

A GEOPHYSICAL SURVEY
AT THE CARROLL HOUSE

3 April 1987

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A Geophysical Survey at the Carroll House

① This survey detected a possible well or other type of refilled pit on the south side of the house. Several likely paths, now buried, were delineated. See Figure 1.

② Many areas of fill soil were mapped. There appears to be a buried earth layer, possibly a garden bed or pavement, extending east-west across the site; this interface can be partly traced beneath a recently-constructed cemetery terrace.

③ Concentrations of debris underground were also located. While some could be lenses of trash, others could help define lost structures. This geophysical survey did not detect anything of the tavern which might have formerly been at the east side of this site.

The Site

The Charles Carroll House is located on the south side of historic Annapolis, where the Duke of Gloucester Street meets Spa Creek. Charles Carroll, the house builder's son, was one of the signers of the Declaration of Independence. The house is a part of the property for St. Mary's Roman Catholic Church and plans are being made for the historical renovation of the house and garden.

In about 1948, extensive earthwork was done on the property; within the area of survey it appears that fill is more likely than earth removal. On the eastern side, an earlier terrace was extended for a small cemetery.

The relief at the site is about 25 ft, with high ground on the north and west. Adjacent to Spa Creek, the surface is only a few feet above the tidal water.

The site is covered by mown lawn grass with a moderate number of trees and bushes. The soil is somewhat sandy and appears to contain few stones.

Buried water pipes, drains, and electric wires are known to be on the property. The surrounding land is residential or commercial, with no industries or electric train lines in the vicinity. The Carroll House is built of brick.

Method A grid was set up along the line of the principal waterfront retaining wall, with a bend in this wall as a reference point.

While not parallel to the house, this alignment allowed the survey to be easily done down the line of bushes in the garden. Baseline offsets, extended up the hill from the waterfront, have an east-west error of as much as 5 ft due to the fact that bushes and topography block the line of sight. After the survey, Paul Shackel nailed metal jar lids at 50 ft multiple points on the geophysical grid to aid its relocation (W140 is the only irregular line).

The surficial information of Figure 1 is derived from a site map made by Bill Roulette and Eileen Williams, with supplementary measurements by Bill Helton, and by comparison with the at-surface indications on the radar profiles. The radar's location of walkways provides independent evidence of the lines of traverse.

The Survey

A SIR System-7 ground-penetrating radar, manufactured by Geophysical Survey Systems, profiled a length of 18,630 ft (3.53 miles). A model 3105 (180 MHz) antenna was found to be the most suitable at this site. A high resolution antenna, model 3102 (315 MHz), was tested but had too shallow a profiling depth; the soil resistivity here is about 60 ohm-m and geophysics indicates that the soil gets less sandy with increasing depth.

The depth scale of the radar profiles was estimated by a geometrical analysis of some echoes; from the information in Figure 3, an average pulse velocity of 0.35 ft/nanosecond provided this calibration.

The radar traverse speed was $5/8$ ft per second and traverses were usually made toward the east and spaced by 5 ft. Bill Helton aided this survey.

Two additional geophysical instruments supplemented the investigation of some areas. A total of 221 measurements were made with a proton magnetometer (the average field was 54,500 nanotesla) and 210 readings were made of the electrical resistance of the earth. These surveys were done in collaboration with Eileen Williams, Mark Woods, Barbara Little, and Paul Shackel.

This field work was done over the period March 17-21, 1987. The weather was mostly sunny and warm then and there was no rainfall.

Survey Results

Figure 1 summarizes the major findings of the geophysical survey. The results there are derived from the detailed map of radar echoes, Figure 2. The depths indicated in Figure 2 are more likely to be overestimates than underestimates.

The right hand side of Figure 4 shows a reverberating echo of the radar pulse at a concrete sidewalk; there is evidently an abrupt change in the earth below the walk, causing the radar pulse to resonate in the surface layer.

The deep echo toward the left side of the profile is more interesting. The fact that rather different echoes are vertically-aligned suggests that a deep refilled pit or similar feature could be here; a well or privy could cause this type of echo. The feature is less than 5 ft wide and extends to a depth of over 7 ft. It was also detected on parallel lines $2\frac{1}{2}$ ft either side of this line. The resistivity data in Figure 5 indicate that the earth has anomalously high electrical resistivity at the location of the deep radar echo; rubble or sand could cause this.

The echoes at E35-40 in Figure 4 are seen in Figure 2 to form a band; a buried path is likely. Figure 5 suggests that this likely path has low resistivity, suggesting an entrenched path or possibly construction with cinders rather than gravel. Several other possible paths are indicated in Figure 1; they are marked with a stippled pattern.

The earliest part of the Carroll House is on the east side, but historical records indicate a now-demolished extension even farther east. The radar profile of Figure 6 crosses this area and reveals a flat surface about 2 ft below ground with a more complex soil strata on the east (right). The radar also found many metal objects below the sidewalk on the south side of the house; Figure 7 shows the zone. A fluxgate magnetometer detected magnetic materials in this same zone.

Along line N110, a buried interface was detected which gives an unusually strong radar echo. It is mapped in Figure 1 between E85 and E320. Figure 8 gives an illustration. Fill earth for the extension of the cemetery terrace appears to have been placed over this stratum, for Figures 8 and 9 show it beneath the fill.

The material of this radar-reflecting stratum is not known, but it could be soil more loamy or more sandy than the other soils in the area. While about 3 ft below the present surface, this layer is somewhat deeper on the uphill side.

The radar also detected more complex strata in some areas. The area of irregular soil strata just south of the house, shown in Figure 1, could be at the location of a cow stable which is indicated on a map from about 1900. Other regions of irregular soil strata are shown in Figures 1 and 2. An illustration is given as Figure 10. These radar echoes could be caused by now-buried earthworkings or excavations, lenses of rubble or debris, or similar moderately complex soil features.

Cross-hatched patterns in Figure 1 map some of the areas where fill earth was detected. While the downhill half of the cemetery is also fill, it is not mapped here because geophysics did not reliably indicate it. The area of irregular soil strata around N140W50 may also be caused by fill soil. While these areas of fill can mask or mimic archaeological features, they might also preserve them.

A rather deep feature was found near the south end of the property. It is shown in Figure 11 and is more likely to be a natural earth contrast than a cultural feature. Figure 12 is the map of a magnetic survey done in the area; anchor rods from the wooden sea wall cause the strong magnetic low on the east (these rods also cause the radar echoes at a 10 ft spacing on line N10). A magnetic object near S105W130 at a depth of less than about 2 ft causes a distinct magnetic anomaly and also appears to have caused the reverberating echo of Figure 13. This is probably an iron object weighing less than 5 lb.

Line N55 is unusual. For a band probably less than 10 ft wide, there is almost a complete lack of radar echoes going east-west across the width of the site. Figure 14 shows the sharp contrast with 5 ft away. While a path or similar feature could be here, it was not directly detected by the radar.

It is possible that several summer houses were once somewhat offset from that line. Two resistivity profiles were measured along line N40. The sawtooth pattern predominant on the left side of Figure 15 is caused by unresolved earth features less

than 2 ft deep and spaced by 4-8 ft; this could be the result of cultivation of the soil. The span E300-310 shows a modest anomaly, although the radar profile of Figure 16 indicates only a small contrast there.

The two radar antennas were compared in a profile across the cemetery, Figure 17. Echoes from recent graves, on the left, are very shallow and the cause is not known. There is little detection of the seven reburials from moved 19th century graves.

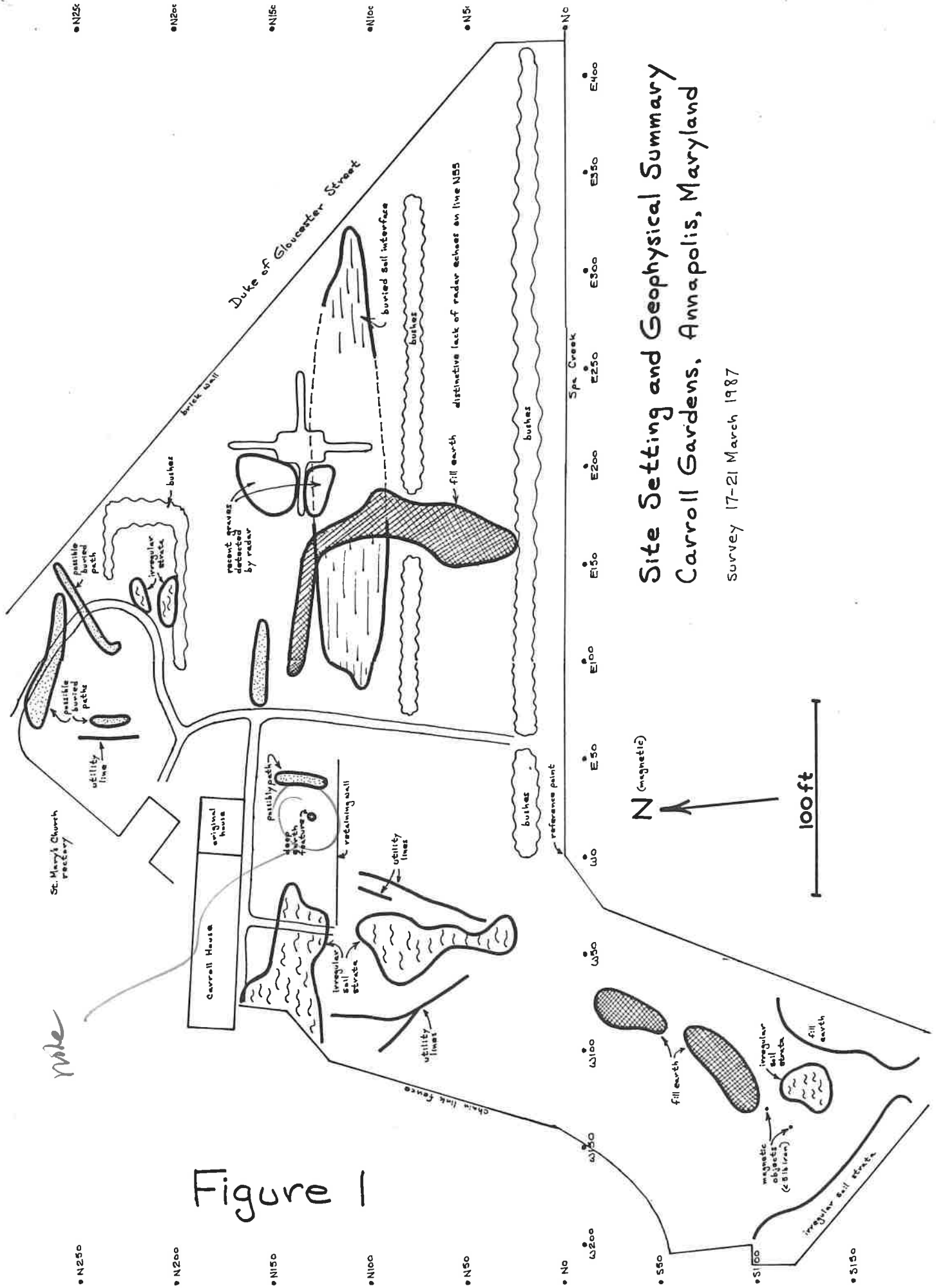


Figure 1

Site Setting and Geophysical Summary Carroll Gardens, Annapolis, Maryland

Survey 17-21 March 1987

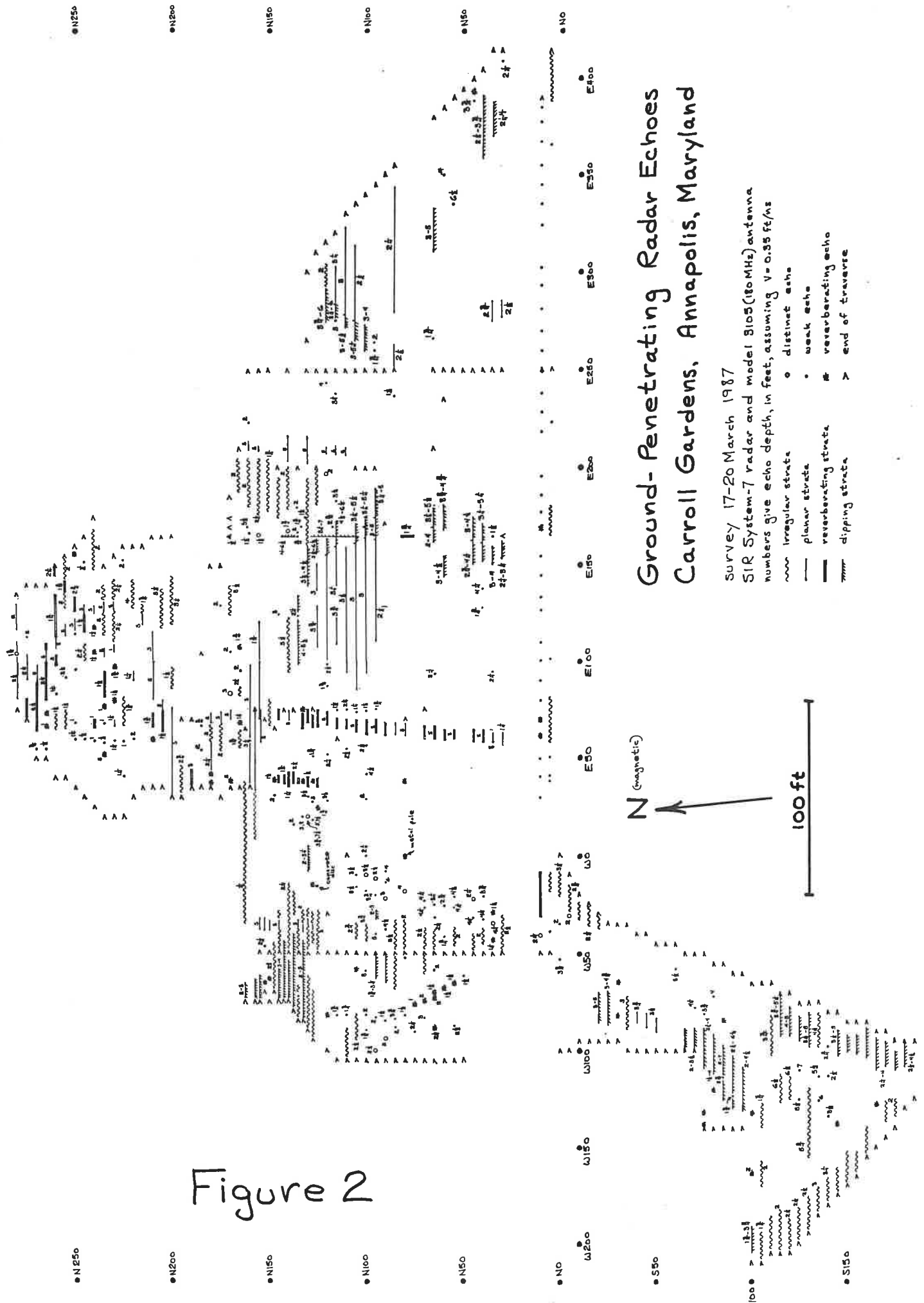


Figure 2

Ground-Penetrating Radar Echoes Carroll Gardens, Annapolis, Maryland

Survey 17-20 March 1987
SIR System-7 radar and model 8105 (180 MHz) antenna
numbers give echo depth, in feet, assuming $V = 0.35 \text{ ft/ns}$

