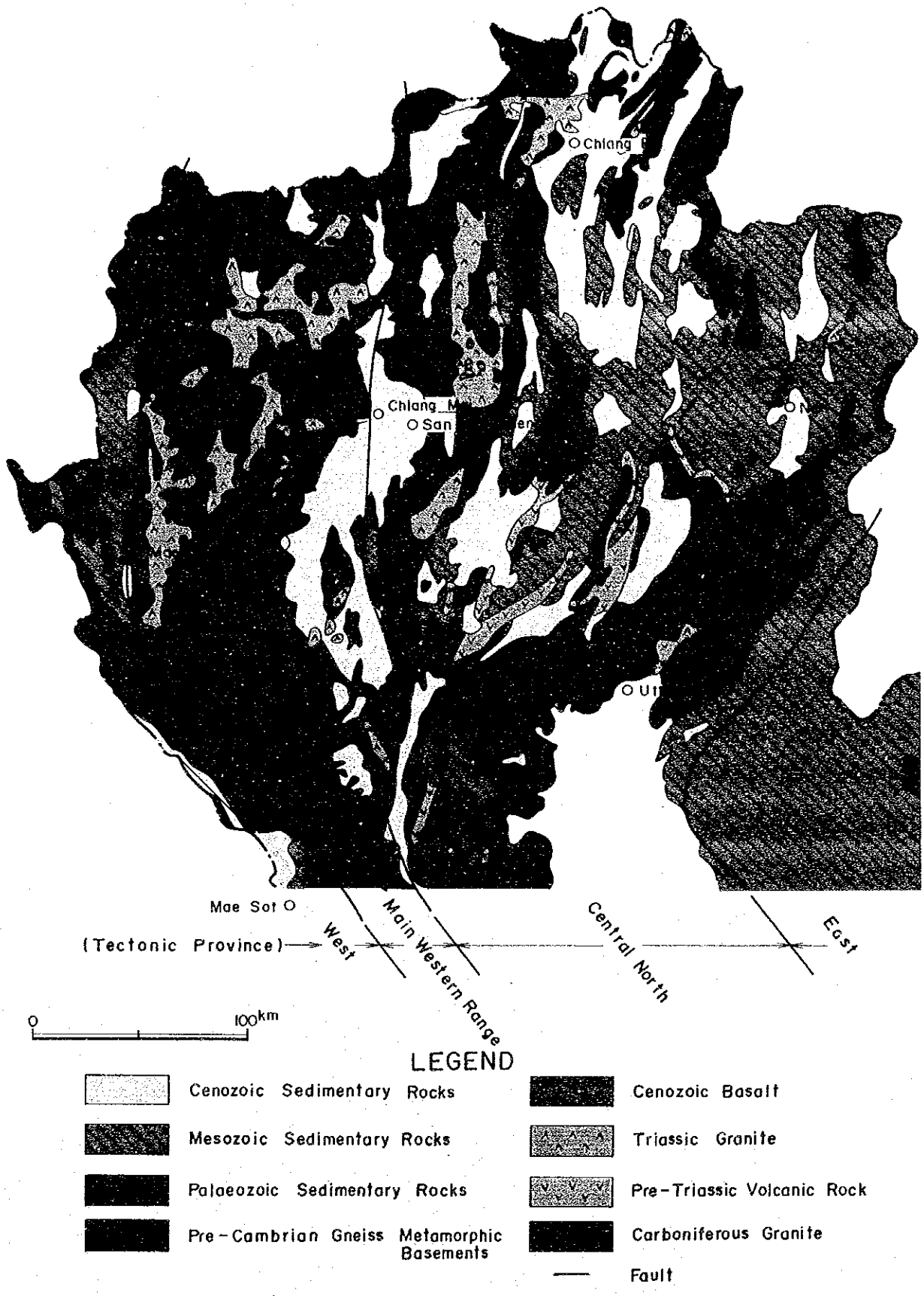


Fig. 1.1-2 General Geology of Northern Thailand

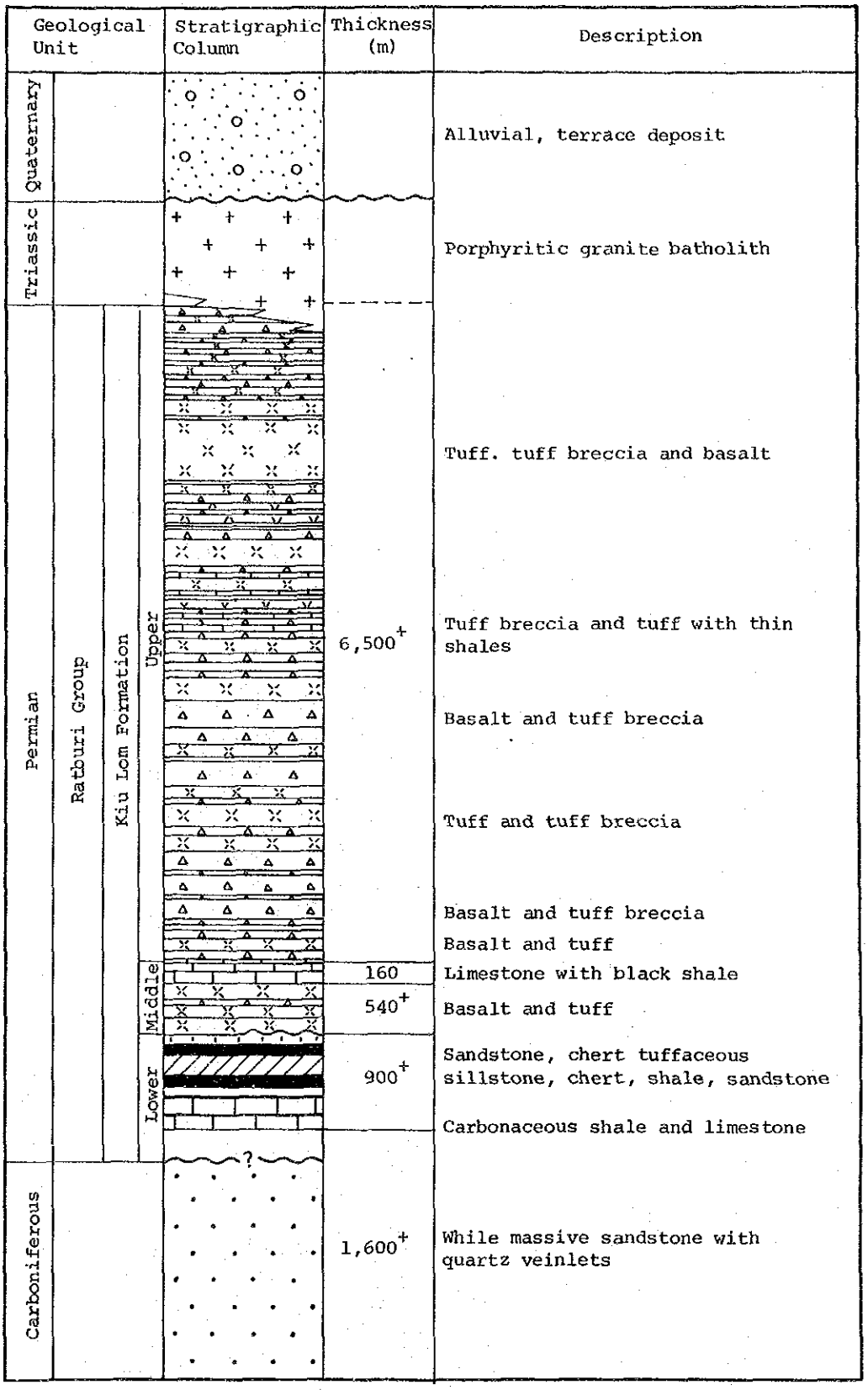
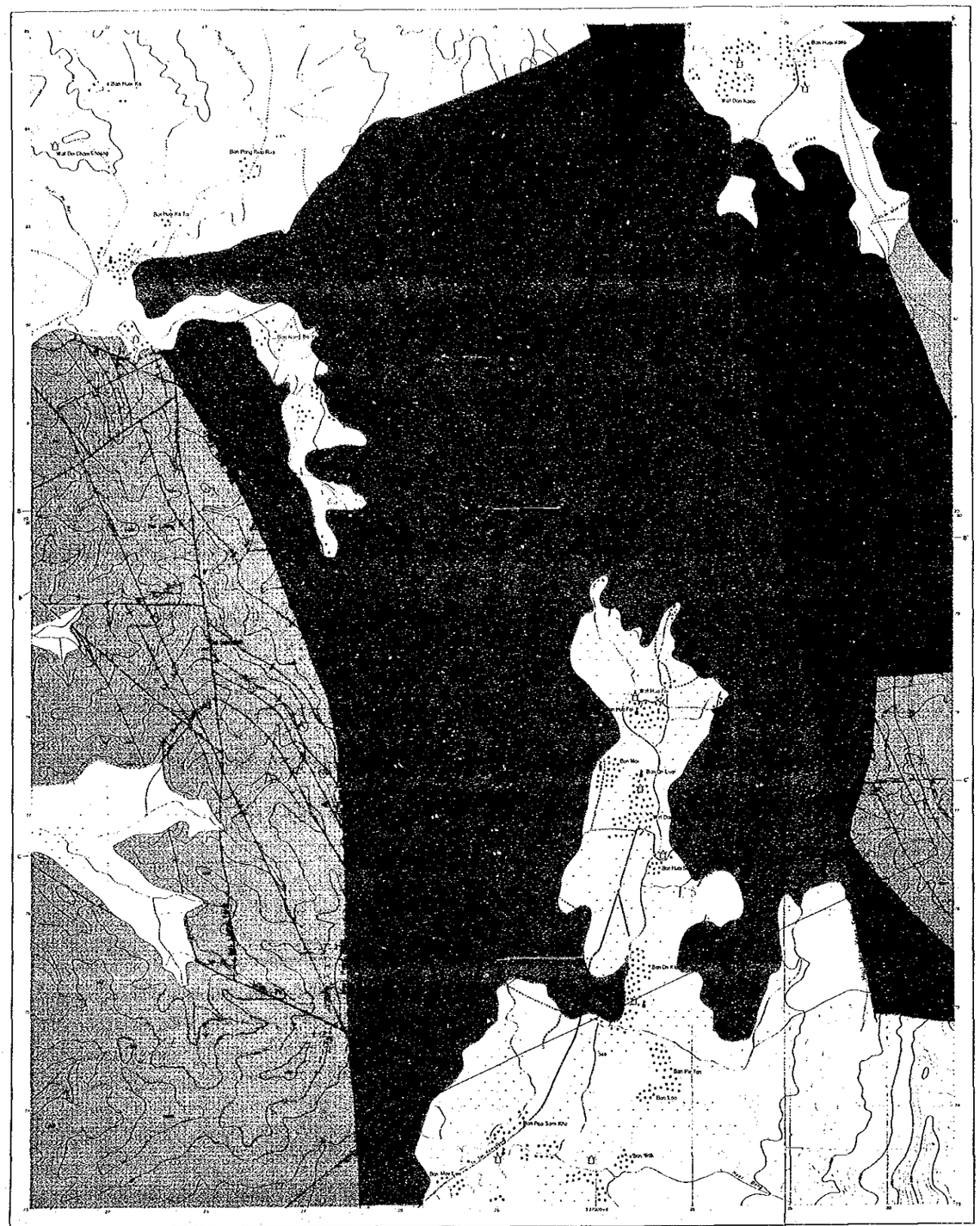


Fig. 1.1-4 Geological Column of San Kampaeng Area



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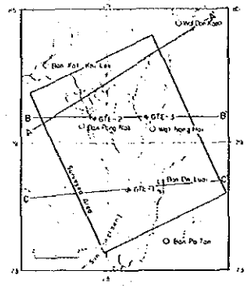
GEOLOGICAL MAP



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LEGEND

- Alluvium — Alluvial deposit
- Permian, Kiu Lom Formation
  - Basaltic tuff
  - Basaltic tuff breccia, Lapilli tuff
  - Basalt
  - Shale
  - Siltstone ≫ Sandstone
  - Sandstone
  - Chert
  - Sandstone ≫ Chert
  - Chert ≫ Sandstone
  - Shale ≫ Sandstone > Chert
  - Limestone
- Carboniferous, Mae Tro Formation
  - Shale
  - Sandstone
- Porphyritic granite
- Bedding plane
- Joint
- Fissure
- Quartz vein
- Fault
- Anticline axis
- Syncline axis
- Structure line
- A——A Location of geological Profile

Fig. 1.1-5 Geological Map

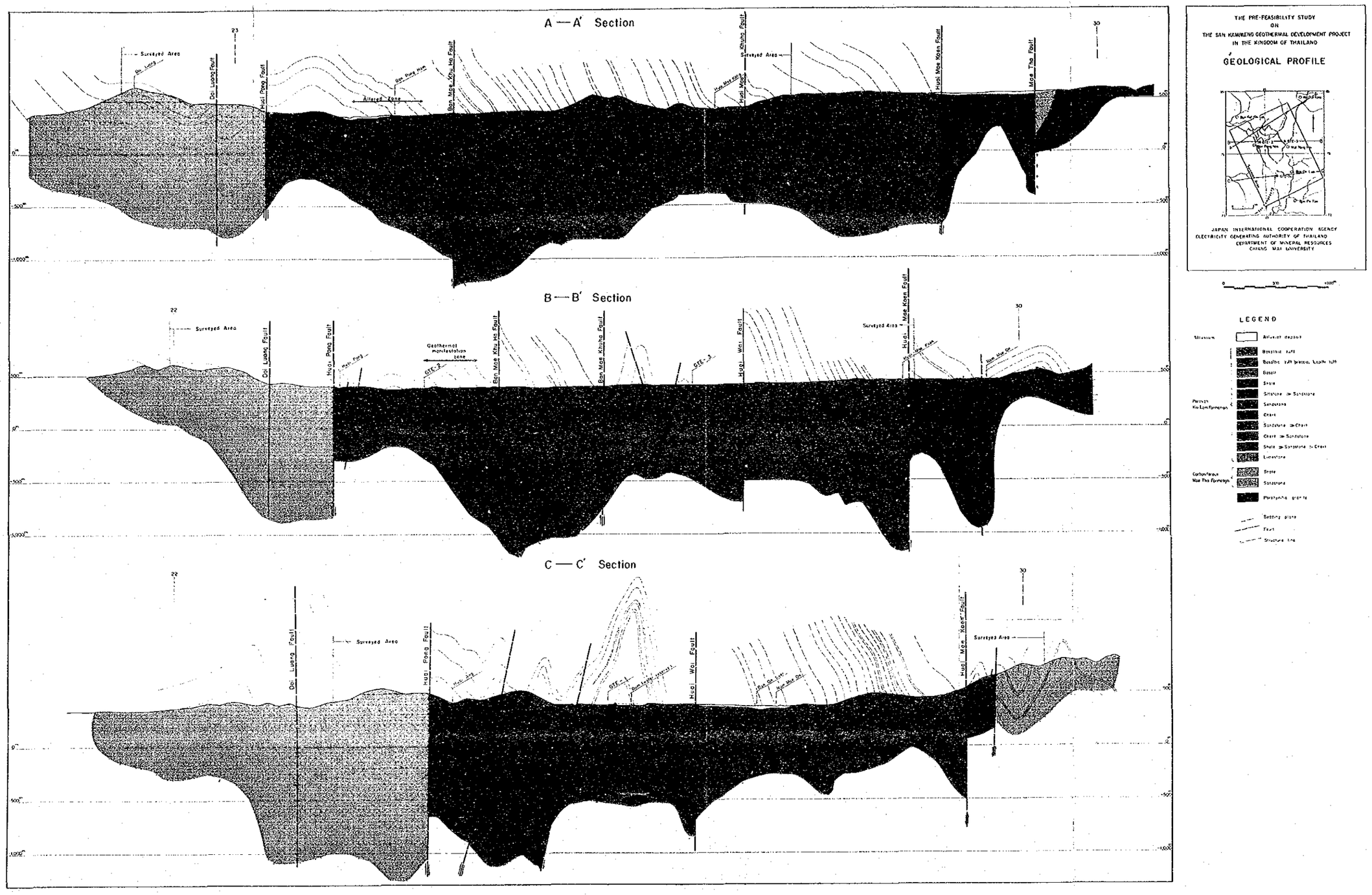
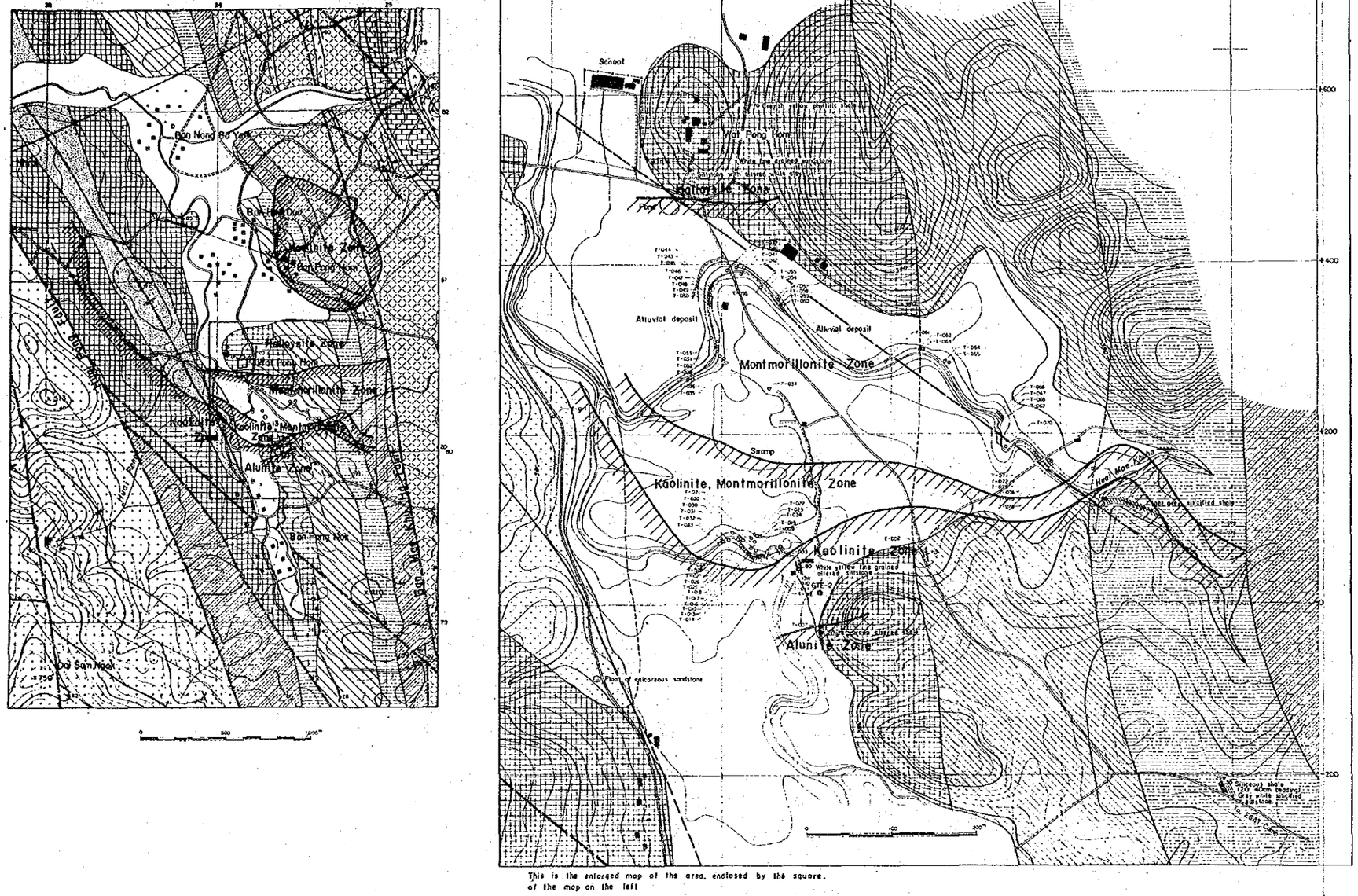


Fig. 1.1-6 Geological Profile



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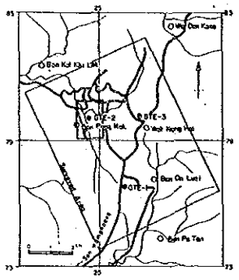
ZONAL DISTRIBUTION MAP OF ALTERATION ZONE



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DEPARTMENT OF MINERAL RESOURCES
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LEGEND

