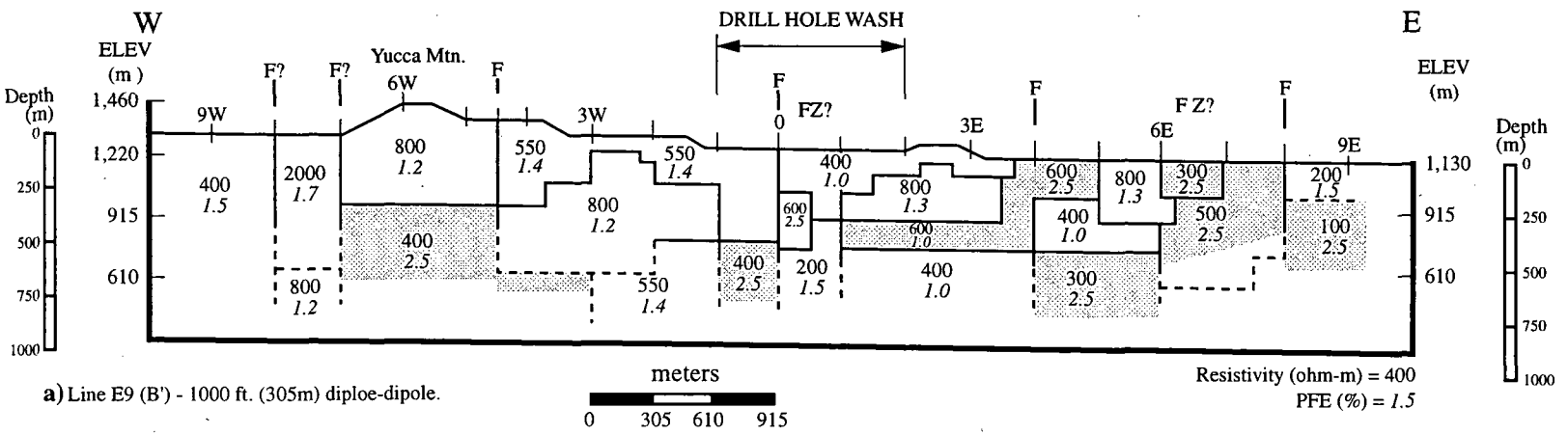
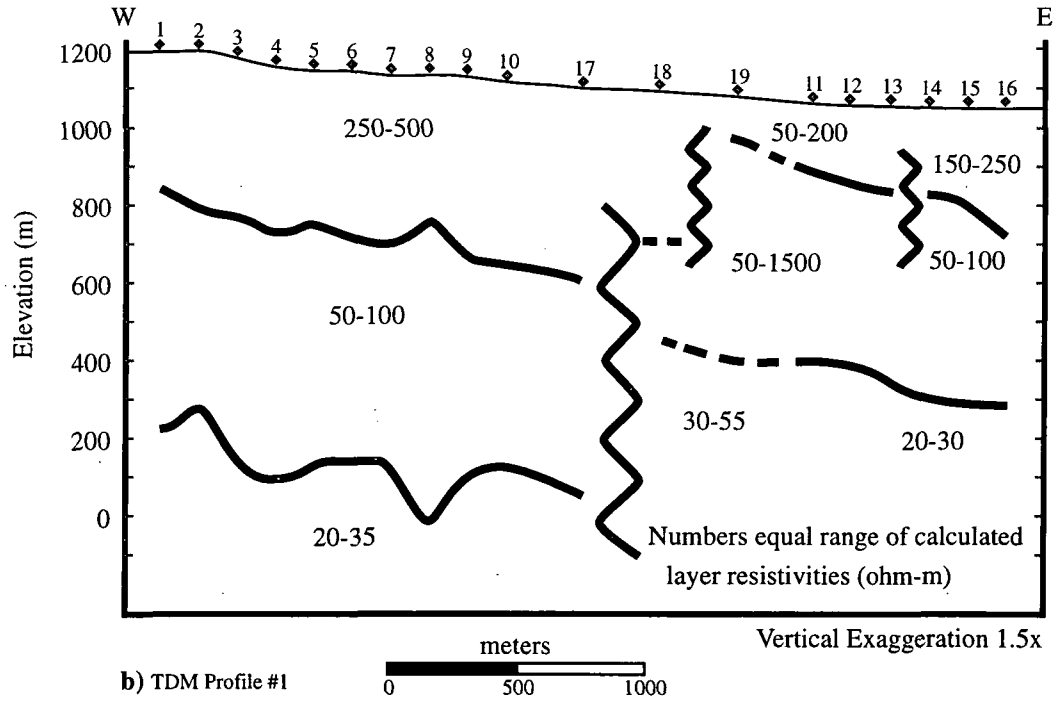


a) Line E9 (B') - 1000 ft. (305m) diploe-dipole.



b) TDM Profile #1

FIGURE 4. GP

7°00'

45'

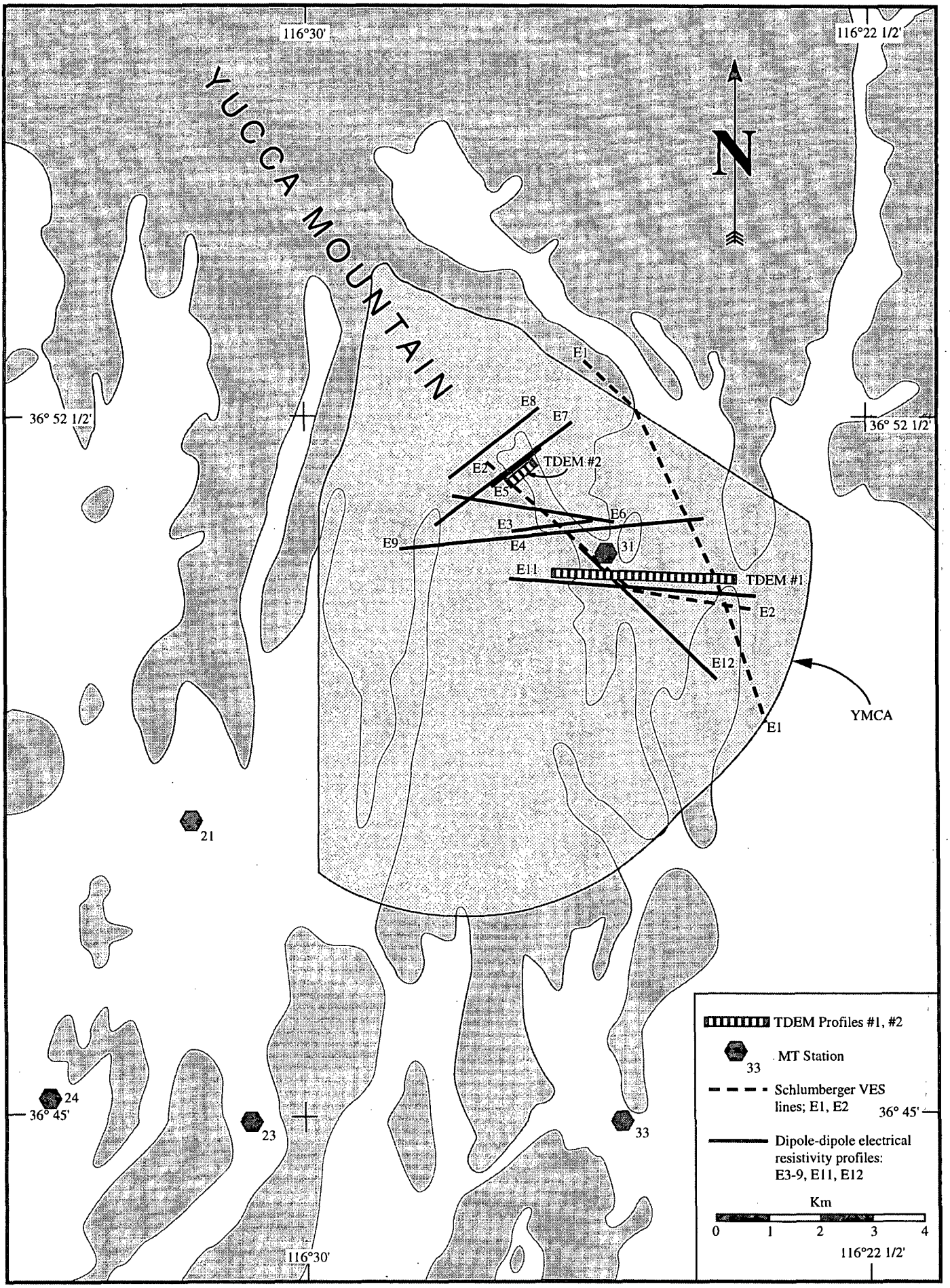
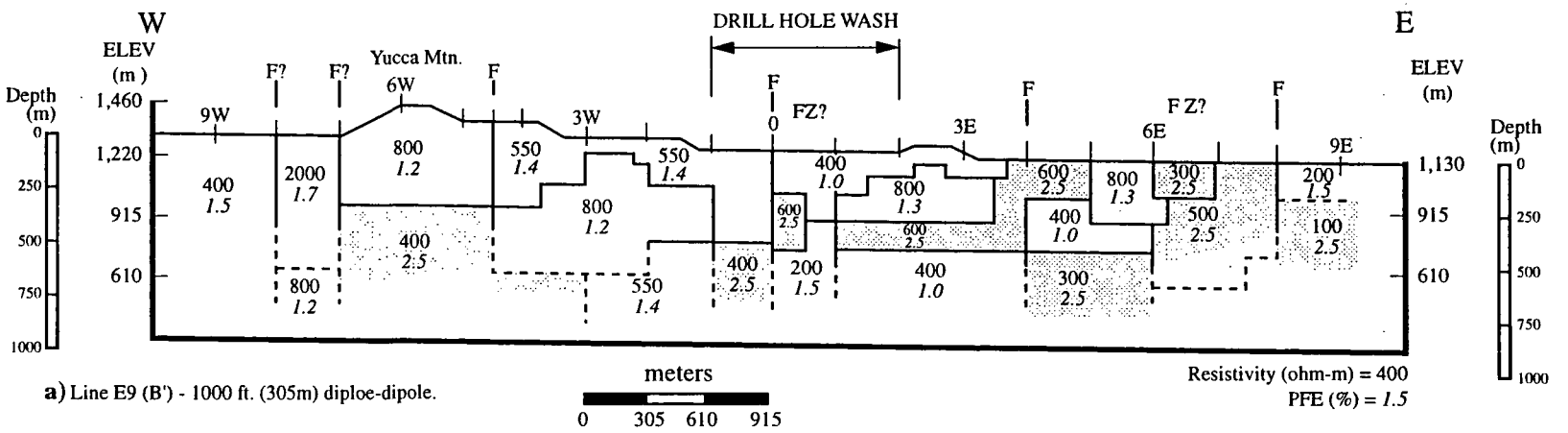

116°30'
116°22 1/2'
YUCCA MOUNTAIN
N
E1
E8
E7
36° 52 1/2'
36° 52 1/2'
E2
TDEM #2
E5
E6
E3
E9
E4
31
E11
TDEM #1
E2
E12
YMCA
E1
21
24
36° 45'
23
33
36° 45'
TDEM Profiles #1, #2
MT Station
33
Schlumberger VES lines; E1, E2
Dipole-dipole electrical resistivity profiles: E3-9, E11, E12
Km
0 1 2 3 4
116°30'
116°22 1/2'

FIGURE 3. GP


W
E
ELEV (m)
Depth (m)
DRILL HOLE WASH
Yucca Mtn.
F?
F?
F
F
F
F
F
FZ?
FZ?
9W
6W
3W
0
3E
6E
9E
1,460
1,220
915
610
1,130
915
610
0
250
500
750
1000
400 1.5
2000 1.7
800 1.2
800 1.2
400 2.5
550 1.4
800 1.2
550 1.4
550 1.4
400 2.5
600 2.5
400 1.0
200 1.5
800 1.3
600 2.5
400 1.0
600 2.5
800 1.3
400 1.0
300 2.5
300 2.5
500 2.5
200 1.5
100 2.5
meters
0 305 610 915
a) Line E9 (B') - 1000 ft. (305m) diploe-dipole.
Resistivity (ohm-m) = 400
PFE (%) = 1.5

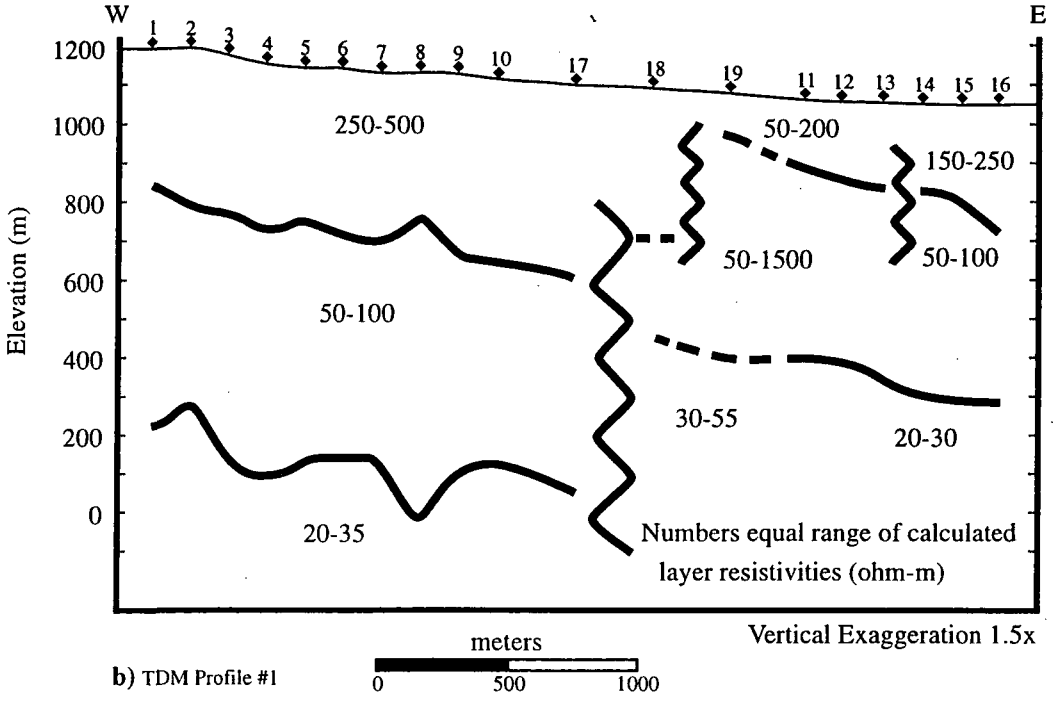
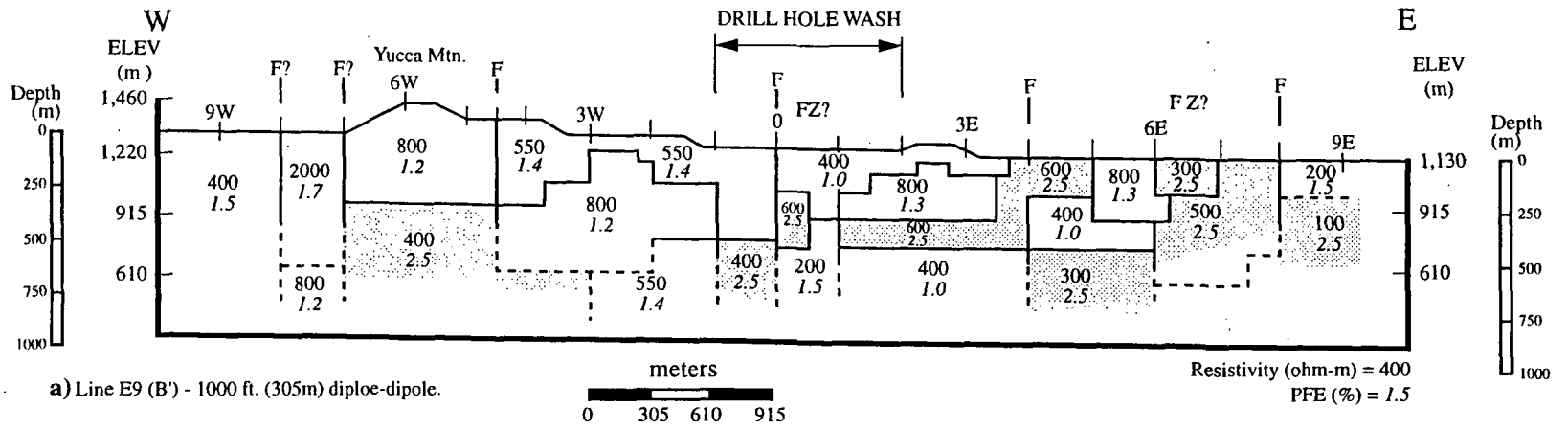
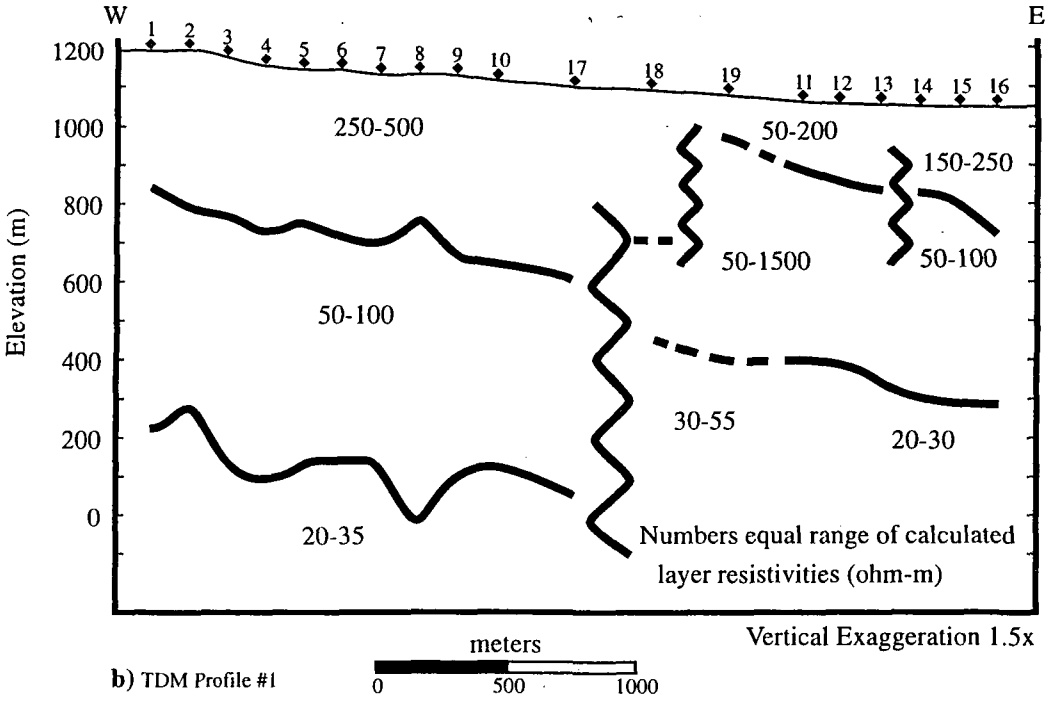

W
E
1 2 3 4 5 6 7 8 9 10 17 18 19 11 12 13 14 15 16
1200
1000
800
600
400
200
0
Elevation (m)
250-500
50-200
150-250
50-1500
50-100
50-100
30-55
20-30
20-35
Numbers equal range of calculated layer resistivities (ohm-m)
Vertical Exaggeration 1.5x
meters
0 500 1000
b) TDM Profile #1

FIGURE 4. GP



a) Line E9 (B') - 1000 ft. (305m) diploe-dipole.

