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OCEANOGRAPHY FOR LONG RANGE SONAR IN ATLANTIC AREA A FOR AUGUST--ETC(U)
AUG 63

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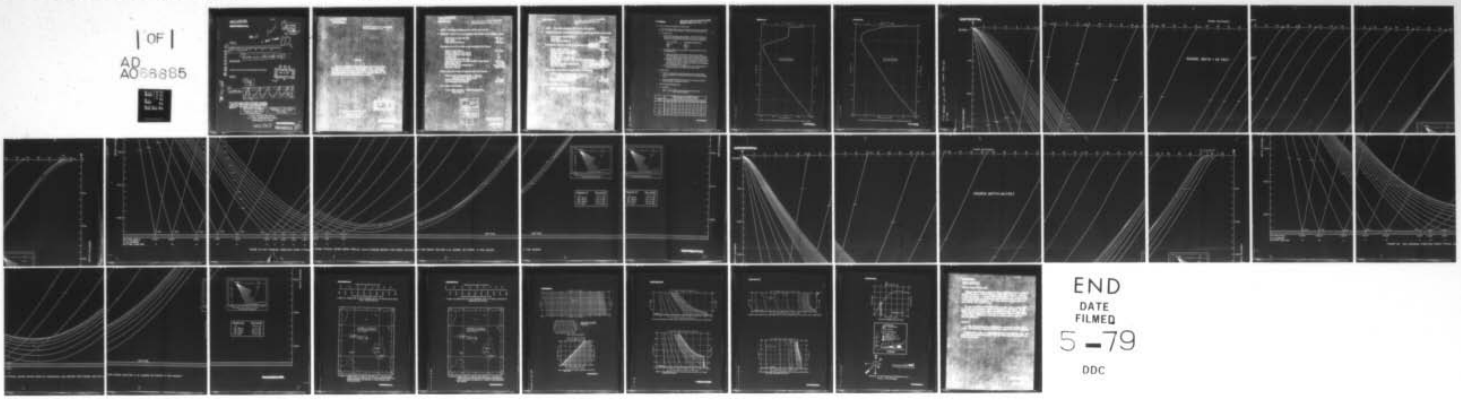

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INFORMAL MANUSCRIPT REPORT

NO. 0-116-63

LEVEL II

Good

MOST Project

TITLE

OCEANOGRAPHY FOR LONG RANGE SONAR IN ATLANTIC AREA A FOR AUGUST,

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AUTHOR

OCEANOGRAPHIC DEVELOPMENT DIVISION

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AUGUST 1963

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WASHINGTON, D.C. 20390

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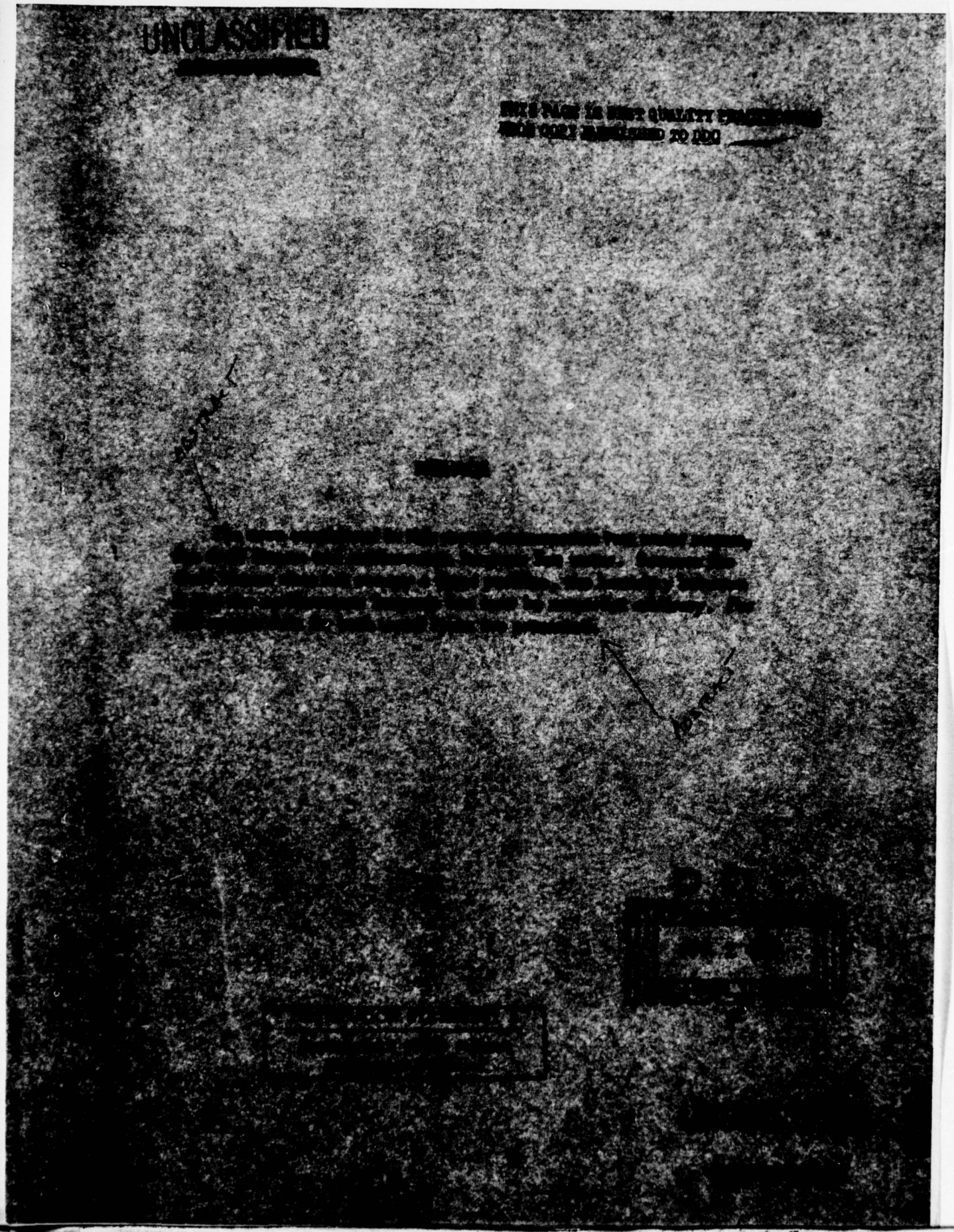

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[illegible]

I. AREA: [illegible] quadrangle 36° to 37°N, 46° to 47°W

II. PREDICTED VALUES FOR QUADRANGLE FOR AUGUST (GULF STREAM WATER)

Initial Speed of Sound (25 feet)	[illegible] ft/sec
Layer Depth	[illegible] ft
Layer Depth Sound Speed	[illegible] ft/sec

Convergence Zone (For a depth of approximately 2,700 fathoms)

Speed at Bottom (Fig 4)	[illegible] ft/sec
Minimum Refracted Angle (Fig 6)	1°
Maximum Refracted Angle (Fig 6)	[illegible]°
Average Angle	2.5°
Ship Equipment Tilt (D/E) Angle	[illegible]°
Mean Horizontal Speed for Ship Tilt (D/E) Angle (Fig 6)	[illegible] ft/sec
Initial Range (Fig 7)	[illegible].3 kyds
Expected Surface Zone Width (Fig 7)	[illegible]
Shot Path Velocity	[illegible] ft/sec

Bottom Bounce (For a depth of approximately 2,700 fathoms)

Minimum Useful Inclination Angle = Maximum Refracted Angle of Convergence + 3° =	[illegible]°
Predicted Detection Range (Fig 7)	[illegible] kyds
Mean Horizontal Speed (Fig 8)	[illegible] ft/sec

3. Near Surface Path Detection

13-knot Figure of Merit + Target Strength 215 db Range (Table 1)	16.8 kyds

[illegible]

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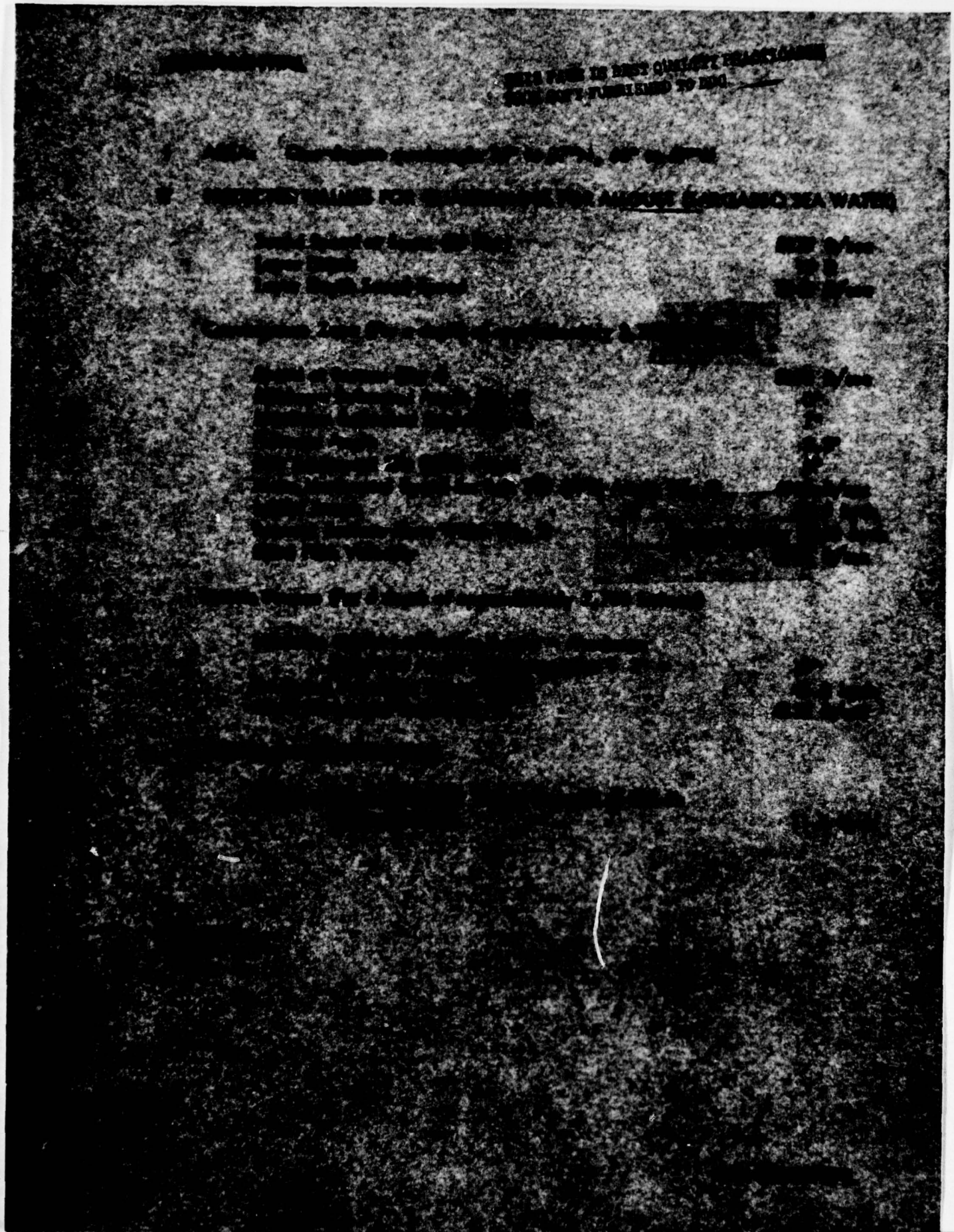

III USE OF GRAPHS FOR PARTICULAR CONDITIONS

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

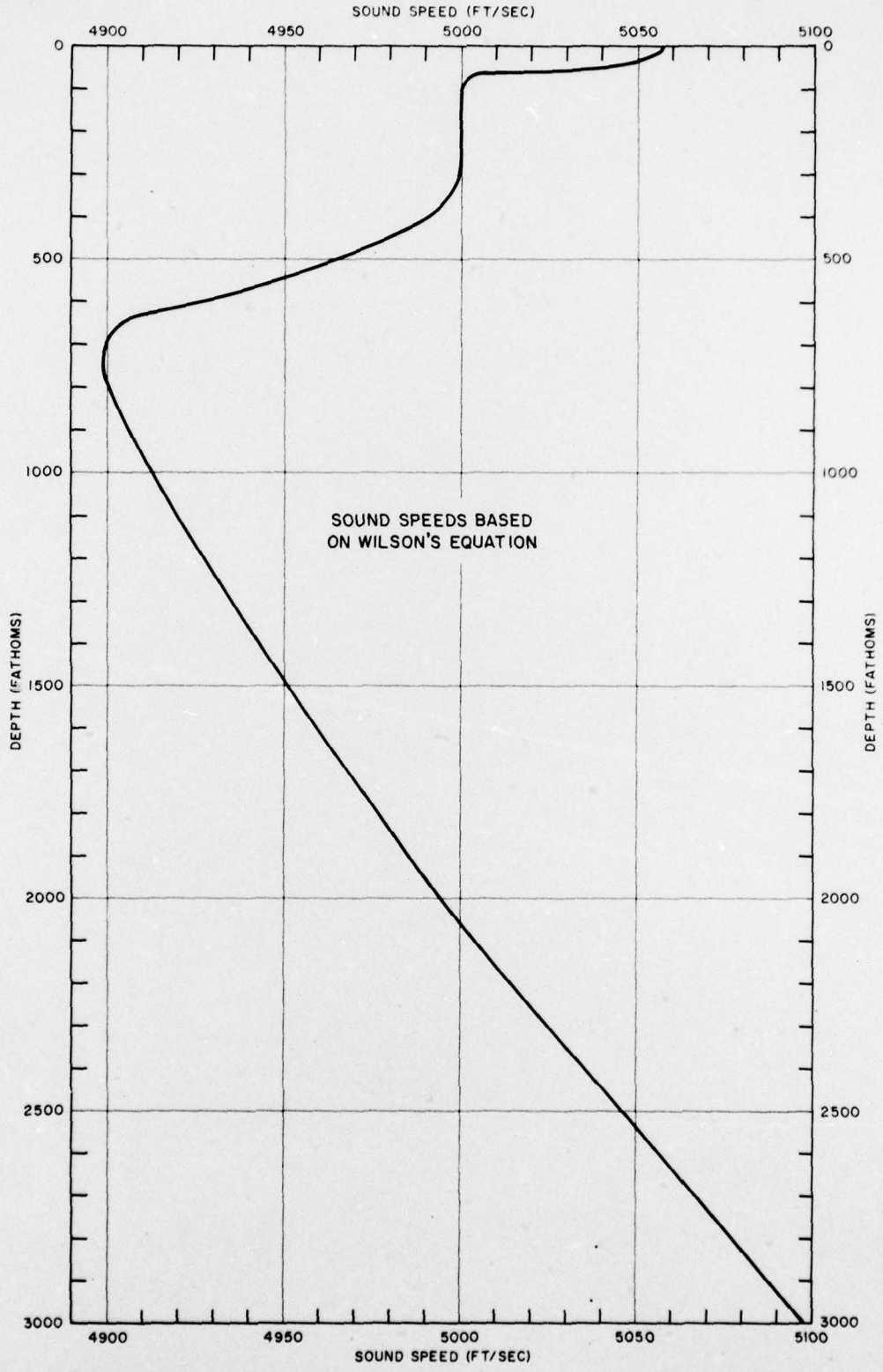

FIGURE IA' TYPICAL SOUND SPEED PROFILE FOR AUGUST (GULF STREAM WATER)

