COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1956, No. 43

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, NORTHERN TERRITORY

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C O N T E N T S.

ILLUSTRATIONS.

ABSTRACT.

This Record discusses the results of geophysical surveys made late in 1954 by the Bureau of Mineral Resources over selected areas within the Rum Jungle mineral province. Investigations were concentrated on the Brown's-Intermediate, Mt. Burton and Mt. Fitch Prospects, using mainly electromagnetic (Slingram) and self-potential (S.P.) methods. It was considered that the search for uranium would be assisted if the sulphide bodies, with which the uranium is most probably associated, could be located.

Geophysical surveys during previous years had located several well-defined S.P. indications in Brown's area, and subsequent drilling indicated that these anomalies are due to sulphides. The strength of the S.P. indications diminished towards White's Prospect and results in other areas were of poor quality.

The present programme included some repeat S.P. measurements at Brown's, with extension of the survey to the Intermediate, Mt. Burton and Mt. Fitch areas. The Slingram method, for detecting highly conducting bodies at fairly shallow depth, was used in all areas.

Good-quality indications were obtained with each method in the Brown's-Intermediate area. Two well-defined Slingram indications were obtained, one of which is almost certainly due to a sulphide lode but there is no evidence of any uranium associated with it. The cause of the second indication is not known. Two well-defined S.P. indications are related to the Slingram indications but, although it is suggested that the S.P. indications also arise from mineralisation, the relation between the S.P. and Slingram results is uncertain.

A traverse across the "embayment" area was surveyed by the gravity method. The results show that some of the geological boundaries can be fairly accurately determined by this method and that it is therefore a valuable aid to geological mapping in the area. Moreover, the results show that the "embayment" sediments form a single, slightly overturned syncline rather than the double trough structure at present postulated. The syncline has a westerly plunge and the maximum depth of sediments in the embayment is about 3000 feet.

Results of the electrical surveys at Mt. Burton and Mt. Fitch were not promising, and it is concluded that ore bodies, at least of the type which occur at Brown's, do not exist at these prospects.

Recommendations are made for testing some of the more promising indications, and for extending the gravity survey.

1. INTRODUCTION.

The Bureau of Mineral Resources, Geology & Geophysics has conducted geological and geophysical investigations in the Rum Jungle field since 1949. The earlier part of the work was done by combined geological and geophysical parties, but during the two seasons prior to 1954 the investigations have been principally geophysical.

The geophysical work has consisted of both airborne and ground surveys. Airborne magnetometer and scintillograph surveys were conducted in 1952; a preliminary report on the scintillograph survey was written by Wood and McCarthy (1952), and the results of both the magnetometer and scintillograph surveys have been published in the form of a map (B.M.R., G71-92A) showing magnetic contours and scintillograph anomalies. The results of the airborne work led to further ground investigation of the anomalies.

The ground investigations have consisted mainly of radiometric measurements, both in the field and in the laboratory. The radiometric and allied work has been summarized by Dyson (1956). Allen (1951) used self-potential and potential ratio methods on an area extending from Brown's to Dyson's workings, and Daly (1953) investigated a large-magnitude magnetic anomaly south-west of Brown's workings.

The history of the mining field and of the Bureau's activities prior to the 1954 field season is summarized in the reports of both Allen and Dyson and the details will not be repeated here.

Following the work by Allen and Dyson, the present survey was undertaken with three purposes in mind. These resulted from the following considerations:-

(i) Geological evidence indicates that in some of the known deposits a close relationship exists between uranium and sulphide mineralisation, and it was therefore considered that by using some form of electrical survey to locate the sulphides, the search for the uranium could be assisted.

(ii) Most of the uranium mineralisation is in slate, close to its contact with limestone, and the greater part of the testing (by costeans) of radiometric indications has been concentrated near this contact, with the result that at several places its position is known quite accurately. Originally, it was thought preferable to attempt to locate the position of this contact, and work was planned for areas (e.g. Mt. Fitch and Mt. Burton) where radioactive anomalies had previously been located. From these tested areas it was proposed to extend the geophysical surveys along the intermediate untested portions of the contact. However, an examination of results at an early stage of the field work indicated that it would be better to try to locate the sulphides, with which the uranium is most probably associated, rather than the contact.

(iii) The third intention was to determine whether the boundaries of the various formations and the thickness of the sediments within the granite embayment area could be determined by gravity measurements. The gravity work was subsidiary to the electrical investigations, but it was thought that the method could prove useful in the interpretation of the regional geology and in particular the position of the favourable slate/limestone contact.

2. HISTORY OF OPERATIONS.

Field work under the general direction of Dr.J.Horvath (Senior Geophysicist) commenced on 16th August, 1954. The personnel comprised W.J. Langron and D.W. Smellie (geophysicists), three field assistants, and later a surveyor and chainman from the Department of Interior. Dr. Horvath returned from Rum Jungle on 8th September, 1954 and the party, with W.J. Langron in charge, continued the investigations until 20th October, 1954.

A locality map, showing the areas surveyed by geophysical methods, is shown on Plate 1.

Investigations commenced on Brown's area, where the Slingram (electromagnetic) and self-potential methods were tested over known geology. Results using both these methods were very encouraging. The survey was then transferred to the Mt. Fitch area, but results there were not encouraging. A small area was then pegged and surveyed near the Mt. Burton workings, which are near the limestone/slate contact and intermediate in position between Brown's and Mt. Fitch. Results there were also not encouraging, and the remainder of the time available for field work was spent in surveying extensions to some of the traverses in the Brown's -Intermediate area. These extensions were pegged over radiometric anomalies which were remote from the slate/limestone contact. Some additional traverses were then surveyed on a westerly extension of the grid using Slingram and self-potential methods, and encouraging results were obtained.

3. GEOLOGY.

The Rum Jungle area is part of the Pine Creek geosyncline, which is of Lower Proterozoic age. The Lower Proterozoic sediments have been called the Brock's Creek Group by Noakes (1949), and most uranium occurrences found to date in the Katherine-Darwin region are located in rocks belonging to this group. The Rum Jungle "Beds" form the lowest member of the Brock's Creek Group.

The geology of the Rum Jungle field has been described in reports by Noakes (1947 & 1949), Townley (1950), Ward (1950) and Matheson (1954), and also by geologists of Territory Enterprises Pty. Ltd. and earlier investigators.

Since 1949, when geological mapping commenced, the geological interpretation of the area has varied considerably, but a basic picture of the area has now been established and the main doubts are centred about the ore genesis. The main geological features are shown on Plates 1 and 2.

The mineralised zone is near the southern margin of a mass of granite which has intruded the Lower Proterozoic sediments. The granite occupies the core of a domal structure, but a major fault, known as the "Giant's Reef Fault", has displaced the south-eastern part of the granite to the south-west by a distance of more than 3 miles. The ore deposits lie in the "embayment area" between the southern margin of the main granite mass and the displaced portion, and consist principally of ~~uranium,~~ copper, cobalt and other sulphide minerals, particularly lead, with uraninite. The minerals occur chiefly along bedding planes in the carbonaceous or graphitic slate and ore bodies appear to be localized where the slates are folded and sheared and dragged by faulting. Most of the known deposits lie close to a contact between slate and limestone.

The principal uranium minerals found in the field are torbernite, autunite, saleeite and uraninite. The deposits consist of uranium-copper ore bodies, in which the uranium is present as uraninite associated with pyrite, chalcopyrite and other copper minerals, and as autunite-saleeite deposits. At White's Deposit most of the uranium is leached down to a depth of about 30 feet, but some oxidized uranium minerals have been found at the surface. Near Brown's Prospect, the copper mineralisation gives way to lead sulphide, but the relation between the lead and uranium has not yet been studied very thoroughly.

Condon and Walpole (1955) claim to recognize a dominant and widespread sedimentary control of uranium deposition, and in particular an empirical association between uranium mineralisation and "silicified limestone breccia" (the quartz-hematite breccia of other writers). Syngenetic minerals (uranium, cobalt, lead, copper, etc.) appear to have been precipitated by the abundant growth of micro-organisms in the change from shelf to off-shore reef facies, and later re-concentrated by another process.

Edwards and Carlos (1954), from work on the sulphur-selenium ratio of pyrite, regard the origin of some of the mineralisation as epigenetic, and Condon and Walpole (1955) concede that "the copper, which is generally regarded as belonging to a different metallogenetic generation, may well be epigenetic". However, there is evidence to suggest that the uranium and lead are of sedimentary biological deposition.

Stillwell (1950) noted that several specimens which he examined showed evidence of supergene replacement and that the uraninite was deposited after the formation of pyrite crystals, but before the introduction of chalcopyrite.

From the geophysical viewpoint therefore, it is evident that location of the sulphide bodies offers the greatest assistance in the search for uranium.

4. THE PROBLEM AND METHODS USED.

The ultimate object of all the geophysical work has been the location of uranium mineralisation, but the radiometric method is handicapped by the thickness of the overburden. However, fairly extensive radiometric investigations have been carried out in costeans and drill holes.

Geological evidence from White's area indicates that the various types of mineralisation occur in discreet zones within the mineralised portion. Just how generally this association applies throughout the field is not certain, but it is likely that the majority of the uranium occurs in association with sulphides.

The converse is not always true, e.g. radiometric logging of some of the drill holes which intersected sulphides at Brown's gave negative results, but this may merely indicate that the two types of mineralisation can occur at widely separated places.

The geophysical problem was to locate the sulphide bodies with which the uranium mineralisation could be associated and for this reason the present survey was confined mainly to the region near the slate/limestone contact.

Due attention was given to the results of the electrical work done by Allen (1951), who obtained distinct S.P. indications over Brown's and other areas. Though the drilling results are not conclusive, there is strong evidence to suggest that the anomalies are due to the presence of sulphide bodies. At the Intermediate area, results were of poorer quality; at White's, a complex pattern of S.P. results was obtained, whilst at Dyson's, where no primary ore has been found, no S.P. negative centres were located. Thus, there is considerable variation in S.P. response throughout the region; this is probably due to different conditions of oxidation and ore occurrence. However, a close relation is apparent between the positions of the S.P. indications and the carbonaceous beds, and Allen does not overlook the possibility that some S.P. indications may be related to the graphitic slates.

The results of the potential-ratio work carried out by Allen, whilst being of interest and generally supporting the S.P. results, do not justify the use of the method for further investigation.

Most geophysical methods for locating metalliferous deposits depend on the electrical and magnetic properties of the supposed deposits. The methods have been described by Horvath (1936). The Slingram method, a modified form of the electromagnetic method, was considered to be the most suitable for the present survey. Electromagnetic methods promise more than S.P. work, which depends for its success on so many additional factors.

Mineral deposits such as pyrite, galena, etc. have high electrical conductivity. Rock types such as graphitic schists, and mineralized waters within shear zones, also have high conductivity, and the presence of these may therefore complicate the search for the sulphide minerals. At Brown's, conditions appeared to be very promising for isolating effects due to sulphide mineralisation from those due to other causes, and it was decided to test the electromagnetic method there before investigating other parts of the field.

For the Slingram survey a portable transmitter unit, consisting of oscillator and coil, is moved along the traverse to be surveyed. A receiving unit, consisting of search coil and compensator, is connected to, and kept at a constant distance from, the transmitter, so that the whole moves as a unit along each traverse. During the present work, a transmitting frequency of 1500 cycles per second and a constant separation of 200 feet between the transmitter and receiver coils was used. Readings were taken at station intervals of 25 feet along traverses. With these parameters, it was considered that conductors such as could be expected to occur at Rum Jungle would be located.

Mumme (unpublished results) has shown that the bodies located by Allen give no magnetic response, so the magnetic method was not used during the present search for sulphides. However, a more detailed examination and interpretation of the magnetic anomaly located to the south-west of Brown's by Daly (1953) has been made by Smellie. The results of Smellie's work are being analysed and will be issued in a separate report.

In addition, further self-potential work was planned, including repeat measurements by this method on some traverses previously surveyed by Allen, an extension of the method to other parts of Brown's and the Intermediate area, and a survey of new areas at Mt. Fitch and Mt. Burton. Dyson (1956) and Mumme (1956) surveyed some regional S.P. traverses at Mt. Fitch and other areas considered in the present survey but, except for definite indications in an area known as the Power Plant, no encouraging results were obtained by them.

The repeat work was done as a check on the seasonal variation of the S.P. indications, and the new work was intended to show if anomalies similar to those at Brown's are present in other areas.

It was also planned to survey one or two regional gravity traverses across the granite embayment area. It was not expected that the mineralisation would be located directly by this means but it was hoped that gravity measurements would (a) assist in the geological interpretation and in the location of boundaries obscured by surface soils, (b) enable the depth of the sediments within the "embayment" to be estimated, and (c) give some useful information on the cause of the magnetic anomaly south-west of Brown's.

5. DISCUSSION OF RESULTS.

Encouraging results were obtained with each of the methods used, but the results of the electrical methods showed considerable differences between the several areas, even though these areas appear to be within the same geological environment. It has already been mentioned that the same phenomenon was experienced by Allen in the S.P. work from Brown's to White's and by Dyson (1955) and Mumme (1956), who conducted S.P. work in other areas.

The results of the survey are discussed below in relation to the particular areas.

(a) Brown's-Intermediate Area.

(i) S.P. method.

Traverses 84 to 44 were surveyed by this method. Two principal indications were obtained, the axes of which are shown on Plate 2. The readings have not been contoured, but the profiles are shown on Plate 3.

The first indication extends from traverse 78 to traverse 84 in Brown's Area. If these results are compared with those of Allen, it will be seen that, whereas his northernmost indication is confirmed by the present work, there is practically no confirmation of his southernmost indication, although there is an indefinite feature in a corresponding position at 180N on traverse 80. This point could be clarified by surveying traverse 79. The "disappearance" of S.P. anomalies (usually during the "wet" season) has been noted by other workers in the northern parts of Australia and is generally ascribed to the level of the ground water rising and preventing active oxidation of the body.

Drilling results which have been made available by the operating company show that the northernmost indication obtained by Allen is almost certainly due to sulphides. The results of earlier attempts to test Allen's S.P. indications were inconclusive, because the targets were not drilled in accordance with his recommendations, and on this score, criticism levelled at the value of the S.P. method in the Rum Jungle Area is not justified.

The present S.P. survey did not extend as far west as Allen's work and his western anomalies were not checked. Detailed measurements were continued easterly, however, to the vicinity of White's and included some traverses which Allen surveyed in the Intermediate area.

The second anomaly located by the present work is a well-defined indication in the Intermediate area extending from traverse 62 to traverse 67, though it is of lower intensity than the indication at Brown's. A study of these profiles reveals that:-

(a) The body responsible for this indication has a westerly pitch; the termination of the indication between traverses 62 and 60 is probably due to cross faulting.

(b) The conducting body dips at a moderately steep angle to the south, and therefore conforms to the dip of the enclosing formations.

