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THE FARRELL MINING CO. LTD. MINES - TULLAH.

Introduction -

The following report on the mines of the Farrell Mining Co. Ltd. situated on the following mineral leases at Tullah, Consolidated Lease No. 7191/M of 256 acres and mineral leases Nos. 11065/M 80 acres, 11257/M 20 acres and 11292/M 20 acres, is the outcome of the systematic investigation of the silver-lead deposits of the Farrell district commenced late in 1941.

The purpose of this report is to indicate the geological factors controlling the future prospects of the mines. In such a discussion two of the more important phases of the problem are the structural features of the lodes as a whole and the distribution and persistence of the ore shoots. The salient points of both phases of the problem will be indicated in respect to the Farrell Mine, at present being operated by the Company, and attention drawn to such conclusions as are applicable from a study of published reports and mine plans of the old North Mount Farrell mine, which has been closed since 1932.

Location and Access.

The present mine workings are situated on the western edge of the slate belt flanking the west side of Mount Farrell, about 2,300 feet north of the old North Mount Farrell mine main shaft.

The topography of the area is one of high relief and is due primarily to the forces which have tilted the strata to high angles, modified by faulting and differential erosion during the natural denudation which has taken place since the folding of the rocks.

Previous Literature -

The literature on the geology and mineral deposits of the Farrell district is not extensive. A list of publications of the Geological Survey of Tasmania on the mining district of the Mount Farrell region (Quadrangle No. 44) may be found in Tas. Geol. Surv. Bull. No. 3 1907.

Previous reports by officers of the Geological Survey on the Farrell mining district which refer to the North Mount Farrell mine and the area in the vicinity of the Farrell Mine are as follows:-

In June 1900, W.H. Twelvetrees examined and reported on the mines which were in active operation. He describes the open-cut and adit workings above the No. 4 adit level of the North Mount Farrell mine.

The next visit was by G.A. Waller in March, 1904, and his report includes a description of the North Mount Farrell mine workings and the efforts to prospect the lodes on the Mackintosh Copper and Gold Mining Co. N.L. lease in the immediate vicinity of the present Farrell mine, and the suggestion that it could only be developed by shaft.

L.K. Ward visited the area in 1907 and prepared a comprehensive report which was published as Geol. Surv. Bull. No. 3.

The only other report is a brief typewritten one by P.B. Nye in 1931 entitled "The Tribute at North Mount Farrell, Tullah."

Outline of the Geology -

The understanding of the general geological structure has been advanced by the detailed systematic geological survey of the ore deposits of the Farrell district commenced in December, 1941; but as it is the present intention to publish a report on the geology and ore deposits of the Mackintosh Quadrangle No. 44 which embraces the Farrell mining field, only a brief outline of the geology will be given in so far as it affects the present problem.

The geological section consists of the western limb of an overturned syncline in which the sequence of rocks, from west to east is as follows:-

1. A thick series of "felsites" consisting of lavas, with interbedded breccias, agglomerates, tuffs and sediments.

2. The "felsites" are succeeded by approximately 1,500 feet of the Farrell slate series. These are black slates and tuffs with occasional tongues of sheared intrusive porphyries (sericite schist). The main Farrell fault, a high angle overthrust fault with which are associated the silver-lead ore bodies, occurs at the western margin of these slates and tuffs.

3. Overlying the Farrell slate series, apparently conformably, is approximately 1,000 feet of an "older conglomerate" series, consisting of fragments of slate in a tuffaceous matrix. Occasional pebbles of the red quartzite which forms the bulk of the West Coast Range Conglomerate are included near the top of the series.

4. A disconformity or even an unconformity divides the older conglomerate from the West Coast Range Conglomerate series which forms the main mass of Mount Farrell.

5. East of the West Coast Range Conglomerate the facies changes to a sandy one becoming finer-grained and eventually is overlain by

6. the White Hawk limestone.

For the purpose of this report, it is sufficient to say that in consideration of the general geology, the age of the mine rocks is tentatively placed as Middle Cambrian. These have been intruded by the later, probably Devonian, granite massif and associated dykes and it is with these instrusives, which have risen along pre-existing lines of weakness that the ore-bodies are associated.

The only rock types occurring in the Farrell mine are the black slates and tuffs with intercalated sericite schists. There has been differential movement on all junctions and the true relationship between the rock types cannot be observed.

Quartz "Lodes" -

The barren quartz "lodes", usually with excellent definition, have caused no little waste of time and money in fruitless prospecting, so that the matter of the correct interpretation of these lodes is of considerable importance. There is extensive evidence on the surface of the persistence of the line of quartz lodes east of the Farrell - North Mount Farrell mines and their true relationship to the silver-lead ore-bodies must be understood.

There can be no doubt that the lead veins are later than the quartz "lodes." Evidence showing the age relationship is available in the open cut at the North Mount Farrell mine, where the silver-lead ore can be seen filling fractures right across the quartz. The quartz lodes being the older may well be expected to be traversed by the veins of the silver-lead ore if conditions were favourable.

The fractures probably remained lines of weakness and during subsequent fissuring and impregnation, a fracture parallel with the original one or even coincidental with it was formed and then filled by the mineralising solutions.

The vein filling materials are two totally different types, the earlier is essentially a quartz filling while the later consists of galena, sphalerite and a little pyrite with the characteristic gangue mineral siderite, the iron carbonat

Nature of Fault Movements -

It is generally assumed, with good reason that in a region of overthrust faulting the hanging wall of the fault moves upward. In some cases, however, the movement is not directly upward but there is a lateral movement also. In the lode channel slicken-slided surfaces plunge about south 70°, indicating the hanging wall has moved northwards as it ascended; although this appears to be the general direction, some striae indicate relative movement to the south.

