101

194002

INTERPRETATION REPORT
AIRBORNE MAGNETOMETER SURVEY
IN
SOUTHWEST TASMANIA

FOR

THE BROKEN HILL PROPRIETARY COMPANY, LIMITED



AERO COMMANDER

194003

203

194004

TABLE OF CONTENTS

PAGE

INTRODUCTION..... 1

SUMMARY AND CONCLUSIONS..... 4

MAGNETIC INTERPRETATION THEORY..... 7

COMPILATION..... 12

GEOPHYSICAL INTERPRETATION..... 14

SHEET 1..... 20

SHEET 2..... 29

SHEET 3..... 38

SHEET 4..... 46

BIBLIOGRAPHY..... 51

APPENDICES

APPENDIX 1..... STATISTICAL SUMMARY

APPENDIX 2..... THE EARTH'S MAGNETIC FIELD

APPENDIX 3..... THE FLUX-GATE MAGNETOMETER

APPENDIX 4..... PRELIMINARY REPORT

- - - - - - -

ILLUSTRATIONS

FIGURE	SUBJECT
1.	Aero Commander Aircraft
2.	Index Map
3.	Total Field Anomalies at Inclination 70°
4.	Magnetometer Head
5.	Correlation of Geophysical Data
6.	Quantitative Analysis of Anomaly 28
7.	Quantitative Analysis of Anomaly 31
8.	Quantitative Analysis of Anomaly 36
9.	Quantitative Analysis of Anomaly 106 and 107
10.	Quantitative Analysis of Anomaly 108

TABLES

TABLE 1..... Tabulation of Magnetic Anomalies

- - - - - - -

VOL II

Maps

1. Aeromagnetic contour map
2. Aeromagnetic survey Sheet 1
3. ✓ ✓ Sheet 2
4. ✓ ✓ Sheet 3
5. ✓ ✓ Sheet 4

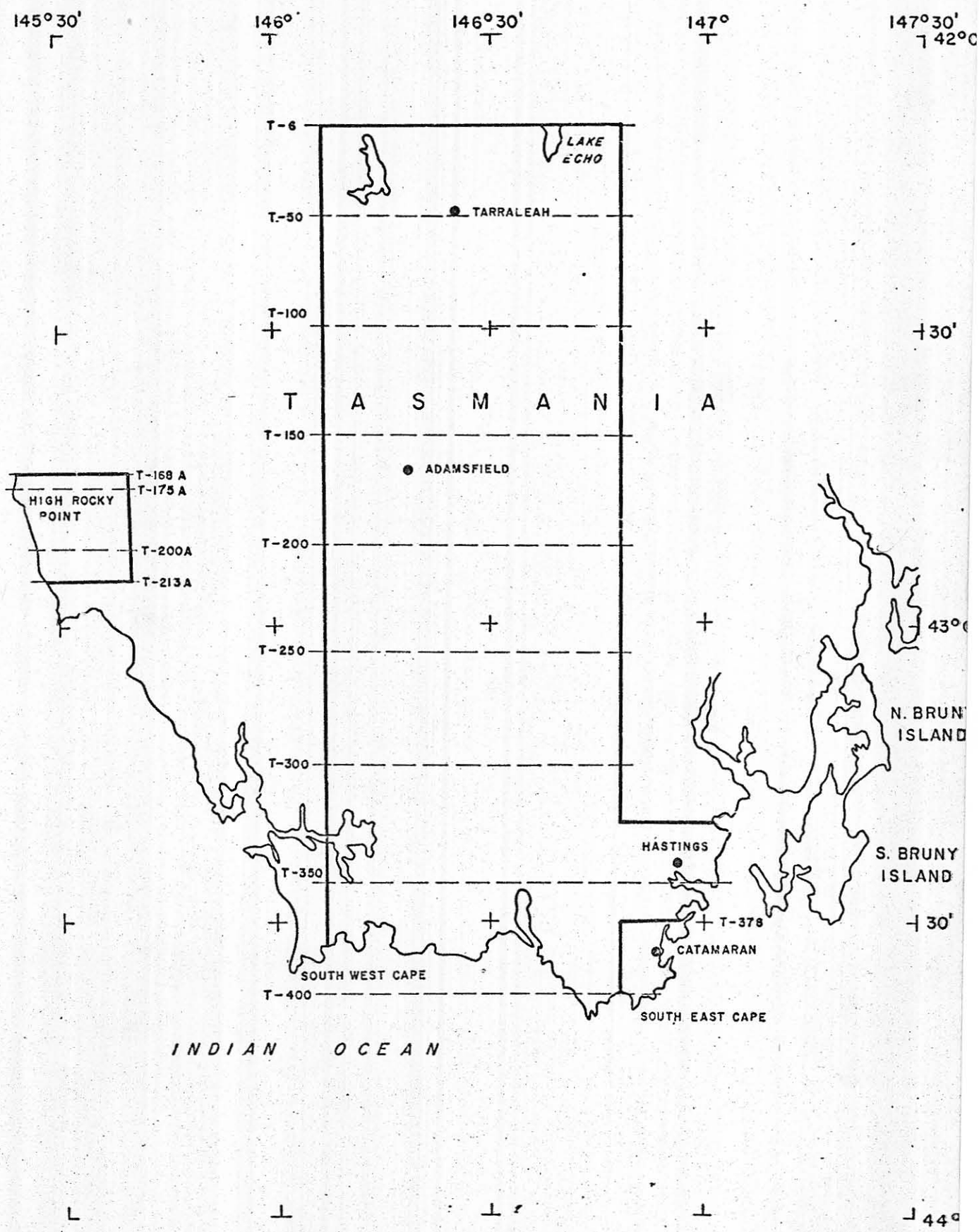

145°30'
146°
146°30'
147°
147°30'
42°
30'
T-6
T-50
T-100
T-150
T-200
T-250
T-300
T-350
T-400
LAKE ECHO
TARRALEAH
ADAMSFIELD
T A S M A N I A
T-168 A
T-175 A
HIGH ROCKY POINT
T-200A
T-213A
HASTINGS
T-378
CATAMARAN
SOUTH WEST CAPE
SOUTH EAST CAPE
N. BRUNY ISLAND
S. BRUNY ISLAND
43°
30'
44°
INDIAN OCEAN
5 cm
INDEX TO SURVEY AREA
10 0 10 20 MILES

FIGURE 2

INTRODUCTION

During the course of two seasons of operations, from February to May 1965 and February to May 1966, an airborne magnetometer survey was performed over two areas in south-western Tasmania for The Broken Hill Proprietary Company Ltd. by Aero Service Ltd. of Sydney, Australia. The report submitted herewith presents the final results of the geological interpretation of this survey.

The accompanying index map shows the locations and extent of the areas of coverage. The principal area, located in the central and southern parts of Tasmania, covers an area of about 3, 550 square miles. It lies approximately between latitudes 42° 10' S to 43°35' S and longitudes 146°05' E to 146° 50' E. A small protrusion extends eastward to the coast near the southern end of the area. The second portion of the survey is much smaller in area, measuring approximately 153 square miles. It is located 22 miles to the west of the principal area along the southwestern coast of Tasmania, lying between latitudes 42°44' S to 42°55' S in a north-south direction and between longitude 145°40' E and the coastline in an east-west direction.

The survey flight direction was east-west in both areas; the tie line flight direction was at right angles to the traverse

direction. The distance between adjacent traverses was one-quarter mile. The survey altitude was 500 feet above terrain level. The principal operational base for the survey was Hobart, Tasmania.

The aircraft used for the survey were an Aero Commander and a Dornier; both equipped with a Gulf Mark III continuously recording, total field intensity, flux-gate magnetometer. Auxiliary airborne equipment included an APN-1 Continuously Recording Radio Altimeter and an Aeropath 35 mm Aerial Camera. Diurnal effects were monitored by a Gulf Magnetic Storm Monitor. Navigation was accomplished by visual ground reference assisted by photographic recovery of the flight path.

The purpose of the aeromagnetic survey was to locate and define geologic information as it is reflected in the aeromagnetic records, and to relate such information to the location of areasfavorable for the emplacement of metalliferous ore deposits. Specific parameters pertinent to such interpretation would include the depths to anomaly sources, their strikes and dips, their apparent magnetic susceptibility contrasts, and the location of contacts, faults, intrusives and any other structural or lithologic information which may be indicated by the magnetic data.

The interpretation map is presented on the four sheets accompanying this report at a scale of 1:63,360. The isomagnetic maps are at scales of 1:23,760 and 1:63,360. Additional comments concerning the features annotated on the interpretation map are included in the section on Geophysical Interpretation.

SUMMARY AND CONCLUSIONS

The interpretation of the aeromagnetic survey in southwestern Tasmania has achieved a number of aims. The magnetic patterns observed over the area are sufficiently diagnostic to permit regional correlations of causative rock types throughout the area and, moreover, to correlate many of the patterns with the mapped geology. The latter has served to more precisely define the limits of many of the rocks present.

In addition, the survey has revealed a number of localities having magnetic characteristics which are not explained by the geological information presently available. These localities are in general, of interest from the standpoint of further investigation either from the air or on the ground, since they are indicative of geologic features heretofore unknown.

In summary, most members of Magnetic Unit A correlate well with the known geology. Unit A_3 in the southwest corner of the principal area is an exception to this. Magnetic Unit B correlates well with mapped dolerites in almost every area of its occurence, with the principal exception of the B zone on Sheet 4. Unit B_1 correlates with ultrabasic rocks. Unit B_2 has no apparent correlation, while Units B_3 and B_4 have questionable relationships to the mapped geology. These three units, therefore, should be checked further. All members of Unit C have questionable

correlations, and require additional investigation to determine their true causes. The peripheral regions of all the B and C zones, including subdivisions, are generally regarded as potential zones of mineralization. Fault zones fall into the same category. The body of the report contains comments on the relative merit of these localities.

The determination of the susceptibility and magnetite content for those anomalies selected for quantitative analysis has been based on figures which are, at best, arbitrary. Field investigation will alter these concepts and cause a revision upward or downward of the value of the selected anomalies. Since no anomaly was recorded which could conceivably constitute a magnetic iron ore deposit, the chief significance of these anomalies which are present is that they are indicative of some type of localized ferrous mineralization. Whether associated non-ferrous mineralization is present, and in sufficient amount and grade to constitute an ore, remains to be answered by further exploration.

The results of the quantitative analysis of anomalies are summarized in Table 1. The relative merit of each as regards possible associated non-ferrous mineralization is indicated by the field check priority ranking.

The nature of the objective in the case of this survey does not permit the establishment of definite conclusions con-

cerning the economic potential of this area. It is felt, however, that sufficient information has been provided herein to facilitate directed field procedures which will ultimately resolve this question.

MAGNETIC INTERPRETATION THEORY

The interpretation of airborne magnetometer data can be conveniently separated into its two main aspects: the qualitative recognition of structural and petrologic units, and the quantitative assessment of anomalies or groups of anomalies with regard to depth, dimension and susceptibility.

The rock units delineated are based on differences in the frequency, extent, shape, orientation, local magnetic relief and general intensity levels of the magnetically anomalous zones. These rock units will not, in all cases, correspond to contacts mapped in the field on the basis of observed stratigraphic criteria (that is, rock units mapped on the basis of chronologic relationships). The reason for this is that different formations having similar magnetic mineral concentration and distribution will be expressed by similar magnetic patterns, while conversely, lithologic contrasts within the same geologically mapped unit will give rise to contrasting magnetic patterns.

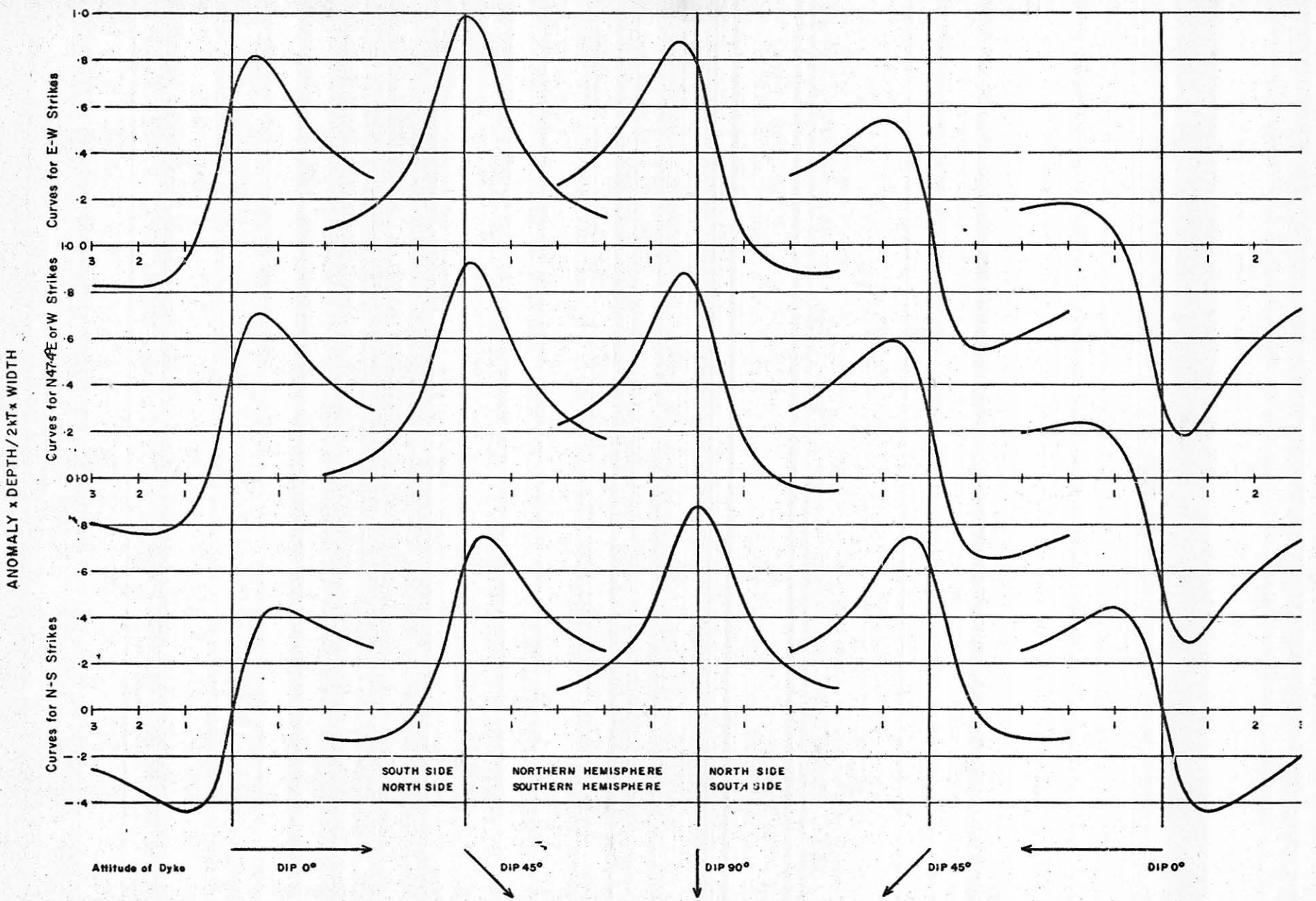
With few exceptions, the sedimentary rocks are virtually non-magnetic. The local distortions in the natural magnetic field are considered to arise primarily from the igneous and metamorphic bedrock. In general, the stronger the local magnetic relief and intensity, the greater the proportion of magnetic minerals (chiefly magnetite) that is in the rock unit influencing the magnetic pattern. By further inference, the more likely it

is to have a more basic composition.

