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No. 7

Preliminary Report

ON THE

Zinc Lead Sulphide Deposits of the Rosebery District

BY

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Preliminary Report on the Zinc-lead Sulphide Deposits of the Rosebery District.

I.—INTRODUCTION.

This report deals with the results of a detailed examination of the northern portion of the Read-Rosebery zinc-lead sulphide belt. It is thus the second purely preliminary report dealing with these important deposits, as the southern portion of the belt has been treated in Report No. 3 of the Geological Survey, entitled "Preliminary Report on the Zinc-lead Sulphide Deposits of Mt. Read." In that report it was pointed out that for the purposes of geological examination, the whole belt had been divided into two—a southern portion in the immediate vicinity of Mt. Read; and a northern portion having the town of Rosebery as its centre. The former has been dealt with in the publication referred to above, while the present report deals with the latter portion of the belt. It is therefore apparent that this report is the natural sequel to that dealing with the Mt. Read district, and it is thus essential that it should be read in conjunction therewith.

The complete bulletin on the Mt. Read field is in the printer's hands, but has not yet been published. That bulletin contains a complete delineation of the data and the reasonings therefrom, which fully justify the important conclusions as to the structural features, genesis, and persistence of the zinc-lead sulphide ore-bodies briefly stated in that report. It is not expected that a mere statement as to the conclusions reached should completely convince technical men of their reliability, particularly as the minutest study of the exposures throughout the field is absolutely essential before the true structure is realised; a partial examination being entirely misleading. It is unfortunate, therefore, that the bulletin is not available at the time of issue of this report, but it is felt that the results obtained from the investigation of the northern portion of the belt just concluded are so important

as to justify the publication of a preliminary statement exactly similar in character to that already issued for the southern portion of the field. The bare statements thus made must therefore be accepted, pending the publication of the complete bulletins, which will present the data and reasoning on which they are based. Suffice it here to say that these results bear out completely the conclusions arrived at in the Mt. Read district as to the structural features and mode of origin of the ore-deposits.

Inasmuch, however, as this report has been compiled immediately on the completion of the field work, the statements made must necessarily, in some cases, be only tentative, requiring, as they do, the complete plotting and correlation of the data which will be included in the bulletin. With this reservation the statement of the results of the investigation will now be proceeded with.

II.—AREA INCLUDED IN THE INVESTIGATION.

The southern boundary of the area included in this examination coincides with the northern boundary of that dealt with in the Mt. Read district, viz., an east and west line drawn at the northern boundary of the Jupiter consolidated lease. The southern boundary therefore coincides with the southern limit of the Koonya consolidated lease, and the examination was continued from that point to the Pieman River as the northern boundary. The eastern and western limits of the area are approximately indicated by meridional lines drawn about 3 miles either side of a line joining the western sideline of the Koonya Mine to the Pieman bridge.

Included in this area are the following mining properties:—Tasmanian Copper Mining Company's properties, including the section originally known as the Black P.A.; Primrose Mining Company's properties, including the old Mt. Black Proprietary and Great South Rosebery Mines; North Tasmanian Copper Company's properties; Colebrook Proprietary Association's lease (the Koonya Mine), including the old Grand Centre; the mines originally known as the Dalmeny, Berry Consols, Chamberlain, Salisbury, Black Extended, Black No. 1, Milton, Ladas, Cutty Sark, &c., but now either held by various new lessees or are vacant.

As was pointed out in the preliminary report on the Mt. Read district, the general geology of the area was studied in detail, in addition to that on the mining leases themselves, as this is absolutely essential to the successful elucidation of the genesis and persistency of the ore-deposits. This practice has been followed during this investigation also, and an area of approximately 50 square miles, including the whole of Mt. Murchison, has been geologically studied and mapped. In this work care has been taken to connect up with the area mapped for the Mt. Read district, so that the geological maps of the two districts should be quite continuous. That object has been attained. The geological maps accompanying Parts I. and II. of the bulletins on the Read-Rosebery zinc-lead sulphide deposits will thus, when combined, cover a continuous area of approximately 100 square miles.

III.—GENERAL AND ECONOMIC GEOLOGY.

The three rock series more or less associated with the zinc-lead sulphide ore-bodies, viz., the Read-Rosebery schists, Dundas slates and breccias, and felsite or keratophyre, continue uninterruptedly from the Mt. Read district into this area. The slates and breccias occupy the western portion, the Read-Rosebery schists the central, and the felsite or keratophyre the eastern part of the field. The relative ages of these three rock series have been conclusively established to be in the order last named, the slates and breccias being the oldest, although the whole three series are conformable. They represent, in fact, an old series of mixed sedimentary and submarine igneous accumulations. This combined series of conformable sediments, volcanic tuffs, and lava flows has been subjected to an intense compression and metamorphism, during which they were thrown into a complex series of folds and converted into typical schistose rocks.

