Tasmania

DEPARTMENT OF MINES

GEOLOGICAL SURVEY MINERAL RESOURCES

No. 1

Tungsten and Molybdenum

Part II.

MIDDLESEX AND MT. CLAUDE DISTRICTS

BY

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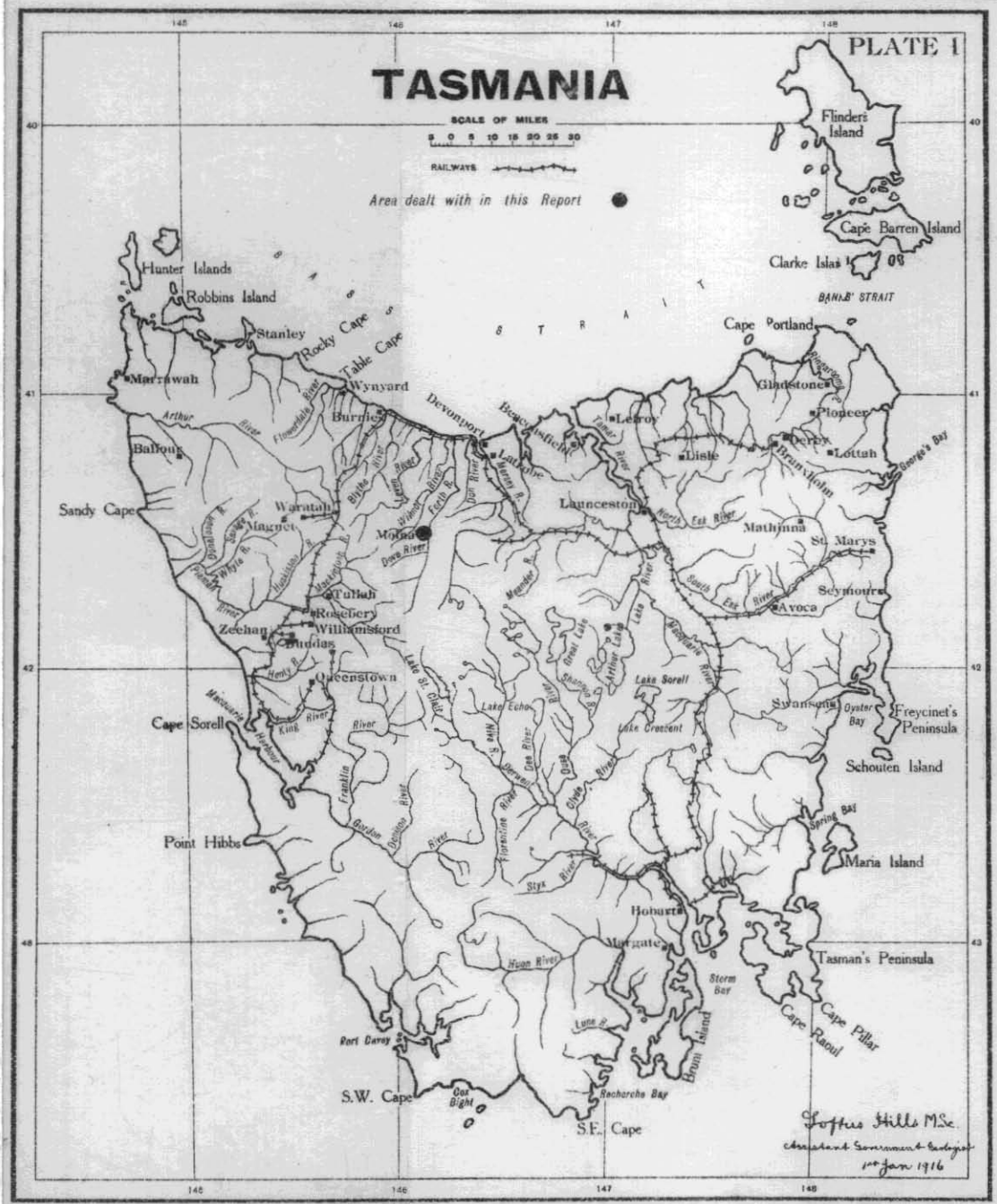

LOCALITY MAP

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MIDDLESEX AND MT. CLAUDE DISTRICTS.

