

THE TUNGSTEN RESOURCES OF TASMANIAP.B. NYE1. INTRODUCTION

In Tasmania, tungsten deposits occur mainly in the north-eastern and central northern districts and on King Island. Deposits of lesser importance occur in the western district. The only tungsten minerals present are wolfram (iron-manganese tungstate) and scheelite (Calcium tungstate). Scheelite is present in the King Island deposit, but all other deposits contain wolfram.

The deposits occur in metamorphosed sedimentary rocks ranging in age from Pre-Cambrian to Silurian and in granite of Devonian age.

The total production of wolfram to the end of 1940, was 4,054 tons with a total value of £568,755 and of scheelite was 1,066 tons with a total value of £191,082. Of the above, there has been produced since 1917, some 3,336 tons of wolfram valued at £493,330 and all the scheelite quoted. The largest producers during the period since 1917 have been:-

Storeys Creek	(Wolfram)	2,573 tons -	£362,804
King Island	(Scheelite)	1,066 tons -	£191,082
Avoca (probably includes part of Gipps Ck. & Storeys Ck. production)	(Wolfram)	323 tons -	£63,094
Aberfoyle Mine	(Wolfram)	212 tons -	£38,788
S. & M. Mine	(Wolfram)	99 tons -	£14,006

The most important producing mines have, therefore been Storeys Creek at Stony Creek, the King Island mine and the Aberfoyle at Rossarden. These three mines are still producing tungsten ores.

11 THE NORTH-EASTERN DISTRICTA. INTRODUCTION

In the north-eastern district, the areas in which wolfram deposits occur are:-

1. Story Creek, which includes the Storey Ck. Mine
2. Rossarden, Aberfoyle tin mine which produces wolfram as well as cassiterite.
3. Gipps Creek
4. Upper Scamander
5. St. Helens.

The first two areas contain producing mines, and a very small amount is produced at Gipps Creek, but there is no current production from Upper Scamander and St. Helens.

The survey of the tungsten resources was, in accordance with departmental instructions, restricted to non-producing areas in the first place. Only the Gipps Creek, Upper Scamander and St. Helens areas will therefore be described in this section of the report.

B. THE GIPPS CREEK AREA

(1) INTRODUCTION

The Gipps Creek area is situated in the north-eastern portion of Tasmania, and some 2½ miles to the south-south-west of the southern end of Ben Lomond. Access is gained by a branch road from the Avoca-Storey Creek road, the distance from Avoca being 12 miles. The township of Avoca is on the State railway system.

(2) Previous Reports and History

Earlier reports are included in the following list. The reports are published ones unless otherwise indicated:-

- Montgomery, A. Report on the Ben Lomond District, 1892.
- Waller, G.A. Report on the Tin Mining district of Ben Lomond, 1901.
- Hills, Loftus Tungsten and Molybdenum, Part 1 North-Eastern and Eastern Tasmania, Geol. Sur. Min. Res. No. 1., 1916.
- Nye, P.B. Report on the Gipps Creek district, 1926 (typewritten), (also included in Tas. Geol. Surv. Bulletin No. 40).

The history of the field is not known in detail. The main workings were those, between 1899 and 1908, of the Tungsten Company and its successors, and will be described below when dealing with the Tungsten Mine. Apart from such operations, workings have been conducted at intervals by small parties. At present, the only work is the small scale operations of Mr. Hayes.

(3) Geology

The area is occupied chiefly by granite rocks of Devonian age. To the north of the area, slates and quartzites of the Cambro-Ordovician system outcrop, and represent a remnant of the rocks into which the granite was intruded. In Dillon Bottom and at a few localities along Cradle Creek, Permo-Carboniferous pebbly shales and mudstones occur. Those in Cradle Creek are lying horizontally, and those in Dillon Bottom are dipping vertically. The latter junction with the granite to the east, and at first sight, the contact would appear to be an intrusive one. This, however, is not in accordance with evidence in adjacent parts of the district and the real explanation is that the junction is a faulted one and represents a portion of the fault mapped by Mr. A.M. Reid in the Avoca Coalfield (see Mineral Resources No. 7) and in the Avoca Mineral Field (see Bulletin No. 40).

The granite is a medium-grained, non-porphyrific type in which quartz and feldspar are abundant, and mica subordinate in amount.

(4) Economic Geology

The wolfram deposits are quartz reefs in granite rocks. The reefs have strikes to 30° west of north to 20° east of north, but the general strike is between 330° and 350°. The dips are to the east at low angles. In the western and southern parts of the field, the dips are between 10° and 20°, but on the eastern part of the lease 11314/M, the dip is about 45°.

The area in which the reefs occur has a length from north to south of 1,800 feet and a width of 900 feet. This area represents the southern portion of the Gipps Creek field. In the northern portion of the field, the mineral deposits are those of tin, and not of wolfram.

The reefs are of normal quartz type, but contain much black tourmaline. Wolfram is irregularly distributed through-out the quartz in medium to large sized pieces. A few pieces of pyrite and chalcopyrite were found on the dumps of the Tungsten workings.

There is no sign of crushing or schisting in the granitic rocks, and the reef channels appear to be one of the systems of master joints. It has been stated by operators on the field that the reefs are affected by vertical north-south faults. Few of the latter are available for examination, but those available suggest vertical joints rather than faults. Quartz veins occur in one of these joints in the Tungsten workings. The reefs end against such vertical joints, but are not faulted by them.

(5) Tungsten Mine (Lease 35M/40)

The mine workings known as the old Tungsten mine are situated on the south-western side of Gipps Creek and in the south-western portion of lease 35M/40 held by V.H. Hodgman and D.M. McLeod.

The ground has been held under lease almost continuously since at least 1887. The presence of wolfram was probably known from an early date, but owing to the absence of markets, and to the low price, mining did not become active until the close of the nineteenth century. The Ben Lomond Tungsten Mining Co., N.L. was formed in 1899 and the Lease was transferred to that company. Operations continued until 1902 and a small amount of ore was mined, but the treatment plant was small and inadequate. The lease reverted to Thomas Briggs in 1903 and he worked the mine (the greater part of the underground workings were the result of his effort) until his death in 1908. It was held by other interests from 1909 to 1922 and by various interests since 1937. At different times, the dumps have been treated by sluicing etc. At present, no work is being carried out.

