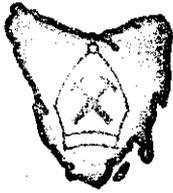


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AN APPRAISAL

OF

THE GEOPHYSICS CARRIED OUT OVER THE

SELINA, ROLLESTON AND DORA AREAS

FOR

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THE MOUNT LYELL MINING AND RAILWAY COMPANY LIMITED

BY

DR. J.R. BISHOP

December, 1980

ML/MG80/03

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Figure A1 Selina magnetic modelling

Figure A2 Rolleston magnetic modelling

Note: The IP surveys on all three areas were pole-dipole and 2 spacings were used. The array geometry varied from grid to grid and a diagram is shown in each IP section. The IP figures included in this report and listed above only show the results for surveys with the receiving dipole east of the transmitting electrode. The pole-dipole array gives asymmetric results and gives these figures continuity from grid to grid. Inevitably some significant information is not shown and this is discussed in the appropriate section.

For Selina the log average of the  $n = 4$  and  $n = 5$  resistivities and the average of the chargeabilities are plotted, since both receivers were on the eastern side of the transmitting electrode.

The plot for Rolleston is the data from the  $n = 4$  receiver, except for the southernmost line 56S which is  $n = 5$ .

The plot for Dora is the  $n = 5$  data.



### SUMMARY

The Selina-Rolleston-Dora area is part of a narrow belt of prospective Mt. Read Volcanics on the eastern side of EL 9/66. Approximately 10kms. of the 20km. belt have been gridded and this covers three 1:5000 scale maps which have been named after large lakes within each of the areas. The results of the various geophysical surveys over each of the three grids are discussed area by area.

The geophysical coverage over Selina consists of:

aeromagnetics	- RTAE (late 1950's)
	- Scintrex (1973) - part of grid
	- Dighem (1980)
ground magnetics	- CGG (1970/71)
	- Mt. Lyell (1972/73) - part of grid
airborne electromagnetics	- Turair (1973) - part of grid
	- Dighem (1980)
induced polarisation	- CGG (1970/71) - part of grid
self potential	- CGG (1970/71) - part of grid
gravity	- Scintrex (1980) - one test line

A pyrite body with interesting silver values was revealed by an IP survey, east of Lake Selina. Four DDH's have shown the body to be truncated to the south against the faulted contact with the Ordovician sediments but open to the north. There is a strong magnetic anomaly north of the body but any relationship this may have with the mineralisation has not yet been established. This magnetic anomaly is centred over a contact between the prospective acid volcanics and the (probably barren) Jukes Breccia of the Tyndall Group. A similar anomaly occurs on the eastern side of the grid over a similar contact.



The Dighem and Turair airborne electromagnetics (AEM) responded (poorly) to the pyrite body. Dighem also responded (more strongly) to a belt of black shales on the eastern side of the grid (the Turair survey did not extend this far east). AEM anomalies in the SW corner of the grid are attributed to conductive layers within the glacial moraine which covers this part of the grid. A reinterpretation of the Dighem results is being undertaken, in which all possible anomalies are being plotted: one further anomaly has been picked over the pyrite body and other possible conductors of interest were interpreted over both the western and eastern magnetic anomalies.

The only SP anomaly was over the pyrite body and a broad high from a test gravity profile over the body may be due to the mineralisation. The grid needs to be completed with IP to determine: the northern boundaries of the pyrite body; the association, if any, with the magnetic anomalies; and to prospect the remaining half of the area. There should be considerable overlap with the northern section of the original survey.

The geophysical coverage over the Rolleston grid consists of:

- aeromagnetics - RTAE (late 1950's)
- ground magnetics - CGG (1969/70)
- electrical soundings - CGG (1969/70)
- induced polarisation - CGG (1969/70)  
- CGG (1970/71)
- self potential - CGG (1969/70)

A pyrite body has also been defined at the northern end of the Rolleston grid. This may be an offset southern extension of the Selina body, however there is a well defined magnetic anomaly over this mineralisation. Three DDH's have defined the body; the base metal values are low and although they increase to the south, the geophysics suggests that the body does not extend south of the last DDH.

*what if it becomes less conductive?  
ie Cu, Pb, Zn ↑*

005



A weaker IP anomaly and associated magnetic anomaly occurs to the east of the pyrite body over old workings. This zone has not yet been drilled. Much of the Rolleston grid is covered by moraine, however for the most part, it is not conductive and the IP would be expected to penetrate it. (Electrical soundings have shown this to be at least 130m. thick in places.) A probable exception is the anomalies from the gradient array IP survey north west of Lake Rolleston; these are possibly due to clay layers within the moraine. There are well defined magnetic anomalies down the length of the grid on the eastern side; weak IP anomalies are associated with them, but these may be responses to the magnetite. IP also responded over black shales on the eastern edge of the grid.

There was no SP anomaly over the pyrite body, but responses were obtained over black shales on the eastern edges of some of the lines. As mentioned above, much of the area is covered by glacial moraine and SP does not usually give useful results in such environments.

An IP anomaly occurs over the three southernmost lines of the grid, west of the baseline: a magnetic anomaly occurs approximately 100m. to the east. The IP response cuts a contact between the acid volcanics and the Ordovician sediments. The area is not covered by moraine and further evidence (geological or geochemical) is needed before drilling is recommended.

The geophysical coverage over the Dora grid consists of:

- aeromagnetics - RTAE (late 1950's)
- ground magnetics - RTAE (1958)
- OGG (1969/70)
- induced polarisation - OGG (1969/70)
- self potential - OGG (1969/70)
- electromagnetics - RTAE (1958)
- gravity - RTAE (1958)

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The IP surveys produced anomalies in the NW and SW corners of the grid. None are directly related to any of the many old workings on the grid. The IP anomalies in the NW are southern extensions of anomalies on the Rolleston grid and further evidence is needed before these areas become drilling targets.

In the SW, the magnetics defines a (hidden) contact between the volcanics and the Ordovician sediments. Several IP anomalies plus the Turair anomaly overlie and cross this contact. They are interpreted as being due to conductive and polarisable zones within the glacial cover.

There is a weak IP anomaly in the NE quarter of the grid, loosely associated with a magnetic anomaly on strike with similar and better defined anomalies on the Rolleston grid. Investigation of this anomaly would depend upon results of drilling of the Rolleston anomalies.

The extension of the grid south to Lake Spicer and the coverage of IP and magnetic surveys will mean that a weaker RTAE Turam anomaly will be investigated. Also weak IP anomalies on the southernmost line of the Dora grid will be defined.

The mineralisation found on the area so far has been polarisable but not very conductive; IP is therefore the best geophysical tool. The surveys that have been carried out over the grids are considered to have given good data and little purpose would be gained from further IP except where specific targets were being investigated. It is recommended that the IP coverage of the Selina grid be completed; a continuation of the pole-dipole array is preferred but a gradient array is recommended on cost-effective grounds. Following this survey a DDH is recommended over the northern extension of the pyrite zone east of Lake Selina.

Further investigation is warranted on the IP and magnetic anomalies centred over old workings at 700E on line 48N on the Rolleston grid.

The geophysical anomalies in the SW corner of the Dora grid could be investigated by determining the thickness of the moraine (by electrical soundings or seismic refraction) and by then drilling over interesting targets. If the seismic velocities of the Ordovician and Cambrian rocks



are sufficiently different, a seismic survey by itself could map the rock types beneath the cover.

For the compilation of geophysical data on to the new AMG base sheets, the IP data already transferred on to 1:5000 is an adequate representation of the Rolleston and Dora areas, although only one of the dipole spacing has been transferred. The contour maps show both coverage and anomalies. The smoothed magnetics may also be presented in this way. However a note should emphasise that the smoothing of the magnetics (while enhancing the larger, deeper bodies) has removed the effects of the surface mineralisation and for these the user is referred back to the original OGG maps. Two other sheets could be used for all other methods, one to show the coverage and the other to show anomalies. All geophysical data over the Selina-Dora area is worth preserving (insofar as it appears to be 'good' data) and should be transferred to the base maps.



## INTRODUCTION

The Selina-Dora area is within a narrow belt of prospective Mt. Read volcanics extending for about 20kms. on the Mt. Lyell EL 9/66. Approximately 10kms. has been gridded from Lake Dora to north of Lake Selina. This report lists the geophysical coverage up to September 1980. The results are examined and some recommendations are made for further exploration.

The area was first prospected near the turn of the century when copper mineralisation was discovered near Lake Dora. There are several old workings between Lakes Dora and Selina. The area next received attention when Mt. Lyell sampled these workings in the 1930's, with disappointing results. In 1957/58 Rio Tinto Australia Exploration (RTAE) carried out geochemical and geophysical surveys over the Dora area; the latter included Turam, magnetics and gravity surveys. RTAE concluded that the area did not warrant further work and no drilling was done. The Consolidated Syndicate commenced work in 1969/70; the present grid was surveyed and between then and the end of the 1972/73 summer season, geological mapping, geochemical sampling, drilling and the geophysical surveys forming the bulk of this report were all undertaken. A description of the geology and a summary of the exploration up to this time is given by Wells (1975).

Exploration recommenced in 1979/80 when drill cores and rock chips were assayed; an airborne EM survey (Dighem) was flown over the Selina grid and a test gravity survey was made on one profile line over the Selina pyrite body. Work planned for the 1980/81 field season includes completing the IP coverage of the Selina grid and extending the grid from Lake Dora to Lake Spicer. IP, magnetics and soil sampling will be carried out over this extension.

The area has been gridded by east-west lines nominally 800 ft. (244m.) apart, pegged at 100 ft. (30m.) intervals and covers three 1:5000 scale maps. These have been named (south to north) Dora, Rolleston, Selina after lakes on each map. In the report the geophysical results from each map area are discussed separately.



## SELINA AREA

### Geology:

A sequence of acid volcanics known as the Mt. Read Volcanics are host for much of the mineralisation on the west coast of Tasmania. On the Selina grid, these volcanics trend approximately north-south with a steep to near-vertical dip to the west, and occupy the central part of the grid (see Figure 2). To the east, the rocks pass conformably downwards into an apparently barren Lower Cambrian series of shales, sandstones and conglomerates ('Sticht Range Sequence' - a Success Creek correlate). These in turn unconformably overlie the Precambrian Sticht Range Quartzite. To the west, the Ordovician Owen Conglomerate unconformably overlies the volcanics. This latter contact is obscured for most of its length on the Selina grid by moraine. In the northern central part of the area, the acid volcanics are overlain unconformably by the Jukes Breccia, part of the (again, apparently barren) Tyndall Group which is part of the upper sequence of rocks in the Mt. Read Volcanics. A small chert body has been mapped immediately west of the Jukes Breccia on lines 152N and 160N. Thus to the west, the grid lines terminate on either the Owen Conglomerate or on moraine overlying the conglomerate. To the east, the northern lines terminate in Lower Cambrian sediments, whilst the southern lines extend past these rocks and terminate in the Sticht Range Quartzites. Moraine covers nearly all of the southernmost lines and much of the Rolleston grid to the south.

### Mineralisation:

There are several known mineralised occurrences (copper, lead, pyrite, haematite, magnetite) in the Selina-Dora area. The main mineral occurrence on the Selina grid is a pyrite body containing some silver within the acid volcanics. Its southern end is truncated by the contact with the Owen Conglomerate and it is open to the north. DDH's have been drilled on lines 112N to 136N (LS7, 4, 5 and 6 respectively). Each hole intersected mineralisation, with the best silver values on the northernmost line. Old workings exist near the volcanics/conglomerate contact on lines 80N, 96N and 104N (Figure 2).

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The Selina Grid:

The Selina grid is a northern extension of the Rolleston-Dora grid, the Selina baseline being offset 3000 ft. to the east. The grid itself is situated to the east of Lake Selina. On the 1:5000 scale maps the Selina grid is defined as being from lines 80N to 184N. The lines have been surveyed at a (nominal) distance apart of 800 ft. (244m.) and pegged along line at 100 ft. (30m.) intervals. Grid north is approximately 20° west of AMG north.

Geophysics:

The following geophysical surveys have been carried out over the Selina grid:

- Magnetics - Airborne:
  - RTAE (late 1950's)
  - Scintrex Turair (1973) - covers small portion of grid
  - Dighem (1980)
- Ground:
  - CGG (1970/71)
  - Mt. Lyell (1972/73) - part of grid only
- Electromagnetics - Airborne:
  - Turair (1973)
  - Dighem (1980)
- Induced Polarisation:
  - CGG (1970/71) - part of grid only
- Self Potential:
  - CGG (1970/71) - part of grid only
- Gravity:
  - 1980 - one test line

Aeromagnetics:

The aeromagnetic survey for Rio Tinto of Australia Exploration P/L covers the whole of the Selina-Dora area. The Mt. Lyell Mining and Railway Company Limited has the results in the form of 100γ contours, drawn on a 1:50,000 base map. The survey was reviewed for Mt. Lyell by J.L. Irvine in 1974 who wrote: "It is assumed that a fluxgate instrument was installed in a helicopter and a mean terrain clearance of approximately 500 ft. was employed. A flight line direction of east-west was utilised at a line spacing of one mile."

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The survey is useful only for showing the general magnetic behaviour of the local area (the survey did not extend east of the Sticht Range) and for delineating the stronger magnetic highs. Two highs occur in the Selina area, one closely associated with Mount Selina, the other some 1,700m. to the south. The second high is on the boundary of the Selina and Rolleston 1:5000 maps (80N - 72N). These are detailed in the Ground Magnetics section.

The magnetics recorded at the time of the Turair survey agree with and contribute nothing to the magnetics recorded during the (larger area) Dighem survey. Contours for both surveys were presented on 1:10,000 scale maps. The Dighem magnetics have been enlarged to 1:5000 scale and are presented here at 1:20,000 (Figure 3). An enhanced magnetics map is also presented by Dighem (at 1:10,000); this emphasises the near-surface features at the expense of deeper seated bodies. The Dighem survey had a flight line spacing of 150m. and a nominal receiver height of 50m.

The Dighem survey revealed several anomalies and a very similar picture to the smoothed ground magnetic data was obtained, however, the coverage did not extend south of 104N. Thus the Dighem magnetics are included below with the ground magnetics in a more detailed discussion of the magnetic results.

#### Ground Magnetics:

A McPhar M700 fluxgate magnetometer was used to record the vertical magnetic intensity over the Selina grid. The reading interval along lines was 50 ft. and anomalies were recorded as positive. The readings were taken by Consolidated Syndicate personnel in 1970/71 and then forwarded to CCG for contouring and interpretation. The south-west portion of the grid was read by proton magnetometer in 1972/73. There is little difference between the two surveys.

The fluxgate results were presented as contours only (no values plotted) by CCG on a 1:6000 scale map (however an undrafted map of the data values was also prepared). The contour intervals were 500 $\gamma$  and 250 $\gamma$ . The map shows several magnetic zones but it largely under-represents the data and does not readily lend itself to an interpretation. A plot of the data in profile form shows that, in many places, readings were affected by

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occurrences of surface or near-surface magnetite in veins. A contour plan of smoothed magnetics on a 1:5000 scale map was produced by hand smoothing the profiles and marking the 100γ contour intervals on the base map (Figure 4). As stated above, the resultant map is very similar to the Dighem magnetics map. Other interpretations for smoothing the data and deciding the contour positions are quite possible and thus the truth may be other than as shown. Also, the smoothed map removes the responses of the surface magnetite which may be significant if magnetite is associated with sulphide mineralisation.

As previously mentioned, the Dighem magnetic map is very similar to the smoothed magnetic data and both maps are referred to in the description that follows.

The Selina magnetics map (both the Dighem and ground) is dominated by two large anomalies located on either side of the Jukes Breccia which covers the central northern part of the area. These two anomalies combined to give the one large anomaly on the aeromagnetic map produced for Rio Tinto. The western anomaly on the Dighem map is closely associated with the chert body (the ground magnetics map has the peak of the anomaly further south), while the eastern anomaly is located beneath the Jukes Breccia/acid volcanics contact.

A ridge of magnetic highs extending south from this eastern anomaly closely follows the contact to its southern limit, but then continues south to the edge of the map (this is more evident from the ground data, Figure 4, which shows a little more detail). Between 96N and 104N this ridge, in common with adjacent features, shows a sudden change in direction of contours which suggests a sinistral fault, possibly trending north-west through the southern portion of the Selina area, and indeed such a fault has been suggested on some geological maps of the area. Drilling in the area immediately south of the dominant anomaly to the west of the Jukes Breccia has defined a pyrite body which probably truncates against the Owen Conglomerate to the south (at line 112N), but which is open to the north and extends into this magnetic high. Drilling to the south (in the Rolleston area) has revealed another pyrite body close to the Owen Conglomerate/acid volcanics contact. This may be an (offset) extension of the more northerly body.



There is a series of NNE trending magnetic highs in the eastern portion of the map. There are two well defined anomalies within this zone (one between lines 136N and 144N and the other on line 168N) apart from a narrow intense high which extends over three lines (500m.) in the NE corner of the map.

The contact between the acid volcanics and the Lower Cambrian sediments fairly closely follows the steep magnetic gradient forming the eastern boundary of the Dighem magnetic map. There is no such correlation with the western boundary of the acid volcanics (mostly covered by moraine).

The distribution of surface magnetite is best examined from the (unsmoothed) profiles (not included with this report). These show that the surface magnetite veins are associated with the western magnetic high (north of the pyrite body) from lines 128N to 160N. The ridge of magnetic highs extending south from the dominant eastern magnetic high shows evidence of surface magnetite in varying amounts on all lines. There is also a narrow band a few hundred feet east of the base line on lines 88N to 112N extending out to 1200 ft. east on line 120N. All these magnetic features are further discussed in the Interpretation section.

#### Electromagnetics:

A Turair survey was conducted by Scintrex in February 1973 over the southwestern portion of the Selina grid. The flight line spacing was 800 ft. (245m.) and the nominal terrain clearance of the receiver was 200 ft. (60m.). The anomalies were "extremely weak and often near or within the noise level of the system". The survey appears to have been badly executed; the signal strength was off-scale (despite minimum power input through the loop - an undesirable feature) and the short record length allowed poor resolution of any possible anomalies. Nevertheless anomalies were interpreted over the (known) pyrite body east of Lake Selina. Anomalies were also picked to the north and south of this body. Other anomalies were interpreted at the Owen Conglomerate/moraine contact and within the moraine.



A Dighem (airborne EM) survey was carried out in March 1980 over the Selina grid (surveys were also carried out in the Henty-Yolande and Lynch Creek areas) with a line spacing of 150m. and a nominal receiver height of 30m. A detailed assessment of the Dighem results will be given in a future report. A summary only is given here. Anomalies occurred on all lines at the eastern limits of the grid. The anomalies were generally graded no. 2 (out of 6 with 1 the poorest anomaly) and are interpreted as being caused by graphitic shales within the Lower Cambrian sediments. (The Turair survey did not extend to this area.) A grade 2 anomaly was also picked on one flight line over the pyrite body. (This anomaly occurs within 60m. of a Turair anomaly.) One grade 1 anomaly and 'a possible conductor' were also interpreted within the moraine in the south-western corner of the grid. In summary, a poor anomaly occurred on one line over known mineralisation and no other areas of interest were delineated. However a reinterpretation is being undertaken in which very small trace excursions, probably noise, have been plotted as possible conductors. Alignments, coincidence with other anomalies etc. will be looked for. Some of these possible anomalies are mentioned in the Interpretation section below.