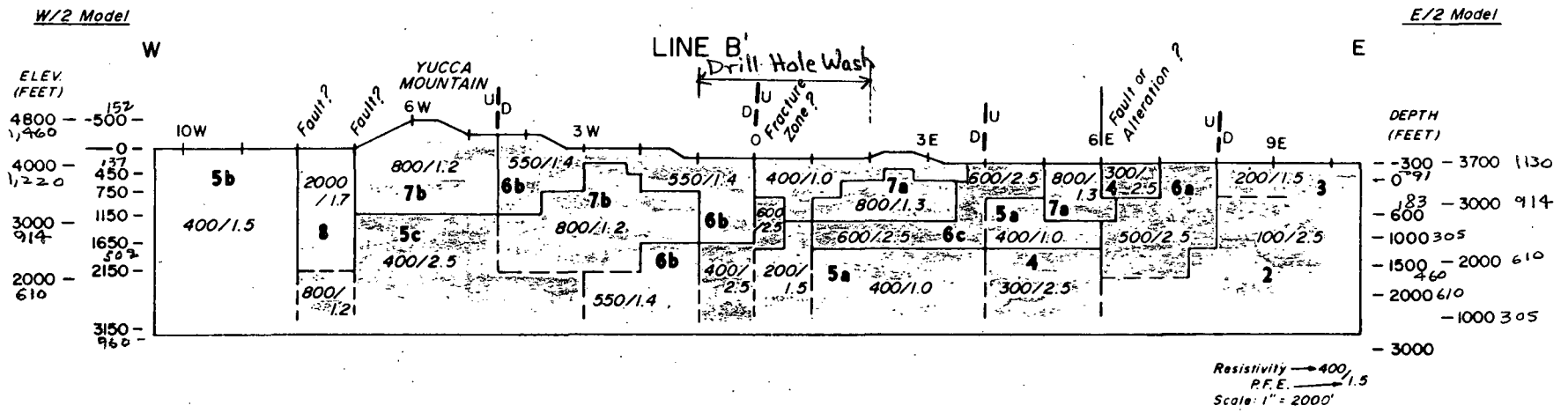


b) TDM Profile #1

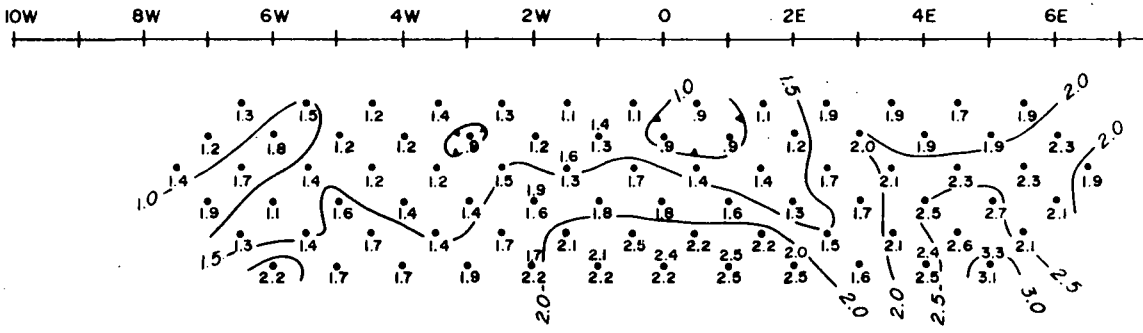
FIGURE 4. GP

y.90

PLATE IV

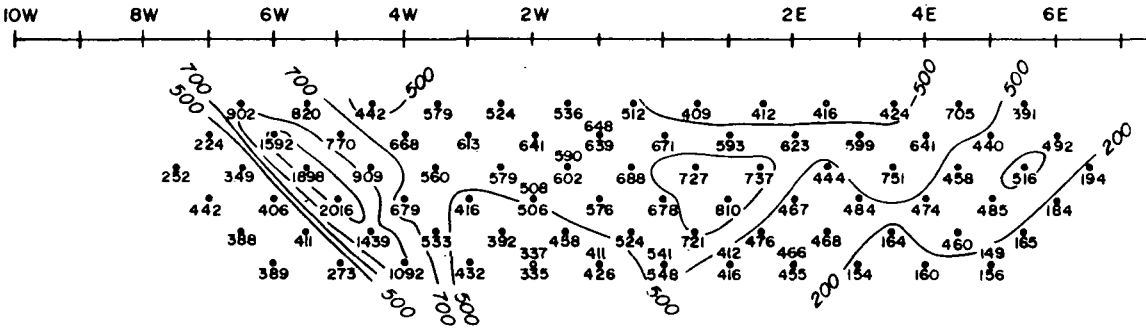


OBSERVED P.F.E.



BODY NO.	RESISTIVITY (ohm-m)	P.F.E %
1 air	200,000	0.0
2	100	2.5
3	200	1.5
4	300	2.5
5a	400	1.0
5b	400	1.5
5c	400	2.5
6a	500	2.5
6b	550	1.4
6c	600	2.5
7a	800	1.3
7b	800	1.2
8	2000	1.7

OBSERVED APPARENT RESISTIVITY



$W_s = \left(\frac{45 \cdot PFE}{\rho}\right)^{1/2}$

(4) $W_s = \left(\frac{45 \times 2.5}{300}\right)^{1/2} = 0.61$

(5c) $W_s = \left(\frac{45 \times 2.5}{400}\right)^{1/2} = 0.53$

(6a) $W_s = \left(\frac{45 \times 2.5}{500}\right)^{1/2} = 0.47$

(6c) $W_s = \left(\frac{45 \times 2.5}{600}\right)^{1/2} = (0.43)$

PLATE IV (2) $W_s = \left(\frac{45 \times 2.5}{100}\right)^{1/2} = (1.06)$

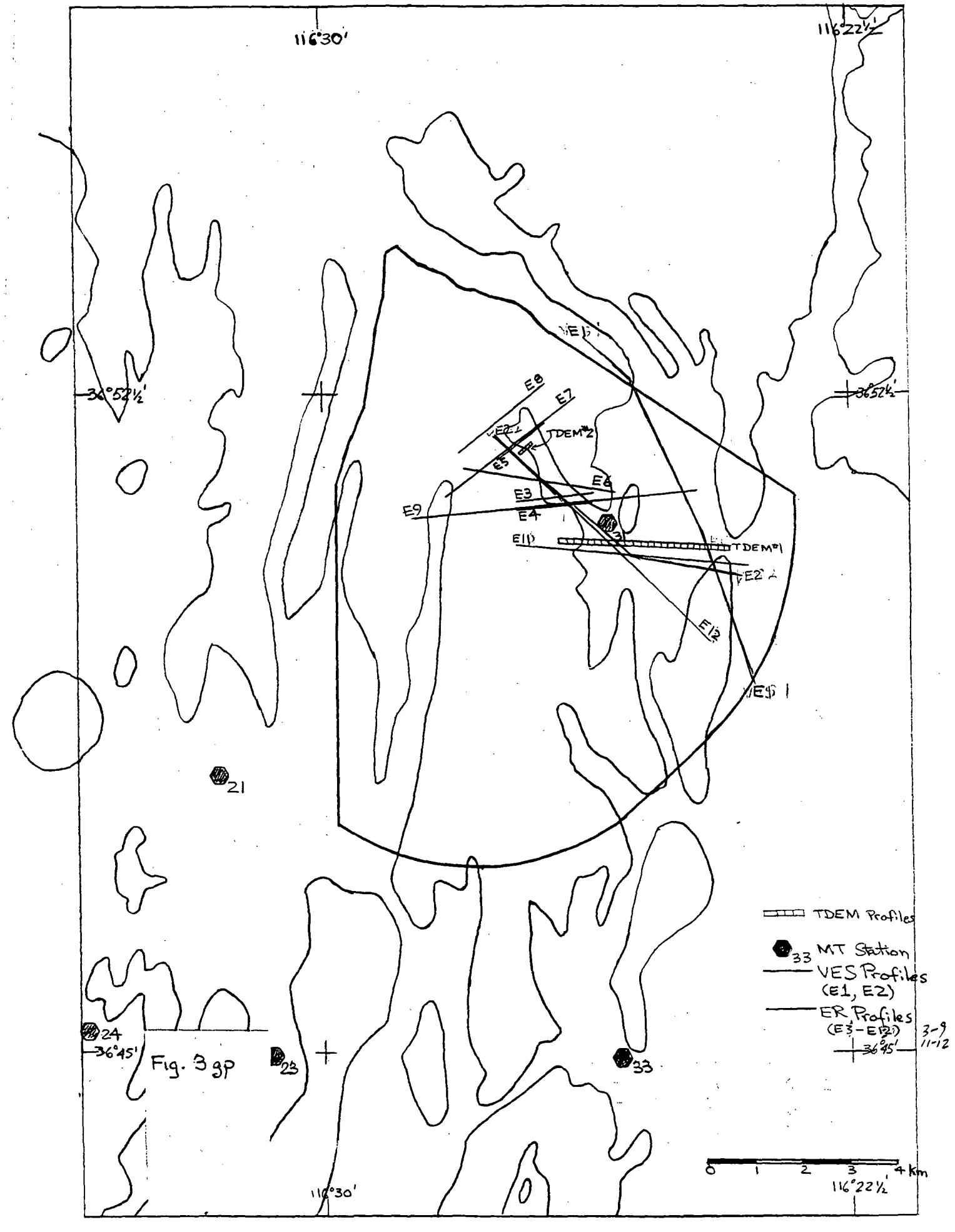

116°30'
116°22½'
36°52½'
36°45'
E8
E7
E2
TDEM#2
E5
E6
E3
E9
E4
E11
TDEM#1
E2
E12
E1
21
24
23
33
TDEM Profiles
33 MT Station
VES Profiles (E1, E2)
ER Profiles (E3-E12)
3-9
11-12
0 1 2 3 4 km

Fig. 3 gp

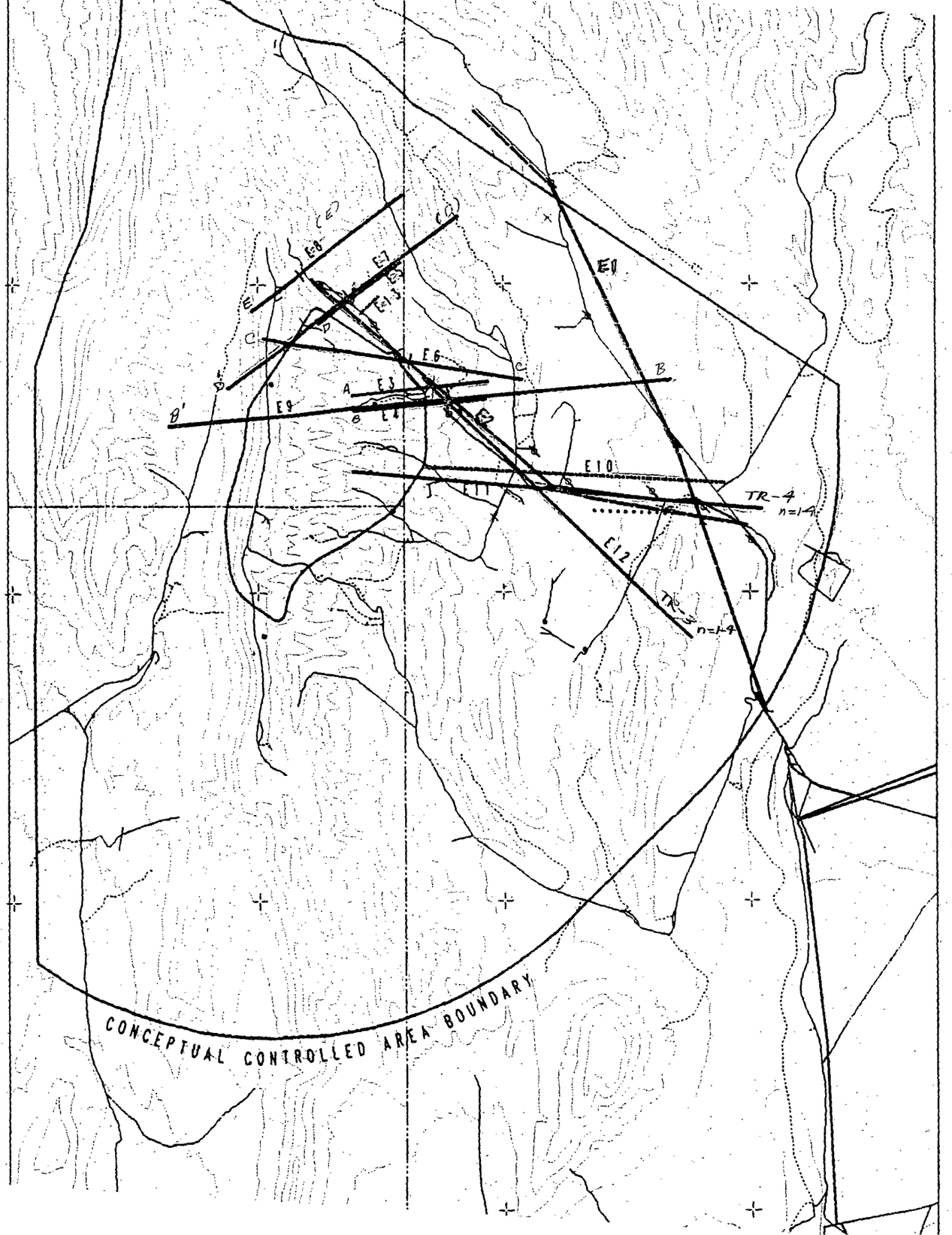


FIGURE 2.3-2. Location of Geoelectric Traverses in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

TR-4, n=1-4
1.0-2.0 PFE

TR-3,
0.6-1.5 pfe

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 900 M DEEP

Interfit

- SCHLUMBERGER SOUNDING TRAVERSE E1, E2 — d = 1-600 m
- DIPOLE-DIPOLE TRAVERSE E3, E4, E5, E6, E7, E8 — 60-600 m
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE E10, E13 — 200-1200 m; E9, E11, E12 w/o top
- AUDIOMAGNETOTELLURIC TRAVERSE

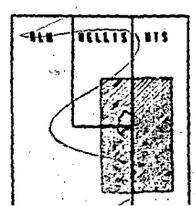
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY

CONCEPTUAL PERIMETER DRIFT BOUNDARY

Line Designation

Fig 4 sp

E1	VES 1
E2	VES 2
E3-A	200'
E4-B	200'
E5-D	200'
E6-C	500'
E7-D	500'
E8-E	500'
E9-B'	1000
E11-TR-4	



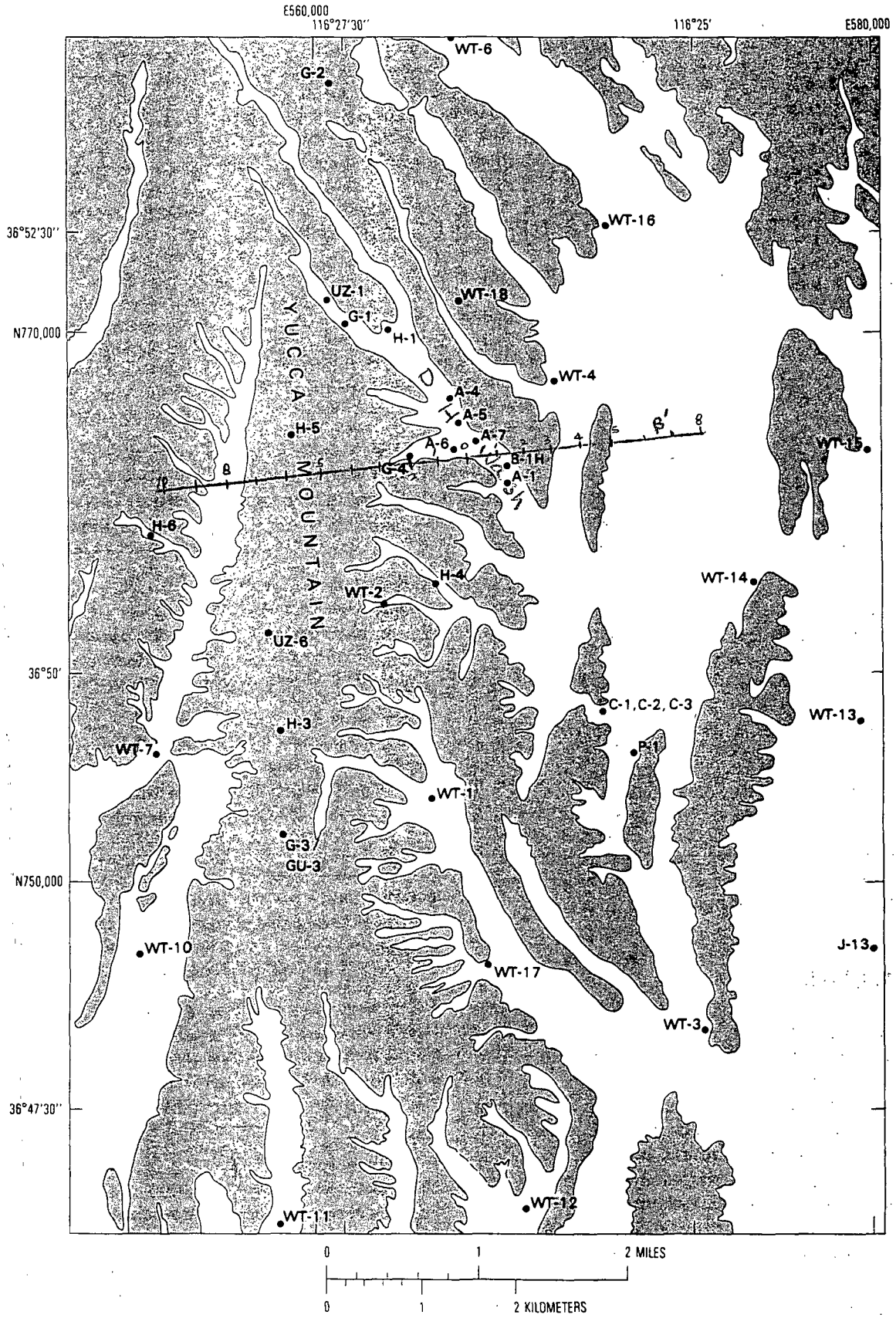
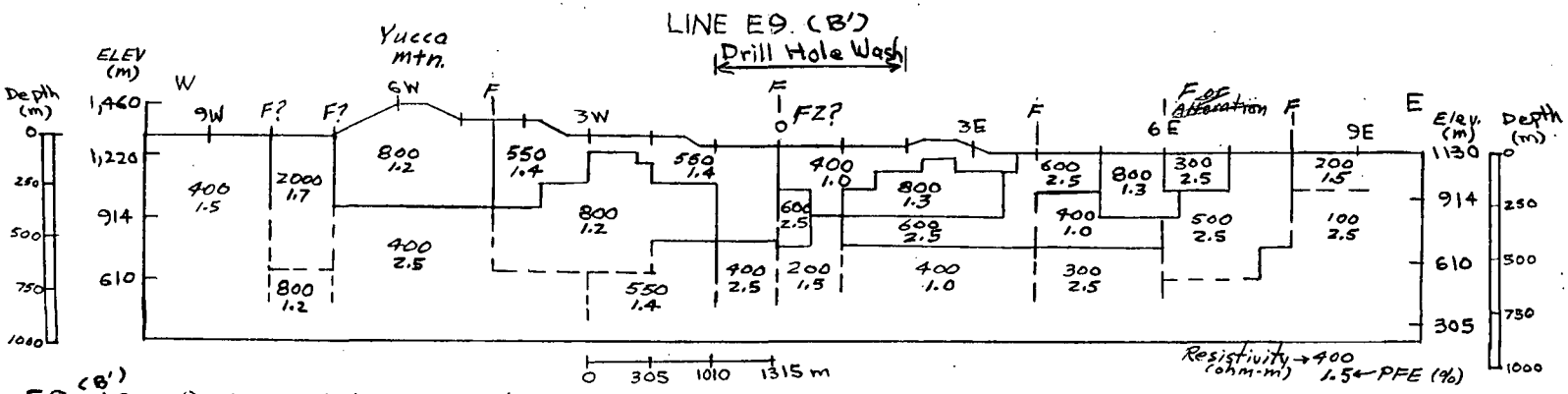


Figure 1. Index map showing location of 38 of 40 logged boreholes at Yucca Mountain, Nev. Boreholes USW VH-1 and USW VH-2 are located approximately 6 mi west of Yucca Mountain.



a) Line E9 (B') ~1000 ft. (305m) dipole-dipole.