(c) The conductor is fairly narrow.

Unfortunately, the drilling results in this section do not give any information concerning the nature and cause of the S.P. indication, but it is reasonable to expect that the indication is due to sulphide mineralisation.

Other aspects of the interpretation (particularly the relation between the S.P. and electromagnetic indications) are discussed more fully in the next section.

(ii) Electromagnetic method.

Whereas S.P. results depend on many variable factors, the electromagnetic indications depend only upon the electrical conductivity of the formation under examination and its attitude relative to the direction of the energising field. It is to be expected, then, that a deposit which produces an electromagnetic anomaly may, in some instances, not give any S.P. response; this is so in the Rum Jungle area.

The only correction which has to be applied to the Slingram field readings is for the difference in elevation between the transmitter and search coils. For an elevation difference of 7.5 feet, the correction to the field reading is about one per cent. With the exception of a few portions of the Rum Jungle area, the corrections are negligible, and for most of the work the readings at field stations could be plotted without correction for elevation.

The Slingram method has the further advantage that all indications are directly related in magnitude, and the uncertainty attached to comparing two indications at different distances from a straight primary cable does not have to be contended with. The effect of the general ground conductivity is, of course, still present, but because of the constant distance between the coils, this effect can be allowed for more easily.

Traverse 78 was read with the transmitter coil first on the northern side of the receiver coil and then on the southern side. Indications were obtained only in the vicinity of Brown's and the difference in position and size of the corresponding indications on each set of readings was negligible. This denotes a narrow conductor. All subsequent Slingram work at Rum Jungle was carried out with the transmitter coil on the northern side of the receiver coil.

The results of the Slingram survey have been studied in the form both of profiles and of vector diagrams. In the latter, the value of the real component at each station is plotted along the "x" axis and the imaginary component is plotted along the "y" axis of a rectangular co-ordinate system; the successive points obtained in this way are joined to give the vector diagram for the traverse. A discussion of the interpretation of results plotted in the form of vector diagrams is given by Hedstrom (1940). A selection of vector diagrams is shown on Plate 4 and the axes of the indications which are contained in the vector diagrams have been plotted on Plate 2.

A study of the results shows that there are two principal axes of conductivity. These have been designated as "A" (northern) and "B" (southern). Unfortunately, because of the buildings at Brown's drilling camp, the area between traverses 86 and 92 could not be surveyed by this method.

The indications contained in the vector diagrams vary in intensity and strength throughout the area. As with profiles, the intensity of an indication is shown directly by its amplitude. Also, some idea of the depth to the current concentration within the body is given by the width of the indication. The slope of the indication is a measure of the conductivity of the conductor, a higher conductivity being shown by a steeper slope. It can be seen that the conductivity of conductor "A" ranges from very good near traverse 76 to fair near traverse 98. If the indication is due to mineralisation, the variation in conductivity may be a guide to the percentage of copper in the ore. However, for a given percentage of copper, the conductivity will be less if the copper is disseminated than if it is compact. Drilling results show that the percentage of copper increases in an easterly direction from Brown's whilst the percentage of lead increases towards the west.

<u>Indication "A"</u>. Usually, depending mainly on the width and dip of the body, the S.P. axis is displaced up-dip from that of the electromagnetic axis, because the S.P. indication originates from a portion of the body nearer to the surface. Such a difference is found in the position of the axes of the S.P. and electromagnetic indications at Brown's, but in addition the axes diverge, the distance between them ranging from a few feet at traverse 76 to more than 100 feet at traverse 84. Because of the small amount of core drilling, the drill sections supplied by the company (see Plate 5) are not very helpful in explaining the divergence of the electrical axes, but two alternatives may be considered.

As the first alternative, it is possible that the self-potential and electromagnetic indications have their origin in the same body. In its simplest form, a body with a very flat dip would be required to explain such a wide separation of the electromagnetic and S.P. axes, as is recorded for example near traverse 84. However, this is contrary to the condition known to exist at Brown's where the drilling results indicate that the dip of the bodies is at least 50°.

The second alternative is that the self-potential and electromagnetic indications have their source in different bodies and this idea is borne out to a certain extent by the drilling results. The drill sections between traverses 78 and 84 (see Plate 5, Figs. 1, 2 and 3) show that the S.P. and electromagnetic anomalies of Indication "A" are possibly associated with different sulphide shoots. There appear to be corresponding trends of the axes of the anomalies and of the sulphide shoots until each joins, to form an almost coincident axis and lode respectively, near traverse 78.

This explanation, likewise is open to some doubt because there is no <u>a priori</u> reason why one of the shoots should give one type of anomaly and not the other, unless there is a difference in their mineral composition. A better understanding of the problem is possible by examining the geophysical and drilling results along traverse 84.

The drill results from DDH.172 show that there are two separate lead sulphide shoots, S1 and S2. The results from the deeper hole, DDH.163, are incomplete because no core was taken in the first 300 feet. The existence of shoot S1 at depth is, therefore, not confirmed but shoot S2 is proved to be of considerable thickness.

The electromagnetic indication shown in the vector diagram of traverse 84 consists of a weak shallow indication at 370N superimposed upon a broad and moderately strong indication at the same place, which must have its source at some considerable depth. This result suggests that the main broad indication is due to the main shoot S2 and the weak indication to S1 which must be only a small vertical shoot off the main body, as suggested in the modified section in Plate 5, Fig. 1.

An examination of the self-potential profiles leads to the same conclusion. There is a large S.P. anomaly at 470N which must be associated with the main shoot S2 and a very weak indication at 350N which could be due to the much smaller shoot S1. The large amplitude of the S.P. anomaly at 470N suggests that shoot S2 does not pinch out towards the surface, as the drilling results indicate, but that is has a considerable thickness. Moreover, the upper portion of S2 must lie above the level of the water table at the time of the survey, i.e. it must extend to within 30 feet of the surface, if it is the source of the strong S.P. anomaly. This idea can be tested only by further drilling.

There are several other possibilities that have to be considered in the interpretation of the electromagnetic and S.P. results. The electromagnetic indication could be due to graphitic schist, but the definition and the high conductivity shown by the indications in the vector diagrams do not support this view. Also, it is unlikely that such well-defined S.P. indications would be obtained from sources other than mineralisation.

The writer does not know of one instance where an S.P. indication has not been found to be associated with mineralisation (though often only pyrite). R.F. Thyer (Chief Geophysicist, Bureau of Mineral Resources) has suggested that perhaps the carbon in the slates plays an important role in maintaining the current flow, e.g. by preventing "poisoning" of the cell. There is thus the possibility that the S.P. indication is related to mineralised graphitic beds and the electromagnetic indication to sulphide.

The width of some of the S.P. indications appears to be too great to be caused by a compact mineralised lode, especially as the depth to ground water is only about 30 feet at Brown's, but it is possible to obtain such indications even from fairly narrow conducting bodies at this depth. It may also be noted that S.P. readings were extended to 6000 feet an traverse 78 (i.e. across the northern slates) but no other indication was obtained.

It appears, therefore, that at Brown's both the S.P. and the electromagnetic indications arise frommineralised bodies, or shoots from one body, though the effect observed may depend to some extent on the mineral composition of the shoots. The geophysical results cannot be interpreted more specifically than this until more drilling information becomes available.

Indication "B". Neither the surface geology nor the drilling results give any information on the source of Indication "B". This indication is well defined on many traverses, but, like Indication "A", represents a considerable variation in conductivity throughout its length. This variation is shown on both the vector diagrams (Plate 4) and on Plate 2. It should be noted that on several traverses (e.g. traverse 78) the conductivity of the two conductors "A" and "B" is approximately of the same order.

The trend of Indication "B" and its continuity suggest that it is a continuation of the electromagnetic/S.P. indication in the Intermediate area, which is associated with sulphide mineralisation. This points to the possibility that, at Brown's also, Indication "B" is due to sulphide, a possibility which is supported by the presence of Allen's second S.P. indication in close proximity to the line of Indication "B" and a short distance up-dip from it.

Whether the length of Indication "B" is a factor against its being due to an ore body is questionable. Perhaps the indication may in part represent only the ore-channel or even a barren shear zone, with the stronger electromagnetic indications occurring over sulphide deposits. This is pure conjecture on the writer's part; the matter can be clarified only by test drilling.

(iii) Gravity Method.

Gravity measurements were made along traverses 78 and 104 and, for the purpose of correlating the gravity profile on traverse 78 with the known geology, the Company's Chief Geologist, Mr. W.N. Thomas, prepared a generalised geological section along this traverse. The section is shown on Plate 6.

The gravity profiles along traverses 78 and 104 are shown on Plate 7, Figure 1. The density of the granite is less than that of the slates and limestone and for the purpose of direct correlation with the geological section, the profiles have been plotted inversely, i.e. with gravity values increasing downwards.

The gravity values which have been plotted are the field readings to which free air, Bouguer and latitude corrections have been applied. All gravity readings have been referred to station 500N on traverse 78 as base. The method of plotting a "density profile" (Nettleton, 1940 p.57) to obtain a density value for use in the Bouguer correction was used but it was not satisfactory because of the low topographical relief in the area. A density value of 2.3 was selected for this correction but the value may be somewhat in error. However, it is unimportant because the maximum difference in elevation along the traverses is 55 feet.

Densities of the Rocks.

The densities of some of the sedimentary members have been measured and these are shown in Table 1 (densities of drill-core samples) and Table 2 (densities of surface samples collected along the traverse).

The results of the density measurements show clearly that the density of the sediments is generally greater than the average density of the underlying granite and granitised sediments which average 2.61. Of particular note is the dense limestone which crops out on traverse 78 between 2200N and 400N. This is the same limestone that is intersected by the drill holes listed in Table 1. Its average density, determined from both the drill-core and surface samples, is 2.96. The limestone which crops out between 5500N and 4650N could not be sampled with the same thoroughness because fresh samples were unavailable, but it appears that this limestone is less dense than the limestone between 2200N and 400N. The sediments other than the

TABLE 1.

DENSITY DETERMINATION OF DRILL CORE SAMPLES

SLATE

D.D.H. No.	Depth (ft.)	Density
171	99	2.69
	123	2.88
	150	2.83
	165	2.79
	180	2.85
	219	2.77
	283	2.72
	463	2.79
170	417	2.73
160	201	2.75
	300	2.79
163	450	2.94
156	354	2.77
154	57	2.56
157	100	2.78
81	80	2.58
	Average	2.76

LIMESTONE

D.D.H. No.	Depth (ft.)	Density
170	482	3.06
	505	3.03
171	508	2.95
172	383	3.06
	403	3.00
157	214	2.84
160	390	2.90
	Average	2.98

TABLE 2.

DENSITY DETERMINATIONS OF ROCK SAMPLES ALONG TRAVERSE 78

Location	Description	Density
7400N.	Coarse-grained "porphyritic" granite	2.71
7050N, 75W.	Porphyritic granite	2.66
6600N.	Finer grained micaceous granite, porphyritic	2.62
6300N.	Granitized grit (or crushed granite?), much sericite	2.41, 2.67
	. . . .	
6250N.	Hematite boulder conglomerate	3.00
6200N, 100W	White quartzite	2.62
4900N, 500W (approx. pos.)	Asbestiform limestone (? non siliceous)	2.40
3500N.	Pink quartzite breccia, sandy matrix, little hematite.	2.97
3450N, 100W	Pink quartzite breccia, very hematitic, silicified.	2.73
3375N.	Pink quartzite & pink sandstone	2.67
2950N, 200W	Pink sandstone	2.60
	. . . .	
1550N, 75W	Massive marble	2.85
550N, 200W	Bedded limestone from pit 6' deep, little altered.	2.94
550N, 75W	Massive limestone, from sub-surface outcrop, partly altered	2.95
	. . . .	
1450S, 50E	Grey sandy quartzite	2.60
1975S	Pink quartzite breccia from leached and laterized outcrop.	2.57
2500S	Pink quartzite & gritty member with abundant white quartz veins	2.68

limestone between 2200N and 400N have been grouped for the purpose of interpretation, and their average density is approximately 2.85.

In the interpretation, therefore, use has been made of the following average densities.

Granite and granitised sediments	2.61
Limestone (between 2200N and 400N)	2.96
Remainder of sediments	2.85

Interpretation of Traverse 78.

The Company's Chief Geologist, in preparing at the author's request the generalized geological section along traverse 78, (Plate 6), assumed that the limestone which crops out between 5500N and 4650N is identical with the limestone which crops out between 2200N and 400N. It was also assumed that it terminates at depth against the Giant's Reef Fault on the southern end of the traverse. As a result of these assumptions, the general structure is shown as two adjacent synclines with axes at approximately 3500N and 600S, the thickness of sediments in the southern syncline being approximately double the maximum thickness in the northern syncline.

The gravity profile to be expected from such a section, in which the sediments are denser than the underlying granite, would contain two maxima coinciding with the two troughs, the anomaly being a maximum over the axis of the southern trough. The observed profile, however, shows only one maximum coinciding approximately with the centre of the limestone outcrop between 2200N and 400N. This strongly suggests the presence of only one syncline with its axis coinciding with the gravity maximum. The gravity data could be brought into agreement with the geology by assuming that the limestone which crops out between 5500N and 4650N is distinct from that which crops out between 2200N and 400N. This conclusion is supported by the density measurements referred to above which indicate that there is a marked density difference between the two limestones.

The interpretation of the gravity profile has therefore been based on the assumption of a single syncline. The shape of the profile indicates that this syncline is asymmetrical and that the greatest depth of sediments is at 1300N. The variations of the gravity profile indicate that the granitized sediments and the Crater Grits are of approximately the same density; the principal density contrast is between those and the remainder of the sediments, i.e. the limestones, slates and breccias.

The drilling information from Brown's area proves that the slate-limestone contact has a southerly dip. To obtain a geological cross-section which is in agreement with the gravity results it is necessary to assume overturning of the beds in the region of the contact. This assumption is justified because drilling near White's has indicated the presence of overturned folding. Moreover, the asymmetry of the gravity profile is consistent with such overturning.

If the northerly dips shown near 2800N on the Company's section (Plate 6) are real, it will probably be necessary to assume some overturning of the beds in this region also to obtain agreement between the geology and the gravity results. However, it is doubted whether the dips shown are based on reliable field measurements.

To obtain some idea of the distribution of sediments in the syncline a number of theoretical sections were calculated and the theoretical and observed anomalies were then compared. It has been necessary to assume a regional gradient, the value of which is shown on Plate 7, Figure 1, because a prominent feature of the gravity profile is the continued southerly decrease in gravity to values much less than those on the northern end of the profile.