#### Electrical Soundings:

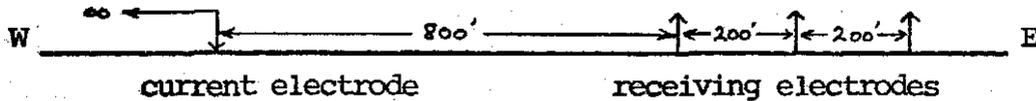
Before commencing the IP survey, resistivity soundings were made at two sites to determine the thickness and electrical properties of the moraine which covered the western half of the surveyed area. ES1 was made 91m. (300 ft.) south of 3900W on line 152N and ES2 was made at 3500W on line 96N. ES2 showed the moraine to have a conductive layer above the resistive bedrock. CGG's interpretation stated that the depth to basement would be less than 18m. (60 ft.). A qualitative inspection of the results suggests that basement is certainly less than 25m. Sounding ES1 appears to have been affected by lateral changes in resistivities, however its graph suggests an even shallower depth to basement with possibly a somewhat less conductive overburden. Chargeability measurements were not made.

#### Induced Polarisation:

In 1970/71 CGG carried out a pole-dipole survey over part of the Selina grid. The survey went as far north as line 160N and, with the exception of two lines,



remained west of the base line. The array used was pole-dipole. The dipole length was 200ft. and two dipole spacings (1000 ft. and 800 ft.) were recorded (see diagram below).



Scintrex IPR-7 receivers were used with a 7.5 KVA Hunttec IP transmitter. Self potential measurements were also made.

The results were presented as contoured values of apparent resistivity and apparent chargeability on 1:6000 maps (with separate sheets for each dipole spacing). M. Hutton has plotted and contoured the average chargeability values from the two receivers and the average of the logs of the resistivities on to 1:5000 scale maps (see Figures 5 and 6; the effect of averaging the log of the resistivities has been to weight the lower values).

The averaged chargeability map has been contoured in 10ms intervals and the apparent resistivities at the following intervals: 500, 1000, 2000, 5000 ohm-m.

Both the averaged chargeability and resistivity contours show a linear anomaly centred on lines 120N, 128N and 136N, but extending from line 88N to 144N, with both ends open (the northern end of the anomaly being past the contact with the Jukes Breccia and showing no sign of diminishing). Chargeability values read a peak value of 72 ms with a large anomalous area of greater than 30 ms in a general background of around 10 ms. The resistivity values have a minimum value of 210 ohm-m in an area of less than 500 ohm-m in a background of around 3000 ohm-m. This is the A1 anomaly of CCG's report. This zone has been drilled by four drill holes (LS4 on line 120N, LS5 on line 128N, LS6 on line 136N and LS7 on line 112N) which defined a pyrite body with very little base metals but with promising silver content.



The resistivity map shows a 'low' (less than 1000 ohm-m) in the south-west corner over the moraine (confirming the electrical sounding which showed a conductive horizon at the base of the moraine), however there is no corresponding chargeability anomaly.

#### Self Potential:

The self potential results are not given by CGG, although apparently a measurement was made at each IP station (100 ft. intervals along lines spaced 800 ft. apart). The CGG (1970/71) report states that on line 136N, between 2250W and 2450W a strong anomaly of -400 millivolts occurred. "There is no significant SP anomaly on any other profile". The -400 mV anomaly coincides with the known pyrite body on line 136N.

#### Gravity:

One test line of gravity was carried out along line 120N in March 1980. A very broad anomaly was recorded over the line which may be due to the pyrite body. I have not yet made a detailed evaluation of this survey and no quantitative interpretation was attempted on the Lake Selina data.

#### Interpretation

The Selina grid has been covered by magnetics and aero-electromagnetics, but has only been partially surveyed by IP. The IP has produced strong anomalies over the known sulphide mineralisation in contrast to the poor EM responses of the Dighem and Turair surveys. (It is planned to complete the IP coverage of the grid in early 1981.)

The IP to date only partly covers the interesting area north of the pyrite body. In this NW corner of the grid, the Mt. Read Volcanics are wedged between the Jukes Breccia to the east and the Owen Conglomerate to the west. To the north is a small body of chert (on lines 152N and 160N). North of line 160N, the Jukes directly contacts the Owen with no intervening volcanics. The highest chargeabilities are on line 120N above the widest intersection of the pyrite body (Figure 7) and the contours suggest that the mineralisation continues NE through the volcanics/Jukes contact. However anomalous values also trend north to the chert. The existence of the chert, apparently on



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strike with the sulphide body, suggests a 'favourable horizon' model (e.g. discussed by Sangster, 1972) in which "exhalite, in the form of chert and weak sulphide iron-formation, is the regionally stratigraphic equivalent of the economic base metal sulphide bodies". (Bodies of chert "variably mineralised by veins and disseminations of sulphides" are found near the Mt. Lyell ore bodies - Reid, 1975). The role of magnetics is important since "the three major forms of exhalite iron-formation i.e. oxide, carbonate, sulphide, are considered to represent a change of facies corresponding to an increase in water depth". There is some discrepancy between the Dighem and ground magnetics map between lines 144N and 152N (which is the area between the pyrite body and the chert); the former has the maximum value very close to line 152N, the latter on line 144N. (These two lines are actually over 350m. apart in this area, due to a large cliff in between.) The Dighem survey is more detailed since an intermediate line, 148N, was flown. It is recommended that further ground magnetics be carried out between lines 136N and 168N on say a 100m. line spacing. Nevertheless neither survey has its maximum coinciding with the chert body and one possible interpretation is an increase in magnetite content along the favourable horizon north away from the pyrite towards the chert. The contour map of the unsmoothed magnetics (CGG, 1970/71) shows that magnetite veins occur on or near the surface over the pyrite body on lines 128N and 136N and then, offset some 150m. to the east, further mineralisation extends north to line 160N. These unsmoothed magnetics contours suggest the presence of a thin, narrow north-south striking magnetic 'dyke' between lines 136N and 160N (through the chert body). However the Dighem survey (and the smoothed magnetics) has responded to a three-dimensional body at depth. Using a sphere as a first approximation, and matching to the west side of the Dighem profile line 152N (i.e. on the assumption that the east side has been influenced by the other magnetic body to the NE), a reasonable match (see appendix and Figure A1) gives a depth to centre of approximately 275m.  $\pm$  25m. and for a (high) susceptibility of .01, a radius of 200m. is obtained. Thus for a nominal magnetometer height of 50m., the body is 225m. to centre below ground level.

The reinterpretation of the Dighem EM data (Bishop, 1980) found no possible conductors between the pyrite body and the chert (though one was defined over the mineralisation on the next line to the south), but two were defined

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(with the lowest grading) within the general area. Their locations are approximately: (1) 100m. north of line 144N, 3100W, (2) 50m. south of line 160N, 1100W. The former anomaly is well to the west of the likely extension of the pyrite body, though probably over acid volcanics (the surface is covered by a quaternary swamp); the latter is within the Jukes Breccia and though close to the strike of the mineralisation (extrapolated over 700m.), it is well to the east of the magnetic response.

The 'favourable horizon' is apparently (and locally?) truncated to the south by the conglomerate/volcanics contact near line 112N and whilst the oxide facies (magnetite) may not be the target area according to the model, the magnetic anomaly should be drilled (after further ground magnetics on more closely spaced lines) and the possible Dighem anomalies followed up, as part of a more detailed exploration of the area which lies between the Jukes Breccia and Owen Conglomerate, north of the (known) pyrite body.

The other large magnetic anomaly on the Selina Grid lies beneath the eastern Jukes/Volcanics contact and has some similar characteristics to the western anomaly described above. The Dighem and the smoothed magnetics both show a deep seated body (this time in closer agreement), while the original ground magnetics map (CGG, 1971) emphasises the surface or near-surface magnetite. The shallow response coincides with the eastern boundary of the Jukes from 128N to the northern limit of the grid. However a narrow, elongate anomaly is continuous north from line 80N - this is particularly evident on Figure 4.

The IP does not yet cover this eastern anomaly and a detailed interpretation will depend upon this information. However reinterpretation of the Dighem survey picked three possible conductors (two of lowest grading and one of second lowest), some of which may be associated with the magnetics. The stronger anomaly is about 150m. east of the surface magnetic ridge as shown on Figure 4 and is located 100m. north of line 136N, 700E (again approximate, and the distance is much less on the Dighem magnetics map which may be 'looking' deeper). The other two anomalies are over the southern half of the eastern magnetic anomaly and are situated within the Jukes Conglomerate. The two (approximate) positions are: (1) 50m. south of line 152N, 300E, and (2) 125m. north of line 152N, 950E (Figure 7).

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Among the many possible explanations for these magnetic anomalies are the following:

- (1) A structural feature, for example a syncline, with a magnetic horizon within the Jukes or volcanics producing the observed pattern.
- (2) Repetition of a 'favourable horizon'. The conditions that caused the eastern anomaly and its surface magnetics are repeated in the volcanic cycle and hence the appearance of the (younger) western anomaly. This possibility makes the superposition of the narrow ('surface') magnetic anomaly and the contact, coincidental, which is supported by the fact that the surface magnetic anomaly extends south past the contact.
- (3) The eastern anomaly and its southern extension through the grid is due to a magnetite-bearing unit within the acid volcanics; this unit either thickens beneath the Jukes or, more likely, combines with magnetite in the Jukes to form the larger anomaly. This lithological cause is the favoured explanation and is supported by the parallel, though less continuous, magnetic anomalies further to the east. Also recent mapping has revealed veins of magnetite within the Jukes (Hutton, pers. comm.).

As mentioned above, a magnetic ridge extends from the eastern anomaly along the Jukes/acid volcanics contact south west to a southern magnetic anomaly centred on line 88N, 2500W (Figure 4). The anomaly has a second closure on line 96N at 3200W. The IP survey has covered this part of the grid and a north-south trending chargeability high (which encompasses the anomaly caused by the pyrite body) passes through the magnetic anomaly. The magnetic ridge and a possible Dighem EM anomaly 70m. north of 1650W on line 104N are close to but not coincident with this high (Figure 7). A quartz porphyry has been mapped (Wells, 1975) within the bounds of the southern magnetic anomaly and again this fits the favourable horizon model as discussed by Sangster, 1972.

CGG (1970/71) indicated a continuous anomalous zone (A1) from 40N to 136N. This encompassed a mineralised zone on the Rolleston grid, passed through the quartz porphyry, by two mineral occurrences (lines 80N and 104N) to the northernmost (known) limit of the pyrite body. However the chargeability



contours (Figure 6) suggest that the volume of sulphides decreases considerably south of line 120N, whilst they are still strongly anomalous on line 144N.

A second magnetic ridge (again on the smoothed magnetics map), 400-500m. east of the magnetic ridge discussed above, parallels it for much of the grid (from line 88N to about 144N). Except for one small portion where there is a 'kink' to the west, this elongate anomaly has not been covered by IP. In the kink a possible EM anomaly has been picked from the Dighem reinterpretation (second lowest grading). It is coincident with this second magnetic ridge but there is no IP anomaly.

Other Dighem anomalies and possible anomalies are discussed in the Dighem reinterpretation, including the anomalies over, and east of, the black shales which form the eastern boundary of the Selina grid. However a more detailed interpretation will be possible after completion of the IP coverage over the grid.

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ROLLESTON AREA

Geology:

Nearly all of the Rolleston area is covered by moraine. Electrical soundings (CGG, 1970) established that the cover is up to 134 metres thick with considerable variation.

In the northern third of the grid, close to the base line, prospective acid volcanic rocks outcrop in places (Figure 8). South-east of Lake Rolleston the rocks again outcrop in a complex association with the Owen Conglomerate. On the eastern edge of the grid, striking approximately north-south, are the Lower Cambrian sediments (which include black shales).

Mineralisation:

A thin belt of hematite/magnetite mineralisation occurs near the contact of the acid volcanics/Owen Conglomerate. This zone, a probable extension of the pyrite body on the Selina grid, occurs on lines 56N to 80N (80N is on the Selina grid) and strikes NNE at about 150m. west of the base line. Three holes have been drilled; LS1 on line 72N, LS2 on line 64N and LS3 on line 48N. All three holes intersected pyrite with minor amounts of base metal mineralisation. The core was also analysed for silver, the highest values being recorded on LS3 (8 ppm).

Two mineral occurrences (of pyrite, chalcopyrite and galena) are marked on the geology map, near 700E on line 48N.

The Rolleston Grid:

The Lake Rolleston grid as plotted on the 1:5000 scale maps (reduced to 1:20,000 for this report) extends from 56S to 72N. The lines run from a maximum of 5500 ft. (1677m.) west to 4300 ft. (1311m.) east. The lines are spaced 800 ft. (244m.) apart and are pegged every 100 ft. (30m.). Lake Rolleston lies in the SW corner of the grid. The grid is parallel to the Selina grid but the Rolleston base line is offset 3000 ft. (915m.) to the west.

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Geophysics:

The following geophysical surveys have been carried out over the Rolleston grid:

- Magnetics - Airborne:                   - RTAE (late 1950's)
- Ground:                   - CGG (1969/70)
- Electrical Soundings:                 - CGG (1969/70)
- Induced Polarisation:                 - CGG (1969/70)
- CGG (1970/71)
- Self Potential:                         - CGG (1969/70)

Aeromagnetics:

What little is known of the survey is described in the Selina section. There is a magnetic high on the Selina/Rolleston boundary and two closely spaced highs south-east of Lake Rolleston over the acid volcanics.

Ground Magnetics:

A 1:6000 scale map of vertical magnetic intensity values with unmarked contours was prepared by CGG (1969/70). Station spacing was 50 ft. M. Hutt M. Hutton has prepared a 1:5000 scale contour plan (contour interval of 100 $\gamma$ ) of smoothed values, taken from the smoothed profiles (Figure 9). Apart from one or two instances of surface mineralisation, the smoothing removed fluctuations of 20-30 $\gamma$  which might be attributable to the accuracy of the fluxgate magnetometer used to take the readings.

The smoothed magnetic map shows a high of some 700-800 $\gamma$  between lines 48N and 72N, situated just west of the base line and trending NNE, which corresponds with the previously mentioned belt of mineralisation. This corresponds with CGG's anomaly A1. A ridge of magnetic highs trends just east of north for the whole (eastern) extent of the the grid, extending to the top north-east corner (CGG's anomalies A9, A10 and A12). A lithological cause is suggested. At line 40S this is joined by a NNW trending high, centred on line 32S (800 $\gamma$  maximum) but extending north to the lake and south past line 56S, the southernmost line of the Rolleston grid. (This is not indicated on

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the CGG, 1969/70 anomaly compilation.) There is a small localised high of about 600 $\gamma$  at 800E on line 48N (CGG's anomaly A2).

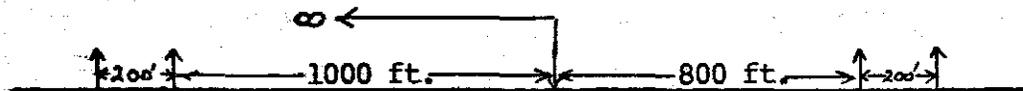
CGG (1970) stated that the magnetic results showed a fault between 16S and 8S at right angles to strike, and there is a slight displacement suggesting a sinistral movement.

Electrical soundings:

CGG conducted several (at least 5) electrical soundings to determine the composition and thickness of the glacially derived overburden. The results of only one sounding are given (ES 24N - 800W). From these soundings CGG (1969/70) made the following conclusions: the true resistivity of the unweathered Cambrian volcanics varies between 2000 and 15,000 ohm-m; the sediments to the east, 1000 to 3000 ohm-m; and the conductive formation (black shales) within the sediments, down to 30 ohm-m. Electrical soundings at 24N - 800W, 16N - 1600W and 8S - 450E were sited on moraine. The top of the moraine was found to have a true resistivity of about 8000 ohm-m while the bottom was conductive with a value of about 100 ohm-m. (Apparent resistivities recorded in the field generally do not reach the true resistivity values.) Moraine thickness at the three soundings varied between 50 and 135m.

Induced Polarisation:

A pole-dipole survey was conducted over the Rolleston grid. Two receivers were used in the manner shown below:



plotting posn .

receiver 1 (n = 5)

. plotting posn

(n = 4) receiver 2

The dipole length was 200 ft. for both receiving dipoles and the station interval was 200 ft. CGG presented the results of each receiver as contoured values on 1:6000 scale maps for both resistivity and charge-



ability. M. Hutton has prepared 1:5000 scale maps of the resistivity and chargeability values for the  $n = 4$  pole-dipole survey (except the southernmost line 56S which is  $n = 5$ , thus all lines have the receiver on the eastern side of the transmitter). These maps (Figures 9 and 10, reduced to 1:20,000) also contain the (smoothed) information from a later gradient array survey (CGG 1970/71) between 16S and 40N, north of Lake Rolleston (broken lines). Resistivities are contoured at 500, 1000, 2000, 5000, 10000 ohm-m. intervals. Chargeabilities from the pole-dipole survey are contoured at 10 ms intervals and those from the gradient survey at 5 ms intervals.

Resistivity values did not go much below 500 ohm-m with the exception of the eastern limit of line 64N where values below 30 ohm-m were recorded. There is a resistivity low at the base line on lines 64N and 72N, trending NNE. This corresponds with the mineralised zone drilled by LS1, LS2 and LS3 (the eastern offset being caused by the geometry of the pole-dipole array and conductor). This is the only resistivity low that is strongly supported by any worthwhile chargeability anomaly (up to 36 ms at 300W on 56N). There is a zone of less than 500 ohm-m at the base line on lines 00 to 16N (trending NNW). There is a broad resistivity low in the area surveyed by gradient array also trending NNW, with values below 500 ohm-m only on lines 16S, 32N and 40N, but these too are unsupported by chargeability anomalies. Resistivities on the  $n = 5$  CGG (1969/70) map are higher in magnitude with no zones of interest that are not evident on Figure 9.

Resistivity lows at the eastern ends of lines 64N and 24S are supported by high chargeability values, but these anomalous values occur over black shales within the Lower Cambrian sediments.

The best anomalies on the Rolleston chargeability plan (Figure 10) are over known mineralisation, that is, the pyrite body west of the base line between lines 48N and 72N, and the old workings east of the base line, between lines 48N and 56N (see Figure 7). Apart from the high responses over black shales on the eastern ends of lines 24S, 64N and 72N, Figure 11 shows only one other interesting zone which is defined by the 15 ms contours west of the base line between lines 48S and 32S. This anomaly continues to the south.

The  $n = 5$  survey over Rolleston recorded a 20 + ms anomaly on the last two readings on the eastern end of line 24S. Its position is indicated on



Figure 11. This anomaly, together with those mentioned above, are further discussed in the 'Interpretation' section.

Self Potential:

Self potential measurements were made at 6lm. (200 ft.) intervals over the Rolleston grid down to 48S. The results were presented as profiles with the negative voltage plotted upwards. The only significant response was obtained at the eastern end of lines 48S, 40S, 64N and 72N. These anomalies occur over black shales within the Lower Cambrian sediments.

