HYDROGEOPHYSICAL REPORT 85/2.

GUNYANGARA ELECTROMAGNETIC

SURVEY

HYDROGEOPHYSICAL REPORT 85/2

GUNYANGARA ELECTROMAGNETIC SURVEY

PETER FURNESS

PF:TJ:134
10:REP4

CONTENTS

PF:TJ:134
10:REP4

Resistive zones a and c clearly arise due to the presence of impermeable granite gneiss outcropping in both locations. The very low but similar magnitudes observed with both coil configurations over zone a (see Figures 5.1 and 5.2) confirm the presence of a highly impermeable bedrock under shallow cover at this location. The groundwater potential (salt or fresh) of both zones a and c is considered negligible.

On the other hand resistive zone b exhibits considerable potential as the possible site of a freshwater aquifer. Unlike zones a and c there is no evidence here of granite gneiss. Moreover, this zone occupies one of the highest topographic locations on the peninsula.

The relative magnitudes of the two coil configurations observed over zone b (Figures 5.1 and 5.2) suggest a relatively resistive section with a mildly increasing conductivity profile (compatible with some considerable thickness of fresh water saturated alluvials). This is quite distinct from the behaviour observed over the salt contaminated region north of 2000N on the same profile.

It should be noted however that an alternative interpretation of zone b involving a region of granite gneiss covered by a moderate thickness of sands and clays would equally satisfy the data. Indeed, the location of outcropping granite on the coast immediately to the south east of zone b (mapped by the BMR) would argue in favour of this alternative explanation.

Conductive zone e is continuous with the coastal fringe of high conductivity areas and clearly reflects the inland migration of sea waters to the north east of the peninsula. In all probability conductive zone d has a similar causation (though to a lesser degree) at this location which is the narrowest part of the peninsula.

Again, conductive zone d could result from an alternative causation which would give it some significance as a possible fresh water aquifer. There is evidence to suggest that this zone could comprise some considerable thickness of fresh water alluvials with a significant clay fraction. This however is more likely to be the case if the causation of zone b transpired to be an area of shallow granite gneiss bedrock.

PF:TJ:134
10:REP4

5. RESULTS

The locations of all traverses on the peninsula are shown in Map 1. These include:

1. the base line running along the major north-south road,

2. a system of east-west traverses across the peninsula completed at 500 metre intervals along the base line, and

3. traverses A, B, D and E completed in areas requiring more detailed coverage and generally following local tracks.

Initially, as part of a reconnaisance exercise the base line was completed at a coil separation of 40 metres with both horizontal and vertical coplanar configurations. These data are shown in profile format in Figures 5.1 and 5.2.

With some differences in the amplitude of responses due to their different depths of investigation both configurations show basically similar behaviour along the peninsula. Predictably, the horizontal coplanar data tends to be noisier than the vertical coplanar results.

Since both coil configurations show much the same trends on the base line profile the vertical coplanar system was used for the remainder of the survey due to its ease of operation in vegetated areas. The resulting data is shown in contour map form in sheet 1. This indicates a fringe zone of high apparent conductivities caused by salt water contamination of the groundwater in the coastal regions of the peninsula. It also shows the interior of the peninsula to be composed of a mosaic of high and low conductivity zones. The high resistivity zones include:

a) the area south of 1000N,

b) between 1300N and 2100N, and

c) the area west of the base line between 2000N and 2500N.

High conductivity zones include:

d) the region between 900N and 1300N, and

e) north of 2100N.

PF:TJ:134
10:REP4

1. INTRODUCTION

During the period 10 to 13 April, 1985 a small electromagnetic survey was conducted on the Drimmie Peninsula by geophysical staff of the Water Resources Division of the N T Department of Mines and Energy.

In All, a field crew comprising one geophysicist and two field assistants completed 12.6 line km of electromagnetic profiling involving approximately 330 observations of apparent conductivity. This work was significantly interrupted during the period of the survey, by bad weather - approximately only 30% of the four days spent in the area being suitable for field operations.

The present work was conducted as part of an effort to provide a substantial groundwater supply for horticultural and domestic purposes on the peninsular. Previous scout drilling in the area had failed to achieve this objective.