All these observations are in accord with the generally accepted theory that in regions of overthrusts faulting the dominant element is upward. Although there appears to be a considerable amount of movement, the actual amount may not be great, it merely being the crumpling of incompetent beds, the Farrell Slate series, against the competent felsites.

The hanging wall of the fault has moved with a zig-zag motion, at one time north, then south, but the vertical element of movement, so far as indicated by the directions of striae, was greater that the horizontal movement.

Fractures -

The fractures, in which the fissure veins of the Farrell district occur, are not simple ones wherein the ore has filled one well defined fracture only, but a complex system of parallel fractures in which ore may develop in any one over a wide zone. The main fracture consists of a fault and a crushed zone of crumpled and contorted slates and intercalated tuffs in which the metallic minerals, galena, sphalerite and pyrite together with siderite and quartz consitute the main bulk of milling ore.

All the workable deposits are in or along fissures and nearly all are faults of appreciable throw, Most of the faults of the system show mineralization but none of them, however, are mineralized throughout their length. In many places the lodes are sheeted zones instead of a single fracture filled with ore.

Nearly all the faulting is believed to have taken place at about the same period in the history of the region and it is probable that the chief displacement occurred during a rather brief geologic epoch. This epoch preceded mineralization. However, minor movements have taken place since metallization as indicated by some crushing and slickensliding or ore material in nearly all the lodes.

The age of the faults cannot be positively determined owing to the lack of younger rocks.

It is probable that, as least, the major faulting took place before the intrusion of the granite.

Ore Deposits -

The development of the continuous fracture system now traceable by its ore filling and the development of characteristic ore minerals along its course through the Company's leases is due to the differential behaviour of the rocks when subjected to stress.

The structure of the lodes is of the fissure vein type, of tabular form, the location of which is governed by pre-existing fractures that have served as circulation channels to the ore-bearing solutions. The nature of the fractures, undoubtedly, has had a great influence in governing the distribution of the ore-bearing solutions, but beyond this, wall-rock has had no effective control of ore-deposition. The ore-bodies are not confined to simple, single fractures but to a complex system of fractures, a distributive break rather than a single fissure.

Undoubtedly, there are shoots of ore, for the lode fracture is often traceable by a seam of pug and the development of siderite on one or both sides in the slates beyond the point regarded as the present economic limits of stoping. The irregularity of the ore shoots along the line of strike is remarkable and is due, apparently to irregular developments on two sets of shears rather than a flattening or steepening of a single swinging strike line.

A reason for the southerly pitch of the ore shoots is apparent from the general geological structure. The main mass of the Granite Tor - Murchison granite was intruded south of the Mount Farrell area and the apophyses extended north and upwards from that centre along two known and possibly three lines of existing weaknesses.

Temperature zoning is apparent with the decrease in sphalerite (zinc sulphide) as the workings extend northwards from the old Murchison mine.

The internal structure of the lodes is complex but the ore minerals do not share that complexity. At times, there is a distinct banding of the vein minerals, which is usually parallel to the general direction of the lodes. Usually the banded and brecciated ore structures occur together and constitute the typical "seconds" or milling ore. The variability of the lodes is indicated by the distribution of the oreshoots in them. These shoots are in many cases determined by the structural features of the lode-fissures, which bulge and contract along the course of the lode in such a manner that in places only the bare track of the fracture can be followed between the lenses of ore.

Character of Ore -

The hypogene minerals are few in number. Galena, both coarsely crystalline and dense, fine grained, is the most abundant metallic mineral. When banded the ore usually consists of a parallel arrangement of galena of varying grain-size rather than an alternation of gangue and ore.

Chalcopyrite is conspicuous in some places but more commonly it is found in small particles associated with tetrah rite, which is usually inconspicuous but is persistent through out the better mineralised portions of the lode.

Pyrite is irregularly scattered throughout the ore. The galena frequently shows evidence of recrystallisation indicating that the ore has been subjected to pressure by post-ore movements.

Quartz and siderite occur as gangue minerals, but in most of the shoots the ore consists of massive, crystallised metallic sulphides without gangue minerals.

In some places, the ore occurs as a part of the cement of a breccia and here too, there is a paucity of introduced gangue.

The intimate manner is which the sulphides are found; the apparent absence of other copper minerals that could be altered to chalcopyrite or tetrahedrite; and the complete lack of any evidence of alteration by descending waters in the main shoots of silver-lead ore imply that the chalcopyrite and tetrahedrite, like the galena are hypogenic in origin and will probably persist to such depths as the silver-lead.

Period of Deposition of the Ores-

After the main crushing and folding of the rocks, came the filling of the fissures, which already were prepared for the impregnation by the initial folding and were modified by fractures superimposed upon the crushed rocks by later stresses.

HISTORY OF MINING

Galena was first discovered on the North Mount Farrell leases, in the bed of a creek about 16 chains north of north boundary of the Mount Farrell Co. Lease No. 2409/93M. Mining was commenced by driving adits at successive levels, resulting in a steady production of ore. Only the first class ore could be sold, owing to the inaccessibility of the district, with its consequent high transport charges.

The first ore was sold in 1899.

In 1902 the Company commenced the construction of the wooden horse tram to Boco siding on the Emu Bay railway a distance of eight miles.

The mine entered the profit-earning stage during 1904 and sinking below the No. 4 adit level was commenced. By 1907 the mine had developed to such an extent that the mill capacity had been doubled, the construction of the existing steam tramway commenced and a water-power scheme from Lake Herbert completed. In spite of the heavy rainfall, the water-power scheme was a complete failure owing to the extremely limited catchment area.

Mining operations from the four adit levels continued satisfactorily until 1909 when there was a serious tonnage reduction of ore mined owing to the rapidly diminishing ore reserves above No. 4 adit level. Additional prospecting and developmental work failed to increase these reserves and it was decided to sink a main shaft. Circumstances compelled the expediency of sinking an internal shaft from the No. 4 adit level.

