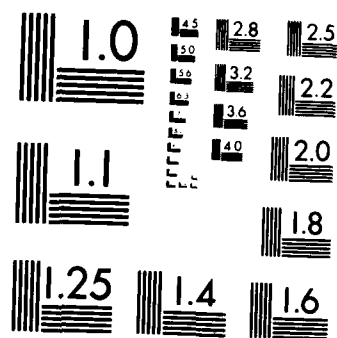


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HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM
OPTOMA23
9-19 November 1986

by

J. Edward Johnson
Paul A. Wittmann
Christopher N.K. Mooers

January 1988

Approved for public release; distribution is unlimited

Prepared for:

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Monterey, California 93943

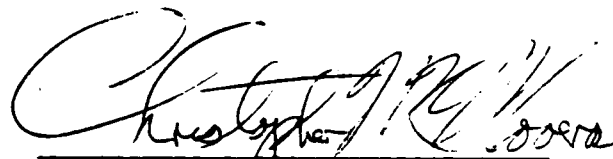
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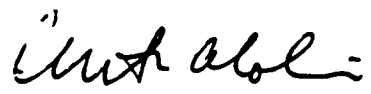
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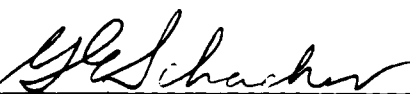

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REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified			1b. RESTRICTIVE MARKINGS		
2a. SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release distribution unlimited		
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE					
4. PERFORMING ORGANIZATION REPORT NUMBER(S) NPS 68-88-001			5. MONITORING ORGANIZATION REPORT NUMBER(S)		
6a. NAME OF PERFORMING ORGANIZATION NAVPGSCOL Dept. of Oceanography		6b. OFFICE SYMBOL (If applicable) 68	7a. NAME OF MONITORING ORGANIZATION		
6c. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5008			7b. ADDRESS (City, State, and ZIP Code)		
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Office of Naval Research		8b. OFFICE SYMBOL (If applicable) (1120 PO)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N000146WR24027		
8c. ADDRESS (City, State, and ZIP Code) Arlington, VA 22217			10. SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO. 61153N	PROJECT NO. RR0310306	TASK NO.
11. TITLE (Include Security Classification) Hydrographic Data from the OPTOMA Program, OPTOMA23, 9-19 November 1986; Approved for public release; distribution unlimited.					
12. PERSONAL AUTHOR(S) J. Edward Johnson, Paul A. Wittmann, Christopher N.K. Mooers					
13a. TYPE OF REPORT Progress		13b. TIME COVERED FROM <u>Nov 86</u> TO <u>Sep 87</u>		14. DATE OF REPORT (Year, Month, Day) 88 January 08	
15. PAGE COUNT 88					
16. SUPPLEMENTARY NOTATION					
17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	California Current System		
			Physical Oceanography		
			Dynamic Oceanography		
19. ABSTRACT (Continue on reverse if necessary and identify by block number) Five P3 flights comprising OPTOMA23 were undertaken from 9 November 1986 through 19 November 1986 to sample a subdomain of the California Current System. This report presents the hydrographic data, acquired by AXBT deployments, from the flights.					
20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS			21. ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a. NAME OF RESPONSIBLE INDIVIDUAL J. Edward Johnson			22b. TELEPHONE (Include Area Code) (602) 688-5737		22c. OFFICE SYMBOL 68

Hydrographic Data from the **OPTOMA** Program:

OPTOMA23

9 - 19 November, 1986

by

*J. Edward Johnson
Paul A. Wittmann
Christopher N. K. Mooers*

*Chief Scientist:
J. Edward Johnson*



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The **OPTOMA** Program is a joint program of

Department of Oceanography
Naval Postgraduate School
Monterey, CA 93943.

Center for Earth and Planetary Physics
Harvard University
Cambridge, MA 02138.

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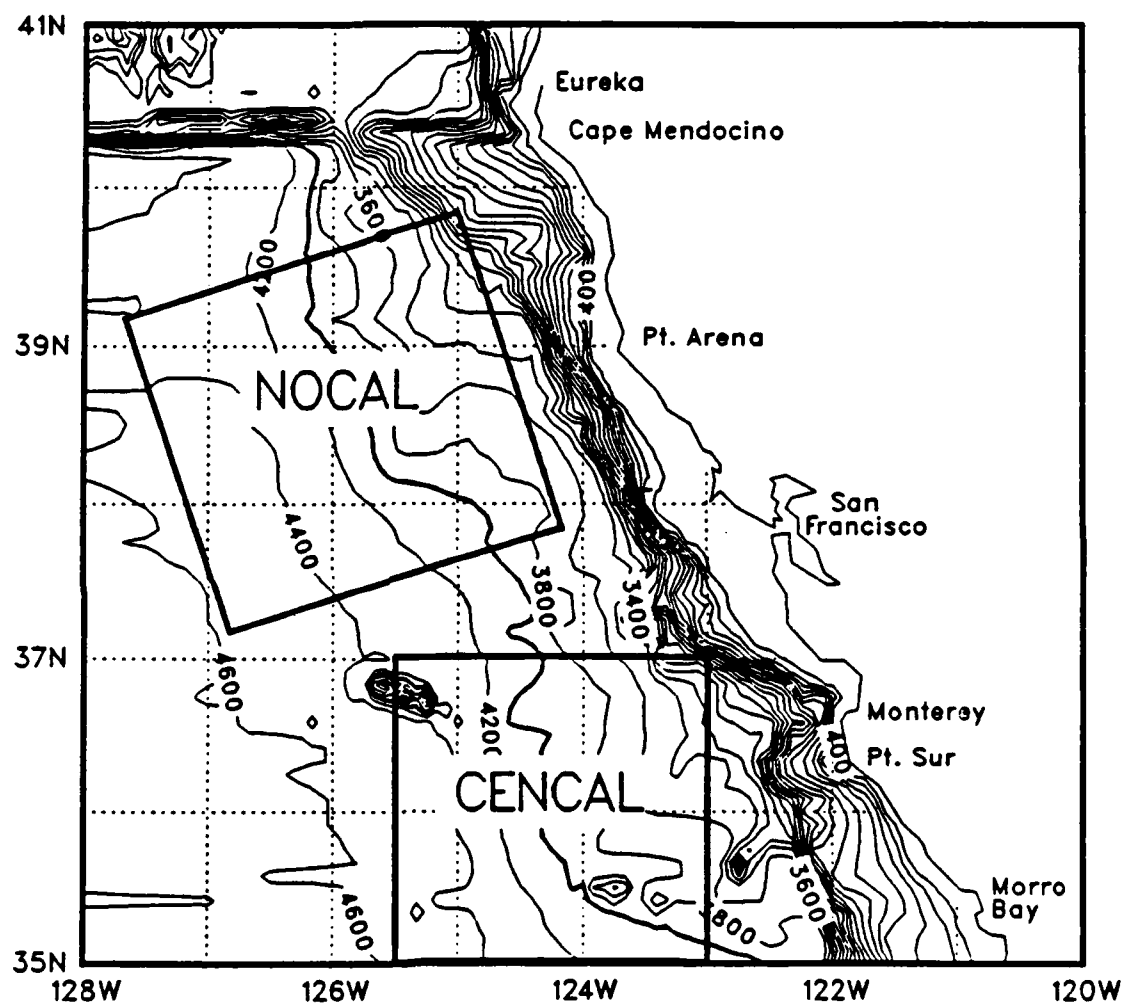


Figure 1: The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observation, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System (CCS) and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises and flights were planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

Naval Oceanographic Office (NAVOCEANO) Project OS-06-87 was a two week deployment of the BIRDSEYE RP-3D aircraft in support of the OPTOMA program. A total of six flights were flown between 9 and 19 November; five of these were surveys of the OPTOMA domain and one was an acoustical survey of Monterey Bay. During the last two flights, the R/V POINT SUR acquired data in the CENCAL domain.

OPTOMA 23 is the last of the OPTOMA surveys and it is unique in that this was the first effort to integrate concurrent satellite, drifting buoy, ship, and aircraft data in a comprehensive oceanographic, meteorological and acoustical study of the CCS. Specific goals of the airborne surveys were to:

- provide synoptic data for objective analysis of various parameters (e.g., SST from AXBT and PRT-5, mixed layer depth, thermal structure)
- provide initialization, boundary condition updating, and verification fields for dynamical model forecasts
- coordinate the observational strategy of the R/V POINT SUR by using near-real-time analyses to vector the ship into areas of interesting mesoscale activity

The aircraft flew at an altitude of 800 to 1000 feet at a speed of 240 knots. Each survey took about 9 hours to accomplish including 2 hours transit time to and from Monterey airport. Approximately 100 airborne expendable bathythermographs (AXBT) were deployed on each flight over the tracks shown in figures 2,7 12,17 and 22. Station positions were determined by two Litton 72 inertial navigation systems supplemented by LORAN C fixes and are estimated to be accurate to within about 0.1 km. Nominal station spacing was about 40 km along-track.

DATA ACQUISITION

Data acquired during OPTOMA23 include temperature-depth profiles from Sippican, Hermes, and Magnavox AXBT's, and PRT-5 surface temperatures, with accuracies as given in Table 1. The AXBT data were digitized at 0.1 second intervals

using the NPS Airborne Digital Data Acquisition System with a Sippican MK9 unit and the NAVOCEANO airborne acquisition system. Continuous flight level dewpoint, flight level temperature, PRT-5 sea surface temperature, and PRT-5 upward looking measurements (to detect overcast conditions) were also recorded on strip chart and digitized on 9-track tape. All data were recorded on strip charts, cassette tapes or on 9-track tapes. In this report, the AXBT data are presented.

DATA PROCESSING

All data were transferred to the IBM 3033 mainframe computer for editing and processing. The digitized AXBT data were edited with a spike removal routine and smoothed. Since the AXBT's used were from three different manufacturers, the standard Navy equation was used to convert AXBT time of fall to depth.

AXBT failure rate for various reasons was high, about 20%. Of the remaining records, approximately 96% were retained in the data set. The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, DC.

DATA PRESENTATION

The flight tracks, station locations, and station numbers are shown for each of the five OPTOMA legs in figures 3,8,13,18, and 23. On the flight track figures, transect extremes are identified by letter to aid in cross-referencing the data presented in subsequent figures. These figures are followed by a listing of the stations with their coordinates, the date and time when each station was occupied, and the surface information obtained at the station.

Vertical profiles of temperature from the AXBT casts are shown in staggered fashion. The first profile on each plot is shown with its temperature unchanged; to each subsequent profile, an appropriate multiple of 5 C has been added. The location of these profiles may be found by reference to the various maps of the cruise tracks. Transect extremes are identified as nearly as possible.

Vertical transects of the temperature field are shown on the next pages. The tick marks identify station positions and, again, the transect extremes are shown on these plots.

Mean profiles of temperature and the standard deviation envelope from the AXBT's for each flight are given in figures 6,11,16,21, and 26.

Table 1: Scientific instruments aboard the RP-3D BIRDSEYE aircraft

Instrument	Variable	Range	Operational Accuracy
Hygrometer Cambridge System Model 137-00-53	Dew Point	$\pm 50^{\circ} \text{C}$	1.0°C
Rosemont Temperature Probe 102E4AL	Air Temp	-60°C to $+40^{\circ} \text{C}$	5%
Sippican Magnavox Hermes AXBT	Temperature to 300 or 800 m	-2 to $+35^{\circ} \text{C}$	0.2°C
	Depth		5% depth
Litton 72 Inertial Navigation	Position	N/A	2 km
Airborne Radiation Thermometer (PRT-5)	Surface Temp	-0.2 to $+35^{\circ} \text{C}$	$\pm 0.4^{\circ} \text{C}$

Section 1

OPTOMA 23 Flight P1

9 November 1986

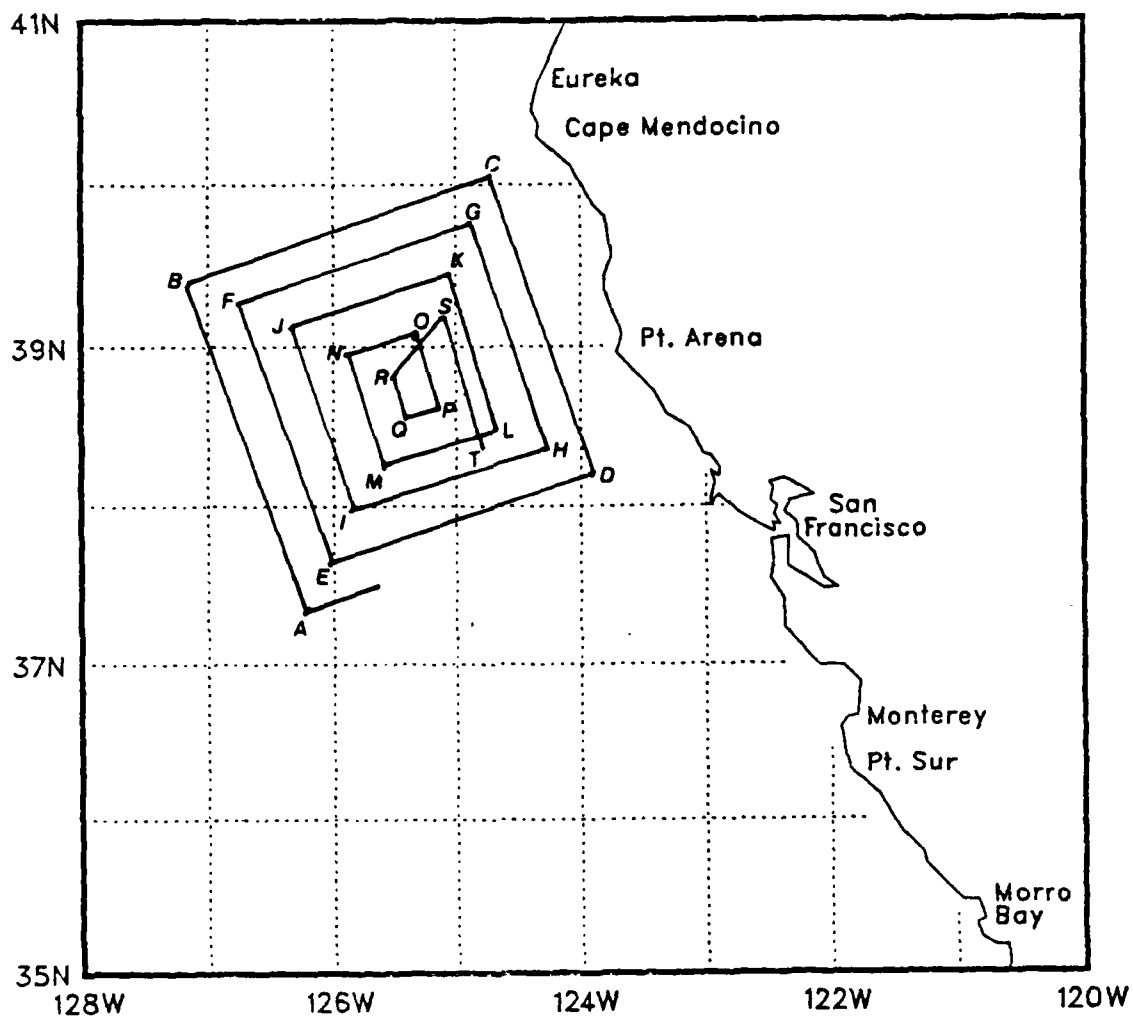


Figure 2. The flight track for OPTOMA 23, leg P1.

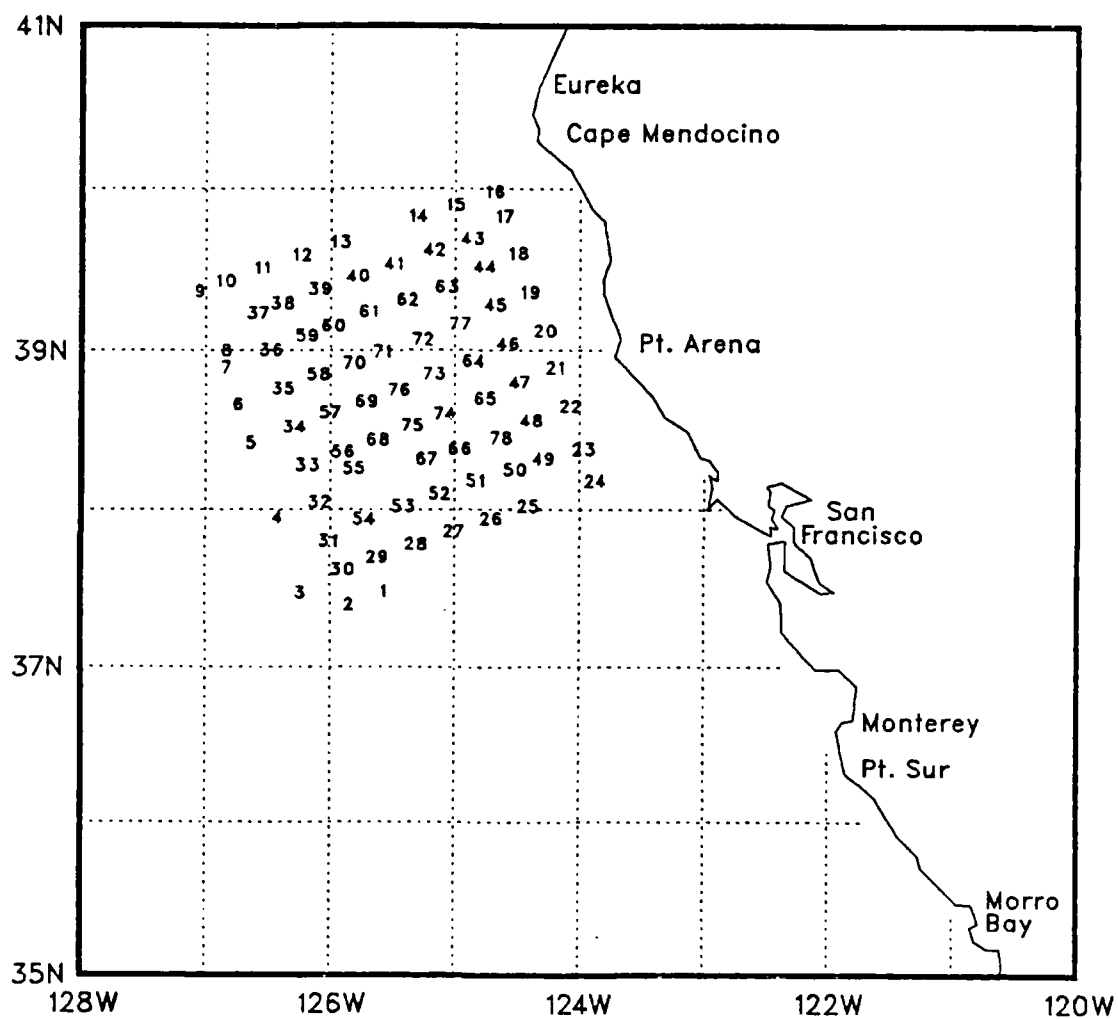


Figure 3. AXBT locations for OPTOMA 23, leg P1.

Table 1: Flight 1 Station Listing

Stn	Type	Yr/Day	GMT	Lat (North) (dd. mm)	Long (West) (ddd. mm)	Surface Temp (deg C)
1	AXBT	86313	1818	37.27	125.35	13.9
2	AXBT	86313	1823	37.22	125.53	14.9
3	AXBT	86313	1829	37.26	126.16	14.9
4	AXBT	86313	1838	37.55	126.28	14.6
5	AXBT	86313	1846	38.23	126.40	16.2
6	AXBT	86313	1850	38.38	126.46	15.6
7	AXBT	86313	1854	38.52	126.52	15.0
8	AXBT	86313	1858	38.58	126.52	14.0
9	AXBT	86313	1902	39.20	127.05	16.0
10	AXBT	86313	1904	39.24	126.55	15.6
11	AXBT	86313	1908	39.29	126.36	15.2
12	AXBT	86313	1912	39.34	126.17	14.3
13	AXBT	86313	1915	39.38	125.59	14.3
14	AXBT	86313	1923	39.48	125.22	13.2
15	AXBT	86313	1927	39.52	125.04	12.7
16	AXBT	86313	1930	39.57	124.45	13.0
17	AXBT	86313	1933	39.48	124.40	12.6
18	AXBT	86313	1936	39.34	124.34	12.4
19	AXBT	86313	1940	39.20	124.28	12.4
20	AXBT	86313	1943	39.05	124.22	14.4
21	AXBT	86313	1946	38.52	124.16	14.3
22	AXBT	86313	1950	38.37	124.09	14.3
23	AXBT	86313	1953	38.21	124.03	13.9
24	AXBT	86313	1956	38.09	123.57	13.7
25	AXBT	86313	2004	37.59	124.29	12.8
26	AXBT	86313	2008	37.55	124.47	13.5
27	AXBT	86313	2011	37.50	125.05	13.8
28	AXBT	86313	2015	37.45	125.23	13.9
29	AXBT	86313	2019	37.40	125.42	14.5
30	AXBT	86313	2023	37.35	125.59	13.9
31	AXBT	86313	2027	37.46	126.05	14.2
32	AXBT	86313	2031	38.01	126.10	13.9
33	AXBT	86313	2035	38.15	126.16	14.9
34	AXBT	86313	2039	38.29	126.22	15.7
35	AXBT	86313	2043	38.44	126.28	15.8
36	AXBT	86313	2048	38.58	126.34	14.6
37	AXBT	86313	2052	39.12	126.40	14.6
38	AXBT	86313	2055	39.16	126.28	14.6
39	AXBT	86313	2059	39.21	126.10	14.6
40	AXBT	86313	2102	39.26	125.52	14.4
41	AXBT	86313	2107	39.30	125.34	14.0
42	AXBT	86313	2110	39.35	125.15	13.4
43	AXBT	86313	2114	39.40	124.57	14.1
44	AXBT	86313	2117	39.29	124.51	14.0
45	AXBT	86313	2120	39.15	124.46	14.2

Stn	Type	Yr/Day	GMT	Lat (North) (dd. mm)	Long (West) (ddd. mm)	Surface Temp (deg C)
46	AXBT	86313	2124	39.01	124.40	14.3
47	AXBT	86313	2127	38.46	124.34	14.2
48	AXBT	86313	2130	38.32	124.28	13.9
49	AXBT	86313	2134	38.17	124.22	13.7
50	AXBT	86313	2137	38.13	124.36	13.6
51	AXBT	86313	2141	38.09	124.54	13.2
52	AXBT	86313	2145	38.04	125.12	13.3
53	AXBT	86313	2149	37.59	125.30	13.8
54	AXBT	86313	2153	37.55	125.49	14.2
55	AXBT	86313	2157	38.14	125.53	13.4
56	AXBT	86313	2201	38.20	125.59	14.3
57	AXBT	86313	2205	38.35	126.05	15.6
58	AXBT	86313	2209	38.49	126.11	15.9
59	AXBT	86313	2213	39.04	126.16	15.1
60	AXBT	86313	2217	39.07	126.04	15.5
61	AXBT	86313	2220	39.13	125.46	15.1
62	AXBT	86313	2224	39.17	125.28	13.0
63	AXBT	86313	2228	39.22	125.09	13.2
64	AXBT	86313	2235	38.54	124.56	13.7
65	AXBT	86313	2239	38.40	124.50	14.0
66	AXBT	86313	2247	38.21	125.02	13.6
67	AXBT	86313	2251	38.17	125.18	13.7
68	AXBT	86313	2258	38.25	125.42	14.4
69	AXBT	86313	2303	38.39	125.47	15.1
70	AXBT	86313	2307	38.53	125.53	15.7
71	AXBT	86313	2310	38.58	125.39	15.6
72	AXBT	86313	2314	39.02	125.20	14.7
73	AXBT	86313	2318	38.49	125.15	13.8
74	AXBT	86313	2321	38.34	125.10	14.1
75	AXBT	86313	2325	38.30	125.25	13.6
76	AXBT	86313	2329	38.43	125.32	13.9
77	AXBT	86313	2340	39.08	125.02	14.1
78	AXBT	86313	2351	38.25	124.43	13.7

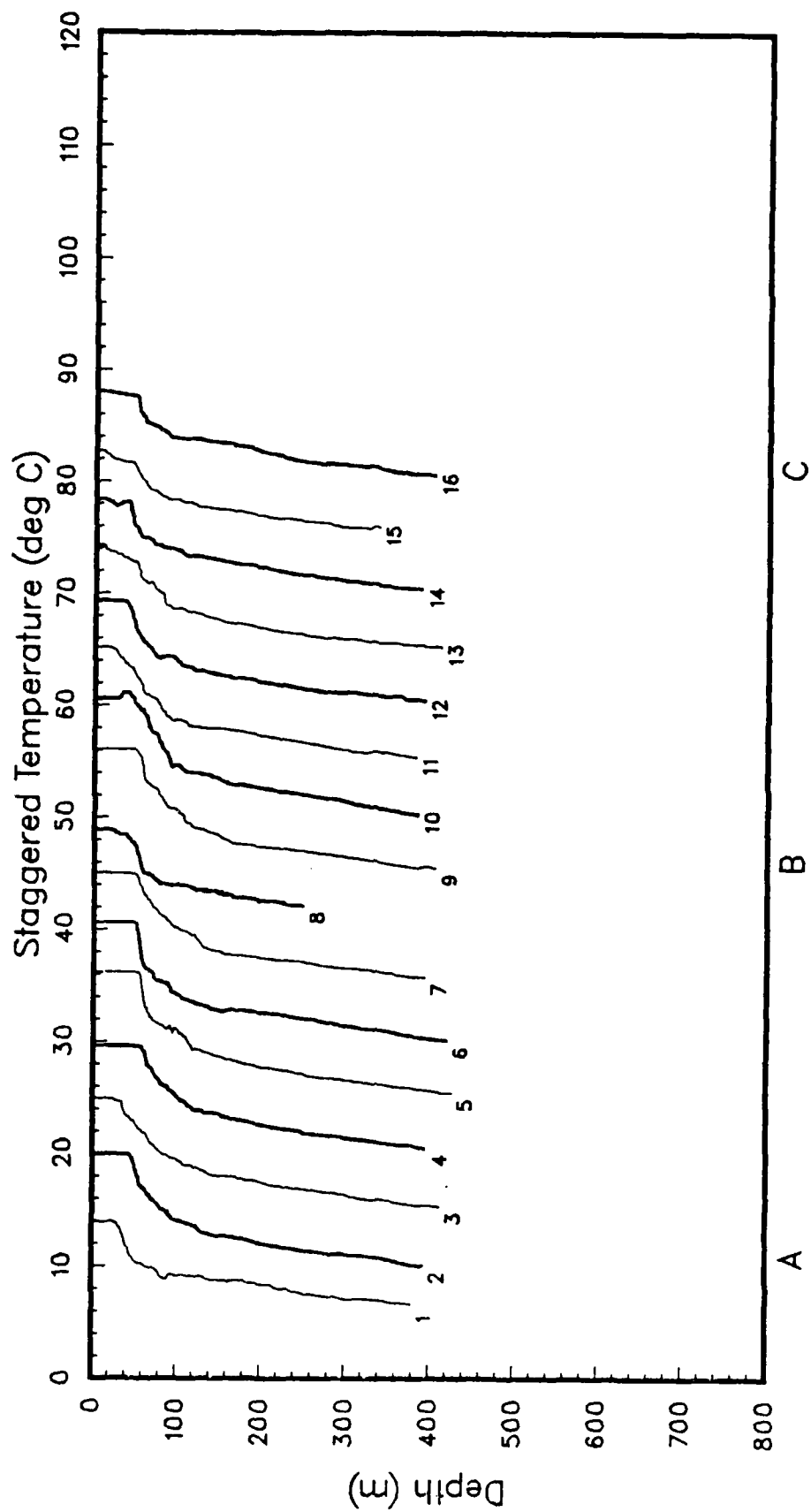


Figure 4(a). AXBT temperature profiles, staggered by multiples of 5 C (OPTOMA 23, leg P1).

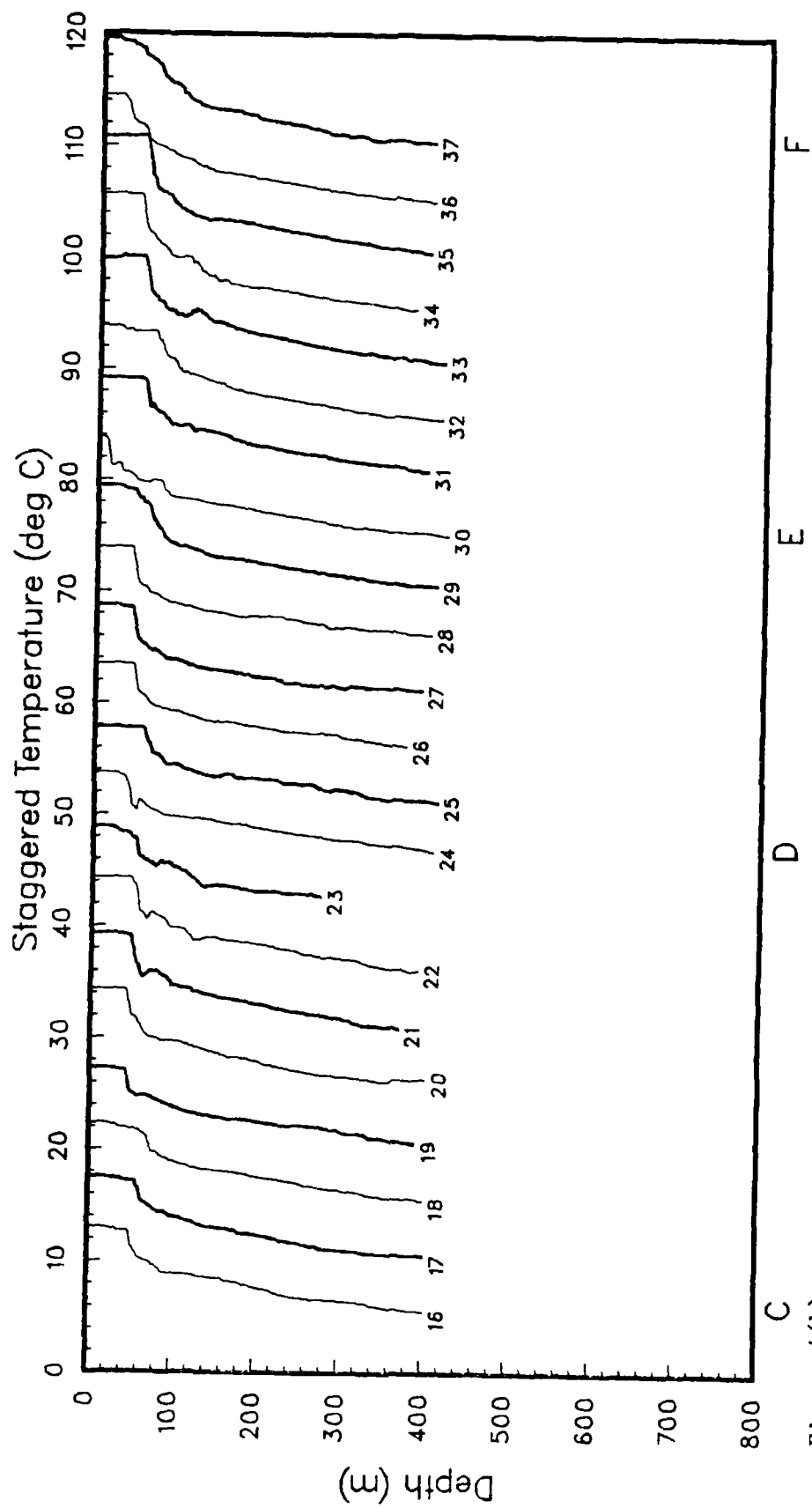


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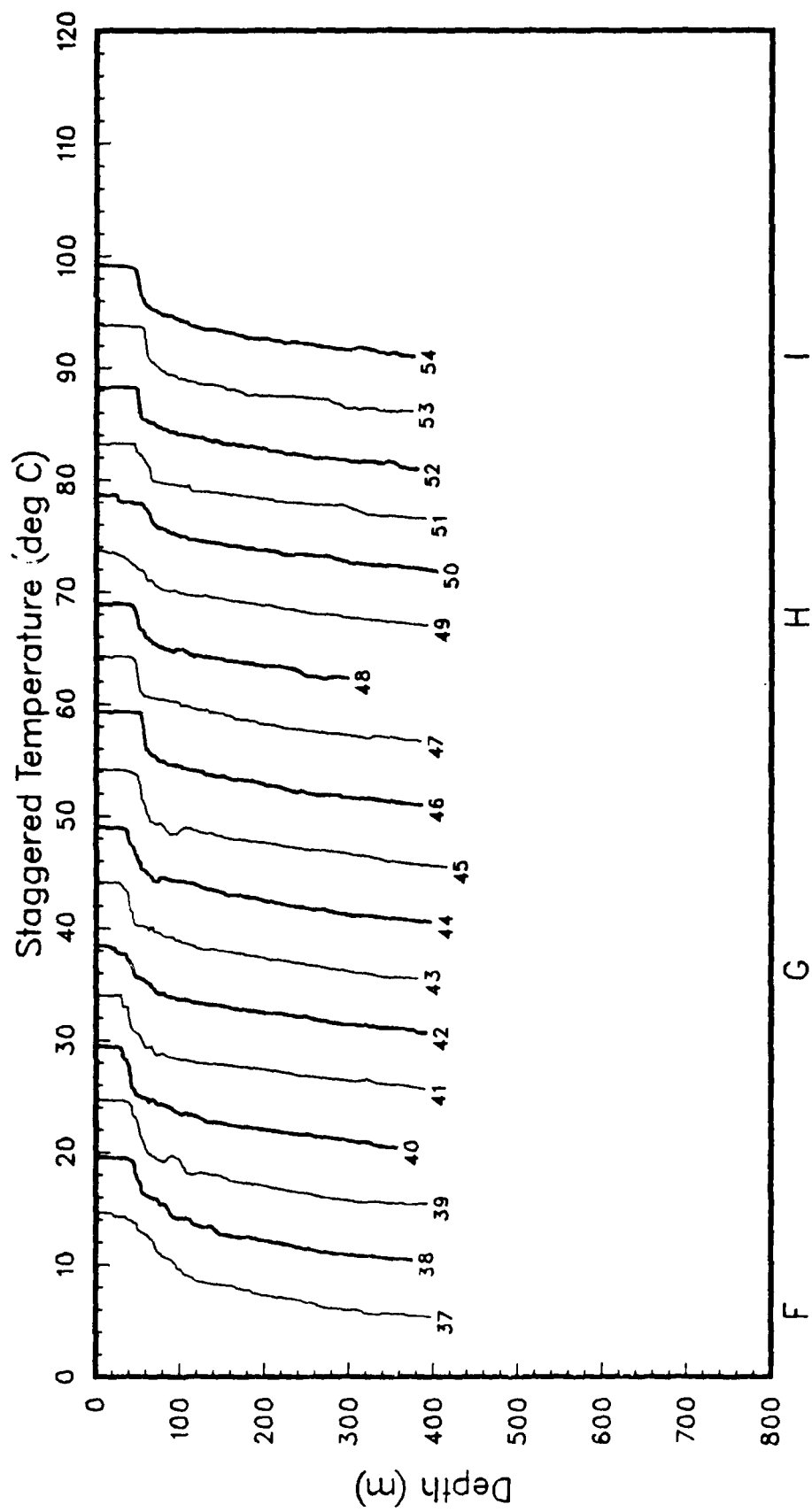