AREA A AUGUST 0-116-63

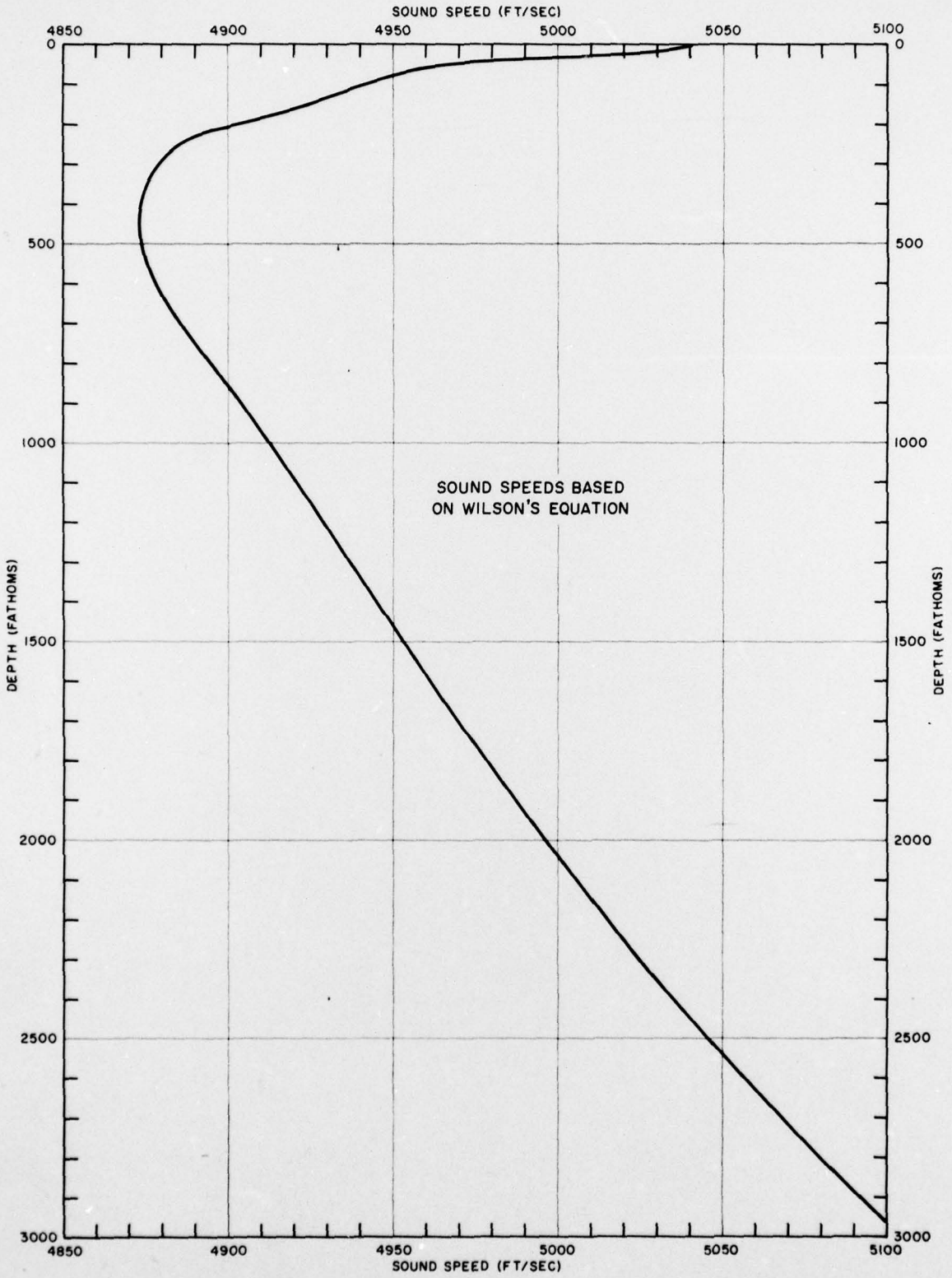

FIGURE IB TYPICAL SOUND SPEED PROFILE FOR AUGUST (SARGASSO SEA WATER)

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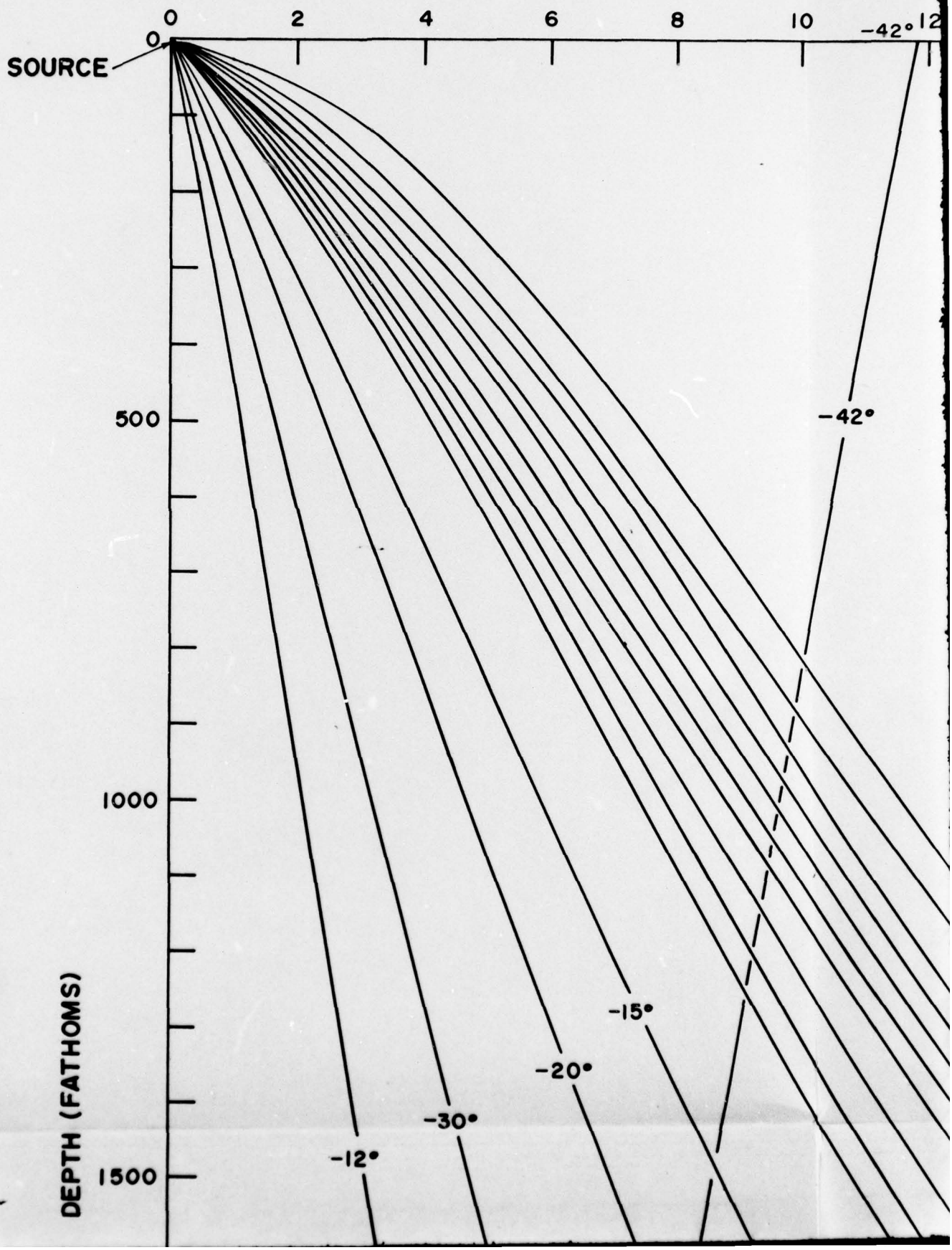