Previous reports on the mine are:-

- Waller, G.A. Report on the Tin Mining district of Ben Lomond, 1901, p33-34.
- Nye, P.B. Gipps Creek Area, 1926 (Incorporated in Tas, Geo.Surv. Bulletin No. 40, 1929, pp. 62-71.

The country rock is a medium-grained granite. The mineral deposit is a wolfram-bearing quartz vein or veins. The unstoped portions of the workings consist largely of white and dense quartz. In a few places tourmaline is abundant, but little wolfram is visible. The pieces on the dumps suggest that the worked portions of the veins probably contained more tourmaline and more wolfram. A few pieces of sulphides (pyrite, chalcopyrite, etc.) are present in the dumps.

The workings consist of a line of surface workings and six-adit-drives (with an intermediate drive from one of them).

The workings prove that the vein (or veins) has a general strike of 25° to 35° and a dip to the east at low angles - the No. 1 vein dips at 15° and the No. 2 at 10°. There appears to be either two veins or alternatively one vein faulted or with an abrupt change of strike and dip over a short portion of its length. The latter seems to be, at least in part, the most likely explanation. The south-western portion will be termed the No. 1 vein or shoot and the north-eastern portion the No. 2 vein or shoot (these portions probably correspond to the No. 1 and 2 veins of Waller).

The No. 1 vein was stoped from the surface, at the No. 4 intermediate and the No. 4 adit. The No. 5 adit has reached the vein but followed it for only a short distance and no stoping has been done. It is not known whether the No. 2 and 3 adits were extended to cut this vein. The lengths worked were 120 feet at the surface 50 feet at No. 4 intermediate and 40 to 50 feet at No. 4 adit. The depth from surface to No. 4 adit (measured along the vein) is 200 feet. As far as can be seen, the vein ranged in width up to 12 inches, but it may have been wider in the stoped portions. The vein still exists in the southern faces of Nos. 4 and 5 adits. The north-eastern end pitches to the south or south-east.

The No. 2 vein has been stoped from the Nos. 1, 2, 3, 4 and 5 adits. The length stoped at the upper three adits levels is not known, but at Nos. 4 and 5 adits, it was 45 feet. The depth (down the vein) from No. 1 to No. 5 adit is 200 feet. The unstoped portion of the vein ranges in width up to 12 inches, but the width in the stoped portion is not known. The vein has a pitch to the south or south-east. The north-eastern end of the stopes apparently represent the north-eastern end of the vein. At the No. 5 adit, the vein ends against a steeply drifting vein, but no such vein was seen in the No. 4 adit. The No. 2 vein probably terminates at its north-eastern end against a high dipping joint which, in places, may contain a quartz vein.

The No. 1 vein in the surface stopes and the No. 2 vein in the No. 1 adit are at levels differing by 20 to 25 feet. The No. 2 vein does not lie below the No. 1 vein, but ends near the north-eastern end of the latter. As the No. 1 vein dips at 15° and the No. 2 at 10°, the north-eastern end of the No. 1 vein and the south-western end of the No. 2 vein will approach one another in level as depth is attained. Thus at No. 4 adit there is a difference in level of approximately 10 feet, and at the No. 5 adit the difference is nearer to 5 feet. The narrow zone between the ends of the two veins has a pitch to the south or south-east.

It is not possible to obtain the production from this mine, due mainly to the fact that the production was not in some cases separated from that of adjacent mines in the Gipps Creek area and in other cases, not separated from the other mines in the Ben Lomond district.

Seven samples were taken - four from the No. 5 adit, and three from the No. 4 adit, the positions being shown on the attached plate (No. 2). The samples were generally of white to glassy quartz with no visible wolfram. Sample No. 2 was soft and contained much tourmaline, while No. 5 contained some tourmaline. It was expected that the samples would contain little, if any, wolfram, and this was confirmed by the assay results, viz. that all the samples, contained less than a trace (or 0.1 per cent) of tungstic oxide.

The two veins in the mine have been explored over a combined maximum length of 170 feet and to a depth of 200 feet (down the dip). As far as can be seen the width of the veins ranges up to 12 inches, but in the stopes the width may have ranged to 18 or 24 inches (Waller gave a range from 18 to 24 inches). The veins dip at low angles and have been worked from adit drives. The present faces suggest that all the profitable ore that had been developed, was mined and this is generally confirmed by the samples taken. Further exploration and development is, therefore, necessary to determine if any further profitable ore is at present in the veins. The exploration possible includes :-

1. Driving the faces of the No. 4 intermediate, No. 4 and 5 adits to the south-west along the No. 1 vein.
2. Driving the No. 6 adit to the south-west to test the downward extensions of the Nos. 1 and 2 veins. The No. 6 adit has been driven in a direction which will cause it to pass below the veins. The direction of this adit, should, therefore, be turned to the south-west, but it might be preferable to commence a new adit.

(6) LEASE 11902/M

This lease is of 5 acres and in the names of E.R.O. and D.E.M. Hayes. It is situated on the northern side of Gipps Creek immediately to the north of the Tungsten workings.

It is occupied by granite with alluvium along Gipps Creek in the southern portion of the lease. The granite is weathered and there are few, if any, outcrops.

One wolfram-bearing reef has been found and been opened up by four adits on the southern slopes of the hill above Gipps Creek. The workings form a line with a general east-south-easterly trend, but they are situated along the dip of the reef and not along the strike. The true strike would be between 330° and 350° and the dip to the east at approximately 13°.

The lowest adit occurs at the eastern end of the line of workings. It is stated to have been driven by Mace and that a fault was encountered. The workings are completely blocked and neither reef nor reported fault can be examined.

