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GEOLOGICAL REPORT ON HATCHES CREEK

WOLFRAM FIELD.

Report No.1943/21. Plan No.951-954.

INTRODUCTION.

The Hatches Creek wolfram field is situated at the south-east end of the Davenport Ranges approximately 300 miles by road north-north-east of Alice Springs. The new military highway is followed for 220 miles from Alice Springs, but in the last 80 miles there are many rough patches. This part of the country is so dissected, that it will always be difficult to maintain an earth road. Visual, aerial reconnaissance might be worthwhile to see whether a better route could not be followed from the main road. At the same time a possible road connection to Tauchope might be investigated.

The field was mapped in considerable detail by the North Australian Survey in 1940. The report of this survey was not published but the manuscript and copies of the field plans are available for study.

In March, 1942, Mr. P.B. Nye, formerly Executive Officer of The North Australian Survey and Mr. C.J. Sullivan, who, with V.M. Cottle, had done most of the field work at Hatches Creek, prepared a report giving a summary of the results obtained from the field and indicating the possibilities of future development. Mr. W.A. Hughes was available for discussion when this report was being prepared and subsequently based his development programme upon it.

The present report is written primarily to indicate the amount of ore which may be expected in the principal mines, chiefly by limited development in depth, and to suggest certain lines of prospecting and development which are likely to result in production of ore and which will enable a more confident statement of possibilities to be made at an early date. The information upon which to base such a report is rather sketchy and in most instances it has been necessary to set down a tentative favourable view rather than a considered technical opinion. This is done because –

(1) The project has already cost a considerable sum of money for little result or return.

(2) The project cannot very well be abandoned because of the nature of the labour force engaged and because of the urgent necessity to produce wolfram, even at a loss.

(3) Wolfram produced in the next nine months will be more valuable than at any future time, when other large producers should be operating.

(4) The work outlined should soon reveal production possibilities more clearly and enable the present proposals to be reconsidered at an early date.

At least three kinds of information are lacking at present –

(1) Accurate information concerning the form, size and values of the veins at the ends of the upper levels and in stopes not now accessible.

(2) Information concerning distribution of values and shape of shoots generally.

(3) Information concerning any possible relation between values (or even persistence of veins) and wall rock.

To obtain this information good plans will be necessary, together with critical geological study at frequent intervals. A start has been made on the preparation of plans and it has been arranged that Mr. C.J. Sullivan will keep in close touch with developments.

GENERAL GEOLOGY.

The rocks adjacent to the worked areas of the Hatches Creek field includes sediments-shales, quartzites and sandstone-and basic igneous rocks which have been referred to as amphibolites. To the south of the worked area, tuffs porphyries etc. have been mapped. To the north, porphyry occurs, which appears to have been folded with the sediments. Here also a small area is occupied by mica-syenite, which is believed to be intrusive. The relationship of many of the igneous rocks to the sediments has not been satisfactorily determined. It is important that an attempt be made to do this, since it may have a bearing on ore distribution from more than one mine.

The North Australian Survey geologists consider the Hatches Creek sediments to be Pre-Cambrian. Despite their antiquity, however, the rocks have suffered only very mild dynamic metamorphism.

STRUCTURE.

An area of about 120 square miles has been aerially photographed and the structure within this area is fairly well-known. The regional structure, however, cannot be deduced even from this large amount of mapping, which reveals only a broad arcuate trend swinging from east-west on the western side of the field to northeast-southwest on the eastern side. The regional dip is south to south-east at an average angle of about 60°.

Superimposed on this broad structure are sharp folds, whose axes are parallel to the regional strike.

Many faults have been mapped trending north-east, and broadly convex to the east-south-east, which are believed to be pre-mineralisation.

THE VEINS.

The veins appear to be simple fissure fillings of fracture zones formed under moderate load. They vary in width from stringers to about 5 feet and they have the characteristic overlapping arrangement of the type. Two dominant trends may be noted, one parallel or nearly parallel to the regional strike and the other meridional.

The former type is well illustrated at the "Pioneer" where the workings reveal that, in general, there is a slight divergence in dip between the veins and the sediments. Close study may reveal slight divergences in strike also, which, possibly, have been a factor in determining the en-echelon arrangement of the veins, and may have some bearing on the shape of the ore-shoots.

