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## TENEMENT INFORMATION

EL 46/86 is a 93km<sup>2</sup> tenement located in the Dial Range/Leven River area, south of Penguin in NW Tasmania (Figure 1). The precise location, access, land use and physical geography of the EL are shown on the map in Appendix 1. Six mineral leases, totalling 278 hectares, are currently held within the boundaries of EL 46/86. The property was granted to Derwent Minerals Pty. Ltd. in March 1987 for the licence year 19/3/1987 - 18/3/1988. The EL is owned 100% by Derwent Minerals.

## EXPLORATION PHILOSOPHY AND OBJECTIVES

Substantial effort has been put into the Dial Range area by previous exploration companies seeking either base metals in the Cambrian and Precambrian volcano-sedimentary sequences, or skarn and sulphide hosted tin mineralisation, associated with Devonian granitoids. This work, together with the results achieved by early prospectors and small scale miners, has produced a large amount of information on the locations of various examples of mineralisation, rock alteration possibly related to mineralisation, and geophysical and geochemical trends, some of which may also indicate mineralisation.

Derwent Minerals aims to examine existing data and generate base metal/precious metal targets which will be subject to prospect scale exploration. The area is considered by the company to be geologically typical of the western Tasmanian mineral province and the recent success of base/precious metal exploration in this province justifies the company's objectives at Dial Range.

## SUMMARY OF WORK COMPLETED IN YEAR 1

In the past year, two studies of a regional nature were completed on open file data produced by previous explorers. A review of known prospective areas was conducted by consultant geologist Mr P. Jones (Appendix 2) and a review and partial interpretation of regional magnetics, radiometrics and gravity was conducted by consultant geophysicist, Dr D. Leaman (Appendix 3).

## REGIONAL SURVEYS

### 1. Review of Prospects.

A summary of this work, together with a map, is enclosed in Appendix 2. It is based largely on the findings of two companies; Penzoil and Geopeko. Significant evidence of hydrothermally altered and mineralised zones around the Dial, Keddies and Revells workings Gold values ranging from 2.5 - 9.0 g/t are recorded from pyritic breccias. Penzoil encountered weak to moderate gold values in soil and drill core, associated with significant copper and arsenic mineralisation.

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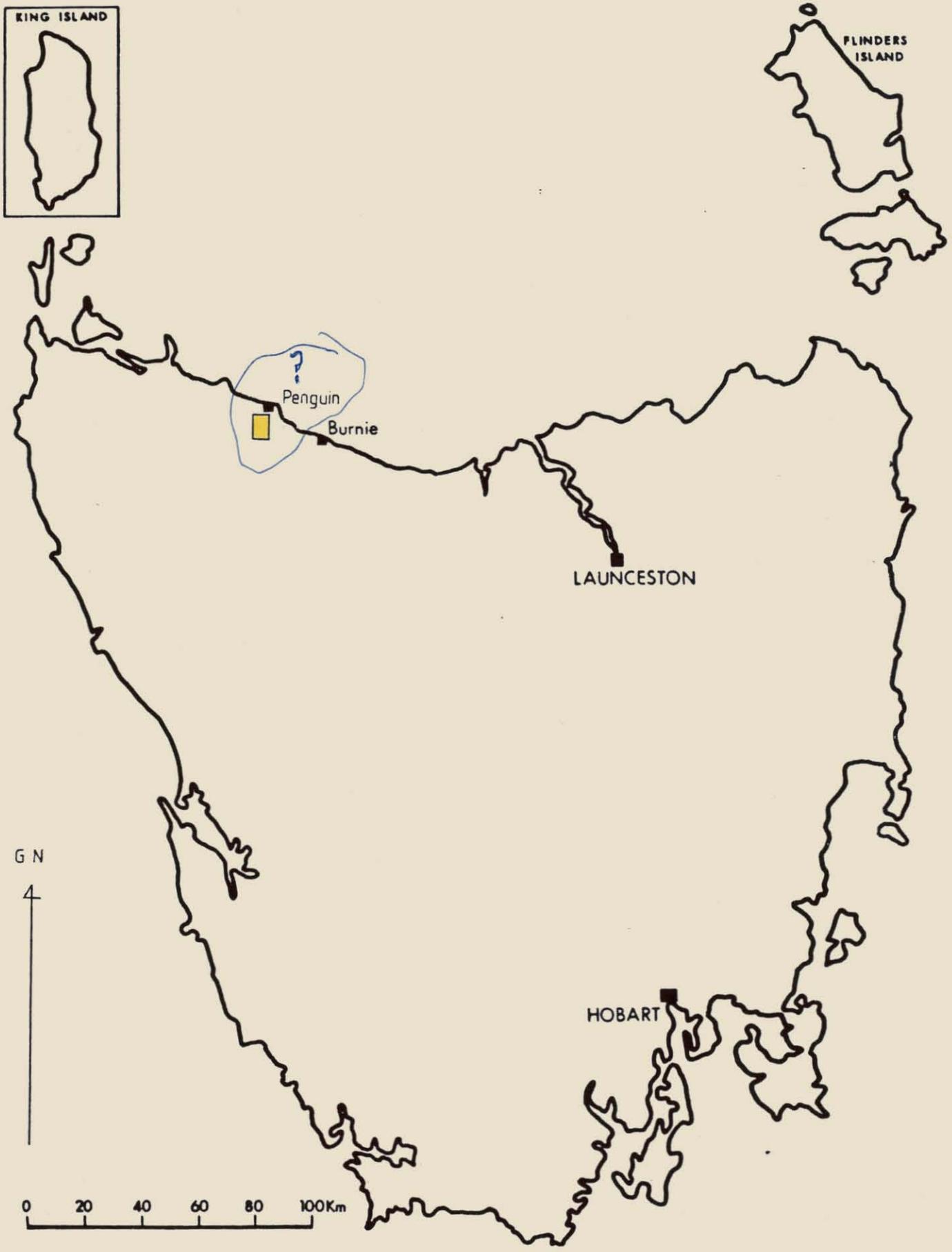


Figure 1. Location Map, EL 46/86

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Most of the exploration conducted by Geopeko was directed towards replacement tin mineralisation but some encouraging stream sediment and drill core values of copper, arsenic and gold were encountered. The Venture 10 area, around Revells workings (see Appendix 2) produced gold values of up to 1.5 g/t from fissure fill sulphide/quartz, carbonate barite mineralisation in altered volcanics and mudstone. Stream sediments draining the area also produced anomalous gold values.

Other significant discoveries by Geopeko were high copper, silver and gold values from gossan overlying a brecciated porphyry at Devon Consuls and the aeromagnetic definition of Precambrian ironstones, in places mineralised with silver/lead/barite, and probable granodioritic intrusions in the Lobster Creek volcanics, co-incident with moderate to strong gold anomalies in stream sediments.

## 2. Review of Regional Geophysics

The report produced by D. Leaman is enclosed in Appendix 3. Three data sources were used; the 1983 Geopeko aeromagnetic survey, the 1985 Mines Department aeromagnetic and radiometric survey and the Mines Department gravity data base surveys.

The review concludes that the properties of the Cambrian Lobster Creek Volcanics can be used to define alteration and structural character but most other Cambrian lithologies are not magnetic enough to allow such definition. Four alteration zones are identified in the Cambrian sequence, adjacent of early workings. A vent system is suggested for this cluster of prospects. In two cases (near Leven River and NW of Russels Prospect) alteration zones detected magnetically, also correspond to radiometric anomalies. Gravity data suggest that granitic intrusive rocks are prevalent in the subsurface, but it is not clear from their distribution whether they are related genetically or as modifiers or not at all, to the non-tin mineralisation of the area.

The Precambrian ironstone bodies and the mineralisation they host are related to an array of linears. A primary NE-SW structure is identified in the Dial Mine area, and this feature appears to control a system of fractures, the granitic intrusions, and much of the known mineralisation.

Definite alteration is restricted to quite small areas, especially east of the Dial Mine and north of Keddies prospect. Few other possibly altered sites are accessible, exposed or available for rapid inspection. Both gravity and magnetic data support this conclusion. Significant alteration can be related to major structural disturbances or reflections of them. There is evidence for basement control. Cambrian and Devonian structures have been controlled by persistent deep structural elements.

### CONCLUSIONS AND RECOMMENDATIONS

1. Existing data from previous exploration proves that several mineralised localities with distinctive and detectable physical and chemical properties exist in the Cambrian, and to a lesser extent, the Precambrian, units of the Dial Range area.
2. The distribution of mineralised, hydrothermally altered breccias associated with fractured volcanic and volcano-sedimentary rocks supports the Cambrian sea floor vent model at Dial Range. This mineralisation style has yielded several ore bodies and numerous prospects in western Tasmania.
3. Year 2 exploration will be directed at the detailed field exploration of one or more of the target areas defined during Year 1.

### PROPOSED FUTURE EXPLORATION

Mapping, soil sampling and possibly ground geophysics will be conducted in one of three altered areas identified by a review of previous geophysical surveys. The three areas are:

1. East of the Dial/Revells/Keddies zones previously explored.
2. East of Huttons.
- or 3. South of Blacks.

A decision on which area is preferred will be made after a closer examination of the geophysical trends map produced in Year 1.



REVIEW OF PROSPECTS ON EL 46/86 - DIAL RANGE  
FOR DERWENT MINERALS PTY. LTD

Notes by P. Jones

Totalling: 93km<sup>2</sup>

Granted: 18-3-87

The Licence Area covers an equivalent trough sequence to the Dundas Trough with development commencing in the Late Precambrian and continuing through to the Ordovician. Importantly, prospective acid and basic volcanic and intrusive rocks, equivalent to the Mount Read Volcanics, were deposited in the trough along with associated clastic sediments and cherts. Prominent north-south trending major fractures are observed throughout the tenement, some with associated gold mineralization.

The following is a summary of prospective areas (see accompanying map).

DIAL MINE AREA (including Keddies & Revells workings)

- The area includes a large proportion of hydrothermally altered, tourmalinized and mineralized (py, cpy +/- Au, Ag) breccias.
- Keddies (north of Dial) pyrite mineralization assaying trace to 2.5 g/t Au, in breccia zone within or near volcanic contact.
- Dial, best parcel of ore assayed 9 g/t Au, 9% Cu - however, run of mill assays range from trace to 2.5 g/t Au.
- Work by Penzoil was directed primarily for VMS Cu-Pb-Zn-Ag deposits. Best results obtained (although little assaying for Au was conducted) are:
  1. Au in gossan Dial Mine - 0.12g/t over composite 3 metre.  
Rock chip near Revells - 0.2 g/t.
  2. Weak gold of above associated with prominent copper soil anomalies coincident with altered agglomeratic breccias.
  3. Soil gold - weak, with values ranging up to 0.07 g/t but associated with v. strong arsenic anomalies assaying up to 0.5% and averaging 0.1 to 0.3% (coincident with copper and altered breccias).
  4. Penzoil drilled 6 DDHs looking for base metal mineralization. Assayed probably 20% of core for gold. Importantly the level of oxidation was approximately 80 to 100 metres below surface. Best value was DDH 5 2m @ 0.3 g/t Au from clay altered siltstone/tuffaceous.

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sandstone. NB: most of sedimentary facies were not assayed for gold - only volcanic portions, primarily where copper mineralized.

Work by Geopeko was directed primarily for replacement tin deposits.

Best results obtained are:

1. Collected stream/seds. draining into Leven River and anomalous values to 0.035 g/t delineated.
2. Drilled 4 diamond holes looking for tin in altered breccias - NO assays done for gold.
3. Best hole DDH 10; 117 - 137 = 20m @ 0.7% Cu (red bed association?). Reassayed core for As and found to be highly anomalous to 0.7% As. Anomalous zone adjacent to high copper zone.
4. Shell looked at JV property and randomly selected forty odd samples from 4 drill holes with no gold observed.

#### VENTURE 5 AREA

- along strike to the south of the Dial area.
- large aeromagnetic feature coincident with altered tourmalinized breccias.
- Rock chips have very high arsenic values.
- ground magnetics indicate airborne feature due to averaging of high intensity narrow features.

#### VENTURE 10 AREA

- aeromagnetic feature coincident with Russels workings.
- Russels workings on fissure filling in altered volcanics and mudstone.
- Mineralization includes Ba, qtz, siderite, Apy, Cpy, (gold to 1.5 g/t).
- stream sediments draining area are very anomalous 0.085, 0.095 g/t gold.

#### VENTURE 8 AREA

- coincident aeromagnetic feature with Precambrian ironstones.
- no assaying for gold along ironstones.
- Badger prospect east of Ironstone recorded Pb, Zn, Fe, Cu with dolomite. In 1960 Mines Department drilled

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hole underneath and recorded wide veins of Ba, Pb, Ag with trace Au.

#### DEVON CONSULS

- gossan overlying faulted, brecciated porphyry.
- high copper/silver assays with trace to minor gold - one assay to 6oz Au.

#### WALLOKA CREEK

- old workings adjacent to major fault zone (Cu, Pb, Ag, Au)
- rock chip sample to 0.4 g/t Au, 0.06% Cu.

#### VENTURE 11

- aeromagnetic feature adjacent to Russels Area. Geopeko put magnetics down to microgranodiorite intrusive with Lobster Creek Volcanics.
- Possible gold host? as nearby stream sediment to 0.04 g/t (gold background 5ppb). Moderate to strongly anomalous.

#### DIAL IRON

- Ferruginous shear? zone in Owen Conglomerate equivalent.
- no assays for gold.

#### VENTURE 15

- Peko put down aeromagnetic anomaly initially to metabasalt, but later found to be due to hematitic jasper within metabasalt sequence.

#### VENTURE 16

- similar to above

#### DRAINAGE EAST OF MT LORYMER

- Anomalous stream sediments are found in streams draining into the Leven River.
- Results to 0.045 g/t Au were delineated

VENTURE 17

- aeromagnetic anomaly with associated 0.1 g/t Au stream sediment value.

PROPOSED PROGRAMME

1. To complete stream sediment sampling over the tenement.
2. Follow up sampling using rock chips and reconnaissance geology over anomalous areas defined from the stream sampling programme as well as from areas defined from the literature search.
3. Grid, geochemically and geophysically survey, geologically map anomalous zones delineated from previous reconnaissance surveys.