Faults may be manifested magnetically by dislocations or disruptions in magnetic pattern or by persistent changes in pattern over long distances. Plugs, dikes and other igneous phenomena are inferred from the shape and intensities of the associated magnetic features. Recognition of such features is, to some extent, subjective in nature.

Individual anomalies are amenable to quantitative study with regard to depth, dimension, shape and susceptibility contrast. Many methods have been developed and are in use. All of these depend on the following general characteristics of the anomalous features.

1. Horizontal attentuation of the anomaly normal to strike is related to depth and width. The magnetic field, as a potential field, obeys the inverse square law (in modified form because the contributions of the sum of both positive and negative poles exert influence). With increasing distance between an idealized magnetic source and the plane of observation, the anomalous field will be present over a predictably greater horizontal area, although it will be diminished in amplitude. In addition to this, the non-neutralized positive and negative poles are



TOTAL FIELD MAGNETIC ANOMALIES CAUSED BY A THIN SHEET AT INCLINATION 70°

19703

located at the edge surfaces of the magnetic source, so that the width of the anomaly is also a function of the width of the source.

2. Profile shape (relationships of the peak, trough, and inflection points) is related to attitude, as it affects the angular relationship between the anomaly source and the direction of the external field.

3. The gross susceptibility of an anomaly source may be estimated from the amplitude of the anomaly. By definition, magnetic susceptibility is the ration between the induced and applied field strength.

The most versatile magnetic model in quantitative interpretation is that of the tabular body. The general case equation for the induced magnetic expression of a tabular body of infinite length and depth is:

$$T = K \left[\sin (21\text{-}D) \quad \emptyset + \cos \quad (21\text{-}D) \quad \text{Ln} \frac{R_2}{R_1} \right]$$

where:

K = function of susceptability contrast, intensity of the earth's field, and the angular relationships between the attitude of the body and the magnetic inclination.

I = projection of the magnetic inclination in the plane normal to the strike of the body.

D = dip of tabular body.

ϕ = angle subtended at the point of observation by upper corners of the tabular body.

R_1, R_2 = distances from the point of observation to the upper corners of the tabular body.

The computed susceptibility contrast of the source of an anomaly is a function of the proportional amplitude of the anomaly in the earth's total magnetic field, the length, width, depth and strike of the source, and the inclination of the earth's field. The higher the figure for the calculated bulk susceptibility, the greater the concentration of magnetic minerals, and by inference the more basic its composition.

The general relationship for calculating the bulk susceptibility contrast of a rock body is:

$$\Delta k = \frac{\Delta T}{T\ (2 \sin \gamma)\quad (2\phi)}$$

where:

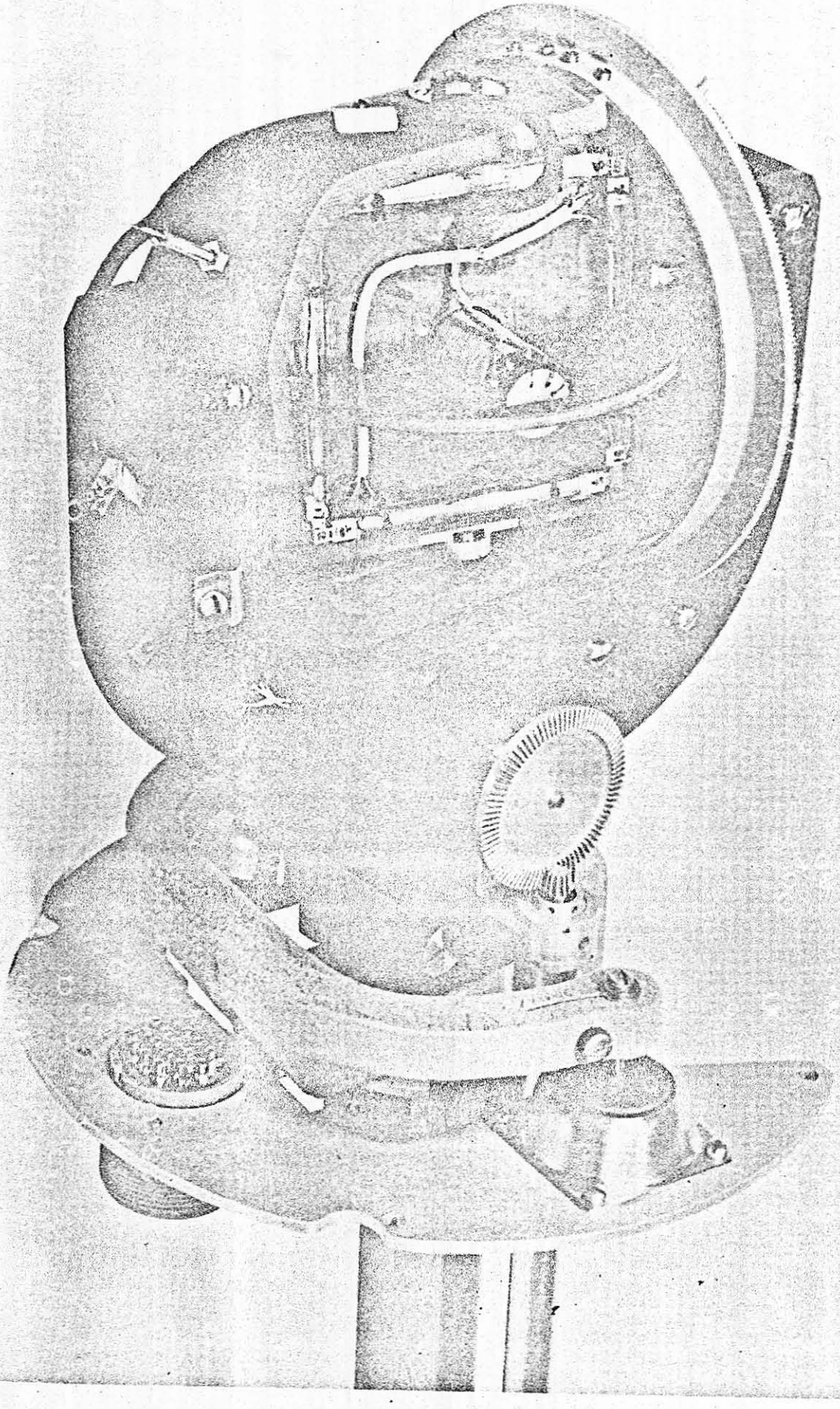
Δk = susceptibility contrast, in c.g.s. units.

ΔT = observed anomaly amplitude, in gammas.

γ = arc tangent of the distance between the source of the anomaly and the magnetometer, divided by half the length of the body.

ϕ = arc tangent of the distance between the source of the anomaly, divided by half the width of the body, expressed in radian measure.

T = general intensity of the earth's magnetic field.



MAGNETOMETER HEAD

The dimensions, depth, and susceptibility of the sources of the intense anomalies have been calculated, for those features that approximate two-dimensional conditions, by curve matching against idealized tabular body standards (see Fig. 2). Consideration of the basic equation will show that the susceptibility contrast is critically dependent on the assumed width, the susceptibility contrast will be greater than that calculated and conversely if the true width is greater than the assumed width, the susceptibility contrast will be lower than that calculated. In relating susceptibility contrast to percentage of magnetite by volume in excess of magnetite in the country rock, a figure of 0.3 c.g.s. units has been used.

All methods of quantitative study require assumptions of homogeneity and idealized shape. Inasmuch as rock bodies cannot be expected to satisfy these assumptions except under the most unusual of circumstances, quantitative conclusions should be regarded as estimates of magnitude rather than precise depths.

COMPILATION PROCEDURE

The initial steps in compilation are generally taken in the field, at the survey site. The individual records are inspected at the termination of each flight to be certain that all instruments were operating properly, and that there was no undue diurnal activity or magnetic storm activity. The strip film is developed and the flight path is recovered on the navigational flight strips by image-matching comparison with the strip film for the overland portions of the survey to be certain that each traverse was flown over the prescribed course. The altimeter record is inspected to be certain that the correct altitude was maintained.

At the home office, the individual traverses are recovered in detail on the base map. Each fiducial point is located and plotted on the base map by image-match comparison with the strip film, and then these fiducial points are transferred to a transparent overlay of the base map, called the manuscript.

The points of intersection of the base lines and the traverses are noted on the base line and traverse magnetometer records in their proper fiducial positions. The differences between the raw base line and traverse values, at each point of intersection, are plotted, and the graphic least squares solution of the differences along each base line determines the true relative magnetic value at each intersection point.

Using these values, datum lines are drawn on each traverse from base line intersection.

The values on the magnetic records, measured from the base line, are then transferred to the manuscripts by use of an instrument known as a transcriber, which embodies the principle of a variable pantograph. Following this, the map sheets are contoured on transparent sheets overlying the manuscript.

As a final step, each sheet is subjected to exhaustive, independent inspection to detect and correct any mistakes.

CORRELATION
OF
AIRBORNE GEOPHYSICAL RECORDS



FLIGHT MAP



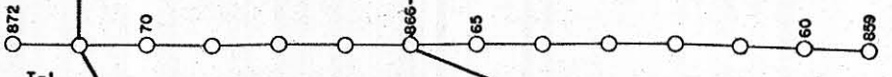
STRIP CAMERA - PRINT



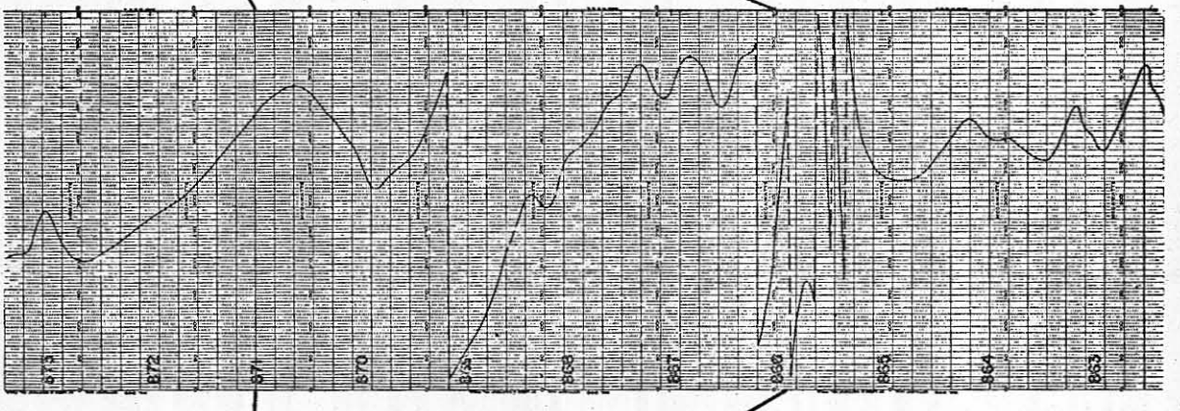
PHOTO MOSAIC



TOPOGRAPHIC MAP



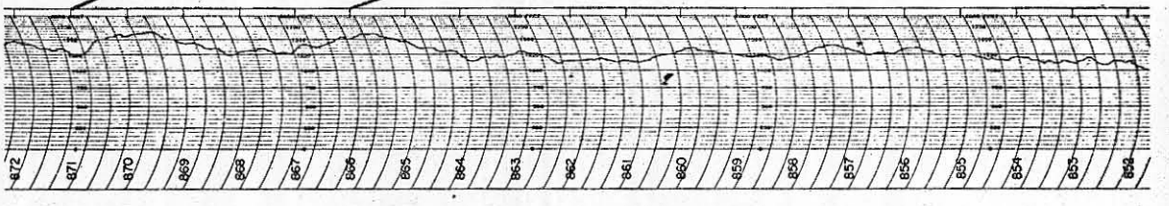
MANUSCRIPT



MAGNETIC RECORD



MANUSCRIPT



RADIO ALTIMETER RECORD

GEOPHYSICAL INTERPRETATION

Interpretation techniques in the case of aeromagnetic surveys for metallic ores are both direct and indirect in nature. High grade concentrations of magnetic iron ores, particularly if they occur near the surface, are manifested directly by very high amplitude magnetic anomalies which are generally diagnostic. Concentrations of non-ferrous ores, in contrast, may show only a moderate to weak magnetic response since the extent to which they are magnetic is dependent on the amount of associated magnetite present. Because of this, it is frequently difficult to distinguish between ore zones and areas of basic igneous rocks by the direct examination of individual magnetic anomalies. Therefore, in order to make such differentiation, an indirect approach, deductive in nature, which utilizes as much information on the areal geology as is possible to obtain and which is based on adherence to geological principles of ore genesis and mode of occurrence, is required. Thus, anomalous magnetic activity in the vicinity of interpreted fault and contact zones, particularly if such are supported by geological mapping, constitute prime areas for the recommending of follow-up investigation on the ground. Similarly, isolated localities of anomalous magnetics which have no apparent

relation to mapped geological units offer additional possibilities as locations of economic mineralization.

Taken collectively, these basic concepts of interpretation comprise the overall philosophy applied to the analysis of the present aeromagnetic survey. In general, the interpretation has proceeded from the general to the specific, and is both qualitative and quantitative in nature. The qualitative inspection of the data has permitted a three-fold regional division of magnetic units based on anomalous magnetic character. The basic units are designated as A, B and C, corresponding to rock units of relatively acidic, relatively basic and generally intermediate mineralogical composition, respectively (i.e., with regard to the relative proportions of silicate vs. ferromagnesian minerals in igneous and metomorphic rocks which, in turn, determine their magnetic properties). Discrete members of these units in areas of particular significance are identified by subscripts (A_1, B_2, etc.). The areal distribution of the units is shown on the accompanying maps. Their significance and relation to the mapped geology is discussed later in this section.

Evidences of faulting, such as linear trends and disruptions in the magnetic pattern, are also identified by qualitative methods. Relatively strong indications of faulting, or where

the magnetic evidence is substantiated by mapped geology, have been delineated as probable faults or fault zones. This has also been done in the case of faults mapped geologically which are not reflected in the magnetics. Relatively weaker evidences are shown as magnetic lineaments, which may or may not correspond to actual zones of faulting.

One further aspect of the qualitative analysis pertains to the presence of magnetic anomalies indicative of concentrated magnetic iron ores. The inspection of the aeromagnetic data indicates that there are probably no such occurrences present in either of the two areas surveyed during the course of this program. By reference to magnetic theory, the magnetic expression of a magnetite ore body approaching economic grade in this region of the world should be an anomaly with an amplitude of at least 5,000 to 6,000 gamma. For example, the aeromagnetic anomaly recorded over the Savage River magnetite deposit in northwestern Tasmania has an amplitude of 14,000 gamma. In contrast, the highest amplitude of any anomaly recorded in the present survey is 2,900 gamma (Anomaly 33).