The latter type may be seen in the "Hit or Miss" and the "Treasure" mines. In both these mines the veins occupy sharply defined fissures which trend nearly at right angles to the strike of the sediments, and in both mines also the veins are offset by strike faults developed in the soft shales. There is no obvious change in mineralisation in these veins, where they traverse rocks of very different lithology, though the pitch of the shoots is reported to be approximately parallel to the dip of the wall rocks. The lithology of the wall rock appears to have been important in determining the persistence of the fissures e.g. south of both the "Hit or Miss" and the "Treasure".

MINERALISATION.

The dominant gangue mineral is white quartz, but mica (probably biotite) and felspar (species not known) have been noted. Dr. Stillwell has also identified zircon, magnetite, hematite "Limonite" and fluorite in concentrates from this field, but it is impossible to say which of these minerals may belong to the vein filling or the wall rock.

Minerals of the metals tungsten, bismuth, copper, molybdenum, and gold have been recorded from Hatches Creek, but a detailed mineralogical study of the ores has not been made.

The dominant ore mineral is wolfram. Scheelite (copper-bearing in places) is present in noteworthy amounts in several of the veins. In the "Pioneer" mine it may be readily identified by its characteristic brilliant blue fluorescence in ultra-violet light. Commonly in this mine, wolfram and scheelite occur together and in places the scheelite seems to have been formed by attack of calcic solutions on the wolfram. In some parts of this mine, however, scheelite is present in noteworthy quantities where no wolfram is visible. Even where patches of this mineral have been revealed by ultra-violet light it is not easy to pick them up again in ordinary light. Ultra-violet light equipment would be of value both in the mine and in the mill. This equipment will be made available as soon as possible.

Bismuthinite (copper-bearing in places) is present in some of the veins e.g. the "Pioneer" and "Horrible Annie". Bismutite and bismite also occur.

Copper minerals are common in some places as in the "Pioneer" and the "Copper Show". They include chrysocolla, malachite, chalcocite and chalcopyrite.

Pyrite is present but only in small amounts.

VALUES.

The Nye-Sullivan report indicates that the ores produced from nearly all the mines on the field return about 2½% wolfram, equal to approximately 1.5% WO_3. In the absence of any later sampling this value has been assumed as probable recoverable WO_3 from the ore shoots of the principal mines.

It is probable a higher figure could be taken for the "Pioneer" mine. Nye and Sullivan state that the wolfram content of ore won from this mine was "3% to 4% and possibly higher". When Mr. Binns of O.T. Lempriere conducted a test at the "Pioneer" mill in 1942, the mill feed was found to contain 1.32% WO_3, but Mr. Binns estimated that the feed contained 60% Mullock and that the ore, therefore, probably contained 3.3% WO_3.

NOTES ON THE PRINCIPAL MINES.

Pioneer: Two distinct lines of reef are being worked. These were formerly known as the Northeast and Central lines, but they are now referred to as No.2 and No.1 shaft workings respectively.

No.2 Shaft Workings. The principal vein worked from No.2 shaft has an outcrop length of 360 feet. Adjacent to the point where the main vein dies out westerly a second vein occurs 10 feet south, which however has an outcrop length of only 120 feet. The average width of the principal vein is about 15 inches.

There are three levels in the mine at 50 ft., 88 ft. and 135 ft. The stope lengths are:

135 ft. level - 170 ft. 50 ft. level - 275 ft 88 ft. level - 350

There is no certain evidence upon which reliance can be place giving a guide to the pitch or shape of the ore shoot or shoots. No assay values are available and there is no record of the appearance of the vein at the ends of the stopes. The impression one gets is that the shoot pitches steeply to the East and that no ore will be found by extending any level west, except perhaps on the offset vein referred to above.

It is urgently necessary either to extend the bottom level east, or to winze near the eastern ends of the 88 and 135 feet levels. These winzes would be in ore to begin with at least, whereas the driving might not produce any ore. This work should be done before sinking the No.2 shaft.

Reference to the longitudinal section (Fig.1) will show that probable reserves above the 135 ft. level are about 890 tons. If the ore dimensions on the 135 ft. level persist, an additional 1200 tons will be developed between this and the 200 ft. level. There can of course be no certainty about this ore until winzes have been put down. Following strict mining practise only a small section of ore would be considered as possible reserves below the 135 level, but it is apparent that very little work is required on that level, to give a pointer to the probable behaviour of the ore-body in depth.

Taking an optimistic view, ore recoverable to 200 feet may amount to 2000 tons containing 1.5 per cent WO_3 (60 per cent of 2.5 per cent wolfram) worth say £9,000 at the mine.

