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COMMONWEALTH OF AUSTRALIA.

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DEPARTMENT OF SUPPLY AND SHIPPING.  
MINERAL RESOURCES SURVEY.

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REPORT No. 1947/8 .

Plans No. 1462/5.

THE NORTHERN STAR GOLD MINE, TENNANT CREEK, WARRAMUNGA  
GOLDFIELD.

by

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CANBERRA.

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DEPARTMENT OF SUPPLY & SHIPPING.

Bureau of Mineral Resources, Geology and Geophysics.

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LOCATION AND ACCESS.

The Northern Star Mine is located on GMLS. 85E, 86E and 87E, twenty-two miles distant, on a bearing a few degrees west of north, from Tennant Creek township. The mine is reached by following the main bitumen road for twenty-three miles and then travelling west at right angles to the road for three miles. The No.1 Government Battery is twelve miles to the south-west. The mine is held by Central Gold Milling Company and is managed by Mr. J. Higgins.

HISTORY AND PRODUCTION.

A small shoot on the southern part of the leases was mined out in 1934-35 for a yield of 428 tons of ore. Development work on the main shoot was initiated in 1937 and was steadily advanced throughout the following years. The ore shoot was defined at the surface by deep costeaning and sampling. A vertical shaft was then sunk at a central point and thirty feet into the hangingwall to a depth of 240 feet. Levels were developed at 235 feet, 200 feet and 100 feet, and a sublevel was unlegged at 150 feet from a rise put up from the 200 feet level.

A total of 13,500 tons of ore had been stoped when operations were suspended under National Security Regulations. Approximately 11,400 tons came from above the 100 ft. level. Altogether 12,055 tons have been milled, and the remaining 1,500 tons are stacked at the shaft head. A total of 5,194 tons of second grade ore were crushed at the No.1 Government Battery for an average yield over the plates of 4.2 dwt. gold (fine) per ton, and the tailings averaged 5.4 dwt. per ton. In addition 6,902 tons of first grade ore were crushed at the Syndicate's own battery for an average yield over the plates of 8.56 dwt. gold (fine) per ton. Total yield of gold over the plates has been 4061.44 oz. fine.

GEOLOGY.

The rocks exposed on the hills in which the mine is located are referable to two general groups - brown shales and ironstone. The shales are fairly uniform in character. They are deep brown in colour generally, and near the hematite assume a reddish brown colour. Bedding is quite inconspicuous and not everywhere to be found. It was usually possible, however, after careful search in a particular area, to determine the attitude of the shale. Sufficient exposures were available to prove that the shales are much folded, with a general north-north-east trend to the axes.

The ironstone varies considerably in composition. Massive black hematite, with no visible quartz, jasper or specular hematite, forms only relatively small outcrops. The two gold shoots are associated with this massive type of ironstone.

The larger masses of iron-bearing material contain quartz, jasper, limonite and specular hematite in variable amounts. The large outcrops in the southern part of the leases carry abundant red jasper and white quartz.

Some areas are occupied by masses of ironstone which are appreciably limonitic and differ in appearance from the massive hematite. In addition there are large areas around the main ore shoot which are covered by limonitic detrital material.

The relationship of the iron-bearing rocks to the enclosing shales is not altogether clear. The two large jasper-hematite areas outcrop on the tops of two hills. Brown shales surround the outcrops and wherever bedding in the latter was observable, it paralleled the contact with the jasper-hematite. The writer came to the conclusion that the latter were formed by metasomatic replacement of beds in the shales. There seems to be no reasonable doubt that these two bodies occupy broad open domes in the shales.

The relationship of the massive black hematite bodies to the other rocks is obscure. In the southern area they are lenticular and dip south at 45 degrees. This seems to conform with the bedding in the shales, but the en echelon arrangement of the bodies suggests an echelon shearing.

The northern ironstone mass is a complex one. It is 700 feet long and 200 feet wide at the widest part. Mining operations have proved it to extend to a depth of at least 250 feet. It is completely surrounded by shales but the contact is obscured in many places. The attitude of bedding in the shales parallels the boundary in many places, and there is more than a suggestion that the ironstone is conformable with the shale. To arrive at some general idea of the relationship of ironstone to shale in other parts of the field, the author inspected the surface crops of several ironstone blows on the Eldorado line of lode, and found that there the ironstones were, so far as he could determine, conformable with the bedding in the shale. A detailed study of the whole field would be necessary to solve the problem.