I.—INTRODUCTION.

THIS is the second of the "Mineral Resources" series of publications of the Geological Survey. It constitutes Part II. of the set dealing with the tungsten and molybdenum resources of the State of Tasmania. Part I. was devoted to the occurrences in North-Eastern and Eastern Tasmania, while this present volume treats of those in the Middlesex and Mt. Claude districts, situated in Northern Tasmania, about 25 miles south of the port of Devonport.

The district has been previously subjected to a thorough geological survey by Mr. W. H. Twelvetrees, Government Geologist, and is fully described in Geological Survey Bulletin No. 14, "The Middlesex and Mount Claude Mining Field." Consequently, the present investigation has been designed to merely supplement the complete bulletin and to specifically indicate the present position in regard to the production of the two metals tungsten and molybdenum, as well as to discuss the future prospects.

The report will be concise, and will contain no material that has already been dealt with in the abovementioned bulletin, or in Part I. of the "Mineral Resources" series, and the reader will find himself repeatedly referred to either of these publications.

The writer wishes to express his appreciation of hospitality and assistance rendered by the following gentlemen during the course of his field examinations:—Mr. W. E. Hitchcock, Moina; Mr. W. Goldsworthy, All Nations; Mr. B. J. Gurr, Moina; Mr. Warwick Castles, and Mr. C. Carlson.

II.—GENERAL CHARACTER, GENESIS, AND MODE OF OCCURRENCE OF WOLFRAM AND MOLYBDENITE.

There is no need to include in this publication the details under this head, as they have been fully delineated in Part I. of this series, and the reader is referred thereto before he proceeds to the next chapter.

In addition, full details of the mode of occurrence and paragenesis of these minerals is contained in Mr. Twelvetrees' bulletin above referred to, and reference to pages 32 to 37 of that publication will supply all the information available.

With the general knowledge thus accessible, the description of the various occurrences can now be proceeded with.

III.—OCCURRENCES OF WOLFRAM AND MOLYBDENITE IN THE MIDDLESEX AND MOUNT CLAUDE DISTRICTS.

(1) *The S. and M. Mine, Moina.*

This is the pioneer and largest mine in the district. It has been fully described in Bulletin No. 14, pages 45-52. In the period which has elapsed since that report was written (four years) considerable development has been carried out. It is only intended to describe here the results of this work and its effect on the future of the mine.

There are four lodes worked on this mine averaging from 12 to 15 inches in width. At the time Mr. Twelvetrees made his examination, the No. 3 adit was the lowest level, and all of the four lodes had been driven on for varying distances. Since then, additional driving on Nos. 2, 4, and 5 lodes has been carried out, and new blocks of ore opened up, a great part of which has been extracted. During the last 12 months, however, a shaft has been sunk from the No. 3 adit level at the No. 6 lode, and connected with the surface. The total depth sunk has been 150 feet below No. 3 adit, and levels driven along the No. 6 lode at 75 feet and 150 feet respectively. These are shown as the No. 2 and No. 3 levels respectively, the No. 3 adit being now known as the No. 1 level. The No. 6 lode at these levels maintains both its size and value, and this development undoubtedly places the mine on a very sound footing. The following particulars will give the position of the mine at the present time in regard to ore reserves:—

No. 4 Creek Drive.—No. 2 lode, length 500 feet, height 87 feet.

No. 3 Adit.—No. 2 lode, length 200 feet, height 154 feet. This block will be increased as driving along the lode is continued.

No. 3 Adit.—No. 4 lode, length 200 feet, height 50 feet.

Main Shaft, No. 2 Level.—No. 6 lode, length 175 feet, height 75 feet.

Main Shaft, No. 3 Level.—No. 6 lode, length 185 feet, height 75 feet.

Both of these latter blocks are being increased as driving along the lode is carried on.

A crosscut from No. 3 level is at present being driven southwards to cut Nos. 5, 4, and 2 lodes in that order, 150 feet vertically below the present workings on them. A distance of 89 feet has already been driven.