No.1 Shaft Workings. The principal vein worked from No.1 shaft has been stoped near the surface for almost the full length of its outcrop of 500 feet, but on the 90 feet and 120 feet level the stope lengths are respectively 300 and 155 feet. If the longitudinal section (Fig.2) gives a true picture of the shape of the ore-shoot the outlook for ore at depth is very disquieting. It may, however, represent merely a stage in stoping development. To establish whether this is so or not, extensions of the levels east, together with sampling is necessary.

Until this work and winzing on the bottom level has been done, there are no positive reserves in the mine. Possible reserves above 120 feet may be taken as 400 tons.

It seems unlikely that the principal vein will be found to extend west but a cross-cut 15-20 feet into the hanging wall at this end of the mine might find ore in a second vein which has an outcrop length of 140 feet.

If the shoot maintains the dimensions proved on the 90 ft. level to a depth of 200 ft., 2700 tons of ore will be available below the 120 feet level. (The average width of the vein is assumed to be 15 inches).

Thus, 3100 tons of ore containing 1.5% recoverable WO_3 might be obtained by development to 200 feet, worth approximately £13,000 at the mine.

A cross-cut put out north from the 90 feet or 120 feet levels for a distance of about 160 feet would have a good chance of proving one of more of the footwall veins shown on the North Australian Survey plan of the Pioneer area. These veins are all short, however, and unlikely to contain large reserves.

All "Pioneer" concentrates will contain bismuth and copper. The nett value of these metals cannot be assessed on present information.

Treasure and Lost Ruby: (Fig.3) Outcrop information suggests that there is an approximately continuous line of vein outcrop extending for a length of 340 feet through the "Treasure" and "Lost Ruby" leases. Development 100 feet below the highest point at the surface confirms this continuity. North of the "Lost Ruby" lease the veins tail out and are low-grade. On the southern end of the "Treasure" lease short broken veins have been worked to shallow depths. The south end of the drive at the 100' level has met a strike fault which is developed approximately at the contact of fine grained igneous rocks and shales. The course of the creek near the main shaft may be determined by this fault zone. If so, the surface evidence suggests mineralisation is discontinuous for some distance south of the fault. As opportunity offers, no doubt drives will be extended north and south, but for the present it would be wise to assume that only 300-340 feet length of reef can be worked from the "Treasure" shaft.

According to C. J. Sullivan, there are two shoots within this 300 feet length. The "Treasure", 130 feet long and the "Lost Ruby" 70 feet long, separated by a barren to low-grade zone 85 feet long. These shoots are thought to pitch southerly at a high angle.

The "Treasure" line is a strongly defined fissure trending approximately at right angles to the strike of the wall rocks. The average width of the vein filling is about 33 inches. Thus the yield per vertical foot is at least twice that of the "Pioneer". This may be offset by lower values, but the massive nature of the wall rock as compared with the shales in the "Pioneer" means that less ore dilution will be experienced in mining.

Assuming the drive at the 100 feet level is in ore and the whole block above this level and between the fault and the old stoping is ore, the following reserves may be present:-

Treasure Shoot	Tons
North of Main Shaft	960
South of Main shaft	1350
North end of 100 feet level below old stopes	275
Lost Ruby Shoot	385
	2,970

Unless the north face of the drive at the 100 feet level continues in ore, it would not be worthwhile extending the level to the Lost Ruby shoot, which should be nearer the shaft at the next level. Assuming a stope length of 200 feet is realised on the 200 feet level and the vein averages 33 inches in width, 4000 tons of ore may be developed by sinking a further 100 feet.

Obviously none of the figures given for reserves are firm ones, but they may be accepted with more confidence than those given for the "Pioneer".

It is interesting to note that a section of Sullivan's "Barren Zone", though reported low-grade, was stoped. This section of the mine, if accessible, should be sampled, as there is no certainty that the relatively simple picture of ore distribution we now have is necessarily wholly true or may not have significant modifications which would have an important bearing on the development programme.

Summarising, it may be said, that, subject to certain assumptions being realised there may be approximately 7000 tons of ore reserves to 200 feet at the main shaft, containing possibly 1.5 per cent

recoverable WO_3 and worth £30,000 at the mine.

It is unlikely that any minerals other than wolfram will be present in sufficient quantity to cause any difficulty in treatment or to affect recovery values. The mineral constitution of the ore is unlikely to change in depth.