F, FZ

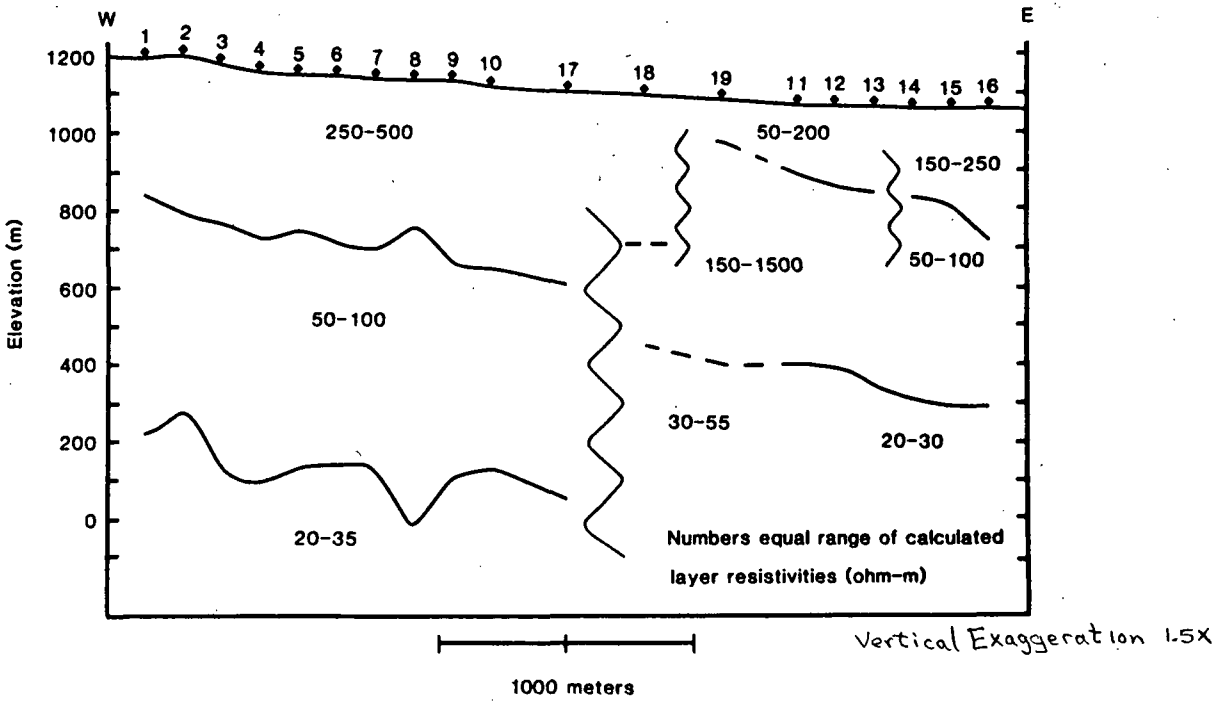
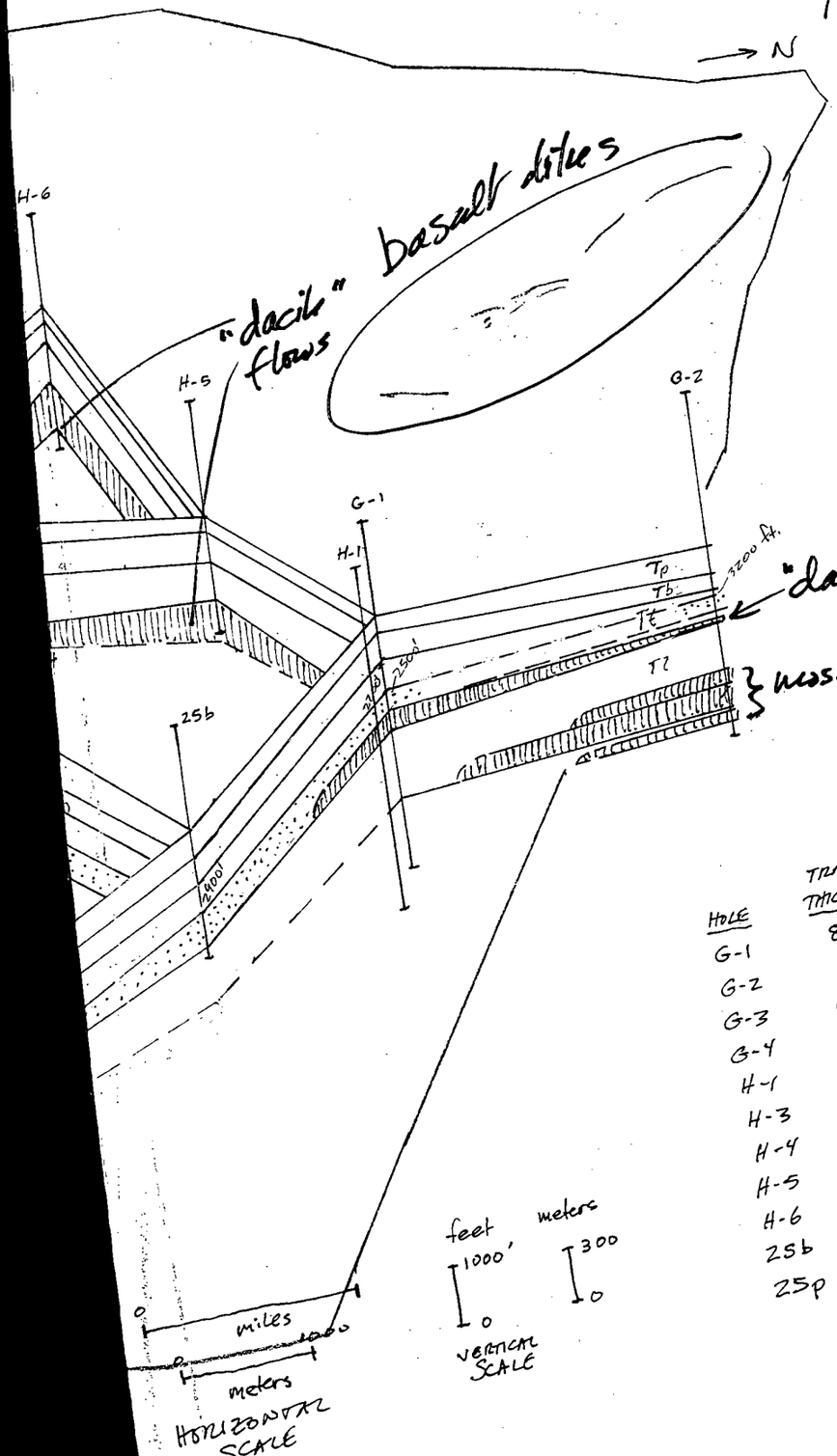


Fig. 4gp

b) TDEM Profile #1

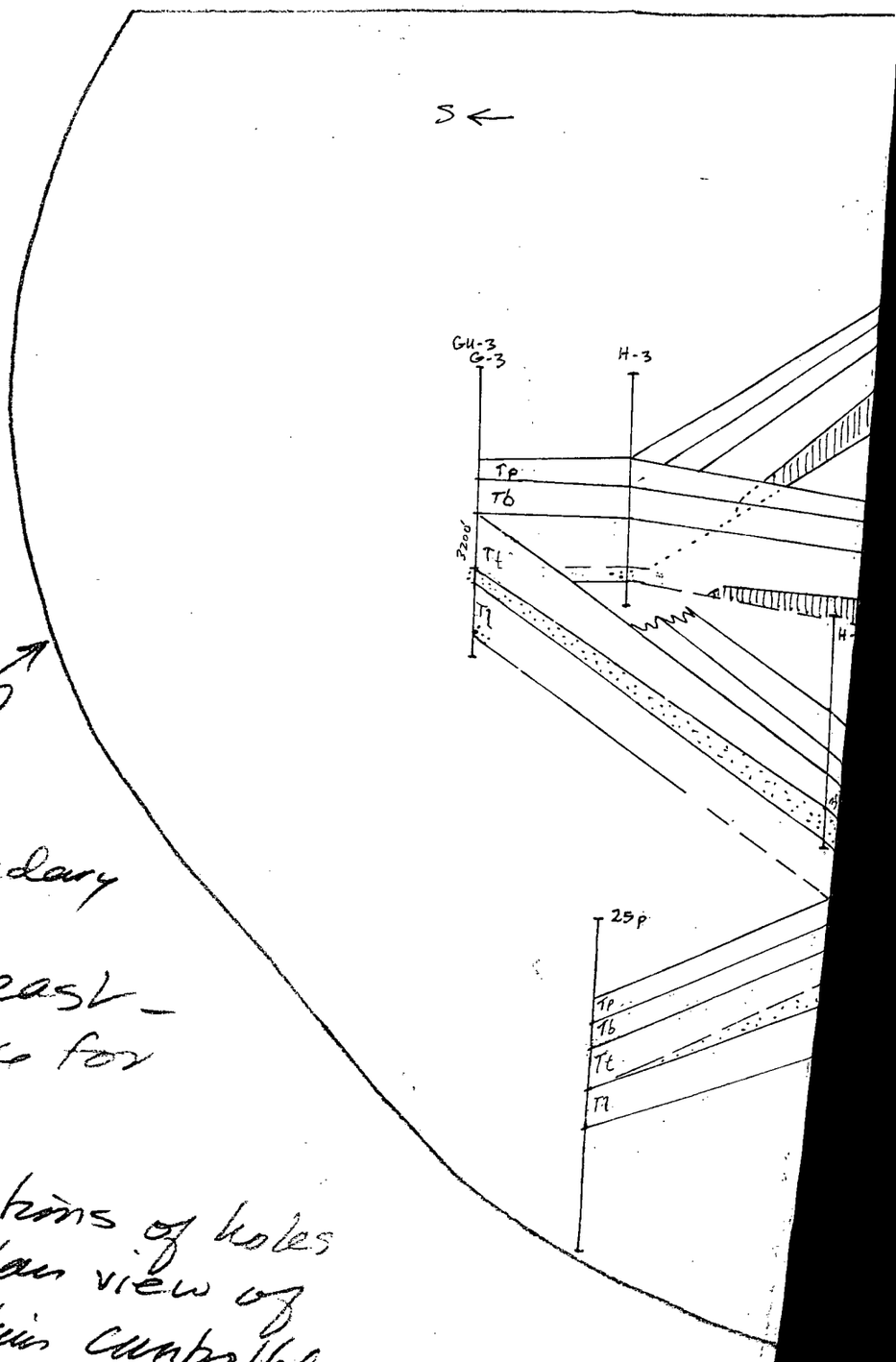
To read this you have to convert the DH stratigraphy to vertical cores into the page mentally.



HOLE	TRIAS THICKNESS	TRIAS PYRITIC
G-1	883	314
G-2	340	137 (?)
G-3	1224	169
G-4	?	0 (ONLY UPPER 241' DRILLED)
H-1	889	~350
H-3	1118	50 (THORADSON ET AL, 1984)
H-4	1124	(WHITFIELD ET AL, 1984)
H-5	670	0
H-6	560	0
25b	1017	573
25p	598	0

Tp = prow pass
Tb = Bull frog
Tt = Fraser
Tl = Lithic Ridge

∴∴∴ = pyrite



Controlled Area boundary

View from east — no allowance for perspective

Collar locations of holes plotted on plan view of Yucca Mountain controlled area

METALLIC MINERAL RESOURCES IN THE CONTROLLED AREA, YUCCA MOUNTAIN, NYE COUNTY, NEVADA

GEOPHYSICAL STUDIES - OUTLINE

INTRODUCTION
- Geophysics in Nuclear Waste Isolation Studies
- Quality Assurance
- Metallic Mineral Exploration Strategy

MAGNETIC STUDIES
- Aeromagnetic Surveys - Regional Scale
- Aeromagnetic Surveys - Area Scale
- Detailed Magnetic Studies
  - Physical Property Studies
  - Detailed Magnetic Surveys

GRAVITY STUDIES
- Physical Properties (Density)
- Interpretative Results

SEISMIC STUDIES
- Seismic Refraction Studies
- Seismic Reflection Studies
- Teleseismic Tomography Studies

ELECTRICAL AND ELECTROMAGNETIC STUDIES
- Magnetotelluric Surveys in the Yucca Mountain Vicinity
- Electrical Resistivity and Controlled-Source Electromagnetic Surveys
  - Data Coverage

REMOTE SENSING STUDIES

AERIAL GAMMA-RAY SURVEYS OVER THE YMCZ

BOREHOLE GEOPHYSICAL STUDIES

DISCUSSION

REFERENCES

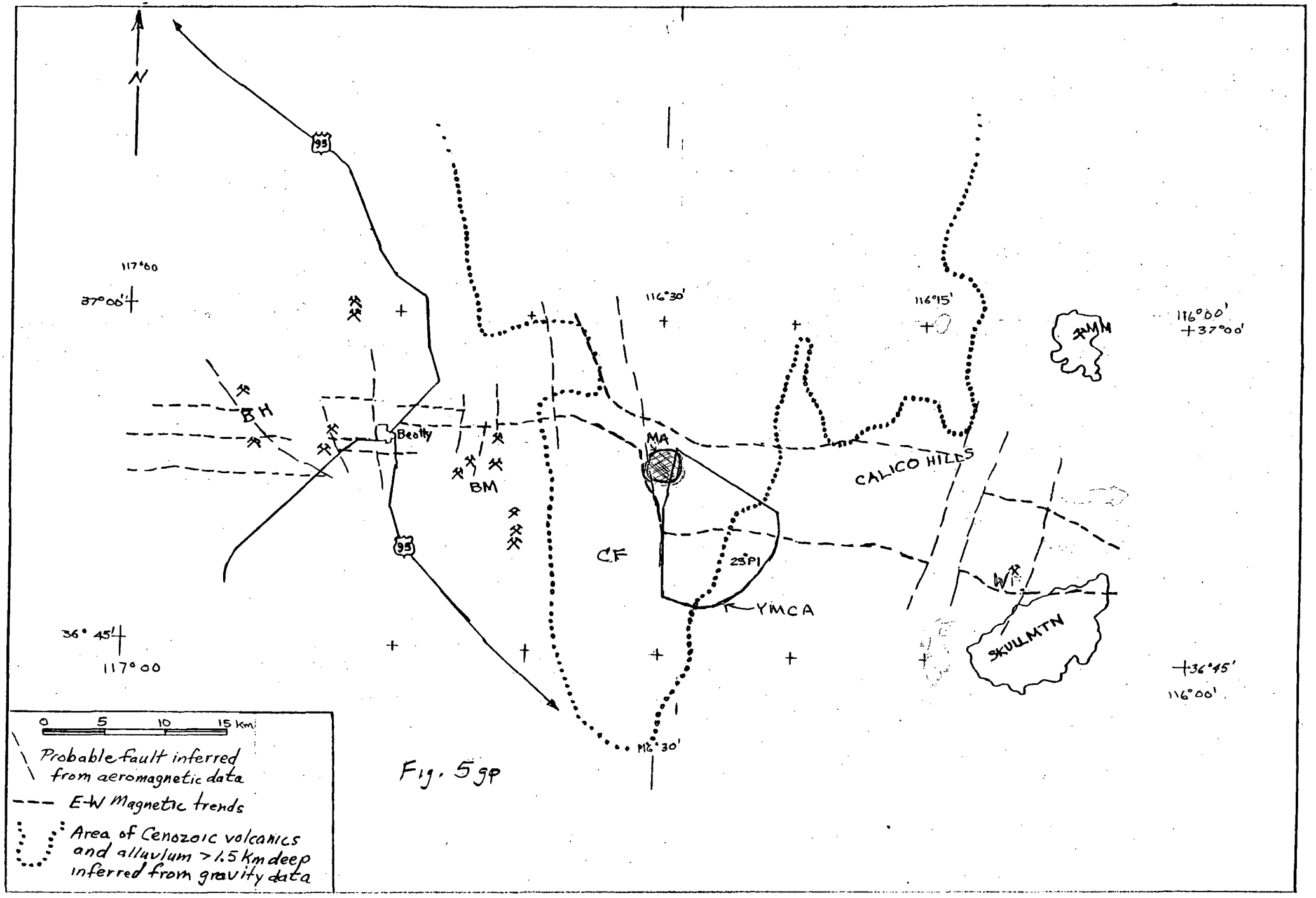

N
95
117°00
37°00'
116°30'
116°15'
116°00'
37°00'
BH
Beatty
BM
MA
CALICO HILLS
CF
23PI
YMCA
SKULLMTN
36°45'
117°00
36°30'
116°00'
0 5 10 15 km
Probable fault inferred from aeromagnetic data
E-W Magnetic trends
Area of Cenozoic volcanics and alluvium > 1.5 km deep inferred from gravity data

Fig. 5gp

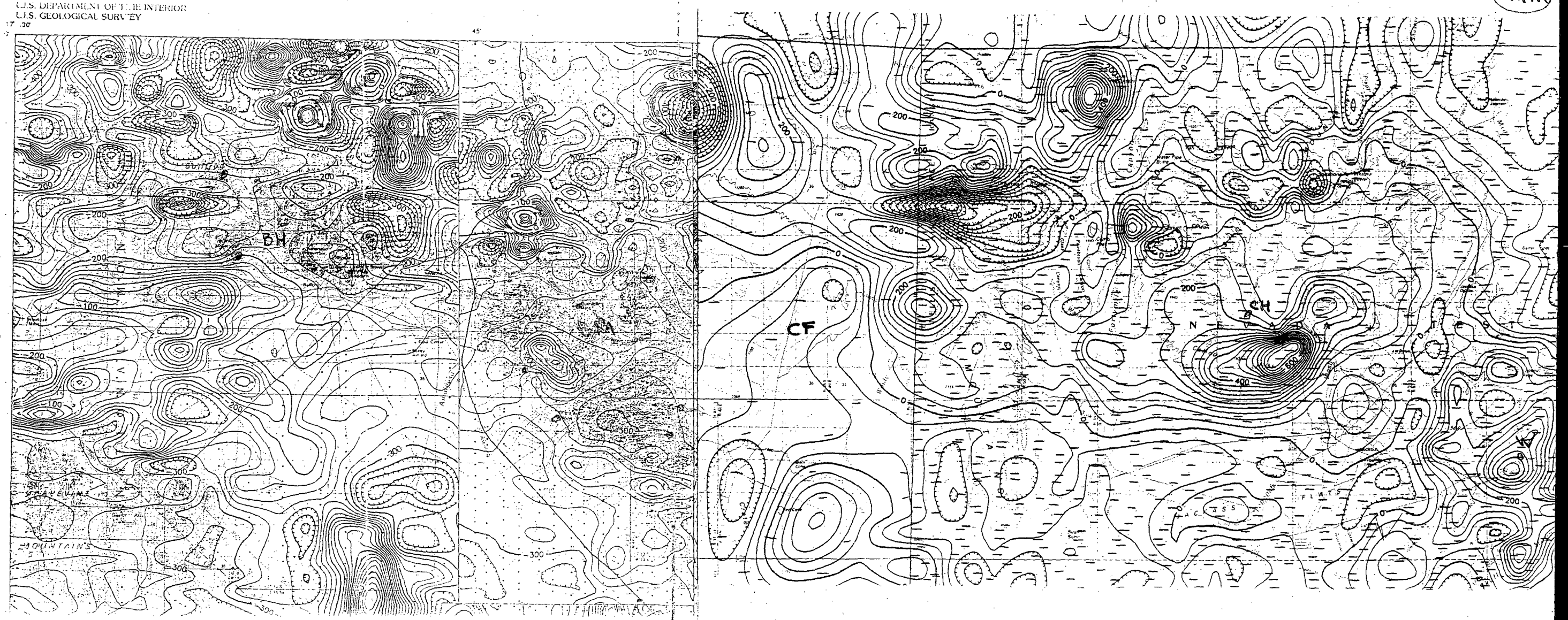
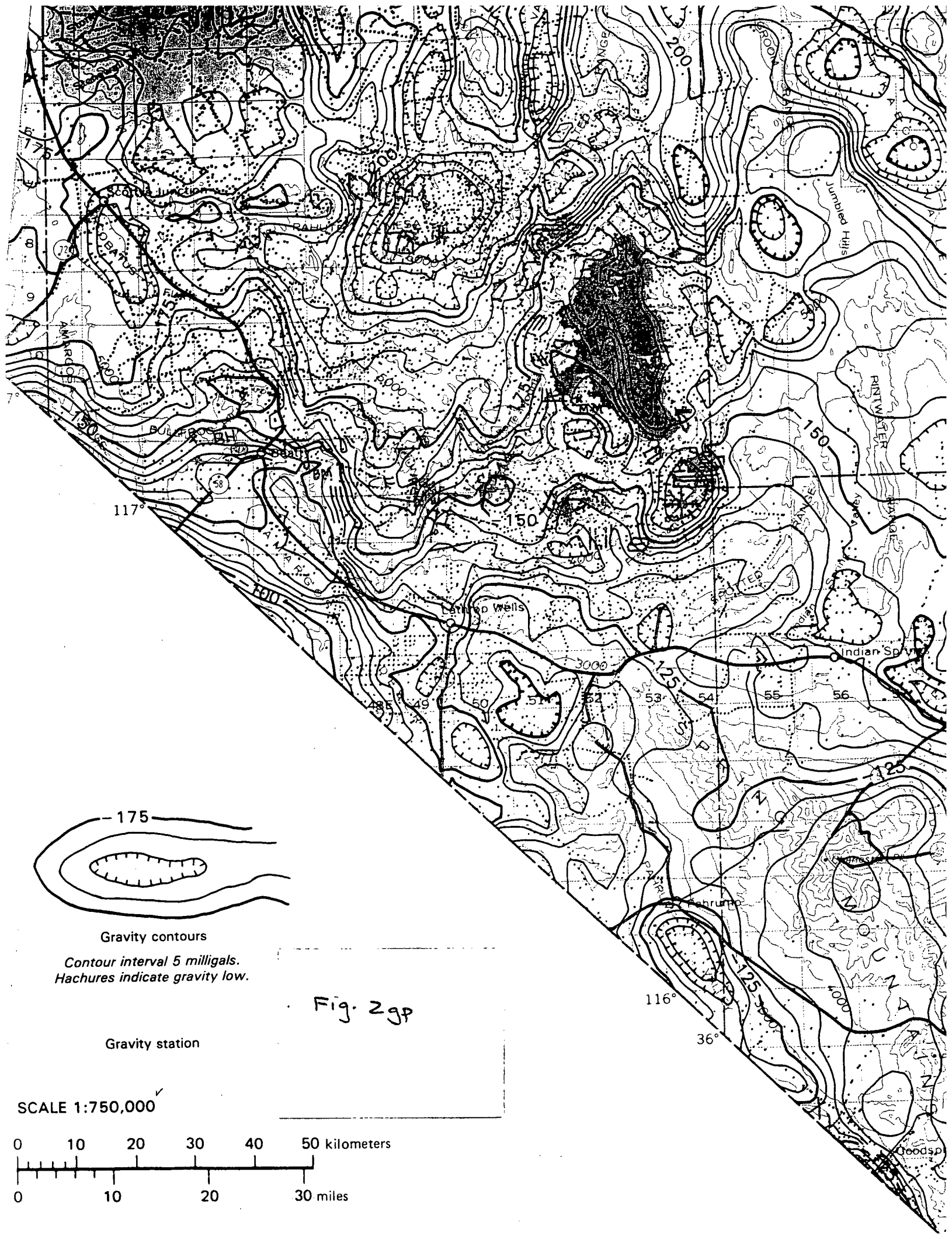
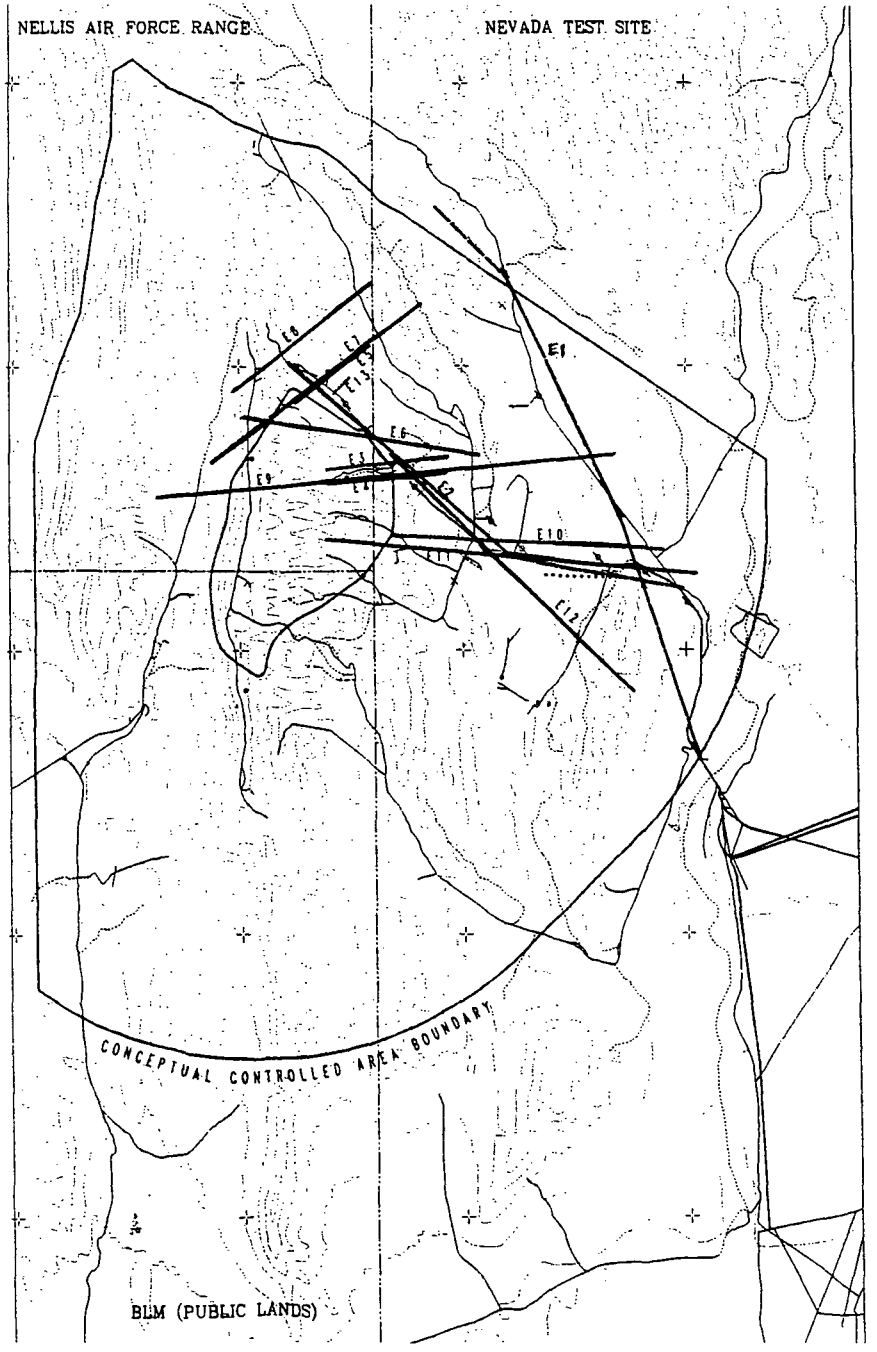

