IESE
Institute of
Earth Science
and Engineering
Aotearoa

DEVORA

Synthesis of Existing Structural Data for the Auckland Volcanic Field

Marion Irwin
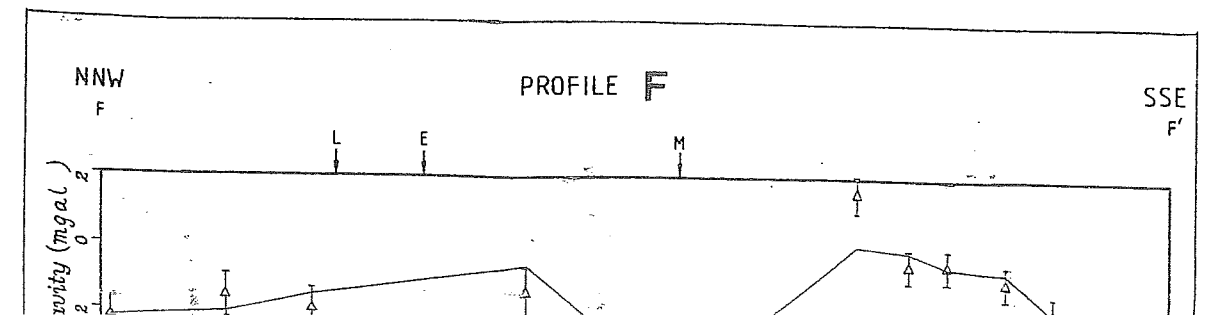
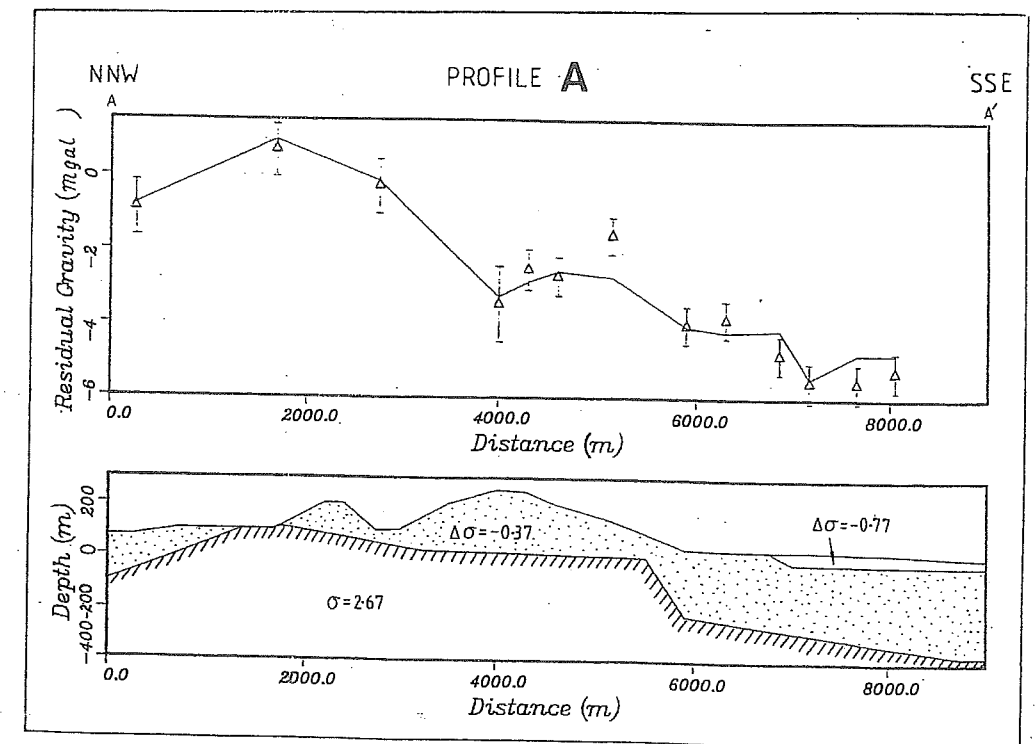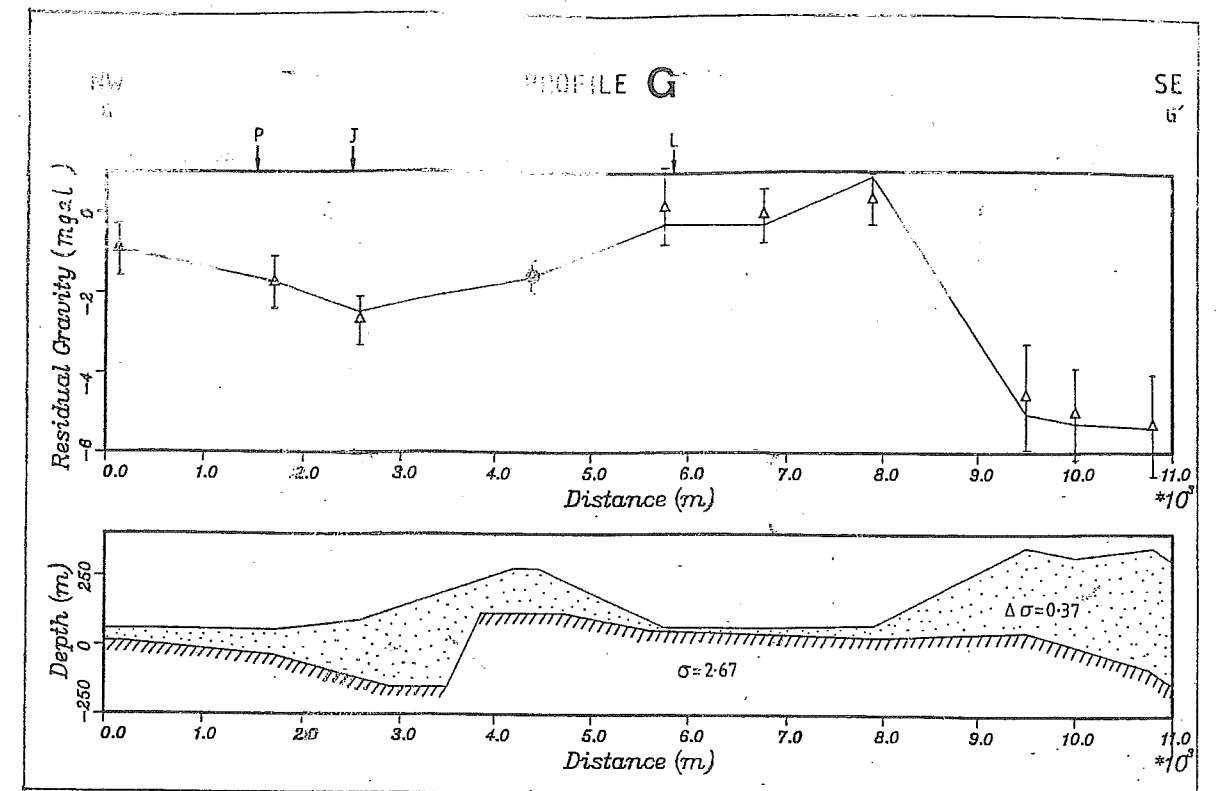# Synthesis of Existing Structural Data for the Auckland Volcanic Field

Marion Irwin[1]

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APPENDIX 3.

DALY - LEIGH/TE ARAI

NW-SE PROFILES

PROFILE N

PROFILE G

PROFILE K

PROFILE A

PROFILE F

PROFILE C

Distance (m)

$\Delta\sigma = -0.77$ $\Delta\sigma = -0.17$

$\Delta\sigma = -0.37$

$\sigma = 2.67$

Depth (m)

Distance (m)

Distance (m)

Residual Gravity

Distance (m)

Depth (m)

$\sigma = 2.67$

$\Delta\sigma = -0.17$

Distance (m)

PROFILE D

SW
D
D
VES W1

NE
D'
C

N   G   VES T3   VES T1,T2   K   T
Seismic Profile=2

Residual Gravity (mgal)

Distance (m)

$\Delta\sigma = -0.77$

Depth (m)

$\Delta\sigma = -0.32$ $\Delta\sigma = -0.37$ $\sigma = 2.67$

Distance (m)

FIGURE 2.6 Modelled Gravity Profile

PROFILE P

SW
P
P

NE
P'

N   G   K

Residual Gravity (mgal)

Distance (m)

Depth (m)

$\Delta\sigma = -0.32$ $\Delta\sigma = -0.37$ $\sigma = 2.67$

Distance (m)

Sand/Alluvium

Waitemata Gp.

Mahurangi Lmst.

Greywacke

Densities and density contras
in models are in units of Mgm

PROFILE B

PROFILE J

PROFILE I

PROFILE O

PROFILE H

PROFILE L

ations of the profiles are shown in Map 1.

Observed gravity with error bars

Observed gravity at trigonometric stations with error bars

Calculated gravity

K
Intersecting profile

VES W1
Projected position of resistivity sounding

eismic Profile #1
Projected position of seismic profile

PROFILE L

NW
E

SE
E'

PROFILE M

NW
M

SE
M'

Location map of profiles
Daly Leigh - Te Arai

Leigh (km) Moko Hinau

400
300
(nT.)
200
0
50
(m)
100

0
5
10
15
20
25
30
35
40
45
50

1·922   1·61   5·0   1·61   1·5e2   5·0

3·5
2·8
(5·0)
????

5·9

0
500
1000
1500
(m)
2000
2500

Inferred   Rock   Types

water
volcanic
unconsolidated sediments
consolidated sediments
older sediments (basement)

Figure 1.4: Absolute Bouguer gravity anomaly map of the Manukau lowlands, produced by the Auckland Regional Water Board in 1989 as part of a study of the Kaawa Formation aquifer system.

Figure 1.5: Proposed fault structure for the study area (Auckland Regional Council 1993) based on selected borehole log interpretation, being an extension eastward of Berry's (1986) modelled fault block system. (After ARC 1993).

Manukau Harbour

Pahurehure Inlet

S.H.1

Papakura Interchange

-20

-20

-20

-40

0

Glassona Bridge

Karaka

Clarks Creek

WRIGHT ROAD

SEAGROVE ROAD

KIDD ROAD

ONEWOOD ROAD

Te Hihi

MUIR ROAD

BLACKBRIDGE ROAD

-40

0

0

Kingseat

-20

BATTY ROAD

CHARLES ROAD

KARAKA ROAD

-20

-40

-60

Clarks Beach

CLARKS BEACH ROAD

Waiau Pā

0

-20

WAIAU PA ROAD

-40

-60

KINGSEAT ROAD

S.H.22

PAERATA ROAD

GLENBROOK ROAD

-40

Taihiki River

Waiuku River

GLENBROOK PENINSULA

Waitemata

0   1   2   3
km

Figure 2.2: Structural contour map of the Waitemata basement surface. Solid circles represent bores that penetrate the basement, empty circles those that do not. Contoured depths are metres above sea-level; contour interval is 20m.

Figure 3.16: Model of the Waitemata basement surface. Elevations are in metres *below* sea-level; contour interval is 10m.

REGIONAL FIELD
1 MGAL CONTOUR INTERVAL

Figure 3.22: Location of modelled profile lines A, B and C.

ABSOLUTE BOUGUER ANOMALIES
Source: Kaawa Formation Report 1989

A.R.W.B. Gravity station

Figure 3.23: Location of modelled profile line D.

