REPORT ON

THE MOINA MINERAL DISTRICT

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INTRODUCTION:

Under instructions from the Director of Mines, the Moina district was visited to determine its possibilities with regard to increasing the output of tin, wolfram, and bismuth ores and to examine reported occurrences of Beryllium ores, and Quartz Crystals of sufficient size and quality to satisfy the requirements of Amalgamated Wireless of Australia Limited. The examination covered the period from 23rd July to 3rd September, 1943.

The principal mine of the district, the Shepherd and Murphy Mine, was discovered in the year 1893. Since the discovery there has been irregular production from the field, of the ores of tin, wolfram and bismuth, resulting in a yield to the total value of approximately £158,118.

The product from most of the mines has been a mixed Tin-Wolfram-Bismuth concentrate with Bismuth more or less as an impurity. Occasionally, however, Bismuth has occurred in a sufficiently concentrated form to enable its separation at its source and small parcels of bismuth concentrates have been despatched, for sale. There is, however, only one instance, Stormont, where mining has been directed primilarily towards the recovery of bismuth ores, and the greater proportion of the bismuth output has resulted from operations at mines whose primary object has been the recovery of tin and/or wolfram ores.

There is no recorded output of Beryllium ore, and the results of the present investigation suggest that Beryllium ores do not occur in economic quantities.

Comparatively large quartz crystals do occur. Both W.H. Twelvetrees and A. McIntosh Reid, in previous publications, have made reference to their occurrence but it is doubtful if any have been taken of sufficient size and quality to comply with the requirements set down by the Amalgamated Wireless of Australia Ltd.

SITUATION AND ACCESS:

The area under review is situated between the Iris and Forth Rivers in the immediate vicinity of the township of Moina. During the period of greatest mining activity, the population of Moina exceeded 300 persons. With decreasing activity the population has decreased until only four families are now resident there with the population not exceeding 20 persons.

The township is situated at distances of 12 and 36 miles in a south-south-westerly direction from the towns of Wilmot and Devonport, respectively. A bus service, operating from Moina, provides direct access to and from Devonport on Wednesday and Thursday of each week, and the mail and Area school bus services from Moina and Sheffield to Wilmot make a daily service possible between Sheffield and Moina with a delay of several hours at Wilmot during the school period. During periods of school recess, the mail service provide access on Monday, Wednesday and Friday of each week.

PREVIOUS REPORTS:

Since the discovery of Wolfram at the Shepherd and Murphy Mine in the year 1893, departmental reports have been written on the whole or portion of the field by the following writers : -

1893 A. Montgomery M.A. Report on the Mineral Discoveries in the neighbourhood of Bell Mount.

1897 J. Harcourt Smith B.A. Report on the Shepherd and Murphy Tin Mine, Bell Mount.

1898 J. Harcourt Smith B.A. Report on the Bell Mount and Middlesex Mineral Fields.

1901 G.A. Waller. Report on the Mineral Districts of Bell Mount, Dove River, Five Mile Rise, etc.

1907 W.H. Twelvetrees. Report on the Bell Mount and Middlesex District.

1913 W.H. Twelvetrees. The Middlesex and Mt. Claude Mining Field. (Tas. Geol. Surv. Bull. No. 14)

1916 Loftus Hills, M.Sc. Middlesex and Mt. Claude District (Mineral Resources No. 1 Part 11 Geol. Surv. Tas.)

1919 A. McIntosh Reid. The Mining Fields of Moina, Mt. Claude and Lorinna (Geol. Surv. Tas. Bull. No. 29)

1927 A. McIntosh Reid. Preliminary Report on Stormont Bismuth Prospects

1933 E. Broadhurst. Report on Stormont and Black Bluff Districts.

A. Montgomery, Geological Surveyor, in his report of 1893, refers to the Iris, Dolcoath and Shepherd and Murphy Mines which apparently were then the operating mines of the Field. Of these mines, the Iris and the Shepherd and Murphy Mines have maintained intermittent production and at present are the only operating mines.

In a repprt dated July 26th, 1897, J. Harcourt Smith B.A., Government Geologist, refers chiefly to the Shepherd and Murphy Mine, and in the description of their workings refers to six main veins occurring.

In 1898, the same writer gives more detailed descriptions of the work done by the Shepherd and Murphy Company and reveals that development then had been extended to Nos. 4,5 and 6 veins. In this report mention is also made of several other sections then held but apparently not since worked.

In the year 1913, W.H. Twelvetrees, then Government Geologist, in Geol. Surv. Bulletin No. 14 gives a detailed description of the workings of the various companies then operating, and shows that companies, operating since J.H. Smith reported, had re-organised and ownership of leases had changed. In this connection in referring to the Lady Barron mine he stated : "This mine was formerly worked under the name of the All Nations Mine."