9 "A" AUGUST 0-116-63 A-AUG FIG 2A

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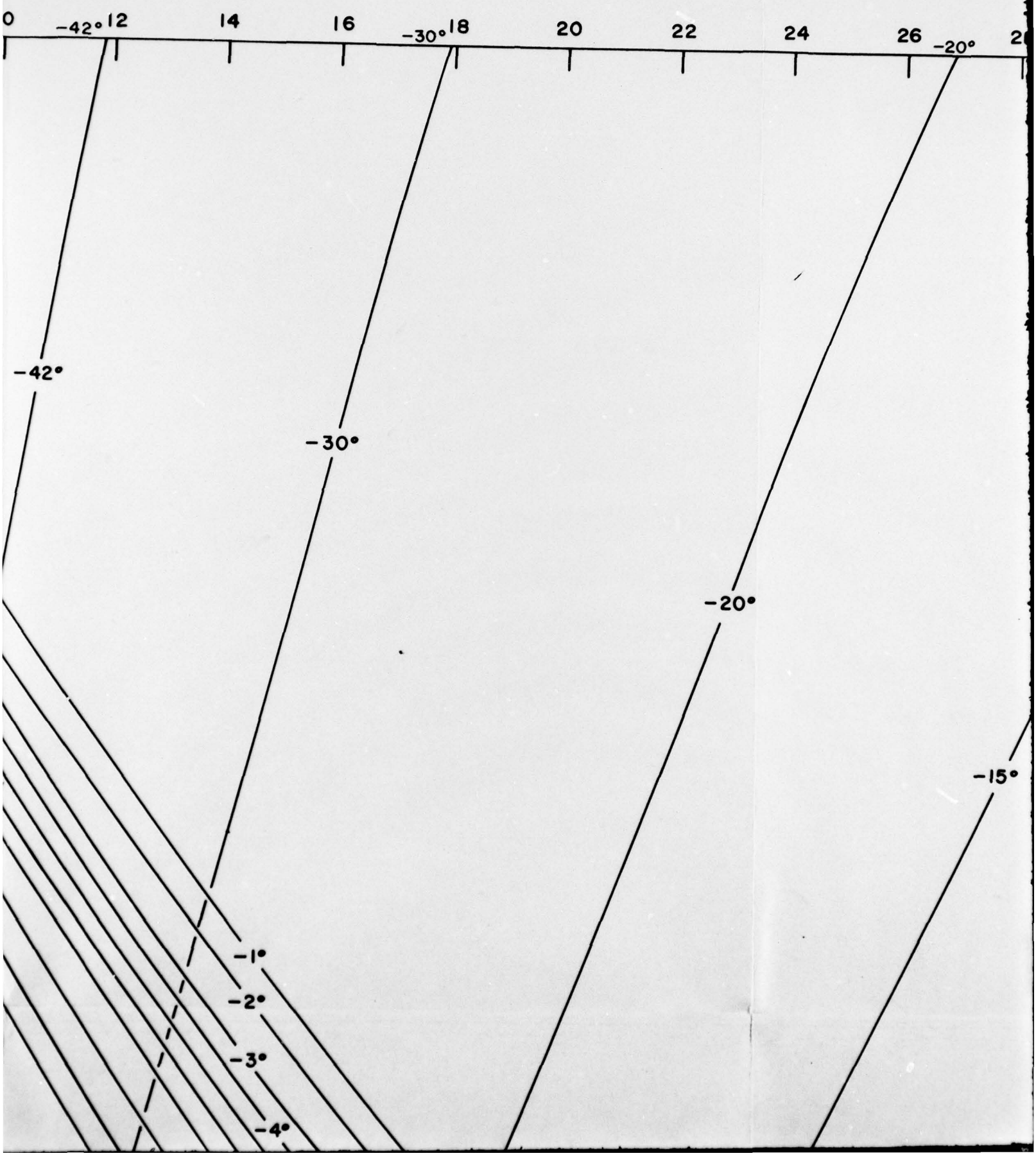
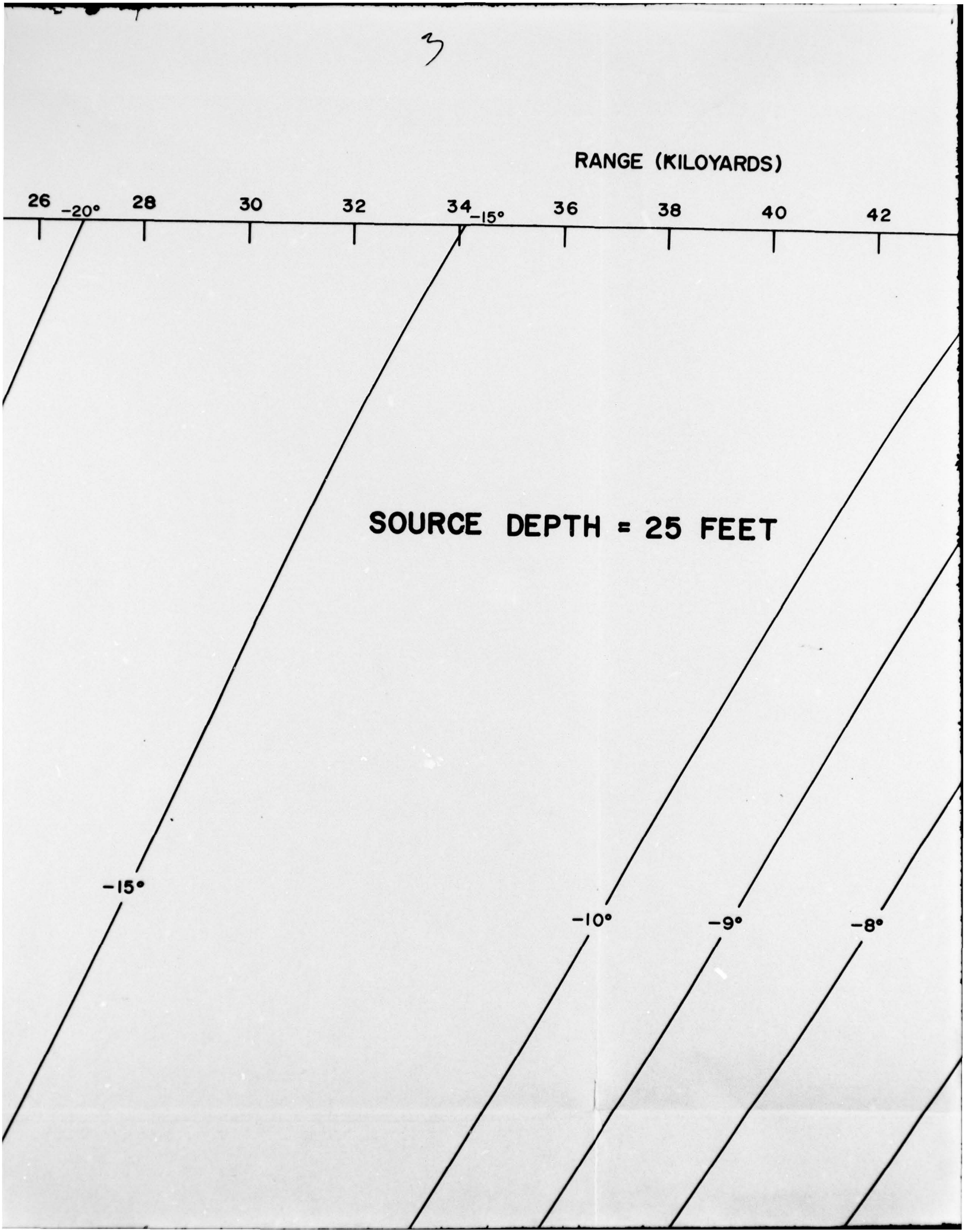
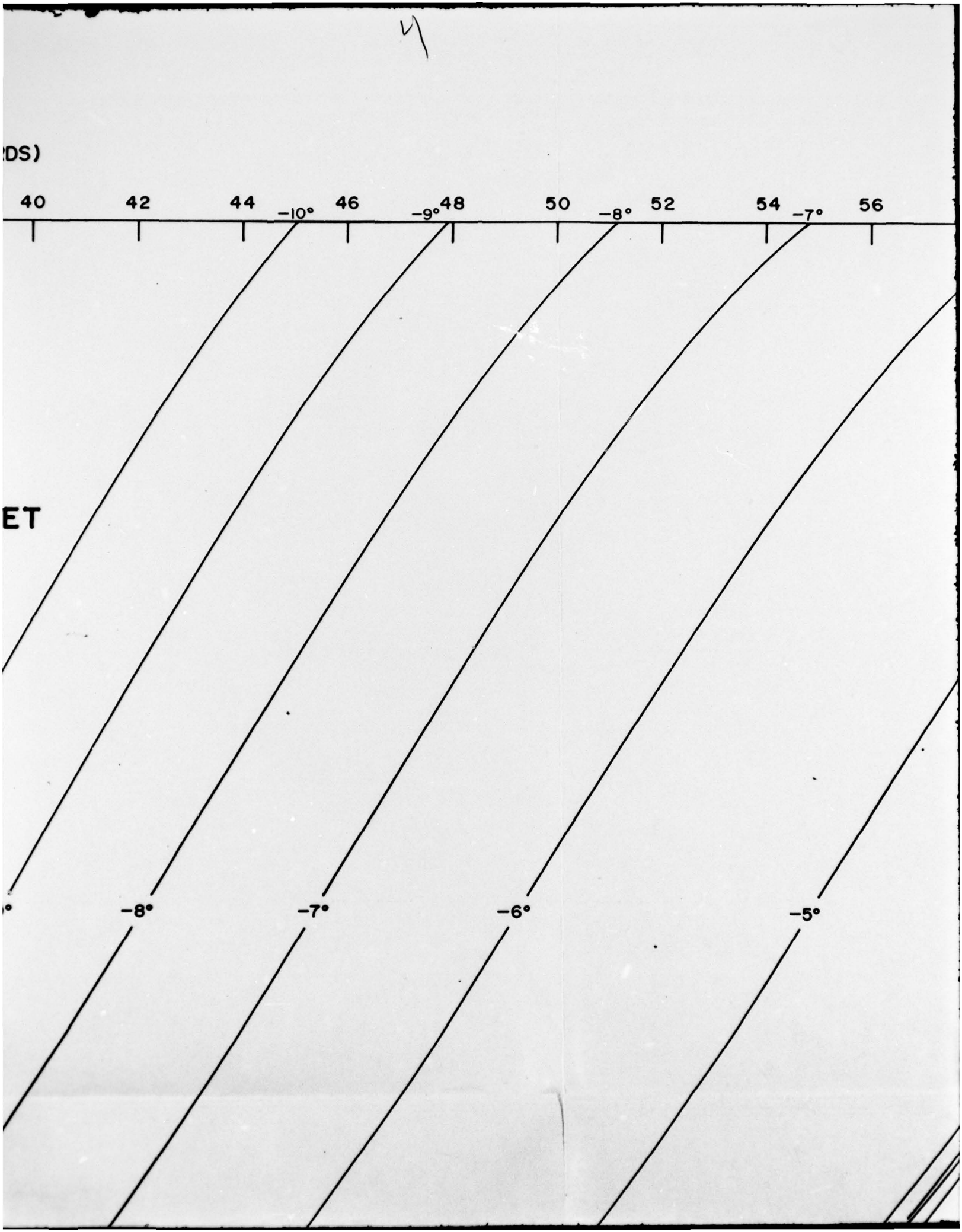
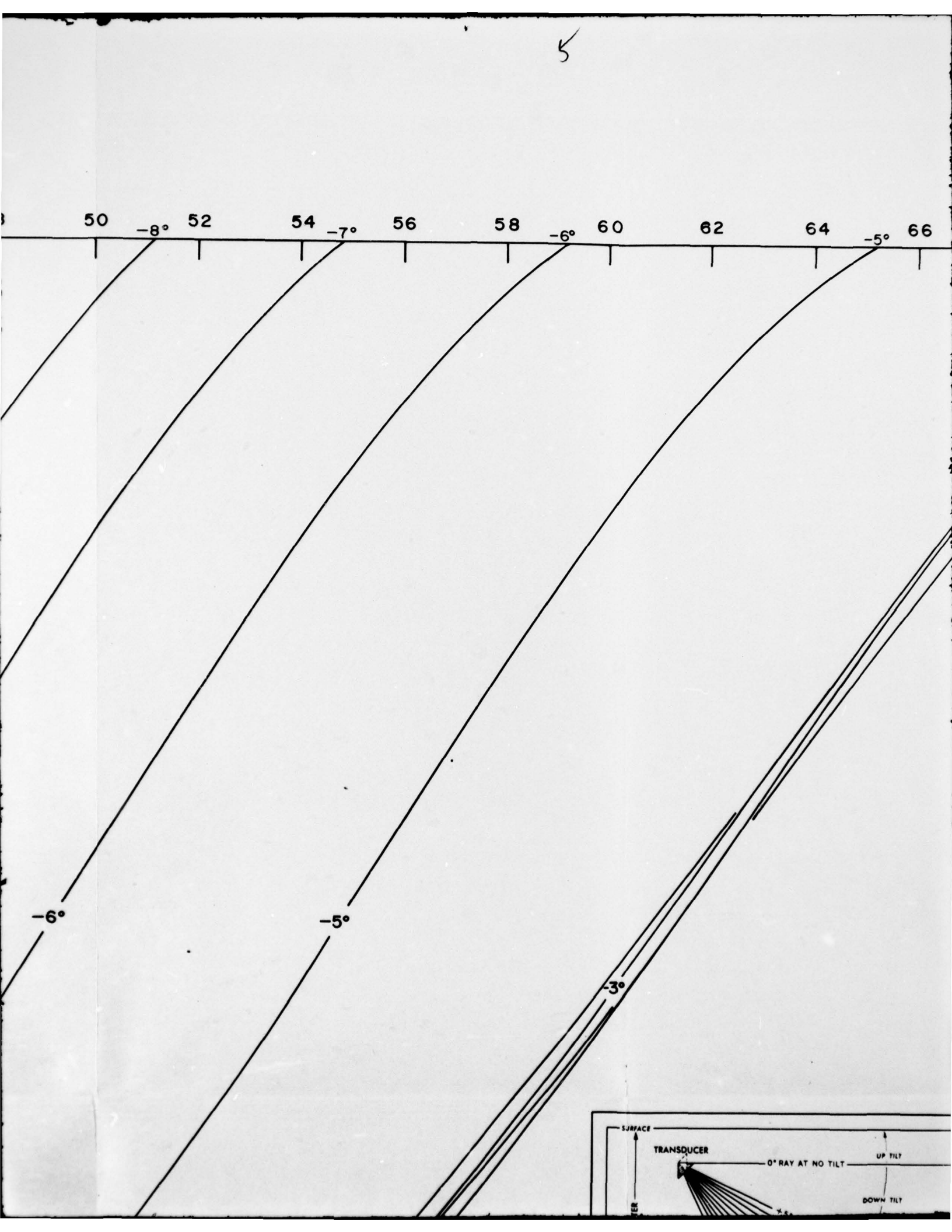

0
-42°
12
14
16
-30°
18
20
22
24
26
-20°
-42°
-30°
-20°
-15°
-1°
-2°
-3°
-4°


RANGE (KILOYARDS)
26
-20°
28
30
32
34
-15°
36
38
40
42
SOURCE DEPTH = 25 FEET
-15°
-10°
-9°
-8°


DS)
40
42
44
46
48
50
52
54
56
−10°
−9°
−8°
−7°
ET
°
−8°
−7°
−6°
−5°


50
52
54
56
58
60
62
64
66
-8°
-7°
-6°
-5°
-6°
-5°
-3°
SURFACE
TRANSDUCER
0° RAY AT NO TILT
UP TILT
DOWN TILT

B

62 64 66 68 70 72 74 76

-5° -4° -3° -2° -1°

-1°

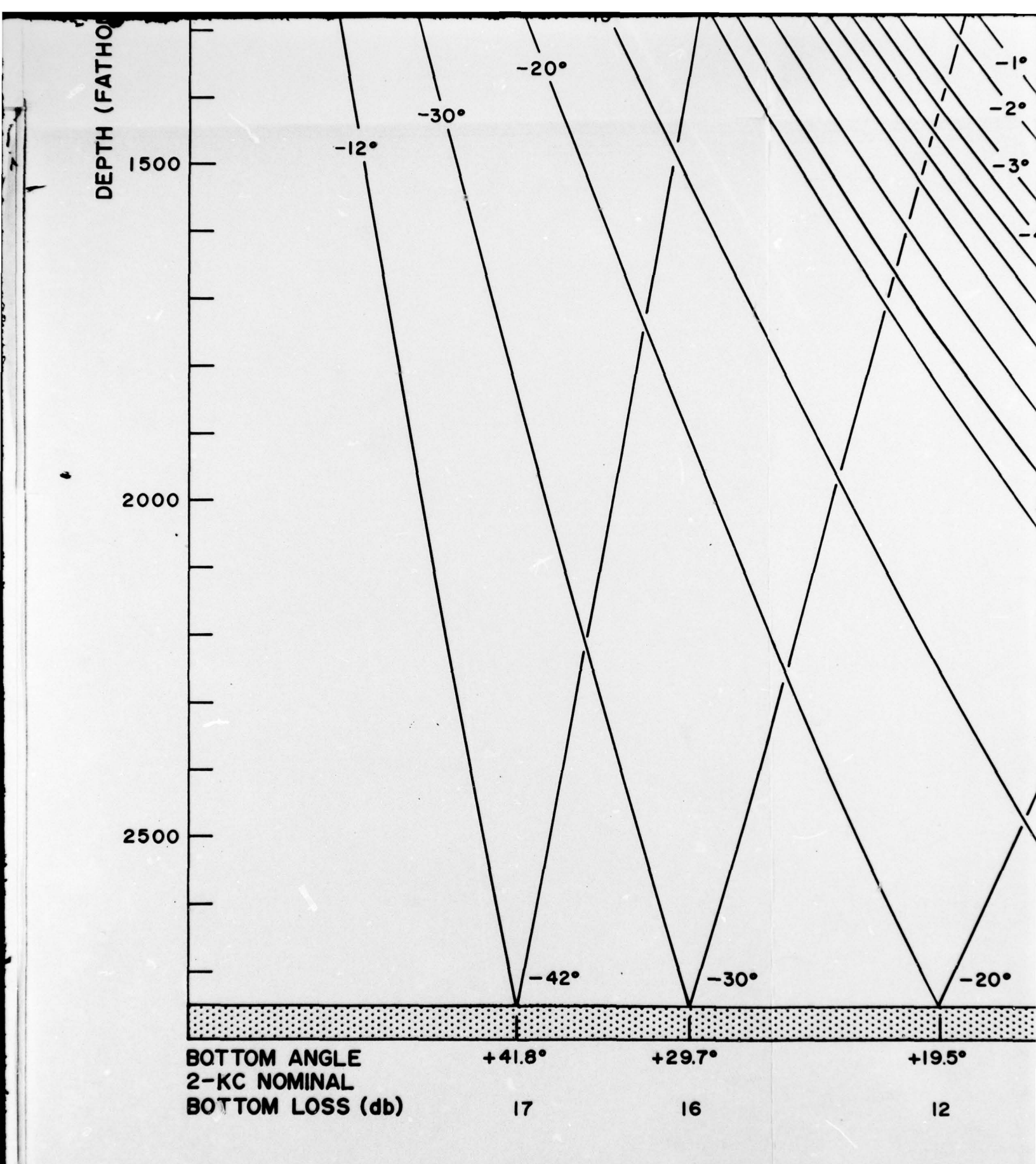
0

500

1000

1500

DEPTH (FATHOMS)


DEPTH (FATHO
1500
2000
2500
-12°
-30°
-20°
-1°
-2°
-3°
-42°
-30°
-20°
BOTTOM ANGLE
+41.8°
+29.7°
+19.5°
2-KC NOMINAL
BOTTOM LOSS (db)
17
16
12