Being cognizant of the fact that any ore bodies present are, therefore, probably non-ferrous in nature and can not be detected directly by the magnetometer, the interpretation has attempted to locate areas favorable for mineral concentrations on the basis

of geological evidence, either interpreted from the magnetics alone or in association with geological mapping. A number of such areas have been identified, and are discussed in the following subsections. The absence of any known mines or deposits in the areas surveyed considerably increases the difficulty of such identification. When such evidence is present, it is often possible to establish correlations from known to unknown localities, based on such parameters as diagnostic structural controls, structural attitude, affinity for a specific rock type, amount of associated disseminated magnetite, and other distinguishing features amenable to analysis by magnetic methods.

Lacking such information in the case of this survey, a system of relative associations based on the quantitative analysis of most of the more significant individual anomalies or anomalous zones has been devised. By use of this system, various parameters of the sources of anomalies can be readily compared from one locality to another, permitting relative correlations to be made. For example, there are a number of instances where anomalies occurring in various parts of the area are very similar in shape, areal extent, amplitude, source depth and magnetic susceptibility. Although all may be recommended for further investigation on the ground, negative results from actual checks at only one or two occurrences will probably suffice for all.

Of course, should evidence of ore formation be encountered, it would be advisable to study every occurrence.

The results of the quantitative analyses are summarized in Table 1, which lists a total of 115 anomalies. Inasmuch as the numbering of anomalies is arbitary in part, in order to assure adequate reference for the location of specific features discussed in the text, not all the anomalies listed have been analyzed. Those analyzed, furthermore, vary as to the detail of analysis. For example, the approximate areal dimensions of the source, its strike, its depth, and its bulk susceptibility contrast are computed for all of the anomalies analyzed, but calculations of dip are restricted to only a few of the more isolated and diagnostic features. The principal reason for this variance is that the time required for such comprehensive analyses is incompatible with the practical limitations of interpretation.

Besides presenting the analyzed parameters of the anomalous sources, Table 1 also indicates their suggested relative priority for field checking. The system used is numerical in nature, where 1 indicates first order priority, 2 indicates second order, and so forth.

The results and significance of the qualitative and quantitative aspects of the interpretation are discussed on the following pages. The discussion is keyed to the four sheets comprising the

1:63,360 scale composite aeromagnetic maps on which the interpretation has been superimposed. Sheets 1 through 3 provide coverage of the principal area, while Sheet 4 covers the smaller coastal area to the west.

Sheet 1

Composite Sheet 1 covers the northern one-third of the principal survey area in central Tasmania, and is a composite of sheets 1 through 12 of the 1:23,760 scale aeromagnetic compilation series.

The mapped geology covering the area of this sheet, obtained from published maps and those supplied by the client, show the greater part of the sheet to be covered by outcropping Jurassic dolerites. These rocks are most prevalent in the northeastern one-half of the sheet where they occur as nearly flat lying sills underlain by sediments of Triassic and Permian age. The dolerites are overlain by non-marine sediments of Tertiary age in major stream valleys, and are intruded by basalts of Tertiary age occurring as flows and volcanic necks. The southwestern one-half of the sheet is characterized by a series of Paleozoic sediments, notably limestone, mudstone and conglomerate, occuring in a structural trough trending northwest to southeast. These sediments are flanked to the west and southwest by a complex of Pre-Cambrian metamorphosed sediments, which include quartzites, quartz schists and dolomites. The Paleozoic sediments are overlain, to the northwest, by a thick series of fluvioglacial deposits occurring in a structural graben which roughly corresponds to the axis of the major trough. In the extreme northwest corner of the sheet, a local exposure of dolerite, underlain by

Permian and Triassic sediments which are in turn underlain by the Pre-Cambrian metamorphics, occurs as an outlier of the main dolerite zone to the east. In the south-western portion of the sheet, a local outcrop of Cambrian ultrabasics is noted on the maps, completely enclosed, and intruded into, the Pre-Cambrian metamorphic complex. A number of faults are mapped in this region, principally in the southwestern half of the sheet. Two sets of faulting are in evidence, one trending northwest-southeast and the other generally trending northeast-southwest.

The interpretation of the aeromagnetic patterns displayed on this sheet agrees very well, in general, with the mapped geology. Three general magnetic patterns, designated as A, B and C, are in evidence. Discrete members of these units in areas of particular significance are identified by subscripts (B_1, B_2, etc.).

Magnetic Unit A, characterized by very broad, low amplitude magnetic anomalies, dominates the southwestern half of the sheet. It is interpreted as the magnetic expression of near-surface rocks of acidic composition, and correlates well in most localities with the mapped outcrops of Pre-Cambrian metamorphics and Paleozoic sediments.

Two possible subdivisions of this unit, designated A_1 and A_2, are shown on the interpretation map. Unit A_1, in the northwestern quarter of the sheet, locates the position of the graben structure filled with fluvioglacial materials. Since there is

no discernible variation in the magnetic pattern over this area from that occurring over the areas of outcropping Pre-Cambrian metamorphics and Paleozoic sediments, this zone is not separated by a definite boundary. Unit A_2, located in the northwestern corner of this sheet, is somewhat similar to members of Unit C but displays a more subdued magnetic character. This unit corresponds well to a mapped zone of Triassic sediments extending southward from Laughing Jack Lagoon between two areas mapped as outcropping dolerite. It is therefore, probably more closely related to Unit C than to Unit A, since it is apparently caused by local erosion of the dolerite cover, with local remnants of magnetic material giving rise to an intermediate magnetic character.

Aside from these broader areas of variation from the normal aspect of Unit A, there are four local zones in the northwestern part of the sheet (Anomalies 4, 5, 6 and 7) which warrant some attention by virtue of their isolated positions. These anomalies are all relatively sharp, positive magnetic features with low amplitudes. The most intense, Anomaly 6, has an amplitude of 260 gamma. Quantitative analysis of this anomaly indicates its source, which should be near the surface, to have an apparent susceptibility contrast of 0.01 cgs units, indicative of a relative increase in magnetite content of approximately 3% by

volume. The sources of the other three features are similar in nature, but occur at a somewhat greater depth. It is apparent that these features are caused by small, isolated bodies of basic rock, but their origin is questionable. It is probable that they are related to the dolerites, either as erosional remnants or chill zone phenomena. There is a possibility that some of them, particularly Anomaly 6, may be caused by local ultrabasic intrusions related to Zone B_1 to the south. The latter possibility should be checked if investigations of the B_1 zones themselves give favorable results. One further possibility is that they are directly related to the Pre-Cambrian metamorphics. These four anomalies were suggested for field checking in the preliminary report included here as an Appendix. Time did not permit the field checking at that time, but is seems essential to establish their cause. If they are related to the metamorphics then they represent areas requiring further exploration, perhaps with electromagnetic techniques.

Magnetic Unit B is characterized by areas of very strong magnetic response with high frequency, high amplitude anomalies. It is interpreted as the magnetic expression of the dolerite sills. They occur over rocks containing a high percentage of ferromagnesian minerals, of which magnetite is commonly an abundant secondary constituent. There is good correspondence with

the known geology in almost every area of this unit's occurrence. It is most extensively expressed in the northeastern part of the area over exposed dolerite sills and basalt flows. The local outlier of dolerite in the northwestern part of the sheet is also well delineated.

Most areas of Unit B, therefore, are interpreted as the magnetic expression of either near-surface dolerite or basalt. The extremely complex character of the anomalies of this unit is due primarily to a highly developed system of faulting which occurs throughout the region. Two major directions of faulting, northeast and northwest, are in evidence, and the most distinct faults are shown on the map. Others, less clearly defined, are undoubtedly present. The trend directions of these interpreted faults agree well with those of the mapped faults to the west, lending support to the interpretation.

One further area of B-type anomalies is that located in the southwestern part of the sheet. This zone, designated B_1, is comprised of a series of very intense magnetic anomalies which combine to produce an elongate, northeast-southwest trending, positive magnetic feature having a sub-regional effect on the magnetic pattern. It is interpreted as the magnetic expression of ultrabasics. The zone is bound on its western flank by a mapped fault, and is offset in two places by transverse

933

194034

ANOMALY 28

TRAVERSE 117

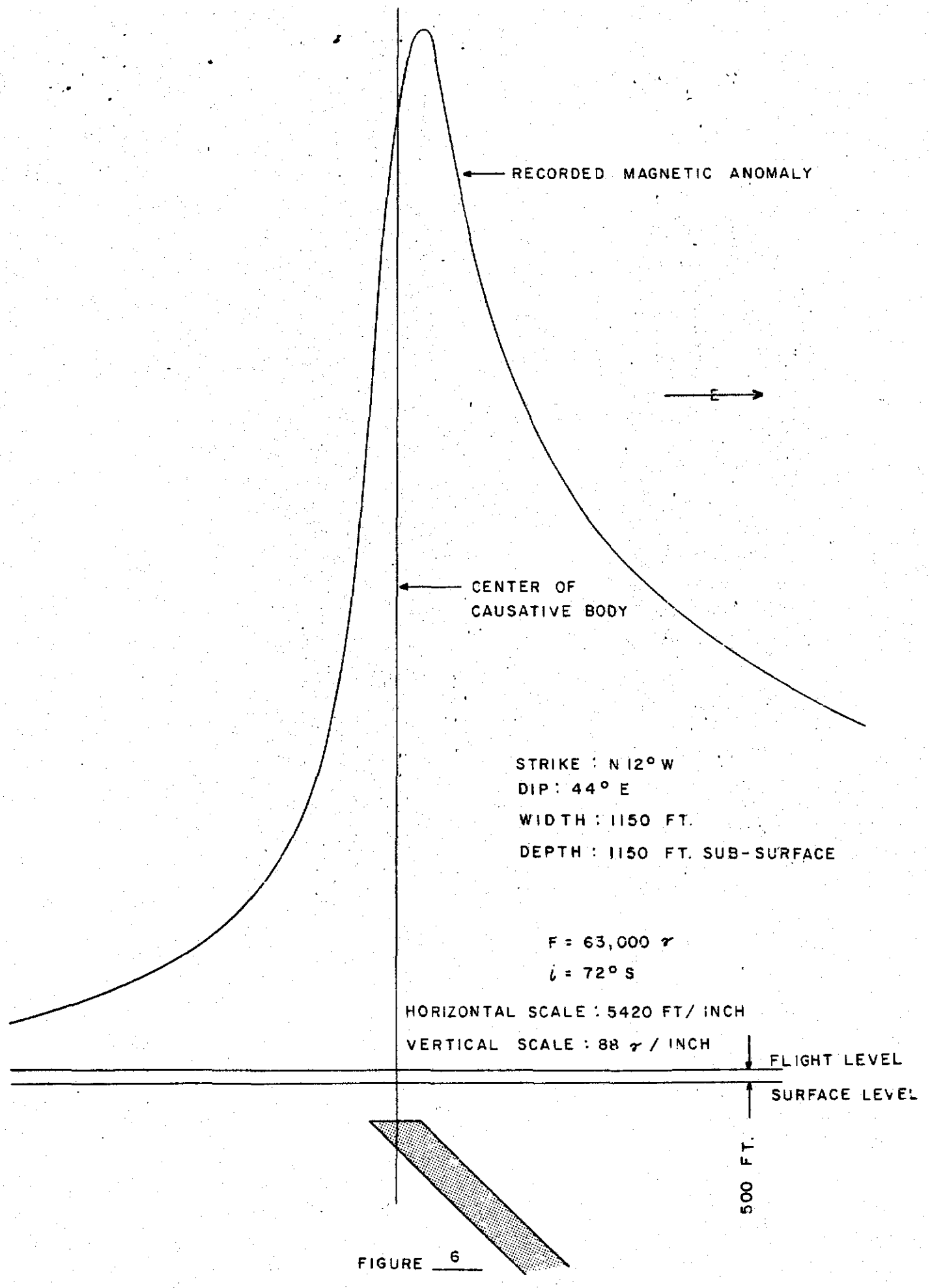


FIGURE 6

faults interpreted from the magnetics. The southern segment of this zone corresponds in location to the mapped exposure of Cambrian ultrabasic rock. The magnetics have clearly shown that this unit has extension to the north and northeast and, further, that the north end is offset to the west by faulting. This zone, associated as it is with complex faulting, constitutes a favorable locality for the presence of base-metal mineralization. It is recommended, therefore, that detailed ground or airborne surveys, incorporating electromagnetic measurements, be conducted along a series of traverses across this feature. A detailed quantitative analysis of Anomaly 28, which is located on the northern limb of this zone, reveals that the source of the anomaly, that is, the main mass of ultrabasic rock, occurs as a dike-like body at a depth of approximately 1150 feet below the surface which is dipping approximately 44° to the east, and is approximately 1150 feet in width. The fact that this portion of the zone apparently does not outcrop explains its absence on available geological maps. Additional, semi-detailed quantitative analyses on the four principal anomalies comprising this zone, which have assumed similar, arbitrary parameters of shape and depth of individual sources, show the magnetic character of this zone to be fairly regular throughout its extent (See Table 1). The apparent disparity evidenced by Anomaly 29, where the cal-

35

194036

ANOMALY 31 TRAVERSE 118

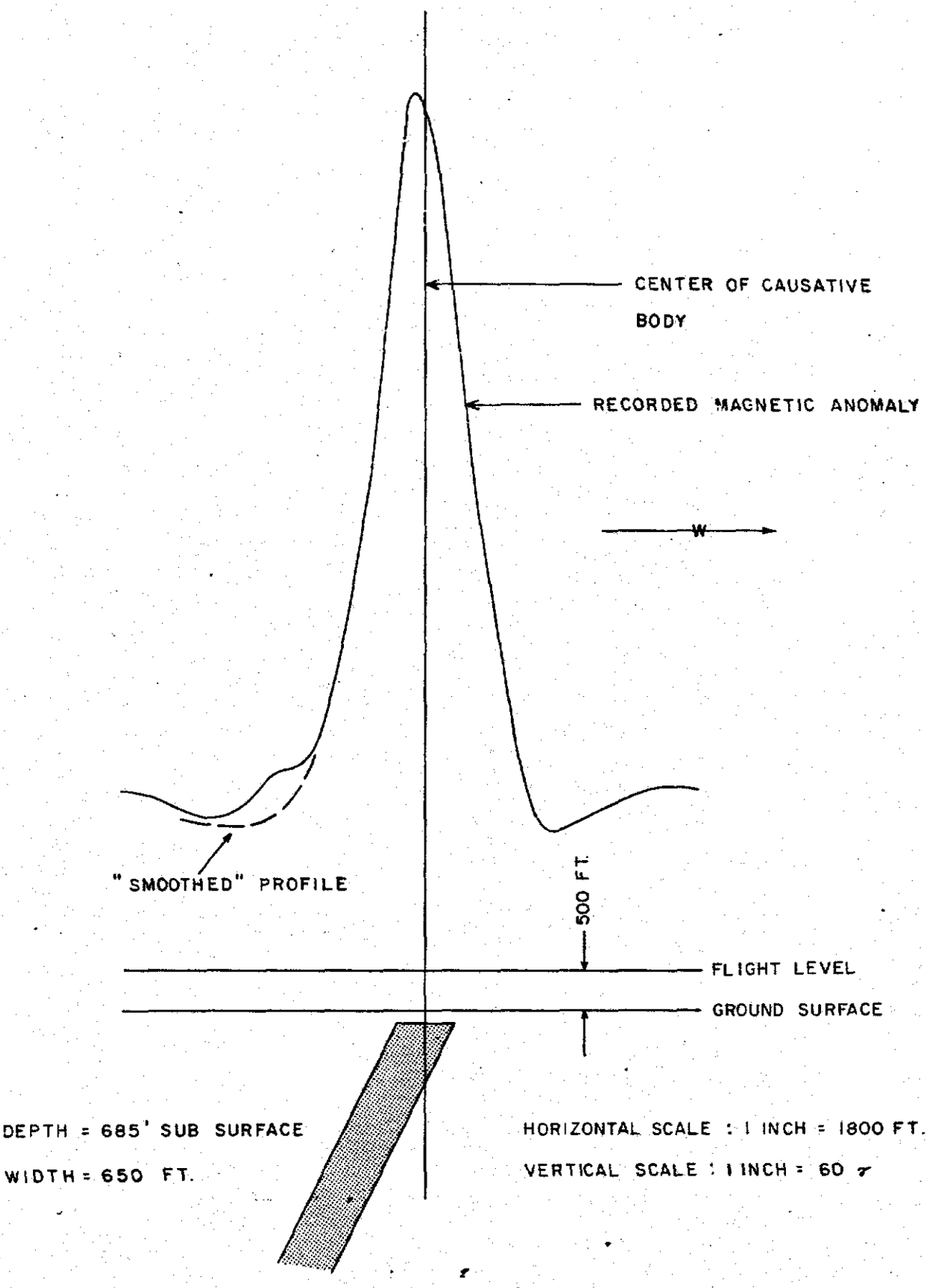


FIGURE 7

5 cm

culated susceptibility contrast is about double that of the other three anomalies, is probably due in part of assuming an overly narrow source width.

