conducted from 1937 through to 1940.

Drilling in 1952 proved additional ore in the South lens only. The bottoming of the North lens was confirmed and the reserve estimate for that lens made in 1940 remains unaffected.

METHOD OF COMPUTING TONNAGE

Cross-sections were drawn through hole intersections in the South lens, and, for the most part, fall along the previous sections made in 1940.

A compensating polar planimeter was used to measure areas on the section. The measurement of these areas of about one square inch, is, according to the manufacturers, subject to an error of 4%, which is inherent in the machine. The error has been deducted from the estimate.

Except in the case of the two sections at either end of the South lens, the northern and southern limits of the blocks were placed at points half-way between sections. Volumes were calculated by determining the areas in sections and multiplying these by half the distance between the sections.

A factor of 7.85 cubic feet per long ton has been used. The 1940 estimate used 7 cubic feet, per short ton.

Many of the diamond-drill cores showed some waste bands. This will reduce to a small extent, the tonnage estimate in the South lens.

TONNAGE CLASSIFICATION

Diamond-drill hole intersections in the South lens were widely spaced in depth. A distance of some 500 feet lies between the deepest holes (55A and 57) and the next higher holes (56,58,59,61). Furthermore, only one hole drilled in 1952 on the South lens failed to cut ore (60). The South lens, therefore, has not been as sharply delineated as the North lens, and for this reason, certain portions in its mid-elevations and at its southern end, have been considered as "indicated" ore. The classifications may be briefly stated:

DEVELOPED ORE - covers that ore which, by hole intersections, crosscuts and geologic conditions, can be definitely counted on.

INDICATED ORE - ore in which the intersections are too widely spaced, but which can be assumed through reasonable projections from developed ore and intersections, and from geologic evidence.

The blocks of ore in each section have been lettered from top to bottom. The sections and ore blocks on the ore-estimate work sheet are lettered accordingly.

GENERAL GEOLOGIC CONDITIONS

The important geologic considerations concerning ore deposition may be briefly summarized:

A. The orebodies are considered to be of

the replacement type, and the presence of ore is dependent upon the existence of a favorable host rock. The localization of ore is determined by -

1. - Shear zones intersecting the favorable host rock.
2. - Folding which modifies, pinches out, or otherwise disturbs the host rock.

B. The shape of the North lens, its thickening in the middle, and its termination at depth, have been determined primarily by folding. This is evidenced by -

1. - Visible folding in the pyrite replacements, in the sericite schists, and in the wall rock.
2. - Marked changes in angles of schistosity in drill cores.

It should also be pointed out that in some drill holes under the North lens no shearing was noted.

C. The South lens is regular in shape, except where there is an increase in width, accompanied by increased folding in the pyrite, sericite schist, and footwall rock around the No. 2 crosscut. The lens dips uniformly 80° E and strikes between due N and N 5° E. The folds, small undulations and striae, visible on shear surfaces along the main adit, all plunge from 70° to 75° south, and strike S 35° E. The widest part of the lens and the places where it is known to pinch out follow this 70° pattern.

It is reasonable, therefore, to describe the South lens as a rhomboid with a horizontal length of about 1300 feet and an indicated depth of 1300 feet, or possibly more, and with a maximum known thickness of 49 feet.

GENERAL CONSIDERATIONS

There is no reason why the South lens should not continue deeper than its presently known depth. There is no geologic basis known thus far to contradict this. However, it should be kept in mind that the extension of the South lens in depth will be found farther south and to the east.

That the North lens pinches out at about minus 200 feet is confirmed by the 1952 drilling. It is assumed that the structural forces, which account for the thickening of the North lens, have also accounted for its pinching out, and there is a good possibility that the same conditions may be repeated with depth, either in the same longitudinal plane of the vein or offset to the south and east. Of course, this is pure surmise and should not be counted on for additional tonnage, as can the downward extension of the South lens.

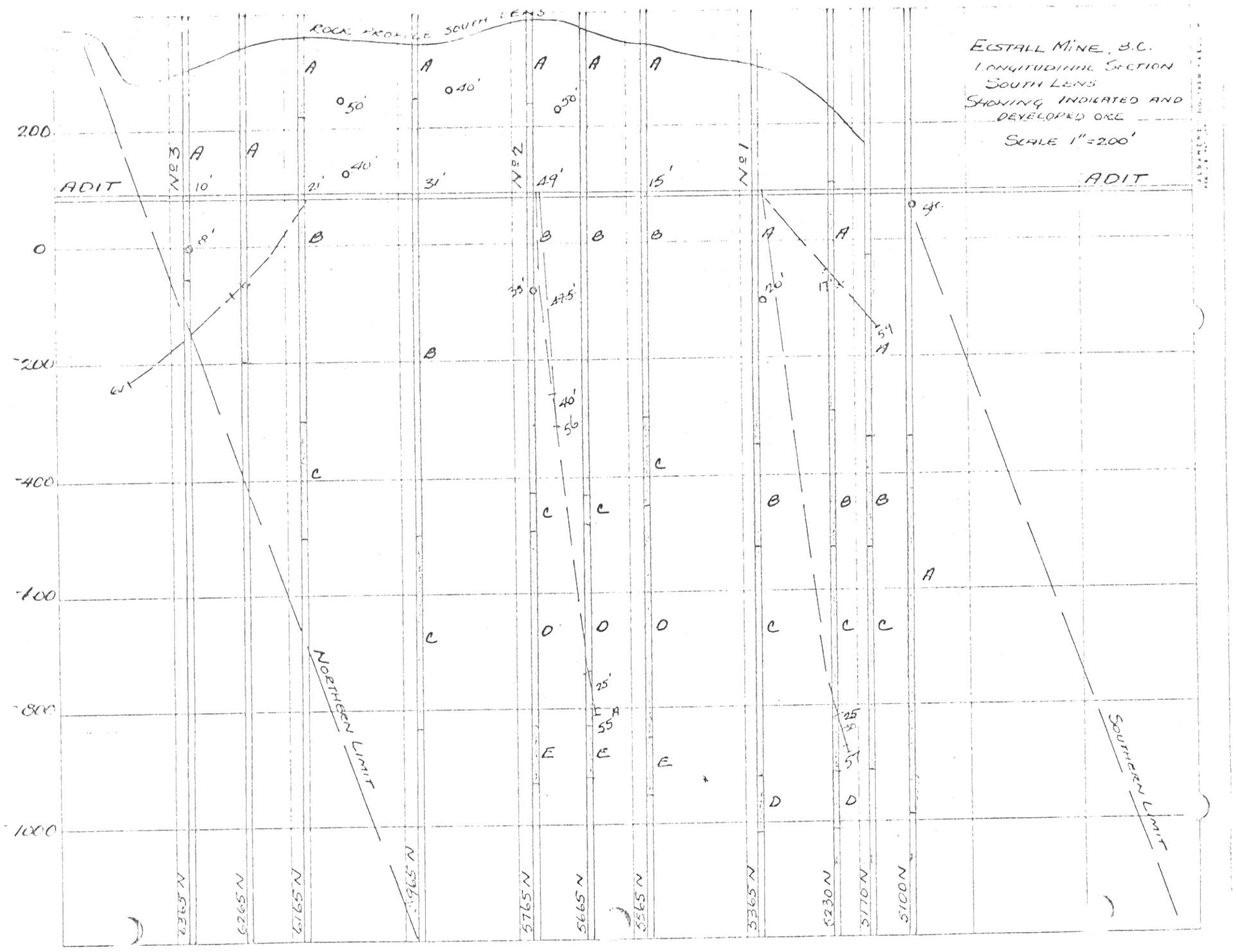
December 23, 1952

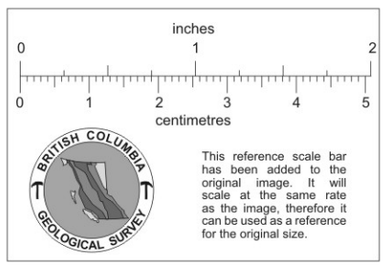
HD:GMO

0+5

ESTIMATE OF ORE RESERVES IN THE SOUTH LENS AT THE PUSTALL MINE, BRITISH COLUMBIA

				Developed Ore						Indicated Ore				
Section	H	S	Half Distance between Sections	Block	Square Feet	Cubic Feet	Cu. Ft. Minus 4% (Max.poss. error)	Tons 7.85 Cu. Ft. per Long Ton	Block	Square Feet	Cubic Feet	Cu. Ft. Minus 4% (Max.poss. error)	Tons 7.85 Cu. Ft. per Long Ton
6365	100	50	150	A	2,900	435,000	417,600	53,197					
6265	50	50	100	A	6,900	690,000	662,400	84,382					
6165	50	100	150	B	12,300	1,845,000	1,771,200	225,630	A	1,350	202,500	194,400	24,764
									C	5,300	945,000	907,200	115,566
5965	100	100	200	B	28,500	5,710,000	5,481,600	698,292	A	5,000	1,000,000	960,000	122,292
									C	14,000	2,800,000	2,688,000	342,420
5765	100	50	150	B	29,400	4,410,000	4,233,600	539,312	A	8,500	1,275,000	1,224,000	155,923
				D	9,700	1,455,000	1,396,800	177,936	C	1,600	240,000	230,400	29,350
									E	2,200	330,000	316,800	40,356
5665	50	50	100	B	27,200	2,720,000	2,611,200	332,636	A	3,600	360,000	345,600	44,025
				D	10,300	1,030,000	988,800	125,971	C	1,700	170,000	163,200	20,789
									E	2,500	250,000	240,000	30,573
5565	50	100	150	B	12,650	1,897,500	1,821,600	232,050	A	1,600	240,000	230,400	29,350
				D	8,400	1,260,000	1,209,600	154,039	C	3,450	517,500	496,800	63,286
									E	2,300	345,000	331,200	42,191
5365	100	67.5	167.5	A	10,350	1,733,625	1,664,280	212,010	B	4,400	737,000	707,520	90,063
				C	9,400	1,574,500	1,511,520	192,550	D	2,700	452,250	434,160	55,307
5230	67.5	30	97.5	A	8,250	804,375	772,200	98,369	B	4,600	448,500	430,560	54,848
				C	10,000	975,000	936,000	119,235	D	2,600	253,500	243,360	31,001
5170	30	35	65	A	4,700	305,500	293,280	37,360	B	4,400	286,000	274,560	34,975
				C	9,300	604,500	580,320	73,926	D	3,000	195,000	187,200	23,847
5100	35	35	70						A	5,800	406,000	389,760	49,650
T O T A L S						27,450,000	26,352,000	3,356,945			11,453,250	10,995,120	1,400,573


ECSTALL MINE, B.C.
LONGITUDINAL SECTION
SOUTH LENS
SHOWING INDICATED AND
DEVELOPED ORE
SCALE 1" = 200'
ROCK PROFILE SOUTH LENS
ADIT
ADIT
No 3
No 2
No 1
NORTHERN LIMIT
SOUTHERN LIMIT
200
0
-200
-400
-600
-800
-1000
6365 N
6265 N
6165 N
6065 N
5765 N
5665 N
5565 N
5365 N
5230 N
5170 N
5100 N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BRITISH COLUMBIA
GEOLOGICAL SURVEY
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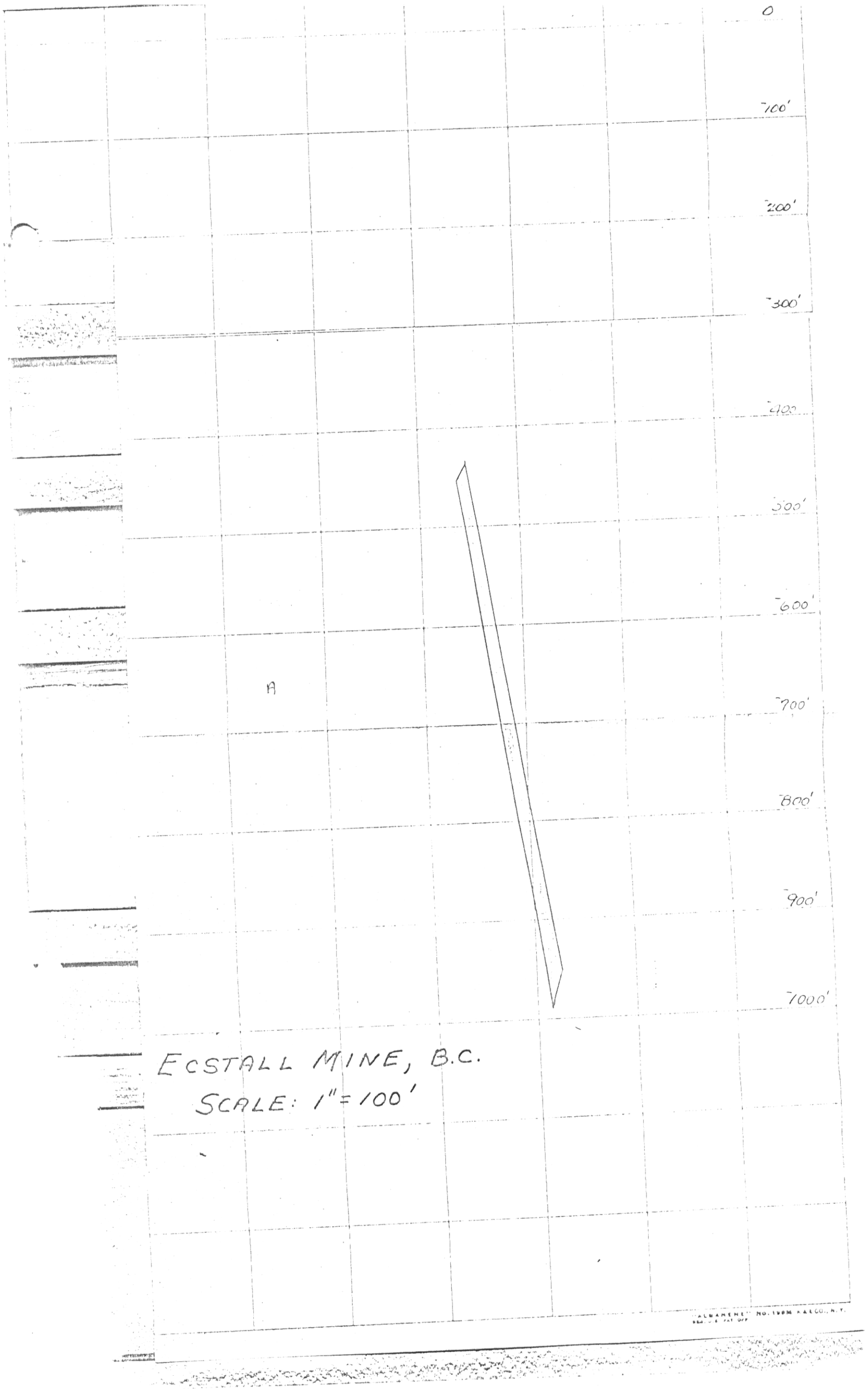
0
100'
200'
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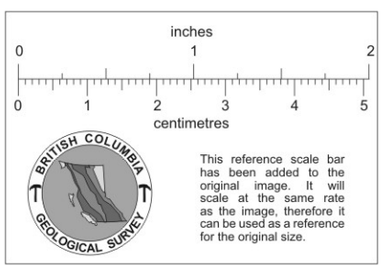
ECSTALL MINE, B.C.
SCALE: 1" = 100'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GEOLOGICAL SURVEY
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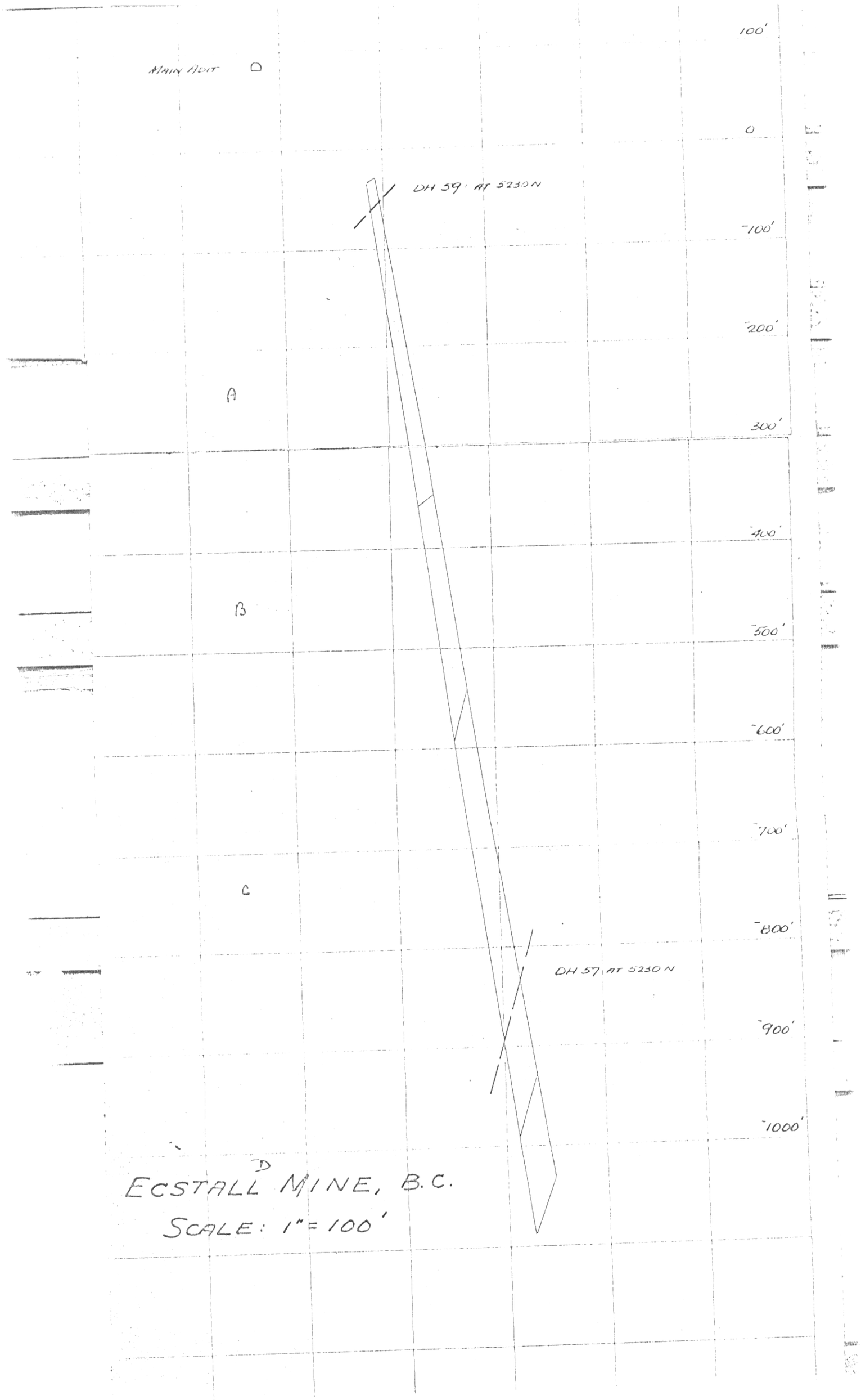
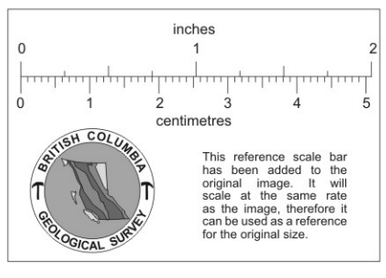

MAIN ADIT
D
A
B
C
DH 59: AT 5230 N
DH 57 AT 5230 N
100'
0
-100'
-200'
-300'
-400'
-500'
-600'
-700'
-800'
-900'
-1000'
ECSTALL MINE, B.C.
SCALE: 1" = 100'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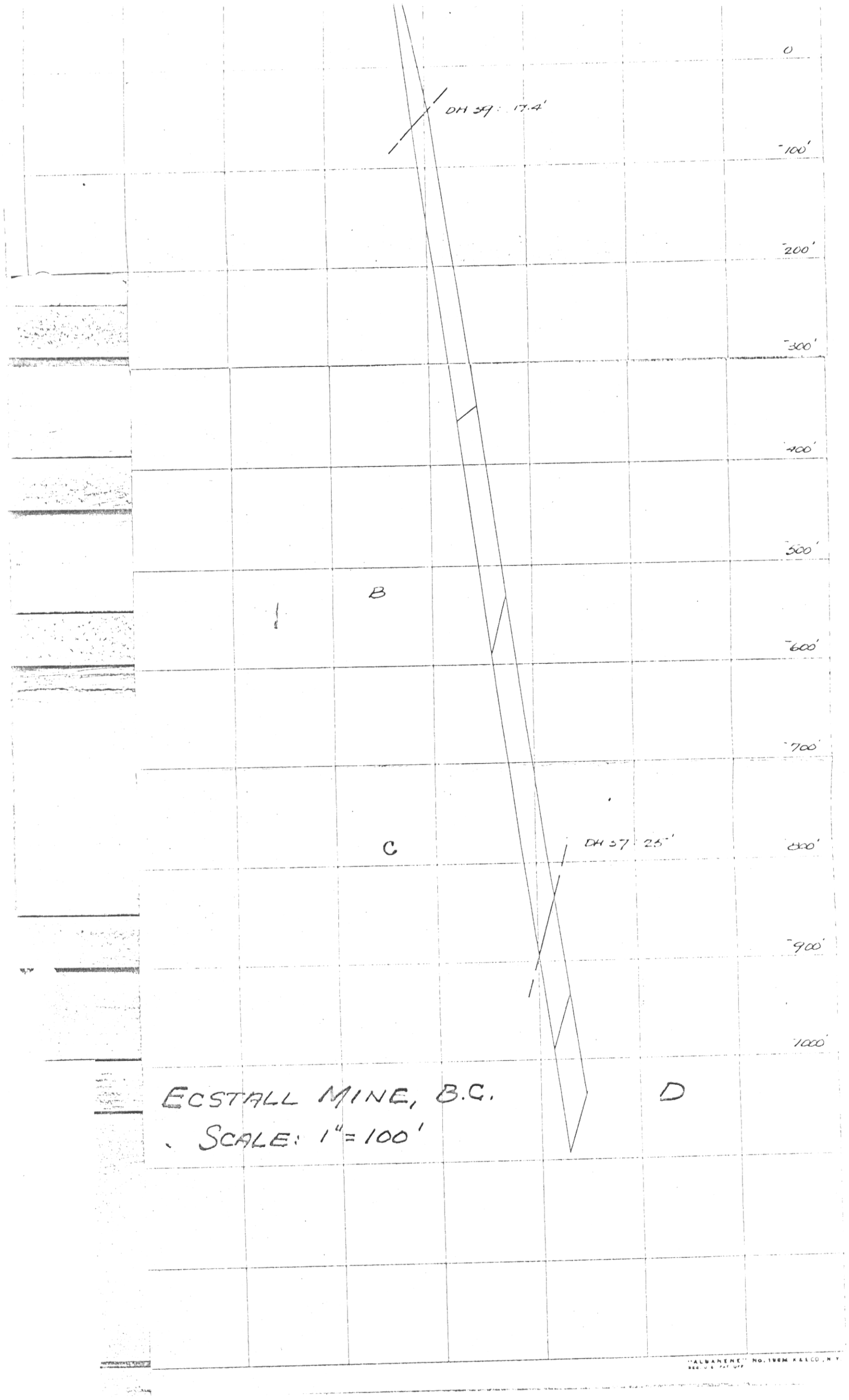
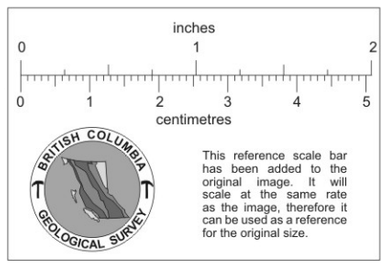