In the year 1919, A. Mc.Intosh Reid, Assistant Government Geologist, in Geol. Surv. Bulletin No. 29 mentions several of the workings and shows that, with the exception of the Shepherd and Murphy and the All Nations Mines, little additional development had taken place since the reports of J. Harcourt Smith in 1897 and 1898.

Since the year 1919 the only new development is the discovery of Bismuth ores, free from Wolfram and Tin, at Stormont. Some development has taken place as shown in reports

in 1927 and 1933 by A. McIntosh Reid, Director of Mines and E. Broadhurst, Field Geologist, respectively. The mine has been idle for a number of years.

GEOLOGY:

In reporting on the Middlesex and Mt. Claude Mining Field, W.H. Twelvetrees, Government Geologist, in Bulletin No. 14 of the Geological Survey of Tasmania, published in 1913, has outlined the geological features of that field.

In the year 1919, A. McIntosh Reid, Assistant Government Geologist, in Bulletin 29 of the Geological Survey of Tasmania reported on the same area under the title of The Mining Fields of Moina, Mt. Calude and Lorinna.

In these two publications, the geological features are set out to show a succession of rock formation ranging from pre-Cambrian to Tertiary in age.

In the Moina field, the greater proportion of the area is occupied by pre-Silurian conglomerates, quartzites, and sandstones, in which most of the mineralised veins have been discovered. The sandstones, etc., are, in general, referred to as the tubicolar series of sandstones.

Overlying these sandstones are smaller areas of Silurian limestones. These occur particularly to the west of the Moina township on the Iris River.

Granitic rocks, regarded as Devonian in age, occur in the south eastern section of the area as a mass intrusive into the quartzite series.

Mineralisation is not confined to the sandstone series, and mineralised veins have been observed to pass from the granites to the quartzites without alteration in size.

A considerable portion of the foregoing formations is covered by basalt of Tertiary age. This has in part covered proportion of the economic minerals have been won.

Shallow deposits of alluvium occur also in many of the creek beds, whilst surface detrital is widespread and is in part of economic value.

ECONOMIC GEOLOGY :

The minerals of economic importance in the Moina field are Wolfram, Tin and Bismuth. These occur both as primary and as secondary deposits sometimes singly but generally in association with each other. They are generally recovered as a mixed concentrate which is separated with difficulty into its components.

Tin as cassiterite occurs in most of the veins which have been exposed or developed; whilst in all the detrital or alluvial deposits it occurs as a considerable proportion of the concentrates won.

Wolfram occurs in all the veins and is also a major consituent of some of the alluvial deposits.

Variation in the Tin and Wolfram contents of the veins is considerable, with a tendency to increase in Wolfram content towards the eastern portion of the district. In the All Nations Mine the major constituent in the concentrates is Wolfram (to 70% WO_3) whilst towards the Sheperd and Murphy Mine, the percentage

of tin in the concentrates increases. In the surface workings at the latter mine, sections of the workings have yielded concentrates up to 70% Sn with only 1% Tungstic acid and Bismuth.

Bismuth occurs irregularly in all the veins, but occasionally in sufficient concentration to enable its separate recovery as a Bismuth concentrate. Generally it occurs as the minor constituent of a mixed Tin-Wolfram-Bismuth concentrate won either as detrital matter or from vein material. Native Bismuth has been recovered, but in general it occurs as the carbonate, Bismutite, and to a lesser extent as the Sulphide of Bismuth, Bismuthenite.

Being regarded as an impurity an endeavour is made to remove the Bismuth from the concentrates by hand picking. Even with this precaution it comprises up to 12% of the mixed concentrate produced and, as no payment is made for this grade of Bismuth conc ntrate, it causes added expense in freight charges, etc., in its transport to the mainland.

Beryllium ores and Quartz crystals have been recorded from the field but their occurrence has not been of economic importance.

THE MINES OF THE DISTRICT:

SHEPHERD AND MURPHY MINE:

Discovered in the year 1893 by the prospectors Thos. Shepherd and Thos. Murphy after whom it was named, the Shepherd and Murphy Mine has contributed the greatest part of the total production of the field.

Until the year 1919 production was fairly regular. In that year the mill and treatment plant at the mine were destroyed by fire. After rebuilding the mill, production was maintained only for a limited period and in the year 1925 the treatment plant was sold. Production consequently has decreased until recently it has been of a negligible order.

The leases on which the mine wokrings, are situated, are now held by Mr. J.P. Godwin. They are situated on the south bank of Bismuth Creek and to the south of the site of the Moina township. These leases, Nos. 11973/M, and 10795/M, have an area of 40 acres.

The principal mine workings consist of a series of adits, both levels and crosscuts, driven from the eastern and northern slopes of the hill. Development has revealed a number of more or less vertical veins, striking in a general easterly direction, on four of which fairly extensive mining operations have been carried out. The veins are all naroow ones ranging in width to a maximum of two feet, but generally of a much lower order.