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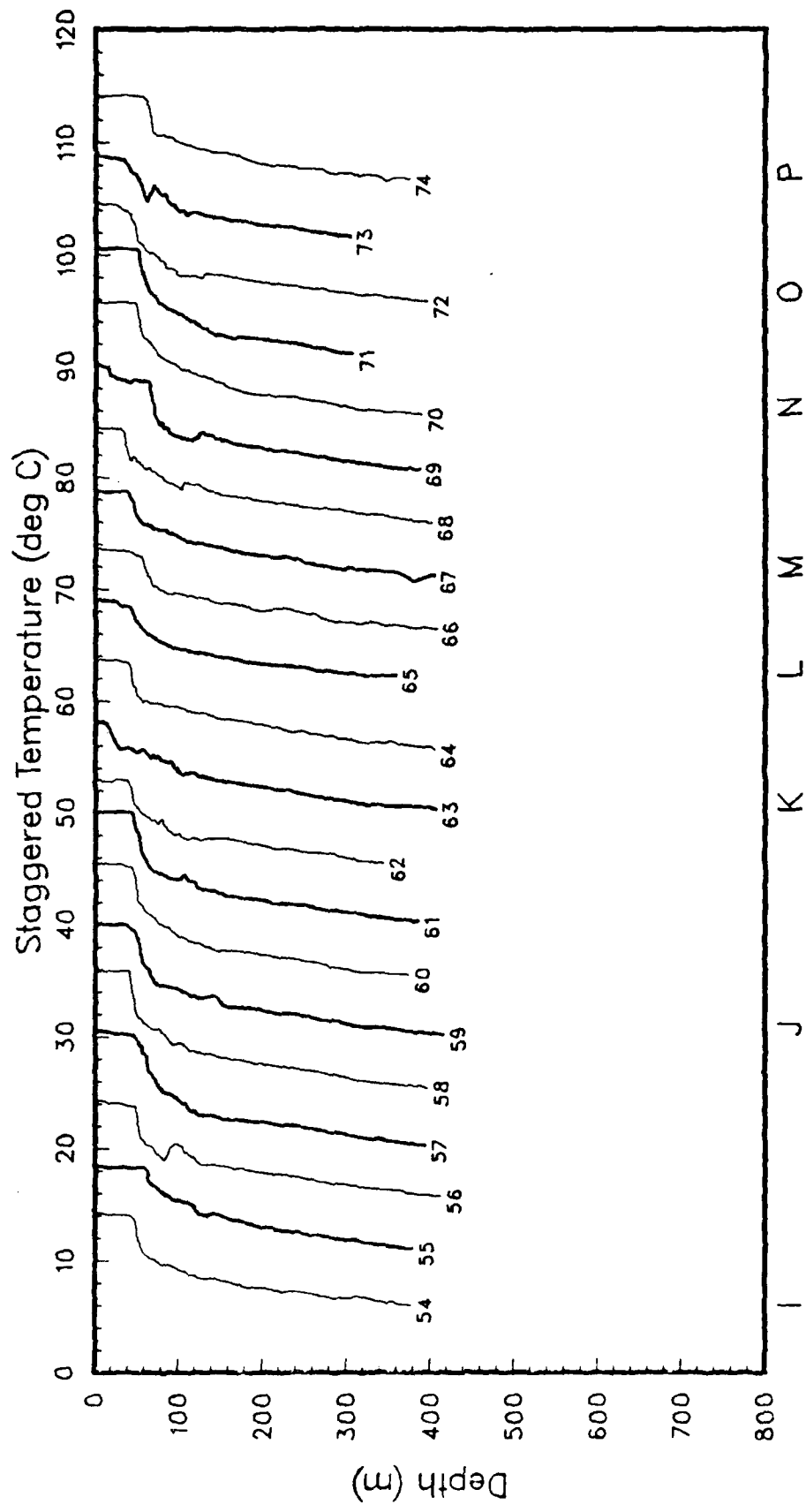


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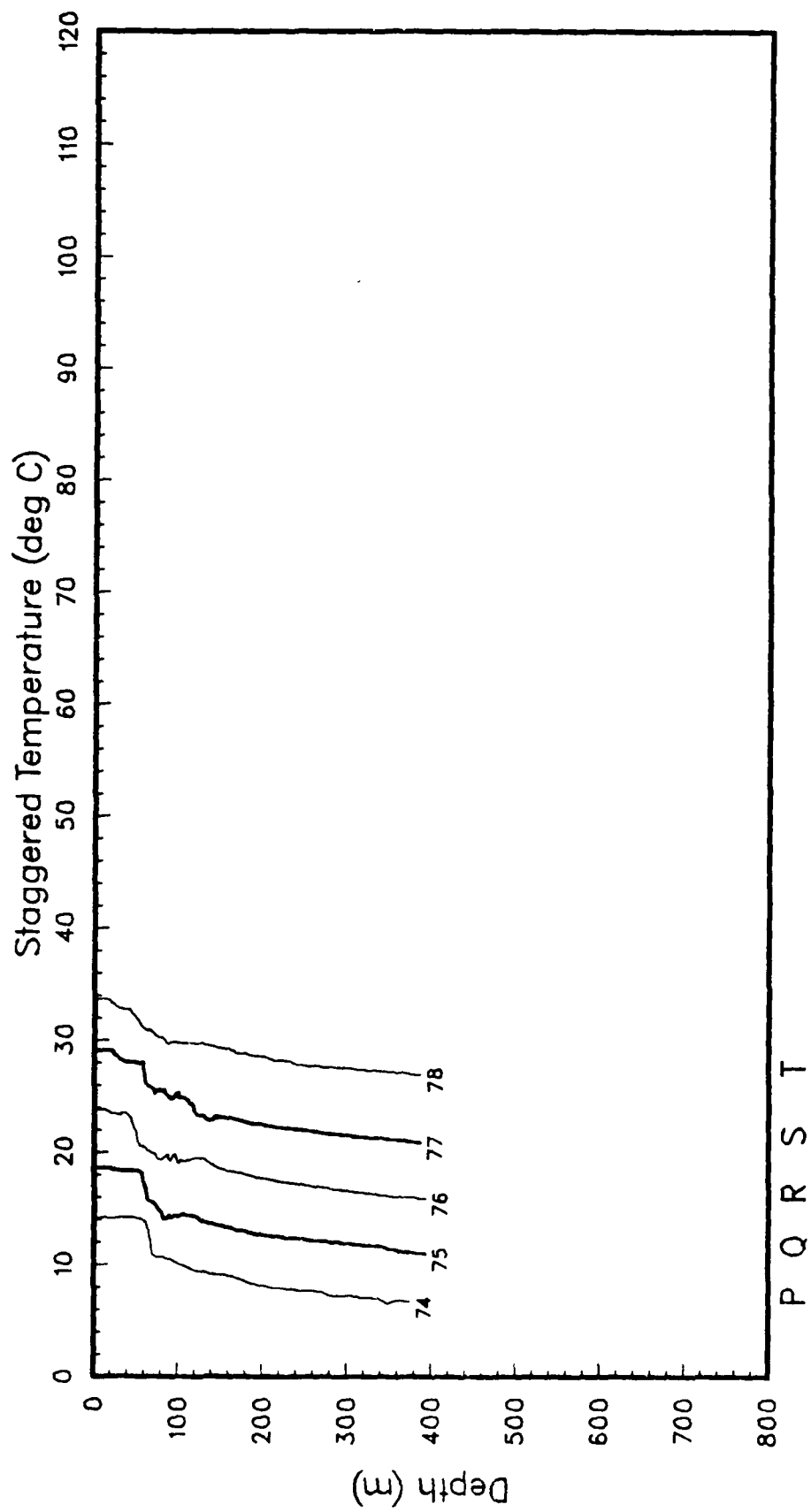


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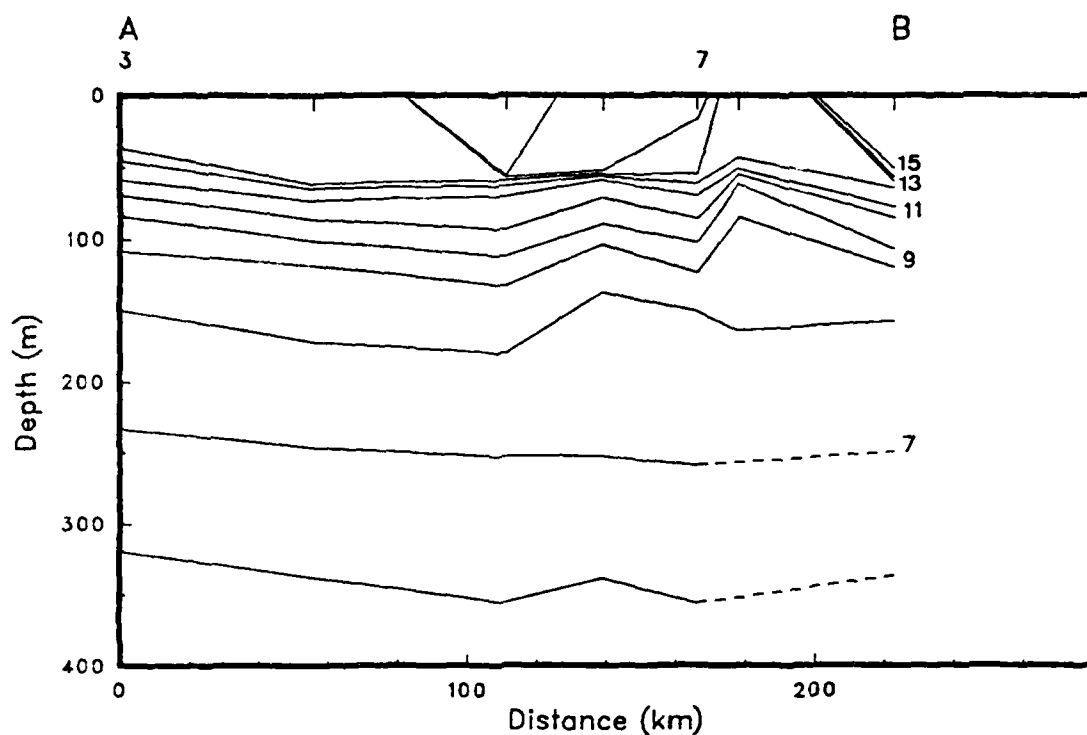


Figure 5(a). Along-track isotherms. Tickmarks along the upper horizontal axis show station positions. Some station numbers are given. Dashed lines are used if cast was too shallow (OPTOMA 23, leg P1).

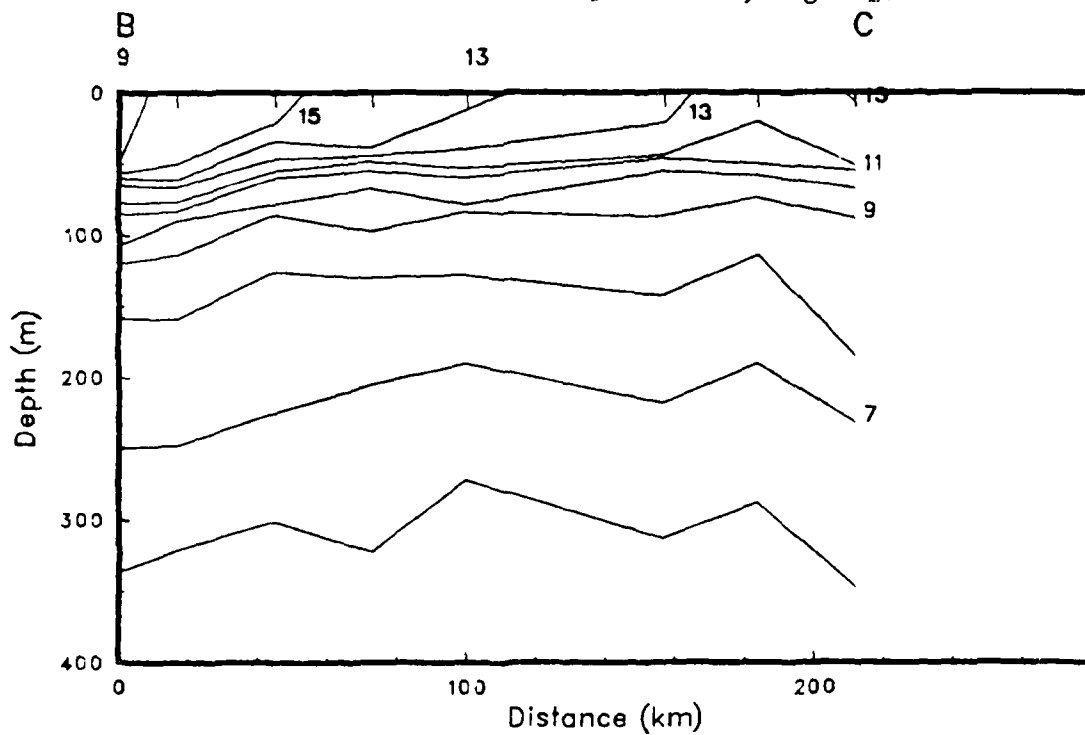


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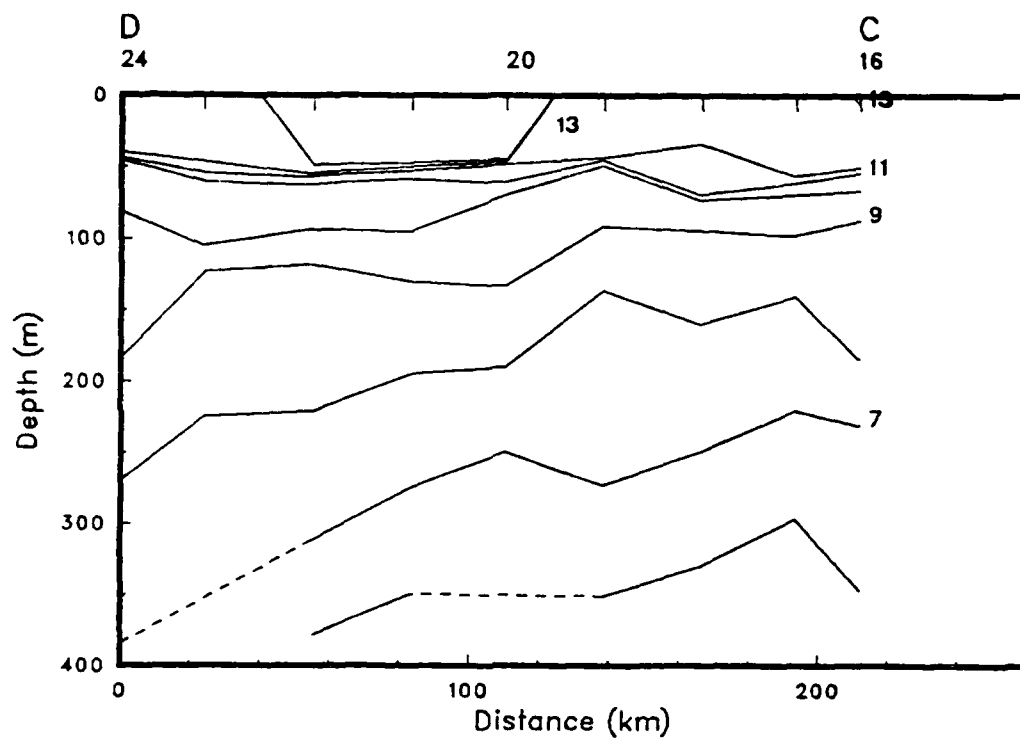


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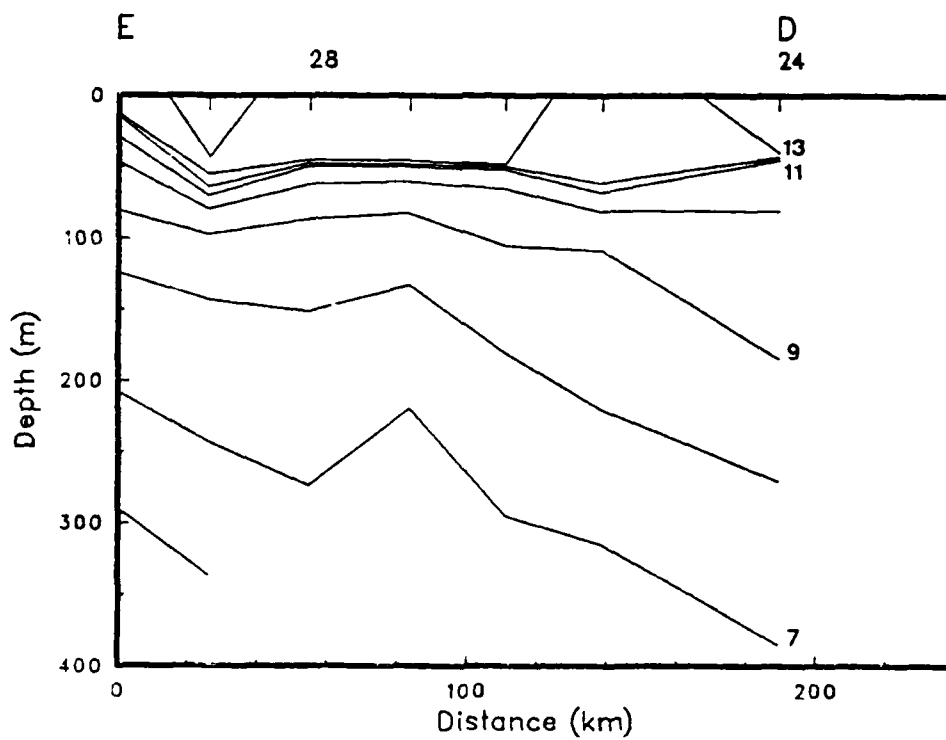


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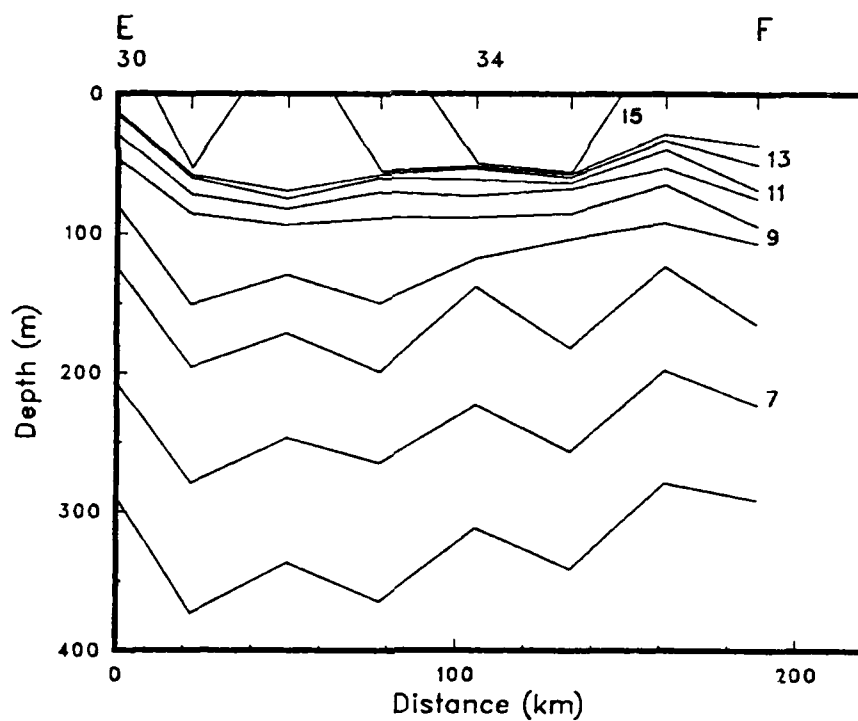


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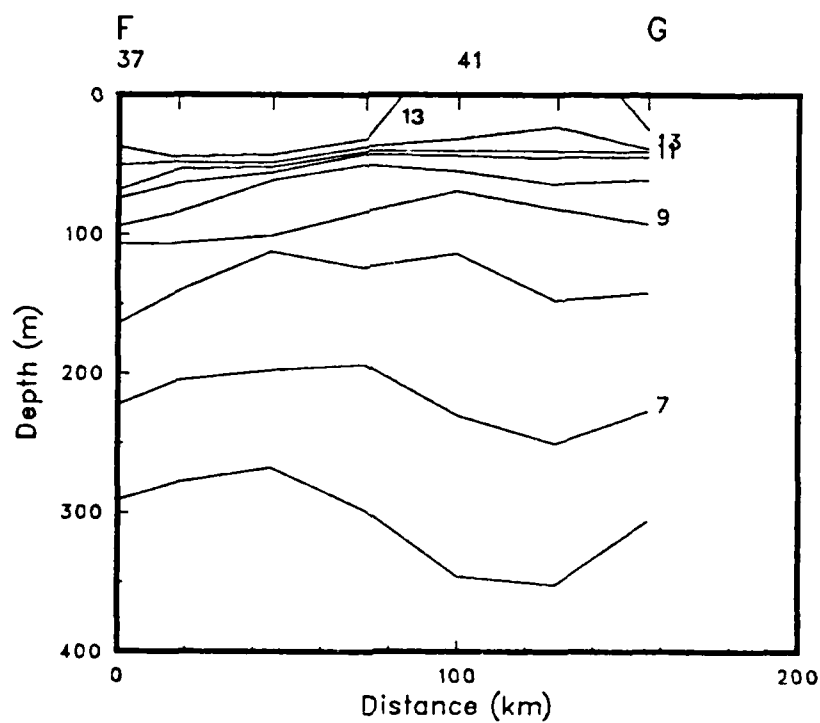


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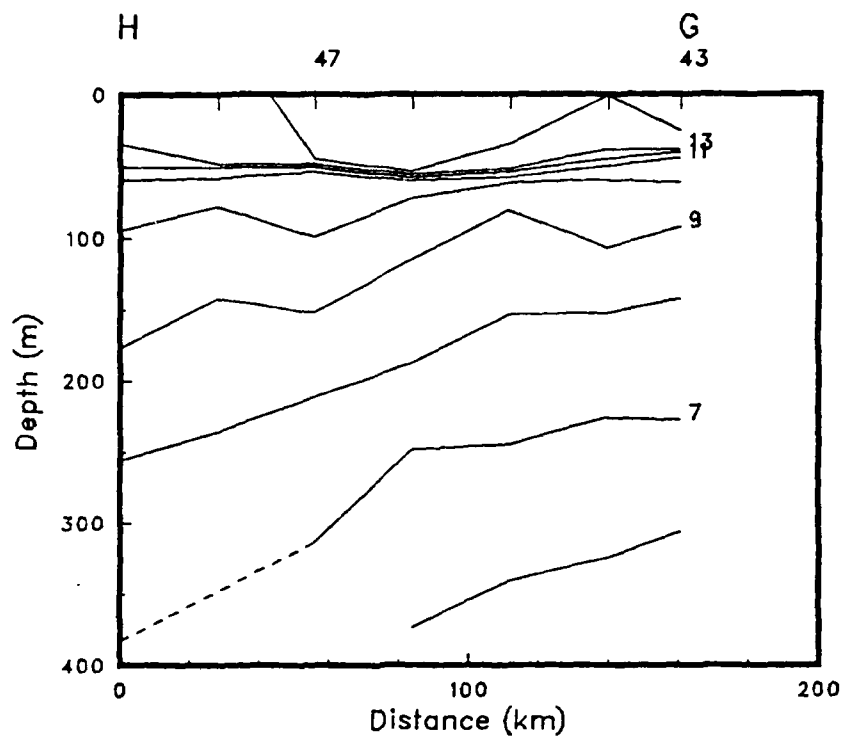


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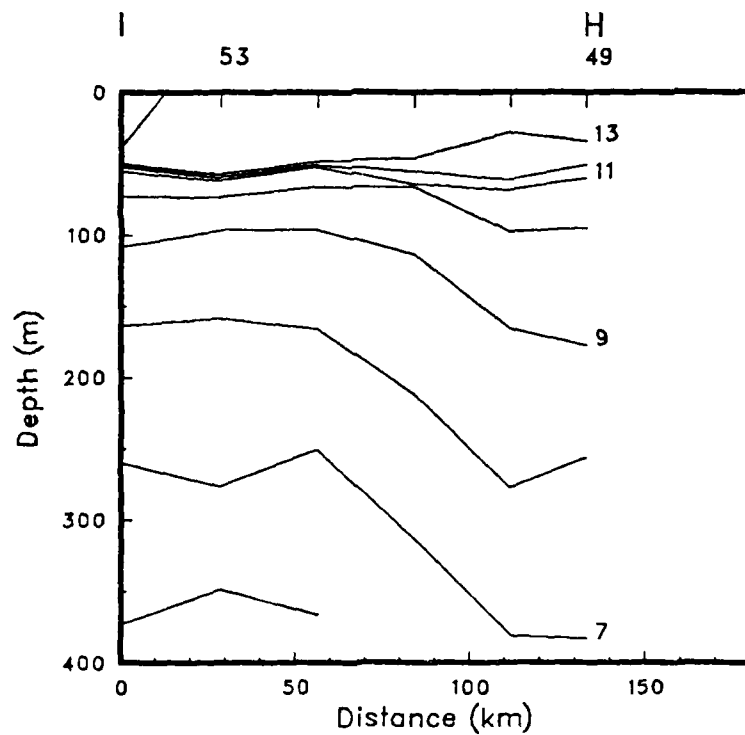


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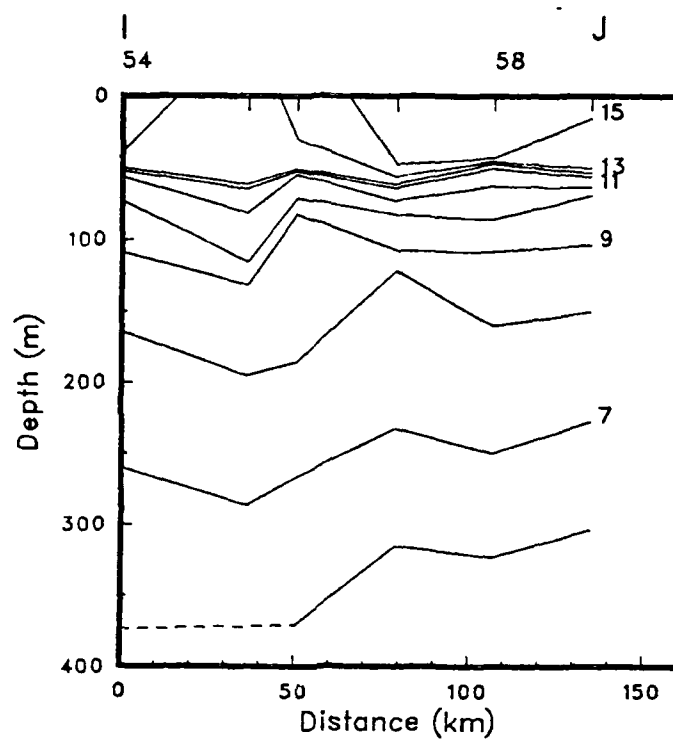


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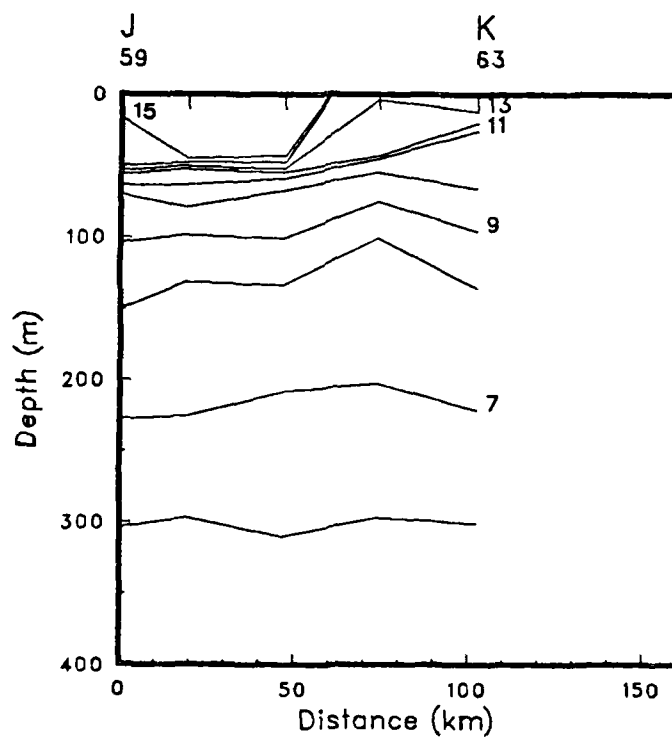


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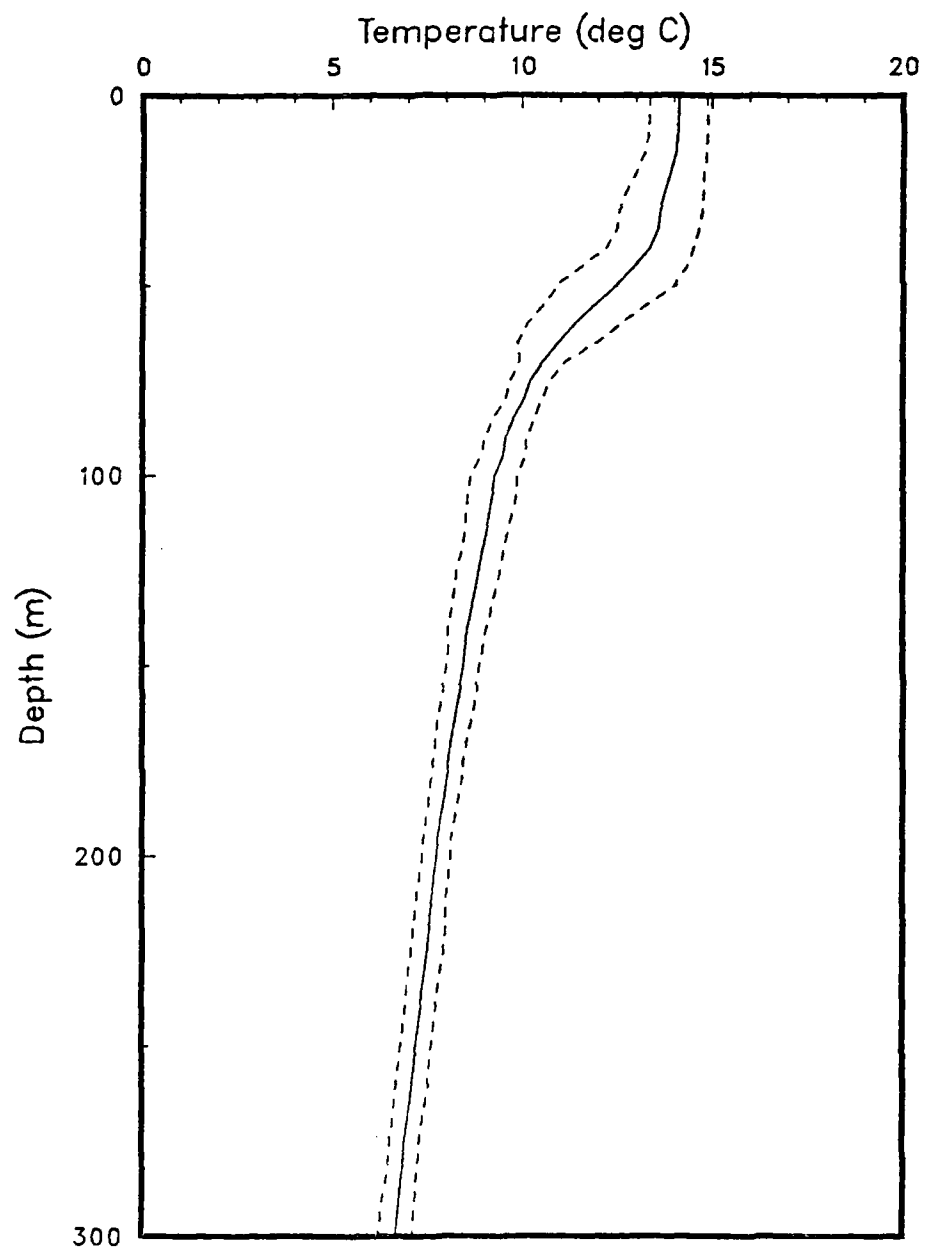


Figure 6. Mean temperature profile with the + and - standard deviation (OPTOMA 23, leg P1).

Section 2

OPTOMA 23 FLIGHT P2

10 November 1986

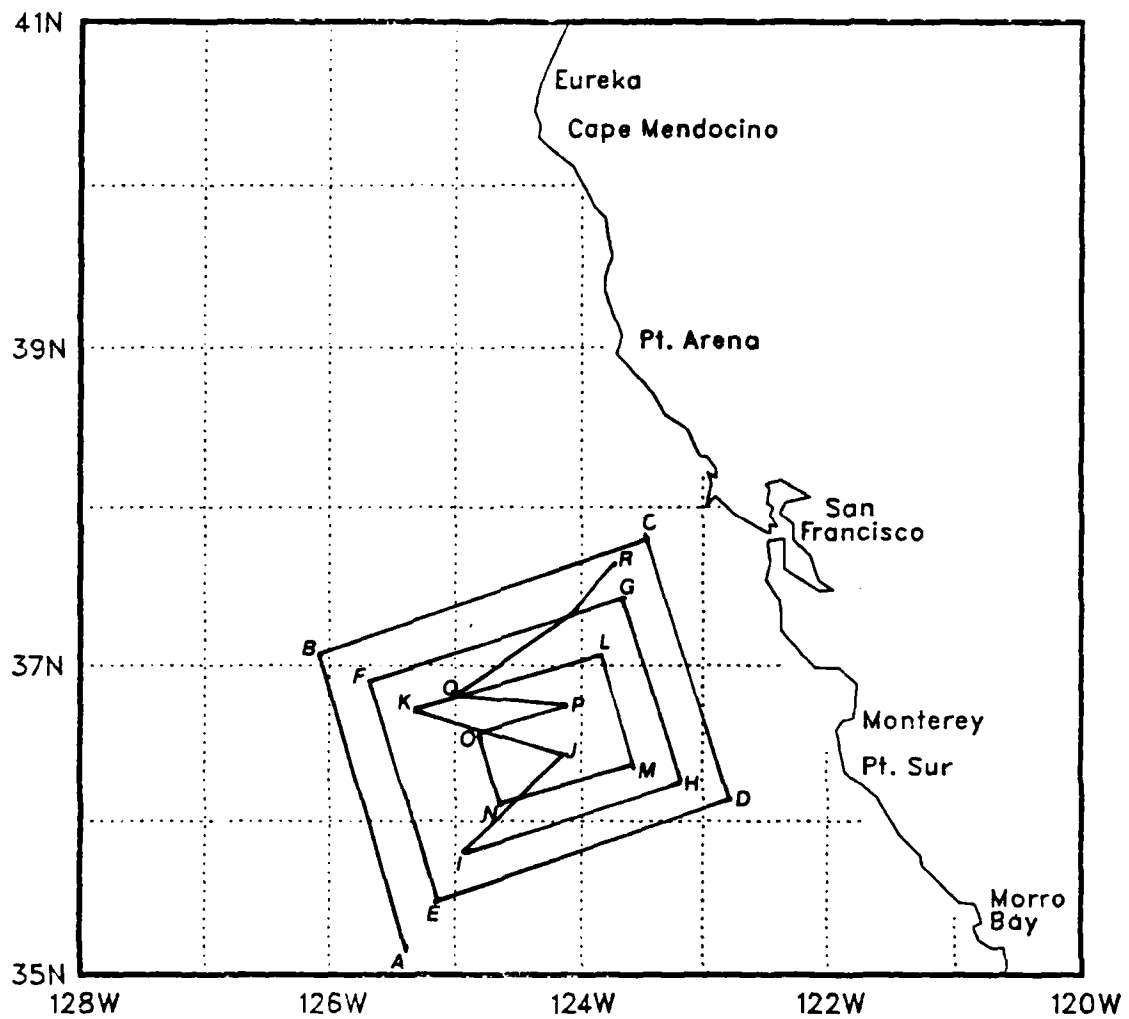


Figure 7. The flight track for OPTOMA 23, flight P2.