As a first approximation, it has also been assumed that the sediments which fill the syncline (of which the top of the Crater Grits forms the base) have a density difference of 0.24 with respect to the underlying granite and granitised sediments. By assuming a body with a lower boundary A, of the shape shown in Plate 7, Figure 2, an approximate agreement was obtained between the northern and part of the southern portions of the theoretical and observed gravity profiles. A second body with a lower boundary B, of additional density 0.11, was then introduced to account for the maximum near the centre of the observed profile. It should be noted that the straight-line boundaries A and B could be replaced by the smooth dotted curves shown in Plate 7, Figure 2, without altering the theoretical curve appreciably.

There is disagreement between the gravity results and the geological section at the southern end of the traverse. The calculated section does not take into account the grits and quartzite breccia which crop out between 1000S and Giant's Reef Fault but these lighter rocks differ little in density from the granite and granitized sediments and therefore do not contribute to the gravity difference. However, it is inferred that certain rocks which do not crop out in this section have some effect upon the gravity profile, although there is no direct evidence for the presence of these other rock types which possibly include the lower density limestone.

There are some minor features on the observed profile which correlate with the geology, e.g. the breccia which crops out between 3700N and 3000N is associated with a slight increase in gravity values. Also, the breccia outcrop between 1800S and 2050S is associated with slightly higher gravity values. Other departures from the general level of the observed curve (such as those in the region of 3800N, 3000N, 1400N, 800N and 400S), and the gravity gradients associated with them, are distinct features on the profile and are most probably due to individual beds whose densities differ slightly from the average value (2.85) that has been assumed for the sediments comprising the main body A. However, although the limestone-slate contact at 400N is accurately known, there is no feature on the gravity profile which can be related to this contact.

The theoretical profile has been used to obtain an approximate order of depth and general form of the sediments. Calculations show that the greatest depth of sediments, i.e. to the base of the Crater Grits, which occurs below 1300N, is approximately 3000 feet.

There is no feature on the gravity profile which corresponds to the Giant's Reef Fault, but if only granite, granitized sediments and/or the grits and quartzites which have similar densities to the granite and granitized sediments are displaced vertically by the fault, no gravity effect could be expected.

It should be emphasized that the geological section which has been constructed from the results of the gravity measurements greatly oversimplifies the actual conditions and is meant only to elucidate the broad structural features of the syncline.

Interpretation of Traverse 104.

Traverse 104 was also surveyed and the gravity profile, plotted to the same datum as that of traverse 78, is included on Plate 7, Figure 1. The traverse was pegged to cover the magnetic anomaly which is known to exist there, and it was limited to a length of 2,900 feet for this purpose.

A comparison between the gravity profiles of traverses 78 and 104 shows that (a) there is a marked similarity in their form, even minor features being repeated, and (b) there is a difference of approximately 1.5 milligals between the general level of the two profiles i.e. a westerly increase of 1.5 milligals. This indicates a deepening of the sediments to the west.

On the basis of the geological section supplied by the Company (Plate 6), and considering also the shape of the outcrop of the denser limestone (density 2.96) in plan (Plate 2), it would have to be concluded that this limestone plunges under the slates and breccias in the vicinity of White's, i.e. that the syncline has an easterly pitch. The gravity results on the other hand show clearly that this syncline pitches to the west.

Conclusions.

Contrary to the geological information supplied by the Company, the gravity measurements suggest the presence of a single syncline which has a maximum depth to the base of the Crater Grits of approximately 3,000 feet and whose axis passes through 1300N. The gravity interpretation also indicates that the syncline plunges to the west.

To obtain agreement between the gravity profile and the known dip of the limestone-slate contact at Brown's, it has been necessary to assume overturning of the beds in the region of the contact. This interpretation is consistent with the gravity results and if it can be accepted, then such overturning, implying as it does a greater degree of folding, shearing and crushing of the rocks, might explain why the mineralisation is confined to this particular contact.

It appears likely that further gravity surveys would aid substantially in the understanding of the general structure of the sediments in the "embayment" area and further gravity investigations are recommended.

(b) Mt. Burton Area.

Six traverses were pegged at Mt. Burton over the radioactive anomalies previously located by geologists of T.E.P. The area is undulating and hilly and is extensively costeaned. The geology is similar to that at Brown's, the mineralization and radioactive indications being located near a slate/limestone contact.

A noticeable feature is that one of the two strong radioactive anomalies occurs over limestone. Usually, radioactivity is associated with the slate members, but south of White's, for example, radioactivity has been noted in association with limestone. This aspect is being investigated by J. Daly (Supervising Geophysicist, Bureau of Mineral Resources), whose opinion is that such radioactivity is only associated with crystalline limestone, such as occurs there and near Mt. Burton.

The test traverses were surveyed by S.P. and Slingram methods. The plan on Plate 8 shows the geology of the area, the geophysical grid and the principal geophysical results, including the radioactive contours prepared by T.E.P. geologists. The results of each geophysical method are discussed below.

(i) S.P. method.

Each traverse was surveyed by this method and the results, in the form of profiles, are shown on Plate 9, Fig. 1. The survey was done during dry weather and two contacts at each station were watered before readings were taken.

The profiles, generally, are irregular, with an average difference of 10 to 20 millivolts between the two readings at each station. Many of the irregularities in the profiles result from the disturbance of the ground by costeaning but, in addition, some are probably due to surface variations in ion concentration.

The only features of interest in the S.P. results are the negative anomalies near the western end of traverses 13N and 14N. The axis joining these two anomalies is shown on Plate 8, on which it will be seen that the S.P. indication is in the quartzite-slate series which are, in part, pyritized, and that it is associated with a rather weak electromagnetic indication. The form of the S.P. profiles suggests that the body responsible for the anomalies has a steep westerly dip, in which case it is possible that the same body is responsible for both the S.P. and the electromagnetic indications. The distance between the axes of the S.P. and electromagnetic indications suggests, however, that the conductor has a flatter dip than is indicated by the S.P. profiles; conditions may, therefore, be similar to those at Brown's.

There is no definite S.P. indication associated with any of the zones of higher radioactivity.

(ii) Electromagnetic method.

Each traverse was surveyed by the Slingram method and some of the results are shown on Plate 9, Fig. 2, as profiles of the imaginary component, and on Plate 10 as vector diagrams. The indications contained in the vector diagrams are weak but stronger indications are contained in the profiles of the imaginary component.

This area is more hilly than the other areas surveyed and it was found that even small errors in pacing the mid-points between the pegs, surveyed at 50 ft. intervals, resulted in appreciable errors in the readings. For this reason, several diagrams contain irregularities. Subsequent Slingram measurements, however, were made at pegged intervals of 25 ft. and it was found that these gave more regular diagrams.

In comparison with the results which were obtained at Brown's, the results at the Mt. Burton area are disappointing. There is one feature which occurs near the western end of traverses 10N to 13N. The indication is weak on traverses 10N, 11N and 13N, but is well defined on traverse 12N and suggests a narrow, highly-conducting body near the surface. The presence of an S.P. indication, which could be related to this Slingram indication, has already been referred to.

There are other very weak indications present, the most distinct being near the midpoint of traverses 10N and 11N, i.e. about 500W. The axis of this indication is shown on Plate 8 and is of interest because (a) it is near the slate/limestone contact, the position of which is not accurately known and (b) it occurs near one of the two strong radioactive anomalies. However, the significance of the indication is doubtful because its direction of strike is contrary to the general direction of strike of the beds.

No sulphide mineralization has been reported from the area. At the time of the survey, the drilling programme had not commenced but the area has been extensively costeaned. It is suggested that the costeans near the two Slingram indications be re-examined for signs of any material which could be responsible for the electromagnetic indication. It would also be worthwhile testing the indication near the western end of traverse 12N by means of a costean, if the proposed drilling does not do this. The quality of the indications does not warrant any recommendation for testing by drilling, as it is extremely doubtful if ore-bodies of the type which exist at Brown's also exist at Mt. Burton.

(c) Mt. Fitch Area.

The area which was surveyed by S.P. and Slingram methods, together with the principal survey results and relevant geology, is shown on Plate 11.

The base line of the geophysical grid was placed so that the traverses would cover the area near the slate/limestone contact and so that the regions which had been extensively costeaned west of the contact, could be tested. Initial tests were made with traverses 200 ft. apart and, later, when more detail was required, intermediate traverses at 100 ft. separation were surveyed.

With the exception of three holes, the drilling which has been done (mainly to test the slate formation) is fairly shallow. However, the evidence from the drill holes also gives some information on the attitude of the underlying limestone and a section along traverse 1S indicates that the limestone lies generally within two hundred feet of the surface for a distance of about 700 ft. west from the base-line. Further west, the limestone plunges very steeply. Within the 700 ft. zone mentioned, the limestone does not lie flat, but has been squeezed into at least two folds with two corresponding troughs. It is believed that the events leading to this structural pattern have been closely associated with the introduction of the ore solutions.

Geologically, this area is similar to the other regions which were tested, but it should be noted from the geological map of the Hundred of Goyder (see Plate 1) that the limestone included in the investigations at Mt. Burton and Mt. Fitch is not the same block, judged by surface mapping, as the limestone which is associated with Brown's and White's deposits. In the writer's opinion, there is a distinct possibility that the two limestones are not identical; this probability has been mentioned previously in connection with the results of the gravity measurements along traverse 78 at Brown's. If the two limestone blocks in question are not identical, then the type of deposit found at Brown's and White's may not occur at Mt. Burton and Mt. Fitch. Correspondingly, the same quality of geophysical indication would not be expected, and this has been found to be so. No sulphide ore has been located at Mt. Fitch, though some oxidized copper ore has been found there. Malachite occurs in several of the costeans and torbernite has been located in the costeans in the region between 700W and 800W on traverse 2N.

The true value of the radiometric work (the contours of which are included on Plate 11) is subject to considerable doubt, as it appears that the radiometric survey was made at a time of the year favourable to the collection of radioactive material in the surface layers. Dyson (1956) has remarked on the same phenomenon in connection with radioactive work at Mt. Fitch.

The S.P. and magnetic tests of Mumme (1956) and Dyson's S.P. work, have already been mentioned. In the course of this work no indications were obtained by the S.P. method and the main use of the magnetic method seems to be to locate the position of the granite/sedimentary contact.

There is no airborne magnetic anomaly near the Mt. Fitch "deposit", as there is at Brown's, for example, but the significance of this observation is not known. The magnetic anomalies may result from basic intrusives or they may outline the perimeters of the granite intrusions. In contrast to Matheson (1954) who believes there is a close relation between uranium mineralization and acid volcanics, Condon and Walpole (1955) believe that the mineralization is subject to a strict sedimentary control. However, there seems to be some evidence for concentrating the search for mineralization in the regions of an airborne magnetic anomaly, but to what extent any relation between such factors holds is open to question.

The above brief comments have been added here to point out that, even before the start of the present test survey, there was considerable doubt regarding the potential of the Mt. Fitch Prospect. The methods, which will not be described in detail, were applied in an endeavour to detect any sulphide bodies which may be present.

(i) S.P. method.

Traverses 5N to 10S were surveyed by this method and a selection of the profiles is shown on Plate 12. In most instances, holes at each station had to be moistened to provide good contacts for the movable electrode.

The tests were commenced along traverse 00 and traverses immediately to the north, i.e., in the slate region, which is most extensively costeaned and which contains most evidence of mineralization. The results of the S.P. measurements are of similar quality to those obtained in the Mt. Burton area and generally the profiles are very irregular. The work was extended to the south, where the ground was not so disturbed by costeaning, but there was little improvement in the quality of the profiles. Differences of 20 to 30 millivolts between the two readings at each station were common along many sections of each traverse.

It will be noticed from the profiles that along most traverses the values decrease from west to east by approximately 50 to 60 millivolts per 500 ft. There is possibly some relation between this gradient and the attitude of the limestone underlying the slate, which may cause a change of pH values and ion concentration along the traverses.

The negative centre located near 250W on traverse 10S is of interest. This indication is due to a body which is situated at shallow depth and dips rather steeply to the west. The indication is located outside the contact region which has been tested by costeaning, and is not associated with an electromagnetic indication. The indication, which is not repeated on traverse 8S (no traverse was surveyed by the S.P. method south of 10S), could be due to sparse sulphide mineralization, and a recommendation for testing by costeaning is made in the next section of this report.

A similar feature near 50W on traverse 5N is due to a steeply dipping, narrow body at shallower depth than the body responsible for the indication on traverse 10S. The weak negative centre near 90W on traverse 3N may be a continuation of the indication on traverse 5N. No costeans have tested the area in the immediate vicinity of the stronger indication and it is recommended that this be done.

Any other negative centres which may be present are obscured by the general irregularity of the profiles and it is considered that no further features can be singled out for examination.

(ii) Electromagnetic method.

The survey extended from traverse 4N to traverse 18S and was concentrated about the regions of higher radioactivity and most intensive costeaning. The southern traverses were pegged so as to include the slate/limestone contact, the position of which is known only approximately. In spite of the fact that the intermediate 25-foot interval pegs were used for the Slingram work on most traverses, the readings were generally irregular. Interpretation from vector diagrams was almost hopeless in many instances, and an initial interpretation was made from the imaginary component profiles, which are less subject to irregularities. The sections of interest were then further examined by plotting the readings in vector diagram form. Many of the electromagnetic indications (the axes of which are shown on Plate 11) have been observed only on the imaginary component profiles though a few appear clearly in the vector diagrams.

Several indications have thus been located, but most are weak and poorly defined, and appear to be due to conductors of very low conductivity. Few seem to be related to other geophysical features. The irregularity of the readings over the extensively costeaned portion of the area is no doubt due partly to errors in pacing the station intervals, though on the flatter southern traverses, where each station was accurately located, the readings were still very irregular. It is considered that the operation of the Slingram method here is probably adversely affected by surface conditions but, even though the readings are not as smooth as at Brown's, any indications due to sulphide bodies such as exist at Brown's would easily have been recognised. It is clear that no such indications exist at Mount Fitch. A selection of vector diagrams is shown on Plate 13. For convenience the axes of the principal electromagnetic indications have been numbered (on Plate 11) from 1 to 4 and these are discussed below.

Axis 1. There are two well-defined indications present on this axis, and the vector diagrams of the relevant portions of traverses 15S and 16S are shown on Plate 13. There is a weak indication on traverse 18S and another on traverse 12S, corresponding in position to the direction of the axis, but no indication is found on traverse 14S.

The character of the vector diagram of traverse 16S suggests that the body responsible for the indication is a fair to poor conductor but of higher conductivity than any other detected in the Mt. Fitch area. The conductivity decreases rapidly both north and south of traverse 16S. It is difficult to estimate the depth of the conductor, but it is probably of the order of 100 ft.

The nature of the conductor is not known as there are no costeans in this region. It is recommended that the indication on traverse 16S be tested by costeaning.

Axis 2 lies within the limestone formation, but appears to be closely related to the contact between limestone and quartzite-grit. With the exception of the indications on traverses 11S and 12S, the axis is poorly defined.