- ~ irregular strata o distinct echo
- planar strata • weak echo
- ~ reverberating strata * reverberating echo
- ~ dipping strata > end of traverse

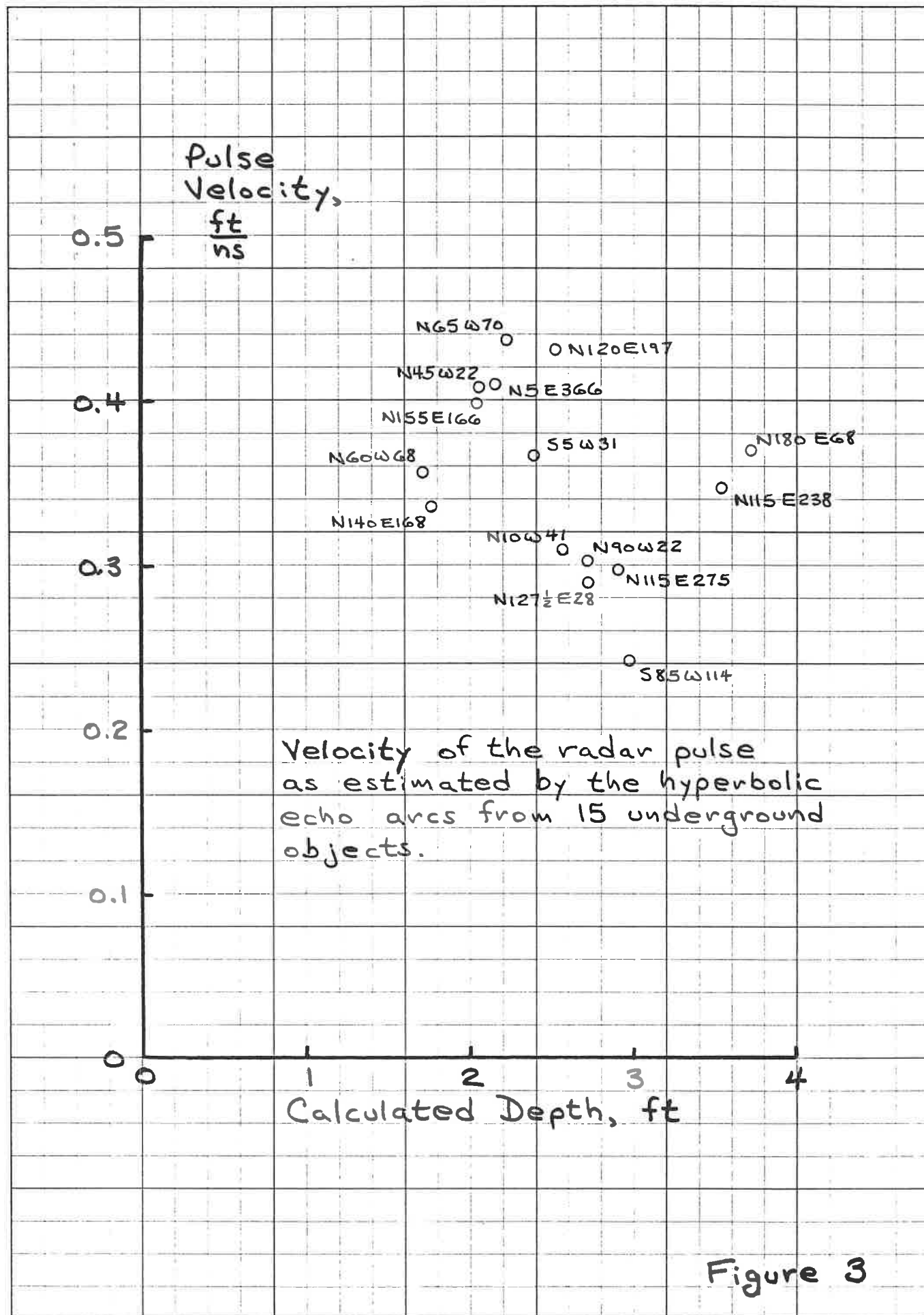


Figure 3

line N130
 markers at 5 ft intervals
 model 3105 (180 MHz) antenna
 survey 18 Mar 87

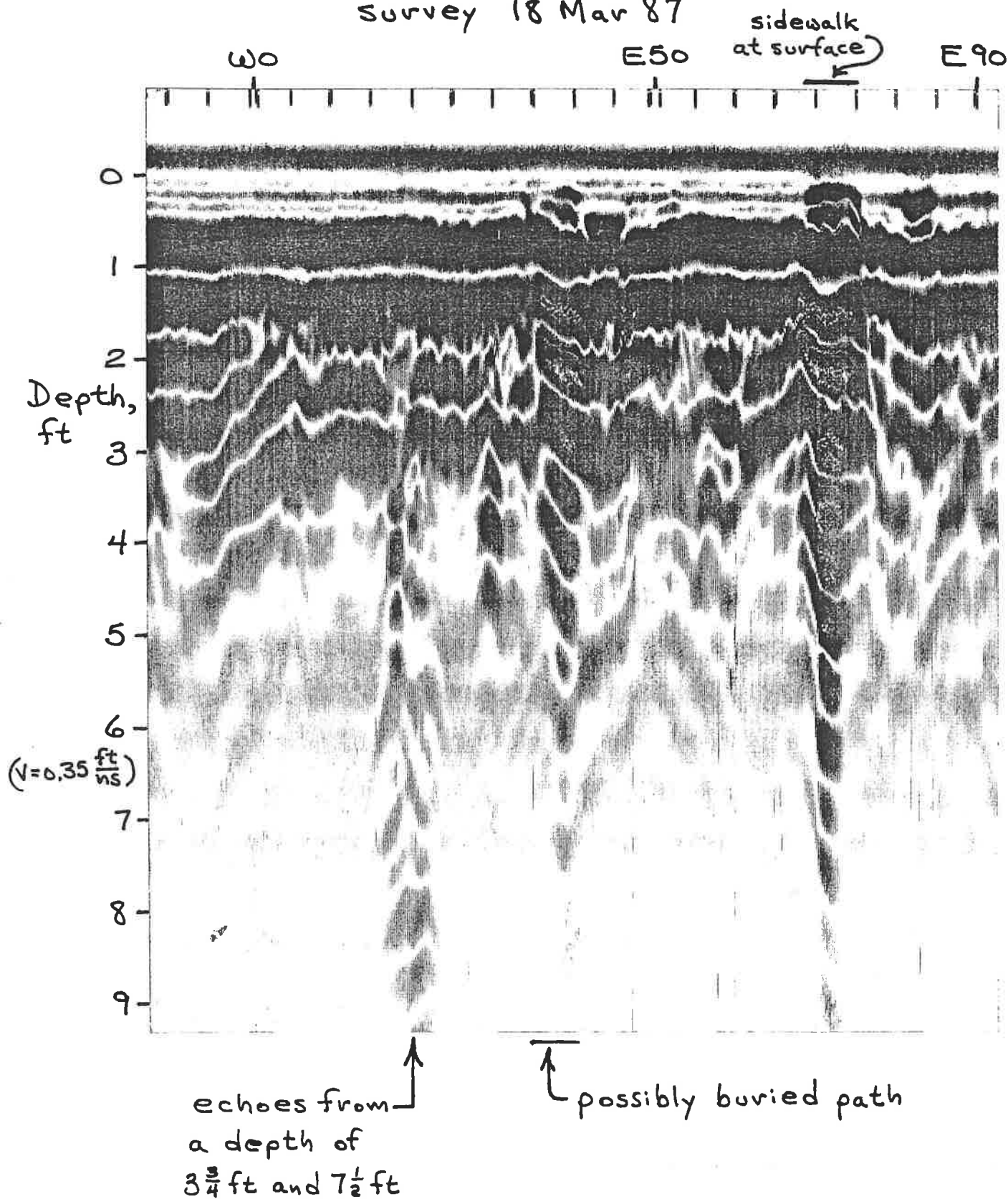
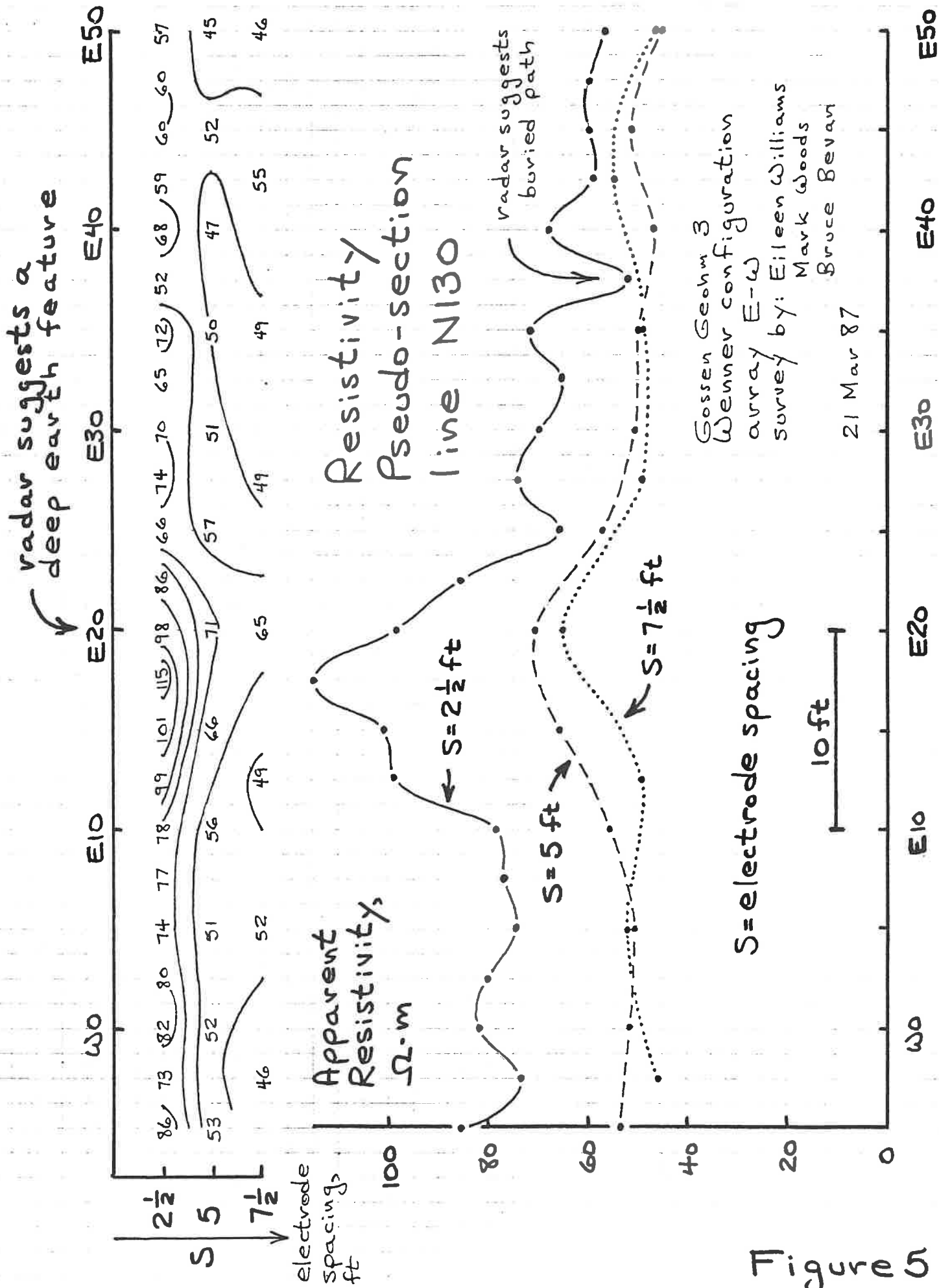


Figure 4



line N180
 markers at 5 ft intervals
 model 3105 (180 MHz) antenna
 survey 18 Mar 87