By 1910, as the No. 5 level developed, prospects steadily improved and the mine was in a sounder position and the outlook brighter than for some time.

The deeper levels developed satisfactorily although there was a serious decline in the first class ore won. The Mackintosh sections were acquired in 1912 giving the Company a considerable extent of lode northwards for future prospecting and development.

Reserves of milling ore were considerably increased in 1913 by the development of No. 6 level which was driven 350 feet on a continuous ore-body, in lode formation which averaged 14 feet in width.

World War 1 caused a temporary suspension of operation in 1914 to early 1915 when a market was secured and ore production increased to fullest capacity.

At this time the Mount Farrell Mining Company made an arrangement with the North Mount Farrell Company to drive south from the No. 4 adit level in order to test at depth any downward extension of the lodes worked in the upper levels on their sections. Some low grade milling ore was intersected but none of commercial value. As this gave 300 feet of backs, any favourable development or ore would be of the utmost importance.

Prospecting of the Mackintosh leases disclosed promising ore-bodies which it was decided would be mined when it is possible to provide the necessary tramway facilities.

For the next three years following 1916 the output was restricted owing to lack of markets, shipping and industrial trouble, and there was a more active developmental programme as productive operations ceased. Conditions were fairly normal until 1926 when it was decided to sink a new shaft, purchase a new crude oil power unit, and install a flotation plant. This decision was made because the length of crosscut necessary to reach to the lode was becoming too great and the existing hoisting engine had reached the limit of its effective operation.

Considerable delay in delivery of the engine and the initial operating difficulties prevented the plant being in commission before 1928, when owing to the low market price of silver and lead the company suspended underground operation and let a contract-tribute to the men.

The company contined with the retreatment of the current mill tailings and the tailing-dump.

Only the minimum amount of essential developmental work was possible by the tributers and there was no hope of maintaining production at the existing rate for very long unless the Company undertook the necessary development work.

Sinking of the main shaft was resumed towards the end of 1929 and by the end of 1930 was completed to the No. 10 level, 838 feet from surface.

The whole of the assets of the North Mount Farrell Mining Co. N.L. were acquired by the late Hon. Frank Bond in October, 1930, and the mine worked on the tribute system until November, 1931 when under new management it was restarted on wages.

The main crosscut was driven 284 feet east to cut the main lode which was driven on both north and south and good milling ore from the No. 10 intermediate level.

In 1932 the continued low price of silver and lead seriously affected productions.

In spite of the fact that it had been pointed out in 1907, (Ward p. 70) that there was insufficient evidence to justify long crosscuts east to test the quartz lodes the No. 4 adit crosscut was extended east for a considerable distance, without intersecting any lodes of economic value and the North Mount Farrell mine ceased underground operations towards the latter part of 1932.

Although low metal prices were a contributary cause the real reasons were the complete lack of development, due to three years mining on tribute, the expediency of sinking a haulage winze from the bottom level with consequent higher mining costs and a shortage of power.

Following the closing down of the mine the men were kept employed, prospecting, north of the Company's leases by the Government with payments from the Unemployment Relief Fund.

Early in March 1933 a party of men discovered six inches of clean galena outcropping on the surface on the old abandoned Mackintosh lease No. 3221/93M and the lease was pegged on behalf of the trustees of the estate of the late Hon. Frank Bond by the manager J.J. Andrew.

In June 1933 the whole of the assets of the old North Mount Farrell Mining Co. N.L. was purchased by the Farrell Mining Co. Ltd., an Adelaide Company with W.R. Snow as Chairman of Directors.

After some development work the Company borrowed £4,000 from the Government to equip and further develop the mine, but owing to a very short term policy of placing the main shaft close to the lode outcrop, only £2,800 had been expended when the mine production became payable.

The main shaft was commenced in 1934 and the No. 1 level south driven for over 300 feet. The shoot of ore adjacent to the shaft being 50 feet long. A considerable amount of ore was stoped from the lode channels near the No. 1 prospecting shaft. The lode was patchy over a width of one to four feet and gave good milling ore over a length of 104 feet. Output was maintained by underhand stoping from winzes.

By the end of 1935 the shaft was down 78 feet below the No. 3 level, having passed through the lode just below that level. The No. 3 level south had been driven 279 feet from the shaft and with the exception of the first 60 feet was stoped over a length of 200 feet and although very erratic, averaged approximately two feet six inches of milling ore from which a little first class ore was hand picked.

The shaft was sunk to 369 feet by 1936 and the No.4 level opened out. The south drive being driven 280 feet without exposing any milling ore. A crosscut was driven 19 feet into the footwall of the main ore channel and intersected the main footwall lode. There is a six inch seam of pug carrying "slugs" of galena on the footwall and about 18 inches of milling ore on the other wall.

The No. 3 level south drive proved the lode to be payable although patchy for the greater part of the 446 feet driven and averaged 18 inches of milling ore.

It was not until 1937 when the main shaft had been sunk to the No. 5 level that any real attempt to prospect the ore channels north of the shaft was made and then highly payable ore was cut on the No. 4 level about 50 feet north of the shaft, and was driven on for 180 feet, averaging about two feet of good milling ore.

The branch lode was driven on for 60 feet and proved payable.

About 55 feet above No. 4 level south, from the hanging wall rise, a cross cut was driven 35 feet east and an intermediate level driven on ore north 60 feet and south 110 feet.

Mill capacity was increased during the year by the installation of new elevators and larger rolls.

