

TR5-77-88

REPORT ON THE OCEANA MINE— ZEEHAN

by R. Jack.

LOCATION AND ACCESS

The Oceana silver-lead mine, Lease No. 17M/54 of 613 acres, is held by Zeehan Mines Pty. Ltd. and is situated approximately 3.2 miles south of Zeehan to which it is linked by a fair all weather gravel road. All concentrates produced are trucked to Zeehan then transported to Burnie via the Emu Bay Railway Company for shipment overseas.

INTRODUCTION

The Oceana mine is about to cease operations and this visit was undertaken to record all available information on the underground workings. Once work ceases the mine will flood to within fifty feet of the surface and none of the levels will be accessible.

HISTORY

Little is known of the early activities on the old Oceana leases; trenching was reported by Montgomery ⁽¹⁾ in 1890, and by the year 1893 (Montgomery ⁽²⁾), three prospecting shafts had been sunk and connected by 700 feet of driving along the line of lode. The old main shaft was started and later completed to 145 feet with levels being driven at 32 feet and later at 80 feet. Three shoots of ore were encountered to the north of the shaft, and by 1893 some 1000 tons of ore assaying 39% Pb and 14½ ozs. Ag had been mined. The main shaft later collapsed and the mine ceased operating. The workings were all to the north of the old main shaft. No records are available on Hall's or Fox's open cuts to the south of the main shaft. These open cuts are in the oxidized portions of the ore bodies which have been worked by the present company.

In 1946 prospecting work was again started on the Zeehan Field; intensive exploration by North and South Broken Hill Companies resulted in the drilling of several old mines, the Pyramid, Spray, Nike, Bell, King, Tasmania Crown, Oceana, and the Austral Flux quarries. This and later drilling of several geophysical anomalies proved disappointing and further drilling and exploration was concentrated only on the Oceana Mine. This resulted in the mine being brought into production by the present company in 1954.

GENERAL

The examination of the mine was more difficult than usual owing to partial flooding leaving only the first three levels accessible, extensive timbering of the ore zones on the levels, inaccessible stoping and the sealing off of disused drives to lessen the intake of water and danger of water bursts. Approximately 2½ million gallons of water are daily pumped out of the mine using three four-stage turbine pumps and three Pomona pumps.

PRODUCTION

Production for the past year has been approximately 120 tons per day, averaging 10.36% Pb and 4.42 ozs. Ag per ton, recovery grades. Since Zeehan Mines Pty. Ltd. have held the Oceana leases production from the mine has been as set out on page 80.

PLANS

The geological mapping is recorded on mine survey plans which are substantially correct. Some information was obtained from old geological records, especially in those areas which are now inaccessible or have been mined out.

MINING

The main service shaft (No. 6) is a 12 foot, circular, two winding compartment shaft which was sunk to 200 feet, the first 100 feet being mainly in weak, partly decomposed limestone. Due to the large amount of water encountered, the shaft from 200 feet to the bottom at 648 feet was converted to a four-compartment, rectangular shaft in order to facilitate sinking and provide adequate space for rising mains for pumping.

