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ACOUSTIC ENVIRONMENTAL SUMMARY FOR NORTH ATLANTIC OCEAN AREA NA--ETC(U)
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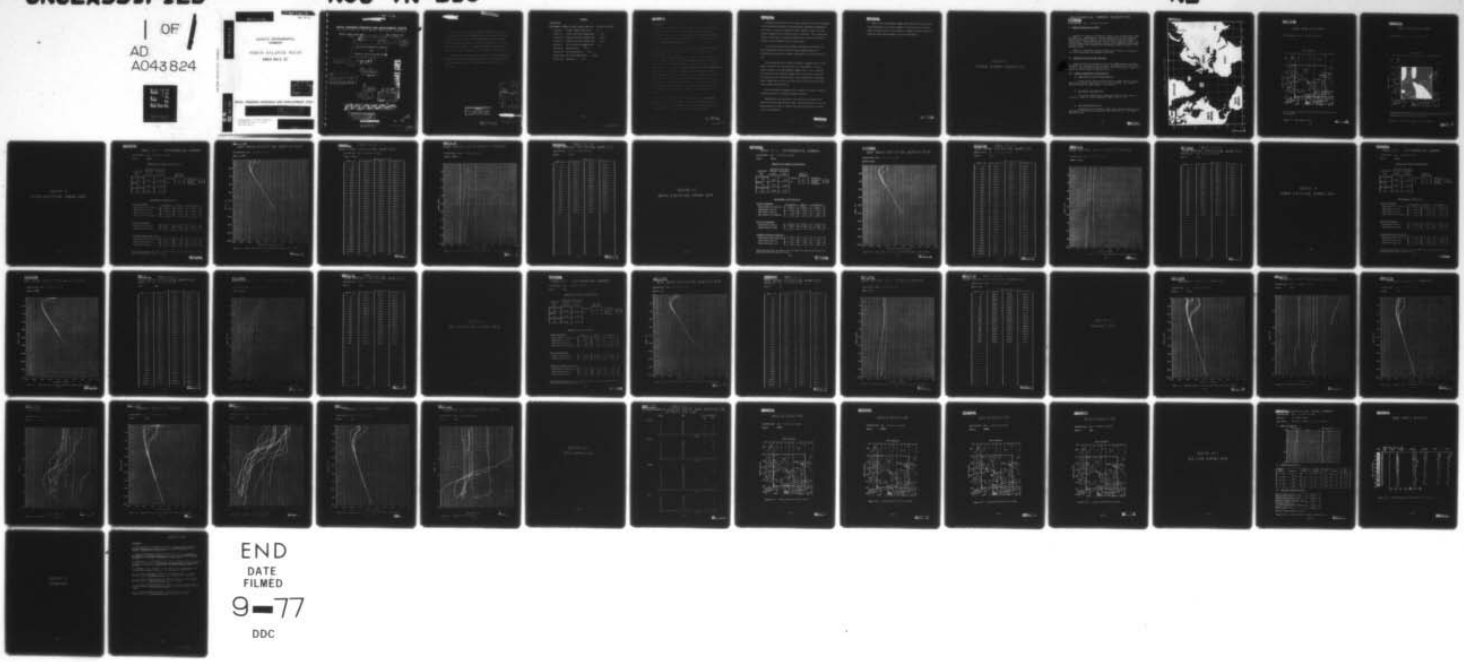

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# NAVAL UNDERSEA RESEARCH AND DEVELOPMENT CENTER

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## ACOUSTIC ENVIRONMENTAL SUMMARY FOR NORTH ATLANTIC OCEAN AREA NA-2.4

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This technical note presents summary oceanographic data which has been generated by the Performance Modeling and Operations Analysis Division, Code 556, of the Naval Undersea Research and Development Center, San Diego. This note is not to be considered as an official NUC report. Its purpose is to document environmental studies which are being carried out in support of current Navy ASW acoustic studies.

The work described in this technical note has been supported under NAVSHIPS Exploratory Development subproject SF 11-121-500, Task 8704, and by Independent Research funds under subproject ZR 011 01 01, Task 0401.





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CONTENTS

INTRODUCTION

This report forms a part of a continuing series of reports published by Code 556 to provide acoustic system oriented users a concise but comprehensive analysis of acoustically significant oceanographic parameters. The analysis approach and a detailed description of the methods employed appears in NUC Technical Paper No. 115.

This report presents a seasonal oceanographic environmental summary for North Atlantic area NA-2. Figure I.1 shows the region from which data was taken for this analysis. Cover the Mid-Atlantic Ridge -- 50-55 deg N x 30-35 deg W.

The contents of this environmental summary represent a statistical cross section of the conditions which can exist in this region. Velocity structure data resulted from an analysis of Nansen cast and bathythermographic data from the Code 556 digital oceanographic data bank which includes 260,000 Nansen Cast stations and 304,000 BT stations. Additional environmental data from Code 556 files, NAVOCEANO publications and from various other sources provided additional information. Special Code 556 computer processing programs, which determine layer depth, gradients, and other profile characteristics, were used in carrying out the velocity profile analysis.

Data generated for this report is primarily for use by NUC system analysts in selecting environmental inputs to sonar system performance predictions. They are also available to other Navy activities requiring information of this type in support of system analysis studies.

Sufficient data exists so that a high confidence level can be assigned to the statistical validity of velocity profile information presented in this report. We may also establish a high confidence level in the sea surface parameters since sufficient data is available. Lack of good data limits our knowledge of scattering coefficients, and we must therefore ascribe a lower confidence level to these values.

Core and other ocean bottom sediment information provided by the Marine Geophysical Survey and other surveys furnished data for a satisfactory description of acoustic properties of the sea floor in the area.

Values appearing in the Statistical Quartile Summary Tables are not always consistent with the layer depth (ZL) and gradient ($\gamma_0$ and $\gamma_1$) values presented in the Environmental Summary Table. This is expected since the Statistical Quartile Summary Table values result from using all station data sets available, while values appearing in the Environmental Summary Table utilize only those station data sets which display surface channel characteristics.

These environmental summaries will be updated at periodic intervals as additional data or information becomes available.

Depending upon the application, the acoustician utilizing these statistical profiles may desire to make a slight modification of the near surface profile in order to exhibit the sound channel which he desires to use in his analysis.

Users of this environmental summary must realize that all parameter values appearing in this report represent a cross section of possible values one might expect to occur based on a complete review of available historical data and consideration of local area dynamics.

# SECTION I

# GENERAL SUMMARY DESCRIPTION

# ENVIRONMENTAL SUMMARY DESCRIPTION

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LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

## I. GENERAL DESCRIPTION OF REGION:

Area NA-2 is located in the Northern Atlantic over the mid-Atlantic Ridge. See Figure I.1. Physiographic Provinces represented are the Rift Mountains and the High Fractured Plateaus, both east and west of the Rift Mountains. Bottom relief is highly variable and the ocean floor is generally rough. The northern branch of the North Atlantic current flows through this ocean expanse and carries water which represents Gulf Stream water mixed with waters of the Labrador Current.

Figure I.2 outlines the specific analysis area. Figure I.3 illustrates the ocean bottom relief and roughness in the area.

## II. TECHNIQUE OF ANALYSIS AND DATA BASE:

Sufficient data are available for winter and summer seasons, but during spring and fall the amount of data is sparse. See Figures VII.1, VII.2, VIII.3, and VII.4. The statistically generated deep ocean velocity profiles appear to exhibit the general shapes of actual profiles.

## III. SUMMARY OCEANOGRAPHIC CHARACTERISTICS:

### A. SOUND VELOCITY PROFILE CHARACTERISTICS:

Sound velocity profiles reflect seasonal changes with well defined deep surface channels occurring most of the time in winter. Much shallower channels dominate the summer season. See Section VI.

### B. SEA SURFACE CHARACTERISTICS:

Sea surface characteristics adequately define the four seasons in this area. Annual sea surface temperature range is 44°F to 60°F.

### C. SEA FLOOR CHARACTERISTICS:

Dominated by the mid-Atlantic Ridge system the bottom depth exhibits considerable variability but is generally less than 10,000 ft. See Figure I.3 and Section VIII.



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GENERAL AREA LOCATION

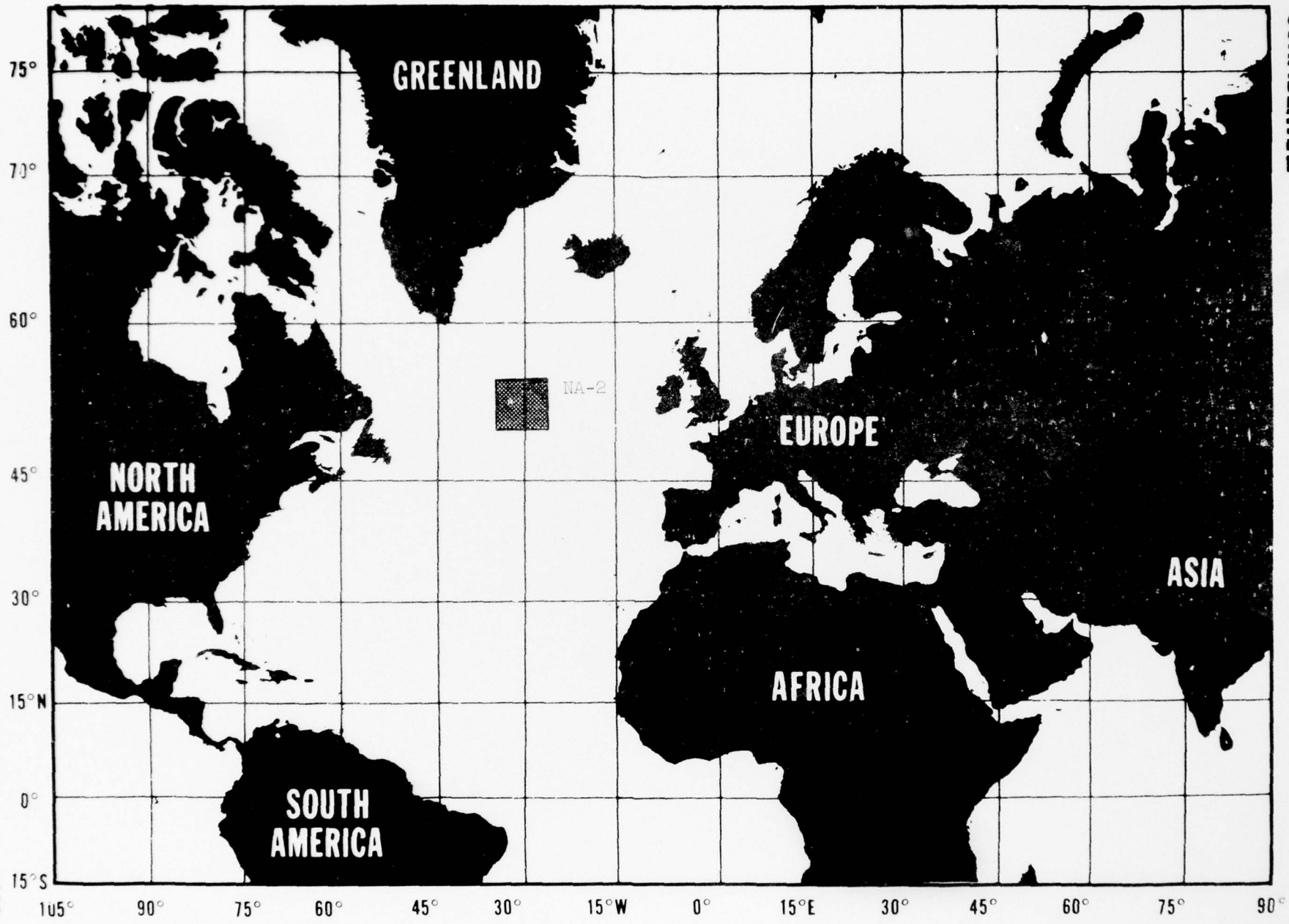
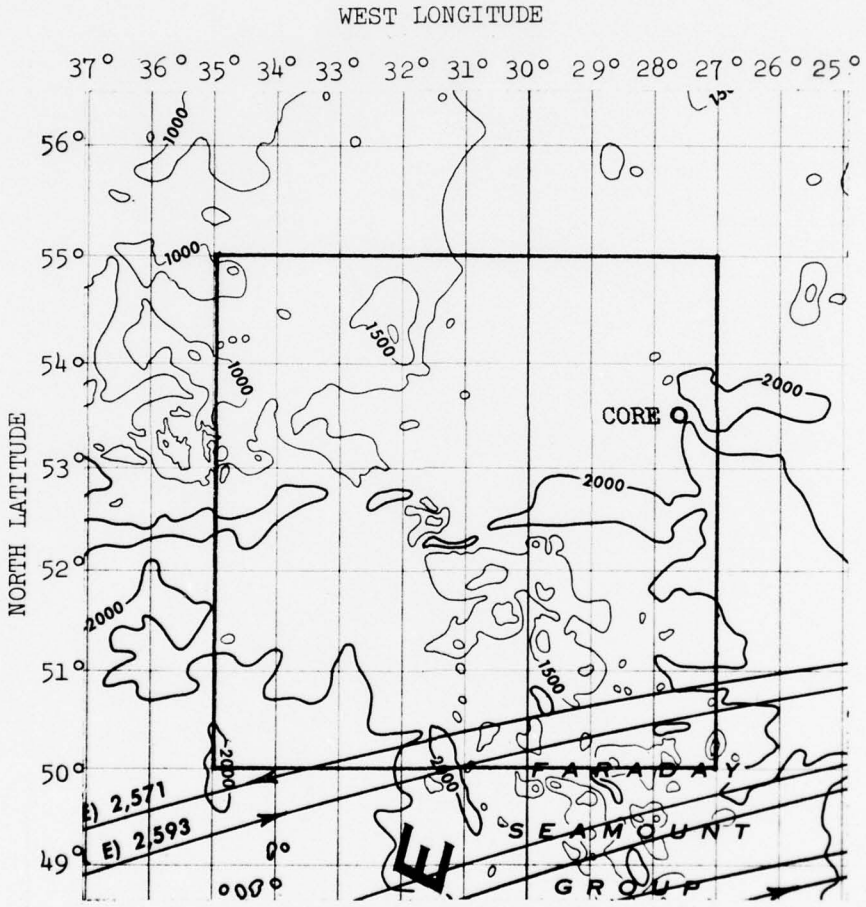



Figure I.1. Location of area NA-2.