To the east and at a slightly higher level, another collapsed adit exists. It is stated that this adit was driven 60 feet along the reef by Harry Smith and that the reef was stoped overhead. In this vicinity the outcrop was sluiced. It is stated that in 1908 or 1909 that wolfram worth about £160 was obtained. Later Hayes sluiced the dump from the above adit and obtained wolfram valued at £91.

Further to the north-west, two more recent adits have driven on the reef and a trench has been cut on it. A small amount of stoping has been carried out above the lower of these adits and there is a rise above the upper adit. A small amount of stoping has also been conducted below the approach of the upper adit. A vertical wall occurs on the western side and it has been regarded as a fault. The reef has, however, been found in the rise from the adit, and also in the trench further west. There is little, if any, displacement of the reef on opposite sides of the wall, and the latter is probably a pre-reef major joint.

As far as can be seen, the reef has a width ranging from 6 to 20 inches but which is usually 10 to 15 inches. The reef is a quartz one and it contains tourmaline and wolfram. The wolfram content is not uniform, but Mr. Hayes has been, and still is, obtaining wolfram ore of a good grade from the workings. Thus, prior to 1926, he reports that he obtained from one of the adits (probably the upper one), seven bags in the first 7 feet, none in the next 14 feet, and six bags from a small stope above the then face. At present, he is also breaking good ore and is concentrating same in a plant consisting of a Ford motor car engine, a small rock-breaker and an one-compartment jig.

Although the workings have produced wolfram ore, the shoots do not appear to be large. The workings seem to suggest a more or less continuous shoot along the outcrop, but the accessible workings do not suggest any great extent into the hill, i.e., along the strike. However, the nature of the wolfram reefs is such that low grade ore in a face does not necessarily mean that the limit of the shoot has been reached.

The economic value of the reef will of course depend largely upon the results of future development work. Search at the surface would probably result in the tracing of the reef further to the north-west and to the north. Underground work should include the driving of the existing adits along the reef, and the re-opening and further driving of the collapsed ones. At the least, the reef will yield further small supplies of wolfram ore.

Near the western boundary of the lease, an adit and shaft exist. The adit was driven in a north-westerly direction to cut a reef worked on lease 26M/40.

(7) LEASE 78M/40

This 13-acre lease is held by V.H. Hodgman and D.M. McLeod. In the north-eastern corner, there is a shallow and irregular open cut situated at the southern end of a line of old workings. The country rock is a coarse-grained granite and in the deepest part of the working, the granite contains narrow quartz-tourmaline veins and some mica greisen over a width of 5 feet.

About 50 feet to the north and on the northern boundary of the lease, there is another shallow open-cut with a winze depressed at a low angle to the east. Quartz-tourmaline occurs on the dump, but no prominent reef or formation appears in the working.

South of Gipps Creek and near the eastern boundary of the lease, there is some shallow sluicing on the surface, which probably yielded some wolfram. A short distance to the west there are two shallow shafts and a short adit. One of the shafts is said to have yielded some wolfram. In the approach to the adit there is a narrow vein and an irregular body, and near the face there are two narrow veins dipping easterly at 30°.

(8) LEASE 26M/40

This lease is of 80 acres and is held by V.H. Hodgman and D.M. McLeod. Its central and western portions contain alluvial and lode tin deposits along the valley of Dillon Bottom, but such deposits will not be described in this report.

A number of old workings on wolfram-bearing quartz-tourmaline veins exist in the south-eastern portion of the lease. The workings consist of shallow trenches and open-cuts (apparently along veins) and an adit. The workings were designed to test and mine the vein, or veins, trending in a general north-north-westerly direction parallel to Gipps Creek and 150 to 250 feet to the east of it.

Little or nothing can be seen of the veins that were worked, but judging by the workings they had a north-north-westerly strike and dip at low angles to the east. The number of veins worked was either two or three. The most important one was apparently that worked in the open-cut and in the two adits driven into it at shallow depths.

(9) LEASE 11314/M

This 20-acre lease is held by T. Stanley and E.L. Egan. It embraces the country to the south of Ockle Creek and east of Gipps Creek.

The lease contains a number of old workings which occur in two groups. One group - the western - exists in the western part of the lease and includes the veins striking generally parallel with Gipps Creek, and the southern portion of which trends through the two leases described above. The eastern group exists in the eastern portion of the lease.

The western group included two reefs. The northern portions have a general north-south strike, and the southern portions have a north-north-westerly strike which also holds for leases 26M/40 and 78M/40. The visible stoping suggests an easterly dip at 10° to 20°. The reefs have been worked by trenches and shallow open cuts along the outcrops. The eastern-most one was worked at greater depths from three vertical shafts. Nothing can be seen of the reefs at present. It is stated that at some places the reefs were affected by vertical joints, but that the reefs were still present at the bottom of the workings.

As will be seen from the plan, the eastern group includes three veins. The strike ranges from 330° to 350° and the dip is easterly at angles of approximately 45°. Each reef has been worked by shallow open-cuts and by adits at shallow depths. The reefs can be seen in very few places but where visible consist of 6 to 10 inches of quartz-tourmaline. It is stated that the reefs exist in the bottom of the workings.

The reefs on this lease and particularly the eastern group were included in the leases of Tungsten Company and probably worked by that Company. There is, however, no record of the working nor of the production by that company or any other operators.

The alluvial deposits in Ockle Creek have been sluiced for both wolfram and cassiterite. The wolfram-bearing zone may extend as far as that creek, but there is no record of any wolfram to the north of that creek.

(10) PRODUCTION

The greatest period of mining activity was between 1899 and 1908, but the records of production are incomplete. The main reason for the incompleteness is that the production from Gipps Creek was generally not separated from that of other parts of the district. The following figures are given for the Tungsten mine, Ben Lomond. Production almost certainly occurred in other periods, but is not available.