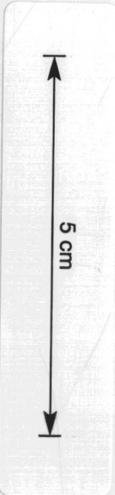
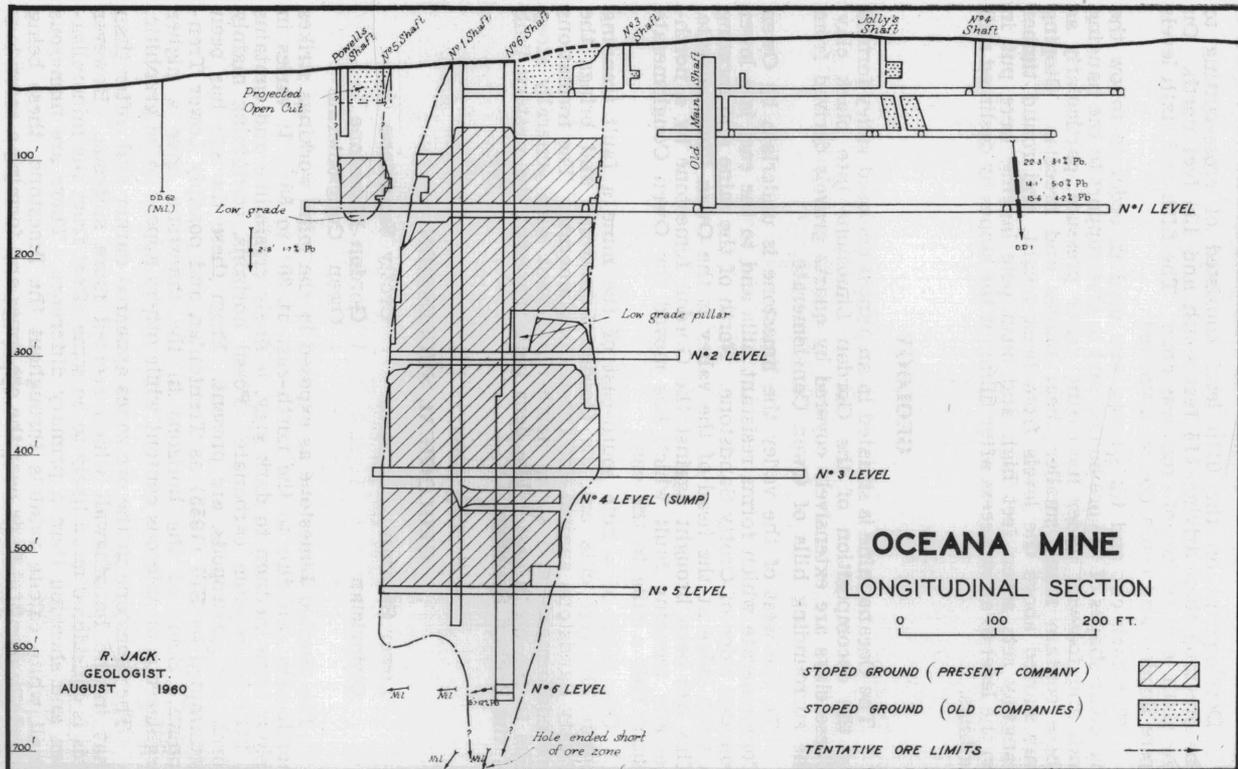
Development was carried out from levels put in at 150 feet intervals for the first two levels, 120 foot intervals for the third and fifth levels, and 100 foot interval for the sixth and deepest level. A sump was made of the fourth level 30 feet below the third level. Cross-cuts were driven west from the shaft to intersect the ore bodies. These cross-cuts are 120 feet long for the top levels and decrease in length to 80 feet on the sixth level, this decrease in length being due to the steep easterly dip of the ore and the narrowing of the ore bodies.

From the cross-cuts drives were driven north and south to delineate the extent of the ore present, and also to connect with the No. 1 ventilation shaft. On first level the southern drive was extended to 210 feet south of the shaft to open up a small lens of ore. On lower levels the drives do not go as far south as drilling under this southern lens did not show any economic values. On first level driving continued to 600 feet north of the shaft to intersect the northern area zone. Unfortunately this drive is now inaccessible beyond 160 feet.

On the second level an attempt was made to drive north, but this was abandoned after 160 feet when a large inflow of water and mud was met. On third level two attempts were made, the first being abandoned after reaching 170 feet north of the shaft and the second after reaching 290 feet north of the shaft when a large fault zone was cut carrying copious amounts of water.

Year	Ore (tons)	Conc. (tons)	Pb (tons)	Pb (%)	Pb (Value) £	Ag (ozs.)	Ag (ozs./ton)	Ag (Value) £	Total Value £
1954	7,977	1,221	893	11.95	106,961	41,247	5.17	15,732	122,693
1955	15,680	2,793	2,031	12.95	260,457	81,375	5.19	30,599	291,056
1956	15,442	2,356	1,732	11.22	243,688	71,334	4.62	29,278	272,966
1957	17,916	2,073	1,958	10.93	219,128	76,818	4.29	31,391	250,519
1958	22,622	3,402	2,434	10.76	212,434	95,646	4.23	37,853	250,287
1959	30,336	4,282	3,142	10.36	314,166	134,013	4.42	55,445	369,611
1960 (to March 31st.)	7,459	1,195	852	11.42	87,521	36,262	4.86	15,412	102,933
1954 to March 31st 1960	117,432	17,322	13,042	11.11	1,444,355	536,695	4.57	215,710	1,660,065

The above figures show all except the last four months' production, these figures not being obtainable at present.



Development on the fifth level consisted of cross-cutting to the ore-zone then driving 115 feet south and 130 feet north. On the sixth level 80 feet of cross was done. The fifth and sixth levels were flooded and could not be inspected.