Early in November, owing to a serious breakdown of the 400 H.P. Diesel engine, milling and mining operations ceased until the end of the year. It was then decided to contract from the Hydro Electric Commission for the supply of electric power which was expected to be available by April 1938. In the meantime mining and milling operations were continued with an emergency power unit, a suction gas plant of 325 H.P.

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The hydro electric power was switched on on April 24th.

Another sink of a 100 feet was completed in the main shaft by the end of 1938 and No. 6 level, 574 feet below the brace opened out. The No. 5 level north had been advanced another 290 feet making a total of 423 feet. The lode had improved and a stope opened up for a distance of 150 feet.

In 1939 the main crosscut was driven 74 feet west from the plat on No. 6 level and a drive north commenced from the end. Thirty-five feet east from this drive, a drive was extended south 130 feet in a crushed quartz lode, two to three feet wide with an average width of 18 inches of payable milling ore, with occasional enlargements of the payable zone. A rise was put up on this ore from No. 6 level to No. 5 level and the rise came out about 20 feet east of the footwall drive on No. 5 level. The No. 5 level north was driven 110 feet of which 90 feet was in milling ore. At the southern end of No. 5 level south, a crosscut was driven 60 feet west and from a point 30 feet from the drive, a drive was driven 70 feet south to locate the assumed depth persistence of ore worked on No. 4 level south. No milling ore was located and when a connection was made with No. 4 level by rising, it revealed that the ore zone failed 12 feet below the level.

On the No. 2 level north the drive was extended 40 feet, then a short crosscut was put in 20 feet east and cut good ore which was driven on north 200 feet. The lode averaged five feet wide with about 40 per cent clean "firsts." This ore, within 80 feet of the main shaft, was not discovered until five years after the sinking of the shaft to that level; clearly demonstrating the need for intense lateral prospecting in places where anticipated ore has not been located.

This development was an important factor in the economics of mining and drew attention to the need for extending the No. 1 level north for the purpose of locating the shoot of ore on that level.

The installation of additional flotation units is claimed to have resulted in an increase in the recovery of silver and lead by raising the grade of the concentrate from 70 per cent to 76 per cent of lead and its silver content from 73 oz. to 81 oz. per ton.

In 1940, the last sink of the main shaft was made to the No. 7 level. The main crosscut was driven a 140 feet west and at 104 feet cut the "quartz" or footwall lode. This was driven on for 105 feet south without showing any milling ore.

The No. 5 level drive south on the "quartz" lode was advanced 200 feet and for at least 100 feet averaged about 18 inches of milling ore.

On the No. 2 level, the northern drive was continued for 360 feet on the main lode which was high grade milling ore for 190 feet. At 220 feet from the main crosscut, the lode widened to 20 feet of high grade milling ore with bunches of pure galena. The enlargement occurred at the junction of the main and branch lodes. This development enabled the output of ore to be materially increased.

The No. 1 level was driven north and intersected the upward extension of the ore developed on No. 2 level. Good milling ore with an average width of 5 feet persisted 260 feet and rises lifted from No. 1 level indicated that the ore persisted for 25 feet above the level.

Failure to locate the ore shhots below No. 5 level caused much concern to the management and a contract was let for the drilling of 2,000 feet of diamond core drilling. Although more than 50 per cent of this drilling was ineffective through being located outside the ore zone, it was instrumental in locating the shoot of ore in the "main" lode channel on No. 6 level south and also its downward extension on No. 7 level south.

Since 1940, the last year in which the main shaft was sunk, there has been no major development work apart from the driving of the No. 6 and 7 levels to develop the ore located by drilling, the driving of the oblique crosscut on No. 6 level to reach the ore located by the No. 1 D.D.H., and the mullock pass put through to surface from No. 1 level, until the end of last year when the haulage winze from a chamber at the end of the main crosscut on No. 7 level was commenced.

Undoubtedly, the deciding factor, in the decision of the management not to sink the main shaft in 1941, was the length of crosscut necessary to reach the lode on the next level. for the average number of men employed on the mine was only two less than the preceding year. The fact, that approximately 250 feet of cross-cutting would be necessary, at less than 800 feet from the surface, is due to the short term policy of placing the main shaft so close to the lode outcrop that it passes through the lode just below the No. 3 level, 268 feet below the surface, and the bottom level (No. 7) was 180 feet east of the main lode.

PRODUCTION

The subjoined table is compiled from production statistics available from official records.

The first sale of ore was made to the Smelting Company at Dapto, New South Wales, on 16th October, 1899, and consisted of 60 bags of 3 tons 5 cwt. gross weight. The ore assayed 54.4 per cent lead and 55 oz. of silver per ton and realised £29.3.4.

The total production from the Farrell mine from 1934 to 1944 was 29,156 tons of silver lead concentrates containing 2,401,083 oz. fine silver and 21,100 tons of lead, with a total value of £688,112.

The North Mount Farrell mine has a recorded production, from its inception in 1899 to 1933 when it ceased operations, of 71,205 tons of concentrate with an estimated silver and lead content of 4,994,338 oz. fine and 48,563 tons respectively, valued at £1,381,902. Thus the total recorded value of productic from the mines on the Farrell Mining Co. Ltd. leases is £2,070,01 Annual production reached its peak in 1940 when 4,664 tons of concentrates and 846 tons of prill ore were produced, containing 468,081 oz. fine of silver and 4,067 tons of lead with a total value of £146,972. This was the last year in which the main shaft was sunk and production has steadily decreased through lack of sufficient development until production is now only one third of that figure.