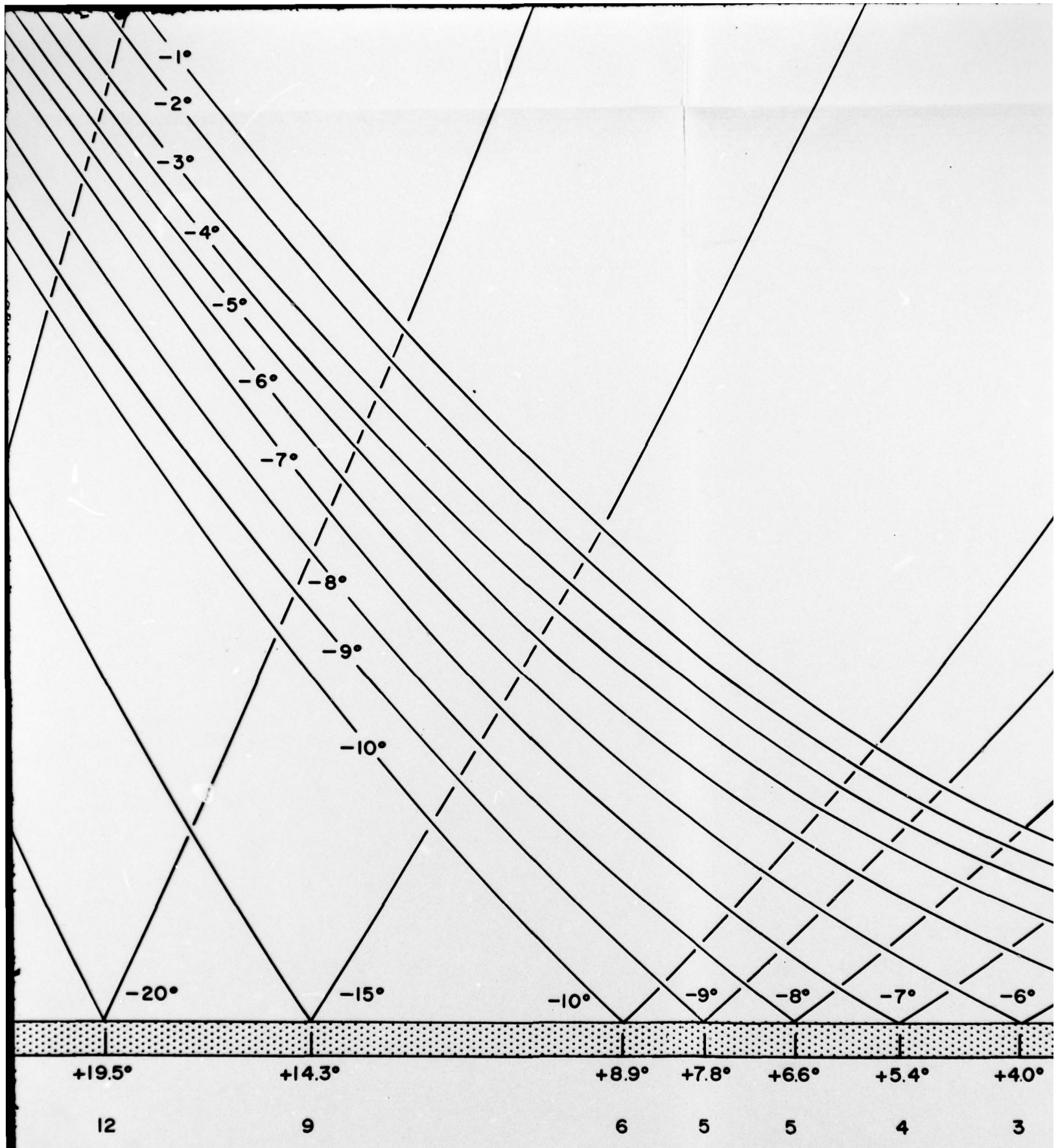
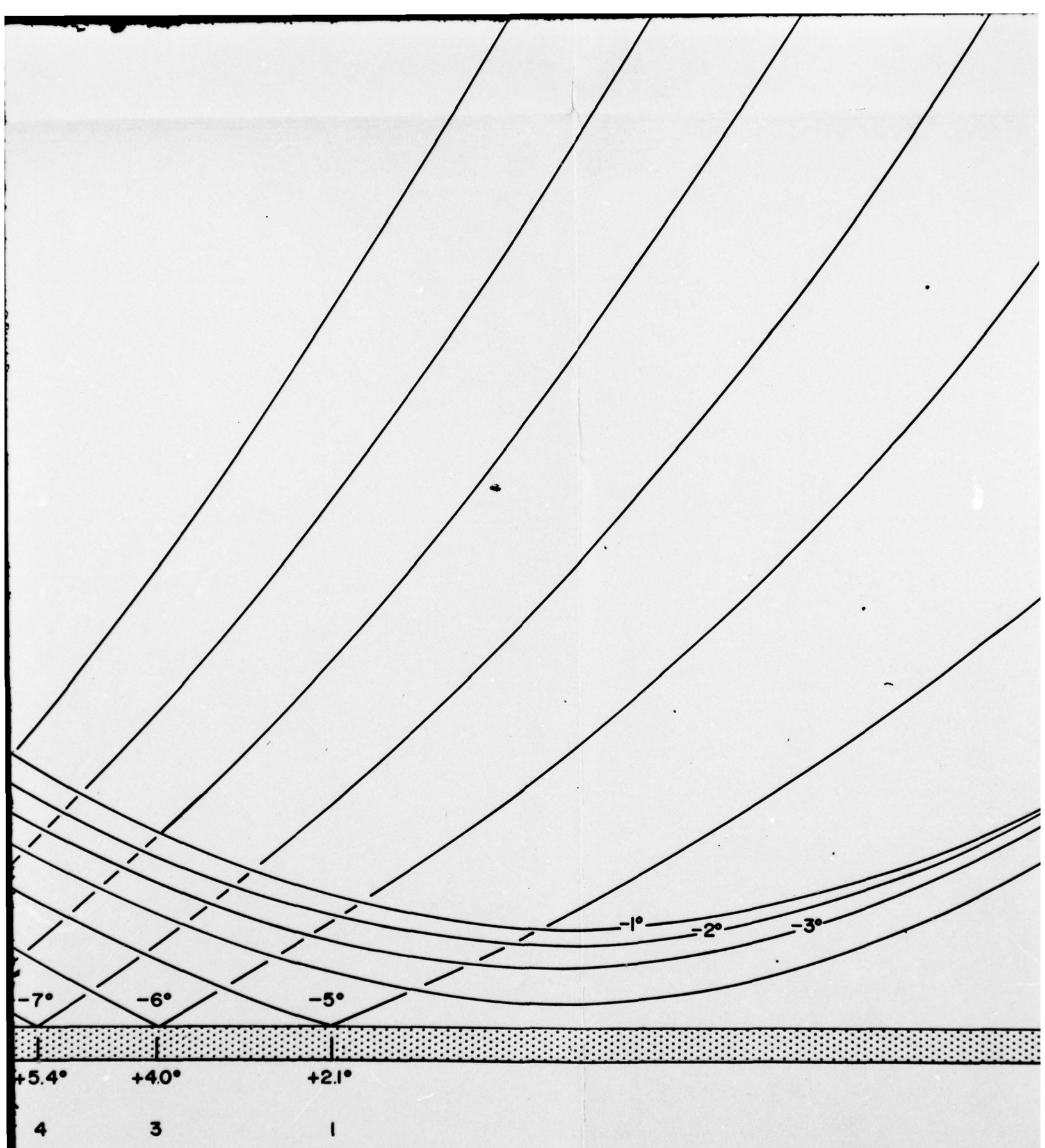
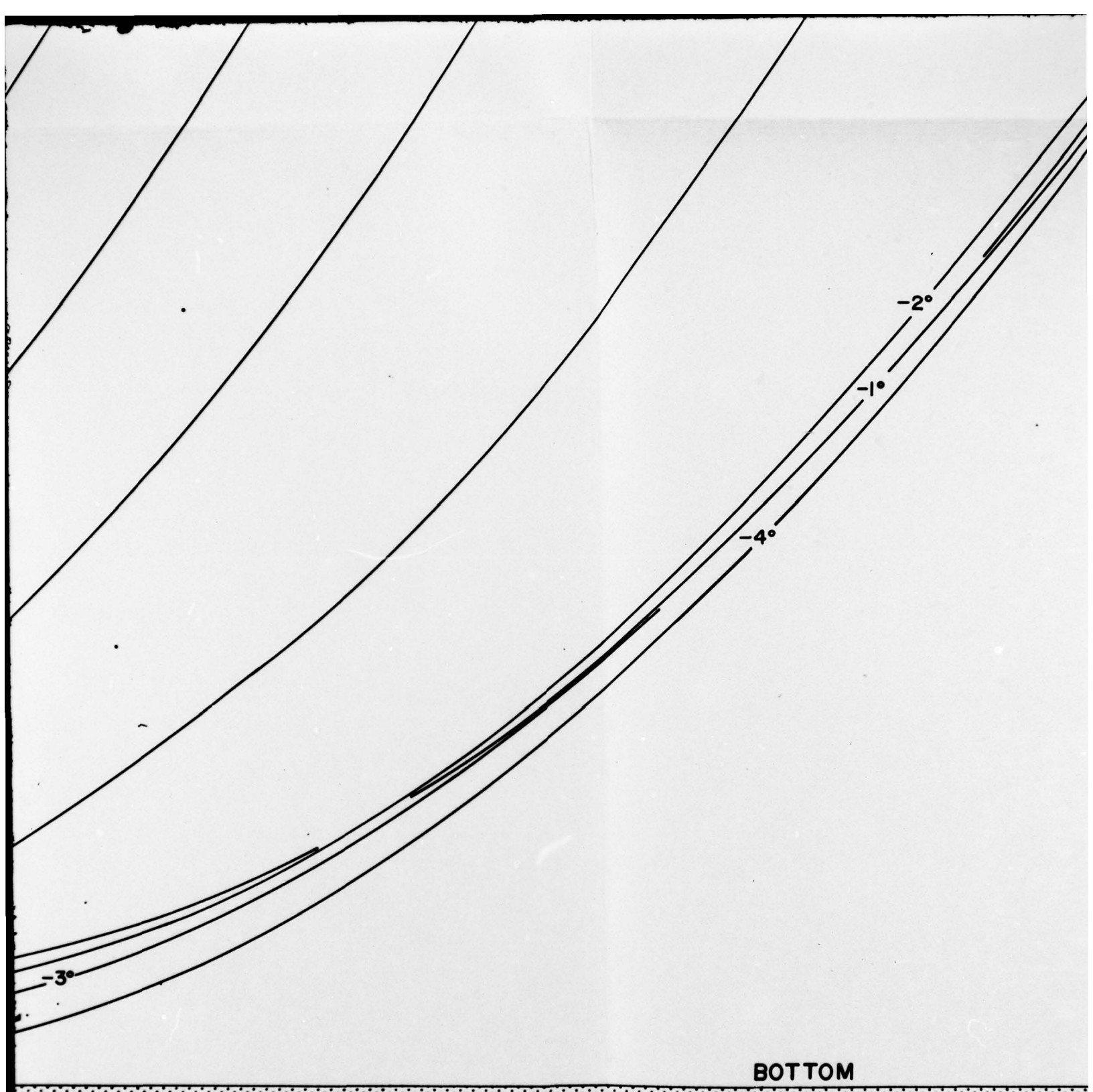


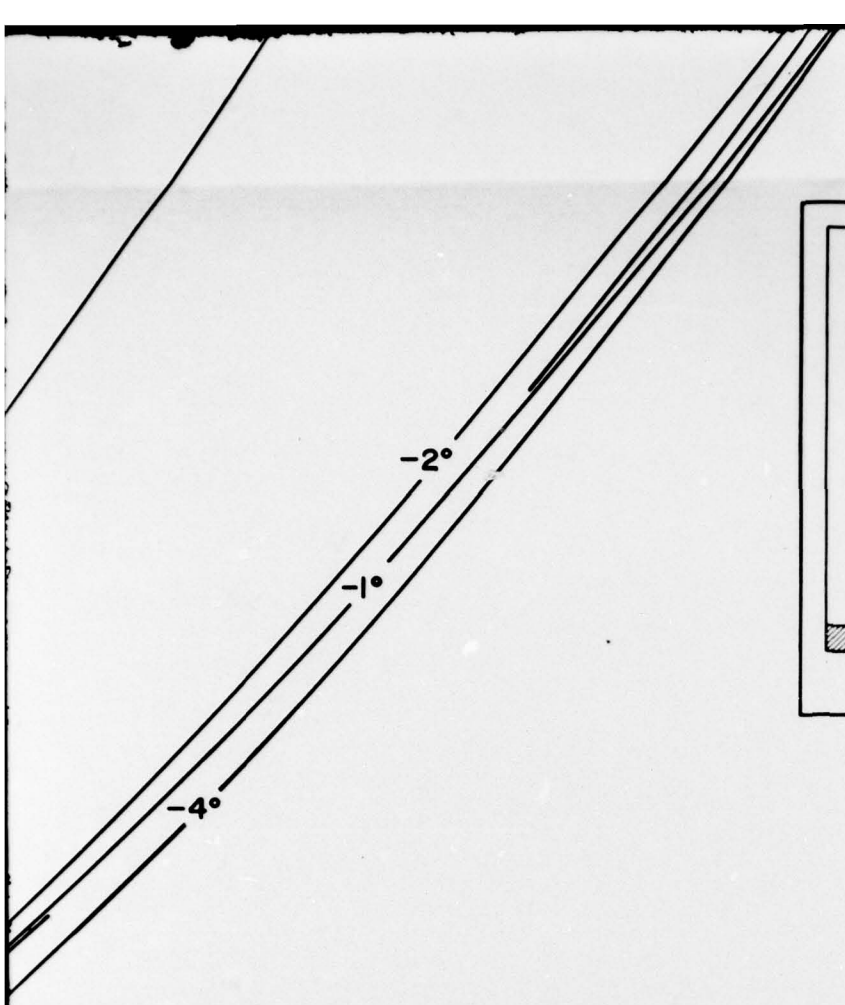
FIGURE 2A RAY DIAGRAM COMPUTED FROM TYPICA



D FROM TYPICAL SOUND SPEED PROFILE (GULF STREAM WATER) FOR CROSS SECTIO



R) FOR CROSS SECTION A-B SHOWN ON FIGURE 4 FOR AUGUST



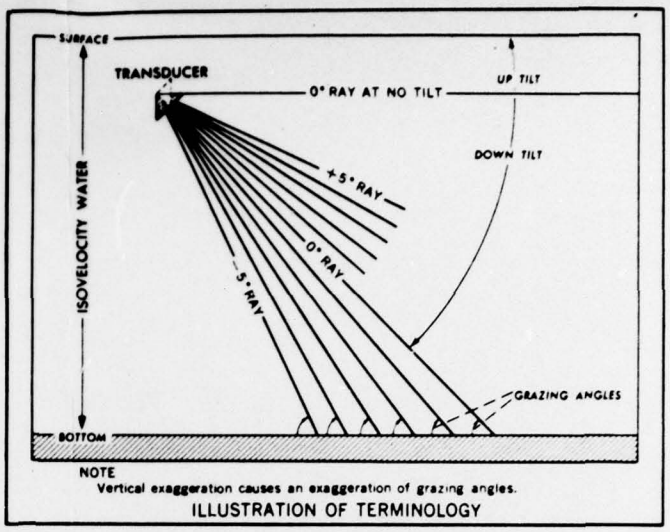
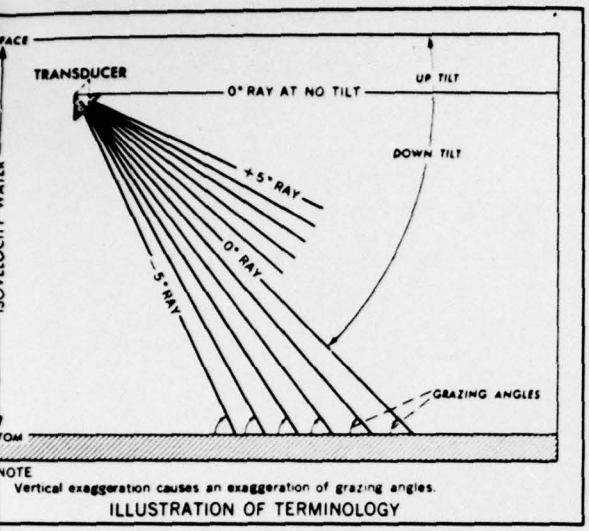


ILLUSTRATION OF TERMINOLOGY

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°

BOTTOM

4 FOR AUGUST



NOTE
Vertical exaggeration causes an exaggeration of grazing angles.

