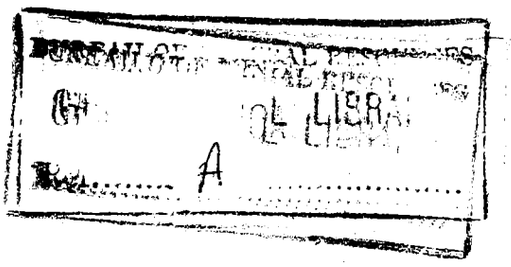

Geophysical Survey of Copperhead Mine, Bullfinch, W.A.

L.A. Richardson

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DEPARTMENT OF SUPPLY & SHIPPING

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

REPORT NO. 1947/3

GEOPHYSICAL REPORT NO.1947/1

PLANS NO. G5 & G6

GEOPHYSICAL SURVEY OF COPP RHEAD MINE, BULLFINCH, W.A.

BY

L.A. RICHARDSON

GEOPHYSICIST

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T A B L E O F C O N T E N T S

PLANS

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G6. Plate showing Geomagnetic Vertical Force Profiles.

GEOPHYSICAL SURVEY OF COPPERHEAD MINE, BULLFINCH, W.A.

I. INTRODUCTION

The question of a geophysical survey of the Copperhead mining property at Bullfinch was first discussed with Western Mining Corporation officers at Kalgoorlie on 29th August, 1946. It was then stated that there was need for a geophysical survey to determine the detailed structure of the jaspilite bodies over a small area concealed by tailings at the eastern end of the jaspilite zone.

As a preliminary step, arrangements were made for Mr. J.C. Dooley to complete some test traverses on the area to determine the order of the magnetic effects produced by the known jaspilite bodies which in some parts are the gold ore-bodies. These tests were made on 10th September and showed that strong anomalies were associated with the main jaspilite bodies, while on the small area at the eastern end no pronounced anomaly was found.

Following further discussion with W.M.C. officers on 29th November, it was decided that a detailed survey over the main Copperhead property should be conducted immediately as the company had commenced a vigorous testing campaign there.

The survey was made by the writer during the period 4th to 11th December, using a Watts Vertical Force Variometer. The pegging of traverses necessary was carried out by members of the W.M.C. staff.

The results were shown to Mr. Clappison of W.M.C. on 12th December and arrangements were made for a plan showing available surface geological mapping to be forwarded to Melbourne. This was received by the writer on 4th February.

II. GEOLOGY AND NATURE OF THE PROBLEM

The following geological notes are extracted from the report entitled COPPERHEAD SYNDICATE, BULLFINCH, YILGARN GOLDFIELD, by R.S. Matheson, B.Sc. and published in the Report of Department of Mines, Western Australia, for the year 1938. -

> "The Copperhead group of leases are situated in an area of highly metamorphosed, interbedded greenstones, jaspilites and erosion sediments which are presumably of the Pre-Cambrian age and the country grades eastwards into replacement gneiss of granitic origin. The rocks are contorted and have a general strike N.N.W. and a general dip 60 degrees W.S.W.
>
> Three types of ore bodies have been mined on this property. Jaspilite lodes, Yellow lodes and Dolomite lodes. The Jaspilite lodes have been formed by the mineralisation of the jaspilite and the injection of auriferous quartz veins presumably emanating from a granite magma. The quartz veins have penetrated the jaspilite where it was fractured, sheared and contorted during folding. The ore shoots occur mainly in the crests and troughs of the dragfolds and are generally absent in the limbs.
>
> Between the surface and the No.2 level (210 ft. V.D.) the weathering of the country rocks has been extensive, and the jaspilite appears mainly as a rock composed of alternate bands of quartzite and iron oxides (hematite, limonite and magnetite.) In some places in this zone, however, owing to leaching by surface waters, the iron oxides are absent, and the jaspilite is represented by a white friable quartzite.

At the No.2 level, where the action of weathering is diminishing, the jaspilite changes to a laminated rock, with alternate bands of quartzite and ferromagnesians (amphiboles and pyroxenes) which can only be distinguished with difficulty from the enclosing greenstones. The sulphide zone commences at about the No.2 level. Blatchford (G.S.W.A. Bulletin No.71, p.81) states that the sulphides are galena and various sulphides of iron, chiefly pyrites, but probably some marcasite and pyrrhotite. The ore bodies locally known as the "Discovery Lode" or "Southern Series", the "Main Lode" and the "Watershaft Lode" are all mixtures of Jaspilite and Yellow lode material.