It has been found impossible to express these ore reserves in figures, as the conditions of working are exceptional. For instance, if an average width of lode of, say, 12 inches is taken, the figures obtained are quite valueless, for the reason that in mining the lode it is found impossible to separate it from the country-rock, with the result that approximately 75 per cent. of the material milled is barren country-rock. As the important figure to be considered is that of the material which is to be treated in the mill, it will be seen that any estimate of ore reserves based on the width of lode is quite valueless. As regards the future of the mine, however, the general statement is quite justified, that, on the evidence at present showing, five years' full work is assured. In addition, the mine has possibilities much in excess of that, both in depth and in the longitudinal extension of the lodes.

Since Mr. Twelvetrees' visit, rock-drills have been installed, and have greatly reduced the cost of mining; in fact, in the hard ground the utilisation of such drills is essential to the working of the mine at a profit. The drills are worked by compressed air supplied by air-compressors driven by Pelton wheels for nine or ten months of the year, and by an auxiliary steam plant during the dry season. The shaft is already equipped with a steam-driven winding engine.

The development footage to date is 9530 feet, and total material milled 55,585·5 tons, which gives 1 foot of development work for every 5·8 tons of crude ore raised.

A general idea concerning the length of the lodes and work done can be gained from the following:—

No. 6 lode has been driven along for a total length of 800 feet, and stoped for a length of 800 feet.

No. 5 lode driven on for 600 feet and stoped for 300 feet.

No. 4 lode driven on for 1400 feet and stoped for 1000 feet.

No. 2 lode driven on for 900 feet and stoped for 800 feet.

The S. and M. has certainly been a consistent producer of the three metals, tin, tungsten, and bismuth, for the

past eight years. During that period the following ore has been produced:—

Details of Ore Milled and Products Obtained.

Crude Ore.	Firsts.	Seconds.	Slimes.	Picked Bismuth.	Picked Wolfram.	Total.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
55,585·5	640·55	274·35	53·55	24·88	3·25	996·58

The details of the composition of the various products mentioned in the above table are given in Bulletin No. 14, and need not be repeated here.

To indicate the contents of the material milled under present conditions, the following information is submitted, which represents the work done during the last 24 weeks:—

Details of Recovery in Present Milling Practice.

	Tons.		Percentage.
Crude ore milled	4880·00	...	
Firsts	37·80	...	0·774
Seconds	44·90	...	0·920
Slimes	4·20	...	0·086
Picked bismuth...	0·35	...	0·007
Total...	87·25	...	1·787

The crude ore thus provides 1·787 per cent. of concentrates of various kinds. This may be taken as the average of the material treated.

The remarks in connection with this mine may be concluded by stating that the present output can be continued for at least the next five years, and that the success of the last eight years will continue.

(2) *The All Nations Mine, Moina.*

This mine is referred to in Mr. Twelvetrees' bulletin as the Lady Barron, and is described on pages 74 to 77 inclusive. It was originally known as the "All Nations," and has thus returned to its old name after many vicissitudes.

There is only one lode on this property, which is essentially a wolfram-bismuth one. Its characteristics have already been fully described in Bulletin No. 14. Since that examination, the spasmodic and unsystematic work which

has characterised all the operations since the discovery of the mine has been continued, and consequently the mine is in on better position than it ever has been. Such operations have consisted for the most part of underhand stoping and treating the crude ore by screening and streaming the fines. A small mill was erected, but was destroyed by fire about 12 months ago.

Since Mr. Twelvetrees' visit an adit has been driven at a depth of 40 feet below the No. 1 adit, and the lode driven on for 235 feet vertically below the approach to the No. 1 adit. All this has been stoped with the exception of 75 feet. At present a winze is being sunk on a rich patch at this level. On the upper level the lode was driven on for 320 feet, and was stoped for 200 feet. On the surface the lode has been underhand-stoped for 550 feet.

The mine has never been handled in a manner which would give it a fair chance of proving its value. The mistake has always been made of endeavouring to make it pay its way from the initiation of operations, with the almost total elimination of capitalisation. The result has been what could reasonably be expected, namely, complete failure to make of it a paying concern. The property suffers from several drawbacks, as compared with the neighbouring S. and M. Mine, notably the scarcity of water, due to its elevation, and the absence of facilities for adit-driving. These disabilities, however, cannot be said to render the mine valueless, as there are certain advantages which, although not very apparent, still exist, and when put to proper use should render the proposition a valuable one. These natural facilities become apparent on studying the adjoining section to the east (Ryan and Colling's), and the discussion of them will be presented after the occurrences on that section have been described.