ILLUSTRATION OF TERMINOLOGY

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°

DEPTH (FATHOMS)

1500

2000

2500

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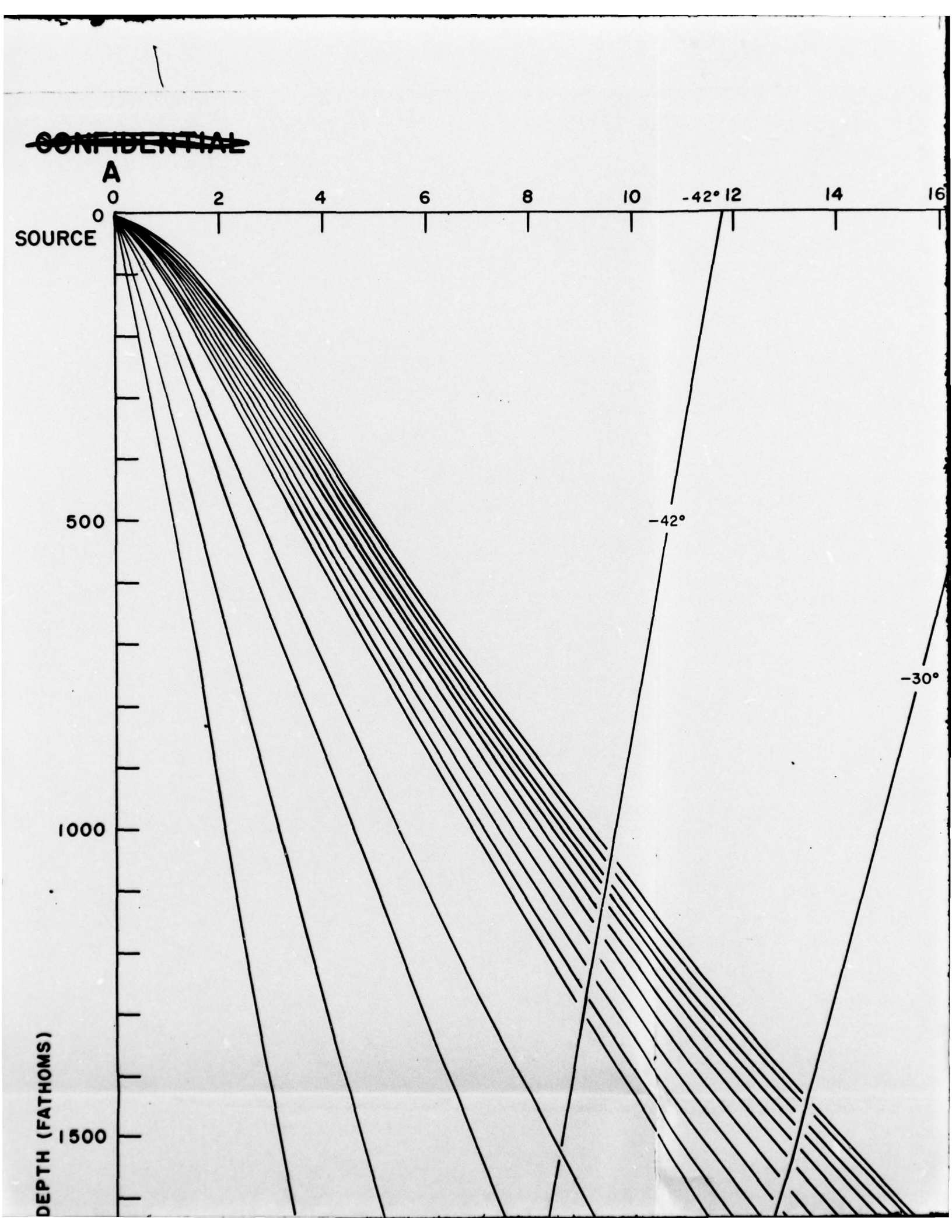

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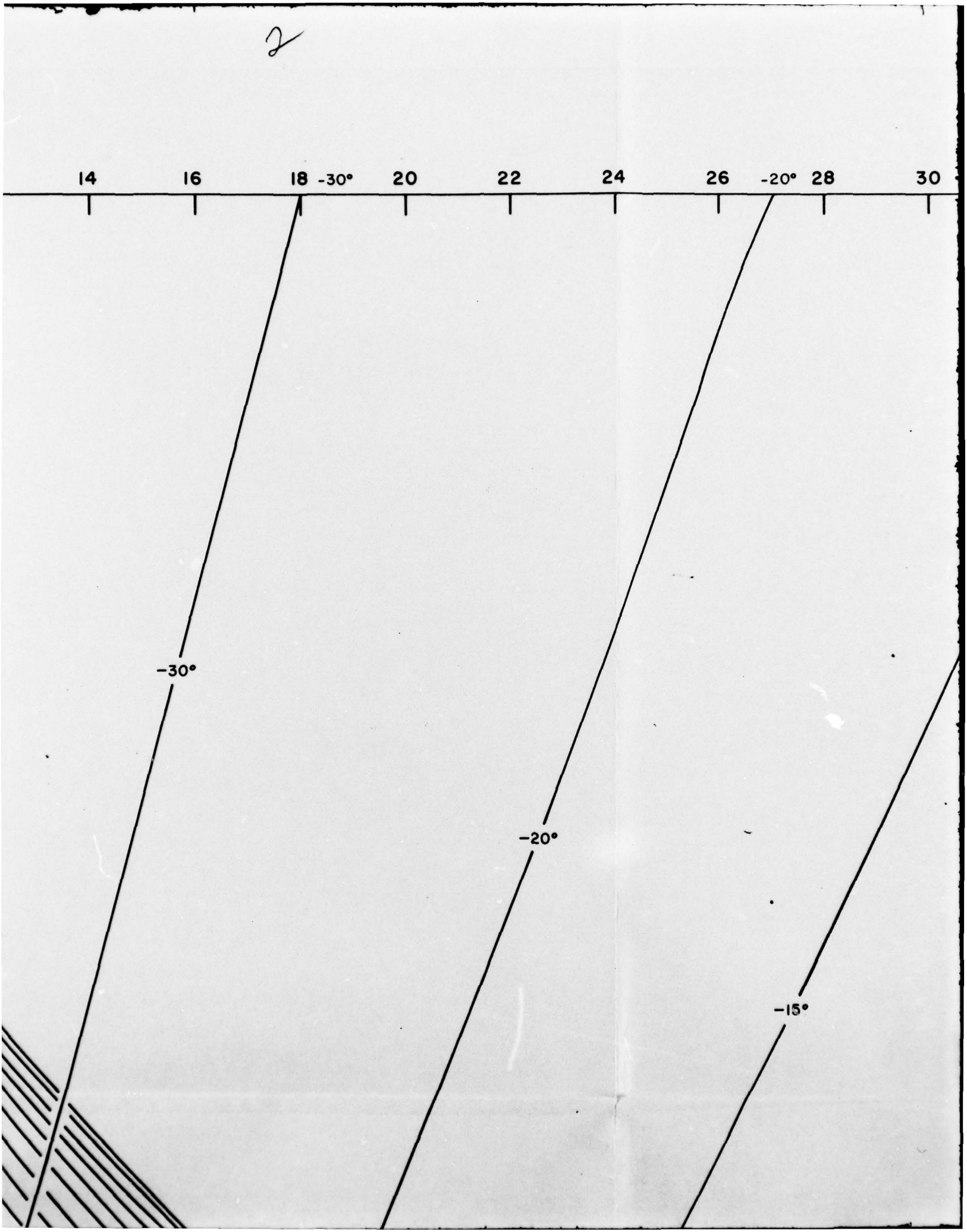
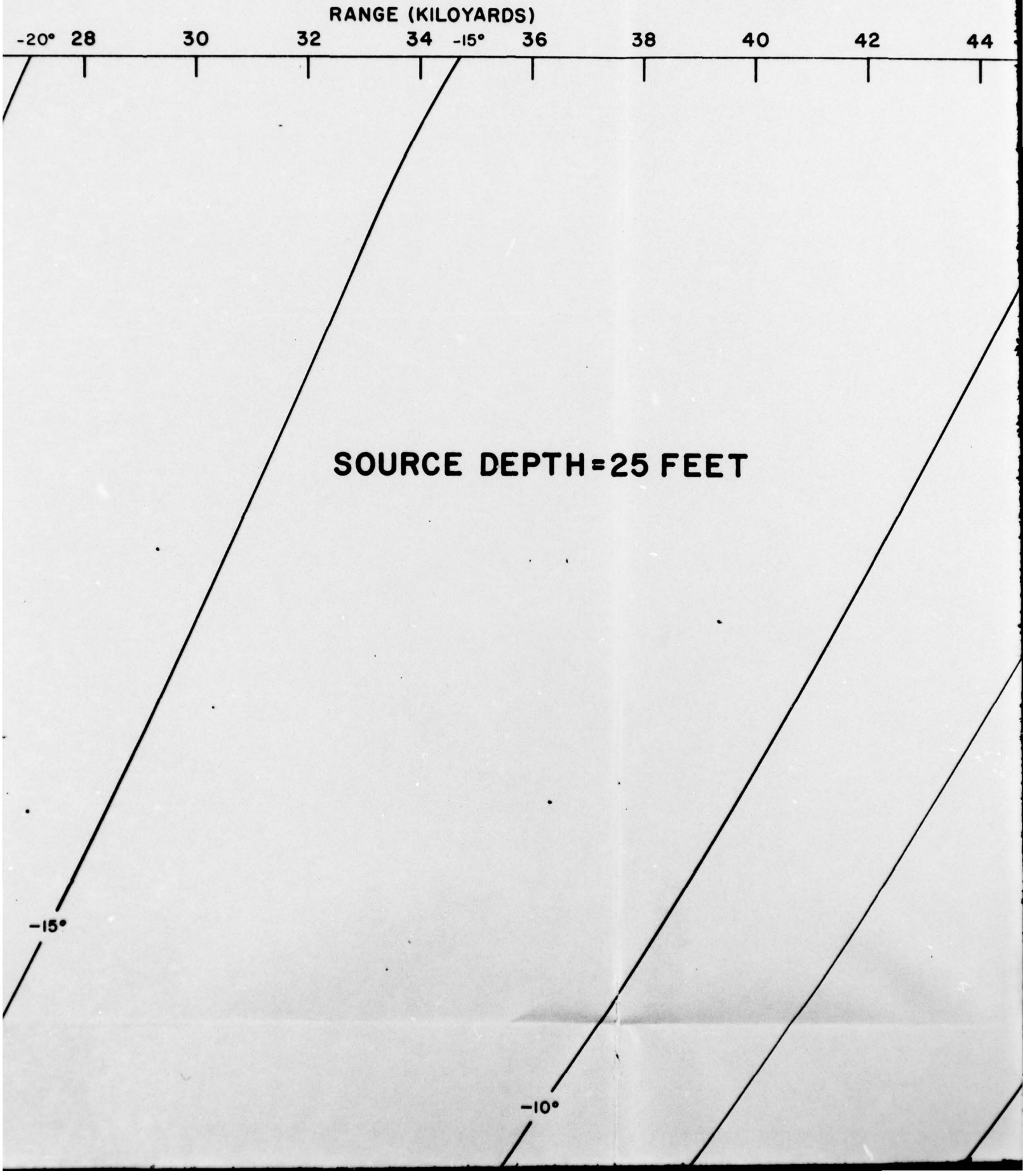
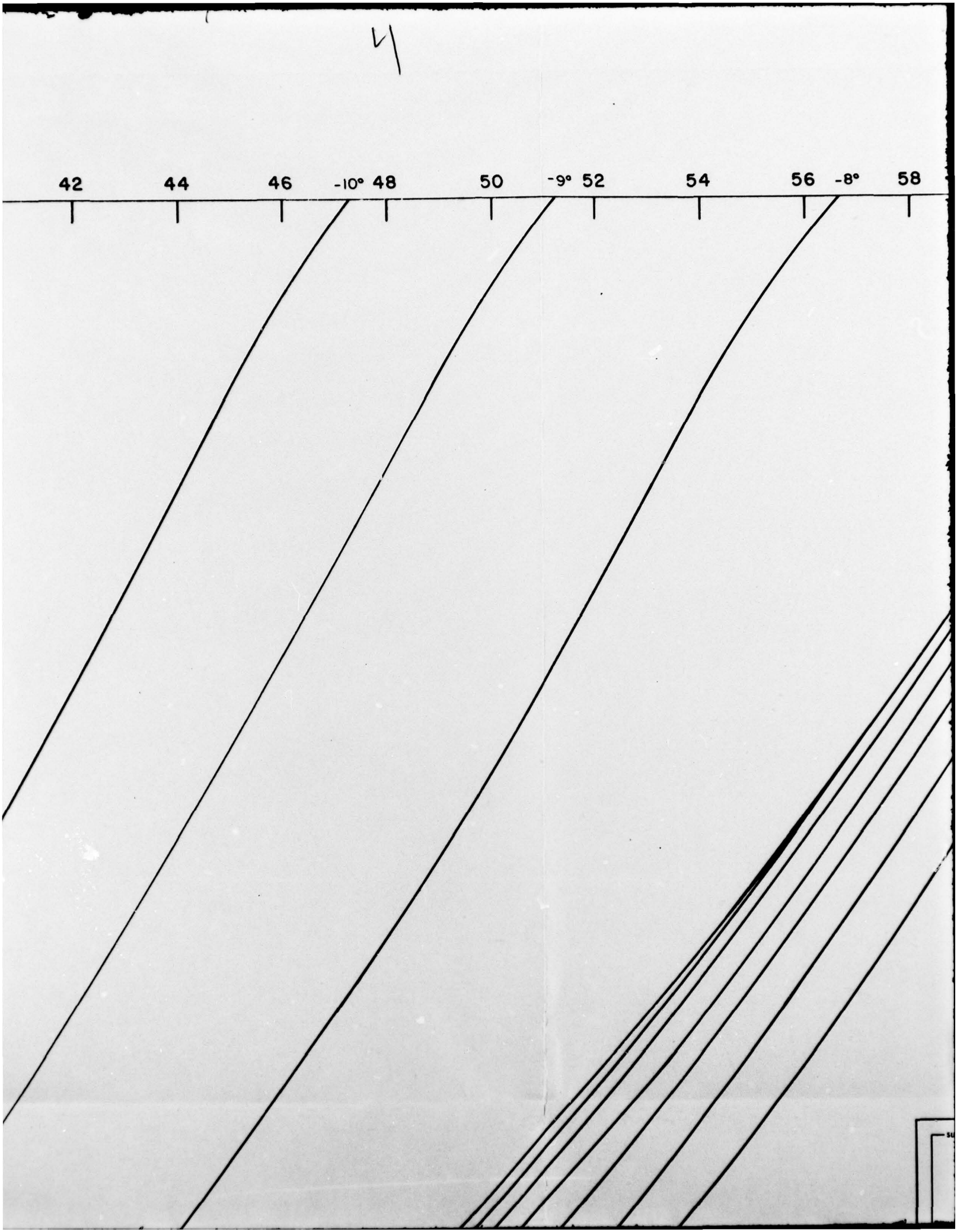
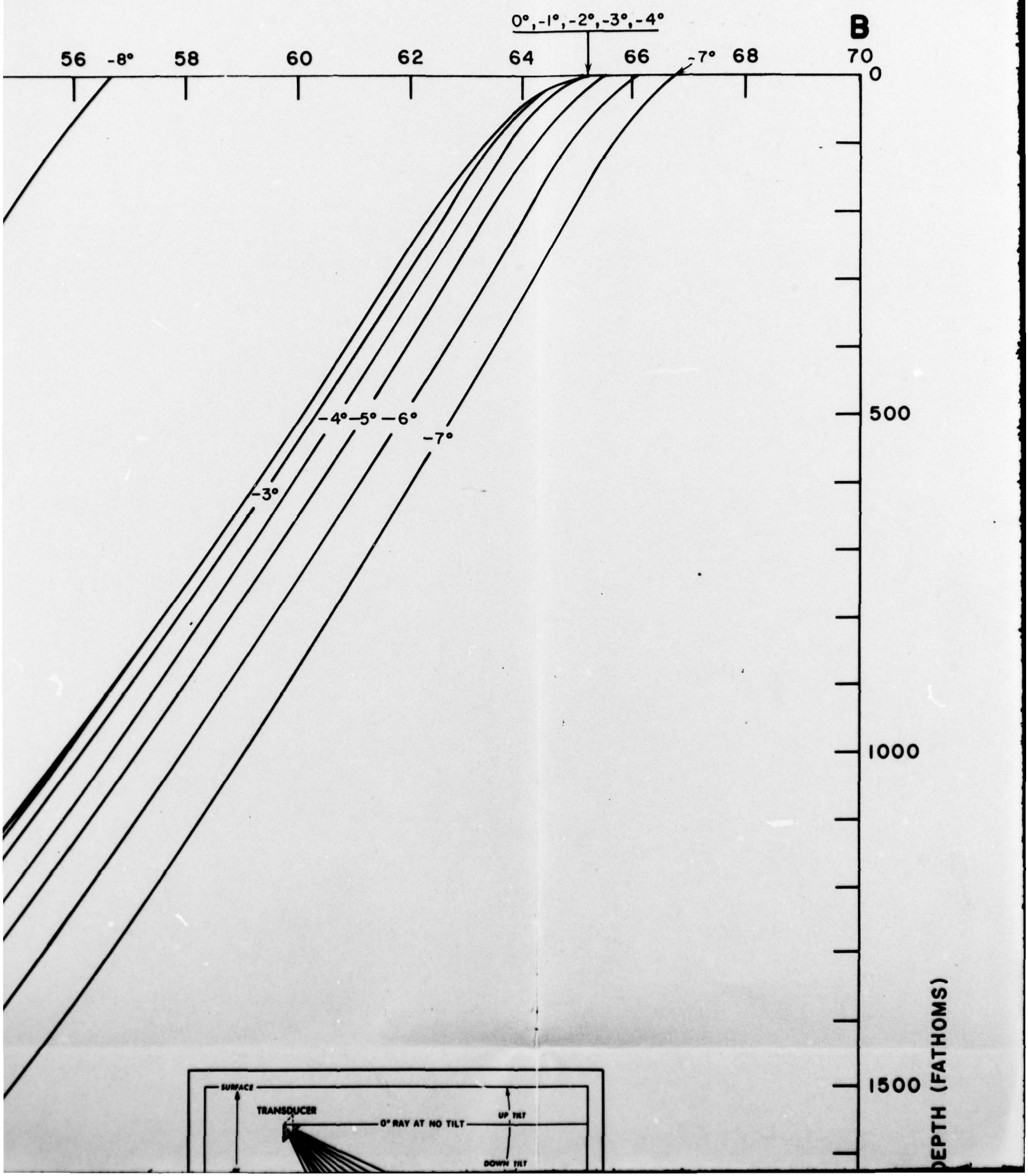
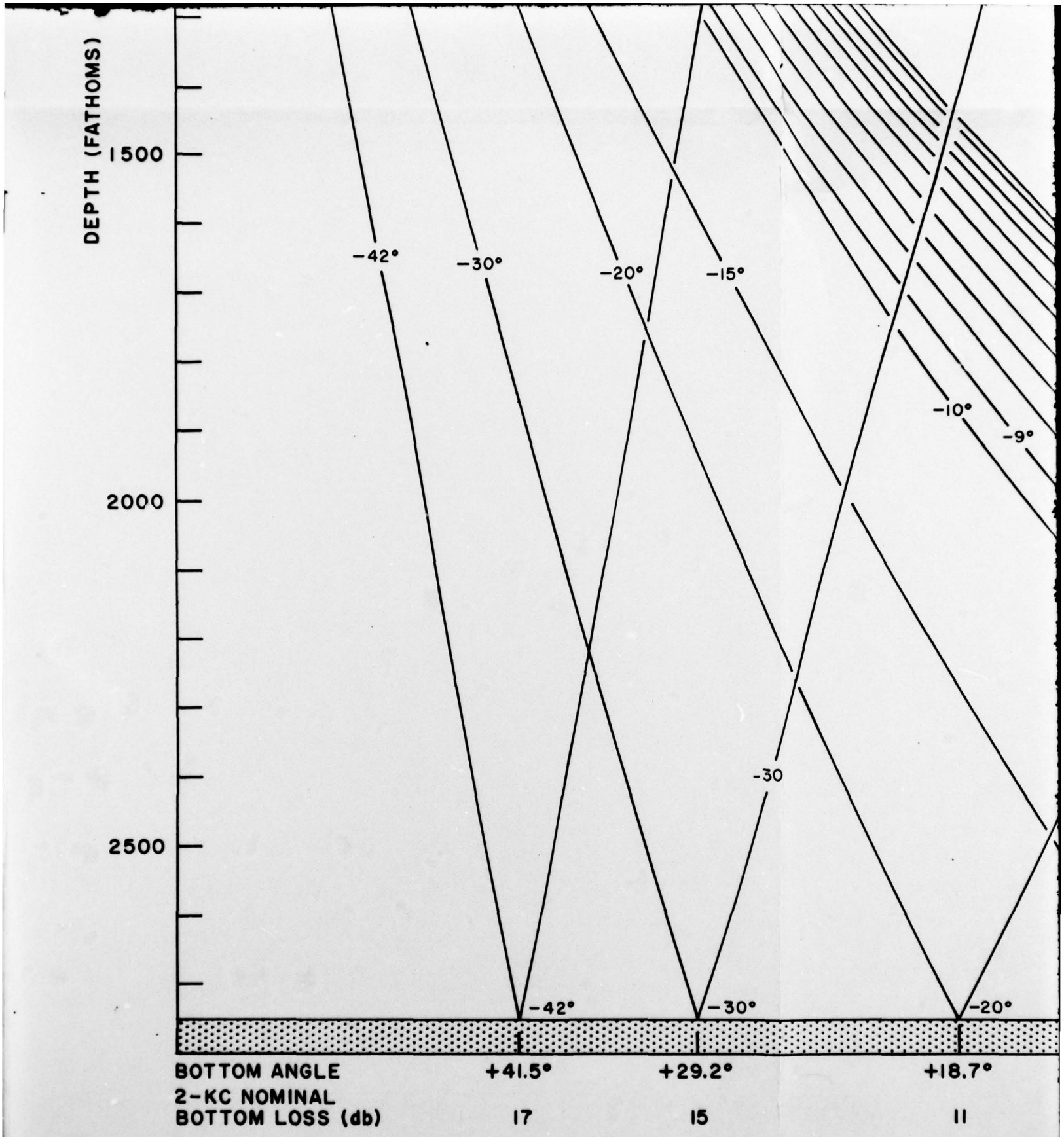



