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

RECORDS 1956, No. 151

GEOPHYSICAL TEST SURVEY AT GRETA & CORELLA PROSPECTS, CLONCURRY MINERAL FIELD, QUEENSLAND

by

W.J. LANGRON and J. HORVATH

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ABSTRACT

During September, 1953, test surveys were conducted on the Greta and Corella Prospects, Cloncurry, which were being explored by the National Lead Company.

At Corella, because of the steep topography, geophysical work was limited to self-potential and magnetic measurements. Three traverses, pegged to cover some previously located geochemical indications, were surveyed. Self-potential indications were confined to a zone of high geochemical copper indications and no anomalies were observed over the zones of lead and zinc indications. It is doubtful if any of the local magnetic highs can be attributed to ore bodies, but the method should prove helpful in structural mapping.

At Greta, electromagnetic, self-potential and magnetic methods were used and six traverses were surveyed. The electromagnetic method showed the presence of a good conducting body, which, from geological evidence, is probably mineralized. Results indicate the presence of a fault, which may have a direct bearing on the mineralization. The self-potential results were inconclusive. The magnetic results may be of assistance in interpreting the structural geology.

Testing of the electromagnetic indication at Greta by drilling or adit, is recommended. Further geophysical work should not be considered until the results of this testing have been examined.

1. INTRODUCTION.

The area known as the Greta Prospect is about 8 miles south of Cloncurry and can be reached by travelling along a track which branches west from the old Cloncurry-Kuridala road (Plate 1).

The Corella area is more difficult of access and is reached by travelling approximately 23 miles along the main Cloncurry-Mt. Isa road and then following the Corella River upstream along a rough track for a distance of seven miles (Plate 1). These prospects were being explored by the National Lead Company, whose geologists selected these and other areas from a large prospecting area which was granted to the company by the Queensland Department of Mines.

The geological work done by the company consisted mainly of mapping and structural interpretation. As the areas upon which it was decided to concentrate the search were selected mainly from structural evidence, and with little direct evidence of the presence of ore bodies, additional methods had to be employed to establish the presence or otherwise of ore in payable quantity. Geochemical sampling by a geochemist attached to the company indicated encouraging copper, lead and zinc values in some areas, particularly Greta and Corella. The Company asked the Bureau to make a geophysical survey to assist them in their exploration programme. This request was agreed to and the authors, accompanied by the company representative, Mr. J. Ivanac, visited the Greta Prospect on 28th July, 1953. A test self-potential traverse was surveyed, using a line of pegs which crossed the Greta outcrop near a long sampling trench which was then being dug. Dr. Horvath made a preliminary examination of the Corella area on 29th July, 1953, but no geophysical tests were conducted. As a result of this preliminary work it was decided that further geophysical tests should be made in both the Greta and Corella areas.

Geological information has been supplied by the National Lead Company, and the two areas for geophysical survey were selected mainly from the available structural and geochemical evidence.

2. CORELLA PROSPECT

A. Geology.

The geology of the Greta and Corella Prospects shows many similarities, and at each prospect the formation of most interest is a siliceous replacement lode which contains lead, zinc and copper mineralization. This type of mineralization is common in the Cloncurry district, but no deposits of this character have been tested at depth.

At Corella, the replacement lode (siliceous gossan) stands out as a very prominent topographical feature (Mt. Corella), and is bounded on the north by gneisses, which in places are pyritic, and on the south by carbonaceous and graphitic schists (Plate 2). The region has been subjected to considerable tectonic movement (as evidenced by the contorted nature of the schists, gneisses, etc.), and folding and faulting are common. In general, the strike of the lode is westerly, and dips generally are moderately steep and to the south.

B. Operations and Methods.

W. J. Langron (party leader) and D. L. Rowston, geophysicists of the Bureau, together with a surveyor and chainman from the Surveyor General's Department, arrived at the National Lead Company's camp on the Corella prospect on 7th September, 1953. Lines 00 and 9W were surveyed using compass and chain, and later line 4E was added to the grid by theodolite and chain (Plate 2). The three lines were surveyed by both self-potential and magnetic methods. The work at Corella was completed on 11th September, 1953.

The selection of the methods to be used on each of the prospects was governed largely by the mineralization and topography. For the problem at Corella, where the terrain is very steep and only three traverses were surveyed, the electromagnetic method was not practicable and the tests were limited to self-potential and magnetic methods in which more portable equipment is used. Line 9W was suitably sited to test a strong copper indication which had been obtained by the geochemical method, and lines 00 and 4E were chosen to test the region of stronger lead and zinc indications.

C. Discussion of Results.

(i) Self-potential results (Plate 3).

On traverse 9W there is general agreement between the geochemical copper indications and the self-potential results and, though this agreement is not a close one, it is reasonable to suppose that the self-potential anomaly is due to copper mineralization.

There is a well-defined negative anomaly on traverse 9W over the carbonaceous and graphitic schists, but this anomaly is less pronounced on the other two traverses.

On traverses 00 and 4E, which were pegged to test lead and zinc geochemical indications, no self-potential anomalies were recorded which could be correlated with the geochemical indications. It is interesting to note here that during the work at the Greta Prospect, some self-potential anomalies were obtained over a region where no copper indication was obtained by geochemical means.

On traverse 00 there is a general decrease in the self-potential values from north to south, probably due mainly to the presence of carbonaceous schists in the southern part of the traverse.

On traverse 4E, the general southerly decrease which was shown on traverse 00 is repeated, and is again most probably due to the northern part of the area being occupied by gneisses and quartzites and the southern part by carbonaceous schists. A broad, poorly-defined zone of lower self-potential values extends from about 550S to 950S.