It will be sufficient at this stage to state that above the present lowest level on the All Nations Mine there are the following blocks of ore remaining untouched: —

Above No. 1 level, 120 feet long, with a maximum height of 80 feet.

Between No. 1 and No. 2 levels, 395 feet long, with height 40 feet.

It is perfectly obvious that instead of stoping a rich patch the work should be directed to driving at the No. 2 level along the lode to get vertically below the easterly outcrop of the lode, and so properly open up the above-

mentioned blocks. It must be constantly borne in mind that in wolfram-mining it is essential that considerable length of lode be operated on at one time, as this is the only way to ensure a constant output from lodes in which the values are sporadically distributed. This has been fully explained in Part I. of this series of publications, and the failure to realise this fact has been partly responsible for the failure of this mine to progress.

The width of the All Nations lode varies from 10 to 20 inches. The values are patchy, as is usual with wolfram lodes. It may be here remarked that it is impossible to arrive at the value of any wolfram lode by face-sampling, owing to the sporadic distribution of values, and attempts made to thus sample the All Nations Mine and others in the district are sure to result in misleading information. The only way to form an accurate estimate is by the testing of a large parcel representing some considerable length of lode. In the case of the All Nations lode the crushings put through in the past and present treatment are available as an indication of the values to be expected from the lode as a whole. In this way the figure of 2 per cent. of concentrates may be stated as representing the value of the lode. The concentrates contain wolfram and native bismuth, with some carbonate of bismuth, and assay approximately:—

Tungstic acid...	68 per cent.
Bismuth	4 per cent.

The total output from this mine is impossible of estimation, but during the last 12 months, with the crude methods of working, has been 7 tons of concentrates.

The future method of working this mine will be discussed in connection with the following description of the neighbouring section (A. Colling's).

(3) *Section* 7207M *(A. Colling's).*

This is described in Bulletin No. 14 as Poachin's Section. Since Mr. Twelvetrees' visit a short adit about 30 feet, on several quartz veins carrying wolfram in white conglomerate country, has been driven. The precipitous slope to the Forth River is here traversed by outcropping quartz veins carrying wolframite. Where driven on, these veins seem to lie on the continuation of the All Nations lode, but no definite statement thereon is at present justified. The work so far accomplished has served to show that the

characteristics of the lode formation are those of small vertical veins, with flat offshoots connecting them, with the result that the whole of the face shows more or less wolfram, the country-rock itself showing bunches of wolfram occasionally. There are two main veins showing in the face at present, one 5 or 6 inches in width, and the other about 3 inches. The quartz veins are very rich in wolfram, with a little bismuth sulphide.

The amount of mineral showing is certainly sufficient to encourage further work, but when viewed in relation to the All Nations property an important inducement for active work is realised. As previously pointed out, the drawbacks to the All Nations Mine are the lack of facilities for driving adits and the scarcity of water. If shaft-sinking were resorted to, the ore would have to be raised and subsequently lowered to a point where water is available. It is desirable to avoid this if possible, and investigation shows that there are two ways of doing so.

The first suggestion takes advantage of the fall from the All Nations to the S. and M. A tunnel driven eastwards from the Bismuth Creek a few feet above the entrance to the No. 4 creek drive would cut the western end of the All Nations lode in approximately 1500 to 2000 feet of driving, giving 200 feet of backs. This is quite a feasible proposition, but is not as desirable as the second suggestion, which will now be indicated.

The country falls away rapidly from near the eastern boundary of the All Nations lease to the Forth River—a total fall of about 1800 feet. Colling's section is on this fall. As stated above, the lode formation partly opened up on this latter section is probably the continuation of the All Nations lode. If an adit were driven along Colling's lode, it would therefore meet the most easterly end of the All Nations lode in about 1300 feet of driving, with some hundreds of feet of backs. In addition to this, the amount of backs can be increased by hundreds of feet if necessary, by starting lower down the hill, with a proportionately small increase in the length of the adit. The additional advantage also exists of opening up one lode formation while driving for a second, as contrasted with the driving along barren ground from the S. and M. lease. A good road passes through the easterly part of Colling's section, connecting with the Middlesex-road. Milling operations could be carried on below the workings in the Forth Valley, and water could be easily brought in from Bull Plain Creek.