0
100'
200'
300'
400'
500'
600'
700'
800'
900'
1000'
DH 39: 17.4'
B
C
DH 37: 25'
D
ECSTALL MINE, B.C.
SCALE: 1" = 100'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BRITISH COLUMBIA
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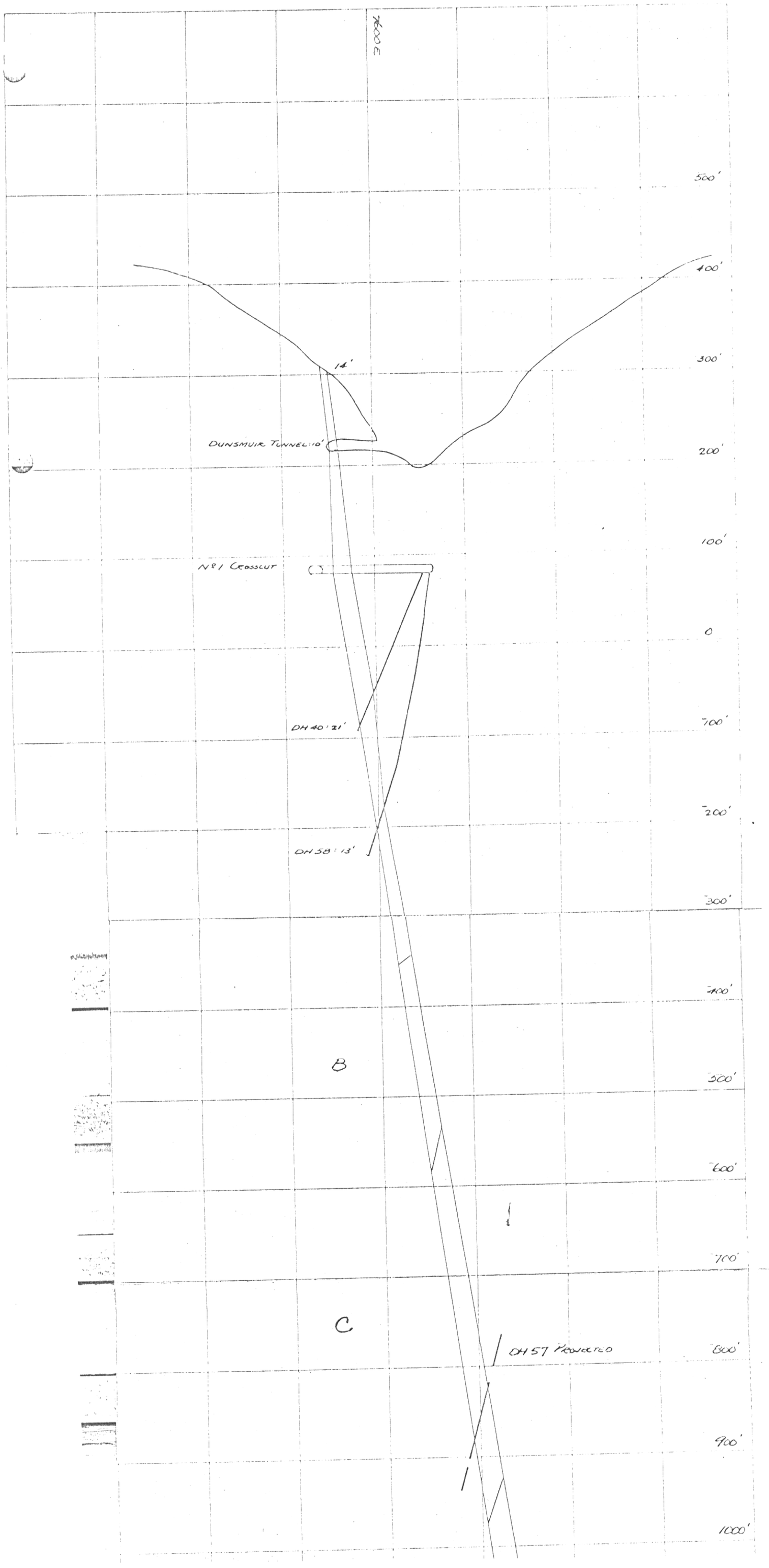
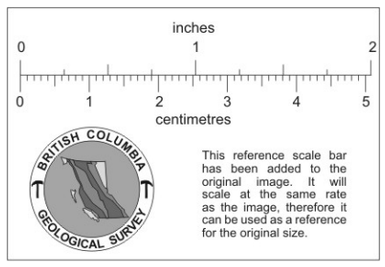
§ 5365 N


600 E
500'
400'
300'
200'
100'
0
100'
200'
300'
400'
500'
600'
700'
800'
900'
1000'
14'
DUNSMUIR TUNNEL 10'
Nº1 CROSSCUT
DH 40' 21'
DH 58' 13'
B
C
DH 57 PROVEN 0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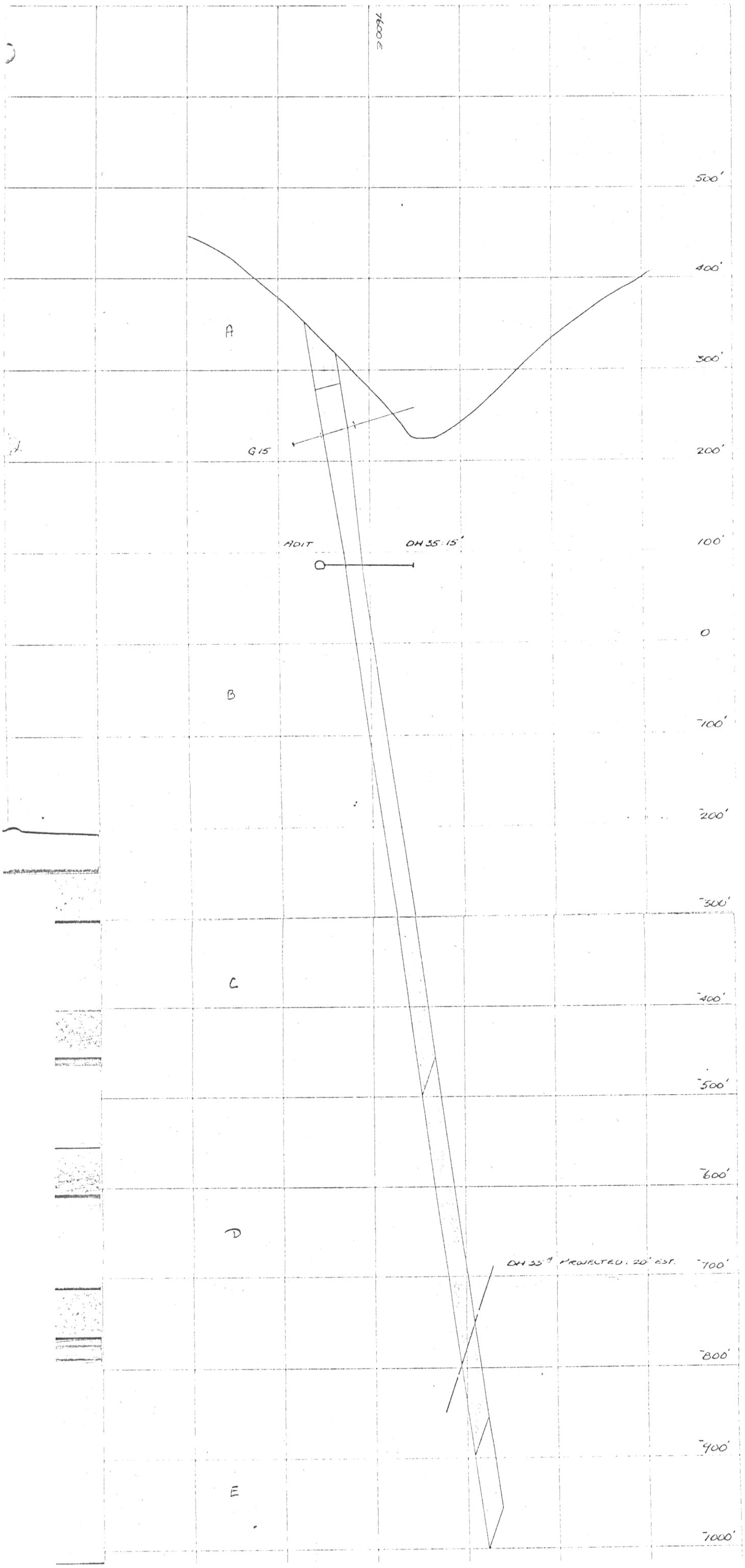
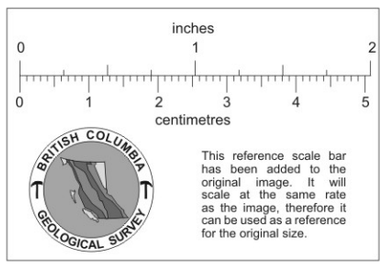
§5565N


7600 E
500'
400'
300'
200'
100'
0
-100'
-200'
-300'
-400'
-500'
-600'
-700'
-800'
-900'
-1000'
A
B
C
D
E
G15
ADIT
DH 35-15'
DH 35-9 PROJECTED: 20' EST.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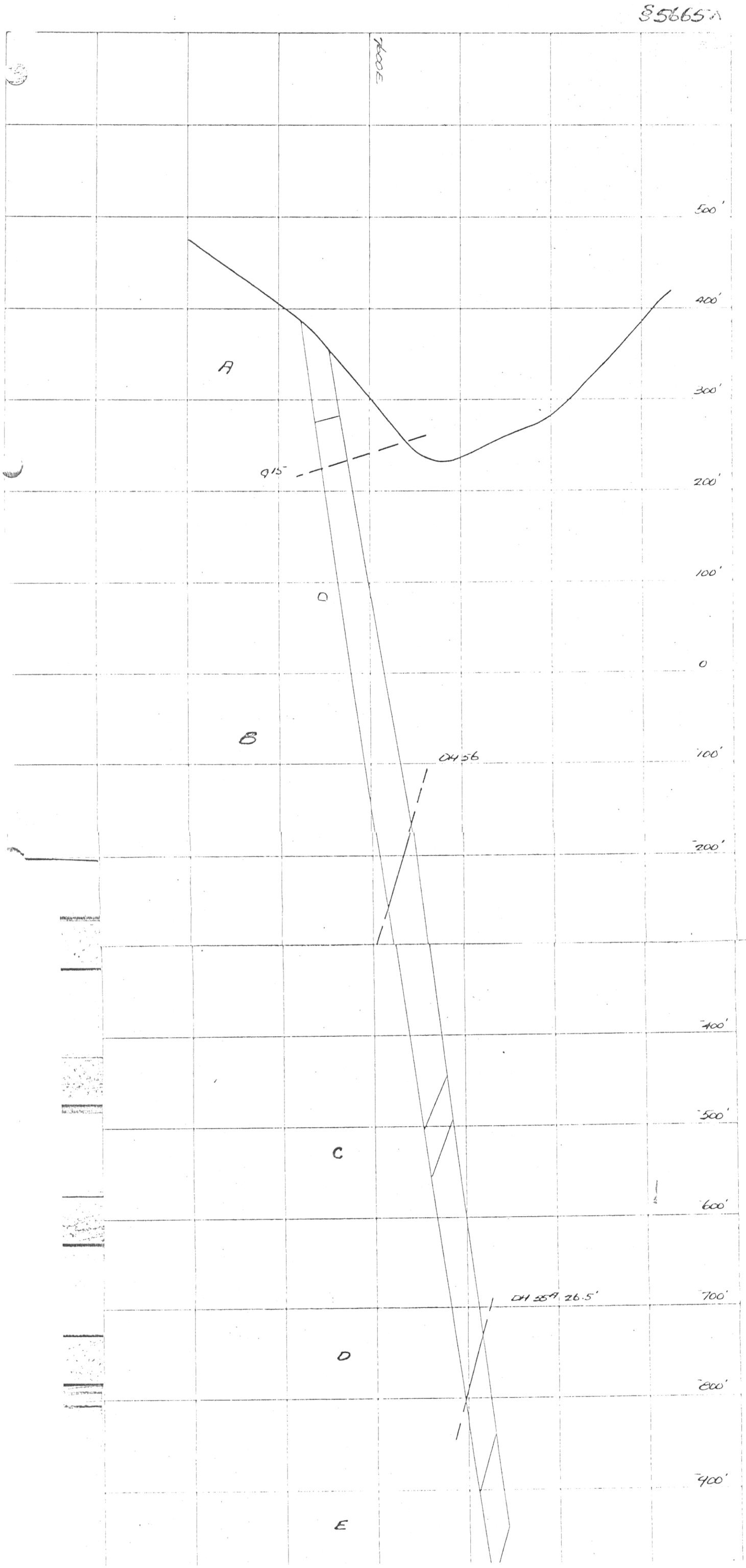
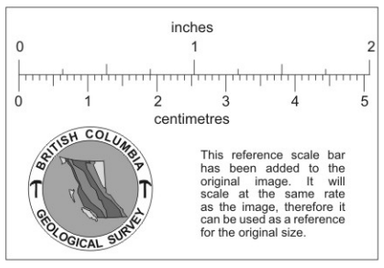

55665A
76DDE
500'
400'
300'
200'
100'
0
100'
200'
400'
500'
600'
700'
800'
900'
A
B
C
D
E
915
DH 56
DH 55A 26.5'


inches
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centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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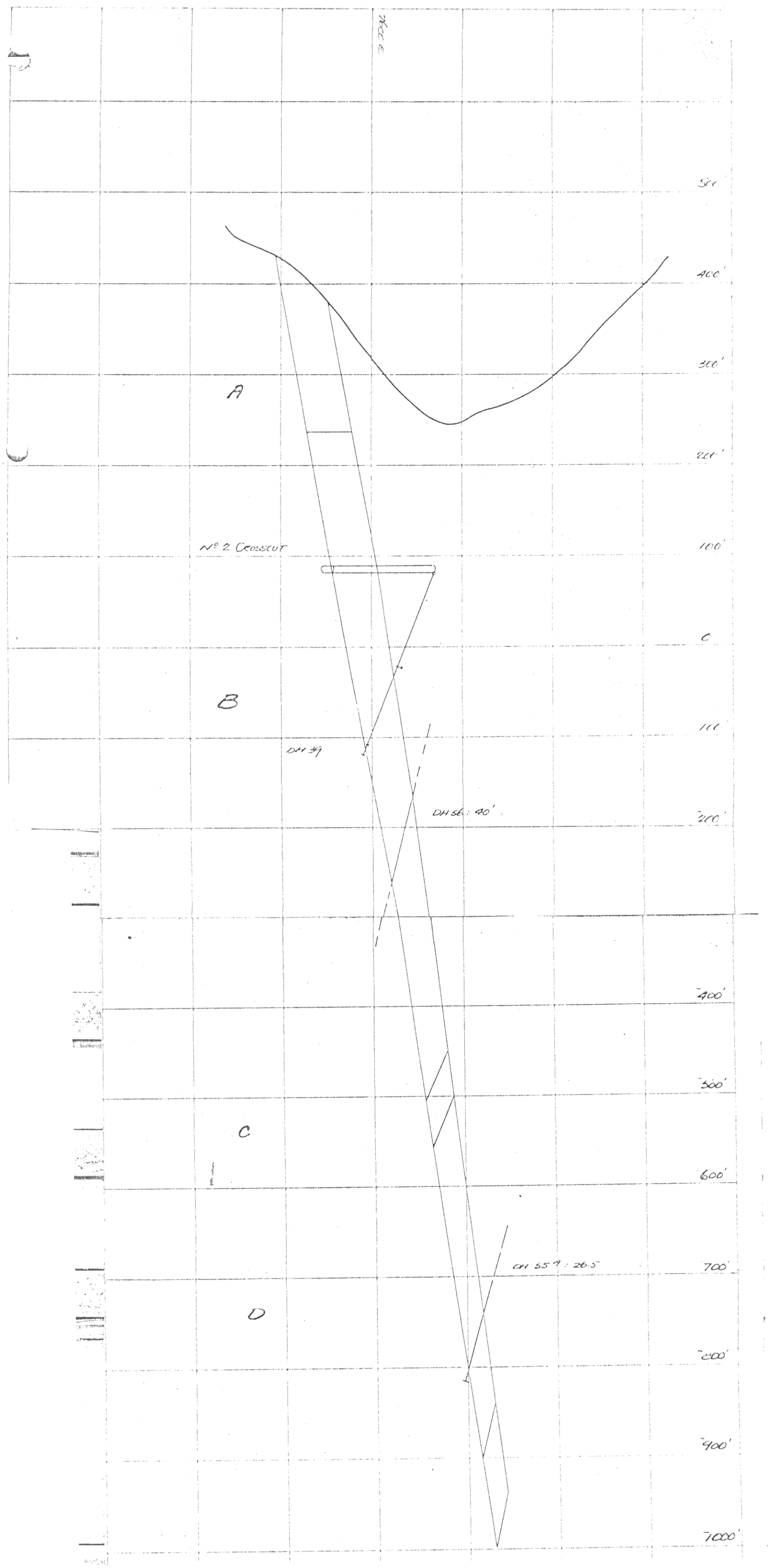
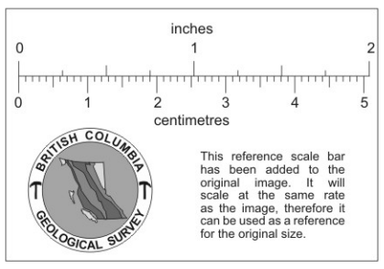
§5765


500'
400'
300'
200'
100'
0
100
200'
300'
400'
500'
600'
700'
800'
900'
1000'
A
B
C
D
No 2 CROSSCUT
DH 39
DH 56 : 40'
DH 55 : 26.5


inches
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5
centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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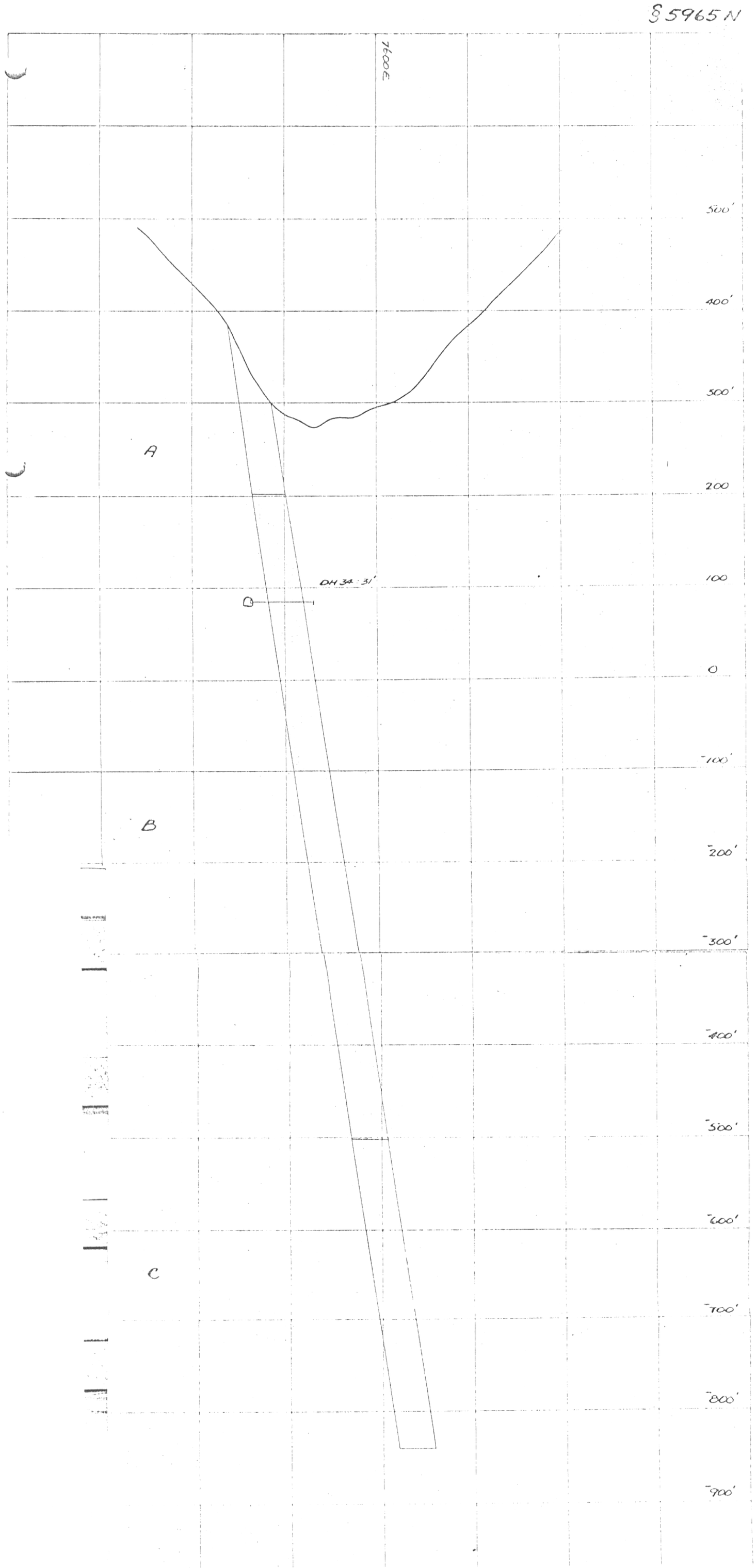
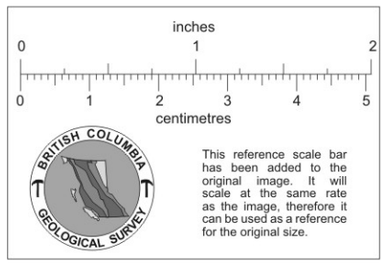