Quarter ending	Sept.	1906	-	3.4 tons
"	"	Dec.	-	3.5 tons
"	"	Mar.	-	2.0 tons
"	"	June	-	3.3 tons
"	"	Dec.	-	1.28 tons
"	"	Mar.	-	2.8 tons
"	"	June	-	4.0 tons
				<hr/>
				20.28 tons.
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(11) CONCLUSION

The Gipps Creek wolfram workings have exposed at least eight quartz-tourmaline reefs containing wolfram. Owing to the collapsed nature of most of the workings, it is not possible to examine more than a few of the reefs and thus the number, size, grade, etc., cannot be accurately determined. The general strike of the reefs is between 330° and 360°, but that of the Tungsten reefs is about 30°. The dips are at low angles to the east and generally are between 13° and 20°, but those of the eastern group are approximately 45°. The width appears to have ranged up to 24 inches but the average would probably be between 9 to 15 inches. Some of the reefs have been exposed at intervals over lengths of 400 feet. One of them - the Tungsten reef - has been worked for 200 feet down the dip.

The average grade of most of the reef could not be determined by sampling because of the inaccessibility of the workings. As a matter of fact, sampling would not have its usual important results, because the wolfram content is so erratic. Several samples were taken from the old

Tungsten workings, but as it was expected from a visual examination of the faces, yielded only a trace of wolfram. Hayes' reef contains some ore of payable grade.

At present, the only reef being worked is Hayes' reef and such work is only on a small scale. In the old Tungsten workings, further underground exploration would be necessary to prove any ore of profitable grade. Little can be said about the reefs (other than that of Hayes) on the north-eastern side of Gipps Creek. According to the statements of Messrs. E.L. Egan and Hayes, the reefs exist in the deepest workings and could still be worked, but owing to the state of the workings, no attempt can be made to check these statements.

If the above statements are correct, the reefs might be such that small scale mining operations could be carried out. Some preliminary testing would, however, be necessary and the following three methods are possible. It should be realized that the western group dip at angles of 10° to 20° and the eastern group at angles of 45° , so that the reefs of the two groups should approach one another at depth, providing they continue at depth and maintain the above dips.

1. By driving an adit crosscut eastwards from a place near the south-western corner of lease 11314/M, and driving along the different reefs. The crosscut would have a total length of 1,100 feet, and would cut the western group at a vertical depth of 40 to 60 feet and the eastern group at a vertical depth of 130 to 170 feet.
2. By driving an adit drive northwards either from the southern part of lease 11902/M, or the north-eastern part of 35M/40, and then crosscutting and driving along the different lodes. The adit could either be driven along Hayes' lode (if arrangements could be made) or from the north-eastern portion of lease 35M/40. The adit would have a length of 600 to 900 feet and the main crosscut a length of 500 feet. The western group would be cut at a vertical depth of 80 to 100 feet, and the eastern group at 160 to 200 feet.
3. Drilling a line of vertical holes between the western and eastern groups to intersect the reefs of the former group, and another line of vertical holes from the eastern part of the lease 11314/M to intersect the reefs of both groups. The first line would intersect the western group between 100 and 200 (or 250 feet). The second line would intersect the eastern group at depths between 100 and 280 feet and the western group at depths between 300 and 450 feet. Holes drilled further to the east would intersect the reefs of the two groups below their possible points of intersection. Such holes would have to have depths of 700 to 800 feet.

In considering the above, it should be remembered that the reefs will only be intersected at the depths stated, providing that they continue downwards below the places where they have been exposed at shallow depths by mine workings, and that they maintain the dips they have at their outcrops.

Of the above three alternatives, it is considered that the second one is the best, the drilling might prove the presence and the positions of the reefs, but would not give any indication of the average grade of the reefs. The second alternative is preferable to the first, because it would give greater amounts of "backs" and the adit would be driven from a place where there is more space for dumping waste rock, &c., and for erection of treatment plant. Further, in the second alternative, the adit could be driven either along Hayes' reef or along one of the other reefs as soon as the latter had been intersected by a crosscut.

While the above scheme could be considered to apply only to lease 11314/M, it would be necessary for the lessees to make arrangements with adjacent lessees to permit the driving of the adit from the latter's lease or leases. The question then arises as to whether it would be advisable for an amalgamation of all the interested lessees. The alternative is, of course, for each group of lessees to develop their properties independently, each providing their own capital and plant.

It should be realized that the reefs are narrow and that the shoots are not long, and that the possibility of establishing a profitable wolfram-mining industry depends entirely on the results of future exploratory and developmental work. At present, the only place where it can be said that wolfram ore is available for mining and treatment, is in Hayes' workings, and the amount developed there is extremely small.

C UPPER SCAMANDER AREA

(1) INTRODUCTION

The Upper Scamander wolfram area is situated near the head of the Wolfram Creek drainage system and about 6.5 miles north-west of Scamander township.

Access is gained by road and track from Scamander. At 5.25 miles on the Upper Scamander road from Scamander, a branch road (to the Eastern copper mine) crosses the river by a bridge to the northern bank. Half a mile north of the bridge, a cart track branches from the road and runs in a general west-north-westerly direction for 2.5 miles. The track follows the ridges and the grades are steep. The track can be used by motor vehicles but several fallen trees require to be removed and a temporary crossing of a branch of Kelly Creek requires attention. From the end of the cart track, a foot track two miles long runs in a general northerly direction to the area. The foot track appears to continue northwards towards St. Helens and probably joins the cart track along the valley of Fern Tree Creek.

Access can also be gained by foot track along the Scamander River and then northwards up the valleys of Fitzgerald and Wolfram Creeks. This route involves the fording of the Scamander River three times and the Avenue River once.

(2) PREVIOUS HISTORY & LITERATURE

The only published reports on the area are:-

Waller, G.A.	Report on the Mining Districts of the Scamander River and St. Helens, 1901.
Twelvetrees, W.H.	The Scamander Mineral District, Tas. Geol. Surv. Bull. No. 9, 1911.
Hills, Loftus	Tungsten and Molybdenum Part 1, Tas. Geol. Surv. Min. Res. No. 1, 1916.

The date of discovery of the wolfram deposits is not known. Two reward leases were granted in 1898, but it is significant that this is approximately the period when the marketing of tungsten ores became more satisfactorily established and it is possible that the deposits were found at an earlier date. An application for a lease for copper had been made over some of the deposits as early as 1896. Most of the work on the deposits had been done during 1899 and 1900. Some further work was done during the 1914-18 war period and during the past 3 to 4 years a small amount of additional work has been performed.

