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GEOPHYSICAL SURVEY OF  
EAST DARWIN.

GEOPHYSICS

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Geophysical Survey of the  
Great Bay, East Darwin  
& Constable Areas (Exhaek)

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EAST DARWIN AREA.

COMMONWEALTH OF AUSTRALIA  
DEPARTMENT OF NATIONAL DEVELOPMENT  
BUREAU OF MINERAL RESOURCES  
GEOLOGY AND GEOPHYSICS

RECORDS 1959, No. 36

Extract from  
GEOPHYSICAL SURVEY OF THE  
GREAT LYELL, EAST DARWIN

and COMSTOCK AREAS,

Queenstown, Tasmania

by

D.L. Rowston

Plates 4A and 4B are attached to copy with Dr. Scott, L.E.E. House.

EAST DARWIN AREAA. Introduction

The East Darwin area is located on the steep eastern slopes of Snake Peak, which is about  $1\frac{1}{2}$  miles north of Mt. Darwin and 12 miles south-south-east of Queenstown (see inste, Plate 1). Access to the area is by a vehicle track along the old Kelly Basin railway line to the Darwin town site, and from there by pack track up to the peak. It takes about two hours to travel the 20 miles by road, whereas the direct air route from Queenstown occupies only ten minutes by helicopter.

The area has the characteristic topography of the West Coast Range Conglomerates, but in spite of its rugged nature proved to be suitable for geophysical work. Most of the area surveyed has an average slope of 25 degrees, and rises to the foot of the conglomerate cliffs surrounding the peak. Patches of dense bauera scrub and the heavily-timbered sides of the Allan Creek ravine were the worst hazards.

B. Mining History and Geology

Mining activity in the locality commenced in 1897 and continued until the Crotty smelters closed in 1903. As a result of this prospecting activity several adits were driven into the mineralised zones at East Darwin but, although some of them are still accessible, the workings are covered by a thick limonitic slime, which obscures the lode material. Douglas sampled the adits in 1940 and a further examination of the copper prospects was made by Company geologists in 1955. The recommendation resulting from the 1955 geological survey was that further investigations be made using geophysical techniques.

The stratigraphic sequence and rock types are similar to those in the Mt. Lyell area, but the shearing and  $N60^{\circ}W$  repetition folding are not as pronounced. The sheared Cambrian sediments are overlain by Ordovician (Owen) conglomerates and limestones which are in turn overlain by Silurian shales and quartzites. The dominant structure is a local syncline pitching north-west which is cut off in the south-east by a steeply dipping fault. The fault strikes  $N10^{\circ}W$  and dips at  $80^{\circ}$  to the west. As a result of the movement, the schists to the east have been upthrown several hundred feet. Surface sulphide mineralisation containing some copper extends in sheared rocks for about 2,500 feet in a narrow north-south zone along the Lyell Shear. Chloritisation and secondary silicification of the schists are well advanced.

The most favourable environment for mineralisation is along the contact fault; Souter's workings disclose blocky chalcopyrite in pyrite at the contact. Elsewhere, pyrite is finely disseminated in highly siliceous chloritic schist along the conglomerate contact. Hematite occurs in blebs and stringers along the schistosity planes but does not appear to be admixed with the pyrite. The assay values of samples taken by Douglas do not agree with the high values mentioned in earlier reports (Hills, 1914). In Souter's workings, the assays over the best five-foot to ten-foot section show a maximum of 1.17 per cent copper. The sampling omitted the random lumps of blocky chalcopyrite which assay between 20 and 36 per cent copper.

Dillon's No. 1 Tunnel, sampled in 5-foot sections, showed 1.71 per cent copper between 175 and 180 feet from the portal, but the remainder of the tunnel between 90 and 190 feet averaged only 0.3 per cent copper. In pearce's workings, the last 60 feet of the main adit averaged 0.15 per cent copper and the north drive in mineralisation only 0.2 per cent over the 70 feet sampled.

C. Geophysical Operations

The East Darwin survey was made over a strip of ground about 1200 feet wide, from Camp Creek in the north to Souter's workings on the edge of the Allen Creek ravine, a distance of about 2,400 feet (see Plate 4a). During the survey, the party camped on the site. The Bristol helicopter

was used to transport the geophysical and camping equipment from the old Darwin town site to the area and, when available, to deliver supplies.