Interpretation:

CGG (1969/70) produced an anomaly compilation map with their report on the geophysical surveys and while they do not appear to have missed any anomalies (although a Scintrex, 1973 report suggested further anomalies on the Dora grid) some appear to be poorly founded and others misplaced. (The map has been reproduced by Wells, 1975, Figure 3a and the CGG anomaly numbers have been used in this report.) The anomalies are discussed in order of their geophysical importance and a compilation is given in Figure 12.

The IP results are of the most interest in the search for sulphide mineralisation in this area and, as was mentioned in the IP section, distinct anomalies were obtained over the pyrite body (intersected by DDH's LS1, LS2 and LS3) and over old workings. These are CGG's anomalies A1 and A2 respectively.

Anomaly A1 as defined by the chargeability (Figure 11) extends from line 48N to north of line 72N (the northernmost line). The magnetics (Figure 9) is largely in agreement but closes on line 72N. CGG's map shows the IP anomaly extending south to line 40N, but the response is considerably reduced by 40N and further drilling south of LS3 on line 48N is considered unwarranted.

Anomaly A2 is indicated by CGG as an IP anomaly on lines 32N and 48N; this is based on a 10 ms contour of the  $n = 5$  survey (which actually reaches

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56N. However the  $n = 4$  survey (Figure 11) has a 20 ms closure over lines 56N and 64N. There is no corresponding resistivity low. A magnetic anomaly is centred on line 48N (coincident with the IP) with high values extending to the north. Thus OGG's anomaly A2 may be enlarged to extend from line 32N to 56N (Figure 12). The more southerly part of the anomaly may be covered by moraine (see Figure 1) and whilst this would not be expected to affect the magnetics (apart from a possible broadening of the anomaly), it might significantly reduce the IP values; the amount depending on the thickness and conductivity of the cover. Two costeans have been made on the anomaly, on 48N and between 40N and 48N. Analysis of five samples from the costeans gave maximum values of 180 ppm Cu, 650 ppm Pb, 270 ppm Zn and 0.4% S (Reid et al, 1980). Despite these unspectacular geochemical results, A2 is the most promising geophysical anomaly on the Rolleston grid.

The next highest zone of IP values of interest are defined by the 15 ms contours west of the base line between lines 56S and 32S. There is an elongate anomaly striking north-south about 150m. west of the base line and there are also high values on the western ends of these lines. A magnetic high is offset from the IP anomaly about 100 m. to the east. The anomaly is open to the south and extends to the Dora grid. OGG have defined anomaly A13 as covering lines 72S to 56S, however the chargeabilities are as high or higher from 56S to 32S and the anomaly can be extended north to 32S. The geological location for this anomaly is not very favourable since it cuts across the Owen Conglomerate/volcanics contacts in the SW corner of the Rolleston grid. There is no associated resistivity low. There is no glacial overburden and encouraging geochemical results would be needed before further work was carried out over this anomaly.

The 10 and 15 ms responses from the gradient array north west of Lake Rolleston are probably due to clays in the glacial moraine. The only other anomalies on Figure 11 are those on the eastern ends of lines 24S, 64N and 72N and these occur over black shales.

There are however two zones of very weak anomalies - probably within the background noise level, that coincide with magnetic anomalies on the eastern side of the grid. The 5 ms contours are shown; the southernmost anomaly covers lines 24S to 8S and the northern one 16N to 32N. These zones

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form part of CCG's anomalies A9 and A10. A9 was defined as a magnetic anomaly from 40N to 8S, with coincident IP from 16N to 8S. A fault was interpreted between 16S and 8S and A10 was defined as a magnetic and IP anomaly on 16S. However a detailed examination of the original CCG results shows that the northern limit of A9 (16N) is defined by a small local high (7.5 ms) it then passes south through chargeabilities less than 5 ms. I suggest that A9 is not a continuous anomaly as shown by CCG, but is a weak IP anomaly, with a strong magnetic response from 16N to 32N. Similarly to the south, between 24S and 8S there is a strong magnetic anomaly with an associated weak chargeability anomaly (see Figure 12). From the magnetic map, a fault is possible as CCG has suggested.

CGG's anomaly A11 at 900E on line 16S is through a small region of 7 ms plus values (highest 9.2 ms) on the n = 5 survey, however alternative (and more likely) contouring would include this 'anomaly' in the background 8 ms plus values which extends over several lines (0 to 32S) near their eastern limits.

The remaining CCG IP anomalies on or partly on the Rolleston grid are A14 and A15. A14 is coincident with a 15 ms contour on the n = 5 CCG chargeability map. However an 'axis' is not defined since high values are maintained to the western limits of lines 48S to 32S. The southern portion of this zone is over Owen Conglomerate, it then cuts north across the contact between the conglomerate and volcanics. It is thus a poorly defined anomaly and considered in the absence of corroborative evidence such as geochemistry, to be of little interest, and is not shown on Figure 12. Anomaly A15 is defined by 20 ms contours on the n = 4 map (Figure 11) over lines 64S (Dora grid) and 56S. It is also supported by a 20 ms plus best reading on the western end of line 56S on the n = 5 survey. It is located over Owen Conglomerate. A dipole-dipole survey centred on the western end of line 56N would better define this anomaly and again other supportive evidence would be needed before drilling.

In summary, anomaly A1 has been adequately investigated and the cause defined as a sub-economic sulphide body. Anomaly A2 has been costeamed and low geochemical analyses have been obtained. However further exploration is considered warranted and a dipole-dipole IP survey should be considered before drilling. Also the depth of moraine should be determined by electrical sounding (which should also measure chargeabilities).



A9 and A10 are similar anomalies with weak IP responses over well defined magnetic highs and both are in moraine-covered areas. The thickness of moraine should be determined by electrical soundings. Presumably soil geochemistry will be of doubtful value and a dipole-dipole IP survey might define a more distinct target, although the proximity of the black shales to the east may cause some interference. The weak IP responses may of course be due solely to magnetite within volcanic intrusives rather than sulphide mineralisation.

The magnetic anomaly over A9 was modelled by taking the profile along 24N and matching it to the theoretical response over a thin tabular body of infinite depth and length. A very approximate fit was obtained for a vertical body 100m. below the surface. For a (high) susceptibility of 0.01, the thickness is 65m. (see appendix and Figure A2).

Anomalies A15 and A13 do not have any coincident magnetic anomalies, however their apparent location within or partly within the Owen Conglomerates is not favourable. More detailed mapping and soil geochemistry (the area is not covered by moraine) is recommended over these two anomalies.

The self potential method was used over all the Rolleston grid, but has received little mention in this interpretation section. The only anomalies obtained were over the black shales on the eastern extremity of the grid. SP would not be expected to work over moraine covered areas, but also no (other) conductive areas were defined by the IP and thus it appears that no SP target lies within the grid.

The IP method is the best geophysical method for looking for disseminated sulphides and the pole-dipole array with two spacings is a good compromise between production and penetration/resolution. The  $n = 5$  array might have been expected to be more useful on the Rolleston grid with its large area of thick glacial cover, however this survey has only contributed to the anomaly compilation map for anomaly A2.



## DORA AREA

### Geology:

The rock units and basic structure are the same as for the Rolleston and Selina grids (see Figure 13). However a north-west trending fault extends from the south-east corner of the grid through the area and this has the effect of increasing the width of the volcanics from a minimum of 730m. in the north to over 1350m. in the south. The eastern boundary of the volcanics is against the Lower Cambrian sediments south of Lake Dora, where the sediments pinch out against the fault. Thus east of Lake Dora the volcanics abutt the Sticht Range Quartzites. The western contact is against Owen Conglomerates, but this is obscured by moraine for the southern half of the grid.

### Mineralisation:

There are several mineralised occurrences within the Dora grid (see Figure 13). The old Dora workings (south of line 110S) "occur in three main mineralised shear zones consisting of quartz and quartz-chlorite schists with magnetite and hematite veins. The mineralisation was reported to consist of pyrite, chalcopyrite, sphalerite and erythrite" (a cobalt, arsenic oxide) (Reid et al, 1980).

### The Dora Grid:

The Dora grid is the southern continuation of the Rolleston grid and extends from 64S to 144S. The old Rio Tinto grid over the Dora area was inclined approximately  $18^{\circ}$  west of the present grid and extended some 750 metres further south. The northernmost line of the RTAE grid extended through the tarn just south of 110S.

### Geophysics:

The following geophysical surveys have been completed over the Dora grid.

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- Magnetics - Airborne: - RTAE (late 1950's)
- Ground: - RTAE (1958)
- CGG (1969/70)
- Induced Polarisation: - CGG (1969/70)
- Self Potential: - CGG (1969/70)
- Electromagnetics: - RTAE (1958)
- Gravity: - RTAE (1958)

Aeromagnetics:

What little is known of this survey is described in the Selina section. There is a magnetic high west of Lake Dora; the highest value being approximately 500m. west of the southern tip of the lake.

Ground Magnetics:

The RTAE (1958) magnetic survey covered two areas; one was a detailed survey over an electromagnetic anomaly, the other, less detailed survey, was designed to locate and better define the aeromagnetic high. This latter survey consisted of five lines 122m. (400 ft.) apart; station spacing was 30m. (100 ft.). Rather than defining a single large anomaly, the survey revealed a series of discrete anomalies of which several were single value highs, indicating surface or near surface magnetic minerals. The former, more detailed survey (station spacing still 30m. but a line spacing of 6m.) defined a linear magnetic anomaly, but this only coincided with the electromagnetic anomaly at its northern end, there being a difference in strike between the two anomalies of some 30°.

The CGG (1969/70) survey used a fluxgate magnetometer and the station interval was 15m. (50 ft.) along the grid lines spaced 245m. (800 ft.) apart. The survey results were presented by CGG, as plotted values on a 1:6000 scale map with unmarked contours. A series of narrow, elongate anomalies suggest the presence of near surface mineralisation. The CGG survey did not extend as far south as the RTAE survey, however the magnetic high of the detailed survey was confirmed. M. Hutton has prepared a smoothed magnetic contour map from smoothed profiles with a contour interval of 100γ (Figure 14). By smoothing, the interfering effect of surface mineralisation is removed and the responses of deeper-seated,

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larger bodies are enhanced.

Both smoothed and unsmoothed maps show a large magnetically unresponsive area on the eastern side of the grid and in the south-west corner. South of line 88S, the western boundary of the eastern 'quiet zone' agrees with the (faulted) contact between the Mt. Read Volcanics and the Lower Cambrian sediments. North of 88S there is up to a 50m. discrepancy, however the nature and direction of the contact changes north of 80S and is thought to be conformable. The south-west corner of the Dora grid is moraine covered, thus obscuring the contact between the Mt. Read Volcanics and the magnetically quiet rock type (Owen Conglomerate?).

In the magnetically 'active' area, several magnetic highs have been defined. The magnetic anomaly defined in the RTAE detailed survey is shown to be part of a north-west trending high, with a 900γ closure on line 114S at 1900W. The zone is still open to the south and partially obscured by Michael Tam. North of Michael Tam there are three localised highs within the zone. There is a north-south trending (1500γ) anomaly on line 104S at 350W that opens out to the north as part of a generally magnetically high area. On line 96S at 1300E, there is an equidimensional broad anomaly of 500γ near the contact with the magnetically quiet area. There are two incomplete anomalies; one at the western end of line 72S, at least 800γ and broad; and one on the eastern side of Lake Dora, open to the lake. The unsmoothed map shows a series of narrow anomalies, mostly situated over the areas just described. One exception is a zone in the north-eastern corner of the Dora grid, abutting the magnetically quiet area. Another is a zone between lines 110S and 120S at 300 to 500 ft. west.

Induced Polarisation:

CGG conducted a pole-dipole time-domain IP survey over the Dora grid using two receiving dipoles, one on either side of the transmitting electrode. The western receiving dipole was distant  $n = 4$  and the eastern,  $n = 5$  (this was the reverse of the survey over the Rolleston grid where the western dipole was  $n = 5$  and the eastern dipole  $n = 4$ ). The chargeabilities and resistivities were presented as contours of plotted values on 1:6000 scale maps - these maps are from lines 144S to 56S.

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As might be expected, the resistivity maps for receivers 1 (n = 5) and 2 (n = 4) are very similar. There is some offset in position between the two and some values are different, however the pattern is essentially the same on both maps. The data from receiver 1 has been plotted on to a 1:5000 scale map for lines 144S to 64S (reduced to 1:20,000 for this report). This map is then comparable with the 1:5000 Rolleston resistivity map which, although distant n = 4 from the transmitter, also has the receiver on the eastern side.

The map (Figure 15) shows a resistivity low (down to <100 ohm-m) extending down the eastern side of the grid (CGG's anomalies A6 and A7) which is most likely due to black shales within the Lower Cambrian sediments. On lines 72S to 88S, the zone is closed east and west, but south of line 96S the zone is open to the east. There is a zone of low resistivity (<500 ohm-m) in the south-west corner of the grid on lines 114S to 144S centred on 2000W. There is also an isolated resistivity low (<500 ohm-m) centred over 3000W on line 120S (part of CGG's anomaly A8). This last anomaly and the zone down the eastern side of the grid have associated chargeability anomalies (Figure 16) of at least 20 ms, the largest value being 65 ms over the black shales on line 88S. The second mentioned low resistivity zone contains the RTAE electromagnetic anomaly but it does not have an associated chargeability anomaly. There is a local chargeability high (12 ms) at 600E on 144S, with no corresponding resistivity low but with an associated geochemical anomaly.

Self Potential:

An SP survey was carried out over the grid with a station spacing of 200 ft. The results were presented as profiles on a 1:6000 scale map with the SP response plotted as negative voltage upwards at a scale of 1 inch equals 100 millivolts. The SP responded to the conductive (black shale) zone on the eastern limit of the grid. A more than 70 mV anomaly was recorded on line 110S centred over 3000W. There is a 50 mV open anomaly at the western end of line 136S which carries through to line 128S which shows a 20 mV anomaly. There are also small anomalies on the western end of lines 64S, 72S and 80S.

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The south-western corner of the grid is covered by moraine and it is therefore likely that the anomalies described above on lines 110S, 128S and 136S are caused by conductive horizons within the moraine. The small anomalies on lines 64S, 72S and 80S are situated close to the volcanics/Owen Conglomerate contact.

Electromagnetics:

A Turam survey was conducted by RTAE in 1958 over their Lake Dora grid. The survey extended for nearly 1600 metres with a line spacing of 122m. (400 ft.). Readings were taken every 30m. (100 ft.). A strong anomaly was recorded north-west of Lake Dora with a much weaker anomaly adjacent to the south-western corner of the lake. The strong anomaly is situated close to 2000W on lines 120S and 128S of the CCG grid. A sub-base line was set up to the west of the anomaly and intermediate lines surveyed. The maximum values for the reduced ratio and phase difference from this more detailed survey were 2.12 and 4.5° respectively. Boniwell (1958) noted that the anomaly is "of good order and quality, dips west at about 50-60 degrees, and is relatively shallow at less than 50 feet, possibly less than 25 feet", and a gravity survey was recommended over the anomaly

Gravity:

A gravity survey was carried out in order to determine whether the EM anomaly was due to massive sulphides. The survey was carried out over the more detailed grid used for the EM survey. A slight gravity low (Maximum value - .16 milligals) was found to coincide with the EM anomaly, thus in all probability ruling out the possibility of massive sulphides as a cause of the electromagnetic responses.

Interpretation:

Unlike the Rolleston or Selina grids, there are no well defined IP responses over known mineralised occurrences. Low chargeability anomalies on lines 80S to 64S (10 ms) and 72S (15 ms), on and east of the base line respectively, encompass small areas of known mineralisation (chalcopyrite and pyrite). There is no associated resistivity low or



magnetic anomaly and the geophysics to date tends to confirm that these particular old workings were on thin veins of mineralisation with only small volumes of sulphide. The various old workings on the rest of the grid (mostly below line 110S and close to the base line), do not have any associated IP response.

CGG defined various IP anomalies on the Dora grid. The chargeability anomaly on the base line mentioned above includes CGG's A13. One anomaly (A12) has a coincident magnetic anomaly, another (A8) has an associated resistivity low. There are also responses over black shales on the eastern limits of the lines. The magnetic anomaly contributing to A12 is due to shallow sources and is not evident on the smoothed magnetics map (Figure 14). The IP anomaly is a 5 and 7 ms zone on the n = 4 survey. As an anomaly type A12 (Figure 17) has similarities with (the revised) anomalies A9 and A10 on the Rolleston grid, and may be a southern continuation of them. Similar anomalies, apparently on strike over such a distance would strongly suggest lithological causes, e.g. a magnetite-bearing volcanic horizon, as was mentioned in the Rolleston Interpretation.

CGG anomaly A15 occurs over two lines between the Rolleston and Dora grids; the section on the Dora grid is in the NW corner on line 64S over Owen Conglomerate. It was stated in the Rolleston Interpretation that, in the absence of more favourable geological or geochemical evidence, the anomaly is of little interest. Anomaly A13 also occurs on both grids; on the Dora grid it occurs solely within acid volcanics, but again other evidence is needed before drilling is recommended.

Anomalies A16 and A8 occur in the SW corner of the grid; neither has an accompanying magnetic anomaly, but a 'conductivity axis' is indicated adjacent to A8. These two anomalies may be part of one zone from line 136S to 110S (see Figure 17), rather than as two specific anomalies as was interpreted by CGG. There is also a slightly anomalous chargeability zone which has been interpreted by Scintrex (1973) from line 144S to 110S. The IP survey indicated a region of higher conductivity between these two zones from line 136S to 120S, and Rio Tinto defined a strong Turam (EM) anomaly within this zone in 1958. However the area is moraine covered and is thought to overlie Owen Conglomerate. Certainly the magnetics suggests a change of rock type in the SW corner (Figure 14). Rio Tinto followed up their Turam anomaly with a gravity survey which revealed a local low over

035



the anomaly, i.e. the conductor was due to low density rocks such as clays within the moraine, rather than massive sulphides. Although the northern part of the Scintrex anomaly is within the volcanics (Figure 17), it is not thought that this SW portion of the grid is a potentially mineralised area. However the thickness of moraine could be determined by either electrical soundings (spot depths) or by seismic surveys (profiles of overburden thickness) and test drill holes could be placed in areas of interest with the thinnest cover.

The narrow, often intense anomalies shown in CCG's presentation of the magnetic results may be readily related to surface or near surface magnetite/hematite veins such as have been observed on the Selina and Rolleston grids in proximity to the sulphide bodies. However the Dora magnetics, either surface, or deeper-sourced as shown in the smoothed magnetics (Figure 14) are not associated with any IP anomaly. And it is noted that the high resistivity of the Mt. Read Volcanics means that in areas free of moraine, excellent penetration should be achieved (i.e. an ore body should be anomalous to at least 100m. in these conditions). In areas that are moraine covered much of the cover is not conductive (the SW corner of the grid is a probable exception) and thus IP should still be effective at depth. Thus there appear to be no promising targets on the Dora grid.

The grid has been extended to the south to Lake Spicer and IP and magnetics will be surveyed over it. This means a second, weaker Turam anomaly from the RTAE survey will be evaluated as well as a possible extension (and hopefully strengthening) of a weak chargeability anomaly on line 144S east of the base line (Figure 16).

