953/15
copy 3

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

RECORDS 1953, No. 15

GEOPHYSICAL TEST SURVEY AT LIONTOWN, NEAR CHARTERS TOWERS, QUEENSLAND

by

J. HORVATH

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

RECORDS 1953, No. 15

GEOPHYSICAL TEST SURVEY AT LIONTOWN, NEAR CHARTERS TOWERS, QUEENSLAND

by

J. HORVATH

CONTENTS.

ILLUSTRATIONS.

PLATE

ABSTRACT.

This report describes a geophysical test survey made in September 1952, at the request of the Queensland Department of Mines and Mines Exploration Pty. Ltd., over an area measuring 750 feet by 1,000 feet in the Liontown area, about 28 miles south-west of Charters Towers, Queensland. The existence of a lead lode was known, because of its exposure in some inclined shafts, and this test survey was made to determine if the geophysical methods used could locate the exact position of the known lode, the ultimate object being, if the test survey were successful, to extend the investigations over a greater area. Self-potential and electromagnetic methods were used.

A fairly strong indication, with an easterly strike, was recorded by the electromagnetic method at a position coinciding with the known lode, but no clear anomaly was recorded there by the self-potential survey. An even stronger electromagnetic anomaly, also with an easterly strike, was recorded about 300 feet south of the known lode, and was continuous from one end of the surveyed area to the other. The only self-potential anomaly of any importance was recorded between the two electromagnetic indications and is probably due to a quartz reef with pyrite mineralisation.

The results show that the test was successful, in that the known lead lode was clearly indicated, and it is recommended that the survey be extended over a greater area to determine the full extent of the mineralisation. A target for a diamond drill-hole is also suggested, to determine the cause of the high electrical conductivity in the southern part of the area.

GEOPHYSICAL TEST SURVEY AT LIONTOWN, NEAR CHARTERS TOWERS, QUEENSLAND.

1. INTRODUCTION.

Mines Exploration Pty. Ltd., (Broken Hill South) in a letter dated 27th June, 1952, approached the Queensland Department of Mines and the Bureau of Mineral Resources requesting a geophysical survey to be made on their Prospecting Area at Liontown, near Charters Towers, North Queensland.

At the time of survey, Mines Exploration Pty. Ltd. had an option over two leases; the first one, "Liontown", was held by G. Parsons, and the second, "New Queen", was held by J. Olsen. Mines Exploration Pty. Ltd., however, also had authority to prospect an area of 6 miles by 2 miles around these two claims.

The Liontown area (see Plate 1) is situated about 28 miles south-west of Charters Towers. The area is reached by travelling 15 miles along the highway towards Clermont, and then branching off in a westerly direction along a good track leading to several homesteads and to the mining field. Liontown was once (1905-1911) a small centre for gold and copper mining and although the occurrence of lead was reported at that time, it was not regarded as being of any economic value. At the time of the geophysical survey, however, the prospecting activity was directed towards developing the lead ore discovered by G. Parsons.

Mines Exploration Pty. Ltd. asked for a test survey over a very limited area, where the occurrence of a lead lode is known through its exposure in some inclined shafts. These, however, were rather shallow, none of them having reached 60 feet in depth.

The test survey was made between 1st and 11th September, 1952, by a geophysical party consisting of J. Horvath and K. Tate. The party was shown over the field by J.G. Banks (Inspector of Mines at Charters Towers), who gave valuable assistance in the preparatory stages.

All the necessary pegging, surveying and levelling was done by the Queensland Survey Branch of the Commonwealth Department of the Interior. A small survey party consisting of surveyor D.A. Ellinson and a chainman was attached to the geophysical party and carried out its work in a very expeditious and efficient manner.

2. GEOLOGY.

The lead ore apparently occurs in lenticular form along a line of lode striking east, with a dip of about 60° to the south. The ore deposit appears to be conformable with the surrounding mica schists which are probably of Cambrian age.

There are two inclined shafts, and these represent the main workings on the lode. One, the "Liontown", sunk by Parsons, had reached a depth of 46 feet along the underlay at the time of the survey and the "New Queen", sunk by Olsen, had reached a depth of 57 feet. Some open-cuts and trenches also exist but the prospecting work done had been restricted to a very shallow depth. It is not surprising therefore that the lead ore encountered up to that time consisted of oxidised and carbonate ore only. No sulphide ore had been found, and zinc was absent, but the accompanying gold and silver ores are of some economic importance. The erratic but comparatively high gold values are probably confined to the zone of oxidation only.

The "Liontown" and "New Queen" shafts are only 240 feet apart, and as a result of these workings the lead mineralisation is known to extend at least over that length. Lead has also been reported in the main shaft of the Carrington Copper-Gold Mine, in the hanging wall of the gold lode. The main shaft, and the No. 2 shaft where some lead has also been reported, are about 4000 feet east of the new lead discovery. This suggests that the lead mineralisation may possibly extend over a considerable distance.

The test survey was carried out over an area measuring 750 feet x 1000 feet, in which there are some old shafts sunk in a gold lode situated about 200 feet south of the new lead lode. The exact relationship of the new lode to the Carrington main lode is not certain, as several thousand square feet of ground covered by alluvium separate the two mining areas.

Thus, a rather large area of perhaps 10,000 feet x 3,000 feet appears to be mineralised, but the degree and nature of the mineralisation is not known at present. For this reason Mines Exploration Pty. Ltd. were considering requesting a geophysical survey covering the whole area, if the test survey proved that the lead lode can be detected by geophysical means. The extensive alluvial cover largely precludes geological observation.

Only in the area between the two shafts and a little farther along the strike were the extent and quality of the ore known. Even there the geological information was far from complete, as the known mine workings were confined to the shallow inclined shafts and a few open-cuts along the line of lode. No crosscuts had been made, and it was not known whether the lead mineralisation is confined to the few feet then being developed and stoped, or if it continues into the hanging wall.

3. GEOPHYSICAL METHODS.

As some magnetic profiles had previously been run by Mines Exploration Pty. Ltd. without revealing any significant results, the geophysical work in the 1952 survey was confined to the use of electromagnetic and self-potential methods.

(a) Self-potential method.

In self-potential work, the potential difference is observed between a front electrode, moved from point to point along the traverses, and a stationary rear electrode. Where no marked electro-chemical activity exists beneath the surface these potential differences are quite small. If a sulphide body is present and is in the process of oxidation, it is usually accompanied by electro-chemical action which gives rise to electric potentials in the body and in the area surrounding it. Above the body itself the strongest negative potential values are found, and these constitute what is known as an "anomaly". It is well known, however, that not all self-potential anomalies are due to sulphide bodies.

In order to avoid the disturbing influences of high contact resistance between the electrodes and the surface of the ground, a direct-current potentiometer with a high internal resistance (i.e. a vacuum-tube voltmeter) was used in the survey.

(b) Electromagnetic method.

In the electromagnetic method an alternating current from a generator is passed through a large rectangular loop of wire on the ground. The current produces, in the area surrounding the loop, a primary magnetic field which is directed vertically at the earth's surface. If, in the neighbourhood of the loop, there are any regions of high conductivity such as sulphide bodies, secondary currents will be induced in them. These in turn will give rise to secondary magnetic fields having both vertical and horizontal components. The total magnetic field observed at any point is the resultant of the primary and secondary fields. An important point concerning the secondary fields is that they are out of phase with the primary field; thus the electromagnetic method of detecting conducting bodies really becomes a search for these out-of-phase components.

The amplitude and the phase relations of both vertical and horizontal components of the resultant field are observed along traverses pegged at right angles to one long side of the rectangular loop. These measurements are made with a search coil, consisting of a large number of turns of copper wire, which is set up at regular intervals along each traverse. The E.M.F. produced in the search coil by the resultant field is measured in both vertical and horizontal directions on an A.C. potentiometer. This measurement determines the "in-phase" vertical and horizontal components (called the "real" components), and the "out-of-phase" vertical and horizontal components (the "imaginary" components).

As indicated above, the values observed are those of the resultant electromagnetic field comprising both the primary and secondary fields. Since the former can be calculated and subtracted from the observed values, the difference between the observed and calculated values represents the components due to secondary currents set up in the buried conducting bodies.

These components are plotted as profiles, the "out-of-phase" components being mainly due to the secondary currents set up in the good conductors underground. The profiles have a characteristic shape, depending on the depth, form and electric conductivity of the buried conductor. For the purpose of interpretation, these components are most conveniently plotted in the form of vector diagrams, as described in Section 4(b).