(3) GEOLOGY

The area is occupied by rocks of the Cambro-Ordovician system of North-eastern Tasmania. The principal types are slates and quartzites. The general strike of the rocks is 330°. The series is a highly folded one, but few dips could be obtained (owing to lack of outcrops) and the nature of the folding could not be determined.

Granite occurs at short distances to the north and west of the area. The proximity of the granite is indicated by the occurrence on lease 11946/M of metamorphosed slates in the form of nodular schists.

(4) ECONOMIC GEOLOGY

The wolfram deposits are quartz reefs with small amounts of tourmaline, and wolfram. The tourmaline is present in small amounts and is usually very fine-grained. On the northern part of lease 11945/M, large pieces of fine-grained tourmaline occur on the surface, but it is not known if such pieces came from the quartz veins or from separate veins of tourmaline. The wolfram is distributed irregularly throughout the quartz and is present in pieces ranging from less than 0.25 in. to 2 in. Molybdenite occurs in two places - one in the northernmost open-cut on lease 11946/M and the other in an opencut in the eastern part of 11974/M.

Most of the reefs have a north-easterly strike, but a few of the reefs on 11946/M have northerly strikes. The dips are to the north-west or west at angles ranging from 50° to 80°, but generally about 70°.

Some 20 to 30 deposits have been exposed in the small workings. The deposits do not appear to have regular arrangement throughout the area. It is found, however, that

the deposits on lease 11974/M and many of those on 11945/M are cross-veins in bands of quartzites (silicified). Thus, the deposits on these two leases are arranged along several bands of quartzite. The deposits on lease 11946/M occur mainly in slates and their arrangement and strikes differ somewhat from those on the other two leases. The arrangement of cross-veins in quartzite is not restricted to the wolfram area, but occurs also on the Western Pinnacle tin area to the south-east and apparently also in the Pyramid tin mine. It, therefore, appears to be a feature of the Scamander district.

The wolfram-bearing veins are short and generally less than 100 feet. Judging by the workings on 11946/M, two veins were 170 and 200 feet long respectively. The veins are narrow and do not exceed 24 inches and the average width would be nearer 12 inches. Some of the deposits are not veins but irregular bodies and while the widths may be greater, the lengths are shorter. The veins have been proved to only shallow depths (less than 50 feet). The adit on lease 11945/M has cut narrow veins at depths of 175 feet, but these veins are not necessarily connected with any on the surface.

(5) LEASE 11946/M - (BADEN POWELL MINE)

This lease of 40 acres is held by B.C. Lutwyche. The ground in this vicinity was leased in 1896 for copper and it was not until 1898 that it was leased for wolfram. The mine has been reported on by Waller (1901) and Hills (1916). When visited by Waller, the mine was being worked by the Baden Powell Wolfram Company.

There are twelve small workings on this lease and they have exposed nine more or less distinct reefs. Waller described seven lodes and as far as possible his numbering will be noted in the following descriptions. Hills described only two lodes and these apparently correspond to the two longest workings (Nos. 1 and 7).

(a) No. 1 Reef This reef strikes at 20° and dips westerly at high angles (70° to 80°). The working on it consist of a line of underhand stopes from the surface, but the northern portion of the workings have been converted into a irregular adit with a length of 140 feet. The reef appears to have been stoped below the surface to depths ranging up to 20 feet in depth, but probably averaging 10 feet. At two places, the stoping has been extended to the depth of the adit, viz., between 0 and 80 feet and between 120 and 140 feet in the adit. The reef has a range in width up to 18 inches.

This is the longest working on the lease and is one of those from which wolfram has been won. The faces available do not show any wolfram and it would appear that all developed shoots have been mined. Further development would be necessary to expose any further payable ore.

At the southern end, the reef appears to end, but it is possible that it is continuous below the exposed face. However, no attempt has been made to find any southerly continuation. An adit was commenced in recent years from a point 100 feet north of the working but although driven for 50 feet did not find any reef. Before starting the adit

it would have been advisable to trace the outcrop (if any) of the reef to the north. This adit is 67 feet vertically below that in the line of workings. If further work is contemplated in the adit, it should be driven due south until the reef is cut, but if not cut within 60 feet then crosscuts should be driven east and west for short distances.

This reef is probably Waller's No. 1, although the width seems greater than reported by Waller. It is probably the eastern lode of Hills, although in this case, also, there appears to be a discrepancy in the width.

(b) No. 2 Reef This reef is situated to the north of No. 1 and on the northern side of a small creek. It has been exposed in a cut 35 feet long. The reef has a strike of 57° and, judging by the places, probably dipped to to the north-west at 70°. The width ranges up to 6 inches. No wolfram was observed, but small amounts of molybdenite (associated with pinite) were seen.

(c) No. 3 Reef This reef is situated 70 feet west of No. 1 reef and has been exposed in a north-south trench 50 feet in length. The reef is not a continuous one. In the southern part and on the western wall of the trench, a vein with a width of 8 to 10 inches, strikes northerly and dips westerly at 70°. In the northern part and on the eastern side of the trench a parallel veins occurs and has an irregular width ranging up to 12 inches.

No wolfram was visible in the quartz. This reef does not appear to have been described by Waller.

(d) No. 4 Reef About 170 feet west of No. 2 reef, there are two workings arranged in a north-south line. The southern one is curved but has a general north-south trend. It exposes a reef with a westerly dip ranging from 40° to 60°, and a width ranging up to 24 inches. It peters out at the southern end but is present in the northern end of the trench. No wolfram is visible in the quartz, but some tourmaline is present.

The branch working to the north did not apparently find the reef and no quartz is visible in the trench or on the dump (except at the northern end).

This reef is possibly the No. 3 lode described by Waller.

(e) No. 5 Reef About 25 feet to the west of No. 4, a small trench exposes an irregular body of quartz up to 36 inches wide. It strikes at 35° and dips to the west at 70° to 80°. No wolfram was visible.