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
BH
CF
CH
MOUNTAINS

Fig. 1 gp.


175
Gravity contours
Contour interval 5 milligals.
Hachures indicate gravity low.
Gravity station
SCALE 1:750,000
0 10 20 30 40 50 kilometers
0 10 20 30 miles
117°
116°
36°
Scotia Junction
Beatty
Lathrop Wells
Indian Spring
Pahrump
Jumbled Hills
Fig. 2gp



YUCCA MOUNTAIN PROJECT

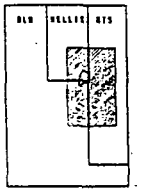
FIGURE 2.3-2. Location of Geoelectric Traverses in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 500 M DEEP
- SCHLUMBERGER SOUNDING TRAVERSE
- DIPOLE-DIPOLE TRAVERSE
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE
- AUDIOMAGNETOTELLURIC TRAVERSE
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY
- CONCEPTUAL PERIMETER DRIFT BOUNDARY



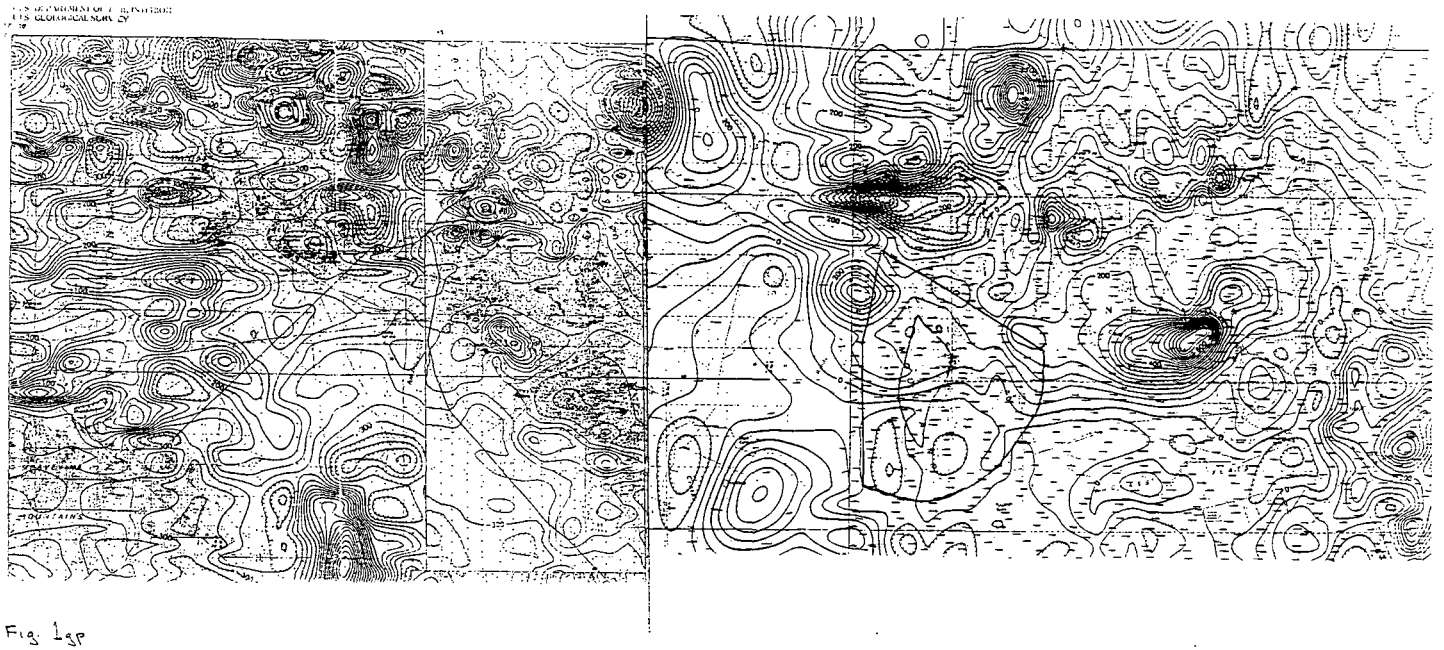
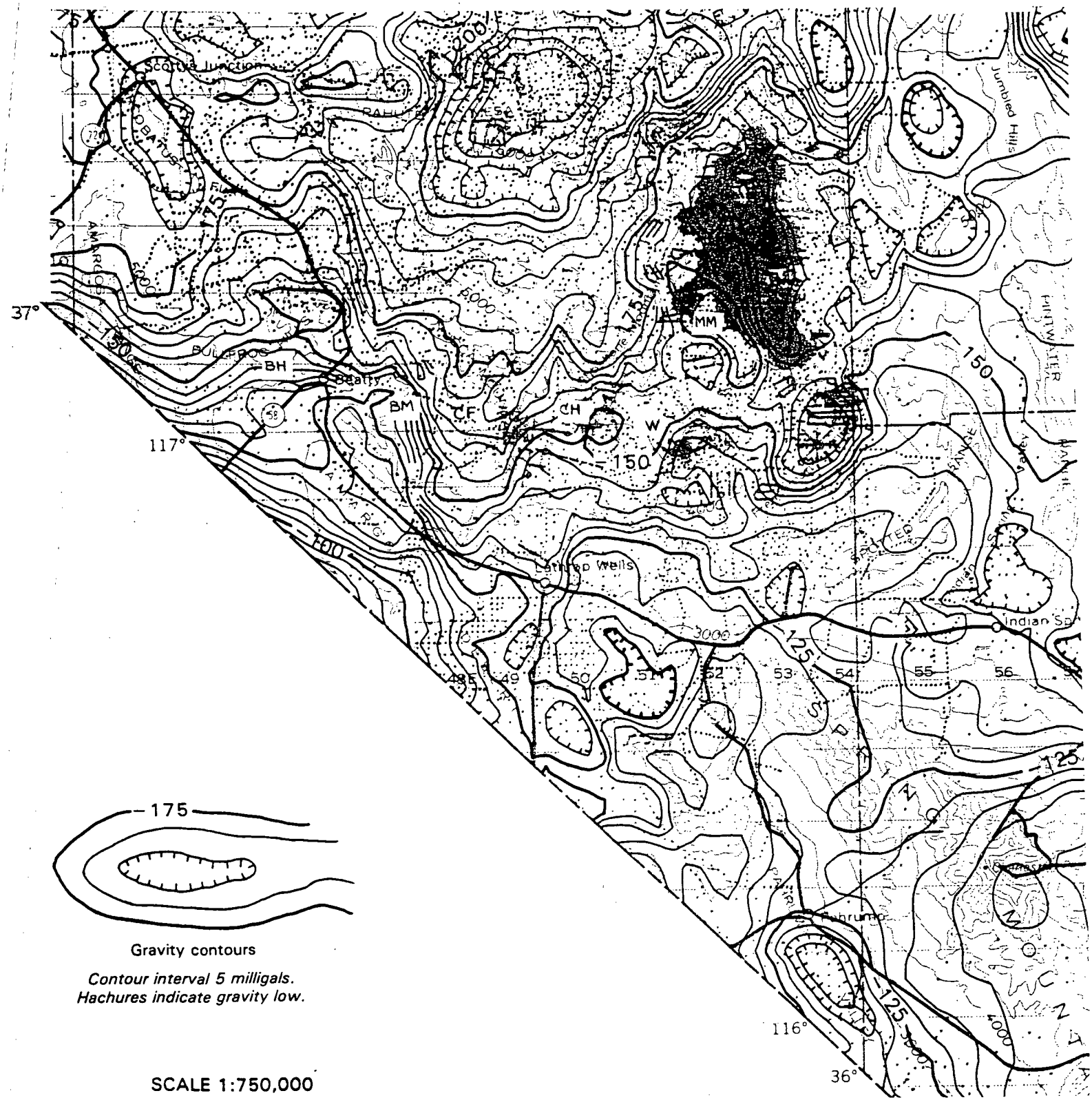


Fig. 1gp

Scale 1:200,000 Locality 1:100,000 Quad NTS 1:250,000 Jersey

1:400,000



-175

Gravity contours

Contour interval 5 milligals.
Hachures indicate gravity low.

SCALE 1:750,000

0 10 20 30 40 50 kilometers

0 10 20 30 miles

C.

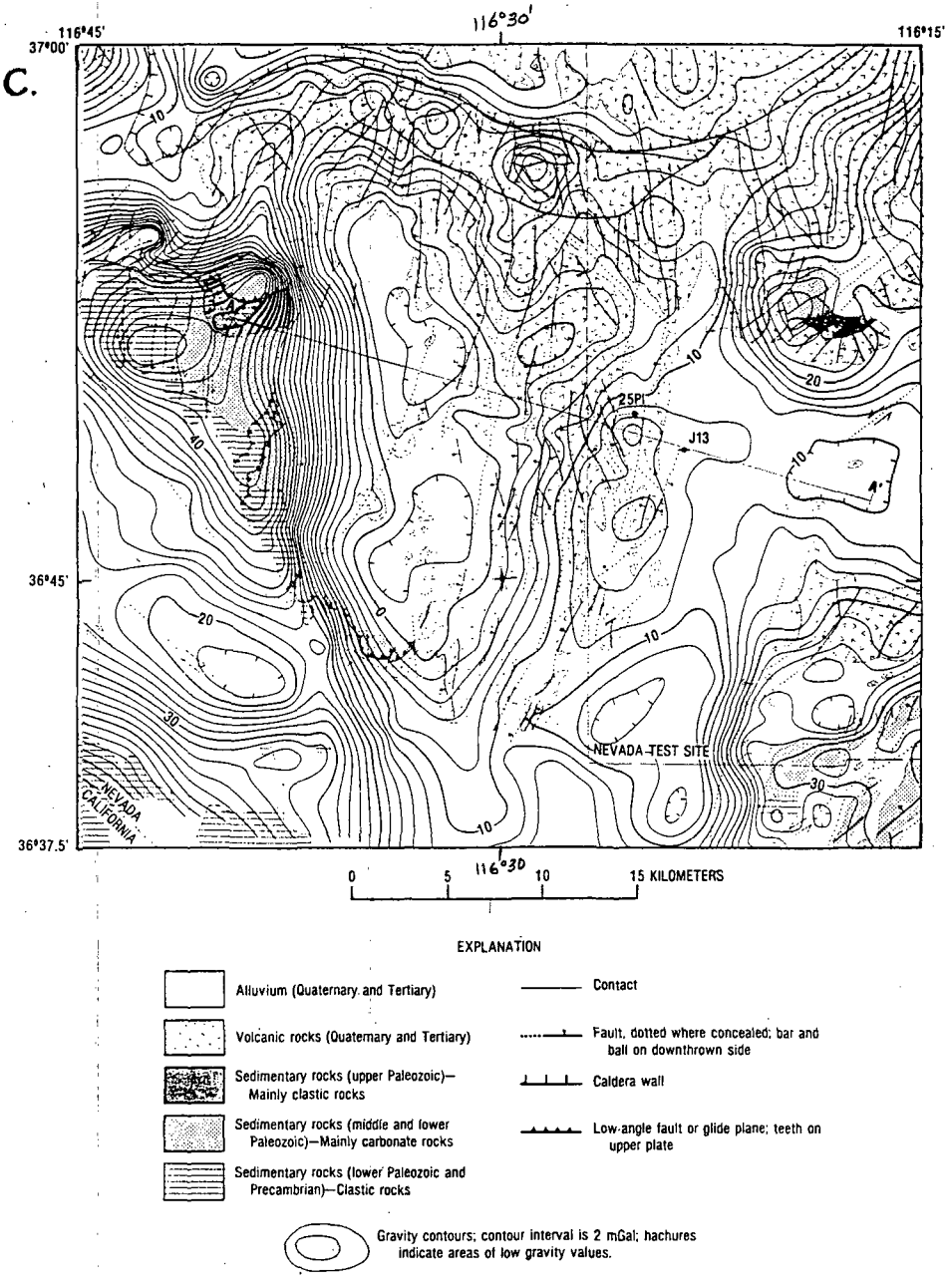
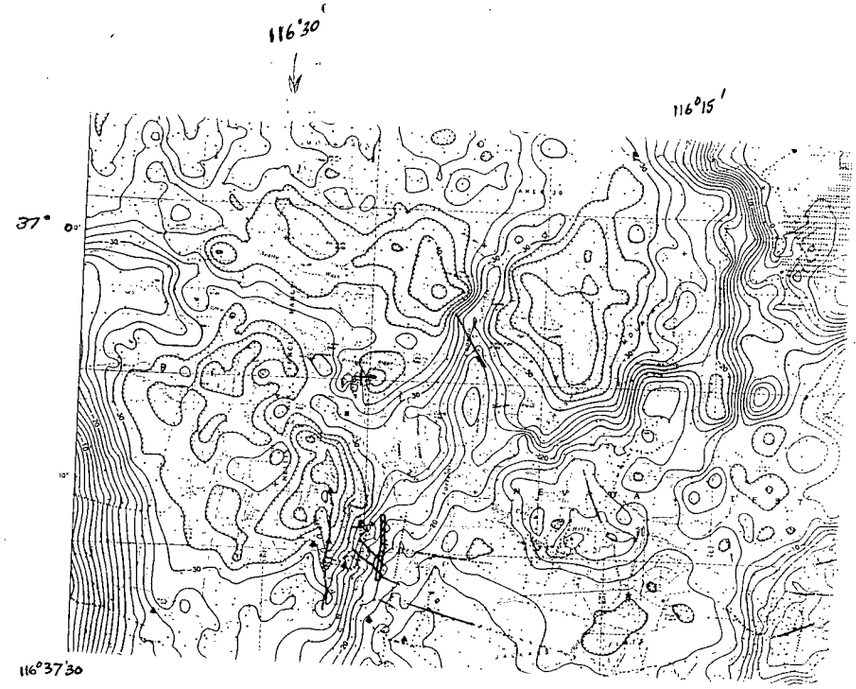
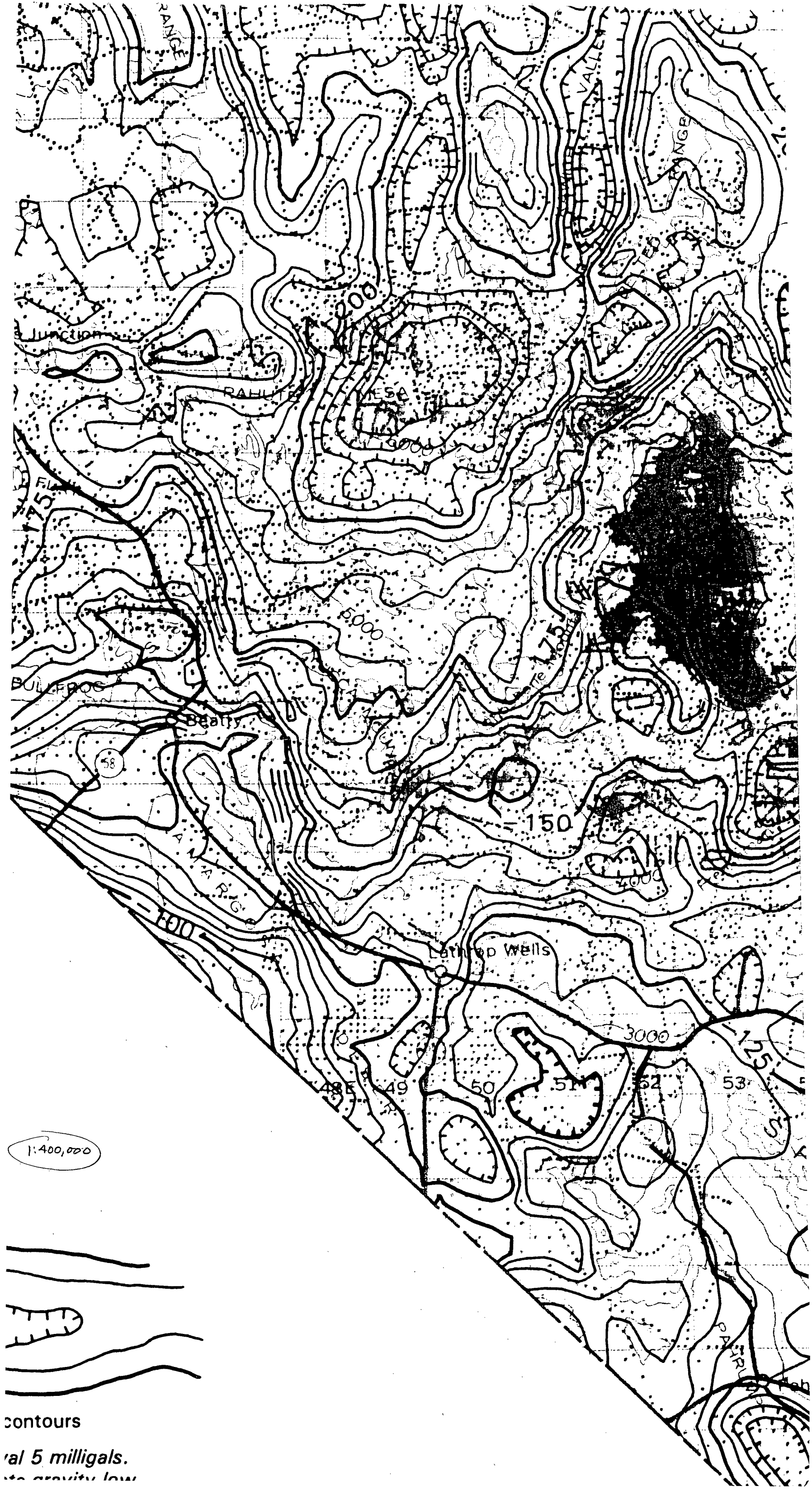


Fig. 4c. Isostatic residual gravity and geologic map of the Yucca Mountain–Crater Flat area (Figure 1). Gravity values are isostatically corrected and reduced at 2.0 g/cm^3. A-A′ is profile of Figure 5.

