Inspection of the Home of Bullion copper property near Barrow Creek, North Australia, was carried out for American Smelting & Refining Company at request of Mr. H. A. Guess.

Every courtesy and facility for the inspection were afforded by W. F. Hartley, Secretary of the Commonwealth Sulphur & Metals Corporation, Adelaide, and by Albert Borlace, Mine Manager in charge of operations at the property.

Time spent by R. B. upon the ground was February 10th to 17th inclusive, 1936.

CR1936/001

Home of Bullion

Cohle

Company Report

Barrow Creek

ASERG
SUMMARY

1. Area of pre-Cambrian, steeply dipping, fine grained sericite schist, containing injected copper bearing lenses unconnected with any known nearby intrusive rock.

2. Of three known lenses only one, the North lode, possesses commercial promise. With its outcrop well exposed, this lode conforms closely in strike and dip to schistosity of the country rock in a general E-W direction and 60° northerly dip. Outcrop length of stopable ore, 482 ft. Average true thickness, 10.5 ft.

3. Over a length of 375 ft. the lode is explored by four shafts of, respectively, 47, 84, 99, and 201 ft. vertical depths. The 99 ft. shaft is collapsed. The other three have five crosscuts through the lode, and show approximately 100 ft. of oxidized, mostly leached lode material, followed by 100 ft. of secondary chalcocite ore with bottom of the chalcocite zone not reached.

4. Grade of ore, based upon results of sampling three crosscuts, through the oxidized zone and two through the chalcocite zone, is 4% Cu for the oxidised, 12.5% Cu, for the sulphide, zinc, with trace Au and approximately 2 ozs. Ag per ton. Primary ore zone not exposed. Judged on evidence from the chalcocite zone, the primary ore is strongly pyritic, with chalcopyrite constituting the copper mineral and with copper content probably not exceeding 3 to 4%. This is largely a guess.

5. Indicated tonnage is 40,000 tons oxidized and 53,000 tons secondary chalcocite ore to depth of 200 ft. Fair possibility exists that the chalcocite zone may persist in depth another 100 ft., making total chalcocite ore 100,000 tons; a 3 year life for a 100-ton plant. Nothing points to possible extensions along the strike, and the remaining two lodes do not promise sufficient tonnage to justify their development.

6. Hangingwall is weak and treacherous, and calls for close filled stoping practice, such as flat back cut and fill with stalls and head-frames. Wares are wide, and based on Mount Isa's experience, 10% dilution may be looked for, bringing stoping grade to 3.6% Cu in the oxidized, and 11.3% Cu in the secondary sulphide, ore.

7. Uneconomic aspect of the oxidized ore eliminates it from consideration except possibly as smelter flux.

8. Chalcocite of the secondary sulphide ore is the sooty type, replacing both schist and massive pyrite. Although nothing final has been obtained in Mount Isa laboratory concentration tests upon the ore, an 85% extraction has been assumed for purposes of calculation.

9. The mine at present makes less than 8,000 gallons water per day. Water supply probably can be developed by sinking wells along ravines, but water occurrence in the district is everywhere capricious, with no known large flows, and with topography unsuited to large reservoir storage of the infrequent storm waters. Outlay for water supply may be greater than allowed in the estimates.

10. Property lies 200 miles by good bush motor road from railhead, which in turn lies 771 miles from tidewater. Transport rates from tide water to the property vary from £7.12. 3 per ton for coal and coke to £25.18. 7 per ton for explosives, after giving effect to 20% rebate allowed by the railway. A proposed new motor road would reduce these charges £1. per ton, and for steady shipment the railway (Commonwealth Government portion) might grant up to 33.1/2% rebate, but transport charges would still remain high.

LOCATION, TRANSPORTATION, ETC.

LOCATION:

In the Territory of North Australia, near geographical centre of the continent; by road 180 miles northerly from Alice Springs along the Overland Telegraph route to Barrow Creek, thence 20 miles E-S-E to the property. Alice Springs, the railhead, is north to minus of the Federal Government's standard gauge railway which extends 771 miles northerly from Port Augusta, the seaport, and lies 981 miles by rail northerly from Adelaide. Road from Alice Springs to Barrow Creek is a first class bush
road of almost imperceptible grade, trafficable to heavy loads the year round except for a few days following heavy downpours. Road from Barrow Creek to the property is at present rough, but may be put into condition for year round heavy traffic by expenditure of £1500.

Property may also be reached by road from Mount Isa westerly to Tennant Creek 480 miles, thence southerly along Overland Telegraph route to Barrow Creek 150 miles, thence 20 miles to property (total 650 miles) but the Mount Isa-Tennant Creek stretch is mostly a poor road and is unreliable during the summer rainy season (mid-December to mid-April).

Surveyed route for extension of the Federal Railway from Alice Springs to Birdum (south terminus of the Darwin branch) swings easterly of Barrow Creek and is said to pass within a few miles of the property, but economic conditions in the territory now existing do not justify extension of the railway beyond Alice Springs.

TRANSPORTATION:

The Federal Government operates a weekly train service from Quorn (25 miles from Port Augusta) to Alice Springs. Freight rates are high, but appreciably lower than for all-rail shipment from Adelaide, due primarily to the fact that freight railed at Adelaide must be reloaded at Terowie from the South Australian 63-in. gauge railway to its 42-in. gauge line, and except in certain cases for carload lorraine, such as explosives and heavy machinery, must be reloaded again into Federal Government Railway cars at Quorn. The Federal Government grants rebates on its quoted freight tariffs for goods destined to points well beyond Alice Springs, but no such rebate is allowed by South Australian Railway for its portion of the charges except on the 25 mile haul from Port Augusta to Quorn. Port Augusta is, therefore, the logical port of entry for goods consigned to the interior, and is used by shippers for nearly all goods except explosives, which originate at Dry Creek, 62 miles from Adelaide, and are shipped through Terowie.

Motor truck haulage in truck loads (three or more tons) from Alice Springs to the property is quoted by Sam Irvine, one of the reliable carriers of the district, at £5/-/ per ton forward loading and £2.10. - back loading (per ton). The £5/-/ rate is equivalent to 6d. per ton mile. This low charge is possible only because of intense competition among carriers for haulage to the Tennant Creek goldfield, the carriers disregarding the 6-hour shift law and in some instances failing to take into account depreciation charges.

The Federal Government operates, for its own haulage purposes, a 20-ton Diesel motor train along the Overland Telegraph line. According to reports in one of the Mining Journals this train effects haulage for 4d. per ton mile.

CLIMATE AND RAINFALL:

Climate is sub-tropical with hot summer days, but with nights usually cool enough for refreshing sleep. Elevation is 1500 to 1600 ft. aneroid.

Comparative temperature and rainfall charts for Barrow Creek and Mount Isa are presented in Figures 1 and 2, Plate 42. Official rainfall records have been kept at Barrow Creek for 60 years, but no temperature records have been kept. Data for Figure 1 have been compiled by taking mean between official temperature recorded at Alice Springs and Tennant Creek. On that basis Barrow Creek shows an advantage of several degrees over Mount Isa. Explanation lies in the longer and cooler nights at Barrow Creek.

At present time the Commonwealth Sulphur & Metals Corporation is being allowed a 20% rebate, and because of the Federal Government's keen desire to develop industry within the Territory it is likely that a slightly better rebate may be obtained in cases where steady shipments are guaranteed. This is a matter for negotiation when operations are assured.
Climate on the whole is healthy, but bush flies in endless swarms are a constant annoyance and source of interruption to surface workers from daylight to dark, both in summer and winter, and despite the dry climate special precautions must be taken to guard against contamination and spread of disease from this source.

TIMBER AND VEGETATION:

Near the property both ridges and plain are covered with sparse to moderate growths of scrub mulga that seldom exceeds 15 ft. in height, and by occasional soft gums up to 40 ft. in height. Ground between is dotted with clumps of spinifex. The mulga and gum furnish an adequate supply of domestic fuel, but are unsuited for mining purposes.

