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D. Leaman
19/6/99

INTRODUCTION

This report provides a review of the nature of, and implications of, existing geophysical data in the region of the Comstock Mining Lease currently held by Oceania Tasmania Pty Ltd near Zeehan. Details of the location of the Comstock Mining Leases, their geological setting and their prospectivity have been provided by Knight (1997).

The area has a lengthy history of geophysical exploration including activity during the world-wide Imperial Geophysical Survey trials of 1931. It has been used for University student exercises and partly covered by various (usually electrical) exploration surveys. None of these data sets contain information of sufficient coverage or data quality to properly assess the Comstock mining leases and much of it is no longer available in a form which allows either restoration or satisfactory examination.

Regional survey data are available but, again, are generally of unsatisfactory detail or coverage. Such data includes magnetic data sets acquired at terrain clearances of up to 150 m and line spacings of up to 500 m. One of the first semi-detailed mineral area gravity surveys completed by the Geological Survey includes the Comstock area and this data is of reasonably high quality. It has rarely been examined since release in 1981; an exception being Leaman (1990) in which the general form of the Heemskirk Granite was assessed in the area west of Zeehan township.

This patchy and unsatisfactory situation has now been largely rectified by new data acquisition specified by Oceania Tasmania Pty Ltd. New data available includes high resolution airborne electromagnetic and magnetic data.

This brief report considers these new data sets and their implications, with emphasis on magnetic data, within the setting offered by the available gravity data and geological mapping.

Figures 1 and 2 provide location of lease boundaries and suggestions of principal structures and prospects within the area and may be used as reference for all discussion. An extract of Figure 2 (at 1:10 000) is used as an overlay for most other figures.

GEOPHYSICAL DATA

Gravity data within the region are of modest precision (estimated at 0.3 mgal) with a data coverage of about five stations per square kilometre in the Comstock area. This coverage is adequate for gross assessments but not satisfactory for prospect or lease scale evaluation.

Figure 3 provides an indication of residual Bouguer anomalies in the Zeehan region. The Comstock lease area has been highlighted. The diagram also indicates the station density.

Complete details of the actual specification of the magnetic and electromagnetic surveys have not been supplied but it is understood that observations were made at about 5 m intervals on a 50 m by 50 m grid at a ground clearance of the order of 50 m. This is a very detailed acquisition and potentially capable of very high resolution.

Figure 4 presents the magnetic data as observed after basic corrections and shows that much of the detail which might have been recovered has been swamped by the local and regional effects of a very strong anomaly in the west of the survey area. Figure 5 presents the magnetic data after a continuation separation to minimise the effect of the primary source. This type of processing (subtraction of the effect at 1 m higher) has the effect of diminishing the effect of any single large response and enabling definition of minor features. These separations also result in enhancement of survey noise or indication of problem line or data segments and comparison of Figures 4 and 5 shows this clearly.

Although the survey was flown in two regionally sensible directions and should therefore respond to the many structures within the area there are no sharp lineaments but many suggestions of diffuse trends. The colour image (Figure 6) oriented to yield best shading of any features based on mapped trends reveals few direct correlations with such mapping.

Derivative processing of the observed magnetic data (Figure 7) should enhance any source edge or lineament effects, especially those which are at shallow depth. There are some subtle correlations but

no definitive responses. Figure 8 presents the results of processing the separated (residual) magnetic data. Although correlations remain subtle there are recognisable relationships.

Some electromagnetic data was supplied for general inspection; detailed review is currently being undertaken by Dr. R. Lewis. An example of inferred apparent resistivity is shown in Figure 9. There is a clear and unambiguous correlation between major structural blocks and limits of conductivity variation although no detailed response, within the gross response, can be associated with specific ore lenses or prospects.

DISCUSSION

Inspection of the data as sampled in the various figures reveals a number of paradoxes. There are many inconsistencies and implied conflicts between the data sets and the currently used geological base map.

Some of these are suggested in Figure 10.

It is important to recognise the geological setting of the ore bodies within the Comstock Field and to appreciate the geological constraints or limitations. Some of these are suggested in Figure 2 where the legend indicates the existence of skarns and other recrystallized rocks intimately associated with a complex thrust zone which involves the Tenth Legion and Balstrup Faults. The Tenth Legion Fault essentially marks the lithological boundary between Cambrian and Precambrian rocks and terminates the exposure of Cambrian rocks. The Heemskirk Granite outcrops about 2 km to the west of the main outcropping ore lenses.

* Leaman (1990) analysed the available gravity data in order to define granite shape and any relationships between granite and tin mineralisation. This work was of sufficient detail to account for the Queen Hill deposits and RGC Exploration incorporated structure contours of granite form on its map compilations (e.g., Figure 2). The analysis was restricted by time and nature of both the commission and the data available and these limitations are evident in two of the original sections (reproduced here as Figures 10 and 11). Firstly, the interpretation is not consistent with rules of interpretation later established by Leaman (1994) but which were not understood in 1990 (and still not used by most interpreters). These rules show that the granite form is generally correct overall but the interpretation may carry an error envelope in excess of 300 m over the crest of the body. Secondly, no allowance was made for local variations in bulk density; the local geology was not included - it being assumed to be relatively uniform in density. While this may be generally acceptable the assumption is inappropriate in the Comstock region where mafic rocks are locally abundant. The effect is most apparent in Figure 10 (for line 357 000 mE) where the ill-defined gravity field responds to the mafic rocks. Leaman (1990) recognised this but could not incorporate this important detail in the model due to job specification. The effect is less pronounced in Figure 11 (for line 358 000 mE) but this is a function of station cover and outcrop distribution. The implication of modelling of this data in the Comstock region was to suggest that the granite was at a depth in excess of 2000 -3000 m. This is the first paradox. If the granite is this deep, why is the thermal alteration so extreme? Have fluids passed up the various faults into the susceptible carbonates for this depth or is there some other explanation? Extreme alteration of a large rock volume would suggest that the granite was no deeper than 600-800 m even if the conduits were large and continuous. This requirement would also suggest that they be sub-vertical as well; the presence of low angle detachments would deflect and spread fluid flow with consequent cooling.

Although the presentation of Leaman (1990) is based on three dimensional modelling, and should be revised using such techniques, some localised two dimensional review has been completed for the response shown in Figure 10. If the mafic complex including gabbro is assumed to possess a bulk density of 2.86 t/cu m (and not 2.74 as presumed in the original interpretation) then the granite surface can be lifted by nearly 2000 m. This suggests that the current model for the granite (shown in Figure 12) in the Sylvester-Comstock area is in error by a large amount and that the enclosing spine at

about 5326 000 mN is much wider. The 'embayment' centred on Sylvester, and which corresponds to the mafic complex in surface distribution, almost certainly does not exist. It also means that the granite in the region of the Comstock skarns is no deeper than about 1000 m and may locally be much shallower (perhaps only 500 m).

A more extensive gravity coverage and more complete analysis would be required to fully and properly resolve and describe the form of the granite but it is clear that the skarns are to be expected. It may also be that aspects of the fault and thrust pattern is consistent with both the form, and manner, of granite intrusion in the region.

Preliminary overview of the electromagnetic data (Lewis, 1999) confirms the general comments made in the previous section. There are some very large responses, many of these cover the entire core fault block zone, and few specific elements can be associated with individual mineralised sites. The responses and their origin do not appear to have been properly tested by any existing drilling and some explanation is needed.

The nature of gross correlations is evident in Figure 13. The principal faults can be mapped, depending upon the components used and the nature of presentation, as can the difference across the Tenth Legion Fault. Lesser structures within the northern block (north of the Tenth Legion Fault) can also be identified. All these associations, especially given the unknown attitude of the Tenth Legion Fault at depth, suggest that the EM data have responded primarily to near surface elements. It is beyond the writer's brief or experience to suggest the possible range of source depths associated with the very large responses observed here. The ultimate limit is, however, set by the granite.