Silver and lead produced by North Mount Farrell Mining Co. N.L. 1899-1932
(Table 1) and Farrell Mine Production, 1934-1944 (Table 2)

Table 1

Year	Ore Long Tons	Concentrate Long Tons	Silver			Lead			Total Value
			Quantity oz. fine	Av. Price per oz. s. d.	Value £	Quantity tons	Av. Price per ton £ s. d.	Value £	£
1899 to Oct. 1904		4,556	294,808	No record	No record	2,733.6	No record	No record	35,798
" 1905	14,076	1,621	110,138	"	"	529	"	"	16,277
" 1906	22,386	2,596	137,005	"	"	1,448	"	"	27,470
" 1907	25,788	3,281	170,381	"	"	1,798	"	"	39,080
Nov.-Dec. - 1907		*220	* 12,890	"	"	*134	"	"	*7,133
1908		3,825	*220,282	"	"	*2,334	"	"	32,146
1909		3,219	*185,377	"	"	*1,963	"	"	26,429
1910	15,344	2,321	*133,663	"	"	*1,410	"	"	19,564
1911	12,000	2,598	*149,618	"	"	*1,537	"	"	24,517
1912	13,219	2,168	*124,847	"	"	*1,324	"	"	24,639
1913	14,243	2,601	153,753	2 2.81	"	1,471	15 3 6	"	29,049
1914	16,118	2,459	128,969	2 1.32	"	1,321	18 13 9	"	23,378
1915	15,047	2,418	136,434	1 11.69	"	1,361	22 17 8	"	32,683
1916	21,380	3,322	170,091	2 7.32	"	1,756	30 19 6	"	42,789
1917	13,081	1,998	95,326	3 4.88	"	1,021	30 0 0	"	23,980
1918	13,919	2,144	102,727	3 11.57	"	1,089	30 2 8	"	26,520
1919	5,462	929	42,960	4 9.06	9,581	447	28 3 11	12,215	21,796

Year	Ore Long Tons	Concentrate Long Tons	Silver			Lead			Total Value
			Quantity oz. fine	Av. Price per oz. s. d.	Value £	Quantity	Av. Price per ton £ s. d.	Value £	£
1920			140,582	5 1.56	36,887	1,349	38 4 7	49,980	86,867
1921		646	34,402	3 0.875	5,858	377	22 14 6	8,734	14,592
1922	23,822	3,496	201,059	2 10.4	31,056	2,022	23 14 10	47,910	77,415
1923	19,550	2,669	187,345	2 8.37	26,851	1,927	25 19 4	50,816	77,869
1924	23,988	3,303	194,702	2 9.97	29,679	1,933	33 13 11	66,173	95,852
1925	20,910	3,429	233,390	2 8	33,713	2,117	35 17 3	75,797	109,510
1926	15,040	2,969	173,295	2 4.2	22,176	1,789	31 2 2	55,671	77,847
1927	21,803	3,097	194,313	2 2.38	22,790	1,870	21 9 6	44,565	67,355
1928	11,713	3,589	176,394	2 2.15	20,665	1,449	22 13 6	30,953	51,618
1929	10,902	5,731	290,536	2 0.57	31,935	2,279	23 4 11	52,845	84,780
1930			392,633	1 5.66	30,801	2,748	18 3 1	49,897	80,698
1931			171,569	1 2.6	11,154	1,655	12 9 0	21,673	32,827
1932			167,477	1 5.8	13,868	1,782	13 13 10	21,303	35,171
1933			207,954		16,999	1,589		18,696	35,695
		71,205	4,994,338		344,013 (from 1919)	48,563		607,228 (from 1919)	1,381,344

1933 production from re-treatment of slimes and tailing dump.

Total value of production 1899-1933 £1,381,344

Table 2

Year	Ore Long Tons	Concentrate Long Tons	Silver: Quantity oz. fine	Silver: Av. Price per oz. s. d.	Silver: Value £	Lead: Quantity tons	Lead: Av. Price per ton £ s. d.	Lead: Value £	Total Value £
1934	5,453s. 8,265	57p. 1,638	129,657	1 9.2	12,009	1,096	11 1 0	12,253	24,262
1935	7,743	1,626	144,393	1 9.95	18,712	1,201	14 5 8	17,179	35,891
1936	10,248	2,365	176,618	1 9.65	15,721	1,634	16 7 9	29,303	45,024
1937	*8,950	128p. 1,972	169,912	1 9.65	15,379	1,519	23 6 1	36,695	52,074
1938	*10,800	78p. 2,455	183,589	1 9.1	15,772	1,715.3	15 6 5	26,804	42,576
1939	13,738	286p. 2,996	249,721	1 8.5	23,482	2,366	15 13 7	37,985	61,467
1940	17,198	846p. 4,664	468,081	2 1	47,047	4,067	25 0 0	99,925	146,972
1941	16,537	3,875	335,352	1 11.44	35,212	2,856	25 0 0	71,400	10,662
1942	10,840	2,300	207,050	1 11.44	21,739	1,799	25 0 0	44,965	66,704
1943	9,648	2,250	193,070	1 11.44	20,273	1,659	25 0 0	41,475	61,748
1944	7,683	1,620	143,640	1 11.44	15,082	1,188	25 0 0	29,700	44,782
	121,650 5,453s.	29,156	2,401,083		240,428			447,684	688,112

s. Slimes re-treated
p. Pril ore
* Estimated

Total value of production 1934-1944 £688,112

Exploration of the Leases of the Farrell Mining Company Ltd.-

In considering the future development of an area that contains lode deposits the geologist may consider four groups of possibilities :-

1. extensions on the strike of developed deposits,

2. fractures and veins in the walls of developed deposits,

3. extension in depth of developed deposits, and

4. undiscovered lodes.

Although the geologist may disclaim any prescience of undeveloped ore-bodies in an area, he may, with propriety, direct attention to what he regards as the most promising location to seek for them.

Extensions on the strike of developed deposits-

As the North Mount Farrell Lode has been the most productive in the district, possible extensions along its strike are of the greatest interest.

The geology of the Farrell fault system has been described above.

Regarding the extension on the strike of developed deposits there is at least 2,000 feet between the North Mount Farrell mine and the Farrell mine that is concealed by morainal material on the surface and is essentially unexplored underground. Details of a diamond drilling campaign designed to explore this area are given below.

North of the Farrell mine and within the northern limit of the Company's leases there is at least 700 feet of line of lode which is essentially unexplored.

For many years, with the exception of the surface prospecting undertaken by the Government of Tasmania as unemployment relief in 1932-3, which resulted in the discovery of the lode being mined at the present Farrell mine, very little work has been done in searching for the north and south extensions of the North Mount Farrell lode. In view of its great productiveness, the belief appears to be fully warranted that the prospecting of the Farrell fault system between the North Mount Farrell mine and Farrell mine offers greater promise of reward than that in some other parts of the district where prospecting has been carried on more vigorously.

Fractures and Veins in Walls of Developed Deposits-

Owing to the lack of definition of the main lode channel many small mineralised fractures make off from it. Some branch north east and others south east. Where such fractures are closely spaced large ore-bodies may result as in the big No. 2 level stope where owing to the presence of many closely spaced fractures in the foot-wall the width of the lode was expanded to over 40 feet.

The production and character of the Farrell lode appears to justify a more thorough prospecting of its walls.

Extensions in Depth- As a bearing on the possibility of profitable development and mining below the existing bottom levels (No. 7 level, Farrell mine and No. 10 level North Mount Farrell mine) certain considerations other than the possible changes in character of the ore merit attention.

The state of the ore indicates that it is primary, and secondary enrichment cannot be anticipated.

The fracturing of the lodes is pronounced but the secondary fracturing is not one of lateral displacement but of continued movement upon existing fractures.

There can be no doubt that the ores have had their origin in the magma of which the Granite Tor - Murchison granite massif-forms the most prominent consolidation product. The exact loci of the ore-bodies are determined by factors outside the parent magma. The ascent of the metalliferous solutions is restricted to certain definite channels surrounding the granite. These channels are fractures formed nearly coincidental with the granitic invasion, for fractures occur in apophyses from the granite magma itself, as at the Murchison mine.

Preferential selection of certain fractures as loci or ore-deposition has taken place because either they offered more ready access for the metalliferous solutions or they were in close proximity to the actual source of supply. The actual deposition of ores in the channels of circulation appears to be due entirely to the physical conditions of temperature and pressure and to the differences in solubility of different metallic minerals. As far as can be ascertained the nature of the wall-rock has in no way influenced the deposition of ore

The crustal movement in the Farrell district has been of such magnitude that the fault planes associated with the deposition of ore must persist to great depths, and all geological evidence in this field is wholly opposed to the belief that there is a barren zone at a shallow depth below the surface.

The very presence of the siderite in the bottom levels of the North Mount Farrell mine is clear proof that the pyritic zone has not been reached by mine development and this should offer every satisfaction to the Farrell Mining Co. Ltd. when confronted with the problem of depth persistence.

It is an established fact that shoots of ore succeed one another at various vertical distances and the termination of one shoot is absolutely no criterion that another does not exist lower down, particularly when there is no structural variation in the lode channel nor any marked variation in the mineralogical composition of the ore or gangue.

The extreme vertical range over which silver lead ore has been mined in the Farrell district does not exceed 900 feet. This is apparent when the topography of the Farrell district is studied. It can be seen that the highest outcrop of a lode which has been mined for silver-lead is a little over 1,100 feet above sea level that is, the upper workings of the Mount Farrell mine, while the deepest level of the mine workings is the No. 7 level of the Farrell mine, at approximately 186 feet above sea level. This depth is insignificant when compared with those, at which, silver lead mining has been carried on in other parts of the world.

(Coeur d'Alene Idaho, U.S.A., over 4,000 feet). There appears to be a general shortening of the ore-shoots in depth.

The distribution of the ore is conditioned by strongly pronounced geological factors and these must be understood if it is desired to gain an intelligent idea of what should be the guiding principles in the development of the mine. There is no evidence that ore deposition has been confined to the purely fortuitous plane of the present surface level.

The metalliferous solutions having their origin in deep seated sources, have been conveyed through ascending channels thousands of feet in length and there is every reason to believe that the ore will persist to great depth. It does not appear possible to forecast the probable distribution of the ore in these channels at depth since it is apparently dependent upon the irregularities in the channel and these are not governed by any recognised criteria.

Prospecting for New Lodes -

In some districts the country rock is highly altered during mineralisation and this alteration extends far from the workable deposits and serves as a guide for exploration; but in the Farrell district alteration is not conspicuous even a few feet from the lodes.

On the present interpretation of the geological structure, with the exception of river gravels and morainal material the ore-deposits are younger than any of the rocks in the district, so none of the hard rock formations can be classed as barren simply on accounts of their age as all were present when the deposits were formed.

Although the principal ore deposits have been found thus far at the base of the Farrell slates series in close proximity to the felsites, it is possible that deposits may be found near the top of the series where the Farrell slates underlie the older conglomerate, but any such development will be outside the limits of the present holdings of the Company.

Thus strike faults in either of these zones may be considered worthy of investigation as possible seats of ore deposition.

There is no geological evidence to justify long cross-cuts east from the existing mines.

Past Drilling Campaign-

The drilling campaign undertaken in 1941 shows a complete lack of reasoned and planned lay-out based on a thorough understanding of the geology of the ore deposits. Much valuable data has been lost because no attempt was made to preserve the core, nor was there any attempt to determine the percentage recovery of core and cuttings. The identification of the core and cuttings was left to the driller with the result that the drill logs are of little value.

