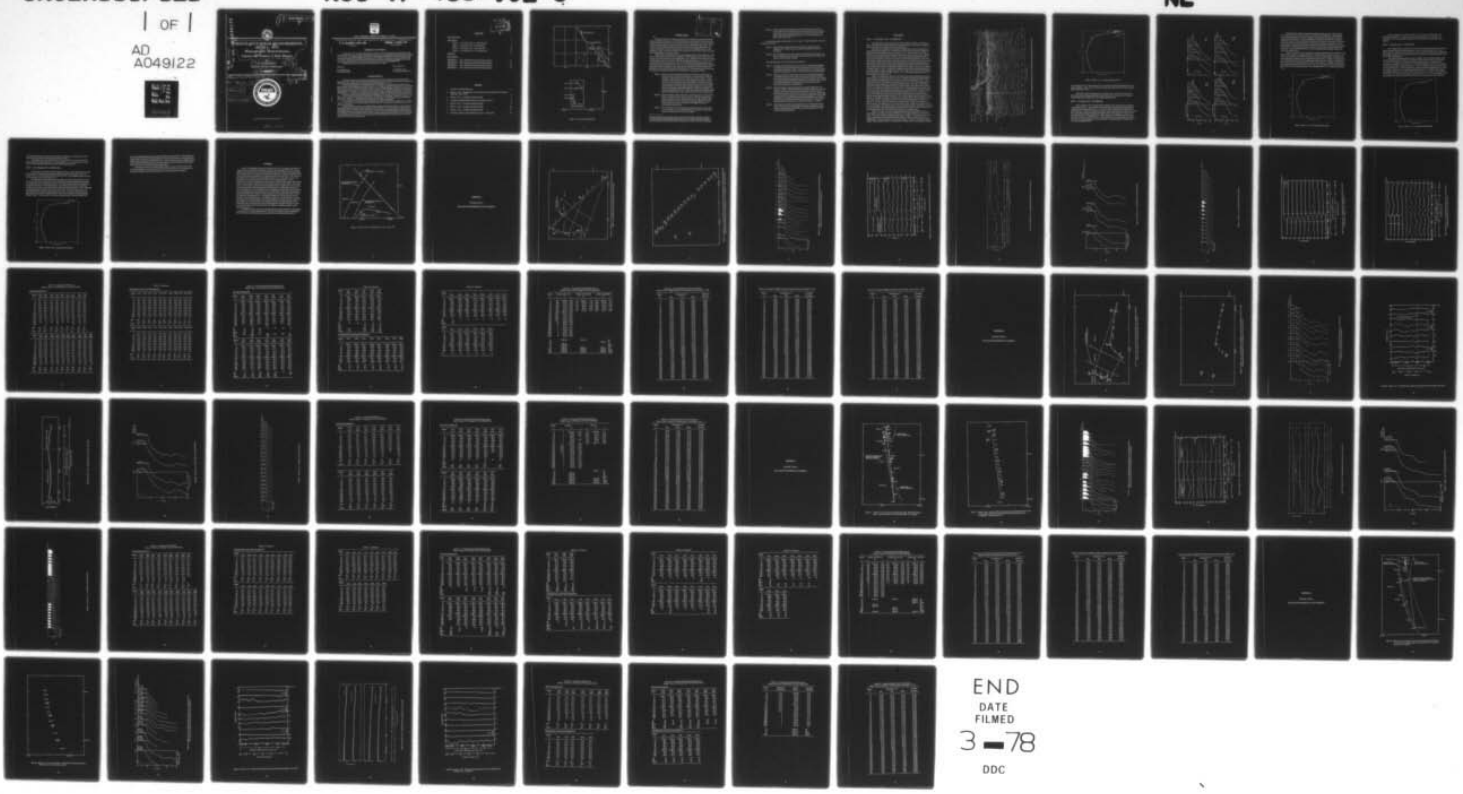
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NUC TP 465 Vol 3

SURFACE-DUCT SONAR MEASUREMENTS (SUDS I - 1972)

Oceanographic Measurements.

Volume III. Station 2 Data Report.

by

E. R. Anderson

Undersea Sciences Department

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AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

R. B. GILCHRIST, CAPT, USN
Commander

HOWARD L. BLOOD, PhD
Technical Director

ADMINISTRATIVE STATEMENT

During February 1972 the Naval Undersea Center conducted a series of 18 propagation loss experiments in three deep-water areas off the coast of California. These experiments are known as the SUrface Duct Sonar Measurements (SUDS I – 1972). This work was originally supported by the then Naval Ships Systems Command, Sonar Technology Division, PMS-302-4 and partly supported by the Office of Naval Research, code 102-OSC. The preparation of this report began in April 1973 under the sponsorship of the Naval Sea Systems Command, code 06H1-4, problem SF 52-552-602, task 19344. This report covers work from March 1971 to January 1976 and was approved for publication in March 1976.

Technical reviewers for this report were M. A. Pedersen and P. G. Hansen.

Released by

H. E. MORRIS, Head
Ocean Sciences Group

Under authority of

B. A. POWELL, Head
Undersea Sciences Department

ACKNOWLEDGMENTS

The SUDS I program was a coordinated and cooperative effort involving personnel from the Undersea Sciences Department and the Undersea Surveillance Department. Also participating in the oceanographic measurement program were personnel from the Lockheed Ocean Laboratory (Lockheed Missiles and Space Co., Inc.).

The Principal Investigator for the SUDS experiments was J. Cummins. P. G. Hansen and K. W. Nelson were the Senior Scientists for the oceanographic measurements program. D. P. Hamm was the Principal Investigator for the Lockheed Ocean Laboratory. The Lockheed Ocean Laboratory, with L. P. Coates as Program Manager, constructed the Teletherm buoy system, operated the system at sea, and provided the initial reduction of the data. The following assisted in a consulting and planning capacity: E. R. Anderson, P. A. Barakos, O. S. Lee, and W. F. Potter. Assisting in the preliminary data reduction and analysis was J. L. Thompson, an exchange scientists from Royal Australian Navy Research Laboratory, Sidney, Australia.

H. P. Bucker was the Scientist-in-Charge aboard the *DeSteiguer,* D. E. Good, the Scientist-in-Charge aboard the *Lee*, and P. A. Hanson, the Scientist-in-Charge aboard the *Cape*. Assisting with the oceanographic measurements at sea were: A. E. Diamond, H. L. Haskall, C. T. Smallenberger, and W. M. Woods. The assistance of the officers and men of the *DeSteiguer, Lee,* and *Cape* in making the oceanographic measurements program a success is acknowledged.

C. L. Barker and C. D. Curtis calibrated the Teletherm buoy sensors, K. W. Nelson, S. L. Speidel, and G. L. Crutcher assisted in the data reduction and computer aspects of the work, and O. S. Lee supervised the spectral analysis of the Wave-rider buoy measurements.

Additional acknowledgments are: Pacific Missile Range, Geophysics Division, Point Mugu, CA, which furnished the Datawell Waverider buoy system; Fleet Numerical Weather Central, Monterey, CA, which furnished the expendable bathy-thermograph probes; Fleet Weather Facility, San Diego, CA, which arranged for air-dropped expendable bathythermographs in the SUDS I areas prior to the ships moving from station 2 to station 3; the Naval Oceanographic Office, Pacific Support Group, San Diego, CA, which provided personnel to make environmental measurements and assistance aboard the *DeSteiguer;* and the Naval Electronics Laboratory Center, Communications Facilities Support Branch, which provided the shore-based portions of the ship-to-shore communications.

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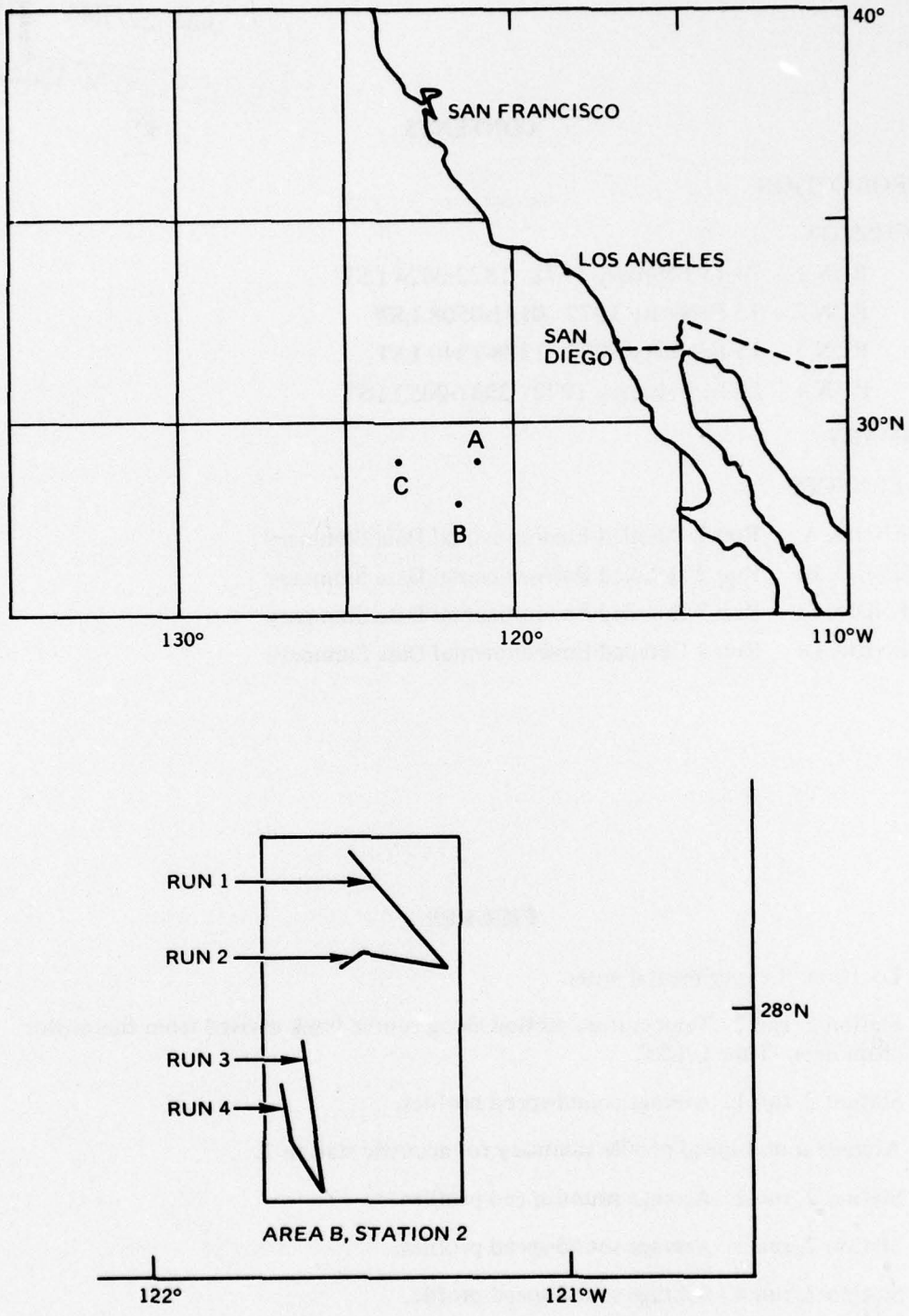
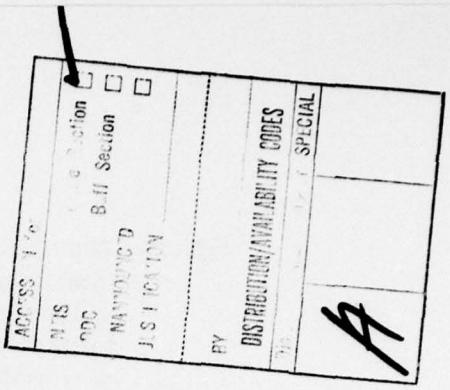


Figure 1. Location of experimental areas.



INTRODUCTION

This is the third of five volumes describing the environmental measurements made during the SUDS I experiments. Volume I discusses the instrumentation used to make the required environmental measurements, the data reduction procedures, an accuracy analysis of the final measurements, and the reconstruction of the experimental track charts. This volume contains a detailed report of the environmental measurements applicable to the acoustic experiments conducted during station 2, where four propagation loss runs were completed. Figure 1 shows the location of the experiments and the track of the source ship. Source ship speed was 3 knots for all runs.

The detailed environmental data for each propagation loss run are summarized in the form of charts, plots, and tables in the appendices. Each appendix presents the same kind of data in the same sequence for all propagation loss runs. Additions and omissions are made as appropriate for the run described. Thus the first appendix figure (i. e., A-1, B-1, etc.) is a chart showing the locations of source and receiver ships, selected propagation paths, and wind velocity. The second figure (A-2, B-2, etc.) is a chart showing the locations of XBT and thermistor chain measurements used to determine the distribution of sound speed present during the acoustic experiments and the identification of the ship making the measurement. The balance of the figures and tables in the appendices are organized as follows:

Figure 3. Plot of selected sound-speed profiles from the surface to 400 m taken along the track of the source ship.* These are derived from the XBT and thermistor chain profiles whose locations are shown in figure 2. These profiles are used to identify any unusual changes in the horizontal distribution of sound speed particularly with regard to vertical profile shape. These plots show sound speed versus depth with the 1503 m/sec isospeed abscissa being located at the proper distance along the source ship track. The area containing sound speeds higher than 1503 m/sec is shaded. If a sound-speed profile boundary is crossed the transition sound-speed profile shapes are shaded darker. The number is the time in local standard time.

Figure 4. Plot of thermistor chain temperature measurements at 10 selected depths about 25 m apart from the surface to 242 m. Abscissas showing time, distance along source track, and acoustic range are also included. These plots are used to reveal any important horizontal temperature changes present during the acoustic experiments that might influence the experimental measurements.

Figure 5. Plot of thermistor chain temperature measurements at the source depth or at two depths, 6 m apart, bracketing the source depth. Format and purpose of the plots are the same as for figure 4.

**In this paper only computed sound speeds are reported. The computed sound speeds are obtained from Anderson's sound-speed equation (Naval Undersea Research and Development Center, NUC TP 243,* Sound Speed in Seawater as a Function of Realistic Temperature-Salinity-Pressure Domains, *by E. R. Anderson, August 1971). Discussions of sound-speed distributions present during the propagation loss measurements are based on the computed sound speeds.*

Figure 6. Plot of sound-speed profiles derived from XBT and thermistor chain measurements. These profiles were made at identically the same and time and are used to give a limited evaluation of the spatial change in profile shape present during the propagation loss runs. The plot format is the same as that used in Fig. 3.

The following figures are included for run 1. Figure 7 is also included for runs 2 and 3 and Fig. 8 for run 4:

Figure 7. Expanded sound-speed profile plots derived from thermistor chain measurements. These are used to accurately establish the position of boundaries.

Figure 8. Plot of thermistor chain measurements for 10 selected depths, about 6 m apart, to delineate the nature of the horizontal temperature change in the vicinity of the boundary crossings.

The following tables are also included in the appendices:

Table 1. Tabulated values of temperature as a function of standard hydrographic cast depths for all XBT and thermistor chain measurements used in the sound-speed distribution analysis. Also tabulated are the isothermal layer depth (ILD), temperature (T) of the ILD, and surface layer depth (SLD).

Table 2. Tabulated values of sound speed as a function of standard hydrographic cast depths and time of day to 400 m for all converted XBT and thermistor chain temperature measurements used in the analysis. Also tabulated are the surface channel depth (SC), depressed channel depths (DC), refractive channel depths (RC), and depths of the maxima below surface channels and depressed channels (MAX).

Table 3. Tabulated values of average sound speed at standard depths from the surface to 1500 m. Also included are the number of observations and the depths of the surface channel, depressed channels, refractive channels, sound-speed maxima, and the axis of minimum sound speed. The average values are obtained from thermistor chain measurements (0-250 M), XBT, hydrographic cast, and STD/SV measurements (300-400 m), and hydrographic casts and STD/SV measurements (500-1500 m). These are the recommended sound speeds to be used from the surface to 1500 m.

Table 4. Tabulated values of the average temperature for each thermistor chain sensor. Shown are the sensor depth, the number of temperature measurements, the minimum and maximum recorded temperature, and the mean and standard deviation.

DISCUSSION

RUN 1 – 14-15 February 1972 1822-0024 LST

This experiment was conducted under adverse weather conditions. As shown in Fig. A-1 the *DeSteiguer* drifted about 8 nm south during the run, resulting in propagation paths that were not in the plane of the source ship track.

The plots of the individual sound-speed profiles shown in Fig. A-3 indicate that a sound-speed profile boundary was crossed between 1943 LST and 2100 LST. Figure A-7 shows sound-speed profiles taken every 10 min, about 1.1 kyd apart, from 1900 LST to 2200 LST. An examination of these profile shapes shows that a transition from a surface-channel depressed-channel profile (profile 1) to a surface-channel-only profile (profile 3) occurred over a distance of about 6.3 kyd between 1950 LST and 2050 LST. The sound-speed profiles plotted in Fig. A-6 also show the existence of a boundary between the sources and receivers. Figure A-4, the plot of the thermistor chain temperature measurements at selected depths, shows that a marked surface-temperature front was crossed at 2014 LST. The surface sensor measured a temperature change of 0.9°C (about 3.0 m/sec) in a distance of approximately 2.1 kyd. This figure also suggests that the frontal surface separating the two water masses extends to a depth of at least 73 m. Figure A-8 is a plot of the 20 thermistor chain sensors located from the surface to 107 m. The vertical dashed line traces the frontal surface to a depth of 73 m.

Figure 2 was prepared to bring out the details of the vertical temperature structure along the source track from the surface to 242 m. The plot was generated using thermistor chain temperature profiles taken at 5-min intervals. The contour interval is 0.2°C. The depths of all even 0.2°C temperature intervals from 8.4°C to 15.4°C were computer determined and plotted using linear interpolation between sensors. The chart was then hand contoured. Note that the highest temperature isotherm present along the entire section is 13.8°C. The depth of this isotherm varied from 73 to 79 m and delineates the top of a uniform mass of water that was present along the entire experimental track. The heavy black line is the position of the frontal surface as defined in figure A-8. The vertical lines at 9.2 and 15.5 kyd show the position of the sound-speed profile transition (profile 2) from a surface channel depressed-channel (profile 1) to a surface-channel-only sound-speed profile (profile 3). Attention is called to the temperature stability present from the surface to about 30 m in the profile 1 and profile 3 volumes. In this layer the temperature variation is less than 0.2°C. It is also noted that the surface front results in a change of sound speed of about 2.0 m/sec in a distance of 0.7 kyd. Also shown in Fig. 2 is the source depth and the five receiver depths. The positioning of the sources and the receivers is optimum for bringing out any effects that these abrupt changes in both the horizontal and vertical distribution of sound speed may have on the near-surface propagation of acoustic energy.

Figure 3 is a plot of the three average sound-speed profiles tabulated in table A-3. The details of the average sound-speed distribution in the upper 200 meters are shown in Fig. 4. The source and receiver depths are also shown. Profile 1 is characterized by a 23-m surface channel and a 38-m depressed channel with the minimum sound speed at 50 m, while profile 3 is characterized by a 30-m surface channel. The reader is reminded that the profiles in the transition volume, as represented by average profile 2, are gradually changing

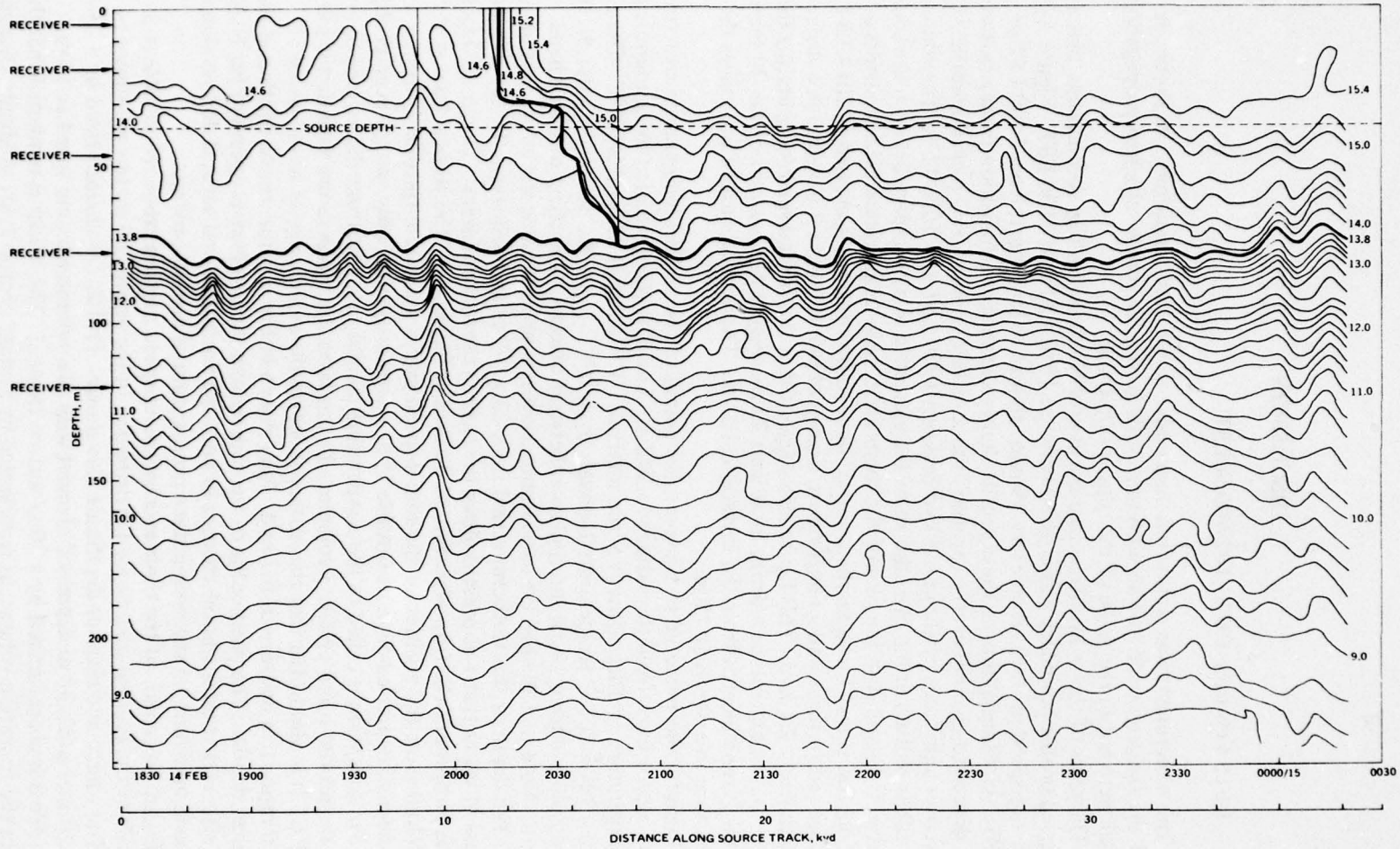


Figure 2. Station 2, run 2. Temperature section along source track derived from thermistor chain data. Time is LST.

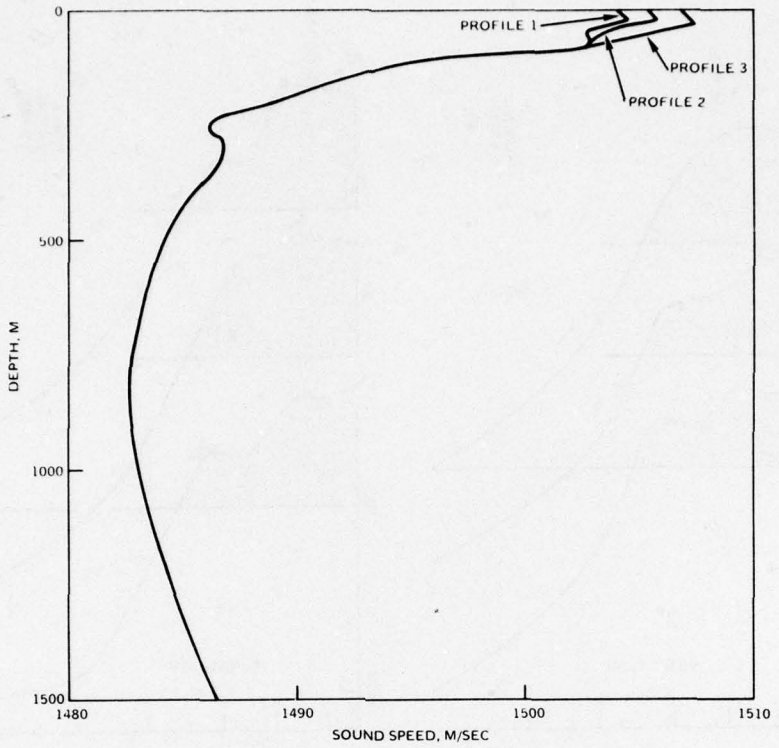


Figure 3. Station 2, run 1. Average sound-speed profiles.

over a range of 6.3 kyd. Thus, profile 2 is not an average sound-speed profile in the same sense as profiles 1 and 3. Over the entire source ship track there also was a 70-m refractive channel centered at 250 m.

During run 1 the *Lee* reported 16- to 20-knot winds, 5- to 8-ft waves, and 10- to 12-ft swell, and the *DeSteiguer* reported 18-knot winds, 3-ft waves, and 6- to 10-ft swell. No Waverider buoy measurements were obtained during this run.