The Yellow lodes exist only above ground water level and consist of secondary enriched decomposed greenstone schist, which is intersected with auriferous quartz veins and stringers.

As is expected of a lode of secondary origin, the shape of the ore bodies is very irregular and the distribution of the values erratic.

The Dolomite lode occurs on the stratigraphic footwall of the northern band of jaspilite and is locally known as the "Northern Series". It consists of a mixture of granitic quartz and dolomite which is associated with minor amounts of greenstone lode material. The dolomite lode appears to have been the most consistent ore body in the mine, and has been worked from the surface to the bottom level (510 feet V.D.). The sulphide zone commences at about 210 feet level and as in the case of the Jaspilite lodes, the sulphides have a close association with the gold."

The geological information supplied by Mr. Clappison and shown on the accompanying plan, is the result of his recent surveys and consists of a surface plan showing the known jaspilite outcrops on the "Southern Series" of jaspilite only.

III. RESULTS OF THE SURVEY

The accompanying plan and sheet of profiles show the complete results obtained. The magnetic contours on the plan (lines of equal vertical force) show the form and distribution of the major anomalies due to deep-seated bodies and of certain minor irregularities of shallow-seated origin. The sheet of profiles shows vertical force profiles across the 3 major anomalies and along certain traverses. In certain disturbed parts the profiles along the traverses have been smoothed to separate the shallow-seated from the deep-seated effects and the smoothed profiles have been used in completing the contours in these parts. Such contours are shown by broken lines.

On certain parts of the area, notably near the office, main shaft and the battery, adequate observations could not be made due to the abundance of scrap-iron, galvanised-iron buildings etc.

It is assumed that the major anomalies and most of the minor anomalies (the shallow-seated ones) are due to jaspilite bodies because they occur on the known line of jaspilite and this material is known to be commonly strongly magnetic due to its magnetite and perhaps pyrrhotite content. Some specimens from near the primary zone were tested and showed strong remanent magnetisation. All greenstone specimens tested in the field exhibited very low magnetisation.

Tests made on specimens from outcropping jaspilite showed that the magnetic properties of the oxidised jaspilite varies between very low and very strong. It is expected that drill core specimens of jaspilite will be available later for measurement of their magnetic properties.

(1) The Major Anomalies

The three major anomalies probably serve to localise the principal deep seated bodies of jaspilite which appear to have a lenticular arrangement along the southern arm of the known jaspilite line.

No.1 major anomaly centred at about 100S/00 and rudely spherical in shape may be due to a plug-like or thick lens of jaspilite of considerable size. It is unlikely that the sub-surface portions of the thin and tortuous outcropping bed of jaspilite nearby, has contributed much to this anomaly although it may be a part of the greater mass of jaspilite which presumably exists at depth and is responsible for the greater part of the anomaly. The profile across this anomaly plotted from the contours is of irregular shape presumably largely due to the effects of nearby relatively shallow-seated bodies of jaspilite. A calculated profile for a spherical shaped body magnetised by induction in the earth's field (Inclination 65 degrees S) and centred at a depth of 350 feet, is shown which would agree in general form with a very severely smoothed version of the measured profile. It is considered that the agreement that does exist is enough to suggest that the mass of jaspilite responsible is centred at about a depth of 350 feet from the surface.

The anomaly body could be explored by drilling a vertical hole at 100S/00 or an inclined hole from the north or south side designed to cut the point 350 feet below the surface at 100S/00.

No.2 major anomaly, centred at 515N/520W is apparently due to an elongated lens of jaspilite of considerable dimensions. In fact it may be largely due to the unoxidised portion of the large lens of jaspilite recently mapped by R.J.S. Clappison and shown on the accompanying plan. If so the relative position of anomaly centre and outcrop centre might be assumed to indicate a westerly pitch affecting the jaspilite of the Southern Arm.

Profile 2 is taken from the contours across this anomaly and is shown together with a calculated profile for a spherical shaped body magnetised by induction in the earth's field (Inclination 60 degrees S) and centred at a depth of 350 feet. The agreement is fair but the shape of the body responsible is obviously far from spherical, as shown by the contours, and the depth figure of 350 feet should be regarded only as a very approximate figure.