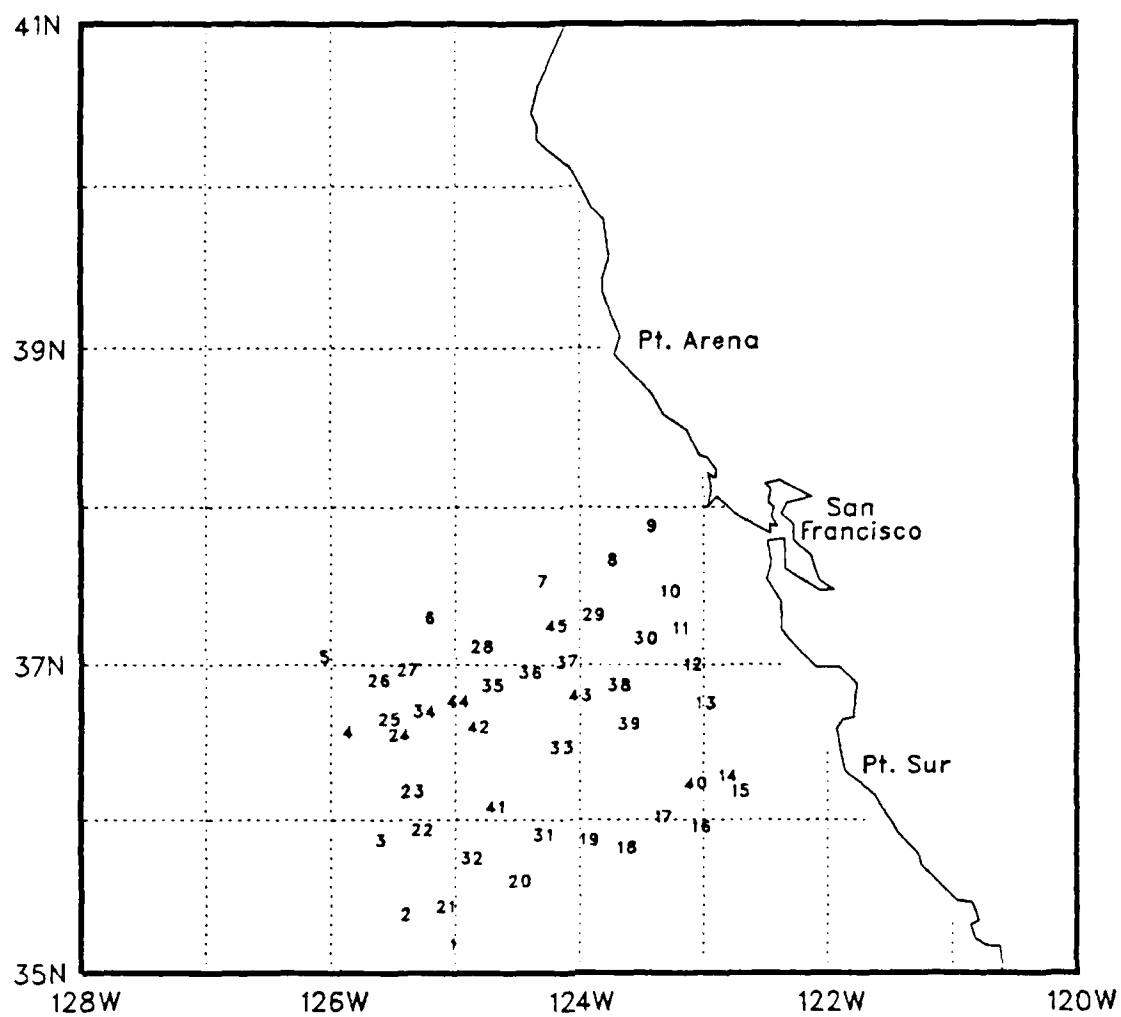


Figure 8. AXBT locations for OPTOMA 23, flight P2.

Table 2: Flight 2 Station Listing

Stn	Type	Yr/Day	GMT	Lat (North) (dd.mm)	Long (West) (ddd.mm)	Surface Temp (deg C)
1	AXBT	86314	1922	35.09	125.02	16.7
2	AXBT	86314	1931	35.21	125.26	14.8
3	AXBT	86314	1940	35.50	125.38	14.7
4	AXBT	86314	1951	36.32	125.54	13.7
5	AXBT	86314	2000	37.01	126.05	14.7
6	AXBT	86314	2012	37.16	125.14	14.4
7	AXBT	86314	2024	37.30	124.20	14.0
8	AXBT	86314	2031	37.38	123.46	13.6
9	AXBT	86314	2035	37.51	123.27	12.8
10	AXBT	86314	2039	37.26	123.20	13.1
11	AXBT	86314	2043	37.12	123.14	14.1
12	AXBT	86314	2047	36.58	123.09	14.2
13	AXBT	86314	2050	36.43	123.03	14.3
14	AXBT	86314	2057	36.15	122.52	14.0
15	AXBT	86314	2100	36.09	122.46	13.9
16	AXBT	86314	2105	35.55	123.05	13.6
17	AXBT	86314	2108	35.59	123.23	13.7
18	AXBT	86314	2112	35.47	123.41	15.3
19	AXBT	86314	2115	35.50	123.59	15.4
20	AXBT	86314	2123	35.34	124.34	14.5
21	AXBT	86314	2130	35.24	125.09	16.1
22	AXBT	86314	2140	35.54	125.21	15.1
23	AXBT	86314	2144	36.09	125.26	15.3
24	AXBT	86314	2148	36.31	125.32	15.3
25	AXBT	86314	2152	36.37	125.37	15.1
26	AXBT	86314	2155	36.52	125.42	14.7
27	AXBT	86314	2159	36.56	125.28	14.9
28	AXBT	86314	2207	37.05	124.52	15.0
29	AXBT	86314	2218	37.17	123.58	13.9
30	AXBT	86314	2226	37.08	123.33	13.3
31	AXBT	86314	2255	35.52	124.22	14.4
32	AXBT	86314	2302	35.43	124.57	15.6
33	AXBT	86314	2314	36.26	124.14	15.0
34	AXBT	86314	2318	36.40	125.20	15.1
35	AXBT	86314	2326	36.50	124.47	15.1
36	AXBT	86314	2330	36.55	124.29	14.2
37	AXBT	86314	2333	36.59	124.11	14.6
38	AXBT	86314	2341	36.50	123.46	14.2
39	AXBT	86314	2344	36.35	123.41	14.5
40	AXBT	86314	2355	36.12	123.09	14.4
41	AXBT	86315	3	36.03	124.45	14.2
42	AXBT	86315	11	36.34	124.54	14.4
43	AXBT	86315	21	36.46	124.05	14.6
44	AXBT	86315	41	36.44	125.04	15.1
45	AXBT	86315	100	37.13	124.16	14.6

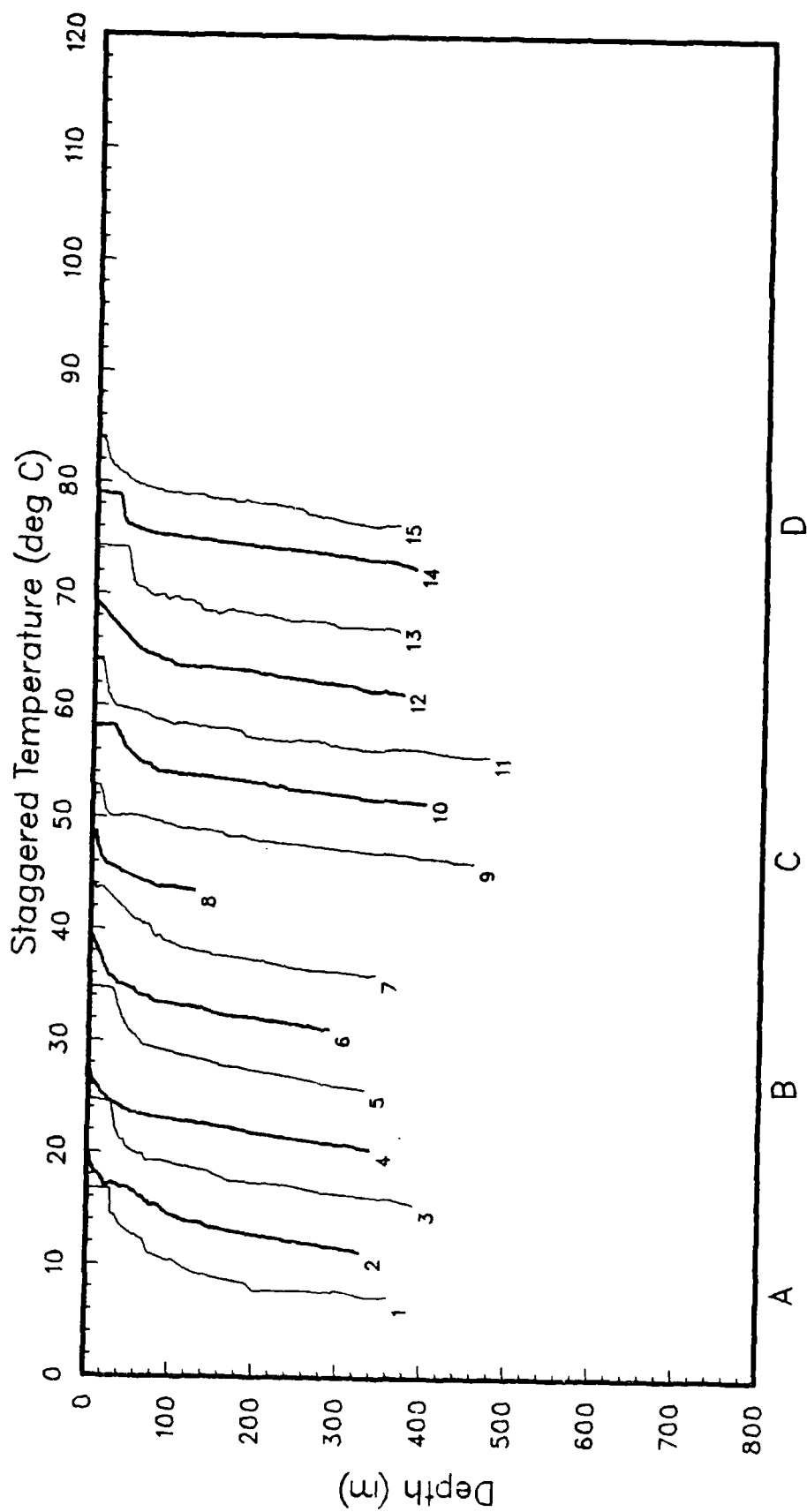


Figure 9(a). AXBT temperature profiles, staggered by multiples of 5 C (OPTOMA 23, flight P2).

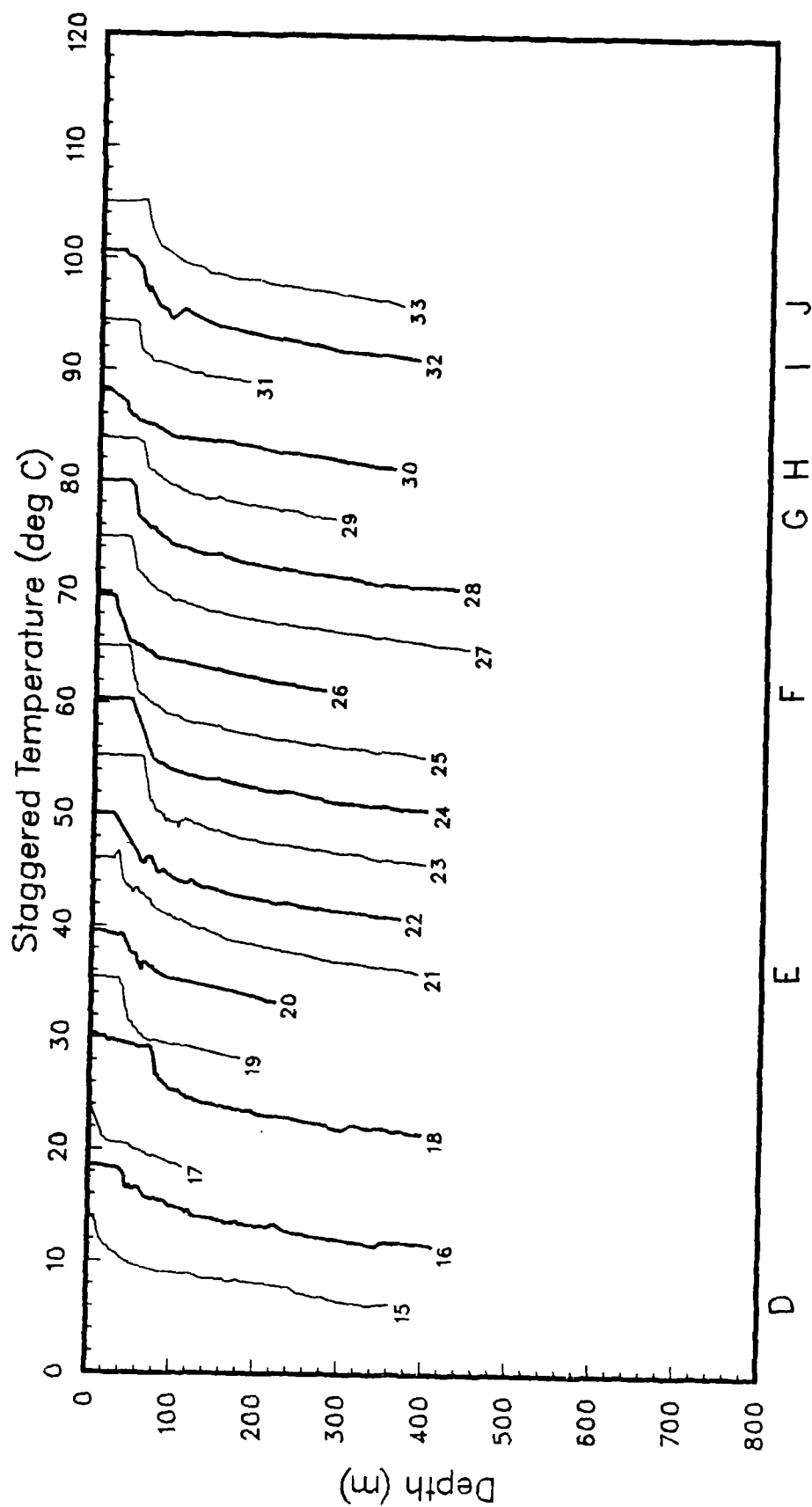


Figure 9(b)

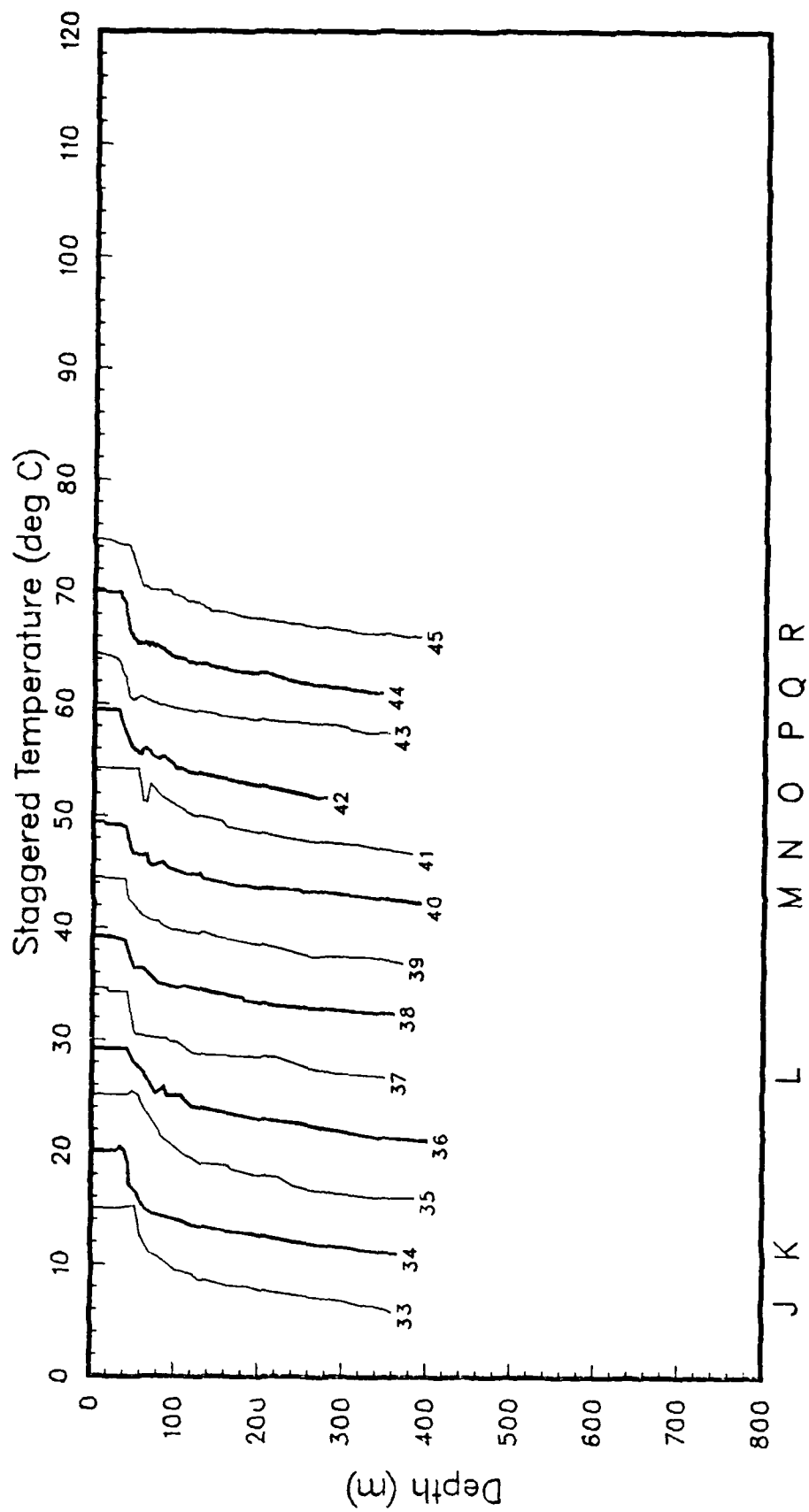


Figure 9(c)

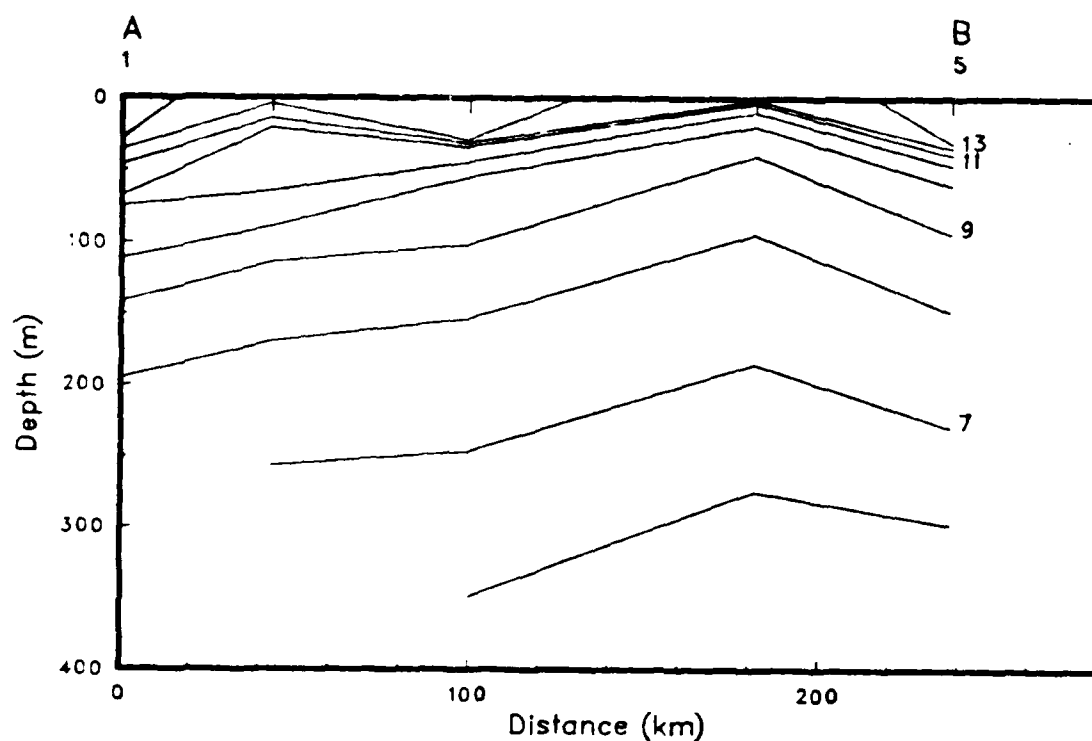


Figure 10(a). Along-track isotherms. Tickmarks along the upper axis show station positions. Some station numbers are given. Dashed lines are used if cast was too shallow (OPTOMA 23, flight P2).

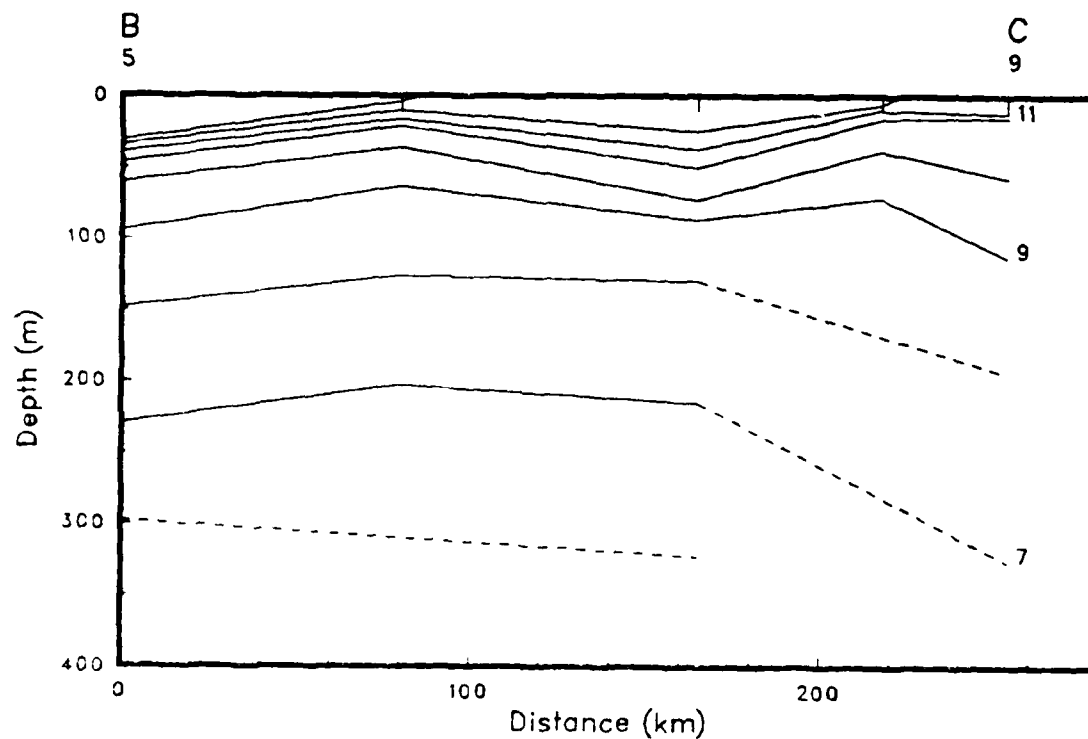


Figure 10(b)

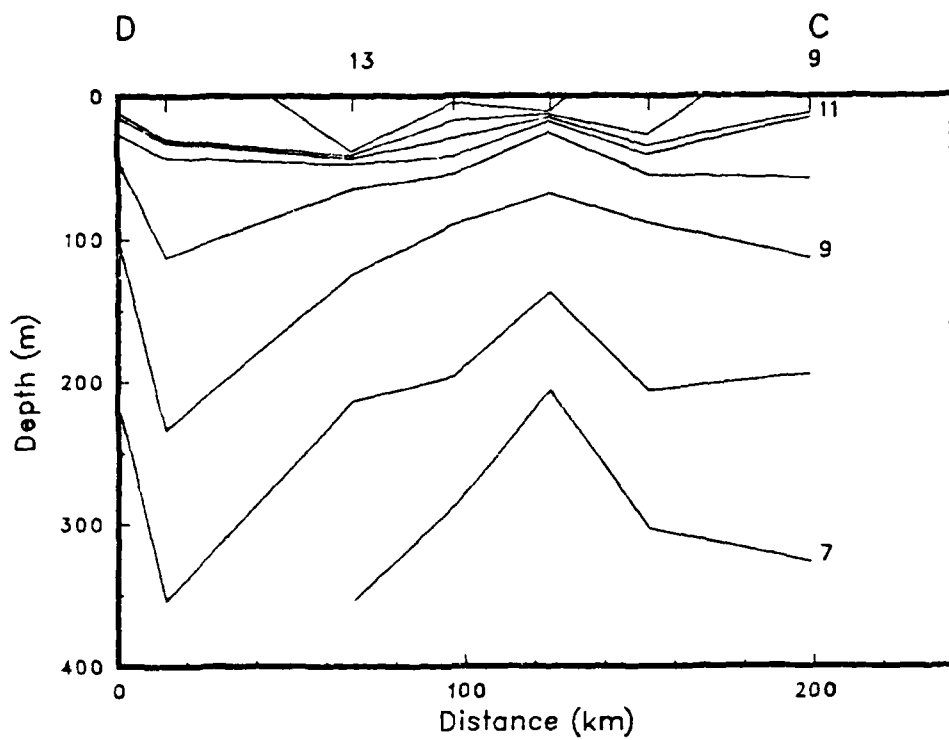


Figure 10(c)

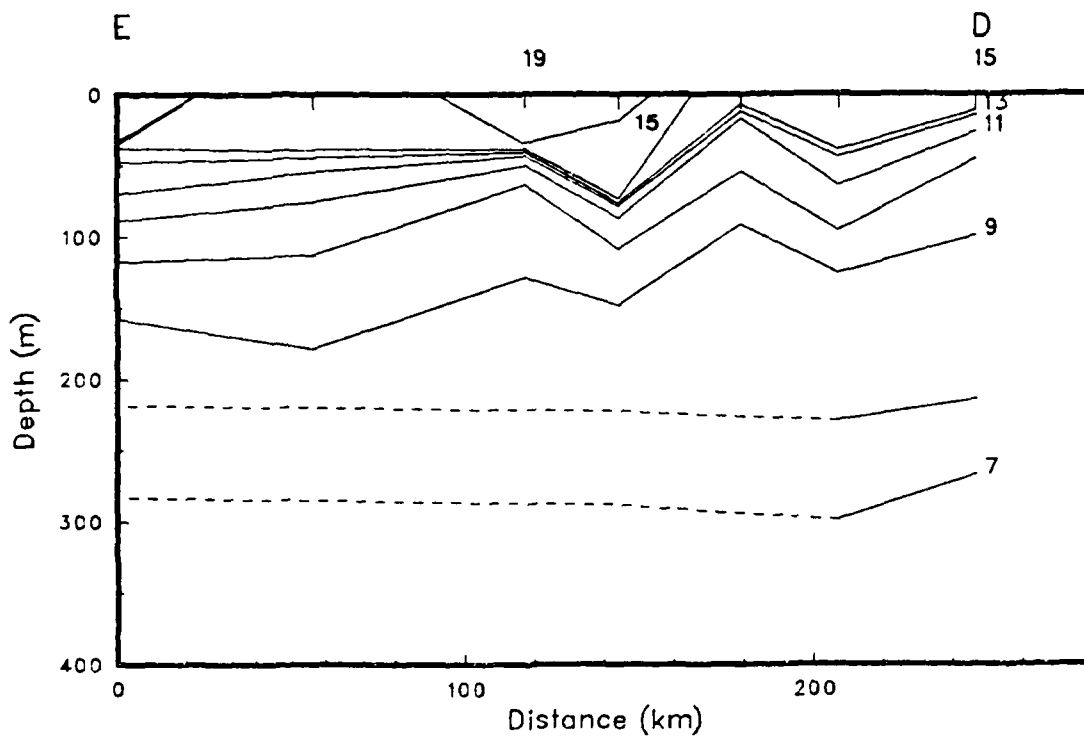


Figure 10(d)

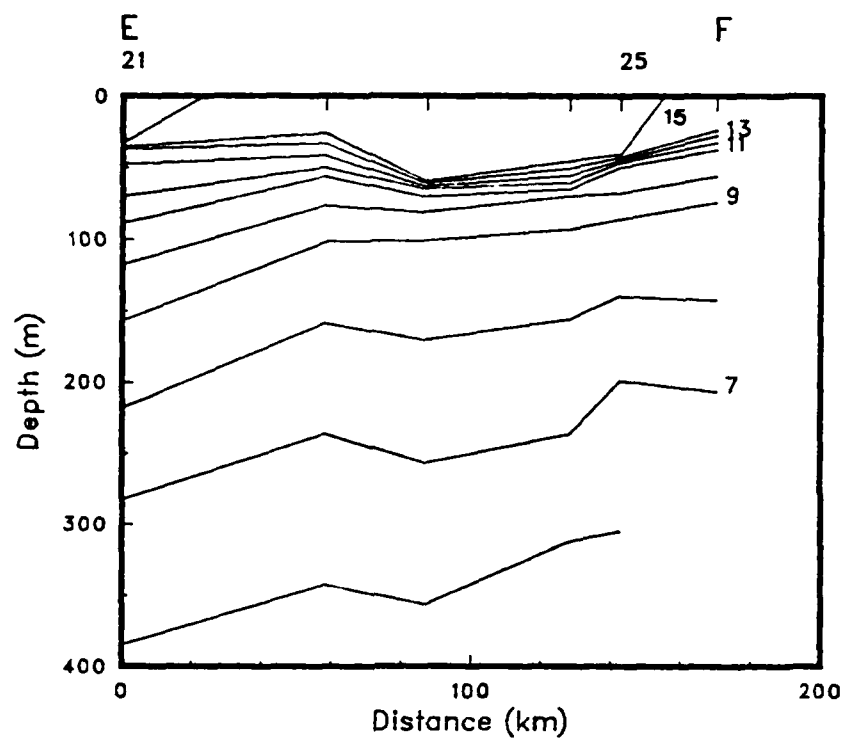


Figure 10(e)

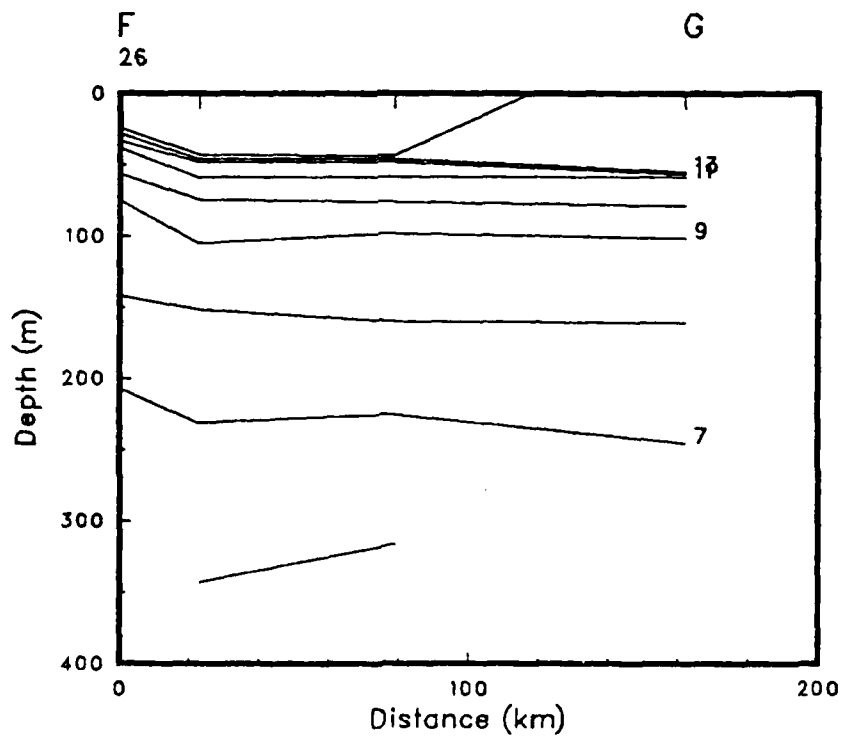


Figure 10(f)

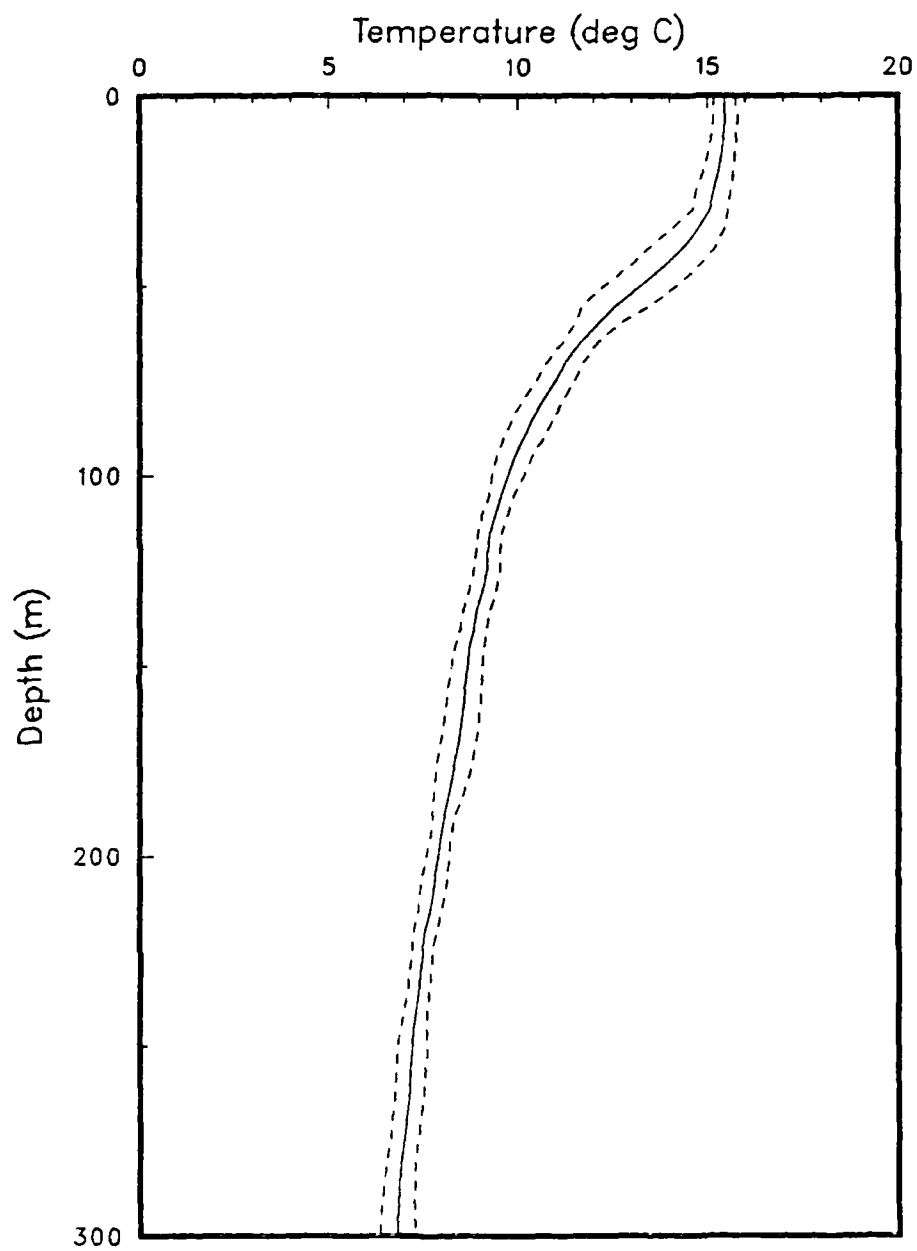


Figure 11. Mean temperature profile with the + and - standard deviation (OPTOMA 23, flight P2).