Hit or Miss: The "Hit or Miss" ore-shoot has an outcrop length of about 200 feet. Its shape in depth has not been ascertained. The longitudinal section shows the stoped area to be decreasing in length with increasing depth. It is most important to know whether this is the shape of the shoot or whether the shape of the stoped ground has been determined by development outwards from the old main shaft. The average width of the vein within the shoot is 33 inches.

The vein has been proved to extend 140 feet further north than the northern end of the shoot outcrop and to vary in width from 12 to 38 inches. At the surface this part of the vein is apparently poor.

South from the southern end of the shoot the vein outcrops, somewhat discontinuously, for a further 450 feet. Here the maximum vein width is twelve inches and the wolfram content, low. Development south ceases approximately at a fault which crosses the plat at the 100 feet level. The main drive at this level cuts the fault again 18 feet south of the plat. The fault represents movement along bedding planes in shales. It is post ore and has only a small displacement. In itself it may have little significance, but the change from sandstone (in which the main ore shoot is developed) to shale may have some importance, as fissuing in the shales may have been expressed as short discontinuous ruptures rather than one strong fissure. The 100 feet level is the most convenient and economical from which to drive south and test the behaviour of the vein south of the fault.

The "Hit or Miss" vein, like the "Treasure" is developed in a well defined shear trending across the strike of the wall rocks and the shear itself is not likely to cut out at depth. The shoot may do so, however. On structural grounds, C. J. Sullivan considers that another shoot may be found below the north shaft. There would be no point in searching for this on the 100 feet level, but sampling on this level would assist materially in defining the shape of the main ore shoot.

If the unworked portions of the reef above the 100 feet level are in ore, they contain about 650 tons of reserves. Assuming the main shoot has a stope length of 150 feet at the 200 feet level, there will be a reserve of 2,000 tons of ore between the 100 and 200 levels. This gives a total reserve of 2,000 to 2,650 tons of ore worth say £12,000 at the mine.

Other Veins: Numerous other veins have been worked, many of them only to a limited extent. Probably the most important are the Black Diamond, Little Wonder-Bumboat (including Horrible Annie), Hidden Treasure and Copper Show. Of these only the "Copper Show" was inspected.

The main vein of the Black Diamond group is reported to be traceable over a length of 445 feet and to have been worked almost continuously over a length of 510 feet. Its width is about 15 inches. C. J. Sullivan estimates that about 1,000 tons of ore have been mined from this vein which averaged approximately 2.5 per cent wolfram. Most of the ore came from a shoot 80 feet long. Mr. Sullivan considers that change of strike, and dip flattening, determined the locus of the shoot. He has made recommendations for further prospecting and development which it is understood are being followed.

The Horrible Annie is mentioned mainly because of its bismuth content. Ore from this mine, together with that from the Pioneer constituted the main source of bismuth produced in Australia in 1941. The shoots so far discovered on this line of reef are reported to be small, but in view of the shortage of bismuth some attention might be given to them when opportunity offers. Apparently there are no figures available for output or grade of ore produced from this vein.

Hidden Treasure. There are two lines of reef on the Hidden Treasure lease which represent a continuation south of the Treasure zone of shearing. The veins are narrower than at the Treasure and have been developed to a much lesser extent. Values also seem to be lower. The more easterly of the two veins has been worked over a length of 250 feet to a depth of 50 feet. It is reported that operations on this lease in the early stages of government control did not bear out statements made by the former lessee concerning wolfram content.

Several short shoots have been worked on three short veins collectively known as the "Copper Show". As the name implies copper minerals are more evident here than elsewhere. It has been found practicable to leach most of the copper from concentrates produced from this mine. There seems to be scope here only for small scale operations.

SURFACE AND ALLUVIAL.

Some attention has been paid to surface and shallow alluvial deposits, as for example near the Black Diamond, but not to the extent which one would expect. If these deposits had been in central New South Wales, there is little doubt considerable surface areas would have been tested by ploughing, scooping and puddling. Water supply at Hatches Creek is adequate for the purpose.

CONCLUSIONS.

It is impossible to make very sound deductions as to the shape of the ore shoots in the three principal veins at Hatches Creek on present evidence, but work now in hand should enable this to be done soon. As information accumulates probably some suggestions can be made for prospecting for shoots in addition to those now worked.