Initially, a grid baseline, 800W, was laid on a true bearing of  $345^{\circ}12'$ . Traverses at 200-foot intervals and at right angles to the baseline were pegged where possible every 25 feet from 300W to 1500W. Because of thick bauera scrub and dense timber in the east and south, some traverses were limited to the essential sections determined by the geophysical results. The grid is shown on Plate 4a with traverses from 200N to 2200S. The relationship of the geophysical grid to the earlier plane-table survey made by the Company in 1955 is also shown.

Electromagnetic (Turam), self-potential and magnetic methods were employed. A frequency of 880 cycles per second and 100-foot coil separation were selected for the Turam technique after examination of the profiles obtained using 440 and 880 cycles per second on test traverses 800S and 1000S. The self-potential survey was unsuccessful; the readings were somewhat erratic due to poor contact conditions caused by a peaty surface layer, and no significant indications were disclosed. Vertical magnetic force observations were made on traverses 200N to 1600S, but the remaining three traverses were omitted because of the lack of significant variations on the adjacent traverses and the difficulties experienced in setting up the instrument in the tangled undergrowth.

#### D. Results and Interpretation

Geophysical indications were obtained by both the electromagnetic and magnetic methods and are shown on Plates 4a and 4b. Plate 4a shows the geophysical grid and the electromagnetic and magnetic indications, the topographic features and contours, and the East Darwin workings; Plate 4b shows the Turam phase contours.

It is considered that the Turam results reveal the extent of the sulphide mineralisation, and that the magnetic variations are associated with patchy hematite occurrences adjacent to the sulphide zone.

Three indications were delineated by the Turam method; they are apparent only in the phase-difference readings. Consequently, the indications represent zones of moderate to low conductivity but nevertheless are well defined. All the electromagnetic indications occur over highly silicified schists containing disseminated pyrite and are ascribed to the higher conductivity of the sulphides.

The three indications are designated Anomalies 1, 2 and 3 on Plate 4b.

Anomaly No. 1 is located over Souter's section and is a very limited lenticular anomaly about 200 feet long. The anomaly is elongated parallel to the schistosity, and is associated with either the sulphide mineralisation or the contact fault. Electromagnetic anomalies are frequently associated with shears but in this instance there is no extension northwards beyond 1900S to correspond with the mapped continuation of the fault zone. Moreover, the areal extent of the anomaly agrees with the mineralised area exposed in Souter's adits, and the sulphides are therefore considered to be the most likely cause of the anomaly.

The indication is very weak on traverse 2200S and because of dense vegetation and the lack of geophysical evidence suggesting a continuation southwards, further investigations in that direction were not considered to be warranted. The main adit and drive along the contact in Souter's workings did not intersect payable mineralisation.

Anomaly No. 2 is the strongest of the electromagnetic indications obtained in the area. The phase difference contours show a narrow lenticular anomaly about 700 ft. long which has its maximum value at 825W on traverse 1400S. The indication arises from a near-surface source with its southern limit near 1600S and extending with a northerly strike and increasing depth to 1000S. Geological mapping revealed that the local structure is a north-pitching syncline and further confirmation of the pitch is obtained from the different levels of Dillon's and Pearce's workings.

Dillon's No. 1 Tunnel, below the maximum of the phase indication, is at a depth of 100 feet and shows pyrite in a siliceous chloritic schist. A similar body is exposed in Pearce's adit below the northern end of the anomaly. The Underground workings are shown on Plate 4b in relation to the geophysical indications. Pearce's tunnel investigated mainly the northern end of the anomaly and did not extend far enough to test the southern end.

North of Anomaly No. 2, the Turam results show no well defined anomaly but a slight increase in conductivity.

Anomaly No. 3 is a weak indication which is also attributed to pyrite mineralisation. Several costeans in the locality show pyrite.

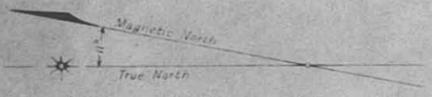
Results of the magnetic survey show a general magnetic high to the west of the base line, with two closures of over 300 gammas, which are shown on Plate 4a. The anomalies bear no obvious relation to the electromagnetic anomalies, and there is no reason to suppose that they have any connection with sulphide mineralisation. They are probably due to accessory iron oxide minerals, occurring as blebs and stringers along the schistosity planes of the sheared sediments.