discussed in section 3.4, and the value for greywacke is compatible with that determined by Hatherton and Leopard (1964), and has been used extensively in other geophysical investigati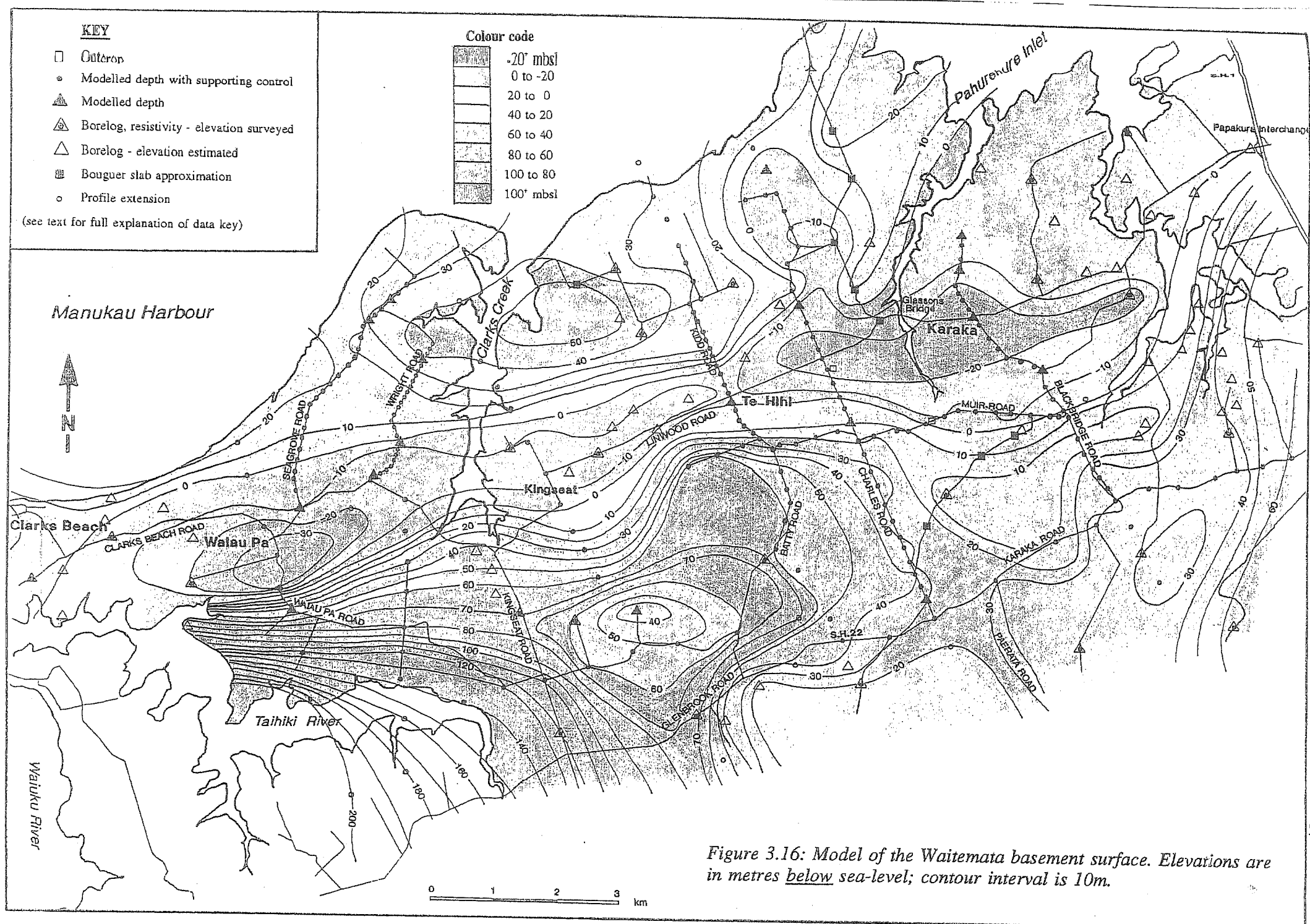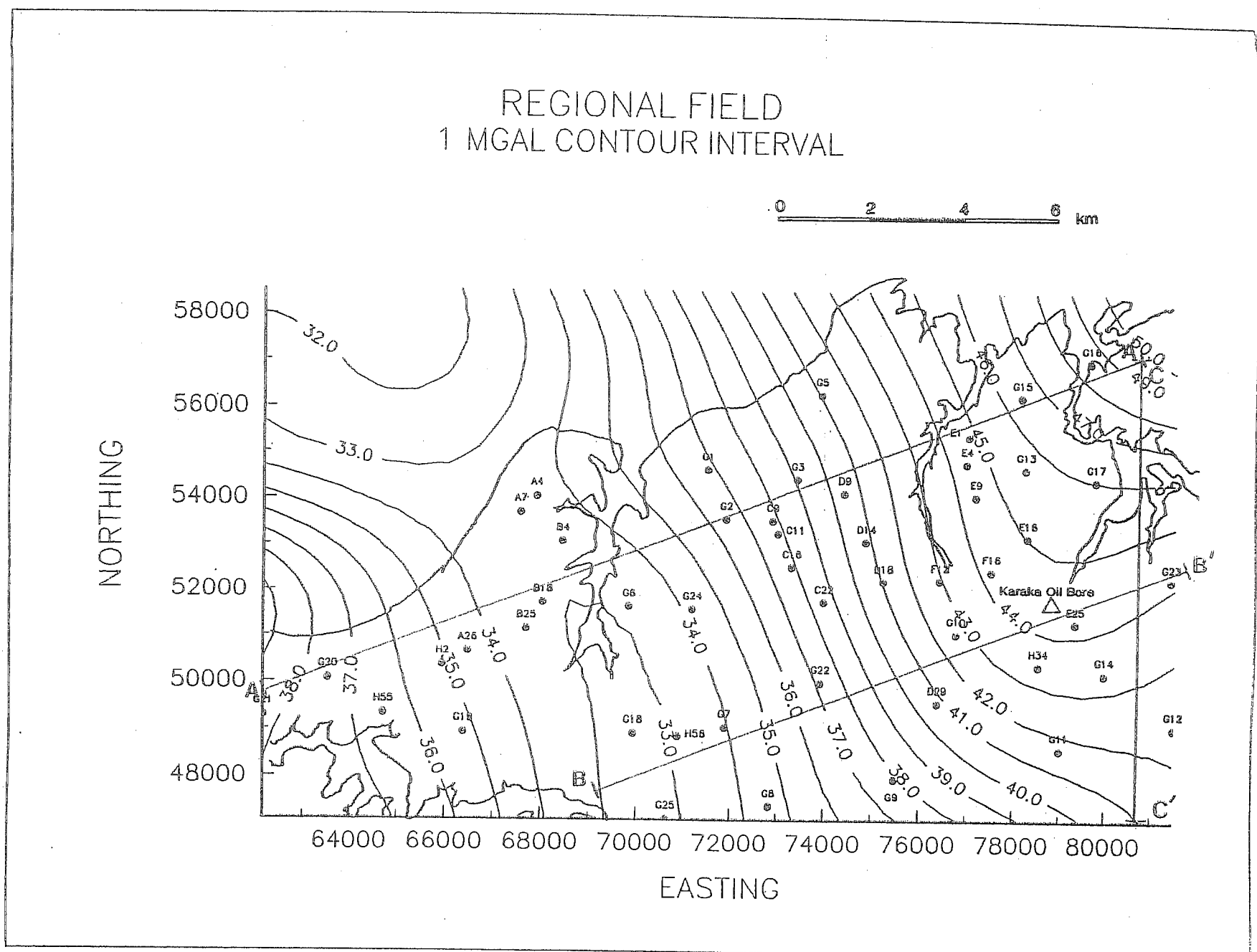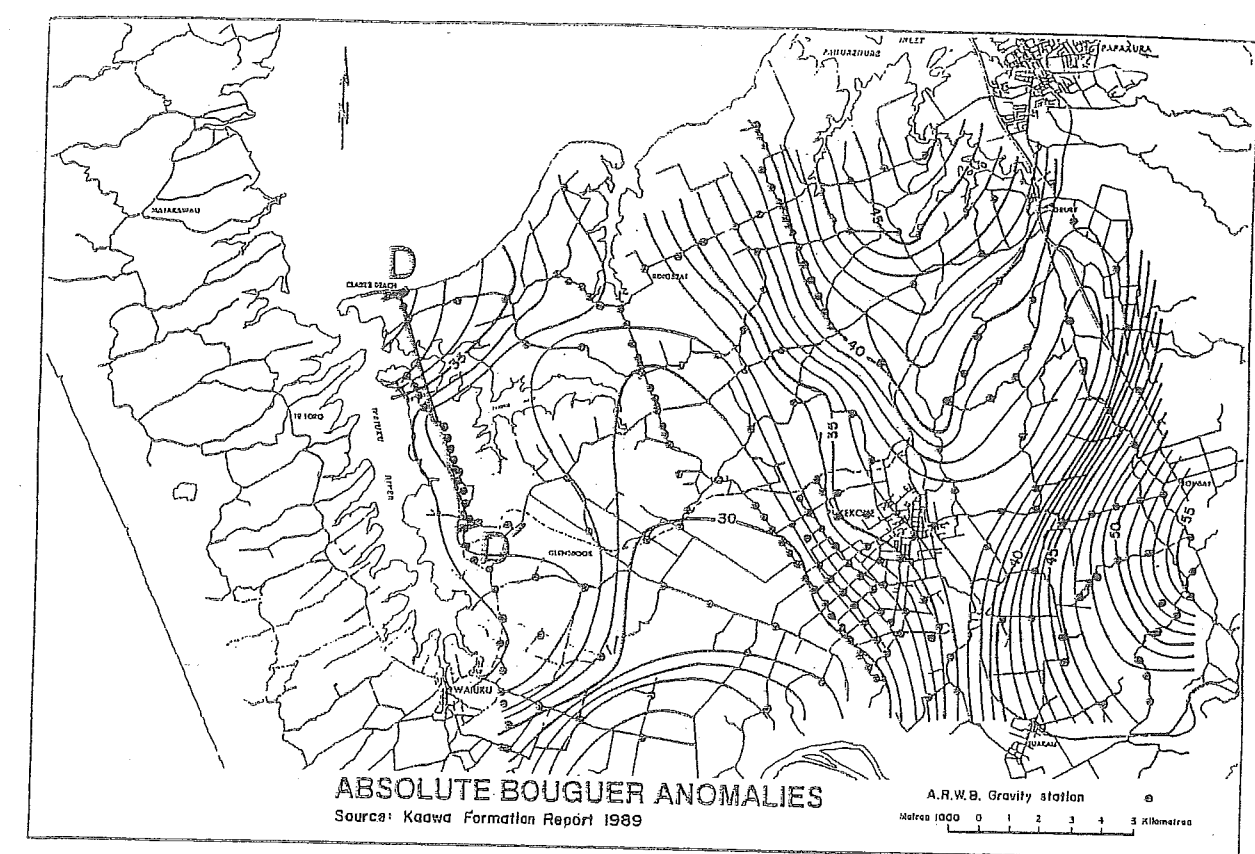ons (eg. Hochstein and Nunns 1976). It has been assumed that there is no significant density contrast between the two greywacke terranes.

Profiles A, B and C and their modelled cross sections are presented in figures 3.24, 3.25 and 3.26; it should be noted that there is a vertical exaggeration of 2x in the sections. The main feature is the general deepening of the basement to the south and to the west. The model for profile A has the greywacke basement increasing in depth from some 250m in the east to a maximum depth of 1900m before rising towards the west; the B profile model similarly reaches a depth of 1835m but only comes to within 625m of the surface to the east. Profile C in the east of the area shows a gradual decline in the greywacke surface southward at a dip of about 5°, presumably reflecting the southwards-increasing west downthrow of the

J. Allen

Figure 3.24: Calculated and observed gravity anomalies and gravity model for profile A.