Cattle and sheep are grazed on adjoining ground, and a plentiful supply of fresh meat is available at reasonable cost. Garden produce has not been thus far successfully raised on the sandy soil, but no real attempt at gardening has been made.

WATER SUPPLY:

Rivers do not exist in the district, waterholes along creeks are at best of a few months duration following the summer rains, and neither topography nor the deep sandy soil along ravines lend themselves to large scale reservoir storage of storm waters.

Small water flows are encountered in shafts and wells at depths of 100 or less feet, but much of it, even from wells along the creeks, is unsuitable for drinking. At present water for domestic purposes is carted by truck 12 miles from Hayes' cattle station.

Development of operating water may be difficult. The 200-ft. main shaft on the property makes less than 8,000 gallons per day, and the supply has not increased in the last 100 ft. of sinking. This water is highly acid.

Water occurrence in the district is everywhere capricious, with no known geologic features pointing to one location as more favourable than another. The water level at Hayes' well never has been lowered, but extraction has been confined to pumping by windmill and bucket bailing by camel, and the well's capacity therefore is not known. No reason exists for thinking the next 100 ft. at the "Home of Bilion" property will develop more water than has the first 200 ft. Principal hope lies in accidentally striking adequate flows, such as the one at Hayes', by sinking wells along the deeper ravines.

POWER:

No electric power lines pass through the district, and no chance exists for developing water power.

Appendix B contains statements regarding cost of fuel oil and coal delivered to Alice Springs, furnished respectively by Shell Oil Company office at Adelaide and Broken Hill Proprietary office at Sydney. On the basis furnished, cost of fuel oil per ton delivered at the property, without giving effect to contract rebates, is as follows:
<table>
<thead>
<tr>
<th></th>
<th>In Drums via Port Augusta</th>
<th>In Drums via Birkenhead</th>
<th>In 20-ton Tank Cars via Birkenhead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Haulage Alice Springs to property</td>
<td>£ 5. -- -</td>
<td>£ 5. -- -</td>
<td>£ 5. -- -</td>
</tr>
<tr>
<td>Plus drums, estimated at 12.5% weight of oil</td>
<td>£ 12. 6</td>
<td>£ 12. 6</td>
<td></td>
</tr>
<tr>
<td>Cost of oil</td>
<td>£ 11.14 -</td>
<td>£ 11.5 -</td>
<td>£ 8.11 -</td>
</tr>
<tr>
<td></td>
<td>£ 6. 2 -</td>
<td>£ 5.10 -</td>
<td>£ 5. -- -</td>
</tr>
<tr>
<td>Total delivered cost</td>
<td>£17.16 -</td>
<td>£16.15 -</td>
<td>£13.11 -</td>
</tr>
</tbody>
</table>

No charge is allowed for returning empty drums to Alice Springs.

Tank car shipment is the cheapest, but minimum tank car loads of 20 tons are required by the Railways, and this means storage tank erection at Alice Springs. Likewise, it is doubtful whether motor oil tanks would withstand the heavy jolting from Alice Springs to the property. If not, oil would have to be reloaded into drums at Alice Springs, with increased transport costs.

Elington Large Coal from Newcastle, N.S.W., used by the South Australian and Federal Government Railways, is quoted by Broken Hill Pty. Sydney office at 37/6 per ton delivered into railway trucks at Port Augusta. Cost at the property is as follows:

- Coal delivered in railway trucks at Port Augusta: £ 1.17. 6
- Gross freight to Alice Springs: £ 2.12. 9
- Less rebate (20%) on freight: £ 4.10. 3
- Net cost at Alice Springs: £ 10. 7
- Motor haulage Alice Springs to property: £ 3.19. 8
- TOTAL DELIVERED COST: £ 8.19. 8

A seam of lignite occurs along the Federal Railway about 120 miles northerly from Quorn, but its steaming qualities, according to W.H. Hartley, are only 50% those of Elington coal. Freight and haulage charges manifestly eliminate its consideration.

In view of the high fuel oil and coal costs, investigation is warranted into possibilities of using local wood as power fuel in a suction gas plant.

Mulga is plentiful in the district. Its fuel value, so far as known, has not been ascertained, but it is not of the species so ideally suited for suction gas power production as at the Sons of Gwalia mine and elsewhere in Western Australia. Furthermore, the growth near Home of Bullion is too stunted to furnish a satisfactory size and supply. Beginning 20 miles south of Barrow Creek, and presumably also 20 miles south of the property, and extending more than 50 miles southward along the Overland Telegraph route, growth of the mulga is larger and more plentiful. This should prove satisfactory, but its long haulage would necessarily raise the cost. Assuming cost of such fuel at twice that of the Sons of Gwalia mine per KWH, Mr. Catt, Chief Mechanical Engineer at Mount Isa, estimates power costs at Home of Bullion on basis of 1,000 K.W. continuous use as follows:

<table>
<thead>
<tr>
<th>Per KWH</th>
<th>Per KWH</th>
<th>Per KWH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam Plant</td>
<td>1.687d.</td>
<td></td>
</tr>
<tr>
<td>Diesel Plant</td>
<td>1.222d.</td>
<td></td>
</tr>
<tr>
<td>Gas Plant</td>
<td></td>
<td>1.117 d.</td>
</tr>
</tbody>
</table>

Full details for arriving at these estimates are furnished in Appendix "C".

The suction gas plant on these bases appears the most economical in operation, and possibility exists of slightly bettering costs for this plant by obtaining mulga somewhat closer to the property than noted.
Scale of operations at Home of Bullion, however, will not require a 1,000 K.W. plant, and no installed plant of adequate size will be in continuous operation. Power costs under conditions likely to prevail, therefore, may be expected to be appreciably higher than shown in the estimate, probably nearer 3d. per unit with even the most economical of the three plants.

PROPERTY AND OWNERSHIP.

Property consists of two groups:

<table>
<thead>
<tr>
<th>Property Group</th>
<th>No. of Leases</th>
<th>Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home of Bullion group</td>
<td>16</td>
<td>960</td>
</tr>
<tr>
<td>Western Group</td>
<td>4</td>
<td>320</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>1280</td>
</tr>
</tbody>
</table>

The Home of Bullion group comprises a solid block nearly two miles in length along the line of lode and 7 1/2th mile wide, except for two 40-acre leases of no value, belonging to Messrs. Muldoon and Driscoll. Mineralised showings occur only upon the 80-acre lease, No. 560. This lease, together with two 40-acre ones, Nos. 519 and 520, into which the principal lode may conceivably dip with depth, constitute the only leases of mineral value.

The relationship of the various leases, with positions of the lodes, is shown on Plate A3.

The western group, whose central point lies 6 miles westerly by road from the Home of Bullion camp, or 14 miles from Barrow Creek, comprises a rectangular block 1 x 2 1/2 mile in extent.

None of the leases, except No. 560, has been surveyed, and the remaining leases are not as rigidly rectangular, or as true to measurement, as shown on the map (see Plate B1).

Both groups are held as mineral leases by Commonwealth Sulphur and Metals Corporation Limited, which guarantees clear title.

HISTORY

Following history of the property was obtained from conversation of R. B. with Albert Borlace, Mine Manager at the property, from conversation with W. F. Hartley, Secretary for the company at its Adelaide office, and from various official reports and prospectuses in the files of the company. Certain details are lacking, but in the main the story of the property is as follows:

Oxidised copper outcrops of the Home of Bullion Lode had been known by local stockmen for many years. 1923 a local cattleman, by name of Hayes, living some 12 miles distant, interested Bill Garnett in the show, the understanding being that Garnett and Hayes were to share equally in the profits if anything developed. Garnett is an old-time Queensland and Northern Territory prospector, one of the three who early in 1933 brought in the Tennant Creek goldfield. Garnett submitted 11 outcrop samples to the Mines Department at Darwin with following results (weight and positions of samples not stated).

