COMMONWEALTH OF AUSTRALIA.

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**DEPARTMENT OF NATIONAL DEVELOPMENT.**

# BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

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**RECORDS:**

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1943/39



GEOLOGICAL REPORT N THE EVERTON MOLYBDENITE-BEARING AREA

DEPARTMENT OF SUPPLY & SHIPPING.

Mineral Resources Survey Branch.

# GEOLOGICAL REPORT ON THE EVERTON MOLYBDENITE-BEARING AREA.

Report No. 1943/39.

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## INTRODUCTION.

### Mapping.

The Everton molybdenite-bearing area was examined by N.H.Fisher and H.B.Owen on June 16th-19th and June23rd, and again by N.H.Fisher on August 17th. All accessible underground workings were mapped in detail on a scale of 20 feet to 1 inch and the surface in the immediate vicinity of the mines was mapped by plane table on a scale of 100 feet to 1 inch. Plans prepared to accompany this report comprise -

Plate 1 - Surface plan, showing the lode outcrops and the surface workings, the boundary of the granite boss in which the orebodies occur, and contours at 20' intervals, scale 1" - 100'.

Plate 2 - Plans of the adit levels of No. 1 and 2 pipes, showing the displacement of the No. 1 pipe by the main fault, scale 1" - 40'.

Plate 3 - Plans of the 60' level, No. 1 pipe and the 37' level, No. 2 pipe, scale 1" - 40'.

Plate 4 - Cross section through Nos. 1 and 2 pipes in a north-westerly direction, scale 1" - 40'.

Plate 5 - Longitudinal projection of No. 1 pipe, showing the distribution of the values and the lode thickness, scale 1" - 40'.

Plate 6 - Longitudinal projection of No. 2 pipe, scale 1" - 40'.

Plate 7 - Block diagram illustrating the structure and relationships of the orebodies, scale 1" - 40'.

### Situation.

Everton township is 13 miles just south of east from Wangaratta along the main road to Bright and the molybdenite mine is 2½ miles north-east of the township. A road leads right to the mill and the workings. Everton Railway Station, which is the junction of the lines to Bright and Beechworth, is two miles to the west, and the Everton-Beechworth line passes within a quarter of a mile of the mine. The two orebodies that have been worked outcrop on the lower slopes of a ridge which rises steeply north and east of the workings two to three hundred feet above the level of the flat country to the southwest.

### Timber and Water.

Timber for mining purposes is scarce near the mine, but readily obtainable within a mile or so.

Water for milling and mining is pumped from the old workings on No. 1 pipe, at the rate of about 9,000 gallons per full working day of eight hours. The mine collects a small quantity

of storm water in addition to the ground water, which is estimated, from the amount that had to be pumped when the mine was being worked to the 152' level to be about 6,000 gallons per day. Water level at present is between 60 and 75 feet, according to the amount that has recently been pumped, and is steadily lowered when the mine and plant are working one shift. During earlier operations water was brought from the head of Hodgson's Creek by a race 6 miles long but as the water was not being returned to the same stream local residents protested and its use had to be discontinued. About a quarter of a mile south of the mine, just across the railway line, a strong natural spring is reported to exist. Its delivery is not known exactly, but it constitutes a promising alternative water supply.

Previous Reports.

The following reports on the Everton molybdenite field by J.P.L.Kenny of the Victorian Geological Survey have been published:

1919 - Records of the Geological Survey of Victoria, Volume IV, Part 3 - Pages 295 to 299.

1923 and 1924 - Records of the Geological Survey of Victoria. Volume V, Part 2 - Pages 215 to 217.

1933 - Records of Geological Survey of Victoria, Volume V, Part 4 - Pages 493 and 494.

1937 - Mining and Geological Journal, Volume I, No. 2, Page 27.

A later report was prepared by Mr. Kenny in May, 1943.

HISTORY.

The main mine, referred to as the No. 1 orebody, was opened up by the Standard Molybdenite Company towards the end of last war, and mining commenced apparently in April, 1918. A flotation plant was completed in 1922 and the company continued to operate until 1926. The pipe was mined out from the adit level down to about 60 feet depth, the recovery averaging 2.3% $MoS_2$. After lying idle for several years the mine was taken up by Yack Conglomerate, N.L., and production began again in 1937. By the end of 1940 the main pipe had been worked out, except for a block of low grade ore, to a depth of 152 feet below the adit level, and the mine was then again closed. In 1942 work was resumed by the same company, but the old mine was not reopened, the No. 2 orebody, 300' to the south-east, being developed instead. A shaft was sunk 52 feet on the best portion of this orebody and a level opened out at 37 feet depth. The ore milled up to the present has come mainly from development work and from a stope west of the shaft. Stoping is now in progress north of the shaft.

The following table gives the production from the mine as far as obtainable up to the end of 1941. Some of the figures given in the official returns of the Victorian Mines Department refer to concentrates containing 84 or 85% $MoS_2$ and these have all been recalculated to the basis of 90% concentrates. Figures for 1937-40 have been obtained from the records of Yack Conglomerate, N.L., also recalculated to 90% concentrates.

PRODUCTION TABLE, NO. 1 OREBODY.

| Year | Tons of Ore Treated | Average value recovered, percentage $MoS_2$ | Tons concentrates produced 90% $MoS_2$ | Total Value £A |
|---|---|---|---|---|
| 1917-18 | 80 x | - | 4.0 / | 1367 |
| 1919-20 | 126 x | - | 9.7 / | 3616 |
| 1921 | 105 ø | - | 0.2 / | 70 |
| 1922 | 591 | - | 13.3 / | 2550 |
| 1923 | 2000 | 2.13 | 47.2 | 6250 |
| 1924 | 1580 | 2.26 | 39.7 | 4850 |
| 1925 | 1156 | 2.51 | 32.3 | 5545 |
| 1926 | 1371 | 2.58 | 39.3 | 7350 |
| 1927-36 | Nil | - | Nil | - |
| 1937 | 1532 | 1.7 | 28.9 | 5587 |
| 1938 | 3665 | .86 | 35.3 | 7517 |
| 1939 | 2551 | .91 | 25.7 | 5141 |
| 1940 | 2457 @ | .72 | 19.8 | 4709 |
| 1941 | Nil | - | Nil | - |
| Totals | 17,214 | 1.54 | 295.3 | £54,551 |

x Hand-picked ore.
/ Estimated from values, concentrates produced not recorded.
ø 100 tons crude ore and 5 tons hand-picked.
@ Includes 700 tons from No. 3 adit, No. 2 Orebody.

During 1942-43 approximately 2,700 tons have been broken from the No. 2 pipe for a return of 11 tons of concentrates, equivalent to a recovery of .37% $MoS_2$.

GENERAL GEOLOGY.

The country rock of the molybdenite orebodies is a medium-grained porphyritic granodiorite, which is intrusive into regionally metamorphosed slate and sandstone, probably of lower Ordovician age. These rocks are referred to in this report as granite and schist respectively. Near the granite contact the schist has been altered to hornfels. It strikes north to north north-west and dips very steeply, generally to the west.

The granite outcrops as a series of bosses, from one acre to more than 30 acres in extent. There are undoubtedly apophyses from an underlying granite mass, which is exposed over a considerable area north of Hodgsons Creek. This granite is referred to by Kenny as part of the main Beechworth granite. The bosses outcrop along a line of ridges which trend about 10 degrees west of north and which undoubtedly owe their elevation to the resistant character of the contact metamorphic rocks adjacent to and overlying the granite. The different granite bosses are referred to by the numbers given to them by J.P.L.Kenny and their position with reference to the No. 1 Orebody is as follows:

No. 1 outcrop; 10 chains north. No. 2 outcrop; contains the orebodies. No. 3 outcrop; 14 chains east-southeast. No. 4 outcrop; 74 chains south-southeast. No. 5 outcrop; 1 mile 16 chains south. No. 6 outcrop; 1½ miles south.

Various types of dykes are found intruding both the schist and the granite, more usually the former. For details of

the general geology of the area reference should be made to J.P.L. Kenny's report, Records of the Geological Survey of Victoria, Volume IV, Part 3, and in particular to Plate XLVII.