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REVIEW OF REGIONAL GEOPHYSICS  
DIAL RANGE TROUGH  
EL 46/86  
for  
DERWENT MINERALS PTY LTD  
by  
Dr. D.E. LEAMAN ✓

September 1987

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## SUMMARY

A careful qualitative review of extant magnetic, gravity and radiometric data across EL 46/86 in the Dial Range area of Northern Tasmania south of Penguin has shown that Devonian granite has pervasively intruded the Cambrian sequence and that the properties of the Cambrian Lobster Creek Volcanics can be used to define alteration and structural character.

Quantitative definition of alteration zones or haloes and quite complex structure has been beyond the scope of this review but the extant data would permit such study should any of the nominated anomalous zones prove to be of interest after surface inspection and sampling.

Very few alteration responses can be identified within the Cambrian units. Only the Lobster Creek Volcanics are sufficiently widespread and magnetic to allow study. Prospects such as Huttons, Leven River and Dial-Keddies-Revells are adjacent to apparent alteration effects. The most distinctive and massive alteration appears to occur less than 1 km NE of the Dial Mine. Burns (1964) noted some alteration in this region. Both gravity and magnetic data imply significant property change into this region.

Two alteration zones identified magnetically correlate with unexplained radiometric anomalies (near Leven River, NW Russells).

Virtually all non ironstone prospects or mines in the region can be associated with an array of lineaments. A primary structure in the Dial Mine area trends NE-SW. This feature has controlled mineralisation, fracturing and intrusion of granite spines. The major Cambrian vent system inferred within the Lobster Creek Volcanics also lies on this axis. Although various trend controls may attach to the known prospects the only unifying characteristic is a near E-W texturing. This may represent the orientation of stress release or basement control. Most prospects are clustered near the implied Cambrian vent and along the major trend toward the Husetop Granite.

The Husetop Granite is exposed only in the far SW of the licence area. Gravity data show, however, that several granite spines and at least one major cupola extend into the Dial Range region. These are angular, abrupt features which reach close to the surface. With few exceptions all known mineralisation is marginal to these features.

This review suggests that much of the area is non prospective for Cambrian mineralisation since the rocks are generally unaltered. Four altered sites have been identified. Devonian mineralisation and remobilisation may be significant and confusing and the established prospects, disregarding their tin content, may represent minor reconcentration of concealed Cambrian vent mineralisation.

Initial detailed surface work (sampling, alteration study) should be restricted to the region around Keddies and east of Dial Mine.

## INTRODUCTION

Exploration licence 46/86 - Dial Range - south of Penguin in NW Tasmania has been claimed by Derwent Minerals Pty Ltd for precious metal exploration. As noted by Burns (1964) the area contains an array of small prospects with shows of copper, silver, lead-zinc and gold. (Geopeko also established the presence of tin, see below) The most recent active exploration was by Geopeko but, apart from the evaluation of tin within the region, this did not range widely from the Dial Mine area (see Figure 2) nor adequately assess precious metals.

Exploration to date has been concentrated in the immediate vicinity of old prospects (eg. Herrmann, 1985) or small mines predominantly associated with the Cateena Group or Lobster Creek Volcanics (refer Burns, 1964). Most activity and drilling has been in the region of Stanton and Dial Creeks (see Figure 1).

The area has not been evaluated specifically for precious metals or structure-alteration patterns which might suggest where mineralisation or fluids might have been concentrated. The Dial-Keddies-Revels area (Figure 2) is clearly an attractive starting point but it may not be the only mineralised ground. The substantial talus fields and Ordovician cover (not separated in Figure 2) may conceal other mineralised zones. Other lithologies, including the Motton Spilite, may present alternative targets as yet unrecognised.

In my contributions to the Mount Read Volcanics Project (eg. Leaman, 1986, 1987) I showed how aeromagnetic data could be used to reveal altered or anomalous rock masses and that mineralisation signatures were generally subtle. It was also shown that, lithological host issues aside, many deposits are structurally controlled and that such features can be defined by gravity and magnetic data. Both methods can be used to assess large areas (EL scale or larger) and Leaman Geophysics was contracted to attempt such an evaluation of extant data in EL 46/86.

This review was requested with the following objectives.

- 1 To examine magnetic data across the entire EL and identify those sites, lithologies or zones in which character is anomalous. Ground assessment could thus be restricted to small areas.
- 2 To recognise any zones of implied alteration and to estimate its scale. Large volumes of alteration imply considerable fluid passage and may contain an economic deposit. Known prospect areas were to be rated as part of the review.
- 3 To examine gravity and magnetic data for suggestions of controlling trend and structural systems.
- 4 To roughly define the scale of the Dial Range Trough and evaluate the possibility of a relationship between known prospects, tin mineralisation and a possible granite cupola. Such information may prove relevant to appraisal of age relationships and genesis of mineralisation.

## GEOPHYSICAL DATA

Considerable ground geophysical data has been acquired within the licence area but most is concentrated in one or two small areas (Geopeko). It is of little value to any regional appraisal and predominantly electrical in origin.

Only three surveys or data sources can be considered relevant to this review; the Geopeko aeromagnetic survey of 1983 (Large and Sumpton, 1983), the Mines Department aeromagnetic and radiometric survey of 1985 and the Mines Department gravity data base surveys. No new data has been specifically acquired for this review.

## MAGNETICS

The Geopeko survey was flown along E-W lines at a nominal clearance of 135 m by Austirex. Line spacing was about 250 m. Part of this survey has been reproduced in Figures 12 and 13. Large and Sumpton (1983) provide full details of this survey but Geopeko did not submit the complete data set, digital or flight records and this loss has limited the options available to this review. A regrettable situation where reporting guidelines have been ignored.

The Mines Department survey of 1985 was flown as part of the original Mount Read Volcanics Project. Lines were N-S at a nominal clearance of 150 m with a separation of 500 m. The survey was flown by Geometrics. Part of this survey has been reproduced in Figure 3.

Both surveys were required to contend with difficult flying conditions and some problems were experienced in obtaining a regular line coverage and approximation of terrain clearance specifications. Profiles from the Mines Department survey were obtained in digital form and compensated wherever possible for clearance deviations. Most profiles included in Figures 7 to 11 have been corrected in this way. Parts of some profiles could not be reliably corrected due to extreme clearances and instability in the required downward continuations. Some profiles included illustrate the first stage of such instability (eg. Figures 7, 10, 11). The profiles were corrected to the original survey specification wherever possible and the corrected data used for this review. True anomaly relativity was maintained in this way and the conclusions are not biased by other effects.

Some similar compensations were apparently made by Geopeko but the raw data is not available for comparison or calculation.

It is useful to compare the two magnetic surveys since the Mines Department survey was flown parallel to most of the strike trends within the Dial Range Trough. This has eased some of the terrain problems but limited resolution of changes in unit

character whether due to lithology or alteration and rendered magnetic texture mapping virtually impossible.

The fine textured anomalies west of Pine Main Road reflect basalt and these obscure deeper sources in unprocessed forms. In general, the field across the Trough is relatively stable and subdued. The largest positive anomalies can be correlated with ironstones south of Ferndene, and the Lobster Creek Volcanics east of Foggs Flat and north of the Leven River (refer Figures 2, 3, 12; use overlay version of Figure 2).

#### RADIOMETRICS

Both Geopeko and Mines Department surveys were accompanied by spectrometer surveys. Geopeko neither utilised nor presented its data (Large and Sumpton, 1983). The Mines Department survey used at 16.8 l crystal and 60 m sampling. The total count results are presented in Figure 4 after correction for scattering, clearance and background. It is unclear how effective or reliable the clearance corrections have been.

#### GRAVITY

The only fully corrected and verified gravity data available is included in the Mines Department TASGRAV data base. An extract from this data base is presented in Figure 5. The nominal precision of the Bouguer values is about 0.5 mGal at a density of 2.67 t/cu m. All values incorporate a 19 km terrain correction.

The Bouguer anomaly does not display any systematic rise across the Dial Range Trough. This is consistent with the well established density contrast between Cambrian and Precambrian materials in W Tasmania. The Bouguer anomalies are complicated by a strong N-S regional gradient. The gravity field is locally negative overall in the Dial Trough region, which may reflect general basement variation, and includes several marked negative responses which do not correlate with Lobster Creek Volcanics, Tertiary materials or Ordovician cover. Devonian granite would appear to exert the principal control on the gravity field.

None of the above-mentioned data sets have been interpreted in any coherent way prior to this review. Geopeko, for example, sought only to observe positions of positive magnetic features and did not use either the radiometric data or the limited gravity data which then existed. It should be noted that the gravity data base has been recently augmented by the Mines Department (1987). No substantive or particular review of the Trough region was provided for the Department as part of its Mount Read Volcanics Project.

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## DISCUSSION

## GENERAL COMMENTS

Previous exploration using magnetic data has been focussed on two specific objectives. These were summarized by Herrmann (1985). Initial exploration by Pennzoil sought volcanogenic base metals in the vicinity of the Lobster Creek Volcanics, which may represent part of a Mt Read style pile, while Geopeko sought replacement tin deposits. No great emphasis was placed on magnetics in the first search and in the second the targets selected were isolated, magnetic peaks since the association was expected to include pyrrhotite-cassiterite and some magnetite. This policy was also spelt out by Large (1981) and the selection of follow-up anomalies has been defined by Sumpton and Turley (1984) and Herrmann (1984). Examples of such targets are shown in Figure 13.

The results of the surface geophysics and Geopeko's approach were so generally disappointing that Herrmann (1984) advised a complete re-appraisal, new thinking and, perhaps, state-of-art finely tuned techniques. The effort had either demonstrated minimal mineralisation, poor concepts/strategy/application or inappropriate methods. While exploration by Pennzoil and Geopeko did show that minor amounts of base metal sulphides were present in the region, especially in the Dial - Keddies - Russells prospect areas, and some tin mineralisation occurs west of the Leven River no detailed picture of precious metal distribution was derived. This contrasts with Burns (1964) who presents a more balanced view. The discovery of tin in the area was an achievement of the Geopeko period.

I believe the apparently unsatisfactory results of previous workers reflects a tunnel vision, to some extent, and an ignorance of what might constitute an economic deposit in this environment and how such a deposit might be flagged. While this review does not offer any grand solutions I have attempted to address the key issues of the probable indicators for any generalised mineralisation.

As will be shown below Geopeko failed to recognise the truly anomalous aspects of the magnetic field and instead emphasized the relatively minor, local, shallowly-sourced positive features located near old prospects. Many of these features were found to be due previously unmapped Tertiary basalt (Sumpton and Turley, 1984; Herrmann, 1984). An example of clear anomalous behaviour, developed below, relates to recognition that the Lobster Creek Volcanics are quite strongly magnetic but in the region east of the Leven River between 5439 and 5441 500 mN this is not the case. Why? Structural, geometric response or alteration causes are possible. If alteration can be proven then the volume involved is such that a significant deposit could be concealed. The ring of known prospects about this site would then be seen for what Geopeko appears to have established - secondary, sweated or derived mineralised sites. The primary mineralisation remains at depth or perhaps to the east. Geopeko's evaluation totally ignored this zone and merely treated its margins! This reflects an exploration approach blinkered by a single concept.

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Consider some of the implications of the magnetic data. This review has been limited by the coarse line spacing and line orientations available since only the Mines Department survey can be manipulated. It is regrettable that Geopeko failed to submit complete data sets with its final reports.

In Figures 7 and 8 the profiles have a comparable style, that of an inverted "U". This response becomes more subdued to the east. It is sharpened and disrupted by the high frequency effects caused by surface basalt. The general change in amplitude eastward does suggest that the source becomes more deeply buried west of the Leven River. In the far west of the licence area the cover may consist only of basalt and associated sediments but within the Range the cover may include Ordovician rocks and much of the Cambrian succession. The patterns can be followed eastward across the profiles, and in the contour plans, to show that the primary magnetic source within the region is in fact the Lobster Creek Volcanics. The responses indicate a substantial volume and depth extent for this unit - consistent with a volcanic pile of the Mount Read type, as suggested by Burns (1964). The magnetic field for the entire area north of about 5437 000 mN reflects the cross folded nature of this massive unit.

The effective contrast of the Lobster Creek Volcanics is not easily determined due to the disturbed character of the large volume involved. The 3D unfolding analysis required to properly define the contrast and quantify variations has been beyond the brief of this review.

Some apparently anomalous zones may be noted in the profiles available.

#### Figure 7

- 1 Line 1042; 416500 E, 5439500 N. Negative effect with no known basalt nearby. Possible extension of the iron deposits.
- 2 Line 1043; 5442000 N. Positive effect. Edge of basalt cover.

#### Figure 8

- 3 Line 1045; 5442500 N. Locally distinctive effect apparently within basalt cover (at 418E). Effect noted in muted form on lines 1044, 1046 at about the same northing. The source is not obviously basaltic and may indicate the position of the Precambrian contact although similar responses are not seen elsewhere.
- 4 Lines 1045, 46, 47; 5443000 N. Distinct rise in field intensity is not due to basalt and is unlikely to be a modified Cambrian response. A Precambrian source is probable and it may represent the termination of the iron stone units at the edge of the Trough.

#### Figure 9

Feature 4 noted above extends beneath the Ordovician cover near the Badger Mine. Other response patterns are maintained.

No major deviations from acceptable geological responses can be recognised in these profiles.

#### Figure 10

- 5 Lines 1052, 53, 54; 5436500 N. A significant negative response occurs near McKenna Creek. This may be partly

geometric in origin but is probably not wholly so. The strong positive response between this feature and 5440 000 N reflects unaltered, and exposed, Lobster Creek Volcanics.

6 Line 1054; 5440500-5441000 N. Small negative effect probably due to basalt.

7 All lines except 10503 cross the Lobster Creek Volcanics north of the Leven River and all display similar responses. The only distinctive zone lies at about 5441500 N on lines 1052 and 1053.

South of the bend in the river, at about 54395-5440000 N, the volcanics are highly anomalous. It is necessary to review the relationship of each line to the outcrop distribution but line 10511 is distinctive. The effects suggested by the Mines Department data are better realised in the Geopeko data. This region is further discussed in a later section of this review.