PF:TJ:134
10:REP4

2. GEOLOGY

The core of the peninsula comprises Archaen Bradshaw Granite (garnetiferous granite gneiss). This crops out in the south of the peninsula as large tors and residual hills. It also outcrops in the north-west where it has been quarried for aggregate and building material. Elsewhere, the interior of the peninsula comprises Cainozoic sands and clays capped with laterite and ferricrete.

PF:TJ:134
10:REP4

3. SURVEY AIMS

Previous water drilling on the Drimmie Peninsula had been unsuccessful. Most groundwater struck had been brackish, while any fresh water encountered tended to be shallow and therefore of limited potential.

The present electromagnetic survey was aimed at elucidating the groundwater regime on the peninsula. In particular it was expected that the survey would:

1. outline the regions of significant salt water influence;

2. outline low permeability areas of subcropping and shallow granite gneiss, and

3. indicate zones of high fresh groundwater potential either directly as by inference from the results of 1 and 2 above.

PF:TJ:134
10:REP4

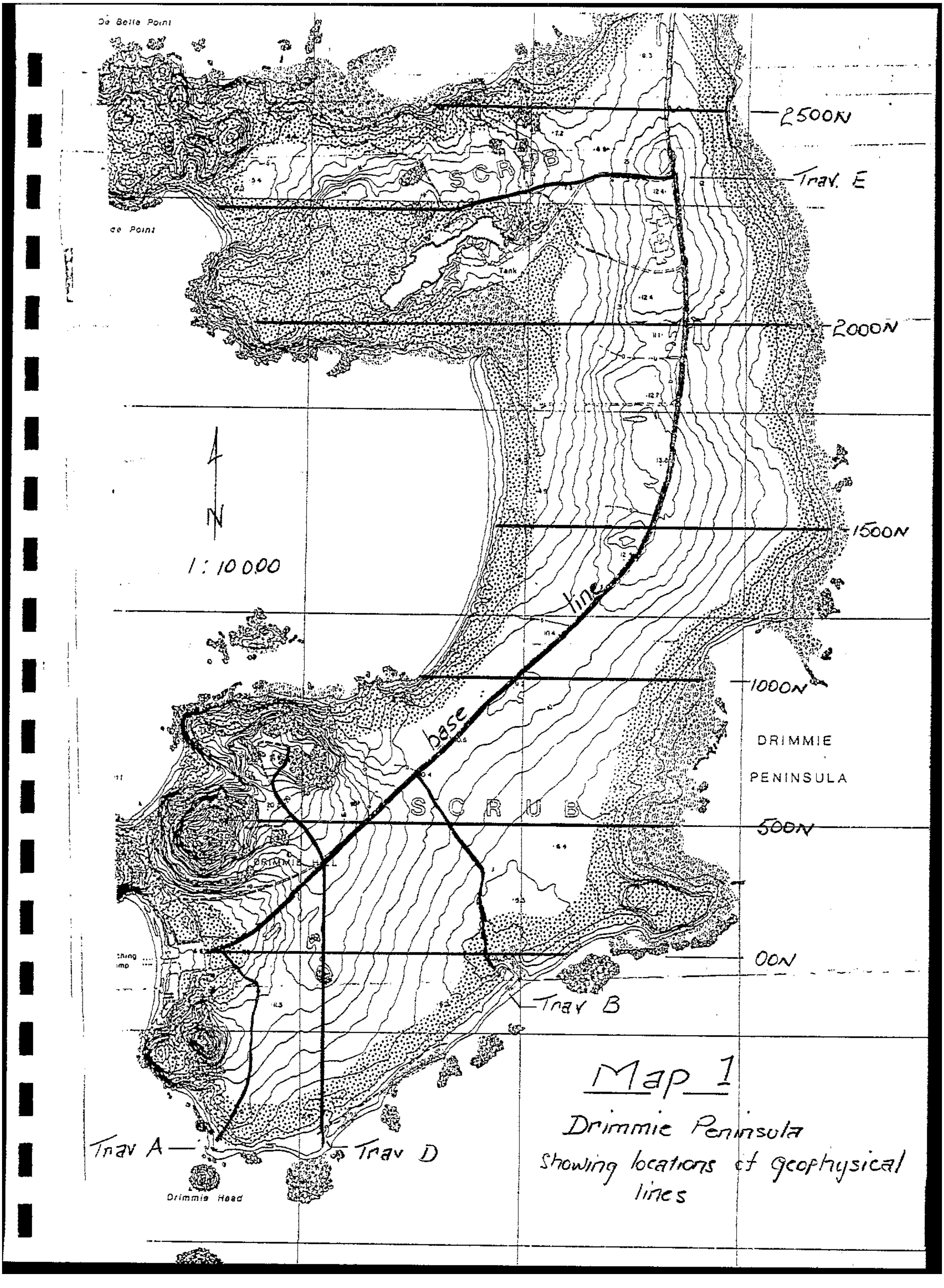
4. INSTRUMENTATION

The equipment used on the Gunyangara survey was an inductive ground conductivity system (EM 34-3) manufactured by Geonics Ltd of Canada. This system is a dual coil system capable of operating in either the horizontal or vertical coplanar configurations at separations of 10, 20 and 40 metres.

Operating frequency and coil separation are selected to ensure operation at low induction numbers. Here an apparent conductivity can be defined from the observed quadrature response and is read directly from the receiver. The received in-phase signal is employed to maintain the required coil separation.

Interpretation is generally based on a geometric factor approach. Within limits, the depth of investigation of this tool is relatively independent of the ground conductivity distribution, and is a function only of coil configuration and separation. The depth of investigation varies linearly with coil separation while for a given separation it is significantly greater for the horizontal coplanar coil arrangement than for the vertical coil system.

PF:TJ:134
10:REP4


De Belle Point
2500N
Trav. E
SCRUB
Tank
2000N
1:10000
N
1500N
base line
1000N
DRIMMIE
PENINSULA
SCRUB
500N
DRIMMIE HILL
00N
Trav B
Trav A
Trav D
Drimmie Head
Map 1
Drimmie Peninsula
Showing locations of geophysical lines