From the point of view of the origin of the zinc-lead sulphide deposits the Read-Rosebery schists are the most important. The zinc-lead sulphide ore-bodies are metasomatic replacements of metamorphosed calcareous beds in this series. The horizon which carried the calcareous beds is approximately 200 feet thick ,varying, however, in different parts of the field. The "feeders" by means of which the *ascending* mineralising solutions reached these replaceable beds are the schist planes; the whole Read-Rosebery schist series, in fact, forming a "sheeted zone." It therefore follows that the calcareous beds will be replaced by zinc-lead sulphide ore practically wherever they occur. In other words, the zinc-lead sulphide ore-bodies will faithfully follow this calcareous horizon in the schists. Moreover, since that horizon has been thrown into a series of folds along with the other members of the three rock series, as described above, it further follows that the exploitation of the ore-deposits consists in tracing the undulations of that particular horizon.

As pointed out in the report on the Mt. Read district, there are two series of these folds, named respectively the Alpha and Beta series. The former have their axes approximately north to south, and therefore undulate from west to east, while the latter have their axes east and west, and undulate from south to north. In the

bulletin on that field these axes are mapped, and in this present investigation that mapping has been extended to the northern half of the belt. The results of the mapping will be now concisely indicated.

We will first deal with the Alpha axes. It will be remembered that at the Ring P.A. the Alpha axes swing from a direction of N. 16° W. to N. 2° E., and continue in the latter direction to the northern boundary of the Jupiter. The present investigation has proved that the axial direction of N. 2° E. is continued northwards to, approximately, an east and west line drawn through the Rosebery Station. Northwards of this, the axial direction swings to the west, and resumes the bearing of N. 16° W., which characterised the Alpha axes from the Dunne's Blocks to the Ring P.A. in the southern portion of the belt.

Considering now the individual Alpha axes and tracing them from west to east, the important conclusion has been arrived at that the most easterly axis mapped for the southern half continues northwards until it passes out of the schist belt near the Rosebery Railway-station, and from that point only influences the structural features of the Dundas slates and breccias, since the Read-Rosebery schists have been denuded from above the slates along the prolongation of the axial direction northwards. It therefore follows that *the influence of the whole of the folds located in the southern portion of the belt can be ignored in determining the location of the ore-bearing horizon in the northern portion, except its extreme western part, as far north as the Rosebery Station.*

It must be remembered, however, that the existence of Alpha folds east of those actually mapped in the Mt. Read district had been demonstrated, although enough data could not be collected to allow of the fixation of the axes. It has been demonstrated during the investigation just completed that the folds located in the schists in the northern half, counting from the most westerly eastwards, lie wholly to the east of the northern continuation of those determined in the southern half, so that the whole series of axes now determined for the whole belt is continuous from the anticlinal axis at Williams' shaft, on the Mt. Read Company's Mine, to the anticlinal axis a few feet west of the shaft on the Dalmeny Mine, making a total of 9 anticlinal axes, which, together with the corresponding synclinal axes, constitute 9 complete major Alpha folds.

The next succeeding anticline east of the most easterly mapped in the southern half of the belt passes out of the schists just south of Section 3908-M, and the westerly limb can be seen in the railway cuttings on the Primrose Spur-line and the Emu Bay railway itself, between the 31 and 32 mile pegs. The same westerly dip can be seen in the road-cuttings near the turn-off of the road to the railway-station from the Rosebery-Williamsford road. From this anticlinal crest there is a dip to the east to a synclinal trough situated a few chains west of the adit driven in the Stitt River gorge on Section 3908-M, west of the Stitt River bridge. From this syncline there is a rise to an anticlinal crest situated some chains east of the Stitt bridge. This explains the westerly dip of the ore-body partially opened up on Section 3908-M.

The next anticline can be seen in the cutting in the Primrose Spur-line, about 100 feet west of the ore-bins. The same anticline can be seen in the excavation made for the smelter site, between this point and the mine offices. This anticline corresponds with that seen in the western end of the No. 1 adit at the Koonya Mine, the axial direction at this point being N. 2° E., changing, as explained above, to one of N. 16° W. east of the Rosebery Station.