Altogether 19 holes were drilled, 18 from underground locations in the Farrell mine and one from the surface in the vicinity of the present mill site. Apparently there was no precise location or orientation of the drill holes, neither was there any survey of the amount and direction of the deflection of the holes. D.D. Holes Nos. 17 and 18 were drilled at right angles to the direction of the end of the No. 3 level rather than normal to the direction of the lode channel, No. 18 being drilled only 25 feet into the ore zone, while No.17 was drilled over 50 feet in hanging wall country.

The No. 1 diamond drill hole was drilled from a cuddy at the north end of No. 6 level in a westerly direction for 300 feet, and passed through five inches of galena at 105 feet. An oblique crosscut was driven to reach this ore and short drives north and south driven to test the ore channel. It is claimed that the ore cut in the drill hole is the same as in the drive but I doubt this very much, and until such times as this hole is surveyed for deflection the true position of the ore located by the drill will be unknown.

At 100 feet south of No.1 D.D. Hole the No. 2 D.D. Hole was drilled from a short crosscut, in a westerly direction for 130 feet without intersecting any ore, but as this hole was started west of the main ore channel, ore could not be reasonably assumed to exist.

No. 3 D.D. Hole No. 5 Level North was drilled 110 feet west of the hanging wall lode channel, beyond the ore zone.

No. 4 D.D. Hole No. 5 Level North was drilled 264 feet east in footwall slates from an eastern crosscut already 80 feet in footwall country. This drilling was wasted as it has already been pointed out that there is no geological evidence to justify long prospect holes east beyond the footwall ore channel.

The same conditions apply to the No. 5 D.D.Hole No. 4 level north as do to the No. 3 hole except that in this case the hole was drilled even deeper into hanging wall namely 164 feet.

On the No. 2 level north, two holes, Nos. 6 and 7, with a total length of 175 feet, were drilled from the footwall drive and cut ore at 23 and 20 feet respectively. This footage could have been utilised to better advantage by increasing the number of holes to four of equal length.

No. 8 D.D. Hole was drilled, from No. 1 level north, 80 feet into footwall country.

Nos. 9, 10, and 11 D.D. Holes were drilled from No. 3 level and all were drilled into footwall country at least 50 feet. The No. 11 hole was south of the shaft and the other two north of it.

From the footwall drive south on the "quartz" lode No. 12 D.D. Hole was drilled 75 feet west and cut six inches of galena. The No. 13 hole was drilled from the main crosscut to test the northern extension of the ore shoot but did not cut any ore.

The No. 14 D.D. Hole was drilled west from the footwall drive south on No. 6 level to test the upward extension of the ore shoot located by D.D. Hole No. 12. The ore was cut at 56 feet and the hole continued another 54 feet in hanging wall country.

To test the upward continuation of this ore on No. 5 level the No. 15 D.D. Hole was drilled 77 feet west from the end of the south crosscut already 30 feet beyond the hanging wall lode channel.

No. 16 D.D. Hole is not shown on the underground plan and it is assumed that this hole was the one drilled from the surface.

On No. 4 level north, No. 19 D.D. Hole was drilled only 27 feet into the ore zone and failed to locate the branch lode, which was subsequently driven on, by 13 feet.

PROPOSED DIAMOND DRILLING PROGRAMME.

The main objects of exploration are to reduce the mining risks, lessen the costs of development and increase the profits of mining by obtaining information upon which intelligent plans of work may be based. The cheapest and quickest method of obtaining this information is by surface and underground exploration by means of the diamond drill.

The diamond drill has a special use in seeking ore in parallel veins and the adoption of a plan of a single footwall prospect drive with relatively short, closely spaced, and nearly horizontal holes to the west or hanging wall country will minimise the length of the nonproductive drives and will increase the speed of exploration. On locating ore, driving would be transferred to the productive parallel ore channel and later, holes could be drilled back to explore the extensions of the footwall channel.

The approximate limits of the ore shoots can be found by "fanning" holes from the one set up both vertically and horizontally.

When an extensive campaign of core-drilling is undertaken, the care and preservation of the core becomes a matter which warrants much thought and attention.

A continuous core furnishes accurate information concerning the character of the rocks and lode material passed through. Extreme care should be exercised in the collection of the diamond drill-hole smaples, which consist of core or sludge or both. If core recovery is low, then the sludge must be saved and its assay combined with that of the core, in proportion to their volume. Few diamond or rotary drill holes are straight and it is essential that a survey be made of the amount and direction of deflection of each hole, in order to plot the true position of any ore occurrence. It is also essential that the holes be collared accurately to the pre-determined direction.

To test the prospects between the North Mount Farrell mine and the Farrell mine from surface locations, 12 holes, on a 200 foot grid, aggregating 6,350 feet of core drilling are proposed. On maxima and minima considerations, six holes are designed to intersect possible ore positions at the level of the No. 3 level of the Farrell mine, R.L. 572 feet above sea level, and the other six to test the ore channels 200 feet lower, on the level of the No. 5

level Farrell mine, R. L. 372 feet above sea level.

No. 1 D.D. Hole.

Location : Five hundred and forty feet east and 510 feet north of the North Western corner of the new main shaft at the North Mount Farrell mine.

Bearing : South 83° east. Depression : 58°.

Depth of Hole: 285 feet.

No. 2 D.D. Hole

Location : 203 feet north 8° west of D.D.H. No. 1.

Bearing : South 83° east. Depression : 55°.

Depth of Hole : 280 feet.

No. 3 D.D.Hole

Location : 300 feet south 82° west of D.D.H. No. 2.

Bearing : South 83° east. Depression: 60°.

Depth of Hole : 635 feet.

No. 4 D.D.Hole

Location : 413 feet north 60° east of D.D.H. No. 3.

Bearing : South 83° east. Depression : 69°

Depth of Hole : 450 feet.