Section 3
OPTOMA 23 Flight P3
16 November 1986

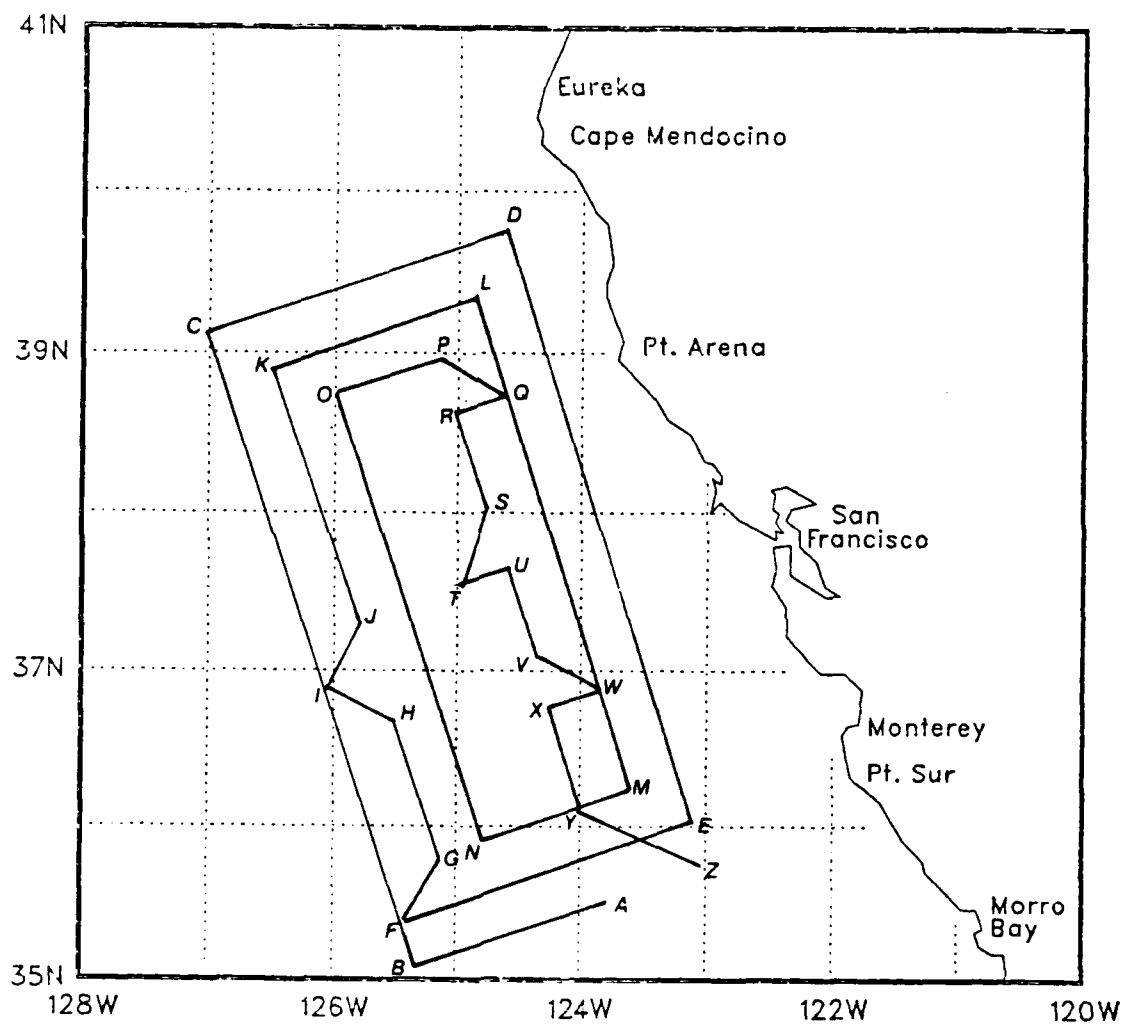


Figure 12. The flight track for OPTOMA 23, flight P3.

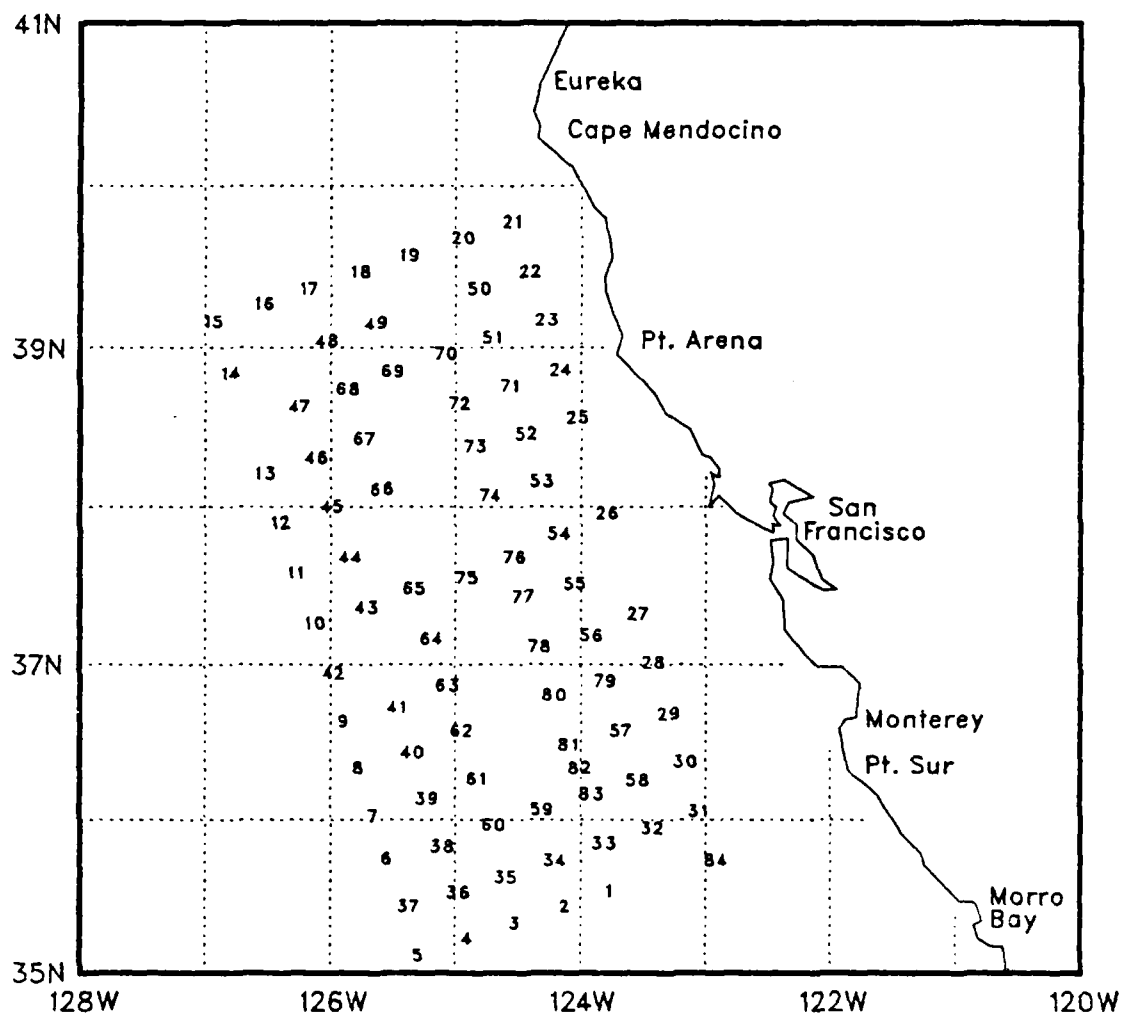


Figure 13. AXBT locations for OPTOMA 23, flight P3.

Table 3: Flight P3 Station Listing

Stn	Type	Yr/Day	GMT	Lat (North) (dd.mm)	Long (West) (ddd.mm)	Surface Temp (deg C)
1	AXBT	86320	1737	35.30	123.47	15.6
2	AXBT	86320	1740	35.24	124.10	15.4
3	AXBT	86320	1745	35.17	124.34	15.2
4	AXBT	86320	1749	35.11	124.56	16.0
5	AXBT	86320	1754	35.05	125.20	16.3
6	AXBT	86320	1805	35.43	125.35	15.7
7	AXBT	86320	1809	35.59	125.41	15.6
8	AXBT	86320	1814	36.18	125.49	15.0
9	AXBT	86320	1819	36.36	125.56	14.9
10	AXBT	86320	1830	37.14	126.11	14.5
11	AXBT	86320	1835	37.33	126.20	14.7
12	AXBT	86320	1840	37.52	126.28	13.4
13	AXBT	86320	1846	38.11	126.35	15.0
14	AXBT	86320	1856	38.49	126.52	14.9
15	AXBT	86320	1902	39.08	127.00	15.3
16	AXBT	86320	1907	39.14	126.36	14.7
17	AXBT	86320	1913	39.20	126.14	14.2
18	AXBT	86320	1917	39.26	125.50	14.1
19	AXBT	86320	1922	39.32	125.26	12.6
20	AXBT	86320	1927	39.39	125.02	13.0
21	AXBT	86320	1932	39.45	124.37	13.0
22	AXBT	86320	1937	39.26	124.29	12.4
23	AXBT	86320	1942	39.08	124.22	14.3
24	AXBT	86320	1946	38.50	124.14	13.9
25	AXBT	86320	1951	38.32	124.07	13.9
26	AXBT	86320	2001	37.56	123.52	13.4
27	AXBT	86320	2010	37.17	123.37	13.9
28	AXBT	86320	2015	36.59	123.30	14.5
29	AXBT	86320	2021	36.39	123.23	14.2
30	AXBT	86320	2026	36.20	123.15	13.8
31	AXBT	86320	2030	36.01	123.08	15.0
32	AXBT	86320	2035	35.55	123.31	15.5
33	AXBT	86320	2040	35.49	123.54	14.0
34	AXBT	86320	2045	35.42	124.17	15.5
35	AXBT	86320	2049	35.35	124.41	15.0
36	AXBT	86320	2054	35.29	125.04	15.4
37	AXBT	86320	2058	35.24	125.27	16.5
38	AXBT	86320	2115	35.47	125.11	15.9
39	AXBT	86320	2120	36.06	125.19	15.3
40	AXBT	86320	2125	36.24	125.26	15.2
41	AXBT	86320	2129	36.41	125.32	15.0
42	AXBT	86320	2137	36.55	126.04	14.6
43	AXBT	86320	2149	37.20	125.48	14.6
44	AXBT	86320	2154	37.39	125.56	14.3
45	AXBT	86320	2200	37.58	126.04	13.2

Stn	Type	Yr/Day	GMT	Lat (North) (dd.mm)	Long (West) (ddd.mm)	Surface Temp (deg C)
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46	AXBT	86320	2205	38.17	126.12	13.4
47	AXBT	86320	2211	38.36	126.20	15.0
48	AXBT	86320	2221	39.01	126.07	14.4
49	AXBT	86320	2226	39.07	125.43	15.1
50	AXBT	86320	2237	39.20	124.54	13.9
51	AXBT	86320	2241	39.02	124.47	14.0
52	AXBT	86320	2250	38.26	124.31	14.1
53	AXBT	86320	2254	38.08	124.24	13.8
54	AXBT	86320	2259	37.48	124.16	14.4
55	AXBT	86320	2304	37.29	124.08	14.5
56	AXBT	86320	2309	37.09	124.00	14.2
57	AXBT	86320	2319	36.32	123.46	14.3
58	AXBT	86320	2324	36.13	123.38	15.1
59	AXBT	86320	2334	36.02	124.23	14.7
60	AXBT	86320	2338	35.56	124.47	14.6
61	AXBT	86320	2344	36.14	124.54	15.1
62	AXBT	86320	2349	36.32	125.02	15.2
63	AXBT	86320	2353	36.50	125.09	13.6
64	AXBT	86320	2358	37.08	125.16	15.2
65	AXBT	86321	3	37.27	125.25	15.0
66	AXBT	86321	14	38.05	125.40	13.5
67	AXBT	86321	19	38.24	125.49	13.9
68	AXBT	86321	25	38.43	125.57	13.7
69	AXBT	86321	30	38.49	125.35	13.7
70	AXBT	86321	35	38.56	125.10	13.3
71	AXBT	86321	42	38.44	124.38	13.6
72	AXBT	86321	48	38.37	125.03	13.8
73	AXBT	86321	52	38.21	124.56	13.9
74	AXBT	86321	57	38.02	124.48	13.9
75	AXBT	86321	105	37.31	124.59	15.0
76	AXBT	86321	111	37.39	124.37	14.7
77	AXBT	86321	115	37.24	124.32	15.0
78	AXBT	86321	120	37.05	124.25	14.5
79	AXBT	86321	127	36.52	123.53	14.2
80	AXBT	86321	133	36.46	124.18	14.7
81	AXBT	86321	138	36.27	124.10	14.2
82	AXBT	86321	141	36.18	124.05	14.0
83	AXBT	86321	144	36.08	124.00	13.9
84	AXBT	86321	153	35.42	123.00	14.8

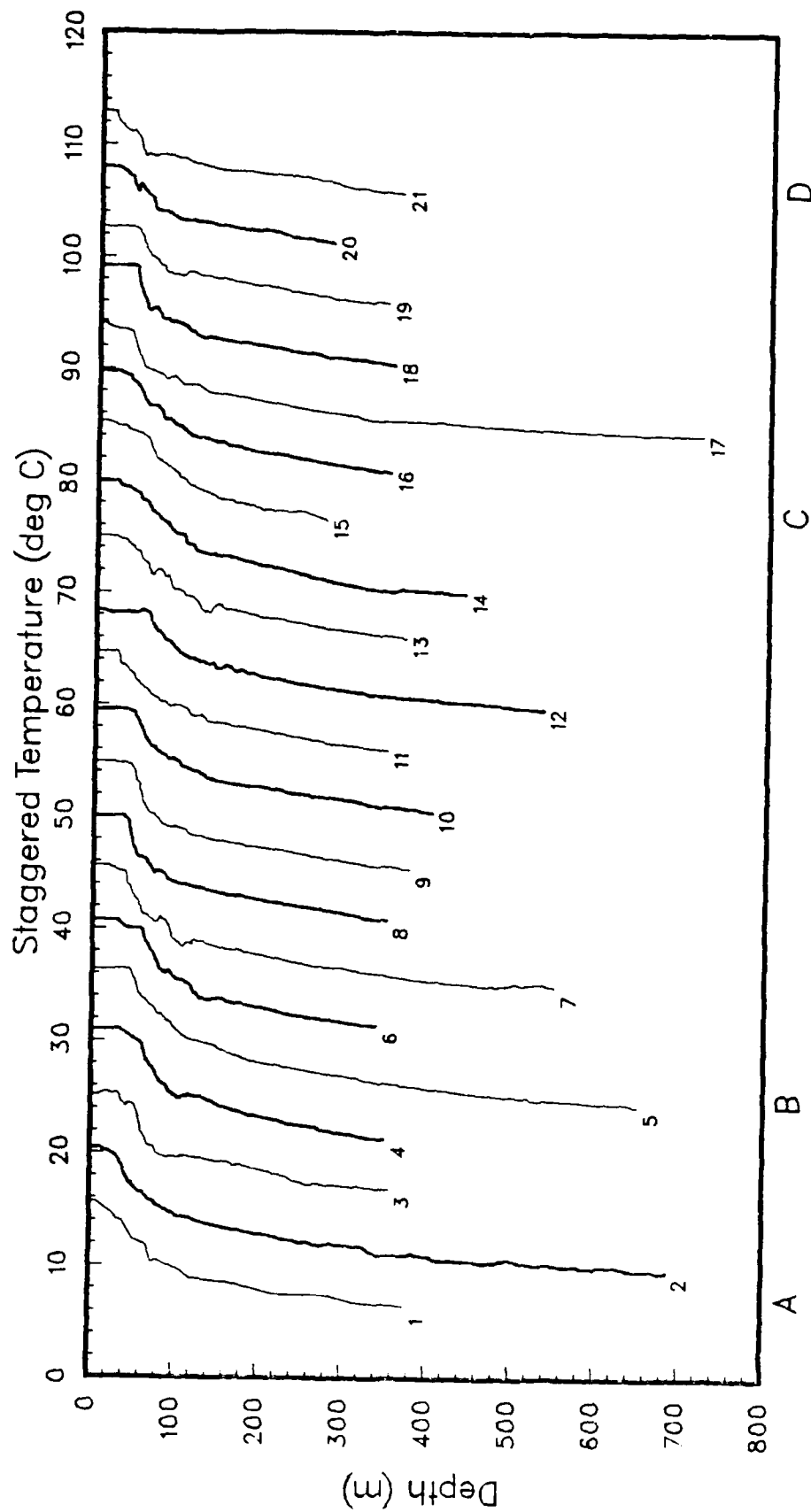


Figure 14(a). AXBT temperature profiles, staggered by multiples of 5 C (OPTOMA 23, flight P3).

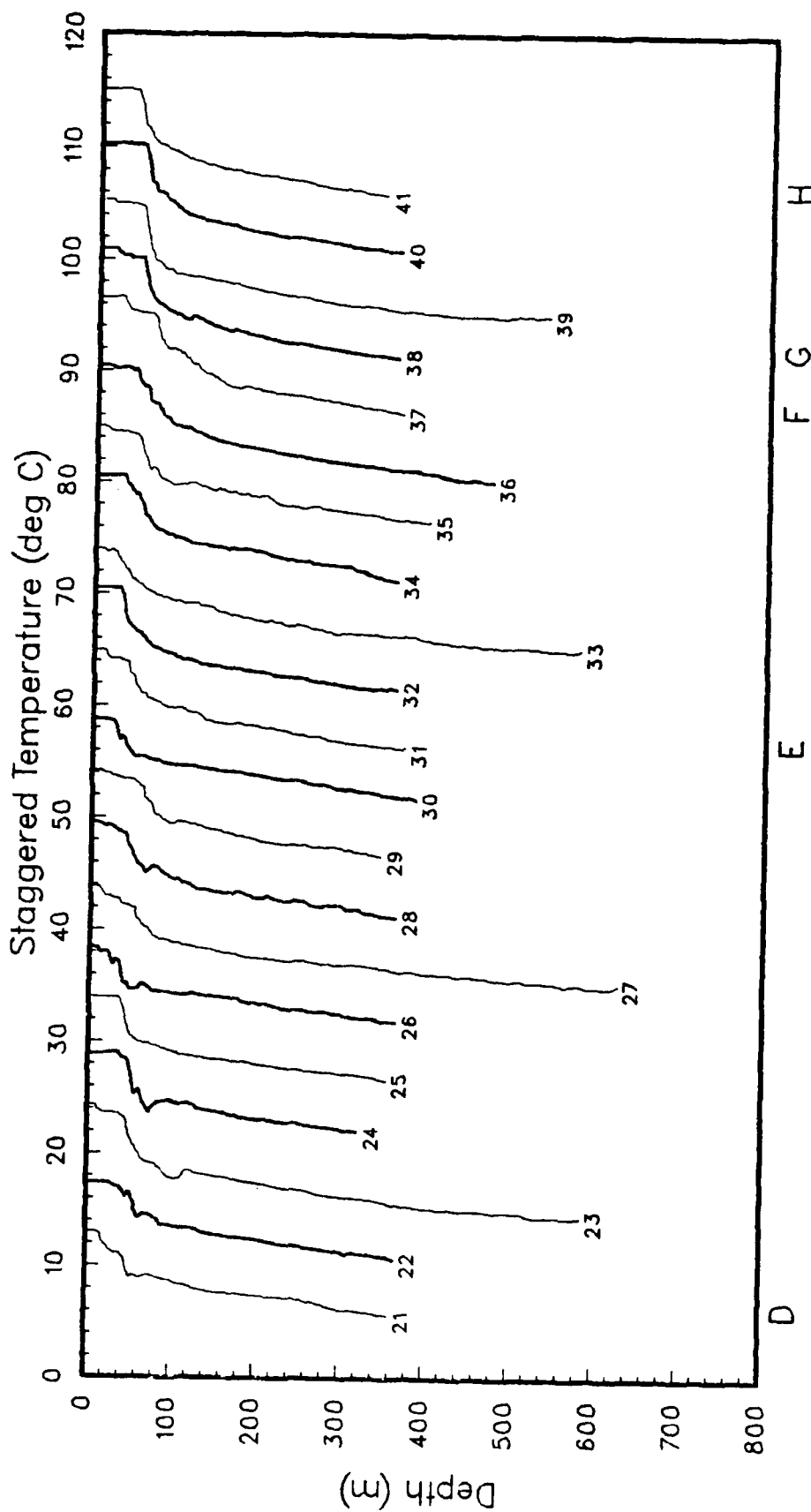


Figure 14(b)

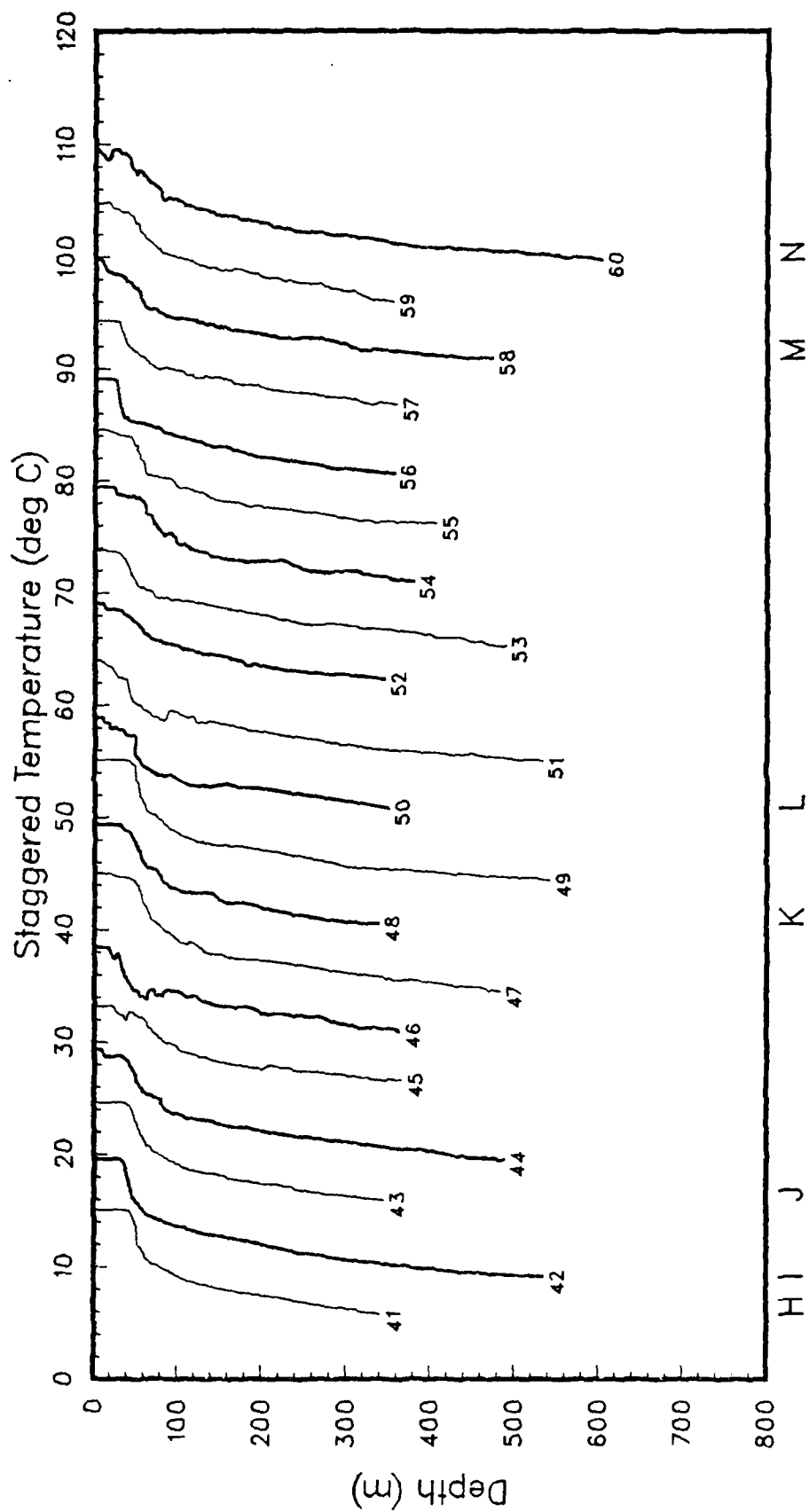


Figure 14(c)

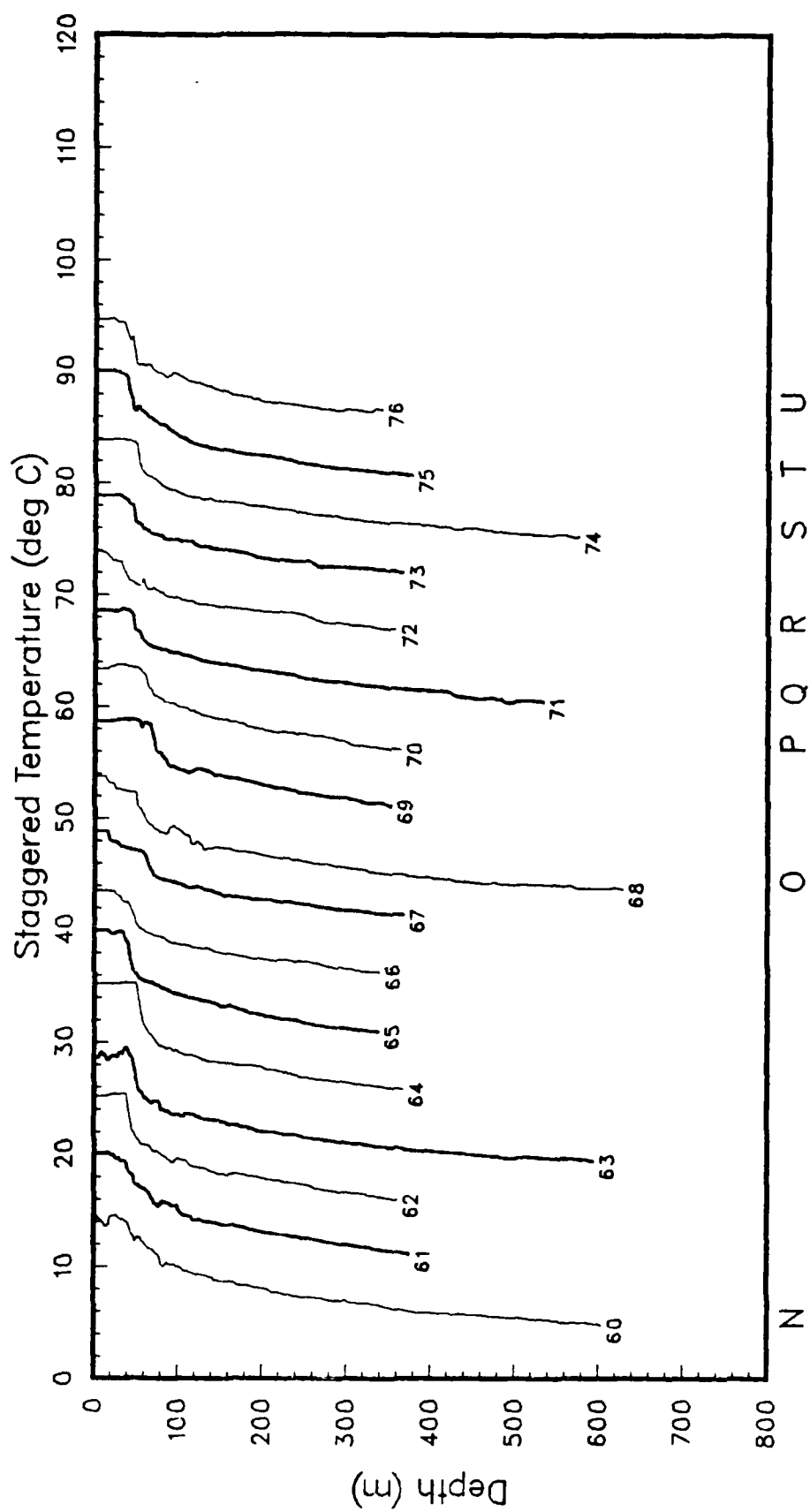


Figure 14(d)

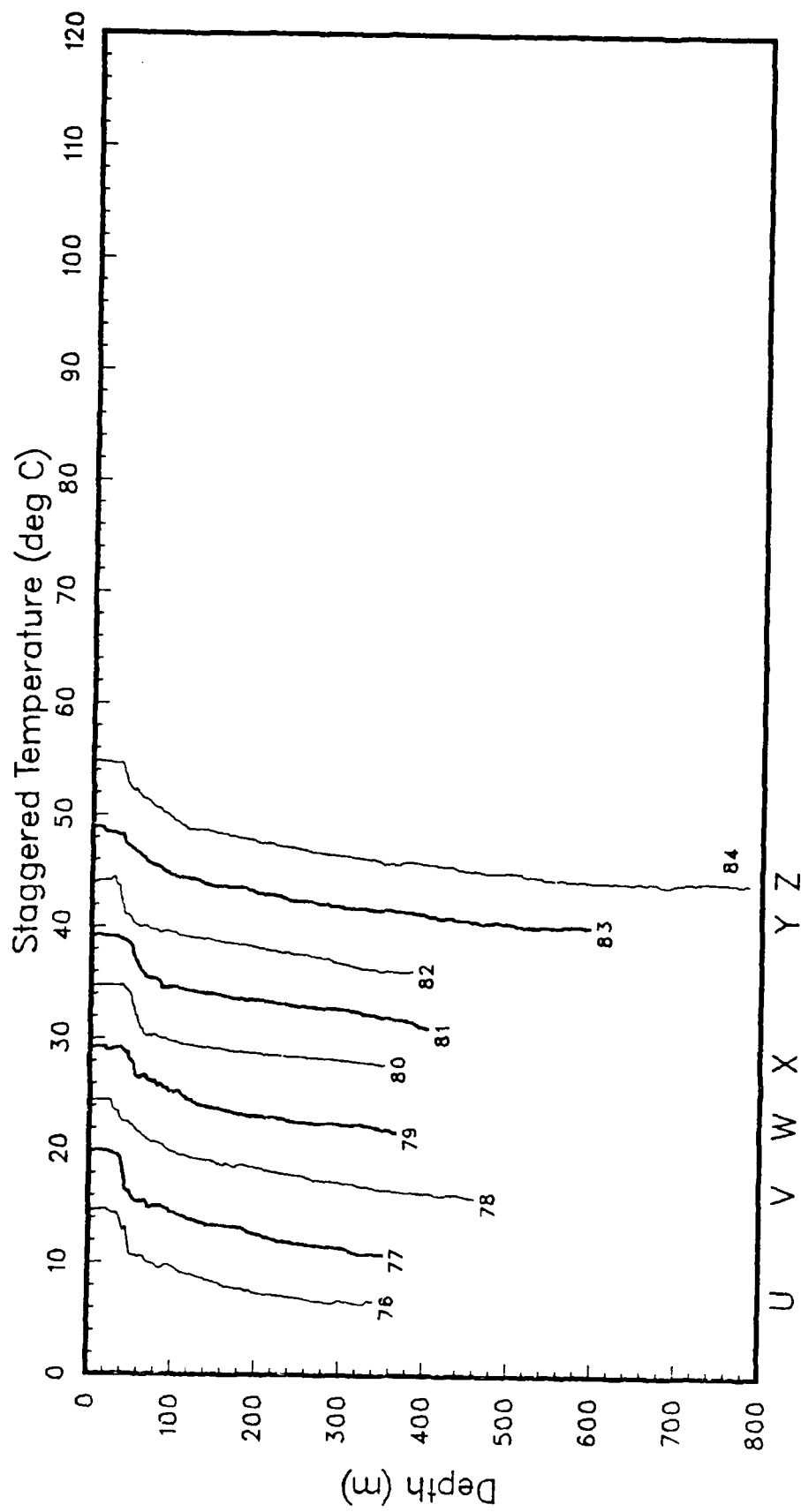


Figure 14(e)

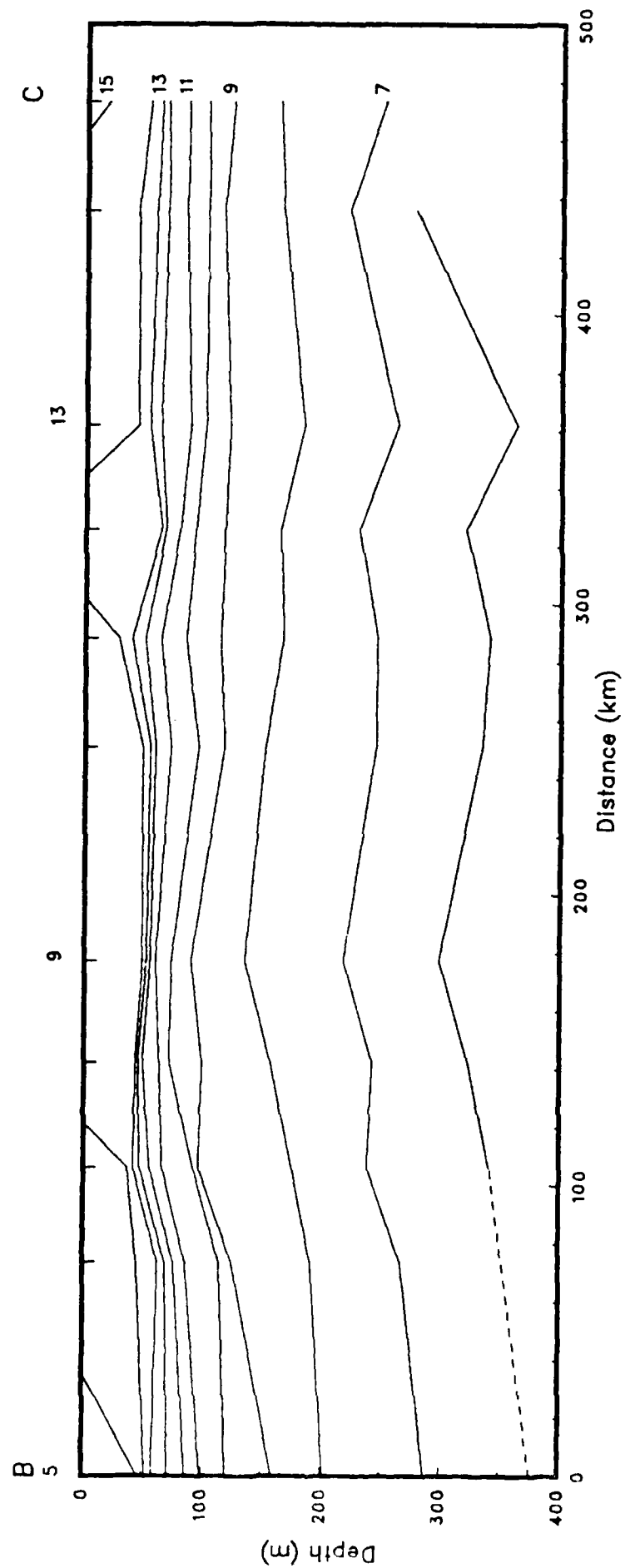


Figure 15(a). Along-track isotherms. Tick marks along the upper axis show station positions. Some stations are numbered. Dashed lines are used if cast was too shallow (OPTOMA 23, flight P3).