1:400,000
Isostatic Gravity
Ponce, Harris, Oliver, 1988





contours

val 5 milligals.

nts gravity low

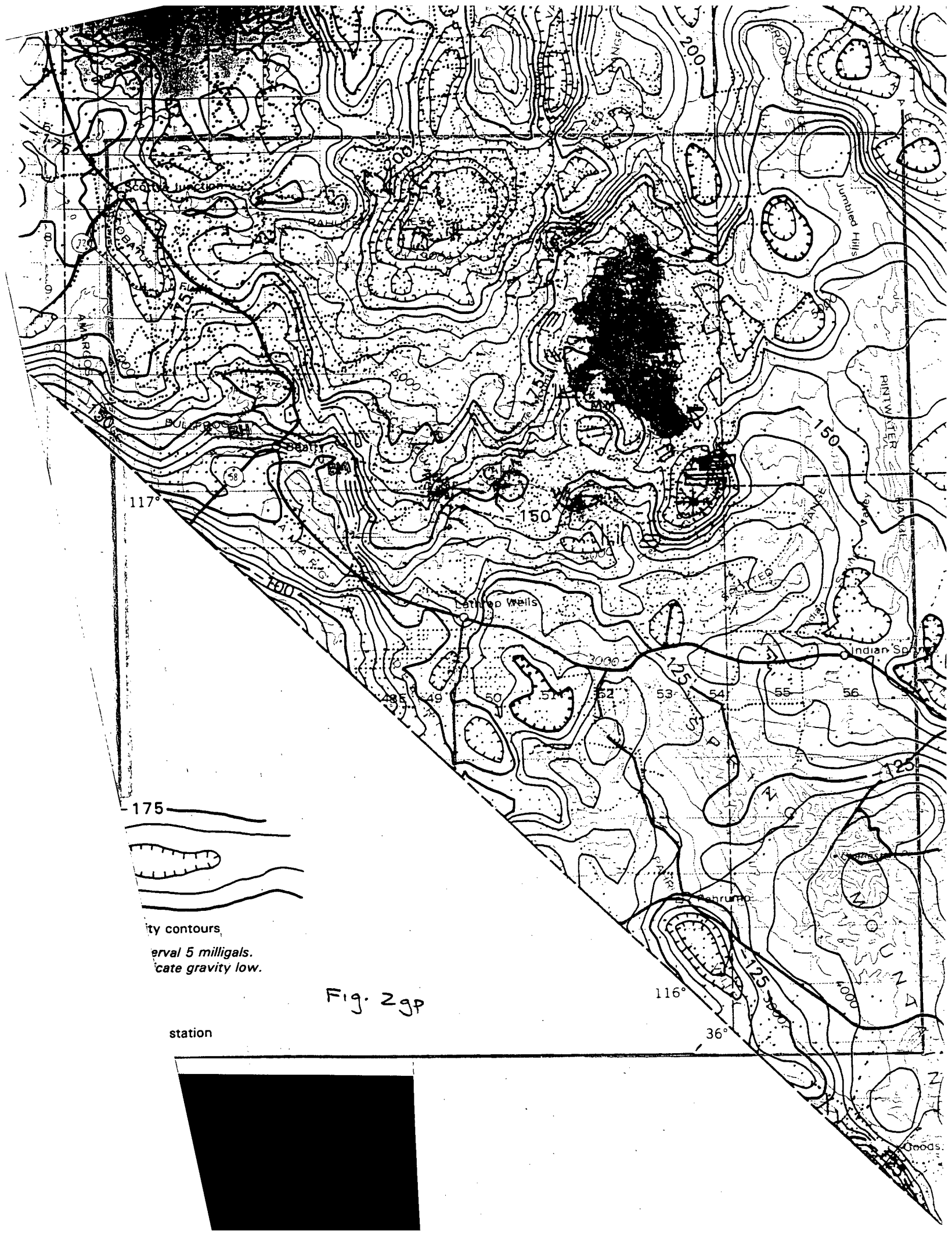
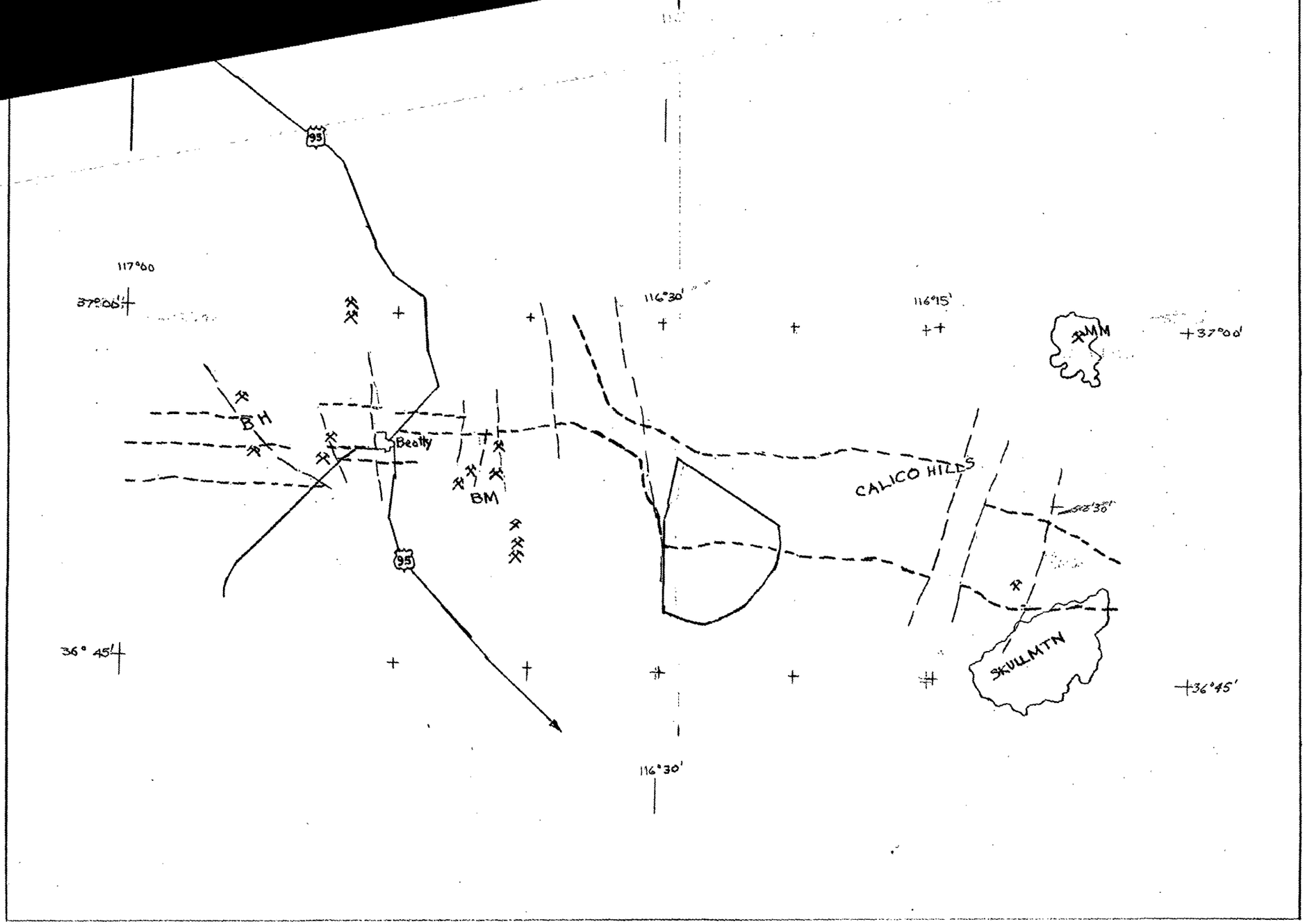
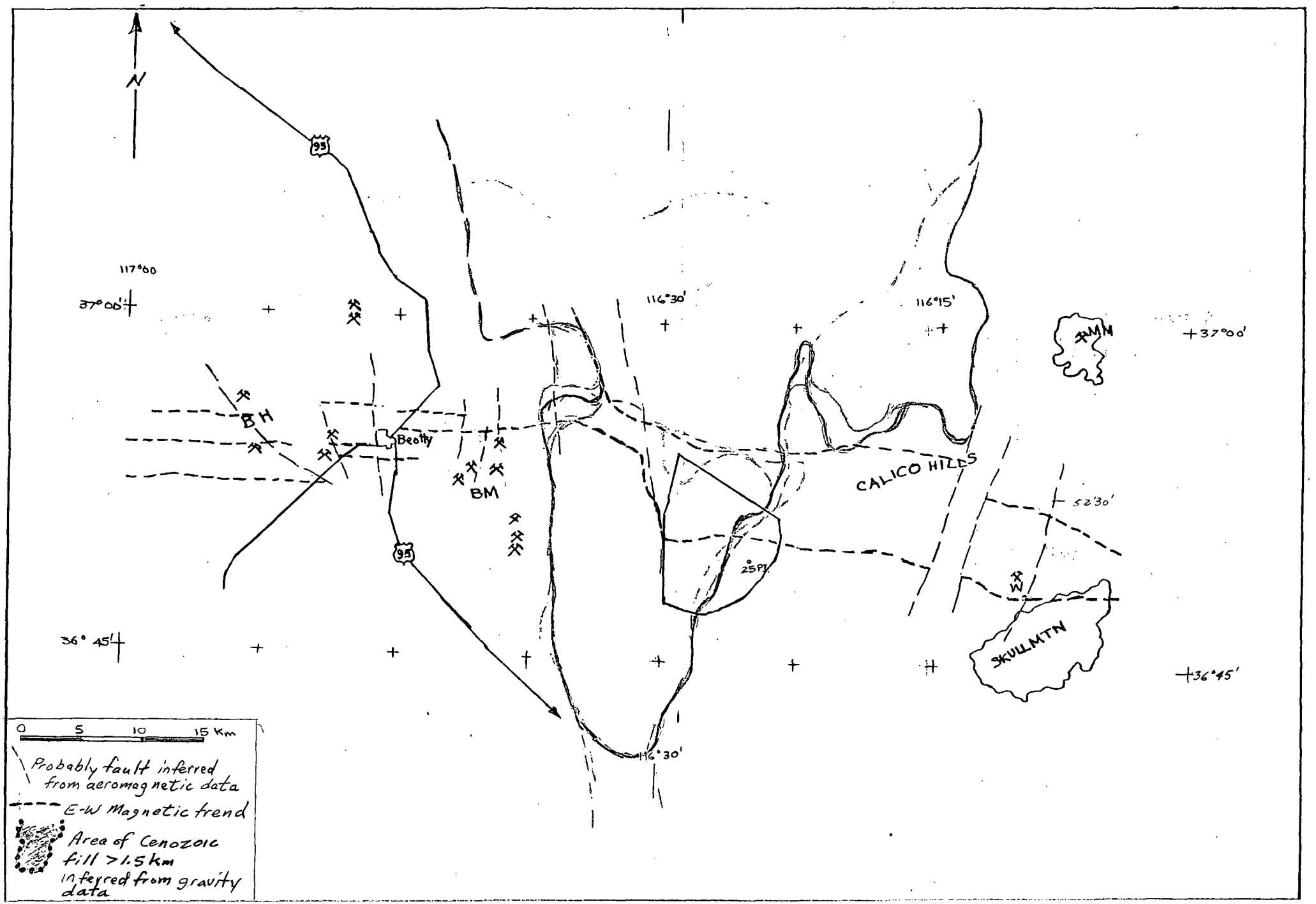
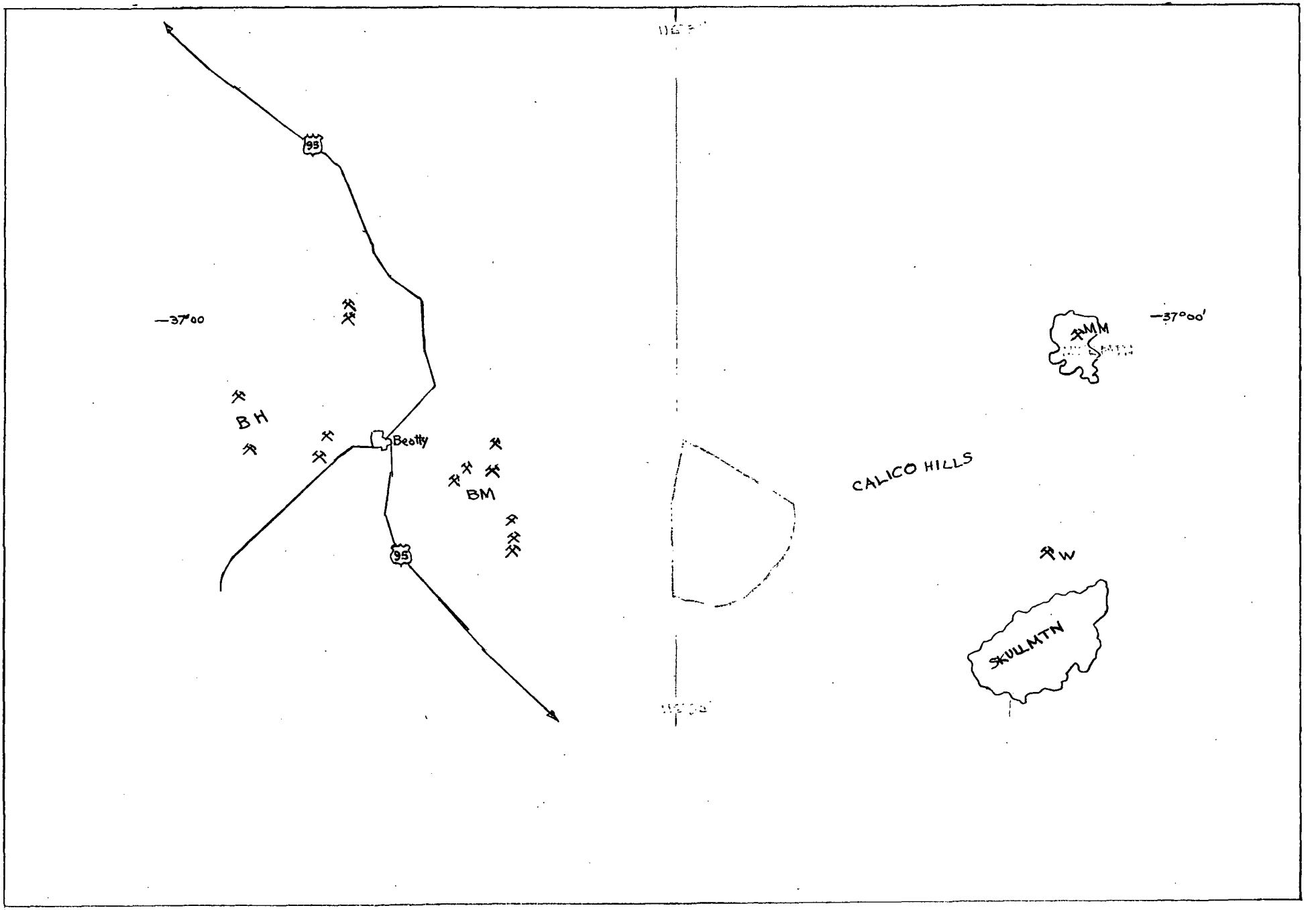
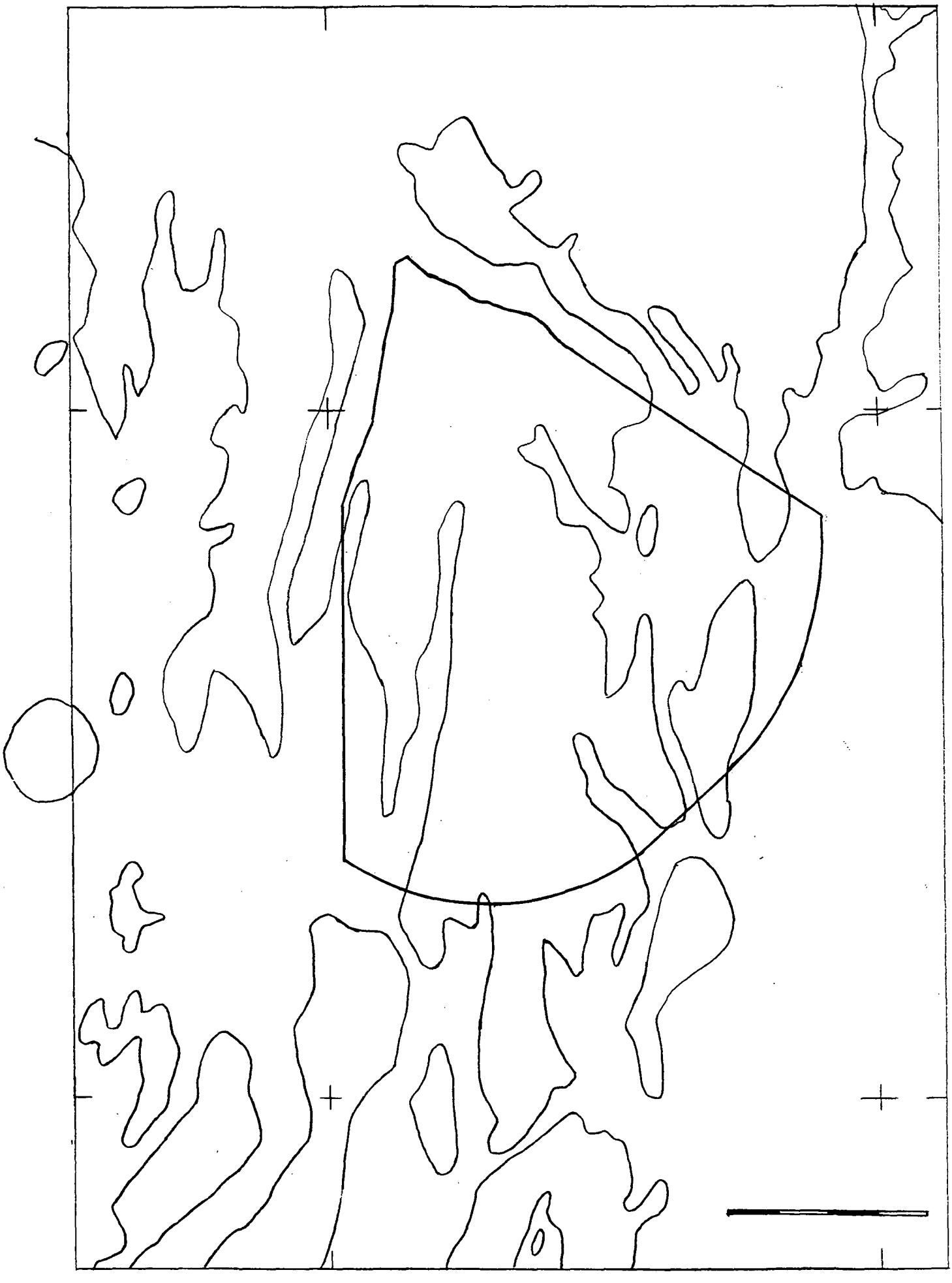