Figure 3.25: Calculated and observed gravity anomalies and gravity model for profile B.
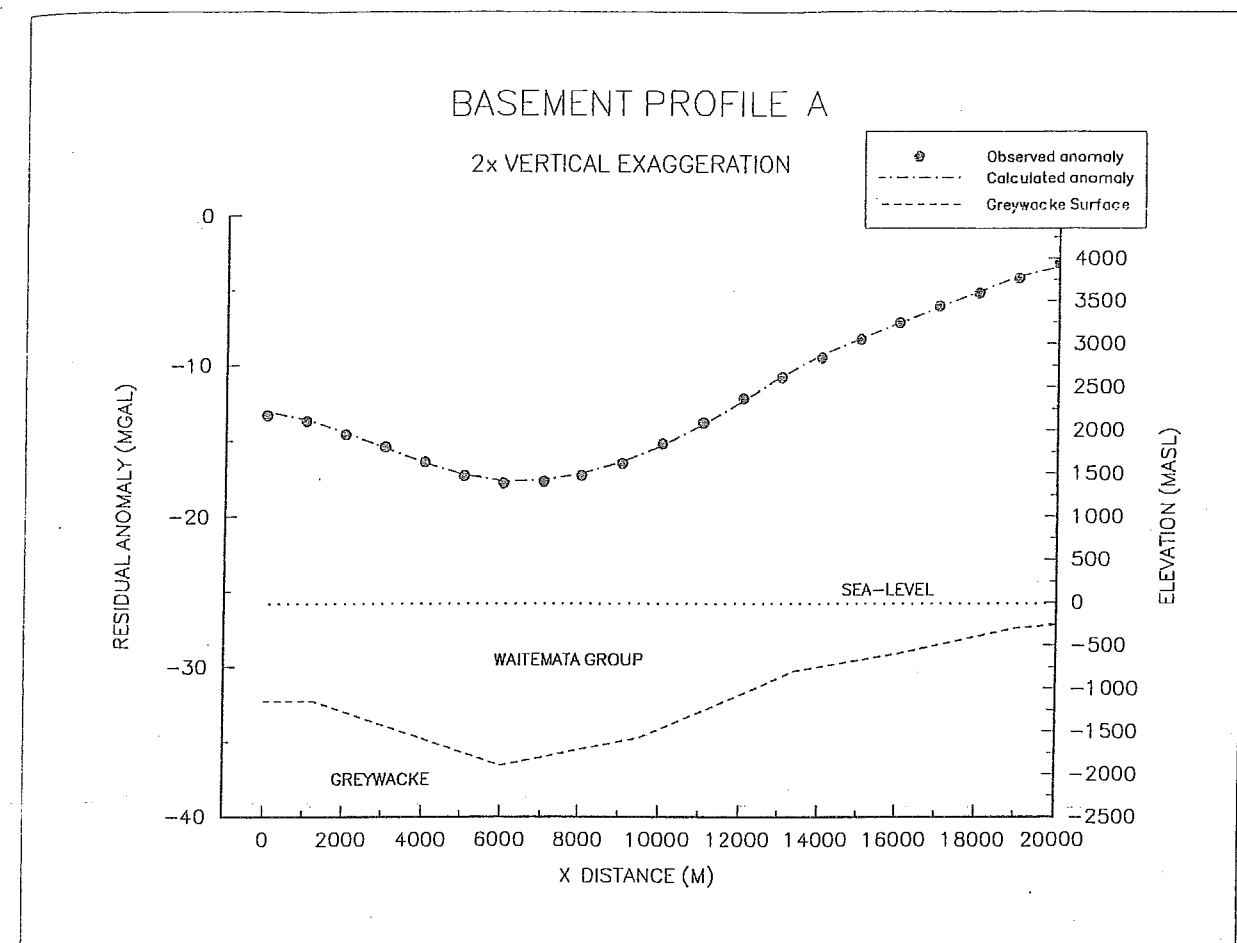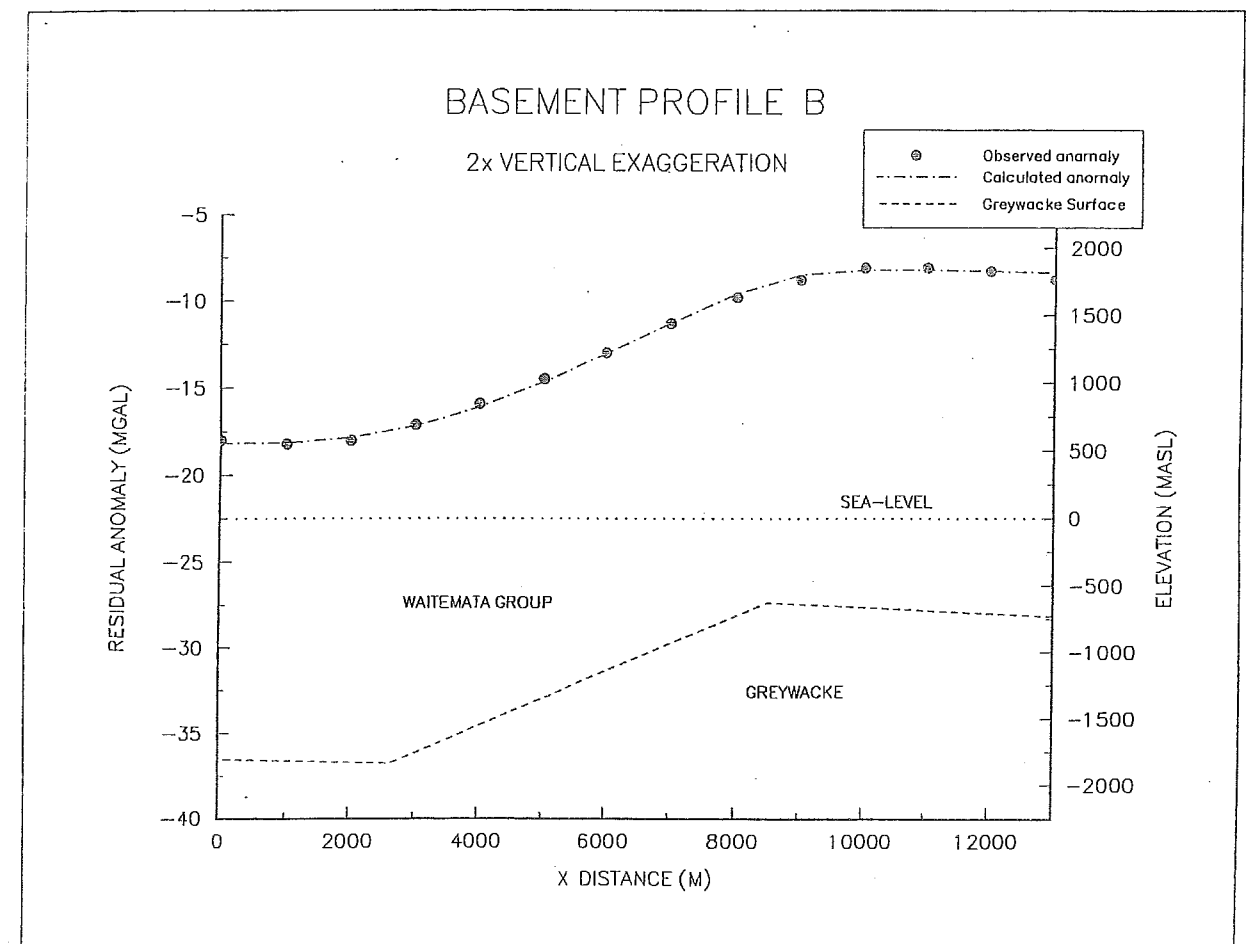
Figure 3.26: Calculated and observed gravity anomalies and gravity model for profile C.

Figure 3.27: Calculated and observed gravity anomalies and gravity model for profile D.

N

A Decreasing throw north of Alfriston
0.5km Ardmore
2.7km Paeroa

DEVEY FAULT

ST STEPHENS FAULT

PUNI FAULT Reverse

POKENO FAULT 0.9km throw

depth to basement in W
from [illegible]

if Waikato-Pokeno
are one
not simple
scissor.

sense
different
from Waikato fault

other
throw

depth to basement
suggests subsurface
E ext. of Waikato fault
(at least 6km
E of Tuakau

depth to basement N ext
suggests subsurface

WAIHAKATA FAULT

WAIKATO FAULT

2.5km throw

2.5km
throw
base

S. Auck.
volcanics

Scale

0   37°S   10km

175°E

LOCATION MAP

AFTER: SCHOFIELD 1968, WATERHOUSE 1976, KEAR 1978,
CURTIS & NUNNS 1976, RAFFERTY 1977, HADFIELD 1987

GEOLOGY

DIAGRAM SHOWING BOREHOLE GROSS STRATIGRAPHY AND POSITION
(Details of Boreholes in Table 1.2A)

DRURY FAULT

ST STEPHENS FAULT

POKENO FAULT

POKENO

WAIKATO FAULT

KEY

VERTICAL SCALE

Km

HORIZ SCALE

0   KM   5

Auck Volcanics

QUATERNARY

· Tauranga Gp.

· Kaihu Gp.

MIOCENE

· Waitemata Gp

OLIGOCENE

· Te Kuiti Gp

EOCENE

· Coal Measures

FAULT

MESOZOIC

· Greywacke

Junction Ultramafics
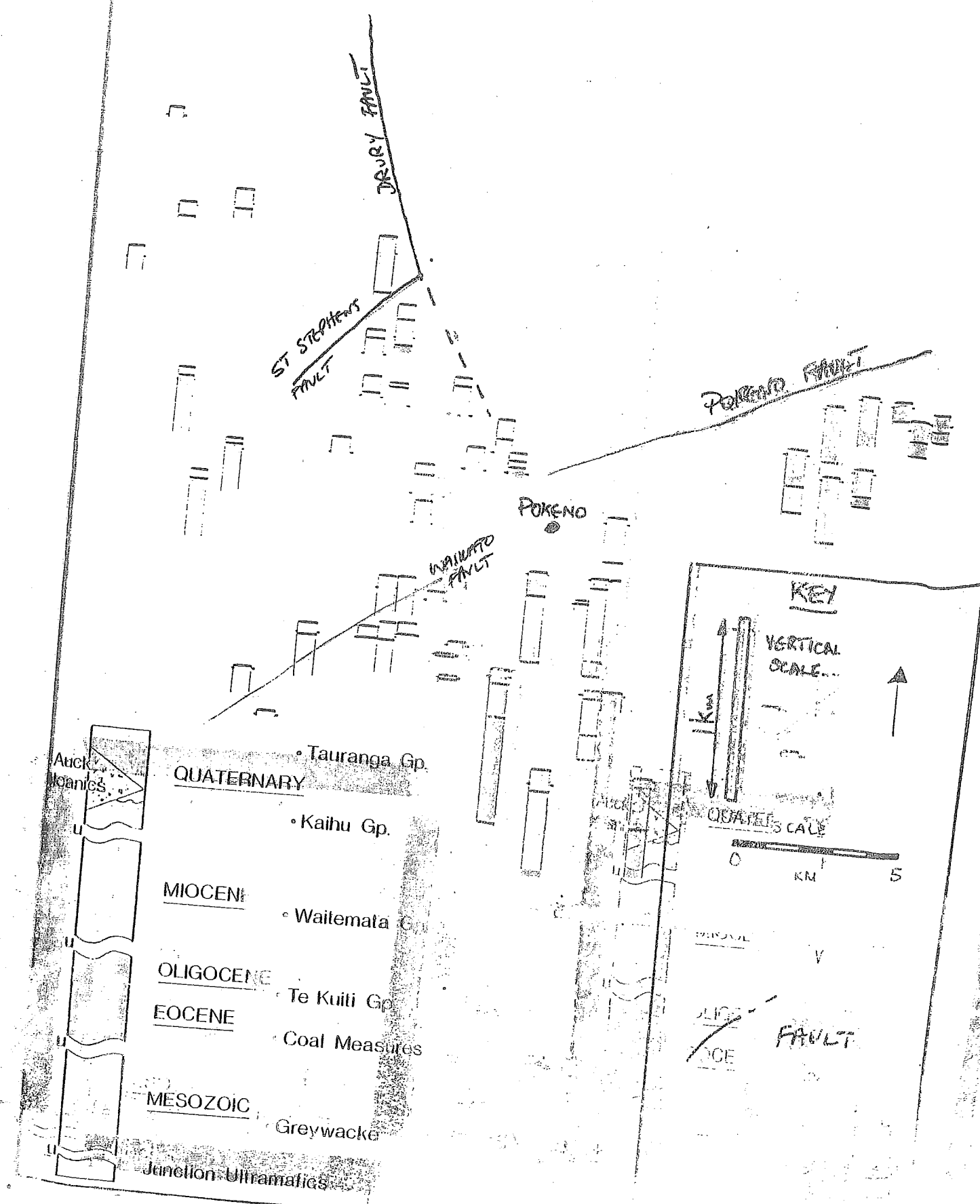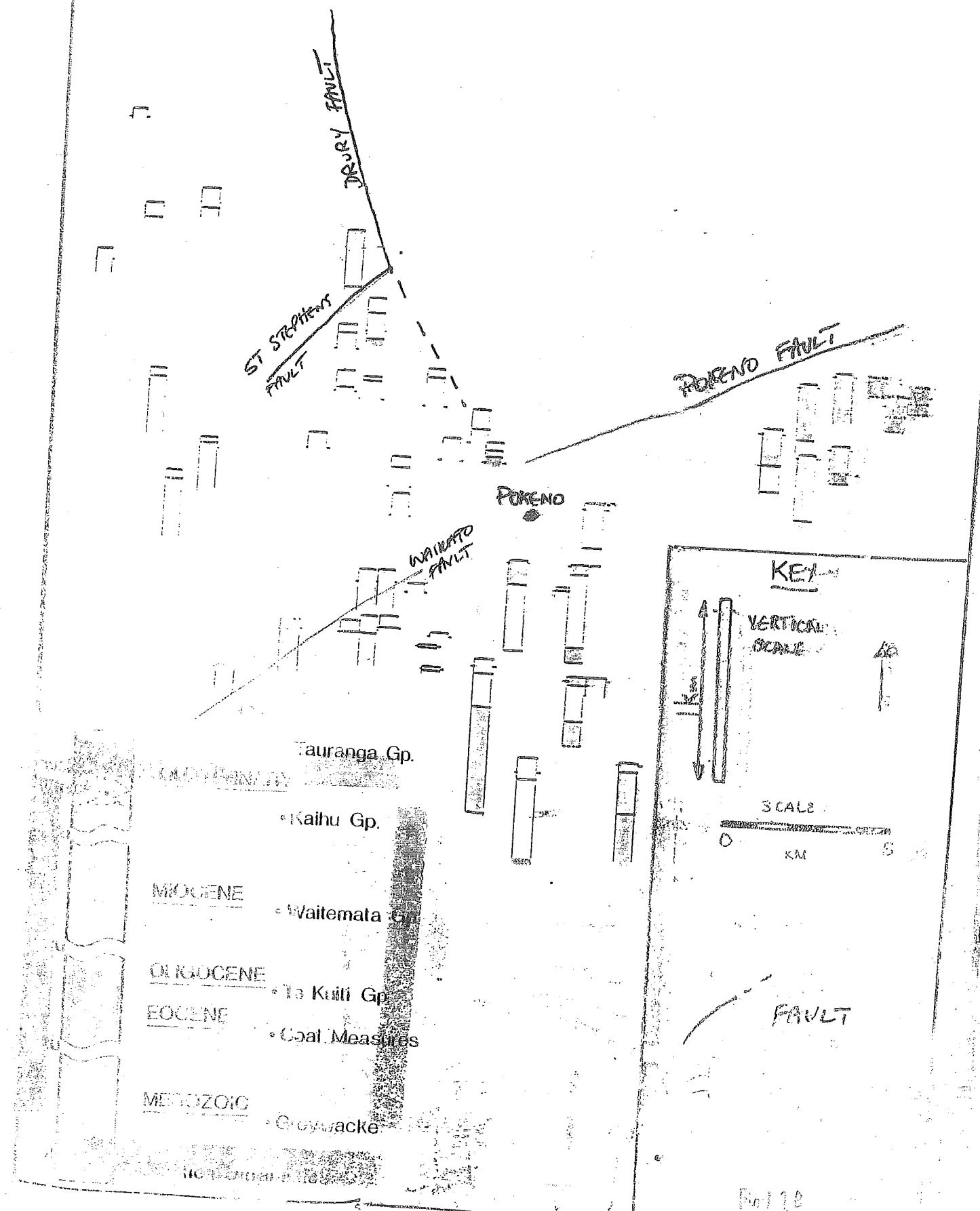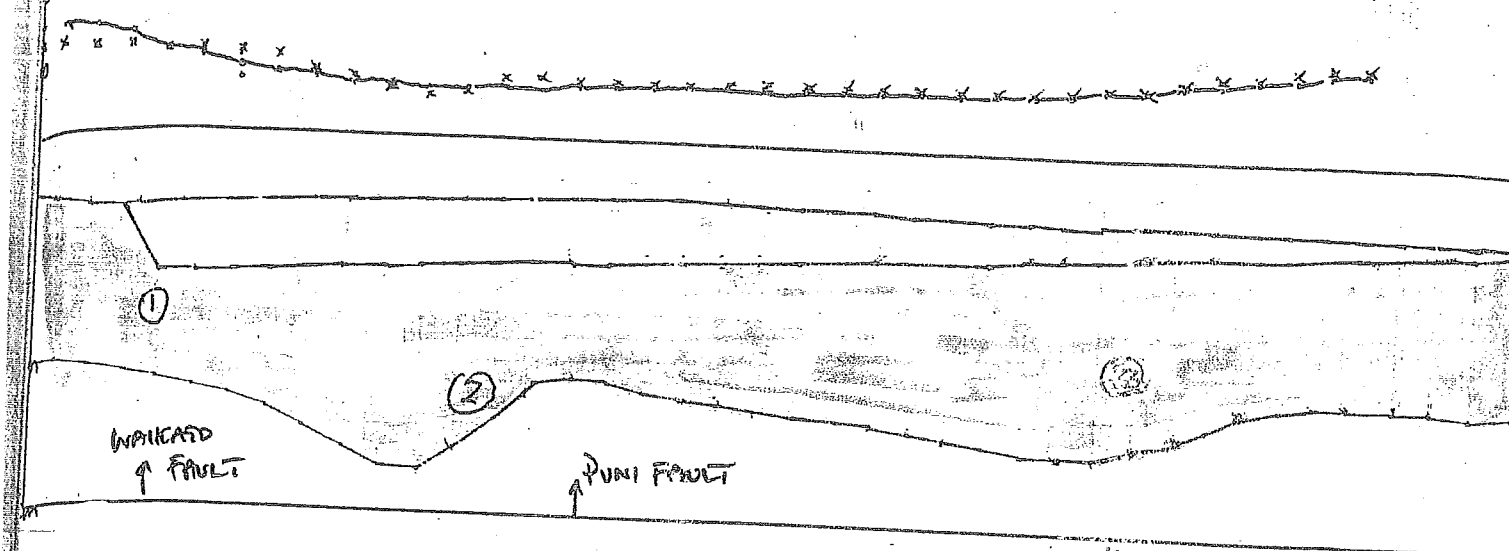
Fig 1.2 B