The final interpretation of the electromagnetic indications, using profiles and vector diagrams, gives a fairly accurate estimate of the location and possibly the shape and depth of conducting bodies in the ground, provided such bodies are not at too great a depth. The interpretation may not, however, show the presence of ore bodies only, since other geological features such as shear zones, faults and strongly graphitic schists also show higher electrical conductivity than the surrounding rock.

The geological interpretation of the geophysical indications must also take into account such factors as strike, dip and shape of the conducting bodies and their relative conductivity. Very rarely is it possible to differentiate these factors so accurately that the exact cause of the electric indication can be traced, and it is usually necessary to put down a drill-hole, trench or prospecting shaft in order to discover whether the indication is caused by a payable ore body, some uneconomic mineralisation, a fault, a shear zone or other similar geological feature. However, a careful investigation of the known geology, combined with the interpretation of the geophysical results, should give some indication of what can be expected.

4. RESULTS OF THE GEOPHYSICAL SURVEY.

The test survey was made mainly for the purpose of discovering whether any indications could be obtained from the known lead lode, and was accordingly confined to a limited area.

The results of the survey are shown on Plates 2 to 7.

Plate 2 shows the geophysical traverses and observation points, the various mine workings and other features such as tracks and lease boundaries.

The base line was laid out along the northern boundary of the area at a bearing of 82°28' magnetic, and the following traverses, each 1,000 feet long, were laid out and surveyed:-

200.E, 100.E, 00, 100.W, 200.W, 300.W, 400.W, 550.W.

All traverses were surveyed by self-potential and electromagnetic methods, with the exception of traverse 200.W on which only the electromagnetic method was used.

Traverse 00 was laid about 20 feet west of the "New Queen" shaft, with the point 500.S situated directly on the outcrop of the lead lode. The "Liontown" shaft is about 220 feet west of traverse 00. It is also at about 500.S, since the base line was laid out parallel to the strike of the outcrop.

(a) Self-potential Method.

The self-potential profiles are shown on Plate 3, and the contours on Plate 4.

Due probably to the dry lateritic surface soil and the charred remmants of bush fires, the self-potential observations are somewhat erratic, and little importance can be attributed even to rather large deviations from normal values where these are observed on one point only. The distance between observation points was therefore fixed at only 25 feet, in order that a better general trend of the profiles might be obtained by eliminating the erratic values due to local surface conditions. Furthermore, the precaution was taken of making two observations at each point, spaced about a foot apart. These checks have shown that, especially in some parts of the north-eastern and southern portions of the surveyed area, the self-potential values differ considerably between points only one foot apart. These differences are due solely to surface influences without any geological significance, but they make it difficult to obtain the true potentials caused by sub-surface features. In drawing the self-potential contours, these irregularities have been smoothed out as far as practicable.

The negative centre of a self-potential anomaly usually corresponds, in position, to the uppermost (oxidised) part of the sulphide body. The results of the present survey show that there is no clear self-potential indication associated with the outcrop of the lead lode which lies at about 500S. This is to be expected if no iron or zinc is present, as lead alone does not usually give rise to self-potential anomalies. The self-potential values at the outcrop are rather erratic but mostly positive, except on the most easterly profile (200.E) where pronounced negative values were observed. These, if they are real, might indicate that some pyrite or sphalerite is present in the lode material. Near "Liontown" shaft and further west the self-potential profiles are less erratic and also show no anomaly caused by the lead lode. The fact that no indications were observed over the lode outcrop near the two prospecting shafts shows that the self-potential method is unable to trace the lead lodes in the area.

A distinct self-potential anomaly can be observed, however, in the area 600.S to 700.S, between traverses 200.E and 100.W, and again in a corresponding position on traverse 550.W. Some potholes and shafts had been sunk on the line of this negative self-potential anomaly, and an examination of the mullock heaps indicates that some work was done on a quartz reef, probably a gold prospect, containing pyrite and chalcopyrite. The presence of these sulphide ores would explain the observed anomaly.

Although the sparsely disseminated sulphides might not seem encouraging as a prospect for a copper mine, the well-defined self-potential anomaly indicates that the sulphide mineralisation extends over a considerable length (200.E to at least 100.W) and is probably identical with that producing the fairly strong self-potential indication on the same line of strike on traverse 550.W.

As the most pronounced anomalies occur on the most easterly and most westerly traverses, it is possible that the reef continues outside the surveyed area.

An anomaly of moderate intensity was recorded between 400.S and 450.S on traverse 100.W. It is of small extent and does not appear to be associated with any mineralisation. It is probably due to surface conditions brought about by the presence of tailings.

(b) Electromagnetic Method.

The results of the electromagnetic survey are shown on Plates 2, 5A-5D, 6A-6C and 7.

Plates 5A to 5D show all four components of the electromagnetic field along traverses 00, 100.W, 200.W and 400.W respectively, these having been selected to show the results obtained in the vicinity of the lead lode. On Plates 5A, 5B and 5C the profiles show an indication about 50 to 75 feet on the hanging wall side of the lode outcrop (between 550.S and 600.S), the horizontal components showing a maximum at this position and the vertical components an inflection point. Although the indication cannot be characterised as strong, it is quite distinct, and can be recognised on all profiles from 200.E to 300.W, but the intensity and character of the indications are different from traverse to traverse. On most profiles the indication is sharp and suggests a shallow depth only, but on other profiles such as 200.W and 200.E, it is broader and suggests a greater depth.

The indications are more pronounced on the real than on the imaginary components, a fact which is in accordance with the presence of a good conductor. The secondary current induced in an "ideal" conductor is 180° out-of-phase with the primary current, so that the real component is most affected.

The displacement of the indication some 50 to 75 feet to the hanging wall side of the lode outcrop is due largely to the fact that the induced secondary currents originate mainly below the groundwater level, thus giving the position of the lode not at the outcrop, but at some depth. Another possible reason for this displacement is that the hanging-wall side is often more crushed and porous than the foot-wall side, and therefore holds more mineralised water with a low pH-value. This would increase the electrical conductivity and tend to displace the position of the indication towards the hanging-wall side.

To show this indication and displacement more clearly, profiles of all the real horizontal components are given together on Plate 7.

The indication is strongest on traverses 00 (at point 570.S), 100.W (at 550.S) and 200.W (at 575.S), although nowhere does it exceed one microgauss per ampere. The indication is weak on 100.E (at 570.S), but becomes stronger again on 200.E (at 550.S).

Towards the west it weakens on 300.W (at 580.S) and has disappeared altogether on 400.W. The reappearance of the indication on traverse 550.W (at 540.S) is probably due to an extension of the lode, as this point is approximately in the direction of strike of the lode.

A prominent feature of the electromagnetic profiles is the strong indication which can be followed from the eastern to the western end of the surveyed area between 800.S and 900.S. On traverses 00 and 100.W, the real horizontal component shows an anomaly of nearly 2 microgauss per ampere, this indication being more pronounced than that caused by the known lead lode. This feature is all the more noteworthy as, being broader, it is more deep-seated than the first indication and is also farther away from the cable. Furthermore it must, to some extent, have been subject to an electrical shielding effect from the known conducting body which lies between it and the cable. The shape of the profiles of the second anomaly shows that the conductor causing it dips rather steeply, probably to the south. As in the case of the lead lode, no self-potential anomaly was observed to correspond to this electromagnetic indication. The vertical component profiles confirm, though less strongly, the indication shown on the horizontal components.

Plates 6A, 6B and 6C show the vector diagrams of the horizontal components on traverses 00, 100.W and 400.W respectively. These diagrams were obtained by plotting the imaginary component as the abscissa and the real component as the ordinate, thus giving for each observation a certain point in the vector system. These points are then connected with each other to give the vector diagram, a careful analysis of which can give useful information on the influence of the general ground conductivity and the depth, size, shape, dip and conductivity of any good sub-surface conductor. Vector diagrams can also be plotted from the vertical components, but due to the overlapping of points these are more difficult to read and are therefore omitted from this report.

It should be noted at this point that, as a check on the results obtained by the inductive electromagnetic method using a horizontal loop, traverse 100.W was surveyed by the galvanic method using a grounded cable. The results of this grounded cable method are plotted on Plate 6B.

The vector diagrams all show the characteristic rapid variation from traverse to traverse previously referred to, although the axis of the indications from the known lead lode remains at almost a constant slope, indicating that the conductivity of the ore changes only slightly. The second indication, namely that between 800.S and 900.S, is also clearly shown on the vector diagrams, the steep slope of the axis suggesting fairly high electrical conductivity of the conducting body, although there are no geological factors to support the assumption that an ore body is the cause of the electrical indication. It may result from an ore deposit, a mineralised fault or shear, or a strongly graphitic bed in the schists, especially if this were also pyritised or impregnated with other sulphide materials. Pyrite or graphite, however, usually give a pronounced self-potential anomaly if they extend into the zone of weathering, and here no such anomaly was observed.