RANGE (KILOYARDS)
-20°
28
30
32
34
-15°
36
38
40
42
44
SOURCE DEPTH=25 FEET
-15°
-10°


42
44
46
-10°
48
50
-9°
52
54
56
-8°
58


0°,-1°,-2°,-3°,-4°
B
56
-8°
58
60
62
64
66
-7°
68
70
0
500
1000
1500
-3°
-4°
-5°
-6°
-7°
DEPTH (FATHOMS)
SURFACE
TRANSDUCER
0° RAY AT NO TILT
UP TILT
DOWN TILT


DEPTH (FATHOMS)
1500
2000
2500
-42°
-30°
-20°
-15°
-10°
-9°
-30
-42°
-30°
-20°
BOTTOM ANGLE
+41.5°
+29.2°
+18.7°
2-KC NOMINAL
BOTTOM LOSS (db)
17
15
11

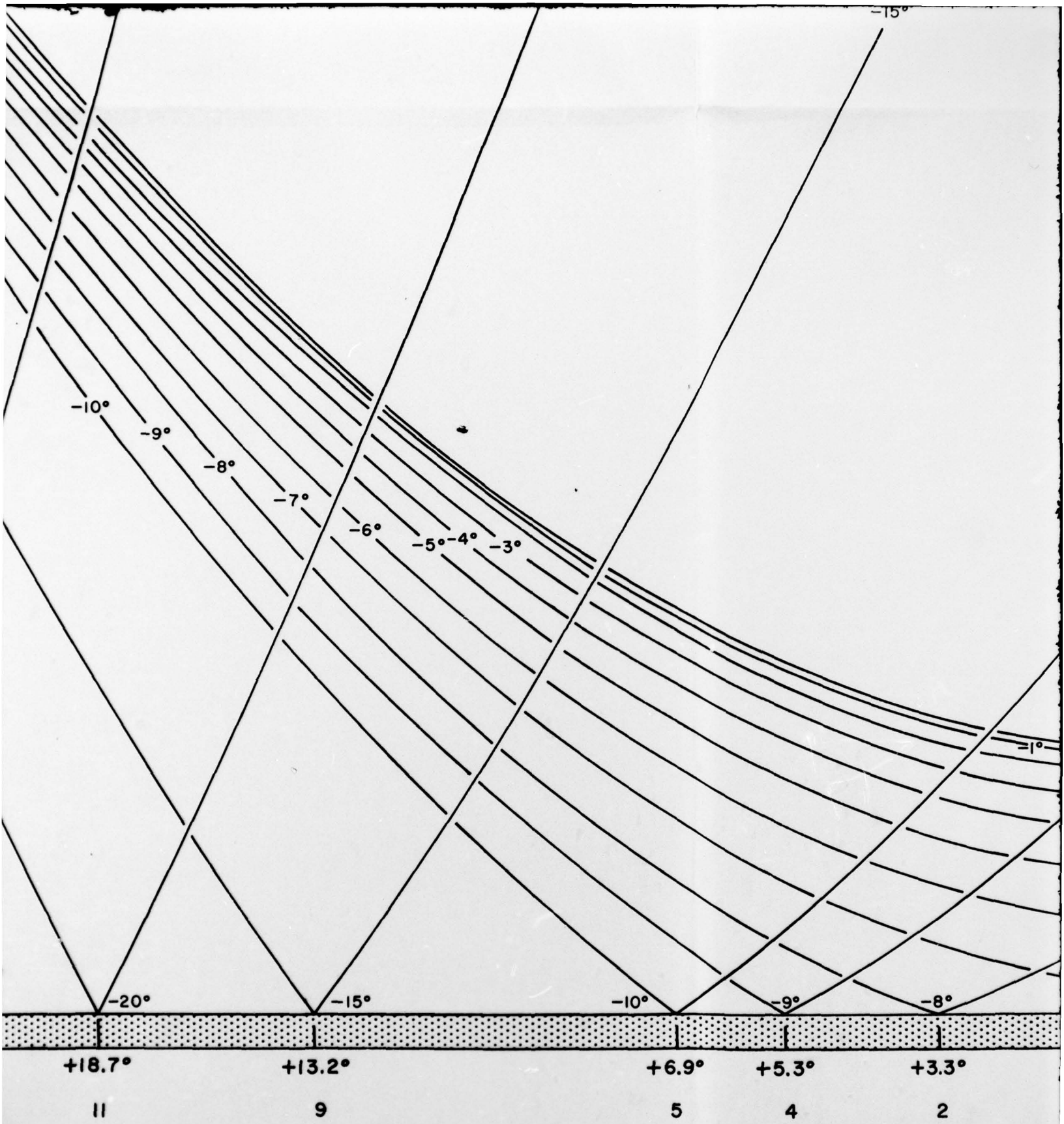
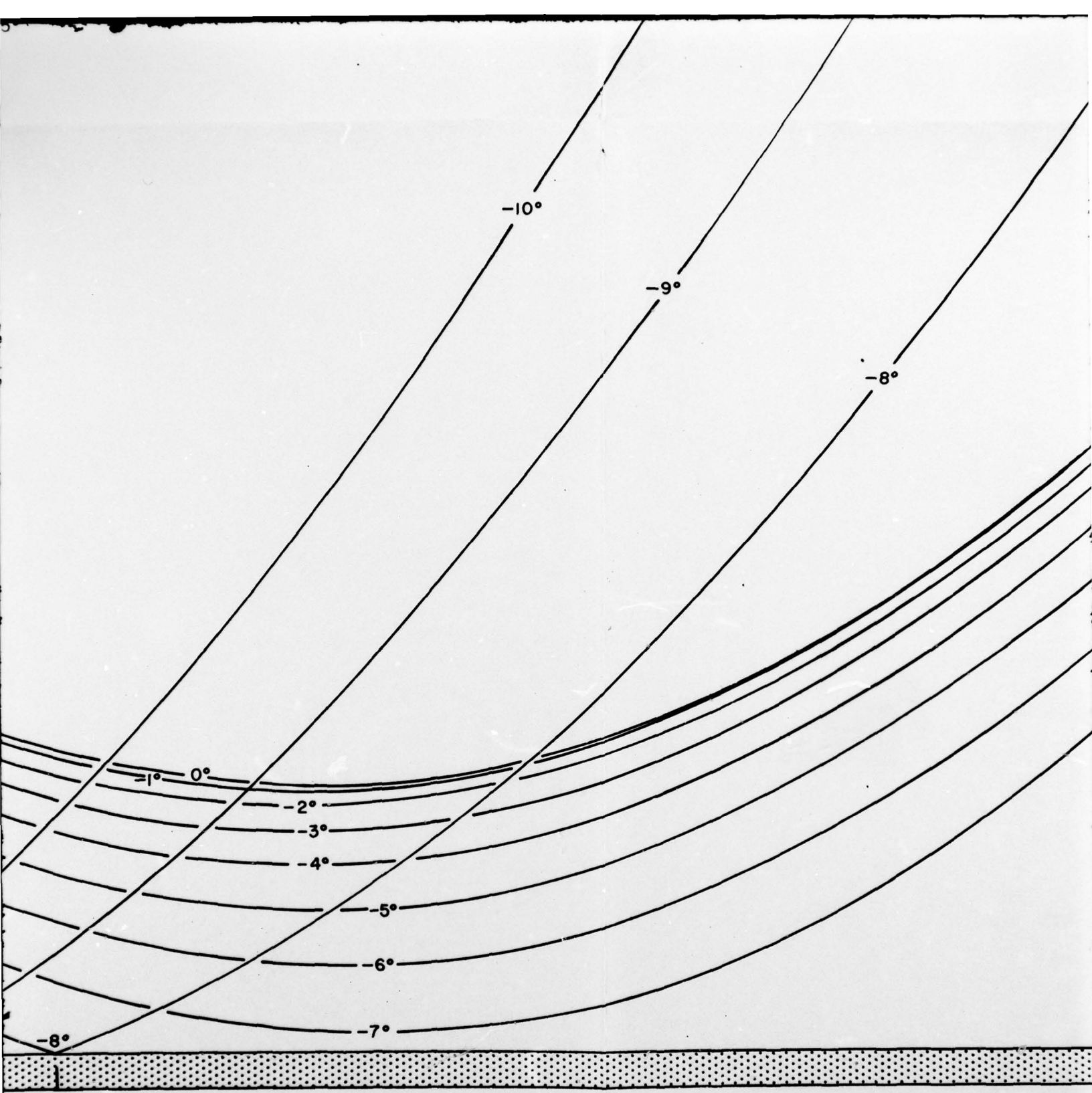