There is a narrow strip of ground between the All Nations lease and Colling's section, recently applied for by H. E. Walduck. The three sections concerned in the proposed scheme are the All Nations, Colling's, and Walduck's.

It will thus be seen that by regarding the problem in a broad way, a proposition which at short range possesses marked disadvantages, can be attacked in a comprehensive manner and converted into one possessing very favourable features. The writer has no hesitation, on the evidence available, in recommending the adoption of such a scheme, the details which must be decided upon by a competent engineer experienced in wolfram mining.

(4) *The Squib (Gurr's) Mine.*

This mine has been fully described by Mr. Twelvetrees in Bulletin No. 14. There are six lodes on the property, carrying varying percentages of wolfram, bismuth, and molybdenite. They occur partly in granite and partly in the adjacent quartzites. It has been observed that the value, as well as the size of the lodes, is greater in the granite.

Four of the lodes were being worked by open-cut mining at the time of Mr. Twelvetrees' visit, in order to take advantage of the numerous small stringers carrying metal. The whole of the dirt was being milled in a small plant erected on the Narrawa Creek. Since that date, however, the open-cut system has been abandoned, owing to lack of haulage and transport facilities, and an adit is being driven at a depth of 100 feet below the open-cut, along one of the lodes in an easterly direction. Three hundred feet have already been driven, leaving 200 feet more before a point vertically below the open-cut is reached. The lode being driven on is small and broken, but at times shows good values in wolfram and bismuth. It is expected that the values and size of lode will increase when the granite is entered. Crosscutting will then open up the parallel lodes.

Additional facilities for a deeper adit exist, giving a further 150 feet of backs.

During the past 12 months 3 tons 5 cwts. of concentrate have been obtained, from which clean wolfram assaying 70 per cent. WO_3, and 7 cwt. of bismuth ore assaying 40 per cent. Bi, have been extracted.

There is quite an appreciable amount of molybdenite showing on this property, and the tailings in the mill show

the mineral freely. It is quite possible that the amount present could be profitably extracted by flotation of the crushed mill tailings, but the wisest plan to adopt is to await developments at the present adit level, and then determine by a bulk test of the mill tailings whether the extraction of the molybdenite would be profitable.

The present scheme of operations is certainly justifiable, and there is certainly a prospect of a payable proposition developing.

(5) *The Iris Mine.*

This is an alluvial proposition, and was the first discovery in the district. Most of the ground is already worked out, but the present owners, Messrs. Adam and Davis, have acquired a mill lease adjoining to the north, until lately held by the Lady Barron Company, which contains a run of nice ground which ensures about five years' working at the present rate.

During the last 12 months 6 tons of concentrate, containing tin and wolfram, have been obtained, and this rate of output should characterise the future. The great difficulty of working at this elevation is lack of water.

(6) *Section* 7114M *(J. Ware and E. L. Smith)—Urquhart's Section.*

This section was described by Mr. Twelvetrees under the name of D C. Urquhart, the lessee at that time. Since his report an adit has been driven for about 30 feet on the lode below the lowest trench described in Bulletin No. 14. This has disclosed the lode, and shows it to be exceedingly rich, though small. In the face, it is split into two portions, one 6 inches in width and the other about 3 inches, making 9 inches in all. The lode is in granite country It carries values of wolfram and bismuth sulphide in about equal proportions. A small parcel obtained by dollying has been sent out, and amounted to 7 cwt. containing about equal proportions of wolfram and bismuth sulphide. In addition about 70 lbs. of hand-picked bismuth were obtained.

At present two men working in a very crude fashion can obtain one bag of concentrate a week from the lode-stuff as mined.

When it is remembered that this lode system has been traced for some chains on the surface, it is seen that there

is decided encouragement to actively prospect by continuing the present adit. As showing at present, the lode is as rich in bismuth as any in the field.