Quantitative analyses were also performed on a number of other significant anomalies present on the sheet. Anomalies 4 to 7 have been discussed above. The remaining features, anomalies 1 to 3, 8 to 26, and 31 to 34, are all located within zones of Magnetic Unit B. The results of these analyses are summarized in Table 1. It is interesting to note that the most intense anomalies recorded anywhere in the survey area are included in this magnetic unit (for instance, Anomaly 33, the highest recorded amplitude). In general, however, none of these are strikingly outstanding from the standpoint of probable magnetite content of source. Furthermore, since past prospecting in the dolerite zones has proved to be fruitless, none of these anomalies have been recommended as first order localities for field checking in spite of their relatively high intensities. It is suggested however, that three or four of the most intense anomalies, such as Anomalies 23, 26, 32 and 33, be ground checked to verify their non-economic significance if nothing more. Additional spot checks along the margins of Unit B are also recommended, particularly in the vicinity of relatively more intense anomalies such as Anomalies 8, 9 and 31, to determine the

194038

ANOMALY 36

TRAVERSE ~~168~~ 165?

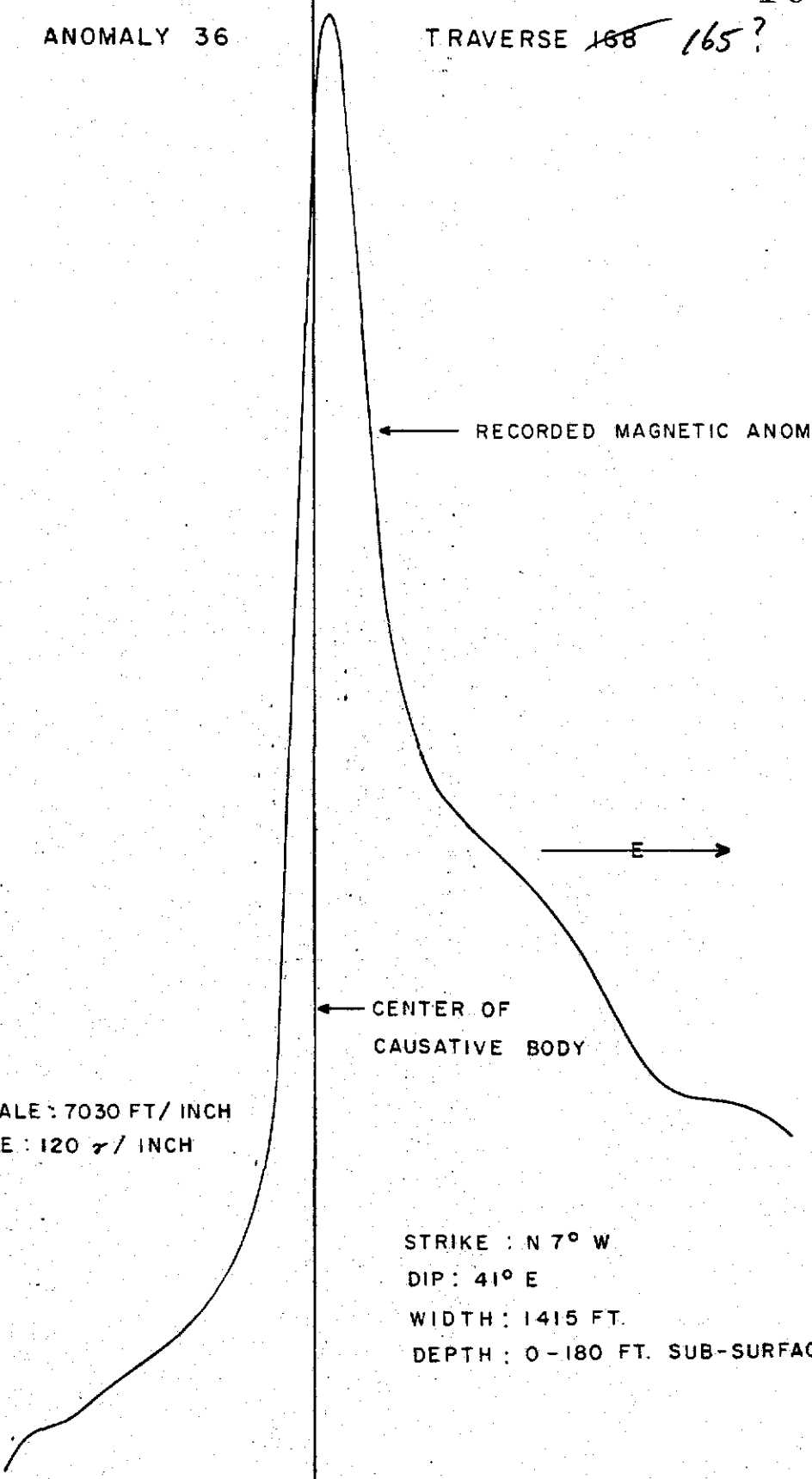


FIGURE 8

5 cm

possibility of mineralization along the contacts of the dolerite sills. The high incidence of faulting throughout the zone constitutes further localities for field checking, to determine the possibilities of associated mineralization. Concurrent studies to determine the cause of the abrupt differences in anomalous intensity between Unit B and Units C and C_1 are also recommended. Additional comments concerning the latter units are presented below.

The third general magnetic pattern present on this sheet, Magnetic Unit C, is intimately associated with Unit B in the eastern, northeastern, and extreme northwestern portions of the sheet. The magnetic character of this unit is intermediate between that of Unit A and Unit B, and is suggestive of rocks having a composition which is more or less evenly distributed between acidic and basic mineral constituents, such as diorite. Inasmuch as there is no discrete geologic unit reported from this area which approximates this condition, it is suggested that such areas may indicate either of two circumstances.

First, that they are the reflection of contact metamorphic phenomena along the edges of the dolerite sheets. In this case, such zones would be of primary interest from an economic standpoint as zones of possible metallic mineralization. The areas annotated C_1 appear to be most attributable to this theory by virtue of their location along the margins of the principal dolerite zones.

The second possibility is that Unit C reflects local thinning, perhaps erosional, of the dolerite or basalt sills which overlie weakly magnetic sediments (as witnessed by Unit A). If this latter possibility proves to be the case, it detracts from the economic potential of this unit. The latter hypothesis is more particularly exemplified by the isolated "inliers" of this unit in the eastern portions of the sheet (designated simply C) which are commonly associated with mapped exposures of Triassic sandstones. This theory also appears to be more applicable to the members of Unit C in the northwestern part of the sheet. Since there appears to be a distinct possibility that Unit C differs from C_1, it is suggested that the two be field checked independently.

Sheet 2

Composite Sheet 2 covers the central portion of the principal survey area, and is a composite of sheets 13 through 24 of the 1:23,760 scale compilation series.

The mapped geology shows the major portion of the area covered by this sheet to be surfaced by rocks of Pre-Cambrian age, principally quartzite and quartz schist. The north-central portion of the sheet exhibits a series of outcropping Paleozoic sediments which define the southern limits of the structural trough extending southward from Composite Sheet 1. The approximate location of the axis of this trough is shown on the interpretation map. Progressing eastward from this axis, the outcrops show a regular progression through sediments of Permian and Triassic age, and finally to Jurassic dolerites, which are the predominant outcrop along the eastern edge of the sheet. Local outcrops of dolerite, assumed to be erosional remnants, occur as resistant topographic highs at various localities in the central portion of the sheet.

To the west of the major Paleozoic syncline an extensive, elongate, north-south trending zone of ultrabasic rocks of Cambrian age is in evidence. It is bounded on its western

margin by a major fault. Additional faulting, principally in a north-south to northwest-southeast direction, is mapped in the southwest portion of the sheet in areas of outcropping Pre-Cambrian metamorphics.

The aeromagnetic patterns exhibited on this sheet are generally analogous to those on Composite Sheet 1 to the north. The predominant pattern is that of Magnetic Unit A, characterized by very broad, gentle, low amplitude magnetic anomalies. This unit is generally interpreted as the magnetic expression of the Pre-Cambrian complex and the Paleozoic sediments, as in the case of Sheet 1. There is some evidence, however, to indicate that this entire region may be underlain by a very large intrusion of roughly granitic composition and of batholithic proportions. Evidence for this is shown in the magnetic contours which, when viewed from a regional aspect, show the entire southwestern one-third of this sheet and the northwestern one-third of Composite Sheet 3 to the south to be dominated by a single, huge, positive magnetic anomaly whose peak is approximately located at Anomaly 73. Inasmuch as the depth of this pluton is undoubtedly very great, its effects on possible mineralization near the surface is problematic. However, its possible presence lends interest

to the economic possibilities of this area, since it could well have provided a source of mineralizing solutions for any portion of the region.

A number of local magnetic features within this broad unit have been annotated on the interpretation map and warrant some consideration. In general, these are all small, isolated, low amplitude anomalies which, although perhaps not directly indicative of mineralization, are related to structural features which in turn may have associated mineralization. Anomalies 69, 70, and 71 for example, delineate the northward interpreted extension of a fault zone mapped on the ground. Anomaly 74 is similarly attributed to fault zone phenomena and is possibly indicative of minor mineralization. The broad positive trend centered on Anomaly 64 in the east-central part of the sheet is interpreted as a possible northwest-trending fault. Because of rather weak evidence, this feature is not delineated as such, but is shown as a magnetic lineament. Anomaly 68 near the center of sheet is an abrupt, low amplitude positive anomaly. Directly north of this feature are two more weak, positive closures. Taken collectively, these features describe an elongate, north-south trending body which is interpreted to be a dike of relatively basic rock. Anomaly 72, a small, low amplitude anomaly in the

west-center of the sheet, corresponds well with the reported location of a small anticlinal structure in the Pre-Cambrian complex. This is, again, a rather intriguing location for further exploration.

The highly anomalous region along the eastern side of the sheet is seen to be the southward extension of Unit B from Sheet 1. Again, members of this unit show good positional correspondence with mapped areas of Jurassic dolerites, and are interpreted to be their magnetic expression. The four smaller, isolated members of Unit B in the northeastern, central and southeastern parts of the sheet can also be correlated with mapped dolerites. Faulting, principally along northeasterly trends, is in evidence throughout the zones of Unit B. The small zone of Unit B in the center of the sheet enclosing Anomaly 67 is transected by two intersecting faults interpreted from the magnetics. Anomaly 67 itself, therefore, could constitute a favorable location for mineralization and is recommended for early field investigation.

A fifth isolated segment of Unit B is shown in the extreme northwestern part of the sheet. Unlike the other areas, this zone does not correspond to mapped dolerites. Only Pre-Cambrian metamorphics are shown to be present at the surface. It is,

nonetheless, tentatively attributed to the presence of dolerite, since the magnetic pattern, even though incompletely mapped, is most similar to that observed over dolerite in other portions of the area. The extremely linear eastern margin of this zone is indicative of faulting, and is interpreted as such.

The large zone designated as Unit B_1 in the north-center of the sheet is analogous in magnetic character to Unit B_1 on Sheet 1 to the north. It is interpreted as the magnetic expression of the zone of Cambrian ultrabasic rock shown on the geologic maps of this area. The major north-south trending fault which has been mapped along the western side of this zone is generally supported by the magnetics. It appears, however, that the zone is offset in its center by a transverse fault trending northwest-southeast. Furthermore, the southern end of the zone is shown to have an extension to the west by the magnetic pattern. The overall appearance of this zone and that of Zone B_1 to the northwest on Sheet 1 suggests that these units are genetically related. It appears possible, furthermore, that they may actually constitute a single unit which has been offset by major faulting along a northwest-southeast trace. Quantitative analysis of Anomaly 36 on this sheet, when compared with

that of Anomaly 28, lends support to this premise. Inasmuch as this relationship would have involved a very considerable amount of lateral displacement, the possible trace of this fault is shown only as a magnetic lineament on the interpretation map.

Several other anomalous localities are present in the general region of Zone B_1. These consist of the small anomalies, 41 and 42, and the larger anomalous zones to the east and west of Zone B_1, which are designated B_2. Anomalies 41 and 42 are very small local features, measuring 140 gamma and 180 gamma, respectively, in amplitude. They are interpreted as small off-shoots or apophyses of the main ultrabasic rock mass. The B_2 zones, however, are sufficiently dissimilar from either Zone B_1 or the zones labeled as B to warrant special consideration.

The B_2 zone located to the west of Zone B_1 consists generally of a broad, complex positive anomaly (Anomaly 40) which is completely encircled by a series of small negative anomalies. The total amplitude of the anomaly is approximately 130 gamma. The two related zones of B_2 located to the east of Zone B_1 consist of a series of somewhat higher amplitude positive anomalies, again generally encircled by low amplitude

negatives. The anomalies comprising these zones (Anomalies 43, 44, 45, 46, 47 and 48) are relatively broad features which are indicative of rocks of basic composition occurring at some depth below the surface. The relative locations of these anomalies suggest, further, that these zones are highly faulted. Three of the more evident faults are shown on the map, although possibly others are present.

The geological maps in this region do not show any rock unit which could logically correspond to the zones of Unit B_2. Although outcrops of Jurassic dolerite are shown to be present to the south of Anomaly 40 and, again, west of Anomaly 44, the magnetic evidence neither confirms their presence in these areas, nor suggests that they are the cause of the B_2 zones. Rather, it is suggested that Unit B_2 reflects the presence of ultrabasic intrusive rocks, probably bearing a genetic relationship to Unit B_1, but occurring at a somewhat greater depth of burial.

