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The Discovery of Scheelite Deposits at Yetholme, N.S.W.

by J. M. Rayner

DEPARTMENT OF SUPPLY & SHIPPING

Mineral Resources Survey Branch

Report No.1943/18.

THE DISCOVERY OF SCHEELITE DEPOSITS AT YETHOLME, N.S.WALES.

1. INTRODUCTION.

The occurrence of molybdenite deposits near Yetholme has been known for many years. The most important deposits are close to the eastern boundary of Ph.Yetholme, Co.Roxburgh, and may be reached by leaving the main Sydney-Bathurst Road at Yetholme and following a good bush track for about five miles in a southerly direction.

The deposits have been worked in a small way for molybdenite at several places, have been examined by several geologists, and have been investigated by two of the major mining companies. The result of this work has shown that although considerable tonnages are available, the molybdenite content is too low to make mining attractive. It is not proposed to describe the geology, mining excavations, and other factors affecting the field in this report since that has already been done in several previous reports, the more important being:

1. The Molybdenum Industry in New South Wales, Mineral Resources No.24, New South Wales Department of Mines, E.C. Andrews, 1916.

2. Yetholme and Gemalla Molybdenite Deposits, N.S.W., Private Report to the American Smelting and Refining Co.,R.Blanchard and L.E. Sinclair, 1936.

3. Sampling Report, Molybdenite, Yetholme, N.S.W., Private Report ot the Broken Hill Proprietary, F.Canavan, 1941.

4. Molybdenite Deposits, Yetholme,N.S.W., Private Report to the Broken Hill Proprietary, E.A. Rudd, 1942.

It is the purpose of this report, however, to point out that the Yetholme deposits contain a considerable amount of scheelite and may well warrant large scale mining for this now important ore of tungsten.

The steps leading to this discovery are somewhat novel and commenced perhaps when the Mineral Resources Survey, with the technical co-operation of the Physics Department of Sydney University, carried out investigations last year on the application of ultra-violet light to the detection of scheelite by reason of its fluorescent properties, and introduced this technique to the Australian mining industry. Scheelite is a very difficult mineral to detect in the field,as is sufficiently evidenced by the fact that in spite of the various examinations made in the past at Yetholme, no-one had detected this mineral in the ore prior to the application of ultra-violet light a few weeks ago. In ultra-violet light, however, scheelite fluoresces brilliantly and can thus be detected with ease wither in the laboratory or in the field. Following the use of ultra-violet light by the Mineral Resources Survey at the scheelite deposits on King Island, it was decided to prospect other likely areas by this method.

At this stage a most fruifful suggestion was made by Mr. L.L. Waterhouse, Lecturer in Economic Geology at Sydney University. He had studied both the scheelite deposits on King Island and the mineral deposits at Yetholme and elsewhere in that district. In view of certain geological similarities between these deposits he suggested that a search for scheelite at Yetholme and Duckmaloi was warranted. In the first place, several specimens of ore from Yetholme and Duckmaloi were obtained from Mr. Waterhouse's collection and examined in ultra-violet light. Points and patches of fluorescence of the type usually due to scheelite (with molybdenum impurity) were observed and marked, and the specimens were returned to Mr. Waterhouse for confirmation by other methods, which positively identified scheelite.

The presence of scheelite in ore from Yetholme and Duckmaloi being established, it was next necessary to determine by examination with ultra-violet light in the field whether scheelite is present in sufficient quantities to be of economic value. Accordingly a visit was made to Yetholme and Duckmaloi and inspections were carried out from the 3rd to/ the 5th of the present month.

On this visit I was accompanied by Mr. F. Canavan, who is on loan to this Branch. Since he recently sampled the deposits under discussion for their molybdenite content on behalf of the Broken Hill Proprietary, his intimate knowledge of the geography and geology of the area was of great assistance. Mr. R. S. Caddy, who while a research student in the Physics Department of the Sydney University afforded valuable assistance in the investigation of the fluorescence of scheelite, was also in the party.