Exploration of the central part of this anomaly could be made with an inclined drill hole from the north or south side and designed to cut the point 350 feet below the surface at 475N/550W. The latter point is selected instead of the anomaly centre because theoretically the anomaly maximum measured at the surface is displaced northerly from the point vertically above the anomaly body, due to the inclination of the earth's inducing field. The decision to drill from the north side or the south side would no doubt be influenced by the available knowledge of the dip of the jaspilite bed. The form of the anomaly does not prove a dip one way or the other.

No.3 major anomaly, centred at 1185N/1050W presumably represents a third concentration of jaspilite along the southern arm. Profile 3 shows the form of the anomaly together with a calculated profile for a spherical shaped body magnetised by induction in the earth's field (Inclination 60 degrees S) and centred at a depth of 225 feet. The agreement is only fair. It is considered that initial exploration should be by drilling from the north or south side to cut the point 225 feet below 1170N/1055W.

The mass of jaspilite responsible for this anomaly is probably considerably smaller than the bodies producing Nos.1 and 2 anomalies.

(11) The Minor Anomalies

The accompanying sheet of profiles shows most of the minor anomalies located. These are numbered on the profiles and the plan, A1, A2, B1, B2 and so on. Other minor anomalies indicated by the contours are numbered 1, 2 and 3. The position of all minor anomalies is shown on the plan by crosses.

It is clear that the survey has failed to trace some of the known narrow bands of outcropping jaspilite. This suggests that all these bands are not strongly magnetic in the oxidised parts. The survey therefore is unable to supply information necessary to complete all gaps in the geological mapping of these jaspilite bands. Certain prominent minor anomalies of possible importance are present, however, and no doubt more could be obtained if certain areas were free from iron buildings and scrap iron.

In the analysis of the minor anomalies, as in the case of the major anomalies, it is assumed that jaspilite is responsible in all cases because no other formation with the necessary magnetisation is as yet known to exist on the area. Future investigation may reveal that bands of greenstone or other rocks are responsible for some of the minor anomalies.

Anomaly A1 is of small magnitude and as shown by the magnetic contours, is apparently part of an anomaly zone extending from Traverse A to 300S/300W. The apparent course of this anomaly is shown on the plan by a line of crosses. Shallow testing by costean or shaft may be practicable where the anomaly crosses Traverse A, i.e at 006N/588W. Elsewhere it is considered that deep exploration may be desirable in the first instance and this could be achieved by a drill hole suitably sited to also test No.1 major anomaly at depth. Such a hole would be one started at 290S/375W and inclined 45 degrees in the direction 62 degrees (mine azimuth).

Anomaly A2 is one of the most pronounced minor anomalies located and it is believed to be due to a fairly shallow seated bed of jaspilite of appreciable width. Because anomalies B2 and C2 are comparable in dimensions and their positions line up well with that of A2 it is assumed that these anomalies are due to the same bed. This line of anomaly could not be traced any further east or west due to the presence of iron buildings and other iron objects on the surface. For the same reason satisfactory observations could not be made along the line of this anomaly between traverses B. and C.

Testing of this anomaly might be successfully accomplished by means of a shallow shaft or even a costean and the point 130N/480W is recommended for such purpose. It may be most convenient to test the anomaly at depth from the 100 feet level by crosscuts or by diamond drilling.

Anomaly 3 is presumably due to a strongly magnetic part of the main outcropping jaspilite.

Anomaly 4 is probably due to the narrow jaspilite band outcropping nearby.

Anomaly 5 may represent the extension of the narrow jaspilite band shown leaving the open cut at the point 120 feet westerly from the position of this anomaly. However, no similar anomaly was found on the invervening N-S (mine azimuth) traverse.

Anomaly B1 is identical with anomaly A1.

Anomaly B2 (see anomaly A2 description)

Anomaly C1 is of small intensity and may be due to a separate narrow bed of jaspilite. It could be tested by a costean centred at 170N/457E.

Anomaly C2 (see anomaly A2 description).

Anomaly C3 is apparently due to a strongly magnetic part of the outcropping jaspilite.