# DATA ANALYSIS AREA

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

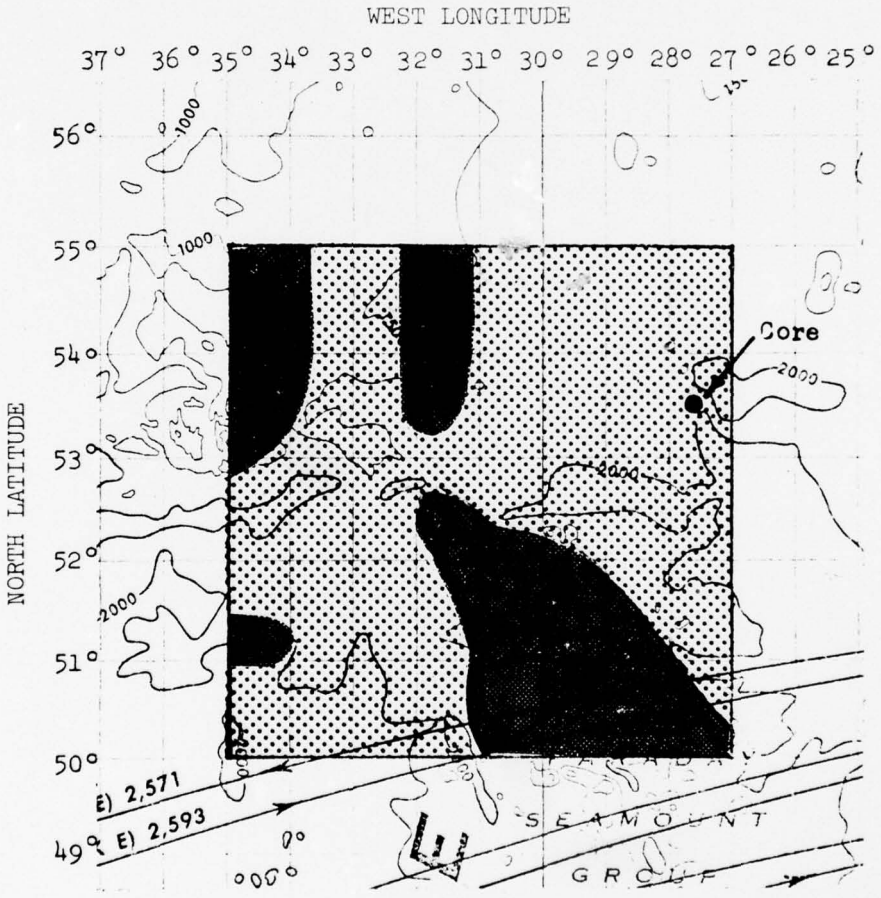



Core and Nansen Cast data are located within area enclosed by rectangle.

Figure I.2. Data analysis area

# DATA ANALYSIS AREA

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W




Cross hatching indicates areas rough areas with bottom slope $\geq$ 6 degrees. Dotted area is representative of reasonably smooth region having a high distribution of bottom scatterers.

Figure I.3. General bottom relief and roughness.

# SECTION II

# WINTER STATISTICAL SUMMARY DATA

# TABLE II.1 ENVIRONMENTAL SUMMARY

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

## SURFACE SOUND CHANNEL CHARACTERISTICS

| LAYER DEPTH (ZL) (FT) | ASSOCIATED GRADIENTS* IN-LAYER ($\gamma_0$) (FT/SEC/FT) | BELOW-LAYER ($\gamma_1$) (FT/SEC/FT) |
|---|---|---|
| 1ST QUARTILE 254 | .0150 | -.0618 |
| MEDIAN 374 | .0159 | -.0554 |
| 3RD QUARTILE 637 | .0162 | -.0438 |

| | AMOUNT OF DATA USED |
|---|---|
| STATION | 31 |
| BT | 13 |

PROBABILITY OF SURFACE CHANNEL OCCURRENCE: >90%

## ENVIRONMENTAL CHARACTERISTICS

### SURFACE PARAMETERS

| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
|---|---|---|---|
| SOUND VELOCITY (CS)(FT/SEC) | 4852.7 | 4883.0 | 4903.4 |
| TEMPERATURE (SST)(°F) | 44.8 | 48.9 | 52.0 |
| WAVE HEIGHT (LWA)(FT) | 1.0 | 7.3 | 12.8 |
| WIND VELOCITY (VWI)(KNOTS) | 13.8 | 22.0 | 29.4 |

### SEA FLOOR PARAMETERS

| | | | |
|---|---|---|---|
| BOTTOM DEPTH (ZBM)(FT) | 8800 | 10,800 | 11,500 |
| BOTTOM POROSITY (PORB) | .71 | .76 | .80 |

### SCATTERING STRENGTH PARAMETERS

| | | | |
|---|---|---|---|
| OCEAN BOTTOM (MUB)(dB/SQ YD) | -20 | -17 | -14 |
| LAYER (MUVL)(dB/CU YD) | -75 | -69 | -58 |
| VOLUME (MUV)(dB/CU YD) | -75 | -70 | -65 |

*Associated gradients are medians for that 50% of the data centered about the specified layer depth quartile values.

# DEEP OCEAN STATISTICAL QUARTILE PLOT

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

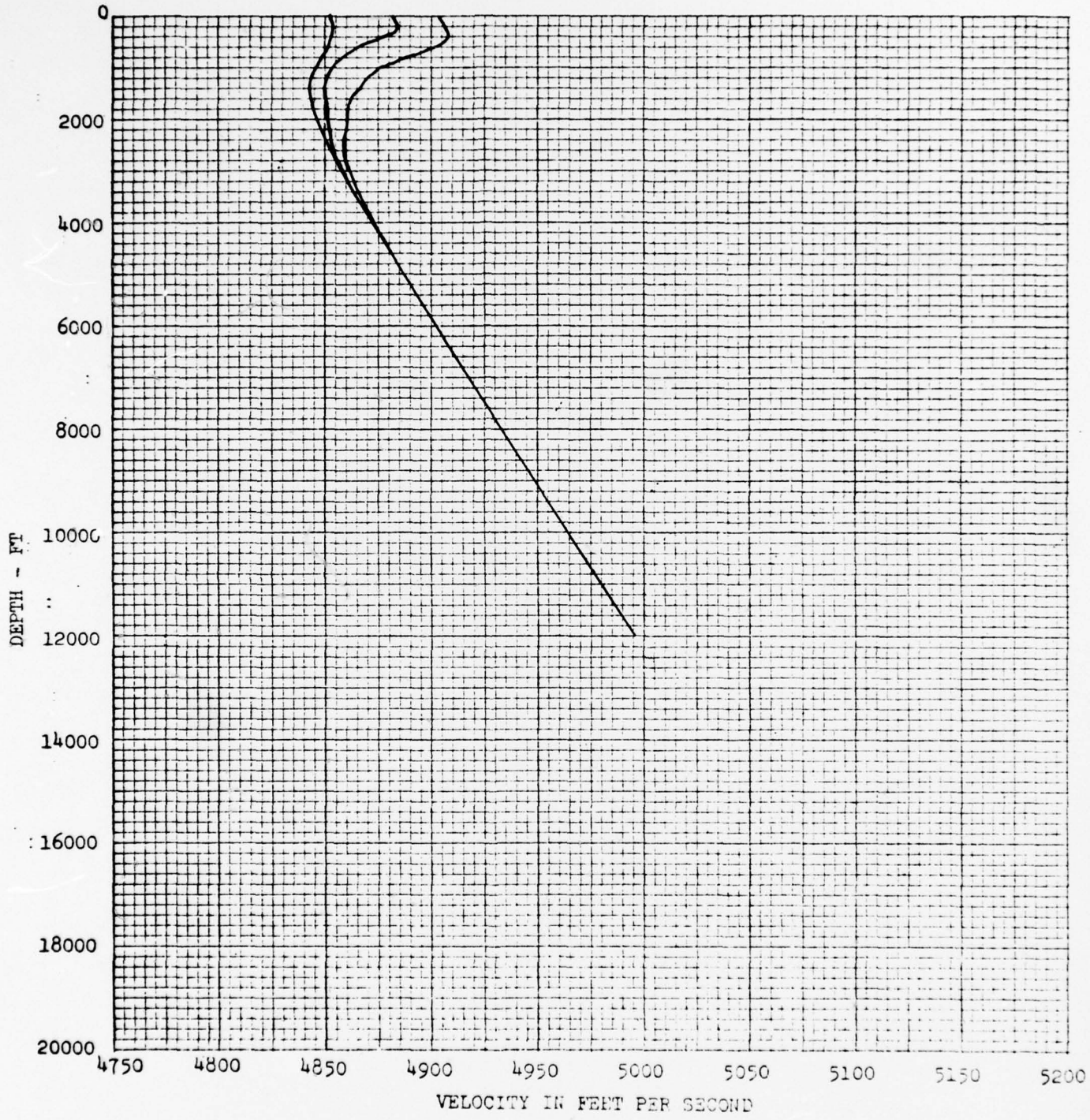



Figure II.1. Deep ocean sound velocity statistical quartile plot, winter.

# TABLE II.II

## DEEP OCEAN STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

| | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| DEPTH - FT | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4852.7 | 4881.8 | 4903.4 |
| 200 | 4854.4 | 4884.5 | 4906.8 |
| 400 | 4853.1 | 4877.4 | 4908.8 |
| 600 | 4850.9 | 4865.2 | 4901.1 |
| 800 | 4848.5 | 4857.7 | 4888.0 |
| 1000 | 4846.2 | 4853.7 | 4875.4 |
| 1200 | 4843.6 | 4850.5 | 4869.7 |
| 1400 | 4843.3 | 4849.5 | 4866.2 |
| 1600 | 4843.6 | 4850.4 | 4862.2 |
| 1800 | 4845.0 | 4850.8 | 4861.1 |
| 2000 | 4847.0 | 4850.8 | 4860.8 |
| 2200 | 4848.9 | 4851.3 | 4860.4 |
| 2400 | 4850.7 | 4852.4 | 4859.8 |
| 2600 | 4852.6 | 4854.1 | 4859.0 |
| 2800 | 4855.1 | 4856.6 | 4859.9 |
| 3000 | 4857.6 | 4859.0 | 4861.4 |
| 3400 | 4862.6 | 4863.5 | 4865.6 |
| 3800 | 4868.4 | 4869.3 | 4870.7 |
| 4200 | 4874.5 | 4875.1 | 4876.3 |
| 4600 | 4880.4 | 4881.0 | 4882.1 |
| 5000 | 4886.4 | 4887.2 | 4887.5 |
| 5400 | 4892.6 | 4893.4 | 4893.9 |
| 5800 | 4898.7 | 4899.2 | 4900.2 |
| 6200 | 4904.8 | 4906.0 | 4906.5 |
| 6600 | 4910.9 | 4912.2 | 4912.8 |
| 7000 | 4917.0 | 4918.2 | 4919.1 |
| 7400 | 4923.1 | 4924.2 | 4925.5 |
| 7800 | 4929.3 | 4930.2 | 4931.8 |
| 8200 | 4935.4 | 4936.2 | 4938.2 |
| 8600 | 4942.0 | 4942.7 | 4944.4 |
| 9000 | 4948.5 | 4949.3 | 4950.7 |
| 10,000 | 4965.5 | 4965.6 | 4965.6 |
| 11,000 | 4980.9 | 4980.9 | 4980.9 |
| 12,000 | 4996.3 | 4996.3 | 4996.3 |
| | | | |

# NEAR SURFACE SOUND VELOCITY PROFILE

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

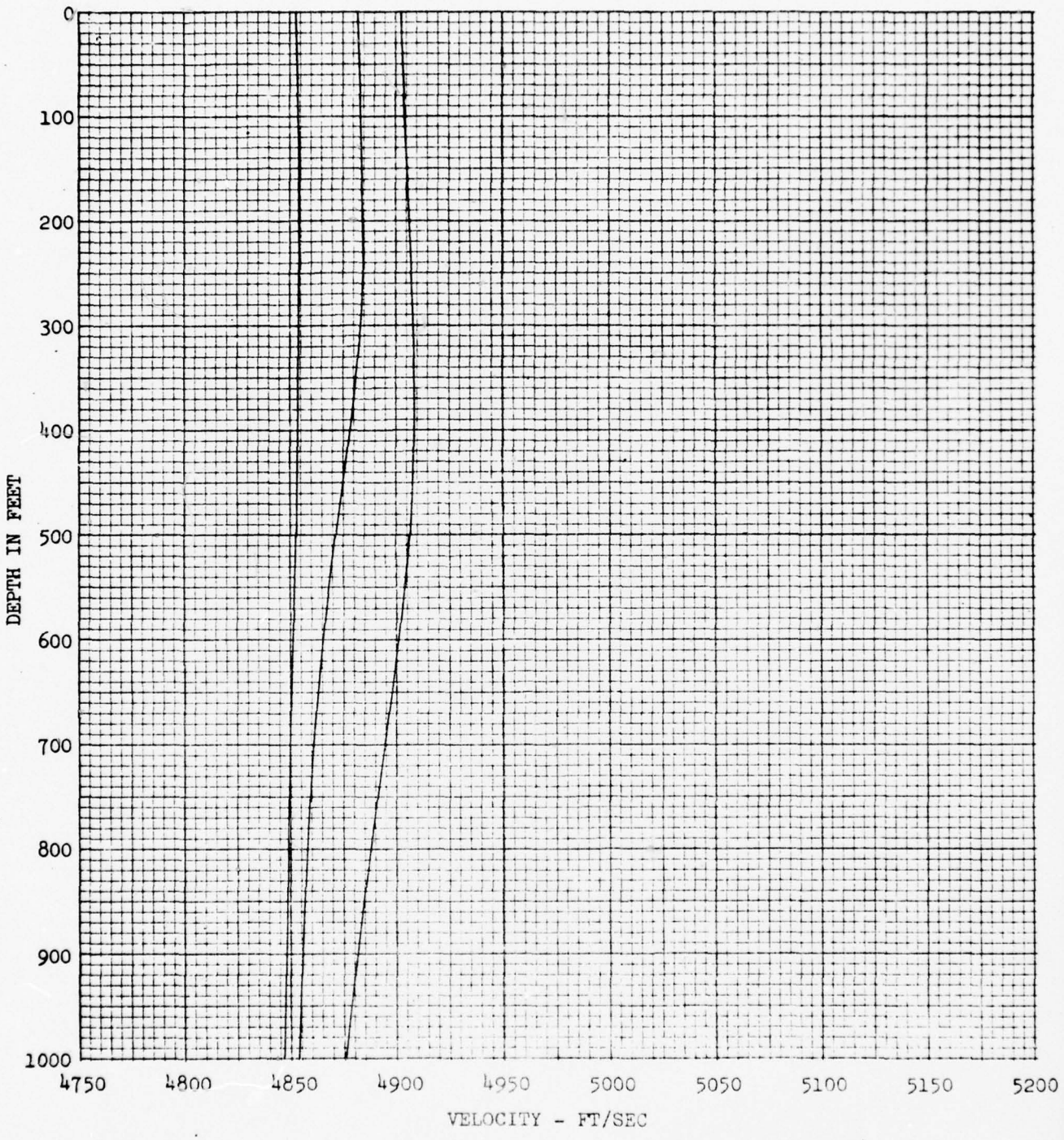



Figure II.2. Near surface sound velocity statistical quartile plot, winter.