FIGURE 2B RAY DIAGRAM COMPUTED FROM TYPICAL SO



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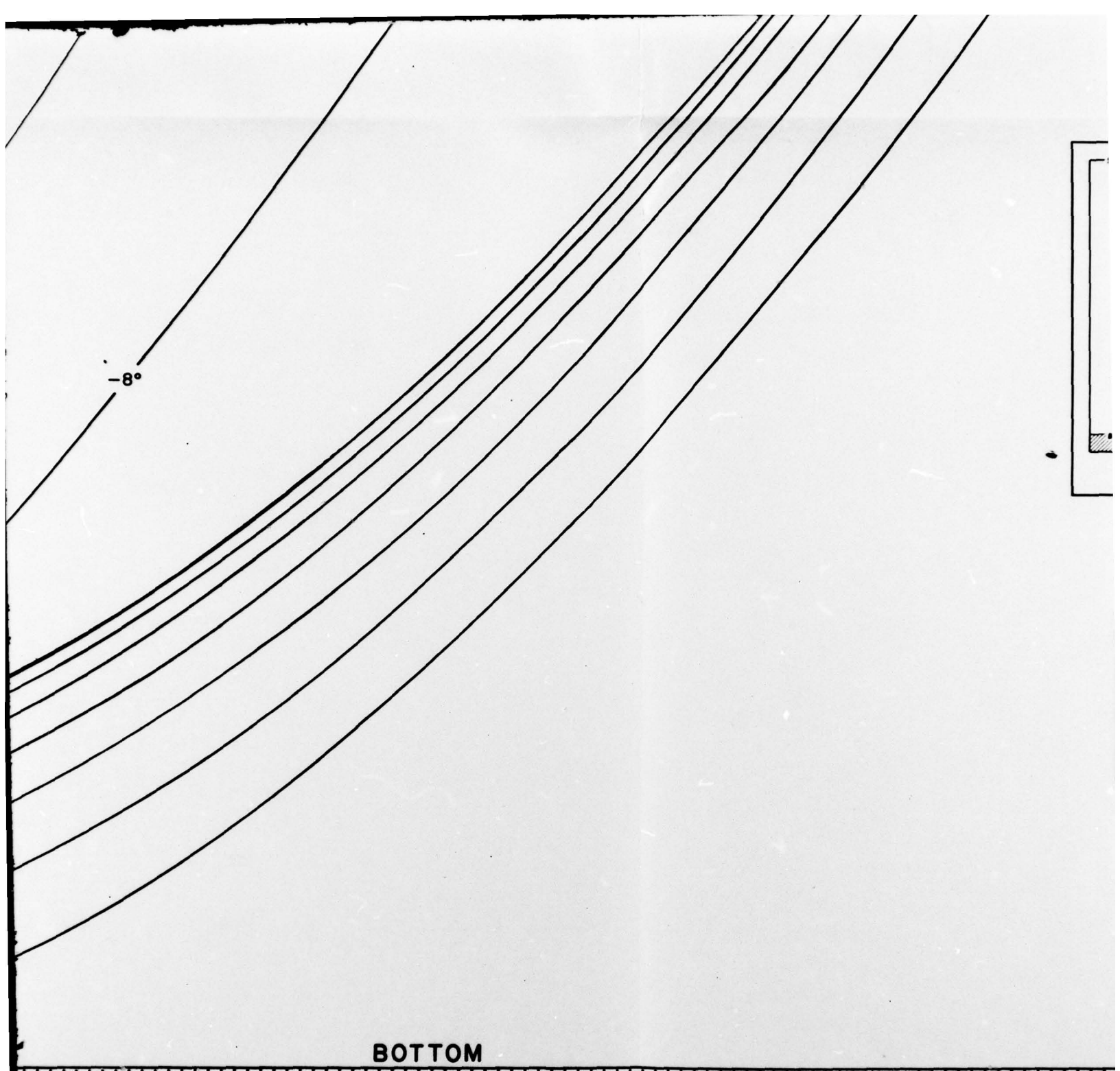
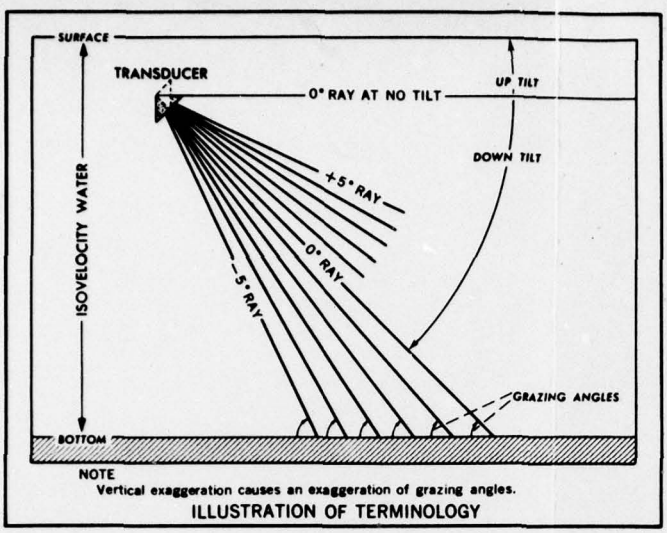
M TYPICAL SOUND SPEED PROFILE (SARGASSO SEA WATER) FOR CROSS SECTION A



FOR CROSS SECTION A—B SHOWN ON FIGURE 4 FOR AUGUST



NOTE
Vertical exaggeration causes an exaggeration of grazing angles.

ILLUSTRATION OF TERMINOLOGY

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°

DEPTH (FATHOMS)

1500

2000

2500

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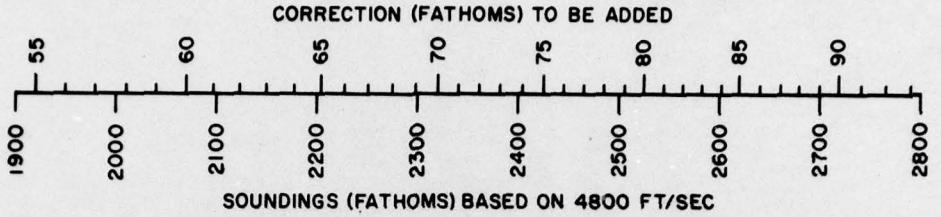

FIGURE 3A CORRECTION TO ECHO-SOUNDER DEPTH TO OBTAIN TRUE DEPTH (GULF STREAM WATER)

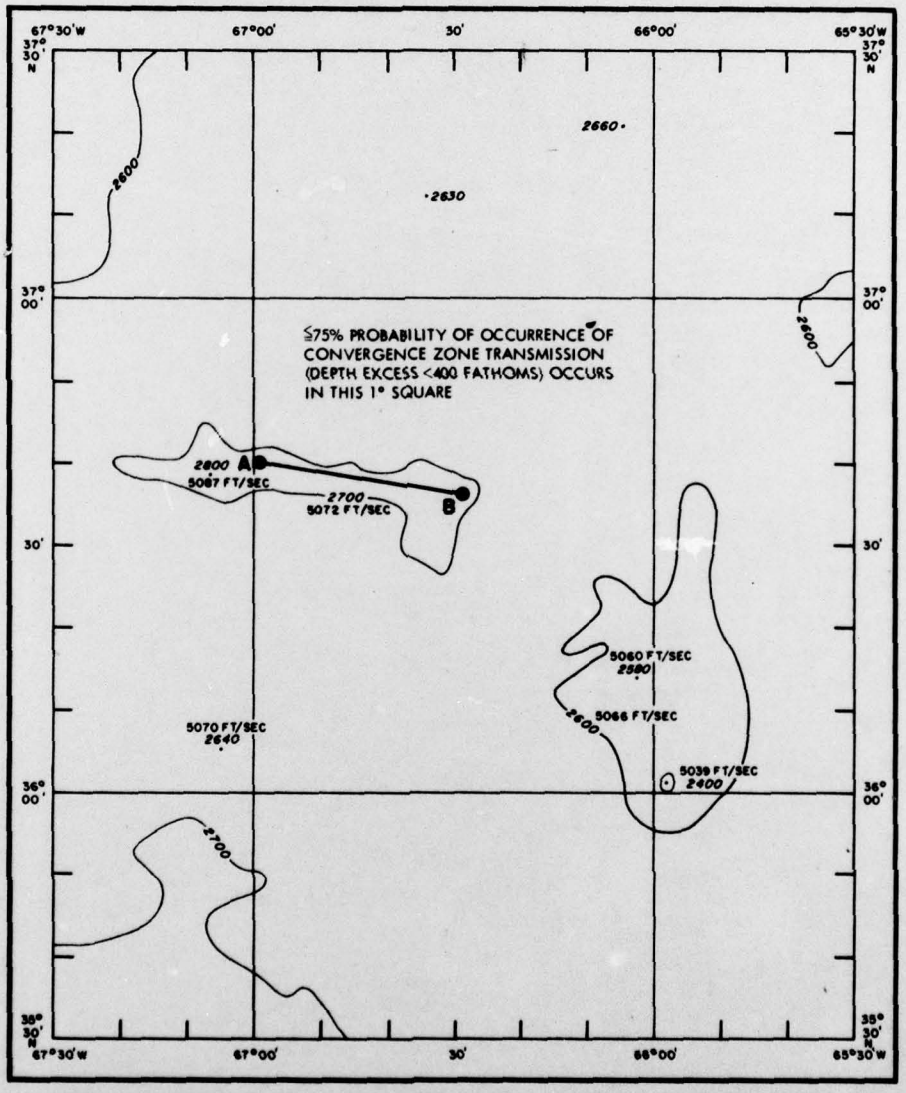

FIGURE 4A SOUND SPEED (FT/SEC) IN SEA WATER AT THE BOTTOM (CORRECTED) AND WATER DEPTH (FATHOMS) UNCORRECTED (ECHO-SOUNDER CALIBRATED AT 4800 FT/SEC) GULF STREAM WATER

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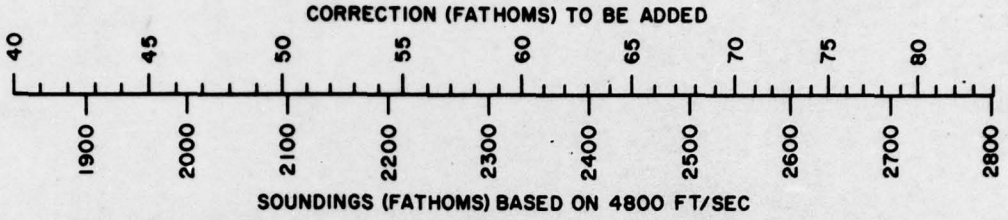


FIGURE 3B CORRECTION TO ECHO-SOUNDER DEPTH TO OBTAIN TRUE DEPTH (SARGASSO SEA WATER)