§5965N
7600E
500'
400'
300'
200
100
0
-100'
-200'
-300'
-400'
-500'
-600'
-700'
-800'
-900'
A
B
C
DH 34-31'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BRITISH COLUMBIA
GEOLOGICAL SURVEY
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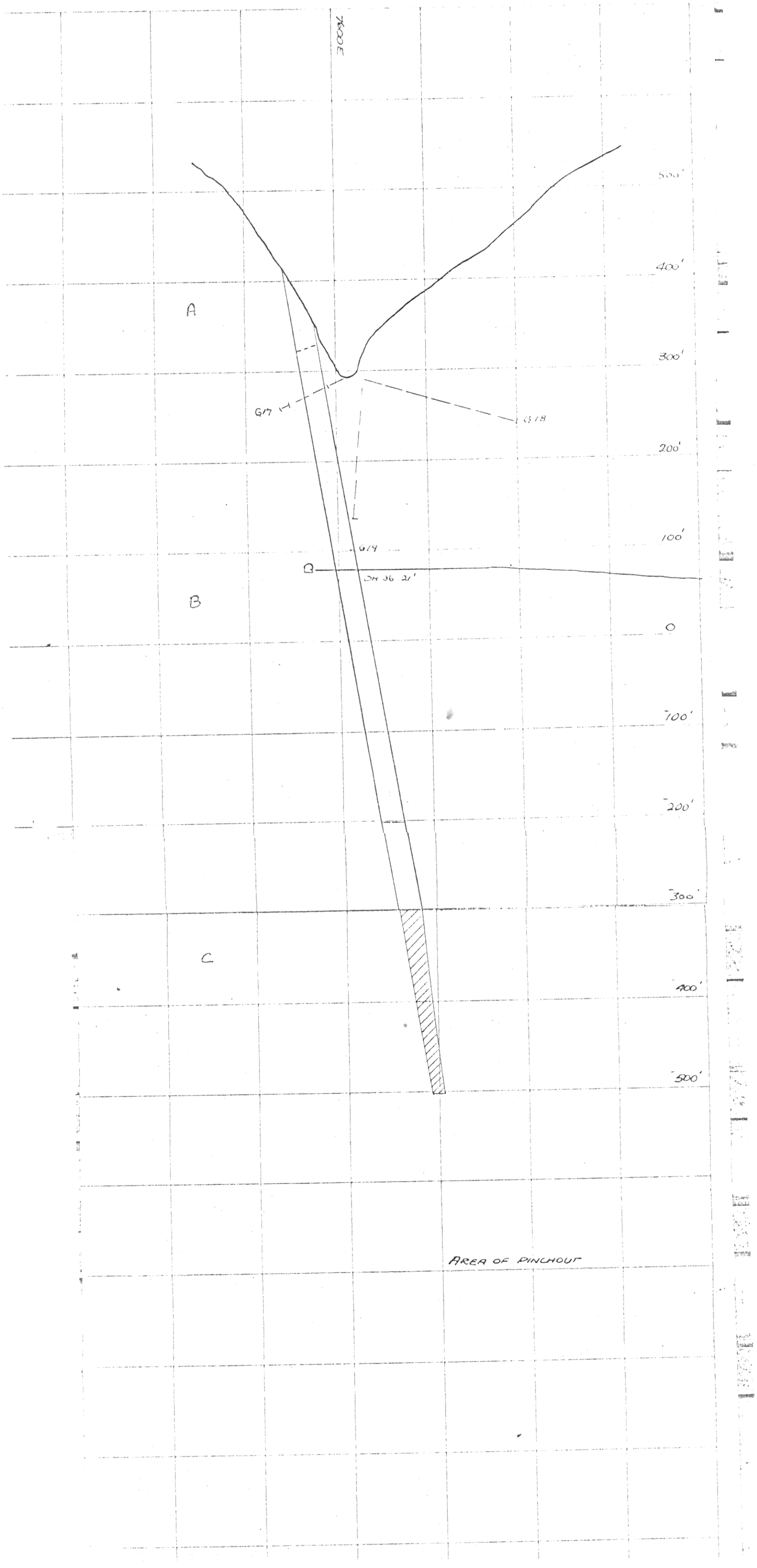
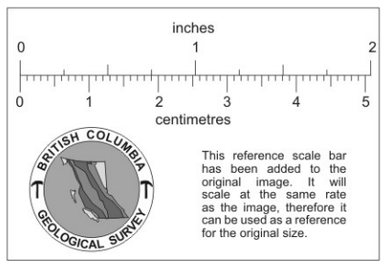

§6165 N
700 E
500'
400'
300'
200'
100'
0
100'
200'
300'
400'
500'
A
B
C
G17
G18
G19
DH 36 21'
AREA OF PINCHOUT


inches
0
1
2
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1
2
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centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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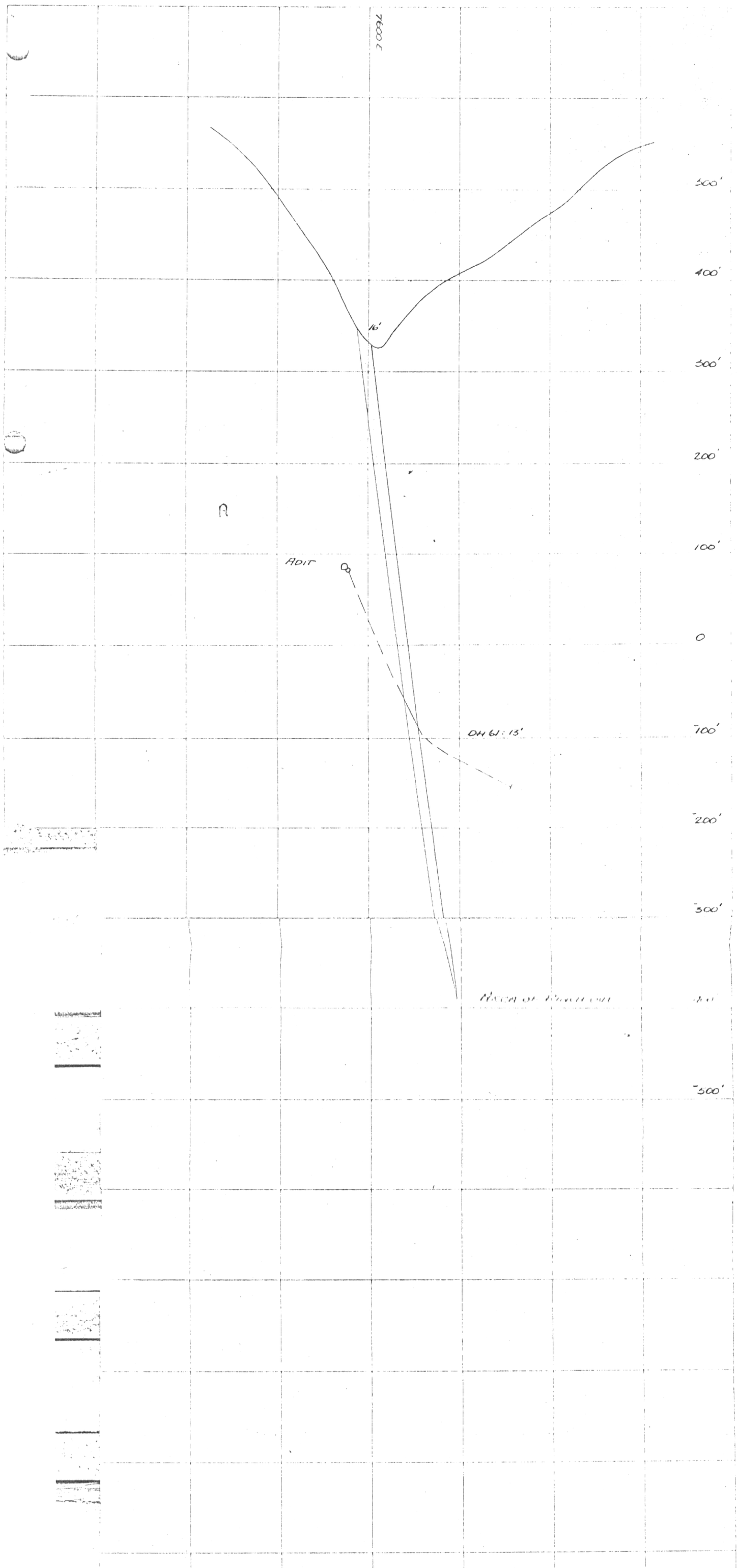
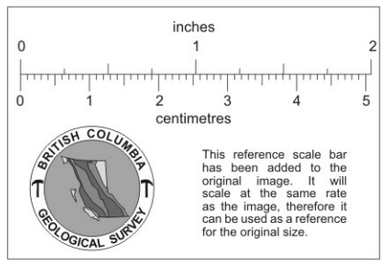
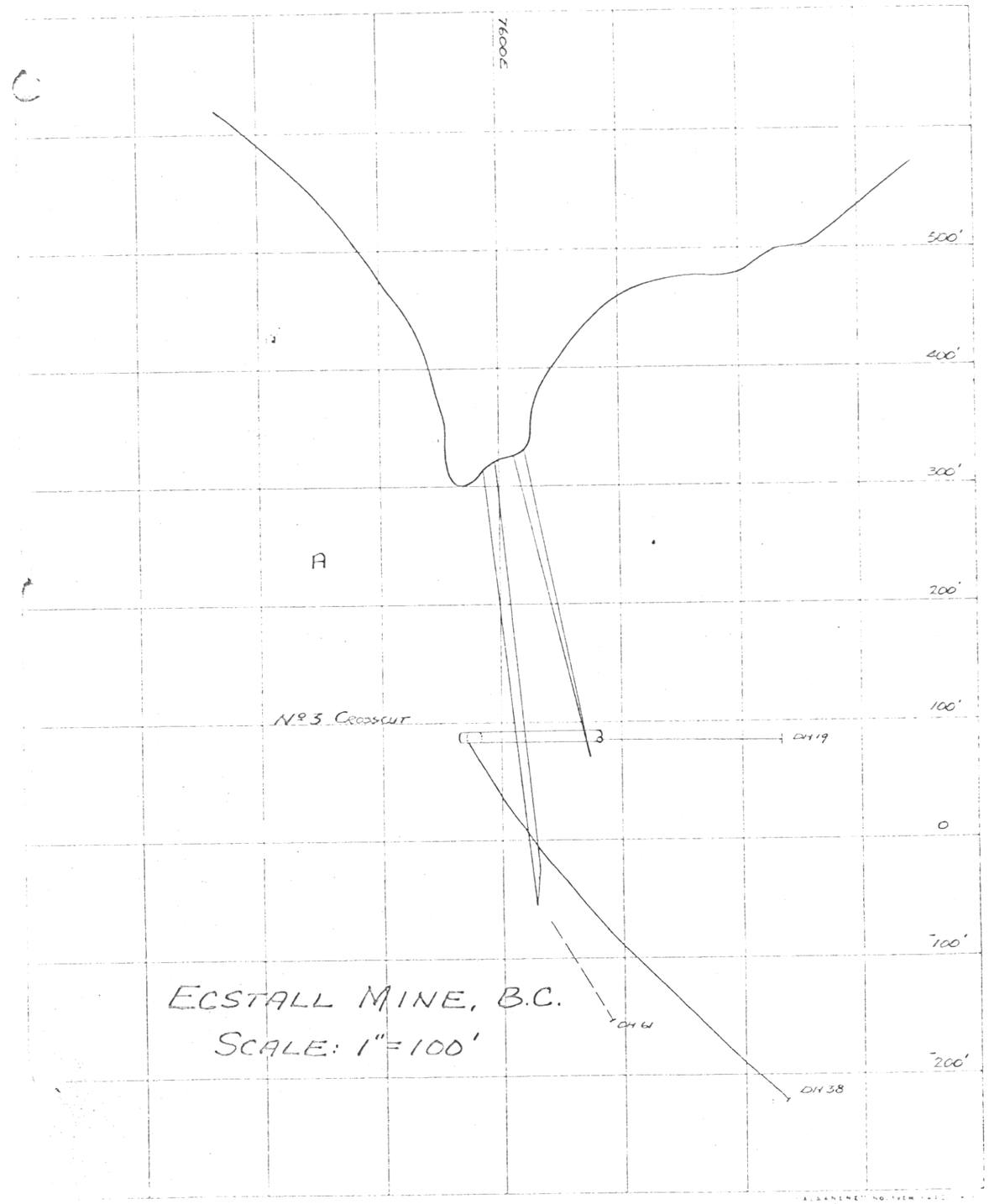
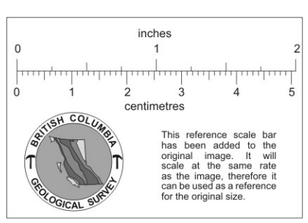




ECSTALL MINE, B.C.

§ 6365 N


7600E
500'
400'
300'
200'
100'
0
-100'
-200'
A
No 3 Crosscut
DH 19
DH W
DH 38
ECSTALL MINE, B.C.
SCALE: 1"=100'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BRITISH COLUMBIA
GEOLOGICAL SURVEY
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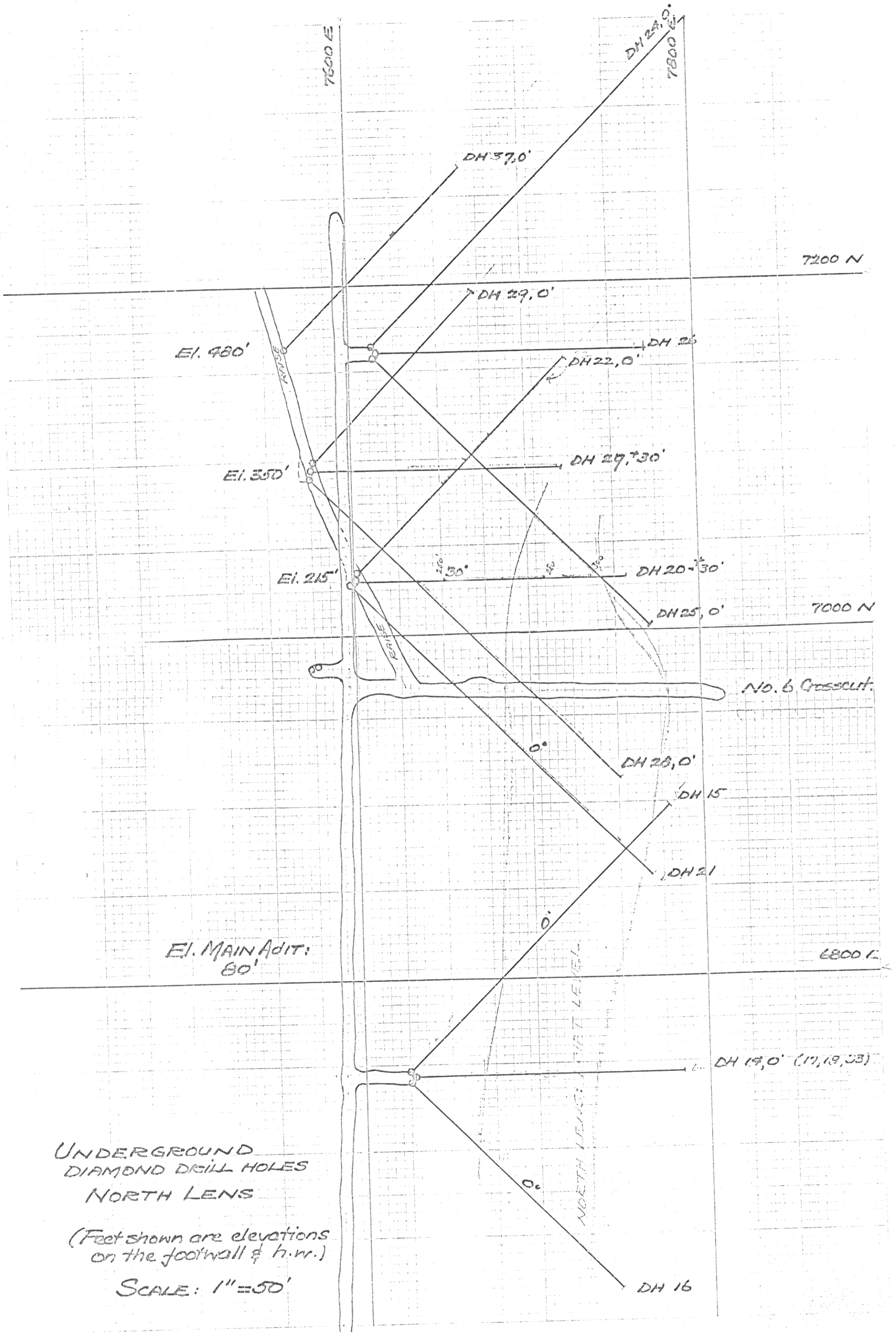
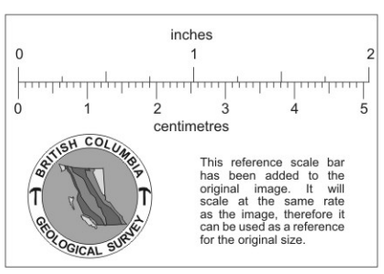

7600 E
7800 E
DH 24.0'
DH 37.0'
7200 N
DH 29.0'
DH 26
El. 400'
RAISE
DH 22.0'
DH 29.+30'
El. 350'
El. 215'
30'
DH 20.+30'
DH 25.0'
7000 N
RAISE
No. 6 Crosscut
0°
DH 28.0'
DH 15
DH 21
0°
El. MAIN ADIT: 80'
6800 E
NORTH LENS: MAIN LEVEL
DH 19.0' (17,19,33)
0°
DH 16
UNDERGROUND
DIAMOND DRILL HOLES
NORTH LENS
(Feet shown are elevations on the footwall & h.w.)
SCALE: 1" = 50'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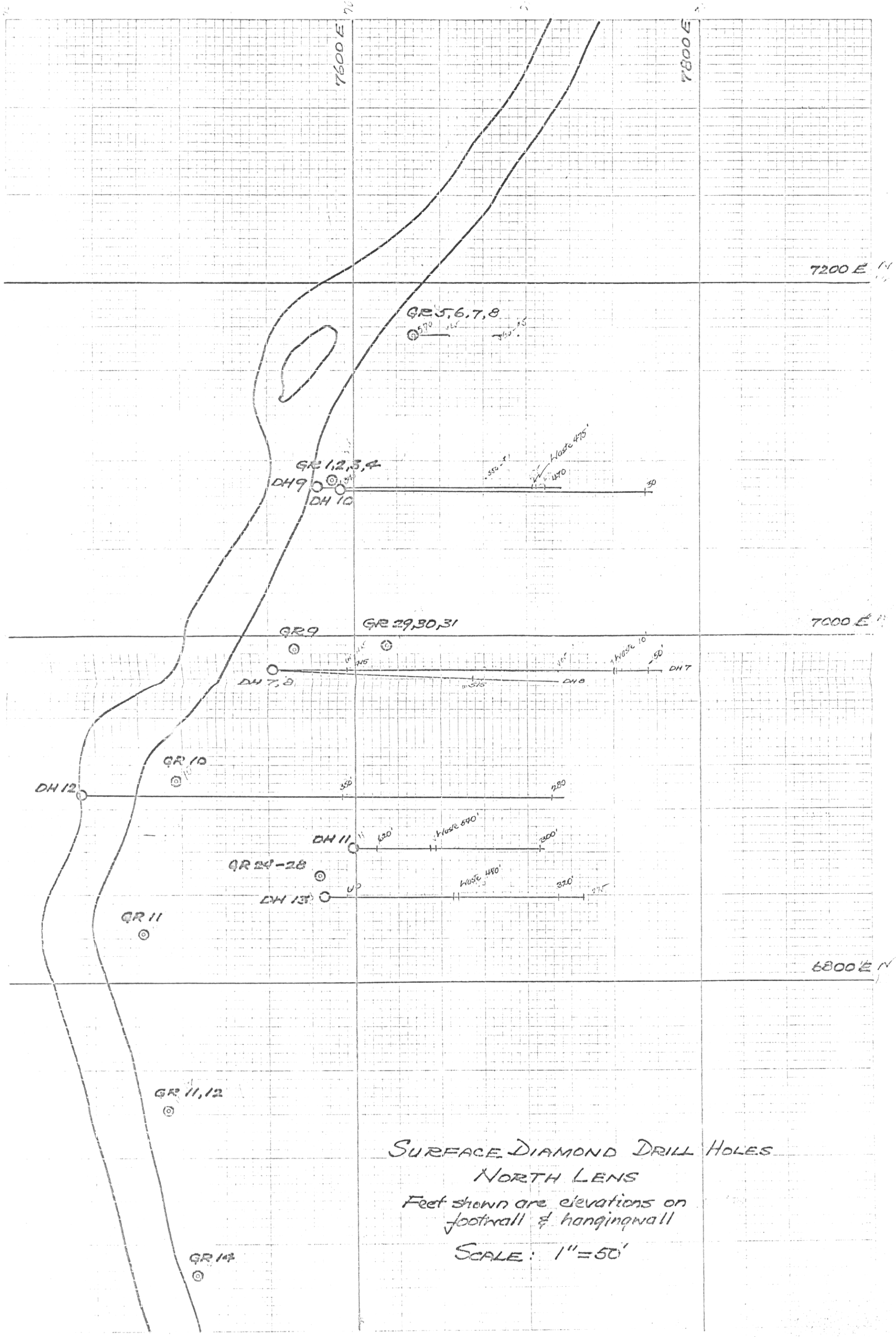