This reef is probably the No. 4 lode of Waller.

(f) No. 6 Reef About 230 feet to the north-west of No. 5 there are two disconnected trenches with a total length of 120 feet. They suggest a reef with a north-easterly strike. Quartz is visible only in the north-western end where it dips to the north-west at 60°. Quartz is present on the dump at the southern end of the same trench. The reef ranges in width up to 20 inches, but no wolfram is visible.

(g) No. 7 Reef is situated 90 feet to the south-west of No. 4. The line of workings is 170 feet long and has a trend of 50°. The workings are underhand stopes up to 25 feet deep, and near the northern end a winze has been sunk to approximately 30 feet. The stopes dip at a high angle to the north-west. The reef cannot be seen in the workings but much quartz is present, on the dumps. Some production occurred from this working.

This reef is probably Waller's No. 5 reef from which he reported a production of 1 ton of wolfram. It is probably also the western lode of Hills.

(h) No. 8 Reef is 120 feet south-west of No. 1 reef. The working is a trench 80 feet long and trending north-easterly. The deepest part is 10 feet and suggests some stoping. Quartz is visible only at the southern end where a 4-inch vein is present. A short cross-trench 10 feet to the south did not expose any quartz. The walls suggest a north-westerly dip of 60°. Some wolfram may have been obtained, but little can now be seen of the reef.

This reef possibly corresponds with Waller's No. 2 lode.

(i) No. 9 Reef is situated 250 feet to the south of No. 8. The working is a trench with a general northerly strike and a maximum depth of 10 feet. The reef is only visible along a short length and consists of two or more veins over a width of 12 to 20 inches, and dipping high to the west.

No wolfram was visible.

This reef is probably the No. 7 lode of Waller (unless there is another working south of No. 7 reef).

(j) Conclusions Nine reefs have been exposed on this lease by shallow workings. The reefs are short and narrow and the two most important, as judged by the length and depth of the workings, are Nos. 1 and 7. In these two reefs - as well as in the others - all quartz-containing visible wolfram has been mined. In order to attempt further production, development work would have to be done to expose further ore. Owing to the erratic distribution of the wolfram content, only a small amount of work might be necessary to achieve this objective.

(6) LEASE 11945/M. (See Plate 4)

This lease is of 40 acres and is held by H.E. Lutwyche. It is situated to the east of 11946/M and also to the east of Wolfram Creek.

The ground in this vicinity was not leased until 1898 when it was granted as a reward for wolfram. It was transferred to the Carson De Beers Wolfram Company Limited in 1899 and held until 1904. Most of the work was conducted before 1901, and though leases have been held since then very little additional work has been conducted.

Descriptions of the workings and reefs are included in the reports of Waller (1901), Twelvetees (1911) and Hills (1916).

The workings are confined to the northern part of the lease. There are eleven small workings on the lease and a low-level adit enters the lease from the north-west. The surface workings have exposed a number of quartz bodies. In the north-western part, these bodies are irregular quartz veins in quartzites, and in the north-eastern part, they are quartz veins in slates. The adit cut a number of narrow quartz veins in slates.

The reefs and workings will be described separately each working being numbered.

(a) No. 1 Working is a face broken across a prominent outcrop of quartzites. The quartzites contain irregular veins of quartz with fine tourmaline. No wolfram was visible.

(b) No. 2 Working consists of a trench and a small open-cut. The eastern end of the cut is in quartzites with irregular quartz veins. Wolfram was seen only in one piece of quartz.

(c) No. 3 Working is an open-cut, at least 7 feet deep, but which contained water. Little can be seen of any reefs, but the dump contains quartzite and quartz. The quartz contains some tourmaline while wolfram was seen in several pieces.

(d) No. 4, 5, and 6 Workings These are short trenches in slates. In each case, a small amount of quartz is present on the dump but none is exposed in the trench.

(e) No. 7 Working is a trench 70 feet long and with a shaft about 30 feet deep sunk near its western end. The trench was cut along a reef striking north-easterly and dipping to the north-west at a high angle. Part of the reef are visible in the south-western part of the trench. It occurs below an irregular hanging-wall and ranges in width up to 18 inches. The shaft indicates that a small shoot was mined and that probably some production took place. Wolfram occurs in the quartz on the dump.

This reef was one of those referred to by Waller and Twelvetrees and that described by Hills. It is apparently, the most important on the lease, but its importance will be determined by any future development work on it.

(f) No. 8 Working is a trench about 60 feet long. In the central portion, there is a reef with an easterly strike, a high dip to the north and a thickness ranging up to 12 inches. No wolfram was visible.

(g) No. 9 Working is a short trench exposing a reef up to 6 inches wide, striking north-east and dipping to the north-west. No wolfram was visible in the quartz.

(h) No. 10 Working is a short trench 50 feet long. At present, quartz is exposed over a length of a few feet in the deepest part of the trench. The reef is parallel to that in No. 9 working, but has a maximum width of 12 inches. No wolfram was visible.

(i) No. 11 Working is a trench 30 feet long and exposing a reef along the greater part of its length. The reef strikes at 65°, dips to the north and is up to 10 inches in width. No wolfram was visible.

(j) Adit An adit was driven in a south-easterly direction for 250 feet and at a depth of approximately 200 feet below the summit of the ridge. It passed through slates and cut four narrow quartz veins and two soft formations, the largest quartz being 7 inches wide. No wolfram was visible in the quartz, but Waller stated that one had been reported to contain wolfram. The adit would have to be extended a further 100 to 150 feet to cut any downward extension of the reefs in workings 7, 8 and 9.

(k) Conclusions Several reefs and formations are exposed in surface workings and four veins in the adit. The reefs are short and only three of them appear to contain wolfram although it is possible that others may have had a small wolfram content. About one ton of wolfram is reported by Waller to have been produced and this probably came mainly from the reef in No. 7 working. Any further work should be devoted, in the first instance, to this reef.

(7) LEASE 11974/M (Jacob Mine)

This lease is of 40 acres and is forfeited, but the ground is included in a Special Prospecting Area held by D. Griffin.