<table>
<thead>
<tr>
<th>Au. oz/t</th>
<th>Ag. oz/t</th>
<th>Cu %</th>
<th>Pb %</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>11.0</td>
<td>30.0</td>
<td>1.5</td>
</tr>
<tr>
<td>10</td>
<td>6.0</td>
<td>46.6</td>
<td>2.4</td>
</tr>
<tr>
<td>10</td>
<td>2.75</td>
<td>-</td>
<td>18.0</td>
</tr>
<tr>
<td>10</td>
<td>16.0</td>
<td>12.2</td>
<td>14.2</td>
</tr>
<tr>
<td>10</td>
<td>4.0</td>
<td>3.3</td>
<td>32.7</td>
</tr>
<tr>
<td>10</td>
<td>20.1</td>
<td>3.0</td>
<td>23.8</td>
</tr>
<tr>
<td>10</td>
<td>23.0</td>
<td>4.7</td>
<td>47.5</td>
</tr>
<tr>
<td>10</td>
<td>4.75</td>
<td>3.4</td>
<td>27.5</td>
</tr>
<tr>
<td>20</td>
<td>16.3</td>
<td>2.7</td>
<td>23.2</td>
</tr>
<tr>
<td>20</td>
<td>13.3</td>
<td>11.9</td>
<td>47.5</td>
</tr>
<tr>
<td>(0.45 dwts)10.8</td>
<td>10.67</td>
<td>10.7</td>
<td>24.2</td>
</tr>
</tbody>
</table>
The matter was brought to the attention of Adelaide parties, chief among whom was Dr. Herbert Basedow of Adelaide University. November 1923 this group of 19 men, known as Central Australian Silver Lead & Copper Mining Syndicate, went to inspect the property. Basedow arrived January, 1924, and channel sampled the principal lode at 20 to 25 ft. intervals over a 480 ft. length for an average yield as follows:

<table>
<thead>
<tr>
<th>Width ft.</th>
<th>Au</th>
<th>Ag. Caz.</th>
<th>Cu %</th>
<th>Pb %</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.44</td>
<td></td>
<td>3.38</td>
<td>10.16</td>
<td>6.67</td>
</tr>
</tbody>
</table>

March, 1924 the Syndicate was changed into Central Australian Silver Lead & Copper Mining Company, with £14,000 capital in 50 shares. Garnett took charge of operations and sank two shafts, No. 1, near south-east end of the lode, and No. 2 at north-west end. These shafts passed through the lode vertically to the footwall and thereafter followed the lode's footwall as inclines down to 50 ft. depth. After several months Garnett was relieved of the managership, he having received £3,000 for the property and £700 for his shaft-sinking. According to Borlace, Hayes never received his share of the sale price from Garnett.

Garnett was succeeded by W.H. Williams, who proceeded to put out crossovers from the two shafts at approximately 50 ft. vertical depths. At No. 1 shaft he reported the crossover to have passed through 26 ft. of lode and to have developed "a very large and rich body of ore" assaying 60 per cent Cu, 19 per cent Pb, 11 ozs. Ag (R.B's sampling of the crossover yielded 20 horizontal feet of 2.91 per cent Cu, 6.6 per cent Pb, 2 ozs. Ag and 0.2 dwt. Au). Williams thereupon deepened the shaft to water level, 84 ft. vertically, and put out another crossover through the lode, reporting 16 ft. of lode material more leached than at the 50 ft. level. He next transferred operations to the No. 2 north-west shaft, where he reported a crossover had cut 20 ft. of lode without reaching the hanging wall, but gave no assays. His connection with the Company terminated at end of 1924.

Williams was succeeded by his assistant, Mr. Carter, who during the next two years completed crossovers at the No. 2 shaft as they are today, and sank a new main shaft (No. 4) vertically out in the lode's hanging wall. Before the lode had been intersected, work was terminated at 90 ft., where water level was reached.

April, 1927, H.C. Davey was placed in charge, and in June of that year the capital was increased to £28,000 in 50 shares, Davey remained in charge until early 1929, but little work seems to have been accomplished during this period.

H. Cliffie then took charge and sank a new (No. 5) vertical shaft in the creek midway between Nos. 1 and 2 shafts (see Longitudinal Section BE, Plate D1). This shaft is now inaccessible and old records are to some extent contradictory, but it appears that after having passed through the lode a crossover was put out into the hanging wall at 84 ft. until the lode was again intersected, at which point an incline winze was put down to 93 ft., where water level and secondary sulphide ore were encountered. Later in the year Cliffie in turn was succeeded by G. McKillop, who deepened the winze a few feet and put out a short drive from its bottom. A 20 ft. width of rich chalcocite ore was reported. This is the first chalcocite ore encountered at the property, and although confirmation is lacking as to its width and grade, the dump shows that rich chalcocite ore has been cut.

September 1930 Dr. Basedow revisited the mine and wrote an optimistic report, but failed to do any systematic sampling. Borlace was placed in charge of the property at about that time, but little or no work was done until July, 1932. Upon Borlace's recommendation, the 90 ft. main (No. 4) shaft was then deepened vertically and the lode cut at approximately 170 to 200 ft., the footwall having been reached just below the 200 ft. mark. Crosscuts were put out on the 145 and 196 ft. levels, and high grade chalcocite ore was encountered in both.

Positions and extent of this exploratory work are shown in longitudinal and cross sections on Plate D1.
During these operations a shaft, No. 3, had been sunk to 90 ft. depth (later filled to 50 ft.) upon another lode which outcropped through the alluvium 600 ft. to the south, and several crosscuts were put out to intersect the lode on the 50 ft. level. Low grade silver-lead-copper ore was encountered, but exploration was not pressed.

Borlace remained at the property, but little further work was done until London parties became interested early in 1935. The Commonwealth Sulphur & Metals Corporation Limited was registered 31.1.35, and took over the property 1.6.35. This company consolidated the Home of Bullion property with the Lindley Duffield patent rights for recovery of native sulphur, copper, iron and other products by direct metallurgical process from the ore, the Home of Bullion owners receiving £150,000 in fully paid shares for their property.

Following formation of the new company, Borlace did some 250 ft. of pitting and costeaming southeast of the Home of Bullion lode in an attempt to pick up its continuation and its junction with the south lode. He likewise took up four additional lenses and did about 150 ft. of trenching on the Western Group, about 5 to 6 miles from the Home of Bullion camp. None of this latter work has disclosed existence of copper or other ore.

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PRODUCTION

Production is limited to a 50-ton shipment of sulphide ore sent to England late 1935 for experimental purposes in connection with the Lindley Duffield metallurgical process, and another 50-ton shipment for the same purpose in course of extraction during A B's visit.

Borlace states that first shipment was taken from the sulphide ore dump of No. 4 shaft as a representative run-of-mine sample. Second shipment is being stope off the main shaft on the 196 level, and is being hand picked to yield the required tonnage of 35% to 40% Cu ore.

***************

GENERAL GEOLOGY

Central Australia consists essentially of a vast, sandy, nearly level plain that varies from 1,000 to 2,000 ft. in elevation. Its dreary monotony is relieved by intermittent ridges, groups of hills, and occasional mesa chains that rise several hundred feet above the plain and usually are separated from one another by 5 to 40 mile widths of the sandy stretches. General trend of the ridges and mesas is E.S.E. One such mesa chain, constituting a prominent landmark, extends from the gap immediately north of Barrow Creek in an E.S.E. direction past the Home of Bullion property and approximately one-half mile to the south of it.

Although continuous outcrops are confined to the more dominant ridges, alluvium of the plain seldom exceeds a few feet in thickness except along ravines, and sufficient exposures usually are present as scattered low emergences throughout most of the plain to disclose character of the country rock.