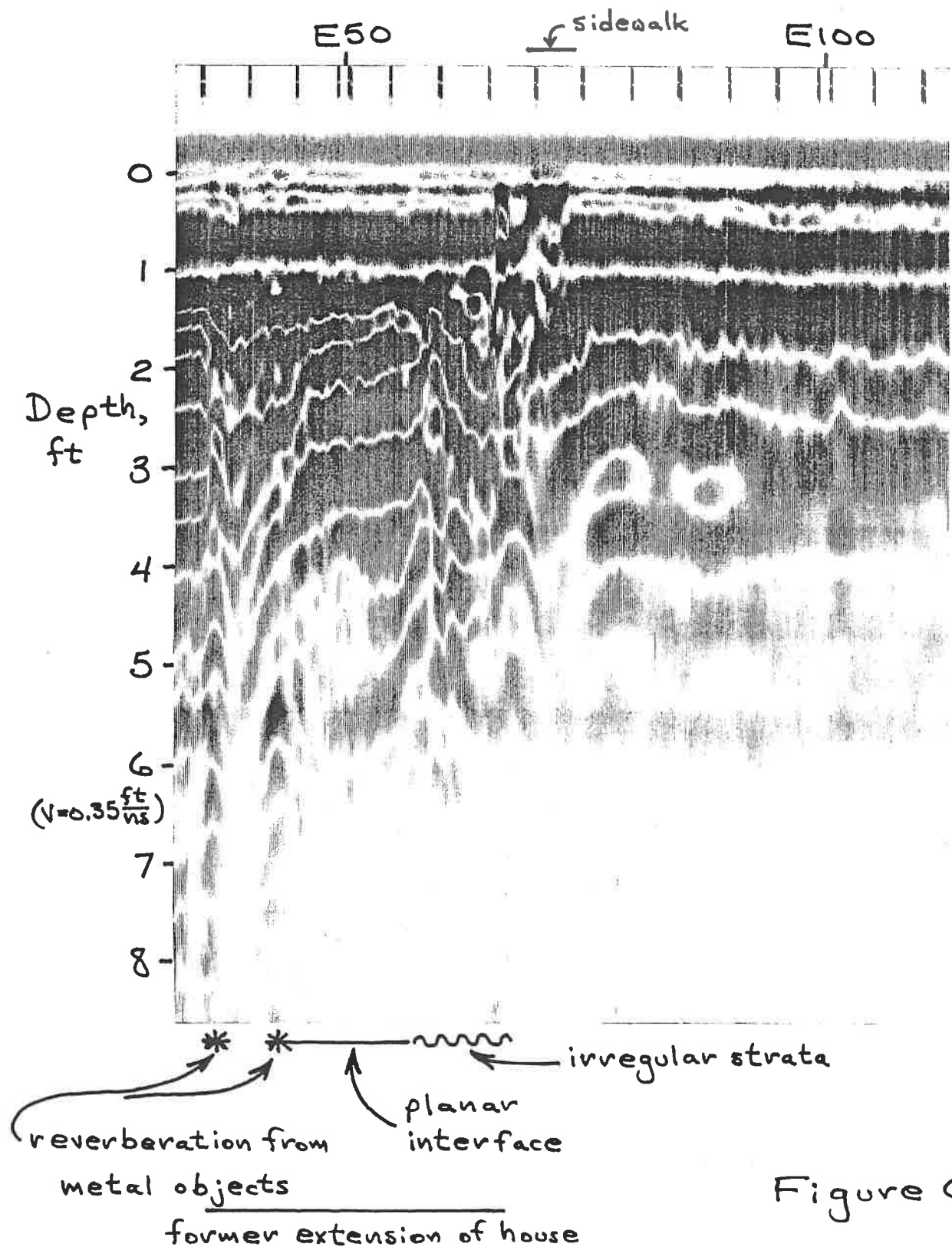
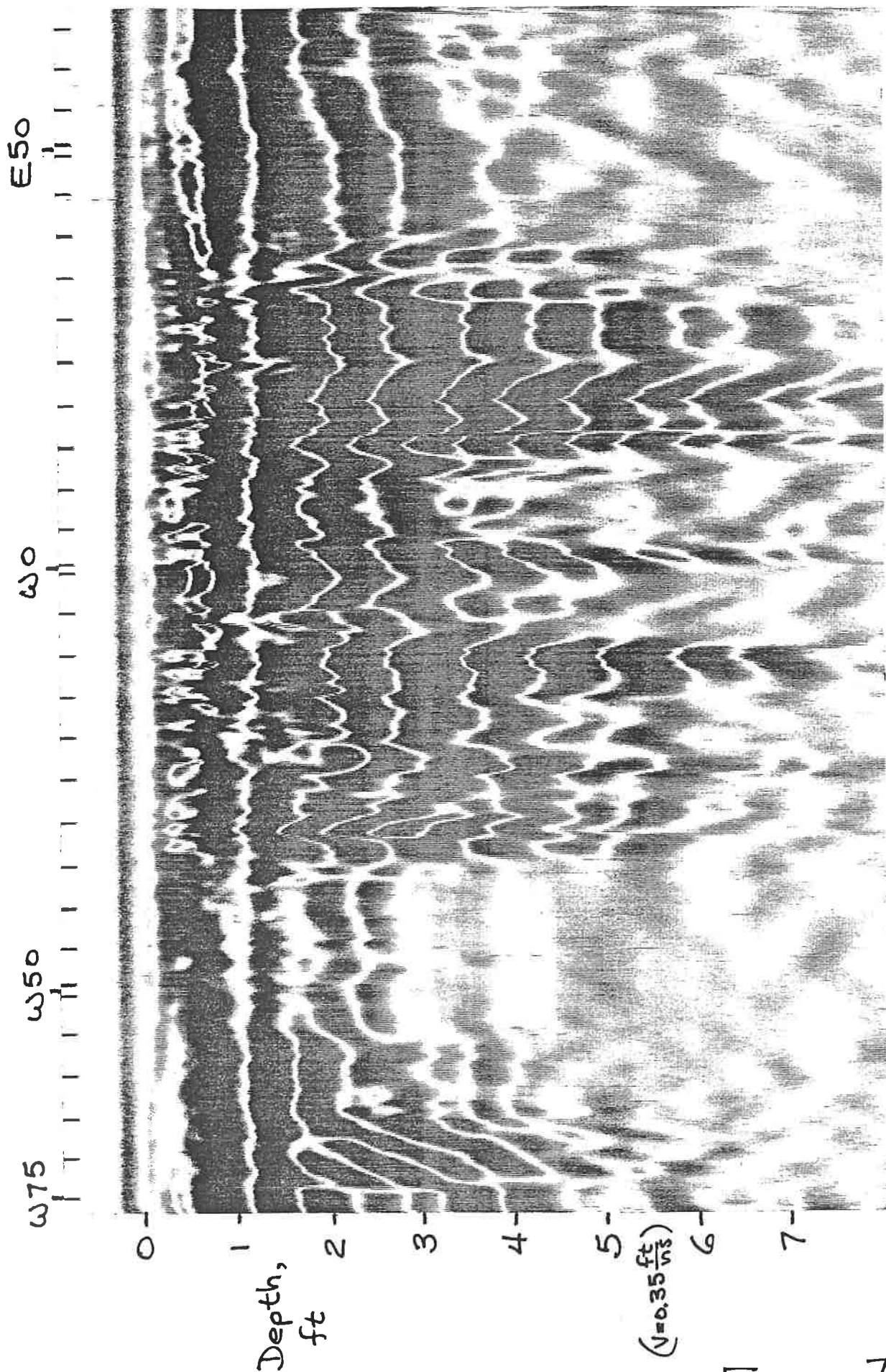


Figure 6

line N162½, markers at 5 ft interval, model 3105 (180 MHz), 20 Mar 87



reverberation from metal objects,
magnetometer detects iron

Figure 7

line N110
markers at 5 ft intervals
model 3105 (180 MHz) antenna
survey 19 Mar 87

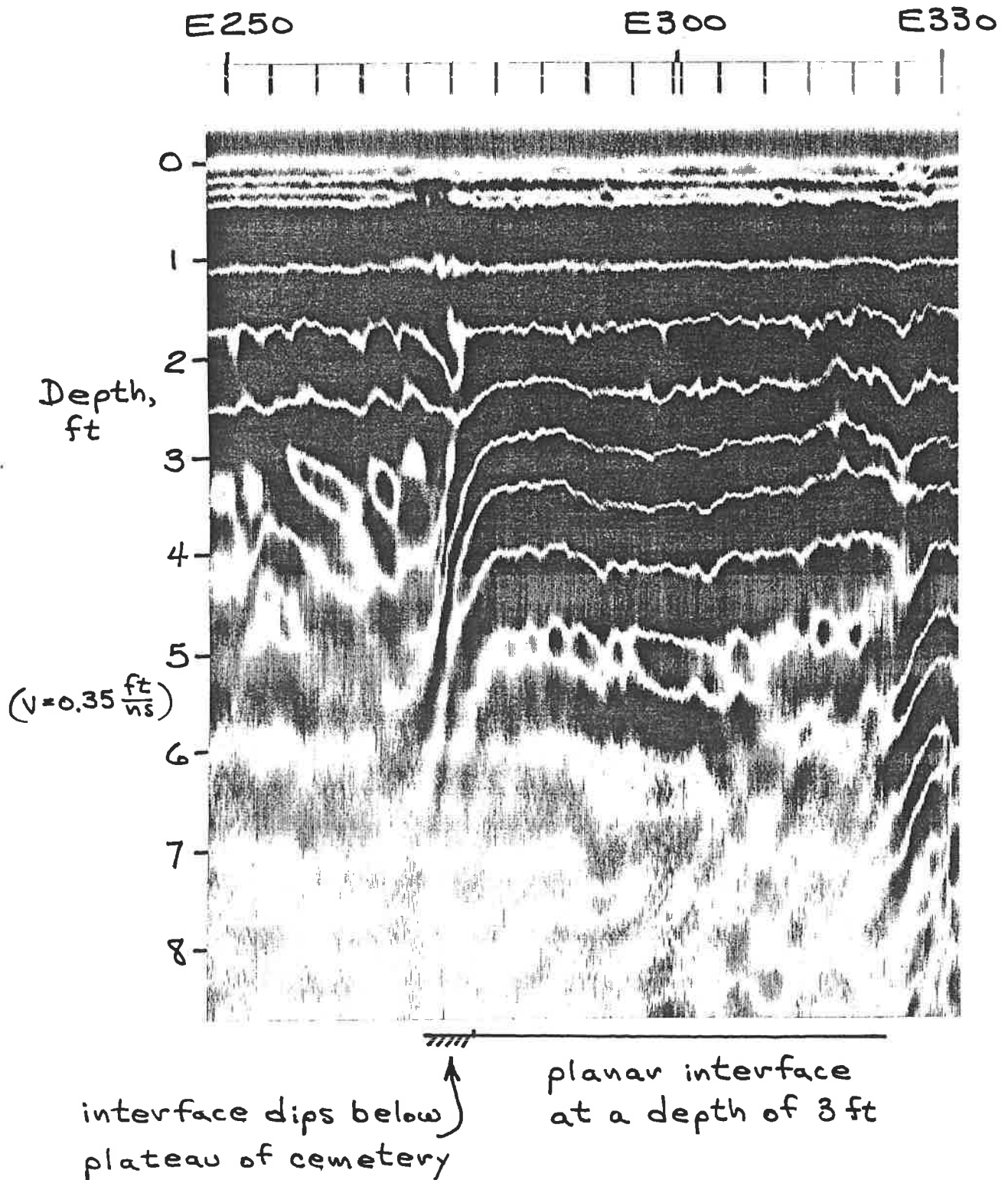


Figure 8

line E165
markers at 5 ft intervals
model 3105 (180 MHz) antenna
survey 20 Mar 87

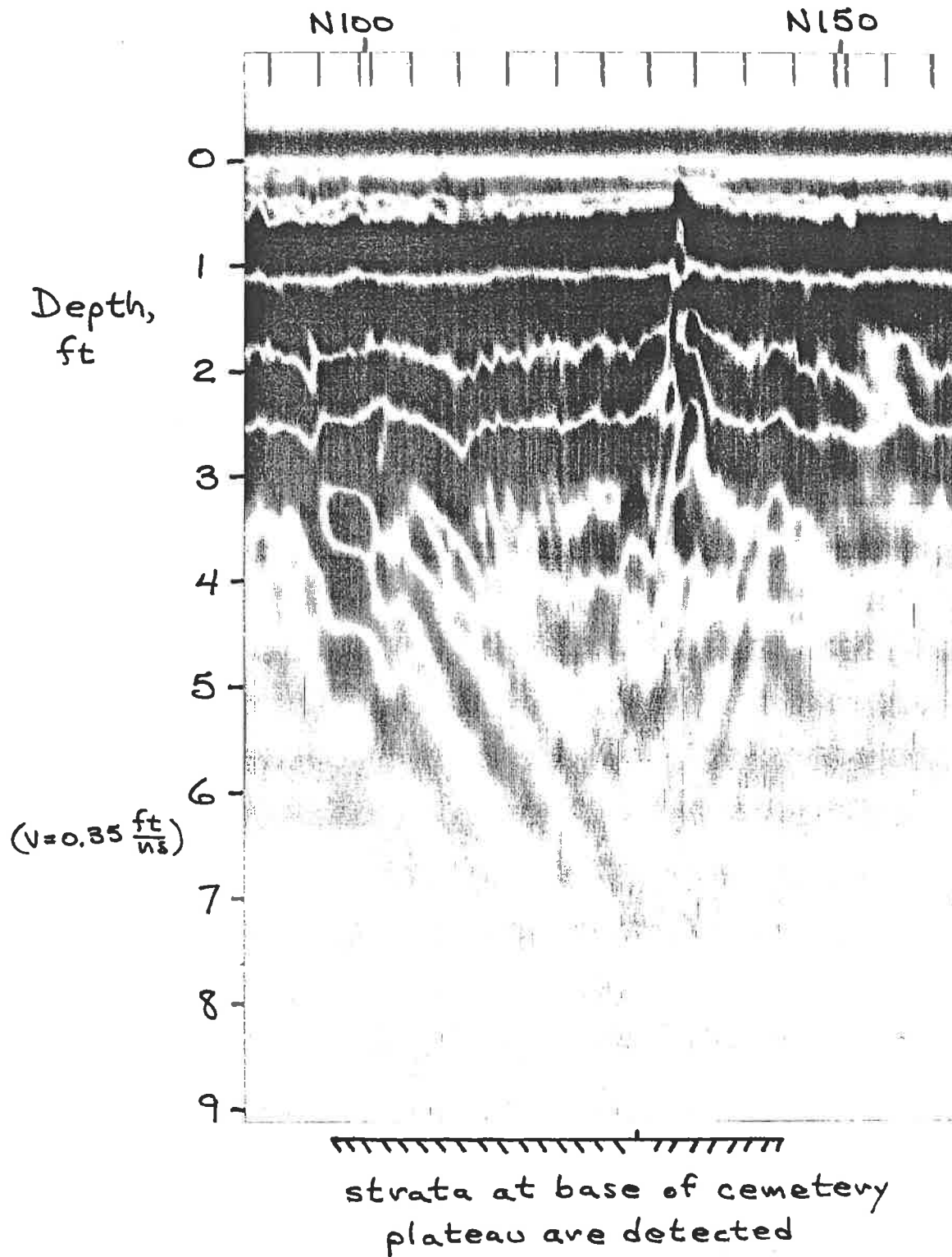


Figure 9

line N220
markers at 5 ft intervals
model 3105 (180 MHz) antenna
survey 17 Mar 87