(ii) Magnetic results (Plate 4).

On traverse 9W there is no magnetic anomaly corresponding to the well-defined, self-potential anomaly, so it appears doubtful whether the mineralization can be detected by magnetic means. There is a change in slope of the profile at about 450S, but because of the lack of detailed geological information it is not known what significance this feature has. Possibly it corresponds to a boundary between the gneiss and a granitised conglomerate that appears in the northern part of the area. The rise in values near 1050S may represent the contact between breccia and schist.

The profile of traverse 00 contains several features of interest and suggests that there are geological boundaries near 50N, 300S, 400S and 650S. There is a gradual increase in value southwards from 650S. The rise near 50N may represent the boundary between breccia and granitized conglomerate and that near 650S, the contact between breccia and schist.

The profile of traverse 4E has a similar appearance to that of traverse 00. There is a zone of higher-than-average values in the region 250S-400S, lower values between 600S and 700S and a general rise in magnetic values southwards from 650S. However whereas the siliceous lode is associated with an increase in magnetic values on traverse 00, it is associated with a decrease on traverse 4E. It is doubtful therefore whether the magnetic method can be used to locate particular formations, but it does seem that some boundaries (e.g. the breccia-schist boundary) may be located.

D. Conclusions and Recommendations.

The self-potential anomalies are limited to the zone of high geochemical copper indications and the graphitic schists. No anomalies were observed over the zones of geochemical lead and zinc indications. The effect produced by the graphitic schist was strong but differed from traverse to traverse. Ground conditions for self-potential work were good and the two readings at each station were usually in close agreement.

It is not possible, from the limited amount of work done, to judge whether any of the local magnetic highs can be attributed to mineralization. The magnetic method may, however, be of help in locating some geological boundaries. It is doubtful whether further geophysical surveys on this prospect would be warranted unless further geological work reveals more evidence of the likely occurrence of ore-bodies.

3. GRETA PROSPECT

A. Geology.

At Greta, the pegged grid covers a succession of graphitic schists and carbonaceous slates, breccia, volcanics and agglomerates (Plate 5). The general strike of the beds is westerly and there are several cross-faults in the region. In general, the beds have a moderate southerly dip, but exceptions to this are common. The breccia (which is the host rock for the siliceous replacement lode), is a prominent feature in the area.

B. Operations and Methods.

The geophysical survey of the Greta area commenced on 14th September, 1953, the pegging and laying-out of traverses having commenced the previous day. It was decided to spend most of the available time on the tests there, because of the better conditions generally, and because more-detailed geological mapping and geochemical results were to hand for the Greta area. The geophysical grid and the main geophysical and physical features are shown on Plate 5. The grid covers the lode formation and includes an area in which testing by trenching had already commenced. The topography is more suitable for the electromagnetic method than that at Corella, and all traverses were surveyed by that method, using search coil and compensator, from both the hanging-wall and foot-wall sides, and by the magnetic and self-potential methods. The survey was completed on 29th September, 1953.

C. Discussion of Results.

(i) Electromagnetic results.

Six traverses were surveyed by the electromagnetic method and the results of the survey from the foot-wall side of the lode (with primary cable along 00) are shown as profiles of the real and imaginary horizontal components on Plate 6, and as vector diagrams of the horizontal component on Plate 7. The results obtained with the primary cable along 1200S have been discarded because of the shielding effect of the highly conducting graphitic schists south of the lode.

The vector diagrams indicate a broad, good conductor in the region of the graphitic schists. This influence is very marked, but in addition, several of the diagrams contain some well-defined indications of good electrical conductivity which are possibly due to sulphide mineralization. These indications are at 450S on traverse 2W, at 475S on traverse 4W, at 500S on traverse 5W and at 520S on traverse 6W. The character of the indications suggests that the good electrical conductor increases in depth towards the west. Another prominent feature of the vector diagrams is that the diagram for traverse 8W differs greatly in character from the other diagrams. This difference is also apparent, though to a somewhat lesser extent, on the self-potential and the magnetic profiles shown in Plates 8 and 9. It is therefore inferred that a major geological feature (probably a fault) cuts across the area of the pegged grid between traverses 6W and 8W. This feature may terminate the conducting body which is indicated on traverses 2W to 6W. The known geology is not inconsistent with the presence of such a feature although no definite evidence of faulting has been recorded.

The vector diagrams for traverses 2W to 6W show that the conducting body giving rise to the indication has a westerly strike and pitches to the west before being terminated at depth by the postulated fault. The indication first appears on traverse 2W where it is weak and shallow-seated, then gradually strengthens and deepens, and is last recorded on traverse 6W. The conductivity of the body responsible for the indication appears to increase slightly towards the west from traverse 2W.

The vector diagrams show, by a change in their slope, that the conductivity of the graphitic schist and carbonaceous slate beds decreases progressively from east to west. The diagrams also show some zones of lower conductivity (e.g. between 300S and 400S on traverse 0), corresponding to an occurrence of limestone.

Geochemical tests showed medium-low values of zinc in the talus from the siliceous lode. Also, medium-low lead indications were obtained near the north-west corner of the grid. The high copper indications recorded were found outside the gridded area to the north-east. Therefore it may be assumed that the electrical indications, if due to sulphide mineralization, are probably due to lead and zinc rather than copper. This is in contrast to the results obtained at Corella where the only self-potential anomaly was probably due to copper mineralization, as it was recorded adjacent to a geochemical copper indication.

(ii) Self-potential results.