Flat-back cut and fill stoping was used in order to follow the irregular shapes of the ore bodies, and to give support to the hanging wall and footwall under increasing water pressure, particularly as these contain many smaller shear planes and breccias. Stoping was started above the levels from back height, and round timber gangway sets seven feet high and bush pole lagging were put in on the level to allow access after filling of the stopes by deslimed mill tailings.

GEOLOGY

The Oceana mine is situated in an almost enclosed valley formed by the decomposition of the Gordon Limestone into black clay. These clays are extensively covered by quartz gravels derived from the surrounding hills of Owen Conglomerate.

To the west of the valley the limestone is underlain by Owen Conglomerate which forms resistant hills and to the east is a lower rounded ridge of Crotty Sandstone. North of the mine and forming a steep ridge at the head of the valley is the Owen Conglomerate. This has been brought against the Gordon Limestone by a north-easterly trending fault which has moved the Owen Conglomerate about half a mile to the east.

One third of a mile south-east of the mine a fault trending north 70° west cuts out the Gordon Limestone, and brings the Crotty Sandstone against the Owen Conglomerate. The formations are conformable and strike north-north-west with generally steep dips to the north-east. The beds here represent the western limb of the Zeehan Syncline.

GEOLOGICAL SUCCESSION

Lower Silurian	Crotty Sandstone
Ordovician	{ Gordon Limestone
	{ Owen Conglomerate

The Gordon Limestone as exposed in the mine workings strikes north-west and dips to the north-east at 80° to 88°. It varies in colour from medium to dark grey, is finely crystalline and contains a little magnesium carbonate. Fossil horizons, containing mainly corals and gastropods, are present. From these the age has been determined by Hill (1955) as Trentonian and possibly Lower Trentonian. Some of the horizons in the limestone have a higher argillaceous or siliceous content while others appear to be graphitic.

The limestone in the ore zones appeared darker and softer than that in the hangingwall which seemed more siliceous. However this is considered more likely to be some effect from the mineralisation and shearing than a primary difference. There are numerous small white calcite veinlets throughout the limestone, these being especially plentiful in or near the ore zones and forming a secondary filling of the fracturing.

MINERALISATION

The mineralisation here is of the siderite-galena type with only very minor amounts of other sulphides present, namely pyrite, sphalerite and chalcopyrite, and it is considered to be of Devonian age. The ore is distributed along two prominent shears which form part of a zone of intense shearing and local brecciation. The shear zone varies in width from a few inches to 60 feet. Siderite is found over the whole width but the galena mineralisation occurs over only half this width and erratically along the strike. The shear zone and the galena mineralisation strike N30W and dip steeply to the north-east at 85°.

This shearing, which is pre-ore, has provided favourable access for the mineralisation which occurs principally along the two most prominent shears and erratically along weaker shears in the hanging wall and footwall of these shears. The mineralisation has also selectively replaced the crushed rock in some of the tension fractures which formed in the shear zone between the two major shears (see diagram). Where these tension fractures are sufficiently mineralised and close together the ore bodies along the two shears are mined as one stope. This is done in the southern ends of the first, second and third level stopes. The rake of the ore bodies is very steep, being 85° to the south.

The ore occurring along the shears varies in grade and there are several rich lenses connected by low grade material. When mined these combine to give an overall grade of 11% Pb though the grade of individual sections varies from 3% to 18% Pb.

THE ORE ZONE

The ore zone is up to 60 feet wide and 350 feet long in the main part of the mine but of this a maximum of 30 feet width and 260 feet length is sufficiently mineralised to be of economic value. This zone was considerably faulted after the earlier shearing and mineralisation. The post-ore faulting is seen in the displacement of the ore bodies with no mineralisation being present on the fault and in the flexure of the ore bodies and beds near the fault due to the drag along the fault planes.

The faulting principally affecting the ore bodies is seen as flattish overthrust faults trending a few degrees west of north and overthrust to the east. One such fault seen above the second level stopes has displaced the ore 10 to 12 feet to the east and gives the ore body a flexed appearance in cross-section. Another overthrust fault appears in the back of the first level stopes; the displacement here could not be seen but it is apparently greater than the second level fault being approximately 25 to 30 feet. More of these faults occur in depth and two are reported at the bottom of the shaft. These would most likely displace any downward extension of the ore zone to the west.

The small lens of ore worked to the south on first level is across the main line of shearing, and is probably a mineralised tension fracture running N 20° E. This stope unfortunately could not be inspected at the time of the visit.