A considerable portion of the area is covered with tertiary basalt. Its presence has hampered prospecting and has retarded development of known alluvial and detrital deposits. The older rocks exposed consist of a series of sandstones, quartzites, and shales of pre-Silurian age with occurrences of a garnetiferous rock, resulting from contact metamorphic alteration of Silurian limestones. In the western portion of the leases the rocks occur in normal sequence with the pre-Silurian quartzite series dipping westerly under the Silurian limestone, but in the eastern section, near bismuth Creek, their occurrence suggest faulting in or near that creek.

The present operations are directed towards the recovery of alluvial tin, by ground sluicing, from shallow ground on the northern slope of the hill. The material treated consists of soils and subsoils, intermixed with boulders and detrital material, in part covered by basalt. The product is in general fine-grained, containing a small proportion of medium grain size and a little coarse material.

The concentrates are composed essentially of cassiterite with a low percentage of Wolfram but an appreciable amount of Bismuth ores. The grade of ore, estimated from a series of sales notes shows considerable variation in the Tin, Wolfram and Bismuth contents. Over the period 1940-1943, the variation was as follows :-

WO_3	varies	from	31.7%	to	1.5%
Sn	"	"	72.0%	to	31.5%
Bi	"	"	12.30%	to	0.25%

with an average grade of :- WO_3 - 17.5%; Sn - 47.7%; Bi - 7.31%.

The above grade is representative of concentrates which have been subjected to hand picking for the removal of the larger pieces of Bismuth and Wolfram ores which are retained until parcels of high grade ore are available for despatch.

The mine plans of the Shepherd and Murphy Mine record at least six veins which have been cut by the adits. Of the workings, the main adit, No. 3, has been driven as a cross-cut for a distance of 1,246 feet to intersect veins, sufficiently large to warrant development, at distances of 396, 955, 1,081, and 1,246 feet, from the portal. These veins are referred to as Nos. 6, 5, 4, and 2, respectively.

On veins Nos. 6 and 4 development has taken place from the main shaft workings below the level of No. 3 adit. The main shaft has been sunk from a position close to the main adit to cut No. 6 vein at that level, and has been continued to a depth of 170 feet below the adit. Levels have been opened at depths of 75 and 150 feet below the adit level and a cross-cut from the lower level has been driven to cut No. 4 vein. On this vein at that depth only limited development has been carried out.

The main development of No. 4 vein has been carried out from the creek level adit. This adit has been driven in a westerly direction, from the west bank of Bismuth Creek, more or less along the course of the vein, for a distance of 876 feet. Cross-cuts have been driven to cut Nos. 5 and 2 veins at distances of 537 and 821 feet from the portal, and these veins have been developed from the adit.

Development of veins Nos. 5, 4 and 2 has been carried out from No. 1 adit, whilst No. 6 vein has been further developed from No. 2 adit.

At the time of this inspection, the mine was for all practical purposes inaccessible. In the creek level adit falls of earth prevented the examination of No. 2 vein, whilst No. 5 vein was open for only a short distance. No. 4 vein, except for a short distance near the portal, has been stoped both above and below the level of the adit.

From the main adit, No.3, except for short distances in the levels on No. 6 and No. 5 veins, all the workings were inaccessible. The workings from the main shaft below the No. 3 adit level were flooded. It has been stated that during the period 1919-1921, when reconstruction of the mill was in progress, large

tonnages of ore were broken and left in the stopes.

The accessible portion of the mine was so limited that any statement as to ore reserves available, would be misleading. The only block of ore open for inspection was that in No. 4 vein which occurs above the portal section of the creek level adit. For the remainder of the mine, any estimate would be conjecture only or based on hearsay evidence. It is evident, however, that the main ore reserve of the mine must be sought below the level of No. 3 adit.

A promising prospect for future development lies in the recently exposed mineralised veins occurring to the north-east of No. 1 adit in a branch of Bismuth Creek. A short adit has been driven in a southerly direction to expose a series of veins, all of which yielded good prospects when tested. Two veins occur to the north of the adit, the first at its approach and the second in the gully about 25 feet to the north. The veins vary in width from two to eight inches. In general, they strike easterly, but one, in a cross-cut to the north near the face of the adit, strikes northerly. Whilst the larger veins dip towards the south in agreement with the principal veins of the field, the smaller veins dip towards the north. As the veins occur within a distance of 100 feet, there is a possibility of juntioning of the veins at depth.

Except for the short adit, there has been no development of these veins which, giving good prospects for Tin, Wolfram and Bismuth, may be regarded as a potential source of ore.