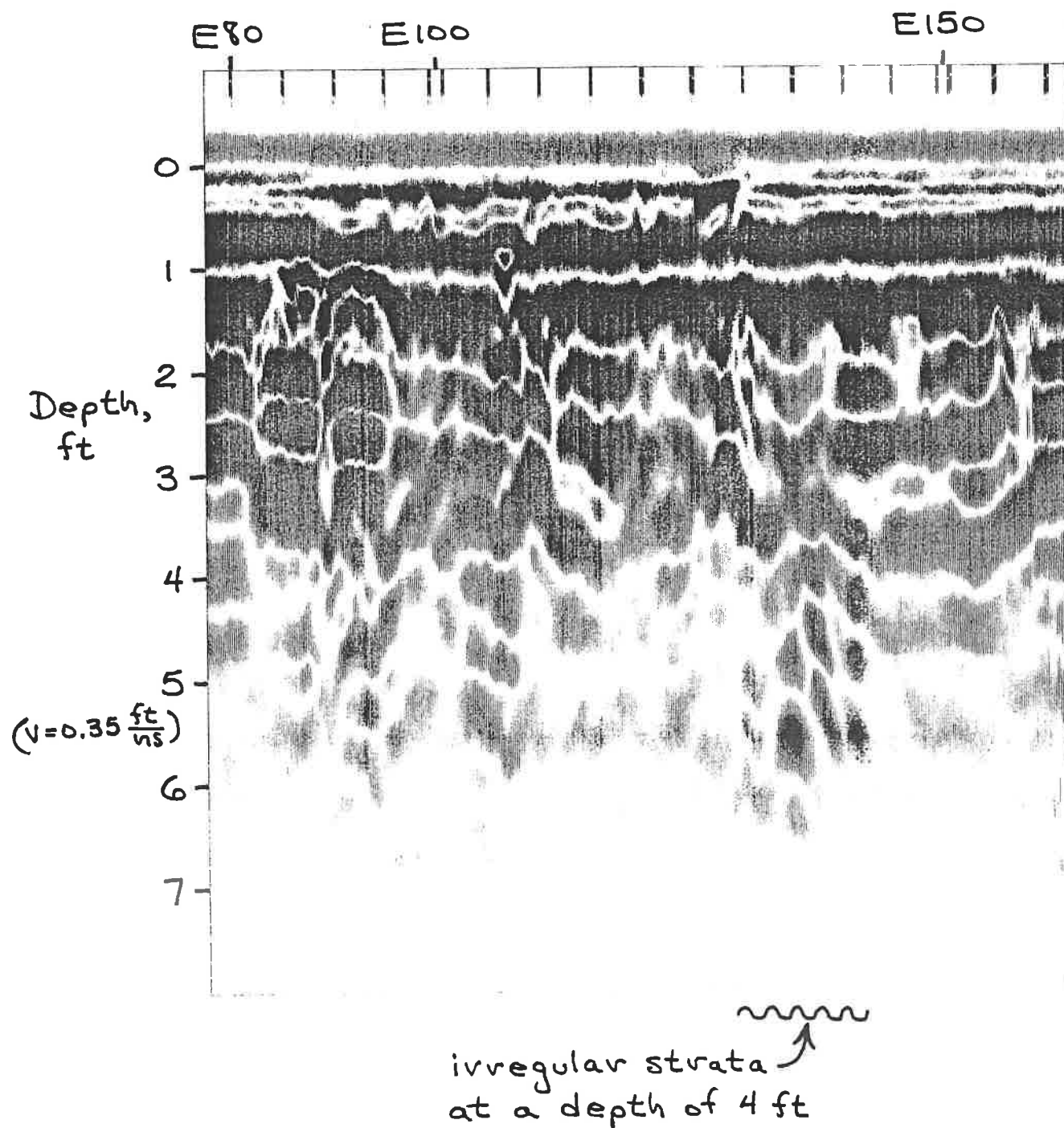
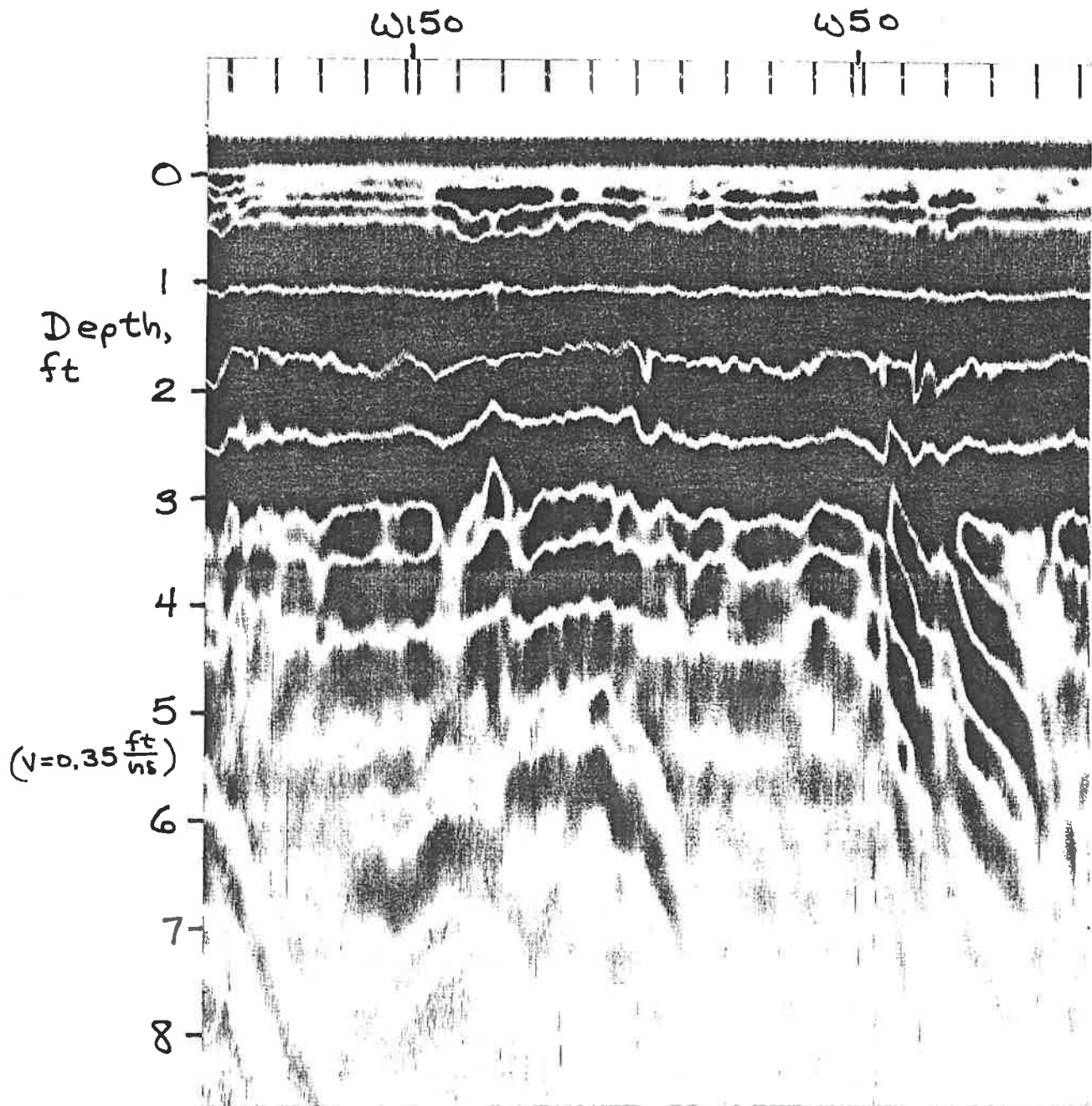