#### Figure 11

These profiles illustrate the fundamental change in character which occurs in the magnetic field east of line 1054. Close examination of the Geopeko and Mines Department contour maps shows that the limit lines for the eastward extent of the Lobster Creek Volcanics and the westward extent of the Motton Spilite overlap this change. The field becomes much more negative. Burns (1964, e.g. p 42) noted this limit but did not offer explanation. It seems likely that this zone represents a rejuvenated eastern marginal development to the Trough during the Cambrian although the change might reflect differences in overall basement composition.

#### TRENDS

Trends inferred from the available data are shown in Figure 14. These are necessarily subjective. It would be possible to adjust the Mines Department survey to a fixed level or higher drap level and minimise the effects of basalt around the Trough in order to produce a more reliable trend analysis on a regional basis but this has not been done. It was not considered justified by the data available and the area involved. The contour maps presented in Figures 3, 12 and 13 are not wholly reliable due to problems with clearance corrections (or absence of them). The Geopeko survey is more detailed and has formed the basis for most of this analysis but, because the raw data is unavailable, comprehensive reworking and derivative analysis is not possible without digitisation which would retain in undefined forms all the deficiencies of the data set.

Trends emphasized in the Figure are additional to those mapped geologically. The two magnetic surveys are consistent and support the presence of several nearly E-W zones up to several hundred metres wide as well as many N-S and NE or NW trending features. All orientations can be identified in each survey set and since the line bias of each survey is different there can be little doubt of the validity of the trends identified. Doubt does, however, attach to the precise location of the features.

Due to the clearance effects problem and the absence of the raw observations for the detailed E-W survey (Geopeko) it is not possible to locate or confirm gradients better than perhaps 50 to 100 m.

The trend pattern shown in the Figure is not consistent with fold systems or major faults as mapped although elements of the structure do possess the orientations deduced. If, however, the terminations or changes in trend or style of mapped features is compared with the lineament inferences then a strong relationship emerges. It is clear that some of the lineaments reflect old, persistent structural controls which have subtly influenced developments within the Trough. Some of these are best illustrated by the trend changes observed for fold axes involving the Lobster Creek Volcanics (see Figure 14). There is no surface or obvious geological reason for such changes and regardless of the deficiencies of the surveys and inferences drawn from them the lineaments clearly mirror deep, fundamental controlling influences.

Radiometric data have been used in a supporting role. Most trends have been extracted from the magnetic surveys. The radiometrics are more directly reflective of surface or shallow features and there is better correspondence with mapped faults. The magnetic data, and gravity data, respond to and reflect variations in larger and deeper rock volumes.

The gravity data are more diffuse than either the magnetic or radiometric data but many critical features can be recognised. These are also reproduced in Figure 14.

#### ABNORMALITIES

Very few units, or parts of any sequence, within the licence area are magnetic or variably magnetic. All large responses can be related to Tertiary basalt or Cambrian Motton Spilite and Lobster Creek Volcanics. The Kerrison Volcanics are not noticeably or persistently magnetic. The Motton Spilite yields a patchy response pattern not unlike the Tertiary basalts but as its distribution and weathering is more erratic, so the pattern is more erratic.

Within the licence area the distribution and variation in properties of the Lobster Creek Volcanics are of most interest. Within the axis of the Dial Range Trough, including the areas capped by Barrington Chert or Ordovician units, virtually the entire magnetic pattern reflects the presence of the Lobster Creek Volcanics.

Complete appraisal of the volume, distribution, structural form and contrast variation requires analysis beyond the scope of this review and perhaps beyond relevance to the project unless surface study indicates that buried extensions of the zones identified should be defined.

Regions containing abnormal field character which cannot be simply or wholly explained by obvious geometrical, burial depth or exposure conditions have been shaded in Figure 15. These bear definite, if not wholly understood, relationships to the lineaments shown in Figure 14. It is possible that some sites may, on further examination using whole geology-component-3D methods, be shown to be artifacts of structural configuration. Those most suspect are deeply buried but none should be dismissed pending such examination.

Inspection of the magnetic survey compilations and available profiles, coupled with limited gradient and trend analyses has resolved several key exploration issues.

- 1 Large volumes of the Lobster Creek Volcanics, whether exposed or not, are not altered and not prospective in any significant way.
- 2 Alteration is concentrated in the zone east of Dial Mine and around Keddies prospect. This conclusion is supported by the limited observations of Burns (1964) concerning chloriticised or sericitised sites. These sites are shown in Figure 15.
- 3 Small positive effects or sharpening of broad anomalies of the type examined by Geopeko reflect local concentrations of iron oxides perhaps including magnetite, ilmenite and some pyrrhotite. Such sites should not be considered favourably for mineralisation other than tin deposits of the Renison type and Geopeko proved these to be absent - at least near surface. The forms of these anomalies imply shallow sources and are therefore not encouraging. In addition my work on West Tasmania base metal deposits (Leaman, 1986, 1987) has shown that any direct responses would be more subtle than most of Geopeko's targets and would always be included in an alteration halo.

A caution must be noted here. Not every negative or low magnetic response reflects alteration or abnormality. The judgments offered in this review are considered and make allowance for geometric effects, source depth changes and other physical variations. While such allowances may be imperfect pending quantitative treatment they have allowed some filtering of possibilities.

Several radiometric responses are not readily explained (see also discussion page 11). While many Tertiary basalts are not strong sources all exposures east of the Leven River produce strong reactions. The association is clear and unambiguous (use overlay Figure 2 on Figure 4). Features not readily accounted for lie within outcropping Ordovician rocks or scree from them. These sites are marked in Figure 15. The two features west of Blacks may reflect fluid leakage and alteration paths from granite spines below (page 9, Figure 15) but that at Mt Montgomery is not explained by this mechanism.

Limited modelling of the gravity field has shown that the Lobster Creek Volcanics may have a normal density as high as 2.85 t/cu m. Their implied density decreases northward toward the Dial Mine area. This is consistent with the magnetic change.

## STRUCTURAL IMPLICATIONS

Some structural implications have been suggested in the discussion of trends and lineaments above. It is clear that old, rejuvenated features have exercised significant and continuous control on the development of the Dial Range Trough. The magnetic properties of the Lobster Creek Volcanics could be used to define the fold patterns within the Trough but this is beyond the present study. Some relevant simple appraisal conclusions have been included in Figure 15.

Gravity data offer much additional information on the Trough development but again most of this can only be extracted with difficulty should it prove useful to further study and only simple, direct procedures have been used here.

Complex regional gradients are evident in the Bouguer anomalies and complete resolution of issues and sources would require a thorough regional 3D treatment. This is beyond the present review. Comparison of Figures 2, 5 and 14 stress the anomalous character of the gravity field in the Dial Trough region.

If it is assumed that the gravity field is neutral in the region SSE of Russells and immediately west of Huttons (use overlay Figure 2 on Figure 5) where substantial Cambrian sections are implied then the regions west of these sites are seen to be abnormally negative. Only in the far SW of the licence area, where the Husetop Granite is exposed, can this be explained directly. The negative anomaly between Russells and Huttons can be ascribed partly to the Barrington Chert but the overall distribution of the effect, and its magnitude, can not be accounted for in this way. It may be noted that the comparable Ordovician siliceous rocks exercise negligible control on the gravity field.

Extending the above assumption it may be implied, given some allowance for the N-S gradient, that the field is near neutral NE of Keddies and slightly positive NW of Badger. These inferences are consistent with the distribution of Lobster Creek Volcanics (probably 2.75 t/cu m) and local Precambrian with ironstones (est 2.80 t/cu m). The remainder of the Cambrian rocks of the Dial Range Trough do not present any obvious density pattern. This demonstrates that the Trough sequence is no longer present since such successions normally contrast against most Precambrian backgrounds.

As mentioned above the strong negative anomaly in the SW corner of the area is associated with the Husetop Granite. This body clearly extends NE toward Penguin with a separate stock or marginal cupola near Russells (see Figure 15). The anomaly along West Pine Road is not influenced by Tertiary materials.

Devonian granite has pervasively intruded the Trough with the principal masses near the original western edge of the Trough. This possibility has been tested by limited, local 2D modelling. This work showed that the West Pine Road body reaches within 150 to 200 m of the surface and may well directly underlie Tertiary materials. The roof of the cupola SW of Russells, although difficult to assess with simple methods, is probably no deeper. The spines of granite inferred are angular and of high relief.

## ALTERATION-MINERALISATION PATTERNS

Each known prospect site has been evaluated in terms of the available data and the developing conclusions.

## HUTTONS

The position of this prospect is a little uncertain but it, and the additional prospect to the SSE (see Figures 2 and 17), fringe a geometric edge anomaly and an anomalous depression in the magnetic field (at Mt Lorymer). There is no obvious lineament control and the field pattern could be explained either by a significant volume of altered volcanics or an absence of them. These options cannot be resolved without 3D analysis. Unless major alteration can be demonstrated no significant mineralisation should be anticipated.

## RUSSELLS

(Including an un named prospect at the mouth of Hardstaff Creek) These sites lie within or adjacent to exposed Lobster Creek Volcanics. There is evidence for some very minor alteration west of Foggs Flats but major changes occur more than 1 km west of these prospects - beneath the Ordovician cover on Mt. Duncan. Even there the implied property changes may not exceed 15% and could be explained geometrically. Perhaps more relevant to both prospects is the association with an array of trend intersections. Control cannot be ascribed to any particular orientation. There is little to suggest any major local alteration or mineralisation.

## LEVEN RIVER

This prospect, at about 5436300 mN, is interesting since it appears to lie beyond the influence of the Lobster Creek Volcanics (Figure 17). The E-W anomaly immediately north of it appears to be geometric in origin and the mineralisation may be related to the Motton Spilite. Both magnetic surveys, however, indicate major E-W lineaments are present and the N-S lines (Figure 10) suggest a truly anomalous and not wholly geometric response. This site should be examined further.

## BLACKS

This prospect is not associated with massive alteration effects but it does lie on near an intersection of several lineaments.

## BADGER

Data coverage of this region is far from ideal but no obvious patterns can be identified. A sub E-W system may be present. The rock mass to the south is unaltered (beneath Ordovician cap).

## REVELLS-DIAL-KEDDIES-LEVEN RIVER

These four prospects have been subject to intense but discouraging attention. This review has suggested why. All lie marginal to, but beyond, the zones of principal alteration in the region. All can be associated with a complex structural zone but the only unifying features appear to be three sub E-W lineaments. On the basis of this review I predict that the most significant alteration, and chance for economic mineralisation,

lies east of the Leven River and N and NW of Keddies (see Figure 15). This is consistent with the only comments in the literature about the alteration of the rocks within the Trough. The magnetic data define the precise areas altered (Figures 16, 17) although quantitative analysis is required in order to reliably estimate the volume or extent of that alteration.

#### EXTENT OF HOUSETOP GRANITE

Tin mineralisation in the heart of the review area confirms the pervasive influence of the Devonian granite. Radiometric data appear to indicate that the granite contact alteration zone extends some distance east of the material mapped by Burns (1964) (see Figure 15). This conclusion, however, may be misleading since there is a comparable response associated with all exposures of the Radfords Creek Mudstone and none with the concealed granite bodies located by the gravity survey. The actual limit of thermal alteration in the SW of the licence area can not be unambiguously determined. Several of the anomalous radiometric responses (SW of Huttons, N and S of Blacks and W of Russells - see page 8) lie above or beside spines off the pluton margin.

Most prospects can be directly related to the gravity field, cross trend patterns and the distribution of granite. The string of prospects SW from the Leven River near Keddies lie in an irregular roof wedge between granite spines which have been controlled by older NE-SW lineaments/structures. Principal alteration of the Lobster Creek Volcanics also occurs along this axis.

Only Badger and the prospect west of the junction of McKenna Creek and the Leven River (see Figure 17) can not be directly associated with granitic features in some way. In the case of Badger this may reflect the type of deposit while the Leven prospect may be wholly Cambrian in origin. Other deposits may have compound or complex origins and history.

## CONCLUSIONS AND RECOMMENDATIONS

Although this review has been limited by data availability or suitability and represents only a detailed qualitative examination of that data a number of major conclusions have been reached.

- 1 The Lobster Creek Volcanics are the only significant magnetic unit in the region of the central Dial Range Trough and offer the means to define major structures, trends and alteration patterns. This unit dominates the magnetic field.
- 2 There is little general evidence for alteration of the Lobster Creek Volcanics. On the assumption that any worthwhile mineralisation, of whatever type normally associated with the Cambrian rocks of Tasmania, will be embedded in a significant alteration halo this suggests that large parts of the Trough were not mineralised in the Cambrian.
- 3 Definite alteration is restricted to quite small areas, especially east of the Dial Mine and north of Keddies prospect. Few other possibly altered sites are accessible, exposed or available for rapid inspection. Both gravity and magnetic data support this conclusion.
- 4 Significant alteration can be related to major structural disturbances or reflections of them. There is evidence for basement control. Cambrian and Devonian structures have been controlled by persistent deep structural elements.
- 5 Devonian granite emplacement has clearly played a significant role in the development and mineralisation of the central Dial Range Trough. The presence of tin is an indicator of its ubiquity in this structural environment.
- 6 It is unclear what proportion of the mineralisation currently established is Cambrian or Devonian in origin. The local alteration of the Lobster Creek Volcanics suggests relatively few Cambrian vents. The cancerous intrusion of the Devonian Housetop Granite into this system may have introduced mineralisation (tin certainly) or remobilised or concentrated older mineralisation. It may be that many of the small mines and prospects discovered and worked over the last century are just that - small, non economic sweated deposits.
- 7 Exploration should be concentrated in the regions which may contain Cambrian vents or where the granite may have come in contact with suitable hosts. The possibility that the known small deposits might have been derived from something hidden in an older deep vent in the region of the Dial Mines must be examined. No previous explorer has been aware of the fact and implication inherent within these conclusions.

- a Areas suggested as being substantially altered should be visited and sampled. Alteration status should be evaluated and metal analyses reviewed. Disseminated gold and silver enrichment should be evaluated since altered areas may reflect nearness to vent systems.
- b Where alteration and mineralisation potential has been confirmed some further use may be made of the magnetic data bases. Areas of exposed potential could be explored and perhaps drilled before further analysis but it should be appreciated that the methods used for this review do offer the capacity to define and quantify any alteration halo established and at the same time indicate the detailed local structural forms. This may prove crucial to the selection of drill sites. Where granite is involved in the exploration concept the gravity data should also be examined in detail.

