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MOST Project -2

INFORMAL MANUSCRIPT REPORT

NO. ~~0-113-63~~

LEVEL II

TITLE

OCEANOGRAPHY FOR SUBMARINE LONG RANGE SONAR IN ATLANTIC AREA J FOR JANUARY AND FEBRUARY

AD A0 66763

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MARINE SCIENCES DEPARTMENT
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WASHINGTON, D.C. 20390

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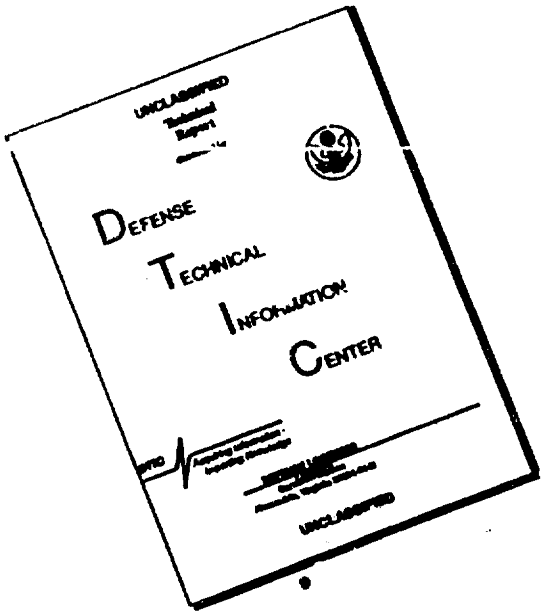

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1. AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W

2. PREDICTED VALUES FOR QUADRANGLE FOR JANUARY THROUGH FEBRUARY (SOURCE DEPTH = 150 FEET)

Sound Speed at Sonar (150 feet)	5042 ft/sec
Layer Depth	262 ft
Layer Depth Sound Speed	5043 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms, surface and bottom reflected rays are not considered)

Speed at Bottom (Fig 4)	5100 ft/sec
Minimum Refracted Angle (Fig 6)	-3° (down)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-5° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8)	4930 ft/sec
Initial Range (Fig 7) at the Surface (-7° down)	72.7 kyds
Reswept Surface Zone Width (Fig 2)	No Retracing Apparent

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	-10° (down)
Predicted Detection Range (Fig 7)	56.8 kyds
Mean Horizontal Speed (Fig 8)	4882 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db Range (Table 1)	37.5 kyds

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Cont'

I AREA: One-degree quadrangle 22° to 23°N, 69°45' to 70°45'W

II PREDICTED VALUES FOR QUADRANGLE FOR JANUARY THROUGH FEBRUARY (SOURCE DEPTH = 250 FEET)

Sound Speed at Sonar (250 feet)	5043 ft/sec
Layer Depth	262 ft
Layer Depth Sound Speed	5043 ft/sec

Convergence Zone (For a depth of approximately 3,000 fathoms, surface and bottom reflected rays are not considered)

Speed at Bottom (Fig 4)	5100 ft/sec
Minimum Refracted Angle (Fig 6)	-1° (down)
Maximum Refracted Angle (Fig 6)	-7° (down)
Average Angle	-4° (down)
Best Equipment Tilt (D/E) Angle	0°
Mean Horizontal Speed for Best Tilt (D/E) Angle (Fig 8a)	4931 ft/sec
Initial Range (Fig 7a) at the Surface (-7° down)	72.4 kyds
Reswept Surface Zone Width (Fig 2a)	No Retracing Apparent

Bottom Bounce (For a depth of approximately 3,000 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence +3° =	-10° (down)
Predicted Detection Range (Fig 7a)	55.8 kyds
Mean Horizontal Speed (Fig 8a)	4878 ft/sec

Near Surface Path Detection

12-knot Figure of Merit + Target Strength 215 db Range (Table 1)	37.5 kyds

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CONT → 3- ~~III~~ USE OF GRAPHS FOR PARTICULAR CONDITIONS (C) ——— ABSTRACT

1. From BT temperature trace, determine and tabulate sound speed at sonar depth (V_1) and at layer depth (V_2) from Figure 5. Tabulate bottom (V_3) from Figure 4.

2. Convergence zone

a. Determine if convergence zone is possible. The difference between the bottom speed (V_3) and speed at sonar depth (V_1) will give a qualitative indication of convergence zone existence according to the table below.

$V_3 - V_1$ (ft/sec)	Convergence Zone Existence
Negative	None
0-30	Borderline
>30	Strong

b. To determine angular width and midpoint of totally refracted rays usable in convergence zone:

(1) Determine minimum angle for totally refracted ray from Figure 6 using sound speed at sonar depth (V_1) and sound speed at layer depth (V_2) (first vertexing speed). With no layer, the minimum angle is 0°.
(2) Determine maximum angle for totally refracted ray from Figure 6 using sound speed at sonar depth and bottom sound speed (V_3) (second vertexing speed) from Figure 4. (Bottom sound speed may also be obtained from sound speed profile in Figure 1).
(3) Best tilt (D/E) angle for convergence zone will be that equipment tilt nearest the average of the minimum and maximum angles.

3. Bottom Bounce

a. Refracted ray angle (to the nearest degree) tangent to the bottom [Item 2 b (2), above] plus 3° determines the minimum useful bottom bounce Ray angle.

b. Use the equipment tilt (D/E) angle nearest to the minimum useful bottom bounce Ray angle as computed in Item III 3 a.

4. Near surface path detection range

a. Use Table 1.

TABLE 1 MEAN SURFACE PATH DETECTION RANGE (KYDS) OF A SHALLOW TARGET

LAYER DEPTH (FEET)	FIGURE OF MERIT PLUS TARGET STRENGTH (ALLOWABLE TWO-WAY LOSS IN DB)										
	170	175	180	185	190	195	200	205	210	215	220
0	3	3	4	4	5	5	6	7	8	8	9
50	7	8	10	11	12	14	15	17	19	20	22
100	10	11	13	16	17	19	22	24	26	29	31
400	13	17	19	23	27	30	34	38	41	45	49

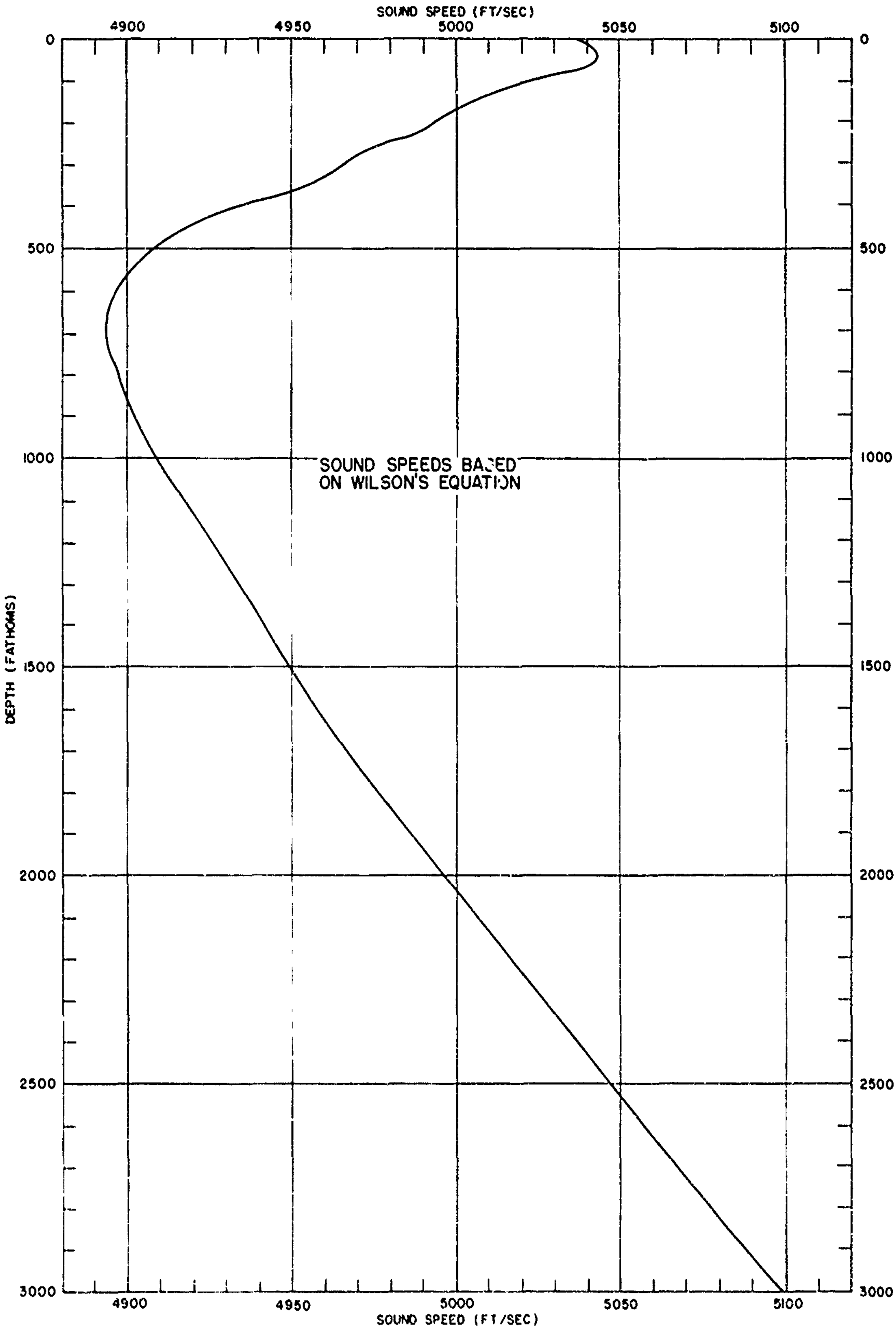

FIGURE I TYPICAL SOUND SPEED PROFILE FOR JANUARY THROUGH FEBRUARY

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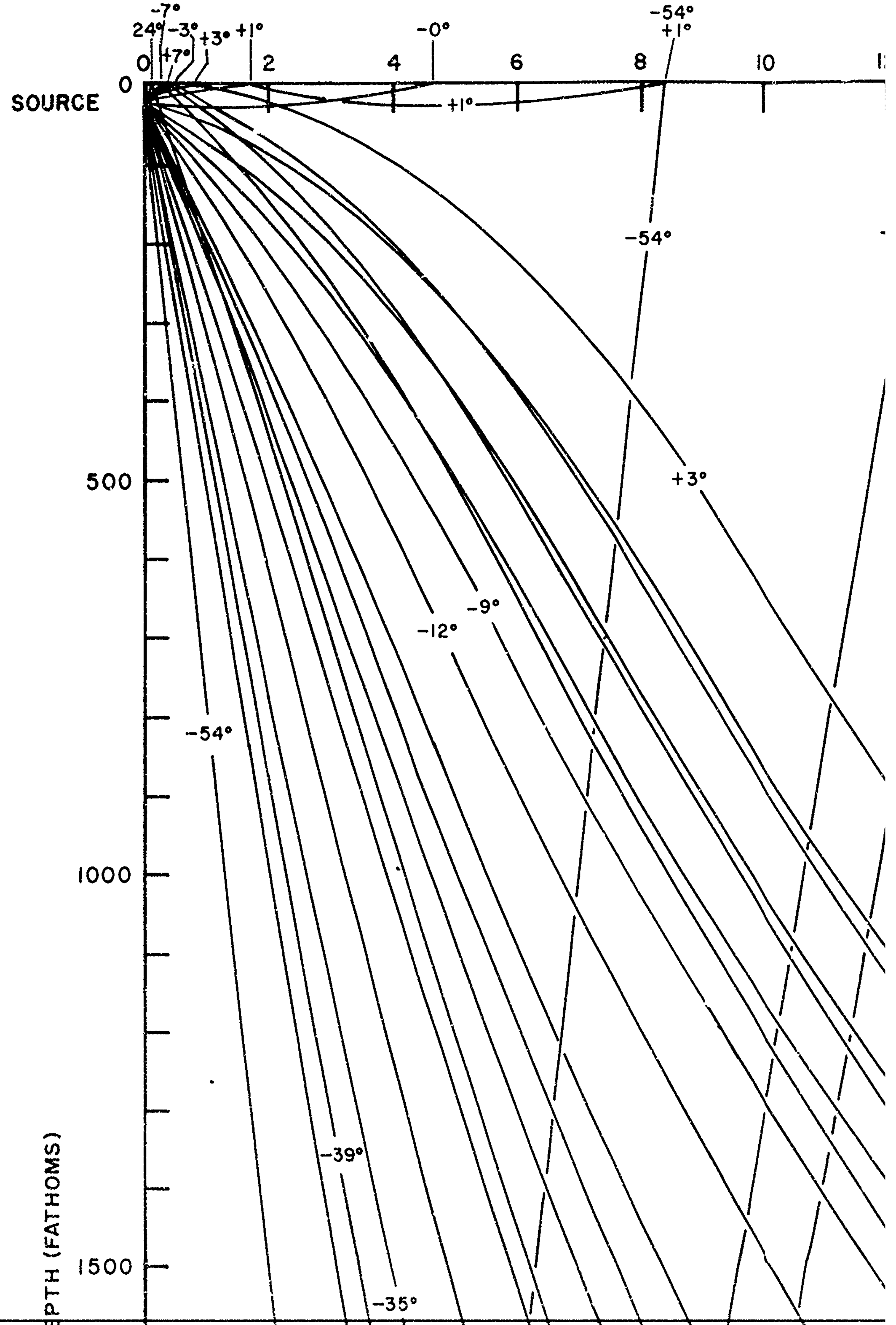
A