PRODUCTION:

The records of production are far from complete. Prior to the year 1907, no figures are available. From 1907 to 1942, inclusive, the mine produced ore to a total value of £147,123 of which ore to the value of £140,931 was won up to and including the year 1920. As the mill was destroyed in 1919, it would appear that the mine was then in a highly productive state, and lends support to the contention that if the mine were now in working condition the present high prices obtainable would assure a profitable return.

The attached table gives details of production for the period 1907-1920.

PRODUCTION - SHEPHERD AND MURPHY MINE, MOINA

YEAR	TIN WON. CONC. TONS	TIN WON. MET. TONS.	TIN WON. VALUE £	WOLFRAM WON. CONC. TONS.	WOLFRAM WON. VALUE £	BISMUTH WON. MET. TONS.	BISMUTH WON. VALUE £	TOTAL VALUE £	MEN EMPLOYED.
1907	29.900	18.837	3485	15.250	1351			4836	32
1908	89.950	56.668	8388	0.900	62	3.400	462	8912	33
1909	83.800	52.794	7767	6.050	487	2.900	980	9234	41
1910	39.150	24.664	4224	20.650	2341	10.700	4249	10814	41
1911	38.830	24.462	5044	22.490	2473	14.370	5748	13265	44
1912	48.580	30.605	7104	22.840	2202	7.490	2606	11912	34
1913	56.410	35.538	7482	28.750	2692	5.030	1616	11790	36
1914	37.275	23.483	3756	23.690	2102	5.265	1609	7467	
1915	70.400	44.352	7917	35.650	3692	5.125	1154	12763	
1916	67.250	42.367	7017	33.150	4406	3.460	1049	12472	
1917	68.850	43.375	6195	36.500	4680	4.150	875	11750	36
1918	59.250	37.327	6403	30.660	3680	4.051	913	10996	31
1919		36.390	9195	23.400	4905	1.570	473	14573	32
1920		0.450	107	0.400	40			147	
			£84,084		£35,113		£21,734	£140,931	
1920 to 1942			2,582		700		910		
			£86,666		£35,813		£22,644	£145,123	

ALL NATIONS MINE:

The earliest record of production from the All Nations Mine is one of two tons of Wolfram in the second quarter of the year 1905.

In the year 1913, W. H. Twelvetrees, Government Geologist, when referring to the Lady Barron workings, stated that the mine had previously been known as the All Nations Mine. It was later referred to as the Lawkemlaw and is at present locally referred to as the All Nations.

Development has proved two sets of mineralised veins separated by a distance of approximately 10 chains. It is to the southern workings that Twelvetrees in 1913 referred as the Lady Barron and the greater part of the Lawkemlaw development was done on these veins.

Since the year 1919, when A. McIntosh Reid, Assistant Government Geologist, reported on the area, the leases then held by Lawson and Riley have been included in the holdings now known as the All Nations. Their workings have been extended a considerable distance towards the Lady Barron workings.

The more northern veins on the holdings have been developed over a considerable distance, the surface workings extending for at least 1,200 feet. They appear as a long, more or less continuous open cut, which in part, originated as such and in part represents the top of stoping from levels driven on the vein from a cross-cut adit at the creek level. The surface workings extend easterly almost to the boundary of the principal lease (11217/M). An adit and a small open cut situated near the north west corner of, but within, lease No. 7207/M, have been regarded as development in the principal mineralised vein. It is probable, however, that the principal vein has not been exposed at this position, but that it occurs some distance further south.

Due to falls of earth, the mine workings are inaccessible, but mine plans show that development at adit level extends for a length of 800 feet, whilst at shallow depths below the adit level, the vein has been developed over a distance of approximately 120 feet with little if any stoping. The plans referred to were prepared in the year 1919. It is, therefore, probable that the lower levels are more extensive.

The southern veins on the All Nations Leases, the Lady Barron workings, have been developed from a series of shafts approximately 60 feet deep. The workings extend over a length of 600 feet of which 400 feet is on the main vein and 200 feet on a branch vein striking east-north-east. On the spoil dump of the shafts, a much decomposed quartz prophyry occurs. It is evident, therefore, that the workings have penetrated the marginal phase of the underlying granite, which outcrops a little to the south of this position.

Lawson and Riley's workings, situated to the east of the Lady Barron workings, have developed two intersecting veins. The workings have collapsed in part but it is reported that development extends in a westerly direction for at least 10 chains. It is considered locally that Lawson and Riley's wokrings are on the continuation of the same veins as the Lady Barron workings. Unless considerable faulting has occurred, and this is not evident, the workings have developed distinct veins.

Mining operations have proved at least seven mineralised veins on the All Nations leases. Of these veins, six have been productive of ore, and the quantity removed suggests that

operations were profitable. As the mine workings are inaccessible, no attempt has been made to estimate reserves of ore, but as operations terminated in the year 1940 when the unit price for Wolfram was 38/6, it is probable that with the present ruling price of 110/- further development would yield profitable results.