The strike and dip of this second series of indications are apparently approximately the same as for the lead lode, but whereas the indication caused by the lead lode appears and then disappears, this second indication is continuous from one end of the surveyed area to the other.

5. CONCLUSIONS.

The survey resulted in three main lines of indications (Plate 2), one of which, about 550.S to 575.S, coincides with the lead lode prospected and developed through the "New Queen" and "Liontown" shafts. This indication was obtained by the electromagnetic method only, the results of the self-potential method being somewhat erratic, with no clear anomaly. The intensity of the electromagnetic indication varies from traverse to traverse, but is strongest between 00 and 200.W, that is between the "New Queen" and "Liontown" shafts.

Farther south, between 600.S and 700.S, a self-potential anomaly was obtained, extending from 200.E to 300.W, but without a corresponding electromagnetic indication. The cause of this anomaly is most probably a gold-quartz reef with some pyrite and chalcopyrite mineralisation. Some old pits and small shafts showing evidence of this mineralisation coincide with the position of the anomaly. As quartz is a very poor conductor and the sulphides are probably only very sparsely distributed within the quartz, no good electrical conductivity and therefore no electromagnetic indication can be expected.

A second electromagnetic anomaly was observed between 800.S and 900.S, being continuous from one end of the surveyed area to the other. This indication is even more pronounced than that due to the known lead lode and, although varying in strength, is found on all profiles. The geological feature causing the strong indication is at present unknown.

The displacement shown in the electromagnetic and self-potential indications, between profiles 400.W and 550.W, suggests a cross fault in this area with the lodes west of the fault displaced to the north.

6. RECOMMENDATIONS.

(a) It is considered that the strong electromagnetic indication between 800.S and 900.S warrants investigation and it is recommended that special attention be paid to this area, including a careful geological survey. The survey might reveal some outcrop which would enable the source of the electromagnetic indication to be traced.

(b) However, if no geological indication is found, a diamond drill hole about 300 feet deep should be put down between traverses 00 and 100.W to trace the source of the high electrical conductivity. The particulars of the recommended drill hole are as follows:-

Collar at	50.W/950.S
Azimuth	0^{o}
Depression	60^{o}
Depth	300 ft.

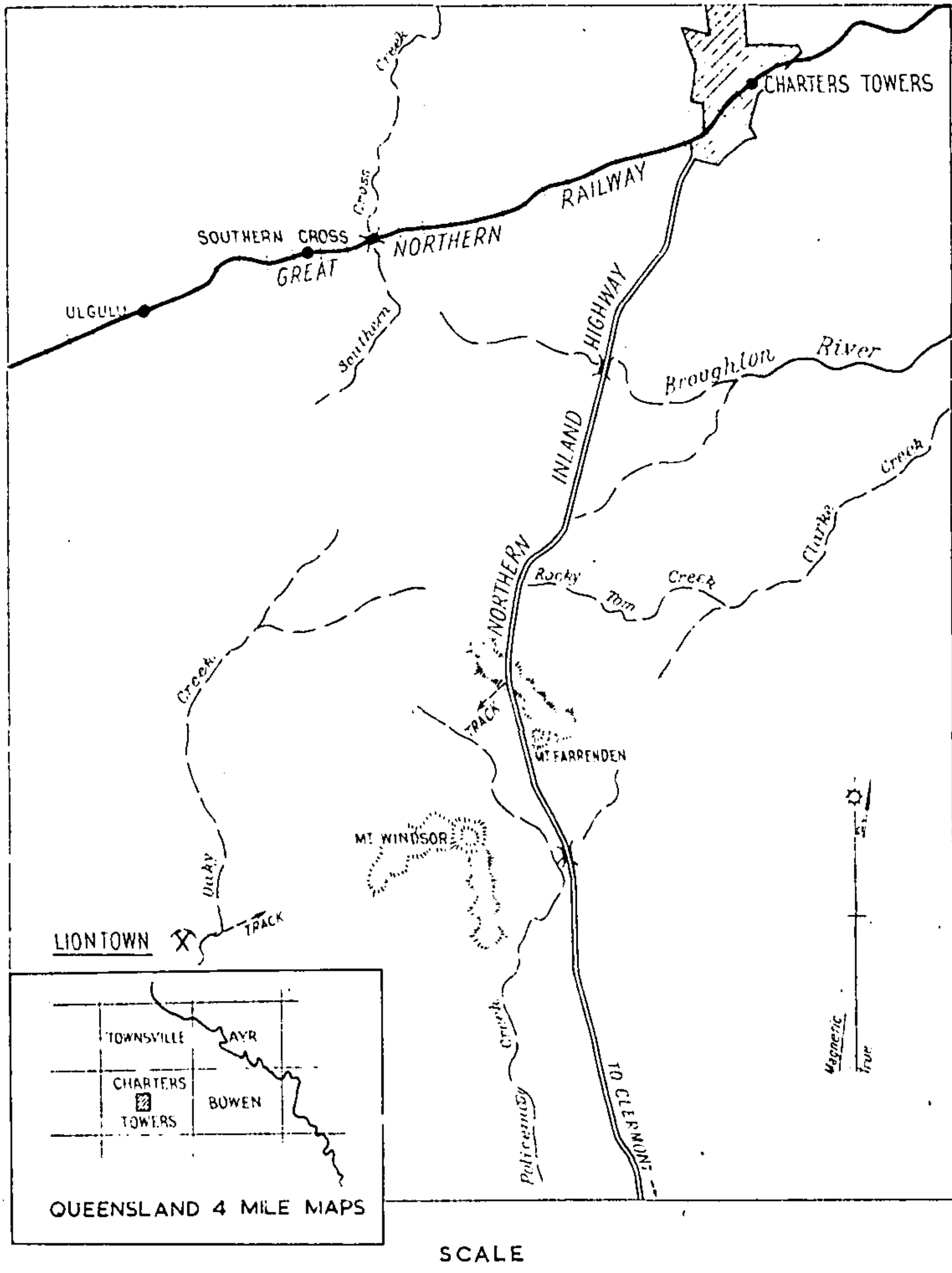
(c) The results of the electromagnetic method show that it is possible to follow the lead mineralisation by this method. It is therefore recommended that the method be used to cover the whole of the area of 10,000 feet by 3,000 feet in which mineralisation might be present. The survey would show the extent of the mineralisation, including any that may be hidden under the alluvial cover.

(d) It might also be helpful to use the self-potential method in some parts of the area since it would indicate the presence of pyrite mineralisation.

ADDENDUM.

The results of the survey were discussed with the interested company and verbal recommendations were made as to sites for drill holes to test the indications. Since this report was written, advice has been received that one hole was drilled to test the strong electromagnetic indication between 800.S and 900.S. Complete details of the drilling are not available, but it has been stated that the hole intersected a lode formation 12 feet thick, carrying a thickness of 6 feet of lead-zinc ore of payable grade. The survey therefore resulted in the discovery of a hitherto unknown lode, which can be readily traced by geophysical methods, and which may be a source of ore reserves in the event of further mining operations being undertaken in the area.