As in the case of Unit B_1 on Sheet 1, these zones of ultrabasic rocks are likely to have associated metallic mineralization. It is recommended, therefore, that field check procedures similar to those described previously be conducted

over the areas of Unit B_1 and B_2 to determine the presence of such mineralization. Anomalies 41 and 42, by virtue of their sharp, local expression, should also be checked in conjunction with the larger zones.

Areas of Unit C present on this sheet are confined to the eastern edge of the survey area. The two C zones in the south-east corner are similar in magnetic character to the C zones on Sheet 1. They are interpreted as local thinning or absence of the dolerite and consequent exposure of the underlying sediments, in spite of the fact that they are mapped as dolerite.

Unit C_2 in the east-center of the sheet is tentatively attributed to a different cause by virtue of a number of interesting peculiarities. Although the overall aspect of this zone is quite similar to that shown by members of Unit C in general, its boundaries are definitively marked by a persistent series of small but intense magnetic anomalies. Anomalies 53, 55, 57 and 58 exemplify this phenomenon. Two possible explanations for this pattern present themselves. The overall aspect of the zone is strongly indicative of a small intrusive body, possibly dioritic in composition. The strong local anomalies along its edge would thus be attributable to

marginal mineralization, with good possibilities for the presence of metallic ores.

The second explanation is that this zone is the expression of a very thin, highly eroded, or possibly sediment covered, sheet of dolerite with a low dip to the east, in which case the marginal anomalies would constitute a magnetic edge effort produced by the exposed side of the sheet. Should this be the case, it would seriously detract from the economic potential of this zone. An early field investigation of this unit, particularly over its margins at the anomalies cited above, is recommended.

Quantitative analyses of the principal anomalies comprising Unit C_2 are summarized in Table 1, as are the other individual anomalies annotated on this sheet. The significance of Anomalies 36 to 48, 53 to 58, 64, and 67 to 74 have been discussed above. Of the remaining features, Anomalies 35, 49 to 52, 59 to 62, and 66 are all attributed to local very low grade concentrations of magnetite within doleritic rocks. Anomaly 63 and its extensions to the northwest and southeast, in the southeast part of the sheet, is attributed to local mineralization along a major fault zone. Anomaly 65 is interpreted to have a similar cause. Both of these features warrant further investigation in the field, although they are of secondary priority.

Sheet 3

Composite Sheet 3 covers the southern one-third of the principal survey area, and is a composite of Sheets 25 through 36 of the 1:23,760 scale aeromagnetic compilation series.

The geology of the area of Sheet 3 is quite similar to that of Sheet 2 to the north. The western half of the sheet is characterized by outcropping metamorphosed sediments of Pre-Cambrian age, notably quartzites and quartz schists which are overlain in many areas by Quaternary alluvium. Graphite schists occur in a number of localities along the coastal margin in this area, and a small exposure of granite is located at the northern end of Cox Bight in the extreme southwestern portion of the sheet. The eastern half of the sheet is dominated by outcropping Jurassic dolerite underlain by Permian and Triassic sediments. Lower Paleozoic sediments are in evidence in the extreme southern portion of the sheet, and a small area of ultrabasic rocks has been reported from a locality on Surprise Creek just north of the coast at Surprise Bay. The mapped structure in the area consists of a number of faults varying in trend from north-south to northwest-southeast.

The predominant magnetic pattern of the sheet is that of broad, low amplitude magnetic anomalies, on which are super-

imposed a scattering of local, higher intensity features. The major portion of the sheet, therefore, is assigned to Magnetic Unit A, corresponding to mapped exposures of Pre-Cambrian metamorphics and Paleozoic sediments. Two slightly more magnetic members of Unit A, in the extreme western portion of the sheet and in the south center (designated A_3), are shown as possible subdivisions. The magnetic pattern in these areas, consisting of low amplitude anomalies having moderate frequency, is suggestive of a rock having a slightly more basic composition than than underlying Unit A, and may arise from a local, non-outcropping intrusion of material which would be of a composition approximating granodiorite. Anomalies 76, 77, 78, 79 and 83 suggest the presence of minor mineralization along the contacts of these units.

Areas of Magnetic Unit B and three significant members thereof are found in various parts of the sheet. The general expression of Unit B, interpreted to be caused by dolerites, is found only in the northeast and extreme southeast corners of the sheet. The areas of their occurrence correspond to mapped dolerite outcrops.

Unit B_1 in the extreme northwestern corner of the sheet does not correspond to any particular rock unit shown on the geologic maps. It is attributed here to the presence of an ultra-basic intrusive which is generally located below the surface,

although its northern end, near anomaly 75, may outcrop. Quantitative analysis of this anomaly shows the source to have a susceptibility contrast in the general range of basic rocks. Two faults have been mapped which approximately straddle the feature at both ends. A small, local fault interpreted from the magnetics offsets the southern end of the body. Due to the possibility of mineralization associated with this zone, a field check of the area is recommended, particularly if favorable results are encountered with respect to the other zones of B_1 to the north.

Two additional zones assigned to Unit B_1, also interpreted as caused by ultrabasic rocks, are located in the southeastern corner of the sheet. The anomalies comprising these zones, Anomalies 97, 98 and 99, are similar to those typically found in Unit B, but are somewhat broader in areal extent. Furthermore, these zones correspond well in location with reported outcrops of ultrabasics. The relative positions of Anomalies 97 and 98 suggest the presence of lateral faulting.

The southwestern corner of the sheet contains three areas of anomalous magnetic activity which have been designated as Unit B_3. The magnetic pattern of this unit has similarities to that of both Units B and B_2, and is generally interpreted to be caused by near-surface, relatively basic rocks. Inasmuch as these zones correlate moderately well with mapped outcrops

of Pre-Cambrian (?) graphite schist, they are tentatively attributed to be the magnetic reflection of these rocks, which have extremely variable magnetic characteristics. Quantitative analyses of the principal anomalies within these zones (Anomalies 80, 81 and 82) show their sources to be rock bodies of basic composition. Anomaly 81 was the only feature actually analyzed, since Anomaly 80 is incompletely mapped and Anomaly 82 is severly distorted. Should these zones be underlain by graphite schist, they are likely to have little or no economic potential. If, on the other hand, they reflect the presence of basic intrusives, their potential is greatly enhanced.

Unit B4, located in the extreme east-central portion of the sheet, covers an area mapped as Jurassic dolerites and Tertiary basalts, intermingled with local exposures of Permian and Triassic sediments. From the geologic evidence, it would appear that this region should produce the magnetic pattern of Unit B. The magnetic pattern present, however, does not correspond to anything observed in other portions of the survey area. The anomalies comprising this zone are similar in amplitude to those of Unit B, but are of lower frequency and are much more elongated. Moreover, they all have a definite northeasterly trend, in contrast to the diverse orientations of anomalies in Unit B. The overall aspect of these features

is that of a series of dike-like bodies rather than continuous flat-lying sheets. For lack of better evidence, however, the zone is generally attributed to the presence of dolerite. Local disruptions in the enlongated anomalous trends indicate transverse faulting in two principal directions in the area. Because of the questionable cause of this unit, a field check of the locality is recommended. The presence of basic dikes rather than dolerite sheets could lend importance to this area from the standpoint of mineralization.

Three members of Magnetic Unit C are present in the eastern portion of the sheet. The zones of Unit C in the extreme southeastern portion occur in an area mapped as Jurassic dolerite. They are attributed to causes analogous to thoseproducing other C zones to the north; that is, local thinning and/or severe erosion of the dolerite cover.

Units C_2 and C_3, near the center of the sheet, appear to bear a genetic relationship with each other. The western margins of these zones are clearly defined by two series of abrupt, local anomalies. Disruptions in the trends of these anomalies are indicative of faulting. The main body of Zone C_2 is more magnetic than that of Zone C_3, and compares favorably with the zone of C_2 mapped on Sheet 2. As in the case of the latter, there are two possible ways in which the cause of this feature

may be suitably explained. In other words, Unit C_2 may be caused by a local intrusive body, with associated marginal mineralization evidenced by Anomalies 90, 91, 92 and others along the delineated boundary. The other alternative is an eroded or buried dolerite sill with an abrupt outcropping edge. The same considerations, with respect to ground follow-up, would apply to this zone as to Unit C_2 on Sheet 2.

The presence of Unit C_3, which has no counterpart on Sheet 2, tends to give precedence to the latter theory (a sill), since it is difficult to explain its very similar pattern in terms of contact metamorphic or metasomatic phenomena. The alternative to this, still assuming that C_2 reflects an intrusive body, is that C_3 is another intrusive, but this seems highly unlikely.

If, in contrast, C_2 is caused by a sill, then C_3 would be another sill at a lower stratigraphic level whose edge outcrops further to the west. The mapped geology, which merely shows dolerite throughout the region, neither supports nor conflicts with any of the above suppositions. Due to the absence on Sheet 2 of a zone complementary to Unit C_3 on this sheet, this area of C_2 and that to the north may well have dissimilar causes, and they should be investigated independently.

Unit C_4, located in the southwestern corner of the sheet, displays a magnetic pattern which is not appreciably

different from the various other members of Unit C in the survey area. The locality where it occurs is mapped as Pre-Cambrian quartz schist. A small exposure of Cambrian granite is mapped just beyond the northwestern corner of the unit, at the northern end of Cox Bight. The location of this outcrop with respect to Unit C_4 suggests that the granite extends southeastward below the surface, and that Unit C_4 is the magnetic reflection of the presence of this body at depth. This possibility leads to further speculation concerning the adjacent anomalous regions of Unit B_3. If a granitic body of substantial size is present here, the B_3 zones may reflect the presence of associated mineralized areas. It is suggested that additional field investigations be performed in this region to resolve these possibilities.

The significance of most of the individual anomalies annotated on this sheet has been described in the foregoing. Quantitative analyses of suitable features are summarized in Table 1. Of the remaining anomalies, Anomalies 85, 86, 95, 96 and 100 to 103 all occur in zones generally attributed to the presence of dolerite. Some of the more intense of these features should be checked on the ground, particularly those in Unit B_4 for the reasons stated above.

Anomaly 84 in the center of the sheet is a broad, low amplitude feature which lends evidence to the location of a major

north-south fault.

Anomalies 93 and 94, just east of this feature, are very sharp, local anomalies. They are interpreted as local mineralized zones. Anomaly 93 is particularly interesting by virtue of its location near the contact of a Paleozoic limestone with dolerite. Both anomalies warrant early investigation on the ground, despite their apparent low content of magnetic materials.

Sheet 4

Composite Sheet 4 provides coverage of the small coastal area to the west of the principal area of survey. It is a composite of Sheets 37 through 40 of the 1:23,760 scale aeromagnetic compilation series. The region surrounding this area and separating it from the principal area has been mapped by previous aeromagnetic surveys which have not, however, been interpreted. Unfortunately, this coverage was not available for reference with the present survey interpretation, making regional correlations of magnetic features difficult. An interpretation of this data, at an early date, would be extremely useful both from the standpoint of tying together the present survey areas, as well as gaining a more comprehensive appraisal of the geological and mineralogical aspects of this region as a whole.

The mapped geology of the area shows a succession of outcropping formations ranging from Pre-Cambrian to Ordovician in age, centered on a major synclinal structure which trends north-south through the center of the area (the Mt. Osmund Syncline). These rocks are intruded by granite of Devonian age, which outcrops in the eastern part of the area. The entire complex is overlain by Tertiary non-marine sediments (Macquarie Harbour formation) in the north-central part of the area. Most of the area has experienced structural deformation, with the principal faults

and folds trending north-south. Other mapped expressions of faulting have northeasterly and northwesterly trends.

The magnetic response observed over the area is divisible into three general zones on the basis of anomalous magnetic character. The eastern two-thirds of the area is characterized by broad, low amplitude magnetic anomalies having diverse orientations. The rocks underlying this region are weakly magnetic and are relatively acidic in overall composition. Magnetic Unit A is comprised of very low magnetic gradients, and is attributed to the Pre-Cambrian metamorphic complex underlying this general region. Unit A_3, covering most of the southern and eastern portions of the sheet, contains anomalies of somewhat higher amplitude and frequency. Inasmuch as it is roughly centered on the outcrop of Devonian granite, this unit is tentatively interpreted as delineating the subsurface areal extent of this intrusive body. The western boundary of this unit, in the center of the sheet, roughly corresponds, perhaps coincidentally, with the mapped contact between exposed Cambrian and Ordovician sediments. The relatively high amplitude anomalies present in this zone, Anomalies 110 to 115 for example, are associated with fault zones either mapped geologically or interpreted from the magnetics, or both. They are attributed to minor mineralization or deformation of the rocks accompanying the faulting.

Two incompletely mapped zones of significantly higher magnetic intensity are evidenced in the extreme south-center of the area. They are caused by rocks of basic composition, and appear to be similar to areas underlain by ultrabasics in the principal survey area to the east. They are tentatively assigned to Unit B_2 in accordance with such similarities.

The western side of the area is divided into two zones of anomalous magnetic character. The easternmost, Unit B, is comprised of high amplitude, high frequency anomalies with varying orientations locally, although having a general overall trend in a north-south direction. The causes of these anomalies are interpreted to be rocks which are relatively basic in composition. The anomalies along the eastern side of the zone are of higher amplitude than those farther west, suggesting that the zone may comprise a sill-like body with a westerly dip. Quantitative analyses of the principal eastern anomalies (Anomalies 104, 105, 106 and 108) show their sources to be dike-like bodies with relatively steep dips to the west. Rather than true dikes being present, however, what is actually being indicated may be the eastern edge of the aforementioned sill, which would fit the magnetic data equally as well. Inasmuch as no evidence of a rock type such as that which must be present in Unit B is shown on the geological maps of the area, the true significance of this zone must await the results of ground investigation.

194061

ANOMALIES 106 & 107

TRAVERSE 185A

HORIZONTAL SCALE = 4325 FT/INCH

VERTICAL SCALE = 60?/INCH

RECORDED MAGNETIC ANOMALIES

CENTERS OF CAUSATIVE BODIES

SMOOTHED PROFILES

E

500 FT

FLIGHT LEVE

SURFACE LEVE

ANOMALY 106

ANOMALY 107

DEPTH = 500 FT. SUB-SURFACE
WIDTH = 1570 FT.
STRIKE = N18° W
DIP = 52° W

DEPTH = SURFAC

WIDTH = 1012
STRIKE = N5°
DIP = 90° (VERTICAL

FIGURE 3

5 cm

The somewhat detached north-south trending series of anomalies culminating at Anomaly 107, which lies to the east of the main zone of Unit B, is interpreted as the expression of a very linear, north-south fault which has been intruded by basic material. Analysis of Anomaly 107 shows the source to be a narrow tabular body with a vertical dip.

The somewhat distorted pattern of anomalies in Unit B is attributed to a system of faults with a general northwest-southeast trend. The more evident of these interpreted faults are shown on the interpretation map, although others are undoubtedly present.

Unit C, occuring only in the extreme western portion of the area, is intermediate in magnetic character between Unit B and the members of Unit A present to the east. The interpretation as to the rocks underlying this unit is ambiguous, as in the case of the C zones in the main area to the east. The character of the anomalies suggests that the zone may reflect the presence of an intrusive body of intermediate composition. The alternative is that it reflects the presence, at depth, of the same rock unit that is present near the surface in Unit B. From the magnetic evidence along, it appears likely that these zones are due to a recurrence of the dolerite sills present further to the east. However, since detailed geological mapping is not presently available for this area, both Unit C and Unit B should be visited on the ground before a definitive judgement of the economic potential

63

ANOMALY 108

TRAVERSE 205 A

194063

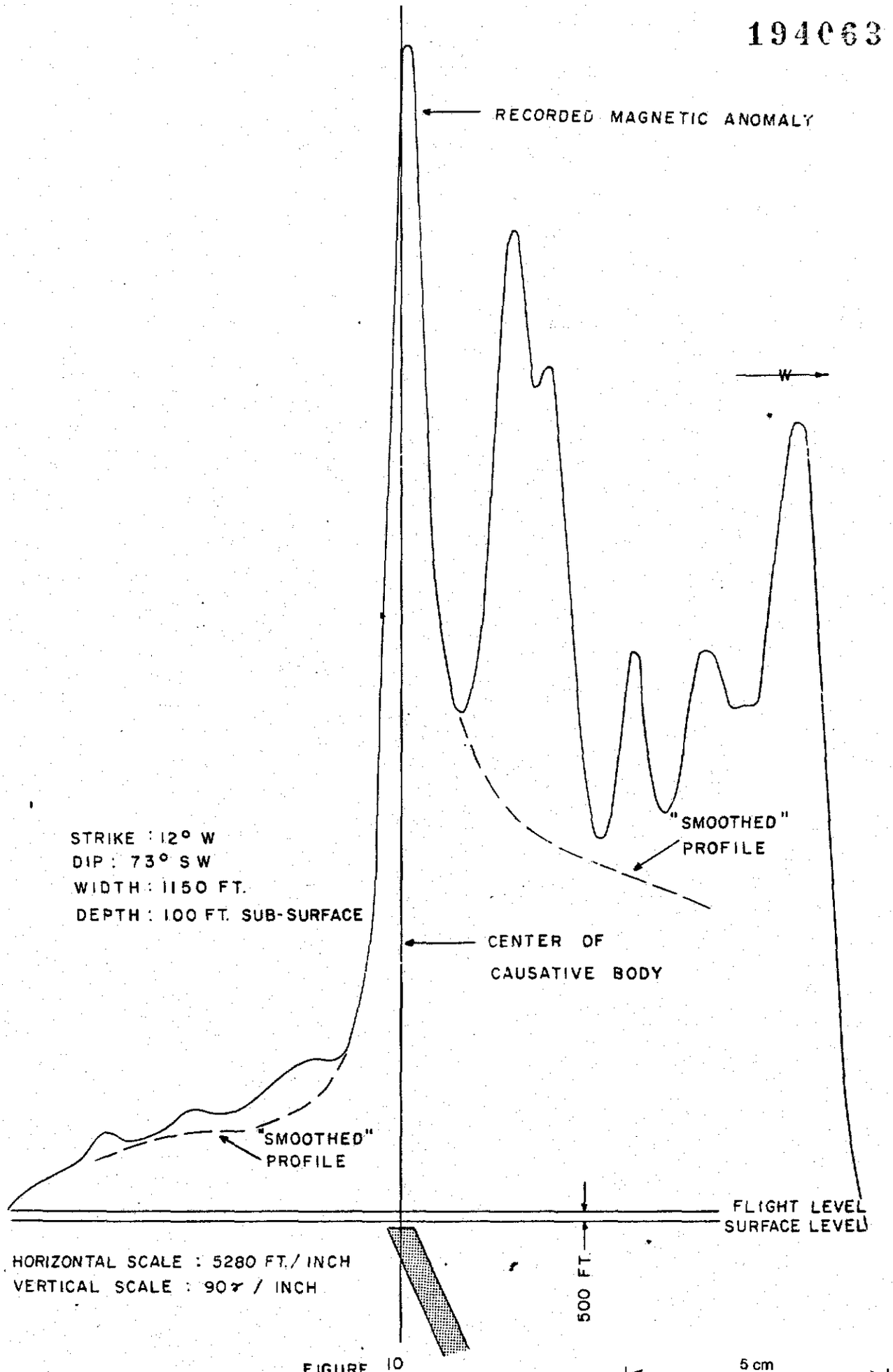


FIGURE 10

194064

of the region is made. Such field work should incorporate visits to the localities of the more intense anomalies, particularly Anomalies 104, 105 and 108. The location of these features along an interpreted contact zone suggests good possibilities for the presence of non-ferrous metallic mineralization, despite their relatively low computed susceptibility contrasts.

Respectfully submitted,

Charles E. Curtis,
Geophysicist

Ronald R. Hartman,
Chief Geophysicist

December 20, 1966
Philadelphia, Pa.

BIBLIOGRAPHY

1. Agocs, W. B. 1955 — "Line Spacing Effect and Determination of Optimum Spacing Illustrated by Marmora, Ontario, Magnetic Anomaly' Geophysics, Vol. XX, No. 4

2. Baker, G., 1959 — "Rodingite in Nickeliferous Serpentinite, Near Beacousfield, Northern Tasmania", Journal of the Geological Society of Australia, Vol. 6, pt. I, pps. 21-37.

3. Blissett, A. H. 1962 — "Geological Survey Explanatory Report: Zeehan", One Mile Geological Map Series, Tasmania Department of Mines.

4. Campana, B. and King, D., 1963 — "Paleozoic Tectonism, Sedimentation, and Mineralization in West Tasmania", Journal Geological Society of Austral Vol. 10.

5. Campana, B., Dickinson, S. B., King, D., and Matheson, R. S., 1958 — "The Mineralized Rift Valleys of Tasmania", F. L. Stillwell Memorial Volume, Australian Institute of Mining and Metallurgy, Melbourne.

6. Cook, K. L., 1950 — "Quantitative Interpretation of Vertical Magnetic Anomalies over Vein Geophysics, Vol. 15.

7. Corbett, K. D. — "Geological Map of the Gordon Area, Tasmania", Gordon Investigation Geological One Inch Series, Scale 1:63,360.

8. _____ — "Geological Map of the Pillinger Area, Tasmania", King Franklin Investigatic Geological One Inch Series, Scale 1:63,360.

9. _____ — "Geological Map of the Rocky Point Area, Tasmania", Gordon Investigation Geological One Inch Series, Scale 1:63,360.

10. Department of Natural Development, 1953 — "Mineral Deposits (map)", Atlas of Australian Resources. Commonwealth Bureau of Mineral Resources, Geology and Geophysics, Scale 1:6,000,000.

11. Dobrin, M. B., 1951 — Introduction to Geophysical Prospecting, McGraw-Hill; New York, N. Y.

12. Fairbridge, R. W., 1949 — "Geology of the Country Around Waddamana, Central Tasmania (map)", Pap. Roy. Soc. Tasmania, Scale 1:10,000.

13. Gardener, J. E. F., 1963 — Oonah Area Geophysical Survey: Zeehan Tasmania, Aust. Dept. of Nat. Resourc

14. Hall, W. D. M., 1966 — Reconnaissance Geological Map of the Adamsfield Area, Tasmania, Scale 1:63,360.

15. _____ — Reconnaissance Geological Map of the North Bathurst Harbor Area, Tasmania, Scale 1:63,360.

16. _____ — Reconnaissance Geological Map of the St. Clair Area, Tasmania; Scale 1:63,360.

17. _____ — Reconnaissance Geological Map of the Southwest Cape and Spring River Areas, Tasmania; Scale 1:63,360.

18. _____ — Reconnaissance Geological Map of the South Coast Area, Tasmania; Scale 1:63,360.

19. Hartman, R. R. Milner, J. E. and Reford, M. S. 1963 — Interpretation Report on Airborne Magnetometer Survey of the Surat-Bowe Area, Eastern Australia, Bureau of Mineral Resources Petroleum Subsidy Branch Open File Report.

20. Henderson, R. G. and Zeitz, I., 1958 — Magnetic-Doublet Theory in the Analysis of Total Intensity Anomalies U. S. Geological Survey Bulletin 105 Washington, D. C.

21. Hills, L., 1916 — Tungsten and Molybdenum, Part I, Northeastern and Northern Tasmania, Geological Survey Mineral Resources No. 1, Tasmania Department of Mines.

22. _____ — Tungsten and Molybdenum, Part II, Middlesex and Mt. Claude Districts, Tasmania, G.S.M.R. No. 1, Tasmania Department of Mines.

23. Hughes, T. D. and Symons, J. E., 1961 — Geological Map of Tasmania, Geological Survey, Department of Mines, Tasmania Scale 1:506,880.

24. Hutchinson, R. D. 1958 — Magnetic Analysis by Logarithmic Curves, Geophysics, Vol. XXIII, No. 4

25. McAndrew, J. (ed.), 1965 — "Geology of Tasmania" Geology of Australian Ore Deposits, Vol. 1, Eighth Commonwealth Metallurgical and Mining Congress; Melbourne, Aust. pps. 464-527.

26. Nettleton, L. L., 1940 — Geophysical Prospecting for Oil, McGraw-Hill; New York, N. Y.

27. Nye, P. B., 1923 — The Silver-Lead Deposits of the Waratah District, Geological Survey Bull. No. 33, Tasmania Department of Mines.

28. Peters, L. J., 1949 — "The Direct Approach to Magnetic Interpretation and Its Practical Application", Geophysics, Vol XIV, No. 3.

29. Prider, R. T., 1948 — "Geology of the Country Around Tarraleah, Tasmania (map)", Pap. Roy. Soc. Tasmania, Scale 1:84,000.

30. Reford, M. S., 1960 — Airborne Magnetometer Surveys for Petroleum Exploration, Aero Service Corporation; Philadelphia, Pa.

31. Reid, A. F., 1918 — The North Pieman and Huskisson and Sterling Valley Mining Field, Tasmania, Geol. Survey Bull. No. 28, Tasmania Department of Mines

32. _____ 1923 — The Mount Bischoff Tin Field, Geol. Surv. Bull. No. 34, Tasmania Department of Mines.

33. Runcorn, S. K., 1960 — "Methods and Techniques in Geophysics" Vol. I, Interscience; New York, N. Y.

34. Solomon, M. — "Geological Map of the Darwin Area, Tasmania", Exploration Department, Mt. Lyell Mining Co., Ltd.

35. Tasmania Department of Mines, 1957 — Technical Reports No. 1, 1956

36. _____ 1958 — Technical Reports No. 2, 1957

37. _____ 1959 — Technical Reports No. 3, 1958

38. _____ 1960 — Technical Reports No. 4, 1959

39. _____ 1961 — Technical Reports No. 5, 1960

40. _____ 1962 — Technical Reports No. 6, 1961

41. _____ 1963 — Technical Reports No. 7, 1962

42. Taylor, B. L. 1955 — Asbestos in Tasmania, Geol. Surv. Mineral Resources No. 9, Tasmania Department of Mines.

43. Vaquier, V. et. al., 1951 — "Interpretation of Aeromagnetic Maps", Geological Society of America, Memoir 47; New York, N. Y.

44. Wade, M. 1958 — "A History of Geological Thought at Mount Lyell", F. L. Stillwell Memorial Volume, Aust. Inst. of Mining and Metallurgy; Melbourne

45. Waterhouse, L. L. 1916 — Tungsten and Molybdenum, Part III King Island, Geol. Surv. Mineral Resources No. 1, Tasmania Department of Mines.

46. Werner, S., 1949 — "Interpretation of Magnetic Anomalies as Sheet-like Bodies", Sveriges Geologiska Undersokning, Ser. C., No. 508, Arsbak 43, No. 6 Generalstabens Litografiska Anstalts Forlag; Stockholm, Sweden

47. Wycoff, R. D., 1948 — "The Gulf Airborne Magnetometer", Geophysics, Vol. 13

TABLE 1

TABULATION OF MAGNETIC ANOMALIES

Anomaly Number	Total Amplitude in Gamma	Approximate Dimensions of Source in Feet		Depth of Source in Feet Subsurface	Apparent Susceptibility Contrast in CGS Units	% Increase in Magnetite Content by Volume	Field Check Priority
		Width *	Length				
1	450	150	700	0	.018	6	3
2	250	150	2000	0	.007	2	3
3	320	150	3000	0	.009	3	3
4	60	—	—	—	—	—	2
5	50	—	—	—	—	—	2
6	260	150	1000	0	.010	3	2
7	60	—	—	—	—	—	2
8	1860	150	2000	0	.055	17	3
9	480	150	1000	0	.018	6	3
10	1360	150	2000	0	.040	13	3
11	1200	150	2000	0	.036	11	3
12	1200	150	3000	0	.034	11	3
13	1400	150	3000	0	.039	13	3
14	1800	150	2000	0	.053	16	3
15	1600	150	2000	0	.047	14	3
16	1100	150	1500	0	.035	11	3
17	1900	150	2000	0	.056	17	3
18	1550	150	3000	0	.043	14	3
19	750	150	2000	0	.022	8	3
20	1850	150	6000	0	.050	15	3
21	1450	150	2000	0	.043	14	3
22	2000	150	4000	0	.055	17	3
23	2450	150	3000	0	.069	20	2
24	1900	150	3000	0	.053	16	3
25	2000	150	3000	0	.056	17	3
26	2500	150	5000	0	.068	20	2
27	550	150	1000	0	.021	7	1
28	720	1150	1500	1150	.021	7	1
29	1700	150	3000	0	.048	14	1
30	650	150	1500	0	.021	7	1

Note:

To facilitate comparison, a standard souce width of 150 feet is assumed for most anomalies. (See Magnetic Interpretation Theory - discussion of Susceptibility.)

Anomaly Number	Total Amplitude in Gamma	Approximate Dimensions of Source in Feet		Depth of Source in Feet Subsurface	Apparent Susceptibility Contrast in CGS Units	% Increase in Magnetite Content by Volume	Field Ch Priority
		Width *	Length				
31	400	650	2000	685	.009	3	3
32	2300	150	4000	0	.063	19	2
33	2900	150	2000	0	.086	25	2
34	1500	150	5000	0	.041	13	3
35	600+	150	±1500	0	.019	6	4
36	1650	1415	3000	0-180	.005	2	1
37	1540	150	2000	0	.046	14	1
38	1450	150	2000	0	.043	13	1
39	1500	150	2000	0	.044	13	1
40	130	150	—	—	—	—	1
41	140	150	1000	0	.055	2	1
42	180	150	1000	0	.007	2	1
43	430	1500	3000	0	.002	1	1
44	680	150	3500	0	.019	6	1
45	240	150	3000	0	.007	2	1
46	230	150	2000	0	.007	2	1
47	240	150	2000	0	.007	2	1
48	740	150	3000	0	.021	7	1
49	1200	150	1500	0	.038	12	3
50	660	150	2000	0	.020	7	4
51	1250	150	2500	0	.036	11	3
52	1250	150	2000	0	.037	11	3
53	250	—	—	—	—	—	1
54	70	—	—	—	—	—	4
55	200	150	1000	0	.008	3	1
56	200	—	—	—	—	—	4
57	350	150	1500	0	.011	4	1
58	300	150	1500	0	.099	3	1
59	500	150	3000	0	.014	5	4
60	400	—	—	—	—	—	4

071

194071

Nomaly Number	Total Amplitude in Gamma	Approximate Dimensions of Source in Feet		Depth of Source in Feet Subsurface	Apparent Susceptibility Contrast in CGS units	% Increase in Magnetite Content by Volume	Field Ch. Priorit
		Width *	Length				
61	1200	150	3000	0	.033	11	3
62	800	—	—	—	—	—	4
63	690	150	1500	0	.022	7	2
64	30	—	—	—	—	—	4
65	150	—	—	—	—	—	2
66	390	150	1500	0	.012	4	4
67	180	150	5000	0	.005	2	1
68	110	150	1000	0	.004	2	4
69	30	—	—	—	—	—	4
70	60	—	—	—	—	—	4
71	20	—	—	—	—	—	4
72	30	—	—	—	—	—	2
73	400 +	—	—	—	—	—	—
74	45	—	—	—	—	—	4
75	300	150	2000	0	.009	3	1
76	100	—	—	—	—	—	4
77	60	—	—	—	—	—	4
78	40	—	—	—	—	—	4
79	60	—	—	—	—	—	4
80	300 +	—	—	—	—	—	2
81	230	150	1000	0	.009	3	2
82	400	—	—	—	—	—	2
83	60	—	—	—	—	—	4
84	50	—	—	—	—	—	—
85	130	150	1000	0	.005	2	4
86	600	150	2000	0	.018	6	4
87	90	—	—	—	—	—	2
88	240	150	2000	0	.007	2	2
89	400	150	2000	0	.012	4	2
90	230	150	1000	0	.002	1	2

Anomaly Number	Total Amplitude in Gamma	Approximate Dimensions of Source in Feet		Depth of Source in Feet Subsurface	Apparent Susceptibility Contrast in CGS Units	% Increase in Magnetite Content by Volume	Field Ch. Priority
		Width *	Length				
91	800	150	2000	0	.024	8	2
92	450	150	1500	0	.014	5	2
93	220	150	1500	0	.007	2	1
94	100	150	1000	0	.004	1	1
95	250	150	2000	0	.007	2	4
96	60	—	—	—	—	—	4
97	270	150	2000	0	.008	3	1
98	170	150	2000	0	.005	2	1
99	100+	—	—	0	—	—	1
100	850	150	7000	0	.023	7	2
101	1700	150	6000	0	.045	14	2
102	1100	150	2000	0	.033	10	2
103	900+	—	—	—	—	—	2
104	900	150	4000	0	.025	8	2
105	800	520	3000	730	.020	7	2
106	600	1570	3500	500	.004	1	2
107	210	1012	2000	0	.001	<1	2
108	950	1150	5000	100	.005	2	2
109	70	—	—	—	—	—	3
110	60	—	—	—	—	—	4
111	90	—	—	—	—	—	4
112	60+	—	—	—	—	—	4
113	40	—	—	—	—	—	4
114	30	—	—	—	—	—	4
115	70	—	—	—	—	—	4

APPENDIX 1

STATISTICAL SUMMARY

General Specifications

Aircraft	Aero Commander Dornier
Flight Altitude	500 Feet above the terrain
Flight Line Interval	1/4 Mile
Flight Direction	East-West
Flight Personnel . . . Pilots:	A. Holtzclaw L. Taylor E. McKenzie J. Braund
Electronic Technicians:	O. Fagernes R. Welshe D. Hill W. Clark D. Lyus
Duration of Survey	28 February 1965 to 1 May 1966
Airport	Hobart, Tasmania Devonport, Tasmania
Fiducial Spacing	Approximately 1/10 Mile
Number of Map Sheets	Forty (40) at Scale 1:23,7 Four (4) at Scale 1:63,3
Contour Interval	10 Gamma
Number of Survey Lines	Principal Area 389 Coastal Area 46
Operational Flight Distance	Approximately 15,000 Mile
Area Surveyed	Principal area 3,550 Square Miles Coastal Area 153 Square Miles

Aircraft Equipment

Gulf Research and Development Mark III Airborne Magnetometer

Aeropath 35 mm Strip Film Aerial Camera

APN-1 Continuously Recording Radio Altimeter

Auxiliary Ground Equipment

Gulf Research and Development Ground Magnetic Storm Monitor

Magnetometer Specifications

Model.....Gulf Research and Development Mark III

Type.....Fluxgate, saturable core

Installation ..... Tail extension

Component of Field.....Total intensity

Recording Sensitivity ..... 600 Gamma full scale deflection

Response Time ..... 0.5 seconds

Regional Intensity of Field ..... 63,000 Gamma

Magnetic Inclination ..... 72° inclined toward south pole

Declination ..... 12° east of astronomic north

APPENDIX 2

THE EARTH'S MAGNETIC FIELD

A magnetic field, such as that of the earth, is vectorial in nature since at any point is is characterized by magnitude and direction. On the earth's surface, this vector field is conventionally described by its intensity and by two angular elements defining its direction.

The unit of intensity by which the earth's field is measured is the gamma (γ), which is 1×10^{-5} oersted. The oersted, the c.g.s. standard of magnetic intensity, is by definition the intensity extant at a point one centimeter from a unit magnetic pole. The direction of the earth's field is defined by its inclination, the vertical angle between the intensity vector and the tangent to the earth's surface, and by its declination, the horizontal angle between the vector and geographic north.

The field on the earth's surface resembles in its gross aspects the field distribution that would result were it caused by a relatively short bar magnet located in the center of the earth and inclined about twenty degrees to the geographic polar axis.

Therefore, a magnetic equator exists in the tropics, inclined about twenty degrees to the geographic equator, which passes through Peru, Bolivia and Brazil in South America; Sierra Leone, Nigeria, Sudan and Ethiopia in Africa; and Ceylon, Thailand and the Philippines in the Orient. Along this line, the magnetic

inclination is zero; that is, the intensity vector is horizontal with respect to the earth's surface. The magnetic poles, the points on the surface at which the intensity vector is perpendicular to the earth's surface, are located at the north end of Prince of Wales Island, Canada (the north magnetic pole) and on the coast of the Australian-claimed sector of Antarctica (the south magnetic pole).

Using the bar magnet approximation, the total intensity of the earth's magnetic field at any point is defined as:

$$T = M/r^3 \quad (1 + 3 \sin^2 \phi)^{\frac{1}{2}}$$

where:

T = intensity of the earth's total field

M = earth's magnetic moment

r = mean radius of the earth

ϕ = magnetic latitude

The magnetic latitude, ϕ, is related to the magnetic inclination, i, as follows:

$$\phi = \tan^{-1} \left(\tfrac{1}{2} \tan i\right)$$

The bar magnet expression indicates that the intensity at the magnetic poles is double that at the magnetic equator. This is in agreement with field observation; the general intensity at the poles is about seventy thousand gammas, and along the magnetic equator it is about thirty-five thousand gammas. The

transition from equator to pole is gradual and systematic in both direction and intensity.

The earth's surface field would presumably follow the bar magnet distribution perfectly if the planet was perfectly homogeneous in composition and magnetic properties, or if it was composed of concentric shells of homogeneous composition and properties. However, the near-surface and surface magnetic disturbances, mainly the rocks of the upper mantle, cause local distortions in the idealized field of the earth, termed magnetic anomalies, manifesting geologic structures and rock units. These are caused by variations in the concentration and distribution of the magnetic minerals, primarily magnetite. These relatively local magnetic disturbances are the diagnostic features in airborne magnetometer surveys. Their shape and intensity are determined by many factors. Of these factors, the regional inclination and intensity are of critical importance. The remaining factors are properties of the causative body itself; composition, shape, size, orientation, etc.

The proportion and direction of remanence in the causative body, as compared to induced magnetization, is another important factor in the determination of the characteristics of the magnetic anomaly. This, however, cannot be assessed without laboratory study of many oriented samples of the body causing an anomaly;

therefore, induced conditions are normally assumed in airborne magnetometer exploration.

APPENDIX 3

THE FLUX-GATE MAGNETOMETER

The Flux-Gate Magnetometer makes use of a ferromagnetic element of such high permeability that the earth's field can induce a magnetization that is a substantial proportion of its saturation value. If the earth's field is superimposed upon a cyclic field induced by a sufficiently large alternating current in a coil around the magnet, the resultant field will saturate the core. The place in the energizing cycle at which saturation is reached is proportional to the intensity of the earth's ambient field.

In practice, two parallel cores are aligned with their axes in the direction of the earth's field. Identical primary coils, in series, magnetize the two cores with the same flux density, but in opposite directions since their coil windings are opposite around the respective cores. Thus, the earth's field reinforces the field set up by one coil and opposes the field of the other. In the Gulf Mark III airborne magnetometer, the output pulses are continuously balanced by means of a compensating coil. The current flowing through this coil is recorded on a self balancing moving tape potentiometer recorder.

Inasmuch as variations in the earth's field are of much more importance than absolute values in exploration work, provision is made for balancing out most of the field with one of

several compensating coils so that the differences can be recorded with maximum sensitivity. The higher the full scale sensitivity selected for the potentiometer, the larger will be the proportion of the field so nullified. The total field is the compensated portion plus the residual as recorded.

The orienting system that automatically keeps the measuring element described above parallel to the earth's total magnetic field consists of two flux-gate elements mounted so that they are mutually perpendicular to each other and to the measuring element. The outputs of the orienting elements activate servo-mechanisms which keep them in a position of zero magnetic field, thus keeping the measuring element parallel to the earth's field.

081

194081

APPENDIX 4

INTRODUCTION

During the course of two seasons of operation, from February to May, 1965 and February to May, 1966, an airborne magnetometer survey was performed over two areas in southwestern Tasmania for The Broken Hill Proprietary Company, Ltd. by Aero Service Ltd. of Sydney, Australia. The report submitted herewith presents preliminary results of the geological interpretation of this survey in the northern one-quarter of the principal area. The purpose of this report is two-fold. First, it will provide the client with timely information on the area of interest. Second, it will provide an appreciation of the general scope and content of the interpretation work so that the client in turn may supply further direction to the study, if required, based on more intimate knowledge of the study area.

The specific area discussed in the following extends from Yard 764,000 N to Yard 812,000 N, and from Yard 408,000 E to Yard 474,000 E on the International Grid. The written report is supplemented by a composite map of the isomagnetic contour sheets (sheets 1 to 9) covering

this area, at a scale of 1:63,360, or one inch to the mile. The known geology of the area is shown superimposed on this map in blue and is discussed in the following section. The interpretation of the aeromagnetic data is shown in red on the same map for purposes of comparison.* The significance of the interpreted features, and their relationship to the available geological information within the area comprises the body of this report.

* NOTE: It is not presently planned to use this format on the final interpretation maps, which will show only the interpreted features.

GEOLOGY

The geological information shown was obtained from the four sources listed below:

1) B.H.P. Map 1 - St. Clair Scale = 1:63,360
2) B.H.P. Map 2 - Tarraleah Scale = 1:84,000
3) B.H.P. Map 3 - Waddamana Scale = 1:126,720
4) Geological Map of Tasmania Scale = 1:506,880

In view of the variations in scale and attendant degree of detail on these maps, information from the largest scale was used in the case of localities with overlapping coverage. Thus, some portions of the accompanying map are considerably more detailed than others, and frequently are not compatible with surrounding areas. The following comments on the geology consider the area of the accompanying map as a whole.

The available maps of the region show a succession of geological formations from west to east across the area which range from Pre-Cambrian to Triassic in age. Dolerite sills of Jurassic age intrude most, if not all, of these formations and comprise the predominant outcrops in the northern and eastern portions of the area. Pre-Cambrian

984

metamorphosed sediments, notably quartzites, quartz schists and dolomites, outcrop along the western edge of the area, with Paleozoic limestone, mudstone and conglomerate predominating in the south central portion. The north and northeast sectors are further characterized by frequent local exposures of Tertiary basalt occurring as flows and volcanic necks. Sediments of Tertiary age have limited occurrence in the area, being confined to one exposure of a non-marine formation in the southeastern corner. Quaternary continental deposits, many of which are of glacial origin, occur locally throughout the area, particularly in the north and east.

INTERPRETATION OF AEROMAGNETICS

The qualitative inspection of the aeromagnetic data has permitted a three-fold regional division of magnetic units based on anomalous magnetic character. The solid red lines on the map represent boundaries of these units, and may or may not correspond to geologic contacts. They are significant to the extent that they bound areas of source rocks having similar, and perhaps even homogeneous, magnetic properties, even though internal variations in chemical composition of the rocks may preclude their unanimity in a petrologic sense. For example, the mapped units of Jurassic dolerite and Tertiary basalt can be differentiated on the basis of their petrological characteristics, but because of their analogous magnetic properties cannot be distinguished on the basis of anomalous magnetic response and thus are grouped together as a single magnetic unit.

Another common reason for lack of correspondence between geologic and magnetic units is the tendency of magnetic signatures, particularly in areas of low regional dip, to reflect the location of sub-outcrop contacts which are considerably displaced from their surface

counterparts. Such phenomena may result from near-surface thinning of the petrological unit, degree of weathering, or a combination of the two which has resulted in a significant alteration of the magnetic properties.

The aeromagnetic patterns of the area are divided into three general units designated as A, B and C. Discrete members of these units in areas of particular significance are identified by subscripts (B_1, B_2, etc.). The areal distribution of the units is shown on the accompanying composite map.

Unit A comprises areas of very weak magnetic expression, and is characterized by broad, low amplitude anomalies. The rocks underlying this unit are interpreted to be acidic in composition, i.e., containing relatively high percentages of silicate minerals and low percentages of ferromagnesian minerals. This is in general agreement with the known geology in the extreme western part of the area where Unit A occurs over exposed or near-surface Pre-Cambrian siliceous metasediments.

In the west central portion of the area, however, (A_1, A_2 and A_3) this unit is not in accordance with the known geology since it occurs over what the geologic maps show as dolerite outcrops, which are significantly basic in composition. In view of the more normal magnetic response of dolerites observed further to the east (magnetic Unit B), it appears questionable that dolerite is indeed present here unless it is extremely thin and severly weathered. Rather, these areas are more probably underlain by either an acidic igneous rock, such as granite, or by a continuation of the Pre-Cambrian metasediments or Paleozoic sediments observed to the west and south. A reconnaissance field check of these areas (A_1, A_2 and A_3) is recommended, since the presence of small granitic bodies here could be extremely important from the standpoint of mineralization, as in the Zeehan area to the northwest.

Unit B is characterized by areas of very strong magnetic response with high frequency, high amplitude anomalies. It is interpreted as the magnetic expression of basic rocks; that is, rocks containing a high percentage of ferromagnesian minerals, of which magnetite is commonly

a primary constituent. There is good correspondence with the known geology in almost every area of this unit's occurrence, since it is most extensively expressed in the eastern part of the area over exposed dolerite sills and basalt flows.

Most areas of Unit B, therefore, are interpreted as the magnetic expression of either near-surface dolerite or basalt. The extremely complex character of the anomalies of this unit is due primarily to a highly developed system of faulting which occurs throughout the region. Two major directions of faulting, northeast and northwest, are in evidence, and the most distinct faults are shown on the map. Others, less clearly defined, are undoubtedly present.

Two areas of Unit B warranting further attention are those designated as B_1 and B_2 in the western part of the map. The former is an elongate zone of intense anomalies which could be the result of a number of causes. Since it occurs along the margin of Unit A_1, the presence of contact zone mineralization is a distinct possibility, especially if field checking establishes Unit A_1 as granite. Another possibility is that it represents an erosional outlier of the main dolerite

zone, or perhaps a genetically unrelated member of this group. Zone B_1 has possible extension to the south and east and may include the local positive magnetic anomalies at B_3, B_4 and B_5. Whether or not this is the case, these isolated features are worthy of ground checking.

Zone B_2, near the southern edge of the area, is a very broad, intense magnetic anomaly which continues to the south. Although located in an area mapped as Pre-Cambrian metasediments, it is undoubtedly caused by an intrusive body of very basic composition. The western side of this anomaly is coincident with a surface fault shown on the geological maps, indicating structural control of the intrusive body. Quantitative analysis of the anomaly indicates a sub-surface source with an easterly dip. Similar anomalies to the south have been observed over outcropping zones of Pre-Cambrian ultrabasic rocks. Field reconnaissance of the area of this anomaly is definitely warranted by virtue of the good possibilities of base metal mineralization associated with the intrusive body.

The magnetic character of Unit C is intermediate between that of Unit A and Unit B, and is suggestive of rocks having a composition which is more or less evenly distributed between acidic and basic mineral constituents, such as diorite. Inasmuch as there is no discrete geologic unit reported from this area which approximates this condition, it is suggested that such areas may indicate either of two circumstances.

First, that they are the reflection of contact metamorphic phenomena along the edges of the dolerite sheets. In this case, such zones would be of primary interest from an economic standpoint as zones of possible metallic mineralization. The areas annotated C_1 appear to be most attributable to this theory by virtue of their location along the margins of the principal dolerite zone.

The second possibility is that Unit C reflects local thinning, perhaps erosional, of the dolerite or basalt sills which overlie weakly magnetic sediments (as witnessed by Unit A). If this latter possibility proves to be the case, it detracts from the economic

potential of this unit. The latter hypothesis is more particularly exemplified by the isolated "inliers" of Unit C in the eastern portions of the area (C_2) which are commonly associated with mapped exposures of Triassic sandstones. Since there appears to be a distinct possibility that Unit C_2 differs from C_1, it is suggested that the two be field checked independently.

RECOMMENDATIONS

We would like to present the following suggestion, recognizing that it may not be feasible because of time or equipment limitations. Nevertheless, we feel that it could be of considerable assistance in the remaining interpretation:

The localities indicated in the foregoing, zones A_1, A_2, A_3, B_1, B_2, B_3, B_4, B_5, C_1 and C_2, should be ground checked and the rock type indentified. If possible, a few ground EM profiles should be run, particularly in the case of zones B_1, C_1 and C_2 if the explanation of contact metamorphism proves to be valid. If this information could be obtained prior to the completion of the final report, it would undoubtedly be of invaluable assistance to this analysis.

Respectfully submitted,

Charles E. Curtis
Geophysicist

Ronald R. Hartman
Chief Geophysicist

December 20, 1966
Philadelphia, Pa.

1744

Macquarie Harbour

Gordon River

Point Hibbs.

Low Rocky Point.

Port Davey

South West Cape.

Lake Pedder

Adamsfield

Maydena

BHP

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30	31
32	33	34	35
		36	

37 38
39 40

AEROMAGNETIC CONTOUR MAP
E.L. 1/64 - SOUTH WEST TASMANIA.

SCALE OF MILES
0 5 10 15 20

1: 250000
(APPROX.)

COMPILATION FROM L.E.E. SURVEY. 1957
(WEST HALF)
AND B.H.P. SURVEY 1966

5 cm

66-445

194033

1744 Map 1

G3239

G3239

1745

LEGEND

- BOUNDARY OF MAGNETIC UNIT — GENERALLY CORRESPONDING TO GEOLOGIC CONTACTS
- POSSIBLE BOUNDARY
- FAULT ZONE
- FOLD AXES
- COMPUTED STRIKE AND DIP
- MAGNETIC LINEAMENT
- G — FEATURE BASED ON GEOLOGICAL EVIDENCE
- M — FEATURE BASED ON MAGNETIC EVIDENCE
- M G — MAGNETIC FEATURE CONFIRMED BY GEOLOGY
- 38 — SIGNIFICANT MAGNETIC ANOMALY OR ANOMALOUS LOCALITY
- A, B_2 — MAGNETIC UNITS (GENERALLY CORRESPONDING TO GEOLOGIC UNITS) REFERENCED IN REPORT

SHEET INDEX

		1		
37	38	4		
39	40			
		2		
		3		

CONTROL LINE INTERVAL — VARIABLE
TRAVERSE INTERVAL — 1/4 MILE
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
ALTITUDE 500 FEET MEAN TERRAIN CLEARANCE

PROJECTION — TRANSVERSE MERCATOR
GRID INTERVAL — 2000 YARDS
HORIZONTAL CONTROL DERIVED FROM TOPOGRAPHIC MAPS OBTAINED FROM STATE GOVERNMENT DEPARTMENTS, HOBART, TASMANIA

TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY - S. W. TASMANIA

THE BROKEN HILL PROPRIETARY CO. LTD.

SCALE 1:63360

1 0 1 2 3 4 5 MILES

5 cm

FLOWN AND COMPILED 1965 - 66
AERO SERVICE LTD., SYDNEY, AUSTRALIA

SHEET 1 OF 4

194031

1745

Map 2

1746

LEGEND

- BOUNDARY OF MAGNETIC UNIT
- POSSIBLE BOUNDARY
- FAULT ZONE
- FOLD AXES
- COMPUTED STRIKE AND DIP
- MAGNETIC LINEAMENT

} GENERALLY CORRESPONDING TO GEOLOGIC CONTACTS

- G — FEATURE BASED ON GEOLOGICAL EVIDENCE
- M — FEATURE BASED ON MAGNETIC EVIDENCE
- MG — MAGNETIC FEATURE CONFIRMED BY GEOLOGY
- 38 — SIGNIFICANT MAGNETIC ANOMALY OR ANOMALOUS LOCALITY
- A, B_2 — MAGNETIC UNITS (GENERALLY CORRESPONDING TO GEOLOGIC UNITS) REFERENCED IN REPORT

SHEET INDEX

1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	
39	40	

CONTROL LINE INTERVAL — VARIABLE
TRAVERSE INTERVAL — 1/4 MILE
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
ALTITUDE 500 FEET MEAN TERRAIN CLEARANCE

PROJECTION — TRANSVERSE MERCATOR
GRID INTERVAL — 2000 YARDS
HORIZONTAL CONTROL DERIVED FROM TOPOGRAPHIC MAPS OBTAINED FROM STATE GOVERNMENT DEPARTMENTS, HOBART, TASMANIA

TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY — S. W. TASMANIA

THE BROKEN HILL PROPRIETARY CO. LTD.

SCALE 1 63 360

1 0 1 2 3 4 5 MILES

5 cm

FLOWN AND COMPILED 1965 - 66
AERO SERVICE LTD., SYDNEY, AUSTRALIA

SHEET 2 OF 4

map 3

1940251746

66-445

LEGEND

———	BOUNDARY OF MAGNETIC UNIT	GENERALLY CORRESPONDING TO GEOLOGIC CONTACTS
– – –	POSSIBLE BOUNDARY	
~~	FAULT ZONE	
✕ ✳	FOLD AXES	
	COMPUTED STRIKE AND DIP	
	MAGNETIC LINEAMENT	
G	FEATURE BASED ON GEOLOGICAL EVIDENCE	
M	FEATURE BASED ON MAGNETIC EVIDENCE	
M G	MAGNETIC FEATURE CONFIRMED BY GEOLOGY	
38	SIGNIFICANT MAGNETIC ANOMALY OR ANOMALOUS LOCALITY	
A, B_4	MAGNETIC UNITS (GENERALLY CORRESPONDING TO GEOLOGIC UNITS) REFERENCED IN REPORT	

SHEET INDEX

1	2	3			
4	5	6			
7	8	9			
10	11	12			
13	14	15			
16	17	18			
19	20	21			
22	23	24			
25	26	27			
28	29	30			
31	32	33			
34	35	36			
37	38				
39	40				

CONTROL LINE INTERVAL — VARIABLE
TRAVERSE INTERVAL — 1/4 MILE
CONTOUR INTERVAL — 10 GAMMA
BASE INTENSITY — ARBITRARY
ALTITUDE 500 FEET MEAN TERRAIN CLEARANCE

PROJECTION — TRANSVERSE MERCATOR
GRID INTERVAL — 2000 YARDS
HORIZONTAL CONTROL DERIVED FROM TOPOGRAPHIC MAPS OBTAINED FROM STATE GOVERNMENT DEPARTMENTS, HOBART, TASMANIA

TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY – S. W. TASMANIA

THE BROKEN HILL PROPRIETARY CO. LTD.

SCALE 1 63360

FLOWN AND COMPILED 1965 – 66
AERO SERVICE LTD., SYDNEY, AUSTRALIA

SHEET 3 OF 4

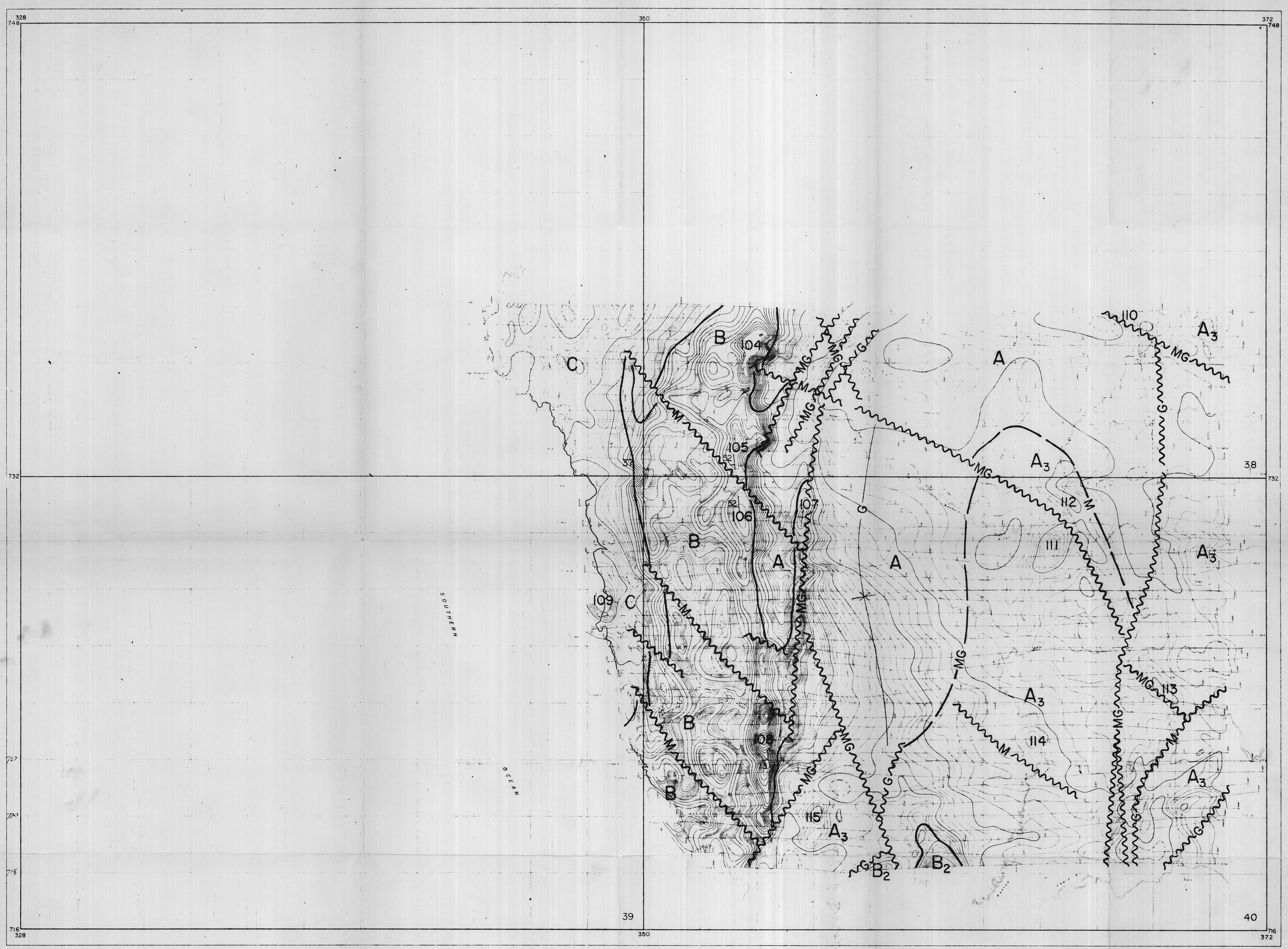
1747

Map 4

CR 592

1747

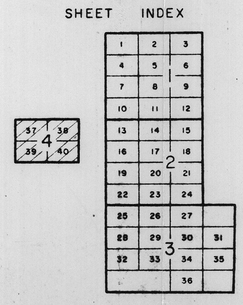
194096



LEGEND

———	BOUNDARY OF MAGNETIC UNIT } GENERALLY CORRESPONDING TO GEOLOGIC CONTACTS
— — —	POSSIBLE BOUNDARY } GENERALLY CORRESPONDING TO GEOLOGIC CONTACTS
~~	FAULT ZONE
X ✳	FOLD AXES
	COMPUTED STRIKE AND DIP
	MAGNETIC LINEAMENT
G	FEATURE BASED ON GEOLOGICAL EVIDENCE
M	FEATURE BASED ON MAGNETIC EVIDENCE
MG	MAGNETIC FEATURE CONFIRMED BY GEOLOGY
38	SIGNIFICANT MAGNETIC ANOMALY OR ANOMALOUS LOCALITY
A, B_2	MAGNETIC UNITS (GENERALLY CORRESPONDING TO GEOLOGIC UNITS) REFERENCED IN REPORT

SHEET INDEX



1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30	31
32	33	34	35
		36	

CONTROL LINE	INTERVAL	VARIABLE
TRAVERSE	INTERVAL	1/4 MILE
CONTOUR	INTERVAL	10 GAMMA
BASE	INTENSITY	ARBITRARY

ALTITUDE 500 FEET MEAN TERRAIN CLEARANCE

PROJECTION TRANSVERSE MERCATOR
GRID INTERVAL 2000 YARDS
HORIZONTAL CONTROL DERIVED FROM TOPOGRAPHIC MAPS OBTAINED FROM STATE GOVERNMENT DEPARTMENTS, HOBART, TASMANIA

TOTAL MAGNETIC INTENSITY

AEROMAGNETIC SURVEY – S. W. TASMANIA

THE BROKEN HILL PROPRIETARY CO. LTD.

SCALE 1:63,360

5 cm

1 0 1 2 3 4 5 MILES

FLOWN AND COMPILED 1965 - 66
AERO SERVICE LTD., SYDNEY, AUSTRALIA

map 5

194097

SHEET 4 OF 4

Low Rocky Pt. approx.

1748

66-445