COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD No. 1963/94

BON ACCORD GEOPHYSICAL SURVEY NEAR ZEEHAN, TASMANIA 1954

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SUMMARY

A geophysical survey was made over the old lead-zinc mining area at Bon Accord, east of Zeehan, Tasmania, using self-potential and electromagnetic methods.

The survey area was fully covered using the self-potential method but only in part by the electromagnetic method. Several self-potential anomalies were revealed, the main ones being over the abandoned Bon Accord and Owen Meredith workings. Medium to weak electromagnetic anomalies were recorded near the Owen Meredith workings.

The interpretation of the geophysical anomalies is doubtful as they may be caused by sulphide mineralization, or graphitic shale, or both. It is recommended that a close study should be made of the underground workings in conjunction with the geophysical results before any drilling is undertaken to test the geophysical anomalies.

1. INTRODUCTION

A brief geophysical survey was made by the Bureau of Mineral Resources in 1954 in the Bon Accord mining area east of Zeehan, Tasmania. Bon Accord was one of several lead-zinc prospects in this district which at one time supplied lead ore to the smelters in Zeehan, but the district never achieved a sizeable production.

The geophysical survey was requested by the Tasmanian Mines Department following some detailed geological mapping of the area by that Department. The purposes of the survey were:

(a) to determine whether the ore is situated on one or two lines of lode or on shear zones in a defined geological pattern,

(b) to investigate the extent of ore shoots, and

(c) give targets for diamond drilling.

The field party consisted of geophysicists O. Keunecke (party leader) and M.J. O'Connor, and field assistants provided by the Mines Department. The Mines Department undertook the clearing and pegging of traverse lines for the geophysical survey. The magnetic survey at Bon Accord was commenced on 29th March 1954. Owing to a shipping strike, the main equipment was delayed on its way to Tasmania; it arrived in Zeehan on 7th April, was transported to a camp in the area, and self-potential field work was commenced on 13th April. At the request of the Mines Department, the geophysical survey at Bon Accord was terminated at the beginning of June to allow the party to transfer to the Montana Mine area near Zeehan, where a geophysical survey was considered to be urgently required because of the rapid exhaustion of reserves in the Montana Mine. Also the weather had deteriorated to such an extent that field work in the heavily timbered Bon Accord area had become practically impossible. The party withdrew from the Bon Accord area before the planned survey had been completed.

The only access to the Bon Accord area was along a walking track from the Zeehan/Renison Bell road near Renison Bell which connected with the disused Dunkley's tram track. The survey camp, which was situated on this tram track near Traverse G, was about one hour's walking distance from the road.

2. GEOLOGY

The rock formations of the Bon Accord area consist mainly of grey and black shale occupying the western part of the surveyed area and purple and green argillite in the eastern part. The direction of strike is generally north-west and the dip is north-east with varying angles but mainly around 60 to 70 degrees. The formations belong to the Cambrian Dundas Group.

The ore occurs at, or near, the contact of shale with argillite and the lodes mainly conform to the country rock. A number of old mines and prospects extend over a length of about one mile along the strike but all the mine workings are inaccessible because they have fallen in and are covered by secondary growth. The country is heavily timbered and there are few outcrops although overburden is mostly only light. The ore occurs along one or two lines of lodes, or along shear zones dipping steeply north-east.

The mines were worked only on a small scale from about 1890 to 1900. The ore was hand picked and sent over a long tram line to Zeehan. No concentrating plant ever existed on the field and for this reason, and also because of the difficulties and high cost of the ore transport, not much exploration work was done in this area. The ore carried galena as the main mineral and has silver and low zinc content.

3. GEOPHYSICAL METHODS

As in the other areas in western Tasmania, the use of the self-potential (S-P) and electromagnetic methods was regarded as best suited for the investigation of this type of deposit. The magnetic method was tested but did not reveal any anomalies which could be connected with the mineralization. After 17 traverses were surveyed this method was discontinued. The main results were achieved by the S-P method which was used over the whole grid.