II. THE USE OF ULTRA-VIOLET LIGHT.

The use of ultra-violet light in the search for scheelite is a novel technique but has been dealt with at length in a recent publication of this Branch entitled:

"Miscellaneous Report No. 2, Fluorescence of Scheelite and Its Application in the Mining Industry".

It is not proposed to describe the technique in this report, but to refer only to a few points having a direct bearing on the examinations at Yetholme.

Since fluorescence is only visible in the dark or semi-dark it was necessary to examine quarry faces and dumps of ore at night. Adits and underground excavations were examined during the day-time.

Since the Branch's most suitable ultra-violet light lamp was in use at King Island, a lamp built up from spare parts was used in the present survey. Owing to the rough terrain, it was found most convenient to run the lamp from small dry batteries carried on the back rather than carry the much heavier wet battery.

Normally scheelite fluoresces with a light blue colour. When powellite is present as an impurity or when molybdenum is present in the scheelite crystal lattice, however, even in minute quantities, the colour of the fluorescence is yellow. At Yetholme the colour of the fluorescence is predominantly yellow although in some parts it tended to light blue. It might be mentioned that in the King Island deposit the colour of the fluorescence is also predominantly yellow.

By ~~use~~ the use of ultra-violet light, it is possible not only to detect the presence of scheelite, but also to make an estimate of the grade of the ore, either in a sample or in the face of a mine or quarry. The grading may be done by measuring the ratio of the area of the fluorescence to the total area of the face examined and from this working out the grade with due regard to the density of the gangue. At Yetholme, however, where the scheelite is disseminated, the grade was estimated by comparing the general luminosity of the faces in ultra-violet light with the appearance of faces and samples of known grade.

III. DETAILS OF EXAMINATION.

Although there are several areas in the Yetholme and Oberon districts where there is reason for supposing that scheelite may possibly be found, it was decided to restrict the present examination to the main deposits at Yetholme since they are the most extensive and could be mined within a comparatively short period.

Throughout the examination abundant points and patches of fluorescence of a type usually due to scheelite were observed on the faces of the quarries and the underground excavations. It is assumed in this report that all such fluorescence is due to scheelite containing minor amounts of molybdenum in the crystals. This appears to be a reasonable assumption since the fluorescence is similar to that observed in specimens where the determinations in ultra-violet light have been subsequently checked by other methods.

The scheelite is disseminated, as is the molybdenite, in a more or less flat lying or gently arched zone of garnet rock which dips into the hill-sides in some places, but outcrops or is scarcely covered by overburden over considerable areas. In the past search for molybdenite this zone of garnet rock has been explored by open cuts, adits, shafts, etc. These were examined in ultra-violet light as were also dumps and several outcrops of garnet rock between the excavations. The garnet rock is decomposed in places and some of the smaller cuts did not penetrate further than the zone of decomposition.

In many of the workings the faces were much covered by dust and mud. These faces often gave a poor fluorescent response suggesting low grade ore. It is significant, however, that where cleaned or where recent sampling has exposed fresh rock in such faces, the fluorescent effect was increased several times.

Another feature is that the fluorescence observed on a dump generally appeared much greater than on the faces of the open cut from which the dump material had been taken. This is no doubt partly due to the fact that on a dump a greater surface area for a given volume of ore is exposed. It is also partly due to the fact that the blocks of ore on the dumps are cleaner than the faces of the open cuts which in many cases are partly covered by fallen soil or decomposed rock.

Although it is evident that there is abundant scheelite at Yetholme, the estimates made in ultra-violet of the grade of the dumps and faces are extremely tentative. Some of the reasons for this are given above. Samples were collected which are typical of the various degrees of fluorescent effect, and when these have been assayed, it will be possible to form a more definite opinion as to the value of the deposits. Numerous very rich specimens of scheelite ore were also collected for subsequent studies.