The rocks outcropping on the leases belong to the series of pre-Silurian quartzites, conglomerates, and sandstones, generally referred to as the tubicolar series. That granite occurs at no great depth is proved for the Lady Barron shafts have penetrated it and granite outcrops on the southern slopes of the hill.

PRODUCTION:

The recorded production from the All Nations Mine is as follows : -

YEAR	BISMUTH		WOLFRAM	
	Tons	Value £	Tons	Value £
1910			.350	39
1911	.025	10	9.320	1047
1912	.100	40	4.050	235
1913-4	Nil		Nil	
1915			3.250	579
1916			5.600	1065
1917	.050	16	3.450	622
1918	.345	77	2.205	424
1919			1.450	302
1920			.210	55
1921-35	Nil		Nil	
1936			.317	35
1938			1.458	374
1939			2.622	485
1940			1.140	229
1941			.260	45
1942	No production		No production	

THE IRIS MINE:

The earliest report on the Iris Mine was that of A. Montgomery, Government Geologist, in the year 1893 when he reported on the Mineral Discoveries in the neighbourhood of Bell Mount. Since that date, the mine has been known for periods as the Red Robin Mine or the Rainbow Mine.

A mixed Wolfram-Tin-Bismuth product is won by ground sluicing of the alluvial and detrital material occurring on the southern slopes of the hill on the summit of which the All Nations (Lady Barron) veins occur. From previous reports and records it is evident that the product from this mine has always been detrital in character. From the present operations a mixed Wolfram-Tin product is obtained in which the Wolfram product varies to yield up to 48% of Tungstic acid with sufficient tin to give a total yield of approximately 70% for the combined WO_3 Sn content.

Some Bismuth is present in the preliminary concentrate, but this apparently is eliminated in the final treatment by jigs, the marketed product seldom containing more than 2% Bismuth. This suggests an appreciable loss of product in the final cleaning of the ore. Production figures supplied by the present owner, Mr. Townsend, indicate that the material being treated yields an average return of approximately 8/- per yard treated.

There is generally insufficient water to enable continuous operations, and during the summer months, when rainfall is lowest, production ceases. With high Wolfram content in the final product the continuity of operations depends also on the market price of Wolfram. It is evident that operations have been discontinuous and governed by that factor, for had production been maintained continuously since the mine's inception, ore reserves would have been exhausted.

The earlier work was confined to treatment of material in the bed of the creek and in the immediate vicinity of the creek. This section of the holdings may be regarded as worked out. There still remains, however, an appreciable area on which detrital and alluvial material occurs for depths approximating six feet.

Some of the surface material, to a depth of approximating two feet had been treated by earlier operators, evidently for the recovery of tin concentrates only. The deeper ground is of an appreciably higher grade for Wolfram the market price of which will govern future production from the mine. With the present price of Wolfram assured for the duration of the war, production for that period should depend only on the water supply available.

The water for ground sluicing is conserved in two comparatively small dams, that in the higher dam being kept in reserve to replenish the supply of the lower dam. From the lower dam the water is delivered to the scene of operations by pumping through a pipe line 4 inches in diameter at its outlet. The power for pumping is supplied by a 16 h.p. Twin cylinder, high speed, Lister Diesel Engine of 1200 revs.p.m., whilst the pump is a 4 inch single stage, ball bearing Centrifugal pump delivering its output for a distance of 1100 feet against a head of 75 feet.

The water after use is directed to a comparatively flat area where the tailings accumulate and the water returns to the dam.

PRODUCTION:

The recorded production from the Iris Mine is shown in the accompanying table : -

YEAR	BISMUTH		WOLFRAM		TIN	
	Tons	Value £	Tons	Value £	Tons	Value £
1912			3.800	485		
1913			2.920	342		
1914	.004	1	.433	32	3.703	373
1915			,700	119	2.380	264
1916			2.245	267		
1917	.012	4	.830	140	3.880	571
1918			.737	148	2.697	526

	Whilst known as Komp's Rainbow			
1927		.55	.41	
1928		.51	77	1.75 353
	Whilst known as Red Robin			
1939				.105 25
1940		.21	21	.056 14
1941		1.39	243	.380 98
1942		1.39	527	.460 119

THE SQUIB MINE:

The holdings of the Squib Mine have an area of 120 acres as three leases, Nos. 11832/M-20 acres; 11335/M-20 acres; and 11737/M-80 acres, in the name of W.S. Henderson. Narrawa Creek flows more or less centrally through these holdings.

The earliest reference to this area appears in a report dates 1898 by J. Harcourt Smith B.A., Government Geologist, when he refers to Section 930/93G known as Packetts workings. Limited operations by dollying had been carried out for the recovery of gold. Smith also refers to the occurrence of veins of quartz, bearing wolframite. Packetts area would overly portion of lease No.11832/M and extend some distance to its south. The early workings would correspond with portion of those situated near the site of the recent treatment plant.