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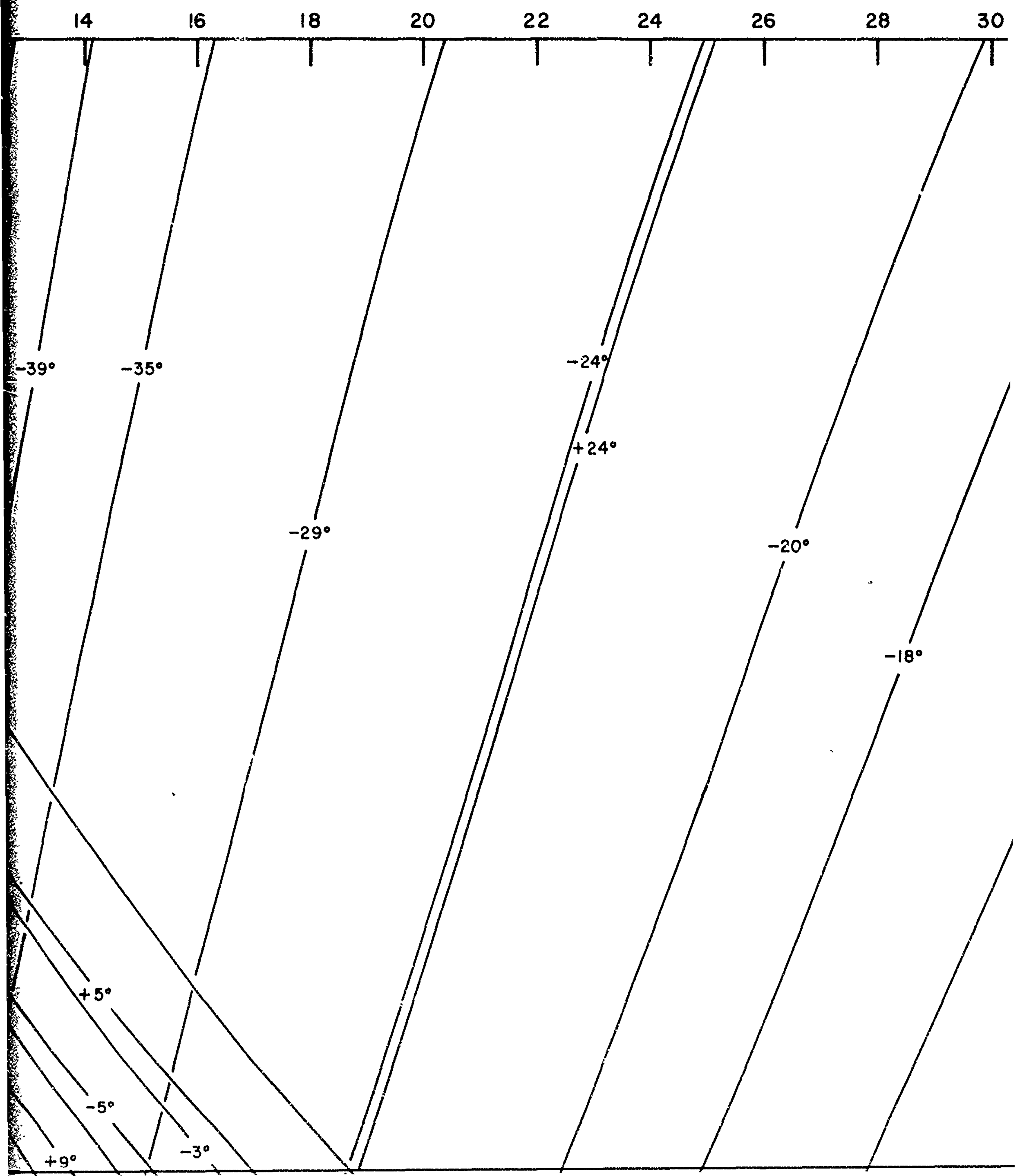
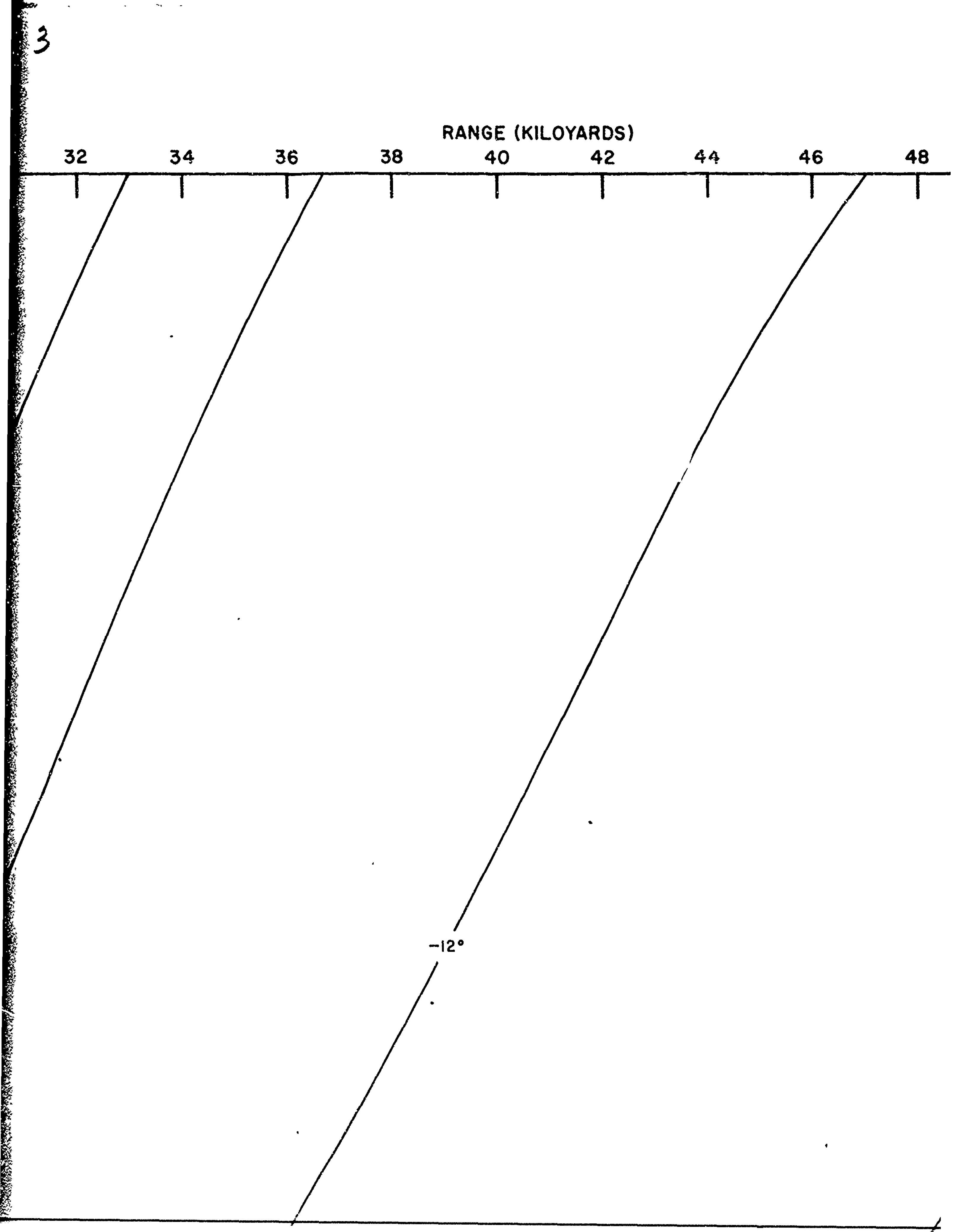
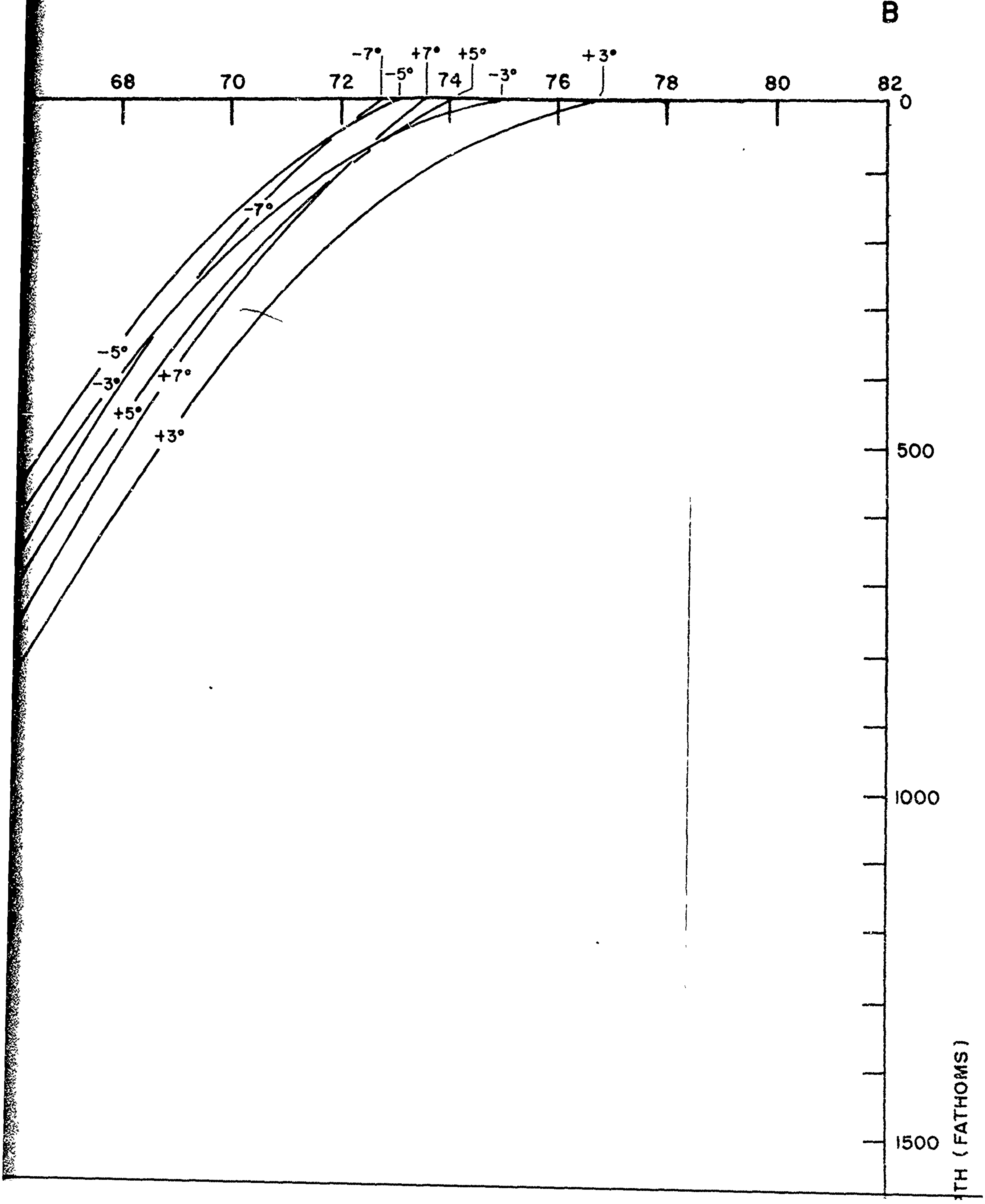


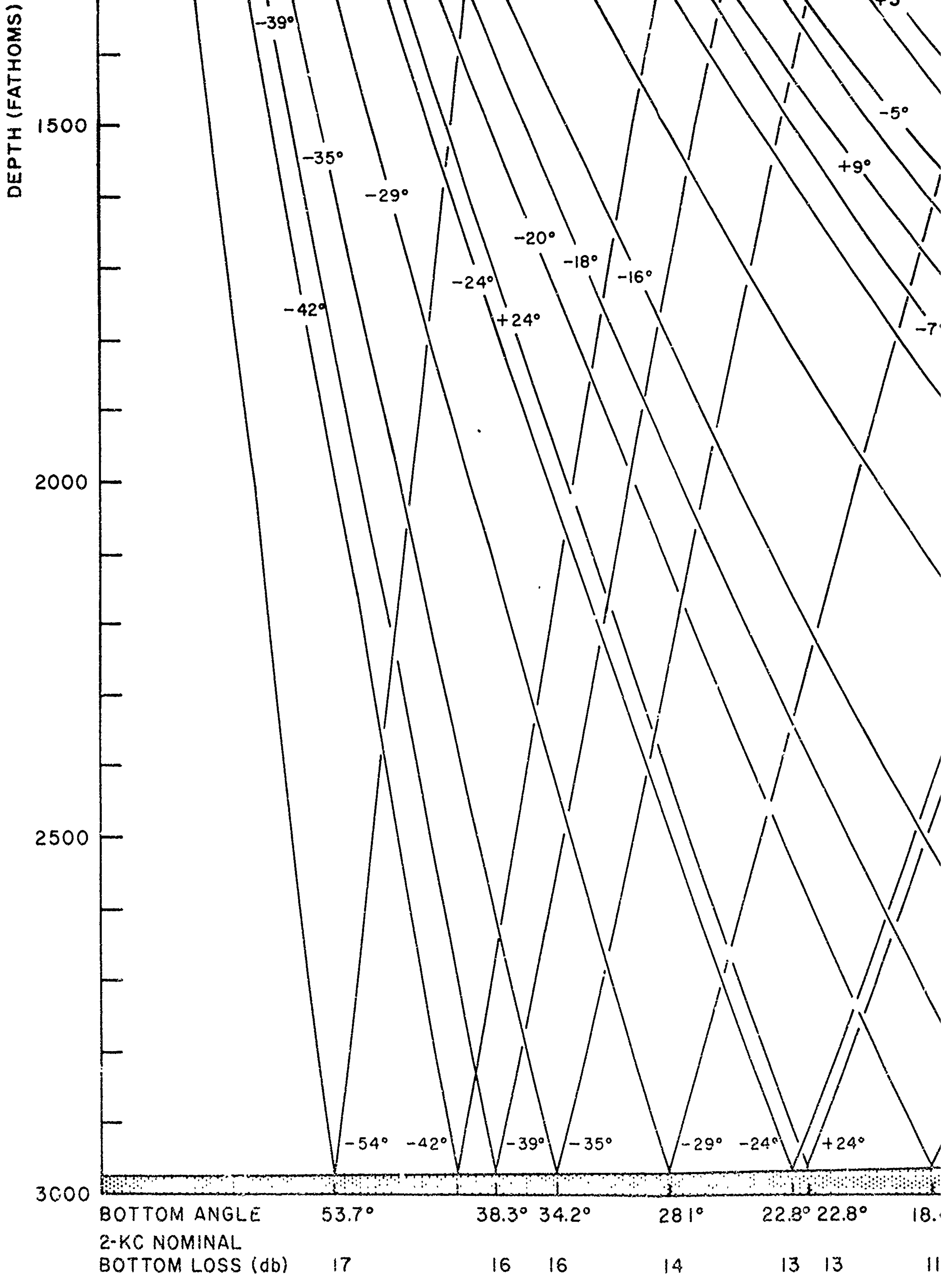
14
16
18
20
22
24
26
28
30
-39°
-35°
-24°
+24°
-29°
-20°
-18°
+5°
-5°
-3°
+9°