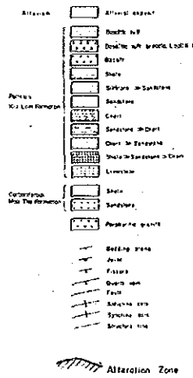


Fig. 1.1-7 Zonal Distribution Map of Alteration Zone

Depth (m)	Drill Diameter Casing Program	Lost Circulation ℓ/min	Depth (m)	Geological Column	Inclination	Rock Name	Rock Facies	Alteration	Number of Cracks per m (5 – 10)	Form of Core	Temperature (°C) (50 – 100)	Logging Data: SP (mV) / SHORT (Ω-m) / NORMAL (Ω-m)
50	2.0" water pipe		5.2			basaltic andesite	weathered, greyish green	chlorite, calcite				
							greenish purple mdg ~ csg					
							porphyritic, pyroxene bearing					
						tuff						
							calcite & quartz veinlet					
			34.5									
			35.0			basaltic andesite	greyish green fng					
							green mdg ~ csg					
							porphyritic, pyroxene bearing					
						tuff	flow structure (43 ~ 47m)					
100	Hole ø = 6.75" 100m		61.0									
			64.0			basaltic andesite	greyish green ~ violet fng ~ mdg					
							greyish green ~ purple mdg ~ csg					
						tuff	flow structure (64.0 ~ 65.4m)					
			76.0			tuff	greyish green ~ purple csg					
			82.0				porphyritic, pyroxene bearing					
						tuff	greyish green ~ purple mdg ~ csg					
			94.0									
						basaltic andesite	greyish green fng ~ mdg					
150	casing pipe ø = 5.5"		104.0				irregular quartz & calcite veinlet					
							greyish green ~ purple fng ~ mdg	chlorite				
						basaltic andesite	pyroxene & chlorite predominant					
			124.5				greyish green ~ purple mdg ~ csg					
						tuff	brecciation zone					
			133.5									
							purplish green ~ greyish green mdg ~ csg					
						tuff	flow structure (140m)					
200	Hole ø = 4.89"		151.0				pyroxene predominant (150 ~ 160.5m)					
						tuff						
			169.5									
			173			tuff	greyish green fng ~ mdg	chlorite				
			179.0			tuff	brecciation zone (169.5 ~ 173.0m)					
						tuff	purplish green ~ greyish green mdg					
			188.0			andesite	flow structure (184.3 ~ 188m)	chlorite				
			194.0			tuff	greyish green fng ~ mdg					
			196.0			tuff	brecciated fragment (188.5 ~ 191.0m)					
			200.0			andesite						
250	226m						greyish green ~ purplish fng ~ mdg					
						tuff						
			226.0			basaltic andesite	greyish green mdg ~ csg					
			237.0				flow structure (228.7 ~ 231.5m)(233.8 ~ 234.3m)	chlorite (236.8 ~ 237.0m)				
			251.0			andesite	greyish green fng ~ mdg					
300			256.0			tuff						
						tuff						
			265.0			tuff	greenish grey fng ~ mdg					
			268.5				greyish green fng ~ mdg					
						tuff	flow structure (274.85 ~ 275m) fng mdg layer					
350	Hole ø = 3.78"		317.0									
			320.0			tuff	greyish green fng ~ mdg					
						tuff		chlorite				
			333.0				greyish green ~ purplish green mdg					
							flow structure (326m)					
						tuff						
400			378.0				some xenolith of greenish andesite					
			380.0			basaltic andesite	greyish green fng					
						tuff breccia ?	flow structure with brecciated rock					
						basaltic andesite	greyish green ~ greenish purple fng ~ mdg					
			399.0									
			403.0			tuff breccia	xenolith of csg andesite (380.4 ~ 385.7m)					
						tuff						
	425m		424.0									
			425.0			tuff breccia	greyish green ~ greyish purple mdg					
			430.0			tuff	xenolith or fragment					
450							greyish green ~ greenish purple fng ~ mdg					
						basaltic andesite	porphyritic flow structure					
	Hole ø = 2.98"											
			470.0			tuff						
							greyish green fng ~ mdg					
500	500m		500.0			tuff breccia ?	xenolith : csg andesite					

LEGEND

Rock Name: Basaltic andesite; Andesite; Tuff; Tuff breccia

Fig. 1.1-8 Compiled Column of GTE-1

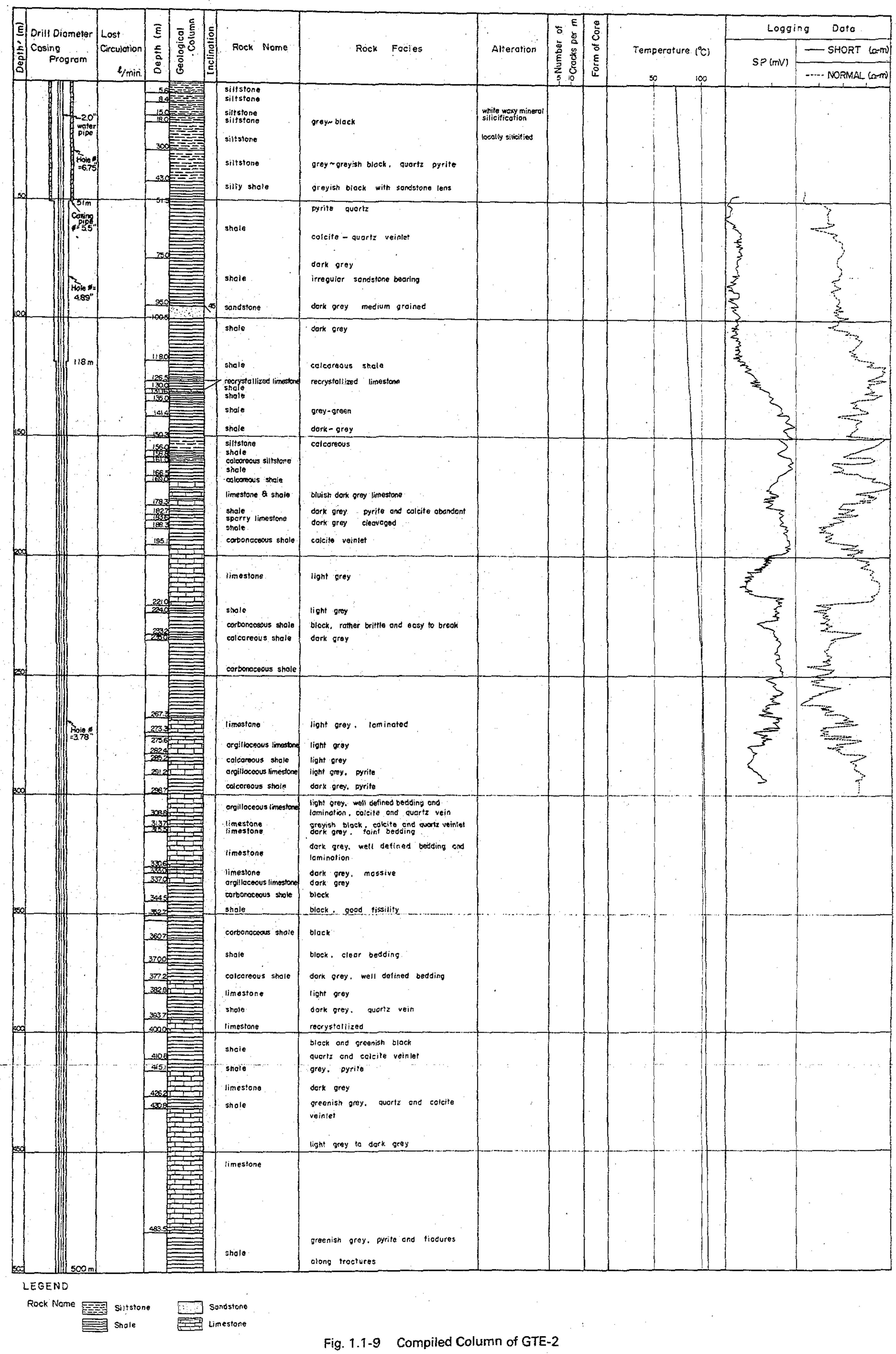


Fig. 1.1-9 Compiled Column of GTE-2

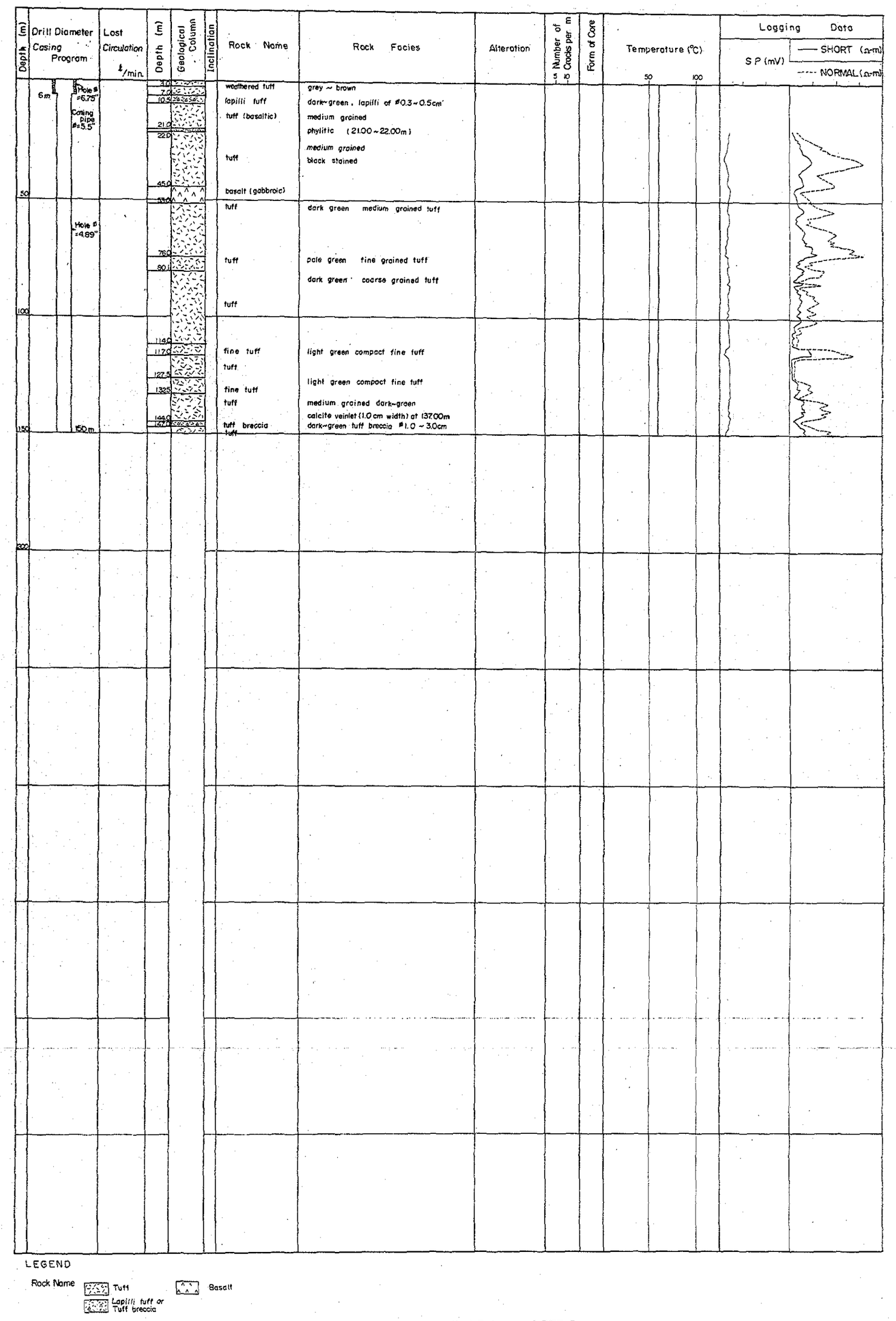


Fig. 1.1-10 Compiled Column of GTE-3

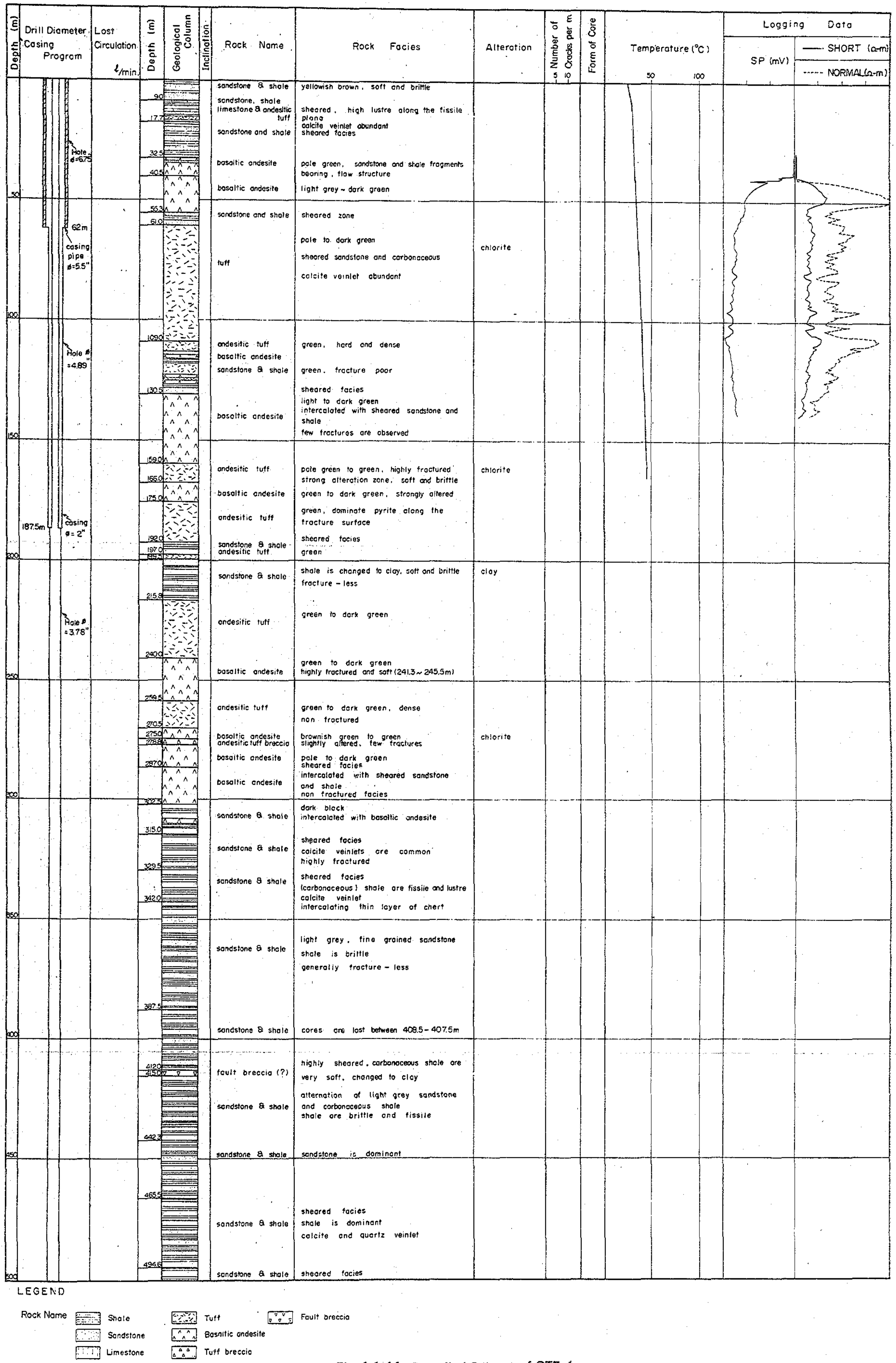


Fig. 1.1-11 Compiled Column of GTE-4

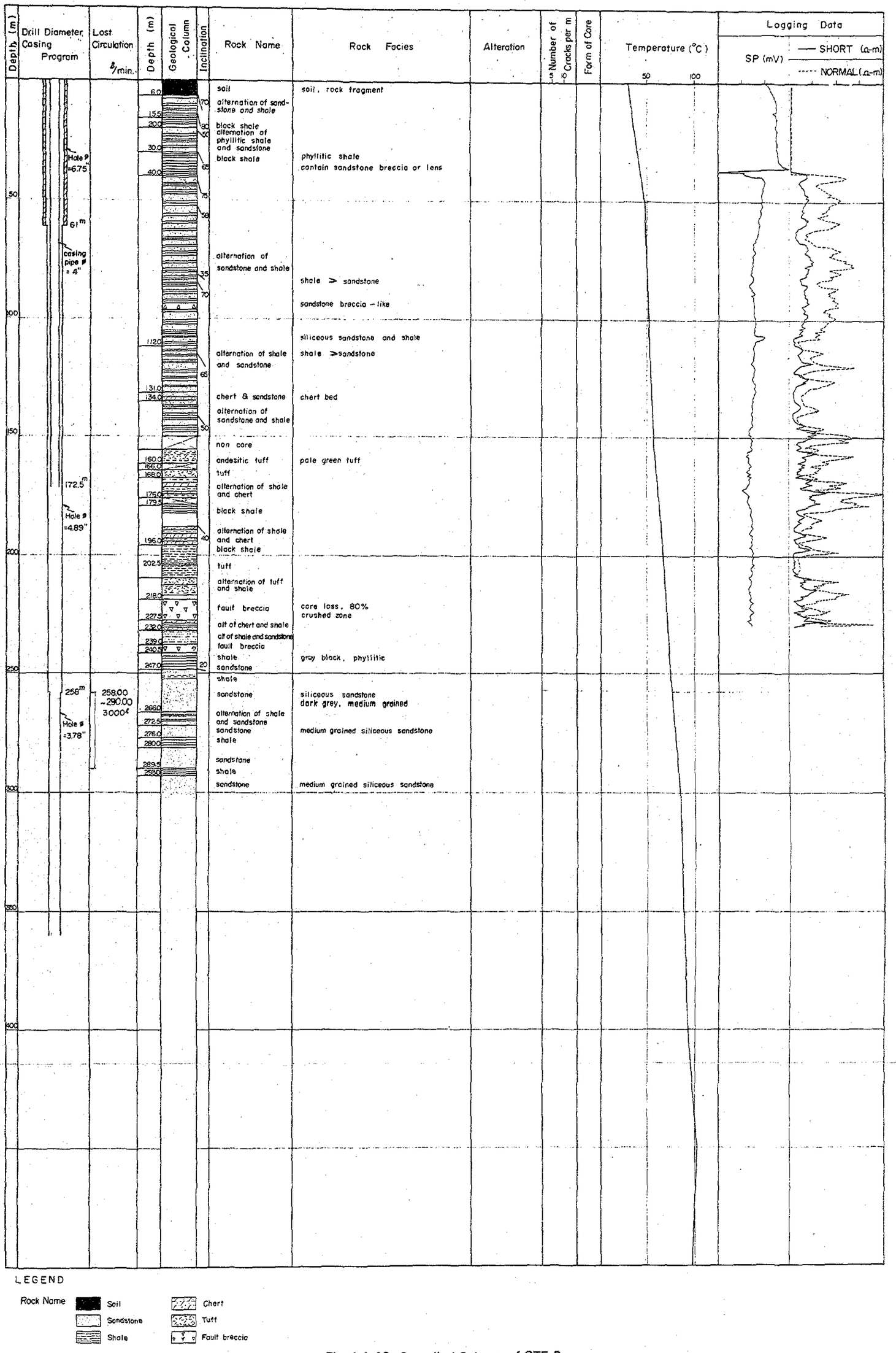


Fig. 1.1-12 Compiled Column of GTE-5

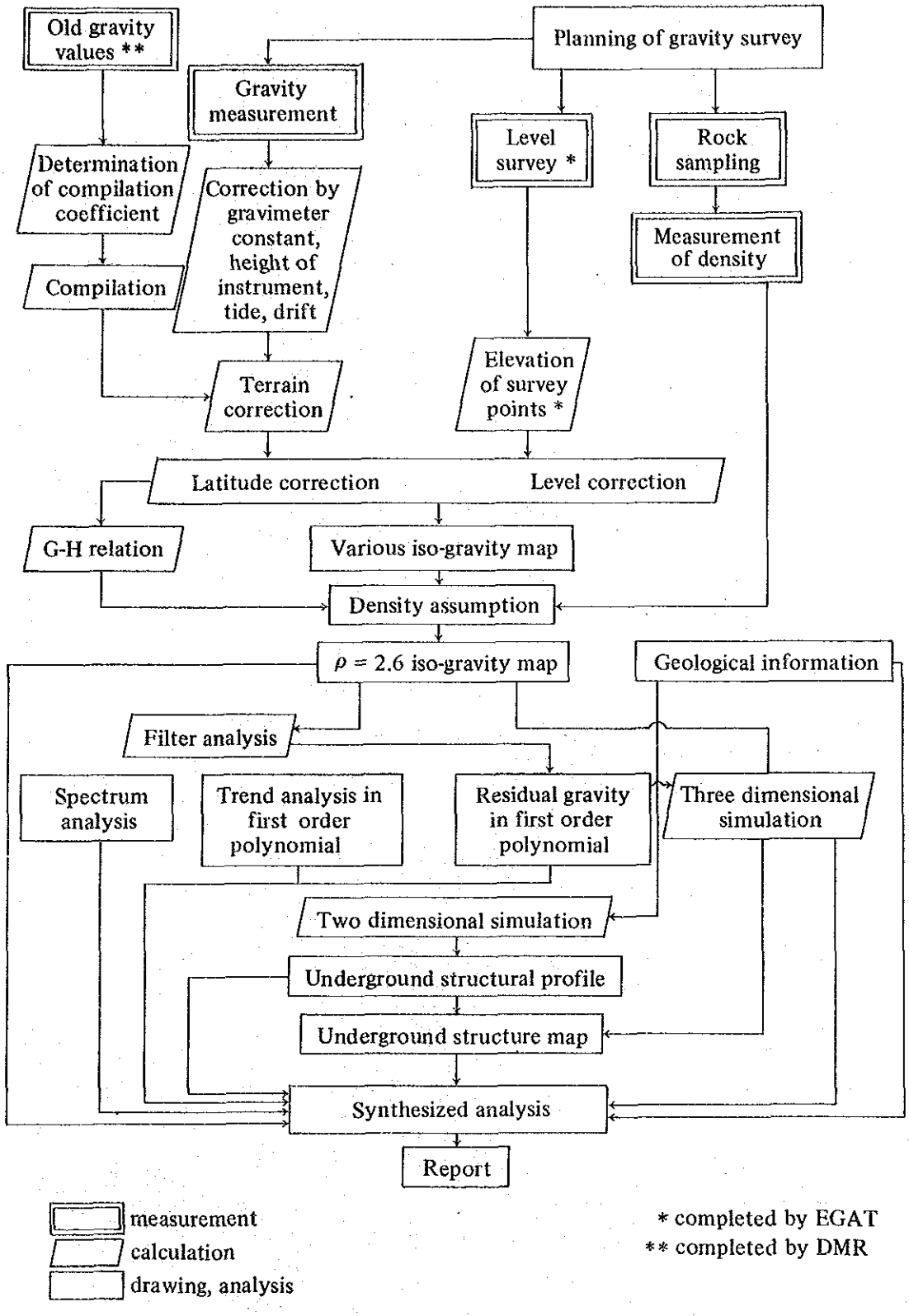


Fig. 1.2-1 Flow Chart of Gravity Survey

Geological age	Geological unit		Lithology	Amount	Average of density (g/cm^2)	
Permian	Kiu Lom Formation	Upper	Basaltic tuff Tuff breccia Lapilli tuff	19	2.93	2.93
			Basalt	13	2.94	
		Middle	Shale	11	2.54	2.59
			Sandstone	9	2.54	
			Chert	5	2.46	
			Limestone	13	2.71	
Carboni-ferous	Mae Tha Forma-tion		Sandstone	6		2.58
Triassic			Granite	3		2.57
			Quartz vein	5		2.62