PLATE I



GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

LOCALITY MAP

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics G125-1

PLATE 2

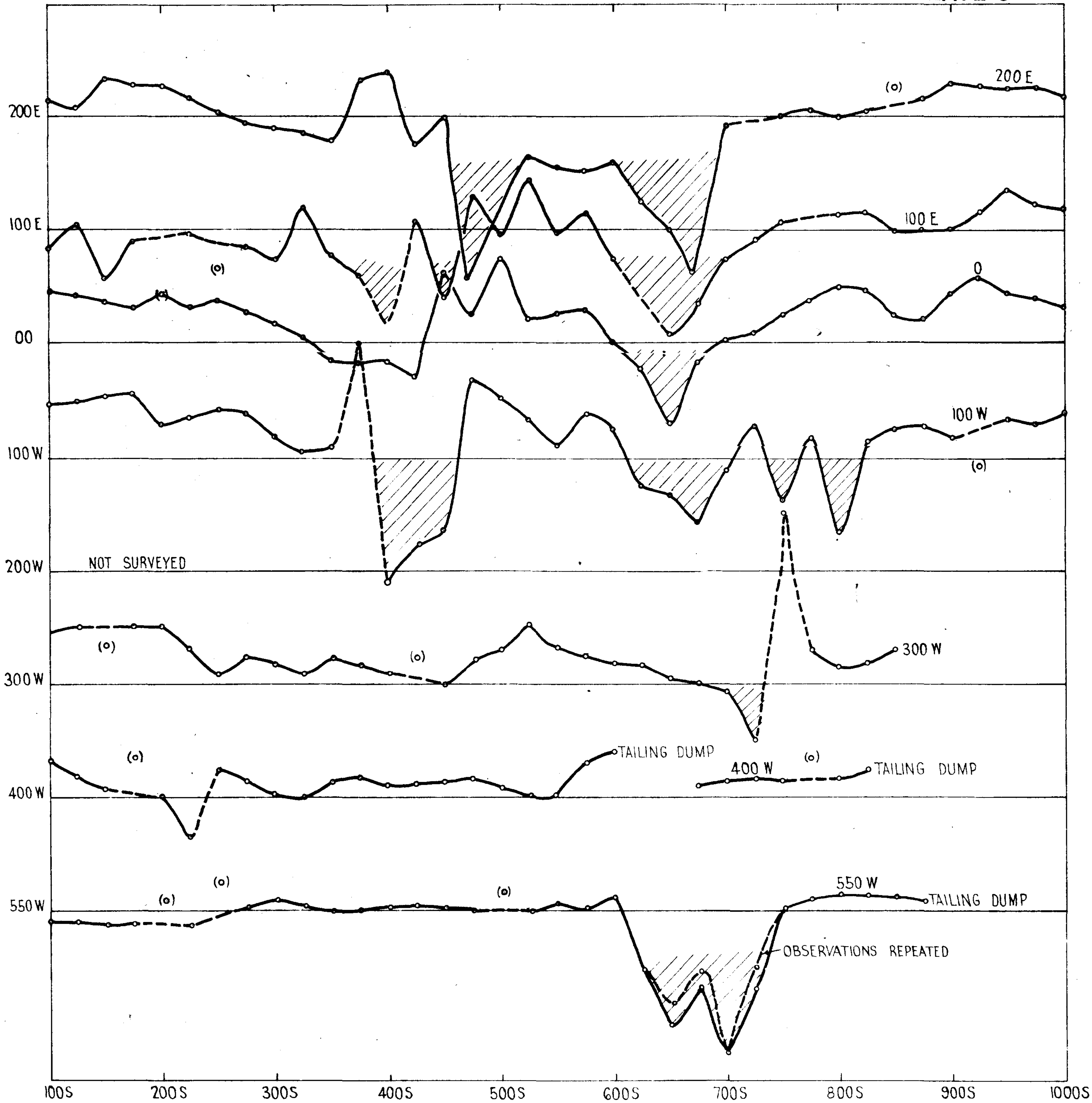
GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

GEOPHYSICAL TRAVERSES, MINE WORKINGS, AND ELECTRICAL INDICATIONS

Geophysical Section Bureau of Mineral Resources, Geology and Geophysics

G125-2

PLATE 3



SELF-POTENTIAL ANOMALY

SCALES

HORIZONTAL 100 0 100 200 FEET

VERTICAL 100 0 100 200 MILLIVOLTS

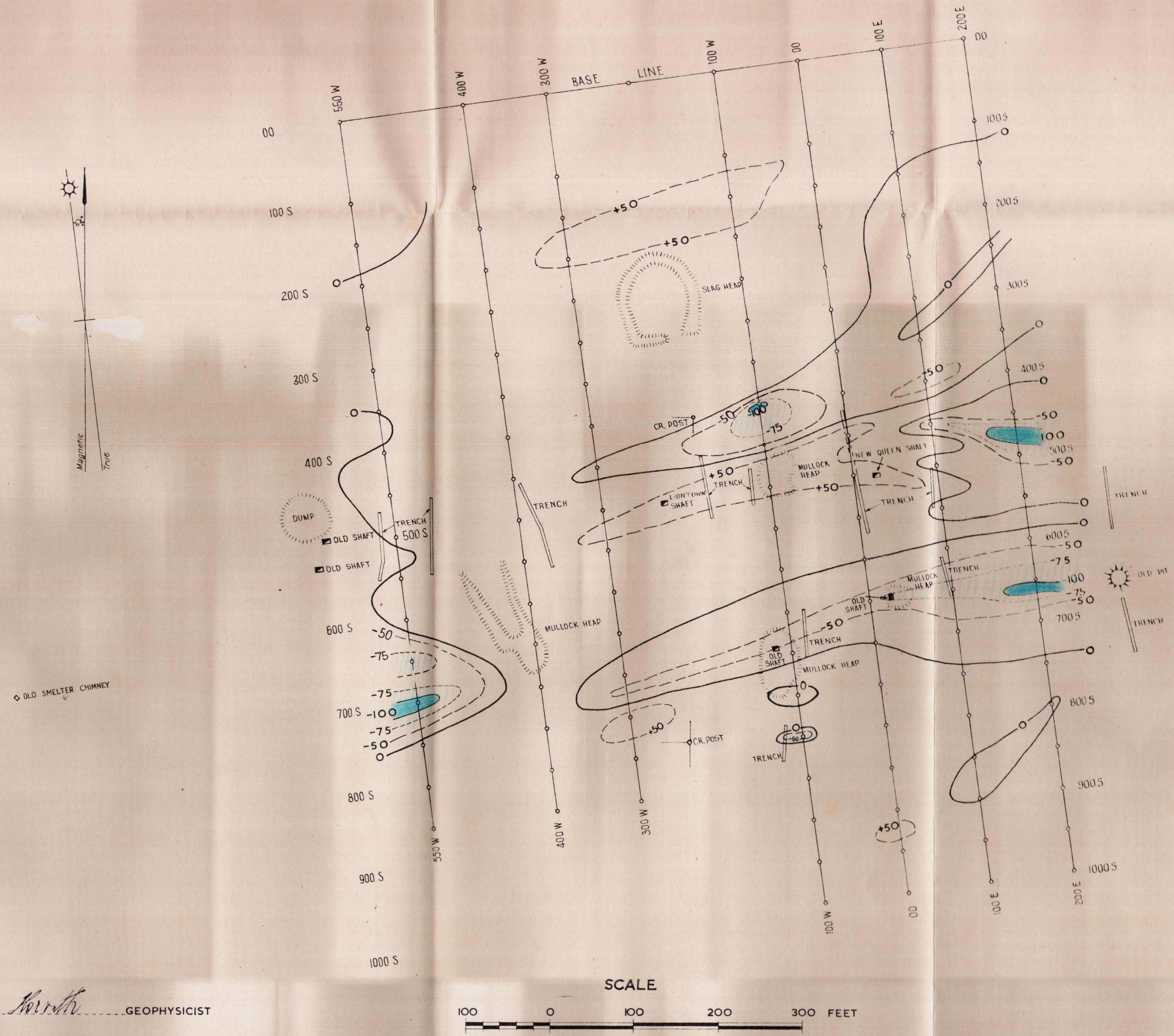
GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