3
RANGE (KILOYARDS)
32
34
36
38
40
42
44
46
48
-12°

4

5


B
-7°
+7°
+5°
+3°
-5°
74
-3°
68
70
72
76
78
80
82
0
-7°
-5°
-3°
+7°
+5°
+3°
500
1000
1500
TH (FATHOMS)


DEPTH (FATHOMS)
1500
2000
2500
3000
-39°
-35°
-29°
-42°
-24°
+24°
-20°
-18°
-16°
-5°
+9°
-54°
-42°
-39°
-35°
-29°
-24°
+24°
BOTTOM ANGLE
53.7°
38.3°
34.2°
28.1°
22.8°
22.8°
2-KC NOMINAL
BOTTOM LOSS (db)
17
16
16
14
13
13

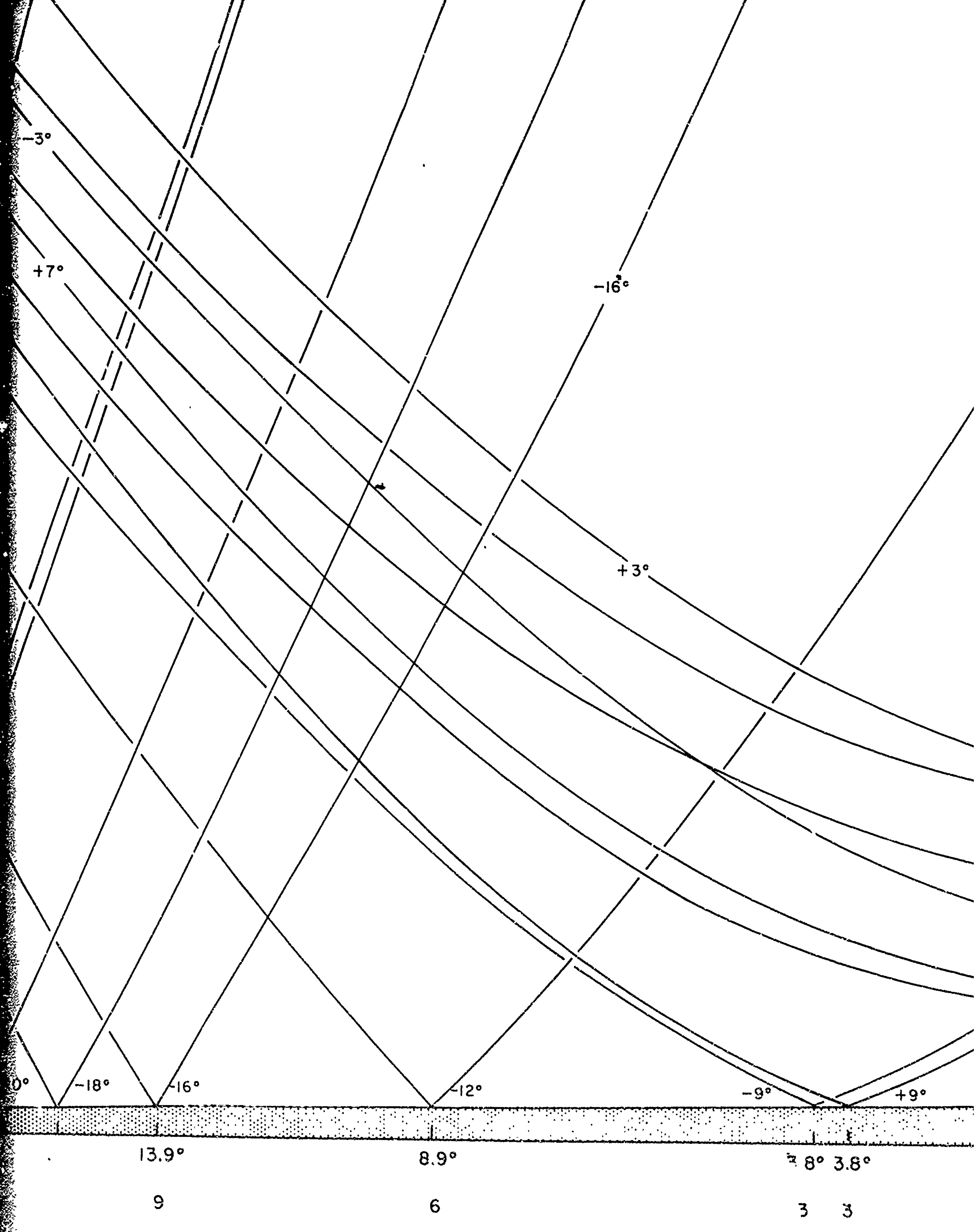
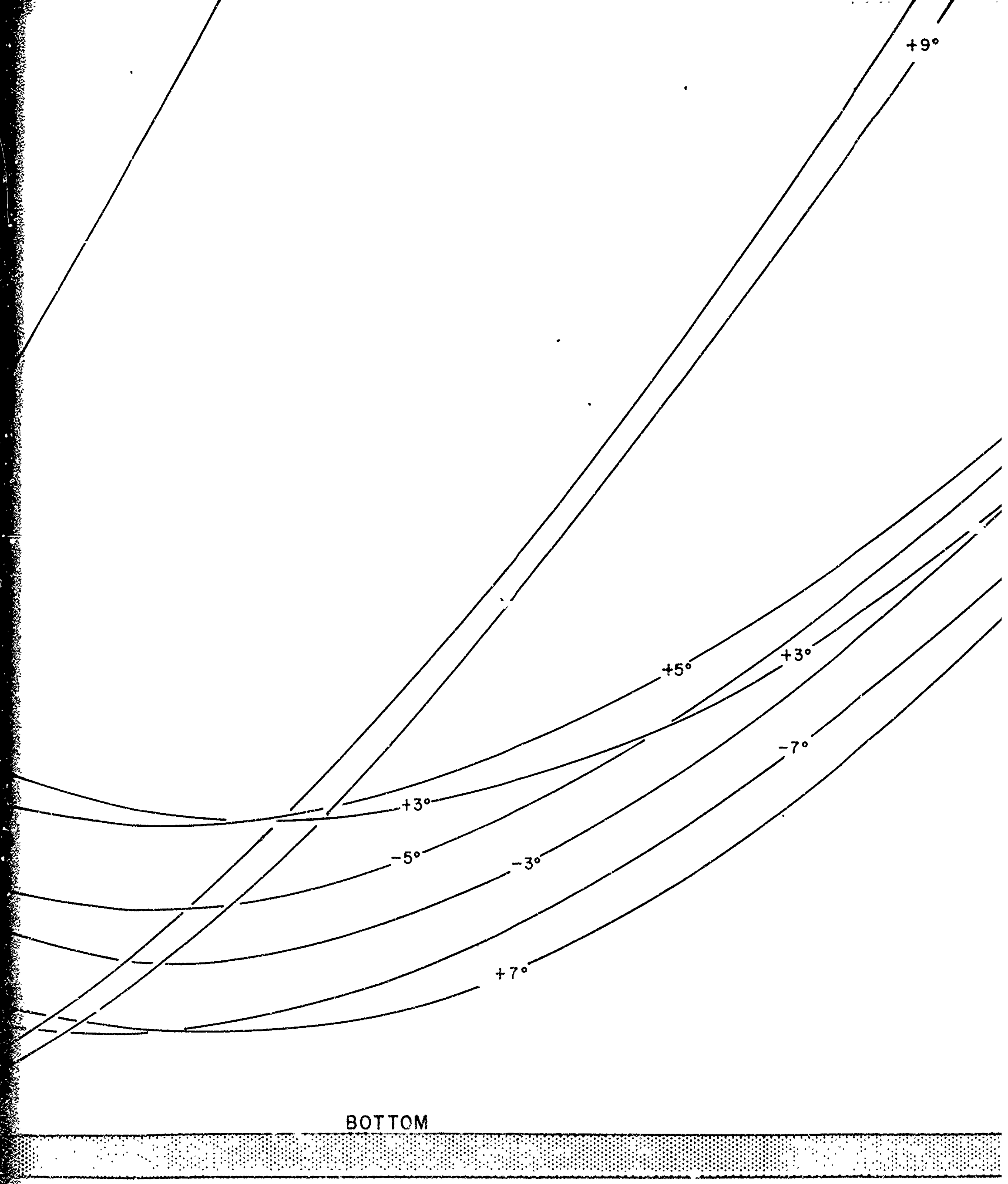
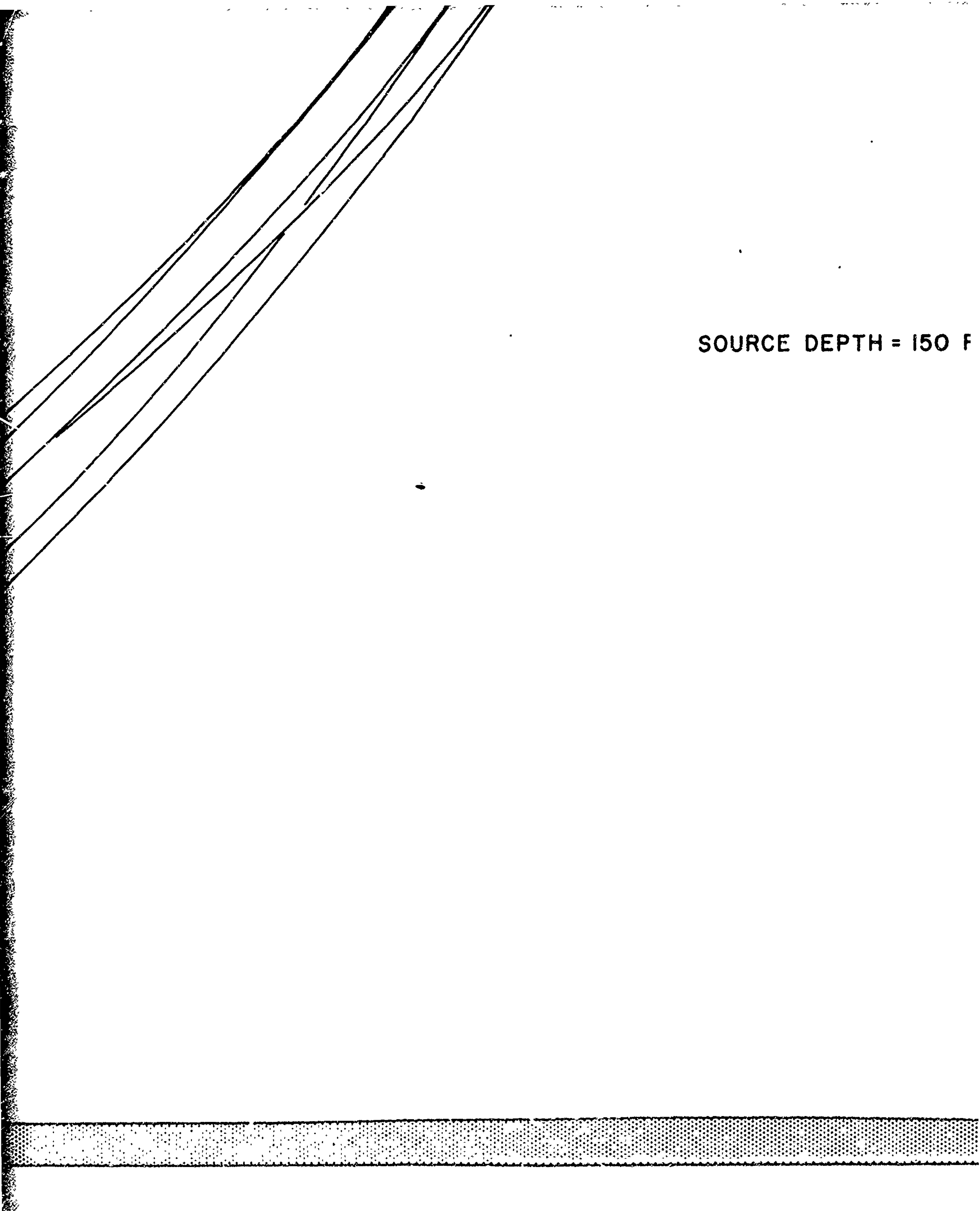