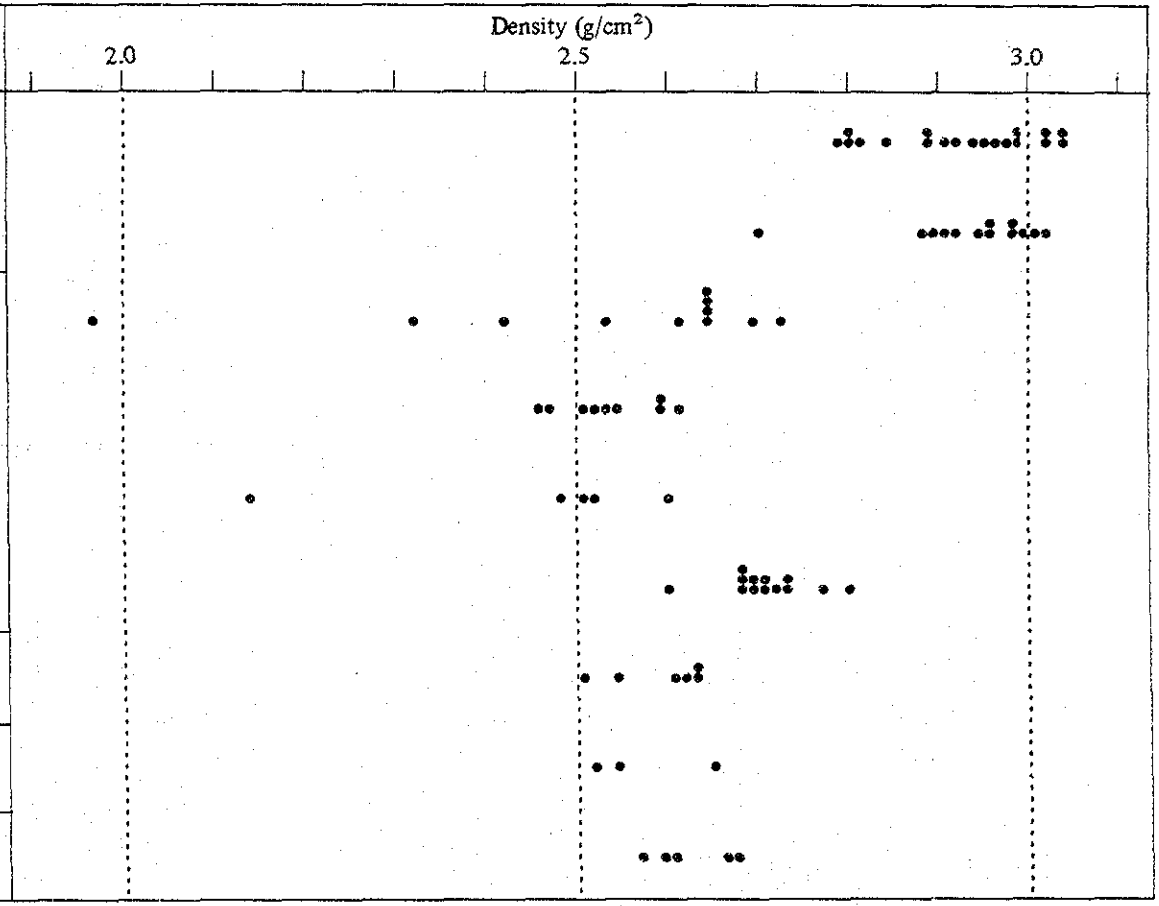


Fig. 1.2-2 Distribution of Rock Density

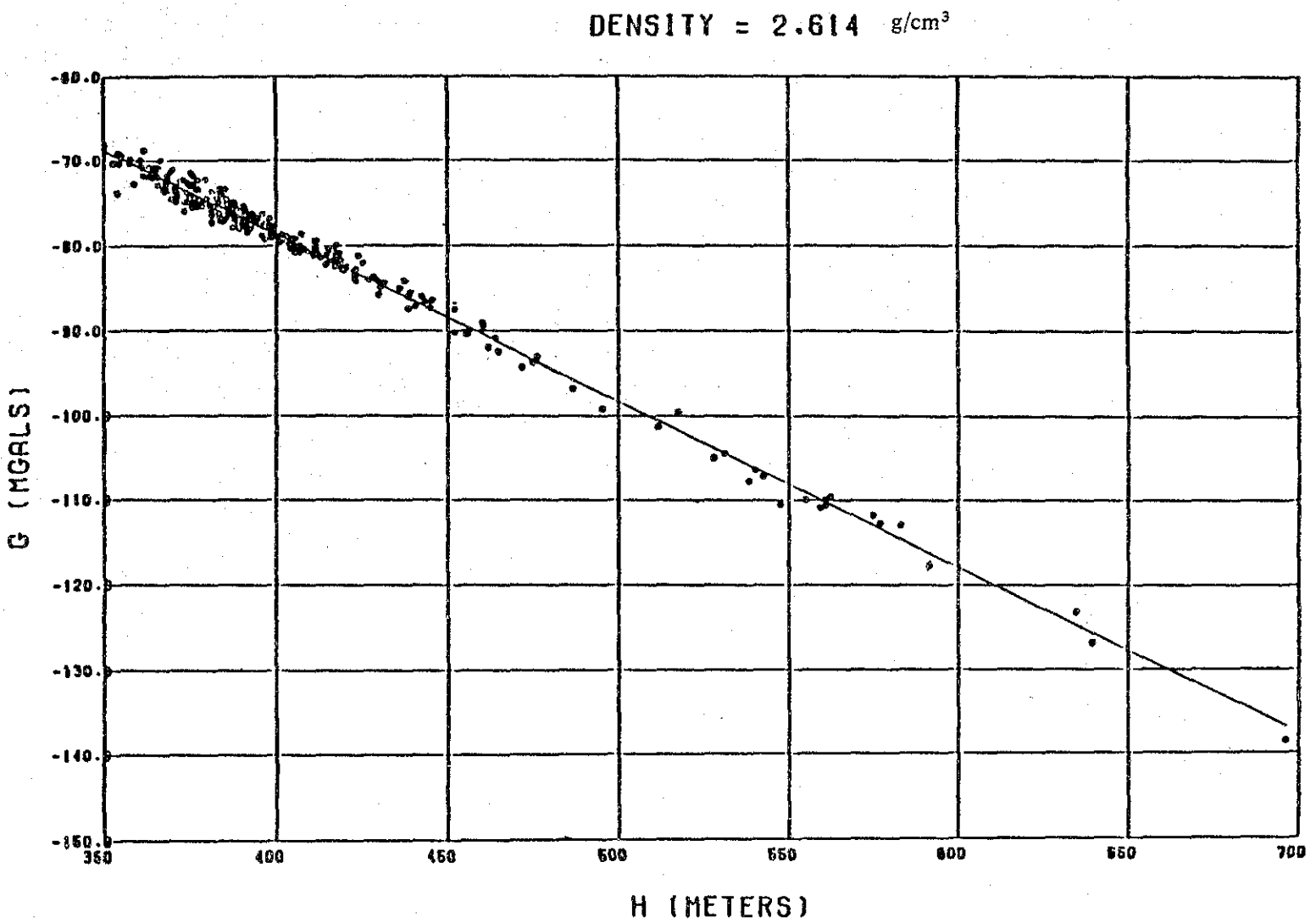


Fig. 1.2-3 G-H Relation

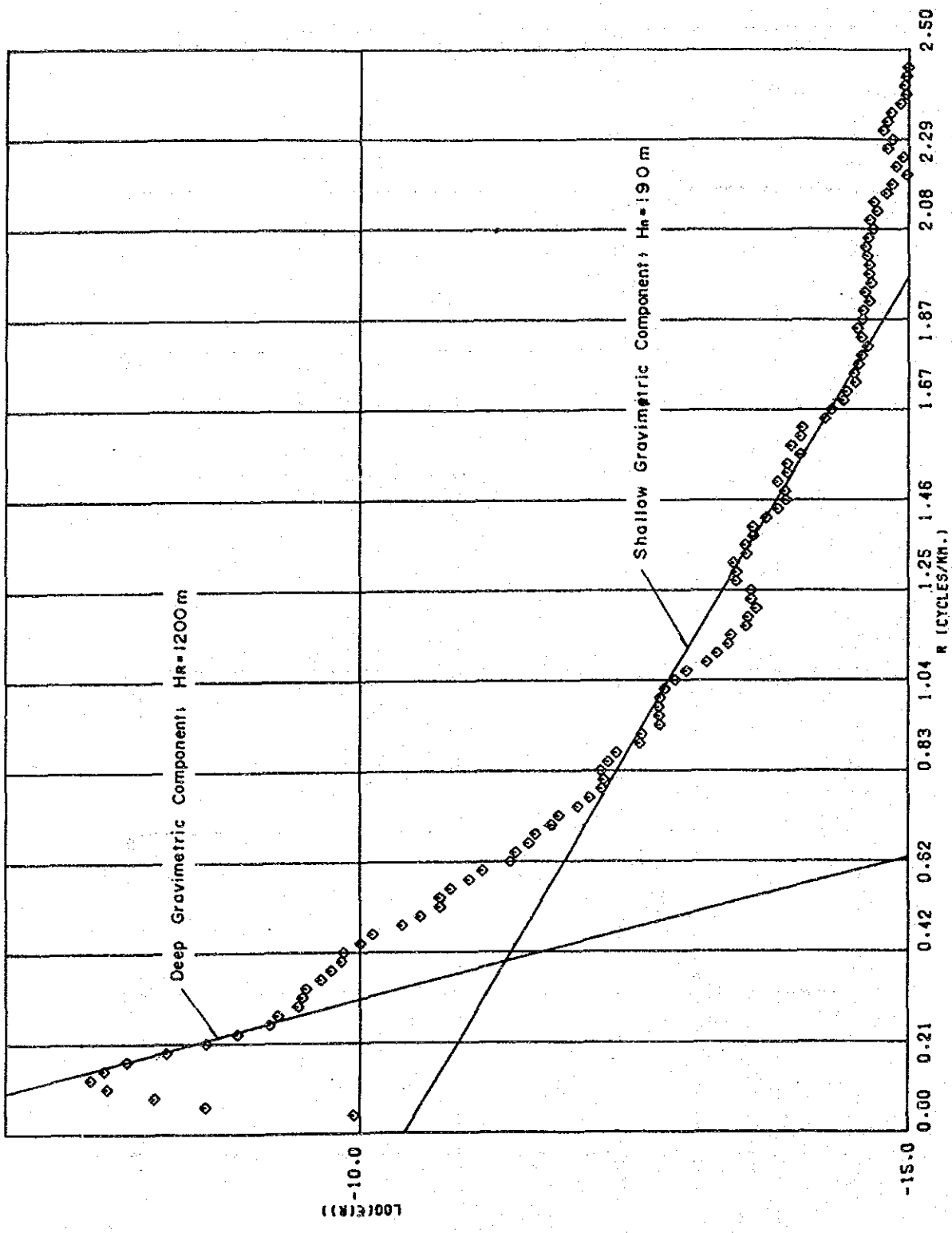
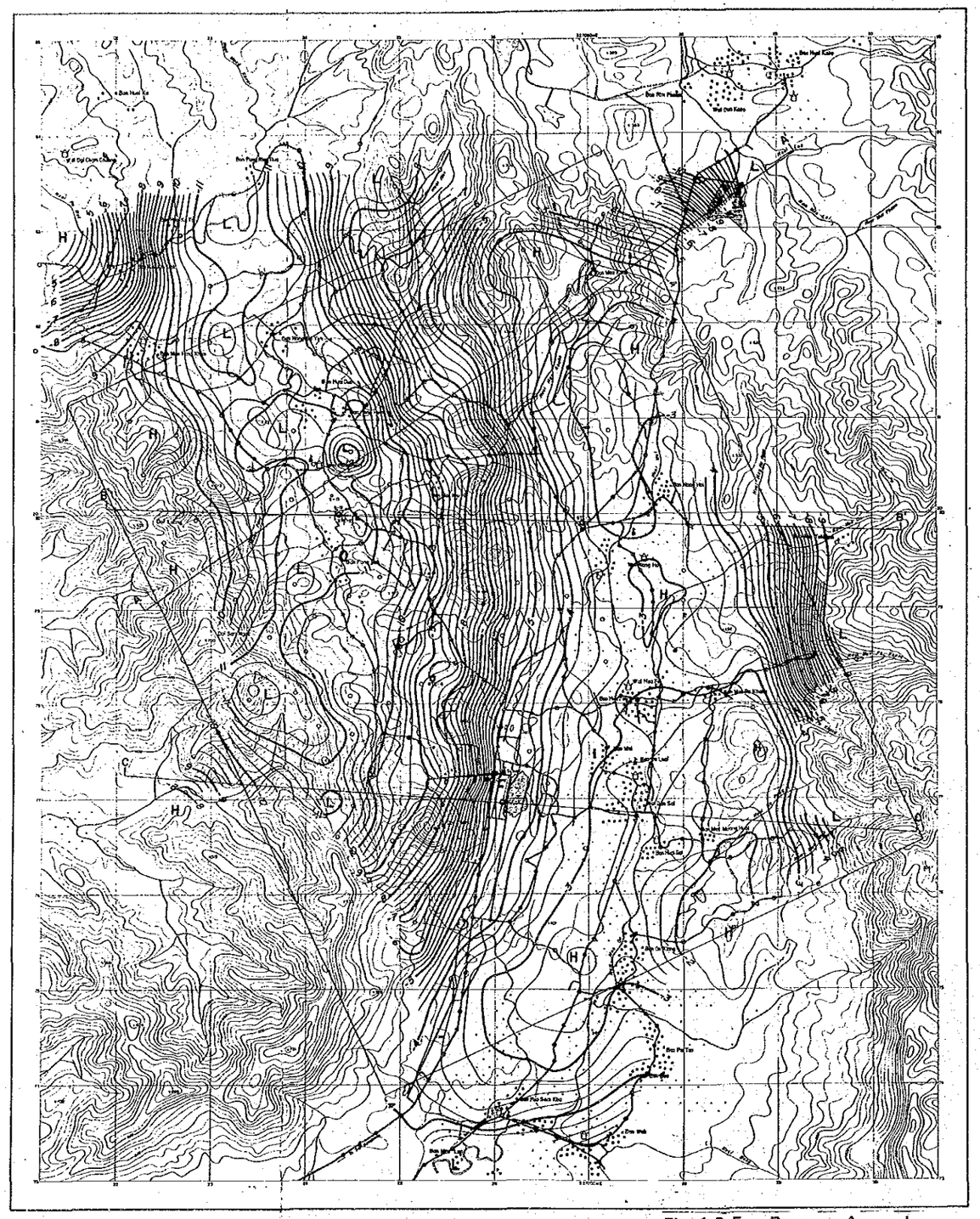


Fig. 1.2-4 Spectral Analysis



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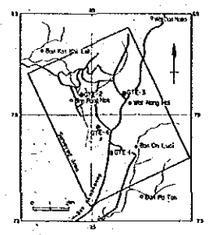
BOUGUER ANOMALY (ρ = 2.6)



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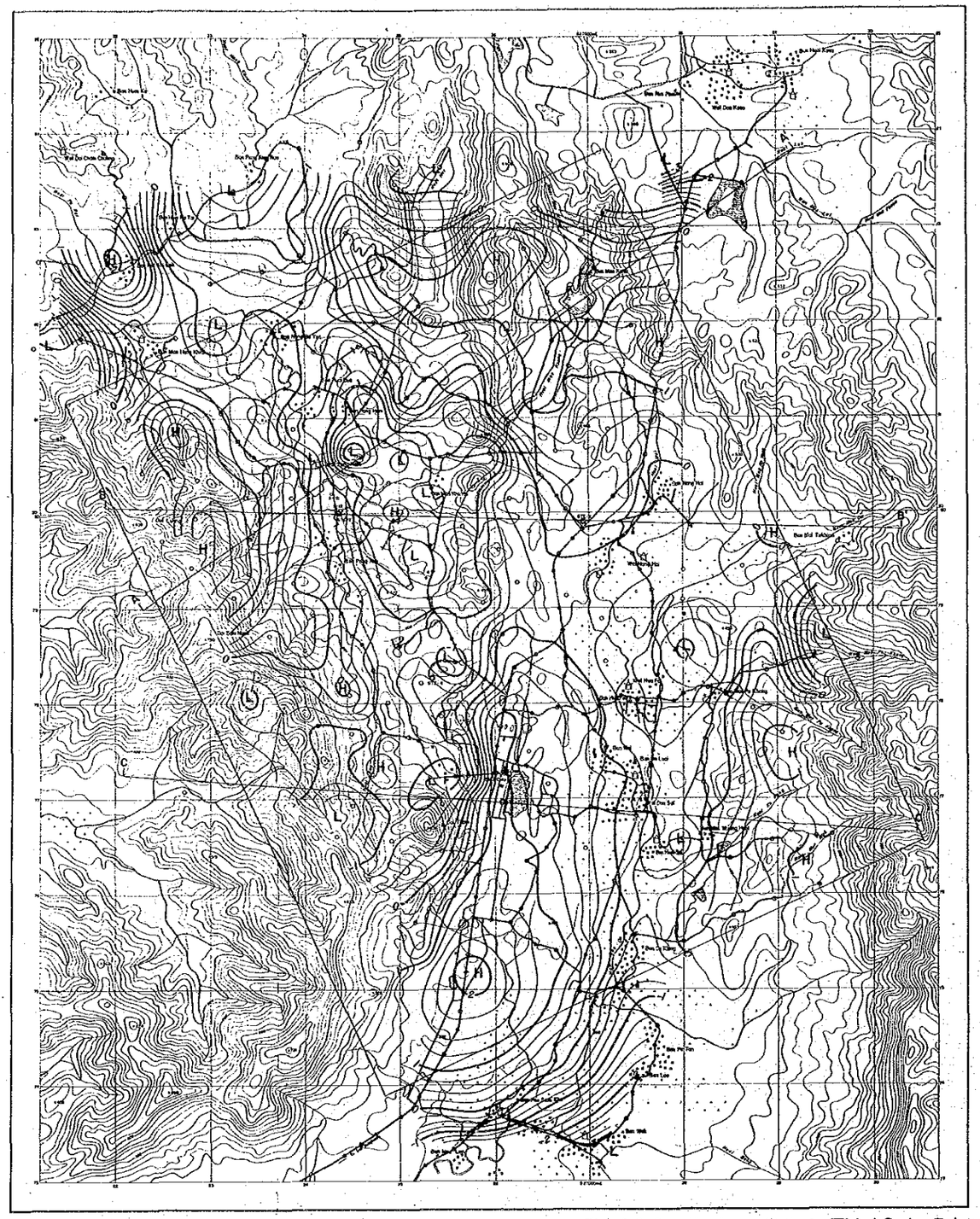
0 1000 2000m

LEGEND

- Wide road
- Narrow path
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Gravity station surveyed by JICA
- Gravity station surveyed by DMR
- Drill hole
- 1.0 mgal / 0.25 mgal — Contour line
- H — High gravity anomaly
- L — Low gravity anomaly
- A — A' — Profile of underground Structure

Fig. 1.2-5 Bouguer Anomaly



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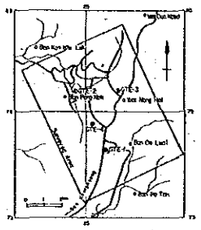
RESIDUAL GRAVITY
(THIRD ORDER POLYNOMIAL)



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DEPARTMENT OF MINERAL RESOURCES
CHIANG MAI UNIVERSITY

0 1000 2000m

LEGEND

- Wide road
- Narrow path
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Gravity station surveyed by JICA
- Gravity station surveyed by DMR
- Drill hole
- 1.0 mgal, 0.25 mgal — Contour line
- H High gravity anomaly
- L Low gravity anomaly
- A–A' Profile of underground structure

Fig. 1.2-6 Residual Gravity (Third Order Polynomial)