The S-P values at all observation points were determined with reference to a common base station, which was situated near Traverse F over neutral ground. The S-P method measures on the surface the electrical potentials developed by the electro-chemical action between sulphide minerals in the process of oxidation and the solutions with which they are in contact. The potentials depend on the chemical composition of the minerals in contact with the solutions surrounding the ore and upon the ion concentrations of these solutions. The S-P survey gives therefore a picture of the electro-chemical activity going on at the time of the survey and in areas with high rainfall is dependent somewhat upon the seasonal changes through rise and fall of the ground-water table. In swampy areas access of oxygen might be prevented through overlying waterlogged peat.

Graphite also causes strong S-P anomalies, which are hard to distinguish from anomalies caused by sulphide ore, especially if both occur in the same area as they do in the Bon Accord area.

The electromagnetic method is designed to detect subsurface conductors and is commonly used in prospecting for sulphide bodies, which in general possess good electrical conductivity. A primary electromagnetic field is produced by passing an alternating current through a long straight cable. This field induces secondary currents in any good conductor lying below the surface and the secondary currents in turn set up a secondary electromagnetic field. The resultant field is measured at observation points along traverses at right angles to the primary cable. After the calculated value of the primary field is deducted, the residual value gives the field due to the good conductor. A search coil is set up at each observation point and the electro motive forces induced in the search coil are measured on an A.C. potentiometer or compensator. This instrument determines the value of the component in phase with the primary current (real component) and the component 90 degrees out of phase with the primary current (imaginary component).

In the Bon Accord area, observations were made at intervals of 25ft along the traverses. The primary cable was grounded at both ends. Heavy rain hampered the field work and affected the performance of the compensator. When the survey was terminated only parts of the area, mainly in the south, had been surveyed.

4. RESULTS

Self-potential method

Plate 2 shows the layout of the geophysical traverses, the geological boundaries and mine workings and the results of the S-P survey in the form of contours with 50-mV intervals.

The S-P contours show several elongated anomalies following fairly closely the boundary between grey and black shale and purple argillite. The centres of the anomalies are mainly within the zone of shales. The mineralization seems to be confined to this zone.

The main S-P anomalies occur over black carbonaceous shales and may be due to graphite, or sulphides, or both. It is not possible to distinguish between the anomalies arising from these sources. Pyrite gives a stronger S-P anomaly than galena and it is likely that the S-P results are mainly influenced by the pyrite and graphite distribution. In the known workings the lodes dip about 50 to 70 degrees east; the S-P minima however are mostly somewhat farther west suggesting that either the mineralization extends farther into the footwall side or the S-P anomaly has been shifted to a more westerly position through the influence of the black shale.

The S-P anomaly over the Bon Accord workings is long and narrow and follows closely the geological boundary. If the anomaly is due to mineralization it wouldindicate that the Bon Accord workings are the most important in the group of prospects in this area and that the mineralization extends mainly south from the Bon Accord shaft. It is recorded that a tunnel 500 ft long was driven at the Bon Accord mine. The tunnel has fallen in and its direction could not be ascertained and no results of the tunnel appear to be available. If it had been driven in a southerly direction, it might have explored to some extent the area of the S-P anomaly.

At Traverse AH the anomaly swings sharply north-west, whereas the mine workings continue north to the Success Extended. No S-P anomalies coincide with the Success Extended workings. No explanation can be given for the change of direction of the Bon Accord anomaly or for the absence of anomalies over the Success Extended workings.

The anomaly at the Owen Meredith workings is wider and more irregular in shape and strike than the Bon Accord anomaly. In the middle part (Traverse C) the anomaly consists of two minima, the eastern one of which coincides with the northern Owen Meredith workings. A long drive from the Owen Meredith shaft might have reached the southern part of the main anomaly.

The S-P contours give the impression, to some extent substantiated by the geological mapping, that the Owen-Meredith anomaly is cut off in the north by a cross fault at Traverse G and in the south also by a fault near Traverse BG. The weak S-P minimum near the Success workings could therefore be due either to a faulted part of the Owen Meredith mineralization or to a separate body. The results on Traverses BH and BJ show an anomaly striking north-west which may be due to a faulted part of the Success mineralization thrown to the west. The anomaly is quite strong on Traverse BJ and there is a possibility that the mineralization continues still farther south.

Electromagnetic method

The electromagnetic results have not been shown on the map as the method was used on only a portion of the area and furthermore some of the field observations are of doubtful reliability owing to the effects of the heavy rain on the performance of the equipment. The primary cable was first laid along 00. As observations cannot be made closer than 200 or 250 ft to the cable, this layout did not allow coverage of the S-P anomalies which are mainly west of 250 E. The cable was relaid along 200 W and the traverses were completed between 00 and 250 E.

Electromagnetic anomalies were found on Traverses BJ and BH and on Traverses A, B, C, D, and E over the Owen-Meredith S-P anomaly. The electromagnetic anomalies either coincided with S-P minima or were 25 to 50 ft farther east. Although these anomalies are distinct they are only medium to weak and do not indicate a good conductivity as would be expected from compact ore.

5. CONCLUSIONS AND RECOMMENDATIONS

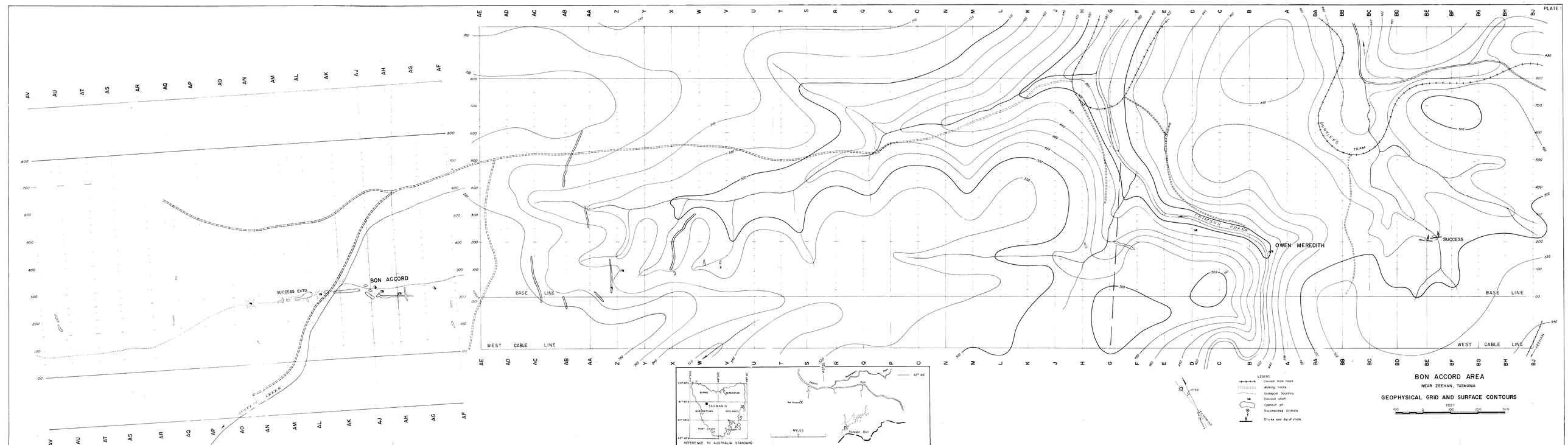
The geophysical survey revealed both S-P and electromagnetic anomalies, which, on the basis of the geological information available, may be due to sulphide mineralization, or to graphitic shale, or to both. The electromagnetic anomalies are relatively weak and do not point to the existence of any large bodies of compact ore.

The two main S-P anomalies, one at the Bon Accord workings and extending south, and the other at the Owen-Meredith workings, are extensive enough and in a sufficiently favourable geological position to merit further attention. Before any drilling is done to test the Bon Accord anomaly, it is considered that the Bon Accord mine should be reopened to ascertain if the main drive went into the area of the anomaly. A close study of the underground workings in conjunction with the geophysical results could determine whether or not any drilling would be worth while. If drilling is undertaken, two holes would be recommended; one hole should be sited on Traverse AA at about 100E and drilled in a westerly direction with a depression of 45 degrees and the other on Traverse Y at 150 E with the same direction and depression.

In the Owen Meredith area, opening up of the Meredith shaft and the main drive from it should precede any further exploration. No underground maps of any of the mines were available to the geophysical party, but if these exist they should be studied in relation to the geophysical results. If the southern drive is really located as shown on Plate 2 it will have gone too far south to test the S-P minimum, and some cross-cuts west might reveal more mineralization than was found in the southern end of the drive. Although there are more old workings at Owen Meredith than at Bon Accord they do not seem to have revealed much ore of economic grade. The wider and more complicated shape of the Owen Meredith S-P anomaly makes it advisable to map thoroughly the surface and the workings before deciding on drilling, and selection of drill sites would best be left until the results of this work are available.

It is considered that attention should be paid to the two southernmost traverses, viz. BH and BJ, where a strong S-P anomaly was revealed. If any mineralization can be detected it should be followed along the strike in a south-easterly direction. The centre of the S-P anomaly is expected to lie outside the surveyed grid.

PLATE I



BON ACCORD AREA

NEAR ZEEHAN, TASMANIA

GEOPHYSICAL GRID AND SURFACE CONTOURS

FEET

100 0 100 200 300

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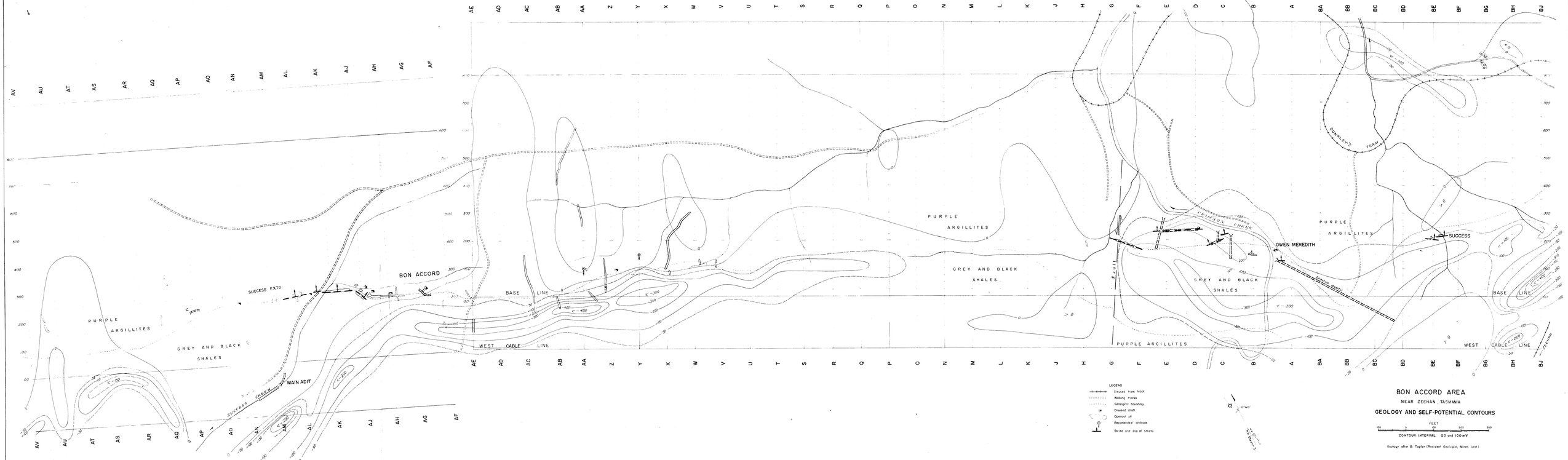

LEGEND

- Disused tram track
- Walking tracks
- Geological boundary
- Drained shaft
- Opencut pit
- Recommended drillhole
- Strike and dip of strata

BON ACCORD AREA

NEAR ZEEHAN, TASMANIA

GEOLOGY AND SELF-POTENTIAL CONTOURS

FEET

CONTOUR INTERVAL 50 and 100 mV

Geology after B. Taylor (Resident Geologist, Mines Dept.)

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