Jumbled Hills
Lathrop Wells
Indian Spr
Pahrump
Beatty
Scotty Junction
117°
116°
36°
-175
-150
-125
-100
-75
ity contours
erval 5 milligals.
cate gravity low.
station

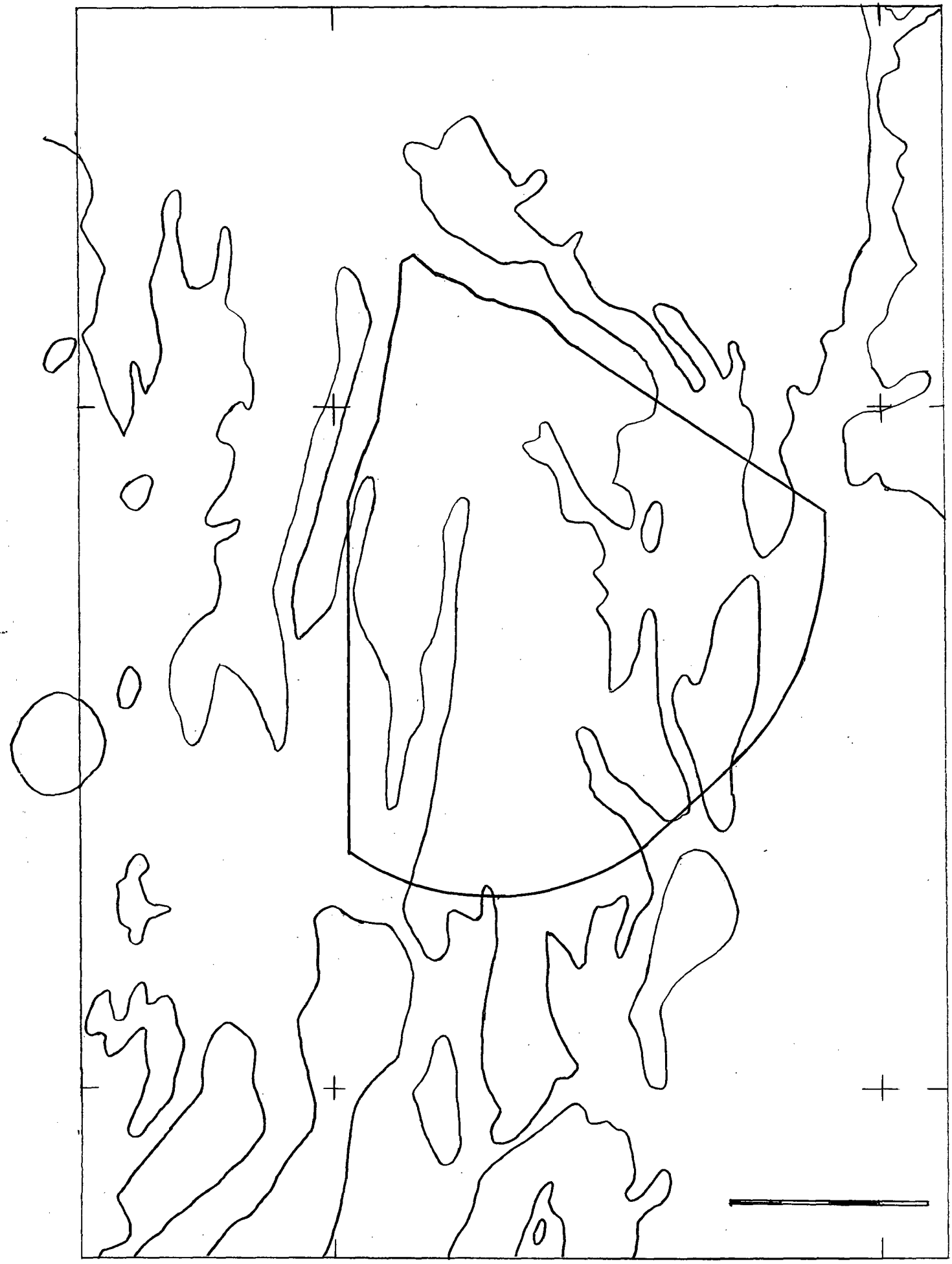
Fig. 2gp


95
117°00
37°00'
116°30'
116°15'
37°00'
MM
BH
Beatty
BM
95
CALICO HILLS
SKULL MTN
36° 45'
36°45'
116°30'


N
95
117°00
37°00'
116°30'
116°15'
37°00'
BH
Beatty
BM
95
CALICO HILLS
52'30'
25PJ
36° 45'
SKULL MTN
36°45'
116°30'
0 5 10 15 Km
Probably fault inferred from aeromagnetic data
E-W Magnetic trend
Area of Cenozoic fill >1.5 km inferred from gravity data


0
1
15
95
Beatty
BH
BM
CALICO HILLS
SKULLMTN
W
MM
—37°00
—37°00'





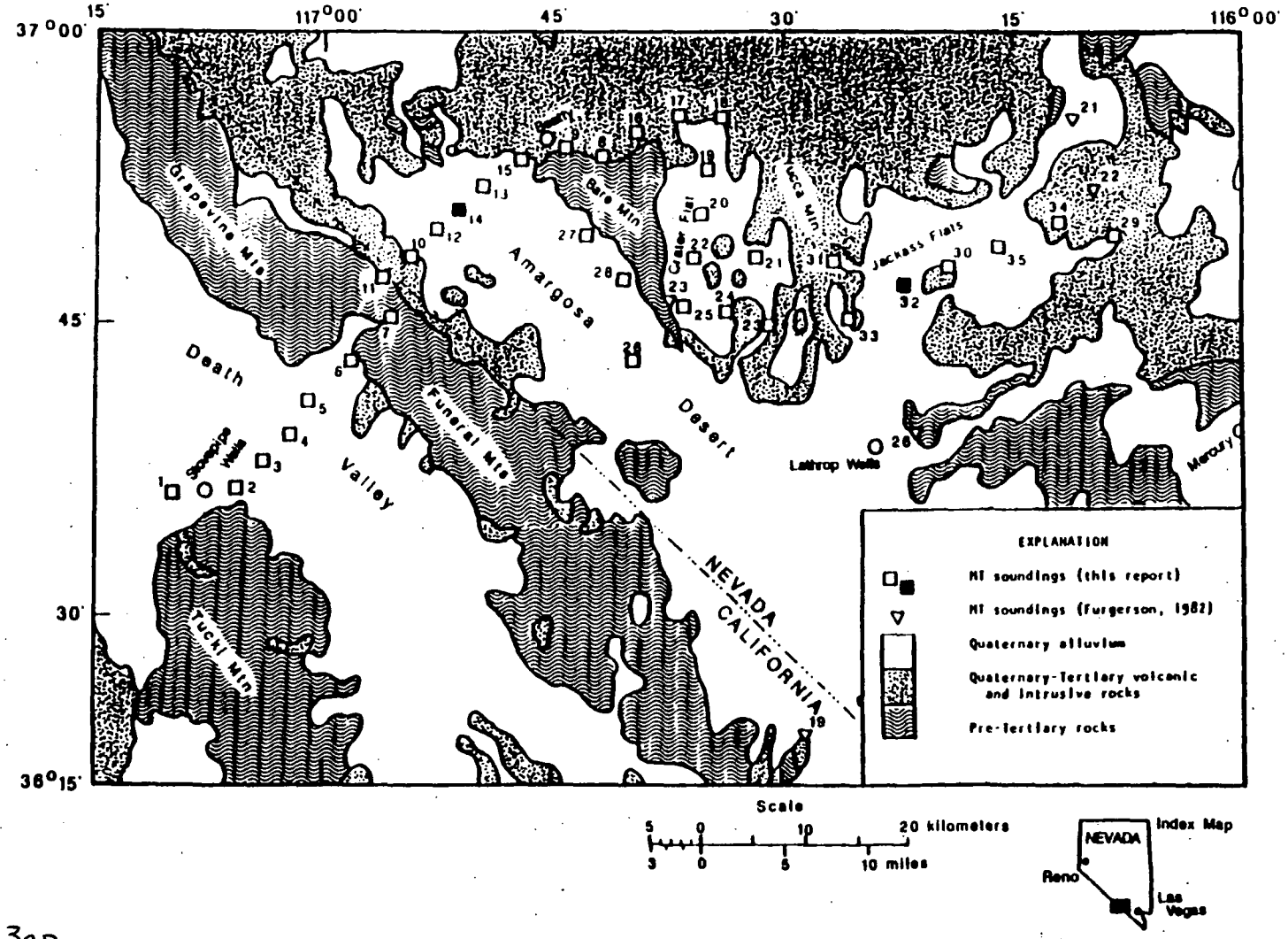


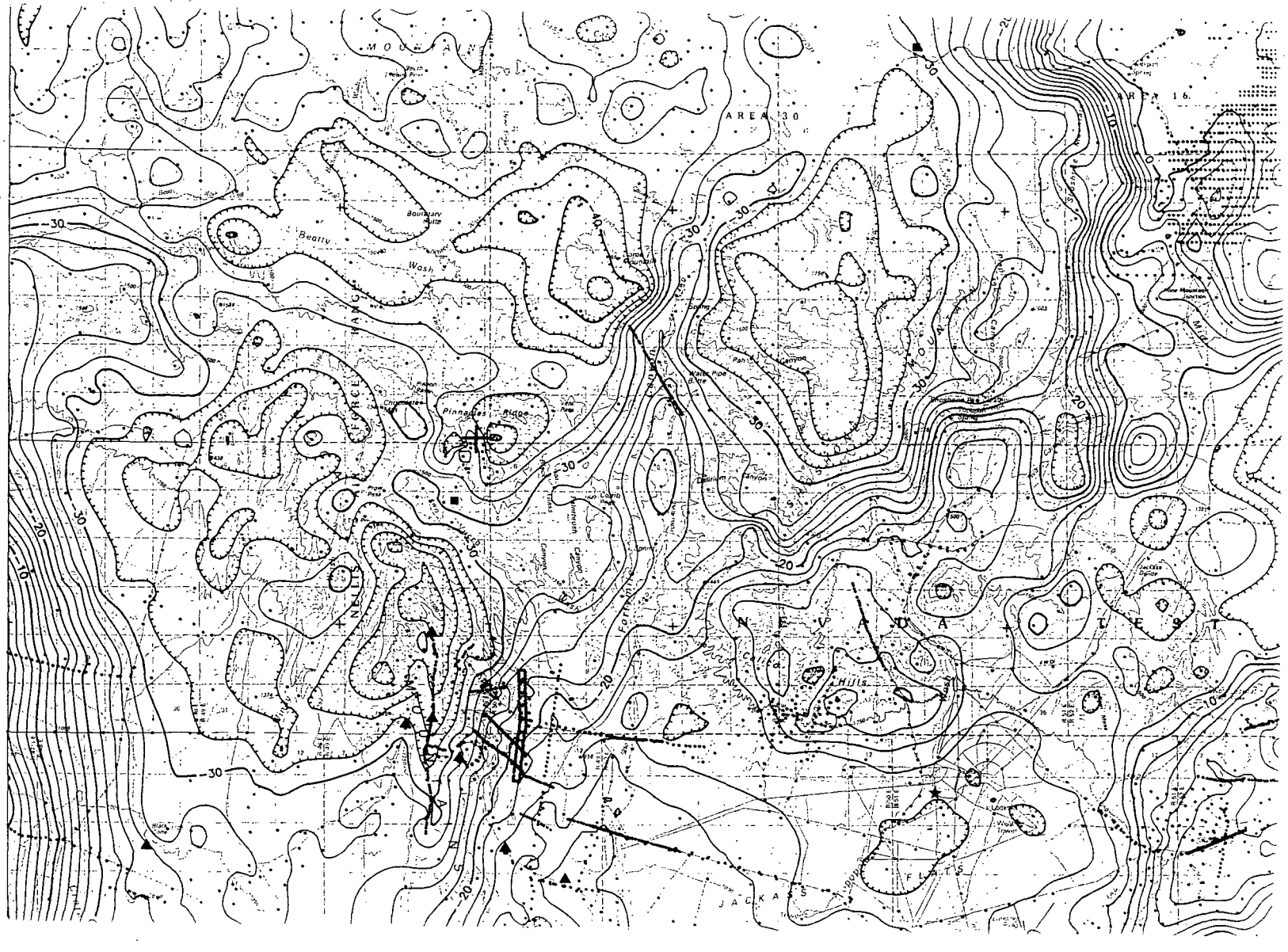
Fig. 3gp.

~~Fig. 4.4~~—Location map showing MT soundings acquired by the U.S. Geological Survey in 1986 (shown as squares). MT data locations from Furgerson (1982) are shown as triangles. Soundings sensing apparent 1-D resistivity structure are indicated by filled-in symbols. Geology generalized from Stewart and Carlson (1978) and Chapman and others (1971).

116°30'

37°00'

52' 30"



ISOSTATIC GRAVITY

1:200,000

cated that shapes of TDEM profiles are simpler than shapes of FDEM profiles. Furthermore, unpublished model data suggested that lateral changes in resistivity cause less distortion of TDEM sounding curves than of large-offset loop-loop FDEM sounding curves.

GEOLOGY AND STRUCTURE OF THE STUDY AREA

The Yucca Mountain study area is located in the Great Basin at the southern margin of the Timber Mountain-Oasis Valley caldera complex (Byers et al., 1976). Surface lithologies include Quaternary alluvium and colluvium and Tertiary volcanics (Lipman and McKay, 1965). The alluvial deposits consist of pebble, sand, and silt-size fragments of the surrounding volcanics, locally cemented by caliche. Alluvium thicknesses range from 0 up to approximately 100 m. Outcrops of volcanic rocks representing primarily the Miocene age Paintbrush Tuff occur in the study area. Drilling of hole USW G-1 (Spengler et al., 1981) to a depth of 1829 m (6000 ft) has indicated the presence of other major volcanic rock units of the local strati-

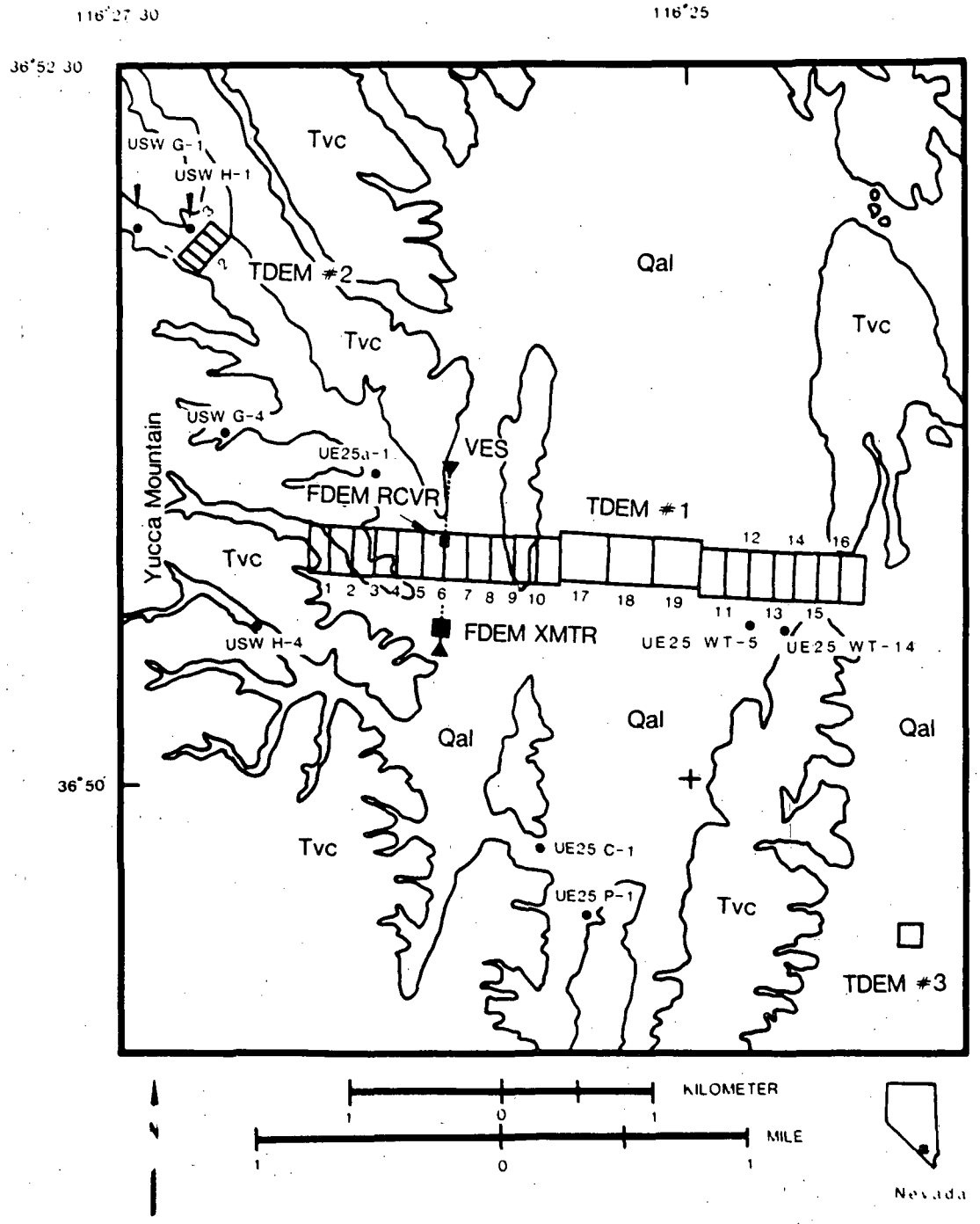
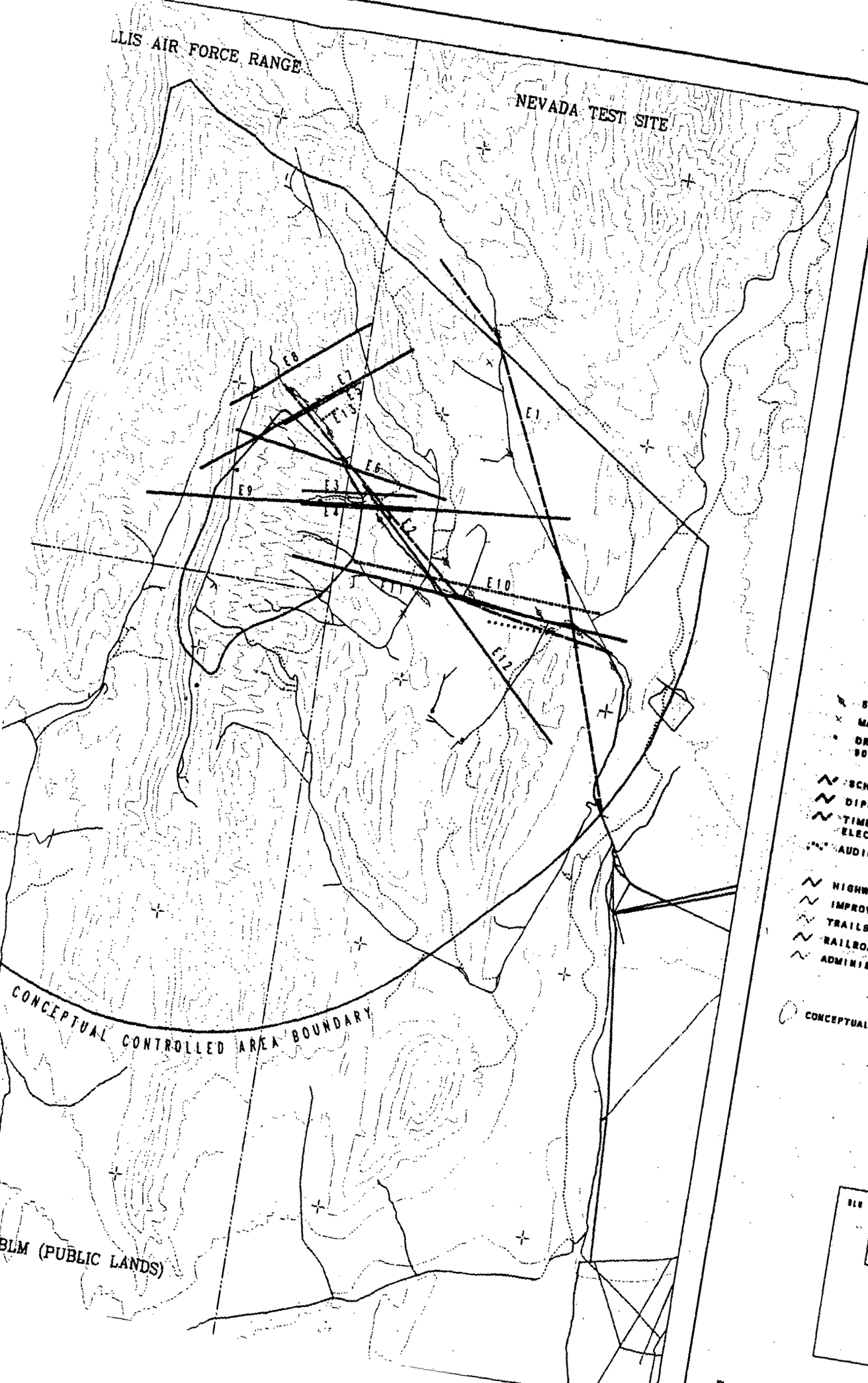


FIG. 1. Location map of study area showing outcrop patterns, drill hole locations, and geoelectrical array sites.