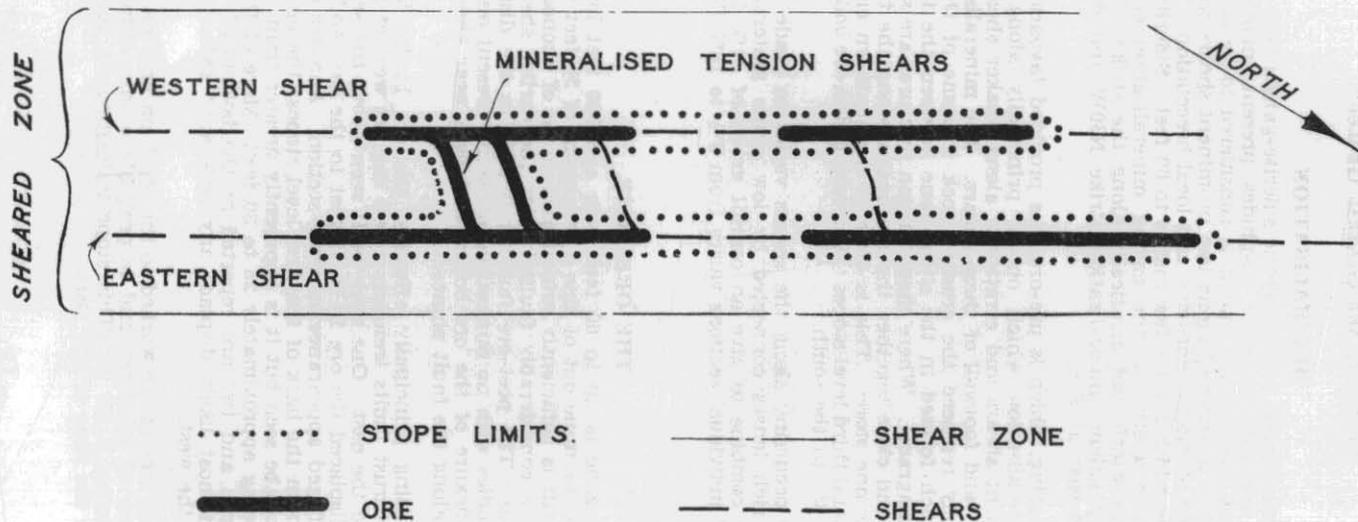
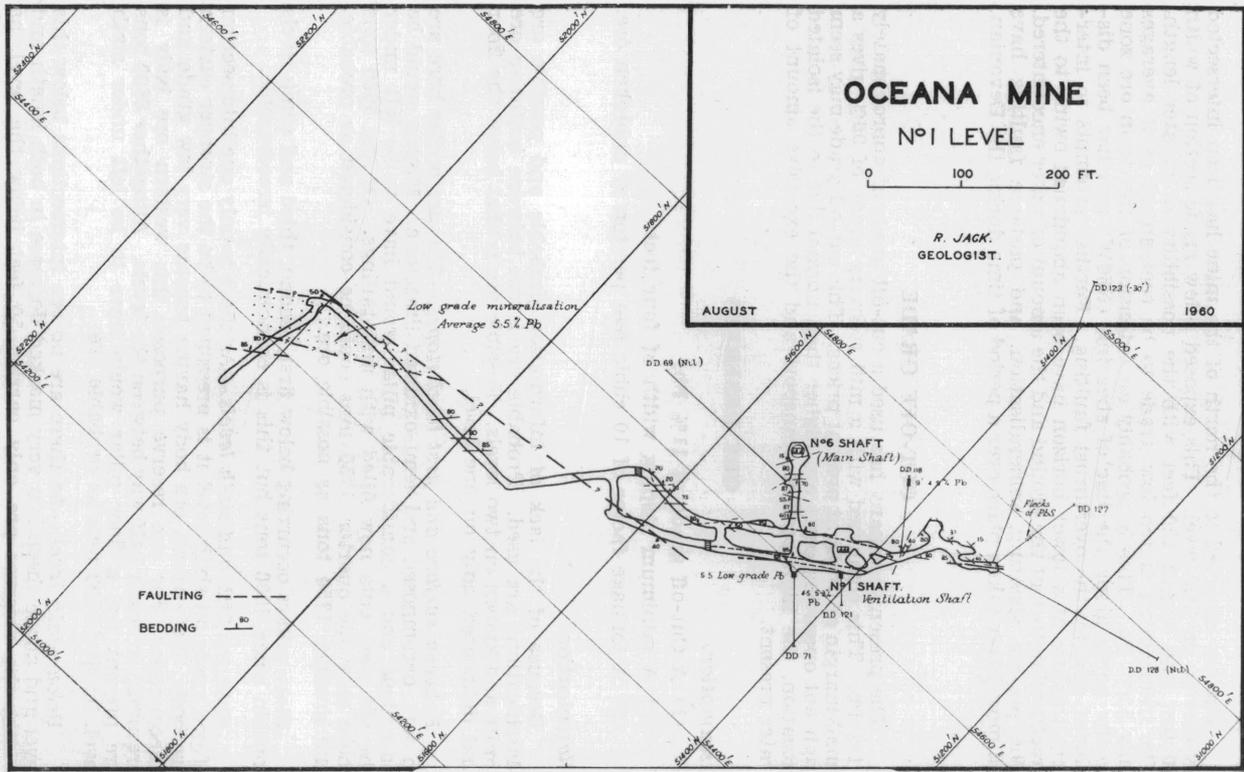