Summarised field-book entries made on the field with reference to the excavations examined are as follows. The localities referred to may be seen on the accompanying plan which is based on plans prepared by the Broken Hill Proprietary when sampling the deposits for molybdenite. The plan is illustrated by sections in order to make clear the manner of occurrence of the garnet rock carrying the scheelite.

<u>MAMMOTH WORKINGS (MARKED MA ON PLAN)</u>

<u>West Section</u>: Garnet rock fresh, but many faces dirty. Scheelite distributed throughout with occasional rich patches. Average grade rather less than ½% WO_3. Fair molybdenite values. Generally best scheelite ore is also best molybdenite ore.

East Section: Remarks as above but average grade about ¼% WO_3.

BROKEN HILL PROPRIETARY OPEN CUTS (MARKED ON PLAN AS BELOW)

A: Garnet rock decomposed. Points and few small patches fluorescence. Traces of scheelite only. Molybdenite values very low.

B: Garnet rock decomposed. Not examined with ultra-violet light.

C: Mostly fresh garnet rock in faces and on dumps. Brilliant fluorescent effects. Average about 1% WO_3. Also rich in molybdenite.

D: Fresh garnet rock in faces and on dumps. Appears average about ¼% in faces and rather more than ¼% on dumps. Good molybdenite values.

E: Faces decomposed and very dirty. Average less than ¼% WO_3. Fair molybdenite values.

F: Fresh garnet rock in faces and on dumps. Ore in faces generally less than ¼% WO_3 but there are a number of large rich patches. Dump material averages about 1% WO_3. Good molybdenite values.

G: Rock much decomposed. Faces show traces only but hard boulders on dump show ore rather less than ¼% WO_3. Molybdenite values low.

H: Faces dirty but appear average about ¼% WO_3. A large face, however, recently shot down shows ore better than 1% WO_3. Dump material averages about 1% WO_3. Fair molybdenite values.

I: Fresh garnet rock in faces and on dumps. Faces appear average about ¼% WO_3 but dump materials appear to range from ½ to 1% WO_3. Molybdenite values rather low.

J: Not examined in ultra-violet light.

K: Fresh garnet rock in faces and on dump. Average rather more than ¼% WO_3. Molybdenite values rather poor.

L: Fresh garnet rock in faces and on dump. Average about ¼% WO_3. Molybdenite values rather low.

M: Rock much decomposed. Scheelite present throughout but low grade averaging much less than ¼% WO_3. Molybdenite values very low.

N: Garnet rock decomposed. Traces WO_3 only. Molybdenite values very low.

O: Fresh garnet rock in faces and on dump. Average about ¼% WO_3. Molybdenite values rather poor.

S: Alternate solid and decomposed rock in faces. Occasional points and patches fluorescence in solid rock but practically none in decomposed rock. Trace WO_3 only. Molybdenite values very low.

T: Remarks as for S above.

Z: Fresh garnet rock but faces very dirty. Trace to low grade WO_3. Practically no fluorescence seen in weathered rock. Molybdenite values rather low.

LITHGOW WORKINGS (MARKED LA ON PLAN).

Fresh garnet rock. Scheelite distributed throughout ranging from ¼ to ½% WO_3. Fair molybdenite values.

Shaft 3: Examined three small dumps of hard, garnet rock. Averaged about ½% WO_3. Molybdenite values rather low.

IV. CONCLUSIONS.

1. Prospecting with ultra-violet light at Yetholme has shown that there is a considerable amount of scheelite present in the zone of garnet rock which has previously been extensively investigated as a possible source of molybdenite.

2. As regards the tonnage and grade of ore available only the possibilities can be indicated at the present time. Figures for the tonnage may be roughly estimated from surveys of the garnet rock made in the past when sampling the deposits for molybdenite. Such surveys have yielded figures ranging from rather less than a million to several million tons. The grade of the scheelite in the ore was estimated from its appearance in ultra-violet light as compared with samples and faces of known grade, and is extremely tentative.