Analysis for this study has not been definitive. More refined treatment will require access to the raw Geopiko data and it should be requested from the original explorer per the good offices of the Mines Department. Reporting guidelines normally ensure such data is available for later workers. Treatments required to fully quantify alteration or structures must allow for all terrain and geological considerations within gravity and magnetic data and be based on highly resolving 3D whole geology procedures.

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Report submitted on behalf of  
Leaman Geophysics  
by

*D. Leaman*

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M.Aus.I.M.M., M.M.I.C.A

14-9-87



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810032

EL 46/86

420 000 ME

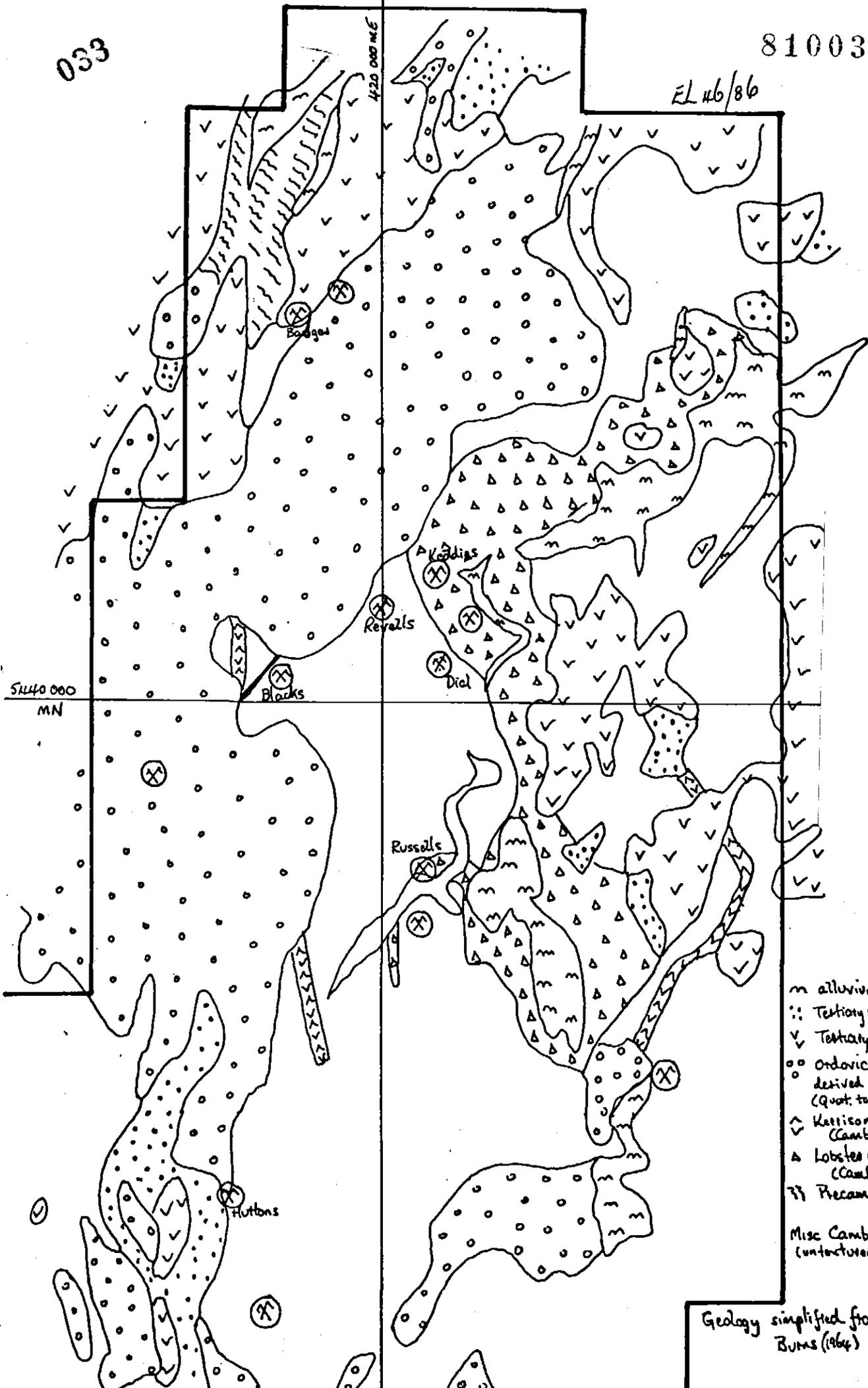
5440 000 MN

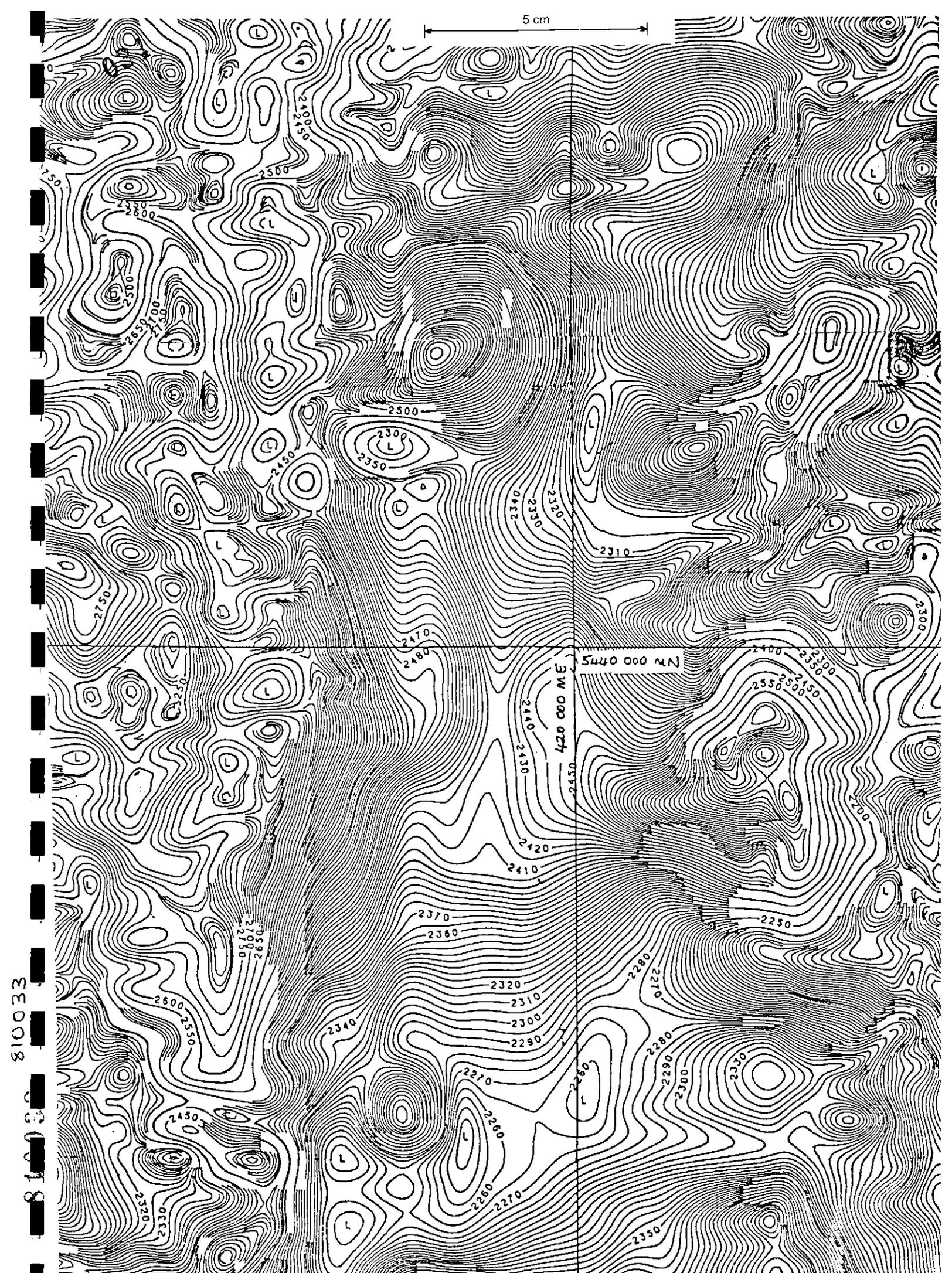
5 cm

- m alluvium
- :: Tertiary sands
- v Tertiary basalt
- oo Ordovician + derived debris (Quat. talus)
- ^ Kestison vels (Cambrian)
- ▲ Lobster c/d bles (Cambrian)
- ?? Precambrian
- Misc Cambrian (unfractured)

Geology simplified from Burns (1964)