(7) *Properties on the Eastern Side of the Forth River.*

Above the Lorinna-road, a little south of the Cage, on a section charted in the name of S. S. McLean, a tunnel has been driven for about 15 feet on a quartz lode in the granite, carrying wolfram and molybdenite. The width varies from 12 to 15 inches, and average samples are said to have returned over 2 per cent. each of wolfram and molybdenite. It would be as well, however, to place no reliance on such figures, as it is impossible to obtain a satisfactory estimate of the value of such a lode by taking face samples. At the same time, there is no doubt that the lode carries nice values in molybdenite and wolfram, and especially the former, for occurrences in such large flakes are exceptional in molybdenite lodes in Tasmania.

The drawback to the proposition, however, is the extreme hardness of the enclosing rock. If it were not for that fact it would be an attractive proposition to a fossiker to break down the lode and obtain the molybdenite and wolfram by hand-picking and dollying. As it is, it is certainly worth while trying in this manner, but it is extremely doubtful whether a company could do any good at it.

There are numerous other occurrences of molybdenite in this vicinity, but they are all so sporadic and indefinite in character that they do not warrant further attention.

There has been no work done on any other sections since Mr. Twelvetrees' visit, and consequently no mention of them is necessary in this publication.

IV.—THE METHODS OF CONCENTRATION EMPLOYED IN THE DISTRICT.

These have been fully described in Bulletin No. 14, in two papers contributed by Mr. W. E. Hitchcock and the writer respectively. The former deals with the mining and milling methods at the S. and M. Mine, and the article contributed by the writer is descriptive of the electro-magnetic separation of tin, wolfram, and tungsten ores. These will be found on pages 52 to 73 of the bulletin referred to.

There is nothing new to add to these descriptions, except that several mechanical improvements have been effected in the S. and M. mill which increase its efficiency and smoothness of running.

The most important point concerning the concentration of the S. and M. ore is in connection with the pyrite. The scheme adopted is to produce two grades of concentrate—"firsts" nearly free from pyrite, and "seconds" containing approximately 50 per cent. thereof. The latter are treated by a special adaptation of the electro-magnetic process worked out by the writer, and converted into high-grade wolfram and tin-bismuth products corresponding with those produced from the firsts.

The methods adopted at the S. and M. must serve as a model for the whole district.

In regard to the recovery of molybdenite the only method applicable is that of passing the tailings from the concentrating mill to a tube-mill, and reducing them to slime before treating in flotation boxes, by which the molybdenite will be obtained as a float. The details of such a scheme should be left to the Mineral Separation De Bavay Processes Proprietary Company Limited, Melbourne.

V.—CONCLUSION.

(1) *The Output from the District.*

The total output of wolfram from the district is impossible of exact estimation, but probably is not very far from 350 tons of concentrate, assaying 70 per cent. tungstic acid.

The present output is approximately at the rate of 6 tons of wolfram per month.

(2) *General Recommendations.*

A brief summary of the conclusions arrived at in the preceding pages will now be presented, and it may be remarked that the urgency of the need of wolfram and molybdenite should influence the rate at which exploration on the lines indicated should be carried out.

(1) The S. and M. Mine is working continuously and systematically, and cannot do better than continue its present scheme of operations. An output of approximately 27 cwt. of wolfram per week can thus be depended upon. Although molybdenite occurs scattered throughout this mine, there is no justification for an attempt to recover it, as it is too small in amount to pay.

(2) The All Nations Mine and Colling's Section should be worked in conjunction by driving an adit from the latter section along the lode to open up the All Nations lode at a depth. The milling plant should be erected somewhere in the Forth gorge, and water brought in from Bull Plain Creek. In this way the properties can be systematically worked, and will become important producers of wolfram. The present system of working is of no value either to the owners themselves or to the British Empire.

(3) The present system of operations at the Squib Mine should be continued, and stoping initiated when the adit reaches a point beneath the open-cut. Investigations as to the possibility of extracting the molybdenite from the mill tailings should then be undertaken.

(4) The Iris Mine cannot do better than continue the present rate of output.

(5) Active development of the lode on Ware and Smith's Section should be initiated by continuing the present adit.

(6) The molybdenite and wolfram lode on the eastern side of the Forth gorge should be taken in hand by one or two miners and worked by hand-picking. This is the only chance of working it at a profit.

It will thus be seen that there are possibilities of increasing the output of wolfram from the district if systematic work is immediately undertaken, and it is possible that an output of molybdenite may eventuate from the Squib Mine with a little from hand-picking on McLean's Section.

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Launceston, 1st January, 1916.