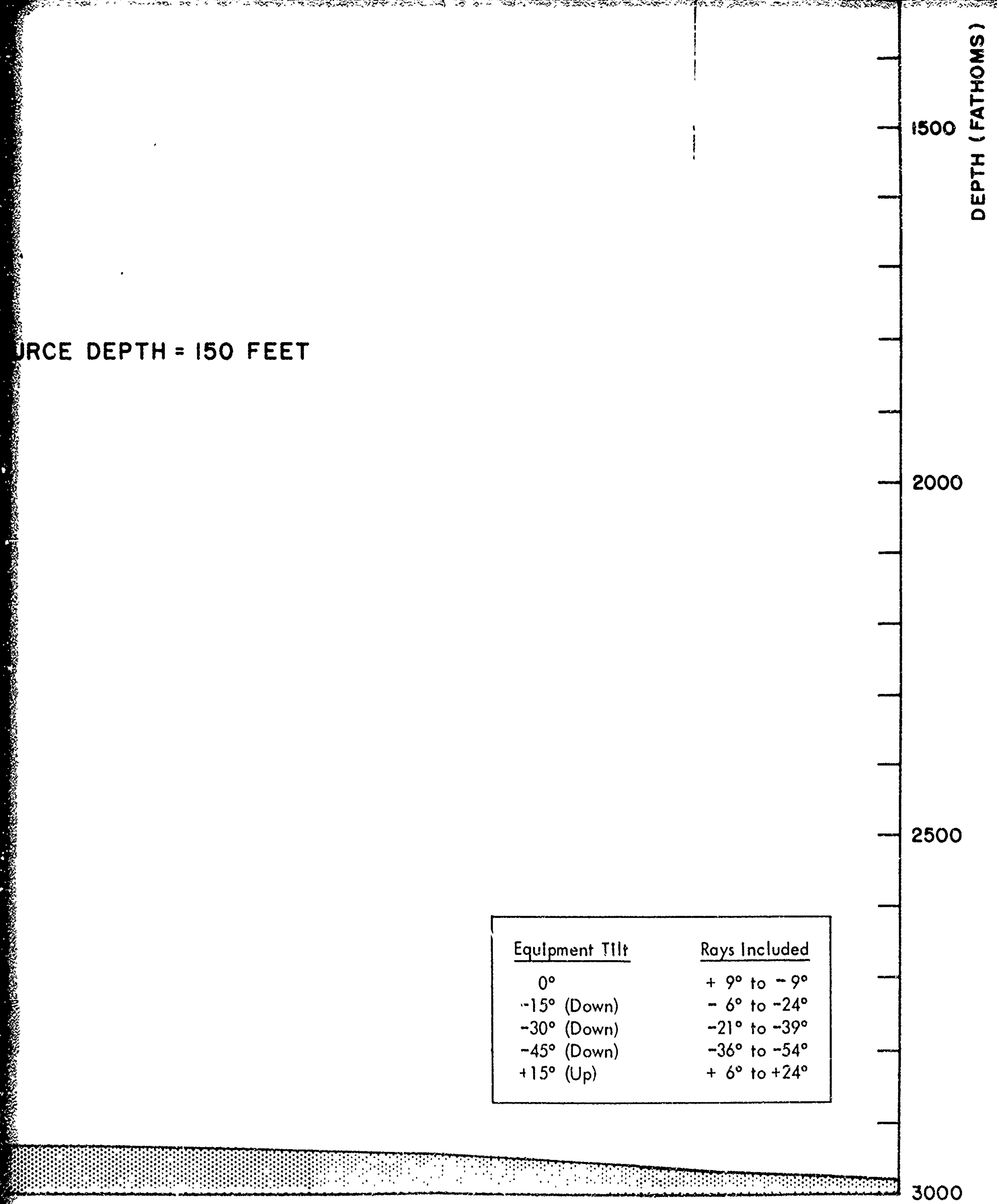
FIGURE 2 RAY DIAGRAM COMPUTED FROM TYPICAL



OUND SPEED PROFILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4 FOR JANUA



AND FEBRUARY



Equipment Tilt	Rays Included
0°	+ 9° to − 9°
-15° (Down)	− 6° to -24°
-30° (Down)	-21° to -39°
-45° (Down)	-36° to -54°
+15° (Up)	+ 6° to +24°

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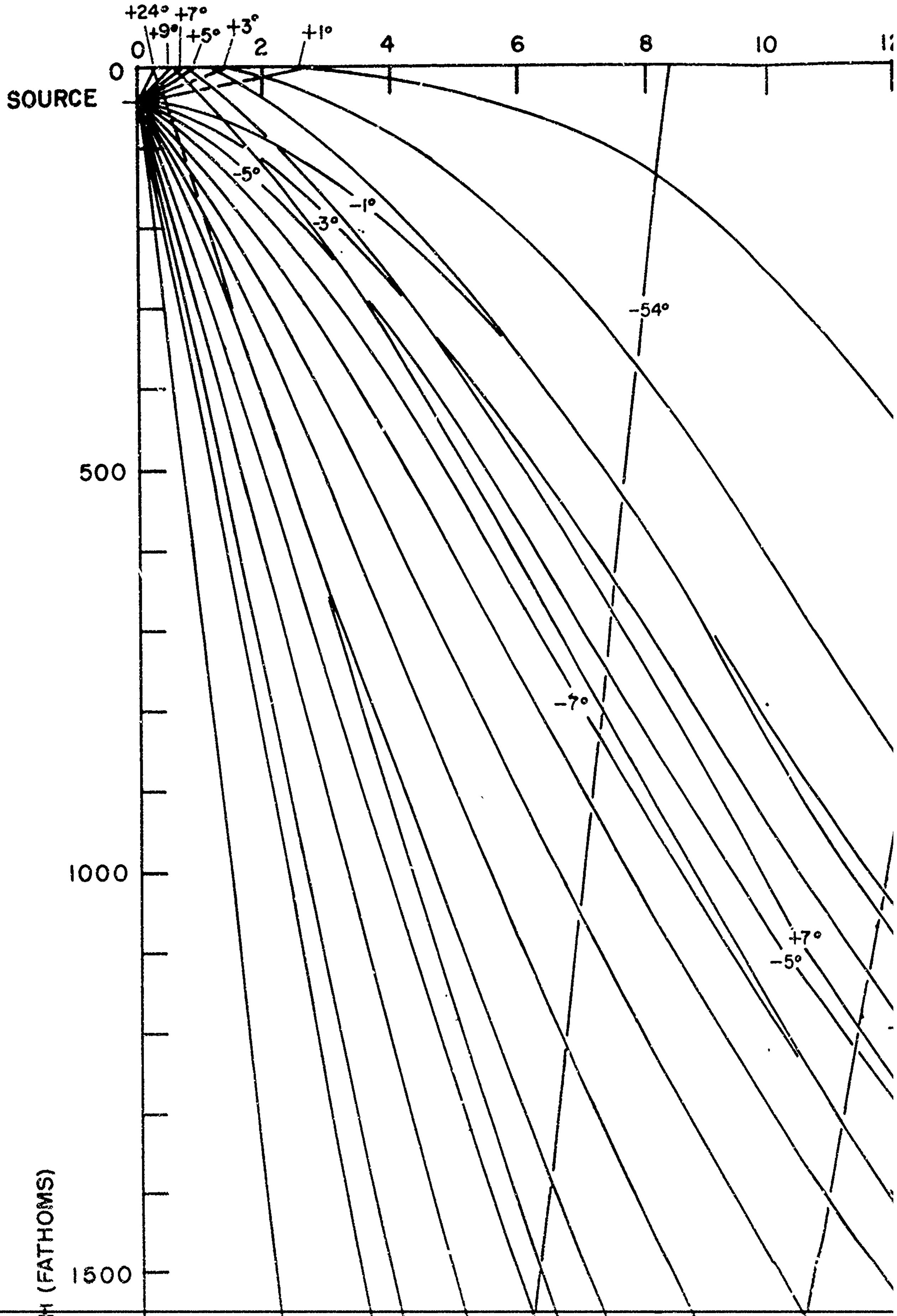
A



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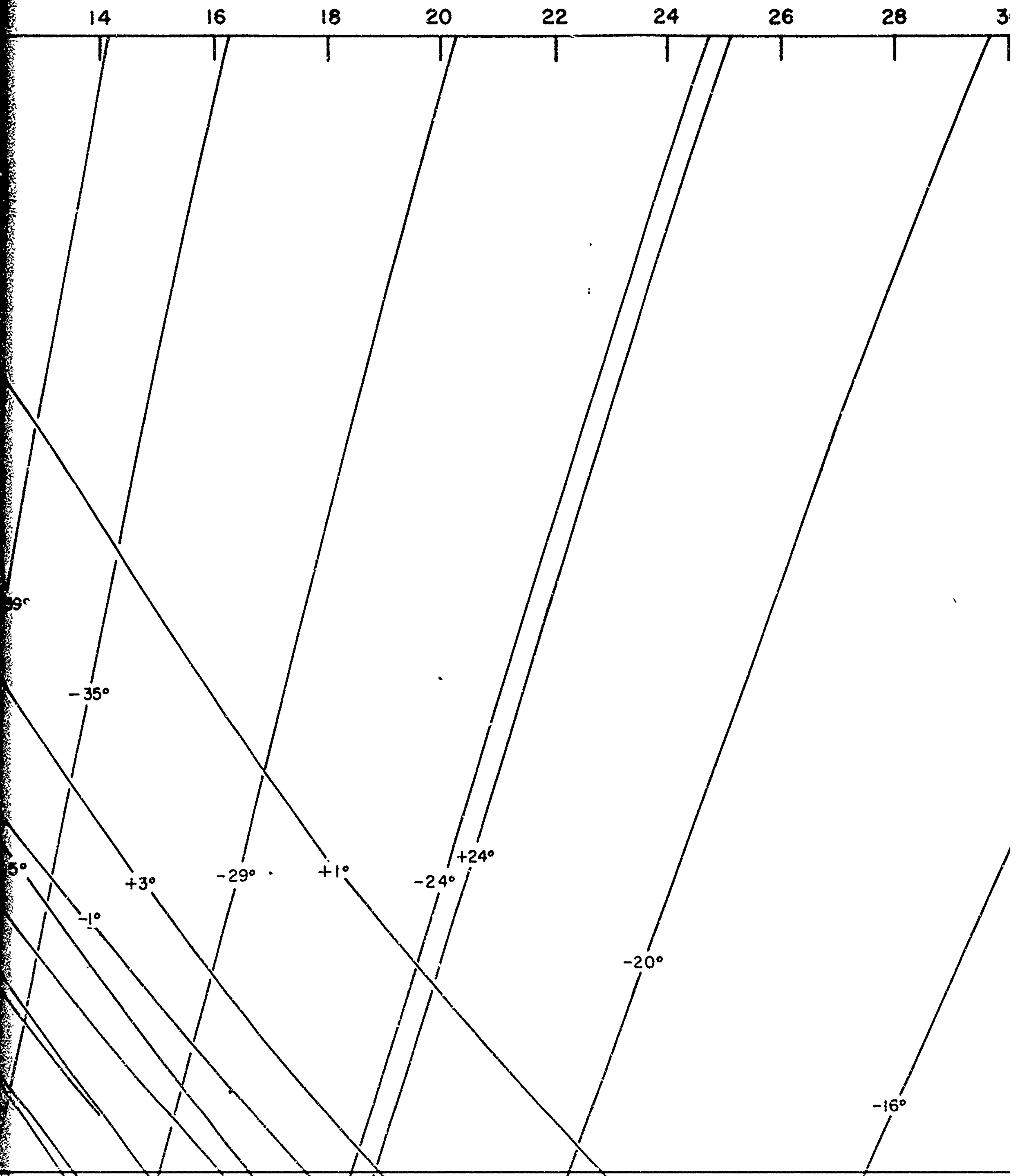
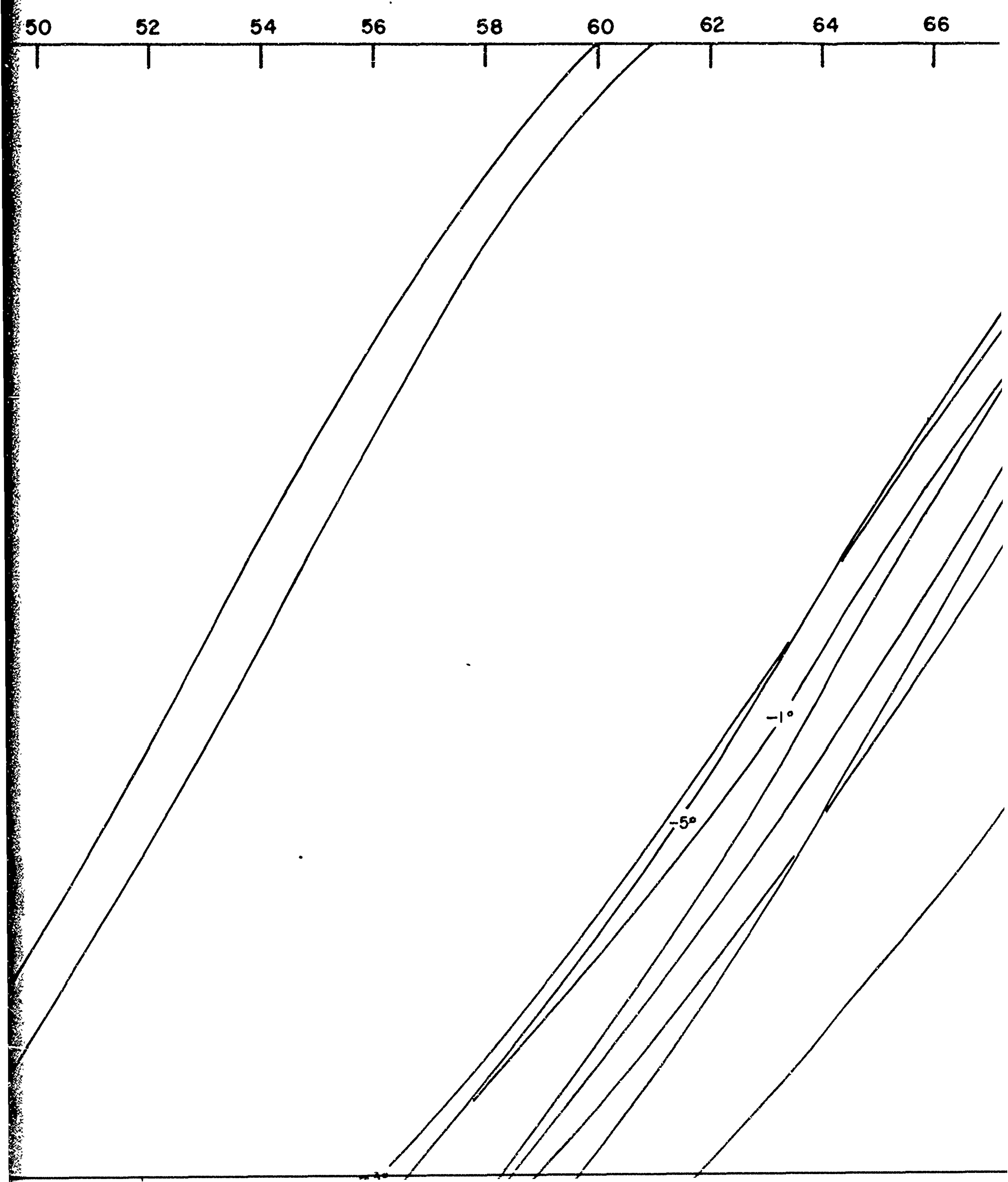
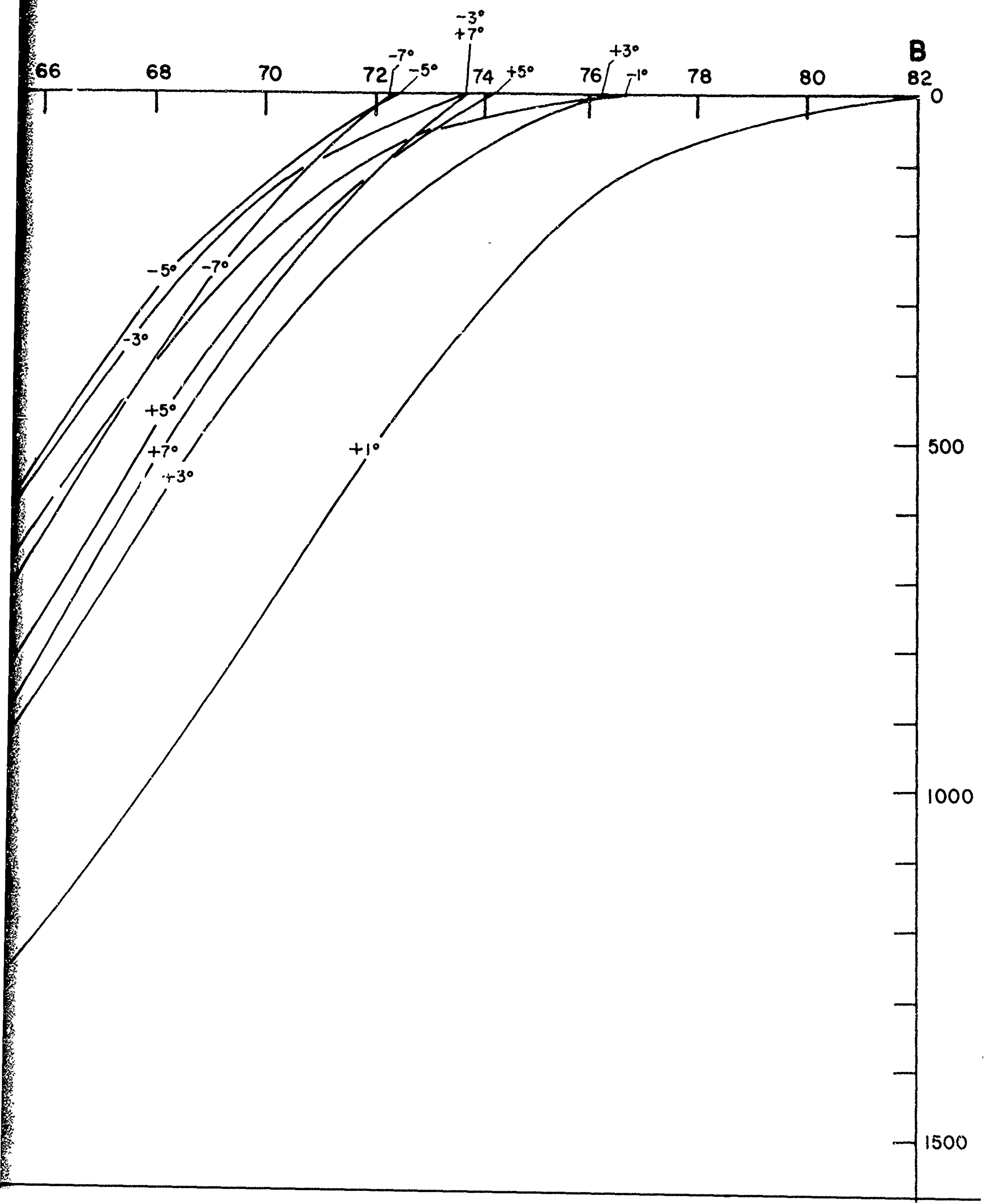
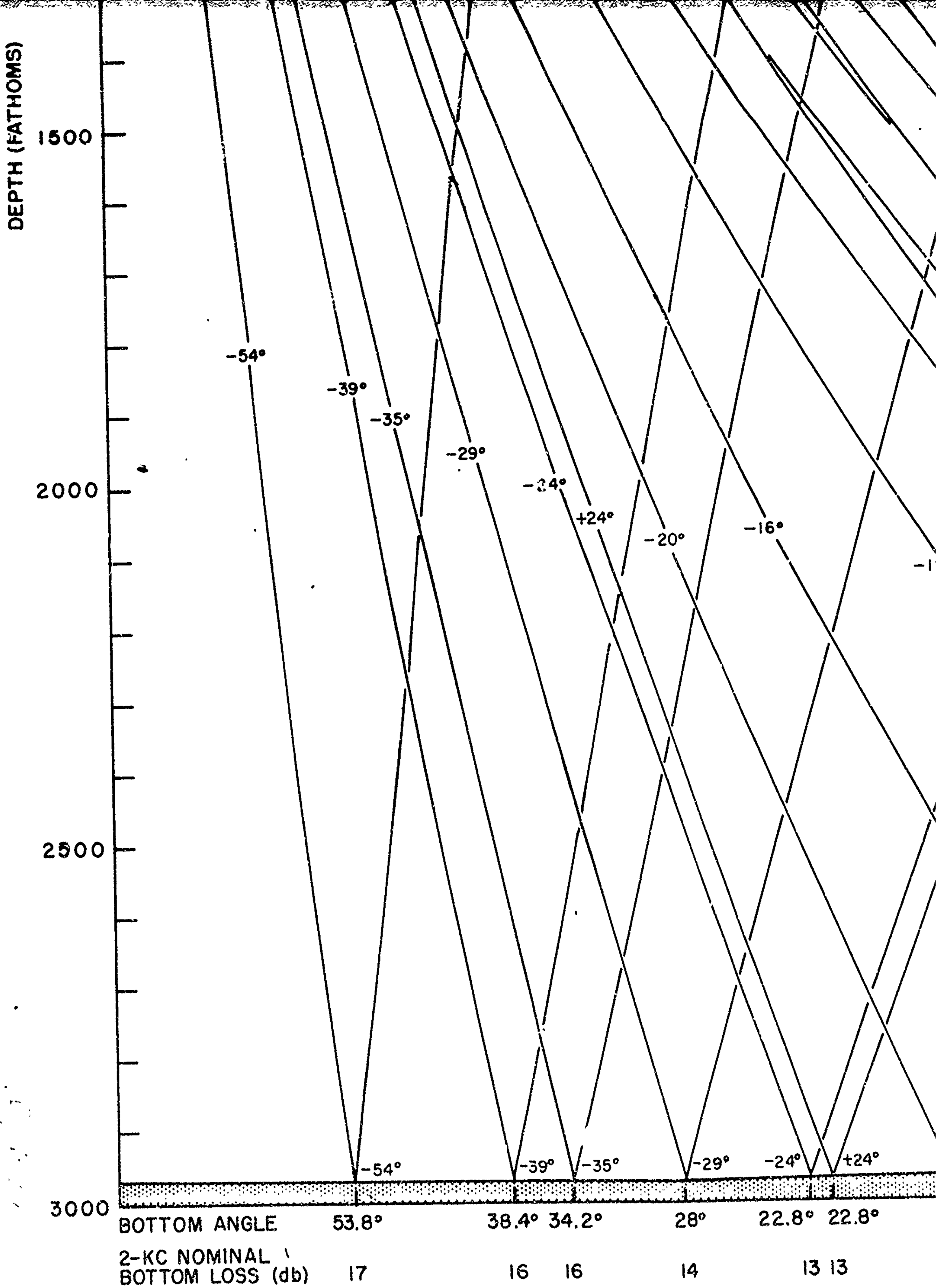