No. 5 D.D.Hole

Location : 310 feet south 86° west of D.D.H. No. 4.

Bearing : South 83° east. Depression : 60°.

Depth of Hole : 640 feet.

No. 6 D.D.Hole

Location : 423 feet north 60° east of D.D.Hole No.5.

Bearing : South 83° east. Depression : 69°.

Depth of Hole : 430 feet.

No. 7 D.D.Hole

Location : 295 feet south 86° west of D.D.H. No. 6

Bearing: South 83° east Depression : 54°.

Depth of Hole : 685 feet.

No. 8 D.D.Hole

Location : 395 north 57° east of D.D.H. No. 7

Bearing : South 83° east. Depression 69°.

Depth of Hole 440 feet.

No. 9 D.D. Hole

Location: 256 feet south 85° west of D.D.H. No. 8.

Bearing : South 83° east. Depression : 58°.

Depth of Hole: 675 feet.

No. 10 D.D. Hole

Location : 366 feet north 52° east of D.D.H. No. 9.

Bearing : South 83° east. Depression : 60°.

Depth of Hole : 450 feet.

No. 11 D.D. Hole.

Location : 276 feet south 85° west of D.D.H. No. 10.

Bearing : South 83° east. Depression : 57°.

Depth of Hole : 675 feet.

No. 12 D.D. Hole

Location : 203 feet north 80° west of D.D.H. No. 11.

Bearing : South 83° east. Depression : 51°.

Depth of Hole : 705 feet.

It is estimated that an additional six holes probably averaging 500 feet, would be necessary to scout drill the norther extension of the Farrell line of lode, within the Company's lease but it is recommended that this prospecting be undertaken only when the area between the two mines has been thoroughly explored. The following underground prospecting is also recommended:-

Farrell Mine.

1. To test the downward extension of the shoot of ore north of No, 5 level by "fanning" holes downward from the eastern crosscut on No. 5 level north.

2. Drilling of horizontal holes 50 feet apart in an easterly direction to explore the "quartz" lode channel on No. 7 level.

3. Extension of No. 5 level south with lateral prospecting.

4. Lateral drill-holes in an easterly direction from No. 4 level south of the shaft.

5. Extension of the No. 3 level north with lateral prospecting to explore the northern continuation of the ore channels.

6. Testing of the downward extension of the ore-shoot north on No. 4 level by "fanning" holes in a westerly directic from the No. 1 eastern crosscut north of the shaft.

7. Extension of the No1 3 level south at least 100 feet, with lateral drilling "fanned" in an easterly direction from the one set up to test the downward extension of the Central Mackintosh ore occurrence.

North Mount Farrell Mine.

It is recommended that a comprehensive drilling campaign of horizontal and "fanned" drill holes above and below prospecting drives be undertaken when the mine is unwatered. The north drive from the No. 8 (shaft) level and the south drive from the No. 4 adit level are ideally located for the type of exploratory drilling suggested. Short crosscuts may be necessary.

Conclusions and Recommendations.

The dominant note throughout the history of the North Mount Farrell mine has been a deficiency of power to develop adequately the mine. This lack does not exist today. The other factor which has, undoubtedly, had considerable influence has been the failure to realise the necessity of intense lateral prospecting and this is equally true in the working of the Farrell mine. The absolute necessity of intense lateral prospecting is of such importance as to fully warrant the purchase of a small core-drilling plant. Long holes are not required, the average probably would not exceed 50 feet.

The value of the total output of the two mines on the Company's leases exceeds £2,000,000. This production has been won from very moderate depths, and even at that depth has not exhausted the possible ore reserves. Much still remains to be done to explore the horizontal extensions of the ore channel within the area under discussion.

But it must be borne in mind that even if exploration at existing levels does result in the location of new ore bodies, the permanency of mining can only be achieved by continuous sinking and it is to provide justification for such a policy, that I have discussed facts which have a fundamental significance in the future of mining at Tullah.

The guidance of the present developmental work in the mines is not the only issue. The whole future of the district and further prospecting of the yet undiscovered lodes are vitally concerned with the correct interpretation of the geology of the known ore occurrences.

I am of the opinion that an understanding of the events leading to the formation of the ore-bodies and an appreciation of the necessary conditions for the accumulation of the different metallic ores in veins or lodes as outlined above will disperse the feeling of hesitancy which has retarded the deep development of these mines.

It is recommended that serious consideration be given to the prospecting outlines above with a view to developing the two mines from a centrally located main shaft.

The timid and short sighted policy of sinking haulage winzes, from the lowest shaft levels, which is an expediency to be deplored, must be replaced by a vigorous and long range developmental policy if the mines are to be worked to their full capacity.

Consideration of a working programme would be facilitated if the management could be prevailed upon to record upon their underground mine plan such geological information as change of country rock (the varieties are not perplexing in character) stri and dip variations in the individual ore channels and ore widths and whether the drives are on lode, lode channel or country rock. It is also desirable that they have prepared individual level plans instead of the present practice of keeping one plan on which all levels are shown in a confusing mass, without regard to the true outline of each level. They are shown merely as parallel lines to the plotted line of sight of the instrument. The levels require to be levelled for the purpose of making accurate cross sections, as the grade on most of the levels is excessive and this appears as a swinging strike on the geological plan whereas it is merely a rise up the dip.

Although the available statistical evidence is insufficient for a correct assessment of the worlds lead supply outlook, it appears reasonable to assume that in the years following the war, in contrast with other metals, there will be no serious surplus problem. A constant market for Australian lead production is indicated by the statement by the Secretary of the United States Lead Industries Association that domestic production, given adequate labour, will be unable to satisfy the demand and that the United States will permanentl need imports.

Q.J. Henderson

FIELD GEOLOGIST

8th October, 1945,

HOBART.