Each of the traverses was read by the self-potential method. Two readings, about one foot apart, were taken at each station and these were usually in good agreement. The smoothed profiles are drawn on Plate 8 and show two features of interest, namely, the positive anomaly at about 400S on traverses 2W, 4W, and 5W and the negative anomalies on traverses 6W and 8W.

The positive anomaly is the more interesting, because it has a direction of strike which is in agreement with the geology and the electromagnetic indication, though its axis is, on the average, about 80 feet to the north of the axis of the electromagnetic indication.

Positive self-potential anomalies have been discussed by Slichter (1932) and Rao (1945), but it might well be added here that such anomalies have frequently been recorded in other parts of northern Queensland and the Northern Territory. Slichter attributes positive peaks to the presence of graphite. Rao discusses some positive indications in India which were tested and proved to be due to a disseminated, graphitic, pyritized lode at depth.

There are some minor negative anomalies on the profiles, but generally, the trend of these indications is so indefinite that they can hardly be used for interpretation purposes. A more definite feature, however, is the negative anomaly centred at about 200S on traverse 8W. The significance of this feature is not certain. Its centre is in the knotted graphitic schists and carbonaceous slates, but it lies close to the boundary between these and the conglomerate. It is noted that an occurrence of copper mineralization has been recorded nearby. However, this negative self-potential indication lies to the west of the feature which presumably terminates the electromagnetic indication, and its significance could be ascertained only by extending the survey farther west.

(iii) Magnetic results.

All traverses were surveyed with a vertical-force magnetometer and the results, in the form of profiles, are shown on Plate 9.

The profiles, generally, show very few interesting features. Some higher magnetic readings occur over the agglomerates and breccia formations. The axis of these indications has the same general direction as that of the electromagnetic indications. The disturbed readings are probably due to the presence of some magnetic material in the volcanics, and by tracing these beds the magnetic method could perhaps be of assistance in the geological mapping and interpretation in the area. There is no evidence that the magnetic anomalies are connected in any way with a mineralized zone.

D. Conclusions and Recommendations.

The electromagnetic method showed the presence of a good conducting body within a zone of generally good conductivity. The indication extends for about 400 feet along the direction of strike, and is due to a body which is close to the surface near traverse 2W, pitches towards 6W, and terminates between 6W and 8W. The indication is thought to be due to mineralization, as its position agrees very well with the known geology and it is in the horizon at which an ore-body could be expected. The indication is strongest on traverses 4W and 5W but, even there, it cannot be regarded as being really strong.

The electromagnetic measurements also suggest the presence of a cross-feature between traverses 6W and 8W, which appears to have a direct bearing on the extent of the mineralization.

It is recommended that the electromagnetic indication be tested by drilling; a hole about 200 feet long, collared at the position shown on Plate 5, and depressed at 45°, would test the target at a vertical depth of about 175 feet (see Plate 5). Alternatively, the indication could be tested by an adit driven in the direction of No.9 trench, as shown on Plate 5. The adit should be started deep enough to reach the zone of mineralization at least 50 to 100 feet below the surface.

Further electromagnetic work on the Greta Prospect would be warranted if the results from the testing which is recommended prove ore in sufficient quantity and of suitable grade.

The self-potential results are inconclusive and the method appears to be of little value in this area.

The magnetic method was of no value in detecting the mineralization but may be of some assistance in obtaining further information on the structural geology.

4. ACKNOWLEDGMENTS.

It is desired to express appreciation to Mr.J.Ivanac and employees of National Lead Co. for their continued and willing assistance to the geophysical party during the survey.

5. REFERENCES.

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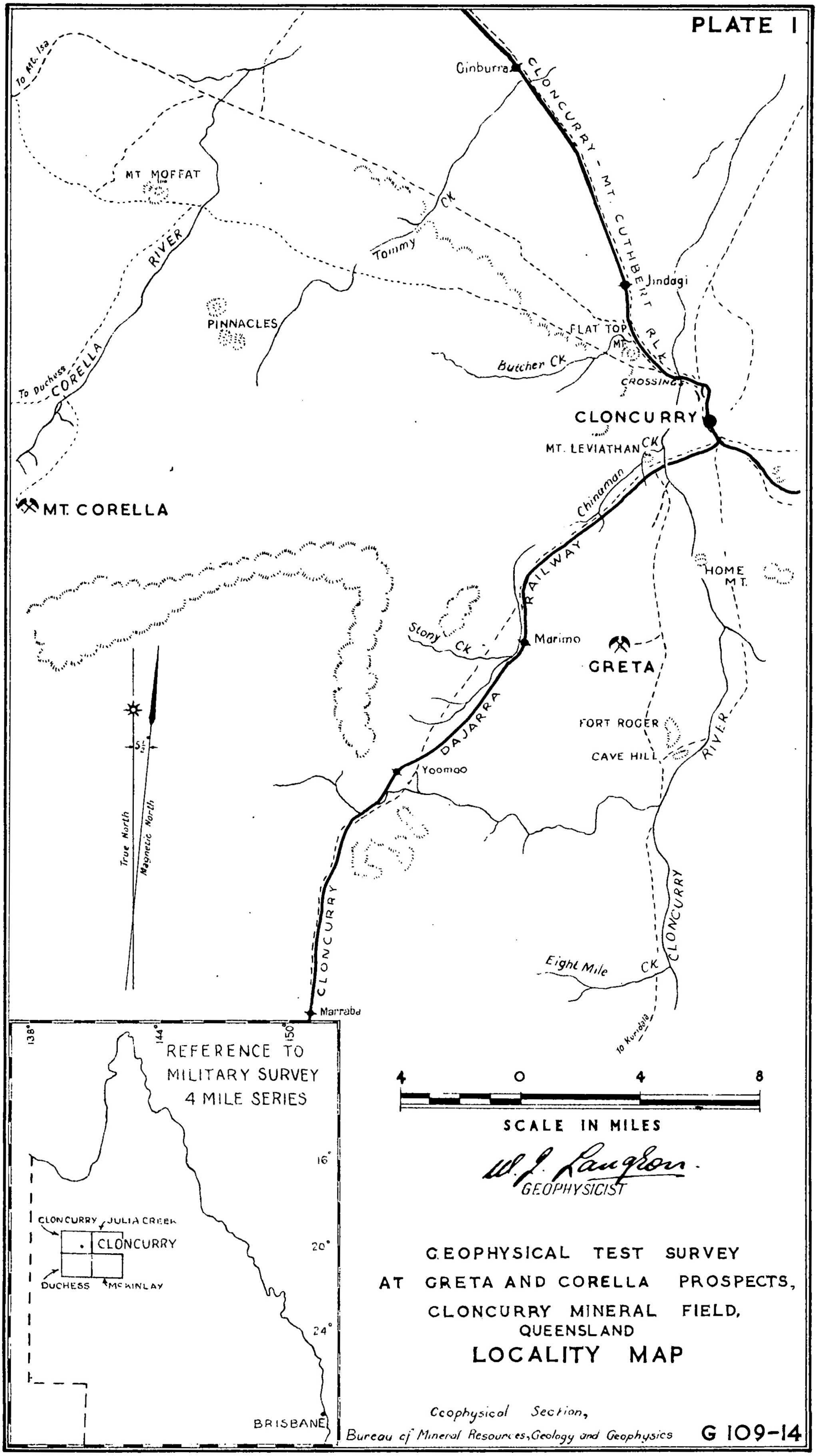
Slichter, L.B., 1932 - Discussion, Trans, A.I.M.E., 97, 35.