In the Barrow Creek section rocks are of two series- 1) Archean gneiss and schist, steeply tilted and intruded at various places by granite; 2) younger rocks, predominantly sandstone and conglomerate, which lie unconformably upon the older ones, usually with flat to horizontal dip. Erosion has removed most of the sandstone and conglomerate so that now, where present, they remain as thin capping on the higher ridges and mesas. Ore deposits have been found only in the Archean series.

The Home of Bullion copper lode occurs in a low ridge of steeply-tilted schist, about a mile in length, which parallels the more dominant mesa to the south. It outcrops a few feet above the alluvium on south slope of the ridge. Nearest known granite, or related intrusive rock, is a small outcrop of quartz monzonite near Hayes' station, about 10 miles westerly.
ORE GEOLOGY

Schist of the low ridge comprises sericite of smooth, silky lustre, with minute inclusions of attelite. Its strike is E.S.E., parallel with structure of the country. Dip averages 60° N. On the whole the schist is regular in strike and dip, the outstanding exception being a disturbed area about 500 ft. north of the main shaft, which probably represents a sharp fold, 100 or more ft. across, with attendant minor faulting. It has no observed direct relation to the ore.

The lode occurs with well defined walls as a copper-stained lenticular replacement in the schist, following the schistosity closely in strike and dip, with its semi-gossanous surface eroded slightly below level of the schist walls. Total length is 540 ft. Width varies generally up to 25 or more feet, averaging along its more promising portion 10 to 12 feet. Replacement varies from disseminations, small nodules and thin bands that parallel the schistosity and together make up 10 to 50 per cent. of the volume, to replacement so complete across full width of the lode that its original composition is wholly obliterated. Frequent patches up to several feet across of wholly unreplace schist occur, however, throughout the lode. Quartz, though present, is not generally conspicuous in the outcrop.

The primary ore zone is not exposed, only the oxidised and secondary sulphide zones.

SECONDARY SULPHIDE ZONE:

The secondary sulphide zone is strongly defined on the 145 ft. and 196 ft. crosscuts of the Main (No. 4) shaft. It has not been reached on the 84 ft. level of No. 1 shaft (see longitudinal section, Plate D.1). Authenticated reports state that it was encountered at 93 to 99 ft. depth of No. 5 shaft. The zone, therefore, may be assumed to begin 100 ft. below the surface and to be proved at one place to 200 ft. depth.

The secondary sulphide zone shows pyrite to have been a predominating primary sulphide, with associated small nodules of chalcopyrite up to several inches across, and with occasional small nodules of galena. Pyrite effects partial replacement of the schist as disseminations and as seams up to 2 in. thick along the schistosity and fracture planes, and effects complete replacement as solid pyrite masses up to several feet across. The massive pyrite is itself much seamied and fractured.

Secondary copper minerals are chalocite, bornite and covellite, Chalocite predominates; bornite and covellite are relatively unimportant, and represent transitional stages which may be traced through all gradations into chalocite. The secondary copper sulphides, chiefly as sooty black chalocite, have completely replaced the pyrite disseminations and the thinner pyritic seams along schistosity and fracture planes. Along the thicker pyrrhotite seams and along fracture planes of the massive pyrite, the exposed surfaces are variably coated with sooty chalocite. So thick are these coatings and replacements locally that ore of 30 to 40 per cent Cu can be hand-sorted. Average grade for the lode is brought down through irregularity of the secondary copper sulphide replacements and by the unaltered schist masses which occur erratically within the lode.

OXIDISED ZONE:

Copper minerals of the oxidised zone comprise malachite, with lesser azurite, and with small occurrences of chrysocolla and chalocite. The latter mineral is almost wholly leached. These minerals are scattered as irregular patches through the gossan's lode material and constitute a medium to low grade ore. In the three crosscuts off Nos. 1 and 2 shafts (see Plate D1) which penetrate the oxidised zone, copper minerals are less in evidence than at the surface, and fixation of copper carbonate at and immediately beneath the surface seems an inescapable conclusion.

Nodules of bornite up to 2 in. across were observed whose secondary origin cannot be vouched for, but nothing in the field evidence points convincingly to their primary origin. Most of the bornite occurs as thin replacement coatings, and is obviously secondary.
For that reason, sampling of the outcrop probably would be misleading. Both the outcrop and crosscuts of the oxidised zone show by their limonitic products, however, that copper has been leached from them, and that at one time they corresponded closely in copper content with the existing secondary sulphide zone below.

Limonite of the oxidised zone is of three types: (1) Caked limonite crusts, up to 1/8th in. thick, of tan to deep brown colour, the crusts often imperfectly coated with closely-adhering pulverulent limonite which stands out so as to impart well-defined relief to the caked material. The crusts may be traced through all gradations into copper carbonate minerals, and clearly represent their leached derivatives. In the outcrop the crusts have been to some extent coalesced and rendered slightly glossy by weathering, but immediately beneath the surface the characteristic crusted product with pulverulent coating appears. This is the predominant limonite product of the oxidised zone. (2) Pulverulent limonite of deep maroon colour and exceptionally strong relief, with remnants of corroded and rounded cellular structure preserved within the pulverulent mass. This type of limonite occurs as disseminations, as fracture coatings, as very small nodular masses in the schist, and as continuous thin parallel seams along the lines of schistosity. Only rarely is it traceable by direct gradation into its parent mineral; but it is the same characteristic leached derivative that occurs throughout South-western United States in leached capping over the disseminated copper deposits, and it here represents chalcocite and covellite leached from a pyritic ore. It is especially conspicuous along central and east half of the outcrop. (3) Dark brown to black, smeary-coated, hard limonite or limonitic jasper, occurring mostly as nodules and solid masses up to several inches across. This is the characteristic derivative of massive pyrite leached from a gangue of moderate neutraliser that occurs throughout South-western United States, and it here represents the leached derivative from the more strongly pyritic portions of the lode. Occurs throughout the oxidised zone as nodular masses, and as both minute cores and as very thin discontinuous, fragile coatings on surface of the two limonite types of copper derivation above described.

A small amount of limonite of hematite derivation occurs where the lode splits near west end of the outcrop of No. 2 shaft. Occasional small remnants of chalcopyrite-derived limonite likewise are present, and several unidentified limonite types occur at various places. The latter are too small in amount to be significant.

The important considerations are: (1) that the lode's gossanous outcrop constitutes, through its limonite products, a clear reproduction of the copper and other minerals that existed within the lode prior to the present extensive leaching; (2) that through its limonite products, and with minor variations such as much of the chalcocite having been changed to copper carbonate, it corresponds closely to the secondary sulphide zone exposed in the 145 and 196 ft. level crosscuts off the main shaft; and (3) it consequently becomes a reliable guide (a) for estimating from the surface the extent of possible commercial mineralisation along the lode and (b) for estimating copper content to be expected beneath other mineralised oxidised showings of the district.

**North Lode.**

For reasons discussed, results obtained by Dr. Basedow in sampling outcrop of the North, or Home of Bullion, lode have been ruled out. Upper portions of Nos. 1 and 2 shafts which pass vertically through the lode have had to be kept close-timbered owing to caving nature of the ground, and cannot be readily put into condition for sampling. For these reasons reliance for grade estimate in the oxidised zone has had to be placed upon results obtained in sampling the two crosscuts off No. 1 shaft at 50 and 84 ft. depths respectively, and the crosscut off No. 2 shaft at 49 ft. depth.