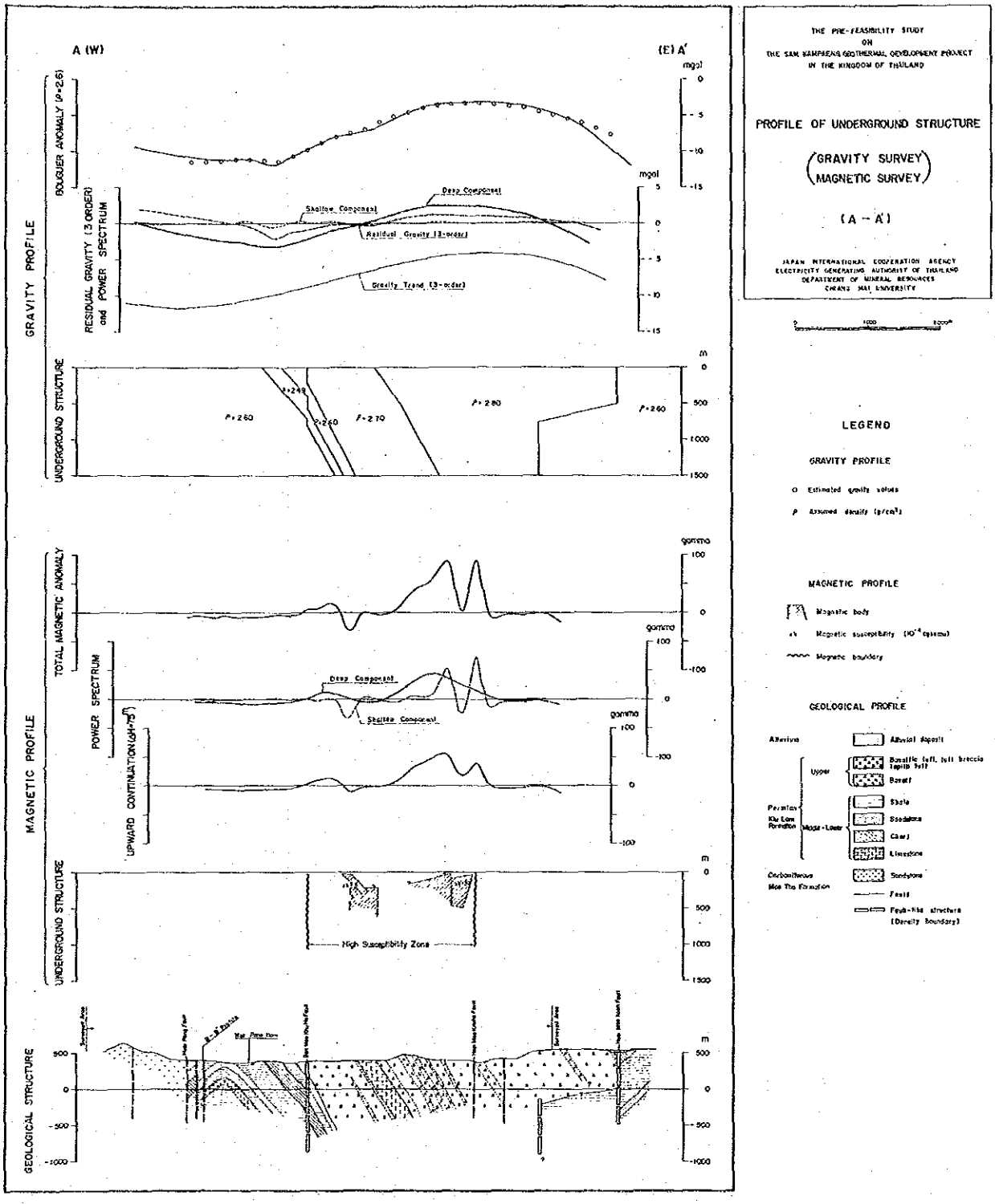

Fig. 1.2-7 Profile of Underground Structure (A-A')

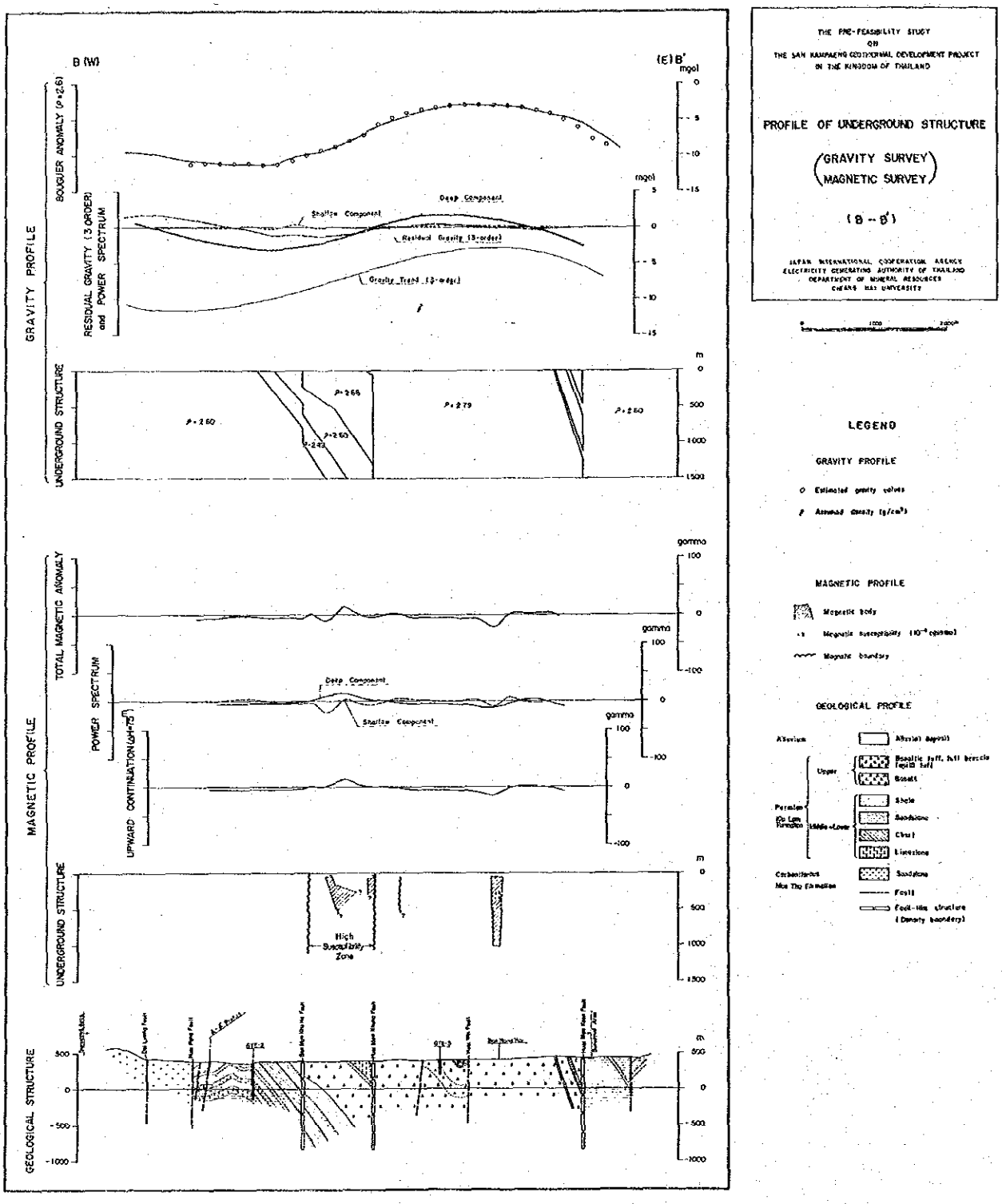

Fig. 1.2-8 Profile of Underground Structure (B-B')

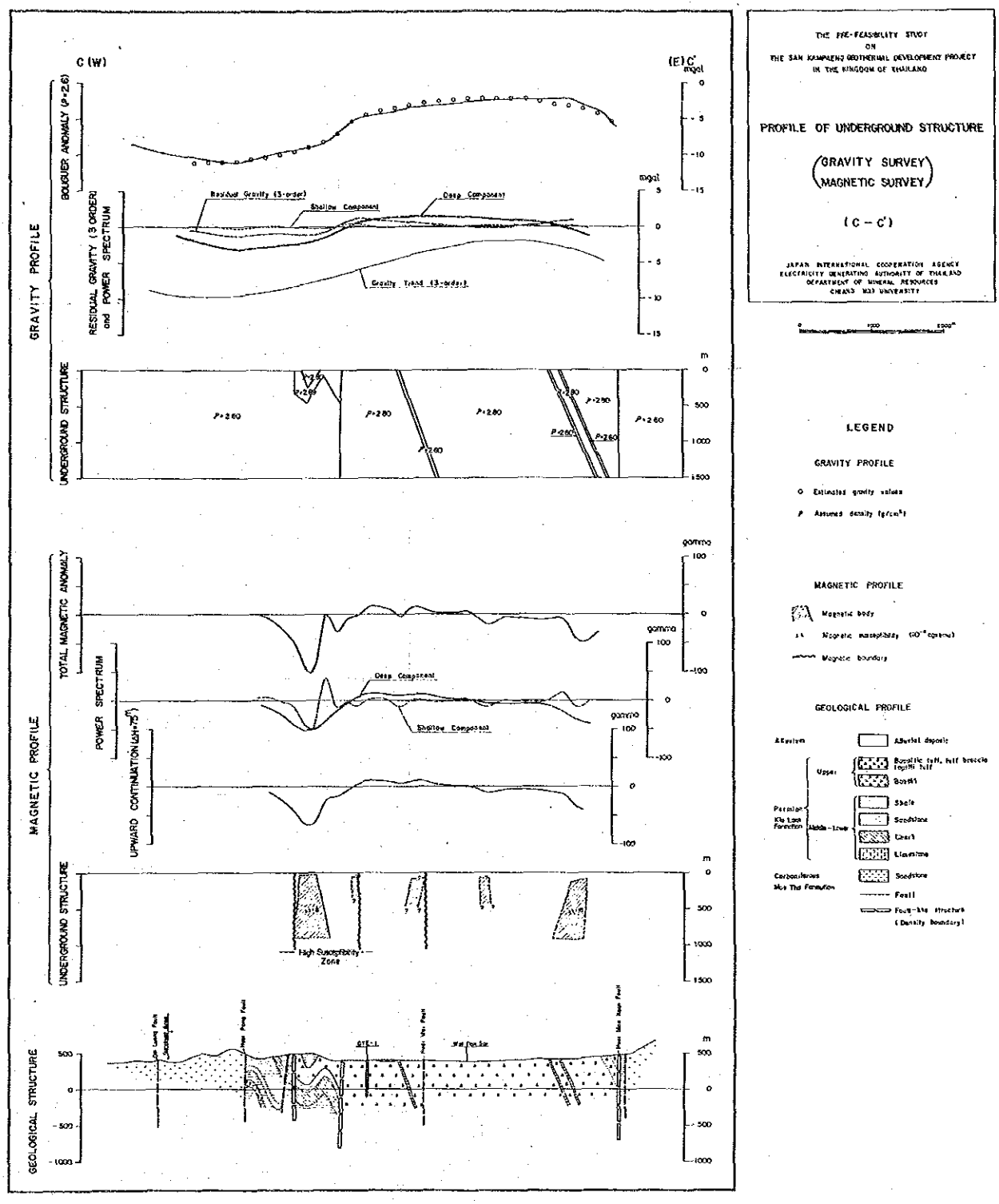

Fig. 1.2-9 Profile of Underground Structure (C-C')

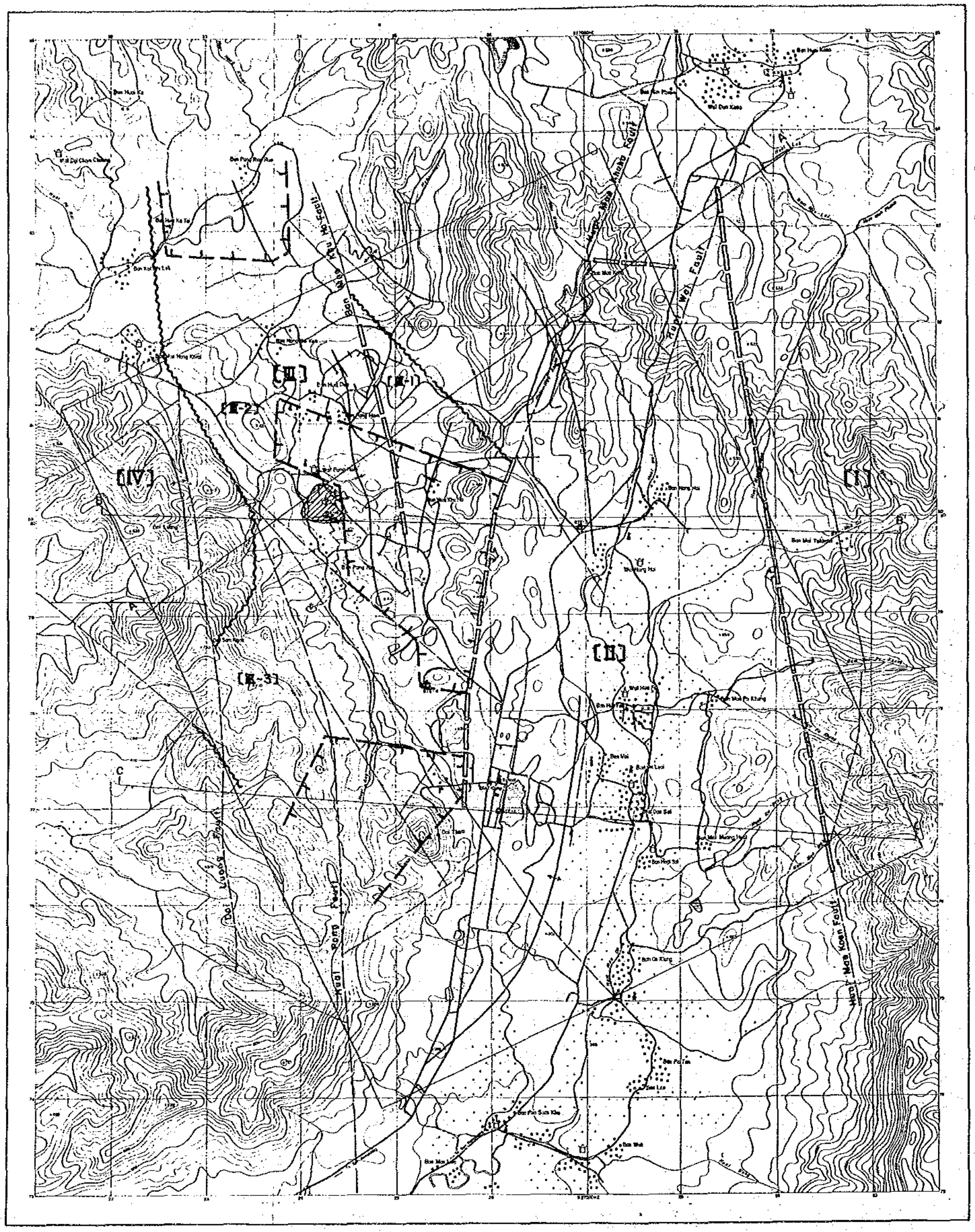

Fig. 1.2-10 Underground Structure

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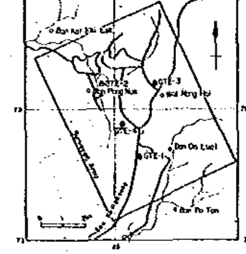
UNDERGROUND STRUCTURE



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0 1000 2000m

LEGEND

- Confirmed road
- Unconfirmed road
- Stream
- Village
- Drill hole
- Profile of underground structure
- Geothermal manifestation
- Block of gravity structure
- Fault-like structure and dip direction
- Density boundary
- Main fault
- Axis of high gravity
- Axis of low gravity
- Low residual gravity zone (third order polynomial)
- Wat
- School
- Rice field
- Dam (water reserve)