PLATE I



GEOPHYSICAL TEST SURVEY AT GRETA AND CORELLA PROSPECTS, CLONCURRY MINERAL FIELD, QUEENSLAND

LOCALITY MAP

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PLATE 2

GEOPHYSICAL TEST SURVEY, GRETA AND CORELLA PROSPECTS,
CLONCURRY MINERAL FIELD, QUEENSLAND

SURFACE GEOLOGY, GEOPHYSICAL TRAVERSES AND GEOPHYSICAL RESULTS AT CORELLA PROSPECT

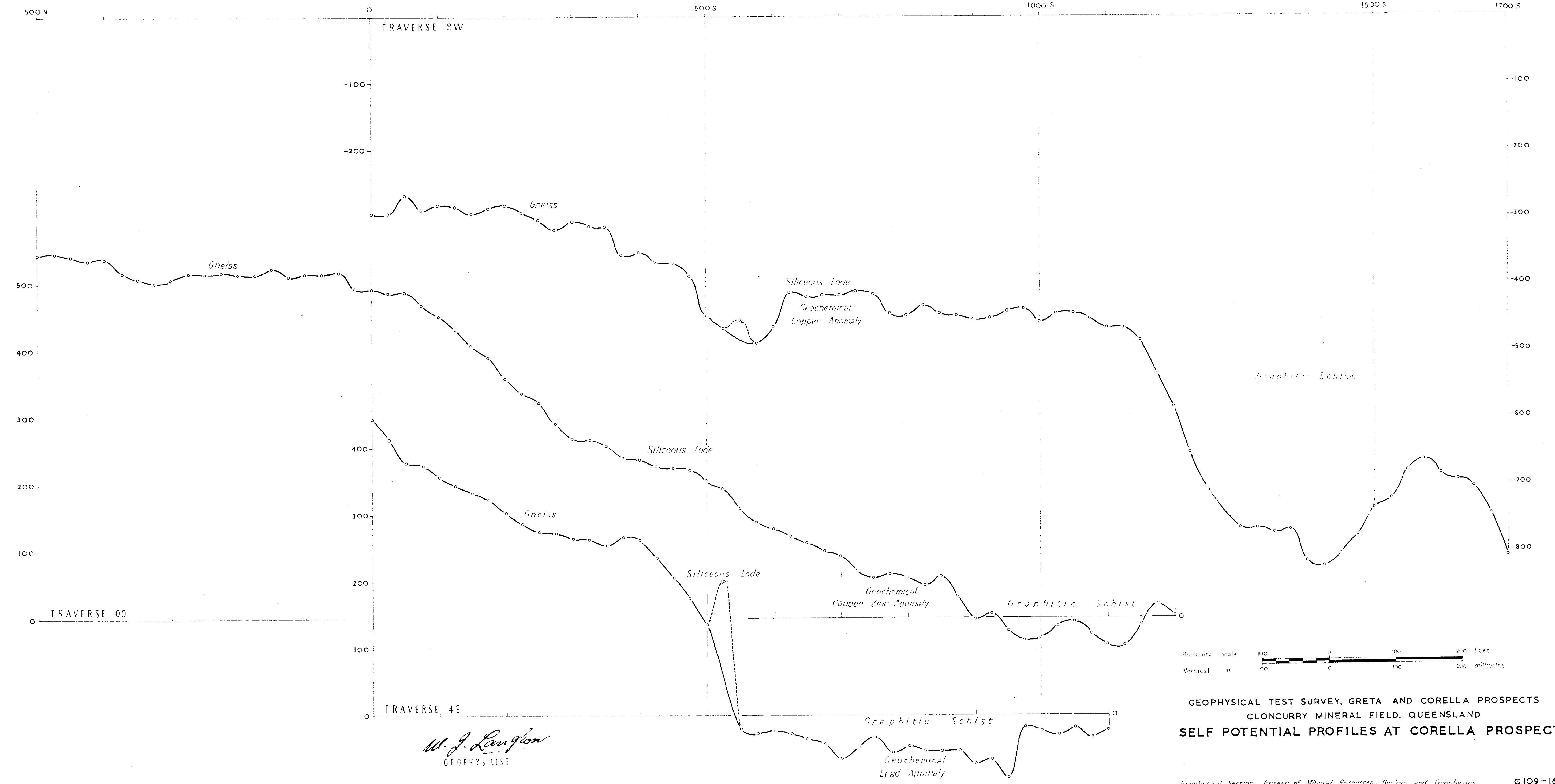
Surface geology after mapping by J. Ivanac, National Lead Company.
Geochemical results by National Lead Company.