#### CONCLUSIONS

The low level aeromagnetics over the Selina area recorded in conjunction with the Dighem electromagnetic survey defined nearly all anomalies found by the ground magnetics survey, except the near surface magnetite. The results are useful for regional geological mapping, however the significance (if any) between magnetic bodies and sulphide deposits in this area has yet to be established. Certainly the aeromagnetic anomalies which RTAE located and further defined failed to produce any mineralised areas of interest.

036



The electromagnetic results are generally disappointing. Neither the Turair nor the Dighem survey showed a strong anomaly over the pyrite body, however the IP results show that the body is by no means strongly conductive. The Dighem survey also showed low grade anomalies over the black shales on the eastern side of the grid. The reinterpretation of the Dighem survey has defined several possible anomalies including some in interesting areas near the two large magnetic anomalies. Other anomalies, some defined in the original (Dighem) interpretation, were located in the SW quarter of the grid. Several Turair anomalies were also interpreted here. However the area is covered by moraine and is considered to be of little interest, particularly since there are no corresponding IP anomalies.

The above is not to say that EM methods are not a worthwhile exploration tool. In the Tasmanian environment of extremely difficult access, in an area with no preferred targets (e.g. mineralised occurrences), then airborne electromagnetics (with aeromagnetics) is a good 'first-pass' anomaly finder. However failure to find an anomaly in an area may not significantly reduce that area's prospectiveness.

The induced polarisation method has generally shown itself to be an effective anomaly finder. The pole-dipole array used (with two receiving dipoles) seems to be a good compromise between the information available from a dipole-dipole type survey and the productivity of the gradient array. However a better description of the reading and plotting of the data could have been provided by CGG for this and adjacent surveys.

Experience here and elsewhere suggests that the self potential method has no application in areas of glacial cover, but may be most effective where there is no such cover; further, the method is cheap and quick.

The gravity method may be used to help reduce the ambiguities inherent in other geophysical methods, provided that very accurate measurements are taken and full corrections are made; the expense, both in the field and office, rising rapidly as the topography becomes more extreme.

On the Selina grid, geophysics, primarily IP, defined a (previously known) pyrite body (the extent of which has still not been verified by drilling). There are no other obvious geophysical targets, but the grid needs to be completed with IP.



037

Geophysics also defined another (same?) pyrite body on the Rolleston grid which has been tested by three drill holes. The next most promising geophysical target on this grid is CCG's anomaly A2 on line 48N. It has a well pronounced magnetic anomaly, and although the chargeability response is poor (14 to 22 ms) with no corresponding resistivity low, its situation over old workings adds further significance.

Soil sampling is planned for lines 56N, 48N and 40N only, and it is possible (but unlikely) that the geophysical results may assume a different significance following that survey.

Like the Selina area, there is no immediate target on the Dora grid from the geophysics so far. However the grid is being extended south to Lake Spicer and this will cover the previous RTAE work which includes a small Turam anomaly.

#### RECOMMENDATIONS

On the Selina grid it is recommended that the gridded area be completed with IP; while it would be preferable to continue with the same arrays that were used over the rest of the grid, a gradient array is recommended on cost effective grounds. This array is quicker, cheaper and is not expected to miss anomalous zones in the area. There should be considerable overlap with the northern section of the original survey.

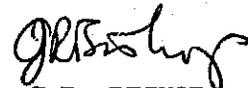
It is also recommended that more detailed magnetics be carried out between lines 144N and 152N to better define the magnetic anomaly north of the pyrite zone. Further drilling to the north of LS6 on line 136N would investigate (i) a northern continuation of the mineralisation; (ii) the cause of the magnetic anomaly; (iii) the nature of the acid volcanics/Jukes Breccia contact. The significance of this and the other magnetic anomalies on the Selina grid should be better understood after the completion of the IP survey and the above proposed drilling.

On the Rolleston grid, it is recommended that the old workings indicated at 750E on line 48N be investigated and the geophysics reconsidered in the light of that inspection and the geochemical sampling. In particular it may be worthwhile establishing the thickness of the moraine in the



immediate vicinity (by resistivity soundings or seismic refraction); a thick section of moraine could perhaps explain the poor IP response. However except in areas of conductive moraine (e.g. the SW corner of the Dora and Selina grids), the cover should not occlude a response.

There are various geophysical responses on the SW of the Dora grid. The area is moraine covered and is thought to be underlain by Owen Conglomerate. Electrical sounding or a seismic survey would determine moraine thickness in areas of interest and a test drill hole could confirm the geology. If there is an appreciable difference in velocity between the volcanics and conglomerate, a seismic survey by itself could map the contact. There are no other zones of (geophysical) interest on the Dora grid.

  
J.R. BISHOP

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APPENDIX

Modelling of Magnetic Anomalies

Selina:

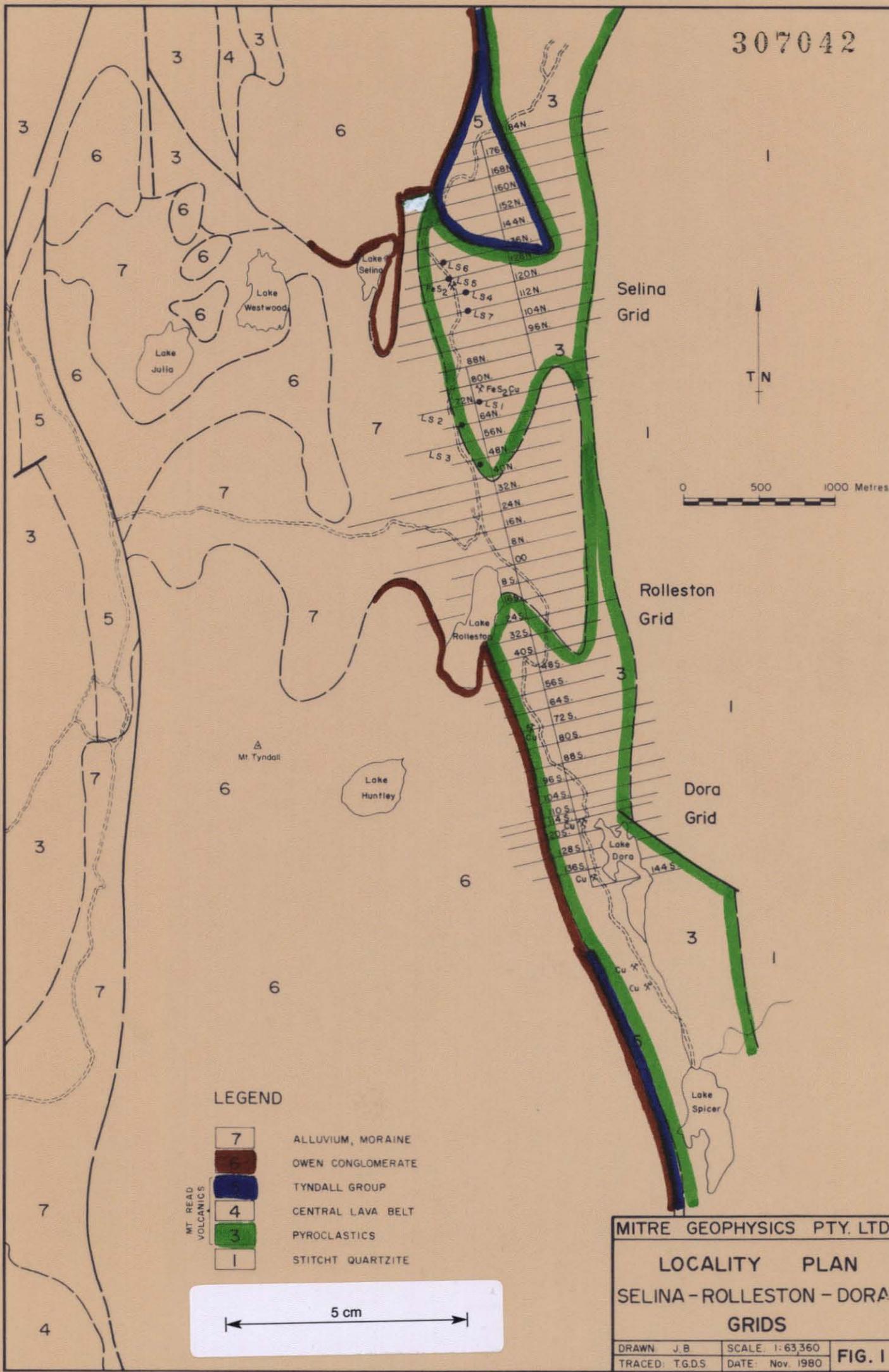
The large magnetic anomaly on the western side of the Selina grid was modelled. A sphere was used to approximate the three dimensional body. A profile was taken across line 152N of the Dighem survey from 4100W to 1000W. A match was made to the western limits of the anomaly (E\_W profiles over symmetric magnetic bodies should be symmetric) on the assumption that the eastern side was influenced by the adjacent anomaly to the east. Comparison of the field curve with the response to a sphere, with a depth to centre of 275m., and for a (high) susceptibility of .01; a radius of 200m., is shown in Figure A1. Since the Dighem magnetometer has a nominal clearance of 50m., the depth to centre below ground level is 225m. A background magnetic intensity 62,500 $\gamma$  was assumed.

Rolleston:

The elongate magnetic anomaly on the eastern side of the Rolleston grid was modelled. A thin, infinite, tabular (dyke-like) body was used to approximate the effectively two dimensional body. A profile was taken across line 24N from the ground, fluxgate magnetometer survey. The best fitting model was for a vertically dipping dyke 100m. below the surface (see figure A2). For a (high) susceptibility of .01, the thickness is 65m. The strike is approximately magnetic north.

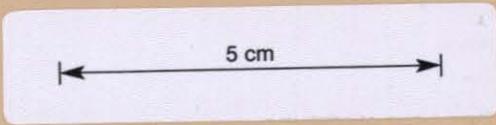
041

307042



LEGEND

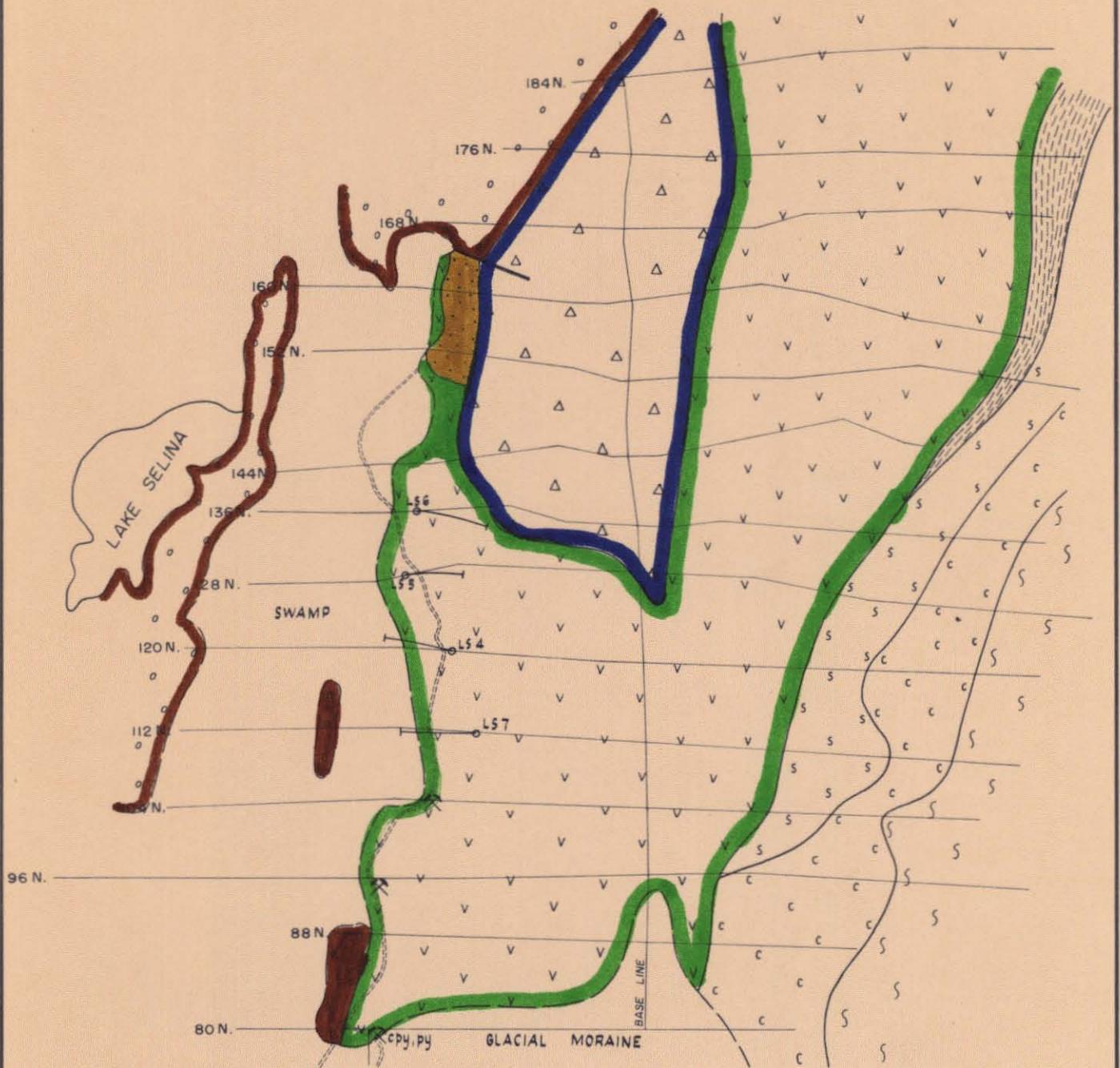
- 7 ALLUVIUM, MORAINÉ
  - 6 OWEN CONGLOMERATE
  - 5 TYNDALL GROUP
  - 4 CENTRAL LAVA BELT
  - 3 PYROCLASTICS
  - 1 STICHT QUARTZITE
- MT READ VOLCANICS



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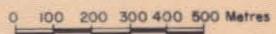
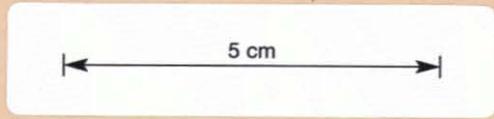
LOCALITY PLAN  
SELINA - ROLLESTON - DORA  
GRIDS

DRAWN: J.B.	SCALE: 1:63,360	FIG. 1
TRACED: T.G.D.S.	DATE: Nov. 1980	



LEGEND

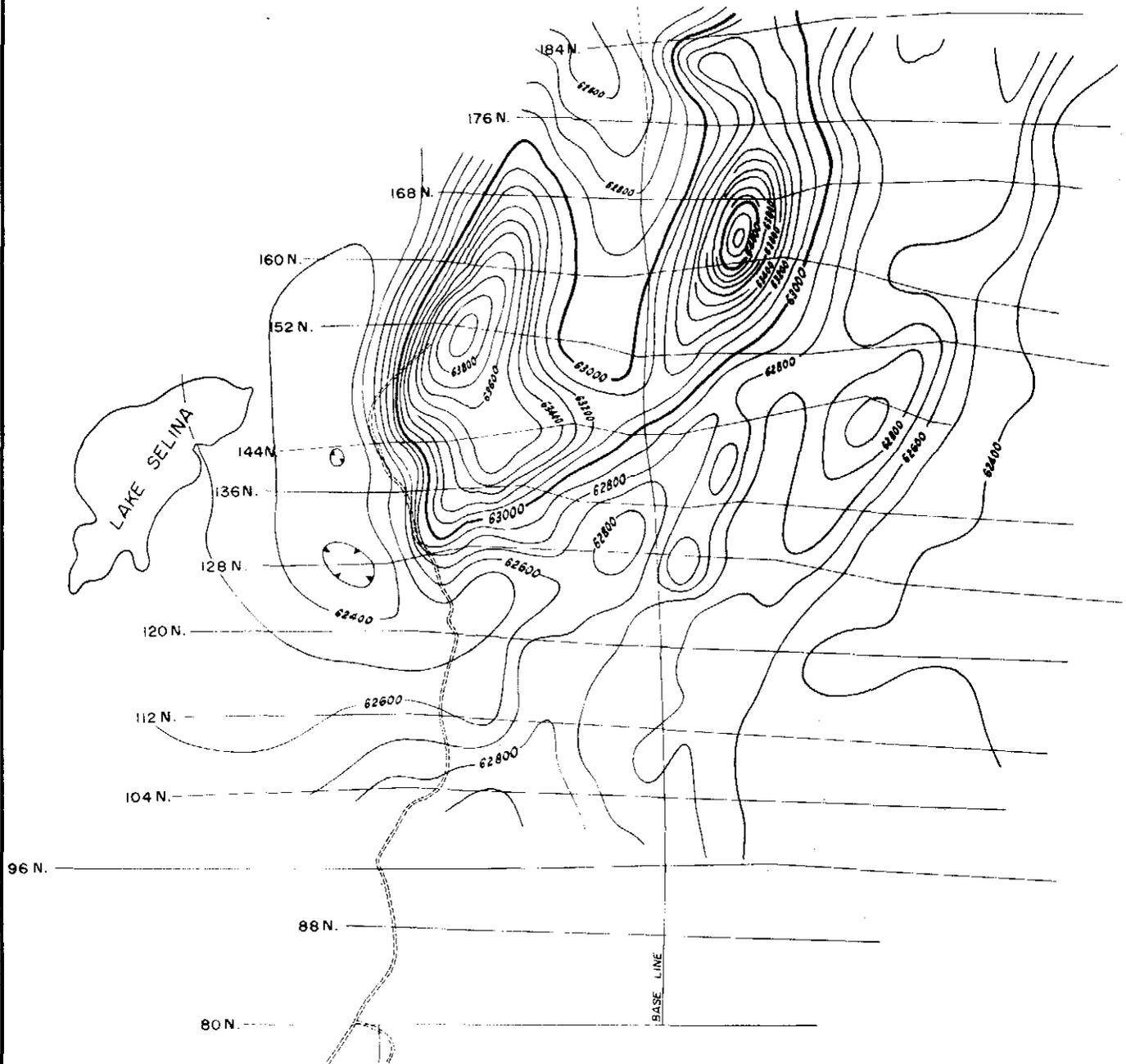
- QUATERNARY  Moraine, alluvium
- ORDOVICIAN  Owen Conglomerate
- UPPER CAMBRIAN  Jukes Breccia
- CAMBRIAN  Chert
- CAMBRIAN  Acid Volcanics
- LOWER CAMBRIAN  Shales
- LOWER CAMBRIAN  Sandstone
- LOWER CAMBRIAN  Conglomerate
- PRECAMBRIAN  Quartzite
- Old Workings
- Diamond Drill Holes



MITRE GEOPHYSICS PTY. LTD.		
SELINA GRID		
GEOLOGY PLAN		
DRAWN: J.B.	SCALE: 1:20,000	FIG. 2
TRACED: T.G.D.S.	DATE: Jan. 1981	

043

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NOTES.

1. Helicopter magnetic (and electromagnetic) survey. Magnetometer height nominally 50m.
2. Flight lines approximately the same distance apart as the grid lines.
3. Original map 1:40,000 scale with a 25 y contour interval.
4. Contour interval 100 y.