The vector diagram of traverse 11S is included on Plate 13, and it will be seen that the indication is due to a poor conductor. Again the possible cause of the indication is doubtful, especially as it occurs wholly within the limestone. The depth to this body appears to be slightly greater than that to the conductor associated with Axis 1.

There are no costeans in the immediate vicinity of this axis and it is recommended that the indication on either 11S or 12S be investigated by costeaning.

Axis 3 lies in the slate formation and is roughly parallel to the slate/limestone contact. Some of the indications are very weak, and the axis, which could be a continuous feature from 4N to 11S, is shown as broken in several places. The position of this indication is interesting because it bears a similar relation to the limestone/slate contact as does Indication "A" at Brown's. Only on a few traverses is the indication clearly shown, perhaps the strongest indication being that on traverse 3N.

It is considered that this indication could represent mineralisation, but the evidence is not very strong. It is recommended that each of the costeans near the indications be examined for any signs of mineral which could be responsible for the electromagnetic indication. It is also recommended that this axis be investigated by means of the Turam electromagnetic method, as it is possible that the depth penetration of the Slingram equipment is too limited.

Axis 4 is also of interest as it corresponds in position to Indication "B" at Brown's, though the indications here are not as well defined as at Brown's, and some of the indications shown on the axis are doubtful. The region of the axis is extensively costeaned and there are several shallow bore-holes, the logs of which are not to hand. It is recommended that the results from each of the relevant costeans and boreholes be re-examined.

Axis 1 may be a continuation of Axis 4, though no indication was obtained on the intervening traverses. The presence of the well-defined S.P. negative centre at 250W on traverse 10S may be significant in this regard.

6. SUMMARY AND CONCLUSIONS.

It may be stated generally that in some areas the electrical methods have located several good conductors, which in some instances are known to be sulphides. The quality of the results varies considerably from one area to another and it is suggested that this is due mainly to the difference in the quality of the sulphide occurrences.

Several conductors were found and these require further examination, but whether or not this will lead to the discovery of uranium deposits is questionable in view of the negative results which were obtained from the radiometric logging of the drill holes at Brown's.

The limitations of the electrical methods when applied to the search for sulphide bodies have also been discussed.

At Brown's, two well-defined electromagnetic indications were located. These have been designated as Indication "A" and Indication "B". From consideration of the drilling results supplied by the Company, it is almost certain that Indication "A" is due to sulphides. There is also a well-defined S.P.

indication associated with this electromagnetic indication, but there is a marked divergence of their axes. Such divergence has been noted in surveys by other workers, and evidence has been presented to show that at Brown's, both the electromagnetic and S.P. indications are due to sulphides, and that differences in the mode of occurrence of the ore account for the observed effect.

Indication "B" is also well defined, but its cause is uncertain, as the drilling programme did not extend to this region. However, it is suggested that the indication is a continuation of a well-defined indication on the Intermediate area. At the Intermediate area there is also a well-defined S.P. anomaly, with a divergence of the S.P. and electromagnetic axes as at Brown's. The drilling results (Plate 5) show that both the S.P. and electromagnetic indications are probably due to copper mineralisation. The nature of the conductor giving rise to Indication "B" at Brown's can only be determined by drilling, as it is not certain that this indication is a continuation of the indication in the Intermediate area.

The gravity results show that the method provides a most useful aid in the geological interpretation of the area. To be of real value, however, more gravity measurements need to be made, preferably over a grid system covering the whole "embayment area".

The gravity results show that the present geological cross-section (Plate 6) along traverse 78 is incorrect. Calculations of the probable dimensions of bodies having simple shapes, suggested by the gravity results, indicate that the greatest depth of sediments (about 3,000 ft.) occurs at 1300N and that the syncline is asymmetrical. Overturning and folding of members within the syncline is probable. Many features on the profile can be correlated with surface geology and a cross-section based on the gravity results has been included in Plate 7.

The results at Mt. Burton and Mt. Fitch are disappointing and no indications were obtained of comparable size or definition to those at Brown's. At Mt. Burton, the electromagnetic and S.P. tests were confined to traverses on which radioactive anomalies had been found. With the exception of a fairly well-defined S.P. anomaly and a weak electromagnetic indication, neither of which is related to any known mineralization, the results are not promising.

At Mt. Fitch, results similar to those at Mt. Burton were obtained. Several weakly-defined electromagnetic indications (due to conductors of low conductivity) and two S.P. indications, one of which is not related to any Slingram indication, were located. As at Mt. Burton, the profiles are greatly disturbed and it is considered that the irregularities are due in part to the disturbed nature of the surface. In the southern portion, the results are a little more promising and some weak but reasonably well-defined indications were located. In no instance is the definition or size of the anomaly comparable with the indications at Brown's. However, the positions of the indications on Axes 3 and 4 (and possibly Axis 1) in relation to the slate/limestone contact, are similar to those of Indications "A" and "B" of Brown's, and this may be significant. A fourth electromagnetic indication (Axis 2) is within the limestone and its origin is uncertain.

7. RECOMMENDATIONS.

At Brown's, it is recommended that Indication "B" be tested by drilling. A hole collared at 35S on traverse 76, depressed at 60° to the north and drilled in the azimuth of the traverse, would test the indication at a vertical depth of about 90 feet below the axis of the anomaly. If the results of this test are favourable as regards ore occurrence, then Indication "B" should be systematically tested along its length.

It is considered that Indication "A" has been satisfactorily accounted for, and testing by drilling should be continued, along the lines already followed, to determine the extent and form of the sulphide body.

No testing of the gravity results is recommended, but a closer examination of the dips and dispositions of the formations included in the traverse, is desirable.

In view of the promising results which have so far been obtained, it is recommended that the "embayment" area be covered by a gravity survey with readings at intervals of 200 feet along traverses 1,000 feet apart. It is firmly believed that the results of such a survey would be of considerable assistance in geological interpretation. Of immediate assistance would be one of two traverses parallel to traverse 78 (one of these to be over the nose of the embayment), a traverse through 1600N parallel to the present base-line and a southerly extension of traverse 78 by approximately 2,000 ft.

At <u>Mt. Burton</u>, costeans in the vicinity of the principal electromagnetic and S.P. indications should be re-examined for signs of mineralisation. If no costeans exist in the vicinity of the indication on traverse 12N, it is recommended that this indication be tested by costeaning between 875W and 1000W. A second costean from 900W to 1000W on traverse 14N would test the well-defined S.P. indication on that traverse.

At <u>Mt. Fitch</u>, it is recommended that three of the stronger indications be tested by costeaning. The recommended costeans are :-

(a) From 100W to 25E on traverse 16S to test the electromagnetic indication of Axis 1.

(b) From 500E to 650E on traverse 11S to test the electromagnetic indication of Axis 2.

(c) From 350W to 200W on traverse 10S to test the S.P. indication.

Because of the rather weak indications, these recommendations are not made with confidence, but the indications are the best obtained in this area. Indications on Axes 3 and 4 should be investigated by re-examining the many costeans through which the axes pass. It is felt that at this stage no further recommendations would be justified.

The interpretation of the present results, particularly those from the Mt. Fitch area, should be reviewed when the results of the recommended tests are available.

It is strongly recommended that any further electrical work (both electromagnetic and S.P.) should continue from west of Brown's and extend over the region of the slate limestone contact towards the Mt. Burton Area.

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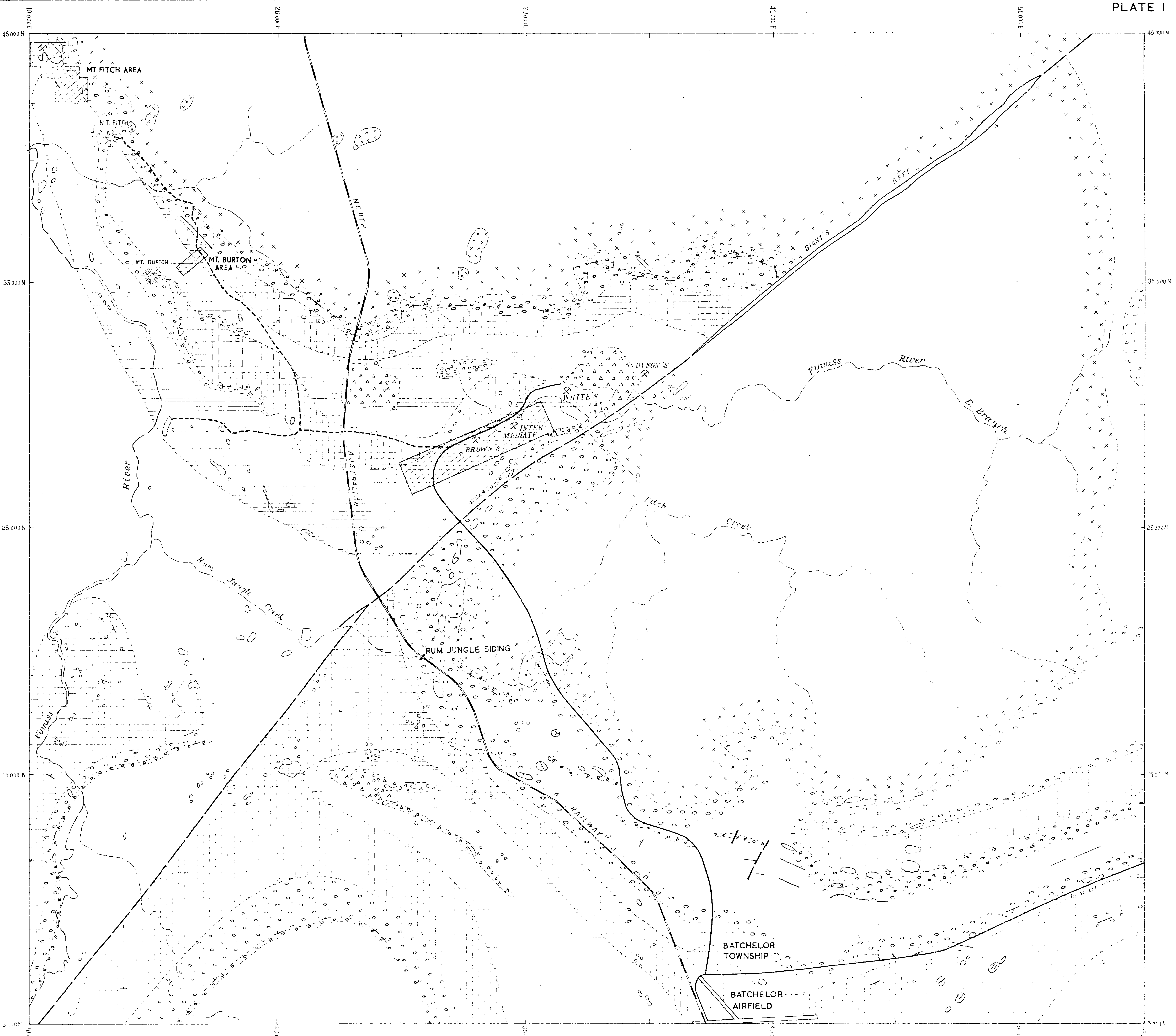
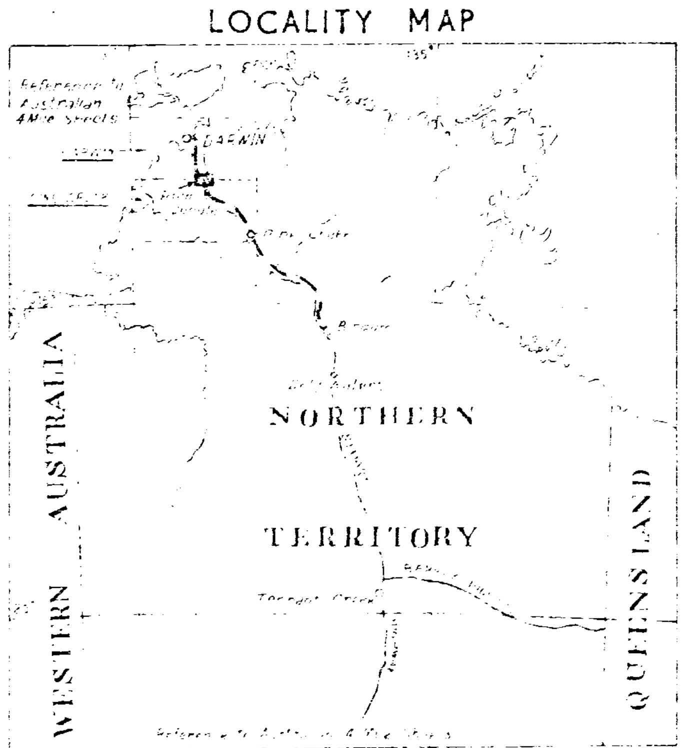
PLATE I



LOCALITY MAP



LEGEND

- Granite and granitized sediments
- Hematitic quartzite "breccia"
- Hematitic boulder conglomerate
- Black slates, grey hematitic slates chloritic slates and schists
- Limestone (silicified crystalline)
- Grits and quartzites (Crater Formation) and pebble beds
- Areas of geophysical survey
- Shear zone
- Observed rock exposure
- Fault
- Strike and dip
- Prospect
- Railway
- Road and track