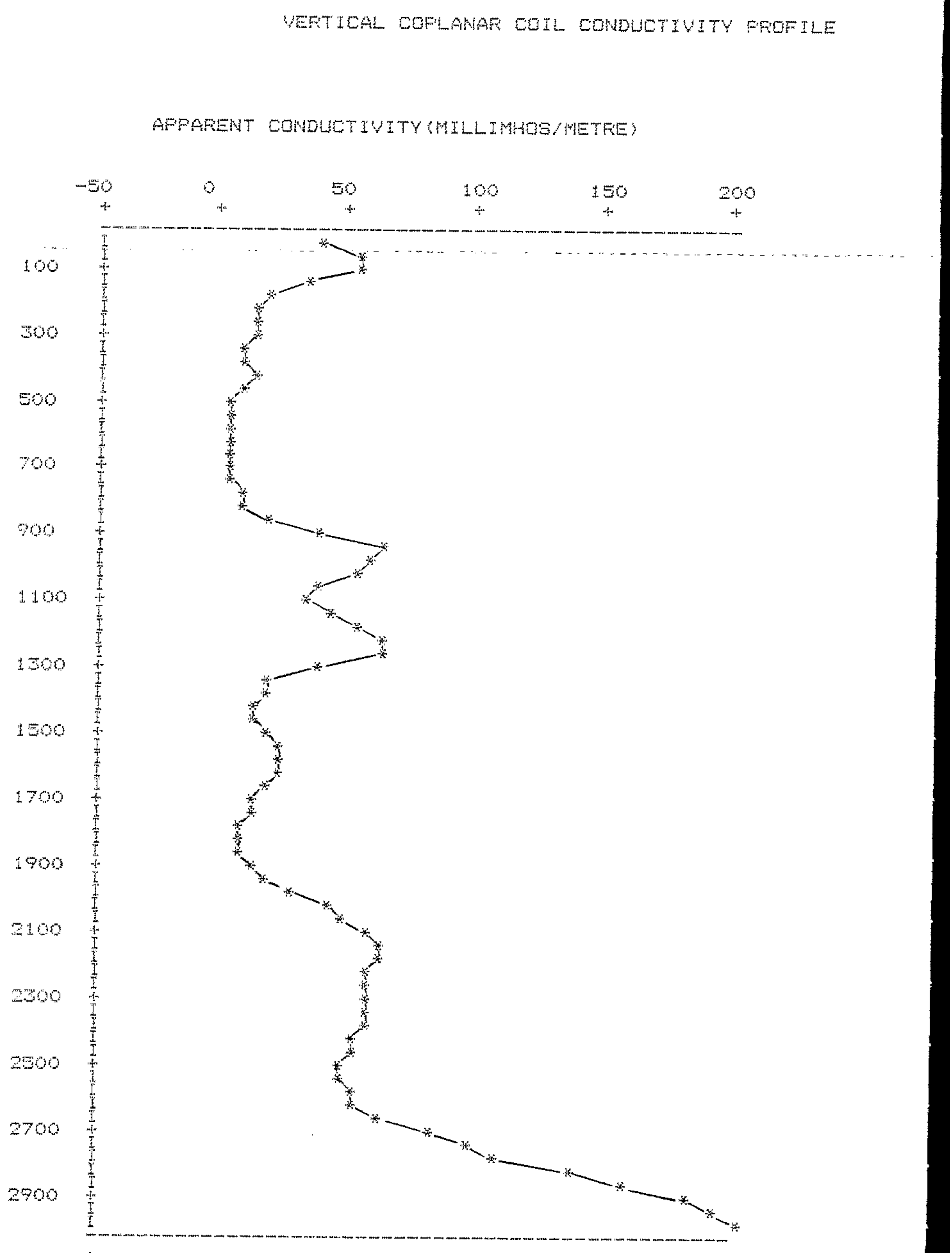

VERTICAL COPLANAR COIL CONDUCTIVITY PROFILE
APPARENT CONDUCTIVITY(MILLIMHOS/METRE)
-50
0
50
100
150
200
100
300
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
2700
2900