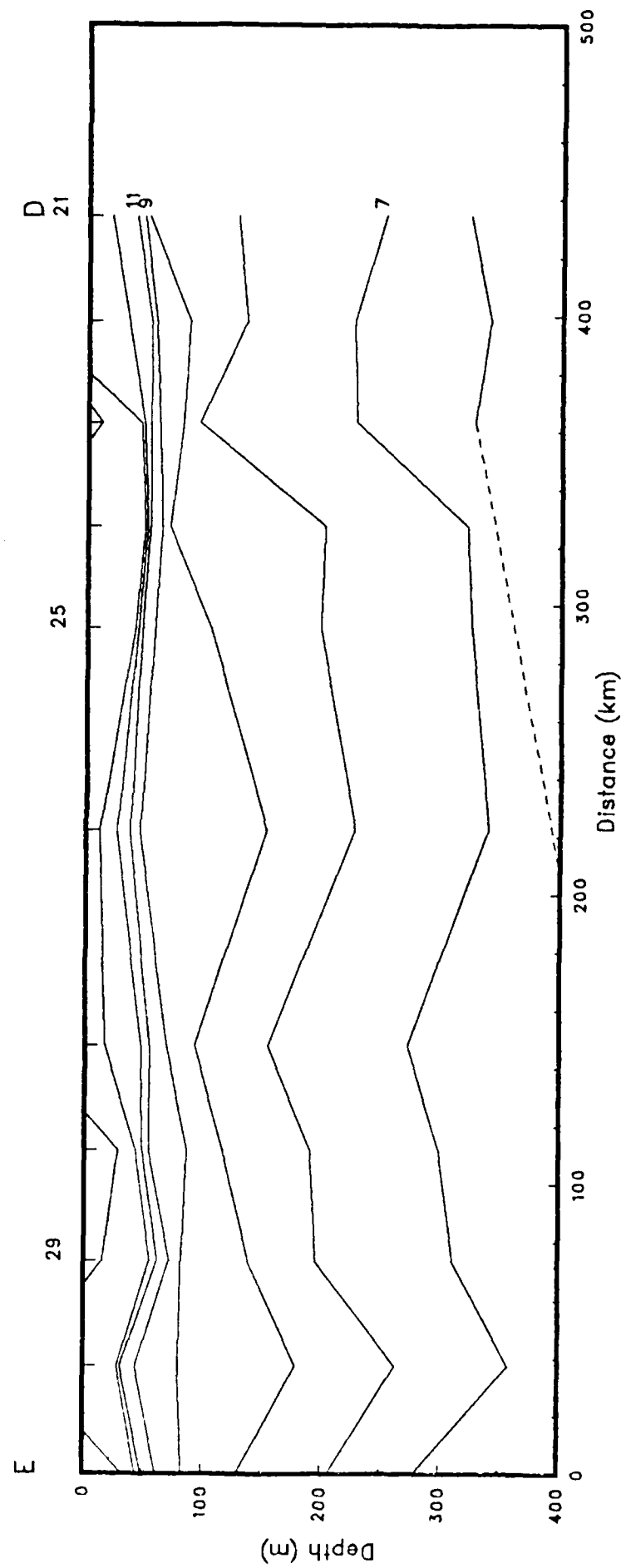


Figure 15(b)

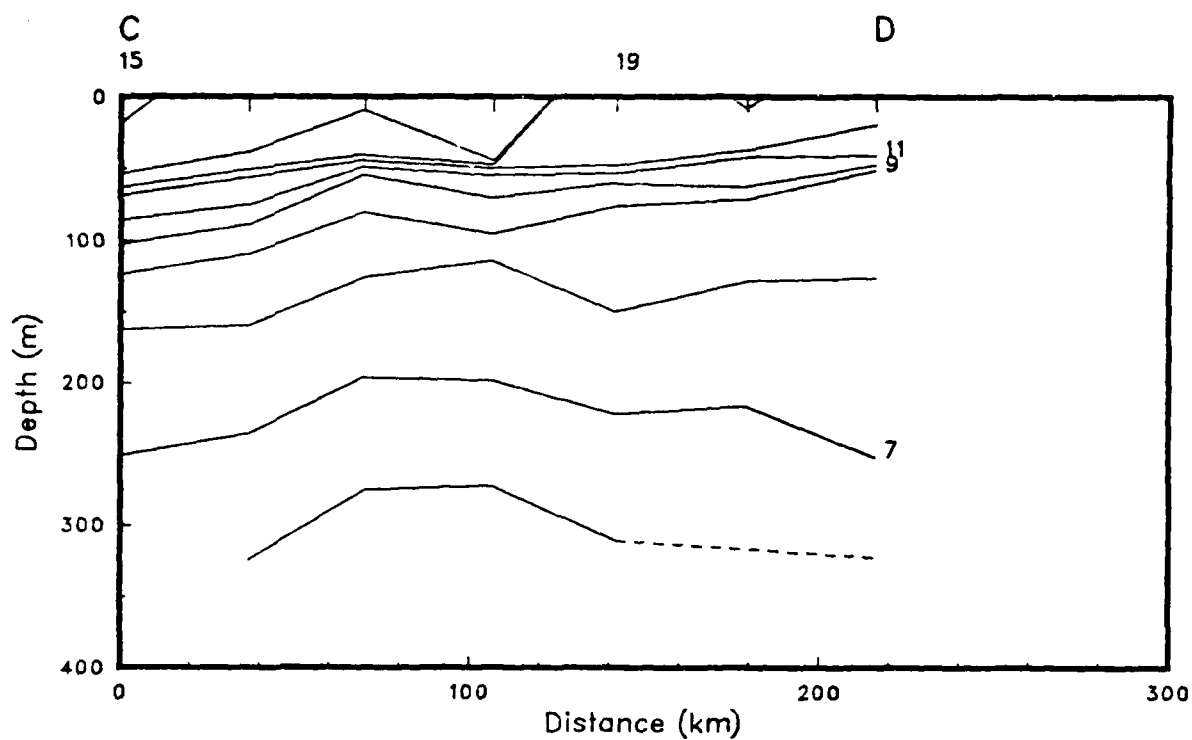


Figure 15(c)

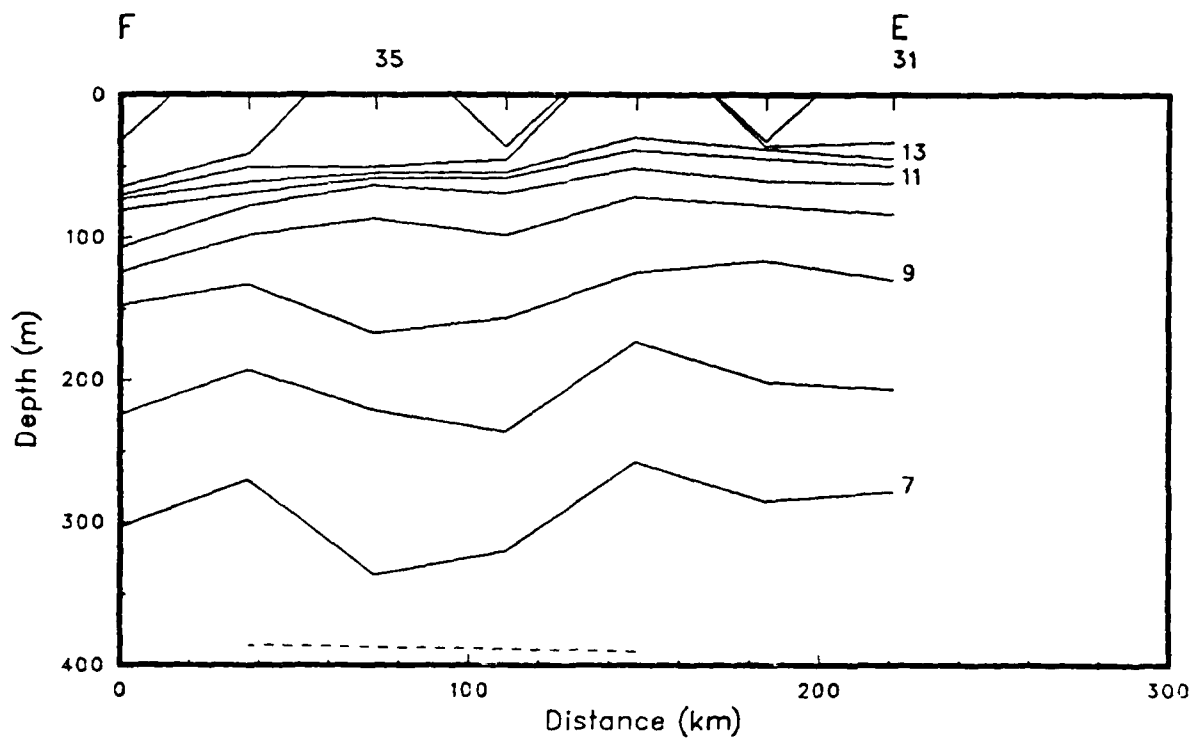


Figure 15(d)

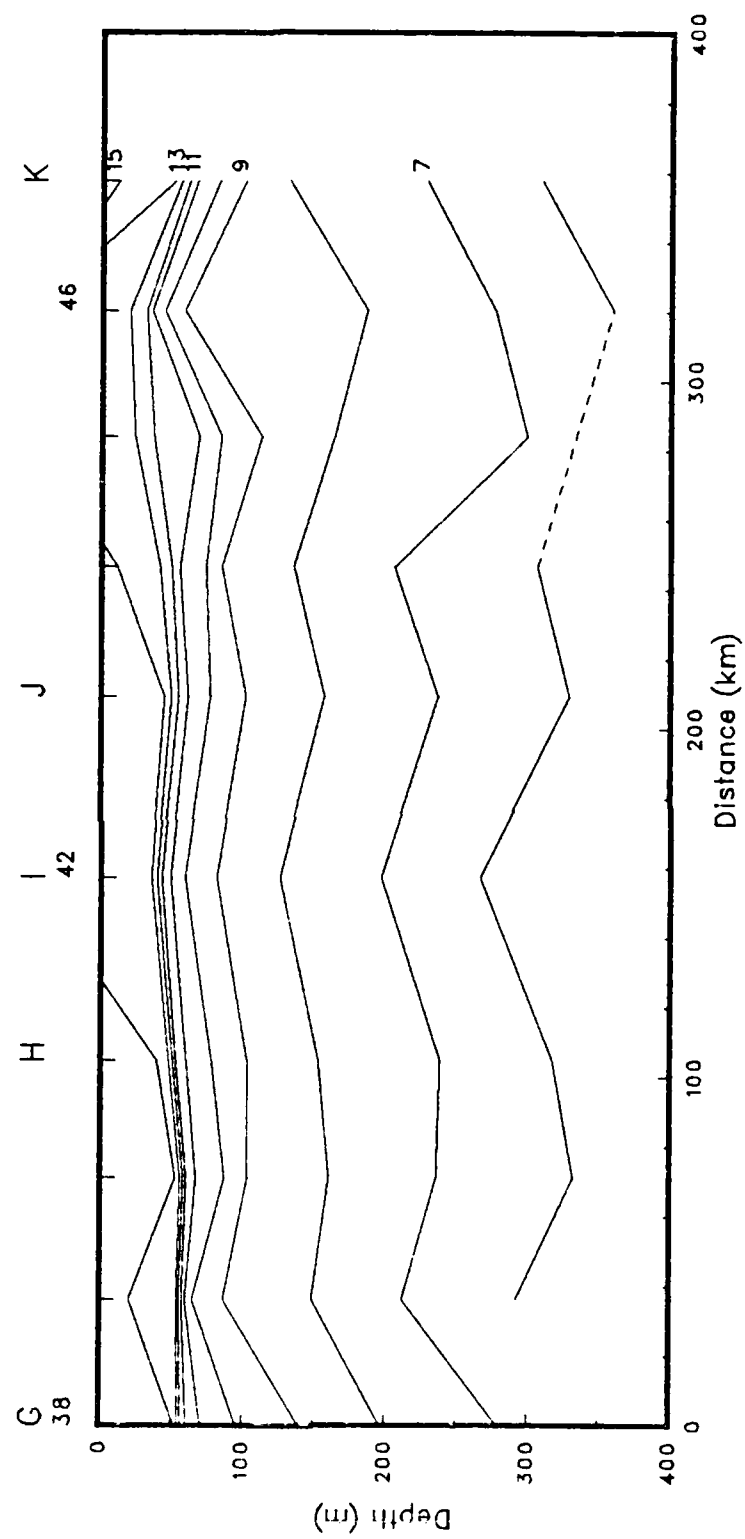


Figure 15(e)

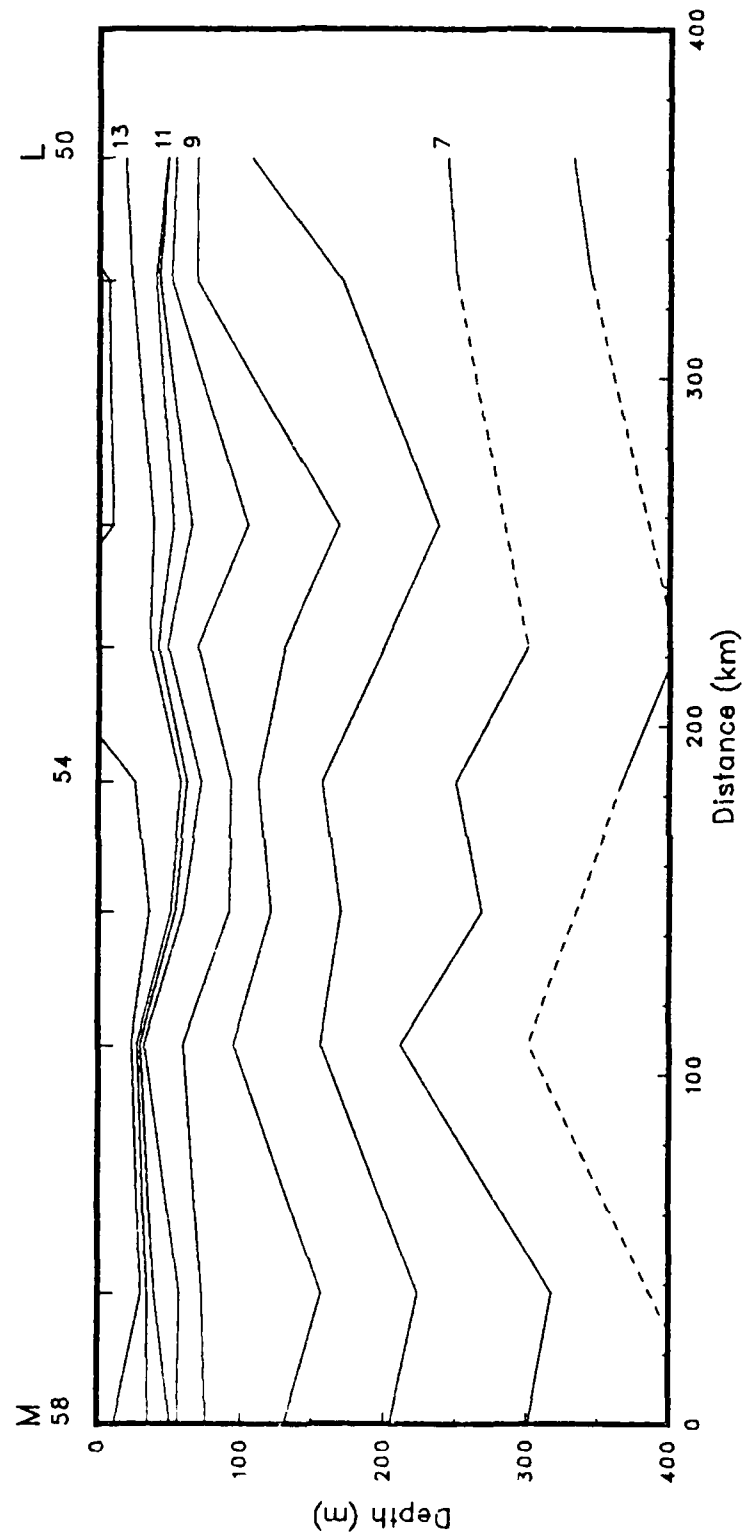


Figure 15(f)

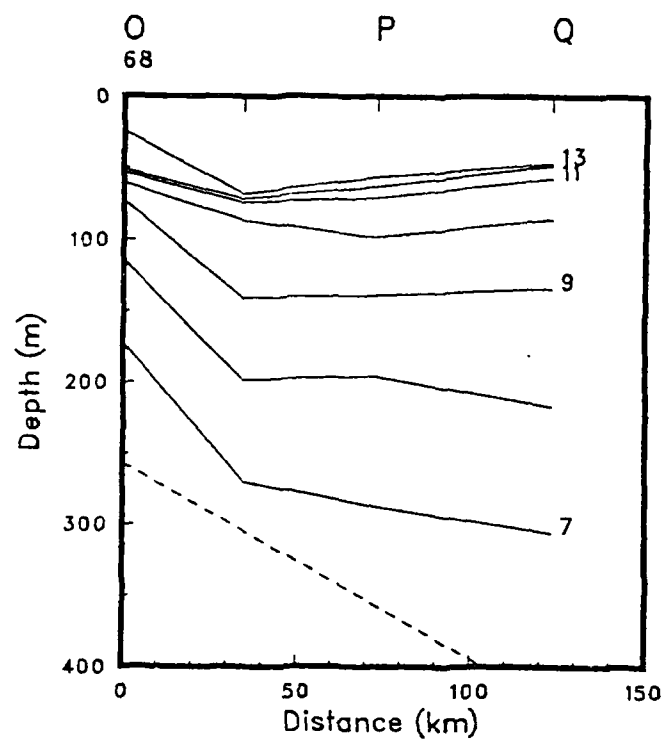


Figure 15(g)

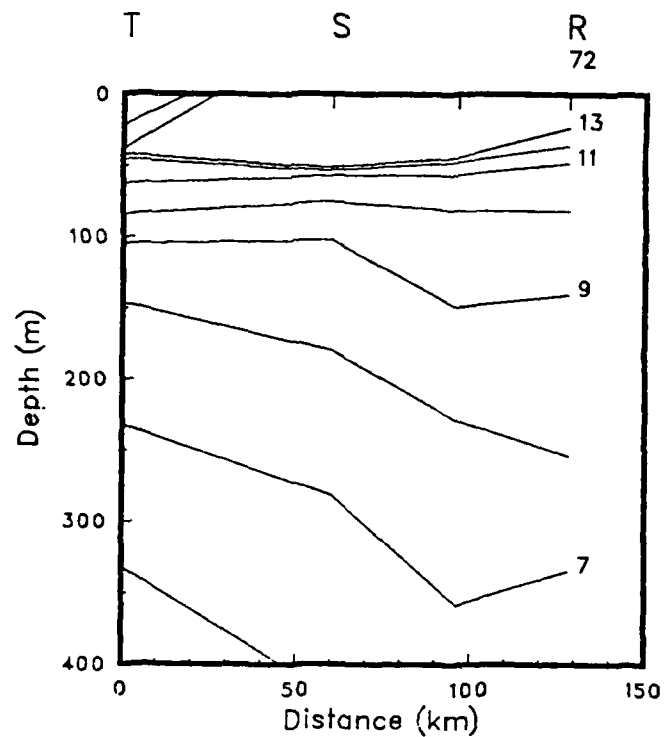


Figure 15(h)

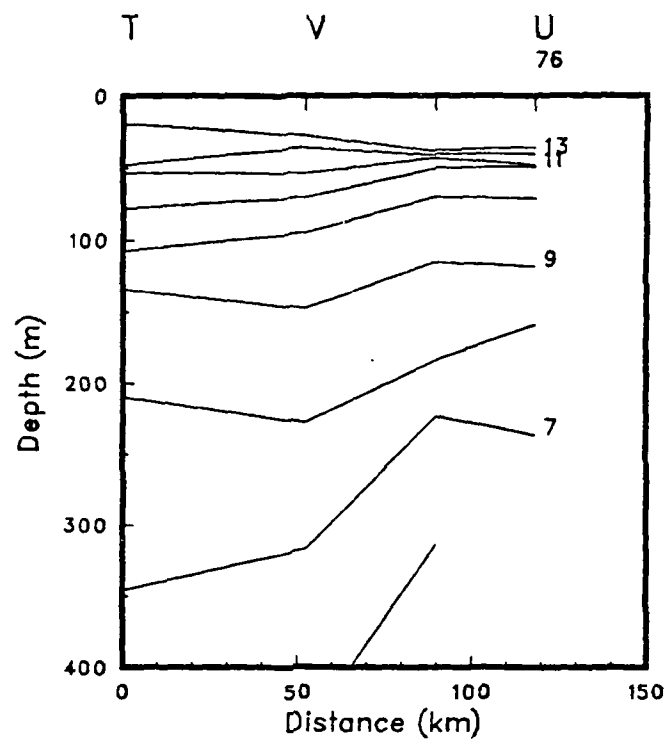


Figure 15(i)

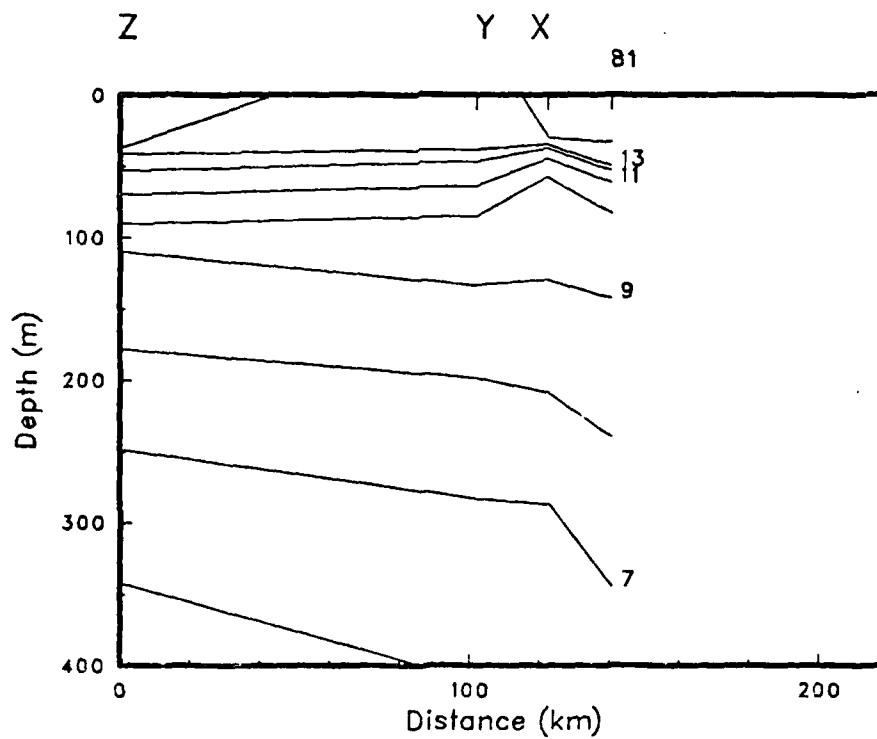


Figure 15(j)

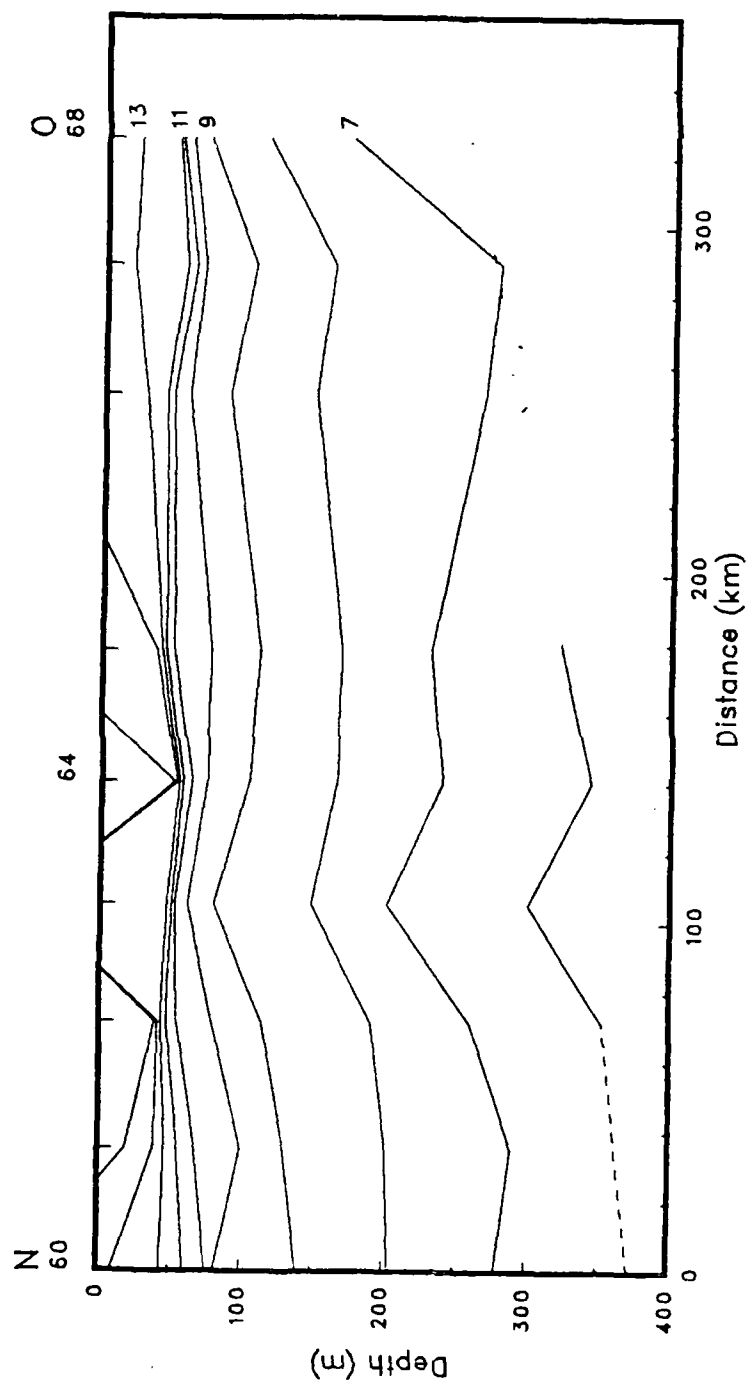


Figure 15(k)

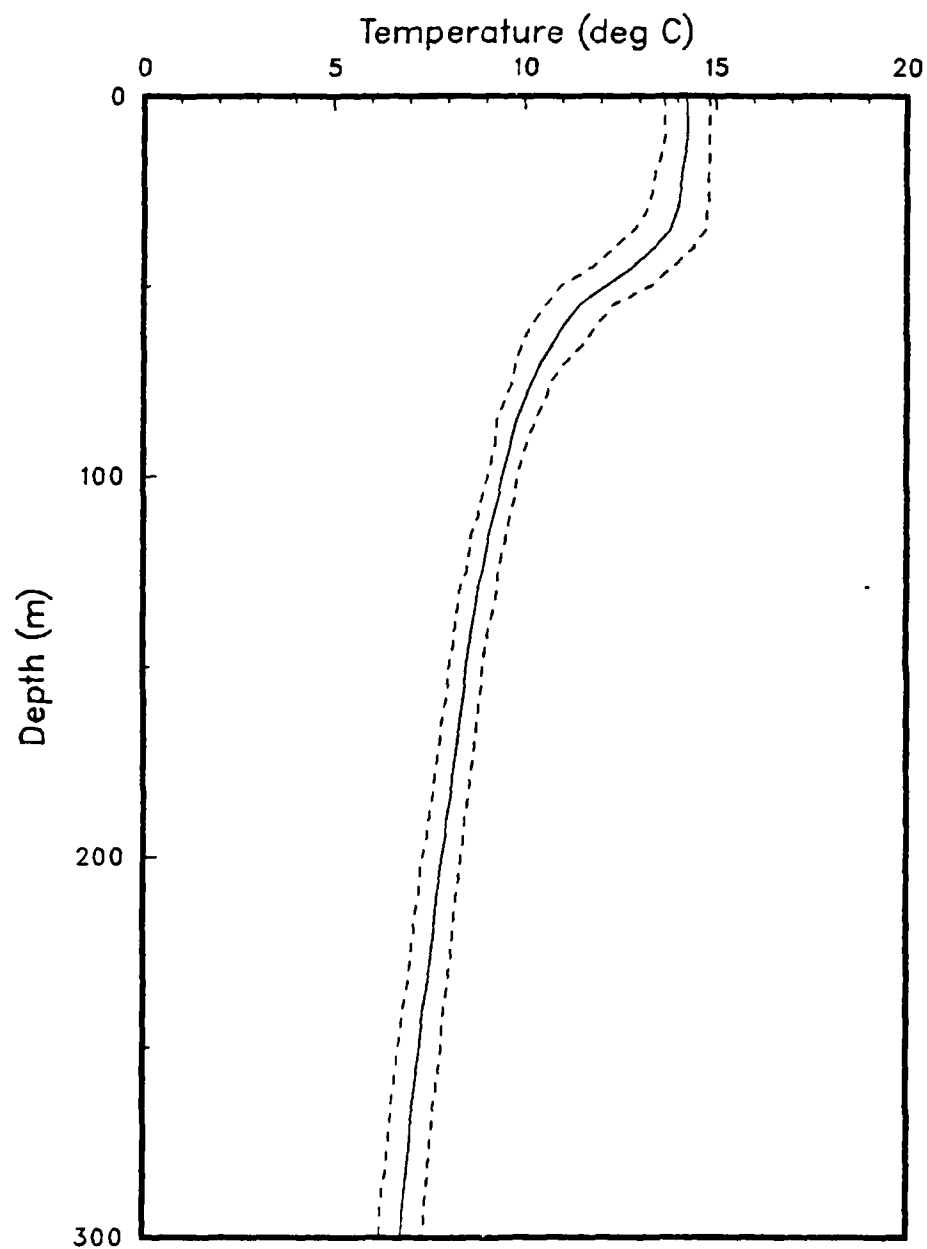


Figure 16. Mean temperature profile with the + and - standard deviation (OPTOMA 23, flight P3).

Section 4

OPTOMA 23 Flight P4

17 November 1986

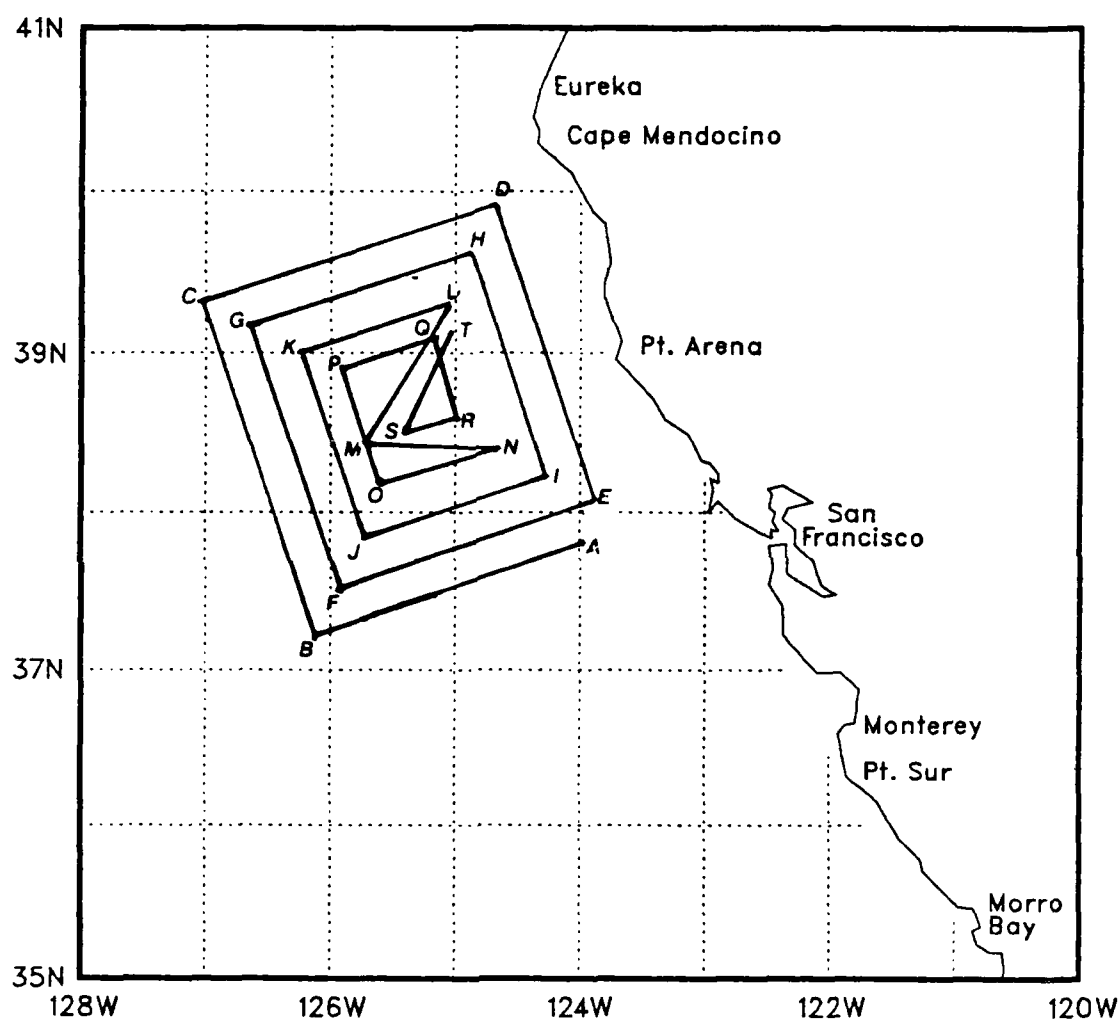


Figure 17. The flight track for OPTOMA 23, flight P4

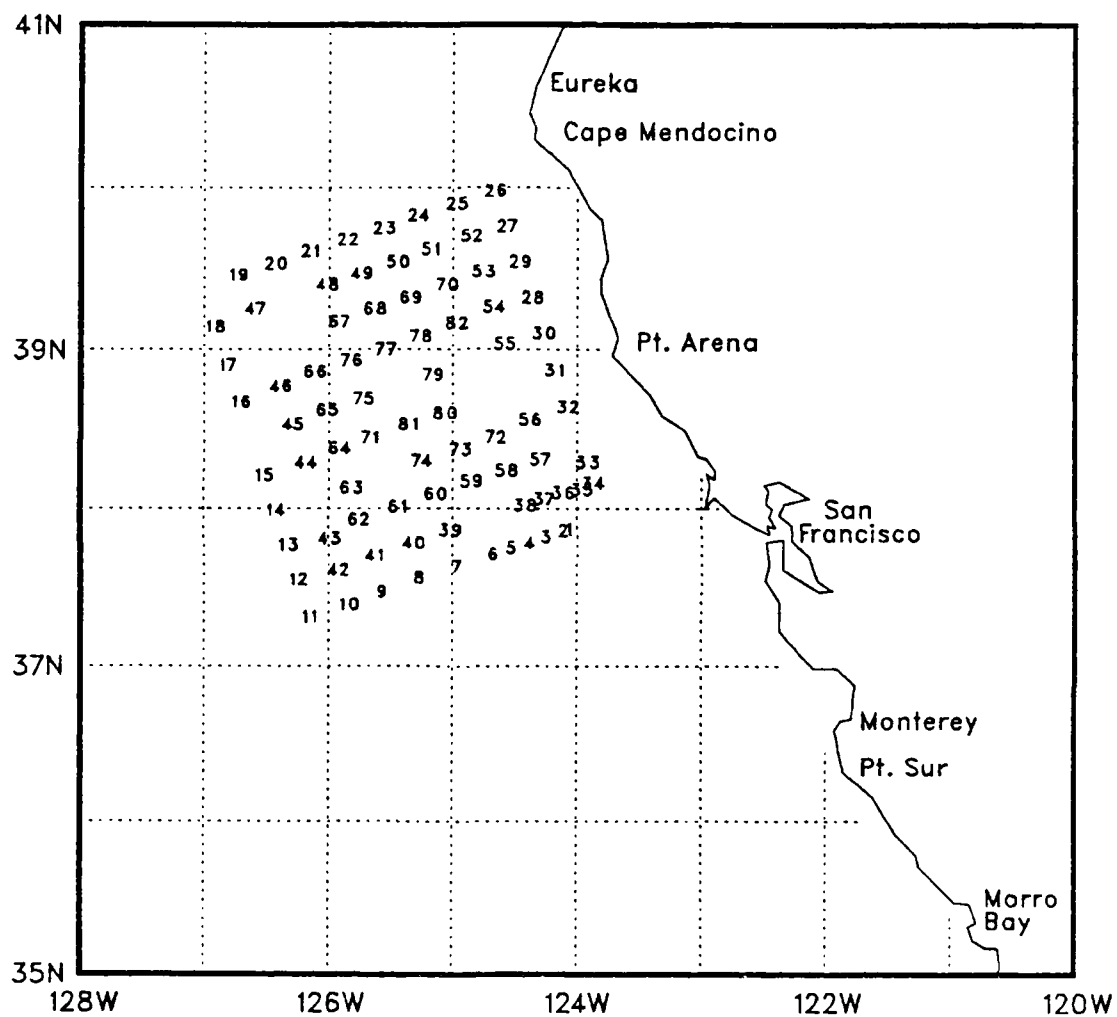


Figure 18. AXBT locations for OPTOMA 23, flight P4.

Table 4: Flight 5 Station Listing

Stn	Type	Yr/Day	GMT	Lat (North) (dd.mm)	Long (West) (ddd.dd)	Surface Temp (deg C)
1	AXBT	86321	1934	37.50	124.04	13.7
2	AXBT	86321	1935	37.50	124.08	13.9
3	AXBT	86321	1936	37.47	124.17	14.6
4	AXBT	86321	1938	37.45	124.25	14.6
5	AXBT	86321	1940	37.43	124.34	14.8
6	AXBT	86321	1942	37.41	124.42	15.0
7	AXBT	86321	1946	37.36	125.00	15.1
8	AXBT	86321	1950	37.32	125.18	14.9
9	AXBT	86321	1953	37.26	125.36	14.3
10	AXBT	86321	1957	37.22	125.54	14.7
11	AXBT	86321	2000	37.17	126.12	14.7
12	AXBT	86321	2005	37.31	126.18	14.8
13	AXBT	86321	2008	37.44	126.23	14.2
14	AXBT	86321	2012	37.58	126.29	13.2
15	AXBT	86321	2015	38.11	126.35	14.6
16	AXBT	86321	2023	38.38	126.46	15.0
17	AXBT	86321	2026	38.52	126.52	15.5
18	AXBT	86321	2030	39.07	126.59	15.9
19	AXBT	86321	2038	39.26	126.47	15.0
20	AXBT	86321	2042	39.30	126.31	14.6
21	AXBT	86321	2045	39.35	126.13	14.1
22	AXBT	86321	2049	39.39	125.56	13.4
23	AXBT	86321	2052	39.43	125.38	12.9
24	AXBT	86321	2056	39.48	125.22	13.3
25	AXBT	86321	2100	39.52	125.03	12.8
26	AXBT	86321	2103	39.57	124.44	13.0
27	AXBT	86321	2107	39.44	124.38	12.3
28	AXBT	86321	2114	39.17	124.26	13.5
29	AXBT	86321	2110	39.31	124.32	13.1
30	AXBT	86321	2117	39.04	124.21	14.1
31	AXBT	86321	2120	38.50	124.15	13.6
32	AXBT	86321	2124	38.37	124.09	14.2
33	AXBT	86321	2129	38.16	124.00	14.0
34	AXBT	86321	2131	38.08	123.57	12.9
35	AXBT	86321	2133	38.05	124.02	11.7
36	AXBT	86321	2135	38.04	124.11	13.4
37	AXBT	86321	2137	38.02	124.20	14.0
38	AXBT	86321	2139	37.59	124.30	13.9
39	AXBT	86321	2146	37.50	125.06	14.6
40	AXBT	86321	2150	37.45	125.24	14.1
41	AXBT	86321	2153	37.40	125.42	14.7
42	AXBT	86321	2157	37.35	126.00	14.2
43	AXBT	86321	2201	37.47	126.05	13.9
44	AXBT	86321	2208	38.16	126.16	13.5
45	AXBT	86321	2212	38.30	126.22	14.4

Stn	Type	Yr/Day	GMT	Lat (North) (dd. mm)	Long (West) (ddd. dd)	Surface Temp (deg C)
46	AXBT	86321	2216	38.44	126.28	15.4
47	AXBT	86321	2224	39.13	126.40	14.9
48	AXBT	86321	2231	39.22	126.06	14.3
49	AXBT	86321	2235	39.26	125.49	14.2
50	AXBT	86321	2238	39.31	125.32	13.2
51	AXBT	86321	2242	39.35	125.15	12.8
52	AXBT	86321	2246	39.40	124.56	14.0
53	AXBT	86321	2249	39.27	124.50	13.3
54	AXBT	86321	2252	39.14	124.45	15.3
55	AXBT	86321	2256	39.00	124.40	13.7
56	AXBT	86321	2302	38.32	124.28	13.5
57	AXBT	86321	2306	38.17	124.22	13.6
58	AXBT	86321	2310	38.13	124.39	13.9
59	AXBT	86321	2313	38.08	124.56	13.9
60	AXBT	86321	2317	38.04	125.13	13.9
61	AXBT	86321	2320	37.59	125.31	13.1
62	AXBT	86321	2324	37.54	125.50	14.4
63	AXBT	86321	2328	38.06	125.54	13.3
64	AXBT	86321	2332	38.21	125.59	13.6
65	AXBT	86321	2336	38.35	126.05	14.8
66	AXBT	86321	2340	38.50	126.11	15.0
67	AXBT	86321	2348	39.08	125.59	14.3
68	AXBT	86321	2351	39.13	125.43	14.8
69	AXBT	86321	2355	39.17	125.25	14.3
70	AXBT	86321	2358	39.22	125.08	13.1
71	AXBT	86322	13	38.25	125.44	13.9
72	AXBT	86322	13	38.25	124.44	13.9
73	AXBT	86322	17	38.20	125.01	13.9
74	AXBT	86322	20	38.16	125.20	13.9
75	AXBT	86322	32	38.40	125.48	13.9
76	AXBT	86322	36	38.54	125.54	14.7
77	AXBT	86322	40	38.58	125.37	15.2
78	AXBT	86322	44	39.03	125.20	14.4
79	AXBT	86322	48	38.49	125.14	14.2
80	AXBT	86322	51	38.34	125.09	14.2
81	AXBT	86322	55	38.30	125.26	13.9
82	AXBT	86322	108	39.08	125.03	14.8

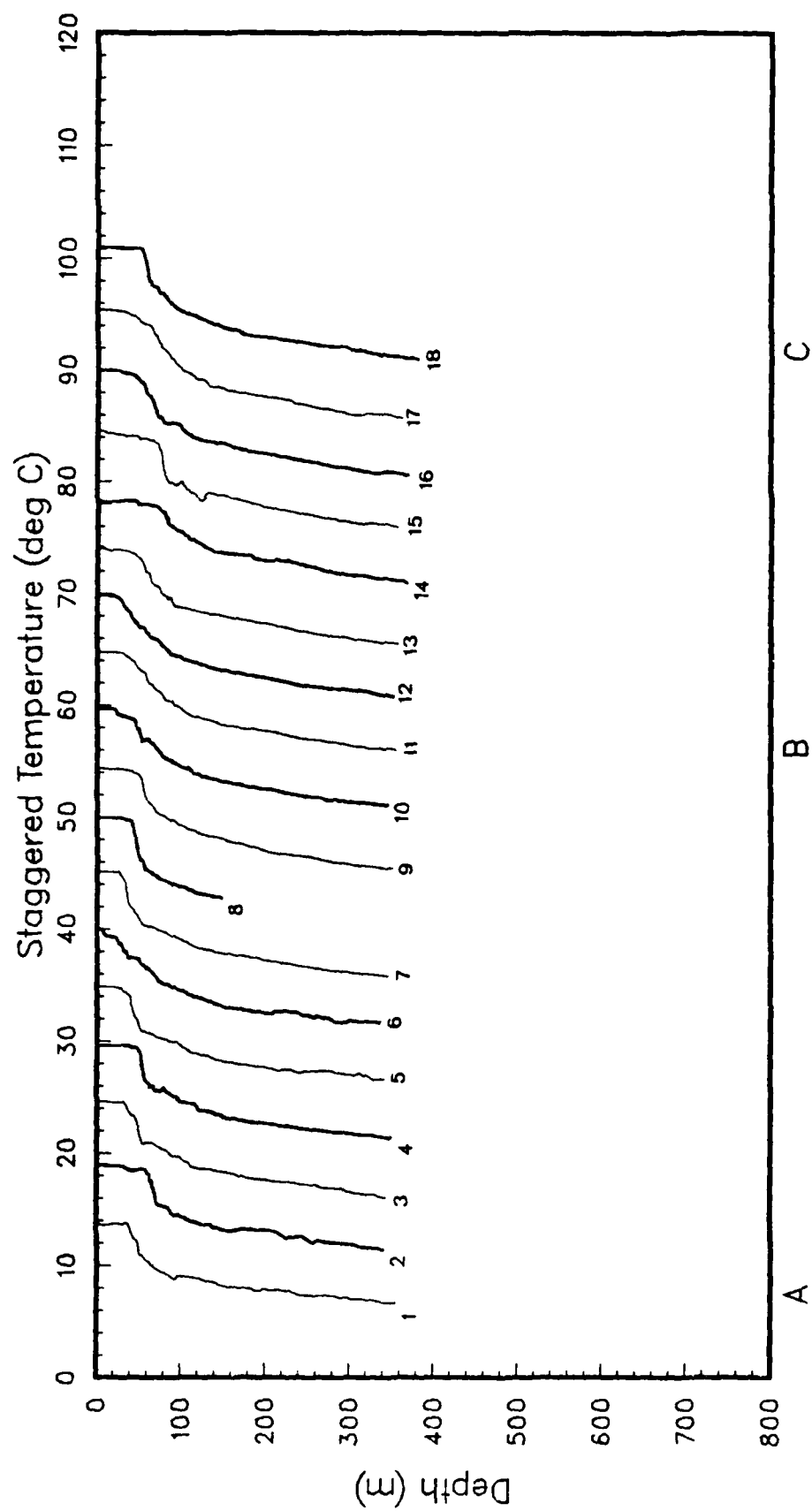


Figure 19(a). AXBT temperature profiles, staggered by multiples of 5 C (OPTOMA 23, flight P4).

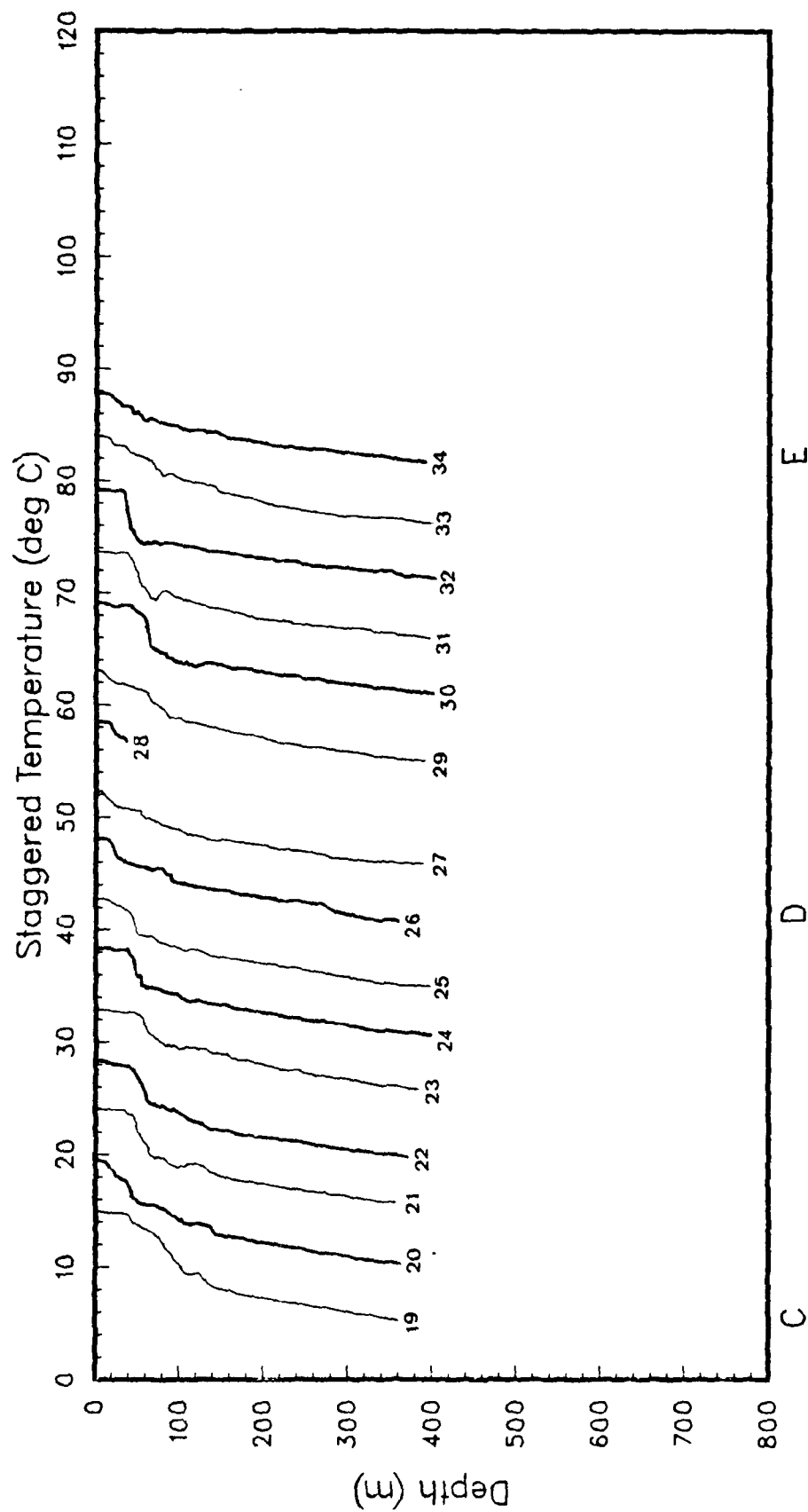


Figure 19(b)

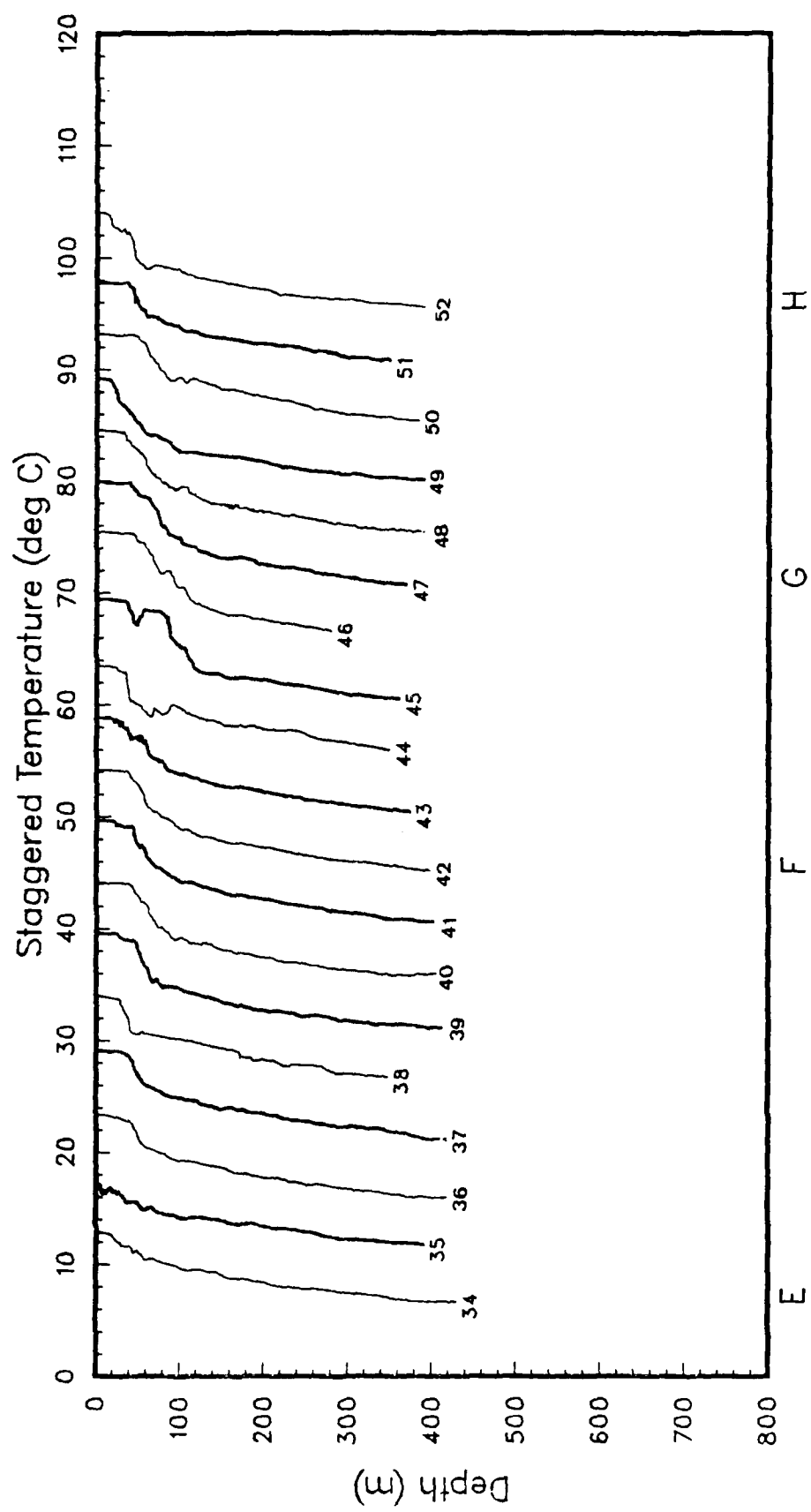


Figure 19(c)

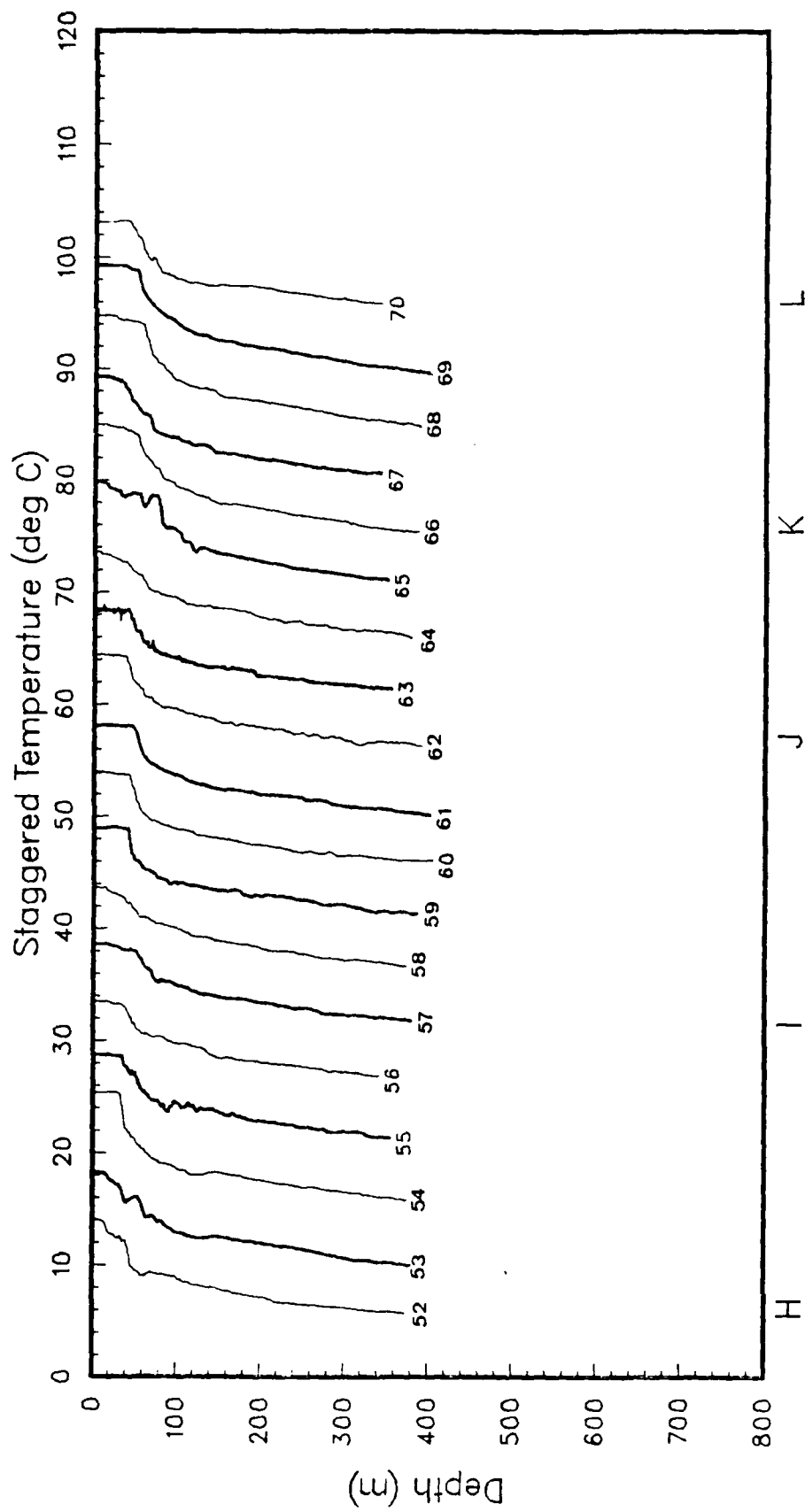


Figure 19(d)

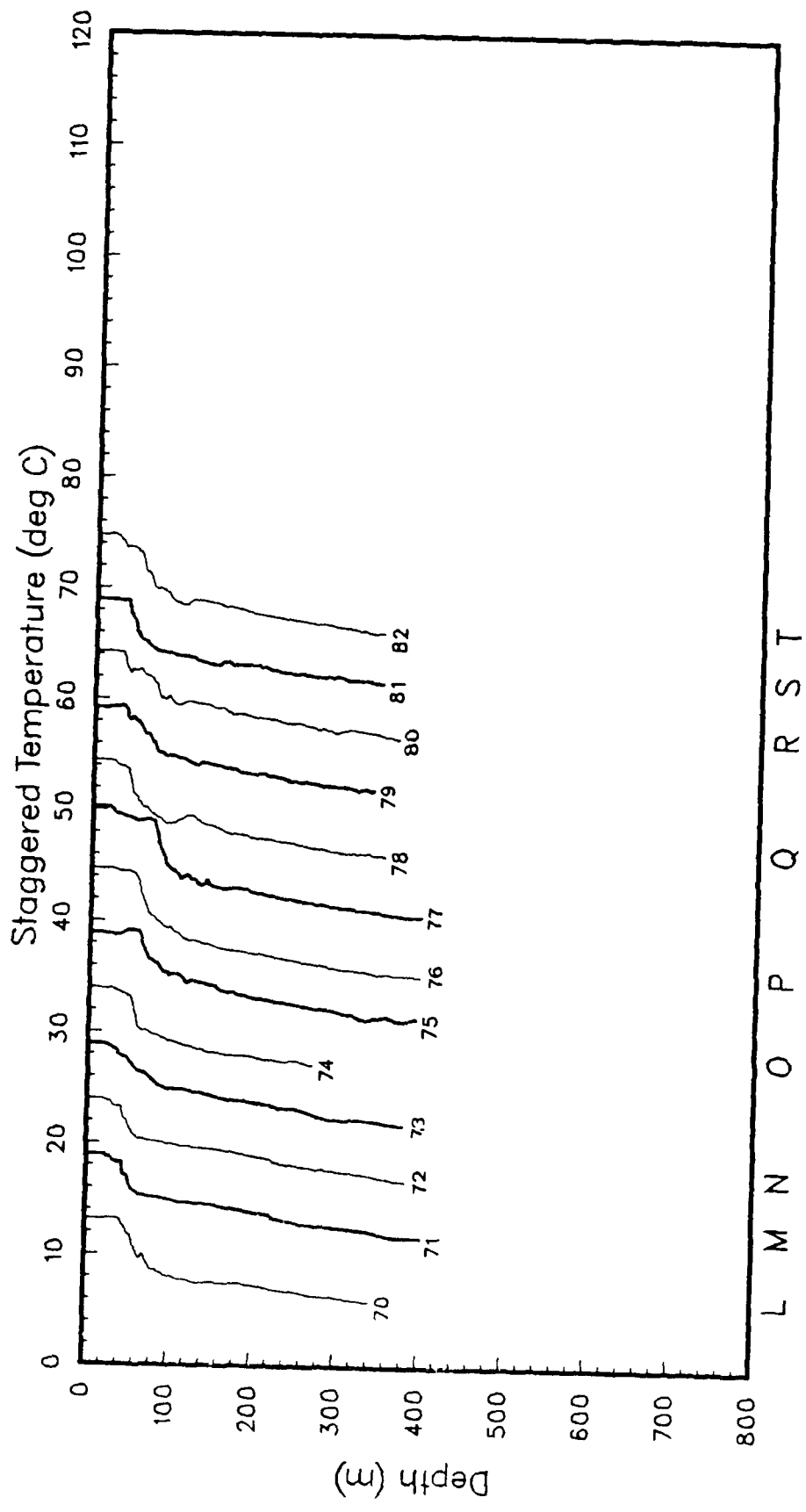


Figure 19(e)

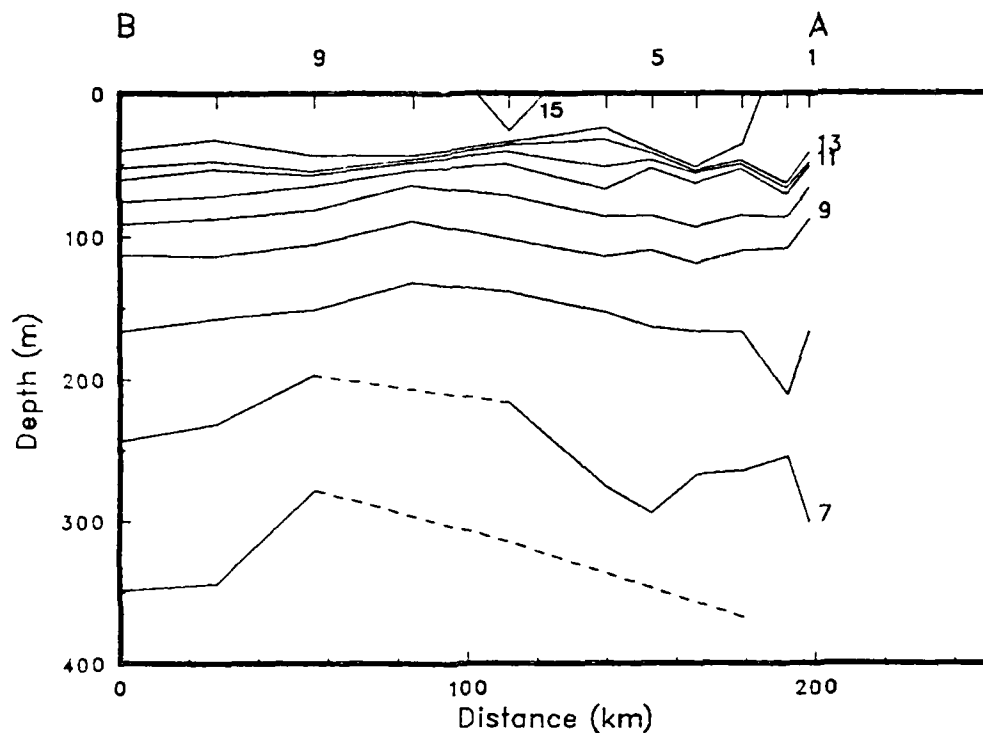
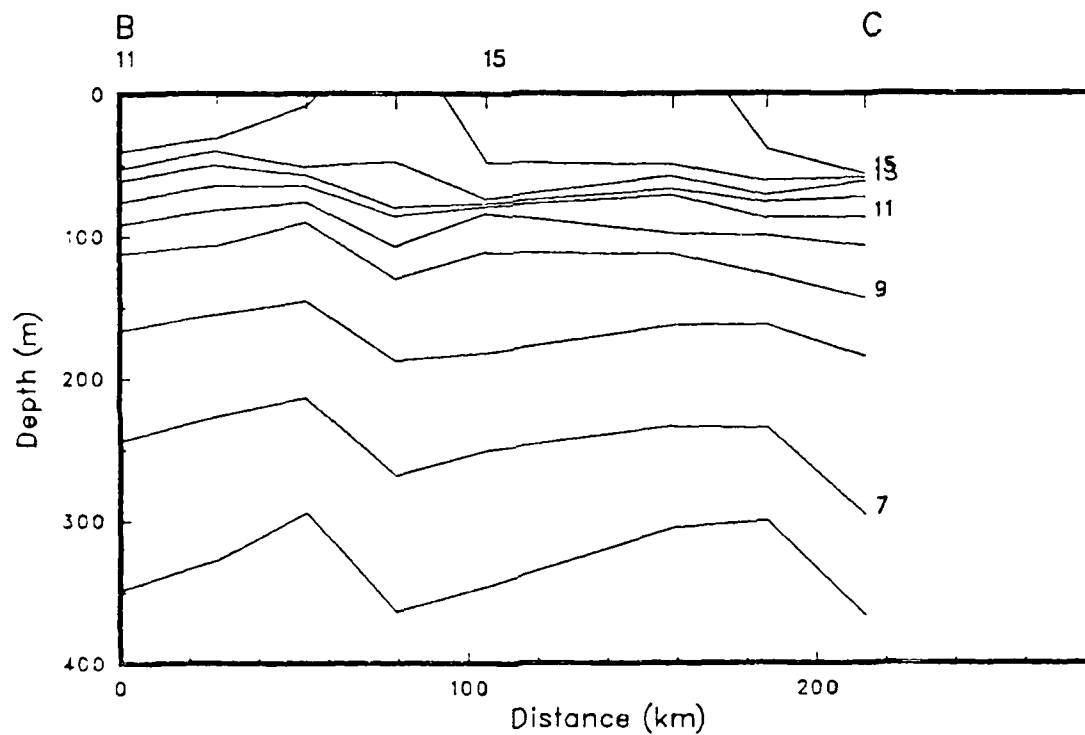


Figure 20(a). Along-track isotherms. Tick marks along the upper axis show station positions. Some station numbers are given. Dashed lines are used if cast was too shallow (OPTOMA 23, flight P4).



Flight 20(b)

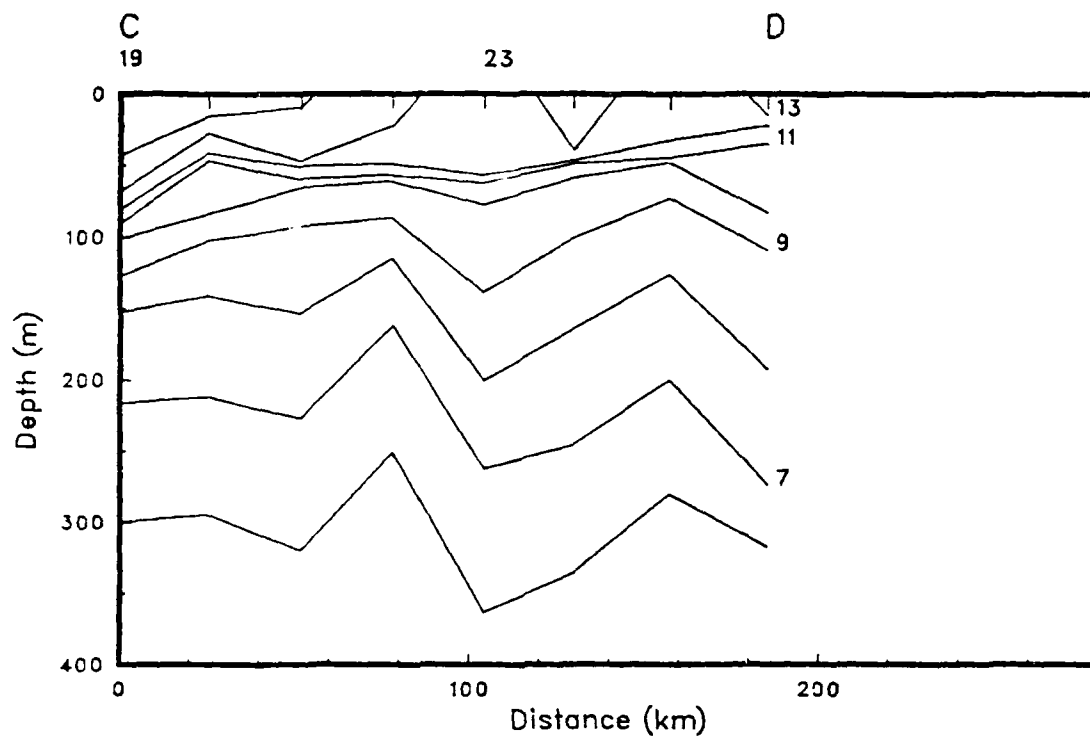


Figure 20(c)

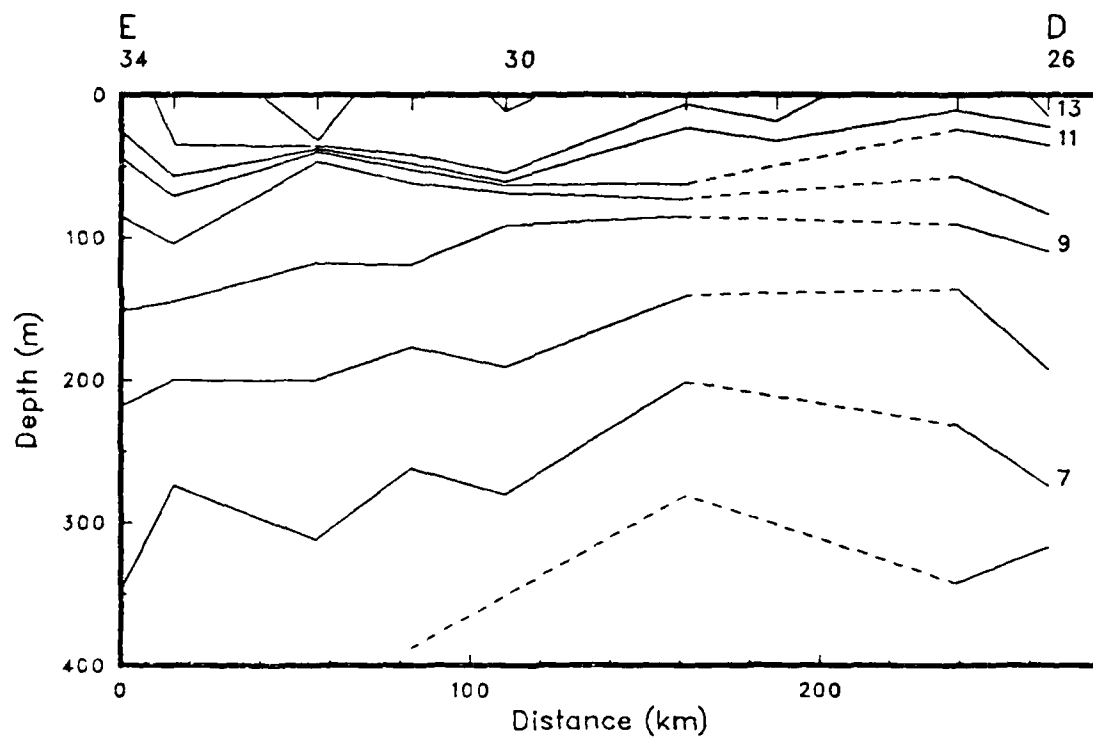


Figure 20(d)

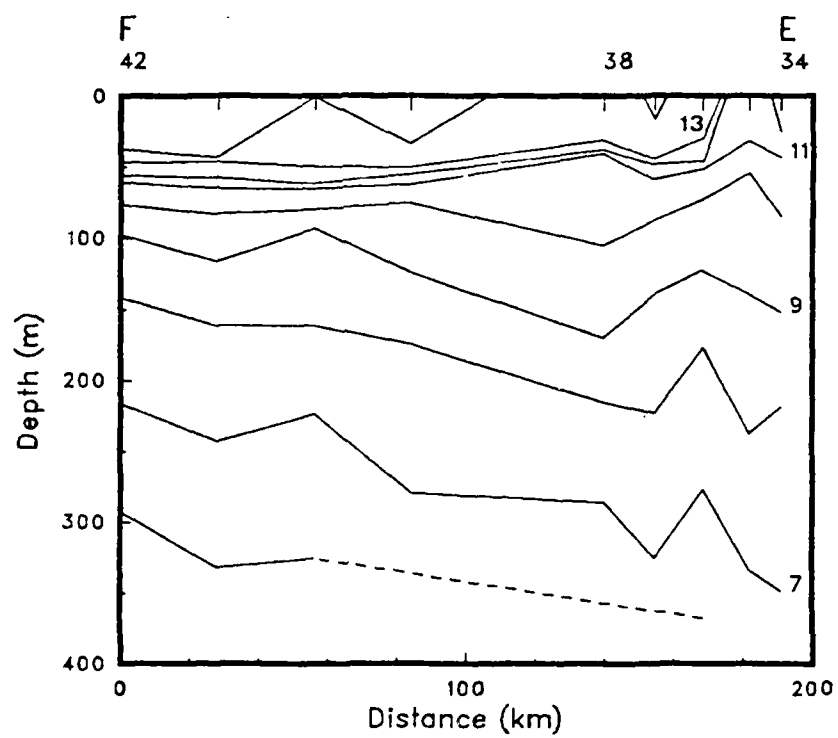


Figure 20(e)

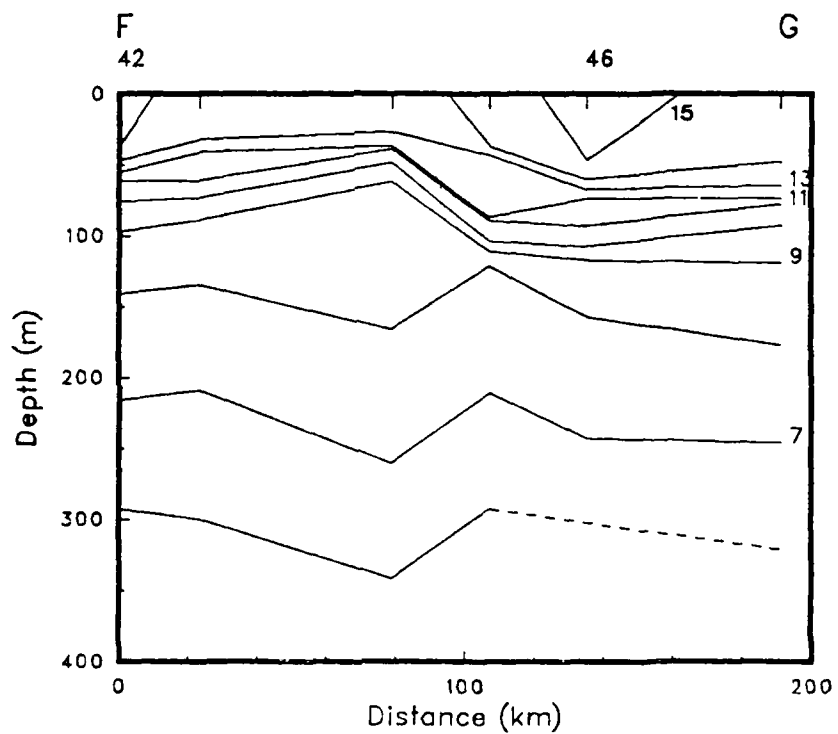


Figure 20(f)

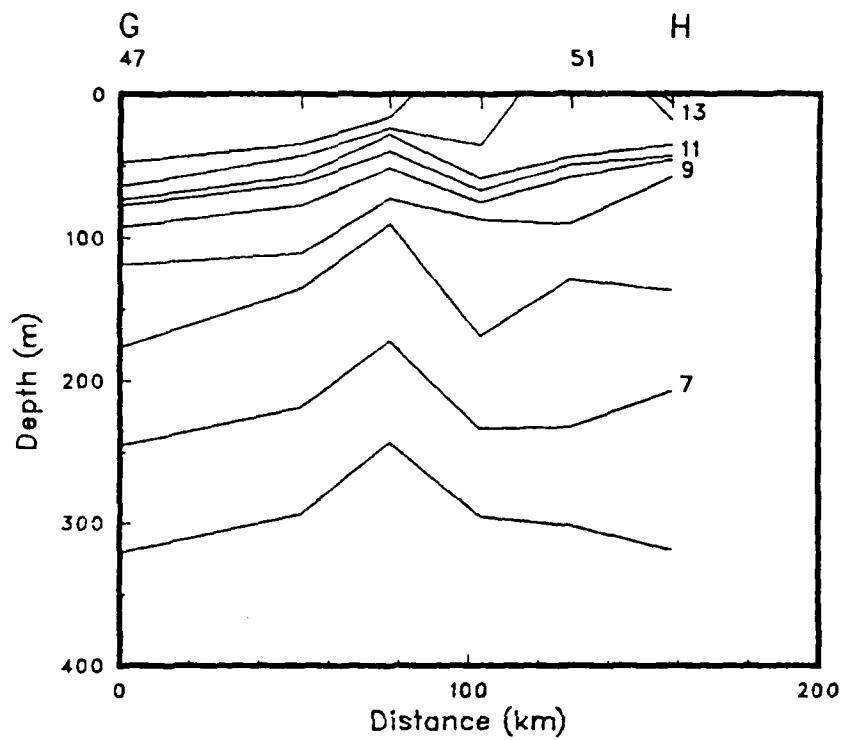


Figure 20(g)

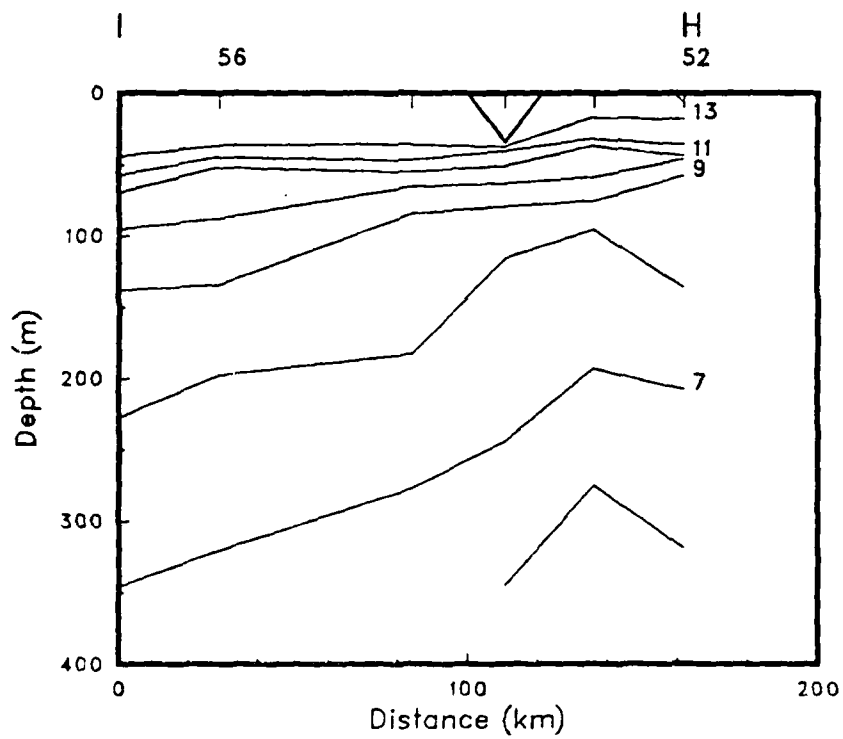


Figure 20(h)

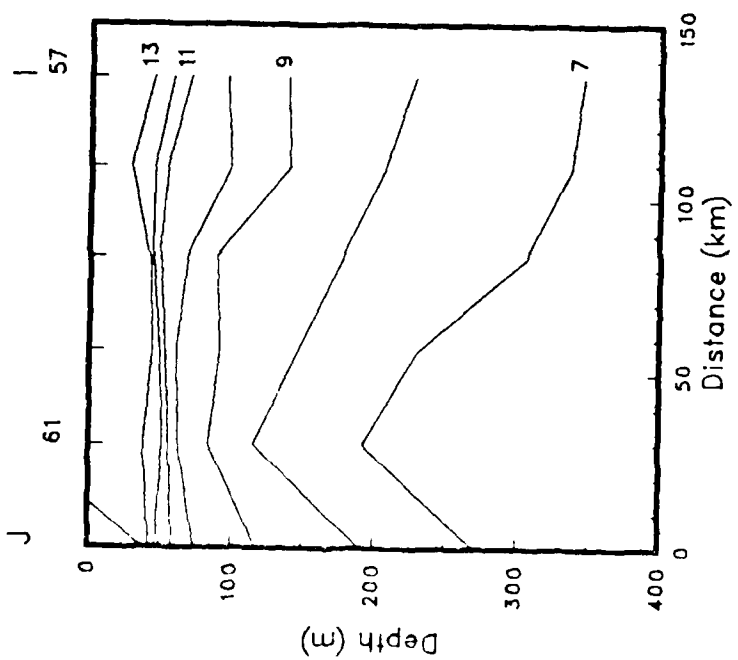


Figure 20(i)

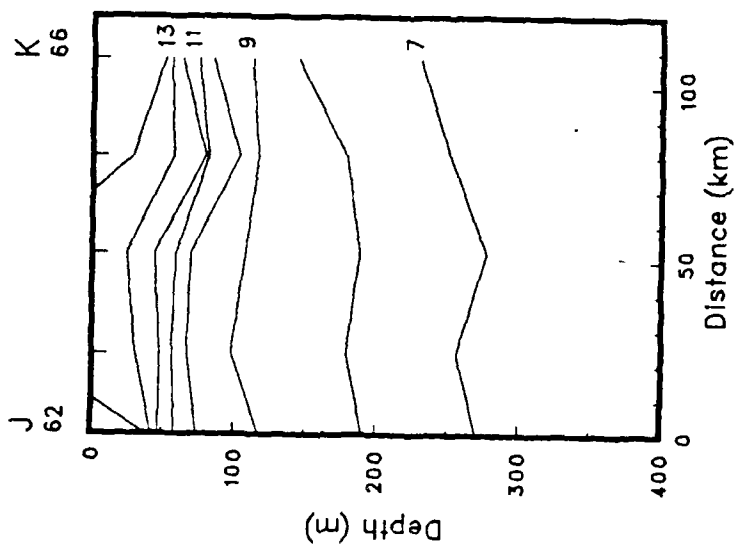


Figure 20(j)

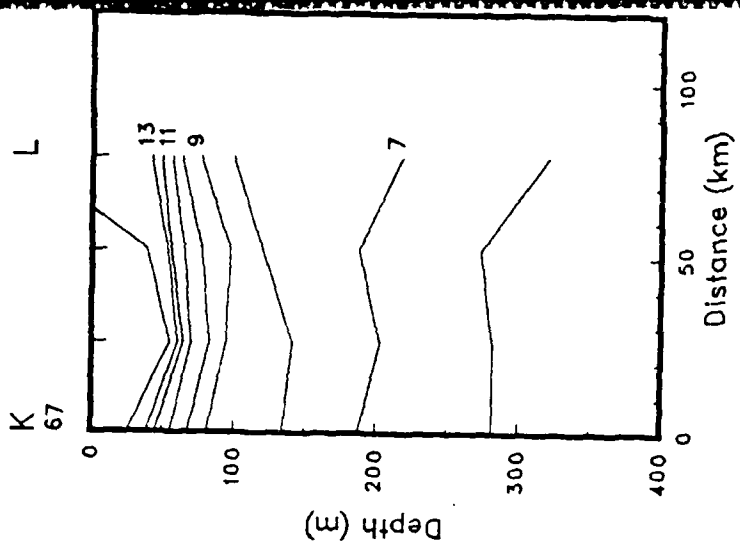


Figure 20(k)

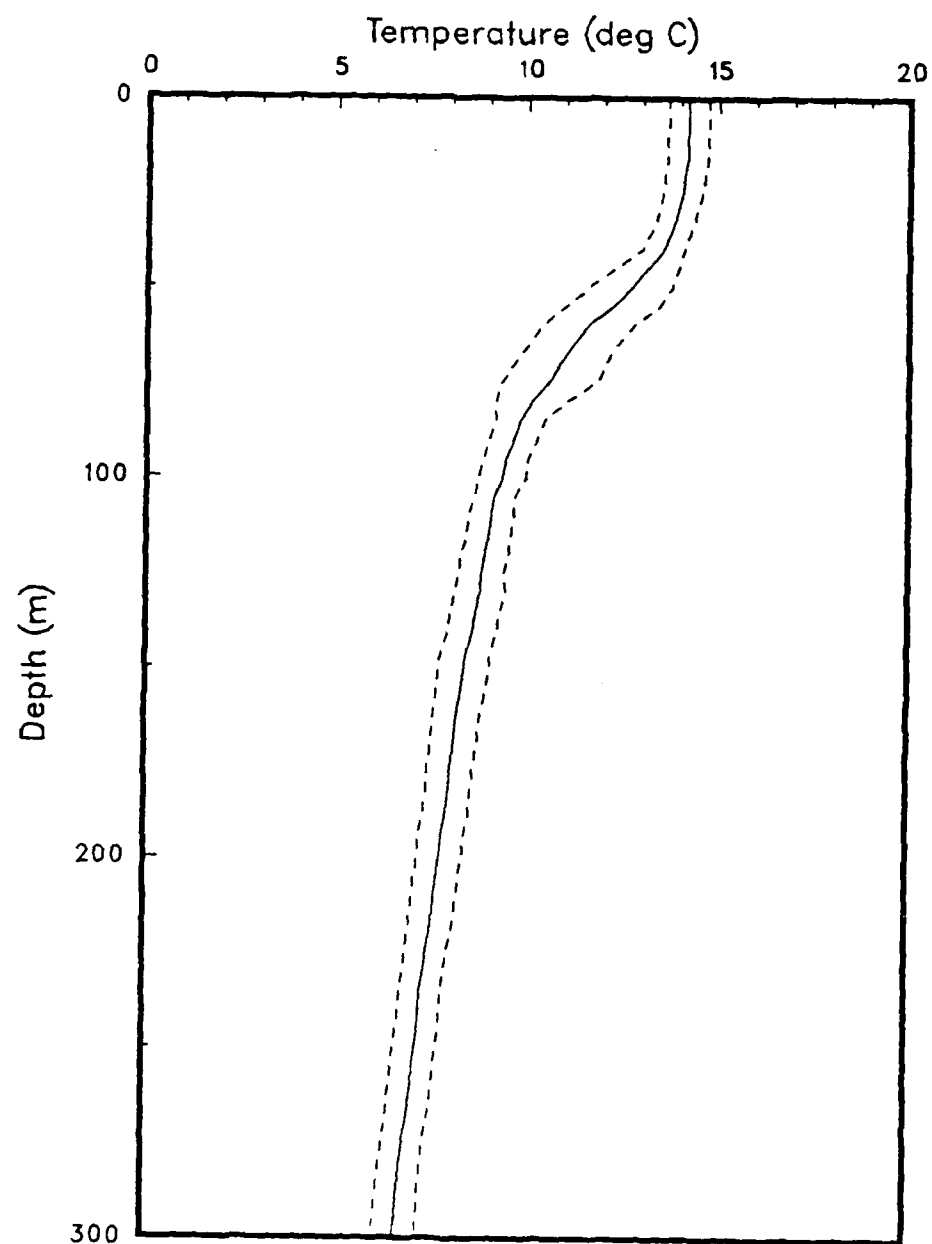


Figure 21. Mean temperature profile with + and - the standard deviation (OPTOMA 23, flight P4).

Section 5

OPTOMA 23 Flight P5

19 November 1986

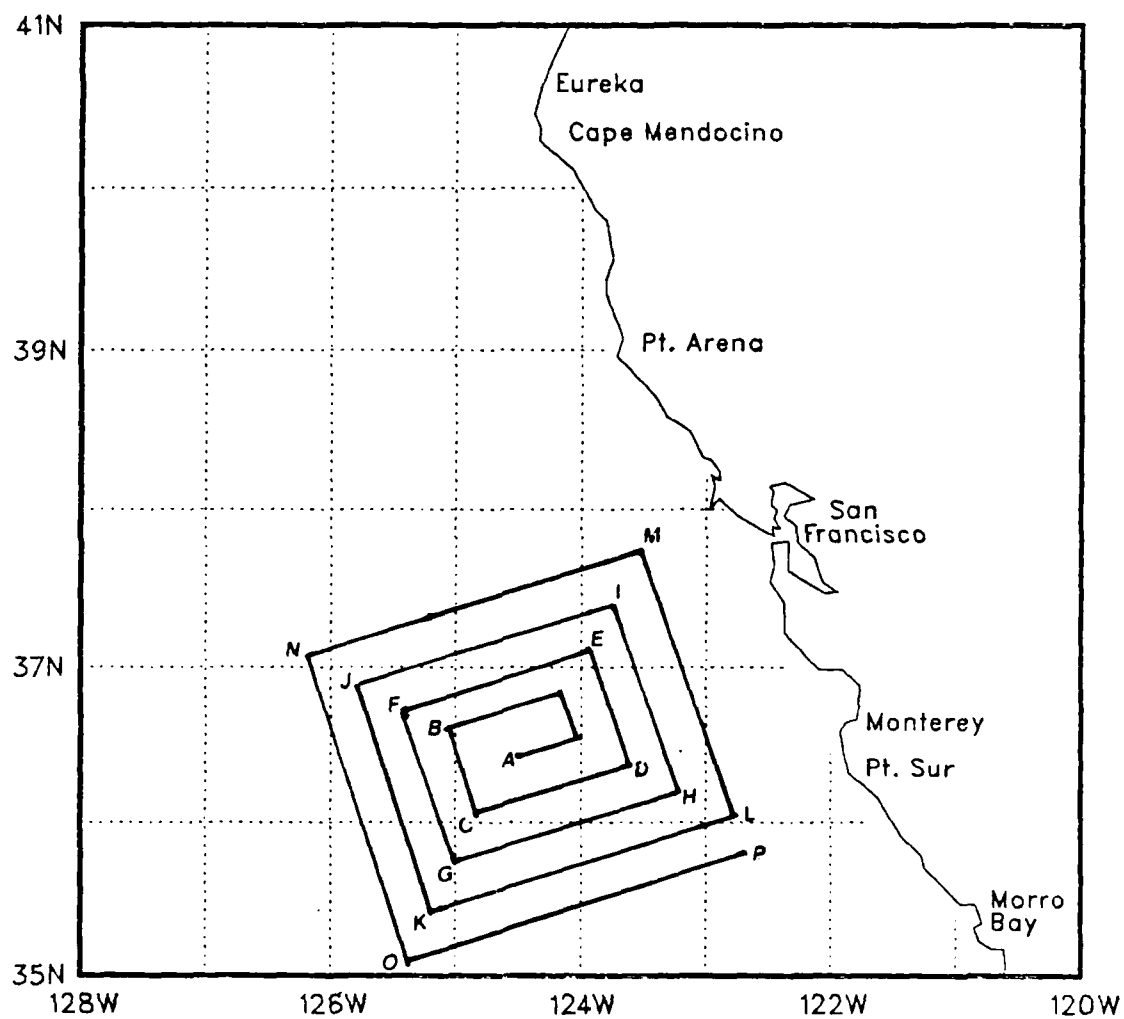


Figure 22. The flight track for OPTOMA 23, flight P5.

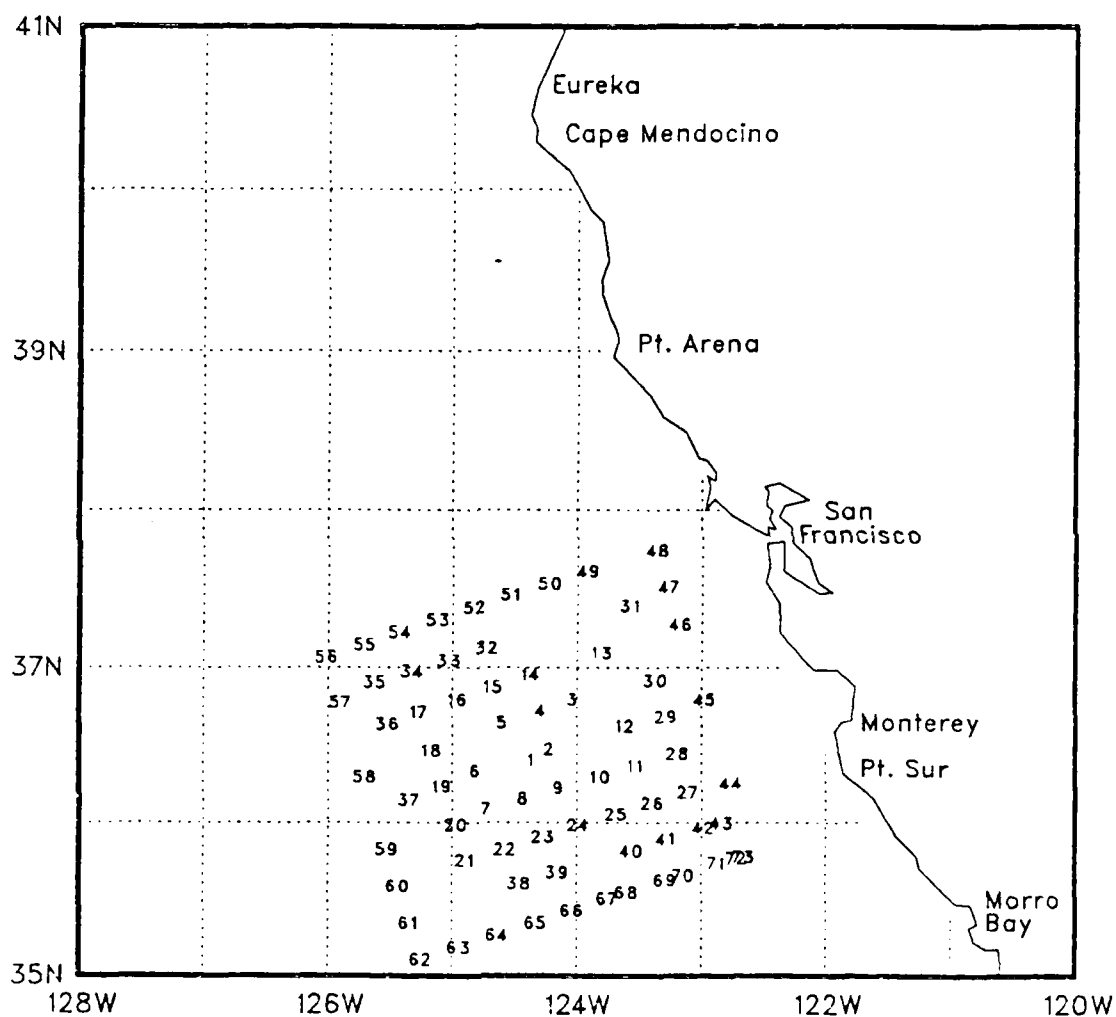


Figure 23. AXBT locations for OPTOMA 23, flight P5.

Table 6: Flight P5 Station Listing

Stn	Type	Yr/Day	GMT	Lat (North) (dd. mm)	Long (West) (ddd. mm)	Surface Temp (deg C)
1	AXBT	86323	2208	36.22	124.23	14.0
2	AXBT	86323	2211	36.26	124.16	14.9
3	AXBT	86323	2220	36.46	124.04	15.1
4	AXBT	86323	2224	36.41	124.20	15.4
5	AXBT	86323	2228	36.37	124.38	14.3
6	AXBT	86323	2236	36.18	124.51	14.3
7	AXBT	86323	2240	36.03	124.46	15.3
8	AXBT	86323	2244	36.07	124.28	13.9
9	AXBT	86323	2247	36.11	124.11	15.6
10	AXBT	86323	2251	36.16	123.53	15.1
11	AXBT	86323	2255	36.20	123.35	12.7
12	AXBT	86323	2300	36.35	123.41	14.4
13	AXBT	86323	2308	37.04	123.52	14.7
14	AXBT	86323	2315	36.55	124.26	15.4
15	AXBT	86323	2319	36.50	124.44	13.7
16	AXBT	86323	2323	36.46	125.02	15.5
17	AXBT	86323	2327	36.41	125.20	15.9
18	AXBT	86323	2331	36.26	125.14	15.9
19	AXBT	86323	2334	36.12	125.09	15.9
20	AXBT	86323	2338	35.57	125.04	16.3
21	AXBT	86323	2341	35.43	124.58	16.2
22	AXBT	86323	2346	35.47	124.40	15.9
23	AXBT	86323	2349	35.52	124.22	14.0
24	AXBT	86323	2353	35.57	124.04	15.6
25	AXBT	86323	2357	36.01	123.46	15.5
26	AXBT	86324	0	36.05	123.29	15.8
27	AXBT	86324	4	36.10	123.11	15.3
28	AXBT	86324	8	36.25	123.17	14.4
29	AXBT	86324	12	36.39	123.22	14.5
30	AXBT	86324	16	36.53	123.28	15.0
31	AXBT	86324	24	37.22	123.39	14.3
32	AXBT	86324	39	37.05	124.49	15.7
33	AXBT	86324	43	37.01	125.07	15.8
34	AXBT	86324	47	36.56	125.25	15.1
35	AXBT	86324	51	36.52	125.43	15.4
36	AXBT	86324	55	36.36	125.37	15.3
37	AXBT	86324	102	36.07	125.26	15.4
38	AXBT	86324	121	35.34	124.33	14.8
39	AXBT	86324	124	35.38	124.14	14.7
40	AXBT	86324	131	35.47	123.39	16.2
41	AXBT	86324	135	35.52	123.22	15.6
42	AXBT	86324	139	35.56	123.04	15.4
43	AXBT	86324	141	35.58	122.56	14.1
44	AXBT	86324	147	36.13	122.51	14.4
45	AXBT	86324	156	36.46	123.04	14.7

Stn	Type	Yr/Day	GMT	Lat (North) (dd.mm)	Long (West) (ddd.mm)	Surface Temp (deg C)
46	AXBT	86324	204	37.14	123.16	14.6
47	AXBT	86324	208	37.29	123.21	13.6
48	AXBT	86324	212	37.43	123.27	13.6
49	AXBT	86324	219	37.35	124.00	14.6
50	AXBT	86324	223	37.30	124.19	15.0
51	AXBT	86324	226	37.26	124.37	14.4
52	AXBT	86324	230	37.21	124.55	15.0
53	AXBT	86324	234	37.16	125.13	15.1
54	AXBT	86324	237	37.11	125.31	15.1
55	AXBT	86324	241	37.07	125.47	13.6
56	AXBT	86324	245	37.02	126.06	15.1
57	AXBT	86324	249	36.44	125.59	15.4
58	AXBT	86324	256	36.16	125.47	15.4
59	AXBT	86324	303	35.47	125.37	16.3
60	AXBT	86324	306	35.33	125.31	16.3
61	AXBT	86324	309	35.19	125.25	16.8
62	AXBT	86324	313	35.04	125.20	15.7
63	AXBT	86324	317	35.09	125.02	15.5
64	AXBT	86324	321	35.14	124.43	15.5
65	AXBT	86324	324	35.19	124.25	15.8
66	AXBT	86324	328	35.23	124.07	15.1
67	AXBT	86324	331	35.28	123.50	15.5
68	AXBT	86324	333	35.31	123.41	15.8
69	AXBT	86324	338	35.35	123.22	15.3
70	AXBT	86324	340	35.37	123.14	15.5
71	AXBT	86324	344	35.42	122.57	15.6
72	AXBT	86324	346	35.44	122.48	15.6

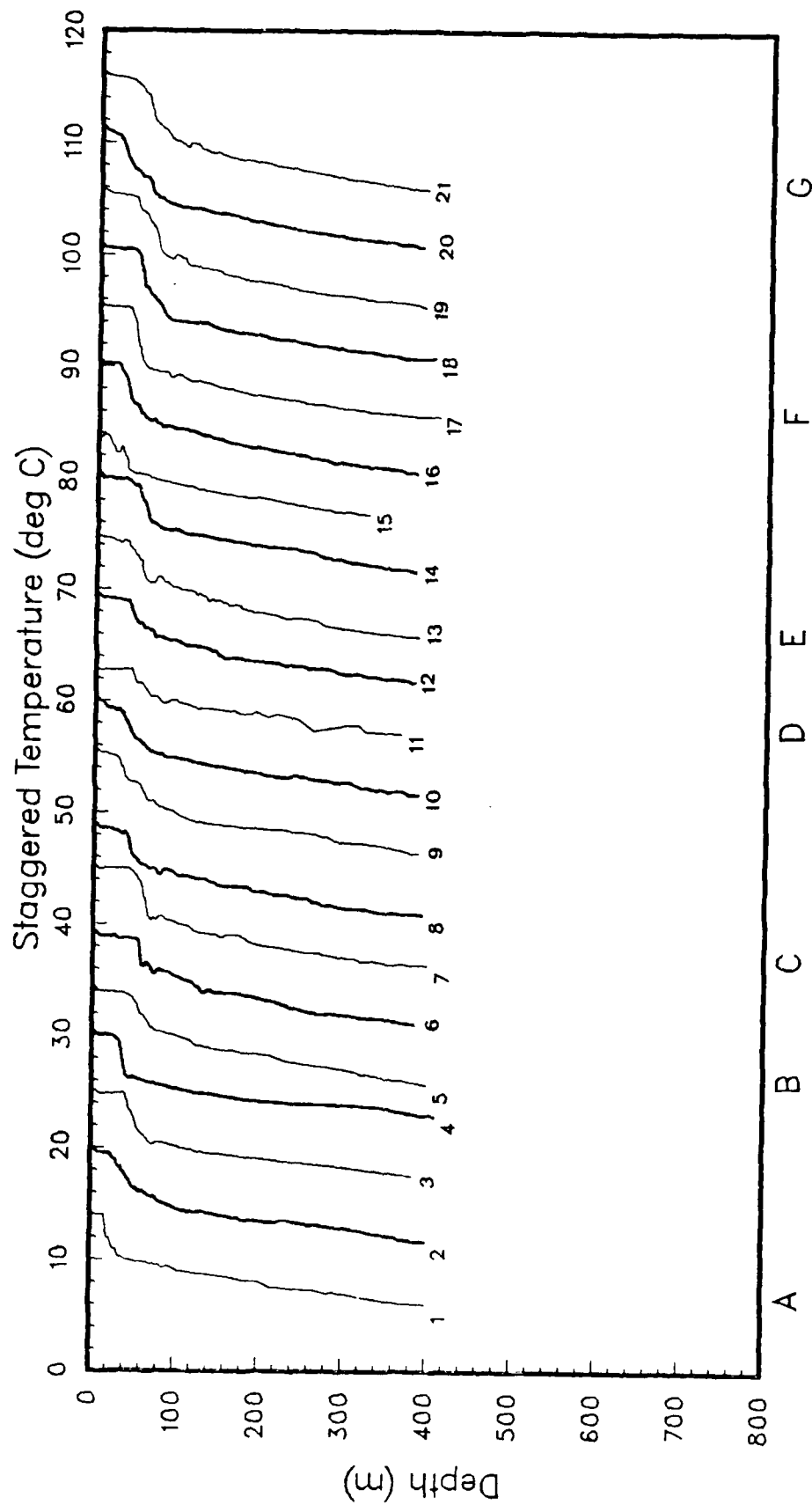


Figure 24(a). AXBT temperature profiles, staggered by multiples of 5 C (OPTOMA 23, flight P5).

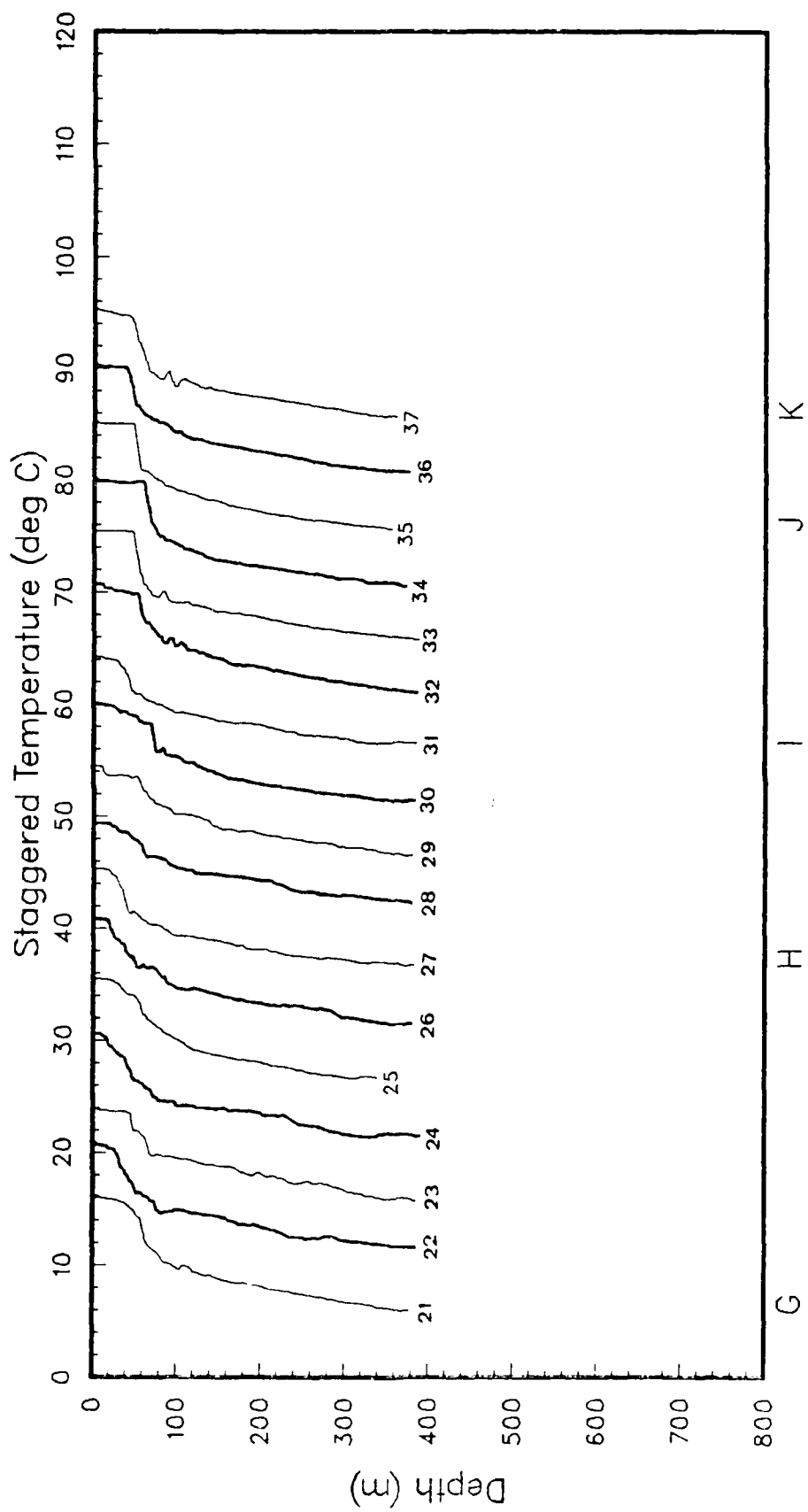


Figure 24(b)

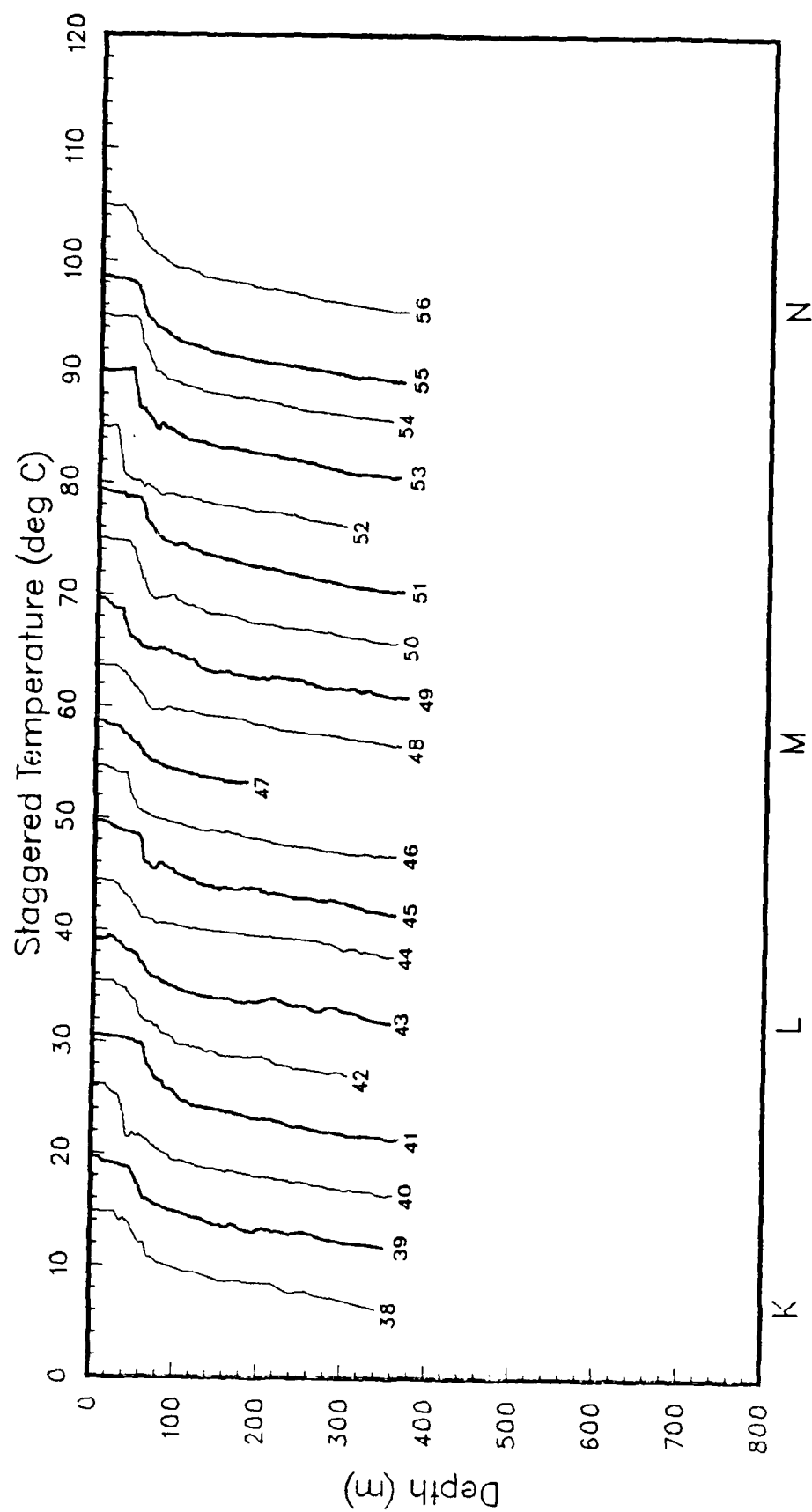


Figure 24(c)

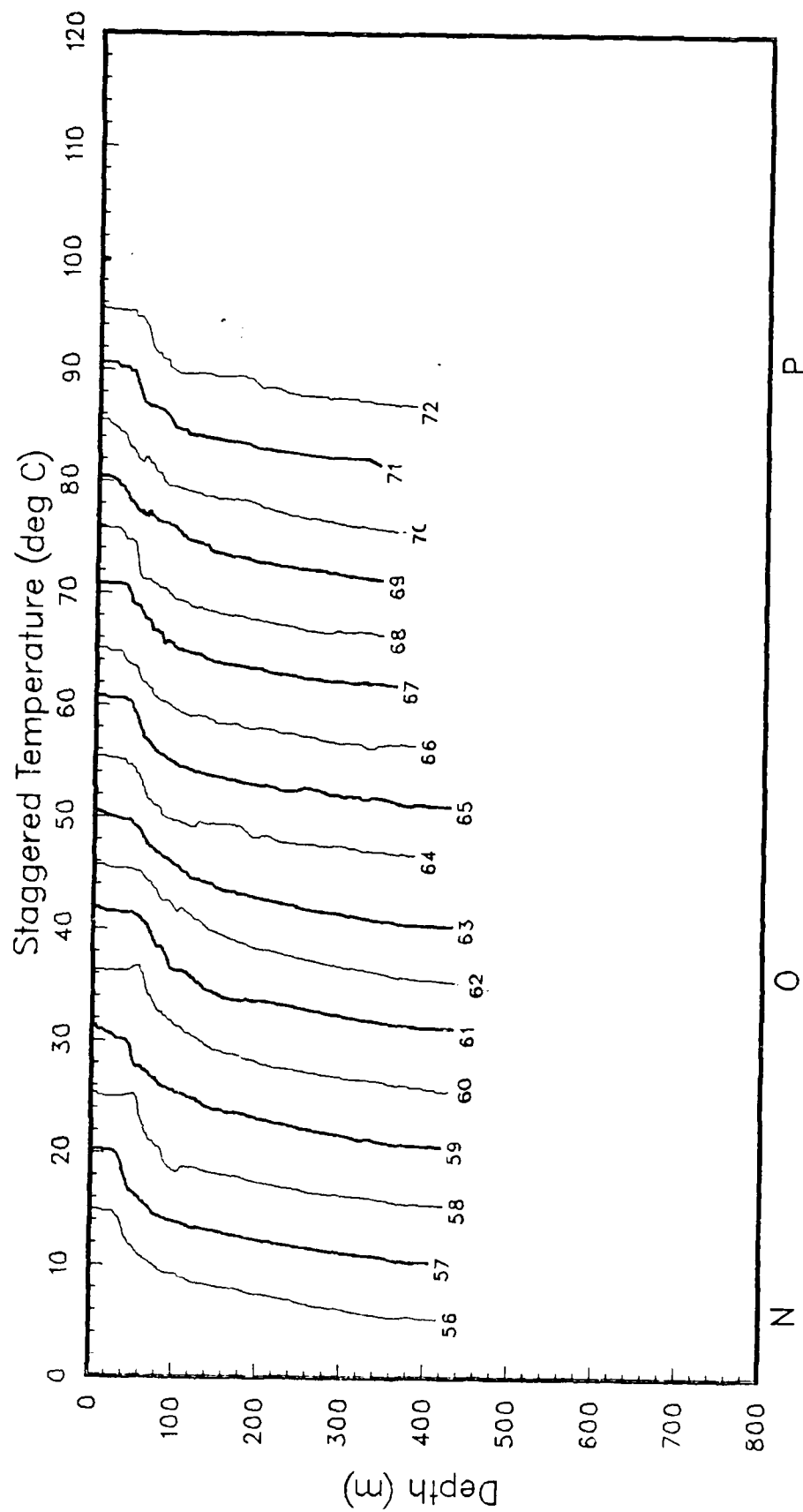


Figure 24(d)

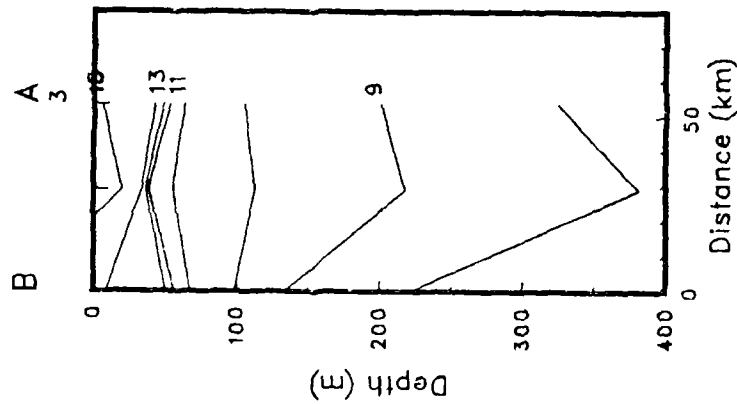


Figure 25(a)

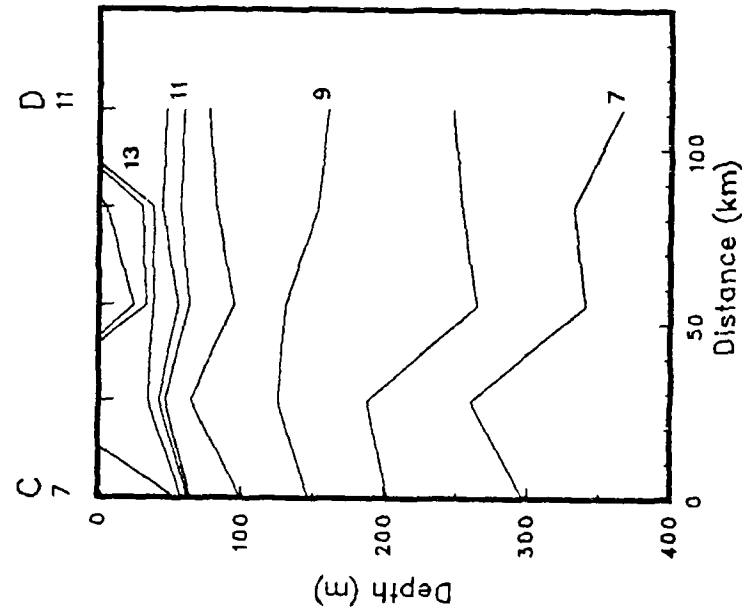


Figure 25(b)

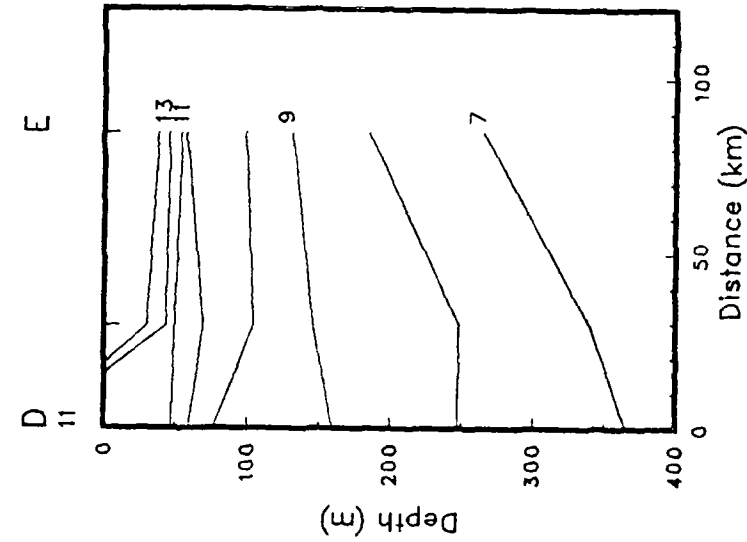


Figure 25(c)

Figure 25. Along-track isotherms. Tick marks along the upper axis show station positions. Some station numbers are given. Dashed lines are used if cast was too shallow (OPTOMA 23, flight P5).

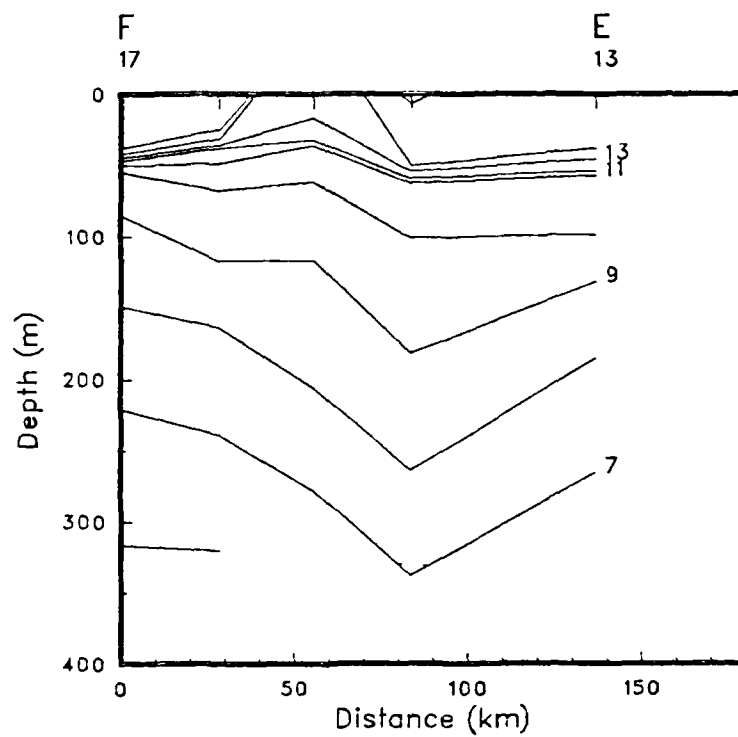


Figure 25(d)

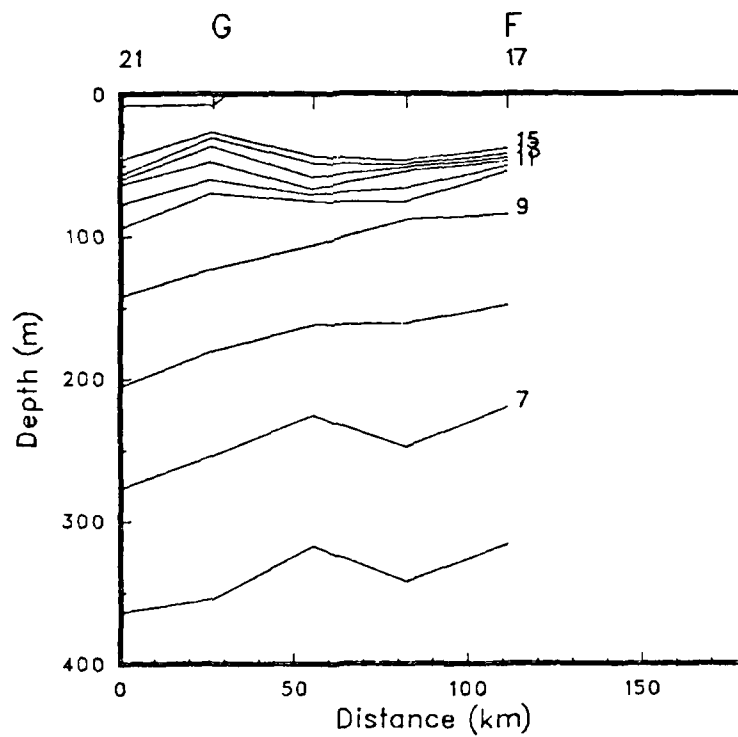


Figure 25(e)

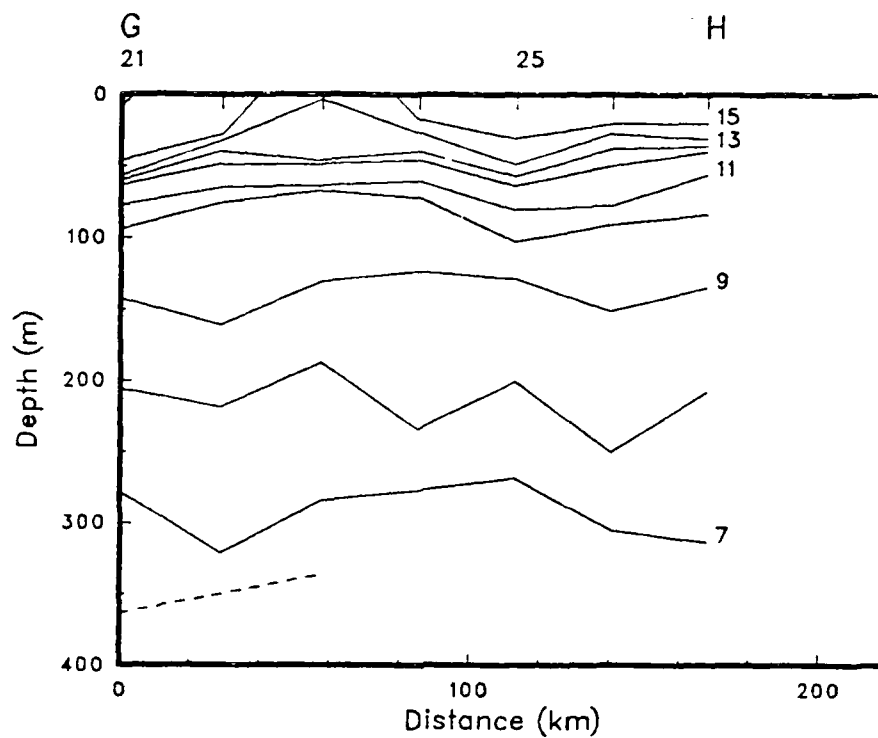


Figure 25(f)

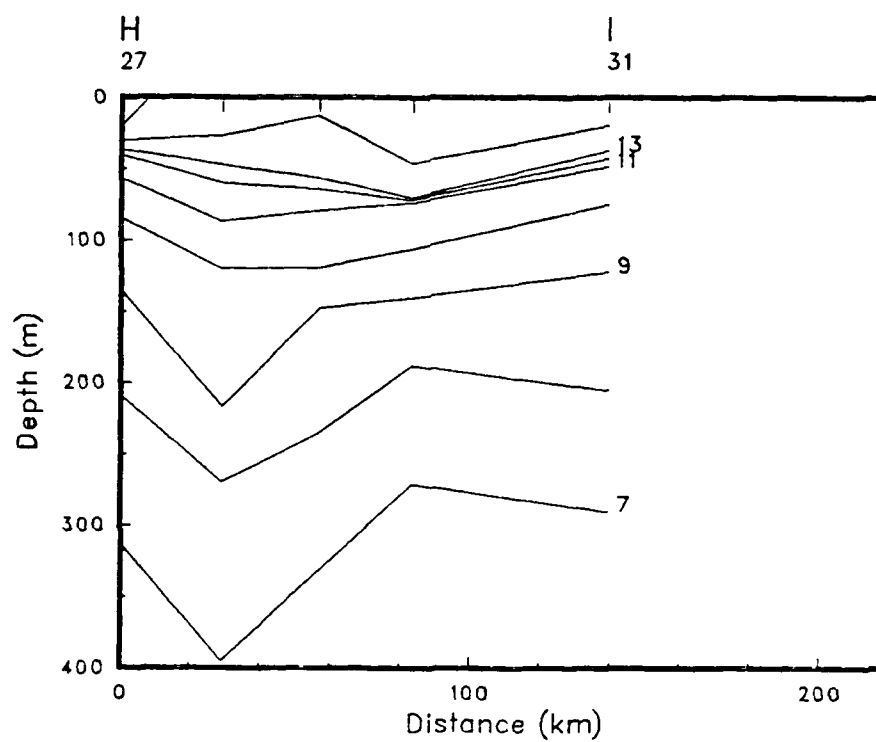


Figure 25(g)

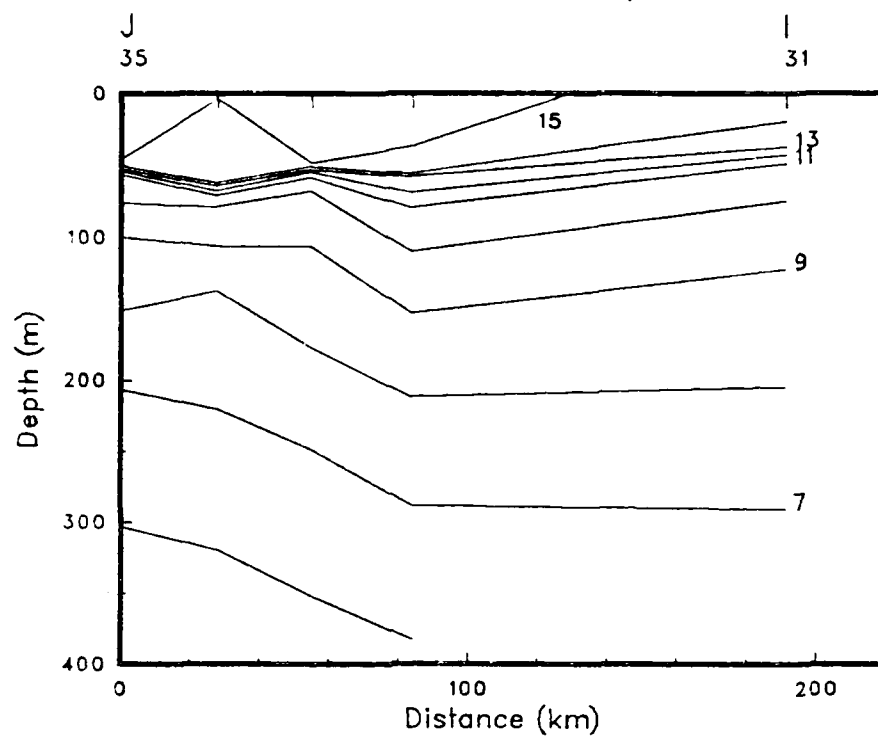


Figure 25(h)

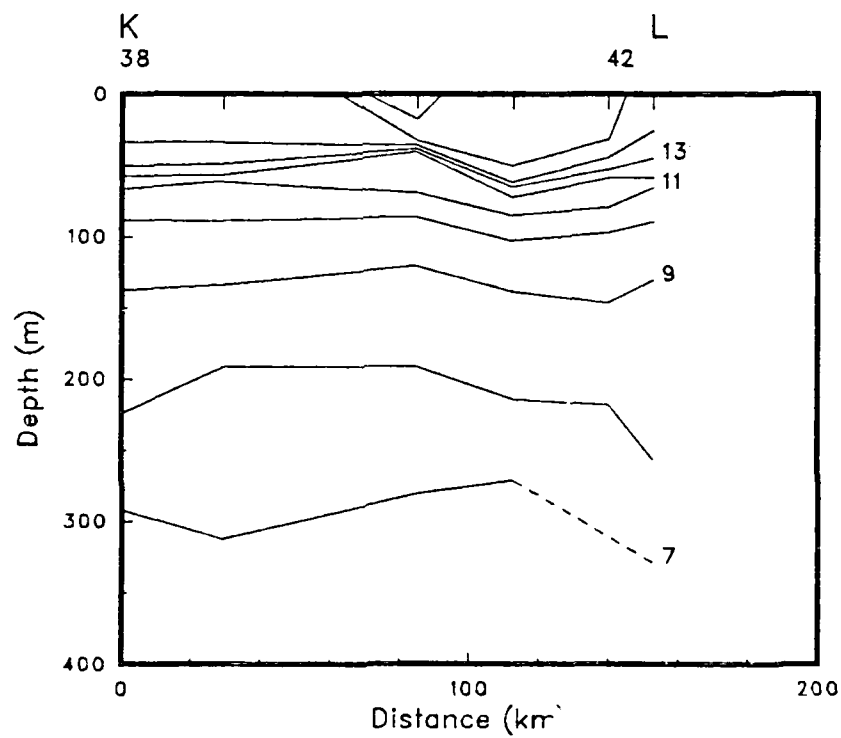


Figure 25(i)

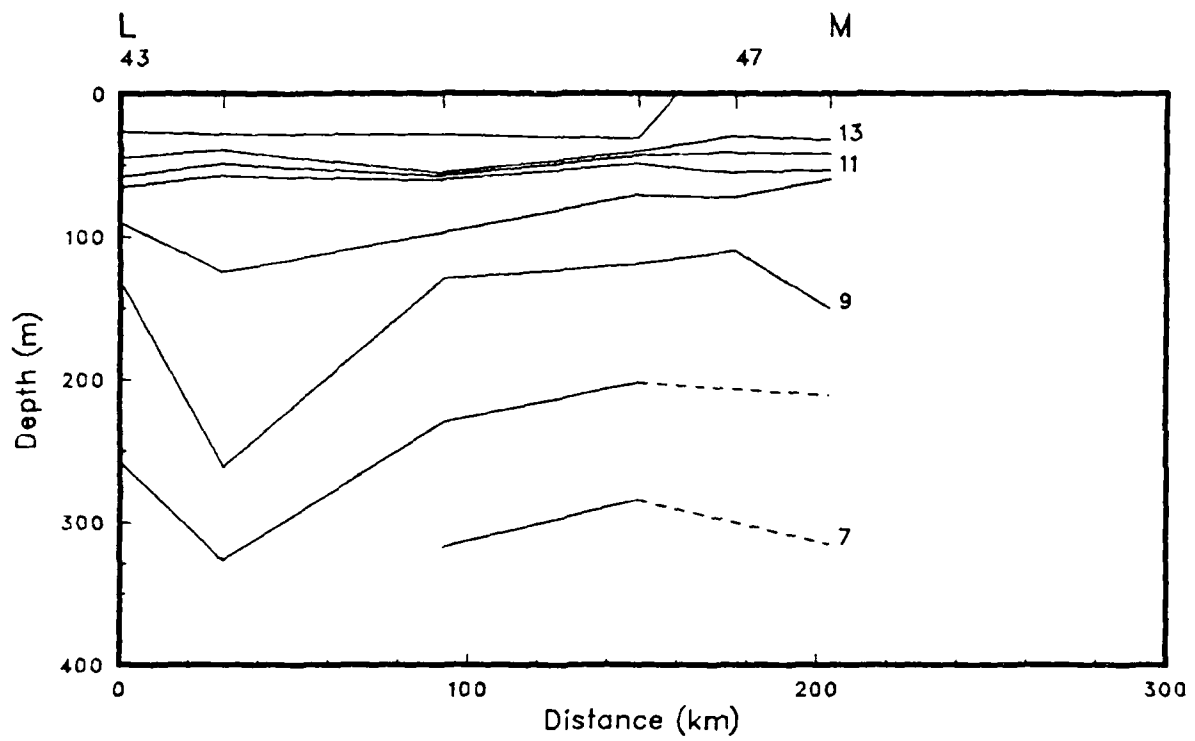


Figure 25(j).

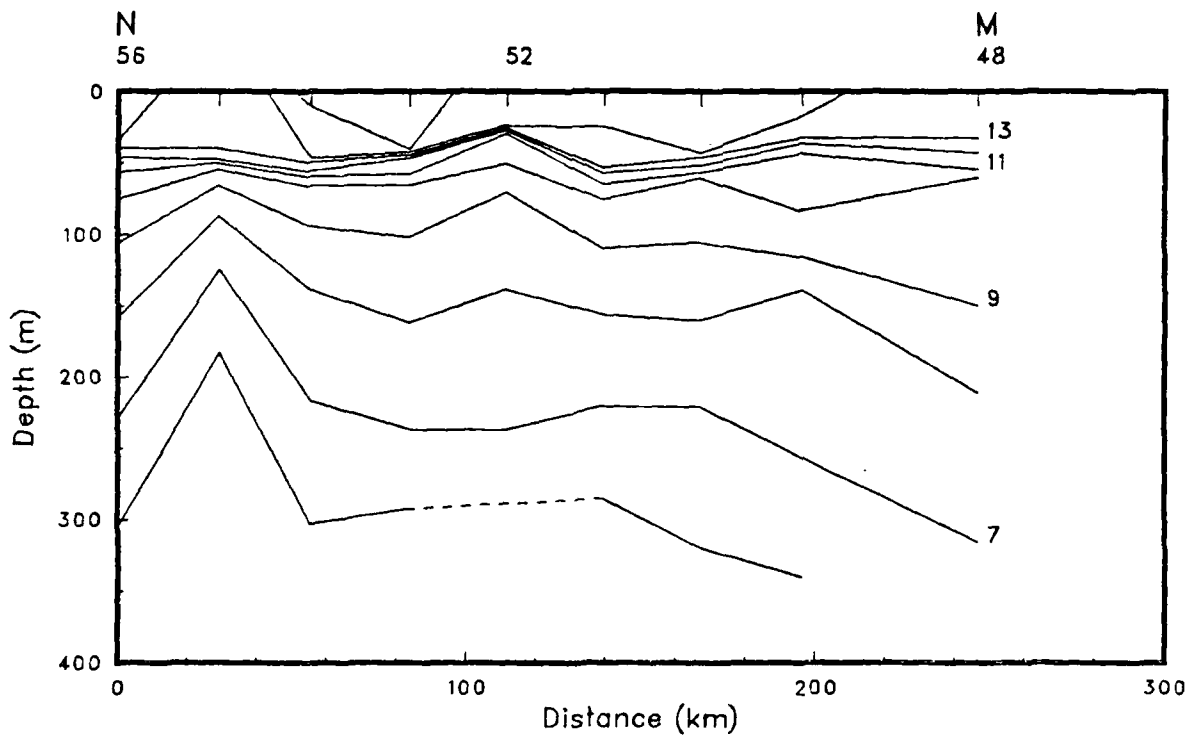


Figure 25(k)

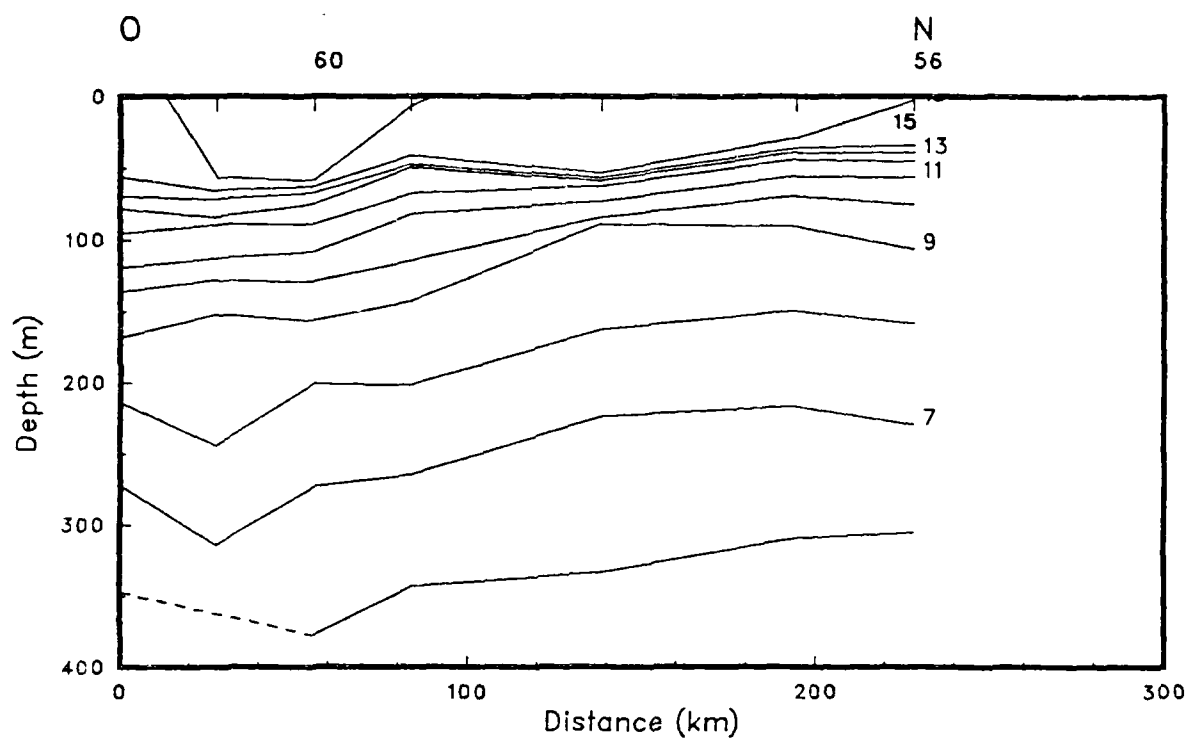


Figure 25(1)

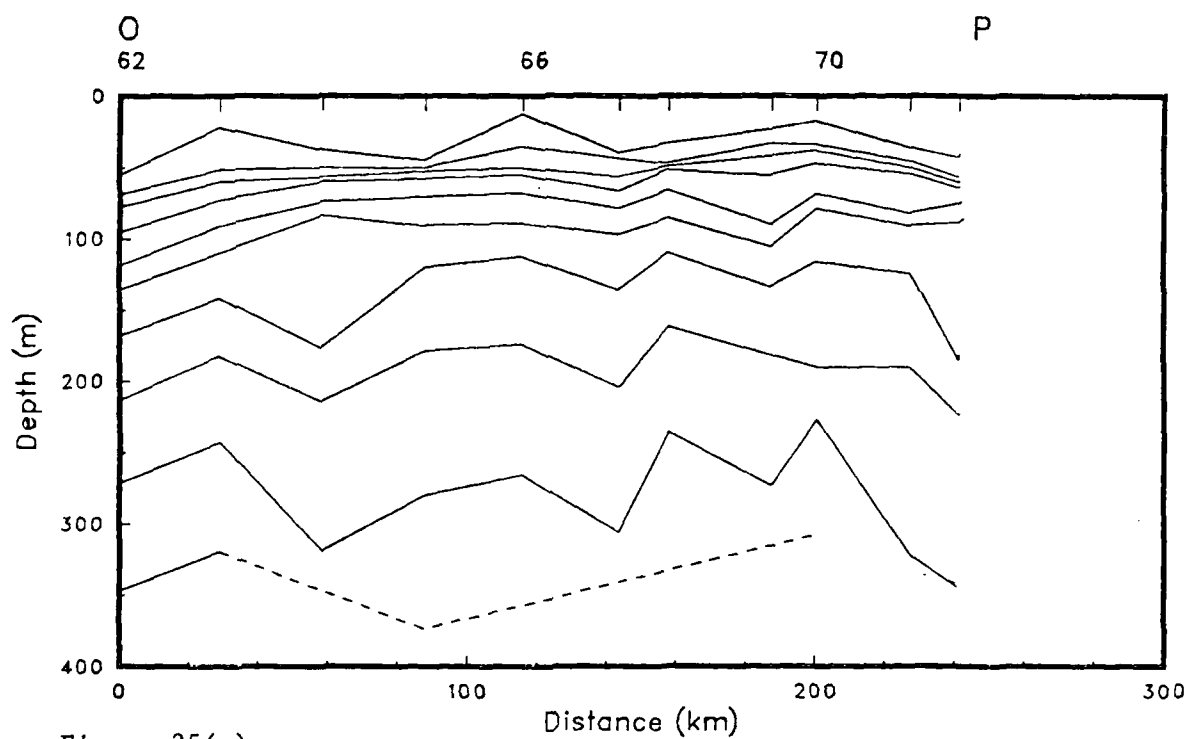


Figure 25(m)

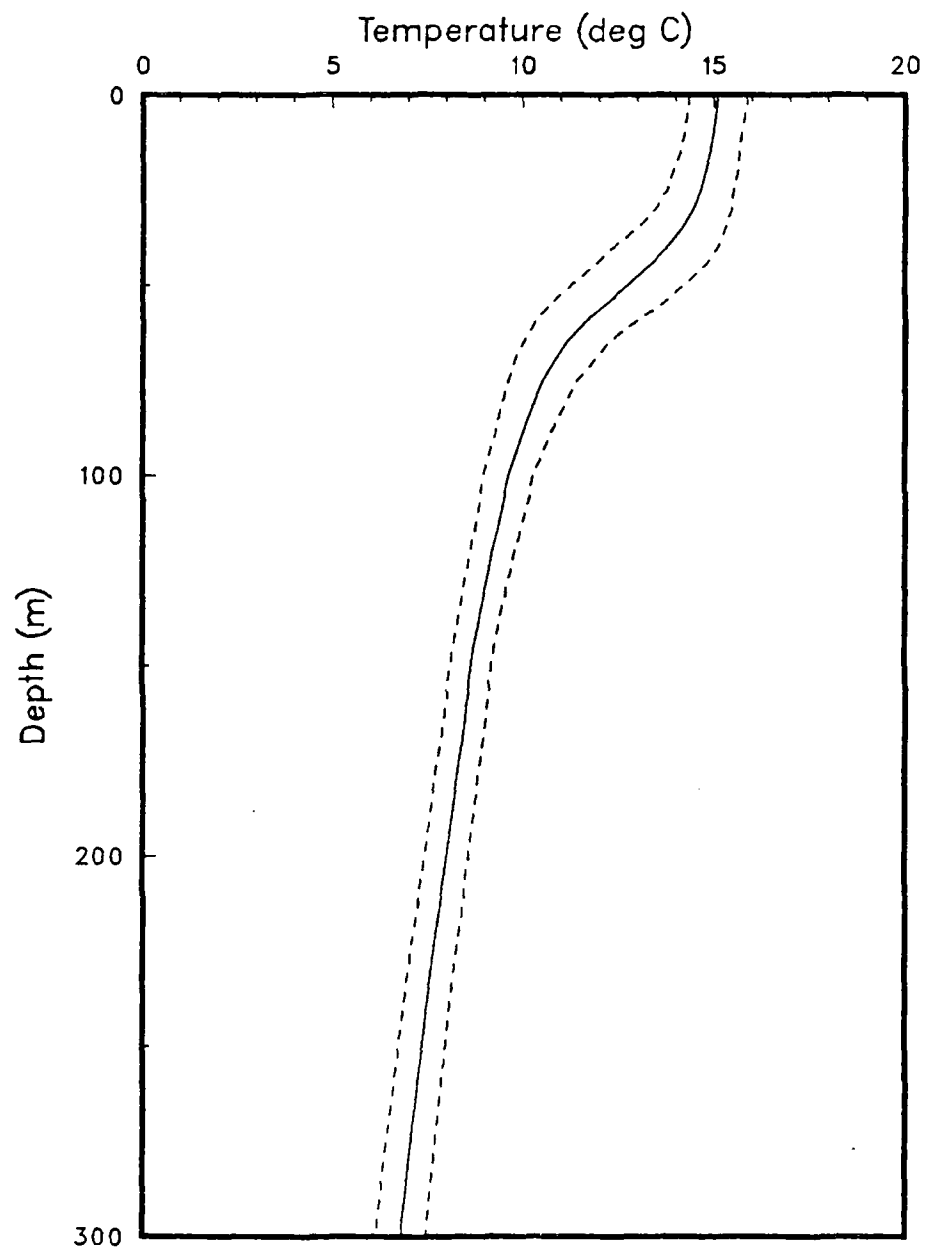


Figure 26. Mean temperature profile with the + and - standard deviation (OPTOMA 23, flight P5).

ACKNOWLEDGEMENTS

This research was sponsored by the ONR Physical Oceanography Program. The members of crew one of Ocean Development Squadron Eight (VXN-8) headed by LCDR Ron Repper were most capable, very flexible and thoroughly professional in carrying out the missions assigned by the scientific party. The members of the scientific party were:

LCDR J. Edward Johnson, Chief Scientist, NPS
Ms. Melissa Ciandro, Party Chief, NPS
Mr. Jeff Kerling, NAVOCEANO
Mr. Gary Athey, NAVOCEANO
Dr. Janet Boyd, NORDA

Thanks also to Ms. Arlene Bird for her help in editing this report and processing it through the final stages.

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