GEOPHYSICAL SURVEY
IN THE RUM JUNGLE AREA, N.T. 1954

LOCALITY MAP AND GENERAL GEOLOGY

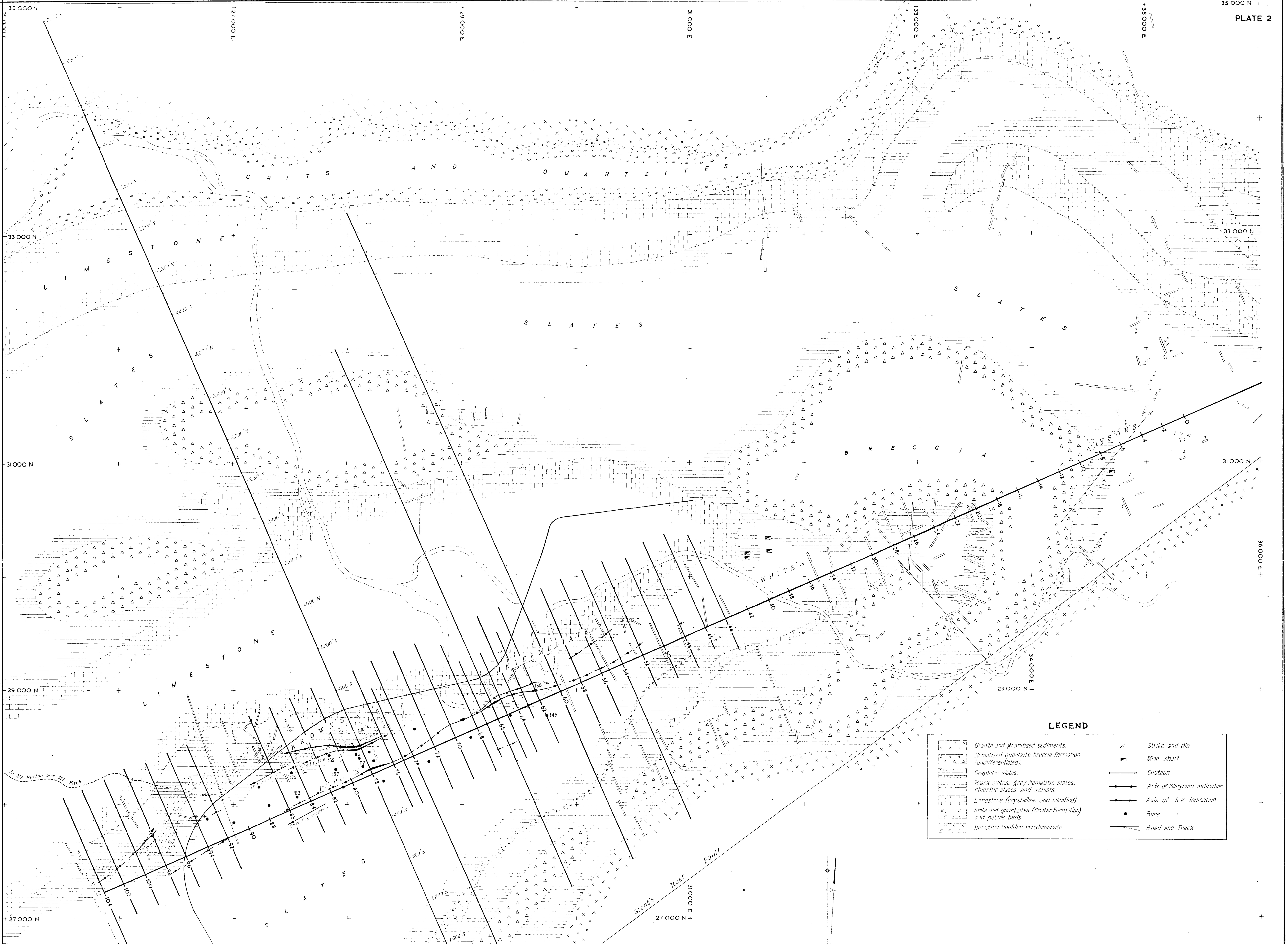
GEOLOGICAL INFORMATION FROM PLAN SUPPLIED BY T.E.P.

SCALE IN MILES

½ 0 ½ 1 1½ 2

W. J. Langron
GEOPHYSICIST

PLATE 2



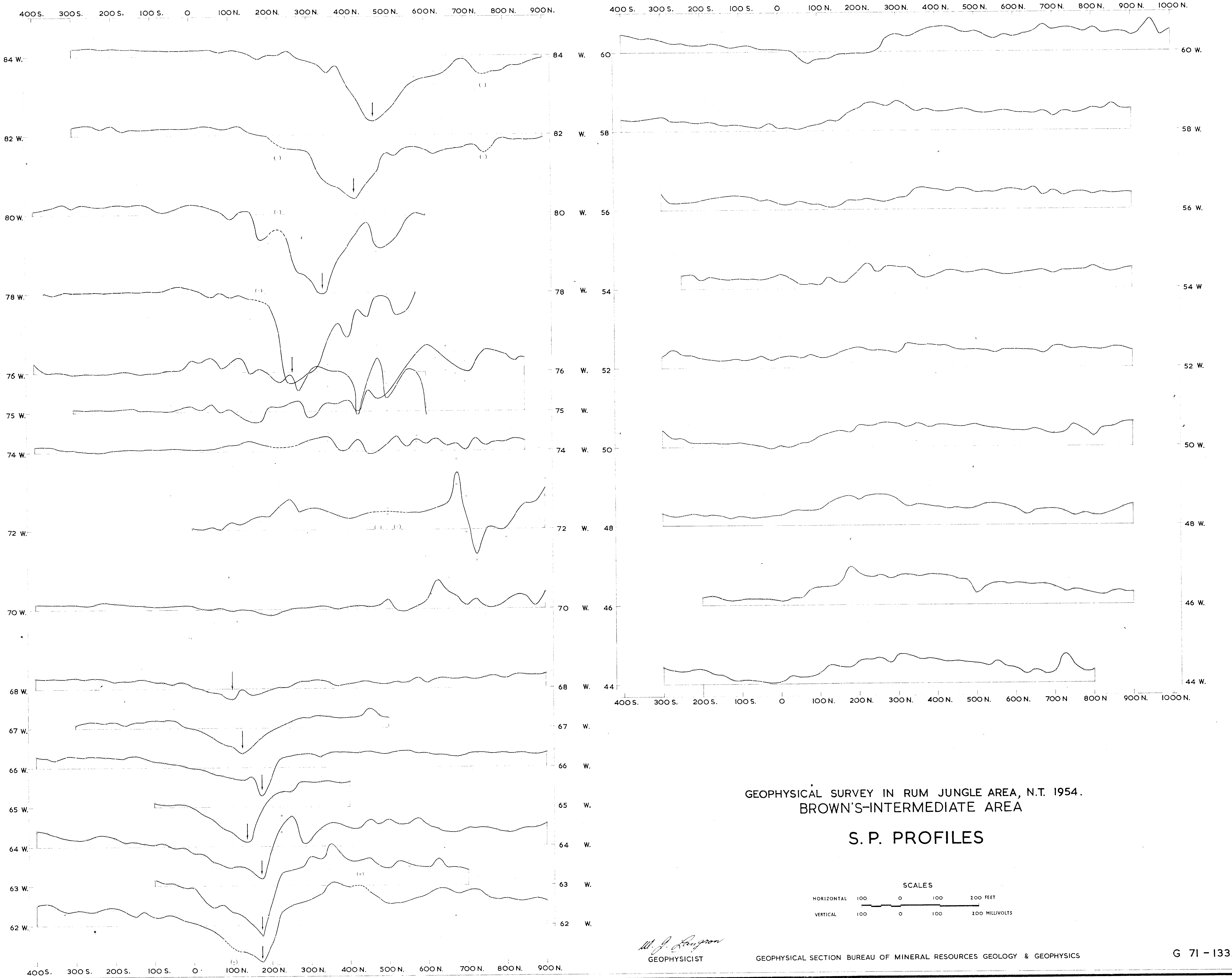
GEOPHYSICAL SURVEY
IN THE RUM JUNGLE AREA, N.T. 1954

GEOLOGY, GEOPHYSICAL TRAVERSES AND PRINCIPAL SURVEY RESULTS

GEOLOGICAL INFORMATION FROM PLAN SUPPLIED BY T.E.P.

SCALE IN FEET
400 0 400 800 1200 1600

GEOPHYSICIST



GEOPHYSICAL SURVEY IN RUM JUNGLE AREA, N.T. 1954.
BROWN'S-INTERMEDIATE AREA

S. P. PROFILES

SCALES

HORIZONTAL 100 0 100 200 FEET

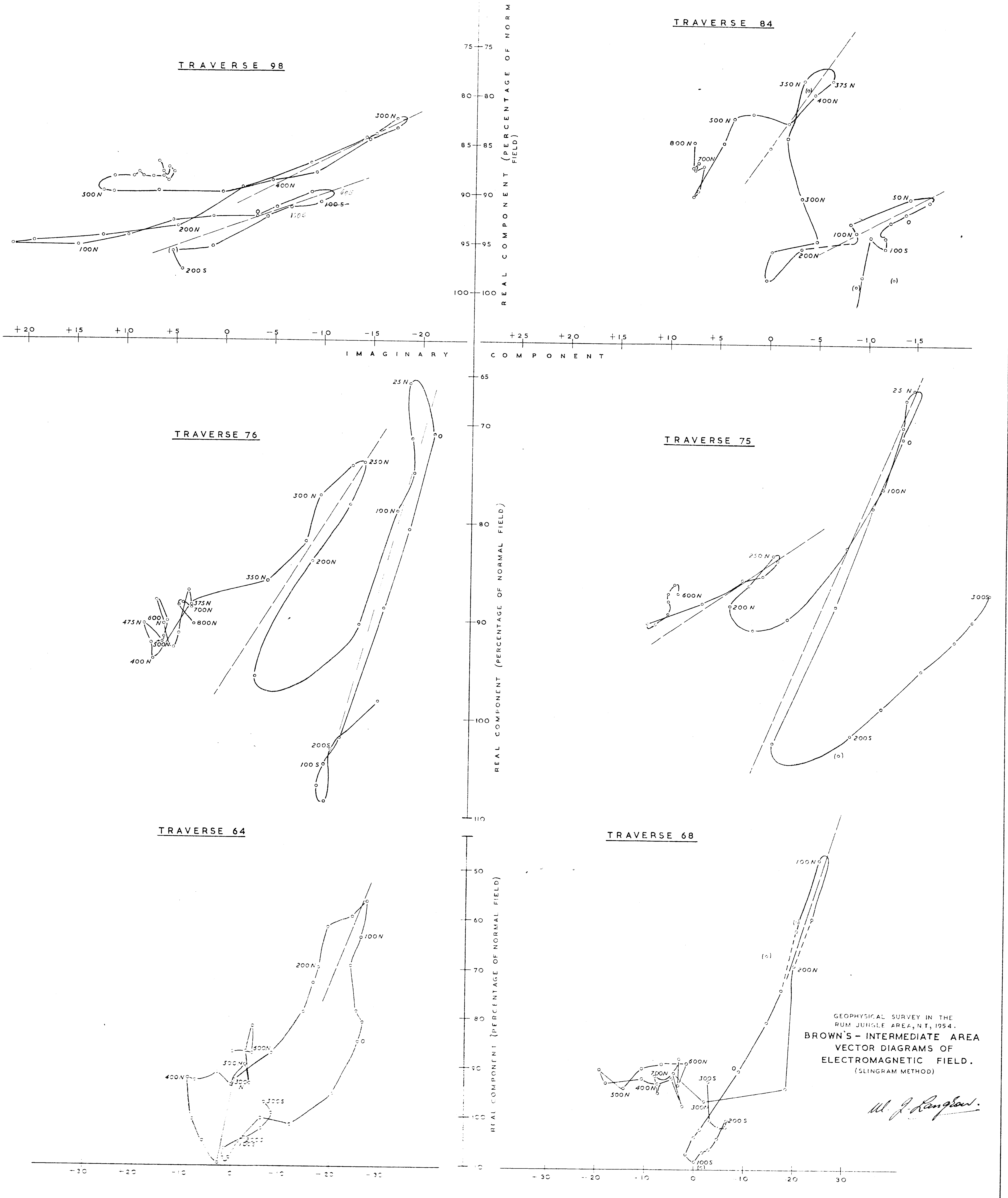
VERTICAL 100 0 100 200 MILLIVOLTS

W. J. Langron
GEOPHYSICIST

GEOPHYSICAL SECTION BUREAU OF MINERAL RESOURCES GEOLOGY & GEOPHYSICS

G 71 - 133.

PLATE 4



Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics. G 71–143

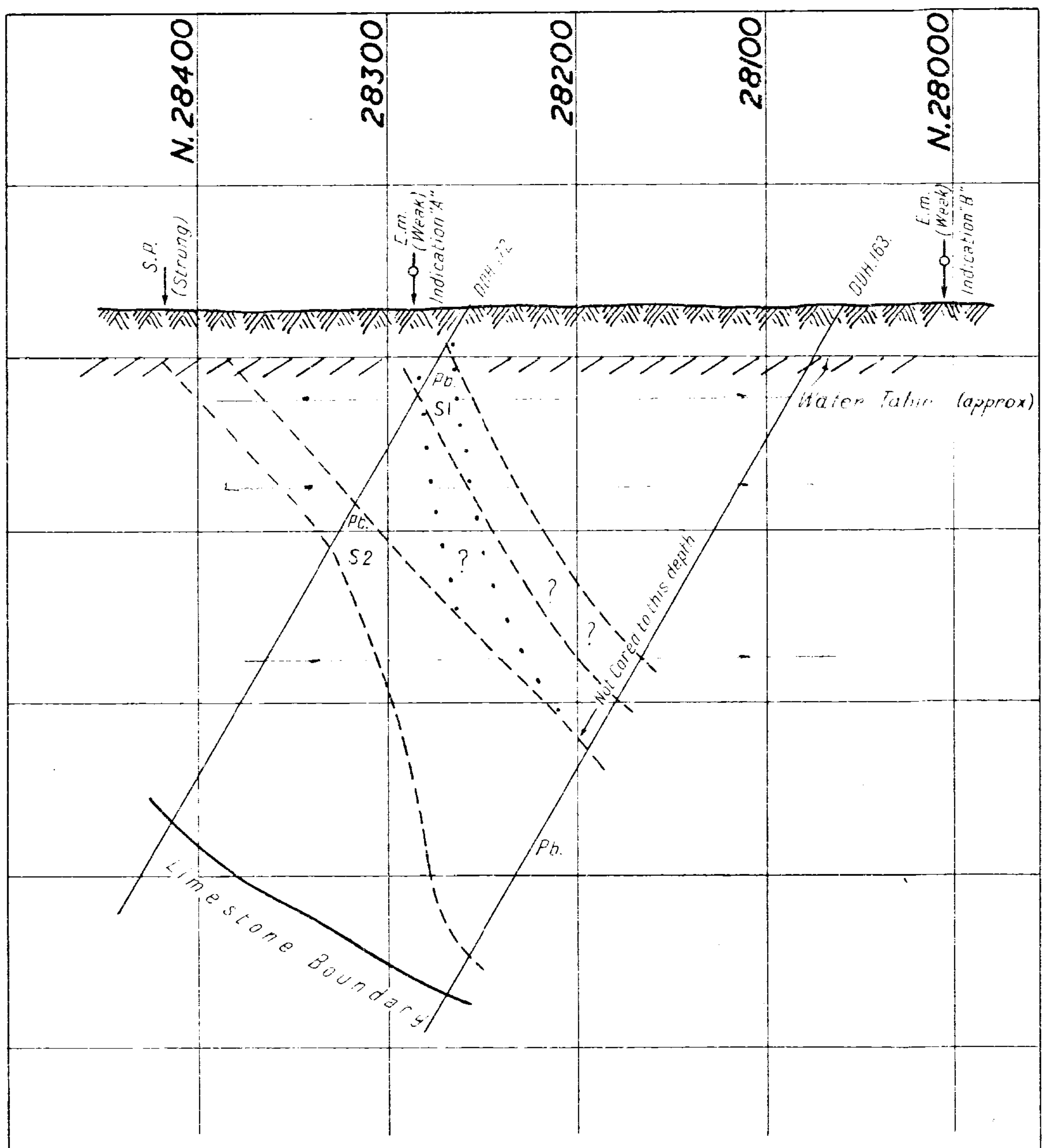


FIG. 1. SECTION NEAR TRAV. 84.