# TABLE II.III
# NEAR SURFACE STATISTICAL QUARTILES

**LOCATION/AREA:** NA-2 50°-55°N x 30°-35°W

**SEASON:** WINTER

| | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| DEPTH - FT | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4852.7 | 4881.8 | 4903.4 |
| 20 | 4852.9 | 4882.1 | 4903.8 |
| 40 | 4853.1 | 4882.5 | 4903.2 |
| 60 | 4853.3 | 4882.8 | 4904.6 |
| 80 | 4853.5 | 4883.1 | 4904.9 |
| 100 | 4853.7 | 4883.2 | 4905.2 |
| 150 | 4854.5 | 4883.8 | 4906.0 |
| 200 | 4854.4 | 4884.5 | 4906.8 |
| 250 | 4854.0 | 4884.8 | 4907.7 |
| 300 | 4853.3 | 4882.7 | 4908.7 |
| 350 | 4852.9 | 4880.2 | 4909.2 |
| 400 | 4853.1 | 4877.4 | 4908.8 |
| 450 | 4852.8 | 4874.1 | 4907.8 |
| 500 | 4852.3 | 4870.9 | 4906.3 |
| 600 | 4850.9 | 4865.2 | 4901.1 |
| 700 | 4849.6 | 4860.7 | 4895.1 |
| 800 | 4848.5 | 4857.7 | 4888.0 |
| 900 | 4847.6 | 4855.6 | 4881.4 |
| 1000 | 4846.2 | 4853.7 | 4875.4 |

# SECTION III

# SPRING STATISTICAL SUMMARY DATA

# TABLE III.1 ENVIRONMENTAL SUMMARY

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

## SURFACE SOUND CHANNEL CHARACTERISTICS

| LAYER DEPTH (ZL) (FT) | ASSOCIATED GRADIENTS* IN-LAYER ($\gamma_0$) (FT/SEC/FT) | BELOW-LAYER ($\gamma_1$) (FT/SEC/FT) |
|---|---|---|
| 1ST QUARTILE 82 | .0060 | -.0365 |
| MEDIAN 97 | .0073 | -.0378 |
| 3RD QUARTILE 118 | .0089 | -.0151 |

| | AMOUNT OF DATA USED |
|---|---|
| STATION | 11 |
| BT | 62 |

PROBABILITY OF SURFACE CHANNEL OCCURRENCE: 55%

## ENVIRONMENTAL CHARACTERISTICS

### SURFACE PARAMETERS

| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
|---|---|---|---|
| SOUND VELOCITY (CS)(FT/SEC) | 4875.3 | 4888.0 | 4908.3 |
| TEMPERATURE (SST)(°F) | 47.9 | 49.9 | 52.7 |
| WAVE HEIGHT (LWA)(FT) | 1.0 | 4.9 | 8.0 |
| WIND VELOCITY (VWI)(KNOTS) | 8.5 | 15.0 | 22.5 |

### SEA FLOOR PARAMETERS

| | | | |
|---|---|---|---|
| BOTTOM DEPTH (ZBM)(FT) | 8,800 | 10,800 | 11,500 |
| BOTTOM POROSITY (PORB) | .71 | .76 | .80 |

### SCATTERING STRENGTH PARAMETERS

| | | | |
|---|---|---|---|
| OCEAN BOTTOM (MUB)(dB/SQ YD) | -20 | -17 | -14 |
| LAYER (MUVL)(dB/CU YD) | -75 | -64 | -52 |
| VOLUME (MUV)(dB/CU YD) | -75 | -70 | -65 |

*Associated gradients are medians for that 50% of the data centered about the specified layer depth quartile values.

# DEEP OCEAN STATISTICAL QUARTILE PLOT

**LOCATION/AREA: NA-2** 50°-55°N x 30°-35°W

**SEASON: SPRING**

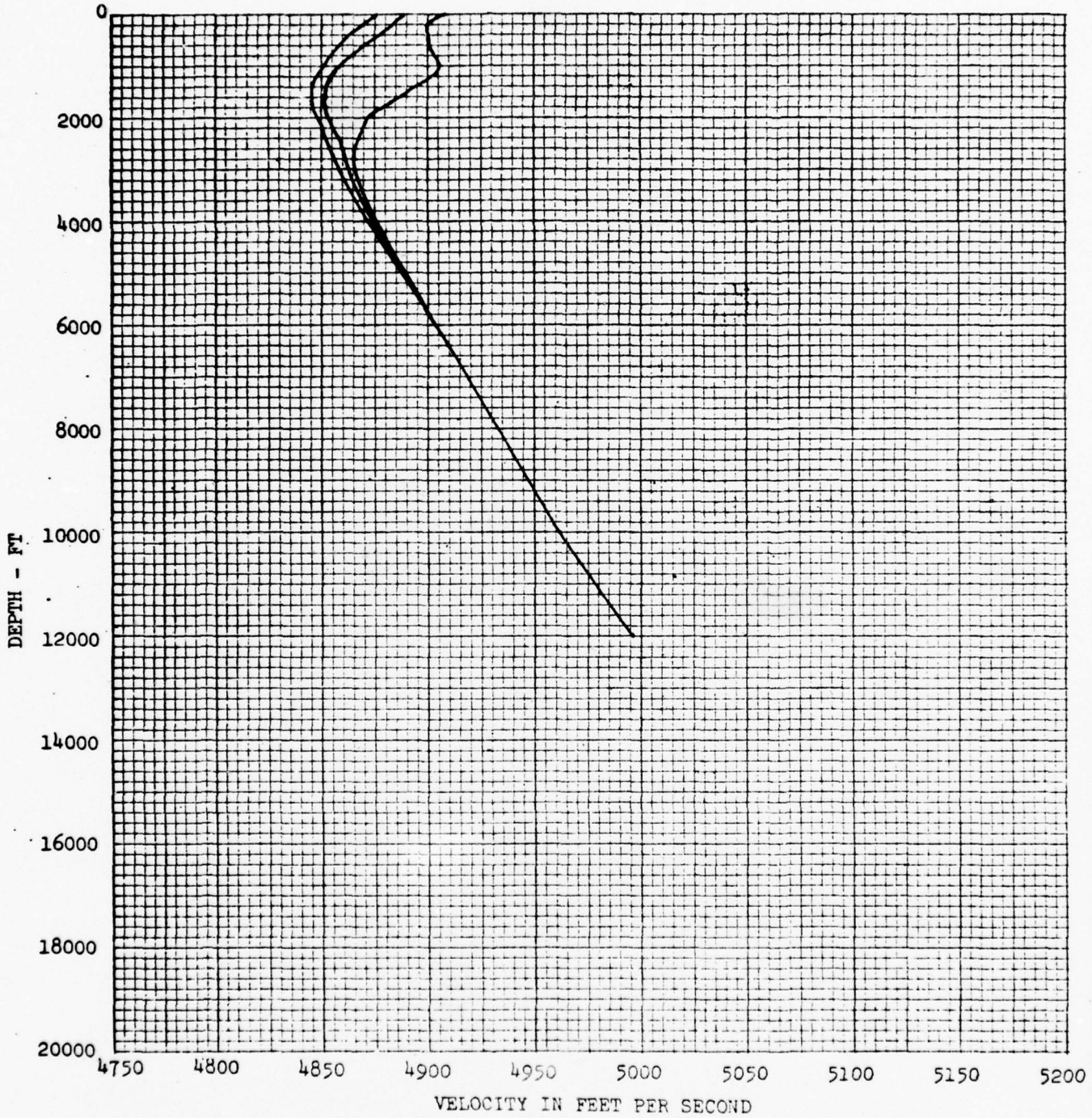



Figure III.1. Deep ocean sound velocity statistical quartile plot, spring.

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# TABLE III.II
# DEEP OCEAN STATISTICAL QUARTILES

**LOCATION/AREA:** NA-2 50°-55°N x 30°-35°W

**SEASON:** SPRING

| DEPTH - FT | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| | 1ST QUARTILE | MEDIAN | 3RD QUAPTILE |
| 0 | 4875.3 | 4888.0 | 4908.3 |
| 200 | 4868.3 | 4882.7 | 4899.5 |
| 400 | 4863.4 | 4877.9 | 4900.2 |
| 600 | 4859.1 | 4869.6 | 4900.3 |
| 800 | 4854.3 | 4863.4 | 4902.7 |
| 1000 | 4851.0 | 4858.0 | 4905.5 |
| 1200 | 4847.9 | 4853.8 | 4901.4 |
| 1400 | 4845.6 | 4852.9 | 4894.6 |
| 1600 | 4845.4 | 4851.1 | 4887.9 |
| 1800 | 4846.8 | 4851.5 | 4879.4 |
| 2000 | 4848.5 | 4852.7 | 4871.6 |
| 2200 | 4850.3 | 4855.2 | 4869.7 |
| 2400 | 4852.1 | 4857.7 | 4867.7 |
| 2600 | 4853.9 | 4860.2 | 4865.5 |
| 2800 | 4856.1 | 4861.5 | 4865.3 |
| 3000 | 4858.4 | 4862.7 | 4865.7 |
| 3400 | 4863.4 | 4866.3 | 4868.7 |
| 3800 | 4868.7 | 4870.6 | 4872.6 |
| 4200 | 4874.7 | 4876.5 | 4877.8 |
| 4600 | 4881.2 | 4882.1 | 4883.5 |
| 5000 | 4886.7 | 4888.1 | 4889.2 |
| 5400 | 4892.8 | 4894.3 | 4895.1 |
| 5800 | 4898.9 | 4900.4 | 4901.0 |
| 6200 | 4904.7 | 4906.0 | 4906.6 |
| 6600 | 4909.6 | 4911.6 | 4912.8 |
| 7000 | 4916.7 | 4917.2 | 4917.9 |
| 7400 | 4922.6 | 4922.8 | 4923.6 |
| 7800 | 4928.0 | 4928.3 | 4929.2 |
| 8200 | 4935.3 | 4935.8 | 4936.3 |
| 8600 | 4941.7 | 4942.2 | 4942.3 |
| 9000 | 4948.1 | 4948.6 | 4949.1 |
| 10,000 | 4965.4 | 4965.6 | 4965.7 |
| 11,000 | 4980.9 | 4980.9 | 4980.9 |
| 12,000 | 4996.3 | 4996.3 | 4996.3 |
| | | | |



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# NEAR SURFACE SOUND VELOCITY PROFILE

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

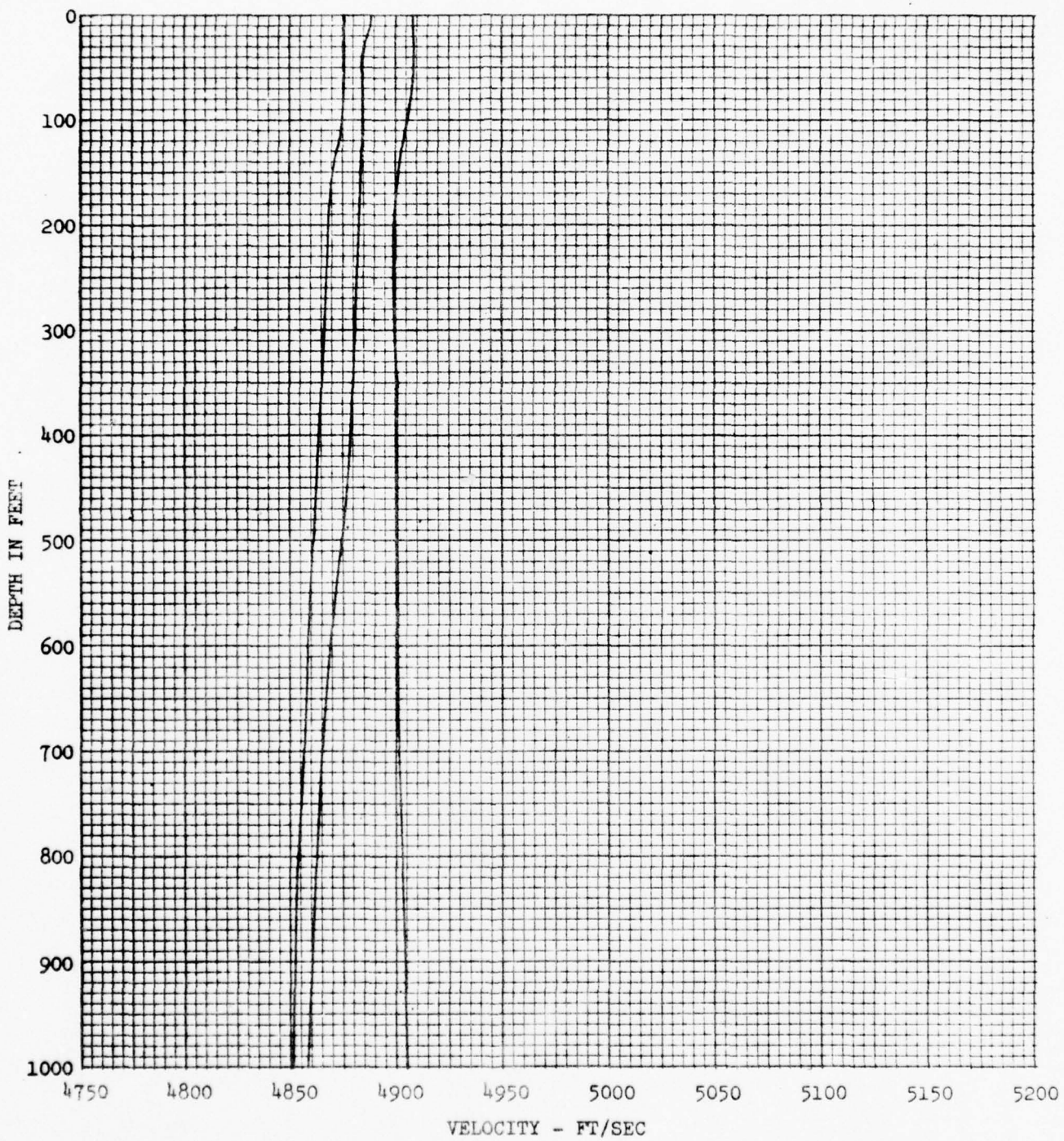


Figure III.2. Near surface sound velocity statistical quartile plot, spring.