DIAGRAM SHOWING BOREHOLE GROSS STRATIGRAPHY AND POSITION
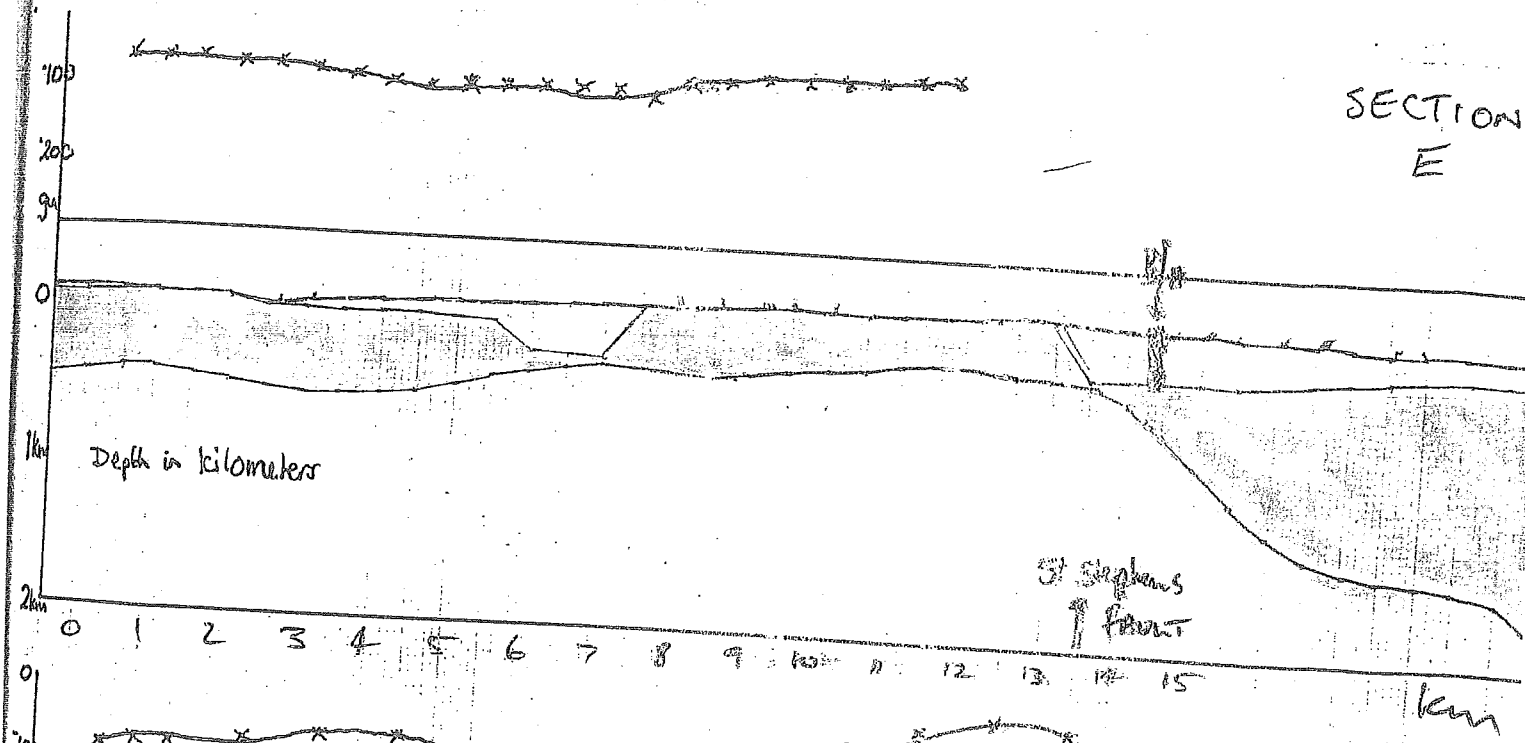(Details of Boreholes in Table 1.2A)

DRURY FAULT

ST STEPHENS FAULT

POKENO FAULT

POKENO

WAIKATO FAULT

KEY

VERTICAL SCALE

SCALE

0 ___ 5
KM

FAULT

Tauranga Gp.

Kaihu Gp.

MIOCENE — Waitemata Gp.

OLIGOCENE — Te Kuiti Gp.

EOCENE — Coal Measures

MESOZOIC — Greywacke

ORMEROD

①

②

③

WAIKATO
↑ FAULT

PUNI FAULT

SECTION
E

'100
'200
9u
0

1km   Depth in kilometer

2km

St Stephens
↑ FAULT

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   km

0
'100
'200
9u

SECTION
F

0

1km   Depth in kilometer

Quaternary
Tertiary
Basement

POKENO
↑ FAULT

DISTANCE NORTHING NZMG COORDINATES (mN)

MENT

AST

JXIMATELY

Detail Approximate Model—
True Scale

Northing NZMG COORD/100

N

LINES A–F INDICATE
POSITION OF SECTIONS
THROUGH SECOND MODEL
SHOWN IN FIG 7.3A
(1 and 2)

FINAL MODEL - 2D SECTIONS   EAST/WEST   Fig 7.3A

ST

EAST

SECTION
A

KEY

Observed

X = Residual 2 Anomaly

— = Calculated

Gravity Effect of model
shown in profile below.

Note: Calculated anomalies
are for three
dimensional
model.

≡ Borehole

pth in kilometers

①

②

DRURY
↑ FAULT

1 2 3 4 5 6 7 8 9 1010 11 121 13 14 15 Km

Km

SECTION
B

epth in kilometers

WHANGARATA
↑ FAULT

SECTION
C

epth in kilometers

Quaternary
Tertiary
Basement

TABLE 1.2B

TABLE OF BOREHOLES

WVA#/REF#	Coordinates mE	mN	Height m	Top of Waitemata G	Max Depth of B.Hole	Top of Basement
2290/1	6892	4398	100	65		
1930/3	6812	4404	56	n/r	−20	
1921/5	6860	4348	103	5	−238	
1208/7	6838	4349	56	n/r	−180	
1330/8	6795	4417	63	n/r	−253	
1429/9	6856	4433	172	100	−300	
1439/10	6866	4382	120	n/r	−58	
1450/11	6767	4410	109	n/r	+40	
1923/12	6862	4363	69	n/r	−160	
1427/13	6790	4465	20	−57	−246	
2309/14	6806	4467	467	−95		
2308/15	6850	4456	~100	−210		
453/16	6775	4450	~60	n/r		
/17	6849	4428	140	91	−141	
/18	6855	4414	120	108		
/19	6850	4416	110	23		
/20	6871	4419	220	168		
/21	6871	4418	220	149		
/22	6876	4414	200	155		
2302/23	6802	4390	59	−26		
/24	6841	4400	80	n/r	−318	
/25	6881	4398	120	128	3	
/26	6866	4391	160	114		
/27	6861	4363	70	n/r		
/28	6863	4359	70	4	−180	
/29	6857	4348	60	2		
/30	6835	4349	65	n/r		
/31	6819	4338	20	n/r	−200	
/32	6827	4325	10	20	−141	
/33	6880	4348	155	25		
/34	6878	4345	105	−10		
/35	6878	4339	100	−10		
2307/36	6889	4403	180	n/p		
1370/37	6782	4490	~60	−42	wc +88	80
1422/38	6919	4337	20	n/r		
9140/39	6978	4402	27	n/p	−100	
9141/40	6988	4425	20	n/r		−343
9142/41	6967	4409	8	−170	−272	
9143/42	7005	4418	47	n/p	wc −304	−470
9144/43	6988	4405	15	n/p	wc −57	−125
9145/44	6978	4422	10	−291	wc −130	−179
9146/45	7008	4420	51	n/p	−382	
9147/46	6998	4424	21	n/p	wc −32	−81
8064/47	6932	4314	6	−35		−75
8078/48	6906	4369	8	−45	wc −266	−728
8088/49	6896	4369	22	−107	wc −451	−535
8096/50	6907	4385	31	−216		−475
/51	6902	4311	82	−37		−309
/52	6894	4340	44	−39	wc −501	
/53	6919	4337	~10	−18	wc −231	−810
8/55	6915	4363	20	13	wc −220	