FIGURE 15A.

FIGURE 16.



The ore reported to the north of the mine has been intersected by driving on first level. This exposed a low grade section of width 40 feet and length 120 feet with the possibility of greater length. The intersection is too low grade to be economical as it averages only 5.5% Pb. This is probably an extension of the main ore zone to the north along the line of shearing (N30W) and has been displaced east by the overthrust faulting. Further attempts to intersect this ore at a lower horizon have been abandoned owing to the fractured nature of the ground and the amount of water encountered. The pre-ore shearing, mineralisation, and post-ore faulting have all most likely taken place over a period of time during the Devonian.

CUT-OFF GRADE

The present company has used a cut-off grade of approximately 11% Pb. This combined with a mill recovery grade of 96% gives a small margin of profit at present prices. This cut-off grade may seem high but operating costs are higher than normal due to the isolated situation, the high cost of transport and the excessive amount of water present.

ORE RESERVES

Assumptions

- (1) A Cut-off grade of 11% Pb.
- (2) A minimum stoping width of four feet.
- (3) A tonnage factor of 10 cubic feet per ton of unbroken ore.

Classification

Because of the lack of information probable and possible ore classifications are used. Probable ore is ore between tentative ore limits and known on two levels. Possible ore is that below the floor and delineated only on one level.

Between surface and first level stopes.—The ore bodies here are in soft, decomposed and semi-oxidized limestone. Mining would be hazardous and a considerable pillar would have to be left under the old open cuts now filled with mill tailings. Of the 7000 tons there only one quarter, 1750 tons could be considered as probable, and another 1750 tons as possible ore.

Floor pillars occurring below first, second, third and sump levels contain some 4000 tons but this is economically irrecoverable.

Between fifth and sixth levels.—As there is only one intersection of ore grade on sixth level it is presumed to be the stronger eastern ore body, the western ore body having become very low grade and uneconomic. For ore reserve purposes this western ore body is presumed to reach half way between the levels. Altogether 8600 tons are present but a floor pillar would have to be left under sixth level, leaving 7500 tons as probable ore.

Below sixth level.—As there are no ore intersections below this level and above there is a very marked decrease in both length and width, the reserves are only carried 50 feet below the level, as 1250 tons of possible ore.