SELF POTENTIAL PROFILES

GEOPHYSICIST. Korrik

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics

G125-3



GEOPHYSICIST

GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

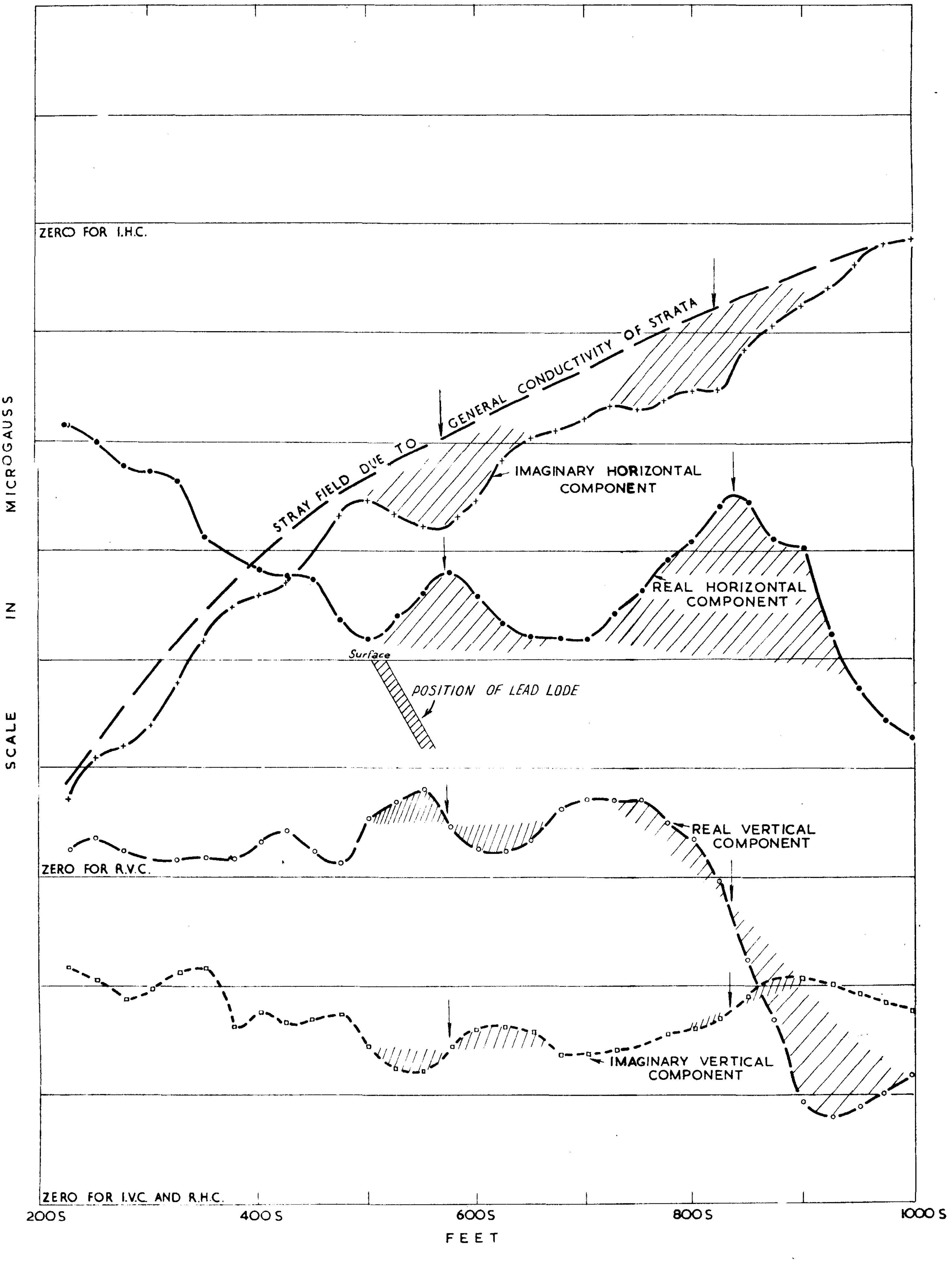
SELF POTENTIAL CONTOURS

CONTOUR INTERVAL 25 MILLIVOLTS

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics.

G 125 – 4

PLATE 5 A



GEOPHYSICAL SU'VEY AT LIONTOWN, (CHARTERS TOWERS,) QUEENSLAND

ELECTROMAGNETIC PROFILES ON TRAVERSE OO.