---

* Lead carbonate is present in small amounts at various places along the outcrop, and in the 50 ft. crosscut of the No. 1 shaft, but not in sufficient amount to be commercially important.
Similarly, owing to collapse of No. 5 shaft, reliance for grade estimate in the secondary sulphide zone has had to be placed upon results obtained in sampling the 145 and 196 ft. crosscuts off the main (No. 4) shaft. (The shaft, where cut by the lode vertically above the 196 ft. level, did not present a satisfactory surface for sampling at time of visit, owing to stoping operations then in progress around the shaft and to a minor quartz lens in the undisturbed portion,)

Grade of the oxidized ore therefore is based upon results of sampling 3 crosscuts, and grade of the secondary sulphide ore is based upon results of sampling 2 crosscuts. Those workings are, however, reasonably well distributed over the lode (see Longitudinal Section, Plate D1) and, so far as can be ascertained from inspection of the outcrop, are in lode material representative of the 485 ft. favourable length except that all occur in sections of lode wider than the average.

For sampling purposes all surfaces were thoroughly cleaned and freshly faced, and cuts were then moiled from 2 to 3-in. depth into the prepared wall. Sulphide ore samples were cut to yield 5 to 6 lbs. per linear ft.; oxidized ore samples, 4 to 5 lbs. per linear ft.

Because of the lode's collapsed hangingwall, 2 ft. of hangingwall of lode on the 196 ft. level could not be sampled. Visual inspection shows the last 2 ft. to carry slightly less copper than the 5-5 ft. section beneath, but to be so nearly similar that results obtained for the 5-5 ft. section may be regarded as representative across the full 7-5 ft.

<table>
<thead>
<tr>
<th>OXIDIZED ORE:</th>
<th>Width</th>
<th>Au. OZS.</th>
<th>Ag. OZS.</th>
<th>Cu %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No. 1 shaft</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 ft. level</td>
<td>11</td>
<td>0.01</td>
<td>2.0</td>
<td>0.95</td>
</tr>
<tr>
<td>H.W.</td>
<td>9</td>
<td>0.01</td>
<td>2.0</td>
<td>5.3</td>
</tr>
<tr>
<td>F.W.</td>
<td>20</td>
<td>0.01</td>
<td>2.0</td>
<td>2.91</td>
</tr>
<tr>
<td>84 ft. level</td>
<td>9</td>
<td>0.01</td>
<td>1.1</td>
<td>0.92</td>
</tr>
<tr>
<td>H.W.</td>
<td>10</td>
<td>0.04</td>
<td>0.9</td>
<td>2.6</td>
</tr>
<tr>
<td>F.W.</td>
<td>19</td>
<td>0.025</td>
<td>0.99</td>
<td>1.82</td>
</tr>
<tr>
<td><strong>No. 2 shaft</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47 ft. level</td>
<td>13</td>
<td>0.01</td>
<td>1.2</td>
<td>4.2</td>
</tr>
<tr>
<td>H.W.</td>
<td>10</td>
<td>0.47</td>
<td>4.6</td>
<td>10.0</td>
</tr>
<tr>
<td>F.W.</td>
<td>23</td>
<td>0.21</td>
<td>2.68</td>
<td>6.72</td>
</tr>
<tr>
<td><strong>Average of 3 crosscuts</strong></td>
<td>0.088</td>
<td>1.94</td>
<td>3.99</td>
<td></td>
</tr>
<tr>
<td><strong>Average of F.W. Samples only</strong></td>
<td>0.179</td>
<td>2.52</td>
<td>5.99</td>
<td>5.14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECONDARY SULPHIDE:</th>
<th>Width</th>
<th>Au. OZS.</th>
<th>Ag. OZS.</th>
<th>Cu %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ZONE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. 4 Shaft</td>
<td>20</td>
<td>0.01</td>
<td>1.8</td>
<td>12.85</td>
</tr>
<tr>
<td>196 ft. level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.W.</td>
<td>7.5</td>
<td>0.15</td>
<td>3.2</td>
<td>5.05</td>
</tr>
<tr>
<td>F.W.</td>
<td>10.5</td>
<td>0.01</td>
<td>1.5</td>
<td>11.8</td>
</tr>
<tr>
<td>18.0</td>
<td>0.012</td>
<td>2.27</td>
<td>8.99</td>
<td></td>
</tr>
<tr>
<td><strong>Average of 2 crosscuts</strong></td>
<td>0.011</td>
<td>2.02</td>
<td>11.02</td>
<td>tr.</td>
</tr>
</tbody>
</table>

*Probably high, due to one sample yielding 9.4 dwts.

Remainder: Five samples yielded maximum of 0.8 dwts., four of them yielding 0.2 dwts. each.

**True thickness.** Shaft was filled below 196 ft. This prevented sampling bottom 1 ft. next to footwall. Because the sampling clearly shows high Cu content in footwall than in hangingwall portion of lode, it may be assumed that this 1 ft. thickness is at least equal in Cu content to the 10.5 ft. above - possibly slightly higher.
This compares with Dr. Madigan's sampling, as follows:

<table>
<thead>
<tr>
<th>OXIDIZED ORE</th>
<th>Width</th>
<th>Az. Cts.</th>
<th>Cu %</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 Shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 ft. level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan</td>
<td>20</td>
<td>2.0</td>
<td>6.9</td>
</tr>
<tr>
<td>R.B.</td>
<td>20</td>
<td>2.0</td>
<td>2.91</td>
</tr>
<tr>
<td>34 ft. level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan</td>
<td>10</td>
<td>0.19</td>
<td>3.5</td>
</tr>
<tr>
<td>R.B.</td>
<td>10</td>
<td>0.9</td>
<td>2.6</td>
</tr>
<tr>
<td>No. 2 Shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47 ft. level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan</td>
<td>20.5</td>
<td>3.0</td>
<td>6.5</td>
</tr>
<tr>
<td>R.B.</td>
<td>23</td>
<td>2.68</td>
<td>6.72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECONDARY SULPHIDE ORE</th>
<th>Width</th>
<th>Az. Cts.</th>
<th>Cu %</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 Shaft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>145 ft. level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan</td>
<td>19</td>
<td></td>
<td>14.7</td>
</tr>
<tr>
<td>R.B.</td>
<td>20</td>
<td></td>
<td>12.85</td>
</tr>
<tr>
<td>196 ft. level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madigan</td>
<td>23</td>
<td></td>
<td>15.5</td>
</tr>
<tr>
<td>R.B.</td>
<td>18</td>
<td></td>
<td>8.99</td>
</tr>
</tbody>
</table>

* True thickness, less 1 ft. immediately above footwall, not sampled, which should raise average grade very slightly.

According to Borlace, R.B.'s samples were about three times larger than Dr. Madigan's. With this taken into account, close correspondence exists for No. 2 shaft and for the 245 ft. level of No. 4 shaft.

In both crosscuts off No. 1 shaft the east wall carries prominent copper carbonate stain; the west wall carries very little. In these crosscuts R.B. cut channels on both walls, and mixed the two cuts for his sample.

On the 196 ft. level of No. 4 shaft, stopping has taken place since Dr. Madigan's sample was cut, so that same wall is not now represented. Furthermore, R.B.'s channel on this level cut across a 2-ft. sericite horuse, which reduced average grade. Such horuses are common, however, throughout the lode, and must be taken into account. Since they are not everywhere present in cross section, possibly the true grade lies between Dr. Madigan's and R.B.'s samples. Arithmetical average of the two is 12.25% Cu.

At time of visit, as previously stated, ore was being stopped from the 196 ft. level to provide a sorted 35 to 40% Cu. product for shipment to London. R.B. took a 3 cwt. sample of this ore for mill test. The sample was taken as 60 shoveltipfuls uniformly spaced over the heaps of finally broken ore that represented 2 blastings from the stope. All ore involved came from the higher grade footwall portion of the lode, since object of the stopping was to produce the highest grade ore possible. The sample presumably represents correct average of material being stopped, but manifestly is not correct average for full width of lode. Analysis of the sample yields 15.6% Cu. This shows only 0.1% higher Cu content than Dr. Madigan's sample across the full lode, and the conclusion seems necessary that Cu content over short distances along the lode is highly variable, and that Dr. Madigan's sample probably represents a higher than average grade portion of the lode just as R.B.'s channel sample may represent a lower than average grade portion.