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# TABLE III.III
# NEAR SURFACE STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

| | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| DEPTH - FT | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4875.3 | 4888.0 | 4908.3 |
| 20 | 4875.4 | 4885.8 | 4908.7 |
| 40 | 4875.4 | 4884.3 | 4908.6 |
| 60 | 4875.3 | 4884.5 | 4907.6 |
| 80 | 4875.1 | 4884.5 | 4907.1 |
| 100 | 4874.7 | 4884.5 | 4906.7 |
| 150 | 4870.3 | 4883.5 | 4901.5 |
| 200 | 4868.3 | 4882.7 | 4899.5 |
| 250 | 4867.3 | 4882.0 | 4898.7 |
| 300 | 4866.7 | 4880.3 | 4899.7 |
| 350 | 4865.5 | 4878.9 | 4900.3 |
| 400 | 4863.4 | 4877.9 | 4900.2 |
| 450 | 4862.4 | 4876.5 | 4900.1 |
| 500 | 4861.6 | 4874.8 | 4900.1 |
| 600 | 4859.1 | 4869.6 | 4900.3 |
| 700 | 4856.6 | 4865.7 | 4901.1 |
| 800 | 4854.3 | 4863.4 | 4902.7 |
| 900 | 4852.6 | 4860.7 | 4904.3 |
| 1000 | 4851.0 | 4858.0 | 4905.5 |



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# SECTION IV

# SUMMER STATISTICAL SUMMARY DATA

# TABLE IV.1 ENVIRONMENTAL SUMMARY

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

## SURFACE SOUND CHANNEL CHARACTERISTICS

| LAYER DEPTH (ZL) (FT) | ASSOCIATED GRADIENTS* IN-LAYER ($\gamma_0$) (FT/SEC/FT) | BELOW-LAYER ($\gamma_1$) (FT/SEC/FT) |
|---|---|---|
| 1ST QUARTILE 90 | .0163 | -.4757 |
| MEDIAN 98 | .0107 | -.4530 |
| 3RD QUARTILE 122 | .0107 | -.2493 |

| | AMOUNT OF DATA USED |
|---|---|
| STATION | 41 |
| BT | 16 |

PROBABILITY OF SURFACE CHANNEL OCCURRENCE: 51%

## ENVIRONMENTAL CHARACTERISTICS

### SURFACE PARAMETERS

| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
|---|---|---|---|
| SOUND VELOCITY (CS)(FT/SEC) | 4926.2 | 4932.3 | 4944.6 |
| TEMPERATURE (SST)(°F) | 56.0 | 57.2 | 59.0 |
| WAVE HEIGHT (LWA)(FT) | 2.7 | 5.1 | 8.0 |
| WIND VELOCITY (VWI)(KNOTS) | 9.0 | 15.0 | 22.5 |

### SEA FLOOR PARAMETERS

| | | | |
|---|---|---|---|
| BOTTOM DEPTH (ZBM)(FT) | 8,800 | 10,800 | 11,500 |
| BOTTOM POROSITY (PORB) | .71 | .76 | .80 |

### SCATTERING STRENGTH PARAMETERS

| | | | |
|---|---|---|---|
| OCEAN BOTTOM (MUB)(dB/SQ YD) | -20 | -17 | -14 |
| LAYER (MUVL)(dB/CU YD) | -75 | -64 | -52 |
| VOLUME (MUV)(dB/CU YD) | -75 | -70 | -65 |

*Associated gradients are medians for that 50% of the data centered about the specified layer depth quartile values.

# DEEP OCEAN STATISTICAL QUARTILE PLOT

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

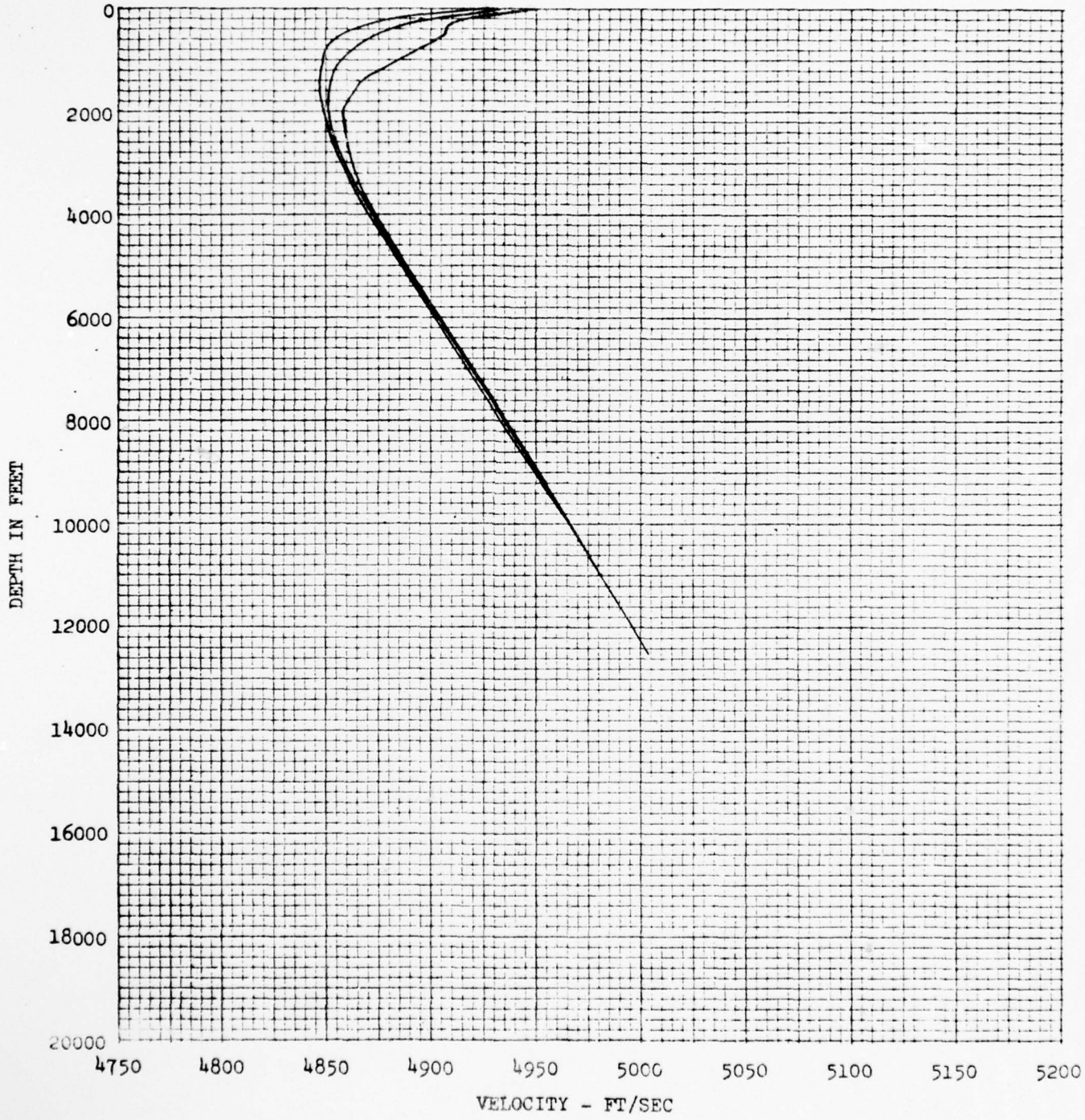


Figure IV.1. Deep ocean sound velocity statistical quartile plot, summer.

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# TABLE IV.II
# DEEP OCEAN STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

| DEPTH - FT | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4926.2 | 4932.3 | 4944.6 |
| 200 | 4882.3 | 4898.3 | 4916.1 |
| 400 | 4864.3 | 4879.3 | 4906.7 |
| 600 | 4854.0 | 4869.2 | 4902.6 |
| 800 | 4850.0 | 4862.6 | 4893.9 |
| 1000 | 4849.0 | 4858.1 | 4885.2 |
| 1200 | 4848.2 | 4853.7 | 4874.5 |
| 1400 | 4847.5 | 4852.1 | 4866.9 |
| 1600 | 4846.9 | 4851.7 | 4863.7 |
| 1800 | 4848.0 | 4851.6 | 4860.6 |
| 2000 | 4849.5 | 4851.7 | 4857.9 |
| 2200 | 4850.6 | 4852.2 | 4858.5 |
| 2400 | 4851.9 | 4853.2 | 4859.1 |
| 2600 | 4853.5 | 4854.4 | 4860.0 |
| 2800 | 4855.7 | 4856.5 | 4861.1 |
| 3000 | 4858.1 | 4858.7 | 4862.3 |
| 3400 | 4862.9 | 4863.6 | 4865.6 |
| 3800 | 4868.5 | 4869.1 | 4870.8 |
| 4200 | 4874.5 | 4874.9 | 4876.4 |
| 4600 | 4880.5 | 4880.8 | 4882.3 |
| 5000 | 4886.6 | 4887.0 | 4888.1 |
| 5400 | 4892.9 | 4893.6 | 4894.3 |
| 5800 | 4899.2 | 4900.1 | 4900.6 |
| 6200 | 4905.4 | 4906.5 | 4907.1 |
| 6600 | 4911.8 | 4913.0 | 4913.5 |
| 7000 | 4917.7 | 4919.2 | 4919.8 |
| 7400 | 4923.8 | 4925.4 | 4926.1 |
| 7800 | 4929.8 | 4931.6 | 4932.4 |
| 8200 | 4935.8 | 4937.8 | 4938.7 |
| 8600 | 4942.4 | 4944.0 | 4944.8 |
| 9000 | 4949.0 | 4950.2 | 4951.0 |
| 10,000 | 4965.6 | 4965.7 | 4965.8 |
| 11,000 | 4980.9 | 4981.0 | 4981.1 |
| 12,000 | 4996.3 | 4996.3 | 4996.3 |



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# NEAR SURFACE SOUND VELOCITY PROFILE

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

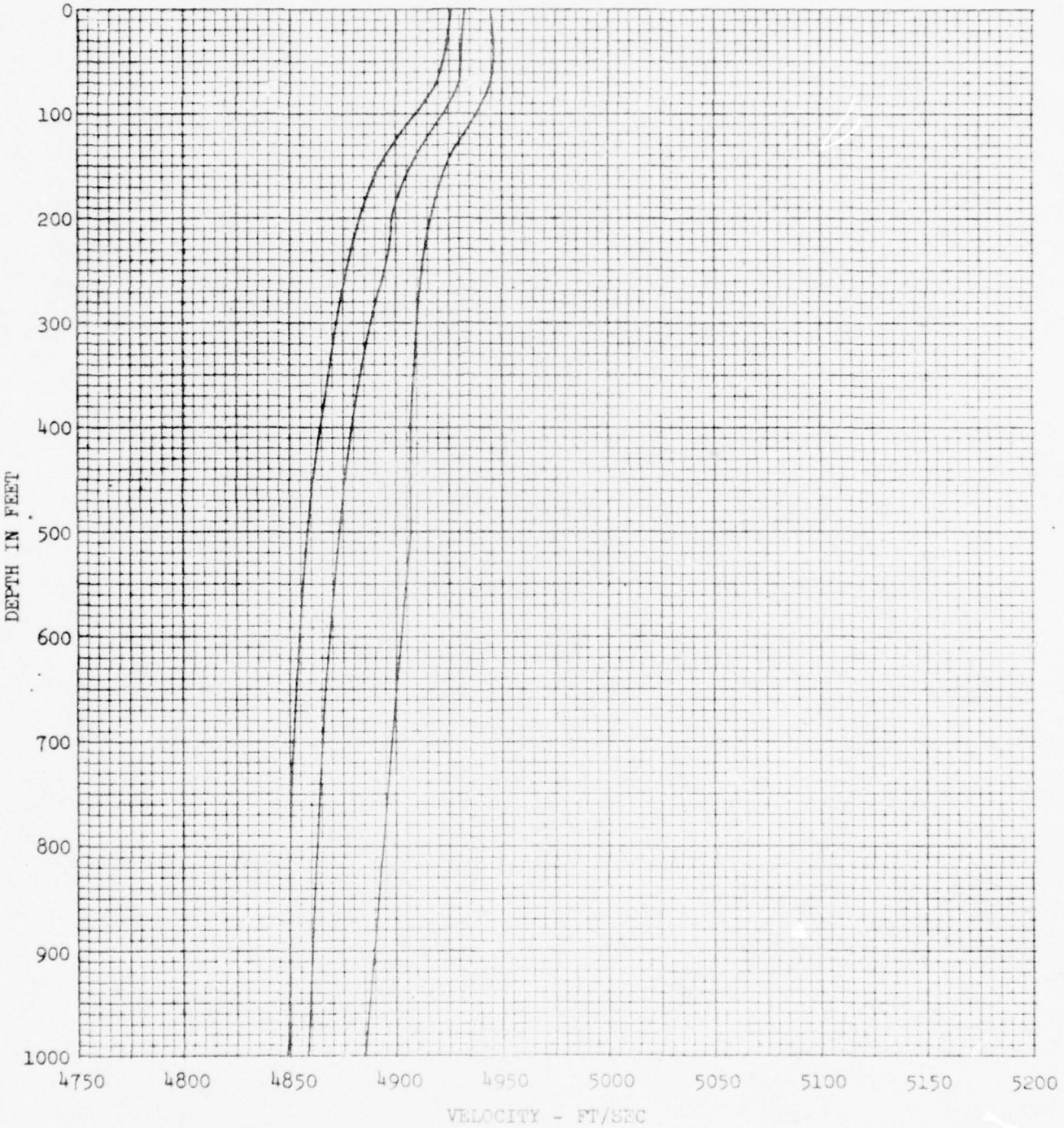


Figure IV.2. Near surface sound velocity statistical quartile plot, winter.

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# TABLE IV.III
# NEAR SURFACE STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

| DEPTH - FT | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4926.2 | 4932.3 | 4944.6 |
| 20 | 4924.3 | 4931.5 | 4945.3 |
| 40 | 4922.6 | 4930.8 | 4945.8 |
| 60 | 4921.4 | 4930.4 | 4945.7 |
| 80 | 4916.1 | 4927.3 | 4942.8 |
| 100 | 4909.0 | 4922.7 | 4938.5 |
| 150 | 4891.8 | 4905.6 | 4923.6 |
| 200 | 4882.3 | 4898.3 | 4916.1 |
| 250 | 4875.9 | 4894.5 | 4911.6 |
| 300 | 4871.8 | 4888.0 | 4909.9 |
| 350 | 4868.0 | 4882.8 | 4908.3 |
| 400 | 4864.3 | 4879.3 | 4906.7 |
| 450 | 4861.2 | 4875.8 | 4906.8 |
| 500 | 4858.4 | 4872.6 | 4907.0 |
| 600 | 4854.0 | 4869.1 | 4902.6 |
| 700 | 4851.1 | 4865.8 | 4898.2 |
| 800 | 4850.0 | 4862.6 | 4893.9 |
| 900 | 4849.4 | 4860.3 | 4889.6 |
| 1000 | 4849.0 | 4858.1 | 4885.2 |



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# SECTION V

# FALL STATISTICAL SUMMARY DATA

# TABLE V.1 ENVIRONMENTAL SUMMARY

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

## SURFACE SOUND CHANNEL CHARACTERISTICS

| LAYER DEPTH (ZL) (FT) | ASSOCIATED GRADIENTS* IN-LAYER ($\gamma_0$) (FT/SEC/FT) | BELOW-LAYER ($\gamma_1$) (FT/SEC/FT) |
|---|---|---|
| 1ST QUARTILE 283 | .0165 | -.0911 |
| MEDIAN 342 | .0179 | -.0673 |
| 3RD QUARTILE 465 | .0179 | -.0775 |

| | AMOUNT OF DATA USED |
|---|---|
| STATION | 11 |
| BT | 14 |

PROBABILITY OF SURFACE CHANNEL OCCURRENCE: >90%

## ENVIRONMENTAL CHARACTERISTICS

### SURFACE PARAMETERS

| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
|---|---|---|---|
| SOUND VELOCITY (CS)(FT/SEC) | 4885.4 | 4889.3 | 4900.7 |
| TEMPERATURE (SST)(°F) | 49.5 | 50.3 | 52.5 |
| WAVE HEIGHT (LWA)(FT) | 4.0 | 8.0 | 11.3 |
| WIND VELOCITY (VWI)(KNOTS) | 13.2 | 21.0 | 28.2 |

### SEA FLOOR PARAMETERS

| | | | |
|---|---|---|---|
| BOTTOM DEPTH (ZBM)(FT) | 8,800 | 10,800 | 11,500 |
| BOTTOM POROSITY (PORB) | .71 | .76 | .80 |

### SCATTERING STRENGTH PARAMETERS

| | | | |
|---|---|---|---|
| OCEAN BOTTOM (MUB)(dB/SQ YD) | -20 | -17 | -14 |
| LAYER (MUVL)(dB/CU YD) | -75 | -66 | -57 |
| VOLUME (MUV)(dB/CU YD) | -75 | -70 | -65 |

*Associated gradients are medians for that 50% of the data centered about the specified layer depth quartile values.