EL 46/86 KNOWN PROSPECTS-GEOLOGY (after Burns, 1964) FIGURE 2  
1:50000

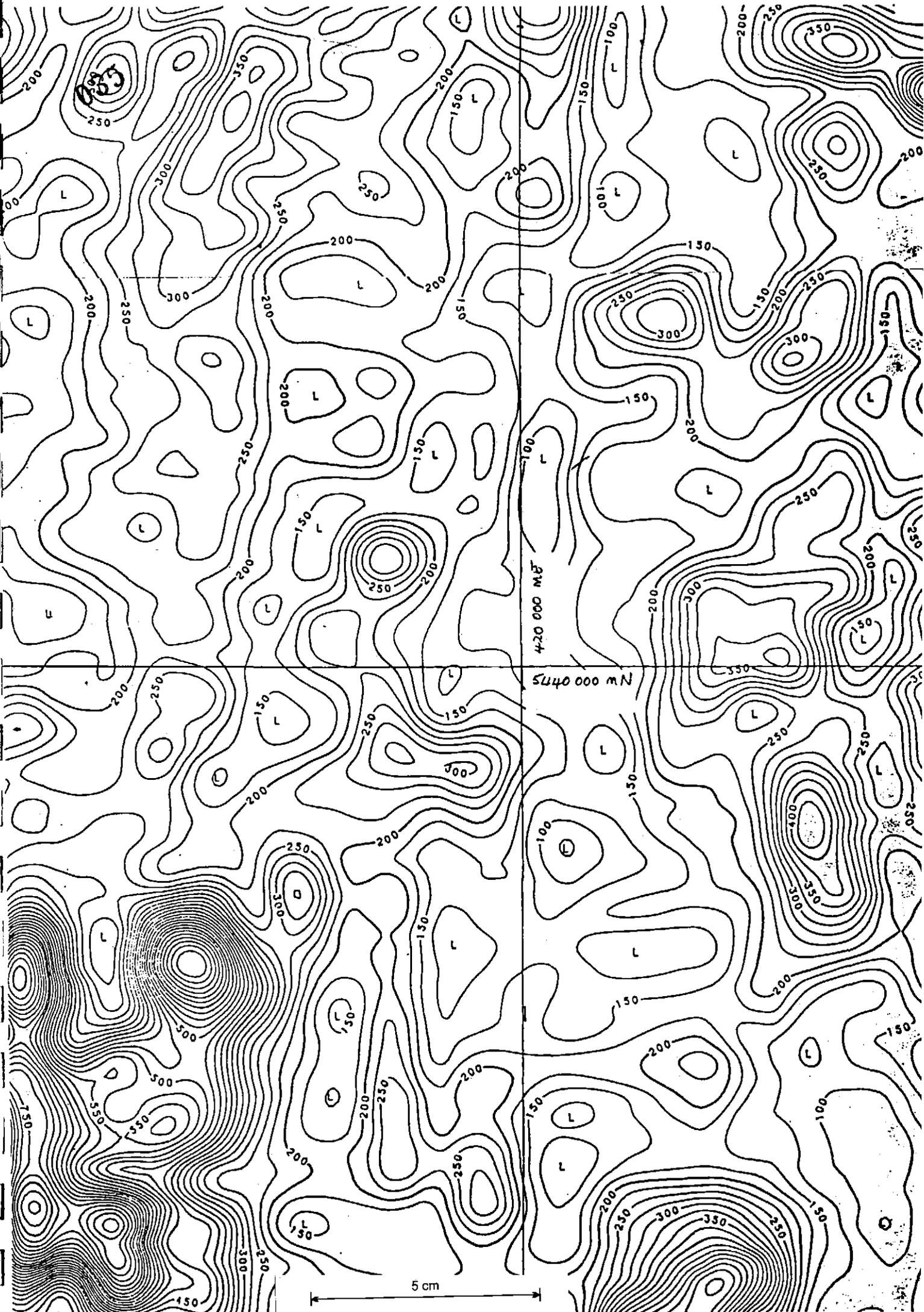




810033

EL 46/86 TOTAL MAGNETIC FIELD (MINES DEPT SURVEY 1985) FIGURE 3

810034



EL 46/86 TOTAL COUNT RADIOMETRICS (MINES DEPT 1985) FIGURE 4

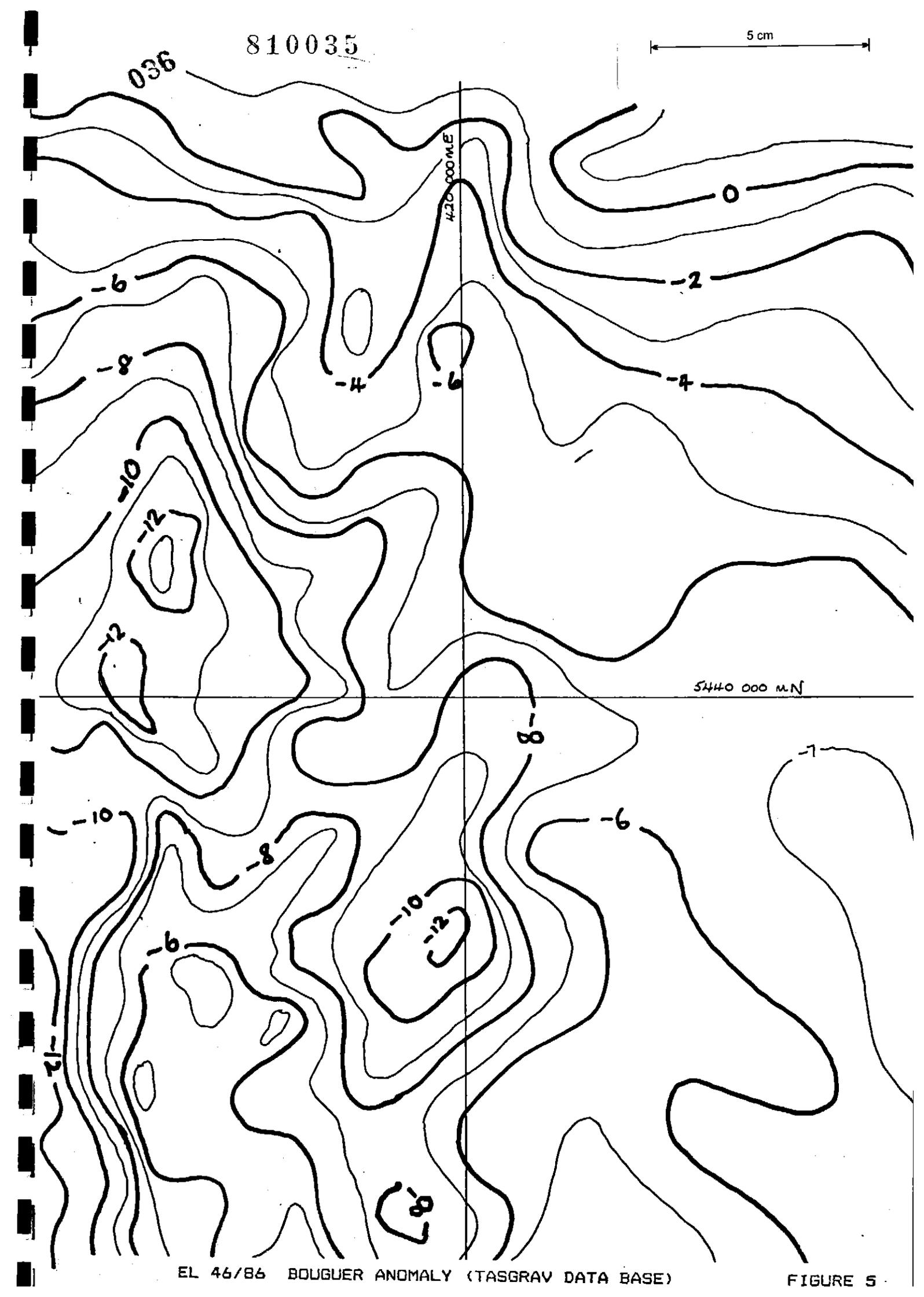
810035

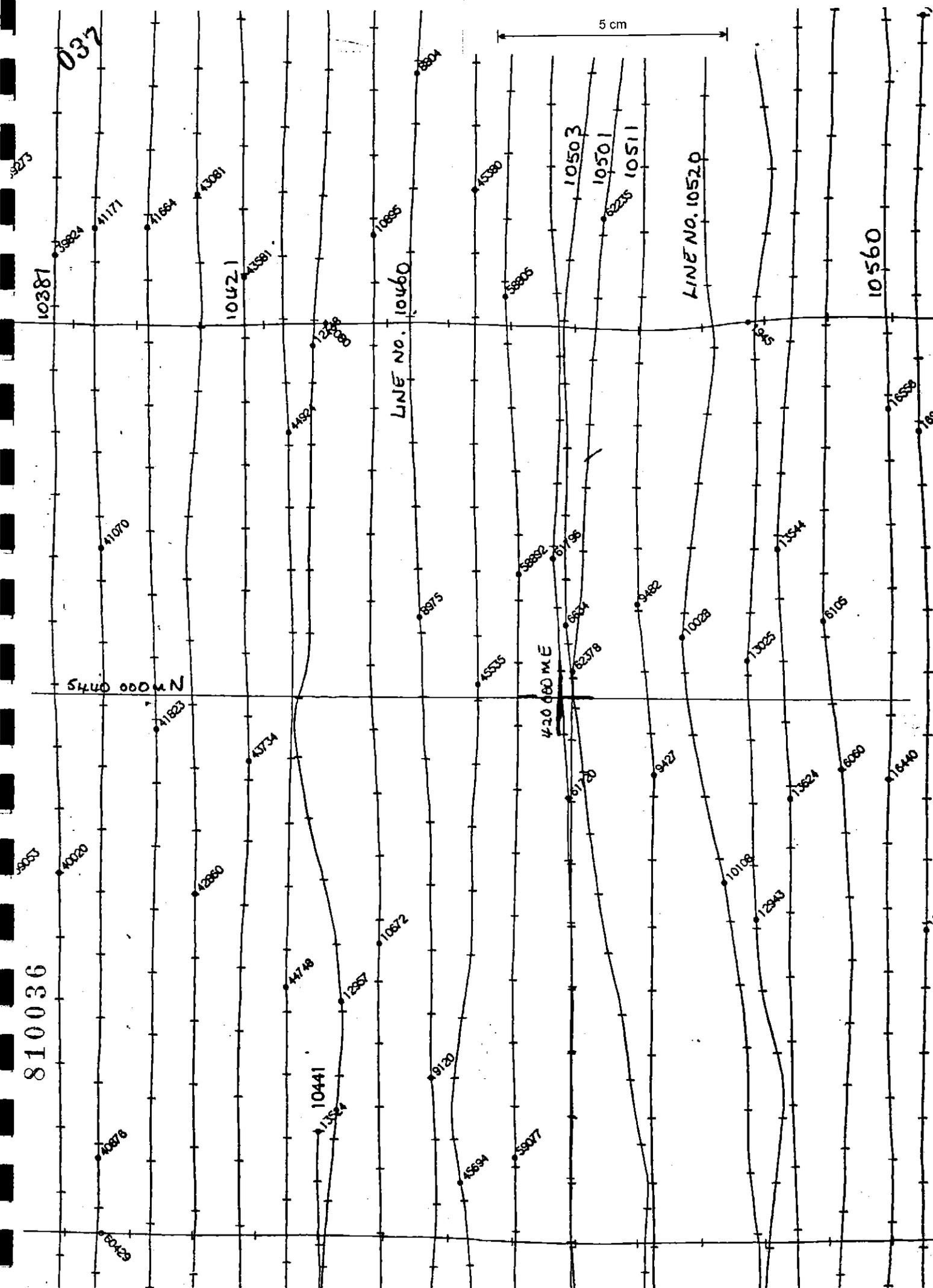
5 cm

036

420 000 ME

5440 000 MN





810036

037

5 cm

LINE NO. 10460

LINE NO. 10520

10560

5440 000 M N

420 080 M E

EL46/86 LINE POSITIONS (MINES DEPT SURVEY 1985)

FIGURE 6

- 1 B:DRP10391 150 M DRAPE DIAL RANGE MAGNETICS
- 2 B:DRP10401 150M DRAPE DIAL RANGE MAGNETICS 10401
- 3 B:M10411 DIAL RANGE MAGNETICS 10411
- 4 B:DRP10421 150M DRAPE DIAL RANGE MAGNETICS 10421
- 5 B:DRP10431 150M DRAPE DIAL RANGE MAGNETICS 10431

ZERO SHIFT : 0

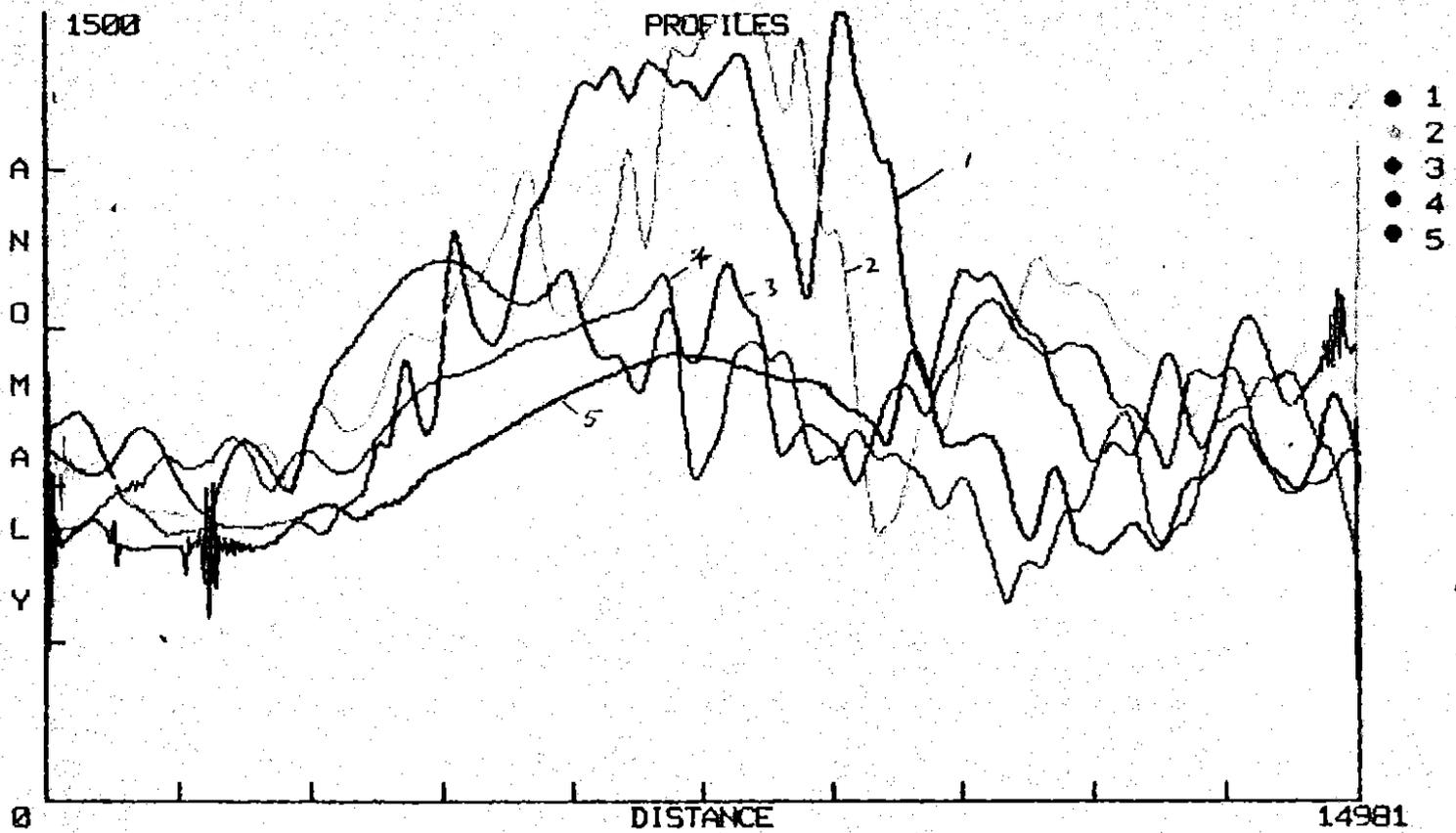


FIGURE : 7

DIAL RANGE TROUGH MAGNETICS  
MINES DEPARTMENT 1985 SURVEY

- 1 B:DRP10431 150M DRAPE DIAL RANGE MAGNETICS 10431
- 2 B:M10440 DIAL RANGE MAGNETICS 10440
- 3 B:M10450 DIAL RANGE MAGNETICS 10450
- 4 B:M10460 DIAL RANGE MAGNETICS 10460
- 5 B:M10471 DIAL RANGE MAGNETICS 10471