In view of all these factors, and until the secondary sulphide zone is exposed at more places, it seems unwise to place average grade of the 196 ft. level higher than 12.25% Cu. On that basis average for the secondary sulphide zone is:
145 ft. level crosscut
196 ft. level crosscut
Arithmetical average

As to the oxidized ore, after eliminating the abnormal copper concentration in the outcrop, it appears to carry copper only sporadically, and this chiefly in the footwall half. The three-crosscut average, amounting to 3.99% Cu, is believed to constitute a fairly close approximation for the oxidized zone as a whole.

As discussed later under Mining Method, the weak hanging-wall precludes clean mining. Based on Mount Isa's experience in stoping high grade lead carbonate ore at the Black Rock and Rio Grande mines by filled stope methods, a minimum 10% dilution may be looked for in stoping. On that assumption, grade of ore at Home of Bullion on a stoping basis, as now indicated, is:

<table>
<thead>
<tr>
<th>Type</th>
<th>Cu %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidized Ore</td>
<td>3.6</td>
</tr>
<tr>
<td>Secondary Sulphide Ore</td>
<td>11.3</td>
</tr>
</tbody>
</table>

SMALL LODE:

Because of its small size, the "Small" lode was not sampled. It carries erratic copper and lead carbonate. Dr. Basedow sampled its surface at three places along a 65 ft. length, his average being:

<table>
<thead>
<tr>
<th>Width In.</th>
<th>Au. Ozs.</th>
<th>Ag. Ozs.</th>
<th>Cu %</th>
<th>Pb. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>.017</td>
<td>13.8</td>
<td>10.0</td>
<td>22.5</td>
</tr>
</tbody>
</table>

SOUTH LODE:

Outcrop of the South, or Parallel, lode is poorly exposed. Dr. Basedow sampled it at one place across an unstated width. R.B. sampled it on the 50 ft. level where it is cut diagonally by the north crosscut. Results are:

<table>
<thead>
<tr>
<th>Surface (Dr. Basedow)</th>
<th>Width</th>
<th>Au Ozs.</th>
<th>Ag. Ozs.</th>
<th>Cu %</th>
<th>Pb %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unstated</td>
<td>n d</td>
<td>1.1</td>
<td>12.3</td>
<td>2.0</td>
<td></td>
</tr>
</tbody>
</table>

50 ft. level

<table>
<thead>
<tr>
<th></th>
<th>H.W.</th>
<th>F.W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>.01</td>
<td>3.6</td>
</tr>
<tr>
<td>26</td>
<td>.03</td>
<td>3.2</td>
</tr>
</tbody>
</table>

In this case the hangingwall, rather than the footwall, portion carries the higher metal content. The lode, however, is poorly defined, and it is not certain that the 6 ft. footwall portion may not be merely iron and copper stained, partly decomposed, schist.

As at the North lode, indicated copper content of the oxidized ore is about 4%. Both the outcrop and the 50 ft. level disclose more hematite gangue, more limonite of pyrite and hematite origin, and less limonite of chalocite derivation than does the exposed zone of the North lode. Limonite of chalocite derivation in particular is rare, although minute amounts of chalocite and cuprite are present in the outcrop. It therefore is unlikely that grade of ore here in the secondary zone will equal that of the North lode, although that is a matter which exploration alone can decide.
TONNAGE IN SIGHT

Plate D.1 shows that, at the North lode, only a 485 ft. length carries ore of commercial promise.

The Plate shows likewise that crosscuts at Nos. 1, 2 and 4 shafts occur at abnormally wide portions of the lode, and do not represent average width. The main shaft, which yields data for estimates of the secondary sulphide zone, occurs at the lode's greatest lenticular swelling, if there be taken into account a probable slight southward rake of the ore shoot (see Plate D1), indicated at No. 2 shaft. No. 2 shaft occurs where the lode splits (Not shown on surface map Plate D 1 because lode junction is mostly covered by dump), and the 47 ft. level crosscut there consequently shows a greater than normal lode width.

Nothing seen in nature of the deposit points convincingly to the lode, t 100 or 200 ft. depth averaging greater in width than it does at the surface; everything suggests that it pinches and swells down the dip just as it does along the strike. Average horizontal surface width of the lode along its 485 ft. of length (as shown on Plate D 1) is 12 ft. Allowing for a 60° dip, this gives a true thickness of 10.5 ft.

Longitudinal Section Plate D 1 shows that oxidized ore may be expected for average vertical depth of 100 ft., or 115 ft. down the dip. Secondary sulphide ore has been proved at one place through an additional 100 ft. vertical depth.

At Mount Isa, high grade ore of the Rio Grande runs approximately 10,8 cu.ft. per long ton. In tonnage estimates 11 cu. ft. is regularly allowed. In view of the unreplaced small horses of schist in the Home of Bullion lode frequently encountered it seems unwise to use a lower cubic footage then is allowed for Mount Isa high grade ore. For that reason 11 cu. ft. per ton is used in this estimate for the secondary sulphide ore.

Oxidized ore is mostly a porous gossan, lighter in weight than Mount Isa Black Star lead carbonate ore, where 14 cu.ft. per ton is allowed. For that reason, it is felt that 15 cu.ft. per ton for Home of Bullion oxidized ore should be the minimum.

On the above basis, assuming 60° dip, ore in sight per 100 ft. vertical depth is:

<table>
<thead>
<tr>
<th></th>
<th>Tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidized</td>
<td>39,042</td>
</tr>
<tr>
<td>Secondary sulphide</td>
<td>53,243</td>
</tr>
</tbody>
</table>

The oxidized zone averages slightly more than 100 ft. vertical depth. Oxidized ore therefore may be placed at 40,000 tons.

.............

CHANCE FOR FURTHER ORE

North Lode:

Extension along strike:

Plate D.1 shows the schist to outcrop for substantial distances along the strike at both ends of the North Lode. At no place along those outcrops does anything in structure or appearance of the schist suggest extensions of the lode or occurrence of other lodes (except the small Lode's outcrop already discussed). Hope for further ore at the North Lode consequently lies in downward extension of the secondary sulphide zone, and, more unlikely, in a primary ore zone.

Secondary Sulphide Ore in Depth:

Dr. Madigan expects the secondary sulphide zone to extend undiminished to the 300 ft. level. He bases his conjecture upon (a) fact that the chalcocite enrichment is strongly defined on the 145 ft. and 196 ft. levels of the main shaft, and (b) fact that in the Cobar district of New South Wales, under largely similar climatic conditions and with the copper ore at that place occurring lenticularly in steeply dipping schist, the chalcocite zone had a 200 ft. thickness.
Chalcocite enrichment of the 145 and 196 ft. levels has sufficient uniformity and strength to suggest its persistence for some distance below the 196 ft. level; prediction of the actual distance is a matter of judgment. The chalcocite zone probably will not have a sharp cut-off at the base, but will pass by irregular gradation into the primary zone. For that reason it is unwise to assume that existing indicated stoping grade of 11.3% Cu will be maintained through more than another 100 ft. of depth. It seems more likely that before the 300 ft. level is reached stopping grade in portions of the lode may diminish below 11.3% Cu, even though the chalcocite zone locally should persist further. Deeper, and more extensive lateral, exploration certainly is required before a full 200 ft. depth of secondary chalcocite ore of 11.3% Cu average stoping grade may be counted upon.

Primary ore:

The Deposit is of a type whose original primary ore deposition would not be expected to pinch out suddenly at depth. Since the primary ore zone is not exposed, no satisfactory basis exists for estimating its grade. Such occurrences as were noted on the 145 ft., and more particularly on the 196 ft. level of the main shaft suggest that the primary copper sulphide is chiefly or wholly chalcopyrite, and that average copper content at best will not exceed 3% or 4%. This is a guess.