Figure 5.1

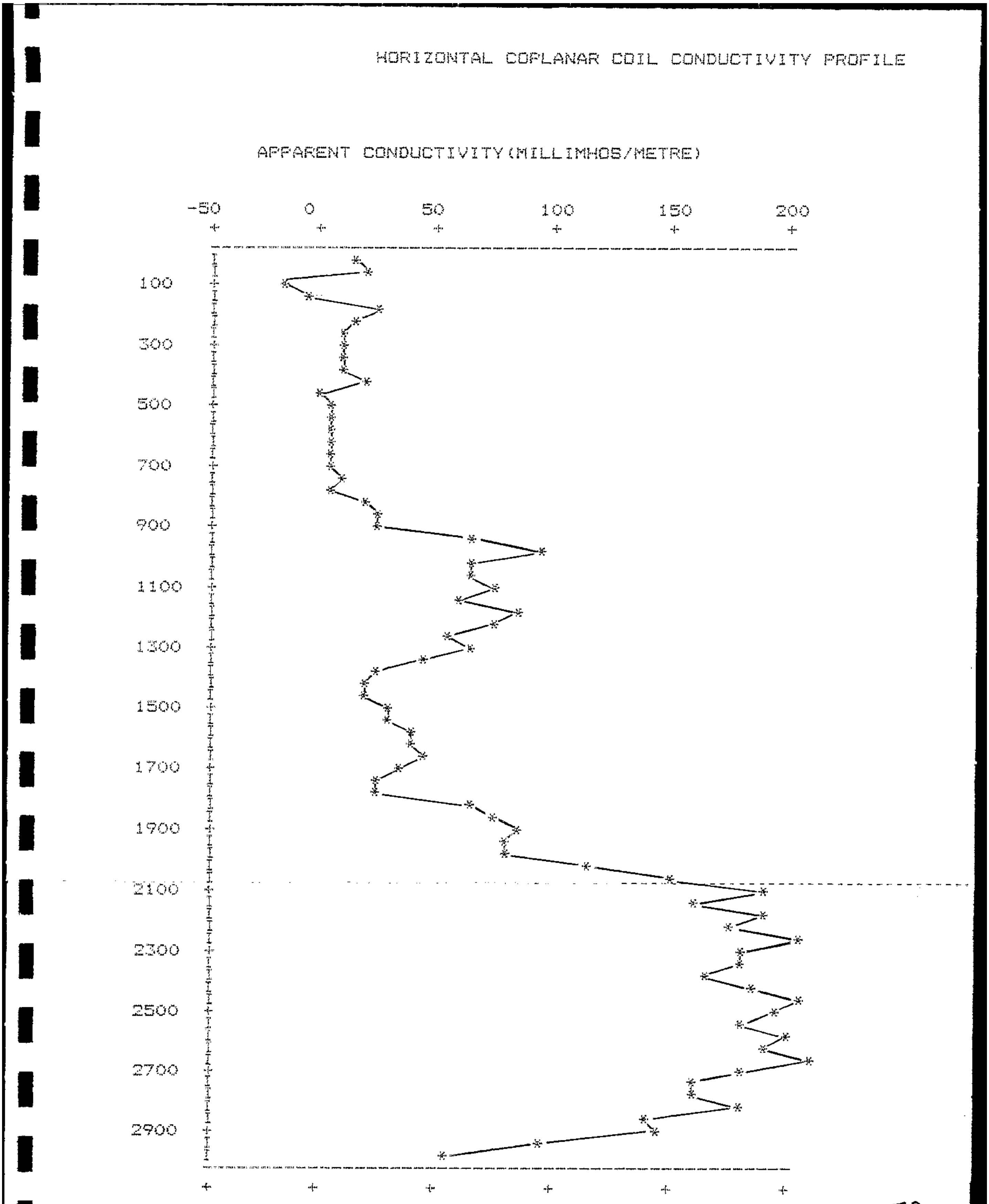

HORIZONTAL COPLANAR COIL CONDUCTIVITY PROFILE
APPARENT CONDUCTIVITY(MILLIMHOS/METRE)
-50
0
50
100
150
200
100
300
500
700
900
1100
1300
1500
1700
1900
2100
2300
2500
2700
2900

Figure 5.2

5. RESULTS

The locations of all traverses on the peninsula are shown in Map 1. These include:

1. the base line running along the major north-south road,

2. a system of east-west traverses across the peninsula completed at 500 metre intervals along the base line, and

3. traverses A, B, D and E completed in areas requiring more detailed coverage and generally following local tracks.

Initially, as part of a reconnaisance exercise the base line was completed at a coil separation of 40 metres with both horizontal and vertical coplanar configurations. These data are shown in profile format in Figures 5.1 and 5.2.

With some differences in the amplitude of responses due to their different depths of investigation both configurations show basically similar behaviour along the peninsula. Predictably, the horizontal coplanar data tends to be noisier than the vertical coplanar results.

Since both coil configurations show much the same trends on the base line profile the vertical coplanar system was used for the remainder of the survey due to its ease of operation in vegetated areas. The resulting data is shown in contour map form in sheet 1. This indicates a fringe zone of high apparent conductivities caused by salt water contamination of the groundwater in the coastal regions of the peninsula. It also shows the interior of the peninsula to be composed of a mosaic of high and low conductivity zones. The high resistivity zones include:

a) the area south of 1000N,

b) between 1300N and 2100N, and

c) the area west of the base line between 2000N and 2500N.

High conductivity zones include:

d) the region between 900N and 1300N, and

e) north of 2100N.

PF:TJ:134
10:REP4