W. J. Langron
GEOPHYSICIST

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

G109-15

PLATE 3



GEOPHYSICAL TEST SURVEY, GRETA AND CORELLA PROSPECTS
CLONCURRY MINERAL FIELD, QUEENSLAND

SELF POTENTIAL PROFILES AT CORELLA PROSPECT

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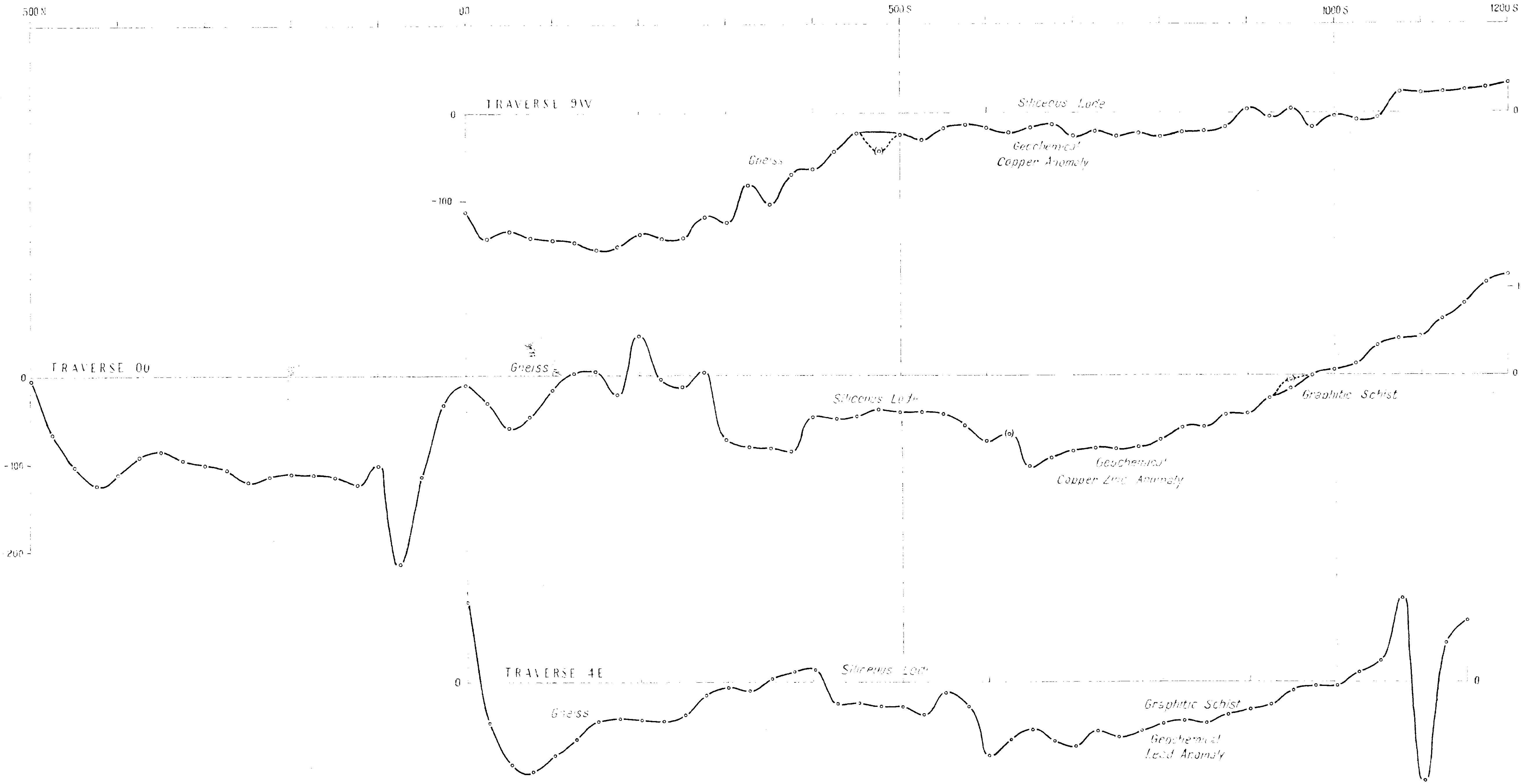
PLATE 4



SCALES

Horizontal 100 0 100 200 300 feet

Vertical 100 0 100 200 300 gamma

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MAGNETIC VERTICAL FORCE PROFILES AT CORELLA PROSPECT

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GEOPHYSICAL TEST SURVEY
AT GRETA AND CORELLA PROSPECTS,
CLONCURRY MINERAL FIELD, QUEENSLAND

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SURFACE GEOLOGY, GEOPHYSICAL GRID. GEOPHYSICAL RESULTS AND RECOMMENDATIONS FOR TESTING AT GRETA PROSPECT

SURFACE GEOLOGY
AFTER MAPPING
BY
J. IVANAC
NATIONAL LEAD CO.