Anomaly D1 may be due to the extension of the jaspilite bed shown mapped nearby. If so, it might be assumed that this jaspilite bed passes through the northern edge of the Watershaft open cut. Its subsequent course is not definitely determined by the survey.

Anomaly 1 could not be measured in adequate detail due to the presence of iron debris from a wrecked house. However, on the basis of results available it is fairly clear that there is a lens shaped anomaly of low intensity and fairly deep-seated origin centred at 1050N/235E. It is probably due to a lens of jaspilite of appreciable dimensions. Such a body of jaspilite may represent the extension of the northern series of jaspilite deposits. Initial testing of this anomaly is recommended by drilling vertically at 1050N/235E.

Anomaly 2 is an isolated anomaly found on traverses 800 N and 700 N. at 350 W and 375 W respectively. Additional observations are required to completely outline the anomaly which, on available evidence, appears to be shallow seated and an examination of the abovementioned site may reveal some outcropping or near-outcropping jaspilite.

Anomaly 3 occurs at 400S/700W and may be due to a narrow band of jaspilite. The anomaly presumably extends beyond the area of survey and additional work should be completed to trace it further and locate its centre.

IV. CONCLUSIONS

The geophysical survey has located 3 major concentrations of magnetic material on the southern arm of the known jaspilite line. This material will undoubtedly prove to be jaspilite. There is no evidence of comparable concentrations on the northern arm of the jaspilite but there is one minor anomaly of possible importance on this arm. It is likely that additional concentrations would be found by extending the survey along the known lines of jaspilite. It is believed that the survey results will prove a useful guide to exploration by localising the diamond drilling necessary to test the jaspilite bodies and adjacent parts at depth. A number of minor anomalies have been located which may prove to be important. It is considered that the survey should be extended easterly to the granite contact as well as westerly along the known lines of jaspilite.

The results demonstrate clearly how the jaspilite bodies of the Yilgarn and no doubt of other Western Australia goldfields, may be traced by geophysical survey.

L.A. Richardson

(L.A. RICHARDSON)
Geophysicist.

Melbourne, 21st February, 1947.

COPPERHEAD MINE
BULLFINCH, W.A.

GEOPHYSICAL SURVEY PLAN

SHOWING

GEOMAGNETIC VERTICAL FORCE CONTOURS

AT INTERVALS OF 100 GAMMAS

SCALE: 100 FEET TO AN INCH

Data supplied by Western Mining Corporation.

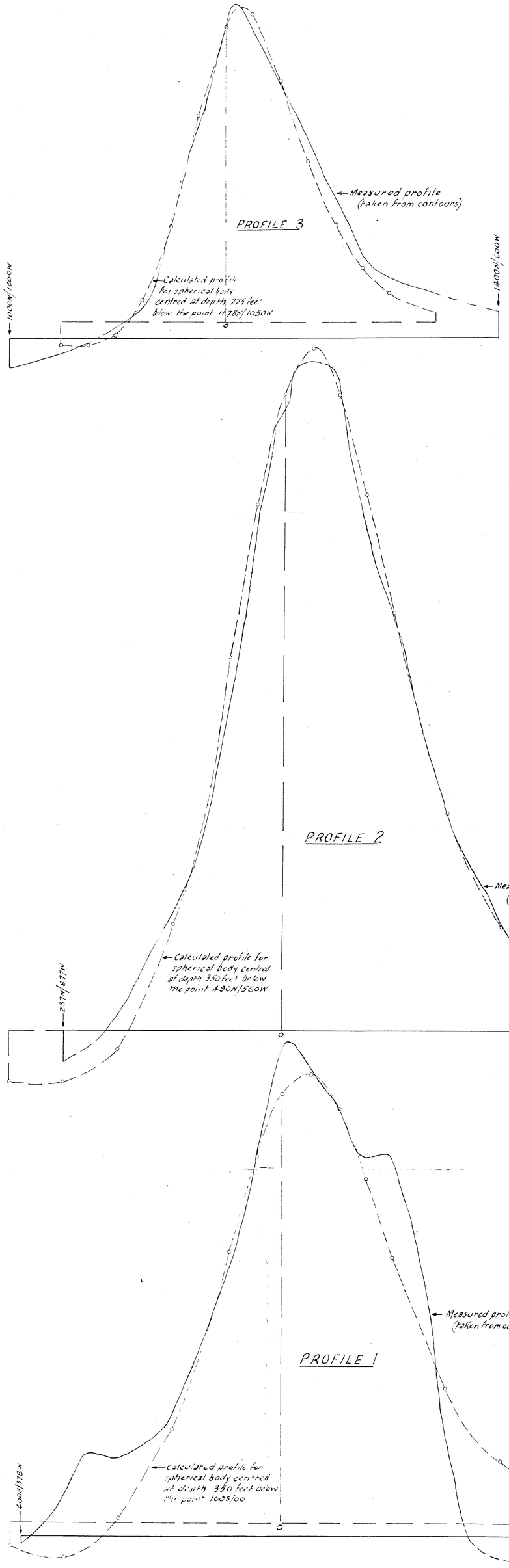
Fosgrlife outcrops definite /// doubtful ///