ZERO SHIFT :-239

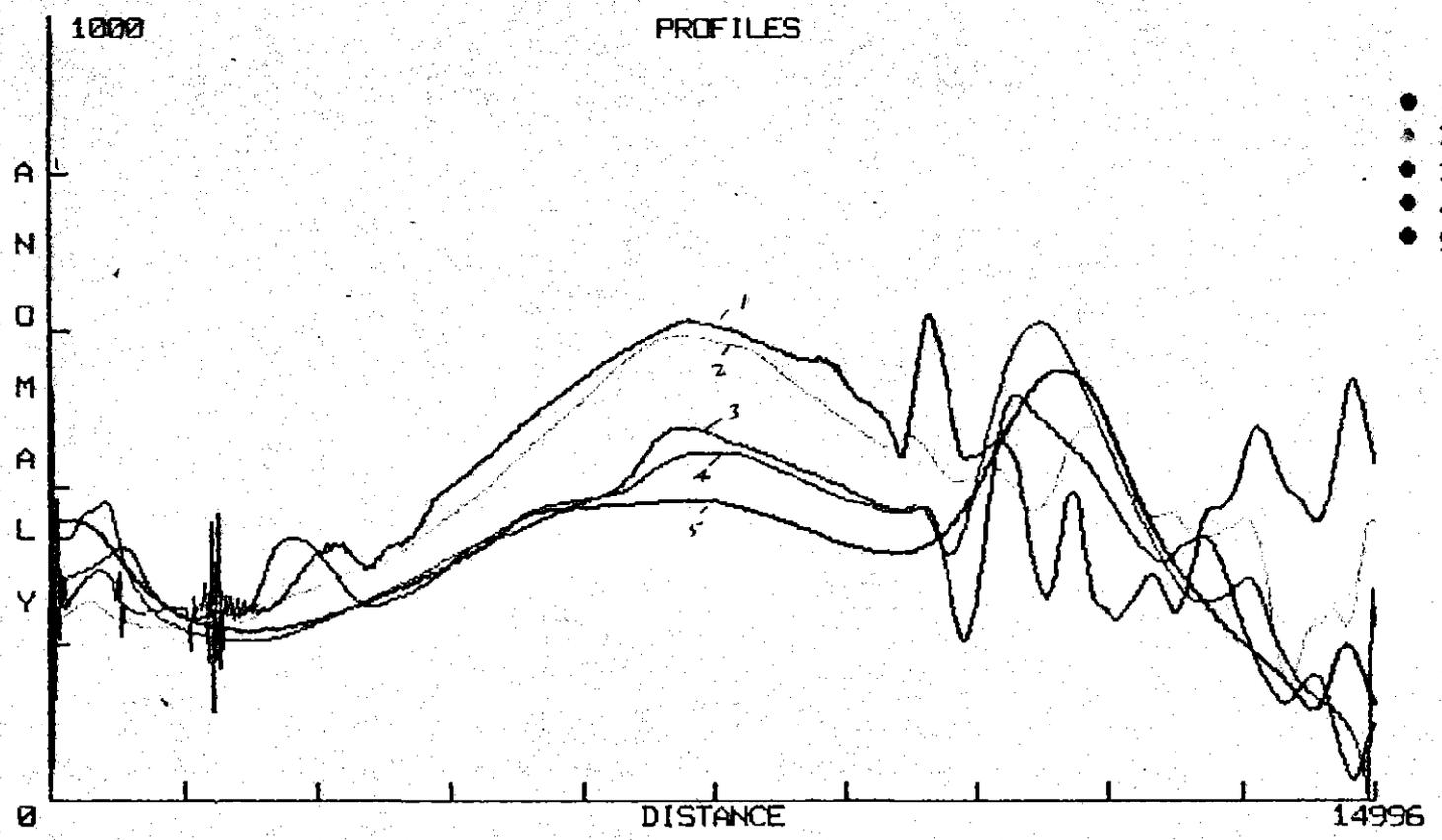


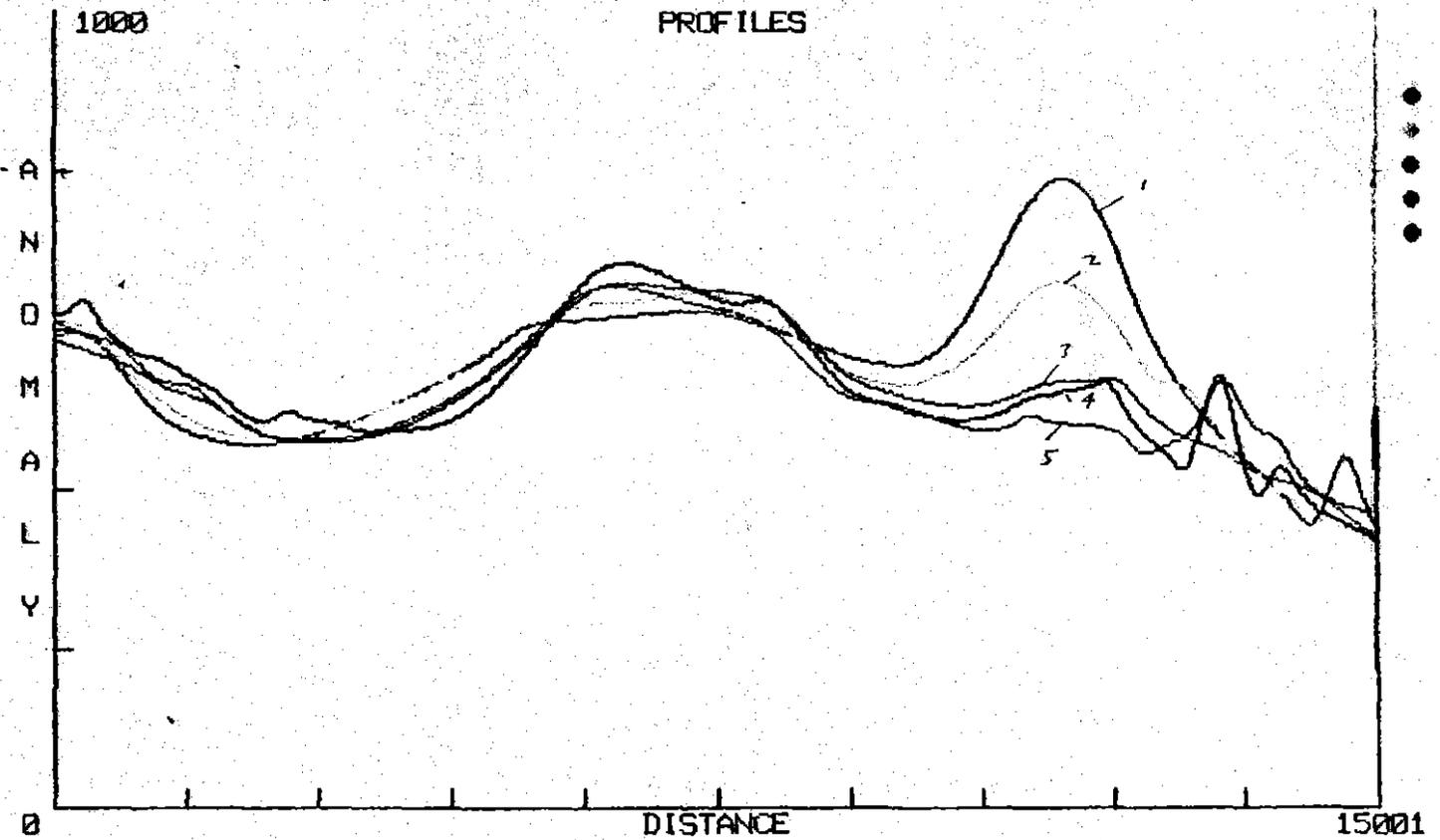
FIGURE : 8

DIAL RANGE TROUGH MAGNETICS  
MINES DEPARTMENT 1985 SURVEY

040

1	B·M10471	DIAL RANGE MAGNETICS 10471
2	B·M10481	DIAL RANGE MAGNETICS 10481
3	B·M10490	DIAL RANGE MAGNETICS 10490
4	B·M10501	DIAL RANGE MAGNETICS 10501
5	B·M10503	DIAL RANGE MAGNETICS 10503

ZERO SHIFT : 0



5432000N

5439500N

FIGURE : 9

DIAL RANGE TROUGH MAGNETICS  
MINES DEPARTMENT 1985 SURVEY

041

810040

1	B:M10503	DIAL RANGE MAGNETICS 10503
2	B:M10511	DIAL RANGE MAGNETICS 10511
3	B:M10520	DIAL RANGE MAGNETICS 10520
4	B:DRP10530	150M DRAPE DIAL RANGE MAGNETICS 10530
5	B:M10540	DIAL RANGE MAGNETICS 10540

ZERO SHIFT :-13.48926

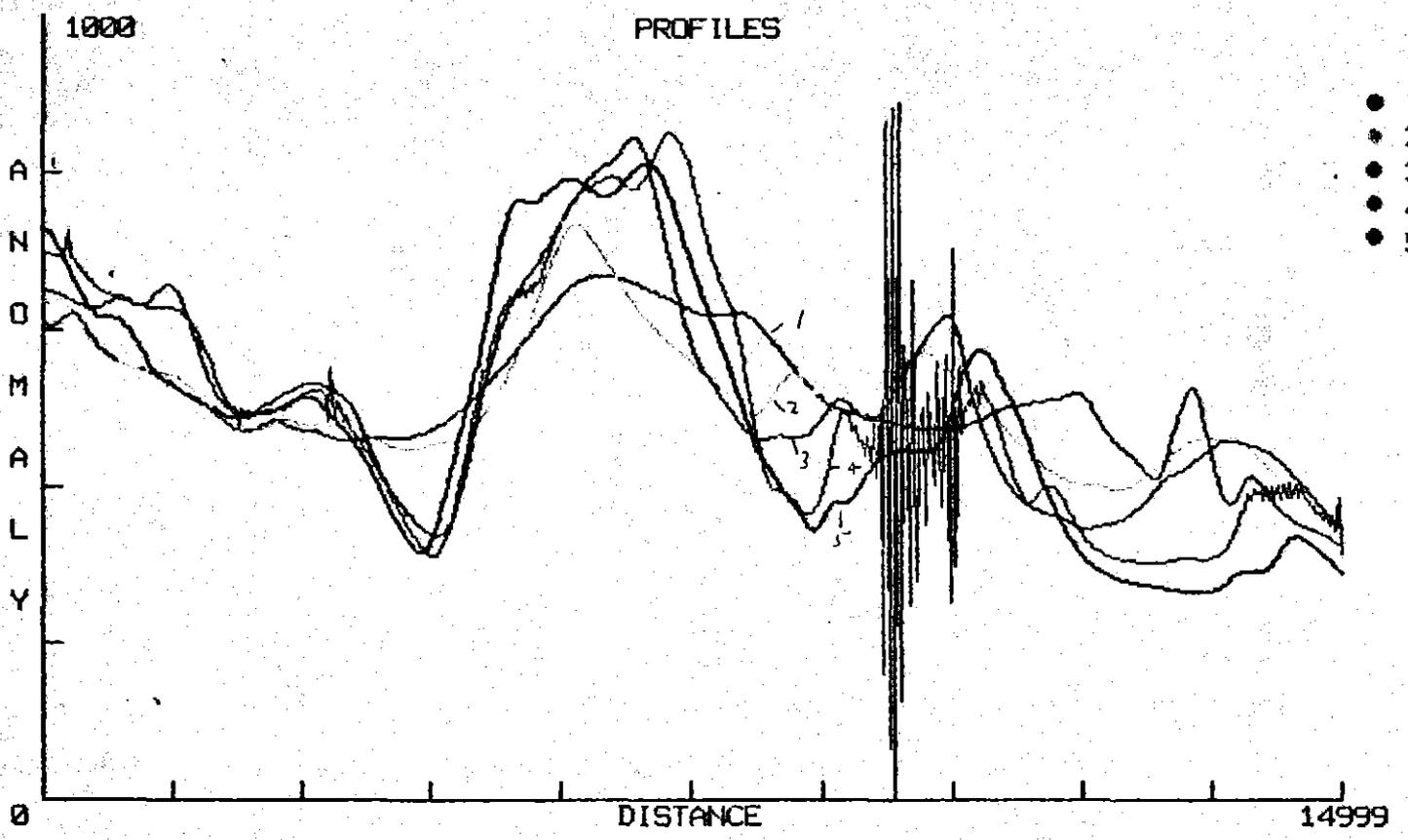


FIGURE : 10

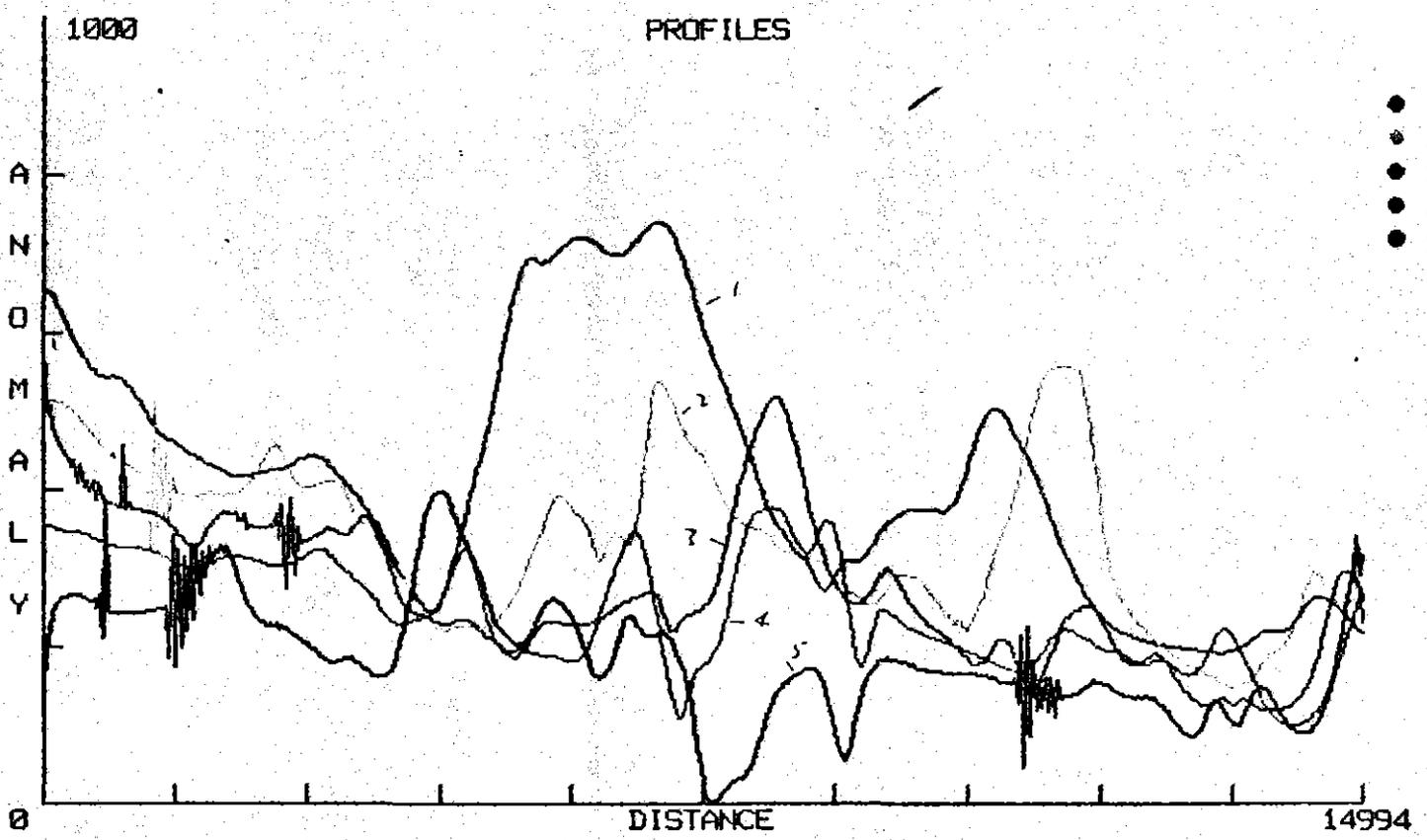
DIAL RANGE TROUGH MAGNETICS  
MINES DEPARTMENT 1985 SURVEY

042

810041

- 1 B:M10540 DIAL RANGE MAGNETICS 10540
- 2 B:DRP10550 150M DRAPE DIAL RANGE MAGNETICS 10550
- 3 B:DRP10560 150M DRAPE DIAL RANGE MAGNETICS 10560
- 4 B:M10570 DIAL RANGE MAGNETICS 10570
- 5 B:DRP10581 150M DRAPE DIAL RANGE MAGNETICS 10581