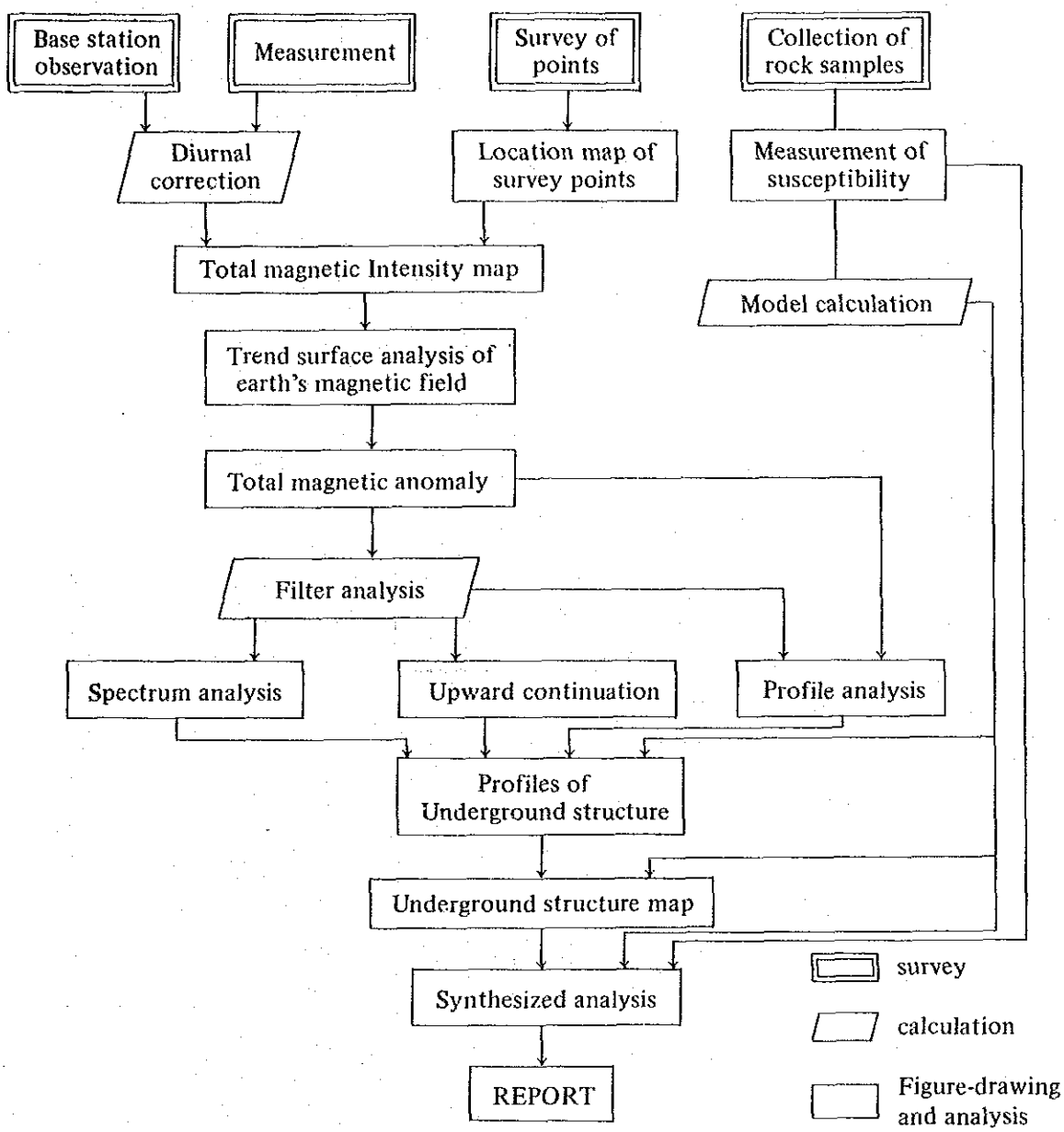


Fig. 1.3-1 Flow Chart of Magnetic Survey

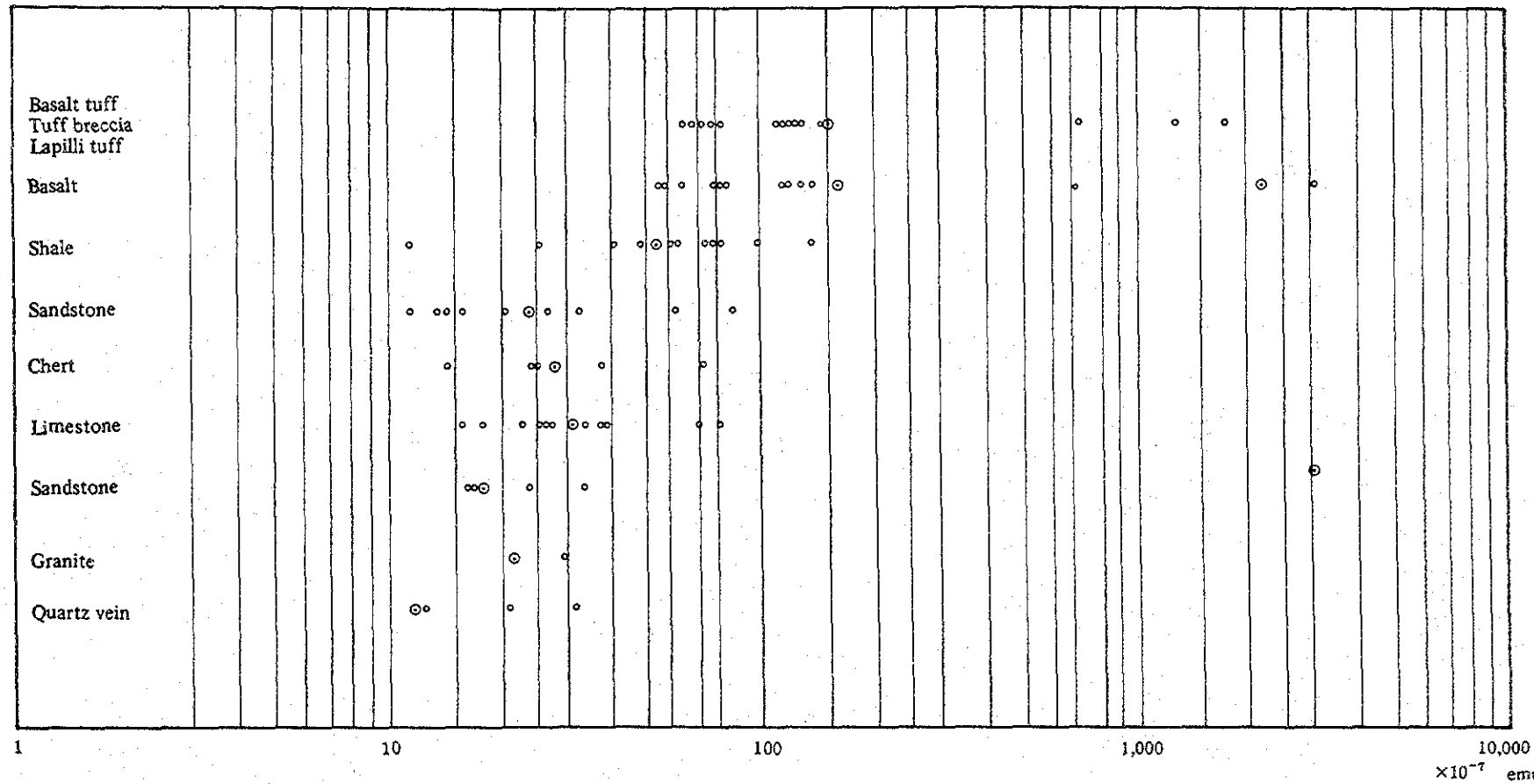


Fig. 1.3-2 Magnetic Susceptibility Distribution

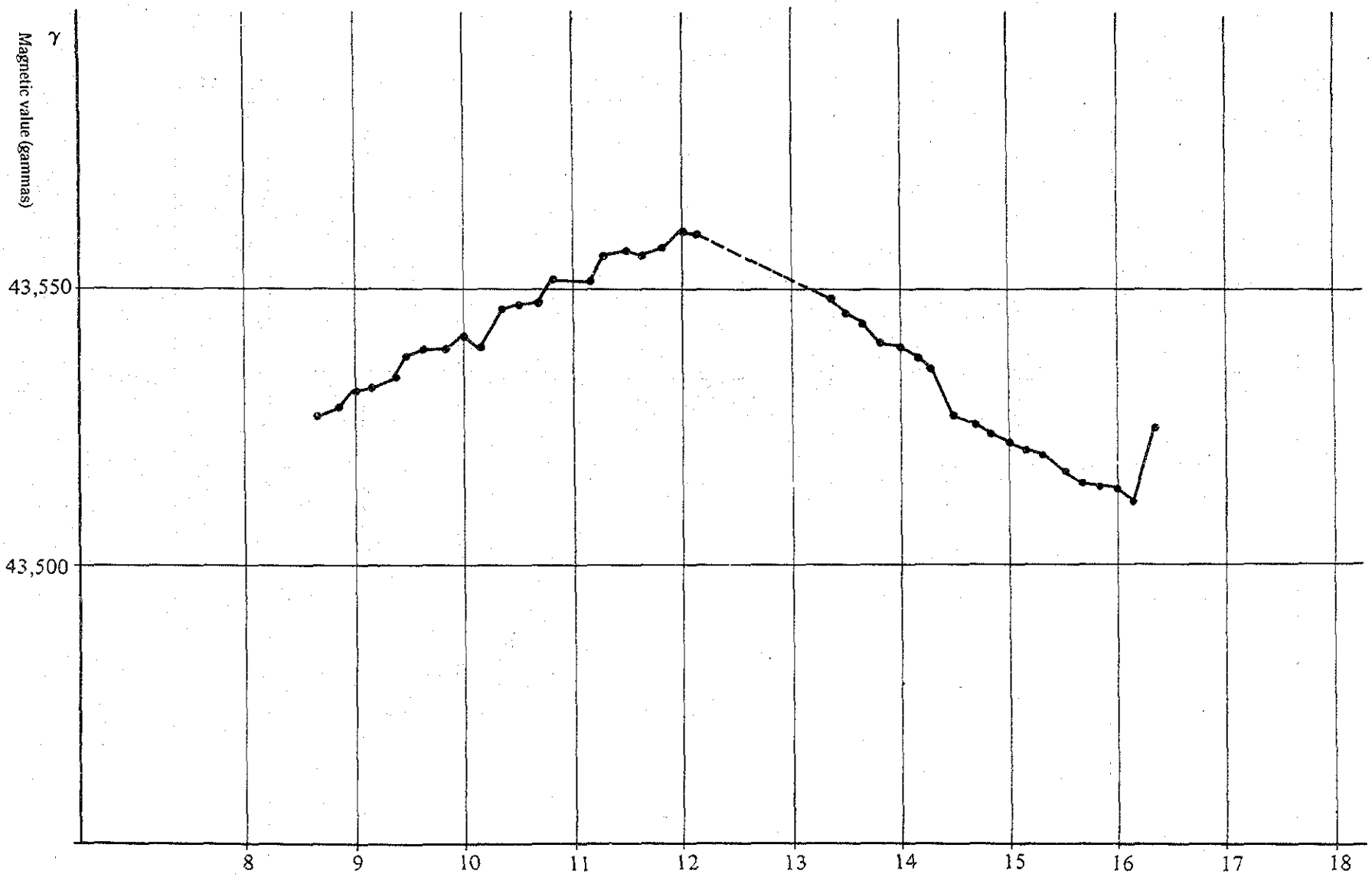


Fig. 1.3-3 Diurnal Variation of Geomagnetic Field (Date: Nov. 23, 1982)

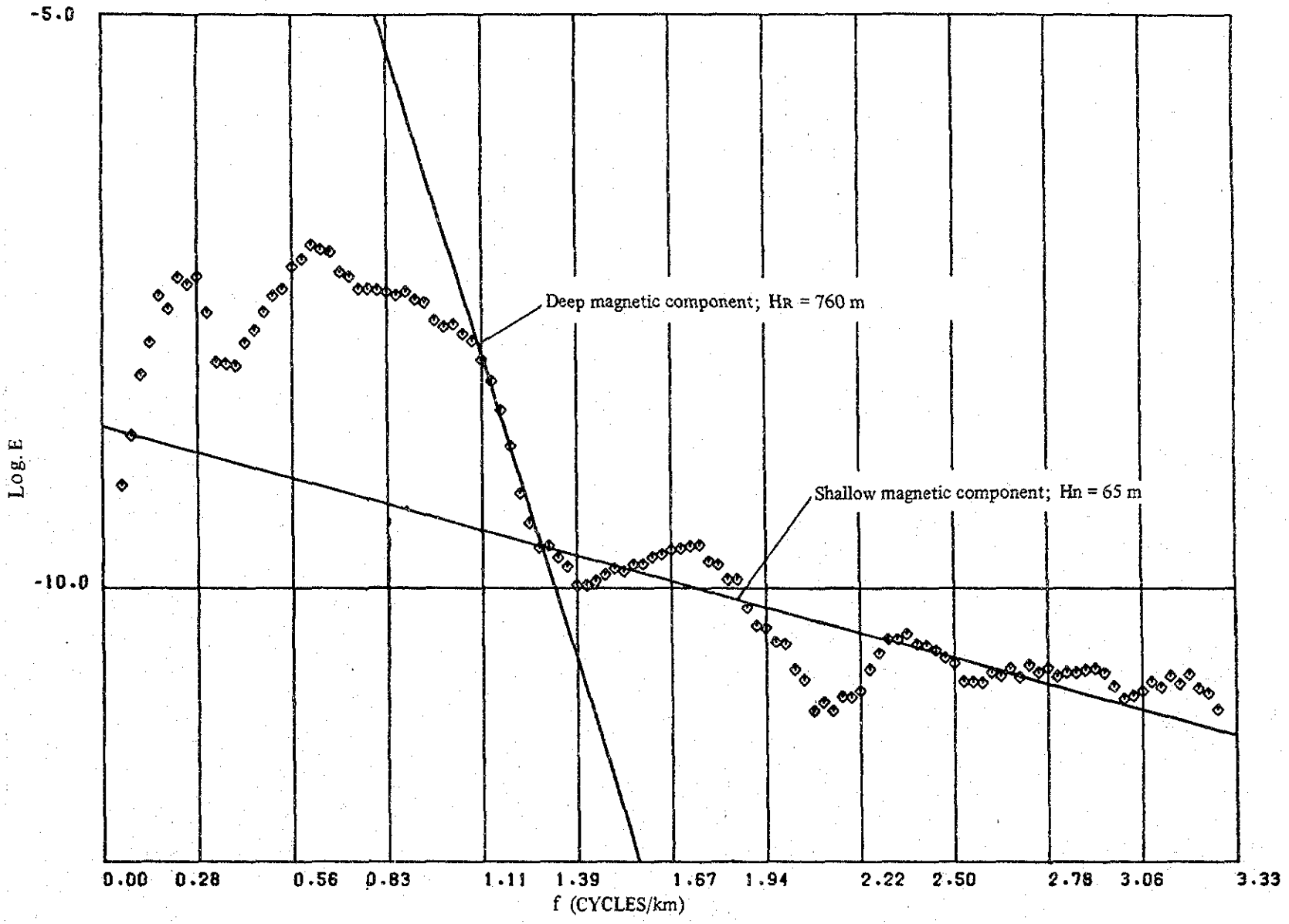
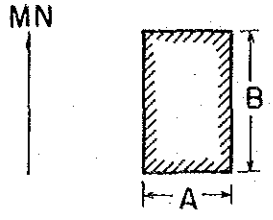
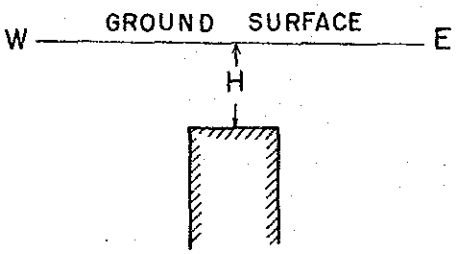


Fig. 1.3-4 Spectral Analysis



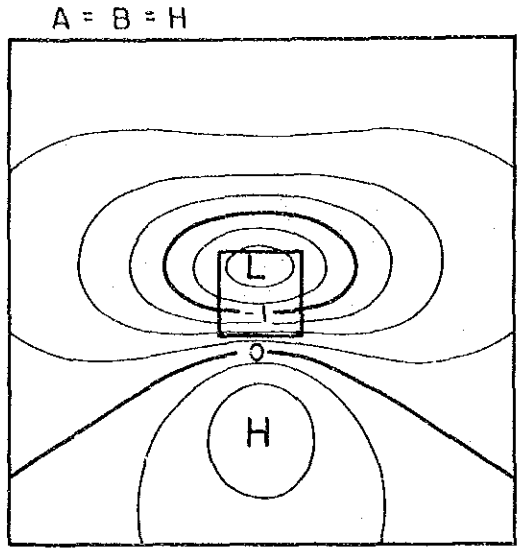


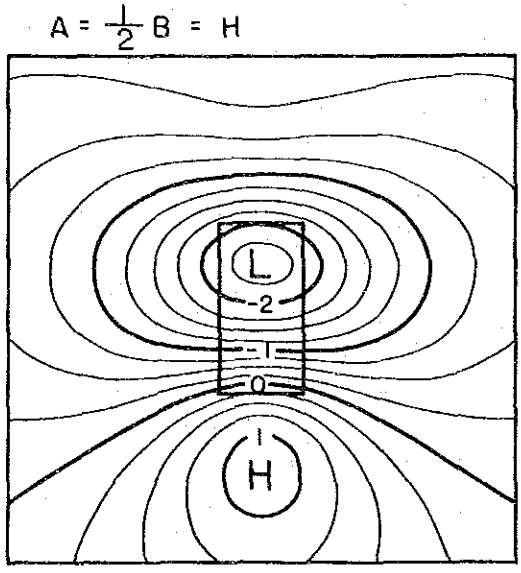
Inclination 15° N

Declination 0°

Total Intensity 43,500 gammas

Magnetic Susceptibility 10^{-4} cgsemu





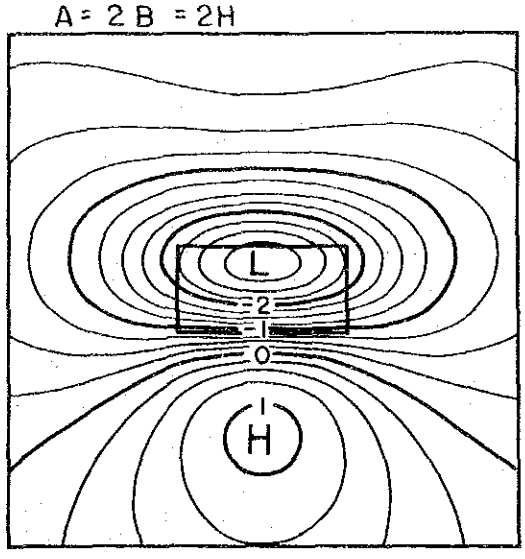
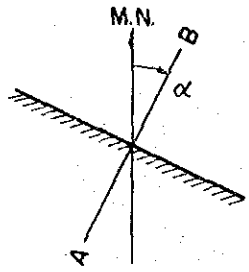
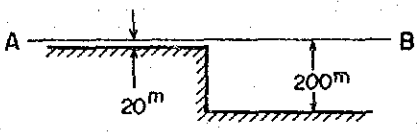


Fig. 1.3-5 Magnetic Response of Prism Model





Inclination 15° N
Declination 0°
Total Intensity 43,500 gammas
Magnetic Susceptibility 10^{-4} cgsemu

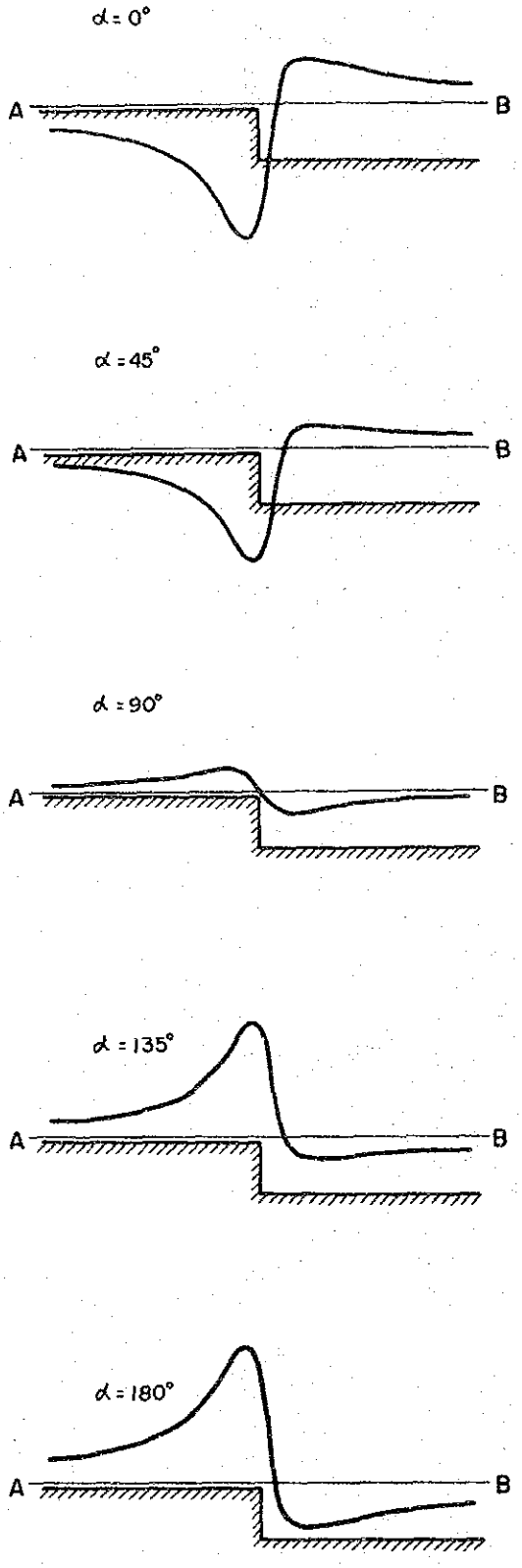
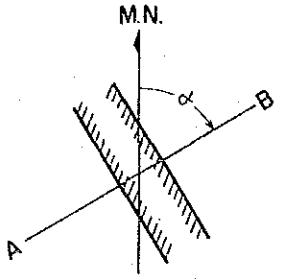
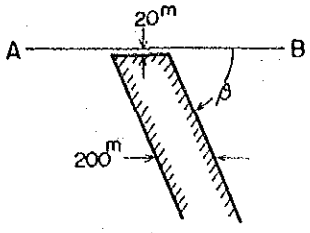


Fig. 1.3-6 Magnetic Response of Step Model





Inclination 15° N
Declination 0°
Total Intensity 43,500 gammas
Magnetic Susceptibility 10^{-4} cgsemu