The magnetic field pattern, unlike the EM responses, shows little clear correlation with any known surface distribution. The differences are striking.

Magnetic data, even after substantial processing, do not define any structure clearly although there are ghost indicators of the Balstrup Fault zone in the derivative formats. There is also no textural grain, which was anticipated given the fractured nature of the terrane and the presence of iron compounds in many structures, and this is clearly anomalous *unless* it be accepted that most of the magnetic responses are not derived from the surficial materials.

The only prospect or known ore body with an unambiguous response is Sylvester. The writer is not certain whether this is due to the ore or to local infrastructure (no photo was supplied).

The largest magnetic response is associated with skarns and the effect of such sources greatly exaggerates the anomaly. Part of this difference is evident by comparison of Figures 4 and 5 but a large anomaly persists across half the lease. Similar deviations can be noted in Figures 7 and 8 which present versions of the first derivative for total and residual fields at the same sun angle. The best correlations between surface features and magnetic features are offered by derivatives of the residual field which, although rather noisy, should make such connections. Even so, only the Balstrup Fault corridor can be recognised with assurance.

The field can be linked with exposure of Cambrian mafic rocks and their likely extension.

Figure 13 presents trends and source regions based on all EM and magnetic data and shows how these may be associated with surface geology. The Balstrup Fault is well, if patchily, defined by both EM and magnetic data. There is virtually no other magnetic correlation (although there are many EM correlations). This diagram does show that the group of lenses east of Boss near the Balstrup Fault lie near a conductor change. It is also clear that the Tenth Legion Fault is not represented magnetically as a simple, continuous change - as suggested by the EM data - and that the zone between the major fault systems is a magnetic low.

If, however, the distribution of the mafic rocks south of the Tenth Legion Fault is considered, then it is found that the south, disrupted anomaly pattern is sourced within this rock suite. The eastern margin of the large magnetic change (seen in Figures 4, 5, 6, 7, and 8) is overlies the edge of the suite. This suggests, since the main magnetic anomaly to the north has a similar margin, that the large response in the centre of the lease is due to alteration of an extension of this same suite. Such a solution would also imply that the Tenth Legion Fault does not persist as a simple shallow structure to the north but either plunges steeply northward or has been sliced out by another fault sub-parallel to the Balstrup system but a little south of it. Figure 13 suggests where this additional structure could be; one point lies near Allison's prospect. A complex pairing of faults could have two possible effects;

either a slice of the mafic suite has been removed by upthrust and erosion or it is much deeper due to additional burial. These alternatives cannot be separated with any certainty at this stage but the former is most likely geologically. The latter is unlikely given the intensity of the field reduction. A less likely alternative is that the suite has been absorbed or displaced by the granite. A detailed gravity coverage would be required to assess this third option.

The distribution of zinc values, and their northerly termination, may be associated with the eastern edge of the mafic suite (see Knight, 1997, Figure 5). The negative correlation with arsenic (also Knight, 1997) also confirms the likely distribution of the mafics at depth. A plot of copper values may be even more instructive - if the data exists. This concealed boundary provides the general NE trend within various physical and geochemical data sets.

If the magnetic field responses are indeed sourced at moderate depth then it may also be deduced that the Balstrup Fault System is not of large displacement since there are no major disruptions of the inferred northern extension of the mafic suite. The termination of the main magnetic source near 5361 200 mN is consistent with the revised view of the position of the granite margin.

CONCLUSIONS

The variation in correlations between EM and magnetic data and surface geological constraints suggests that the EM data have been significantly influenced by relatively shallow effects and that the magnetic data offer a deeper constraint. Both data sets suggest that the fault block, clearly much disrupted, lying between the Balstrup and Tenth Legion Fault systems is structurally anomalous and altered. The magnetic data indicate the presence of additional, concealed faults while the EM data suggest the level of alteration and, perhaps, mineralisation. Much fluid has passed through this zone and the distribution of skarns and ore lenses confirms this. Gravity data show that the underlying granite is intimately associated with all structures and the nature of alteration.

The Comstock lease area is surprisingly complex and much care will be needed to properly locate targets. This is especially true of the area west of Allison's. There is much potential for large targets given the presence of granite, heat, carbonates and much fracturing. The corner of the mafic suite near Allison's is certainly worthy of close examination. The sweep of known ore lenses to the east fans from this point. The eastern, concealed, margin of the mafic suite may well be highly prospective.

Further quantitative analysis of the magnetic data is feasible but this should not be contemplated until at least one deep hole has been drilled in the core zone near, or south of, Allison's and the geological map has been upgraded. A detailed gravity coverage of the lease area and near surrounds may also prove worthwhile. Such a survey should directly resolve many minor questions, including the scale of the ore lenses, the nature of the zone between the faults and the sub surface extension of the mafic suite. Gravity data would also permit a comprehensive revision of the granite model; the location of the granite places the ultimate limits on exploration and prospectivity.

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- Leaman, D.E., 1990. An interpretation: form of Heemskirk Granite, Zeehan EL 42/87. Report for RGC Exploration by Leaman Geophysics, October.
- Lewis, R.J.G, 1999. A preliminary overview of a helicopter EM survey for Oceania Tasmania Pty Ltd at the Comstock Prospect, Zeehan Tasmania. Report for Oceania by Liddington Technology Pty Ltd, April.

* See over for Reference to Leaman, D.E. 1994.

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Re: Comstock Project April 99 From: Malcolm Bendall

CC:

Urgent For Review Please Comment Please Reply Please Recycle

Dear Therese,

Dr Leaman has authorised the following text which was omitted on page 5. Please thank Dr Bob Richardson for bringing to my attention.

Leaman, D.F., 1994

Criteria for evaluation of potential field interpretations
First break 12(4) 181-191

Yours sincerely, - Wesley Phillips
Personal Assistant to Malcolm Bendall
Managing Director - Bass Resources NL

PROTOCOL -

* Dr Leaman has given me permission to Publish, Broadcast and Archive his April 99 Report updated on 14.7.99 regarding this new mine discovery near Zechan.