Strong cleavage is well developed over the whole of the lease. It dips steeply and trends generally slightly north of east. The strike varies locally and there is also a broad warping. The cleavage was apparently developed concurrently with the folding.

#### ORE SHOOTS.

A small orebody was found on the footwall side of a lens of ironstone in the southern part of the leases. The shoot lived to only a very shallow depth.

Low grade mineralisation was found on the hangingwall side of another lens in the same general locality.

The main orebody occurs entirely within the northern ironstone body. It is oriented within a few degrees of east-west. It conforms faithfully with the strike and dip of the cleavage, which has a general easterly strike within the limits of the shoot. Above the 50 ft. level the underlay is steep to the north, between 50 feet and 150 feet level it swings through the vertical to the south and gradually flattens below the 150 ft. level to a dip of 55 degrees at the 235 ft. level. Here the shoot cuts out.

A zone up to 35 feet wide carries payable gold values, and low-grade mineralisation extends beyond these limits. The average width of the shoot is approximately 20 feet. At the surface the shoot was proved by costeaning to have a length of 210 feet. It lengthens to 240 feet at 50 ft. depth, but from this point downwards contracts to 40 ft. at the 150 ft. level. Below the 150 ft. level a tongue of ore some 30 feet long pitches east at 50 degrees and cuts out at a depth of 250 ft.

There is no doubt that the cleavage has provided the channels along which the mineralisation entered. This cleavage, within the length of the pay shoot, strikes a few degrees either side of east. The actual cleavage planes are not linear but swing slightly north and south of east, and in one place at least, fold fairly sharply.

Beyond the eastern end of the shoot at the surface the cleavage swings away to the north. The same swing is observable at the 100 ft. level, although at the 50 ft. level the cleavage appears to trend straight east in the eastern face. At the 150, 200 and 235 ft. levels in the eastern part of the shoot, the cleavage swings away markedly from the east-west trend. Payable gold values are confined to the eastwest striking portion.

The western limit of the shoot is practically a straight line pitching east at 50 degrees. At each level at, or a little to the west of, the eastwest trending shoot, a formation of different character angles obtusely across the line of strike. At the 235, 200 and 150 ft. levels, this formation consists of six feet of brown clay (shale) with micaceous ironstone and quartz in the footwall. At the 100 ft. level it is represented by a thin bed of silicified shales again with micaceous hematite in the footwall. The evidence points to this formation being interbedded with the ironstone. Fracture cleavage in the ironstone ends abruptly against the bed and payable values cut off at the bed or a little to the east.

#### ORE RESERVES.

The orebody has been developed very well by four levels spaced at intervals of 50 ft. and by surface costeaning. Rises between levels are not everywhere in ore, but the shape of the orebody has been determined sufficiently well in plan and section for it to be regarded as blocked out. Estimates of ore reserves, on the assumption of a conversion factor of 10 cu.ft. to the ton, are as follow -

	<u>Tons</u>
50' stope level to surface, allowing for 25% of waste rock in orebody.	15,450
10' pillar above 100' level	(7,000)
150' to 100' level	15,600
200' to 150' level	3,650
10' pillar above 200' level	(1,100)
235' to 200' level	<u>2,100</u>
Total, excluding two pillars	36,800
Plus ore at grass	<u>1,500</u>
<u>Total Reserves -</u>	<u>38,300</u>

#### GRADE.

Over the period 1937-1942, 12,095 tons of ore were mined and milled and a further 1,500 tons hauled to the surface. Calculations made from mine plans and sections show that ore has been mined from the various levels in approximately the following amounts.

	<u>Tons</u>
Stope above 100' level (15,100 minus 3,700 tons of waste)	11,400
Development work at 100' level	1,100
Development work at 150' level	900
Development work at 200' level	500
Development work at stoping at 235' level	<u>240</u>
	<u>14,140</u>

Sampling has proved the three lower levels to be richer than the two upper levels so that an estimate of the grade of ore made from crushing returns for the 12,095 tons of ore milled should be rather conservative.

No.1 State Battery crushed 5,194 tons of second grade ore for an average yield over the plates of 4.2 dwt. (fine) per ton, and the tailings averaged 5.4 dwt. per ton. Head value was therefore 9.6 dwt.