E. Conclusions and Recommendations

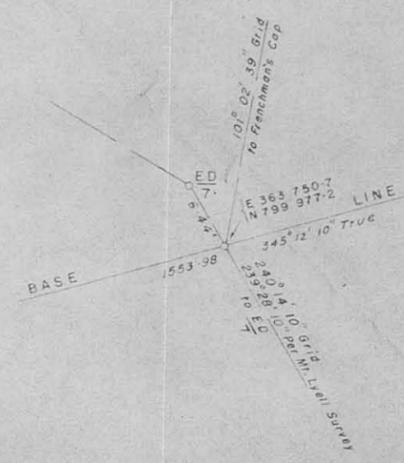
The geophysical anomalies located at East Darwin by the Turam and magnetic methods are attributed to sulphide mineralisation and hematite respectively. The concentrations of magnetic minerals are distinct from the sulphides and seem to have no commercial significance. Three indications were obtained by the electromagnetic technique and these outline the extent of the mineralisation in the area. Two of the indications, Anomalies 1 and 3, suggest that the sulphides associated with them are very limited in extent. Anomaly No. 1, over Souter's workings, indicates that, although the geological environment is favourable, the patchy mineralisation is restricted to the immediate vicinity of the adits and is unlikely to extend further south. In the light of Douglas' assays of samples from Suter's adits it is considered that further examination of Anomaly No. 1 is unnecessary.

The strongest indication in the area, Anomaly No. 2, has been intersected at depth by Pearce's and Dillon's adits, which show that the disseminated sulphides to which the indication is attributed are about 80 feet wide. The geophysical results indicate that the ore body is about 700 feet long. Pearce's adit has not been extended far enough to the south to examine the strongest part of the indication. If the assay results in the known sections are not too discouraging, it is recommended that the south drive of Pearce's adit be extended for another 250 feet to determine whether the copper values improve. However, the systematic sampling carried out by Douglas in 1940 is perhaps adequate for an assessment of the indication.

As there are no other geophysical anomalies that can be correlated with mineralisation, no further recommendations are made for testing the area.



CABLE LINE (extended 1000' each way from -200N & 2200S)

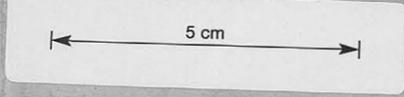


PEARCES SEC. 4654

DILLON'S No. 1

SOUTERS SEC. 4615 M

378006



SCALE IN FEET  
CONTOUR INTERVAL 50'

- LEGEND
- ADIT
  - SHAFT
  - COSTEAN
  - TRACK
  - CONTACT
  - CREEK
  - ELECTROMAGNETIC INDICATIONS (-4" contour)
  - MAGNETIC ANOMALY (300' contour)

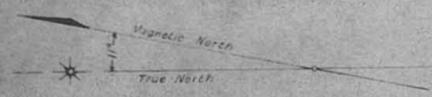
GEOLOGY BY M. L. WADE MT. LYELL M & R CO. LTD.

GEOPHYSICIST *B. H. Houston*

GEOPHYSICAL SURVEY AT MT. LYELL,  
QUEENSTOWN, TASMANIA  
EAST DARWIN AREA

GEOPHYSICAL GRID, INDICATIONS,  
TOPOGRAPHY AND GEOLOGY

004



CABLE LINE (extended 1000' each way from -200N & 2200S)



BASE LINE  
345° 12' 10" True

BASE LINE

SOUTERS  
SEC. 4615 M

PEARCES  
SEC. 4654

DILLON'S No. 1

ANOMALY No. 2

ANOMALY No. 3

ANOMALY No. 1

LEGEND

- ADIT
- SHAFT
- COSTEAN

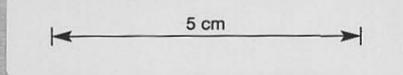
GEOPHYSICIST *R. Houston*

378007

SCALE IN FEET



CONTOUR INTERVAL 1 DEGREE



GEOPHYSICAL SURVEY AT MT. LYELL,  
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EAST DARWIN AREA

TURAM PHASE CONTOURS

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