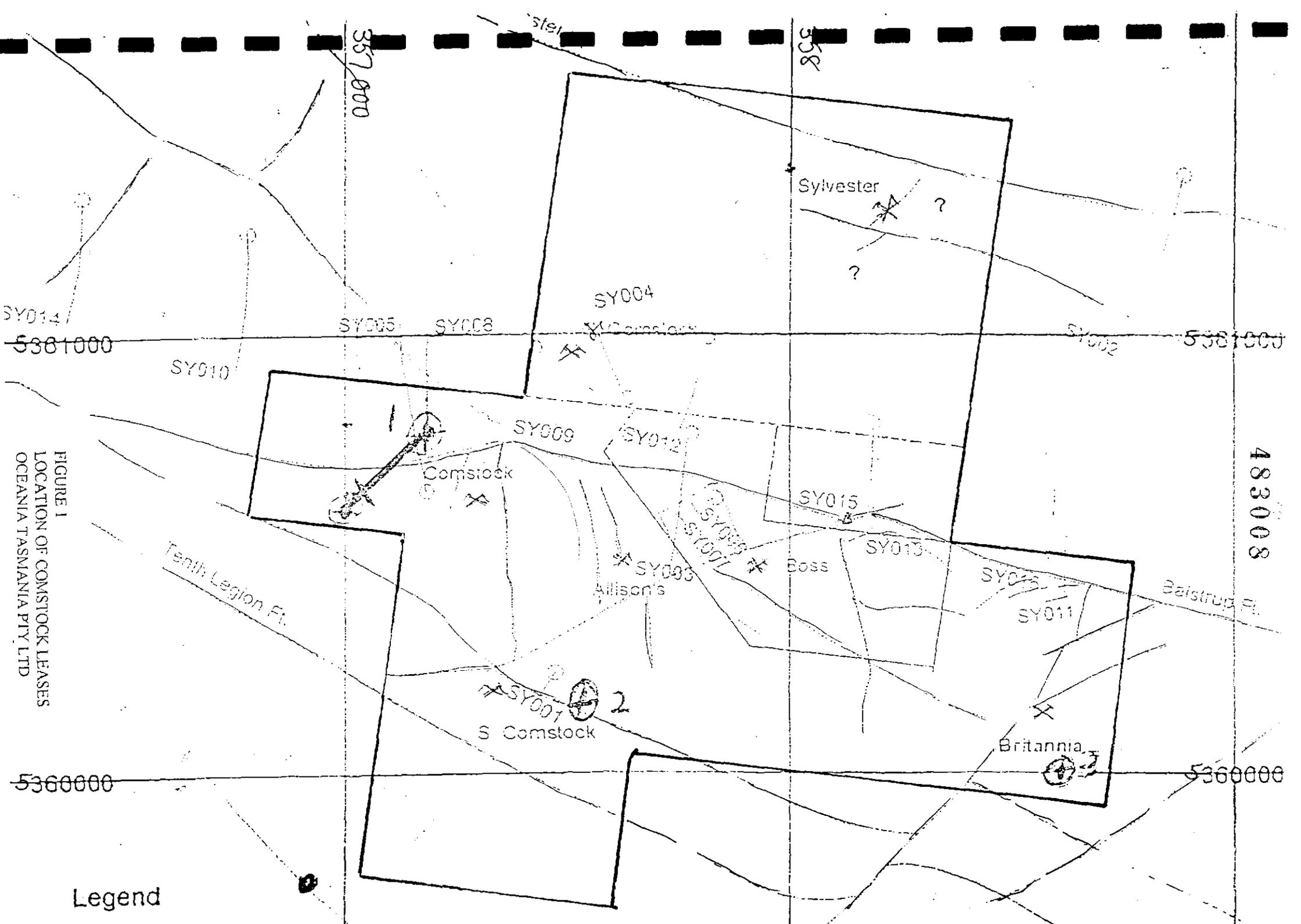
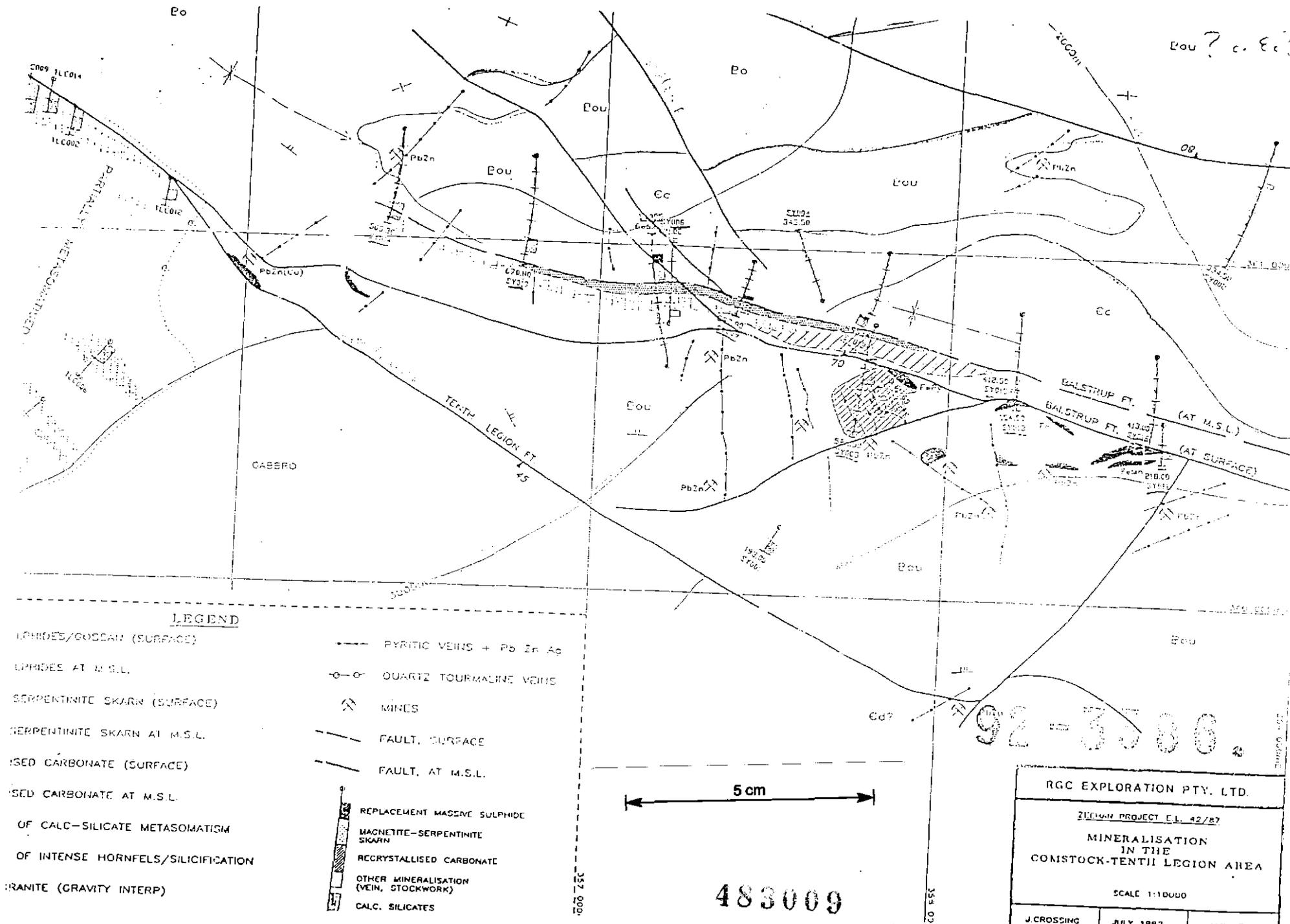


FIGURE 1
 LOCATION OF COMSTOCK LEASES
 OCEANIA TASMANIA PTY LTD

Legend

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FIGURE 2
 CURRENT COMPILATION OF GEOLOGICAL BASE MAP
 COMSTOCK LEASE AREA