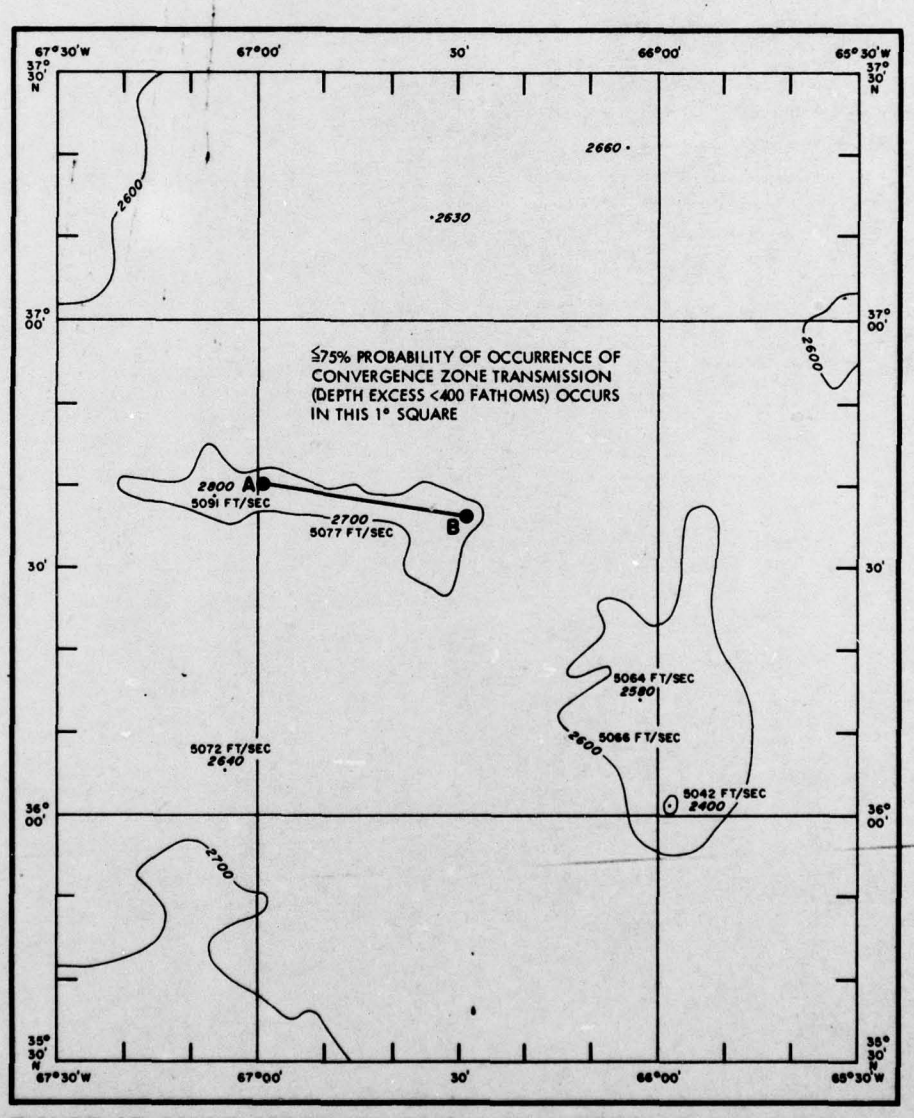
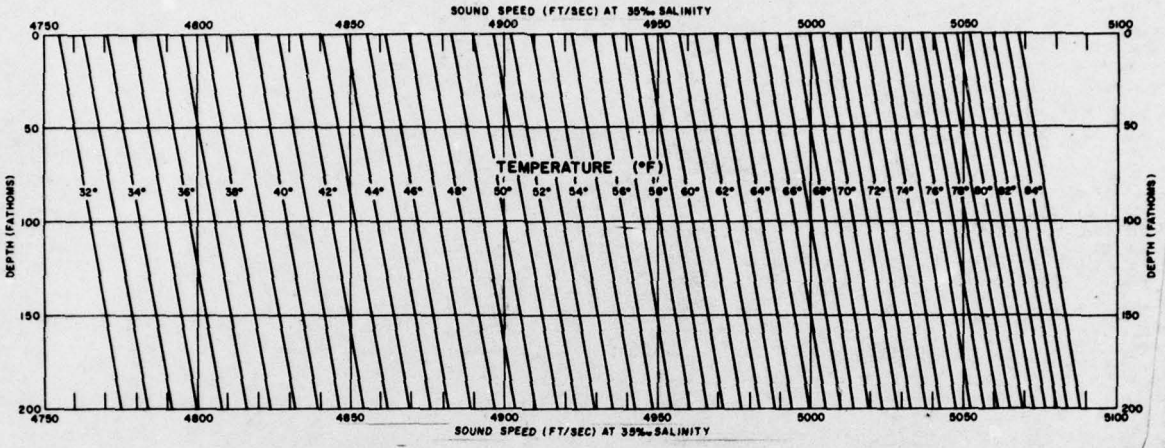
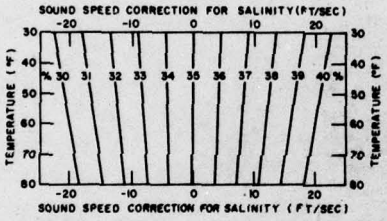


FIGURE 4B SOUND SPEED (FT/SEC) IN SEA WATER AT THE BOTTOM (CORRECTED) AND WATER DEPTH (FATHOMS) UNCORRECTED (ECHO-SOUNDER CALIBRATED AT 4800 FT/SEC) SARGASSO SEA WATER

AREA N AUGUST 0-116-63

[redacted]





NORMAL SALINITY CORRECTION FOR THIS AREA AND SEASON IS -3 FT/SEC

FIGURE 5 SOUND SPEED NOMOGRAM

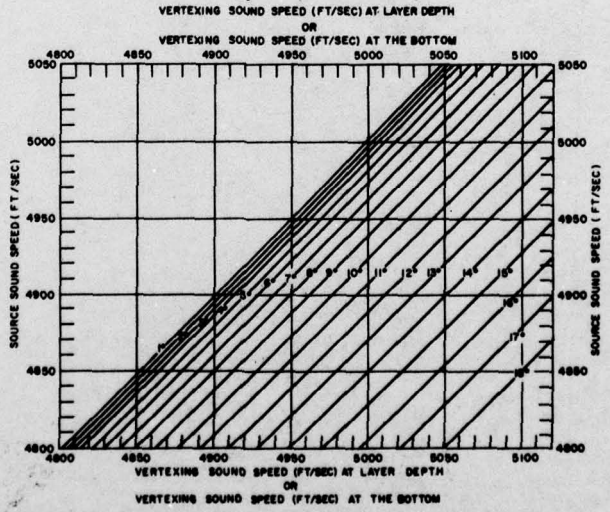


FIGURE 6 INCLINATION ANGLE VS SOURCE SOUND SPEED AND VERTEXING SOUND SPEED

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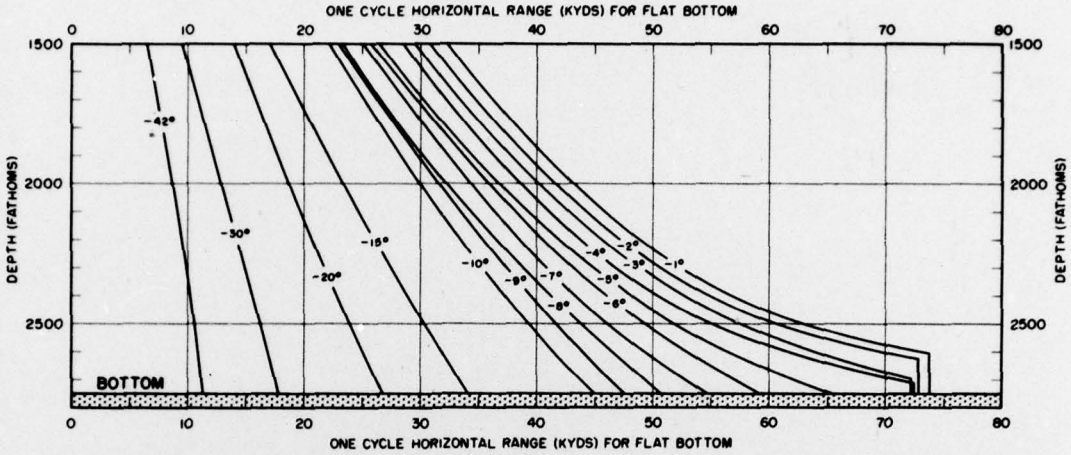

FIGURE 7A MEAN HORIZONTAL RANGE VS INITIAL ANGLE AND WATER DEPTH FOR AUGUST (GULF STREAM WATER)

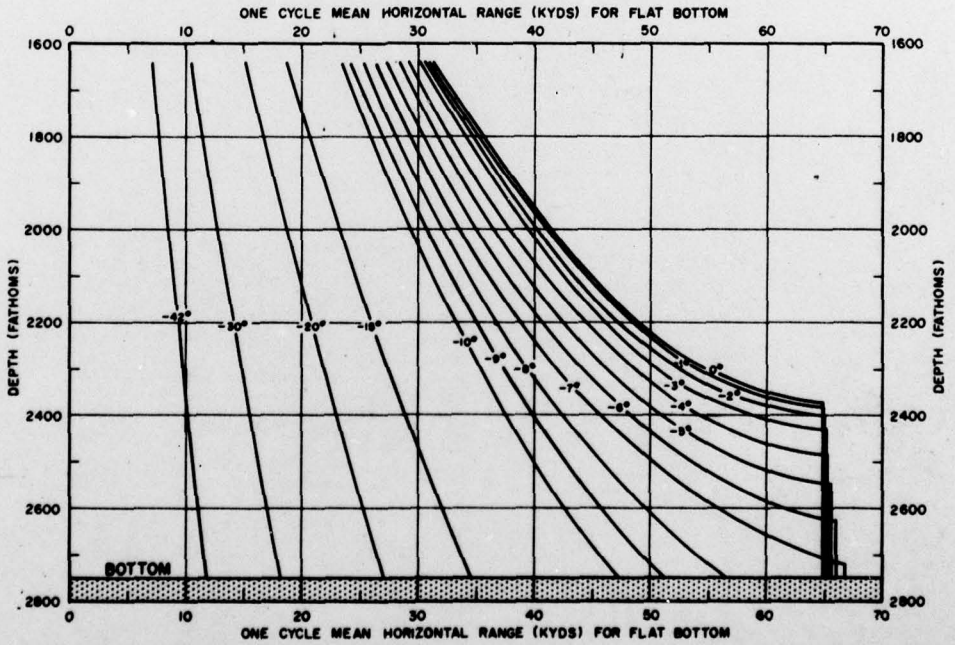

FIGURE 7B MEAN HORIZONTAL RANGE VS INITIAL ANGLE AND WATER DEPTH FOR AUGUST (SARGASSO SEA WATER)

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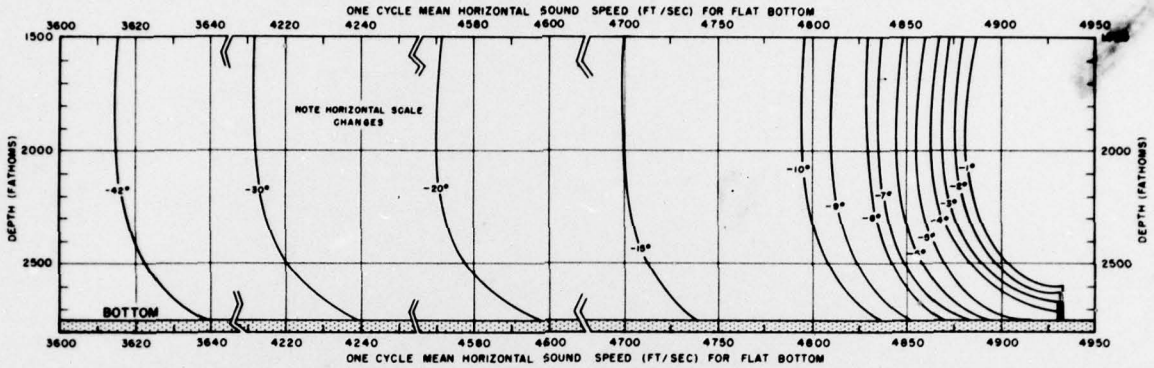


FIGURE 8A MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE AND WATER DEPTH FOR AUGUST (GULF STREAM WATER)

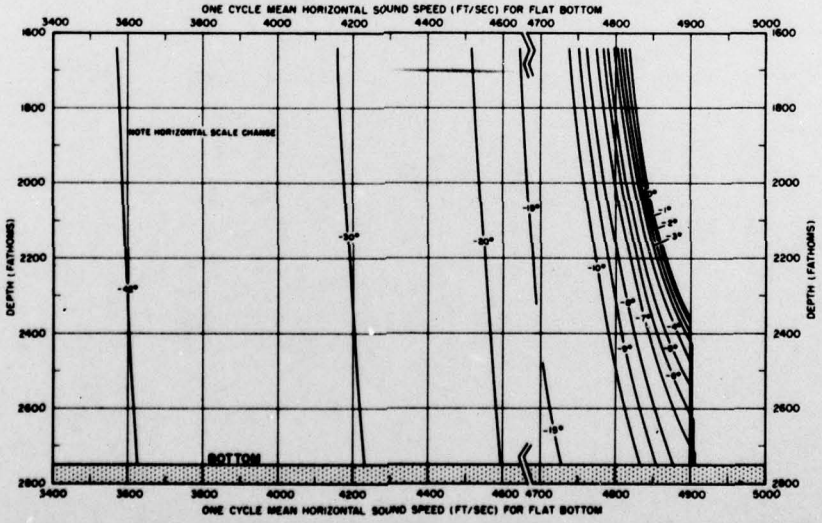


FIGURE 8B MEAN HORIZONTAL SOUND SPEED VS INITIAL ANGLE AND WATER DEPTH FOR AUGUST (SARGASSO SEA WATER)

AREA 'A' AUGUST 0-116-63

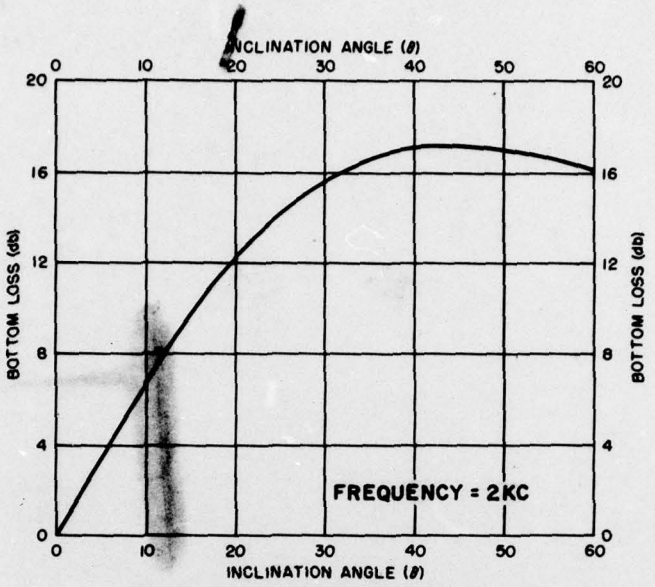
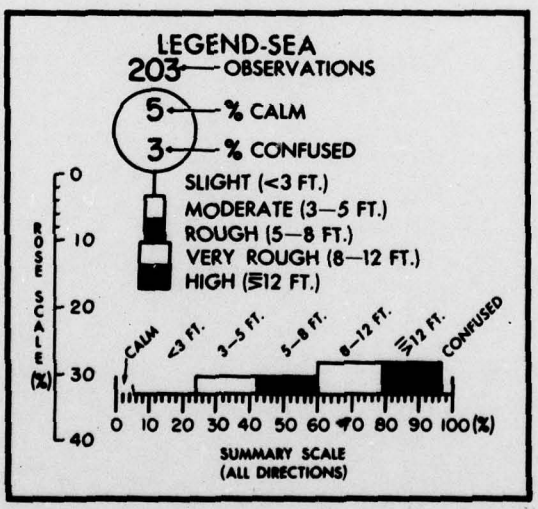


FIGURE 9 NOMINAL BOTTOM LOSS



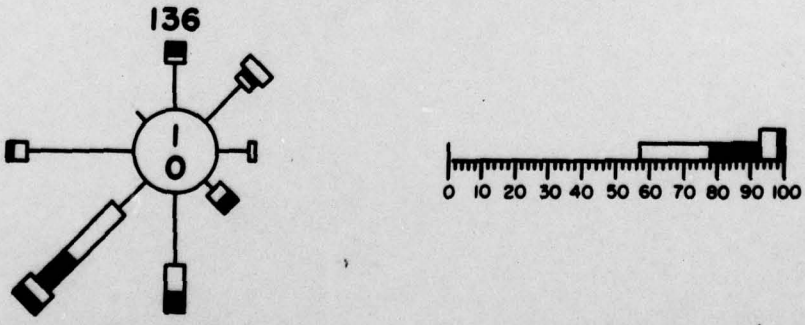


FIGURE 10 SEA STATE ROSE AND HISTOGRAM FOR JULY, AUGUST, AND SEPTEMBER