Small lode:

The Small Lode, whose more strongly mineralised portion is 100 ft. long and averages 42 ft. wide (see Plate D 1), is not explored. Possibility of its present outcrop constituting top of a larger lenticular swelling beneath must be considered, but the tight schist at either end does not suggest this. Furthermore, if the outcrop does represent top of a larger lens, and if it be assumed that grade of the primary ore was not more than 3% to 4% Cu, no important secondary chalcocite zone could exist beneath, because insufficient copper would have been leached from the available 100 ft. of oxidised depth to produce an important chalcocite orebody.

South, or parallel, lode:

Original copper-stained length of the South, or Parallel, Lode is now partly obliterated by dump of No. 3 shaft, but is stated by Dr. Basedow to have been 127 ft. At present mineralisation occurs chiefly along a 30 ft. length of copper-stained-hematite outcrop westerly from the shaft (see Plate D 1).

Lode dip, both at the surface and on the 50 ft. level, is poorly defined. Locally dips from 30° to 60° may be observed. This fact, plus uncertainty whether the lode outcrop beneath No. 3 shaft dump makes it impossible to determine true thickness of the lode. Basedow's initial report gave it as 5 to 14 ft. (presumably horizontal measurement). If a 10 ft. true thickness and a 50° dip be assumed, the 127 ft. mineralised length will yield per 100 ft. vertical depth:

<table>
<thead>
<tr>
<th>Ore Type</th>
<th>Tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxidised Ore</td>
<td>11,000</td>
</tr>
<tr>
<td>Secondary sulphide ore</td>
<td>15,000</td>
</tr>
</tbody>
</table>

These would seem to be maximum figures, and much additional exploration must be done before they are established - particularly since the surface suggests that the outcrop beneath No. 3 shaft dump and the 30 ft. length outcrop to the west may constitute individual lenses rather than the two ends of a continuously mineralised zone.

Easterly along strike of this lode, 360 ft. easterly from No. 3 shaft (see Plate D 1) occurs another prominent outcrop of 140 ft. length x 15 to 20 ft. horizontal width, with a probable 100 ft. weaker eastward extension. The outcrop consists entirely of hematite partly silified, with no outcrop itself discloses nothing to suggest immediate connection with a copper orebody. Dr. Madigan was hopeful that the South Lode might equal in tonnage and grade that of the North lode. In conversation with R.B. at Adelaide University March 2, 1936, he acknowledged, however, that owing to his inexperience with limonitic outcrops he may have overrated the South lode's possibilities. Three trenches put across the line of lode between the hematite outcrop and No. 3 shaft since Dr. Madigan's visit.
show only unmineralised schist. Hope for a copper crebody consequently seems confined to the 127 ft. lode length near No. 3 shaft.

700 ft. easterly from No. 3 shaft, beyond the hematite outcrop and slightly out of the line of lode, along a ravine, occurs a 2 ft. outcrop of prominent copper-stained rock with much limonite of copper carbonate derivation. A small amount of digging about the outcrop yields no satisfying information, but a 27 ft. trench dug along the strike 15 ft. farther to the east (see Plate D 1) discloses only unmineralised schist. Further digging about the outcrop is needed to establish anything definite, but at this time the occurrence is interpreted as representing a large boulder derived from the North lode's outcrop which it closely resembles, brought down the ravine by storm waters.

**JUNCTION OF NORTH AND SOUTH LODES:**

Late in 1935 Mr. Borlace did considerable pitting and trenching in the alluvial flat easterly from the North and South lodes, and believes he has picked up their extension and junction across a 200 ft. width (see Plate D 1). The "lode" at this place consists merely of one of numerous doleritic injections into the schist that occur at many places on the alluvial flats of the district. The dolerite itself discloses schistose structure at various places, but carries no evidence of either copper or pyrite mineralisation in any form.

At one of the pits in the sericite schist (see Plate D 1) a very small streak of lead carbonate occurs associated with gypsum and quartz on what conceivably may be the extreme tail end of mineralisation for either the North or the Small lode. Almost continuous outcrops of unmineralised schist along the strike proves, however, that it can have no sustained continuity with either of those lodes.

**WESTERN AREA:**

Encouraged by disclosures at the Home of Bullion, Mr. Borlace pegged four 80 acre leases, and did about 150 ft. of trenching in a section of ground five to six miles westerly from the Home of Bullion where construction of a new road to Harrow Creek had revealed similar doleritic injections into the sericite schist. Three lines, or "lodes", of such lenticular doleritic injections are embraced within the four leases. They were mapped by compass and pacing survey by R.B., and are shown on Plate B 1.

Although the dolerite in numerous places is cut by small lenticular buck quartz reefs, such reefs are of general occurrence in Archean rocks throughout the district, and have no necessary relationship to ore. The dolerite itself contains no evidence of mineralisation by either copper or pyrite, and the 4 leases in question have no present or potential value from an ore standpoint.

**NEXT STEP IN EXPLORATION**

Unless the higher grade footwall portion of the oxidised ore should be wanted for flux in smelting operations, probably little will be gained by further testing of the oxidised zone.

To establish grade and tonnage of the secondary sulphide ore calls for drifts and raises through the ore, with systematic crosscuts to both walls.

Two drifts are desirable, one near the top, one near bottom of the chalcocite zone, because at these places, particularly near the bottom, copper content is likely to be erratic. Presumably the drifts would be run along the higher grade footwall portion of the lode, with crosscuts to the hanging wall at 100 ft. intervals. Once bottom of the chalcocite zone is established, it should be possible to lay out the drifts so the lower one may be converted later into an undercut for stoping; the upper one, for servicing the stopes.

Minimum of two raises or winzes connecting with the footwall drifts, and having crosscuts to the hanging wall at 50 ft. intervals.
between drifts, are desirable: one in east central, one in west central, portion of the lode. These would establish continuity and grade of the ore through its vertical range.

By sinking No. 4 shaft as an incline below the 196 ft. level to bottom of the chalcocite zone, and by raising along the lode's footwall from the 196 ft. level to the proposed upper drift, No. 4 shaft would serve the purpose of the proposed east raise. Sinking No. 4 shaft as an incline below the 196 ft. level, would be in any event the logical first exploratory step to establish depth of the chalcocite zone.

Conversion of No. 2 shaft into the west raise, or winze, is not recommended, because of an indicated eastward rake to the oreshoot which may put the winze outside the ore not far below existing 47 ft. level. A better position would be between No. 3 and No. 2 shafts (see Longitudinal Section, Plate D 1). The additional 47 ft. of sinking in the soft oxidised zone required for a new winze, would be a minor item. Location of this raise or winze would be chosen to fit in winze would be chosen to fit in with the subsequent stoping programme.

An exploratory programme as above outlined seems necessary and at the same time reasonably adequate for establishing the chalcocite oreshoot's tonnage and grade. Some risk attaches to choosing horizon for the lower drift, so as to keep it near base of the ore, yet within ground of stopping grade. Footwall portion of the lode, however, carries the highest chalcocite content; and by keeping the incline portion of No. 4 shaft on the footwall, it is reasonable to assume that when bottom of mineable ore has been reached in the shaft, position for bottom of stope across the lode as a whole will be slightly higher.

Because stoping details remain to be worked out, the proposed exploratory work above discussed has not been outlined upon the longitudinal section of Plate D 1. Inspection of that section and of the cross section, however, makes readily comprehensible a visualisation of the proposed work.

This proposed exploratory programme, together with cost thereof and time likely to be consumed in its execution, has been discussed with Mr. Mann. Following estimates represent our joint views as to what is reasonably accomplishable under conditions likely to prevail at Home of Bullion, but with assumption of airtight supervision, and non-interruption due to labour difficulties or shortage. The per-foot costs allowed may seem high, but prevailing high labour and explosive costs must be borne in mind.