SCALES

HORIZONTAL 100 0 100 200 FEET

VERTICAL 0 1 2 3 MICROGAUSS

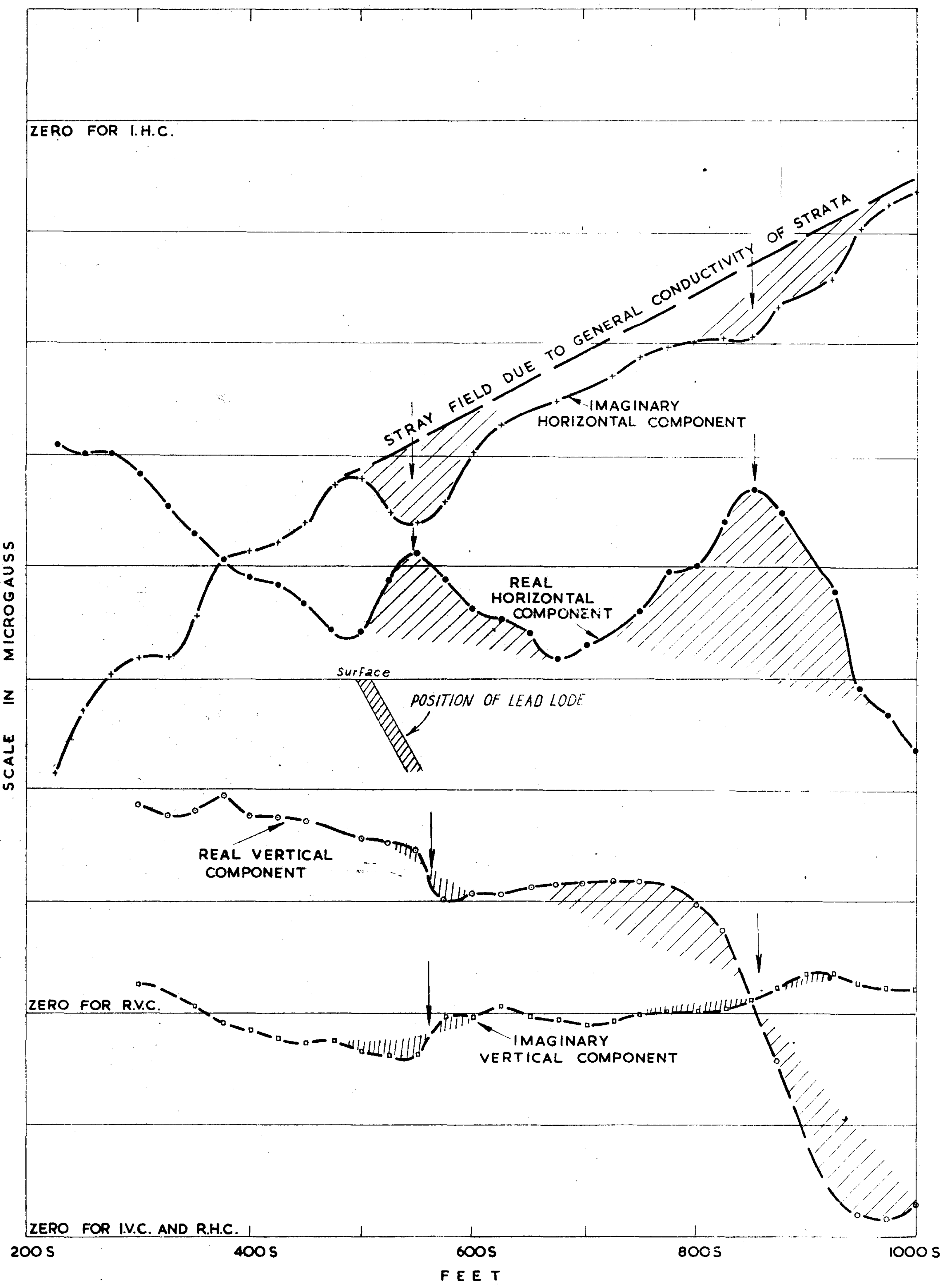
LEGEND

ELECTROMAGNETIC INDICATION

CENTRE OF INDICATION

GEOPHYSICIST

PLATE 5B



GEOPHYSICAL SURVEY AT LIONTOWN, (CHARTERS TOWERS,) QUEENSLAND

ELECTROMAGNETIC PROFILES ON TRAVERSE 100. W

SCALES

HORIZONTAL 100 0 100 200 FEET

VERTICAL 0 1 2 3 MICROGAUSS

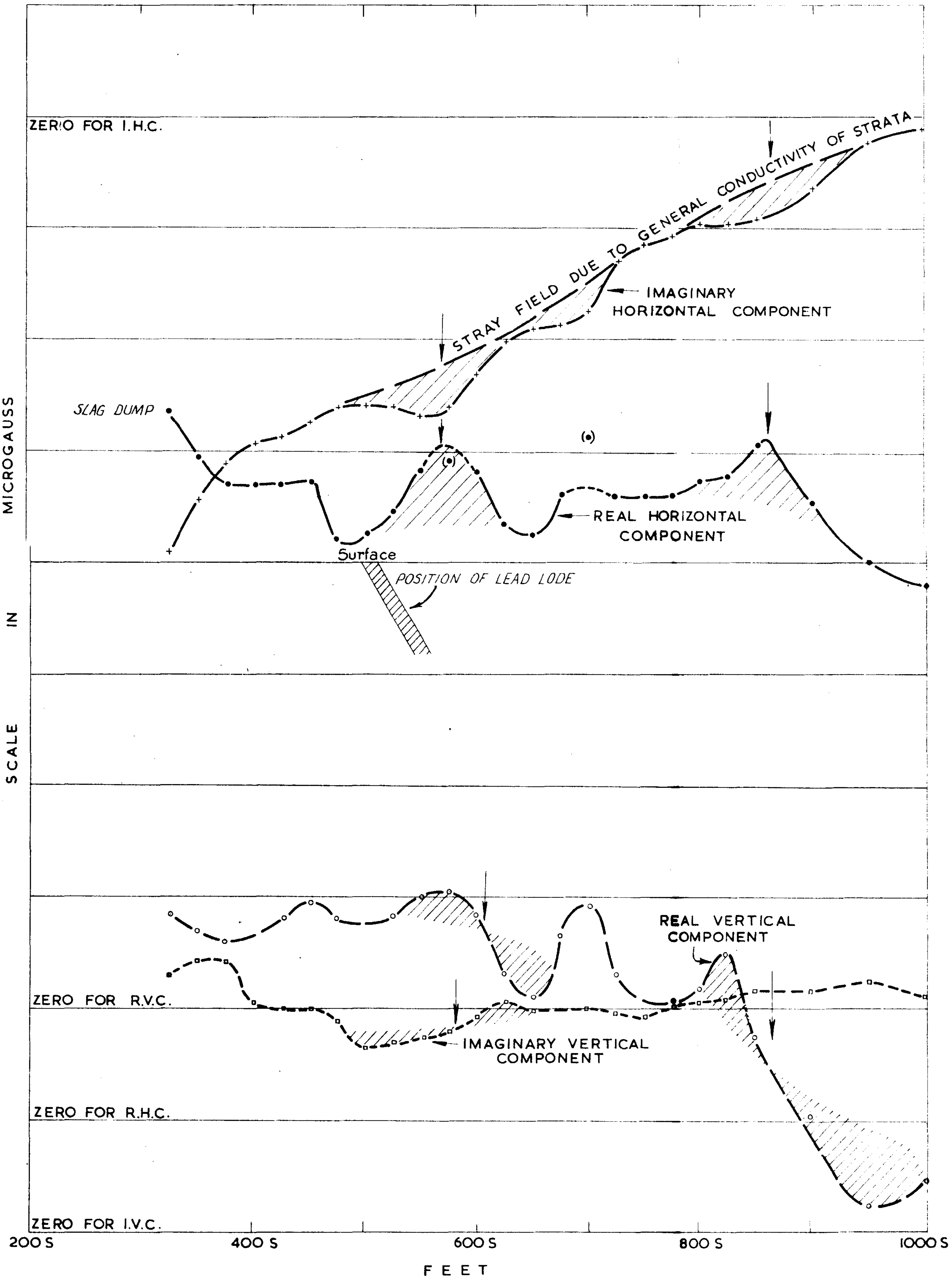
LEGEND

ELECTROMAGNETIC INDICATION

CENTRE OF INDICATION

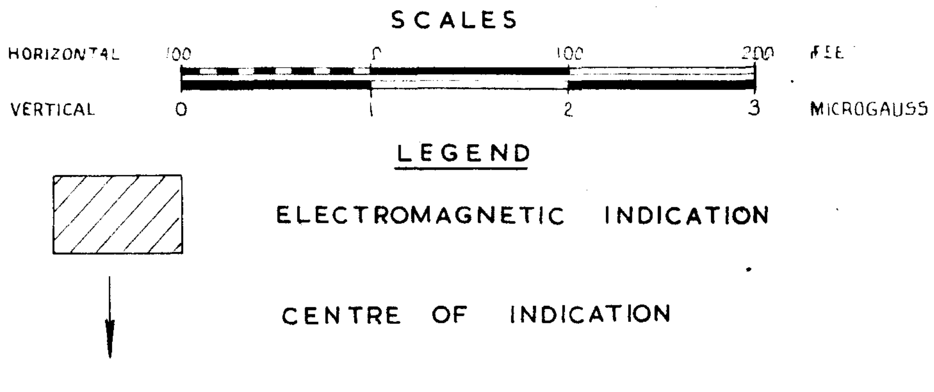
GEOPHYSICIST

Geophysical Section Bureau of Mineral Resources, Geology and Geophysics. G 125-6



GEOPHYSICAL SURVEY AT LIONTOWN, (CHARTERS TOWERS,) QUEENSLAND.

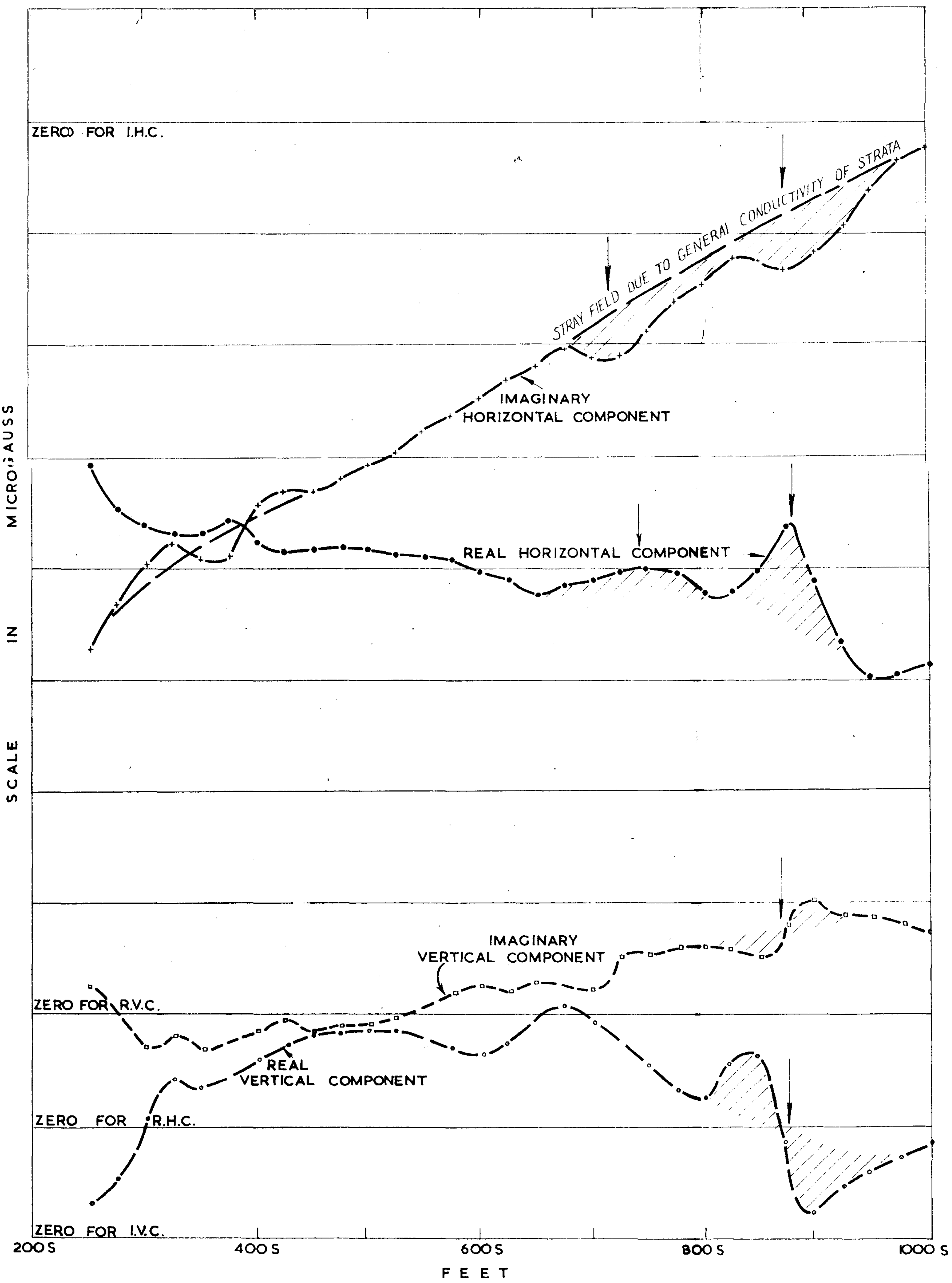
ELECTROMAGNETIC PROFILES ON TRAVERSE 200. W



GEOPHYSICIST Horvath

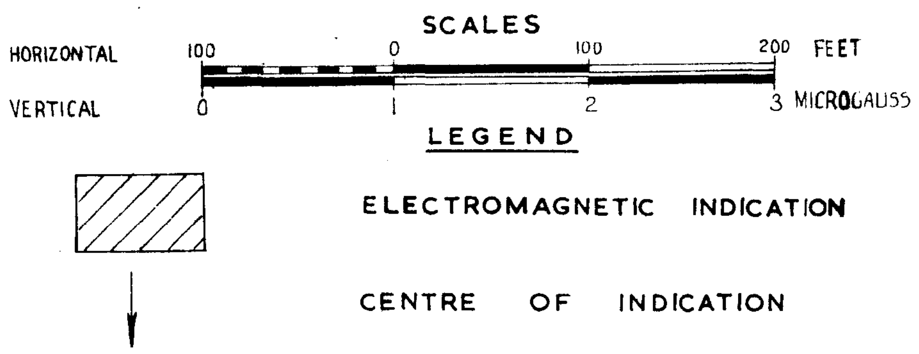
Geophysical Section: Bureau of Mineral Resources, Geology and Geophysics G 125 - 7

PLATE 5 D



GEOPHYSICAL SURVEY AT LIONTOWN, (CHARTERS TOWERS,) QUEENSLAND.