RUN 2 – 15 February 1972 0141-0508 LST

This run began 1 hr 17 min after the conclusion of run 1 and may be considered as a continuation of run 1. This experiment was conducted under the same adverse weather conditions that prevailed during run 1. As shown in Fig. B-1 the *DeSteiguer* drifted 4 nm south-southwest. As the run progressed, it became apparent that the run could not be closed due to the rapid southerly drift of the *DeSteiguer*, and a course change of 57 deg was executed between 0355 LST and 0405 LST. This resulted in near-parallel tracks with a very slow rate of closure. At 0508 LST the run was terminated at an acoustic range of 10.7 kyd. Because of the resulting geometry of the experiment, no measurements were made along any of the propagation paths.

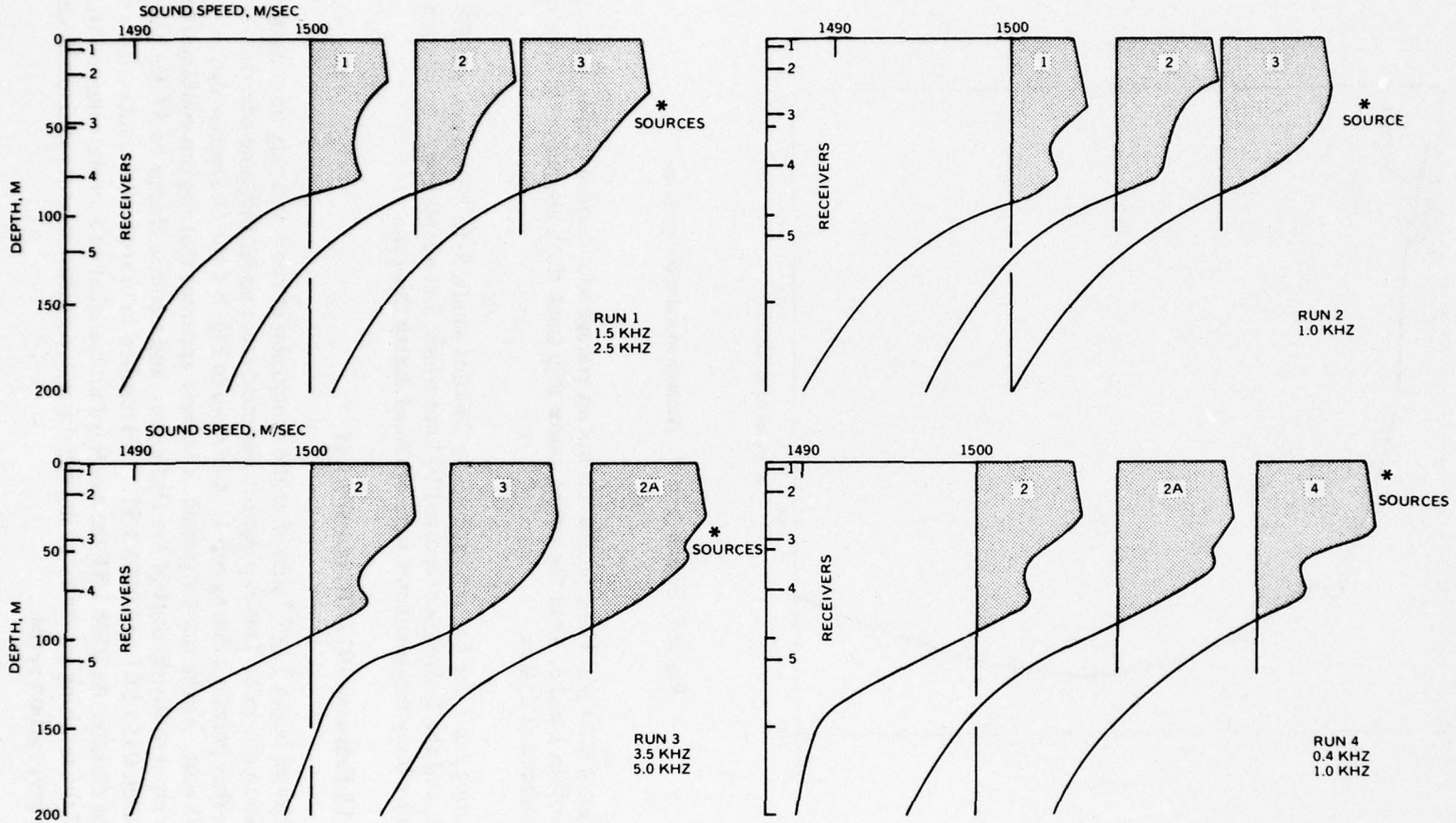


Figure 4. Average sound-speed profile summary for acoustic station 2.

Figure B-6 shows that the sound-speed profile boundary volume, crossed during run 1, was between the source and receivers at 0200 LST and 0400 LST. The individual sound-speed profiles shown in Fig. B-3 suggest that the southeastern edge of the profile 2 volume crossed during run 1 was recrossed between 0400 LST and 0420 LST. However, neither the plot of 10-min sound-speed profiles shown in Fig. B-7 nor the plot of the thermistor chain temperature measurements in Fig. B-4 clearly support the recrossing. Consequently, it was concluded that the sources remained in the profile 3 volume and the receivers in the profile 1 volume, with the profile 2 volume between them, during the entire experimental run. The extrapolated location of the sound-speed profile boundaries is shown in Fig. B-1 as a dash-dot line.

Figure 5 is a plot of the two average sound-speed profiles tabulated in Table B-3. The details of the average sound-speed distribution in the upper 200 m are shown in Fig. 4. Profile 1 is derived from the two XBT measurements made by the *DeSteiguer*, and profile 3 is derived from the thermistor chain measurements made by the *Lee*. Profile 1 is characterized by a 40-m surface channel and a 36-m depressed channel with the minimum sound speed at 60 m, while profile 3 is characterized by a 30-m surface channel. In addition, a 90-m refractive channel was observed centered at 250 m. Since no measurements were made in the profile 2 volume, the sound-speed profile 2 values tabulated from run 1 in Table A-3 should be used.

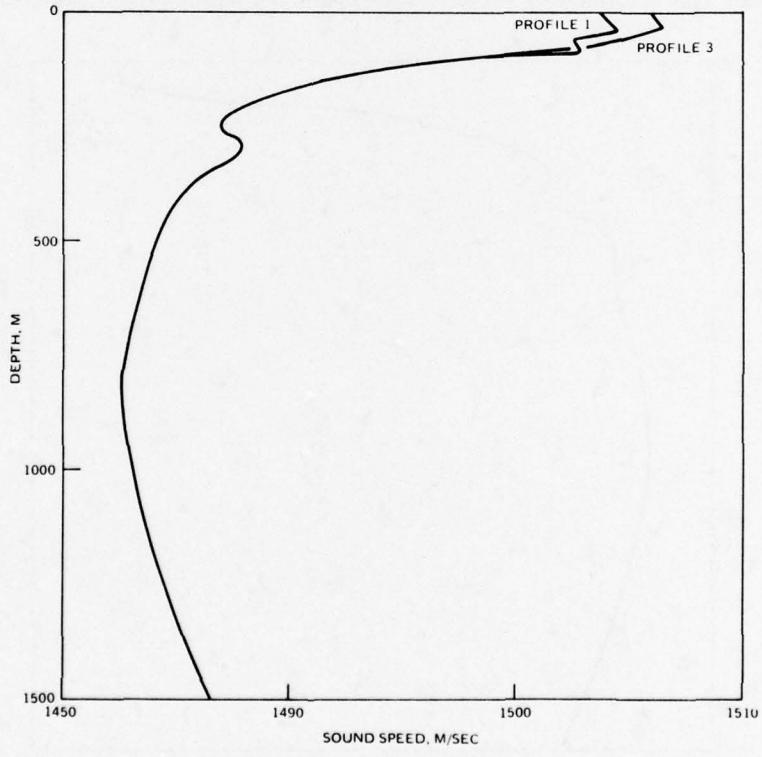


Figure 5. Station 2, run 2. Average sound-speed profiles.

The *Lee* reported 17- to 20-knot winds, 6- to 7-ft waves, and 10-ft swell. The *DeSteiguer* reported 18- to 20-knot winds, 3- to 4-ft waves, and 8- to 12-ft swell. As a consequence of the adverse weather conditions no Waverider buoy measurements were obtained.

RUN 3 -- 15 February 1972 1328-1940 LST

Run 3 began about 12 nm south of run 2 and was conducted under the same adverse weather conditions that prevailed during runs 1 and 2. As shown in Fig. C-1 the source ship's track was southerly, the same direction as the drift of the receiving ship. Consequently, the propagation paths closely coincide with the track of the source ship and the plane of the source ship's measurements.

The individual profiles plotted in Fig. C-3 suggest that a sound-speed profile boundary was crossed between 1520 LST and 1540 LST and recrossed between 1700 LST and 1720 LST. An examination of the 10-min-interval profiles, Fig. C-7, suggests that the crossings occurred about 1531 LST and 1722 LST. This appears to be a southern extension of one of the boundaries crossed during run 1. Profile 2 is probably the same transition profile crossed during run 1. This profile gradually changes with decreasing latitude into profile 2A. Figure 6 contains a plot of average sound-speed profile 2. The details of the average sound-speed distribution in the upper 200 m are shown in Fig. 4. There is a high likelihood that profile 3 is in the same water mass as profile 3 of runs 1 and 2. All three average sound-speed profiles are characterized by 30-m surface channels, with profiles 2 and 2A having

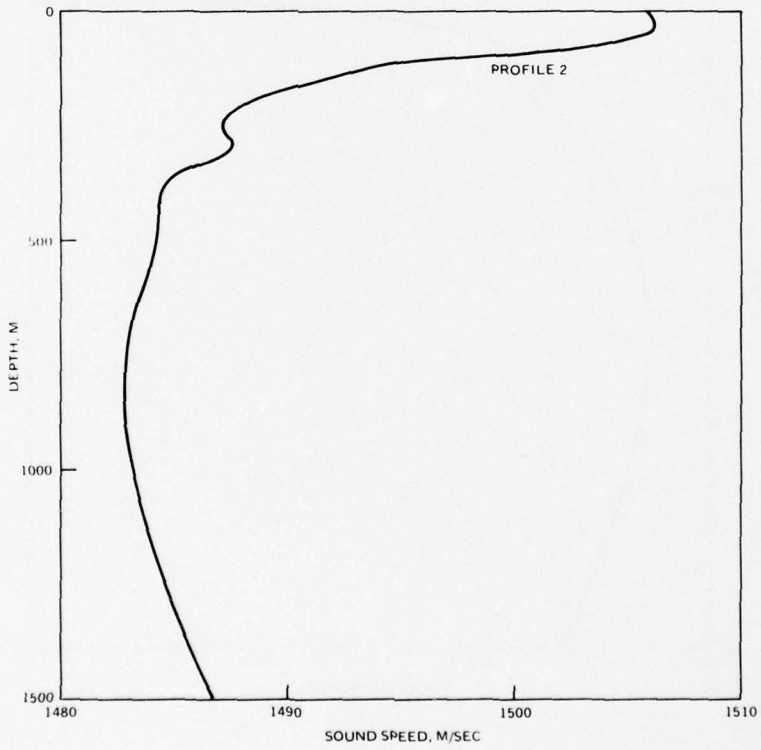


Figure 6. Station 2, run 3. Average sound-speed profiles.

minor depressed channels centered at 68 m and 50 m, respectively. Profile 3 has a 70-m refractive channel with the minimum sound speed at 250 m.

During this run the *Lee* reported 20- to 22-knot winds, 5- to 7-ft waves, and 10-ft swell, and the *DeSteiguer* reported 17- to 20-knot winds, 3- to 4-ft waves, and 8- to 10-ft swell. No Waverider buoy measurements were obtained during this run.

RUN 4 – 15-16 February 1972 2031-0052 LST

Run 4 began 51 minutes after the completion of run 3. Run 4 was conducted under the same adverse weather conditions that prevailed during the other station 2 runs. As shown in Fig. D-1 the *DeSteiguer* drifted south about 2 nm. The propagation paths were not in the same plane as the source ship's track.

An examination of the individual profiles plotted in Fig. D-3 shows that the track of the source ship was in a uniform water mass containing a sound-speed profile characterized by a surface channel and a depressed channel. These observations coupled with those made during the other station 2 runs suggest that the source ship track was west of a southerly extension of the profile 2 and 2A sound-speed volumes crossed during runs 1 and 3. Although no measurements were made by the receiver ship, it appears that it remained in the run 3 sound-speed profile 2 water volume during the entire run. Attention is called to Fig. D-8, which shows the temperature stability present in the surface channel and in the depressed channel. Figure 7 contains a plot of average sound-speed profile 4, and the details of the

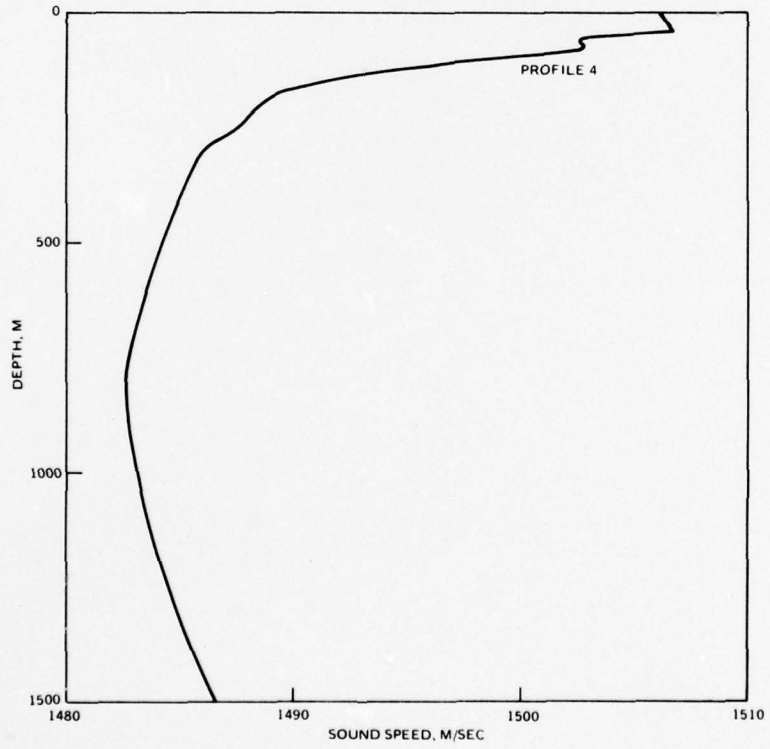


Figure 7. Station 2, run 4. Average sound-speed profile.

average sound-speed distribution in the upper 200 m are shown in Fig. 4. The average sound-speed profile at the source is characterized by a 39-m surface channel and a 20-m depressed channel with the minimum sound speed at 60 m. Since the receivers are in a different sound-speed profile volume than the source, profile 4 should be used in conjunction with profiles 2 and 2A of run 3 in any acoustic study or application.

During this run the *Lee* reported 20-knot winds, 5-ft waves, and 10-ft swell. The *DeSteiguer* reported 15- to 20-knot winds, 4-ft waves, and 8-ft swell. As a consequence of the adverse weather conditions no Waverider buoy measurements were obtained.

SUMMARY

Four CW propagation loss runs were made at station 2. These runs were made over a period of 30 1/2 hours from 14 February 1822 LST to 16 February 0052 LST. Oceanographic measurements made in this area during these experiments showed the experimental area contained three water masses, each being characterized by a unique sound-speed profile. These water masses were separated by a transitional water mass (see Fig. 8). The water mass boundaries were involved in all of the propagation loss runs. At the start of runs 1 and 2 both the receivers and sources were in a water volume containing profiles 1 and 2, respectively. As the runs progressed, the sources were towed through a second water volume and into a third volume, while the receivers remained in the first water volume. In the case of run 1, the transition zone (profile 2) separating the profile 1 and profile 3 water volumes was characterized by a marked temperature frontal surface extending from the surface to 73 m. This feature was very well defined by the temperature measurements that were made while the propagation loss measurements were being recorded. Accompanying this temperature discontinuity was an abrupt 2.8-m/sec increase in sound speed in the surface channel. The boundaries separating the run 3 sound-speed profiles were not as well defined as the boundary encountered during run 1. In addition, during run 3, all three profiles were characterized by 30-m surface channels with very little difference between the water volumes in the absolute value of sound speed. Thus, despite the presence of three different profile shapes there was a continuous 30-m surface channel present during the entire run. During run 2 and run 4 the sources and receivers were in different sound-speed profile volumes during the entire run.

In addition, all four runs were made under adverse weather conditions. Wind speeds, varying from 15 to 22-knots, produced 3- to 8-ft wind waves, which were accompanied by a 6- to 10-ft swell. No Waverider buoy measurements were obtained during station 2.

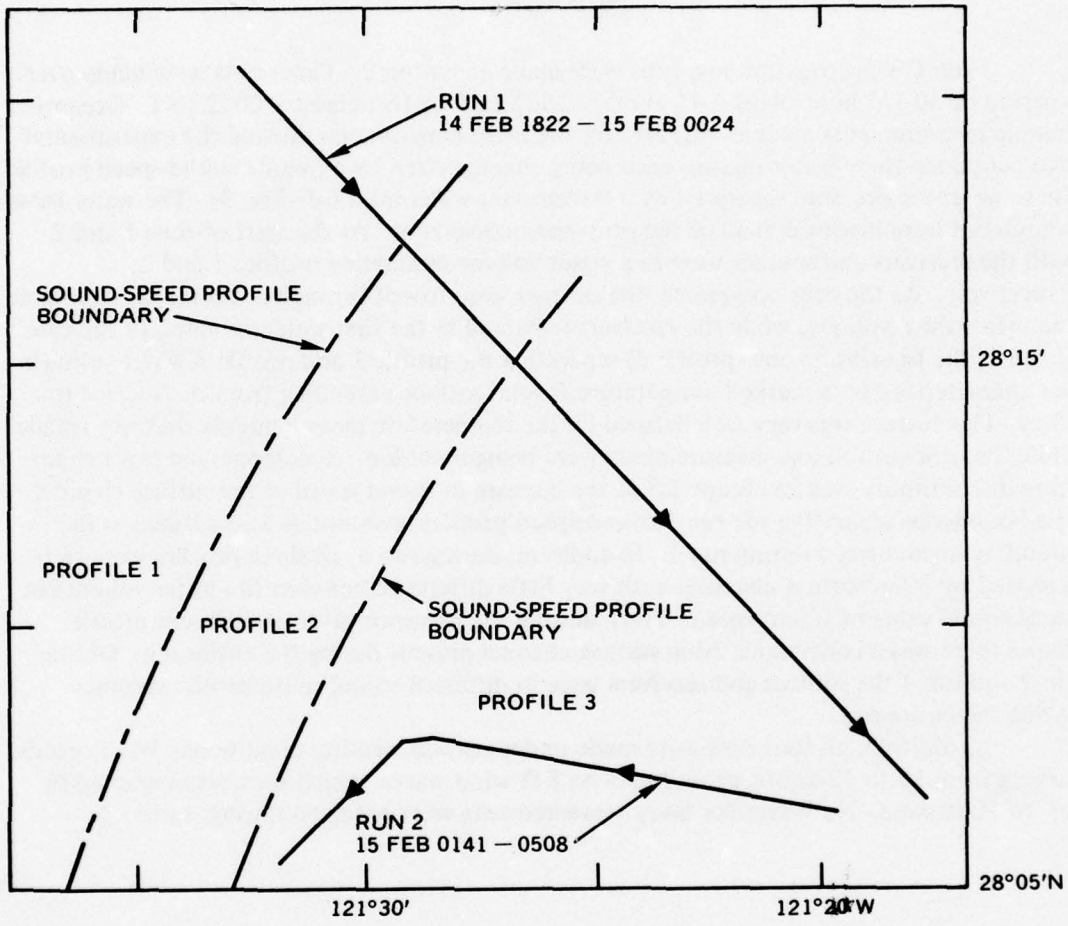


Figure 8. Location of station 2 experimental runs 1 and 2. Time is LST.

APPENDIX A

STATION 2 RUN 1

DETAILED ENVIRONMENTAL DATA SUMMARY

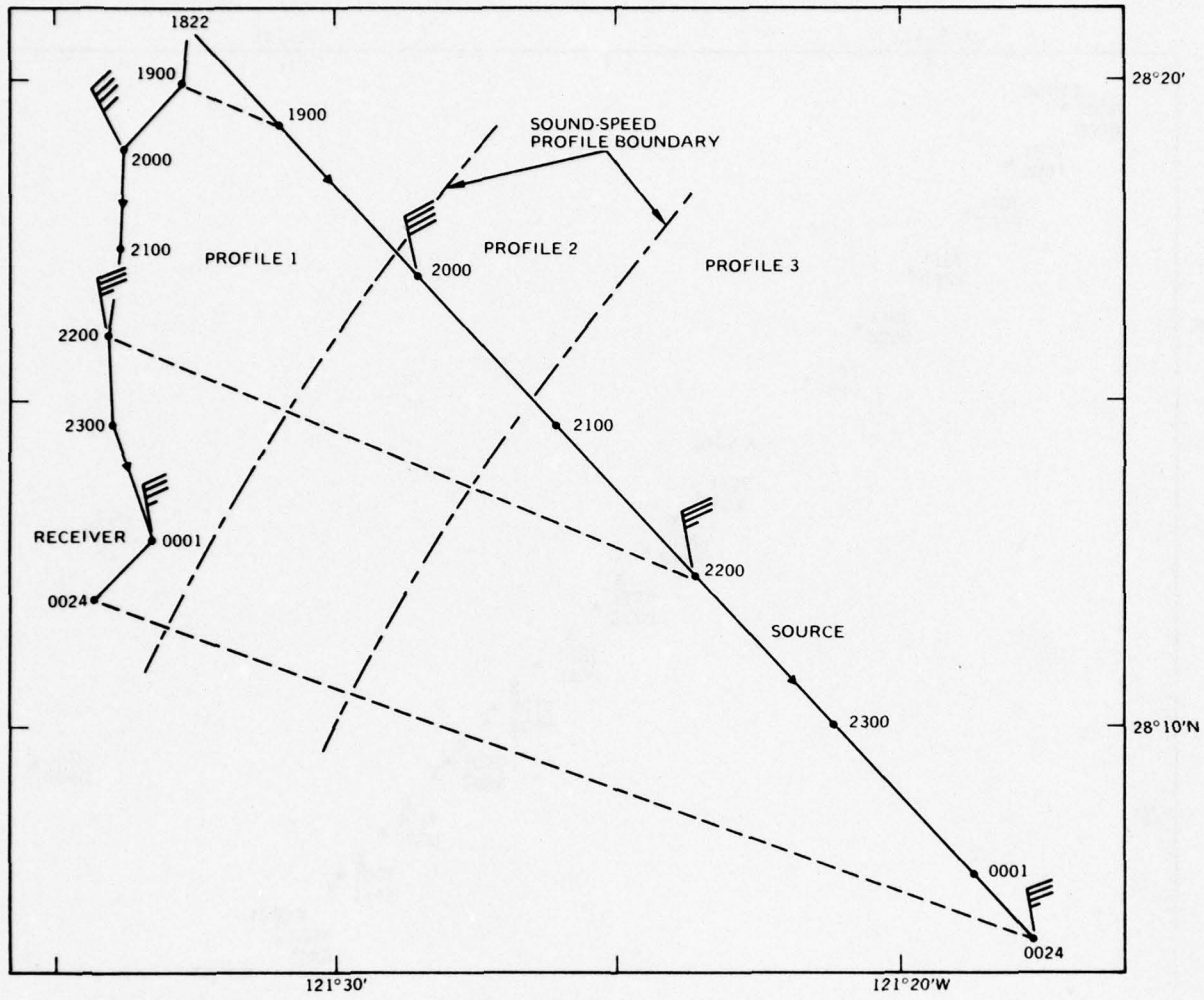


Figure A-1. Station 2, run 1. Location of source and receiving ships, 1900, 2200, and 0024 LST propagation paths (---), and wind velocity (10-knot east wind, 1 bar = 5 knots).

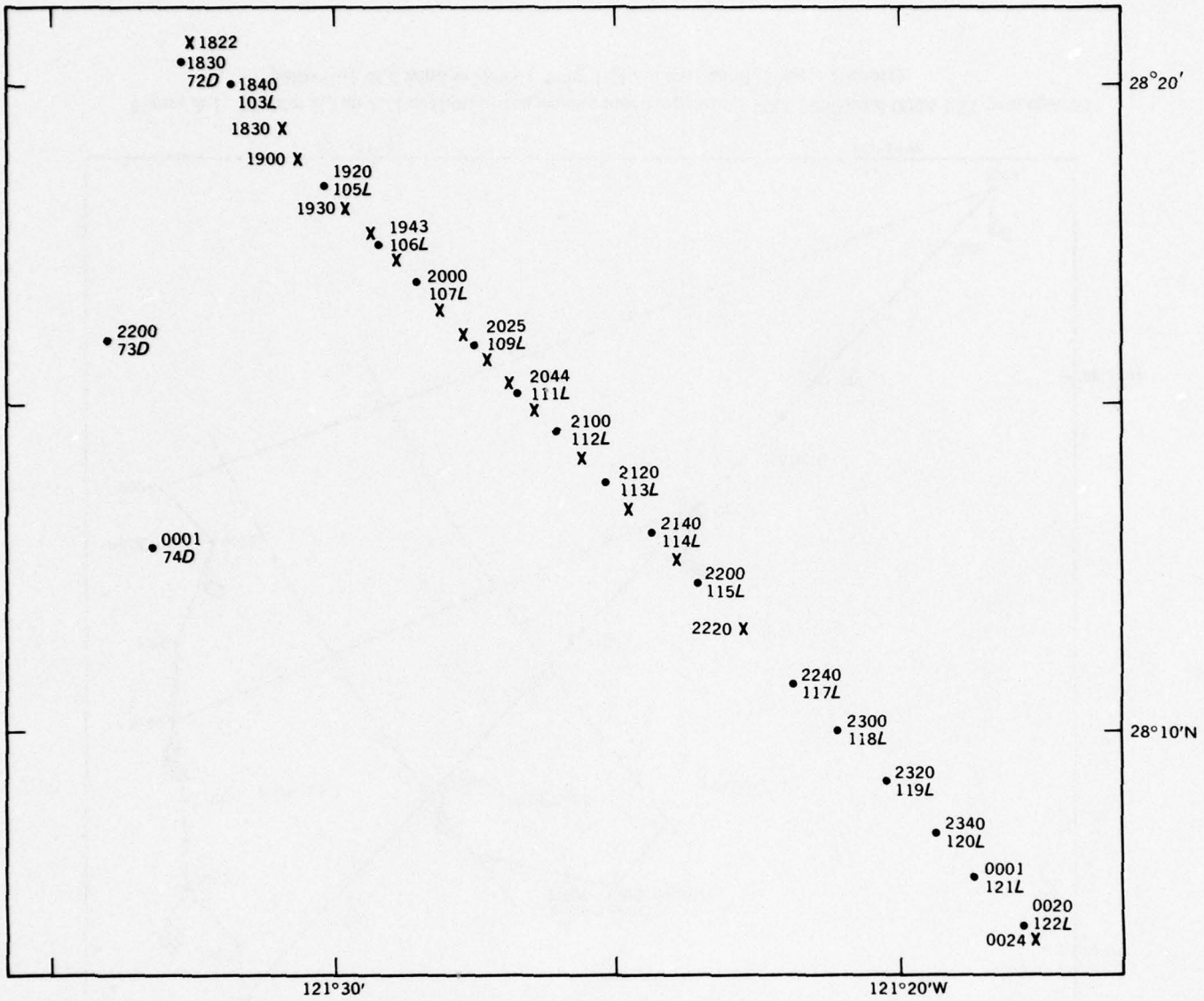


Figure A-2. Station 2, run 1. Location of XBT (·) and thermistor chain (X) measurements. The letter following the XBT number denotes the ship which took the measurement (L: Lee, D: DeSteiguer). Times shown are LST.

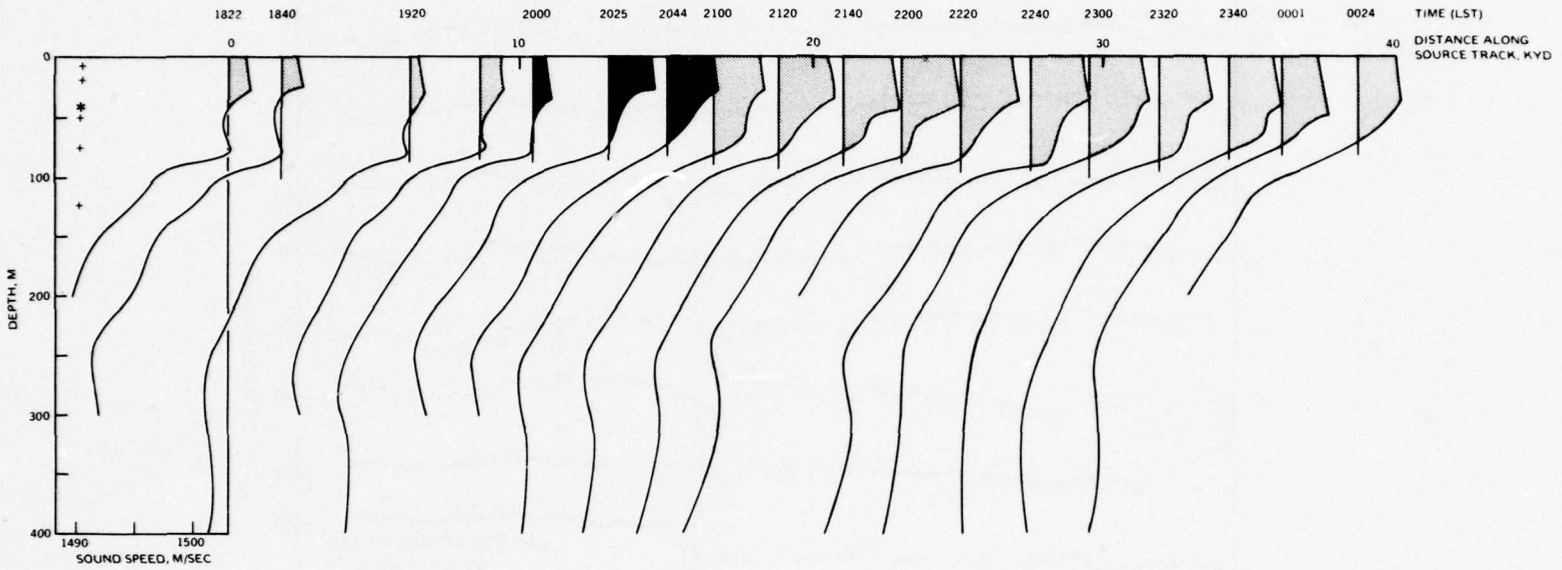


Figure A-3. Station 2, run 1. Sound-speed profiles along track of source ship derived from XBT and thermistor chain data. Source depth (*), receiver depth (+).

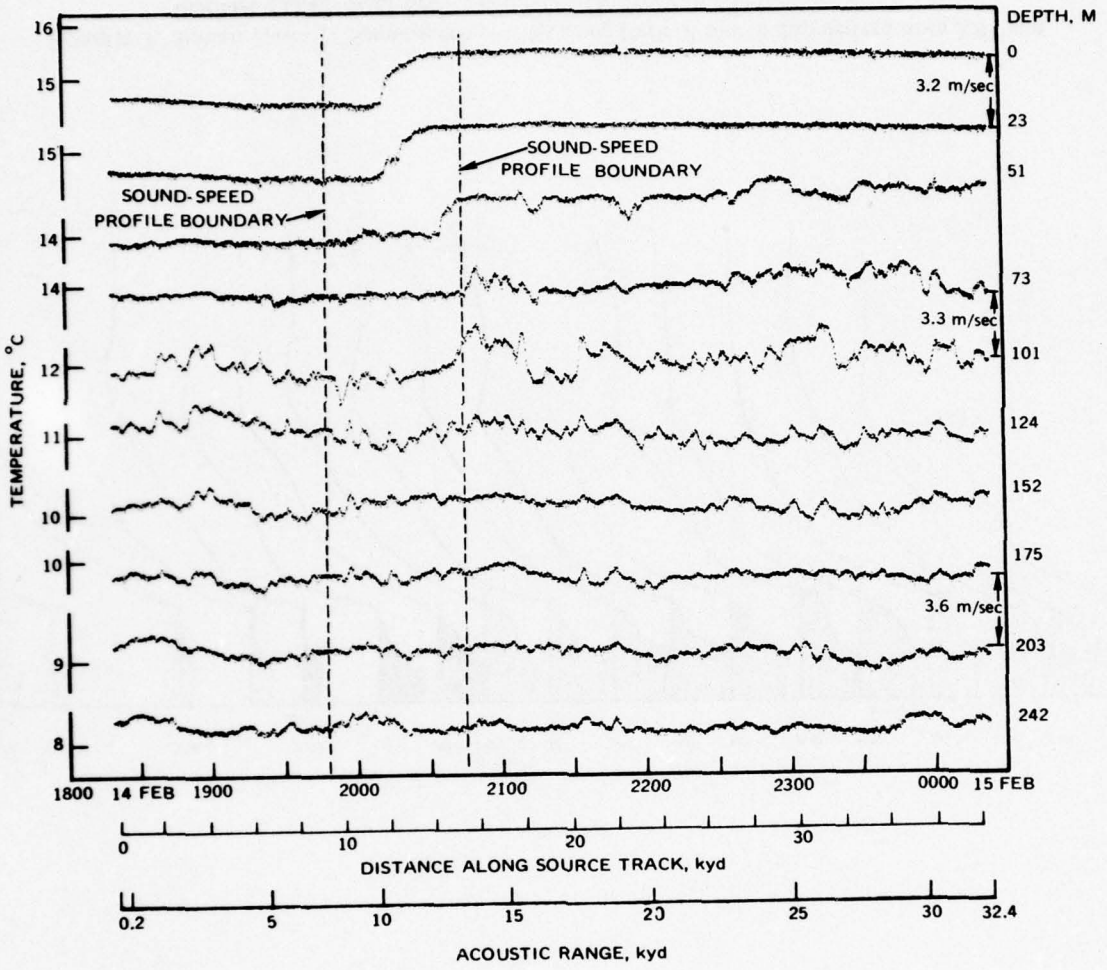


Figure A-4. Station 2, run 1. Thermistor chain temperature measurements at selected depths. Time is LST.

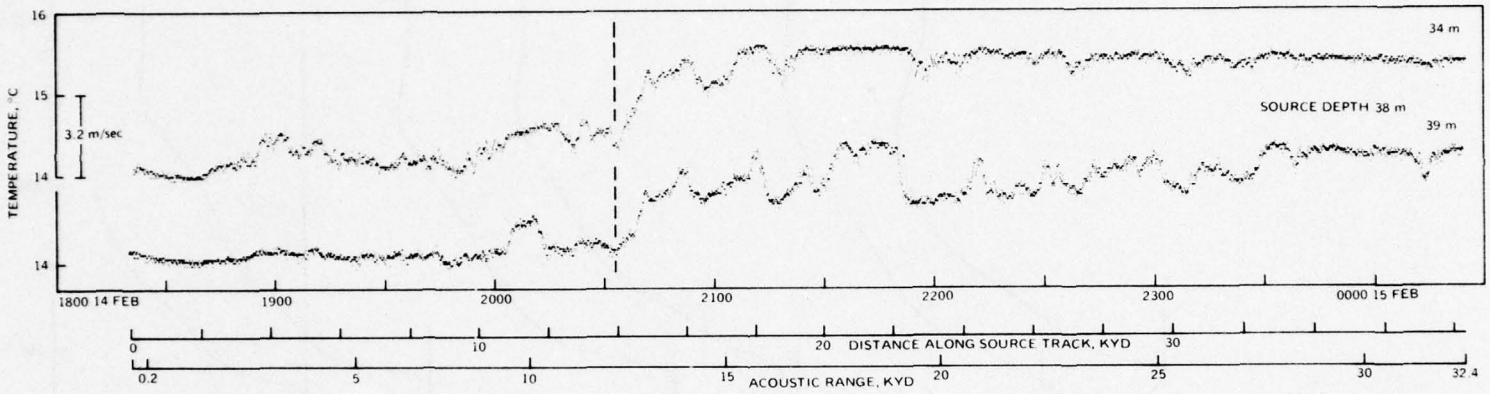


Figure A-5. Station 2, run 1. Temperatures above and below source. Time is LST.

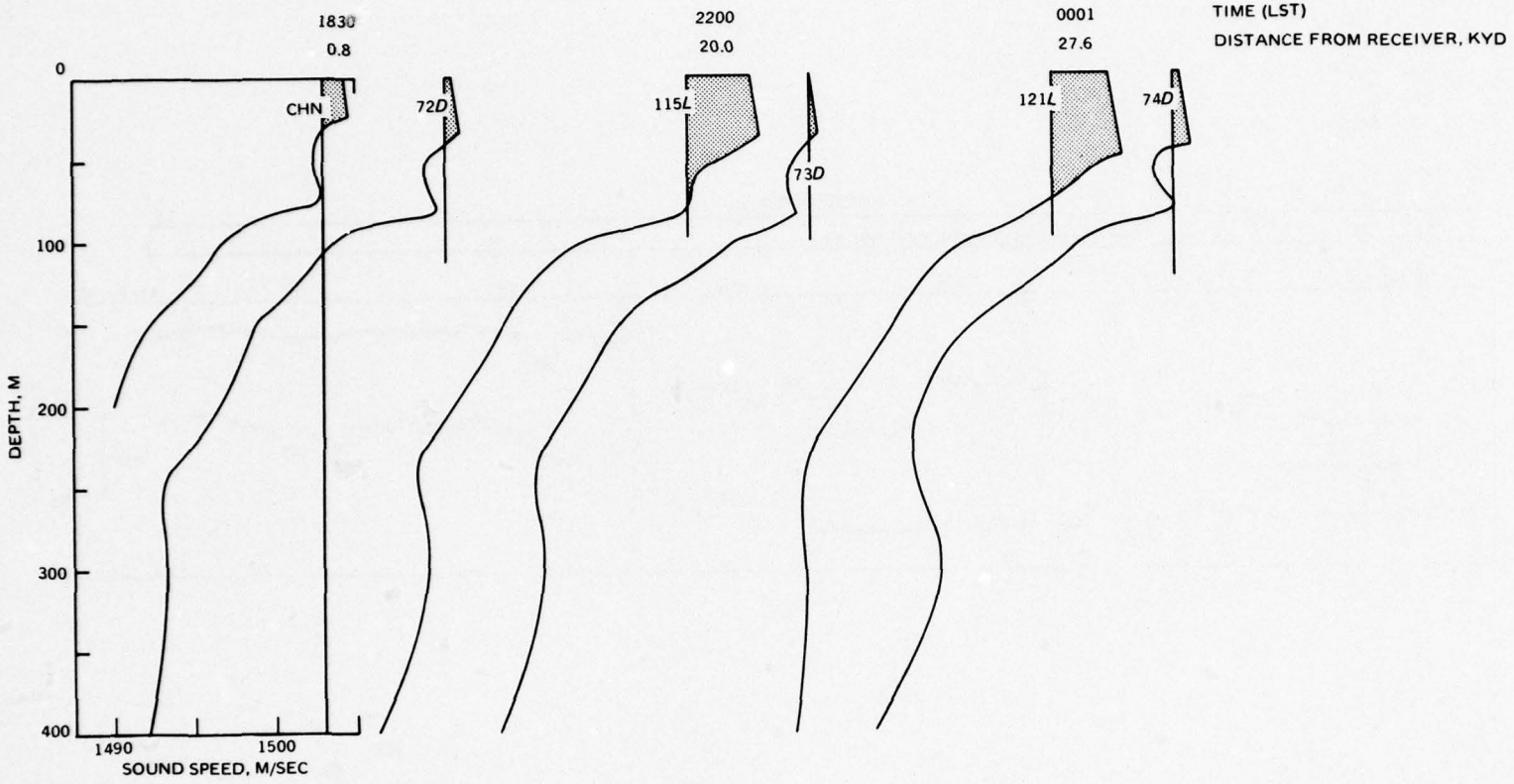


Figure A-6. Station 2, run 1. Spatial change in sound-speed profiles.

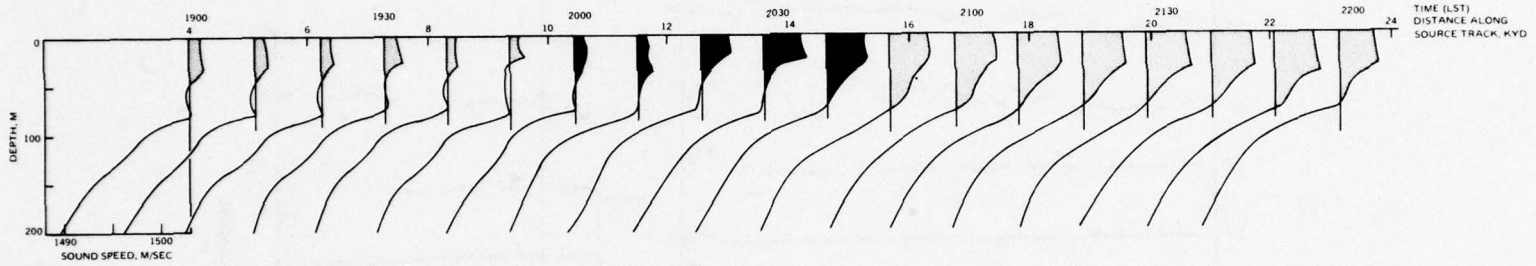


Figure A-7. Station 2, run 1. Expanded sound-speed profile plot.

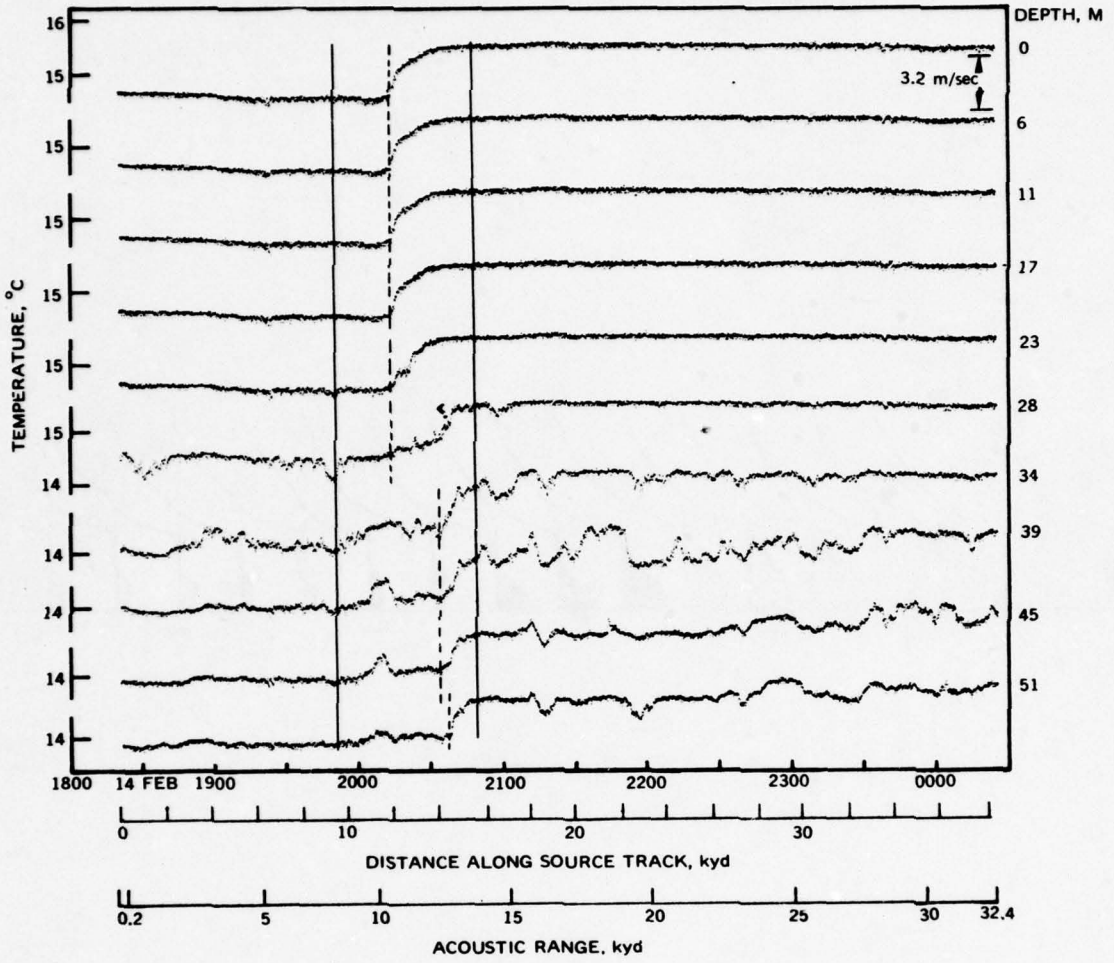


Figure A-8a. Station 2, run 1. Thermistor chain temperature measurements at about 6-m intervals from surface to 51 m. Time is LST.

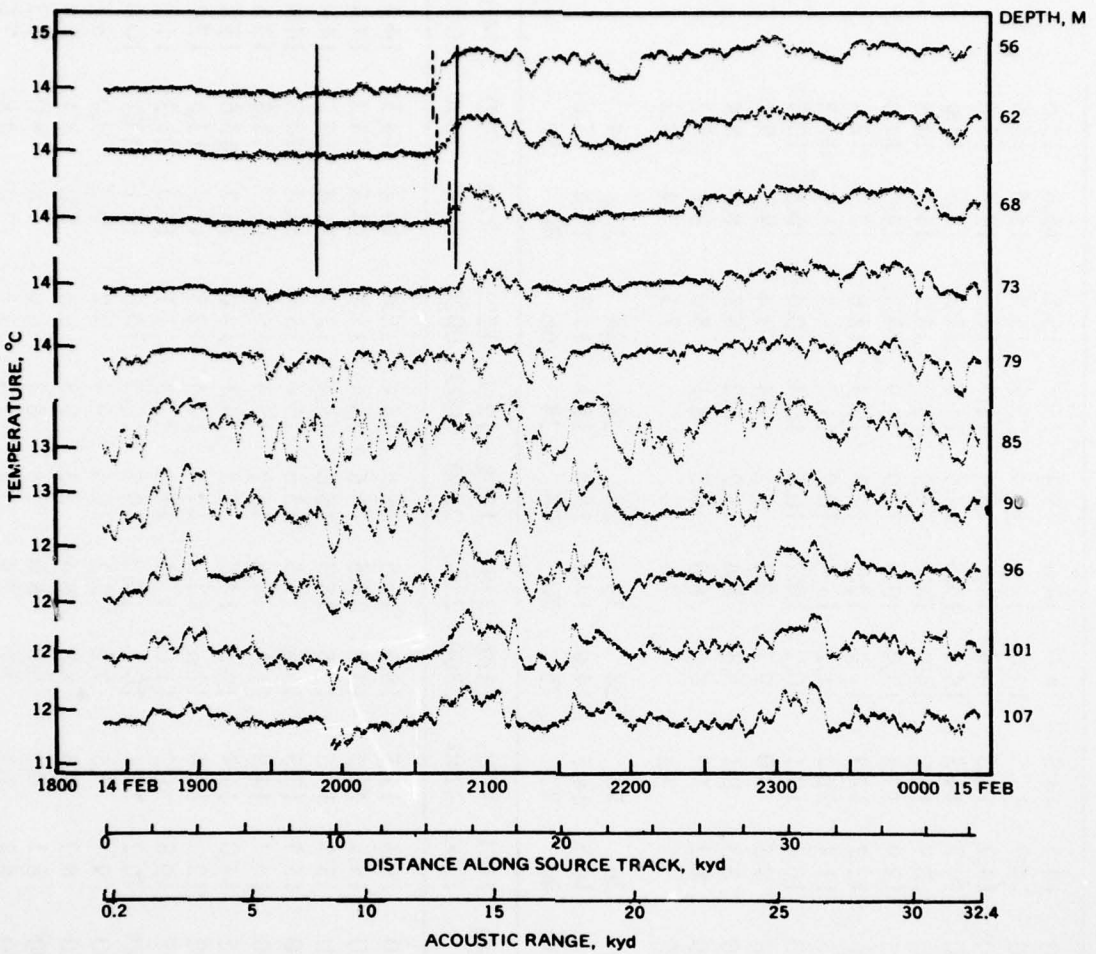


Figure A-8b. Station 2, run 1. Thermistor chain temperature measurements at about 6-m depth intervals from 56 to 107 m. Time is LST.

Table A-1. Temperature Profiles (°C),
Station 2 Run 1 (14-15 February 1972 1822-0024 LST).

XBT MEASUREMENTS

Depth, m	103L 1840	105L 1920	106L 1943	107L 2000	109L 2025	111L 2044	112L 2100	113L 2120	114L 2140
0	14.7	14.5	14.7	14.6	15.4	15.5	15.5	15.6	15.6
10	14.7	14.5	14.6	14.6	15.4	15.5	15.5	15.6	15.6
20	14.7	14.5	14.6	14.6	15.4	15.5	15.5	15.6	15.6
30	14.2	14.5	14.5	14.6	14.8	15.3	15.3	15.6	15.6
50	13.9	14.0	14.0	14.1	14.3	14.7	14.9	14.8	14.8
75	13.9	13.8	13.9	13.9	13.9	13.9	14.3	14.1	14.0
100	12.3	12.3	11.9	12.0	11.9	12.4	12.6	12.1	12.4
125	11.4	11.3	11.2	11.4	10.9	11.2	11.4	11.2	11.2
150	10.4	10.1	10.2	10.7	10.5	10.4	10.6	10.5	10.5
200	9.5	9.0	9.3	9.5	9.2	9.4	9.4	9.4	9.4
250	8.3	8.1	8.3	8.4	8.2	8.2	8.3	8.3	8.4
300	8.2	7.7	8.1	8.0	8.2	8.1	8.0	8.1	8.2
400		7.3		7.6			7.5	7.4	7.2
ILD	26	30	28	34	28	28	28	32	44
T	14.7	14.5	14.6	14.6	15.4	15.5	15.5	15.6	15.6
SLD	80	82	75	80	78	28	66	80	89

Depth, m	115L 2200	117L 2240	118L 2300	119L 2320	120L 2340	121L 0000	122L 0020	72D 1830	73D 2200	74D 0000
0	15.5	15.5	15.5	15.5	15.6	15.4	15.4	14.4	14.3	14.4
10	15.5	15.5	15.5	15.5	15.6	15.4	15.4	14.4	14.3	14.4
20	15.5	15.5	15.5	15.5	15.6	15.4	15.4	14.4	14.3	14.4
30	15.5	15.5	15.5	15.5	15.6	15.4	15.4	14.4	14.3	14.4
50	14.7	14.8	15.1	14.8	15.2	15.4	15.1	13.7	13.8	13.8
75	14.0	14.4	14.3	14.5	14.5	14.1	14.0	13.7	13.6	13.8
100	12.0	12.4	12.4	12.4	12.7	12.4	12.3	11.8	12.5	12.2
125	10.8	11.2	11.0	11.1	11.4	11.3	11.1	11.0	11.3	11.2
150	10.2	10.7	10.2	10.2	10.5	10.7	10.6	10.1	10.1	10.0
200	9.1	9.5	9.2	9.2	9.4	9.4	9.2	9.2	9.0	8.7
250	8.2	8.3	8.3	8.4	8.5	8.5	8.3	8.0	8.1	8.4
300	8.1	8.2	8.0	8.0	7.8	8.3	8.1	7.8	8.0	8.5
400	6.8	7.1	7.1	7.4	7.4	7.6	7.1	7.0	6.8	7.0
ILD	38	34	35	35	40	50	40	32	35	45
T	15.5	15.5	15.5	15.5	15.6	15.4	15.4	14.4	14.3	14.4
SLD	80	90	58	65	60	50	45	82	86	85

Table A-1, continued.

THERMISTOR CHAIN MEASUREMENTS

Depth, m	1822	1900	1910	1920	1930	1940	1950	2000	2010	2020	2030
0	14.7	14.7	14.6	14.6	14.6	14.6	14.6	14.6	14.6	15.2	15.5
10	14.7	14.6	14.6	14.6	14.6	14.6	14.5	14.6	14.6	15.2	15.5
20	14.7	14.6	14.6	14.6	14.6	14.5	14.6	14.5	14.5	15.0	15.5
30	14.5	14.6	14.5	14.4	14.3	14.5	14.1	14.4	14.5	14.6	14.7
50	13.9	14.0	14.0	13.9	13.9	13.9	13.9	14.0	14.2	14.0	14.1
75	13.9	13.9	13.8	13.9	13.7	13.8	13.8	13.9	13.9	13.8	13.8
100	12.0	12.4	12.2	12.2	11.9	11.8	12.0	11.9	11.8	11.8	12.0
125	11.2	11.6	11.5	11.3	11.1	11.1	11.2	11.3	10.8	10.8	11.1
150	10.3	10.6	10.5	10.2	10.2	10.1	10.3	10.5	10.3	10.3	10.4
200	9.4	9.3	9.2	9.1	9.2	9.3	9.2	9.3	9.3	9.2	9.3
ILD	28	28	28	23	23	28	23	28	11	17	23
T	14.7	14.6	14.6	14.6	14.6	14.6	14.6	14.5	14.6	15.2	15.5
SLD	79	79	79	79	79	73	79	73	79	73	79

Depth, m	2040	2050	2100	2110	2120	2130	2140	2150	2200	2220	0024
0	15.5	15.5	15.5	15.5	15.6	15.5	15.6	15.5	15.5	15.5	15.4
10	15.5	15.5	15.6	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.4
20	15.5	15.5	15.5	15.5	15.5	15.5	15.6	15.5	15.5	15.5	15.4
30	15.3	15.4	15.4	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.4
50	14.5	14.7	14.7	14.8	14.6	14.6	14.8	14.7	14.5	14.7	14.9
75	13.8	14.0	14.1	13.9	13.9	13.8	13.9	14.1	14.0	14.1	13.9
100	12.0	12.7	12.5	12.5	11.8	12.0	12.2	12.4	11.9	12.1	12.2
125	11.0	11.2	11.4	11.2	11.0	11.2	11.2	11.3	10.8	10.9	11.0
150	10.4	10.4	10.5	10.4	10.3	10.3	10.4	10.4	10.2	10.2	10.4
200	9.3	9.3	9.4	9.3	9.3	9.3	9.2	9.3	9.2	9.1	9.2
ILD	23	23	28	28	28	34	39	39	28	34	39
T	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.4
SLD	79	62	62	79	73	34	85	79	79	79	39

Table A-2. Computed Sound-Speed Profiles (m/sec),
Station 2 Run 1 (14-15 February 1972 1822-0024 LST).

XBT MEASUREMENTS

Depth, m	103L 1840	105L 1920	106L 1943	107L 2000	109L 2025	111L 2041	112L 2100
0	1504.3	1503.7	1504.3	1504.0	1506.6	1506.9	1506.9
10	04.5	03.9	04.2	04.2	06.8	07.1	07.1
20	04.7	04.0	04.3	04.3	06.9	07.2	07.2
30	03.2	04.2	04.2	04.5	05.2	06.8	06.8
50	02.5	02.9	02.9	03.2	03.9	05.2	05.8
75	02.9	02.6	02.9	02.9	02.9	02.9	04.2
100	1497.9	1497.9	1496.5	1496.8	1496.8	1498.2	1498.9
125	95.3	95.0	94.6	95.3	96.3	96.4	95.3
150	92.3	91.3	91.6	93.4	92.7	92.3	93.0
200	90.1	88.4	89.4	90.1	89.1	89.8	89.8
250	86.7	86.0	86.7	87.1	86.3	86.3	86.7
300	87.3	85.4	86.9	86.5	87.3	87.9	86.5
400		85.7		86.9			86.5
SC	26	30	28	34	28	28	28
DC	50	65	60				
MAX	80	82	75				
RC	250	280	275	280	250	260	275
MAX		340		340			340

Depth, m	113L 2120	114L 2140	115L 2200	117L 2240	118L 2300	119L 2320	120L 2340
0	1507.2	1507.2	1506.9	1506.9	1506.9	1506.9	1507.2
10	07.4	07.4	07.1	07.1	07.1	07.1	07.4
20	07.6	07.6	07.2	07.2	07.2	07.2	07.6
30	07.7	07.7	07.4	07.4	07.4	07.4	07.7
50	05.5	05.5	05.2	05.5	06.5	05.5	06.8
75	03.6	03.2	03.2	04.6	04.2	04.9	04.9
100	1497.2	1498.2	1496.8	1498.2	1498.2	1498.2	1499.3
125	94.6	94.6	93.2	94.6	93.9	94.3	95.3
150	92.7	92.7	91.6	93.4	91.6	91.6	92.7
200	89.8	89.8	88.7	90.1	89.1	89.1	89.9
250	86.7	87.1	86.3	86.7	86.7	87.1	87.5
300	86.9	87.3	86.9	87.3	86.5	86.5	85.8
400	86.1	85.3	83.7	84.9	84.9	86.1	86.1
SC	32	44	38	34	35	35	40
RC	275	265	240	260	250		340
MAX	340	310	300	310	280		

Table A-2, continued.

Depth, m	121L 0000	122L 0020	72D 1830	73D 2200	74D 0000
0	1506.6	1506.6	1503.4	1503.0	1503.4
10	06.8	06.8	03.5	03.2	03.5
20	06.6	06.9	03.7	03.4	03.7
30	07.1	07.1	03.9	03.5	03.9
50	07.4	06.5	01.9	02.2	02.2
75	03.6	03.2	02.2	01.9	02.6
100	1498.2	1497.9	1496.1	1498.6	1497.5
125	95.0	94.3	93.9	95.0	94.6
150	93.4	93.0	91.3	91.3	90.9
200	89.8	89.1	89.1	88.4	87.3
250	87.5	86.7	85.6	86.0	87.1
300	87.7	86.9	85.8	86.5	88.5
400	86.9	84.9	84.5	83.7	84.5
SC	50	40	32	35	45
DC			60	65	65
MAX			82	86	85
RC	260		260	240	225
MAX	325		310	300	300

THERMISTOR CHAIN MEASUREMENTS

Depth, m	1822	1900	1910	1920	1930	1940	1950	2000
0	1504.4	1504.2	1503.9	1504.0	1503.9	1504.0	1503.9	1503.7
10	04.6	04.3	04.1	04.0	04.2	04.0	03.9	04.2
20	04.7	04.3	04.3	04.2	04.4	04.1	04.4	04.1
30	04.3	04.6	04.3	03.8	03.4	04.0	02.7	04.0
50	02.6	02.8	02.7	02.6	02.5	02.6	02.4	02.9
75	03.0	03.0	02.7	02.9	02.3	02.6	02.7	02.8
100	1496.7	1498.2	1497.4	1497.4	1496.4	1496.3	1496.7	1496.6
125	94.7	95.9	95.6	95.1	94.4	94.4	94.7	95.0
150	91.8	92.9	92.8	91.6	91.4	91.3	91.8	92.7
200	89.6	89.5	89.2	88.8	88.9	89.2	89.1	89.5
SC	28	30	30	23	23	28	23	10
DC	55	55	60	60	50	55	50	60
MAX	79	79	79	79	68	73	79	73

Table A-2, continued.

Depth, m	2010	2020	2030	2040	2050	2100	2110	2120
0	1503.9	1506.0	1506.8	1507.0	1506.9	1506.9	1507.0	1507.1
10	04.1	06.1	06.9	07.0	07.2	07.2	07.2	07.2
20	03.9	05.5	07.3	07.2	07.3	07.3	07.2	07.3
30	04.3	04.5	04.8	06.7	06.9	06.9	07.5	07.4
50	03.4	03.0	03.2	04.4	05.2	05.3	05.3	05.0
75	02.8	02.5	02.7	02.7	03.1	03.7	03.0	02.8
100	1496.3	1496.0	1496.8	1496.8	1499.1	1498.5	1498.6	1498.3
125	93.2	93.3	94.3	93.9	94.5	95.2	94.6	94.0
150	91.9	92.1	92.5	92.3	92.2	92.7	92.3	91.8
200	89.6	89.1	89.3	89.4	89.6	89.9	89.5	89.3
SC	11	17	23	23	23	28	30	30
DC	20							
MAX	34							

Depth, m	2130	2140	2150	2200	2220	0024
0	1507.0	1507.1	1507.0	1506.9	1506.9	1506.7
10	07.2	07.1	07.2	07.2	07.0	06.8
20	07.2	07.4	07.3	07.3	07.2	07.0
30	07.5	07.5	07.5	07.4	07.4	07.0
50	04.9	05.3	05.3	04.6	05.2	06.0
75	02.7	03.0	03.6	03.4	03.4	03.2
100	1498.7	1497.6	1498.2	1496.6	1497.1	1497.4
125	94.5	94.5	94.9	93.4	93.5	93.8
150	91.9	92.2	92.4	91.7	91.6	92.5
200	89.6	89.1	89.5	89.0	88.9	88.9
SC	34	39	39	30	34	39

Table A-3. Average Sound-Speed Profile (m/sec),
Station 2 Run 1 (14-15 February 1972 1822-0024 LST).

Depth,	Profile 1 1822-1951			Profile 2 1951-2049			Profile 3 2049-0024		
m	n	$\bar{C}$	σ	n	$\bar{C}$	σ	n	$\bar{C}$	σ
0	540	1504.09	0.20	351	1505.45	1.35	1296	1506.86	0.16
10	540	04.24	0.20	351	05.60	1.36	1296	07.05	0.16
20	540	04.37	0.20	351	05.67	1.36	1296	07.18	0.16
30	540	03.93	0.39	351	04.94	1.04	1296	07.29	0.32
50	540	02.61	0.14	351	03.30	0.76	1296	05.44	0.43
75	540	02.76	0.20	351	02.66	0.17	1296	03.37	0.54
100	2187	1497.36	0.92						
125	2187	94.18	0.67						
150	2187	91.97	0.45						
200	2187	89.25	0.46						
250	2187	86.33	0.38						
300	19	86.84	0.73						
400	15	85.36	1.06						
500	2	84.12	2.13						
600	2	83.47	0.71						
800	2	82.60	0.73						
1000	2	83.03	0.36						
1200	2	84.16	0.39						
1500	2	86.39	0.30						
23		1504.40			1505.70				SC
30								1507.29	SC
50		1502.61							DC
79		1502.80							MAX
250		1486.33			1486.33			1486.33	RC
300		1486.84			1486.84			1486.84	MAX
800		1482.60			1482.60			1482.60	AXIS

Table A-4. Average Thermistor Chain Temperatures, Station 2 Run 1, **Profile 1** (number of measurements at each depth: 540).

Depth, m	Temperature, °C			Standard Deviation
	Min	Max	Mean	
0	14.45	14.72	14.62	0.058
6	14.40	14.72	14.62	0.057
11	14.37	14.72	14.62	0.061
17	14.42	14.72	14.61	0.057
23	14.40	14.72	14.60	0.062
28	14.10	14.67	14.50	0.119
34	13.97	14.52	14.18	0.130
39	13.90	14.20	14.04	0.053
45	13.82	14.07	13.96	0.045
51	13.72	14.02	13.92	0.044
56	13.75	14.02	13.93	0.051
62	13.75	14.00	13.93	0.047
68	13.67	13.97	13.91	0.047
73	13.62	13.97	13.87	0.057
79	13.35	13.95	13.76	0.128
85	12.62	13.85	13.32	0.337
90	12.07	13.47	12.71	0.332
96	11.92	13.25	12.40	0.240
101	11.67	12.45	11.99	0.180
107	11.62	12.10	11.80	0.104
113	11.37	11.87	11.69	0.078
118	11.02	11.75	11.52	0.157
124	11.07	11.67	11.32	0.152
130	10.80	11.52	11.13	0.131
135	10.47	11.22	10.93	0.147
141	10.27	11.07	10.70	0.204
147	10.10	10.90	10.49	0.194
152	9.90	10.60	10.22	0.144
158	9.80	10.37	10.10	0.134
164	9.72	10.20	9.99	0.100
169	9.62	10.07	9.86	0.094
175	9.42	9.90	9.71	0.096
180	9.37	9.77	9.59	0.077
186	9.27	9.65	9.52	0.074
192	9.17	9.62	9.45	0.102
197	9.02	9.60	9.34	0.141
203	8.90	9.55	9.24	0.148
209	8.85	9.40	9.13	0.139
214	8.77	9.27	9.03	0.134
220	8.62	9.22	8.93	0.142
226	8.55	9.12	8.78	0.158
231	8.37	8.95	8.58	0.120
237	8.27	8.72	8.49	0.105
242	8.15	8.62	8.37	0.109

Table A-4, continued. **Profile 2** (number of measurements at each depth: 351).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	14.45	15.55	15.04	0.421
6	14.47	15.57	15.04	0.423
11	14.45	15.57	15.04	0.424
17	14.47	15.52	15.02	0.420
23	14.42	15.55	14.99	0.417
28	14.15	15.50	14.81	0.348
34	14.02	15.25	14.56	0.297
39	13.92	15.00	14.34	0.257
45	13.87	14.80	14.22	0.241
51	13.85	14.72	14.12	0.228
56	13.85	14.65	14.05	0.206
62	13.82	14.55	13.96	0.147
68	13.77	14.20	13.90	0.076
73	13.72	14.02	13.87	0.044
79	12.87	13.92	13.71	0.191
85	12.27	13.67	13.16	0.305
90	11.77	13.05	12.56	0.278
96	11.75	12.80	12.21	0.219
101	11.30	12.60	11.86	0.214
107	11.25	12.25	11.70	0.232
113	11.20	11.80	11.51	0.146
118	10.92	11.62	11.31	0.153
124	10.77	11.37	11.04	0.138
130	10.65	11.07	10.84	0.091
135	10.47	10.82	10.68	0.057
141	10.35	10.75	10.59	0.071
147	10.27	10.65	10.50	0.084
152	10.02	10.47	10.29	0.094
158	9.90	10.35	10.22	0.101
164	9.82	10.30	10.13	0.106
169	9.67	10.15	9.94	0.107
175	9.57	9.95	9.76	0.080
180	9.50	9.75	9.64	0.058
186	9.37	9.70	9.56	0.049
192	9.32	9.60	9.48	0.047
197	9.12	9.52	9.34	0.068
203	9.02	9.40	9.23	0.071
209	8.87	9.27	9.09	0.092
214	8.82	9.20	8.97	0.088
220	8.77	9.05	8.88	0.048
226	8.52	8.95	8.79	0.102
231	8.40	8.95	8.65	0.148
237	8.30	8.82	8.54	0.130
242	8.17	8.65	8.38	0.116

Table A-4, continued. **Profile 3** (number of measurements at each depth: 1296).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	15.32	15.60	15.48	0.050
6	15.32	15.57	15.49	0.049
11	15.27	15.60	15.49	0.050
17	15.25	15.60	15.47	0.050
23	15.32	15.60	15.48	0.049
28	15.27	15.57	15.47	0.054
34	14.92	15.55	15.37	0.101
39	14.72	15.55	15.13	0.205
45	14.52	15.32	14.89	0.162
51	14.27	15.07	14.75	0.130
56	14.12	14.97	14.64	0.166
62	14.02	14.80	14.44	0.210
68	13.90	14.60	14.27	0.196
73	13.67	14.47	14.09	0.162
79	13.07	14.20	13.86	0.201
85	12.65	13.97	13.35	0.330
90	12.22	13.62	12.83	0.256
96	11.97	13.25	12.58	0.234
101	11.65	12.77	12.16	0.232
107	11.42	12.50	11.85	0.213
113	11.15	12.10	11.56	0.159
118	10.90	11.72	11.29	0.165
124	10.70	11.45	11.06	0.148
130	10.57	11.22	10.85	0.143
135	10.32	11.05	10.63	0.134
141	10.22	10.80	10.49	0.110
147	10.07	10.62	10.38	0.109
152	9.87	10.45	10.19	0.127
158	9.82	10.37	10.10	0.128
164	9.67	10.30	9.99	0.124
169	9.62	10.15	9.86	0.112
175	9.47	10.00	9.73	0.099
180	9.35	9.90	9.61	0.115
186	9.22	9.77	9.50	0.118
192	9.07	9.65	9.39	0.114
197	8.90	9.52	9.27	0.127
203	8.77	9.37	9.15	0.124
209	8.77	9.27	9.01	0.109
214	8.65	9.10	8.89	0.084
220	8.47	9.00	8.78	0.105
226	8.37	8.95	8.65	0.115
231	8.22	8.80	8.51	0.111
237	8.15	8.72	8.44	0.107
242	8.12	8.55	8.33	0.087

APPENDIX B

STATION 2 RUN 2

DETAILED ENVIRONMENTAL SUMMARY

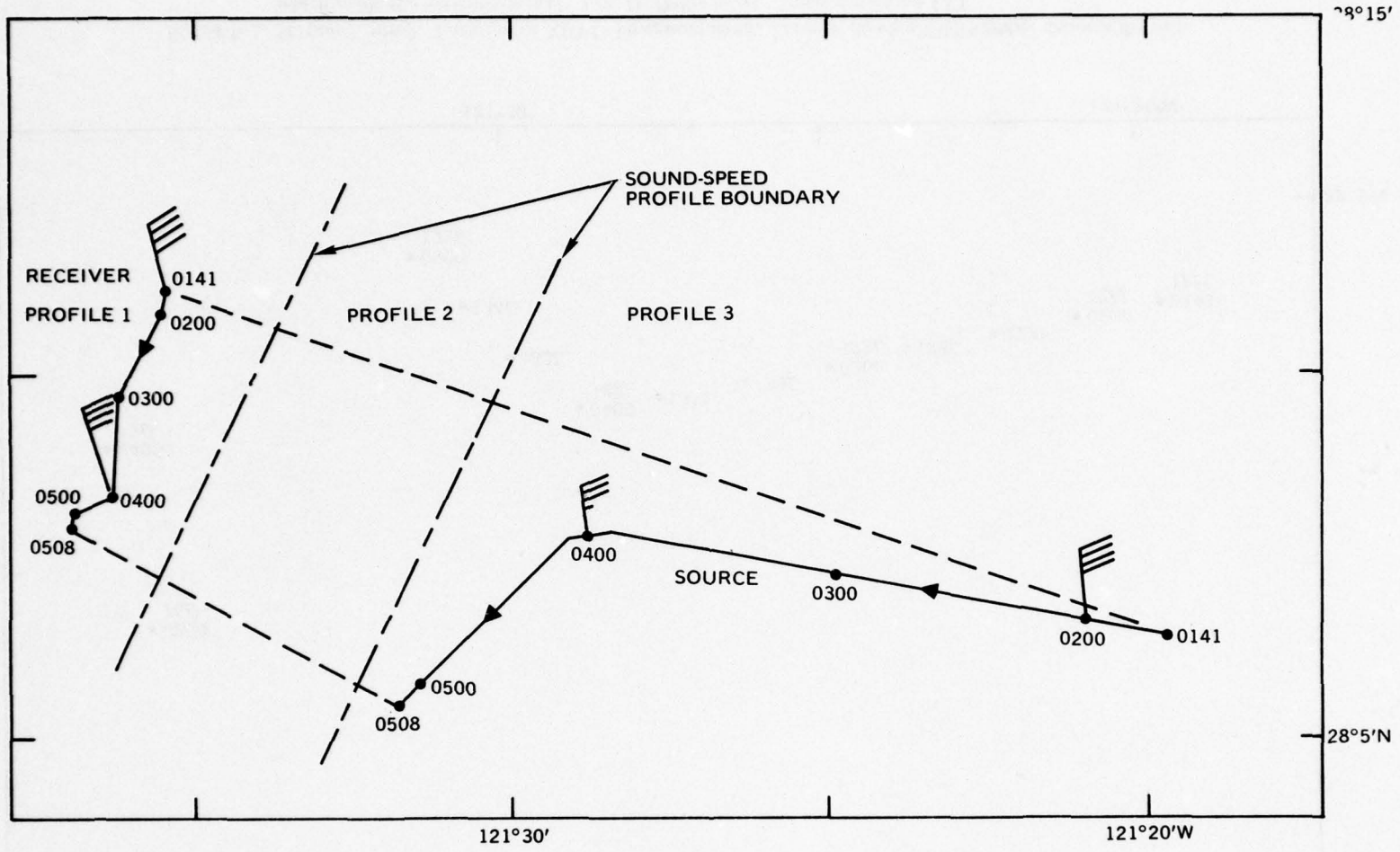


Figure B-1. Station 2, run 2. Location of source and receiver ships, 0141 and 0508 LST propagation paths (---), and wind velocity (10-knot east wind, 1 bar = 5 knots).

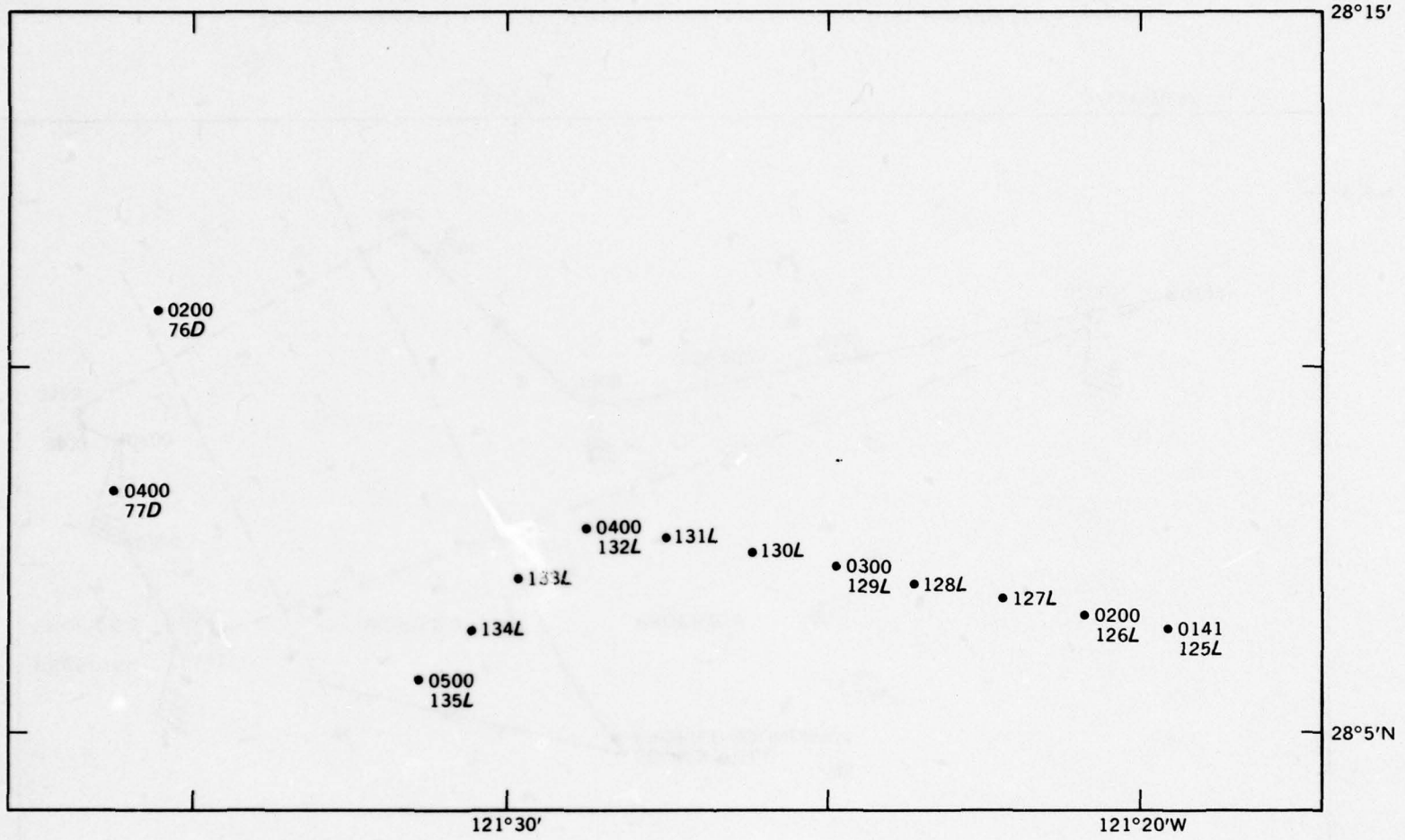


Figure B-2. Station 2, run 2. Location of XBT (·) measurements. Letter following XBT number denotes the ship which made the measurement (*L: Lee, D: DeSteiguer).* Times shown are LST.

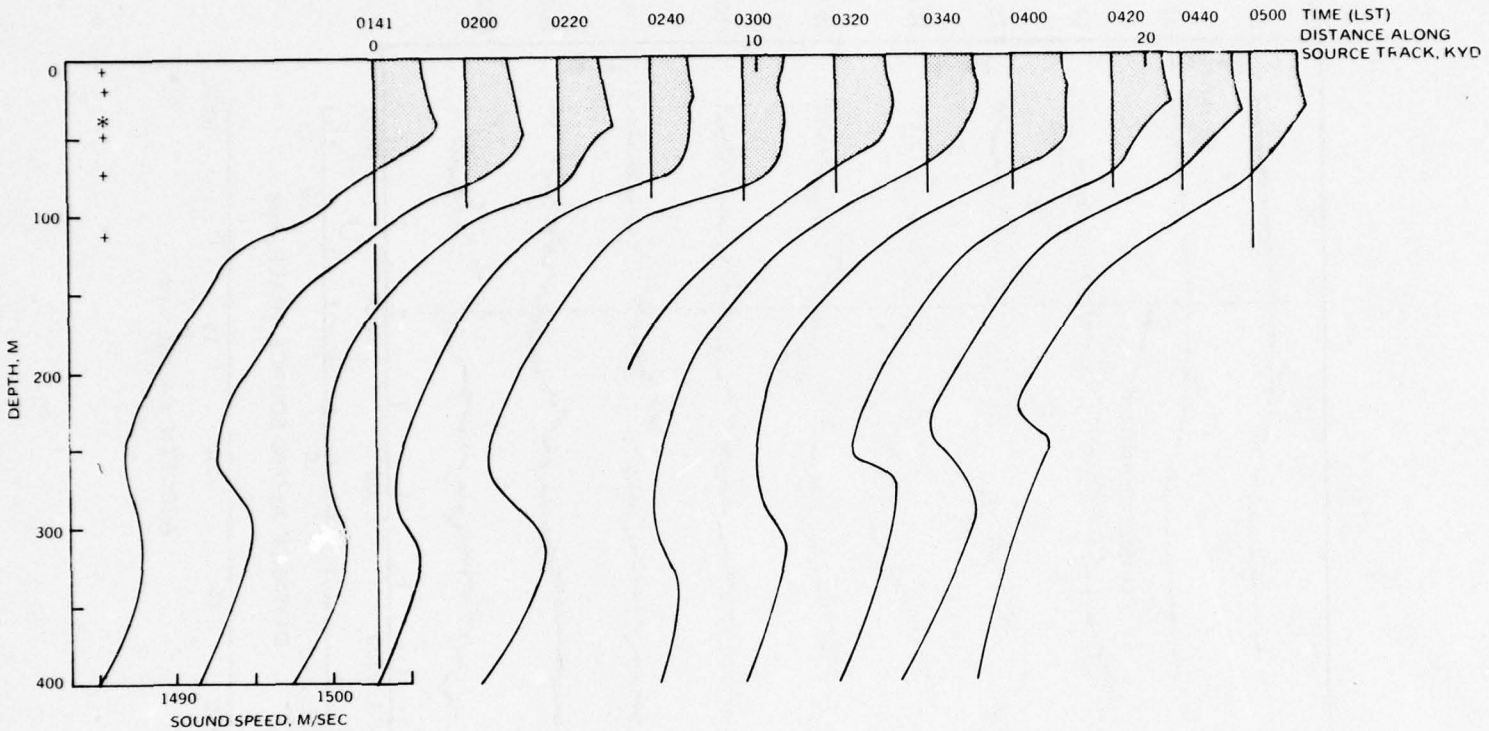


Figure B-3. Station 2, run 2. Sound-speed profiles along track of source ship derived from XBT data. Source depth (*), receiver depth (+).

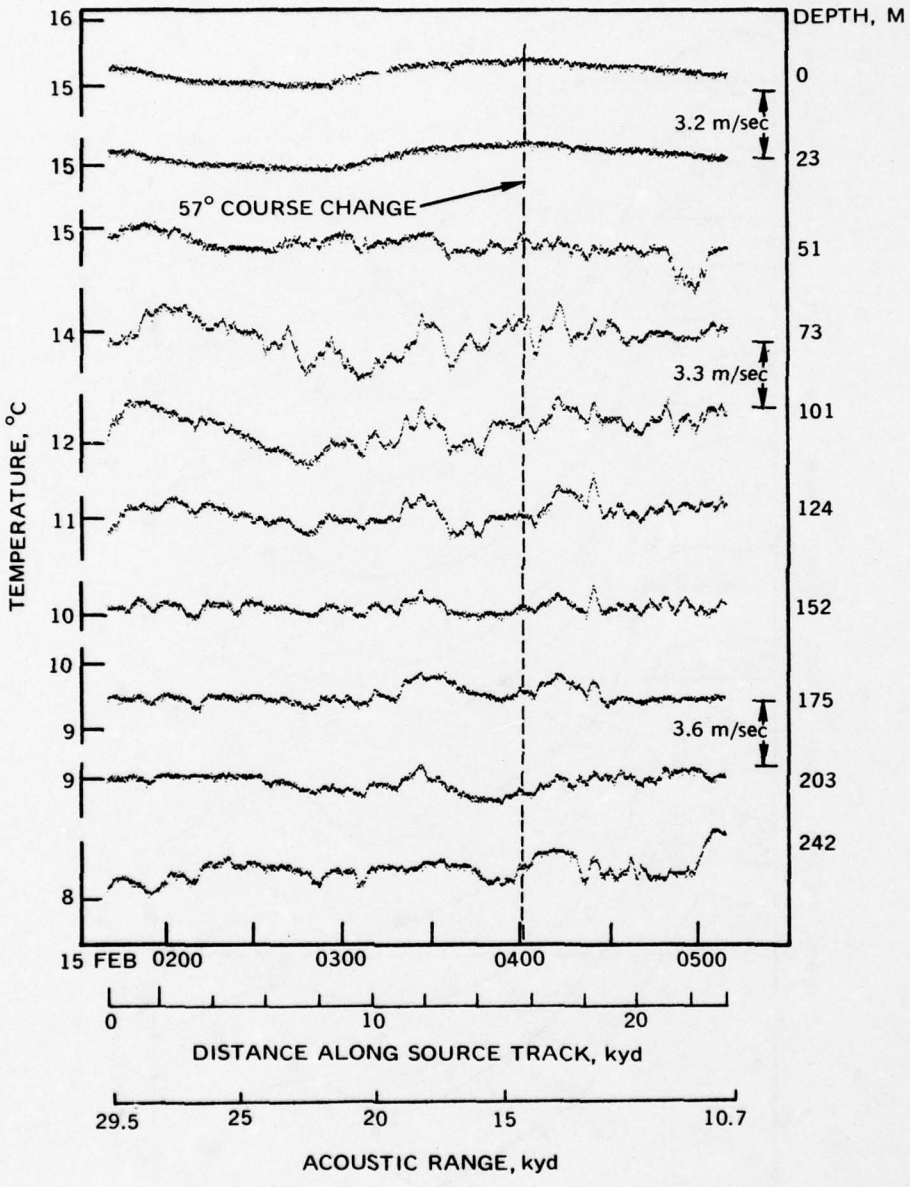


Figure B-4. Station 2, run 2. Thermistor chain temperature measurements at selected depths. Time is LST.

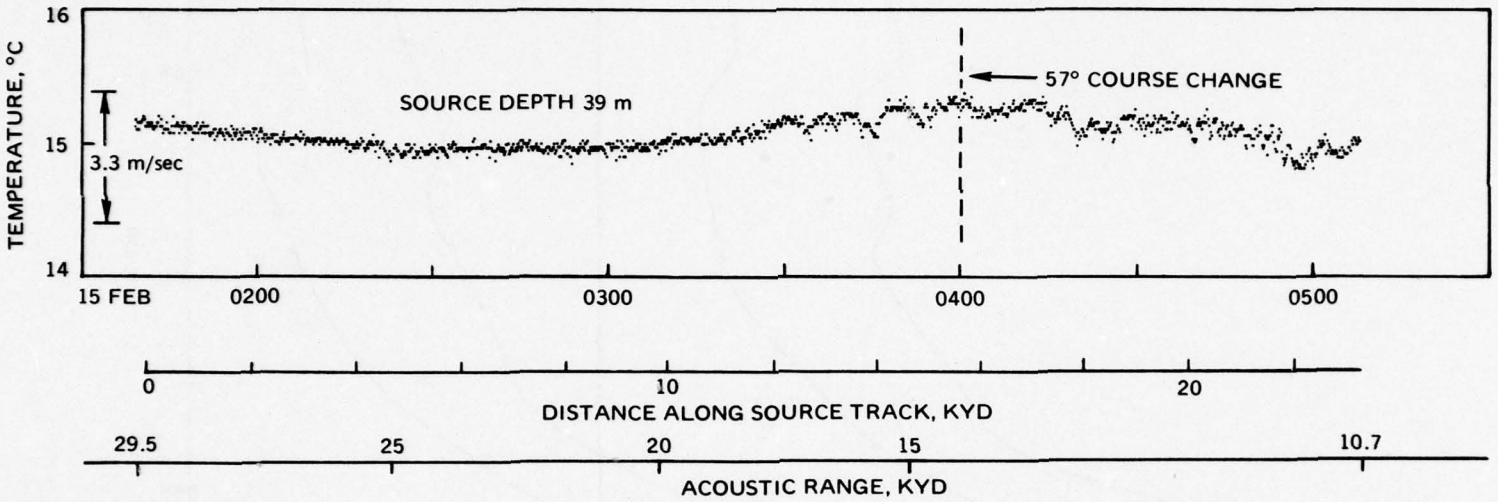


Figure B-5. Station 2, run 2. Temperatures at source depth. Time is LST.

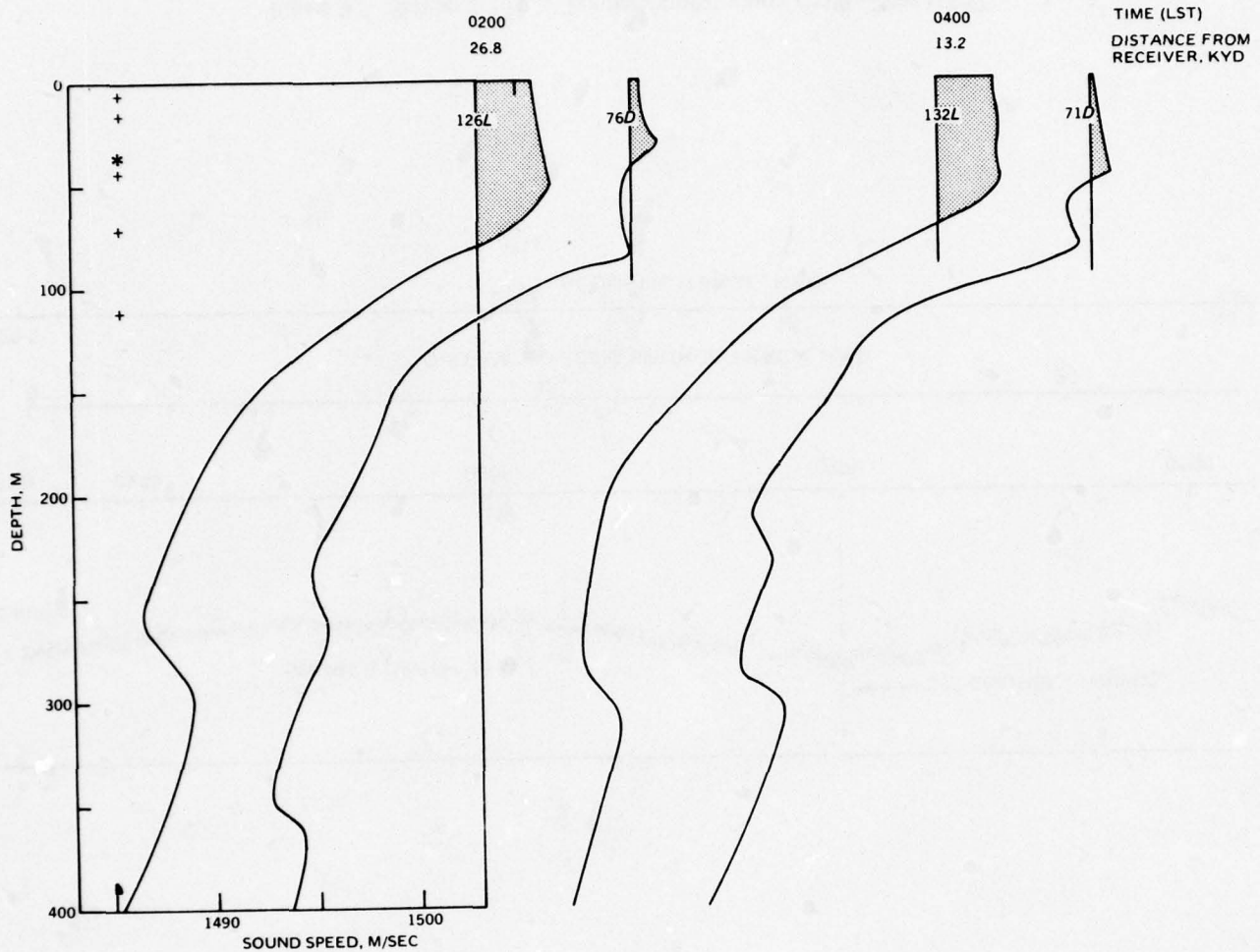


Figure B-6. Station 2, run 2. Spatial change in sound-speed profiles.

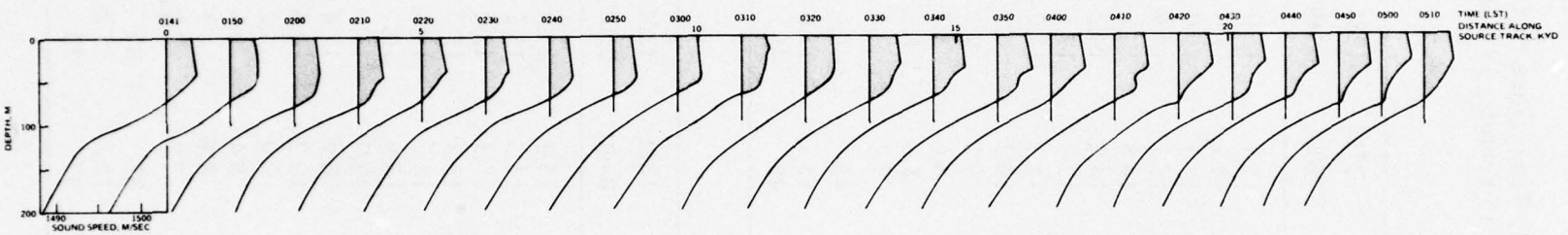


Figure B-7. Station 2, run 2. Expanded sound-speed profile plot.

Table B-1. Temperature Profiles (°C),
Station 2 Run 2 (15 February 1972 0141-0508 LST).

XBT MEASUREMENTS

Depth, m	125L 0142	126L 0200	127L 0200	128L 0240	129L 0300	130L 0320	131L 0340
0	15.2	15.1	15.1	15.0	15.1	15.3	15.2
10	15.2	15.1	15.1	15.0	15.0	15.3	15.2
20	15.2	15.1	15.1	15.0	14.9	15.3	15.2
30	15.2	15.1	15.1	14.9	14.9	15.3	15.1
50	15.1	15.1	14.8	14.8	14.8	15.0	14.7
75	13.7	14.3	14.2	14.2	14.4	13.7	13.6
100	12.6	12.5	12.3	12.1	12.0	12.6	12.0
125	10.9	11.4	11.1	11.0	10.9	11.4	10.8
150	10.3	10.3	10.3	10.2	10.2	10.5	10.0
200	9.1	9.1	9.1	9.1	9.0	9.3	8.7
250	8.3	8.3	8.6	8.3	8.2		8.0
300	8.3	8.6	8.6	8.1	8.7		7.6
400	7.1	7.2	7.2	7.1	7.3		7.2
ILD	40	50	45	45	0	30	20
T	15.2	15.1	15.1	15.0	15.1	15.3	15.2
SLD	40	50	45	45	54	58	45

Depth, m	132L 0400	133L 0420	134L 0440	135L 0500	76D 0200	77D 0400
0	15.3	15.3	15.3	15.2	14.4	14.5
10	15.3	15.3	15.3	15.2	14.4	14.5
20	15.3	15.3	15.3	15.2	14.4	14.5
30	15.2	15.3	15.3	15.2	14.5	14.5
50	15.1	14.6	14.7	14.8	13.9	14.3
75	13.9	13.9	13.9	14.1	13.8	13.8
100	12.2	12.2	12.2	12.7	12.3	12.2
125	11.0	10.9	10.9	11.4	11.0	10.6
150	10.1	10.1	10.2	10.4	10.1	10.0
200	8.7	8.9	9.0	9.2	9.2	8.7
250	8.2	8.1	8.4	9.1	8.5	8.4
300	8.2	8.5	8.7	8.3	8.0	8.4
400	7.2	7.1	7.0	7.1	7.4	7.0
ILD	20	30	37	35	30	48
T	15.3	15.3	15.3	15.2	14.4	14.5
SLD	40	36	37	35	86	82

Table B-2. Computed Sound-Speed Profiles (m/sec), Station 2 Run 2 (15 February 1972 0141-0508 LST).

XBT MEASUREMENTS

Depth, m	125L 0141	126L 0200	127L 0220	128L 0240	129L 0300	130L 0320	131L 0340
0	1506.0	1505.6	1505.6	1505.3	1505.6	1506.3	1506.0
10	06.1	05.8	05.8	05.5	05.5	06.4	06.1
20	06.3	06.0	06.0	05.6	05.3	06.6	06.3
30	06.5	06.1	06.1	05.5	05.5	06.8	06.1
50	06.5	06.5	05.5	05.5	05.5	06.2	05.2
75	02.2	04.2	03.9	03.9	04.6	02.2	01.9
100	1498.9	1498.6	1497.9	1497.2	1496.8	1498.9	1496.8
125	93.6	95.3	94.3	93.9	93.6	95.3	93.2
150	92.0	92.0	92.0	91.6	91.6	92.7	90.9
200	88.7	88.7	88.7	88.7	88.4	89.4	87.3
250	86.7	86.7	87.8	86.7	86.3		85.6
300	87.7	88.9	88.9	86.9	89.3		85.0
400	84.9	85.3	85.3	84.9	85.7		85.3
SC	40	50	45	25	0	30	20
DC					25		
MAX					54		
RC	260	260	278	292	265		290
MAX	320	300	318	320	317		337

Depth, m	132L 0400	133L 0420	134L 0440	135L 0500	76D 0200	77D 0400
0	1506.3	1506.3	1506.3	1506.0	1503.4	1503.7
10	06.4	06.4	06.4	06.1	03.5	03.9
20	06.6	06.6	06.6	06.3	03.7	04.0
30	06.5	06.8	06.8	06.6	04.2	04.2
50	06.5	04.8	05.2	05.5	02.5	03.9
75	02.9	02.9	02.9	03.6	02.6	02.6
100	1497.5	1497.5	1497.5	1499.3	1497.9	1497.5
125	93.9	93.6	93.6	95.3	93.9	92.5
150	91.3	91.3	91.6	92.3	91.3	90.0
200	87.3	88.0	88.4	89.1	89.1	87.3
250	86.3	86.0	87.1	89.7	87.5	87.1
300	87.3	88.5	89.3	87.7	86.5	88.1
400	85.3	84.9	84.5	84.9	86.1	84.5
SC	20	30	37	35	30	48
DC					50	60
MAX					86	82
RC	280	255	230	235	235	210
MAX	310	275	293	250	270	234

Table B-3. Average Sound-Speed Profile (m/sec),
Station 2 Run 2 (15 February 1972 0941-0508 LST).

Depth,	Profile 1			Profile 3		
m	n	$\bar{C}$	σ	n	$\bar{C}$	σ
0	2	1503.54	0.23	1251	1505.83	0.42
10	2	03.69	0.23	1251	05.99	0.42
20	2	03.85	0.23	1251	06.12	0.42
30	2	04.19		1251	06.27	0.42
50	2	03.20	0.93	1251	05.50	0.53
75	2	02.56		1251	01.75	0.85
100	2	1497.71	0.25	1251	1497.71	0.85
125	1251	93.93	0.57			
150	1251	91.45	0.29			
200	1251	88.22	0.43			
250	1251	86.90	0.64			
300	12	87.86	1.28			
400	12	85.11	0.47			
500	2	84.12	2.13			
600	2	83.47	0.71			
800	2	82.60	0.73			
1000	2	83.03	0.36			
1200	2	84.16	0.39			
1500	2	86.39	0.30			
30					1506.27	SC
40		1504.34				SC
60		1502.20				DC
85		1502.70				MAX
250		1486.90			1486.90	RC
300		1487.86			1487.86	MAX
800		1482.60			1482.60	AXIS

Table B-4. Average Thermistor Chain Temperatures, Station 2 Run 2 (number of measurements at each depth: 1251).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	14.90	15.37	15.16	0.129
6	14.77	15.40	15.16	0.129
11	14.87	15.40	15.16	0.129
17	14.85	15.40	15.15	0.130
23	14.87	15.37	15.14	0.129
28	14.87	15.37	15.14	0.128
34	14.87	15.35	15.10	0.123
39	14.77	15.35	15.05	0.115
45	14.42	15.22	14.90	0.128
51	14.02	15.07	14.73	0.162
56	14.02	14.95	14.60	0.156
62	13.97	14.72	14.46	0.161
68	13.82	14.65	14.23	0.198
73	13.25	14.42	13.90	0.245
79	12.92	14.05	13.53	0.303
85	12.42	13.80	13.09	0.300
90	12.15	13.25	12.72	0.221
96	11.87	13.00	12.51	0.200
101	11.57	12.65	12.17	0.238
107	11.37	12.42	11.88	0.228
113	11.07	12.22	11.58	0.199
118	10.87	11.95	11.28	0.185
124	10.65	11.65	11.04	0.164
130	10.45	11.37	10.82	0.157
135	10.22	11.05	10.58	0.141
141	10.07	10.80	10.42	0.124
147	10.00	10.60	10.27	0.109
152	9.87	10.40	10.06	0.084
158	9.72	10.22	9.94	0.082
164	9.47	10.07	9.78	0.111
169	9.32	9.95	9.60	0.127
175	9.22	9.82	9.48	0.121
180	9.10	9.72	9.36	0.126
186	8.97	9.62	9.24	0.115
192	8.87	9.45	9.13	0.127
197	8.75	9.30	9.01	0.120
203	8.60	9.17	8.91	0.123
209	8.55	9.05	8.80	0.122
214	8.40	9.05	8.70	0.129
220	8.42	8.95	8.64	0.116
226	8.37	8.92	8.61	0.116
231	8.22	8.82	8.56	0.113
237	8.17	8.95	8.52	0.141
242	8.05	9.05	8.43	0.171

APPENDIX C

STATION 2 RUN 3

DETAILED ENVIRONMENTAL SUMMARY

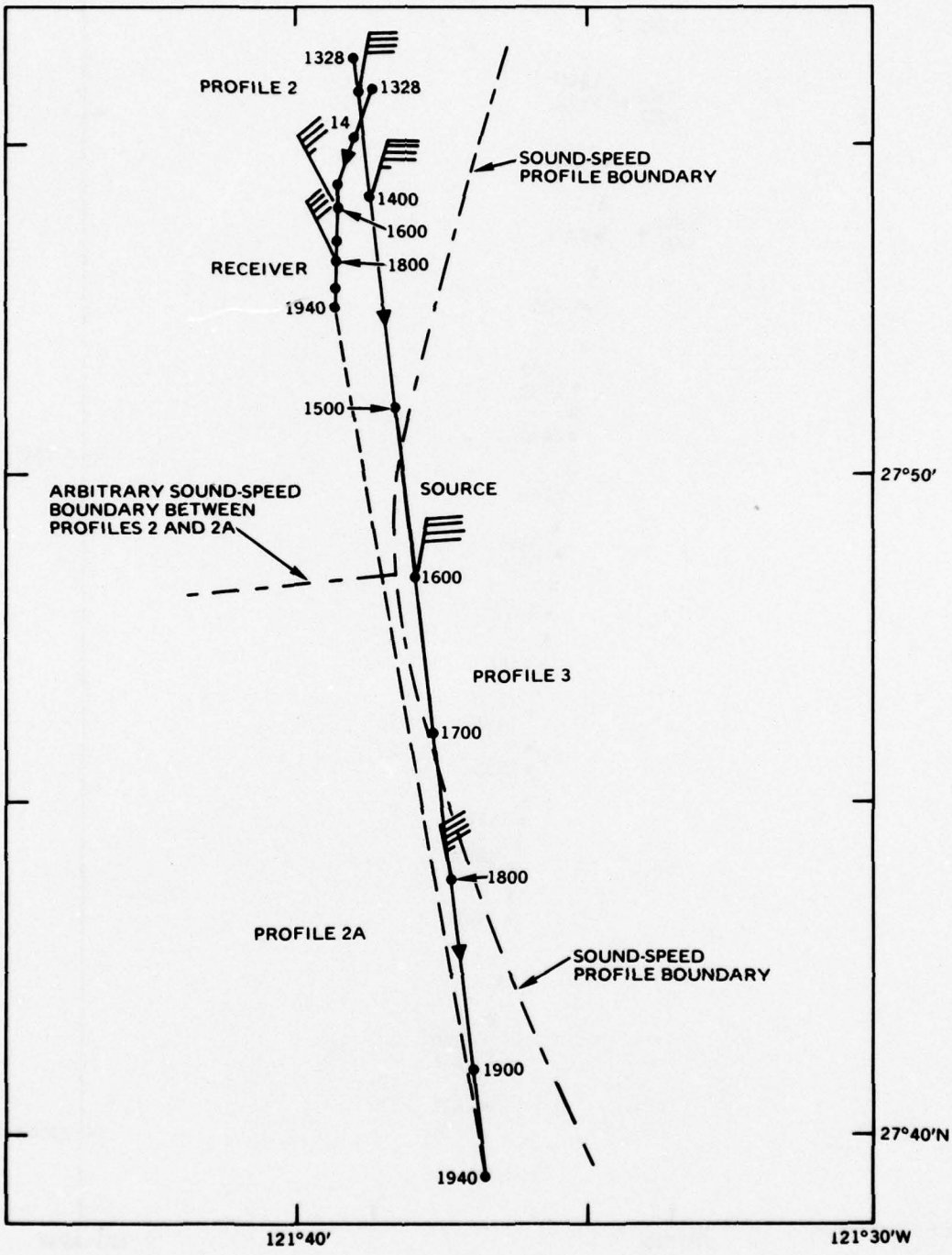


Figure C-1. Station 2, run 3. Location of source and receiver ships, 1940 LST propagation path (---), and wind velocity (10-knot east wind, 1 bar = 5 knots).

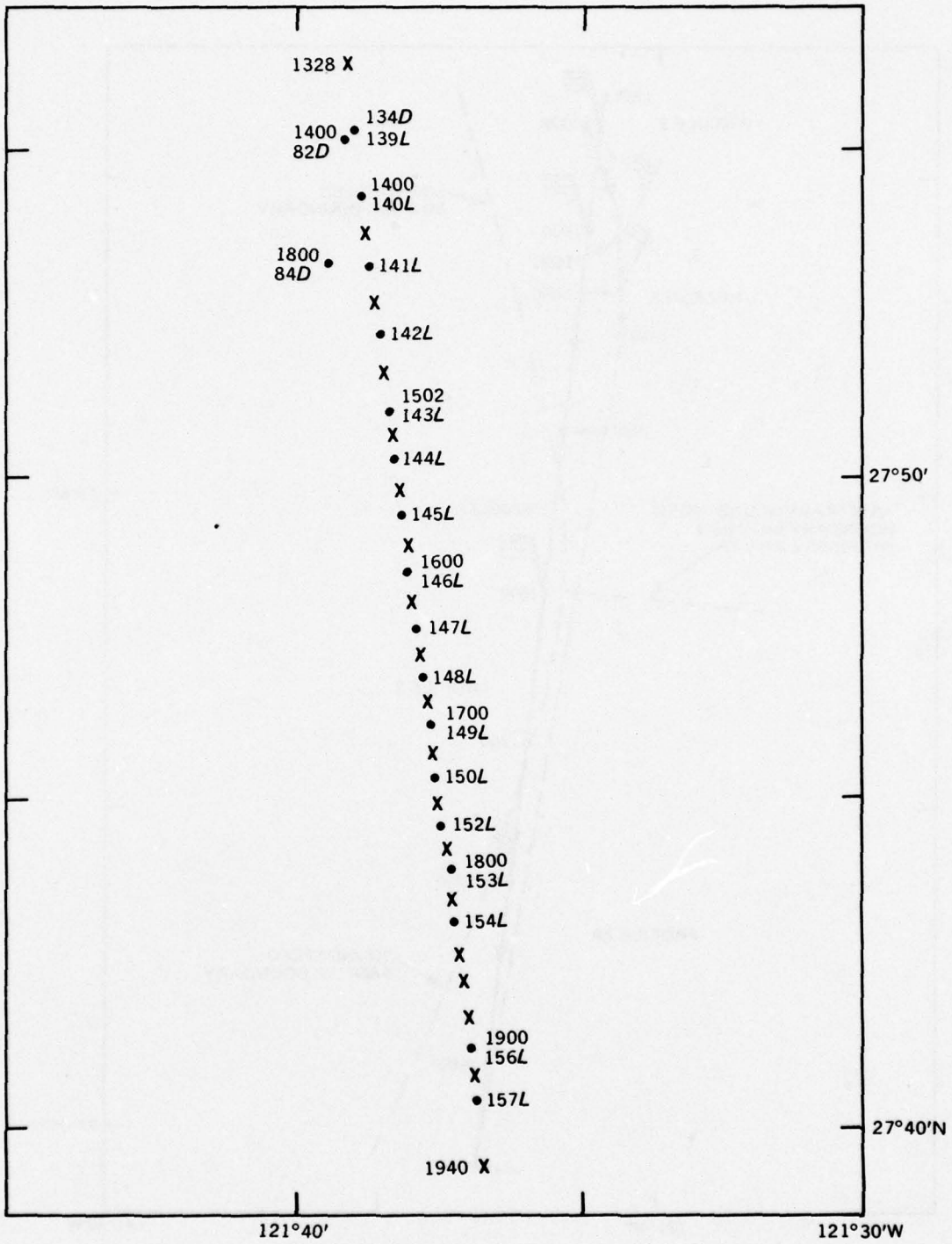


Figure C-2. Station 2, run 3. Location of XBT (·) and thermistor chain (X) measurements. Letter following XBT number denotes the ship which took the measurement (*L: Lee, D: DeSteiguer).* Times shown are LST.

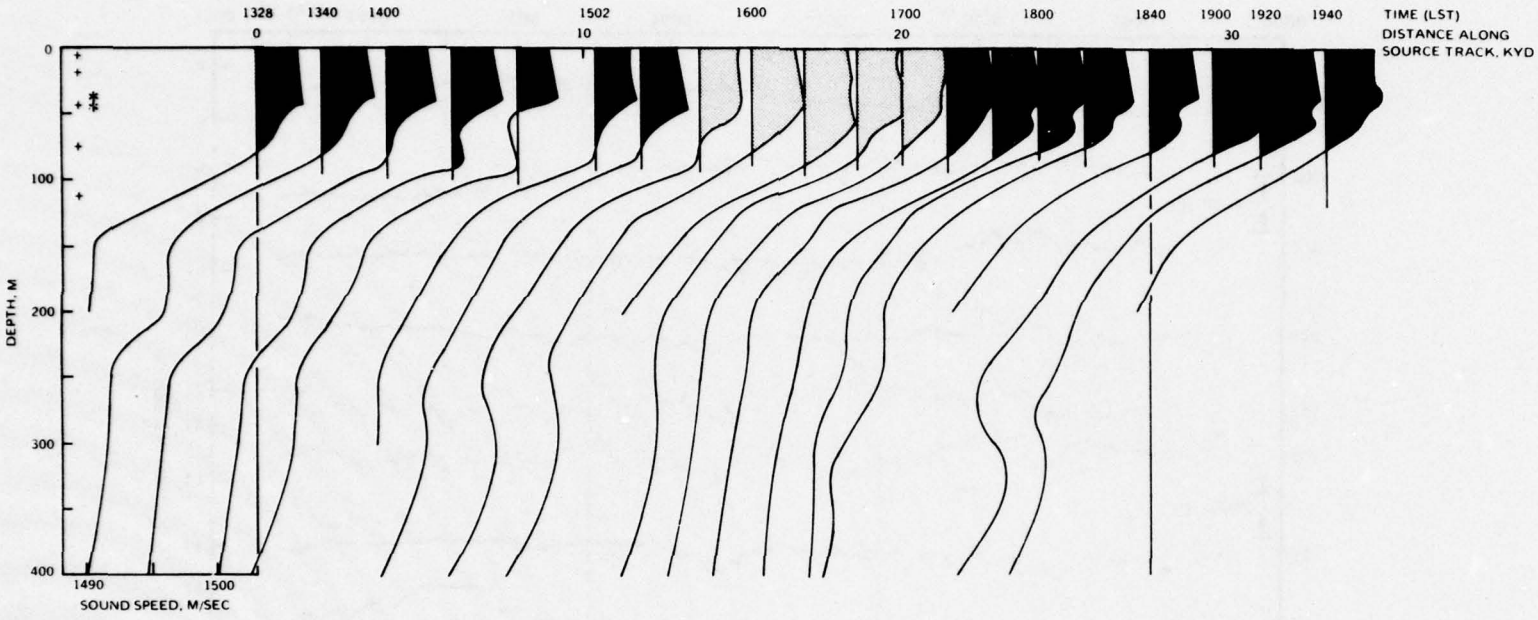


Figure C-3. Station 2, run 3. Sound-speed profiles along track of source ship derived from XBT and thermistor chain data. Source depth (*), receiver depth (+).

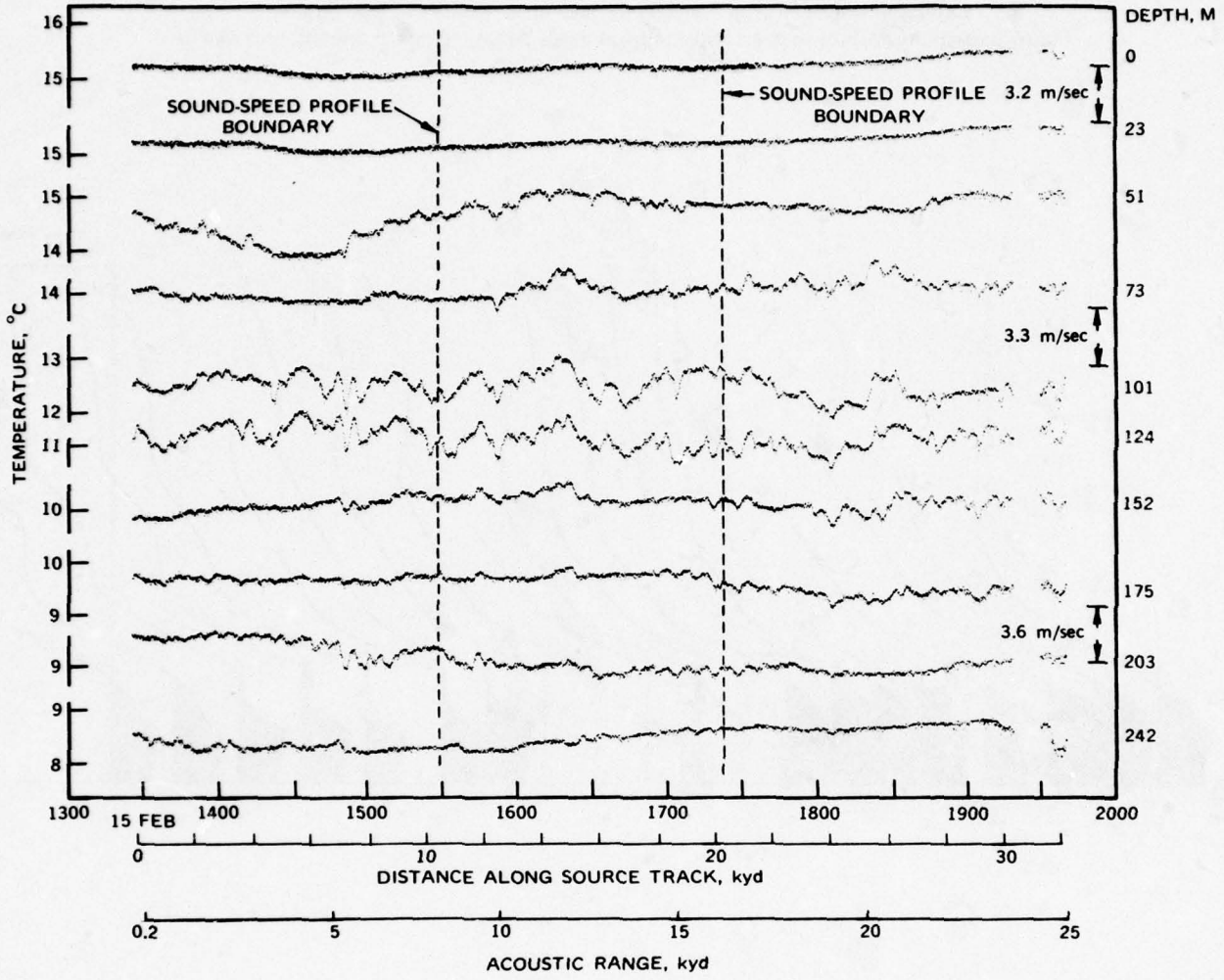


Figure C-4. Station 2, run 3. Thermistor chain temperature measurements. Time is LST.

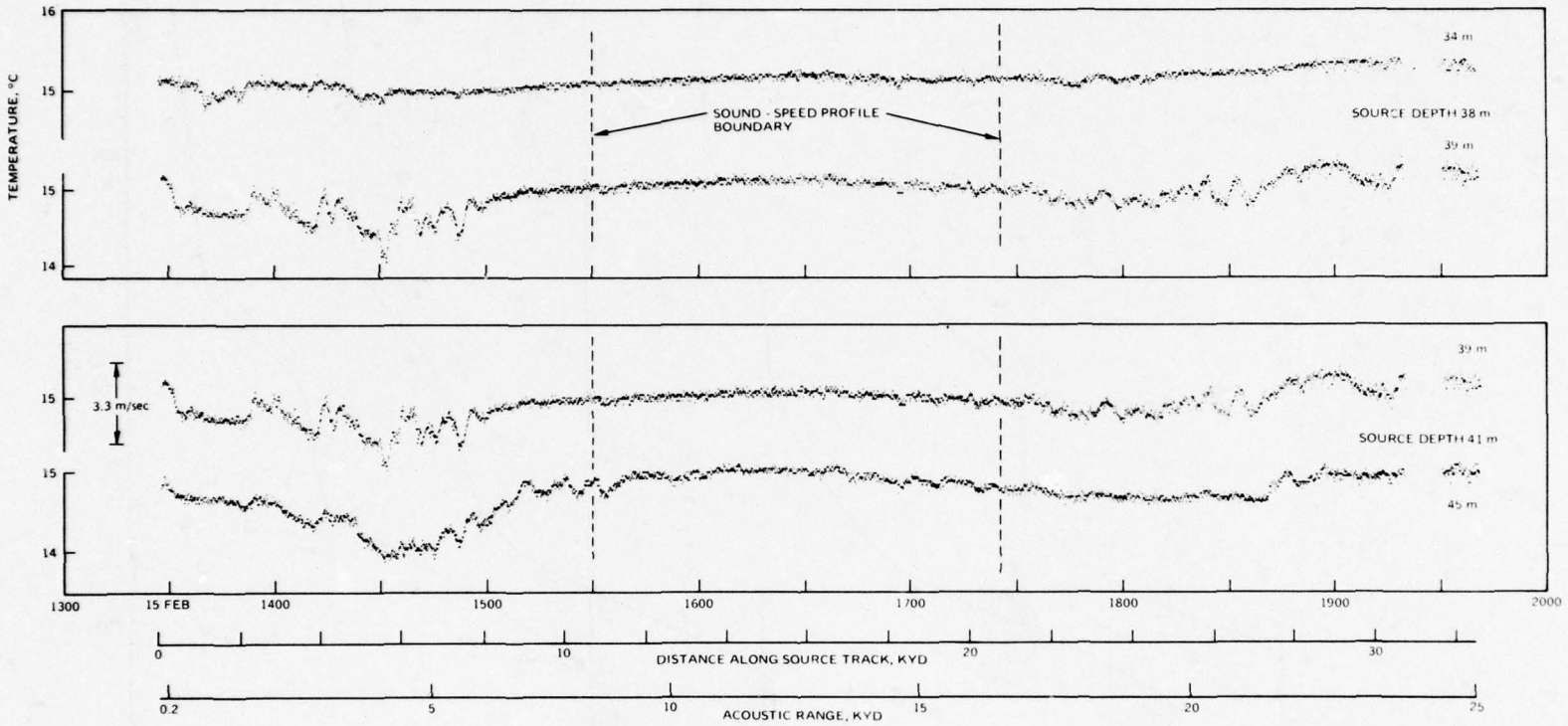


Figure C-5. Station 2, run 3. Temperatures above and below source. Time is LST.

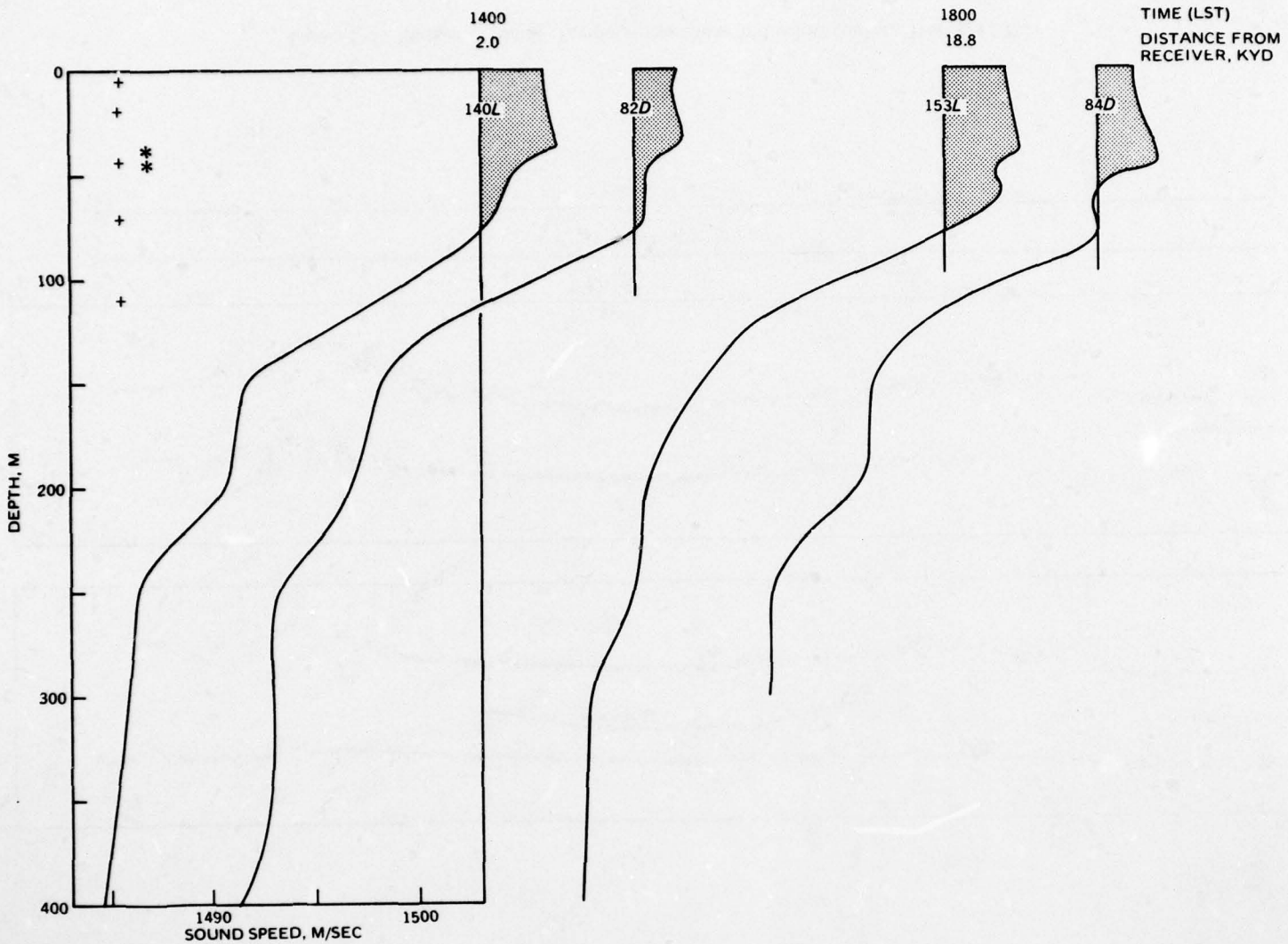


Figure C-6. Station 2, run 3. Spatial change in sound-speed profiles.

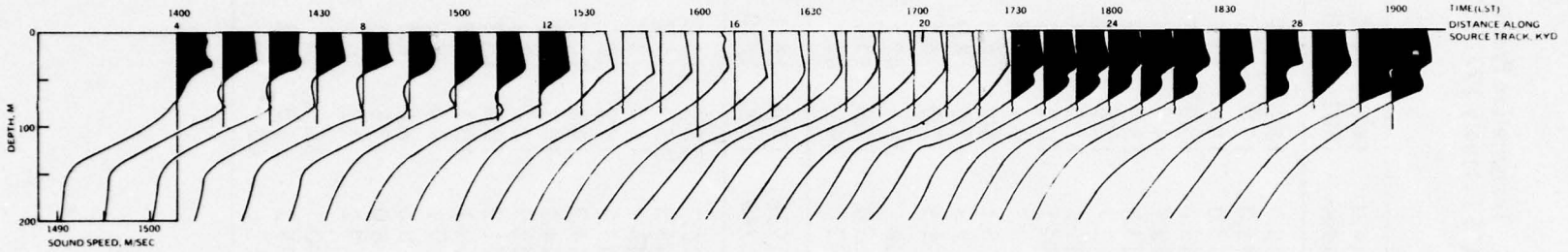


Figure C-7. Station 2, run 3. Expanded sound-speed profile plot.

Table C-1. Temperature Profiles (°C),
Station 2 Run 3 (15 February 1972 1328-1940 LST).

XBT MEASUREMENTS

Depth, m	139L 1340	140L 1400	141L 1420	142L 1440	143L 1502	144L 1520	145L 1540	146L 1600	147L 1620
0	15.3	15.2	15.2	15.0	15.1	15.1	15.2	15.3	15.3
10	15.3	15.2	15.2	15.0	15.0	15.1	15.1	15.3	15.3
20	15.3	15.2	15.2	15.0	15.0	15.1	15.1	15.3	15.3
30	15.3	15.2	15.2	15.0	15.0	15.1	15.1	15.3	15.2
50	14.7	14.5	14.6	13.9	14.7	14.8	14.9	15.1	15.2
75	14.1	14.4	14.1	13.8	13.9	13.9	13.9	14.0	14.5
100	12.6	12.8	12.8	12.7	12.6	12.5	12.8	12.8	13.1
125	11.0	11.4	11.3	11.1	11.0	11.1	11.1	11.2	11.5
150	10.1	10.2	10.3	10.1	10.2	10.3	10.3	10.4	10.6
200	9.7	9.6	9.7	9.2	9.1	9.3	9.1	9.2	9.2
250	8.3	8.2	8.4	8.1	8.2	8.3	8.2	8.5	
300	8.0	7.8	8.0	7.8	7.9	8.0	8.2	8.4	
400	7.1	7.0	7.1	6.5	7.3	6.6	6.8	6.9	
ILD	37	38	40	39	38	47	46	40	54
T	15.3	15.2	15.2	15.0	15.0	15.1	15.1	15.3	15.2
SLD	75	90	85	92	84	82	85	40	54

Depth, m	148L 1640	149L 1700	150L 1720	152L 1740	153L 1800	154L 1820	156L 1900	157L 1920	82D 1400	84D 1800
0	15.3	15.3	15.2	15.2	15.2	15.2	15.4	15.5	14.9	14.8
10	15.3	15.3	15.2	15.2	15.2	15.2	15.4	15.5	14.9	14.8
20	15.2	15.2	15.2	15.2	15.2	15.2	15.4	15.5	14.9	14.8
30	15.2	15.1	15.2	15.2	15.2	15.2	15.4	15.5	14.8	14.9
50	15.2	14.9	14.9	14.9	14.8	14.7	15.1	15.2	14.2	14.1
75	14.1	14.0	14.1	14.2	14.1	13.9	14.3	14.3	14.0	13.9
100	12.7	12.9	12.8	12.9	12.3	12.1	12.6	12.6	12.4	12.5
125	11.0	11.1	10.9	11.2	10.8	10.8	11.4	11.2	10.7	11.5
150	10.3	10.3	10.3	10.1	10.1	9.9	10.4	10.4	9.9	10.3
200	9.0	9.0	8.9	9.1	9.0	8.8	9.2	9.2	9.2	9.8
250	8.5	8.5	8.5	8.6	8.6	8.5	7.9	8.4	8.0	8.4
300	8.3	8.1	8.0	8.0	7.8	7.5	7.9	7.9	7.7	8.1
400	7.1	7.1	7.1	7.2	7.2	6.6	6.7	6.8	6.8	
ILD	50	10	40	40	38	40	46	38	33	45
T	15.2	15.3	15.2	15.2	15.2	15.2	15.4	15.5	14.8	14.8
SLD	80	45	60	62	60	70	60	60	74	81

Table C-1, continued.

THERMISTOR CHAIN MEASUREMENTS

Depth, m	1328	1400	1410	1420	1430	1440	1450	1500	1510
0	15.2	15.2	15.2	15.2	15.0	15.1	15.0	15.0	14.9
10	15.2	15.2	15.2	15.2	15.1	15.0	15.0	15.0	15.0
20	15.2	15.1	15.2	15.1	15.0	15.0	15.0	15.0	15.0
30	15.2	15.2	15.2	15.1	15.1	15.0	15.0	15.0	15.0
50	14.7	14.4	14.1	14.1	13.9	13.9	14.0	14.3	14.5
75	14.0	13.9	13.9	13.9	13.8	13.8	13.8	13.9	13.9
100	12.7	12.9	12.7	12.6	12.7	12.8	12.9	12.3	12.6
125	11.0	11.3	11.2	11.0	11.5	11.2	11.4	10.9	11.2
150	9.8	10.1	10.0	10.1	10.1	10.1	10.2	10.1	10.2
200	9.5	9.6	9.5	9.5	9.4	9.4	9.5	9.1	9.1
ILD	39	34	28	34	28	28	34	34	39
T	15.2	15.2	15.2	15.1	15.0	15.0	15.0	15.0	15.0
SLD	79	90	79	79	79	90	85	79	85

Depth, m	1520	1530	1540	1550	1600	1610	1620	1630	1640
0	15.1	15.1	15.1	15.1	15.1	15.2	15.2	15.2	15.2
10	15.1	15.1	15.1	15.1	15.2	15.1	15.2	15.1	15.2
20	15.1	15.1	15.0	15.1	15.1	15.1	15.2	15.2	15.2
30	15.0	15.1	15.1	15.1	15.1	15.1	15.2	15.1	15.1
50	14.6	14.7	14.8	14.8	14.8	15.1	15.0	15.0	14.9
75	13.9	13.9	13.8	13.8	13.9	14.1	14.3	14.0	14.0
100	12.5	12.4	12.6	12.5	12.6	12.9	13.0	12.5	12.6
125	11.1	11.0	11.0	11.0	11.0	11.2	11.2	11.0	10.9
150	10.3	10.3	10.3	10.3	10.3	10.4	10.4	10.3	10.2
200	9.3	9.3	9.1	9.2	9.1	9.0	9.0	9.0	8.9
ILD	39	39	45	45	39	51	45	39	39
T	15.1	15.1	15.0	15.1	15.1	15.1	15.1	15.2	15.2
SLD	79	79	79	45	39	51	51	39	39

Table C-1, continued.

Depth, m	1650	1700	1710	1720	1730	1740	1750	1800	1810
0	15.2	15.2	15.2	15.2	15.2	15.2	15.2	15.3	15.2
10	15.1	15.2	15.1	15.1	15.2	15.2	15.1	15.2	15.2
20	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.2	15.2
30	15.1	15.2	15.1	15.1	15.1	15.2	15.1	15.2	15.2
50	14.9	14.8	14.9	14.8	14.8	14.8	14.7	14.7	14.6
75	13.9	14.0	14.1	13.9	13.8	13.9	14.0	13.9	14.0
100	12.4	12.8	12.8	12.8	12.7	12.6	12.4	12.2	12.2
125	10.8	11.0	10.8	10.7	10.7	10.9	10.9	10.7	10.7
150	10.2	10.2	10.2	10.0	10.1	10.1	10.1	10.0	9.9
200	8.9	8.9	9.0	8.9	8.9	9.0	9.1	8.9	8.8
ILD	45	39	45	34	34	34	34	28	34
T	15.1	15.2	15.1	15.1	15.2	15.2	15.2	15.2	15.2
SLD	45	39	45	34	56	56	56	56	56

Depth, m	1820	1830	1840	1850	1900	1910	1940
0	15.2	15.3	15.3	15.3	15.3	15.4	15.4
10	15.2	15.2	15.3	15.3	15.4	15.4	15.4
20	15.2	15.2	15.3	15.3	15.4	15.4	15.3
30	15.3	15.2	15.3	15.3	15.3	15.4	15.4
50	14.7	14.7	14.7	14.8	15.0	15.0	15.0
75	14.0	14.2	14.2	13.9	14.0	14.0	14.0
100	12.2	12.7	12.4	12.2	12.4	12.5	12.6
125	10.8	11.2	11.0	11.8	11.1	11.2	11.2
150	9.9	10.1	10.2	10.1	10.2	10.3	10.1
200	8.8	8.9	8.9	8.9	9.0	9.0	9.1
ILD	34	34	34	34	39	34	34
T	15.2	15.2	15.3	15.3	15.3	15.4	15.4
SLD	62	68	62	68	68	62	56

Table C-2. Computed Sound-Speed Profiles (m/sec),
Station 2 Run 3 (15 February 1972 1328-1940 LST).

XBT MEASUREMENTS

Depth, m	139L 1340	140L 1400	141L 1420	142L 1440	143L 1502	144L 1520	145L 1540	146L 1600
0	1506.3	1506.0	1506.0	1505.3	1505.6	1505.6	1506.0	1506.3
10	06.4	06.1	06.1	05.5	05.5	05.8	05.8	06.4
20	06.6	06.3	06.3	05.6	05.6	06.0	06.0	06.6
30	06.8	06.5	06.5	05.8	05.8	06.1	06.1	06.8
50	05.2	04.5	04.8	02.5	04.2	05.5	05.8	06.5
75	03.6	03.2	03.6	02.6	02.9	02.9	02.9	03.2
100	1498.9	1499.6	1499.6	1499.3	1498.9	1498.6	1499.6	1499.6
125	93.9	95.3	95.0	94.3	93.9	94.3	94.3	94.6
150	91.3	91.6	92.0	91.3	91.6	92.0	92.0	92.3
200	90.8	90.5	90.8	89.1	88.7	89.4	88.7	89.1
250	86.7	86.3	87.1	86.0	86.3	86.7	86.3	87.5
300	86.5	85.8	86.5	85.8	86.2	86.5	87.3	88.1
400	84.9	84.5	84.9	82.4	85.7	82.9	83.7	84.1
SC	39	37	37	40	39	47	0	40
DC			65	55	10	70	10	
MAX			85	92	38	83	46	
RC						270	250	240
MAX						300	300	300

Depth, m	147L 1620	148L 1640	149L 1700	150L 1720	152L 1740	153L 1800	154L 1820	156L 1900
0	1506.3	1506.3	1506.3	1506.0	1506.0	1506.0	1506.0	1506.6
10	06.4	06.1	06.4	06.1	06.1	06.1	06.1	06.8
20	06.6	06.3	06.3	06.3	06.3	06.3	06.3	06.9
30	06.5	06.5	06.1	06.5	06.5	06.5	06.5	07.1
50	06.8	06.5	05.8	05.8	05.8	05.5	05.2	06.5
75	04.9	03.6	03.2	03.6	03.9	03.6	02.9	03.7
100	00.7	1499.3	00.0	1499.6	00.0	1497.9	1497.2	1498.9
125	1495.7	93.9	1494.3	93.6	1494.6	93.2	93.2	95.3
150	93.0	92.0	92.0	92.0	91.3	91.3	90.6	92.3
200	89.1	88.4	88.4	88.0	88.7	88.4	87.6	89.1
250		87.5	87.5	87.5	87.8	87.8	87.5	85.2
300		87.7	86.9	86.5	86.5	85.8	84.6	86.2
400		84.9	84.9	84.9	85.3	85.3	82.9	83.3
SC	20	0	10	40	40	38	40	46
DC	30	10			50	50		50
MAX	54	50			62	60		60
RC	350					350	320	285
MAX	300					400	360	347

Table C-2, continued.

Depth, m	157L 1920	82D 1400	84D 1800
0	1506.9	1505.0	1504.7
10	07.1	04.8	04.8
20	07.2	05.0	05.0
30	07.4	05.2	05.5
50	06.8	03.5	04.2
75	04.2	03.2	02.9
100	1498.9	1498.2	1498.6
125	94.6	92.9	95.7
150	92.3	90.6	92.0
200	89.1	89.1	91.2
250	87.1	85.6	87.1
300	86.2	85.4	86.9
400	83.7	83.7	
SC	38	0	45
DC	43	50	60
MAX	60	60	80
RC	280	350	260
MAX	335	400	296

THERMISTOR CHAIN MEASUREMENTS

Depth, m	1328	1400	1410	1420	1430	1440	1450	1500
0	1506.0	1505.8	1506.0	1506.0	1505.5	1505.5	1505.4	1505.2
10	06.1	06.1	06.2	06.0	05.6	05.6	05.3	05.5
20	06.3	05.8	06.2	05.9	05.7	05.5	05.7	05.5
30	06.3	06.4	06.4	06.2	06.0	05.9	05.8	05.7
50	05.1	04.1	03.3	03.2	02.6	02.4	03.0	03.7
75	03.3	03.0	02.9	02.9	02.7	02.7	02.6	02.7
100	1499.2	1499.8	1499.2	1499.0	1499.1	1499.7	00.0	1498.0
125	94.0	95.0	94.5	93.9	94.8	94.7	1495.3	93.6
150	90.4	91.2	90.8	91.2	91.1	91.4	91.5	91.1
200	90.1	90.4	90.1	90.2	89.8	89.8	90.0	88.8
SC	39	10	30	10	30	10	0	34
DC		20		20		20	10	
MAX		34		34		30	34	
DC			65	62	56	50	56	68
MAX			79	79	79	90	85	79

Table C-2, continued.

Depth, m	1510	1520	1530	1540	1550	1600	1610	1620
0	1505.1	1505.5	1505.5	1505.5	1505.6	1505.5	1505.8	1506.0
10	05.5	05.6	05.9	05.6	05.7	06.0	05.8	06.1
20	05.6	05.9	06.0	05.7	06.0	05.9	06.0	06.2
30	05.8	05.9	06.1	06.0	06.1	06.1	06.2	06.3
50	04.6	04.9	05.0	05.4	05.6	05.4	06.4	06.2
75	03.0	02.9	02.8	02.7	02.7	02.8	03.5	04.1
100	1499.0	1498.4	1498.3	1499.1	1498.6	1499.0	1499.9	00.2
125	94.7	94.3	93.8	94.1	93.9	94.0	94.6	1494.7
150	91.5	91.8	91.9	91.8	91.8	91.8	92.2	92.3
200	88.8	89.3	89.5	88.8	89.0	88.7	88.4	88.2
SC	39	39	39	45	45	10	51	34
DC						20		
MAX						39		

Depth, m	1630	1640	1650	1700	1710	1720	1730	1740
0	1505.9	1506.0	1505.8	1505.9	1505.8	1505.8	1505.9	1505.9
10	05.9	06.2	05.9	06.1	05.9	05.9	06.0	06.1
20	06.2	06.1	06.1	06.2	05.9	06.0	06.0	06.1
30	06.3	06.2	06.2	06.3	06.1	06.1	06.3	06.3
50	06.2	05.9	05.9	05.4	05.7	05.5	05.3	05.5
75	03.3	03.1	03.0	03.2	03.4	02.9	02.7	02.9
100	1498.7	1498.9	1498.3	1499.5	1499.7	1499.5	1499.1	1499.0
125	93.8	93.5	93.4	93.9	93.3	92.9	92.9	93.5
150	91.9	91.5	91.4	91.6	91.6	91.1	91.3	91.1
200	88.2	88.0	88.1	88.1	88.3	87.9	87.8	88.5
SC	39	10	45	39	45	34	34	34
DC		20					45	45
MAX		39					56	56

Table C-2, continued.

Depth, m	1750	1800	1810	1820	1830	1840	1850
0	1506.0	1506.1	1506.0	1506.0	1506.1	1506.2	1506.3
10	05.9	06.2	06.2	06.0	06.1	06.3	06.4
20	06.1	06.4	06.3	06.3	06.3	06.3	06.4
30	06.3	06.5	06.6	06.6	06.4	06.6	06.8
50	05.3	05.2	04.9	05.2	05.2	05.1	05.5
75	03.4	02.9	03.3	03.1	03.7	02.7	02.7
100	1498.3	1497.6	1497.5	1497.4	1499.3	1498.2	1497.5
125	93.5	92.8	93.0	93.3	94.7	94.0	93.1
150	91.1	90.8	90.6	90.6	91.3	91.6	91.3
200	88.5	88.0	87.7	87.8	87.7	87.9	87.8
SC	0	28	34	34	34	34	34
DC	10						
MAX	34						
DC	45	49	49	51	45	45	
MAX	56	56	56	62	62	62	

Depth, m	1900	1920	1940
0	1506.3	1506.6	1506.5
10	06.8	06.9	06.6
20	06.9	07.0	06.6
30	06.9	07.1	07.1
50	06.1	06.0	06.0
75	03.3	03.3	03.2
100	1498.1	1498.4	1499.0
125	94.4	94.7	94.5
150	91.7	91.8	91.2
200	88.4	88.4	88.5
SC	39	34	34
DC	45	45	51
MAX	62	62	56

Table C-3. Average Sound-Speed Profile (m/sec),
Station 2 Run 3 (15 February 1972 1328-1940 LST).

Depth,	Profile 2 1328-1531			Profile 3 1531-1722			Profile 2A 1722-1940		
m	n	$\bar{C}$	σ	n	$\bar{C}$	σ	n	$\bar{C}$	σ
0	738	1505.61	0.26	675	1505.74	0.13	774	1506.12	0.29
10	738	05.76	0.26	675	05.89	0.13	774	06.28	0.29
20	738	05.89	0.26	675	06.02	0.14	774	06.44	0.32
30	738	06.01	0.26	675	06.14	0.13	774	06.62	0.35
50	738	03.93	0.83	675	05.67	0.43	774	05.47	0.36
75	738	02.86	0.21	675	03.07	0.48	774	03.23	0.58
100	738	1498.97	0.56	675	1499.22	0.74	774	1498.41	0.69
125	738	94.50	0.60	675	93.76	0.67	774	93.83	0.60
150	738	91.13	0.56	675	91.62	0.25	774	91.27	0.46
200	738	89.75	0.61	675	88.36	0.46	774	88.08	0.32
250	738	86.33	0.31	675	86.97	0.46	774	87.65	0.38
300	8	86.20	0.53	5	87.33	0.62	5	85.84	0.76
400	17	84.21	0.98						
500	2	84.12	2.13						
600	2	83.47	0.71						
800	2	82.60	0.73						
1000	2	83.03	0.36						
1200	2	84.16	0.39						
1500	*2*	*86.39*	*0.30*						
30		1506.01			1506.14			1506.62	SC
50								1505.47	DC
55								1505.55	MAX
68		1502.70							DC
79		1503.20							MAX
250					1486.97				RC
300					1487.33				MAX
800		1482.60			1482.60			1482.60	AXIS

Table C-4. Average Thermistor Chain Temperatures, Station 2 Run 3 **Profile 2** (number of measurements at each depth: 738).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	14.92	15.30	15.09	0.079
6	14.92	15.25	15.09	0.078
11	14.92	15.25	15.09	0.077
17	14.92	15.22	15.08	0.074
23	14.92	15.22	15.08	0.075
28	14.92	15.25	15.07	0.072
34	14.77	15.20	15.00	0.076
39	14.10	15.17	14.77	0.195
45	13.87	15.00	14.48	0.274
51	13.82	14.70	14.26	0.251
56	13.80	14.62	14.11	0.195
62	13.75	14.35	14.00	0.124
68	13.77	14.20	13.93	0.085
73	13.77	14.10	13.90	0.071
79	13.70	14.05	13.86	0.060
85	13.05	13.90	13.67	0.186
90	12.60	13.77	13.28	0.310
96	12.47	13.65	12.95	0.285
101	11.97	12.80	12.51	0.155
107	11.77	12.60	12.22	0.214
113	11.35	12.37	11.85	0.212
118	11.07	11.85	11.49	0.185
124	10.77	11.55	11.20	0.172
130	10.35	11.40	10.86	0.202
135	10.12	10.92	10.50	0.175
141	9.92	10.67	10.25	0.132
147	9.82	10.37	10.15	0.118
152	9.72	10.30	10.00	0.126
158	9.75	10.17	9.97	0.085
164	9.67	10.10	9.89	0.070
169	9.57	10.00	9.78	0.077
175	9.50	9.80	9.66	0.049
180	9.47	9.70	9.58	0.041
186	9.42	9.72	9.57	0.060
192	9.37	9.80	9.54	0.058
197	9.17	9.62	9.44	0.096
203	8.90	9.60	9.35	0.172
209	8.62	9.50	9.17	0.215
214	8.52	9.45	8.96	0.215
220	8.42	9.30	8.79	0.215
226	8.35	9.12	8.57	0.155
231	8.25	8.97	8.43	0.102
237	8.17	8.60	8.35	0.083
242	8.12	8.52	8.27	0.080

Table C-4, continued. **Profile 3** (number of measurements at each depth: 675).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	14.97	15.25	15.13	0.044
6	15.02	15.25	15.13	0.043
11	15.02	15.25	15.13	0.042
17	14.97	15.22	15.12	0.043
23	14.97	15.22	15.13	0.043
28	15.02	15.25	15.12	0.041
34	14.97	15.20	15.09	0.042
39	14.92	15.20	15.08	0.055
45	14.72	15.15	15.00	0.086
51	14.50	15.05	14.83	0.131
56	14.17	14.95	14.60	0.162
62	13.97	14.75	14.37	0.192
68	13.85	14.67	14.18	0.190
73	13.62	14.40	14.00	0.142
79	13.42	14.27	13.85	0.141
85	13.07	13.90	13.54	0.164
90	12.72	13.65	13.16	0.195
96	12.47	13.42	12.92	0.177
101	12.05	13.00	12.54	0.211
107	11.67	12.72	12.14	0.246
113	11.27	12.30	11.71	0.209
118	10.80	11.80	11.34	0.185
124	10.60	11.47	11.00	0.189
130	10.42	11.20	10.72	0.153
135	10.27	10.90	10.52	0.125
141	10.15	10.80	10.40	0.111
147	10.07	10.60	10.33	0.107
152	9.92	10.50	10.15	0.100
158	9.77	10.30	10.06	0.084
164	9.72	10.12	9.93	0.075
169	9.62	10.00	9.81	0.072
175	9.42	9.90	9.70	0.067
180	9.25	9.80	9.62	0.119
186	9.02	9.82	9.49	0.235
192	8.97	9.82	9.34	0.261
197	8.82	9.57	9.08	0.153
203	8.67	9.27	8.93	0.105
209	8.52	9.10	8.78	0.097
214	8.47	8.97	8.66	0.076
220	8.35	8.80	8.57	0.078
226	8.20	8.67	8.50	0.120
231	8.15	8.67	8.44	0.150
237	8.17	8.70	8.40	0.142
242	8.12	8.62	8.38	0.124

Table C-4, continued. **Profile 2A** (number of measurements at each depth: 774).

Depth, m	Temperature, °C Min	Max	Mean	Standard Deviation
0	15.05	15.47	15.25	0.094
6	15.07	15.45	15.26	0.096
11	15.02	15.45	15.25	0.094
17	15.02	15.45	15.24	0.097
23	15.07	15.45	15.25	0.095
28	15.05	15.45	15.25	0.096
34	14.97	15.42	15.20	0.109
39	14.72	15.45	15.05	0.167
45	14.62	15.12	14.84	0.121
51	14.57	15.02	14.78	0.109
56	14.50	15.07	14.75	0.122
62	14.25	14.87	14.61	0.097
68	13.95	14.62	14.39	0.122
73	13.75	14.52	14.10	0.131
79	13.22	14.25	13.77	0.171
85	12.95	13.90	13.44	0.166
90	12.67	13.65	13.06	0.208
96	12.27	13.40	12.78	0.231
101	11.87	12.80	12.33	0.203
107	11.42	12.60	12.01	0.209
113	10.97	12.05	11.66	0.184
118	10.65	11.70	11.30	0.175
124	10.47	11.35	11.00	0.169
130	10.17	11.20	10.73	0.157
135	10.07	10.85	10.49	0.158
141	10.00	10.65	10.34	0.131
147	9.92	10.52	10.24	0.124
152	9.62	10.25	10.00	0.126
158	9.47	10.02	9.79	0.106
164	9.40	9.95	9.65	0.103
169	9.22	9.90	9.54	0.107
175	9.12	9.60	9.40	0.101
180	9.02	9.45	9.25	0.092
186	8.92	9.32	9.14	0.078
192	8.82	9.30	9.06	0.078
197	8.72	9.20	8.96	0.093
203	8.67	9.17	8.89	0.094
209	8.57	9.10	8.81	0.086
214	8.57	9.00	8.75	0.069
220	8.57	8.92	8.72	0.063
226	8.37	8.85	8.69	0.061
231	8.45	8.80	8.62	0.063
237	8.25	8.80	8.61	0.074
242	8.05	8.80	8.58	0.101

APPENDIX D

STATION 2 RUN 4

DETAILED ENVIRONMENTAL DATA SUMMARY

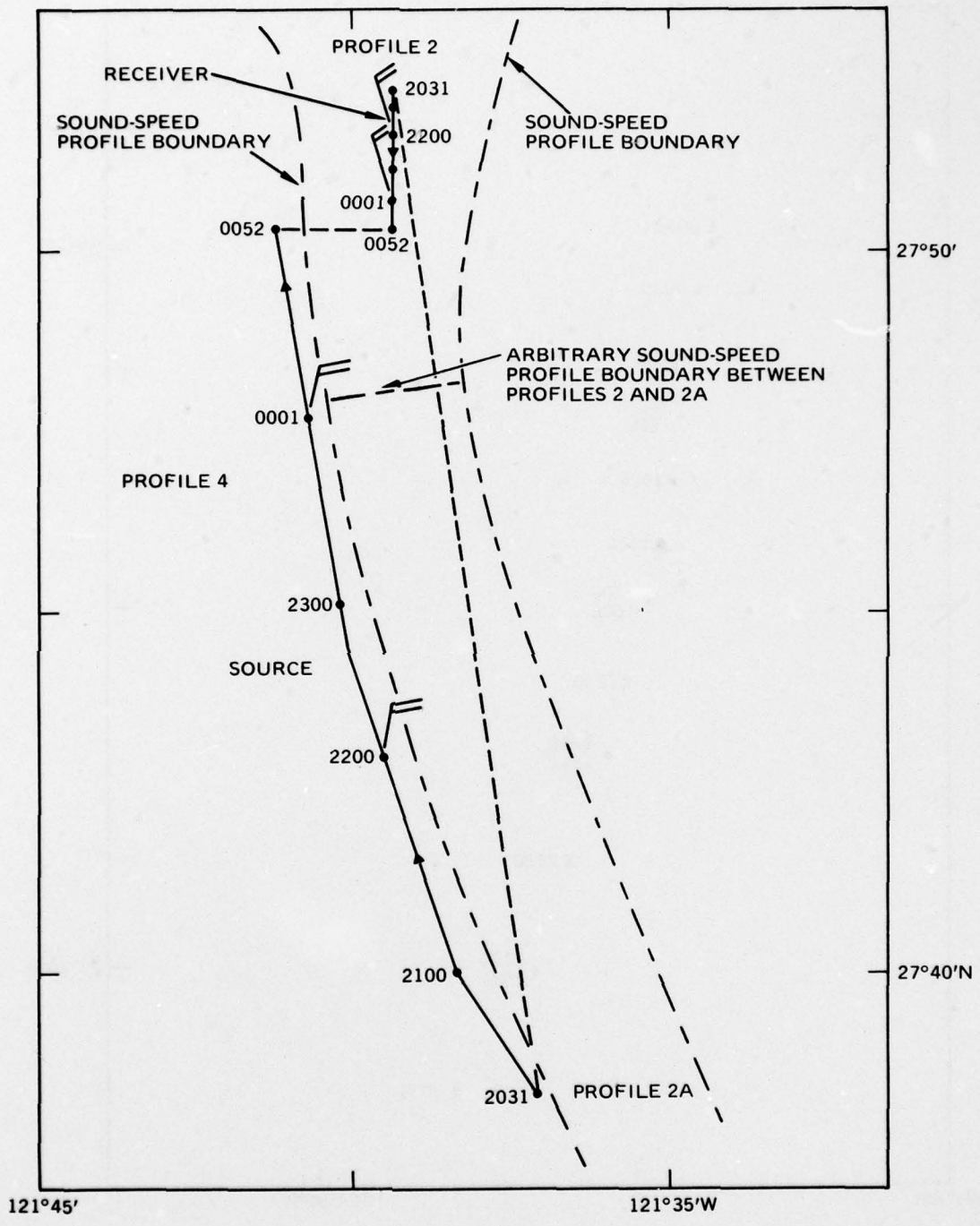


Figure D-1. Station 2, run 4. Location of source and receiver ships, 2031 and 0052 LST (15-16 Feb. 1972) propagation paths (---), and wind velocity (10-knot east wind, 1 bar = 5 knots).

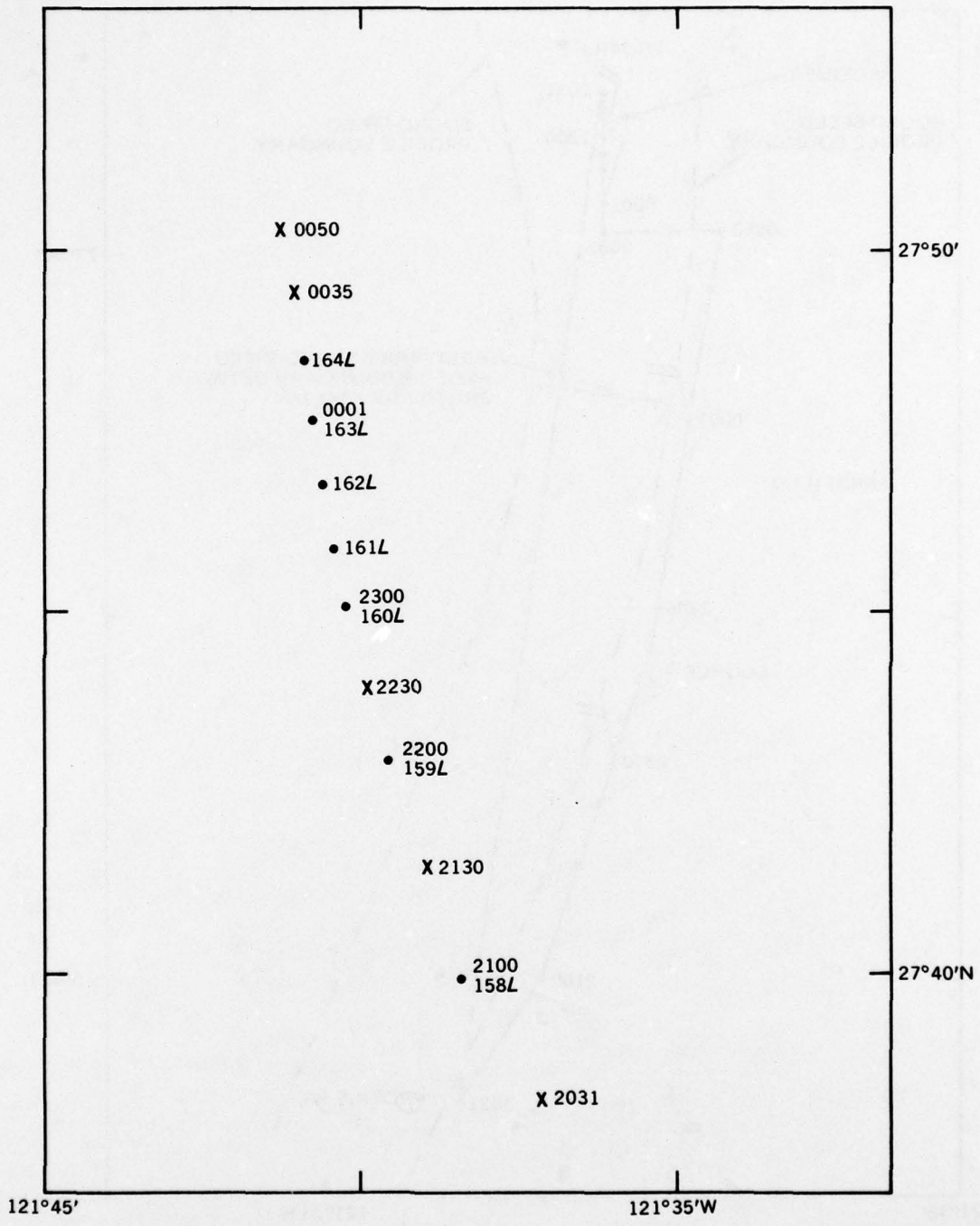


Figure D-2. Station 2, run 4. Location of XBT (·) and thermistor chain (X) measurements. XBTs taken by the *Lee*. Times shown are LST.

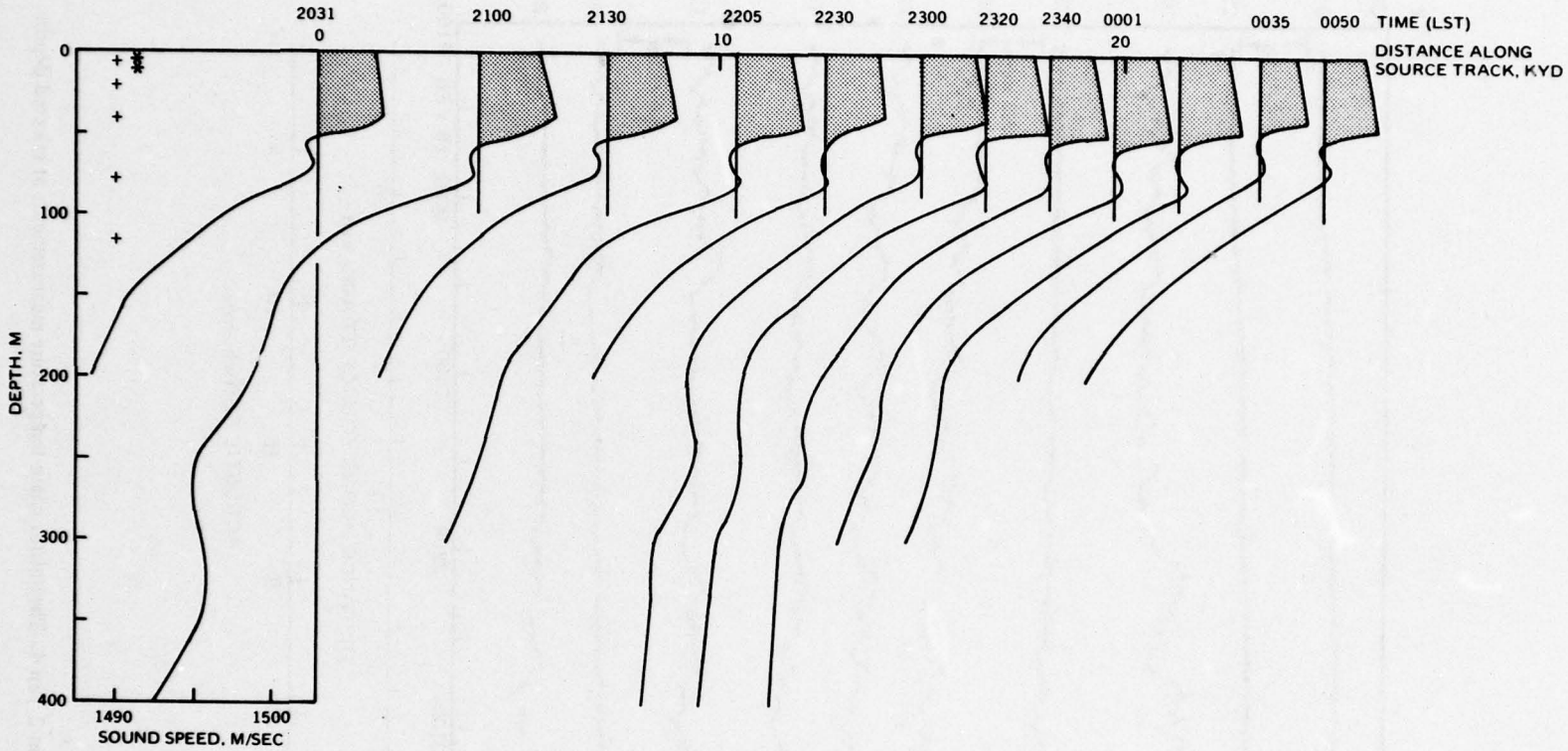


Figure D-3. Station 2, run 4. Sound-speed profiles along track of source ship derived from XBT and thermistor chain data. Source depth (*), receiver depth (+).

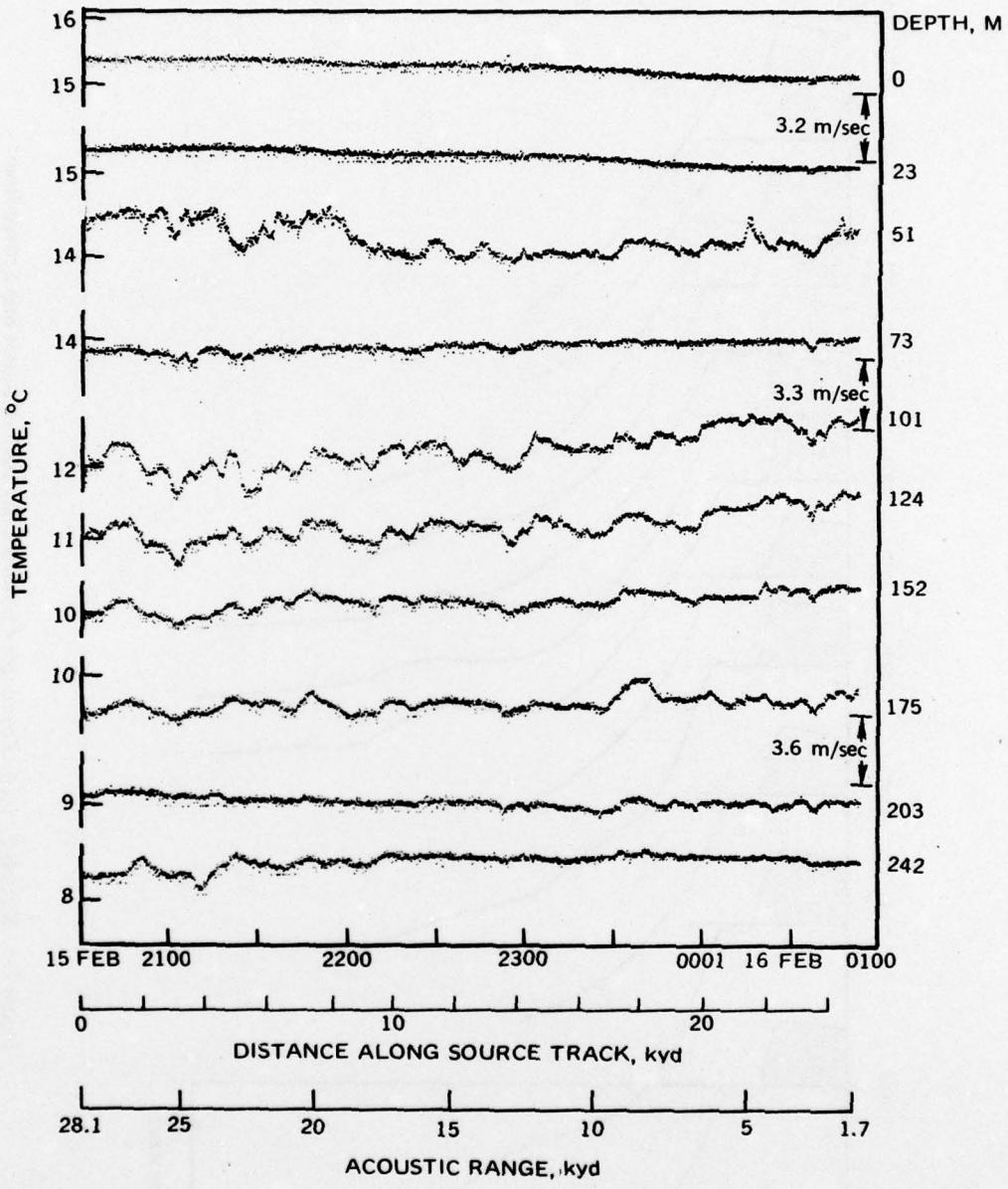


Figure D-4. Station 2, run 4. Thermistor chain temperature measurements at selected depths. Time is LST.

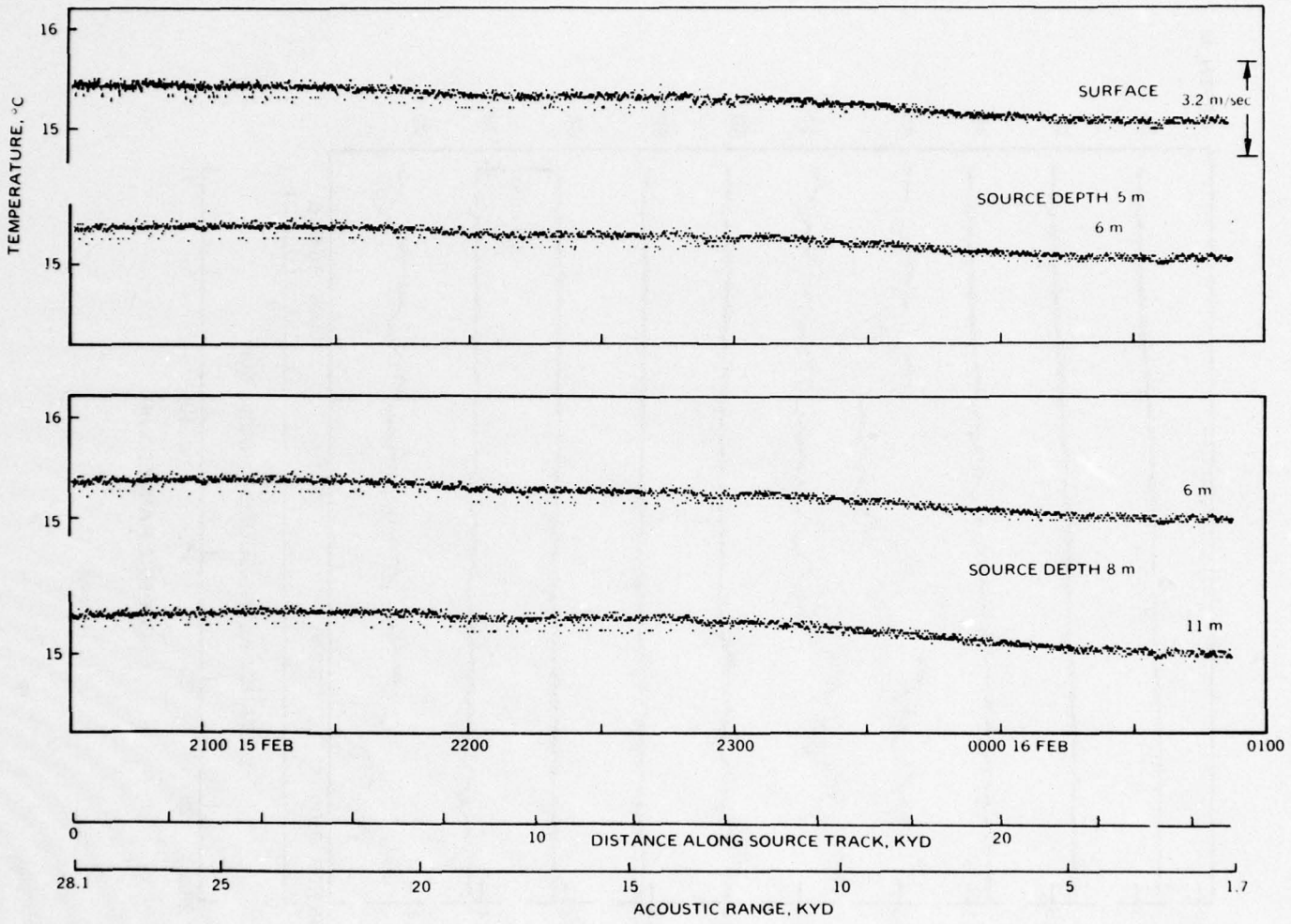


Figure D-5. Station 2, run 4. Temperatures above and below source. Time is LST.

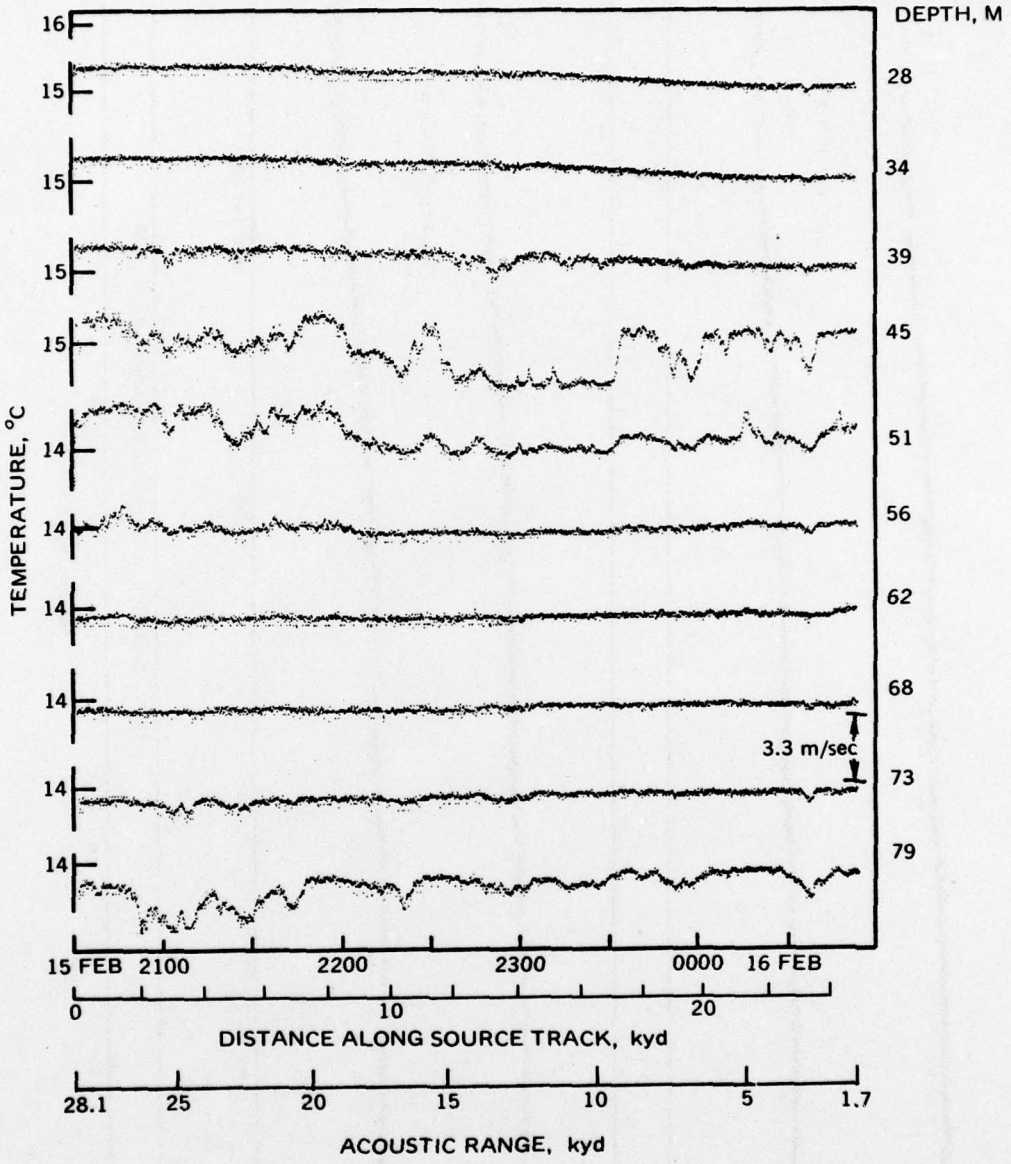


Figure D-8. Station 2, run 4. Thermistor chain temperatures at about 6-m depth intervals from 28 to 79 m. Time is LST.

Table D-1. Temperature Profiles (°C),
Station 2 Run 4 (15-16 February 1972 2031-0052 LST).

XBT MEASUREMENTS

Depth, m	158L 2100	159L 2205	160L 2300	161L 2320	162L 2340	163L 0000	164L 0020
0	15.4	15.3	15.3	15.2	15.1	15.1	15.2
10	15.5	15.3	15.3	15.2	15.1	15.1	15.2
20	15.5	15.3	15.3	15.2	15.1	15.1	15.2
30	15.5	15.3	15.3	15.2	15.1	15.1	15.2
50	14.8	14.8	14.1	14.3	15.1	15.1	14.7
75	13.8	13.9	13.8	13.9	13.9	14.0	14.0
100	11.9	12.4	12.3	12.5	12.6	12.8	12.9
125	10.6	10.9	11.2	11.1	11.3	11.4	11.7
150	9.9	10.3	10.1	10.2	10.4	10.3	10.6
200	9.2	9.0	9.0	8.9	9.1	9.1	9.0
250	8.0	8.4	8.9	8.6	8.6	8.6	8.6
300	7.8	7.6	8.0	7.9	7.9	7.8	7.9
400	6.6		7.3	7.2	7.3		
ILD	40	47	40	48	50	50	47
T	15.5	15.3	15.3	15.2	15.1	15.1	15.2
SLD	75	80	72	80	80	80	82

THERMISTOR CHAIN MEASUREMENTS

Depth, m	2031	2130	2230	0035	0050
0	15.4	15.4	15.3	15.0	15.0
10	15.4	15.4	15.3	15.0	15.1
20	15.4	15.4	15.3	15.0	15.1
30	15.3	15.4	15.3	15.0	15.1
50	14.5	14.4	14.3	14.0	14.3
75	13.7	13.7	13.9	13.8	13.9
100	12.1	11.9	12.5	12.4	12.6
125	11.0	11.0	11.2	11.3	11.5
150	10.1	10.1	10.3	10.3	10.4
200	9.1	9.1	9.1	8.9	9.0
ILD	39	39	39	39	45
T	15.4	15.4	15.3	15.0	15.1
LSD	79	73	79	73	73

Table D-2. Computed Sound-Speed Profiles (m/sec), Station 2 Run 4 (15-16 February 1972 2031-0052 LST).

XBT MEASUREMENTS

Depth, m	158L 2100	159L 3325	160L 2300	161L 2320	162L 2340	163L 0000	164L 0020
0	1506.6	1506.4	1506.3	1506.0	1505.6	1505.6	1506.0
10	07.1	06.4	06.4	06.1	05.8	05.8	06.1
20	07.2	06.6	06.6	06.3	06.0	06.0	06.3
30	07.4	06.8	06.8	06.5	06.1	06.1	06.5
50	05.5	05.5	03.2	03.9	06.5	06.5	05.2
75	02.6	02.9	02.6	02.9	02.9	03.2	03.2
100	1496.5	1498.2	1497.9	1498.6	1498.9	1499.6	00.0
125	92.5	93.6	94.6	94.3	95.0	95.3	1496.4
150	90.6	92.0	91.3	91.6	92.3	92.0	93.0
200	89.1	88.4	88.4	88.0	88.7	88.7	88.4
250	85.6	87.1	89.0	87.8	87.8	87.8	87.8
300	85.8	85.0	86.5	86.2	86.2	85.8	86.2
400	82.9		85.7	85.3	85.7		
SC	40	47	40	48	50	50	47
DC	60	60	55	56	60	60	60
MAX	75	80	72	80	80	80	82
RC	260		200	215	220		
MAX	342		250	260	260		

THERMISTOR CHAIN MEASUREMENTS

Depth, m	2031	2130	2230	0035	0050
0	1506.5	1506.4	1506.3	1505.2	1505.4
10	06.7	06.8	06.4	05.4	05.7
20	06.8	06.8	06.5	05.7	05.8
30	06.9	07.0	06.6	05.8	06.0
50	04.7	04.3	03.9	20.9	03.9
75	02.4	02.3	02.9	02.5	02.9
100	1487.0	1496.5	1498.4	1498.3	1499.0
125	94.0	93.8	94.5	94.9	95.6
150	91.2	91.3	91.8	91.9	92.2
200	88.9	88.7	88.6	88.0	88.3
SC	39	39	39	39	45
DC	55	60	65	51	56
MAX	70	70	79	73	73

Table D-3. Average Sound-Speed Profile (m/sec), Station 2 Run 4 (15-16 February 1972 2031-0052 LST).

Depth, m	Number of Observations	Average Speed	Standard Deviation
0	1575	1506.09	0.39
10	1575	06.28	0.42
20	1575	06.41	0.39
30	1575	06.56	0.39
50	1575	04.03	0.74
75	1575	02.73	0.27
100	1575	1498.13	0.85
125	1575	94.36	0.74
150	1575	91.80	0.46
200	1575	88.50	0.32
250	1575	87.47	0.38
300	7	85.93	0.50
400	4	84.88	1.37
500	2	84.12	2.13
600	2	83.47	0.71
800	2	82.60	0.73
1000	2	83.03	0.36
1200	2	84.16	0.39
1500	2	86.39	0.30
39		1506.71	SC
60		1502.50	DC
75		1502.73	MAX
800		1482.60	AXIS

Table D-4. Average Thermistor Chain Temperatures, Station 2 Run 4 (number of measurements at each depth: 1575).

Depth, m	Temperature, °C			Standard Deviation
	Min	Max	Mean	
0	14.97	15.45	15.24	0.124
6	14.97	15.47	15.25	0.124
11	14.92	15.50	15.25	0.125
17	14.95	15.45	15.24	0.123
23	14.97	15.45	15.24	0.125
28	14.92	15.45	15.24	0.124
34	14.92	15.42	15.22	0.123
39	14.82	15.45	15.20	0.123
45	14.07	15.40	14.77	0.315
51	13.77	14.75	14.24	0.236
56	13.75	14.32	13.96	0.077
62	13.57	14.05	13.88	0.050
68	13.67	13.97	13.86	0.050
73	13.52	13.97	13.86	0.075
79	12.95	13.95	13.65	0.206
85	12.82	13.75	13.24	0.223
90	12.27	13.40	12.93	0.184
96	12.02	13.12	12.71	0.227
101	11.52	12.77	12.25	0.268
107	11.27	12.45	11.92	0.267
113	10.97	12.27	11.67	0.225
118	10.75	11.95	11.41	0.206
124	10.50	11.67	11.15	0.207
130	10.32	11.42	10.91	0.209
135	10.25	11.25	10.69	0.198
141	10.12	10.97	10.51	0.141
147	9.92	10.65	10.36	0.129
152	9.75	10.42	10.14	0.125
158	9.65	10.30	10.02	0.129
164	9.52	10.17	9.87	0.109
169	9.35	10.05	9.71	0.117
175	9.22	9.92	9.55	0.110
180	9.07	9.82	9.39	0.097
186	8.97	9.55	9.25	0.079
192	8.92	9.35	9.15	0.082
197	8.80	9.27	9.06	0.082
203	8.75	9.27	9.01	0.085
209	8.67	9.20	8.93	0.101
214	8.62	9.10	8.86	0.100
220	8.52	9.02	8.80	0.095
226	8.47	8.95	8.71	0.078
231	8.37	8.85	8.64	0.073
237	8.37	8.80	8.62	0.065
242	8.07	8.75	8.55	0.104