5 cm

0 100 200 300 400 500 Metres

MITRE GEOPHYSICS PTY. LTD.

SELINA GRID

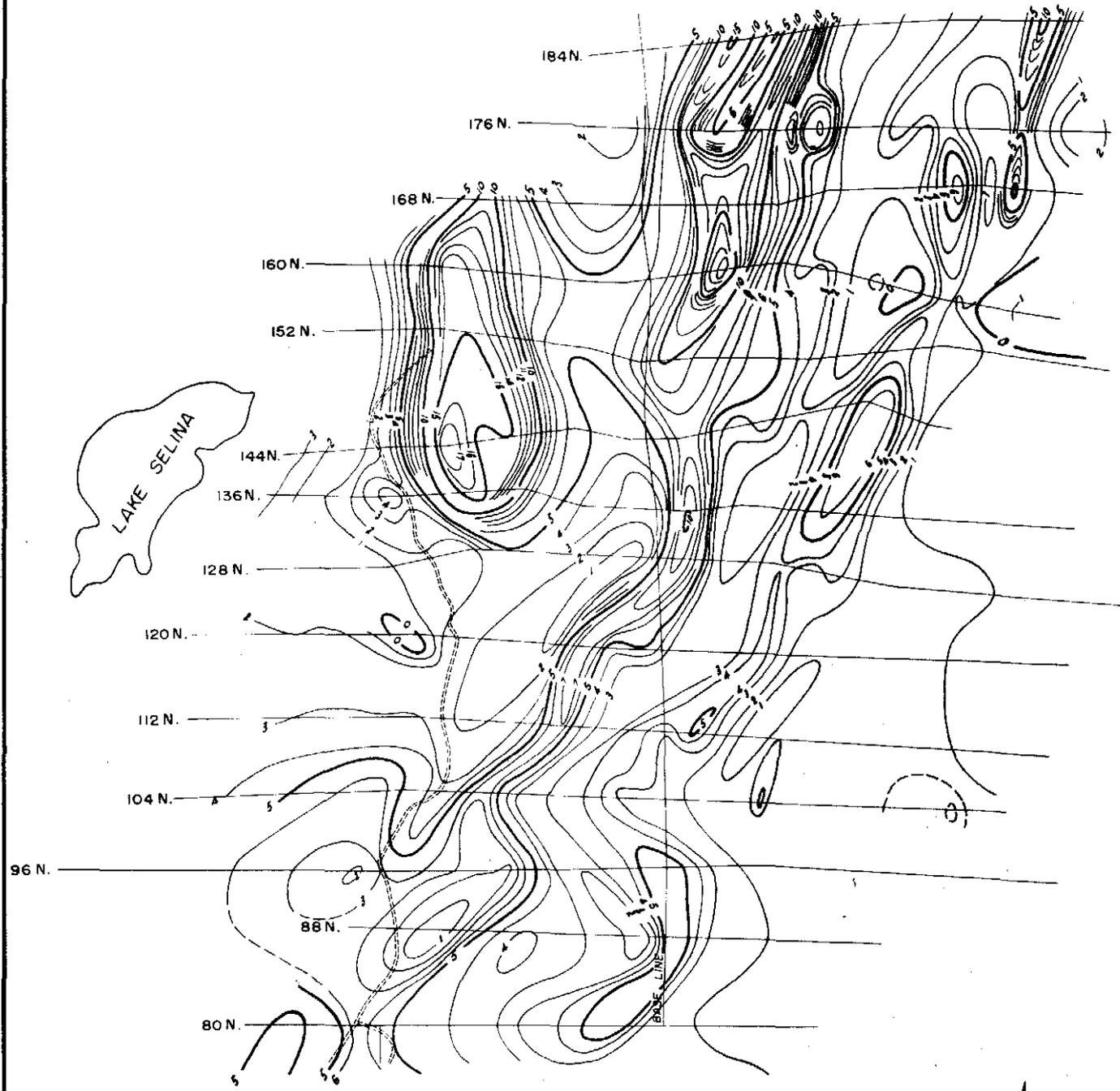
DIGHEM AEROMAGNETICS

DRAWN: J.B.	SCALE: 1:20,000
TRACED: T.G.D.S.	DATE: Jan. 1981

FIG. 3

044

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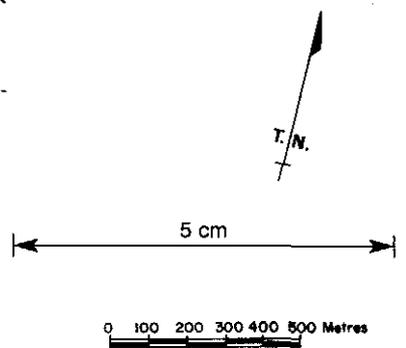


NOTES:

Vertical magnetic intensity was recorded using a fluxgate magnetometer with a station interval of 15.2m (50 ft).

Profiles were taken of the magnetic data and smoothed by hand. This contour plan was then prepared from the smoothed profiles.

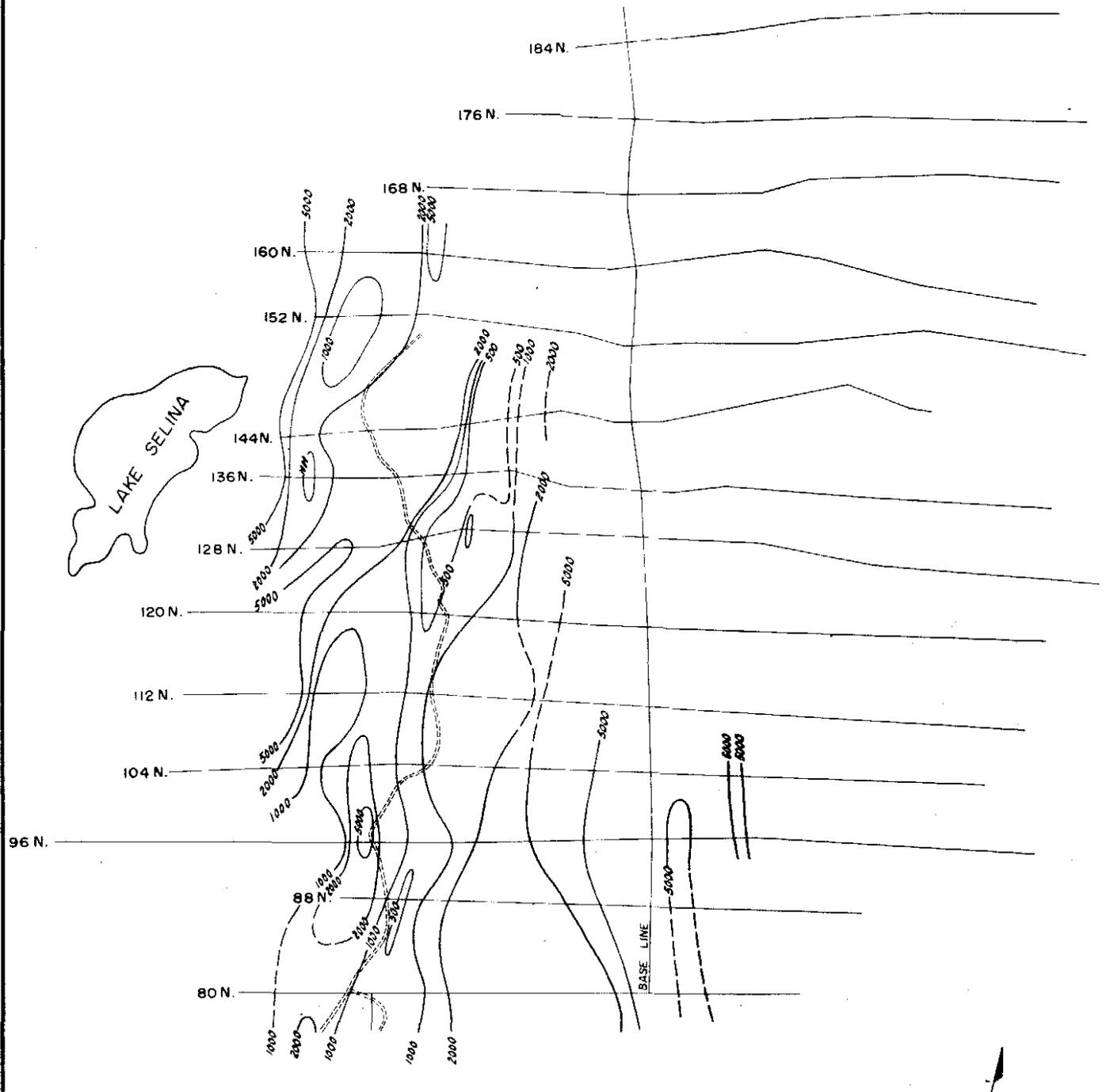
Contour interval 100 gammas.



MITRE GEOPHYSICS PTY. LTD.	
<b>SELINA GRID</b>	
<b>GROUND MAGNETICS</b>	
<b>SMOOTHED CONTOUR PLAN</b>	
DRAWN: J.B.	SCALE: 1:20,000
TRACED: T.G.D.S.	DATE: Jan. 1981
<b>FIG. 4</b>	

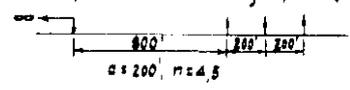
045

307046

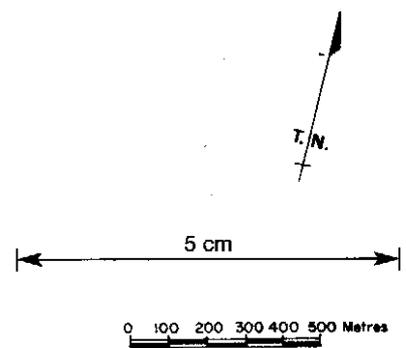


NOTES:

- 1. Electrode Configuration Pole-dipole with 2 receiving dipoles (C.G.G. 1970/71)



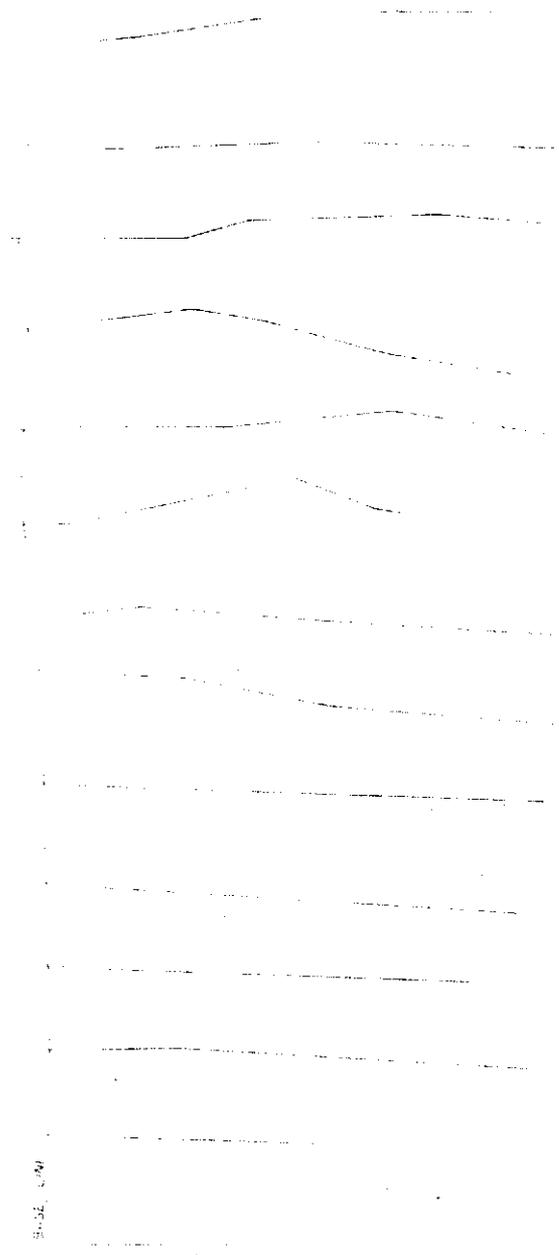
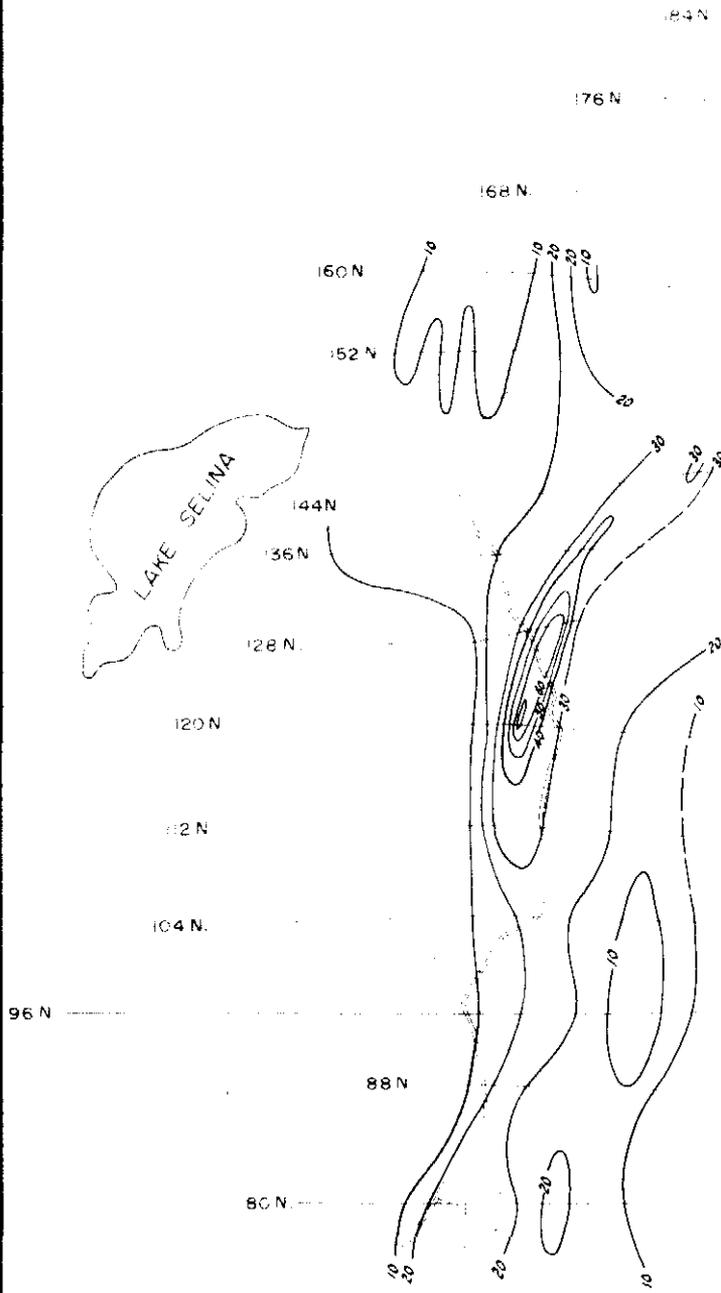
- 2. The average of the logs of the 2 resistivities plotted.
- 3. Contour intervals 500, 1000, 2000, 5000 ohm-m.



MITRE GEOPHYSICS PTY. LTD.		
<b>SELINA GRID</b>		
<b>POLE - DIPOLE SURVEY</b>		
<b>RESISTIVITY</b>		
DRAWN: J.B.	SCALE: 1:20,000	<b>FIG. 5</b>
TRACED: T.G.D.S.	DATE: Jan. 1981	

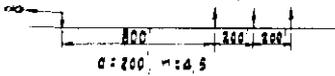
046

307047

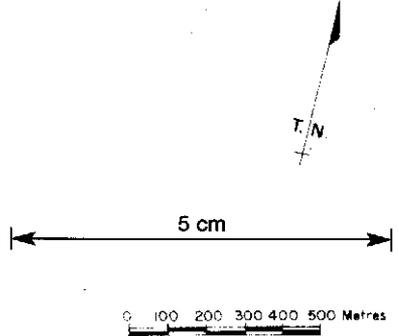


NOTES:

- 1. Electrode Configuration Pole-dipole with 2 receiving dipoles (C.G.G. 1970/71)



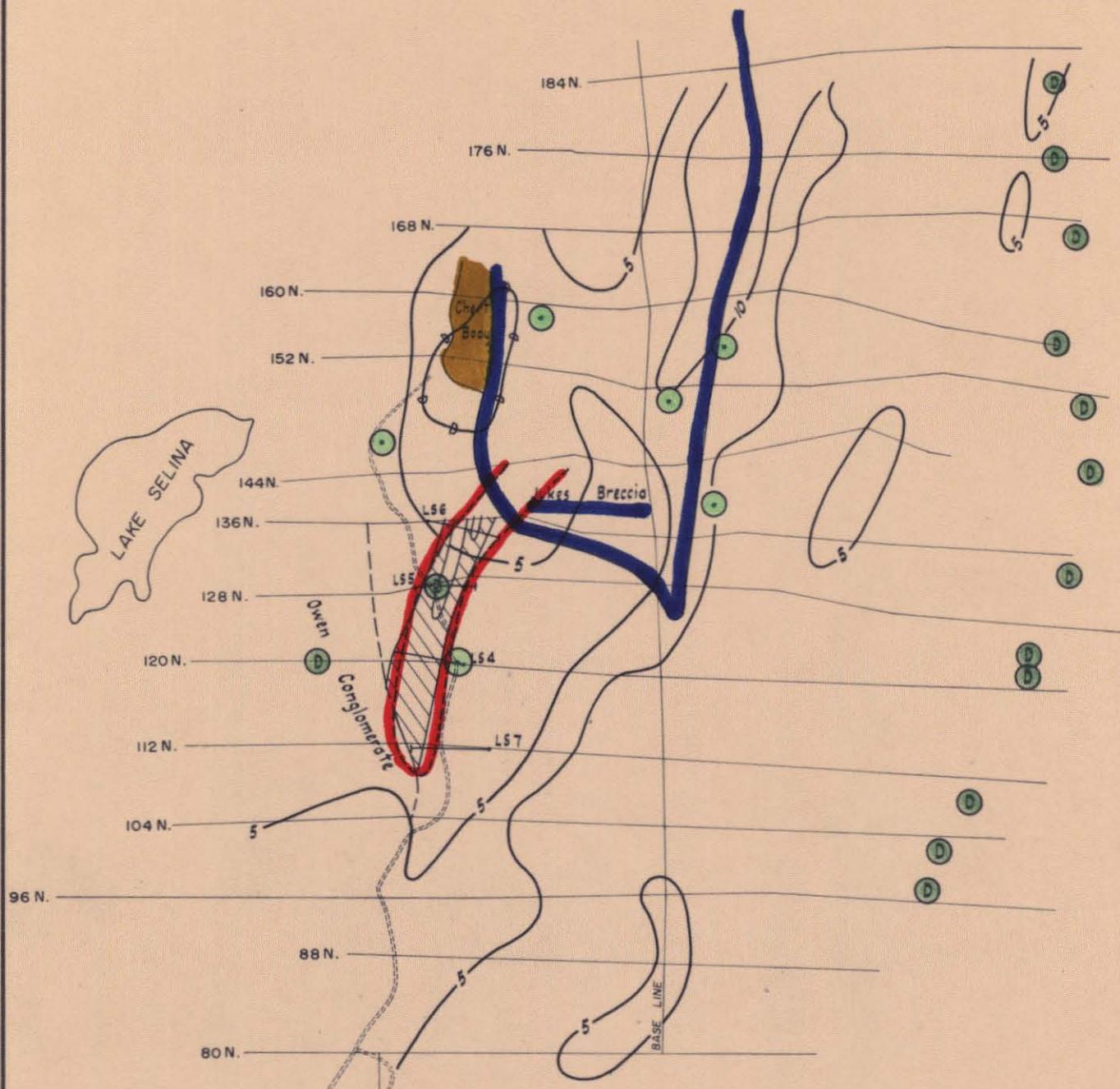
- 2. The average of the 2 chargeabilities plotted.
- 3. Contour interval 10ms.