The anticline succeeding this on the east is an exceptionally large one, and the whole of the ore-bodies disclosed in the Primrose, Tasmanian Copper, and North Tasmanian Copper Mines are on the descending easterly limb of it, which has been demonstrated to carry minor monoclinal folds. The same general easterly dip continues to a synclinal trough to the east, from which a rise occurs to another anticlinal situate a few feet west of the Dalmeny shaft. No further data as to the folding are available east of that.

Before entering on a description of the behaviour of the ore-bearing horizon it is necessary to take into consideration the effect of the Beta folds. It will be remembered that there is a very deep plunge of the ore-bearing horizon from the Hercules down to the Ring P.A. From that Beta syncline a rise was proved to exist with an undeterminable number of minor folds continuously northwards to the Jupiter Mine workings. It has now been demonstrated that that rise continues to a Beta anticline to be seen at the No. 1 crosscut No. 1 adit level, on the Koonya Mine. From that anticline another major plunge occurs to a Beta syncline situated approximately at the location of the turning-point of the Alpha axes

from N. 2° E. to N. 16° W. From that syncline a continuous rise occurs to an anticline situate at about the centre of the North Tasmanian Copper Company's consolidated lease, with many minor Beta folds, some of which can be seen in the first cutting on the Primrose Spur-line going west from the ore-bins, some of which are monoclinal in character. From the Beta anticlinal crest on the North Tasmanian Copper Company's lease, a plunge downwards northwards occurs, beyond which no data are available.

The combined effect of these two series of folds, taken in conjunction with the effect of the surface configuration, is extremely difficult to follow, and cannot be demonstrated without the aid of plans and sections. It is therefore impossible to attempt in this report an exposition of the explanation thus afforded of the complicated outcrops of the keratophyre in this portion of the Read-Rosebery district, which has been interpreted as indicative of the intrusive character of that rock. Suffice it here to say that the combined effect of the folding and the topography is such as to explain quite satisfactorily this involved surface exposure, in accordance with the effusive origin of the keratophyre.

Considering now the effect of both series of folds together with the topography on the position of the ore-bearing horizon, we will first take its northern continuation from the Jupiter ore-body, which, in the Mt. Read bulletin, has been proved to be on the same eastern limb as the "A," "B," "C," "D," and footwall portion of the "E" ore-bodies in the Hercules Mine. The crest of that anticline rises in accordance with the Beta folding to a crest of a dome situated in the extreme south-east corner of the Tasmanian Metals Extraction Company's consolidated lease 5669-M, but has most probably been denuded. The outcrop of the easterly-dipping ore-bearing horizon, therefore, extends northwards from the Jupiter mine workings through S. W. White's section, 6826-M, into the Tasmanian Metals Extraction Company's lease 5669-M, where it is covered with a thick layer of glaciofluviatile deposits. Northwards of this still, it has been removed from above the slates and breccias by denudation. The next Alpha anticline to the east is situated at a lesser height above datum than its westerly neighbour, and the ore-bearing horizon is therefore below the surface at the northern boundary of the Jupiter, and continues so northwards to the Beta anticline, and thence continues

beneath the surface until it reaches the neighbourhood of the Rosebery Station, beyond which it is denuded completely.

The same applies to the anticlinal crests succeeding them to the east, and the result is that the ore-bearing horizon is left constantly beneath the surface to the Beta anticline, because the surface rises correspondingly, and down to the Beta syncline to the northwards, because the surface likewise falls in that direction less than the amount of dip in the fold. North of the Beta syncline, however, the surface being approximately level for some distance, the rise from the syncline brings the ore-bearing horizon out at the surface, whence it has been denuded for a considerable area. We see the ore-bearing horizon remaining at two localities, viz., portion of a westerly limb on Section 3908-M (the old Black P.A.), and portion of an easterly limb of greater dimensions, constituting the ore-bodies on the Primrose, Tasmanian Copper Company, and North Tasmanian Copper Company's properties. The ore-bearing horizon between these two western and eastern exposures has been removed by denudation, as well as the northern continuation of the western outcrop, not very far north of the workings, as in that direction the schists give place to the slates and breccias. The occurrence of the ore-bearing horizon on Section 3908-M at such a low level is due to the effect of a minor syncline of the Beta series, combined with a syncline of the Alpha series.