n/r=not reached   n/p=not present   wc=depth to Coal measures
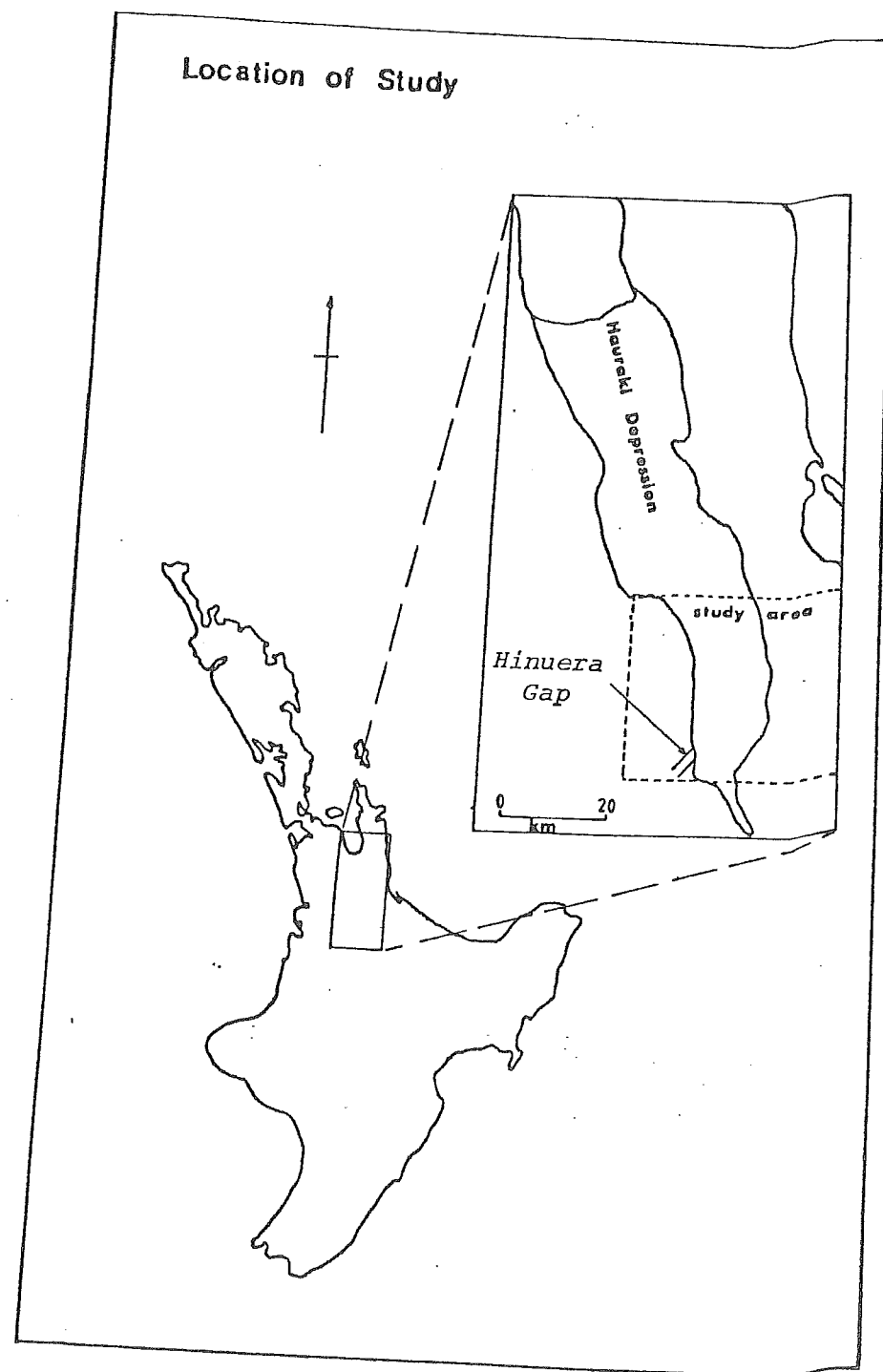? = driller unsure

figure 1.1

1.3 Regional Geology

The South Hauraki Lowlands are the southern end of the Hauraki Depression. The Hauraki Depression is a broad valley about 25 km wide which extends from the study area northward into the Hauraki Gulf.
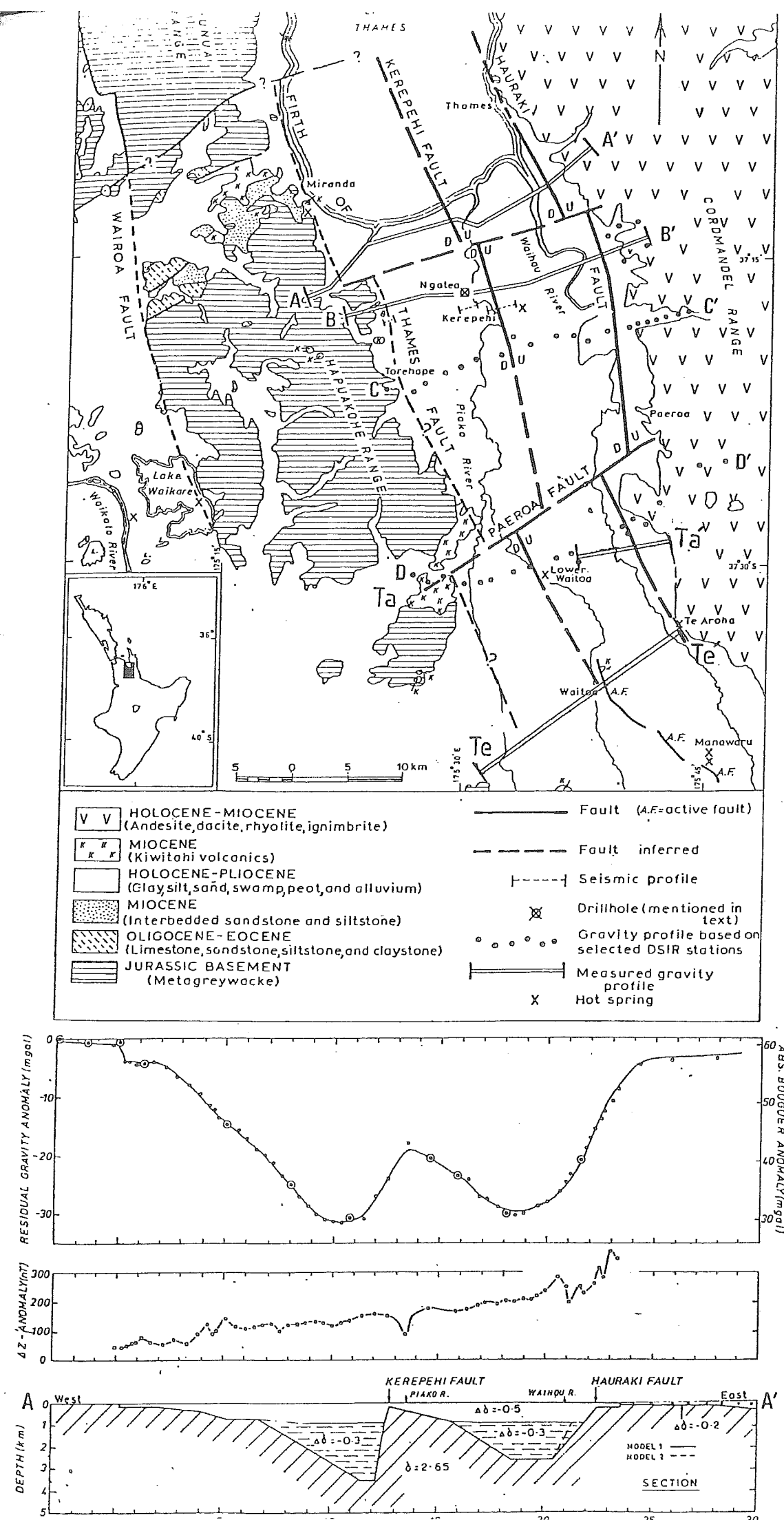
DAVIDGE

Figure 1.2   (After Hochstein and Nixon 1979): Shows a summary
of the geology in the north Hauraki Depression
and also the location of two gravity profiles
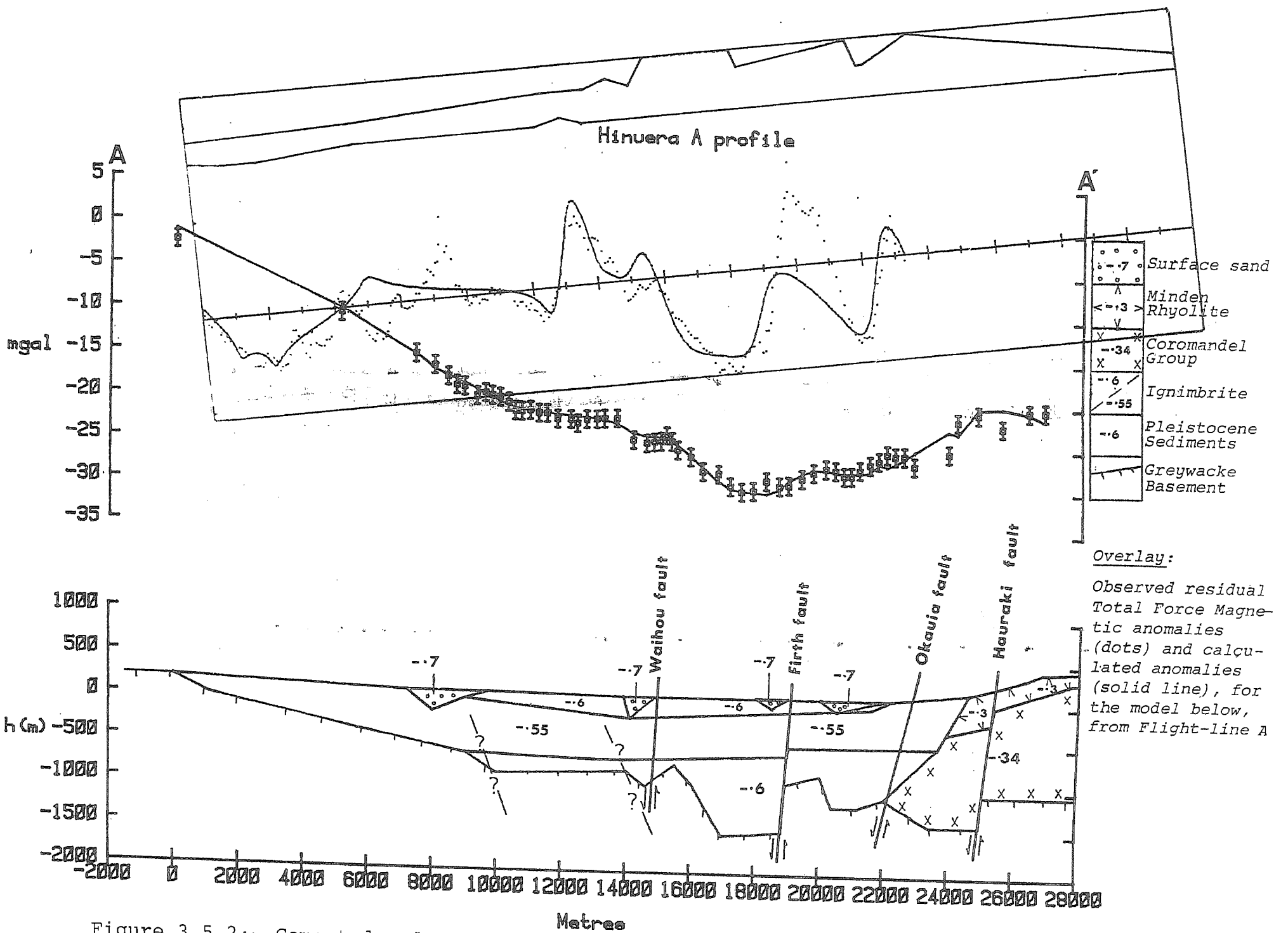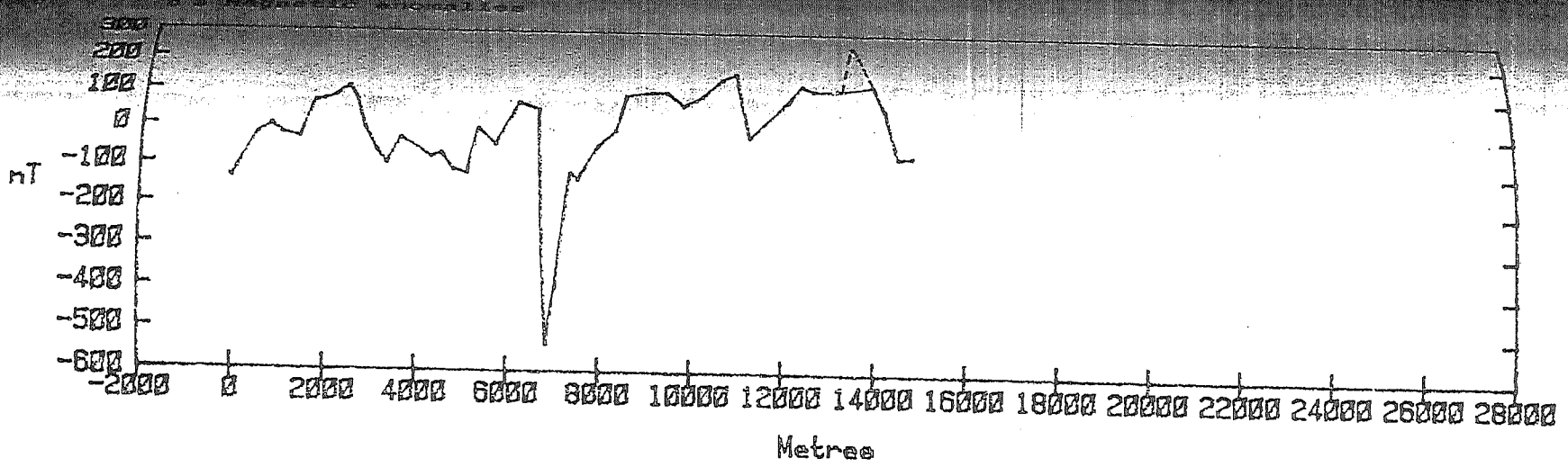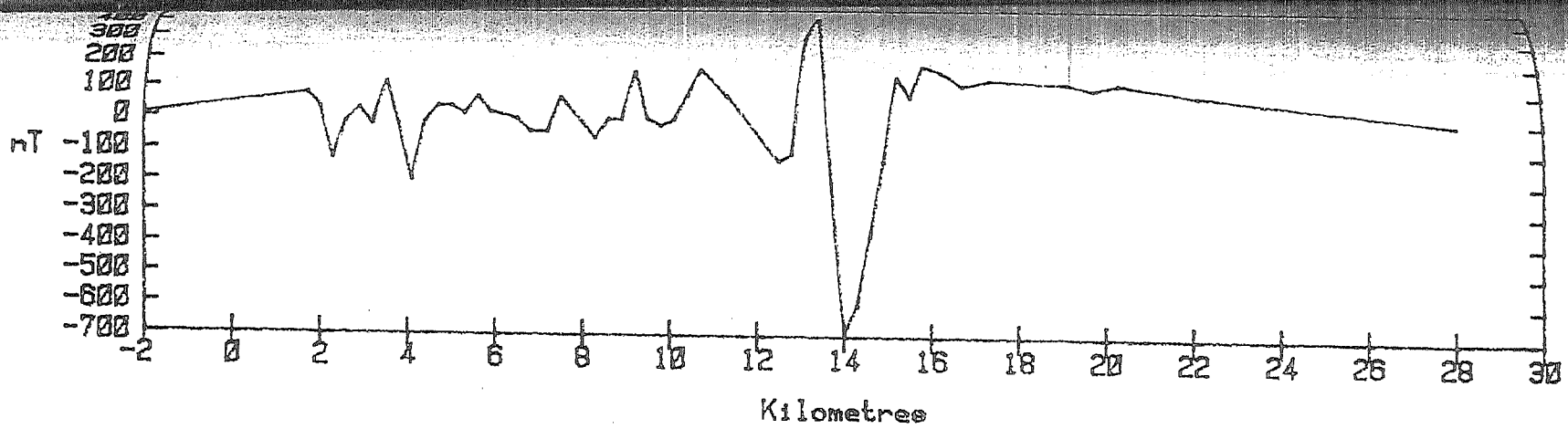discussed later in this thesis (§ 3)