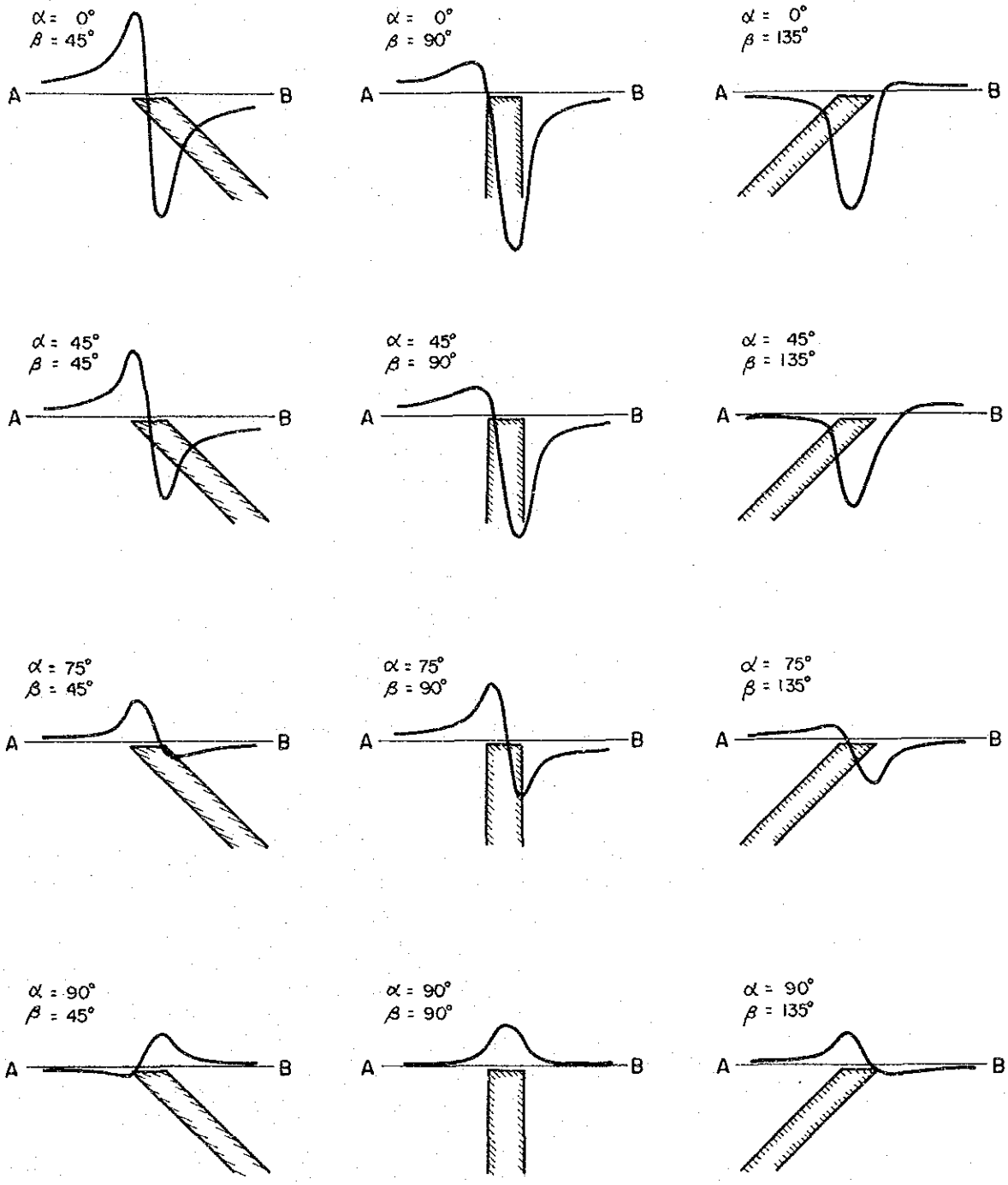


Fig. 1.3-7 Magnetic Response of Dyke Model

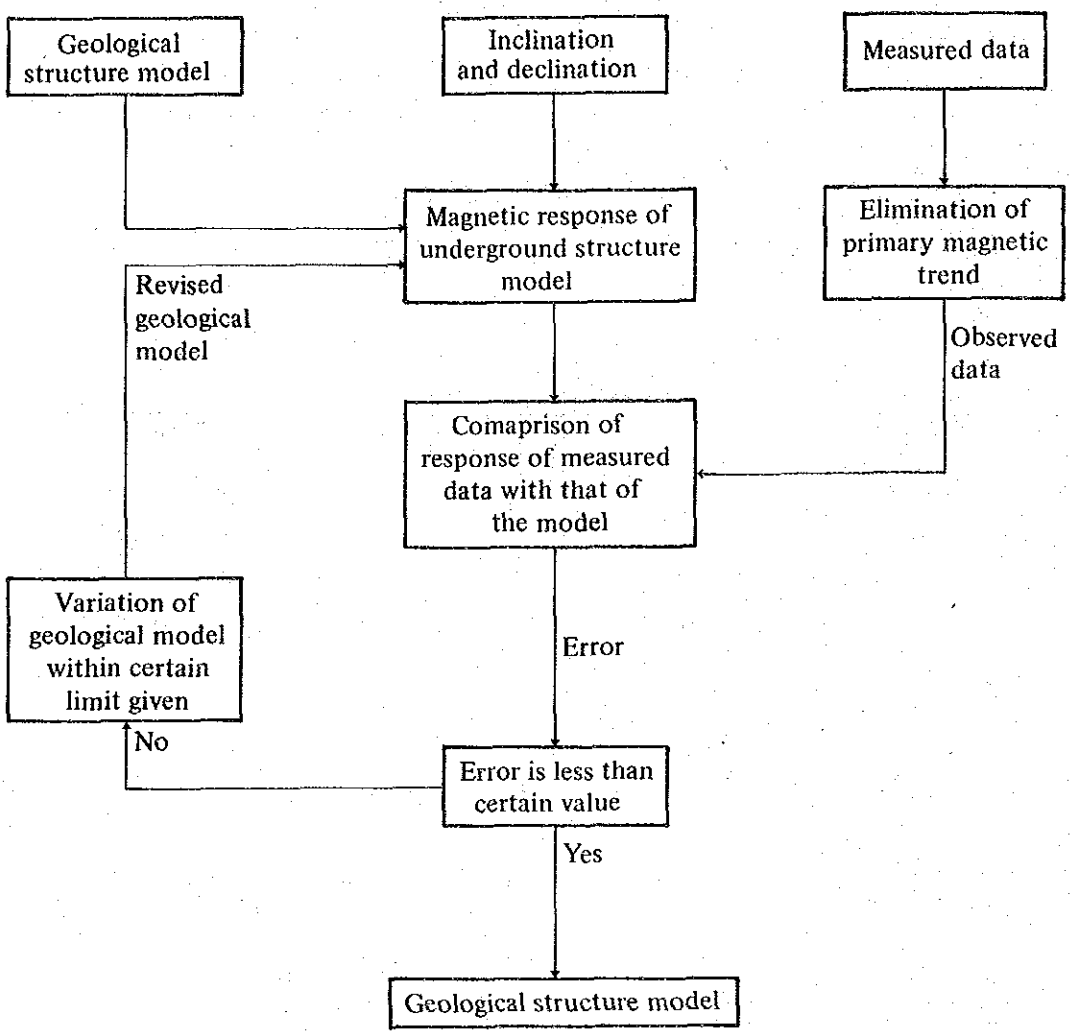


Fig. 1.3-8 Flow Chart of Magnetic Profile Analysis

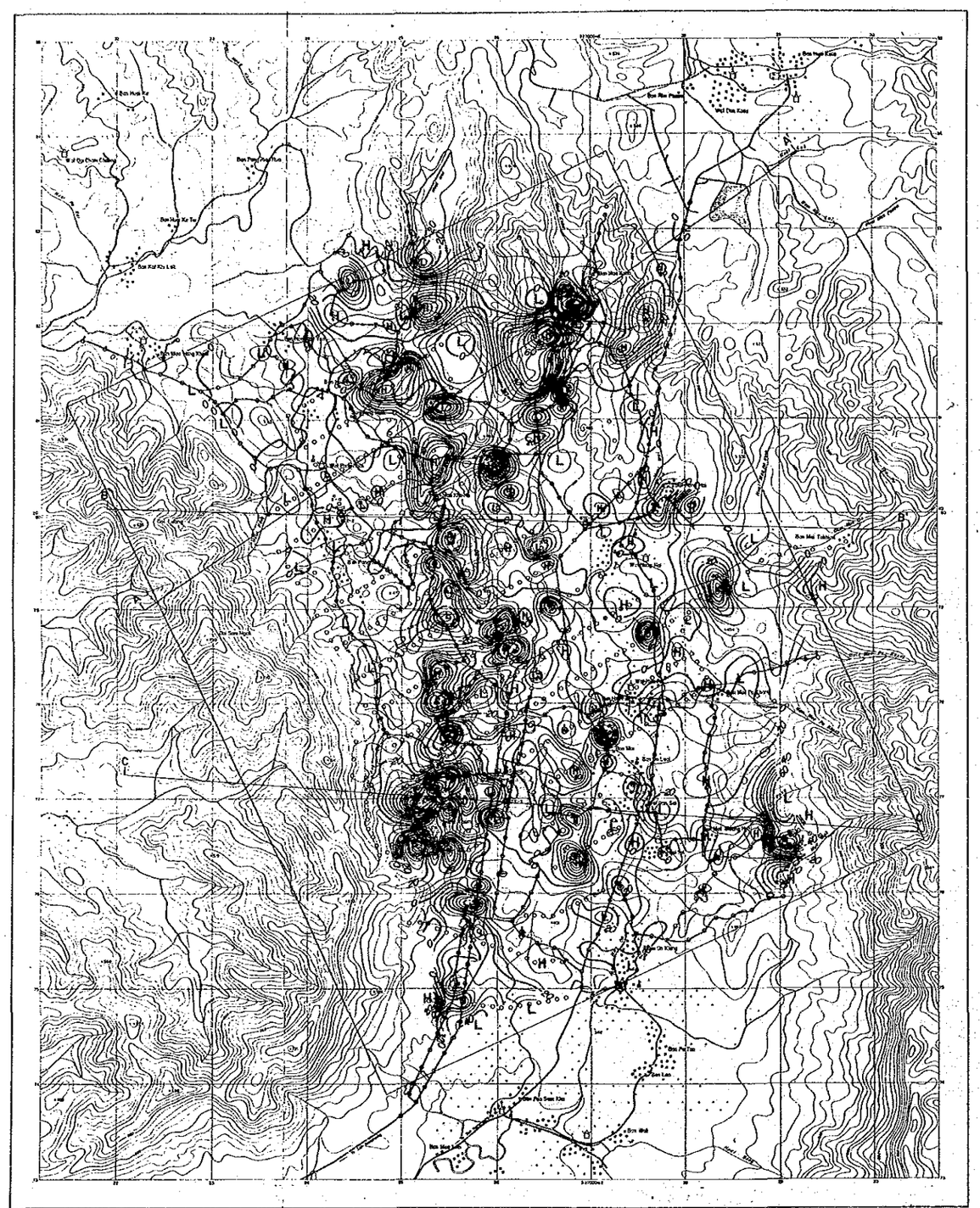


Fig. 1.3-9 Total Magnetic Intensity

THE PRE-FEASIBILITY STUDY
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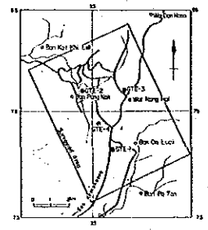
IN THE KINGDOM OF THAILAND

TOTAL MAGNETIC INTENSITY



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DEPARTMENT OF MINERAL RESOURCES
CHIANG MAI UNIVERSITY

0 1000 2000m

LEGEND

- Wide road
- Narrow pass
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Magnetic station
- Drill hole
- 20 gamma / 5 gamma — Contour line
- H — High magnetic anomaly
- L — Low magnetic anomaly
- A — A' — Profile of underground structure

Inclination : 15°N
Declination : N 6°W
Total Intensity: 43,556 gamma

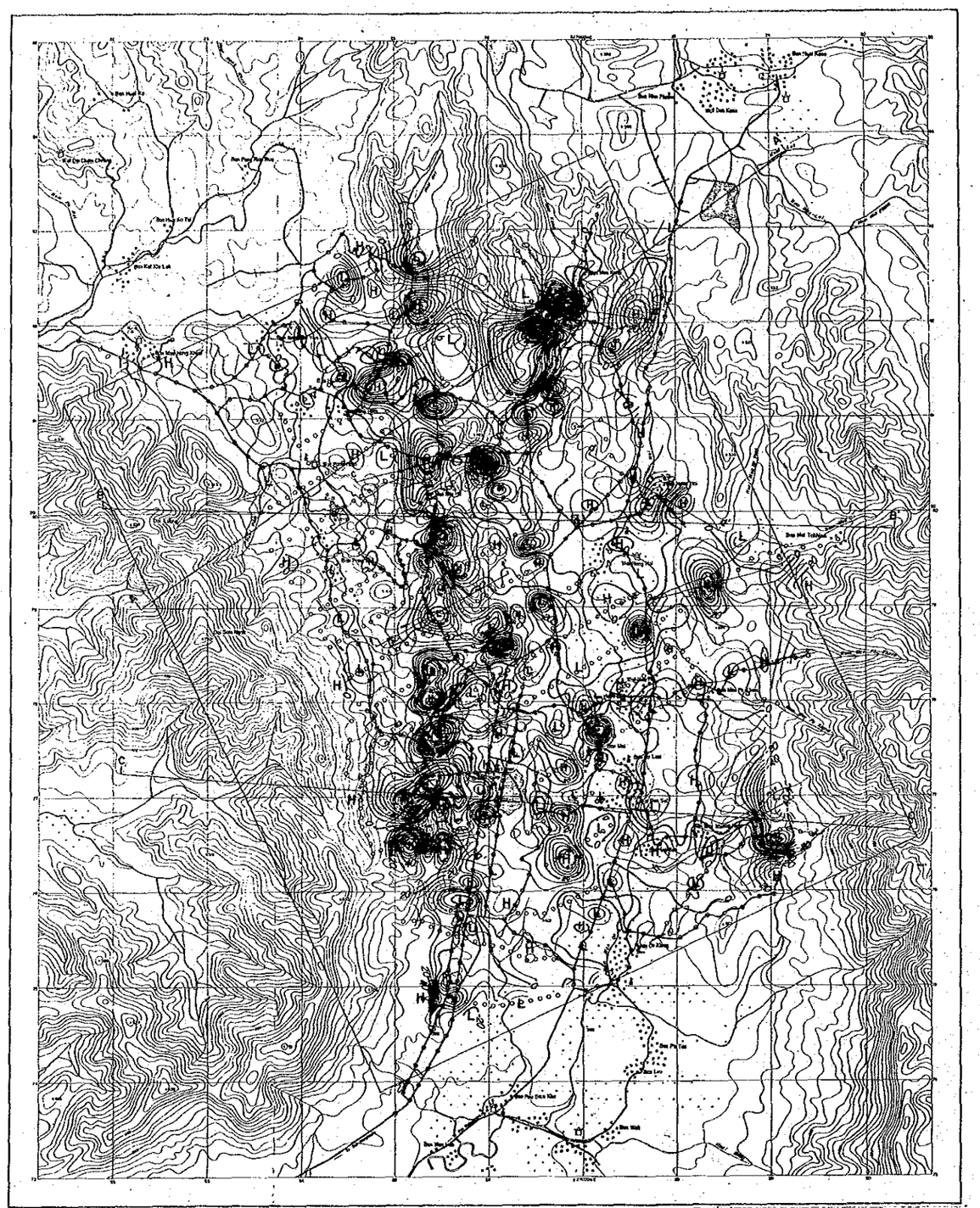

Fig. 1.3-10 Total Magnetic Anomaly

THE PRE-FEASIBILITY STUDY
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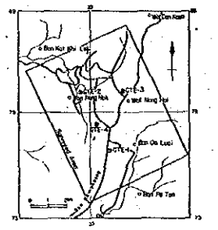
TOTAL MAGNETIC ANOMALY



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CHIANG MAI UNIVERSITY

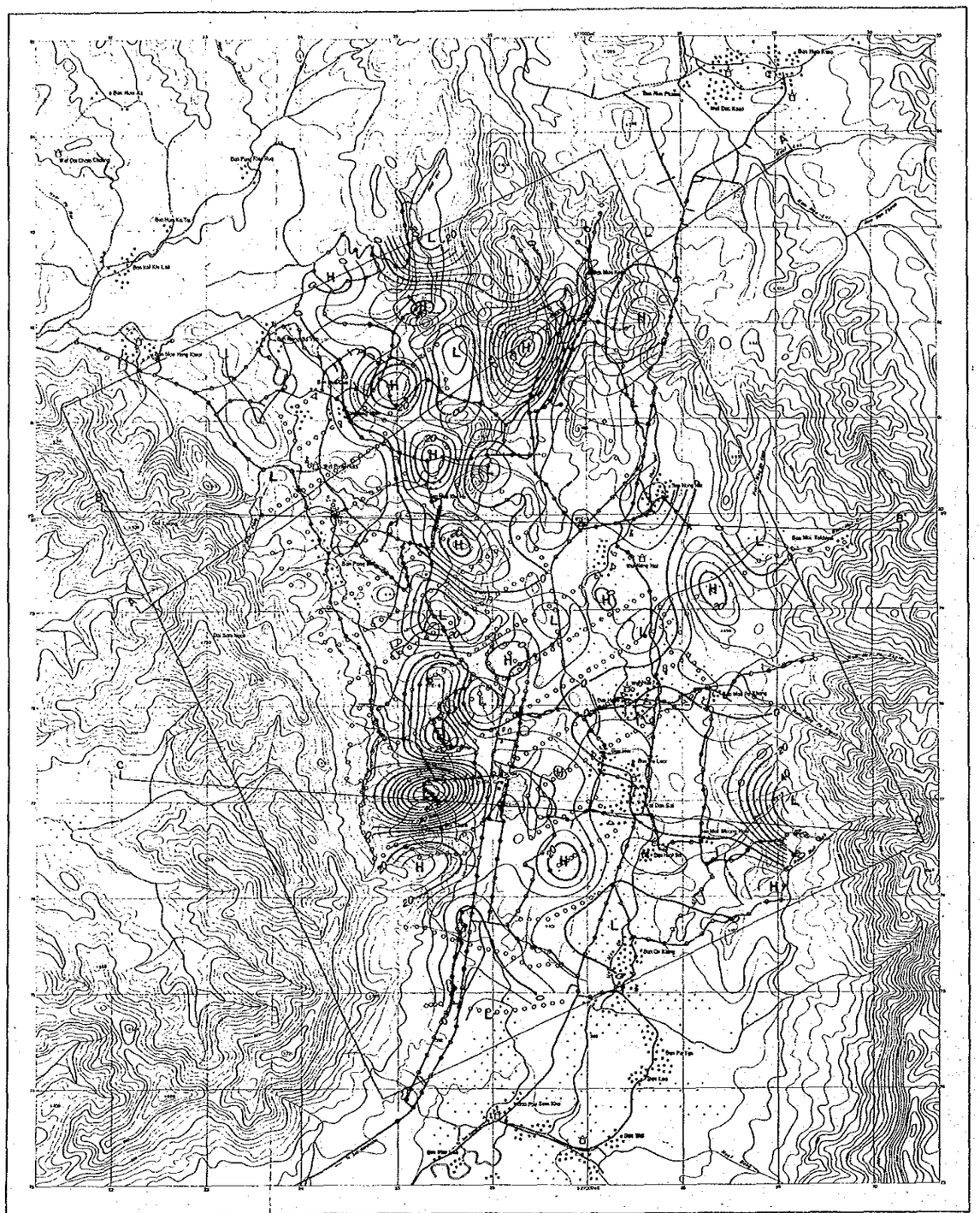
0 1000 2000m

LEGEND

- Wide road
- Narrow pass
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Magnetic station
- Drill hole
- 20 gamma / 5 gamma — Contour line
- H — High magnetic anomaly
- L — Low magnetic anomaly
- A — A' — Profile of underground structure

Inclination : 15°N
Declination : N 6°W
Total intensity: 43,500 gamma

- C — C' — Profile for magnetic modeling
- A — A' — Geological profile



THE PRE-FEASIBILITY STUDY
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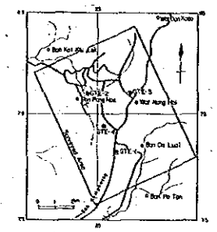
DEEP MAGNETIC COMPONENT



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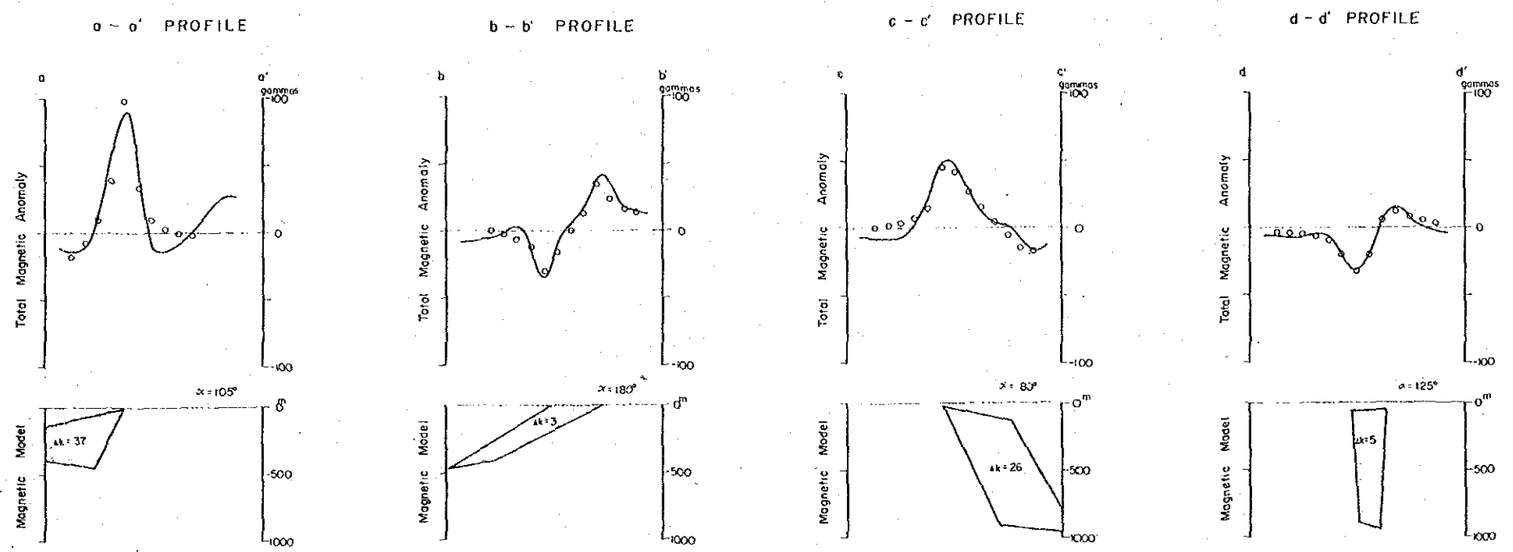
0 1000 2000m

LEGEND

- Wide road
- Narrow pass
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Magnetic station
- Drill hole
- 20 gamma / 5 gamma — Contour line
- H — High magnetic anomaly
- L — Low magnetic anomaly
- A A' — Profile of underground structure

Inclination : 15°N
Declination : N 6°W
Total intensity : 43,556 gamma

Fig. 1.3-11 Deep Magnetic Component



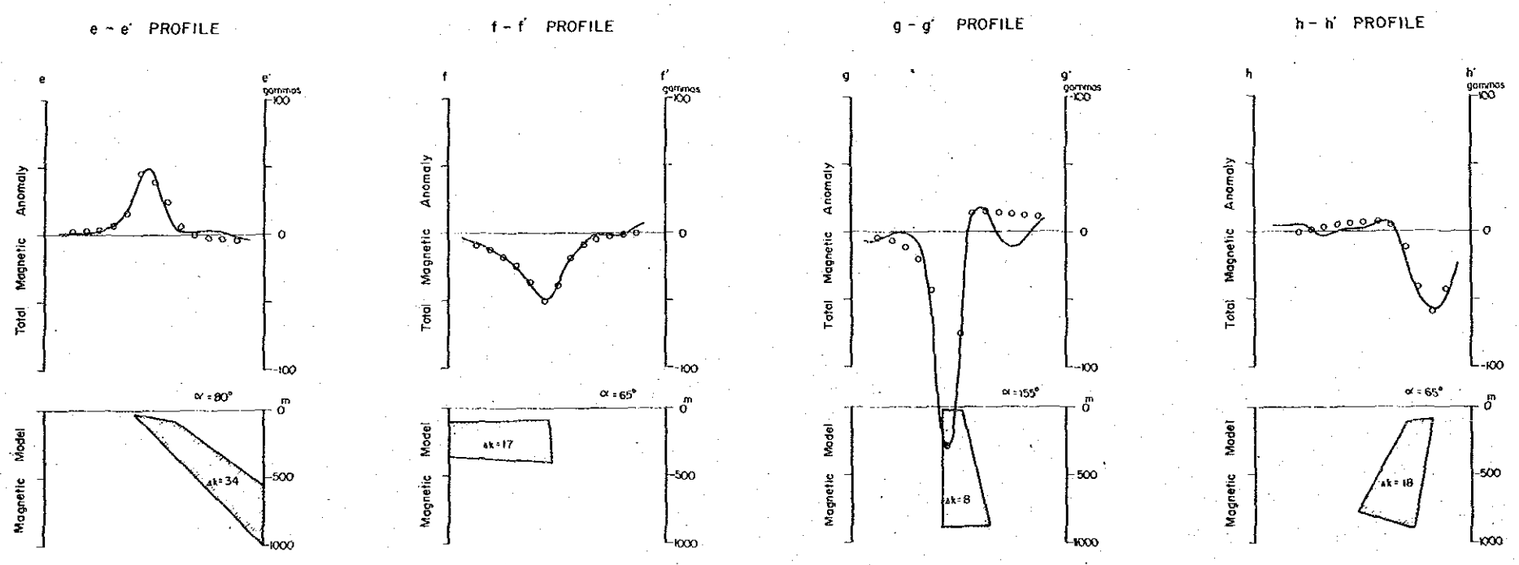


Fig. 1.3-12 Result of Magnetic Modeling

THE PRE-FEASIBILITY STUDY
ON
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IN THE KINGDOM OF THAILAND

RESULT OF MAGNETIC MODELING

JAPAN INTERNATIONAL COOPERATION AGENCY
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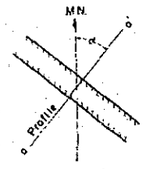
DEPARTMENT OF MINERAL RESOURCES
CHIANG MAI UNIVERSITY