On the Koonya Mine the No. 1 adit just penetrated the ore-bearing horizon at the crown of a dome, the dip north and south from the Beta axis being visible as well as the dip east and west from the Alpha axis. As previously pointed out, that Alpha anticlinal axis is the one lying immediately to the west of the anticline, on the descending easterly limb of which occur the Primrose and Tasmanian Copper Company's ore-bodies. It therefore follows that the ore-bearing horizon is wholly beneath the surface on the Koonya Mine (Colebrook Prospecting Association, consolidated lease 6458-M), the portion corresponding to the Primrose and Tasmanian Copper Company's ore-body lying immediately to the east of the eastern boundary; *i.e.*, in J. C. Macmichael's lease, 6919-M, and the vacant section 3056-M.

It is thus quite evident that the ore-bearing horizon is beneath the surface on the following sections, which are now held:—S. W. White's Sections 6826-M, 6833-M. 6835-M, 6834-M; C. H. Ferguson's Section 6863-M; T. O.

Thomas' Section 6856-M; and Roberts & Conroy's Lease 6264-M. It is further evident that it continues beneath the surface to an approximate line of outcrop extending from the 33 mile-peg in a north-easterly direction. The portion north of this line is denuded, with the exception of the two occurrences specifically indicated above.

At the North Tasmanian Copper Company's Lease 2708-M there occurs a northerly plunge down from a Beta anticlinal axis, thus tending to bury the ore-bearing horizon beneath the surface. The evidence, however, is not in favour of the idea of an indefinite extension of the replaceable beds in that direction, for not very far to the north there is distinct evidence that the Read-Rosebery schists change in character from a mixed assemblage of argillaceous calcareous and quartzitic schists to a series essentially quartzitic in composition without any interlamination of the other varieties. The ore-bearing horizon may, therefore, be expected not to continue much further than the northern boundary of the North Tasmanian Copper Company's sections along the axial direction of the Alpha folds so far considered, and confined in that direction to the easterly limb of the large anticline referred to.

We have now taken into consideration the effect on the position of the ore-bearing horizon as far east as the syncline lying to the east of the great anticline. Now a zinc-lead sulphide ore-body is known to occur on the Dalmeny Mine, at present held by J. C. Macmichael as Section 6936-M. This has generally been regarded as the southern continuation of the Primrose ore-body, since the outcrop of the latter is approximately N. 20° W. of the Dalmeny outcrop. It has been established that this is not so, for even without taking into consideration the swinging of the Alpha axial direction from the N. 16° W. to the N. 2° E. direction (which it assumes before reaching as far south as the Dalmeny), the continuation of the average strike of the ore-bodies (N. 16° W., and not N. 20° W., as generally accepted) from the main adit level, which is approximately the level of the Dalmeny outcrop, towards the latter, would bring the ore-body considerably to the west of the known outcrop. The conclusion arrived at in this investigation is that there is a rise from the lastmentioned synclinal trough to an Alpha anticline, situated a few feet west of the Dalmeny outcrop, and (owing to the swinging of the axis) just east of the south-east corner peg of the Tasmanian Copper Company's consolidated lease 2707-M, lying east of the 500-feet bore.

It therefore follows that the ore-bearing horizon corresponding with this synclinal trough and anticline occurs wholly beneath the surface in J. C. Macmichael's Sections 6918-M, 6919-M, and 6936-M, as well as the southern portion of the Primrose Company's workings and the extreme north-eastern portion of the Tasmanian Copper Company's lease.

It is apparent, therefore, that the easterly dip which characterises the ore-body on the Tasmanian Copper and Primrose Mines will not continue indefinitely, but will change to a westerly dip at a height above datum, increasing constantly when followed from south to north until the Beta anticline described above is reached. It is also apparent that the most easterly anticline at only one point allows the ore-bearing horizon to reach the surface, viz., at the Dalmeny outcrop.

A very important corollary can now be drawn from the fact that these Alpha axes are thus fixed, lying, as they do, to the east of those already mapped in the southern portion of the belt; for if they be continued southwards parallel with the correct axial directions, we have thus the data which will enable us to determine the distribution of the ore-bearing horizon a considerable distance east of that already determined in the bulletin on the Mt. Read district. Some of the greatest value of the data obtainable in the northern portion of the belt lies, therefore, in the application of such information to the eastern extension of the southern portion.

IV.—THE ORE-DEPOSITS.

The general character and composition of the zinc-lead sulphide ore-bodies is exactly similar to those in the southern portion of the belt, the predominating character of the ore being the banded structure, which does not represent crustification, but is the direct result of the selective precipitation from the mineralising solutions by means of the varying composition of the replaced rock. An interesting point is the fact that in the main ore-body in this portion of the belt the banding in the ore is exactly parallel with the stratification of the schists, which at this locality is coincident with the planes of schistosity.