The ground was first leased by Isaac Jacob in 1899. Most of the work was done before 1901 and little has been done since. The reefs and workings were briefly described by Waller (1901), Twelvetrees (1911) and Hills (1916).

A number of trenches and small open-cuts and perhaps one adit exist on this lease. They have exposed short and irregular quartz reefs. The reefs have a general north-easterly strike and dip to the north-west at high angles. They are restricted to bands of quartzites and represent cross-veins in those rocks.

Each working is numbered on the plan and will be described separately below.

(a) No. 12 Working is an open cut, now collapsed. Little can be seen of the reef except at the northern end of the cut, where 4 inches of quartz are present. The workings had a maximum depth of 30 feet and there may be an adit under the collapsed ground. Some of the quartz on the dump contains wolfram and there may have been a small production from this working.

(b) No. 13 Working is partly an open cut and partly a short adit. Much of the open cut has fallen in and the reef cannot be seen. In the western face, veins of quartz occur in quartzite. The adit beneath the eastern end is 15 feet long and passes through slates. Two short veins of quartz are exposed, one being 6 to 8 inches wide and the one at the face 4 inches wide. There is much iron-stained quartz on the dump, but no wolfram was visible.

(c) No. 14 Working is an open cut, with a maximum depth of 12 feet along a reef. A reef, with a strike of 68° and a dip of 65° to the north, is present on the southern face. The reef is in quartzites and does not appear to extend into the slates at the western face.

(d) Working No. 15 is a small cut and exposes irregular veins of quartz in quartzites.

(e) Working No. 16 is an irregular open cut. It exposes short and irregular veins of quartz and quartzites. Some pieces of the quartz contain wolfram and some contain molybdenite. The narrow veins have a general north-easterly strike.

(f) Working No. 17 is an irregular open cut. The southwestern part has been cut along two veins of quartz striking at 50° and dipping northerly. This portion of the cut is in quartzites, but the eastern, is in slates and no quartz is visible. The vein on the southern face has a maximum width of 18 inches. The quartz contains wolfram, the content being greater than that of any other reef on the field.

(g) Other Workings A few small workings occur to the south of No. 16 and to the east of No. 17. They consist of small open-cuts and trenches. Those in quartzites usually contain quartz reefs, but those in slates do not show any quartz.

(h) Conclusions The reefs on this lease are confined almost entirely to the quartzites. They are short and irregular and apparently have yielded very little wolfram. The one with the greatest amount of wolfram showing is that in Working No. 17 in the south-western corner of the lease. Any further work should be confined in the first instance to that reef as it is possible that a small amount of wolfram could be obtained from it.

(7) CONCLUSIONS

Although numerous reefs have been found in this field, they are, in general, short and narrow and have not been tested to any great depth. The total production from them could not have exceeded a few tons.

In the present state of development, the only reef from which a small amount of wolfram could be won quickly is that in Working No. 17 on lease 11974/M. All other reefs would require developmental work to expose ore from which wolfram could be obtained. The reefs most worthy of development are, judging by the results of past workings, No. 1 and 7 on lease 11946/M and that in Working No. 7 on 11945/M. Although most of the existing faces do not show wolfram, it should be remembered that the wolfram content of the reefs is very irregular and that only a small amount of work might be necessary to expose wolfram-bearing quartz. Considerable work would, however, be necessary to prove any ore-reserves.

The reefs have been prospected and mined near the surface where the rocks are weathered. Work, at greater depths, would expose harder rocks and, moreover, many of the reefs are in hard quartzites so that rock drills would be necessary to treat any ore developed. The question as to whether such capital expenditure is justified by the prospects has to be considered. It can be said that the venture would be subject to risks, at least equal to those usually associated with mining operations. Further, a treatment plant should not be considered until sufficient ore-reserves are proved.

D. ST. HELENS AREA (See plate 5)

(1) Introduction

The St. Helens wolfram area is situated near the head of Constable Creek and some 3.5 miles to the south-west of St. Helens. Access is gained by road along the southern side of Medeas Cove. From a point about 2 miles from St. Helens, a track (at present used for hauling logs) runs up the eastern side of Constable Creek for about 1.5 miles and then a foot track is followed to the mine.

(2) Previous Literature & History

The only published report on the area is contained in:-

Hills, Loftus, Tungsten and Molybdenum Part 1. Tas. Geol. Surv. Min. Res. No. 1, 1916.

The land was first leased in 1900 and portion was granted as a reward claim for bismuth, but it was apparently worked for wolfram about 1900. Later (1909) it was leased for tin, but a small amount of mining for wolfram was done in 1918.

(3) Geology

The southern side of Medeas Cove is occupied by granite, but going southwards up the Constable Creek Valley, slates and quartzites of the Cambro-Ordovician system occur. Around, and to the south of the workings on 7204/M, granite exists, the boundary with the slates etc., being about 50 feet to the north of the workings.

In the workings on 7204/M, the granite is an even or medium-grained type with, in some places, an aplitic appearance. This type evidently forms the margin of the intrusion adjacent to the intruded slates, etc.

To the south-east and near the workings near 4177/M, the granite is coarser and approaches the normal type of the St. Helens district.

(4) Economic Geology

The wolfram deposits consist of quartz reefs accompanied by a small amount of quartz-mica greisen. The wolfram is present in peices up to 2 inches in size, but usually below 1/2 inch. A small amount of molybdenite is present in one working. Arsenopyrite was reported to be present by Loftus Hills. The first lease was granted as a reward for bismuth, but no bismuth mineral was seen.

The reefs occur in granite. They are somewhat irregular in strike and particularly in width and have silicified the adjacent granite. The general strike is 110° to 120° and dips are vertical.

(5) Lease 7204/M

This is a forfeited lease of 40 acres, situated on the north-western side of Constable Creek. It is the ground within this lease that was first held as a reward claim for bismuth and was subsequently leased for tin, and later for wolfram. It was reported on by Hills in 1916.

There are ten small workings in the north-western portion of the lease, the two largest being the two open cuts - one at the north-western and the other at the south-western end. These workings have revealed two irregular lines of quartz reefs striking at 110° to 120°, and dipping vertically. These two lines are arranged en echelon.