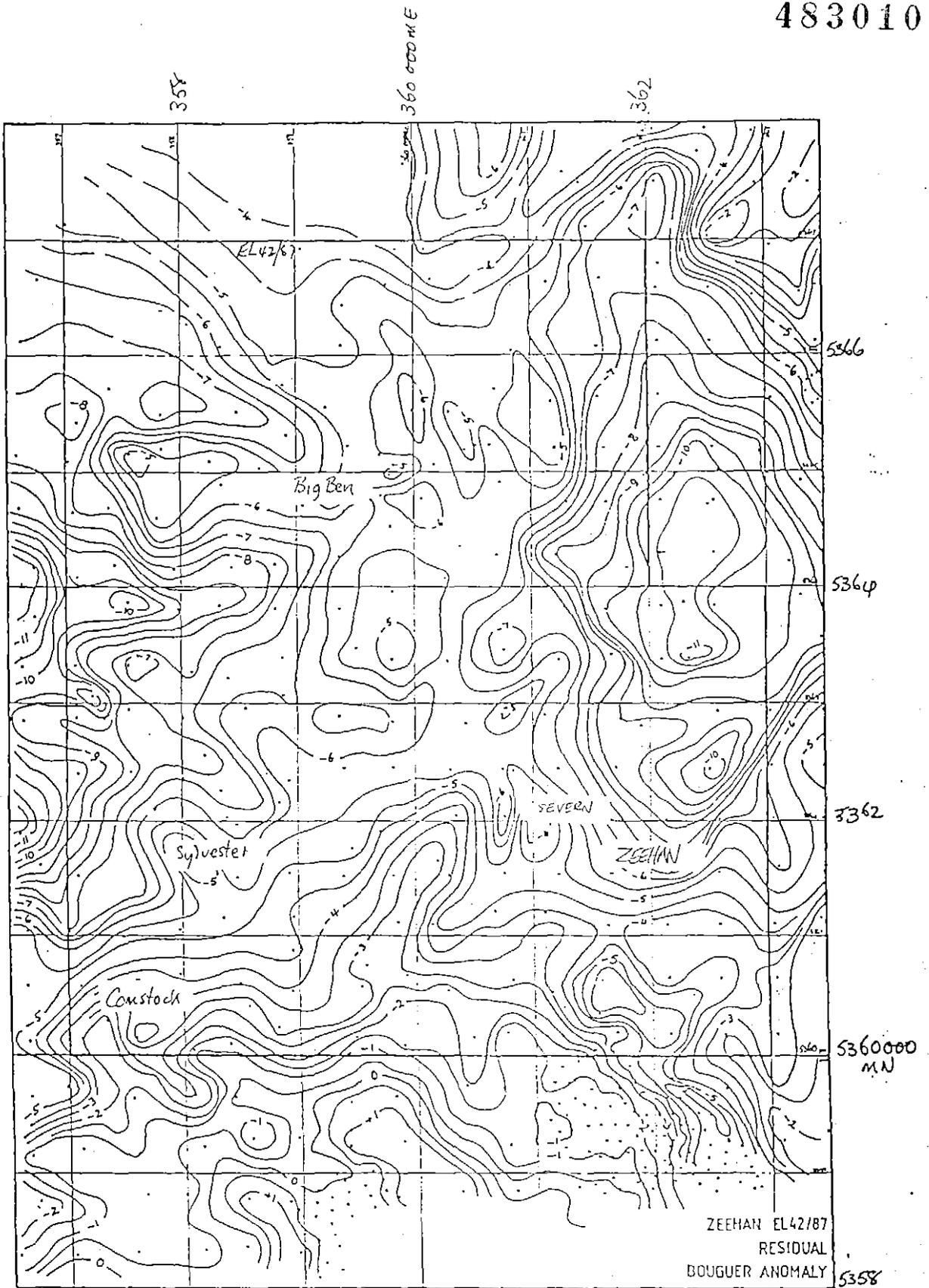


FIGURE 3
RESIDUAL BOUGUER ANOMALY
ZEEHAN AREA (AS AT 1990)