YUCCA MOUNTAIN PROJE

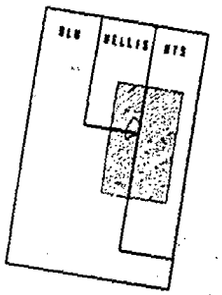
FIGURE 2.3-2. Location of Geoelectric Tr
in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 900 M DEEP
- SCHLUMBERGER SOUNDING TRAVERSE
- DIPOLE-DIPOLE TRAVERSE
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE
- AUDIOMAGNETOTELLURIC TRAVERSE
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY
- CONCEPTUAL PERIMETER DRIFT BOUNDARY



N

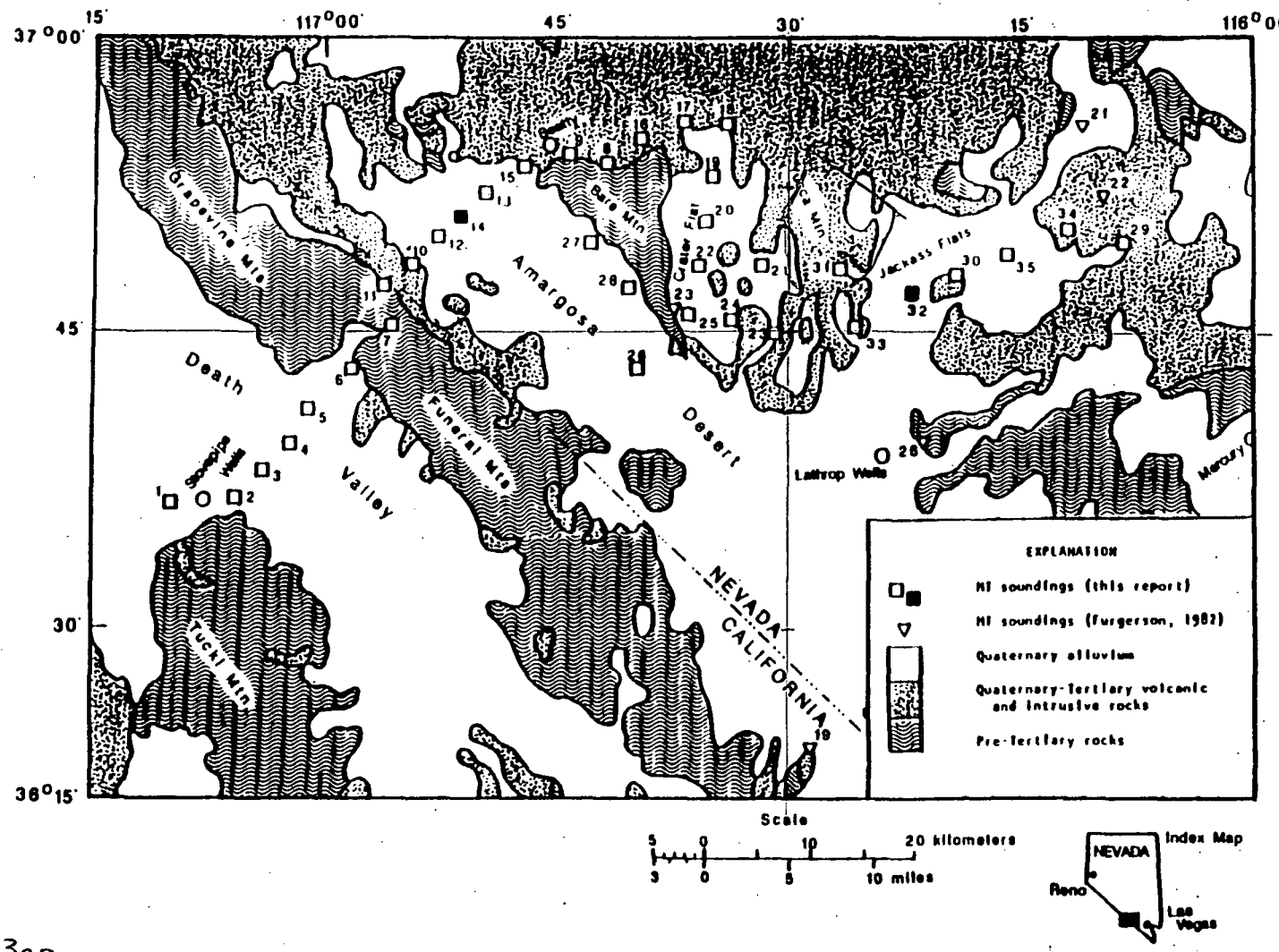


Fig. 3gp.

~~Fig. 4.4~~—Location map showing MT soundings acquired by the U.S. Geological Survey in 1986 (shown as squares). MT data locations from Furgerson (1982) are shown as triangles. Soundings sensing apparent 1-D resistivity structure are indicated by filled-in symbols. Geology generalized from Stewart and Carlson (1978) and Chapman and others (1971).

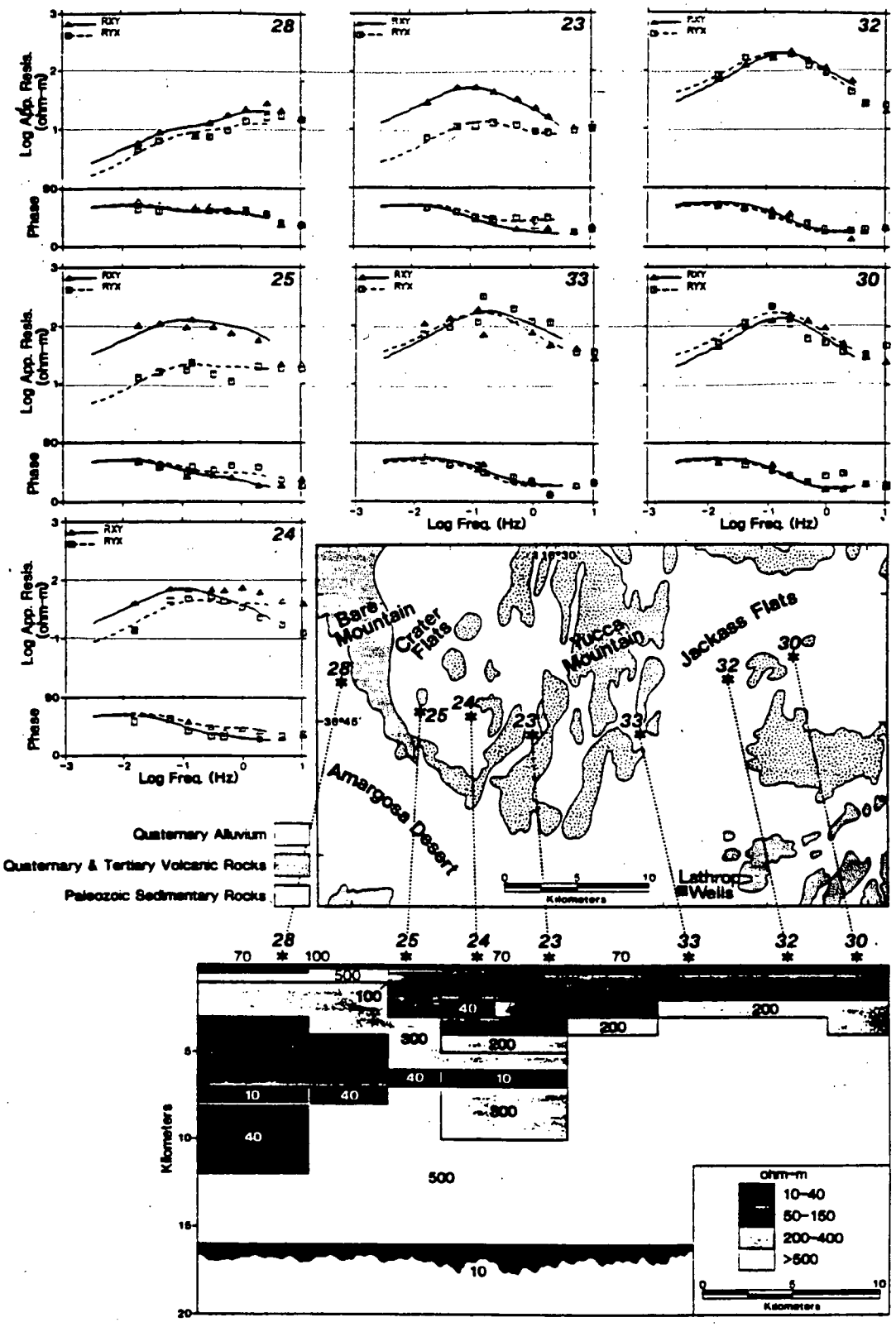
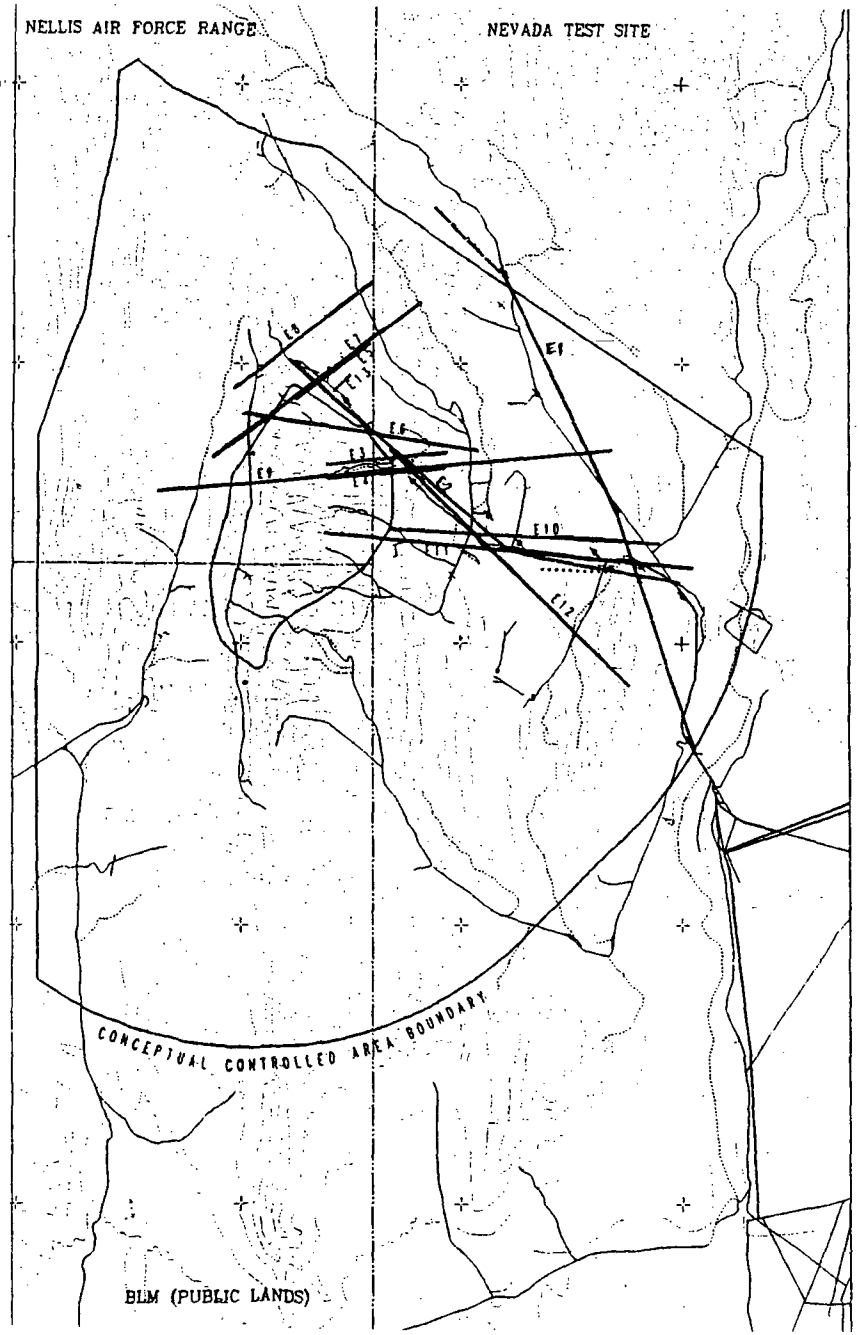


Fig 3gp.

Fig. 4.6--Preliminary 2-D resistivity model across the southern part of the Yucca Mountain area based on USGS MT data acquired in 1986. The model was generated using the 2-D algorithm of Swift (1971). Observed sounding data are shown by discrete symbols (triangles and square boxes); computed response curves are shown by solid and dashed lines. Triangles and continuous lines respesent the E-parallel mode (TE); boxes and dashed lines represent the E-perpendicular mode (TM).



YUCCA MOUNTAIN PROJECT

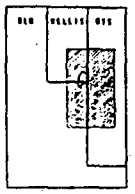
FIGURE 2.3-2. Location of Geoelectric Traverses in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 900 M DEEP
- SCHLUMBERGER SOUNDING TRAVERSE
- DIPOLE-DIPOLE TRAVERSE
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE
- AUDIOMAGNETOTELLURIC TRAVERSE
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY
- CONCEPTUAL PERIMETER DRIFT BOUNDARY



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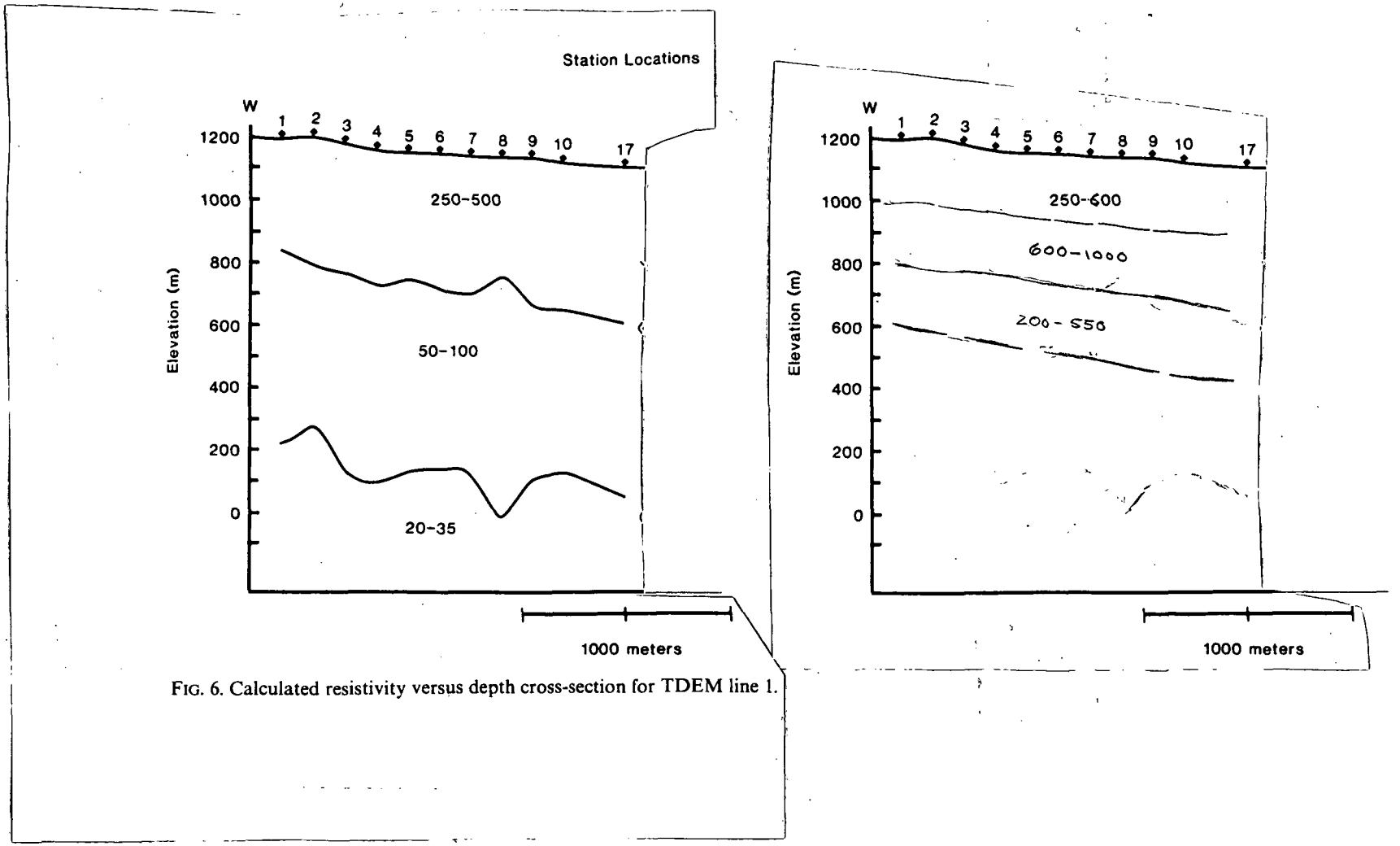


FIG. 6. Calculated resistivity versus depth cross-section for TDEM line 1.

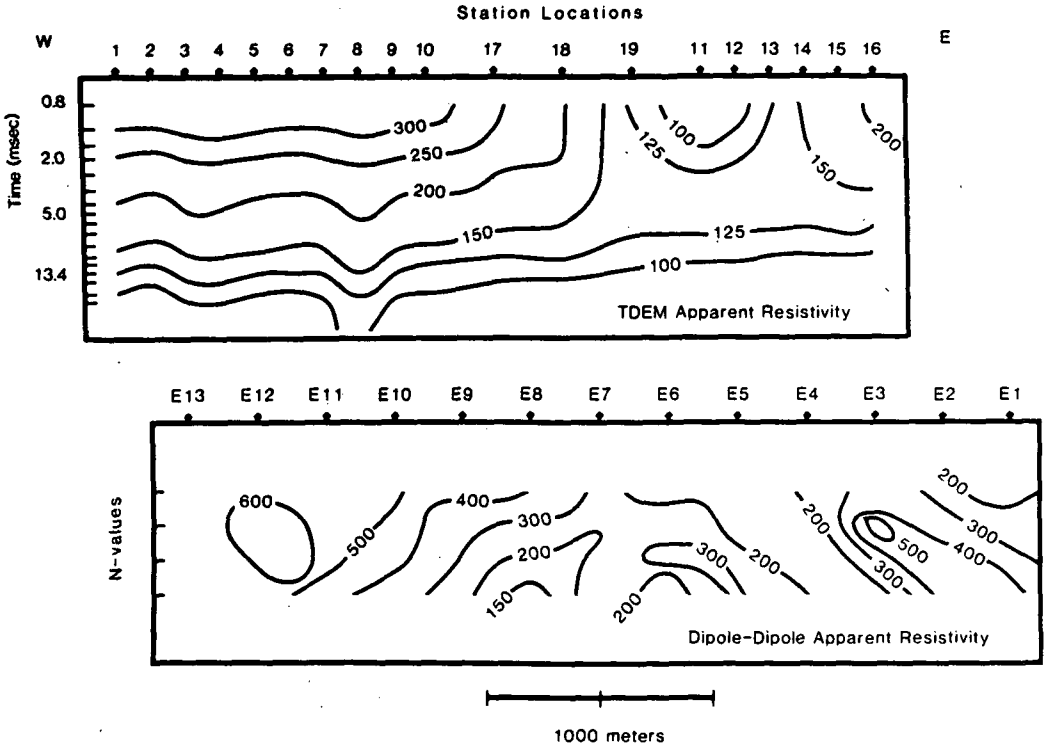


FIG. 5. Apparent resistivity pseudosections from TDEM line 1 and from a nearby, parallel dipole-dipole traverse.