It is thought that in the circumstances ruling on the field it is a justifiable risk to plan development assuming the following reserves of ore (which might be expected to return 2½% wolfram per ton) are available to 200 feet:-

	Tons
Pioneer	5,000
Treasure	7,000
Hit or Miss	2,500
	14,500

Of these, the Treasure is the most likely and the Pioneer least likely to be realised. If some of these estimates are not realised, the deficiency could probably be made up from other veins. The best way to ensure that prospecting of other veins goes on is to allow gougers to operate and to keep in touch with their work.

ACKNOWLEDGEMENTS.

This report is based to a considerable extent upon

mapping by Mr. C. J. Sullivan with whom also the geology of the field has been discussed and to whom it is pleasure to express my indebtedness.

CANBERRA, A.C.T.

14/5/43

H. G. RAGGATT,
Director.

FIG. 1

SCALE :- 1" = 40 FT.

PIONEER MINE.

Nº 2 SHAFT WORKINGS

LONG.L VERTICAL SECTION

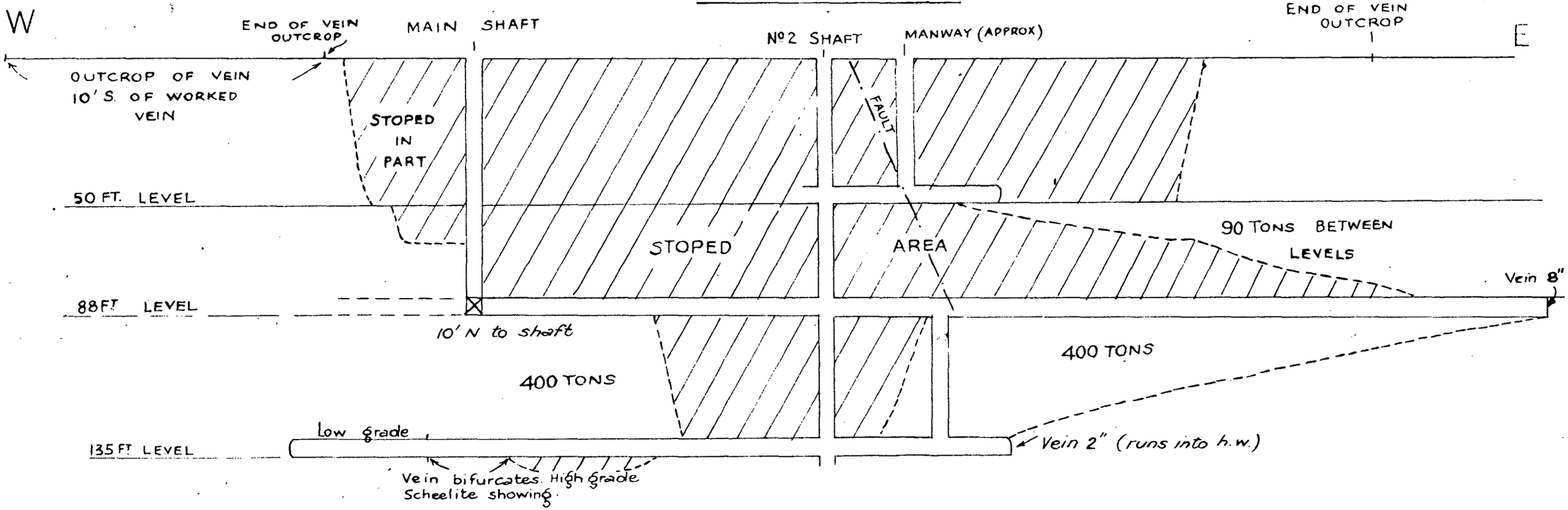


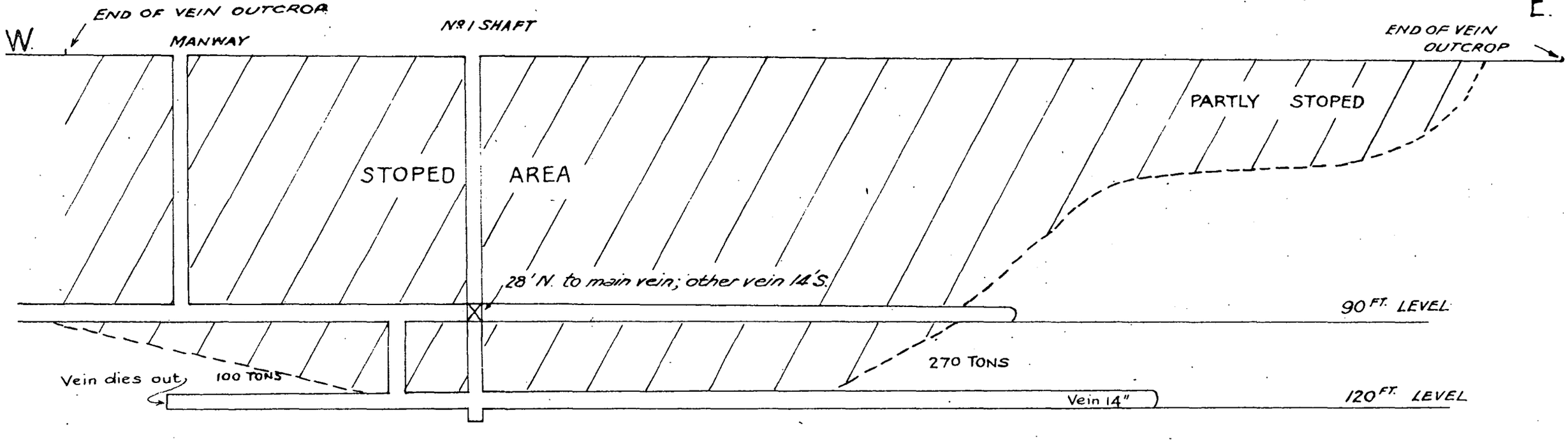
FIG. 2.

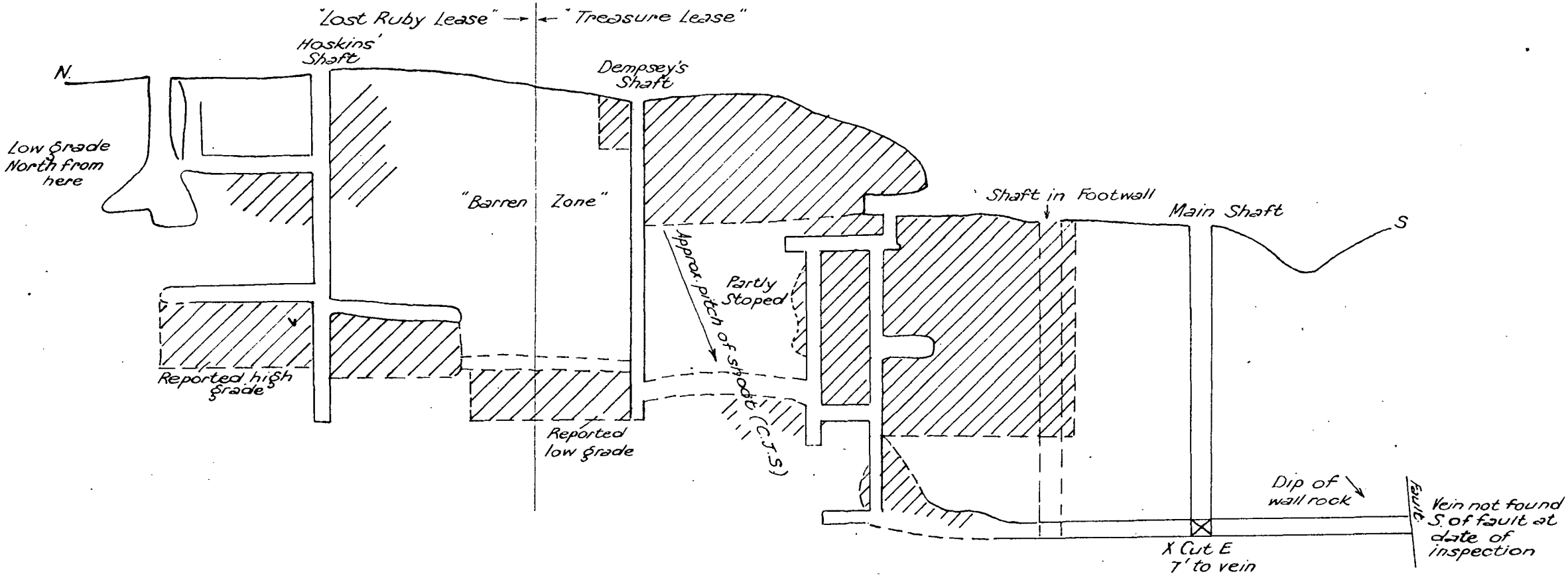
PIONEER MINE

Nº 1 SHAFT WORKINGS

LONGᵀ VERTICAL SECTION

SCALE :- 1" = 40 FT.