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# DEEP OCEAN STATISTICAL QUARTILE PLOT

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

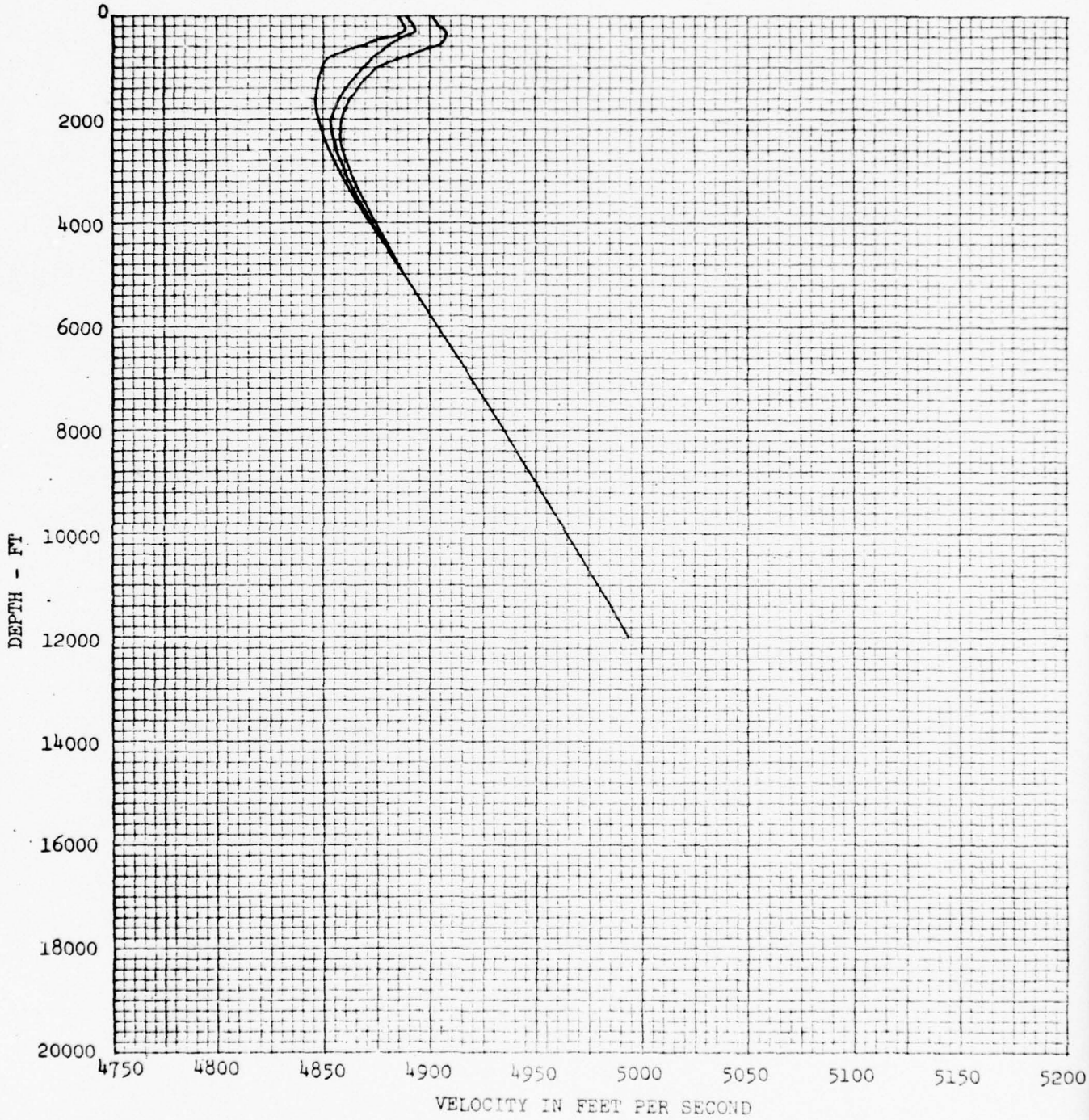


Figure V.1. Deep ocean sound velocity statistical quartile summary, fall.



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# TABLE V.11
# DEEP OCEAN STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

| DEPTH - FT | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4885.4 | 4889.3 | 4900.7 |
| 200 | 4888.4 | 4891.8 | 4903.8 |
| 400 | 4882.8 | 4888.3 | 4907.4 |
| 600 | 4865.9 | 4879.7 | 4900.5 |
| 800 | 4853.4 | 4873.7 | 4886.9 |
| 1000 | 4849.3 | 4868.7 | 4874.7 |
| 1200 | 4847.8 | 4863.9 | 4869.0 |
| 1400 | 4846.7 | 4861.1 | 4865.5 |
| 1600 | 4846.6 | 4858.7 | 4862.6 |
| 1800 | 4847.3 | 4855.8 | 4860.3 |
| 2000 | 4848.1 | 4853.7 | 4858.4 |
| 2200 | 4849.3 | 4854.5 | 4857.8 |
| 2400 | 4850.8 | 4855.3 | 4858.0 |
| 2600 | 4852.7 | 4856.1 | 4859.2 |
| 2800 | 4855.2 | 4857.6 | 4861.2 |
| 3000 | 4857.8 | 4859.3 | 4863.3 |
| 3400 | 4863.2 | 4864.0 | 4867.7 |
| 3800 | 4868.6 | 4869.3 | 4872.0 |
| 4200 | 4874.3 | 4874.9 | 4876.5 |
| 4600 | 4880.7 | 4881.0 | 4881.9 |
| 5000 | 4886.3 | 4887.3 | 4888.1 |
| 5400 | 4892.4 | 4893.8 | 4894.6 |
| 5800 | 4898.6 | 4900.2 | 4901.1 |
| 6200 | 4905.1 | 4906.9 | 4907.9 |
| 6600 | 4910.3 | 4913.5 | 4915.8 |
| 7000 | 4916.4 | 4919.5 | 4921.6 |
| 7400 | 4922.5 | 4925.6 | 4927.5 |
| 7800 | 4928.6 | 4931.6 | 4933.3 |
| 8200 | 4934.7 | 4937.6 | 4939.1 |
| 8600 | 4941.7 | 4943.6 | 4945.2 |
| 9000 | 4948.7 | 4949.7 | 4951.4 |
| 10,000 | 4964.7 | 4964.7 | 4964.7 |
| 11,000 | 4979.5 | 4979.5 | 4979.5 |
| 12,000 | 4994.2 | 4994.2 | 4994.2 |



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# NEAR SURFACE SOUND VELOCITY PROFILE

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

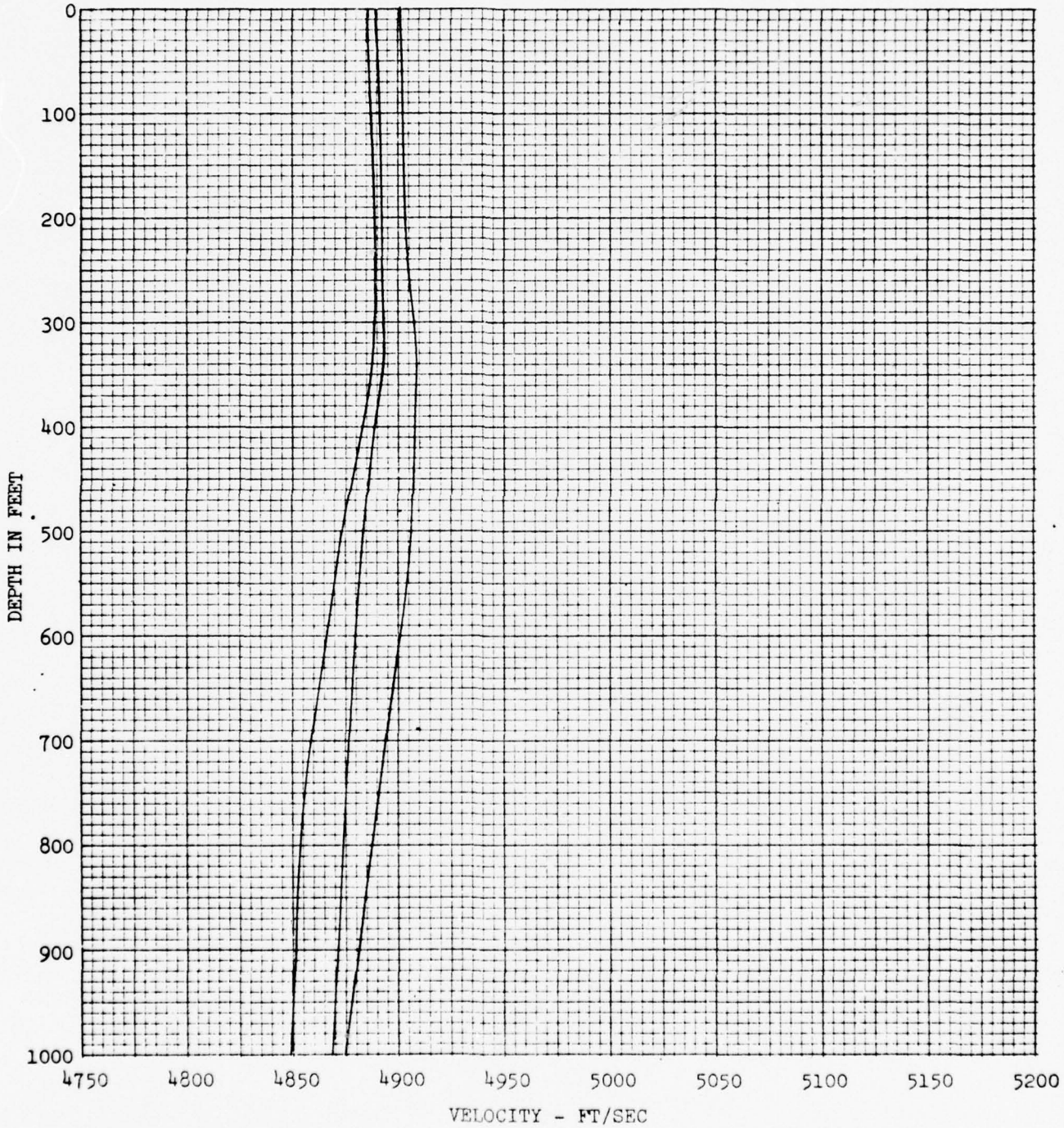


Figure V.2. Near surface sound velocity statistical quartile plot, fall.

# TABLE V.III
# NEAR SURFACE STATISTICAL QUARTILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

| DEPTH - FT | SOUND VELOCITY - FPS | | |
|---|---|---|---|
| | 1ST QUARTILE | MEDIAN | 3RD QUARTILE |
| 0 | 4885.4 | 4889.3 | 4900.7 |
| 20 | 4885.6 | 4889.5 | 4901.5 |
| 40 | 4885.7 | 4889.8 | 4902.0 |
| 60 | 4886.2 | 4890.4 | 4902.3 |
| 80 | 4886.7 | 4890.9 | 4902.4 |
| 100 | 4887.2 | 4891.2 | 4902.5 |
| 150 | 4888.0 | 4891.3 | 4902.9 |
| 200 | 4888.4 | 4891.8 | 4903.8 |
| 250 | 4888.6 | 4892.6 | 4905.0 |
| 300 | 4888.6 | 4893.5 | 4907.8 |
| 350 | 4886.8 | 4892.3 | 4908.7 |
| 400 | 4882.8 | 4888.3 | 4907.4 |
| 450 | 4877.9 | 4885.8 | 4907.1 |
| 500 | 4873.0 | 4883.8 | 4906.5 |
| 600 | 4865.9 | 4879.7 | 4900.5 |
| 700 | 4859.4 | 4876.3 | 4894.0 |
| 800 | 4853.4 | 4873.7 | 4886.9 |
| 900 | 4850.8 | 4871.2 | 4880.5 |
| 1000 | 4849.3 | 4868.7 | 4874.7 |

# SECTION VI
# MEASURED DATA

# MEASURED VELOCITY PROFILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

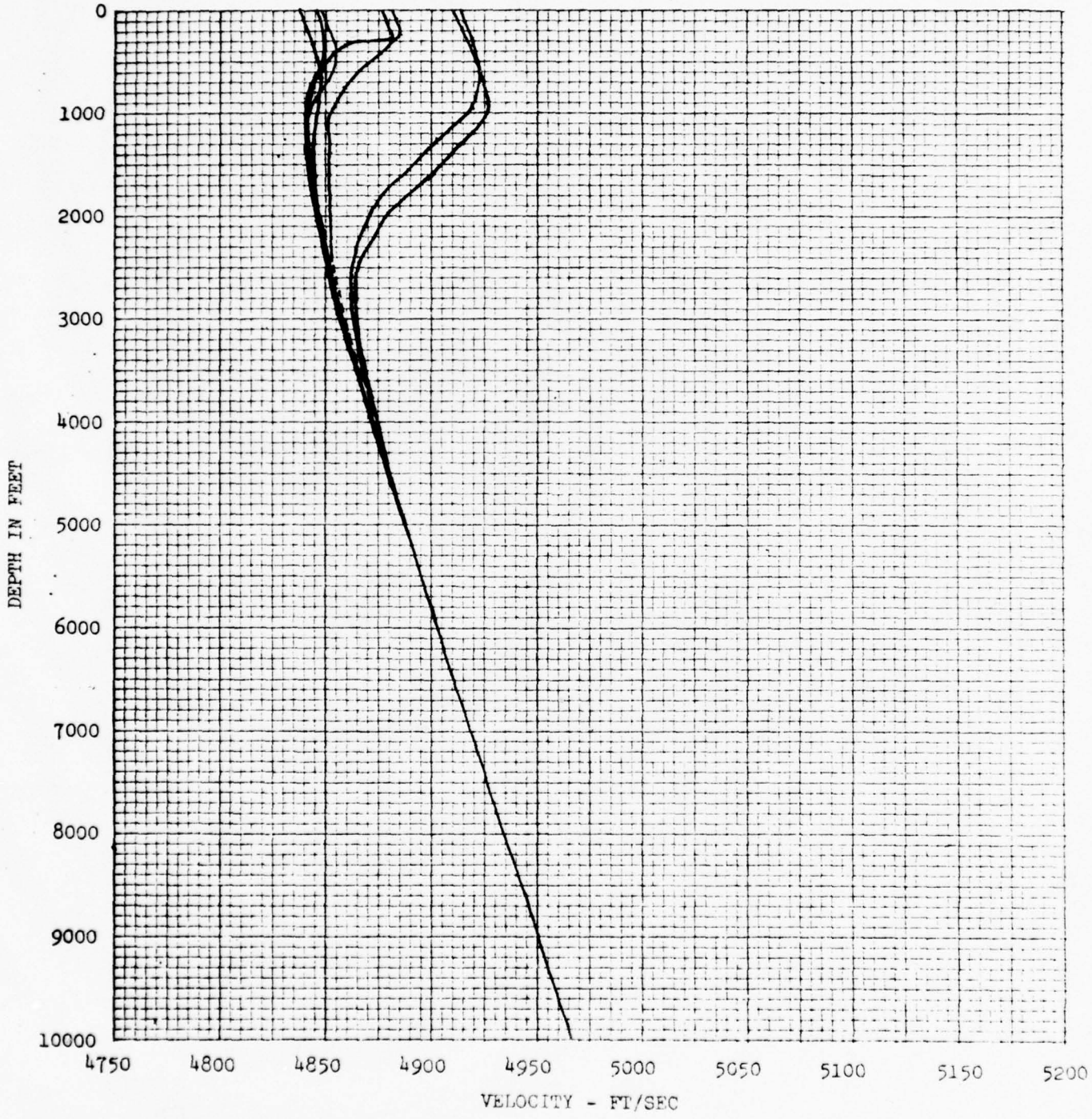


Figure VI.1. Measured sound velocity profiles from station data, winter.