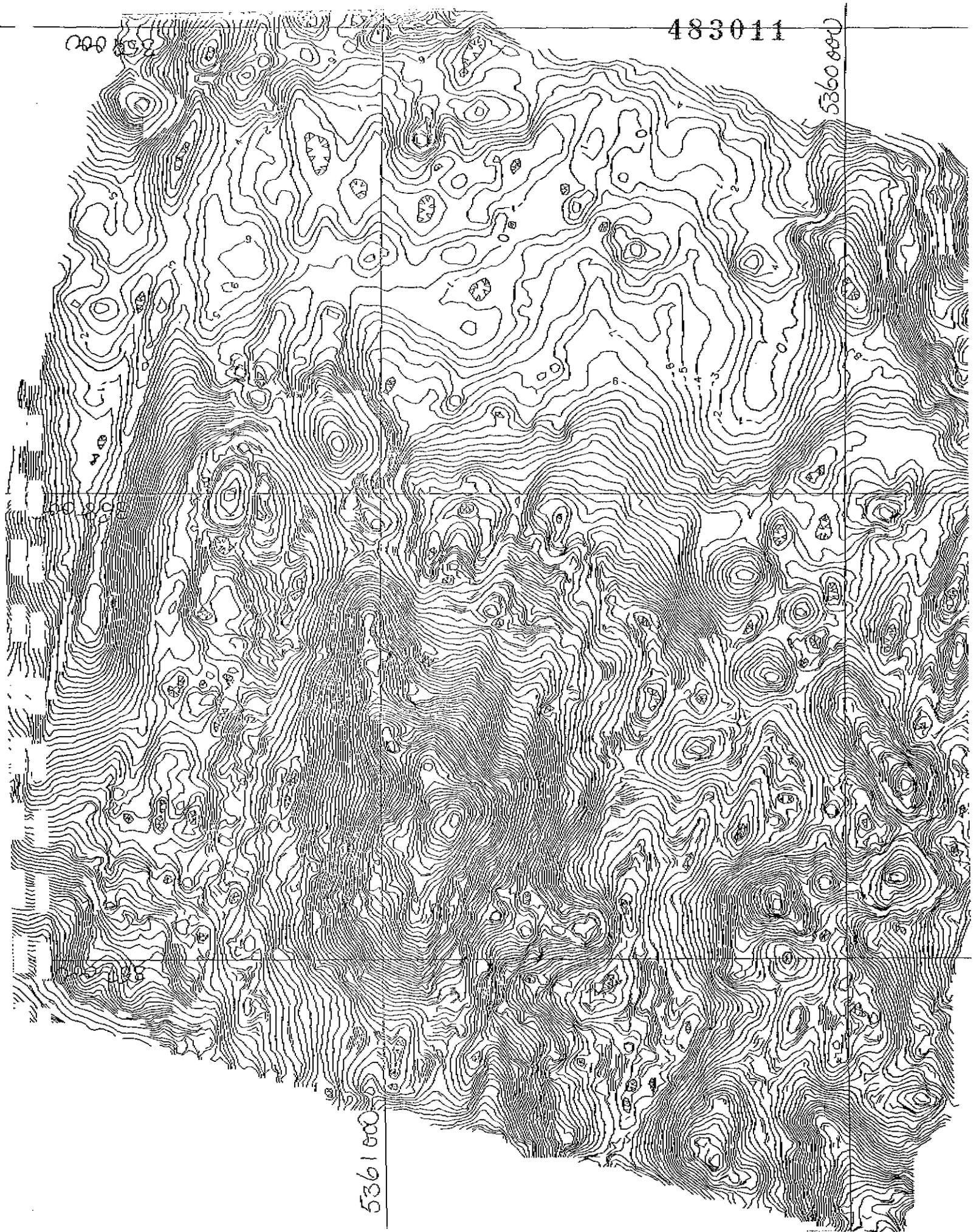


FIGURE 5
RESIDUAL MAGNETIC FIELD
NEW HELICOPTER SURVEY AFTER CONTINUATION SEPARATION

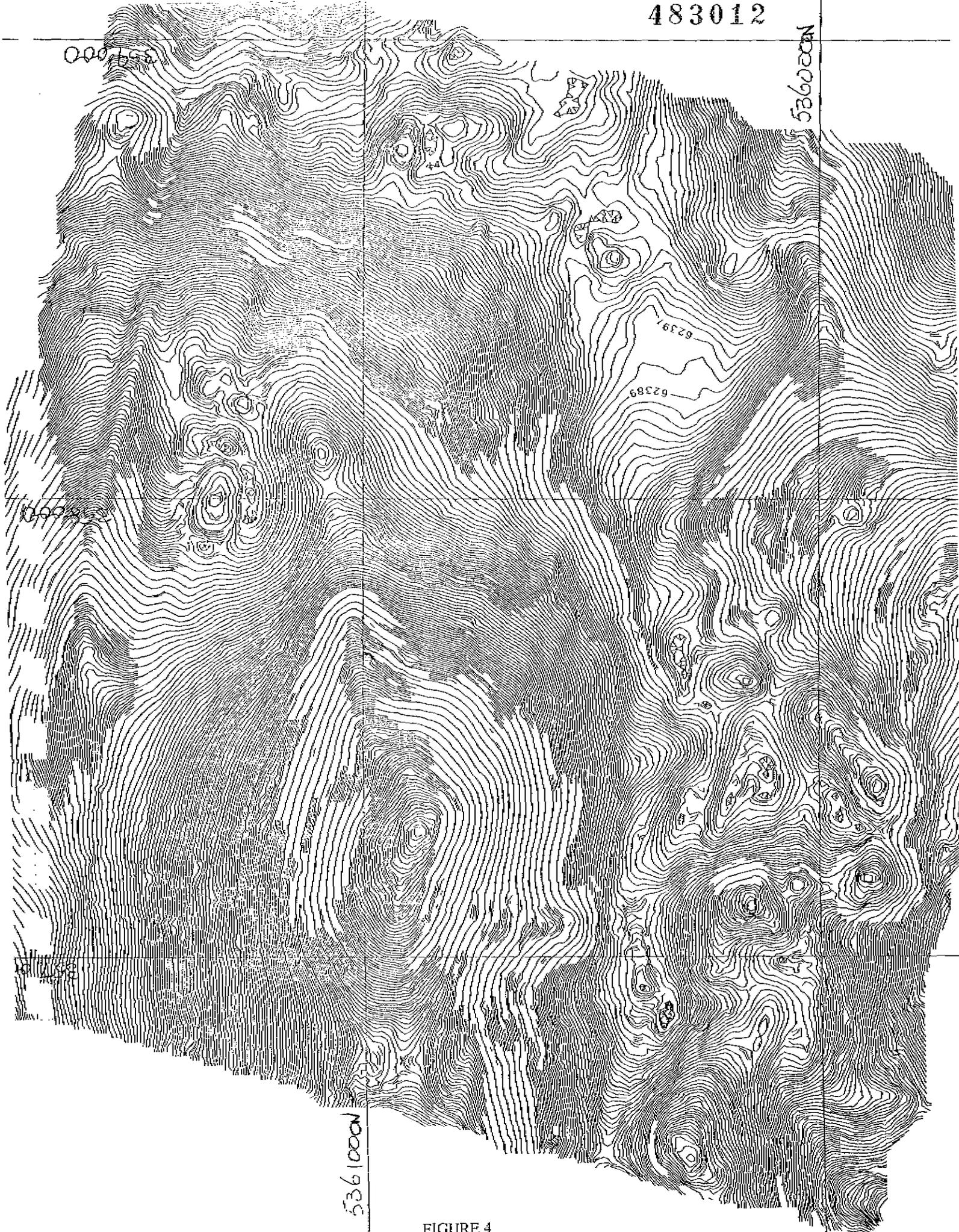
000

000

483012

000658

536000N



000852

5361000N

5361000N

FIGURE 4
TOTAL MAGNETIC FIELD
NEW HELICOPTER SURVEY (1 nT CONTOURS)

N

N

5361

5360

358

357

7 or 8c?

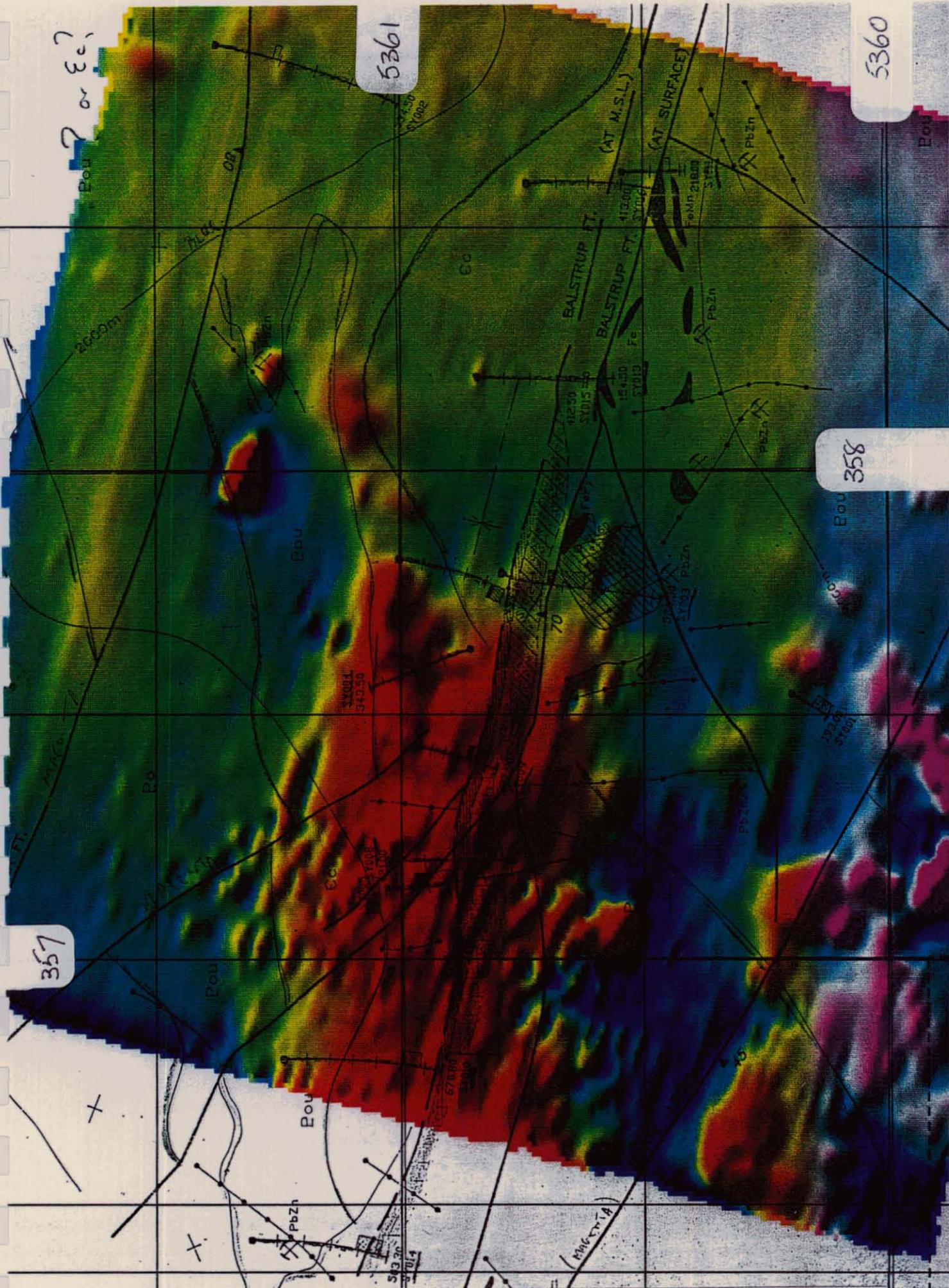


FIGURE 7
IMAGE OF FIRST DERIVATIVE (TOTAL FIELD, NE SUN)