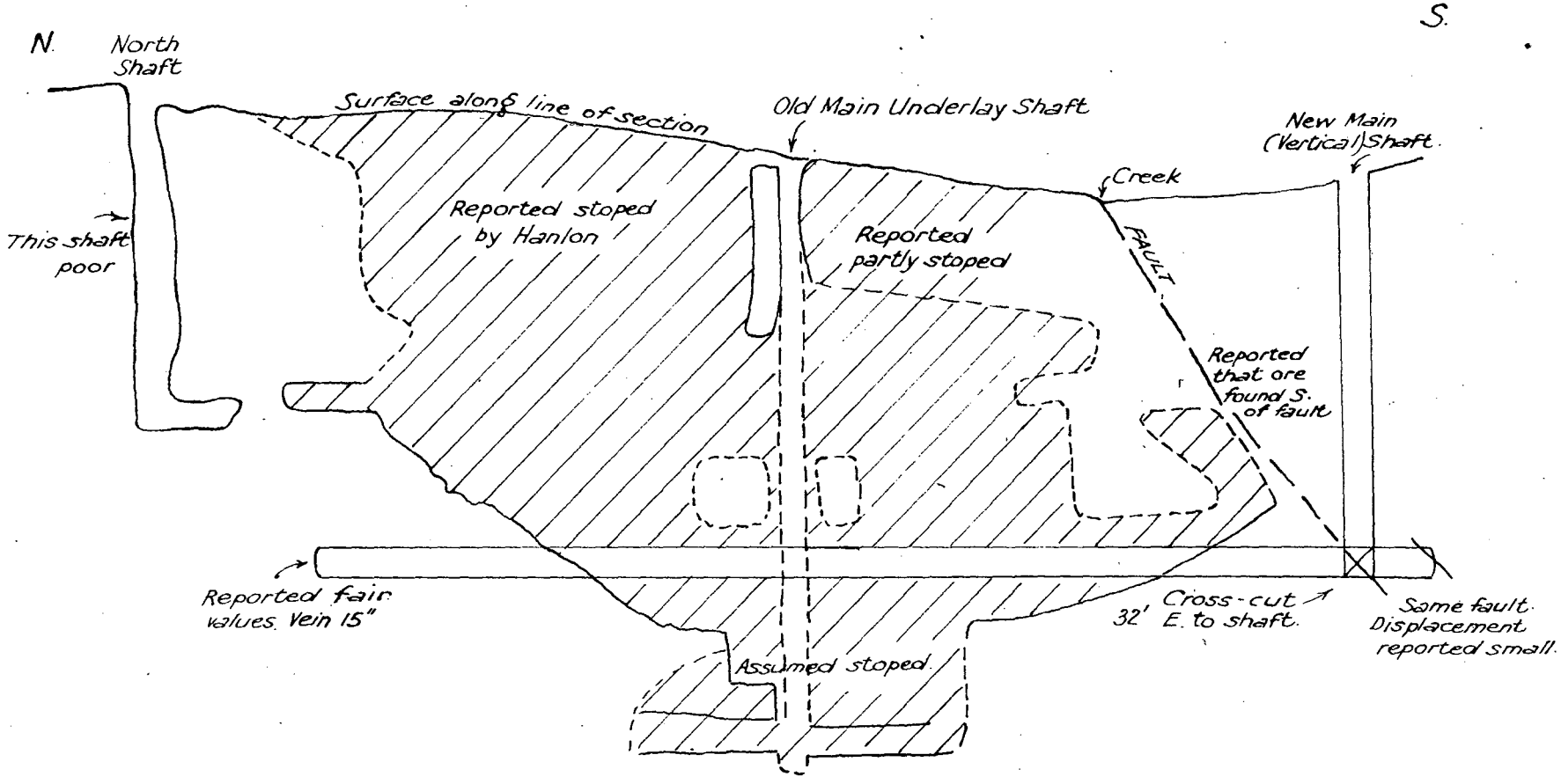


LONGITUDINAL VERTICAL SECTION

"LOST RUBY" & "TREASURE" MINES

HATCHES CREEK, N.T.