Figure 3.5.2:- Computed and observed residual Bouguer anomalies A-A' (see Map 2 for location), also plotted are ΔZ Magnetic anomalies.
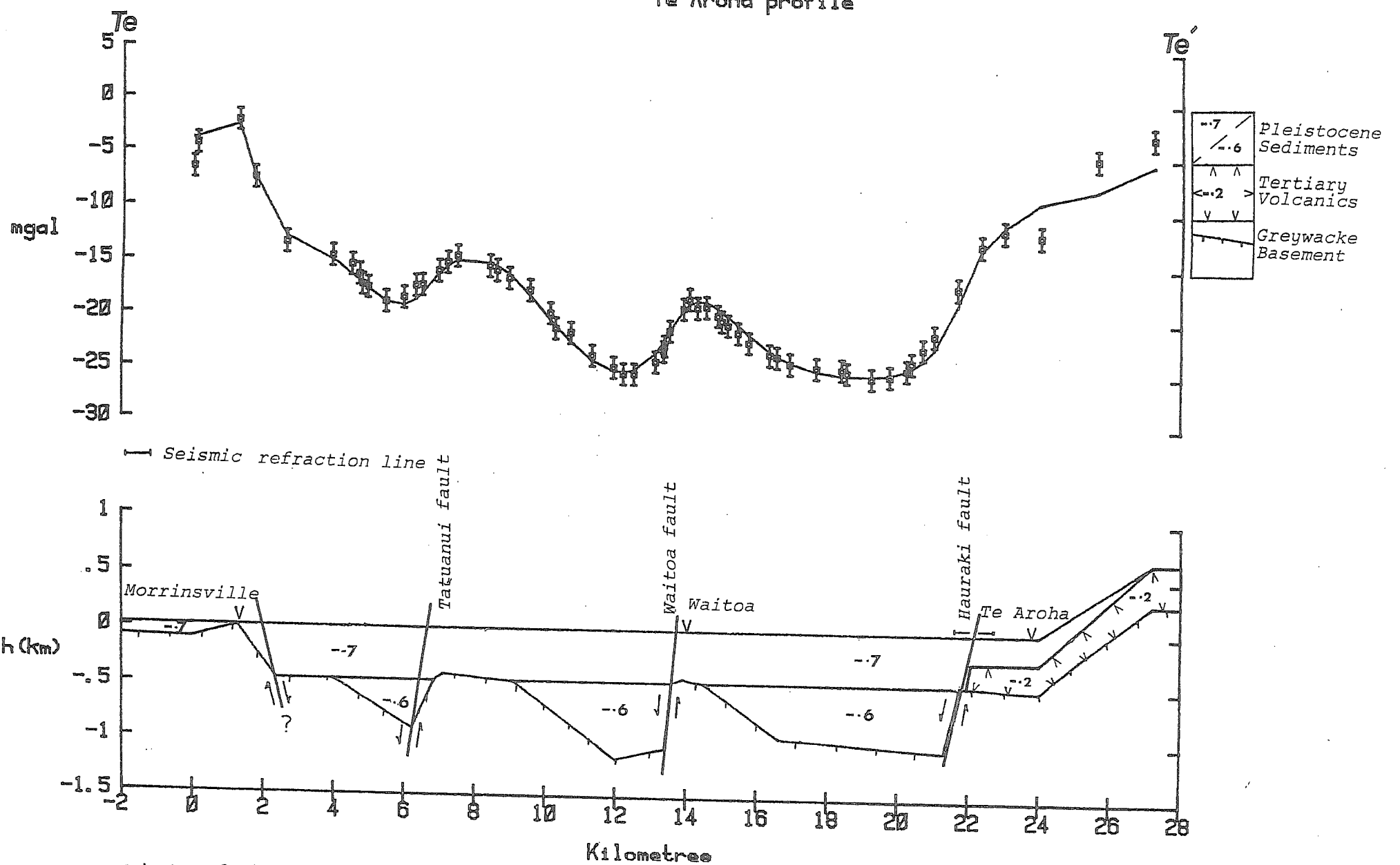
Figure 3.5.5:- Computed and observed residual Bouguer anomalies Te-Te' (see figure 1.2 for location), also plotted are ΔZ Magnetic anomalies.

N Manukau City,
Auckland

HOWICK

PAKURANGA

HITFORD

LEGEND

erved faults

red faults, fault scarps

ours on Waitemata Group base (50m)
(relative to MSL)

KEY

s

ms

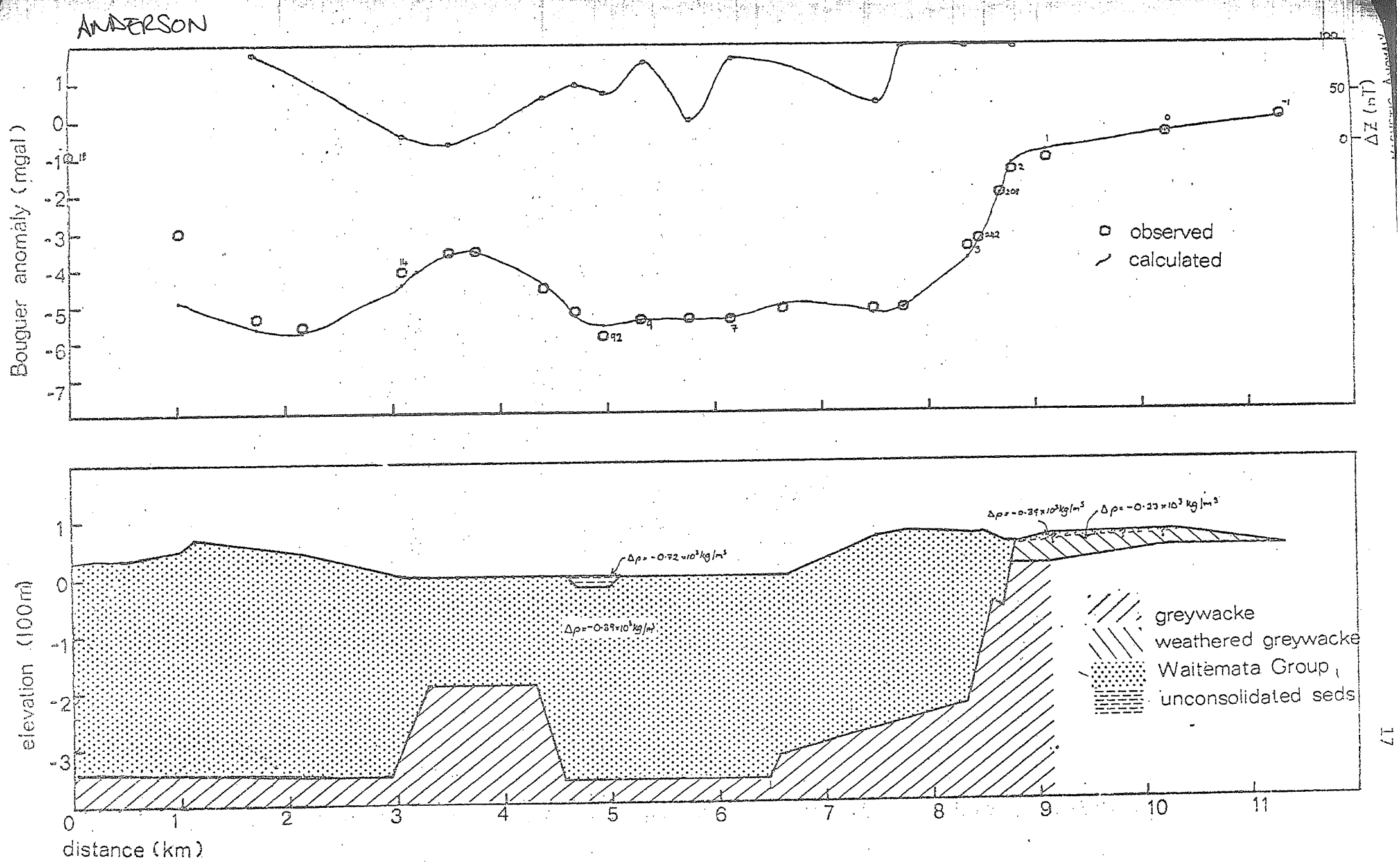ty stations

ore profile gravity stns (Nixon)

gravity stns

SCALE : 1:50000

MANUREWA

ALFRISTON

DRURY FAULT

PAPAKURA

CLEVEDON – WAIKOPUA FAULT

PAPAKURA VALLEY FAULT

KIRIPAKA

FIGURE 3 OBSERVED and CALCULATED BOUGUER ANOMALIES

PROFILE A

S

BOSHER 2

N

MALTBY 2

FREER 2

MALTBY 3

Waitemata Group

Blue grey sandstone

Loose sand

Waitemata Group:

Waitemata Group

Siltstone and sandstone

Blue grey siltstone and sandstone

Soft siltstone and sandstone

Siltstone and sandstone

-10 Alluvium

occasional coal fragment

Band of carbonised material

0

Waitemata Group:
Blue grey siltstone and sandstone

Soft limestone

-10

Heavily fractured calcite vein greywacke

limestone with layer of sandstone and conglomerate

Waiheke Group
Fractured greywacke

-20

More broken and less calc.

-30

Carbonaceous silt (0.5m)
Green silty sandstone

Waiheke Group:

-40

limestone with sandstone (fractured)

-50

Basal conglomerate

Alternating hard/soft greywacke (fractured)

Greenish hard to very hard greywacke with abundant vein materials

-60

-70

Hard calcitic greywacke

Soft greenish greywacke, abundant veins.
Soft white clay with occasional greywacke
1 m thick white vein material

-80

Greenish very hard greywacke with abundant vein material

-90

Very hard, grey pale, green greywacke.

-100

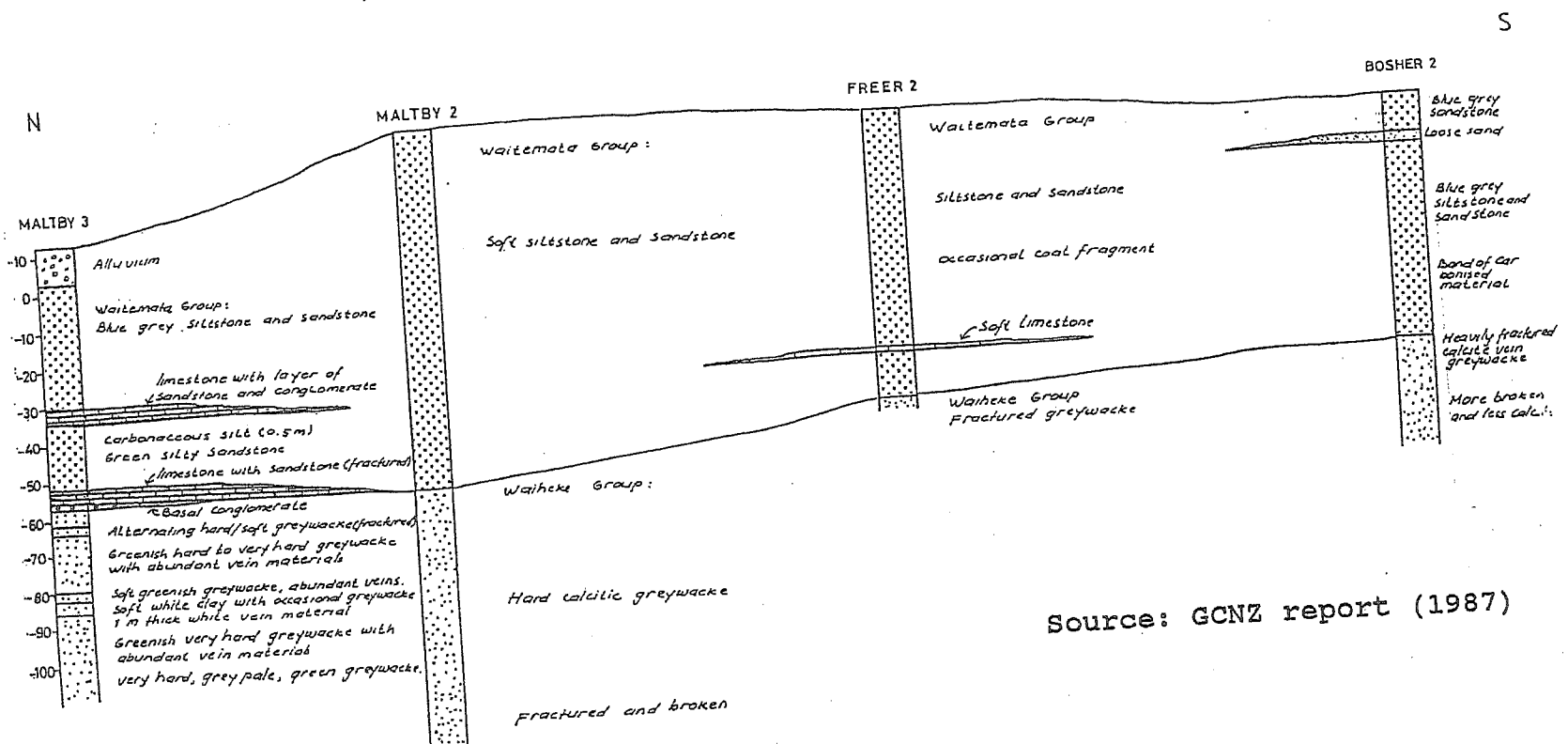Fractured and broken

Source: GCNZ report (1987)

Fig. 2.2 Stratigraphic correlation across the Whitford warm water prospect.