Figure 10

line S130
 markers at 5 ft intervals
 model 3105 (180 MHz) antenna
 survey 20 Mar 87



~~~~~

interface at  
 an apparent depth  
 of  $5\frac{3}{4}$  ft

fill

(depths are overestimated  
 where below water table)

Figure 11



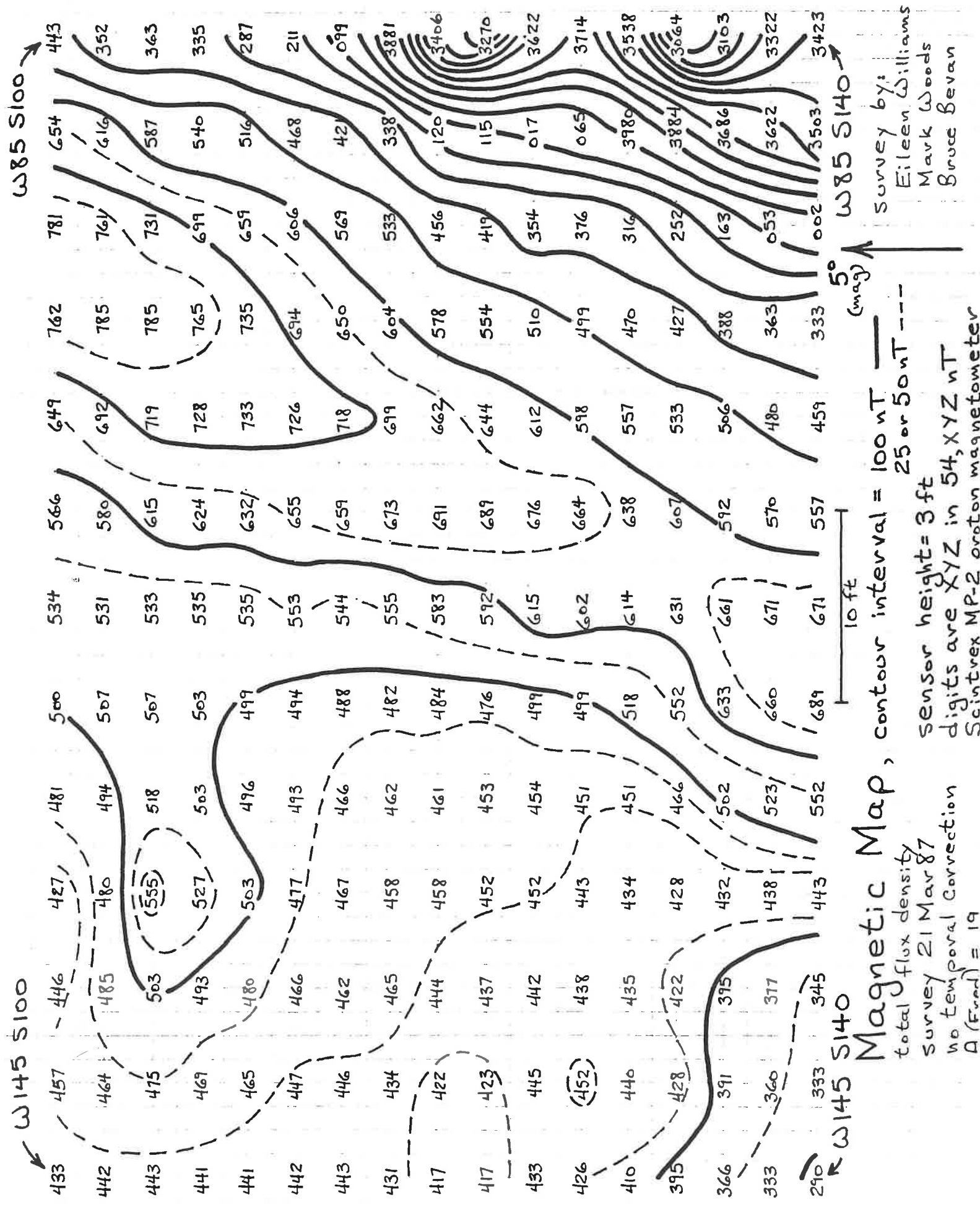


Figure 12



line 5105  
markers at 5 ft intervals  
model 3105 (180 MHz) antenna  
survey 20 Mar 87

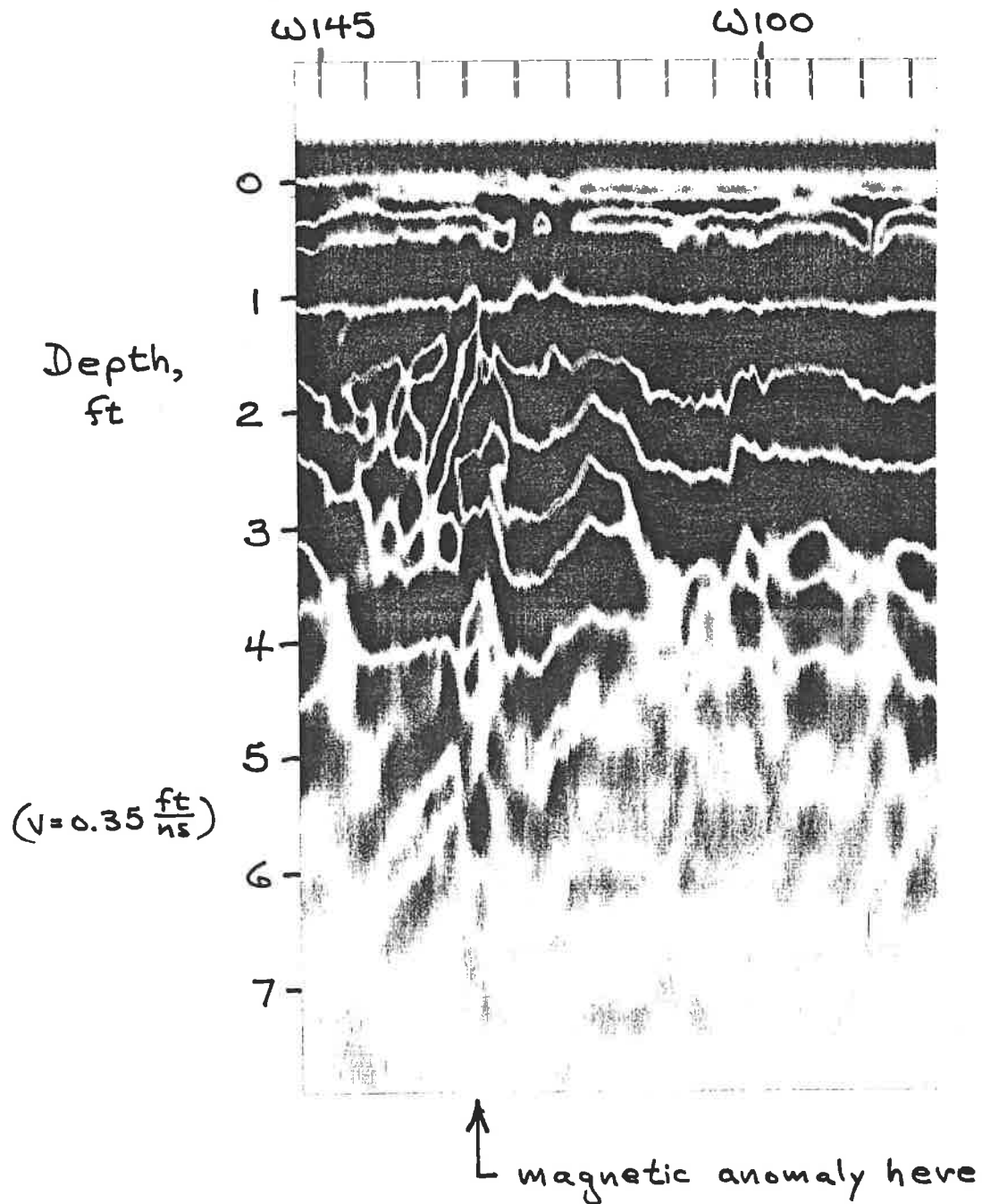
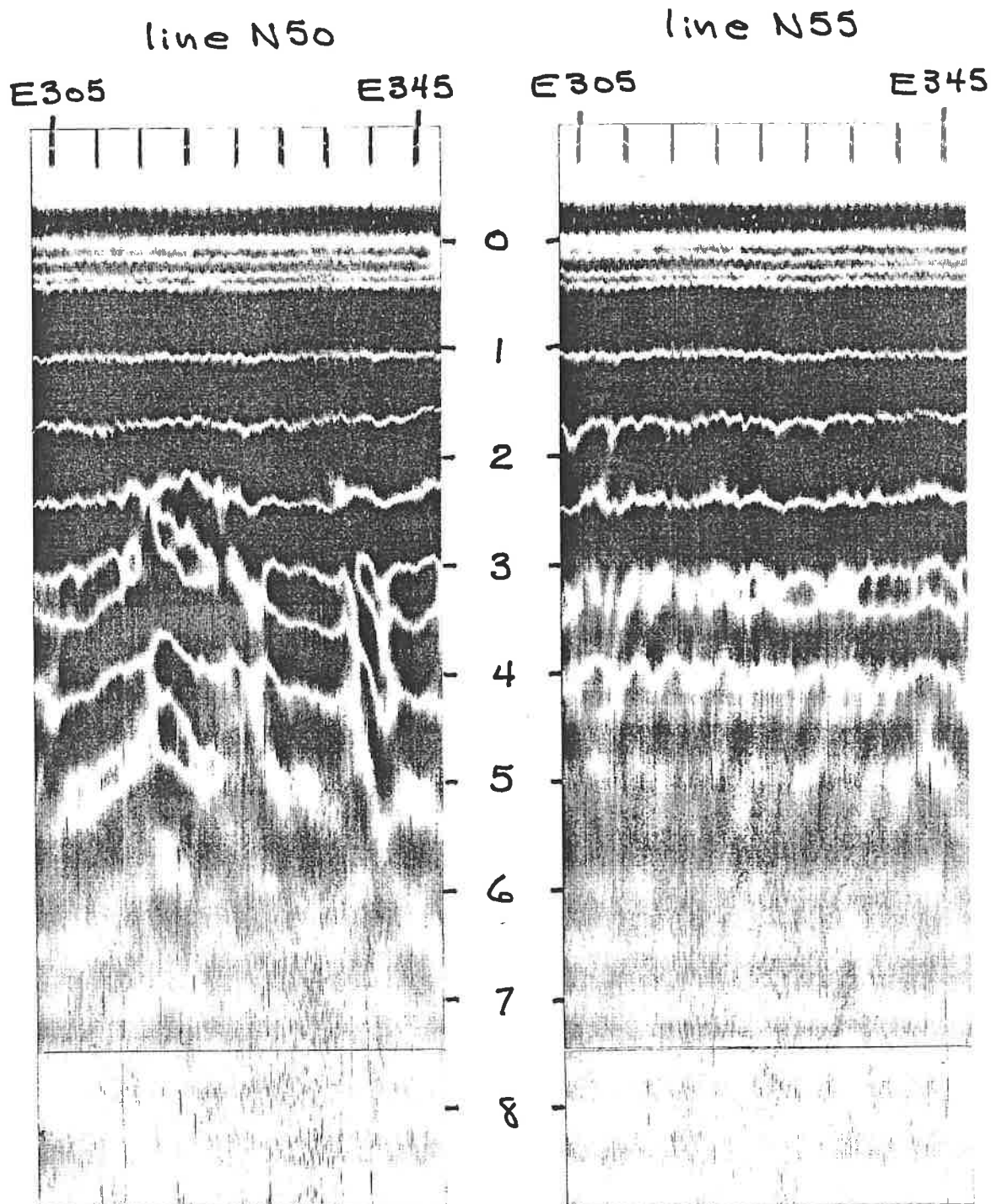


Figure 13



markers at 5 ft intervals  
model 3105 (180 MHz) antenna  
survey 19 Mar 87



Depth,  
ft

very few echoes  
detected on  
line N55

$(v=0.35 \frac{\text{ft}}{\text{ns}})$

Figure 14



# Resistivity Profiles

line N40

Apparent  
Resistivity,  
 $\Omega \cdot m$

electrode spacing =  $2\frac{1}{2}$  ft

electrode spacing = 5 ft

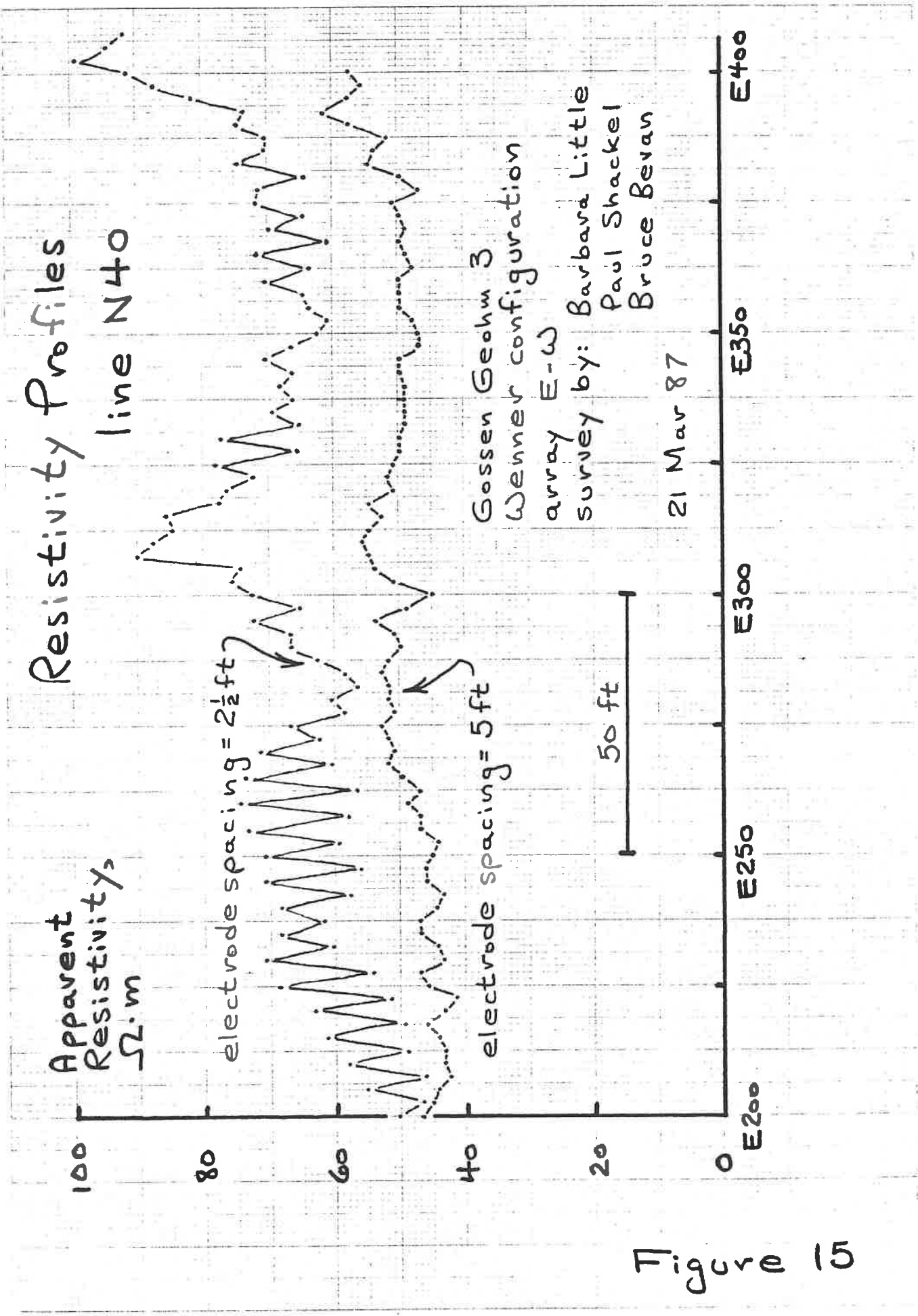
50 ft

Gossen Geohm 3  
Wenner configuration  
array E-W  
survey by: Barbara Little  
Paul Shackel  
Bruce Bevan

21 Mar 87

E200 E250 E300 E350 E400

Figure 15





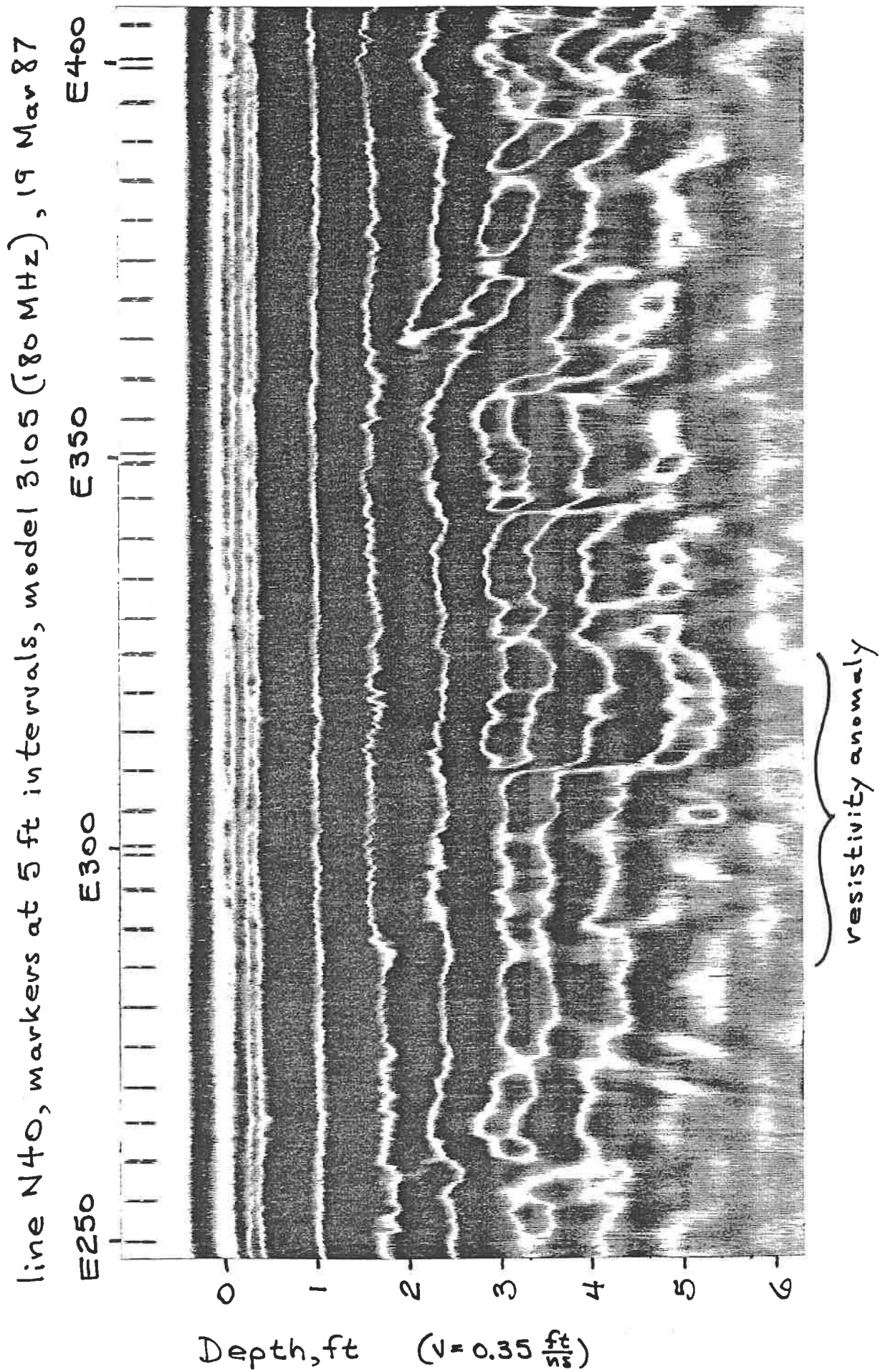


Figure 16



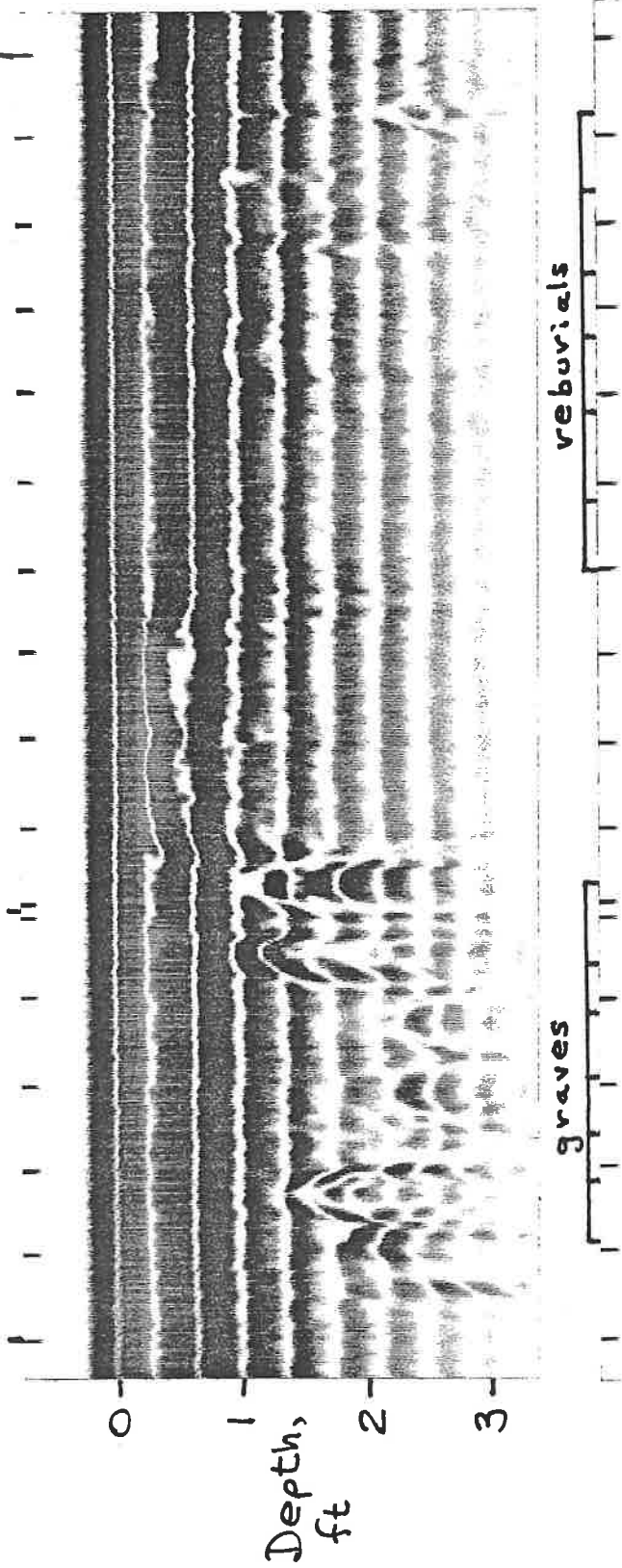
line N140, markers at 5 ft intervals, survey 20 Mar 87

E175

E200

E250

model 3102 (315 MHz)



model 3105 (180 MHz)

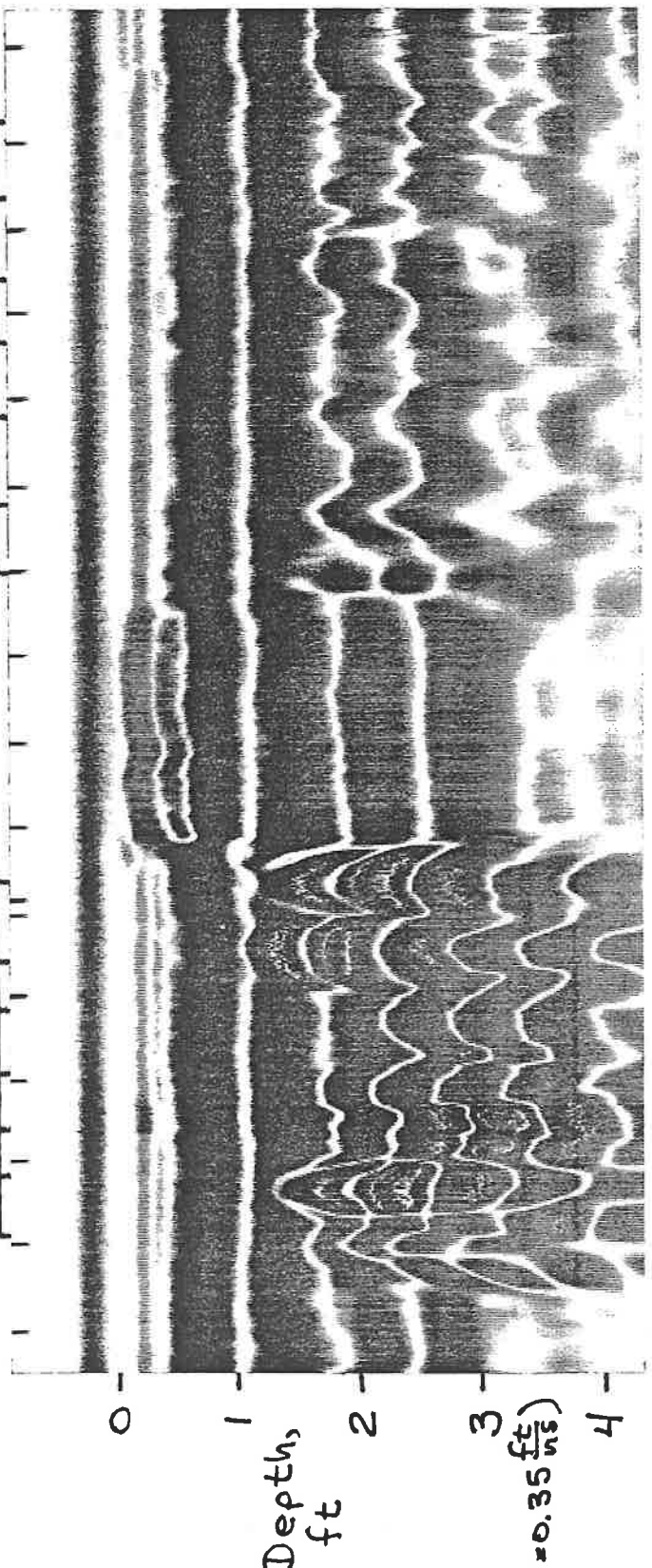
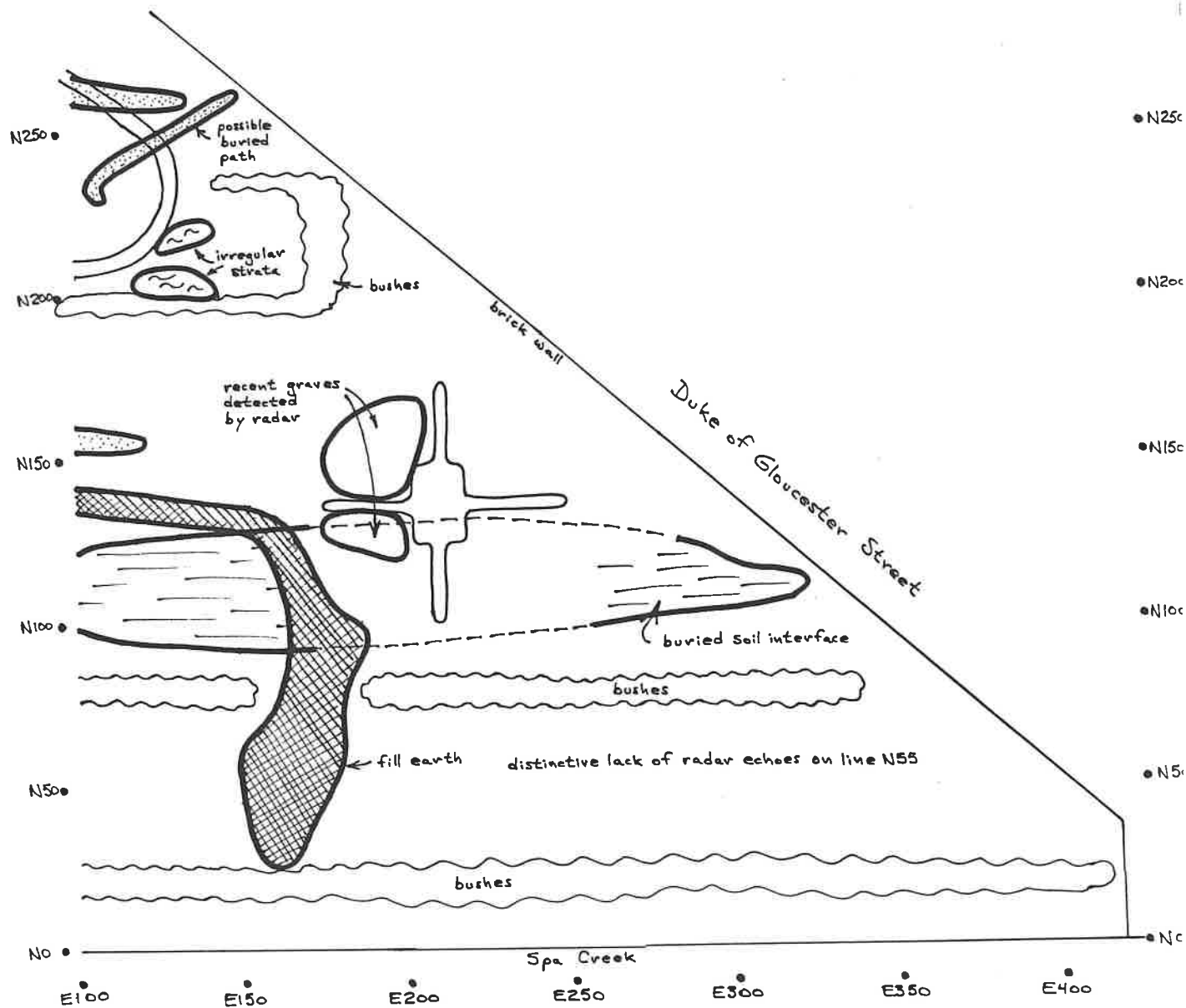


Figure 17  
( $v=0.35 \frac{ft}{ns}$ )





## Site Setting and Geophysical Summary Carroll Gardens, Annapolis, Maryland

Survey 17-21 March 1987

Fig. 1a



• N250

• N200

• N150

• N100

• N50

• N0

• S50

• S100

• S150

Figure 1

St. Mary's Church  
rectory

utility line

possible  
buried  
paths

• N250