0 1000 2000m

LEGEND



Inclination : 15° N

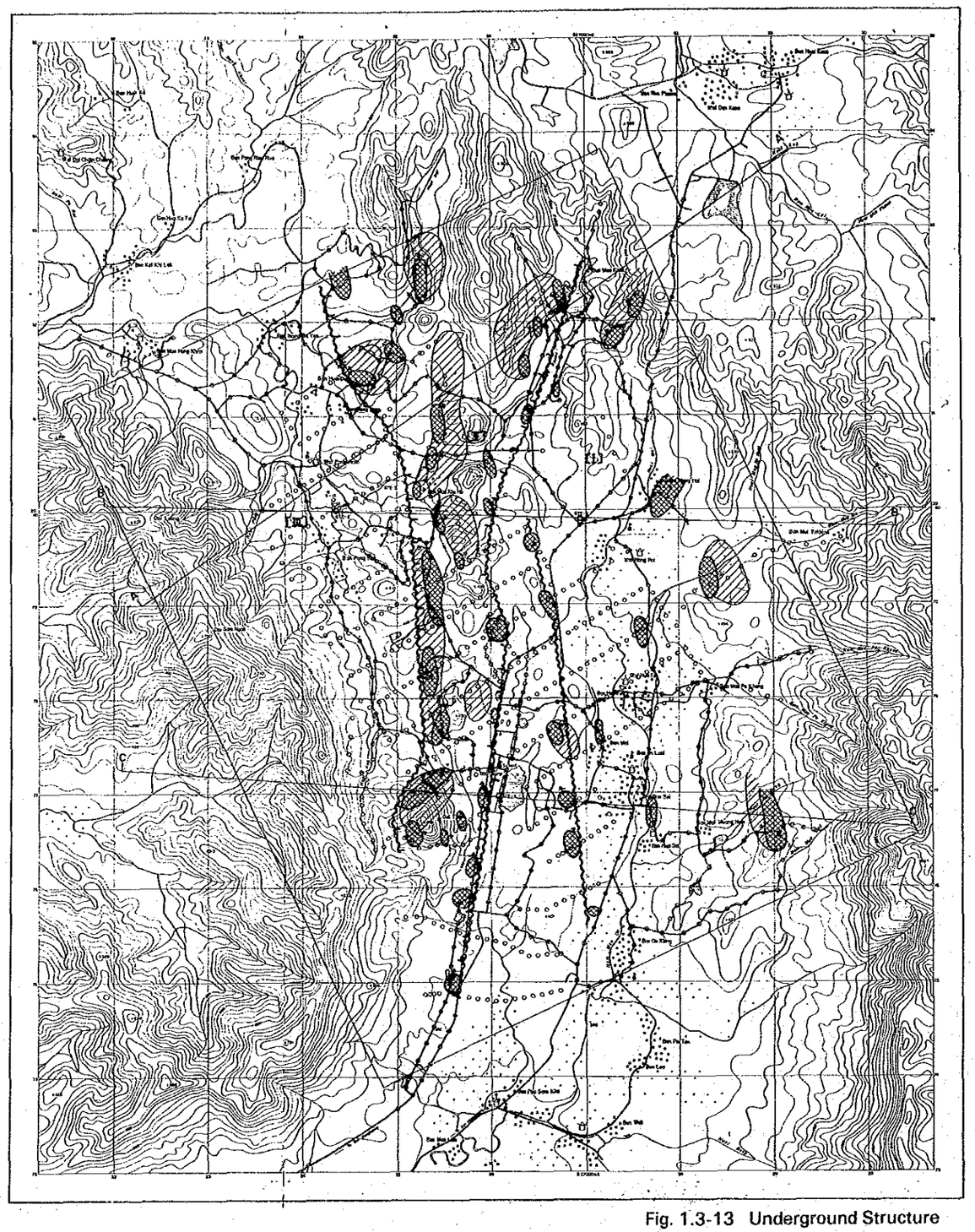
Declination : N 6°W

Total intensity : 43,556 gamma

o o o Estimated magnetic values

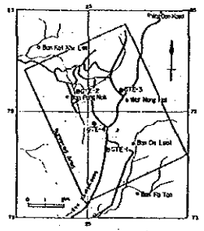
Magnetic body

Δk Magnetic susceptibility : 10^{-4} cgsemu



THE PRE-FEASIBILITY STUDY
ON
THE SAN KAMPAENG GEOTHERMAL DEVELOPMENT PROJECT
IN THE KINGDOM OF THAILAND

UNDERGROUND STRUCTURE



JAPAN INTERNATIONAL COOPERATION AGENCY
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DEPARTMENT OF MINERAL RESOURCES
CHIANG MAI UNIVERSITY

0 1000 2000m

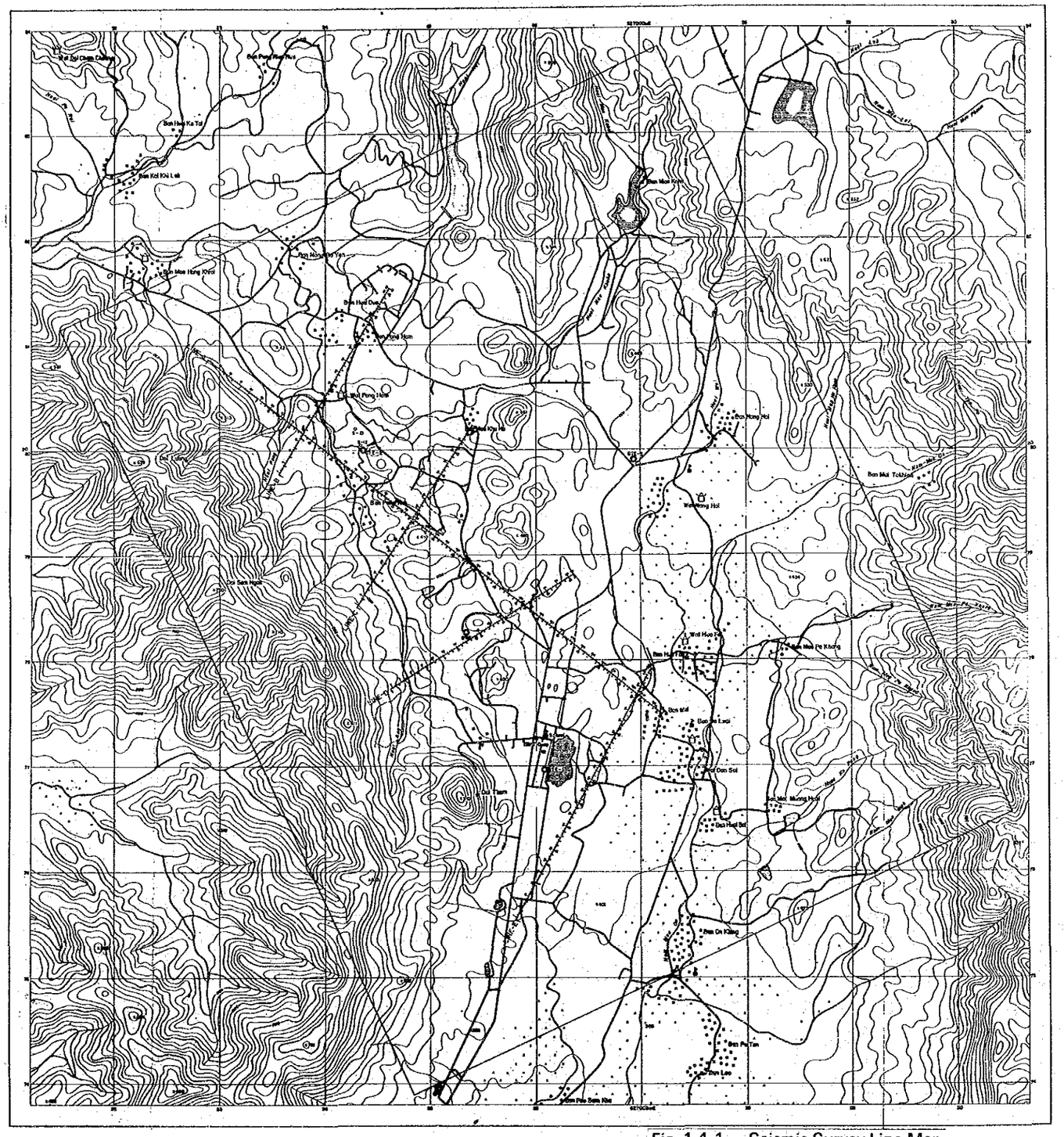
LEGEND

- Wide road
- Narrow pass
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)

- Magnetic station
- Drill hole
- Shallow magnetic body and dip direction
- Deep magnetic body
- Magnetic boundary
- High susceptibility zone
- Profile of underground structure

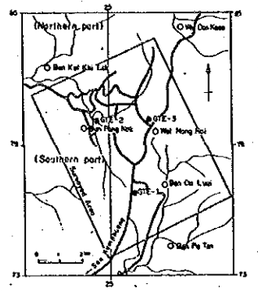
Inclination : 15°N
Declination : N 6°W
Total intensity : 43,556 gamma

Fig. 1.3-13 Underground Structure



THE PRE-FEASIBILITY STUDY
ON
THE SAN KAMPAENG GEOTHERMAL DEVELOPMENT PROJECT
IN THE KINGDOM OF THAILAND

SEISMIC SURVEY LINE MAP



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LEGEND

- Confirmed road
- Unconfirmed road
- Stream
- Village
- Wat
- School
- Rice field
- Dam (water reserve)
- Receive point
- Shot point