5361 500N

5360 500N

483016

5360

5361

358

357

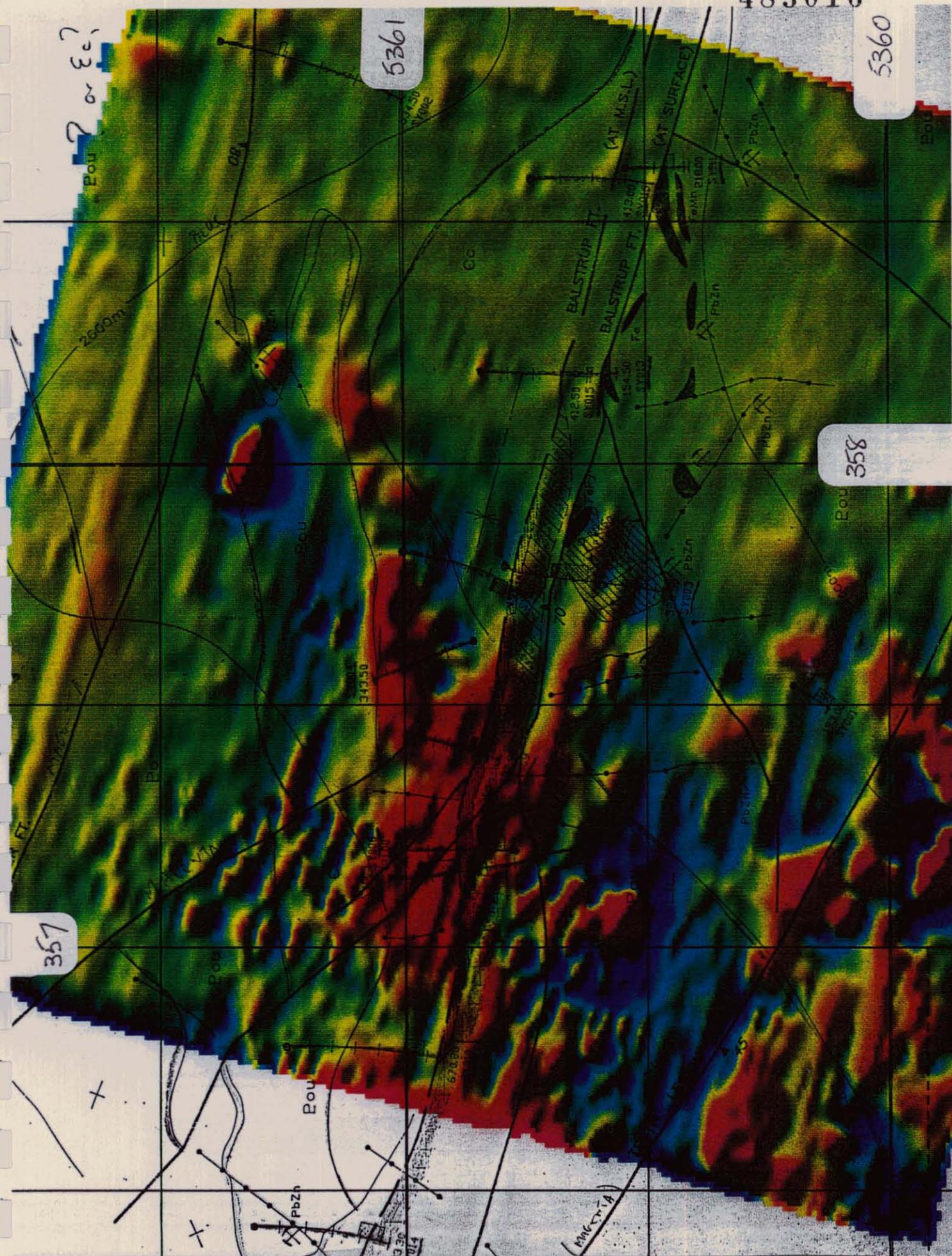


FIGURE 8
 IMAGE OF FIRST DERIVATIVE (RESIDUAL FIELD, NE SUN)