Resistive zones a and c clearly arise due to the presence of impermeable granite gneiss outcropping in both locations. The very low but similar magnitudes observed with both coil configurations over zone a (see Figures 5.1 and 5.2) confirm the presence of a highly impermeable bedrock under shallow cover at this location. The groundwater potential (salt or fresh) of both zones a and c is considered negligible.

On the other hand resistive zone b exhibits considerable potential as the possible site of a freshwater aquifer. Unlike zones a and c there is no evidence here of granite gneiss. Moreover, this zone occupies one of the highest topographic locations on the peninsula.

The relative magnitudes of the two coil configurations observed over zone b (Figures 5.1 and 5.2) suggest a relatively resistive section with a mildly increasing conductivity profile (compatible with some considerable thickness of fresh water saturated alluvials). This is quite distinct from the behaviour observed over the salt contaminated region north of 2000N on the same profile.

It should be noted however that an alternative interpretation of zone b involving a region of granite gneiss covered by a moderate thickness of sands and clays would equally satisfy the data. Indeed, the location of outcropping granite on the coast immediately to the south east of zone b (mapped by the BMR) would argue in favour of this alternative explanation.

Conductive zone e is continuous with the coastal fringe of high conductivity areas and clearly reflects the inland migration of sea waters to the north east of the peninsula. In all probability conductive zone d has a similar causation (though to a lesser degree) at this location which is the narrowest part of the peninsula.

Again, conductive zone d could result from an alternative causation which would give it some significance as a possible fresh water aquifer. There is evidence to suggest that this zone could comprise some considerable thickness of fresh water alluvials with a significant clay fraction. This however is more likely to be the case if the causation of zone b transpired to be an area of shallow granite gneiss bedrock.

PF:TJ:134
10:REP4