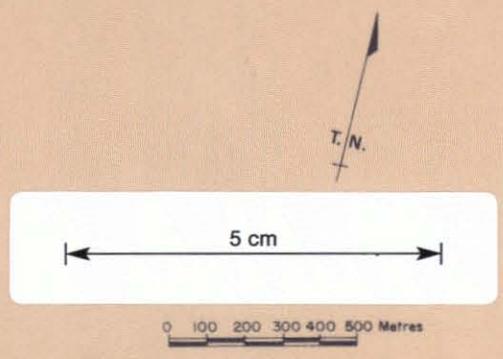
MITRE GEOPHYSICS PTY. LTD.		
<b>SELINA GRID</b>		
<b>POLE - DIPOLE SURVEY</b>		
<b>CHARGEABILITY</b>		
DRAWN: J.B.	SCALE: 1:20,000	<b>FIG. 6</b>
TRACED: T.G.D.S.	DATE: Jan. 1981	

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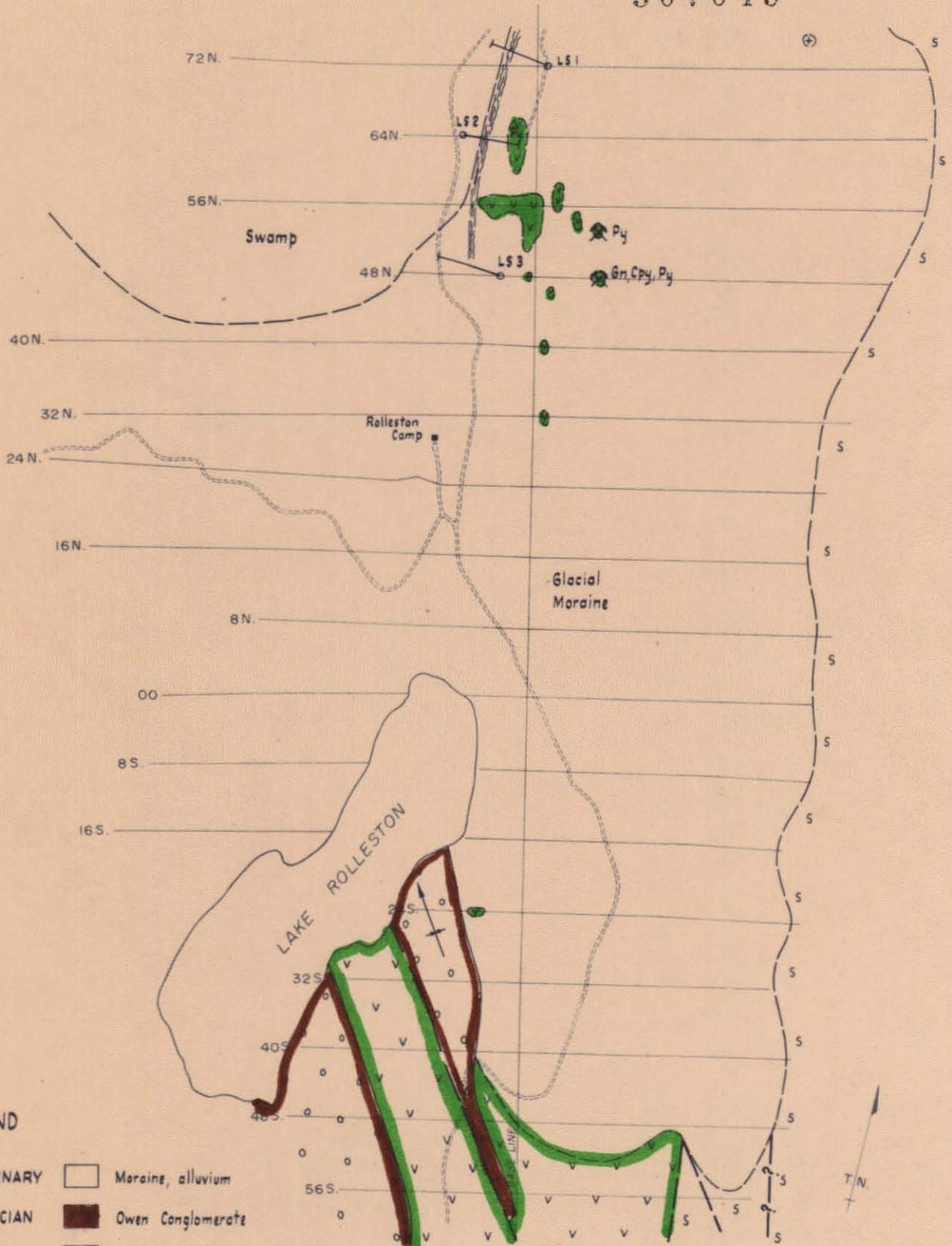


- Magnetic anomalies
- ⊖ Dighem magnetic high
- Chargeability anomaly
- ⊙ Dighem electromagnetic anomaly
- ⊙ Possible Dighem electromagnetic anomaly
- //// Pyrite body



MITRE GEOPHYSICS PTY. LTD.  
 SELINA GRID  
 ANOMALY COMPILATION

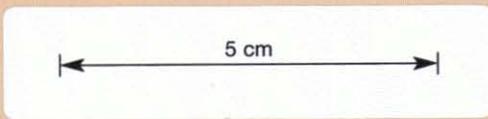
DRAWN: J.B.	SCALE: 1:20,000	FIG. 7
TRACED: T.G.D.S.	DATE: Jan. 1981	



LEGEND

- QUATERNARY  Moraine, alluvium
- ORDOVICIAN  Owen Conglomerate
- UPPER CAMBRIAN △△ Jukes Breccia
- CAMBRIAN VV Acid Volcanics
- LOWER CAMBRIAN S Sediments (Incl. black shales)
- CAMBRIAN + Adamellite (?)
- Magnetite - hematite
- ⚒ Old Workings
- Diamond Drill Holes

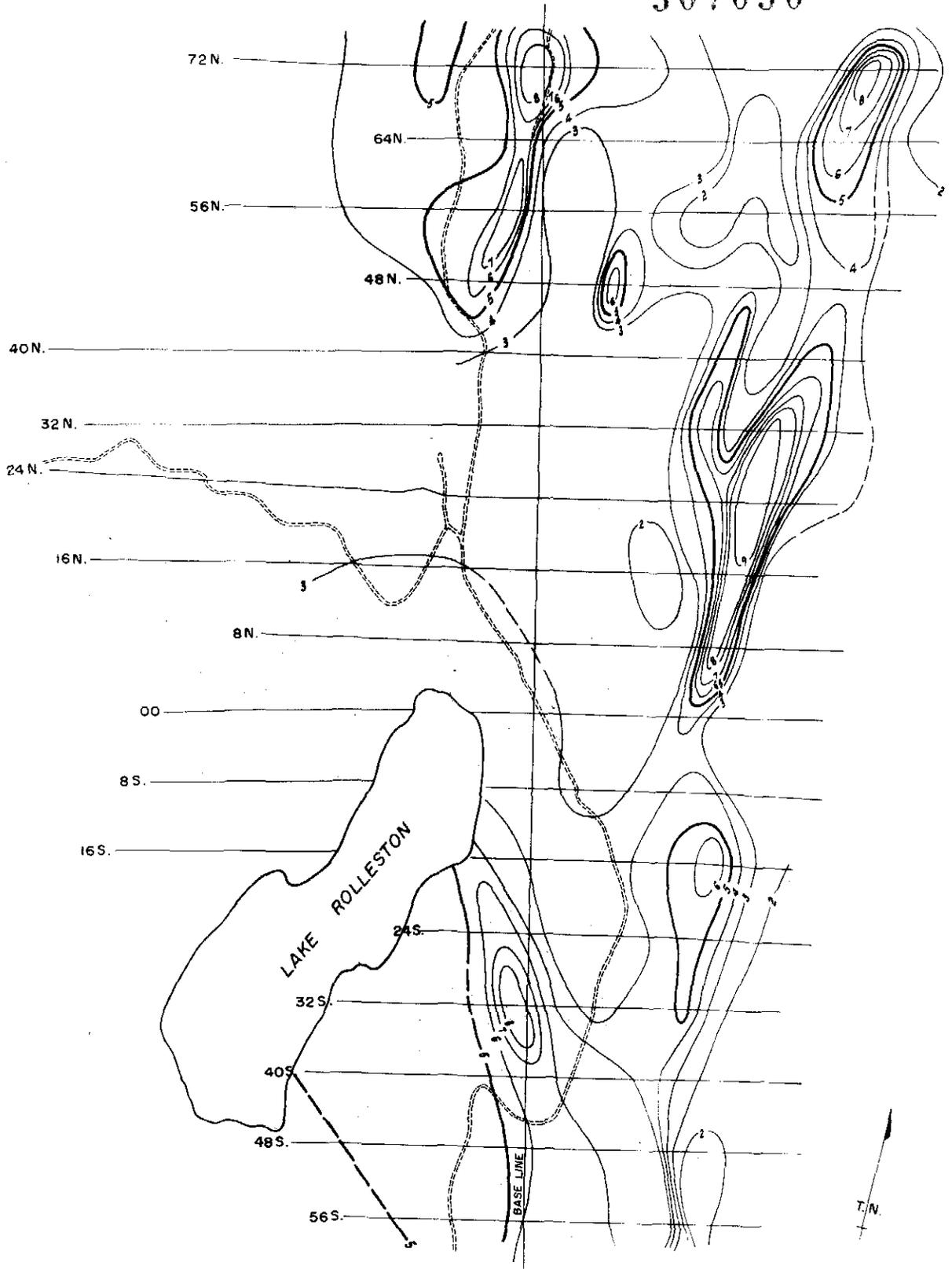
0 100 200 300 400 500 Metres



MITRE GEOPHYSICS PTY. LTD.		
ROLLESTON GRID		
GEOLOGY PLAN		
DRAWN: J.B.	SCALE: 1:20,000	FIG. 8
TRACED: T.G.D.S.	DATE: Jan. 1981	

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**NOTES:**

Vertical magnetic intensity was recorded using a fluxgate magnetometer with a station interval of 152m (50ft).

Profiles were taken of the magnetic data and smoothed by hand. This contour plan was then prepared from the smoothed profiles.

Contour interval 100 gammas.

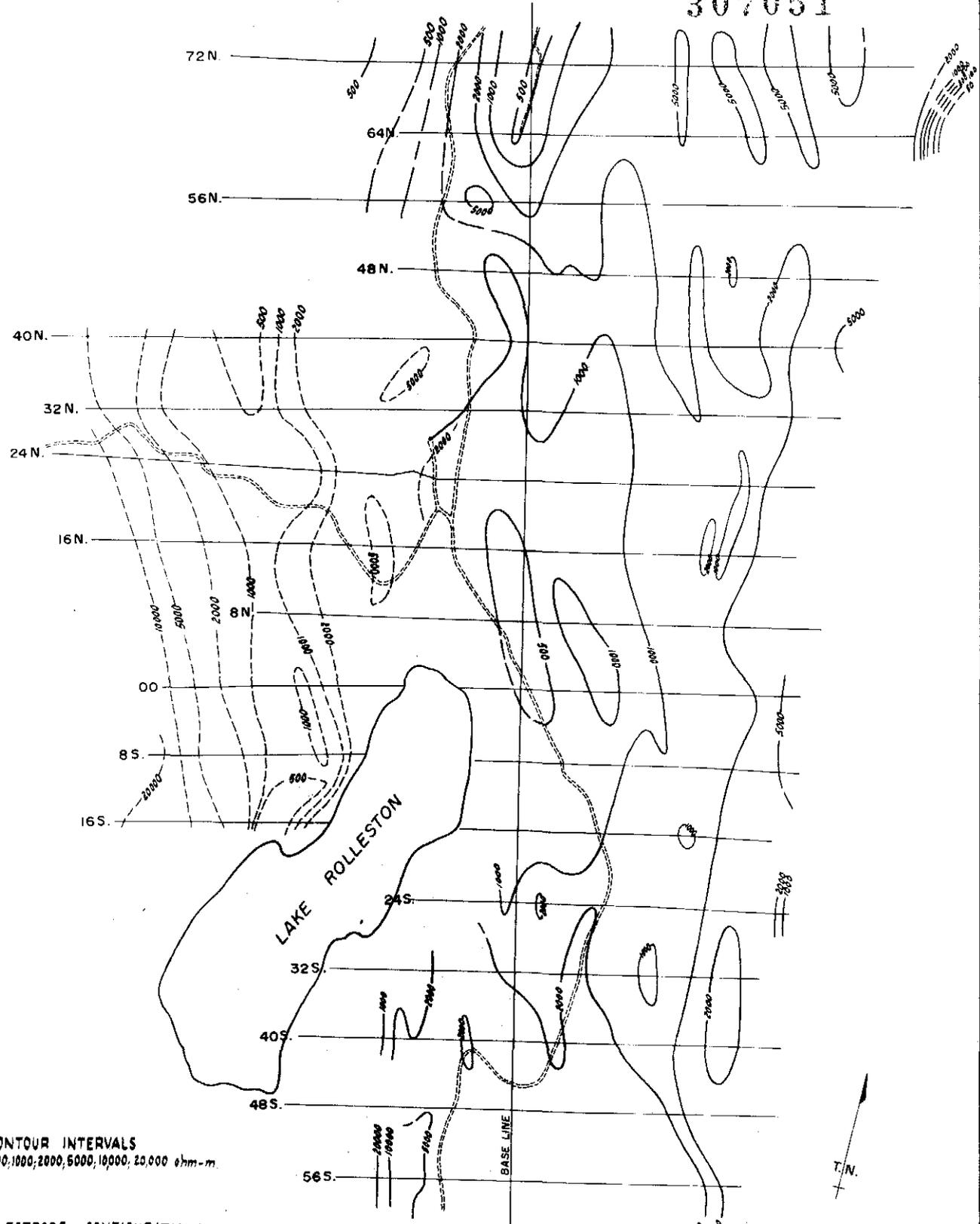
0 100 200 300 400 500 Metres

5 cm

MITRE GEOPHYSICS PTY. LTD.		
ROLLESTON GRID		
GROUND MAGNETICS		
SMOOTHED CONTOUR PLAN		
DRAWN: J.B.	SCALE: 1:20,000	FIG. 9
TRACED: T.G.D.S.	DATE: Jan. 1981	

050

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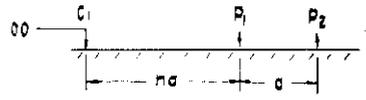


NOTES:

CONTOUR INTERVALS  
500, 1000, 2000, 5000, 10000, 20,000 ohm-m.

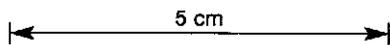
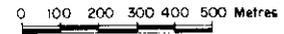
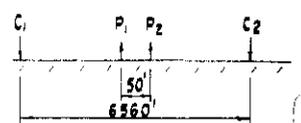
ELECTRODE CONFIGURATIONS

Pole-dipole (C.G.G. 1969/70) solid line contours



a = 200'  
n = 4 (lines 72N - 48S)  
n = 5 (line 56S.)

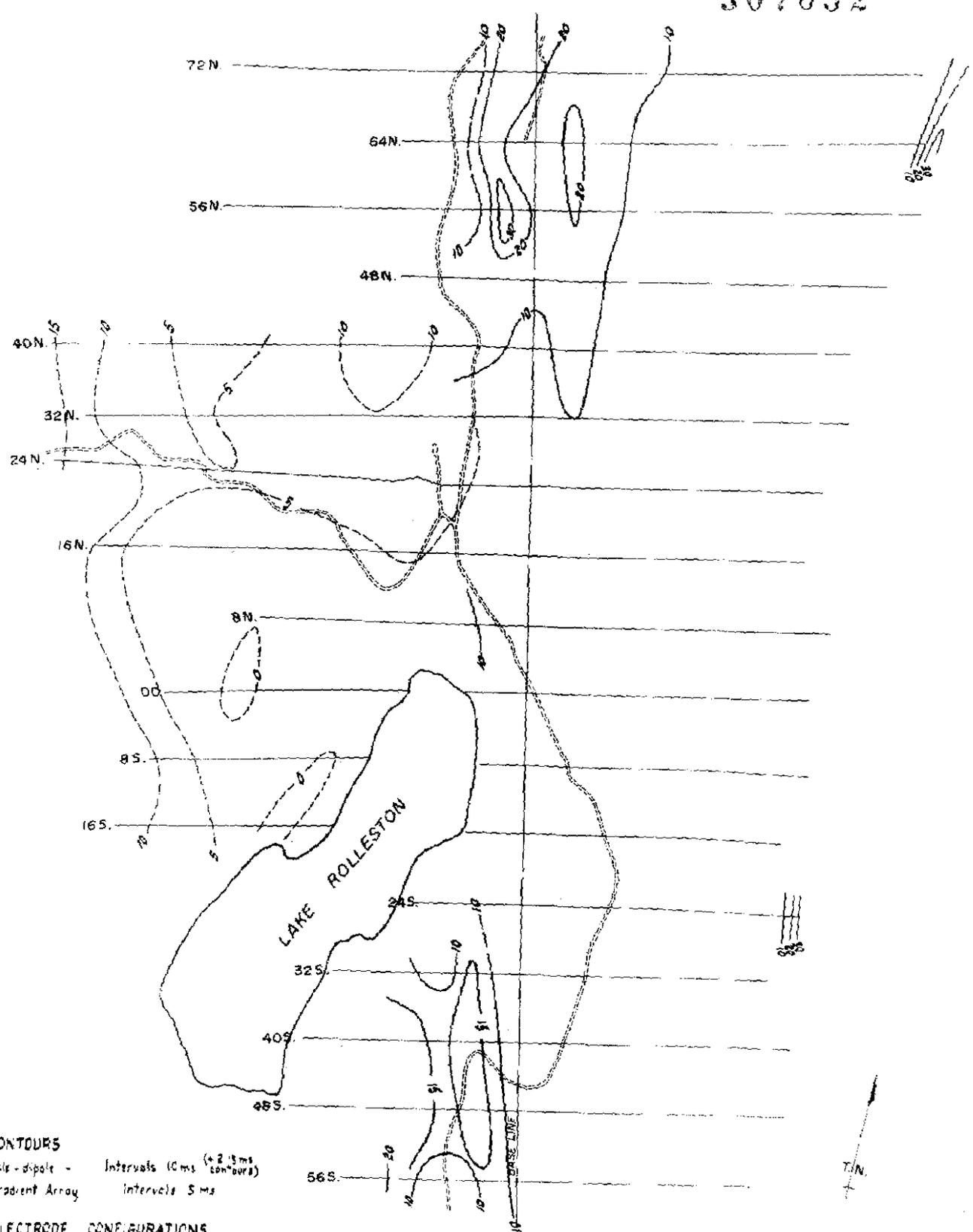
Gradient Array (C.G.G. 1971) broken line contours