3. To give some idea of the prospect, however, it is considered that the possibilities of the deposit are of the order of 1,000,000 tons of ore with an average grade of rather less than ½% WO_3.

4. At least three smaller blocks of ore of higher grade than the above could be selected.

5. A considerable proportion of the tonnage could be readily and cheaply won by quarrying operations. Favourable features are the flat lying attitude of the garnet rock with very little cover over considerable areas (as shown in the accompanying sections) and the fact that the garnet rock has been opened up by cuts, adits and other excavations in the past search for molybdenite.

6. Within the area examined it appears that generally there is a positive correlation between the scheelite and molybdenite values. It is evident, however, from an inspection with ultra-violet light, that in most faces there is more scheelite than molybdenite. Moreover there is a distinct suggestion that the scheelite is more widespread than the molybdenite.

7. The above suggests that the Yetholme deposits may now perhaps be conveniently worked for both the scheelite and molybdenite values.

8. As the result of examining the sediments below and the porphyry above the garnet rock, it appears that the scheelite values are confined to fresh garnet rock since the fluorescence is poor or absent in decomposed garnet rock. There is the possibility, however, that some tungsten may be present in the decomposed rock in a form which is not revealed by fluorescence.

9. The particles of scheelite appear on the whole to be much coarser in the ore at Yetholme than in that at King Island. When the former is viewed in ultra-violet light, it is evident that, in addition to the innumerable fine particles of scheelite, there are many coarse patches while crystalline material is common.

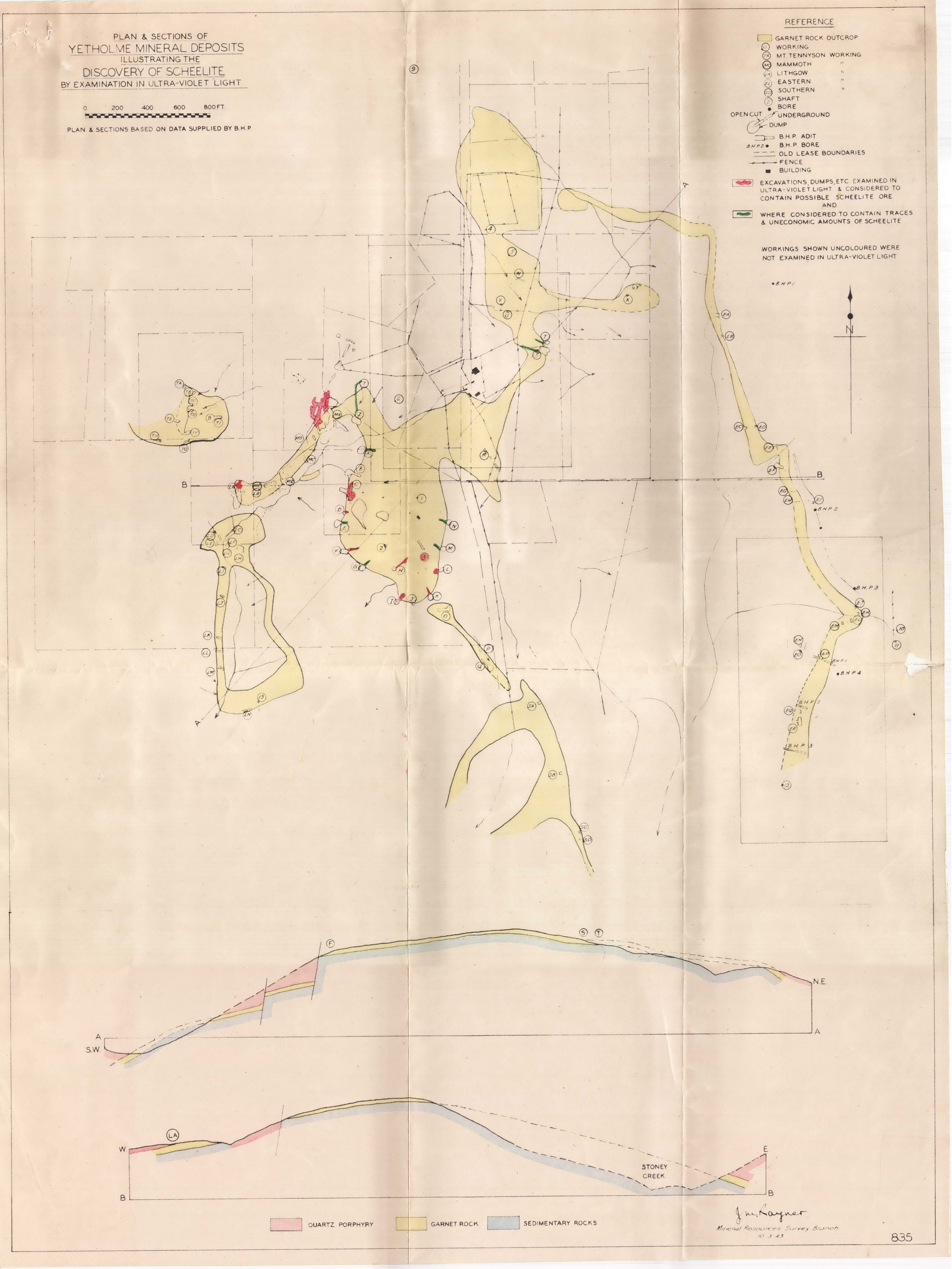
10. The examination described above has no doubt covered the most important area at Yetholme. More accurate grading of this area would result from a much longer examination of the faces with ultra-violet light. It would first of all be necessary to spend some time in cleaning down the faces. It would be advisable, however, to examine with ultra-violet light those outlying portions of the garnet rock not covered by the recent survey.