RANGE (KILOYARDS)
32
34
36
38
40
42
44
46
48
+9°


50
52
54
56
58
60
62
64
66
-1°
-5°



B
66
68
70
72
74
76
78
80
82
0
500
1000
1500
-7°
-5°
-3°
+7°
+5°
+3°
-1°
-5°
-7°
-3°
+5°
+7°
+3°
+1°



DEPTH (FATHOMS)
1500
2000
2500
3000
-54°
-39°
-35°
-29°
+24°
-20°
-16°
-54°
-39°
-35°
-29°
-24°
+24°
BOTTOM ANGLE
53.8°
38.4° 34.2°
28°
22.8° 22.8°
2-KC NOMINAL
BOTTOM LOSS (db)
17
16 16
14
13 13

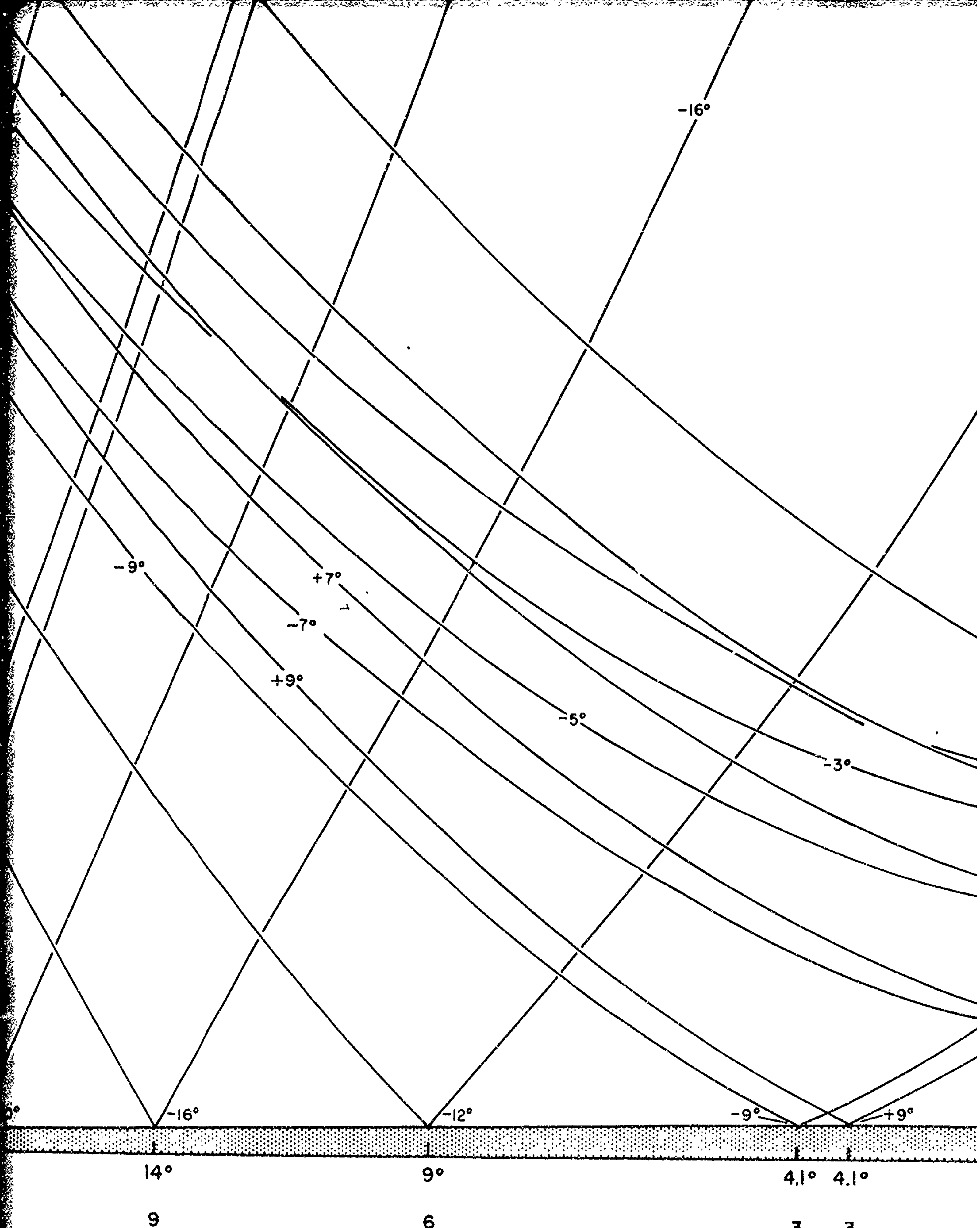
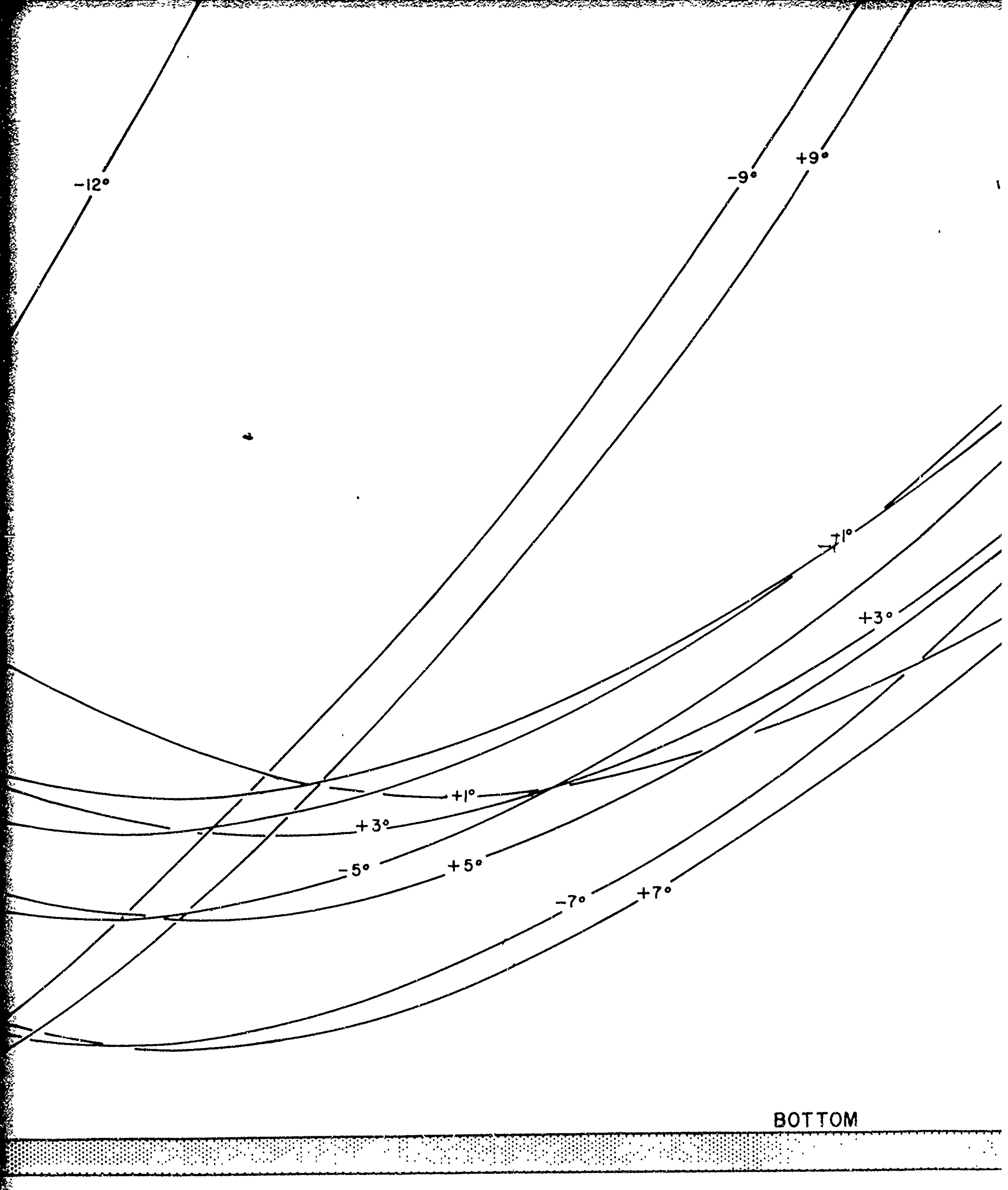
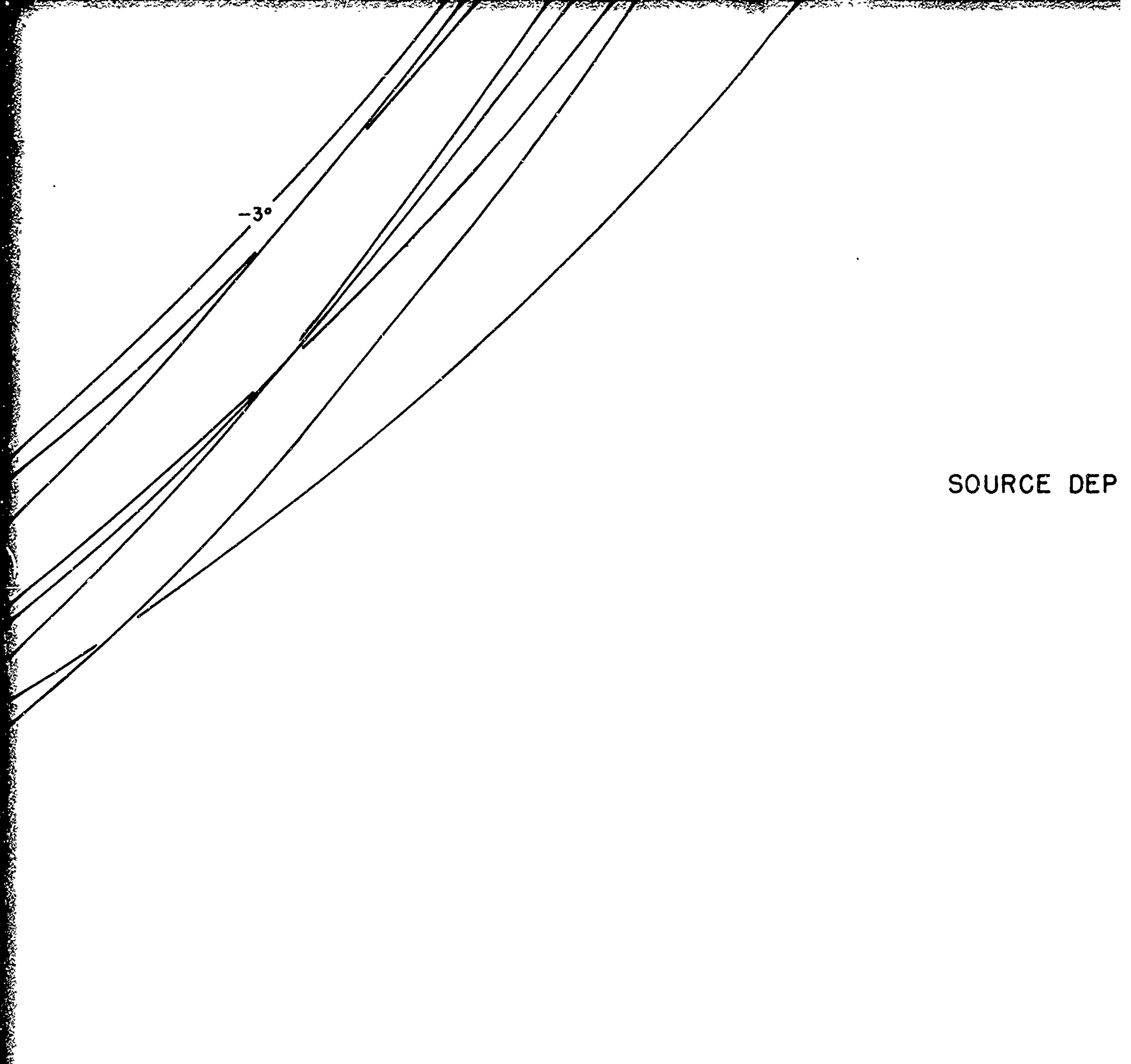