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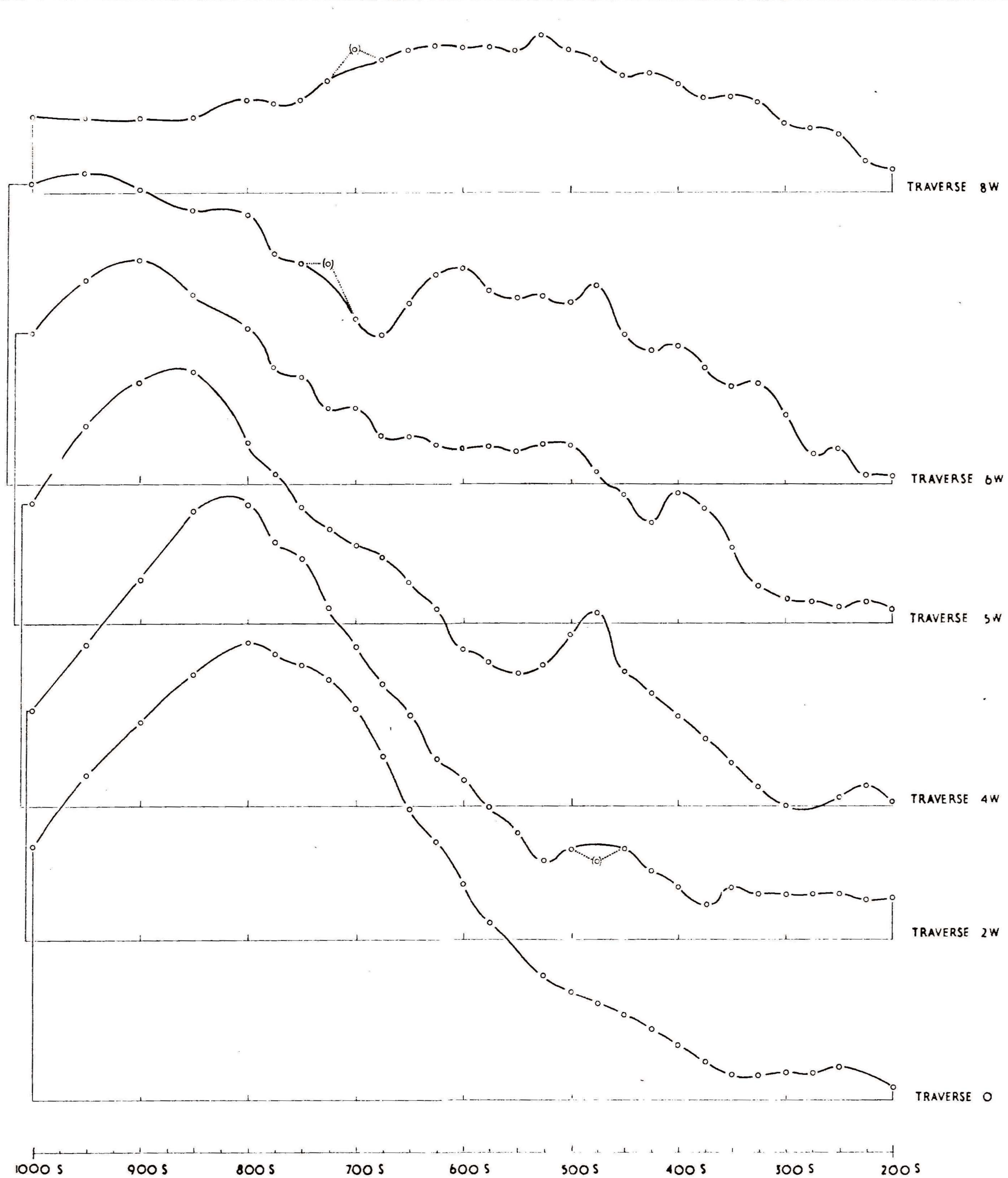
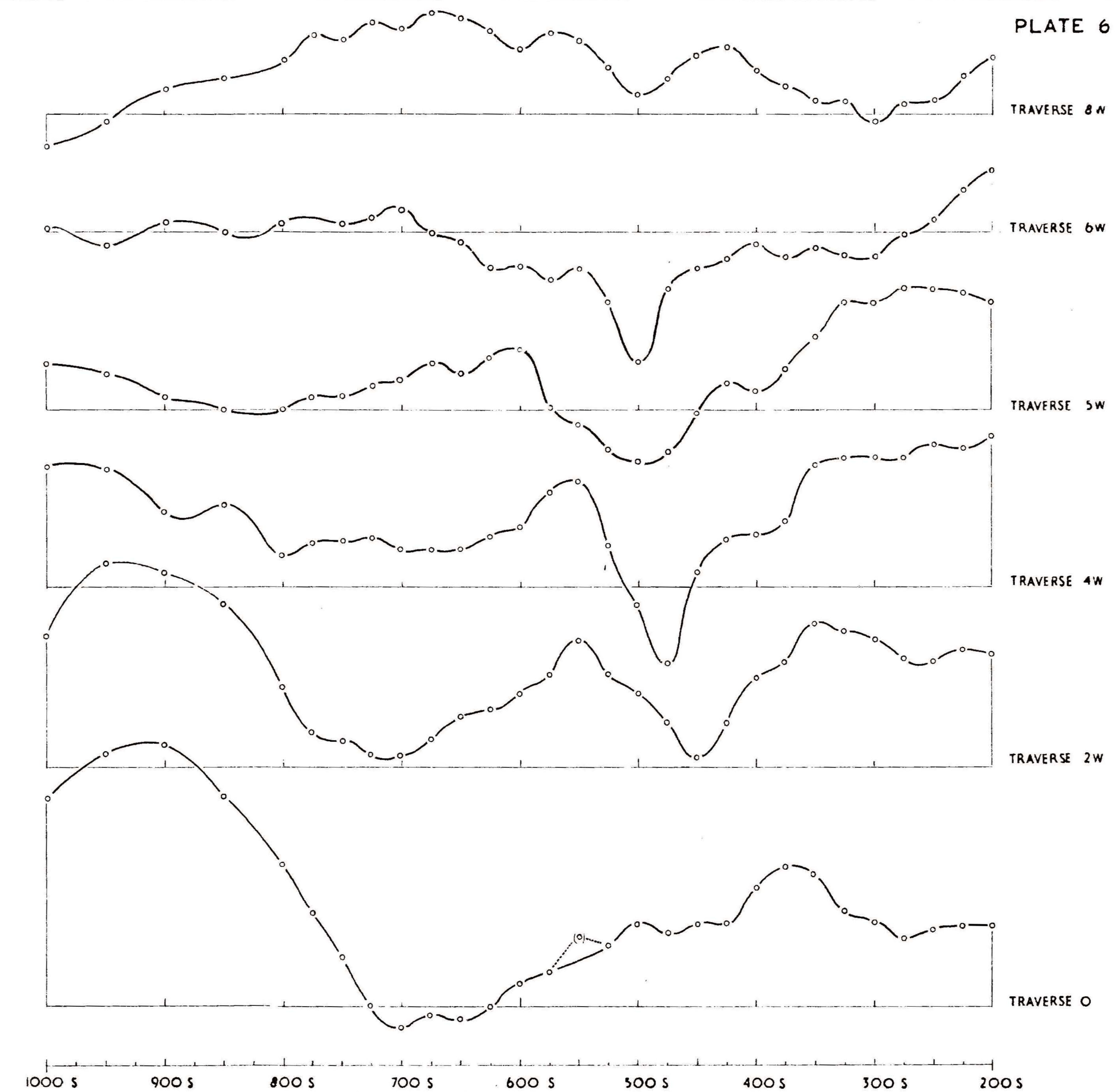
PLATE 6