5361₅₀₀N

5360₅₀₀N

536

536

5360

5361

358

357

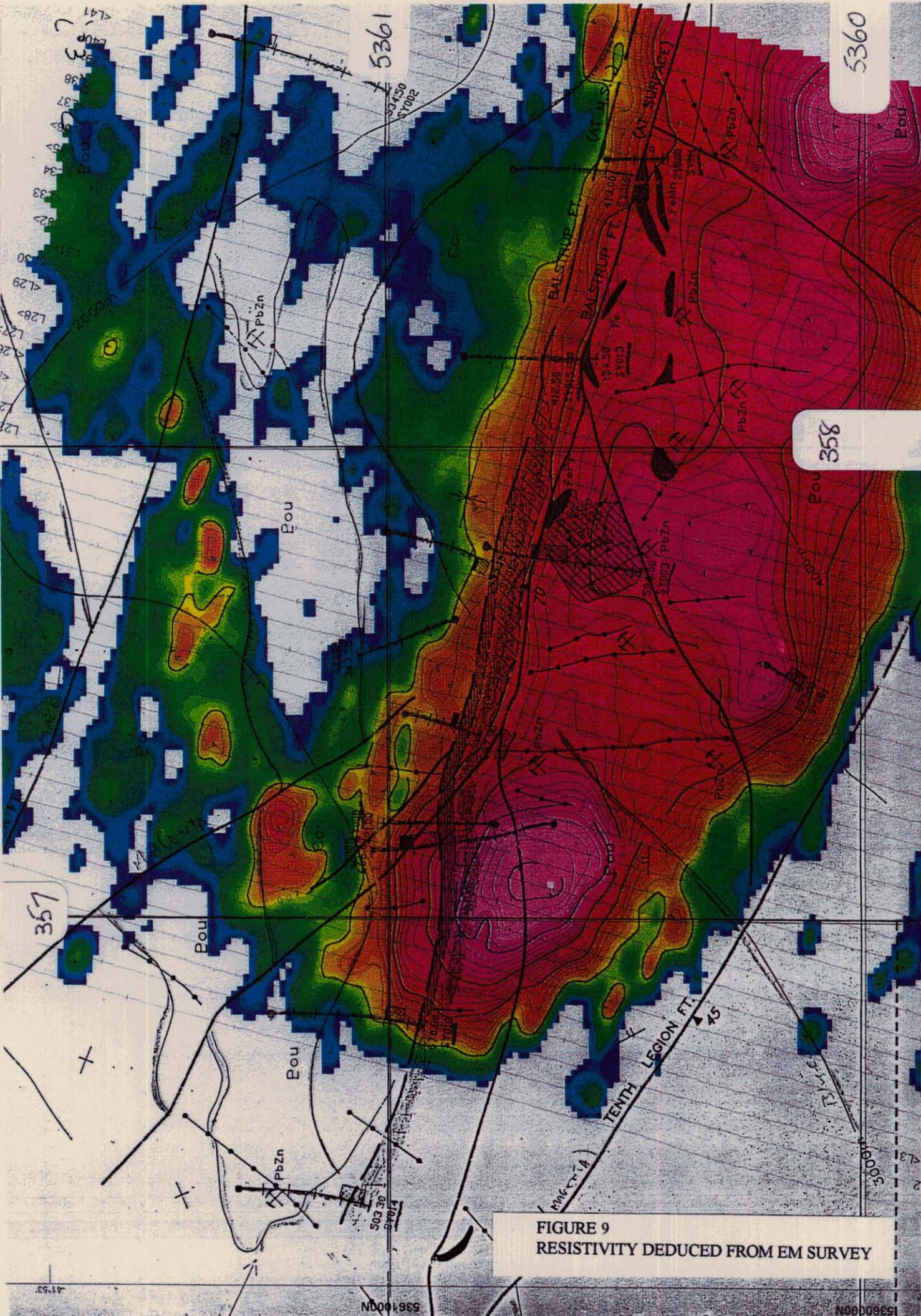


FIGURE 9
RESISTIVITY DEDUCED FROM EM SURVEY

0 1.00 B:ZEEG7
1 1.00 B:G5AML7
2 1.00 B:G08L7
3 2.00 B:SYN3L7

357 000 m E

ZERO SHIFT : 24.29893

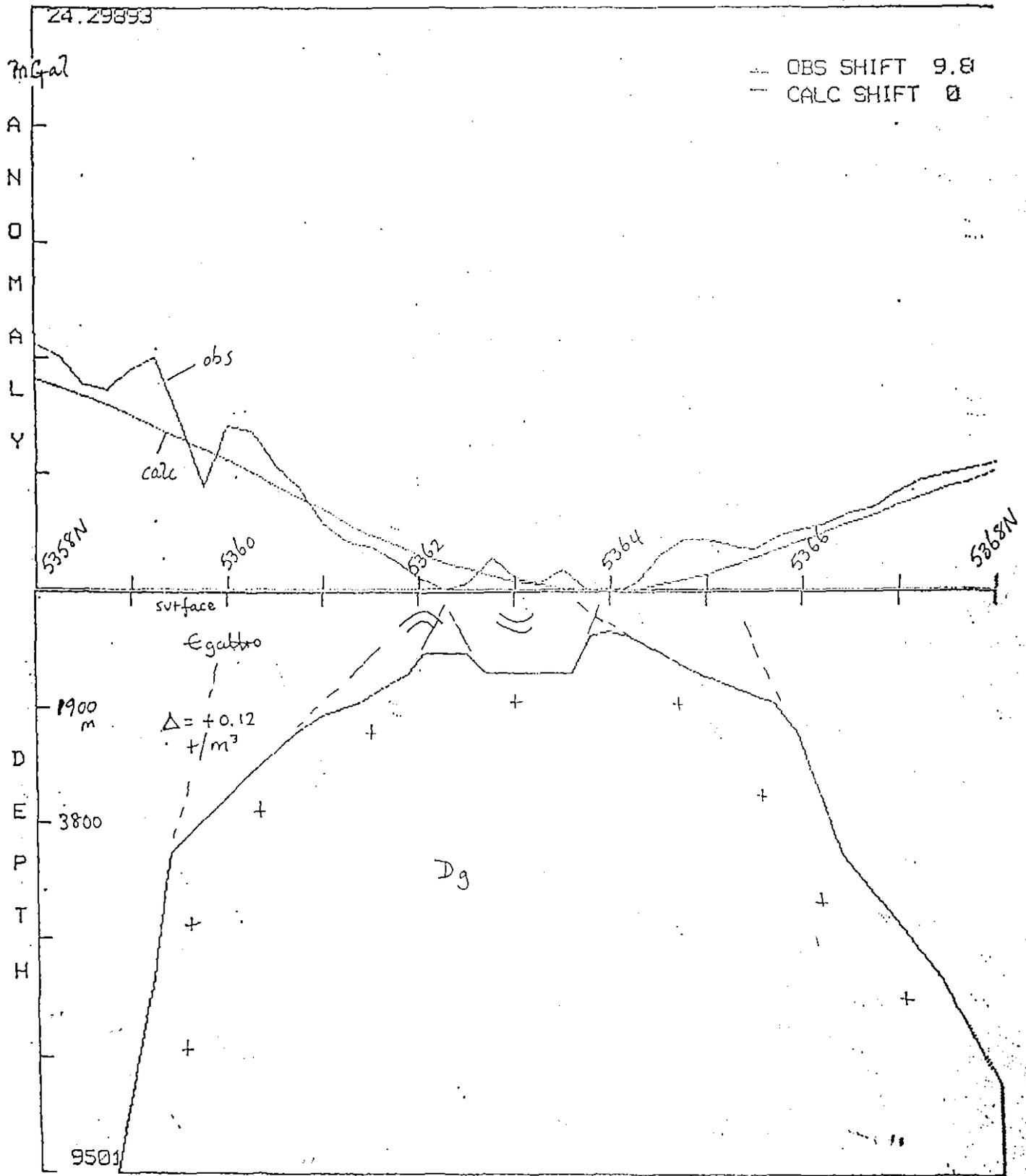


FIGURE 10
GRANITE MODEL LINE 357 000 E (1990 INTERPRETATION)

- 0 1.00 B:ZEEG0
- 1 1.00 B:CSALL0
- 2 1.00 B:G0BL0
- 3 2.00 B:SYN3L0

ZERO SHIFT : 22.95031

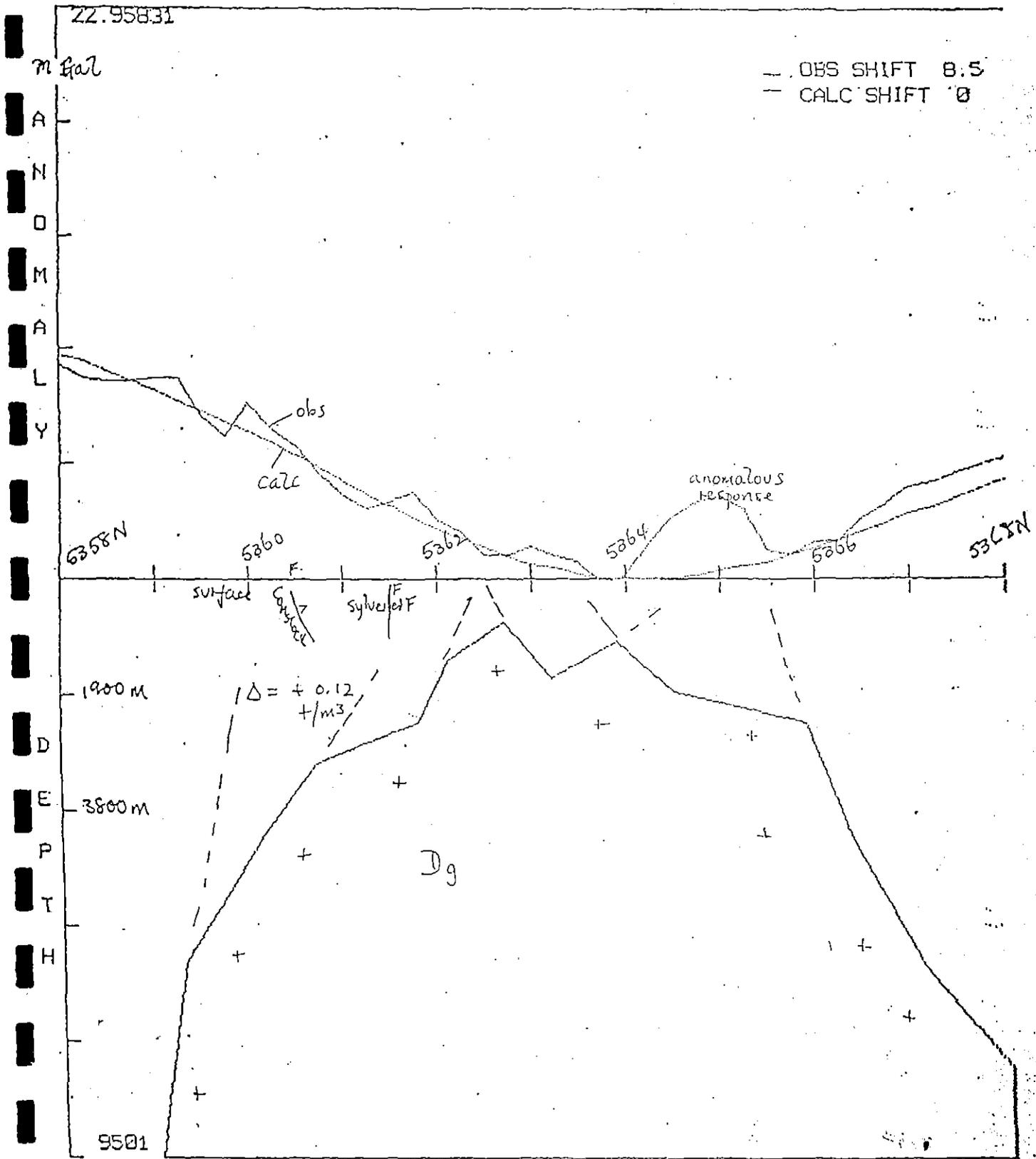


FIGURE 11
GRANITE MODEL LINE 358 000 E (1990 INTERPRETATION)