ZERO SHIFT : -85.3564

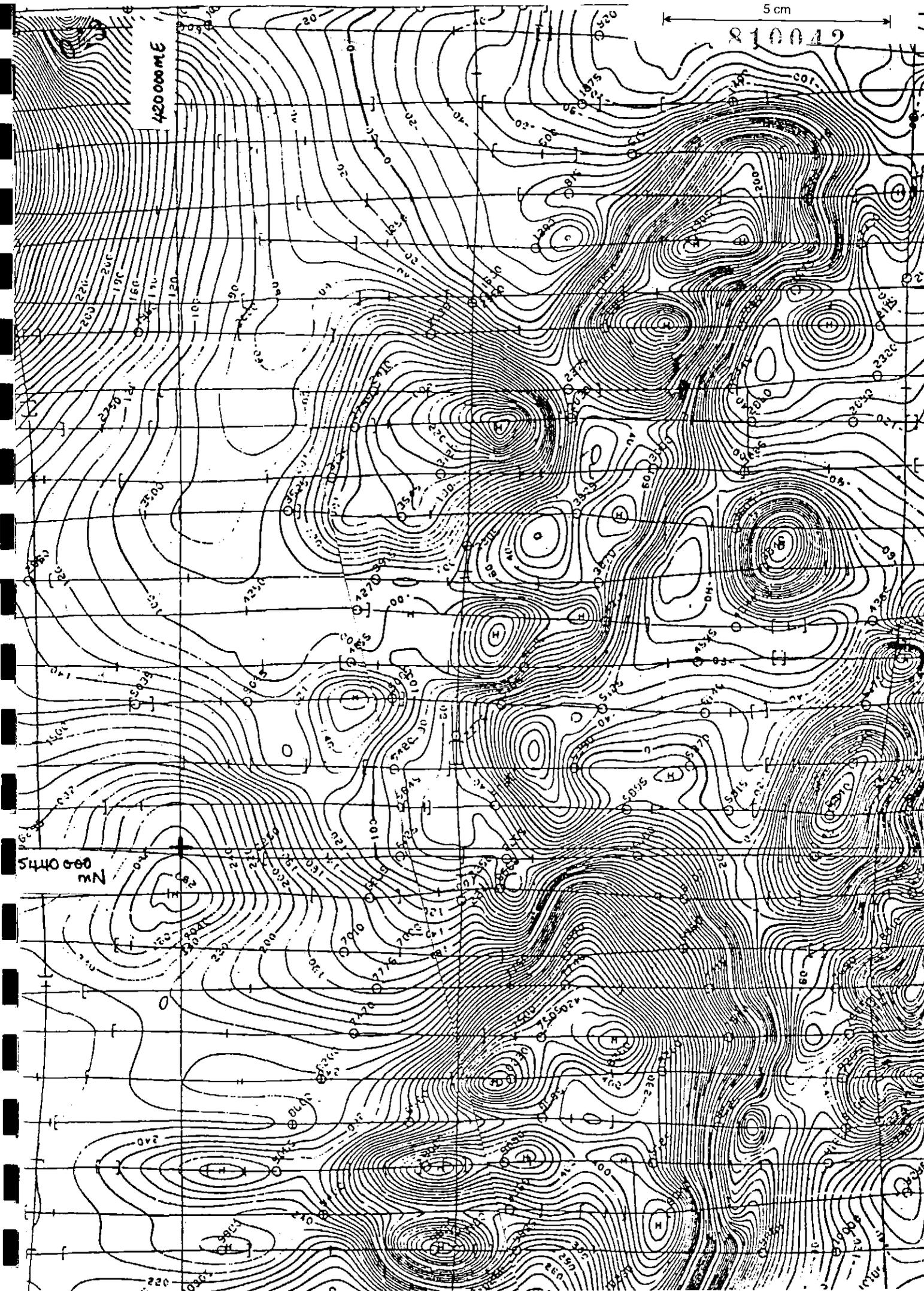


5432000N

5439500N

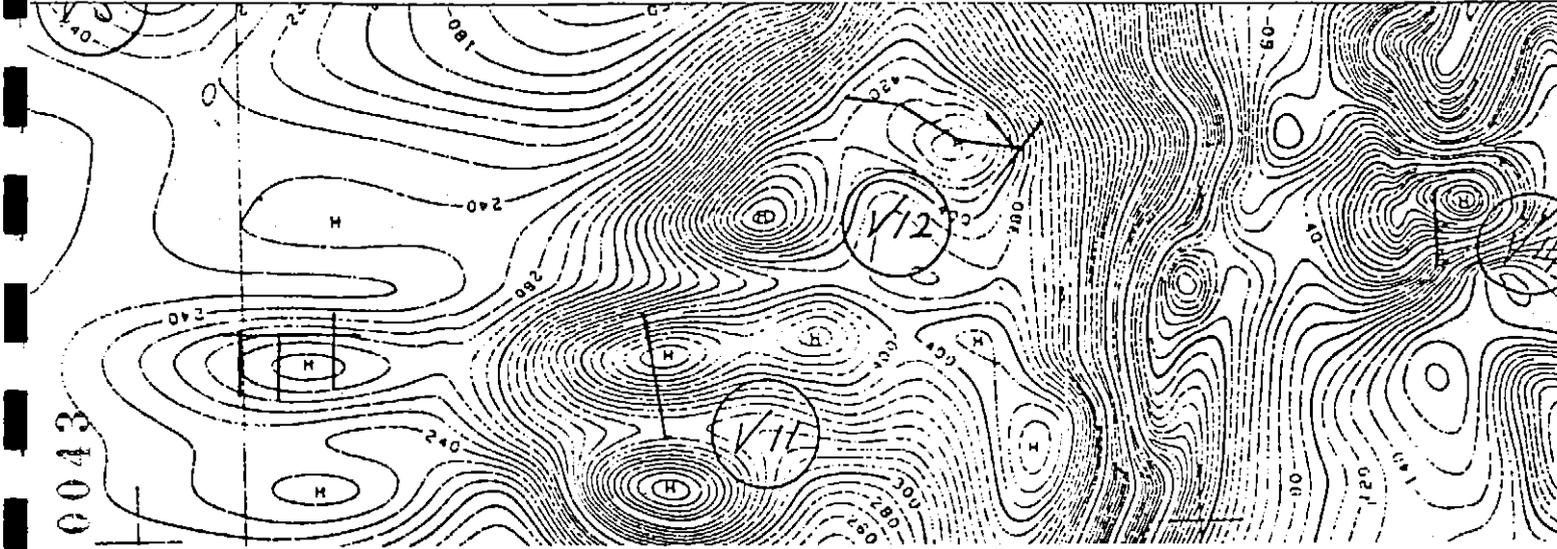
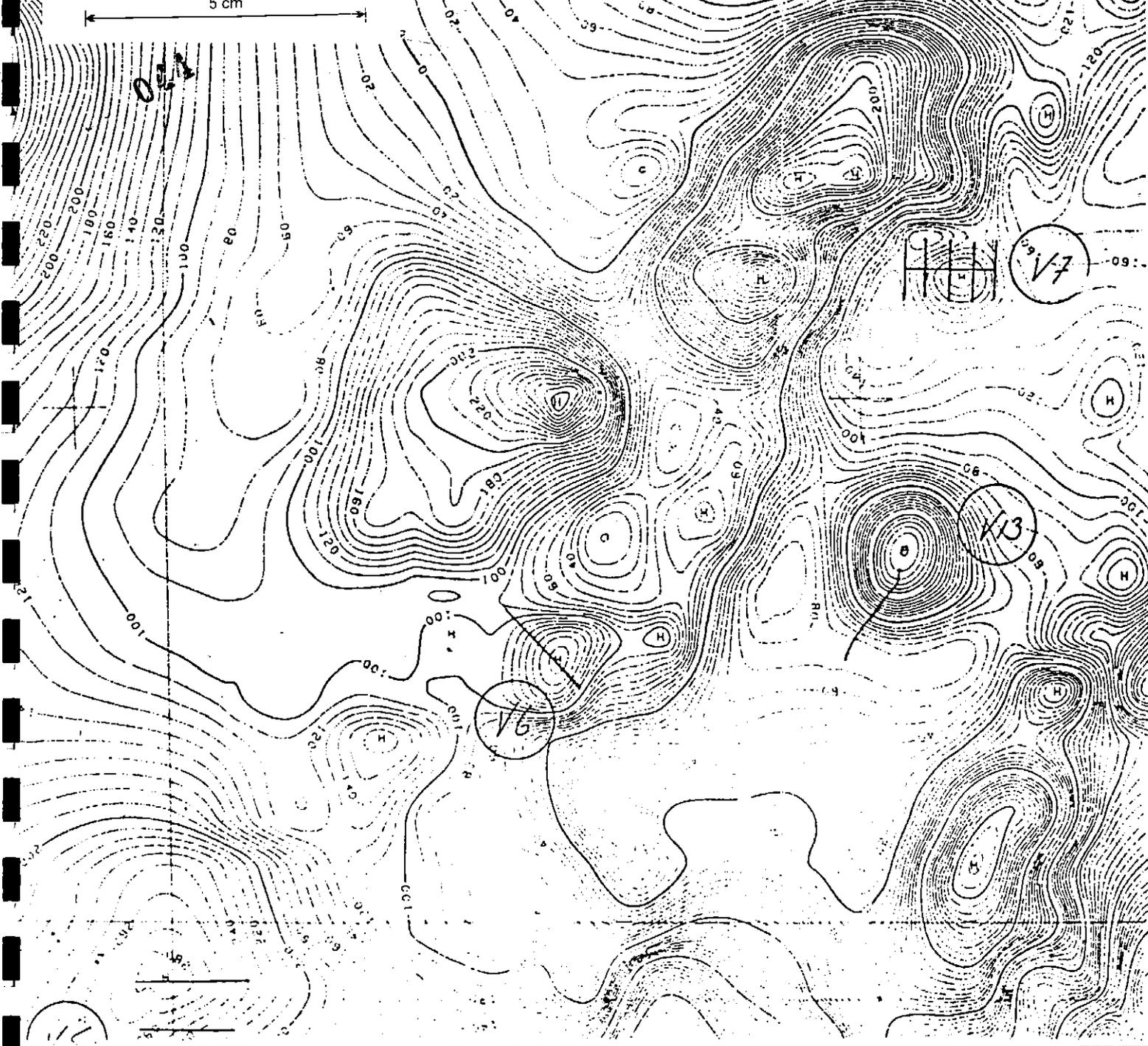
FIGURE : 11

DIAL RANGE TROUGH MAGNETICS  
MINES DEPARTMENT 1985 SURVEY



EL 46/86 TOTAL MAGNETIC FIELD (GEOPEKO SURVEY 1983) FIGURE 12  
 Survey portion centred on Dial Mine Scale 1:25000

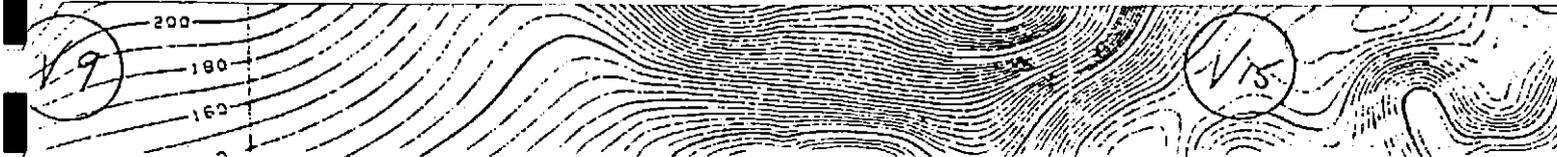
5 cm



810043

EL 46/86 EXAMPLES OF GEOPEKO TARGETS Superimposed on magnetic field.

FIGURE 13 Scale 1:25000



LEAMAN GEOPHYSICS  
G.P.O. Box 320 D,  
Hobart, Tasmania 7001

2.5

810044

- Radiometrics
- Mines Dept magnetic's
- Geoparko Magnetic's
- Gravity
- Geology (folds/faults) after Burns (1964)