Plan "A" assumes that all drilling will be done; all work on contract and under leadership of an experienced, capable contractor of Mr. Borlace's type; that existing 5 h.p. hoist and engine, and 2½ h.p. engine with blower and pump, will be available; that the contractors, upon guarantee of the specified footage, will provide themselves with an additional hoist and engine of this or slightly larger size; that contractors furnish their own water supply and accommodation; and that while No. 4 shaft is being sunk, work upon the upper drift, crosscuts and west winze will be in progress. Shaft sinking and winzing are assumed at 5 ft. per week, raising at 9 ft., drifting and crosscutting at 8 ft., inclusive of preparatory work and timbering where required. Headings are 5 x 7 ft.

Plan "B" assumes work done by the company with machinery which later may be converted into units of the mine plant. In this case suitable accommodation must be provided for the men, and domestic, possibly also operating, water furnished either by pumping or hauled from wells. Diesel or semi-Diesel engines are specified, but corresponding size of suction gas plant to fit into a later power unit could be substituted. Shaft sinking and winzing are assumed at 15 ft. per week, raising at 20 ft. drift and crosscutting at 25 ft., inclusive of preparatory work and timbering, where required. Headings are 5 x 7 ft., two machines to be in operation in separate headings at all times, and, in addition, a stoper in raise work part of the time.

Although advance of headings per week must be determined by trial, the sulphide ground as a whole averages in hardness about the same as Black Star sulphide ground at Mount Isa, and a similar advance per week is assumed after giving effect to the natural handicaps of small prospecting operations in an isolated location.
PLAN "A"

LABOUR:
150 ft. shaft sinking with necessary timbering @ £10
1050 ft. drifting, @ £5.
500 ft. raises @ £5, of which 150 ft. probably would
be winzes @ £7.
250 ft. crosscuts @ £5.
Sampling, assaying and so forth.

Add 20%

£12,000
£2,400

£14,400

Time required: 2 years

It is possible that the heading work could be contracted for
at 80% of the rates shown, in which case the additional amount would be
advantageously spent as bonus for additional weekly or monthly footage.

PLAN "B"

PLANT:
300 cu.ft. compressor, 75 h.p. Diesel
Freight, installation, receiver, piping, and so forth
50 h.p. Diesel hoist, installed
3 Heavy machines, one stoper, air and water hoses,
spares, 1 ton steel
Water supply (estimated minimum)
11,000 detachable bits @ 4 bits per hole, 12 holes
per 3 ft. cut, two re-grindings of each bit
Housing accommodation
Utility and spares

Add 20%

£2,000
1,000
2,000
750
750
1,000
1,000
500

£9,900
1,800

£10,800

No motor truck included, because haulage can be
contracted for @ 6d. per ton mile. Utility, however,
is essential.

LABOUR AND EXPLOSIVES:
1650 ft. drifts, crosscuts, raises @ £3.
150 ft. winzes @ £5.
150 ft. shaft @ £6.

£6, per week wage assumed, but contract rate fixed
so good workers should make £8 - £9. per week.

OVERHEAD:
3 bracemen, 3 platmen, @ £6. per week )£4,368
3 hoistmen, 3 compressor men, @ £8. per wk. ) 1 year
Fuel oil @ .8 lb. per B.H.P. hour )£4,500
Carbide, lubricating oil, miscellaneous
Superintendence, sampling, assaying and so forth

Add 20%

£4,950
750
900

£6,600

£8,868
1,000
1,500

£17,968
3,594
21,562
10,800

£32,362

Time required: 1 year after plant is installed.

On above basis, the exploratory work, if done by hand, costs
45% as much as if done by machinery. The latter method has the advantage of
accomplishing the work in half the time (after plant is installed), and
in having furnished a substantial start upon plant and equipment if production is undertaken.

In view of the high exploration costs noted above, testing the orebody by diamond drilling merits consideration. It has not been recommended because of the orebody's lenticular character, irregularity of its mineralisation, and the fact that, with the abundance of sooty chalcocite occurring along numerous fracture planes, with resulting tendency to salt the sample, reliable diamond drill core samples may be difficult to obtain.

MINING METHOD

Mention has been made of hangingwall collapse where the schist is cut in 64 ft. level crosscut of No. 1 shaft oxidized zone and 196 ft. level crosscut of No. 4 shaft sulphide zone (see Cross Section, Plate B 1). The fine-grained silky sericite slabs off freely, and constitutes a definitely weak hangingwall where disturbed. Shrinkage stoping and sub-level benching consequently are eliminated. Filled stope mining, such as top slicing, or cut and fill, is called for. Of these, cut and fill is believed at the moment to be better suited to the ground.

Hill system of cut and fill may expose too great a vertical range of unsupported wall for safety. Flatback cut and fill, with stulls and headboards, and with vertical cut not exceeding 3 to 10 ft., should prove effective. In very weak ground supplementary pigsty support may be needed, especially in wider portions of the lode.

Stoping will need to be done as comparatively short openings along the lode, and maximum safe stope length probably will not exceed 100 ft. to 125 ft. This calls for three vertical pillars, which may have to be retrieved by square set, but which probably can be mined by staggered cut and fill. It should be possible to stope the full assumed 200 ft. vertical height without an intermediate level pillar.

Mulga, bloodwood and various gums 20 miles to the south are suitable for stulls to any required length, and are satisfactory for ore pass lining; but despite its high cost, Oregon will be more effective for shaft and chute timber, and for headboards. A small sawmill would be needed for squaring local timber.

Schist country rock breaks sufficiently small for fill, and may be gloryholed from the surface.

Because of numerous uncertain factors, no detailed estimate of mining costs is attempted. On basis of 500 tons per day production, miners at 16 s. other direct mining labour at 13 s., and explosives at 6d. per ton, MacKenzie's estimate is 15/6 per ton delivered into the bins.

Mount Isa explosives for stoping during 1935, excluding level development, cost 1/3 per ton. Practically all of this stoping was in sulphide ore, a large part of it by ring blasting. Home of Bullion explosive costs therefore can hardly be figured at less than 1/6 per ton. They may be more.

MacKenzie's estimate includes some labour and several other items which probably can be dispensed with under the stoping method proposed; but in view of present minimum labour charges of 6s. per week in the district, and in view of production to supply the proposed 100 ton plant calling for only 130 tons per mine working day, it is difficult to figure an overall mining cost of much less than 20 s.

As a check against this, Mount Isa's flatback cut and fill stoping in semi-oxidized ground, with occasional pigstys but with few stulls and headboards (H 49 stops), is 12 s. delivered into the bins. Assuming, as previously discussed, that because of the higher labour and freight charges at Home of Bullion the mining costs at that place will be 50% higher than Mount Isa's, an 18/5 cost is indicated. Allowing for extra timber in stoping, and for the smaller scale of operations, it is difficult, on this basis likewise, to figure an overall mining cost of much less than 20 s.
A further check upon mining cost is as follows:

With production at 130 tons per mine working day, using flatback cut and fill, the best that may be expected is about 2 tons per man shift counting all direct and proportionate share of indirect underground and surface labour involved in mining. At £6. per week, average wage per shift is 21.82s. Skilled labour's proportion probably would raise the average to 23 s. or 24 s.

Owing to high transportation rates, supplies will be proportionately costlier than labour, and labour therefore may be regarded as constituting 60% instead of the customary 65% of production charges.

On that basis the outcome is:

\[ \frac{24}{.60} = \frac{40}{2} = 20, \text{ or } 20 \text{ s. per ton.} \]

On basis of average £6. wage the outcome is:

\[ \frac{21.82}{.60} = \frac{36.4}{2} = 18.2, \text{ or } 18.2 \text{ s. per ton.} \]

With no lower levels to develop as a charge against production, however, the 20 s. cost should prove adequate.