MITRE GEOPHYSICS PTY. LTD.		
<b>ROLLESTON GRID</b>		
POLE-DIPOLE / GRADIENT ARRAY SURVEYS		
<b>RESISTIVITY</b>		
DRAWN: J.B.	SCALE: 1:20,000	<b>FIG. 10</b>
TRACED: T.G.D.S.	DATE: Jan. 1981	

150  
051

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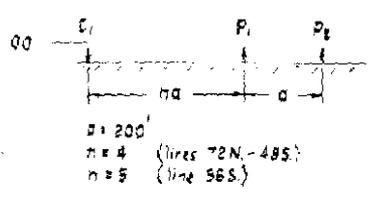
NOTES:

CONTOURS

Pole-dipole - Intervals 10ms (+2.5ms contours)  
 Gradient Array Intervals 5ms

ELECTRODE CONFIGURATIONS

Pole-dipole (C.G.G. 1969/70) solid line contours



Gradient Array (C.G.G. 1971) broken line contours



5 cm

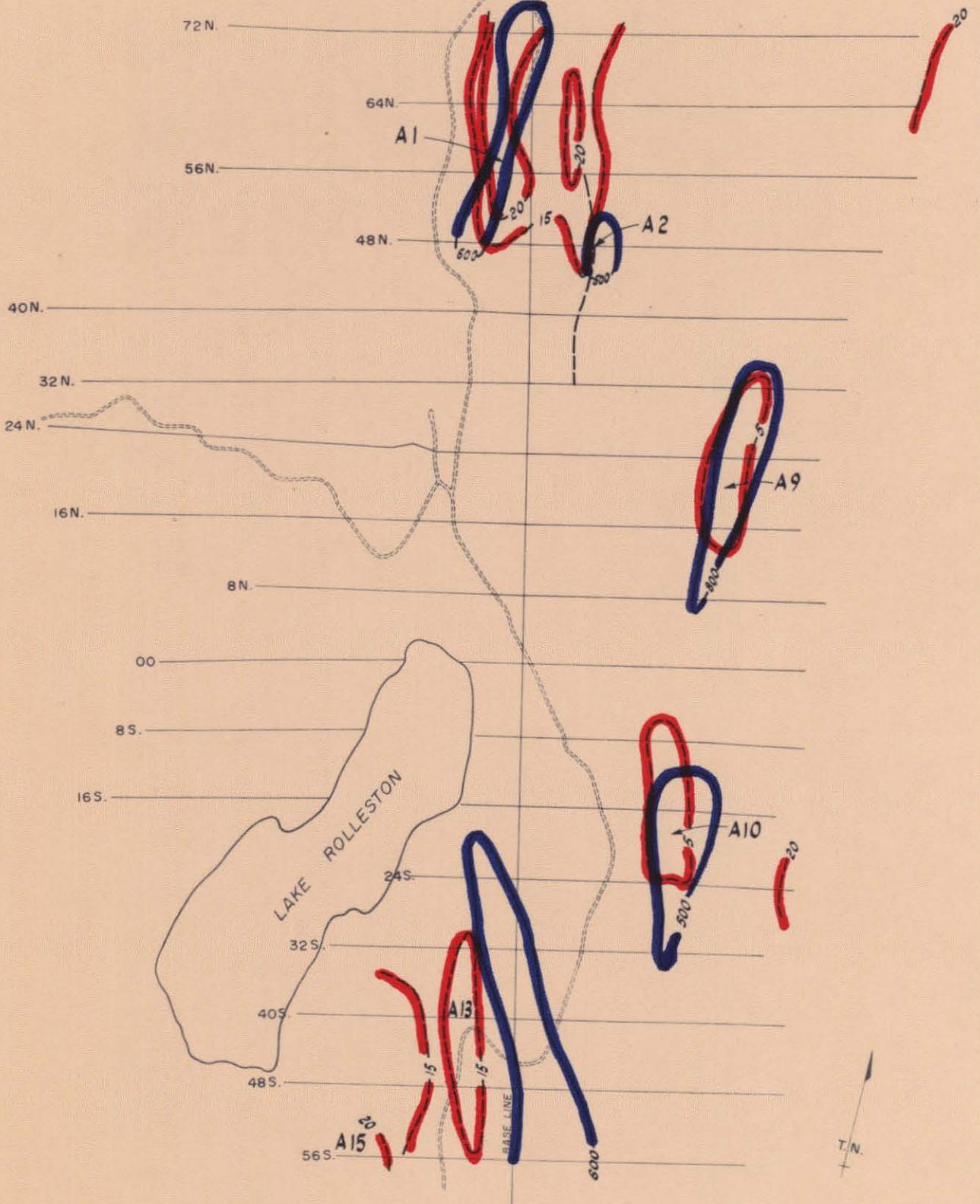
MITRE GEOPHYSICS PTY. LTD.

**ROLLESTON GRID**  
**POLE-DIPOLE/GRADIENT ARRAY SURVEYS**  
**CHARGEABILITY**

DRAWN: J.B.	SCALE: 1:20,000	FIG. 11
TRACED: T.G.D.S.	DATE: Jan. 1981	

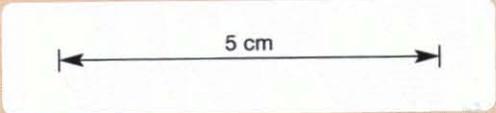
052

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LEGEND

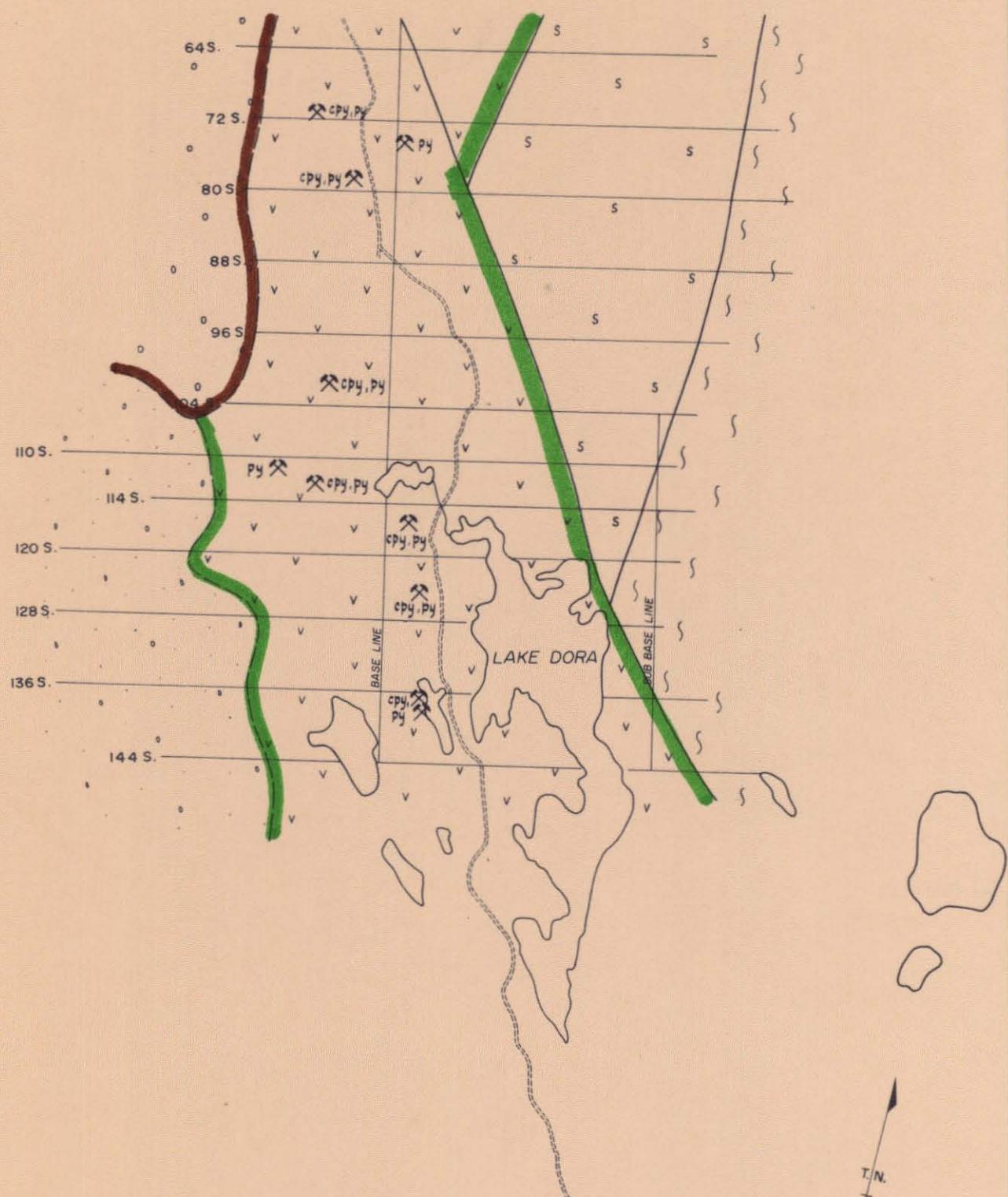
-  Magnetics
-  Chargeability High
- A9 C.G.G. anomaly



MITRE GEOPHYSICS PTY. LTD.		
ROLLESTON GRID		
ANOMALY COMPILATION		
DRAWN: J.B.	SCALE: 1:20,000	FIG. 12
TRACED: T.G.D.S.	DATE: Jan, 1981	

053

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LEGEND

- PLEISTOCENE  Moraine
- ORDOVICIAN  Owen Conglomerate
- CAMBRIAN  Volcanics
- LOWER CAMBRIAN S Sediments
- PRECAMBRIAN S S Quartzite
- ⚒ Old Workings

0 100 200 300 400 500 Metres

5 cm

MITRE GEOPHYSICS PTY. LTD.

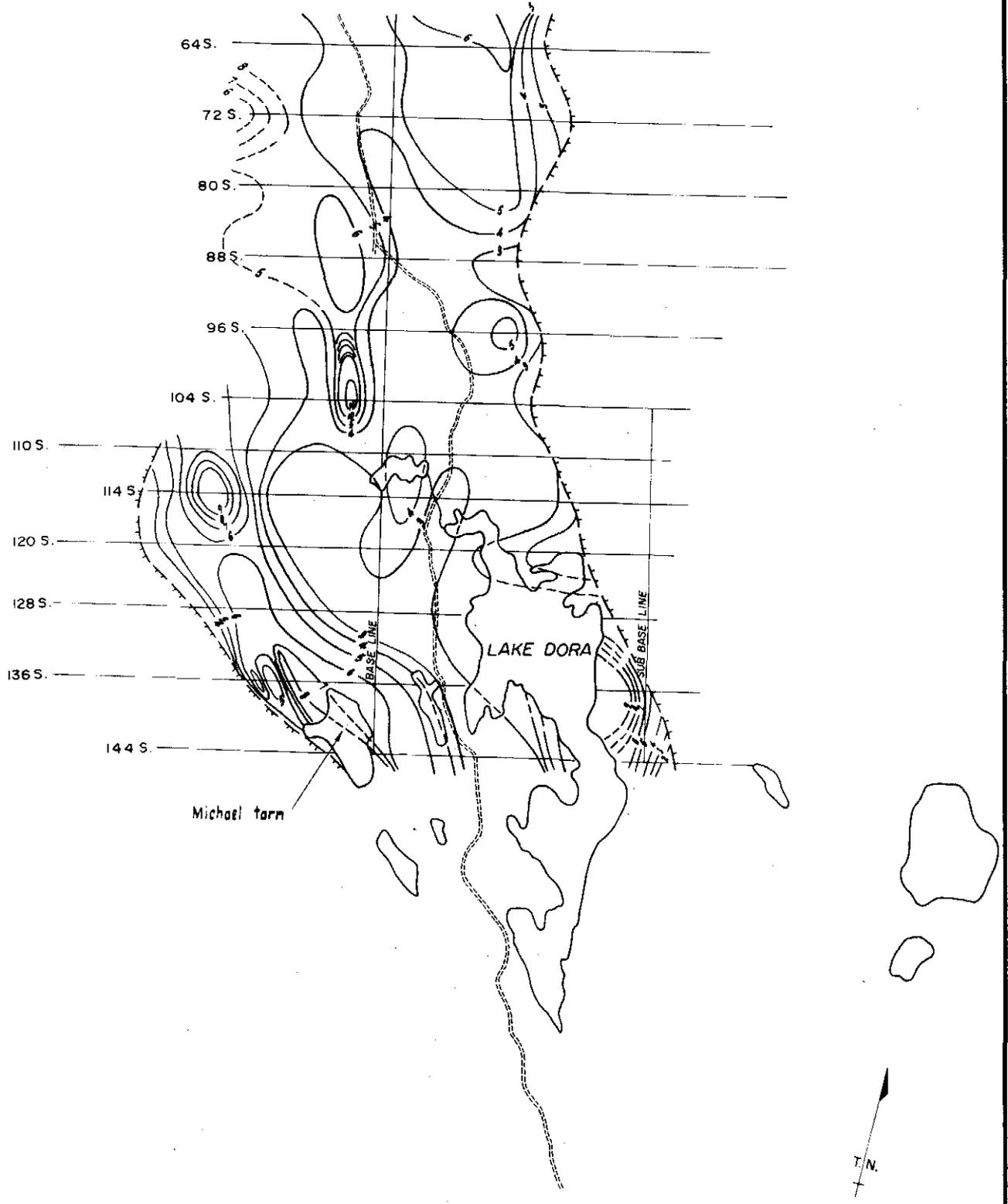
DORA GRID

GEOLOGY PLAN

DRAWN: J.B.	SCALE: 1:20,000	FIG.13
TRACED: T.G.D.S.	DATE: Jan. 1981	

054

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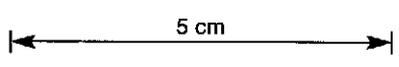
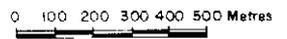


**NOTES:**

Vertical magnetic intensity was recorded using a fluxgate magnetometer with a station interval of 15.2m (50ft).

Profiles were taken of the magnetic data and smoothed by hand. This contour plan was then prepared from the smoothed profiles.

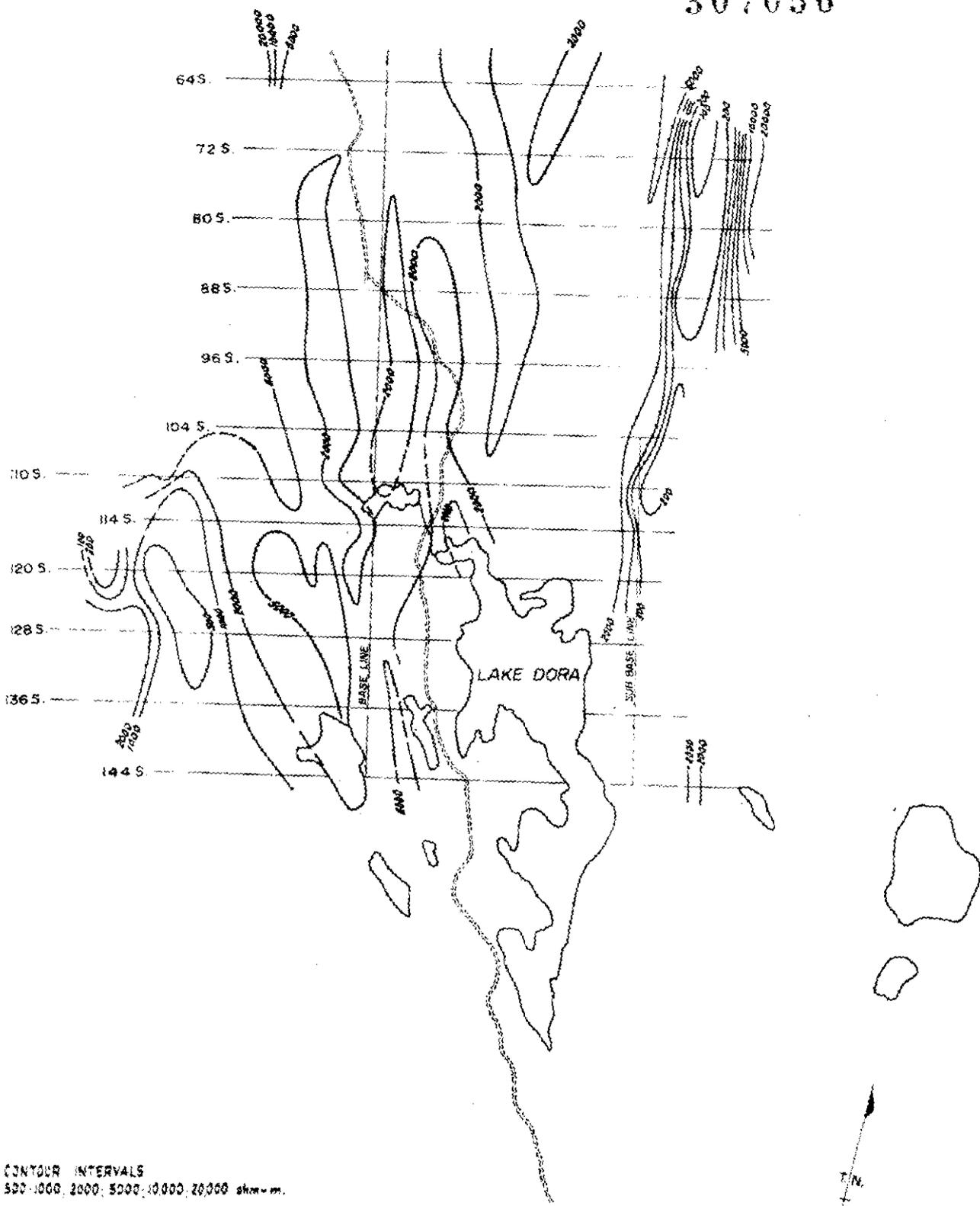
Contour interval 100 gammas.