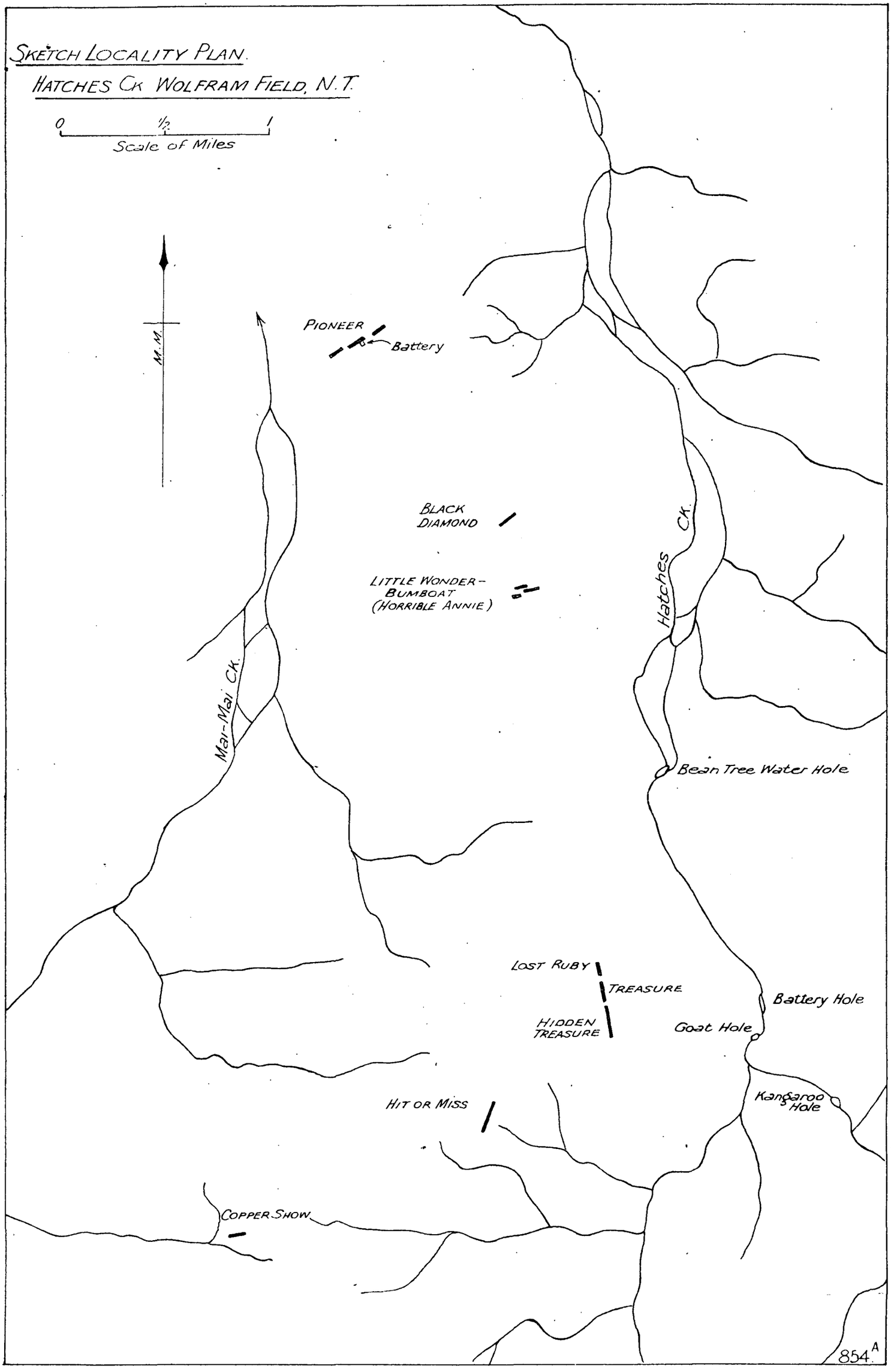
Scale 1" = 40ft.



LONGITUDINAL SECTION.

"HIT OR MISS" MAIN LODE

Scale 1" = 40'


SKETCH LOCALITY PLAN.
HATCHES CK WOLFRAM FIELD, N.T.
0
1/2
1
Scale of Miles
M.M.
PIONEER
Battery
BLACK DIAMOND
LITTLE WONDER-
BUMBOAT
(HORRIBLE ANNIE)
Hatches CK.
Mai-Mai CK.
Bean Tree Water Hole
LOST RUBY
TREASURE
HIDDEN TREASURE
Battery Hole
Goat Hole
Kangaroo Hole
HIT OR MISS
COPPER SHOW
854A