(a) REAL HORIZONTAL COMPONENT



(b) IMAGINARY HORIZONTAL COMPONENT

Horizontal Scale 100 0 100 200 400 feet

Vertical Scale 2 0 2 4 6 microgauss

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PROFILES OF HORIZONTAL ELECTROMAGNETIC COMPONENTS
AT GRETA PROSPECT

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GEOPHYSICAL TEST SURVEY, GRETA AND CORELLA PROSPECTS,
CLONCURRY MINERAL FIELD, QUEENSLAND

VECTOR DIAGRAMS OF HORIZONTAL ELECTROMAGNETIC COMPONENTS AT GRETA PROSPECT

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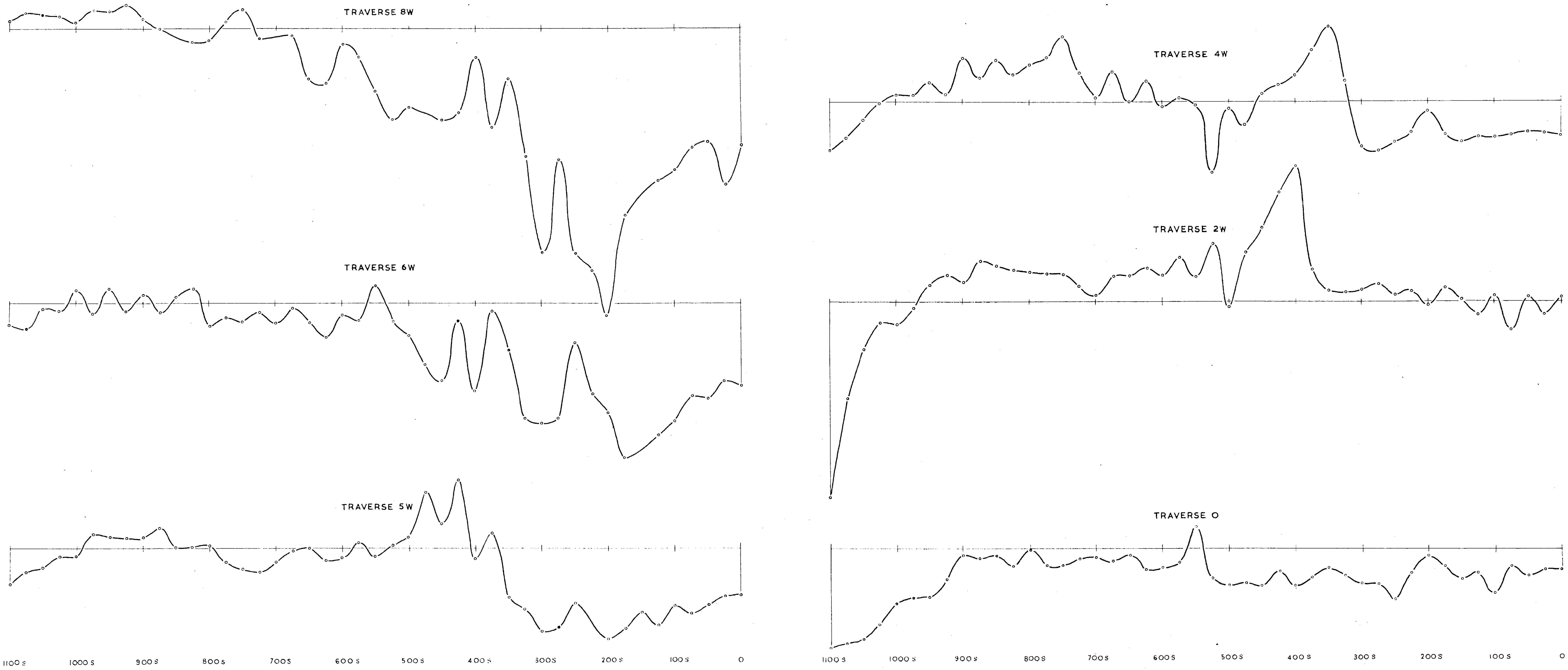