In addition to these zinc-lead deposits there occur a series of lodes closely contiguous with them, characterised by the presence of tourmaline. These latter vary in character from point to point, being in one place (the old Mt. Black Proprietary Mine) composed of the minerals quartz, tourmaline, fluorite, pyrite, chalcopyrite, and bismuthinite, but more often consist almost wholly of quartz and tourmaline, with generally a little pyrite and chalcopyrite, and some siderite. These deposits belong to an earlier phase of the introduction of mineral-bearing solutions into this area, and will not affect in any way the more important zinc-lead sulphide deposits. They will not further be mentioned in this report.

The widest portion of the ore-bodies yet disclosed is approximately 55 feet, and all gradations from this figure to a few inches are observable. Perhaps the most prominent characteristic of this portion of the ore-bearing horizon is the great length of the ore-bodies which have been exposed continuously over a maximum length of 850 feet, but almost certainly will be proved to greatly exceed this figure.

A striking feature of the ore-body in the Tasmanian Copper, Primrose, and North Tasmanian Copper Mines is the sudden bulges and pinchings. These are due to one or more of three causes, the first being a characteristically sudden variation in the thickness of the original sediment; the second reason is due to the existence of the minor monoclinal folding on the eastern limb of the huge anticline; while the third is the effect of the minor Beta folds, which are also occasionally monoclinal in character. Since the measurement taken is the horizontal sec-

tion, it is easily seen that the flattening of the dip at the monoclinal will give the impression of a sudden thickening of the ore-body. Any of these causes will explain the whole of the variations throughout these three mines, although occasionally two causes coincide in their effect. It has been suggested that these sudden increases and decreases in the ore-body are due to the effect of two series of fractures intersecting at a sharp angle, thus developing a series of lenses of ore. The investigations just concluded, however, have established the fact that the occurrence of lenticular masses is the direct result of the original variation in the conditions of sedimentation, combined with the effect of the two series of folds. This is very important in connection with the calculation of "probable ore," and the consideration of "prospective ore."

The ore-bodies in the different mines will now be shortly described from the economic standpoint.

V.—THE MINES.

(1) The Tasmanian Copper Company Limited.

This mine was discovered by Mr. Thomas MacDonald in 1893, and was first owned and worked by the Rosebery Gold Mining Company, until it was reconstructed in 1897 under the title of the Tasmanian Copper Mining Company Limited. It was at that time regarded as a copper mining proposition, and a general manager and metallurgist were appointed, with the object of erecting smelters and working it as such. It was soon found, however, that the ore was a zinc-lead sulphide, and contained no more copper than the average characteristic of that type of ore. Since the realisation of that fact the zinc-lead sulphide ore has been sold to the Tasmanian Smelting Company, Zeehan, and since 1907 to the Tasmanian Metals Extraction Company, under contract. At present the mine is closed down, and has been so for the last two years.

The ore-body on this mine, as explained above, occurs on the descending easterly limb of an exceptionally large anticlinal fold of the Alpha series. Its outcrop on the surface is mostly obscured by glacio-fluviatile deposits. The dip averages about 45° to the east, but varies either above or below this figure, this being the direct result of the minor monoclinal folding. The strike varies from nearly north and south to slightly more than N. 20° W., but averages over the greatest length exposed continuously by the mine workings approximately N. 16° W. The local variation in the strike is the result of the minor Beta folds above referred to.

This ore-body has been partially opened up by eight levels, having a total vertical range of 715 feet. It has been proved to exist at both ends of the line of strike—a distance of 2000 feet, although it has not yet been proved continuous over the whole of this distance. The greatest continuous run of ore actually proved is 660 feet, at the No. 6 level. The width varies from a maximum of 55 feet down to a few inches. The average width as at present proved is approximately 23 feet.

The total output of this mine to date has been 50,826 tons of zinc-lead sulphide ore, assaying—

Au.	Ag.	Pb.	Zn.	Cu.
oz.	oz.	Per cent.	Per cent.	Per cent.
·145	12·3	7·9	28·0	0·5

In addition to this, 600 tons of zinc-lead sulphide have been sold as zinc ore, assaying slightly more than 41 per cent. zinc.