# MEASURED BATHYTHERMOGRAPH PLOTS

**LOCATION/AREA:** NA-2 50°-55°N x 30°-35°W

**SEASON:** WINTER

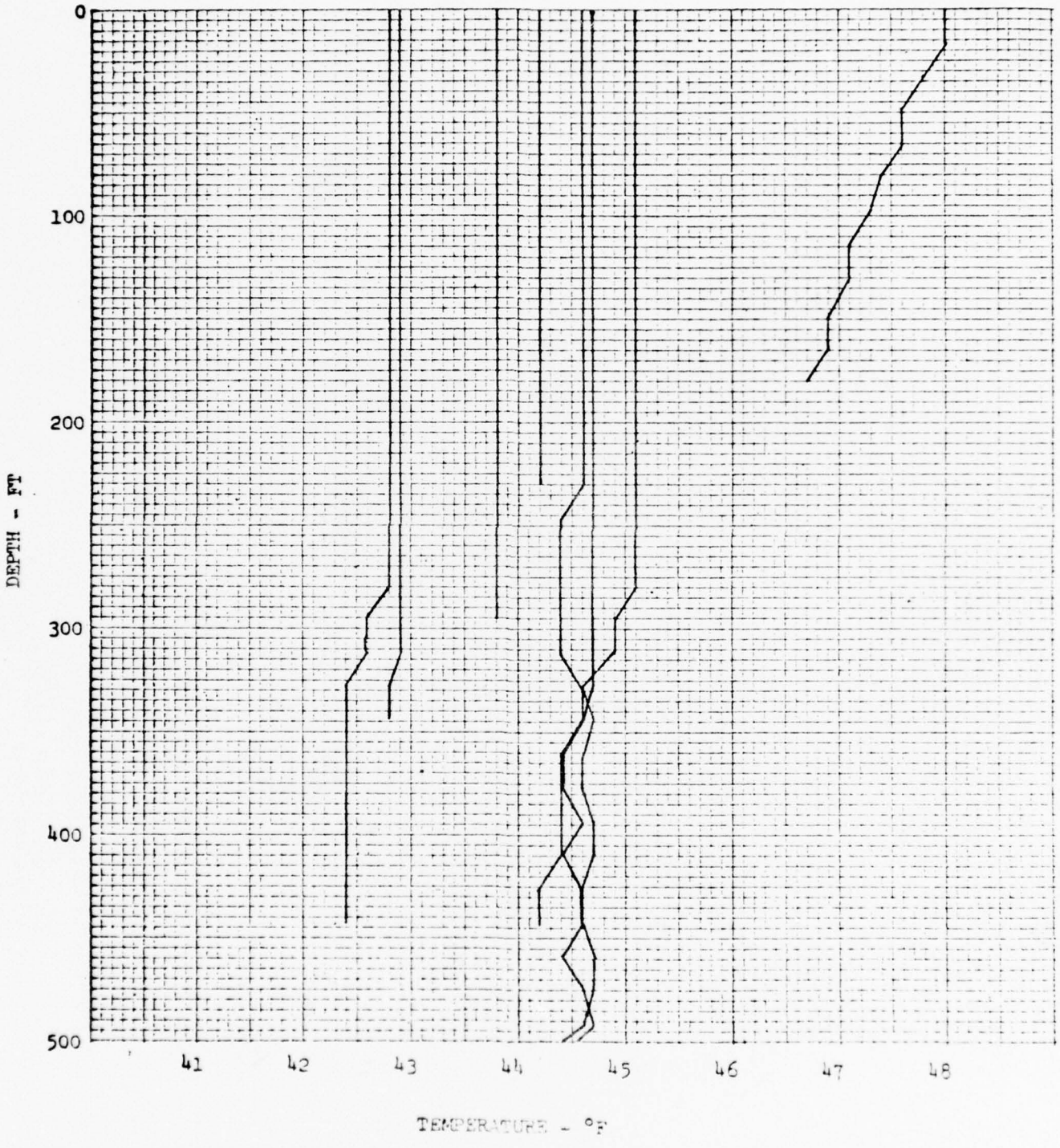


Figure VI.2. Measured BT soundings, winter.

# MEASURED VELOCITY PROFILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

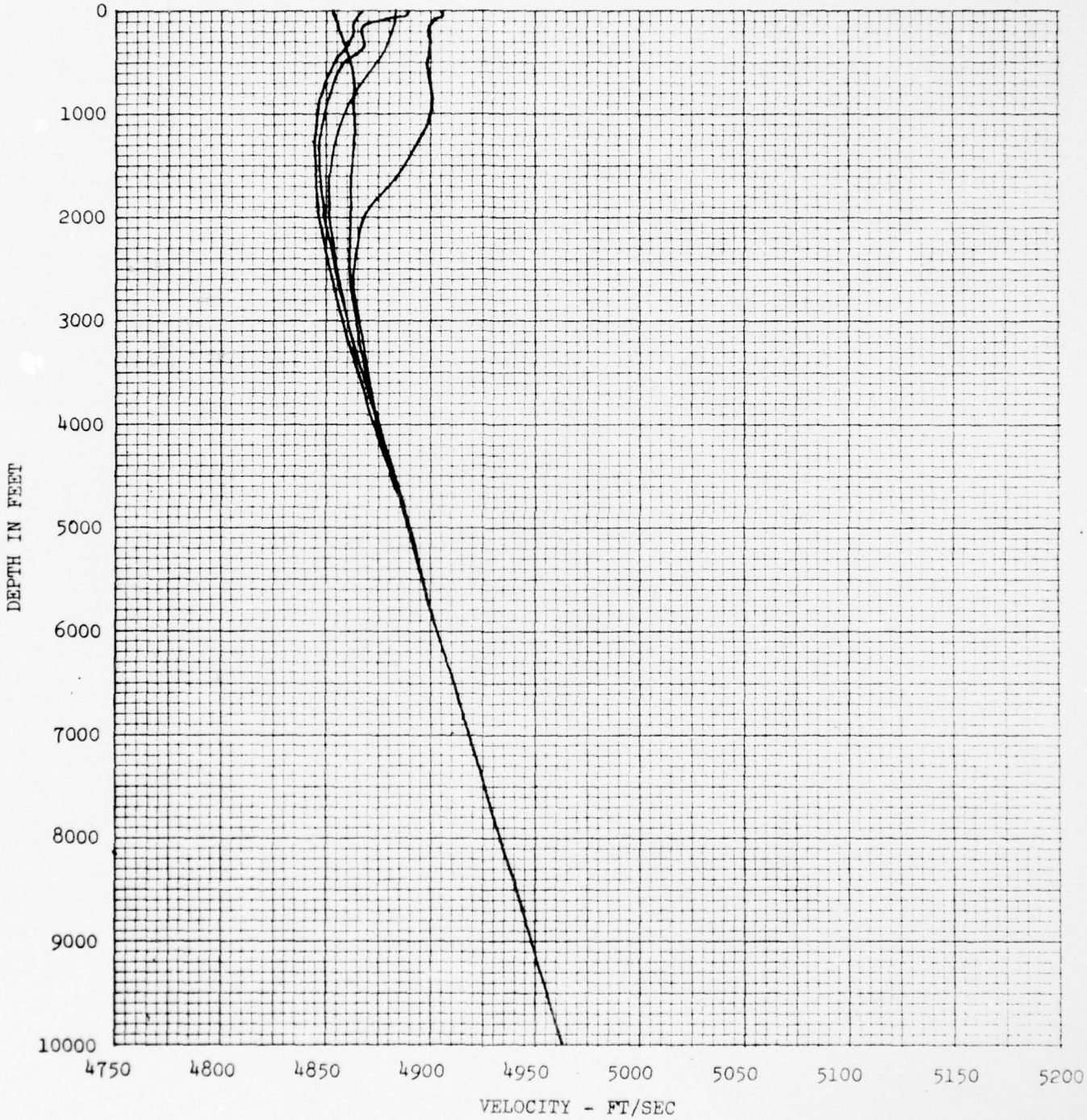


Figure VI.3. Measured sound velocity profiles from station data, spring.

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# MEASURED BATHYTHERMOGRAPH PLOTS

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

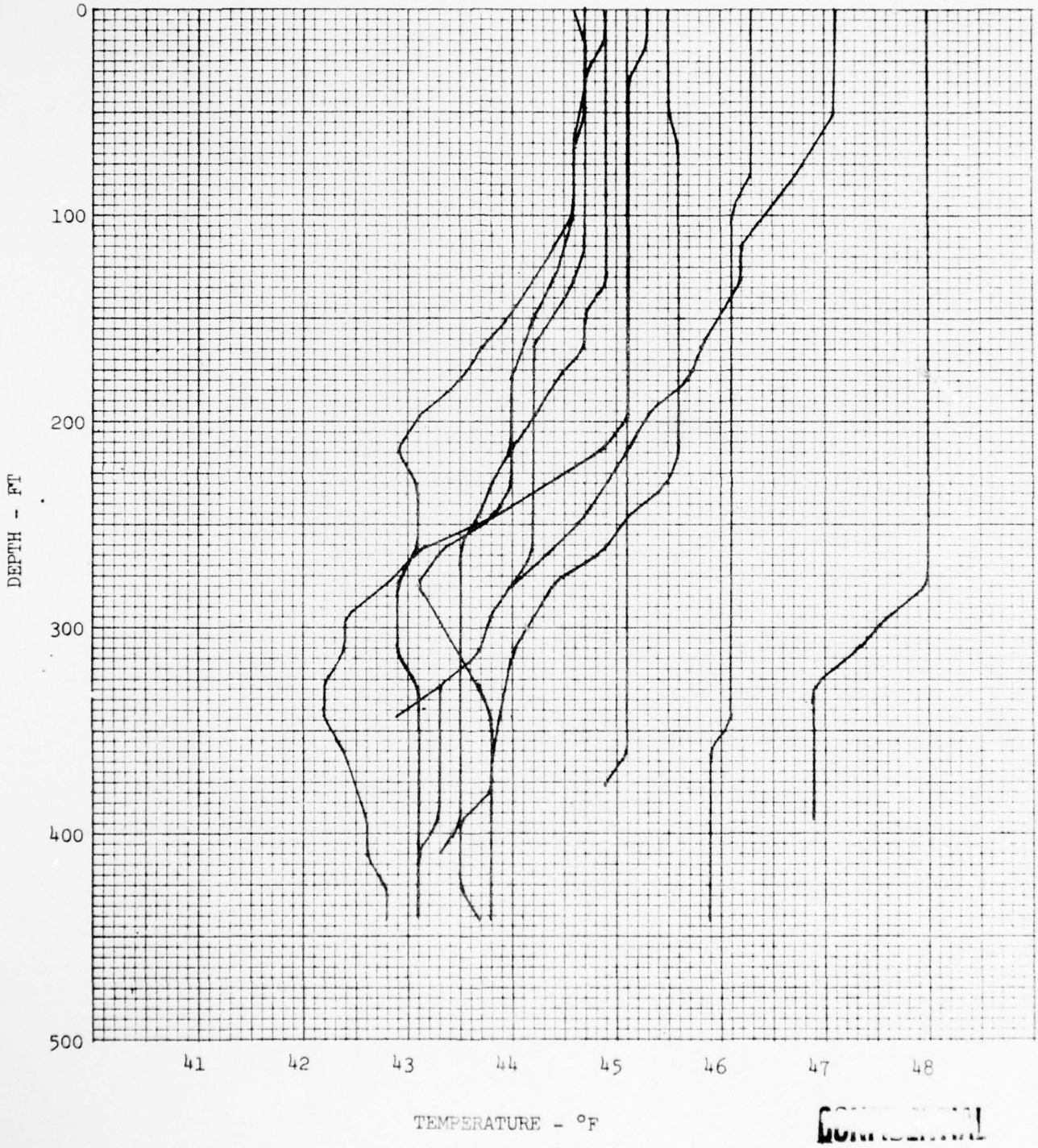


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Figure VI.4. Measured BT soundings, spring.