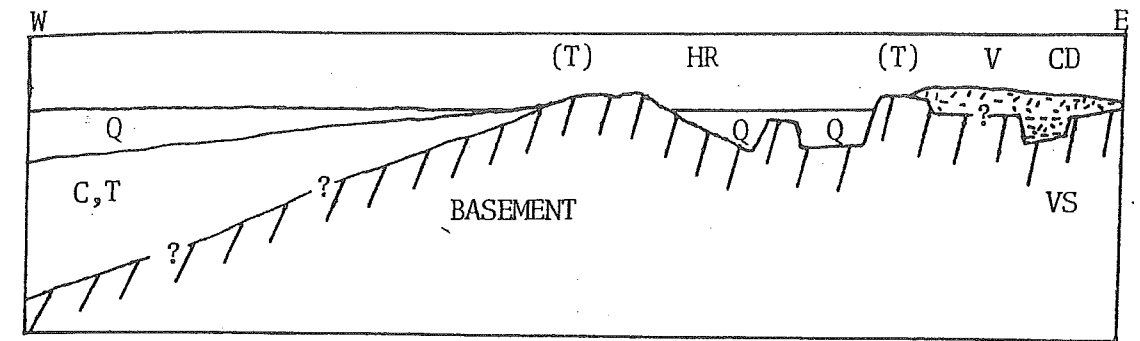Fig 2.2 : Sketch of the principal features of the region in W-E
cross-section. (Not to scale)

Q   =   Quaternary sediments
C,T   =   Cretaceous and Tertiary sediments
(T)   =   Minor pockets of Tertiary sediments
V   =   Volcanics
VS   =   Volcanic sediments
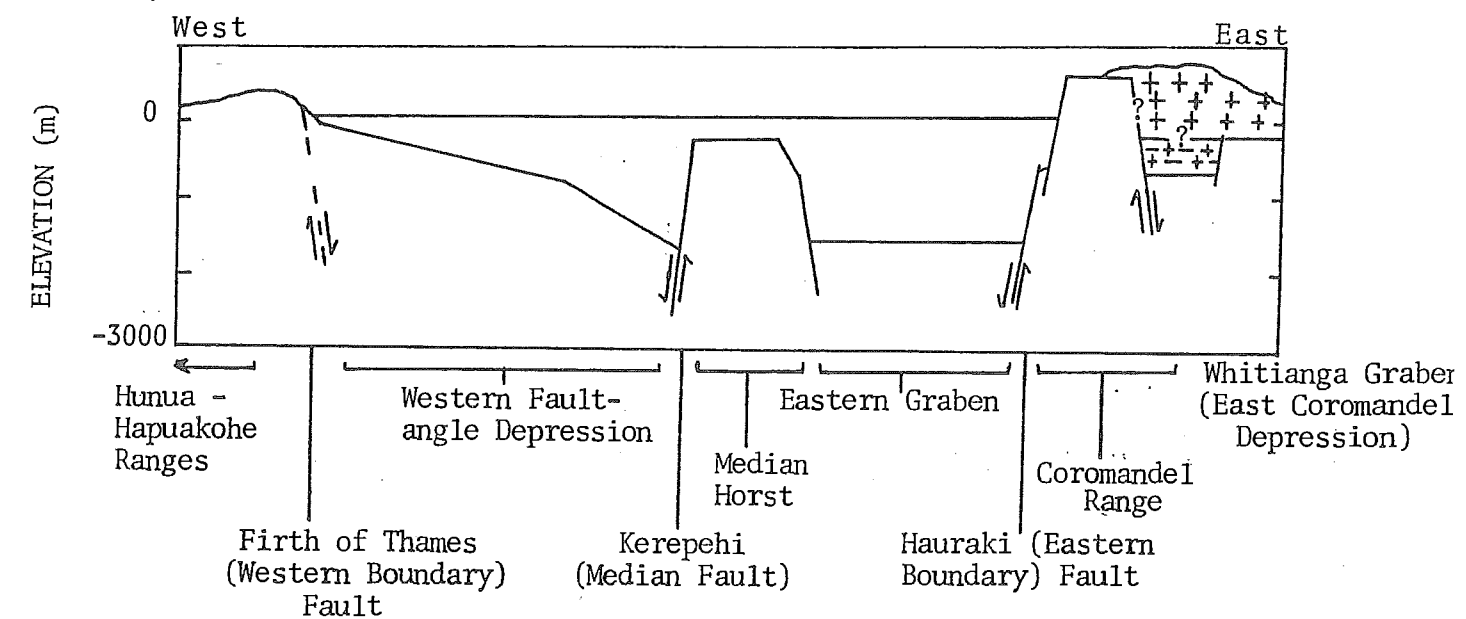HR   =   Hauraki Rift
CD   =   Coromandel Depression

Figure 2.3 : Sketch illustrating essential features of the
generalised structure of the Hauraki Rift
(horizontal scale approximate only)

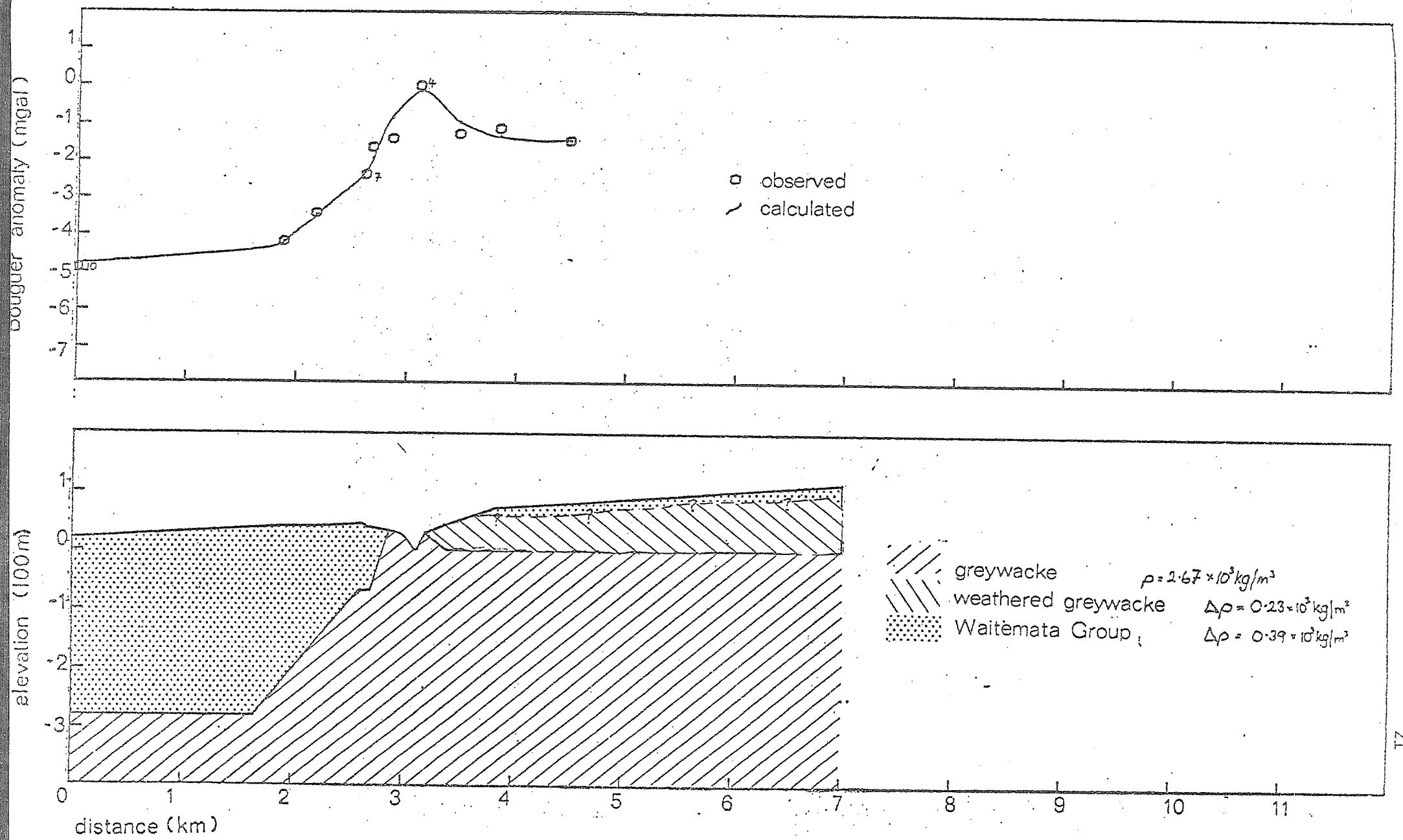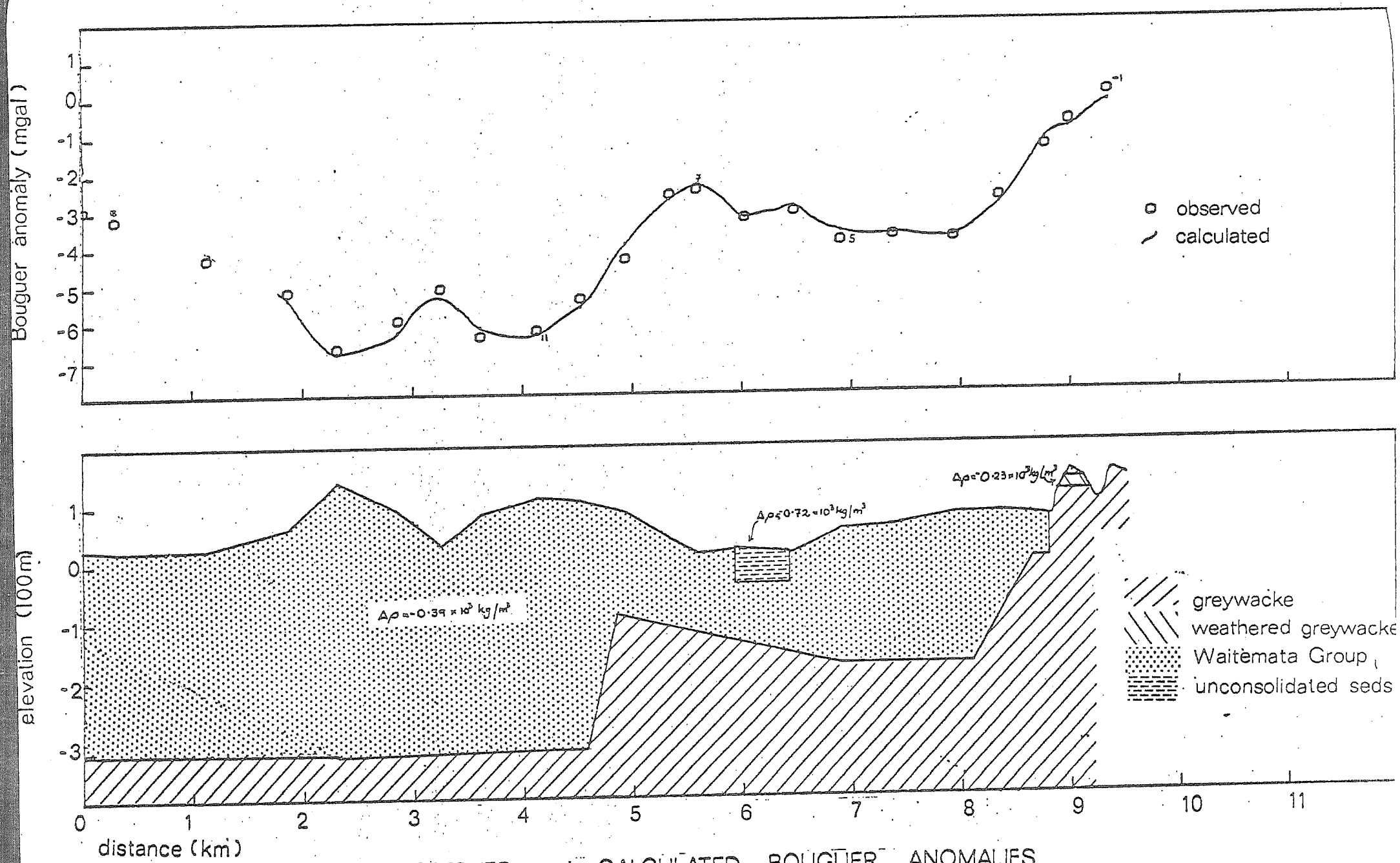FIGURE. 5   OBSERVED and CALCULATED BOUGUER ANOMALIES