SCALES

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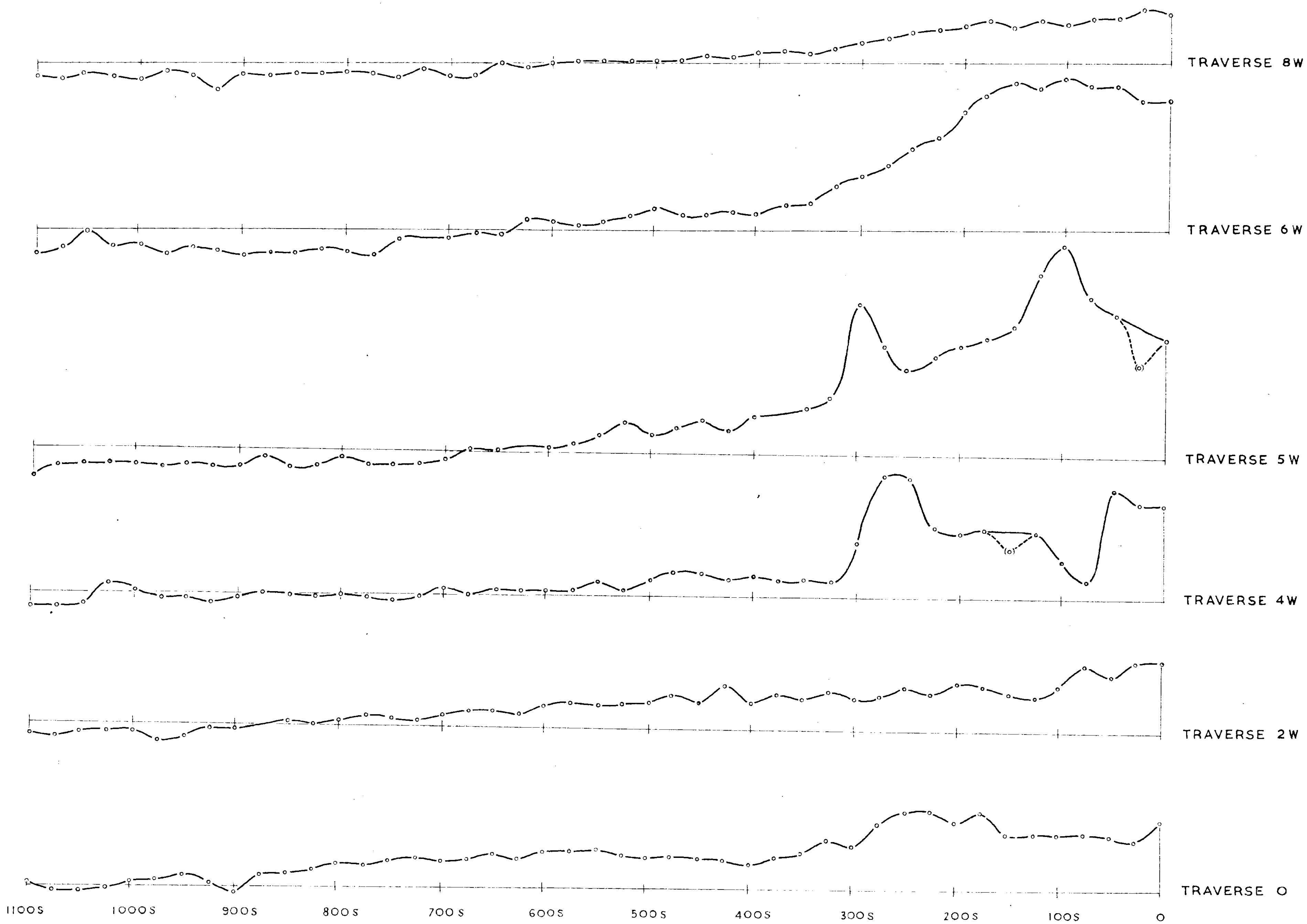
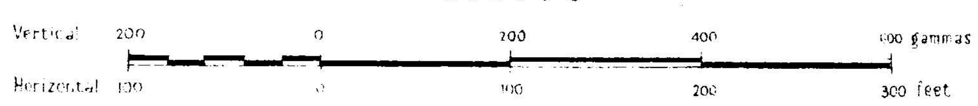
GEOPHYSICAL TEST SURVEY, GRETA AND CORELLA PROSPECTS
CLONCURRY MINERAL FIELD, QUEENSLAND

SELF POTENTIAL PROFILES AT GRETA PROSPECT



SCALES



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GEOPHYSICAL TEST SURVEY, GRETA AND CORELLA PROSPECTS
CLONCURRY MINERAL FIELD, QUEENSLAND

MAGNETIC VERTICAL FORCE PROFILES AT GRETA PROSPECT