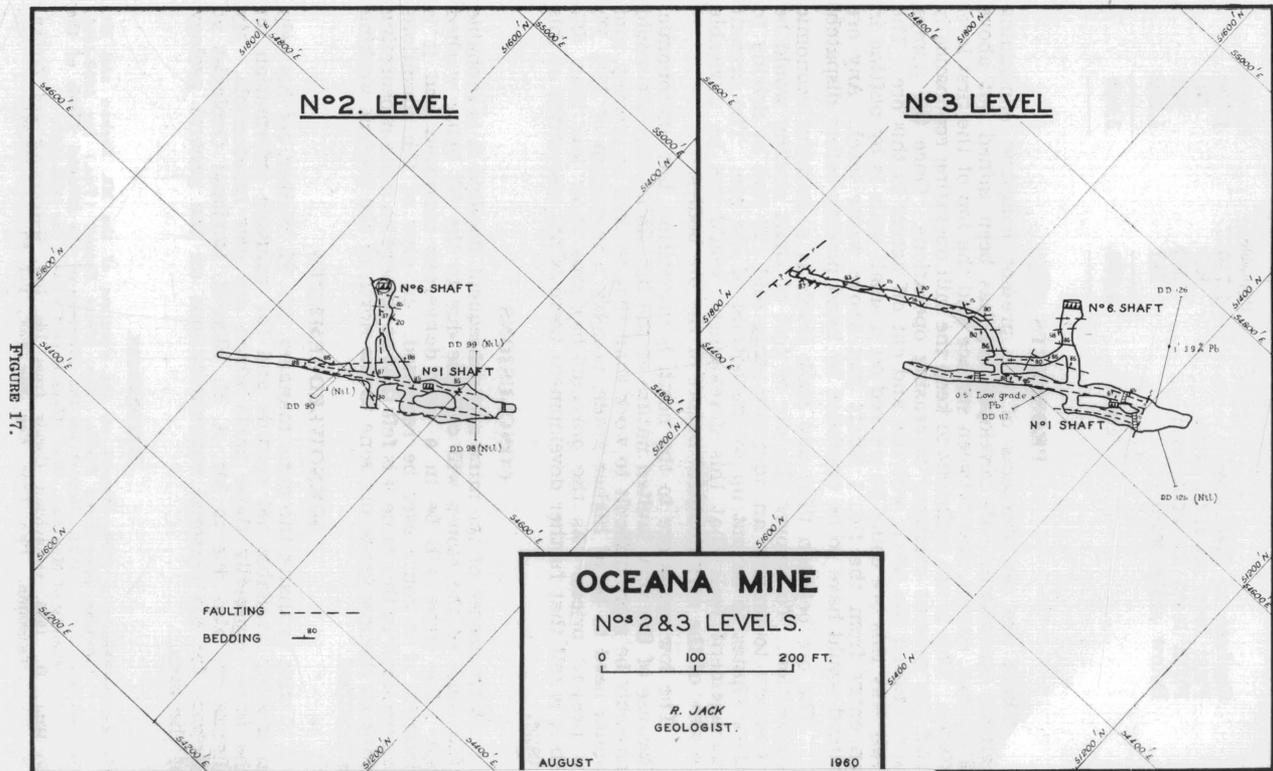
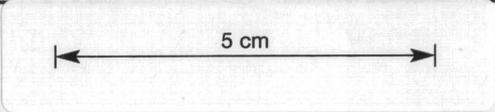


FIGURE 17.



	Probable	Possible
Surface to first level	1,750	1,750
First level to fifth level	Nil	Nil
Fifth level to sixth level	7,500	Nil
Below sixth level	Nil	1,250
Total	<u>9,250</u>	<u>3,000</u>

PROSPECTS

There are no prospects of the present company continuing mining operations. All developed ore has been mined out above fifth level, except that between surface and the top of the first level stopes. This is not sufficient to keep the mill operating economically and the present company is ceasing operations. Once the pumps are removed the water will rise and cut off access to this ore. The only way this ore could be worked on a small scale is by putting in an entry from the No. 1 Shaft just above water level. Any ore mined would have to be upgraded by hand picking before dispatch.

The ore between fifth and sixth levels is a doubtful economic proposition. To recover this ore 50 feet of shaft sinking would be necessary to provide an adequate sump and 120 feet of driving to allow chutes to be put up to the bottom of the ore. The present management feels that this development would not be advisable in view of the very doubtful nature of the ore bodies.

The low grade ore to the north is interesting, but uneconomic. Because of the very faulted nature of the limestones this ore would probably be more difficult to work than that worked at present, and would need to be of higher grade, possibly a minimum of 12% Pb at present prices. As the only intersections show less than 6% Pb it is felt that further development there is not warranted at this stage.

CONCLUSIONS

With closure of the mine and subsequent flooding it is probable that some of the stopes will collapse due to the fill being washed out. The mine will be in a very dangerous condition and it is doubtful if it could ever be reopened. In view of the conditions encountered in this mine it is felt that at present no more prospecting work on the low grade ore zone to the north of the present working is justified.

ACKNOWLEDGEMENTS

I wish to thank the mine manager, Mr. K. Walker, for his help in making available old records and for valuable information on the mine, especially those parts which are now inaccessible. My thanks are also due to Mr. A. H. Blissett, Regional Geologist at Zeehan, for his personal communications on the general geology of the area.

REFERENCES.

- (1) MONTGOMERY, A., 1890.—Report on the progress of the Mt. Zeehan and Mt. Dundas Silver-Lead Fields. *Sec. Mines Report (Tas.)* for 1890-1891.
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- (3) HILL, D., 1955, Ordovician Corals from Ida Bay, Queenstown and Zeehan, Tasmania. *Pap. Proc. Roy. Soc. Tas.*, Vol. 89, p.p. 237-254.