Such being the past achievements of this mine, it is now necessary to state the prospects for the future. At the outset, in this connection, however, it must be stated that, although the ore-body at the various levels has been driven on for some distance, there has been an astonishing lack of cross-cutting. The result is that in a great number of places the true width of the ore-body is not shown, either one or other, or both, of the walls exposed being obviously false. That this is the case was clearly illustrated in the case of the rise from the supposed footwall at the Intermediate level to the No. 4 level, which, following the apparent footwall, emerged at the latter level on the *hanging-wall* of the ore-body opened up. A crosscut driven west from the rise at an intermediate point (No. 5 level) showed the width of the ore-body to be over 50 feet. No crosscut has yet been driven west at the Intermediate level at this rise, but when driven will most probably disclose a considerable width of ore in addition to that already visible. In the same way there are a great number of other points which present clear evidence that the walls at present visible are entirely " false." Systematic cross-cutting at points to be indicated in the complete bulletin will certainly increase the average width from the figure given above, and therefore add to the ore-reserves.

Another point to note is the fact that, although the expense of driving the main adit was incurred, the full benefit to be derived therefrom has not been achieved, namely, the driving on the ore-body northwards. The result is, that what could easily have been converted into " blocked ore," can at present only be regarded as " probable ore." The same remark applies in reality to all the levels where every northern face shows good ore, for if the driving had been continued on all levels to a point 1000 feet north of the Primrose boundary, a large amount of " blocked ore " would have been proved, which now must be calculated under " probable ore."

With these remarks the amounts of ore calculated as the result of this investigation will now be given :-

Ore Reserves.	*Tons.*
Exposed on three or four sides	185,000
Exposed on two sides	120,000
Total " proved ore "	305,000
" Probable ore "	300,000

The calculation of the " probable ore " is based on the assumption that the ore-body continues at the main adit level as far northwards as has been proved in the No 4 level—a distance of 1000 feet from the Primrose boundary—with its average width.

The whole of the above estimates deal only with ore above the main adit level. Above that level, therefore, there are 185,000 tons of ore blocked out ready for mining, together with 420,000 tons of " probable ore." As pointed out above, these amounts will probably both be increased when the ore-body is systematically crosscutted.

As regards ore north of the limit here taken into consideration, it can be stated that not enough data are available to attempt any estimate of " probable ore," but there is every reason to believe that considerable tonnages of ore, which must be regarded as " prospective ore," can be expected. Ore certainly has been proved to exist in No. 2 level as far north as the northern boundary, and below that level the ore-body will probably be more or less continuous for the whole distance from the southern boundary. This, however, has yet to be definitely established.

As regards the ore below the main adit level, there are again not sufficient data to warrant any estimate of tonnage. The 500-feet bore at the northern boundary of the Primrose, however, proved the ore-body to persist to 250 feet vertically below the main adit level. As pointed out previously, however, a synclinal trough exists to the east of this bore, rising northwards to the Beta anticlinal crest. It therefore follows that the ore-bearing horizon will start to rise again east of the 500-feet bore, the point of upturning rising as distance northwards is gained. Whether the ore-bearing horizon carries ore at these points is yet to be established by diamond-drilling, but the opinion may be here expressed that the probability is certainly great.

The future of this mine therefore depends on the ground lying to the east of and below the main adit level and in the unexplored ground to the north of and below No. 4 level, as far as the northern boundary of the section.

The Tasmanian Copper Company also owns Section 3908-M, originally known as the Black P.A. On this section zinc-lead sulphide has been proved to exist. The strike is a little east of north, and the dip towards the west. The maximum width of ore exposed is 9 inches, and the grade of this is exceptionally high. No estimate of tonnage can be made, but the evidence is such as to warrant the statement that no considerable quantity of ore will ever be exposed in this locality, as the ore-bearing horizon cannot go to any appreciable depth at this point, since the schists are lying in a rather shallow synclinal trough on top of the Dundas slates, and, in addition, are wholly denuded a few chains to the north. There is quite enough of the ore-bearing horizon present here, however, to warrant further prospecting, which may be expected to open up a body of ore very small compared with that on the main consolidated lease, but still sufficient to justify attention.

(2) The Primrose Mining Company, No Liability.

This mine was discovered shortly after the Tasmanian Copper Company's mine. It was originally known as the South Rosebery. In 1896 the company was reconstructed under the present name. It was more or less prospected until 1905, when it was let on tribute, which lasted until 1907, when the company started extracting ore, which continued until 1913, since when the mine has been closed down.

The ore-body exposed in this mine is a continuation of that occurring on the Tasmanian Copper Company's property to the north, and partakes of the same general characteristics. The maximum width is 45 feet, and the average over the 5 levels opened up is 25 feet. The length decreases regularly from 250 feet at the No. 1 level to 150 feet at the main adit level, this being due to the fact that the southern termination of the ore-body continues regularly downwards to each succeeding level, while the northern boundary of the property crosses the strike of the ore-body at an angle. As a matter of fact, the ore-body will pass right out of the Primrose property at a depth of approximately 350 feet below the main adit level.