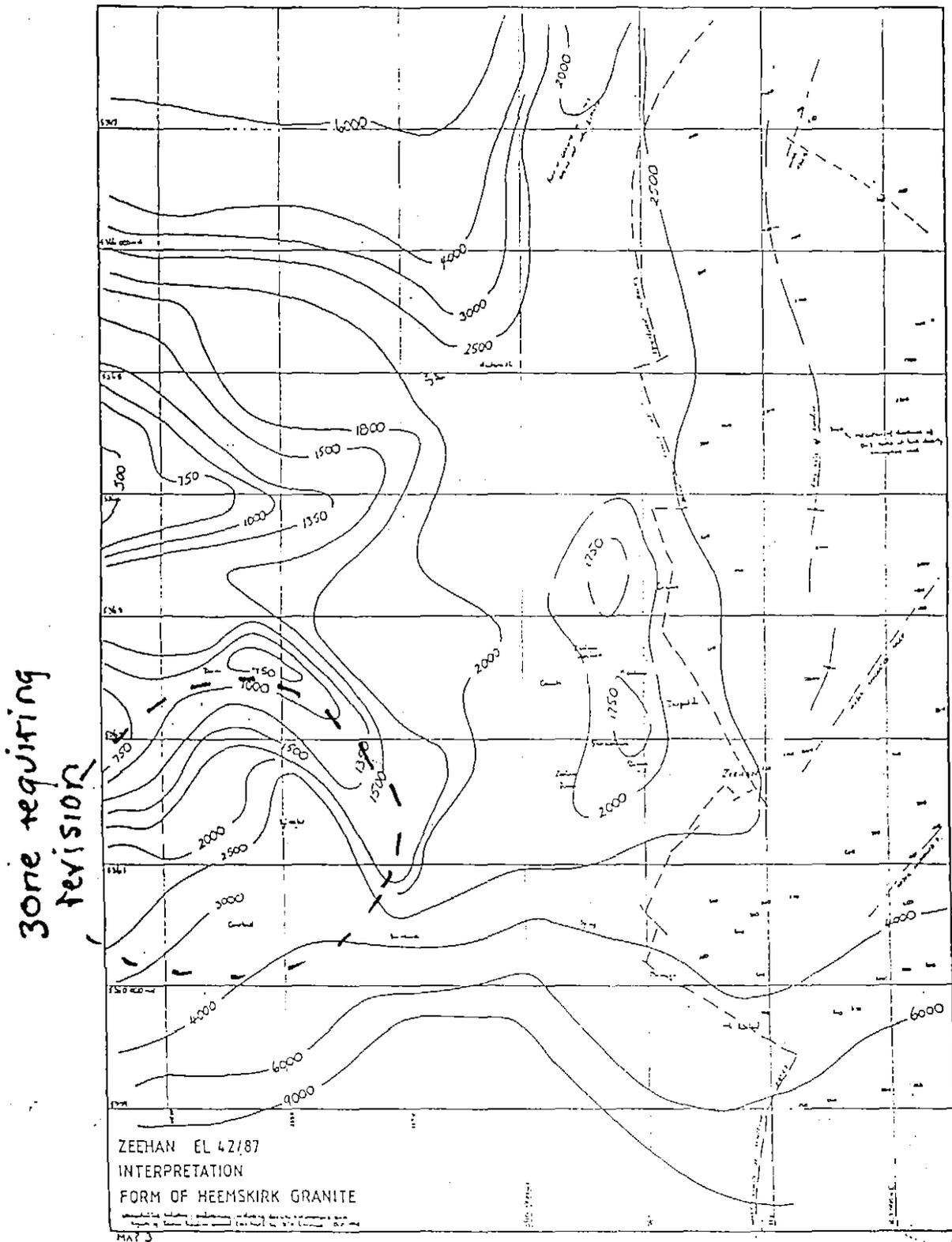


FIGURE 12
GRANITE MODEL - HEEMSKIRK GRANITE (1990 INTERPRETATION)

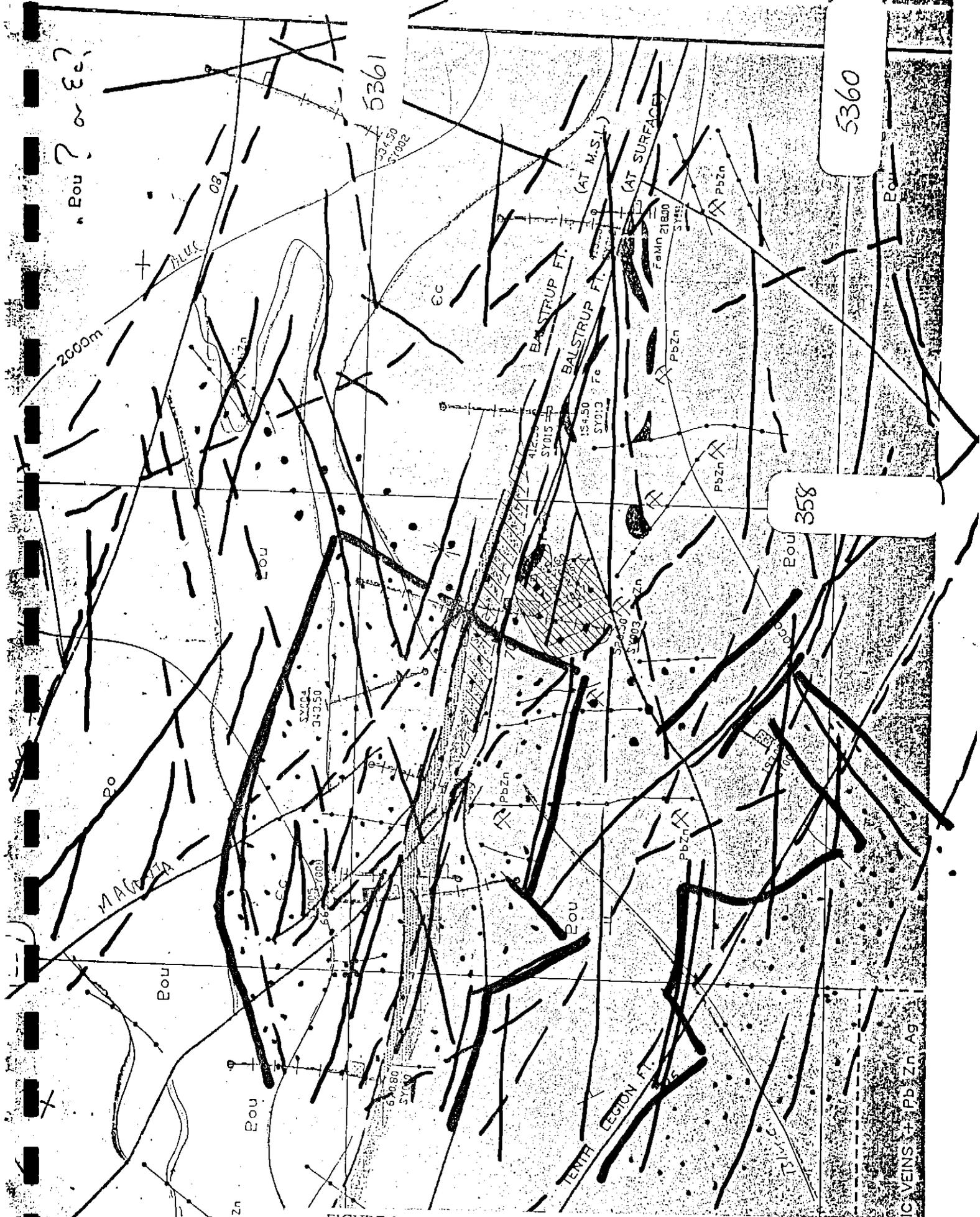


FIGURE 13
 LINEAMENTS AND STRUCTURES
 COMSTOCK LEASE AREA (BASED ON ALL DATA)

Broken lines - EM; Continuous lines - magnetics (field/derivatives)
 Heavy lines - limit of exposed/concealed mafic suite
 Small dots - mafic suites; Heavy dots - trend of Zn anomaly/limit of As anomalies

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