# MEASURED VELOCITY PROFILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

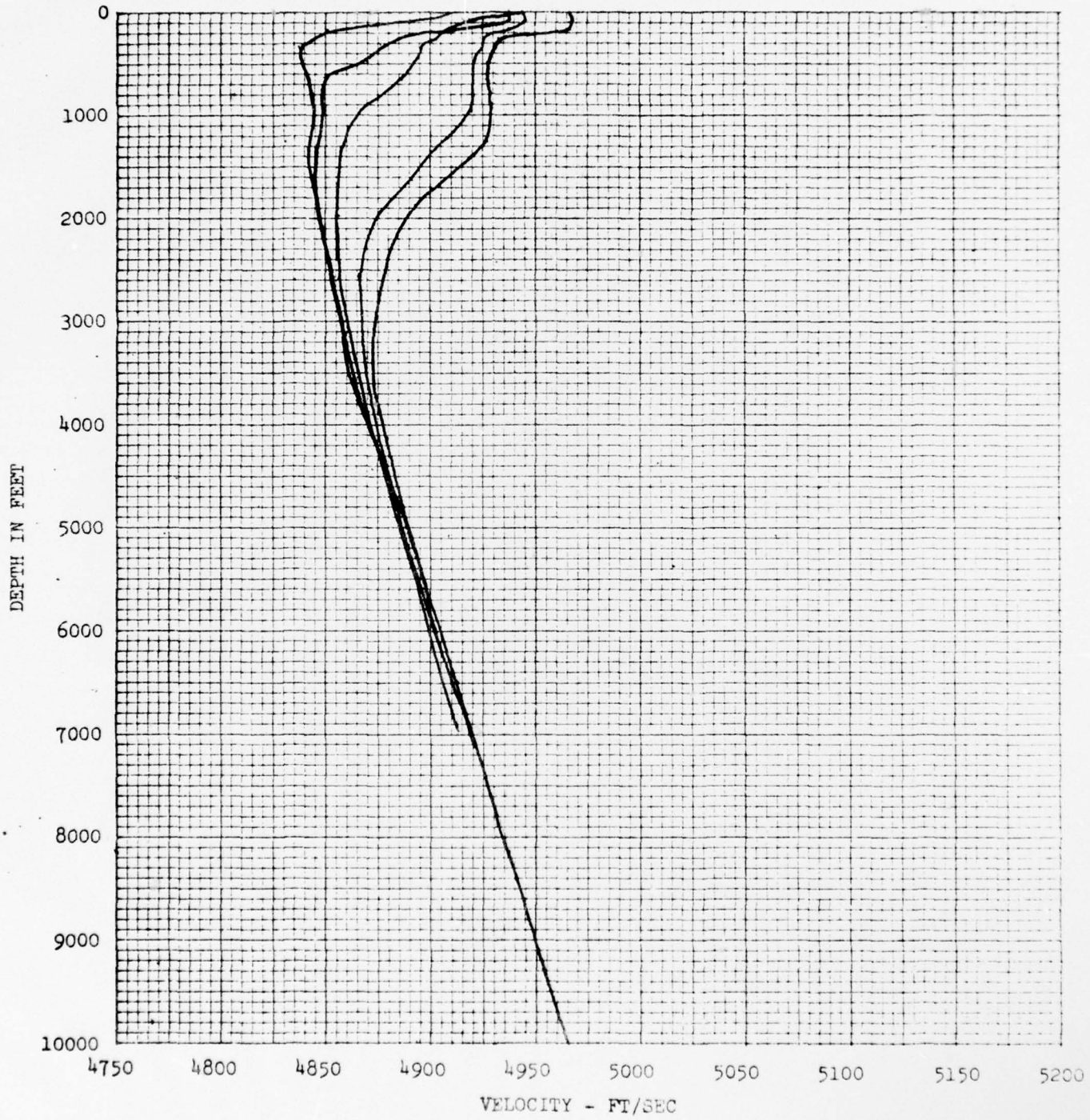



Figure VI.5. Measured sound velocity profiles from station data, summer.

# MEASURED BATHYTHERMOGRAPH PLOTS

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

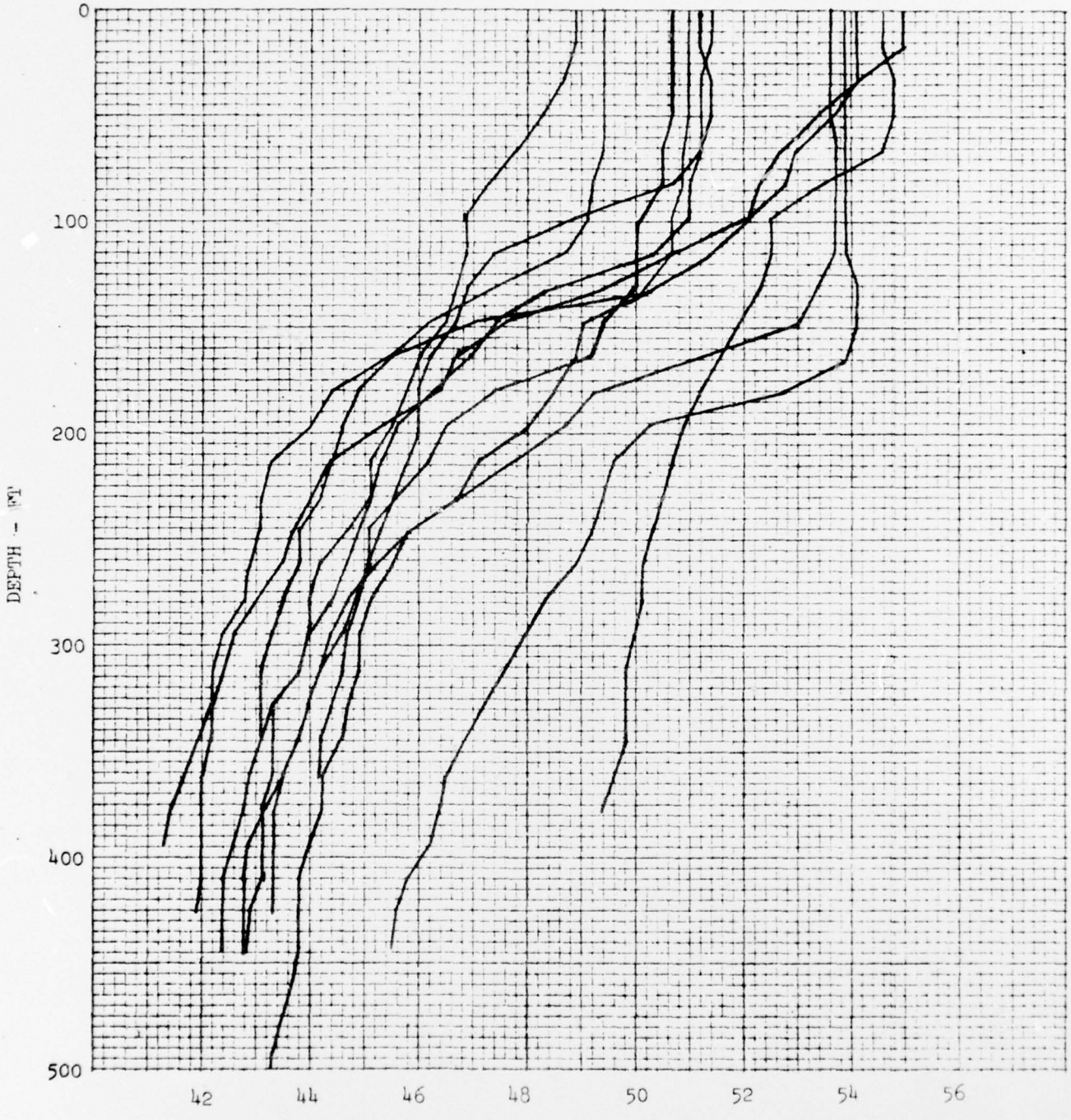



Figure VI.6. Measured BT soundings, summer.

# MEASURED VELOCITY PROFILES

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

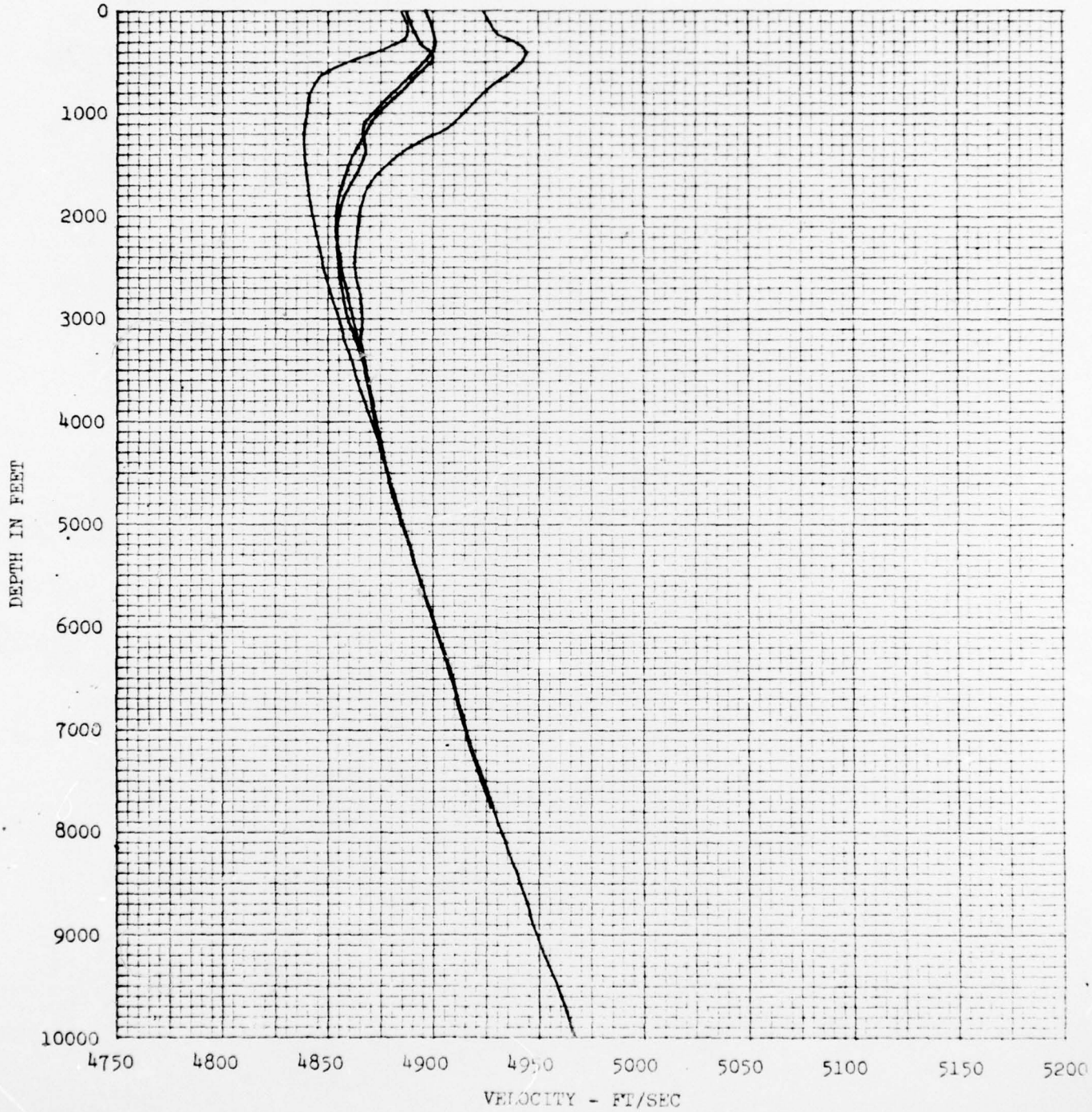



Figure VI.7. Measured sound velocity profiles from station data, fall.

# MEASURED BATHYTHERMOGRAPH PLOTS

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL


Figure VI.8. Measured BT soundings, fall.

# SECTION VII

# DATA DISTRIBUTION

# TABLE VII.1
# OCEANOGRAPHIC STATION AND BT DATA DISTRIBUTION BY MONTH AND YEAR

| | Month | Year | | No. of Stations NC | No. of Stations BT |
|---|---|---|---|---|---|
| WINTER | | | | | |
| | 1 | 62 | | 1 | |
| | 2 | 58 | | | 1 |
| | 2 | 62 | | 4 | |
| | 3 | 57 | | | 5 |
| | 3 | 58 | | 26 | 2 |
| | 3 | 60 | | | 1 |
| | 3 | 64 | | | 4 |
| | | | TOTAL | 31 | 13 |
| SPRING | | | | | |
| | 4 | 56 | | | 23 |
| | 4 | 58 | | 1 | |
| | 4 | 64 | | | 1 |
| | 5 | 56 | | | 12 |
| | 5 | 57 | | | 3 |
| | 5 | 59 | | 3 | 19 |
| | 5 | 60 | | | 1 |
| | 6 | 47 | | 3 | |
| | 6 | 58 | | | 1 |
| | 6 | 60 | | | 2 |
| | | | TOTAL | 7 | 62 |
| SUMMER | | | | | |
| | 7 | 31 | | 1 | |
| | 7 | 51 | | 1 | |
| | 7 | 55 | | | 1 |
| | 7 | 60 | | | 4 |
| | 7 | 61 | | | 2 |
| | 7 | 66 | | | 4 |
| | 8 | 54 | | 3 | |
| | 8 | 55 | | 3 | |
| | 8 | 57 | | 4 | |
| | 8 | 58 | | 19 | |
| | 8 | 59 | | | 3 |
| | 8 | 61 | | | 2 |
| | 9 | 58 | | 5 | |
| | | | TOTAL | 36 | 16 |
| FALL | | | | | |
| | 10 | 56 | | | 1 |
| | 10 | 58 | | 7 | |
| | 10 | 59 | | | 2 |
| | 10 | 60 | | | 1 |
| | 11 | 58 | | | 3 |
| | 12 | 56 | | | 1 |
| | 12 | 58 | | 2 | |
| | 12 | 60 | | | 6 |
| | | | TOTAL | 9 | 14 |

# DATA DISTRIBUTION

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: WINTER

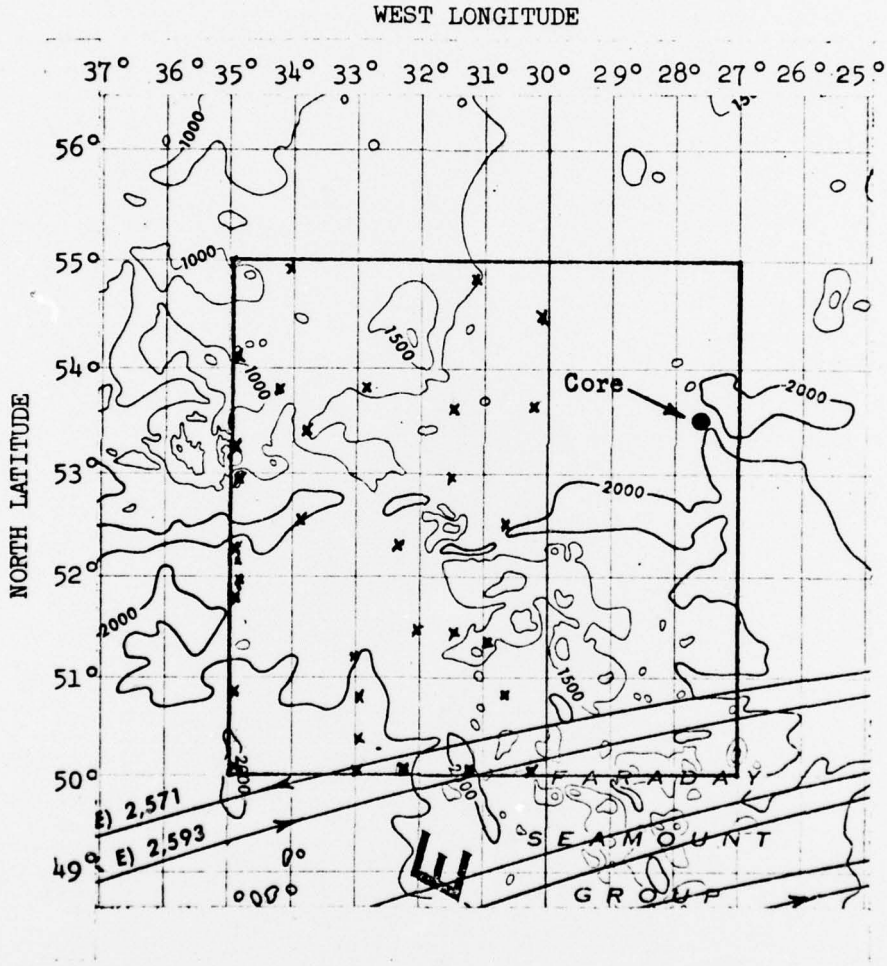



Figure VII.1. Station data distribution, winter.