In 1913 W.H. Twelvetrees, Government Geologist, refers to section 5221/M, held by B.J. Curr. In his report Twelvetrees shows that operations were carried out in the vicinity of the present open cut workings for the recovery of wolfram. Mention is made of the occurrence of Bismuth and records 3 to 4 per cent of Bismuth in the final concentrates. Packetts workings are also mentioned and it is shown that additional work had been done there.

In the year 1919, A. McIntosh Reid, Assistant Government Geologist, reports:-

> "The principal developments consist of two levels-the open cut and the main adit level (120 feet Lower)-both of which are employed in the exploitation of the main lodes."

During the period 1913-1919 the main adit had been completed and the open cut further developed. The main adit is now in a collapsed condition and is inaccessible. The mill for treatment of the ore was then situated on Narrawa Creek at a point about half a mile downstream from the site of the recently demolished mill.

Access:

The leases are situated on Narrawa Creek about a mile distant by road from the main Wilmot-Moina road. The recent mill was situated on Narrawa Creek at the point where the branch road corsses the creek. The road is steeply graded and transport has at all times been difficult. A second road branches from the Cradle Mountain road about half a mile south from the Moina turnoff. This road is evenly graded, but gives access only to the higher open cut workings.

Land Developments:

Since A. McIntosh Reid, Assistant Geologist, reported on the area, further attempts have been made to exploit both the gold bearing and the wolfram bearing deposits.

The Open Cut:

The open cut is situated fully within the area of granite. Its development has revealed a number of small veins in some of which wolfram is visible. None of the veins exceed 8 inches in width, the majority being of the order of one inch in width. Originally mining operations at this position treated only the vein material, and the granitic material was discarded. These operations, though on a small scale, are reported as having been profitable. In an eandeavour to increase production, the open cut method was adopted but with the inclusion of large quantities of granitic material the grade of ore was depreciated and operations were unprofitable. Operations, at a lower level, by adit workings, expose a number of veins varying to seven inches in width. The veins pass from granite into quartzite and preserve the same characteristics as they have in the granite. The veins are generally low in grade and although 3.10% WO_3 was recorded from one vein 6 inches in width, the grade is considered too low to yield a profit.

The veins are, in general, quartz veins in some of which Wolfram shows freely. Returns show that the concentrates at times contain some Bismuth and an occasional flake of Molybdenite was observed in the ore.

The Lower Workings:

The lower workings are in part open cut and in part adit workings. They are situated in Narrawa Creek near the recent mill site and were originally developed for the recovery of gold. It has been reported that profitable returns resulted from the earlier surface work but with depth of workings the grade lessened and the ore became more complex. Operations were terminated because of financial losses sustained.

In these workings a number of parallel veins reported as gold bearing were observed striking easterly in quartzite country. The principal vein has been developed by adit workings and stoping. The stoping has been carried to surface and now appears as a long open cut upwards of 200 feet in length.

The original adit, driven in a southerly direction from the eastern end of the mill site, cut veins at distances of 65 and 87 feet from the portal, that at 65 feet being of only minor dimensions.

The principal vein at the adit level varied in width to approximately 8 feet and the ore was stoped to surface. Results of these operations were considered such as to justify development at depth, and an adit was commenced from a position in the western end of the mill site at a depth of approximately 40 feet below the former workings. On the level of this adit, the vein was found to vary to 14 feet in width. It was heavily pyritic and contained an appreciable amount of galena with some sphalerite. These workings were connected to the upper workings by a rise and the oxidised ore was treated at the mill. There is little doubt that those operations were unprofitable.

SULLIVANS WORKINGS:

Sullivans Workings are situated on the south bank of Narrawa Creek at a point about three quarters of a mile below the recent mill site of the Squib Mine and on lease No. 7567/M. A. McIntosh Reid, Assistant Government Geologist, refers to these workings in Geological Survey Bulletin 29, as Povey and Johnsons

workings. Since Reid reported, the workings have been extended.

A cross-cut adit has been driven for 33 feet in a southerly direction to cut a quartz vein, 4 inches in width, in which Wolfram is easily visible and a little Molybdenum occurs. The vein strikes easterly and dips towards the south at 60 degrees. It has been developed along its strike for a distance of 35 feet in a westerly direction, and 86 feet in an easterly direction from the adit. Throughout this length stoping has been carried to within a few feet of the surface with underhand stoping over a length of approximately 20 feet.

From such limited development on a narrow vein, production could only have been low, but apparently the grade of ore is reasonably high.