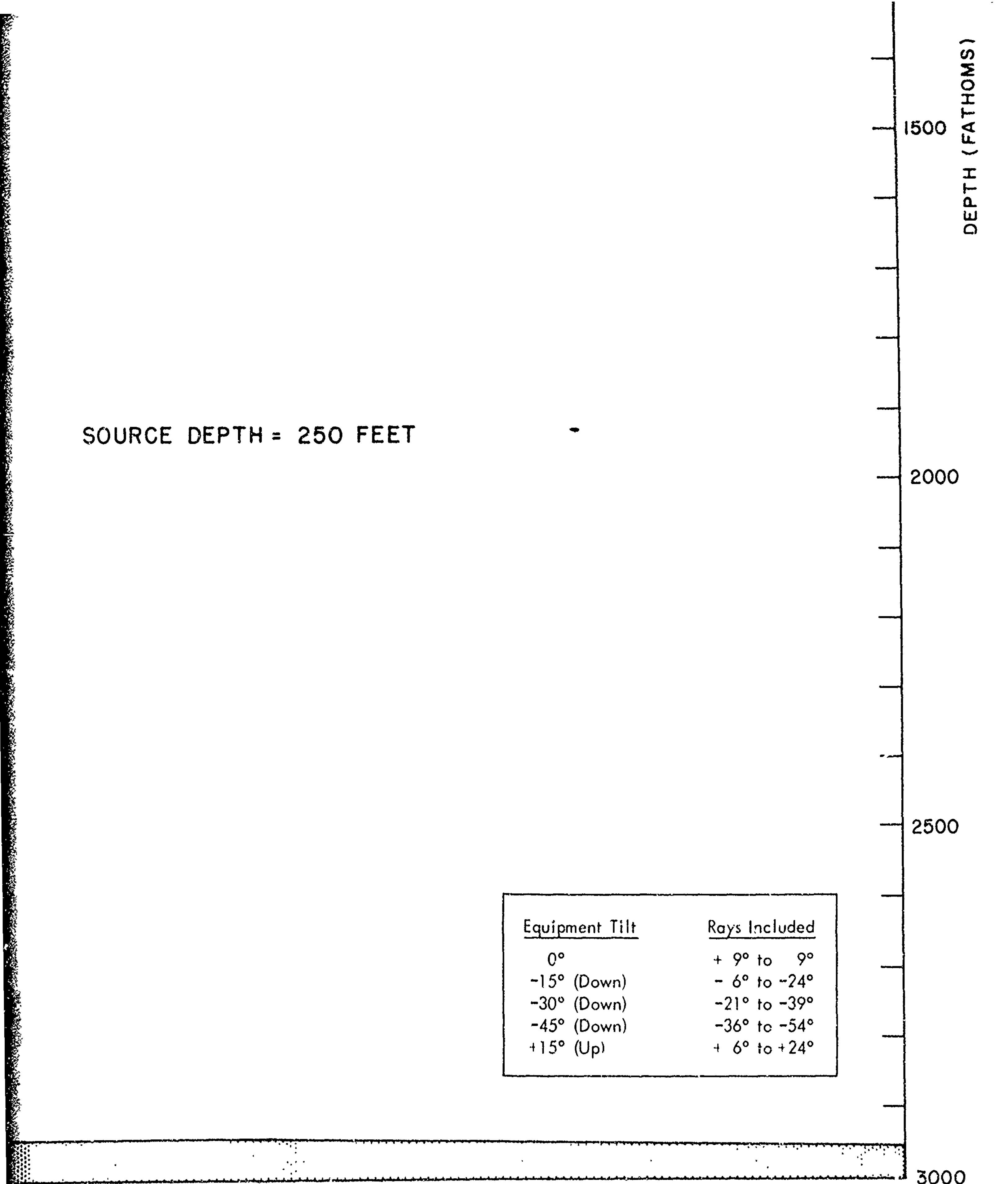
FIGURE 2a RAY DIAGRAM COMPUTED FROM TYP



AL SOUND SPEED PROFILE FOR CROSS SECTION A-B SHOWN ON FIGURE 4



FOR JANUARY AND FEBRUARY



Equipment Tilt	Rays Included
0°	+ 9° to 9°
-15° (Down)	- 6° to -24°
-30° (Down)	-21° to -39°
-45° (Down)	-36° to -54°
+15° (Up)	+ 6° to +24°

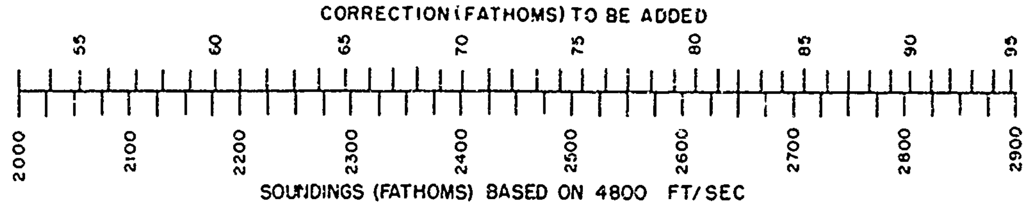


FIGURE 3 CORRECTION TO ECHO-SOUNDER DEPTH TO OBTAIN TRUE DEPTH

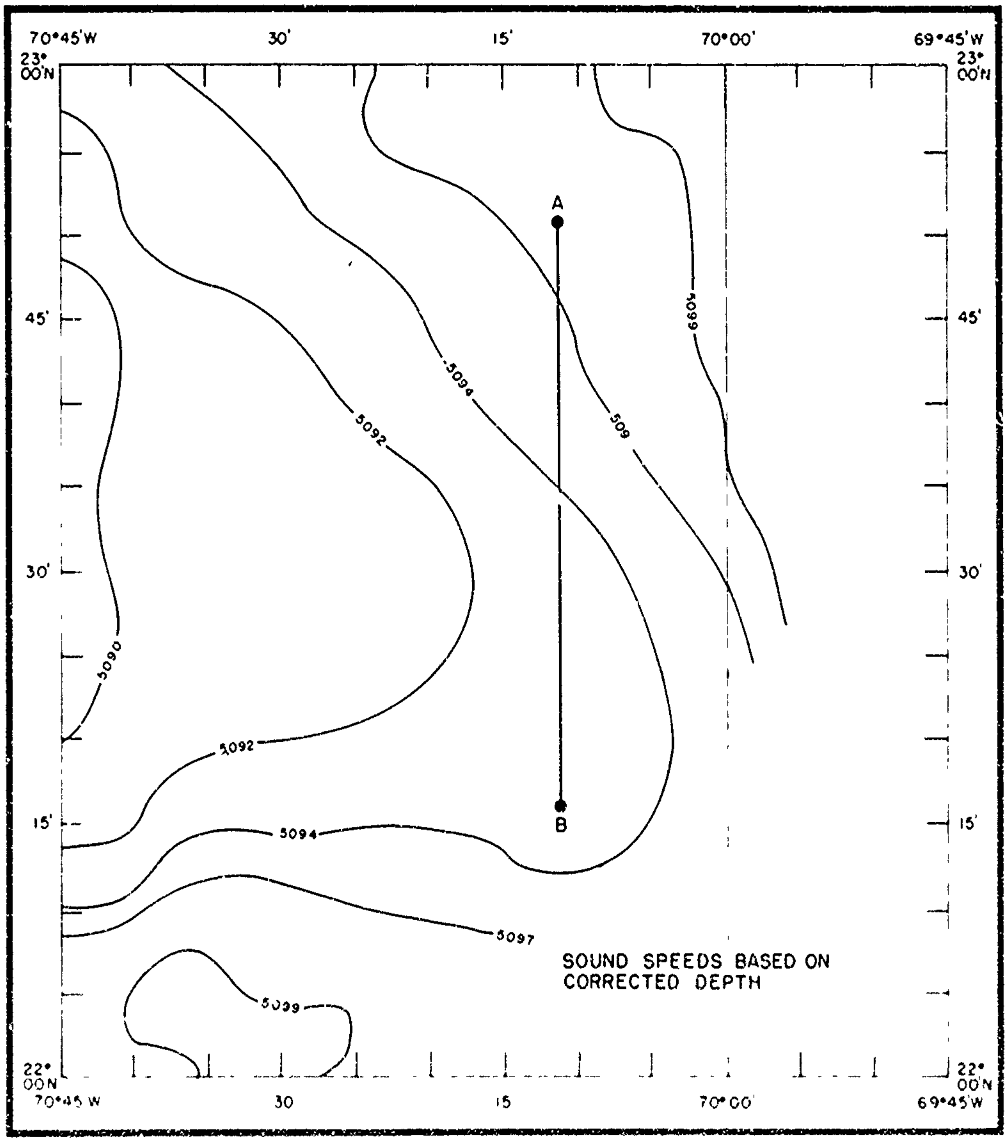
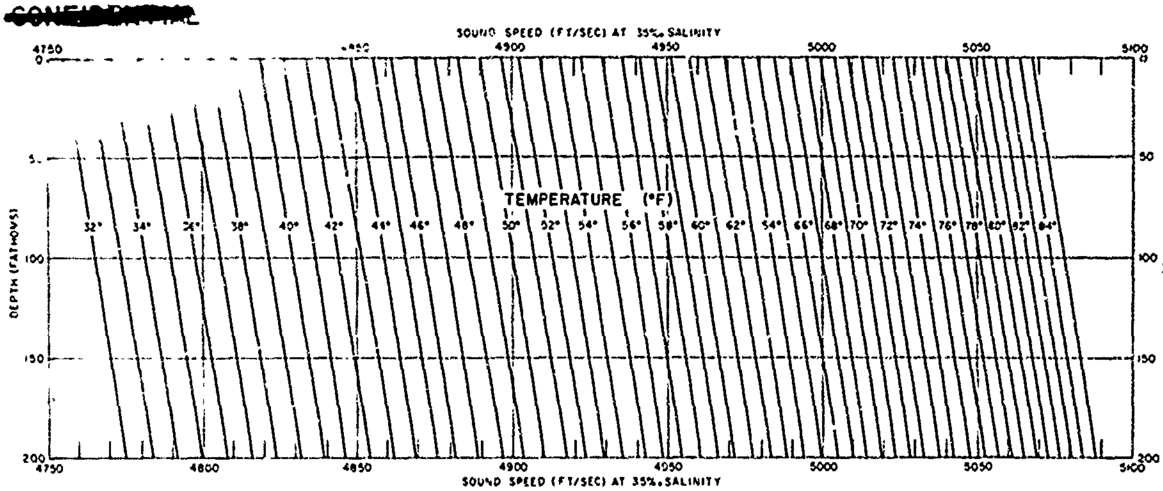
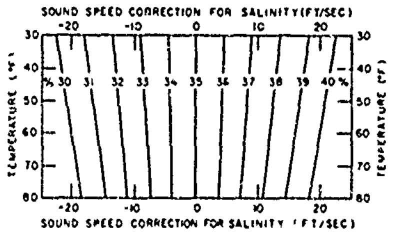