PROFILE D

FIGURE. 6   OBSERVED and CALCULATED BOUGUER ANOMALIES
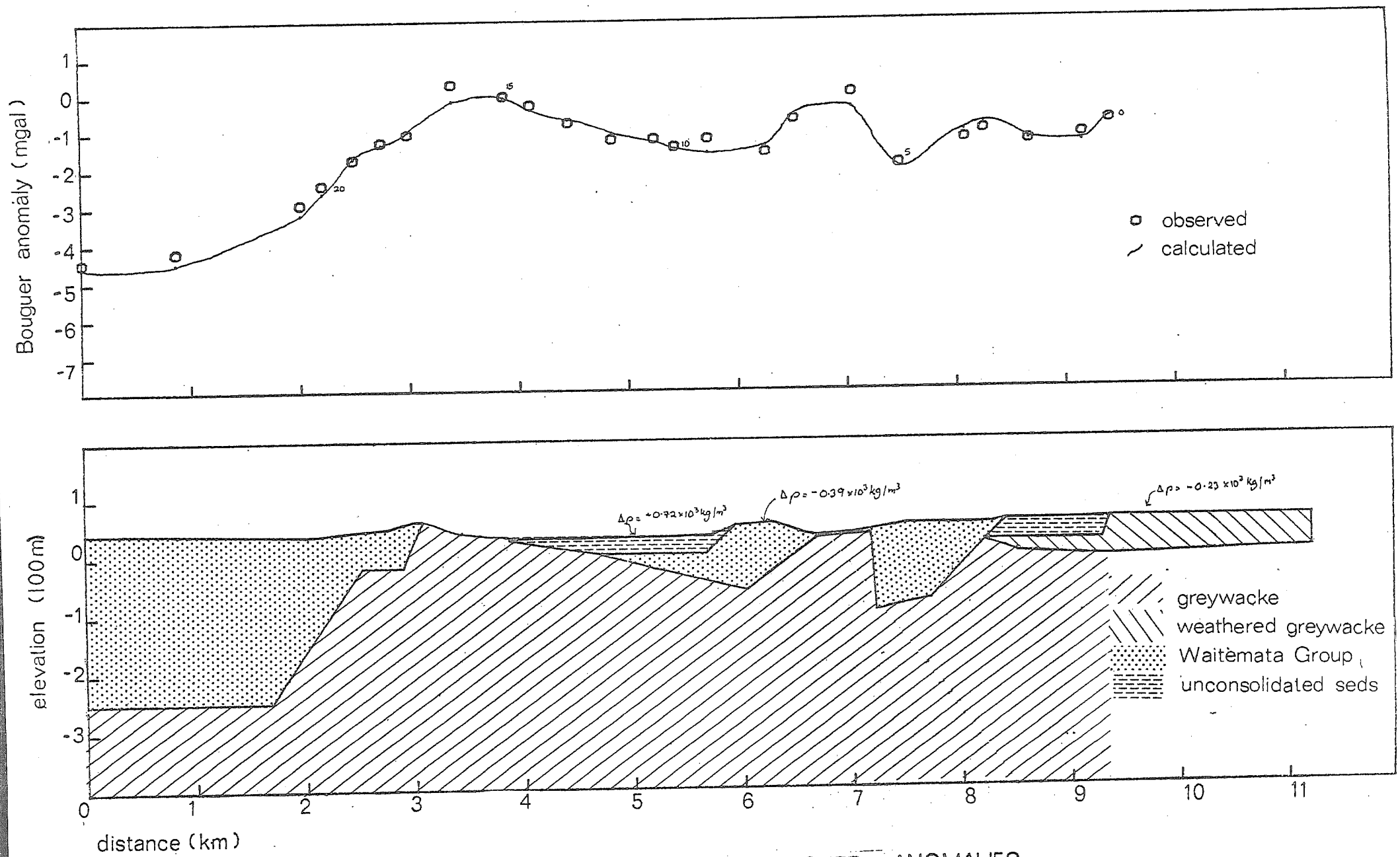
PROFILE B

GREIG

FIGURE 7   OBSERVED and CALCULATED BOUGUER ANOMALIES.
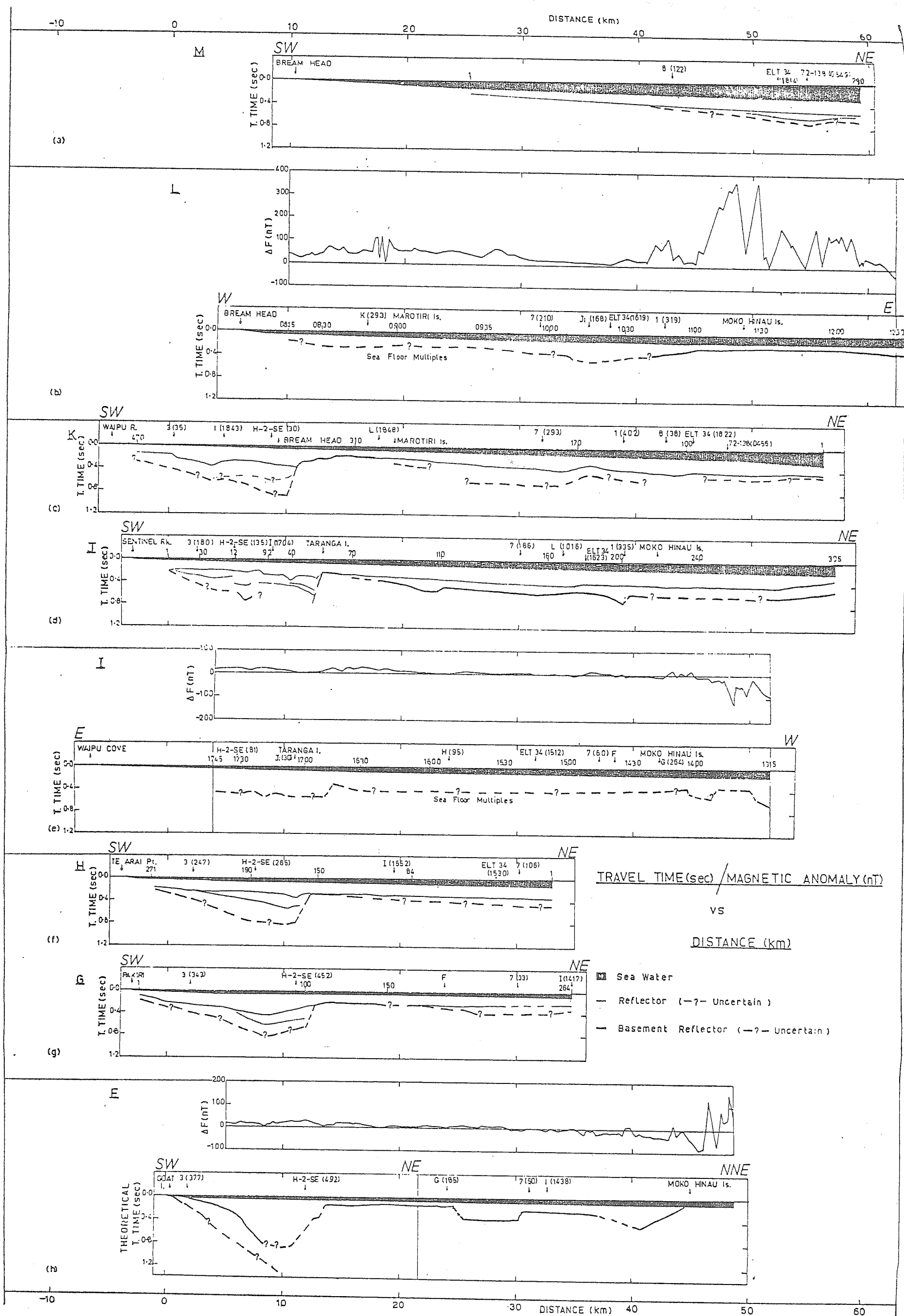
PROFILE C

Figure 2.4 (a - h) Travel time sections/Magnetic anomaly data from near shore profiles across the Hauraki Depression north of Cape Rodney
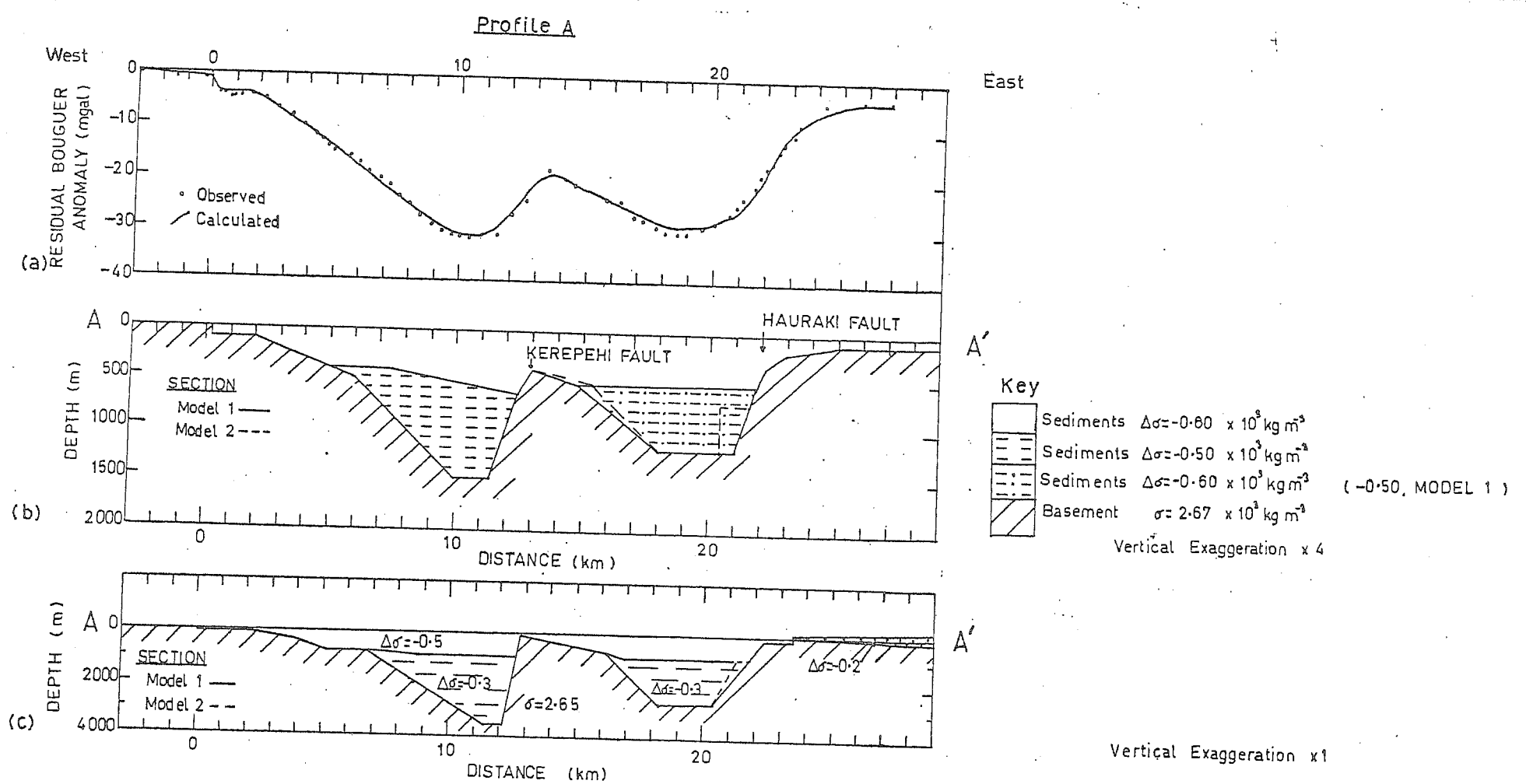
26

Figure VI.1 Observed and recomputed Bouguer anomalies (a) and revised section across the Hauraki Depression (b) along Profile A of Hochstein & Nixon (1979). The calculated anomaly for Model 1 only is shown. The section of Hochstein & Nixon (1979) is shown by (c) for comparison.