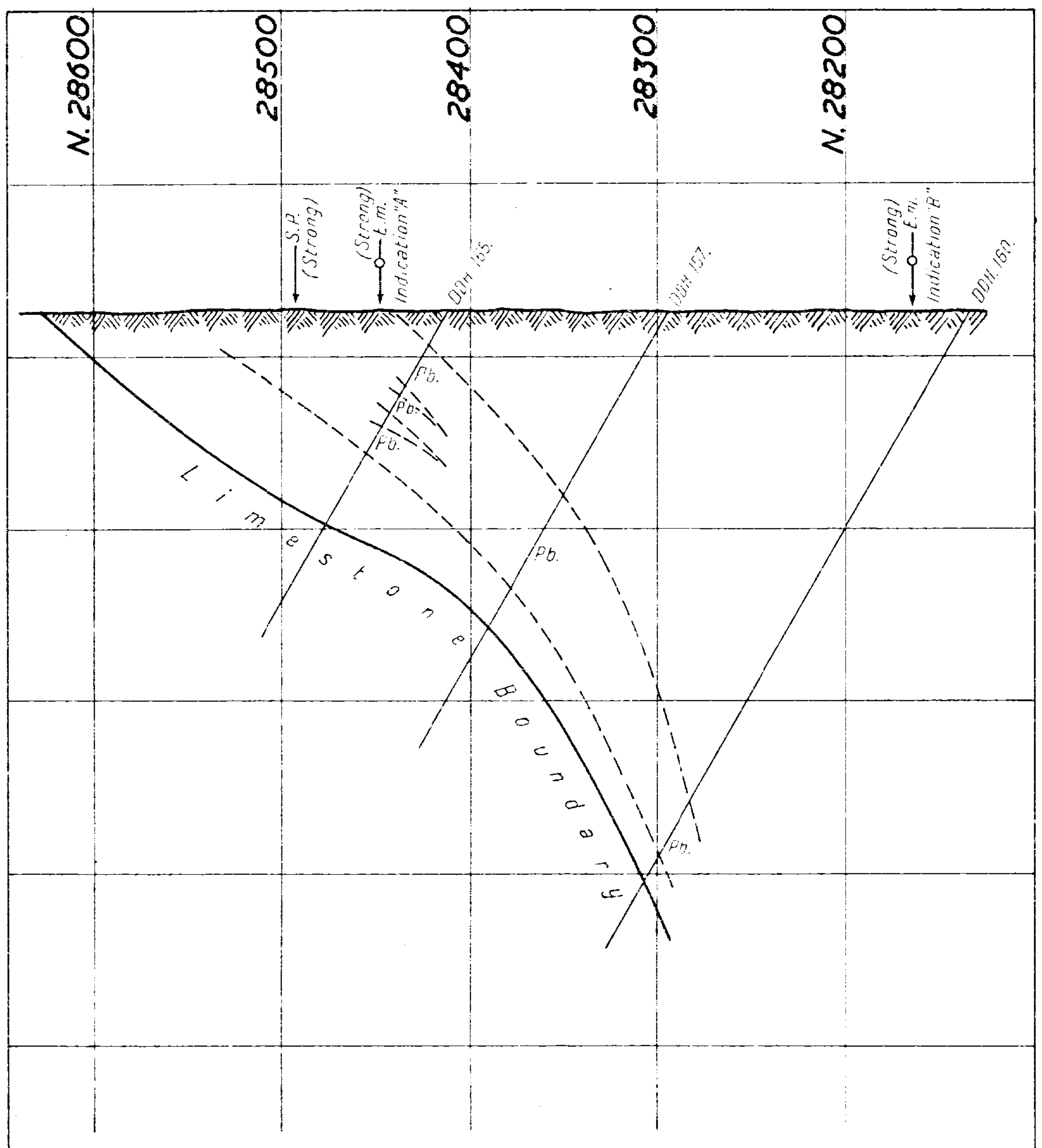


FIG. 2. SECTION NEAR TRAV. 80-82.

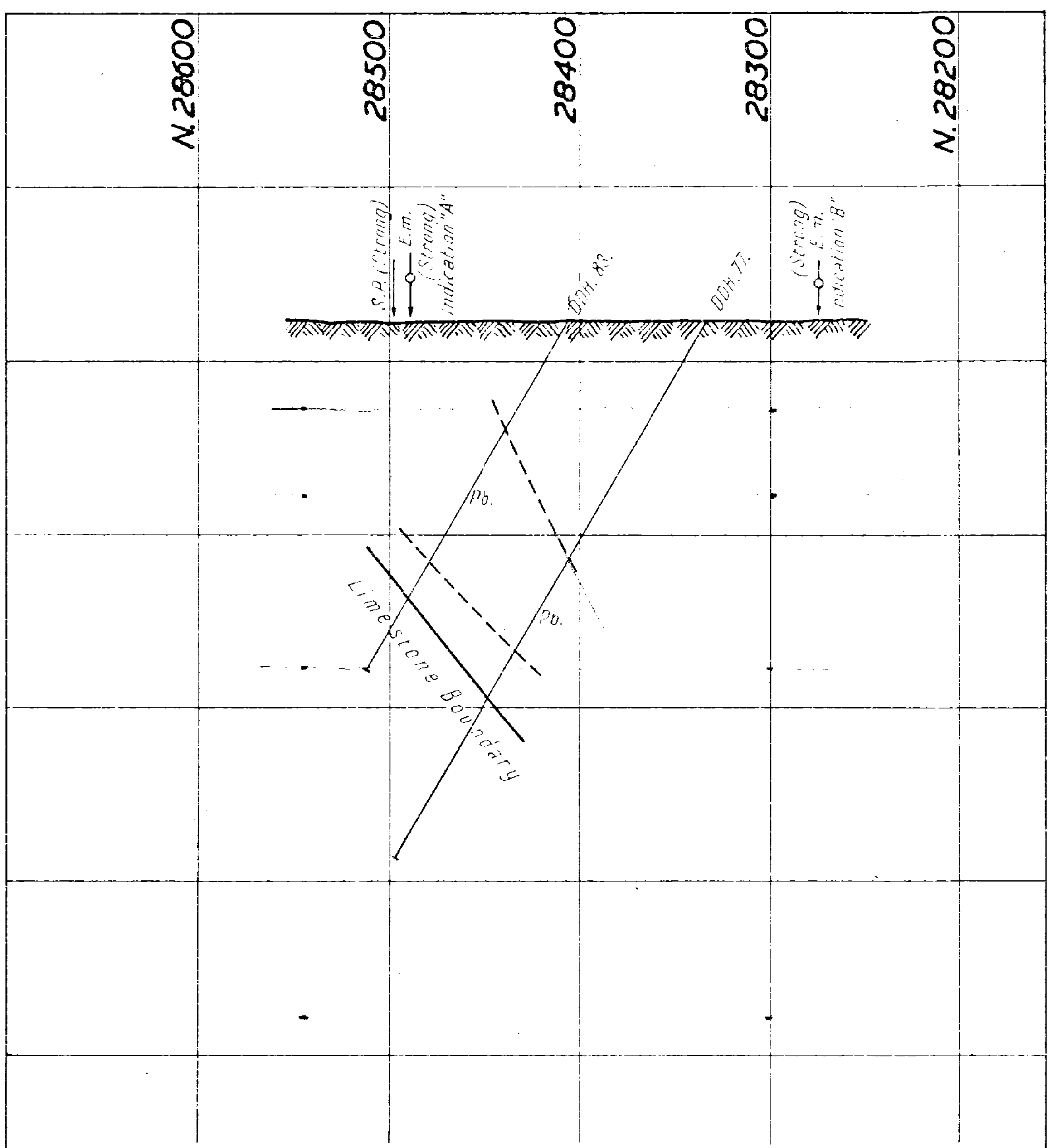


FIG. 3. SECTION NEAR TRAV. 78.

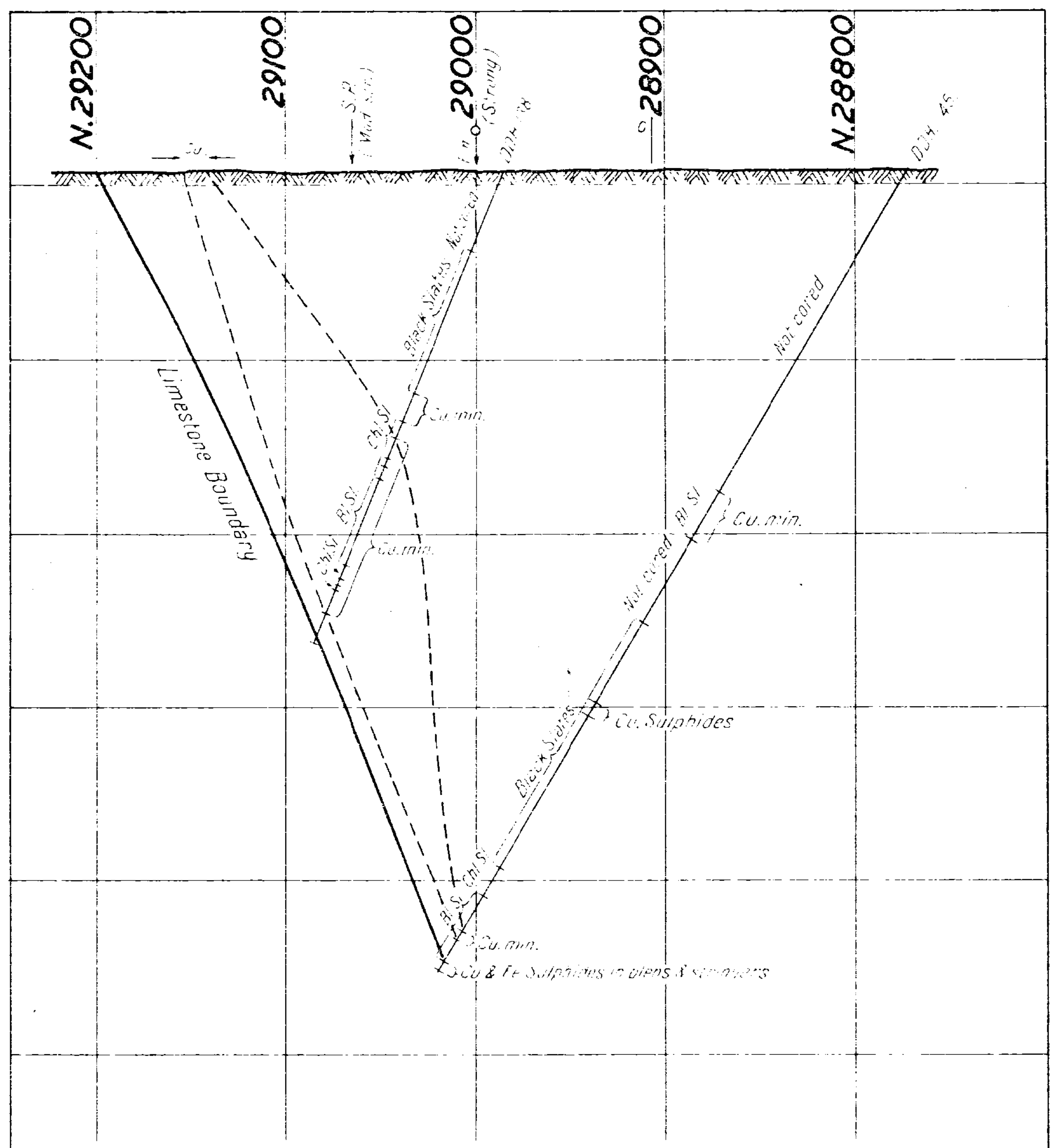


FIG. 4. SECTION ALONG TRAV. 62.

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1954.

BROWN'S - INTERMEDIATE AREA

RELATION BETWEEN AXES OF S.P. AND ELECTROMAGNETIC INDICATIONS AND DRILLING INFORMATION

(DRILLING INFORMATION FROM PLANS SUPPLIED BY T.E.P.)

SCALES IN FEET

HORIZONTAL	100	0	100	200	300
VERTICAL	100	0	100	200	300

W. J. Langron
GEOPHYSICIST

GEOPHYSICAL SECTION BUREAU OF MINERAL RESOURCES GEOLOGY & GEOPHYSICS

G 71 -134

PLATE 6

GEOPHYSICAL SURVEY
IN THE RUM JUNGLE AREA, N.T. 1954

GENERALISED GEOLOGICAL CROSS-SECTION ALONG TRAVERSE 78

AS SUPPLIED BY T.E.P. GEOLOGICAL DEPARTMENT

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

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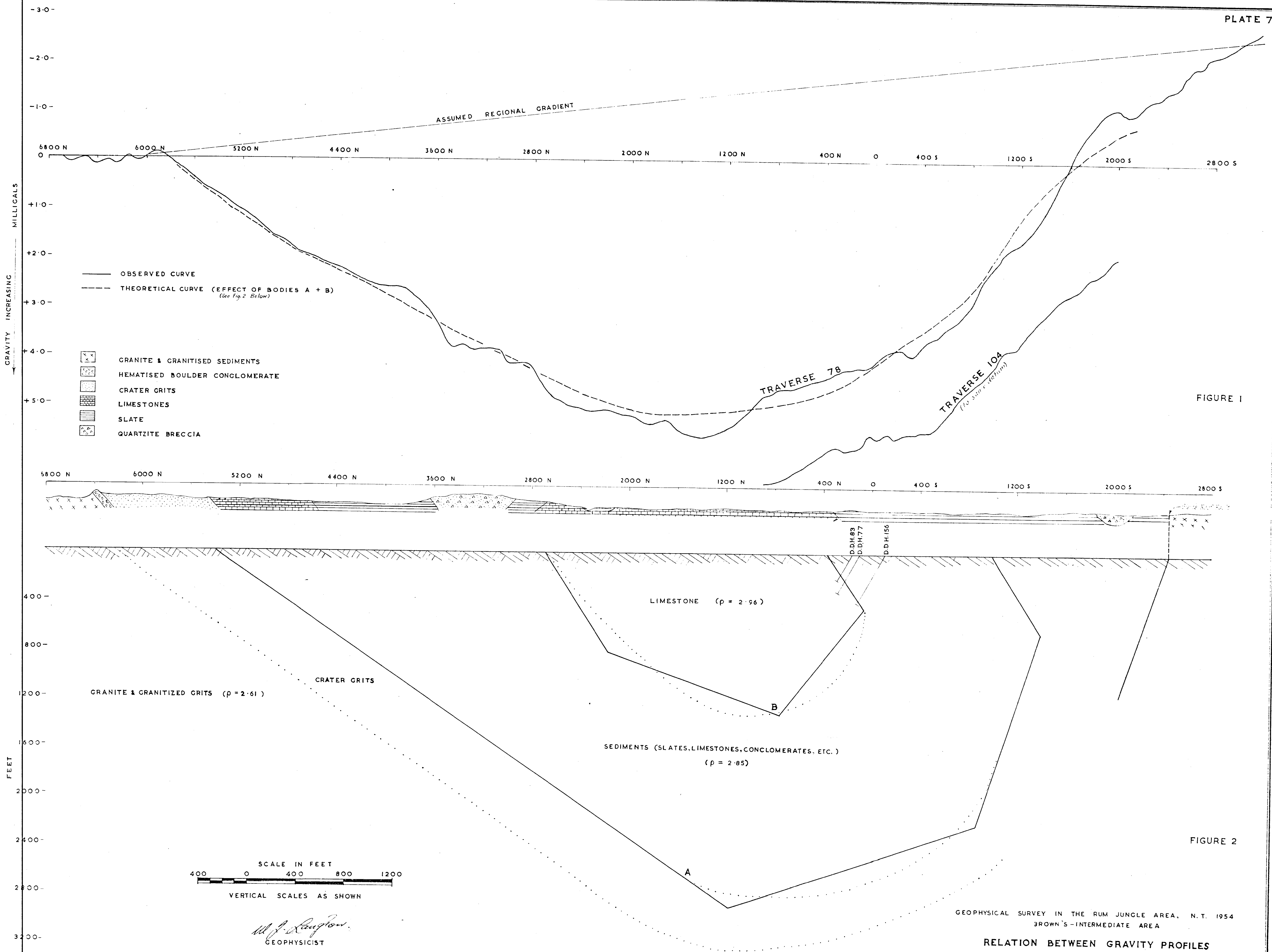

GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1954
BROWN'S-INTERMEDIATE AREA

RELATION BETWEEN GRAVITY PROFILES AND GEOLOGICAL CROSS SECTION

G 71-135

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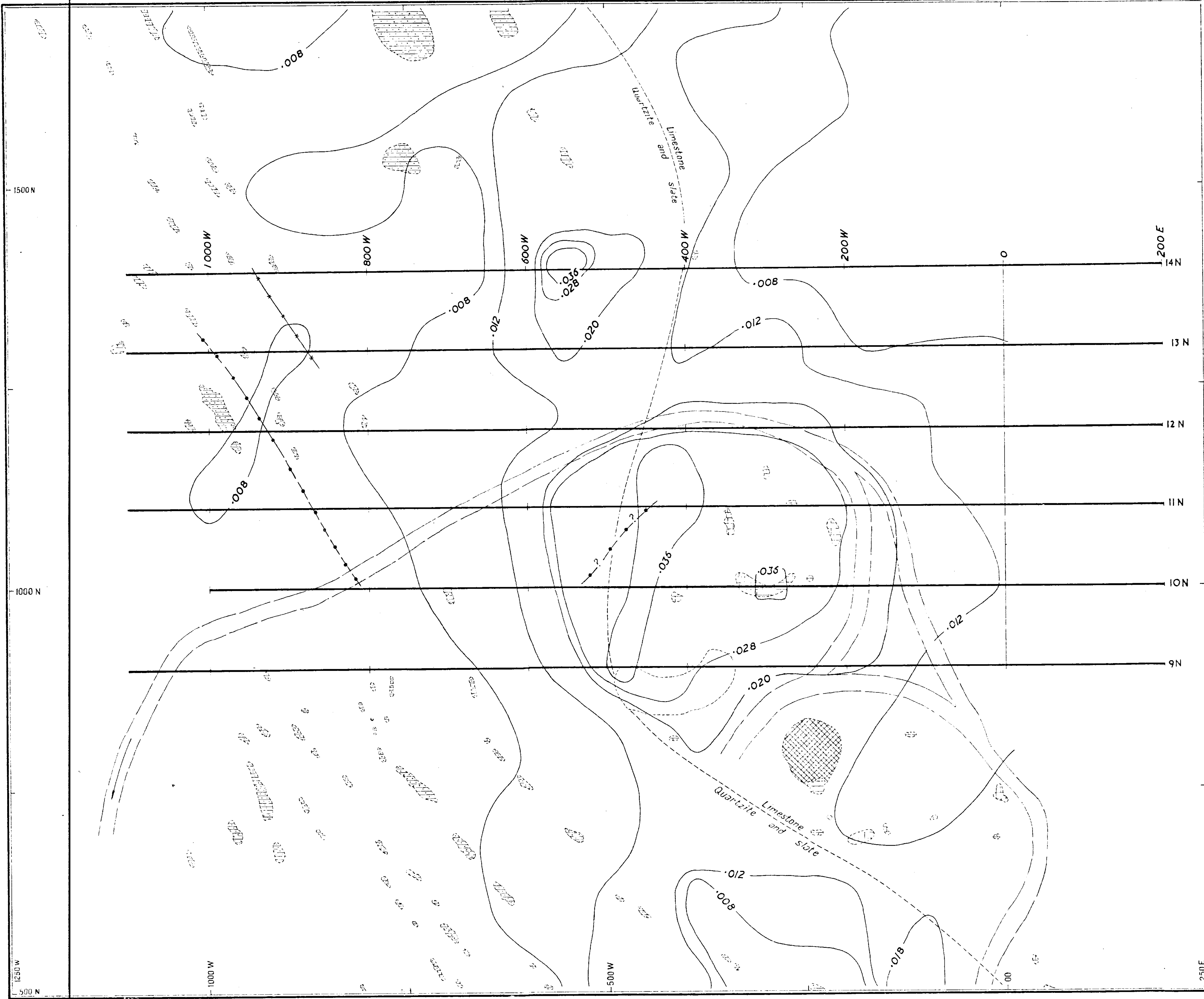


LEGEND

Limestone

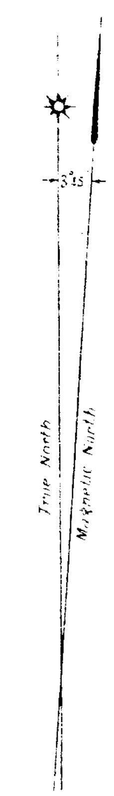
Quartzite interbedded with slate

Laterite

.012 *Radiometric contours in milli roentgens per hour (Obtained by T.E.P. geol. staff)*

Axis of S.P. indication

Axis of Slingram indication



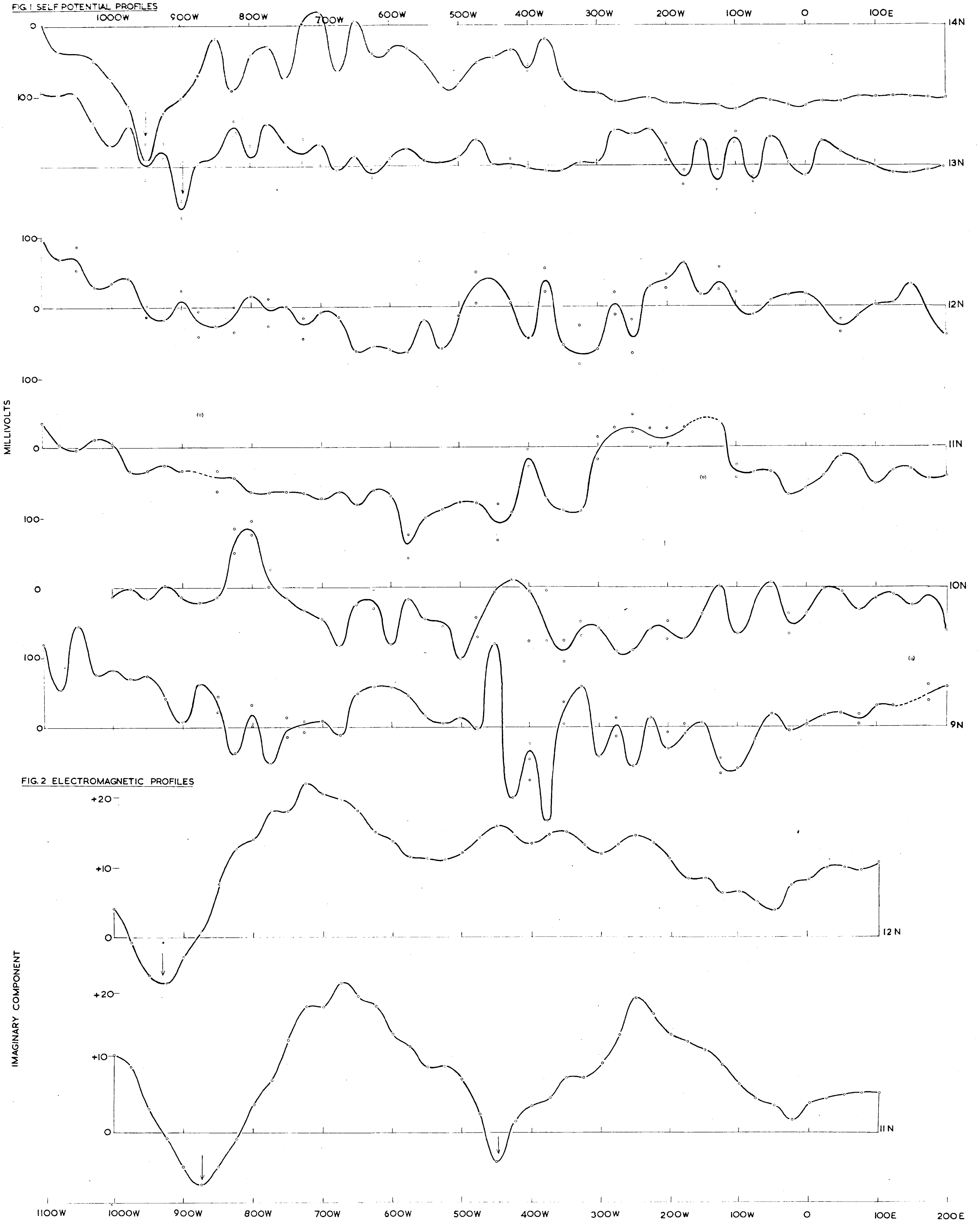
GEOPHYSICAL SURVEY
IN THE RUM JUNGLE AREA, N.T. 1954

MT. BURTON AREA
GEOLOGY, GEOPHYSICAL GRID
AND PRINCIPAL SURVEY RESULTS

SCALE IN FEET

100 0 100 200 300

W. J. Langron
GEOPHYSICIST



GEOPHYSICAL SURVEY

IN THE RUM JUNGLE AREA, N.T. 1954

MT BURTON AREA

SELF POTENTIAL AND ELECTROMAGNETIC PROFILES

W. J. Langron
GEOPHYSICIST

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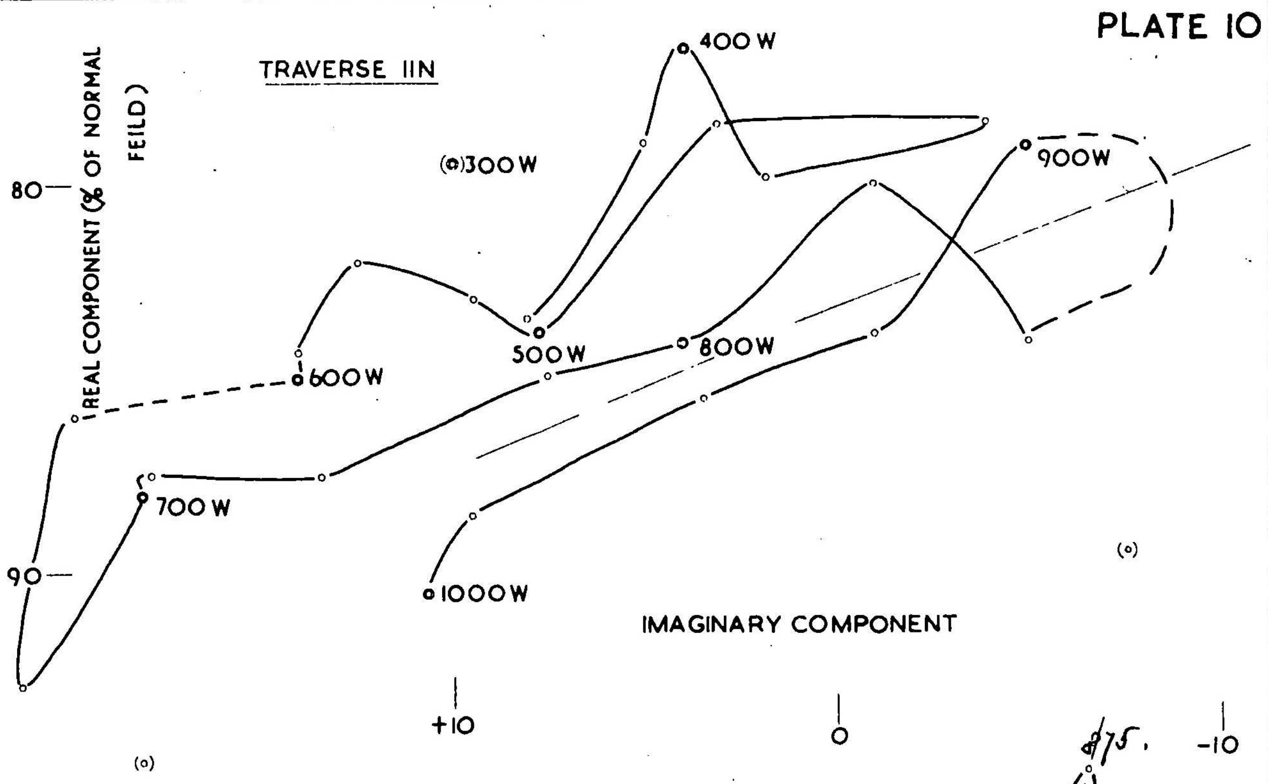
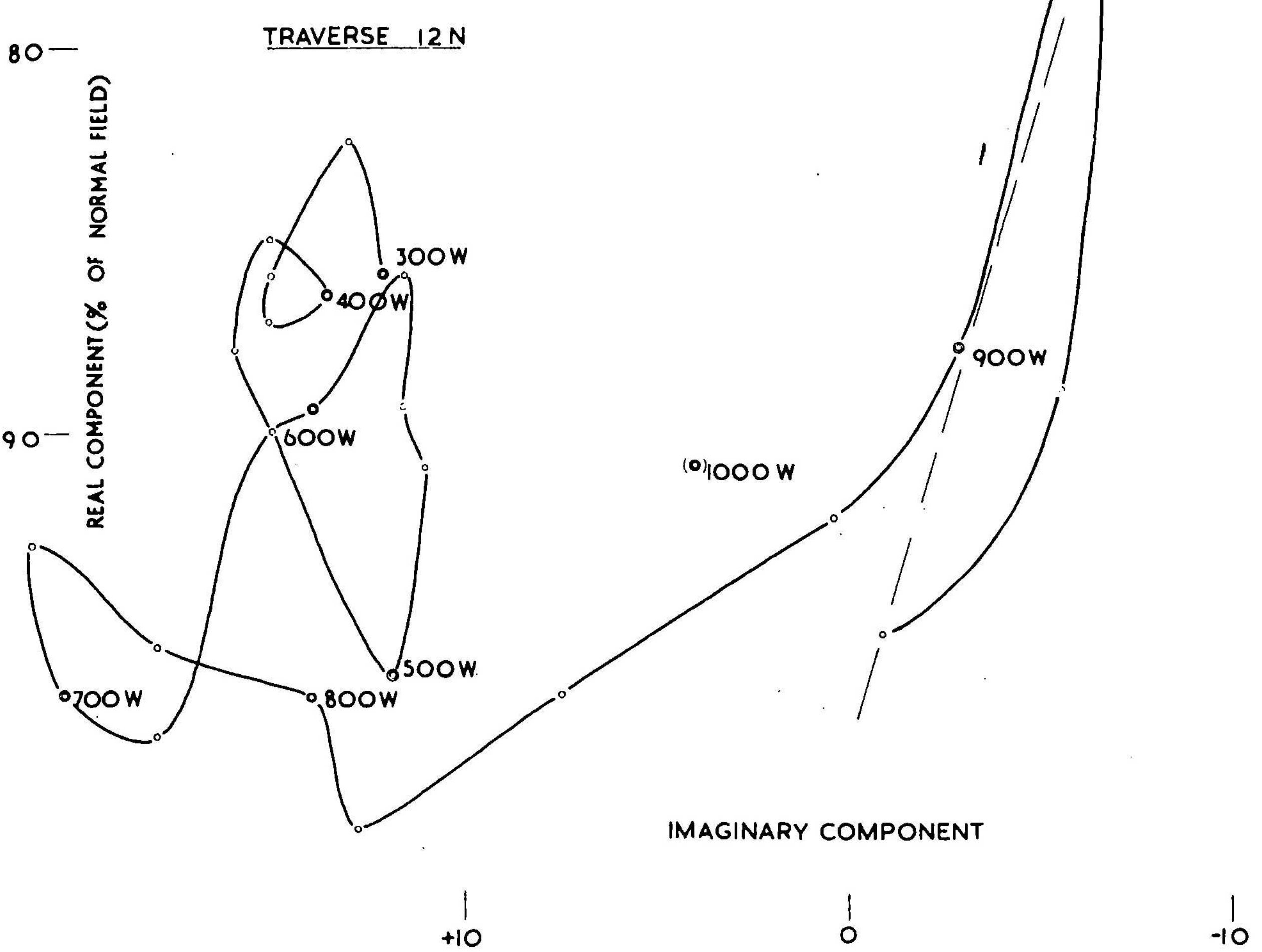
GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