Fig. 1.4-1 Seismic Survey Line Map

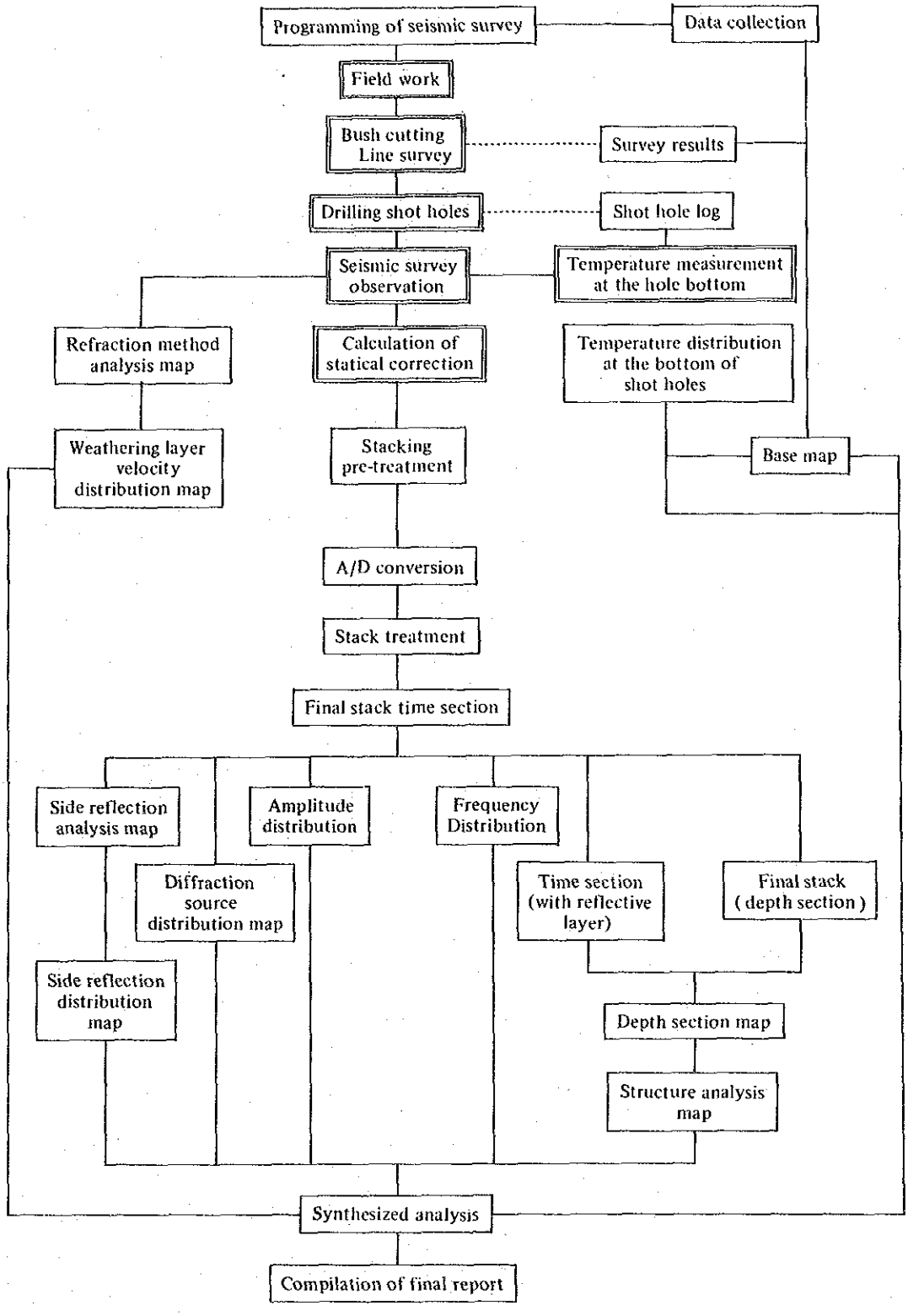


Fig. 1.4-2 Flow Chart of Seismic Survey

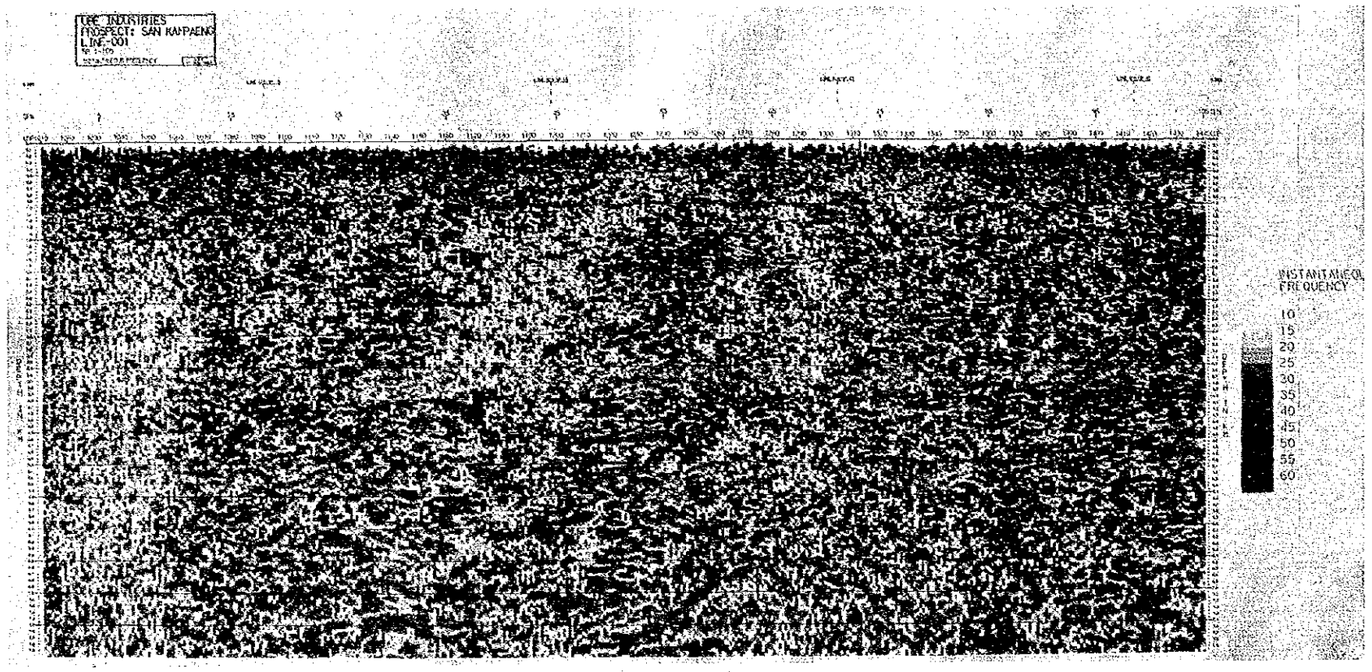


Fig. 1.4-4 Frequency Analysis Section : Line-A

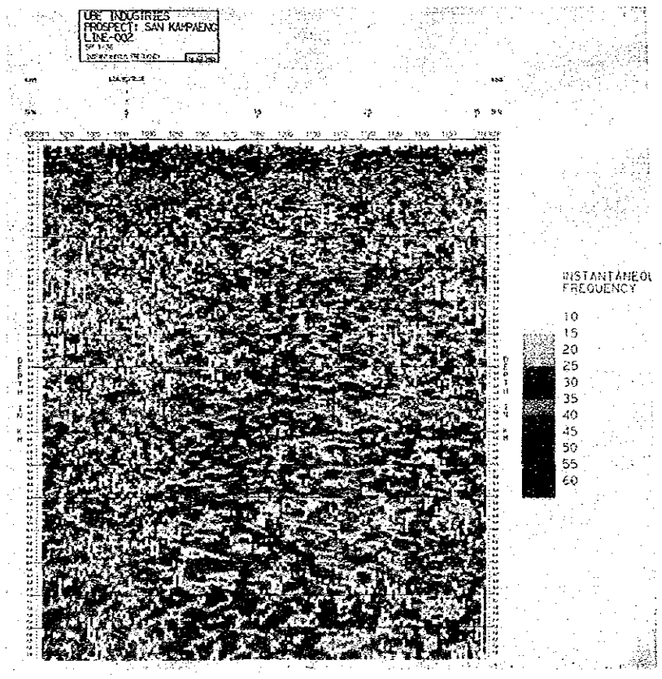


Fig. 1.4-5 Frequency Analysis Section : Line-B

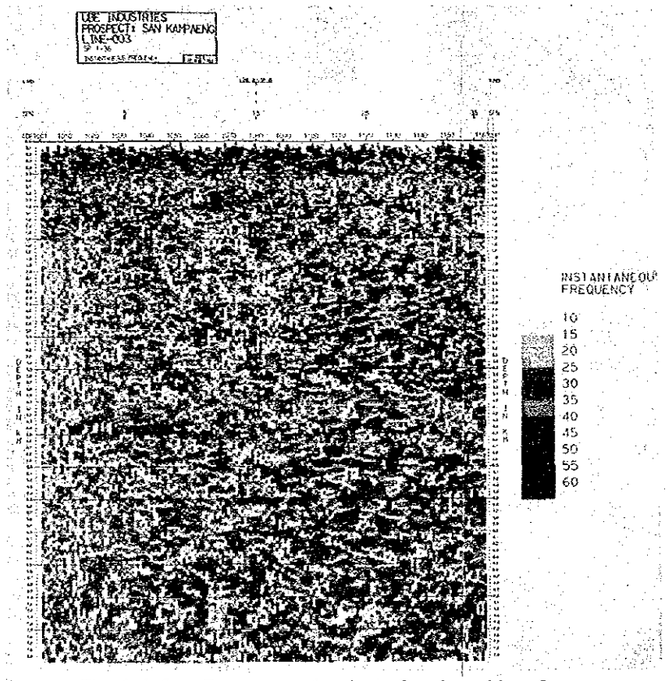


Fig. 1.4-6 Frequency Analysis Section : Line-C

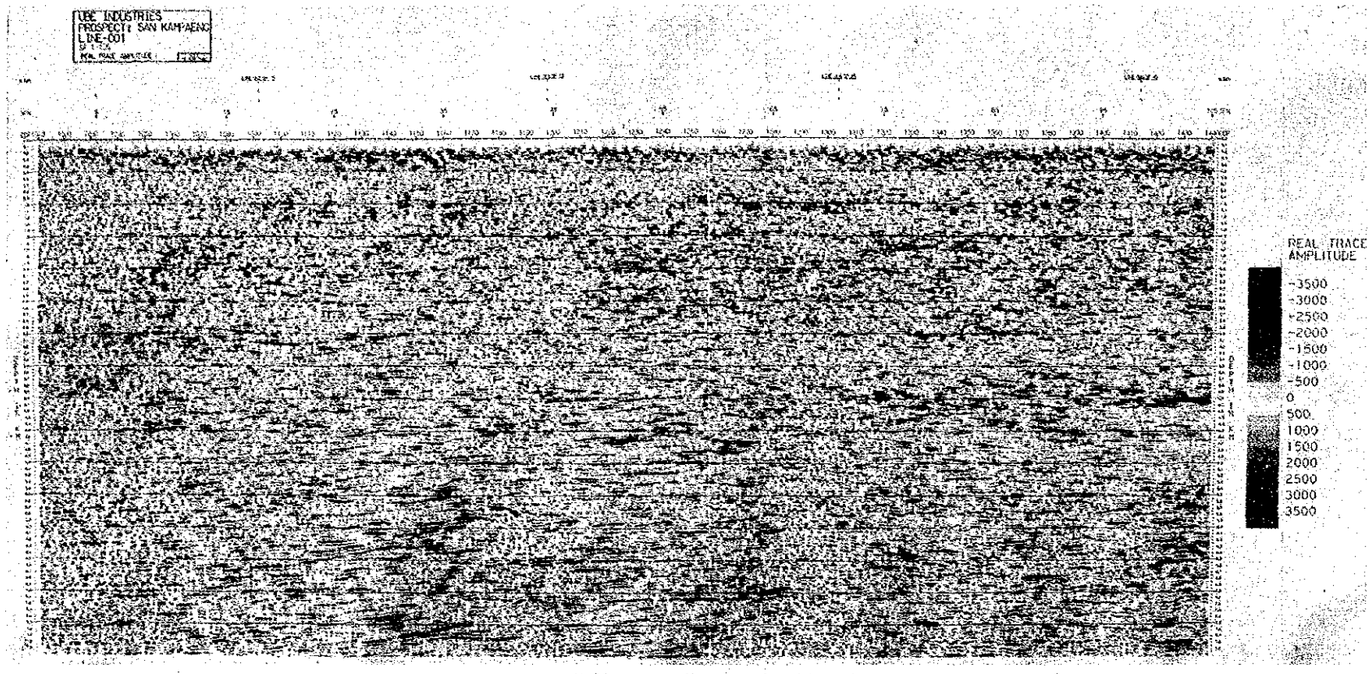


Fig. 1.4-7 Real Trace Amplitudo : Line-A

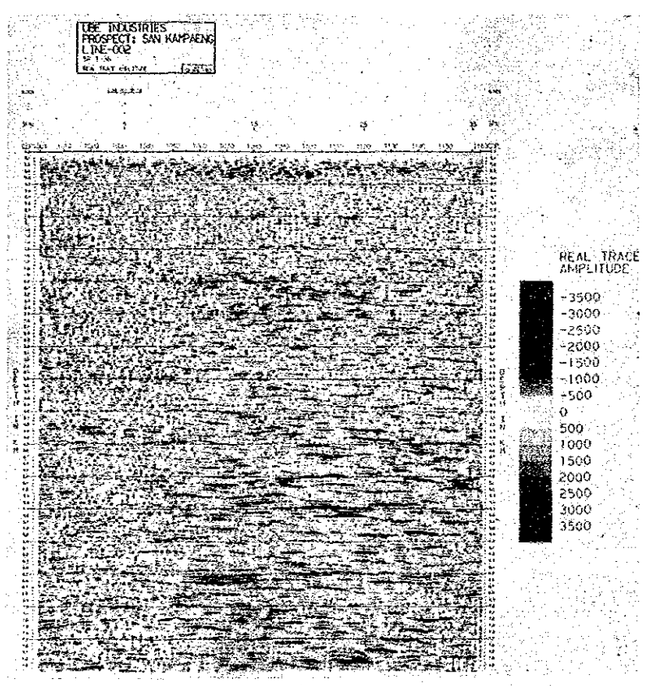


Fig. 1.4-8 Real Trace Amplitudo : Line-B

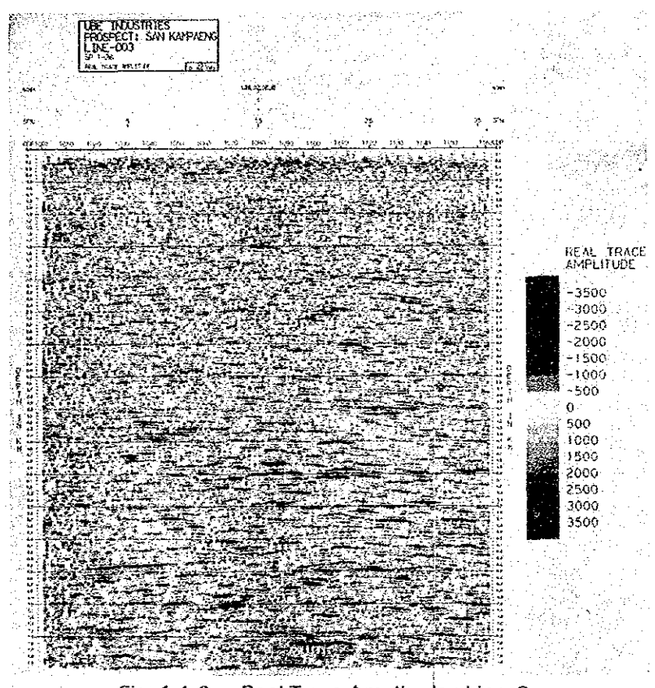
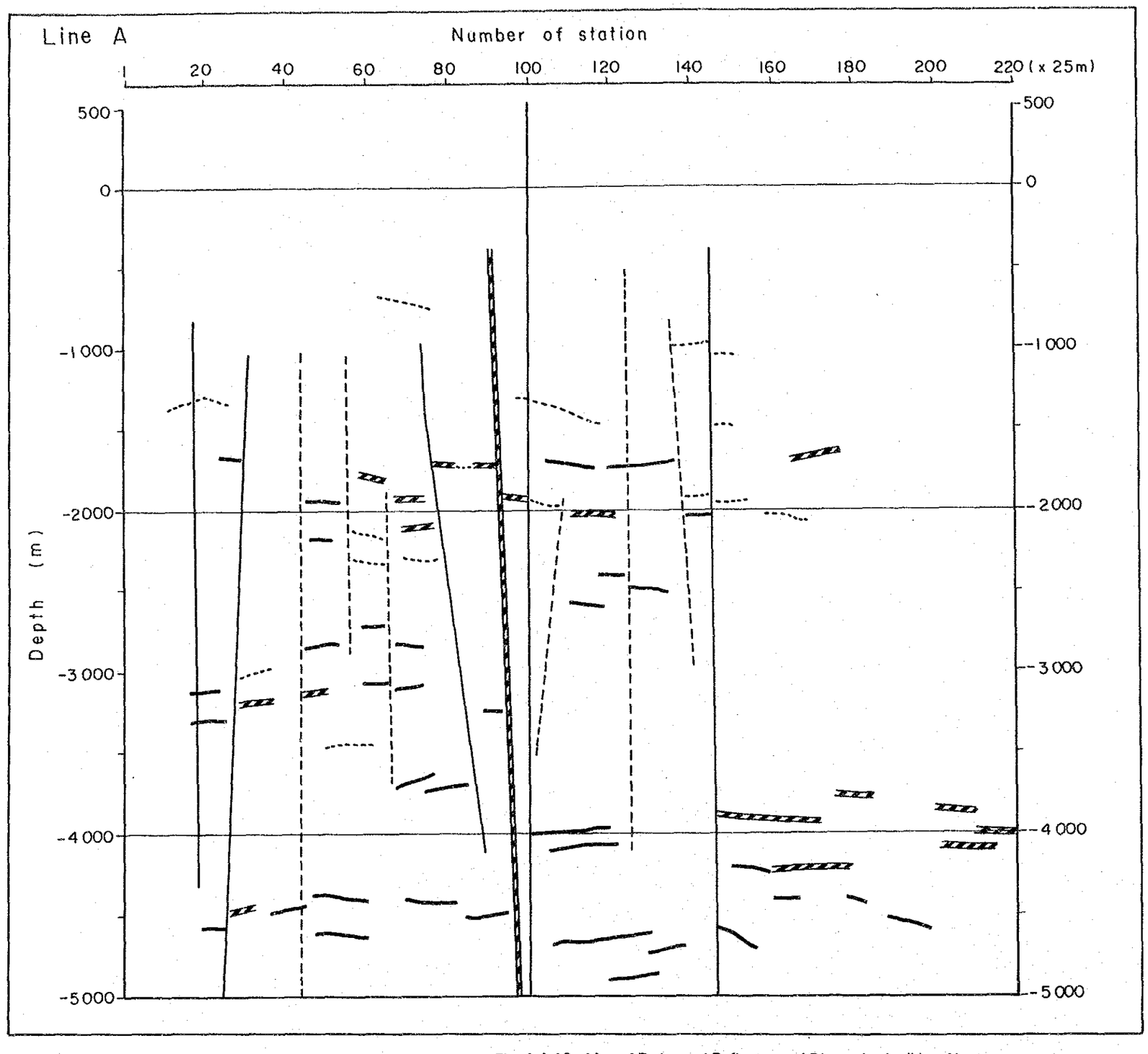
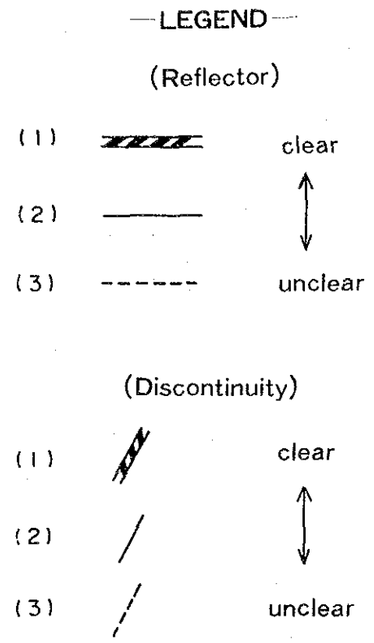


Fig. 1.4-9 Real Trace Amplitudo : Line-C





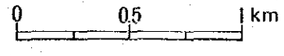


Fig. 1.4-10 Map of Estimated Reflector and Discontinuity (Line A)

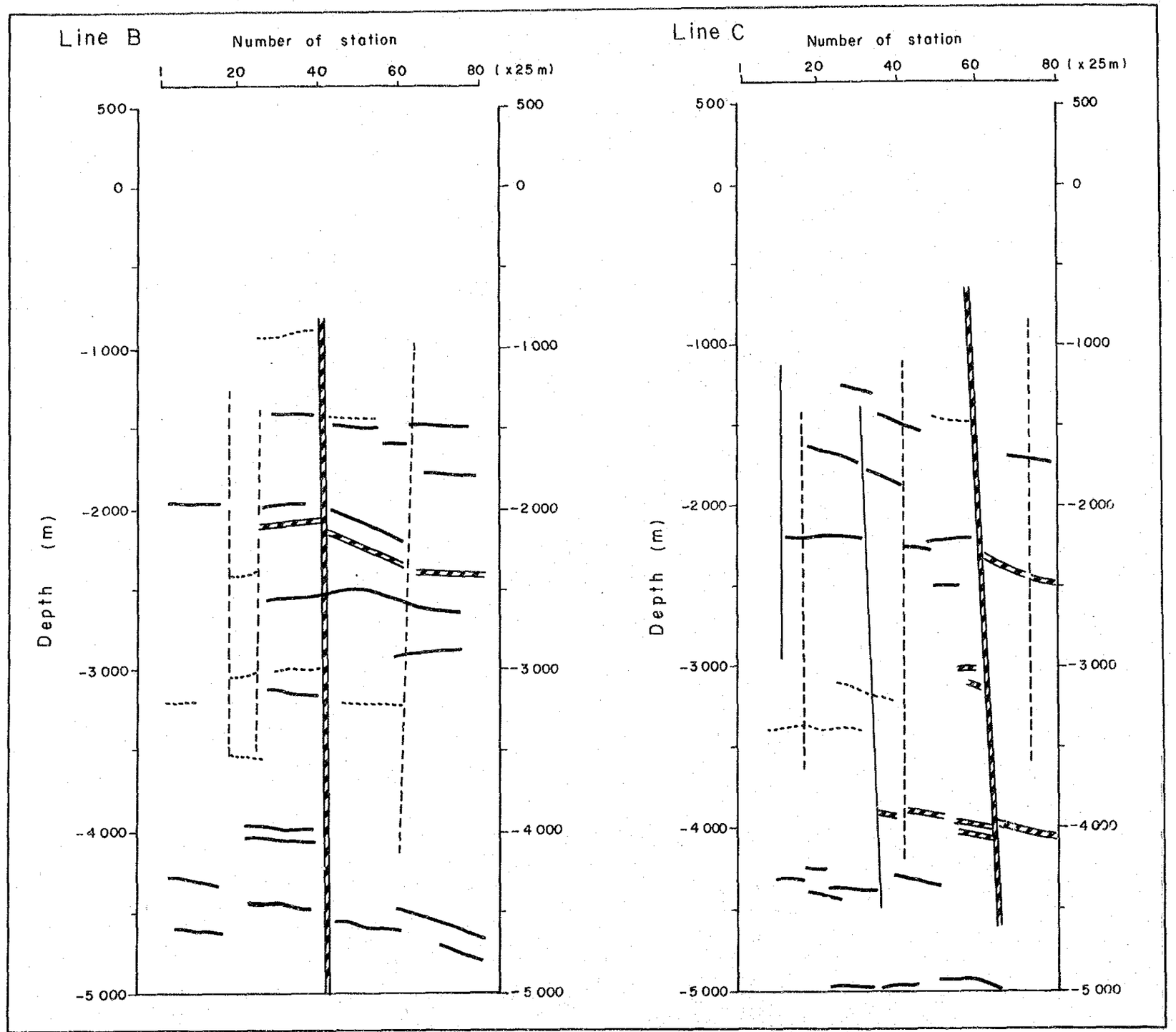


Fig. 1.4-11 Map of Estimated Reflector and Discontinuity (Line B, C)

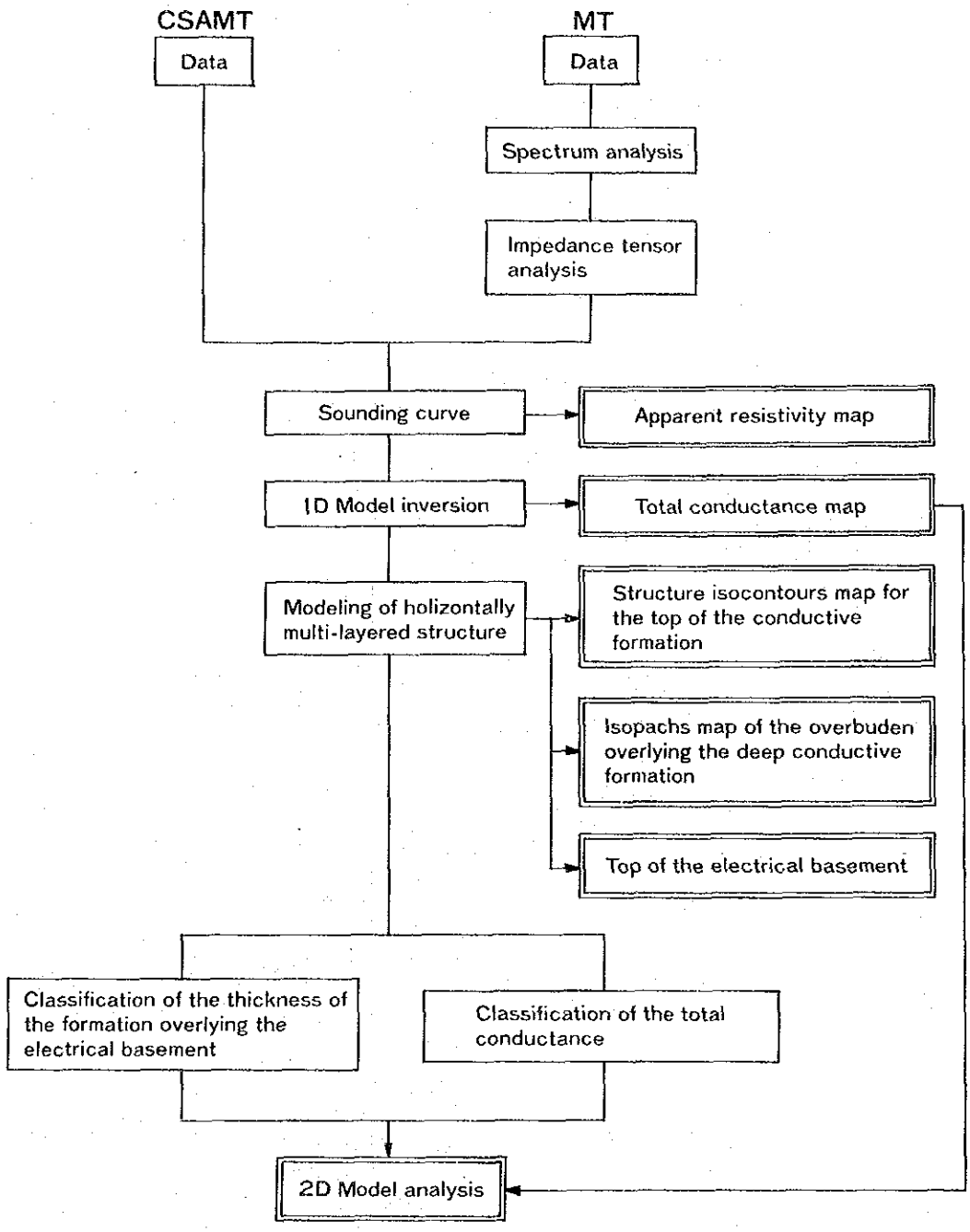
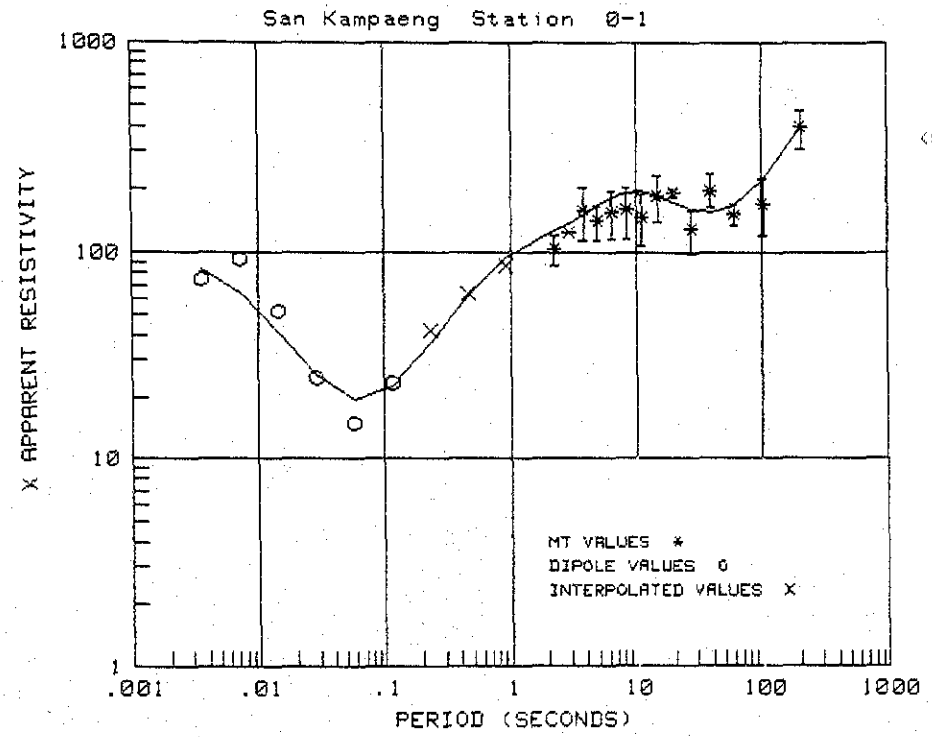


Fig. 1.5-3 Analysis Process of CSAMT Method and MT Method



AVERAGE ROTATION ANGLE= 37.0(DEGREES)
TOTAL CONDUCTANCE = 77.0 (MHOS) (FOR TOP 6 LAYERS)

LAYERED MODEL

RESISTIVITY	DEPTH(KM)	ALTITUDE(M)
		560.0 (SURFACE)
12.1	.013	547.0
201.0	.257	303.0
3.0	.310	250.0
32.9	.628	-68.0
3288.5	8.376	-7816.0
5.8	8.601	-8041.0
3545.0	27.800	-26440.0
45.0	35.000	-34440.0

San Kampaeng Station 0-1

MODEL DATA

PERIOD (SECONDS)	APPARENT RESISTIVITY
.0036	84.12
.0071	64.80
.0143	41.06
.0286	25.52
.0570	19.55
.1143	22.64
.2286	36.21
.4571	62.63
.9143	95.40
2.2605	126.45
2.9257	137.27
3.7926	151.07
4.9230	166.92
6.4000	182.01
8.3934	192.46
11.1304	194.13
14.8406	186.21
20.0787	172.27
27.6755	158.83
39.3840	153.25
60.2373	166.55
102.4003	224.01
204.7921	399.99

X-AXIS FIELD DATA

PERIOD (SECONDS)	APPARENT RESISTIVITY
.0036	74.57
.0071	92.70
.0143	51.72
.0286	24.57
.0570	14.84
.1143	23.64
.2286	41.56
.4571	63.06
.9143	86.42
2.2605	103.54 ± 16.781
2.9257	124.68 ± .426
3.7926	158.77 ± 45.662
4.9230	139.90 ± 25.564
6.4000	154.53 ± 39.867
8.3934	160.39 ± 43.946
11.1304	147.23 ± 39.731
14.8406	184.26 ± 46.646
20.0787	190.55 ± 9.868
27.6755	127.92 ± 29.112
39.3840	197.32 ± 35.570
60.2373	150.38 ± 17.707
102.4003	170.22 ± 49.882
204.7921	393.21 ± 86.284

Fig. 1.5-4 Apparent Resistivity Curve