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centimetres
BRITISH COLUMBIA GEOLOGICAL SURVEY
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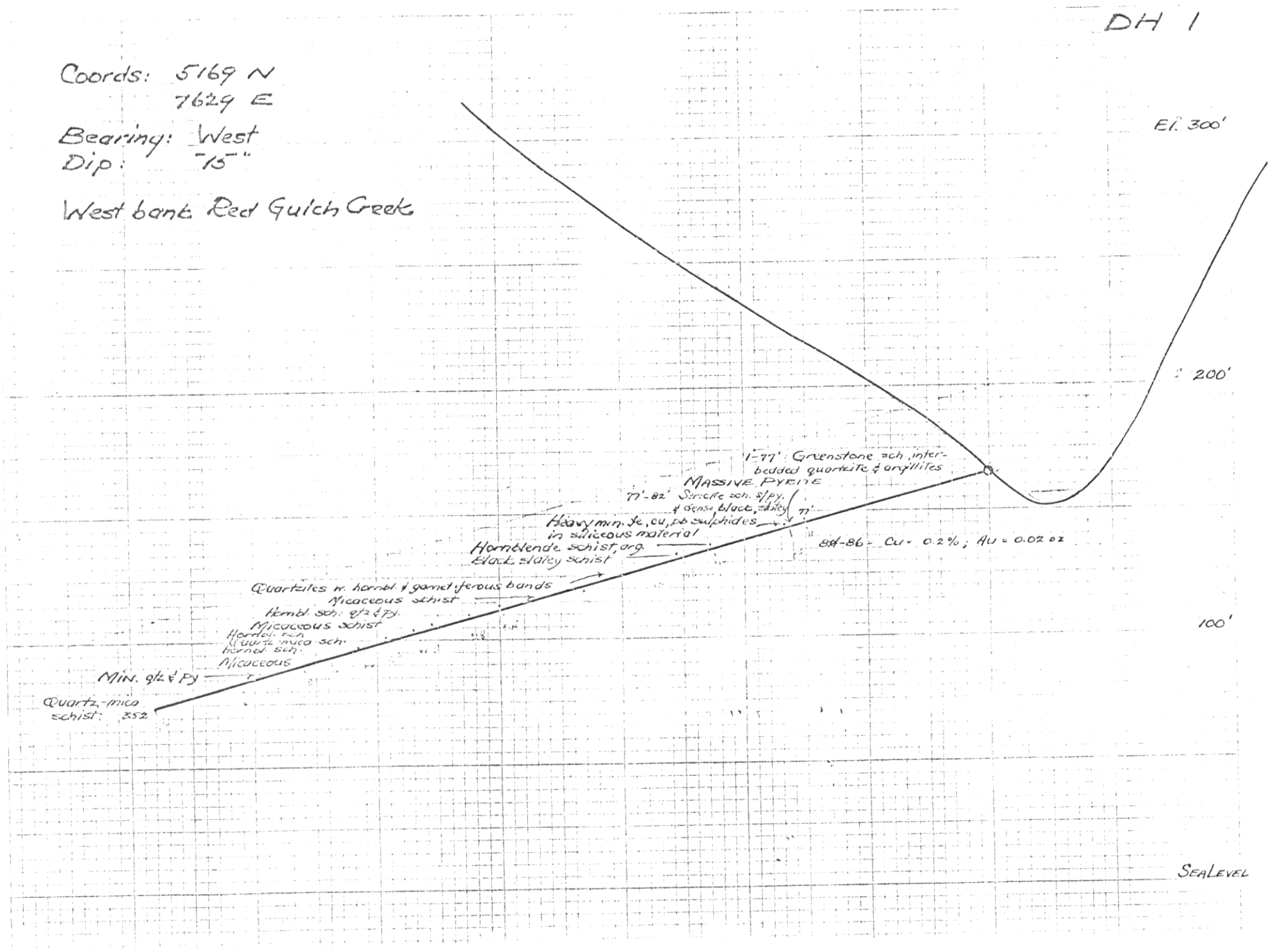

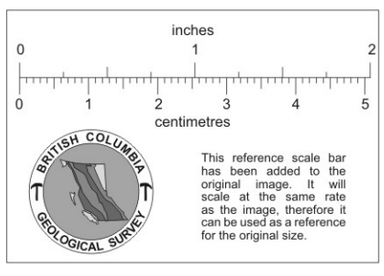

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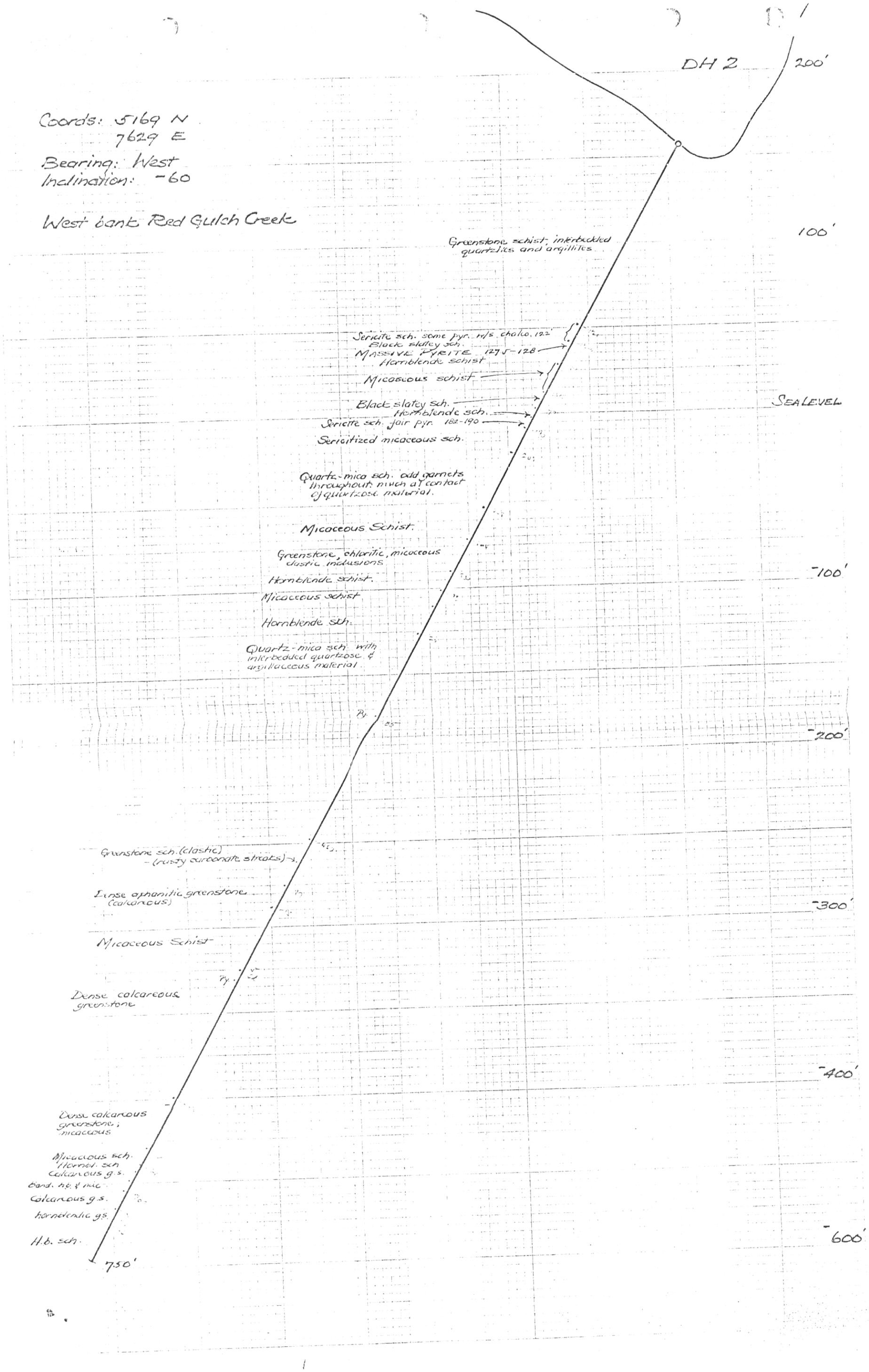
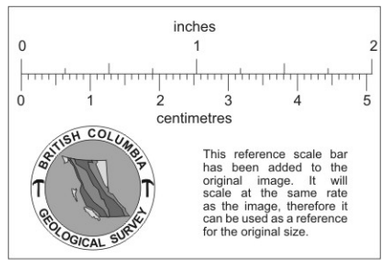

Coords: 5169 N
7629 E
Bearing: West
Inclination: -60
West bank Red Gulch Creek
DH 2
200'
100'
Greenstone schist, interbedded quartzites and argillites
Sericite sch. some pyr. r/s chalco. 122'
Black slatey sch.
MASSIVE PYRITE 127.5-128
Hornblende schist
Micaceous schist
Black slatey sch.
Hornblende sch.
Sericite sch. fair pyr. 182-190
Sericitized micaceous sch.
SEA LEVEL
Quartz-mica sch. odd garnets throughout much at contact of quartzose material.
Micaceous Schist.
Greenstone, chloritic, micaceous clastic inclusions
Hornblende schist.
Micaceous schist
Hornblende sch.
Quartz-mica sch. with interbedded quartzose & argillaceous material
-100'
Py.
-200'
Greenstone sch. (clastic) - (rusty carbonate streaks)
Dense aphanitic greenstone (calcareous)
-300'
Micaceous Schist
Py.
Dense calcareous greenstone
-400'
Dense calcareous greenstone; micaceous
Micaceous sch.
Hornbl. sch
Calcareous g.s.
Band. hb. & mic.
Calcareous g.s.
hornblendic g.s.
H.b. sch.
-600'
750'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centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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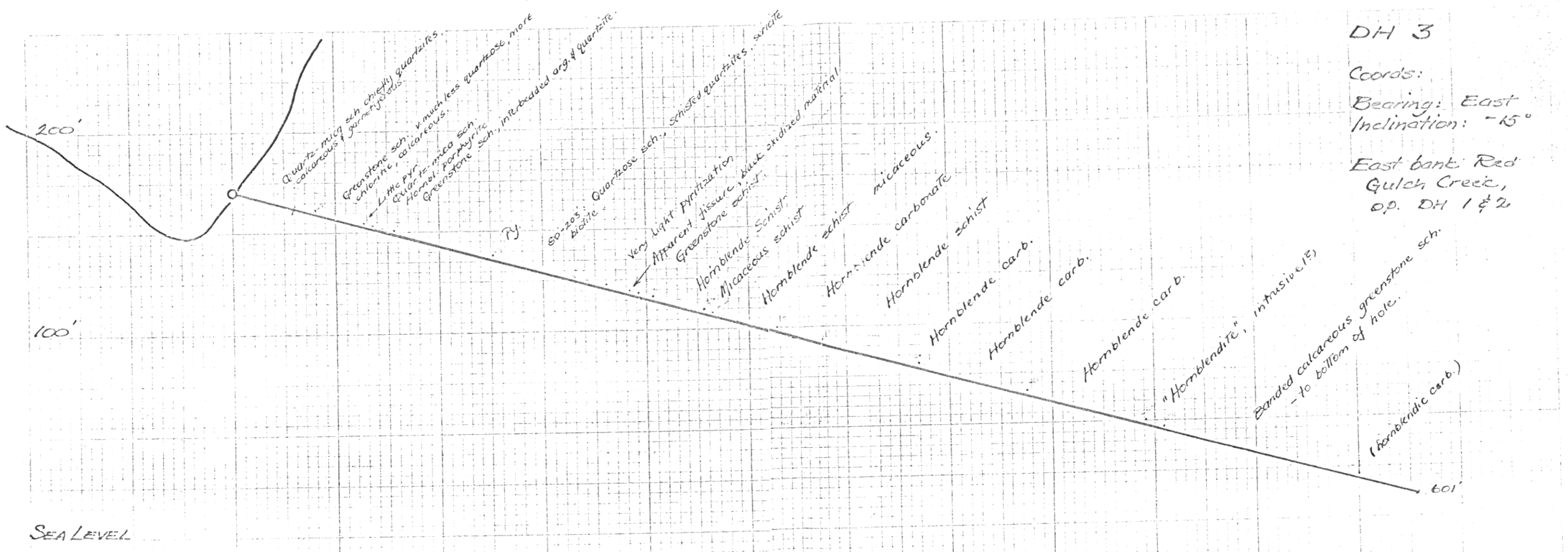

DH 3

Coords:

Bearing: East
Inclination: -45°

East bank Red Gulch Creek, o.p. DH 1 & 2

inches
0 1 2
0 1 2 3 4 5
centimetres
BRITISH COLUMBIA GEOLOGICAL SURVEY
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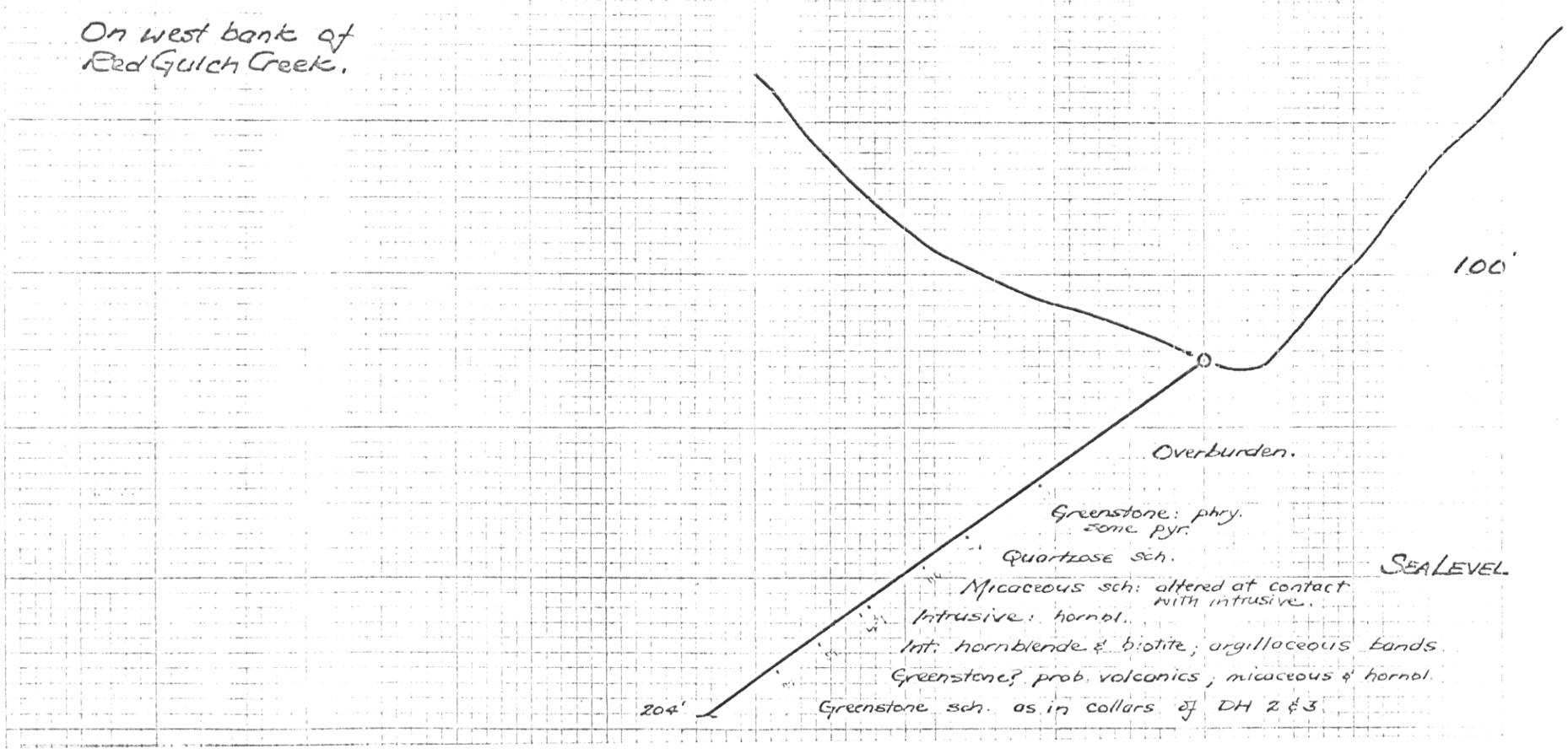
DH 5

Coords: 4789 N
7612 E
Bearing: due West
Inclination: -35°

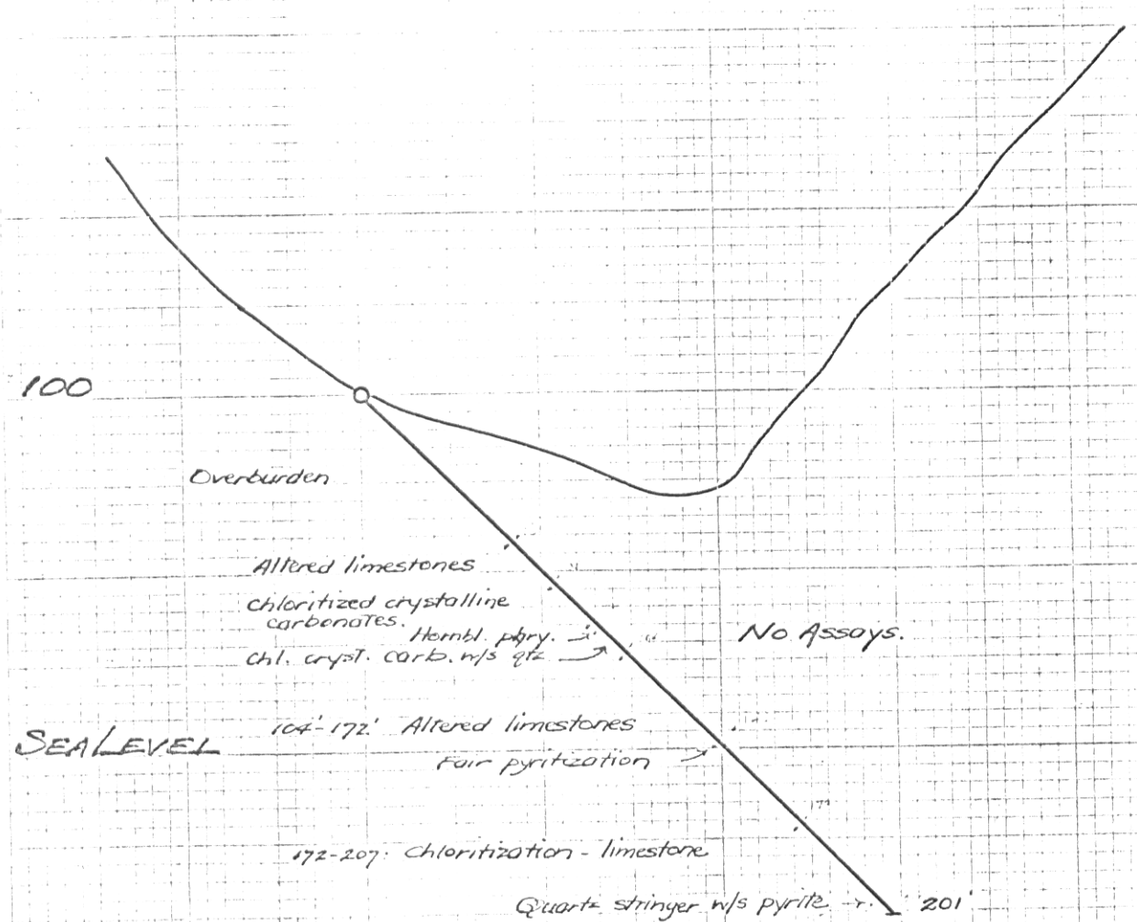
On west bank of Red Gulch Creek.

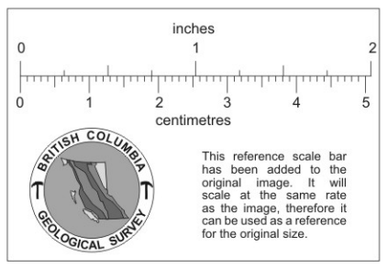


DH 4

Coords: 4799 N
7525 E
Bearing: due East
Inclination: -45°

On old tramway, fill, about 110' west of Red Gulch Creek.