AULDANA ADIT:

The Dalcoath Company was operating in the year 1893 when A. Montgomery M.A., Geological Surveyor, reported on the Moina district. Both W.H. Twelvetrees, Government Geologist, in 1913 and A. McIntosh Reid, Assistant Government Geologist, in 1919, refer to the Dalcoath workings, the latter stating : -

> "Thick scrub and fallen trees completely obscure the surface, and many of the old workings are almost obliterated and could not be examined."

Since that date, an adit, then reported as being 43 feet in length, has been extended to a total length of 200 feet. Several small quartz veins, of a maximum width of six inches, have been exposed in the adit and on two of them, short levels have been driven. A little underhand stoping has been done without production.

The adit has been driven in a northerly direction in greisenised granite from a point near the southern boundary of lease No. 10305/M.

STORMONT BISMUTH MINE:

The greater proportion of the Bismuth produced in the Moina district has resulted from the treatment of mixed Tin-Wolfram-Bismuth concentrates won from the Tin or Wolfram mines. Occasionally it occurs in a form sufficiently concentrated to warrant its separate recovery. Generally it occurs as fine grained mixed concentrates with Tin and Wolfram with occasional pieces of large enough to separated by hand picking.

In the Stormont area, Bismuth occurs as the dominant economic mineral, occurring aither as the Sulphide (Bismuthenite) or the carbonate (Bismutite) in association with Gold.

At the time of this inspection there were no leases in force in the Stormont area. Previously three leases of a total area of 135 acres were held. These leases, Nos. 45M/38, 46M/38 and 11316/M, were situated on the south bank of the Lea River about 2 miles south-west from its junction with the Iris River.

The track from the Iris River passes for the most part over a Basaltic plateau but within a few chains of the mine workings, and to the north of the track, the quartzite and sandstone series outcrops.

In a preliminary report on the Stormont Bismuth prospect, in the year 1927, A. McIntosh Reid, then Director of Mines, describes the occurrence of Bismuth ores as extending from the Lea River in a south-easterly direction for upwards of half a mile.

Operations commenced about that time, the original development being an adit driven in a general south-easterly direction into the ore body. A second adit at a higher level was driven in a north-easterly direction to cross the former. Approximately at their intersection a shaft has been sunk. This development was sufficiently encouraging to warrant the formation of an open cut. The present workings consist of an open cut 100 feet in length with a maximum width of 60 feet, varying in depth to 35 feet. The open cut is bounded on its north-eastern side by a fault plane along which a development adit from the open cut has been carried in a south-easterly direction.

Development was at this stage when in 1934 E. Broadhurst, Field Geologist, made a further inspection and reported on the occurrence.

Since the year 1934, the adit has been extended to a total distance of 130 feet, having a right angled bend at 76 feet where the wall has been displaced by faulting a distance of 13 feet to the north-east. Further development by cross-cut from the adit at a point 40 feet from the open cut has demonstrated the absence of ore of a profitable grade and operations have ceased.

The Bismuth occurs in association with garnet occurring in a zone of alteration and replacement adjacent to the fault fissures. The zone of alteration varies considerably in width approximately 60 feet at the position of the open cut. Minor faulting has taken place contemperaneously with the main fissure, and the open cut is bounded on its south-eastern end by a fault of which the strike is almost perpendicular to the main fissure. In the cross cut to the south from the adit at a point 40 feet from the open cut the country rocks are there only partly altered and bands of the normal sandstone occur.

PRODUCTION:

There has been no production from this mine since 1933 and records exist for only 4 years over the period 1930 to 1933, inclusive. A total production to the value of £2,699 has been recorded, of which the Bismuth won represents a value of £2,320. Details of the production are as follows : -

YEAR	BISMUTH		GOLD	
	Tons	Value	Oz.	Value
1930	.97	475	19.45	140
1931	1.17	686	13.95	82
1932	.92	505	25.48	157
1933	1.22	654		
Total:	4.28	£2320	58.88	£379

FLETCHERS ADIT:

Development at the south-eastern end of the Stormont holdings has shown the presence of low grade Bismuth ore in narrow veins occurring in hard quartzites on the bank of the Lea River. Further development would be required at this point before any reliable estimate could be formed.

Samples of ore taken for assay purposes returned grades ranging from 0.13% to 1.28% Bismuth, whilst the average grade was .57% Bismuth.

BERYLLIUM DEPOSITS:

Reference to the occurrence of Beryllium in the Moina field is made in reports previously published by the Geological Survey of Tasmania. Both W.H. Twelvetrees in Bulletin 14, p.85, and A. McIntosh Reid in Bulletin 29, p.103, make reference to its occurrence on the property then referred to as Sayers Mine. In describing prospecting cuts and shafts on that property, W.H. Twelvetrees states :-

> "A vein of beryl in crystals 3 or 4 inches in length exists in No. 8 trench, and the same mineral apparently persists throughout the distance from the shaft. The crystals are closely set in a more or less parallel direction at right angles to the vein. They have no terminations and are of a pale bluish-green tint. The prisms are striated vertically and are from one sixth to a quarter of an inch in diameter."