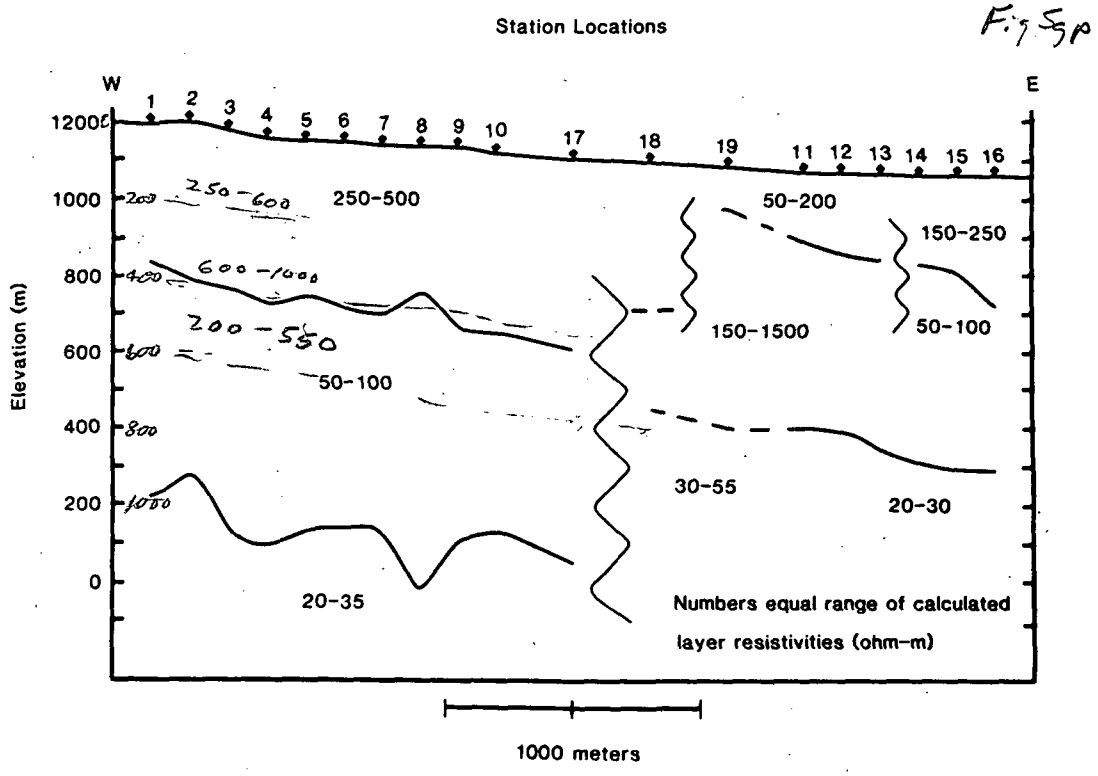


FIG. 6. Calculated resistivity versus depth cross-section for TDEM line 1. Vertical exaggeration 2 : 3.

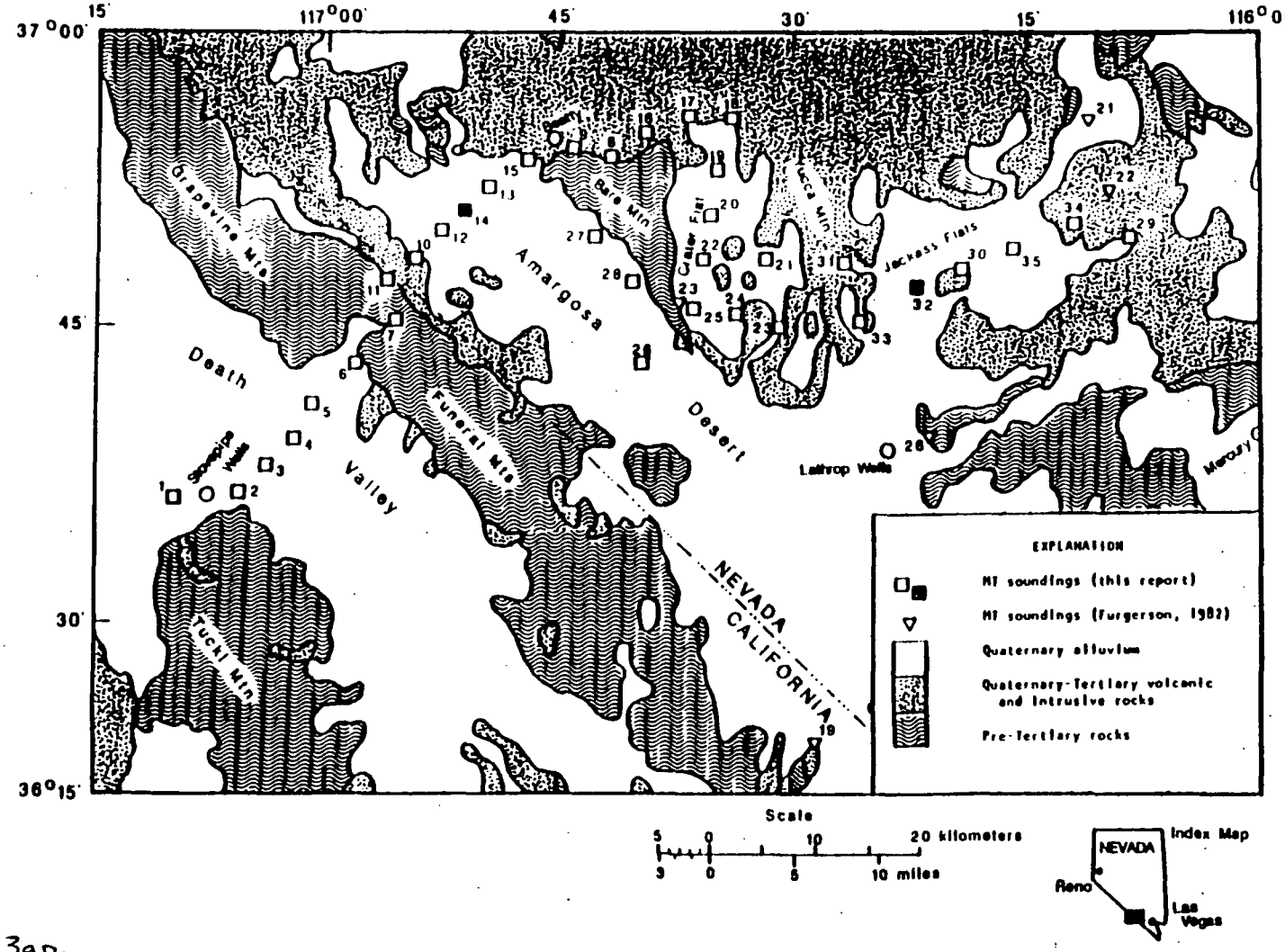
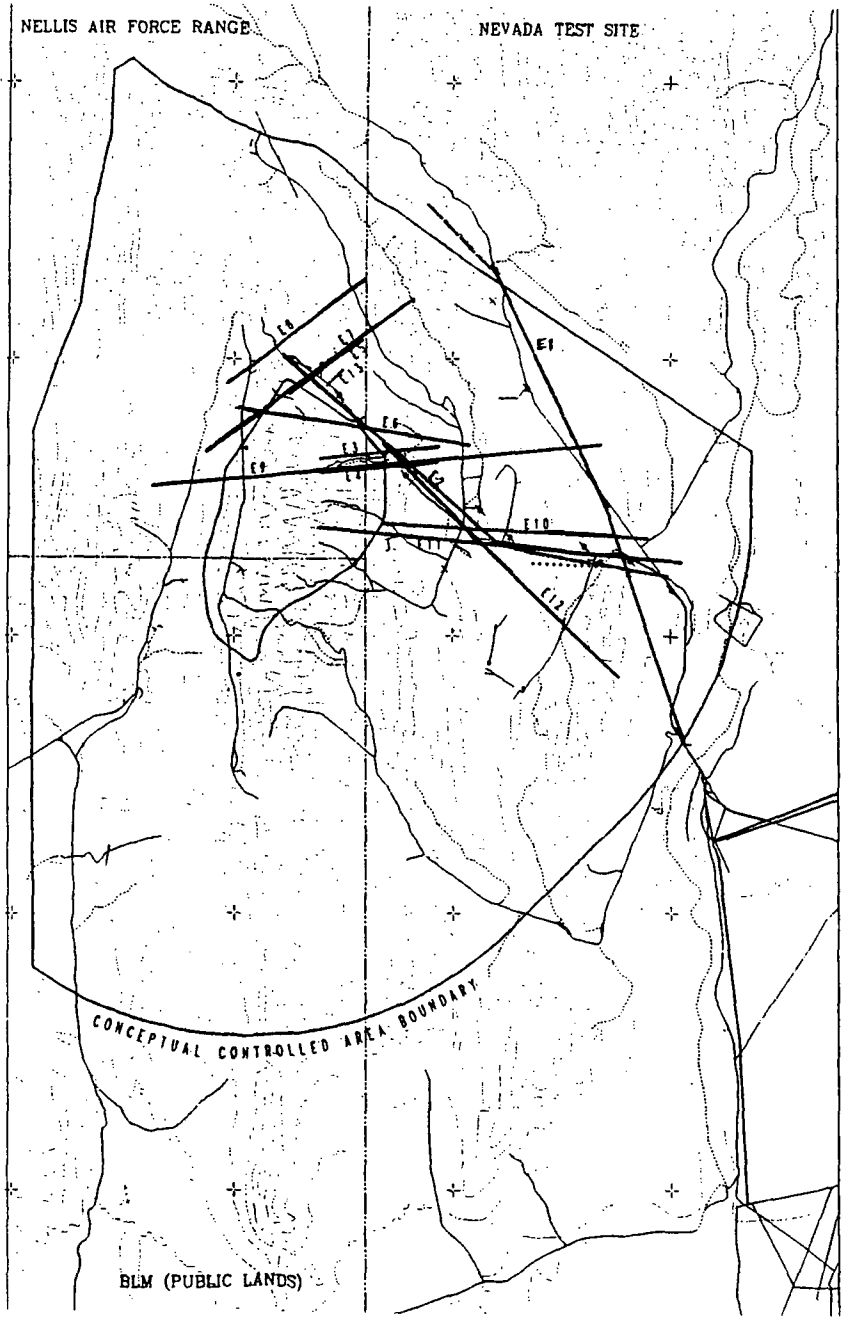


Fig. 3gp.

~~Fig. 4-4~~—Location map showing MT soundings acquired by the U.S. Geological Survey in 1986 (shown as squares). MT data locations from Furgerson (1982) are shown as triangles. Soundings sensing apparent 1-D resistivity structure are indicated by filled-in symbols. Geology generalized from Stewart and Carlson (1978) and Chapman and others (1971).



YUCCA MOUNTAIN PROJECT

FIGURE 2.3-2. Location of Geoelectric Traverses in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 500 M DEEP
- SCHLUMBERGER SOUNDING TRAVERSE
- DIPOLE-DIPOLE TRAVERSE
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE
- AUDIOMAGNETOTELLURIC TRAVERSE
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY
- CONCEPTUAL PERIMETER DRIFT BOUNDARY

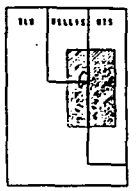
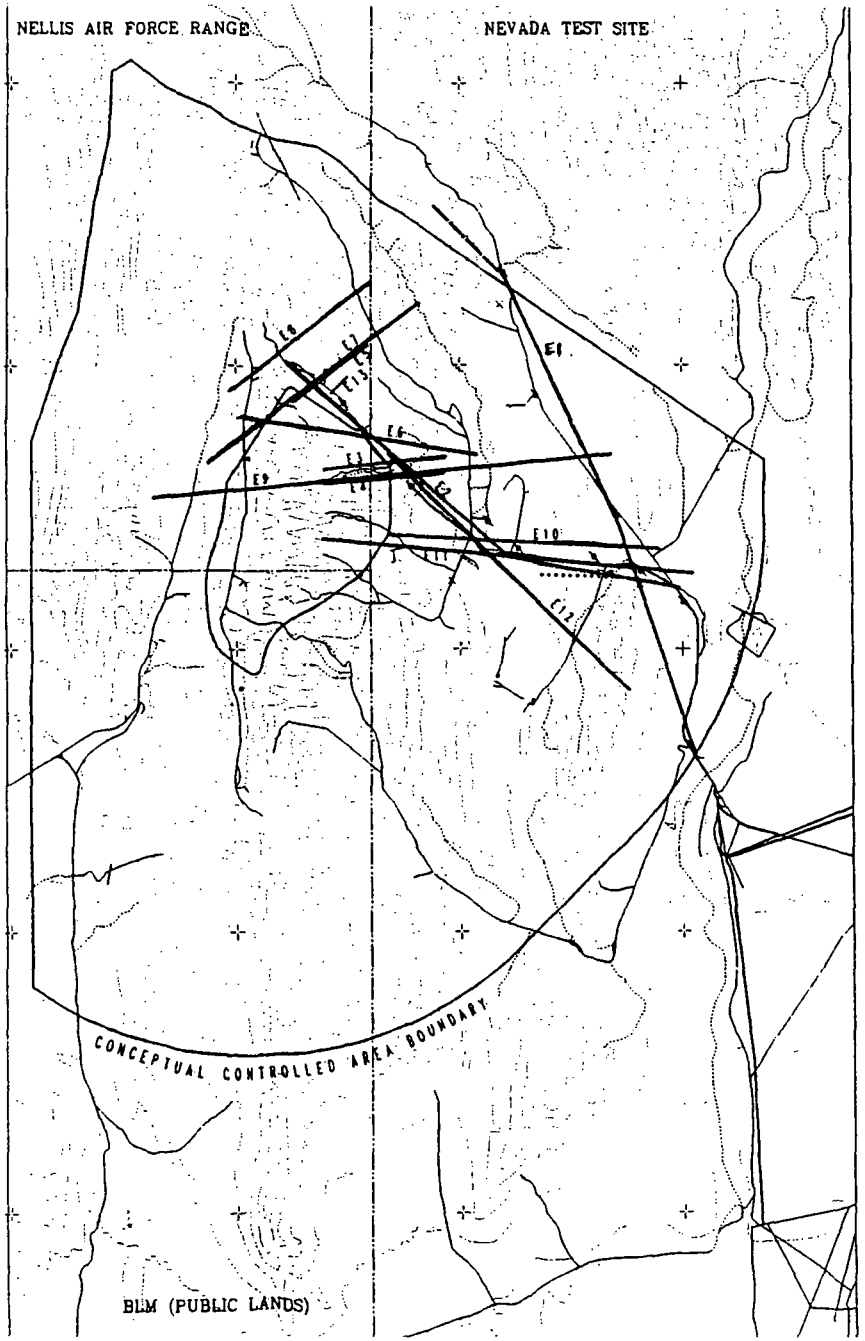


Fig. 4gp



YUCCA MOUNTAIN PROJECT

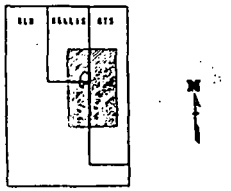
FIGURE 2.3-2 Location of Geoelectric Traverses in the Yucca Mountain Site Area

1 0 1
MILES

1 0 1
KILOMETERS

LEGEND

- SCHLUMBERGER SOUNDINGS
- MAGNETOTELLURIC SOUNDINGS
- DRILL HOLES AT LEAST 900 M DEEP
- SCHLUMBERGER SOUNDING TRAVERSE — E1, E2
- DIPOLE-DIPOLE TRAVERSE — E3, 4, 5, 6, 7, 8, 9, 11, 12
- TIME DOMAIN ELECTROMAGNETIC TRAVERSE — E10, E13.
- AUDIOMAGNETOTELLURIC TRAVERSE
- HIGHWAY
- IMPROVED ROAD
- TRAILS
- RAILROAD
- ADMINISTRATIVE BOUNDARY
- CONCEPTUAL PERIMETER DRIFT BOUNDARY



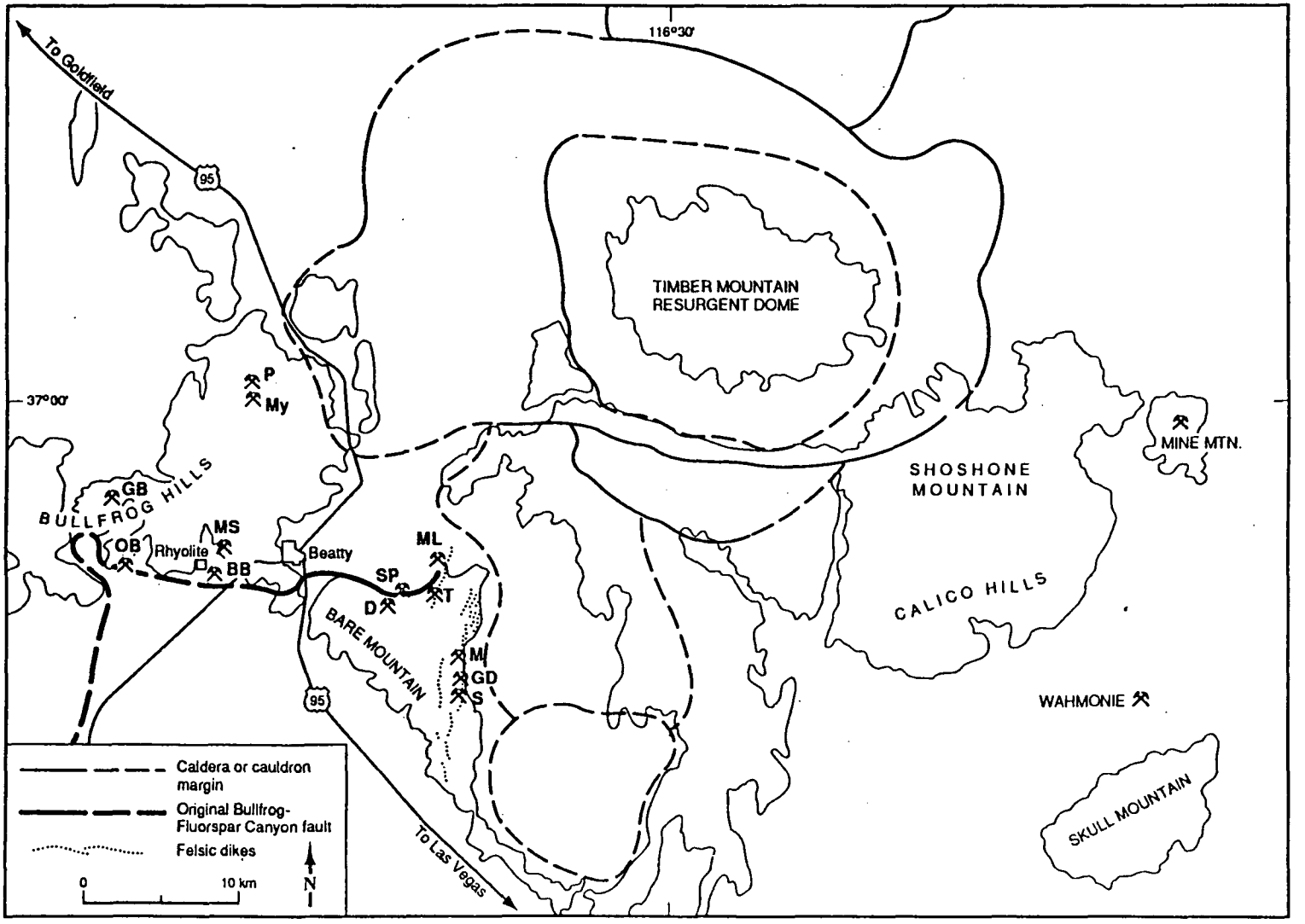


Fig. 2. Map of the south part of the southwestern Nevada volcanic field showing caldera margins, mineral deposits, and other features discussed in the text. (Modified from Noble et al., 1991.) *BB*=Lac Bullfrog mine, *D*=Daisy mine, *GB*=Gold Bar mine, *GD*=Goldspar mine, *M*=Mary mine, *ML*=Mother Lode mine, *MS*=Montgomery-Shoshone mine, *My*=Mayflower mine, *P*=Pioneer mine, *S*=Sterling mine, *SP*=Secret Pass deposit, *T*=Telluride mines. Heavy dashed line shows approximate surface trace of the Original Bullfrog–Fluorspar Canyon detachment fault system.

Beatty
Wash
Dome Mountain
NELLIS AIR FORCE RANGE
YUCCA MOUNTAIN
Chocolate Mtn
Pinyon Pass
Pinnacles Ridge
Vent Pass
Canyon
Prow Pass
The Prow
Black Glass Canyon
Paintbrush Canyon
Comb Peak
Spring
Yucca Wash
Fortymile Wash
Midway Valley
Windy Wash
Black Cone
Red Cone
Crater Flat
Little Cones
Black Marble
Busted Butte
Well
Gravel Pit
Big Dune Sand Dunes
Landing Field
Amargosa Valley
POWERLINE