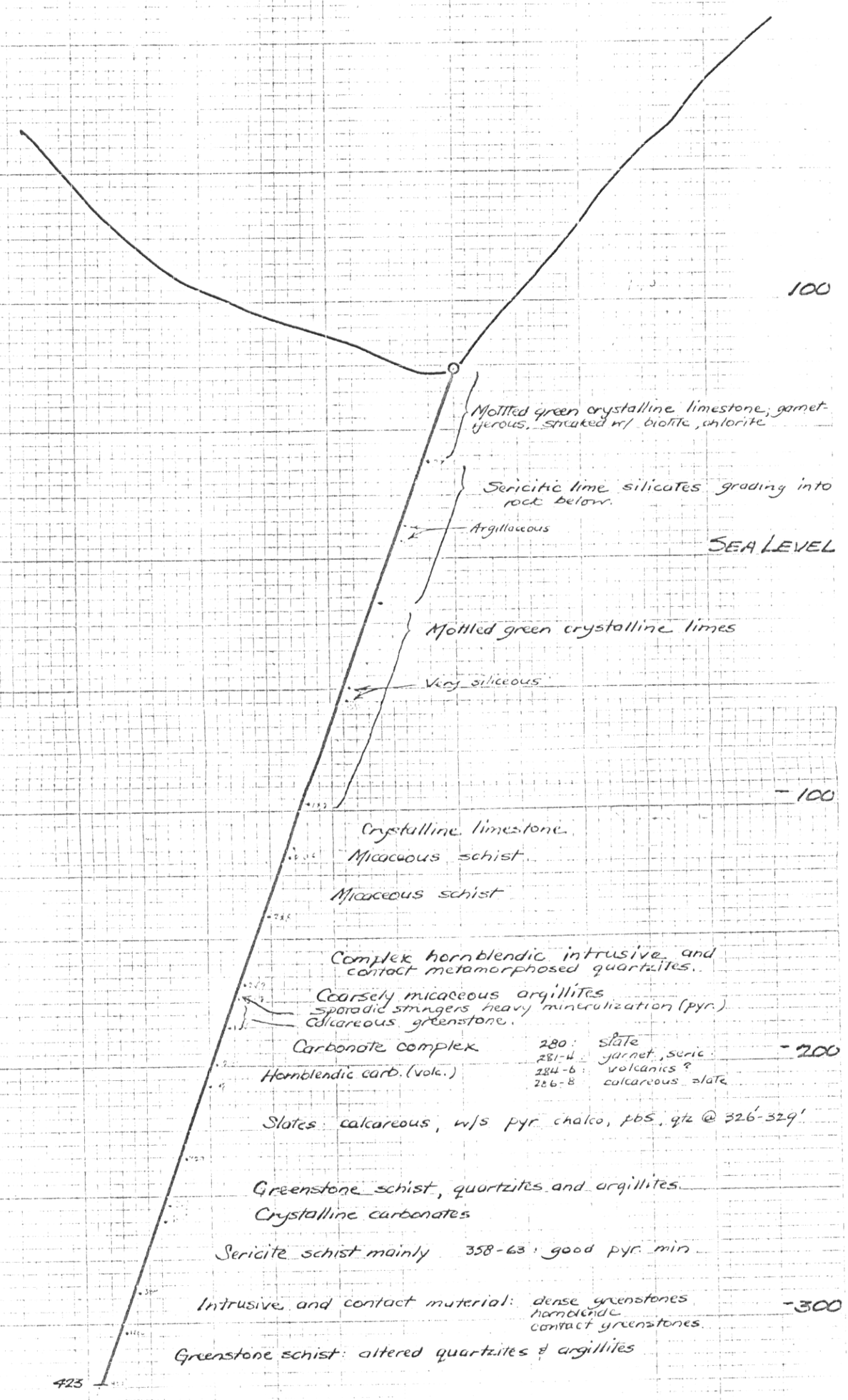


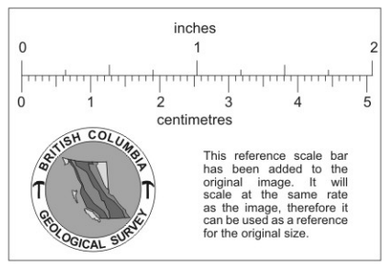
DH 6

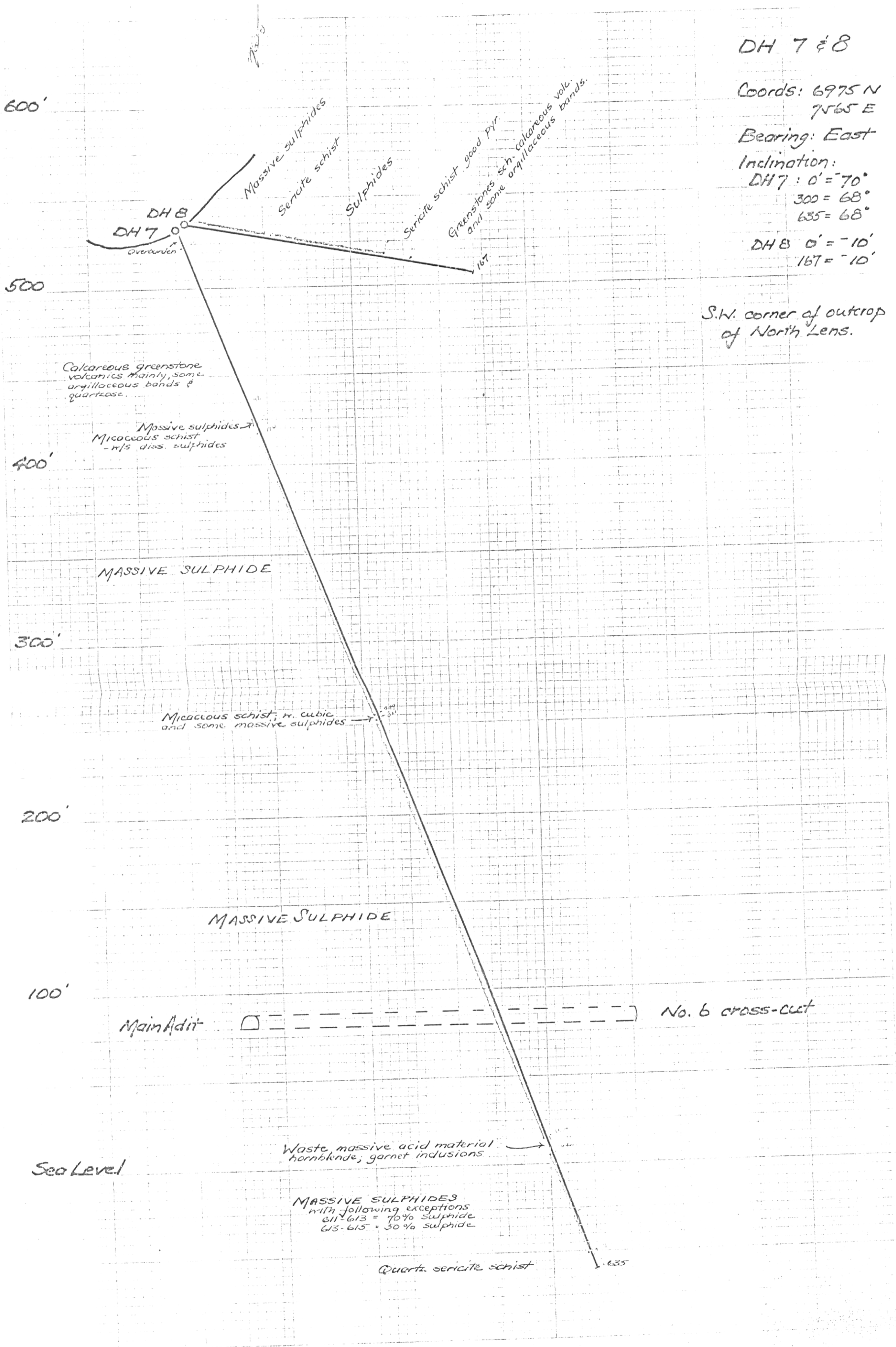
Coords: 4789 N
7627 E

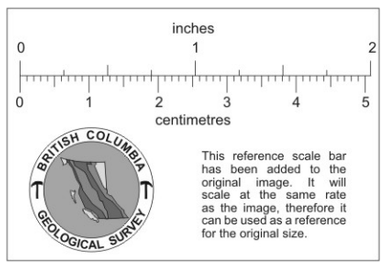
Bearing: due West
Inclination: -70°

On east bank of
Red Gulch Creek.






DH 7 & 8
Coords: 6975 N
7565 E
Bearing: East
Inclination:
DH7 : 0' = -70°
300 = 68°
655 = 68°
DH8 0' = -10'
167 = -10'
S.W. corner of outcrop of North Lens.
600'
500
400'
300'
200'
100'
Sea Level
DH 8
DH 7
Overburden
Massive sulphides
Sericite schist
Sulphides
Sericite schist good pyr
Greenstones sch. calcareous volc. and some argillaceous bands.
167
Calcareous greenstone volcanics mainly, some argillaceous bands & quartzose.
Massive sulphides
Micaceous schist - w/s diss. sulphides
MASSIVE SULPHIDE
Micaceous schist; m. cubic and some massive sulphides
MASSIVE SULPHIDE
Main Adit
No. 6 cross-cut
Waste massive acid material hornblende; garnet inclusions
MASSIVE SULPHIDES
with following exceptions
611-613 = 70% sulphide
613-615 = 30% sulphide
Quartz sericite schist
655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centimetres
BRITISH COLUMBIA
GEOLOGICAL SURVEY
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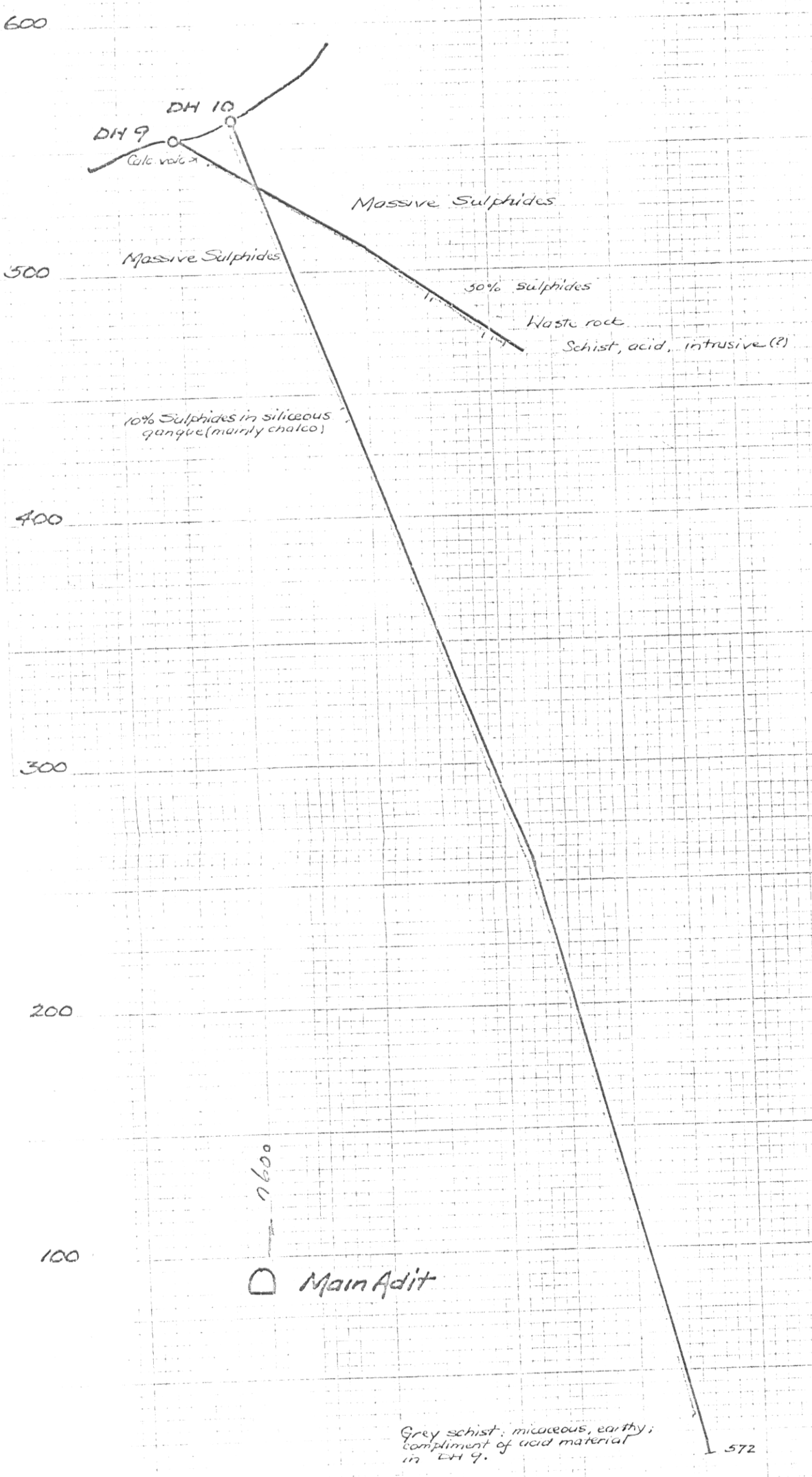


DH 9 & 10

DH9:

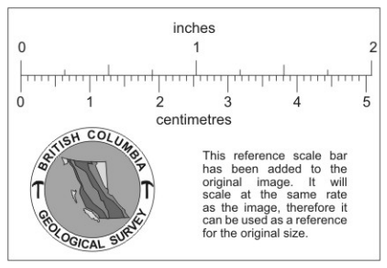
Coords: 7080 N
7580 E

Bearing: due East
Inclination: 0' = -30°
167 = -35°

DH 10:

Coords: 7080 N
7595 E

Bearing: due East
Inclination: 0' = 70°
325' = 75°
570' = 80°



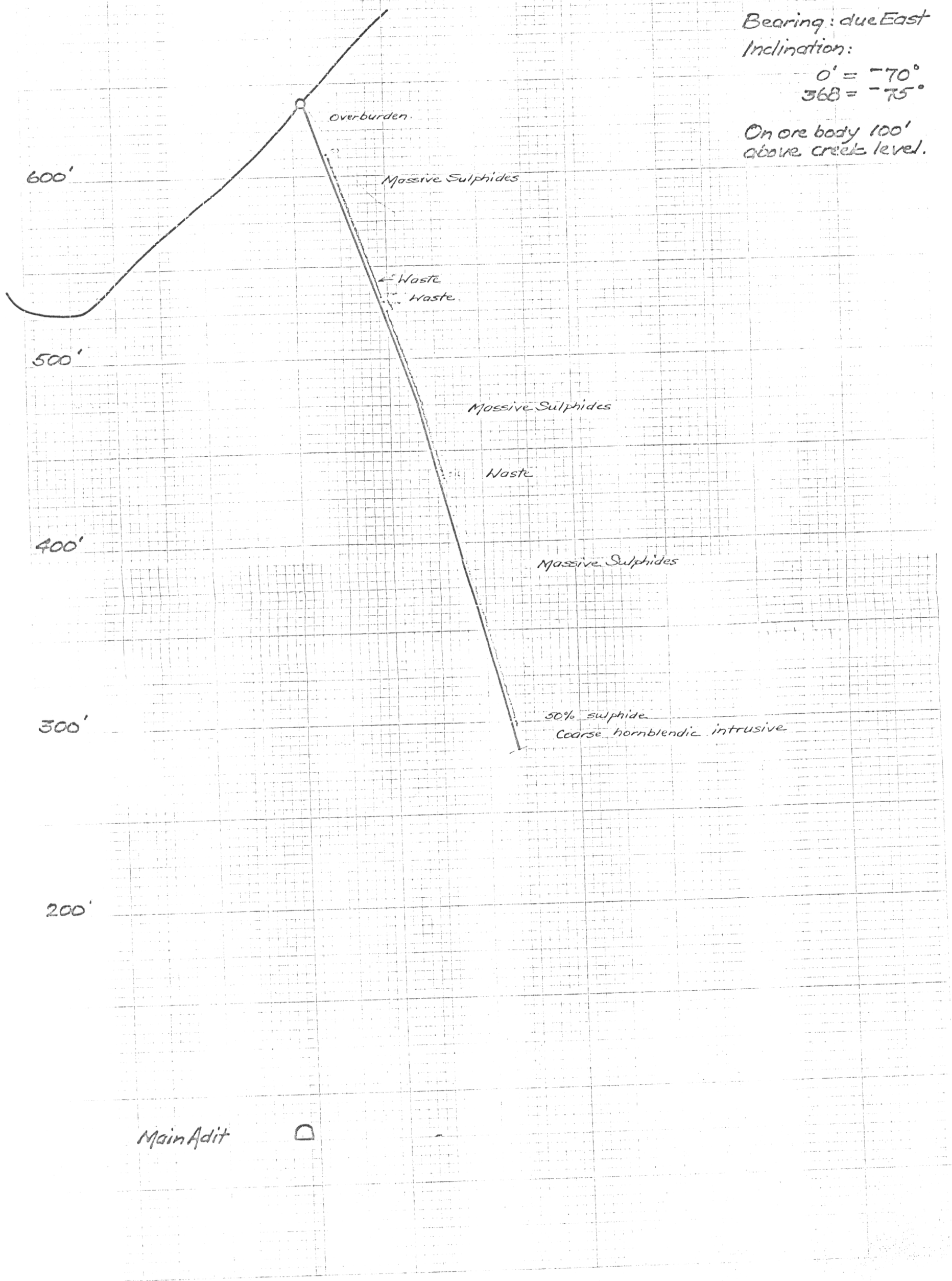
DH 11

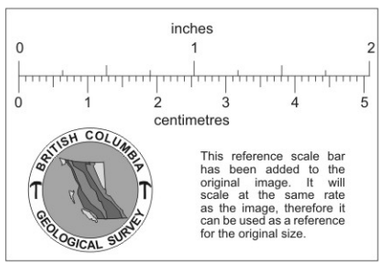
Coords: 6870 N
7605 E

Bearing: due East

Inclination:
0' = -70°
368 = -75°

On ore body 100' above creek level.





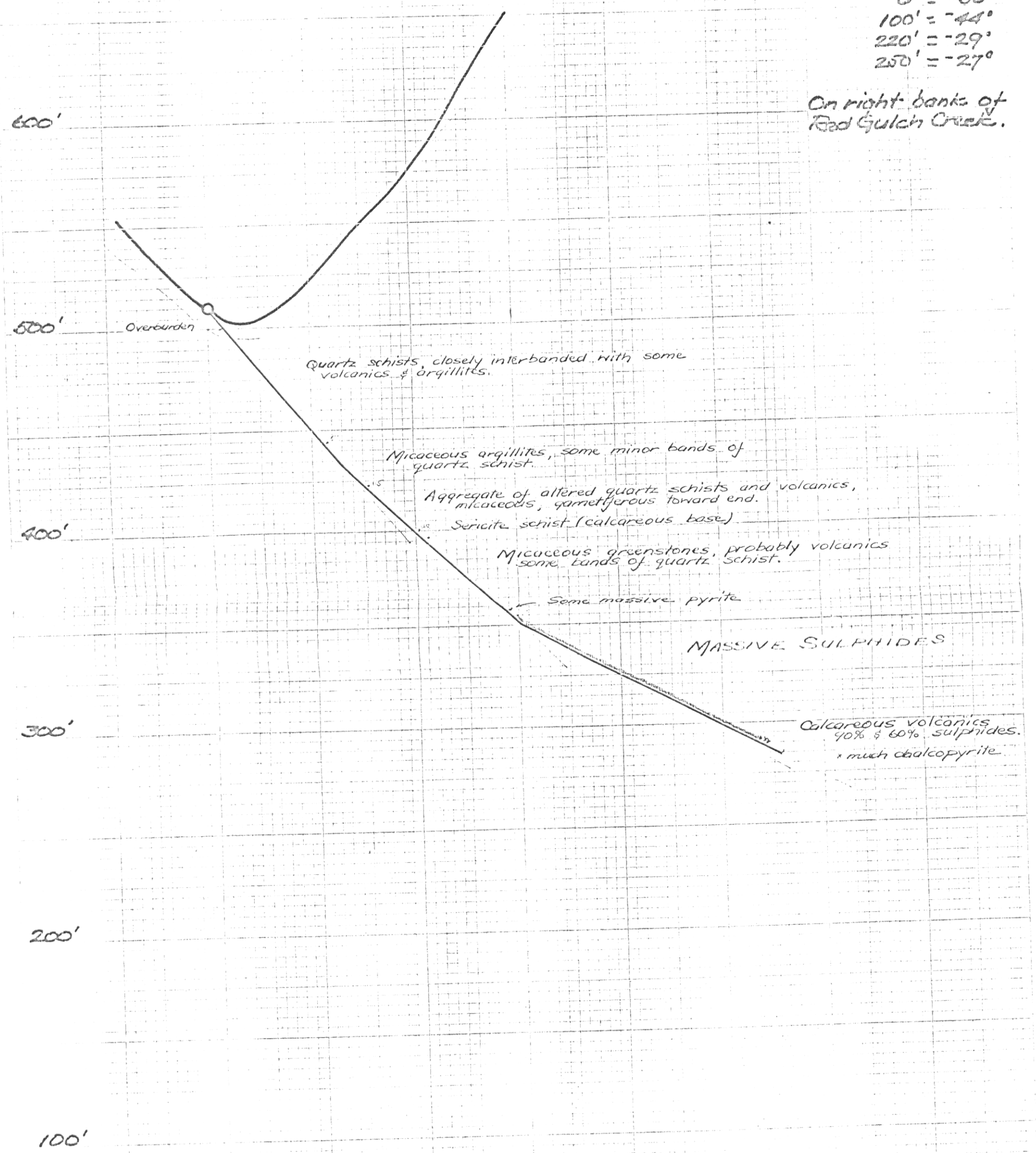
DH 12

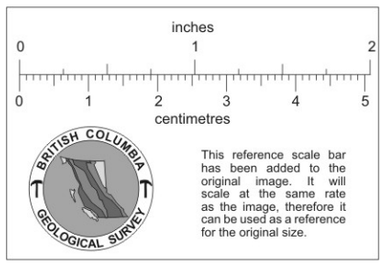
Coords: 6910 N
7450 E

Bearing: due East

Inclination:
0' = -50°
100' = -44°
220' = -29°
250' = -27°

On right bank of Red Gulch Creek.





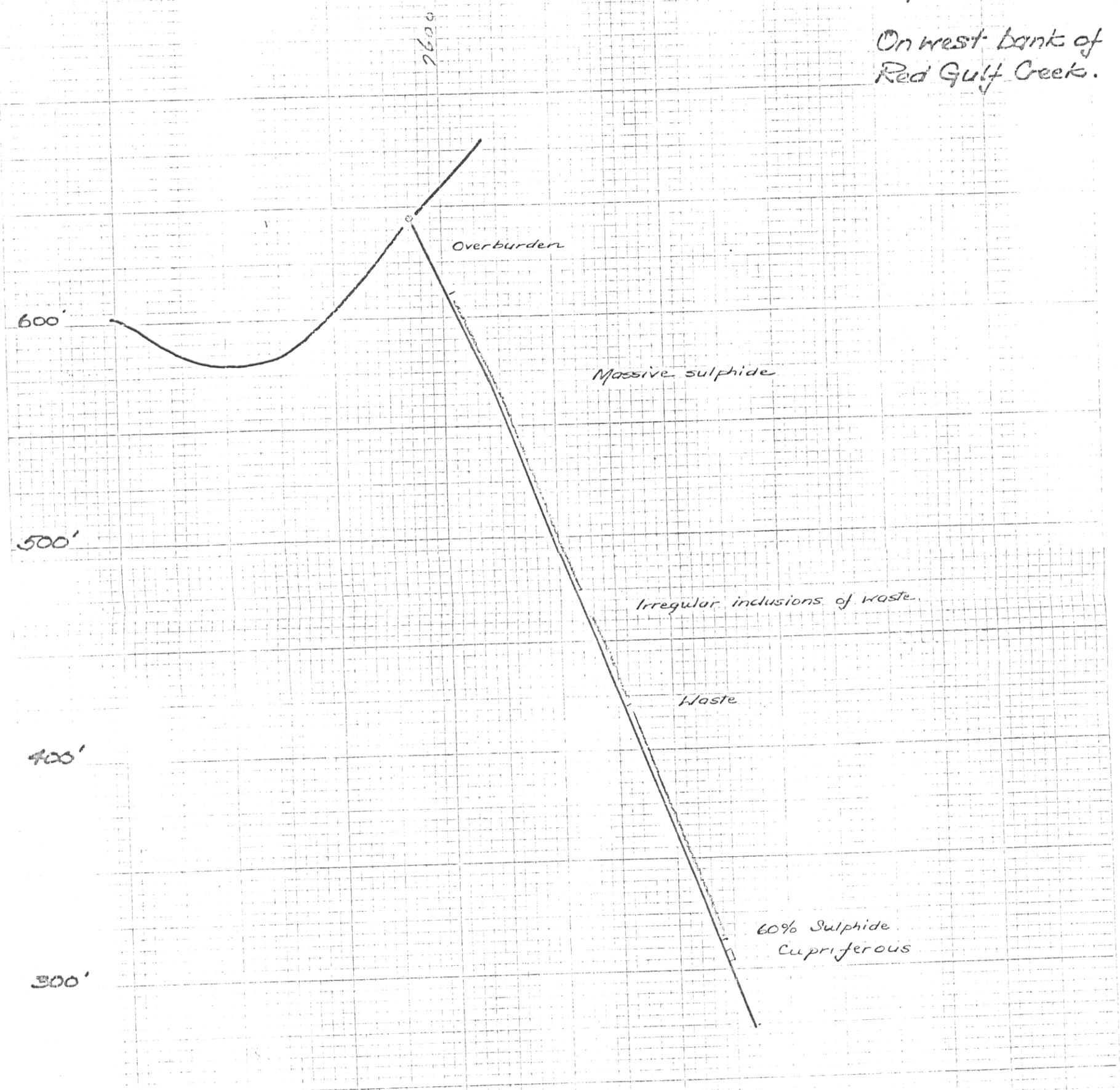
DH 13

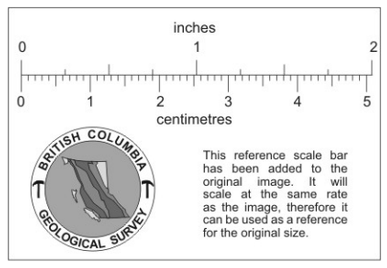
Coords: 6840 N
7585 E

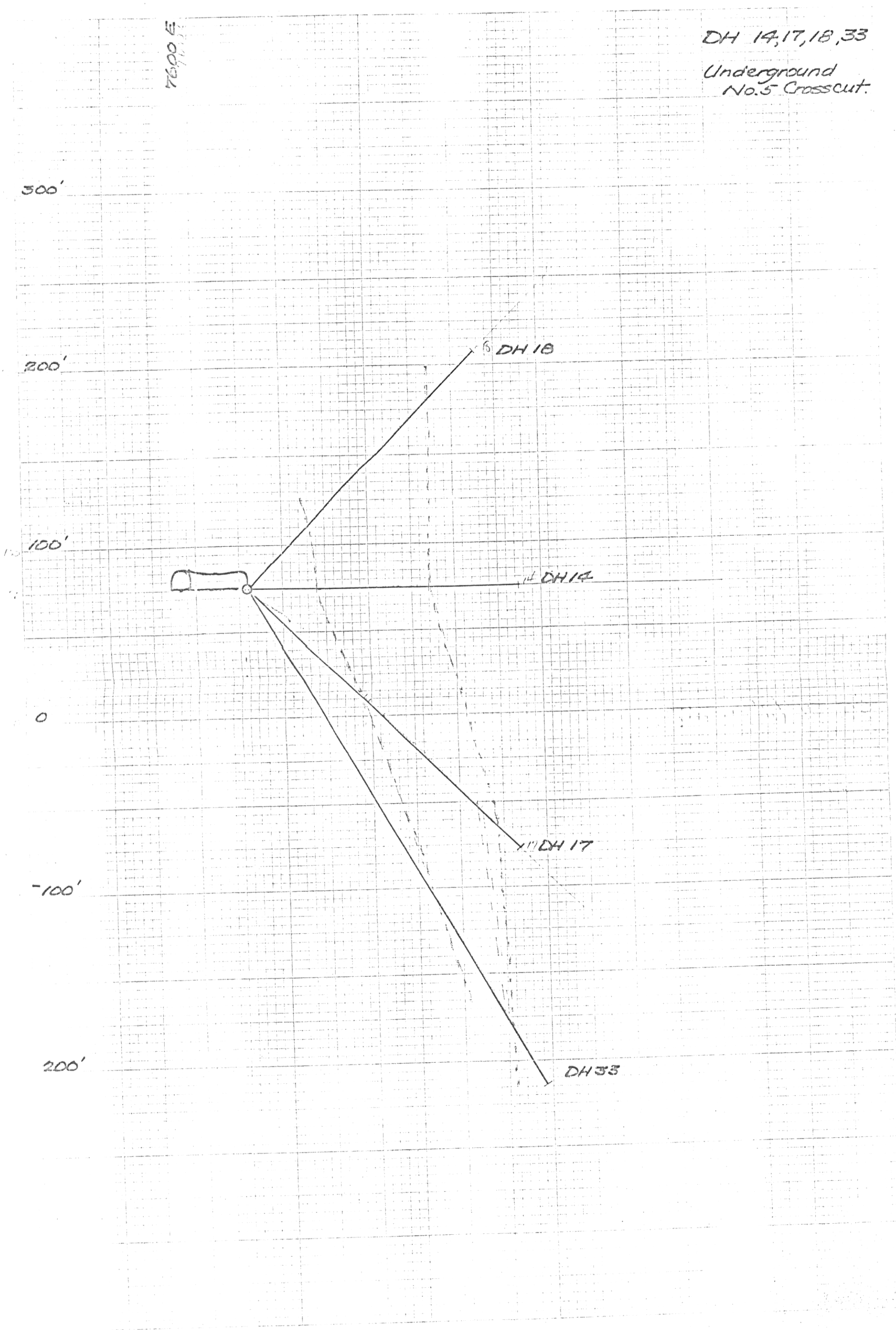
Bearing: due East

Inclination:
65° at top to
70° at bottom

On west bank of
Red Gulf Creek.







inches
0 1 2
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centimetres
BRITISH COLUMBIA GEOLOGICAL SURVEY
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SULGAS PROPERTIES LTD.
ROOM 717
744 WEST HASTINGS STREET
VANCOUVER 1, B.C.

December 31, 1952.

Mr. R. D. Mollison,
Texas Gulf Sulphur Company,
75 E. 45th Street,
NEW YORK 17, N. Y.

Dear Dick:

Enclosed herewith please find two copies of Logs and Analyses of the 1952 diamond drilling program, as well as two copies of some of the early drill holes re-logged.

Yours sincerely,

W. Holyk.

W. Holyk

WH/jg
Enc.

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 1

Bearing at Collar	S 88° E
Elevation	557'
Dip at Collar	12°
Coordinates	7031 N, 7567E

Log Interval	Description
0 - 43	Massive pyrite
43 - 54	Quartz sericite schist with disseminated pyrite.
54 - 74	Massive pyrite
74 - 78	Hornblendic schist
78 - 82	Massive pyrite.
83 - 92	Quartz biotite schist, hornblendic
92 - 109	Quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 2

Bearing at Collar	S 86° 25' E
Dip at Collar	-80°
Elevation	552
Coordinates	7031.5N, 7562E

Log Interval	Description
0 - 18	Quartz hornblendite
18 - 51	Quartz chlorite schist
50 - 238	Missing
238 - 256	Quartz biotite schist, chloritic
256 - 259	Hornblendite
259 - 275	Hornblendite quartz chlorite schist
275 - 285	Quartz chlorite schist
285 - 424	Missing
424 - 462	Quartz chlorite schist
462 - 476	Foliated chlorite schist, some sericite
476 - 497	Quartz chlorite schist
497 - 549	Missing
549 - 577	Hornblendic quartzite
577 - 593	Quartz chlorite schist
593 - 605	Sericite schist, quartz and chlorite
605 - 612	Quartz chlorite schist, minor sericite.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Cranby No. 5

Bearing at Collar	S 86° 50' E
Dip at Collar	-20°
Elevation	578
Coordinates	7111N, 7622 E

Log Interval	Description
0 - 29	Quartz biotite schist plus chlorite
29 - 42	Quartz chlorite schist, minor biotite and sericite.
42 - 47	Massive pyrite.
47 - 48	Quartz chlorite sericite schist.
48 - 61	Quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. GRANBY No. 10

Bearing at Collar	S 85 E
Dip at Collar	-70°
Elevation	523
Coordinates	N 6857, E 7473

Log Interval	Description
3 - 18	Biotitic quartz chlorite schist.
18 - 47	Quartz biotite schist, chloritic.
47 - 87	Quartz chlorite biotite schist.
87 - 128	Missing
128 - 272	Quartz chlorite schist, boxes disturbed.
272 - 304	Quartz chlorite sericite schist
304 - 462	Massive pyrite
462 - 474	Sericite schist with disseminated pyrite.
474 - 479	50% pyrite
479 - 510	Quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 13

Bearing at Collar	N 80° 51' E
Dip at Collar	-45°
Elevation	496
Coordinates	N 6668, E 7461

Log Interval	Description
0 - 105	Missing
105 - 111	Quartz chlorite sericite schist
111 - 115	Hornblendic quartz chlorite schist.
115 - 122	Quartz hornblendite.
122 - 136	Hornblendic quartz chlorite schist.
136 - 140	Sericite schist.
140 - 144	Missing.
144 - 162	Massive pyrite
162 - 186	50% pyrite
186 - 238	Massive pyrite
238 - 239	Sericite schist
239 - 250	Massive pyrite
250 - 261	Quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 14

Bearing at Collar	N79° 30' E
Dip at Collar	-45°
Elevation	490
Coordinates	N 6570, E 7480

Log Interval	Description
0 - 5	Missing
5 - 8	Sericitic quartzite
8 - 16	Quartz chlorite schist
16 - 24	Quartzite
24 - 30	Quartz biotite schist, chloritic
30 - 39	Quartz chlorite biotite schist
39 - 57	Quartzite
57 - 64	Quartz chlorite schist
64 - 82	Sericite schist with disseminated pyrite.
82 - 94	Quartz chlorite schist, hornblendic
94 - 97	Quartz hornblendite
97 - 102	Sericite schist.
102 - 123	Massive pyrite.
123 - 129	50% sulphides.
129 - 133	Black argillite
133 - 151	Quartz chlorite sericite schist.
151 - 158	Quartzite, minor chlorite

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 20.

Bearing at Collar	N 89° W
Dip at Collar	-15°
Elevation	622.5
Coordinates	7291N, 7683 E

Log Interval	Description
0 - 100	Quartz-chlorite schists. Quartzites - 6" at 4', also 34 - 39'.
100 - 110	Chlorite schist, chlorite is somewhat foliated.
110 - 133	Quartz-chlorite schist.
133 - 135	Quartzite
135 - 162	Quartz chlorite schist, biotitic. 6" quartzites at 151 and 157'.
162 - 162.5	Sericite schist and disseminated pyrite
162.5 - 182	Quartz chlorite schist.
182 - 184	Quartz sericite schist.
184 - 196	Quartz chlorite schist plus Mica
196 - 197	Sericite schist.
197 - 220	Chlorite schist, quartz minor.
220 - 236	Quartzite.
236 - 318	Biotitic quartz chlorite schists, minor quartzite bands at 269, 278 and 283'.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 21

Bearing at Collar	due West
Dip at Collar	-15°
Elevation	792
Coordinates	N 8159, E 7741

Log Interval	Description
0 - 27	Biotitic quartz chlorite schist
27 - 48	"Granite" gneiss; chlorite schist 35-37'
48 - 49	Quartzite
49 - 53	Biotitic quartz chlorite schist.
53 - 54	Quartzite
54 - 110	Quartz chlorite schist, minor biotite
110 - 223	Missing.
223 - 260	Sericite schist with disseminated pyrite.
260 - 265	Hornblendic quartz chlorite schist, garnetiferous.
265 - 303	Missing.
303 - 319	Quartz chlorite schist.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 22

Bearing at Collar	West
Dip at Collar	-70°
Elevation	790.4
Coordinates	N 8158.6, E 7746.3

Log Interval	Description
0 - 5	Hornblendic quartz chlorite schist
5 - 52	Quartz chlorite schist, with minor quartzite bands.
52 - 53	"Granite" gneiss.
53 - 69	Biotitic quartz chlorite schist with 3 thin beds of "granite" gneiss.
69 - 80	"Granite" gneiss.
80 - 250	Missing.
250 - 276	Dominantly quartzites with minor interbedded chlorite schists.
276 - 287	Micaceous quartz chlorite schist.
287 - 295	Biotitic quartzite.
295 - 308	Quartz chlorite schist.
308 - 351	Sericite schist with disseminated pyrite.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. Granby No. 27

Bearing at Collar	East
Dip at Collar	-70°
Elevation	640
Coordinates	6800 N, 7554 E

Log Interval	Description
0 - 38	Missing
38 - 163	Massive pyrite
163 - 165	Sericite schist, with disseminated pyrite
165 - 177	Quartz chlorite sericite schist
177 - 186	Quartz chlorite schist, minor sericite.
186 - 207	Quartzite, minor biotite and chlorite
207 - 240	Quartz chlorite schist

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. No. 1

Bearing at Collar	West
Elevation	Surface 185'
Dip at Collar	-15°
Coordinates	5169N x 7629E

Log Interval	Description
0 - 3	Chlorite schists.
3 - 27	Quartzites, chloritic
27 - 31	"granite" gneiss
31 - 35	Chlorite schists, quartzite interbeds.
34 - 45	Quartzites
45 - 56	Quartz chlorite schist, hornblendic
56 - 75	Quartzites, thin banded.
75 - 83	Sericite schist, with disseminated pyrite.
83 - 84	Black argillite
84 - 85	Massive pyrite
85 - 86	Sericite schist
86 - 87	Massive pyrite
87 - 90	Quartz chlorite schist
90 - 99	Chloritic hornblendic quartzite
99 -102	Massive pyrite with 6" black chloritic rock
102-106	Hornblendic quartzite.
106 - 115	Hornblendic quartzite.
115 -130	Black argillite with inliers of sericite schist.
130 -140	Sericite schist, with disseminated pyrite, chalcopyrite. 2" massive pyrrhotite at 135.
140- 189	Biotitic to sericitic quartzites, minor chlorite schist interbeds.
189 -205	Quartz chlorite biotite schist.
205 -218	Hornblendic quartzite.
218 -233	Quartz biotite chlorite schist.
233 -258	Quartzites, thin banded, with chlorite schists.
258 -265	Hornblendic quartzite.
265 -276	Chlorite biotite schist, quartz variable
276 -283	Hornblendic quartzite
283 -307	Biotitic to hornblendic quartzites, interlayers of quartz hornblende biotite schist.
307 -312	Massive biotitic quartzites.
312 -331	Massive quartzite complex with chlorite-biotite schist interbeds.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. NO. 2

Bearing at Collar	West
Elevation	Surface 185
Dip at Collar	-60°
Coordinates	5169N x 7629E

Log Interval	Description
0 - 61	Quartz chlorite schists dominant with interbedded quartzites.
61 -120	Thin bedded quartzites, interlayers of chlorite biotite schists.
120-129	Sericite schist with disseminated pyrite
120 -121	6" 50% pyrite.
126 -127	1' black argillite
127 -128	6" massive pyrite
129 -145	"Hornblendite", possibly hornblendic quartzite
145 -147	20" massive pyrite and some chalcopyrite.
147 -150	Quartz biotite schist
150 -165	"Hornblendite", possibly hornblendic quartzite
165 -176	Dominantly argillites, minor sericite schist, carbonate rock.
176 -188	Sericite schist dominant, 1' quartz at 180, 2" massive pyrite, pyrrhotite at 183.
188 -209	Thin bedded quartzites, chlorite, biotite along foliation.
209 -223	Massive quartzite
223 -283	Thin bedded quartzites with interbeds of chlorite biotite schist becoming more hornblendic
283 -299	Massive hornblendic quartzite.
299 -304	Banded quartz chlorite schists.
304 -317	Quartz biotite chlorite schist, somewhat gneissic.
317 -325	Hornblendic quartzite
325 -326	Biotitic quartzite
326 -327	Chlorite schist
327 -338	Hornblendic quartzite
338 -341	Chlorite schist
341 -352	Biotitic quartzite
352 -355	Chlorite schist
355 -378	Quartz biotite chlorite schist, interbanded quartzites.
378 -420	Thin banded quartzites, with chlorite biotite schist interbeds.
420 -429	Biotitic quartzites.
429 -460	Quartz chlorite schist, hornblendic to biotite, with quartzite interlayers.
460 -477	Quartz chlorite biotite schist.
477 -482	Biotite porphyry
482 -483	Skarn zone, calcareous silicates.
483 -498	Limestone

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 3

Bearing at Collar	East
Elevation	Surface 185'
Dip at Collar	-15°
Coordinates	5172N 7674E

Log Interval	Description
0 - 23	Missing
23 - 80	"granite" gneiss
80 -167	Massive light grey quartzites
167 -169	Argillite and limestone
169 -175	Massive light grey quartzite
175 -202	Sericitic quartzites
202 -209	Chloritic quartzites
209 -217	Chlorite biotite schist
217 -242	Thin bedded quartzites with interbedded chlorite biotite schists.
242 -247	Coarsely hornblendic quartzite
247 -271	Quartz chlorite biotite schist, quartzite interbeds.
271 -300	Biotitic chlorite schist.
300 -303	Hornblendic quartzite
303 - end	Core disturbed, largely chlorite schists, calcareous

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 4

Bearing at Collar	West
Elevation	Surface 185
Dip at Collar	-40° approx.
Coordinates	4798N 7525E

Log Interval	Description
0 - 58	Overburden
58 - 68	Quartzite, porous along foliation, minor sericite.
68 -104	"Granite" gneiss, mottled.
104-132	Quartzites, minor chlorite and sericite along foliation. Grey colour
132-164	Quartzites, sericite along foliation. Cream coloured.
164-168	"Granite" gneiss
168-172	Quartzite, cream coloured, minor sericite
172-207	"Granite" gneiss

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 5

Bearing at Collar	East
Elevation	Surface 150'
Dip at Collar	-15° approx.
Coordinates	4789N 7612E

Log Interval	Description
0 - 68	Missing
68 - 97	"Granite" gneiss
97 -115	Quartzite, some sericite on foliation
115 -139	Quartz chlorite biotite schist
139 -140	Sericite schist, some pyrite disseminations.
140 -141	Limestone
141 -158	Quartzite, hornblendic and garnetiferous
158 -178	Dense chlorite biotite schist. Quartz chlorite schist at 170-172, 175.
178 - end	Core disturbed.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 6

Bearing at Collar	East
Elevation	Surface 150
Dip at Collar	-50° approx.
Coordinates	4789N 7627E

Log Interval	Description
0 - 35	"Granite" gneiss.
35 - 67	Quartzites, sericite along foliation, some disseminated pyrite.
67 -120	"granite" gneiss, hornblendic from 90'.
120-123	Quartzite
123-126	"Granite" gneiss
126-135	Quartzite
135-160	"granite" gneiss
160-162	Quartzite
162-180	"Granite" gneiss
180-198	Quartzite, minor sericite along foliation.
198-222	Quartz chlorite schists, hornblendic to biotitic.
222-230	Sericite and highly foliated chlorite schist.
230-257	Quartzite, biotitic to hornblendic.
257-274	Calcareous chlorite schist, 6", 1" pyrrhotite at 262.
274-280	Chloritic limestone
280-281	Black argillite
281-284	Quartzite
284-285	Sericitic carbonate schist.
285-289	Black argillite
289-300	Brownish anhydrite? may be arenaceous carbonate
300-311	Limestone, interbanded argillite
311-312	Quartzite, chloritic
312-319	Quartzite
319-322	Black argillite
322-328	Limestone, minor argillite, some pyrrhotite disseminations.
328-347	Biotitic to chloritic quartzite
347-352	Limestone
352-358	Quartzite
358-359	Limestone
359-362	Sericite schist, 10% disseminated pyrite 2" massive pyrite at 359.
362-389	Sericitized quartzites, 4-5% pyrite at 375-378.
389-396	Quartz chlorite schists.
396-417	Quartzites, with sericite partings.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 14

Bearing at Collar .... due East
Dip at Collar .... flat
Coordinates .... N 6751 x 7625 E
No. 5 Crosscut (face)

Log Interval	Description
0 10	Quartz biotite schist
10 39	Chlorite biotite schist, some hornblende
39 41.5	Quartzites, biotitic
41.5 44	Massive pyrite
44 46	Quartzites, biotitic, chloritic
46- 106	Massive pyrite
106-119	Hornblende quartzite
119-132	Coarse grained quartz chlorite schist
132-143	Quartzite
143-158	Chlorite schist, some quartzite bands

Logged by Holyk

DIAMOND DRILL LOG

D.D.H. No. 15

Bearing at Collar ... N 45° E
Dip at Collar ... flat
Coordinates
No. 5 Crosscut (face)

Survey Data

Location	Bearing	Dip
0		0°
100		0°
216		0°

Log Interval		Description
0	15	Quartz chlorite schist, minor biotite, hornblende, 1' quartzites at 5' and 10'
15	38	Chlorite biotite schist
38	64	Quartz chlorite biotite schist
64	65	Quartzite
65	75	Quartz chlorite biotite schist, becoming more sericitic
75	199	Massive pyrite
199	207	Sericite schist
207	219	Gneissic quartz biotite chlorite schist

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 16

Bearing at Collar S 45°E
Dip at Collar Flat
Coordinate N 6446 x 7625 E
No. 5 Crosscut (face)

Log Interval		Description
0 -	16	Quartz chlorite biotite schist
16	29	Chlorite biotite schist, quartz minor
29	31	Granitic quartz chlorite biotite schist
31	49	Chlorite biotite schist
49	55	Biotitic quartzite, becoming more sericitic
55	122	Massive pyrite
122	123	Sericite schist
123	144	Massive pyrite
144	149.5	Sericite schist, 25% pyrite disseminations
149.5	159	Quartzites, biotitic
159	167	Quartz chlorite hornblende schist
167-	169	"granite" gneiss

Logged by Holyk

DIAMOND DRILL HOLE

D.D.H. Northern Pyrite No. 17

		Survey Data		
		Location	Bearing	Dip
Bearing at Collar	due East	0		-45°
Dip at Collar	-45°	100		-40°
Coordinates	N5751 x 7625E	200		-40°
No. 5 Crosscut (face)				

Log Interval	Description
0 - 16	Missing
16 - 66	Biotitic quartz chlorite schist
66 - 75	Quartz chlorite schist, plus biotite and hornblende
75 - 92	Sericitic quartz chlorite biotite schist
915- 95.5	Massive pyrite
95.5-106	Quartz biotite gneiss, minor chlorite
106- 107	Sericite schist
107-180.5	Massive pyrite
180.5-184	Hornblende quartz chlorite biotite schist
184-197	Massive pyrite
197-200	Foliated chlorite schist
200-215	Sericite schist, chlorite and disseminated pyrite
215-216	Massive pyrite
216-222	Quartz chlorite schist

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. Northern Pyrite No. 18

Bearing at Collar	due East	
Dip at Collar	+45°	
Coordinates	N 6751 x 7625E	
No. 5 Crosscut (face)		

Survey Data

Location	Bearing	Dip
0		+45
50		+43
150		+40

Log Interval		Description
0	7	Missing
7	25	Quartz chlorite schist, minor biotite
25	26	Sericite schist, with disseminated pyrite.
26	47	Quartz chlorite schist, with minor biotite, and hornblende.
47	50	Quartz hornblendite
50	150.5	Massive pyrite
150.5	152.5	Hornblendite
152.5	154.5	Massive pyrite
154.5	158	Sericite schist
158	178	Quartz chlorite schist, with minor sericite 157-160

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. No. 19

Bearing at Collar	due East
Dip at Collar	flat
Coordinates	N 6370 x 7683E
No. 3 Crosscut (face)	

Interval		Description
0	6	"granite" gneiss
6	43	Quartz chlorite schist, biotitic quartzites of 21-25, 31-35
43	54	Quartzites, minor sericite
54	57	"granite" gneiss
57	61	Quartz chlorite schist
61	67	"granite" gneiss
67	92	Quartz chlorite schist
92	137	"granite" gneiss
137	155	Chlorite schist, minor quartz

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 24

Bearing at Collar ... N 45° E
Dip at Collar ... flat
Coordinates ... N 7167 x 7612 E
No. 7 Crosscut (face)

Log Interval	Description
0 - 54	Chlorite biotite schist, with quartzite interbeds.
54 - 62	Quartzite
62 - 97	Chlorite biotite schist, minor quartzite bands.
97 -101	Biotitic Quartzite
101-148	Quartz biotite schist, somewhat gneissic
148-168	Quartzites, biotitic, with chlorite schists interlayers
168-178	Chlorite biotite schist
178-185	Quartzite
185-198	Chlorite biotite schist
198-228	Quartz chlorite schists, biotitic and hornblendic.
228-248	Quartz biotite schist, metagneiss
248-253	Chlorite schist, with stringers of metagneiss.
253-265	possibly "granite" gneiss.

DIAMOND DRILL HOLE LOG

D.D.H. No. 25

Bearing at Collar	S 45° E
Dip at Collar	flat
Coordinates	N 7158 x 7612E
No. 7 Crosscut (face)	

Log Interval		Description
0	18	Chlorite biotite schist, quartz minor
18	25	Quartzite, biotitic
25-	52	Chlorite biotite schist, quartz minor
52	59	Quartzites, biotitic to hornblendic
59	71	Chlorite biotite schist, quartz minor
71	103	Quartz biotite chlorite schist, hornblendic, gneissic
103	124	Quartzites, biotitic to hornblendic
124	130.5	Sericite schist, with disseminated pyrite
130.5	177	Massive pyrite
177	184	Sericite schist, with disseminated pyrite
184	221	Gneissic quartz biotite schist, intercaled chlorite mica schists.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 26

Bearing at Collar	due East
Dip at Collar	flat
Coordinates	N 7162 x 7621E
No. 7 Crosscut (face)	

Log Interval		Description
0	28	Core disturbed, largely chlorite schist.
28	35	Chlorite biotite schist, minor quartz.
35	40	Quartzite, biotitic
40	58	Chlorite biotite schist, minor quartz.
58	69	Quartzites, biotitic
69	104	Quartz biotite chlorite schist, hornblendic in part. Somewhat gneissic.
104	112	Quartzite, biotitic. 1" pyrite stringers at 111.
112	119	Quartz chlorite schists with minor quartzite bed. Sericite very minor.
119	132	Quartzite, biotitic, minor sericite.
132	-151	Quartz calorite, biotite schist, partly hornblendic. Some garnets, somewhat gneissic.

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DIAMOND DRILL HOLE LOG

D.D.H. No. 31

Bearing at Collar S 60°E
Dip at Collar -61°
Coordinates N 6980 x 7569 E

Survey Data

Location	Bearing	Dip
0		-61°
150		-58°
300		-53°
450		-47°
598		-45°

Log Interval	Description
0 - 35	Quartz chlorite biotite schist
33 - 77	Quartz chlorite schists, some sericite schist, disseminated pyrite at 50, 54 and 57'
77 -133	Quartz chlorite schist, biotitic.
133-173	Quartz chlorite biotite schist, minor quartzite bands.
173-206	Missing.
206-244	Biotitic quartz chlorite schist.
244-289	Quartz chlorite schists, biotitic in part
289-291	Quartzite
291-311	Biotitic quartzite, minor chlorite
311-511	Biotitic quartz chlorite schist predominate minor quartzite beds.
511-582	Quartzite, in part biotitic, minor chlorite.
582-590	Quartz chlorite biotite schist.
590-598	Mottled quartz chlorite biotite schist.

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DIAMOND DRILL HOLE LOG

D.D.H. No. 34

Bearing at Collar .... S 88° E
Dip at Collar .... flat
Coordinates ... N5963 x 7565 E
Adit Tunnel, East Wall (2 x C+200')

Log Interval	Description
0 - 6	Chlorite hornblende schist, quartz minor.
6 - 10	Quartzite, somewhat sericitic
10 - 12.5	Sericitized quartzite
12.5 - 19.5	Massive pyrite, 6" sericite schist at 16'
19.5 - 23	Quartz chlorite biotite schist, becoming sericitic.
23 - 50.5	Massive pyrite.
50.5 - 51.5	Chlorite hornblende schist
51.5 - 54	Massive pyrite
54 - 70	Missing

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 35

Bearing at Collar ... S 86° E
Dip at Collar ... flat
Coordinates N 5570 x 7549 E
Adit Tunnel, East Wall, (1 x C+200')

Log Interval	Description
0 - 15	Missing
15 - 21	Quartz chlorite schist, with interbeds of massive quartzite.
21 - 22.5	Sericite schist
22.5 - 40	Massive pyrite
40 - 43	Chlorite schist with 1' pyrite
43 - 47	Massive pyrite
47 - 49	Sericite schist, with diss. pyrite
49-51	Quartz chlorite schist
51 - 82	Quartz chlorite biotite schist with minor interbeds of quartzite.

Logged by Holyk

DIAMOND DRILL HOLE LOG

D.D.H. No. 30

Bearing at Collar ... due East
Dip at Collar ... -45°E
Coordinates ... N 6982 x 7571E
No. 6 Crosscut West

Survey Data

Location	Bearing	Dip
0		-45°
100		-40°
200		-32°
300		-30°

Log Interval		Description
25	- 39	Sericite and foliated chlorite schist
39	-190	Dominantly quartz chlorite schists, 1' impure limestone at 72'
190	-195	Sericite schist with disseminated pyrite.
196	-203	Massive pyrite
203	-214	Sericite schist with disseminated pyrite.
214	-226.5	Massive pyrite, minor chalcopyrite, calcareous interstices.
226.5	-230	Sericite schist with disseminated pyrite
230	-259	Biotitic quartz chlorite schist
259	-262	Quartzites
262	-300	Quartz biotite schists.

D.D.H. No. 30X

325	-411	Quartz chlorite schist dominant.

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DIAMOND DRILL HOLE LOG

D.D.H. 36 and 36x

Location: Main adit between No. 2 and No. 3 cross-cut
Coordinates:
Date begun on extension of hole 36: 26 June 1952.
Date finished: 4 July 1952.
Remarks: also numbered No. 7; old hole No. 36 was extended.

Survey data: Collar S 88 E 0
250 S 83 E -07
500 S 84 E -09

LOG:

Interval:	Description	Angle Schistocity
0 - 7	Grey quartzites, minor sericite	
7 - 10	Chlorite schist, foliated between 9 and 10	
10 - 23	Grey quartzites	
23 - 28	Sericite schist, disseminated pyrite	
28 - 51	Massive pyrite	
51 - 53	Sericite schist, disseminated pyrite	
53 - 54	8" massive pyrite	
54 - 59	Chlorite sericite schist	
59 - 62	Quartz chlorite biotite schist, some garnets at 59	

No. 36x

63 - 76	Chlorite schist
76 - 99	Quartzites, chloritic
99 -111	Hornblende chlorite schists
111-116	"granite" gneiss
116-121	Chlorite schist
141-161	Hornblendic quartzite
161-163	"Granite" gneiss
163-174	Chlorite schist
174-198	Quartzites, minor pyrite
198-264	"granite" gneiss
264-271	Chlorite schist, hornblende
271-274	"granite" gneiss
274-280	Sericite schist, quartzose, 1-2% pyrite
280-288	"granite" gneiss
288-340	Chlorite schist
340-347	Quartzites
347-368	Chlorite schist
368-380	Quartzites
380-390	Chlorite schist
390-400	Quartzites
400-408	Chlorite schist

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DIAMOND DRILL HOLE LOG

D.D.H. No. 51

		Survey Data		
Bearing at Collar	East	Distance	Bearing	Dip
Dip at Collar	-60°			
Coordinates	6980 N, 7575 E (Approx.)	182	N 85 E	-53
Location	No. 6 X-cut, West	250	N 85 E	-41
		306	N 80 E	-38
		398	N 77 E	-30
		444	N 78 E	-26

Log Interval	Description
6 - 20	Quartz biotite chlorite schist
20 - 51	Sericite schist with foliated chlorite schist and disseminated pyrite
51 - 55	Quartzites
55 -186	Quartz biotite chlorite schist
186 -190	Quartzites, micaceous
190 -247	Quartz biotite chlorite schist
247 -252	Quartzites
252 -256	Quartz biotite chlorite schist
256 -273	Quartzites, with biotite, chlorite
273 -284	Quartz biotite chlorite schist
284 -288	Quartzite
288 -379	Quartz biotite chlorite schists
379 -383	Quartzites, biotitic, minor chlorite
383 -416	Quartz biotite chlorite schist
416 -430	Quartzites, minor chlorite, garnet
430 -443	Quartz biotite chlorite schist

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DIAMOND DRILL HOLE LOG

D.D.H. No. 52

		Survey Data		
		Distance	Bearing	Dip
Bearing at Collar	N 89 E	30	N 89 E	74
Dip at Collar	-74°	210		68° (Acid)
Coordinates	6745N, 7628E (Approx.)	350	N 69 E	68
Location	No.5 X-cut, East			

Log Interval	Description
3- 38	Quartz chlorite sericite schist
38-156	Quartz chlorite schist, hornblendic, minor biotite
156-166	As above, minor sericite
166-220	Quartz chlorite schist
220-249	Quartz chlorite schist, minor hornblende, biotite
249-251	Quartzite
251-288	Quartz chlorite schist, minor biotite
288-313	Quartz biotite schist, minor chlorite, hornblende
313-319	Quartz chlorite schist, minor biotite, finely disseminated pyrite.
319-357	Quartz chlorite schist, minor biotite
357-371	Quartzite, minor sericite
371-420	Quartz chlorite schist, minor biotite, garnets, hornblende at intervals.
420-429	Quartzite, minor chlorite, sericite
429-458	Quartz biotite schist, minor hornblende and biotite at intervals.

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DIAMOND DRILL HOLE LOG

DDH. No. 52A

Survey Data

Distance	Bearing	Dip
30	N 89 E	74
210		68° (Acid)
350	N 69 E	68
377	N 71 E	67
398	N 71 E	66
460	N 72 E	63
590	N 73 E	58

Hole 52 wedged at 350', Hall-Roe wedge.

Log Interval	Description
350-398	No core
398-400	Quartz biotite gneiss
400-406	Quartzite, minor chlorite
406-440	Biotitic quartzite
440-442	Quartz hornblendite, seems to be alteration of quartzite by secondary hornblende.
442-449	Hornblendic quartzite
449-456	Quartz chlorite hornblende schist, somewhat gneissic
456-459	Quartzite
459-462	Quartz chlorite biotite gneiss
462-465	Quartzite
465-472	Quartz chlorite mica gneiss
472-491	Quartzites, biotitic, minor sericite
491-498	Quartz chlorite biotite gneiss, hornblendic
498-527	Biotitic quartzite
527-584	Quartz chlorite biotite schist, gneissic
584-599	Quartz chlorite biotite schist, becoming more hornblendic

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DIAMOND DRILL HOLE LOG

D.D.H. No. 53

			Survey Data	
Bearing at Collar	Due East	Distance	Bearing	Dip
Dip at Collar	-75°			
Coordinates	6560N, 7598E approx.	150	N 89 E	72
Location	No. 4 X-cut	300	N 84 E	65
		440	N 86 E	60

Log Interval	Description
6- 19	Sericite schist, minor disseminated pyrite
19- 33	Quartz biotite chlorite schist
33-114	Sericite schist with chlorite schist, minor disseminated pyrite.
93	3" massive pyrite
94.5-96	1.5' massive pyrite
114-198	Dominantly biotitic quartz chlorite schists
198-202	Quartzites
202-285	Dominantly biotitic quartz chlorite schists
285-331	Quartzites dominant
331-353	Quartz chlorite schist
353-445	Quartz chlorite schists, biotitic and hornblendic in part. Calcite along joints

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D D H no. 54

Location: Main adit at D.D.H. 36
Coordinates:
Date begun: 3 July 1952
Date finished: 9 July 1952
Remarks: hole too far off course and therefore abandoned.

Survey Data:				
	150	N 64 E	79	
	300	N 51 E	82	
	400	N 32 E	84	
	20	N 86 E	76	hole collar

LOG

Interval	Description	Angle Schistosity
0 - 93	White quartzite with bands of sericite 46-56 increased biotite and some diss. pyrite	85
93 -109	Garnetiferous quartz-chlorite-hornblende schist; some diss. pyrite	85
109-111	Quartz-biotite schist grading into quartz-chlorite schist.	
111-115	quartzite with small amount of chlorite	
115-126	quartz-chlorite-hornblende schist	
126-138	White quartzite with bands of chlorite	
138-145	Quartz-chlorite schist	
145-146	Quartzite	
146-167	Foliated quartz-chlorite schist	
167-218	Massive quartz-chlorite schist with minor garnet.	
218-219	Massive quartzite	
219-242	Quartz-chlorite-biotite schist with minor garnet and hornblende	
242-245	Quartzite stringers with hornblende	
245-290.5	Quartz-chlorite schist with minor hornblende and garnet.	
290.5-292.5	Massive white quartzite.	

292.5-322 Quartz chlorite schist with minor garnet and hornblende

322 -365 Massive quartzite with bands of chlorite; some coarse crystals of chlorite and minor garnet

365 -429 Quartz-chlorite schist with minor garnet and hornblende; some disa. pyrite.

DIAMOND DRILL HOLE LOG

D.D.H. No. 55A

Bearing at Collar S 83 E
Dip at Collar -75° E
Coordinates 5745N 7668E (Approx.)
Location No. 2 X-cut, face

Survey Data

Distance	Bearing	Dip
20	N 86 E	75
100	N 88 E	76
200	S 80 E	79
300	S 66 E	81
380	S 61 E	82
455	S 64 E	83
464	S 48 E	85
485	S 24 E	83
550	S 22 E	84
600	S 13 E	84
645	S 02 E	84
690	S 18 W	81
735	S 34 W	77
840	S 53 W	72
910	S 54 W	72

Log Interval	Description
10-445	Quartz chlorite biotite schist dominant
445-449	Quartzites
449-598	Quartz chlorite biotite schists dominant, some thin beds of quartzite.
598-608	Sericite schist.
608-830	Dominantly quartz biotite schists with quartzite interbeds. No core at 632-647, 656-672, 682-749.
830-896	Massive pyrite. Walls are highly schistose, sericitic.
896-919	Quartz chlorite schists, interbedded quartzites
919-932	Quartzites.

Logged by Lowrie

ANALYSIS

ECSTALL RIVER

SULCAS PROPERTIES

No.	Location	Description	Core Length From	To	Cu %	Fe "	Zn %	S %	Au. Oz.	Ag. Oz.
26	DDH 55A	Pyrite with 1' diss.pyrite & sph.in sericite. 5' core lost from 832-840	829.6	840	1.1	38.1	0.3	41.6		
27	"	Pyrite	840	845	.5	45.4	0.8	50.3		
28	"	"	845	850	.1	43.5	2.6	49.1		
29	"	"	850	855	Tr.	42.8	3.5	48.4		
30	"	"	855	860	.05	42.0	4.5	48.9		
31	"	" only 3' core	860	870	Tr.	39.5	5.8	47.7		
32	"	Pyrite	870	875	.1	42.8	2.4	49.2		
33	"	"	875	880	Tr.	40.3	3.6	47.5		
34	"	"	880	885	.1	40.8	3.5	47.4		
35	"	"	885	890	.4	41.4	3.4	47.8		
36	"	"	890	897	.4	38.3	3.8	44.3		

DIAMOND DRILL HOLE RECORD

D D H No. 56

Location: End of No. 2 cross-cut
Coordinates:
Date begun: 21 May 1952
Date finished: 25 May 1952
Remarks: Hole also numbered No. 3

Survey Data:				
	20	S 79 E	85 degrees	
	100	S 47 W	87	
	100	S 34 W	87	(resurvey)
	200	S 83 W	79	
	300	S 86 W	75	
	380	S 86 W	72	

LOG:

Interval	Description	Schistocity Angle
0 -146	Calcareous quartz-chlorite schist	80
	50' some diss. pyrite 180' grading into quartz-biotite schist with minor sericite and diss. pyrite. --Calcite is confined entirely to joints normal to the schistocity.--	
146-258	quartz-biotite schist with minor chlorite	72
158-213	Quartz-chlorite-biotite schist	
213-237	Quartz-chlorite schist with sericite and biotite diss. chalcopyrite and pyrite and increase in sericite toward the ore.	
237-309	Massive pyrite; calcareous with diss. chalcopyrite	
309-311	Foliated sericite-chlorite schist.	
311-327	Massive calcareous pyrite with diss.sphalerite	
327-337	Chlorite-sericite schist; foliated with heavy diss. pyrite.	
337-338	Massive pyrite.	
338-339	Quartz and pyrite	
339-343	Massive pyrite and sericite	
343-383	Quartz-chlorite sericite schist with some diss. chalcopyrite.	
383-395	Quartz-chlorite-biotite schist, garnetiferous.	

ANALYSIS

ECSTALL RIVER

SULCAS PROPERTIES

No.	Location	Description	Core Length From	To	Cu %	Fe %	Zn %	S %	Au. Oz.	Ag. Oz.
6	DDH 56	Diss.Pyrite	231.3	232.8	.4	24.6	0.5	27.0		
7	"	Pyrite	232.8	238	.2	45.0	1.3	50.3		
8	"	"	238	243	.1	44.3	1.8	50.0		
9	"	"	243	248	.4	44.4	1.6	49.3		
10	"	"	248	253	.3	44.4	1.6	49.4		
11	"	" 3' core recovered	253	262	.3	43.9	1.8	49.4		
12	"	Pyrite	262	267	Tr	44.1	2.8	50.2		
13	"	"	267	272	.5	41.6	4.2	48.2		
14	"	"	272	277	Tr	42.8	3.3	48.7		
15	"	"	277	281	.3	41.8	4.3	48.5		
16	"	"	281	286	.1	42.8	1.1	46.8		
17	"	"	286	291	.05	44.2	2.3	49.6		
Core missing from 291-299										
18	DDH 56	Pyrite	299	304	Tr	41.6	4.5	48.1		
19	"	"	304	309	Tr	41.7	4.7	48.1		
20	"	"	311	315	.2	42.6	3.3	48.1		
21	"	"	315	320	.2	43.3	3.3	49.0		
22	"	"	320	327	.3	38.1	7.0	46.1		
23	"	Dissem.Pyrite	327	332	Tr	12.3	1.1	11.0		
24	"	" "	332	337	Tr	16.7	Tr.	16.1		
25	"	Pyrite 1.5' quartz band	337	343.5	1.3	35.8	0.7	39.9		

DIAMOND DRILL HOLE LOG

D D H No. 57

Location: No. 2 cross-cut
Coordinates:
Date begun: 13 May 1952 to 19 May 1952
22 July 1952 to 8 August 1952
Remarks: Hole also numbered No. 2;

Survey Data:				
100	S 79 E	79	degrees (same for collar reading)	
200	S 79 E	79		
300	S 71 E	78		
400	S 62 E	80		
500	S 49 E	80		
620	S 18 E	81		
700	due S	79		
800	S 37 W	68		
800	S 25 W	74		(top of wedge 694')
920	S 39 W	69		
1000	S 42 W	68		

LOG:

Interval	Description	Schistocity Angle
0 -436	Quartz-chlorite gneiss with some biotite and hornblende	90
436-734	Dull bit, no core taken	
734-821	Dense quartz-chlorite schist	60
821-851	Quartzite with thin bands of biotite	65
851-922	Grading into quartz-chlorite-biotite schist, predominately quartzitic and bands of quartzite up to 5 inches,	
922-923	Sericite schist with some diss. pyrite.	
923-949	Massive pyrite, very coarse grained 936' - ground one foot 940' - 5" quartzite waste	
949-954	Massive pyrite, fine grained	
954-980	Massive pyrite, coarse grained 973' - ground 2 feet	
980-984	Black Argillite with some sericite	70
984-987.5	Massive pyrite	
987.5-995.5	Black Argillite with some sericite and diss. pyrite.	

Diamond Drill hole Log DDH 57 -- Page 2

995.5-998 Massive pyrite

998-1017 Sericite schist with some diss. pyrite

1017-1019.8 Chlorite schist with some sericite and very little diss. pyrite.

ANALYSIS

ECSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	Core Length To	Cu %	Fe %	Zn %	S %	Au. Oz.	Ag. Oz.
37	DDH 57	Pyrite	923	928	Tr.	39.4	3.3	45.3		
38	"	"	928	933	Tr.	43.1	1.7	48.7		
39	"	"	933	938	Tr.	40.8	3.8	47.6		
40	"	Pyrite, 6" waste	938	943	Tr.	40.2	1.7	45.4	Tr.	0.3
41	"	Pyrite	943	948	Tr.	40.5	3.2	47.0		
42	"	"	948	953	Tr.	43.0	1.9	47.0		
43	"	"	953	958	Tr.	39.1	2.5	46.1		
44	"	"	958	963	.05	36.3	4.6	43.5	.005	0.5
45	"	"	963	968	.05	38.6	3.5	44.9		
46	"	"	968	973	Tr.	39.9	2.9	46.4		
47	"	"	973	980	Tr.	40.5	2.6	45.9	Tr.	0.4
48	"	"	984	987.5	.2	43.3	1.2	45.8		
49	"	"	995.5	998	Tr.	39.4	2.1	44.0		

DIAMOND DRILL HOLE LOG

D D H No. 58

Survey Data: 150' N 80 W 77 degrees
250' N 77 W 71
327' N 75 W 65 degrees

Location: No. 1 cross-cut
Coordinates:
Date begun: 7 May 1952
Finished: 12 May 1952
Remarks: hole also number No. 1.

Log:

Interval	Description	Schistosity Angle
0 - 21	Quartz-chlorite-sericite schist	
21 - 37	Quartz-biotite schist. Minor chlorite and sericite, diss. pyrite, limey joints.	
37 - 80	Massive quartzite with minor sericite and diss. pyrite, limey joints.	72 degrees
80 -138	Quartz-chlorite-sericite schist with minor biotite and hornblende, pyrite limey joints.	
138-160	Quartz-biotite-chlorite schist Limey joints.	
160-259	Quartz-chlorite-biotite schist; sericite and diss. pyrite	60
255-259	Dense chlorite schist; some foliation	
259-284	Massive pyrite; minor sphalerite and chalcopyrite; calcite and quartz interstices. 282' one inch of black argillite	
284-289	Quartz-chlorite-sericite schist with minor biotite.	
289-290	Pyrite; calcareous, strong acid reaction minor chalcopyrite	50
290-334.6	Quartz-chlorite schist with minor sericite; garnetiferous; foliated through short intervals; limey joints	

ANALYSIS

ECSTALL RIVER

SULCAS PROPERTIES

No.	Location	Description	Core Length From	to	Cu %	Fe %	Zn %	S %	Au. Oz.	Ag Oz.
1	DDH 58	Pyrite	258	265	.05	39.6	4.3	47.4		
2	"	"	265	270	.10	41.5	4.0	48.4		
3	"	"	270	275	.10	41.7	4.3	48.4		
4	"	Pyrite with high Quartz and Zinc	275	280	Tr	37.9	4.8	45.1		
5	"	Pyrite with 2" waste	280	284.3	.10	40.4	3.9	46.7		

DIAMOND DRILL HOLE LOG

D.D.H. NO. 59		Survey Data		
		Distance	Bearing	Dip
Bearing at Collar	S 19 W	20	S 19 W	-52
Dip at Collar	-52°	200	S 44 W	-37
Coordinates	5350N, 7654E (approx.)	340	S 55 W	-31
Location	No. 1 X-cut			

Log Interval	Description
3- 86	Quartzose Biotite Chlorite schist.
86-109	Schistose Chlorite biotite, hornblendic
109-140	Quartzites, narrow bands of chlorite biotite schist.
140-166	Quartz chlorite biotite schist, narrow bands of quartzite
166-170	Quartzite
170-176	Sericite schist, disseminated pyrite, trace mariposite
176-206	Massive pyrite, black argillite from 182-184
206-237	Quartzite at contact, gradational to hornblendite at 207.
237-245	Black argillite, 3" pyrite at 246
245-260	Sericite schist, with disseminated pyrite 1' pyrite at 253.
260-279	Quartz biotite chlorite schist
279-303	Quartzites, argillaceous from 288.
303-314	Quartz biotite chlorite schist.
314-317	Sericite schist with minor disseminated pyrite
317-347	Quartz biotite chlorite schist, with some quartzite bands.

Logged by Lowrie

ANALYSIS

ECSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	To	Cu %	Fe %	Zn %	S %	Au. Oz.	Ag Oz.
50	DDH 59	Pyrite 6" Waste	177	182	.05	39.2	0.9	42.6		
51	"	Pyrite	184	189	.1	41.4	1.8	46.5		
52	"	"	189	194	Tr.	36.7	2.4	42.3		
53	"	"	194	199	Tr.	38.1	3.5	45.0		
54	"	"	199	206	Tr.	40.5	2.9	45.9		

DIAMOND DRILL HOLE LOG

D.D.H. No. 60

Bearing at Collar S 80 E
Dip at Collar -66°
Coordinates 5350N, 7654E (approx.)
Location No 1X-cut

Survey Data

Distance	Bearing	Dip
30	S 80 E	-66°
80	S 10 E	-66
180	S 15 E	-60
354	S 01 E	-55
465	S 03 W	-54
590	S 05 W	-50
680	S 11 W	-49
780	S 14 W	-45

Log Interval	Description
4- 10	Quartz chlorite schist, calcareous along joints.
10-186	Quartz chlorite biotite schist, some garnets and minor disseminated pyrite.
186-196	Quartz biotite gneiss, minor chlorite, calcareous joints.
196-277	Quartz biotite chlorite schist
277-278	Quartz stringer
278-318	Quartz biotite chlorite schist
318-401	Quartz chlorite schist, biotite minor.
401-411	Quartzite, some chlorite, biotite, disseminated pyrite.
411-419	Quartz chlorite schist.
419-450	Quartz chlorite schist, minor biotite and some sericite.
450-529	Quartz chlorite biotite schist.
529-552	Quartz biotite schist, minor chlorite
552-627	Quartz chlorite biotite schist
627-635	Quartzite, minor chlorite and biotite
635-640	Quartz chlorite schist
640-662	Quartzite, minor chlorite and biotite
662-669	Biotitic and hornblendic quartzite, minor chlorite
669-697	Quartz chlorite schist.
720-725	Quartzitic rock, minor chlorite and hornblende
725-753	Quartz chlorite schist
753-804	Quartz chlorite biotite schist, more quartzose at 774 with minor chlorite and biotite to 804. One foot quartz at 836.
804-846	Quartz chlorite biotite schist. as above - minor hornblende

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. No. 60A

Top of Thompson wedge at 462' in Hole 60. Bullnose from 462-590'

Survey Data

Distance	Bearing	Dip
465'	S03W	-54°
495'	S03W	-53°
520	S04W	-52
590	S14W	-46
671	S22W	-41
785	S29W	-37

Log Interval	Description
650-671	Quartz chlorite schist
671-681	Quartz biotite schist, chloritic
681-693	Quartz chlorite schist, hornblendic
693-705	Quartz biotite schist, minor chlorite
705-715	Quartz chlorite schist, hornblendic
715-717	Quartz chlorite schist
717-720	Quartzite, minor biotite and chlorite
720-799	Quartz chlorite schist, plus hornblende, biotite, and minor disseminated pyrite.
799-813	Sericite schist with disseminated pyrite
813-816	Black argillite
816-824	Sericite schist with disseminated pyrite
824-828	Quartz chlorite schist
828-830	Black argillite
830-836	Quartz chlorite schist, minor sericite
836-845	Black argillite
845-857	Quartzite, minor chlorite
857-863	Argillaceous quartzite
863-867	Black argillite
867-873	Black argillite and interbanded limestone
873-877	Limestone

Logged by Laurie

DIAMOND DRILL HOLE LOG

D.D.H. No. 61

Bearing at Collar	N 30 E
Dip at Collar	-55°
Coordinates	6158N 7575 E (approx.)
Location	Adit tunnel, in between No. 2 & No. 3 X-cut

Survey Data

Distance	Bearing	Dip
28	N 30 E	-55°
125	N 33 E	-55°
270	N 31 E	-40°
280	N 31 E	-33°

Log Interval	Description
3- 50	Quartzite, sericitic partings
50- 71	As above, minor disseminated pyrite
71-101	Quartz chlorite schist, minor sericite, pyrite
101-121	Coarsely foliated chlorite schist
122-125	Quartz
125-129	Foliated chlorite schist
129-147	Quartz biotite chlorite schist
147-165	Quartz chlorite schist
165-173	Quartzite, sericitic partings
173-192	Quartz chlorite sericite schist, with heavy disseminated pyrite, some chalcopyrite and sphalerite.
192-206	Massive pyrite
206-209	Quartz chlorite sericite schist, 1% pyrite.
209-223	Massive pyrite.
223-225	Foliated chlorite schist with minor sericite, pyrite.
225-245	Quartz chlorite schist, minor sericite.
245-250	Quartzites
250-266	Quartz chlorite biotite schist.
266-267	Biotite chlorite schist
267-290	Quartz chlorite schist, minor biotite, hornblende
290-378	Quartz biotite chlorite schist.
378-398	As above, higher quartz content
398-416	Quartz chlorite schist, plus biotite
416-423	Quartzite
423-450	Quartz chlorite schist, minor biotite
450-493	Quartz chlorite schist.

ANALYSIS

ECSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	To	Cu %	Fe %	Zn %	S %
55	DDH 61	Pyrite	192	197	.3	40.7	1.1	44.6
56	"	"	197	202	1.0	41.1	1.2	44.9
57	"	"	202	207	.6	38.3	3.2	43.9
58	"	"	207	212	1.6	43.6	1.6	48.8
59	"	"	212	217	2.5	44.3	1.4	49.7
60	"	"	217	228	2.4	41.2	1.8	46.3

DIAMOND DRILL HOLE LOG

D.D.H. No. 62

Bearing at Collar S33°E
Dip at Collar -65°
Coordinates 6158N, 7575E (Approx.)
Location Adit tunnel, in between No. 2 & No. 3 X-cut

Survey Data

Distance	Bearing	Dip
110	S 38 E	-67
200	S 26 E	-68
290	S 30 E	-63
380	S 22 E	-60
411	S 21 E	-58
422	S 23 E	-60

Log Interval	Description
4-164	Quartzite, minor sericite partings
164-219	Quartz chlorite biotite schist
219-230	Foliated chlorite schist with some disseminated pyrite.
230-234	Quartz chlorite schist
234-249	Quartz biotite schist, hornblendic and chloritic in part.
249-269	Quartzites, chlorite at intervals
269-299	Foliated chlorite schist, with quartz biotite schist at intervals, some sericite
299-311	Quartz biotite schist, some sericite
311-322	Quartz chlorite schist, some disseminated pyrite
322-335	Chlorite sericite schist with heavy disseminated pyrite at 332-334, some sphalerite
335-355	Quartzites, minor biotite, diss. pyrite
355-358	Quartz biotite schist with sericite
358-373	Quartz chlorite sericite schist, foliated in part.
373-388	Quartz chlorite schist, some disseminated pyrite
388-421	Drilled with swivel bit 357-411.

D.D.H. No. 62B

314-329	No core, wedge at 314.
329-334	Quartz chlorite schist, sericite, heavy disseminated pyrite.
334-360	Foliated quartz chlorite sericite schist.

DD.H. No. 62C

Survey Data

Distance	Bearing	Dip
275	S 49 E	-63°

238-252	No core, wedge at 238
252-279	Quartz chlorite schist, minor biotite
278-287	Quartzite and minor hornblende

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. No. 63

Bearing at Collar N 40 E
Dip at Collar 0
Coordinates 5745N, 7663 E (approx.)
Location No. 2 X-cut, face

Survey Data

Distance	Bearing	Dip
200	N 55 E	+ 8
400	N 67 E	+11

Log Interval	Description
0- 25	Quartz chlorite schist
25- 28	Quartz biotite gneiss
28- 36	Quartz chlorite schist
36- 38	Quartz biotite gneiss
38- 46	Quartz chlorite schist
46- 56	Biotitic quartz chlorite schist
56-125	Quartz biotite gneiss
125-171	Quartz chlorite biotite schist
171-269	Quartz chlorite schist
269-279	Quartzites, minor chlorite
279-303	Quartz chlorite schist, quartz predominant
303-313	Sericite schist, small amounts of disseminated pyrite at 306'
313-374	Quartz chlorite schist
374-378	Sericite schist, quartz and chlorite
378-419	Quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. #XR 1

Location . . . . . Third OTC
Elevation 1113
Bearing at Collar . . . East
Dip at Collar . . . . . -30°

Log Interval	Description
1 - 9	Quartz chlorite biotite gneiss
9 - 50	Quartz chlorite biotite schist
50 - 70	Quartz chlorite sericite schist with disseminated pyrite
70 - 71	3" solid pyrite & pyrrhotite
71 - 78	Quartz chlorite sericite schist with disseminated pyrite.
78 - 85	Quartz chlorite schist, with some sericite
85 - 92	Argillite, with bands of schist
92 - 94	Quartz chlorite schist
94 - 96	Argillite

Logged by Lowrie.

DIAMOND DRILL HOLE LOG

D.D.H. #XRIA

Location ...	Third OTC
Elevation ...	1113'
Bearing at Collar	East
Dip at Collar ...	-50°

Interval	Description
3 - 19	Quartz chlorite biotite gneiss, with 4" and 6" quartz at 15' and 17'.
19- 79	Quartz chlorite schist with minor biotite
79-100	Quartz sericite schist, with disseminated pyrite and pyrrhotite. Heavy disseminated pyrite 91-92, & 98-100.
100-107	Quartz biotite sericite schist
107-113	Biotitic quartz chlorite schist
113-114	Few bands of argillite
114-117	Quartz chlorite schist
117-122	Dominantly argillite
122-143	Biotitic quartz chlorite schist

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. # MR 1B

Location Third OTC
Elevation 1113
Bearing at
Collar N 45° E
Dip at Collar -22°

Interval	Description
0 - 100	Quartz chlorite biotite schist
100- 113	Quartz sericite schist & disseminated pyrite.

Hole suspended because of drilling difficulties.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. #XR3

Location ..... Third Outcrop
Elevation 1076
Bearing at Collar East
Dip at Collar .... -40°

Log Interval	Description
2 - 21	Quartz biotite gneiss
21 - 69	Quartz chlorite biotite schist
69 - 72	As above - hornblendic & garnetiferous
72 - 110	Quartz chlorite schist, plus hornblende and biotite.
110- 122	Quartz biotite sericite schist & disseminated pyrite.
122-125	Massive pyrite
125- 127	Sericite schist & dissem. pyrite
127- 132	Massive pyrite
132- 138	Quartz sericite schist & dissem. pyrite
138- 151	Quartz chlorite biotite schist.

Logged by Lowrie

ANALYSIS

ECSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	Core Length To	Cu %	Fe %	Zn %	S %
61	DDH XR3	Pyrite	121.5	125	.4	38.4	1.7	42.2
62	"	Pyrite, 2' core lost. 8" waste included in sample	127	135	.5	32.1	0.5	33.1

DIAMOND DRILL HOLE LOG

D.D.H. #XR4

Location ..... Third OTC
Elevation..... 1096
Bearing at Collar.. East
Dip at Collar..... -55°

Log Interval	Description
1 - 73	Quartz chlorite schists, biotitic with hornblendic quartzite at 21-28'
73 - 76	Quartz chlorite schist, sericitic with disseminated pyrite.
76 - 92	Quartz biotite schist and disseminated pyrite.
92 - 98	Quartz chlorite sericite schist with heavy disseminated pyrite.
98 - 108	Quartz biotite schist with disseminated pyrite and some sericite.
108 - 130	Quartz chlorite biotite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. #XR4A

Location	Third OTC
Elevation	1096
Bearing at Collar	East
Dip at Collar	-30°

Log Interval	Description
1 - 12	Biotitic quartz chlorite schist
12 - 16	Hornblende quartzite
16 - 43	Quartz chlorite schist, hornblendic to biotitic
43 - 62	Quartz biotite schist, sericitic, with disseminated pyrite.
62 - 63	1' massive pyrite & pyrrhotite
63 - 68	Quartz chlorite sericite schist, with disseminated pyrite.
68 - 69	Argillaceous quartzite.
69 - 84	Quartz chlorite biotite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. AXR5

Location	Third OTC
Elevation	1092
Bearing at Collar	East
Dip at Collar	-40°

Log Interval	Description
1 - 91	Quartz chlorite biotite schist with short intervals of biotitic quartzites.
81 - 96	Quartz sericite schist and dissem. pyrite.
96 -110	Massive pyrite
110-111	Quartz sericite schist
111-113½	Massive pyrite, some chalcopyrite
113½-115	Quartz sericite schist & dissem. pyrite
115-130	Quartz chlorite schist, minor sericite.

Logged by Lowrie

ANALYSIS

ECSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	to	Cu %	Fe %	Zn %	S %
63	DDH XR5	Pyrite	96	101	.5	42.6	3.7	48.3
64	"	"	101	107	1.1	44.8	1.7	49.2
65	"	"	107	113	.3	34.8	1.4	34.9

DIAMOND DRILL HOLE LOG

D.D.H. #XR 5A

Location	Third OTC
Elevation	1092
Bearing at Collar	East
Dip at collar	-55°

Log Interval	Description
0 - 45	Quartz chlorite schist, minor hornblende and biotite.
45 - 95	Biotitic quartzite
46 - 95	Quartz chlorite schist, minor biotite, garnetiferous from 87
95 - 96	Quartz chlorite schist, disseminated pyrite & pyrrhotite.
96 -116	Quartz chlorite schist, biotitic as above with sericite.
121-130	Chlorite schist
130-134	Quartz sericite schist & disseminated pyrite
134-144	Quartz sericite schist with heavy disseminations of pyrite and pyrrhotite, at 135-139.
144-148	Quartz stringer, minor dissem. pyrite, pyrrhotite at 147.
148-149	Quartz biotite schist, with minor chlorite.

Logged by Lowrie.

DIAMOND DRILL HOLE LOG

D.D.H. #XR6

Location	Third OTC
Elevation	1115
Bearing at Collar	West
Dip at collar	-30°

Log Interval	Description
0 - 33	Quartz chlorite schist, biotitic to hornblendic in places. Hornblendic quartzite at 11-18'.
33 - 49	Quartz sericite schist & dissem. pyrite.
49 - 51	Almost massive pyrrhotite, pyrite and chalcopyrite.
51 - 56	Quartz chlorite schist, dissem. pyrrhotite and chalcopyrite.
56 - 61	Biotitic quartz chlorite schist.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. #XR6A

Location	Third OTC
Elevation	1115'
Bearing at Collar	East
Dip at Collar	-45°

Log Interval	Description
0 - 13	Quartz chlorite schist
13 - 24	Quartz hornblende schist
24 - 42	Quartz chlorite schist
42 - 50	Quartz sericite schist & disseminated pyrite. 3 in. pyrite at 47.
50 - 64	Quartz chlorite sericite schist & dissem. pyrite. 3 in. pyrite & pyrrhotite at 64'.
64 - 81	Sericite quartz chlorite schist & dissem. pyrite. 2 in. chalcopyrite & pyrrhotite at 67.
81 - 96	Quartz chlorite schist, biotitic.

Logged by Lowrie.

DIAMOND DRILL HOLE LOG

D.D.H. #XR7

Location	Third OTC
Elevation	1098
Bearing at Collar	East
Dip at Collar	-30°

Log Interval	Description
2 - 72	Quartz chlorite schist with biotitic quartzites at 42-45, 52-54, 65-67.
72 - 76	Quartz biotite sericite schist with dissem. pyrite, pyrrhotite & chalcopyrite.
76 -101	Quartz biotite sericite schist & dissem. pyrite. 4" heavy disseminations at 84'.
101-103	Quartz stringer.

Logged by Lowrie

DIAMOND DRILL HOLE LOG

D.D.H. #XR7A

Location	Third OTC
Elevation	1098
Bearing at Collar	East
Dip at Collar	-45°

Log Interval	Description
0 - 92	Quartz chlorite schist - hornblendic quartzites at 15-18, 33-40, biotitic at 56-60, 73-82.
92 - 98	Quartz chlorite biotite sericite schist & dissem. pyrite, pyrrhotite & chalcopyrite.
98 -105	Massive pyrite, some sphalerite
105-107	Sericite schist.
107-118	Quartz chlorite schist.

Logged by Lowrie.

ANALYSIS

ROSTALL RIVER

SULGAS PROPERTIES

No.	Location	Description	Core Length From	To	Cu %	Fe %	Zn %	S %
66	DDH XR7A	Pyrite	98	105	.4	42.5	2.6	45.8

DIAMOND DRILL HOLE LOG

D.D.H. #XR8

Location	Third OTC
Elevation	1101
Bearing at Collar	East
Dip at Collar	-55°

Log Interval	Description
0 - 12	Quartz chlorite schist, hornblendic
12 - 20	Quartz chlorite schist.
20 - 21	Argillite
21 - 55	Quartz chlorite schist.
55 -102	Dominantly biotitic to hornblendic quartzites, with intercaled quartz chlorite schists at 61-62, 67-68, 73-93.
102-117	Quartz biotite schist, minor chlorite. Quartzitic.
117-138	Quartz biotite schist, minor sericite and disseminated pyrite.
138-145	Quartz biotite schist. Quartzitic.

Logged by Lowrie.