Reid also refers to the same occurrence.

The workings are situated to the east of those referred to as the Squib Workings. The boundary between the granite and sedimentary rocks occurs a little to their north. It is in the marginal phase of the granite that search has been made, and numerous irregular mine openings and trenches occur over a distance of approximately three quarters of a mile easterly from the Squib Mine. Little development has taken place since W.H. Twelvetrees reported on the area.

Except for a few shallow shafts which have recently been cleaned out, the workings are in a collapsed condition. In none of those workings which were accessible was Beryl visible of the type described by Twelvetrees nor is there evidence that the workings examined are on the one line of lode. The accessible workings are situated on lease No. 11960/M, now abandoned, which is portion only of the area previously referred to as Sayers Mine. The workings have revealed only narrow pegmatitic veins in which some Wolfram was visible. In only two instances was Beryl visible. In these veins 1½ inches in width the crystals of Beryl were small and poorly developed. They could not be regarded as of economic importance.

MARKETING:

The product as marketed from the mines of the Moina field is, in general, a mixed product containing Tin, Wolfram and Bismuth. It shows marked variation in composition not only as between the mines of the district but also within the individual mines. Despite the variation, the marketed product yields on assay from 68 to 74 per cent of its bulk as Tin, Tungstic acid and Bismuth, except where hand picking is resorted to to produce high grade Bismuth or Wolfram ore. Separation of the bulk product into its constituent products is effected by means of electro magnetic separators. Owing to the absence in Tasmania of such separators available to the public, the separation is carried out on the mainland by or for the ore buyers or their representatives and the

producer is bound to accept the returns supplied by these firms.

Two products result from electro-magnetic separation :-

1. A high-grade wolfram product contaminated by a little Tin and some Bismuth.

2. A comparatively high-grade tin product contaminated by a little Wolfram and the greater portion of the Bismuth content of the original product.

For the impurities in each of these products, the producer is penalised and in general no payment is made for the Bismuth content of the latter product even though the Bismuth content of the original product may be greater than twelve per cent. with a consequent increase in Bismuth content, after separation, of the Tin product.

The producer, therefore, endeavours to remove as much of the Bismuth as possible. This is done firstly by hand-picking and secondly by excessive cleaning during the final preparation of the concentrates for market. The latter process causes considerable loss of the fine grained material originally won and would be avoided if payment were made for portion at least of the Bismuth content.

SUMMARY AND CONCLUSIONS:

The present investigation has confirmed the findings of previous writers with regard to the occurrence of numerous mineralised veins throughout the Moina field. Seldom do these veins exceed a few inches in width but a vein of two feet in width has been recorded. The veins are known to persist over long distances and mine workings have proved their continuity over distances of from 1200 to 1400 feet. Branching and splitting of veins occur. Shoots of high grade ore occur within the veins and vary both in length and in mineral content. What are locally referred to as bunches of ore consisting essentially of Bismuth or Wolfram minerals have been mined fromdifferent parts of one vein. In general, however, the product is a mixed concentrate containing proportions of Wolfram, Tin and Bismuth ores.

Since its inception, the Moina field has produced mineral products to a total value of £158,118. This figure is based on official records which are admittedly incomplete. They serve, however, as a basis of comparison. Of the quoted total, production from the Shepherd and Murphy Mine has been valued at an amount of £147,123 leaving a balance of only £11,000 as the gross production from the remaining mines.

The present output of the field is insignificant and results from ground sluicing at each of the Shepherd and Murphy and the Iris mines. No underground work is in progress and as the known area of ground, high grade in alluvial concentrates, is limited, future production will depend on either :-

(1) re-opening of the old mines;
(2) operations on the still undeveloped veins and search for undiscovered veins.

The possibility of re-opening the old mines would depend on assurances of ore reserves at their deeper levels. As the deeper levels, in every instance, are flooded,

preliminary operations are necessary to unwater the mines so that reliable estimates of ore reserves could be made.

The undeveloped veins on the Shepherd and Murphy leases are worthy of development to establish their grade and continuity.

The area between the All Nations mine and the Shepherd and Murphy Mine is a potential reserve in which search may reveal the continuation of the veins developed by those mines and which may prove to be identical.

On the All Nations Leases the area lying between the Lady Barron workings and the Main All Nations workings is still undeveloped and may be worthy of further prospecting.

With the high prices ruling for Tin (66/- per unit); Wolfram (110/- per unit); and Bismuth (9/4 per pound), the present is the most opportune time for fresh endeavour in prospecting for the minerals.

Reference has been made to occurrences of Beryllium and Quartz Crystals, neither of which are considered to be present in quantity or quality worthy of development.

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