The Syndicate's own battery crushed 6,902 tons of first grade ore for an average yield over the plates of 8.56 dwt. (fine) per ton. No assays of tailings are obtainable but it is reasonable to assume that they were at least as high as 5.4 dwt. Head value on this assumption would be 13.96 dwt.

Average overall head value of the 12,095 tons was probably 12.1 dwt.

A total of 150 samples was taken from four levels by C.L. Knight, and Mr. Higgins has sampled two of these levels independently. Results are -

Level	Sampler	Weighted Assay of Level Samples dwt. gold/tons	Assumed Average Grade at Level dwt. gold/tons
50 ft.	C.L.Knight	9.8	9.8
100 ft.	C.L. Knight J. Higgins	11.2 7.6	9.4
150 ft.	C.L. Knight	23.0	23.0
200 ft.	J. Higgins C.L. Knight	18.0 17.0	17.0
235 ft.	C.L. Knight	16.0	17.0
236 ton crushing		19.0	

It should be noted that at the 50 ft. level Mr. Higgins stated that ore did not extend right to the walls of the stope but that the outside four feet or so on each wall had been fired for filling. Sampling, however, did not show any appreciable difference between the grade of the outside sections and the central part. The tonnage of stope filling indicates that about 25% of the orebody in the stope was discarded by selective mining. The grade of the ore extracted from the stope would probably exceed 10 dwt.

Average grade calculated by weighting above values by respective tonnages of ore is 12.1 dwt.

A reserve of 38,300 tons of ore of grade 12 dwt. is indicated.

#### PROSPECTS OF FURTHER ORE.

The western end of the ore shoot is a stratigraphic one and there seems to be little likelihood of locating ore in this direction. The ironstone does not continue far to the west and no values whatever have been found on the surface.

To the east and northeast there is a greater length of hematite outcrop. Furthermore, samples taken from the faces at the eastern ends of the 50, 100 and 150 ft. levels all carry gold. It

would be advisable to advance these faces eastward to make sure that the shoot had played out.

Prospecting could be carried out at the 100 ft. level by driving along the cleavage from the eastern end of the north drive.

(C.L. Knight)  
Geologist

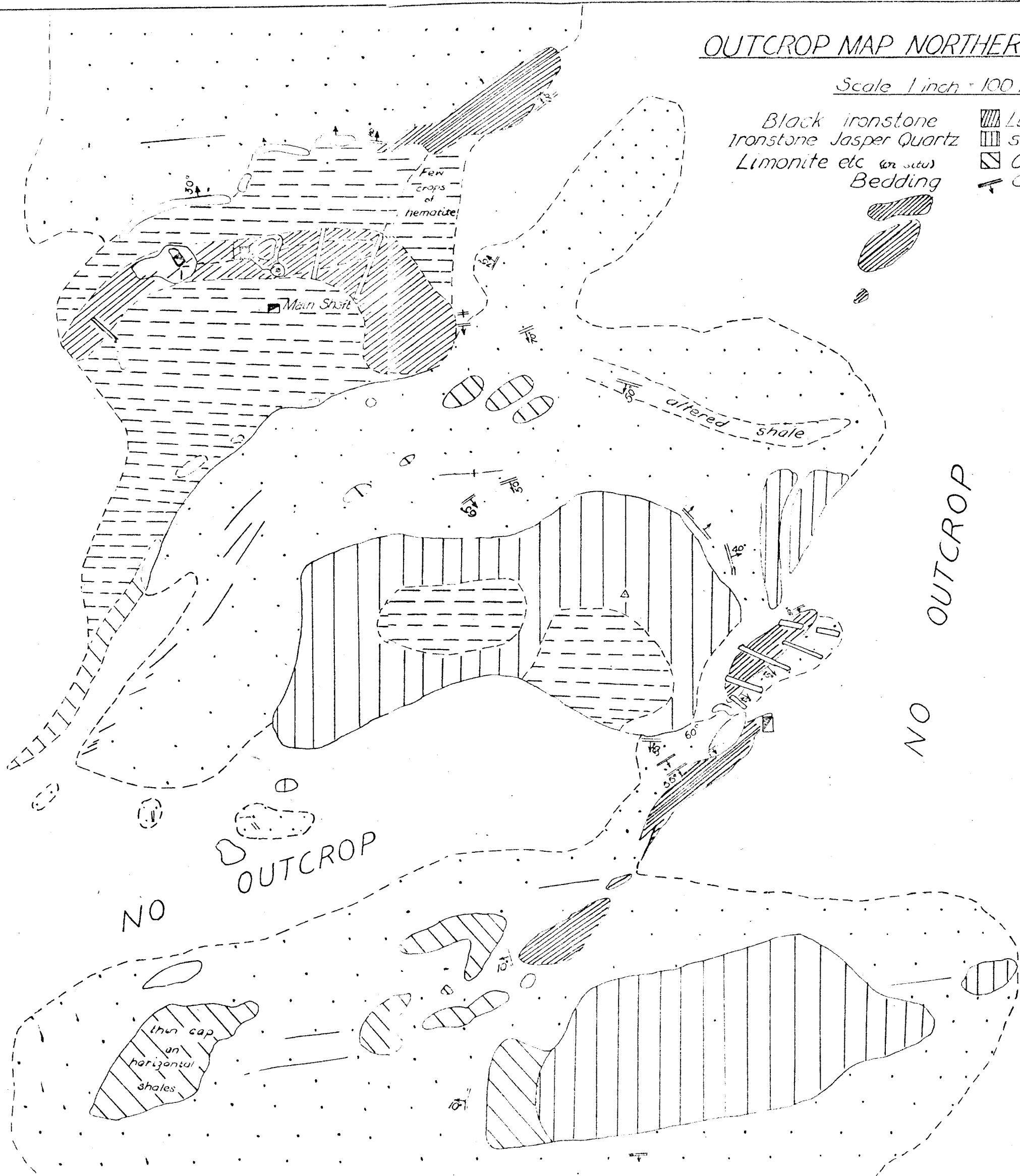
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# OUTCROP MAP NORTHERN STAR G.M.