PLATE 10





GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA N T 1954

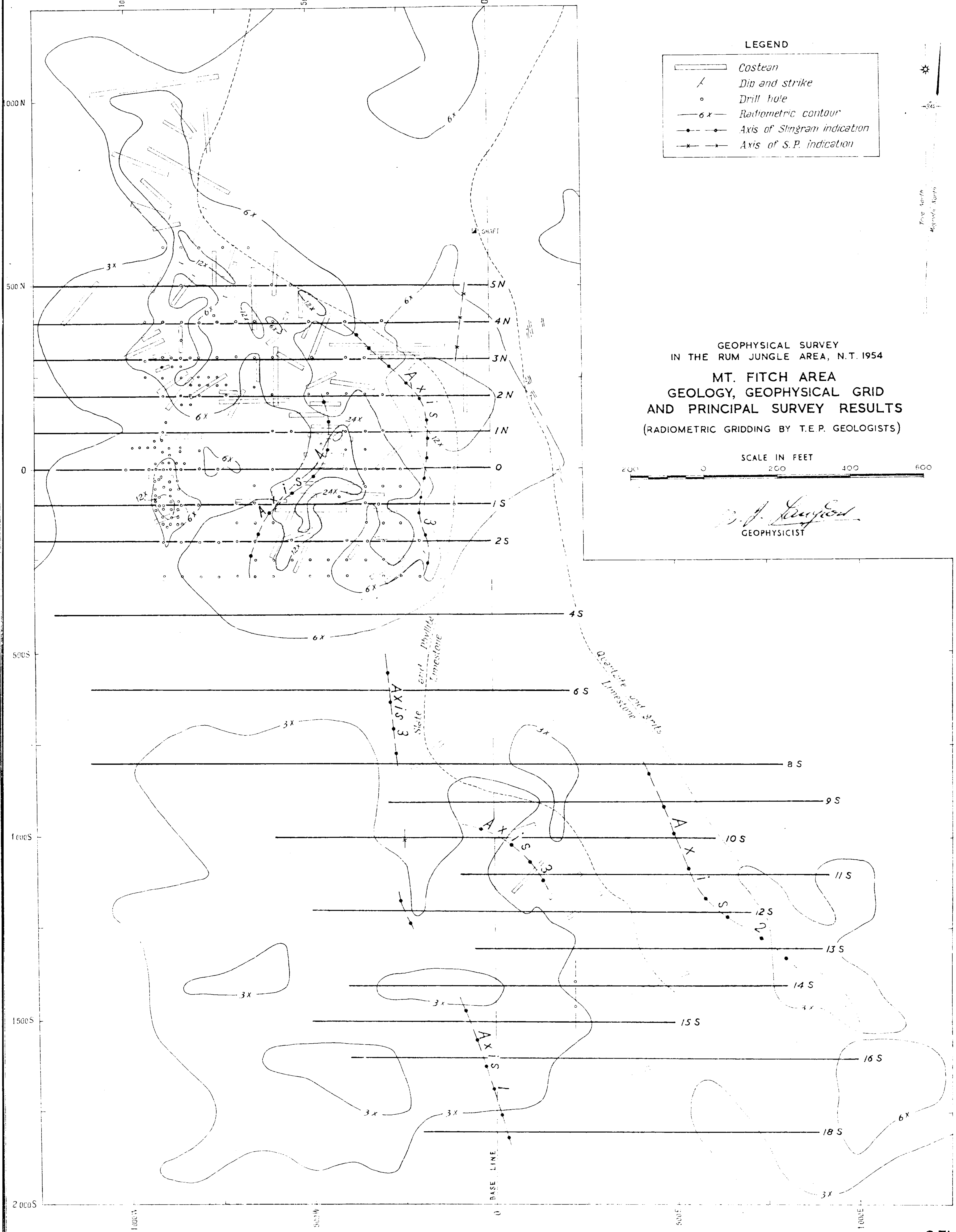
MT BURTON AREA
VECTOR DIAGRAM OF ELECTROMAGNETIC FIELD SLINGRAM METHOD

W. J. Langron
GEOPHYSICIST

G71-139

GEOPHYSICAL SECTION BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

PLATE II

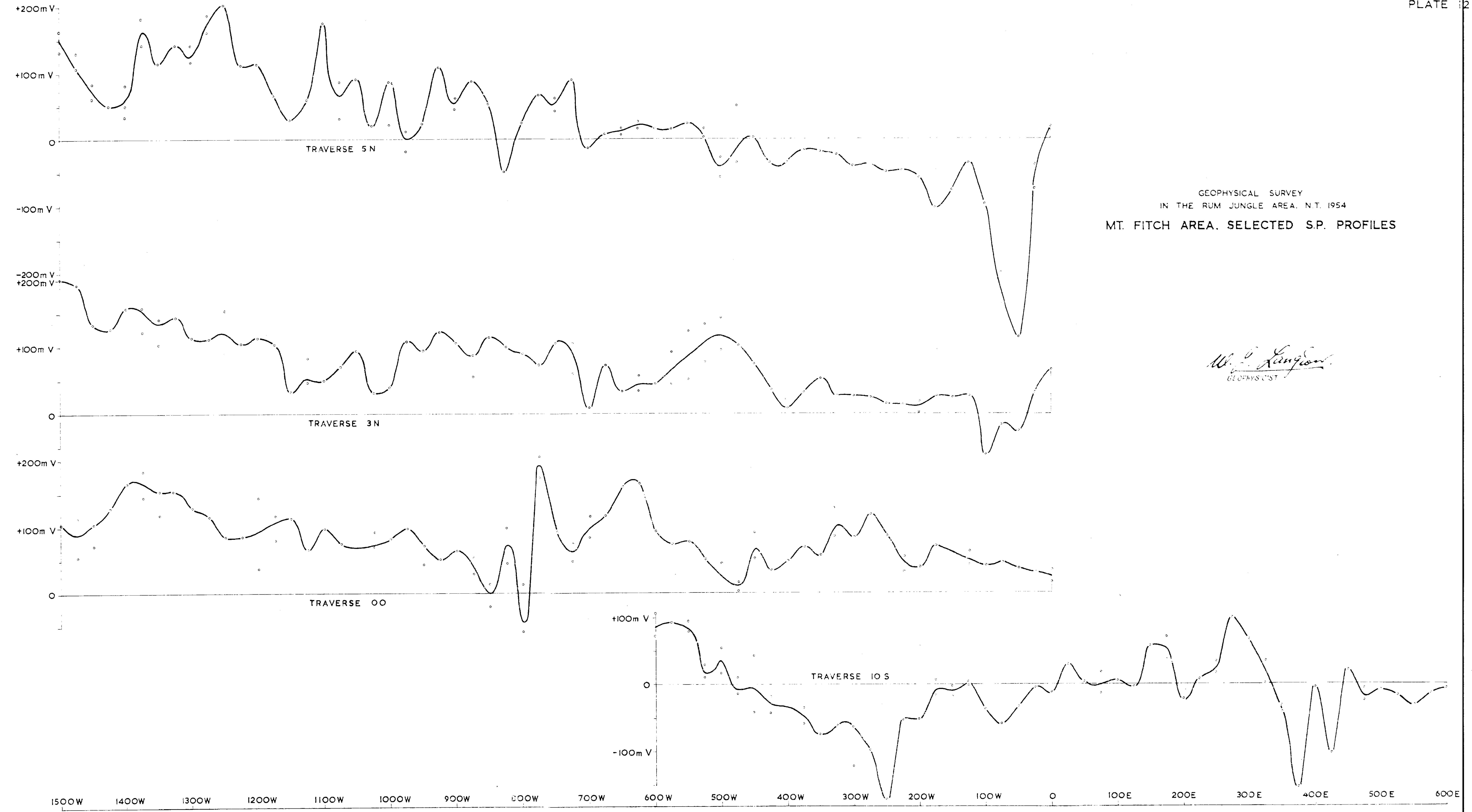


G 71-140

PLATE 12

GEOPHYSICAL SURVEY
IN THE RUM JUNGLE AREA, N.T. 1954

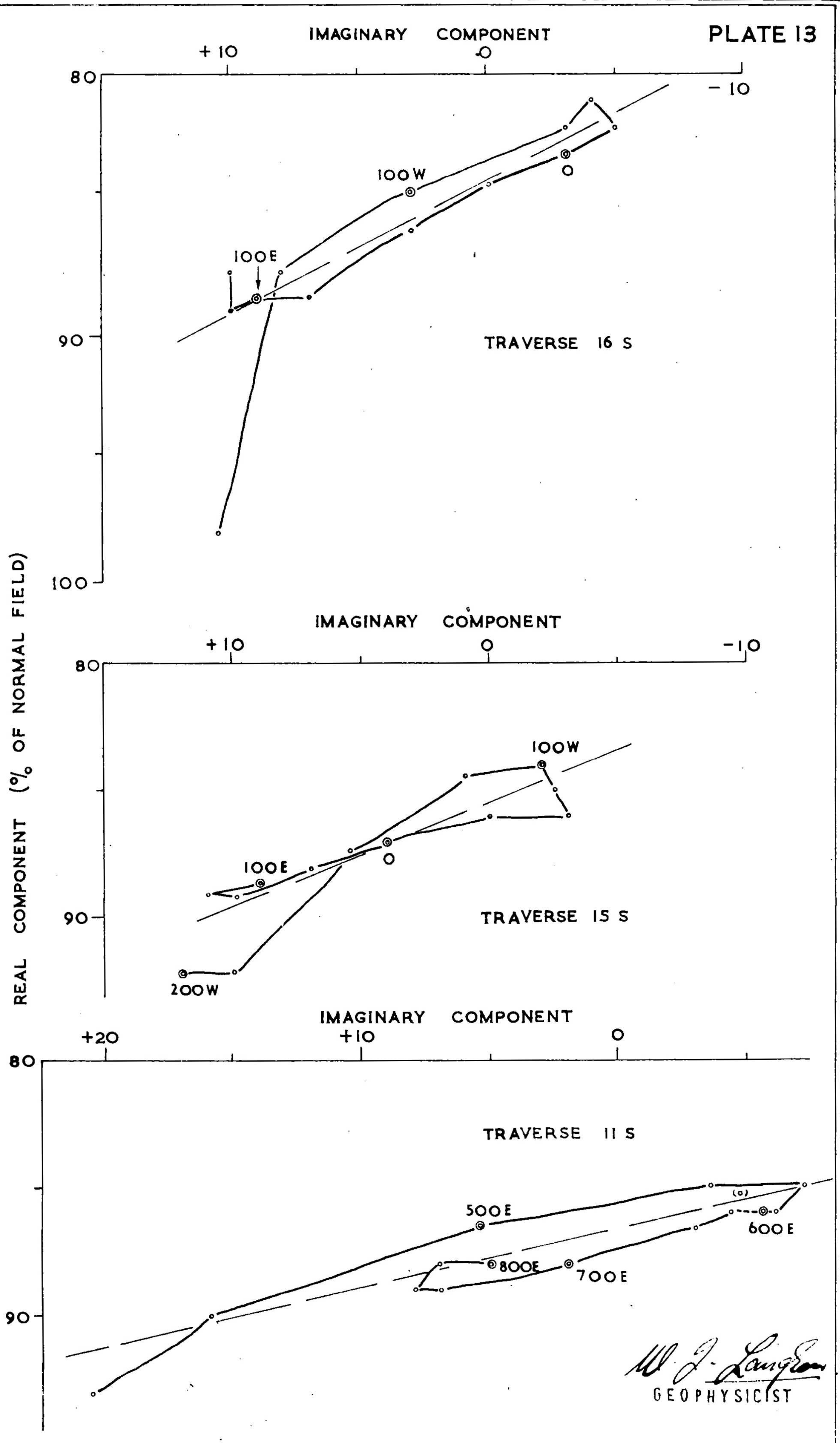
MT. FITCH AREA. SELECTED S.P. PROFILES



GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics G 71-141

PLATE 13



GEOPHYSICAL SURVEY IN THE RUM JUNGLE AREA, N.T. 1954

MT. FITCH AREA

SELECTED VECTOR DIAGRAMS OF ELECTROMAGNETIC FIELD (SLINGRAM METHOD)

G 71-142

GEOPHYSICAL SECTION, BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS