L. A. RICHARDSON & ASSOCIATES

GMS for Staff 149-001

GEOPHYSICAL PROGRESS REPORT

ON THE

GRASSY GRANITE CONTACT ZONE

KING ISLAND

ML 17m/19 1977

Exploration Geophysics

140002

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GMS for Staff

GEOPHYSICAL PROGRESS REPORT

ON THE

GRASSY GRANITE CONTACT ZONE

KING ISLAND

by

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ML 17 m/79

ISG COORDINATES
REFER REPORT 70-0676

April, 1977.

L. A. Richardson & Assoc.
GORDON

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ACCOMPANYING PLANS

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Scale 1:5000

INTRODUCTION

The Grassy Granite contact region in the south-east of King Island is a favourable area for the occurrence of scheelite mineralisation as exists at the nearby Dolphin and Bold Head mines. Detailed gravity and magnetometer surveys were carried out over this area in 1975/1976 to assist in locating zones favourable for scheelite concentrations.

It was hoped that the geophysical results would;

a) assist in defining geological settings similar to the Bold Head and Dolphin orebodies.

and b) indicate the presence of major structural abnormalities in the sub-surface granite contact

The data has already been studied in detail and reported on in "Geophysical Report on the Grassy Granite Contact Zone" by R. Deakin, October, 1976.

Further interpretation of the gravity results has been carried out recently in an attempt to better define the broad structural parameters of the contact zone.

This report describes this recent interpretation work and the results thereof.

GEOLOGY AND NATURE OF THE PROBLEM

The Grassy Granite Contact region King Island is an arcuate zone of mine series rocks consisting of metamorphosed marbles, hornfels and volcanics abutting the northern and western contact of the Grassy Granite stock. The mine series rocks are underlain to the north and west by a quartzite sequence and have a shallow dip towards the granite contact. The whole zone of mine series in this region is highly prospective for scheelite ore bodies but no direct exploration method is available.

The geophysical surveys over the Grassy Granite contact zone were originally proposed as a means of searching for geological settings similar to the Dolphin and Bold Head orebodies. These settings are characterised by the following features:

a) Considerable thicknesses (>200 metres) of mine-series rocks abutting a granite contact.

b) Some "flattening" of the granite contact beneath the mine series.

c) Close proximity to a major fault(s).

Further to this, geological thinking maintains that there is evidence to suggest that minor structural abnormalities in the granite contact, such as 'cusps', ledges, and embayments are prerequisites for scheelite accumulations in this type of environment.

The object of the survey was therefore two-fold:

1. To provide information that will assist in understanding the major structural relationships between the mine-series, granite and

quartzite rocks looking particularly for a.), b.) and c.) above.

2. To search for minor structural abnormalities in the granite contact itself.

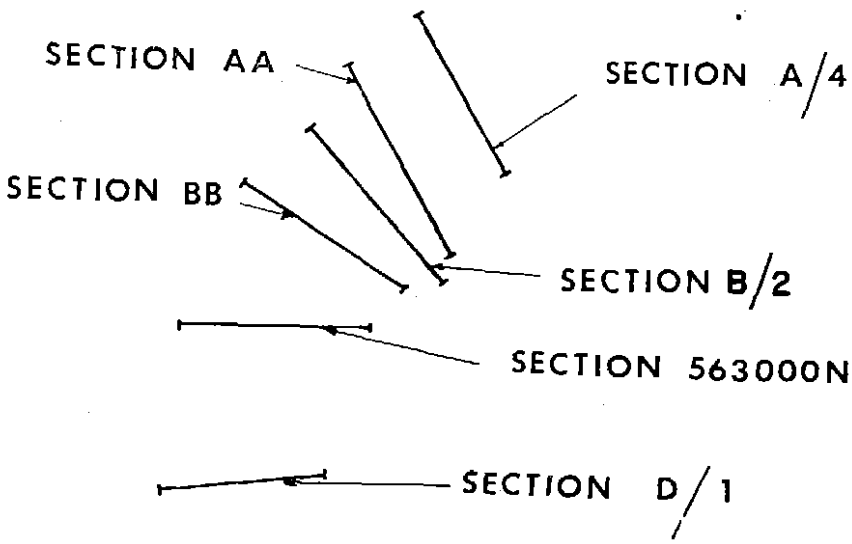
The latter objective, however, has always been recognised as difficult and probably beyond the limitations of the gravity method. The problem is aptly summed up by Beer et al "..... undulations of the granite roof of short wavelength compared with their depth would be undetectable by gravity survey even if their amplitudes were moderately high .....", and "..... gravity survey gives average, rather exact, local depths.....".

The October 1976 report summarises the results of attempts to locate minor structural features in the granite contact from the gravity data. As anticipated these attempts were unsuccessful because;

a) the depth/size geometry of the granite contact irregularities are such that their subtle surface gravity effect cannot be resolved,

and b) the gravity "noise" envelope caused by the variable thickness of overburden effectively masks the subtle effect from deeper structures.

Further development in the area is hampered by the lack of positive geological, geophysical and geochemical information indicating specific targets for testing. Consideration is now being given to the application of an extensive and relatively "unfocussed" drilling program. It was therefore decided to further interpret the geophysical results in terms of the broad structural parameters of the contact zone with a view to providing information that will assist in outlining those parts of the zone that should receive preferential testing.



POSITION OF INTERPRETATION SECTIONS

PLATE 1

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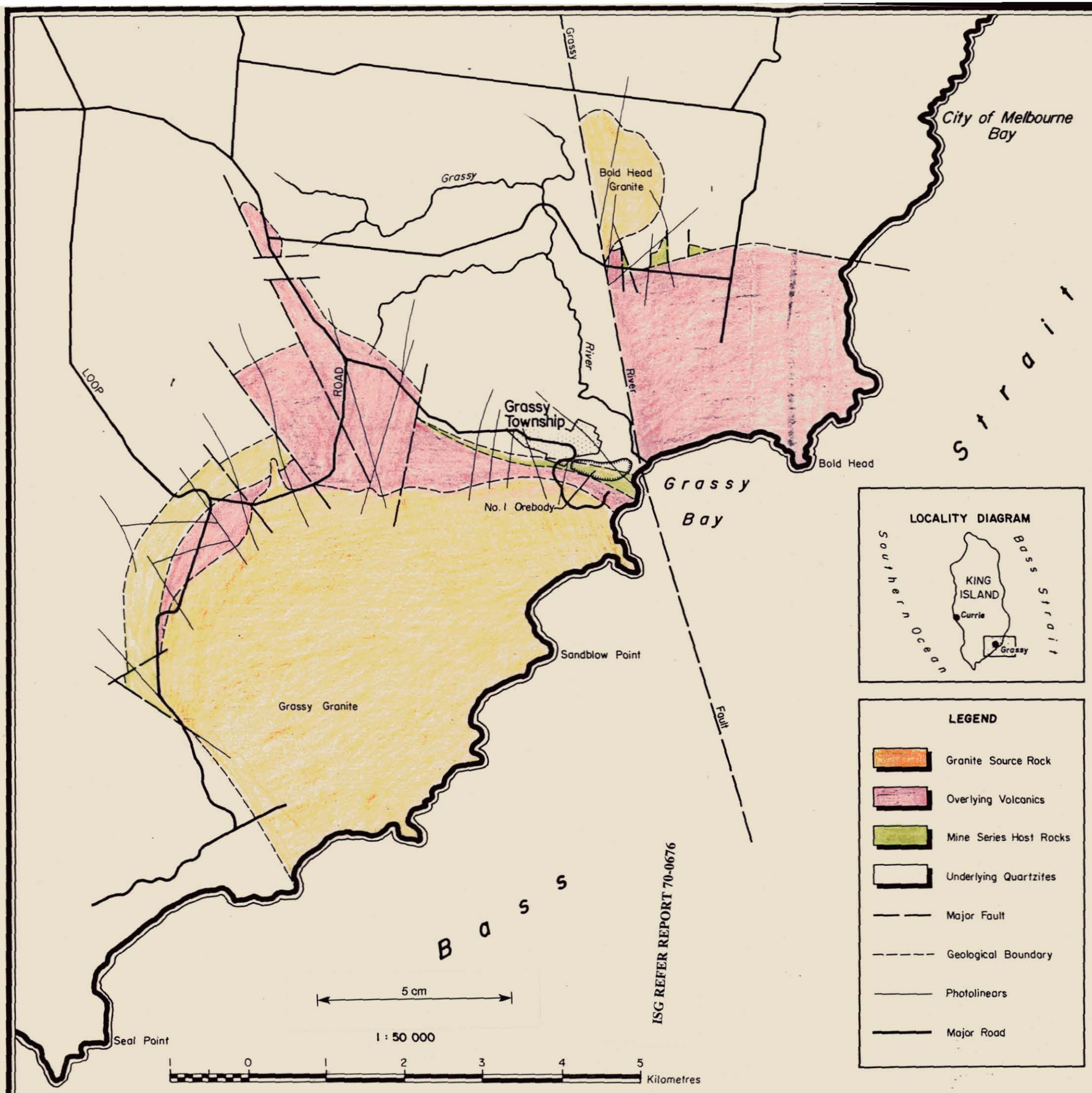

LOCALITY DIAGRAM

LEGEND

- Granite Source Rock
- Overlying Volcanics
- Mine Series Host Rocks
- Underlying Quartzites
- Major Fault
- Geological Boundary
- Photolinears
- Major Road

GRASSY GRANITE CONTACT PROJECT

INVESTIGATOR 1 (East)
Tested, 11 diamond drill holes (DDHs) completed.
Mine Series rocks thin.
Virtually no Ore Potential.

BOLD HEAD OREBODY
Mining proceeding - A, B Main, B Fault Block horizons.
Underground diamond drilling proceeding - to define C_1, C_2, and D Lenses for mining.
Ore horizons open to south and potential exists for limited increase in resource.

DOLPHIN OREBODY
Mining proceeding - C Lens above -150m R.L.
Underground diamond drilling proceeding - to define C Lens at depth and D Lens.
Possibility faulted-off Mine Series rocks exist to north of Northern Fault.
There is a probability of limited increased resource to the southeast of Dolphin Mine adjacent to the Grassy River Fault.

INVESTIGATOR 6
Tested, 15 DDHs.
Only minor Scheelite encountered.

INVESTIGATOR 18
Mine Series rocks 250m beneath Volcanic cover.
3 DDHs.
2 stratigraphic to locate Mine Series rocks.
1 DDH (West) intersected.
8m at 0·56% WO_3 at 200m below surface.
INVESTIGATOR 18 West - PRIORITY 2 Ore Potential.
INVESTIGATOR 18 East - PRIORITY 5 Ore Potential (due to depth).

INVESTIGATOR 23
4 DDHs.
Minor Scheelite within Volcanic sequence.
Mine Series rocks remain untested.
PRIORITY 4 Ore Potential.

INVESTIGATOR 3
6 DDHs (East).
3 intersected minor Scheelite.
PRIORITY 4 Ore Potential.

INVESTIGATOR 22
2 DDHs.
2 intersected B horizon Mine Series rocks - minor Scheelite.
PRIORITY 3 Ore Potential.

INVESTIGATOR 21
10 DDHs.
B horizon open -
250,000 tonnes 'probable' at 0·47% WO_3, 0·12% Mo.
C horizon -
1 DDH only.
7m of sub oregrade Scheelite.
PRIORITY 1 Ore Potential.

INVESTIGATOR 2
2 DDHs.
2 intersected B horizon Mine Series rocks - minor Scheelite.
C horizon not tested.
PRIORITY 2 Ore Potential.

INVESTIGATOR 24
2 DDHs.
Minor Scheelite near surface.
DDH adjacent to major fault.
PRIORITY 3 Ore Potential.

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requiring testing. The results presented however, must be considered as interpretations only and not necessarily representations of the real subsurface geological unit boundaries.

Some shortcomings of the interpretation are:-

a) Often the assumption of a 2 dimensional model is not justified. e.g., Investigator 24 (Section D/1).

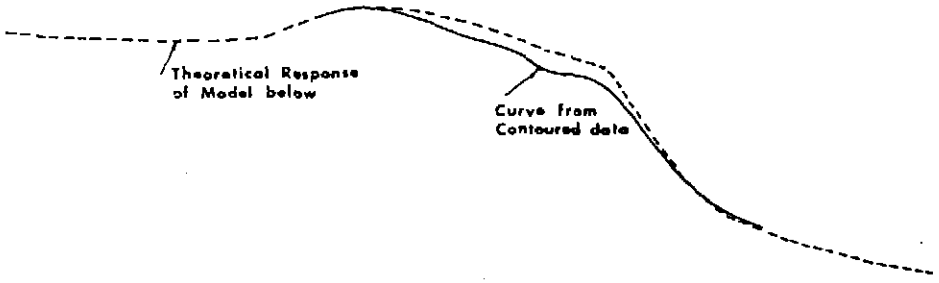
b) Some of the curve fits are poor; suggesting the subsurface density distributions may be quite different from the model used. Density variations within the major rock units could account for poor curve matches without major structural alterations.

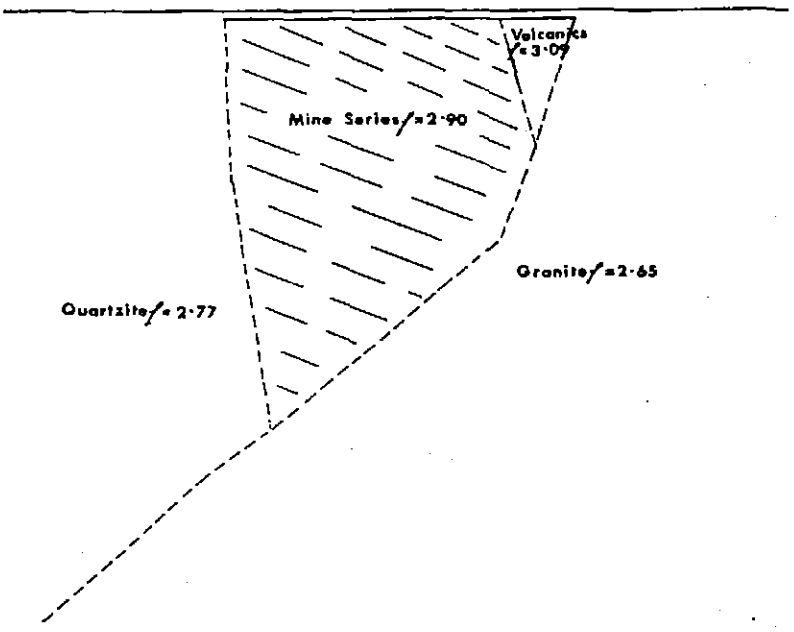
c) Following from (b) it is possible that the densities of the rocks of the area are more complex in distribution and special variation than has been assumed or can be effectively modelled.

d) Subsurface structures may be much more complex than has been assumed or can be effectively modelled.

e) As was stressed in the October 1976 report the effect of variations in the overburden thickness/density is generally an unknown quantity. The Investigator 21 cross section illustrates the overburden effect.

149009





GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

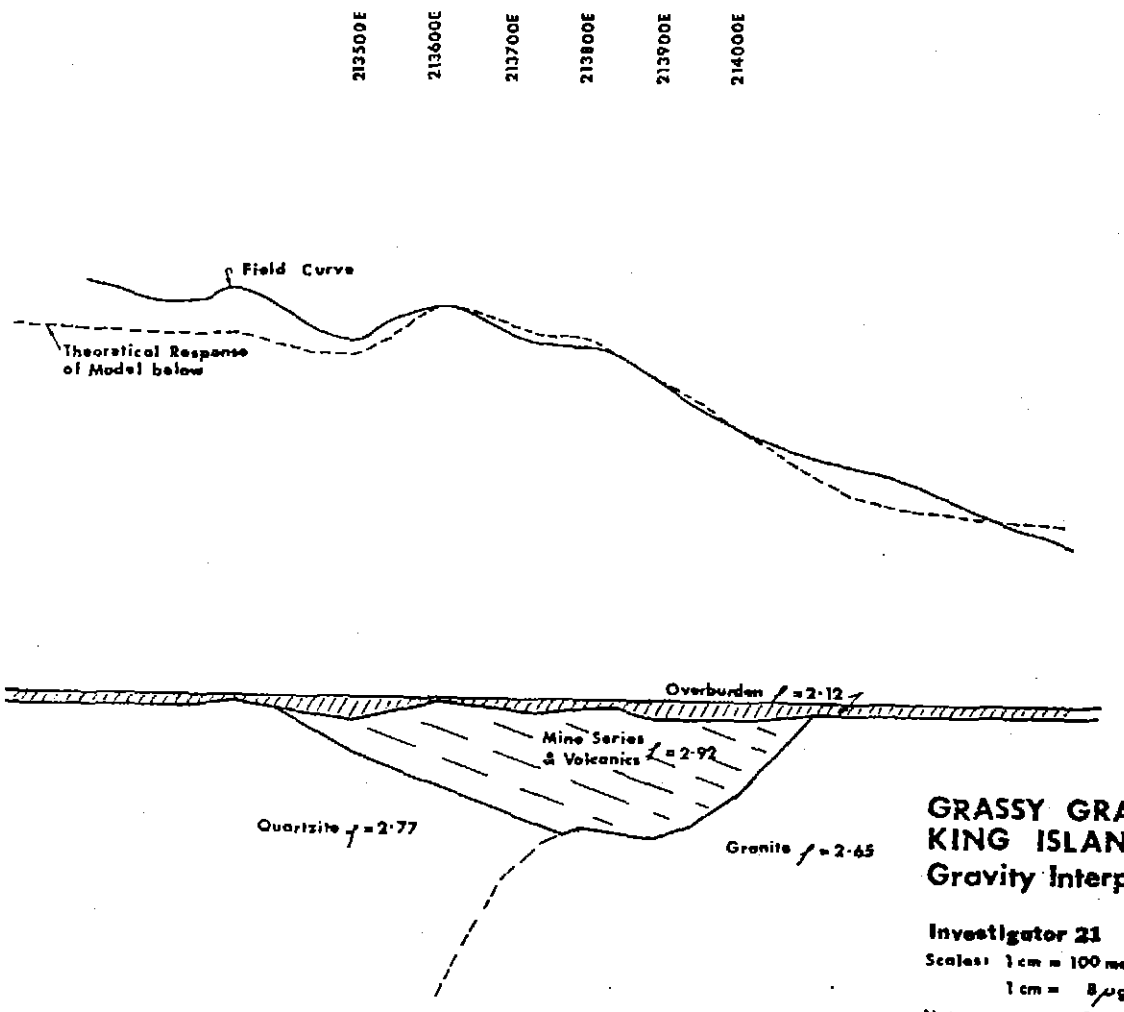
Investigator 24

Scales: 1cm = 100metres Vertical & Horizontal
1cm = 8 milligalileos Vertical

Note: ——— Established Geology
– – – – Interpretation
ρ=2·0 Density gm/cm

5 cm

SECTION D/1
PLATE 2



GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

Investigator 21

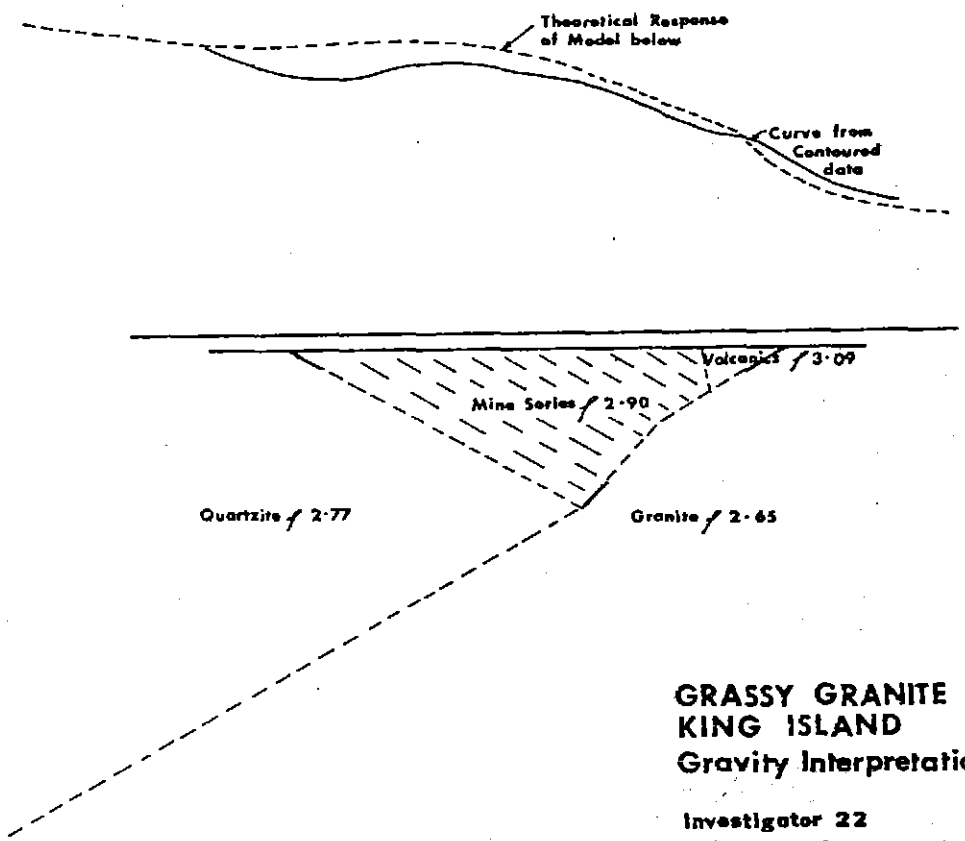
Scales: 1 cm = 100 metres Vertical & Horizontal
1 cm = 8 milligalileos Vertical

Note: —— Established Geology
---- Interpretation
ρ = 2·0 Density: gm/cm

5 cm

SECTION 563000N

PLATE 3



GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

Investigator 22

Scales: 1 cm = 100 metres Vertical & Horizontal
1 cm = 8 gallileos Vertical

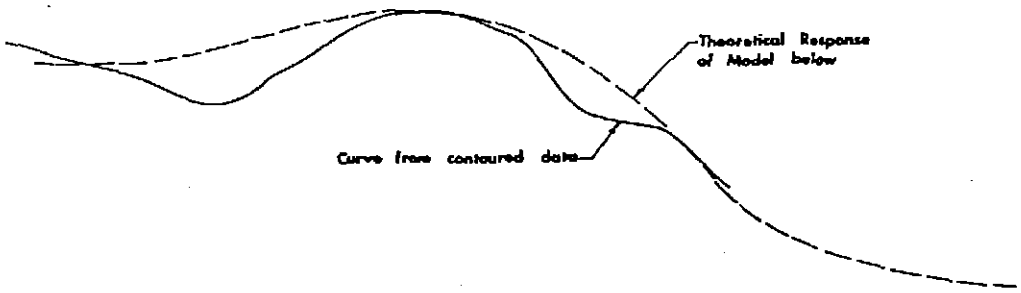
Note: ——— Established Geology
– – – – Interpretation
ƒ = 2·0 Density gm/cm

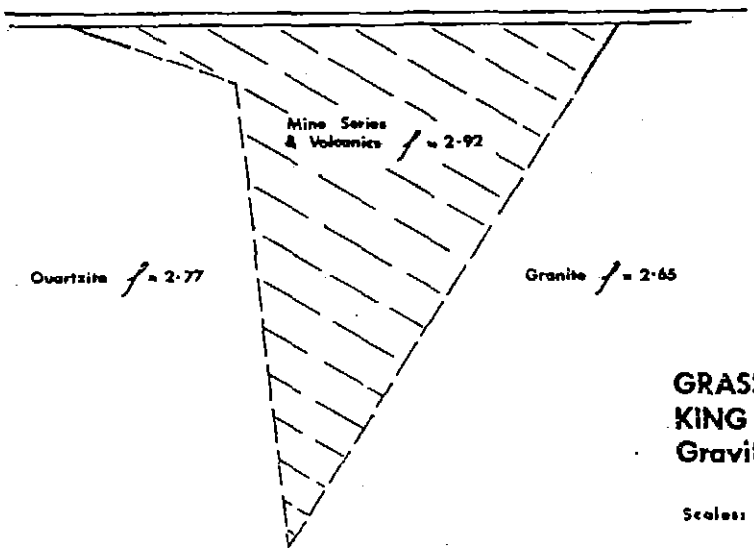
5 cm

SECTION BB

PLATE 4

149012





GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

Scales: 1 cm = 100 metres Vertical & Horizontal
1 cm = 8 milligalileos Vertical

Notes: —— Established Geology
---- Interpretation

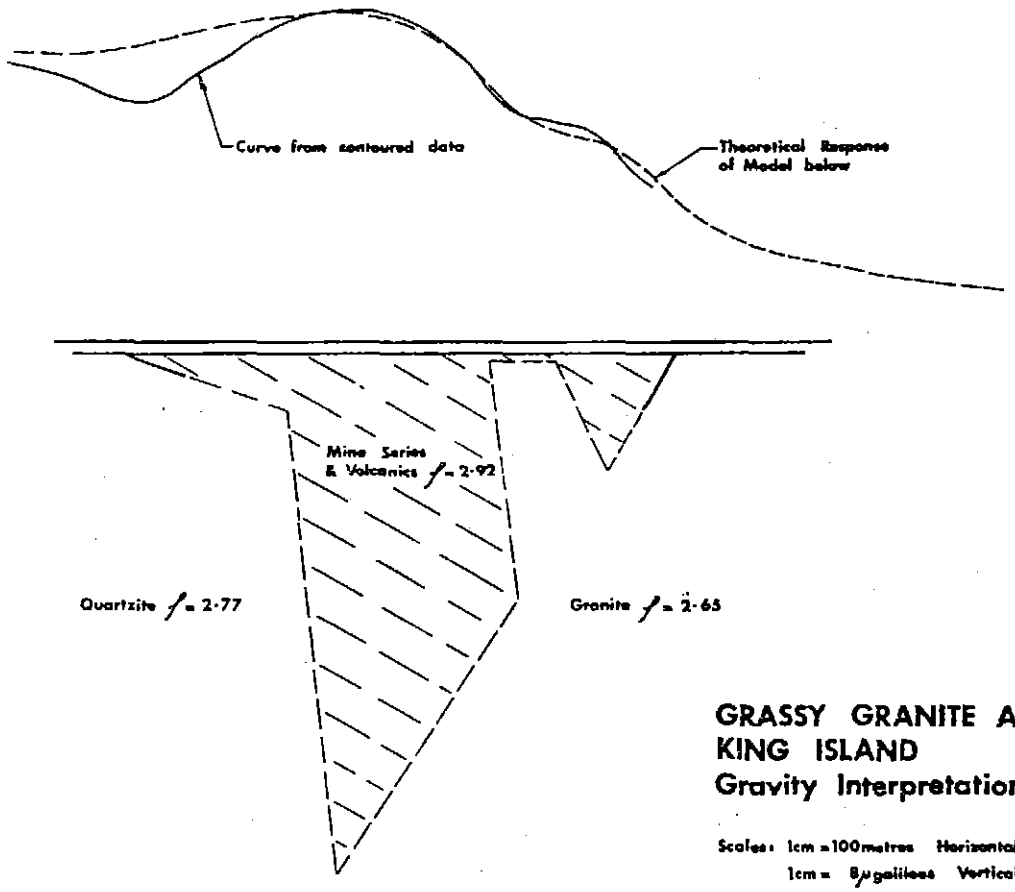
ρ = 2·0 Density gm/cm

5 cm

SECTION B/2

PLATE 5

149013



GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

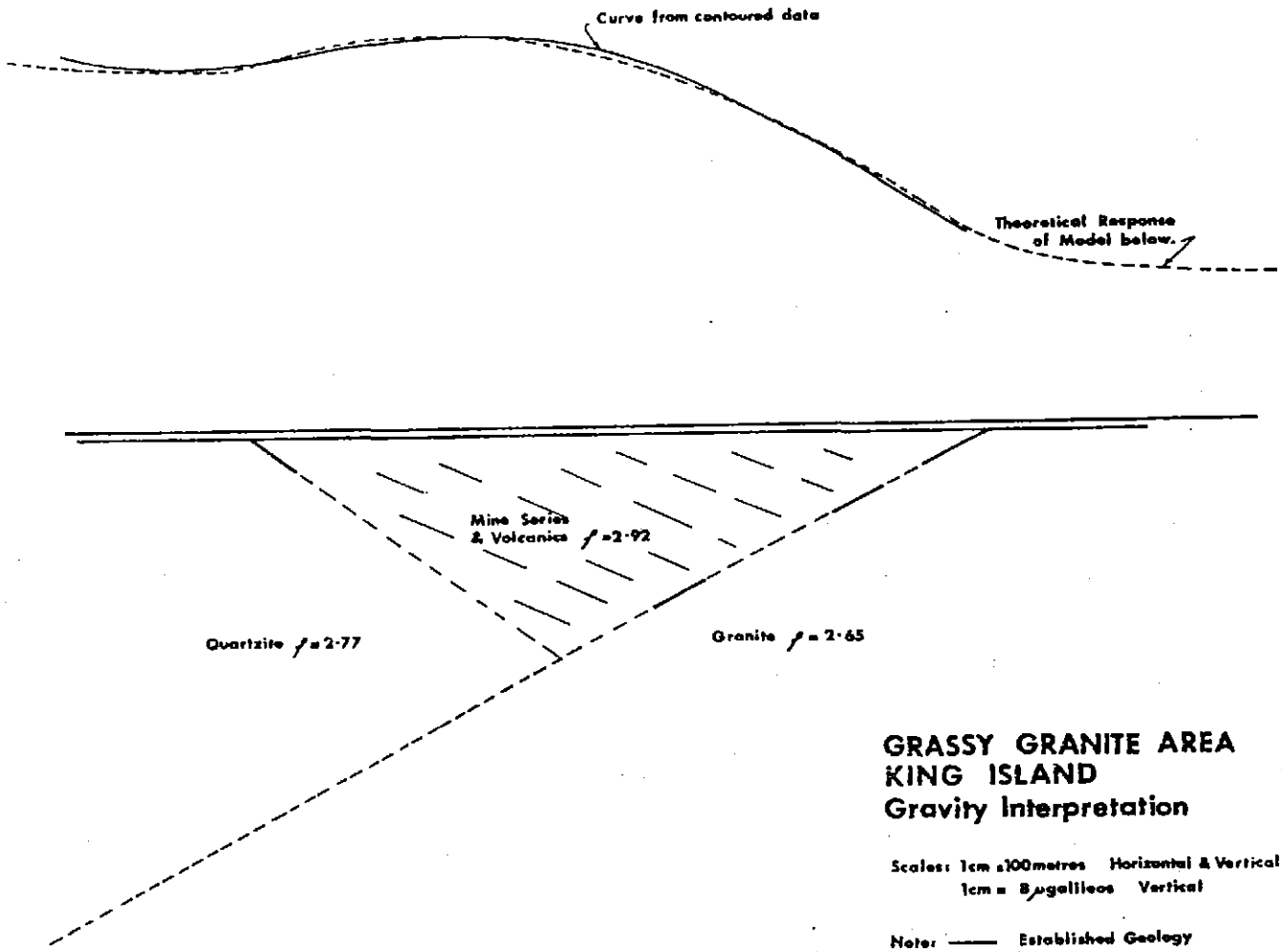
Scales: 1cm = 100metres Horizontal & Vertical
1cm = 8 milligalileos Vertical

Note: —— Established Geology
– – – – Interpretation
ρ = 2·0 Density gm/cc

5 cm

SECTION B/2
PLATE 6

140014



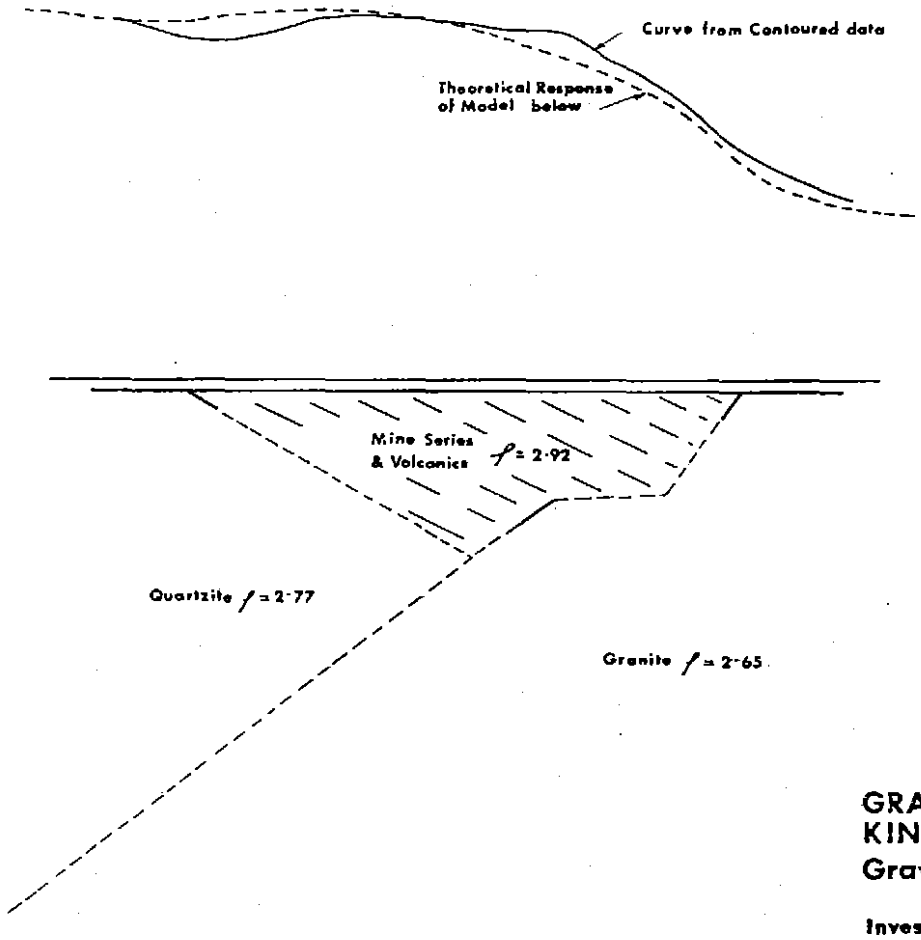
GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

Scales: 1cm ≙100metres Horizontal & Vertical
1cm = 8 milligalileos Vertical

Note: —— Established Geology
---- Interpretation
ρ = 2·0 Density gm/cm

5 cm

SECTION AA
PLATE 7



GRASSY GRANITE AREA
KING ISLAND
Gravity Interpretation

Investigator 3

Scales: 1 cm = 100 metres Vertical & Horizontal
1 cm = 8 milligalileos Vertical

Note: —— Established Geology
---- Interpretation
ρ = 2·0 Density gm/cm

5 cm

SECTION A4

PLATE 8

RESULTS OF INTERPRETATION

Good matches to the observed data were achieved on five of the six sections studied, using geologically reasonable models. Section B/2 proved difficult to interpret with a model that was consistent with known geology. Two different interpretations of section B/2 (Plates 5 and 6) have been included to illustrate the problem but cannot be taken too literally as there are many alternative interpretations.

Investigator 24 Section D/1

The large amplitude and the steep eastern gradient of this gravity profile indicates a thick sequence of Mine Series rocks with steep contacts on both sides. If the Mine Series has a shallow dip then the Quartzite/ Mine Series boundary is probably a major fault.

Drilling in the area indicates the presence of a significant thickness of Upper Volcanics at the eastern margin of the Mine Series sequence. Introducing a separate Upper Volcanic wedge into the gravity model to some degree helps in matching the "bump" on the field profile. The model used suggests there may be a fault in the vicinity of the western margin of the Upper Volcanic wedge.

Investigator 21 Section 563000N

This section has a great deal of geological control. The interpretation presented demonstrates the marked overburden effect and is typical of the expected lack of agreement between the observed gravity profile and the response calculated from the known geology.

Investigator 22 Section BB

Within the geological constraints a poor fit to the field curve was obtained. A "bump" in the gravity profile suggests (Plate 4) that there may be a faulted wedge of Upper Volcanics on the eastern margin of the Mine Series sequence.

To match the field curve in this area the volume of Mine Series rocks needs to be reduced. This suggests possible faulting on the Quartzite contact and the potential for ledge development on the granite contact.

Section B/2

Plate 5 illustrates the difficulty in obtaining a good curve match in this area.

In the region extending from Investigator 22 to the major fault west of Investigator 3 there is a definite "saddle" in the gravity data. This "saddle" is well developed in profile B/2 and among other things could be the response of a buried ridge in the roof of the Grassy Granite (Plate 6). It must be stressed that a granite ridge is only one possible explanation and such a ridge would have to extend almost to the surface to produce the observed gravity effect.

Section AA

This section has a great deal of geological control from drilling and the interpretation provides a very good curve match.

The results suggest that there is a moderate thickness of Mine Series rocks in this area. The possibility of structural abnormalities is very low.

Investigator 3 Section A/4

Geological control in this area is fair. The interpretation provides a moderately good curve match using the geological control available. The gravity profile suggests a steep granite contact at the surface which in turn (Plate 8) gives the area some potential for the existence of a ledge in the granite.

CONCLUSIONS

Using the results of the interpretations discussed above together with the contoured gravity data, the contact area has been sub-divided into five zones (see accompanying map No. 1). These zones represent areas within which the broad structural characteristics of the area are likely to be relatively uniform.

Zone No. 1

This zone appears to have potential for the greatest thickness of Mine Series rocks in the area. (greater than 300 metres). The existence of a major fault between the quartzite and Mine Series, and the steep granite contact, indicate that the zone is similar in structural setting to that at Bold Head.

Zone No. 2

Gravity data indicates that this area is characterised by a flat dipping granite contact and a limited thickness of Mine Series rocks (less than 150 metres thick).

Zone No. 3

Structure in this zone is likely to be fairly similar to that at Investigator 21 (section 563000N) and characterised by a moderate thickness of Mine Series rocks (approximately 150 metres thick) and a broad ledge in the granite contact.

Zone No. 4

Study of the interpretations on Sections B/2, BB and AA together with contoured gravity data indicates that parts of this zone are structurally complex. The difficulty in matching section B/2 with geologically reasonable models, suggests that the structural situation here may be more complex than our standard 2 dimensional model assumes. The following features could be contributing to this complexity:

a) irregular depth of weathering

b) major structural abnormalities in the granite contact

c) stronger than normal density contrasts within the Mine Series sequence

Thickness of Mine Series rocks in this zone is likely to be within the range 200-300 metres with potential for greater thickness in the area of Section BB.

Zone No. 5

Gravity results indicate that the subsurface structure in this area is relatively uniform. Thickness of Mine Series rocks in this zone is likely to be in the range 150-200 metres. Interpretation on Section A/4 suggests the presence of a'ledge' in the granite contact similar to that at Investigator 21.

RECOMMENDATIONS

Drilling targets cannot be specified in this area on the basis of the geophysical work alone.

The results of the geophysical interpretation work to date must be studied in close collaboration with the geologists and geochemists to determine areas for testing. This study should encompass all surface and down-hole geology, geochemistry and the knowledge of the subsurface structure as outlined in this report.

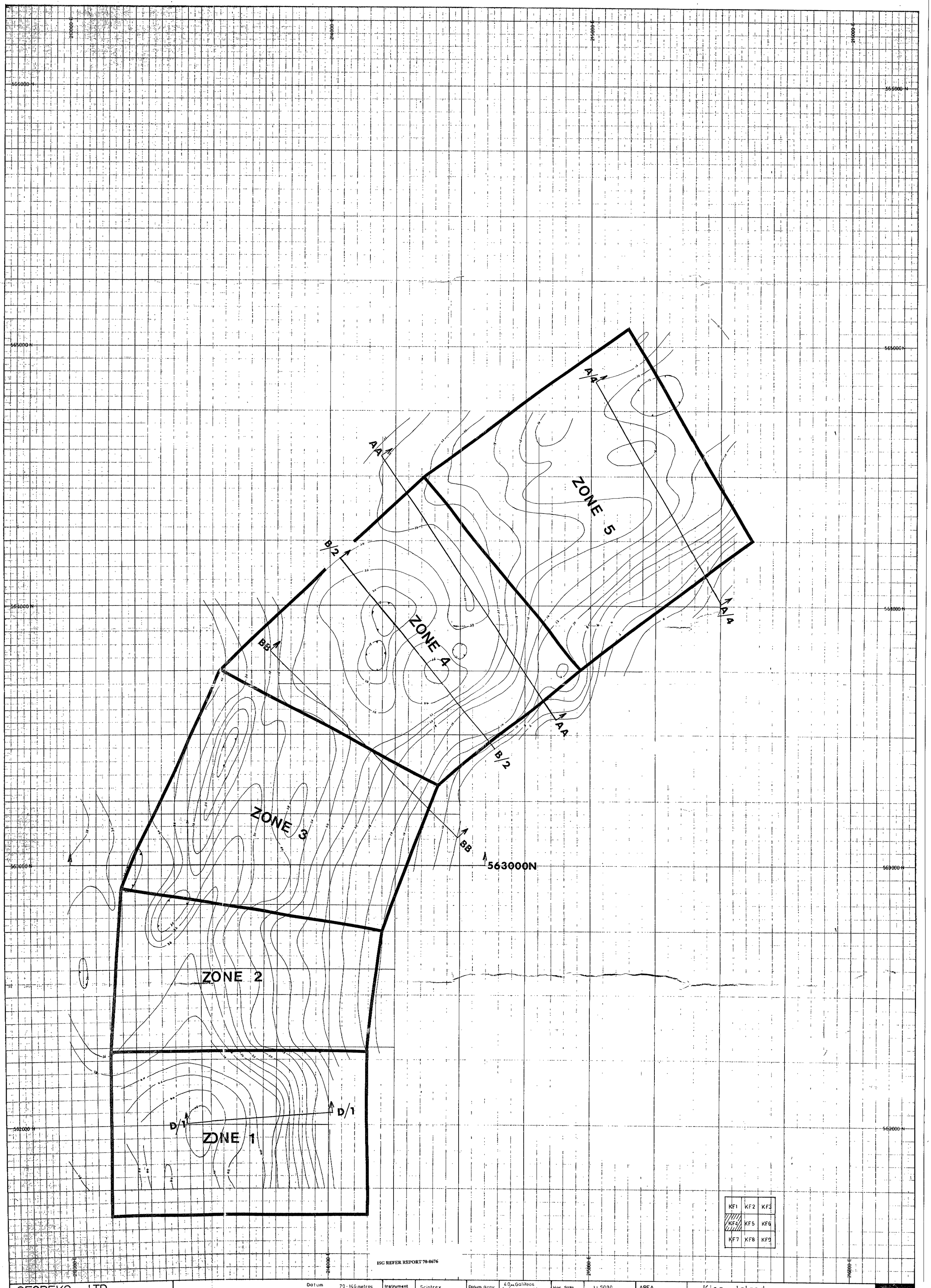
Further drilling and development in the area will be closely monitored by the geophysicists so that our knowledge of the subsurface structure can be up-dated and refined as new information becomes available.

R. C. Deakin
R. L. Richardson.

REFERENCES

BEER K. E., BURLEY A.S., TOOMBS J. M. C. The concealed Granite Roof in South west Cornwall. Tech Notes Institute of Geological Sciences, London. Date unknown.

DEAKIN R. C. "Geophysical Report on the Grassy Granite Contact Zone". L. A. Richardson & Associates Report. October 1976.



GEOPEKO LTD.
Geophysical Surveys.
Plan No. 4

Datum Elevation 79·146 metres
Bouguer Density 2·2 gm/cc

Instrument	Scintrex	Datum Grav	40 Galileos (uncorrected)	Hor Scale	1:5000	AREA	King Island
Observer	R Deakin	Base Reg	SG7120·49 N 220115·16 N	Vert Scale	———	PROSPECT.	GRASSY GRANITE AREA
Scale Fact	1·0187	Date	December 1975	Cont Int	2 Galileos	PLAN SHOWS.	Bouguer Gravity Contours — Sheet KF4

5cm

149023