FIGURE 4 SOUND SPEED (FT/SEC) IN WATER AT BOTTOM





NORMAL SALINITY CORRECTION
FOR THIS AREA AND SEASON
IS +4 FT/SEC

FIGURE 5 SOUND SPEED NOMOGRAM

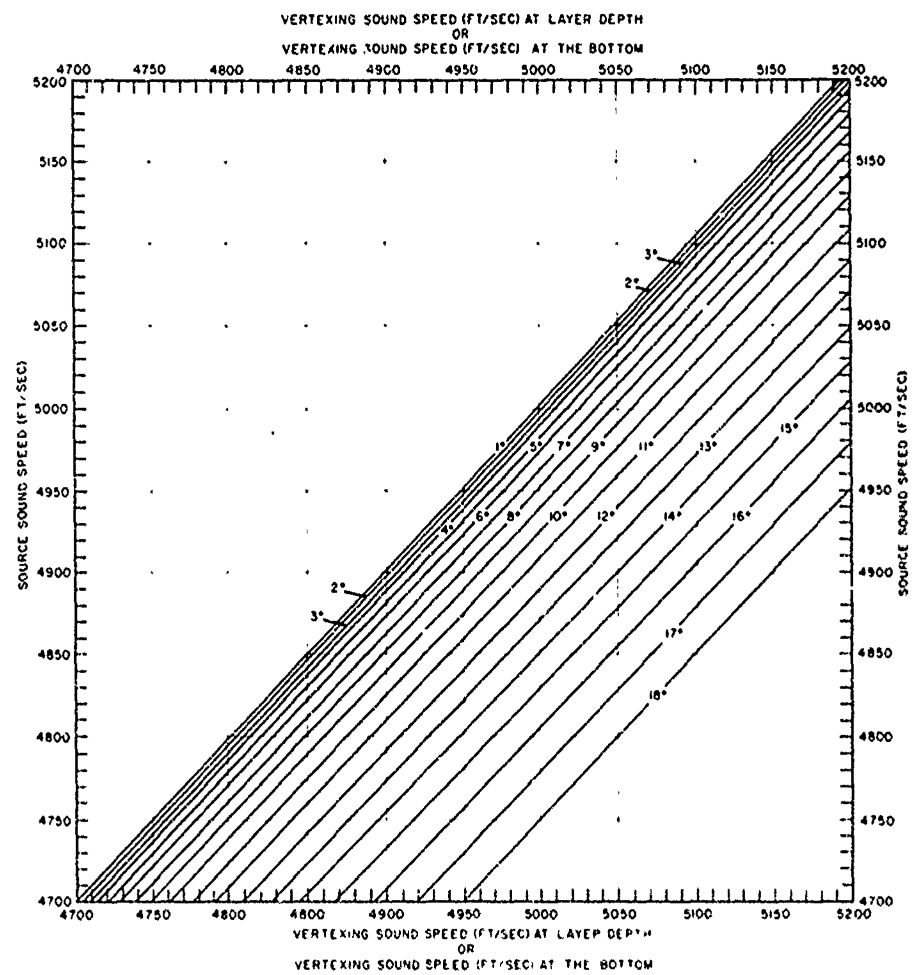


FIGURE 6 INCLINATION ANGLE VS SOURCE SOUND SPEED AND VERTEXING SOUND SPEED

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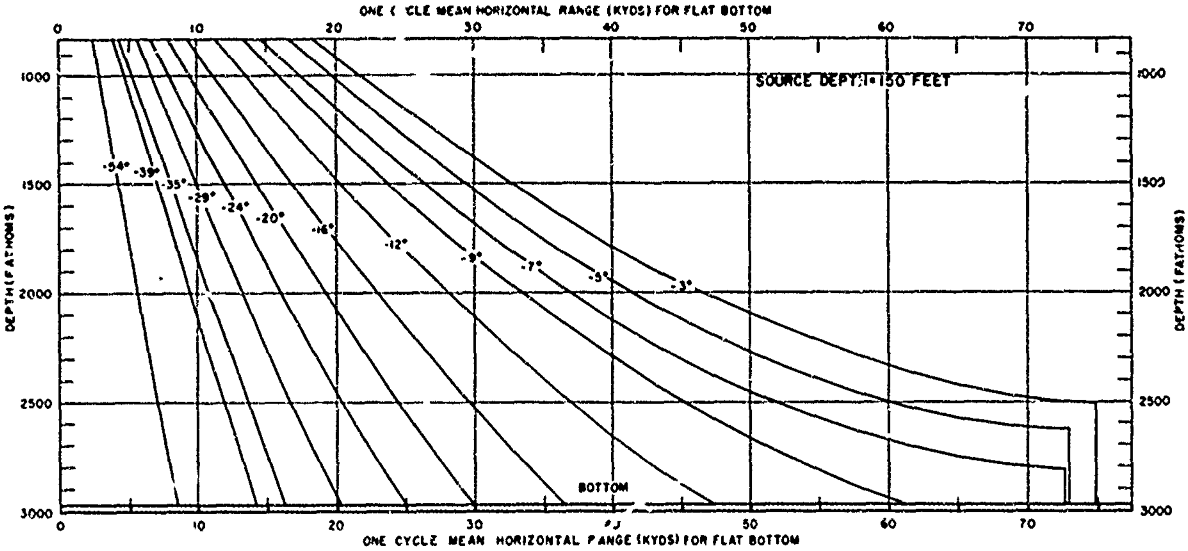

FIGURE 7 MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

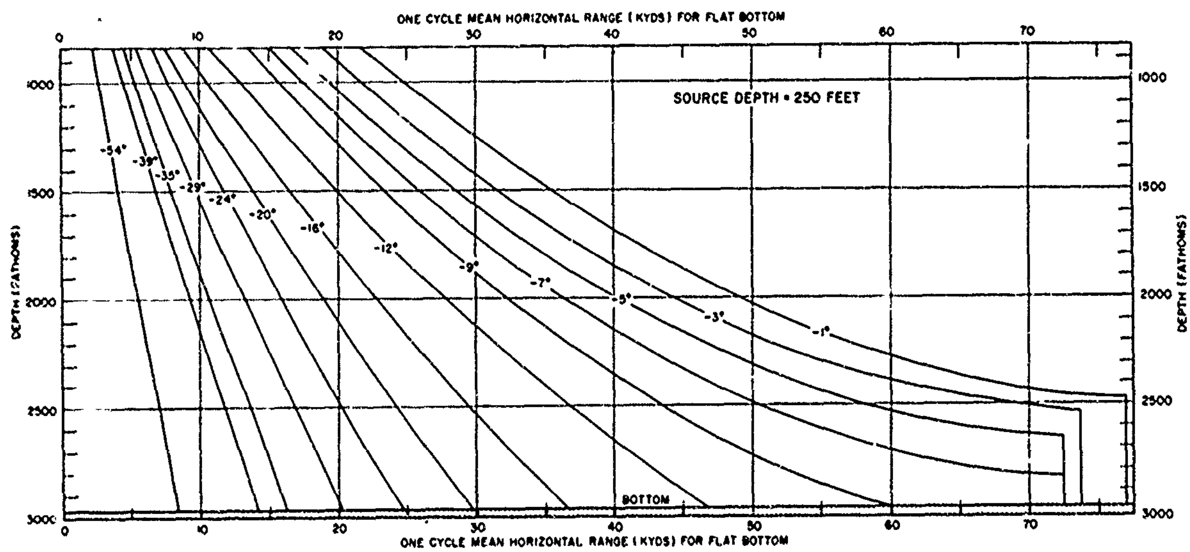

FIGURE 7A MEAN HORIZONTAL RANGE VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

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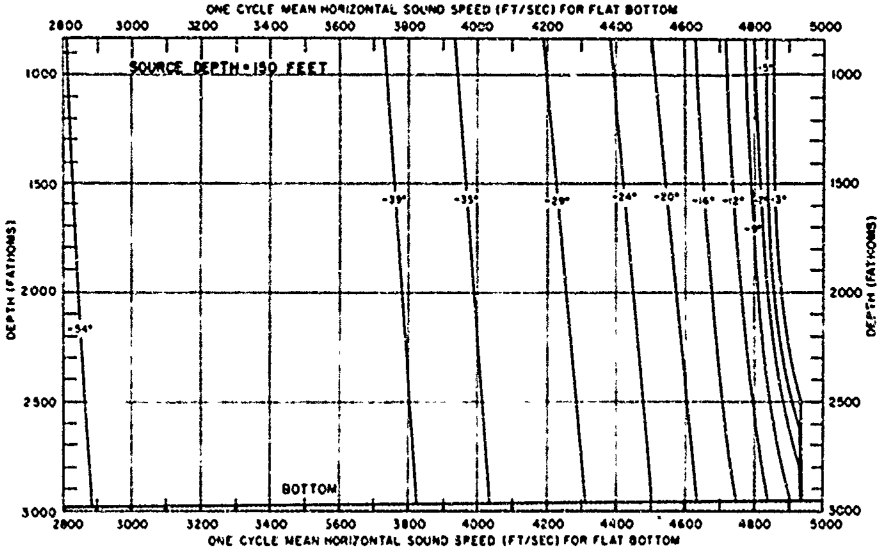

FIGURE 8 MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

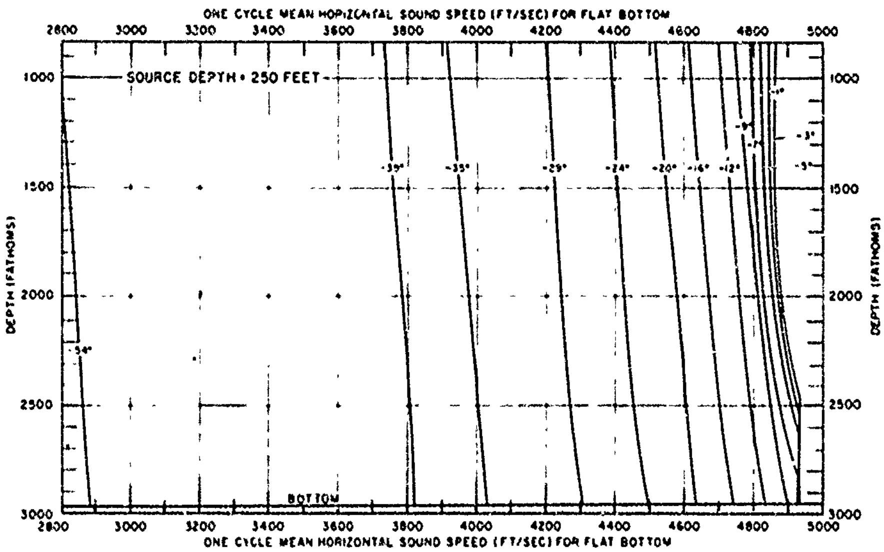

FIGURE 8A MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE (DOWNWARD RAYS) AND WATER DEPTH FOR JANUARY AND FEBRUARY

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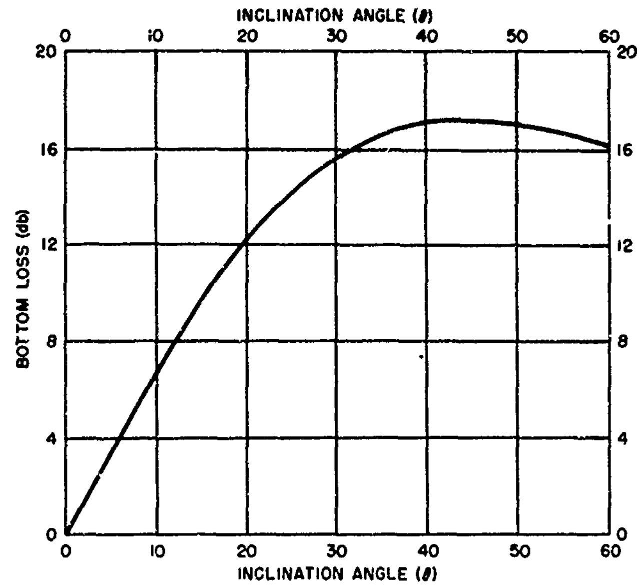