Scale 1 inch = 100 feet

Black ironstone  
Ironstone Jasper Quartz  
Limonite etc (in situ)  
Bedding

Limonite Detritus  
shale  
Ore shoots  
Cleavage



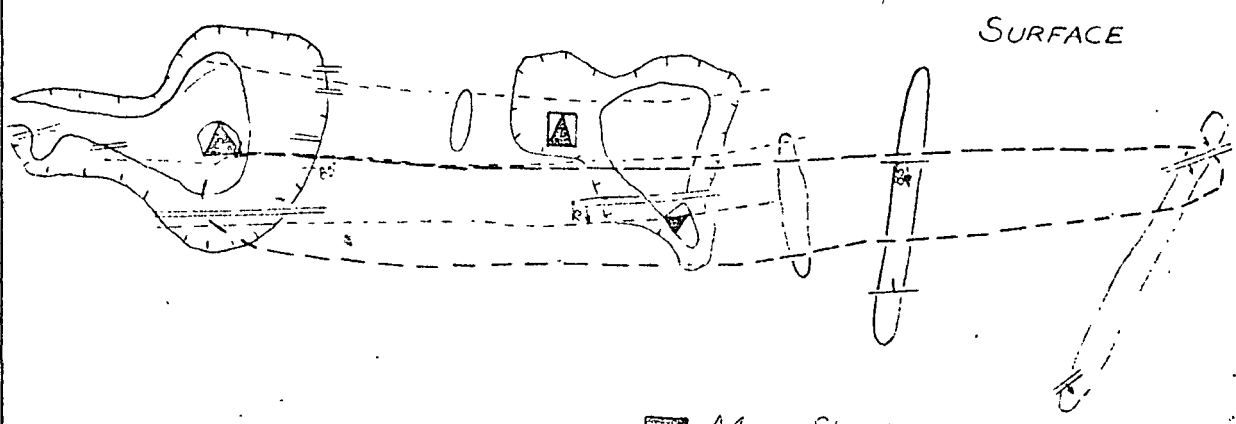


# GEOLOGICAL PLAN

## NORTHERN STAR G.M. WORKINGS

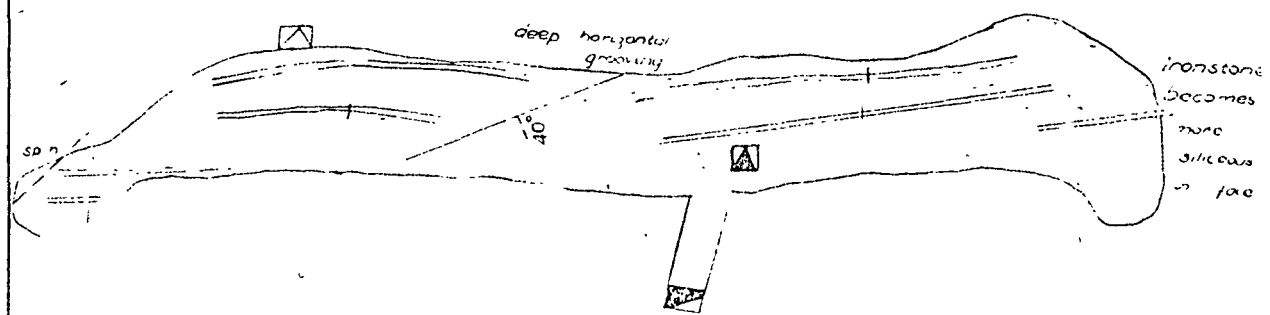
Scale 1 in = 40 ft.

- |                   |                         |
|-------------------|-------------------------|
| ○ Ore Shaft       | M.S. = Main Shaft.      |
| = Cleavage traces | sp.h. Specular Hematite |
| → Heads           | Shale.                  |