# DATA DISTRIBUTION

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SPRING

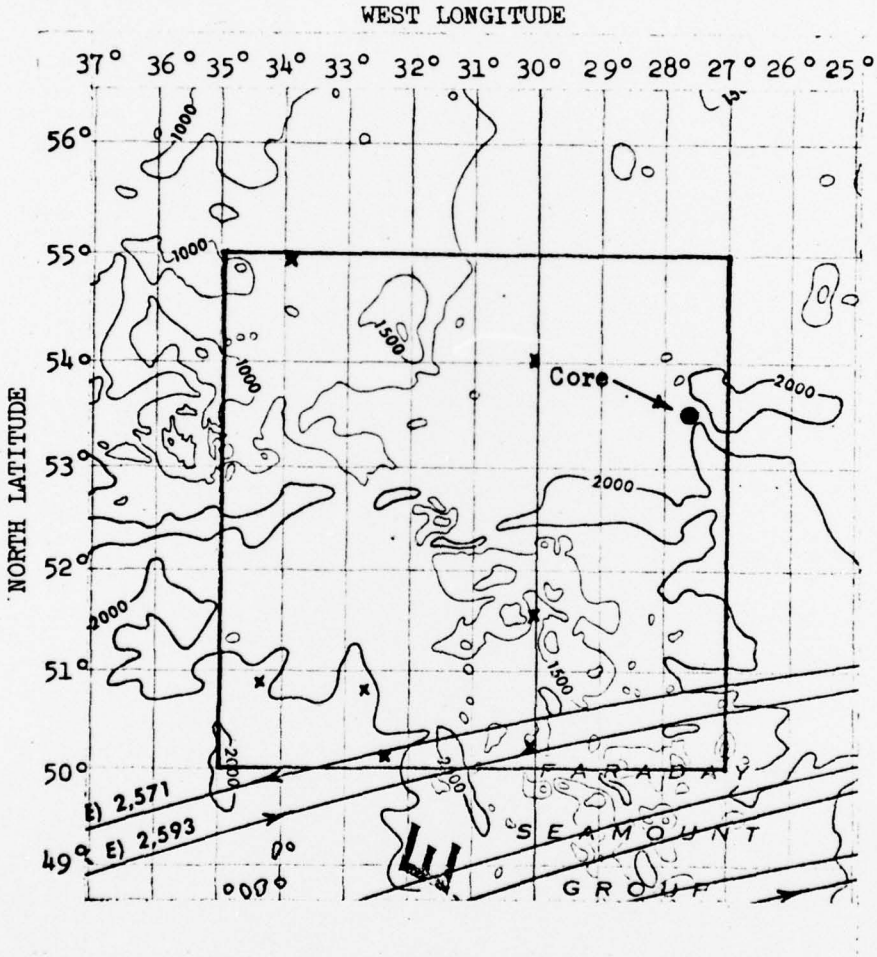



Figure VII.2. Station data distribution, spring.

# DATA DISTRIBUTION

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: SUMMER

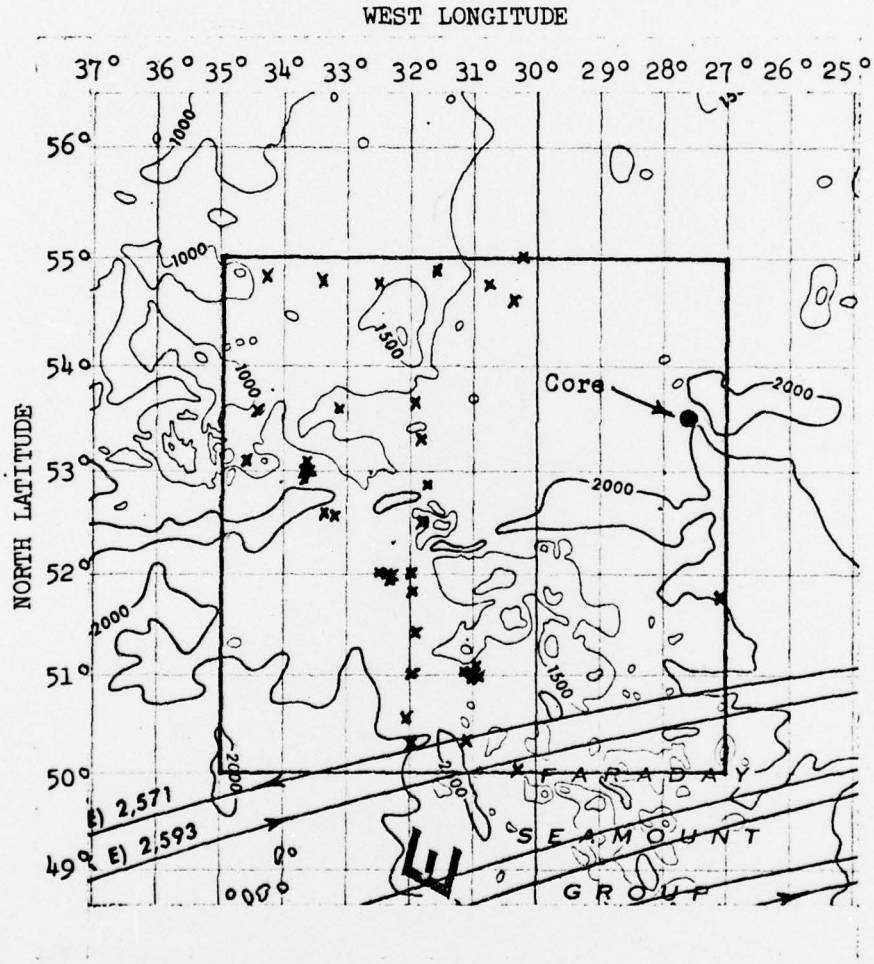



Figure VII.3. Station data distribution, summer

# DATA DISTRIBUTION

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

SEASON: FALL

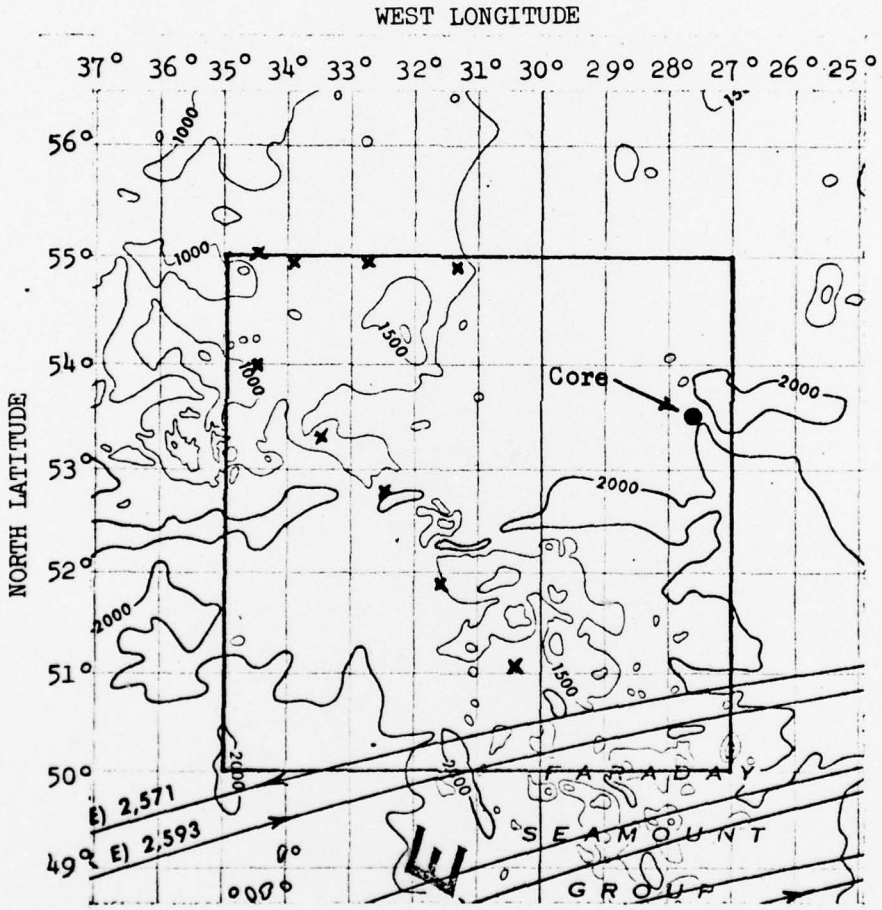



Figure VII.4. Station data distribution, fall.

# SECTION VIII

# SEA FLOOR SUMMARY DATA

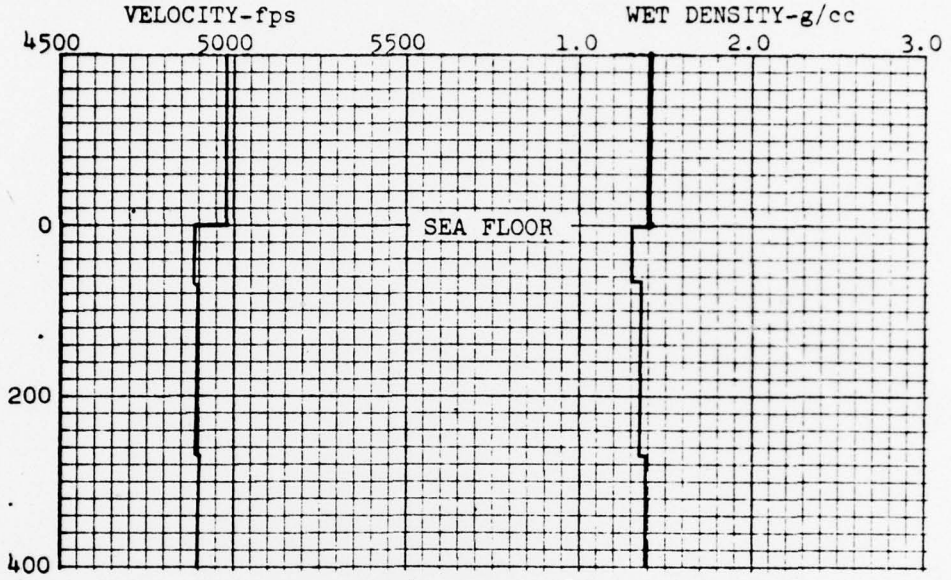
# CONFIDENTIAL ACOUSTIC SEA FLOOR SUMMARY

LOCATION/AREA: NA-2 50°-55°N x 30°-35°W

PROVINCE: MID ATLANTIC RIDGE

DATA SOURCE: MGS AREA 2, VOLUME 6 T.I. INC., CORE AS2-8

I. DEPTH DISTRIBUTION:




II. LAYER CHARACTERISTICS:

| LAYER NUMBER | MATERIAL | LAYER DEPTH-cm* | LAYER THICKNESS cm | VELOCITY fps | POROSITY | WET DENSITY g/cc |
|---|---|---|---|---|---|---|
| 1 | Chalk | 0 | 70 | 4877 | .80 | 1.33 |
| 2 | Clay | 70 | 200 | 4872 | .76 | 1.38 |
| 3 | Chalk | 270 | 178 | 4898 | .73 | 1.43 |
| 4 | Clay | 450 | 260 | 4867 | .71 | 1.47 |

III. SEA FLOOR INTERFACE VALUES:

| | |
|---|---|
| BOTTOM WATER VELOCITY - fps | 4977.6 |
| BOTTOM WATER DENSITY - g/cc | 1.0419 |
| SURFACE SEDIMENT DENSITY - g/cc | 1.33 |
| SURFACE SEDIMENT TO BOTTOM WATER VELOCITY RATIO | 0.9797 |
| BOTTOM DEPTH - ft | 10,800 |

*DEPTH TO UPPER SURFACE OF LAYER

Figure VIII.1. Ocean bottom and sediment characteristics.



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# CORE SAMPLE ANALYSIS

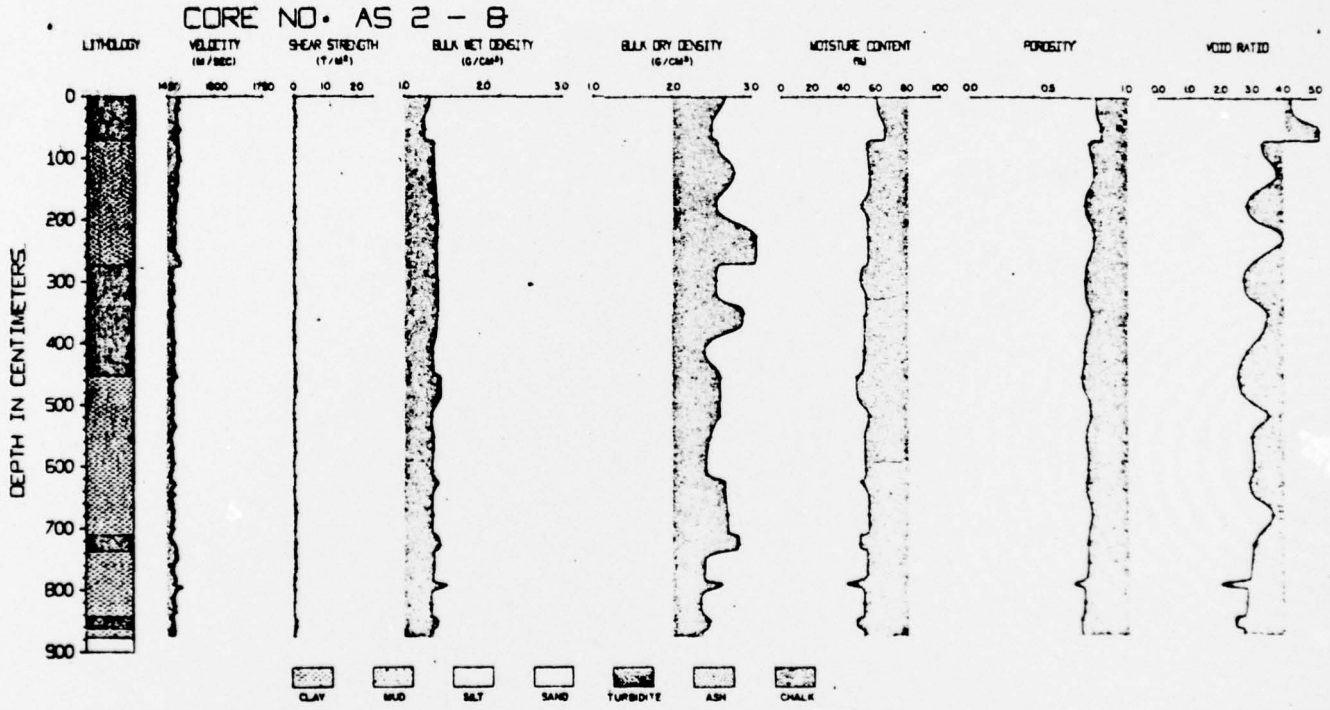


Figure VIII.2. Marine Geophysical Survey Area 2 Core No. AS2-8.

# SECTION IX
# REFERENCES

REFERENCES

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