(a) No. 1 Reef The No. 1 reef is exposed in the south-eastern portion of the workings along a length of 120 feet. The strike is about 120°, but it is irregular. The reef is not necessarily continuous throughout the 120 feet and at some places consists of two more or less parallel veins. In any one exposure, the most persistent vein usually has a width of 10 inches, but ranges up to 20 inches. Irregular veins or bodies of quartz, however, occur over widths up to 42 inches.

Although much quartz is exposed along the line, wolfram is visible only in that from the open - cut at the south-eastern end. This cut is 40 feet long and is stated to have been worked by De Beers (apparently about 1900), the production is not known, but must have been small.

At the south-eastern end of the cut, a quartz reef, striking at 20°, is exposed on the northern side. The quartz is 36 inches wide but has not been exposed elsewhere.

(b) No. 2 Reef The No. 2 reef is situated about 150 feet to the north-west of No. 1 reef. The main working on it is an open cut about 70 feet long. This cut was apparently along the reef although quartz is only visible in it at present at the western end, but there is quartz on the dump along the whole length. This cut would indicate that the reef has a strike of 110°. About 40 feet to the east, there is a trench with quartz on the dump. This trench probably cut the extension of the reef. The trench is close to the boundary of the granite and is generally parallel to that boundary. It would appear that the reef did not enter the slates.

The quartz from the open cut and from the trench contains wolfram, and that from the western end of the cut contains a very small amount of molybdenite. In his report, Hills (1916), stated that the reef warranted expenditure of capital. Apparently as a result of this, the open cut referred to about was dug in 1918 by, it is reported, the S. & M. Company. A small treatment plant was installed in Constable Creek to the east and an aerial ropeway was constructed between the cut and the plant. The results of the working and the amount of production are not known.

(c) Other Reefs Between the Nos. 1 and 2 reefs, there are two small workings with quartz containing wolfram on the dumps. These may be part of one and the same reef trending at 130° or alternatively be two separate and small veins.

(d) Conclusions The two main reefs are short, but have been developed along the greater part of their known lengths. A small amount of production has taken place, but apparently the results were not sufficiently satisfactory to induce further work. The reefs might yield further small quantities of wolfram but it is doubtful if the operations would be profitable. A necessary preliminary step would be the cleaning out and sampling of all workings and it would have to be

followed by development work. For any development at depth, adits could be driven westwards from Constable Creek. The reefs are in hard silicified granite, and rock drills would be necessary for development work on them and it becomes a question as to whether such capital outlay is warranted. Judging by the general appearance of the reefs and the results of past work, very little, if any, expenditure is warranted.

(6) NEAR LEASE 4177/M

This lease is situated to the south of 7204/M on the south-eastern side of Constable Creek. It was held in 1909 for tin. A group of small workings on wolfram-bearing quartz reefs exist near its south-western side, but, as the lease boundaries could not be found, it was not possible to fix the exact position of the workings.

The lease is occupied by hard, coarse-grained granite. Five small workings - trenches - exist and have exposed quartz reefs as shown on the attached plan. Possibly five reefs have been exposed, but only cut in one place. However, two of them cannot be traced, through their surface outcrop, eastwards for 250 feet until they cross a creek. The two reefs strike at 110° to 120° , and the others probably have similar strikes. The reefs range in size up to 36 inches, but in most places are below 18 inches. Wolfram is visible in the quartz in three places. In the northernmost workings, the quartz is associated with quartz-mica greisen.

The reefs in this vicinity have been developed to only a small extent and further prospecting on them and in the vicinity is justified. For any extensive development it would be necessary to use rock drills. Apart from surface testing, adit drives could be driven westwards from the creek.

(7) Conclusions

In this area, two wolfram localities have been discovered and a small number of quartz veins found in each. In one locality, some development work has been done and a small amount of production taken place. In the other, only a small amount of prospecting has been done. Further prospecting in the area would be justified, but for any development, the use of rock drills would have to be considered owing to the hardness of the country rock (granite). As to whether such capital expenditure is warranted would depend on the results of any preliminary prospecting and development.

E SUMMARY AND CONCLUSIONS

The survey of the tungsten resources of North-Eastern Tasmania was, by departmental instruction, restricted to the areas of Gipps Creek, Upper Scamander and St. Helens.

The workings and deposits were surveyed in detail, but an extensive sampling campaign was not undertaken for three main reasons. Firstly, many of the workings could not be entered or otherwise examined because of collapse, water, debris, etc. Secondly, most faces that could be examined were barren of wolfram and sampling would have been useless. Thirdly, the wolfram contents in the deposits are irregularly distributed and unless the deposits were completely exposed along their length, the sampling results would be unsatisfactory and misleading.

The deposits are quartz reefs occurring either in granite as at Gipps Creek and St. Helens or in slates and quartzites as at Upper Scamander. The productions have been small, but that from Gipps Creek has been by far the greatest. The order of importance of the areas as potential producers is Gipps Creek, Upper Scamander and St. Helens.

In the Gipps Creek area, there is a group of, at least, six reefs on which development work may be justified, if the statements (by previous operators) as to the behaviour of these reefs at depth are correct. These reefs could be developed by adits which will give maximum "backs" of 200 feet. Details are given in the section describing this area. There are, at least, two other reefs on the field and a partial, if not a complete, amalgamation of interests might be advisable. There are no proved ore-reserves and the prospects of a profitable venture would depend on the result of the development work.

The Upper Scamander and St. Helens areas, though described separately, could be regarded as two parts of a larger area. A small amount of surface prospecting in this larger area is justified. Of the two, the Upper Scamander area is the more important. The reefs would have to be developed before any ore reserves could be considered to exist. Owing to the shortness of the reefs, and the limited extent of the shoots, careful consideration would have to be given to the possibility of profitable exploitation, before capital expenditure was incurred on mining plant. The same statement applies to the St. Helens area, but in that area, the reefs are fewer and there is less justification for capital expenditure.

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