• N200

• N150

• N100

• N50

• N0

• S50

• S100

• S150

Carroll House

original  
house

possibly path

deep  
earth  
feature

retaining wall

irregular  
soil  
strata

utility lines

utility lines

bushes

reference point

chain link fence

W200

W150

W100

W50

W0

E50

E100

N (magnetic)

100 ft

magnetic  
objects  
( $< 5$  lb iron)

fill earth

irregular  
soil  
strata

fill earth

irregular soil strata



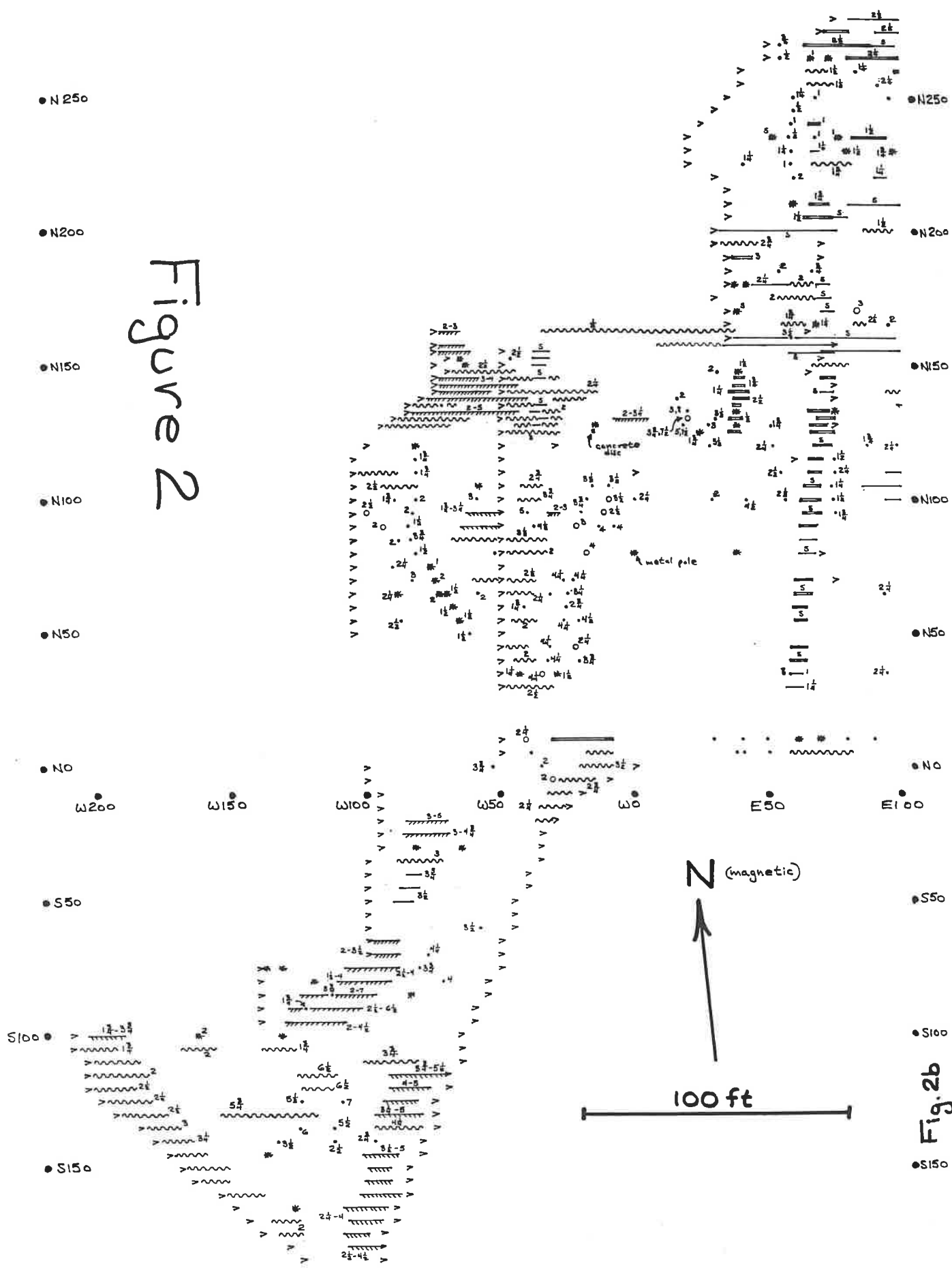
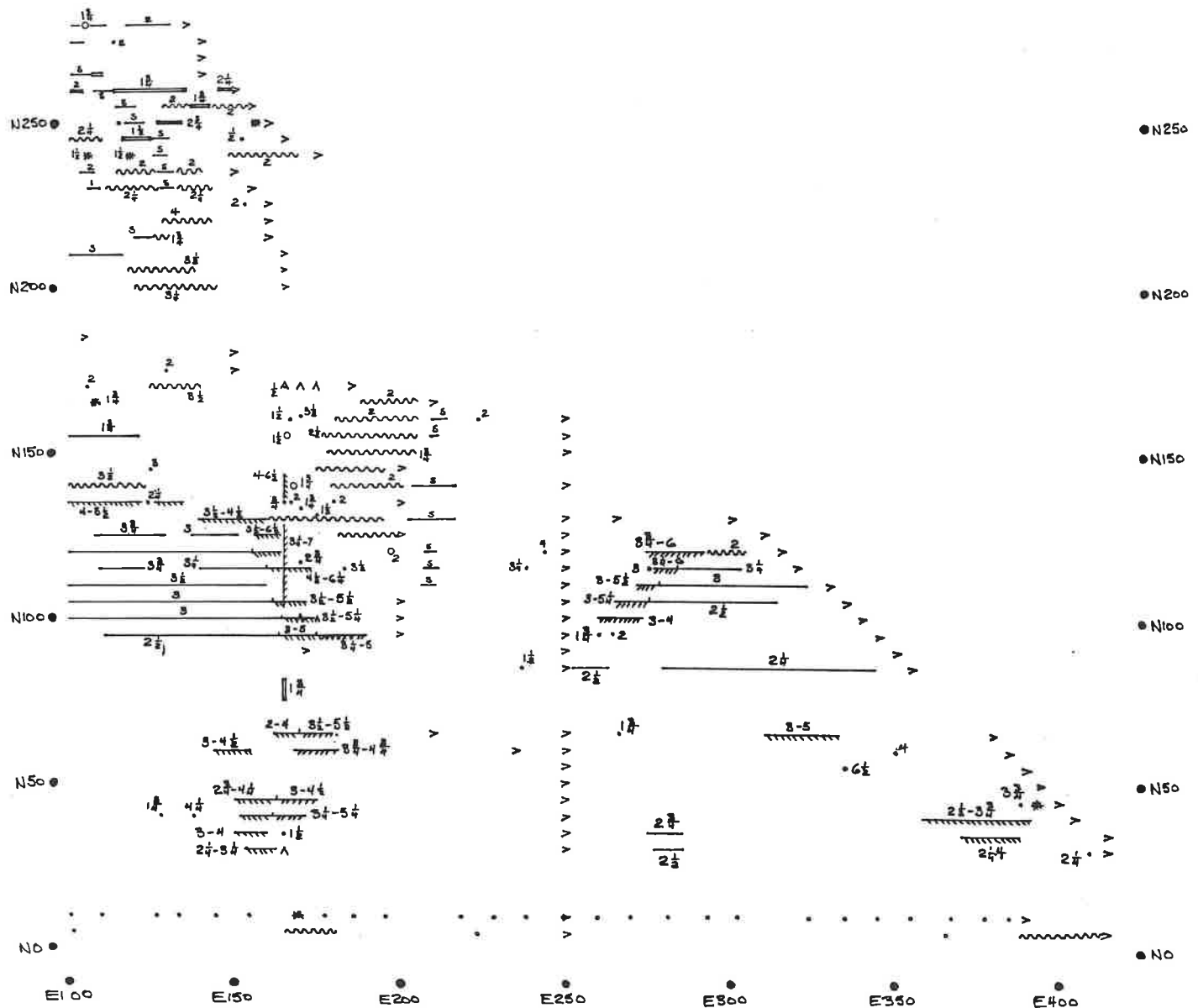


Fig. 2b





## Ground-Penetrating Radar Echoes Carroll Gardens, Annapolis, Maryland

survey 17-20 March 1987

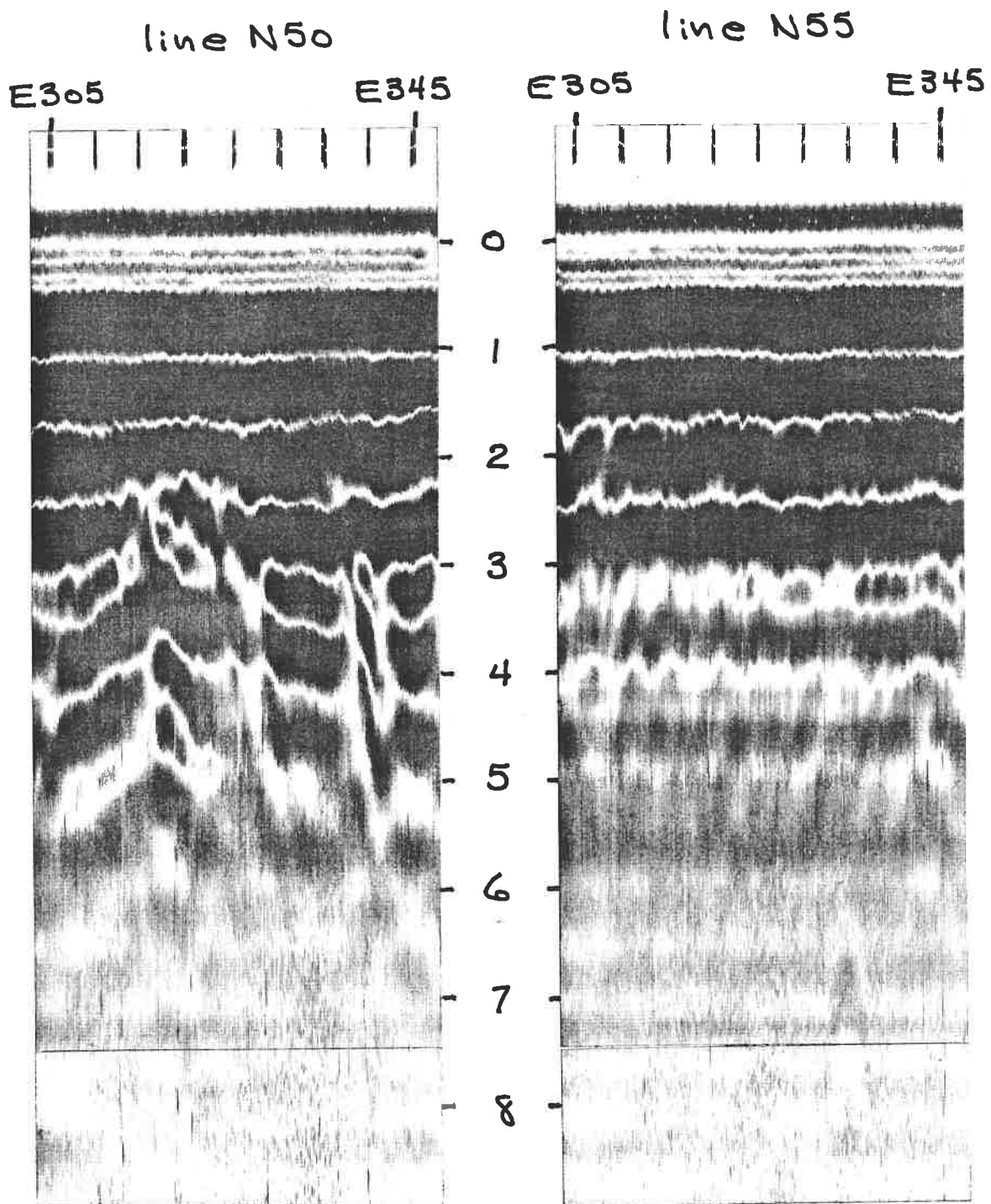
SIR System-7 radar and model 3105 (180 MHz) antenna  
numbers give echo depth, in feet, assuming  $v = 0.35$  ft/ns

- |                            |                      |
|----------------------------|----------------------|
| ~~~~~ irregular strata     | o distinct echo      |
| ———— planar strata         | • weak echo          |
| ===== reverberating strata | * reverberating echo |
| - - - - - dipping strata   | > end of traverse    |

Fig. 2a



markers at 5 ft intervals  
model 3105 (180 MHz) antenna  
survey 19 Mar 87



Depth,  
ft  
 $(v=0.35 \frac{ft}{\mu s})$

very few echoes  
detected on  
line N55

Figure 14



# Resistivity Profiles

line N40

Apparent  
Resistivity,  
 $\Omega \cdot m$

electrode spacing =  $2\frac{1}{2}$  ft

electrode spacing = 5 ft

50 ft

Gossen Geohm 3  
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survey by: Barbara Little  
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21 Mar 87

E200 E250 E300 E350 E400