11. One of the major mining companies which investigated Yetholme as a possible source of molybdenite some 18 months ago, took some 500 samples. These were assayed for molybdenite and it is presumed that the reject portions have been kept. In order to indicate the grade of the scheelite in the deposits more accurately, it is advisable now to arrange for the assay of the tungstic content of these portions.

12. It might perhaps be mentioned that there is a possibility of discovering further deposits of scheelite by the use of ultra-violet light in at least three localities in the Yetholme-Oberon district. One of these near Duckmaloi was very briefly examined during the recent visit. Traces of scheelite were observed in garnet rock but no ore comparable with that at Yetholme was found.

CANBERRA, A.C.T.
11th March, 1943.

(J. M. Rayner)
CHIEF GEOPHYSICIST.


PLAN & SECTIONS OF
YETHOLME MINERAL DEPOSITS
ILLUSTRATING THE
DISCOVERY OF SCHEELITE
BY EXAMINATION IN ULTRA-VIOLET LIGHT
0 200 400 600 800FT.
PLAN & SECTIONS BASED ON DATA SUPPLIED BY B.H.P.
REFERENCE
GARNET ROCK OUTCROP
WORKING
MT. TENNYSON WORKING
MAMMOTH "
LITHGOW "
EASTERN "
SOUTHERN "
SHAFT
BORE
OPEN CUT
UNDERGROUND
DUMP
B.H.P. ADIT
B.H.P. BORE
OLD LEASE BOUNDARIES
FENCE
BUILDING
EXCAVATIONS, DUMPS, ETC. EXAMINED IN ULTRA-VIOLET LIGHT & CONSIDERED TO CONTAIN POSSIBLE SCHEELITE ORE
AND
WHERE CONSIDERED TO CONTAIN TRACES & UNECONOMIC AMOUNTS OF SCHEELITE
WORKINGS SHOWN UNCOLOURED WERE NOT EXAMINED IN ULTRA-VIOLET LIGHT
N
B.H.P.1
B.H.P.2
B.H.P.3
B.H.P.4
A
B
S.W.
N.E.
W.
E.
STONEY CREEK
QUARTZ PORPHYRY
GARNET ROCK
SEDIMENTARY ROCKS
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