FIGURE 9 NOMINAL BOTTOM LOSS

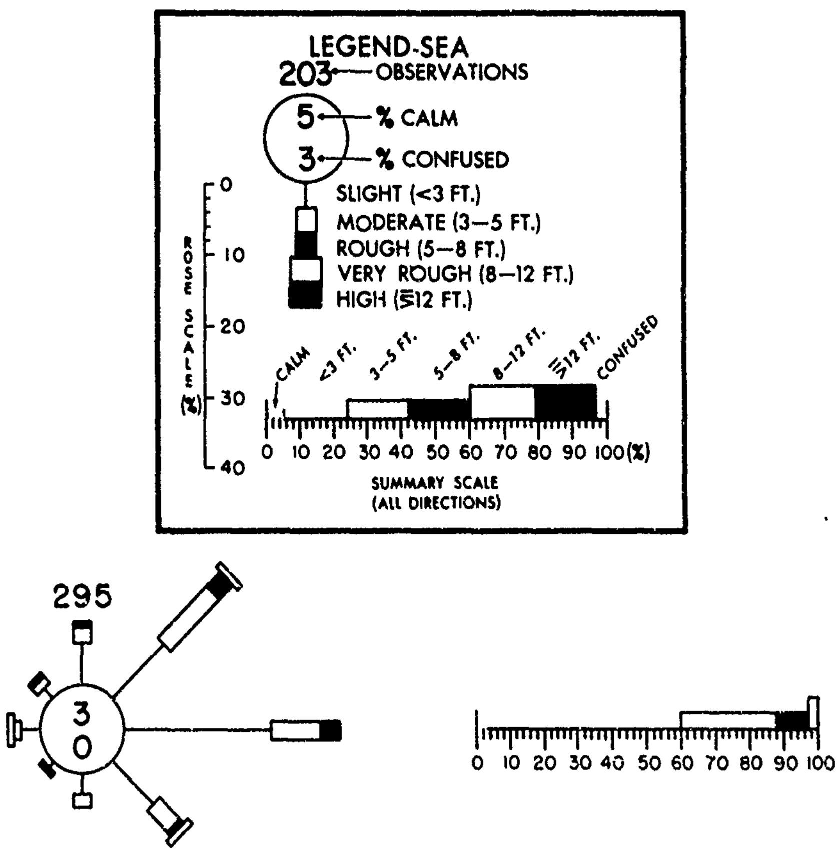

FIGURE 10 SEA STATE ROSE AND HISTOGRAM FOR JANUARY THROUGH MARCH

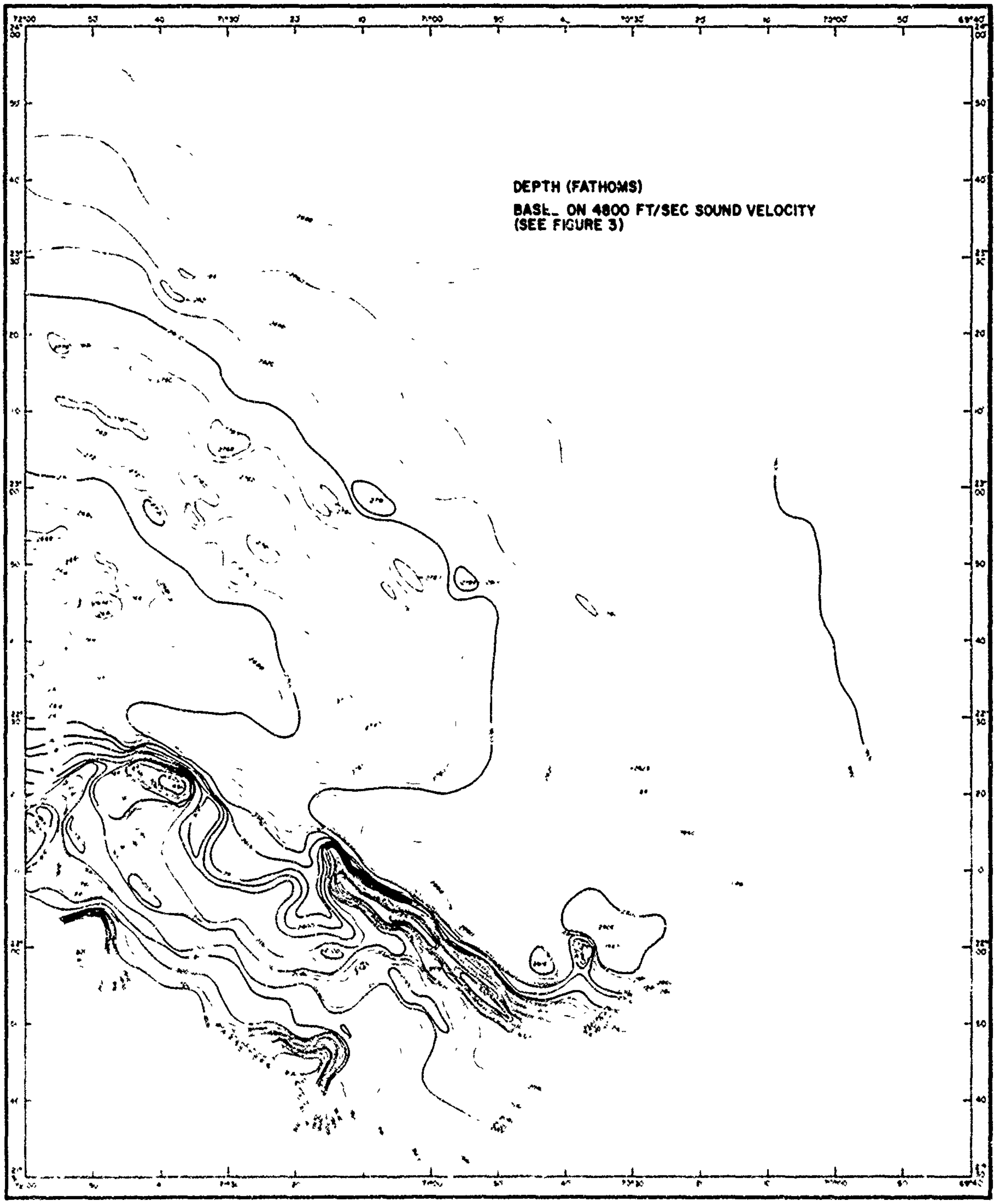

FIGURE II BATHYMETRY

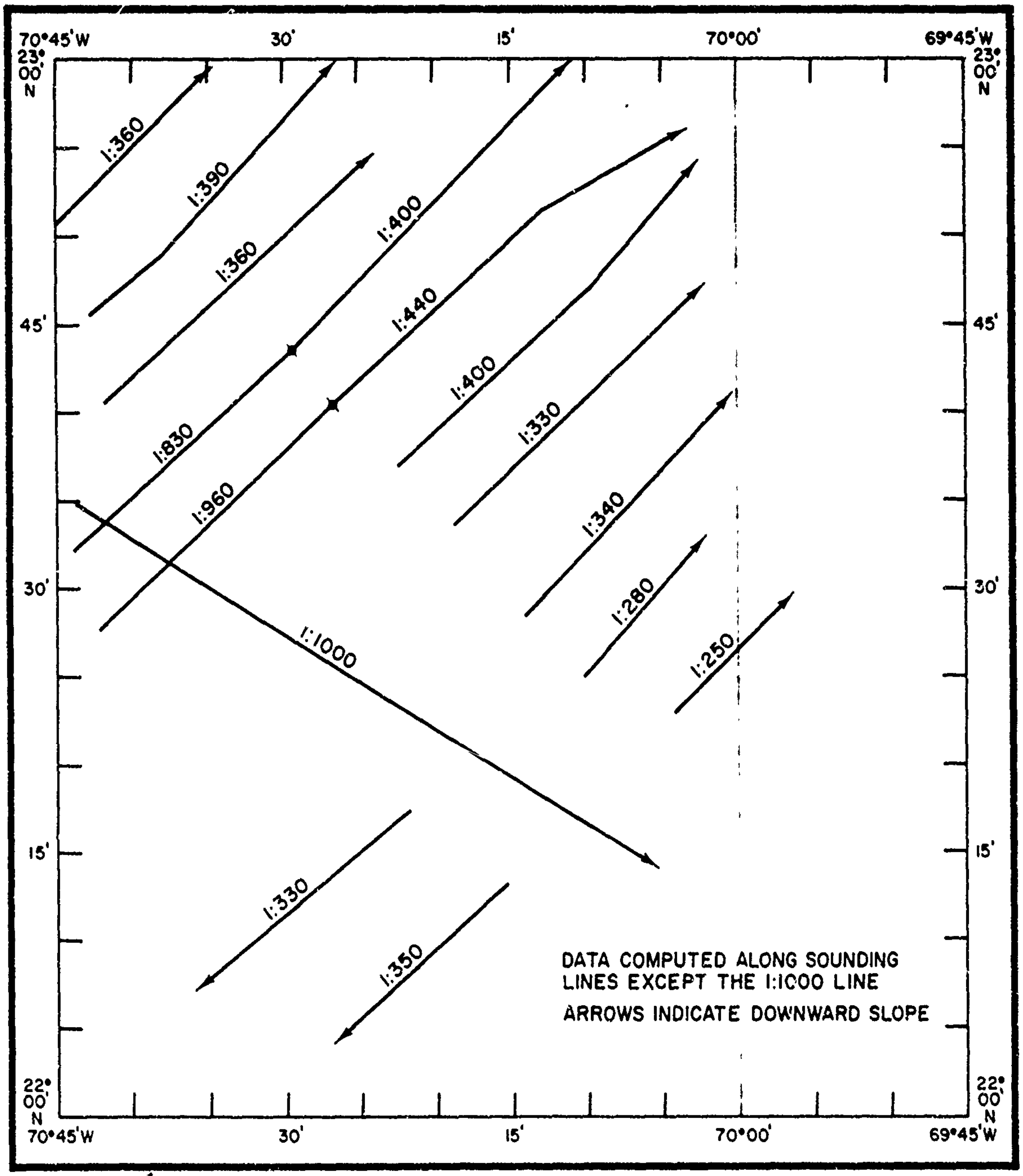

FIGURE 12 BOTTOM SLOPE GRADIENTS

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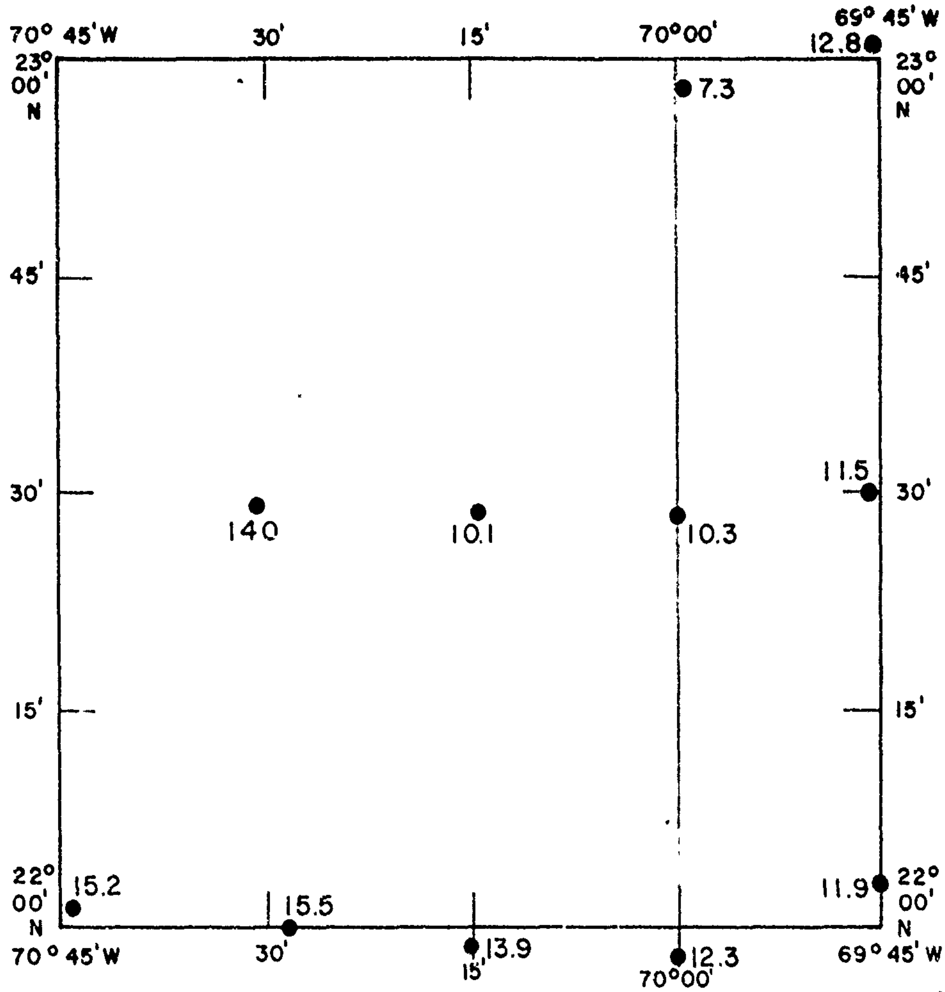

FIGURE 13 12-KC NORMAL INCIDENCE BOTTOM LOSS MEASUREMENTS (db)

AREA "J" 0-113-63

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TOPOGRAPHY

Bathymetric data for this area were collected during 2 separate surveys. One survey was centered at 22°31'N, 70°20'W, covered 1,520 square miles, and used LORAC positioning. The second survey was centered at 22°30'N, 70°10'W, covered 2,000 square miles, and used LORAN A for positioning. The second survey was conducted in 1962 by the USS SHELDRAKE but did not include the southeastern portion of the area.

The area is located on the outer edge of a broad ridge. Gradients have a minimum slope of 1:1000 and a maximum of 1:250. Examination of the 12-kc depth records revealed no penetration of the sound rays into the bottom and no evidence of minor irregularities in the bottom topography.

Bottom sediments consist of soft, sticky brown clay with particles less than 0.074 mm in size and containing as much as 15 % calcium carbonate in the form of globigerina tests.

DEEP SCATTERING LAYER

The deep scattering layer (DSL) occurs throughout this area at depths of 250 to 275 fathoms. The intensity of the layer may vary from day to day.

Discontinuous shallow scattering layers (SSL) have been recorded using 14, 18, and 50 kc equipment. These layers, which have been recorded during all seasons, are nonmigratory and rather uniform in intensity.

BIOLOGY

During January and February there are probably about 3 whales per 1,000 square miles. The occurrence of porpoises is sporadic and cannot be estimated. The number of schooling fishes in this area is unknown, but the area is seaward of the largest concentration of these fishes.