Figure 15



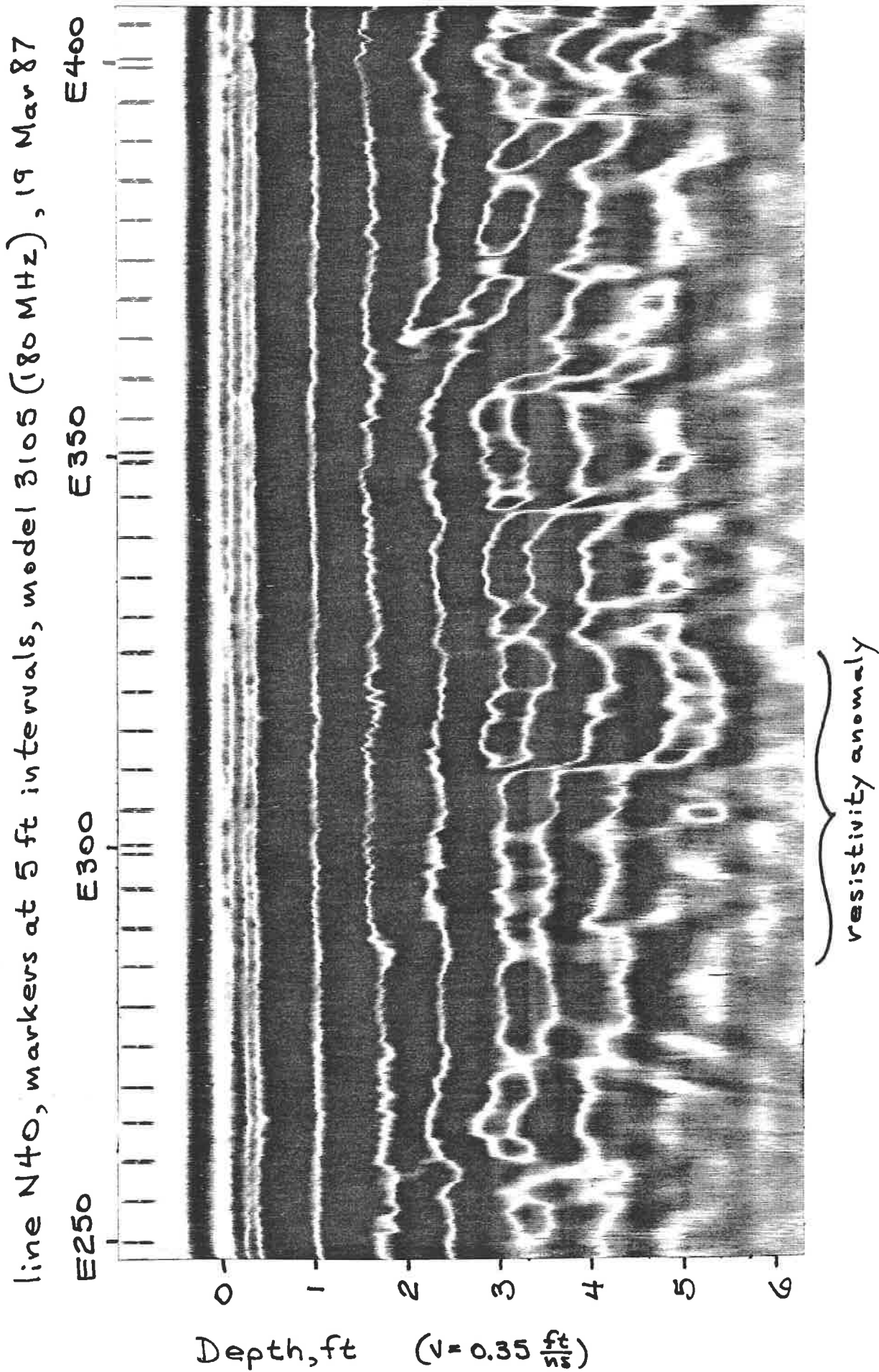
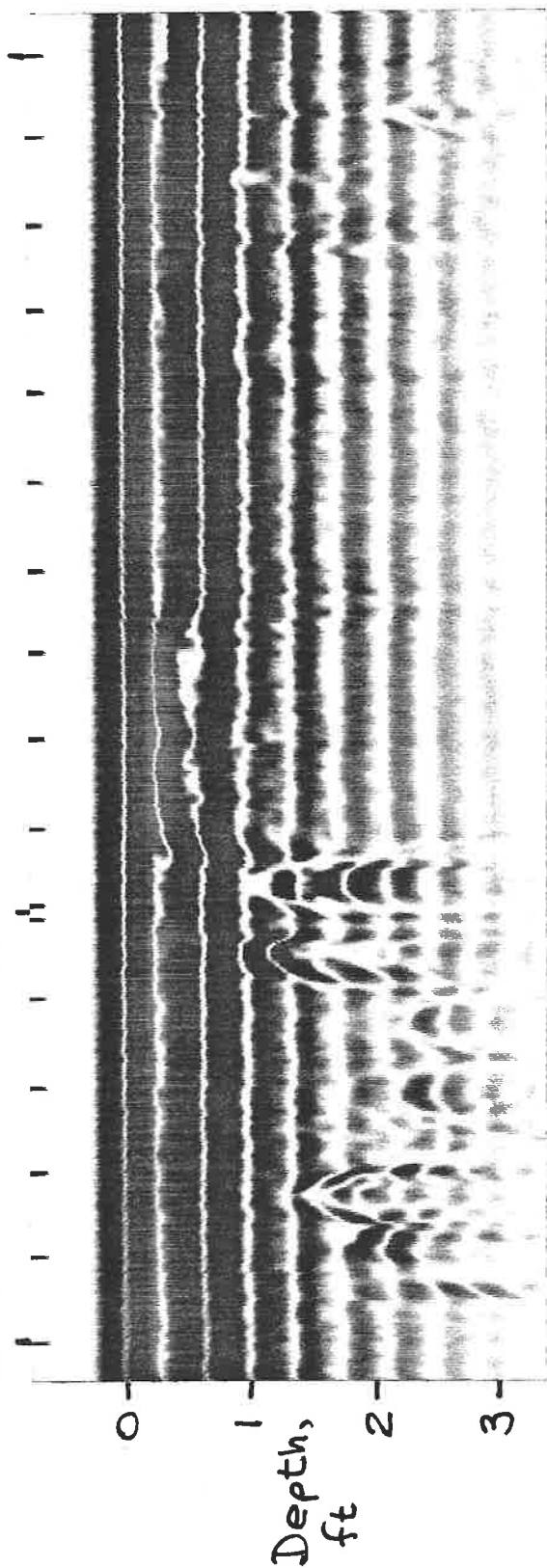


Figure 16



line N140, markers at 5 ft intervals, survey 20 Mar 87  
 E175 E200 E250

model 3102 (315 MHz)



model 3105 (180 MHz)

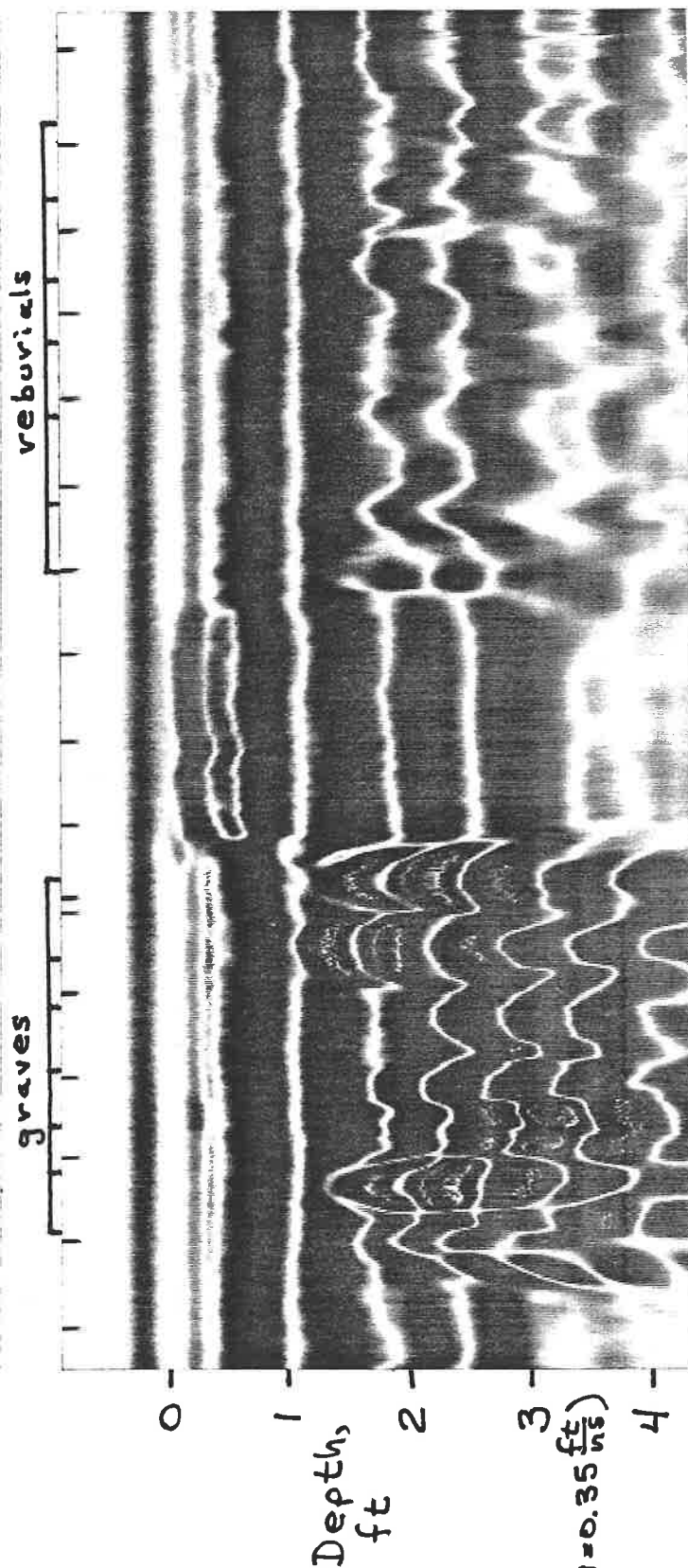
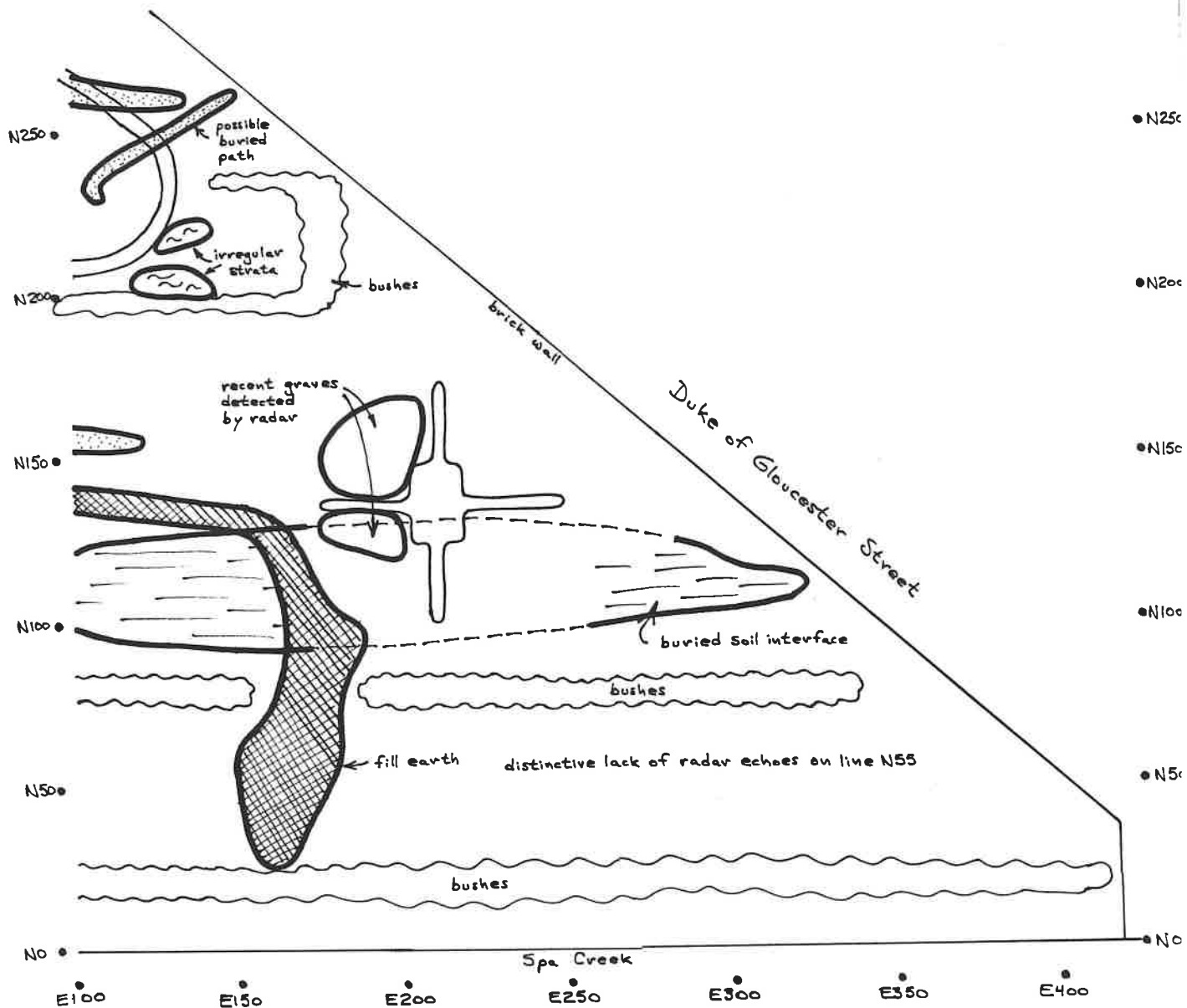


Figure 17  
 $(v=0.35 \frac{ft}{s})$





# Site Setting and Geophysical Summary Carroll Gardens, Annapolis, Maryland

Survey 17-21 March 1987

Fig. 1a



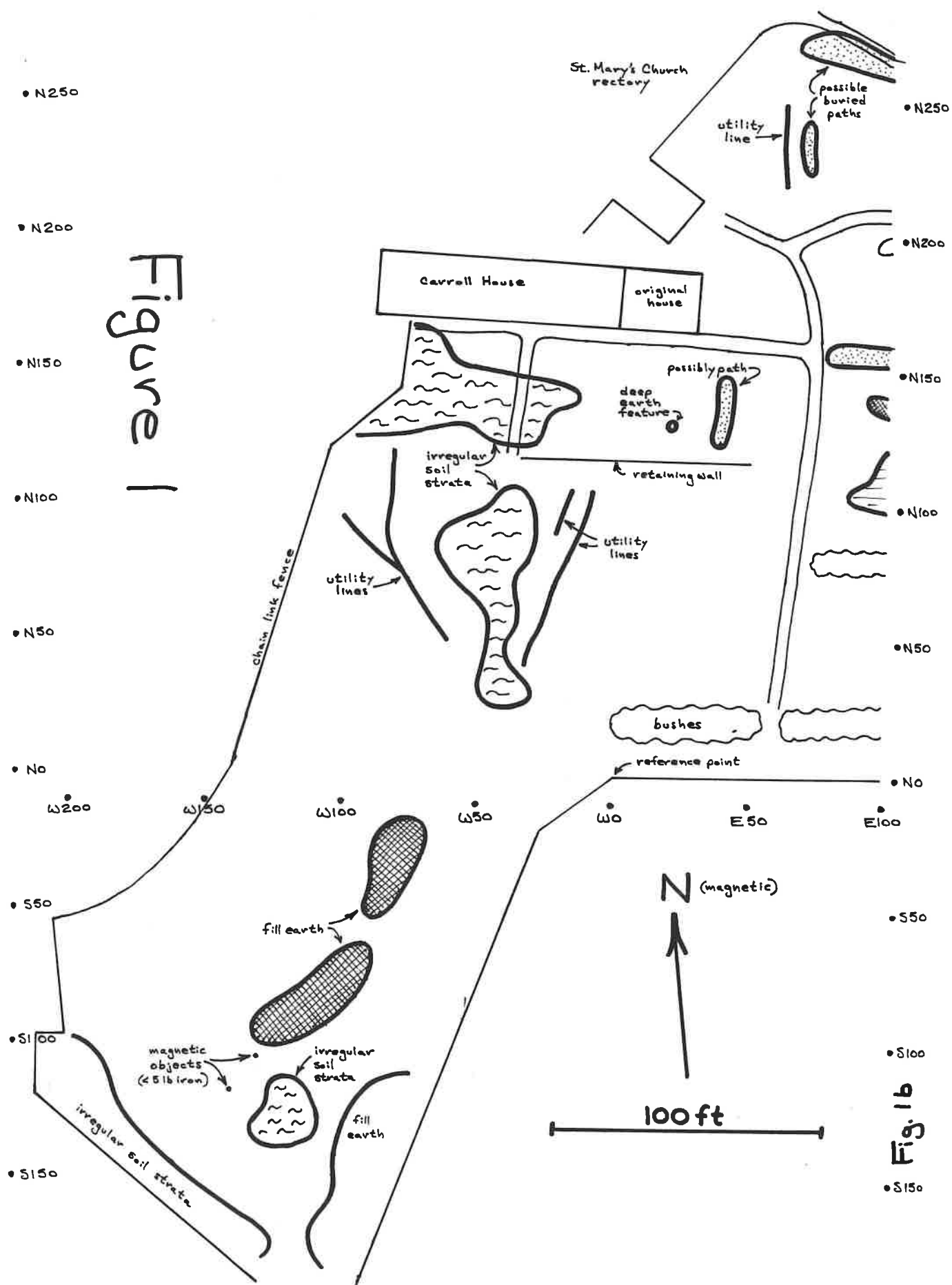
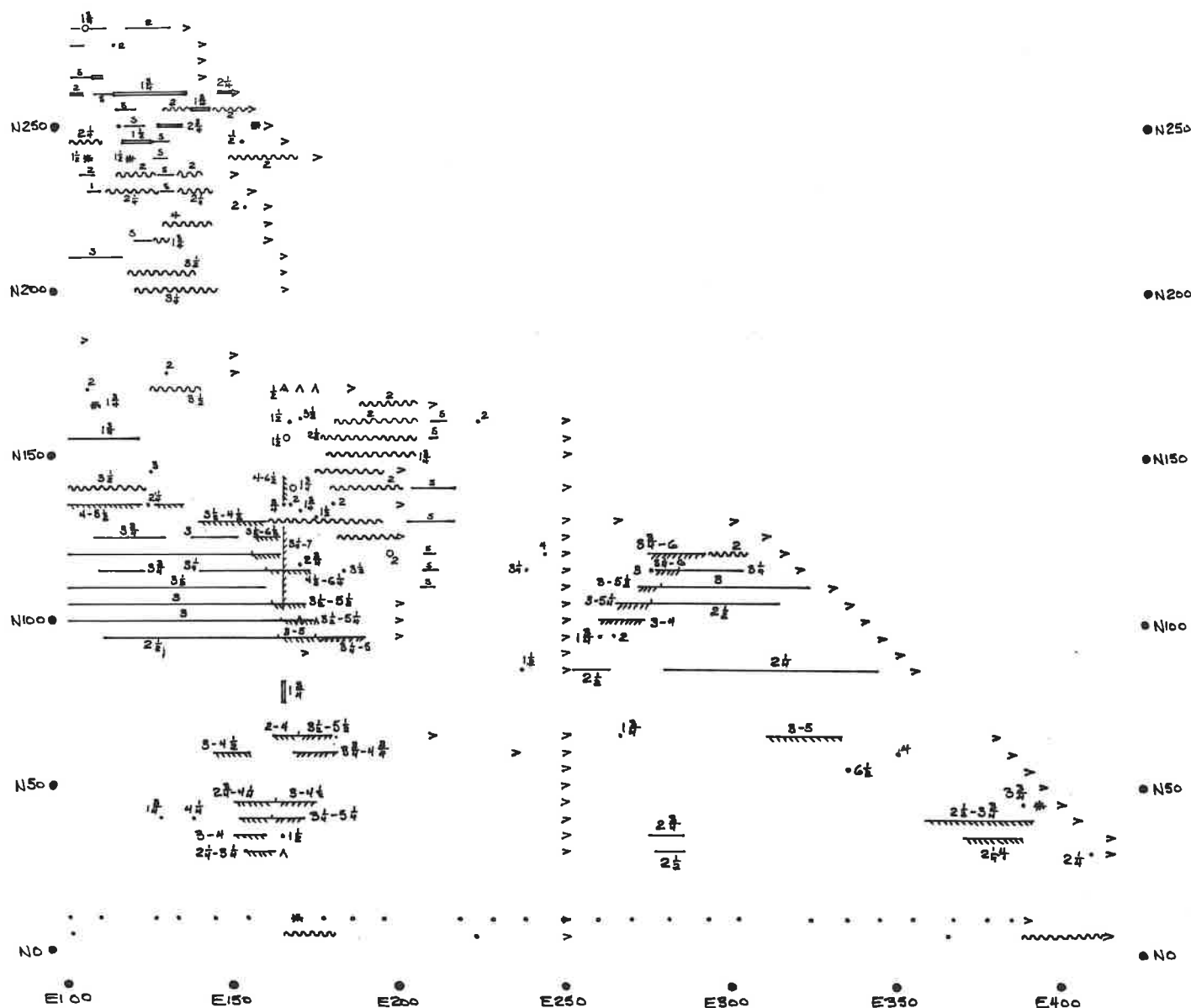


Fig. 1b









## Ground-Penetrating Radar Echoes Carroll Gardens, Annapolis, Maryland

survey 17-20 March 1987

SIR System-7 radar and model 3103 (180 MHz) antenna  
numbers give echo depth, in feet, assuming  $V = 0.35 \text{ ft/ns}$

- |                            |                      |
|----------------------------|----------------------|
| ~~~~~ irregular strata     | o distinct echo      |
| ———— planar strata         | • weak echo          |
| ===== reverberating strata | * reverberating echo |
| ~~~~~ dipping strata       | > end of traverse    |

Fig. 2a



CHARLES CARROLL OF CARROLLTON 250TH ANNIVERSARY COMMITTEE  
Charles Carroll House  
109 Duke of Gloucester St.  
Annapolis, Md. 21401

For Immediate Release

June 3, 1987  
No. 87-4(A)

MARYLAND HUMANITIES COUNCIL TO FUND ARCHAEOLOGY AT CARROLL HOUSE

The Maryland Humanities Council has awarded a grant of \$35,000 to the Charles Carroll of Carrollton 250th Anniversary Committee to finance an archaeological excavation of the grounds of the historic Charles Carroll House in Annapolis.