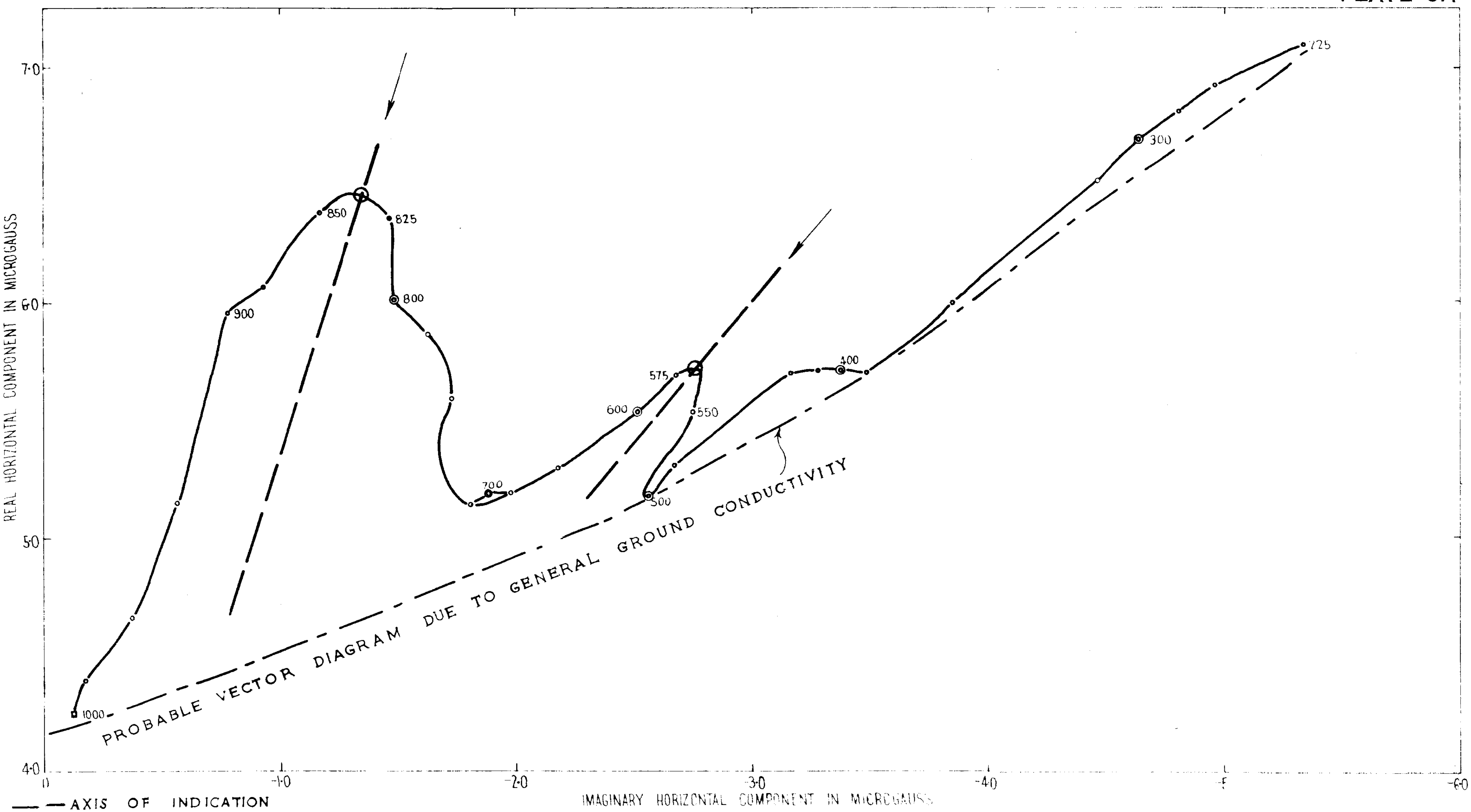
ELECTROMAGNETIC PROFILES ON TRAVERSE 400. W



GEOPHYSICIST [signature]