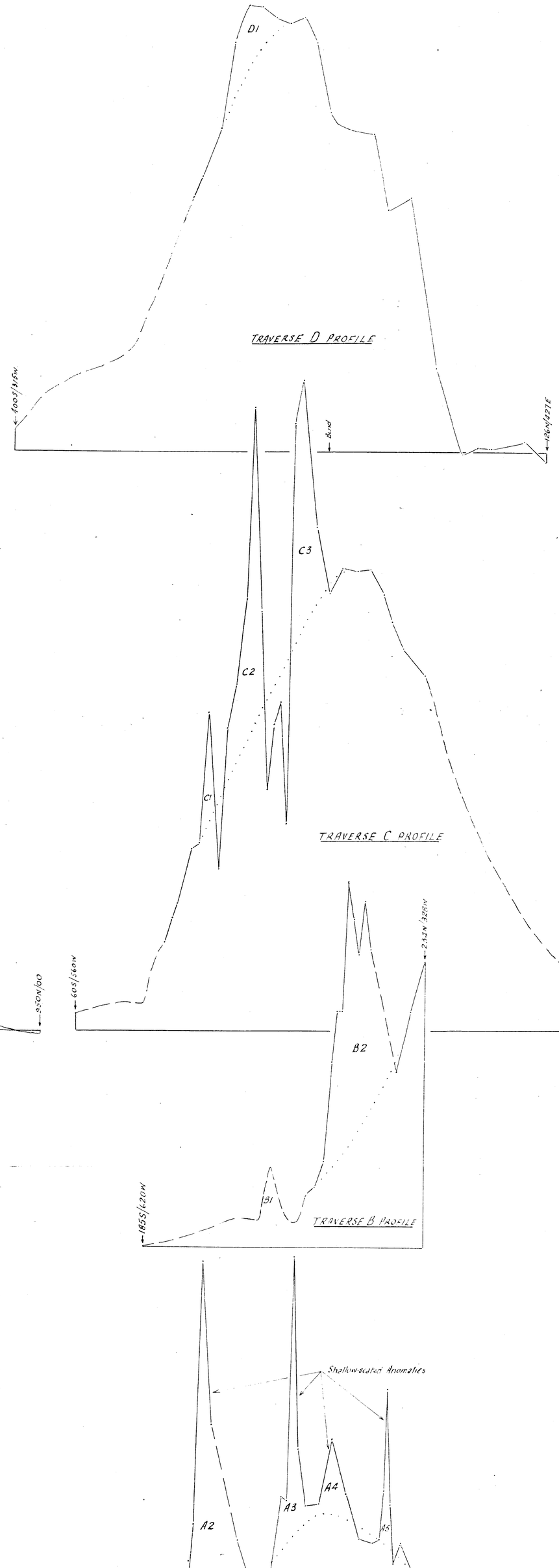
Open cuts,

Axis of Minor Anomaly shown thus: xxx

L.A. Richardson 21/2/47

G. 9.





COPPERHEAD MINE
BULLFINCH, W.A.
GEOPHYSICAL SURVEY

PLATE SHOWING GEOMAGNETIC VERTICAL FORCE PROFILES ALONG LINES INDICATED ON ACCOMPANYING PLAN

SCALES: Plan 0 100 200 300 Feet; Profiles 0 100 200 300 400 500 600 Gammas

L.A. Richardson 21/2/47

G.10.