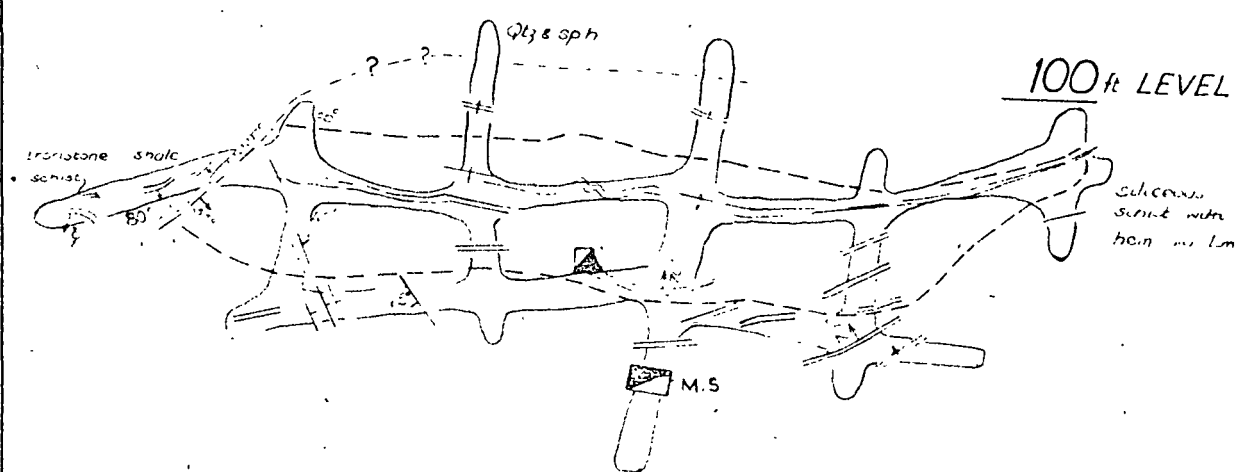


Main Shaft

50 ft LEVEL



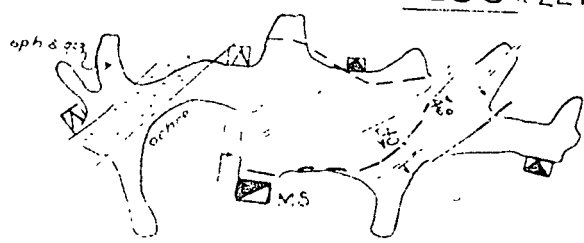
100 ft LEVEL



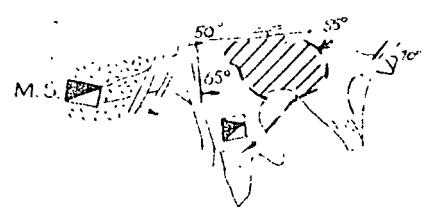
150 ft LEVEL



200 ft LEVEL



235 ft LEVEL



# LONGITUDINAL PROJECTION NORTHERN STAR G.M.

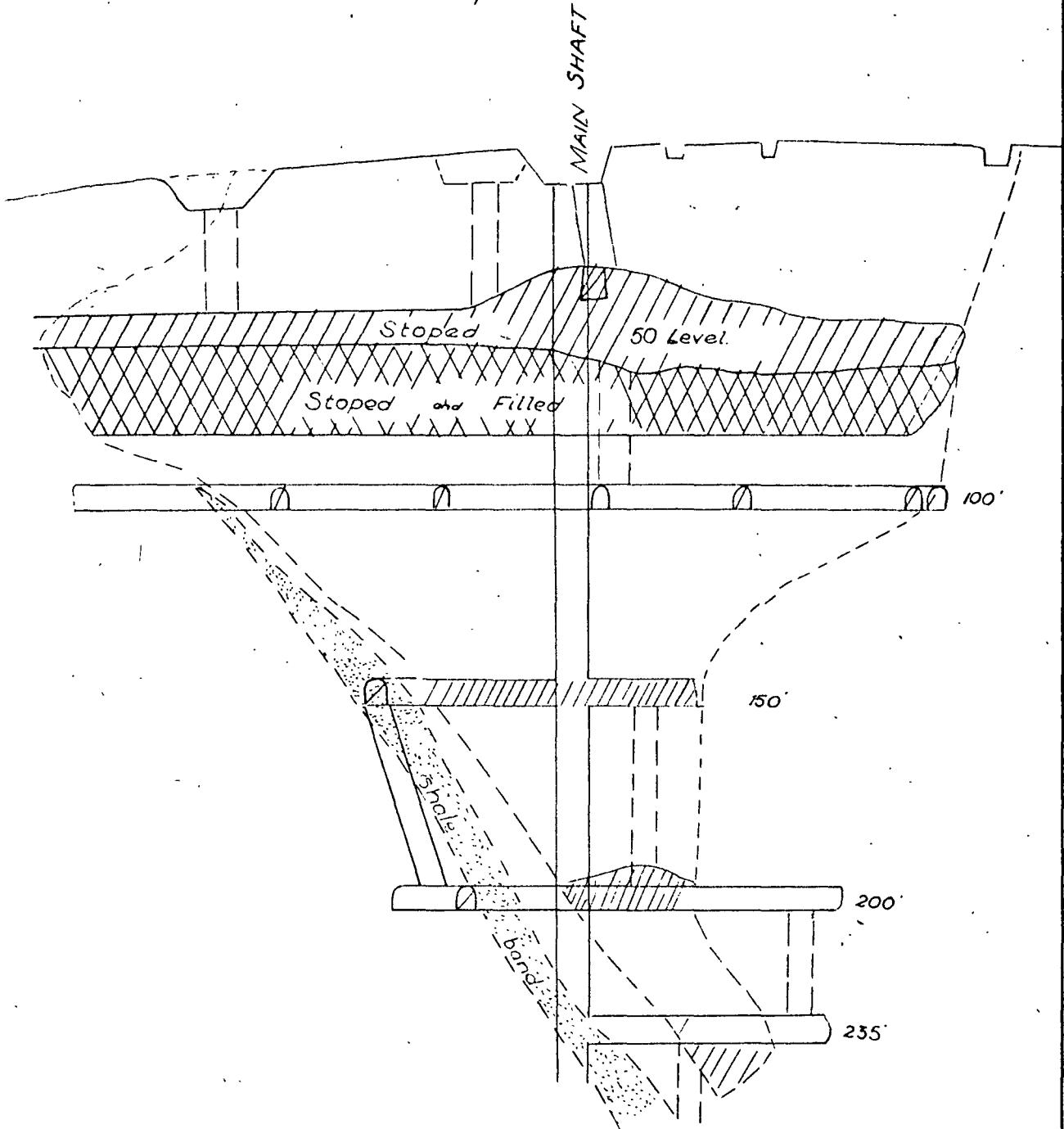
SHOWING

## LIMITS OF ORE SHOOT

Scale 1 in. 40 ft.



Unstoped Ore



# ASSAY PLANS NORTHERN STAR G.M.

Scale 1 in. = 40 ft.

width of Shoot & weighted average <sup>assay</sup> along channels  
assays of samples in dwt gold per ton.  
sample numbers from North to South.