The work will be conducted by Archaeology In Annapolis, a group sponsored by the University of Maryland School of Urban Archaeology, which has been excavating at several sites in the capital city during the past six years in cooperation with Historic Annapolis, Inc. It has found hundreds of thousands of artifacts for historical research. Digging started during the first week of June and sites will be open for public tours in mid-July, according to Anniversary Committee officials. Visitors will be briefed by guides at the site. Next spring, elementary school children will be able to tour.

(More)

The Maryland Humanities Council is a private, non-profit affiliate of the National Endowment for the Humanities and provides financial support in the form of grants to cultural programs throughout the State of Maryland. Its chairman is Dr. R. Cresap Davis with offices at 516 N. Charles St., Baltimore.

The Charles Carroll House, located off Duke of Gloucester St. behind St. Mary's Church, dates back to the 1720s and is the largest archaeologically intact 18th century property in the city's historic district. A geophysical survey with ground-penetrating radar was recently carried out.

September 19 is the 250th anniversary of the birth of Charles Carroll of Carrollton (1737-1832), who was born and lived in the mansion. He was one of four Marylanders to sign the Declaration of Independence. An open house and other events will be held at the mansion that weekend, sponsored by the Anniversary Committee. Included in the program will be artifacts uncovered by the archaeologists.

# # #

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