420 000  
MN

540 000  
MN

5 cm

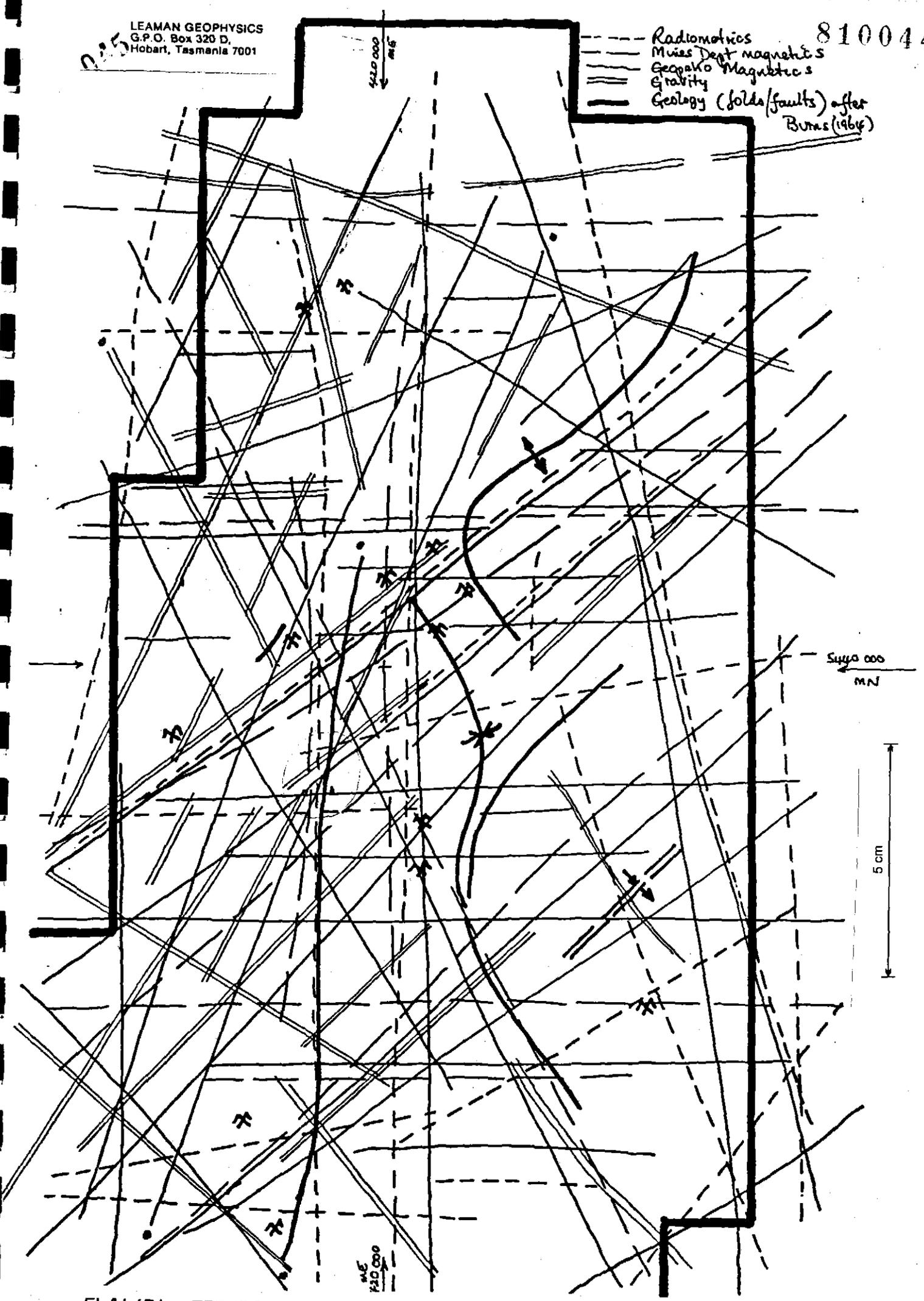
420 000  
MN

EL46/86

TRENDS INFERRED FROM AVAILABLE DATA

Prospects shown. See also geology and topography

FIGURE 14



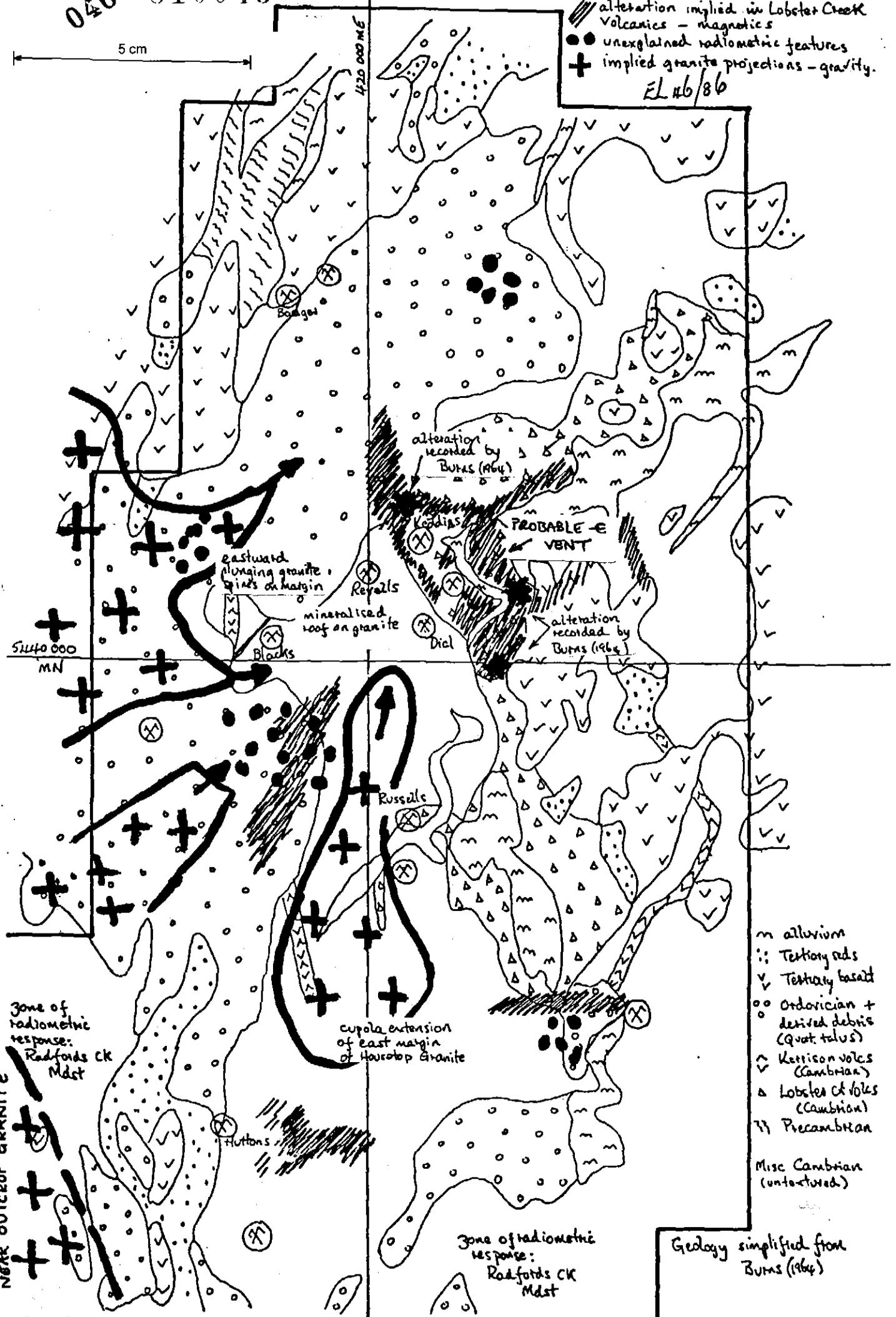
046 810045

5 cm

420 000 ME

- /// alteration implied in Lobster Creek Volcanics - magnetics
- unexplained radiometric features
- + implied granite projections - gravity.

EL 46/86



5140 000 MN

eastward plunging granite spine on margin

alteration recorded by Burns (1964)

PROBABLE E VENT

alteration recorded by Burns (1964)

mineralised roof on granite

Russelle

cupola extension of east margin of Hourstap Granite

zone of radiometric response: Radfords CK Mdst

NEAR OUTCROP GRANITE

zone of radiometric response: Radfords CK Mdst

- m alluvium
- :: Tertiary sands
- v Tertiary basalt
- o Ordovician + derived debris (Quat talus)
- ^ Morrison volcs (Cambrian)
- Δ Lobster Ct volcs (Cambrian)
- ?? Precambrian

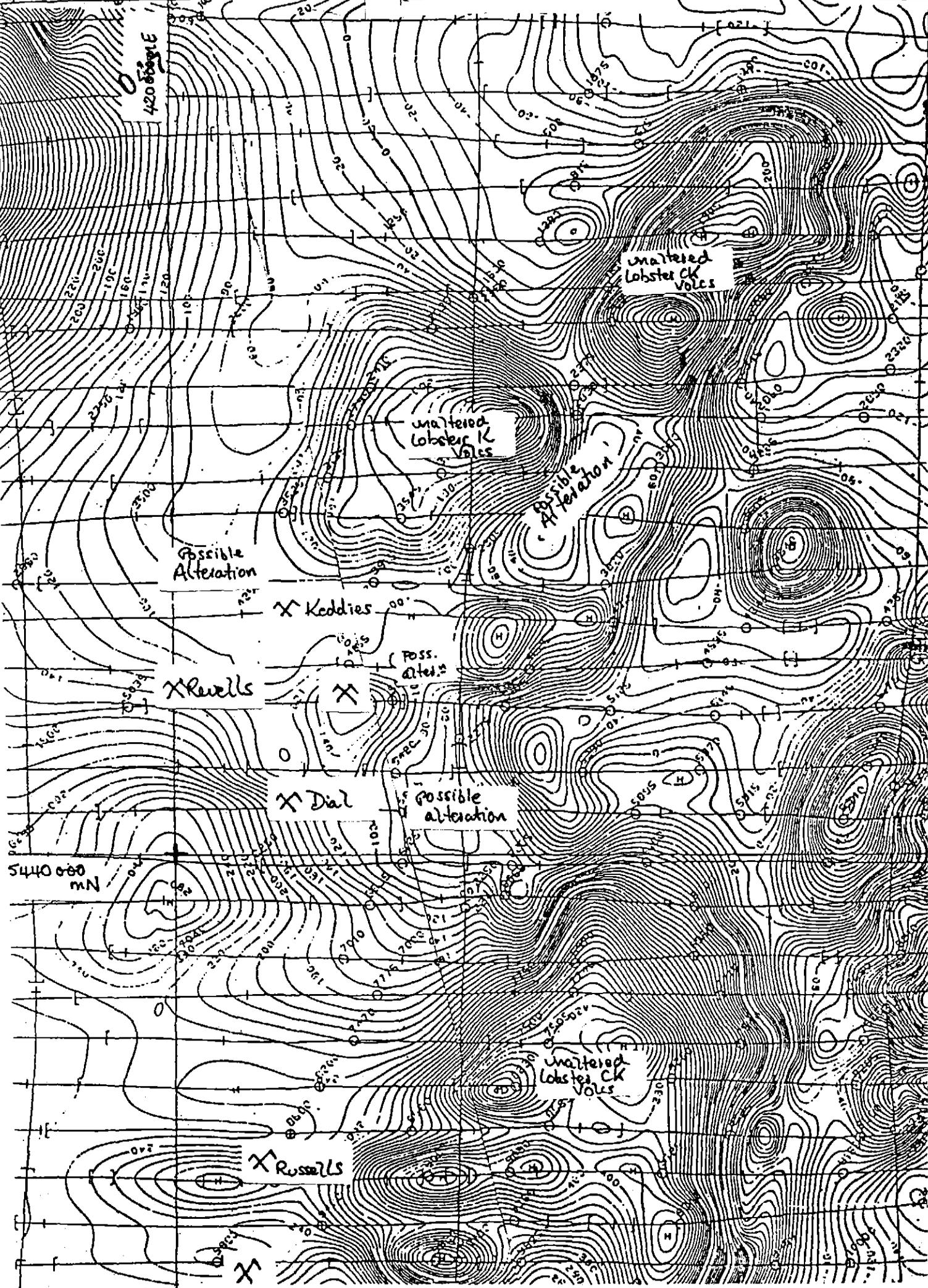
Misc Cambrian (untextured)

Geology simplified from Burns (1964)

810046

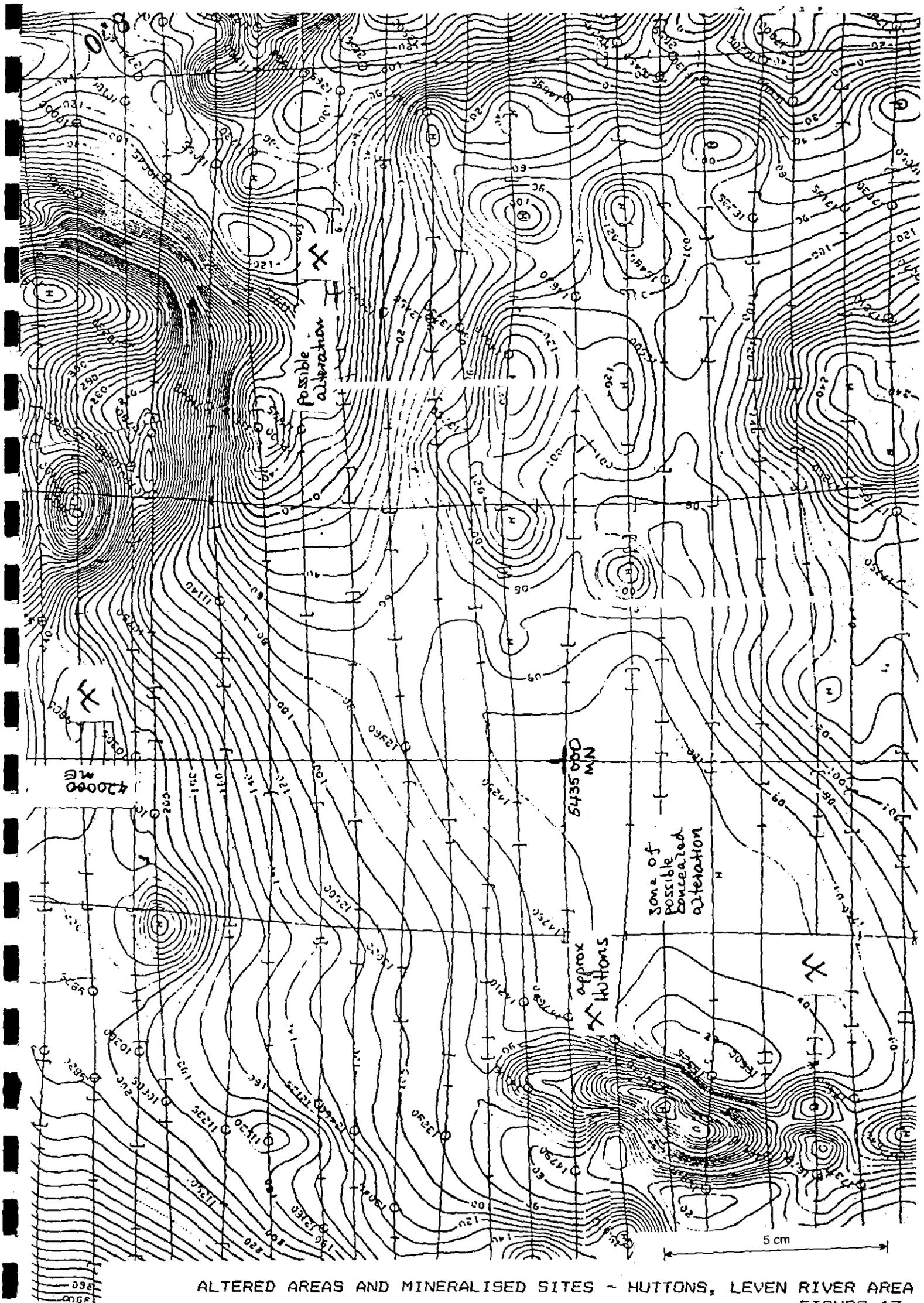
5 cm

420000E



ALTERED AREAS AND MINERALISED SITES - DIAL AREA

FIGURE 16



ALTERED AREAS AND MINERALISED SITES - HUTTONS, LEVEN RIVER AREA