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G 125 – 8

PLATE 6A



— — AXIS OF INDICATION

↓ CENTRE OF ANOMALY

NUMBERS ON PROFILE REFER TO POSITIONS ON TRAVERSE

GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

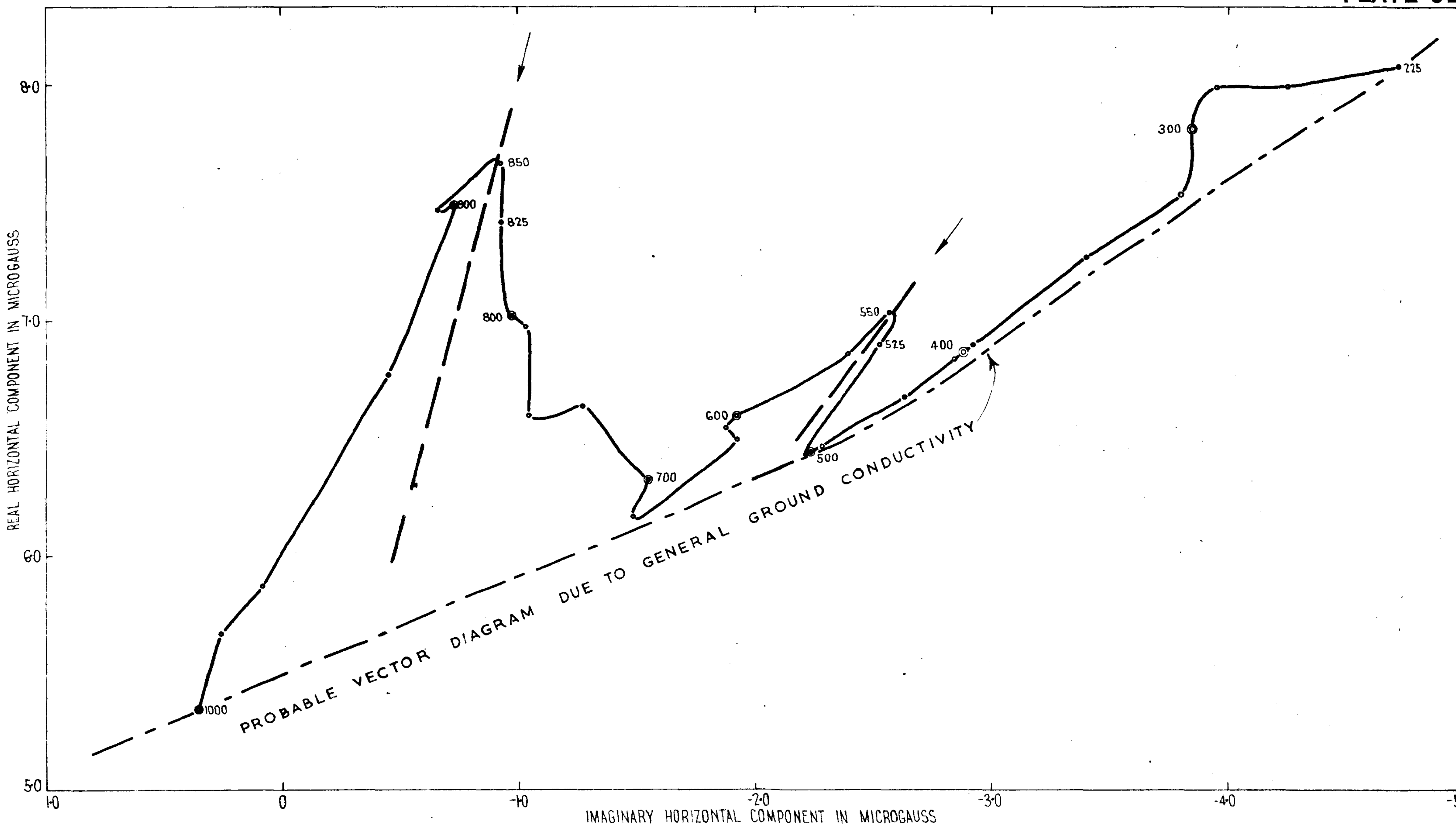
VECTOR DIAGRAM OF HORIZONTAL ELECTROMAGNETIC COMPONENT ON TRAVERSE OO

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics

G125-9

PLATE 6B



AXIS OF INDICATION

CENTRE OF ANOMALY

NUMBERS ON PROFILE REFER TO POSITIONS ON TRAVERSE

GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

VECTOR DIAGRAM OF HORIZONTAL ELECTROMAGNETIC COMPONENT ON TRAVERSE 100. W

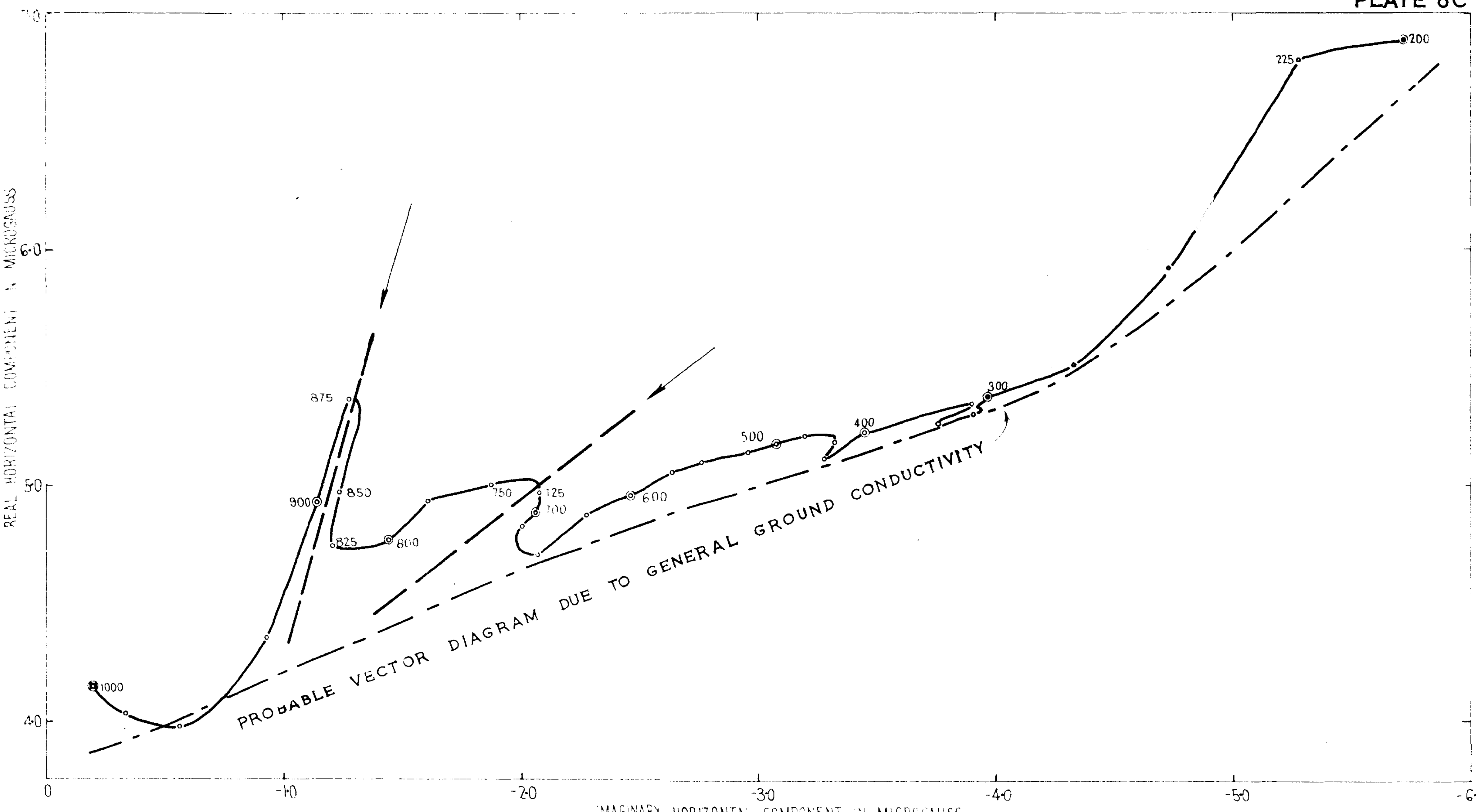
(SURVEYED WITH GROUNDED CABLE)

Horvath
GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

G125-10

PLATE 6C



— — AXIS OF INDICATION

↓ CENTRE OF ANOMALY

NUMBERS ON PROFILE REFER TO POSITIONS ON TRAVERSE

GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

VECTOR DIAGRAM OF HORIZONTAL ELECTROMAGNETIC COMPONENT ON TRAVERSE 400. W

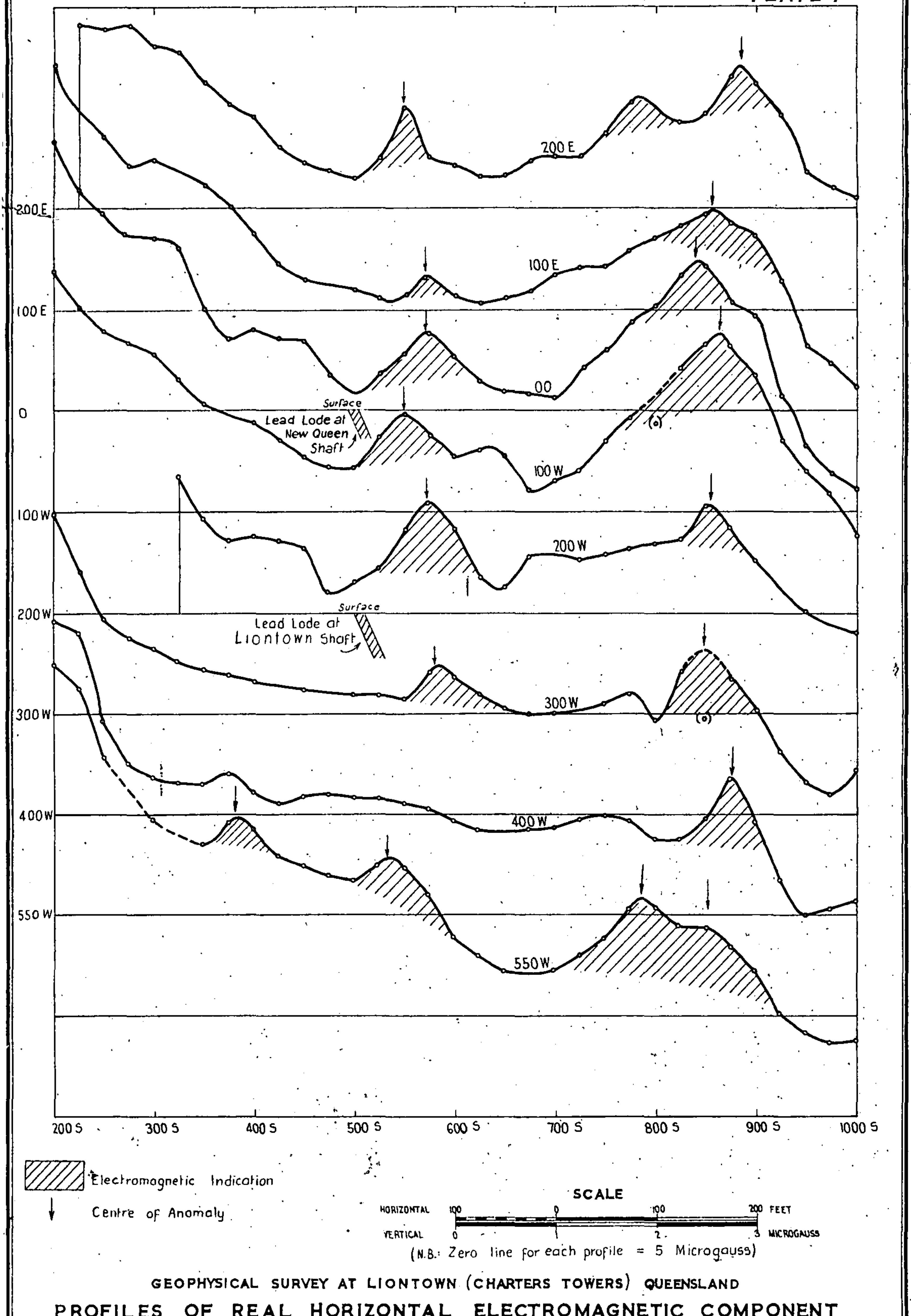
Horvath

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics

G125-11

PLATE 7



GEOPHYSICAL SURVEY AT LIONTOWN (CHARTERS TOWERS) QUEENSLAND

PROFILES OF REAL HORIZONTAL ELECTROMAGNETIC COMPONENT ON TRAVERSES 200.E – 550.W

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources Geology & Geophysics.

G125-12