MITRE GEOPHYSICS PTY. LTD.	
DORA GRID GROUND MAGNETICS SMOOTHED CONTOUR PLAN	
DRAWN: J.B.	SCALE: 1:20,000
TRACED: T.G.D.S.	DATE: Jan. 1981
FIG. 14	

055

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NOTES:

1. CONTOUR INTERVALS  
 500, 1000, 2000, 5000, 10000, 20000 ohm-m.

2. ELECTRODE CONFIGURATION

Pole-dipole (C.G.G. 1969/70)



$a = 200'$   
 $n = 5$

0 100 200 300 400 600 Metres

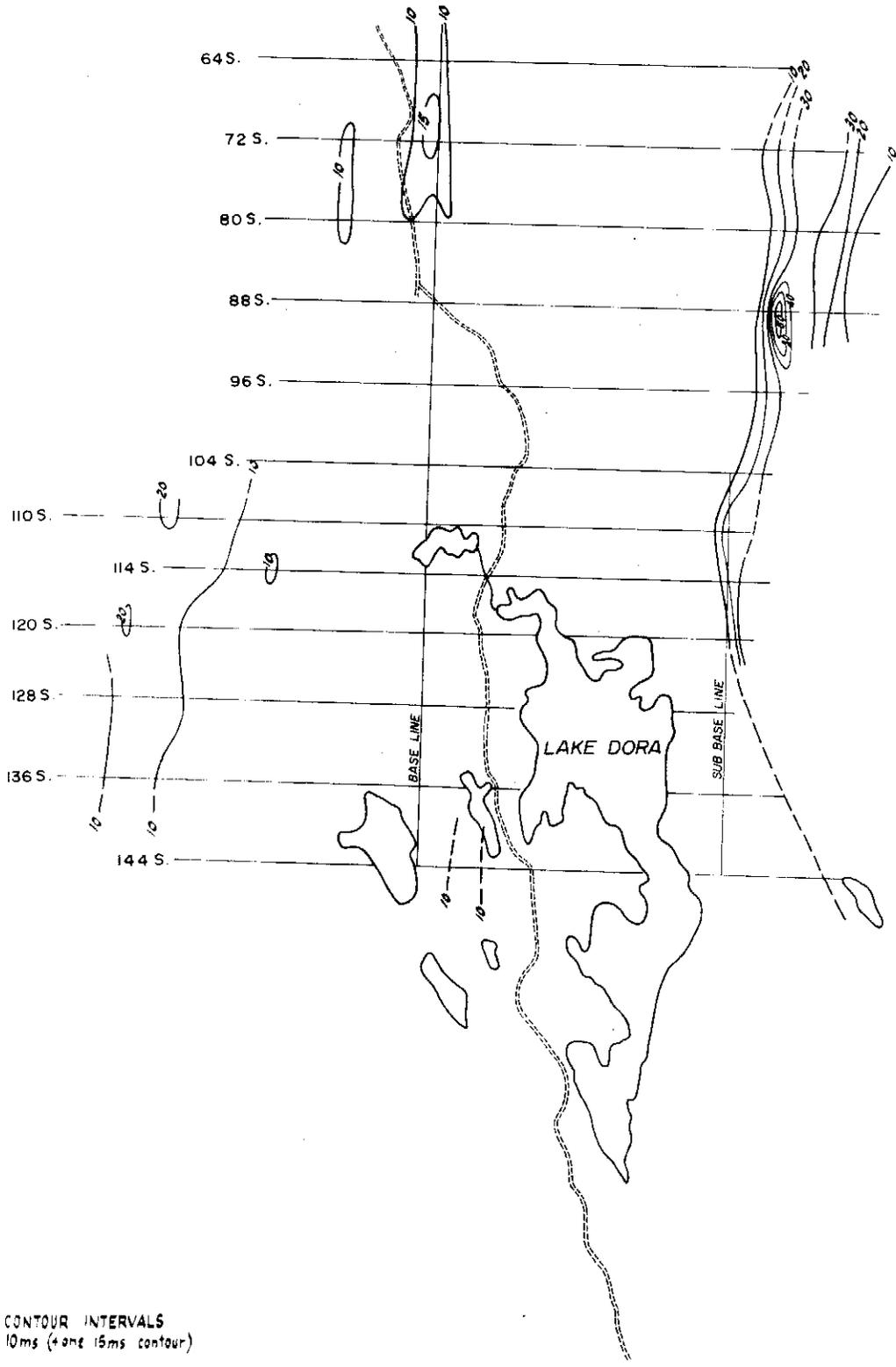
5 cm

MITRE GEOPHYSICS PTY. LTD.  
 DORA GRID  
 POLE - DIPOLE SURVEY  
 RESISTIVITY

DRAWN: J.B.	SCALE: 1:20,000	FIG. 15
TRACED: T.G.D.S.	DATE: Jan 1981	

056

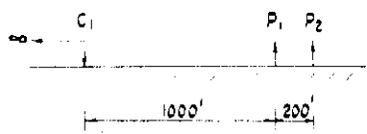
307057



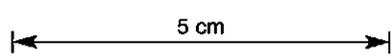
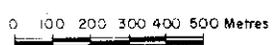
NOTES:

1. CONTOUR INTERVALS  
10ms (+one 15ms contour)

2. ELECTRODE CONFIGURATION  
Pole-dipole (C.G.G. 1969/70)



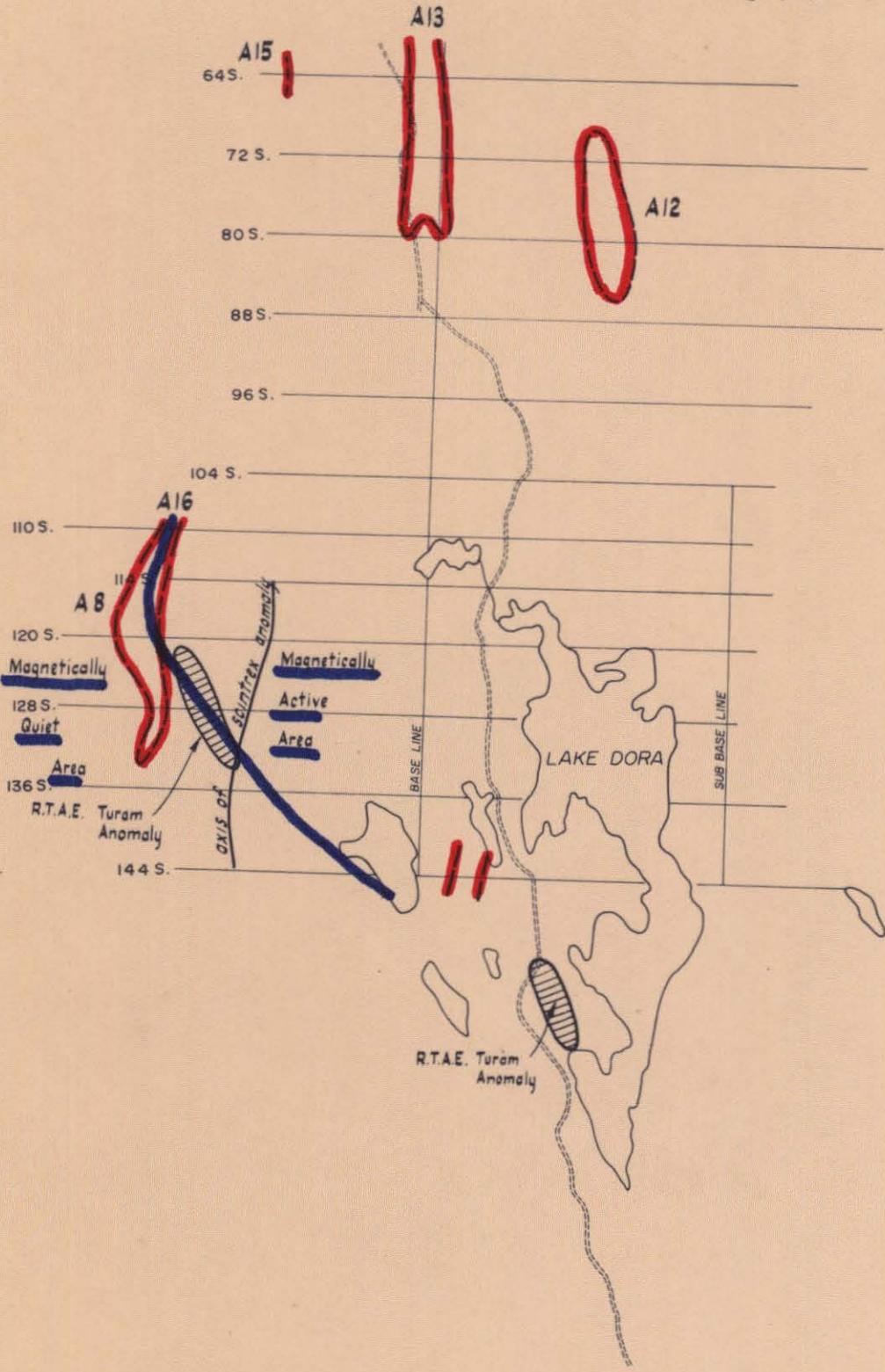
$a = 200'$   
 $n = 5$



MITRE GEOPHYSICS PTY. LTD.		
<b>DORA GRID</b>		
POLE - DIPOLE SURVEY		
<b>CHARGEABILITY</b>		
DRAWN: J.B.	SCALE: 1:20,000	<b>FIG. 16</b>
TRACED: T.G.D.S.	DATE: Jan. 1981	

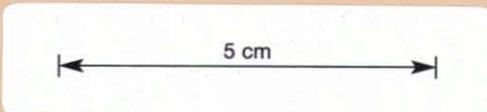
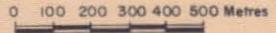
057

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NOTES:

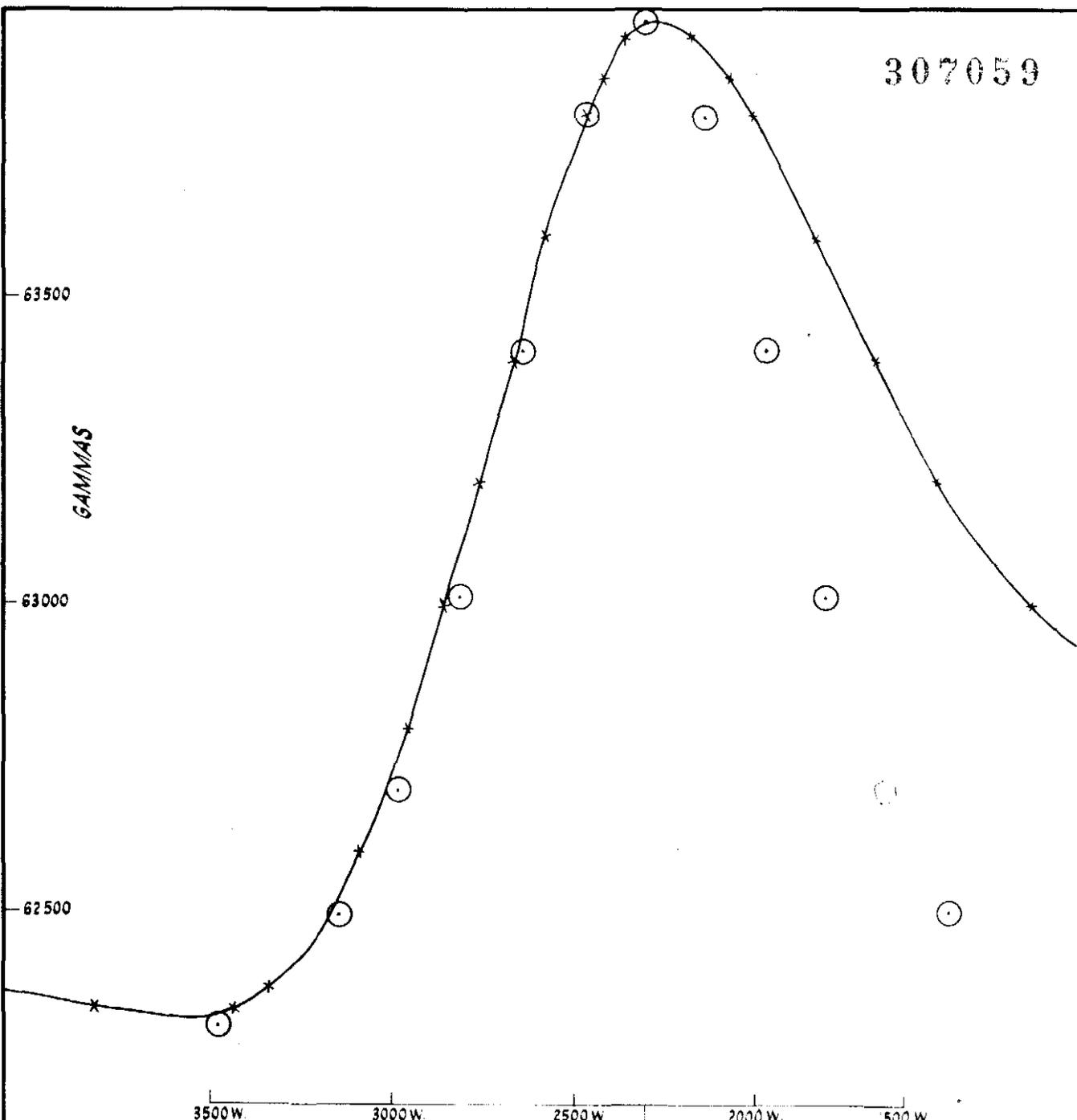
-  Chargeability high.
-  Western boundary between magnetically quiet and active areas.



MITRE GEOPHYSICS PTY. LTD.		
DORA GRID		
ANOMALY COMPILATION		
DRAWN: J.B.	SCALE: 1:20,000	FIG. 17
TRACED: T.G.D.S.	DATE: Jan. 1981	

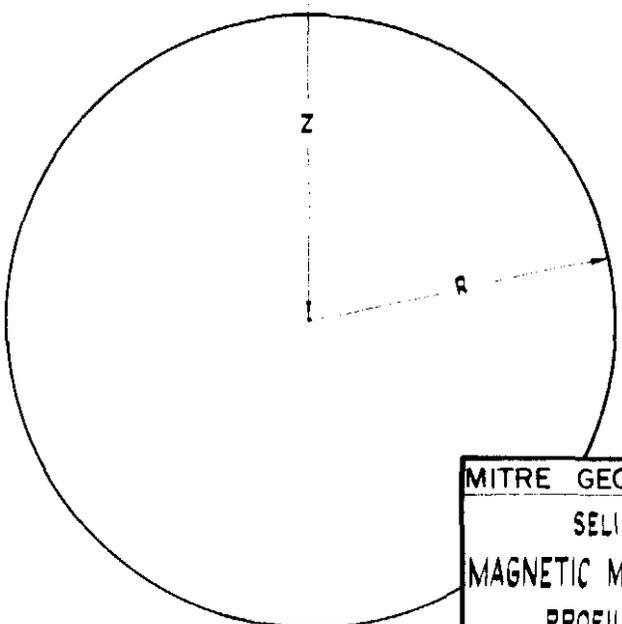
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MAGNETIC SPHERE MODEL

- x Field data
- Model data
- Z = 275 m (below Dighem magnetometer)
- R = 200 m
- for a susceptibility (k) = 0.01



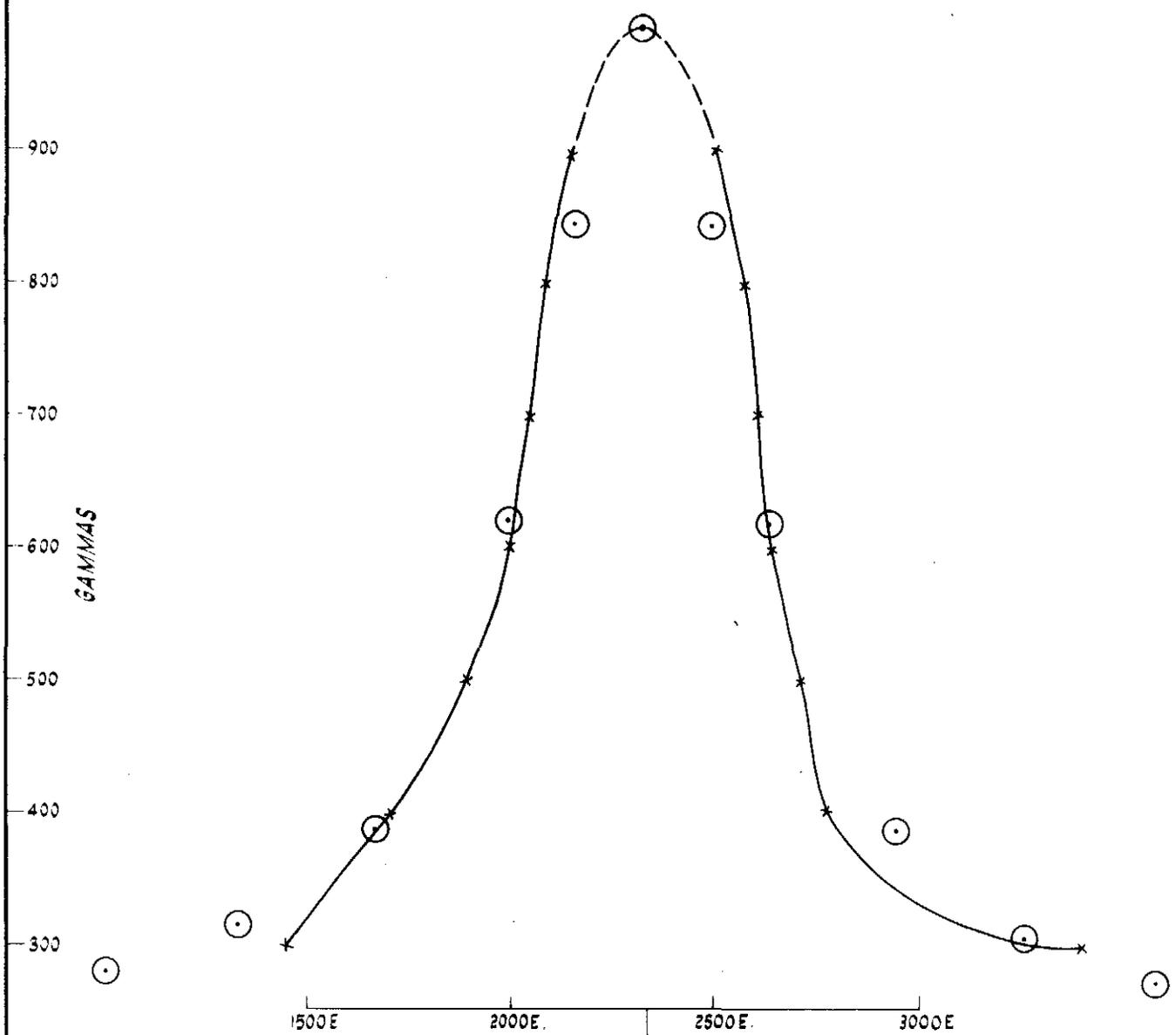
5 cm

MITRE GEOPHYSICS PTY. LTD.	
SELINA	GRID
MAGNETIC MODELLING OF DIGHEM	
PROFILE LINE 152 N.	
DRAWN: J.B.	SCALE: 1:5000
TRACED: T.G.D.S.	DATE: Jan. 1981

FIG. A1

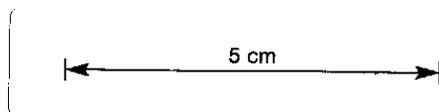
059

307060



MAGNETIC DYKE MODEL (vertical magnetic field)

- x Field data
- Model data
- Z = 100 m
- t = 65 m
- for a susceptibility (k) = 0.01



MITRE GEOPHYSICS PTY. LTD.	
ROLLESTON	GRID
MAGNETIC MODELLING	
PROFILE LINE 24 N.	
DRAWN: J.B.	SCALE: 1:5000
TRACED: T.G.D.S.	DATE: Jan. 1981

FIG.A2