The No. 1 orebody outcrops at the north-west corner of the No. 2 granite boss, the surface extent of which is about 16 acres, and the No. 2 orebody is situated centrally in the northern half of the outcrop. Except for a few hundred feet near the mill, which is covered by alluvium and tailings dumps, the boundary of the granite can readily be traced on the surface. A porphyrite dyke outcrops near the top of the ridge above the No. 2 workings, just outside the granite contact.

Twenty-five specimens for petrological examination were collected, mainly from the orebodies, but also from the various granite outcrops. Dr. F. L. Stillwell's report is attached as an appendix to this report. The locations of most of the specimens are shown on the accompanying plans.

## ECONOMIC GEOLOGY.

### Manner of Ore Occurrence.

The orebodies that have been shown to contain molybdenite in payable quantities are in the form of steeply dipping annular zones of mineralisation surrounding a barren core. Dr. Stillwell's petrological examination indicates that there is a definite petrological distinction between the granodiorite and the core rocks, which he classifies as a quartz-biotite-porphyrite, and that the cores are intrusive porphyritic plugs. In the workings it is difficult to recognize by visual examination the distinction between the various types. The obviously porphyritic phases are confined to the cores, but they usually seem to grade off into granitic types.

The orebodies have been formed by mineralisation of the granodiorite around the margins of the porphyritic cores. For convenience they are referred to as pipes; the orebody worked in the old mine is called the No. 1 pipe, and that in the present workings to the south-east is known as the No. 2 pipe. The ore consists of quartz and granite in varying proportions. The quartz may occur as narrow veins and stringers or as large irregular masses which follow the general course of the pipe but seem to obey no other structural rules. Many of them are flat-lying, some dip steeply and they may be lenticular in any direction. The molybdenite is found disseminated through the granite, and in blebs or along seams, in the quartz, or along the contact of quartz and granite. A particularly common type of occurrence, not only in the pipes, but elsewhere throughout the granite bosses, is as a thin rich facing along the walls of narrow quartz seams. Mining experience has shown that the best values are in granite associated with quartz. If large masses of quartz are present the molybdenite is usually sparsely distributed through it, and the grade in the granite soon drops off away from the quartz, and payable ore is seldom found in granite which does not carry some quartz.

The proportion of quartz, particularly of large masses of quartz, is higher in the No. 2 pipe than in the No. 1, in which quartz occurred only as narrow veins, seldom more than an inch or so in thickness.

The nature of the molybdenite is also said to be different in the two orebodies; in the No. 2 pipe it is brighter in appearance and apparently more flaky, as ore which appears to be the same grade as from No. 1 always gives a much lower return of molybdenite, signifying that the mineral particles have not the

same body as the molybdenite in No. 1 pipe. The only other minerals noticed were pyrite, often along fractures, and a small amount of chalcopyrite. Calcite is also recorded by Dr. Stillwell from the cores of drill holes put down from the 37' level of No. 2 orebody. The character of the mineralisation, the nature of the wall rock alteration (refer to Appendix I) and the general geological environment suggest mesothermal rather than hypothermal conditions of ore deposition.

The walls of the orebodies are seldom well-defined; occasionally they may coincide for a short distance with fractures in the granite, and in parts of the No. 2 pipe the wall of solid quartz masses is locally near enough to the wall of the lode. In the high grade portions values die out fairly rapidly on the inner and outer walls, but in the poorer sections considerable difficulty has often been experienced in following and defining the ore. The rock is very hard and difficult to bore and the cost of breaking ore is correspondingly high.

Structural Features.

Fracturing and faulting are very common in the orebodies, but the faulting is as a rule of small displacement, with the exception of the main flat fault at adit level on the No. 1 pipe. The fracturing is made use of extensively in mining, as the granite breaks to the nearest fracture, and it has been found possible to achieve a much higher standard of efficiency by limiting the length of the drill holes according to the position of the nearest fracture plane. It is difficult to establish any regular pattern for the fracturing and faulting, except that their strike tends to be either roughly parallel or at right angles to the walls of the orebodies, but their dip is very variable. A fairly common type is a nearly flat fault or fracture. Many of these were noticed in No. 2 pipe, particularly on the eastern side, with a dip towards the core of the pipe of about 5 degrees. Several of the stronger fracture planes were observed to displace steeply dipping veins of quartz and molybdenite by amounts varying up to nearly 2 feet, the displacement in every case being inwards towards the core on the top side of the fault. As these faults were observed only on the east side of the No. 2 orebody, the movement is probably complementary to that shown by the main fault on No. 1 orebody. Faulting and fracturing is nearly all pre-ore, as many of the faults carry mineralisation. That some movement has taken place subsequent to ore deposition is shown by strong slickensiding on massive molybdenite found along a fault plane on the north side of No. 1 pipe. The main fault on the No. 1 pipe, which strikes 80° east and dips to the north at 12 degrees or less, displaces the upper portion of the pipe 15 to 25 feet in a northeasterly direction. If it be accepted that the core of the pipe is the result of a later intrusion, then it is obvious that the faulting occurred after this intrusion, but before the mineralisation.

No. 1 Pipe.

The outcrop of this orebody included a narrow lens of rich ore, said to be 1 foot 6 inches wide and carrying 5% molybdenite. This high grade portion actually occupied the contact of the schist and granite, even protruding into the schist a little, and molybdenite can still be found on the walls in the schist. At the point where the schist contact diverges from the pipe on the north side, the space between the contact and the pipe is occupied by 6 feet width of quartz mineralisation carrying an occasional speck of molybdenite. Only a little ore has been mined from the surface, but enough has been done to define the northeastern half of the ring clearly enough, though values for the most part seem to be low. The southwest half of the pipe is obscured by overburden, but it apparently abuts against the schist contact (Plates 1 and 7).

The best exposure of the lode formation is seen on the adit level, which was the main working level of the old mine. A strong fault or fault zone here displaces the upper portion of the pipe to the northwest and the fault is well exposed in the open cut and in the old workings, dipping at an average angle of 12 degrees to the north above the adit level, and flattening out slightly below. The fault is earlier than the mineralisation, as the outline of the pipe and the grade of the ore above and below the fault did not correspond, and the fault itself carried considerable mineralisation, extending some 45 feet along the fault plane to the southeast, where a very rich pocket of molybdenite was taken out. It is this mineralisation along the fault, together with the displacement of the southeastern side of the orebody above the fault into the position of the core below the fault (Plate 2), that caused the pipe to be described in earlier reports as a dome-shaped orebody, the flat fault forming the cap of the dome. The fault appears to have acted to a considerable extent as a cut-off to the mineralisation, as the molybdenite content of the pipe was much lower above the fault than below. The pipe has been stoped above the level for only 10 feet or so, except on the northwest side where ore has been taken out for a height of up to 35 feet at one place and a small connection put through to the surface (Plates 4 and 5). In the westerly corner of the orebody a sort of satellite pipe is said to have been locally developed (Plate 2). Mineralisation on the western side is locally irregular and not well defined, probably due to proximity of the schist contact and to the dislocation of the course of the mineralising solutions by the fault. The remainder of the pipe is better defined and three samples were taken above the level, Nos. 1 and 2 in the wide portion near the shaft and No. 3 on the northern side. Their position is shown on Plate 2. These samples were assayed by the Victorian Mines Laboratory for the following results.

| No. | Location. | Width. | % $MoS_2$: |
|---|---|---|---|
| 1 | Near shaft, 10 feet above adit level, from core outwards. | 8'3" | |
| 2 | Continuation of No.1. | 4'6" | |
| 3 | North side of pipe, 6' above level. | 7' | |

The volume of the pipe which remains unstoped above the level amounts to about 2,000 tons. Little is known of the grade, apart from the above samples, except that it was considered too low to work in former times. However, it is worth noting that the ore mined in those days returned over 2% $MoS_2$ and it is quite possible that with the present high prices and with improved mill recoveries this block may contain a worthwhile proportion of payable ore.

Ore below the fault was of good grade around the whole circumference of the pipe down to the 60' level. The yield obtained by the Standard Molybdenite Company from 1923 to 1926 averaged 2.3% $MoS_2$, and the recovery for individual years was close to this average, with no diminution of value down to the 60' level (refer to Production Table, page 3). A series of twelve samples taken on the 60' level by J. R. Godfrey prior to re-opening the mine averaged 4.6% $MoS_2$ for a mean width of 6'5". Below the 60' level values were still high down to about 75 feet below the adit level. Here the orebody belled out at 45 degrees everywhere except the section from 30 feet west to 50 feet east and south of the shaft, (Plate 7), and the values decreased, though not to such an extent on the flatter portion as in the section that remained steep. At about the 115' level the orebody resumed the normal steep dip and values decreased sharply, though the width increased from an average of 7 feet above the 115' level to nearly 15 feet at the 152' level.

The belling out of the lode has had a decided effect upon the distribution of the molybdenite. The quantity of molybdenite per vertical foot in the constricted portion down to 70 feet depth was considerably greater than that below, despite the increased diameter on the lower levels, and, on the 152' level, the increased width of ore. The grade began to increase downwards at the top of the belled-out section and decreased very markedly where the dip steepened again. The drive on the 115' level, just at the bottom of the flatter section, was in poor ore, but the grade improved noticeably in the stopes above. The stopes above the 152' level were still in poor average ore, though the level itself was considered to be slightly better. On the western side of the orebody the grade of the ore was good right to the bottom level.

The average recoverable grade of the ore decreased from nearly 2% immediately below the 60' level, to .6% on the 152' level. The percentage recovery for each quarter during the period 1937-1940 is graphically illustrated in Plate 8. During that time 10,205 tons returned 114 tons of concentrates, equivalent to a recovery of very nearly 1% $MoS_2$. The graph shows how the general grade decreased as the workings became deeper. The high values during the first quarter of 1939 must correspond to an especially rich shoot of ore, and the improved recoveries in the final period are obtained from the drawing off of rich pillars. The grade recovered during most of 1939 and 1940, when all the ore was being obtained from below the 115' level, varies between .55 and .75. The lowest returns were in March and April, 1940, when 700 tons of ore from No. 3 adit were included in the mill heads and recoveries dropped below .4% for several weeks. It appears that .6% $MoS_2$ can safely be adopted as the recoverable grade of the ore below the 115' level. The block of ore remaining above the level is shown on Plate 5. Southwards from the shaft, that is, in a clockwise direction, the lode has been stoped for an average height of 16 feet above the level over a length of about 230 feet. West of the shaft no stoping was done and the drive was not connected through on the 152' level. About 15 feet from the shaft the ore cut out . On the level above a similar feature was noticed; good values were found for twenty feet from the shaft and the next twenty feet contained very little molybdenite. Dr. Jack estimated that 4,000 tons remain unstoped between the 115' and 152' levels, but this estimate is conservative and it is not unreasonable to expect 5,000 tons exclusive of a pillar on either side of the shaft.

No. 2 Pipe.

The present working shaft on the southeast side of the No. 2 pipe is 340 feet southeast from the old main shaft, but the two orebodies at the nearest point are only 150 feet apart. On the surface the No. 2 pipe, which is much larger than the No. 1, can be traced continuously from the present working shaft northwards through the open cut above the No. 3 adit and then west along the contour of the hillside, where it appears as sporadic outcrops of massive quartz in which little mineralisation can be seen. At the northwest corner an irregular line of quartz veining makes off in the direction of No. 1 adit and this can be followed across to and through the open cut workings above the adit level on that orebody (Plate 1). From the northwest corner the No. 2 pipe outcrop can be traced downhill to the No. 2 open cut and back to the open stope west of the shaft. In No. 2 open cut fair values of molybdenite in quartz and granite are exposed over a depth of 20 feet. The best ore on the surface was found at the southeast end of the pipe, near the shaft and to the west of it, where it is well exposed in the open stope which has been brought up from the level below. North of the shaft the grade on the surface is fairly poor, though a rise put up from the 37' level about 30 feet north of the shaft was in good ore over the full width (15 feet) right up to the top, 34 feet 6 inches above the rails, i.e. within three feet of the level of the collar of the shaft.

No. 3 adit was driven in the early days of the field, partly in the silicified porphyritic core, and partly on the orebody. It was subsequently opened out for a length of 80 feet or so to practically the full width of the lode, which consists largely of massive bodies of quartz and is said to carry ¼ to ½% $MoS_2$. A winze was sunk on the best ore 80 feet from the portal of the adit, but at a depth of 10 feet the values had faded away. This winze was later connected through to the level below. The probable outline of the pipe on the adit level (Plate 2), where not exposed in the drive or in the open cut workings, is interpolated from the surface above. The average external diameter is 130 feet and the circumference of the core about 320 feet.

The shaft was sunk 52 feet from the surface, the first 30 feet entirely in ore, which then underlies to the west and passes out of the shaft at the bottom on the west side. On the 37' level drives have been opened out to the full width of the orebody for a distance of 65 feet west and northwest, on the left hand side of the pipe, and 90 feet northeast and north, on the right hand side. West of the shaft a stope has been taken up to the surface the full width of the orebody and the upper limit of the better quality ore was found to pitch to the northwest (Plate 6). On the level northeast of the shaft payable ore cuts out about 15 feet past the rise 40 feet from the shaft. The right hand wall in this section consists of schist which has been silicified and altered by contact metamorphism, and as it was not found to outcrop it is probably only an inclusion in the granite. At the end of the drive a rise in low grade ore connects to the No. 3 adit. The lode in this end of the drive consists mainly of granite with a little quartz and has been estimated to contain about ½% molybdenite.

Four diamond drills were put down from the floor of the level and the results, according to Mr. Kenny's latest report, are as follows. Their position is shown accurately on Plate 3.

| Bore No. | Bearing | Inclination | Average Assay Results % $MoS_2$. |
|---|---|---|---|
| 1 | 295° | 65° | 0'-11' - 1.13<br>15'-20' (not determined) |
| 2 | 271° | 76° | 0'- 9' - .61<br>9'-12' - n.d.<br>12'-21' - .37<br>21'-28'6" - n.d. |
| 3 | Vertical | Vertical | Abandoned at 8' |
| 4 | 74° | 68° | 0'-16' - .56<br>16'-23'6" - n.d. |

Of these bores No. 1 probably passed out of the orebody into the core, and No. 4 may quite easily have done likewise if the wall had a slight westerly dip. No. 2 is directed along the strike of the lode and is close to the inner wall throughout its depth. The fact that the bottom few feet of the holes did not carry determinable values therefore does not necessarily indicate that the ore has played out, and all that the bores can be said to have proved is that ore of similar grade to that on the level persists for at least 20 feet below it.

The ore remaining above the level is estimated at 2,500 tons, with a further possible 800 tons if the lower limit of the payable ore above the 37' level should repeat the pitch to the left shown by the upper limit of the shoot (Plate 6). Ore

below the level can only be estimated on the assumption that the dimensions on the level will be maintained below it, and this would amount to 130 tons per vertical foot. Recoverable grade is taken as .5% $MoS_2$.

It is always possible of course that further driving on the course of the pipe or diamond drilling may disclose other shoots of ore. The present proposal for development of the orebody is to sink a new shaft in the No. 2 open cut, the floor of which is already 10' below the collar of the shaft in use. From this it would be possible to mine out the ore around the old shaft. The proposed site is shown on Plates 1 and 6. The wall of the open cut here carries fair grade ore, which would help to pay for the sinking of the shaft, and the site also has the advantage that the ore being mined above the 37' level is pitching towards it.

Origin of the Ore.

If it be accepted that the cores of the pipes are porphyritic plugs intrusive into the granodiorite, then the explanation of the shape of the orebodies is greatly simplified. The ore-bearing solutions have made their way/around the margin of the intrusive, filling the fractures with quartz and mineralising the adjacent granodiorite. Contraction of the plug on cooling may have helped to make the periphery of the core more susceptible to mineralisation, and it is possible that torsional stress may also have contributed towards defining the locus of the ore. A study of the plan of the No. 1 pipe above and below the main fault (Plate 2) suggests that the displacement has been rotary as well as lateral and that the bottom portion of the orebody has turned in a clockwise direction relative to the upper portion.

The granodiorite and the porphyrite are undoubtedly consanguineous, as indicated by Dr. Stillwell, and the mineralising solutions are later emanations from the same magma. Sufficient time elapsed between the intrusion of the core and the mineralisation to enable the faulting to take place.

The fault seems to have played an important part in the distribution of the mineralisation, and by acting as a dam to the rising solutions below it, has been responsible for the high values down to the 60' level. The decrease in molybdenite content below that level to .6 per cent/merely represent a return to what might be regarded as the normal value of the ore. If this is correct the prospects of the pipe below the bottom level are better than would be expected by simply considering the decrease in grade downward illustrated in Plate 5 as a feature which would continue until the ore cut out at no great depth below the bottom level. Some support is lent to this theory by the fact that the drive on the 152' level was reported to carry slightly better grade ore than the stopes above it.

It is possible also that its proximity to the schist contact has had some effect upon the concentration of ore in the No. 1 pipe. The pipe must have abutted against the schist at no great height above the present surface and this also probably helped to confine the mineralisation within the upper portion of the pipe.

The lower grade of ore in No. 2 pipe may be partly due to its larger size and partly due to the absence of the structural features which have favoured ore concentration in No. 1 pipe.

Other Areas.

A brief inspection was made of the outcrops of the other granite bosses and the workings thereon were examined. The most northerly outcrop, separated from the main granite mass only by alluvium, is probably continuous with it. The next one, the No. 1

outcrop, carries a considerable amount of scattered mineralisation but no defined orebody has been located. Molybdenite is often seen closely associated with small quartz seams and usually occurs as a veneer along the contact of the quartz seam with the granite. No large bodies of quartz were observed and on the whole mineralisation was not as intense throughout this granite boss as in that in which the proved orebodies occur, though it was noticeably more so than in any of the other granite outcrops.

In the No. 2 outcrop, which includes the mine workings, quartz stringers and veinlets up to 6 inches wide are abundant, particularly on the eastern side of the outcrop of No. 1 pipe. A line or zone of quartz veining can be followed across on the surface to the outcrop of No. 2 pipe, suggesting a fissuring in the granite connecting the two. Exposures are seldom good enough to enable the attitude of the small veins to be determined, but in the gully east of the mine the principal set of veins strikes north - west and dips nearly vertically with, in places, smaller veins striking 80 degrees west. Intensity of mineralisation is much greater in this outcrop than in any of the others and in a general way decreases away from the lode outcrops. Molybdenite can be seen in many places on the sides of small quartz veins, and shafts costeans and adits, e.g. No. 4 adit (Plate 1), have been put in at various places without revealing any promising formations.

The No. 3 granite outcrop to the east shows very little quartz veining or other signs of mineralisation. Workings are limited to one small cut in a gully and an old shaft down 45 feet.

On the No. 5 outcrop, one mile 15 chains south of the mine (refer to Kenny's plan, Plate XLVII) an adit has been driven 100 feet into the side of the hill in an east-southeasterly direction, underneath an outcrop of quartz 3 feet in width. The quartz, 3 to 4 feet wide, was struck in the adit at 75 feet and was driven on about 20 feet north and 6 feet south. From the drives the quartz, which dips vertically, appears to be circular in form, with a suggested diameter of about 60 feet. A little molybdenite can be seen in the south face but otherwise the formation consists of massive barren white quartz. The granite country evidently carries chalcopyrite in small crystals, especially in the core, for the walls of the adit are strongly copper-stained. This in the only occurrence apart from Nos. 1 and 2 pipes where the ring formation is in evidence.

On the No. 6 outcrop, which is some 40 acres in extent, quartz veinlets with a small amount of molybdenite can be found and a little prospecting has been done, but again no defined formation has been located.

Altogether the signs of mineralisation are much less abundant in these other outcrops than in the No. 2 near the mine. Diamond drilling, in the hope of locating new orebodies, could only be recommended if subsequent collecting, followed by petrological examination reveals further porphyritic bodies similar to those which form the core of Nos. 1 and 2 pipes, associated with other signs of mineralisation.

Comparison with other molybdenite orebodies.

A close geological parallel to the Everton pipes is presented by the huge Climax orebody in Colorado, U.S.A., though of course the difference in scale is tremendous. The Wonbah pipe near Mount Perry Queensland is also very similar, the chief point of difference being that the core of the Wonbah pipe is quartz and at Everton it is a porphyritic intrusive. The pipes at Kingsgate, Whipstick, Wolfram Camp and Bamford differ in their smaller size, less regular shape and mineralisation, and especially in the absence of the central barren core. On account of the similarity of size

the Wonbah pipe provides the most interesting comparison with the Everton No. 1 pipe and the various features of the two orebodies are tabulated below:-

Comparison Everton No. 1 Pipe with Wonbah.

| | Everton No. 1 | Wonbah |
|---|---|---|
| Depth Mined | 152' | 237' |
| Tonnage mined | 17212 | 13000' ? |
| Tonnage $MoS_2$ concentrates recovered | 295.3 | 87.6 |
| Average Recoverable grade of ore mined | 1.54% $MoS_2$ | .6% $MoS_2$ |
| Probable grade below bottom level | .6 - .7% $MoS_2$ | .6 - .7% $MoS_2$ |
| Tonnage per foot below bottom level | 250 to 300 | 100 |
| Tonnage $MoS_2$ concentrates per foot below bottom | 1.5 to 2 | .6 to .7 |
| Esternal Diameter of Pipes | 48' at adit level increasing irregularly to 110' at 152' level. | 40' at surface increasing fairly regularly to 66' at 237' level |
| Average width of ore | 7 - 8 feet down to 115' level increasing to 14' below | 11' - 15' down to 160' level, 8' below |
| Grade of ore | Decreases going down from 2.5 to .6 with increased size of the orebody. | Fairly constant as far as known. |
| Axis of Pipe | Vertical or slightly concave to northwest. | Dips northeast at 75° |
| Core of Pipe | Porphyry | Quartz |
| Country Rock | Granite boss, near schist contact. | Granite, not far from contact. |
| Gangue | Granite and quartz | Quartz, with some calcite. |
| Other Minerals | Small amounts of pyrite and chalcopyrite. | Small amounts of chalcopyrite, pyrite, galena and sphalerite. |
| Mode of occurrence of molybdenite | Along contact of quartz seams and granite, disseminated through the granite, or as bunches in the quartz. | As bunches or thin veins in the quartz. |
| Faulting | Upper portion displaced to northwest at adit level by flat pre-ore fault which has cut off the best values. | None reported. |

≠ 9591 tons are recorded up to the end of 1920 when the Wonbah Company ceased operations. Mining up till that time was entirely above the 160' (No. 2) level. Later records are incomplete, but the additional 3400 tons is calculated from the amount of mining which has been subsequently carried out, principally below the No. 2 level.

// The Everton production has been recalculated to 90% $MoS_2$ concentrates. The grade of the Wonbah concentrates was not reported but probably averaged between 85 and 90% $MoS_2$.

ø The lesser width below 160' level may be due to the fact that the mine was being operated by a small party who may have confined their operations to the higher grade ore which usually occurs near the periphery.

RESUME OF ORE RESERVES.

Ore remaining in the No. 1 pipe above the 152' level is estimated at 5,000 tons, probable grade .6% $MoS_2$, equivalent to 30 tons of molybdenite.

Ore below 152' level in the No. 1 pipe is estimated at 250 to 300 tons per foot of depth probable grade .6 to .7% $MoS_2$ equivalent to 1.5 to 2 tons of molybdenite.

Ore above adit level, 2000 tons, grade .5% $MoS_2$ equals 10 tons molybdenite.

Ore remaining in the No. 2 pipe above the 37' level is 2500 tons plus a possible 800 tons, grade .5% $MoS_2$ equivalent to 12.5 to 16.5 tons molybdenite.

Ore below the 37' level on the No. 2 pipe as at present developed is 130 tons per foot of depth, grade .5% $MoS_2$ equivalent to .65 tons of molybdenite.

A large proportion of the No. 2 Pipe is low grade or unexplored and some of this may be ore. The total volume of the pipe amounts to 400 to 450 tons per vertical foot.

RECOMMENDATIONS.

In view of the urgency of the need for increased production of molybdenite and the extreme scarcity of other likely producers in Australia, it is recommended that everything possible should be done to increase production at Everton to the maximum.

Steps to be taken include:-

1. Reaching a working agreement with the management of the mine.

2. Providing adequate labour to work, mine and mill three shifts.

3. Supplying the necessary additional mining and milling plant.

The old mine (No. 1 pipe) should be dewatered, the shaft timbered, and stoping of the block of ore left above the 152' level proceeded with as soon as possible and preparations made to stope below the level.

Because of the diminution in grade downwards of the ore in the main pipe, one would hesitate under other circumstances to recommend reopening the mine, but as the orebody does not lend itself

to testing by diamond drill, the risk of the values continuing to decrease must be faced, and in any case it is considered almost certain that the mine will be workable for at least another 50 feet of depth.

It will probably be most expedient to develop the lower levels of the No. 2 pipe by drives from the workings in No. 1. Waste rock from this development could be disposed of as filling in old or current stopes. In this work the possibility of exposing patches of ore corresponding to the line of quartz veining shown on the surface plan between the orebodies, should be remembered, and the drives should be put in along the northeastern side of the area between the pipes.

The No. 2 pipe can be prospected by diamond drilling more conveniently, although on account of the erratic distribution of mineralisation displayed by the workings on this pipe the diamond drill is by no means the ideal method of exploration. However, if the exploitation of these orebodies is to be undertaken, and if plant is readily available, diamond drilling has the advantage that it can be carried on concurrently with other development work. A programme of ten short holes, five to be drilled from each end of the 37' level, has been laid out, designed to test the pipe at 50' intervals on the 37' level and at a depth of 50 feet below it. The location of the proposed holes is shown on Plate 3 with their length and inclination, and they are also tabulated below:

| No. | Location | Bearing | Inclination | Length in feet |
|---|---|---|---|---|
| 1 | North end of the 37' level | 284 | Horizontal | 100 |
| 2 | Do. | 284 | -31° | 120 |
| 3 | Do. | 250 | Horizontal | 100 |
| 4 | Do. | 250 | -31° | 120 |
| 5 | Do. | 214 | -38° | 102 |
| 6 | Western end of the 37' level | 357 | Horizontal | 100 |
| 7 | Do. | 357 | -31° | 120 |
| 8 | Do. | 35 | -38° | 102 |
| 9 | Do. | 80 | -43° | 95 |
| 10 | Do. | 123 | -43° | 95 |

Total length of drilling in the programme outlined is 1054'. It is again emphasized that/decision to develop the mine should not wait upon the results of this diamond drilling, but should be implemented immediately and some working arrangement reached with the present management by which the production can be increased as soon as practicable.

/the

ACKNOWLEDGEMENTS.

Mr. W. A. Cameron, Manager of the mine, and other officials of Yack Conglomerate, N.L., have been most helpful and have readily made available the information in their possession regarding the orebodies. We are especially indebted to Mr. V. Nightingale, mine foreman, for supplying details of ore occurrence in both No. 1 and No. 2 pipes, and especially of that part of No. 1 pipe which is now below water level.

SUMMARY.

The Everton molybdenite orebodies are annular zones of mineralisation in porphyritic granodiorite surrounding quartz-

biotite-porphyrite cores. A resume of the features of the No. 1 pipe is given on page 11. The No. 2 pipe which is developed to 37 feet depth, is larger and of lower grade than No. 1 and only partly explored. Ore reserves in the No. 2 pipe are 2,500 to 3,300 tons of .5% ore, with 130 tons per foot of depth below the 37' level. Immediate development to maximum possible production from both pipes is recommended.

CANBERRA, A.C.T.
26th August, 1943.

N.H.FISHER,
Chief Geologist.

H.B.OWEN,
Geologist.

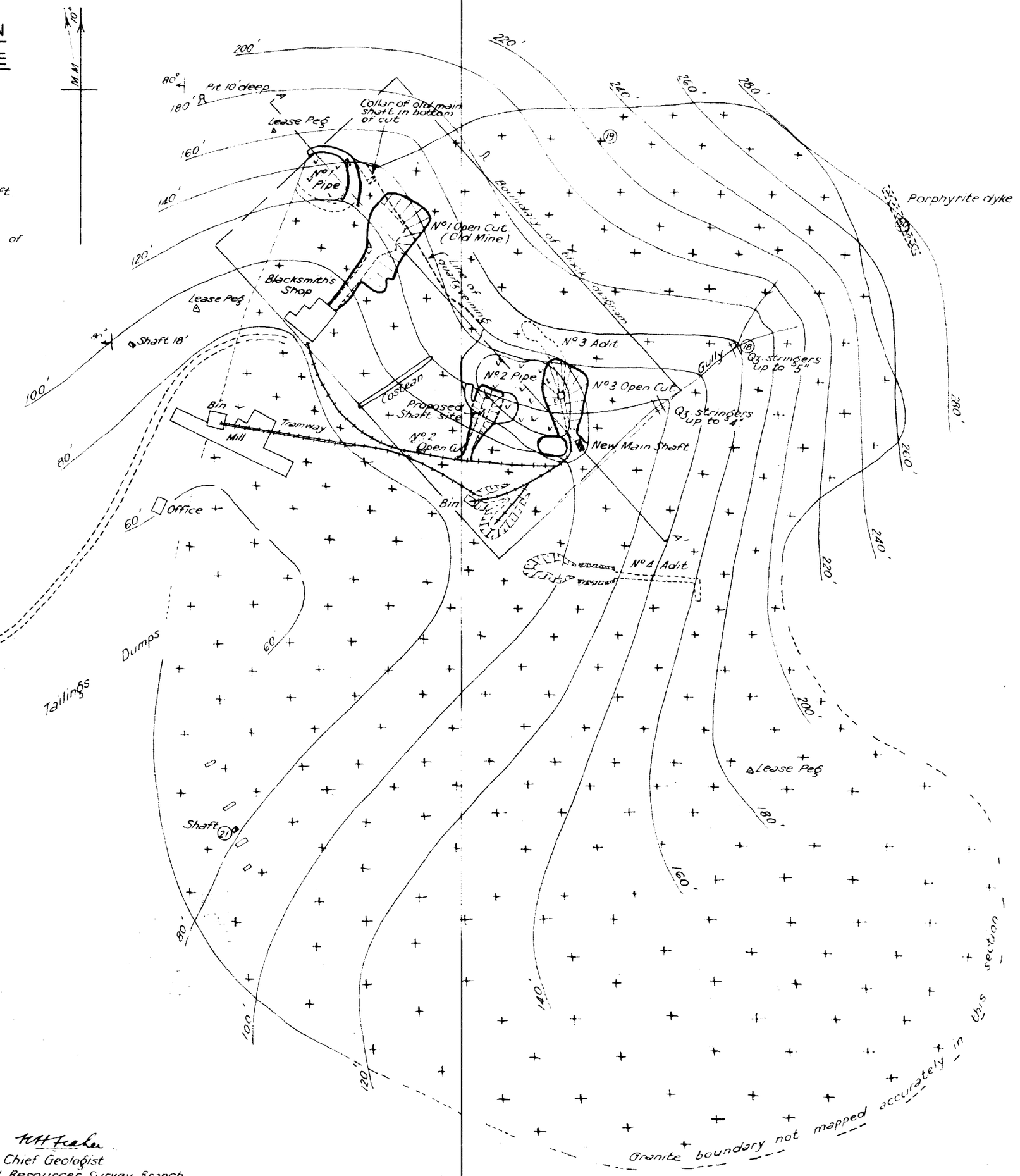
# SURFACE GEOLOGICAL PLAN
# EVERTON MOLYBDENITE MINE
## PORTION NO.5
## PARISH OF EVERTON
## COUNTY OF BOGONG
## VICTORIA

0 100 200 ft

Contours at 20' intervals. Datum is collar of New Main Shaft, taken to be 100'.

LEGEND

- Lode outcrop
- Granite
- Porphyry Core
- Schist, hornfels, etc. Lower Ordovician
- Quartz veins
- 80° Strike & dip
- A A' Section Line
- (21) Rock specimen for examination in thin section




H.H. Fraser
Chief Geologist
Mineral Resources Survey Branch
July 1943.

# LEVEL PLANS
## EVERTON MOLYBDENITE MINE
### ADIT LEVEL, NO.1 PIPE, R.L. 81'
### AND
### NO.3 ADIT LEVEL, NO.2 PIPE, R.L. 100'

0 — 40 — 80 FT.

M.M

Plane of projection of Longitudinal Section, Plate 5.

Boundary of Block Diagram

Section Line A-A'

Sample No 3
Outline of ore body on Level, R.L. 81'; above fault
No 1 Pipe
Sample No 1
Sample No 2
Old Main Shaft, collar
12° Main fault, dip flattens to north
12°
No 1 Open Cut
Outline of ore body below fault
Ore along fault
Patch of ore on top of fault 20' above level
Rich patch of ore under fault 13' above level
Blacksmith's Shop

55°
30-45°
Qz
Gte
170°
No 3 Adit R.L. 100'
20'
75°
Winze
Probable outline of ore body on No 3 Adit Level R.L. 100'
No 2 Pipe
50°
5'
50-60°
Silicified Gte
Banded Qz
65°
10°
No 2 Open Cut
Stoped below
Open Cut
New Main Shaft R.L. Collar 100' (adopted datum)

Plane of projection of Long' Section Plate 6

### LEGEND

- > 2% $MoS_2$
- 1 - 2% $MoS_2$
- ½ - 1% $MoS_2$
- < ½% $MoS_2$
- 30° — Fault
- 70° — Fractures
- (15) Rock specimens for examination in thin section
- Qz Quartz
- Gte Granite
- Country rock all granite outside pipes, porphyry within
- Ore quartz & granite carrying molybdenite

Chief Geologist
Mineral Resources Survey Branch
July 1943

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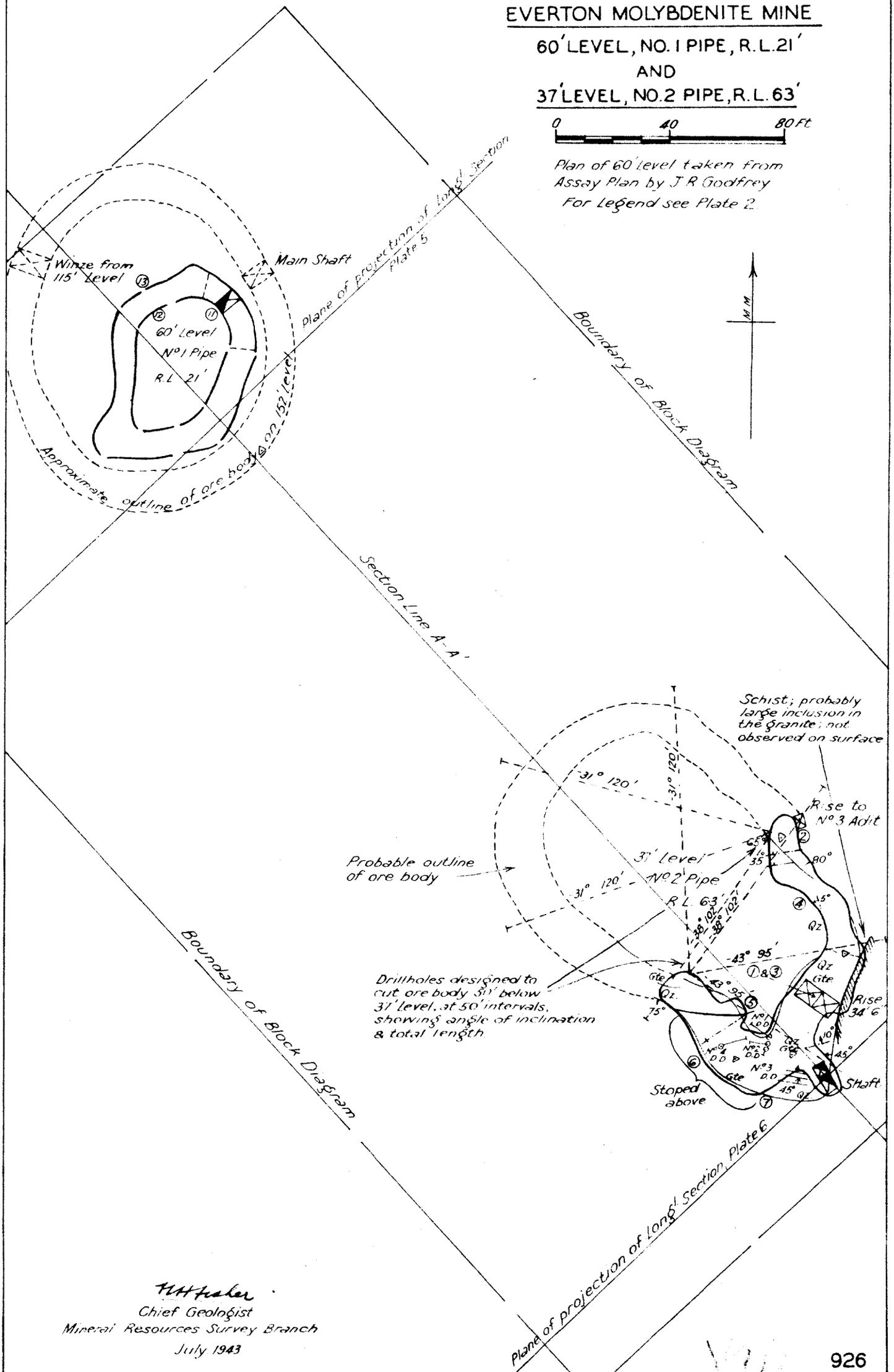
# LEVEL PLANS
# EVERTON MOLYBDENITE MINE
## 60' LEVEL, NO. 1 PIPE, R.L. 21'
## AND
## 37' LEVEL, NO. 2 PIPE, R.L. 63'

0 40 80 Ft

Plan of 60' level taken from Assay Plan by J.R. Godfrey
For Legend see Plate 2

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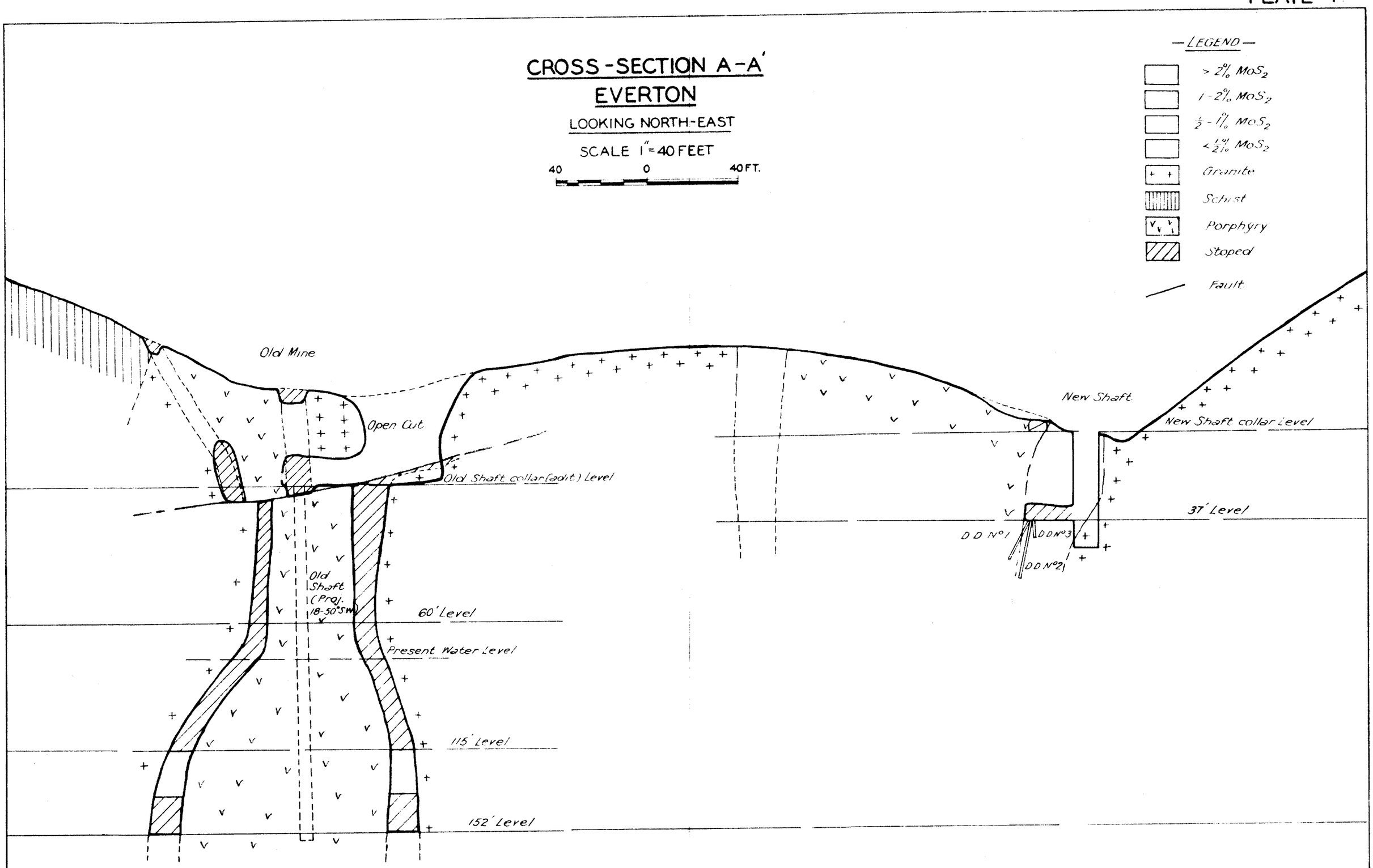
July 1943

# CROSS-SECTION A-A'
## EVERTON
LOOKING NORTH-EAST

SCALE 1"=40 FEET

40 0 40 FT.

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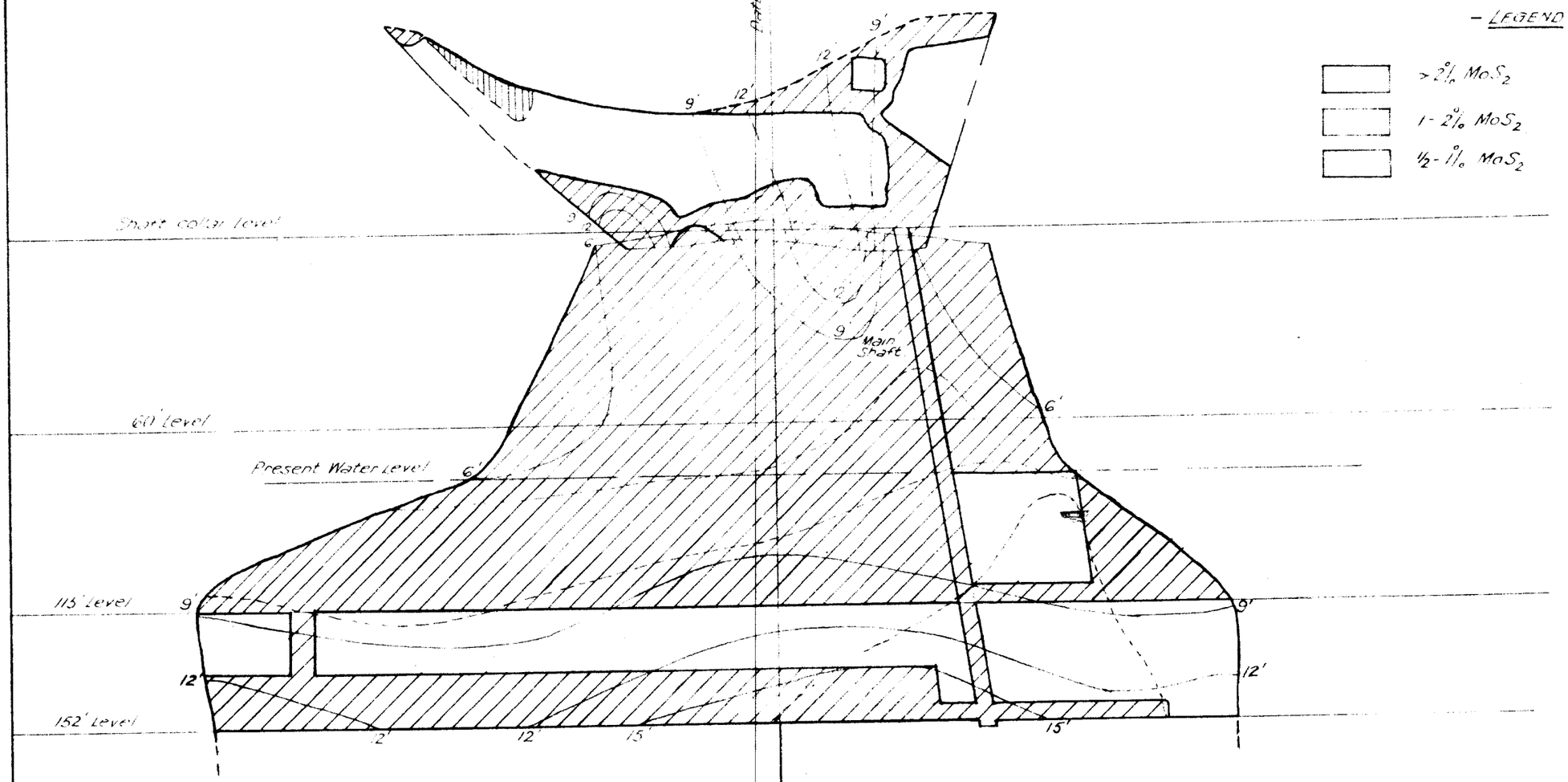
# LONGITUDINAL SECTION

# EVERTON OLD MINE

LOOKING NORTHWEST

0 40 80 FT.

In compiling this section the ore body is imagined to be opened out along Section Line A-A' & projected to a vertical plane at rightangles to that Section Line. The datum line represents the plane in which Section A-A' cuts the southeast side of the ore-body & the lateral extremities the corresponding plane on the north-west side.
length of ore is taken as the mean circumference on any level
Contours show ore thickness at 3' intervals
Both contours & grade lines are approximate only, being based on sketchy information, but are drawn to give a general picture of the ore-body




- LEGEND -

- > 2% $MoS_2$
- 1 - 2% $MoS_2$
- ½ - 1% $MoS_2$
- < ½% $MoS_2$
- Stoped
- Schist

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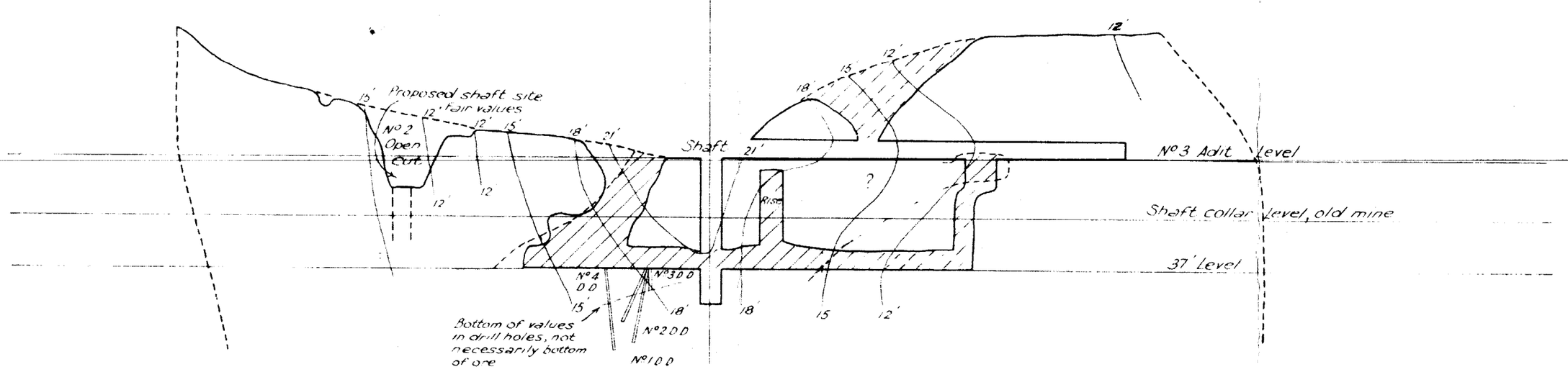
July 1943

# LONGITUDINAL SECTION
# EVERTON MOLYBDENITE MINE

LOOKING NORTHWEST

0 40 80 FT.

FOR EXPLANATION & LEGEND SEE PLATE 5.

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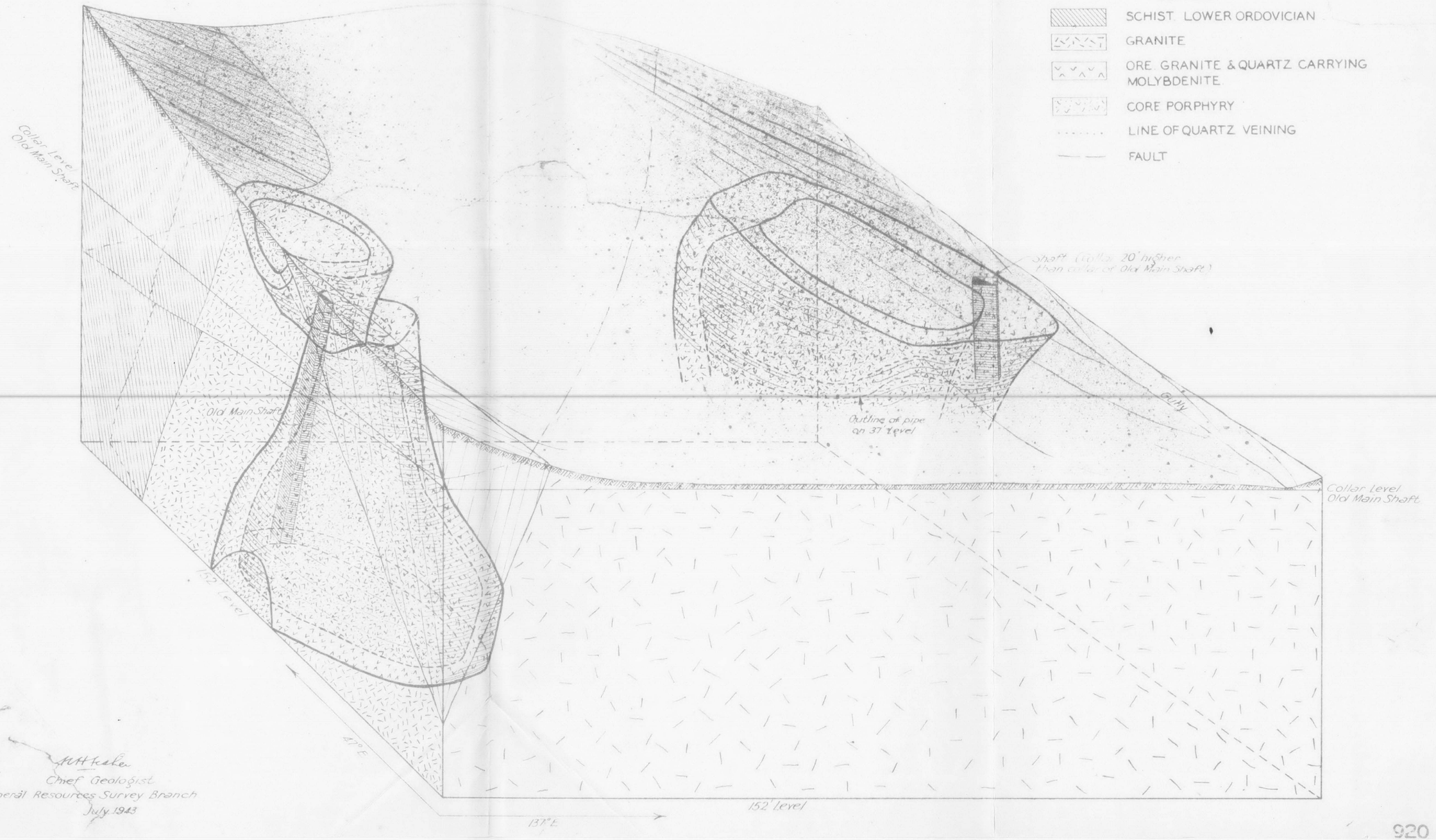
# BLOCK DIAGRAM
# EVERTON MOLYBDENITE ORE BODIES
# IN PARALLEL PERSPECTIVE

0 40 80 FT.

LEGEND

- SCHIST. LOWER ORDOVICIAN
- GRANITE
- ORE. GRANITE & QUARTZ CARRYING MOLYBDENITE
- CORE PORPHYRY
- LINE OF QUARTZ VEINING
- FAULT

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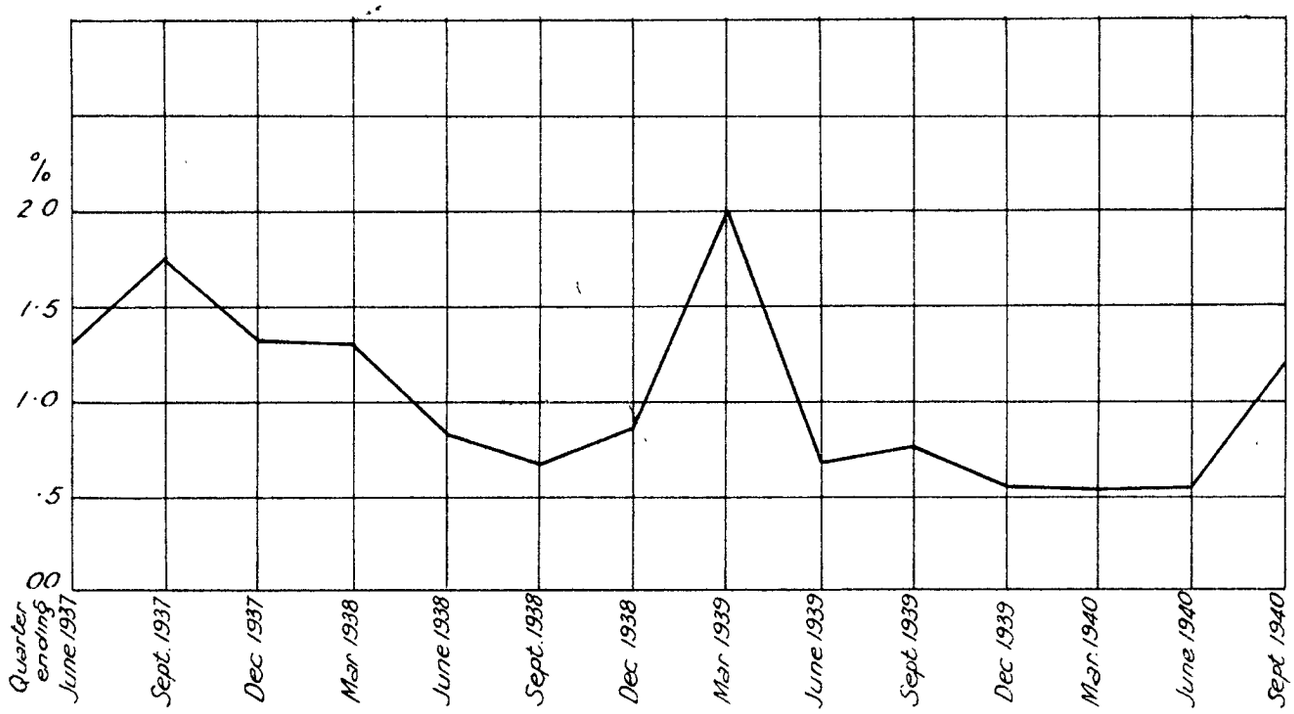


GRAPH SHOWING AVERAGE PERCENTAGE RECOVERY OF $MoS_2$ FROM EVERTON NO.1 PIPE DURING 1937 - 1940; IN QUARTERLY INTERVALS

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Aug 1943.