In addition to this ore-body, there is another parallel body penetrated by the east crosscut at the south end of the main adit level. No calculation as to the ore-reserves in connection with this ore-body can be attempted, but

undoubtedly this is destined to increase the ore-reserves when properly opened up.

The total output of the mine to date has been 44,369 tons, having an average assay of—

Au.	Ag.	Pb.	Zn.	Cu.
oz.	oz.	Per cent.	Per cent.	Per cent.
·152	12·5	10·0	30·0	0·5

The ore-body above No. 2 level has been nearly worked out, but approximately 4000 tons yet remain to be extracted.

Between the No. 2 and main adit levels there are 29,000 tons of ore exposed on four sides.

Below the main adit level ore has been proved by diamond-drilling to exist for 250 feet vertically. This will allow of the calculation of the contents of a triangular block of ore, which works out at 49,000 tons.

Tabulated, therefore, the ore-reserves are as follows:—

Ore blocked out ready for mining ...	32,000 tons
Probable ore	49,000 tons

As regards the future prospects of this property, apart from that indicated by the above estimates, we are faced with the fact that three bores put down to cut the southern continuation of the so-called "lode channel" failed to prove the existence of ore. It is quite possible, however, that these bores did not penetrate the real ore-bearing horizon which lies to the west of them, but any definite pronouncement on that question must be postponed until the actual plotting of the data obtained in the field is completed in preparing the bulletin. We certainly know that there is good ore to the south of this property on the Dalmeny, so that there is every reason to expect that the replaceable horizon may be ore-bearing at any point between the present mine workings and the southern boundary.

Finally, it may be stated, that the ore-body encountered in the only eastern crosscut of any length in the property is distinct proof of the need of systematically cross-cutting eastwards in the property, as it is in the Tasmanan Copper Company's Mine.

(3) North Tasmanian Copper Company Limited.

This property is north of and adjoining the Tasmanian Copper Company's lease, and the same ore-body continues into it.

It has been opened up by two levels, but the development work has not proceeded very far. The maximum width of the ore-body on this property is 30 feet at the northern end of the No. 2 level of the Tasmanian Copper Company. The average width proved is 7 feet. The greatest length observable is 100 feet at the No. 1 level.

The output has been only 200 tons, assaying—

Au.	Ag.	Pb.	Zn.
oz.	oz	Per cent.	Per cent.
·125	8·0	6·5	28·0

The ore-reserves may be stated thus:—

Proved ore (exposed on two sides) ... 10,000 tons.

As regards the future prospects of this property, it may be stated that practically the whole of the ground to the north of the southern boundary and below the No. 1 level is unprospected, and if the ore-bearing horizon be followed in these directions, there is every prospect of opening up a considerable body of ore.

(4) The Koonya Mine.

This mine is owned by the Colebrook Prospecting Association, No Liability, and includes the old Grand Centre Mine. The occurrence of zinc-lead sulphide ore on this property was established in 1913 by Mr. Joseph Will, the discoverer of the Hercules Mine, who, after sinking a shaft on gossan containing approximately 10 dwts. of gold to the ton, drove an adit to cut its downward continuation, with the surprising result that a zinc-lead sulphide ore-body was encountered below the gossan, but with about 12 feet of barren schist between the two ore-bodies.

This ore-body was cut at the extreme summit of a dome, from which it dips away in all directions. The greatest width exposed is 13 feet, and the length is 70 feet. The average assay is approximately as follows:—

Au.	Ag.	Pb.	Zn.
oz.	oz.	Per cent.	Per cent.
·038	4·0	12·0	19·8

At present another adit is being driven to cut the downward continuation of this ore at a depth of 137 feet. That adit is now in 434 feet, and another 150 feet of driving will be necessary before the ore-body is cut.

The prospects of opening up a large body of ore on this property are certainly good, for the ore-bearing horizon

lies both to the west and east, and below No. 1 level. When the lower adit penetrates the ore-body it should be continued westwards to cut the western limb of the Alpha anticlinal fold.

(5) The Dalmeny Mine.

This mine is now held by J. C. Macmichael as Section 6936-M. The zinc-lead sulphide ore-body outcrops in the bed of the Stitt River as mineralised schist. This outcrop is surrounded on all sides by keratophyre. The outcrop, in fact, is the crest of an Alpha anticlinal fold. A bore put down to the east of the outcrop penetrated a zinc-lead sulphide ore-body at a depth of 80 feet. Three feet of core were obtained, assaying, approximately:—

Au.	Ag.	Pb.	Zn.
oz.	oz.	Per cent.	Per cent.
·250	15·0	32	17

There is no doubt that the ore-bearing horizon carries high-grade ore in this locality, and prospecting by diamond-drilling both to the east and west and north and south of the known occurrence of ore will prove whether the continuation of the ore-bearing horizon carries ore. That boring campaign must form part of the complete scheme, to be fully described in the bulletin, in exactly the same way as for the Mount Read Field. When the ore is thus proved by drilling, its exploitation must be carried out by shaft-sinking both on this and on the sections immediately to the north and south.

(6) Other Leases.

As regards those leases held by S. W. White, T. O. Thomas, C. H. Ferguson, Roberts and Conroy, and J. C. Macmichael, it has already been stated that the ore-bearing horizon exists on them almost without exception beneath the surface.

The approximate depth beneath the surface at any point can only be determined when the data are completely plotted and mapped. Any statement in that connection, therefore, must be postponed for the complete bulletin, in which, when outlining the diamond-drilling scheme, I will indicate the approximate depths at which the ore-bearing horizon will occur. Work on these sections, therefore, should not be attempted until that bulletin is published.

VI.—THE POTENTIALITIES OF THE ZINC-LEAD SULPHIDE DEPOSITS OF THE READ-ROSEBERY DISTRICT.

We are now in a position to give some indication of the resources of this important mineral belt. In doing so it is necessary to anticipate the figures as to ore reserves given in the Mount Read bulletin. These, together with the information contained in this report, enable the following table to be constructed:—

Mine.	Proved Ore.	Probable Ore.	Total Ore Reserves
	Tons.	Tons.	Tons.
Hercules	273,000	413,000	686,000
Tasmanian Copper	305,000	300,000	605,000
Mt. Read		124,000	124,000
Primrose	32,000	49,000	81,000
North Tas. Copper	10,000	—	10,000
	620,000	886,000	—
Grand Total	—	—	1,506,000

To further indicate the present position of the mining properties in question, the following details as to "proved ore" are given:—

Mine.	Ore blocked out ready for mining.	Ore proved by drilling.	Remarks.
	Tons.	Tons.	
Hercules	150,000	123,000	The whole of the 150,000 tons of "blocked ore" cannot be regarded as quite ready for mining, as some of it occurs in ground affected by considerable falls
Tasmanian Copper	185,000	—	The whole of this amount is ready for immediate extraction. In addition there are 120,000 tons of ore exposed on two sides
Primrose	32,000	49,000	Ready for immediate extraction
North Tas. Copper	—	—	There are 10,000 tons of ore exposed on two sides

Apart from this amount of 1,506,000 tons of ore actually capable of calculation, there is conclusive evidence that an amount of "prospective ore" can be anticipated far in excess of that figure on the five mines mentioned. In addition there are known to occur important ore-bodies on the following mines:—South Hercules, Dunne's Blocks, Jupiter, Ring P.A., Koonya, Black P.A., and Dalmeny. No estimate of ore-reserves can be made on any of these mines, but there is no doubt that development work will open up a very large tonnage of ore.

In addition to this the ore-bearing horizon exists throughout the remainder of the 7 miles of this belt, stepping downwards towards the east, and the possibility of its actually carrying zinc-lead sulphide ore-bodies increases in direct ratio to the proximity of a known occurrence of ore. It is apparent, therefore, that there are great possibilities in the systematic exploration of this ore-bearing horizon. It is certainly the writer's opinion, based wholly on the complete investigations just concluded that there will ultimately be proved an amount of ore compared with which the above estimate will be very small indeed.

VII.—CONCLUSION.

It will thus be seen that a considerable advance has been made in our knowledge of this zinc-lead sulphide belt, and it is abundantly evident that there is contained therein one of the most important assets of the State of Tasmania. The conversion of that potential wealth by a combination of efficient metallurgical and mining methods and sound finance into actual monetary value will initiate a new era of prosperity for the West Coast of Tasmania.

These deposits also are destined to play a very important part in the zinc industry in Australia, and in connection with the establishment of zinc smelters in the Commonwealth the potential output of the Read-Rosebery district must constitute one of the leading factors influencing any decision in that important question.

It is intended that the manner of presentation of the whole of the facts concerning the zinc-lead sulphide deposits of the Read-Rosebery district in the three bulletins, one of which is completed, and the remaining two are to follow this report, will be commensurate with their importance.

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